



Fish and freshwater crayfish communities of the Brunswick and Preston Rivers

*Prepared for the Leschenault Catchment Council
March 2006*

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Freshwater Fish Research



Acknowledgements

The authors would like to thank Leigh Taylor (Leschenault Catchment Council) and Cassandra Jury (Cape to Cape Catchments Group) for initiating the study and coordinating sample sites. We would also like to thank the South West Catchment Council for funding the project.

Brief

This report details the findings of the survey conducted by *Freshwater Fish Research* in February 2006 of the fish and freshwater crayfish fauna of the Brunswick and Preston Rivers that was commissioned by the Leschenault Catchment Council (LCC). The results of this study will be used by the LCC in preparing River Action Plans for these two systems.

Report should be cited as:

Morgan, D. & Beatty, S. (2006). Fish and freshwater crayfish communities of the Brunswick and Preston Rivers. Freshwater Fish Research, Murdoch University report to the Leschenault Catchment Council.

Background

The Leschenault Inlet, located on the Swan Coastal Plain near Bunbury, is the estuary of the Brunswick, Collie, Preston and Ferguson Rivers. There is a considerable amount of information detailing the fish fauna of the Leschenault Inlet with Potter *et al.* (1997, 2000) recording 42 species of fish from 26 families. The estuary is dominated by gobies, atherinids and clupeids which comprised almost 90% of the fishes. Potter *et al.* (2000) also reported 13 species from gill net captures in the lower (tidal) Collie River. Neither of these studies reported on the fishes found within the freshwaters of the Leschenault Inlet catchment and although Pen & Potter (1990, 1991a, b, c, d, 1992) conducted biological studies on a number of native and introduced freshwater fishes in the upper Collie River by, there is no published information regarding the prevailing fishes (or freshwater crayfishes) of the Brunswick or Preston Rivers.

Hale *et al.* (2000) reported on the fish fauna of one site in the upper Brunswick River, near the confluence with the Augustus River, one site in the Augustus River and two sites in the Ernest River. While they recorded only two species of freshwater fish from the Ernest River (i.e. Western Pygmy Perch (*Edelia vittata*) and Nightfish (*Bostockia porosa*)), they captured a further two endemic freshwater fishes from the Augustus and upper Brunswick Rivers (i.e. Western Minnow (*Galaxias occidentalis*) and Freshwater Cobbler (*Tandanus bostocki*)) as well as larval (ammocoetes) Pouched Lampreys (*Geotria australis*) and three introduced fishes (i.e. Rainbow Trout (*Oncorhynchus mykiss*), Brown Trout (*Salmo trutta*) and Eastern Mosquitofish (*Gambusia holbrooki*)). The presence of the larger introduced fishes, the lamprey and the Freshwater Cobbler in the Augustus River compared to the Ernest River was attributed to the provision of environmental water releases from Freshwater Lake. These species are more often associated with permanent waters over ephemeral systems.

The distributions of fishes inhabiting the inland waters of the south-western corner of Western Australia were documented in Morgan *et al.* (1998) and include the systems from Capel to Two People's Bay east of Albany and thus does not encompass the more northerly Leschenault catchments, but does include some sites on the Collie River South Branch. The aims of the present study were to ameliorate the paucity of knowledge of the fishes and freshwater crayfishes inhabiting two of the major systems flowing into the Leschenault Inlet and thereby provide the Leschenault Catchment Council with an overview of the fishes of the Brunswick and Preston Rivers.

Methods

During February 2006, seven sites were sampled for fish and freshwater crayfish on each of the Brunswick River and Preston River (Figure 1). Additional sites were sampled for freshwater fish in the Brunswick and Preston Rivers by the senior author in the summer of 1999/2000. Data on fish presence/absence from these and additional sites in Morgan *et al.*

(1998) from the Collie River (into which the Brunswick River flows) are included on the species maps. Site photographs are included in Appendix 2.

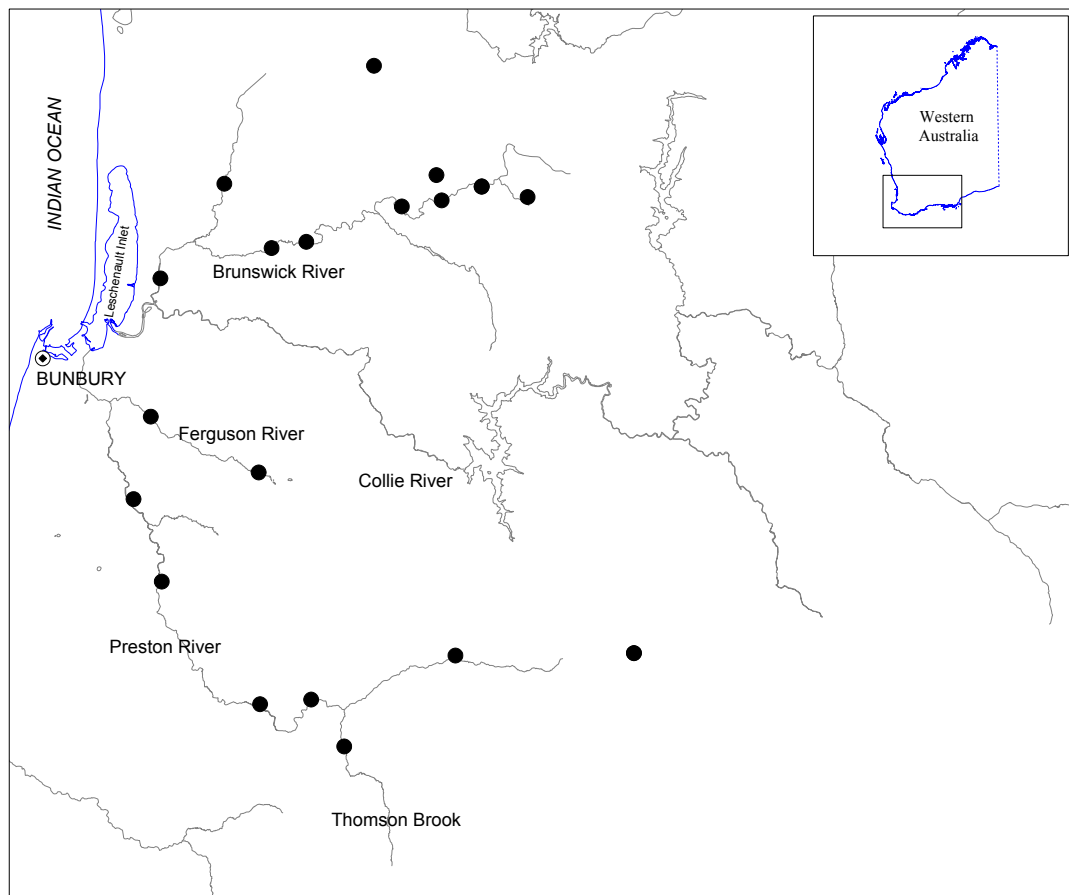


Figure 1 Sites sampled for fish and freshwater crayfish in the Brunswick and Preston Rivers.

