Aquatic fauna survey of the terminal section of Washpen Creek, Euston NSW.

Bernard McCarthy, Prue McGuffie and Susie Ho

Report to the NSW Murray Wetlands Working Group Inc. as part of the Lake Caringay Rehabilitation Project.

Murray-Darling Freshwater Research Centre

Final Report

July 2007
Aquatic fauna survey of the terminal section of Washpen Creek, Euston NSW.

Report to the NSW Murray Wetlands Working Group.  
Head Office: P.O. Box 797, Albury NSW 2640

The report forms part of the Lake Caringay Rehabilitation Project.

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Report citation


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Cover photograph

Eastern banjo frog *Limnodynastes dumerili* at Washpen Creek, November 2006.

Photographs in this report are by B. McCarthy (© MDFRC) unless noted otherwise.
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Aquatic fauna survey of Washpen Creek, Euston NSW
Acknowledgements

The study was funded by the NSW Murray Wetlands Working Group Inc (NSW MWWG) as part of the Lake Caringay Rehabilitation Project.

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The Lower Murray Darling Catchment Management Authority kindly provided aerial imagery of the Euston Lakes system and the Murray-Darling Basin Commission and NSW Department of Natural Resources provided bathymetric survey data for Washpen Creek.

The report has benefited from reviews by Iain Ellis (MDFRC), Mark Henderson (MDFRC), Clayton Sharpe (MDFRC), James Val (DECC), Paula D’Santos (NSW MWWG), Deb Nias (NSW MWWG), Peter Ewin (DECC) and Claire Wilkinson (LMDCMA).

Thanks also to Pam Clunie (ARI) and John Koehn (ARI) for discussions of freshwater catfish.

Ethics and permits

Fish sampling was performed in accordance with Charles Sturt University Ethics Protocol number 06/100 and NSW Department of Primary Industries Scientific Collection Permit No. F98/130(B) – 3.0.

List of acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARI</td>
<td>Arthur Rylah Institute for Environmental Research</td>
</tr>
<tr>
<td>BACI</td>
<td>Before-After-Control-Impact (experimental design)</td>
</tr>
<tr>
<td>DECC</td>
<td>Department of Environment and Climate Change</td>
</tr>
<tr>
<td>DNR</td>
<td>Department of Natural Resources</td>
</tr>
<tr>
<td>GPS</td>
<td>Global Positioning System</td>
</tr>
<tr>
<td>LMDCMA</td>
<td>Lower Murray Darling Catchment Management Authority</td>
</tr>
<tr>
<td>MDBC</td>
<td>Murray-Darling Basin Commission</td>
</tr>
<tr>
<td>MDFRC</td>
<td>Murray-Darling Freshwater Research Centre</td>
</tr>
<tr>
<td>NSW MWWG</td>
<td>New South Wales Murray Wetlands Working Group Inc.</td>
</tr>
<tr>
<td>SA1</td>
<td>Survey Area 1 (section of Washpen Creek downstream of block bank)</td>
</tr>
<tr>
<td>SA2</td>
<td>Survey Area 2 (section of Washpen Creek upstream of block bank)</td>
</tr>
<tr>
<td>TL</td>
<td>Total length</td>
</tr>
<tr>
<td>W</td>
<td>Weight</td>
</tr>
</tbody>
</table>
Executive summary

The NSW Murray Wetlands Working Group Inc. (NSW MWWG) is investigating opportunities for the rehabilitation of Lake Caringay through the return of natural flood flows to the wetland. A short-term option of pumping water to the lakebed from a permanently inundated section of Washpen Creek is also being considered. This management option will involve the repair of water leakage from an earthen block bank and a steel regulator that will allow the terminal 1.1km reach of Washpen Creek to receive an intermittent water regime rather than a permanent one. The NSW MWWG commissioned the MDFRC to undertake an aquatic survey of fish, frogs and water quality at the terminal section of Washpen Creek in Spring 2006 and Autumn 2007 to determine if there are any species of ecological significance that may be impacted by the proposed management activity.

Four sites were sampled in the 1.1km Survey Area 1 (SA1) downstream of the block bank. Four sites were also sampled in Survey Area 2 (SA2), a 1.1km ‘reference’ section of Washpen Creek immediately upstream of the block bank.

A total of 7,303 individual fish representing nine species were sampled with large and small fyke nets. The six native fish species consisted of freshwater catfish *Tandanus tandanus*, carp gudgeon *Hypseleotris* spp., flathead gudgeon *Philypnodon grandiceps*, Australian smelt *Retropinna semoni*, dwarf flathead gudgeon *Philypnodon* sp. and flyspecked hardyhead *Craterocephalus stercusmuscarum fulvus*, with the exotic fish being common carp *Cyprinus carpio*, goldfish *Crassius auratus* and eastern gambusia *Gambusia holbrooki*. The most abundant large bodied fish was freshwater catfish (n=31, 48%) followed by common carp (37%) and goldfish (15%). Freshwater catfish and flyspecked hardyhead were present only in SA2.

Five species of frog were sampled at Washpen Creek by listening for male calls and spotlighting. The surveyed species included Peron’s tree frog *Litoria peroni*, spotted marsh frog *Limnodynastes tasmaniensis*, barking marsh frog *Limnodynastes fletcheri*, eastern banjo frog *Limnodynastes dumerili* and eastern sign-bearing froglet *Crinia parinsignifera*. None of the species are considered threatened under state or commonwealth legislation. The threatened southern bell frog *Litoria raniformis* known to occur in the region was not sampled. Most of the frogs sampled in November 2006 were recorded as male calls, and no frogs were heard calling during the recording periods in April 2007. Higher numbers of frogs were observed with spotlighting in April 2007 than November 2006.

The Washpen Creek water quality variables of electrical conductivity, turbidity, ammonia nitrogen, oxides of nitrogen and filterable reactive phosphorus were at levels considered “low risk” for creating adverse biological effects. Total phosphorus and pH levels were mostly below the guideline trigger values for slightly disturbed lowland rivers and are typical of other lowland river wetlands of the region. Total nitrogen concentrations exceeded guidelines for lowland rivers but were not considered a risk for wetland systems as they are typical of the Euston Lakes system and other local wetlands. Dissolved oxygen concentrations were low, particularly in SA1, and may be limiting the habitat for some biota including some species of fish.

The following recommendations are made based on the findings of this study, and take into account the recent proposal for isolating all of the Euston Lakes systems as part of drought water recovery measures:

- An ephemeral water regime is returned to the 1.1km terminal section of Washpen Creek downstream of the block bank (Survey Area 1) pending hydrogeological advice.
- Assess and monitor the freshwater catfish population within the Euston Lakes system.
- Investigate the ecology of the section of Washpen Creek downstream of the block bank following any change in water regime.
- Undertake a sulfidic sediment assessment at Washpen Creek.
Introduction

Background

Lake Caringay is a large ephemeral deflation basin wetland (1022ha; RMWD, 2003) located 14km east of Euston. It is the largest of three lakes that make up the wetland and floodplain complex termed the Euston Lakes system (Figure 1). The other lakes, Dry Lake (589ha) and Lake Benanee (748ha) (areas from McCarthy et al., 2004), are permanently inundated from the Murray River due to the elevated river level of the weir pool created by the Euston weir (Murray River Lock and Weir #15). Lake Caringay has not received flood flows since the early 1960s when ‘block bank’ regulatory structures were installed across two inlets (Washpen Creek and Caringay Creek) (Figure 2) to allow agricultural production on the lakebed.

