

Kendenup Lakes Ecological Investigation



September 2017

Report prepared for Green Skills Inc, Denmark WA.

by Geraldine and Steve Janicke

This project is supported by funding from the Western Australian Government's State Natural Resource Management Program, supported by Royalties for Regions. It has also been supported by the Great Southern Science Council Regional Science Engagement Project through Great Southern Development Commission and Inspiring Australia. The event is part of Green Skills' wetland conservation activities and has also been supported the Kendenup Primary School who received a South Coast NRM's Regional Landcare facilitator's grant with funding from the Australian Government's National Landcare Program.



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Cover photos: Citizen Scientists assisting in collecting bird and macroinvertebrate data from Lake Meenulup. (photo by S. Janicke.)

Acknowledgements

The authors would like to acknowledge Basil Schur of Green Skills Inc. and Liz Tanner with the Great Southern Science Council for coordinating the survey and arranging the publicity and the access to the lakes. Local farmers Geoffrey Sandilands and James Stirling provided permission for their land to be accessed for the survey. Thanks to Anthony Peterson, Brad Kneebone and Andrew Dickinson (Albany Bird Group) and to the other Citizen Scientists who assisted with the survey. The involvement of the Kendenup Primary School in the survey of Lake Matilda was facilitated by Fiona Hall, the School Principal.

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INTRODUCTION

This report presents an ecological investigation of Lake Matilda, and two nearby lakes on G. Sandilands property, Lake Meenulup and a small wetland labelled Project 3. Site visits were conducted on 6 September 2017. These wetlands are part of a suite lying approximately 25 kilometres north of Mt Barker near the town of Kendenup. The sites were visited as part of a Citizen Science event and the data collected contributes to a better understanding of the numerous wetland systems that are the focus of the Green Skills Inc. Living Lakes and Wetlands of Gondwana Link.

Lake Matilda had been part of a regional wetland monitoring program undertaken from 1999 to 2007 by the then Water and Rivers Commission and Green Skills¹. There had been concern over rising saline groundwater levels and the health of fringing vegetation and it was hoped that the twice yearly monitoring would ensure early detection of any changes to water quality and wetland health.

To answer the question “How has the condition of Lake Matilda changed between 2007 and 2017?” would require macroinvertebrate sampling over several years to include comparable seasonal rainfall variation. Water quality chemistry may need longer. The twice yearly sampling from 1999 to 2007 included a very wet year in 2005 (191mm above average for Kendenup) and a very dry year in 2006 (229mm below average at Kendenup). This one off sampling of macroinvertebrates cannot indicate any trend. However the results of this investigation seem fall within the range of results reported by DOW for 1999 to 2007.



Figure 1: The target wetlands and sampling sites for this investigation.

¹ DOW (June 2008). Lake Matilda Report Card, South Coast Wetland Monitoring Project. (Available online: http://www.rivercare.southcoastwa.org.au/activities/wetsurvey/reports/lake_matilda.pdf)

