

# Fish Fauna of Margaret River Western Australia



*Report to the  
Margaret River Regional Environment Centre*

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***Freshwater Fish Research***  
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## Background

In order to enhance the migrations of fish species in the Margaret River the *Margaret River Regional Environment Centre*, in conjunction with the *Water and Rivers Commission*, constructed a fishway at the town weir in March and April 2003. The only data previously existing with regard to the fishes of the Margaret River is that by Morgan *et al.* (1998) and a few records in the Western Australian Museum. To ascertain the current suite of species in the river and the extent to which they occur throughout the river a number of sites were sampled in March 2003. Furthermore, to determine the extent to which the two weirs on the river impede the upstream migration of lampreys, the densities of larval lampreys (and thus recruitment success) were assessed throughout the river, i.e. both upstream and downstream of the weirs.

## Introduction

The south-west of Australia (Southwest Coast Drainage Division) has a unique assemblage of freshwater fishes, with eight of the 10 species being endemic to the region (Morgan *et al.* 1998, Allen *et al.* 2002). Furthermore, the south-west has the highest proportion of endemic species for any of Australia's drainage division's (Morgan *et al.* 1998). Also found in south-western Australia is the pouched lamprey (*Geotria australis*), the sole representative of the Geotriidae and one of only four extant lamprey species found in the Southern Hemisphere (Potter 1996a). The pouched lamprey has a unique life-cycle whereby adults migrate from the sea to spawn in the rivers of the south-west with the larval stage (ammocoetes) burrowing into the substrate. Considering the high endemicity of the native fishes of the region, together with the complex life history of the lamprey and the increasing pressure being placed on aquatic ecosystems in the south-west, it is necessary that both areas of high conservation value are conserved and that any threats to this unique fauna are mitigated.

Margaret River represents one of the few river systems in south-western Australia that has not become salinised as a result of large scale land clearing (Morgan *et al.* in press), and one that has much of its natural riparian and fringing vegetation intact. However, it is one of the few rivers in the region that has seen the main channel regulated with the construction of two weirs. These weirs (see Figure 2) are seen as obstructing the upstream movement of native fishes, including the pouched lamprey. To determine the extent to which these barriers impede the upstream migration of lampreys, the densities of larval lampreys (and thus recruitment success) were

assessed at eight sites throughout the river, i.e. both upstream and downstream of the weirs. The teleosts present at each site were also recorded.

## Methods

During March 2003, the fish fauna of eight sites (see Figure 1) on the Margaret River were sampled using a variety of methods including: electrofishing, seine nets, gill nets and a diving visual survey using mask and snorkel. The use of an electrofisher allowed the capture of larval lampreys (ammocoetes) that are buried in the substrate. Immediately following capture all fish were released and the relative abundance of each species captured at each site recorded. The total length (mm) of each ammocoete was recorded.

Species maps were created using GPS data recorded at each site and the mapping software MapInfo. These maps also include data reported in Morgan *et al.* (1998) and those records that exist in the Western Australian Museum collections.

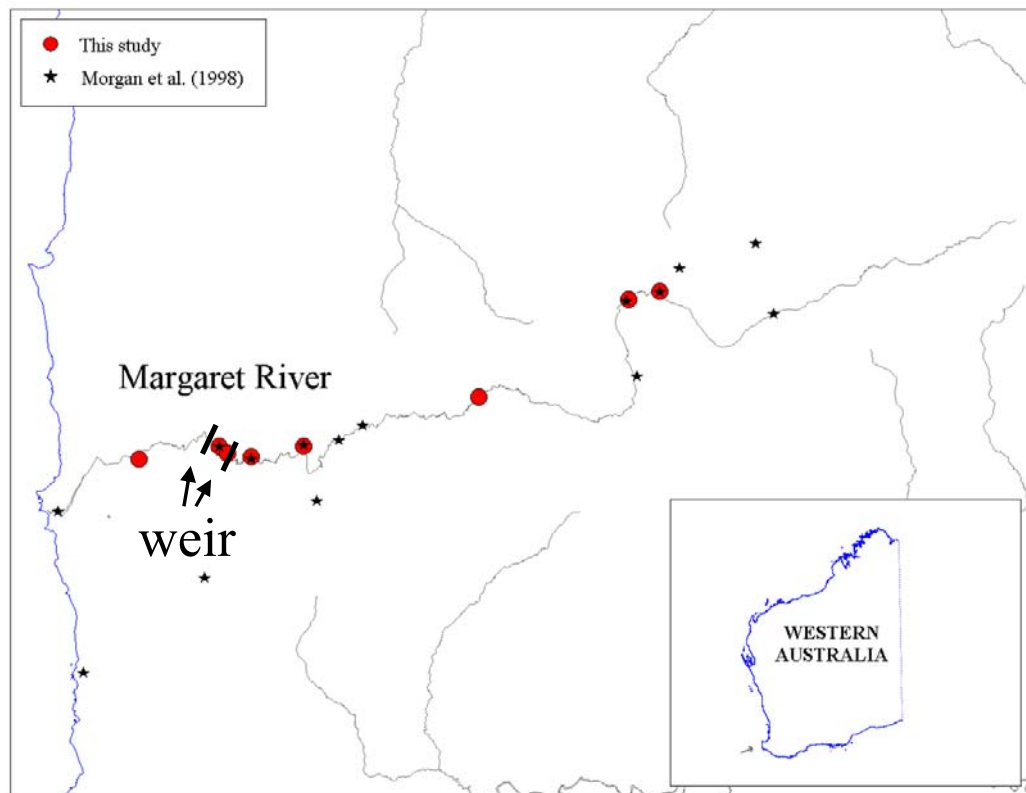


Figure 1 The sites sampled for fish on Margaret River.

