

Freshwater fish and crayfish communities of the tributaries of the Margaret River



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Prepared for



*Cape to Cape
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Project Brief

Tributaries and headwaters of major rivers are known to be important spawning and nursery habitats of freshwater endemic fishes in south-western Australia (see for example the collie River in Pen & Potter 1990, and the Blackwood River in Beatty et al. 2006, 2008). Fishes of the Margaret River have previously been examined by Morgan *et al.* (1998) and Morgan & Beatty (2003) with the monitoring of the functioning of the two fishways on the river documented in Morgan & Beatty (2004, 2007) and Beatty & Morgan (2008). The river is known to be of conservation importance due to it housing five of the eight endemic freshwater fishes of the south-west region, as well as housing the majority (five of the six species) of the *Cherax* species of freshwater crayfishes found in the south-west; including the Margaret River endemic Critically Endangered Hairy Marron.

Despite this known value and considerable volume of research on the fishes in the main channel of the Margaret River, little is known on the fishes and freshwater crayfishes of the river's major tributaries. The aim of this study is to document the freshwater fish distribution in the major tributaries of the Margaret River (i.e. Bramley, Darch, and Yalgardup Brooks) during or close to the breeding period for the majority of the species and to provide a broad assessment and comparison of population demographics of the different species in the different tributaries. This information is required for the formulation of River Action Plans for these systems by the Cape to Cape Catchments Group.

Methodologies

Eleven sites were sampled during October 2008 for fish and freshwater crayfishes; six in Bramley Brook (the largest tributary), two in Darch Brook, and two in Yalgardup Brook. An additional site was sampled in the main channel of the Margaret River downstream of the tributaries (in a section of the river not previously sampled for fish in the aforementioned studies) (Figs 1-4).

Three sites were chosen for the examination of upstream and downstream movements of fish and crayfish; including one each on Bramley and Darch Brooks (downstream most sites) and the Margaret River main channel site (Fig. 1). Downstream sites were chosen to give an indication of the levels of downstream recruitment of the different species into the main channel that had spawned upstream in the tributary sites (note that insufficient flow in Yalgardup Brook prevented the setting of fyke nets). Density estimates of fish and freshwater crayfish were undertaken at all eleven sites using a back-pack electrofisher (*Smith Root model 12-A*).

All fish and freshwater crayfish were identified and a sub-sample of fish and freshwater crayfish were measured to the nearest 1 mm total length (TL) or orbital carapace length (OCL), respectively. Length-frequency distributions of each species were plotted and analysed. These data were then used to provide an overall assessment of the fish communities in each system.

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Figure 1: Sites sampled on Bramley, Darch and Yalgardup Brooks and Margaret River in October 2008 (map from South West Regional Atlas 2004, Department of Environment and Conservation, Western Australia). N.B. triangles indicate fyke netting sites, dots indicate density sampling points.

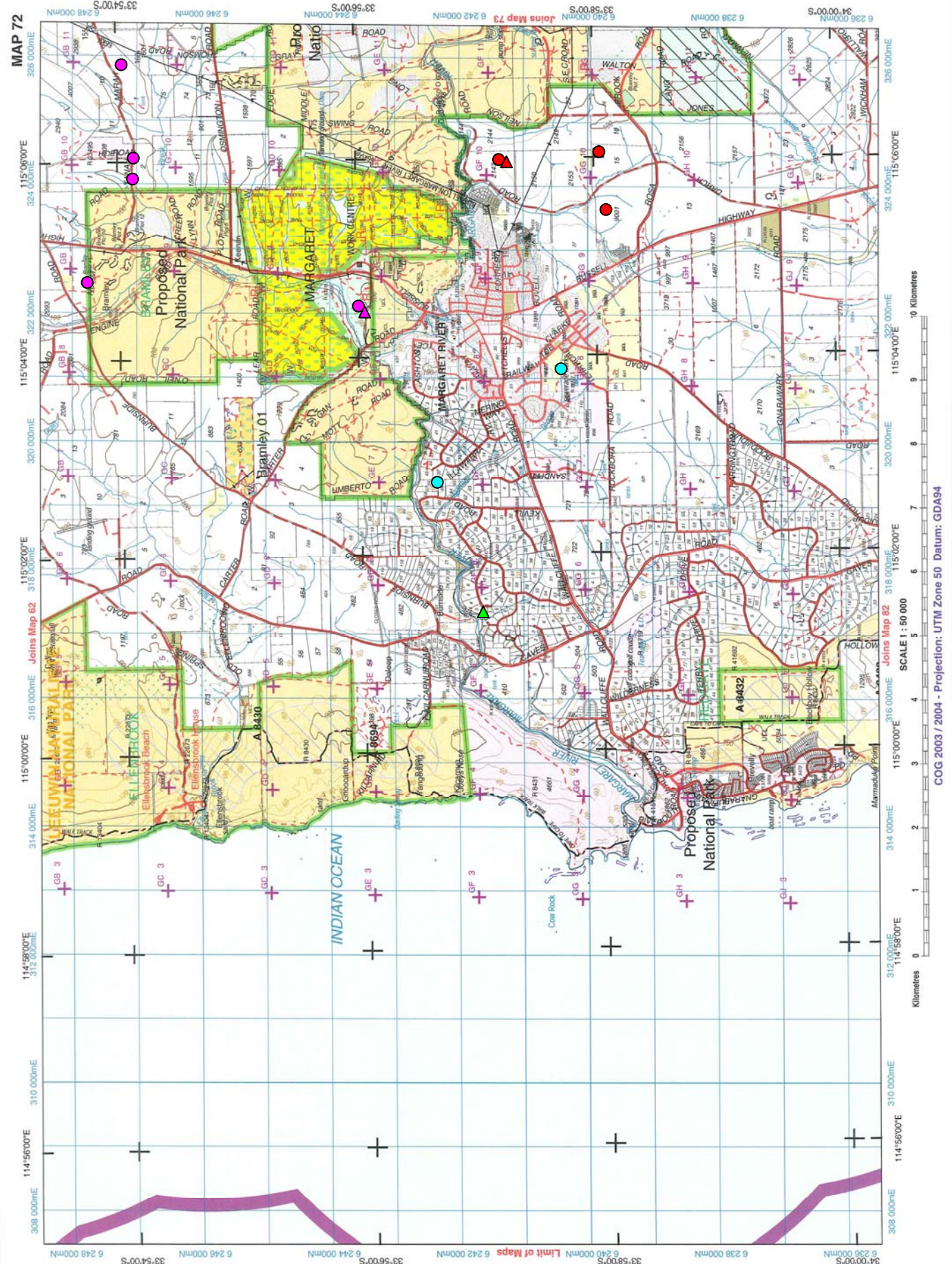


Figure 1 (cont): (map from South West Regional Atlas 2004, Department of Environment and Conservation, Western Australia).

