Management of aquatic fauna during the refurbishment of Churchman Brook Reservoir

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Background

The potential impacts on the prevailing aquatic fauna from partial or complete drainage of Churchman Brook Reservoir by the Water Corporation in the summer of 2004/2005 (necessary to conduct remedial works on the dam wall) were identified in the report by Beatty *et al.* (2003). The report identified the key aquatic species in the dam as being: two native freshwater crayfish (marron and gilgies), two introduced species of teleost fishes (Rainbow Trout and Mosquitofish); and the native Oblong Turtle. Depending on the final degree of drainage of the reservoir, there was a considerable risk of high or complete mortality of some or all of these species.

Given the uncertainty of the presence and water quality of any coffer dam that may have been present to house these fauna at lowest drainage levels during the project, the Water Corporation commissioned the Centre for Fish and Fisheries Research at Murdoch University to mitigate these potential impacts by undertaking an intensive fish-out of the key species. This is consistent with the precautionary principal of Ecologically Sustainable Development and also aimed at mitigating the potential for considerable public concern regarding large mortalities of the key species.

Of particular concern was the potential high mortality of the endemic freshwater crayfish the Marron, which although not fished in this water-body, are a highly prized recreational fishing target in the south-west. Of further consideration was the potential release and impact of exotic aquatic fauna from the reservoir on the downstream environment. This impact had the potential to be high when considering the large numbers of the predatory Rainbow Trout that were identified in the reservoir (Beatty *et al.* 2003). Gilgies were previously only found in the spring-fed waters of the brook and as no remedial works were to be carried out in this part of the reservoir they were not relocated.

Aims

- Remove large numbers of trout and Marron from Churchman Brook Reservoir prior to drainage. This aimed to reduce the potential for highly visible mortalities in the completely (or near completely) drained basin of the reservoir, and to reduce the downstream impacts of the large, introduced Rainbow Trout (a similar risk existed during the recent Waroona Dam drainage project that resulted in large numbers of the predatory Redfin Perch escaping downstream (Molony *et al.* 2005).
- Relocate Marron to nearby sites in the Canning River in order to make those animals available to be captured as part of the annual recreational Marron fishing season.
- Maintain a number of Marron at Murdoch University and re-stock into the reservoir following refill.
- Re-stock the reservoir with Marron sourced from sites in the Canning River that des-stocked animals were placed.

Methods

Destocking

Aquatic fauna was de-stocked from Churchman Brook Reservoir during five days of intensive fishing during October, November and December 2004. Freshwater crayfishes were captured using up to 84 box-style crayfish traps set overnight, and hand scooping from the banks of the reservoir. Bait used was limited to commercial poultry pellets enclosed in mesh to prevent unnecessary release of organic material into the water-body. The majority of Marron captured were sexed and measured to the nearest 1 mm orbital carapace length (OCL) prior to relocation into the upper Canning River.

As it was known that Rainbow Trout in Churchman Brook Reservoir was a self-maintaining population and thus consisted of multiple age (and length) cohorts (Beatty *et al.* 2003), the destocking method necessitated the use of a series of gill nets and an electrofisher in order to capture as wide a size range of fish as possible. Four gill nets were thus used ranging in length from 30 m to 120 m with various mesh widths ranging from 1 inch to 4 inch stretched mesh. The electrofisher was used in the stream. All fish captured were euthanased immediately in an ice slurry and used for investigations into the population biology of this relatively unique, self-maintaining population and also to determine their degree of predation on the Marron population in the dam (Tay 2005). For these methodologies see Tay (2005).

Relocation of destocked Marron

Translocation of aquatic organisms between environments should only occur if it is absolutely necessary and should be limited to translocations within the same catchment in order to maintain genetic integrity of potentially different stocks. The majority of Marron were re-located to a total of 8 nearby sites on the upper Canning River to enable them to be available to the iconic recreational Marron fishery (Figure 2). A small proportion (~10%) of crayfish were also moved into a 2000 L indoor tank at Murdoch University and maintained for the life of the project in order to supplement wild-captured animals in the re-stocking phase of the project.

