# WATERBIRDS IN WETLANDS ON THE SOUTH COAST OF WESTERN AUSTRALIA SUMMER 1991-2

**Roger P. Jaensch**

C/- Wildlife Research Centre
Department of Conservation and Land Management
Ocean Reef Road, Woodvale, Western Australia

February 1992

# WATERBIRDS IN WETLANDS ON THE SOUTH COAST OF WESTERN AUSTRALIA, SUMMER 1991-2

**Roger P. Jaensch**

c/- Wildlife Research Centre
Department of Conservation and Land Management
Ocean Reef Road, Woodvale, Western Australia

February 1992

## CONTENTS

LIST OF TABLES

LIST OF FIGURES



FRONTISPIECE

Australasian Bittern at Owingup Swamp, 9 January 1992. There are few if any published photographs of this species in flight. (Photo taken by R. Jaensch).

## SUMMARY

In summer 1991-2, surveys were conducted at 27 permanent lakes and swamps on Crown Land near the south coast of Western Australia to determine waterbird usage (species present, species breeding, numbers of individuals present and habitats used), as part of a CALM wetland inventory funded by the Australian National Parks and Wildlife Service.

Common survey techniques were used, including wading through flooded vegetation to improve chances of finding the more secretive species that live therein, notably bitterns and rails. Old nests were included in the data recorded. Several other sources were searched for additional data on waterbird usage (since 1970) of the wetlands surveyed.

Forty species were recorded in summer 1991-2, 14 of them breeding. Considering all available data, 62 species have been recorded at the 27 wetlands over the past 20 years, 19 of them breeding. One species that had not previously been recorded in the 27 wetlands and six species not previously known to breed there were recorded in summer 1991-2. Two of the newly recorded species are secretive.

In summer 1991-2 the Pacific Black Duck was both the most widespread and abundant species. The Purple Swamphen was the most widespread breeding species.

One declared rare species, the Australasian Bittern, was recorded in summer 1991-2. Five were seen at Owingup Swamp, which is probably the most important wetland for the species on the south coast. In earlier surveys up to three were found at Boat Harbour Lake 1, Saide and Powell Lakes. Breeding has not been recorded in the wetlands surveyed.

Finding Little Bittern nests at Jasper and Saide Lakes during the summer 1991-2 surveys confirmed that this species breeds on the south coast.

In summer 1991-2 Owingup Swamp supported the highest numbers of species (32) and individuals (1 180), and the equal highest number of species found breeding (6), which was also shared by Jasper and Saide Lakes.

Combining all data (1970-present) and comparing rankings based on numbers of species, breeding species and individuals to indicate relative importance, the top five wetlands for waterbirds were Powell, Owingup, Saide, Jasper and Maringup Lakes.

The results of this study suggest that the combination of habitats which would optimise waterbird usage of a south coast wetland is extensive open water, some bare land and extensive tall sedges or low shrub thickets inundated at base by water 50-100 cm deep.

The most serious threat to waterbirds in the study area is possible frequent burning of shrub thickets and cedar forest.

Recommendations of the study include: 1) that Saide Lake be given greater conservation security; 2) that fire control regimes be established for wetland vegetation; and 3) that the breeding ecology of the Australasian Bittern be studied at Owingup Swamp and that its population in the whole of south-western Australia be monitored through annual surveys.

# 1. INTRODUCTION

## 1.1 Background

In 1991-2, the Australian National Parks and Wildlife Service provided $36 000 under the States Co-operative Assistance Program, to enable the Department of Conservation and Land Management (CALM) to conduct wetland inventory work on the south coast of Western Australia. This work was to include surveys of flora (by Mr C. Robinson) and invertebrate fauna and water chemistry (by Dr D. Edward) (additional to those done in 1990-1), and other fauna (waterbirds, frogs and fishes). Surveys of the waterbirds were done by the author under contract to CALM and are the subject of this report.

The inventory work was needed because CALM lacked comprehensive baseline biological data that would enable the conservation significance of the subject wetlands to be determined and against which potential impacts on the wetlands and their biota could be assessed. Potential impacts included possible future demands on water resources, proposed exploration and possible mining for mineral sands and increasing recreational use of the wetlands.

CALM already had comprehensive data on waterbird usage of some wetlands of south-western Australia (Kalbarri to Cape Arid), such as those in the Lake Muir district, from previous research (e.g. Jaensch *et al.* 1988, Jaensch and Vervest 1988a), but that research included few of the south coast wetlands especially those between Walpole and Cape Naturaliste.

This report addresses the deficiency: it includes the results of surveys conducted by the author during the summer of 1991-2, raw and summary data for each wetland, and discussion on the relationships between waterbird usage and habitat, the relative importance of each wetland for waterbirds and management issues.

## 1.2 Study Area

The study area was the south coast of Western Australia from Cape Naturaliste to Albany, within 20 km of the coast (Fig. 1). This is the coastal portion of the Warren Botanical Sub-district.

## 1.3 Wetlands to be Surveyed

A sample of wetlands to be surveyed was selected from the 35 permanent lakes and swamps identified from 1:50 000 CALM topo-cadastral maps as occurring on Crown Land (most of it vested in CALM) in the study area. Eight of the 35 were omitted because they were not readily accessible and limited time was available.

The sample of 27 was almost identical to the 27 surveyed earlier for flora (Robinson in prep.): one wetland (Crystal Lake) in Robinson's sample was omitted and one (Warren River Oxbow) that was not surveyed by Robinson was included. Maximum commonality of wetlands surveyed for flora and waterbirds was desirable to facilitate examination of relationships between waterbird usage and habitat (vegetation).

Several wetlands (e.g. Lake Jasper) that CALM already considered important for waterbird conservation and possibly under threat were included.

The wetlands to be surveyed provided a comprehensive representation of the types of permanent lakes and swamps occurring in the study area, varying greatly in area ($< 1.0$ ha to $> 300$ ha), maximum depth ($< 1.0$ m to $> 10.0$ m), and extent of vegetation subject to inundation (fringing to throughout the wetland). Most were fresh (total soluble salts $< 1.0$ parts per thousand), but a few were brackish (t.s.s. $< 3.0$ p.p.t.); many were acidic but a few were alkaline and pH ranged from 4.3 to 8.8 (Robinson in prep.).

The distribution of these wetlands within the study area is shown in Figure 1: four are between Capes Naturaliste and Leeuwin, 14 are between Cape Leeuwin and Point Nuyts and nine are between Point Nuyts and Albany.

## 1.4 Objectives

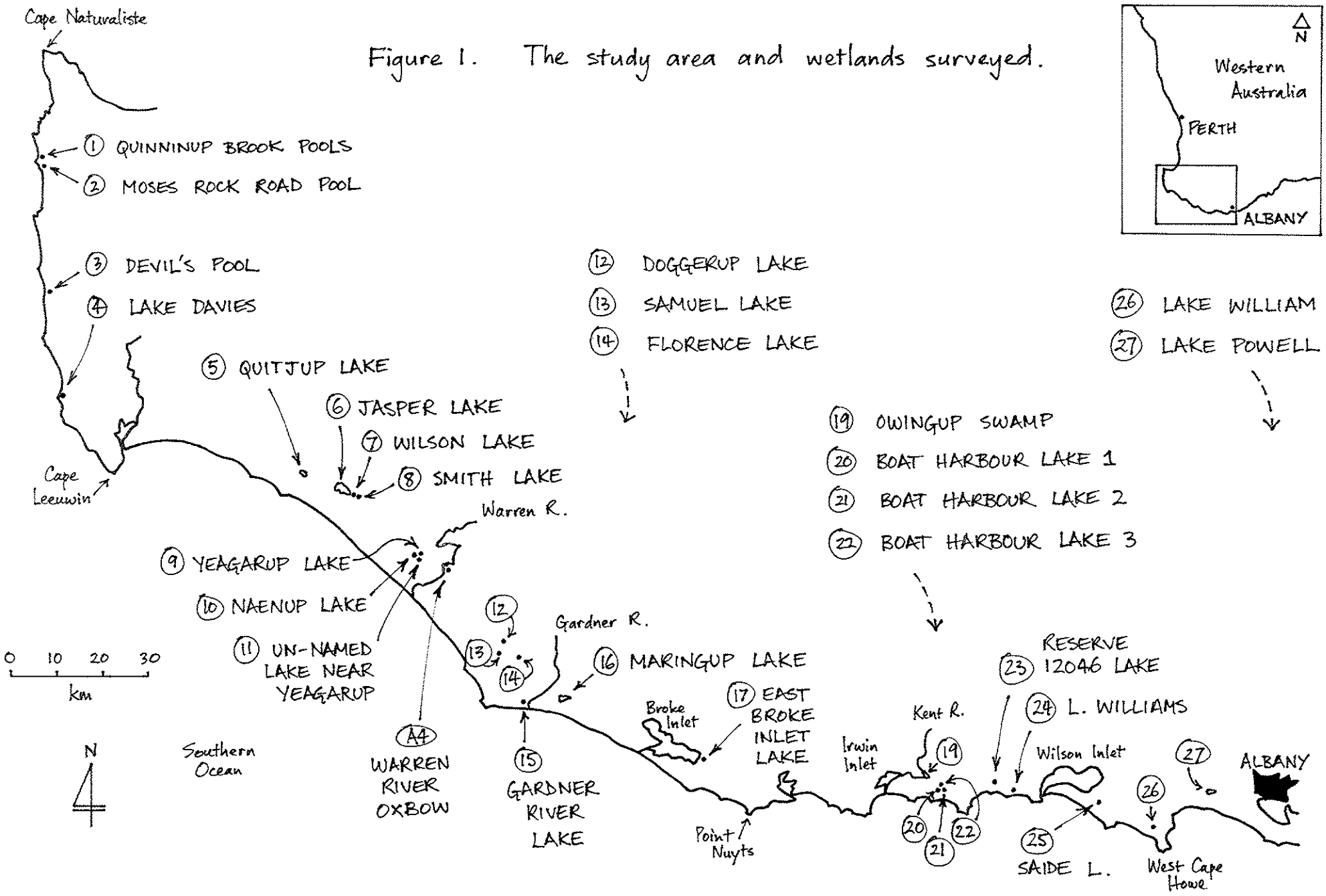
Objectives of the waterbird surveys were:

1. to conduct at least one comprehensive survey of each wetland, recording waterbird species present, number of individuals present, species currently breeding or having bred recently, number of nests, wetland vegetation communities used by each species and wetland salinity and (where possible) depth;

2. to search intensively for the more secretive species (e.g. bitterns, rails) that live in dense wetland vegetation; and

3. to present the results in unpublished report format, with detailed datasheets for each wetland and appropriate discussion.

Figure 1. The study area and wetlands surveyed.



## 2. METHODS

### 2.1 Summer 1991-2 Surveys

The waterbird surveys were conducted on a total of 20 days within the 40 day period from 3 December 1991 to 11 January 1992.

#### 2.1.1 Habitats and Coverage

Habitat types selected for use in describing waterbird usage of the wetlands surveyed were the wetland vegetation communities identified by Robinson (in prep.), as follows:

* Tall Sedges (usually dominated by *Baumea articulata*) - code: TS.
* Cedar Dense Low Forest (dominated by *Agonis juniperina*) - code: CF.
* *Agonis floribunda* Heath (Thicket) over Tall Sedges - code: AF.
* *Agonis linearifolia* Thicket - code: AL.
* *Astartea* Thicket - code: AT.
* Low Sedges (often dominated by *Baumea vaginalis* or *Leptocarpus* spp.) - code: LS.
* Paperbark Low Forest - code: PF.
* *Callistachys* Thicket - code CT.
* *Beaufortia* Heath - code: BH.
* *Kunzea* Thicket - code: KT.

In addition to the above, I identified two non-vegetated habitats:

* Open Water - code: OW.
* Bare Land (e.g. beach, sandspit, mudflat) - code: BL.

(These are included with the wetland vegetation communities in the tables of this report).

In the surveys, 100 per cent coverage of Open Water was attempted, using several shoreline viewing points and a boat. Larger areas were divided into survey sections and the results summed. Bare Land was covered concurrently with Open Water.

Inundated fringing vegetation was surveyed by selecting a number of sample areas. Sometimes Tall Sedges could be probed by boat. Extensive stands (particularly thickets) were surveyed by wading through where depth of water (up to ca. 70 cm) and firmness of lake-bed permitted, looking for birds that had been flushed and listening for birds calling.

At several sites, two waterbird surveys were conducted (2-3 weeks apart) because the first survey had been inadequate (coverage not comparable with coverage at other similar sites) due to time constraints or because there were nests to be re-visited to check breeding success, or prospects of finding nests that (due to bird behaviour) were suspected but not found in the first survey. Where surveys at one site extended over two or three consecutive days, they were considered as one survey and allowances were made in calculating waterbird numbers to minimise the risk of duplication.

As a guide for possible future surveys, information about coverage (e.g. total observation time, percentage of wetland area surveyed, whether or not a boat was used) was recorded on the original survey datasheets together with notes on access. Copies of Robinson's maps of wetland vegetation communities were attached and annotated with waterlines at the time of survey and survey routes.

Maximum lake depth was read from CALM gauges where these were present (Lakes Davies, Jasper and Powell). Water samples were collected from all sites and salinity (total soluble salts) of samples was measured by conductivity (TPS LC80 kit).

Summary datasheets for each site, with survey maps and photographs, are included in Appendix II. Original datasheets are held by CALM at the Woodvale Research Centre.

### 2.1.2 Waterbird Data

The bird species regarded in these surveys as waterbirds were as defined by Jaensch *et al.* (1988). They include the wetland dependent raptors and warblers and are listed in taxonomic order, with English and scientific names and datasheet codes, in Appendix I.

Methods used for finding, identifying and counting waterbirds also follow those of Jaensch *et al.* (1988).

Essentially, the best possible count of birds present, or calling but not seen, was obtained. An estimate was also made of the total population of each species by extrapolating for total area of suitable habitat.

Surveys were also conducted at night at as many of the wetlands as possible, to increase chances of finding secretive species such as bitterns by hearing their calls. Where the inundated vegetation was judged to be sufficiently extensive, tall and dense for use by the Little Bittern, vocal imitations of its `Advertising Call' (Jaensch 1988; Marchant and Higgins 1990) were given in the hope that any birds present would call back.

To improve chances of finding secretive crakes and rails, plans were made to trap them at several wetlands; relevant CALM permits were obtained. The method was to use fence-lines of steel flywire (ca. 25 cm high) that would direct crakes into steel-mesh box traps (door triggered by foot plate), in thickets and/or tall sedges where water was a few centimetres deep, i.e. a similar method to 'drift-line' trapping for small mammals on dry land.

Whenever a bird or nest was detected, the wetland vegetation community and estimated or measured depth of water at the point of detection was recorded.

Data on breeding activity were obtained opportunistically while searching for waterbird species and from intensive searches of wetland vegetation judged likely to be suitable for nests, based on experience. Typical nest sites of some of the secretive waterbird species are depicted in Figure 2.

Current breeding activity was defined using the same terms as Jaensch *et al.* (1988):

* e = eggs in the nest.
* yn = young in or beside the nest.
* DR = downy runners or ducklings sighted.

(In the tables of this report the term "brood" refers to "DR").

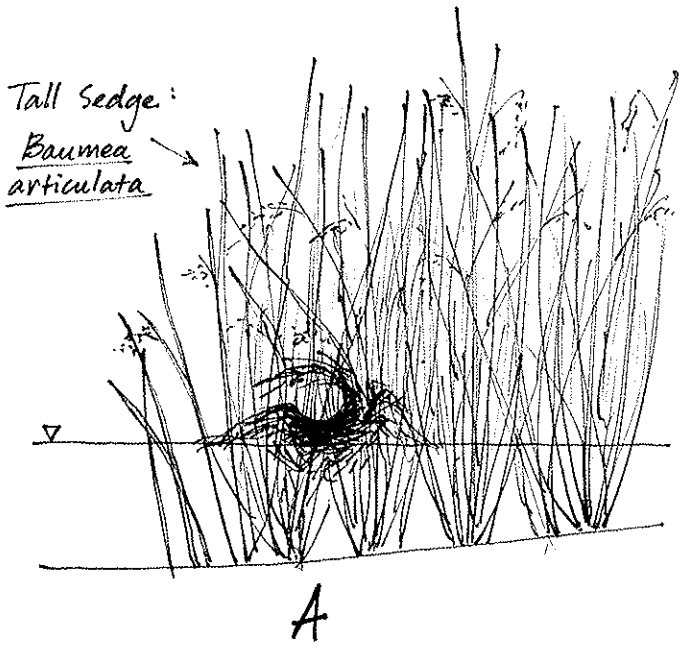
Earlier breeding activity, completed in a previous month or year, was recorded on the basis of those empty nests found which could be confidently identified to species. It was entered separately from current activity on the datasheets.

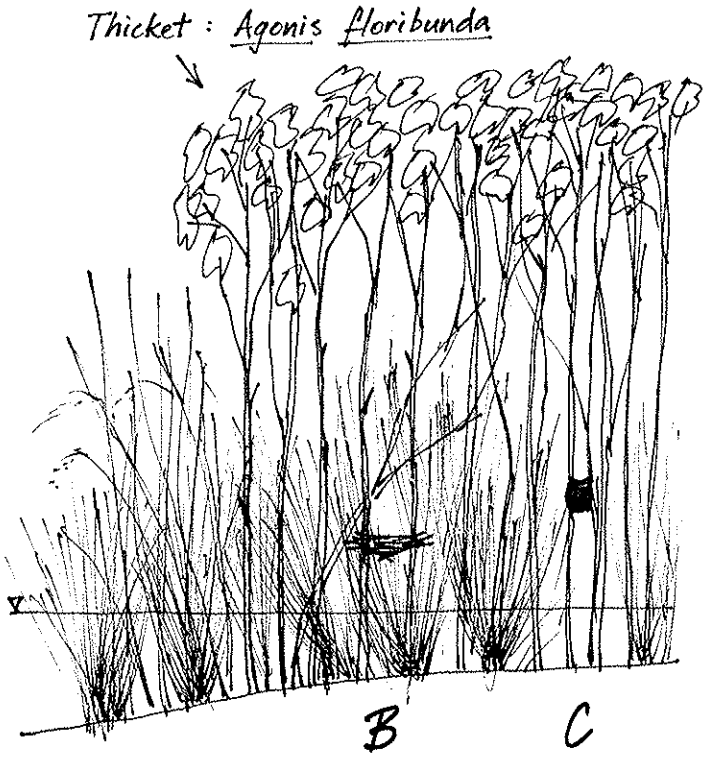
Given that only one or two surveys were possible at each wetland and all were in summer (which is past the main breeding season for many species: Halse and Jaensch 1989), use of the data was maximised by combining current and earlier breeding data in the presentation and analysis of results. That is, if a species had bred at the wetland earlier (i.e. an old nest was identified to species) but was not breeding in summer 1991-2, it was nevertheless included in the tally of species found breeding. Furthermore, if an old nest of a certain species was found but that species was not seen or heard, the species was nevertheless included in the total number of species recorded during the survey.

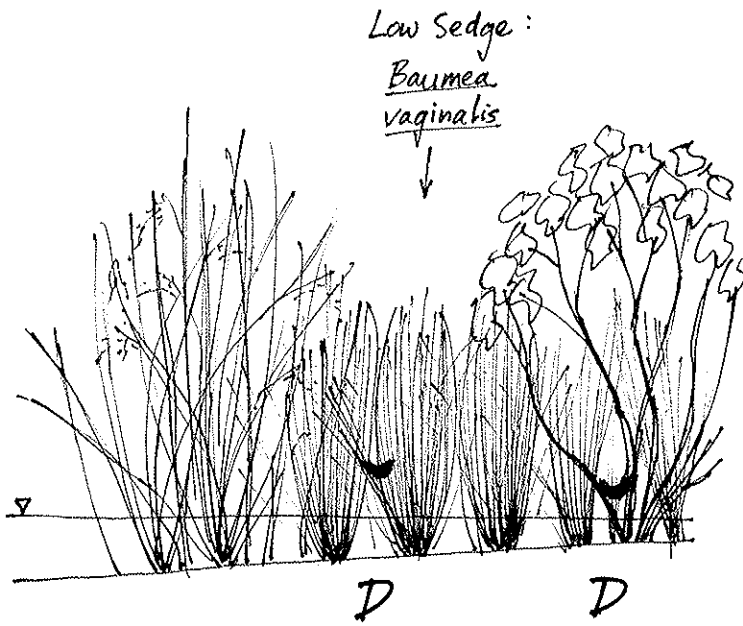
Other species thought to be present in dense wetland vegetation at the time of survey (e.g. because wetland conditions were suitable) were listed on the original datasheets (but not

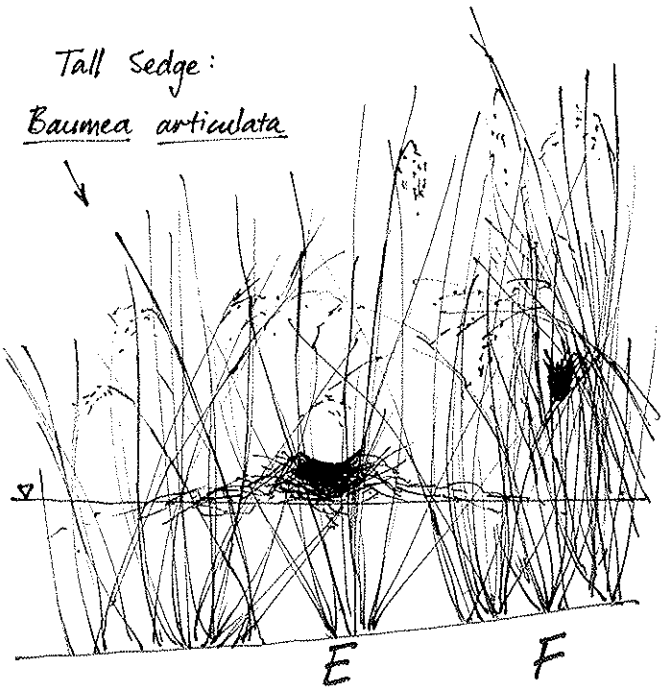
Figure 2.

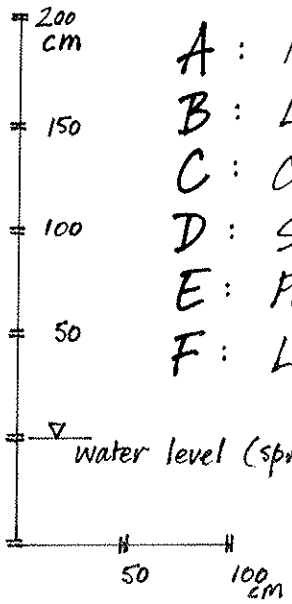
Common nest sites for waterbird species that breed in dense vegetation.




A: Musk Duck.
B: Little Bittern.
C: Clamorous Reed-Warbler.
D: Spotless Crake.
E: Purple Swamphen.
F: Little Grassbird.

included in results), for follow-up in possible future surveys. Nest sites were marked on the wetland map and photographs were taken of nests and nest sites (see Appendix II).

## 2.2 Data from Other Sources

In order to make the best possible assessment of the relative importance of each wetland for use by waterbirds, including comparison with other wetlands in south-western Australia, data from previous surveys were sought. Potential sources searched were:

a) data stored on CALM computer from surveys by the Royal Australasian Ornithologists Union (RAOU) of 603 wetlands in south-western Australia in the period July 1981 to June 1988 (results from 207 of these wetlands for 1981-5 are published in Jaensch *et al.* 1988);

b) Robinson (in prep.), who gives anecdotal observations of waterbirds seen during flora surveys from January to September 1991;

c) files held at the CALM Wildlife Research Centre, which contain some data from a variety of surveys conducted since 1970; and

d) original data listings, mostly on CALM computer, from the RAOU-CALM counts of swans, ducks and coots in south-western Australia in March 1986-91 and November 1988-91 (Jaensch and Vervest 1988b, 1988c; Halse *et al.* 1990, in press).

## 3. RESULTS

### 3.1 Summer 1991-2 Surveys

#### 3.1.1 Species, Numbers and Breeding

Summary data from the summer 1991-2 surveys are given in Table 1 (arranged by wetland) and Table 2 (arranged by species).

Considering all wetlands, the number of species recorded was 40 from a possible 120 known to occur in south-western Australia, and the number of species found breeding was 14 from a possible 63 known to breed in south-western Australia (Jaensch *et al.* 1988 and recent RAOU data).

The highest number of species recorded at any one wetland was 32 at Owingup Swamp. No species was recorded at Quinninup Brook Pools or East Broke Inlet Lake.

The highest number of species found breeding at any one wetland was six at each of Jasper Lake, Owingup Swamp and Saide Lake. No species was found breeding at each of ten wetlands.

The most widespread species, recorded at 19 wetlands, was the Pacific Black Duck, followed by the Spotless Crake (16) and Musk Duck and Little Grassbird (13). Ten species were each recorded at only one wetland.

No Spotless Crakes or other species were realized from trapping efforts, which were done only at Wilson and Yeagarup Lakes since few convenient and suitable trapping sites were found.

The most widespread breeding species, found breeding at seven wetlands, was the Purple Swamphen, followed by the Spotless Crake (6) and Clamorous Reed-Warbler and Little Grassbird (5).

One species that is declared under the Wildlife Conservation Act (1950, amended 1990) as `likely to become extinct, or is rare', the Australasian Bittern, was recorded in the surveys but only at Owingup Swamp (minimum of five birds) and no nests were found despite intensive searching.

One colonially breeding species, the Great Cormorant, was found breeding in the surveys but only at Gardner River Lake.

The surveys yielded a total of 87 nests, including old nests from earlier breeding activity, and six broods of young that were not associated with nests (Table 3). Nests of the Clamorous Reed-Warbler (24) and Purple Swamphen (15) were the most numerous. The 11 active nests were divided as follows: Australasian Grebe (1), Spotless Crake (2), Black-fronted Plover (1), Clamorous Reed-Warbler (5) and Little Grassbird (2). Australasian Grebes, Black Swans, Blue-billed Ducks and Purple Swamphens had broods.

Species recorded in the greatest variety of wetland vegetation communities were the Pacific Black Duck, Spotless Crake and Marsh Harrier, each occurring in six communities (though the harrier was only flying over three of those: Table 4). Species using the greatest variety of wetland vegetation communities for nest sites were the Spotless Crake (4 communities) and Clamorous Reed-Warbler and Little Grassbird (3).

Species that were recorded in highest numbers at any one wetland were the Australian Shelduck and Pacific Black Duck, each with 300 at Owingup Swamp on 21 December 1991, followed by Eurasian Coot (260) and Australasian Shoveler (110), both at Powell Lake on 11 January 1992.

Table 1. Number of surveys conducted, seasons covered, waterbird species recorded and breeding species recorded and highest number of individuals recorded at each of the wetlands surveyed in summer 1991-92 and similar data from earlier surveys ('other sources').

| W/L Code | Wetland (W/L) Name | Number of Surveys Conducted | | | Number of Seasons (d) Covered | | | Number of Waterbird Species (b) | | | Number of Breeding Species (c) | | | Highest No. of Individuals (e) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (a) | s | o | a | s | o | a | s | o | a | s | o | a | s | o | a |
| 1 | Quinninup Brook | 1 | 0 | 1 | 1 | - | 1 | 0 | - | 0 | 0 | - | 0 | 0 | - | 0 |
| 2 | Moses Rock | 1 | 0 | 1 | 1 | - | 1 | 1 | - | 1 | 1 | - | 1 | 2 | - | 2 |
| 3 | Devil's | 1 | 2 | 3 | 1 | 2 | 3 | $7^{2}$ | 2 | 7 | $2^{2}$ | 0 | 2 | 47 | 2 | 47 |
| 4 | Davies | 1 | 3 | 4 | 1 | 2 | 3 | $5^{1}$ | 3 | 6 | $3^{1}$ | 0 | 3 | 13 | 3 | 13 |
| 5 | Quitjup | 1 | 16 | 17 | 1 | 3 | 3 | 10 | 11 | 16 | $2^{2}$ | 0 | 2 | 47 | 102 | 102 |
| 6 | Jasper | 1 | 22 | 23 | 1 | 4 | 4 | $19^{1}$ | 14 | 22 | $6^{5}$ | 0 | 6 | 340 | 354 | 354 |
| 7 | Wilson | 1 | 7 | 8 | 1 | 2 | 3 | 8 | 0 | 8 | $1^{1}$ | 0 | 1 | 15 | 0 | 15 |
| 8 | Smith | 1 | 7 | 8 | 1 | 2 | 3 | 5 | 0 | 5 | 1 | 0 | 1 | 14 | 0 | 14 |
| 9 | Yeagarup | 1 | 8 | 9 | 1 | 2 | 3 | $3^{1}$ | 0 | 3 | $2^{2}$ | 0 | 2 | 3 | 0 | 3 |
| 10 | Naenup | 1 | 0 | 1 | 1 | - | 1 | 6 | - | 6 | 1 | - | 1 | 16 | - | 16 |
| 11 | un-named nr. 9 | 1 | 0 | 1 | 1 | - | 1 | 5 | - | 5 | 0 | - | 0 | 13 | - | 13 |
| 12 | Doggerup | 1 | 1 | 2 | 1 | 1 | 2 | 2 | 1 | 3 | 0 | 0 | 0 | 2 | 1 | 2 |
| 13 | Samuel | 1 | 7 | 8 | 1 | 2 | 3 | 3 | 2 | 5 | $1^{1}$ | 0 | 1 | 8 | 2 | 8 |
| 14 | Florence | 1 | 6 | 7 | 1 | 2 | 3 | 2 | 1 | 2 | 0 | 0 | 0 | 3 | 5 | 5 |
| 15 | Gardner River | 1 | 1 | 2 | 1 | 1 | 2 | 7 | 1 | 7 | $2^{2}$ | 1 | 2 | 16 | 11 | 16 |
| 16 | Maringup | 1 | 17 | 18 | 1 | 4 | 4 | 12 | 15 | 20 | $2^{1}$ | 1 | 2 | 92 | 1419 | 1419 |
| 17 | East Broke Inlet | 1 | 0 | 1 | 1 | - | 1 | 0 | - | 0 | 0 | - | 0 | 0 | - | 0 |
| 19 | Owingup | 2 | 15 | 17 | 1 | 4 | 4 | 32 | 33 | 39 | $6^{1}$ | 2 | 6 | 1180 | 1457 | 1457 |
| 20 | Boat Harbour 1 | 2 | 27 | 29 | 1 | 4 | 4 | 14 | 32 | 34 | 0 | 0 | 0 | 133 | 403 | 403 |
| 21 | Boat Harbour 2 | 1 | 1 | 2 | 1 | 1 | 2 | 3 | 1 | 4 | 1 | 1 | 2 | 13 | 2 | 13 |
| 22 | Boat Harbour 3 | 1 | 1 | 2 | 1 | 1 | 2 | 6 | 1 | 7 | 0 | 1 | 1 | 10 | 2 | 10 |
| 23 | Reserve 12046 | 2 | 1 | 3 | 1 | 1 | 2 | $6^{1}$ | 5 | 10 | $1^{1}$ | 0 | 1 | 16 | 70 | 70 |
| 24 | Williams | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 2 | 2 |
| 25 | Saide | 2 | 23 | 25 | 1 | 4 | 4 | 18 | 32 | 34 | $6^{2}$ | 2 | 7 | 256 | 1132 | 1132 |
| 26 | William | 1 | 0 | 1 | 1 | - | 1 | 1 | - | 1 | 0 | - | 0 | 4 | - | 4 |
| 27 | Powell | 1 | 68 | 69 | 1 | 4 | 4 | 25 | 54 | 55 | $4^{4}$ | 12 | 13 | 766 | 4417 | 4417 |
| A4 | Warren Oxbow | 1 | 0 | 1 | 1 | - | 1 | 3 | - | 3 | 0 | - | 0 | 8 | - | 8 |

(a) Source of data: "s" = summer 1991-2 surveys; "o" = other sources; "a" = all surveys.

(b) Superscript in SPECIES (s) column indicates number of species not recorded but old nests found in summer 1991-2 surveys (included in the main figure).

(c) Superscript in BREEDING SPECIES (s) column indicates number of species not found breeding but old nests found in summer 1991-92 surveys (included in the main figure).

(d) "Seasons" are spring, summer, autumn and winter.

(e) "Highest number of individuals" is the highest number of waterbirds recorded at that wetland in any one survey.

Table 2. Highest number of individuals of each waterbird species recorded in summer 1991-92 surveys at each of the 27 wetlands and wetlands in which breeding was recorded (a).



| Species Name | Species Code | Wetlands (b) 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | A4 | (c) No Wl | (d) No Br | (e) High Indv |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Great Crested Grebe | GCGb | | | | | | 3 | | | | | | | | | | 2 | | | | | | | | | | | | 2 | 0 | 3 |
| Hoary-headed Grebe | HhGb | | | 2 | 1* | | | | | | | | | | | | | | 15 | | | | | | 50 | | 27 | | 5 | 1 | 50 |
| Australasian Grebe | AuGb | | 2* | | 6* | | | | | | | | | | | | | | | | | | | | | | | | 2 | 2 | 6 |
| Australian Pelican | APel | | | | | | 1 | | | | | | | | | | | | 5 | | | | | | 2 | | | | 3 | 0 | 5 |
| Great Cormorant | GreC | | | | | 4 | | 6 | | | | | | 5 | | 6* | | | 4 | 1 | | | 1 | | | | 1 | 2 | 9 | 1 | 6 |
| Little Black Cormorant | LiBC | | | | | 1 | 75 | | | | | | | | | | 1 | | 100 | | | 2 | 3 | | 1 | | 2 | | 8 | 0 | 100 |
| Little Pied Cormorant | LPiC | | | | | | 11 | | | | | | | | 1 | | 6 | | 8 | 1 | | 2 | 2 | | | | 3 | | 8 | 0 | 11 |
| Darter | Dart | | | | | | | | | | | | | | | | 4* | | 2 | | | | | | | | | | 2 | 1 | 4 |
| White-faced Heron | WfHn | | | 1 | | | 6 | 1 | | | | | 1 | | | 4 | | | 24 | 3 | | | | | 5 | | 7 | | 9 | 0 | 24 |
| Great Egret | GrtE | | | | | | | | | | | | | | | | | | | | | | | | | | 3 | | 1 | 0 | 3 |
| Rufous Night Heron | RNHn | | | | | | | | | | | | | | | | | | 3 | | | | | | | | 1 | | 2 | 0 | 3 |
| Little Bittern | LitB | | | | | 1 | 1* | | | | | | | | | | | | | | | | | | 1* | | | | 3 | 2 | 1 |
| Australasian Bittern | AusB | | | | | | | | | | | | | | | | | | 5 | | | | | | | | | | 1 | 0 | 5 |
| Sacred Ibis | SacI | | | | | | | | | | | | | | | | | | 80 | | | | | | 1 | | | | 2 | 0 | 80 |
| Yellow-billed Spoonbill | YbSl | | | | | | | | | | | | | | | | | | 7 | 4 | | | | | | | 3 | | 3 | 0 | 7 |
| Black Swan | Swan | | | | | 2 | 1 | | | | | | | | | 1 | 7 | | 27* | 80 | 4 | | | | 71* | | 3 | | 9 | 2 | 80 |
| Australian Shelduck | Shel | | | | | | 70 | | | | | | | | | | | | 300 | | | | | | 5 | | 215 | | 4 | 0 | 300 |
| Pacific Black Duck | PaBD | | | 33 | 3 | 10 | 123 | 1 | | 2 | 4 | 9 | 1 | | 2 | 1 | 50 | | 300 | 8 | | | 14 | 1 | 123 | | 60 | 4 | 19 | 0 | 300 |
| Grey Teal | GyTl | | | | | | | | | | | | | | | | | | 2 | | | | | | | | 2 | | 2 | 0 | 2 |
| Australasian Shoveler | Shov | | | | | | | | | | | | | | | | | | 7 | | | | | | 2 | | 110 | | 3 | 0 | 110 |
| Pink-eared Duck | PeaD | | | | | | | | | | | | | | | | | | | | | | | | | | 18 | | 1 | 0 | 18 |
| Hardhead | Hard | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | 1 | 0 | 1 |
| Maned Duck | ManD | | | 8 | | | 1 | | | | | | | | | 1 | 5 | | 1 | | | | | | | | 6 | 2 | 7 | 0 | 8 |
| Blue-billed Duck | BbiD | | | | | | | | | | | | | | | | | | 1 | | | | | | 14* | | 6 | | 3 | 1 | 14 |
| Musk Duck | MusD | | | | | | 8* | 2* | 1 | | 1 | | | 1 | | | 10 | | 20* | 7 | 5 | 1 | 2 | | 18 | | 6 | | 13 | 3 | 20 |
| Marsh Harrier | MaHa | | | | | 2 | 2 | 1 | 2 | | 1 | 1 | | | | | 1 | | 4 | 2 | | | | | 3 | 4 | 4 | | 12 | 0 | 4 |
| Osprey | Ospy | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | 1 | 0 | 1 |
| Spotless Crake | SpCk | | | 1* | 1* | 7* | 5* | 2 | 2 | 1* | 4 | 1 | | | | 3 | 2 | | 19* | 13 | | 1 | | | 5 | | 17 | | 16 | 6 | 19 |
| Purple Swamphen | PuSn | | | 1* | | 2* | 2* | | 2* | | 3* | 1 | | | | | 2 | | 6* | | | 1 | 1* | | 3 | | 1 | | 12 | 7 | 6 |
| Eurasian Coot | Coot | | | 3 | | | 1 | | | | | | | | | | | | 200 | | | | | | 60* | | 260* | | 5 | 2 | 260 |
| Black-fronted Plover | BfoP | | | | | | | | | | | | | | | | | | 4* | 1 | | | | | | | | | 2 | 1 | 4 |

Table 2 (cont'd)



| Species Name | Species Code | Wetlands (b) 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | A4 | (c) No Wl | (d) No Br | (e) High Indv |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Black-winged Stilt | BwSt | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | 1 | 0 | 1 |
| Wood Sandpiper | WooS | | | | | | | | | | | | | | | | | | 3 | | | | | | | | | | 1 | 0 | 3 |
| Greenshank | Gank | | | | | | 2 | | | | | | | | | | | | 6 | | | | | | | | 1 | | 3 | 0 | 6 |
| Red-necked Stint | RenS | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | 1 | 0 | 1 |
| Silver Gull | SiGl | | | | 3 | | 15 | | | | | | | | | | | | | | | | | | | | 1 | | 3 | 0 | 15 |
| Whiskered Tern | WhiT | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | 1 | 0 | 6 |
| Caspian Tern | CasT | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | 1 | 0 | 1 |
| Clamorous Reed-Warbler | CReW | | | | | 4 | 9* | 1 | | | 3 | | | | | 1* | | | 6 | 1 | 4* | | | | 5* | | 7* | | 10 | 5 | 9 |
| Little Grassbird | LiGd | | | | | 14 | 5* | 1 | 1 | 1* | | 1 | | 2 | | | 2 | | 21* | 6 | | 3 | | | 1* | | 2* | | 13 | 5 | 21 |

Notes:

(a) An asterisk indicates species was found breeding (includes old nests - see text under METHODS).
(b) Wetland codes are given in Table 1.
(c) No Wl = number of wetlands in which species was recorded.
(d) No Br = number of wetlands in which species was found breeding.
(e) High Indv = highest number of individuals recorded in any wetland.