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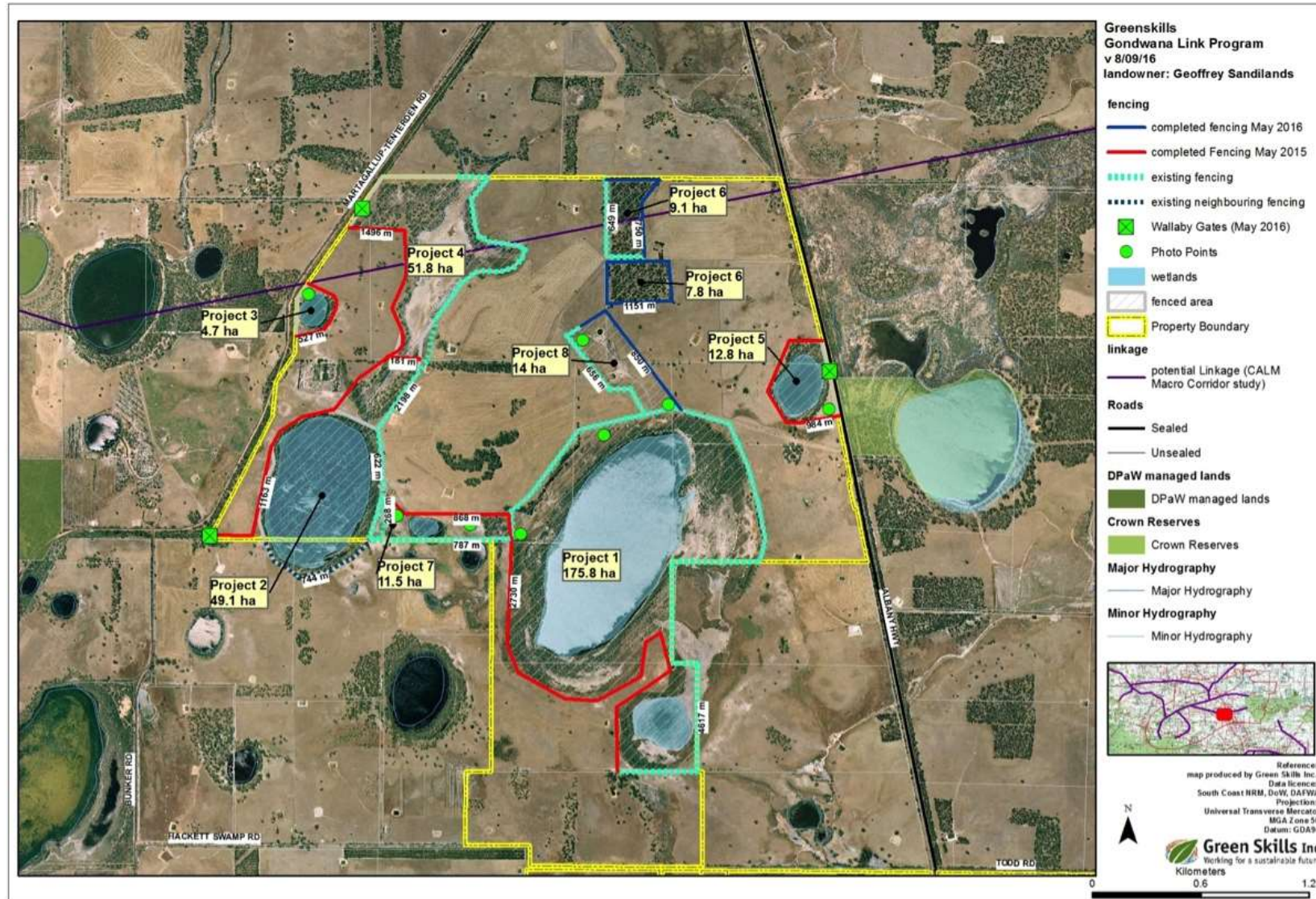


Figure 2: Green Skills Inc. protection and rehabilitation plan for the lakes on G. Sandilands property.

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Figure 3: Green Skills Inc revegetation work done on G. Sandilands property.

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The results of this investigation and the findings from other studies of the wetlands around the region confirm that South Coast wetlands are quite diverse in their aquatic ecology. This diversity is expressed through wide range of water quality conditions from fresh to hyper-saline, seasonal water depth, hydro-geological influences, position in the landscape, fringing vegetation and the surrounding land use. This is true despite their proximity to one another.

Figure 1 above shows the relative location of the target wetlands and the sampling sites. Figure 2 shows the Green Skills Inc. protection and rehabilitation plan for the G. Sandilands property containing two of the three wetlands.

METHOD

The three target lakes, Lake Matilda, Lake Meenulup and Sandilands Project 3 were sampled on 6 September 2017 for macroinvertebrate composition, water quality and water bird presence.

The waters from the three wetlands were tested for Salinity, pH, temperature and turbidity. A turbidity tube and ADWA Pocket EC/TDS and pH testers were used to obtain water quality measurements.

Aquatic macroinvertebrates were sampled using a 250µm mesh net to sweep an area approximately 8 metres by 30 metres along the foreshore. Citizen Science volunteers assisted at Lake Meenulup and Sandilands Project 3. The Year 5/6 Class from the Kendenup Primary School assisted in the sampling of the foreshore adjacent to the Lake Matilda bird hide using a variety of scoop nets. All samples were placed in white trays and macroinvertebrates were live picked and placed in containers with the help of the students and Citizen Science volunteers. Estimates of animal numbers were also made while examining the trays. All picked animals were placed into sample containers with 70% ethanol, and returned to the laboratory where all specimens were identified to the lowest taxonomic level possible.

