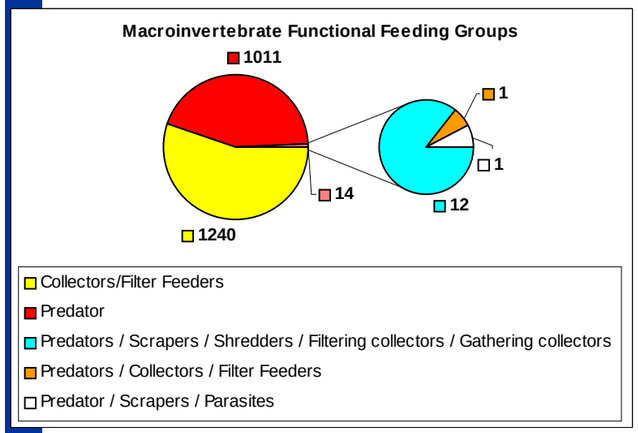
Benje Benjinup Lake

South Coast Wetland Monitoring Project **June 2008**

Functional Feeding Groups (FFG). A healthy wetland should have a representative of each functional feeding group. The composition of these groups at Benje Benjinup Lake are displayed in the below graph.

Conclusion



Benje Benjenup Lake is a highly saline lake that receives water from the catchment through surface and sub-surface flow and via the northern creek line. Recent groundwater investigations determined there is a perched moderately saline groundwater aquifer below Benje Benjenup Lake which is likely to be connected to the lake through a spring on the western edge of the lake. The extreme salinities are a product of evaporation and salt accumulation in the large shallow basin of the lake. Nutrient concentrations in Benje Benjenup Lake were also consistently high.

Some knowledge gaps were identified during the investigation, monitoring and data analysis for this wetland which should be addressed to improve understanding of the water quality and biodiversity and to detect changes over time. The monitoring period was relatively short and some effects of previous and current land use change and management may not yet be evident. Macroinvertebrates would need to be identified to family or species level to allow more detailed analysis of ecological condition and relationship to other wetland characteristics.

The hydrology of the wetland and its catchment is not fully understood or monitored, particularly the interaction between groundwater and surface water. A future monitoring program should be developed to address these issues.

Acknowledgements

The Department of Water would like to sincerely thank and acknowledge the following people for their assistance and contribution toward the South Coast Wetland Monitoring Program and production of this report.

- Nils and Penny Blumann for their support of the project and allowing access to the lake through their property.
- John Simons (Department of Agriculture and Food, Esperance) for providing knowledge of the hydrogeology associated with Benje Benjenup Lake and editing assistance.
- Ania Lorenz, Sherrie Randall, Kevin Hopkinson, and Albany Department of Water team who conducted the monitoring.
- Kevin Hopkinson, Naomi Arrowsmith, Andrew Maughan and others for their support and editing assistance.
- Sherrie Randall and Tracy Calvert for data analysis and report compilation.

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For further information please contact Tracy Calvert at the Department of Water Albany (08) 9842 5760.

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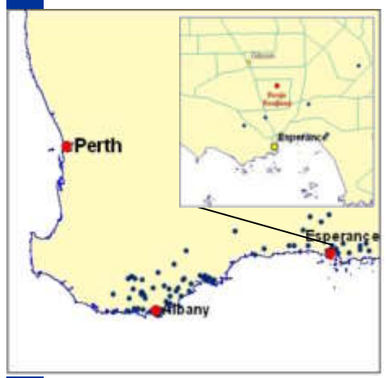
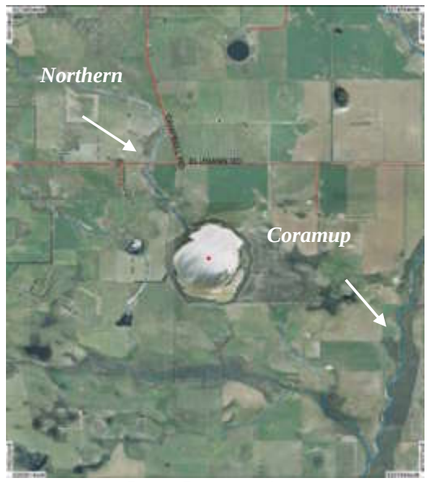
This report card summarises the Department of Water's current state of knowledge of the physical, chemical and biological characteristics of Benje Benjenup Lake based on the knowledge gained from investigation and monitoring conducted by the Department of Water through the South Coast Wetland Monitoring Program. Accompanying this document is an appendices that provides more detailed information about the wetland monitoring program, terminology of wetland classification, parameters monitored, methodology and the ANZECC&ARMCANZ guidelines used in this report.

Funding for this program has been provided through South Coast Natural Resource Management Inc. - supported by the Australian Government and the Government of Western Australia.