1. If an old nest was found but no birds of that species were recorded in any survey, the entry in this table is given as one (1) bird.
2. Unidentified nests are not included in breeding data in this table although two were included in totals in Table 1: unidentified crake nest at site 13 and unidentified cormorant nest at site 16.
3. An unidentified grebe was seen at site 20.

Table 3 Number of nests (a) recorded in each wetland vegetation community (b) and number of broods observed in the summer 1991-92 surveys.

| Species | Wetland Vegetation Community | | | | | | | Total Nests | Number of Broods (c) |
|---|---|---|---|---|---|---|---|---|---|
| | TS | LS | AF | AL | AT | CF | BL | | |
| Hoary-headed Grebe | | $1^{1}$ | | | | | | 1 | 0 |
| Australasian Grebe | 1 | 1* | | | | | | 2 | 1 |
| Great Cormorant | | | | | | $16^{16}$+ | | 16 | 0 |
| Darter | | | | | | $2^{1}$ | | 2 | 0 |
| Little Bittern | $1^{1}$ | | $1^{1}$ | | | | | 2 | 0 |
| Black Swan | $3^{3}$ | | | | | | | 3 | 2 |
| Blue-billed Duck | | | | | | | | 0 | 1 |
| Musk Duck | $2^{2}$ | | | | | $2^{2}$ | | 4 | 0 |
| Spotless Crake | $3^{2}$ | 1 | $1^{1}$ | $3^{3}$ | $1^{1}$ | | | 9 | 0 |
| Purple Swamphen | $10^{10}$ | | $5^{5}$ | | | | | 15 | 2 |
| Eurasian Coot | $2^{2}$ | | | | | | | 2 | 0 |
| Black-fronted Plover | | | | | | | 1 | 1 | 0 |
| Clamorous Reed-Warbler | $17^{12}$ | | $6^{5}$ | | | $1^{1}$ | | 24 | 0 |
| Little Grassbird | $4^{1}$ | | | $2^{2}$ | | | | 6 | 0 |
| Totals | 43 | 3 | 13 | 5 | 1 | 21 | 1 | 87 | 6 |

(a) Numbers in superscript refer to old nests, e.g. $3^{2}$ indicates 3 nests found, two of them old.
(b) See Section 2.1.1 for meaning of wetland vegetation communities.
(c) Number of broods of young away from the nest, i.e. DR category (Jaensch *et al.* 1988).

Notes:
* this nest probably was that in which the brood recorded at the same wetland was raised.
\+ this was the total from three small colonies at the one wetland.

Table 4. Occurrence of waterbirds in the various wetland vegetation communities, summer 1991-2.

| Species Code | Wetland vegetation community (WVC) | | | | | | | | Total number of WVCs used |
|---|---|---|---|---|---|---|---|---|---|
| | TS | LS | AF | AL | AT | CF | BL | OW | |
| GCGb | | | | | | | | * | 1 |
| HhGb | | * | | | | | | * | 2 |
| AuGb | * | * | | | | | | * | 3 |
| APel | | | | | | | * | * | 2 |
| GreC | | | | | | * | | * | 2 |
| LiBC | | | | | | * | * | * | 3 |
| LPiC | | | | | | * | | * | 2 |
| Dart | | | | | | * | | | 1 |
| WfHn | * | | (*) | | | * | * | (*) | 5 |
| GrtE | | | | | | | * | | 1 |
| RNHn | (*) | | | | | (*) | | | 2 |
| LitB | * | | * | | | | | | 2 |
| AusB | * | * | | | | | | | 2 |
| SacI | | | | | | * | * | | 2 |
| YbSl | | | | | | | * | * | 2 |
| Swan | * | | | | | | | * | 2 |
| Shel | * | | | | | | * | * | 3 |
| PaBD | * | * | | | * | * | * | * | 6 |
| GyTl | | | | | | | * | * | 2 |
| Shov | * | | | | | | * | * | 3 |
| PeaD | | | | | | | * | | 1 |
| Hard | | | | | | | | * | 1 |
| ManD | | | | | * | * | * | * | 4 |
| BbiD | | | | | | | | * | 1 |
| MusD | * | | | | | * | | * | 3 |
| MaHa | * | * | (*) | (*) | | * | | (*) | 6 |
| Ospy | | | | | | * | | | 1 |
| SpCk | * | * | * | * | * | * | | | 6 |
| PuSn | * | * | * | * | | | * | | 5 |
| Coot | * | | | | * | | | * | 3 |
| BfoP | | | | | | | * | (*) | 2 |
| BwSt | | | | | | | | * | 1 |
| WooS | | | | | | | * | | 1 |
| Gank | | | | | | | * | | 1 |
| RenS | | | | | | | * | | 1 |
| SiGl | | | | | | | | * | 1 |
| WhiT | | | | | | | | (*) | 1 |
| CasT | | | | | | | * | | 1 |
| CReW | * | * | * | | | * | | | 4 |
| LiGd | * | * | * | * | | * | | | 5 |
| Totals | 16 | 9 | 7 | 4 | 4 | 15 | 18 | 24 | |

Notes:

1. Where a nest was found but no birds recorded (in that habitat⊕ or wetland), the habitat⊕ in which the nest was found was entered in this table.(⊕ WVC)

2. Three species (GreC, LiBC, Dart) were also recorded roosting in jarrah woodland fringing a wetland.

3. (*) indicates the species was only recorded flying over that habitat.

The most abundant species was the Pacific Black Duck, with a minimum population of 749 individuals in the 27 wetlands surveyed, followed by Australian Shelduck (590) and Eurasian Coot (524). (The population was calculated by summing the number recorded at each wetland (Table 2), assuming no movement of birds between wetlands or that movements cancelled each other during the 40 day study period.)

The highest number of individuals (total including all species) counted at any one wetland was 1 180 birds at Owingup Swamp on 21 December 1991.

### 3.1.2 Rankings and Relative Importance of Wetlands

The wetlands were ranked according to number of species recorded, number of species found breeding and highest number of individuals counted (Table 5). In each case, Owingup Swamp ranked first or equal first and was joined by Lakes Powell, Jasper and Saide in the top four. The rankings by species and by individuals were more similar to each other than to rankings by breeding species.

Using a simple scoring system that combined the three rankings of Table 5, the wetlands were placed in order of relative importance (Table 6). On this basis, the most important wetland was Owingup Swamp, followed by Lakes Jasper, Powell, Saide and Maringup.

## 3.2 Data from Other Sources

Summary data from other sources for 20 of the 27 wetlands, are given in Table 1 and Table 7 (original material is in Appendix III). They were derived from 234 surveys, including 68 at Powell Lake and more than 20 at each of Lakes Jasper, Boat Harbour 1 and Saide.

The Whiskered Tern was the only species recorded in the 27 wetlands for the first time during the summer 1991-2 surveys. Added to the 61 species recorded in previous surveys, the total from all surveys thus now stands at 62. Most of the 22 species that were recorded earlier but not in summer 1991-2 were rails (5 species) and shorebirds (12).

The total number of species found breeding in the 27 wetlands after all surveys now stands at 19. In summer 1991-2, five species were found breeding in the 27 wetlands for the first time: Hoary-headed Grebe, Australasian Grebe, Little Bittern, Spotless Crake and Black-fronted Plover. Five species were found breeding in previous surveys but not in summer 1991-2: Australian Shelduck, Pacific Black Duck, Australasian Shoveler, Marsh Harrier and Black-winged Stilt.

Considering data from all surveys, the highest number of species recorded at any one wetland was 55 at Powell Lake. One species, the Rufous Night Heron, was first recorded at Powell Lake in summer 1991-2. Species recorded at one or more of the other 26 wetlands but not at Powell included the Darter and Long-toed Stint.

Powell Lake also supported by far the highest number of breeding species (13). These 13 included four not recorded breeding at any of the other 26 wetlands in any survey: Australasian Shoveler, Pacific Black Duck, Marsh Harrier and Black-winged Stilt.

Inclusion of data from other sources did not significantly alter the lists of most widespread occurring and most widespread breeding species (cf. Section 3.1.2.). However, the species recorded in highest numbers changed to Grey Teal (1 800, March 1988) followed by Red-necked Avocet (1 560, January 1986), both at Powell Lake. The most abundant species changed to Eurasian Coot, with a minimum population of 3 217 birds in the 27 wetlands.

There were additional records of the `declared rare' species Australasian Bittern in earlier surveys:

Table 5. Rankings of wetlands by number of species recorded, number of species found breeding and highest number of individuals recorded in any summer 1991-2 survey.

| a) RANKING BY NUMBER OF SPECIES RECORDED | | | b) RANKING BY NUMBER OF SPECIES FOUND BREEDING | | | c) RANKING BY HIGHEST NUMBER OF INDIVIDUALS BREEDING RECORDED IN ANY SURVEY | | |
|---|---|---|---|---|---|---|---|---|
| Rank | Wetland | No. of Species | Rank | Wetland | No. of Species Found Breeding | Rank | Wetland | Highest No. of Individuals |
| 1 | **Owingup** | 32 | =1 | **Jasper** | 6 | 1 | **Owingup** | 1180 |
| 2 | **Powell** | 25 | =1 | **Owingup** | 6 | 2 | **Powell** | 766 |
| 3 | **Jasper** | 19 | =1 | **Saide** | 6 | 3 | **Jasper** | 340 |
| 4 | **Saide** | 18 | 4 | **Powell** | 4 | 4 | **Saide** | 256 |
| 5 | **Boat Harbour 1** | 14 | 5 | Davies | 3 | 5 | **Boat Harbour 1** | 133 |
| 6 | **Maringup** | 12 | =6 | **Devil's** | 2 | 6 | **Maringup** | 92 |
| 7 | **Quitjup** | 10 | =6 | **Quitjup** | 2 | =7 | **Devil's** | 47 |
| 8 | **Wilson** | 8 | =6 | Yeagarup | 2 | =7 | **Quitjup** | 47 |
| =9 | **Devil's** | 7 | =6 | **Gardner River** | 2 | =9 | **Naenup** | 16 |
| =9 | **Gardner River** | 7 | =6 | **Maringup** | 2 | =9 | **Gardner River** | 16 |
| =11 | **Naenup** | 6 | =11 | Moses Rock | 1 | =9 | **Reserve 12046** | 16 |
| =11 | Boat Harbour 3 | 6 | =11 | **Wilson** | 1 | 12 | **Wilson** | 15 |
| =11 | **Reserve 12046** | 6 | =11 | Smith | 1 | 13 | Smith | 14 |
| =14 | Davies | 5 | =11 | **Naenup** | 1 | =14 | Davies | 13 |
| =14 | Smith | 5 | =11 | Samuel | 1 | =14 | Un-named (Site 11) | 13 |
| =14 | Un-named (Site 11) | 5 | =11 | Boat Harbour 2 | 1 | =14 | Boat Harbour 2 | 13 |
| =17 | Yeagarup | 3 | =11 | **Reserve 12046** | 1 | 17 | Boat Harbour 3 | 10 |
| =17 | Samuel | 3 | =18 | Quinninup Brook | 0 | =18 | Samuel | 8 |
| =17 | Boat Harbour 2 | 3 | =18 | Un-named (Site 11) | 0 | =18 | Warren Oxbow | 8 |
| =17 | Warren Oxbow | 3 | =18 | Doggerup | 0 | 20 | William | 4 |
| =21 | Doggerup | 2 | =18 | Florence | 0 | =21 | Yeagarup | 3 |
| =21 | Florence | 2 | =18 | East Broke Inlet | 0 | =21 | Florence | 3 |
| =23 | Moses Rock | 1 | =18 | **Boat Harbour 1** | 0 | =23 | Moses Rock | 2 |
| =23 | Williams | 1 | =18 | Boat Harbour 3 | 0 | =23 | Doggerup | 2 |
| =23 | William | 1 | =18 | Williams | 0 | 25 | Williams | 1 |
| =26 | Quinninup Brook | 0 | =18 | William | 0 | =26 | Quinninup Brook | 0 |
| =26 | East Broke Inlet | 0 | =18 | Warren Oxbow | 0 | =26 | East Broke Inlet | 0 |

Note: Wetlands in bold face are those featured in Table 6, i.e. the 12 most important wetlands based on combination of the three rankings above.

Table 6. Relative importance of wetlands based on ranks from summer 1991-2 data.

| Order of Relative Importance | Wetland | Scores from : | | | Total Score |
|---|---|---|---|---|---|
| | | rank by species | rank by breeding | rank by individuals | |
| 1 | Owingup | 27 | 27 | 27 | 81 |
| 2 | Jasper | 25 | 27 | 25 | 77 |
| 3 | Powell | 26 | 24 | 26 | 76 |
| 4 | Saide | 24 | 27 | 24 | 75 |
| 5 | Maringup | 22 | 22 | 22 | 66 |
| 6 | Quitjup | 21 | 22 | 21 | 64 |
| 7 | Devil's | 19 | 22 | 21 | 62 |
| 8 | Gardner River | 19 | 22 | 19 | 60 |
| 9 | Boat Harbour 1 | 23 | 10 | 23 | 56 |
| =10 | Wilson | 20 | 17 | 16 | 53 |
| =10 | Naenup | 17 | 17 | 19 | 53 |
| =10 | Reserve 12046 | 17 | 17 | 19 | 53 |

Scores are derived from the rankings in Table 5. Scores were calculated as follows:

| rank | (gives) | score |
|---|---|---|
| 1 | | 27 |
| 2 | | 26 |
| 3 | | 25 |
| \| | | \| |
| 26 | | 2 |
| 27 | | 1 |

Note that wetlands with equal rank were given the same score, e.g. wetlands ranking equal 6 for breeding species each scored 22 points.

Table 7. Highest number of individuals of each waterbird species recorded in any survey at each of the 27 wetlands and wetlands in which breeding was recorded (a).



| Species | | Wetland (b) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | A4 | (c) No Wl | (d) No Br | (e) High Indv |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Number of surveys | 1 | 1 | 3 | 4 | 17 | 23 | 8 | 8 | 9 | 1 | 1 | 2 | 8 | 7 | 2 | 18 | 1 | 17 | 29 | 2 | 2 | 3 | 2 | 25 | 1 | 69 | 1 | | | |
| Great Crested Grebe | GCGb | | | | | | | 3 | | | | | | | | | | 2 | | | | | | | | | | 2 | | 3 | 0 | 3 |
| Hoary-headed Grebe | HhGb | | | | 2 | 1* | | | | | | | | | | | | 20 | | 55 | | | | 8 | | 111 | | 140 | | 7 | 1 | 140 |
| Australasian Grebe | AuGb | | 2* | | | 6* | | 7 | | | | | | | | | | | | | | | | | | 11 | | 119 | | 5 | 2 | 119 |
| Australian Pelican | APel | | | | | | | 1 | | | | | | | | | | | | 6 | 8 | | | | | 7 | | 8 | | 5 | 0 | 8 |
| Great Cormorant | GreC | | | | | | 4 | | 6 | | | | | | 5 | | 11* | 1 | | 4 | 1 | | | 1 | | | | 3 | 2 | 10 | 1 | 11 |
| Pied Cormorant | PieC | | | | | | | | | | | | | | | | | | | 4 | | | | | | | | | | 1 | 0 | 4 |
| Little Black Cormorant | LiBC | | | | | | 25 | 200 | | | | | | | | | | 1 | | 100 | 1 | | 2 | 3 | | 18 | | 97 | | 9 | 0 | 200 |
| Little Pied Cormorant | LPiC | | | | | | 1 | 20 | | | | | | | 1 | 1 | | 6 | | 8 | 3 | | 2 | 2 | | 41 | | 8 | | 11 | 0 | 41 |
| Darter | Dart | | | | | | 3 | | | | | | | | | | | 4* | | 3 | | | | | | | | | | 3 | 1 | 4 |
| White-faced Heron | WfHn | | | | 1 | | 6 | 8 | 1 | | | | | 1 | | | 4 | 1 | | 24 | 30 | | | | | 50 | | 28* | | 11 | 0 | 50 |
| Great Egret | GrtE | | | | | | | | | | | | | | | | | | | 5 | 2 | | | | | 14 | | 3 | | 4 | 0 | 14 |
| Cattle Egret | CatE | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | 1 | 0 | 1 |
| Rufous Night Heron | RNHn | | | | | | | | | | | | | | | | | | | 3 | | | | | | 3 | | 1 | | 3 | 0 | 3 |
| Little Bittern | LitB | | | | | | 1 | 1* | | | | | | | | | | | | | | | | | | 1* | | 1 | | 4 | 2 | 1 |
| Australasian Bittern | AusB | | | | | | | | | | | | | | | | | | | 5 | 3 | | | | | 1 | | 3 | | 4 | 0 | 5 |
| Sacred Ibis | SacI | | | | | | | | | | | | | | | | | | | 80 | 6 | | | | | 9 | | 9 | | 4 | 0 | 80 |
| Straw-necked Ibis | SnkI | | | | | | | | | | | | | | | | | | | 3 | 9 | | | | | 42 | | 12 | | 4 | 0 | 42 |
| Yellow-billed Spoonbill | YbSl | | | | | | | | | | | | | | | | | | | 24 | 4 | | | | | 3 | | 18 | | 4 | 0 | 24 |
| Black Swan | Swan | | | | | | 2 | 3 | | | | | | | | | 1 | 7 | | 88* | 162 | 4 | 2* | 23 | | 200* | | 323* | | 11 | 4 | 323 |
| Australian shelduck | Shel | | | | | | 100 | 70 | | | | | | | | | | 10 | | 492 | 21 | | | | | 120* | | 719* | | 7 | 2 | 719 |
| Pacific Black Duck | PaBD | | | | 33 | 3 | 13 | 123 | 1 | | 2 | 4 | 9 | 1 | | 5 | 1 | 200 | | 300 | 100 | | | 14 | 2 | 400 | | 1411* | 4 | 19 | 1 | 1411 |
| Grey Teal | GyTl | | | | | | 8 | 1 | | | | | | | | | | 800 | | 27 | 40 | | | 7 | | 198 | | 1800 | | 8 | 0 | 1800 |
| Chestnut Teal | ChTl | | | | | | | | | | | | | | | | | | | | | | | | | | | 32 | | 1 | 0 | 32 |
| Australasian Shoveler | Shov | | | | | | | | | | | | | | | | | | | 10 | 50 | | | | | 20 | | 500* | | 4 | 1 | 500 |
| Pink-eared Duck | PeaD | | | | | | | | | | | | | | | | | | | | | | | | | | | 155 | | 1 | 0 | 155 |
| Hardhead | Hard | | | | | | | | | | | | | | | | | 1 | | 1 | | | | | | | | 250 | | 3 | 0 | 250 |
| Maned Duck | ManD | | | | 8 | | | 1 | | | | | | | | | 1 | 5 | | 2 | | | | | | 2 | | 30 | 2 | 8 | 0 | 30 |
| Blue-billed Duck | BbiD | | | | | | | | | | | | | | | | | 4 | | 6 | | | | | | 14* | | 140* | | 4 | 2 | 140 |
| Musk Duck | MusD | | | | | | 2 | 32* | 2* | 1 | | 1 | | 1 | 1 | | | 28 | | 20* | 15 | 5 | 1 | 2 | | 18 | | 46* | | 15 | 4 | 46 |
| White-bellied Sea-Eagle | WbSE | | | | | | | 1 | | | | | | | | | | | | | 1 | | | | | | | | | 2 | 0 | 1 |
| Marsh Harrier | MaHa | | | | | | 2 | 2 | 1 | 2 | | 1 | 1 | | | | | 3 | | 4 | 2 | | | | | 3 | 4 | 4* | | 12 | 1 | 4 |
| Osprey | Ospy | | | | | | | | | | | | | | | | | | | 1 | | | | | | 2 | | | | 2 | 0 | 2 |
| Buff-banded Rail | BbaR | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | 1 | 0 | 2 |

Table 7 (cont'd)



| Species | | Wetland (b) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | A4 | (c) | (d) | (e) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Number of surveys | 1 | 1 | 3 | 4 | 17 | 23 | 8 | 8 | 9 | 1 | 1 | 2 | 8 | 7 | 2 | 18 | 1 | 17 | 29 | 2 | 2 | 3 | 2 | 25 | 1 | 69 | 1 | No Wl | No Br | High Indv |
| Baillon's Crake | BaCk | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | 1 | 0 | 1 |
| Australian Crake | AuCk | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | 1 | 0 | 1 |
| Spotless Crake | SpCk | | | | 1* | 1* | 7* | 5* | 2 | 2 | 1* | 4 | 1 | | | | 3 | 2 | | 19* | 13 | | 1 | | | 5 | | 25 | | 16 | 6 | 25 |
| Black-tailed Native-hen | BtNh | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | 1 | 0 | 2 |
| Dusky Moorhen | DuMo | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | 1 | 0 | 6 |
| Purple Swamphen | PuSn | | | | 1* | | 2* | 2* | | 2* | | 3* | 1 | | 1 | | | 2 | | 6* | 11 | 2* | 1 | 1* | | 12 | | 14 | | 15 | 8 | 14 |
| Eurasian Coot | Coot | | | | 3 | 1 | | 2 | | | | | | | | | | 1320 | | 1200 | 30 | | | 30 | | 150* | | 481* | | 9 | 2 | 1320 |
| Pied Oystercatcher | PiOy | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | 1 | 0 | 2 |
| Red-kneed Dotterel | RkDo | | | | | | | | | | | | | | | | | | | | | | | | | | | 7 | | 1 | 0 | 7 |
| Red-capped Plover | RcaP | | | | | | | | | | | | | | | | | | | | 40 | | | | | | | 159 | | 2 | 0 | 159 |
| Black-fronted Plover | BfoP | | | | | | | | | | | | | | | | | | | 26* | 4 | | | | | 2 | | 85 | | 4 | 1 | 85 |
| Black-winged Stilt | BwSt | | | | | | | | | | | | | | | | | | | 2 | 12 | | | | | 130 | | 111* | | 4 | 1 | 130 |
| Banded Stilt | BaSt | | | | | | | | | | | | | | | | | | | | | | | | | 180 | | 212 | | 2 | 0 | 212 |
| Red-necked Avocet | RnAv | | | | | | | | | | | | | | | | | | | | 150 | | | | | | | 1560 | | 2 | 0 | 1560 |
| Wood Sanpiper | WooS | | | | | | | | | | | | | | | | | | | 3 | | | | | | 1 | | 1 | | 3 | 0 | 3 |
| Grey-tailed Tattler | GtaT | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | 1 | 0 | 2 |
| Greenshank | Gank | | | | | | | 2 | | | | | | | | | | | | 6 | 6 | | | | | 150 | | 26 | | 5 | 0 | 150 |
| Marsh Sandpiper | MarS | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | 1 | 0 | 1 |
| Sharp-tailed Sandpiepr | ShtS | | | | | | | | | | | | | | | | | | | | | | | | | | | 7 | | 1 | 0 | 7 |
| Pectoral Sandpiper | PecS | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | 1 | 0 | 2 |
| Red-necked Stint | RenS | | | | | | | | | | | | | | | | | | | 1 | 200 | | | | | | | 460 | | 3 | 0 | 460 |
| Long-toed Stint | LotS | | | | | | | | | | | | | | | | | | | 7 | | | | | | | | | | 1 | 0 | 7 |
| Curlew Sandpiper | CurS | | | | | | | | | | | | | | | | | | | | 80 | | | | | | | 52 | | 2 | 0 | 80 |
| Broad-billed Sandpiper | BbiS | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | 1 | 0 | 1 |
| Silver Gull | SiGl | | | | | 3 | | 25 | | | | | | | | | | | | 2 | 2 | | | | | 1 | | 500 | | 6 | 0 | 500 |
| Whiskered Tern | WhiT | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | 1 | 0 | 6 |
| Caspian Tern | CasT | | | | | | | | | | | | | | | | | | | 1 | 1 | | | | | | | 2 | | 3 | 0 | 2 |
| Clamorous Reed-Warbler | CReW | | | | | | 4 | 9* | 1 | | | 3 | | | | | 1* | | | 6 | 1 | 4* | | | | 5* | | 12* | | 10 | 4 | 12 |
| Little Grassbird | LiGd | | | | | | 14 | 5* | 1 | 7 | 1* | | 1 | | 2 | | | 2 | | 21* | 6 | | 3 | | | 1* | | 13* | | 13 | 5 | 21 |

Table 7 (cont'd)



Notes:

(a) An asterisk indicates species was found breeding (includes old nests - see text under METHODS).
(b) Wetland codes are given in Table 1.
(c) No W1 = number of wetlands in which species was recorded.
(d) No Br = number of wetlands in which species was found breeding.
(e) High Indv = highest number of individuals recorded in any wetland.

1. If an old nest was found but no birds of that species were recorded in any survey, the entry in this table is given as one (1) bird.
2. Unidentified nests are not included in breeding data in this table although two were included in totals in Table 1: unidentified crake nest at site 13 and unidentified cormorant nest at site 16.
3. An unidentified grebe was seen at site 20.

at Owingup Swamp - 2-3 in October and November 1987 and January 1988;

at Boat Harbour Lake 1 - three in November 1984 and one in October 1987;

at Saide Lake - one in August 1984; and

at Powell Lake - three in September 1982; two in May 1983; 1-2 in January, March, September and November 1984; and 1-2 in March and May 1985.

However there were no breeding records of this species.

Eleven Great Cormorants were attending nests with eggs at Gardner River Lake in July 1991. No other waterbird breeding colonies have been found in the 27 wetlands.

The highest number of individual waterbirds recorded in any survey was 4 417 at Powell Lake in January 1986, followed by 1 457 at Owingup Swamp in March 1991.

Rankings derived in the same way as those of Table 5 were produced using all available data (Table 8). The result was similar. To put this in regional context, extra columns in Table 8 show the rank that each wetland would have had if it had been one of the (603) wetlands surveyed by the RAOU in 1981-8 (see Section 2.2 (a)). Wetlands ranked in the top ten per cent (of the 603) by species, breeding or individuals were Powell, Owingup, Boat Harbour 1 and Saide Lakes.

### 3.3 Relative Importance of Wetlands based on All Data

Table 9 presents the ten most important wetlands, based on scored rankings from all data. The top five wetlands are the same in Table 6 and Table 9 (Powell, Owingup, Saide, Jasper and Maringup Lakes) but in Table 9 Powell replaces Owingup as the most important wetland for waterbirds.

### 3.4 Factors that may Influence Waterbird Usage

The following observations on the effects of different habitat parameters on waterbird usage are derived from the summer 1991-2 surveys. Time prevents statistical analyses being conducted. However, impressions gained from fieldwork and from collation of data for the tables are presented.

#### 3.4.1 Wetland Vegetation

Each of the five most important wetlands for waterbirds (Table 6) had extensive areas of both inundated vegetation and Open Water. Some of the lowest-ranked wetlands (Table 5), such as Lake Williams and Quininnup Brook Pools, had very little inundated vegetation.

Tall Sedges was the most extensive wetland vegetation community at four of the top five sites, with *B. articulata* the dominant sedge species at Owingup Swamp and Maringup Lake and *Typha orientalis* dominant at Powell and Saide Lakes. Tall Sedges also was present in substantial extent at the fifth site (Jasper Lake, *B. articulata* dominant).

Nests of 12 of the 14 species found breeding were in inundated vegetation; nests of the other two species were either not found (Blue-billed Duck: young seen) or found on bare land (Black-fronted Plover: Table 3).

Ignoring the Great Cormorant colonies in Cedar Forest at Gardner River Lake, Tall Sedges and *Agonis floribunda* Thickets were the most important wetland vegetation communities for waterbird nest sites (Table 3).

Table 8. Rankings of wetlands by number of species recorded, number of species found breeding and highest number of individuals recorded in any survey (all data sources) and comparisons with RAOU data for 603 other wetlands.

| a) RANKING BY NUMBER OF SPECIES RECORDED | | | | b) RANKING BY NUMBER OF SPECIES FOUND BREEDING | | | | c) RANKING BY HIGHEST NUMBER OF INDIVIDUALS RECORDED IN ANY SURVEY | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ranks | | Wetland | No. of Species | Ranks | | Wetland | No. of Breeding Species | Ranks | | Wetland | No. of Individuals |
| (a) R1 | (b) R2 | | | R1 | R2 | | | R1 | R2 | | |
| 1 | 9 | **Powell** | 55 | 1 | =10 | **Powell** | 13 | 1 | 43 | **Powell** | 4417 |
| 2 | =28 | **Owingup** | 39 | 2 | =48 | **Saide** | 7 | 2 | 104 | **Owingup** | 1457 |
| =3 | =46 | **Boat Harbour 1** | 34 | =3 | =69 | **Jasper** | 6 | 3 | 108 | **Maringup** | 1419 |
| =3 | =46 | **Saide** | 34 | =3 | =69 | **Owingup** | 6 | 4 | 124 | **Saide** | 1132 |
| 5 | =150 | **Jasper** | 22 | 5 | =138 | Davies | 3 | 5 | 207 | **Boat Harbour 1** | 403 |
| 6 | =168 | **Maringup** | 20 | =6 | =168 | **Devil's** | 2 | 6 | =221 | **Jasper** | 354 |
| 7 | =223 | **Quitjup** | 16 | =6 | =168 | **Quitjup** | 2 | 7 | 343 | **Quitjup** | 102 |
| 8 | =300 | **Reserve 12046** | 10 | =6 | =168 | Yeagarup | 2 | 8 | =366 | **Reserve 12046** | 70 |
| 9 | =337 | Wilson | 8 | =6 | =168 | **Gardner River** | 2 | 9 | =390 | **Devil's** | 47 |
| =10 | =359 | **Devil's** | 7 | =6 | =168 | **Maringup** | 2 | =10 | =456 | Naenup | 16 |
| =10 | =359 | **Gardner River** | 7 | =6 | =168 | Boat Harbour 2 | 2 | =10 | =456 | **Gardner River** | 16 |
| =10 | =359 | Boat Harbour 3 | 7 | =12 | =217 | Moses Rock | 1 | 12 | =459 | Wilson | 15 |
| =13 | =390 | Davies | 6 | =12 | =217 | Wilson | 1 | 13 | =460 | Smith | 14 |
| =13 | =390 | Naenup | 6 | =12 | =217 | Smith | 1 | =14 | =464 | Davies | 13 |
| =15 | =422 | Smith | 5 | =12 | =217 | Naenup | 1 | =14 | =464 | Un-named (Site 11) | 13 |
| =15 | =422 | Un-named (Site 11) | 5 | =12 | =217 | Samuel | 1 | =14 | =464 | Boat Harbour 2 | 13 |
| =15 | =422 | Samuel | 5 | =12 | =217 | Boat Harbour 3 | 1 | 17 | =474 | Boat Harbour 3 | 10 |
| 18 | =438 | Boat Harbour 2 | 4 | =12 | =217 | **Reserve 12046** | 1 | =18 | =480 | Samuel | 8 |
| =19 | =460 | Yeagarup | 3 | =19 | =290 | Quinninup Brook | 0 | =18 | =480 | Warren Oxbow | 8 |
| =19 | =460 | Doggerup | 3 | =19 | =290 | Un-named (Site 11) | 0 | 20 | =492 | Florence | 5 |
| =19 | =460 | Warren Oxbow | 3 | =19 | =290 | Doggerup | 0 | 21 | =498 | William | 4 |
| 22 | =487 | Florence | 2 | =19 | =290 | Florence | 0 | 22 | =502 | Yeagarup | 3 |
| =23 | =502 | Moses Rock | 1 | =19 | =290 | East Broke Inlet | 0 | =23 | =506 | Moses Rock | 2 |
| =23 | =502 | Williams | 1 | =19 | =290 | **Boat Harbour 1** | 0 | =23 | =506 | Doggerup | 2 |
| =23 | =502 | William | 1 | =19 | =290 | Williams | 0 | =23 | =506 | Williams | 2 |
| =26 | =524 | Quinninup Brook | 0 | =19 | =290 | William | 0 | =26 | =524 | Quinninup Brook | 0 |
| =26 | =524 | East Broke Inlet | 0 | =19 | =290 | Warren Oxbow | 0 | =26 | =524 | East Broke Inlet | 0 |

(a) R1 = rank in the 27 wetlands, considering all data.

(b) R2 = rank if the wetland had been one of the (603) wetlands surveyed by the RAOU, 1981-8.

Note: Wetlands in bold face are those featured in Table 9, i.e. the 10 most important wetlands based on combination of the three rankings above.

Table 9. Relative importance of wetlands based on ranks from all data.

| Order of Relative Importance | Wetland | Scores from: rank by species | rank by breeding | rank by individuals | Total Score |
|---|---|---|---|---|---|
| 1 | Powell | 27 | 27 | 27 | 81 |
| 2 | Owingup | 26 | 25 | 26 | 77 |
| 3 | Saide | 25 | 26 | 24 | 75 |
| 4 | Jasper | 23 | 25 | 22 | 70 |
| 5 | Maringup | 22 | 22 | 25 | 69 |
| 6 | Quitjup | 21 | 22 | 21 | 64 |
| 7 | Devil's | 18 | 22 | 19 | 59 |
| 8 | Gardner River | 18 | 22 | 18 | 58 |
| 9 | Boat Harbour 1 | 25 | 9 | 23 | 57 |
| 10 | Reserve 12046 | 20 | 16 | 20 | 56 |

Scores are derived from rankings (R1) of Table 8. Scores were calculated as follows:

| rank | (gives) score |
|---|---|
| 1 | 27 |
| 2 | 26 |
| 3 | 25 |
| \| | \| |
| 26 | 2 |
| 27 | 1 |

Note that wetlands with equal rank were given the same score, e.g. wetlands ranking equal 6 for breeding species each scored 22 points.

In Tall Sedges, 24 nests were found in pure stands of *T. orientalis* compared with 12 in pure *B. articulata* and seven in *B. articulata* mixed with *B. vaginalis*.

In terms of waterbird occurrence in the various habitats, Open Water (24 species), Bare Land (18) and Tall Sedges (16) were the most important wetland vegetation communities (Table 4). No species was recorded in Paperbark Low Forest (very small areas), or *Kunzea* Thicket, *Callistachys* Thicket or *Beaufortia* Heath (generally dry).

### 3.4.2 Water Depth

Insufficient data were gathered on maximum wetland depth for observations to be made concerning the influence of that parameter.

At most wetlands where fringing vegetation was inundated, water depth in that vegetation was less than 100 cm. Water in thickets of shrubs such as *A. floribunda* typically was 10-50 cm deep and in Tall Sedges such as *B. articulata*, typically 50-100 cm deep. (See Section 3.4.1 for significance of inundated vegetation.)

Considering the 11 active nests (Table 3), the eight that were in Tall Sedges were over water 3-100 cm deep. Active nests of the Clamorous Reed-Warbler were over water 30-50 cm deep, while those of the Spotless Crake were over water less than 20 cm deep (see datasheets in Appendix II).

### 3.4.3 Salinity

The least fresh wetlands (t.s.s. above 0.5 p.p.t.) were Lake Davies, Boat Harbour Lake 2, Owingup Swamp, Boat Harbour Lake 1, Warren Oxbow Lake and Powell Lake. Three of these were among the five most important wetlands (Table 6). However, the other two wetlands in the top five (Jasper and Maringup Lakes) were much fresher, around 0.2 p.p.t.

### 3.4.4 Nutrients

Measurements of nutrients were taken by Edward (preliminary report to CALM) earlier in 1991. Powell Lake had much higher nutrient levels than the other 26 wetlands and was one of the most important wetlands for waterbirds (Table 6). However, some near-pristine wetlands such as Maringup and Quitjup Lakes, which had comparatively low nutrient levels, also were important wetlands for waterbirds (Table 6).

### 3.4.5 Wetland Area

The six most important wetlands (Table 6) were the six largest in area, some of them covering a few hundred hectares. However, several of the top 12 which were only a few hectares in area (e.g. Devil's Pool, Reserve 12046 Lake) were more important than larger wetlands such as Boat Harbour Lake 2.

# 4. DISCUSSION

## 4.1 Limitations

### 4.1.1 Design of Surveys

The sample of wetlands surveyed was not perfectly representative because the least accessible sites were omitted amd these were all small in area. Due to their small size these sites were unlikely to have been of great importance to waterbirds, particularly in terms of number of individual waterbirds occurring (see Section 3.4.5).

Surveys in early summer are not optimal for recording waterbird breeding, most of which occurs in spring in south-western Australia (Halse and Jaensch 1989). Furthermore, secretive species such as bitterns are more likely to be calling before and during breeding, so that records of these birds would be fewer in summer. However, it was possible to determine the relative importance of the 27 wetlands for waterbird breeding because old nests (from earlier activity) were included in the data collected in summer 1991-2 (see Section 2.1.2).

### 4.1.2 Fieldwork

Limited time (usually one day per wetland) and the difficulty of wading through the dense vegetation that dominated many of the wetlands surveyed, provided limited opportunities for finding secretive waterbird species. Movement through Cedar Forest was impeded by numerous fallen logs. Often the Tall Sedges could not be penetrated by boat and water was too deep to wade in. However, representative samples of all wetland vegetation communities were covered and a good indication of the secretive species present in the 27 wetlands was obtained.

