The Distribution of Freshwater Fish in the South-Western Corner of Australia

Report to Water and Rivers Commission

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STREAMLINE ABSTRACT

This study investigates the distribution of freshwater fishes in the Busselton to Walpole Region. A total of 311 sites in 19 major catchments along the south-west coast from Capel to Walpole, were sampled using a variety of methods. New data was collated with that from previous studies to generate 15 species distribution maps. Habitat and life history notes and recommendations for conservation are made for each species. Changes in fish distribution are also commented upon.

This study contributes to series of documents published for the purposes of water allocation planning in the Busselton to Walpole Region. Other publications focus on the following topics:

- Recreational Use on Waterbodies in the Busselton - Walpole Region
- Report on an Investigation into the Aboriginal Significance of Wetlands and Rivers in the Busselton-Walpole Region.
- Environmental Significance of Wetlands and Rivers in the Busselton - Walpole Region
- Historical Association of Wetlands and Rivers in the Busselton - Walpole Region.
- Divertible Water Resources

Key Words

Water Resources Planning, Freshwater Fish Distribution, Wetland and Rivers, Busselton to Walpole, Western Australia.

FOREWORD

The Water and Rivers Commission's Policy and Planning Division is currently undertaking a series of studies aimed at developing a water resources allocation strategy for each of the six regions into which the State has been divided for the purpose. Allocation strategies are to be based on the Commission's aim of promoting a sustainable balance between environmental, economic and social values of the State's water resources. This report contributes directly to that aim.

This current study relates to the Busselton - Walpole Region of the South West. It is the second region to be covered and follows a study of the Perth - Bunbury Region carried out between 1985 and 1991.

As part of the study a consultant was engaged by the Commission to investigate the distribution of the south-west's highly endemic and depauperate fish fauna in the wetlands of the region.

This report by the consultants is being published by the Commission in order to inform the community, and to encourage wide debate on this component of the community's need for water, and on the allocation planning process as a whole. While this report has been prepared consistant with the Commission's resource management aims, many of the opinions expressed are those of the consultant and are not necessarily all endorsed by the Water and Rivers Commission.

The Commission would welcome comments on the report from any interested person or organisation. Comments should be addressed to the undersigned.

Tim McAuliffe
Director, Policy and Planning Division
Water and Rivers Commission
November 1996

ABSTRACT

A total of 311 sites in the 19 major watersheds in the south-western corner of Australia, bounded by Capel in the north-west and Walpole in the south-east, were sampled for freshwater fish using one or more of the following methods: seine netting, dip netting, trapping, electrofishing and light trapping and haul netting for larvae. The fish caught at each site were identified and the number of each species recorded. The water depth and, where appropriate, the approximate size of the water body at each site were recorded. The predominant vegetation type was also noted. These data were then collated with those derived from the studies of Christensen (1982) and Jaensch (1992), and with the records of the Western Australian Museum. The comprehensive distributional data sets, compiled for each of the freshwater fish species found in this region, were subsequently used to produce distribution maps for each of those freshwater species endemic to south-western Australia, namely, *Lepidogalaxias salamandroides, Galaxias occidentalis*, *Galaxiella nigrostriata*, *Galaxiella munda*, *Bostockia porosa*, *Edelia vittata* and *Nannatherina balstoni*. Distribution maps were also produced for the anadromous lamprey *Geotria australis*, those native species which are commonly found in the freshwaters of the region, but have a recent marine origin, i.e. *Leptatherina wallacei* and *Pseudogobius olorum*, and those species introduced into freshwater in the region, i.e. *Oncorhynchus mykiss, Salmo trutta*, *Gambusia holbrooki* and *Perca fluviatilis.*

The most common and widespread native freshwater fishes were *G. occidentalis*, *B. porosa* and *E. vittata.* These species were found in a variety of habitats throughout the entire sampling regime and in all river catchments. These species were also present in the many of the lakes and pools of the region. The freshwater catfish, *Tandanus bostocki*, was caught at only two sites during the present study (Alexander Bridge on the Blackwood River and at Lake Smith), and was recorded at only Lake Wilson by Jaensch (1992), and at Pemberton and Nannup in the Museum Records.

The remaining endemic species, *L. salamandroides*, *G. nigrostriata*, *G. munda* and *N. balstoni*, were effectively restricted to the region bounded by Margaret River in the west and Albany in the east. However, *G. nigrostriata*, *G. munda* and *N. balstoni* have disjunct distributions, each having an isolated population at Gingin, which is well to the north of the other populations. While *L. salamandroides* and *G. nigrostriata* were almost always associated with the ephemeral pools of the southern peat flats the latter species was also found in very low numbers in Lakes Doggerup and Samuel. Although *N. balstoni* was most abundant in the pools of the peat flats, it was also present in very low numbers in a number of rivers and lakes. *Galaxiella munda* was also found in a number of pools in the peat flats, but was most common in the headwaters of the major rivers of the area.

Adult *G. australis* were recorded migrating up the Warren, Donnelly and Margaret Rivers during winter and spring. Although the precise locations at which they spawn are unknown, a number of maturing adults were caught both in isolated pools and the main channel of the headwaters of the Warren River in autumn and winter. Ammocoetes were collected from shallow silty banks in the Capel, Margaret, Donnelly, Warren, Gardner, Shannon and Deep Rivers, while downstream migrants were typically associated with the sandy substrates of the deeper and faster-flowing waters of these systems.

The endemic fish with recent marine origins that were frequently caught in the freshwaters of the south-west, namely *L. wallacei*, *P. olorum* and *Afurcagobius suppositus*, were generally associated with coastal water bodies. However, these species were found considerable distances inland, e.g. Blackwood River, and in a number of isolated lakes, e.g. Lake Jasper.

The most common and widespread exotic species in the south-western corner of Australia was *G. holbrooki*, but *P. fluviatilis* was also often locally abundant. Both of these species were generally associated with habitats that had been substantially altered by human activity. For example, these species were often common in reservoirs, e.g. Big Brook Dam, in mined areas, e.g. Collie River South Branch, RGC Mineral Sands, and in those systems subject to enrichment through agricultural run-off, e.g. certain areas of the Blackwood River, Capel River, Lake Unicup. The two trout species, *O. mykiss* and *S. trutta*, were rarely captured in large numbers, and were only captured in those systems where regular stocking had taken place, i.e. predominantly in the streams of the Pemberton area.

Habitat alteration and possibly the introduction of exotic species pose the main threats to the highly endemic fish fauna of this region. Habitat alteration is likely to occur through the construction of water points for fire fighting, road maintenance, mineral sand exploration and mining, the construction of dams, groundwater extraction and also agricultural and forestry practices in the uppermost catchment, causing alterations to inflow, salinisation, siltation and eutrophication. Although three of the endemic species, *G. occidentalis, B. porosa* and *E. vittata*, are typically represented by large populations in most types of habitat throughout their extensive ranges, and are thus currently under no threat, local populations may be threatened. In contrast, four of the endemic freshwater species, *L. salamandroides, G. nigrostriata, G. munda* and *N. balstoni,* are generally represented by small populations in specific habitats and have a very restricted range. These latter species can therefore be considered to be potentially vulnerable to the continuing loss or alteration of habitat and to the introduction of non-native species.

From the results of this study, it would appear that the most important actions that should be taken to ensure the conservation of our depauperate but unique freshwater fish fauna is the maintenance of 'natural' flow regimes in rivers and the preservation of the lentic water bodies of the peat flats. To ensure this, buffer zones should be maintained in areas used for farming and/or forestry and the effects of water usage on stream flow should be minimised, and the position of new water points, roads etc. in the peat flats should be carefully located. Furthermore, every effort should be made to ensure that non-endemic species should be introduced only into water bodies designated appropriate by the W.A. Fisheries Department.

CONTENTS

LIST OF FIGURES

LIST OF TABLES

1.0 INTRODUCTION

South-western Australia is defined as the region bounded by Geraldton in the north-west and Esperance in the south-east. This region has a typical Mediterranean climate, with cool wet winters and warm/hot dry summers (Lake, 1971; Allen, 1982). It contains numerous short coastal rivers, lakes and flats, the first of which are thus subjected to large seasonal fluctuations in flow rates. Furthermore, water levels in these water bodies, which are high in winter, as a result of the heavy winter rains, decline markedly in summer, when there is little or no rain.

Geological, palaeoclimatic and palaeobotanical evidence suggests that the biota of the south-western corner of Australia has been separated from other regions of Australia since at least the middle Miocene, i.e. for at least 15 million years (Archer & Fox, 1984). This isolation is believed to have led to the speciation of the biota *in situ*, thereby accounting for the high endemicity of the flora and fauna that is characteristic of the region today (Archer & Fox, 1984). The unique assemblages of plants and animals in this region would thus alone argue that a high priority should be given to both a description of its biota and the formulation of management plans for its conservation. This priority is particularly relevant since the increasing human exploitation of the water, timber, agricultural and tourist resources of south-western Australia is undoubtedly having an increasing impact on both the aquatic and terrestrial ecosystems of the region. It should be noted that, not only is the flora and fauna of south-western Australia highly endemic, but that the freshwater fauna is also far more depauperate than that of south-eastern Australia (Allen, 1982, 1989; Bunn & Davies, 1990). The latter authors concluded that this low diversity can be attributed to a number of factors, including the insular nature of the south-west, a history of greater aridity, and an extremely low level of primary productivity.

South-western Australia contains only ten species of native freshwater fish, eight of which are endemic to the region (Allen, 1982). These ten species, which belong to seven genera and five families, comprise one species of the Plotosidae (*Tandanus bostocki*), the sole representative of the Lepidogalaxiidae (*Lepidogalaxias salamandroides*), five species of the Galaxiidae (*Galaxias maculatus*, *Galaxias truttaceus*, *Galaxias occidentalis*, *Galaxiella nigrostriata* and *Galaxiella munda*), one species of the Percichthyidae (*Bostockia porosa*) and two representatives of the Nannopercidae (*Edelia vittata* and *Nannatherina balstoni*).

With the exception of the freshwater catfish, *T. bostocki*, none of these endemic species typically exceeds 140 mm in total length and five of these species have maximum total lengths of less than 90 mm (Allen, 1989; Morgan *et al.*, 1995a). Four of these species, *L. salamandroides*, *G. nigrostriata*, *G. munda* and *N. balstoni*, are typically confined to the high rainfall region in the extreme lower south-western corner of Western Australia, although disjunct populations of *G. nigrostriata* do occur at Bunbury and Gingin, while populations of *N. balstoni* and *G. munda* also occur at Gingin (Allen, 1989, pers. comm.). The remaining species, *T. bostocki*, *G. occidentalis*, *B. porosa* and *E. vittata*, are much more widely distributed.

The biology of the eight species endemic to south-western Australia has been studied in recent years. Information is thus now available on the life history and ecology of *T. bostocki* (Morrison, 1988; Hewitt, 1992), *L. salamandroides* (Pusey, 1981, 1983, 1989, 1990; McDowall & Pusey, 1983; Leung, 1988; Allen & Berra, 1989; Berra & Allen, 1989, 1991, 1995; Berra *et al.*, 1989, 1990; Pusey & Stewart, 1989; Martin *et al.*, 1993), *G. occidentalis* (Pen & Potter, 1991a, b), *G. nigrostriata* (Pen *et al.*, 1993), *G. munda* (Pen *et al.*, 1991), *B. porosa* (Pen & Potter, 1990), *E. vittata* (Shipway, 1949; Pen & Potter, 1991c), and *N. balstoni* (Morgan *et al.*, 1995a).

The remaining two freshwater species, *G. maculatus* and *G. truttaceus*, are both widely distributed throughout south-eastern Australia, possibly reflecting the presence of a marine larval stage in the life cycles of the diadromous forms of these species (McDowall & Frankenberg, 1981; Allen, 1989). While *G. maculatus* is known to occur in coastal streams and swamps between Denmark and Esperance (Allen, 1982; Jaensch, 1992), *G. truttaceus* is thought to be the rarest galaxiid in the south-west, having been collected only in low numbers from a small area between Albany and Two Peoples Bay (Allen, 1982). Although the biology of these two species has been extensively studied in eastern Australia (Benzie, 1968a, b, c, d; Pollard, 1971a, b, 1972a, b, 1973, 1974; Chessman & Williams, 1975; Humphries, 1989, 1990), there have been no investigations on the populations of these species in south-western Australia.

The sole representative of the monotypic family Geotriidae, *Geotria australis*, an anadromous species, is also found in south-western Australia, while a number of estuarine species, for example, *Leptatherina wallacei*, *Pseudogobius*

olorum and *Afurcagobius suppositus*, are also common in the freshwaters of south-western Australia. Detailed accounts of various aspects of the biology of these species are available (Potter *et al.*, 1980, 1983, 1986a, b; Prince *et al.*, 1982a, b; Prince & Potter, 1983; Potter & Hilliard, 1986; Gill & Potter, 1993; Gill & Humphries, 1995).

Four exotic freshwater species, namely *Gambusia holbrooki*, *Oncorhynchus mykiss*, *Salmo trutta* and *Perca fluviatilis*, are also found throughout south-western Australia, the last three species growing to considerably longer lengths than the native species. These last three species were introduced into south-western Australia in attempts to 'enhance' freshwater fishing in the region, while the first species was introduced in an attempt to control mosquito populations. Although a further two species, namely *Carassius auratus* and *Phalloceros caudimaculatus*, have also been introduced into south-western Australia, their distributions are generally restricted to the Swan Coastal Plain (Morgan, unpublished data). The limited information on the impacts of introduced species in south-western Australia, and studies on the same or comparable species in eastern Australia, demonstrate that care must be taken to ensure that the introductions of fish do not have a deleterious effect on the native fauna of south-western Australia (Lloyd, 1989; Hutchinson, 1991; Pen & Potter, 1991d, 1992; Morgan *et al.*, 1995b).