The NSW Murray Wetlands Working Group Inc. (NSW MWWG) is investigating opportunities for the rehabilitation of Lake Caringay through the return of natural flood flows to the wetland. A short-term option of pumping water to the lakebed from a permanently inundated section of Washpen Creek is also being considered given the current drought conditions.

Washpen Creek begins at Dry Lake and is permanently inundated along most of its length due to the Euston weir pool. It extends approximately 12km to a block bank (see Figure 2). In recent years a further 1.1km section of Washpen Creek downstream of the block bank has become permanently inundated due to water leakage through both an eroded section of the earthen block bank and a steel regulator that feeds an excavated bypass channel around the block bank (Figure 3).

The NSW MWWG is considering repairing the block bank and regulator to allow water to be pumped to Lake Caringay via the bypass channel. This management action will allow the return of a wetting and drying cycle to the currently permanently inundated 1.1km length of Washpen Creek downstream of the block bank. The water regime in the section of Washpen Creek upstream of the block bank is not expected to change as a result of this management action.

Study objectives

The NSW MWWG has commissioned the MDFRC to undertake an aquatic survey of fish, frogs and water quality at the terminal section of Washpen Creek in Spring 2006 and Autumn 2007 to determine if there are any species of ecological significance downstream of the block bank. The study has the following objectives (NSW MWWG, 2006):

- Gauge the condition of Washpen Creek;
- Collect baseline data regarding the diversity and abundance of aquatic fauna (fish and frogs) and water quality;
- Provide advice and recommendations to assist future management of the section of focus of Washpen Creek.

This report details the results of this study that was conducted in parallel with a flora survey detailed elsewhere (D’Santos, 2007).
Figure 1. Overview of the Euston Lakes system. Stars highlight lake water quality assessment sites. Image courtesy of LMDCMA.

Figure 2. Detail of the Washpen Creek study area and sites. SA = Survey Area. Image courtesy of LMDCMA.
Figure 3. Detail of the block bank, regulator and bypass channel at Washpen Creek. Image courtesy of LMDCMA.
Methods

Surveys of fish, frogs and water quality were conducted at Washpen Creek in spring 2006 (30/10/06-1/11/06) and autumn 2007 (16/4/07-18/4/07), referred to henceforth as the November 2006 and April 2007 surveys, respectively.

Sites

The length of Washpen Creek downstream of the block bank that held surface water was determined at the time of the first survey to be 1.1km and is termed Survey Area 1 (SA1) to be consistent with D’Santos (2007). Four sites (#1-4) were selected in SA1 that (a) represented the different habitat types present, (b) maximised the distance between sites and (c) had an area of open water >0.3m deep in which to set fish nets. Sites were numbered sequentially from the most downstream site. The same length of creek upstream of the regulator was also mapped (Survey Area 2) and four sites (#5-8) selected based on the above criteria (Figure 2). These upstream sites act as “reference” sites and allow a comparison of the ecological attributes in the section of Washpen Creek identified for potential drying against a section of the same creek that is to remain permanently inundated.

The position of each site was recorded with a Garmin etrex GPS (Position format: UTM/UPS; Map Datum: GDA) and the channel width determined with an Opti-Logic 800XL distance measurer.

Fish

Two large fyke nets and two small fyke nets were deployed at each of the eight Washpen Creek sites. Large fyke nets (30mm stretched mesh) had a single wing (8m x 0.65m) attached to the centre of the first of seven supporting hoops (Ø = 0.55m). Larval fyke nets (<1mm stretched mesh) had dual wings (each 2.5m x 1.2m) with three supporting hoops (Ø = 0.55m) in the main body of the net. A rigid plastic grid with square openings (5cm x 5cm) was attached to the first support hoop to exclude large fish. Even and odd numbered sites were surveyed on consecutive nights. The times of net deployment (15:00-18:00) and hauling (09:00-13:00) were recorded for each net. All fish captured were identified to species level (McDowell, 1996; Allen et al., 2002) (with the exception of *Hypseleotris* spp.; see Bertozzi et al., 2000) and counted. Fish from the large nets were also measured and weighed. A seine net was hauled at a minimum of five additional sites for each survey to actively sample midwater and benthic species. Only fish species presence (not abundance) was measured for the seine nets. Native fish were returned alive to the water at the point of capture, while exotic fish were anaestheticised to Stage 4 (euthanasia) by submersion in Benzocaine solution (100 mg.L⁻¹) and buried.

For calculations of fish biomass, all small bodied fish were estimated to be 1g based on the weight-frequency equations of Scholz et al. (2006).

Frogs

Frogs were assessed at each of the eight Washpen Creek sites. Even and odd numbered sites were surveyed on consecutive nights. Frogs were identified to species level primarily by listening for the male advertisement calls. Calls were recorded for 10 minutes at each site with a Sony digital sound recorder at least 20 minutes after dusk (from 19:50-23:30). The abundance of calling males was counted for each species. The call of the southern bell frog *Litoria raniformis* was also played back for 1 minute in an attempt to elicit calling from any males of this threatened species present at the site. Spotlighting was undertaken for 10 minutes at each site (two observers) to visually identify the frogs present.
Surface water quality

Surface water quality was assessed at the eight Washpen Creek sites on 1/11/06 and 18/4/07. To help contextualise the Washpen Creek water quality, single sites at Dry Lake (54H 670276E, 6178017N), Lake Benanee (54H 672313E, 6178421N) (see Figure 1) and the Murray River at Robinvale (54H 662506E, 6172295N) were also assessed. The physico-chemical variables temperature (°C), pH, turbidity (NTU), electrical conductivity (µS.cm⁻¹@ 25°C) and dissolved oxygen (mg.L⁻¹) were measured at all sites at a depth of 0.2 m with a Horiba U-10 Water Quality Checker (Australian Scientific Ltd.). Nutrient samples for determinations of concentrations of oxides of nitrogen, ammonia nitrogen and filtered reactive phosphorus (0.01 L water sample filtered through a 0.2 µm filter) and total nitrogen and total phosphorus (0.2 L sample) were collected at a depth of 0.2 m at all sites except for Lake Benanee. Samples were frozen in the field and analysed at a NATA-certified laboratory (MDFRC, Wodonga) following standard methods.
Results

Site descriptions

Details of the characteristics of each Washpen Creek site are presented in Table 1. Photographs of each Washpen Creek site at each survey time are presented in Appendix A. Photographs of the Dry Lake, Lake Benanee and Murray River sites are presented in Appendix B. Weather was fine during both surveys, being mostly sunny (maximum temperatures around 25°C) with only light winds at times.

Table 1. Characteristics of the Washpen Creek sites.

