Kerang Lakes Murray hardyhead Survey, March 2014

Final Report

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Executive Summary

As part of investigations that were being undertaken for the Kerang Lakes Bypass Project by G-MW during 2013, one individual Murray hardyhead (*Craterocephalus fluviatilis*) was recorded at Middle Lake, in the Kerang Lakes wetland system. Due to the conservation status of Murray hardyhead (listed as Endangered - EPBC Act, Critically Endangered - DSE Advisory List and Threatened - FFG Act), further investigation regarding the status of the species at Middle Reedy Lake and the interconnected Third Reedy lake was required, to inform the Kerang Lakes Bypass project. In March 2014, CPS Environmental Research was engaged by G-MW to conduct an extensive survey of Middle and Third Reedy Lakes, with the specific aim of targeting the collection of Murray hardyhead. Survey gear types used were tailored to maximise encounter with small bodied fish species, including Murray hardyhead; not to describe the entire fish community (as this was recently done in 2013). Survey equipment used was identical to that used in the efficient capture of Murray hardyhead at other locations, including Cardross Lakes and Lake Hawthorn near Mildura.

This project conducted more than 2,800 hours of netting effort with small meshed fyke nets and seine hauls over eight survey nights during March 2014. Despite this effort, Murray hardyhead were not detected in Middle Lake or Third Lake. Based upon the extensive survey effort applied in this project, the absence of Murray hardyhead in these surveys indicates that the species is not present as a detectible population in either Middle Lake or Third Lake.

A variety of other small bodied fish species were collected in both lakes and these included the natives Australian smelt, Murray-Darling rainbowfish, Un-specked hardyhead, Bony herring, Carp gudgeons, Flatheaded gudgeon and Golden perch and the exotic species Eastern gambusia and Goldfish. With exception of Golden perch and Murray-Darling rainbowfish (which were collected at very low abundances), populations of those remaining species were robust, represented by a wide range of size classes and can be considered self-sustaining. Each species that was collected is considered common to the region.

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1 Introduction

1.1 Scope and purpose

The purpose of this project was to undertake a targeted survey of Third Reedy and Middle Reedy Lakes, near Kerang (Victoria), for the presence or absence of Murray Hardyhead (*Craterocephalus fluviatilis*). Information regarding the presence or absence, distribution and abundance of any Murray hardyhead population subsequently described in either waterbody would be used to inform the 'Kerang Lakes Bypass Project', which is investigating the feasibility of enhancing the environmental values of First Reedy, Middle Reedy and Third Reedy lakes, Little Lake Charm and Racecourse Lake in the Kerang Lakes wetland system (G-MW 2014).

During 2013 a number of investigations were undertaken to inform the feasibility assessment of the Kerang Lakes Bypass Project. During the fauna investigations, fish surveys were undertaken (Biosis 2013). A single Murray Hardyhead (*Craterocephalus fluviatilis* (Endangered - EPBC Act, Critically Endangered - DSE Advisory List and Threatened - FFG Act) was collected in Middle Reedy Lake (but not in other nearby lakes). The individual collected represents the only specimen of this species recorded within the lakes surveyed. The description of the specimen was confirmed by the Arthur Rylah Institute for Environmental Research (as part of DEPI) (Pat Feehan, G-MW pers. comm 2014; Iain Ellis (MDFRC pers. comm 2014).

1.2 Aim

The *Kerang Lakes Fish Surveys 2014* project seeks to establish the presence or absence of Murray hardyhead in Middle Reedy and Third Reedy Lakes.

Specifically, the project aims to:

- Deploy fisheries survey equipment to specifically target the collection of Murray hardyhead;
- identify all fish species and life history stages collected, and
- describe the status of Murray hardyhead populations in Middle Reedy and Third Reedy Lakes.

By providing a better understanding regarding the structure of the Murray hardyhead population in Middle Reedy and Third Reedy Lakes, the project will inform the feasibility study of the Kerang Lakes Bypass project.