A number of large freshwater fish species have been translocated from eastern Australia into south-western Australia, in an attempt to 'enhance' freshwater fishing in the region. These species included *Maccullochella peeli* in the 1890s and *Macquaria ambigua* and *Bidyanus bidyanus* in *ca* 1900, but of these early introductions, only *M. peeli* established a breeding population (Morrissy, 1994). More recently, the Fisheries Department has been considering the proposal that large species should be translocated from eastern Australia, in order to fulfil anglers calls for additional recreational species (see for example Prokop, 1994, and papers therein).

While some data are available for the distributions of freshwater fish in the lower south-west (see McDowall & Frankenberg, 1981; Allen, 1982, 1989; Christensen, 1982; Pusey & Edward, 1990; Jaensch, 1992; Morgan *et al.*, 1995a), these studies were restricted in scope, either concentrating on a particular area, water type or species, or employing just one sampling method, or were aimed only at providing a broad overview.

The aim of the present study was to provide detailed information on the distribution of the different species of freshwater fishes found in the south-western corner of Australia and to give a general account of the habitat types in which they each occur. The collation of data from this study with relevant Museum Records and the records of Christensen (1982) and Jaensch (1992) have provided a reliable account of the distribution of freshwater fishes in the south-western corner of Australia between Capel in the north-west and Walpole in the south-east.

2.0 MATERIALS AND METHODS

Study Area

Between 1994 and 1996, 311 sites were sampled in various permanent rivers, lakes and wetlands, and a considerable number of ephemeral wetlands and roadside pools, located in the south-western corner of Australia, between Capel in the north-west and Walpole in the south-east (Fig. 1, Table 1).

Sampling Methods

Juvenile and adult fish were sampled using seine nets, scoop nets, fish traps and an electrofisher while fish larvae were collected using haul nets, scoop nets and larval light traps. The seine net consisted of two 4 m wings, a 2 m pocket and a 1.5 m drop (all 3 mm mesh), while the scoop nets consisted of 300 mm equilateral triangles of 250, 500 and 1000 µm mesh and the larval haul net comprised a 1 m^2 pocket of 500 µm mesh. The larval light traps, which were constructed of clear perspex and used cyalume sticks for their light source, were placed in pools and streams at dusk and retrieved the following morning. Collapsible fish traps (450 x 250 x 250 mm), consisting of 3 mm woven mesh, and the electrofisher and scoop nets were employed in areas where the seine net could not be used. The electrofisher, a 400 watt battery powered Smith-Root Inc. 12-A model, was also used to establish whether ammocoetes of *Geotria australis* were present in river beds.

Habitat Type

Approximate site size, water depth and vegetation type were recorded at each site sampled.

Collation of Data

The data collected during the present study were collated with W.A. Museum Records and data recorded by Christensen (1982) and Jaensch (1992). Other studies, which include information on the distribution of freshwater fish in lower south-western Australia, were omitted if, precise distributional data were not given or if these data were included in the Museum Records e.g. McDowall & Frankenberg (1981) and Allen (1982, 1989) are taken from the Museum Records and the work of Pusey & Edward (1990) does not include geographic co-ordinates. These data were then used in conjunction with published studies to produce a taxonomic description, details of distribution and abundance, habitat associations, brief notes on the biology and ecology, and conservation recommendations for each species. N.B. the characteristics given in the taxonomic descriptions and the notes on the biology for each species are taken from the following sources, unless otherwise stated:-

All species - Allen (1989).

Endemic species

Plotosidae

Tandanus bostocki - Morrison (1988).

Lepidogalaxiidae

Lepidogalaxias salamandroides - McDowall & Pusey (1983), Pusey (1983), Pusey & Stewart (1989).

Galaxiidae

Galaxias occidentalis - McDowall & Frankenberg (1981), Pen & Potter (1991a, b), Gill & Neira (1994).

Galaxiella nigrostriata - McDowall & Frankenberg (1981), Pen *et al.* (1993) Gill & Neira (1994).

Galaxiella munda - McDowall & Frankenberg (1981), Pen *et al.* (1991), Gill & Neira (1994).

Percichthyidae

Bostockia porosa - Pen & Potter (1990).

Nannopercidae

Edelia vittata - Pen & Potter (1991c).

Nannatherina balstoni - Morgan *et al.* (1995a).

Anadromous species

Geotriidae

Geotria australis - Potter *et al.* (1980, 1983, 1986a, b), Potter & Hilliard (1986).

Species with recent marine origins

Atherinidae

Leptatherina wallacei - Prince *et al.* (1982a, b), Prince & Potter (1983).

Gobiidae

Pseudogobius olorum - Gill *et al.* (1992, in press), Gill (1994), Gill & Potter (1993).

Afurcagobius suppositus - Gill *et al.* (1992), Gill (1993, 1994), Gill & Potter (1993).

Introduced species

Poeciliidae

Gambusia holbrooki - Lloyd *et al.* (1986), Pen & Potter (1991d).

Percidae

Perca fluviatilis - Pen & Potter (1992).

Abbreviations Used in Taxonomic Descriptions

D1 - first dorsal fin.

D2 - second dorsal fin.

A - anal fin.

P - pectoral fin.

V - ventral/pelvic fin.

C - caudal fin.

SL - standard length.

TL - total length.

Roman numerals represent the number of spiny fin rays in a fin.

Arabic numerals represent the number of soft fin rays in a fin.

3.0 RESULTS AND DISCUSSION

3.1 Identification, distribution, abundance, notes on the biology of and conservation recommendations for each of the freshwater fish that are endemic to the south-western corner of Australia

Tandanus bostocki Whitley, 1944 (Plotosidae)

Lepidogalaxias salamandroides Mees, 1961 (Lepidogalaxiidae)

Galaxias occidentalis Ogilby, 1900 (Galaxiidae)

Galaxiella nigrostriata (Shipway, 1953) (Galaxiidae)

Galaxiella munda McDowall, 1978 (Galaxiidae)

Bostockia porosa Castelnau, 1873 (Percicthyidae)

Edelia vittata Castelnau, 1873 (Nannopercidae)

Nannatherina balstoni Regan, 1906 (Nannopercidae)

Tandanus bostocki Whitley, 1944 (Plotosidae)

Common names: Freshwater cobbler, catfish.

Identification: D1 I, 5-6; D2, C and A contiguous, approximately 150 soft rays; gill rakers on first branchial arch 16-21; sharp serrated spine on D1 and P. D1 and D2 separate. Mouth surrounded by four pairs of barbels. Maximum size 400 mm TL. Coloration mid-dark brown, grading to whitish on breast. Fins heavily pigmented.

Distribution: *Tandanus bostocki* is found in the coastal region between the Moore River in the north and the Frankland River in the south. This species was only captured on two occasions during the present study i.e. Alexander Bridge on the Blackwood River and at Lake Smith (Table 1). Jaensch (1992) caught *T. bostocki* from Lake Wilson and the Museum have only two records for this species in the current study area (Pemberton and Nannup).

Abundance, habitat and ecology: Although the sampling methods used during this study were not ideally suited for capturing large numbers of *T. bostocki*, sampling in the Serpentine area, using the same techniques, yielded a number of this species. It would therefore appear that while this species is locally abundant in some regions, it is probably rare in much of the study area. This species has been recorded from lakes and slow flowing rivers and streams. Insect larvae, freshwater shrimps, crayfish, molluscs and small fish are reported to be important dietary items. *Tandanus bostocki* can live for at least nine years. This species is by far the largest of the freshwater endemics of south-western Australia and is the one endemic which is sought by recreational anglers.

Reproduction: In Wungong Dam, to the south-east of Perth, the majority of fish did not become sexually mature until the end of their fourth year of life. Breeding occurred between November and January. The mean fecundity and the mean diameter of mature eggs were approximately 5 000 and 1.8 mm, respectively.

Threats: Habitat alteration may pose threats to some populations of this species.

Conservation status and actions: As *T. bostocki* occurs in relatively large numbers in several reservoirs, it would appear that this species does not warrant inclusion on the Australian Society for Fish Biology's list of Australian threatened fishes.

Conservation recommendations: As little is known about this species in the current sampling area, no recommendations for conservation action are given.

Lepidogalaxias salamandroides Mees, 1961 (Lepidogalaxiidae)

Common names: Western Australian or Australian salamanderfish, salamanderfish, Shannon mud minnow, mud minnow.

Identification: D 5-8; A 13-16; P 10-12; V 4; C 12-14; gill rakers on first branchial arch 4-7; vertebrae 43-47; scales absent dorsally and ventrally, thin embedded scales on side, with a mid-lateral line series of about 65; anal fin and surrounding scales modified to form intromittent organ in males. Maximum size 65 mm SL, common to about 40 mm SL. Brown to grey in colour, with a series of dark saddle-like markings dorsally, midlateral series of dark brown blotches forming a pair of longitudinal stripes during the breeding season (most distinct in males), black bar extending from snout through eye and across operculum, ventral surface only lightly pigmented.

Distribution: Although *L. salamandroides* is largely restricted to a small area of coastal peat flats between

Windy Harbour and Walpole, Museum records indicate that in 1976 isolated populations were found as far north as Margaret River and as far east as Albany (Fig. 2, Table 2).

Abundance, habitat and ecology: *Lepidogalaxias salamandroides* was absent in most habitats within its area of distribution, but was occasionally locally abundant, particularly in the isolated and ephemeral pools of the peat flats within the Doggerup Creek, Gardner River and Shannon River watersheds (e.g. pools/creeks on Windy Harbour, Chesapeake, Deeside and Beardmore Roads) (Table 2). Although *L. salamandroides* was never caught in any of the rivers or lakes of the south-west, it was found in very low numbers in the floodwaters of Lake Smith. The sites in which this species was caught were almost always located in the peat flats and adjacent forested areas. The appearance of fish in previously dry pools, shortly after the first rains of autumn, and also their appearance within hours of a pool being artificially filled with water, indicate that this species can aestivate or survive in moisture below the substrate surface. Unlike *G. nigrostriata,* which was often found in pools that were almost completely dry, *L. salamandroides* was very rarely captured in such pools, indicating that this species buries itself before the water has fallen to this very low level. The water in the shallow isolated pools in which *L. salamandroides* was typically found, is generally dark and acidic (pH 3.0-6.0) and exhibits marked seasonal temperature fluctuations (11-35 ^{O}C). *Lepidogalaxias salamandroides* has several adaptations which would be of value in these harsh conditions. For example, the eyes are adnate, lacking a circum-orbital sulcus, and are covered by a secondary eyelid, these characters presumably protecting the eyes when burrowing and aestivating. This species also has the ability to 'bend its neck', an adaptation presumably related to searching for food, since the muscles necessary for controlling eye movements in other teleosts are absent in *L. salamandroides*. Although the adults of this species were often caught close to riparian vegetation, they were also caught in open water. The larvae of this species were typically found feeding in very shallow water (<10 cm) in areas that were not subject to shade. As the larvae increase in size, they gradually move into deeper water. *Lepidogalaxias salamandroides* is a benthic species, a feature reflected in its diet, which comprises mainly dipteran larvae, trichopterans, cladocerans and ostracods.

Reproduction: Fertilisation is internal. The modified anal fin and associated scale sheaths of the males are used to clasp the female and thus permit direct transfer of sperm. The spermatozoa of *L. salamandroides* are considered to be unique among the teleosts (see Leung, 1988). The breeding season extends from July to September.

Threats: Habitat alteration and possibly the introduction of exotic species pose the main threats to *L. salamandroides* and also to the three other species restricted to the peat flat region. Habitat alteration is likely to occur through the construction of water points for fire fighting, road maintenance, mineral sand exploration and mining, groundwater extraction and also agricultural and forestry practices in the uppermost catchment (causing alterations to inflow, salinisation, siltation and eutrophication). It should be noted that the introduction of exotic fish species (*Oncorhynchus mykiss*, *Salmo trutta, Gambusia holbrooki* and *Perca fluviatilis*) and those species translocated from eastern Australia (*Macquaria ambigua* and *Bidyanus bidyanus*) has already occurred in the major catchments surrounding the peat flats. The introduction of these large and piscivorous eastern Australian species, which are well adapted to similar harsh environments, may pose a serious threat to the small endemic fish of south-estern Australia.

Conservation status and actions: Much of the area in which *L. salamandroides* was found is in the D'Entrecasteaux National Park and therefore guarded against development. This species is classed as Restricted in the Australian Society for Fish Biology's list of Australian threatened fishes and is one of only four freshwater fishes in Australia that is believed to have Pangean origins.

Conservation recommendations: The most important conservation actions are the preservation of small pools, and the maintenance of the shallow areas in these pools which are utilised by their larvae, in the peat flats of south-western Australia. To ensure this, the position of new water points, roads etc. should be carefully monitored. For example, many of the roadside pools in which this species aestivates are mistakenly considered to be devoid of aquatic fauna when dry in summer, and, as such, are often drastically altered when either their substrate is used for 'fill', or the pools themselves are filled during routine road maintenance. Furthermore,

non-endemic species should be introduced only into appropriate water bodies.

Galaxias occidentalis Ogilby, 1900 (Galaxiidae)

Common names: Western minnow, Western galaxias.

Identification: D 10-12 (segmented); A 11-14 (segmented); P 12-15; V 7; C 16; vertebrae 50-57. A small freshwater fish with a scaleless, very elongate body and long straight gut, reaching about 65-75% of the body length. Lateral canine teeth present in both jaws and enlarged fangs at middle of lower jaw. Dorsal fin is posteriorly placed and originates above the origin of the anal ray; no adipose fin is present. Maximum size approximately 170 mm TL. Coloration is highly variable (lighter in clear water, almost black in peaty pools), generally olive-green dorso-laterally fading to whitish ventrally. A series of lateral dark bars are often present. Fins lightly pigmented.