<table>
<thead>
<tr>
<th>Site</th>
<th>Position</th>
<th>GPS</th>
<th>Width</th>
<th>Max. Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Survey Area 1</td>
<td>54H 672445 6171743</td>
<td>23m</td>
<td>0.30m</td>
</tr>
<tr>
<td>2</td>
<td>Survey Area 1</td>
<td>54H 672356 6171780</td>
<td>21m</td>
<td>0.50m</td>
</tr>
<tr>
<td>3</td>
<td>Survey Area 1</td>
<td>54H 672321 6171892</td>
<td>28m</td>
<td>0.80m</td>
</tr>
<tr>
<td>4</td>
<td>Survey Area 1</td>
<td>54H 672391 6171952</td>
<td>27m</td>
<td>0.65m</td>
</tr>
<tr>
<td>5</td>
<td>Survey Area 2</td>
<td>54H 672088 6172094</td>
<td>29m</td>
<td>1.00m</td>
</tr>
<tr>
<td>6</td>
<td>Survey Area 2</td>
<td>54H 671960 6172346</td>
<td>44m</td>
<td>0.94m*</td>
</tr>
<tr>
<td>7</td>
<td>Survey Area 2</td>
<td>54H 671782 6172524</td>
<td>45m</td>
<td>1.57m*</td>
</tr>
<tr>
<td>8</td>
<td>Survey Area 2</td>
<td>54H 671855 6172810</td>
<td>42m</td>
<td>1.33m*</td>
</tr>
</tbody>
</table>

*Data courtesy of MDBC and NSW DNR from a bathymetric survey undertaken on 18 April 2007.

Surface water extended to the same point along Washpen Creek for both surveys (Figure 2). A bathymetric survey undertaken during the April 2007 sampling measured the water level at Washpen Creek as 47.82 m AHD (data courtesy of MDBC and NSW DNR). In comparison, the river level immediately upstream of the Euston weir is generally maintained at 47.60 m AHD.

Fish

Abundance and diversity

A total of 7,303 individual fish representing nine species were sampled in the two surveys of Washpen Creek (Table 2). Six of the nine fish species were native, with the exotic fish being common carp Cyprinus carpio, goldfish Carassius auratus and eastern gambusia Gambusia holbrooki. Freshwater catfish Tandanus tandanus (n=31) and flyspecked hardyhead Craterocephalus stercusmuscarum fulvus (n=4) were present only in the section of Washpen Creek upstream of the block bank.

The most abundant fish was eastern gambusia Gambusia holbrooki (84% of total catch), followed by carp gudgeon Hypseleotris sp. (11.4%) and flathead gudgeon Philypnodon grandiceps (2.5%). The remaining six species each comprised less than 1% of the total catch.

Freshwater catfish was the most abundant large bodied fish (48%) followed by common carp (37%) and goldfish (15%).
Table 2. Fish sampled at Washpen Creek in November 2006 and April 2007

<table>
<thead>
<tr>
<th>Common name</th>
<th>Species name</th>
<th>Family</th>
<th>Nov06</th>
<th>Apr07</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>SA1</td>
<td>SA2</td>
</tr>
<tr>
<td>Freshwater catfish</td>
<td>Tandanus tandanus</td>
<td>Plotosidae</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Common carp*</td>
<td>Cyprinus carpio</td>
<td>Cyprinidae</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Goldfish*</td>
<td>Carassius auratus</td>
<td>Cyprinidae</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Eastern gambusia*</td>
<td>Gambusia holbrooki</td>
<td>Poeciliidae</td>
<td>706</td>
<td>261</td>
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<tr>
<td>Carp gudgeon</td>
<td>Hypseleotris spp.</td>
<td>Gobiidae</td>
<td>93</td>
<td>436</td>
</tr>
<tr>
<td>Flathead gudgeon</td>
<td>Philypnodon grandiceps</td>
<td>Gobiidae</td>
<td>9</td>
<td>80</td>
</tr>
<tr>
<td>Australian Smelt</td>
<td>Retropinna semoni</td>
<td>Retropinnidae</td>
<td>9</td>
<td>26</td>
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<tr>
<td>Dwarf flathead gudgeon</td>
<td>Philypnodon sp.</td>
<td>Gobiidae</td>
<td>3</td>
<td>14</td>
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<tr>
<td>Flyspecked hardyhead</td>
<td>Craterocephalus sternusmuscarum fulvus</td>
<td>Atherinidae</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Totals</td>
<td></td>
<td></td>
<td>822</td>
<td>833</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>1655</td>
<td>5648</td>
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<tr>
<td></td>
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</tbody>
</table>

*Biomass*

The weights of the large bodied fish species are presented in Appendix C. The proportions of native and exotic fish biomass are presented in Table 3 (based on an estimate of a mean mass of 1g for each small-bodied fish (Scholz et al., 2006)).

Table 3. Native and exotic fish biomass at Washpen Creek in November 2006 and April 2007

<table>
<thead>
<tr>
<th>Group</th>
<th>Nov06</th>
<th>Apr07</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SA1</td>
<td>SA2</td>
</tr>
<tr>
<td>Native</td>
<td>2%</td>
<td>52%</td>
</tr>
<tr>
<td>Exotic</td>
<td>98%</td>
<td>48%</td>
</tr>
</tbody>
</table>

Freshwater catfish *Tandanus tandanus* comprised 36% and 55% of the total fish biomass in Survey Area 2 in November 2006 and April 2007, respectively.

*Seine nets*

No additional fish species to those of Table 2 were sampled with the seine nets.

*Freshwater catfish*

A power function best described the length-weight relationship for freshwater catfish (n=29) over the 164 - 415mm total length range sampled (Figure 4). A length-frequency histogram for the 29 freshwater catfish of Washpen Creek is provided in Figure 5. Two of the 31 freshwater catfish sampled were not measured or weighed prior to their release.
y = 3E-06x^{3.2014}
R^2 = 0.9862

Figure 4. Length-weight relationship for freshwater catfish at Washpen Creek (n=29).

Figure 5. Length-frequency histogram of freshwater catfish at Washpen Creek (n=29).

**Bycatch and other observations**

Bycatch in the fish nets included yabbies, corixids, notonectids, shrimp, dyticids, snails, leeches and three eastern long-necked turtles *Chelodina longicollis*. All bycatch was returned alive to the water at the point of capture. Other observations at Washpen Creek included two water rats *Hydromys chrysogaster* and an echidna *Tachyglossus aculeatus*.

Photographs of some of the fish, frogs and other animals encountered at Washpen Creek are shown in Appendix D.
Frogs

Five species of frog were recorded at Washpen Creek. The southern bell frog (or growling grass frog) *Litoria raniformis* was not heard or observed at any of the sites.

Most of the frogs sampled in the November 2006 sampling were recorded as male calls, and no frogs were heard calling during the recording periods in April 2007 (Table 4). In contrast, higher numbers of frogs were observed with spotlighting during the second survey (Table 5).

One Peron’s tree frog and one eastern sign-bearing froglet were heard calling near Site 5 (SA2) outside of the recording times in the April 2007 survey.

Table 4. Frogs sampled as male calls at Washpen Creek in November 2006 and April 2007

<table>
<thead>
<tr>
<th>Common name</th>
<th>Species</th>
<th>November 2006</th>
<th>April 2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peron’s tree frog</td>
<td><em>Litoria peroni</em></td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>Spotted marsh frog</td>
<td><em>Limnodynastes tasmaniensis</em></td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>Barking marsh frog</td>
<td><em>Limnodynastes fletcheri</em></td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>Eastern banjo frog</td>
<td><em>Limnodynastes dumerili</em></td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Eastern sign-bearing froglet</td>
<td><em>Crinia parinsignifera</em></td>
<td>31</td>
<td>0</td>
</tr>
<tr>
<td>Totals</td>
<td></td>
<td>72</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 5. Frogs sampled by spotlighting at Washpen Creek in November 2006 and April 2007

<table>
<thead>
<tr>
<th>Common name</th>
<th>Species</th>
<th>November 2006</th>
<th>April 2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peron’s tree frog</td>
<td><em>Litoria peroni</em></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Spotted marsh frog</td>
<td><em>Limnodynastes tasmaniensis</em></td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Barking marsh frog</td>
<td><em>Limnodynastes fletcheri</em></td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>Spotted or Barking marsh frog*</td>
<td><em>Limnodynastes tasmaniensis or fletcheri</em></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Eastern banjo frog</td>
<td><em>Limnodynastes dumerili</em></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Eastern sign-bearing froglet</td>
<td><em>Crinia parinsignifera</em></td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Totals</td>
<td></td>
<td>5</td>
<td>14</td>
</tr>
</tbody>
</table>

*Moved away before species identification could occur

Some habitat types supported higher abundances of frogs relative to other sites. Frogs were in greatest abundance in areas of low gradient terrain with shallow water depths and short grass cover adjacent to tall stands of cumbungi (Figure 6). Areas with steeper banks and deeper water had fewer calling and spotlighted frogs.
Figure 6. Habitat near Site 3 (SA1) supporting a relatively high abundance of frogs.