# Fish fauna of Margaret River

## *Environmental variables*

The salinity of all sites sampled was low and ranged from 0.2 to 0.5 ppt. Water temperatures at the sample sites ranged from 19.5 to 25.5°C. At the time of sampling the river was not flowing and water levels were very low.

## *Species captured*

A total of 9879 fish from seven species were captured/observed in the eight sites sampled during this study (Table 1, Figure 1). The most numerically abundant was the introduced mosquitofish (*Gambusia holbrooki*) which accounted for over 93% of all fish captured and was found at seven of the eight sites sampled (Table 1, Figure 2). Endemic fishes represented only ~6.3% of captures while 49 pouched lamprey ammocoetes were captured at four sites (Figure 3). Of the native fishes the western minnow (*Galaxias occidentalis*) was the most abundant with 269 recorded at all sites combined (Figure 4). These were followed by the western pygmy perch (*Edelia vittata*) (115 individuals, eight sites) (Figure 5), mud minnow (*Galaxiella munda*) (99, two sites) (Figure 6), Balston's pygmy perch (*Nannatherina balstoni*) (78, two sites) (Figure 7) and the nightfish (*Bostockia porosa*) (63, seven sites) (Figure 8). The introduced redfin perch (*Perca fluviatilis*) was not captured this study but is known to occur in Ten Mile Brook Dam (Morgan *et al.* 1998).

Additionally, 169 marron (*Cherax tenuimanus*) and 6 gilgies (*Cherax quinquecarinatus*) were captured at eight and three sites, respectively.

Table 1 The sites sampled on Margaret River. Includes the species captured, their numbers and relative abundances (fish m<sup>-2</sup>) in parenthesis. N.B. *Ga* = pouched lamprey, *Go* = western minnow, *Gm* = mud minnow, *Bp* = nightfish, *Ev* = western pygmy perch, *Nb* = Balston's pygmy perch and *Gh* = introduced mosquitofish.

Site name	Area sampled (m <sup>2</sup> )	<i>Lamprey</i>		Endemic fishes				Feral
		<i>Ga</i>	<i>Go</i>	<i>Gm</i>	<i>Bp</i>	<i>Ev</i>	<i>Nb</i>	<i>Gh</i>
Kevill Rd waterpoint	200	5 (0.025)	60 (0.300)	-	3 (0.015)	2 (0.010)	-	2000 (10.000)
Town Weir	345	7 (0.020)	40 (0.116)	-	12 (0.035)	1 (0.003)	-	3650 (10.580)
Below large weir	112	-	29 (0.259)	-	-	4 (0.036)	-	1000 (8.929)
Upstream V-notch weir	320	1 (0.003)	56 (0.175)	-	12 (0.038)	12 (0.0375)	-	1250 (3.906)
Railway Bridge Crossing	35	35 (1.029)	46 (1.314)	-	4 (0.114)	5 (0.143)	-	3 (0.086)
Jindong Treeton Rd	76	-	19 (0.250)	-	1 (0.013)	1 (0.013)	-	1300 (17.105)
Canebreak Pool	130	-	10 (0.077)	60 (0.462)	8 (0.062)	30 (0.231)	47 (0.362)	-
Rapids Pool	30	-	9 (0.300)	39 (1.300)	23 (0.767)	60 (2.000)	31 (1.033)	3 (0.10)
<b>TOTAL</b>		<b>49</b>	<b>269</b>	<b>99</b>	<b>63</b>	<b>115</b>	<b>78</b>	<b>9206</b>

### *The pouched lamprey (Geotria australis)*

The lampreys (Petromyzontiformes) and hagfishes (Myxiniiformes) are the sole surviving members of the Agnatha (jawless vertebrates) (Potter 1996a). The absence of jaws and paired fins separates the agnathans from the cartilaginous (sharks and rays) and bony (teleosts) fishes. Of the 40 species of extant lampreys, only four are known from the Southern Hemisphere, of which three are found within Australia. The Western Australia representative is the pouched lamprey (*G. australis*) and is the sole member of the Geotriidae. The species is known from south-western and south-eastern Australia, Tasmania, New Zealand and south-western and south-eastern South America (Potter 1996b). Much of the work on the species has taken place in south-western Australia by Ian Potter and his colleagues at Murdoch University. The life-cycle is complex, with the worm-like larval stage (ammocoete) (Plate 1, Figure 3) living in 'burrows'

below the substrate where they feed on diatoms, detritus and micro-organisms (Potter 1996a). In south-western Australia at approximately 4.25 years of age (and at approximately 90 mm TL) the ammocoete undergoes metamorphosis (Plate 1, Figure 3) with the resultant downstream migrant leaving the river during winter. During its apparently two year marine trophic phase, where it presumably feeds on fish, their length increases to approximately 500-700 mm TL. The adult then ceases feeding, re-enters rivers and embarks on an upstream migration (moving predominantly at night) during winter and spring. After spending approximately 15-16 months in the river, when they survive off accumulated fat reserves, the adults spawn and die. During this 15-16 month period the adults mature and the males develop a large gular pouch (hence the name pouched lamprey) (Plate 1). An enlargement of the oral disc also occurs during this maturation period (Plate 1).

