Report to the Department of Conservation and Land Management Western Australia

Wetlands of the Nullarbor and Hampton Bioregions

Collation of data on wetlands for potential listing in the "Directory of Important Wetlands in Australia"

prepared by

Doug Watkins Roger Jaensch

Wetlands International - Oceania

October 1997

Wetlands of the Nullarbor and Hampton Bioregions: Collation of data on wetlands for potential listing in the "Directory of Important Wetlands in Australia"

Credits

This report was prepared by Wetlands International - Oceania under contract to the Department of Conservation and Land Management (WA).

Wetlands International - Oceania GPO Box 636 Canberra ACT 2601 Australia Tel: (066) 250 0780 Fax: (066)250 0799

Reference this document as:

Watkins, D. and Jaensch, R.P. 1997. Wetlands of the Nullarbor and Hampton Bioregions: Collation of data for potential listing of important wetlands. Unpublished consultancy report to the Department of Conservation and Land Management (WA). Wetlands International - Oceania. Canberra.

Copyright of this report is vested in the Executive Director of the Department of Conservation and Land Management.

Contents

1.0 Background	1
2.0 The Nullarbor and Hampton Bioregions	1
3.0 Geology and Geomorphology	2
4.0 Climate	3
5.0 Anthropological Setting	5
6.0 Wetland Research	7
7.0 Wetland Resources	8
 7.1 Hampton bioregion	
 8.0 Field Program	10 10 11
9.0 Recommendations	11
10.0 References	13

Tables

Table 1	High Rainfall Years (150% of mean) for Rawlinna	
Table 2	High Rainfall Months for Rawlinna (>50% of annual rainfall)5	;

Figures

Figure 1	Annual Rainfall for Rawlinna (1917 - 1996)4
Figure 2	Nullarbor Land Tenure (from McKenzie and Robinson 1987)6
Figure 3	Areas traversed during Fieldwork, July 1997
Figure 4	Detailed map of the Paleodrainage Channel on Gunnadorah Station

Photographs

Photograph 1	Eastern end of the Hampton Bioregion: View south across the Roe Plain from the top of the scarp at Eucla16
Photograph 2	Eastern end of the Hampton Bioregion: View west along the Roe Plain from the top of the scarp at Eucla16
Photograph 3	"Linesmans Camp Dam" with the Roe Plain in the background
Photograph 4	"Linesmans Camp Dam" with the Roe Plain in the background
Photograph 5	Madura Cave, 10 km south of Madura
Photograph 6	View south across the Roe Plain from the lookout at the car park on the Eyre Bird Observatory access track. Note <i>Melaleuca</i> thicket18
Photograph 7	View of scarp and rock face that contains Yarrabie Rockhole (light coloured rock in centre) from the Eyre Bird Observatory access track.
Photograph 8	View SE over "Carlisle's Rockhole". This is located on the scarp face behind "Carlisle's Hut", Twilight Cove
Photograph 9	Reconstruction of rock coverage over a small rockhole adjacent the intersection of Moondadong Rockhole track and Cocklebiddy west track. This rockhole is approximately 30 cm across and 50 cm deep. Nuytsland Nature Reserve. {32° 04.836' S, 126° 08.635' E}20
Photograph 10	Enlarged rockhole and tank used as waterpoint during an unsuccessful attempt to establish a pastoral station between Cocklebiddy and Burnabbie in the 1930's. Nuytsland Nature Reserve. {32° 05.345' S, 126° 07.771' E}
Photograph 11	Moondadong Rockhole, Nuytsland Nature Reserve {32° 04.413' S, 126° 13.852' E}21
Photograph 12	Blasted rockhole adjacent to Moondadong Rockhole, Nuytsland Nature Reserve {32° 04.413' S, 126° 13.852' E}21
Photograph 13	View across Saltbush-Bluebush plains in northern Arubiddy Station. Stipa grassland on colluvium soil in centre of the photograph (1)22
Photograph 14	View across Saltbush-Bluebush plains on northern Arubiddy Station. <i>Stipa</i> grassland on colluvium soil in the centre of the photograph (2)
Photograph 15	Twilight Cove - freshwater soak area along the base of the cliff24
Photograph 16	View west along the samphire flats at Twilight Cove25
Photograph 17	View NE along the samphire flats at Twilight Cove25
Photograph 18	Cologna Rockhole. View south across the five rockholes which are locatèd on a bare slopping rock surface on top of the scarp. Small pools can be seen around the main rockholes from a shower of rain at the time of the visit
Photograph 19	View north from the Burnabbie-Madura track to Colonga Rockhole29

Photograph 20	View north of the gully that contains Yudenda Rockhole. The gully forks to both the NW and NE
Photograph 21	Yudenda Rockhole - view southwest
Photograph 22	View NNE from the Burnabbie-Madura track of the gully in which Norina Rockhole is located
Photograph 23	View south across the Roe Plain from the top of the scarp above Norina Rockhole
Photograph 24	Norina Rockhole - view S over the rockhole and across the Roe Plain
Photograph 25	View south-east across the Roe Plain from the base of the scarp near Toondi Rockhole, 9 km west of Madura33
Photograph 26	"Dam" structure across the gully on the top of the scarp at Toondi Rockhole, 9 km west of Madura
Photograph 27	"Duck Pond" in the Ram Paddock, Arubiddy Station
Photograph 28	"Duck Pond" in the Ram Paddock, Arubiddy Station
Photograph 29	Turkey-nest dam on Gunnadorah Station
Photograph 30	View W to Steve's Dam and a paleodrainage channel on Gunnadorah40
Photograph 31	View south down the paleodrainage channel from Double Bore/Yellow-tail Bore track, Gunnadorah Station41
Photograph 32	"Crab holes" in the paleodrainage channel, 2 km south of the Double Bore/Yellow-tail Bore track, Gunnadorah Station
Photograph 33	View south of an erosion gully in the paleodrainage channel, 1 km south of the Double Bore/Yellow-tail Bore track, Gunnadorah Station
Photograph 34	View south across Save Way Dam on the paleodrainage channel, adjacent to the Double Bore/Homestead track, Gunnadorah Station. 42
Photograph 35	View south along the bed of the paleodrainage channel, approximately 10 km NNE of Family Dam, Gunnadorah Station,43
Photograph 36	View NE across Family Dam, Gunnadorah Station43

iii

 ${\bf x}_{\rm c}$

Appendices

Appendix 1	Twilight Cove Wetlands (Nuytsland Nature Reserve)23
Appendix 2	Hampton Scarp Rockholes - Burnabbie to Madura (VCL and Madura Station)
Appendix 3	"Duck Pond" (Arubiddy Station)
Appendix 4	Dongas (Seemore Downs, Premier Downs & Kinclaven Stations)
Appendix 5	Paleodrainage Channels (Gunnadorah Station)
Appendix 6	Wetlands Resource Materials for the Nullarbor and Hampton Bioregions44
Appendix 7	Wetland Field Resource Kit (Hampton Bioregion)45
Appendix 8	Wetland Field Resource Kit (Nullarbor Bioregion)47

Acknowledgments

We would like to thank the following people for their hospitality, time, information and assistance during the fieldwork:

- James and Debbie Brownlie (Eyre Bird Observatory)
- Peter and Barbara Brown (Arubiddy Station)
- Brett and Dot Day (Gunnadorah Station)
- Donald Hogg (Seemore Downs Station).