Restocking methodology

Restocking of Marron into Churchman Brook Reservoir occurred on the 24-25th of November 2005. This allowed time for the reservoir to refill and settle. The recapture method in the Canning River consisted of 20 opera traps set overnight. Prior to release into the reservoir, the OCL of each Marron captured was measured to the nearest 1 mm.

In order to determine whether Marron survived the period of drainage, five opera traps were also set near the wall of the re-filled reservoir.

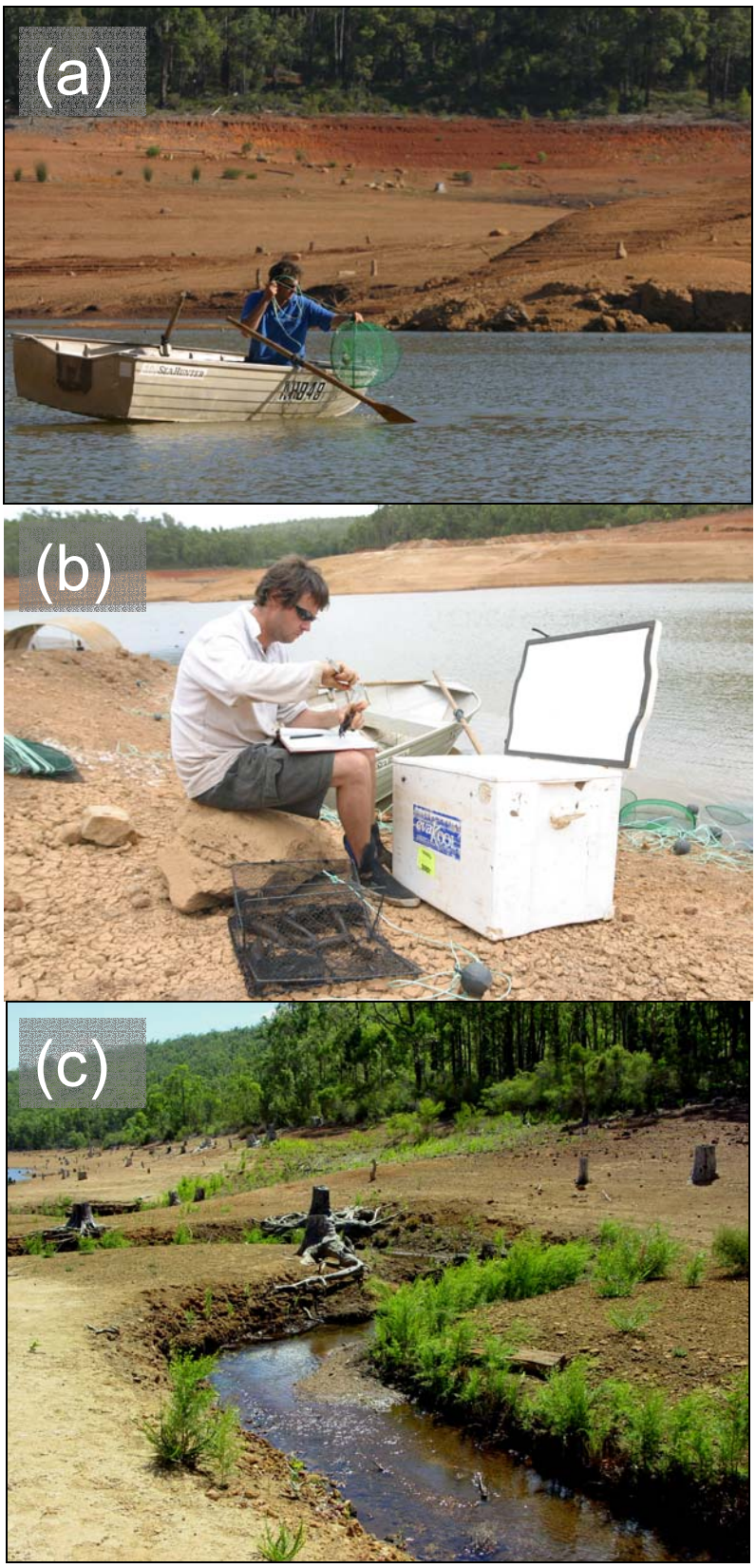

Figure 1 (a) Destocking of Marron from Churchman Brook Reservoir using opera-style crayfish traps, (b) measuring the Marron to gain information on population structure prior to relocating into the upper Canning River, and (c) Churchman Brook entering the reservoir that was habitat for Gilgies and juvenile Rainbow Trout.

Figure 2 Relocating Marron into the upper Canning River during December 2004.

Results

Destocking of Churchman Brook Reservoir

During the destocking program, a total of 1100 Marron were captured and relocated from Churchman Brook Reservoir (Table 1). The sex ratio of these animals was essentially 1 female : 1.6 males. This reflected that the de-stocking period occurred when many females were berried and less catchable. A wide size range of Marron was destocked during each of the three fish-out months representing a range of age cohorts (Figure 3).

Table 1 The total number of Marron destocked from Churchman Brook Reservoir during 2004 and the number of Marron restocked in 2005.

Event	**Date**	**Marron**			**Rainbow Trout**
		Males	Females	Not sexed	
Trout Destocking	Sep. 2004				29
Destocking	20th Oct. 2004	100	58	82	23
Destocking	9-12th Nov. 2004	81	48	412	65
Destocking	15th Dec. 2004	194	125		
Total		375	231	494	
Total destocked				**1100**	**117**
Restocking	9-10th Mar. 2005	91	44		
Total restocked				**135**	