1.3 Study Area

Middle Reedy and Third Reedy Lakes

The study area comprises Middle Reedy and Third Reedy Lakes which sit within the broader Kerang Lakes Wetland system. Many of the waterways and wetlands found within the system are used by Goulburn-Murray Water as water carriers forming part of the Torrumbarry Irrigation System.

2 Regional Fish Communities

Fifteen fish species have been recorded across the Kerang Lakes wetland system; ten native and five exotic species (Biosis 2013). The structure of fish assemblages in Middle and Third Reedy Lakes were most recently described by Biosis (2013), who surveyed the Lakes during summer 2012/13. Up to seven native and five exotic species have been recorded in Middle and Third Reedy Lakes. Characteristics of the Middle and Third Reedy Lakes fish community include:

- The assemblage is generally dominated by small bodied fish from 6 species, less than 100 millimetres (mm) in length.
- The native Carp gudgeons and Un-specked hardyhead are the most abundant species recorded.
- Most fish species recorded are considered common at other lowland areas of the mid-Murray valley (Sharpe et al. 2011; Lintermans 2007).
- Murray hardyhead have only been recorded in Middle Reedy Lake (Biosis 2013), where only one individual was described.
- Of the six non-native species Carp and Gambusia are the most abundant.

3 Methodology

3.1 Overview

This study aimed to encounter Murray hardyhead. Accordingly, gear types were targeted to those known to be efficient at capturing small bodied fish species, including Murray hardyhead. Small meshed fyke nets and seine hauls were used exclusively. In each of Middle Reedy and Third Reedy Lake, 18 small meshed fyke nets and four seine hauls were deployed over four survey days/nights for each lake, with 72 individual fykes and 16 seine hauls deployed for each lake over the survey period. Fyke nets were set in littoral areas within areas of dense structural habitat and in open areas, encompassing all available habitats. Fyke nets were set approximately 200m apart around the complete circumference of each lake on each survey night. Seine hauls were made at four random locations per lake survey day. Surveys were conducted between the 10th and 21st of March 2014. Small bodied fish species diversity and assemblage structure were assessed by identifying each individual fish to species and measuring the first 50 individuals for each species for each lake. Relative abundance for each species was determined by counting all individuals encountered.

This targeted sampling regime was considered the most effective at encountering the diversity of small bodied species and size classes present at each lake. The soak-time (the duration that nets were set) of nets deployed on each survey night was determined and the relative abundance of fish was standardised as the number of fish per sampling hour (fish/hr) for each lake.

Habitat attributes known to influence the occurrence and resilience of fish populations were mapped at four survey sites per lake. The habitat assessments were adapted from the established AUSRIVAS Rapid Physical Assessment Protocol and USEPA Habitat Assessment templates. Patterns in the occurrence or absence of Murray hardyhead are described in relation to particular habitat attributes to identify which if any habitat features might be associated with patterns in the species distribution and abundance.

3.2 Methods

Fish

Small fyke nets had dual wings (each 2.5 m x 1.2 m), with a first supporting hoop (∅ = 0.4 m) fitted with a square entry (0.15 m x 0.15 m) covered by a plastic grid with rigid square openings (0.05 m x 0.05 m). Small fyke nets had a stretched mesh size of 2 mm. Fyke nets were set approximately 200m apart, with the complete net-set encompassing the circumference of each Lake. Seine nets had a 6mm mesh, a 1.0m drop and were 5m in length. The seine net was hauled for approximately 20m in an ark from the bank at the point of deployment. Four seine hauls were conducted at each lake on each of four survey days (16 hauls per lake). For all fish encountered, identifications followed keys provided in McDowall (1996) and Lintermans (2007). All Carp Gudgeons were identified to genus level

only (i.e. *Hypseleotris spp.*) owing to the current taxonomic uncertainty of the group (Bertozzi et al. 2000). Each individual of any hardyhead species collected was preserved in 95% ethanol for taxonomic identification in the laboratory. Specimens of hardyhead were identified first by the author following the above keys, and then by Mr. Iain Ellis (Murray-Darling Freshwater Research Centre, Mildura) who is regarded as a leading expert in the taxonomy, ecology and distribution of Murray hardyhead across the southern Murray-Darling Basin. With exception of hardyhead species, all native fish were released at their point of capture and non-native fish were disposed of following Animal Care and Ethics Committee Guidelines (Griffith University permit number ENV/03/12/AEC).