At each site, the water temperature ($^{\circ}\text{C}$), conductivity ($\mu\text{S}/\text{cm}$), pH and dissolved oxygen (ppm) were measured at three locations and a mean determined.

The sampling regime for fish and freshwater crayfish aimed at determining the densities of each species present at each site over an area of up to 340 m^2 . A range of in-stream habitats at each site was sampled to account for differential use of micro-habitats by the prevailing species. Sampling was primarily undertaken using a back-pack electrofisher (*Smith-Root Model 12-A*) to temporarily stun the fish and crayfish. Electrofishing is an effective tool in the capture more cryptic species. A variety of seine nets were also deployed over sites where flat benthic habitat dominated.

Upon capture, all species were identified, measured to the nearest 1 mm total length (TL) (for fish) or orbital carapace length (OCL) (for freshwater crayfish) and the majority promptly released. A sub-sample of animals was retained from each river for further analysis of disease. In order to determine the structure of the populations of fish and crayfish within each system, the length-frequencies of each species captured in adequate numbers were plotted.

Environment of the rivers

The water temperatures within the sites of the Brunswick and Preston rivers illustrate a general decline upstream (Figure 2). Aside from the two brackish downstream-most sites, the conductivities within the Brunswick River sites were all very fresh. The upper and lower two sites on the Preston River were brackish with the remainder fresh (Figure 2). The pH at sites on both rivers was generally close to neutral aside from the water-point site (Brun 5) on the Brunswick which was slightly acidic. The dissolved oxygen levels in both rivers were variable as is typically the case during periods of low flows.

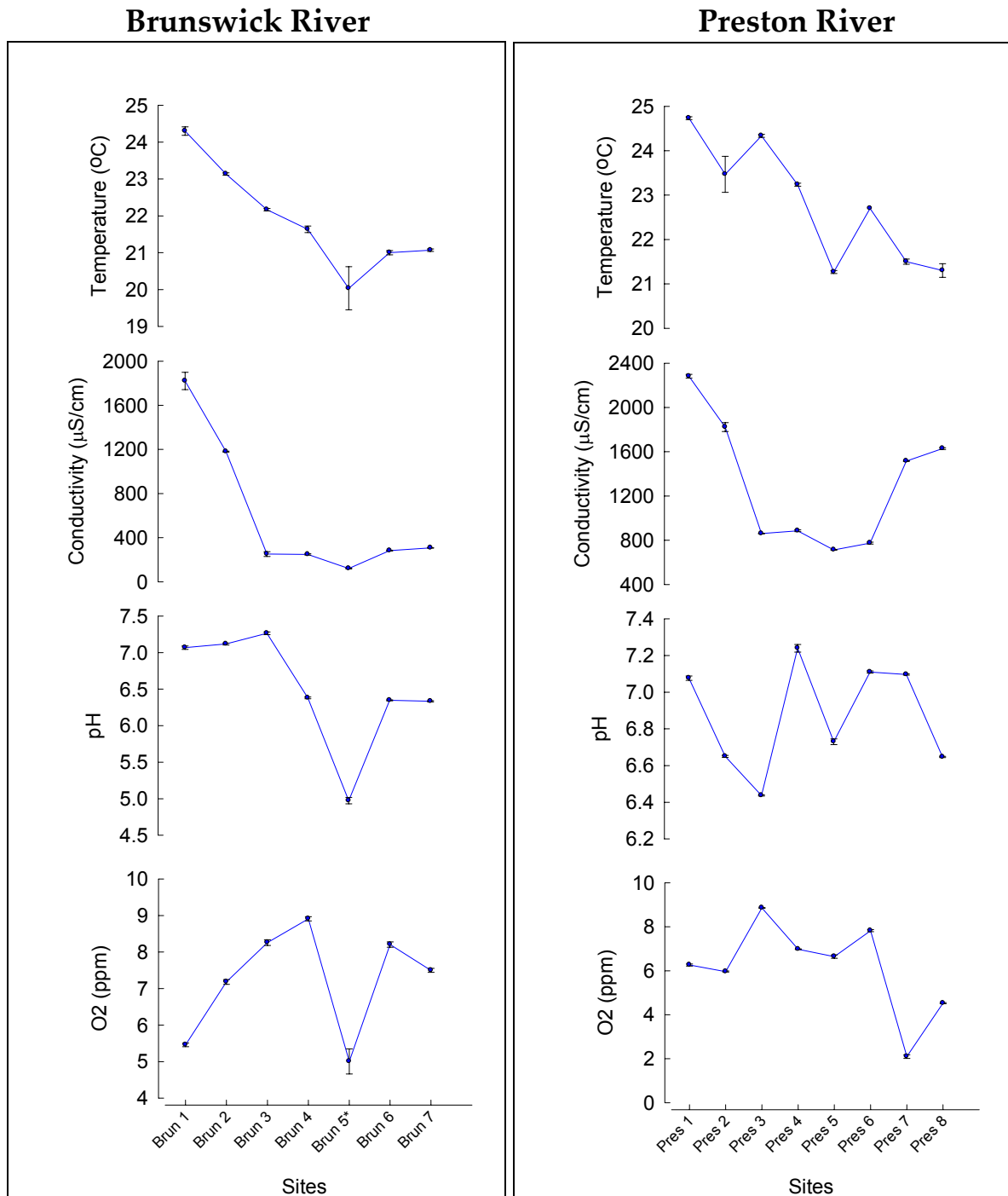


Figure 2 Water temperatures (°C), conductivities (μS/cm), pH and dissolved oxygen (ppm) levels in the sites sampled in the Brunswick and Preston Rivers.

The fishes in the drainages of the Leschenault Inlet: Brunswick and Preston Rivers

A total of 1336 and 1334 fish were captured in the Brunswick and Preston Rivers, respectively (see Appendices 3 and 4). Within the Brunswick River however, 529 fish were from five estuarine species that were captured in a tidally influenced site. To allow comparisons between the fauna in the different systems it is appropriate to exclude these fish and focus on the freshwaters. For example, of the 807 fish captured in the freshwaters of the Brunswick River, 486 or over 60% were from four freshwater fish species that are endemic to south-western Australia, while the remaining fishes captured were from two introduced species. In comparison, within the Preston River endemic freshwater fishes also accounted for approximately 60% of the fishes captured, with introduced fishes from three species contributing to ~38% of captures and the remainder being made up of three estuarine species (see below).