Surface water quality

Measurements of the surface water quality variables at the Washpen Creek sites are summarised in Table 6. Median values (with ranges in parentheses) are shown. Surface water quality results for Dry Lake, Lake Benanee and the Murray River are provided in Table 7.
Table 6. Water quality values at Washpen Creek (median values with ranges in parentheses) in November 2006 and April 2007

<table>
<thead>
<tr>
<th>Variable</th>
<th>November 2006</th>
<th>April 2007</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SA1</td>
<td>SA2</td>
</tr>
<tr>
<td>Time</td>
<td>08:50–10:10</td>
<td>10:20–12:00</td>
</tr>
<tr>
<td>Electrical Conductivity</td>
<td>807 (687–956)</td>
<td>556 (514–628)</td>
</tr>
<tr>
<td>pH</td>
<td>7.1 (7.0–7.2)</td>
<td>7.8 (7.2–8.7)</td>
</tr>
<tr>
<td>Turbidity (NTU)</td>
<td>19 (16–34)</td>
<td>16 (5–27)</td>
</tr>
<tr>
<td>Dissolved Oxygen (mg.L⁻¹)</td>
<td>2.7 (1.8–4.6)</td>
<td>6.4 (2.3–6.6)</td>
</tr>
<tr>
<td>Temperature (°C)</td>
<td>15.7 (14.3–16.9)</td>
<td>18.1 (17.2–19.5)</td>
</tr>
<tr>
<td>Total Nitrogen (µg.L⁻¹)</td>
<td>1310 (1210–1480)</td>
<td>900 (860–1020)</td>
</tr>
<tr>
<td>Ammonia Nitrogen (µg.L⁻¹)</td>
<td>&lt;5 (&lt;5 – 10)</td>
<td>&lt;5 (&lt;5)</td>
</tr>
<tr>
<td>Oxides of Nitrogen (µg.L⁻¹)</td>
<td>5 (4 – 5)</td>
<td>5 (4 – 9)</td>
</tr>
<tr>
<td>Total Phosphorus (µg.L⁻¹)</td>
<td>51 (40 – 61)</td>
<td>35 (29 – 37)</td>
</tr>
<tr>
<td>Filterable Reactive Phosphorus (µg.L⁻¹)</td>
<td>11 (9 – 12)</td>
<td>9 (8 – 9)</td>
</tr>
</tbody>
</table>

Electrical conductivity increased along a gradient when moving from the Murray River to Dry Lake and the Washpen Creek sites (Figure 7), with electrical conductivity at each Washpen Creek site greater during the April 2007 survey.

Figure 7. Electrical conductivity (µS.cm⁻¹@25°C) at various study sites in November 2006 and April 2007.
Table 7. Water quality values at Dry Lake, Lake Benanee and the Murray River in November 2006 and April 2007

<table>
<thead>
<tr>
<th>Variable</th>
<th>Dry Lake</th>
<th></th>
<th>Murray River</th>
<th></th>
<th>Lake Benanee</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nov06</td>
<td>Apr07</td>
<td>Nov06</td>
<td>Apr07</td>
<td>Nov06</td>
<td>Apr07</td>
</tr>
<tr>
<td>Time</td>
<td>14:40</td>
<td>15:20</td>
<td>15:10</td>
<td>15:45</td>
<td>14:15</td>
<td>15:00</td>
</tr>
<tr>
<td>Electrical Conductivity (µS.cm⁻¹@25°C)</td>
<td>255</td>
<td>162</td>
<td>96</td>
<td>111</td>
<td>1190</td>
<td>1210</td>
</tr>
<tr>
<td>pH</td>
<td>7.2</td>
<td>7.8</td>
<td>7.9</td>
<td>8.3</td>
<td>8.5</td>
<td>8.9</td>
</tr>
<tr>
<td>Turbidity (NTU)</td>
<td>435</td>
<td>250</td>
<td>29</td>
<td>16</td>
<td>621</td>
<td>109</td>
</tr>
<tr>
<td>Dissolved Oxygen (mg.L⁻¹)</td>
<td>7.9</td>
<td>9.4</td>
<td>8.5</td>
<td>10.0</td>
<td>8.3</td>
<td>10.5</td>
</tr>
<tr>
<td>Temperature (°C)</td>
<td>21.9</td>
<td>23.3</td>
<td>21.8</td>
<td>21.6</td>
<td>19.8</td>
<td>22.4</td>
</tr>
<tr>
<td>Total Nitrogen (µg.L⁻¹)</td>
<td>983</td>
<td>687</td>
<td>303</td>
<td>338</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ammonia Nitrogen (µg.L⁻¹)</td>
<td>&lt;5</td>
<td>&lt;5</td>
<td>&lt;5</td>
<td>&lt;5</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Oxides of Nitrogen (µg.L⁻¹)</td>
<td>6</td>
<td>4</td>
<td>5</td>
<td>8</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total Phosphorus (µg.L⁻¹)</td>
<td>138</td>
<td>120</td>
<td>37</td>
<td>35</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Filterable Reactive Phosphorus (µg.L⁻¹)</td>
<td>11</td>
<td>12</td>
<td>10</td>
<td>8</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Dissolved oxygen was low at several Washpen Creek sites, particularly Sites 1-4 of SA1, but also at Site 6 where the floating fern *Azolla pinnata* covered the water surface (see Appendix A). The turbidity of the surface water was low at all Washpen Creek sites and the Murray River, but higher at the lake sites.

Interpretation of the surface water quality values is provided in the Discussion.
Discussion

This study assessed the ecological condition of the terminal section of Washpen Creek through the sampling of fish, frogs and surface water quality. To the authors’ knowledge, this and the concurrent flora survey (D’Santos, 2007) are the first detailed ecological surveys of Washpen Creek.

The primary area of focus of this study was Survey Area 1 (SA1) downstream of the block bank, as it is this area that may receive a changed water regime from permanent to intermittent. An important question therefore, is whether there are any fish or frog species present in SA1 that are not present in the “reference” SA2. A second important question is whether there are any species present in SA1 that are listed as threatened under state or commonwealth legislation and may be impacted by a changed water regime.

All species of fish, and all but one species of frog, sampled in SA1 were also present in SA2. No fish or frog species recorded in SA1 is listed as threatened in state or commonwealth legislation.