Rita and George Watkins provided information and some photographs based on their experience as wardens of Eyre Bird Observatory between October 1992 and February 1996.

Jim Lane, John Blyth, Grant Pearson (CALM) and Bill Williams provided information and assistance with some field equipment.

Thanks also to Johnny Websdale (APB Dogger) for the insights he give about the country during 1980 when Doug Watkins was at Eyre Bird Observatory.

Brigitta Wimmer (Wetlands International - Oceania) assisted with report production.

Summary

Environment Australia has been working with State and Territory agencies for several years to develop a comprehensive directory of important wetlands in Australia. The second edition of the directory lists 110 important wetland areas in Western Australia. All but two (Nullarbor and Hampton) of the 26 bioregions in Western Australia are represented in this edition directory.

To address the lack of representation of wetlands in the Nullarbor and Hampton bioregions Wetlands International - Oceania was commissioned, by the Department of Conservation and Land Management, to collate preliminary information and identify potential surface wetlands for listing in the directory.

The desk study has shown that the combination of geology, geomorphology and semiarid to arid climate of the region result in a low diversity and number of wetlands.

The only wetland types identified in the Hampton bioregion were freshwater soaks and coastal marshes at Twilight Cove in Nuytsland Nature Reserve

In the Nullarbor bioregion wetland types include rockholes, dongas and paleodrainage channels. Specific sites identified were: rockholes on the Hampton scarp face between Burnabbie and Madura; a small donga on Arubiddy Station, and; an extensive paleodrainage channel on Gunnadorah Station.

Discussion with several land managers during the fieldwork found them to be "cautiously" supportive of having wetlands listed in the directory. These managers were assured that the Department of Conservation and Land Management would contact them before any further action was taken.

The report contains five recommendations for follow-up action by the Department of Conservation and Land Management.

This report is accompanied by three additional compilations of information of the wetlands resources of the bioregions:

- Wetland Field Resource Kit (Hampton Bioregion)
- Wetland Field Resource Kit (Nullarbor Bioregion)
- Key Reference Materials for Wetlands in the Nullarbor and Hampton Bioregions.

1.0 Background

Environment Australia has been working with State and Territory agencies for several years to develop a directory of important wetlands in Australia. The aim of the directory is to increase awareness of the importance of these areas. The Department of Conservation and Land Management (CALM) obtained funding from Environment Australia to survey and inventory wetlands of Western Australia for the 3rd edition of "A Directory of Important Wetlands in Australia".

The Directory presently lists 698 important wetlands in Australia with 110 in Western Australia (Phillips 1996). At the ANZECC Wetlands Network meeting in August 1994 it was agreed that assessments of the wetland resources would be assisted and be more meaningful by taking a biogeographic approach (Phillips 1996). Analysis of the 2nd edition of the Directory shows wetlands to be represented from 71 of the 80 bioregions (Thackway 1996) of Australia. Two of the bioregions that are not represented occur in Western Australia and these are the Nullarbor and Hampton bioregions (Lane *et al.* 1996).

In June 1997 Wetlands International - Oceania was contracted by CALM to obtain preliminary information on potentially important wetlands of the Nullarbor and Hampton bioregions. A number of wetlands were excluded from the brief because information was already available. There included: the karst wetlands of the Nullarbor caves, Lake Boondaroo and the chain of saline lakes along the northern edge of the Nullarbor bioregion.

The consultancy was for three weeks and was to include both a desk study and a field survey.

2.0 The Nullarbor and Hampton Bioregions

The boundaries of the two bioregions (Thackway and Cresswell 1995) have been modelled on the baseline data set of Beard (1980). A brief description of the two bioregions in given in Box 1.

The boundaries of most bioregions are broad and it serves little ecological purpose to define them to points on the ground. In the case of applying the bioregionalisation to wetlands in this region it is necessary to decide in which bioregion the Hampton scarp face is located. For the purposes of this report the base of the Hampton scarp has been as the northern boundary of the Hampton bioregion. This decision has been made on the basis that the geomorphological and related wetlands features of the scarp face are more closely related to those of the Nullarbor bioregion.

Box 1: An Interim Biogeographic Regionalisation for Australia: a framework for establishing the national system of reserves, Version 4.0

Hampton Bioregion

Quaternary marine dune systems on a coastal plain of the Eucla Basin, backed by stranded limestone scarp. Areas of marine sand are also perched along the top edge of the scarp. Various mallee communities dominate the limestone scree slopes and pavements, as well as the sandy surfaces. Alluvial and calcareous plains below the scarp support eucalypt woodlands and Myall open low woodlands.

Nullarbor Bioregion

Tertiary limestone plain; subdued arid karst features. Bluebush - Saltbush steppe in central areas; low open woodlands of Myall over bluebush in peripheral areas, including *Myoporum platycarpum* and *E. oleosa* in the east and west. Arid Non-seasonal.

http://www.anca.gov.au/protecte/nrs/document/ibra_95/app1.htm

3.0 Geology and Geomorphology

The two bioregions are situated on a landform feature called the Bunda Plateau (Van De Graaff *et al.* 1977). The Bunda Plateau is underlain by deep limestone deposits that were formed 45 -35 million years ago when the area was flooded by a shallow sea. At this time rainfall was greater and several large rivers ran into the sea from the north and north-west (Van De Graaff *et al.* 1977). Around 15 million years ago several major changes occurred: the sea level fell and the Bunda Plateau was uplifted. At this time the climate was arid and erosion rates were low.

During the period 5 to 3 million years ago the rainfall increased and several paleorivers ran water on to the edge of the Nullarbor where chains of playas formed (eg Plumridge Lake, Jubilee Lakes). In some cases these drainage channels ran further out on to the Nullarbor but these are no longer continuous (Van De Graaff et al. 1977). It is considered that the river flows were unable to reach the coast because of evaporation and infiltration (Jennings 1967). This wet phase was important in the development of caves and sinkholes across the Nullarbor.

In the Pleistocene, down faulting occurred along the southern edge of the Nullarbor to form the Hampton Range (Lowry 1971). The area below the scarp is called the Roe Plain (Lowry 1972) and it consists of calcareous sand deposited by marine processes as the sea retreated. The area is a broad flat plain with elevations of 5 - 10 m (Photograph 1 and 2). At the western end of the Plain, and in places along the coast, extensive dune fields have developed. In places this sand has been blown up into sand dunes of 80 m elevation (Photograph 6).

4.0 Climate

The present day climate of the region is semi-arid to arid. Annual rainfall varies from 300 mm on the coast (Eyre) to 187 mm on the Trans-Australian Railway line (Forrest). Along the coast rainfall is higher in winter but this trend declines with distance from the coast (Beard 1975).

