Department of
Environment and Conservation

Our environment, our future

Resource Condition Report for a Significant Western Australian Wetland

Lake Gore

2008

Figure 1 – A view across the water body at Lake Gore.

This report was prepared by:

Anna Nowicki, Technical Officer, Department of Environment and Conservation, PO Box 51, Wanneroo 6946

Stephen Kern, Botanist, Department of Environment and Conservation, Locked Bag 104 Bentley Delivery Centre 6983

Adrian Pinder, Senior Research Scientist, Department of Environment and Conservation, PO Box 51, Wanneroo 6946

Glen Daniel, Environmental Officer, Department of Environment and Conservation, Locked Bag 104 Bentley Delivery Centre 6983

Invertebrate sorting and identification was undertaken by:

Nadine Guthrie, Research Scientist, Department of Environment and Conservation, PO Box 51, Wanneroo 6946

Ross Gordon, Project Officer, Department of Environment and Conservation, PO Box 51, Wanneroo 6946

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1. Introduction

Lake Gore is a large open, near-permanent saline lake that lies approximately 30 km west of Esperance (Figure 2). It is part of the Lake Gore Wetland System, a series of inter-connected lakes and swamps of various sizes which are intermittently inundated.

Lake Gore was selected as a study site in the current project because the Lake Gore Wetland System is recognised as being of international significance under the Ramsar Convention on Wetlands (Ramsar). The system was listed because it is known to support large numbers of waterbirds and provide significant habitat for six species of waterbird. It is also listed in the Directory of Important Wetlands in Australia (Environment Australia 2001). The system is recognised as a good example of system of saline coastal lakes of varied depth and salinity, which at times has extensive associated brackish/saline marshes.

This Resource Condition Report (RCR) was prepared by the Inland Aquatic Integrity Resource Condition Monitoring project (IAI RCM). The information presented in the current report will supplement the Ecological Character Description (ECD) for the Lake Gore System that is soon to be published (Watkins, 2008). In order to avoid duplication of the contents of that ECD, minimal background information is provided in this RCR.

1.1. Site Code

Ramsar Site Number: 55.

Directory of Important Wetlands in Australia: WA026.

Register of the National Estate Place ID: 100072.

Inland Aquatic Integrity Resource Condition Monitoring Project (DEC): RCM039.

Salinity Action Plan Wetland Biological Survey (DEC): SPS136.