Fish

The outstanding finding from the fish survey was the significant local population of freshwater catfish Tandanus tandanus in SA2 of Washpen Creek. This species has experienced a significant decline in its abundance and distribution throughout its southern range (Harris and Gehrke, 1997, Morris et al., 2001; Clunie and Koehn, 2001). The species is listed as threatened (Flora and Fauna Guarantee Act 1988) (and as endangered in the advisory list of DSE, 2003) in Victoria and is protected in South Australia (Fisheries Act 1982). Whilst there is no current formal listing for the species in New South Wales, predominately due to numerous populations in impoundments, it is suggested that the status for inland NSW populations of Tandanus tandanus should be “Vulnerable” (Morris et al., 2001). Further, the poor status of freshwater catfish in the Murray system is reflected in the mandatory requirement to release any freshwater catfish captured recreationally in the Murray and Murrumbidgee Rivers (NSW Recreational Freshwater Fishing Guide 2006-07).

Other regional wetlands that have known populations of freshwater catfish include Cardross Lakes near Mildura and Wee Wee Creek near the junction of the Murray and Wakool Rivers. Cardross Lakes is a series of interconnected drainage basins and supports a diverse fish community including freshwater catfish (Raadik, 2001; Sharpe et al., 2003). A survey of the lakes in April 2003 sampled 24 individuals of the length range of 300 - 490mm (Sharpe et al., 2003). At Wee Wee Creek, a site known historically to support a freshwater catfish population, sampled three freshwater catfish of the size range 349 - 408mm (Clunie and Zampatti, 1999). However, freshwater catfish are typically absent from most wetlands of the region as highlighted by a fish survey of 24 Murray River wetland and river sites in the Victorian Mallee in 2004 that did not sample any freshwater catfish (Ho et al., 2004).

None of the freshwater catfish sampled at Washpen Creek were from SA1. As such, the proposed management action to return SA1 to an ephemeral system is not expected to impact upon the resident freshwater catfish population located at SA2. However, the recent proposal to isolate the Euston Lakes system from the Murray River as part of the NSW Government’s Drought Water Recovery Process does threaten the freshwater catfish population of SA2 and is discussed further in a separate section below.

The fish communities differed between SA1 and SA2, particularly with regard to native fish comprising less than 3% of total fish biomass in SA1 but over 50% in SA2 (52% in November 2006 and 58% in April 2007). A measure that highlights the significance of the freshwater catfish population in SA2 is that this species comprised 36% and 55% of the total fish biomass in November 2006 and April 2007, respectively.

With the exception of freshwater catfish (discussed further below), no native fish species captured in SA1 or SA2 were listed as threatened under state or commonwealth legislation.
The species sampled in this survey are typically widespread (MDBC, 2003), and are particularly abundant at other wetlands in the region (e.g. Ho et al., 2004; McCarthy et al., 2003; Conallin et al., 2003; Ellis and Meredith, 2005; Ellis and Suitor, 2004; Scholz et al., 2006).

The most abundant fish sampled was eastern gambusia *Gambusia holbrooki*. This exotic fish is an abundant species in many wetlands from the area (Ho et al., 2004) and can possess a competitive advantage in resource use and rates of reproduction over other fish species in shallow and still habitats (Pyke, 2005).

MDFRC (unpublished data) conducted a fish survey at Dry Lake, Lake Benanee and a section of Taila Creek (between these two lakes) in January 1998. The 1998 survey captured some additional species to those recorded in this study, including redfin perch *Perca fluviatilis*, bony bream *Nematalosa erebi* and golden perch *Macquaria ambigua*. These species were only captured within the lake environments, which may reflect their preferred habitat. The freshwater catfish, goldfish and flyspecked hardyhead sampled in this study were not encountered in the 1998 study.

Other species not sampled at Washpen Creek but known to have a historical distribution in the area (McDowall, 1996) include Murray cod *Maccullochella peeli peeli*, silver perch *Bidyanus bidyanus*, golden perch *Macquaria ambigua*, crimsnspotted rainbowfish *Melanotaenia fluviatilis*, Murray hardyhead *Craterocephalus fluviatilis* and purple spotted gudgeon *Mogurnda adspersa*. Some of these species (e.g. Murray cod, silver perch and golden perch) are more commonly associated with the main river channel and deeper water areas, and may not have been sampled (if present) within the littoral habitats targeted.

**Freshwater catfish**

The relatively high abundance and biomass of freshwater catfish indicates that Washpen Creek is providing appropriate habitat for the species. Clunie and Koehn (2001) reviewed the existing biological information for freshwater catfish and highlighted the species general preference for still or slow flowing waters and habitat with aquatic vegetation, conditions present at Washpen Creek (D’Santos, 2007). The aquatic vegetation at Washpen Creek is likely important in providing refuge and food sources for the predominately benthic feeding freshwater catfish.

Freshwater catfish appear to be non-migratory and tend to remain in the same area for most of their lives (Davis, 1977 cited in Clunie and Koehn, 2001). This has implications for the Washpen Creek population as it suggests that the freshwater catfish are successfully breeding within the creek. Freshwater catfish rely on changes in water temperature to spawn rather than changes in water level, and lay eggs on circular or oval nests typically consisting of gravel and sand (McDowall, 1996).

The length-frequency histogram for the 29 freshwater catfish measured in this study is difficult to interpret confidently given the sample size. Similarly, freshwater catfish length is highly variable for a known age of freshwater catfish (Clunie and Koehn, 2001). Despite these uncertainties, and based on the evidence that freshwater catfish breed annually between October and March (Clunie and Koehn, 2001), the length-frequency histogram does demonstrate that (1) several age classes are present at Washpen Creek and (2) there is no evidence for recruitment during the October 2006 – March 2007 period given the absence of small freshwater catfish. It remains unclear whether the population failed to recruit during this period or whether the gear type failed to sample small individuals. Sharpe et al. (2003) also failed to sample small freshwater catfish in their survey at Cardross Lakes (minimum size of 300mm for 24 freshwater catfish).

It is difficult to isolate reasons for the absence of freshwater catfish from SA1, although several explanations appear plausible. The shallow water depths of SA1 may be inappropriate habitat for freshwater catfish, with fish avoiding these areas to reduce their risk of becoming stranded following a lowering of water level. Freshwater catfish may also be avoiding swimming through the very shallow and narrow section of the block bank that connects SA1 with the remainder of Washpen Creek. The lower gradient banks in the shallow SA1 may also provide fewer undercut banks and root masses that provide important habitat for the species (Pusey et al., 2004).
Low dissolved oxygen concentrations may be providing a competitive advantage to freshwater catfish over other native fish species. The shallow water levels, high levels of shading and high abundance of aquatic macrophytes (D’Santos, 2007) likely explain the very low dissolved oxygen concentrations of SA1 due to overnight autotrophic and heterotrophic respiratory demands. Freshwater catfish have been sampled in south-eastern Queensland in waters with dissolved oxygen levels as low as 0.3 mg L\(^{-1}\), which is consistent with observations that freshwater catfish are (a) often one of the last fish species to survive when present in drying pools of water (Pam Clunie pers. comm.) and (b) are benthic dwellers in still or slow flowing waters.

Introduced species, and particularly common carp, are considered a significant threat to freshwater catfish (Clunie and Koehn, 2001). Common carp have a similar ecological niche to freshwater catfish given their wide distribution, preference for slower flowing habitats and predominately benthic feeding (Clunie and Koehn, 2001; Pusey et al., 2004). The higher biomass of freshwater catfish than carp at Washpen Creek suggests that the current ecological conditions are favouring freshwater catfish, and there would be important research opportunities at this site to address knowledge gaps relating to interactions between common carp and freshwater catfish including whether common carp cause disturbance to freshwater catfish nests (Clunie and Koehn, 2001).