About Benje Benjenup Lake



Benje Benjenup Lake is located approximately 20km north of Esperance, Western Australia, within the Coramup Creek Catchment and the smaller sub-catchment of Benje Benjenup Lake. The wetland lies at approximately 80-100m Australian Height Datum (AHD) and receives an annual average rainfall of 560mm.



Benje Benjenup Lake

	Coordinates		
Wetland Suite	***Easting***	***Northing***	***MGA Zone***
Benje Benjenup Suite	398387	6270134	51

Benje Benjenup Lake is located on Conservation Reserve land within the Esperance Shire and has a small catchment of approximately 130km^2 of privately owned agricultural land. The lake is listed on the National Estate Register under the Jamba and Camba agreement (Japan China and Australian migratory Birds Agreement) as it is an important bird breeding site for shorebirds including Hooded Plovers.

Above: Hooded Plovers at Benje Benjenup Lake

Above: Shorebirds at Benje Benjenup Lake

The Lake lies within a fenced wetland vegetation buffer zone that extends approximately 120-250m from the wetland edge. Vegetation predominantly consists of *Melaleuca sp.* (paperbark), *Banksia sp. Gahnia trifidia*, *Baumea juncea, Juncus kraussii* as well as samphire and salt bush.

Melaleuca sp. on the shore of Benje Benjenup Lake

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Approximately 95% of the catchment has been cleared of native vegetation for cropping and livestock. Coramup Creek is located east of the lake and flows south toward the Lake Warden Wetland system. A creek flows into the northern corner of Benje Benjenup Lake which captures drainage from the rural properties to the northwest. The Benje Benjenup catchment is internally drained and does not overflow into the Coramup Creek.

Water quality monitoring commenced on the 13/01/2006 and included physical, chemical and biological parameters as outlined in the appendices.

Classification of Benje Benjenup Lake has been evaluated on the basis of guidelines developed by V & C Semeniuk Research Group (1997). For further explanation please refer to the attached appendices.

Wetland Classification

Wetland type	*Water Salinity*	*Consistency of Salinity*	*Size (Metres)*	*Shape*
Lake	Hypersaline - Brine	Poikilohaline	Macroscale 1540 x 1255	Irregular - Round

Salinity

Salinity over the sample period was far greater than seawater ranging between 141-1600 mS/cm. Fluctuations in salinities relate to seasonal fluctuations in rainfall which in turn determines the amount of surface runoff particularly via the creek entering at the northern end of the lake which drains agricultural land to the north, some of which is affected by secondary salinisation.

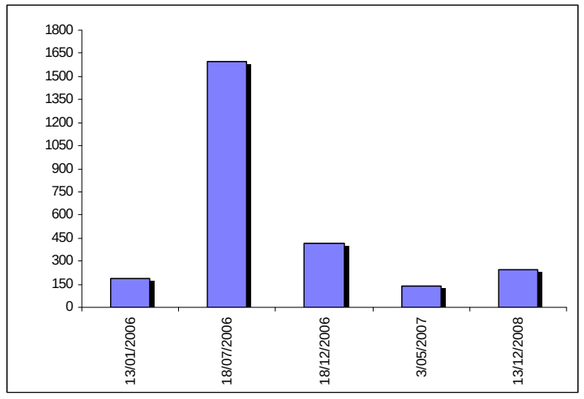
Salinities may also alter due to the presence of a spring feeding into the western edge of the wetland which is saline but significantly lower than the main lake. At the time of sampling on the 13/12/2007 salinity in the pool at the spring site was 80mS/cm in comparison to the main water body which was 243mS/cm.

Freshwater spring on the north western edge of the lake

It is likely that the pool water salinities correspond with the comparatively fresher groundwater (3.81mS/cm) measured in a perched superficial aquifer intercepted during recent (2008) groundwater drilling investigations on the agricultural land adjoining the northern boundary of the lake basin. The superficial aquifer is perched on clays and is 3.0m below ground level.

Higher salinities in the pool relate to evaporation and its connection to the lake. At depth (42m) there is a confined or artesian aquifer that is saline. Considering the extreme salinities in the lake it is likely that there is no direct connection between the lake and groundwater (apart from inputs from the spring).

Extreme salinities are a product of evaporation and salt accumulation in the large shallow basin of Benje Benjenup lake.



Salinities (mS/cm) over the sample period

Nutrients

Total Nitrogen (TN) concentrations were high ranging from 7.8-13mg/L. TN concentrations on all sampling occasions exceeded the guidelines developed for ecosystem protection for southwest Australian wetlands for slightly disturbed systems of 1.5mg/L. Note: no TN data was collected on the 13/1/2006 and 18/7/2006.