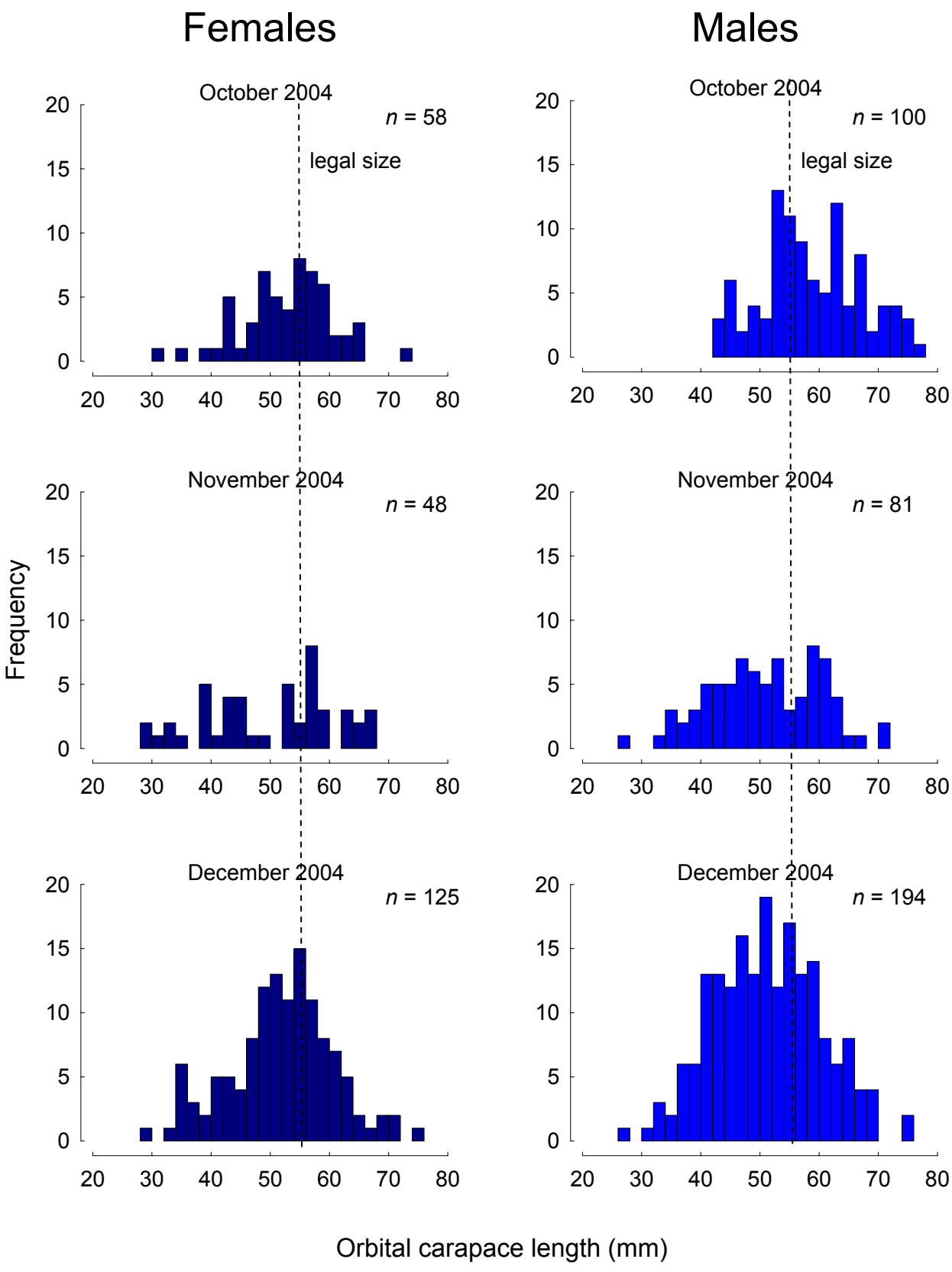

Figure 3 The length-frequency distribution of Marron destocked in each month from Churchman Brook Reservoir. N.B. Approximate minimum legal size of 55 mm OCL in most systems is also given (i.e. 76 mm carapace length) and an additional 82 and 412 Marron were captured in October and November, respectively, but were not measured.

It is evident that there was a general increase in the proportion of Marron <50 mm OCL captured as the water levels declined between October to November (Figure 3). This was also found in a similar destocking program undertaken in Phillips Creek Reservoir (Beatty and Morgan, 2005). This was likely due to the larger Marron excluding smaller individuals from traps early in the destocking effort with smaller individuals making up a greater proportion in later captures due to the reduction in large animal abundance as the destocking program progressed.

During October and November, approximately 40% of female Marron were berried (carrying eggs or newly hatched juveniles), i.e. they had eggs or small developing Marron attached to their pleopods (Figure 4).