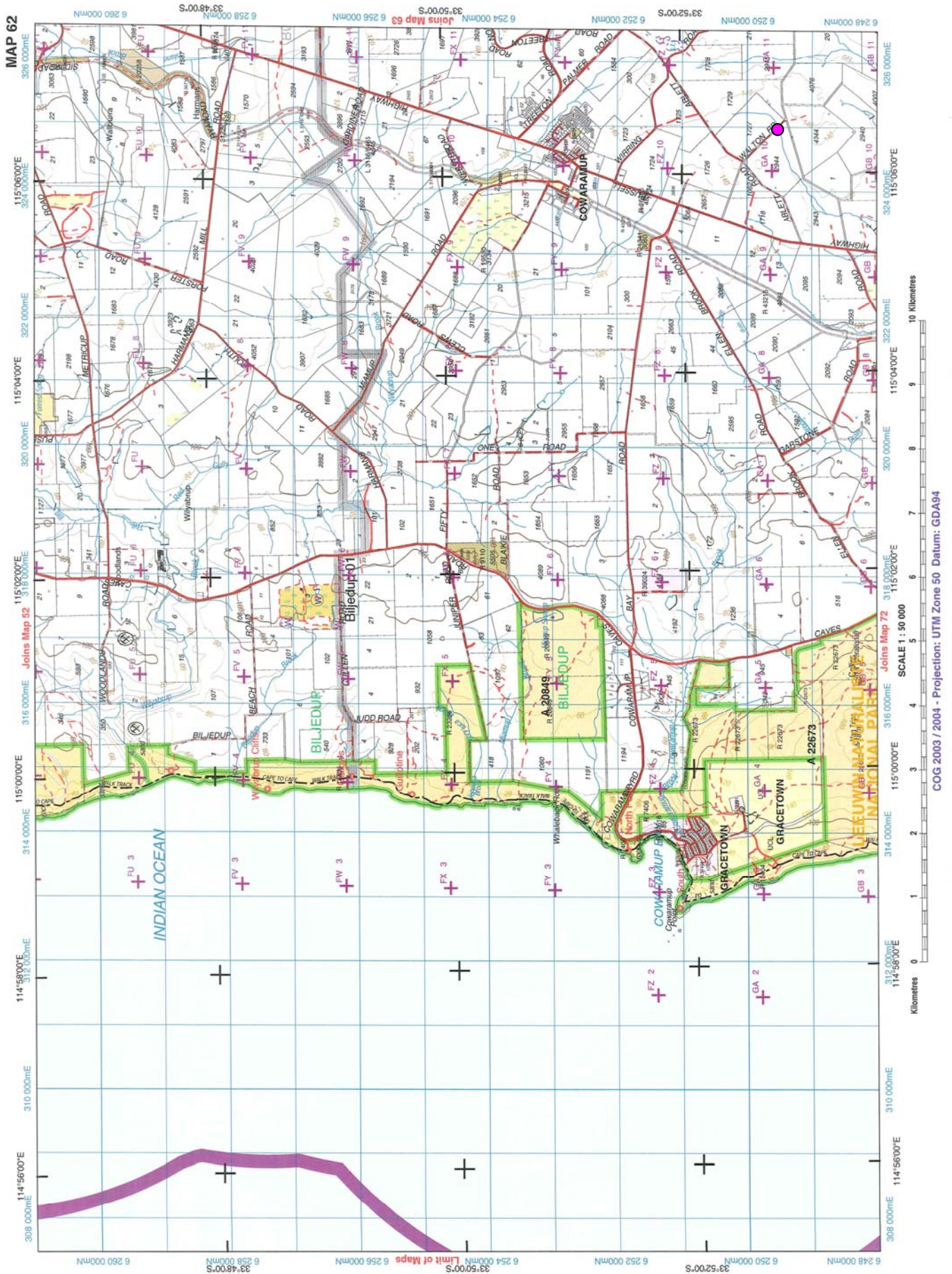
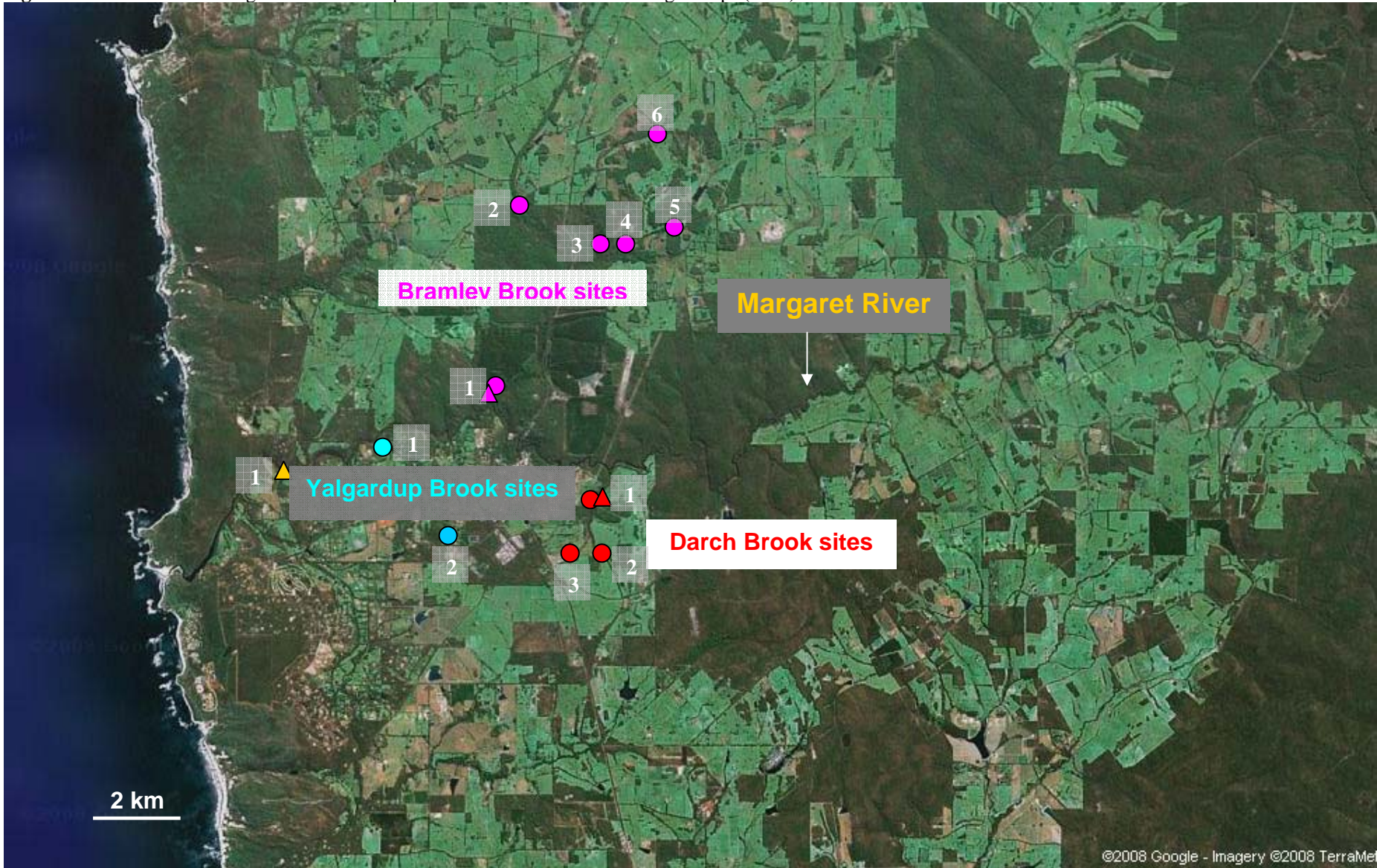


Figure 2: Satellite image of the sites sampled in October 2008. Source Google Maps (2008).





Caters Rd crossing



Burnside Rd crossing



Walton Rd crossing



Tanah Merah Rd crossing 1



Tanah Merah Rd crossing 3



Tanah Merah Rd crossing 2

Figure 3: Sites sampled on Bramley Brook during sampling in October 2008 (moving in a downstream to upstream direction, clockwise from top left).



Pool down from Halcyon Rd



Upper Darch Rd crossing



Small lower reservoir on Darch Brook in Brookfield estate.

Figure 4: Sites sampled on Darch Brook (moving in a downstream to upstream direction, clockwise from top left).



Kevill Rd crossing



Mansfield Rd crossing

Figure 5: Sites sampled on Yalgardup Brook during sampling in October 2008.