Water bird observations were made by Brad Kneebone, Anthony Peterson and Andrew Dickinson of the Albany Bird Group.



Figure 4: Geraldine Janicke guiding Citizen Scientist volunteers in sampling Lake Meenulup for macroinvertebrates. (Image: Basil Schur)

RESULTS AND DISCUSSION

Part of the shore of **Lake Matilda** adjacent to Albany Highway lies in a Reserve while the rest of the lake lies in fenced and well vegetated freehold land. Tree cover around the lake was patchy with Yate trees, abundant *Melaleuca cuticularis* saplings and Samphires at the water's edge. Weed cover was sparse. The area of open water was about 40H Ha.

Lake Meenulup was surrounded by fenced native vegetation and revegetation in a band between 20 to 100 metres wide and encompassing 165Ha. The area of open water was about 66Ha. At the sampling area, the dominant species were healthy *Melaleuca cuticularis* and Samphires. There was a moderate cover of pasture grasses within the fenced area.

Sandilands Project 3 wetland had only a narrow band of vegetation dominated by healthy Yates and a variety of sedges with only sparse weed invasion. The fenced area encompasses 4Ha with about 2Ha of open water.

All three wetlands were full and the riparian vegetation was inundated at Lake Matilda and Sandilands Project 3 wetland.

Water Quality

Lake Meenulup had the highest salinity at 1.5 times as salty as seawater while **Lake Matilda** was the least saline at just over half seawater (Table 1). All three wetlands were alkaline as is common for saline wetlands in the region

Table 1: Water Quality measurements for the three lakes.

Parameter	Lake Meenulup	Sandilands Project 3	Lake Matilda
Salinity (mS/cm) (ppt conversion factor = 0.55)	78.3 (43ppt)	49.8 (27ppt)	29.5 (16ppt)
pH (meter)	8	8.1	8.1
Temperature °C	17.7	15.5	
Turbidity (NTU)	< 10	< 10	20

Wetland salinity categories (Pinder et al, 2004)².

- <6mS/cm (3ppt), freshwater
- 6 to 20mS/cm (3-12ppt), sub-saline, brackish
- 20 to 52mS/cm (12-35ppt), saline
- >52mS/cm (35 ppt), hyper-saline.

Note: seawater is usually 52mS/cm (35 ppt).

During the regional wetland monitoring program undertaken from 1999 to 2007 by the then Water and Rivers Commission, the salinity at Lake Matilda varied between 10 to 44 mS/cm. This is due to seasonal variations in rainfall and evaporation. The variation of salinity between the three wetlands sampled in this investigation would be due to variations in catchment size, groundwater hydrology and evaporative surface area. Lake Meenulup had the largest surface area of open water (66Ha) and was relatively shallow (0.15m depth at the sampling area) which would promote evapo-concentration of salts. Lake Matilda has the largest catchment and collects surface runoff besides saline groundwater. Evapo-concentration of salts would likely be low in Lake Matilda due to a smaller open water area (40Ha) and shading from inundated vegetation.

Aquatic biota

Aquatic plants

The three wetlands had very different aquatic plants assemblages.

The bed of **Lake Meenulup** had a fairly even covering of the Water Mat, *Lepilaena* sp.. This small aquatic flowering plant is a low growing halophile (salt loving) that is grazed by herbivorous water

² Pinder, Adrian M., S.A. Halse, J.M. McRae and R.J. Shiel (2004) "Aquatic invertebrate assemblages of wetlands and rivers in the wheatbelt region of Western Australia" *Records of the Western Australian Museum* Supplement No. 67: 7-37 (2004).

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birds and is habitat for macroinvertebrates. There was evidence of grazing with occasional tufts of plants pulled up. There are seven species of *Lepilaena* found in Western Australia with three potentially occurring in the region (*Lepilaena australis*, *L. cylindrocarpa* and *L. preissii*).

Lake Matilda had occasional tufts of Swan Grass (*Ruppia megacarpa*) and occasional small tufts of the plant like algae, Stonewort (*Lamprothamnium papulosum*). Swan Grass (or Widgeon grass) provides a sheltered habitat for many macroinvertebrates and food for many wetland birds and ducks as well as for macroinvertebrate grazers.

Sandilands Project 3 wetland had only some remnant clumps of Swan Grass and these were mostly dead.