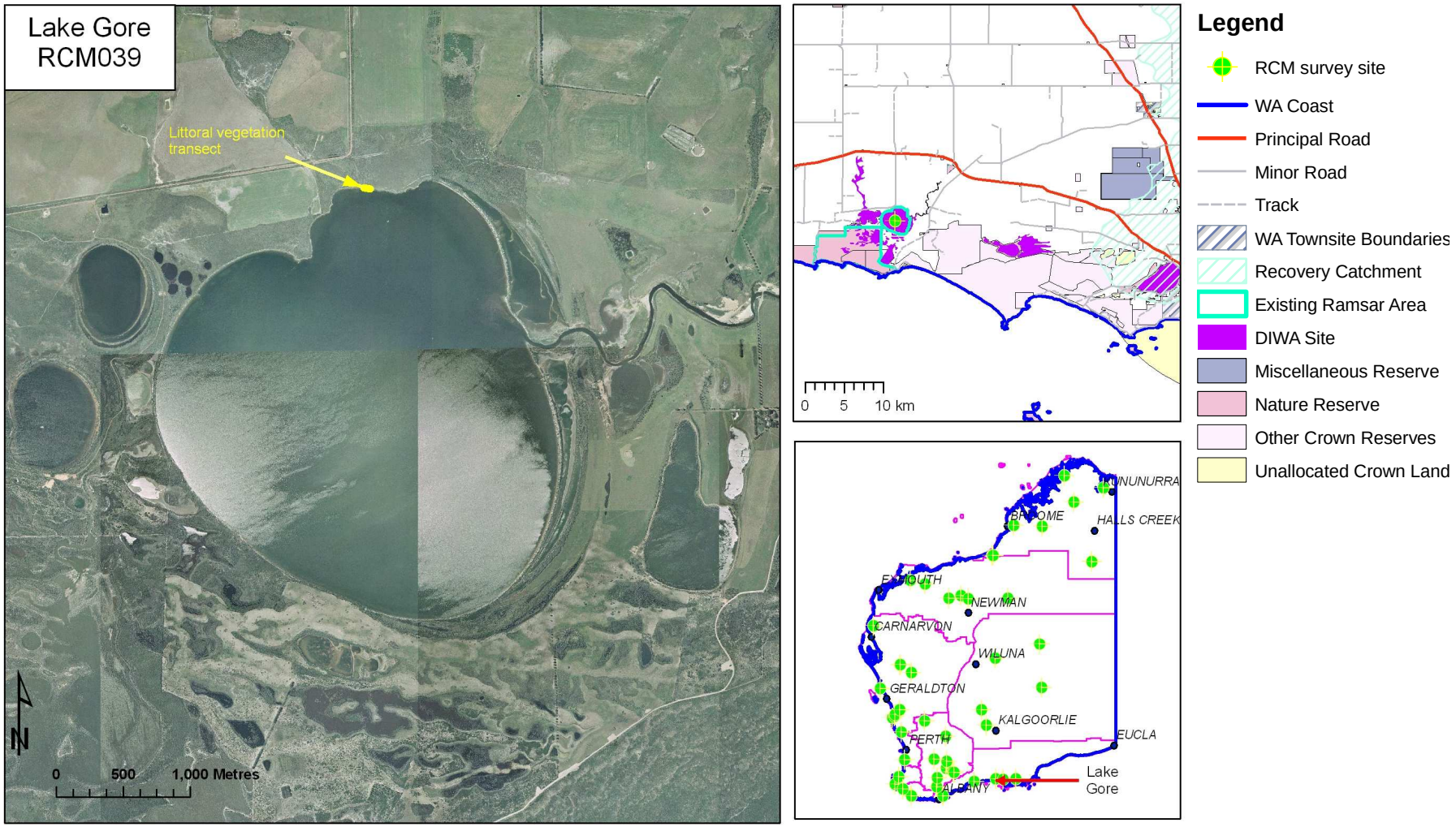

Figure 2 – Aerial photograph showing the location of the vegetation transect at Lake Gore. Aquatic invertebrate and water quality samples were collected adjacent to the transect. The upper insert shows the location of the survey site relative to the Lake Gore Wetland System and surrounding cadastre. The lower insert shows the location of the lake in Western Australia and in relation to remaining IAI RCM survey sites.

2. Summary of IAI RCM survey findings at Lake Gore

Lake Gore was surveyed by the IAI RCM project on 12th November 2008. Information was collected about the lake's vegetation, water quality, aquatic fauna and threats according to the methodology described by DEC (2008). The results of the survey are presented below.

Lake Gore has also been previously surveyed by the Department of Environment and Conservation (formerly the Department of Conservation and Land Management) as part of the Salinity Action Plan Wetland Biological Survey (Pinder *et al.* 2004, 2005). Further information about the lake can be found in the Lake Gore ECD (Watkins 2008, in preparation).

2.1. Water Quality

The water of Lake Gore was highly saline and slightly alkaline (Table 1). Nitrogen and phosphorus concentrations were both well in excess of trigger values for physical and chemical stressors for south-west Australia for slightly disturbed ecosystems.

Table 1 – Water quality parameters at Lake Gore.

pH	7.97
Alkalinity (mg/L)	255
TDS (g/L)	57
Turbidity (NTU)	0.25
Colour (TCU)	16
Total nitrogen (ug/L)	7,600
Total phosphorus (ug/L)	220
Total soluble nitrogen (ug/L)	6,200
Total soluble phosphorus (ug/L)	5
Chlorophyll (ug/L)	19
Na (mg/L)	16,100
Mg (mg/L)	1,760
Ca (mg/L)	318
K (mg/L)	340
Cl (mg/L)	26,200
SO_4 (mg/L)	4,100
HCO_3 (mg/L)	311
CO_3 (mg/L)	0.5

2.2. Benthic Plants

No benthic plants were recorded.

2.3. Littoral Vegetation

A single vegetation transect, 30 m in length, was established on the northern side of Lake Gore (Table 2).

Table 2 – Site attributes of the Lake Gore vegetation transect.

Datum		WGS84
Zone		51
Easting		363076
Northing		6263540
Length		30 m
Bearing		50
Wetland state		Full
Soil state (%)	Dry	100
	Waterlogged	0
	Inundated	0
Substrate (%)	Bare	20
	Rock	0
	Cryptogam	0
	Litter	30
	Trash	2
	Logs	0
Time since last fire		no evidence
Community condition		Impacted
Upper Stratum	Cover (%)	100
	Height (m)	<5
Mid Stratum	Cover (%)	-
	Height (m)	-
Ground Cover	Cover (%)	<50
	Height (m)	<0.5

Transect RCM039-R1

The transect was established approximately 5 m from the water's edge (Figure 3, Figure 4). The grey sandy soil was damp at the surface and waterlogged beneath. Vegetation was dominated by *Melaleuca cuticularis* closed forest (100% cover, <5 m tall) over a mixed understorey of low open shrubs, herbs and grasses (<50% cover, <0.5 m tall).

Table 3 provides a complete list of taxa recorded on the transect RCM039-R1. This vegetation extended no further than 20 m from the water's edge, beyond which the vegetation community was dominated by rushes and sedges with an open overstorey.