The failure of trapping to produce (secretive) crakes may have been due either to inappropriate siting or choice of trap or both. In the past, greatest success in this technique has been achieved using large triangular box traps (ca. 1.0 m wide, with funnel entrances), which were too cumbersome for use in the present study since boat access to trapping sites was required and there were no assisting personnel in most surveys.

Coverage of the non-vegetated habitats Open Water and Bare Land was generally close to 100 per cent and thus better than coverage of vegetated habitats. This bias was, however, consistent at all wetlands and is inherent in all waterbird surveys. Therefore it does not restrict comparison of data from different wetlands or projects.

Night surveys were not possible at some sites due to time constraints. However, they were undertaken at those wetlands that were thought most likely to support bitterns, because suitable habitat (such as tall thickets beside open water) existed.

A bias in breeding data occurred because of greater familiarity with the typical nest sites of some species than with others, such as Australasian Bittern. However, searching for nests was done intensively in a sample area of each wetland vegetation community so the likelihood of finding nests of any locally breeding waterbird was relatively high.

### 4.1.3 Discussion on Results

Inclusion of old nests in the breeding records was not done in projects from which other data (Section 3.2) were sought. However, additional surveys at the once-surveyed 27 wetlands probably would have eventually revealed active nests of the species for which only old nests were found in summer 1991-2, so inclusion of old nests was reasonable and optimised use of the data and effort. Tightly constructed nests in sheltered situations, such as reed-warbler nests within thickets, probably would remain mostly intact several years after last use. Loosely constructed nests in exposed situations, such as swamphen nests in sedges close to open water, probably would deteriorate beyond recognition within 12 months.

Inclusion of data from surveys of swans, ducks and coots only (see Section 3.2) introduces a bias towards these 13 species of waterfowl. Nonetheless this inclusion is useful because waterfowl generally are the most abundant species and their presence or absence therefore has great bearing on whether or not a wetland is important for waterbirds in terms of numbers of individuals recorded.

Considerations of wetland importance based on numbers of species, breeding species and individuals alone do not take into account other values and functions that a wetland may have, including support of other fauna and flora and value as a representative example of a wetland type. These other values and functions are not the subject of the present study.

Importance for waterbirds may also take into account whether or not the wetland supports rare species. This was not included in the rankings in the present study but as it happened, the only declared rare species recorded in summer 1991-2 was at the top wetland (Table 6).

It may be argued that, in regard to Table 6 and Table 9, assigning a (lowest) score to wetlands where nil species were recorded or found breeding may be invalid. Assignment of zero scores instead would cause Boat Harbour Lake 1 to be omitted from the top ten sites. However it is likely that each wetland with inundated vegetation has at least one breeding species (e.g. Spotless Crake), which would be discovered in future surveys, so it would in fact be realistic to follow the chosen method.

The assumption of no nett waterbird movement made in calculating minimum populations of species in the study area (see Section 3.1.1) is considered reasonable given the short period of surveys and that there were no significant changes in wetland conditions during that period.

## 4.2 Secretive Species

### 4.2.1 Australasian Bittern

Considering the highest numbers of Australasian Bitterns recorded at various wetlands in south-western Australia in the past decade (Table 10), the discovery of a minimum of five adults at Owingup Swamp on 9 January 1992 was significant in the regional context. Equal or higher numbers have been recorded at only three other wetlands: Kulunilup Swamps (5 birds), Lake Pleasant View (5) and Benger Swamp (8).

Little is known about the breeding requirements of this species, but the large area (150-200 ha) of Tall Sedges inundated annually at Owingup probably would permit up to four pairs to breed there in most years (based on probable territories of 40-50 ha in similar habitat in the region: Marchant and Higgins 1990, p. 1059). Given the occurrence (in previous surveys) of up to three birds at both Owingup and nearby Boat Harbour Lake 1 in spring, these two Quarram Nature Reserve wetlands probably provide a core refuge and breeding area for the Australasian Bittern within the study area.

No Australasian Bitterns have been found west of Owingup on the south coast (Table 7), but birds dispersing after breeding may be discovered there in future surveys. In addition, systematic surveys in spring may reveal calling birds at several of the western wetlands that have never been searched for bitterns in spring and which have extensive Tall or Low Sedges, notably Quitjup Lake (far north-western swamps), Jasper Lake (south-western swamp), the un-named lake near Yeagarup Lake, and Maringup Lake (eastern part).

To the east, the species has been recorded at Powell Lake in spring, summer and autumn. It therefore may breed there, provided the Tall Sedges are sufficiently extensive. The single (winter) record for Saide Lake may have been of a non-breeding visitor since there have been no records there in spring surveys.

Three bitterns seen in the far south of Owingup Swamp in late December 1991 and early January 1992 were flushed several times from shallow water (5-20 cm deep) with medium-

Table 10. Highest numbers of Australasian Bitterns recorded at wetlands in south-western Australia, 1981-92, in RAOU or CALM surveys.

| Wetland | Highest number recorded |
|---|---|
| (a) Swan Coastal Plain | |
| Crackers Swamp | 1 |
| Jandabup Lake | 1 |
| Thomsons Lake | 2 |
| Mealup Lake | 1 |
| McLarty Lake | 1 |
| Benger Swamp | 8 |
| Vasse Estuary | 1 |
| (b) Southern Forest | |
| Wilgarup Swamp | 1 |
| Kulunilup Swamps | 5 |
| Bokarup West Swamp | 1 |
| Yarnup Swamp | 2 |
| Cobertup Swamp | 2 |
| Neeranup Swamp | 1 |
| Byenup Lagoon | 2 |
| Tordit-Gurrup Lagoon | 1 |
| Muir wetland No 7 | 1 |
| (c) South Coast | |
| Owingup Swamp | 5 |
| Boat Harbour Lakes | 3 |
| Saide Lake | 1 |
| Powell Lake | 3 |
| Seppings Lake | 1 |
| Yackamia Swamp | 2 |
| (d) Manypeaks District | |
| Gardner Lake | 1 |
| Moates Lake | 1 |
| Angove Lake | 1 |
| Cheyne Beach Road Swamp | 2 |
| Lake Pleasant View | 5 |
| North Sister West Swamp | 1 |
| North Sister East Swamp | 1 |
| Mettler Lake | 2 |
| (e) Esperance (East) District | |
| Shark Lake | 1 |
| Merivale (Charsley) Swamps | 4 |
| North Le Grande Swamp | 1 |
| Heath's Swamp | 1 |
| Ewert's Lake | 1 |
| Cape Arid Swamps | 1 |
| Total | 69 |

sparse cover of Low Sedges (*Baumea juncea, B. arthrophylla*), adjacent to extensive Tall Sedges interspersed with some *B. vaginalis*. This site was teeming with small (ca. 2 cm) unidentified tadpoles and small (ca. 3 cm) koonacs *Cherax* sp., which presumably were easy prey for the bitterns in that situation. Similar conditions existed elsewhere around the swamp, including on the NE side where two other bitterns were flushed from Tall Sedges and additional birds therefore may have been present.

Comprehensive information on the biology and distribution of the Australasian Bittern in south-western Australia is needed in order to assess conservation security in the study area. Two projects are proposed under RECOMMENDATIONS.

### 4.2.2 Lewin's Rail and Black Bittern

Two of the three other waterbirds that are `declared rare', Lewin's Rail *Rallus pectoralis* and Black Bittern *Dupetor flavicollis* , have been recorded in the study area in the past, though precise locations are not given in the literature (cf. Blakers *et al.* 1984). Neither was recorded in the summer 1991-2 surveys.

There have not been any confirmed sightings of the Lewin's Rail in Western Australia since 1932 (Storr 1991, p. 48). Unfortunately there are no published descriptions of its habitat; lack of this knowledge is a hindrance to attempts to find the species. It is suggested that, of the 27 wetlands surveyed in summer 1991-2, the un-named lake near Yeagarup Lake and Boat Harbour Lake 1 may be suitable targets for concerted searches because they support similar wetland vegetation communities to those in which Lewin's Rail occurs (pers. obs.) in eastern Australia.

Black Bitterns occur in south-western Australia at river pools and timbered swamps. The species has declined markedly in numbers and distribution since European settlement, partly due to salinisation (Blakers *et al.* 1984). Warren Oxbow, which is a relatively undisturbed river pool with fringing trees, is the wetland (of the 27 surveyed) most likely to support this species; timbered channels associated with Devil's Pool, Owingup Swamp (Kent River) and Gardner River Lake also may be suitable. It is not known if the Black Bittern occurs in Cedar Forest; if it does, it may be more widespread, e.g. at Maringup Lake.

### 4.2.3 Little Bittern

Summer 1991-2 records of single Little Bitterns at Quitjup and Saide Lakes and an earlier record from Powell Lake (Tables 2 and 7), together with records of one in September 1984 and three in December 1984 at Gingilup Swamps (RAOU data; Jaensch *et al.* 1988), are the only known non-breeding records of this species in the study area. The summer 1991-2 records of recently completed breeding at Saide Lake and breeding within the last 12-24 months at Jasper Lake are the first records of breeding by Little Bitterns in the study area. The nearest known breeding localities outside the study area are the Lake Muir and Manypeaks districts, 90 km NW and 70 km ENE of Saide Lake respectively (Jaensch *et al.* 1988).

The wetland vegetation community in which Little Bitterns occurred at the adjacent Gingilup, Quitjup and Jasper wetlands was *Agonis floribunda* Thicket. In each case the thicket at the place of observation was 3-4 m in height, in water 30-50 cm deep, infused with medium to dense growth of *B. vaginalis*, adjacent to areas of Tall or Low Sedges and within a few metres of Open Water. In the western parts of Lakes Jasper and Quitjup and near the small permanent lakes in Gingilup Swamp, this wetland vegetation community is extensive, so concerted searches (especially in spring, when birds are likely to be calling frequently) may reveal more birds and nests. The principal conservation threat to continued occurrence and breeding in this community would be frequent and extensive burning of the thickets, since the bitterns seem to favour the most mature stands.

The wetland vegetation community in which Little Bitterns nested at Lake Saide was Tall Sedges (pure *T. orientalis*) and at Powell Lake the bitterns also were recorded in Tall Sedges

(*Typha* and/or *B. articulata*). During summer 1991-2, most of that vegetation seemed unsuitable for breeding by Little Bitterns, being either choked out by couch grass, too short (e.g. collapsed), or too sparse. (The nest at Saide Lake was in the tallest and densest patch of *Typha*.)

A desiccated shrimp *Palaemonetes australis* was found in the Little Bittern nest at Saide Lake on 10 January 1992; it may have been an intended or regurgitated food item of an adult or nestling bittern. Marchant and Higgins (1990) list shrimp as a food item of adult Little Bitterns. The shrimp *P. australis* occurred at Saide Lake and was widespread in the 27 wetlands of the study area in 1991 (D. Edward pers. comm.).

Little Bitterns apparently migrate (Blakers *et al.* 1984) and therefore may occur occasionally at any wetland that has an appreciable area of flooded dense vegetation. As for breeding, several other of the 27 wetlands have suitable vegetation in which the species may breed, notably Quitjup, Wilson and Gardner River Lakes (nest sites in thickets), Owingup Swamp and Boat Harbour Lake 2 (nest sites in tall sedge).

Interestingly, both Little Bitterns recorded in summer 1991-2 responded to vocal imitations by calling, whereas no calls were heard otherwise. The use of imitations therefore is worthwhile.

#### 4.2.4 Spotless Crake

The only other secretive (bittern or small rail) species recorded in the summer 1991-2 surveys was the Spotless Crake. It proved to be both widespread in occurrence and breeding, using a wide variety of wetland vegetation communities including five for nest sites (9 nests found). Therefore at present its conservation seems reasonably secure. Highest numbers recorded were 19 at Owingup Swamp and 17 at Powell Lake; the highest number of nests found was three in *Agonis linearifolia* shrubs at Yeagarup Lake.

#### 4.2.5 Other Secretive Species

Though not recorded in summer 1991-2, Buff-banded Rails, Australian Crakes and Baillon's Crakes have been recorded at Powell Lake in the past (Table 7) and may occur at some of the other 27 wetlands surveyed. The Rail occurs in a wide range of habitats in south-western Australia (Storr 1991). The two crakes are more restricted in range of habitat in this region and could be expected at fewer wetlands.

Both the Rail and the Baillon's Crake rarely call; this may explain the scarcity of records. (Spotless Crakes call more readily.)

Observers would have best chances of seeing these three species if watching the muddy edges of drying beds of Tall Sedge, which may be prevalent in autumn at wetlands such as Owingup Swamp and Saide Lake.

### 4.3 Other Remarks on Species

#### 4.3.1 Other Species Not Recorded

The 58 waterbird species of south-western Australia which have never been recorded from the 27 wetlands (cf. Table 7) include many vagrants and some species that are rare, uncommon or localised in south-western Australia.

Of the 58, the Pacific Heron *Ardea pacifica*, a widespread and easily sighted species, may be considered the most likely to occur in the 27 wetlands. There were records of Pacific Herons throughout the study area during the Atlas of Australian Birds (1977-81: Blakers *et al.* 1984); however, these may have been from winter-wet open marshes, a wetland type favoured by this species but not included in the 27 wetlands.

The other `declared rare' waterbird species not recorded, the Freckled Duck *Stictonetta naevosa*, has been recorded occasionally in or near the study area (Blakers *et al.* 1984), but generally does not occur there (RAOU and CALM data). It may, however, appear in the 27 wetlands if extreme drought forced it to abandon its (few) non-breeding refuges north and east of the study area. It would probably seek undisturbed loafing sites in the middle of one of the larger lakes or at the edge of Cedar Forest and Open Water.

### 4.3.2 Widespread, Abundant and Breeding Species

Widespread occurrence and high numbers of the Pacific Black Duck in the 27 wetlands surveyed is consistent with its occurrence and abundance in coastal south-western Australia generally (Jaensch and Vervest 1988c, Halse *et al.* 1990). At 16 of the wetlands, this was the only dabbling duck species recorded despite widespread occurrence and high numbers of other dabblers such as Grey Teal in south-western Australia. Surveys in other seasons, particularly in drier years, may reveal greater duck variety, since in earlier surveys (Table 7) Grey Teal were found at five of the 16 wetlands, including 40 at Boat Harbour Lake 1 in winter 1987 and 800 at Maringup Lake in autumn 1986 following a year of below average rainfall in all five meteorological districts of south-western Australia (Jaensch and Vervest 1988b, pp. 9-10).

The most probable reason for the Purple Swamphen being the most widespread breeding species is the occurrence of its usual nesting habitat, Tall Sedges adjacent to Open Water, at most of the 27 wetlands surveyed. Also the nest of this species is more conspicuous than those of many other waterbird species.

That Spotless Crakes occurred in six wetland vegetation communities and were breeding in four of them is not surprising, given that this species may be found in any type of dense flooded vegetation (pers. obs.).

A reason for the high number of Clamorous Reed-Warbler nests found is that often several nests are found within a few square metres, perhaps because a pair will maintain a small territory over several years and establish more than one nest in that territory.

The summer 1991-2 surveys were too late in the year (summer rather than spring) for records of breeding by some species (e.g. shelducks) that were recorded breeding in the past (Table 7). Records of species found breeding in summer 1991-2 but not in earlier surveys may be attributed to search methods (e.g. for crakes) used in 1991-2 but not in the past.

High numbers of the Australian Shelduck at a few localities in the surveys may be partly due to their moulting behaviour. During late spring and early summer shelducks typically congregate in large numbers at certain wetlands to moult their primary feathers (Serventy and Whittell 1976, p. 144). Almost half of the 70 at Jasper Lake and 30 per cent of the 300 at Owingup Swamp in December 1991 were flightless due to moulting (see datasheets, Appendix II). Other wetlands where waterfowl moulting was recorded in summer 1991-2 were Devil's Pool and Lakes Davies, Florence and Maringup (one moulting Pacific Black Duck at each), Jasper Lake (20 Pacific Black Ducks) and Owingup Swamp (two Black Swans).

Estimation of total population at individual wetlands was not difficult for some species such as Musk Ducks, a few of which may have been submerged or hiding, but difficult for the less vocal secretive species, hundreds of which may have escaped detection. This subject and the data obtained are not discussed further here but may be worthy of separate study.

### 4.3.3 Species Covered by International Treaties

Fourteen of the 62 species ever recorded from the 27 wetlands (Table 7) are listed in either the Japan Australia Migratory Birds Agreement or the China Australia Migratory Birds Agreement (Appendix I). They comprise the two egrets, the sea-eagle, ten shorebirds and the Caspian

Tern. None of them are considered highly threatened in Australia or globally (cf. IUCN Red Data List).

Only one of the 14, the Greenshank, occurs regularly and sometimes in nationally significant numbers in the 27 wetlands. In February 1983, 150 were recorded at Saide Lake, a total exceeded at only four other wetlands in south-western Australia (RAOU data for 603 wetlands, 1981-8) and 15 other wetlands elsewhere in Australia (Lane 1987). Greenshanks favour shallow open water; deeper and/or more prolonged flooding of Saide Lake may render it unsuitable for this species. Location close to the shallow tidal flats (typical Greenshank habitat) of Wilson Inlet may influence the occurrence and abundance of Greenshanks at Saide Lake. Few of the other wetlands provide comparable habitat and location.

### 4.4 Factors that were found to influence Waterbird Usage

Results of the summer 1991-2 surveys suggest that, in the study area, a wetland with all of the following characteristics would provide optimal waterbird habitat (i.e. supporting high numbers of species, breeding species and individuals):

* extensive Open Water (i.e. at least tens of hectares rather than a few hectares); and
* extensive Tall Sedges and/or *Agonis floribunda* Thicket flooded to 50-100 cm depth in early summer; and
* some bare land such as low islets or seasonally exposed mudflats.

There was no consistent association between waterbird usage and salinity or nutrient levels.

### 4.5 Relative Importance of Wetlands

That the nine most important wetlands for waterbirds as shown in Table 6 is the same set of wetlands as that composing the top nine in Table 9, confirms that recognition of these nine as most important is meaningful and not (even in the case of Powell Lake) a result biased by inclusion (in Table 9) of considerable extra data for certain wetlands.

The tenth most important wetland as shown in Table 9 (Reserve 12046 Lake) is the only one of the ten that subjectively does not appear to be markedly more outstanding for waterbirds than any of the other 17.

Only one wetland in the nearby Lake Muir district, Byenup Lagoon, is comparable with the top five wetlands of the study area in terms of number of species (41), breeding species (5) and individuals (1 306). In contrast, many wetlands of the Swan Coastal Plain are more important than the top five wetlands of the study area: eight support more species (up to 79), five support more breeding species (up to 21) and 42 support more individuals (up to 50 000+) than Powell Lake (RAOU-CALM data, 1981-8).

One of the criteria for nomination of a wetland under the Ramsar Convention on Wetlands of International Importance is that the wetland regularly supports 20 000 waterfowl. None of the 27 wetlands meet that criterion.

### 4.6 Potential Threats to Waterbirds

#### 4.6.1 Mineral Sand Exploration and Mining

Exploration for mineral sands has been proposed in the areas immediately west of Lake Quitjup and Jasper (EPA 1991) and there are possibly other potential mine sites (corresponding with magnetic anomalies) within a few kilometres of Yeagarup and Maringup Lakes (Cable Sands 1991, Figure 3). The potential mining activity may be within the catchments of these wetlands, particularly those of Lakes Quitjup (`West Quitjup' exploration site) and Jasper (`Jangardup South' site), because the exploration sites abut or possibly impinge upon the wetland thickets. Likely impacts of mining may include reduction of water

depth in nearby wetlands due to extraction of groundwater and contamination of surface or ground water flowing into the wetlands.

Lowering of depth by as little as 30-50 cm in spring or early summer would probably dry out large areas of shrub thickets and Tall or Low Sedges, thereby rendering the wetlands unsuitable for breeding by bitterns and most other waterbird species. This result would be unacceptable at Jasper Lake in particular because it is ranked third among the 27 wetlands in terms of number of species found breeding (Table 8), and at Quitjup Lake because bitterns occur and probably breed there.

Contamination of wetland water may reduce or eliminate stocks of organisms such as shrimps, koonacs and frogs on which many of the waterbirds presumably feed (Marchant and Higgins 1990). Given the high overall importance of Jasper, Maringup and Quitjup Lakes (Table 9), that potential impact would be particularly unacceptable at these wetlands.

### 4.6.2 Frequent Burning

Wildfires may burn wetland vegetation that is not flooded at the time or that is flooded at the base but dense enough to burn above water.

It is thought that Tall Sedges, an important habitat for waterbird breeding (Table 3), may recover to full height and density within three to five years after fire and that burning may sometimes improve this habitat for nesting by causing growth of erect stems in areas where stems have collapsed. However, if all areas of this habitat in a wetland are burnt within a period of one or two years, certain species may not be able to nest in that wetland for up to five years. Some waterbird species may become locally extinct if burning is too frequent and mature stages of vegetation are no longer reached.

The impact of fire on *Agonis* thickets is more catastrophic for waterbirds, since these plants apparently are killed by fire and regeneration only occurs, rather slowly, from seedlings (pers. obs.). From observation it is suspected that low-standing *A. floribunda* thickets may take five or possibly ten years to regain a height, density and undergrowth that is suitable for breeding by Clamorous Reed-Warblers and Little Bitterns. The tall-standing Cedar Forest (*A. juniperina*) is transformed to a barren cluster of poles after fire; it is suspected that replacement by mature stands may take decades. Since the thickets are important for breeding (Table 3) and the forest is important for use by a large number of species (Table 4), burning that is too extensive or frequent should be avoided in wetlands where these habitats occur.

During the summer 1991-2 surveys, it was noted that thickets in the western parts of Jasper and Smith Lakes had been extensively burnt out and invaded by Tall or Low Sedges. Most of the Cedar Forest at Jasper Lake had been burnt out. At Quitjup Lake however, thickets had not been burnt for some years and given the loss of this waterbird habitat to fire at the major wetlands (Gingilup, Jasper) on either side of it, this wetland may assume greater importance for waterbirds over the next five years.

### 4.6.3 Recreation

Picnicing at the existing picnic sites at Lakes Davies, Smith, Yeagarup and Maringup should not significantly affect waterbird conservation values since waterbirds are either few in number or able to move to secluded parts at those wetlands and visitors are not likely to enter inundated vegetation and thereby disturb active nests.

CALM currently permits boating on Jasper Lake and there are well developed camping and picnic facilities. Zones for power-boating are clearly marked on signs at shore and by buoys in the water and exclude a 60 m wide strip around the lakeshore of the eastern and western parts of the open lake. My surveys did not show some parts of the lake to be used by considerably more birds than others. Therefore it is concluded, on an interim basis, that the current zonings are reasonable. Moulting ducks and diving species such as grebes probably would move from

mid-lake to the no-entry zones when boats appeared, though drivers of power boats should be warned to look out for and avoid slow-moving ducks and grebes when they make their first circuits.

### 4.6.4 Pollution

Sewage effluent probably enters Powell Lake through one of its inflow drains (Robinson in prep.). Agro-chemicals presumably enter Owingup Swamp and Reserve 12046, Saide and Powell Lakes from farmland in catchments. Limited nutrient enrichment of these wetlands, at least in the short term, may enhance rather than reduce the value for waterbirds by causing food organisms to proliferate. Long term, substantial enrichment probably would reduce the suitability of these wetlands for waterbirds. This matter requires separate study.

### 4.6.5 Exotic Plants

At Saide and Powell Lakes, substantial areas of wetland have been choked out with couch grass *Paspalum vaginatum*. Though partially inundated couch may provide cover and possibly nest sites for a few species, it is believed that replacement of the more useful wetland vegetation communities Tall Sedges and Open Water (and invasion of sedge beds) by couch would greatly reduce the overall value of a wetland for waterbirds. Unfortunately, there may be no simple remedy at Saide and Powell Lakes, but first occurrence of couch at other wetlands should be reported and investigated with a view to removal of the couch and prevention of re-establishment.

There is some debate as to whether or not *Typha orientalis* is native in south-western Australia. Regardless, it is well established in the study area and has shown that it may expand in area, usually due to disturbance, to the extent that waterbird and other wetland values are reduced, e.g. if all open water becomes covered. Given this potential, there is a case for monitoring its distribution in the 27 wetlands and where it does rapidly increase in area, thought may be given to limiting the expansion by manual intervention. (Note, however, that *Typha* is at least as valuable for waterbird breeding as other rushes or sedges (see Section 3.4.1)). Given the importance of Saide Lake for waterbirds, the distribution of *Typha* there may deserve further study.

### 4.6.6 Siltation

At Devil's Pool, Owingup Swamp and Powell Lake, inflow streams or drains from cleared land have caused sandy deltas or spits to form in the wetlands. At present these are useful as loafing sites for many species. However, in the long term, excessive silting may accelerate invasion by plants including undesirable species and reduce the area of Open Water, so that shallow wetlands such as Powell Lake may no longer have the habitats that currently make them important for waterbirds.

### 4.6.7 Road Construction

Apparently it has been suggested that the Hamelin Bay road be re-routed from the south to the north side of Lake Davies. In the absence of a specific study, it can only be assumed that the impact of the new road on waterbirds would be little different to the impact of the present road. The lake currently supports breeding (in flooded sedges) by three species, one of which (Hoary-headed Grebe) has not been found breeding in any of the 26 other wetlands.

## 5. RECOMMENDATIONS

### 5.1 Land Tenure

(i) Given that Lake Saide is one of the `top five' wetlands for waterbirds and that currently it is not in a conservation reserve (it is within Reserve 20781, purpose: common, vesting: Shire of Albany, and Reserve 17464, purpose: camping and recreation, not vested), high priority should be given to redesignation as a nature reserve for conservation of fauna, vested in CALM.

(ii) The other four of the five most important wetlands for waterbirds (Powell, Jasper, Maringup and Owingup: Table 9) are within national park or nature reserve and therefore reasonably secure for conservation of waterbirds. No action on land tenure is recommended for these wetlands.

### 5.2 Wetland Management

(i) A fire management regime should be devised for each appreciable area of wetland vegetation, especially areas of Cedar Forest and *Agonis floribunda* Thicket, with highest priority given to the most important wetlands that have not been recently burnt (Owingup, Maringup, Quitjup).

(ii) Extraction of mineral sand within the catchments of Quitjup, Jasper or Maringup Lakes should not be permitted if it will cause reduced wetland depth or significant inflow of water contaminants.

(iii) Boat users at Jasper Lake should be warned to look out for and avoid flightless moulting ducks and other slow-moving waterbirds and adherance to warnings should be monitored through occasional visits by relevant government officers.

### 5.3 Further Research and Monitoring

(i) In order to wisely protect and manage populations of the `declared rare' Australasian Bittern, an intensive study should be conducted at Owingup Swamp in the July-December period, with the following objectives: 1) to locate, monitor and describe active nests; 2) to identify which parts of the wetland are used for feeding and for breeding; and 3) to collect and identify potential food items at intervals during this period. (This shallow wetland should be easier and safer to work in than the Muir or Manypeaks wetlands.)

(ii) An annual (October) survey of numbers of calling Australasian Bitterns should be conducted at known, probable and some possible breeding localities in south-western Australia, including wetlands of the study area, over a five year period to obtain a better estimate of the species' population.

(iii) Potential observers should be alerted to the need to look out for Black Bitterns and/or Lewin's Rails in the 27 wetlands and given appropriate guidance on identification.

(iv) Relevant CALM officers should report any occurrence of substantial areas of couch grass at wetlands other than Powell and Saide Lakes and consider eradication measures.

## 6. ACKNOWLEDGEMENTS

Thanks are due to the CALM District Managers and staff of Busselton, Nannup, Pemberton, Walpole and Albany Districts who provided advice and other assistance during my field surveys; to Chris Robinson who passed on expertise in the identification of wetland plants and for permission to use his wetland vegetation maps; to Scott Welke who assisted with some surveys; to Grant Pearson for assistance with field equipment; to Jim Lane who supervised the study, gave guidance in project design and provided helpful comments on the manuscript of this report; to Stuart Halse who provided helpful comments on the report; and to Raelene Hick and Jan Rayner who typed the report tables and corrections to text. The funds for this work were provided to CALM by the Australian National Parks and Wildlife Service under the States Co-operative Assistance Program.

REFERENCES

BLAKERS, M., REILLY, P.N. and DAVIES, S.J.J.F. (1984), *The Atlas of Australian Birds*. Melbourne University Press, Melbourne.

CABLE SANDS W.A. PTY LTD (1991), Exploration in the D'Entrecasteaux National Park, Public Environmental Review. *Report to Environmental Protection Authority*, Perth.

ENVIRONMENTAL PROTECTION AUTHORITY (1991), Exploration programme in the D'Entrecasteaux National Park, Cable Sands (WA) Pty Ltd. *Environmental Protection Authority Bulletin* 591, Perth.

HALSE, S.A. and JAENSCH, R.P. (1989), Breeding seasons of waterbirds in south-western Australia - the importance of rainfall. *Emu* 89, 232-249.

HALSE, S.A., JAENSCH, R.P., MUNRO, D.R. and PEARSON, G.B. (1990). Annual waterfowl counts in south-western Australia - 1988/89. *Department of Conservation and Land Management Technical Report* No 25.

HALSE, S.A., VERVEST, R.M., MUNRO, D.R., PEARSON, G.B. and YUNG, F.H. (in press). Annual waterfowl counts in south-western Australia - 1989/90. *Department of Conservation and Land Management Technical Report.*

JAENSCH, R.P. (1988), Little Bitterns breeding in northern Australia. *Australian Bird Watcher* 12, 217-221.

JAENSCH, R.P. and VERVEST, R.M. (1988a), Waterbirds in the eastern Muir wetlands 1986-87. *Royal Australasian Ornithologists Union Report* No 47.

JAENSCH, R.P. and VERVEST, R.M. (1988b), Ducks, swans and coots in south-western Australia: the 1986 and 1987 counts. *Royal Australasian Ornithologists Union Report* No 31.

JAENSCH, R.P. and VERVEST, R.M. (1988c), Ducks, swans and coots in south-western Australia: the 1988 count and recommendations. *Royal Australasian Ornithologists Union Report* No 46.

JAENSCH, R.P., VERVEST, R.M. and HEWISH, M.J. (1988), Waterbirds in nature reserves of south-western Australia, 1981-1985: reserve accounts. *Royal Australasian Ornithologists Union Report* No 30.

LANE, B.A. (1987), *Shorebirds in Australia*. Nelson, Melbourne.

MARCHANT, S. and HIGGINS, P.J. co-ordinators (1990), *Handbook of Australian, New Zealand and Antarctic birds: Volume 1, Ratites to ducks*. Oxford University Press, South Melbourne.

ROBINSON, C.J. (in prep), A survey of the flora of wetlands of the south coast of Western Australia, 1991-2. Department of Conservation and Land Management internal report, Woodvale.

SERVENTY, D.L. and WHITTELL, H.M. (1976), *Birds of Western Australia, fifth edition*. University of Western Australia Press, Perth.

STORR, G.M. (1991), Birds of the South-West Division of Western Australia. *Records of the Western Australian Museum* Supplement No 35.

## APPENDIX I. LIST OF WATERBIRD SPECIES

The listed species were recorded in summer 1991-92 or earlier surveys at the 27 wetlands.

| English Name | Scientific Name | Code used in Field & Tables |
|---|---|---|
| Great Crested Grebe | *Podiceps cristatus* | GCGb |
| Hoary-headed Grebe | *Poliocephalus poliocephalus* | HhGb |
| Australasian Grebe | *Tachybaptus novaehollandiae* | AuGb |
| Australian Pelican | *Pelecanus conspicillatus* | APel |
| Darter | *Anhinga melanogaster* | Dart |
| Great Cormorant | *Phalacrocorax carbo* | GreC |
| Pied Cormorant | *Phalacrocorax varius* | PieC |
| Little Black Cormorant | *Phalacrocorax sulcirostris* | LiBC |
| Little Pied Cormorant | *Phalacrocorax melanoleucos* | LPiC |
| White-faced Heron | *Ardea novaehollandiae* | WfHn |
| *Cattle Egret | *Ardeola ibis* | CatE |
| *Great Egret | *Egretta alba* | GrtE |
| Rufous Night Heron | *Nycticorax caledonicus* | RNHn |
| Little Bittern | *Ixobrychus minutus* | LitB |
| Australasian Bittern | *Botaurus poiciloptilus* | AusB |
| Sacred Ibis | *Threskiornis aethiopica* | SacI |
| Straw-necked Ibis | *Threskiornis spinicollis* | SnkI |
| Yellow-billed Spoonbill | *Platalea flavipes* | YbS1 |
| Black Swan | *Cygnus atratus* | Swan |
| Australian Shelduck | *Tadorna tadornoides* | Shel |
| Pacific Black Duck | *Anas superciliosa* | PaBD |
| Grey Teal | *Anas gibberifrons* | GyT1 |
| Chestnut Teal | *Anas castanea* | ChT1 |
| Australasian Shoveler | *Anas rhynchotis* | Shov |
| Pink-eared Duck | *Malacorhynchus membranaceus* | PeaD |
| Hardhead | *Aythya australis* | Hard |
| Maned Duck | *Chenonetta jubata* | ManD |
| Blue-billed Duck | *Oxyura australis* | BbiD |
| Musk Duck | *Biziura lobata* | MusD |
| Osprey | *Pandion haliaetus* | Ospy |
| *White-bellied Sea-Eagle | *Haliaeetus leucogaster* | WbSE |
| Marsh Harrier | *Circus aeruginosus* | MaHa |
| Buff-banded Rail | *Rallus philippensis* | BbaR |
| Baillon's Crake | *Porzana pusilla* | BaCk |
| Australian Crake | *Porzana fluminea* | AuCk |
| Spotless Crake | *Porzana tabuensis* | SpCk |
| Black-tailed Native-hen | *Gallinula ventralis* | BtNh |
| Dusky Moorhen | *Gallinula tenebrosa* | DuMo |
| Purple Swamphen | *Porphyrio porphyrio* | PuSn |
| Eurasian Coot | *Fulica atra* | Coot |
| Pied Oystercatcher | *Haematopus longirostris* | PiOy |
| Red-kneed Dotterel | *Erythrogonys cinctus* | RkDo |
| Red-capped Plover | *Charadrius ruficapillus* | RcaP |

APPENDIX I cont.

| | | |
|---|---|---|
| Black-fronted Plover | *Charadrius melanops* | BfoP |
| Black-winged Stilt | *Himantopus himantopus* | BwSt |
| Banded Stilt | *Cladorhynchus leucocephalus* | BaSt |
| Red-necked Avocet | *Recurvirostra novaehollandiae* | RnAv |
| *Wood Sandpiper | *Tringa glareola* | WooS |
| *Grey-tailed Tattler | *Tringa brevipes* | GtaT |
| *Greenshank | *Tringa nebularia* | Gank |
| *Marsh Sandpiper | *Tringa stagnatilis* | MarS |
| *Sharp-tailed Sandpiper | *Calidris acuminata* | ShtS |
| *Pectoral Sandpiper | *Calidris melanotos* | PecS |
| *Red-necked Stint | *Calidris ruficollis* | RenS |
| *Long-toed Stint | *Calidris subminuta* | LotS |
| *Curlew Sandpiper | *Calidris ferruginea* | CurS |
| *Broad-billed Sandpiper | *Limicola falcinellus* | BbiS |
| Silver Gull | *Larus novaehollandiae* | SiG1 |
| Whiskered Tern | *Chlidonias hybrida* | WhiT |
| *Caspian Tern | *Hydroprogne caspia* | CasT |
| Clamorous Reed-Warbler | *Acrocephalus stentoreus* | CReW |
| Little Grassbird | *Megalurus gramineus* | LiGd |

Note:

An asterisk (*) indicates that the species is listed under the Japan-Australia Migratory Birds Agreement or China-Australia Migratory Birds Agreement.

# APPENDIX II

## Datasheets, maps and photographs for each wetland from the summer 1991-2 surveys

Waterbirds in Wetlands on the South Coast of Western Australia

SUMMARY DATASHEET

**LAKE** QUINNINUP BROOK POOLS 

## WETLAND DETAILS

Lat: 33° 45′ S. Long: 115° 00′ E. Shire: Busselton.

Land Status: within Leeuwin-Naturaliste National Park.

CALM Region: Central Forest District: Busselton.
Forestry Sheet (1:50 000): Busselton.

Wetland Vegetation Communities (WVCs)(C.J.Robinson):
TS = Tall Sedges.

## SURVEY DETAILS

Date: 3-12-91 Depth: approx. 1.0 m Salinity 0.473 ppt
Fringing vegetation was flooded a little.