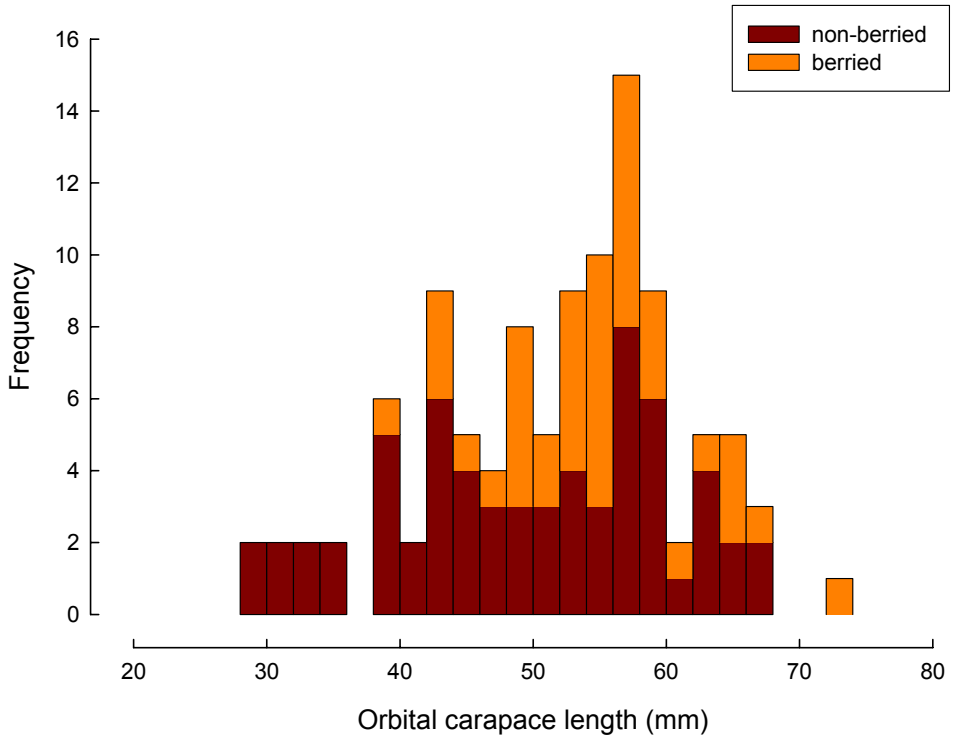

Figure 4 The length-frequency of females in Churchman Brook Reservoir pooled for October and November showing the size distribution of those that were berried.

A total of 117 Rainbow Trout were captured from Churchman Brook Reservoir (Table 1). These fish were used in an Honours study by Tay (2005) who found that the population comprised of a wide size range (23-392 mm TL) including small, 0+ fish that were probably born in late Winter/early Spring 2004 (Figure 5).

The relationship between total length (TL) and wet weight for rainbow trout in Churchman Brook Reservoir was best represented by a simple allometric growth model using a length-weight formula, $W = 0.8 \times 10^{-5} (TL^{3.0385})$, r = 0.995 (see Figure 6).