During this study ammocoetes were captured at four sites, one site of which was below the first weir (0.025 m<sup>-2</sup>), one site above the first weir (0.02 m<sup>-2</sup>) and two sites above the second weir (0.003 and 1.029 m<sup>-2</sup>) (Table 1, Figure 2). The highest abundances of ammocoetes occurred at the bottom site (0.025 m<sup>-2</sup>, waterpoint on Kevill Rd) and at the top site (1.029 m<sup>-2</sup>, Railway Bridge). These sites were characterised by more shade and a higher abundance of organic material on the substrate, factors that are known to influence larval densities (Potter *et al.* 1986).

Analysis of the length-frequency histograms (in conjunction with data from Potter and Hilliard 1986) suggests that during the sampling period (i.e. March 2003) the ammocoete population of Margaret River is dominated by the cohort born in 2000, but is also influenced by what is likely to be the 1999 and 1998 cohorts (Figure 9). Essentially absent from our samples (and possibly the river) were the 2002 and 2001 cohorts (Figure 9). The absence of these latter cohorts (year classes) may reflect the variable strength of the upstream migrations in south-western Australia (Morgan *et al.* 1998). Alternatively, rainfall during these years was considerably lower than that for 1998-2000 (Figure 9). Rainfall may influence the ability of the adults to enter the rivers (particularly during winter and spring as access to rivers is dependent on the sand bar being breached). Also, during dry years the potential habitat would be greatly reduced. However, if rainfall was the main factor then it would be expected that the 2001 cohort, whose parents would have entered the river during the 2000 upstream migration when rainfall was high, would be prevalent. It is probably most likely that the absence of these cohorts is a consequence of both limited recruitment from low numbers of upstream migrants and reduced rainfall events.

## ***Endemic fishes***

Three of the endemic fishes of Margaret River (western minnow, western pygmy perch and nightfish) are widespread throughout south-western Australia (Table 1, Figures 4, 5 and 8). The remaining two species (Balston's pygmy perch and mud minnow), which were only found above Canebreak Pool (Table 1, Figures 6 and 7), are essentially restricted to the south coast between Margaret River and Two People's Bay (just east of Albany) (Morgan *et al.* 1998). Both of these species however, have an isolated population in the Moore River catchment (to the north of Perth) (Morgan *et al.* 1998) and both are listed in the *Australian Society for Fish Biology's List of Threatened Fishes*. Loss of habitat through large-scale land clearing, eutrophication, dewatering of wetlands and salinisation, and the introduction of exotic fishes, such as the mosquitofish, are the probable causes of their severe reduction in distribution. The upper Margaret River is an extremely important refuge for these two species and is one of the few areas where large numbers of each are found. This section of the river, together with the Railway Bridge site, also had the highest abundances of western pygmy perch and nightfish (Table 1), and correspondingly the lowest mosquitofish abundances. The highest abundance of western minnows was found at the Railway Bridge site. Until recently, the upper part of the river remained introduced species free (see Figure 2) (Morgan *et al.* 1998), however mosquitofish (which are probably the greatest threat to the small endemics – see below) are now found in one pool in the upper river (i.e. Rapids Pool, see Figure 2).

Unlike many of the salt-affected river systems of south-western Australia, whereby large numbers of the predominantly estuarine Swan River goby (*Pseudogobius olorum*) and western hardyhead (*Leptatherina wallacei*) are found hundreds of kilometres upstream (Morgan and Gill 2000, Morgan *et al.* 1998, in press), within Margaret River these species are restricted to the estuary. Furthermore, salinisation of many of the region's rivers has seen the less halotolerant species excluded from the salt receiving main channel and restricted to the non-saline tributaries that have forested reaches (Morgan *et al.* in press).

## ***Introduced fishes***

The introduced mosquitofish had a mean density of 7.2 fish m<sup>-2</sup> (range 0.1-17.1 fish m<sup>-2</sup>). The density of this species was highest in degraded sites such as above the weirs (10.6 and 8.9 fish m<sup>-2</sup>) and at the junction of Jindong Treeton Rd (17.1 fish m<sup>-2</sup>). Conversely, densities were lowest where habitat was in relatively 'good' condition (i.e. high structural complexity and shaded).

This species was previously absent from the upper half of Margaret River (Figure 2, Morgan *et al.* 1998, unpublished data) but has now been found in a pool above the Rapids (0.1 fish m<sup>-2</sup>). It is not found in the pools immediately below the Rapids pool and it is suggested that its introduction has occurred since the pool became disconnected from the river during summer. This initial survey revealed only three similar sized animals in the pool but recent sampling (April and May 2003) has seen this number grow to approximately 35. The Rapids pool, together with the pools upstream of Canebreak Pool are an extremely important refuge for two rare species, Balston's pygmy perch and the mud minnow, and represent the only known permanent pools on Margaret River where these species are known to occur. An attempt to eradicate mosquitofish from the Rapids Pool was implemented with all captured destroyed. Urgent eradication was necessary as to minimise the numbers remaining in this isolated pool before they move downstream when the river flows in winter 2003 (i.e. re-connects).