Effort: Walked around the pools and observed them and the stream below the pools from high vantage point. Time spent = 1.0 h (late afternoon to sunset)

## WATERBIRD DETAILS

| species recorded | number counted | active nests | broods (DR) | old nests | WVCs used (* for nest site) |
|---|---|---|---|---|---|
| NIL | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| Totals: | ∅ | ∅ | ∅ | ∅ | (including data on other sheets? NO) |

species (now/earlier) = ∅ ,breeding spp (now/earlier) = ∅

## WATERBIRD DETAILS cont'd

Other species probably now present in dense inundated vegetation: nil.
(* possibly breeding now)

## DETAILS OF NESTS FOUND

| waterbird species | status of nest | contents | site (WVC) | water depth | main plant species |
|---|---|---|---|---|---|
| NIL. | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Other notes on species: Pools may occasionally be used by WftTh or LPiC for feeding (some remains of koonacs (?) found at pool edge), especially since these species occur farther upstream and probably visit the coast. (cont. below)

## ACCESS NOTES

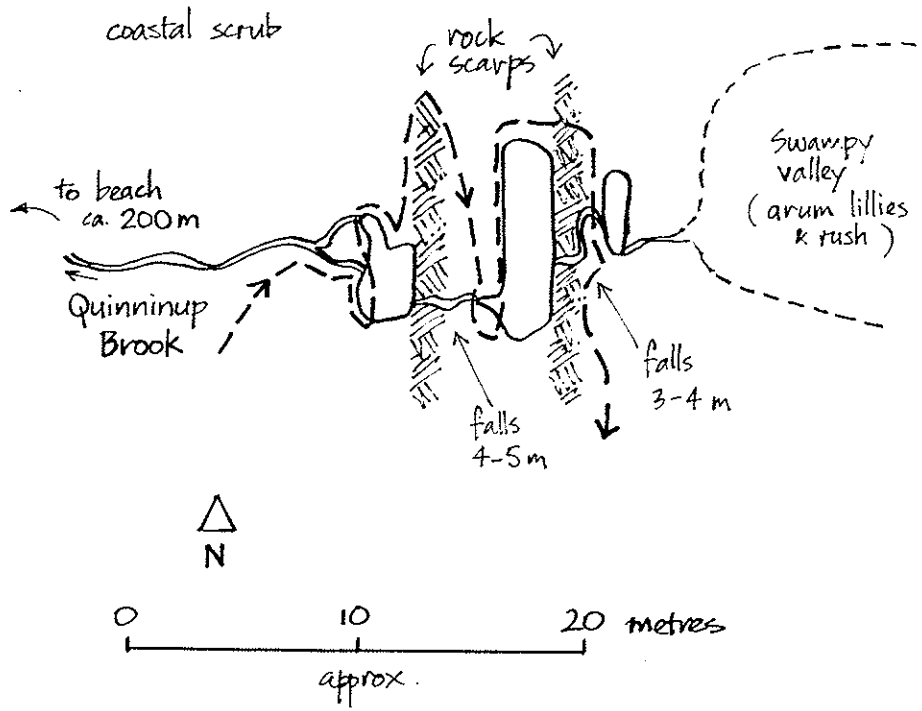
From mouth of stream, follow bare sand (south of stream) to small scarp at waterfalls/pools. Sand is thicker on north side of stream.

## MANAGEMENT CONSIDERATIONS

—

Notes cont'd Species. Pools probably too small to hold significant waterbird populations and species diversity. Not enough wetland vegetation for breeding activity.

# 1. QUINNINUP BROOK POOLS




- — — → — — survey route 3/12/91.
- waterline on 3/12/91 corresponded with that shown by solid line.
- Tall Sedges were sparsely distributed at water edge.

Waterbirds in Wetlands on the South Coast of Western Australia

SUMMARY DATASHEET

**LAKE** MOSES ROCK ROAD POOL 

WETLAND DETAILS

Lat: 33° 46′ S. Long: 114° 59′ E. Shire: Busselton.

Land Status: within Leeuwin-Naturaliste National Park.

CALM Region: Central Forest. District: Busselton.
Forestry Sheet (1:50 000): Busselton.

Wetland Vegetation Communities (WVCs) (C.J.Robinson):
TS = Tall Sedges ; OW = Open Water.

SURVEY DETAILS

Date: 3-12-91 Depth: not recorded. Salinity 0·462 ppt
Fringing vegetation was flooded extensively.

Effort: Walked right around the pool and waded through much of the TS area. Also watched from vantage point on sandhill to west. Spent 1·3 h, in late afternoon.

WATERBIRD DETAILS

| species recorded | number counted | active nests | broods (DR) | old nests | WVCs used (* for nest site) |
|---|---|---|---|---|---|
| AuGb | 2 | 1 | ∅ | ∅ | TS*, OW. |

Totals: 2 1 ∅ ∅ (including data on other sheets? NO)
species (now/earlier) = 1/∅, breeding spp (now/earlier) = 1/∅.

## WATERBIRD DETAILS cont'd

Other species probably now present in dense inundated vegetation: SpCk*, LiGd*, BaCk.
(* possibly breeding now)

## DETAILS OF NESTS FOUND

| waterbird species | status of nest | contents | site (WVC) | water depth | main plant species |
|---|---|---|---|---|---|
| AuGb | active | eggs (2) | TS | 100 cm | Typha sp. |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Other notes on species: Crakes could occur and may venture out onto algal mat especially at dawn. Ducks and cormorants could 'stop-over' at the pool while passing along the coast.

## ACCESS NOTES

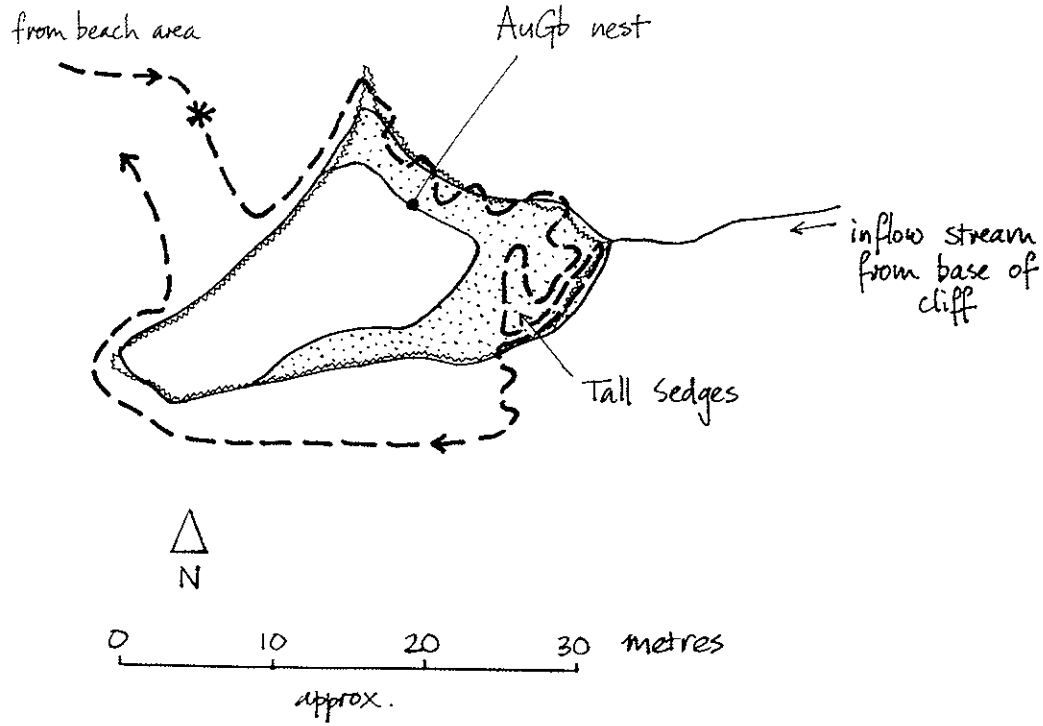
—

## MANAGEMENT CONSIDERATIONS

- Algal mat covering one third of OW.
- Typha sp. was dominant species in TS; medium to sparse density of green stems within medium density of collapsed dry stems.

Notes cont'd

2. MOSES ROCK ROAD POOL



Waterbirds in Wetlands on the South Coast of Western Australia

SUMMARY DATASHEET

**LAKE** DEVIL'S POOL 

## WETLAND DETAILS

Lat: 34° 01′ S. Long: 115° 01′ E. Shire: Augusta-Margaret R.

Land Status: within Leeuwin-Naturaliste National Park.

CALM Region: Central Forest. District: Busselton.
Forestry Sheet (1:50 000): Boranup.

Wetland Vegetation Communities (WVCs) (C.J.Robinson):
TS = Tall Sedges; AT = Astartea Thicket; OW = Open Water; BL = Bare Land.

## SURVEY DETAILS

Date: 4-12-91. Depth: not recorded. Salinity 0·411 ppt
Fringing vegetation was flooded a little.

Effort: Boated around OW and walked in TS and AT in several places. Good views of OW from access track. Total survey time = 3.0 h, in middle of day.

## WATERBIRD DETAILS

| species recorded | number counted | active nests | broods (DR) | old nests | WVCs used (* for nest site) |
|---|---|---|---|---|---|
| PaBD | 33 | ∅ | ∅ | ∅ | OW, BL, TS, AT. |
| ManD | 8 | ∅ | ∅ | ∅ | OW, BL, AT. |
| Coot | 3 | ∅ | ∅ | ∅ | OW, AT. |
| WfHn | 1 | ∅ | ∅ | ∅ | BL. |
| HhGb | 2 | ∅ | ∅ | ∅ | OW. |
| [ SpCk | ∅ | ∅ | ∅ | 1 | AT* ] |
| [ PuSn | ∅ | ∅ | ∅ | 1 | TS* ] |
| | | | | | |
| | | | | | |
| | | | | | |
| Totals: | 47 | ∅ | ∅ | 2 | (including data on other sheets? NO) |

species (now/earlier) = 5/2 extra, breeding spp (now/earlier) = ∅/2 extra.

## WATERBIRD DETAILS cont'd

Other species probably now present in dense inundated vegetation: BbaR, LitB?, BlaB?, RNHn.
(* possibly breeding now)

## DETAILS OF NESTS FOUND

| waterbird species | status of nest | contents | site (WVC) | water depth | main plant species |
|---|---|---|---|---|---|
| SpCk | old ⊕ | (eggshells only) | AT | 0 cm | ?Carex appressa |
| PuSn | old | empty | TS | 20 cm | Schoenoplectus validus |

⊕ presumably used in 1991.

Other notes on species: One PaBD flightless due to moult; lots of primary wing feathers (of ducks?) washed up on shore. SpCk nest in razor-sharp sedge, within AT; eggshell throughout nest (inner layers) so probably used several times/years. Crake footprints in wet mud under AT. (see below)

## ACCESS NOTES

If in doubt about track, keep close to the E-W fence until western end of lake close by — then cut down to the water.

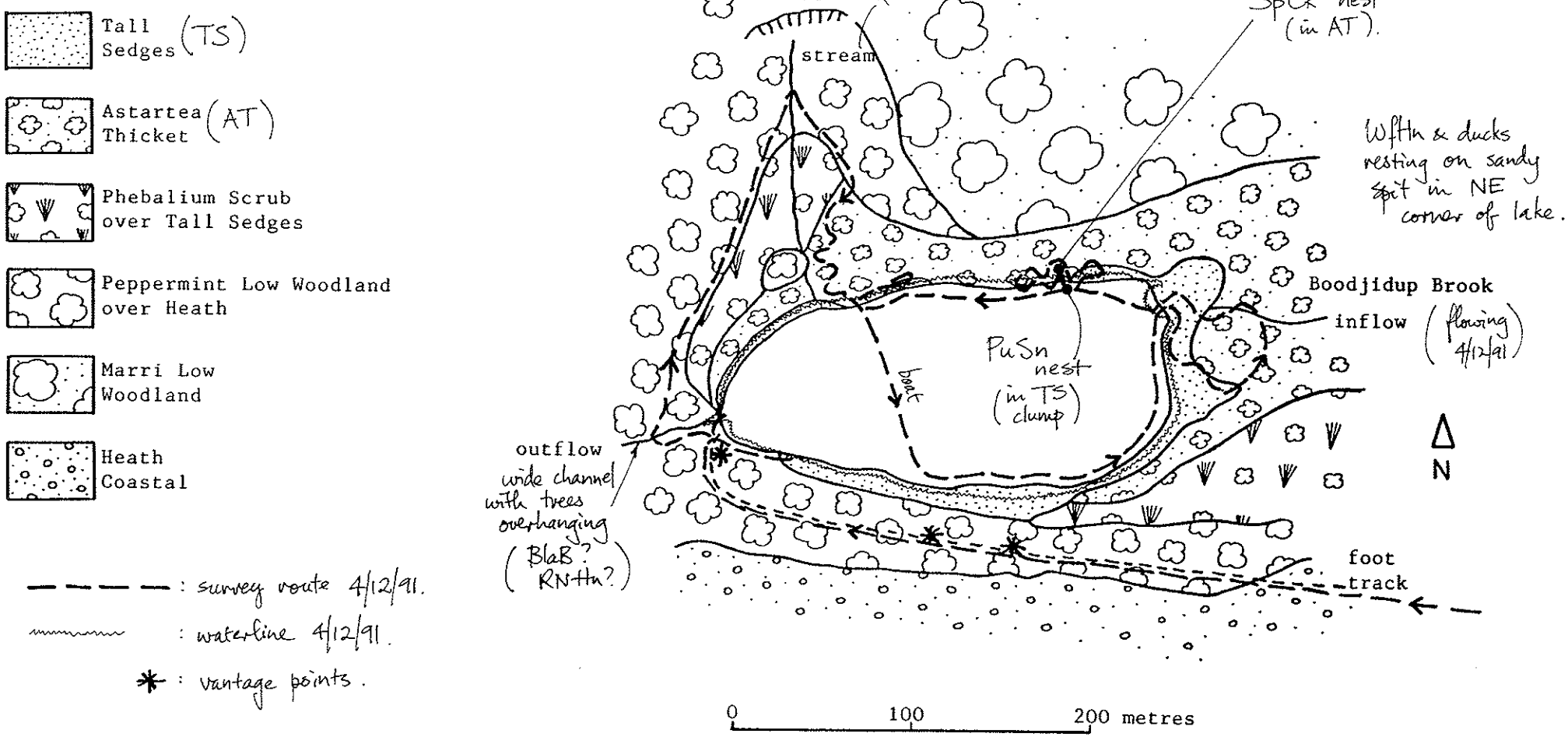
## MANAGEMENT CONSIDERATIONS

Siltation occurring at east end; streams have deposited sandy spits.

Notes cont'd

species. Breast feather of PuSn found.

3 DEVILS POOL



Waterbirds in Wetlands on the South Coast of Western Australia

SUMMARY DATASHEET

**LAKE** DAVIES 

## WETLAND DETAILS

Lat: 34° 13′ S. Long: 115° 02′ E. Shire: Augusta - Margaret R.

Land Status: within Leeuwin-Naturaliste National Park.

CALM Region: Central Forest. District: Busselton.
Forestry Sheet (1:50 000): Boranup.

Wetland Vegetation Communities (WVCs) (C.J.Robinson):

LS = Low Sedges; OW = Open Water.

(Note: Robinson describes the LS as TS = Tall Sedges but for waterbird usage this vegetation is better described as LS.)

## SURVEY DETAILS

Date: 4-12-91 Depth: 4.20 m at gauge Salinity 1.420 ppt
Fringing vegetation was flooded extensively.

Effort: Waded through LS (in mid afternoon) and circumnavigated the lake; returned in night-time to the eastern end only. Total survey time = 2.8 h.

## WATERBIRD DETAILS

| species recorded | number counted | active nests | broods (DR) | old nests | WVCs used (* for nest site) |
|---|---|---|---|---|---|
| AuGb | 6 | ϕ | 1 | (1⊕) | OW, LS*. |
| SiGl | 3 | ϕ | ϕ | ϕ | OW. |
| PaBD | 3 | ϕ | ϕ | ϕ | OW, LS. |
| SpCk | 1 | 1 | ϕ | ϕ | LS*. |
| [ HhGb | ϕ | ϕ | ϕ | 1 | LS*. ] |
| [ unidentified grebe | ϕ | ϕ | ϕ | 1 | LS*. ] |

⊕ omit from total because is probably that of the pair now with a brood.

Totals: 13 1 1 2 (including data on other sheets? NO)

species (now/earlier) = 4/1 extra., breeding spp (now/earlier) = 2/1 extra.

## WATERBIRD DETAILS cont'd

Other species probably now present in dense inundated vegetation: LiGd*, BbaR.
(* possibly breeding now)

## DETAILS OF NESTS FOUND

| waterbird species | status of nest | contents | site (WVC) | water depth | main plant species |
|---|---|---|---|---|---|
| AuGb | recently left ('old') | eggshells ⊙ (empty) | LS | 30 cm | Juncus kraussii |
| SpCk ⊗ | active | 4 eggs | LS | 15 cm | Baumea vaginalis to 1.0m |
| HhGb | old | empty ⊕ | LS | 20 cm | Baumea juncea |
| unidentified grebe | old | empty | LS | 20 cm | Juncus kraussii |

⊗ adult flushed off nest.

⊙ eggshells smooth — as typical for AuGb eggs.

⊕ two rotten eggs in water near nest, with calcareous surface lumps typical for HhGb eggs.

Other notes on species: PaBD may breed in the LS. AuGb chicks (4) probably less than two weeks old, keeping close to LS. One PaBD not flying, due to moult.

## ACCESS NOTES

—

## MANAGEMENT CONSIDERATIONS

Proposed re-routing of Hamelin Bay road to N. side of lake probably would not have adverse effect on waterbird use of lake, especially if there is a buffer zone of (?) 30-50 m (vegetated). Deeper or more prolonged flooding of the LS may create more breeding opportunities, though the present regime should be maintained if possible because it is known to be suitable for breeding by 3 spp.

Notes cont'd

4 LAKE DAVIES

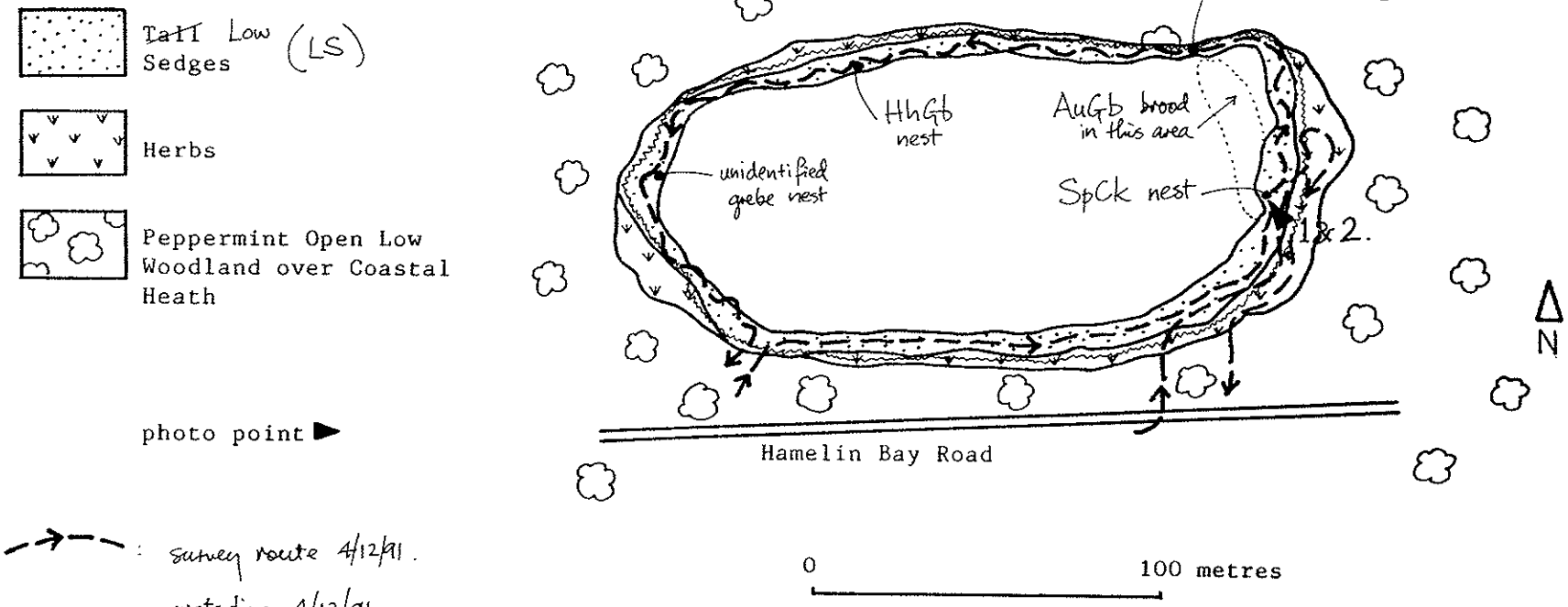


Photo 1. Lake Davies. Nest of Spotless Crake in Baumea vaginalis and Juncus kraussii. 4/12/91.

Photo 2. Lake Davies. Nest and eggs of Spotless Crake. 4/12/91.

Waterbirds in Wetlands on the South Coast of Western Australia

SUMMARY DATASHEET

**LAKE** QUITJUP 

## WETLAND DETAILS

Lat: 34° 23′ S. Long: 115° 35′ E. Shire: Nannup.

Land Status: within D'Entrecasteaux National Park.

CALM Region: Central Forest District: Nannup.
Forestry Sheet (1:50 000): Jasper.

Wetland Vegetation Communities (WVCs) (C.J.Robinson):
TS = Tall Sedges; CF = Cedar Dense Low Forest; AF = Agonis floribunda (Thicket) Heath over Tall Sedges; AL = Agonis linearifolia Thicket; OW = Open Water; LS = Low Sedges. (also see map)

## SURVEY DETAILS

Date: 5-6/12/91 Depth: approx. 1·75 m Salinity 0·116 ppt
Fringing vegetation was flooded extensively.

Effort: Total survey time: 10.0 h; surveys covered all times of day and included night-time (listening for bitterns). Intensive searching for nests in all WVCs. Boat used on OW.

## WATERBIRD DETAILS

| species recorded | number counted | active nests | broods (DR) | old nests | WVCs used (* for nest site) |
|---|---|---|---|---|---|
| PaBD | 10 | ø | ø | ø | OW, TS. |
| LiBC | 1 | ø | ø | ø | OW, fringing jarrah trees. |
| GreC | 4 | ø | ø | ø | OW, fringing jarrah trees. |
| LitB | 1 | ø | ø | ø | AF. |
| Swan | 2 | ø | ø | ø | OW. |
| SpCk | 7 | ø | ø | 1 | AF*, AL. |
| CReW | 4 | ø | ø | ø | AF. |
| LiGd | 14 | ø | ø | ø | TS, AF. |
| PuSn | 2 | ø | ø | 6 | TS*, AF*. |
| Matta | 2 | ø | ø | ø | AL, TS, LS: over-flying. |
| Totals: | 47 | ø | ø | 7 | (including data on other sheets? NO) |

species (now/earlier) = 10/ø, breeding spp (now/earlier) = ø/2 extra.

## WATERBIRD DETAILS cont'd

Other species probably now present in dense inundated vegetation: MusD*, BbaR?, AusB?.
(* possibly breeding now)

## DETAILS OF NESTS FOUND

| waterbird species | status of nest | contents | site (WVC) | water depth | main plant species |
|---|---|---|---|---|---|
| SpCk | old | empty | AF | 30 cm | Agonis sp. (not floribunda) |
| PuSn⊗ | old⊙ | empty | TS | 40 cm | Baumea articulata |
| PuSn | old | empty | AF | 30 cm | Agonis floribunda with Baumea spp. included. |
| PuSn | old | empty | AF | 30 cm | |
| PuSn | old | empty | AF | 30 cm | |
| PuSn | old | empty | AF | 30 cm | |
| PuSn | old | empty | AF | 30 cm | |

[⊗ nests identified to this species on basis of site & structure; also, unlikely to be Coot nest in this type of wetland.]

⊙ several may have been used in 1991.

Other notes on species: Western zone of LS may be suitable for AusB and patchy AF around it may be suitable for breeding by LitB; water 20-30 cm deep, 12/91. Also looked suitable for LitB nests in AF adjacent to TS at W. end of lake; lots of Baumea vaginalis within the AF. (see below)

## ACCESS NOTES

Access track firm but scrub overhanging or overgrowing it in a few places; also, quite steep on NE side of rise not far from the lake. One or two tight turns between trees were required — Ford F250 may scrape?

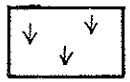
## MANAGEMENT CONSIDERATIONS, CReW

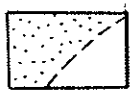
Wetland vegetation not burnt in recent years; LitB and most of the nests were found in the most mature AF, which therefore should be protected from wildfire as far as possible.

Notes cont'd

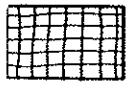
Species. Both species of cormorant were roosting at night in a tall jarrah tree overhanging the lake.

5 LAKE QUITJUP

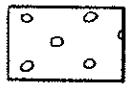

Low Sedges (LS): not marked by Robinson.


Tall Sedges (TS)


Callistachys Thicket Dry.

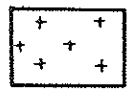

Cedar Dense Low Forest (CF)


Paperbark Low Forest not investigated

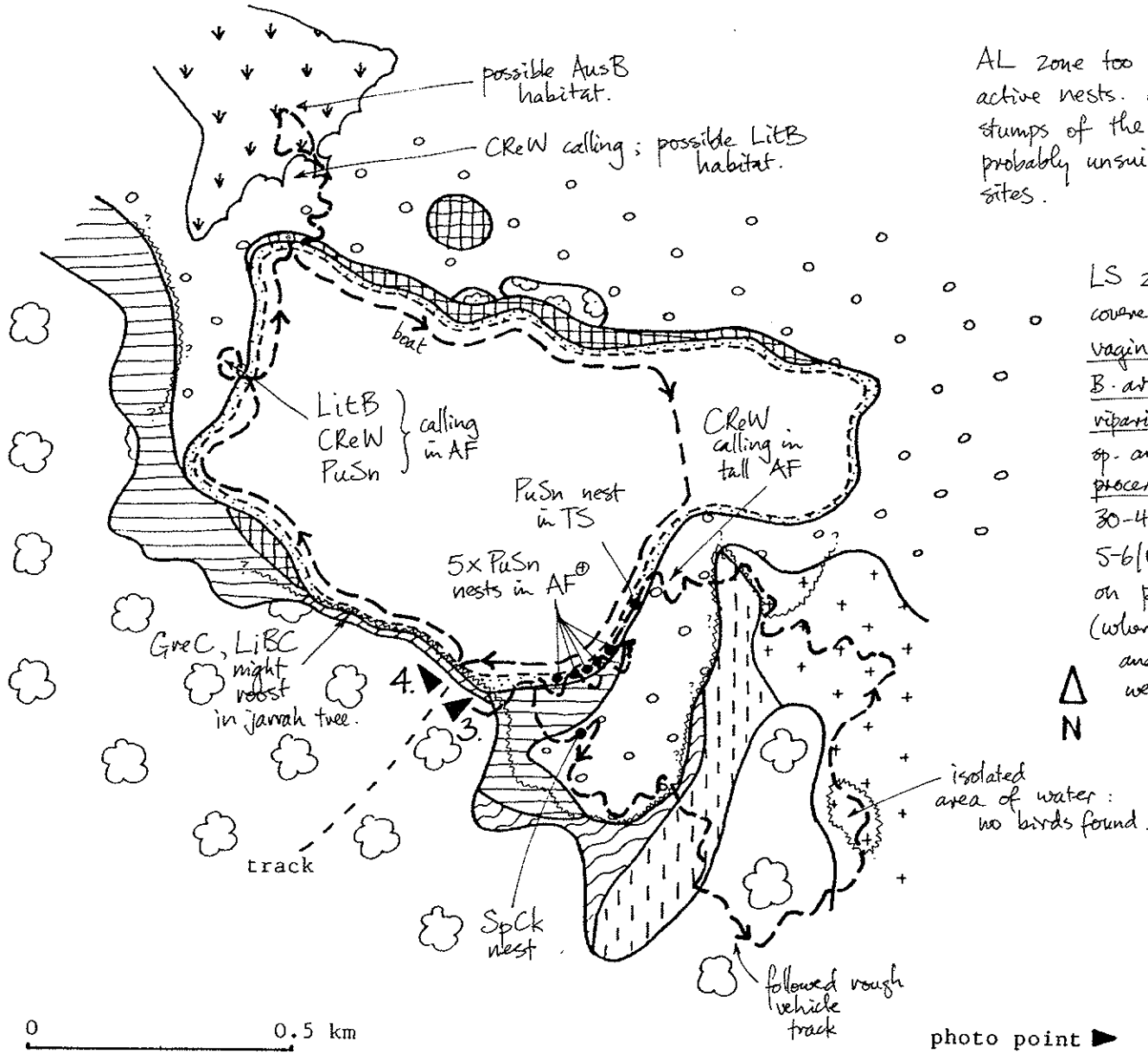

Agonis floribunda Heath over Tall Sedges (AF)


Agonis linearifolia Thicket (AL)


Kunzea Dense Thicket dry.


Beaufortia Heath mostly dry, no birds.


Jarrah Low Woodland over Low Heath




AL zone too shallow for active nests. Also, raised stumps of the shrubs probably unsuitable as nest sites.

LS zone mostly covered in Baumea vaginalis with sparse B. articulata, B. (?) riparia, Leptocarpus sp. and Triglochin procera. Water was 30-40 cm deep on 5-6/12/91, shallower on peaty mounds (where B. articulata and Leptocarpus were denser).

→ : survey route 5-6/12/91.

~~~ : waterline 5-6/12/91.

⊕ there was a thin strip of AF only a few shrubs wide, between AL & TS.
~~~

Photo 3. Quitjup Lake. View over SE part, showing Tall Sedges and thickets. 5/12/91.

Photo 4. Quitjup Lake. View of western end of Open Water. 5/12/91.

Waterbirds in Wetlands on the South Coast of Western Australia

SUMMARY DATASHEET

**LAKE** JASPER 

## WETLAND DETAILS

Lat: 34° 24′ S. Long: 115° 41′ E. Shire: Nannup.

Land Status: within D'Entrecasteaux National Park.

CALM Region: Central Forest. District: Nannup.
Forestry Sheet (1:50 000): Jasper.

Wetland Vegetation Communities (WVCs) (C.J.Robinson):
TS = Tall Sedges, LS = Low Sedges, AF = Agonis floribunda (Thicket) Heath over Tall Sedges, CF = Cedar Dense Low Forest, OW = Open Water, BL = Bare Land (beach).

## SURVEY DETAILS

Date: 14 to 16-12-91. Depth: unable to find depth gauge (lake full). Salinity 0-180 ppt
Fringing vegetation was flooded extensively.

Effort: Total survey time was 9.8 h, including all parts of the day and also night surveys listening for bitterns. One circumnavigation of OW in early morning by boat, to count waterbirds there. Waded in TS, LS, AF, CF searching intensively for nests (at 5 parts of the wetland). (see map)

## WATERBIRD DETAILS

| species recorded | number counted | active nests | broods (DR) | old nests | WVCs used (* for nest site) |
|---|---|---|---|---|---|
| LPiC | 11 | ∅ | ∅ | ∅ | OW. |
| GCGb | 3 | ∅ | ∅ | ∅ | OW. |
| MaHa | 2 | ∅ | ∅ | ∅ | AF : passing over. |
| SiGl | 15 | ∅ | ∅ | ∅ | OW. |
| MusD | 8 | ∅ | ∅ | 1 | TS*, OW, CF. |
| APel | 1 | ∅ | ∅ | ∅ | OW. |
| Shel | 70 | ∅ | ∅ | ∅ | OW. |
| LiBC | 75 | ∅ | ∅ | ∅ | CF, OW. |
| WfHn | 6 | ∅ | ∅ | ∅ | CF, BL. |
| PaBD | 123 | ∅ | ∅ | ∅ | CF, OW. |
| Totals: | 340 | 1 | ∅ | 14 | (including data on other sheets? YES) |

species (now/earlier) = 18/1 extra., breeding spp (now/earlier) = 1/5 extra.

## ADDITIONAL WATERBIRD DETAILS

| species recorded | number counted | active nests | broods (DR) | old nests | WVCs used (* for nest site) |
|---|---|---|---|---|---|
| ManD | 1 | ϕ | ϕ | ϕ | OW, CF. |
| Coot | 1 | ϕ | ϕ | ϕ | OW. |
| Gank | 2 | ϕ | ϕ | ϕ | BL. |
| Swan | 1 | ϕ | ϕ | ϕ | OW. |
| SpCk | 5 | ϕ | ϕ | 1 | TS*, LS, CF. |
| PuSn | 2 | ϕ | ϕ | 3 | TS*, LS. |
| LiGd | 5 | ϕ | ϕ | 1 | TS*, LS. |
| CReW | 9 | 1 | ϕ | 7 | TS*, AF*. |
| [ LitB | ϕ | ϕ | ϕ | 1 | AF*. ] |

BREEDING DATA cont. (from p. 3)

| waterbird species | status of nest | contents | site (WVC) | water depth | main plant species |
|---|---|---|---|---|---|
| CReW | old | empty | TS | 30 cm | Baumea articulata |
| CReW | old | empty | AF | 50 cm | Agonis floribunda |
| CReW | old | empty | AF | 50 cm | " " |
| CReW | old | empty | AF | 50 cm | " " |
| CReW | old | empty | AF | 40 cm | " " |
| CReW | old | empty | AF | 40 cm | " " |
| CReW | old | empty | AF | 40 cm | " " |

## WATERBIRD DETAILS cont'd

Other species probably now present in dense inundated vegetation: BaCk?, BbaR*, AnsB?, LitB*, BbiD.
(* possibly breeding now)

## DETAILS OF NESTS FOUND

| waterbird species | status of nest | contents | site (WVC) | water depth | main plant species |
|---|---|---|---|---|---|
| MusD | old ⊗ | empty | TS | 40 cm | Baumea articulata |
| SpCk | old ⊙ | eggshells (empty) | TS | 60 cm | " " |
| PuSn | old | empty | TS | 50 cm | " " |
| PuSn | old | empty | TS | 50 cm | " " |
| PuSn | old | empty | TS | 40 cm | " " |
| LiGd | old ⊙ | feather, scale (empty) | TS | 30 cm | " " |
| LitB | old | empty | AF | 40 cm | Agonis floribunda |
| CReW | active | 1 egg | AF | 40 cm | " " |

↳ (cont. on p. 2) ⊗ or possibly not yet used in 1991-2 season. ⊙ used in 1991?

Other notes on species: Conditions in western AF thickets seemed suitable for nesting by LitB at the time of survey; two possible (part built) nests were found near the confirmed old nest. The large area of LS near the PuSn nests looked suitable for AusB; likewise near photo point 10. CReW nests in the AF were very close together. 33 Shel + 20 PaBD were flightless due to moult. Boat survey of lake proper did not reveal any big congregations in certain parts — birds were well spread.

ACCESS NOTES → Main track in from east was straightforward. Track from boat ramp and picnic area westward to other parts of the wetland was not difficult but was flooded in one place. Wading in the swamps was not difficult where water < 0.5m deep but deeper areas were softer underfoot, eg. near photo point 9.

MANAGEMENT CONSIDERATIONS

Most of CF had been burnt out: this habitat was therefore more accessible to ducks in some situations, eg. near photo point 7. In the far western swamps (photo points 10-14) some of the vegetation had not been burnt for a long time; the mature AF thickets should be protected, as far as possible, from wildfire. Boating zones seemed reasonable and well marked (E. half of lake).

Notes cont'd
(See original datasheets for more detail.)

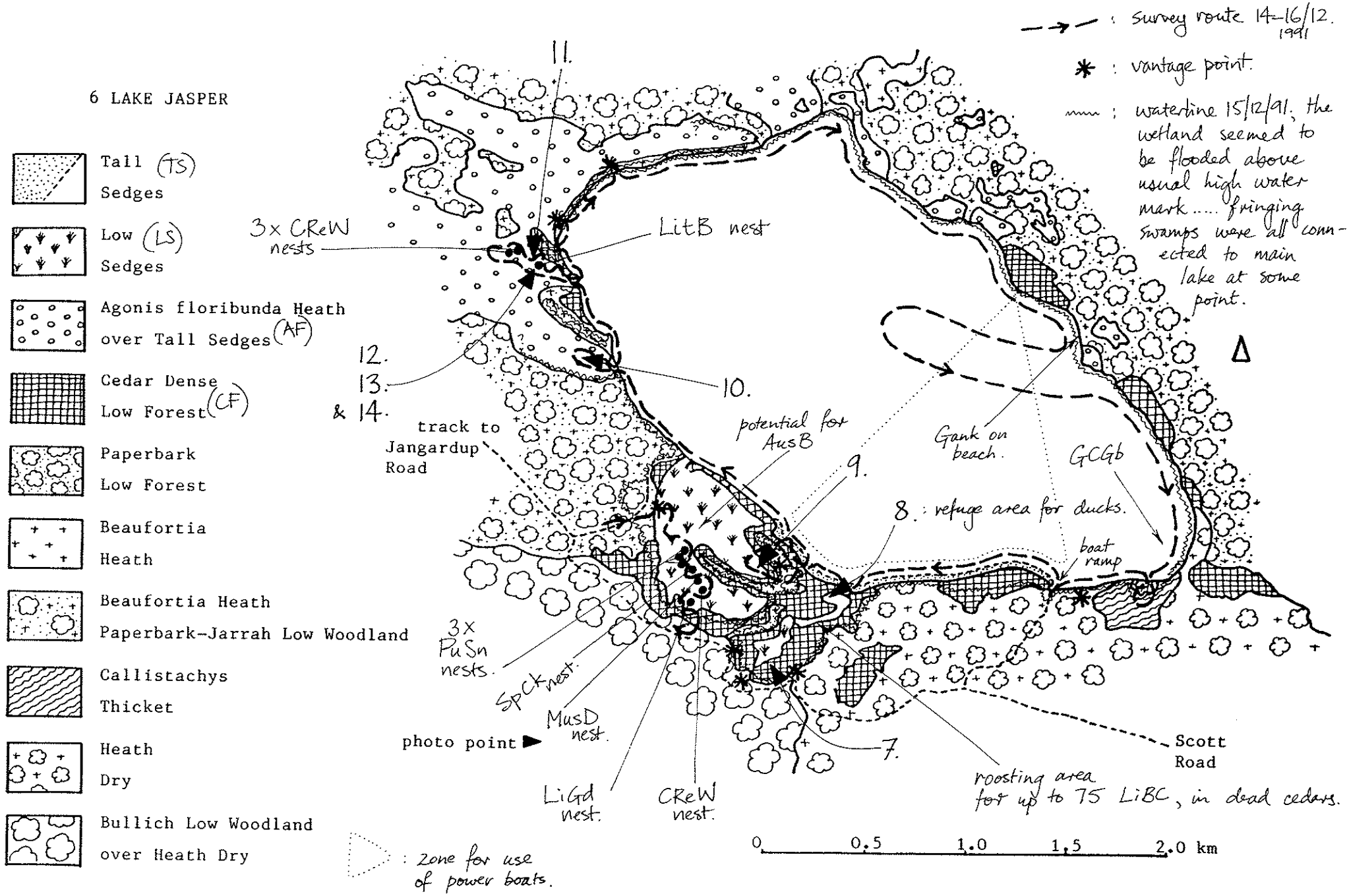

6 LAKE JASPER
Tall (TS) Sedges
Low (LS) Sedges
Agonis floribunda Heath over Tall Sedges (AF)
Cedar Dense Low Forest (CF)
Paperbark Low Forest
Beaufortia Heath
Beaufortia Heath Paperbark-Jarrah Low Woodland
Callistachys Thicket
Heath Dry
Bullich Low Woodland over Heath Dry
: survey route 14-16/12. 1991
* : vantage point.
: waterline 15/12/91, the wetland seemed to be flooded above usual high water mark..... fringing swamps were all connected to main lake at some point.
11.
3x CReW nests
LitB nest
12.
13.
& 14.
10.
track to Jangardup Road
potential for AusB
9.
Gank on beach.
GCGb
8. : refuge area for ducks.
boat ramp
3x PuSn nests.
SpCk nest.
MusD nest.
photo point
7.
Scott Road
LiGd nest.
CReW nest.
roosting area for up to 75 LiBC, in dead cedars.
: zone for use of power boats.
0 0.5 1.0 1.5 2.0 km

Photo 7. Lake Jasper. Southern swamp. Cedar Forest devastated by fire; now used by ducks and cormorants. 15/12/91.