Rainfall data were obtained from the Meteorological Bureau in Perth (attached). The average rainfall for Rawlinna over the past 80 years is 190.5 mm (Figure 1). The highest annual rainfall recorded was 497 mm in 1955 (Table 1). Up to 210 mm have been recorded in one month (Table 2).

Rawlinna has on average only 2.25 effective rainfall events (>20 mm/day) each year and these account for 44% of the annual rainfall. While many of the rainfall events will be associated with the tropical cyclones some have occurred in the winter months.

It does not appear to be possible to use rainfall data to predict with any accuracy when wetlands will be flooded on the central and northern Nullarbor. The most useful method would appear to be to monitor rainfall events by using the Bureau of Meteorological Web site:

- Australian rainfall deciles 1 month
- http://amdisa.ho.BoM.GOV.AU/climate/rainmaps/monthda.shtml

The Bureau of Meteorological has recently worked up data for climate monitoring. Sites from the region involved in this project are Forrest, Eucla, Mundrabilla Station, Rawlinna, Eyre and Belgair. Long term monthly data for each of these sites are available on the Internet at http://amdisa.ho.BoM.GOV.AU/auto_index.shtml.

Annual evaporation rates vary across the Nullarbor from 2000 mm to 2500 mm (Van De Graaff 1975).

Table 1 High Rainfall Years for Rawlinna (150% of mean)

Year	Total	Rain Days
1955	497.4	78
1942	430.8	59
1974	393.8	90
1958	325.3	76
1992	320.9	41
1960	315.7	76
1947	314.2	65
1963	310.0	51
1967	303.3	69
1968	303.2	70
1995	286.7	64



Figure 1 Annual Rainfall for Rawlinna (1917-1996)

4

Date	Monthly Total	Rain Days
January 1942	210.4	6
August 1958	154.9	13
December 1994	136.7	5
June 1955	130.6	16
February 1960	122.9	13
April 1934	113.8	7
December 1988	110.4	7
February 1963	98.0	6

Table 2 High Rainfall Months for Rawlinna (>50% of annual rainfall)

5.0 Anthropological Setting

In the 1800's the Roe Plain and southern edge of the Nullarbor were inhabited by the MIRNING people. It has been estimated that at this time the MIRNING numbered 200 - 250 people (Marun 1974).

The MIRNING are considered to have only occupied the fringes of the Nullarbor (Johnston 1941) and to travel on it only following heavy rains (Tindale 1974). This has been attributed to a lack of surface water.

Rockholes along the scarp, ground water from near the coast and possibly caves are considered to have been the only sources of freshwater (Wright 1971, Marun 1974). The MIRNING are considered to have lived mainly around freshwater soaks on the coast and to have moved up to and on top of the scarp during the winter (Cane and Gara 1989).

Aboriginal people used to cover some of the small rockholes on top of the scarp with large flat rocks to decrease evaporation and prevent access by other animals (Johnny Websdale pers. comm.). A reconstruction using rocks within 2 m of the rockhole is shown in Photograph 9.

In a report on aboriginal association with the Nullarbor Plain mention is made of an important "Aboriginal dam" (Wardargana) in the Forest Lakes area (Crane and Gara 1989). This report refers to information from Daisy Bates that it was an important water source and mythological site, associated with the mallee-hen totem group (Barr Smith Library in Cane and Gara 1989). The dam was apparently also described in detail by Giles (1889) under the name of "Boundary Dam".

In the 1870's a telegraph line was constructed between Western Australia and South Australia which ran along the Roe Plain. A major Telegraph Station was constructed at Eucla and a repeater station at Eyre and these operated until the 1930's. Camels, horses, cattle and sheep were brought into the area for food and to provide transport for the local community.



Figure 2 N

Nullarbor Land Tenure (from McKenzie and Robinson 1987) In 1900 stone masons constructed "water catches" on Madura Station and at Burnabbie Rockhole (Graham 1989). Several wells were also sunk at the base of the scarp and underground tanks constructed to catch surface water runoff. These structures can be seen along the scarp at the "Burnabbie Linesmans Camp" (Photograph 3 and 4) and Toondi Rockhole (Photograph 25 and 26). These structures have not been maintained and now hold water for only short periods following rain.

In the 1930's there was an unsuccessful attempt to establish a sheep station at Burnabbie (Graham 1989). This involved the enlargement of rockholes and the construction of small rock and cement tanks in an area between Burnabbie and Cocklebiddy (Photograph 10 and 12). (This area is outside the Hampton and Nullarbor bioregions).

In the 1960's there was a second wave of development of pastoral stations (see Figure 2). These operations are dependent on the extraction of ground water from up to 80 m underground. Pastoral stations north of the Trans-Australian Railway line supplement the bores with small dams (Steves Dam - Photograph 30, Save Way Dam - Photograph 34 and Family Dam - Photograph 36).

6.0 Wetland Research

Biological research on the wetlands resources covered in this report has been very limited.

In 1984 a biological survey was conducted of the Nullarbor Region (McKenzie and Robinson 1987). This is a provides a excellent overview of the region and its flora and fauna, however it does not contain specific information on wetlands.

The Royal Australasian Ornithologists Union has operated a Bird Observatory at Eyre since 1978 and a number of reports on the biota of the region have been published (Martindale 1980, Congreve 1982, Dymond 1988, Van Delft and McNee 1989 and Goodreid 1996). These reports contain both systematic and anecdotal information on the occurrence of waterbirds in the Eyre-Cocklebiddy area.

There have been a number of publications that give details on the occurrence of waterbirds in the region. The most detailed paper covers opportunistic observations during a study of the Wedge-tailed Eagle on Kanandah, Seemore Downs and Premier Downs Stations (Brooker *et al.* 1979).

Other information published on waterbirds or wetland conditions includes:

- a regional overview (Storr 1987)
- some notes on waterbirds at Twilight Cove (Reilly et al. 1975)
- a traverse from Rawlinna to Neale Junction (Ford and Sedgwick 1967)
- notes on the Nullarbor Plain (Whitlock 1922)
- four ornithological trips to the Nullarbor Plains (White 1919)
- a trip from Kalgoorlie to Eucla (Gibson 1909).

7

7.0 Wetland Resources

The history of the land formation process, high permeability of the soils and rock, and the aridity of the modern climate result in a limited number and diversity of wetlands in the Hampton and Nullarbor bioregions.

7.1 Hampton bioregion

7.1.1 Twilight Cove Wetlands

In the Hampton bioregion wetland types appear to be limited to freshwater soaks and seasonal marshes at Twilight Cove (Photographs 15-17). This area is adjacent to the scarp and has a large dune field that acts as an underground storage area for rainwater. It is the only place on the Roe Plain where the freshwater lens is naturally exposed.