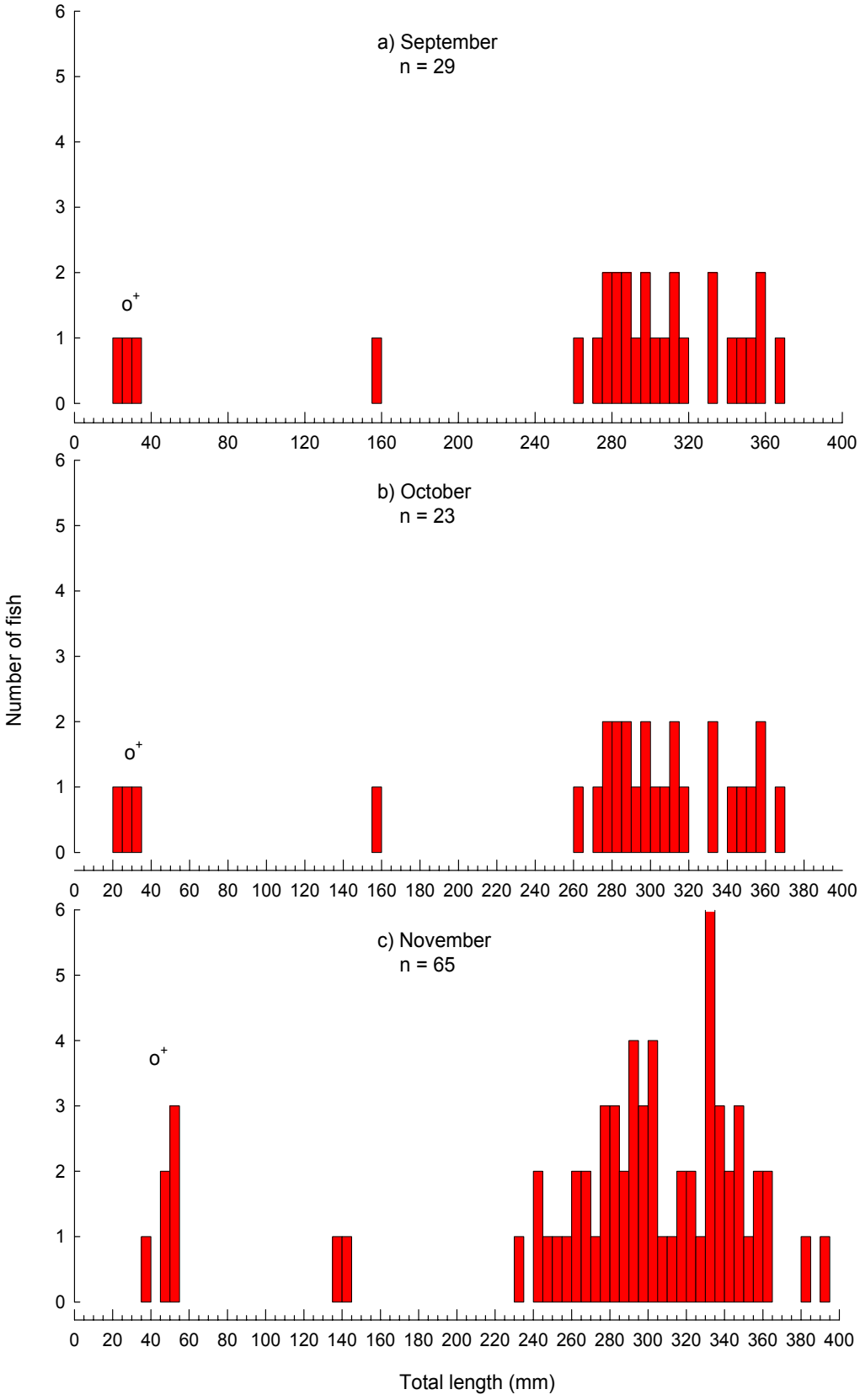

Figure 5 Length-frequency histograms for Rainbow Trout captured at Churchman Brook Reservoir in a) September 2004, b) October 2004, and c) November 2004. Extracted from Tay (2005).