Results and Discussion

A total of 2002 fish and decapods were captured during the study; including 873 (or 44% of the catch) endemic freshwater fish, eight (0.004%) native estuarine fish, 495 (25%) feral fish, 620 (31%) endemic decapods (freshwater crayfish and shrimp), and six (0.003%) introduced freshwater crayfish. The native fish included Western Minnow (*Galaxias occidentalis*), Western Pygmy Perch (*Edelia vittata*), Nightfish (*Bostockia porosa*) and the Mud Minnow (*Galaxiella munda*), the estuarine fish included the Western Hardyhead (*Leptatherina walacei*) and the Silverfish (*Leptatherina presbyteroides*), the feral fish included Eastern Gambusia (*Gambusia holbrooki*) and Goldfish (*Carassius auratus*), the native crayfishes included the Gilgie (*Cherax quinquecarinatus*) and Smooth Marron (*Cherax cainii*) and native shrimp was Western Freshwater Shrimp (*Palaemonedes australis*) and the introduced crayfish was the Yabbie (*Cherax destructor*).

Bramley Brook

Endemic freshwater fishes

Three endemic freshwater fishes were recorded in Bramley Brook (i.e. Western Minnow, Western Pygmy Perch, Nightfish) (Table 1). The Western Minnow was the most widely distributed and abundant species in Bramley Brook (recorded at four of the six sites and accounted for 74% of endemic fish captured in the system) with Western Pygmy Perch also being widely distributed (two sites and as far upstream as at least site 5 (at a density of 0.93m^{-2} , representing 22% of the endemic fish captured). Nightfish were only recorded at the most downstream site (Carters Rd crossing, 4% of the endemic fish captured).

Fyke netting on Carters Rd crossing recorded large numbers of Western Minnows (189 individuals) as well as Western Pygmy Perch (16 individuals), and Nightfish (16 individuals) (Figure 6). The majority of Western Minnows (58%) and Nightfish (63%) were moving in a downstream direction (probably following breeding) whereas the majority of Western Pygmy Perch (88%) were moving in an upstream direction (probably prior to spawning) (Figures 6 and 7).

Relatively wide size ranges of all three native fish species, representing multiple age classes, were evident from native fish in Bramley Brook indicating viable populations of these native species within the system (Figure 6). Recently recruited Western Minnows were also recorded and, from previous studies on the functioning of the Margaret River fishway (see Morgan & Beatty 2007; Beatty & Morgan 2008), the known breeding period of this species in the Margaret River is winter. Given the wide size range and abundances of Nightfish and Western Pygmy Perch in Bramley Brook; these species also use this system for spawning. The one-off sampling undertaken in the current study does not allow determination of the proportion of the

populations of each native species that seasonally move into the main channel of the Margaret River and the proportion that remain in the stream during summer.

Endemic freshwater crayfishes

Smooth Marron and the Gilgie were both recorded in Bramley Brook with Smooth Marron only being recorded at the downstream Carters Rd site (2% of crayfish captures in Bramley Brook, Table 1). Both species were found to mostly be moving in an upstream direction in the fyke nets; however, this movement may have been related to nocturnal foraging rather than upstream spawning movements (Figure 8). The Gilgie was recorded at all six sites up to a density of 4 m⁻² (at site 2) (Table 1). A clear juvenile cohort of Gilgies existed in Bramley Brook (10-15 mm OCL) that would have hatched the previous summer (Figure 9). The Smooth Marron from lower Bramley Brook had a size range from 26 – 41 mm OCL (sub-legal size, likely to be from 0 - 2+ age cohorts).

The Smooth Marron has been introduced into the Margaret River catchment where has displaced the endemic Hairy Marron (now totally restricted to the upper reach of the main channel) and both species require permanent aquatic habitats. This explains why the former species appears to be restricted to the lower, permanent section of Bramley Brook and is found in large numbers in the main channel. The Gilgie is a widespread endemic freshwater crayfish in south-western Australia and occupies a wide range of permanent and temporary habitats including rivers, streams and wetlands. Its presence in the upstream sites in Bramley Brook, that would seasonally dry, reflects its adaptive life-history strategy (Beatty et al. 2005) and ability to burrow into the water table during dry periods.

Introduced species

The Eastern Gambusia was recorded in low abundances at site 3 in Bramley Brook. A small sized (<60 mm) species, it has the ability to rapidly proliferate (live-bearer, young age at maturity), are aggressive via fin-nipping native fishes; particularly Western Pygmy Perch and young (<1 year old) Nightfish (Pen and Potter 1991, Gill *et al.* 1999) (Figure 10). Loss of fin rays from the caudal fin results in reduced swimming ability further increasing susceptibility to attack. Loss of fins may ultimately result in death of individuals (Gill *et al.* 1999). Low abundances of the species in Bramley Brook observed in the current study may suggest that the system does not represent ideal habitat with the species; that generally thrives in slower flowing (or lentic systems), degraded habitats such as irrigation drains that do not offer refuge (instream structure) for native fishes (Gill *et al.* 1999, Morgan unpublished data). However, abundances of the species generally increase during the warmer breeding period and therefore greater numbers may exist in the brook during summer.

The eastern Australian Yabbie was recorded at site 5 (Tanah Merah Rd) in Bramley Brook at a density of 0.13 m⁻² (Table 1). This invasive species is now found in numerous wild aquatic systems in south-western Australia having originally been introduced to the region in the 1930's (Beatty et al. 2005a). It has a life-history strategy (able to breed multiple times at the end of its first year of life) and habitat occupation (both permanent and seasonal aquatic habitats) similar to that of the smaller endemic freshwater crayfishes of the south-west (such as the Gilgie and Koonac) (Beatty et al. 2005a). The species can also compete directly with the large Smooth Marron (and probably other native species) for food resources (Beatty 2006) and can have a similar growth rate to it in its first year (Beatty et al. 2004, 2005a). Its presence in Bramley Brook is therefore of considerable concern. A simple way to differentiate between the Yabbie and Gilgie is presented in Figure 11. The source population of the Yabbie may be in the weir on private property on Tanah Merah Rd immediately upstream of where this species was recorded (i.e. site 5) and, if uncontrolled, the species would undoubtedly be able to breed and probably spread to other sections in Bramley Brook and possibly eventually into the main channel of the Margaret River. It is therefore recommended that a control program be implemented first to confirm the origin of the introduction, and then attempt to reduce its numbers and prevent the spread of the species.

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Table 1: Mean densities (± 1 SE) of fish and decapods at various sites in Bramley, Yalgardup and Darch Brooks and the Caves Rd site in Margaret River (fyke netting only) during sampling in October 2008. N.B. * indicates those species recorded in the fyke netting.

Site description/number	Lat	Long	Native fishes					Native decapods			Introduced Species			
			Western Minnow	Mud Minnow	Nightfish	Western Pygmy Perch	Western Hardyhead	Silverfish	Gilgie	Smooth Marron	South-west Shrimp	Yabbie	Eastern Mosquitofish	Goldfish
Bramley Brook														
Carters Rd Crossing / 1	33.9333	115.0671	0.25*		*	0.04*				0.35*	0.01*			
Burnside Rd crossing – near Engine Rd / 2	33.8949	115.0740	0.04							4.00				
Tanah Merah Rd crossing / 3	33.9018	115.0913	0.12							0.55			0.09	
Tanah Merah Rd crossing / 4	33.9022	115.0947								3.00				
Tanah Merah Rd crossing / 5	33.9007	115.1100	0.14			0.93				0.46		0.13		
Walton Rd crossing / 6	33.8803	115.1081								0.28				
Yalgardup Brook														
Kevill Rd crossing 1	33.9435	115.0391	0.04	0.02		0.02				0.18			4.73	
Manfield Rd crossing 2	33.9614	115.0583								0.19				
Darch Brook														
Halcyan Cres crossing 1	33.9564	115.0916	0.70*		0.04*	0.20*				0.70	0.02*	0.10*	0.24*	0.02
Darch Rd crossing 2	33.9668	115.0941								1.23				
Brookfield estate drain 3										0.08			0.02	1.67
Margaret River														
Caves Rd crossing 1	33.9497	115.0163			*	*	*	*				*	*	