7.1.2 Other areas

Close inspection of the 1:100 000 map sheets suggest that other landform features of potential relevance to this project in the Hampton bioregion are as follows:

Kuthala Sheet:

- five "mainly dry lakes" west of Hearder Hill Repeater Station
- several coastal marshes
- Mundrabilla Roadhouse sewage pond

Red Rocks Point and Archdeacon Sheet:

Not checked

Yalganimirra Sheet:

Mundrabilla Dam

Scorpion Bight Sheet:

 Widdingbillia Rockhole and Burramul Tank - within 2 km of the coast.
 Widdingbillia Rockhole noted to have a capacity of "200 gallons" on a map dated 1877, however the map also notes "no freshwater procurable along this country ...".

Madura Pass Sheet:

- Madura Cave and Nurina Cave
- Madura Roadhouse sewage pond

Burnabbie Sheet:

 Carlyumbria Well and Wonglabilla Well - Originally aboriginal soaks in the sand adjacent to large dunes, may now be covered by mobile sand. No visits to these sites reported in the past 10 years. Freshwater may also be available for short periods are rainfall in tree hollows. Mallees of sufficient size to have significant hollows occur in the dune fields and along the scarp. These water sources, though possibly significant for fauna, do not appear to meet the definition of wetlands under the Ramsar Convention.

7.2 Nullarbor bioregion

The Nullarbor bioregion is more extensive and has a greater number and diversity of wetlands. Wetlands in Western Australian parts of the bioregion that are not covered by this report include:

- extensive subterranean karst systems
- intermittent freshwater pools (associated with Ponton Creek)
- intermittent freshwater lakes (Lake Boondaroo)
- and intermittent saline lakes (Fifty Mile Claypan, Plumridge Lakes, Lake Gidgi, Lake Brown, Lake Nyanga, Jubilee Lakes, Carlisle Lakes, Koolgahbin Claypan, Shell Lakes, Lake Ilma and Forrest Lakes).

In the central and southern areas of the Nullarbor bioregion wetlands are limited to areas where water collects and persists in a impermeable basin. This appears to occur in only four types of landforms: rockholes on the Hampton scarp face, rockholes on horizontal sheets of limestone on the Hampton tableland, "dongas" and paleodrainage channels.

7.2.1 Hampton scarp rockholes

Shallow rockholes are found along the scarp face and exposed flat rock surfaces on top of the scarp. On the scarp face, rockholes are mostly found in small gullies (Photographs 21 and 24), though some exceptions are known at the western end of the scarp (eg. Photograph 7 and 8). The scarp rockholes tend to have a capacity of less than 300 litres. The 1:1 000 000 Nullarbor Plain map sheet shows approximately 20 rockholes along the scarp face in the Nullarbor bioregion. The sequence of 1:100 000 map sheets show 24 rockholes. Rockholes in the Nullarbor bioregion examined during the fieldwork were Colonga, Yudenda, Norina and Toondi (Photographs 18-26).

7.2.2 Hampton tableland rockholes

Rockholes become less numerous as distance from the coast increases. These rockholes are 1-2 m in diameter and depth, and "*exceptionally*" to 3 m (Jennings 1967). The 1:1 000 000 Nullarbor Plain map sheet shows 22 rockholes inland from the scarp in the Western Australian portion of the Nullarbor bioregion. (This type of rockhole is exemplified in Photograph 11). In the Nullarbor bioregion most of these rockholes are on sheep stations (Arubiddy, Moonera, Madura and Mundrabilla) and would be intensively used by sheep and kangaroos during periods when they contain water.

7.2.3 Dongas

In central parts of the Nullarbor shallow, circular closed depressions occur called "dongas". These have gentle slopes and flat clay floors and are 100-500 m in diameter. Dongas are formed by the solution of the limestone rock by rainfall ("solution dolines", Jennings 1963). Many dongas flood following rainfall greater than 20 mm in one day. The plant communities of dongas have been identified as "threatened communities" due to the impact of grazing (CALM 1992).

The "Duck Pond" on Arubiddy (Photograph 27 and 28) has a donga form but is less pronounced then those that are distributed around Rawlinna.

During the fieldwork it was not possible to obtain approval from station managers to identify specific dongas in the Rawlinna area for this report (see additional comments in Appendix 4).

7.2.4 Paleodrainage channels

At least two paleodrainage channels are present in the central and northern parts of the Western Australian portion of the Nullarbor bioregion. One is north of Haig on Gunnadorah Station and the second is on the WA/SA boarder approximately 80 km north of the Trans-Australian Railway line ("The Dip", Jennings 1967). The paleodrainage channels on Gunnadorah Station are covered in detail in the attached sheets (Photographs 30-36).

7.2.5 Other areas

The 1:100 000 sheets between Eyre Highway and the Trans-Australian Railway line (eg. Cocklebiddy, Trans and Haig) show numerous "intermittent lakes". These are difficult to discern on the ground. They consist of slightly lower areas and as such have colluvium soils and different vegetation (often grass *Stipa* spp, Photograph 13 and 14). These areas would flood very infrequently (perhaps 1 event in 50 years) and even then surface water would persist for only a few days.

In the southern part of the Nullarbor there is a series of low ridges and corridors formed by faulting (Lowry 1971). No wetlands are known to be associated with these features.

8.0 Field Program

8.1 Design

Due to the limited amount of time available it was decided to concentrate field work at the western end of the Hampton bioregion and to run a transect from Cocklebiddy to north of Rawlinna. This enable the project to be explained to key community contacts at the start of the fieldwork (Peter Brown, President of Dundas Shire and Debbie & James Brownlie, Wardens, Eyre Bird Observatory). These people provided advice on the route and the people to contact. Fuel is only commercially available in the area from the Eyre Highway Roadhouses. When travelling from the west the last places to obtain a range of supplies is at Kalgoorlie and Norseman.

Access is available to all areas by 4WD tracks. On the Nullarbor the station tracks tend to be rocky and some damage to tyres must be anticipated. These tracks should not be used during or immediately following significant rainfall because of the damage this would cause. Advice on access would be available from the station managers.

8.2 Field Activities

The field work was divided into three sections: Hampton scarp (2 days), Twilight Cove (1 day) and the Nullarbor (3 days). The route traversed and Stations contacted are shown on Map 1. Eyre Bird Observatory provided a convenient base for fieldwork along the Hampton scarp and Twilight Cove.

Discussion with several land managers during the fieldwork found them to be "cautiously" supportive of having wetlands listed in a directory. These managers were assured that the Department of Conservation and Land Management would contact them before any further action was taken.

9.0 Recommendations

- CALM consider listing in the "Directory of Important Wetlands in Australia" the following sites:
 - Twilight Cove wetlands (Hampton bioregion)
 - Hampton Scarp Rockholes between Burnabbie and Madura (Nullarbor bioregion)
 - The "Duck Pond", Arubiddy Station (Nullarbor bioregion)
 - Paleodrainage channel, Gunnadorah Station (Nullarbor bioregion)
 - 2. Land managers be fully consulted about the potential listing of sites in the "Directory of Important Wetlands in Australia" and the implications of this action.
 - Consideration be given to consulting with Native Title Claimants before proceeding with the listing of sites in the "Directory of Important Wetlands in Australia"
 - Following consultations with land managers additional follow-up surveys of these sites be conducted to prepare full datasheet profiles on the wetlands.
 - Further work be conducted to identify specific "dongas" that could be listed in the "Directory of Important Wetlands in Australia".