Habitat

Seven aquatic habitat attributes were assessed in each lake (Table 3.1). The habitat assessment aimed to qualitatively describe the habitat features thought be influencing the status of Murray hardyhead in Middle and Third Lakes and focused on those attributes known to influence the occurrence of Murray hardyhead elsewhere, for example populations in the lower Murray River lakes, Round Lake and Woorinen North Lake, where dense bends of submerged aquatic plants, relatively high salinity levels (1,500-50,000µS/cm) and broad, shallow, open water habitats predominate (Ebner *et al.* 2003; Wedderburn et al. 2007; Stoessel 2008, Hammer and Wedderburn 2008). Habitat attributes were assessed at four netting sites for each lake.

Table 3.1. Habitat Attributes examined in Middle and Third Reedy Lakes

Variable	1	2	3	4	5	6
1. Substrate type	Rocks	Sands	Clays	Fine Silts		
2. Flow characterisation	Water present as disconnected, isolated pools	Water present as continuous standing pool	Very little water in channel, channel connected	Water fills 25–75% of both banks, deposition bars exposed	– Water fills > 75% of both banks, or < 25% of channel exposed	– Water reaches base of both banks (bankfull)
3. Submerged macrophyte occurrence Dominant macrophyte species	No submerged macrophytes detected	< 5% cover submerged	5–10% cover submerged	10–20% cover submerged	20-50% cover submerged	> 50% cover submerged
4 Emergent macrophyte occurrence Dominant macrophyte species	No emergent macrophytes detected	< 5% cover emergent	5–10% cover emergent	10–20% cover emergent	20-50% cover emergent	> 50% cover emergent
5. Structural Woody Habitat (Snags) density	Open Water (no snags visible)	< 5% cover comprising twigs and branches 1–5cm diameter	5–10% cover comprising branches and trees	10–20% cover comprising branches and trees	20–50% cover comprising branches and trees	>50% channel cover comprising branches and trees
6. Riparian zone	Width of RZ <6m, little or no RZ present due to human activities	Width of RZ 6-12m, human activities have impacted the RZ to a high degree	Width of RZ 12-18m, human activities have impacted the RZ only minimally	With of Riparian zone 18-40m, human activities i.e. roads, crops, lawns etc.) present but impact minimal	Width of Riparian zone >40m, human activities do not impact the RZ	
7. Water quality attributes recorded	Electrical Conductivity (µS/cm); pH; Dissolved oxygen (mg/L), Turbidity (NTU); Temperature (°C)					

4 Results and Discussion

4.1 Fish assemblage composition across the study area

4.1.1 Overall

A total of 951 individual fish from 9 species (7 native and two exotic) were collected during this study as shown in Table 4.1. Murray hardyhead were not collected in either lake. It must be recognised that this survey did not aim to describe the entire fish community, hence species such as Common carp, Golden perch and Murray cod are absent from the survey, most likely due to the types of nets and traps used.

Table 4.1 shows the native Australian smelt were the most abundant species collected, with 459 individuals encountered, representing 89% of the overall catch. Australian Smelt were the most abundant native species followed by the native Carp gudgeon (406 individuals, 42% of overall standardised catch).

Table 4.1. Raw abundance of native and exotic fish species encountered in Middle and Third Lakes, near Kerang, during March 2014, as part of this study.