Freshwater Endemic Fishes

The south-west of Western Australia has eight species of endemic freshwater fish. During this study four of these species were found within the catchments that drain into the Leschenault Inlet, including the Freshwater Cobbler, Western Minnow, Western Pygmy Perch and Nightfish. Similarly, Pen & Potter (1990, 1991a, b, c) and Morgan *et al.* (1998) reported these species from the Collie River. Below both the gauging station at Boyanup on the Preston River, and the weir at Brunswick Junction on the Brunswick River, large numbers of fish were captured (see Appendices 3 and 4). It is likely that these weirs severely impact on the upstream migrations of many species within the river.

Freshwater Cobbler (*Tandanus bostocki*)



Capture locations: During this study the Freshwater Cobbler was found in both the Brunswick (5 fish from 3 sites) and Preston (4 fish at 1 site) Rivers and it is known to be common throughout the Collie River, including Wellington Dam (Figure 2). Within the

Preston River it was only found at one site below the gauging station in Boyanup. The species undertakes upstream spawning migrations during late spring and summer and barriers would significantly impact on such movements.

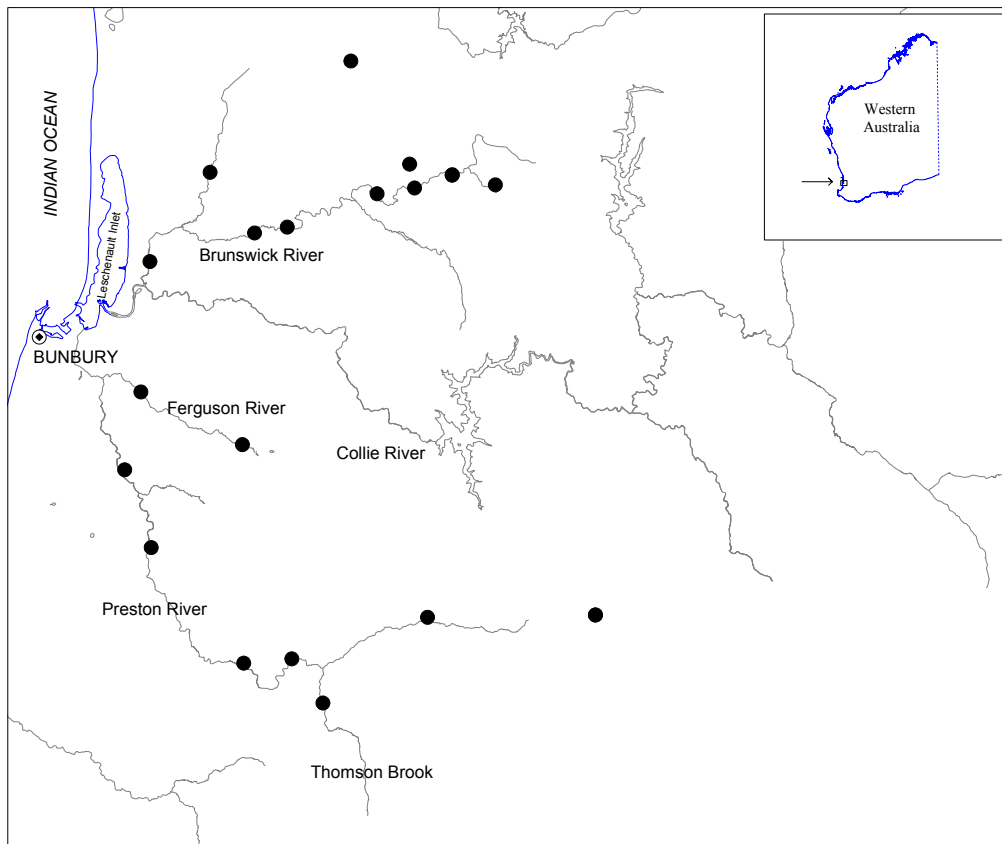


Figure 3 Capture locations of Freshwater Cobbler within the Brunswick and Preston Rivers.

Western Minnow (*Galaxias occidentalis*)



Capture locations: During this study the Western Minnow was found to be widespread throughout both the Brunswick and Preston Rivers and it is known to be common throughout the Collie River (Figure 4). Within the Brunswick River our catches were dominated by larger (>1 year old) fish with only one fish <70 mm TL captured. In contrast,

within the Preston River large numbers of new recruits (0+) were captured (Figure 5). The large sizes and thus longevity of some of the adults is probably a reflection of the continuous flows within these systems offering permanency of habitats. The Western Minnow is widespread in south-western Western Australia and is known from the Arrowsmith River in the north to the Waychinnicup River in the south-east. Maximum size is ~170 mm TL and they occur in all habitat types including small streams, lakes and floodwaters and have a diet that consists largely of terrestrial insects. Major migratory periods include late winter and spring to spawn and late spring for new recruits.

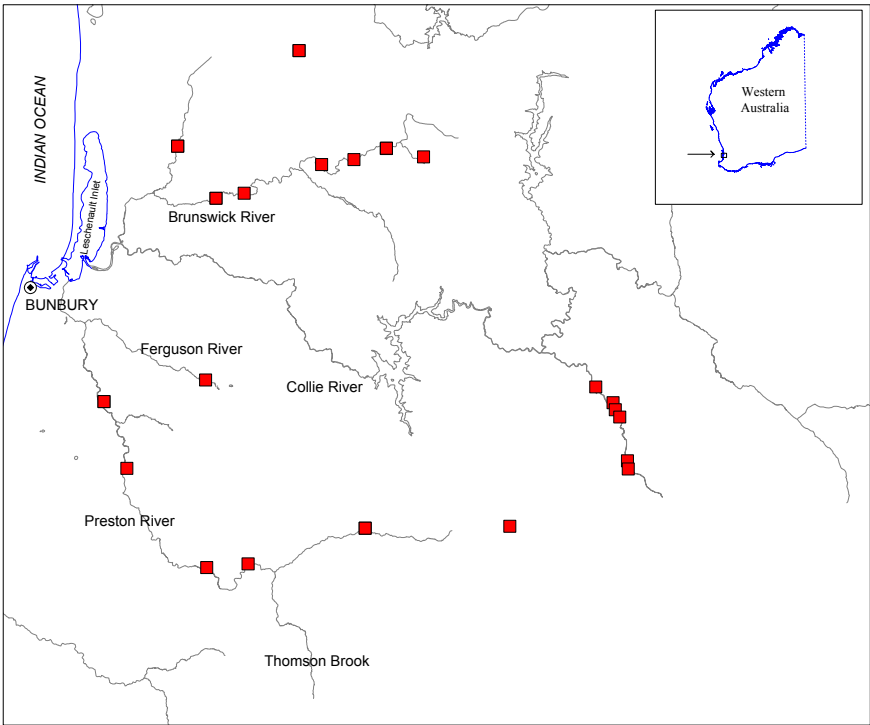


Figure 4 Capture locations of the Western Minnow within the Brunswick and Preston Rivers.