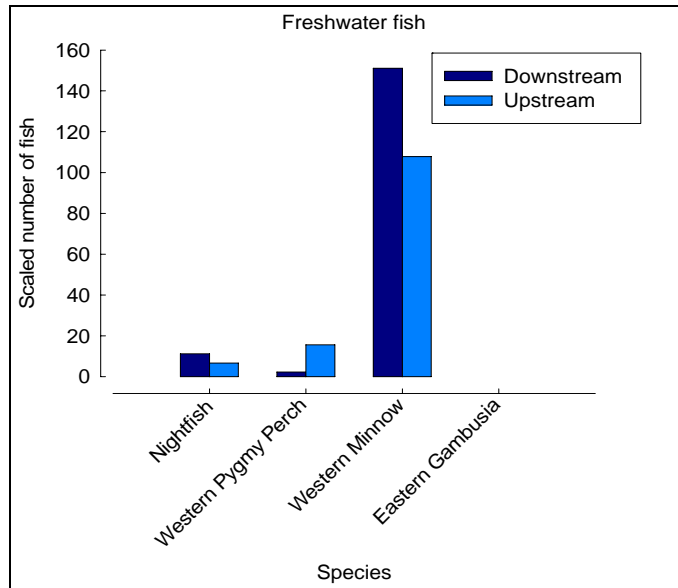


Figure 6: Number and direction of movement of endemic fishes captured at Carters Rd crossing in Bramley Brook.

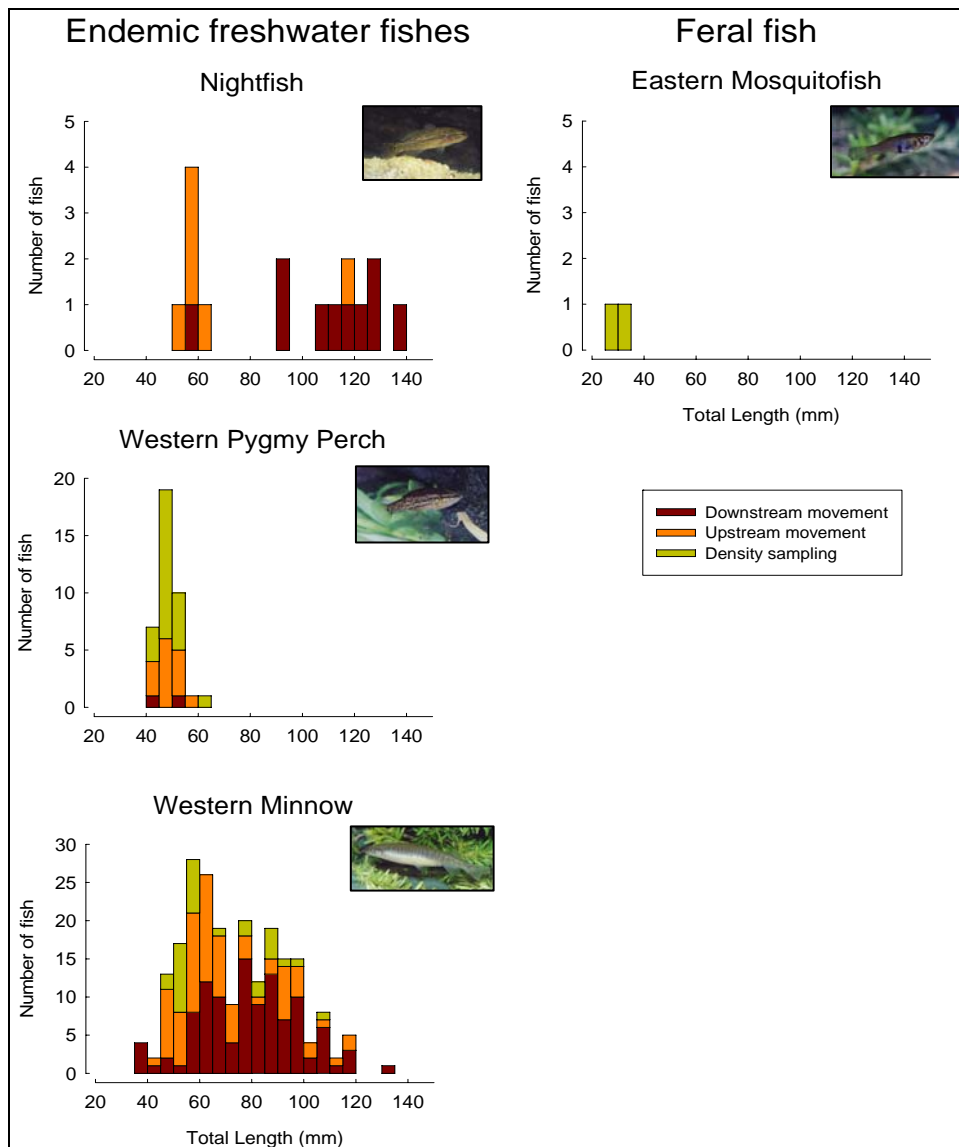


Figure 7: Length-frequency histograms of the fishes captured in Bramley Brook.

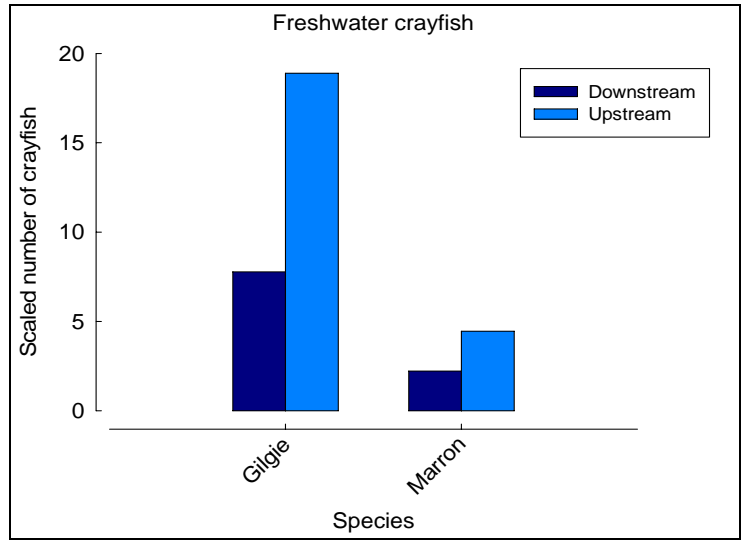


Figure 8: Direction of movement of endemic crayfishes captured at Carters Rd crossing in Bramley Brook.

