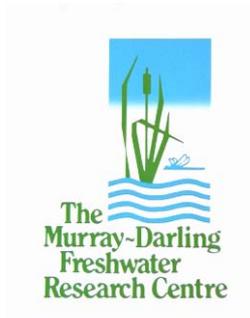


Monitoring of temporarily disconnected River Murray Wetlands:

Refilling Recommendations

by the
Murray-Darling Freshwater Research Centre
to the
South Australian Murray-Darling Basin
Natural Resource Management Board



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Background

The Murray-Darling Freshwater Research Centre (MDFRC) was engaged by the South Australian Murray-Darling Basin Natural Resources Management Board (SAMDBNRMB) to monitor eight wetlands in the Riverland region of South Australia as part of the Living Murray Initiative.

Six of these wetlands were temporarily disconnected from the River Murray in 2007, in order to achieve water savings. These wetlands are Nelwart Swamp, Lake Bonney, Yatco Lagoon, Jaeschke Lagoon, Ross Lagoon and Murbko South. Two additional wetlands that have not been disconnected (Tanyaca Creek and Donald Flat Lagoon) are being monitored as reference sites.

Monitoring of these wetlands includes sampling of eight parameters (Table 1). To date, the parameters being measured 6-weekly have been five times; those being measured 3 monthly have been assessed twice, and the parameters being assessed 6-monthly has been assessed once. Blue-green algae sampling has been undertaken on 12 occasions. Bi-monthly reports have been submitted for all wetlands (reports are 6-weekly for Lake Bonney) to SAMDBNRMB to detail the various sampling period's findings.

Table 1. Monitoring parameters and frequency

	Parameter	Frequency
1.	Water quality	6 weekly ¹
2.	Water level	6 weekly ¹
3.	Groundwater	6 weekly
4.	Vegetation tree health	6 weekly
5.	Vegetation photopoints	6 weekly
6.	Blue-green algae	Fortnightly over summer Monthly over winter
7.	Fish	3 monthly
8.	Vegetation understorey	6 monthly

Overview

Water levels have decreased at the six disconnected wetlands following the installation of barriers and consequent disconnection of the wetland systems. Two wetlands, Ross Lagoon and Jaeschke Lagoon, are currently entirely dry. Nelwart Swamp is virtually dry, supporting two small pools of surface water. Yatco Lagoon, Murbko South and Lake Bonney currently have water covering a substantial proportion of each wetland. Nonetheless, water levels have dropped considerably since monitoring commenced in November 2007.

Changes in abundance and diversity of understorey vegetation (including aquatic and riparian) have been observed at all sites. Small changes in the condition (based on foliage condition) of River Red Gums and Black Box trees at each wetland have been recorded. These changes could potentially be a result of drought conditions, seasonal change (influences of flowering and growth), and/or other life-history traits (natural senescence).

Fish deaths have occurred as water levels decrease, particularly because barriers have impeded fish movement out of the drying wetland and results in death by asphyxiation or by predation by birds. It is reasonable to expect a decrease in abundance and diversity of surveyed fish species as a wetland contracts through drying. There is no evidence that water quality, including dissolved oxygen (DO), has contributed to any fish deaths. No fish species of conservation concern were sampled within the wetlands.

The current ecological status of each wetland is summarised in Table 2. The reported condition of trees is based on observable changes in foliage condition between the first sampling period to the most recent to give overall averages. Each wetland has 30 trees being monitored. All threshold levels mentioned are as stipulated by ANZECC (2000).

Table 2. Current ecological status of each wetland

Wetland	Dry/Wet?	Current ecological status
Nelwart Swamp	Almost completely dry	<ul style="list-style-type: none"> • Fish death has occurred • 10 trees have decreased in crown condition, 3 have increased • EC levels increased from 980 to 14580 uS/cm • pH levels reached 10.76 on 1 sampling period, last sampling recorded 9.1 • DO concentrations remain above 6mg/L • Groundwater movement away from the wetland
Lake Bonney	Water still present, however, levels have dropped 0.5m since January 2008	<ul style="list-style-type: none"> • Increase in fish diversity between November and February • 1 tree increased in health, with 2 decreasing • On 2 occasions pH levels have recorded above threshold level of 9, with highest reading on 23rd April 2008 of 9.73 • DO concentrations of surface readings have remained above 6mg/L • DO concentrations of bottom of lake on average recorded 9-10mg/L, on 3 occasions levels fell below threshold level of 6mg/L • EC levels on average have increased, with a ~1200uS/cm decrease between the last 2 sampling periods • Species of blue-green algae known to be capable of producing toxins were identified in samples collected on 12 March 2008. These species have not been recorded in subsequent samples • Groundwater gradient away from the wetland
Yatco Lagoon	Substantial proportion of wetland still retains water	<ul style="list-style-type: none"> • Groundwater directional away from wetland, with EC values decreasing • Surface water EC increased as wetland dries from 1800 to 6750 uS/cm • pH levels above threshold of 9 (9.64)