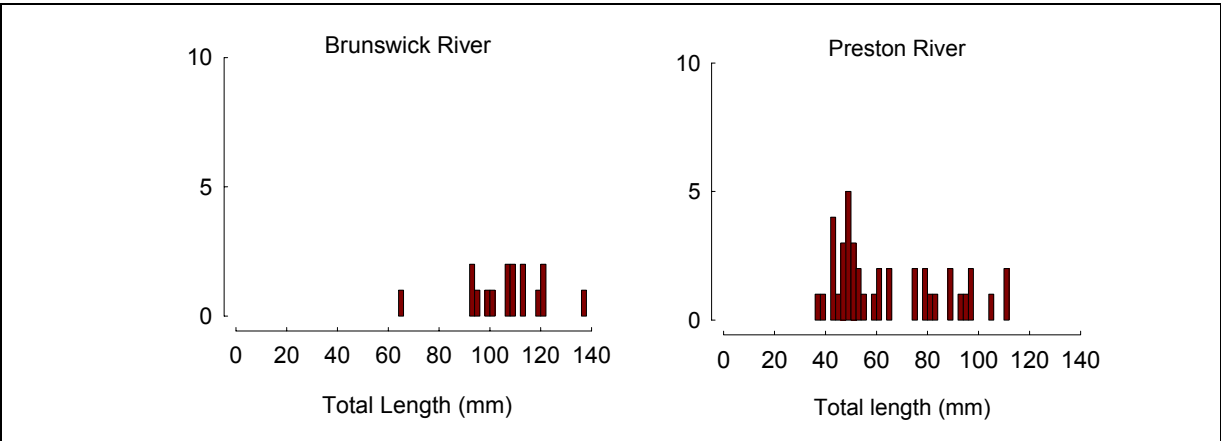


Figure 5 Length-frequency histograms of the Western Minnow within the Brunswick and Preston Rivers.

Western Pygmy Perch (*Edelia vittata*)



Capture locations: The Western Pygmy Perch was found to be widespread throughout both the Brunswick and Preston Rivers and it is known to be common throughout the Collie River (Figure 6). Similar to the Western Minnow, the population of Western Pygmy Perch within the Brunswick River was dominated by larger (>1 year old) fish with far greater recruitment occurring in the Preston River where large numbers of new recruits (0+) were captured (Figure 7). Maximum size is ~70 mm TL and in the Brunswick and Preston Rivers they were captured up to 60 mm TL. The large sizes and thus longevity of some of the adults is probably a reflection of the continuous flows within these systems offering permanency of habitats. The Western Pygmy Perch is widespread throughout south-western Australia, from the Arrowsmith River in the north to the Angove River in the south-east. Its absence from the main channel of some of the region's larger salt-affected rivers suggests a relatively low tolerance to dissolved salts. They are also susceptible to *Gambusia* attack. Spawning is in spring and they live for up to five years.

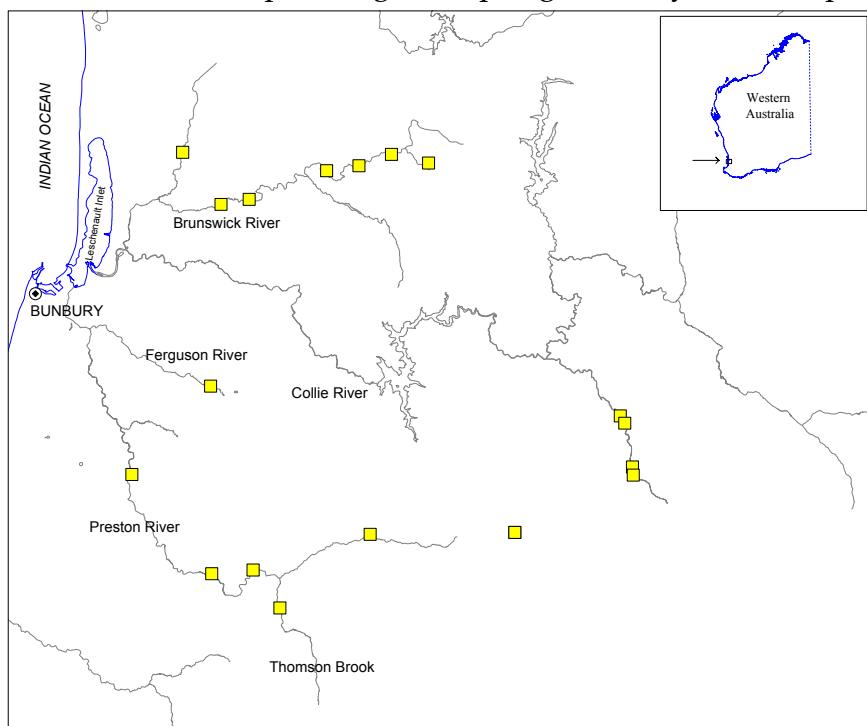


Figure 6 Capture locations of the Western Pygmy Perch within the Brunswick and Preston Rivers.

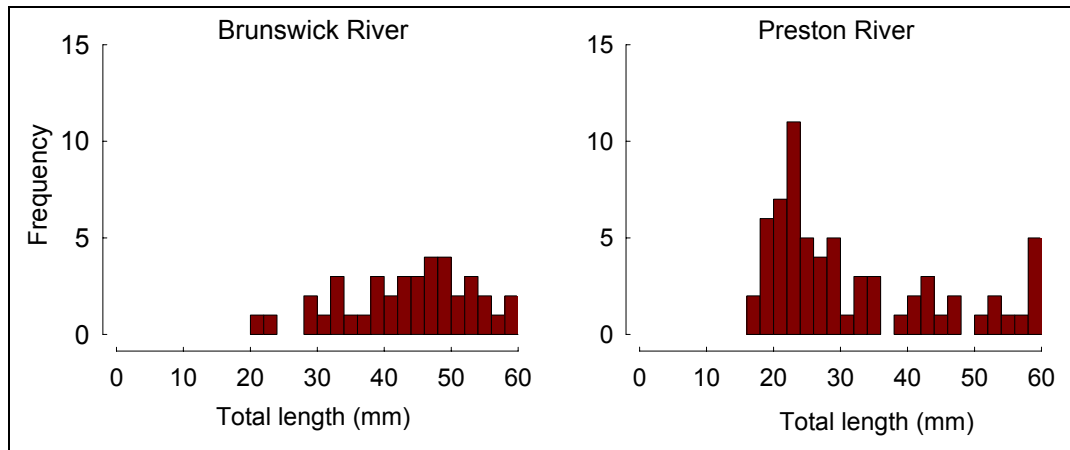


Figure 7 Length-frequency histograms of the Western Pygmy Perch within the Brunswick and Preston Rivers.