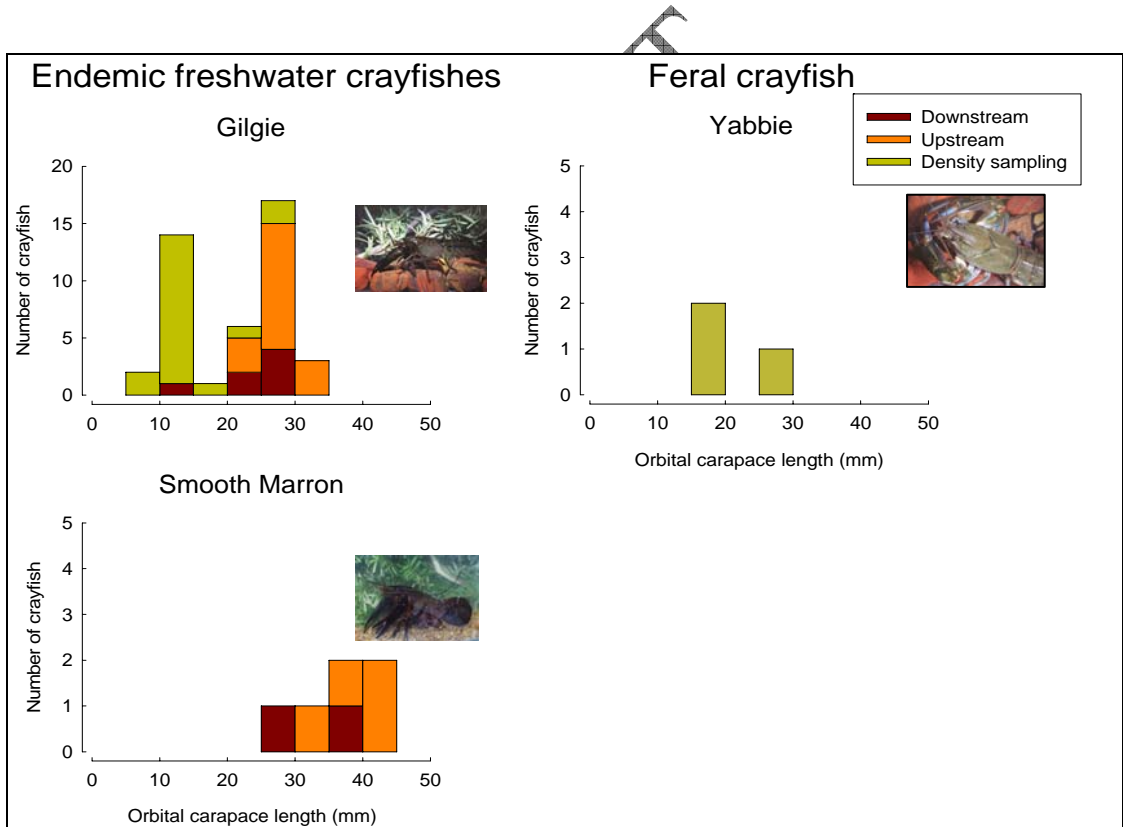


Figure 9: Length-frequency histograms of the crayfishes captured in Bramley Brook.



Figure 10: Fin-nipped Western Pygmy Perch from an Eastern Mosquitofish (insert).

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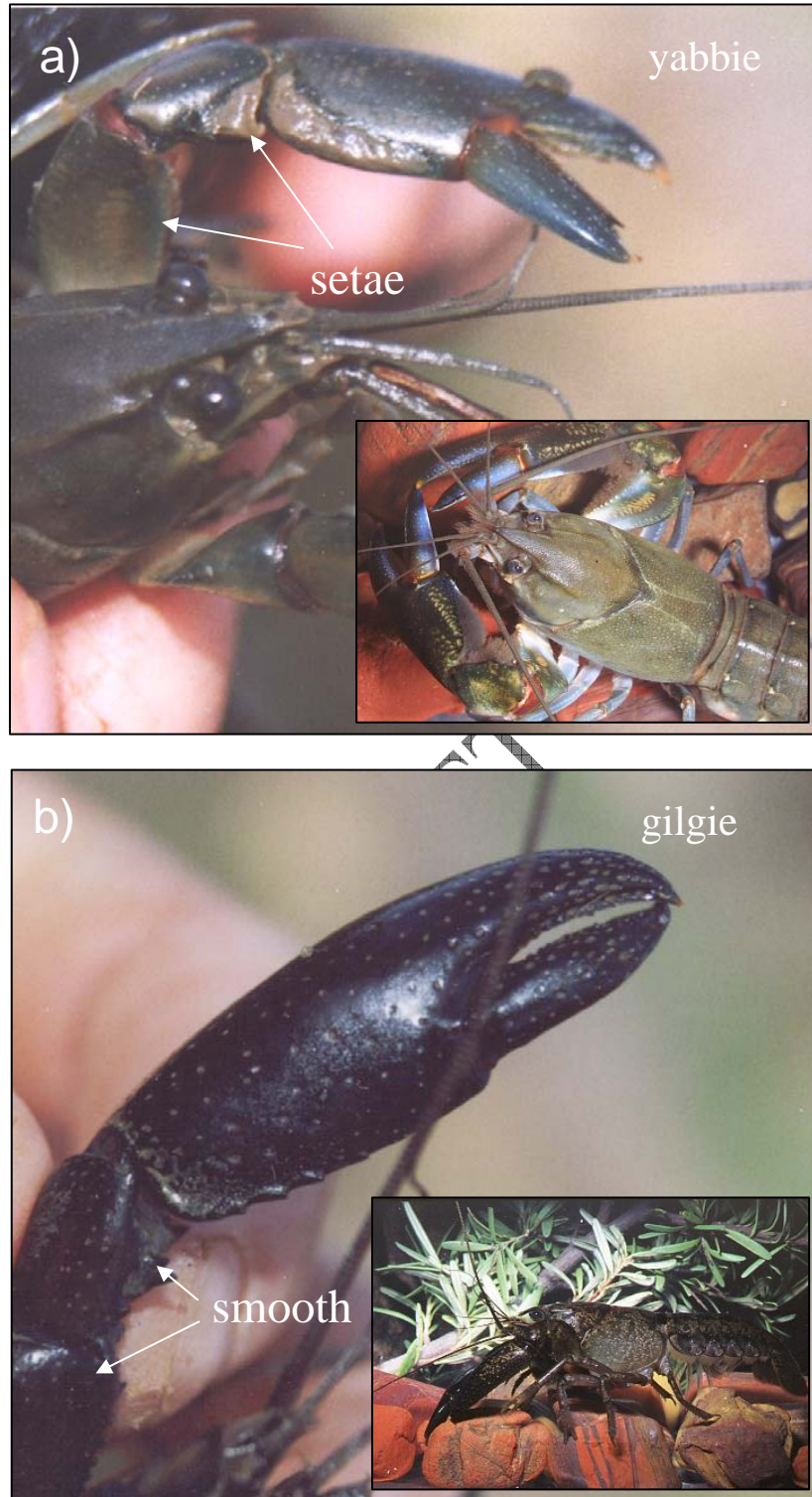


Figure 11: Differentiating between a native Gilgie and the introduced Yabbie. Note the setae on the carpus ('wrist') and merus ('arm') of the Yabbie, compared to the smooth condition of the Gilgie and all other native freshwater crayfish of Western Australia.

Yalgardup Brook

Endemic freshwater fishes

Three endemic freshwater fish species were recorded in Yalgardup Brook. The Western Minnow (0.04 m⁻²) and Western Pygmy Perch (0.02 m⁻²) were recorded at the downstream Kevill Rd site (Table 1, Figures 1, 2 and 5). Of particular note was the discovery of the rare (listed as Schedule 1 (rare or likely to become extinct), *Wildlife Protection Act 1950*) Mud Minnow at the downstream site. This represents the downstream-most known distribution of this species in the Margaret River catchment. The Mud Minnow is generally found in relatively undisturbed habitats (such as in Cane Break Conservation Reserve, upper Margaret River) and therefore its presence in Yalgardup Brook, a system with a relatively cleared catchment, is an unusual but significant finding. The length-frequency histograms highlighted the relatively few numbers of endemic fishes recorded in the system at the time of sampling.

The upstream, cleared site in Yalgardup Brook at Manfield Rd (Figures 2 and 4), was devoid of fish at the time of sampling (Table 1). However, it should be noted that water levels had apparently receded considerably in this relatively small system and it is likely that those species recorded at the lower site would seasonally utilise more upstream sections; probably as spawning habitat.

Introduced species

The Eastern Mosquitofish was found in high densities (4.73 m⁻²) at the downstream site in Yalgardup Brook; the highest density of this species recorded at any site in any system in the study. This also makes the recording of the Mud Minnow at that site even more surprising as it is known to be severely impacted by the feral species due to it occupying similar position in the water column and having a relatively weak swimming ability (Morgan & Beatty, unpublished data).