Photo 8. Lake Jasper. Lagoon in southern swamp, offering shelter for ducks and roost site for cormorants. 15/12/91.

Photo 9. Lake Jasper. South-western swamp. Clumps of taller Baumea articulata in extensive low B. vaginalis provide nests sites for at least five species, e.g. Purple Swamphen. 15/12/91.

Photo 10. Lake Jasper. Extensive areas of Low Sedge in the western swamps may be suitable for the Australasian Bittern. 15/12/91.

Photo 11. Lake Jasper. Agonis floribunda Thicket with emergent Agonis juniperina, in the western swamps; site of old Little Bittern nest (centre left). 15/12/91.

Photo 12. Lake Jasper. Old nest of Little Bittern in Agonis floribunda Thicket, western swamps. 15/12/91.

Photo 13. Lake Jasper. Site of old Little Bittern nest, in Agonis floribunda, Baumea articulata and B. vaginalis. 15/12/91.

Photo 14. Lake Jasper. Little Bittern nest. 15/12/91.

Waterbirds in Wetlands on the South Coast of Western Australia

SUMMARY DATASHEET

**LAKE** WILSON 

## WETLAND DETAILS

Lat: 34°26′ S. Long: 115°43′ E. Shire: Nannup.

Land Status: within D'Entrecasteaux National Park.

CALM Region: Central Forest. District: Nannup.
Forestry Sheet (1:50 000): Jasper.

Wetland Vegetation Communities (WVCs) (C.J.Robinson):
TS = Tall Sedges, AF = Agonis floribunda (Thicket) Heath over Tall Sedges, CF = Cedar Dense Low Forest, OW = Open Water.

## SURVEY DETAILS

Date: 13-14/12/91 Depth: not recorded. Salinity 0.118 ppt
Fringing vegetation was flooded extensively.

Effort: Boated around OW at night and in early morning; waded through TS, AF & CF in morning. Total survey time was 6.0 h. Also attempted crake trapping at eastern end of lake: no success.

## WATERBIRD DETAILS

| species recorded | number counted | active nests | broods (DR) | old nests | WVCs used (* for nest site) |
|---|---|---|---|---|---|
| MusD | 2 | ϕ | ϕ | 2 | CF* OW. |
| GreC | 6 | ϕ | ϕ | ϕ | OW. |
| CReW | 1 | ϕ | ϕ | ϕ | AF. |
| PaBD | 1 | ϕ | ϕ | ϕ | OW. |
| SpCk | 2 | ϕ | ϕ | ϕ | AF. |
| MaHa | 1 | ϕ | ϕ | ϕ | AF: passing over. |
| LiGd | 1 | ϕ | ϕ | ϕ | AF. |
| WfHn | 1 | ϕ | ϕ | ϕ | AF: passing over. |
| | | | | | |
| | | | | | |
| Totals: | 15 | ϕ | ϕ | 2 | (including data on other sheets? No) |

species (now/earlier) = 8/ϕ, breeding spp (now/earlier) = ϕ/1 extra.

## WATERBIRD DETAILS cont'd

Other species probably now present in dense inundated vegetation: LitB?, BbaR?
(* possibly breeding now)

## DETAILS OF NESTS FOUND

| waterbird species | status of nest | contents | site (WVC) | water depth | main plant species |
|---|---|---|---|---|---|
| MusD | old | eggshells (empty) | CF ⊕ | 30 cm | Agonis juniperina with Baumea vaginalis |
| MusD | old | eggshells (empty) | CF | 30 cm | |

⊕ Both nests were in thicket of sapling A. juniperina to approx. 5-6 m height, between older and taller cedars and the AF zone. B. vaginalis was extensive and dense (more so than in older cedars), standing up to 1.0+m in height. Lots of eggshells in nests, suggesting use in 1991 season and also in several previous years. Access to OW for a swimming MusD possible via older cedars where 'channels' of clear water exist, 30-50 cm deep on 14/12/91.

Other notes on species:

GreC roost in bullich tree overhanging the lake. CReW calling strongly in AF (see map), day and night and a part-built nest was found there. (see below). Crake trapping yielded no birds. (this sp.?)

## ACCESS NOTES

—

## MANAGEMENT CONSIDERATIONS

Parts of AF had been burnt out a year or two ago and replaced with mixture of TS and LS. Area of CF where MusD nests were found had not been burnt for many years; there were few fallen logs or stumps and a tall thick growth of low sedge under the cedar saplings — good for nesting.

Notes cont'd

Species. AF in general probably is not tall enough for nesting LitB except in one or two spots. No response to imitations of LitB calls (night survey).

7 LAKE WILSON

8 LAKE SMITH

Tall Sedges (TS)

Agonis floribunda Heath over Tall Sedges (AF)

Cedar Dense Low Forest (CF)

Paperbark Low Woodland

Beaufortia Heath

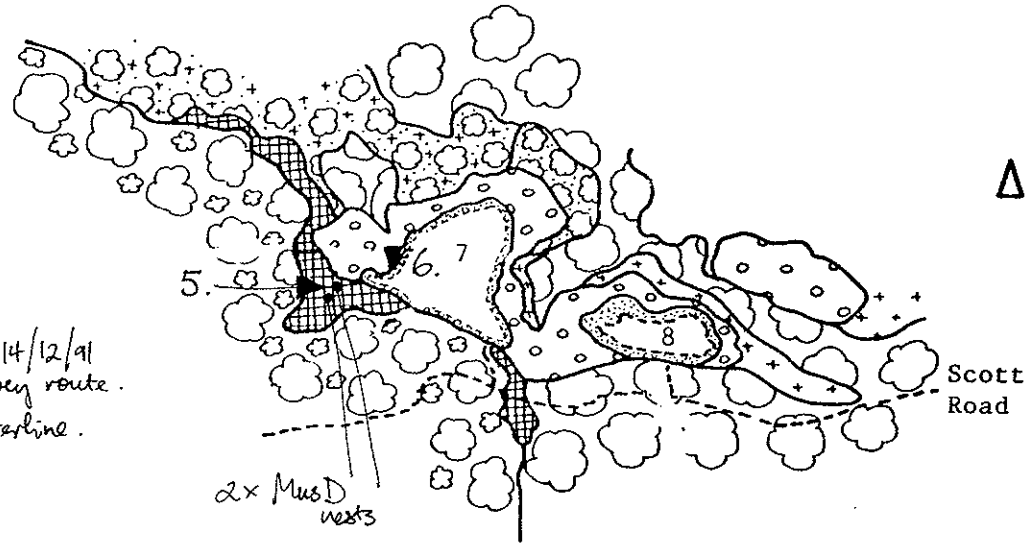
Beaufortia Heath Paperbark-Jarrah Low Woodland

Jarrah Low Woodland over Heath

Bullich Low Woodland over Heath

13-14/12/91 : survey route.

: waterline.




ENLARGEMENT OF L. WILSON (not to scale)

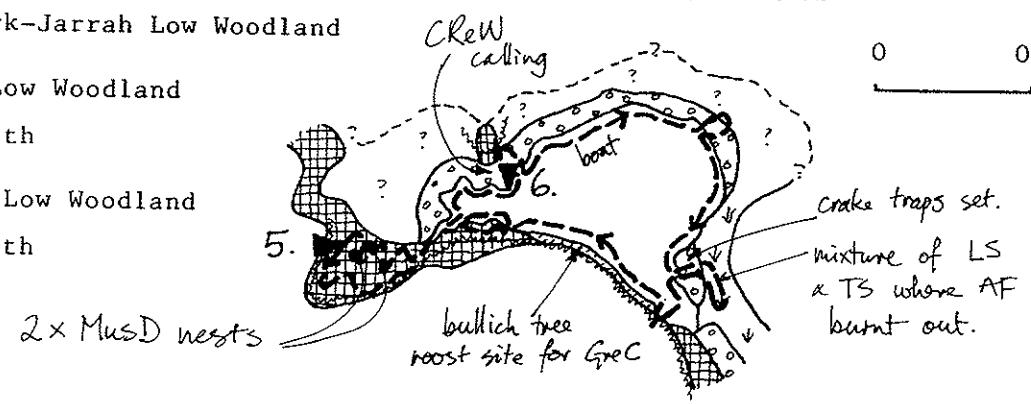



photo point ▶

0 0.5 1.0 1.5 2.0 km

TS insignificant on northern 'shore'.

Unsure of WVC behind AF, i.e. whose burnt out, but probably TS/LS mix as in E.

Photo 5.
Lake Wilson.
Low Cedar Forest
with clumps of
Low Sedge:
nest site for
Musk Ducks.
14/12/91.

Photo 6. Lake Wilson. Fringing Leptocarpus sedges and Agonis floribunda Thicket: habitat for Little Grassbirds. 14/12/91.

Waterbirds in Wetlands on the South Coast of Western Australia

SUMMARY DATASHEET

LAKE YEAGARUP 

## WETLAND DETAILS

Lat: 34° 32′ S. Long: 115° 53′ E. Shire: Manjimup.

Land Status: within State Forest (Charley Block).

CALM Region: Southern Forest. District: Pemberton.
Forestry Sheet (1:50 000): Warren.

Wetland Vegetation Communities (WVCs) (C.J.Robinson):

TS = Tall Sedges, CF = Cedar Dense Low Forest, LS = Low Sedges, AL = Agonis linearifolia Thicket (not identified by Robinson), OW = Open Water.

## SURVEY DETAILS

Date: 16-18/12/91. Depth: not recorded. Salinity 0·104 ppt
Fringing vegetation was flooded a little.

Effort: Intensive search for nests in TS, LS and AL in south-east part of lake; also visits to inspect crake traps set up in same area, at various times of day. Total survey time was 3.8 h.

## WATERBIRD DETAILS

| species recorded | number counted | active nests | broods (DR) | old nests | WVCs used (* for nest site) |
|---|---|---|---|---|---|
| PaBD | 2 | ∅ | ∅ | ∅ | OW. |
| LiGd | 1 | ∅ | ∅ | 2 | AL*, TS. |
| [SpCk | ∅ | ∅ | ∅ | 3 | AL*.] |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| Totals: | 3 | ∅ | ∅ | 5 | (including data on other sheets? NO) |

species (now/earlier) = 2/1 extra., breeding spp (now/earlier) = ∅/2 extra.

## WATERBIRD DETAILS cont'd

Other species probably now present in dense inundated vegetation: BbaR.
(* possibly breeding now)

## DETAILS OF NESTS FOUND

| waterbird species | status of nest | contents | site (WVC) | water depth | main plant species |
|---|---|---|---|---|---|
| LiGd | old | empty | AL ⊙ | < 5 cm | Agonis linearifolia with various sedges growing within, i.e. Baumea articulata, B. vaginalis, B. juncea, Leptocarpus sp., B. riparia. |
| LiGd | old | empty | AL | < 5 cm | |
| SpCk | old | empty | AL | < 5 cm | |
| SpCk | old | empty | AL | < 5 cm | |
| SpCk | old | empty | AL | < 3 cm | |

⊙ AL not recognised as a WVC by Robinson but forms distinct zone between TS or LS, and the Beaufortia Heath. (see map)

Other notes on species: A total of 135 shrubs of A. linearifolia was searched for crake nests — nests were found in three (3) of the 135, which were each 1.5–2.0 m in height, of 'mallee' form, at or near edge of thicket and thickly infused with sedges. (see below)

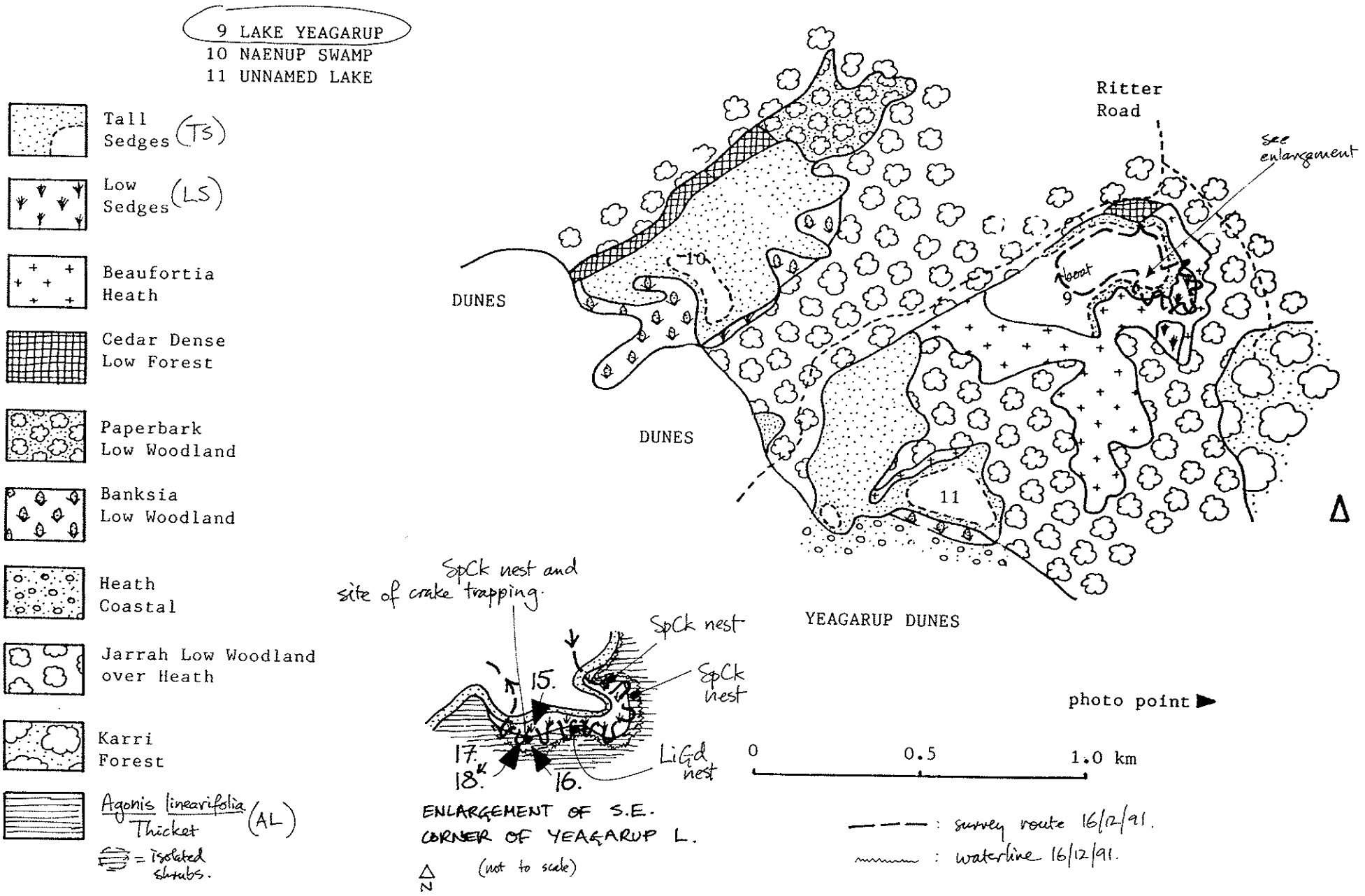
## ACCESS NOTES

—

## MANAGEMENT CONSIDERATIONS

—

Notes cont'd Species. Trapping for crakes, using drift-line fences (2) and box traps (5), was done through TS, LS and AL in the vicinity of one of the crake nests. Water 0–20 cm deep. Nothing caught: siting or equipment may not have been correct.


9 LAKE YEAGARUP
10 NAENUP SWAMP
11 UNNAMED LAKE
Tall Sedges (TS)
Low Sedges (LS)
Beaufortia Heath
Cedar Dense Low Forest
Paperbark Low Woodland
Banksia Low Woodland
Heath Coastal
Jarrah Low Woodland over Heath
Karri Forest
Agonis linearifolia Thicket (AL)
= isolated shrubs.
Ritter Road
see enlargement
boat
DUNES
DUNES
10
9
11
YEAGARUP DUNES
SpCk nest and site of crake trapping.
SpCk nest
SpCk nest
LiGd nest
15.
17.
18.
16.
ENLARGEMENT OF S.E. CORNER OF YEAGARUP L.
(not to scale)
N
photo point
0
0.5
1.0 km
: survey route 16/12/91.
: waterline 16/12/91.

Waterbirds in Wetlands on the South Coast of Western Australia

SUMMARY DATASHEET

**LAKE** SMITH 

## WETLAND DETAILS

Lat: 34° 26′ S. Long: 115° 43′ E. Shire: Nannup.

Land Status: within D'Entrecasteaux National Park.

CALM Region: Central Forest. District: Nannup.
Forestry Sheet (1:50 000): Jasper.

Wetland Vegetation Communities (WVCs) (C.J.Robinson):
TS = Tall Sedges ; LS = Low Sedges ; AF = Agonis floribunda (Thicket) Heath over Tall Sedges ; CF = Cedar Dense Low Forest ; OW = Open Water.

## SURVEY DETAILS

Date: 13-12-91. Depth: not recorded. Salinity 0.101 ppt
Fringing vegetation was flooded extensively.

Effort: Waded through wetland vegetation at southern and western sides of the lake in late afternoon (2.5 h).

## WATERBIRD DETAILS

| species recorded | number counted | active nests | broods (DR) | old nests | WVCs used (* for nest site) |
|---|---|---|---|---|---|
| LiGd | 7 | ∅ | ∅ | ∅ | TS, AF. |
| Matla | 2 | ∅ | ∅ | ∅ | AF. |
| PuSn | 2 | ∅ | 1 | 2 | TS*. |
| MusD | 1 | ∅ | ∅ | ∅ | OW. |
| SpCk | 2 | ∅ | ∅ | ∅ | AF. |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| Totals: | 14 | ∅ | 1 | 2 | (including data on other sheets? No) |

species (now/earlier) = 5/∅ , breeding spp (now/earlier) = 1/∅ extra

## WATERBIRD DETAILS cont'd

Other species probably now present in dense inundated vegetation: CReW*, LitB*, BbaR?, AusB?
(* possibly breeding now)

## DETAILS OF NESTS FOUND

| waterbird species | status of nest | contents | site (WVC) | water depth | main plant species |
|---|---|---|---|---|---|
| PuSn° | old | empty | TS | 30 cm | Baumea articulata and Leptocarpus sp. |
| PuSn° | old | empty | TS | 30 cm | |

° identified as this species on basis of nest site & structure; Coot unlikely to breed in this type of wetland.

Other notes on species: PuSn seen with a downy runner at edge of TS and OW in W end of lake; the adult pulled up a white plant root or tuber (Triglochin??) and passed a fine piece to the young bird before eating part of the nest of it.

## ACCESS NOTES

—

## MANAGEMENT CONSIDERATIONS

NW part of AF zone, not far from NW side of OW, had been burnt out a year or two ago and now mostly taken over by LS (Baumea articulata (sparse) and B. vaginalis (dense)).

Notes cont'd

7 LAKE WILSON

8 LAKE SMITH

Low Sedges (LS) : not marked by Robinson.

Tall Sedges (TS)

Agonis floribunda Heath over Tall Sedges (AF)

Cedar Dense Low Forest (CF) : pools of water to 30cm deep; or dry.

Paperbark Low Woodland

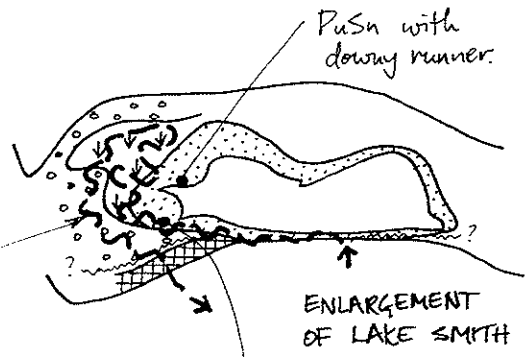
Beaufortia Heath

Beaufortia Heath Paperbark-Jarrah Low Woodland

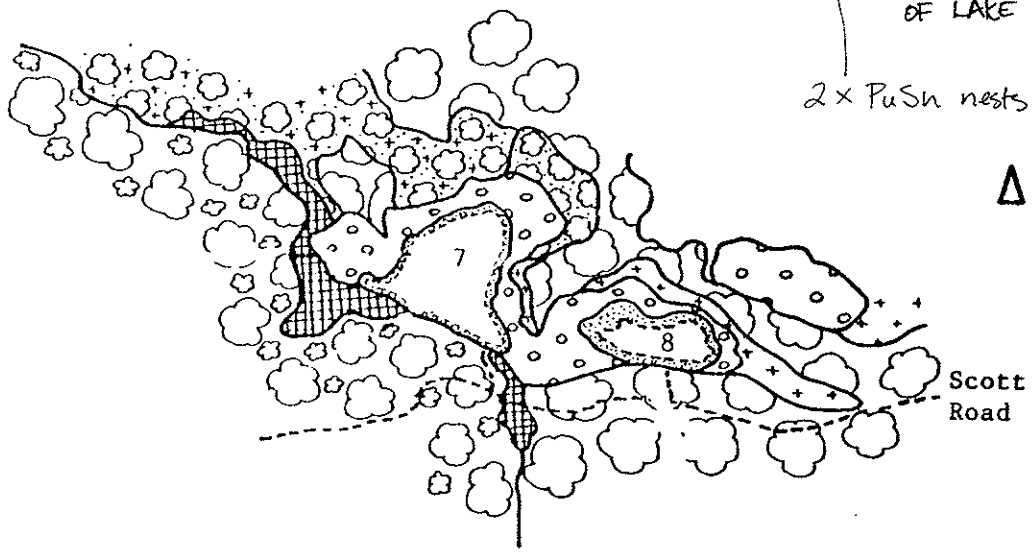
Jarrah Low Woodland over Heath

Bullich Low Woodland over Heath

L. Smith : TS only tall and dense close to edge of OW; low sedges such as Leptocarpus sp. dominate behind the taller Baumea articulata. AF at W end is 2.0-5.0 m high and possibly suitable for breeding by LitB.




2 × PuSn nests




0 0.5 1.0 1.5 2.0 km

: survey route 13/12/91.

: waterline 13/12/91.

Photo 15. Yeagarup Lake. NE side. Agonis linearifolia Thicket with dense Low Sedges: habitat for nests of Spotless Crake. 16/12/91.


Photo 16. Yeagarup Lake. Old nest of Spotless Crake in Agonis linearifolia and Baumea vaginalis. 16/12/91.

Photo 17. Yeagarup Lake. Driftline and box trap set for catching crakes. 16/12/91.

Photo 18. Yeagarup Lake. Box traps set at junction of driftline fences for crake catching. 16/12/91.

Waterbirds in Wetlands on the South Coast of Western Australia

SUMMARY DATASHEET

**LAKE** NAENUP 

## WETLAND DETAILS

Lat: 34° 32′ S. Long: 115° 52′ E. Shire: Manjimup.

Land Status: within State Forest (Charley Block).

CALM Region: Southern Forest. District: Pemberton.
Forestry Sheet (1:50 000): Warren.

Wetland Vegetation Communities (WVCs) (C.J.Robinson):
TS = Tall Sedges, CF = Cedar Dense Low Forest, OW = Open Water. (See map).

## SURVEY DETAILS

Date: 17-12-91 Depth: not recorded. Salinity 0.122 ppt
Fringing vegetation was flooded extensively.

Effort: Walked around western side of lake, wading in TS and small areas of flooded CF and Banksia woodland. Total survey time of 4.5 h was all in middle of day. Also views of OW from top of sandhill.

## WATERBIRD DETAILS

| species recorded | number counted | active nests | broods (DR) | old nests | WVCs used (* for nest site) |
|---|---|---|---|---|---|
| CReW | 3 | ∅ | ∅ | ∅ | TS. |
| PuSn | 3 | ∅ | 1 | ∅ | TS.(*) |
| PaBD | 4 | ∅ | ∅ | ∅ | OW. |
| MusD | 1 | ∅ | ∅ | ∅ | OW. |
| MaHa | 1 | ∅ | ∅ | ∅ | TS: passing over. |
| SpCk | 4 | ∅ | ∅ | ∅ | TS. |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| Totals: | 16 | ∅ | 1 | ∅ | (including data on other sheets? NO) |

species (now/earlier) = 6/∅ extra., breeding spp (now/earlier) = 1/∅ extra.

## WATERBIRD DETAILS cont'd

Other species probably now present in dense inundated vegetation: LitB?, AusB?, LiGd.
(* possibly breeding now)

## DETAILS OF NESTS FOUND

| waterbird species | status of nest | contents | site (WVC) | water depth | main plant species |
|---|---|---|---|---|---|
| NIL. | | | | | |

Other notes on species: Adult PuSh was seen swimming amongst TS at far west side of OW, accompanied by large juvenile. Only a few parts of the TS (Baumea articulata) look suitable for possible nesting by LitB; most of it is too collapsed or sparse. Far western corner of swamp looked best prospect for crake, duck & bittern nests.

ACCESS NOTES

→ Go via sandhills to southern-most point of lake and then follow the relatively clear shoreline.

## MANAGEMENT CONSIDERATIONS

Banksia and cedar woodland, especially on the peninsula at centre-south of lake, probably had not been burnt for a very long time. Lots of leaf litter etc. may result in very destructive hot fire if fire occurred.

Notes ~~cont'd~~

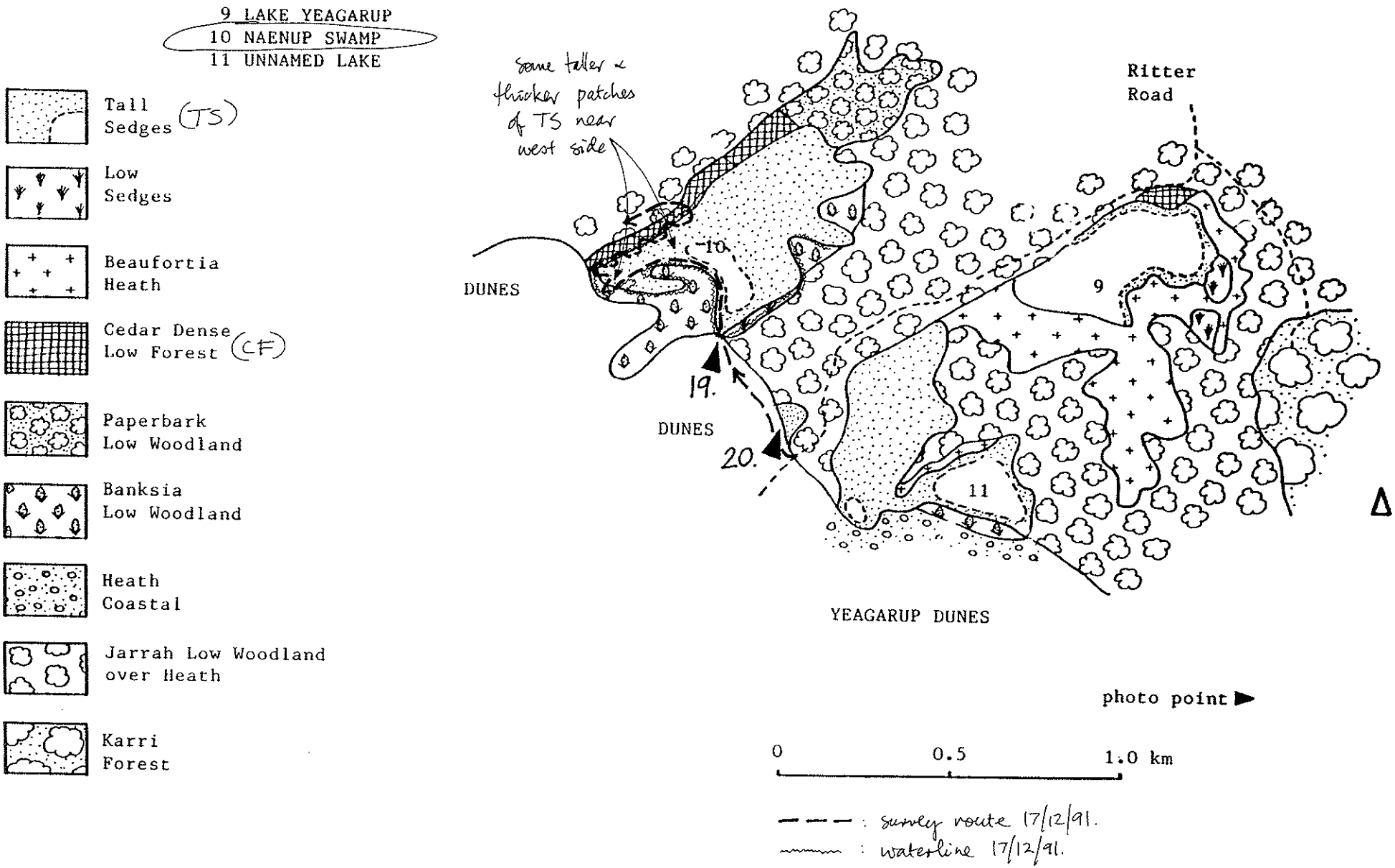

9 LAKE YEAGARUP
10 NAENUP SWAMP
11 UNNAMED LAKE
Tall Sedges (TS)
Low Sedges
Beaufortia Heath
Cedar Dense Low Forest (CF)
Paperbark Low Woodland
Banksia Low Woodland
Heath Coastal
Jarrah Low Woodland over Heath
Karri Forest
some taller & thicker patches of TS near west side
Ritter Road
DUNES
10
9
19.
DUNES
20.
11
YEAGARUP DUNES
photo point
0
0.5
1.0 km
: survey route 17/12/91.
: waterline 17/12/91.

Photo 19. Naenup Swamp. Young Purple Swamphen seen in Tall Sedges. 17/12/91.

Photo 20. Small swamp near Naenup Swamp, with advancing sand-dune. 18/12/91.

Waterbirds in Wetlands on the South Coast of Western Australia

SUMMARY DATASHEET

**LAKE** UN-NAMED near Yeagarup L. 

## WETLAND DETAILS

Lat: 34° 33′ S. Long: 115° 52′ E. Shire: Manjimup.

Land Status: within State Forest (Charley Block).

CALM Region: Southern Forest. District: Pemberton.
Forestry Sheet (1:50 000): Warren.

Wetland Vegetation Communities (WVCs) (C.J.Robinson):

TS = Tall Sedges, OW = Open Water.

Note: some of TS would probably be better classified as LS (Low Sedges) but difficult to map this due to patchiness of distribution.

## SURVEY DETAILS

Date: 16 & 18/12/91. Depth: not recorded. Salinity 0-144 ppt
Fringing vegetation was flooded extensively.

Effort: Waded through TS at south-west side of lake in late afternoon of 16/12/91 and viewed whole wetland from sandhill in early morning of 18/12/91. Total survey time of 2.5 h.

## WATERBIRD DETAILS

| species recorded | number counted | active nests | broods (DR) | old nests | WVCs used (* for nest site) |
|---|---|---|---|---|---|
| LiGd | 1 | ϕ | ϕ | ϕ | TS. |
| PuSn | 1 | ϕ | ϕ | ϕ | TS. |
| SpCk | 1 | ϕ | ϕ | ϕ | TS. |
| PaBD | 9 | ϕ | ϕ | ϕ | OW. |
| Matta | 1 | ϕ | ϕ | ϕ | TS: passing over. |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| Totals: | 13 | ϕ | ϕ | ϕ | (including data on other sheets? NO) |

species (now/earlier) = 5/ϕ extra., breeding spp (now/earlier) = ϕ/ϕ extra.

**LAKE** Un-named nr. Yeagarup L. Datasheet page 2 of 2

WATERBIRD DETAILS cont'd

Other species probably now present in dense inundated vegetation: BbaR, MusD, AusB, LewR ??
(* possibly breeding now)

DETAILS OF NESTS FOUND

| waterbird species | status of nest | contents | site (WVC) | water depth | main plant species |
|---|---|---|---|---|---|
| NIL | | | | | |

Other notes on species: Possibly a good area to look for LewR since WVC similar to LewR habitat in eastern States, at least in south-west corner of wetland (tussocks of Gahnia, dense low sedges, clumps of taller growth etc..). Also looks good for AusB especially in northern part of the wetland. (see below)

ACCESS NOTES

Difficult to get through thickets at edge of forest, so best access is across sandhills (where bare) to centre south side of wetland, where entry to flooded areas is probably easiest. Beware of 'holes' in the peaty substrate to this wetland; can walk easily in places but small channels and holes can be 30-50 cm deeper & soft underfoot.

MANAGEMENT CONSIDERATIONS

—

Notes cont'd Species Much evidence of activity by PuSn in low sedges: platforms for sunning and uprooted sedge within tussocks.

9 LAKE YEAGARUP
10 NAENUP SWAMP
11 UNNAMED LAKE

Tall Sedges (TS)

Low Sedges (LS)

Beaufortia Heath

Cedar Dense Low Forest

Paperbark Low Woodland

Banksia Low Woodland

Heath Coastal

Jarrah Low Woodland over Heath

Karri Forest

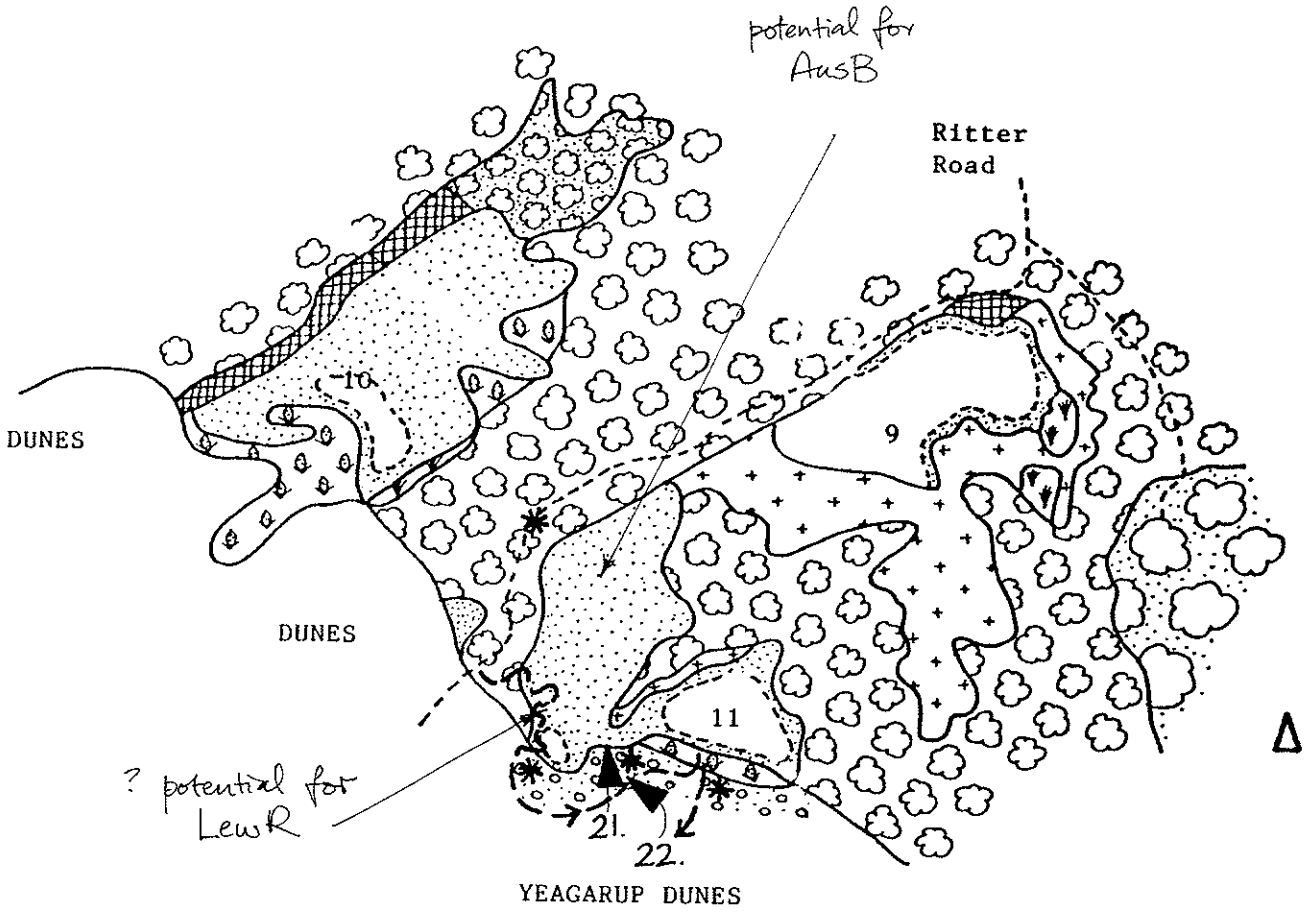



photo point ▶

0 0.5 1.0 km

— ——— : survey route 16/18-12-91. ✱ : vantage point.

— waterline 16/12/91 corresponded with outer edge of TS. i.e. where meets forest etc..

Photo 21. Un-named Swamp near Yeagarup Lake. South-western part. Possible habitat for Lewin's Rail? 18/12/91.

Photo 22. Un-named Swamp near Yeagarup Lake. Central and northern part. Possible habitat for Australasian Bittern? 18/12/91.