Nightfish (*Bostockia porosa*)



Capture locations: During this study the Nightfish was found to be widespread throughout the Preston River but was restricted to the headwaters of the Brunswick River (Figure 8). While a number of larger individuals were captured, a good proportion of new recruits were also caught, indicating successful recruitment from the spring breeding period in 2005 (Figure 9). While the maximum size of the species is considered to be ~140 mm TL, fish within the Brunswick River were caught up to ~150 mm TL, while in the Preston River they approached 140 mm TL. The capture of large fish indicates that the sites in the rivers sampled provide adequate habitat to support and maintain the species.

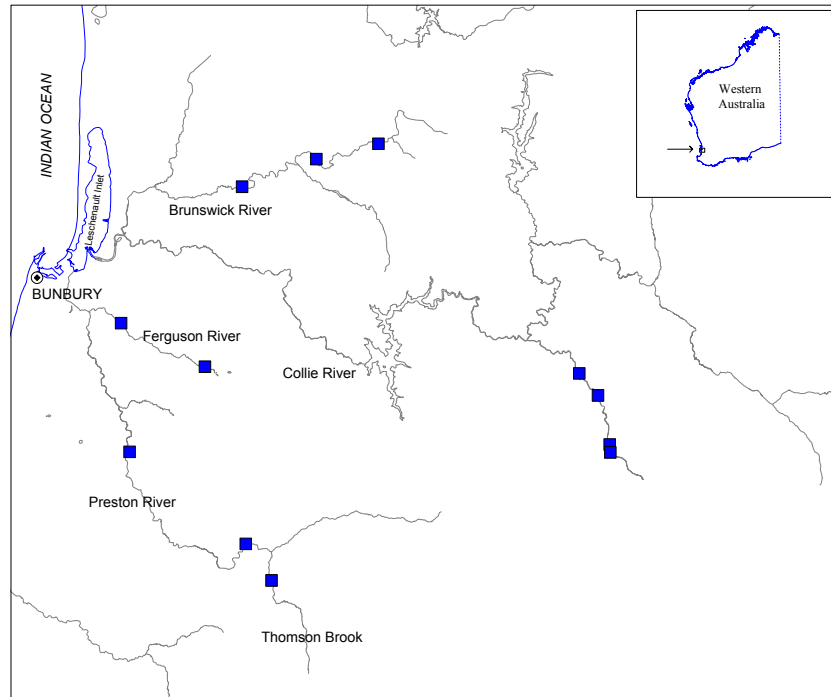


Figure 8 Capture locations of the Nightfish within the Brunswick and Preston Rivers.

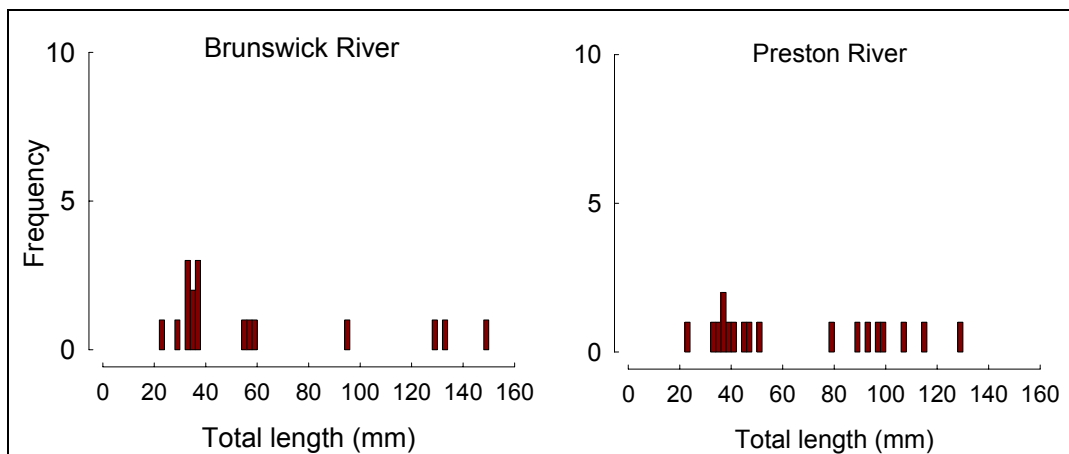


Figure 9 Length-frequency histograms of Nightfish within the Brunswick and Preston Rivers.

Estuarine Fishes in the freshwaters

A number of marine/estuarine fishes are often associated with the freshwater environments of south-western Australia, while a number of others are occasionally encountered within freshwaters. The Leschenault Inlet acts as a nursery ground for numerous fishes of marine origin, such as the mullets (Mugilidae) (Potter *et al.* 2000), but also supports populations of a number of species that are termed estuarine. Within the Brunswick River the marine/estuarine opportunistic Yellow-eye Mullet (*Aldrichetta forsteri*) and Whitebait (*Hyperlophus vittatus*) and the marine straggler Blue Sprat (*Spratelloides robustus*) were captured at the limit of tidal influence, as were the typically estuarine

Western Hardyhead (*Leptatherina wallacei*), the Swan River Goby (*Pseudogobius olorum*) and the South-western Goby (*Afurcagobius suppositus*) (Appendices 3 and 4). None of these was found to penetrate into the freshwater environment of the Brunswick River. In contrast, within the Preston River both the South-western Goby and the Western Hardyhead were captured a considerable distance from the mouth. Each of these three species is commonly encountered within inland waters (rivers/lakes) of south-western Australia (Morgan *et al.* 1998). While it is not clear why these species do not move into the freshwaters of the Brunswick, it is possible that either the channelised lower sections may not be conducive to these species or that the weir restricts their upstream movement.

During this study we captured what appears to be an Empire Gudgeon (*Hypseleotris compressus*) below the Boyanup Gauging Station on the Preston River (see photograph below). In agreement with published morphological counts of the species in Hoese & Allen (1983), the 33 mm TL individual captured in the Preston River had: 2 pores on the preoperculum; 1st dorsal fin rays - VI; 2nd dorsal fin rays - I, 9; anal fin rays - I, 10; and an elongate vertical dark spot just below the base of the caudal fin. ***This is not only the first time that the species has been recorded from the Leschenault system, but is also the first record of it from the entire South West Drainage Division.*** The presence of a single individual is bewildering. It is possible that the individual may be an unwanted aquarium pet that entered the Preston River as the result of a deliberate release (introduction). However, it is also conceivable that it entered the system through the inlet from the marine environment as a larvae or juvenile from populations in the Pilbara (Indian Ocean) Drainage Division (see Morgan & Gill 2004). Gopurenko *et al.* (2003) reported that larval drift from the north, via the Leeuwin Current, was the most likely factor accounting for the recent colonisation of south-western Australian estuaries by another tropical species, the Mud Crab (*Scylla serrata*). Some may argue that the Empire Gudgeon is strictly a freshwater species, but captures in north-western Australia strongly suggest that the species should be considered an estuarine species that moves into freshwater (see Morgan & Gill 2004) and it is known to sometimes be present in full strength sea water (Hoese & Allen 1983). The species was also recently captured in the Chapman River, possibly as a result of larval drift from northerly locations. Within the rivers of the Pilbara it is generally found in the lower reaches of rivers or in estuaries, e.g. Murchison River (Morgan & Gill 2004). Regardless, initial studies should be aimed at determining whether there is a self-maintaining population within the Preston River or Leschenault Inlet and future work should examine the genetic structure of the 'population' to determine whether the occurrence is the result of a translocation or from natural recruitment.