Distribution: *Galaxias occidentalis,* together with *Edelia vittata,* are the most widespread of the freshwater fishes endemic to the south-western corner of Australia. *Galaxias occidentalis* has a range that extends from Winchester, about 250 km north of Perth, to Waychinnicup Creek, 80 km east of Albany. From the data collated during the present study (Fig. 3, Table 3), it is evident that *G. occidentalis* is widely distributed throughout the south-western corner of Australia. Indeed this species was found in all watersheds, except that of Lake Quitjup (Fig. 3, Table 3).

Abundance, habitat and ecology: *Galaxias occidentalis* was common and abundant in rivers, streams, lakes and in pools that are connected to streams throughout most of its range. Furthermore, this species was abundant in water bodies in both Karri and Jarrah forest (e.g. Donnelly River), the peat flats (e.g. D'Entrecasteaux National Park, see Fig. 2.1) and also in areas used for farming (e.g. Ludlow River, Blackwood River). Although this species was often seen close to riparian vegetation, it was also observed in large schools in open water (e.g. Lake Jasper). During the day, terrestrial fauna form the main component of the diet, although dipteran larvae and pupae, cladocerans and copepods are also important components. However, recent work has shown that this species also feeds at night, when the major food item ingested is the freshwater shrimp *Palamonetes australis* (Fairhurst unpubl. data). The life cycle of *G. occidentalis* typically lasts for two years. The total length of the longest fish caught was 172 mm.

Reproduction: In the Collie River, south of Perth, males and females of this species attain lengths of approximately 70 and 75 mm at the end of their first year of life, and 90 and 100 mm at the end of their second year, respectively, with few fish surviving beyond their second year. Individuals in the Collie River attain sexual maturity at the end of their first year of life, at which time they move into creeks to spawn. Breeding occurs between early June and late September, with a peak in August. The mean fecundity and mean diameter of preserved mature eggs are 905 and 1.3 mm, respectively.

Threats: Since *G. occidentalis* was common throughout much of its extensive range, and was found in a wide variety of habitats, it is unlikely that the survival of this species is threatened. However, habitat alteration and the introduction of exotic species may pose threats to some populations of this species. For example, while *G. occidentalis* was absent/rare in the lakes of the RGC Mineral Sands and Muir Watershed, which contained large numbers of the introduced species *Gambusia holbrooki,* it was abundant in the streams of these areas, and in many of those lakes and streams elsewhere in the south-western corner of Australia which did not contain *G. holbrooki*, e.g. Lakes Jasper, Wilson, Smith, Maringup, Doggerup, Samuel; Rivers Shannon, Gardner, Donnelly, Margaret (Figs 3, 14). It should also be noted that *G. holbrooki* has been observed attacking *G. occidentalis* in the streams of RGC Mineral Sands, and that the majority of *G. occidentalis* in these streams had a higher degree of fin damage than those in the nearby Ludlow River, where *G. holbrooki* was far less common (Morgan, unpubl. data). Furthermore, circumstantial evidence collected during the present study suggests that *Perca fluviatilis* and trout species may have an effect on the native fish during dry years. For example, during summer, when water levels decline markedly, a number of isolated river pools in which these large piscivores were present contained very few native fish, while nearby pools, in which these introduced fish were absent, contained large numbers of natives.

Conservation status and actions: Considering the extensive distribution and large populations of *G. occidentalis* in many water bodies, it would appear that this species does not warrant inclusion on the Australian

Society for Fish Biology's list of Australian threatened fishes.

Conservation recommendations: The most important conservation action is to maintain 'natural' flow regimes which are necessary for successful spawning migrations and to preserve suitable habitat for spawning. To ensure this, buffer zones must be maintained in areas used for farming and/or forestry, while the effects of water usage on stream flow should be minimised. Furthermore, non-endemic species should be introduced only into appropriate water bodies.

Galaxiella nigrostriata (Shipway, 1953)(Galaxiidae)

Common names: Black-stripe minnow.

Identification: D 6-8; A 8-11; P 11-14; V 5-6; C 12-15; vertebrae 38-43; myomeres 38-42. A small freshwater fish with a scaleless, elongate body and long straight gut, reaching about 60-65% of the body length. Dorsal fin is posteriorly placed and originates anterior to the vertical that passes through the fifth anal ray; no adipose fin is present. Maximum size 48 mm TL. Between June and September, both the larvae and adults of this species are characterised by their striking coloration, which consists of two black longitudinal bands separated by a vivid yellow to red stripe. This brightly coloured lateral stripe gradually disappears after September and by December/January most fish have a relatively uniform brown to blackish colour. The larvae of *G. nigrostriata* are heavily pigmented and characterised by a very bright yellow to red stripe between the dorso-lateral and ventro-lateral black bands. The smallest preflexion larvae recorded was 4.12 mm TL.

Distribution: *Galaxiella nigrostriata* is restricted to the small area of coastal peat flats found in the south-western corner of Australia that extends from Augusta in the west to Albany in the east, while disjunct populations have recently been discovered in a small pool at Bunbury and Gingin, approximately 200 and 400 km to the north, respectively (Allen, pers. comm.). It seems likely that this discontinuity in distribution represents the loss of suitable habitat caused by widespread urban and rural development in this region. From the results of this study, it is evident that the centre of the distribution of *G. nigrostriata* is in the peat flats surrounding Windy Harbour (i.e. D'Entrecasteaux National Park) (Fig. 4, Table 4).

Abundance, habitat and ecology: *Galaxiella nigrostriata* was absent in most habitats within its area of distribution. However, this species was occasionally locally abundant, particularly in the isolated and ephemeral pools of the peat flats within the Doggerup Creek and Gardner River watersheds (e.g. pools/creeks on Windy Harbour and Chesapeake Roads) (Table 4). Although *G. nigrostriata* was never caught in any of the rivers of the south-west, it was found in very low numbers in Lakes Samuel and Doggerup and in the floodwaters of Lake Smith. The sites in which this species was caught were almost always located in the peat flats and adjacent forested areas. The water in the shallow isolated pools in which *G. nigrostriata* was typically found, was generally dark and acidic (pH 3.0-6.0) and exhibits marked seasonal temperature fluctuations (11-35^{O}C). The appearance of fish in previously dry pools, shortly after the first rains of autumn, and also their appearance within hours of a pool being artificially filled with water, indicate that this species may aestivate or survive in moisture below the substrate surface. The ability of *G. nigrostriata* to survive in little water is clearly demonstrated by the occurrence of fish living in a shallow pool, approximately 30 cm in diameter. Although the adults of this species were often caught close to inundated riparian vegetation, they were also caught in open water. The larvae of this species were typically found feeding in very shallow water (<10 cm) amongst flooded riparian vegetation in areas that were not subject to shade. As the larvae increase in size they gradually move into deeper water. This species was often found in pools that also contained *Lepidogalaxias salamandroides,* but was rarely abundant in those pools that contained the percicthyid *Bostockia porosa* or the nannopercid *Nannatherina balstoni.* Both of the latter two larger fish may prey on *G. nigrostriata.* Calanoid copepods and terrestrial fauna (flying ants and dipterans) are the main prey items ingested in all seasons, while other prey items are important seasonally, e.g. collembolans (winter), dipteran larvae and pupae (summer and autumn) and diatoms (autumn). The life cycle of this species typically lasts for just over one year, the longest male and female caught measuring 44 mm (0.22 g) and 48 mm (0.73 g), respectively.

Reproduction: At the end of their first year of life, males and females reach total lengths of 33 and 37 mm, respectively, and attain sexual maturity, developing a bright breeding livery comprising two black longitudinal bands separated by a vivid yellow to red stripe. This species is a multiple spawner and breeds between early June and September with a peak in activity between late June/early July, a period when water temperatures and day length are at their minimum.

Threats: Habitat alteration and possibly the introduction of exotic species pose the main threats to *G. nigrostriata*. Habitat alteration is likely to occur through the construction of water points for fire fighting, road maintenance, mineral sand exploration and mining, groundwater extraction and also agricultural and forestry practices in the uppermost catchment (causing alterations to inflow, salinisation, siltation and eutrophication). It should be noted that the introduction of exotic fish species (*Oncorhynchus mykiss*, *Salmo trutta*, *Gambusia holbrooki* and *Perca fluviatilis*), and those species translocated from eastern Australia (*Macquaria ambigua* and *Bidyanus bidyanus*) has already occurred in the major catchments surrounding the peat flats. The introduction of the latter two large and piscivorous eastern Australian species, which are well adapted to similar harsh environments, may pose a serious threat to the small endemic fish of south-western Australia.

Conservation status and actions: Much of the area in which *G. nigrostriata* is found is listed as National Park. This species has been listed as restricted by the Australian Society for Fish Biology.

Conservation recommendations: The most important conservation action is preservating the small pools in the peat flats of south-western Australia, and inparticular, the shallow areas and riparian vegetation in these pools, which are utilised by their larvae. To ensure this, the position of new water points, roads etc. should be carefully monitored. For example, many of the roadside pools in which this species 'aestivates' are mistakenly considered to be devoid of aquatic fauna when dry in summer and, as such, are often drastically altered when their substrate is used for 'fill', or the pools themselves are filled during routine road maintenance. Furthermore, non-endemic species should be introduced only into appropriate water bodies.

Galaxiella munda McDowall, 1978 (Galaxiidae)

Common names: Western mud minnow.

Identification: D 6-8; A 9-12; P 9-12; V 5-7; C 13-15; vertebrae 38-43; myomeres 41-43. A small freshwater fish with a scaleless, elongate body and long straight gut, reaching about 65-70% of the body length. Dorsal fin is posteriorly placed and originates posterior to the vertical that passes through the fifth anal ray; no adipose fin is present. Maximum size 58 mm TL. Between June and October, the adults of this species develop two olive-brown longitudinal bands that are separated by an orange stripe and a silver belly. The coloured lateral stripe gradually disappears to become a thin silver-white line after October and by January most fish have a relatively uniform light olive-brown colour. Larvae of *G. munda* are moderately to heavily pigmented. The smallest preflexion larvae recorded was 5.0 mm TL.

Distribution: *Galaxiella munda* is restricted to a small area in the south-western corner of Australia, that extends from Margaret River in the west to Albany in the east, with an isolated population approximately 100 km north of Perth at Gingin. The discontinuity in the distribution of this species may represent the loss of suitable habitat caused by widespread urban and rural development in the intervening region. During this study, *G. munda* was collected from the following watersheds; Margaret River, Warren River, Lake Muir, Doggerup Creek, Gardner River, Shannon River, Broke Inlet, Deep River, Frankland River, Kent River and Hay River (Fig. 5, Table 5). Other studies also found this species in the Blackwood River and Donnelly River watersheds (Fig. 5, Table 5).

Abundance, habitat and ecology: *Galaxiella munda* was rare throughout most of its distribution, but was occasionally abundant in the headwaters and tributaries of rivers, and in a number of shallow pools connected to streams. This species was most abundant in creeks and streams of the Gardner River and Shannon River watersheds (Table 5). For example, in Boorara Brook, a tributary of the Gardener River, over one hundred fish were caught in a small pool (3 m by 1 m), while one fish was found in a nearby 'pool', approximately 2 cm in diameter. Although the sites in which this species were caught were often located in the peat flats and adjacent forested areas, this species penetrated further into the forested areas than *N. balstoni*, *G. nigrostriata* and *L. salamandroides*. The water in the pools and streams in

which *G. munda* was typically found, was generally dark and acidic (pH 3.0-6.0) and exhibits marked seasonal temperature fluctuations (11-35 ^{O}C). Although the adults of this species were often caught close to the riparian vegetation of streams they were also caught in the open water of pools. The larvae of this species were typically found feeding in the very shallow water of pools (<10 cm) amongst flooded riparian vegetation in areas that were not subject to shade. As the larvae increase in size, they gradually move into the deeper water of the pools and then into the streams to which these pools are connected. Terrestrial fauna (dipterans) and dipteran larvae and pupae are the main component of the diet in winter, spring and summer, while cladocerans and copepods form the most important component in autumn. The life cycle of *G. munda* typically lasts for one year, the longest fish caught measuring 58 mm and weighing 0.98 g.

Reproduction: At the end of their first year of life, females and males reach total lengths of 47 and 43 mm, respectively, and attain sexual maturity, developing a breeding livery of two olive-brown longitudinal bands separated by an orange stripe. This species breeds between July and October, with spawning activity peaking in late August, when water temperatures and day length have begun to rise.

Threats: Habitat alteration and possibly the introduction of exotic species pose the main threats to *G. munda* and also to the three other species restricted to the peat flat region. Habitat alteration is likely to occur through the construction of dams, groundwater extraction and also agricultural and forestry practices in the uppermost catchment (causing alterations to inflow, salinisation, siltation and eutrophication). It should be noted that the introduction of exotic fish species (*Oncorhynchus mykiss*, *Salmo trutta*, *Gambusia holbrooki* and *Perca fluviatilis*) and those species translocated from eastern Australia (*Macquaria ambigua* and *Bidyanus bidyanus*) has already occurred in many of the major catchments in the region. The combined effects of habitat alteration and introductions may explain the apparent loss of *G. munda* from the headwaters of Lefroy Brook. Thus, whereas Pen *et al.* (1991) reported viable populations of this species in these waters, this study has found very few *G. munda* in these streams, and none above Big Brook Dam. It is therefore pertinent that during several recent dry years the reservoir immediately above Big Brook Dam (Fig. 5.1b) was the only upstream section of Lefroy Brook to retain water during summer and autumn. Furthermore, during these dry years, the piscivorous *P. fluviatilis* was introduced to the reservoir and is now well established in this reservoir and in the headwater streams.

Conservation status and actions: *Galaxiella munda* is listed as restricted by the Australian Society for Fish Biology.

