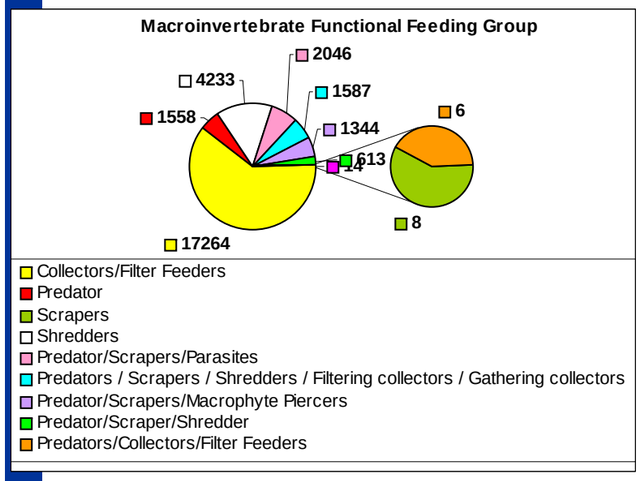
Bunker Swamp

South Coast Wetland Monitoring Project **June 2008**

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), others are parasitic (Parasites) and some are Macrophyte piercers that feed off living plants and algae fluids. These groups are called Functional Feeding Groups (FFG). Some macroinvertebrates fit into more than one of these groups, for example the Water Boatman is a Predator, a Scraper and a Macrophyte piercer.

A healthy wetland should have a representative of each functional feeding group. A loss or dominance in a particular group may indicate a change in ecology of the wetland. The composition of these groups at Bunker Swamp are displayed in the below graph.



Conclusion

Bunker Swamp salinities ranged between brackish and highly saline. The wetland was previously fresh and perched above the groundwater table however due to groundwater rise of 2.2m observed since 1993 it is now both surface water and groundwater fed. The groundwater table is now approximately 1.6m above the lake bed and discharges into the swamp resulting in the higher salinity of the lake.

Total nitrogen levels including the available forms on some occasions are high although phosphorus levels are low. The main issues to consider are the salinity and high nitrogen levels, groundwater rise and the effects on the ecology of the wetland.

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.

- Brian & Barbara Bunker for their support of the project and allowing access to the lake on their property.
- Ruhi Ferdowsian (Department of Agriculture and Food, Albany) for providing knowledge of the hydrogeology associated with Bunkers Swamp.
- 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.

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 Bunker Swamp 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 are 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 the South Coast Natural Resource Management Inc. - supported by the Australian Government and the Government of Western Australia.

About Bunker Swamp

Bunker Swamp is located approximately 45km north west of Mount Barker Western Australia within the Irwin Inlet catchment and the Kent River sub-catchment. The wetland is at approximately 235m AHD (Australian Height Datum) and the area receives an annual average rainfall of 515mm.

	GPS Location Coordinates		
Wetland Suite	Easting	Northing	MGA Zone
Unicup Suite	521589	6191434	50

Bunker Swamp

Bunker Swamp is located on privately owned land within a catchment of approximately 10.5km^2 in the Shire of Cranbrook. The Swamp lies within a fenced wetland vegetation buffer zone that ranges between 40-80m from the wetland edge. Vegetation is predominantly mature *Eucalyptus rudis* (Flooded Gums) with some dead trees situated in the shallows and some small regenerating trees around the perimeter.

In the past (approximately10 years ago), the swamp was unfenced and surrounding vegetation was grazed by stock. Wetland vegetation has also previously been burnt, however since fencing there has been a return of understorey vegetation including rushes.

Eucalyptus rudis around Bunkers Swamp

Approximately 55% of the catchment has been cleared of native vegetation for stock, cropping and plantation forestry. Historically the area adjacent to the lake was used as a stock route.

A small clay lined sump is situated next to the swamp which is filled from the swamp. A valve is situated at the base of the sump to control exchange between the swamp and the sump. Water is pumped from the sump for stock watering during drought years.

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Water quality monitoring commenced in November 1999. Monitoring included physical, chemical and biological parameters as outlined in the appendices.