10.0 References

Barr Smith Library, University of Adelaide. Daisy Bates - BSL 2/VII/3a/9.

Beard, J. 1975. *The vegetation of the Nullarbor area.* Vegetation Survey of the Western Australia, 1:1,000,000 vegetation series. University of Western Australia Press, Perth.

Beard, J. S. 1980. A new phytogeographic map of Western Australia. Western Australian Herbarium Research Notes 3: 37-58.

Brooker, M.G., Ridpath, M.G., Estbergs, A.J., Bywater, J., Hart, D.S. and Jones, M.S. 1979. Bird Observations on the north-western Nullarbor Plain and neighbouring regions, 1967-1978. *Emu* 79:176-190.

CALM. 1992. A Nature Conservation Strategy for Western Australia (A draft for Public Comment). Department of Conservation and Land Management, Western Australia.

Cane, S. and Gara, T. 1989. Undiri. Aboriginal Association with the Nullarbor Plain. A Report to National Parks and Wildlife Service, South Australia.

Congreve, P. and D. 1985. *Eyre Bird Observatory Report* 1979-1981. Royal Australasian Ornithologists Union - WA Group.

Dymond, N. 1988. Eyre Bird Observatory Report 5 1986 - 1987. Royal Australasian Ornithologists Union. Report No. 66.

Ford, J. and Sedgewick, E.H. 1967. Bird distribution in the Nullarbor Plain and Great Victoria Desert Region, Western Australia. *Emu* 67: 99-124.

Gibson, C.G. 1909. Birds observed between Kalgoorlie and Eucla, W.A. Emu 9: 71-77.

Giles, E. 1889. Australia Twice Traversed. (2 Vols). Sampson and Low, London. pp: 170-85.

Goodreid, G. and G. 1996. Eyre Bird Observatory Report 6 1988 - 1992. Royal Australasian Ornithologists Union Report No. 97.

Graham, W.T. 1989. A History of Eyre. in: Van Delft, C. and McNee, S. (eds). Eyre Bird Observatory Report 5 1986-1987. Royal Australasian Ornithologists Union. Report No. 66.

Jennings, J.N. 1963. Some geomorphological problems of the Nullarbor Plain. Royal Soc. South Australia Trans. Vol. 87: 41-62.

Jennings, J.N. 1967. The Surface and Underground Geomorphology. in: Dunkley, J.R. and Wigley, T.M.L. (eds). 1967. *Caves of the Nullarbor*. Speleol. Mus. Vict.

Johnston, T.H. 1941. Some Aboriginal routes in the western portion of South Australia. *Proc. Roy. Geog. Soc. Aust.* (S. Aust) 42: 33-65. Lane, J.A.K., Jaensch, R. and Lynch, R. 1996. Introduction - Western Australia. in: Australian Nature Conservation Agency. 1996. A Directory of Important Wetlands in Australia. 2nd edition, Australian Nature Conservation Agency, Canberra.

Lowry, D.C. 1971. Explanatory notes on the Eucla-Noonaera 1:250,000 geological sheet SH/52-14, SI/52-2. Bur. Miner. Resour., Canberra.

Lowry, D.C. 1972. Explanatory notes on the Madura - Burnabbie 1:250,000 geological sheet SH/52-13, SI/52-1. Bur. Miner. Resour., Canberra.

Martindale, J. 1980. Eyre Bird Observatory Report 1977-1979. Royal Australasian Ornithologists Union - WA Group.

Marun, L.H. 1974. The Mirning and their predecessors on the coastal Nullarbor Plain. PhD Thesis. University of Sydney.

McKenzie, N.L and Robinson, A.C. (eds). 1987. A Biological Survey of the Nullarbor Region South and Western Australia. Department of Conservation and Land Management, W.A. and Department of Environment and Planning, S.A. Government Printer, South Australia.

Phillips, 1996. Introduction. in: Australian Nature Conservation Agency. 1996. A Directory of Important Wetlands in Australia. 2nd edition, Australian Nature Conservation Agency, Canberra.

Reilly, P.N., Brooker, M.G. and Johnstone, G.W. 1975. Birds of the south-western Nullarbor Plain. *Emu* 75: 73-76.

Storr, G.M. 1987. Birds of the Eucla Division of Western Australia. Records of the West. Aust. Mus. Supp. No. 27.

Tindale, N.B. 1974. Aboriginal tribes of Australia: Their terrains, environmental controls, distribution, limits and proper names. University of California Press, Berkely.

Thackway, T. 1996. The Interim Biogeographic Regionalisation of Australia. in: Australian Nature Conservation Agency. 1996. A Directory of Important Wetlands in Australia. 2nd edition, Australian Nature Conservation Agency, Canberra.

Thackway R and Cresswell I D. 1995. (eds). An Interim Biogeographic Regionalisation for Australia: a framework for establishing the national system of reserves, Version 4.0. Australian Nature Conservation Agency, Canberra.

Van Der Graaff, W.J.E., 1975. Explanatory notes on the Seemore 1:250 000 geological sheet. AGPS, Canberra.

Van De Graaff, W.J.E., Crowe, R.W.A., Bunting, J.A. and Jackson, M.J. 1977. Relict Early Cainozoic drainages in arid Western Australia. Zeit. Geomorph. 21(4): 379-400.

Van Delft, C and McNee, S (Eds), 1989. Eyre Bird Observatory Report 5 1986-1987. Royal Australasian Ornithologists Union. Report No. 66.

Whitlock, F.L. 1922. Notes from the Nullarbor Plain. Emu 21: 170-187.

White, S.A. 1919. Four ornithological Trips to the Nullarbor Plains. Emu 28: 189-198.

Wright, R.V.S. 1971. An ethnographic background to Koonalda Cave prehistory. in: Wright, R.V.S. (ed). Archaeology of the Gallus site. *Koonalda Cave*. AIAS Canberra.

1



Photograph 1 Eastern end of the Hampton Bioregion: View south across the Roe Plain from the top of the scarp at Eucla. (July 1997, Doug Watkins).

1)

Ц

Π.



Photograph 2 Eastern end of the Hampton Bioregion: View west along the Roe Plain from the top of the scarp at Eucla. (July 1997, Doug Watkins).



Photograph 3 "Linesmans Camp Dam" with the Roe Plain in the background. (1995, Rita Watkins).



Photograph 4 "Linesmans Camp Dam" with the Roe Plain in the background. (1995, Rita Watkins).



Photograph 5 Madura Cave, 10 km south of Madura. (January 1997, Doug Watkins).

U

1,

1

IJ



Photograph 6 View south across the Roe Plain from the lookout at the car park on the Eyre Bird Observatory access track. Note *Melaleuca* thicket. (July 1997, Doug Watkins)



Photograph 7 View of scarp and rock face that contains Yarrabie Rockhole (light coloured rock in centre) from the Eyre Bird Observatory access track. (July 1997, Doug Watkins).