Conservation recommendations: The most important conservation action is the preservation of 'natural' flow regimes and suitable habitat, for all life cycle stages, in the small streams of south-western Australia. To ensure this, buffer zones must be maintained in areas used for both farming and forestry, and further introductions of non-endemic species should be made only into appropriate water bodies.

Bostockia porosa Castelnau, 1873 (Percicthyidae)

Common names: Nightfish.

Identification: D1 VII-VIII; D2 16-17; A III, 11-12; P 13-15; gill rakers on first branchial arch 11-12; tubed lateral-line scales 43-47. Greatest body depth 3.1-3.6 of SL. Deep notch between D1 and D2. Mouth large, extending to middle of eye. A series of large pores are present on the snout and around the eyes. Maximum size 160 mm TL. Coloration, mottled olive-brown to dark purplish-brown dorso-laterally (occasionally black in peat stained waters), grading to pinkish-white on breast and belly. Fins lightly to moderately pigmented, D1, D2, A and C spotted.

Distribution: *Bostockia porosa* is one of the most widespread of the freshwater fishes endemic to the south-western Australia, with a range that extends from Moore River in the north to Albany in the east. Our studies show that this species is found in the majority of watersheds sampled (Fig. 6, Table 6).

Abundance, habitat and ecology: *Bostockia porosa* was common and abundant throughout most of its range and is found in rivers, streams, lakes and pools. This species was typically found under ledges, rocks, logs and amongst inundated vegetation and was only found in open water when water levels had receded to such a point that no cover was available (Fig. 6.1). The very few small larvae of this species that have been collected were caught in the relatively deep open water of a pool that is connected to a stream and in the shallow floodwaters of a large pool. While, ostracods and

dipteran larvae are important dietary items in all seasons and for all size classes, larger prey types, such as odonatan larvae, decapods and gastropods become increasingly important as these fish increase in size. Although Pen & Potter (1990) considered that *B. porosa* was active mainly at night, recent work showed that juveniles fed predominantly during the day (Morgan, unpubl. data). The life cycle of *B. porosa* typically lasts for two years, although a male of six years has been recorded.

Reproduction: In the Collie River, south of Perth, the males and females of this species both attain lengths of *ca* 56 mm at the end of their first year of life, and reached 76 and 79 mm at the end of their second year and 85 and 91 mm by the end of their third year of life, respectively. Very few fish survive beyond their third year. In the Collie River, the majority of males attain sexual maturity at the end of their first year of life, while the majority of females do not attain maturity until the end of their second year. On attaining sexual maturity, fish move into flooded creeks to spawn. Breeding occurs between late August and early September. The mean fecundity and mean diameter of preserved mature eggs are 608 and approximately 1.5 mm, respectively.

Threats: Since *B. porosa* was common throughout much of its extensive range and found in a wide variety of habitats, it is unlikely that this species is threatened. However, habitat alteration and the introduction of exotic species may pose threats to some populations of this species. For example, while *B. porosa* was absent/rare in the lakes of the Unicup area, which contained large numbers of the introduced species *Gambusia holbrooki,* it was abundant in the streams of this area and in Lakes Wilson and Smith, water bodies which do not contain *G. holbrooki.* Furthermore, in the lakes and streams of RGC Mineral Sands at Capel, which contain large numbers of *G. holbrooki* and have little cover, *B. porosa* was only abundant in a stream which contained few *G. holbrooki* and had large amounts of cover in the form of aquatic macrophytes and boulders. *Gambusia holbrooki* has been observed attacking *E. vittata* in the RGC system and the majority of native fish, including *B. porosa,* in this system had a high degree of fin damage (Morgan, unpubl. data).

Conservation status and actions: Considering the extensive distribution of *B. porosa,* and its high abundance in some water bodies, this species does not warrant inclusion in the Australian Society for Fish Biology's list of Australian threatened fishes.

Conservation recommendations: The most important conservation actions are to maintain 'natural' flow regimes which are necessary for successful spawning migrations, to preserve suitable habitat for spawning and the areas of riparian vegetation, rocks and submerged logs etc. with which the juveniles and adults of this species are usually associated. To ensure this, buffer zones must be maintained in areas used for farming and/or forestry, while the effects of water usage on stream flow should be minimised. Furthermore, non-endemic species should be introduced only into appropriate water bodies.

Edelia vittata Castelnau, 1873 (Nannopercidae)

Common names: Western pygmy perch, pygmy perch.

Identification: D1 VII-IX; D2 8-9; A III, 6-8; P 11-13; gill rakers on first branchial arch 11-13; tubed lateral-line scales interspersed with normal scales. Greatest body depth 2.9-3.3 of SL. Deep notch between D1 and D2. Mouth small, not extending to eye. Maximum size 68 mm TL. Coloration mid-dark brown, grading to whitish on breast and belly, often with brown mid-lateral stripe bordered by broad yellow-white stripes. Fins lightly to moderately pigmented. During the breeding season, females often become bluish dorsally, while males become darker and the whitish lateral stripes and belly become orange

Distribution: *Edelia vittata,* together with *Galaxias occidentalis,* are the most widespread of the freshwater fishes endemic to the south-western corner of Australia. *Edelia vittata* has a range which extends from the Moore River, north of Perth, to the Philipps River, east of Albany. During the present study, *E. vittata* was found in all watersheds (Fig. 7, Table 7).

Abundance, habitat and ecology: *Edelia vittata* was widespread and abundant in rivers, streams, lakes and pools. Furthermore, this species was abundant in water bodies in both Karri and Jarrah forest (e.g. Donnelly River), the peat flats (e.g. D'Entrecasteaux National Park) and areas used for farming (e.g. Ludlow River). This species was generally associated with riparian vegetation or other forms of cover (submerged macrophytes, algae, snags etc) and was rarely caught in open or deep water. While cladocerans, copepods and dipteran larvae are always important dietary items, this

species ingests a wide range of small prey types in all seasons. The life cycle of *E. vittata* typically lasts for just over two years, the longest fish caught measuring 68 mm and weighing 4.6 g.

Reproduction: In the Collie River, south of Perth, males and females of this species attain lengths of approximately 42 and 43 mm at the end of their first year of life and 51 and 53 mm at the end of their second year, respectively, with few fish surviving beyond the second year. Sexual maturity is attained at the end of their first year of life, at which time fish move into flood waters of the main river and associated creeks to spawn. Breeding occurs between late July and November with a peak in late September/early October. This species spawns more than once in a breeding season, with the mean diameter of mature eggs being 0.9 mm.

Threats: Since *E. vittata* was common throughout much of its extensive range, and was found in a wide variety of habitats, it is unlikely that this species is under any threat. However, habitat alteration and the introduction of exotic species may pose threats to some populations of this species. For example, while *E. vittata* was absent/rare in the lakes of the Swan Coastal Plain, which contain large numbers of the introduced species *Gambusia holbrooki,* it was abundant in streams of the lower south-west and in Lakes Wilson, Smith, Maringup etc. (Table 7), which do not contain *G. holbrooki.* Furthermore, the only lake of the RGC Mineral Sands at Capel that contains both large numbers of *G. holbrooki* and large amounts of cover in the form of aquatic macrophytes and algae, was the only one in which *E. vittata* was abundant. It should also be noted that *G. holbrooki* has been observed attacking pygmy perch in this pool, and that the majority of *E. vittata* in this lake had a higher degree of fin damage than those in the nearby Ludlow River, where *G. holbrooki* was far less common (Morgan, unpubl. data). This absence of this species from our samples in the upper Blackwood River may be attributed to both the high numbers of *G. holbrooki* and the salinity of the catchment.

Conservation status and actions: Considering the extensive distribution and large populations of *E. vittata* found in many water bodies, it would appear that this species does not warrant inclusion on the Australian Society for Fish Biology's list of Australian threatened fishes.

Conservation recommendations: The most important conservation action is to maintain 'natural' flow regimes which are necessary for successful spawning migrations and to preserve suitable habitat for spawning. To ensure this, buffer zones must be maintained in areas used for farming and/or forestry, while the effects of water usage on stream flow should be minimised. Furthermore, to maintain local populations, further introductions of non-endemic species should be made only into appropriate water bodies.

Nannatherina balstoni Regan, 1906 (Nannopercidae)

Common names: Balston's Pygmy Perch or Perchlet, King River Perchlet.

Identification: D1 VII-VIII; D2 9-11; A III, 8-10; P 12-13; gill rakers on first branchial arch 6-15, very poorly developed; tubed lateral-line scales 2-17, interspersed with normal scales. Greatest body depth 3.4-4.0 of SL. Deep notch between D1 and D2. Mouth relatively large, extending to well under the eye. Maximum size 90 mm TL. Coloration mid to dark brown, grading to whitish on breast and belly, often with darker brown mid-lateral stripe bordered by broad yellow-white blotches or stripes. Fins lightly to moderately pigmented; D2, caudal, and anal fins variegated.

Distribution: *Nannatherina balstoni* is restricted to the small area of coastal peat flats in the south-western corner of Australia that extends from Margaret River in the west to Albany in the east, with an isolated population approximately 100 km north of Perth at Gingin (Fig. 8, Table 8). The discontinuity in the distribution of this species may represent the loss of suitable habitat caused by widespread urban and rural development in the intervening region. The centre of the distribution of *N. balstoni* is in the peat flats of the Doggerup, Gardner and Shannon River watersheds (Figs 2.1, 8, Table 8).

Abundance, habitat and ecology: This species is the rarest of all the endemic freshwater fishes of south-western Australia. However, *Nannatherina balstoni* was moderately abundant in a number of shallow pools and creeks that often dry up in summer (e.g. pools/creeks on Windy Harbour, Chesapeake, Deeside and Beardmore Roads). It was only ever captured in very low numbers in the major rivers (e.g. Margaret, Scott, Donnelly, Shannon, Gardner and Deep Rivers) and lakes of the lower south-west (Lakes Quitjup, Smith, Doggerup and Maringup). The sites in which this species were caught

were almost always located in the peat flats and adjacent forested areas. The water in the shallow isolated pools in which *N. balstoni* was typically found, was generally dark and acidic (pH 3.0-6.0) and exhibits marked seasonal temperature fluctuations (11-35 ^{O}C). In winter and spring this species was typically found amongst inundated riparian vegetation, habitat which it presumably uses as both feeding and spawning grounds. Although the adults of this species were often caught close to this riparian vegetation, they were also caught in open water. The larvae of this species were typically found feeding in very shallow water (<10 cm) amongst flooded riparian vegetation in areas that were not subject to shade. As the larvae increase in size, they gradually move into deeper water. Larval (<15 mm) and small (15-25 mm) *N. balstoni* feed predominantly on cladocerans, while terrestrial fauna (arachnids and adults of hymenopterans, coleopterans and dipterans) are the main prey items ingested by *N. balstoni* >25 mm. The life cycle of this species typically lasts for one year. The total lengths of the longest male and female were 82 mm (5.6 g) and 90 mm (7.3 g), respectively.

Reproduction: When males and females attain sexual maturity, at the end of their first year of life, their total lengths are on average 60 and 63 mm, respectively. *Nannatherina balstoni* spawns once in the breeding season (June to September), which peaks in mid-July to early August, when water levels are at their maximum. Fecundity ranges from 550 in a 61 mm fish to 1600 in an 82 mm fish.

Threats: Habitat alteration and possibly the introduction of exotic species pose the main threats to *N. balstoni* and also to the three other species restricted to the peat flat region. Habitat alteration is likely to occur through the construction of water points for fire fighting, road maintenance, mineral sand exploration and mining, groundwater extraction and also agricultural and forestry practices in the uppermost catchment (causing alterations to inflow, salinisation, siltation and eutrophication). Exotic fish species (*Oncorhynchus mykiss*, *Salmo trutta, Gambusia holbrooki* and *Perca fluviatilis*) and those species translocated from eastern Australia (*Macquaria ambigua* and *Bidyanus bidyanus*) are present in the major catchments surrounding the peat flats. The introduction of the two latter large and piscivorous eastern Australian species, which are well adapted to similar harsh environments, may pose a threat to the small endemic fish of south-western Australia.

Conservation status and actions: Much of the area occupied by *N. balstoni* is in nature reserves, particularly the D'Entrecasteaux and Shannon National Parks. This species has recently been proposed for inclusion in the vulnerable category in the Australian Society for Fish Biology's list of Australian threatened fishes.

Conservation recommendations: The most important conservation actions are to ensure that the small pools in the peat flats of south-western Australia, and the shallow areas and riparian vegetation in these pools used by the larvae, are conserved. To ensure this the position of new water points, roads etc. should be carefully monitored. Furthermore, non-endemic species should be introduced only into appropriate water bodies.

3.2 Identification, distribution, abundance, notes on the biology of and conservation recommendations for the anadromous fish of the south-western corner of Australia

Geotria australis Gray, 1851 (Geotriidae)

Geotria australis Gray, 1851 (Geotriidae)

Common names: Pouched lamprey.

Identification: Jawless eel-like fish. Two posteriorly placed dorsal fins, no paired fins. Seven separate gill openings. Juveniles (ammocoetes) with no external eyes. Maximum size about 650 mm TL. Ammocoetes brown in colour. Downstream migrants and newly returned adults are blue dorsally and silver ventrally, the adults bearing a dorso-lateral blue-green stripe. As the adults move upstream to their spawning grounds, the bright coloration is lost and they become dull brown in colour. During this upstream migration, the males develop a large pouch below the mouth.

Distribution: In Western Australia *G. australis* is common in the rivers south of Margaret River, however, this species has been recorded as far north as the Swan River. *Geotria australis* has an extensive range, being found in eastern Australia, Tasmania, New Zealand, Chile and Argentina. During this study, adults were collected from the Margaret, Donnelly and Warren Rivers, while ammocoetes were collected from the Capel, Margaret, Donnelly, Warren, Gardner, Shannon and Deep Rivers (Figs 9, 10, Tables 9, 10). Museum records show that *G. australis* is also found in the Collie and Blackwood Rivers.