Waterbirds in Wetlands on the South Coast of Western Australia

SUMMARY DATASHEET

**LAKE** DOGGERUP 

## WETLAND DETAILS

Lat: 34° 43′ S. Long: 116° 04′ E. Shire: Manjimup.

Land Status: within D'Entrecasteaux National Park.

CALM Region: Southern Forest. District: Pemberton.
Forestry Sheet (1:50 000): Northcliffe.

Wetland Vegetation Communities (WVCs) (C.J.Robinson):
TS = Tall Sedges, AL = Agonis linearifolia Thicket, OW = Open Water.

## SURVEY DETAILS

Date: 18-12-91. Depth: not recorded. Salinity 0.108 ppt
Fringing vegetation was flooded a little.

Effort: Searched for nests along northern side in middle of day (0.8 h).
Little potential for nests or birds — very little cover still flooded.

## WATERBIRD DETAILS

| species recorded | number counted | active nests | broods (DR) | old nests | WVCs used (* for nest site) |
|---|---|---|---|---|---|
| PaBD | 1 | ∅ | ∅ | ∅ | TS. |
| WfHn | 1 | ∅ | ∅ | ∅ | OW: passing over. |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| Totals: | 2 | ∅ | ∅ | ∅ | (including data on other sheets? No) |

species (now/earlier) = 2/∅ extra., breeding spp (now/earlier) = ∅/∅.

## WATERBIRD DETAILS cont'd

Other species probably now present in dense inundated vegetation: SpCk?, BbaR??
(* possibly breeding now)

## DETAILS OF NESTS FOUND

| waterbird species | status of nest | contents | site (WVC) | water depth | main plant species |
|---|---|---|---|---|---|
| NIL | | | | | |

Other notes on species: Some potential for crake or duck nests in shrubs close to OW on northern side, but few shrubs have sedges in them (generally required for nesting by crakes) and most have raised stump-like bases which are not ideal for nest sites. Period of flooding may be too brief.

## ACCESS NOTES

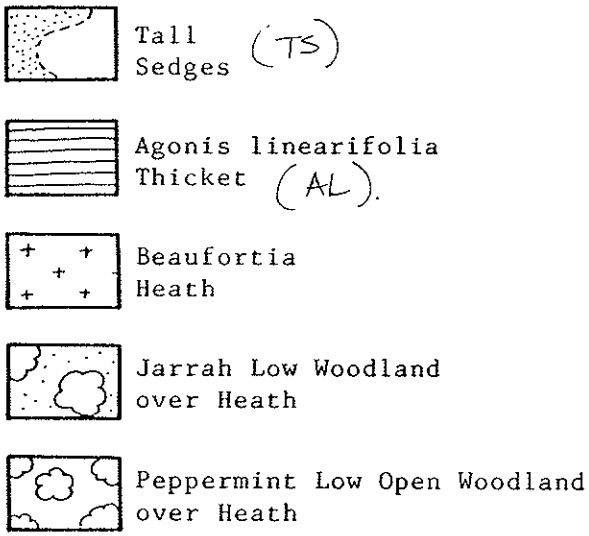
Take Malinup Track (off Windy Harbour Rd, 2.00 km S of Ladhams Rd) for 0.9 km, then go straight (slight veer to right) onto minor track and keep in that approx direction for 1.7 km. Then lake is visible off to left at base of sandy ridge. Beware boggy patch just about 1.6 km mark.

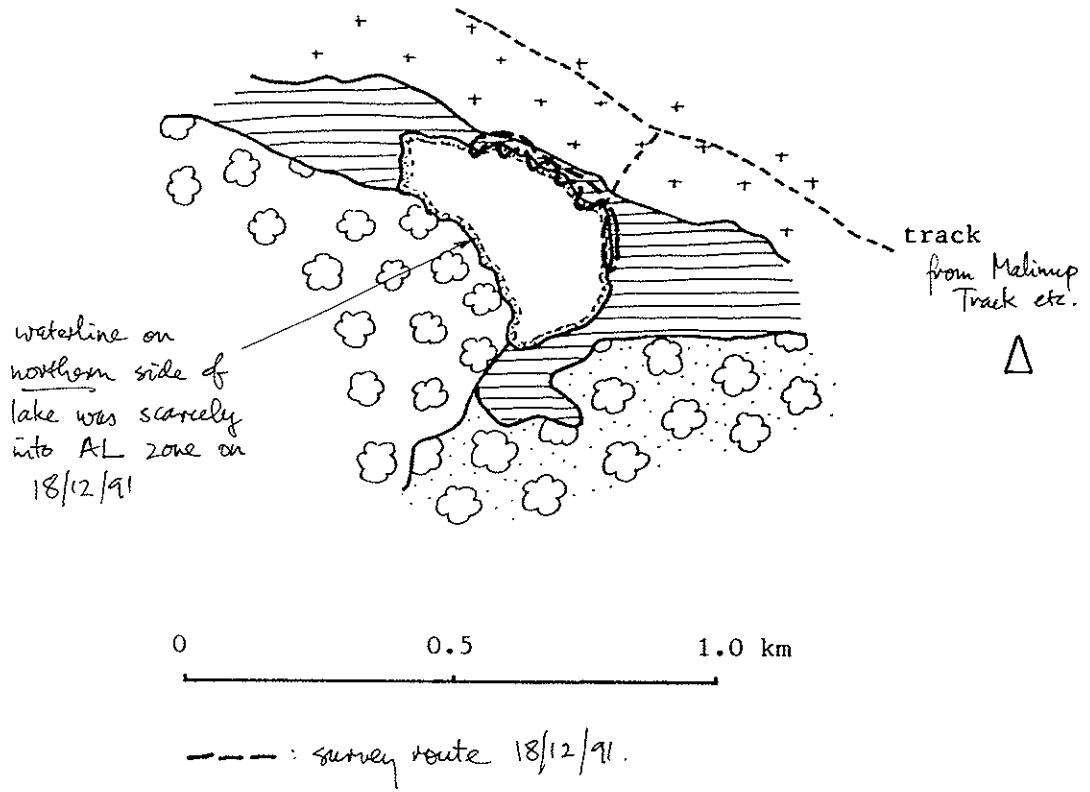
## MANAGEMENT CONSIDERATIONS

—

Notes cont'd

12 DOGGERUP LAKE



Waterbirds in Wetlands on the South Coast of Western Australia

SUMMARY DATASHEET

**LAKE** SAMUEL 

## WETLAND DETAILS

Lat: 34° 44′ S. Long: 116° 04′ E. Shire: Manjimup.

Land Status: within D'Entrecasteaux National Park.

CALM Region: Southern Forest. District: Pemberton.
Forestry Sheet (1:50 000): Northcliffe.

Wetland Vegetation Communities (WVCs) (C.J.Robinson):
TS = Tall Sedges, LS = Low Sedges, CF = Cedar Forest,
OW = Open Water.

## SURVEY DETAILS

Date: 18-12-91. Depth: not recorded Salinity 0.099 ppt
Fringing vegetation was flooded extensively.

Effort: Waded through sedges and thickets in northern part of lake for 1.5 h in middle of day.

## WATERBIRD DETAILS

| species recorded | number counted | active nests | broods (DR) | old nests | WVCs used (* for nest site) |
|---|---|---|---|---|---|
| MusD | 1 | ϕ | ϕ | ϕ | OW. |
| GreC | 5 | ϕ | ϕ | ϕ | OW: passing over. |
| LiGd | 2 | ϕ | ϕ | ϕ | CF, LS. |
| [unidentified crake | ϕ | ϕ | ϕ | 1 | TS*. ] |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Totals: 8 ϕ ϕ 1 (including data on other sheets? NO)

species (now/earlier) = 3/ϕ (extra identified), breeding spp (now/earlier) = ϕ/1 (extra not identified).

## WATERBIRD DETAILS cont'd

Other species probably now present in dense inundated vegetation: SpCk, BbaR, CReW?
(* possibly breeding now)

## DETAILS OF NESTS FOUND

| waterbird species | status of nest | contents | site (WVC) | water depth | main plant species |
|---|---|---|---|---|---|
| unidentified crake | old ⊕ | empty | TS | 0 cm | Baumea vaginalis |

⊕ probably used in 1991 season because there were pieces of green rush/sedge in the nest lining. No eggshells to confirm if it was a SpCk nest. Nest supported by bent-over tussocks of B. vaginalis.

Other notes on species: Also, two possible nests of LiGd in Agonis flexibunda shrubs with B. vaginalis, in NW part of lake. Too old to be sure of species.

## ACCESS NOTES

Follow Malimup Track for 3.9 km from Windy Harbour Road, taking care at the creek crossing, then another 0.3 km to partly overgrown track in to lake on left. Probably 4x4 track all year.

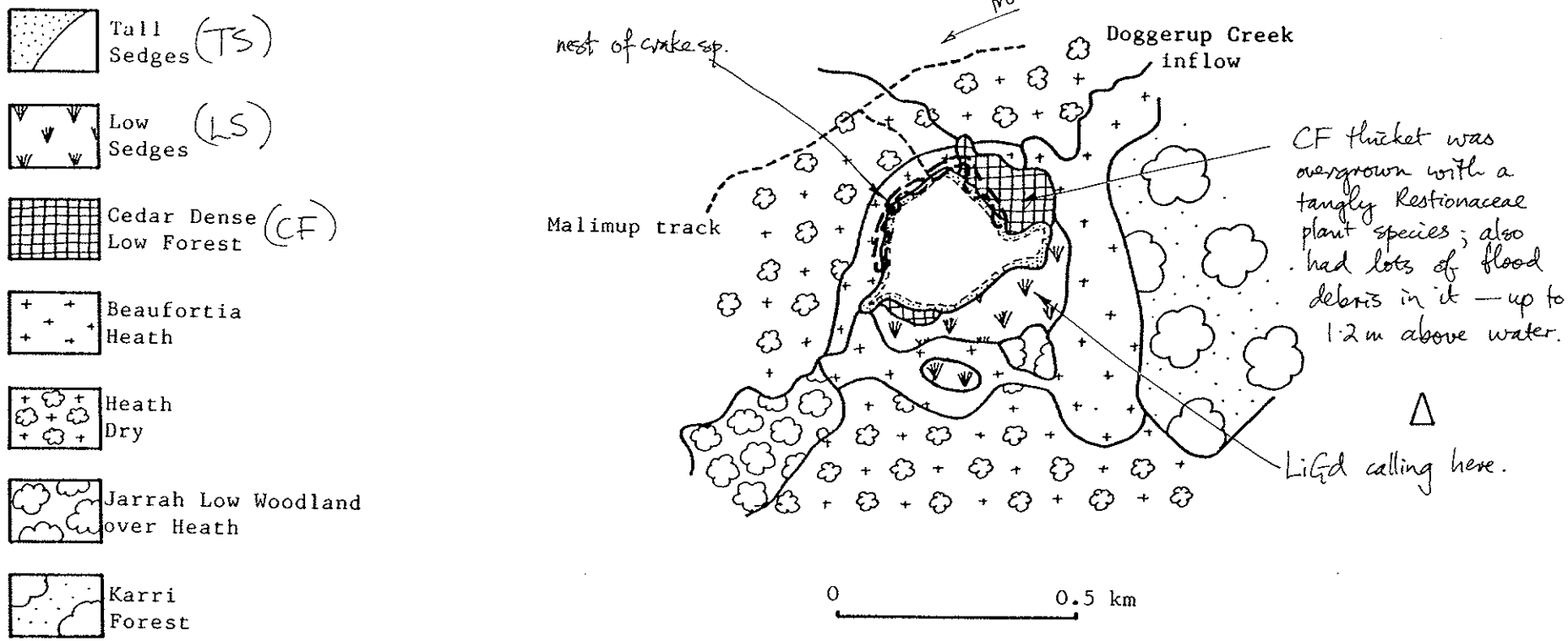
## MANAGEMENT CONSIDERATIONS

—

Notes cont'd

13 LAKE SAMUEL

TS in north of lake was mostly tall and dense Baumea vaginalis and/or B. riparia/preissii, flooded on 18/12/91 to width of several metres.




Tall Sedges (TS)

Low Sedges (LS)

Cedar Dense Low Forest (CF)

Beaufortia Heath

Heath Dry

Jarrah Low Woodland over Heath

Karri Forest

---- : survey route 18/12/91.

Waterline on 18/12/91 : very close to boundary between TS and outer vegetation. Very little water in CF apart from inflow creek — flowing.

Waterbirds in Wetlands on the South Coast of Western Australia

SUMMARY DATASHEET

**LAKE** FLORENCE 

## WETLAND DETAILS

Lat: 34° 44′ S. Long: 116° 06′ E. Shire: Manjimup.

Land Status: within D'Entrecasteaux National Park.

CALM Region: Southern Forest. District: Pemberton.
Forestry Sheet (1:50 000): Northcliffe.

Wetland Vegetation Communities (WVCs) (C.J.Robinson):
TS = Tall Sedges, CF = Cedar Dense Low Forest, OW = Open Water.

## SURVEY DETAILS

Date: 18-12-91 Depth: not recorded. Salinity 0·118 ppt
Fringing vegetation was flooded extensively.

Effort: Waded through flooded shrubland to SW of lake (along track) and around part of lake edge in the TS and CF. Total survey time 1·6 h in late afternoon.

## WATERBIRD DETAILS

| species recorded | number counted | active nests | broods (DR) | old nests | WVCs used (* for nest site) |
|---|---|---|---|---|---|
| LPiC | 1 | ϕ | ϕ | ϕ | CF : perched. |
| PaBD | 2 | ϕ | ϕ | ϕ | OW. |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| Totals: | 3 | ϕ | ϕ | ϕ | (including data on other sheets? NO) |

species (now/earlier) = 2/ϕ extra, breeding spp (now/earlier) = ϕ/ϕ.

## WATERBIRD DETAILS cont'd

Other species probably now present in dense inundated vegetation: SpCk, LiGd, MusD.
(* possibly breeding now)

## DETAILS OF NESTS FOUND

| waterbird species | status of nest | contents | site (WVC) | water depth | main plant species |
|---|---|---|---|---|---|
| NIL | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Other notes on species: Found two breast feathers of PeaD! One of the PaBD was flightless due to moult. Little potential for other bird species — seemed a rather 'dead' wetland.

## ACCESS NOTES

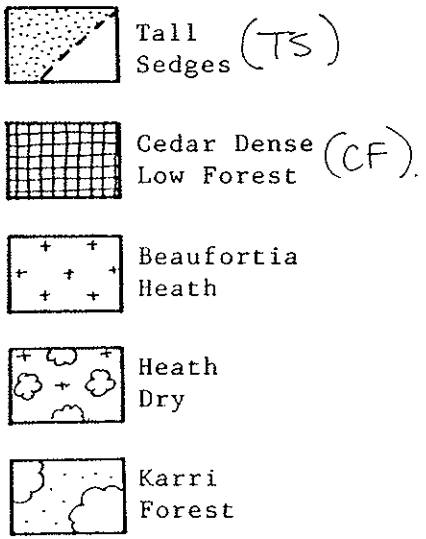
CALM barrier, at edge of main road, is 2.0 km S of Malinup Rd turnoff. Can bypass wet area in front of barrier if using 4 x 4 vehicle — turn in 20 m farther to S. Wet areas along track nearer to lake have firm base and may be OK to drive through — not tested.

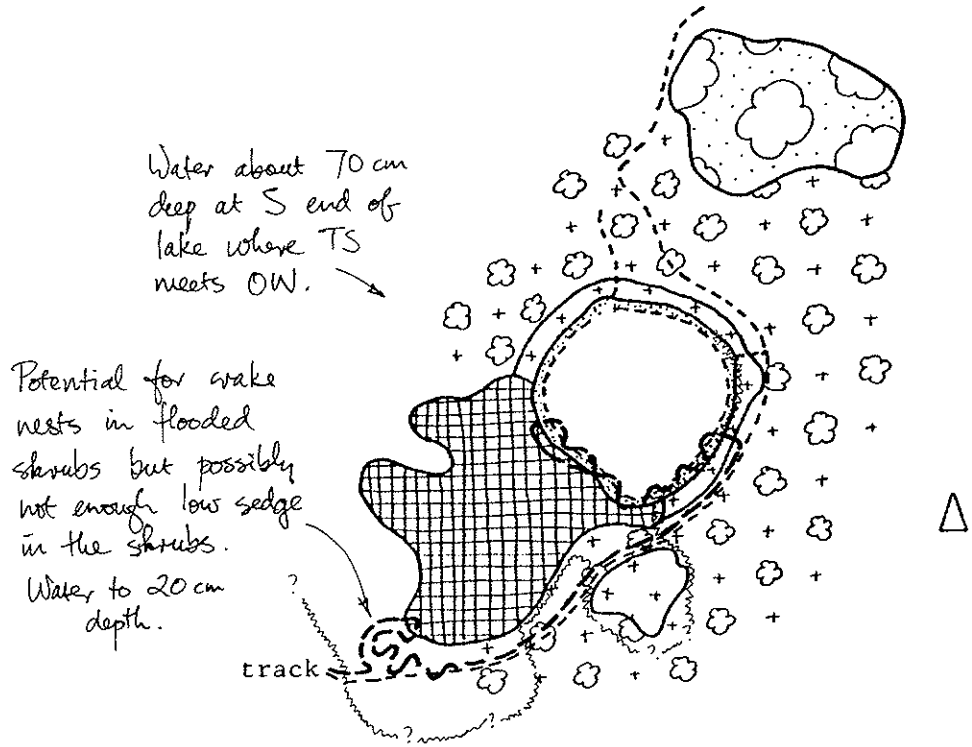
## MANAGEMENT CONSIDERATIONS

—

Notes cont'd

14 LAKE FLORENCE




---: survey route 18/12/91.

mmm: waterline 18/12/91: wide areas flooded to SW of lake; line close to edge of TS on east side of lake itself.

Waterbirds in Wetlands on the South Coast of Western Australia

SUMMARY DATASHEET

**LAKE** GARDNER RIVER LAKE 

## WETLAND DETAILS

Lat: 34° 50′ S. Long: 116° 06′ E. Shire: Manjimup.

Land Status: within D'Entrecasteaux National Park.

CALM Region: Southern Forest. District: Pemberton.
Forestry Sheet (1:50 000): Broke Inlet.

Wetland Vegetation Communities (WVCs) (C.J.Robinson):
TS = Tall Sedges, CF = Cedar Dense Low Forest, AF = Agonis Floribunda (Thicket) Heath over Tall Sedges, OW = Open Water.

## SURVEY DETAILS

Date: 18-19/12/91 Depth: approx. 1.0m Salinity 0.232 ppt
Fringing vegetation was flooded extensively.

Effort: Boated the full length of the long pool (from east to west) in late afternoon & night of 18/12/91, listening for bitterns. Waded in CF, TS & AF on 19/12/91 looking intensively for nests. Total survey time was 5.0 h.

## WATERBIRD DETAILS

| species recorded | number counted | active nests | broods (DR) | old nests | WVCs used (* for nest site) |
|---|---|---|---|---|---|
| Swan | 1 | ∅ | ∅ | ∅ | OW. |
| ManD | 1 | ∅ | ∅ | ∅ | OW. |
| GreC | 6 | ∅ | ∅ | 16 | CF*, OW. |
| SpCk | 3 | ∅ | ∅ | ∅ | CF. |
| CReW | 1 | ∅ | ∅ | 1 | CF*. |
| PaBD | 1 | ∅ | ∅ | ∅ | OW. |
| WfHn | 3 | ∅ | ∅ | ∅ | CF : passing over. |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| Totals: | 16 | ∅ | ∅ | 17 | (including data on other sheets? NO) |

species (now/earlier) = 7/∅ extra., breeding spp (now/earlier) = ∅/2 extra.

## WATERBIRD DETAILS cont'd

Other species probably now present in dense inundated vegetation: LitB*, BbaR, MusD, LiGd, BlaB??
(* possibly breeding now)

## DETAILS OF NESTS FOUND

| waterbird species | status of nest | contents | site (WVC) | water depth | main plant species |
|---|---|---|---|---|---|
| CReW | old | empty | CF ⊕ | 5 cm | Agonis floribunda |
| 16× GreC | old | empty | CF ⊙ | 50-100 cm | Melaleuca raphiophylla |

⊙ total of 16 nests at 3 sites, all being M. raphiophylla trees overhanging OW, with 2, 11 and 3 nests respectively at the 3 sites.

⊕ emergent saplings of CF over thicket of A. floribunda with dense Baumea spp. particularly B. vaginalis; really more akin to AF than CF.

Other notes on species: The 6 GreC were flushed from the colony of 11 nests; they were immatures and although quite capable of flight, were not keen to abandon the site, eventually returning to roost there overnight. The low thickets of CF and AF (see map) looked suitable for nesting by LitB, but no nests found and no birds responded.. (cont. below)↓

ACCESS NOTES ↘

Total distance of 8.9 km from main road at Windy Harbour rubbish tip, via camping ground near river mouth and the eastern end of Tragedy Track, to edge of wetland — can put a boat in easily. (See original datasheet for mud-map.)

## MANAGEMENT CONSIDERATIONS

Thickets have not been burnt for some years and currently support thick growth of sedges such as B. vaginalis; therefore worthy of protection from wildfire. ↘ ideal for waterbird nesting

Notes cont'd

Species: ....to imitations of calls. One CReW calling vigorously (day & night) from CF/AF thicket where an old nest was eventually found. All SpCk also in this WVC.

15 GARDNER RIVER LAKES

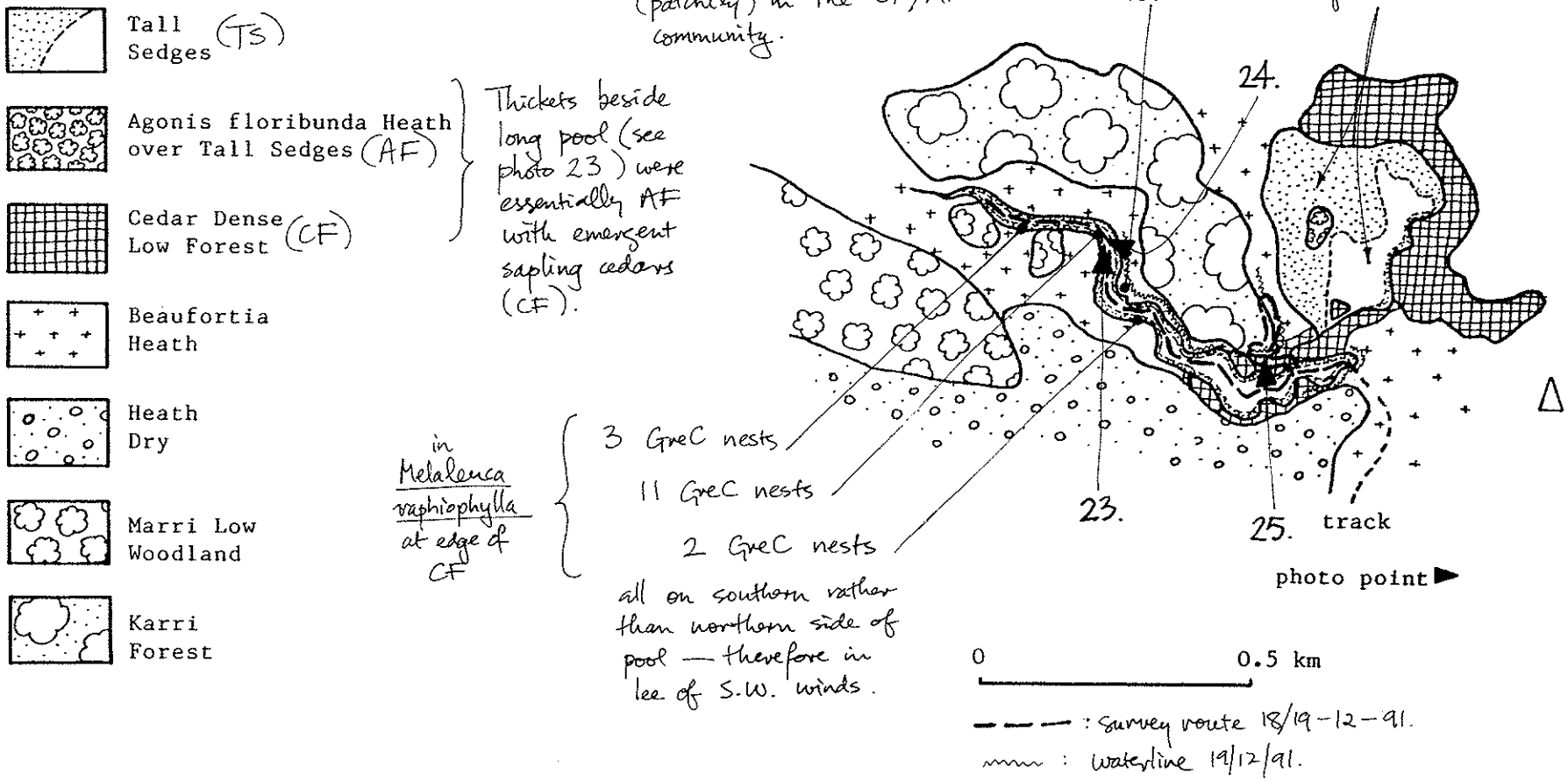


Photo 23. Gardner River Lake. Western (channels) part. Nesting habitat for Clamorous Reed-Warbler and possibly Little Bittern, i.e. thickets of young cedars over Tall Sedges. 19/12/91.

Photo 24. Gardner River Lake. Colony of Great Cormorant nests, not in use, in Melaleuca raphiophylla. 19/12/91.

Photo 25. Gardner River Lake. Thicket of young cedars over tall Baumea vaginalis: possible nesting site for Little Bitterns. 19/12/91.

Waterbirds in Wetlands on the South Coast of Western Australia

SUMMARY DATASHEET

**LAKE** MARINGUP 

## WETLAND DETAILS

Lat: 34° 50′ S. Long: 116° 12′ E. Shire: Manjimup.

Land Status: within D'Entrecasteaux National Park.

CALM Region: Southern Forest. District: Pemberton.
Forestry Sheet (1:50 000): Broke Inlet.

Wetland Vegetation Communities (WVCs) (C.J.Robinson):
TS = Tall Sedges, CF = Cedar Dense Low Forest, OW = Open Water.

Note: much of the area in east of lake, marked by Robinson as TS, probably could be classified as LS = Low Sedges.

## SURVEY DETAILS

Date: 19-20/12/91 Depth: not recorded. Salinity 0-212 ppt
Fringing vegetation was flooded extensively.

Effort: Boat surveys of all OW were done in late afternoon to night on 19/12/91 and in early morning on 20/12/91. Patches of TS were waded through on 20/12/91 in the morning. Total survey time was 4.5 h.

## WATERBIRD DETAILS

| species recorded | number counted | active nests | broods (DR) | old nests | WVCs used (* for nest site) |
|---|---|---|---|---|---|
| MusD | 10 | ∅ | ∅ | ∅ | OW. |
| Swan | 7 | ∅ | ∅ | ∅ | OW. |
| PaBD | 50 | ∅ | ∅ | ∅ | OW. |
| ManD | 5 | ∅ | ∅ | ∅ | OW. |
| GCGb | 2 | ∅ | ∅ | ∅ | OW. |
| MaHa | 1 | ∅ | ∅ | ∅ | TS: passing over. |
| LPiC | 6 | ∅ | ∅ | ∅ | CF. |
| Dart | 4 | 1 | ∅ | 1 | CF*. |
| LiBC | 1 | ∅ | ∅ | ∅ | CF. |
| SpCk | 2 | ∅ | ∅ | ∅ | TS. |
| Totals: | 92 | 1 | ∅ | 2 | (including data on other sheets? YES) |

species (now/earlier) = 12/∅ extra., breeding spp (now/earlier) = 1/1 extra. (not identified)

## ADDITIONAL WATERBIRD DETAILS

| species recorded | number counted | active nests | broods (DR) | old nests | WVCs used (* for nest site) |
|---|---|---|---|---|---|
| PuSn | 2 | ∅ | ∅ | ∅ | TS. |
| LiGd | 2 | ∅ | ∅ | ∅ | TS. |
| [ unidentified cormorant | ∅ | ∅ | ∅ | 1 | CF*. ] |

| waterbird species | status of nest | contents | site (WVC) | water depth | main plant species |
|---|---|---|---|---|---|

## WATERBIRD DETAILS cont'd

Other species probably now present in dense inundated vegetation: LitB ?, AusB, CReW*, BlaB ??
(* possibly breeding now)

## DETAILS OF NESTS FOUND

| waterbird species | status of nest | contents | site (WVC) | water depth | main plant species |
|---|---|---|---|---|---|
| Dart | active ⊕ | 5 eggs | CF | 100 cm | Agonis juniperina |
| Dart | old ⊙ | empty | CF | 150 cm | " " |
| unidentified cormorant ⊗ | old | empty | CF | 150 cm | " " |

Note: all three nests were in cedar trees extending well out over OW.

⊕ Adults were attending the nest.

⊙ A pair was in the vicinity of the nest: planning to use it soon?

⊗ Both LPiC and LiBC were roosting in same tree.

Other notes on species: One swan and one PaBD were unable to fly due to moult. Thickets of sapling cedars, with dense Baumea vaginalis, may be suitable for breeding by LitB: in northern arm of the lake. In boat survey, largest number of waterbirds was in far SW corner of lake and in E end. (See below)

ACCESS NOTES

Follow Moore's Track from Chesapeake Road for 16 km; last 6 km beyond (to R of) hut is sandiest and needing 4 x 4 vehicle. Boat can be taken to extremities of OW while water is high, but some weed to negotiate. Can follow narrow channel deep into eastern area of TS/LS, where it is possible to walk on firm-ish peaty substrate if plenty of sedge above water.

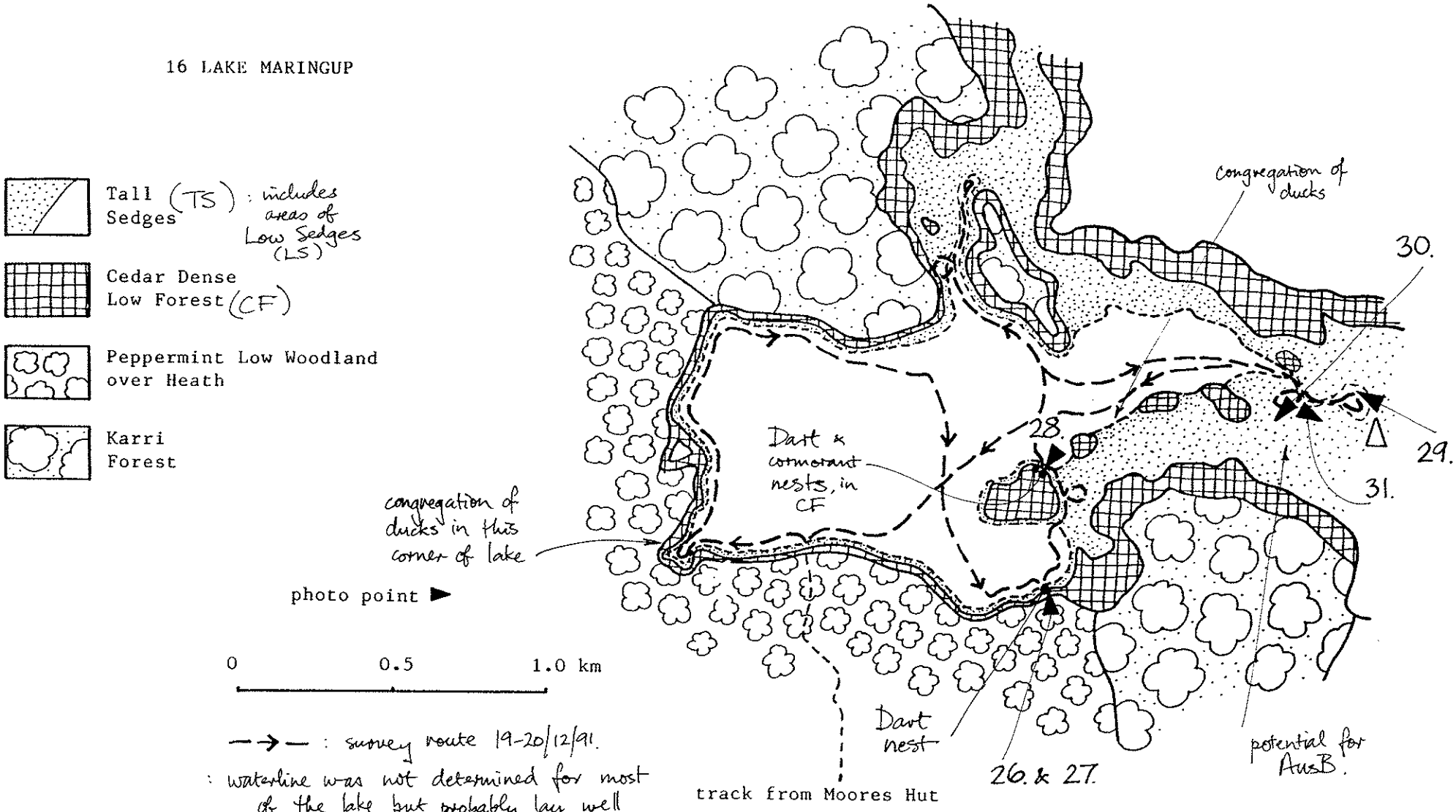
MANAGEMENT CONSIDERATIONS

Fringing CF and thickets have not been burnt for many years and should be protected from wildfire as far as possible.

Notes cont'd

Species. Extensive area of TS/LS in east of lake may be suitable for AusB. No calls heard, despite good listening conditions.

16 LAKE MARINGUP



Photos 26 & 27. Maringup Lake. SE side. Nest and eggs of Darter in cedar overhanging the lake. 19/12/91.

Photo 28. Maringup Lake. Central eastern part. Old Darter nest, low in cedar overhanging the lake. 20/12/91.

Photo 29. Maringup Lake. Eastern part. Feeding area for swans and swamphens. 20/12/91.

Photos 30 & 31. Maringup Lake. Eastern part. Extensive area of mixed Tall and Low Sedges: potential habitat for Australasian Bittern. 20/12/91.

Waterbirds in Wetlands on the South Coast of Western Australia

SUMMARY DATASHEET

**LAKE** BROKE INLET EAST LAKE 

## WETLAND DETAILS

Lat: 34°57′ S. Long: 116°32′ E. Shire: Manjimup.

Land Status: within D'Entrecasteaux National Park (formerly in State Forest, Inlet Block).

CALM Region: Southern Forest. District: Walpole.
Forestry Sheet (1:50 000): Walpole.

Wetland Vegetation Communities (WVCs) (C.J.Robinson):
TS = Tall Sedges, CF = Cedar Dense Low Forest, OW = Open Water.
Also a small area of 'Agonis floribunda (Thicket) Heath over sedges' (= AF) in the inflow area at east side of lake — see map.

## SURVEY DETAILS

Date: 20-12-91. Depth: not recorded. Salinity 0.208 ppt
Fringing vegetation was flooded a little.

Effort: Walked through CF and searched there for nests, then continued through TS to east side. Total survey time was 1.2 h in late afternoon.

## WATERBIRD DETAILS

| species recorded | number counted | active nests | broods (DR) | old nests | WVCs used (* for nest site) |
|---|---|---|---|---|---|
| NIL | | | | | |

Totals: ∅ ∅ ∅ ∅ (including data on other sheets? NO)

species (now/earlier) = ∅ , breeding spp (now/earlier) = ∅

**LAKE** Broke Inlet East Lake

Datasheet



## WATERBIRD DETAILS cont'd

Other species probably now present in dense inundated vegetation: SpCk, LiGd, PaBD?
(* possibly breeding now)

## DETAILS OF NESTS FOUND

| waterbird species | status of nest | contents | site (WVC) | water depth | main plant species |
|---|---|---|---|---|---|
| NIL | | | | | |

(A possible (old) crake nest was found in sedge under saplings of cedar, Agonis flexuosa and Melaleuca at N end of lake, 4-5 m from OW.)

Other notes on species: Potential for crake nests in AF at east side where Leptocarpus sedge dense and prolific; water in the AF on 20/12/91 was 10-40 cm deep. Otherwise not much potential for waterbirds at this wetland.

## ACCESS NOTES

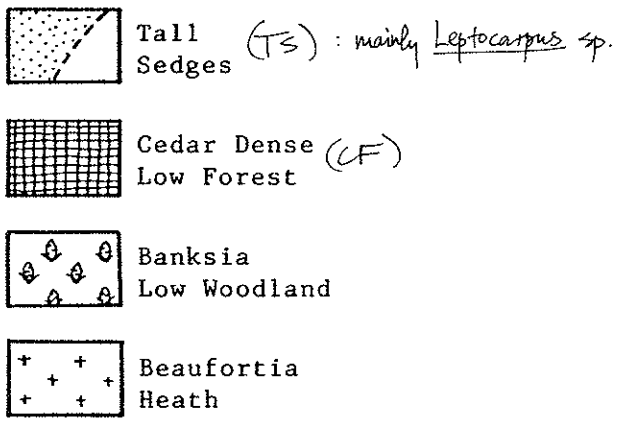
Walk through heath and light scrub (recently burnt, so easy-going), leaving Inlet Road where it meets Inlet River 500 m from Broke Inlet and heading south for approx. a kilometre. Look for the patch of tall CF as landmark. See original datasheet for mud-map of access.

## MANAGEMENT CONSIDERATIONS

—

Notes cont'd

17 BROKE INLET LAKE



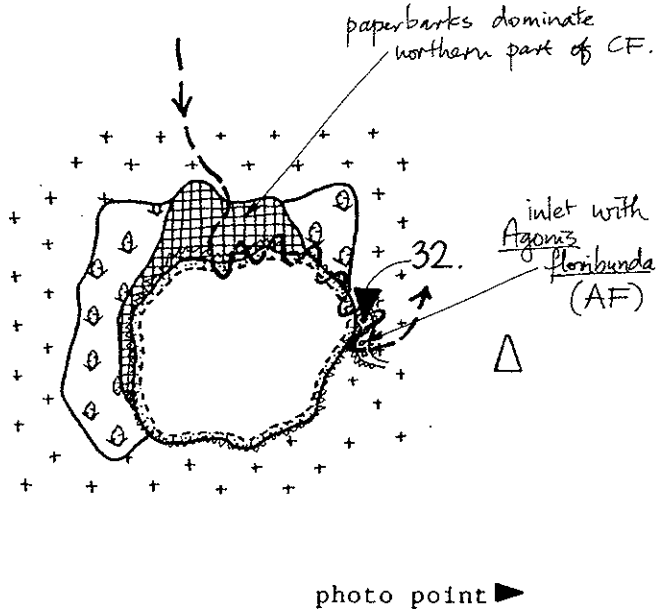



Photo 32. East Broke Inlet Lake. Eastern side. Possible breeding habitat for Spotless Crake: low Agonis floribunda Thicket over Low Sedges (Leptocarpus sp.). 20/12/91.