Fish species		Waterbody		
Native species	**Scientific name**	**Middle Lake**	**Third Lake**	**Grand Total**
		Raw Abundance	Raw Abundance	Raw Abundance
Australian smelt	*Retropinna semoni*	213	246	459
Bony herring	*Nematalosa erebi*	1	5	6
Carp gudgeon	*Hypseleotris spp.*	60	346	406
Flatheaded gudgeon	*Philypnodon grandiceps*	8	11	19
Golden perch	*Macquaria ambigua*	1		1
Murray-Darling rainbowfish	*Melanotaenia fluviatilis*		3	3
Un-specked hardyhead	*Craterocephalus stercusmuscarum fulvus*	16	10	26
Exotic species	**Scientific name**	**Middle Lake**	**Third Lake**	**Grand Total**
		Raw Abundance	Raw Abundance	Raw Abundance
Goldfish	*Carassius auratus*	1	1	2
Eastern gambuisa	*Gambusia holbrooki*	7	22	29
Grand Total		307	644	951

Based upon catch data it was possible to examine the percentage contribution of each species to overall abundance for each assemblage (Middle Lake v Third Lake). Key differences between the assemblages were:

- species composition was similar in both lakes, with six native species encountered in either lake.
- Australian smelt were the most abundant species overall and were collected at similar densities between lakes
- The native carp gudgeons were more abundant in Third Lake as compared to Middle Reedy Lake
- Un-specked hardyhead were collected in both lakes, at relatively low abundances (Figure 1).

- Murray-Darling Rainbowfish were only found in Third Lake and was the least abundant species overall (Figure 2).

- With exception of Murray-Darling Rainbowfish and Golden perch, which were collected only at Third Reedy Lake, the remaining 7 species encountered were common to both survey sites (Table 1).

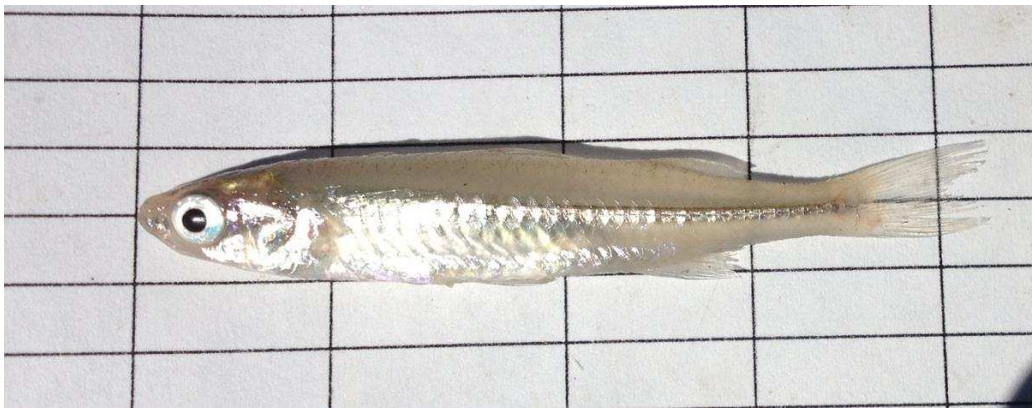

Figure 1. Un-specked hardyhead, detected in Middle and Third Reedy Lakes

Among the exotic species, Table 1 shows:

- Eastern gambusia and Goldfish were the only exotic species encountered.