There now appears to be some groundwater connectivity as monitoring of groundwater by the Department of Agriculture and Food indicates groundwater has risen by 2.2m since 1993. Recent monitoring measured the groundwater pressure head at 1.6m above the swamp surface

Wetland Classification

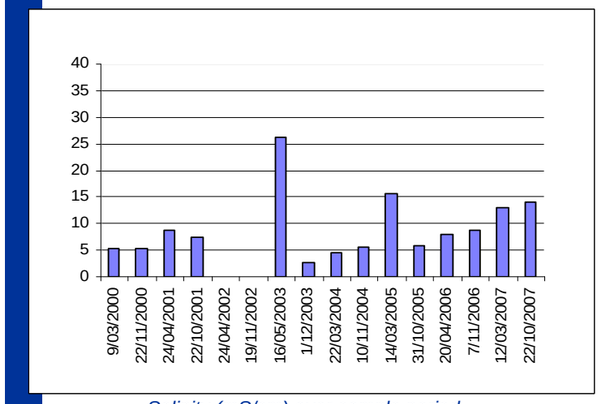
Wetland type	*Water Salinity*	*Consistency of Salinity*	*Size (Metres)*	*Shape*
Lake	Fresh—Hyposaline	Stasohaline	Macroscale 1850 x 1485	Ovoid

Classification of Bunker Swamp has been evaluated on the basis of guidelines developed by V & C Semeniuk Research Group. For further explanation please refer to the appendices.

which suggests the groundwater discharges into the swamp. Salinities in the adjacent sump are also lower than the swamp which indicates groundwater and evaporation are contributing factors to salinity in Bunker Swamp.

Salinity

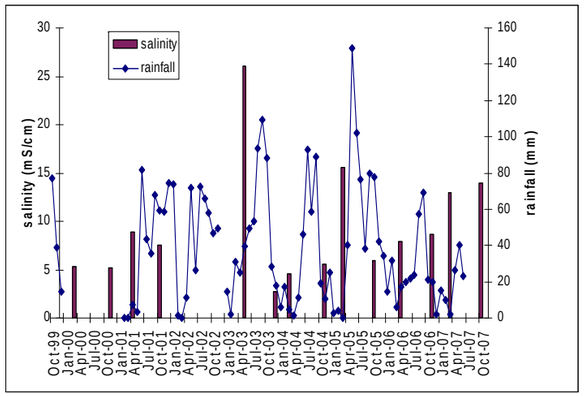
Salinity over the sample period ranged between brackish (2.7mS/cm) to highly saline (26.1mS/cm). Fluctuations in salinities relate to seasonal fluctuations in rainfall which in turn determines the amount of surface runoff from the surrounding land.



Salinity (mS/cm) over sample period

During the onset of winter rains stored salts may initially flush into the swamp however the swamp may freshen as surface flows become more diluted. During high rainfall events surface flows may migrate from the Murdellup Lake area in the north and increase the wetland salinities.

Bunker Swamp lies within a paleochannel (ancient river channel) which is made up of marine derived Pallinup Siltstone overlaying the deeper Werillup formation made up of lignite, clays and coarse sand. Historically Bunker Swamp was a freshwater system perched above the groundwater and inundated seasonally; it was fresh until approximately 20 years ago.



Salinities fluctuate with rainfall and fresh water surface flows

Nutrients

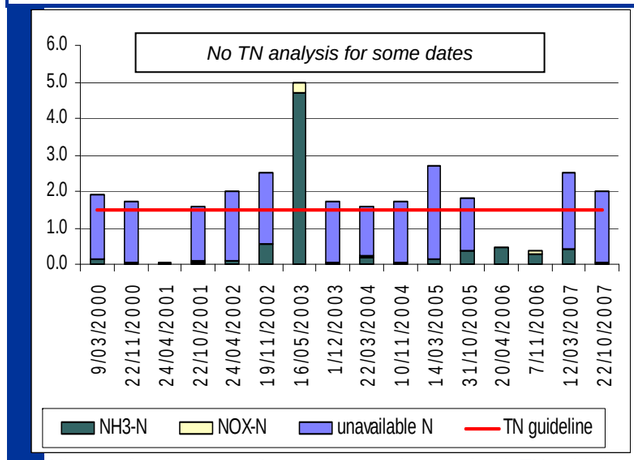
Total Nitrogen (TN) concentrations ranged between 1.6 and 2.7mg/L which exceeded the guidelines developed for ecosystem protection for southwest Australian wetlands for slightly disturbed systems of 1.5mg/L on all sample occasions. Note: No TN data collected in 2006.