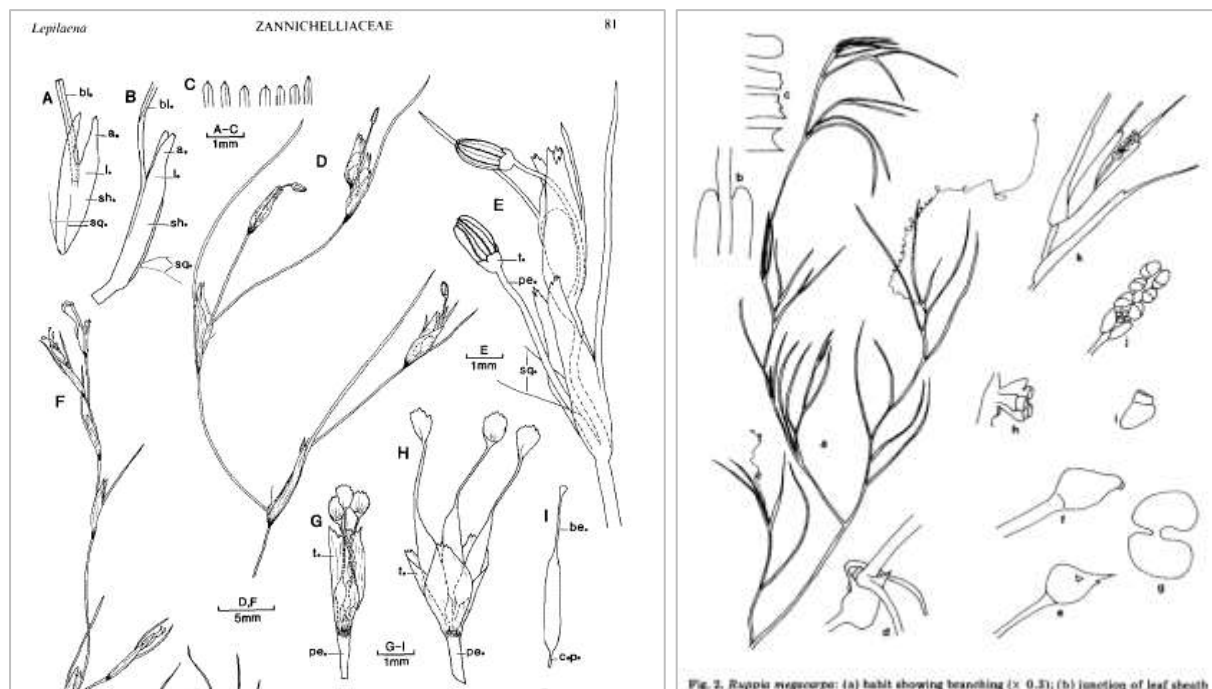


Figure 5: Left: *Lepilaena cylindrocarpa* illustration from Womersley, 1984³. Right: *Ruppia megacarpa* illustration from Brock, 1982⁴

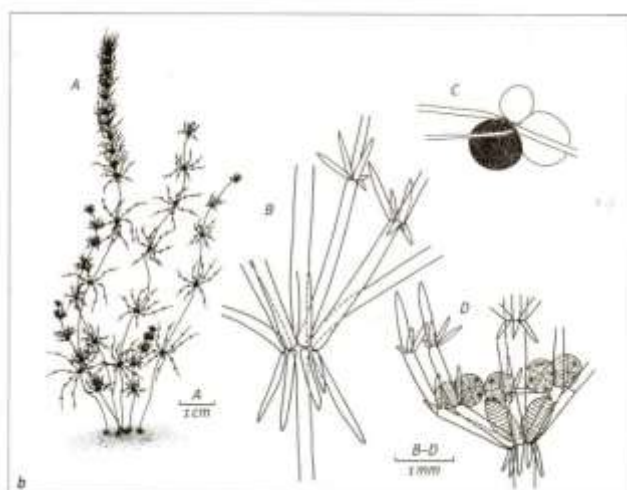


Figure 6: *Lamprothamnium papulosum* illustration from Womersley, 1984⁵.

Stonewort, requires low salinities for spore germination to occur but grows well in salinities up to 60ppt although it has been recorded in salinities as high as 104 ppts (3 times more saline than seawater). Mature *Lamprothamnium* produces starch bulbils which are also a food source for birds (Delroy, 1974⁶).