The *M. cuticularis* plants were mostly in good health, but no recruitment of young plants was observed. Seven of the fourteen species recorded on the transect were weeds, most of which were grasses. The overall community condition was considered 'impacted' (Appendix: Table 7).

Figure 3 – Lake Gore vegetation transect RCM039-R1.

Figure 4 – The northern margin of Lake Gore, looking east.

Table 3 – Plant taxa recorded along vegetation transect RCM039-R1 (in order of stratum then dominance).

Genus	Species	Height (m)	Stratum[1]	Form
Melaleuca	*cuticularis*	5	U1	Tree
Suaeda	*australis*	0.4	G1	Chenopod
Sarcocornia	sp.	0.2	G1	Chenopod
Apium	*prostratum* var. *prostratum*	0.4	G1	Forb
**Sonchus*	*oleraceus*	0.5	G1	Forb
Rhagodia	*baccata* subsp. *Baccata*	0.5	G1	Chenopod
**Lolium*	*rigidum*	0.4	G1	Grass
**Ehrharta*	*longiflora*	0.4	G1	Grass
Gahnia	*trifida*	1	G1	Sedge
**Briza*	*maxima*	0.4	G1	Grass
**Bromus*	*diandrus*	0.4	G1	Grass
Threlkeldia	*diffusa*	0.4	G1	Chenopod
**Rumex*	*crispus*	0.8	G1	Forb
**Hordeum*	sp.	0.4	G1	Grass

1 In an NVIS description, 'U' denotes the upper storey, 'M' the mid storey and 'G' the under storey (ground cover). Numerals to denote substrata from tallest (ESCAVI 2003).

* Introduced species.

According to the National Vegetation Information System (NVIS), the vegetation community may be described as (ESCAVI 2003):

U1+ ^*Melaleuca cuticularis*\6\d; G1 ^*Suaeda australis*, *Sarcocornia* sp., *Apium prostratum* var. *prostratum*, **Sonchus oleraceus*, *Rhagodia baccata* subsp. *baccata*\shrub, forb, grass\1\i.

2.4. Aquatic Invertebrates

Lake Gore was previously surveyed by the Salinity Action Plan (SAP) in September 1998 (Pinder *et al*. 2005). At the time of the SAP survey, Lake Gore had very low species richness (Table 4), reflecting its high salinity (54 g/L). Macroinvertebrate richness was higher when the lake was surveyed by the IAI RCM project in 2008 with an additional six macroinvertebrate species being recorded. Despite samples being taken from the same place in both surveys, the species composition changed almost completely between the two surveys (Table 4, Figure 5). This is most likely associated with the lower salinity in 2008 (42 g/L).

Table 4 – Aquatic invertebrate diversity at Lake Gore as described by the Salinity Action Plan Wetland Biological Survey and the Inland Aquatic Integrity Resource Condition Monitoring project.

Diversity measure	SAP Sep 1998	RCM Nov 2008
Total invertebrate species richness	8	-
Macroinvertebrate species richness	4	10
Total invertebrate family richness	6	-
Macroinvertebrate family richness	4	7

Figure 5 –Examples of the aquatic invertebrates collected at Lake Gore.

All species obtained on both dates are widespread, with the exception of the polychaetes (a class of annelid worm). All polychaetes are restricted to marine environments and coastal saline wetlands because they are either halophilic (salt-loving) species or are eurytolerant to salinity (tolerant of both freshwater and a wide range of salinities). The presence of polychaetes reflects the salinisation of Lake Gore over many years. The origin of the polychaete is unknown. It was not collected from this site in 1998 and may have been introduced by seabirds that use this wetland.

The SAP survey sample was collected by conducting two 50 m benthic sweeps using nets with 250 µm mesh and 50 µm mesh. The IAI RCM survey collected three subsamples using 15 m benthic sweeps and a net with 250 µm mesh (Table 5). The absence of previously collected ostracods and copepod species in the RCM sample is likely due to this difference in sampling technique.

Table 5 – Aquatic invertebrate species collected at Lake Gore. Shading indicates microinvertebrates and numbers indicate replicate samples.