Mosquitofish are an extremely aggressive species that fin-nip the native species and also occupy the same niche as Balston's pygmy perch and mud minnows (Pen *et al.* 1991, Morgan *et al.* 1995, Gill *et al.* 1999). For example, each of these species inhabit the littoral zone and are surface feeders. Their aggressiveness, wide environmental tolerance and ability to rapidly proliferate (livebearers, short gestation and young age at maturity) has lead them to become one of the great environmental threats to the region's highly endemic fish fauna. This species often removes the entire caudal (tail) fin of its prey.

The only other introduced fish known from the river is the redfin perch (*Perca fluviatilis*), which was introduced into south-western Western Australia 1890s (Coy 1979). Redfin perch are now entrenched in many south-west's waterways including the Swan, Murray, Harvey, Collie, Capel, Carburnup, Margaret, Blackwood, Donnelly and Warren rivers (Morgan *et al.* 2002). While not captured during this study it was found previously in Ten Mile Brook Dam (Morgan *et al.* 1998). The likelihood of Ten Mile Brook Dam acting as a source for their downstream colonisation is a considerable threat to the native fishes of the river. Redfin perch in Big Brook (near Pemberton) and the Collie River were found to predate heavily on decapods (marron and gilgies) and fish (mosquitofish, western pygmy perch and nightfish) (Pen and Potter 1992, Morgan *et al.* 2002). In less than five years since their introduction into Big Brook Dam they almost entirely eliminated the native fishes (Morgan *et al.* 2002). Due to its predatory nature it is regarded as a nuisance species by the Department of Fisheries WA and if captured must not be released.



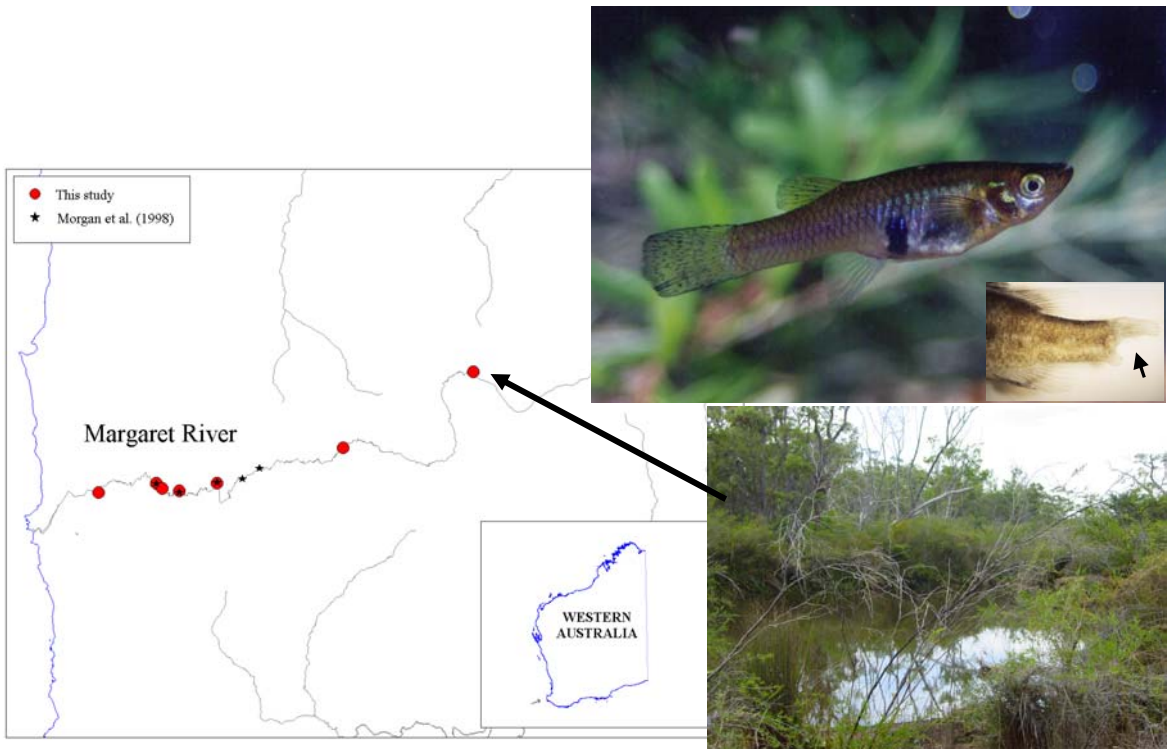


Figure 2 The sites where the introduced mosquitofish was captured on Margaret River, showing Rapids Pool and the result of mosquitofish attacks on western pygmy perch.

## Pouched Lamprey

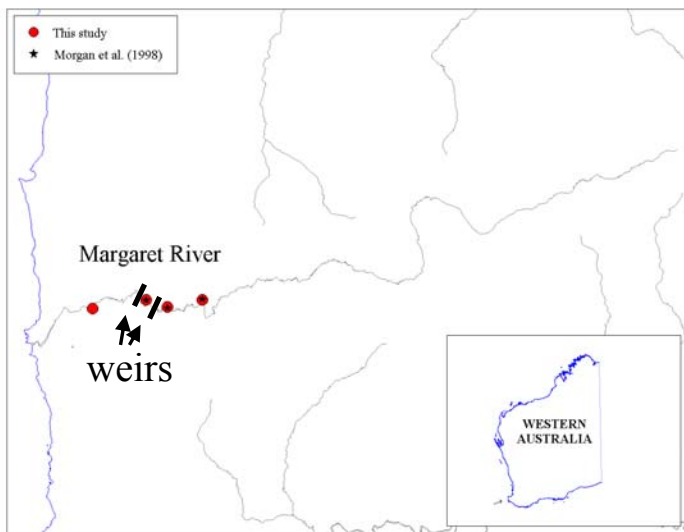


Figure 3 The sites where larval lampreys (ammocoetes) were captured on Margaret River.