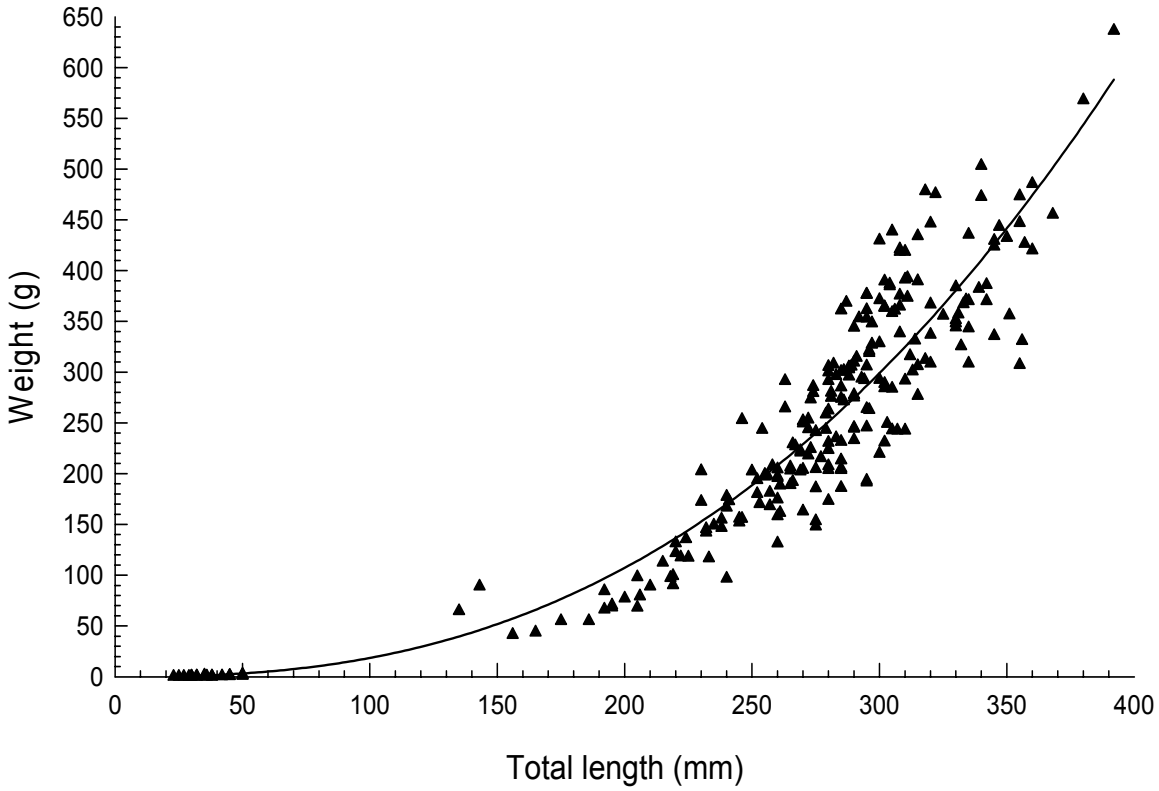

Figure 6 Relationship between total length (TL) and wet weight of 117 rainbow trout captured at Churchman Brook Reservoir.

Tay (2005) also demonstrated that almost 70% of Rainbow Trout captured in Churchman Brook Reservoir during this project had at least one Marron in its stomach (Table 2). Overall Marron accounted for over 60% of the volume of all Rainbow Trout examined. Furthermore, over 90% of the 48 Rainbow Trout examined that were >300 mm TL having Marron in their stomach. This suggests that at least in some reservoirs of south-western Australian Rainbow Trout is a major predator of Marron.

Table 2 The relative contribution by volume and percentage occurrence of prey items of 105 rainbow trout captured at Churchman Brook Reservoir. Extracted from Tay (2005).

Prey type	% Contribution	% Occurrence
Amphipoda	2.3	17.1
Anisoptera larvae	4.8	13.3
***Cherax cainii* (Marron)**	**60.9**	**67.6**
Chironomidae larvae	0.7	3.8
Chironomidae pupae	0.4	1.9
Culicidae larvae	0.1	1.0
Dytiscidae	10.0	30.5
Noteridae	0.2	1.0
Oncorhynchus mykiss	0.8	1.0
Tabanidae larvae	0.1	1.0
Zygoptera larvae	0.0	1.0
Other Coleoptera	0.1	1.9
Apoidea*	0.2	1.0
Arachnida*	0.0	1.0
Diplopoda*	4.2	6.7
Diptera*	4.4	10.5
Formicidae*	6.1	7.6
Tabanidae*	2.2	3.8
Terrestrial insect*	0.8	4.8
Feather	0.1	1.0
Unidentified animal matter	1.3	2.9
Vegetation	1.9	5.7

* Terrestrial fauna

Restocking

Figure 7 shows the length-frequency distribution of the Marron restocked into Phillips Creek Reservoir in November 2005. A total of 135 Marron were captured from the previously stocked sites on the Canning River along with stocks captively held and Murdoch University. There was a wide size range of re-stocked Marron in order to ensure ongoing reproduction over successive spring breeding periods. However, the majority of restocked Marron were under the legal recreational size limit in order to not negatively impact on the next recreational fishery at those sites

(i.e. not taking many individuals that would be able to be retained to the summer 2006 fishery).