Waterbirds in Wetlands on the South Coast of Western Australia

SUMMARY DATASHEET

# LAKE OWINGUP SWAMP



## WETLAND DETAILS

Lat: 35°00' S. Long: 117°04' E. Shire: Denmark.

Land Status: within Quarrum Nature Reserve.

CALM Region: South Coast. District: Albany.
Forestry Sheet (1:50 000): Denmark.

Wetland Vegetation Communities (WVCs) (C.J.Robinson):
TS = Tall Sedges, CF = Cedar Dense Low Forest, OW = Open Water, BL = Bare Land. (Also small patches of LS = Low Sedges.)

## SURVEY DETAILS

Date: (a) 21-23/12/91 & (b) 9/1/92. Depth: not recorded (approx. 1.0m) Salinity (a) 1.113 (b) 1.019 ppt
Fringing vegetation was flooded extensively.

Effort: (a) 21-23/12/91 : total survey time of 15.0 h including all times of day, and night-time listening for calling bitterns; one systematic survey of OW by boat; took boat up Kent River; waded in TS in the north, east & south.
(b) 9/1/92 : waded in TS → WATERBIRD DETAILS → in south & east for 3.0 h.

| species recorded | number counted | active nests | broods (DR) | old nests | WVCs used (* for nest site) |
|---|---|---|---|---|---|
| HhGb | 15 | ϕ | ϕ | ϕ | OW. |
| GreC | 4 | ϕ | ϕ | ϕ | OW. |
| LiBC | 100 | ϕ | ϕ | ϕ | OW. |
| LPiC | 8 | ϕ | ϕ | ϕ | OW. |
| Dart | 2 | ϕ | ϕ | ϕ | jarrah trees fringing river. |
| APel | 5 | ϕ | ϕ | ϕ | OW, BL. |
| WfHn | 24 | ϕ | ϕ | ϕ | BL, CF. |
| AusB | 5 | ϕ | ϕ | ϕ | TS, (LS). |
| RNHn | 3 | ϕ | ϕ | ϕ | TS : passing over. |
| SacI | 80 | ϕ | ϕ | ϕ | CF, BL. |
| Totals: | 1180⊗ | 3 | 2 | 8 | (including data on other sheets? YES) |

species (now/earlier) = 32/ϕ, breeding spp (now/earlier) = 5/1 extra.

⊗ highest tally of individuals was 1180 on 21/12/91.

## ADDITIONAL WATERBIRD DETAILS

| species recorded | number counted | active nests | broods (DR) | old nests | WVCs used (* for nest site) |
|---|---|---|---|---|---|
| YbSl | 7 | ϕ | ϕ | ϕ | BL. |
| Shel | 300 | ϕ | ϕ | ϕ | BL, OW, TS. |
| PaBD | 300 | ϕ | ϕ | ϕ | BL, OW, TS. |
| Shov | 7 | ϕ | ϕ | ϕ | TS, OW. |
| MusD | 20 | ϕ | ϕ | 1 | TS*, OW. |
| ManD | 1 | ϕ | ϕ | ϕ | OW. |
| HarD | 1 | ϕ | ϕ | ϕ | OW. |
| GyTl | 2 | ϕ | ϕ | ϕ | OW. |
| MaHa | 4 | ϕ | ϕ | ϕ | TS : passing over. |
| Ospy | 1 | ϕ | ϕ | ϕ | CF. |
| SpCk | 19 | 1 | ϕ | 1 | TS*. |
| PuSn | 6 | ϕ | 1 | 6 | TS*. |
| Coot | 200 | ϕ | ϕ | ϕ | OW. |
| BfoP | 4 | 1 | ϕ | ϕ | BL*. |
| WooS | 3 | ϕ | ϕ | ϕ | BL. |
| Gank | 6 | ϕ | ϕ | ϕ | BL. |
| CasT | 1 | ϕ | ϕ | ϕ | BL. |
| RenS | 1 | ϕ | ϕ | ϕ | BL. |
| LiGd | 21 | 1 | ϕ | ϕ | TS*. |
| CReW | 6 | ϕ | ϕ | ϕ | TS, CF. |
| Swan | 27 | ϕ | 1 | ϕ | TS, OW. |
| BbiD | 1 | ϕ | ϕ | ϕ | OW. |

| waterbird species | status of nest | contents | site (WVC) | water depth | main plant species |
|---|---|---|---|---|---|

## WATERBIRD DETAILS cont'd

Other species probably now present in dense inundated vegetation: LitB*, BbaR, AuCk?, BaCk?, BlaB?
(* possibly breeding now)

## DETAILS OF NESTS FOUND

| waterbird species | status of nest | contents | site (WVC) | water depth | main plant species |
|---|---|---|---|---|---|
| MusD | old | empty ⊙ | TS | 30 cm | Baumea articulata |
| SpCk | active ⊕ | 4 eggs | TS | 3 cm | B. vaginalis |
| SpCk | old | empty | TS | 5 cm | B. vaginalis |
| BfoP | active ⊕ | 2 eggs | BL | 0 cm | — |
| LiGd | active | 1 egg, 3 young | TS | 15 cm | Baumea articulata |
| PuSn | old | empty ⊗ | TS | 30 cm | Baumea articulata |
| PuSn | old | empty | TS | 15 cm | " " |
| PuSn | old | empty | TS | 15 cm | " " |

⊕ both nests empty on 9/1/92. ⊗ feather scale in nest: runner seen nearby (see broods, p. 2)!
⊙ down in nest: used 1991?

Therefore, the following species bred in 1991 season: MusD, SpCk, BfoP, LiGd, PuSn and Swan.

Other notes on species:

Gave imitations of LitB calls at many sites, both day and night, but no response; perhaps TS not tall enough, though more likely it was suitable.

Some of the WfHn were immatures.

Swan young were now quite large in size.

(cont. p. 4).

ACCESS NOTES → Summer track 2.15 km off Boat Harbour Road gives easy access (2x wheel drive probably) through scrub to south-east side of lake. Can launch boat there but water very shallow — beware of rusty stubs of star-picket fence. Wading generally O.K. — firm substrate. (see below)

MANAGEMENT CONSIDERATIONS

→ Siltation may eventually become a problem — by reducing extent of OW — but unlikely in near future (deserves separate study perhaps).

Notes cont'd (YES - see p. 4)

Access: Substrate boggier around clumps of TS in deeper water. Other than shallows at river mouth, access by boat was O.K. for 1-2 km up-river.

## ADDITIONAL WATERBIRD DETAILS

| species recorded | number counted | active nests | broods (DR) | old nests | WVCs used (* for nest site) |
|---|---|---|---|---|---|

OTHER NOTES ON SPECIES – cont.

Two of the Swans and 30% of the Shel's were flightless due to moult. CReW were all individuals, calling from widely-spaced sites within the wetland. HhGb were giving 'breeding calls'. RNHn flew in at night from site to South-east of the lake. Possible record of BbaR, calling in early morning. Few birds along Kent River other than cormorants; at a junction of streams there were 3 small-cormorant nests and two Dart nests in trees overhanging water. Majority of the SpCk were in S. of swamp, where mud was showing between many tussocks of Tall Sedge. Small patches of CF in south-east were too dry for waterbird use at time of survey.

AusB, in far south of swamp, presumably were feeding on small koonacs & tadpoles which were abundant in warm shallows within low sedges (Baumea juncea, B. arthrophylla, B. vaginalis) close to shore (water 0–25 cm). Two on E. side were flushed in taller TS but similar food was abundant in nearby shallows so may have been feeding there also. No AusB nest found despite searching.

BREEDING DATA cont.

| waterbird species | status of nest | contents | site (WVC) | water depth | main plant species |
|---|---|---|---|---|---|
| PuSn | old | empty | TS | 15 cm | Baumea articulata |
| PuSn | old | empty | TS | 15 cm | " " |
| PuSn | old | empty | TS | 15 cm | B. vaginalis |

19 OWINGUP SWAMP

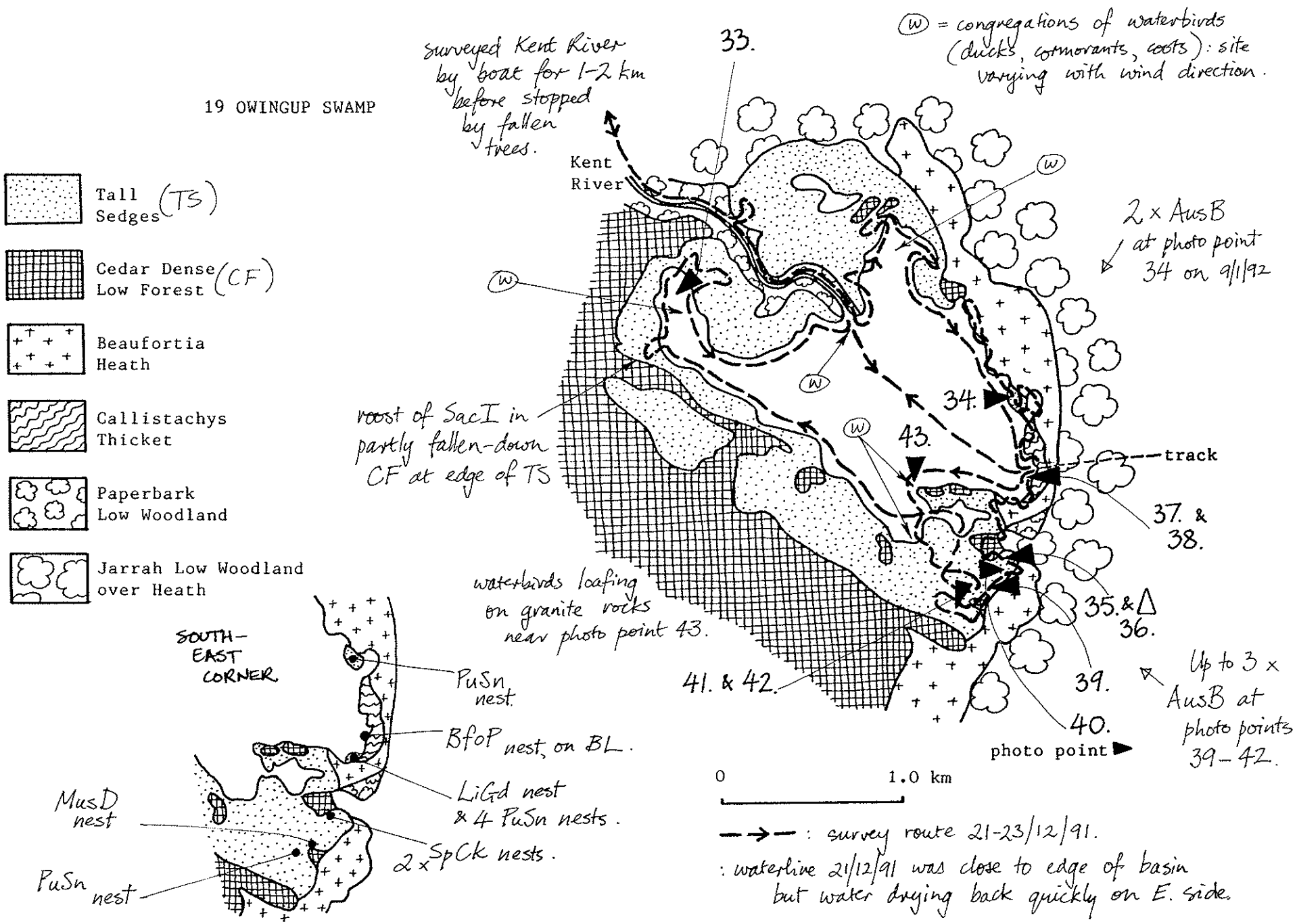


Photo 33. Owingup Swamp. NW part. Tall Sedges - Baumea articulata: habitat for Purple Swamphen nests. 22/12/91.

Photo 34. Owingup Swamp. Old nest of Purple Swamphen in Baumea articulata. 22/12/91.

Photo 35. Owingup Swamp. Southern part. Site of Spotless Crake nest: Baumea articulata and B. vaginalis. 22/12/91.

Photo 36. Owingup Swamp. Nest and eggs of Spotless Crake in Baumea vaginalis. 22/12/91.

Photo 37. Owingup Swamp. SE side. Site of Black-fronted Plover nest, at centre. 23/12/91.

Photo 38. Owingup Swamp. Nest and eggs of Black-fronted Plover. 23/12/91.

Photo 39. Owingup Swamp. Southern part. Feeding area for Australasian Bittern: Baumea arthrophylla, B. juncea and B. vaginalis. 23/12/91.

Photo 40. Owingup Swamp. Southern part. Australasian Bittern in flight over feeding area in Low Sedges. 9/1/92.

Photo 41. Owingup Swamp. Southern part. Australasian Bittern in flight over Tall Sedges (Baumea articulata), where it landed. 9/1/92.

Photo 42. Owingup Swamp. Southern Part. Refuge area for Australasian Bitterns: Baumea articulata and B. vaginalis. 9/1/92.

Photo 43. Owingup Swamp. SE part. Granite islets used for loafing by spoonbills, cormorants and ducks. 23/12/91.

Waterbirds in Wetlands on the South Coast of Western Australia

SUMMARY DATASHEET

**LAKE** BOAT HARBOUR LAKE 1 

## WETLAND DETAILS

Lat: 35°01' S. Long: 117°05' E. Shire: Denmark.

Land Status: within Quarram Nature Reserve.

CALM Region: South Coast. District: Albany.
Forestry Sheet (1:50 000): Denmark.

Wetland Vegetation Communities (WVCs) (C.J.Robinson):
TS = Tall Sedges, OW = Open Water.
Areas of Low Sedges (LS) occur within the TS; Robinson did not separate them from TS.

## SURVEY DETAILS

Date: (a) 21-12-91. (b) 8&9-1-92. Depth: not recorded Salinity 8/1/92: 0.693 ppt
Fringing vegetation was flooded extensively.

Effort: (a) 21/12: brief inspection of OW from roadside. (b) 8&9/1/92: total survey time was 2.1 h including late afternoon, night and early morning; looked at OW from several vantage points and waded in TS/LS in north part of lake.

## WATERBIRD DETAILS

| species recorded | number counted | active nests | broods (DR) | old nests | WVCs used (* for nest site) |
|---|---|---|---|---|---|
| BwSt | 1 | ϕ | ϕ | ϕ | OW. |
| CReW | 1 | ϕ | ϕ | ϕ | TS. |
| Swan | 80 | ϕ | ϕ | ϕ | OW. |
| MaHa | 2 | ϕ | ϕ | ϕ | TS. |
| PaBD | 8 | ϕ | ϕ | ϕ | OW. |
| MusD | 7 | ϕ | ϕ | ϕ | OW. |
| SpCk | 13 | ϕ | ϕ | ϕ | TS. |
| WfHn | 3 | ϕ | ϕ | ϕ | OW. |
| YbSl | 4 | ϕ | ϕ | ϕ | OW: passing over. |
| LiBC | 1 | ϕ | ϕ | ϕ | OW: " " |
| Totals: | 133⊗ | ϕ | ϕ | ϕ | (including data on other sheets? YES) |

species (now/earlier) = 14/ϕ extra., breeding spp (now/earlier) = ϕ/ϕ.

⊗ highest tally was 133 on 8-9/1/92.

**LAKE** Boat Harbour Lake 1 Datasheet 

## ADDITIONAL WATERBIRD DETAILS

| species recorded | number counted | active nests | broods (DR) | old nests | WVCs used (* for nest site) |
|---|---|---|---|---|---|
| BfoP | 1 | ϕ | ϕ | ϕ | OW: passing over. |
| LiGd | 6 | ϕ | ϕ | ϕ | TS. |
| APel | 1 | ϕ | ϕ | ϕ | OW. |
| WhiT | 6 | ϕ | ϕ | ϕ | OW. |

| waterbird species | status of nest | contents | site (WVC) | water depth | main plant species |
|---|---|---|---|---|---|

## WATERBIRD DETAILS cont'd

Other species probably now present in dense inundated vegetation: BbaR, AuCk, LewR ??, AusB.
(* possibly breeding now)

## DETAILS OF NESTS FOUND

| waterbird species | status of nest | contents | site (WVC) | water depth | main plant species |
|---|---|---|---|---|---|
| NIL | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Other notes on species: Swans loafing in mid-lake in very sparse Typha. Matta: two immatures flushed from Gahnia tussocks. Gahnia tussockland (TS) and Baumea vaginalis patches (LS) in north and south of wetland seems like good habitat for AusB. No suitable habitat for LitB. (see below)

## ACCESS NOTES

—

## MANAGEMENT CONSIDERATIONS

—

Notes cont'd

Species. Would be worth scanning the edges of TS and OW in north-east of lake, especially when water low and interface area muddy, to look for LewR — is in similar habitat in South Australia.

BOAT HARBOUR ROAD LAKES

20 LAKE 1

21 LAKE 2

22 LAKE 3

Tall Sedges (TS)

Cedar Dense Low Forest (CF)

Callistachys Thicket

Beaufortia Heath

Heath Dry

Heath Coastal

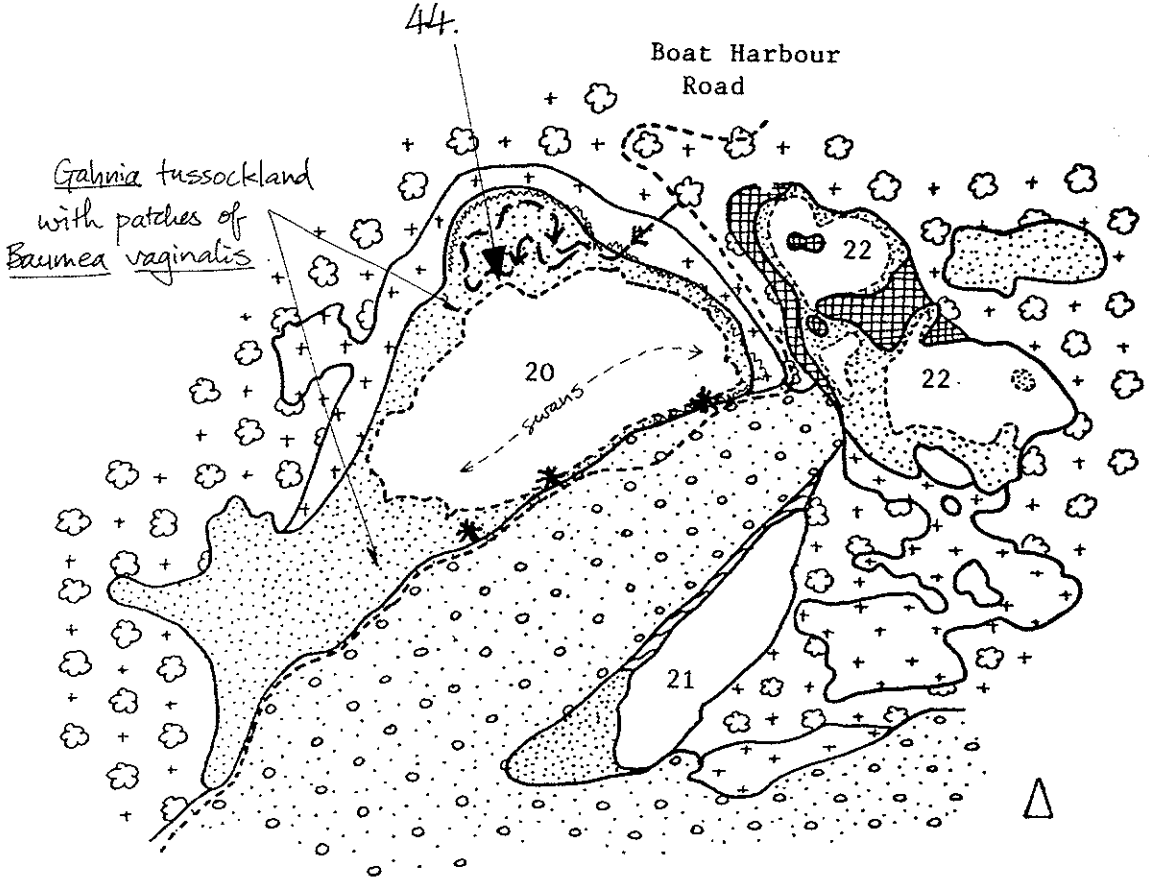


Photo 44. Boat Harbour Lake 1. NW part. Tussocks of Gahnia tri fida and Low Sedges: presumed habitat of Australasian Bitterns recorded in earlier surveys. 9/1/92.

Waterbirds in Wetlands on the South Coast of Western Australia

SUMMARY DATASHEET

**LAKE** BOAT HARBOUR LAKE 2. 

## WETLAND DETAILS

Lat: 35°01′ S. Long: 117°06′ E. Shire: Denmark.

Land Status: within Quarram Nature Reserve.

CALM Region: South Coast. District: Albany.
Forestry Sheet (1:50 000): Denmark.

Wetland Vegetation Communities (WVCs) (C.J.Robinson):
TS = Tall Sedges, OW = Open Water.
(Also some Low Sedges (LS) at far South-west end of lake.)

## SURVEY DETAILS

Date: 8-1-92. Depth: not recorded Salinity 1.280 ppt
Fringing vegetation was flooded extensively.

Effort: Total survey time was 1.5 h, in late afternoon and night (when listened for bitterns). Waded in TS (Typha) at South-west end of lake and looked over OW from high ridge.

## WATERBIRD DETAILS

| species recorded | number counted | active nests | broods (DR) | old nests | WVCs used (* for nest site) |
|---|---|---|---|---|---|
| CReW | 4 | 1 | Ø | 3 | TS* |
| MusD | 5 | Ø | Ø | Ø | OW. |
| Swan | 4 | Ø | Ø | Ø | OW. |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| Totals: | 13 | 1 | Ø | 3 | (including data on other sheets? NO) |

species (now/earlier) = 3/Ø extra., breeding spp (now/earlier) = 1/Ø extra.

**LAKE** Boat Harbour Lake 2 Datasheet 

## WATERBIRD DETAILS cont'd

Other species probably now present in dense inundated vegetation: AusB, LitB*, SpCk*, BbaR, PuSn, LiGd*.
(* possibly breeding now)

## DETAILS OF NESTS FOUND

| waterbird species | status of nest | contents | site (WVC) | water depth | main plant species |
|---|---|---|---|---|---|
| CReW | active | 4 eggs JW | TS | 50 cm | Typha orientalis |
| CReW | old | empty | TS | 50 cm | " " |
| CReW | old | empty | TS | 50 cm | " " |
| CReW | old | empty | TS | 50 cm | " " |

Other notes on species: Typha looked suitable for nests of LitB. Mixed Typha and adjacent LS patches may be suitable for AusB.

## ACCESS NOTES

(Lake 1)

Find area of campsites near middle of South-east side of lake, then retreat along Boat Harbour Road ca. 20-30 m to find horse trail; follows trail to south. Trail bends around and eventually comes parallel to the high dune/ridge on North-west side of Lake 2. Water too deep for extensive wading in the Typha.

## MANAGEMENT CONSIDERATIONS

—

Notes cont'd

BOAT HARBOUR ROAD LAKES
20 LAKE 1
21 LAKE 2
22 LAKE 3

Tall Sedges (TS)

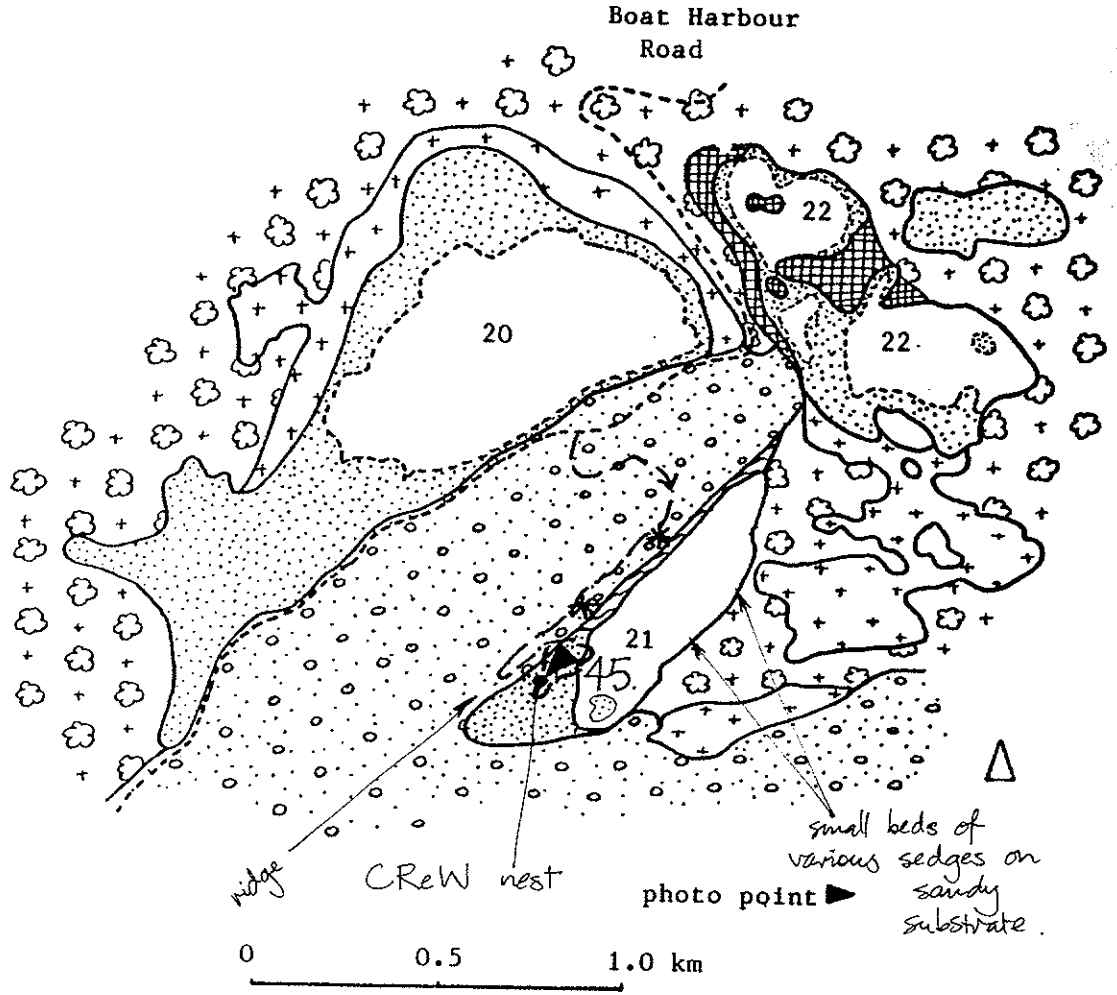
Cedar Dense Low Forest

Callistachys Thicket

Beaufortia Heath

Heath Dry

Heath Coastal




→ : survey route 8/1/92. * : vantage point.
: waterline close to outer edge of basin.

Photo 45. Boat Harbour Lake 2. SW part. Nest and eggs of Clamorous Reed-Warbler in Typha. 10/1/92.

Waterbirds in Wetlands on the South Coast of Western Australia

SUMMARY DATASHEET

**LAKE** BOAT HARBOUR LAKE 3. page 1 of 2

WETLAND DETAILS

Lat: 35° 01′ S. Long: 117° 06′ E. Shire: Denmark.

Land Status: within Quarram Nature Reserve.

CALM Region: South Coast. District: Albany.
Forestry Sheet (1:50 000): Denmark.

Wetland Vegetation Communities (WVCs) (C.J.Robinson):
TS = Tall Sedges, CF = Cedar Dense Low Forest.
(Also some LS within area marked as TS.)

SURVEY DETAILS

Date: 8&9/1/92. Depth: not recorded. Salinity 0.468 ppt
Fringing vegetation was flooded extensively.

Effort: Total survey time was 1.0 h including late afternoon and middle of day. Waded in CF and TS in central part and looked over eastern part. Did not inspect northern part.

WATERBIRD DETAILS

| species recorded | number counted | active nests | broods (DR) | old nests | WVCs used (* for nest site) |
|---|---|---|---|---|---|
| LiGd | 3 | ϕ | ϕ | ϕ | TS. |
| LPiC | 2 | ϕ | ϕ | ϕ | CF. |
| LiBC | 2 | ϕ | ϕ | ϕ | CF. |
| PuSn | 1 | ϕ | ϕ | ϕ | TS. |
| MusD | 1 | ϕ | ϕ | ϕ | OW. |
| SpCk | 1 | ϕ | ϕ | ϕ | TS, LS. |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| Totals: | 10 | ϕ | ϕ | ϕ | (including data on other sheets? NO) |

species (now/earlier) = 6/ϕ extra., breeding spp (now/earlier) = ϕ/ϕ extra.

## WATERBIRD DETAILS cont'd

Other species probably now present in dense inundated vegetation: CReW, AusB?
(* possibly breeding now)

## DETAILS OF NESTS FOUND

| waterbird species | status of nest | contents | site (WVC) | water depth | main plant species |
|---|---|---|---|---|---|
| NIL | | | | | |

Other notes on species: Small cormorants were roosting in CF close to the road, in the evening. Probably not enough thicket or TS for LitB.

## ACCESS NOTES

Difficult to get into the central area of TS/LS

## MANAGEMENT CONSIDERATIONS

Horse riders pass along the beach at east end of lake.

Notes cont'd

BOAT HARBOUR ROAD LAKES
20 LAKE 1
21 LAKE 2
22 LAKE 3

Tall Sedges (TS)

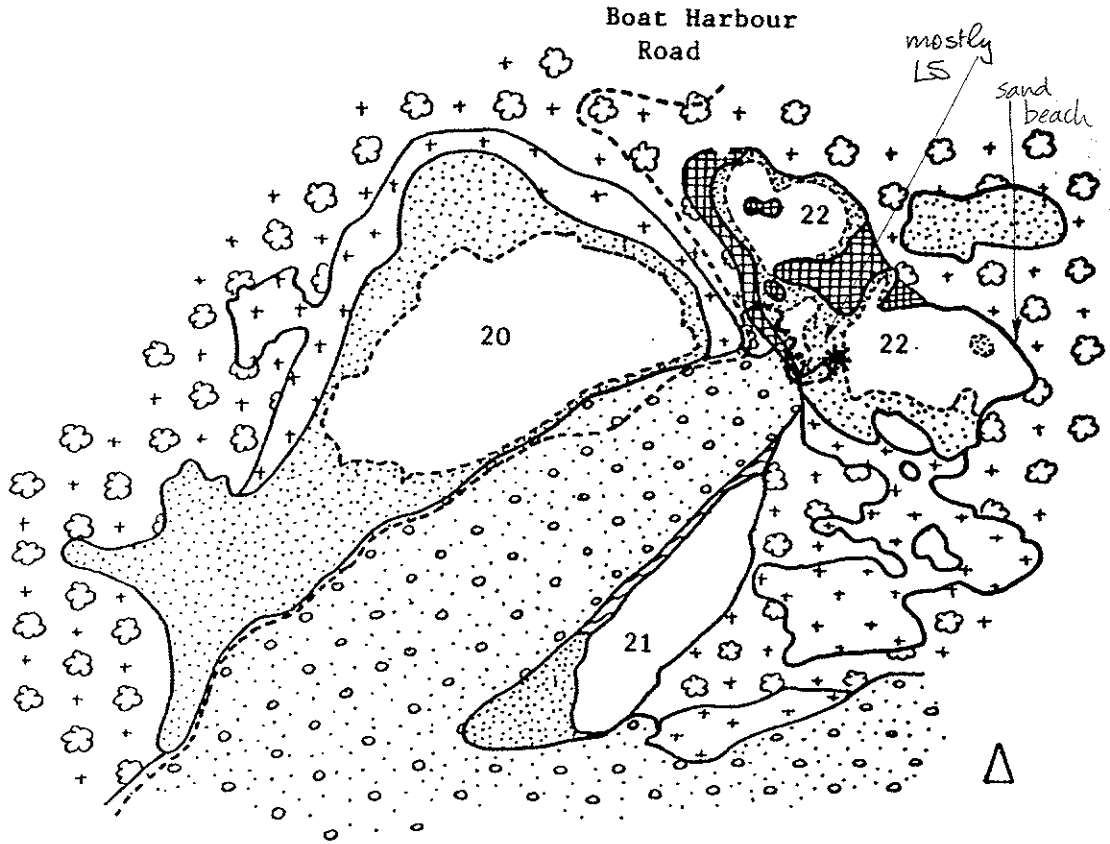
Cedar Dense Low Forest (CF)

Callistachys Thicket

Beaufortia Heath

Heath Dry

Heath Coastal




——— : survey route 9/1/92.

✱ : vantage point.

: waterline close to edge of wetland.

Waterbirds in Wetlands on the South Coast of Western Australia

SUMMARY DATASHEET

**LAKE** RESERVE 12046 LAKE 

## WETLAND DETAILS

Lat: 35°00' S. Long: 117°13' E. Shire: Denmark.

Land Status: within William Bay National Park.

CALM Region: South Coast. District: Albany.
Forestry Sheet (1:50 000): Denmark.

Wetland Vegetation Communities (WVCs) (C.J.Robinson):

TS = Tall Sedges, CF = Cedar Dense Low Forest,
OW = Open Water.

## SURVEY DETAILS

Date: 10-1-92. & 21-12-91. Depth: not recorded. Salinity 0.351 ppt
Fringing vegetation was flooded a little.

Effort: Total survey time was 0.75 h, mostly on 10/1/92. Scanned OW from western side and walked around north side of lake, wading into TS.

## WATERBIRD DETAILS

| species recorded | number counted | active nests | broods (DR) | old nests | WVCs used (* for nest site) |
|---|---|---|---|---|---|
| MusD | 2 | ∅ | ∅ | ∅ | OW. |
| PaBD | 14 | ∅ | ∅ | ∅ | OW. |
| GreC | 1 | ∅ | ∅ | ∅ | OW: overhead. |
| LiBC | 3 | ∅ | ∅ | ∅ | OW: |
| LPiC | 2 | ∅ | ∅ | ∅ | OW. |
| [PuSn | ∅ | ∅ | ∅ | 1 | TS*.] |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| Totals: | 16⊗ | ∅ | ∅ | 1 | (including data on other sheets? No) |

species (now/earlier) = 5/1 extra., breeding spp (now/earlier) = ∅/1 extra.

⊗ highest tally was 16 on 10/1/92.

WATERBIRD DETAILS cont'd

Other species probably now present in dense inundated vegetation: MusD, LiGd, SpCk?
(* possibly breeding now)

DETAILS OF NESTS FOUND

| waterbird species | status of nest | contents | site (WVC) | water depth | main plant species |
|---|---|---|---|---|---|
| PuSn | old | empty | TS | 10 cm | Baumea articulata with sparse B. vaginalis. |

Other notes on species: TS too sparse for significant waterbird use. Ranger K. Moon stated there were 30-40 PaBD and a Swan on the lake on 8-9/1/92. Ducks can take shelter under edge of CF in north-east of lake.

ACCESS NOTES

—

MANAGEMENT CONSIDERATIONS

—

Notes cont'd

23 ↑ 12046 WILLIAM BAY ROAD

Tall Sedges (TS)

Cedar Dense Low Forest (CF)

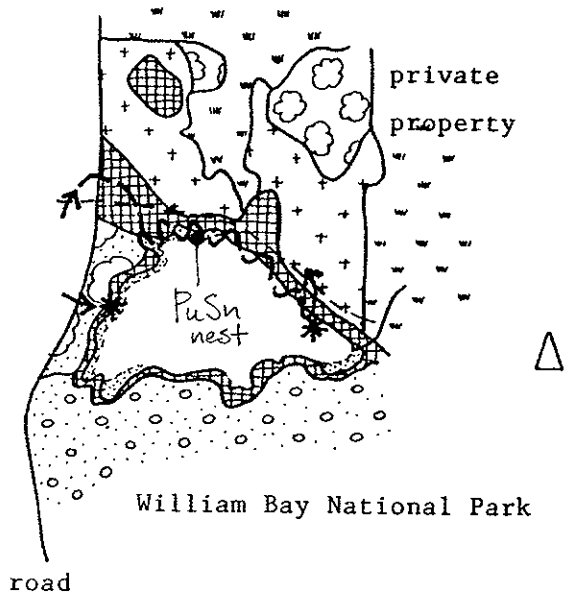
Heath Coastal

Blackbutt Open Low Woodland over Beaufortia Heath

Karri Forest

Jarrah Low Woodland over Low Heath

Pasture




→ : survey route on 10/1/92.

* : vantage point.

: waterline just inside TS

Waterbirds in Wetlands on the South Coast of Western Australia

SUMMARY DATASHEET

**LAKE** WILLIAMS 

## WETLAND DETAILS

Lat: 35°01′ S. Long: 117°16′ E. Shire: Denmark.

Land Status: within William Bay National Park.

CALM Region: South Coast. District: Albany.
Forestry Sheet (1:50 000): Denmark.

Wetland Vegetation Communities (WVCs) (C.J.Robinson):
TS = Tall Sedges, CF = Cedar Dense Low Forest, OW = Open Water.

## SURVEY DETAILS

Date: 9-1-92 Depth: not recorded. Salinity 0·435 ppt
Fringing vegetation was flooded a little.

Effort: Scanned lake from north end; waded through TS. Total survey time was 0·5 h.

## WATERBIRD DETAILS

| species recorded | number counted | active nests | broods (DR) | old nests | WVCs used (* for nest site) |
|---|---|---|---|---|---|
| PaBD | 1 | ∅ | ∅ | ∅ | TS. |

Totals: 1 ∅ ∅ ∅ (including data on other sheets? NO)

species (now/earlier) = 1/∅ extra., breeding spp (now/earlier) = ∅/∅.