³ Womersley, H.B.S. (31 May, 1984) The Marine Benthic Flora of Southern Australia Part I

⁴ Brock, Margaret, (1982) Biology of the salinity tolerant genus *Ruppia* L. in saline lakes in South Australia.

⁵ Womersley, H.B.S. (31 May, 1984) The Marine Benthic Flora of Southern Australia Part I

⁶ Delroy, L.B. (1974). The food of waterfowl (*Anatidae*) in the southern Coorong saltwater

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Macroinvertebrates

The three lakes sampled showed some distinct differences in macroinvertebrate composition as seen in Figure 7 and Table 2 with Sandilands Project 3 lake having the highest number of species and Lake Meenulup the lowest. However, Lake Matilda had the highest relative invertebrate abundance with the Giant Ostracod *Mytilocypris tasmanica chapmani* dominating the water column.

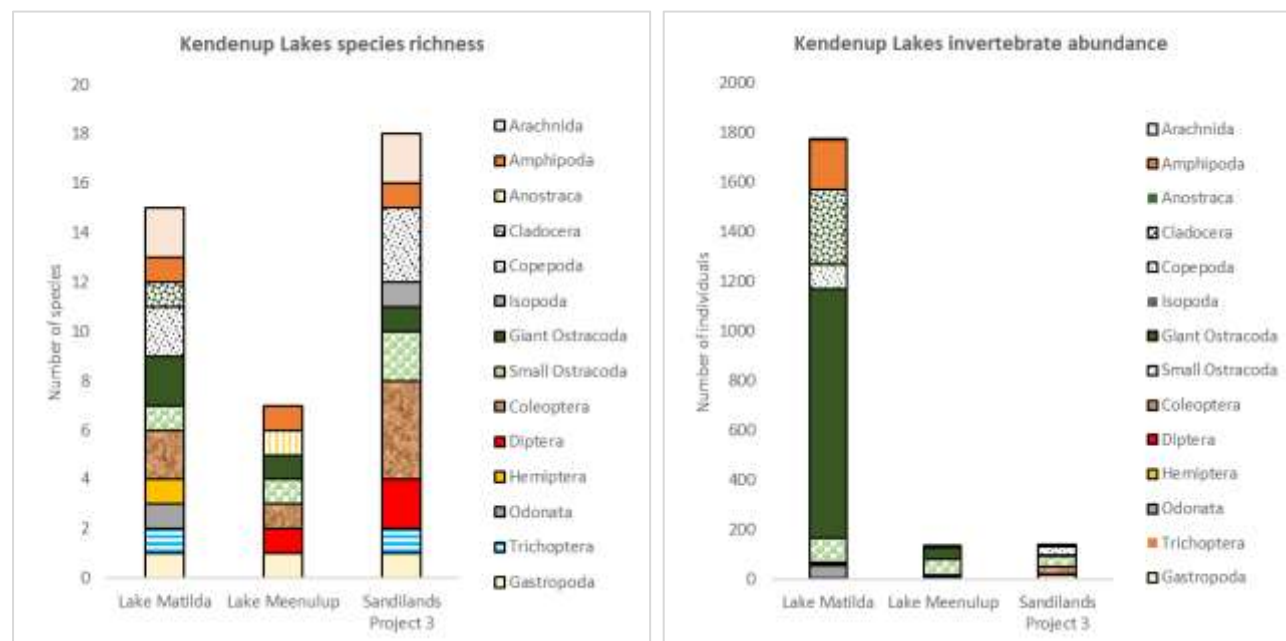


Figure 7: Macroinvertebrate species richness (number of different species) and abundance (relative number of individuals) for the Kendenup Lakes sampled.

The Lake Matilda sample had a species richness of 15 from this investigation which is below average for secondarily salinised naturally sub-saline to saline wetlands (18-20, Pinder et al, 2004⁷). The species collected at each wetland represent only a subset of those probably present at the time of sampling and those utilising the wetland at other seasons. During the regional wetland monitoring program undertaken from 1999 to 2007 by the then Water and Rivers Commission (DOW, 2008⁸), nineteen groups of macroinvertebrates were found at Lake Matilda of which the most abundant included; Cladocera (water fleas), Ostracoda (seed shrimp), Copepoda (copepods), Amphipoda (scuds), Gastropoda (snails/limpets), Zygoptera (damselflies), and Notonectidae (backswimmers). Species from these groups were present in the sample collected for this investigation.