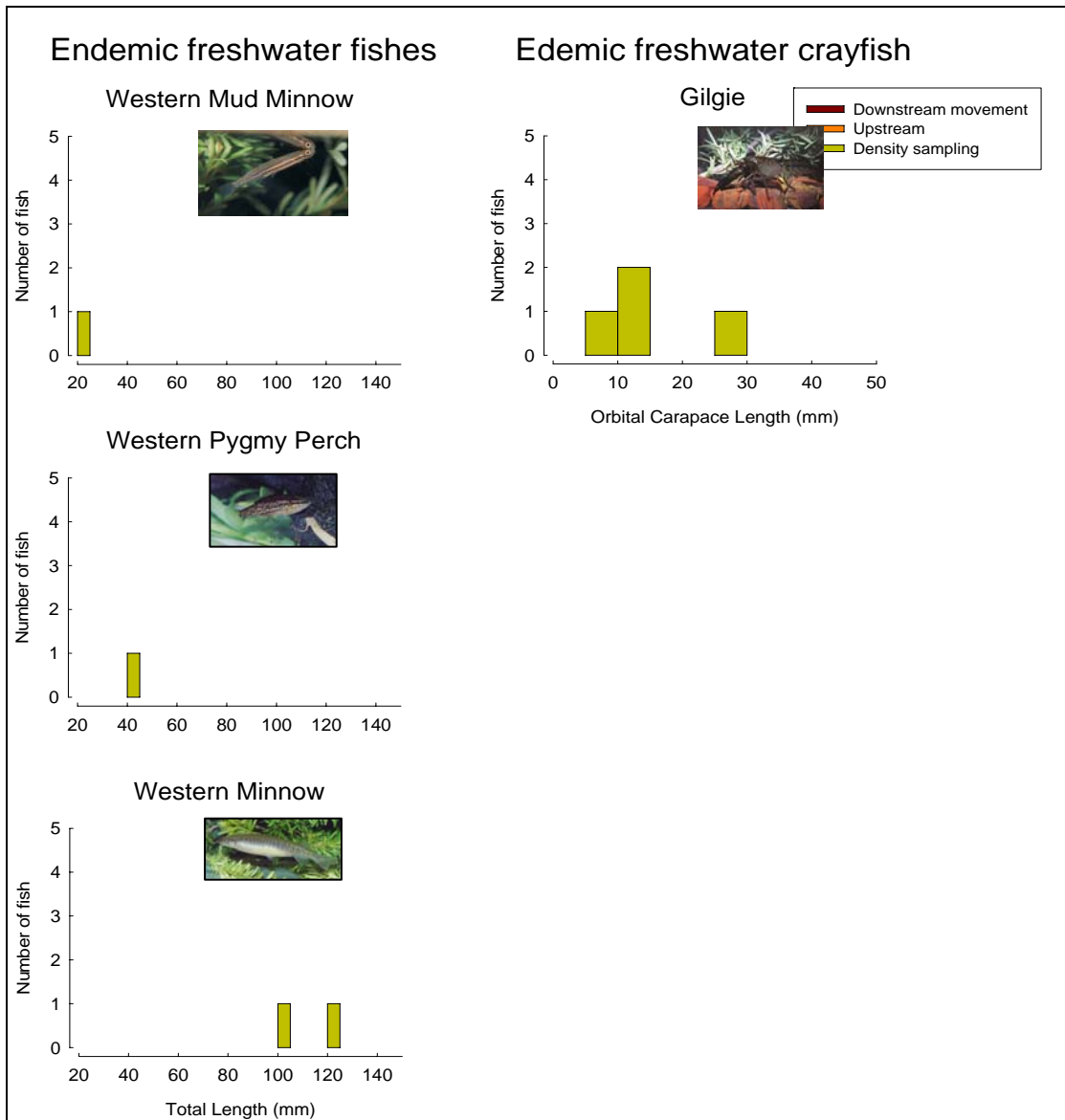


Figure 12: Length-frequency histograms of the fishes in Yalgardup Brook.

Darch Brook

Endemic freshwater fishes

Three endemic fishes were recorded in Darch Brook; all recorded at the downstream-most site at Halcyan Cres. (the same species as were recorded in Bramley Brook) (Table 1, Figures 2 and 4). Very high densities of Western Minnow (0.70 m^{-2}) were recorded at the downstream-most site with the Western Pygmy Perch and Nightfish also being recorded from this site. Large numbers of Western Minnows were captured mostly moving downstream in Darch Brook (Figure 13). Slightly more Western Pygmy Perch were recorded moving downstream than upstream in the system with very few Nightfish also recorded moving downstream (Figure 13).

Length-frequency distributions revealed a wide size range of the Western Minnow; similar to that revealed in Bramley Brook and Darch Brook and also apparently represents important spawning habitat for this species. Large numbers of the Western Pygmy Perch were recorded in Darch Brook and would utilise the system for spawning; however, newly recruited juveniles were not recorded as the sampling probably occurred prior to the spawning period. Western Pygmy Perch recorded in this system were generally smaller in size (mode 35-40 mm TL) than those recorded in Bramley Brook (mode 45-50 mm TL). The size difference may have been due to a slower growth rate in Darch compared to Bramley Brook and/or an earlier spawning of the species in Bramley Brook. The limited numbers of Nightfish recorded in the system had a size range of 55-70 mm TL and were probably ~1 year of age. Given their low abundances and single age cohort, it is unclear as to whether the species also utilises Darch Brook for breeding, noting that while males of the species mature in their first year, breeding is delayed in females until age 2 (Pen and Potter, 1990).

Endemic freshwater crayfishes

The Smooth Marron and Gilgie were recorded in Darch Brook with the Smooth Marron only being recorded (during fyke netting, Figure 13) at the downstream-most Halcyan Cres. site (Table 1, Figures 2 and 4). However, this species is also known from the lakes at Brookfield Estate (authors, unpublished data). As with the other two tributaries sampled, the Gilgie was the most widely distributed species in Darch Brook being recorded at all three sites and attained a density of 1.23 m^{-2} at Darch Rd crossing (Table 1, Figures 2 and 4).

Introduced species

The Eastern Mosquitofish and Goldfish were both recorded in Darch Brook at the Halcyan Cres. and Brookfield Estate (Table 1). Relatively low numbers of Goldfish were recorded and although previously known from Brookfield Estate (Drew McKenzie and the authors, unpub. data), had not

previously been recorded downstream from that point until the current study. Those recorded had a size range of 140-182 mm TL, however, three other larger individuals were visually observed in the lower lake on Brookfield Estate (Figure 4). It is possible that only limited numbers have moved downstream in Darch Brook and therefore it may still be possible to eliminate this species from the system. A successful control program was undertaken by community members coordinated by Cape to Cape Catchments Group in 2008 and it is recommended that an ongoing control program be conducted during low water levels (i.e. summer) in Brookfield Estate in order to attempt to eliminate the species.

The Yabbie was recorded from Brookfield Estate (also previously being recorded at this site by Cape to Capes Catchments Group and the authors) (Table 1, Figure 13). The individuals recorded were relatively large and probably mature (size range of 38-40 mm OCL, see Beatty et al. 2005a) (Figure 15). As with the Goldfish, it is recommended that a control program of this species be conducted to attempt to reduce its movement into other sections of Darch Brook and the main channel of the Margaret River. Unfortunately, there have been reports of the species having been recorded at the Halcyan Cres. site (Drew McKenzie pers. comm.); although it was not found during current sampling. Controlling the spread of this species may prove difficult; however, a reduction in numbers from the source population at Brookfield Estate could occur simultaneously with the control of the Goldfish population at this site (see below) and the species is unlikely to proliferate to the same extent in Margaret River as it has in the eutrophic Vasse River.