- Eastern gambusia accounted for less than 4% of the overall catch

Figure 2. Murray-Darling Rainbowfish, found only at Third Reedy Lake

Habitat

Middle and Third Reedy Lakes were overall similar in habitat features. Both are large, elliptical floodplain lakes that share substrate types of predominantly fine silts and clay, with fine silts representing > 80% of the substrate sampled (Table 4.2). Both Middle and Third Reedy Lake were classified as 'bank full' at the time of survey. Emergent macrophytes dominated the littoral zone with Cumbungi (*Typha* sp) the most common emergent species, accounting for more than 70% of the emergent plant composition at Middle Reedy Lake and >80% at Third Reedy Lake. *Phragmities* sp. and Lignumn (*Muehlenbeckia* sp) were also present (Table 4.2). Notably, submerged aquatic macrophytes were absent at each survey site and were not observed anywhere at either lake during the study (Table 4.2). Structural woody habitat density was relatively high for both lakes, present at 10-20% of Middle Reedy lake (predominantly Lignum and drowned trees (coarse woody debris) and 20-50% at Third Lake. Woody habitats were predominantly standing drowned trees and fallen trees and logs (Table 4.2).Water quality attributes were within expected ranges (Table 4.3). Notably, salinity levels (recorded as electrical conductivity) were relatively low in both lakes (116 and 121 µS/cm for Middle and Third Lakes respectively). Figure 4.3 depicts the overall habitat character and is representative of both Middle and Third Reedy lakes.

Figure 4.3. Middle Reedy Lake showing the expanse of lake habitat (left) and typical littoral habitat with standing drowned trees, the littoral zone composed of dense cumbungi, giant rush and lignum, and the riparian zone consisting of redgum/black box trees.

Table 4.3. Overall description of habitat attributes for Middle and Third Reedy Lakes

Variable	Middle Reedy Lake					Third Reedy Lake				
1. Substrate type	Fine Silts					Fine Silts				
2. Flow characterisation	– Water reaches base of both banks (bankfull)					– Water reaches base of both banks (bankfull)				
3. Submerged macrophyte occurrence Dominant macrophyte species	No submerged macrophytes detected					No submerged macrophytes detected				
4 Emergent macrophyte occurrence Dominant macrophyte species	10–20% cover emergent					< 5% cover emergent				
5. Structural Woody Habitat (Snags) density	10–20% cover comprising branches and trees					20–50% cover comprising branches and trees				
6. Riparian zone	Width of RZ 12-18m, human activities have impacted the RZ only minimally					Width of RZ 12-18m, human activities have impacted the RZ only minimally				
	pH	EC µS/cm	Turbidity NTU	DO mg/L	Temp oC	pH	EC µS/cm	Turbidity NTU	DO mg/L	Temp oC
7. Water quality	7.54	116.00	118.00	7.00	18.60	8.17	121	105	8.12	20.8

4.2 Key Findings

4.3 Overall

The Key finding from this study was the absence of Murray hardyhead from Middle and Third Reedy Lakes during March 2014. Based upon the extensive survey effort applied of more than 2,000 netting hours over 9 days, it can be considered that Murray hardyhead was not present in either lake as a detectible population. This however does not preclude the complete absence of Murray hardyhead in either lake, because the species was recently recorded in Middle Lake (Biosis 2013).

The absence of submerged aquatic plants and the relatively low salinity levels for each lake (recorded as electrical conductivity) are two habitat features considered likely to influence the status of Murray hardyhead in Middle and Third Reedy Lake. In other locations where the species occurs, a close association between the occurrence Murray hardyhead and the presence of submerged aquatic plants has been identified (Wedderburn *et al*. 2007; Hammer and Wedderburn 2008). In particular, it has been noted that dense beds of aquatic plants are required for the species to proliferate, with plants offering critical spawning substrate and shelter from predation.

Equally, it has been observed that where abundant Murray hardyhead populations occur, water quality is highly saline (Wedderburn et al. 2007; Stoessel 2008). Wedderburn *et al.* (2007) and Hammer and Wedderburn (2008) postulated that Murray hardyhead exhibit a competitive advantage over other hardyhead species by tolerating highly saline water quality, with Wedderburn *et al.* (2008) noting that Murray hardyhead rarely occur in conjunction with other hardyhead species primarily due to the species ability to tolerate elevated salinity levels . Ebner *et al.* (2003) stated that Murray hardyhead has an affinity for the more saline deflation basin lakes of the Murray River system and the species is most frequently recorded in highly saline floodplain lakes within which dense bends of submerged aquatic plants occur. Accordingly, the relatively low salinities (EC's) recorded during the present study in Middle and Third Reedy Lakes most likely do not offer Murray hardyhead a competitive advantage over other native small bodied species. Combined with the absence of submerged aquatic plants, it appears that Middle and Third Reedy lake do not offer the key habitat conditions conductive to the proliferation of Murray hardyhead as has been suggested for populations at other locations (Ebner *et al*. 2003; Wedderburn *et al*. 2007; Stoessel 2008).