## Ammocoete



## Downstream migrant



## Adult



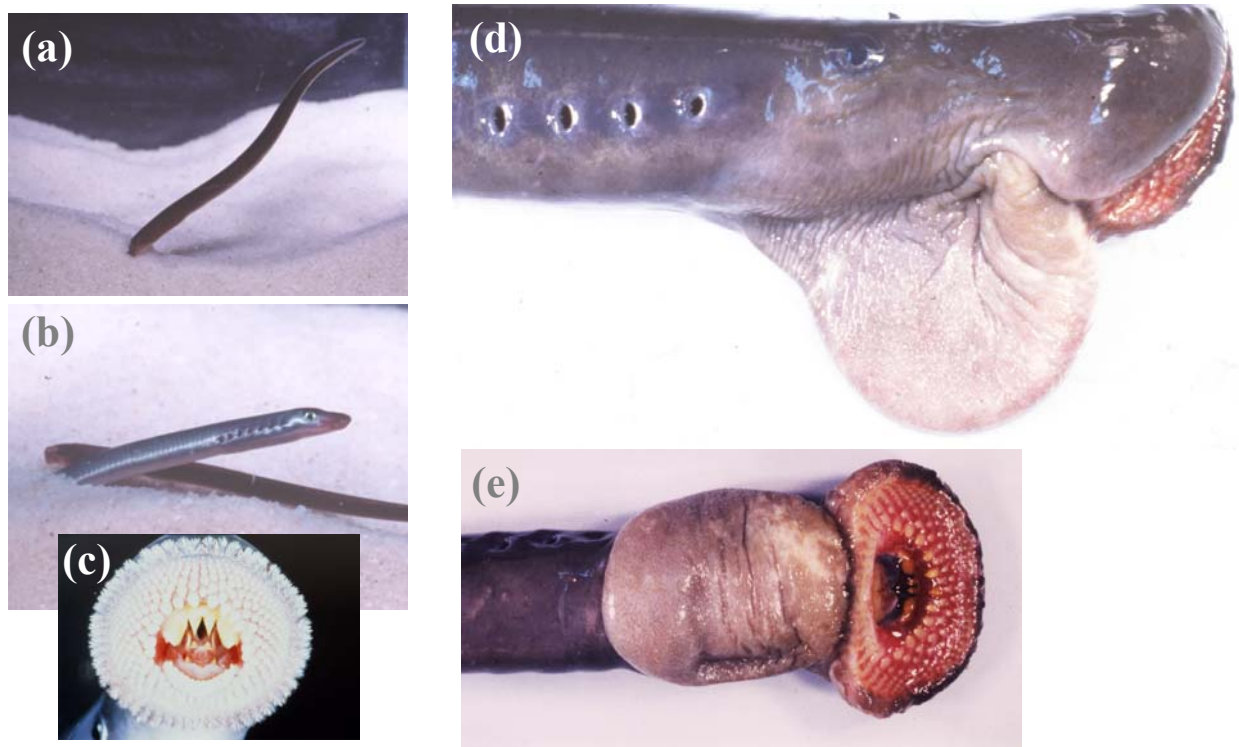


Plate 1 (a) Ammocoete burrowing, (b) ammocoete and metamorphosing 'downstream migrant', (c) downstream migrant oral disc, (d) and (e) mature male adult lamprey showing gular pouch and enlarged oral disc.