The total length (TL, mm) – weight (W, g) equation for the freshwater catfish of this study (\(W = 3.0 \times 10^{-6} \text{ TL}^{3.2014}\), \(n=29\), \(r^2=0.9862\), range = 164 - 415mm TL) was similar to the equation for populations in the Gwydir River and elsewhere in the Murray-Darling Basin (\(W = 2.96 \times 10^{-6} \text{ TL}^{3.223}\), \(r^2=0.992\), \(n=858\), range = ~30 - 590mm TL) (Pusey et al., 2004).

**Frogs**

The five species of frog sampled at Washpen Creek are each common to wetlands of the region (Frogs of Australia, 2007; Val et al., 2007) and none are considered threatened under state or commonwealth legislation. All five species were recorded within four Murray River wetlands between Euston and the South Australian border that had been recently filled (Val et al., 2007).

Four individual eastern banjo frogs *Limnodynastes dumerili* were sampled at SA1 in November 2006 but not at SA2. This species is common and widespread (Frogs of Australia, 2007) and it is probable that it is present at other areas of Washpen Creek.

No frogs were heard calling during the recording period of the April 2007 survey. This is not surprising given the falling temperatures and expected reduction in male calling activity. Most of the species calling in November 2006 have been registered at other sites as calling in the month of April (Table 8) although mid-April is nearing the end of their known calling/breeding period. Despite the absence of calling males in April 2007, frogs remained active as evidenced by their relatively higher abundance from spotlighting than for the November 2006 survey.

**Table 8. Calling activity for frogs (Frogs of Australia, 2007)**

<table>
<thead>
<tr>
<th>Species</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Litoria peroni</em></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Limnodynastes tasmaniensis</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Limnodynastes fletcheri</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Limnodynastes dumerili</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Crinia parinsignifera</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Litoria raniformis</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
A survey of frogs on 12 April 2006 at Six Mile Creek near the Murray River / Great Anabranch of the Darling River confluence (Val et al., 2007) sampled the calls of four of the frog species listed in Table 8 with the exceptions of L. peroni and L. raniformis. Six Mile Creek was surveyed at a similar time of year to this study, but the wetland differed to Washpen Creek in that it had an intermittent water regime and was highly productive following it receiving pumped water in February-March 2006.

Higher abundances of frog were noted in areas of low gradient terrain where water was shallow, short grass was present and tall stands of cumbungi were nearby. This structural habitat appears important to many species of frogs, and is consistent with observations from frog surveys at Barmah-Millewa Forest (Ward, 2004).

Returning an ephemeral hydrology to SA1 will likely benefit the frog population by allowing for high rates of production that are typical of rewetted wetlands following a drying phase (e.g. Zukowski et al., 2003). Recent surveys of four NSW wetlands found considerably greater numbers of frogs at recently inundated sites than at nearby permanent water sites from where the pumped water was sourced (Val et al., 2007). Similarly, Ward (2004) recorded higher abundances of frogs at wetlands at Barmah-Millewa Forest following inundation than at more permanent waterbodies.

The southern bell frog Litoria raniformis, a species known to the region, was not sampled at Washpen Creek. This species is listed as Endangered in NSW (Threatened Species Conservation Act 1999), Threatened in Victoria (Flora and Fauna Guarantee Act 1988) and Vulnerated nationally (Environmental Protection and Biodiversity Conservation Act 1999). At Washpen Creek, the abundant vegetation cover including the emergent cumbungi Typha orientalis, still/slow-flowing water and shallow (<1.5m) water depths provide ideal habitat for the southern bell frog (DEWR, 2007). Whilst the species relies upon permanent water bodies (DEWR, 2007), it may also be dependent upon occasional flooding to increase the productivity of the wetland and allow for successful breeding such as occurred at Moorna State Forest Wetlands (Val et al., 2007).

Washpen Creek is at the edge of the known range for the eastern common froglet Crinia signifera (Frogs of Australia, 2007). The species was not sampled at Washpen Creek or at Murray River wetlands downstream of Euston (Val et al., 2007; Ho et al., 2004), but was present approximately 40km south-east of Washpen Creek at Fishers Lagoon near the Murray River (Ho et al., 2004). The Mallee spadefoot toad Neobatrachus pictus and common spadefoot toad Neobatrachus sudelli are species of the study region but were not sampled. These frogs are typically associated with more arid areas (Frogs of Australia, 2007).

Surface water quality

There is an absence of data to form water quality guidelines for wetlands such as Washpen Creek (ANZECC & ARMCANZ, 2000). However, some guidance can be taken from the trigger values for slightly disturbed lowland rivers of south-east Australia. These guideline trigger values are considered levels below which there is a low risk that adverse biological effects will occur (ANZECC & ARMCANZ, 2000). Where guidelines are exceeded, further investigations and professional judgement should be utilised to determine the likelihood of an indicator generating adverse biological effects.

The water quality variables of electrical conductivity, turbidity, ammonia nitrogen, oxides of nitrogen and filterable reactive phosphorus were below the trigger values for slightly disturbed lowland rivers, and are therefore considered at low risk of having adverse biological effects. Total nitrogen and pH values at two sites marginally exceeded the trigger values on one occasion and are typical of values from other wetlands in the region (e.g. Ho et al., 2004). Total nitrogen concentrations at all sites within Washpen Creek exceeded considerably the 500µg.L⁻¹ trigger threshold for slightly degraded lowland rivers. While the Murray River site was below this level, concentrations increased in Dry Lake and remained high within Washpen Creek. These concentrations are not unusual for other local wetland systems, particularly due to elevated...
Dissolved oxygen concentrations were very low and are likely limiting the occurrence of some biota at Washpen Creek. Dissolved oxygen levels fluctuate during the diel period and reflect the balance between respiration, photosynthesis and atmospheric reaeration. The high abundance of aquatic macrophytes throughout Washpen Creek suggests that diel oxygen concentrations would be highly variable (e.g. Boulton and Brock, 1999). The low dissolved oxygen concentrations, particularly in the morning, are consistent with the high night-time oxygen demands of the respiring submerged macrophytes and other primary producers, in addition to ongoing heterotrophic demands from animals such as fish. While dissolved oxygen concentrations increased during the day through photosynthesis, they typically did not approach saturation levels by early afternoon. This may reflect the considerable shading occurring at most sites from the emergent cumbungi *Typha orientalis*, in addition to the shading of surface water from the floating fern *Azolla pinnata* at some sites.

The low dissolved oxygen concentrations may at least partly dictate the composition of the fish community at Washpen Creek. The exotic species common carp is tolerant to low (<1mg.L\(^{-1}\)) dissolved oxygen concentrations (Moyle 2002 cited in Moyle and Cech, 2004; McNeil and Closs, 2007). Similarly, goldfish is able to survive anoxia for hours to days due to their particular metabolism (Moyle and Cech, 2004). Eastern gambusia is also highly tolerant of low dissolved oxygen concentrations (McNeil and Closs, 2007), and was abundant at Singing Spring, Florida USA where mean dissolved oxygen concentrations were 0.2mg.L\(^{-1}\) (McKinsey and Chapman, 1998). The high tolerances of these exotic species to low dissolved oxygen conditions may explain their dominance in SA1 where dissolved oxygen concentrations were lowest. Most native fish of the region and the exotic redfin perch appear to be less tolerant to low dissolved oxygen concentrations (Koehn and O’Connor, 1990; Pusey *et al*., 2004; McNeil and Closs, 2007).