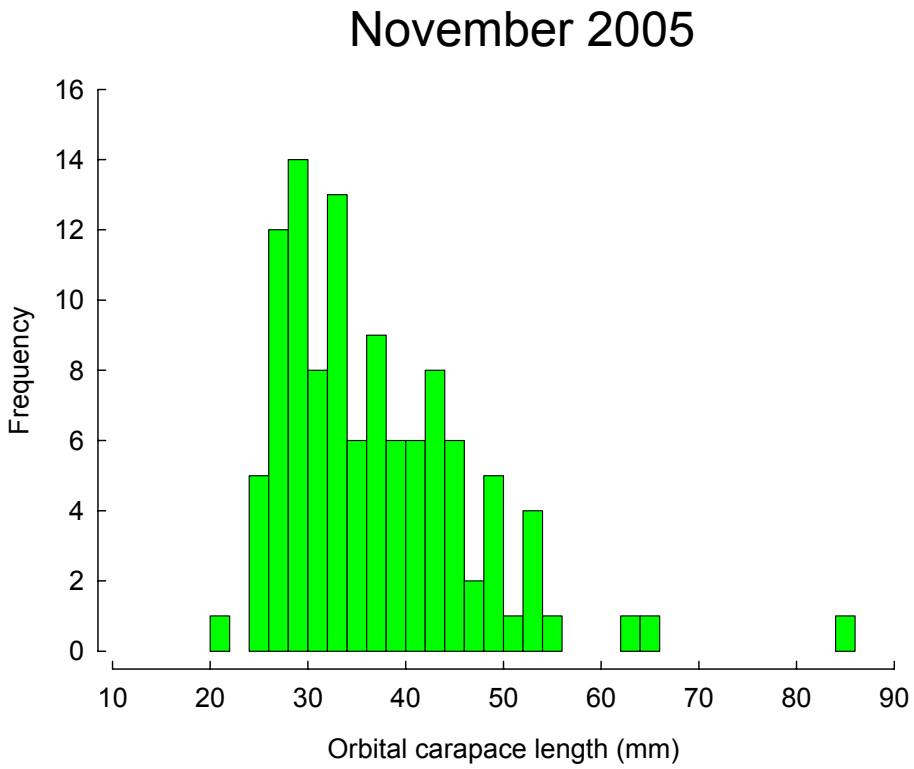

Figure 7 Length-frequency histogram of Marron (pooled sexes) restocked into Churchman Brook Reservoir in November 2005 following refill.

It was uncertain as to whether Churchman Brook Reservoir was to be drained completely in order to undertake the remedial works and therefore the risk of mortality of the Marron population was equally uncertain which necessitated the destocking effort outlined in this report. However, a remnant pool of considerable size remained in the reservoir throughout the summer of 2004/2005 and at no stage was the reservoir drained completely. The five opera traps deployed in November 2005 resulted in the capture of 25 Marron (a number of females were berried) indicating that the Marron population remained viable despite the lowering of the water levels. Those Marron, together with those restocked as part of this project, should ensure that the Marron population in Churchman Brook Reservoir remains viable.

Furthermore, during the restocking in November 2005, a Rainbow Trout was visually observed on the water surface and therefore suggests that the population also survived the lowering of the water level in the reservoir. The ongoing viability of this (previously) self-maintaining population should be monitored in the future as it is relatively unique with most Rainbow Trout populations in the south-west thought not to be self-maintaining and the fishery instead relying on annual stocking of hatchery-reared fish by the Department of Fisheries Western Australia.

Conclusions and recommendations

- **This aquatic faunal management program was designed to manage the risk associated with the draining of Churchman Brook Reservoir down to an uncertain level in order to undertake major engineering work on the dam.**
- **The project resulted in the removal of a large number (1100) of Marron, thereby 'thinning' the population that remained in the water body during the lowest water levels observed and aiding in the survival of animals remaining in the partially drained reservoir.**
- **The release of destocked Marron into the upper Canning River simultaneously enhanced recreational fishing opportunities within that system.**
- **Removal of Rainbow Trout was designed to reduce the degree of visible mortality of fish in the drained basin but also reduce predation on Marron.**
- **The diet of Rainbow Trout was dominated both qualitatively and quantitatively by Marron.**
- **An examination of the Rainbow Trout removed confirmed that the population was self-maintaining and thus relatively unique to this region.**
- **As Churchman Brook Reservoir was not drained completely and a considerable sized body of water remained throughout the project, the Marron (and possibly Rainbow Trout) population remained viable in the reservoir after it refilled but will be aided by the restocked Marron.**
- **This project is a good example of the effective management of the risk to aquatic fauna during dam draining events.**
- **The long-term viability of the Marron and Rainbow Trout populations should be assessed by future monitoring.**

References

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