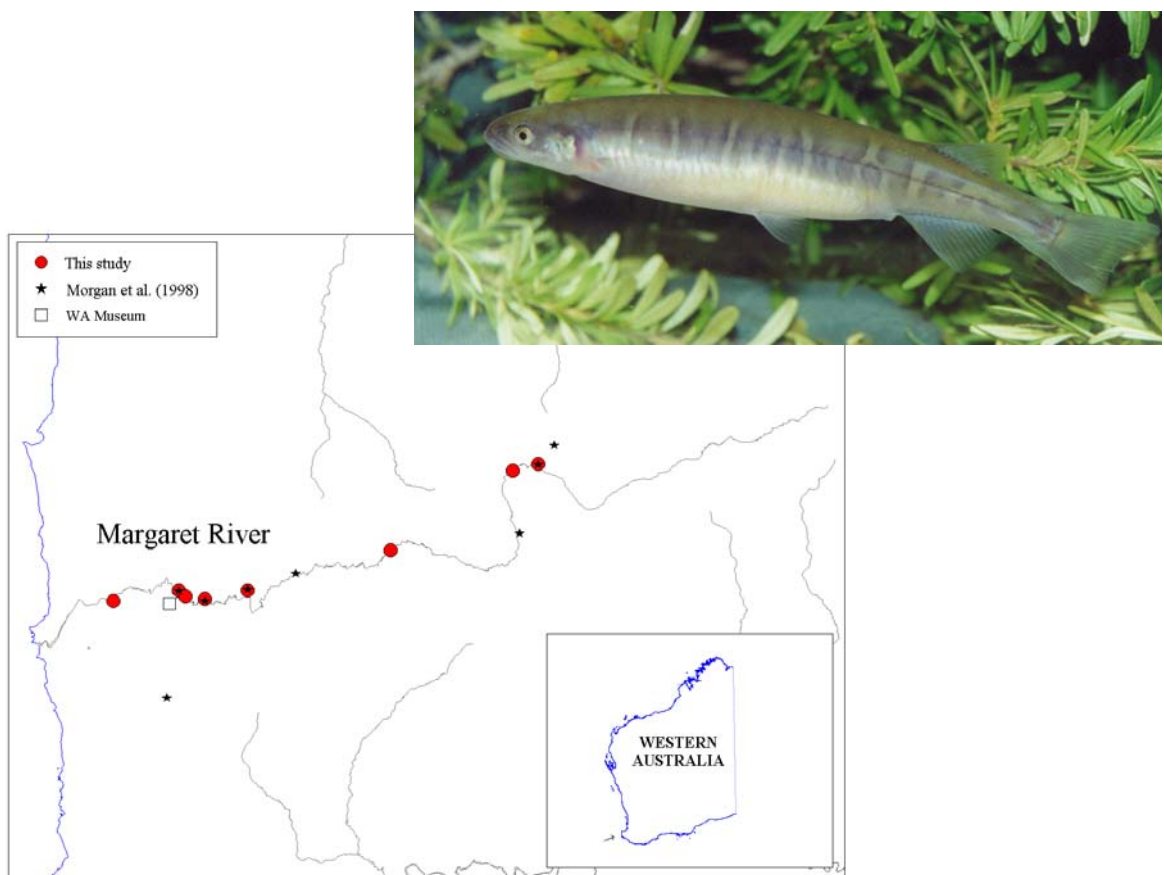


Figure 4 The sites where the western minnow was captured on Margaret River.

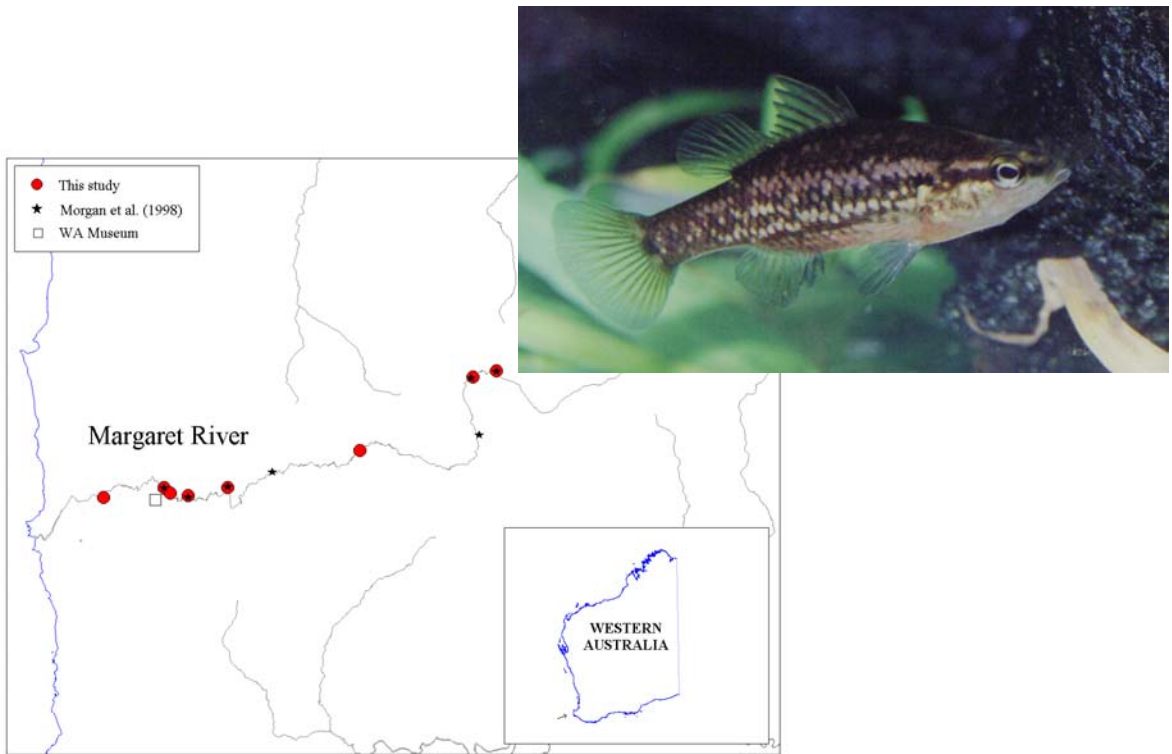


Figure 5 The sites where the western pygmy perch was captured on Margaret River.



Figure 6 The sites where the mud minnow was captured on Margaret River.