		<ul style="list-style-type: none"> • Water temperature ranges from 16-32 °C, influenced by ambient air temperatures • DO above threshold of 6mg/L • Introduced fish species surveyed have increased in abundance • 3 trees increased in health while 2 decreased
Jaeschke Lagoon	Lagoon is dry	<ul style="list-style-type: none"> • Fish deaths has occurred • 11 trees increased in tree health, 1 declined • Water quality sampled only once in November, pH recorded 9.4 and EC 2000 uS/cm • Groundwater gradient away from the wetland
Ross Lagoon	Lagoon is dry	<ul style="list-style-type: none"> • Water quality sampled only once in November, pH recorded 9.97 and EC 37400 uS/cm • Fish deaths and/or migration has occurred • 6 trees have declined in health, none have increased • Health of 2 trees categorised as near dead • Groundwater gradient away from the wetland
Murbko South	Substantial proportion of wetland still retains water	<ul style="list-style-type: none"> • Increase in surveyed native fish abundance (CPUE) • 3 trees decreased in crown condition and 5 increased • 2 trees have recorded a near dead status in April 2008 • EC levels have increased from 870 to 1670 uS/cm • pH levels have averaged over time at 9.2, with levels reaching as high as 10.33 • DO concentration has remained above 6mg/L • Threatened species, <i>Elatine gratioloides</i>, observed in small numbers in November 2007 • Groundwater gradient towards the wetland
Tanyaca Creek (reference site)	Disconnection has not occurred, depth of water in centre of channel >2m	<ul style="list-style-type: none"> • Increase in surveyed fish species diversity and abundance (CPUE) • 3 trees increased in crown condition while 4 decreased

		<ul style="list-style-type: none"> • EC remained relatively stable averaging 264 uS/cm • pH levels have remained high with 4 of 6 sampling periods recording 9 or higher • DO concentrations dropped below 6mg/L on 1 occasion recording 5.77
Donald Flat Lagoon (reference site)	Disconnection has not occurred, depth of water in centre of channel >2m	<ul style="list-style-type: none"> • Increase in surveyed native fish species abundance (CPUE) and decrease in introduced species • 8 trees decreased in crown condition health and only 1 increased • EC has decreased over time, April reading 510uS/cm • pH levels below 9 on all occasions, except December 2007 • Water temperature range 16-24 °C • DO concentrations have remained above 6mg/L

Significant variations to key water quality parameters such as pH and dissolved oxygen occur as a result of natural process throughout the diurnal cycle. Consequently, readings that are taken at one spot on one occasion in each sampling period need to be interpreted with caution. This issue is partially addressed in this project by the installation of real time water quality loggers at Lake Bonney.

Refilling recommendations:

The water requirements of individual wetlands are defined by factors including duration, frequency, depth, timing and extent of inundation. Variation in these parameters influence on the ecological communities a wetland supports. The temporary disconnection of the wetlands being monitored by this water-saving project has begun, with a complete or partial drying state currently achieved.

The fundamental biogeochemical processes necessary for healthy ephemeral wetland function that occur as wetlands dry will be in early phases within these wetlands. In most Murray-Darling Basin ephemeral wetlands, a dry phase of at least 6 months would adequately allow for the ephemeral wetland processes, such as microbial soil processes and/or vegetation succession. Sediments will benefit from the drying out, and regeneration of terrestrial plants should establish on the wetland bed, fuelling productivity boom later, when refilling occurs. A flooding regime of once every 2-3 years will aid increases in biodiversity at these sites, especially in these wetlands which have been historically inundated for longer than 2 years.

The refilling of wetlands has potential to benefit native fish species, but only if connectivity to the River Murray is maintained. Due to the disconnectedness of several wetlands via blockbanks, there is limited capability for fish or other fauna to re-establish back into these wetlands from the main river channel, especially where refilling is via pumping mechanisms. Adults of large-body fish species are likely to be precluded from these wetlands via pumping. This may not be a significant concern since no high conservation fish species were recorded. This method of refilling would ensure adult carp do not re-establish immediately in these wetlands. If water is to be put back into any wetlands which have connectivity to the River Murray, consideration should be given to the installation of carp screens whilst they are dried down and before refilling occurs.

A desirable zooplankton and macroinvertebrate community may be able to re-establish if there is a viable egg bank stored in the sediment of these wetlands and/or they are transferred through pumps. Establishment of a diverse and abundant invertebrate community will (i) shape the fish community that can develop within the wetlands; and (ii) influence the bird species that would frequent these wetlands.

No long-term or irreversible problems attributed to drying have currently been observed during the monitoring of the wetlands. Current die-back of foliage of some River Red Gums may be the result of natural seasonal and/or senescing processes, so rewetting now would be of no benefit to them. Their longer term health would be dependant on a longer (> 6 months) dry phase, and consideration for a return to an ephemeral state over the long term will ensure greatest ecological benefit. System wide, there are still many permanently connected wetlands in the Murray-Darling Basin, so if any of these wetlands were returned to an ephemeral state, it would be of benefit locally, but also to the system scale.

References

ANZECC (2000). National water quality management strategy. Australian and New Zealand Guidelines for fresh and marine water quality. Australia and New Zealand Environment and Conservation Council, and Agriculture and Resource Management Council of Australia and New Zealand, Canberra.