Abundance, habitat and ecology: Ammocoetes were often very abundant in the sheltered areas of river systems, where the substrate was suitable for this burrowing stage, i.e. silty for ammocoetes and sandy for metamorphosed juveniles. During the present study ammocoetes were very abundant in the lower reaches of the Margaret and Gardner Rivers, Lefroy Brook (Warren River) and Fly Brook (Donnelly River), but very few were caught in the Capel River and none in the Boorara Brook (upper Gardner River) or the Blackwood River. The larval phase in the life cycle of *G. australis* is spent burrowed in the soft substrate, with the larva feeding on diatoms, detritus and micro-organisms that are drawn into the pharynx on a water current from the substrate surface. After an average of 4.3 years, the ammocoete metamorphoses into a young adult with prominent eyes and a suctorial disc. Metamorphosis is completed in 5-6 months, after which the young adult migrates downstream (moving predominantly at night) to the sea in July and August where it feeds parasitically on fish. During its marine trophic phase, which is believed to last two years, *G. australis* increases from *ca* 90 to 650 mm. The fully-grown adult ceases feeding and re-enters rivers, embarking on an upstream migration (moving predominantly at night) which, after a further 15-16 months, will culminate in spawning and death. The strength of the upstream migration is highly variable.

Reproduction: Although no mature adults of *G. australis* have ever been captured and their precise spawning areas are unknown,the pattern of development of lampreys in the laboratory and the time of appearance of small, very young ammocoetes strongly indicate that spawning takes place in October/November, approximately 15-16 months after they first re-entered the rivers. A number of maturing adults were collected from Dombakup Brook (Warren River), the main channel of the Warren River and Lefroy Brook (Warren River), where they were found under rocks and logs and among submerged grass.

Threats: Habitat alteration poses the main threat to *G. australis*. Habitat alteration is likely to occur through, the construction of dams, groundwater extraction and also agricultural and forestry practices in the uppermost catchment. These practises can cause alterations to inflow, salinisation, siltation and eutrophication which may lead to the loss of ammocoete beds. For example, no ammocoete beds were found in the parts of streams running through cleared agricultural land, where it is believed that agricultural run-off and increased inflow adverseley effect the composition of the substrate (Macey, pers. comm.). Furthermore, although adults are known to move overland around dams, it is likely that on dry nights the large dams found in many catchments will act as barriers to the migrating adults. For example, in late September 1994, approximately 5 000 upstream migrants were observed on and below the Lefroy Dam, but none were using the fish ladder provided, which was dry at the time. On the following morning, large numbers of dead animals were present at the bottom of the dam.

Conservation status and actions: Considering the extensive distribution and generally large populations of *G. australis* it would appear that this species does not warrant inclusion on the Australian Society for Fish Biology's list of Australian threatened fishes. *Geotria australis* is the sole member of the monotypic family Geotriidae and is the only representative of the Petromyzontiformes found in Western Australia.

Conservation recommendations: The most important conservation action is the preservation of 'natural' flow regimes and suitable habitat in the small streams of south-western Australia. To ensure this, buffer zones must be maintained in areas used for both farming and forestry. The construction of large dams must include design elements which readily permit the upstream spawning migration.

3.3 Identification, distribution, abundance, notes on the biology of and conservation recommendations for each of the fish with recent marine origins that are found in freshwater and are endemic to the south-western corner of Australia

Leptatherina wallacei (Prince, Ivantsoff & Potter, 1981)

Pseudogobius olorum (Sauvage, 1880)

Afurcagobius suppositus (Sauvage, 1880)

Leptatherina wallacei (Prince, Ivantsoff & Potter, 1981)

Common names: Swan River hardyhead, Western hardyhead.

Identification: D1 V-VIII; D2 I, 8-10; A I, 9-12; P 11-15; gill rakers on lower limb of first branchial arch 14-17. Mouth relatively small, extending to front of eye. A large gap is present between the two dorsal fins.

Maximum size about 80 mm TL. Coloration, olive dorsally and silvery laterally and ventrally, a very obvious midlateral copper coloured stripe is often present. Fins pale.

Distribution: The range of this species extends from Moore River in the north to Pallinup in the south-east. During the present study, *L. wallacei* was found in the Abba, Margaret, Blackwood, Scott, Gardner, Shannon, Inlet and Forth Rivers and in Lakes Jasper and Towerrinning as well as being found in a number of roadside pools on Windy Harbour Road (Fig. 11, Table 11).

Abundance, habitat and ecology: *Leptatherina wallacei* is very abundant, often forming large schools in estuaries, rivers, streams and lakes in the coastal areas throughout its range. It also penetrated considerable distances up the Blackwood River (Figs 11). In the Swan Estuary, planktonic crustaceans, flying insects, polychaetes and unicellular algae are the most important dietary items of this species.

Reproduction: In the Swan Estuary, males and females of this species attain lengths of 45 and 55 mm at the end of their first year of life, respectively, at which age they attain sexual maturity. Very few fish survive beyond their first year. This species has a protracted spawning period that peaks in late spring.

Threats: Since *L. wallacei* was common and abundant throughout much of its extensive range, it is unlikely that this species is threatened.

Conservation status and actions: Considering the extensive distribution of *L. wallacei*, it would appear that this species does not warrant inclusion on the Australian Society for Fish Biology's list of Australian threatened fishes.

Conservation recommendations: Due to the extensive distribution and wide range of habitats in which this species is abundant, no specific conservation recommendations are made.

Pseudogobius olorum (Sauvage, 1880)

Common names: Swan River goby, blue spot goby.

Identification: D1 VI; D2 I, 7-8; A I, 7-8; P 15-16; V I, 5 (pelvic fins form distinct disc); gill rakers on first branchial arch 8-9; operculum lightly scaled; cheek naked; cephalic lateral-line system longitudinal; cephalic lateral-lines short. Mouth small and sub-terminal, extending to front of eye. Maximum size about 60 mm TL. Coloration, light brown and pale ventrally. Lateral series of seven to nine dark blotches. Dorsal and caudal fins with a series of brown or black reticulating lines; D1 bearing prominent blue or black spot posteriorly. Pectoral fin transparent. Pelvic and anal fins pale, becoming dark blue to black during the breeding season. Pigmentation varies with site of capture, sex, reproductive status, and preservation, and is usually strongest in breeding males which are often almost completely black.

Distribution: The range of this species extends from Moore River in the north to Esperance in the south-east. N.B. *Pseudogobius olorum* and related species and genera are currently under revision and the placing of fish from eastern Australia into this taxon is no longer valid (Larson pers. comm.). The results of this study show that *P. olorum* is generally associated with the coastal water bodies between Capel and Albany, but does penetrate considerable distances inland in certain rivers e.g. the Blackwood River (Fig. 12), as well as being found in a number of pools and isolated lakes e.g. Lake Jasper, Lake Maringup and Lake Towerrinning (Fig. 12, Table 12).

Abundance, habitat and ecology: *Pseudogobius olorum* was common and very abundant throughout most of its range and was found in estuaries, rivers, streams and both freshwater and hypersaline lakes (Halse, 1981). In the Swan Estuary, algae and mats of bacteria and fungi are the major dietary components in spring, summer and winter, while a considerable amount of animal material is only ever consumed in winter. However, in the lakes of the Swan Coastal Plain, this species feeds predominantly on animal taxa in all seasons (Fairhurst, 1993). This species can tolerate extreme salinities and temperatures and is one of the few native species found in highly eutrophic systems (Halse, 1981; Fairhurst, 1993). The life cycle of *P. olorum* typically lasts for less than a year.

Reproduction: *Pseudogobius olorum* spawns in both spring and autumn and at best to only a limited extent in summer. Length-frequency and gonadal data show that the progeny of the spring-spawning group frequently spawn in the following autumn, when they are approximately five months old, and that those of the autumn-spawning group frequently spawn in the following spring, when they are approximately seven months old. Some representatives of these two

spawning groups survive through the winter and summer, respectively, to breed in a second season.

Threats: Since *P. olorum* was common and abundant throughout much of its extensive range it is unlikely to be threatened.

Conservation status and actions: Considering the extensive distribution and abundance of *P. olorum*, this species does not warrant inclusion on the Australian Society for Fish Biology's list of Australian threatened fishes.

Conservation recommendations: Due to the extensive distribution and wide range of habitats in which this species is abundant no specific conservation recommendations are made.

Afurcagobius suppositus (Sauvage, 1880)

Common names: Big headed goby.

Identification: D1 VI; D2 I, 8; A I, 7; P 15-16; V I, 5 (pelvic fins form distinct disc); gill rakers on first branchial arch 6-11; vertebrae 27; scales in lateral row 30-38; transverse scale count 10-13+1; predorsal scales 0-4; prepelvic area naked; cheek and operculum naked; tongue truncate; cephalic lateral-line system longitudinal; cephalic lateral-line row a1 short. Greatest body depth 5.0-6.5 in SL. Mouth large, extending to rear of eye. Maximum size about 110 mm TL. Coloration, light brown to black dorsally and pale ventrally. Lateral series of six or seven dark blotches. Head usually heavily pigmented. Dorsal and caudal fins with a series of brown or black reticulating lines; D1 bearing prominent dark spot posteriorly. Pectoral fin transparent. Pelvic and anal fins pale, darker during breeding season. Pigmentation varies with site of capture, sex, reproductive status and preservation, and is usually strongest in breeding males.

Distribution: The range of this species extends from Moore River in the north to Esperance in the south-east. This species penetrates inland waters, e.g. Warren, Scott and Blackwood Rivers, and is also found in Lake Jasper (Table 1).

Abundance, habitat and ecology: *Afurcagobius suppositus* is common and occasionally locally abundant throughout most of its range and is found in estuaries, rivers, streams and coastal lakes. This species has a strong preference for heavy cover (Gill & Humphries, 1995). Hemipterans and dipteran larvae are important dietary components in all seasons, while bivalves, terrestrial insects, ephemopterans, trichopterans and teleosts are important in some seasons (Young, 1994). The duration of the life cycle of *A. suppositus* is unknown, but probably lasts for at least two years.

Reproduction: Although the breeding biology of this species has not been documented, it is likely that this species breeds at the end of its first year of life. Males guard a nest under stones or among aquatic macrophytes where several females have laid their eggs. Breeding probably occurs between late spring and early summer (Gill, unpubl. data).

Threats: Since *A. suppositus* is common throughout much of its extensive range, it is unlikely that this species is under any real threat. However, the loss of habitat through urban and agricultural development and agricultural and forestry practices, causing alterations to inflow and the deposition of silt, may pose threats to some populations of this species. N.B. A related species (*Favonigobius lateralis*) has been shown to be intolerant of a substrate that contains fine particles.

Conservation status and actions: Considering the extensive distribution and abundance in some water bodies occupied by *A. suppositus*, it would appear that this species does not warrant inclusion on the Australian Society for Fish Biology's list of Australian threatened fishes.

Conservation recommendations: The most important conservation actions are the preservation of suitable habitats, and the careful monitoring of any activities which may result in the deposition of silt. While the taxonomy of this species has received much recent attention, little is known about its general biology, a situation which should be addressed before further recommendations can be made.

3.4 Identification, distribution, abundance and notes on the biology of the freshwater fish that have been introduced to the south-western corner of Australia

Oncorhynchus mykiss (Wilbaum) (Salmonidae)

Salmo trutta Linnaeus (Salmonidae)

Gambusia holbrooki Girard (Poeciliidae)

Perca fluviatilis Linnaeus (Percidae)

Oncorhynchus mykiss (Wilbaum) (Salmonidae)

Salmo trutta Linnaeus (Salmonidae)

Common names: Rainbow trout.

Brown trout.

Identification: Trout can be recognised by the presence of an adipose fin between the dorsal and caudal fins. Mouth relatively large, extending to rear of eye. Maximum size about 700 mm TL. Coloration blue-black (rainbows) to olive (browns) dorsally and silver to bronze ventrally, a very obvious midlateral pink stripe is often present in rainbows. The body and tail are covered in small black spots in rainbows, whereas in brown trout these spots are large, and black and red (often with white surrounds), and are absent on the tail.

Distribution: During this study, these species were found in rivers, streams, lakes and dams in the Margaret, Donnelly, Warren and Gardner River catchments (Fig. 13, Table 13), however, stocking of trout, particularly *O. mykiss*, into dams and rivers has occurred on a wide scale throughout much of the south-west, and includes: Big Brook Dam, Cowan Dam, Drakesbrook Dam, Glen Mervyn Dam, Harvey Weir, Lake Leshenaultia, Logue Brook Dam, Nornilup Dam, Pemberton Swimming Pool, Samson Dam, Stirling Dam, Waroona Dam, Albany area, Blackwood River, Brunswick River, Collie Gorge, Dirk Brook, Donnelly River, Harvey River, Hesters Brook, Lefroy Brook, Marrinup Brook, McKnows Brook, Murray River, Samson Brook, Serpentine River, Warren River, Wokalup Brook and Wooroloo/Jane Brook (Morrissy pers. comm.). Of the 1 965 500 trout stocked into public waters in the south-west of Australia between 1985 and 1994, 28 and 70 % were released into dams and rivers, respectively, while it is not clear where the remainder were released (Table 14). The majority of trout that were stocked into either dams or rivers in the south-west were fry or yearling *O. mykiss* i.e. of the 1 606 000 trout fry and 168 800 yearlings released, 98.8 % were *O. mykiss* (Table 14).

Abundance, habitat and ecology: These species are locally abundant in those waters which have been subject to continued stocking and where they form an important recreational fishery.

Reproduction: Although there is probably some limited reproductive success in the south-west, trout populations are maintained by the stocking of water bodies with hatchery reared fry and yearlings, although some fertilised eggs and ex-brood stock are also released (Table 14).