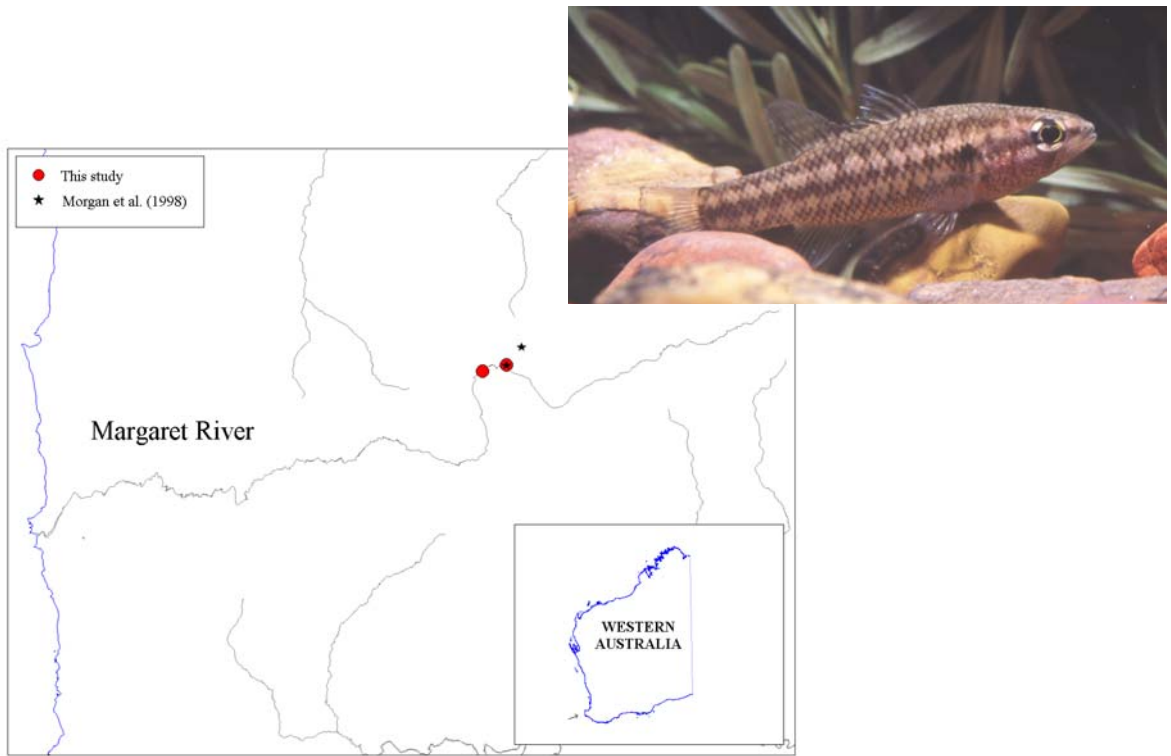


Figure 7 The sites where Balston's pygmy perch was captured on Margaret River.

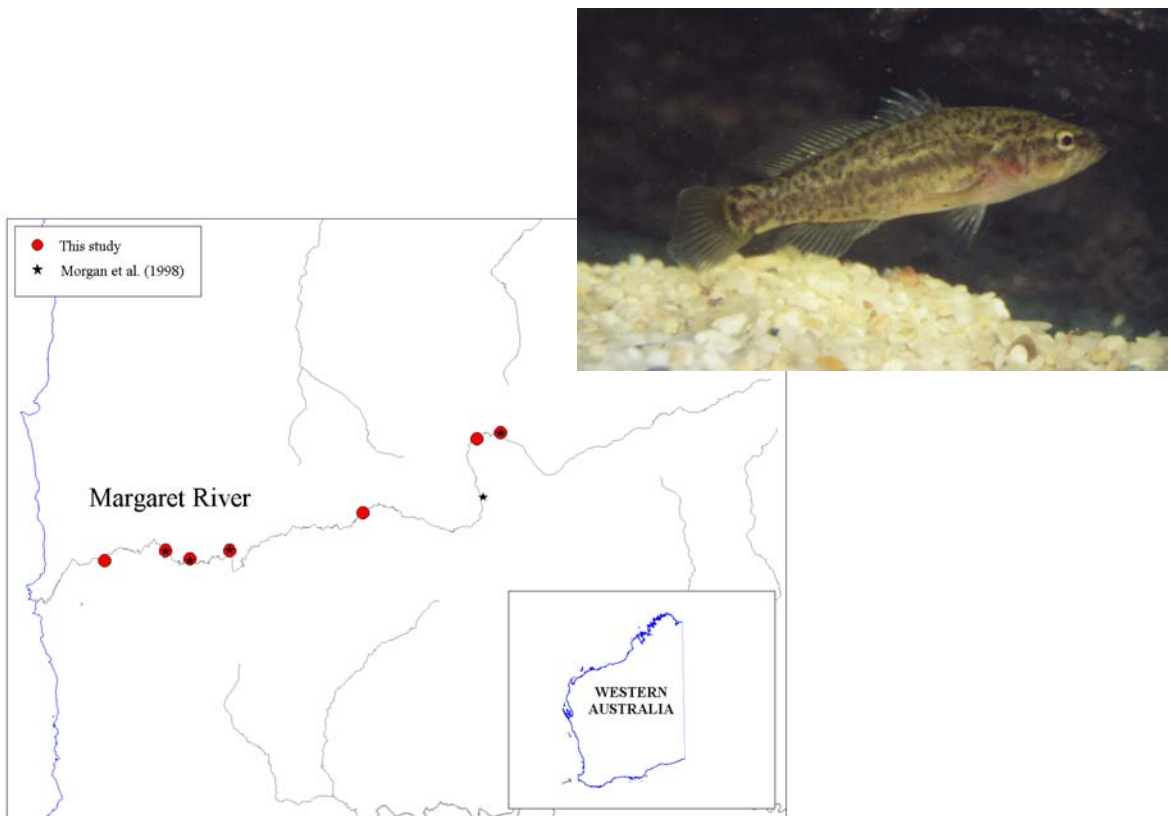


Figure 8 The sites where the nightfish was captured on Margaret River.