The actual Empire Gudgeon captured in the Preston River

Introduced Fishes

A total of 10 species of introduced freshwater fish are reported from Western Australia (Morgan *et al.* 2004). During this study we captured three introduced fishes, including: two Goldfish (*Carassius auratus*) from the Preston River below the gauging station at Boyanup; a number of Rainbow Trout (*Oncorhynchus mykiss*) from the upper Brunswick River, and; Eastern Mosquitofish (*Gambusia holbrooki*) from numerous sites throughout both systems (Figures 10 and 11, Appendices 3 and 4). Morgan *et al.* (1998) and Pen & Potter (1992) reported Redfin Perch (*Perca fluviatilis*) as being widespread throughout the Collie River, while Hale *et al.* (2000) reported Brown Trout (*Salmo trutta*) in the Augustus River. As Goldfish were only found below the gauging station it may be that this barrier has limited their spread upstream. It may also suggest that the initial site of release was in the lower Preston River, potentially near the urban centre of Bunbury. Rainbow Trout were captured in the upper Brunswick River and these fish are most likely to have been fish that were stocked by the Department of Fisheries WA. Between 1999 and 2004 some 90000 Rainbow Trout fry were stocked into the Brunswick River, and a further 240000 fry and 8200 yearlings were stocked within the Collie River (Collie Gorge) during the same period. The impact of the continued stocking of trout into the Brunswick River should be assessed to determine predation levels on native fish and freshwater crayfish. Impacts of W.A.'s introduced fishes are summarised in Morgan *et al.* (2004), but in general range from competition for food and habitat with native fishes to predation on native fishes and crayfishes.



Goldfish



Eastern Mosquitofish

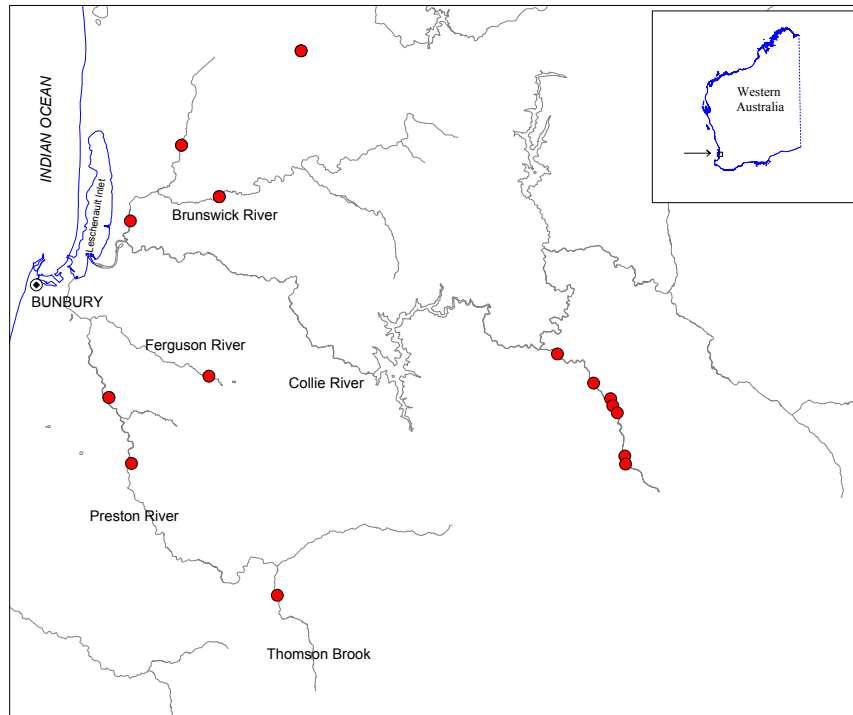


Figure 10 Capture locations of the introduced Eastern Mosquitofish within the Brunswick and Preston Rivers.

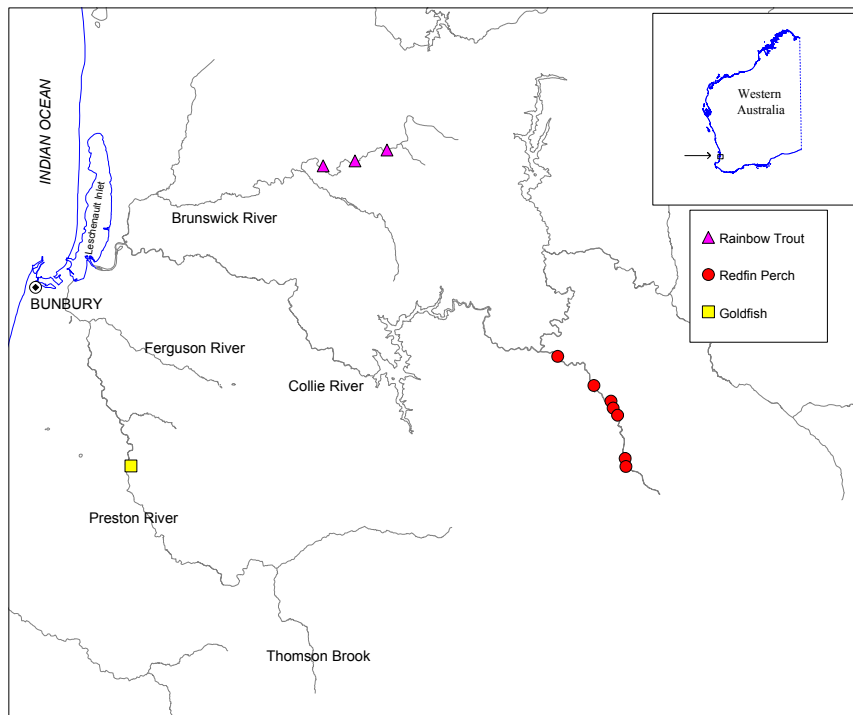


Figure 11 Capture locations of the introduced Rainbow Trout in the Brunswick River; Goldfish in the Preston River and; Redfin Perch in the Collie River.