Threats: Not applicable.

Conservation status and actions: Not applicable.

Conservation recommendations: Not applicable.

Gambusia holbrooki (Girard) (Poeciliidae)

Common names: Gambusia, mosquitofish.

Identification: One soft dorsal fin and moderately deep body. Mouth small. Maximum size about 60 mm TL. Coloration, olive-brown dorsally and silver to light bronze laterally and ventrally. Fins lightly pigmented. Mature females with large ventro-lateral blotch. Mature males have elongate anal fin rays, which are modified to form an intromittent organ.

Distribution: This species is widespread and is found in the Collie, Capel, Ludlow, Abba, Carbanup, Margaret, Blackwood, Scott, Donnelly, Warren, Gardner, Shannon, Frankland and Lake Muir catchments (Figs 14, Table 15).

Abundance, habitat and ecology: When present, this species is typically very abundant. In the Collie River and the wetlands of the Swan Coastal Plain *G. holbrooki* fed at the water surface and throughout the water column on a wide range of prey types (Pen & Potter 1991d; Fairhurst, 1993). While Pen & Potter (1991d) found no evidence of fin nipping or agonistic behaviour by this species in lotic waters, recent work in the RGC Wetlands demonstrated that *G. holbrooki* displayed agnostic behaviour towards the native species in that lentic system. Furthermore, the majority of natives in that system had extensive damage to their fins, presumably the result of fin nipping by *G. holbrooki*. This species was introduced to Western Australia in 1934 to control mosquitos. Fertilisation is internal, with the female bearing live young rather than eggs and

sexual maturity is reached in a short time. Because of these latter characteristics, it is now considered a pest in many areas of the world.

Reproduction: Fertilisation and development are internal in this species. In the Collie River, *G. holbrooki* breeds when the water temperature is greater than about 15 ^{O}C. The larger progeny of the spring recruits breed in late summer and early autumn, while the smaller individuals overwinter and breed in the following spring. The autumn spawned fish overwinter and breed in the following spring and summer.

Threats: Not applicable.

Conservation status and actions: Not applicable.

Conservation recommendations: Not applicable.

Perca fluviatilis Linnaeus (Percidae)

Common names: Redfin perch, European perch, perch, redfin.

Identification: Spiny first dorsal, soft second dorsal fin and moderately deep body. Mouth relatively large, extending to rear of eye. Maximum size about 500 mm TL. Coloration, olive dorsally and silvery ventrally, a series of vertical bars dorso-laterally. Paired and anal fins orange to red in colour.

Distribution: These species are found in the Collie, Capel, Margaret, Blackwood, Donnelly and Warren River catchments (Figs 15, Table 16).

Abundance, habitat and ecology: When present, this species was typically abundant. In the Collie River, small *P. fluviatilis* feed predominantly on planktonic crustaceans while larger fish feed predominantly on benthic invertebrates. Fish of all sizes prey on endemic teleosts. This species forms an important recreational fishery in some areas of south-western Australia.

Reproduction: The large numbers of very small *P. fluviatilis* caught in November and December, in the Collie River, suggests that this species spawns in spring.

Threats: Not applicable.

Conservation status and actions: Not applicable.

Conservation recommendations: Not applicable.

4.0 SUMMARY & RECOMMENDATIONS

Distribution, abundance and habitat requirements

Freshwater fish that are endemic to the south-western corner of Australia

Based on their distribution patterns, abundance and habitat requirements, the seven small freshwater fish endemic to the south-western corner of Australia, located between Geraldton in the north-west and Esperance in the south-east, can be divided into two main groups. Three species, namely *G. occidentalis*, *B. porosa* and *E. vittata,* are abundant in rivers, streams, lakes and pools throughout the entire south-western corner of Australia. Furthermore, these three species are common in water bodies within forested areas, the peat flats and agricultural areas. Indeed, the only habitat type in which these species were rare or absent were those water bodies that were devoid of cover, i.e. did not possess riparian vegetation, boulders, submerged snags etc.

The other four small endemic species, *L. salamandroides*, *G. nigrostriata*, *G. munda* and *N. balstoni*, are restricted to the region bounded by Margaret River in the west and Albany in the east, except for a small number of disjunct populations of the last three species. i.e. *Nannatherina balstoni* has disjunct populations in Gingin and in the Collie River, while *G. nigrostriata* has disjunct populations at Gingin and Bunbury and *G. munda* has been found at Gingin. These species were only present in certain habitat types in which they were sometimes abundant. Thus, *L. salamandroides, G. nigrostriata* and *N. balstoni* were almost always associated with the ephemeral pools of the southern peat flats and adjacent forested areas. While *G. munda* was also found in a number of pools in the peat flats, it was most abundant in the headwaters and streams of the major rivers in the peat flats and adjacent forested areas. The range of this species extended further into the forested areas than those of *L. salamandroides, G. nigrostriata* and *N. balstoni.* None of these four species was ever caught in cleared agricultural areas.

All of the above seven species utilise flooded areas for spawning, either within flooded creeks or amongst the inundated vegetation of pools and lakes (Pen & Potter 1990, 1991a, c; Pen *et al.,* 1991, 1993; Morgan *et al.,* 1995a, unpubl. data) The larvae of *L. salamandroides, G. nigrostriata, G. munda* and *N. balstoni* utilise very shallow waters (<10 cm deep), particularly amongst inundated vegetation, for feeding, gradually moving into deeper waters as they increase in size (Gill, unpubl. data).

The freshwater catfish, *T. bostocki,* was caught at only two sites during the present study (Alexander Bridge on the Blackwood River and at Lake Smith), and was recorded only at Lake Wilson by Jaensch (1992), and at Pemberton and Nannup in the Museum Records. However, the studies of Morrison (1988), Hewitt (1992) and Morgan & Gill (unpubl. data) suggest that this species inhabits the deeper areas of lakes and slow flowing rivers and is more susceptible to capture by sunken gill nets and large seine nets than by the methods employed in this study.

Anadromous fish of the south-western corner of Australia

Adult *G. australis* have been caught migrating up the Warren, Donnelly and Margaret Rivers during winter and spring, the strength of these upstream migrations varying greatly amongst years (Morgan and Potter, pers. observation). Although the precise locations at which they spawn are unknown, a number of maturing adults have been caught in isolated pools and the main channel of the headwaters of the Warren River in autumn and winter, where they were found under rocks, logs and amongst submerged bankside grass. Ammocoetes were collected from shallow, silty banks in the Capel, Margaret, Donnelly, Warren, Gardner, Shannon, and Deep Rivers, while downstream migrants were typically associated with the sandy substrates of the deeper and faster-flowing waters of these systems.

Fish with recent marine origins that are found in freshwater and are endemic to the south-western corner of Australia

The endemic fish species with recent marine origins that were most frequently caught in the freshwaters of the south-west, namely *L. wallacei, P. olorum* and *A. suppositus,* were generally associated with coastal water bodies. However, these species penetrated rivers to a considerable distance inland e.g. Blackwood River, and were also found in a number of isolated lakes e.g. Lake

Jasper. *Leptatherina wallacei* and *P. olorum* were often caught in open water and in large numbers. However, *A. suppositus* was only captured in small numbers during the present study, probably reflecting a preference for very heavy cover (Gill & Humphries, 1995).

Freshwater fish that have been introduced to the south-western corner of Australia

Although the most common and widespread exotic species in the south-western corner of Australia was *G. holbrooki*, *P. fluviatilis* was also often locally abundant. Both of these species were generally associated with habitats that had been substantially altered by human activity. For example, these species were often common in reservoirs (e.g. Big Brook Dam), in mined areas (e.g. Collie River South Branch, RGC Mineral Sands) and in those systems subject to enrichment through agricultural run-off (e.g. certain areas of the Collie River, Capel River, Blackwood River and Lake Unicup). The two trout species, *O. mykiss* and *S. trutta*, were rarely captured in large numbers, and were only captured in those systems where regular stocking had taken place, i.e. predominantly in the streams of the Pemberton area. The eastern Australian species *Macquaria ambigua* and *Bidyanus bidyanus* have been recently translocated into the major catchments surrounding the peat flats (see Prokop, 1994, and papers therein).

Threats and conservation recommendations

Although three of the endemic species, *G. occidentalis, B. porosa* and *E. vittata,* were typically represented by large populations in most types of habitat throughout their extensive ranges, and are thus currently under no threat, local populations of these species may be vulnerable to loss of suitable habitat and the introduction of exotic species. For example, recent work in the lakes and pools of the Perth Metropolitan Area has shown that, while all three of these species are abundant in at least some of the few remaining 'coloured' water bodies of the region, they are absent or greatly reduced in number in the eutrophic water bodies that are common in the region (Fairhurst, 1993). Furthermore, while these species were absent/rare in the lakes of the south-west which contain large numbers of the introduced species *G. holbrooki,* they were abundant in the nearby streams and lakes which do not contain this species. The only pools, lakes and streams of the RGC Mineral Sands complex in which the endemic species were abundant contained large amounts of cover and contained few *G. holbrooki*. It should also be noted that the endemic species in the RGC complex had a higher degree of fin damage than those in the nearby Ludlow River, where *G. holbrooki* was far less common.

In contrast to *G. occidentalis, B. porosa* and *E. vittata,* the other endemic species, namely *L. salamandroides, G. nigrostriata, G. munda* and *N. balstoni,* are generally represented by small populations in specific habitats and have a restricted range. These latter species can therefore be considered to be particularly vulnerable to the continuing loss or alteration of habitat and, under certain conditions, to the introduction of non-native species. For example, the effects of habitat alteration and possibly predation by introduced fish may explain the apparent loss of *G. munda* from the headwaters of Lefroy Brook above Big Brook Dam. Thus, whereas Pen *et al.* (1991) found this species in these waters, the present study has failed to record any *G. munda* in these streams. It is therefore pertinent that, during several recent dry years, the reservoir immediately above Big Brook Dam was the only upstream section of Lefroy Brook to retain water during summer and autumn. Furthermore, during these dry years, the piscivorous *P. fluviatilis* was introduced to the reservoir and is now well established in both the reservoir and the headwater streams.

In the case of both *L. salamandroides* and *G. nigrostriata*, many of the roadside pools in which these species aestivate are mistakenly considered by CALM authorities to be devoid of aquatic fauna when they become dry in summer. Their substrate is thus used for 'fill' or the pools themselves are filled during routine road maintenance, which often drastically alters or destroys the pools and thus removes fish habitat. It should also be noted that *G. nigrostriata, G. munda* and *N. balstoni* are each represented by an isolated population well to the north of the peat flats. The disjunct distributions of these three species suggest that these species once had ranges extending to the northern-most part of the region. It is therefore likely that the contraction of their ranges to essentially the relatively pristine area of the peat flats has occurred through habitat degradation due to urban and agricultural development. For example, almost 80% of the wetlands on the Swan Coastal Plain (Moore River to Vasse River) are believed to have been totally destroyed and the majority of the remainder have been drastically modified (EPA, 1991). Furthermore, in the southern section of the Swan Coastal Plain, between Harvey and

Dunsborough, more than 95% of the wetlands have been drained for agricultural purposes (Fisheries & Wildlife, 1978).

Much of the evidence that implicates introduced species in the decline of native fish populations in Australia is circumstantial or anecdotal. However, evidence collected during the present study suggests that *P. fluviatilis* and trout species may have an effect on the native fish during dry years. For example, during summer, when water levels decline markedly, a number of isolated river pools in which these large piscivores were present contained very few native fish, while nearby pools, in which these introduced fish were absent, contained large numbers of native fish. In addition, Lloyd *et al.* (1986) state that *G. affinis* (*G. holbrooki*) may be responsible for the loss of populations of endemic species in eastern Australia and cite several references implicating the introduction of this species as the major cause in the loss of native species in many localities. In addition to the three introduced species caught during the present study, *M. ambigua* and *B. bidyanus* have been translocated from eastern Australia into dams in several of the major catchments surrounding the peat flats. As these species are adapted to environments similar to those found in Western Australia, and as they are piscivorous, their introduction into the few pristine habitats remaining in the south-west could pose a threat to the small endemic species in these areas.

Although adults and ammocoetes of *G. australis* were often both very abundant, habitat alteration may pose a threat to this species in some of the rivers in which it is currently found. For example, any changes that lead to the removal of soft substrate will reduce the habitat available for ammocoetes. In the case of adults, it is critical that there are no impediments to their upstream migration to spawning areas further upriver.

From the results of this study, it appears that habitat alteration and possibly the introduction of exotic species pose the main threats to the highly endemic fish fauna of this region. Habitat alteration is likely to occur through the construction of water points for fire fighting, road maintenance, mineral sand exploration and mining, the construction of dams, groundwater extraction and those agricultural and forestry practices in the uppermost catchments that produce alterations to inflow, salinisation, siltation and eutrophication. Non-native species, i.e. *G. holbrooki*, continue to be introduced by local councils for mosquito control.

Thus, it is apparent that the most important actions that should be taken to ensure the conservation of our depauperate but unique freshwater fish fauna are as follows:

1. The maintenance of 'natural' flow regimes in rivers and the preservation of the lentic water bodies of the peat flats. To ensure this, buffer zones should be maintained in areas used for farming and/or forestry and the effects of water usage on stream flow should be minimised, while the positions of new water points, roads etc. in the peat flats should be carefully established.
2. Every effort should be made to ensure that in the future non-endemic species should be introduced only into appropriate water bodies. Thus, it is important to have strict criteria and regulations governing the introduction of fish into water bodies in Western Australia. Furthermore, the Fisheries Department of Western Australia has developed a comprehensive policy for translocations of, particularly, exotic species, including those from the eastern states, while the new Freshwater Management Act now provides for regional discrimination in freshwater (see Prokop, 1994, and papers therein).