Photograph 8 View SE over "Carlisle's Rockhole". This is located on the scarp face behind "Carlisle's Hut", Twilight Cove. (July 1997, Doug Watkins).

Photograph 9 Reconstruction of rock coverage over a small rockhole adjacent the intersection of Moondadong Rockhole track and Cocklebiddy west track. This rockhole is approximately 30 cm across and 50 cm deep. Nuytsland Nature Reserve. {32° 04.836' S, 126° 08.635' E}. (July 1997, Doug Watkins).



Photograph 10 Enlarged rockhole and tank used as waterpoint during an unsuccessful attempt to establish a pastoral station between Cocklebiddy and Burnabbie in the 1930's. Nuytsland Nature Reserve. {32° 05.345' S, 126° 07.771' E}. (July 1997, Doug Watkins).



Photograph 11 Moondadong Rockhole, Nuytsland Nature Reserve {32° 04.413' S, 126° 13.852' E}. (July 1997, Doug Watkins).



Photograph 12 Blasted rockhole adjacent to Moondadong Rockhole, Nuytsland Nature Reserve {32° 04.413' S, 126° 13.852' E}. (July 1997, Doug Watkins)



Photograph 13 View across Saltbush-Bluebush plains in northern Arubiddy Station. *Stipa* grassland on colluvium soil in centre of the photograph (1). (July 1997, Doug Watkins).



1

Photograph 14 View across Saltbush-Bluebush plains on northern Arubiddy Station. *Stipa* grassland on colluvium soil in the centre of the photograph (2). (July 1997, Doug Watkins).

Appendix 1

Hampton Bioregion

Twilight Cove Wetlands (Nuytsland Nature Reserve)

The wetlands at Twilight Cove consist of several hectares of samphire flats and a freshwater soak along the base of the cliff (Photograph 15-17).

The samphire flats flood (up to 10 cm deep) for short periods following heavy rain. The water table exists at a shallow depth. Several small "soaks" give animals year round access to fresh to low salinity water. Emus and Grey Kangaroos appear to make extensive use of these soaks.

The freshwater soak at the base of the cliff is on the west side of a small cave in the cliff face. Access to the soak is difficult because of a thick stand of Boobialla (*Myoporum insulare*). This soak has surface water most of the year (Doug Watkins pers.obs.).

Key Field Information: See accompanying Wetlands Field Resource Kit (Hampton Bioregion).

Management Issues: High levels of recreational use, vehicle tracks across the marsh, camping by commercial fishing (owner operator - few times a year).

Principal Contacts:

- Debbie and James Brownlie, Wardens, Eyre Bird Observatory (Phone/Fax: 08 9039 3450). http://home.vicnet.net.au/~birdsaus/observatories/eyre.html
- CALM District Manager, Esperance : Phone: 08 9071 3733 Fax: 08 9071 3657 http://www.calm.wa.gov.au/calm_offices.html#south_coast

Access: Via Eyre Bird Observatory or direct from Cocklebiddy

Map: Burnabbie 1:100 000

Aerial Photos: Coastal Photography WA 3782(c), Run 24, Photos 5162, 5164, and 5166

Compiler: Doug Watkins, Wetlands International - Oceania Date: September 1997



Photograph 15 Twilight Cove - freshwater soak area along the base of the cliff. (July 1997, Doug Watkins).



[]

U

[]

Photograph 16 View west along the samphire flats at Twilight Cove. (July 1997, Doug Watkins).



Photograph 17 View NE along the samphire flats at Twilight Cove. (July 1997, Doug Watkins).

Nullarbor Bioregion

Burnabbie-Madura Scarp Rockholes (VCL and Madura Station)

The scarp between Twilight Cove and Eucla forms the boundary of the Hampton and Nullarbor bioregions. Along the western 50 km of the scarp (from Cologna Rockhole) the Nullarbor bioregion shifts inland and the Coolgardie and Mallee bioregions bridge the gap between the western edge of the scarp and the Nullarbor bioregion.

The 1:100 000 map sheets show a sequence of six rockholes between Cologna Rockhole and Madura. Travelling from west to east these are Cologna, Yudenda, Norina, Olwolgan, Mungedija and Toondi. During the fieldwork four of these rockholes were visited.

Aquatic invertebrates were observed in Colonga, Yudenda and Norina Rockholes. Algae was the only aquatic plant observed.

Colonga Rockhole 26 km east of "Green Bottle Junction", [Vacant Crown Land]

This consists of five circular holes in a large slightly inclined rockface (Photograph 18). These rockholes were unusual in that they were at the top of the scarp to the east of a small gully (Photograph 19). The largest of the rockholes was approximately 2 m in diameter. The rockholes were approximately half full and had a water depth of approximately 0.5 m. One of the rockholes had a large amount of filamentous algae.

Yudenda Rockhole 37 km east of "Green Bottle Junction", [Vacant Crown Land]

One rockhole is located in the centre of the gully line about a third the way up the scarp (Photograph 20). It is a small rockhole about 1 m in diameter (Photograph 21). There was considerable fresh kangaroo and emu faeces on the rocks around the rockhole.

Norina Rockhole 43 km east of "Green Bottle Junction", [Vacant Crown Land]

Norina Rockhole is the largest of this set of rockholes (Photograph 22 and 23). It was full at the time of the visit (following recent rain) and measured approximately 2.5 m by 2 m (Photograph 24). It was approximately 0.8 m deep. The rockhole is in the centre line on the gully near the top of the scarp. There are also several other much smaller rockholes above and below the main pool.

Toondi Rockhole approx. 9 km west of Madura, [Madura Station]

This is the site of a stock watering point probably developed around 1900. Constructions in the area include the ruin of a small building, a tank, a (dry) well and three "dams" across the gully up the scarp (Photograph 25 and 26).

There are a number of small rockholes in the gully. The largest rockhole located was 0.4 m in diameter and 1.5 m in depth.

Note: The manager of Madura Station has not been contacted about the potential listing of Toondi Rockhole (because of a lack of time during field program). As such Toondi Rockhole is included for information only.

Key Field Information: See accompanying Wetlands Field Resource Kit (Hampton Bioregion). The information have been placed in this kit because these sites are accessed from the track below the scarp which is in the Hampton bioregion.

Management Issues: Toondi Rockhole is part of Madura Station and is used as a watering point by sheep. There is also an old track up the scarp on the west side of the gully. This is probably not passable by vehicle.

Principal Contacts:

- Debbie and James Brownlie, Wardens, Eyre Bird Observatory (Phone/Fax: 08 9039 3450). http://home.vicnet.net.au/~birdsaus/observatories/eyre.html
- 2. Manager, Madura Station
- CALM District Manager, Esperance: Phone: 08 9071 3733 Fax: 08 9071 3657 http://www.calm.wa.gov.au/calm_offices.html#south_coast

Maps: Scorpion Bight, Karulbie, Madura Pass 1:100 000

Aerial Photos:

Project: 830478, Film No. 2216, Photo Numbers 5082, 5083, 5085, 5087, and 5089.