Class	Order	Family	Lowest ID	SAP survey SPS136 spring 1998	RCM survey RCM039 spring 2008
Polychaeta	-	-	*Capitella* sp.		1,2,3
Arachnida	Acariformes	-	Oribatida		1,3
Crustacea	Ostracoda	Cyprididae	*Australocypris insularis*	1	
			Diacypris compacta	1	
			Platycypris baueri	1	
	Copepoda	Cyclopidae	*Meridiecyclops baylyi*	1	
	Isopoda	Oniscidae	*Haloniscus searlei*	1	
Insecta	Coleoptera	Dytiscidae	*Necterosoma penicillatus*	1	
	Diptera	Ceratopogonidae	*Culicoides* sp.	1	1,2,3
		Chironomidae	*Dicrotendipes pseudoconjunctus*		3
			Tanytarsus barbitarsus		1,2,3
		Ephydridae	*Ephydrid* sp. 7 (SAP)		3
			Ephydrid sp. 6 (SAP)		3
		Muscidae	*Muscid* sp. C (SAP)		2,3
			Muscid sp. D (SAP)		2,3
		Stratiomyidae	Stratiomyidae		1
		Ephydridae	Ephydridae sp. 6 (SAP)	1	

2.5. Waterbirds

No waterbirds were sighted during the RCM survey. However, limited survey effort was invested in the waterbird survey as high water levels caused difficulties in accessing the lake shore and no boat was available. High water levels may have also limited habitat available, limiting the number of waterbirds actually present at the wetland.

Waterbirds have been recorded at Lake Gore by DEC previously (Watkins 2008, in preparation).

2.6. Other Fauna

No fish were sighted during the RCM survey. There was no evidence of other terrestrial vertebrate fauna.

2.7. Threats to the Ecology of Lake Gore

Only a very small area of Lake Gore was surveyed, so a comprehensive description of threats cannot be provided. However, in the area surveyed, there is a moderate threat of waterlogging and salinisation which was indicated by the *Melaleuca* deaths. This finding is supported by previous studies which have attributed tree deaths in several wetlands of the Lake Gore Wetland System to salinisation and excessive inundation (Jaensch 1992). The prolonged inundation is caused by increased inflow of water to the lake following wet years. Weeds were also widespread among the *Melaleuca* woodland surrounding the lake and are evidently impacting on the native vegetation (Figure 6).

Figure 6 – The vegetation to the north of Lake Gore, which is being impacted by weeds.

References

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Appendix

Table 6 – Herbarium Records for Lake Gore.

Search Coordinates: NW corner 33.7498°S, 121.4902° E; SE corner 33.7986°S, 121.5494°E

Family	Species	Alien	Cons. Status
Boraginaceae	*Heliotropium curassavicum*	Y	
Cyperaceae	*Ficinia nodosa*		
Cyperaceae	*Gahnia ancistrophylla*		
Haemodoraceae	*Anigozanthos rufus*		
Juncaceae	*Juncus kraussii* subsp. *australiensis*		
Loranthaceae	*Nuytsia floribunda*		
Malvaceae	*Lawrencia glomerata*		
Myrtaceae	*Darwinia vestita*		
Myrtaceae	*Melaleuca cuticularis*		
Myrtaceae	*Verticordia sieberi* var. *sieberi*		
Phormiaceae	*Dianella brevicaulis*		
Poaceae	*Distichlis distichophylla*		
Polygonaceae	*Rumex crispus*	Y	
Proteaceae	*Isopogon formosus* subsp. *formosus*		

Table 7 – Overall Vegetation Community Condition Rating as adapted from (Thackway and Lesslie 2005). Shading indicates the condition of Lake Gore.

Overall Community Condition Rating					
	0	1	2	3	4
Community Condition Class	RESIDUAL BARE	NATURAL	IMPACTED	DEGRADED	REMOVED / REPLACED
	Areas where native vegetation does not naturally persist	Native vegetation community structure, composition and regenerative capacity intact - no significant perturbation from land management practices	Native vegetation community structure, composition and regenerative capacity intact but perturbed by land management practices	Native vegetation community structure, composition and regenerative capacity significantly altered by land management practices	Species present are alien to the locality and either spontaneous in occurrence or cultivated. Alternatively, vegetation may have been removed entirely
Regenerative Capacity	Natural regenerative capacity unmodified - ephemerals and lower plants	Regenerative capacity intact. All species expected to show regeneration are doing so	Natural regenerative capacity somewhat reduced, but endures under current/past land management practices	Natural regenerative capacity limited and at risk due to land management practices. Rehabilitation and restoration possible through removal of threats	Regenerative potential of native vegetation has been suppressed by ongoing disturbances. There is little potential for restoration
Vegetation Structure	Nil or minimal	Structural integrity of native vegetation is very high. All expected strata, growth forms and age classes are present	Structure is altered but persists, i.e. some elements of a stratum are missing	Structure of native vegetation is significantly altered, i.e. one or more strata are missing entirely	All structural elements of native vegetation are missing or highly degraded
Vegetation Composition	Nil or minimal	Compositional integrity of native vegetation is very high. All species expected at the site are present	Composition of native vegetation is altered. All major species are present, although proportions may have changed. Some minor species may be missing	Significant species are missing from the site and may have been replaced by opportunistic species. Loss of species affects structure of vegetation	Native vegetation removed entirely +/- replaced with introduced species