Table 2: Species richness and relative abundance between the Kendenup lakes sampled in this investigation.

	Lake Matilda	Lake Meenulup	Sandilands Project 3
Species Richness	15	7	18
Macroinvertebrate relative abundance	1775	140	144
Crustacean richness	7	4	7
Insect richness	5	2	7

The difference between the number of Crustacean species and Insect species in the lakes sample can be seen in Table 2. The south-west of Western Australia is a global hotspot for inland crustacean diversity

⁷ Pinder, Adrian M., S.A. Halse, J.M. McRae and R.J. Shiel (2004) "Aquatic invertebrate assemblages of wetlands and rivers in the wheatbelt region of Western Australia" *Records of the Western Australian Museum* Supplement No. 67: 7-37 (2004).

⁸ DOW (June 2008). Lake Matilda Report Card, South Coast Wetland Monitoring Project.

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with brine shrimp being one of the groups that contribute to this status. The brine shrimp (*Parartemia cylindrifera*) found in Lake Meenulup is known to favour *Ruppia* dominated lakes and has a wide salinity tolerance. The brine shrimp genus is endemic to Australia, and 14 of the 19 known species occur only in Western Australia (Timms *et al*, 2009⁹). Although brine shrimp have a wide tolerance to salinity (can tolerate up to 5½ times seawater), they rarely colonise secondary salinised wetlands and some are disappearing from naturally saline lakes affected by altered hydrology.

The seed shrimp, *Australocypris insularis* was found most abundantly in Lake Meenulup. It is described by Halse and McRae (2004)¹⁰ as frequently occurring in secondarily salinised wetlands. De Deckker (1983b)¹¹ comments that *Haloniscus searlei* is also an endemic crustacean that is a common inhabitant of Australian salt lakes.

The Blue Ringtail damselfly (*Austrolestes annulosus*) was also abundant at Lake Matilda with flying adults and large larvae present. These would provide a good food source for a variety of birds.



Figure 8: Male (left) and female (right) Blue Ringtail damselflies (*Austrolestes annulosus*) (images Doug McDougie, Western Australian Insects Facebook page).



Figure 9: Brad Kneebone with members of the Albany Bird Group recording bird observations at Lake Meenulup. (Image: Basil Schur)

⁹ Timms, Brian V., Pinder, Adrian M., and Campagna, Veronica S., (2009) The biogeography and conservation status of the Australian endemic brine shrimp *Parartemia* (Crustacea, Anostraca, Parartemiidae) in *Conservation Science W. Aust.* 7 (2) : 413–427 (2009)

¹⁰ S.A. Halse & J.M. McRae (2004) New genera and species of ‘giant’ ostracods (Crustacea: Cyprididae) from Australia in *Hydrobiologia* 524: 1–52, 2004.

¹¹ De Deckker, Patrick (1983b) “Australian salt lakes: their history, chemistry, and biota - a review” *Hydrobiologia* 105, 231-244 (1983)

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Bird observations

Lake Matilda had the highest number of water birds (individuals and species) observed during this investigation. These were mostly herbivores, dabblers, divers and specialist feeders.

The high number of swans observed in Lake Matilda implies a healthy population of aquatic plants. There was not a high number of aquatic plants observed at the sampling site in Lake Matilda during this survey, however what plants were observed were healthy and there may be more at other sections of the lake. The abundance of large macroinvertebrates ('giant' ostracods, damselfly larvae and amphipods) would provide an abundance of food for other waterbirds in the wetland.

There were many trees around Sandilands Project 3 Lake which would provide nesting sites for the Australian Shelduck while pasture grasses outside the fence line would provide food for them.

Table 3: Bird observations at the three lakes on 06/09/17 (Data supplied by Brad Kneebone, Albany Bird Group) and 14/15 Jan 2017 (Data from Dr Nic Dunlop and helpers observed during Wetland visits to 4 lakes in the Tenterden / Cranbrook area.