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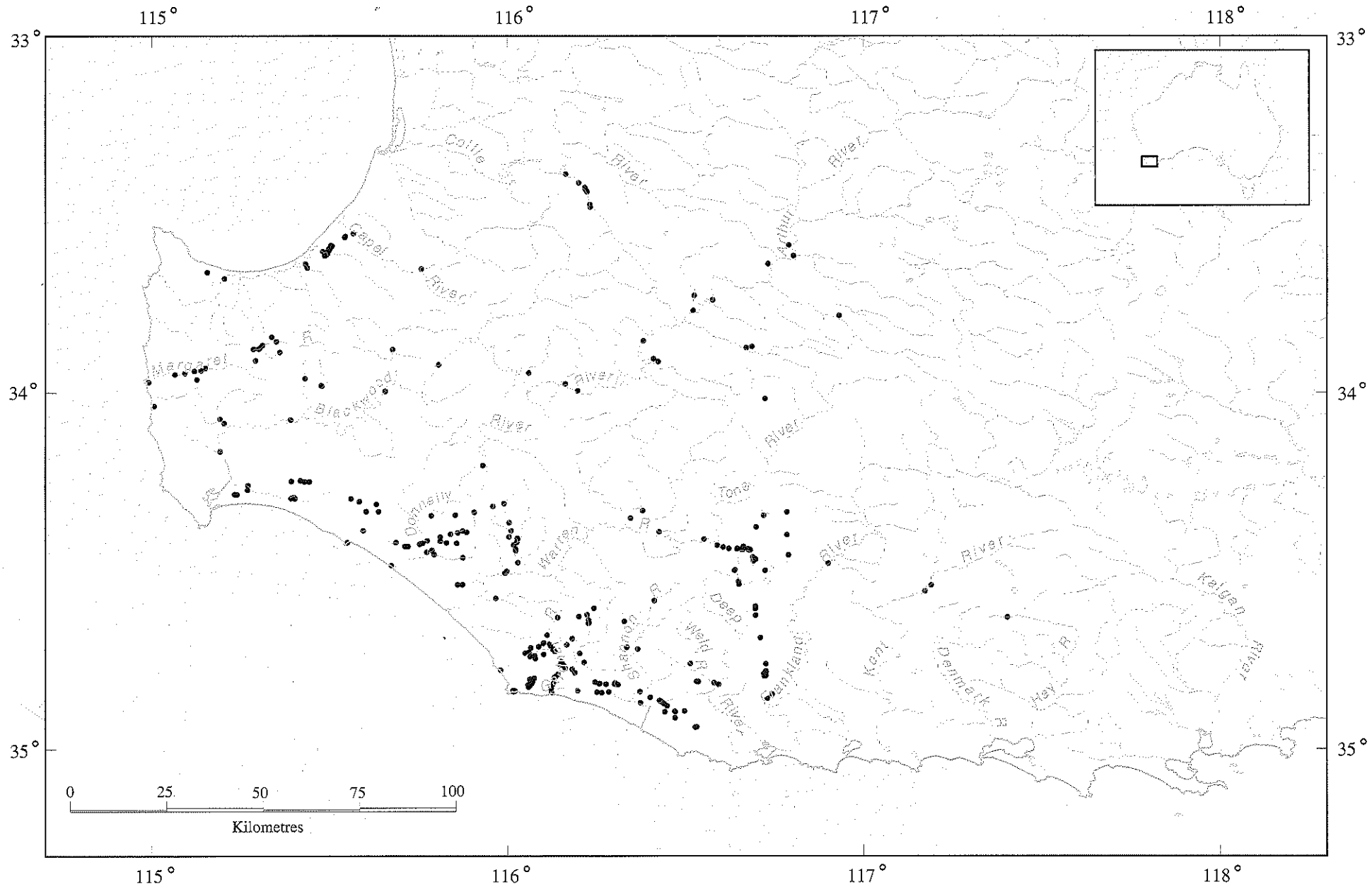

Figure 1 . The sites sampled during the present study of the distribution of fish in the south-western corner of Australia.

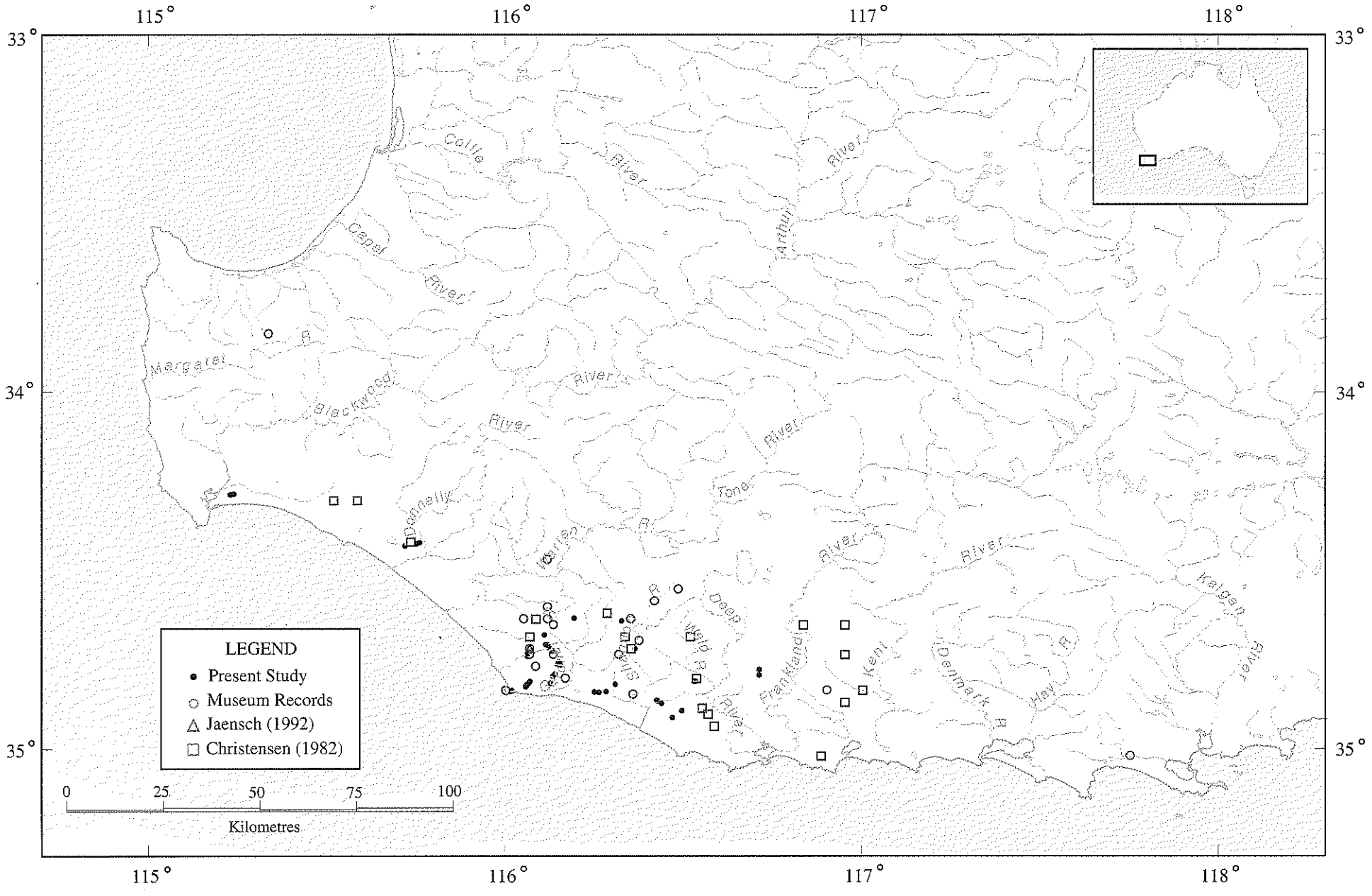

Figure 2 . The distribution of *Lepidogalaxias salamandroides* in the south-western corner of Australia.

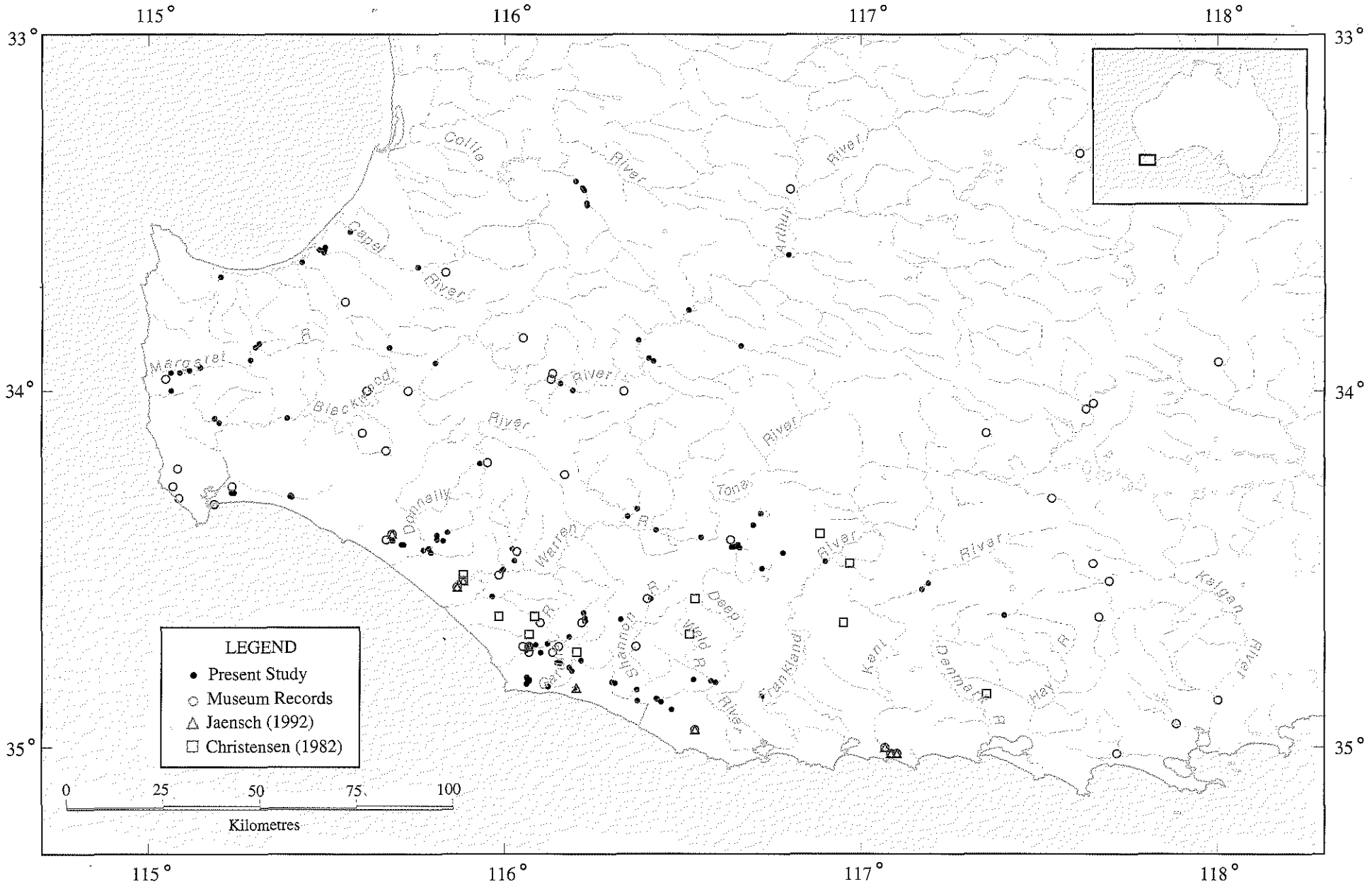

Figure 3 . The distribution of *Galaxias occidentalis* in the south-western corner of Australia