Dissolved inorganic nitrogen fractions of ammonia (NH_3-N) and total oxidised nitrogen (NOx-N), ranged from 0.01-0.36mg/L and 0.01-0.05mg/L respectively. All NH_3-N fractions

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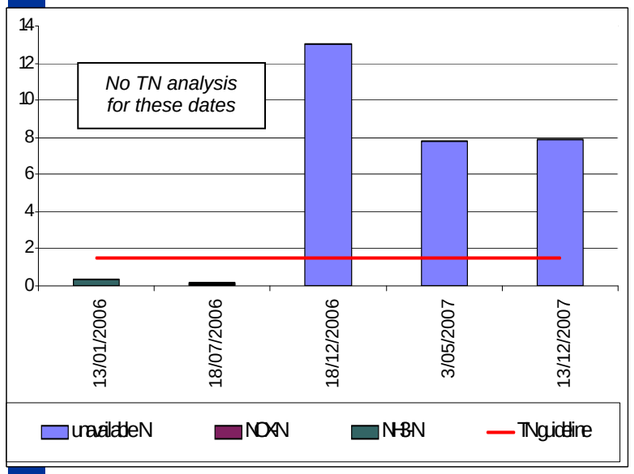
exceeded the recommended guideline value of 0.04mg/L except on the 13/12/2007. In comparison, the NO_X-N fraction did not exceed the recommended value of 0.1mg/L except on one occasion on the 18/07/2006.



Nitrogen fractions in mg/L over the sample period with TN guideline illustrated

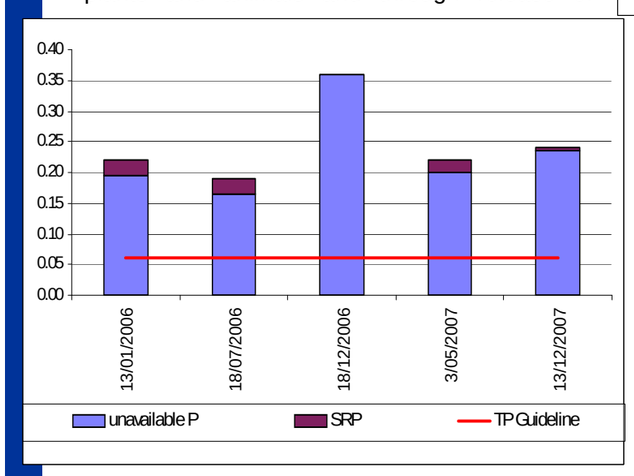
Total Phosphorus (TP) concentrations ranged from 0.19-0.24mg/L. TP concentrations on all sampling occasions exceeded water quality guidelines of 0.06mg/L.

Soluble Reactive Phosphorus (SRP) (form of phosphorus available for uptake by plants) ranged from 0.005-0.026mg/L. In relation to water quality guidelines SRP exceeded the recommended value of 0.03mg/L on all sampling occasions.

Nutrients are recycled naturally through the lake due to uptake and assimilation of nutrients by plants and animals and through release of nutrients for example through microbial breakdown of organic material.

Catchment stores of nutrients may also enter Benje Benjenup Lake through surface runoff, sub surface flow from the surrounding land and through the northern drainage channel.

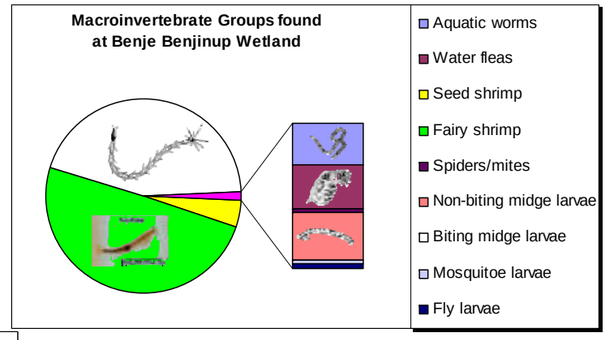
Being a large shallow lake, nutrients may be released from suspended sediment due to wind stirring as well as become concentrated when water levels are low which may explain the higher nutrient concentrations on the 18/12/2006. The presence of birds can also contribute to the nutrient content in the lake.



Phosphorus fractions in mg/L over the sample period with TP guideline illustrated

Macroinvertebrates

Nine groups of macroinvertebrates were found at Benje Benjinup Lake during the monitoring period of which the most abundant included Anostraca (fairy shrimp), Ceratopogonidae (biting midge larvae), Ostracoda (seed shrimp). Other groups of less abundance included, Oligochaeta (aquatic worms), Cladocera (water fleas), Chironomidae (non-biting midge larvae), Acarina (spiders/mites), Culicidae (mosquitoe larvae), Other Diptera (fly larvae).



The abundance of these groups ranged from no life present to thousands. High macroinvertebrate abundance and low diversity is a typical trend in highly saline wetlands because of the reduced salt tolerance at this range by a large number of macroinvertebrate groups.

Each group of Macroinvertebrate play a different role in the food chain, some feed on organic material (Shredders), others feed on fine organic particles (Collectors/filter feeders), others graze on algae (Scrapers), some feed on each other (Predators), and others are parasitic (Parasites). These groups are called