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The turbidity levels within Washpen Creek were low and allowed light to pass through the water column to facilitate photosynthesis and growth of the extensive macrophyte communities present in Washpen Creek (D’Santos, 2007). However, this habitat may not be present in the most upstream reaches of Washpen Creek due to potentially high turbidity levels limiting light penetration. While water entering Dry Lake from the Murray River is typically carrying only a low suspended sediment load, the turbidity in the shallow lake itself increases dramatically as a result of sediment resuspension through wind and wave action (McCarthy *et al*., 2004). Water entering Washpen Creek as a result of evaporation and seepage along the creek’s 13km length would therefore likely be highly turbid. The sheltered creek and slow flowing water would facilitate the sedimentation of the suspended loads, and one would anticipate (but it remains to be tested) that the majority of sediment deposition would occur in the most upstream reaches of Washpen Creek. This deposition may have implications for potential freshwater catfish populations in this area, as sedimentation ranked second behind introduced species as likely threats to freshwater catfish populations in the Murray-Darling Basin based on various expert opinion (Clunie and Koehn, 2001). Sedimentation has the potential to smother the nests and eggs of freshwater catfish and threaten their reproductive success (Clunie and Koehn, 2001).

Electrical conductivity increased along a gradient from the Murray River, to Dry Lake, and then downstream along Washpen Creek. This gradient is predicted based on a model of increasing evapoconcentration of salts within the water column when moving further from the inlet point, and is similar to patterns observed in wetlands elsewhere (e.g. Conallin *et al*., 2003).

**Drought water recovery**

A separate drought water recovery proposal to prevent inflows to the Euston Lakes system has the potential to implement a drying phase to SA1, in addition to the remaining 12km of Washpen Creek and the other permanent water areas within the Euston Lakes system. This has clear ramifications for the local freshwater catfish population. As such, a document was developed by MDFRC and NSW MWWG in April 2007 to inform managers of the significant freshwater catfish population in Washpen Creek, and this information was sent to people involved in the NSW Government’s Drought Water Recovery Process (Appendix E).
If the drought water recovery process were to proceed at the Euston Lakes, one recommended option is for a small drawdown of the Euston weir pool to generate flow from the lakes system to the Murray River (Appendix E). This option may trigger some native fish species to move from the Euston Lakes complex back to the Murray River channel. It is unclear whether freshwater catfish would move from Washpen Creek in response to a lowering of water level, or whether they would survive in the main river channel. It is therefore recommended that the opportunity be taken to monitor the responses of the freshwater catfish population to this type of management change.
Recommendations

The following recommendations are made based on the findings of the study:

1. An ephemeral water regime is returned to the 1.1km terminal section of Washpen Creek downstream of the block bank (Survey Area 1) pending hydrogeological advice.

It is not a requirement for SA1 to be dried to allow the pumping of water to Lake Caringay. For example, the regulator could potentially be repaired and closed during any pumping operation then opened at other times to allow SA1 to remain permanently inundated. However, we do not recommend that SA1 remain permanently inundated. Rather, we predict that returning SA1 to a managed ephemeral system will provide greater ecological and management benefits through the return of pulses of productivity and succession processes to benefit the native flora and fauna over the longer term.

A drying phase of sufficient period will allow dieback of cumbungi that has extended across most of the shallow channel of SA1. Any loss of cumbungi biomass resulting from a drying phase will reduce resistance to water (including pumped) travelling along Washpen Creek toward Lake Caringay. This decrease in resistance may also occur within the excavated bypass channel that has become almost completely covered with dense stands of cumbungi and through which any pumped water would need to flow.

Drying the section of Washpen Creek downstream of the block bank whilst maintaining a more elevated section of creek immediately upstream of the block bank creates a hydraulic head that could potentially result in the surface expression of groundwater in SA1. It is recommended that advice from a hydrogeologist be sought to determine the level of risk of this occurring prior to any drying phase being implemented.

2. Assess and monitor the freshwater catfish population within the Euston Lakes system.

The local population of freshwater catfish in Washpen Creek discovered as part of this study is significant given the species’ documented decline in rivers throughout the Murray-Darling Basin. There is an important research opportunity to investigate the size and range of this population within the Euston Lakes system, and to glean important ecological information regarding the species. In particular, there is considerable potential for research (potentially through a PhD project) to investigate aspects of the biology of this species such as movement and habitat utilisation in a system where freshwater catfish dominate the large bodied fish community. Further surveys may also resolve whether recent recruitment of freshwater catfish has occurred in Washpen Creek. There are also opportunities for studies of resource competition between freshwater catfish and common carp, or the effects of sedimentation on freshwater catfish populations within Washpen Creek. A research priority should be monitoring the fate of the Washpen Creek freshwater catfish population should the proposed drought water recovery project proceed and isolate the Euston Lakes system from the Murray River.

3. Investigate the ecology of the section of Washpen Creek downstream of the block bank following the change in water regime.

Applying an intermittent water regime to a section of Washpen Creek that has been permanently inundated allows for an important opportunity to improve our knowledge of the effects of water regime change upon ecological processes and communities. Targeted management questions could also be tested with knowledge generated being applied to other wetlands. In the case of Washpen Creek, a rigorous BACI (before-after-control-impact) experimental design could be implemented to contrast the new ‘ephemeral’ section of creek (impact site) with an unchanged permanent section of Washpen Creek upstream of the block bank (control site) both before and after the change in water regime.
Areas for research are myriad and may include investigations of moisture conditions and time periods required for *Typha orientalis* dieback or death, changes in macrophyte community structure or water quality, or temporal changes in frog and fish communities between the permanent and ephemeral areas. Data from this survey and that of D’Santos (2007) could potentially form a “before” dataset for some research questions.

4. Undertake a sulfidic sediment assessment at Washpen Creek.

Sulfidic sediments (acid sulfate soils) are being recognised as an important management problem in inland regions of Australia (Fitzpatrick *et al*., 1996; Hall *et al*., 2006). A mostly-permanent wetland in the lowland river wetlands of the region has acidified in response to a partial drying (McCarthy *et al*., 2006) and others are potentially at risk of acidification if not managed appropriately (Hall *et al*., 2006).

Restoring a drying phase to a permanently inundated system can be detrimental to a wetland where sulfidic sediments are present (e.g. McCarthy *et al*., 2006). Baldwin *et al*. (2007) have developed a protocol to assess whether a wetland contains sulfidic sediments at levels that could cause ecological damage. We recommend that this assessment be undertaken specifically within SA1 prior to any water regime change, and potentially more broadly across the Euston Lakes system to determine whether sulfidic sediments pose a threat to the ecological values of this area.

Project outputs

A three-page document was developed by the MDFRC and NSW MWWG in April 2007 to highlight the significant freshwater catfish population discovered in Washpen Creek as part of this study. The document was sent by the NSW MWWG to people involved in the NSW Government’s Drought Water Recovery Process. There is a proposal to temporarily prevent regulated flows to the Euston Lakes system, including Washpen Creek, that will impose a partial or full drying of the system depending on the period of isolation. Details are in Appendix E.
References


Appendices

Appendix A. Photographs of the Washpen Creek sites.
Aquatic fauna survey of Washpen Creek, Euston NSW
Appendix B. Photographs of the Dry Lake, Lake Benanee and Murray River sites in November 2006.