		Date of Survey 06/09/17 Time 0930-1230			Saturday/Sunday 14/15 Jan 2017	
Water bird feeding guild		Lake Matilda	Lake Meelenup	Sandilands Project 3	Lake Matilda	Lake Meelenup
Black Swan	herbivore	32			264	
Australian Shelduck	herbivore		1	6*	20	66
Eurasian Coot	specialist	25			200-300	
Grey Teal	dabbler	2				
Chestnut Teal	dabbler	2		4		
Pacific Black Duck	dabbler	2		1		
Hardhead	diver	3				
Musk Duck	diver	3			30	
Hooded Plover	waders		2			1
Red-capped Plover	waders		2			
Unidentified Wader	waders		3			
Black-fronted Dotterel	waders			1		
Banded Stilt	waders					27
Black-winged Stilt	waders					9
Greenshank	waders					3
Silver Gull	generalist		1			2
Little Black Cormorant	generalist	1				
White-faced Heron	generalist					1
TOTAL No. individuals		70	9	12	Up to 614	109
Total No. species		8	5	4	4	7
* Breeding Record (2 young, age 1week)						
Hooded Plover observed at southern edge of the lake shoreline						

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APPENDIX 1 – MACROINVERTEBRATE LIST

Class	Family/subfamily Genus/species	Common name	Lake Matilda	Lake Meenulup	Sandilands Project 3	Endemic status
Arachnida	Terrestrial unknown spiders	Spiders	3		3	
Arachnida	Tetragnathid sp.	Spiders	1		2	
Crustacea	Ceinidae <i>Austrochiltonia subtenuis</i>	Scud	200	6	7	Australia
Crustacea	Parartemiidae <i>Parartemia cylindrifera</i>	Fairy shrimp		3		Sthn Australia
Crustacea	Daphniidae <i>Daphniopsis pusilla</i>	Water flea	300			SW Australia
Crustacea	Calanoid Copepoda sp.	Copepod	50		10	
Crustacea	Cyclopoid Copepoda sp.	Copepod			10	
Crustacea	Harpacticoid Copepoda sp.	Copepod	50		10	
Crustacea	Oniscoidea <i>Haloniscus searlei</i>	Pill bug			4	Australia
Crustacea	Cyprididae <i>Australocypris inularis</i>	Giant Ostracod	2	50	4	
Crustacea	Cyprididae <i>Diacypis</i> sp.	Seed shrimp		50		
Crustacea	Cyprididae <i>Mytilocypris tasmanica chapmani</i> complex	Giant Ostracod	1000			Australia
Crustacea	Cyprididae <i>Reticypis</i> sp.	Seed shrimp	100		10	Australia
Crustacea	Cyprididae <i>Sarcipridopsis</i> sp.	Seed shrimp		10	30	Australia
Insecta	Curculionidae <i>Curculionid</i> sp.	Terrestrial weevil	1		4	
Insecta	Dytiscidae <i>Lancetes lanceolatus</i>	Diving beetles			1	Sthn Australia
Insecta	Dytiscidae <i>Necterosoma penicilatus</i> adults	Diving beetles	2	11	24	
Insecta	Hydrophilidae <i>Berosus discolour</i> adults	Scavenger Beetle			3	
Insecta	Ceratopogonidae sp.	Biting midge larvae			3	
Insecta	Chironomidae/Tanypodinae <i>Procladius paludicola</i>	Non-biting midge larvae			1	Australia
Insecta	Tabanidae larvae	March/Horse fly		5		
Insecta	Notonectidae <i>Anisops gratis</i>	Backswimmer	10			
Insecta	Lestidae <i>Austrolestes annulosus</i>	Blue Ringtail damselfly	50			Australia
Insecta	Leptoceridae <i>Symphitoneuria wheeleri</i>	Caddisfly larvae	3		1	Sthn Australia
Mollusca	Pomatiopsidae <i>Coxiella</i> sp.	Snail	3	5	17	
	Species richness		15	8	18	
	Invertebrate abundance		140	144	1775	



APPENDIX 2 - BIRDS FEEDING GUILDS

Waterbirds can be placed into guilds based on their foraging behaviour and principle food sources. Table 4: Waterbird feeding guilds and species observed on salt lakes of the region is based on feeding guilds determined by Kingsford et al (2010)¹².