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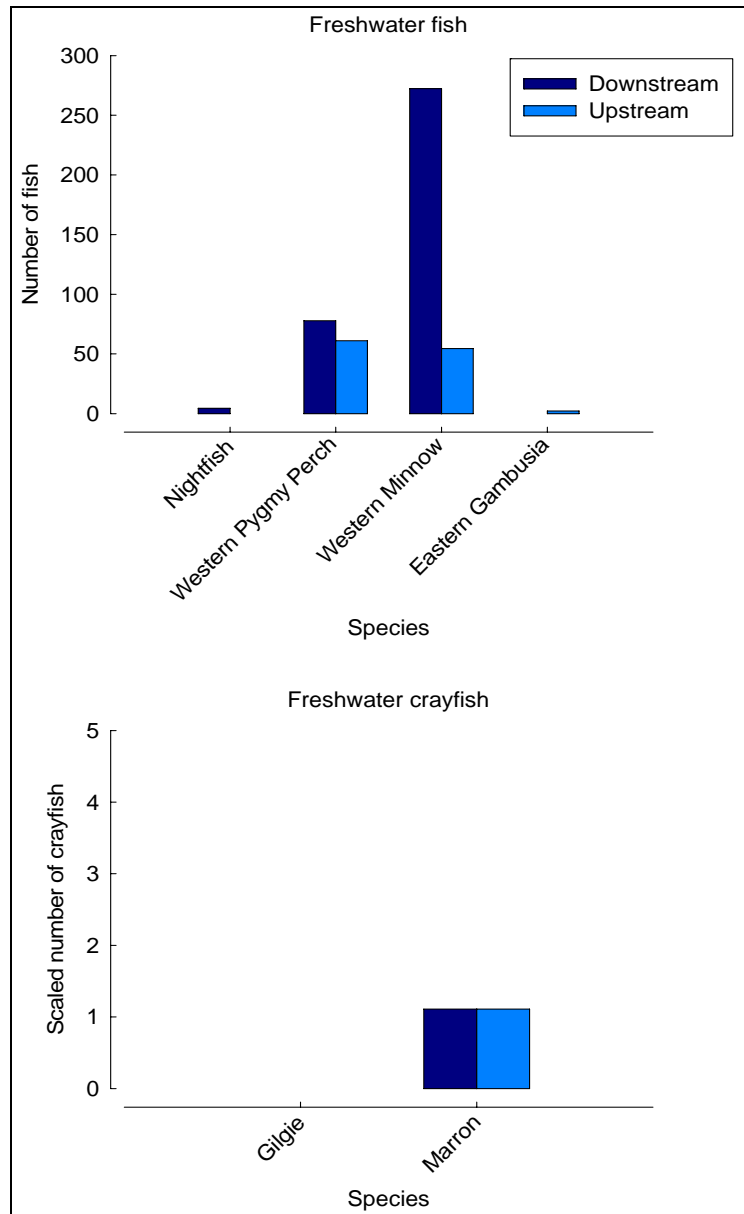


Figure 13: Number and direction of movement of fishes and crayfishes captured in Darch Brook.

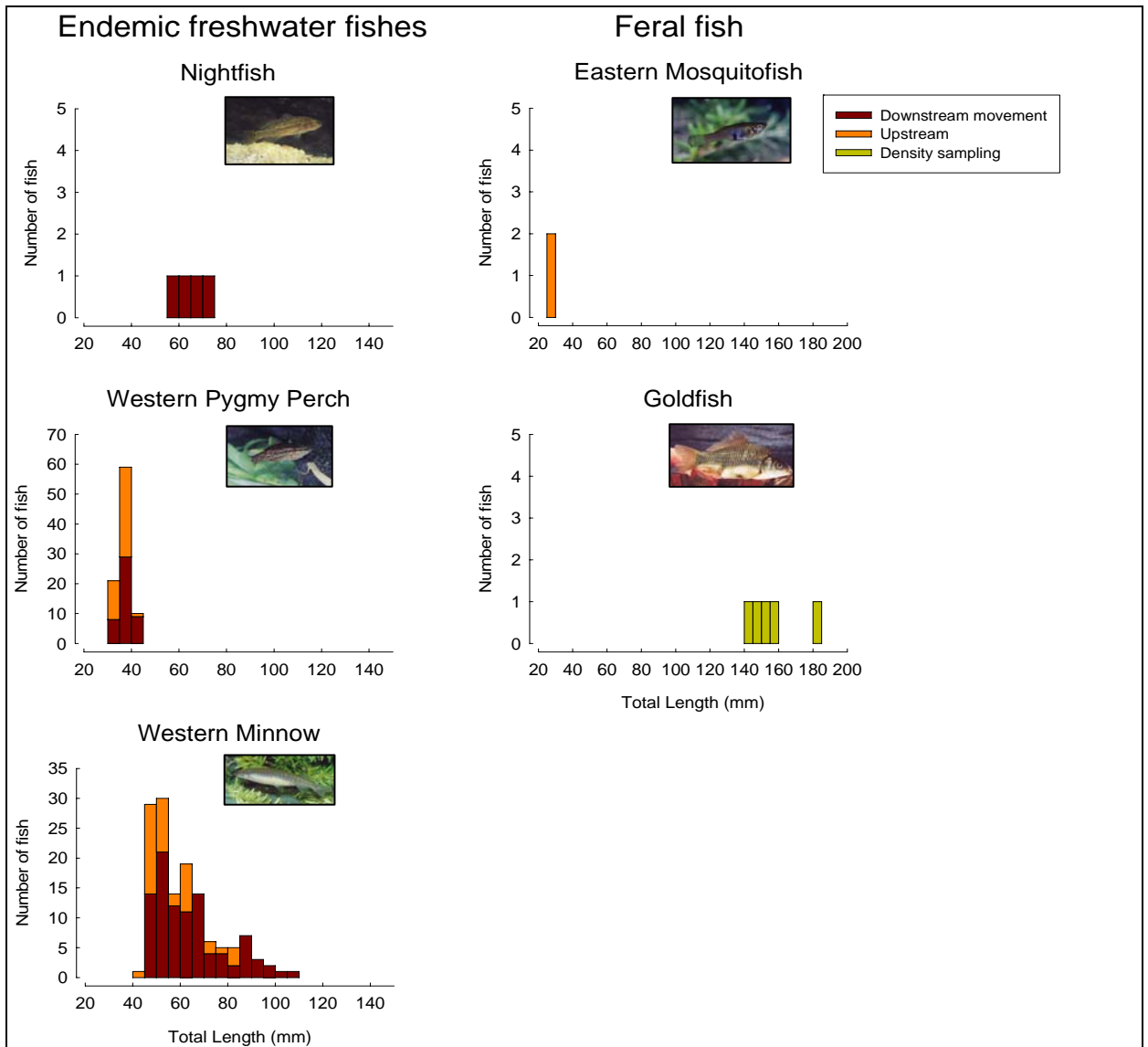


Figure 14: Length-frequency histograms of the fishes captured in Darch Brook.

