Management of aquatic fauna during refurbishment of Phillips Creek Reservoir

Prepared for the Water Corporation of Western Australia

Freshwater Fish Group
CENTRE FOR FISH & FISHERIES
MURDOCH UNIVERSITY
PERTH, WESTERN AUSTRALIA

This report was prepared by S.J. Beatty and D.L. Morgan in the Freshwater Fish Group at Murdoch University's Centre for Fish & Fisheries Research for the Water Corporation of Western Australia.

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Background and Aims

To determine the potential impacts that the draining of Phillips Creek Reservoir may have on the prevailing aquatic fauna, the Freshwater Fish Group at the Centre for Fish & Fisheries Research, on request from the Water Corporation, conducted a survey of the fish and freshwater crayfish of the reservoir. The report to the Water Corporation in May, 2003 entitled 'Fish Resource Survey of Phillips Creek Reservoir' (Beatty *et al.* 2003) identified one native freshwater crayfish (Marron *Cherax cainii*) and one introduced fish (Redfin Perch *Perca fluviatilis*) from the reservoir. A destocking program was then implemented with the major aims of:

- Reducing the level of mortality of the sizeable Marron population resulting from the draindown.
- Boosting recreational Marron fishing opportunities in the Warren River Catchment via relocation of the removed animals to public waterbodies (e.g. Big Brook Dam).
- Removing large numbers of the Redfin Perch, a species known to prey heavily on native freshwater fish and crayfish, to reduce any potential impact on the downstream environment (Morgan *et al*. 2002).

Methodology

Destocking methodology
Fish and freshwater crayfish were removed from Phillips Creek Reservoir using crayfish traps (~50 traps/night), commercial crab traps (7 traps), gill nets (180 m/night composite mesh), seine nets (20 seines) and via manual scooping.

Destocking events all occurred during the draining of the reservoir. Initial destocking occurred during late November 2003 (18-19th, 24-25th); when water levels were considerably high (see Figure 1a). Further destocking occurred between the 22nd and 23rd January 2004; when the only remaining water was a small pool (see Figure 1b). All Marron captured were measured to the nearest 1 mm OCL (orbital carapace length).

As a large number of berried female Marron (eggs or embryos attached – see Results) were captured, an opportunity arose to gain an understanding of the size at sexual maturity of female Marron in this reservoir. These data are also useful in fisheries management of Marron stocks via comparisons with other fished and non-fished populations (see Beatty *et al*. 2005) and will aid in any future decisions relating to the management of Marron stocks in similar Water Corporation reservoirs. The orbital carapace length (OCL) at which 50% (L_{50}) and 95% (L_{95}) of female Marron matured in Phillips Creek (maturity based on whether or not the individual was berried) were determined using those individuals captured during the November destocking (the peak period of berried activity in most systems thus far examined in the south-west (Beatty *et al*. 2003, 2005).

Logistic regression analysis was undertaken on the percentage of individual mature (berried) females grouped into 5 mm OCL increments. Data were randomly re-sampled and reanalysed to create 1000 sets of bootstrap estimates. The medians of the bootstrap estimates were used as the point estimates of the parameters and the probability of maturity at each length category. The bootstrap estimates also determined the 95% confidence limits (CL) of the parameters.

The logistic equation is:
$P_L = 1 / [1 + e^{-\ln 19 (L - L_{50}) / (L_{95} - L_{50})}]$, where P_L is the proportion of berried Marron during November at OCL interval L, and L_{50} and L_{95} are the OCLs at which 50% and 95% of the population are deemed mature.

Figure 1 Water levels in Phillips Creek Reservoir during (a) late November 2003 and (b) January 2004.

Relocation of destocked Marron

While all Redfin Perch that captured were euthanased in an ice slurry, all Marron were relocated to a number of sites throughout the Big Brook and Lefroy Brook catchments, including Big Brook Dam (Figure 3). The release sites are in a region of the catchment that all receive substantial recreational fishing pressure and thus the addition of these animals may provide additional fishing opportunities.