Dry Lake

Lake Benanee

Murray River at Robinvale
Appendix C. Total length (mm) and weight (g) data for large bodied fish species.

<table>
<thead>
<tr>
<th>Common name</th>
<th>Nov06</th>
<th>Apr07</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SA1</td>
<td>SA2</td>
</tr>
<tr>
<td>Freshwater catfish</td>
<td>0</td>
<td>230-385mm 114-600g</td>
</tr>
<tr>
<td>Common carp</td>
<td>198-640mm 114-3840g</td>
<td>226-250mm 183-240g</td>
</tr>
<tr>
<td>Goldfish</td>
<td>0</td>
<td>144-265mm 60-340g</td>
</tr>
</tbody>
</table>
Appendix D. Photographs of some of the fish, frogs and other animals sampled or observed at Washpen Creek.

Freshwater catfish *Tandanus tandanus*

Common carp *Cyprinus carpio*

Australian smelt *Retropinna semoni*

Goldfish *Crassius auratus*

Carp gudgeon *Hypseleotris spp.*

Flathead gudgeon *Philypnodon grandiceps*
Appendix D continued. Photographs of some of the fish, frogs and other animals sampled or observed at Washpen Creek.

Eastern gambusia *Gambusia holbrooki*

Peron’s tree frog *Litoria peronii*

Barking marsh frog *Limnodynastes fletcheri*

Spotted marsh frog *L. tasmaniensis*

Eastern long-necked tortoise *C. longicollis*

Echidna *Tachyglossus aculeatus*

Washpen Creek (Euston Lakes system) Fish Survey

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NSW Murray Wetlands Working Group Inc.

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April 2007

Background

As part of the NSW Murray Wetlands Working Group’s (MWWG) Lake Caringay Rehabilitation Project, the Murray-Darling Freshwater Research Centre (MDFRC) has conducted a baseline aquatic fauna survey within a section of Washpen Creek in November 2006 and April 2007. Findings from the survey have indicated that a significant population of freshwater catfish (*Tandanus tandanus*) is present within Washpen Creek.

Washpen Creek forms part of the Euston Lakes system and extends approximately 13 km from Dry Lake towards Lake Caringay.

Since the inception of the Lake Caringay Rehabilitation Project, the NSW Government’s Drought/Water Recovery Process proposes to temporarily restrict regulated flows from further inundating parts of the Euston Lakes system, including Washpen Creek, and therefore imposing a partial or full drying of the system (details of the operation are still to be confirmed).

The following information has been forwarded to the managers of the Drought/Water Recovery Process to highlight the significant local population of freshwater catfish (*Tandanus tandanus*) currently present within Washpen Creek. It is hoped that this information will be utilised to help guide decisions on how best to manage the Euston Lake System and minimise impacts on local fish communities during any water recovery process.

The study

The large bodied fish community was sampled with large fyke nets. Eight nets were set overnight in a 1 km section of Washpen Creek which is located towards the end of the weir pool influence. The large fish captured with this technique are presented in Table 1. (Note that a small bodied fish survey was also conducted and results are available upon request).

Table 1. Abundance of large bodied fish sampled in Washpen Creek in November 2006 and April 2007.

<table>
<thead>
<tr>
<th>Common name</th>
<th>Species name</th>
<th>Family</th>
<th>Nov06</th>
<th>Apr07</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freshwater catfish</td>
<td><em>Tandanus tandanus</em></td>
<td>Plotosidae</td>
<td>4</td>
<td>27</td>
</tr>
<tr>
<td>Common carp*</td>
<td><em>Cyprinus carpio</em></td>
<td>Cyprinidae</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Goldfish*</td>
<td><em>Carassius auratus</em></td>
<td>Cyprinidae</td>
<td>8</td>
<td>0</td>
</tr>
</tbody>
</table>

*exotic fish

Aquatic fauna survey of Washpen Creek, Euston NSW 32
Freshwater catfish dominated the fish catch in the April 2007 survey. At both sampling times, the biomass of freshwater catfish exceeded that of each of the other species. Freshwater catfish are uncommon in the Lower Murray and adjacent wetlands, and these results demonstrate that the habitat of Washpen Creek (relatively stable water levels with abundant aquatic macrophytes and low turbidity water) is sustaining a significant freshwater catfish population.

**Conservation status of freshwater catfish**

The freshwater catfish *Tandanus tandanus* was once abundant throughout the Murray-Darling Basin but has experienced a significant decline in distribution and abundance throughout its southern range (Morris *et al*., 2001; Clunie and Koehn, 2001). The conservation status of freshwater catfish from selected states is listed in Table 2.

**Table 2. Conservation status of freshwater catfish *Tandanus tandanus*.**

<table>
<thead>
<tr>
<th>State</th>
<th>Status</th>
<th>Act</th>
</tr>
</thead>
<tbody>
<tr>
<td>Victoria</td>
<td>Listed as “endangered”</td>
<td><em>Flora and Fauna Guarantee Act 1988</em></td>
</tr>
<tr>
<td>New South Wales</td>
<td>Currently not listed. Protected from recreational fishing in the Murray and Murrumbidgee Rivers.</td>
<td></td>
</tr>
<tr>
<td>South Australia</td>
<td>Protected</td>
<td><em>Fisheries Act 1982</em></td>
</tr>
</tbody>
</table>

The absence of a formal listing in New South Wales for the freshwater catfish does not necessarily indicate that the species population is sustainable. It is suggested that the status for inland populations of *Tandanus tandanus* be “Vulnerable” (Morris *et al*., 2001). The poor status of freshwater catfish in the Murray system (Harris and Gehrke, 1997) is reflected in the closure of the freshwater catfish fishery in the Murray and Murrumbidgee Rivers (NSW Recreational Freshwater Fishing Guide 2006-07).

**Site details**

The area of Washpen Creek surveyed (indicated in Figure 1) is approximately 1.4km upstream from the terminal end of Washpen Creek. The naturally ephemeral system is today permanently inundated due to the elevated water levels of the Lock 15 weir pool. Freshwater catfish were more abundant in the deeper sections of the creek, suggesting that they would most likely be present throughout the deeper section of the Washpen Creek system towards Dry Lake. Taila Ck and the lakes (Dry and Benanee) may also contain catfish populations although this has not been investigated.
Figure 1. Overview of the Euston Lakes system and the Washpen Creek study area.

Recommendations

If restrictions are to be implemented to regulated flows that inundate the Euston Lakes system (i.e. Dry Lake, Lake Benanee, Taila and Washpen Creeks), it is recommended that considerations be made to conduct a temporary drawdown of the Euston weir pool prior to any structures being installed. Drawing down of the weir pool should provide triggers for native fish to move from the lake system to the main channel of the Murray River, and thus decrease the numbers of fish that may become stranded within the system once structures are put in place.

It is unclear whether freshwater catfish will move to the river if a drawdown proceeds. It is therefore recommended that a survey for remaining fish populations be conducted once structures have been installed and monitoring of any populations found be conducted throughout the process. One further option is to position any potential regulator one or two kilometres from the river channel so as to provide some channel habitat that may support part of the catfish population. This channel may also serve as a potential relocation site if freshwater catfish or other native fish are recovered from drying pools in the lake system (successful translocations of freshwater catfish have occurred in Victoria).

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References