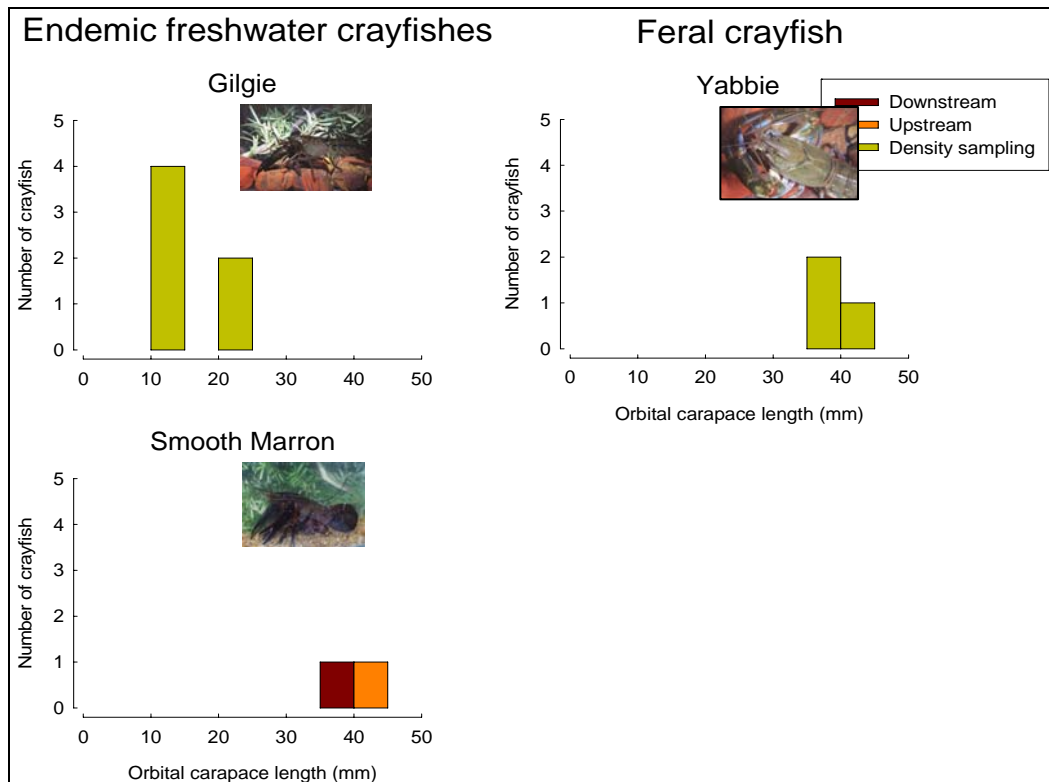


Figure 15: Length-frequency histograms of the crayfishes captured in Darch Brook.

Margaret River

Endemic freshwater fishes

Sampling in the main channel was limited to one site (Caves Rd) where the freshwater Nightfish and Western Pygmy Perch were recorded along with the estuarine Western Hardyhead and Silverfish also recorded (Table 1). Little is known on the migration patterns of freshwater fishes in the main channel aside from the usage of the two main channel fishways that are both known to particularly allow the passage of the Western Minnow; see Morgan & Beatty (2007), Beatty & Morgan (2008). It is recommended that seasonal determination of fish movements in the main channel (and tributaries) be undertaken in order to increase the understanding of spatial and temporal migration patterns in the system and also to better the understanding of the relative usage of the fishways by the native fishes of the river. For example, if a species was found to have strong upstream movements in the main channel but found not to use the fishway during that period then it may be assumed that the fishway is not conducive to allowing the passage of that species.

Summary and recommendations

This study represents the first examination of the fish and freshwater crayfish of the major tributaries of the Margaret River. The study recorded four species of endemic freshwater fish, two native estuarine fishes, two introduced fishes, two species of endemic freshwater crayfish, one freshwater shrimp, and one introduced freshwater crayfish.

- The largest tributary, **Bramley Brook**, represents important habitat for three of the endemic fishes and the Gilgie and Smooth Marron also utilise the system and is presumably also significant spawning and nursery for the endemic fishes. The introduced Yabbie was also recorded at one site in Bramley Brook.
- **Yalgardup Brook** also housed three endemic fishes (including the rare Mud Minnow) and also the common Gilgie. It is likely that these species utilise this Yalgardup Brook for spawning and additional winter sampling at high water levels could better determine this usage.
- **Darch Brook** housed the same three endemic fishes as Bramley Brook and similarly represents important habitat for these species. However, Darch Brook also housed the introduced Yabbie, Goldfish and Eastern Mosquitofish.
- The Goldfish were recorded downstream from Brookfield Estate for the first time and may have already moved into the Margaret River.
- Nonetheless, the low numbers recorded at the downstream site in Darch Brook suggests that a control program targeting the source population of the Goldfish and Yabbies in Brookfield Estate may still allow eventual elimination of these species (particularly Goldfish) from Darch Brook or may at least slow or prevent their spread and establishment in the Margaret River.
- Greater understanding on the spatial and temporal patterns of fish migrations in the Margaret River system as well as an enhanced understanding of the success of the two fishways in the main channel could be achieved by undertaking seasonal determination of fish movements in the main channel and tributaries of the Margaret River.

REFERENCES

- Beatty, S. J. (2006). The diet and trophic positions of translocated, sympatric populations of *Cherax destructor* and *Cherax cainii* in the Hutt River, Western Australia: evidence of resource overlap. *Marine & Freshwater Research* 57(8): 825-835.
- Beatty, S.J., McAleer, F.J. & Morgan, D.L. (2008). *Interannual variation in fish migration patterns and habitats of the Blackwood River and its tributaries: annual progress report*. Centre for Fish & Fisheries Research, Murdoch University Report to Department of Water.
- Beatty, S.J. & Morgan, D.L. (2008). *Monitoring the Margaret River Fishways – 2007*. Centre for Fish & Fisheries Research, Murdoch University Report to Cape to Cape Catchments Group and Department of Water.
- Beatty, S.J., Morgan, D.L. & Gill, H.S. (2004). Biology of a translocated population of the large freshwater crayfish, *Cherax cainii* (Austin & Ryan, 2002) in a Western Australian river. *Crustaceana* 77(11): 1329-1351.

- Beatty, S.J., Morgan, D.L. & Gill, H.S. (2005). Life history and reproductive biology of the gilgie *Cherax quinquecarinatus*, a freshwater crayfish endemic to south-western Australia *Journal of Crustacean Biology* 25(2): 251-262.
- Beatty, S.J., Morgan, D.L. & Gill, H.S. (2005a). Role of life history strategy in the colonisation of Western Australian aquatic systems by the introduced crayfish *Cherax destructor* Clark, 1936. *Hydrobiologia* 549: 219-237.
- Beatty, S., Morgan, D., McAleer F., Koenders A. & Horwitz P. (2006). *Fish and freshwater crayfish communities of the Blackwood River: migrations, ecology and the influence of surface and groundwater*. Centre for Fish & Fisheries Research, Murdoch University Report to South-west Catchments Council and Department of Water, Western Australia.
- Gill, H.S., Hambleton, S.J. & Morgan, D.L. (1999). Is *Gambusia holbrooki* a major threat to the native freshwater fishes of south-western Australia? In Seret, B. & Sire, J.-Y., (eds). *Proceedings 5th Indo-Pacific Fish Conference (Noumea, 3-8 November 1997)*. Pp. 79-87. (Paris: Societe Francaise d'Ichtyologie & Institut de Recherche pour le Development).
- Morgan, D. & Beatty, S. (2004). *Margaret River Fishway*. Centre for Fish & Fisheries Research, Murdoch University Report to the Margaret River Regional Environment Centre.
- Morgan, D.L. & Beatty, S.J. (2007). *Fish migrations patterns on the Margaret River fishways: 2006* Centre for Fish & Fisheries Research, Murdoch University Report to Department of Water and Cape to Capes Catchments Group.
- Morgan, D.L., Gill, H.S. & Potter, I.C. (1998). Distribution, identification and biology of freshwater fishes in south-western Australia. *Records of the Western Australian Museum Supplement No. 56*, 97 pp.
- Morgan, D. & Beatty, S. (2003). *Fish fauna of Margaret River Western Australia*. Centre for Fish & Fisheries Research, Murdoch University Report to the Margaret River Regional Environment Centre.
- Pen, L.J. and Potter, I.C. (1991a). Biology of the western minnow, *Galaxias occidentalis* Ogilby (Teleostei: Galaxiidae), in a south-western Australian river. 1. Reproductive biology. *Hydrobiologia* 211: 77-88.

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