Figure 3 Relocating Marron to Big Brook Dam during November 2003.

Restocking methodology

Between the 8th and 9th March 2005, a total of 191 Marron were captured from the stocking sites and re-stocked into the re-filled reservoir. Capture methods consisted of the use of up to 20 opera traps per site, manual scooping around submerged vegetation, and the use of a 5 m seine net. Prior to release into the reservoir, the OCL of each Marron captured was measured to the nearest 1 mm.

The re-stocking of a mix of cohorts (including 0+ animals) should ensure ongoing reproduction over successive spring breeding periods and have insignificant impact on the recreational fishery at those sites. Furthermore, the sex ratio of the re-stocked population was similar to that previously recorded in the destocking program and that which is generally found in wild populations.

Results

Destocking of Phillips Creek Reservoir

A total of 1129 Marron were destocked from Phillips Creek Reservoir between November 2003 and January 2004 (Table 1, Figure 4). The sex ratio of these animals was essentially 1:1. During November a large number of female Marron were berried, i.e. they had eggs or small developing Marron attached to their pleopods (Figures 4 and 5). As a result of a successful breeding period at a time when water levels were declining rapidly, a number of small juveniles were captured in January.

Table 1 The number of Marron (different sexes) and Redfin Perch destocked from Phillips Creek Reservoir during November 2003 and January 2004 and the number of Marron restocked in March 2005.

Event	**Date**	**Marron caught**			**Redfin caught**
		Males	Females	Juveniles	
Destocking	18-19th Nov. 2003	84	23		20
Destocking	24-25th Nov. 2003	257	238		2
Destocking	22-23rd Jan 2004	219	292	16	895
Total destocked		**560**	**553**	**16**	**917**
Restocking	9-10th March 2005	76	71	44	

From Figure 4 it is evident that catches varied considerably between November and December, with two distinct groups of Marron caught in November, i.e. approximately 50% were greater than 50 mm OCL in November when water levels were high. In contrast, during January, when only a small pool was left, there was a far greater abundance of smaller Marron captured.

The fact that almost all berried females captured in Phillips Creek Reservoir were captured at the dam wall where they were afforded some protection from predators, such as Redfin Perch, highlights the importance of complex habitat for Marron development and thus recruitment. While all the Marron captured were relocated within the same catchment, the berried females were placed around the wall in Big Brook Dam to aid in the survival of eggs and juveniles.

Based on the proportion of berried females in each length-class (see Figure 6) as an indicator of maturity status, and using a logistic equation, the length at which 50% of females are berried is ~55 mm OCL (95% confidence limits of 52.1 to 57.6 mm OCL). The length at which 95% of female marron are berried is ~75 mm OCL (95% confidence limits 67.3 to 85.6 mm OCL).

A total of 925 Redfin Perch were removed from Phillips Creek Reservoir and these fish comprised a wide range cohorts but were dominated by 0+ fish. An examination of the stomachs of 20 Redfin Perch (220-321 mm total length) captured in November demonstrated that the overall dietary volume was dominated by Marron (~65%). Amphipods (~21%), odonatan larvae (6%) and coleopteran larvae (6%) were the other main prey ingested. Similarly, high proportions of Marron were found in the diets of Redfin Perch in the nearby Big Brook Dam (Morgan *et al*. 2002).