Compiler: Doug Watkins, Wetlands International - Oceania Date: September 1997



Photograph 18 Cologna Rockhole. View south across the five rockholes which are located on a bare slopping rock surface on top of the scarp. Small pools can be seen around the main rockholes from a shower of rain at the time of the visit. (July 1997, Doug Watkins).



11

1

Π

Photograph 19 View north from the Burnabbie-Madura track to Colonga Rockhole. (July 1997, Doug Watkins).



Photograph 20 View north of the gully that contains Yudenda Rockhole. The gully forks to both the NW and NE. (July 1997, Doug Watkins).



1

1

Photograph 21 Yudenda Rockhole - view southwest. (July 1997, Doug Watkins).



Photograph 22 View NNE from the Burnabbie-Madura track of the gully in which Norina Rockhole is located. (July 1997, Doug Watkins).



Photograph 23 View south across the Roe Plain from the top of the scarp above Norina Rockhole. (July 1997, Doug Watkins).



0

U

1

Ш





I

11

1

Photograph 25 View south-east across the Roe Plain from the base of the scarp near Toondi Rockhole, 9 km west of Madura. (July 1997, Doug Watkins).



Photograph 26 "Dam" structure across the gully on the top of the scarp at Toondi Rockhole, 9 km west of Madura. (July 1997, Doug Watkins).

Nullarbor Bioregion

"Duck Pond" (Arubiddy Station)

The lease holders for Arubiddy Station are Peter and Barbara Brown. Peter considered there was really only one area on Arubiddy that held water for more than a few weeks following summer thunderstorms.

This area is called the "Duck Pond" and it is approximately 5 km north-east of the homestead in the Ram Paddock (31° 48.733' S 125° 57.338' E). It is an area on low ground that has its own catchment of about 10 ha. The "pond" exists as a bare surface about 50 m in diameter (Photograph 27 and 28). The area floods "*in most years*", sometimes to 1 m and for periods of up to 3 months. Peter said that rainfall as low as 10 mm will result in some surface water.

Birds seen on the wetland in the past include Australian Pelican, several species of ducks, Hoary-headed Grebe and Straw -necked Ibis.

Peter said that there were also a number of small rockholes, particularly in the south of the Arubiddy. He did not offer any details.

Peter and Barbara said that no frogs have ever been seen on Arubiddy.

Comment: Peter was cooperative and supportive and said he would welcome follow-up by CALM on the "Duck Pond".

Key Field Information: See accompanying Wetlands Field Resource Kit (Nullarbor Bioregion).

Management Issues: The site is grazed by sheep (Ram Paddock).

Principal Contacts:

- 1. Peter and Barbara Brown
- Lessees, Arubiddy Station
 CALM Regional Manager, Kalgoorlie Tel: 08 9021 2677 Fax: 08 9021 7831

http://www.calm.wa.gov.au/calm_offices.html#goldfields

Maps: Cocklebiddy 1:100 000

Aerial Photos: Sheet: SA 51-16 Naretha CAF 8750, Run 28, Photo 271 Date 12/2/78, 1:50 000, CAF 4011, Run 7, Photo 46, Date 16/10/61, 1:80 000

Compiler: Doug Watkins, Wetlands International - Oceania Date: September 1997



Photograph 27 "Duck Pond" in the Ram Paddock, Arubiddy Station. (July 1997, Doug Watkins).



Photograph 28 "Duck Pond" in the Ram Paddock, Arubiddy Station. (July 1997, Doug Watkins).

Nullarbor Bioregion

Dongas

(Seemore Downs, Premier Downs & Kinclaven Station)

The lease for these three stations are held by Donald Hogg. Donald made 1.5 hours available to talk about what happens after heavy rain on the stations.

He said that there were numerous dongas on the stations. These held water only after heavy thunderstorms, usually associated with the tail end of cyclones. He said water remained for up to 6 weeks. He said that there are two "turkey-nest" dams on the station that are used as bore pump-out areas. He said there are some rockholes but that these dry out quickly.

Donald has an interest in birds and we talked about interesting sightings and changes in the abundance of birds. Frogs are seen in the area after heavy rain.

Donald was not prepared at this stage to invite interest by CALM (or others) in potential wetlands on his stations.

Comment: While these three stations are the core area for the donga landform, they do also extend onto Gunnadorah, Rawlinna and Belgair Stations. There many also be representative examples on Vacant Crown Land east of Gunnadorah. All of the dongas on pastoral leases will have adverse effects for cattle and sheep. Identifying potential "donga wetlands" on the Vacant Crown Land east of Gunnadorah has the benefits of lower disturbance and minimising conflicts with station management.

Key Field Information: See accompanying Wetlands Field Resource Kit (Nullarbor Bioregion).

Management Issues: Impact of grazing (cattle and sheep) and bore construction on pastoral leases.

Principal Contacts:

- 1. Donald Hogg
 - Leesee, Seemore Downs, Premier Downs and Kinclaven Stations Phone: 08 9022 6435
- CALM Regional Manager, Kalgoorlie Phone: 08 9021 2677 Fax: 08 9021 7831 http://www.calm.wa.gov.au/calm_offices.html#goldfields

Map: Seemore 1:250 000

Aerial Photos: see flight diagrams.

Compiler: Doug Watkins, Wetlands International - Oceania Date: September 1997

Nullarbor Bioregion

Paleodrainage Channels (Gunnadorah Station)

Wetlands on the Gunnadorah Station consist of dongas, paleodrainage channels, small dams, rockholes (?) and caves (?). There are two types of small dams in Gunnadorah. One type is an excavation in a donga the main paleodrainage channel. The second type is a smaller turkey-nest design used as a storage area for bore pump-out water.

The paleodrainage channels are referred to by the Day's and other local people as the "old river channel" or the "ancient river valley".

One turkey-nest dam was visited near Brittania Tanks (?) (Photograph 29). No aquatic vegetation was observed in the dam.

Brett Day said that the dongas and the paleodrainage channels had significant water one year in five. At the time of the visit in July 1997 there had not been any surface water on Gunnadorah Station for 12 months.

Steves Dam, 22 km from homestead (30° 54.366' S, 126° 02.127' E)

This is an elongated channel approximately 3 km in length (Photograph 30). The area has had high densities of stock and this is altering the vegetation and soil structure. Brett Day said that at one time water extended for over 2 km in this channel.

Main Paleodrainage Channel (north end - 30° 47.911' E, 126° 13.940' S)

During the field work we drove from the north end of the paleodrainage channel, west of Double Pump Bore, along the channel down to Save Way Dam on the Double Pump - Homestead track. Brett said that the channel does not extend far north on the Double Pump - Yellowtail Bore track. He said there had been a small group of aboriginal people camped in this area for several years in the early 1980's. These people had moved on the new community on the north side of the Nullarbor.

In places the channel had eroded to 1 m deep (Photograph 33). "Crab holes" were found in the northern section (Photograph 32). It is presumed that these are formed by water seeping into under ground cavities.

The are had a medium intensity of grazing at the time of the visit. The native bunchgrass was heavily grazed in the river bed.