## WATERBIRD DETAILS cont'd

Other species probably now present in dense inundated vegetation: SpCk??
(* possibly breeding now)

## DETAILS OF NESTS FOUND

| waterbird species | status of nest | contents | site (WVC) | water depth | main plant species |
|---|---|---|---|---|---|
| NIL | | | | | |

Other notes on species: Insufficient TS for waterbird use. Passing ducks and cormorants could visit the lake. CF in south-east of wetland could support waterbirds if flooded long enough.

## ACCESS NOTES

—

## MANAGEMENT CONSIDERATIONS

—

Notes cont'd

24 LAKE WILLIAMS

Tall Sedges (TS)

Callistachys Thicket

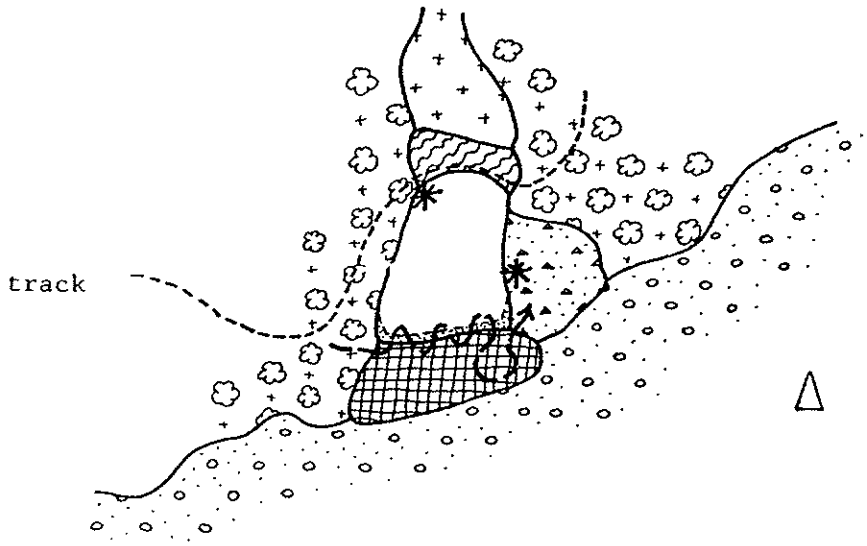
Cedar Dense Low Forest (CF)

Beaufortia Heath

Granite Heath

Heath Dry

Heath Coastal




0 0.1 0.2 0.3 km

→ : survey route 9/1/92.

✱ : vantage point.

: waterline only to edge of TS/CF.

Waterbirds in Wetlands on the South Coast of Western Australia

SUMMARY DATASHEET

LAKE SAIDE page 1 of 3

## WETLAND DETAILS

Lat: 35°03′ S. Long: 117°28′ E. Shire: Albany.

Land Status: within Reserves 20781 (Shire of Albany, common) and 17464 (not vested, camping & recreation).

CALM Region: South Coast. District: Albany.
Forestry Sheet (1:50 000): Denmark.

Wetland Vegetation Communities (WVCs) (C.J.Robinson):
TS = Tall Sedges, CF = Cedar Dense Low Forest, OW = Open Water, BL = Bare Land.

## SURVEY DETAILS

Date: (a) 22-12-91. (b) 10-1-92. Depth: not recorded. Salinity (10/1/92): 0.760 ppt
Fringing vegetation was flooded extensively.

Effort: (a) On 22/12/91, walked to edge of OW from Brown's Road and waded through TS for 1.5 h including after sunset. (b) On 10/1/92, waded through TS adjacent to Brown's Road (out to OW) in middle of day; also briefly in TS near outflow drain and from hill overlooking S. end (3.1 h). Total survey time: 4.6 h. (a) + (b)

## WATERBIRD DETAILS

| species recorded | number counted | active nests | broods (DR) | old nests | WVCs used (* for nest site) |
|---|---|---|---|---|---|
| HhGb | 50 | ∅ | ∅ | ∅ | OW. |
| APel | 2 | ∅ | ∅ | ∅ | BL. |
| LiBC | 1 | ∅ | ∅ | ∅ | OW: passing over. |
| WfHn | 5 | ∅ | ∅ | ∅ | TS: passing over. |
| LitB | 1 | ∅ | ∅ | 1 | TS*. |
| SacI | 1 | ∅ | ∅ | ∅ | BL. |
| Swan | 71 | ∅ | 1 | 3 | TS*, OW. |
| Shel | 5 | ∅ | ∅ | ∅ | OW, BL. |
| PaBD | 123 | ∅ | ∅ | ∅ | OW, BL. |
| Shov | 2 | ∅ | ∅ | ∅ | OW. |
| Totals: | 256⊗ | 4 | 2 | 13 | (including data on other sheets? YES) |

species (now/earlier) = 18/∅ extra, breeding spp (now/earlier) = 4/2 extra.

⊗ highest tally was 256 on 10/1/92.

## ADDITIONAL WATERBIRD DETAILS

| species recorded | number counted | active nests | broods (DR) | old nests | WVCs used (* for nest site) |
|---|---|---|---|---|---|
| BbiD | 14 | Ø | 1 | Ø | OW. |
| MusD | 18 | Ø | Ø | Ø | OW. |
| MaHa | 3 | Ø | Ø | Ø | TS: passing over. |
| SpCk | 5 | Ø | Ø | Ø | TS. |
| PuSn | 3 | Ø | Ø | Ø | TS. |
| Coot | 60 | Ø | Ø | 1 | OW, TS*. |
| CReW | 5 | 3 | Ø | 8 | TS* |
| LiGd | 2 | 1 | Ø | Ø | TS* |

BREEDING DATA cont. (from p. 3).

| waterbird species | status of nest | contents | site (WVC) | water depth | main plant species |
|---|---|---|---|---|---|
| CReW | active | 3 eggs | TS | 25 cm | Typha orientalis. |
| CReW | old | empty | TS | 20 cm | 〃 〃 |
| CReW | old | empty | TS | 20 cm | 〃 〃 |
| CReW | old | empty | TS | 40 cm | 〃 〃 |
| CReW | old | empty | TS | 40 cm | 〃 〃 |
| CReW | old | empty | TS | 30 cm | 〃 〃 |
| CReW | old | empty | TS | 30 cm | 〃 〃 |
| CReW | old | empty | TS | 30 cm | 〃 〃 |
| CReW | old | empty | TS | 30 cm | 〃 〃 |

## WATERBIRD DETAILS cont'd

Other species probably now present in dense inundated vegetation: BbaR, BaCk?, AuCk?, AusB?
(* possibly breeding now)

## DETAILS OF NESTS FOUND

| waterbird species | status of nest | contents | site (WVC) | water depth | main plant species | |
|---|---|---|---|---|---|---|
| LitB | old (young just left the nest) | empty | TS | 30 cm | Typha orientalis | |
| Swan | old | rotten egg (empty) | TS | 25 cm | 〃 | 〃 |
| Swan | old | empty | TS | 30 cm | 〃 | 〃 |
| Swan | old | empty | TS | 20 cm | 〃 | 〃 |
| Coot | old | empty | TS | 0 cm | 〃 | 〃 |
| LiGd | active | 1 egg | TS | 40 cm | 〃 | 〃 |
| CReW | active | 3 eggs | TS | 30 cm | 〃 | 〃 |
| CReW | active | 1 egg | TS | 30 cm | 〃 | 〃 |

continued on page 2.

Other notes on species: 9 of the CReW nests, the LiGd nest, the LitB nest and one of the Swan nests (total: 12 nests) were in the tallest green Typha (to 3.0–3.5m high) — covering an area of 10m x 15m at edge of OW. Potential for bitterns, including AusB, in far south-eastern areas of TS. (see below)

## ACCESS NOTES

No easy access to north-eastern side of lake: not investigated, though looked to have potential for nests (less couch in the TS). Extensive southern area of TS was not investigated but could do so from the road continuing from Saide Road to hillside with view of the wetland (see map). Wading in OW not difficult (close to TS) because bottom mostly firm; boggier inside TS.

## MANAGEMENT CONSIDERATIONS

Couch infestation probably beyond control; has reduced area of TS useful to waterbirds.

Notes cont'd

Species:
- LitB: calling adult (in response to imitation) at same site as 22/12 where nest was found on 10/1; nestlings probably recently left nest — wet droppings in nest; shrimp Palaemonetes australis in nest.
- CReW nests often in loose clusters of 3; usually also within 1–2 m of TS/OW edge. Swan brood was 3 largish juveniles. BbiD had 4 small ducklings on 22/12 but only 1 on 10/1/92; other pairs displaying/courting.

25 LAKE SAIDE

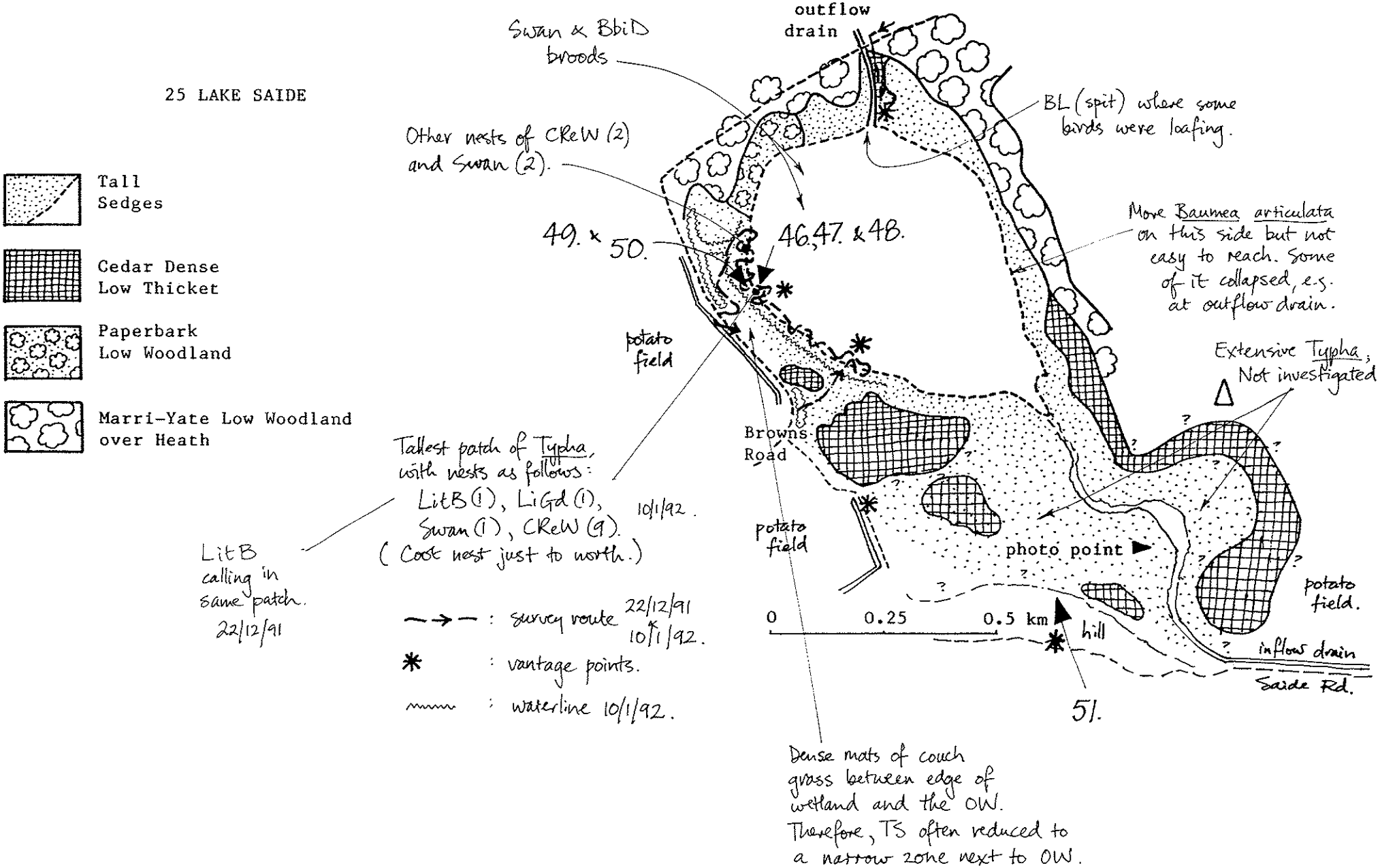


Photo 46. Saide Lake. South side. Tall, dense Typha: site of nest of Little Bittern (at centre of photo). 10/1/92.

Photo 47. Saide Lake. Recently-used nest of Little Bittern in Typha. 10/1/92.

Photo 48. Saide Lake. Recently-used nest of Little Bittern in Typha. 10/1/92.

Photo 49. Saide Lake. Site of Little Bittern nest: tall, erect Typha with seedhead stalks. 10/1/92.

Photo 50. Saide Lake. Old nest of Eurasian Coot in Typha and tussock. 10/1/92.

Photo 51. Saide Lake. Eastern end. Extensive Typha: potential for use by bitterns? 10/1/92.

Waterbirds in Wetlands on the South Coast of Western Australia

SUMMARY DATASHEET

**LAKE** WILLIAM 

## WETLAND DETAILS

Lat: 35°05′ S. Long: 117°36′ E. Shire: Albany.

Land Status: within West Cape Howe National Park.

CALM Region: South Coast. District: Albany.
Forestry Sheet (1:50 000): not applicable.

Wetland Vegetation Communities (WVCs) (C.J.Robinson):
TS = Tall Sedges, OW = Open Water.

## SURVEY DETAILS

Date: 10-1-92 Depth: not recorded. Salinity 0.241 ppt
Fringing vegetation was flooded a little.

Effort: Total survey time was 0.8 h. Scanned OW from north end and waded through TS in south-east of wetland.

## WATERBIRD DETAILS

| species recorded | number counted | active nests | broods (DR) | old nests | WVCs used (* for nest site) |
|---|---|---|---|---|---|
| MaHa | 4 | ø | ø | ø | OW : overhead. |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| Totals: | 4 | ø | ø | ø | (including data on other sheets? NO) |

species (now/earlier) = 1/ø extra., breeding spp (now/earlier) = ø/ø.

## WATERBIRD DETAILS cont'd

Other species probably now present in dense inundated vegetation: SpCk, BaCk?, LiGd.
(* possibly breeding now)

## DETAILS OF NESTS FOUND

| waterbird species | status of nest | contents | site (WVC) | water depth | main plant species |
|---|---|---|---|---|---|
| NIL | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Other notes on species: Main part of lake has fringing beach & no flooded vegetation, so minimal potential for waterbird use. Small areas of TS (mostly Baumea vaginalis) are on north and south-east sides of lake and may support crakes or nesting ducks.

## ACCESS NOTES

—

## MANAGEMENT CONSIDERATIONS

—

Notes cont'd

26 LAKE WILLIAM

Tall Sedges (TS)

Callistachys Thicket

Heath Dry

Peppermint Open Low Woodland Over Heath Coastal

Beaufortia Heath

Karri Forest

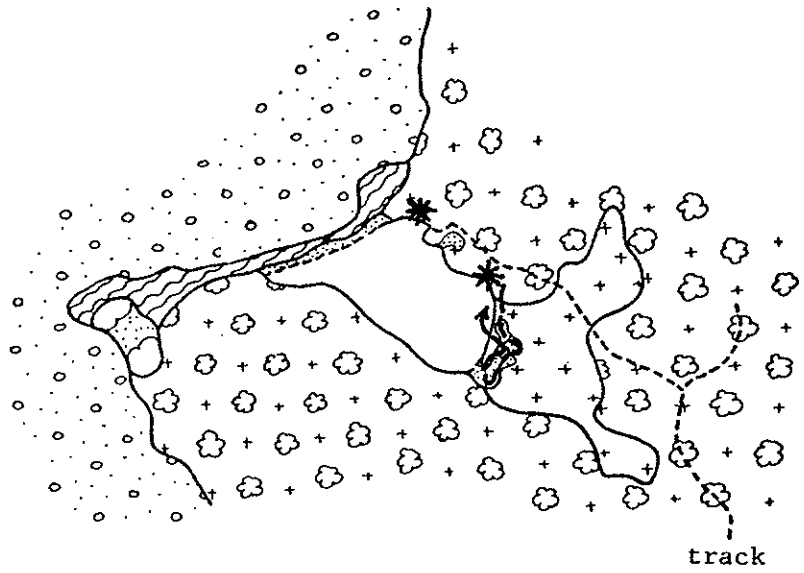



photo point ▶

0 0.5 1.0 km

→— : survey route 10/1/92.

✱ : vantage points.

: waterline was at edge of wetland basin, so TS at north & south-east sides was inundated.

Waterbirds in Wetlands on the South Coast of Western Australia

SUMMARY DATASHEET

**LAKE** POWELL 

## WETLAND DETAILS

Lat: 35°01′ S. Long: 117°44′ E. Shire: Albany.

Land Status: within Powell Lake Nature Reserve.

CALM Region: South Coast. District: Albany.
Forestry Sheet (1:50 000): Redmond.

Wetland Vegetation Communities (WVCs) (C.J.Robinson):
TS = Tall Sedges, CF = Cedar Dense Low Forest, OW = Open Water, BL = Bare Land (islets, sandspits).

## SURVEY DETAILS

Date: 11-1-92. Depth: 0.72 m at gauge. Salinity 0.541 ppt
Fringing vegetation was flooded extensively.

Effort: Total survey time was 4.3 h in the middle of the day and at night (listening for bitterns). Intensive searching for nests in TS at north end of lake (including islets of TS) and at east end of lake near drain. Views of OW from several vantage points.

## WATERBIRD DETAILS

| species recorded | number counted | active nests | broods (DR) | old nests | WVCs used (* for nest site) |
|---|---|---|---|---|---|
| LiGd | 2 | ϕ | ϕ | 1 | TS*. |
| RNHn | 1 | ϕ | ϕ | ϕ | CF : flying over. |
| PuSn | 1 | ϕ | ϕ | ϕ | TS. |
| SiGl | 1 | ϕ | ϕ | ϕ | OW. |
| HhGb | 27 | ϕ | ϕ | ϕ | OW. |
| Shel | 215 | ϕ | ϕ | ϕ | OW, BL. |
| PaBD | 60 | ϕ | ϕ | ϕ | TS, OW, BL. |
| Shov | 110 | ϕ | ϕ | ϕ | OW, BL. |
| YbSl | 3 | ϕ | ϕ | ϕ | BL. |
| CReW | 7 | ϕ | ϕ | 1 | TS*. |
| Totals: | 766 | ϕ | ϕ | 5 | (including data on other sheets? YES) |

species (now/earlier) = 25/ϕ extra., breeding spp (now/earlier) = ϕ/4 extra. (one not identified)

## ADDITIONAL WATERBIRD DETAILS

| species recorded | number counted | active nests | broods (DR) | old nests | WVCs used (* for nest site) |
|---|---|---|---|---|---|
| Coot | 260 | ϕ | ϕ | 1 | TS*, OW. |
| MusD | 6 | ϕ | ϕ | ϕ | OW. |
| LPiC | 3 | ϕ | ϕ | ϕ | OW. |
| Swan | 3 | ϕ | ϕ | ϕ | OW. |
| ManD | 6 | ϕ | ϕ | ϕ | BL. |
| WfHn | 7 | ϕ | ϕ | ϕ | BL. |
| LiBC | 2 | ϕ | ϕ | ϕ | BL. |
| BbiD | 6 | ϕ | ϕ | ϕ | OW. |
| GreC | 1 | ϕ | ϕ | ϕ | OW. |
| MaHa | 4 | ϕ | ϕ | ϕ | OW (overhead) & CF (perched). |
| SpCk | 17 | ϕ | ϕ | ϕ | TS. |
| GyTl | 2 | ϕ | ϕ | ϕ | BL. |
| PeaD | 18 | ϕ | ϕ | ϕ | BL. |
| Gank | 1 | ϕ | ϕ | ϕ | BL. |
| GrtE | 3 | ϕ | ϕ | ϕ | BL. |
| [unidentified duck | ϕ | ϕ | ϕ | 2 | TS*. ] |

| waterbird species | status of nest | contents | site (WVC) | water depth | main plant species |
|---|---|---|---|---|---|

## WATERBIRD DETAILS cont'd

Other species probably now present in dense inundated vegetation: AuCk, BaCk?, BbaR, LitB, AusB?
(* possibly breeding now)

## DETAILS OF NESTS FOUND

| waterbird species | status of nest | contents | site (WVC) | water depth | main plant species |
|---|---|---|---|---|---|
| LiGd | old | empty | TS | 10 cm | Typha orientalis |
| CReW | old | empty | TS | 20 cm | Typha orientalis |
| Coot | old | empty | TS | 30 cm | Baumea articulata |
| [unidentified duck | old | empty | TS | 20 cm | Typha orientalis] |
| [unidentified duck | old | empty | TS | 20 cm | Typha orientalis] |

Other notes on species: Islands of TS (Typha) at north end of lake seemed ideal for nests but few found. Two old nest(?) platforms found in Typha in north part of lake may have been LitB nests but were too much deteriorated to be sure. Quite a few species and individuals were loafing on BL at north & eastern ends of lake.

ACCESS NOTES

A road through Elleker, near hall, leads to an access track beside a drain entering the far north-west end of lake: this gives excellent views of OW. Main road also gives numerous good vantage points. Turn in at reserve sign near eastern end for access to end of eastern drain & spit.

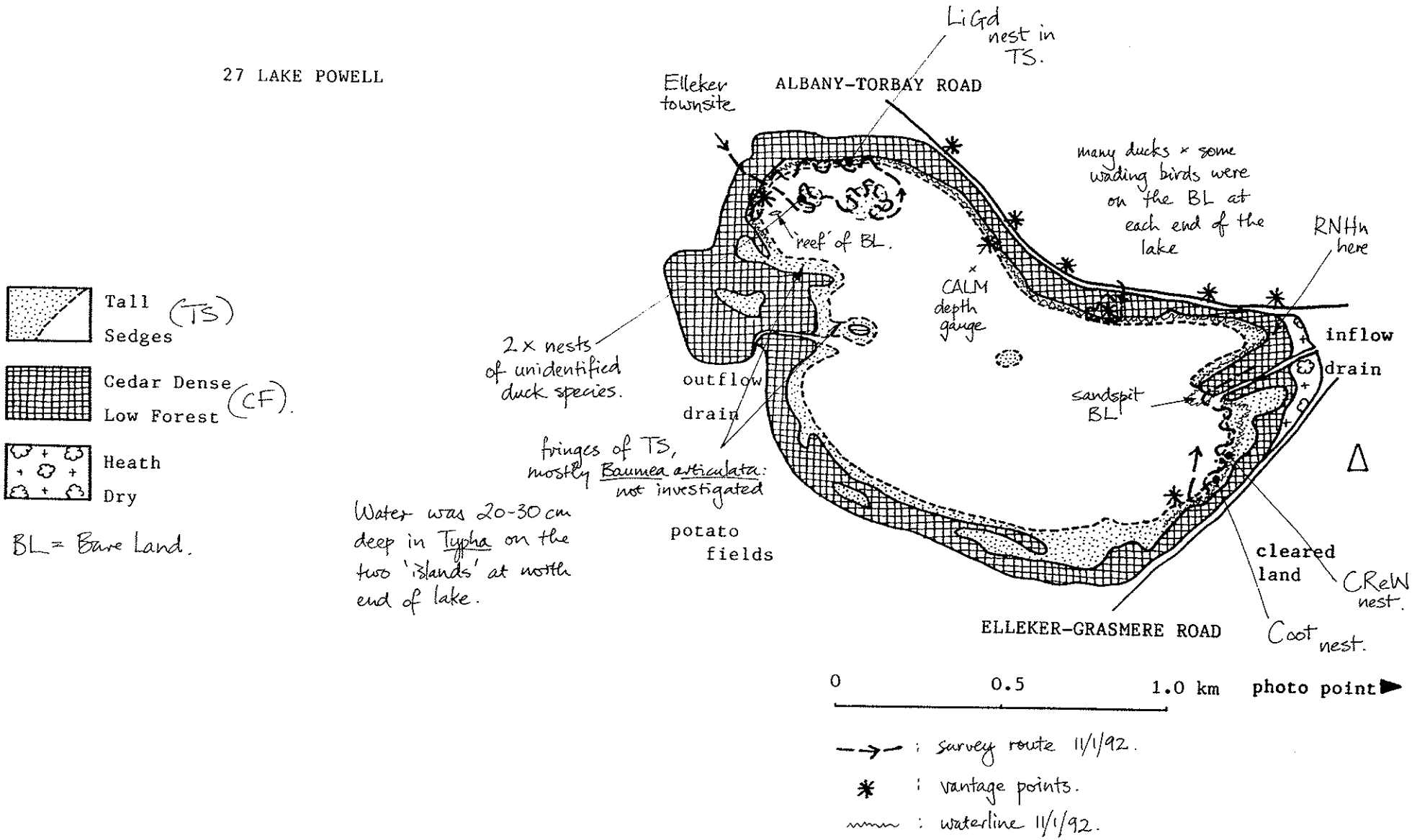
MANAGEMENT CONSIDERATIONS

Walking in TS was generally easy due to firm substrate & shallow water.

Algal bloom developing in the water, espec. at eastern end. Much of TS either collapsed or choked out with couch grass mats; thus much of TS was not useful for waterbirds.

Notes cont'd

27 LAKE POWELL



Waterbirds in Wetlands on the South Coast of Western Australia

SUMMARY DATASHEET

# LAKE WARREN RIVER OXBOW



## WETLAND DETAILS

Lat: 34° 34′ S. Long: 116° 55′ E. Shire: Manjimup.

Land Status: within State Forest (Dombakup Block).

CALM Region: Southern Forest. District: Pemberton.
Forestry Sheet (1:50 000): Warren.

Wetland Vegetation Communities (WVCs) (C.J.Robinson):
CF = Cedar Dense Low Forest, TS = Tall Sedges, OW = Open Water.

## SURVEY DETAILS

Date: 17-12-91. Depth: not recorded. Salinity 0·580 ppt
Fringing vegetation was flooded a little.

Effort: Total survey time was 0·4 h in late afternoon. Scanned from western end of pool.

## WATERBIRD DETAILS

| species recorded | number counted | active nests | broods (DR) | old nests | WVCs used (* for nest site) |
|---|---|---|---|---|---|
| PaBD | 4 | ∅ | ∅ | ∅ | OW. |
| ManD | 2 | ∅ | ∅ | ∅ | OW. |
| GreC | 2 | ∅ | ∅ | ∅ | OW. |

Totals: 8 ∅ ∅ ∅ (including data on other sheets? NO)

species (now/earlier) = 3/∅ extra., breeding spp (now/earlier) = ∅/∅.

## WATERBIRD DETAILS cont'd

Other species probably now present in dense inundated vegetation: BlaB ?
(* possibly breeding now)

## DETAILS OF NESTS FOUND

| waterbird species | status of nest | contents | site (WVC) | water depth | main plant species |
|---|---|---|---|---|---|
| NIL. | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Other notes on species: BlaB could occur in cedars, paperbarks and river gums overhanging the pool; other suitable habitat is in the Warren River itself, nearby. Probably is a good refuge, and also a breeding area, for cormorants and ducks.

## ACCESS NOTES

Go to very end of Plantation Road (see map on original datasheet); then follow small track down hillslope to edge of floodplain/valley; then go right around edge of floodplain until reach the Oxbow, which is right at base of hill (walk higher up, if progress becomes impeded by scrub/weeds.

## MANAGEMENT CONSIDERATIONS

Infestation of thorny exotic shrubs between Oxbow and River.

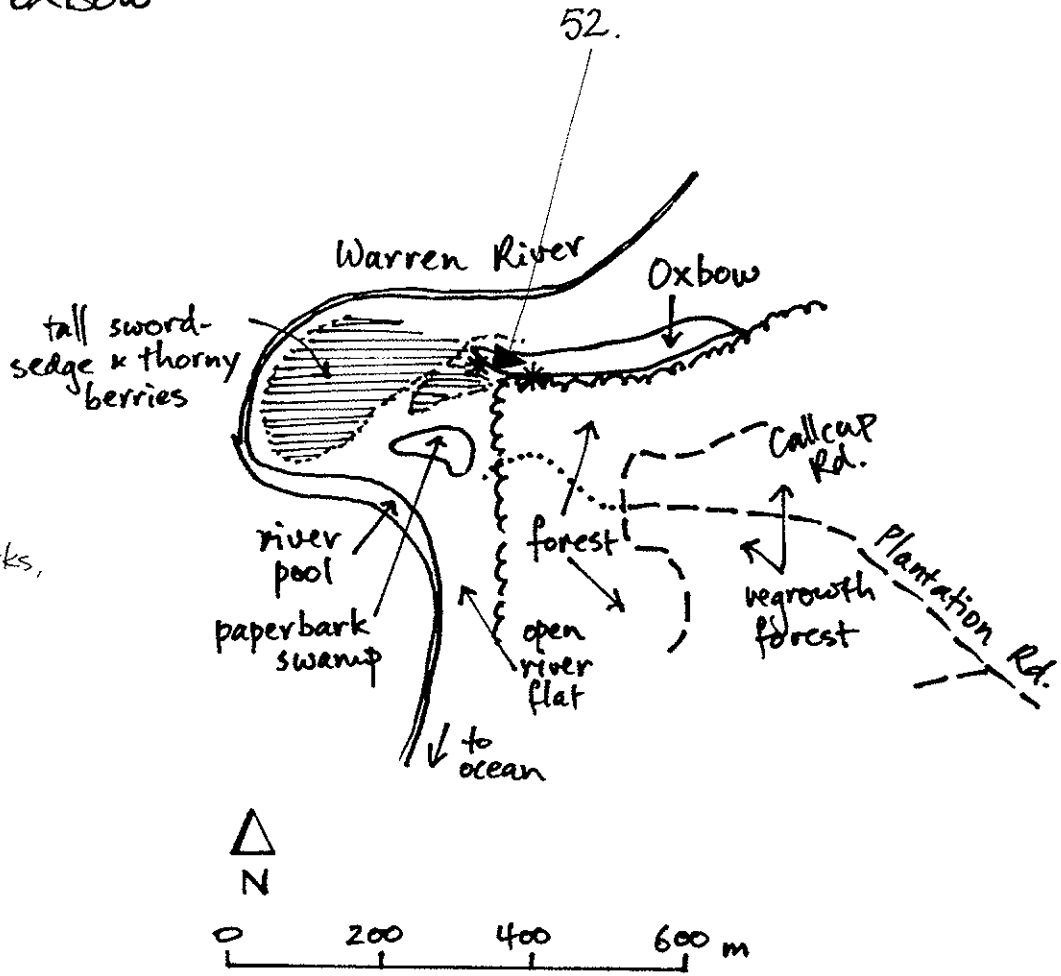
Notes cont'd

# A4 WARREN RIVER OXBOW

Fringing vegetation (partly flooded on 17/12/91):

CF = Cedar Forest

TS = Tall Sedges (Baumea vaginalis, Schoenoplectus? sp.) and scattered Melaleuca paperbarks, river gums Eucalyptus rudis etc.




▶ : photo point.

✱ : vantage point.

: oxbow waterline was close to edge of wetland, on 17/12/91.

Photo 52. Warren River Oxbow. Cedars, paperbarks and river gums fringing the pool, western end. 17/12/91.

## Appendix III. Data from other sources

The following data were obtained from surveys of the various wetlands conducted before summer 1991-92; sources of the information were CALM and RAOU (see report text for detail).

---

Interpretation

Summary data about the surveys is given in parentheses after the wetland name:

| | | |
|---|---|---|
| 'surveys' | = | number of surveys conducted |
| 'seasons' | = | seasons in which surveys were conducted (su = summer, au = autumn, wi = winter, sp = spring) |
| 'species' | = | number of species recorded, from all surveys |
| 'breeding' | = | number of species found breeding, from all surveys |
| 'individuals' | = | highest number of individual waterbirds counted in any one survey, with month and year of the survey. |

Then follows a list of species recorded (see Appendix I for full names) and the highest number recorded for that species in any survey, in parentheses. An asterisk indicates breeding was recorded in at least one survey.

---

Devil's Pool

(surveys = 2 / seasons = au, wi / species = 2 / breeding = 0 / individuals = 2)
Coot 1, PaBD (1).

Davies Lake

(surveys = 3 / seasons = au, wi / species = 3 / breeding = 0 / individuals = 3)
PaBD (1), Coot (1), unidentified grebe (1).

Quitjup Lake

(surveys = 16 / seasons = su, au, sp / species = 11 / breeding = 0 / individuals = 102 in Nov 77) GreC (1), LiBC (25), LPiC (1), Dart (3), WfHn (6), Swan (1), Shel (100), GyTl (8), PaBD (13), MusD (2), MaHa (1).

Jasper Lake

(surveys = 22 / seasons = all 4 / species = 14 / breeding = 0 / individuals = 354 in Nov 90) APel (1), GCGb (2), AuGb (7), LiBC (200), LPiC (20), WfHn (8), Swan (3), Shel (20), PaBD (25), GyTl (1), MusD (32), WbSE (1), Coot (2), SiGl (25).

Wilson Lake

(surveys = 7 / seasons = au, sp / species = 0 / breeding = 0 / individuals = 0).

Smith Lake

(surveys = 7 / seasons = au, sp / species = 0 / breeding = 0 / individuals = 0).

Yeagarup Lake

(surveys = 8 / seasons = au, sp / species = 0 / breeding = 0 / individuals = 0).

Doggerup Lake

(surveys = 1 / seasons = wi / species = 1 / breeding = 0 / individuals = 1) MusD (1).

Samuel Lake

(surveys = 7 / seasons = au, sp / species = 2 / breeding = 0 / individuals = 2) PuSn (1), LPiC (1).

Florence Lake

(surveys = 6 / seasons = au, sp / species = 1 / breeding = 0 / individuals = 5 in Nov 88) PaBD (5).

Gardner River Lake

(surveys = 1 / seasons = wi / species = 1 / breeding = 1 / individuals = 11 in Jul 91) GreC (11*): 5 pairs nesting - with eggs.

Maringup Lake

(surveys = 17 / seasons = all 4 / species = 15 / breeding = 1 / individuals = 1419 in Mar 87) GCGb (1), HhGb (20), GreC(1), LPiC (3), Dart (3*), WfHn (1), Swan (7), Shel (10), PaBD (200), GyTl (800), BbiD (4), MusD (28), Hard (1), MaHa (3), Coot (1320).

Owingup Swamp

(surveys = 15 / seasons = all 4 / species = 33 / breeding = 2 / individuals = 1457 in Mar 91) HhGb (55), APel (6), Dart (3), PieC (4), LiBC (20), LPiC (3), WfHn (4), GrtE (5), AusB (3), SacI (17), SnkI (3), YbSl (24), Swan (88*), Shel (492), PaBD (172), GyTl (27), Shov (10), ManD (2), BbiD (6), MusD (15), MaHa (4), SpCk (1), PuSn (2), Coot (1200), BfoP (26), BwSt (2), WooS (1), Gank (5), MarS (1), LotS (7), SiGl (2), CReW (3), LiGd (8*).

Boat Harbour Lake 1

(surveys = 27 / seasons = all 4 / species = 32 / breeding = 0 / individuals = 403 in Mar 85) APel (8), GreC (1), LiBC (1), LPiC (3), WfHn (30), GrtE (2), AusB (3), SacI (6), SnkI (9), Swan (162), Shel (21), PaBD (100), GyTl (40), Shov (50), MusD (15), WbSE (1), MaHa (2), SpCk (7), PuSn (11), Coot (30), RcaP (40), BfoP (4), BwSt (12), RnAv (150), Gank (6), RenS (200), CurS (80), SiGl (2), CasT (1), CReW (1), LiGd (2), unidentified grebe (1).

Boat Harbour Lake 2

(surveys = 1 / seasons = wi / species = 1 / breeding = 1 / individuals = 2) PuSn (2*).

Boat Harbour Lake 3

(surveys = 1 / seasons = wi / species = 1 / breeding = 1 / individuals = 2) Swan (2*).

Reserve 12046 Lake

(surveys = 1 / seasons = au / species = 5 / breeding = 0 / individuals = 70 in Mar 87) HhGb (8), LPiC (2), Swan (23), GyTl(7), Coot (30).

Williams Lake

(surveys = 1 / seasons = wi / species = 1 / breeding = 0 / individuals = 2) PaBD (2).

Saide Lake

(surveys = 23 / seasons = all 4 / species = 32 / breeding = 2 / individuals = 1132 in Feb 83) HhGb (111), AuGb (11), APel (7), LiBC (18), LPiC (41), WfHn (50), GrtE (14), RNHn (3), AusB (1), SacI (9), SnkI (42), YbSl (3), Swan (200*), Shel (120*), PaBD (400), GyTl (198), Shov (20), ManD (2), BbiD (4), MusD (15), Ospy (2), MaHa (2), SpCk (2), PuSn (12), Coot (150), BfoP (2), BwSt (130), BaSt (180), WooS (1), Gank (150), SiGl (1), CReW (3).

Powell Lake

(surveys = 68 / seasons = 4 / species = 54 / breeding = 9 / individuals = 4417 in Jan 86) GCGb (2), HhGb (140), AuGb (119), APel (8), GreC (3), LiBC (97), LPiC (8), WfHn*(28), GrtE (2), CatE (1), LitB (1), AusB (3), SacI (9), SnkI (12), YbSl (18), Swan (323*), Shel (719*), PaBD (1411*), GyTl (1800), ChTl (32), Shov (500*), PeaD (155), Hard (250), ManD (30), BbiD (140*), MusD (46*), MaHa (3*), BbaR (2), BaCk (1), AuCk (1), SpCk (25), BtNh (2), DuMo (6), PuSn (14), Coot (481*), PiOy (2), RkDo (7), RcaP (59), BfoP (85), BwSt (111*), BaSt (212), RnAv (1560), WooS (1), GtaT (2), Gank (26), ShtS (7), PecS (2), RenS (460), CurS (52), BbiS (1), SiGl (500), CasT (2), CReW* (12), LiGd (13).