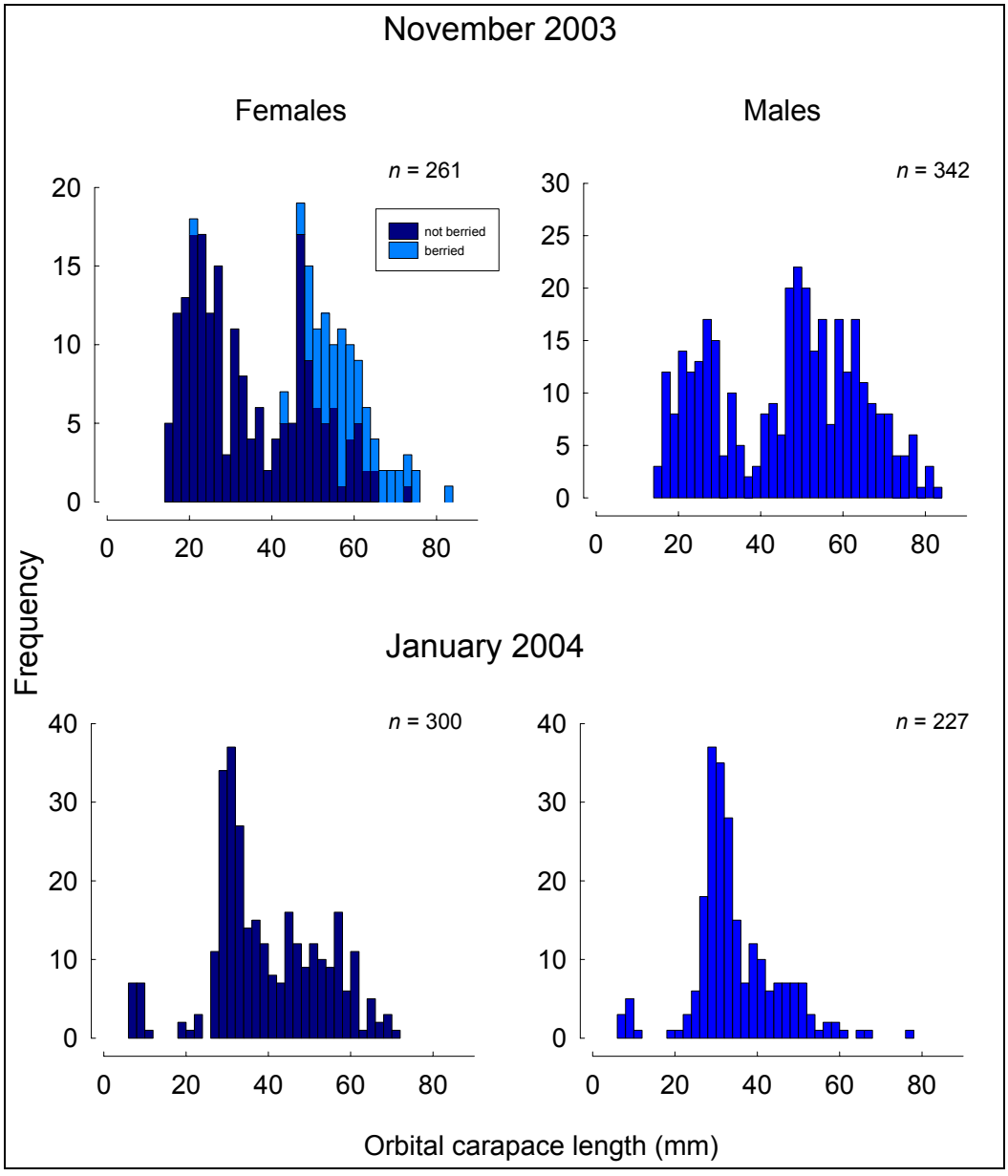

Figure 4 Length-frequency histograms of female and male Marron destocked from Phillips Creek Reservoir in November 2003 and January 2004. Note berried females in November. An orbital carapace length (OCL) of 55 mm is a carapace length (CL) of approximately 76 mm (legal size).

Figure 5 Berried female Marron.