The round trip along river valley to Double Pump Bore to 90 minutes (and included a staked tyre).

Family Dam (30° 47.911 S 126° 13.910 E)

Drove section of valley to Family Dam (Photograph 36). Vegetation of channel bed was more uniform saltbush than upper section (Photograph 35).

Key Field Information: See accompanying Wetlands Field Resource Kit (Nullarbor Bioregion).

Management Issues: All sites are grazed by cattle.

Principal Contacts:

- 1. Brett and Dot Day Lessees, Gunnadorah Station Phone: 08 9022 6432
- CALM Regional Manager, Kalgoorlie Phone: 08 9021 2677 Fax: 08 9021 7831 http://www.calm.wa.gov.au/calm_offices.html#goldfields

Map: Loongana 1:250 000

Aerial Photos: Loongana SH 52-9 CAF 8678, Date 9/5/83,1:85 000,

Run 3, Photo	569
Run 4, Photo	654
Run 5, Photo	756, 758
Run 6, Photo	842, 846
Run 7, Photo	863, 867
Run 8, Photo	916, 980

Compiler: Doug Watkins, Wetlands International - Oceania Date: September 1997





IJ

11

11

IJ

21

Photograph 29 Turkey-nest dam on Gunnadorah Station. (July 1997, Doug Watkins).



Photograph 30 View W to Steve's Dam and a paleodrainage channel on Gunnadorah. (July 1997, Doug Watkins).

Wetlands of the Nullarbor and Hampton Bioregions



Photograph 31 View south down the paleodrainage channel from Double Bore/Yellowtail Bore track, Gunnadorah Station. (July 1997, Doug Watkins).



Photograph 32 "Crab holes" in the paleodrainage channel, 2 km south of the Double Bore/Yellow-tail Bore track, Gunnadorah Station. (July 1997, Doug Watkins).

Wetlands of the Nullarbor and Hampton Bioregions



Photograph 33 View south of an erosion gully in the paleodrainage channel, 1 km south of the Double Bore/Yellow-tail Bore track, Gunnadorah Station. (July 1997, Doug Watkins).



Photograph 34 View south across Save Way Dam on the paleodrainage channel, adjacent to the Double Bore/Homestead track, Gunnadorah Station. (July 1997, Doug Watkins).



Photograph 35 View south along the bed of the paleodrainage channel, approximately 10 km NNE of Family Dam, Gunnadorah Station. (July 1997, Doug Watkins).

N

N

U

11



Photograph 36 View NE across Family Dam, Gunnadorah Station. (July 1997, Doug Watkins).

Wetland Resource Materials for the Nullarbor and Hampton Bioregions

Vegetation of the Nullarbor 1:100 000 (Beard 1975).

Rainfall Data for Rawlinna - annual.

Rainfall Data for Rawlinna - monthly.

Relict Early Cainozoic drainages in arid Western Australia (Van de Graaff et al. 1977).

Undiri. Aboriginal Association with the Nullarbor Plain. (Cane S and Gara T. 1989).

Study "What lived where on the Nullarbor" in 1984.

Climate, Geology and Geomorphology, Land Use and History (McKenzie and Robinson 1987).

Index of Resource Material, Bibliography & Aerial Photographs for Nullarbor Region (McKenzie and Robinson 1987).

Notes from the Nullarbor Plain. (Whitlock 1922)

Bird Distribution in the Nullarbor Plain and Great Victoria Desert Region, Western Australia. (Ford and Sedgwick 1967).

Four Ornithological Trips to the Nullabor Plains (White 1919).

Description of a New Shrike-Robin. (Le Souef 1909).

Birds of the south-western Nullarbor Plain. (Reilly et al. 1975).

Birds of the Eucla Division. (Storr 1987).

Bird Observations on the north-western Nullarbor Plain and neighbouring regions, 1967-1978. (Brooker *et al.* 1979).

Aerial Photography Order Form & Price List 1997, AUSLIG

Order form Central Map Agency, DOLA

Wetland Field Resource Kit (Hampton Bioregion)

Title Page

Map of Hampton Bioregion

Wetlands of the Nullarbor and Hampton Bioregions: Collation of data for potential listing of important wetlands. (Watkins and Jaensch 1997).

Nullarbor Land Tenure (Figure 3)

Index to 1:100 000 Map Sheets

Vegetation Map (Beard 1975) - Western Roe Plain

Eyre Bird Observatory - information sheet

Appendix 1 Twilight Cove Wetlands (Watkins and Jaensch 1997).

Burnabbie 1:100 000

Index of aerial photos of Twilight Cove/Eyre Coast

Eyre/Cocklebiddy Land Tenure Map (ca. 1930's)

Appendix 2 Hampton Scarp Rockholes - Burnabbie to Madura (Watkins and Jaensch 1997).

Port chart 1054

Route of South Australian Stock Route Expedition (Coolgardie to Eucla)

Roll plan 74 (K S Casey 4, 1877)

Cocklebiddy/Burnabbie Land Tenure Map (ca. 1930's)

Madura Area Land Tenure (ca. 1930's)

Scorpion Bight 1:100 000

Karulbie 1:100 000

Madura Pass 1:100 000

Eastern Hampton Bioregion (Cover sheet)

Middini	1:100 000
Yalganimirra	1:100 000
Kuthala Pass	1:100 000
Eucla	1:100 000
Burnabbie	1:250 000
Madura	1:250 000
Eucla	1:250 000

Madura - Burnabbie Geological Map

Eucla - Noonaera Geological Map

Wetland Field Resource Kit (Nullarbor Bioregion)

Title Page

Map of area investigated (Figure 3)

Wetlands of the Nullarbor and Hampton Bioregions: Collation of data for potential listing of important wetlands (Watkins and Jaensch 1997).

Nullarbor Land Tenure (Figure 2)

Index to Map Sheets

Appendix 3 "Duck Pond" - Arubiddy Stations (Watkins and Jaensch 1997)

Cocklebiddy	1:100 000
Trans	1:100 000
Rawlinna	1:100 000
Haig	1:100 000
Youlganah	1:100 000

Naretha - Special Project Photography, Flight Diagram, Sheet SH 51-16 (1975,78) Naretha - Special Project Photography, Flight Diagram, Sheet SH 51-16 (1961)

Appendix 6 Dongas (Seemore Downs, Premier Downs & Kinclaven Stations) (Watkins and Jaensch 1997)

Seemore 1:250 000

Seemore - Aerial Photography, Flight Diagram, Sheet SH 51-12 (1983) Seemore - Aerial Photography, Flight Diagram, Sheet SH 51-12 (1961)

Appendix 5 Paleodrainage Channels - Gunnadorah Station (Watkins and Jaensch 1997)

Detailed map of paleodrainage channels (Figure 4)

Loongana 1:250 000

Loongana - Aerial Photography, Flight Diagram, Sheet SH 52-9 (1983) Loongana - Aerial Photography, Flight Diagram, Sheet SH 52-9 (1961)

 Jubilee
 1:250.000

 Plumridge
 1:250.000

Seemore Geological Map Loongana Geological Map