The freshwater crayfishes in the drainages of the Leschenault Inlet: Brunswick and Preston Rivers

Freshwater Endemic Crayfishes

Two species of freshwater crayfish were captured during this study, the Gilgie (*Cherax quinquecarinatus*) and the Marron (*Cherax cainii*) (Figure 12) (Appendices 3 and 4). While the Gilgie was extremely widespread and often found in high densities, the Marron was less abundant and somewhat restricted. For example, of the 269 and 335 freshwater crayfish captured in the Brunswick and Preston Rivers, respectively, Gilgies represented ~97-98% of the catch in these systems (Appendices 3 and 4). The Gilgie is a species that occupies a wide range of permanent and temporary habitats as it is able to burrow to escape habitats that dry out. These habitats in the south-west include swamps, streams, large rivers and drainage canals (Austin and Knott 1996). The Gilgie is widely distributed throughout the region from Moore River to just east of Albany. The life-cycle of the Gilgie is adapted to occupying these small, relatively unpredictable environments (Beatty *et al.* 2005a). In contrast, the Marron (the third largest freshwater crayfish species in the world) only occupies permanent water bodies that have adequate water quality particularly in terms of dissolved oxygen levels and lower temperatures.

However, the Marron has been translocated for aquaculture purposes and is found from the Hutt River (north of Geraldton) to the Esperance region. Both these species are relatively intolerant of salinity and thus their inland range in wild systems has been reduced due to secondary salinisation of waterways. The biology of Marron has recently been described in Beatty (2003) and Beatty *et al.* (2004).



Gilgie



Marron

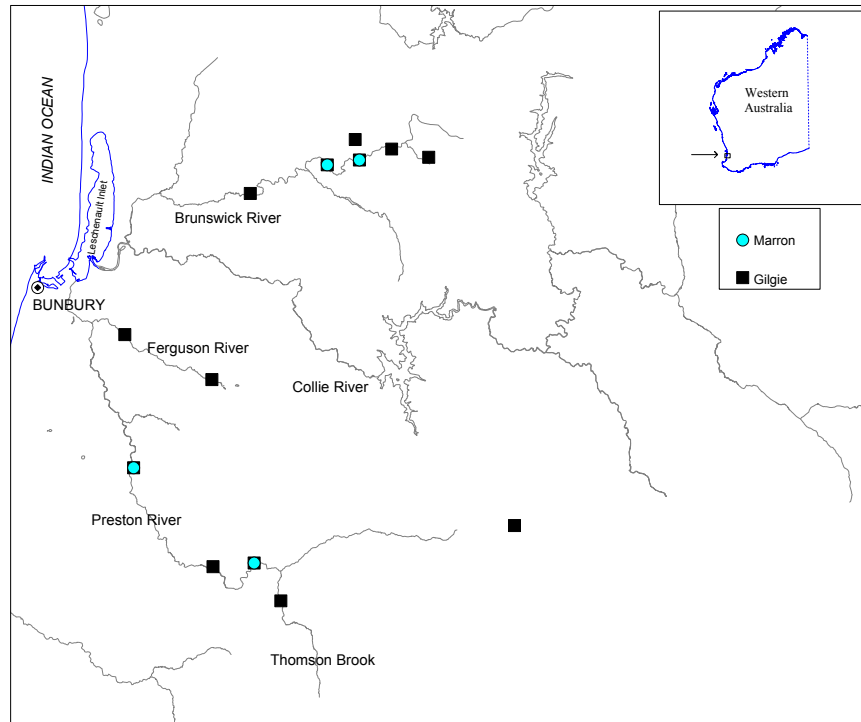


Figure 12 Capture locations of the Marron and Gilgies in the Preston and Brunswick Rivers.

Conclusions

Perennial flows in the Brunswick and Preston Rivers support good populations of a number of south-western Australia's endemic freshwater fishes, including the Western Minnow, Western Pygmy Perch and Nightfish, and also a small number of Freshwater Cobbler. Higher recruitment of these species within the Preston River compared to the Brunswick River appears to have occurred during 2005.

A number of typically estuarine fishes, including the Western Hardyhead, the Swan River Goby and the South-western Goby, were found within the freshwaters of the Preston River but none of these was found to penetrate into the freshwater environment of the Brunswick River.

Two species of endemic freshwater crayfish were found within these systems, the Gilgie and the Marron. While the Gilgie was extremely widespread and was often found in high densities, the Marron was less abundant and somewhat restricted.

This study reported the Empire Gudgeon below the Boyanup Gauging Station (Preston River) which is not only the first time that the species has been recorded from the Leschenault system, but it is also the first record of it from the entire South West Drainage Division. It is possible that the individual may be an unwanted aquarium pet that entered the Preston River as the result of a deliberate release (introduction) or it is conceivable that it entered the system through the inlet from the marine environment as a larvae or juvenile. Initial studies should be directed at determining whether there is a self-maintaining population within the Preston River or Leschenault Inlet and future work

should examine the genetic structure of the 'population' to determine whether the occurrence is either the result of a translocation or from natural recruitment.

Both rivers are also occupied by introduced Eastern Mosquitofish, while Goldfish were captured in the Preston River and Rainbow Trout were found within the Brunswick River, presumably as a consequence of a stocking programme in that system. An impact assessment of the stocked trout within the Brunswick River should be conducted. A further introduced fish species, the Redfin Perch, is present throughout the Collie River.

The impact of the weirs/gauging stations in these systems on migratory patterns of the native fishes requires examination.