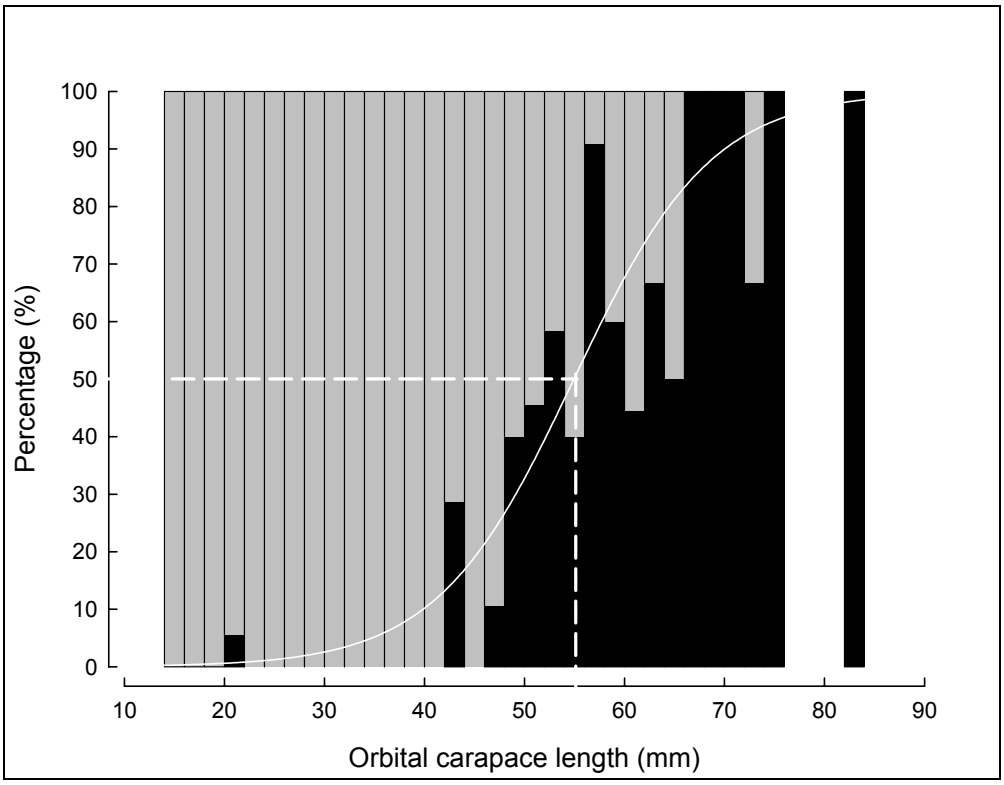

Figure 6 Length at maturity of female Marron destocked from Phillips Creek Reservoir in November 2003 which is based on berried animals, i.e. black bars represent berried females while grey bars represent non-berried Marron.

Marron restocked in Phillips Creek Reservoir

A total of 191 Marron were restocked into Phillips Creek Reservoir when the reservoir was filled with water (Table 1, Figure 6). These animals were sourced from a number of locations throughout the catchment, primarily from the original relocation sites. Most of these animals were <50 mm OCL and represented a number of age classes. The sex ratio of stocked Marron was approximately 1:1.