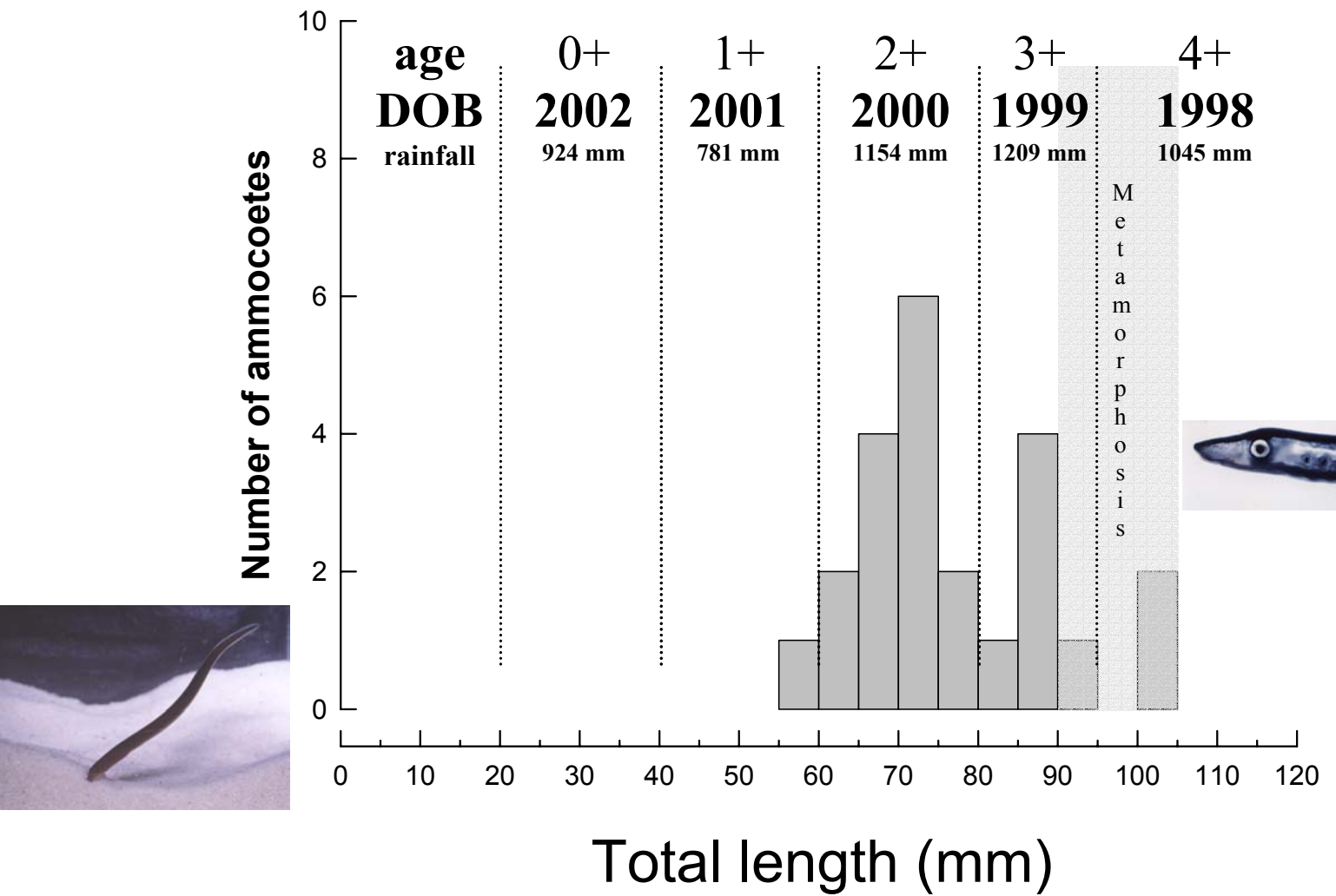


Figure 9 Length-frequency histograms for larval lampreys (ammocoetes) captured at Margaret River, including the age class (age), year of birth (DOB), prevailing rainfall (rainfall) and approximate length at which metamorphosis occurs.

## **Conclusions**

Margaret River contains five of the south-west's eight endemic teleosts, two of which are rare and have very restricted distributions. The river also acts as an important breeding ground and nursery for the pouched lamprey. Two introduced fishes, both of which have been shown to be detrimental to the native fishes of south-western Australia, are also found within the river. The two major weirs on the main channel of the river act as significant barriers to fish migrations, however densities of ammocoetes were highest above the weirs. Thus, although the weirs impede the upstream migration of lampreys, significant numbers are reaching the important breeding and nursery grounds above the weirs. It is possible that the upstream ammocoetes sites, which had higher organic material on the substrate, were more suitable as larval lamprey habitat. The immediate upstream and downstream habitats created by the weirs are not as conducive to larval lampreys as the unmodified sections of the river. The weirs also increase the opportunity for predation on the fishes and lamprey of the Margaret River. The construction of a fishway at these weirs will not only enhance the upstream (and downstream) migrations of fishes and the lamprey, but will also help mitigate the impact of avian predation in these areas.

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