Table 4: Waterbird feeding guilds and species observed on salt lakes of the region

Feeding Guild	Bird species observed on salt lakes in the region
Ducks –dabbling (upend for food) in the shallow water and littoral zone Food includes: Aquatic plants and animals and invertebrates, as well as gastropods and crustaceans.	Pacific Black Duck <i>Anas superciliosa</i> , Grey Teal <i>Anas gracilis</i> , Chestnut Teal <i>Anas castanea</i> , Blue-billed Duck <i>Oxyura australis</i> ,
Ducks – diving in deep or shallow water. Dives for bottom dwelling animals, invertebrates, plant material, small fish.	Musk Duck <i>Biziura lobate</i> , Hardhead <i>Aythya australis</i> Australasian Grebe <i>Tachybaptus novaehollandiae</i> Hoary-Headed Grebe <i>Poliocephalus poliocephalus</i>
Filter-feeding duck - using special lamellae (grooves) along the edges of the bill to filter insects, crustaceans and a variety of plants from the water.	Australasian Shoveler <i>Anas rhynchotis</i> , Pink-Eared Duck <i>Malacorhynchus membranaceus</i>
Specialist - feed almost entirely on vegetable matter, supplemented with only a few insects, worms and fish.	Eurasian Coot <i>Fulica atra</i> ,
Grazing – The Black Swan is a vegetarian. Grazing ducks eat algae, insects and molluscs or by grazing on grasslands.	Black Swan <i>Cygnus atratus</i> , Australian Shelduck <i>Tadorna tadornoides</i> , Australian Wood Duck <i>Chenonetta jubata</i> ,
Waders , foraging in littoral zone & mudflats. Waders feed on insects, especially chironomids, crustaceans, molluscs, vegetation, seeds and roots.	Banded Stilt <i>Cladorhynchus leucocephalus</i> , Black-winged Stilt <i>Himantopus himantopus</i> , Common Greenshank <i>Tringa nebularia</i> , Common Sandpiper <i>Actitis hypoleucos</i> , Hooded Plover <i>Thinornis rubricollis</i> , Red-Necked Avocet <i>Recurvirostra novaehollandiae</i>
Other birds , generalist feeders - frogs, insects, small fish and crustaceans found in shallow wetlands or in open grassy areas.	White-Faced Heron <i>Ardea pacifica</i> , Silver Gull <i>Chroicocephalus novaehollandiae</i>

¹² Kingsford, R. T, D. A. Roshier and J. L. Porter (2010) Australian waterbirds - time and space travellers in dynamic desert landscapes in *Marine and Freshwater Research*, 2010, 61, 875–884

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APPENDIX 3 – SELECTED PHOTOS FROM THE EVENT

Lake Matilda



Lake Matilda Bird Hide and inundated *Melaleuca cuticularis* saplings. (Images Geraldine Janicke)



Basil Schur giving an introductory talk to Citizen Scientist volunteers and members of the Albany Bird Group at Lake Matilda.



Children from the Year 5/6 class of Kendenup Primary School preparing to sample Lake Matilda for macroinvertebrates. (Image: Basil Schur)

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Geraldine Janicke explaining about macroinvertebrate groups to children from the Year 5/6 class of Kendenup Primary School. (Image: Basil Schur)



Steve Janicke explaining basic principles of water quality measurement to the Year 5/6 class of Kendenup Primary School. (Image: Basil Schur)

Kendenup Lakes Ecological Investigation Lake Meenulup



Lake Meenulup flats at the sampling site. (Image: Geraldine Janicke)



Moderate covering of the water mat *Lepilaena australis* in Lake Meenulup (Image: Geraldine Janicke)



Steve Janicke explaining simple water quality monitoring to Citizen Scientist volunteers and members of Albany Bird Group. (Image: Basil Schur)

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Citizen Scientist volunteers and members of the Albany Bird Group examining the aquatic macroinvertebrates from Lake Meenulup. (Image: Basil Schur)



Members of the Albany Bird Group make bird observations on Lake Meenulup. (Image: Basil Schur)

Kendenup Lakes Ecological Investigation Sandilands Project 3 lake



Sandilands Project 3 wetland with the constructed island. (Image: Geraldine Janicke)



Geraldine Janicke and a Citizen Scientist volunteer sample Sandilands Project 3 lake for macroinvertebrates. (Image: Basil Schur)



Left: Brad Kneebone recording bird observations. Right: Citizen Scientist volunteers doing a live pick of macroinvertebrates from Sandilands Project 3 lake. (Images: Basil Schur)