Dissolved inorganic nitrogen fractions of ammonia (NH_3-N) ranged between 0.02-14.7mg/L which exceeded the recommended guideline value of 0.04mg/L on fourteen of the sixteen sample occasions. Total oxidised nitrogen (NOx-N) ranged between 0.01 and 0.1mg/L which did not exceed the recommended guideline value of 0.1mg/L on any sample occasion.

Substrate photo of Bunker Swamp taken 22nd October 2007

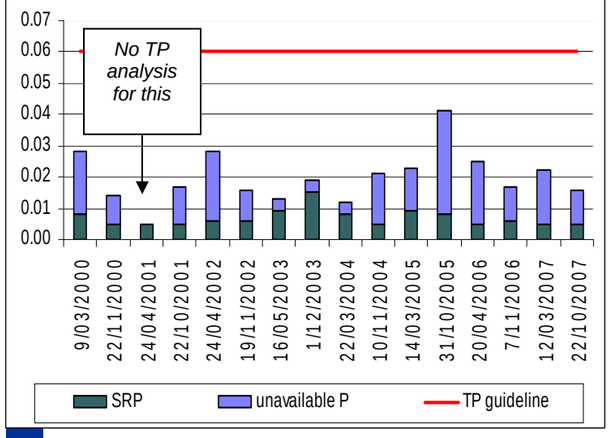
Bunker Swamp

South Coast Wetland Monitoring Project June 2008



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

Total Phosphorus (TP) concentration ranged between 0.012-0.041mg/L which did not exceed the water quality guidelines of 0.06mg/L on any sample occasion. Soluble Reactive Phosphorus (SRP) (form of phosphorus available for uptake by plants) ranged between 0.005-0.015mg/L which did not exceed the recommended water quality guideline value of 0.03mg/L.



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

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

Nutrients may enter Bunker Swamp through inflow from surrounding agricultural lands that have accumulated nutrient stores over a long period of time. Nutrients may also enter the lake through groundwater.

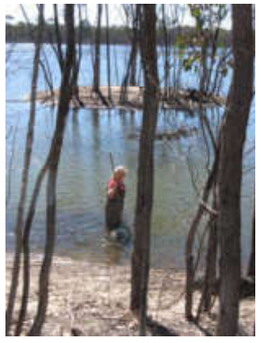
Low proportions of phosphorus may relate to the Swamp being groundwater fed and the phosphorus absorption potential of the clays beneath the agricultural land absorbing phosphorus before the water recharges the aquifers.

Macroinvertebrates

Twenty five groups of macroinvertebrates were found at Bunker Swamp during the monitoring period of which the most abundant included; Ostracoda (seed shrimp), Copepoda (copepods), Cladocera (water fleas), Acarina (spiders/mites), Amphipoda (scuds), Notonectidae (backswimmers), Corixidae (waterboatmen), Chironomidae (non-biting midge larvae), Trichoptera (caddisflie larvae), and Decopoda (shrimp/prawn/crayfish).

Other groups of less abundance were found including; Oligochaeta (aquatic worms), Hirudinea (leeches), Gastropoda (snails/ limpets), Bivalvia (bivalve molluscs), Isopoda (slater like), Ephemeroptera (mayflies), Epiproctophora (dragonflies), Zygoptera (damselflies), Hemiptera (water bugs), Coleoptera (beetles) adult, Coleoptera (beetles) larvae, Ceratopogonidae (biting midge larvae), Culicidae (mosquitoe larvae), Other Diptera (fly larvae) and Other taxa.

The diversity of macroinvertebrates found over the sample period ranged between thirteen to twenty five groups with a median of seventeen, which rates high based on the Ribbons of Blue Wetland Habitat Score.



Catching macroinvertebrates at Bunker Swamp