The timing of the present survey (March 21st) is considered not to have greatly influenced the likelihood of detecting Murray hardyhead in either lake. Whilst the species is known to exhibit a population crash and decline in abundance over the winter months (Stoessel 2008; Ellis 2008), the timing of the present surveys (early autumn) occurred during the period when abundances have been recorded as relatively high at other locations (Stoessel 2008; Ellis 2008). Indeed, Stoessel (2008) encountered higher abundances of Murray hardyhead in Round Lake (near Kerang) during autumn 2008 than in spring 2007. Rather, it is considered that the lack of aquatic plants and the relatively low salinity levels (recorded as electrical conductivity) in Middle and Third Reedy Lakes are not conductive to the occurrence of Murray hardyhead as an abundant population.

5 References

Bertozzi, T, Adams, M, and Walker, K (2000). Species boundaries in carp gudgeons (Eleotrididae : Hypseleotris) from the River Murray, South Australia: evidence for multiple species and extensive hybridization. *Marine and Freshwater Research, 2000,* **51,** 805-815.

Biosis (2013) Kerang Lakes Fauna Assessment. Report for the North Central Catchment Management Authority and Goulburn-Murray Water.

Ebner, B, Raadik, T. and Ivantsoff, W (2003) Threatened fishes of the world: *Craterocephalus fluviatilis* McCulloch, 1913 (Atherinidae). *Environmental Biology of Fishes* **68:** 390, 2003.

Ellis, I (2008). Conservation of Murray Hardyhead - Captive maintenance of Murray Hardyhead from Lake Hawthorn and Cardross Basin 1 (near Mildura). A report prepared for the Mallee Catchment Management Authority (MCMA), North Central Catchment Management Authority NCCMA), and the Victorian Department of Sustainability and Environment (DSE). Murray Darling Freshwater Research Centre, Mildura

Hammer, M. and Wedderburn, S (2008). The threatened Murray hardyhead; Natural history and captive rearing. *Fishes of Sahul* **22** Jan-March 2008.

Lintermans, M (2007). Fishes of the Murray-Darling Basin: An Introductory Guide. Murray-Darling Basin Commission, Canberra. 157pp

Sharpe, C., Mallen-Cooper, M. and Stuart, I. (2011). *Mid-Murray Floodplain Reconnection Project: Workshop Discussion Paper*. A discussion paper prepared for the North Central Catchment Management Authority by CPS Environmental Research, Fishway Consulting Services and Kingfisher Research. December 2011.

Stoessel, D. (2008). Status of Murray hardyhead (Craterocephalus fluviatilis) populations in three lakes in the Kerang region, Victoria (2007-2008). Report to the Department of Sustainability and Environment. Arthur Rylah Institute for Environmental Research, Heidelberg.

Victorian Department of Sustainability and Environment (2007). Advisory list of threatened vertebrate fauna in Victoria – 2007. Department of Sustainability and Environment, East Melbourne, Victoria.

Wedderburn SD, Walker KF (2008) Osmoregulation in populations of an endangered hardyhead (Atherinidae: Craterocephalus fluviatilis McCulloch 1912) from different salinity regimes. Ecology of Freshwater Fish 2008: 17: 653–658

Wedderburn SD, Walker KF, Zampatti BP (2007). Habitat separation of Craterocephalus (Atherinidae) species and populations in off-channel areas of the lower River Murray, Australia Ecology of Freshwater Fish 2007: 16: 442–449