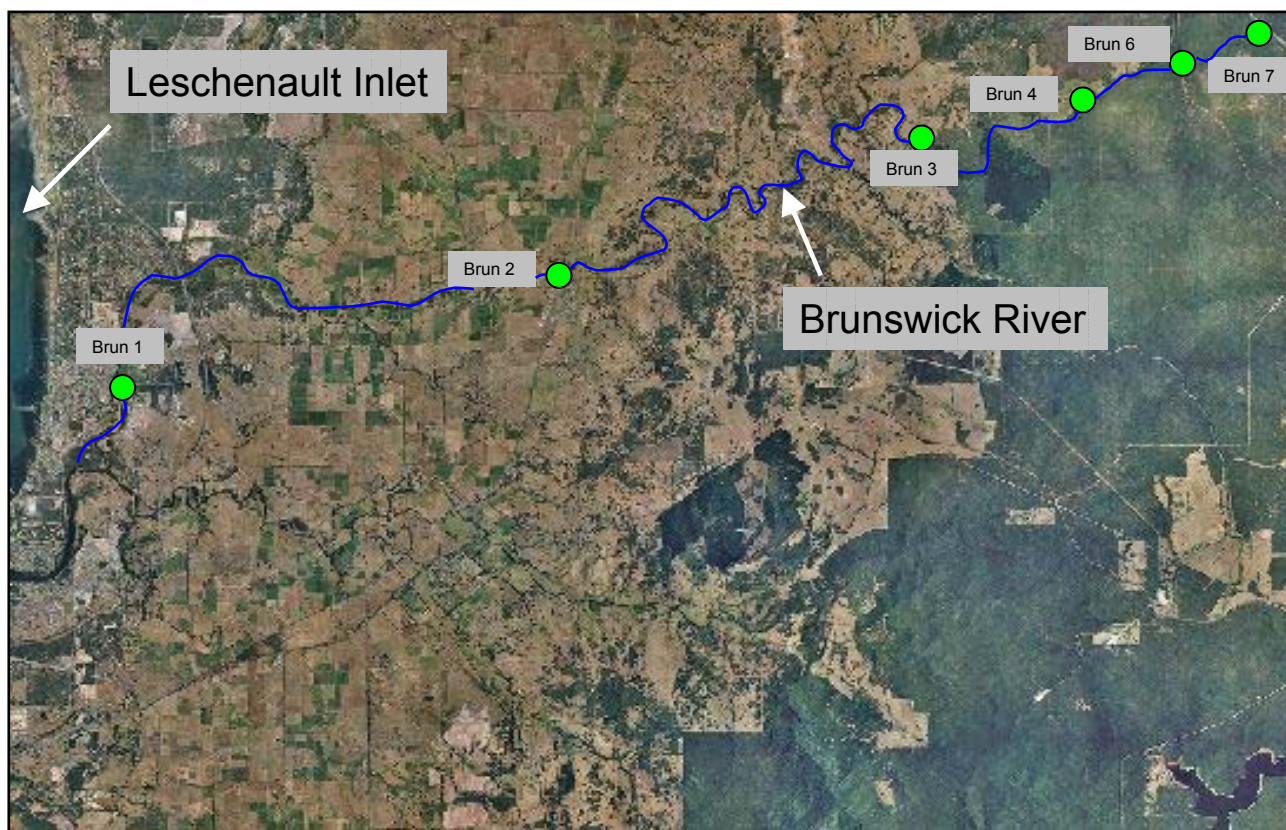
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Appendix 1

Aerial photograph of the Brunswick River showing sites sampled.



Appendix 2

Photographs of sites sampled on the Preston and Brunswick Rivers

Preston River



Ferguson Bk Martin-Pelusey Rd (Pres 1)



Ferguson Brook Pile Rd (Pres 2)



Boyanup gauging station (Pres 3)



Irishtown Rd (Pres 4)



Beelerup Rd (Pres 5)



Thomson Brook Sandhills Rd (Pres 6)



Collie Rd (Pres 7)

Brunswick River



Australind (Paris Rd)



Brunswick Junction SW Hwy



Flynn Rd



Camford Rd



Artificial water point off Camford Rd



Mornington Rd



Power Line Rd (off Mornington Rd)

Site location	Lat	Long	Native Freshwater Fishes				Native Estuarine Fishes					Introduced Fishes		Native Freshwater Crayfishes	
			Nightfish	Western Pygmy Perch	Western Minnow	Freshwater Cobbler	South-west Goby	Swan River Goby	Yellow-eye Mullet	Western Hardyhead	Blue Sprat/ Whitebait	Rainbow Trout	Eastern Mosquitofish	Gilgie	Marron
Australind (Paris Rd)	33.2746	115.7324					1 (0.003)	2 (0.01)	204 (0.6)	219 (0.64)	103 (0.3)		315 (0.93)		
Brunswick Junction South-West Highway	33.25	115.85	4 (0.02)	122 (0.61)	60 (0.30)									40 (0.20)	
Flynn Rd	33.2262	115.927	15 (0.10)	60 (0.4)	48 (0.32)	1 (0.01)						1 (0.01)		110 (0.73)	3 (0.02)
Camford Rd	33.2221	115.9591		50 (0.33)	60 (0.4)	1 (0.01)						3 (0.02)		30 (0.2)	6 (0.04)
Artificial water point off Camford Rd	33.2051	115.9549												3 (0.3)	
Mornington Rd	33.2130	115.9913	15 (0.15)		35 (0.35)							2 (0.02)		65 (0.65)	
Power Line Rd (Mornington Rd)	33.2198	116.0283	1 (0.05)	7 (0.35)	4 (0.20)	3 (0.15)								12 (0.6)	
Wokalup Creek, Mornington Rd	33.1315	115.9046			*								*		
Wokalup Creek, Mornington Rd	33.2126	115.9914		*	*										
Wellesley Rd	33.2542	115.822		*	*								*		
Wellesley River, Marriott Rd	33.2109	115.784		*	*		*						*		
TOTAL			35	239	207	5	1	2	204	219	103	6	315	260	9

Appendix 3 Sites sampled and number of each species captured (with densities (m⁻²) in parentheses) on the Brunswick River in February 2006. N.B. * denotes sites sampled by D. Morgan in 2000.

Site	Lat	Long	Native Freshwater Fishes				Native Estuarine Fishes						Introduced Fishes			Native Freshwater Crayfishes	
			Nightfish	Western Pygmy Perch	Western Minnow	Freshwater Cobbler	South-west Goby	Swan River Goby	Yellow-eye Mullet	Western Hardyhead	Whitebait /Blue Sprat	Empire Gudgeon	Rainbow Trout	Goldfish	Eastern Mosquitofish	Gilgie	Marron
Ferguson Bk Martin-Pelusey Rd	33.3676	115.7247	1 (0.02)													15 (0.33)	
Ferguson Brook Pile Rd	33.4052	115.8116	7 (0.10)	34 (0.47)	22 (0.31)										7 (0.10)	22 (0.32)	
Boyanup gauging station	33.4786	115.7335	2 (0.01)	10 (0.05)	64 (0.30)	4 (0.02)	4 (0.02)			2 (0.01)		1 (0.005)		2 (0.01)	382 (1.82)	29 (0.14)	4 (0.02)
Irishtown Rd	33.5611	115.8128		18 (0.18)	202 (2.02)		5 (0.05)			1 (0.01)						55 (0.55)	
Beelerup Rd	33.5580	115.8539	6 (0.03)	8 (0.04)	2 (0.01)		6 (0.03)									42 (0.21)	2 (0.01)
Thomson Brook Sandhills Rd	33.5895	115.8806	113 (2.26)	263 (5.26)											121 (2.42)	125 (2.50)	
Collie Preston Rd*	33.5267	116.1141		19 (0.32)	28 (0.47)											41 (0.68)	
Dardanup Rd West	33.4231	115.7108			*					*					*		
Wellington Lowden Rd	33.5284	115.9702		*	*		*										
Collie Preston Rd	33.5267	116.1141		*													
TOTAL			129	352	318	4	15			3		1		2	510	329	6

Appendix 4 Sites sampled and number of each species captured (with densities (m⁻²) in parentheses) on the Preston River in February 2006. N.B. * denotes sites sampled by D. Morgan in 2000.