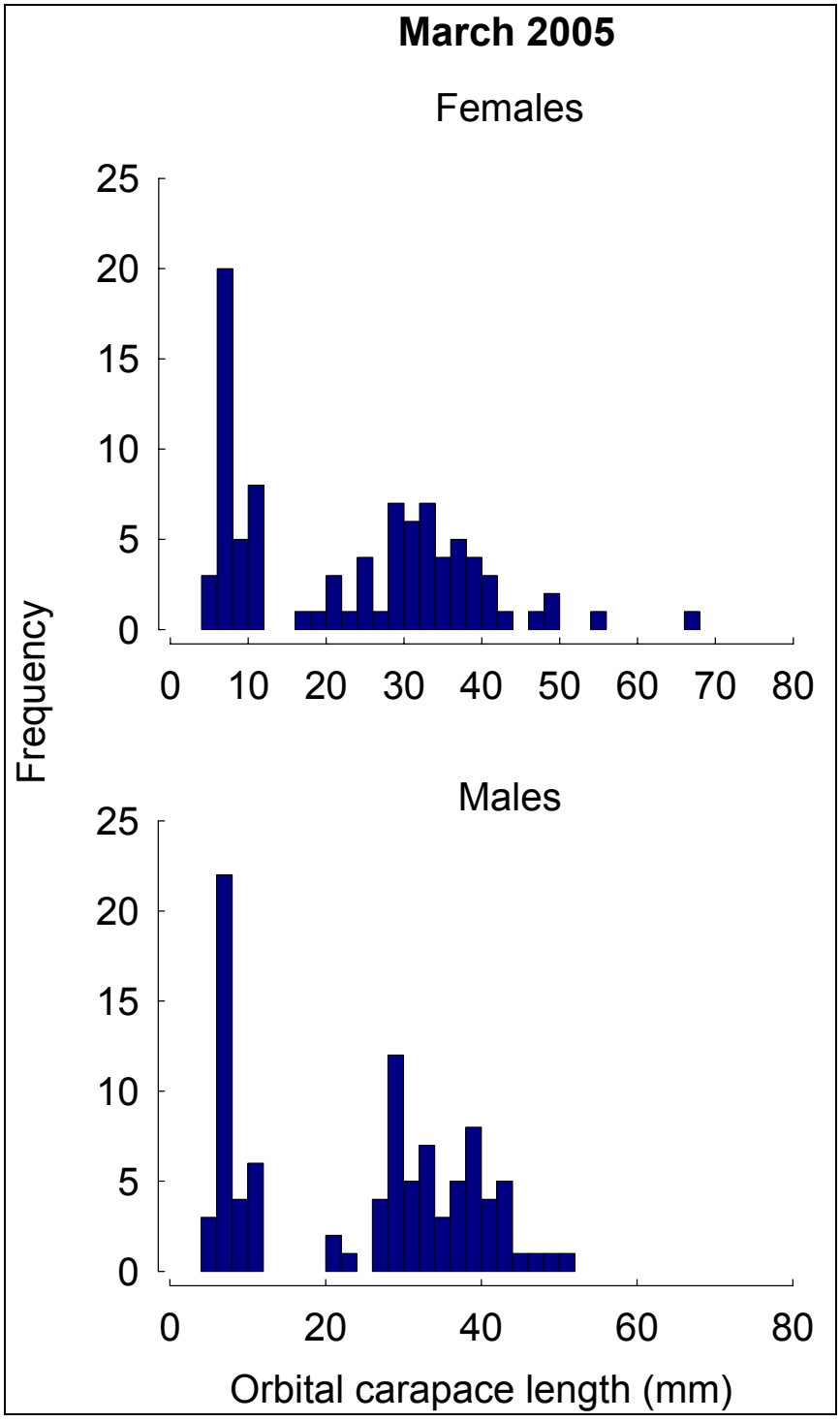

Figure 7 Length-frequency histograms of female and male Marron restocked into Phillips Creek Reservoir in March 2005 when the reservoir was again filled with water. An orbital carapace length of 55 mm is a carapace length of approximately 76 mm (legal size).

Conclusions and recommendations

- **This study prevented large scale deaths of Marron in Phillips Creek Reservoir, and simultaneously enhanced recreational fishing opportunities within the Warren River catchment.**
- **Removal of large numbers of the introduced Redfin Perch during the draining process limited the opportunity for this feral species to move downstream.**
- **This project highlights the importance of implementing aquatic faunal surveys at early stages of the planning process of reservoir draindown projects in order to subsequently devise and implement an effective ecological management strategy.**
- **The long-term success of the restocking program should be assessed by future monitoring.**
- **Eradication of feral species from water supply dams provides future opportunities for such systems to be utilised as refuges for a number of the regions rare fishes.**

References

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