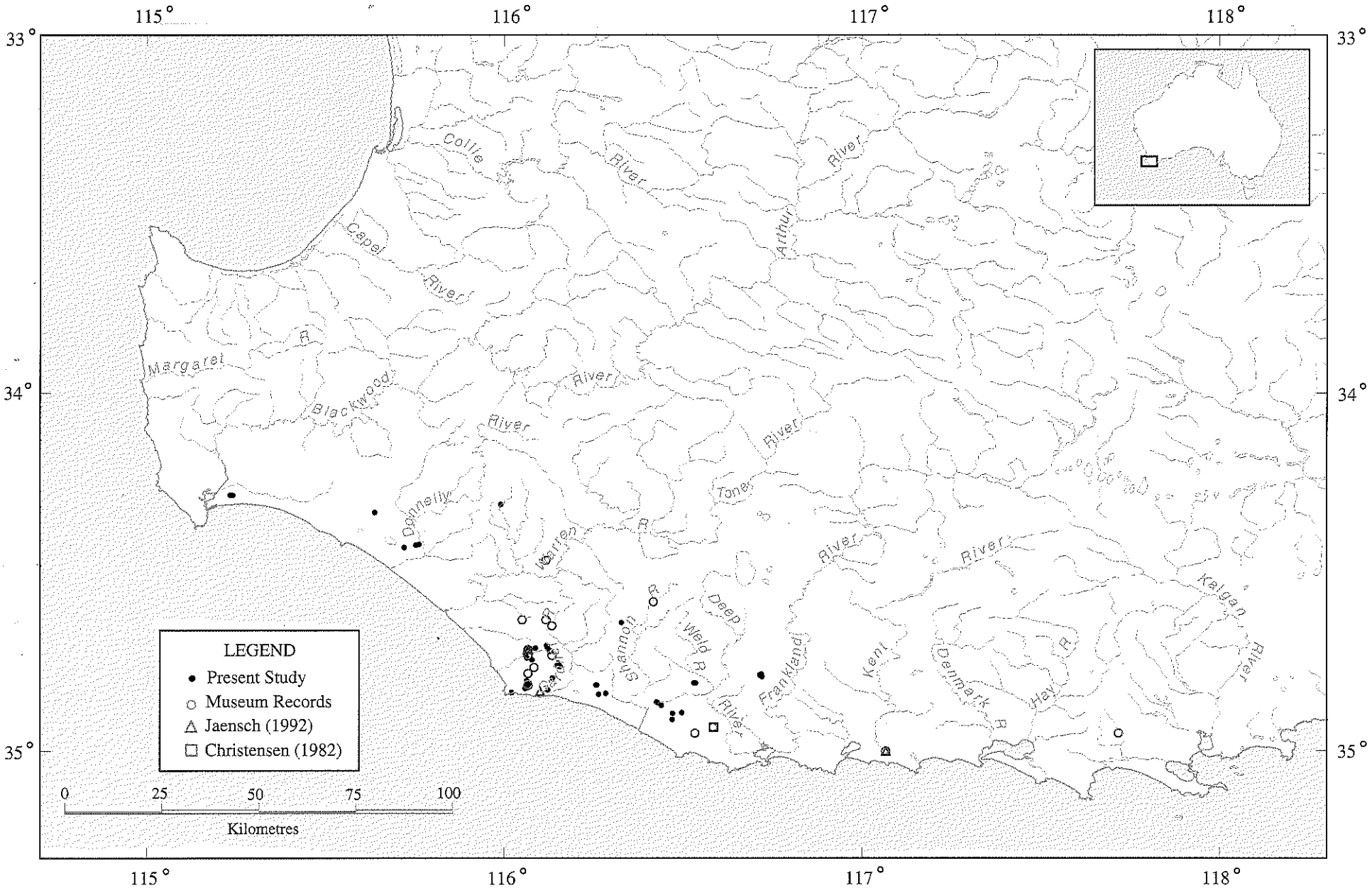

Figure 4 . The distibution of *Galaxiella nigrostriata* in the south-western corner of Australia

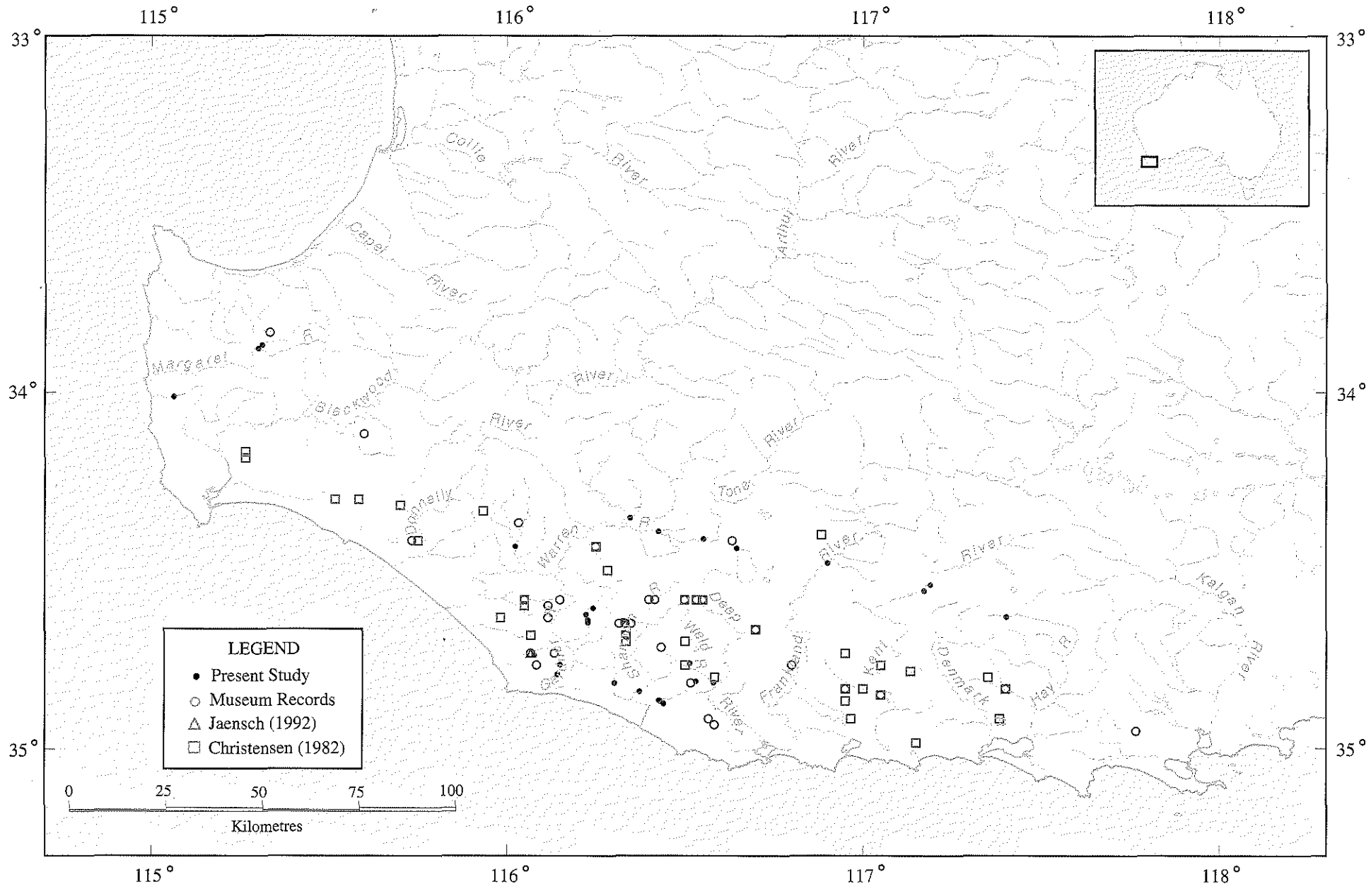

Figure 5 . The distribution of *Galaxiella munda* in the south-western corner of Australia .

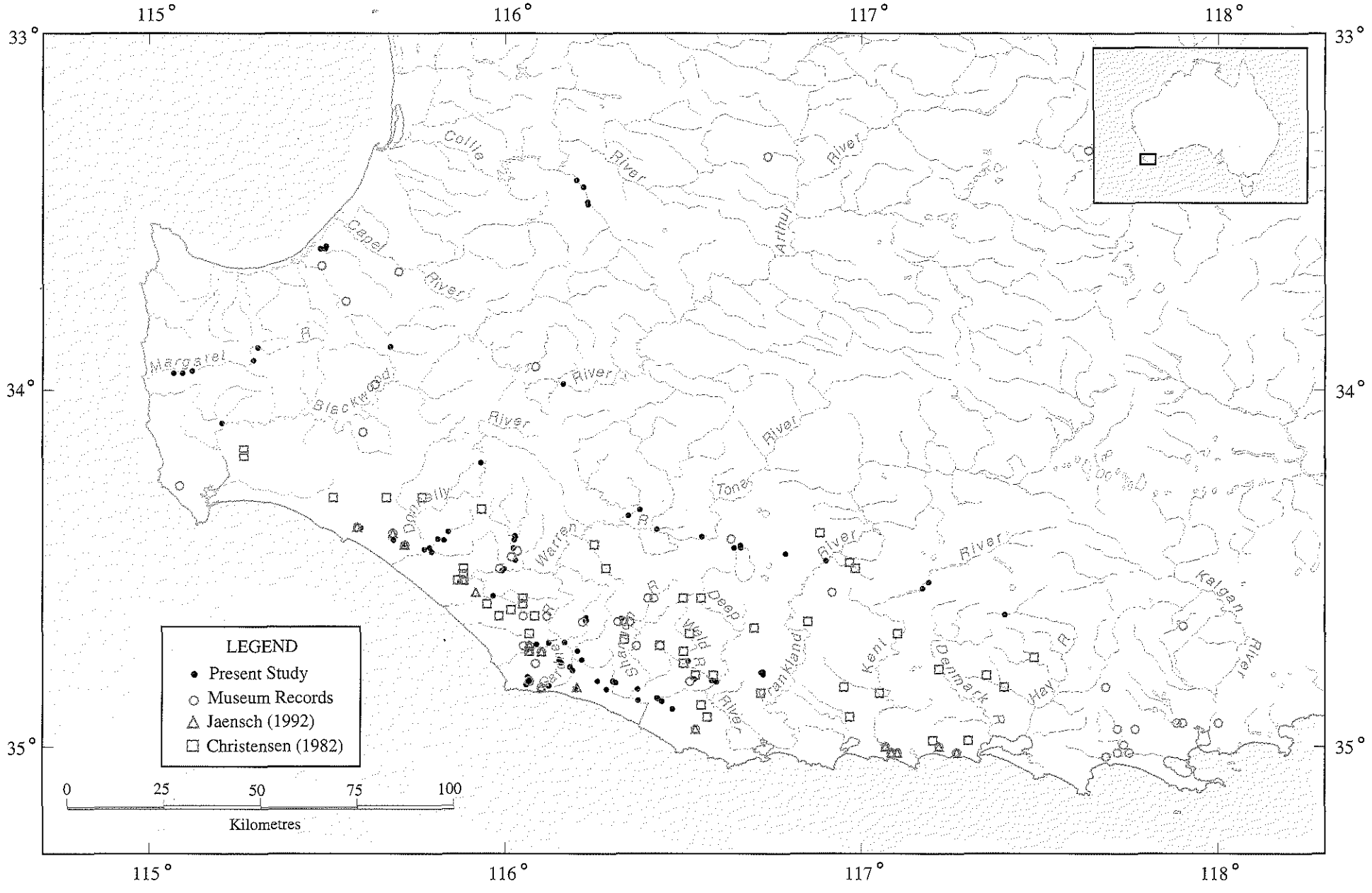

Figure 6 . The distribution of *Bostockia porosa* in the south-western corner of Australia

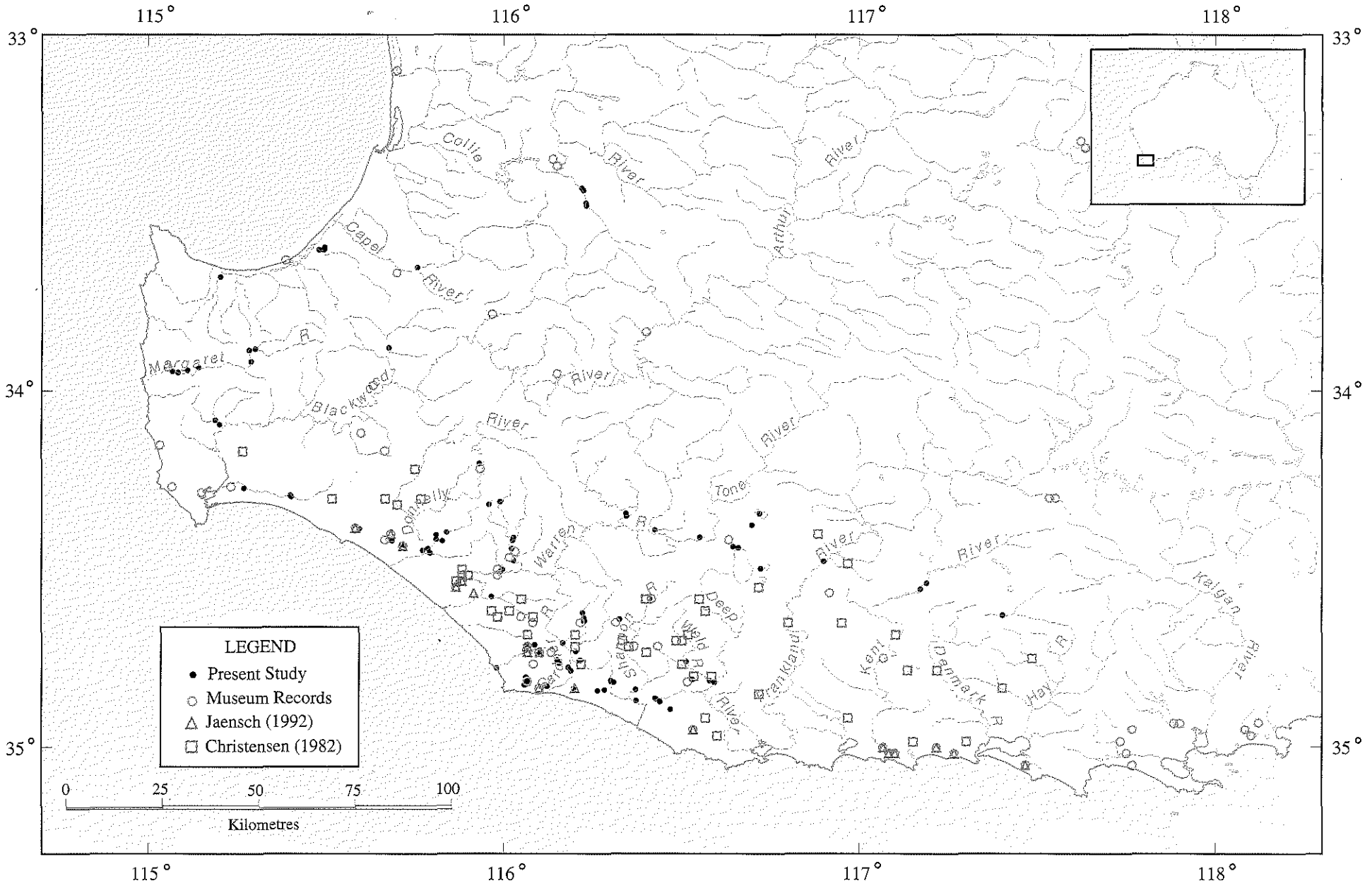

Figure 7 . The distribution of *Edelia vittata* in the south-western corner of Australia

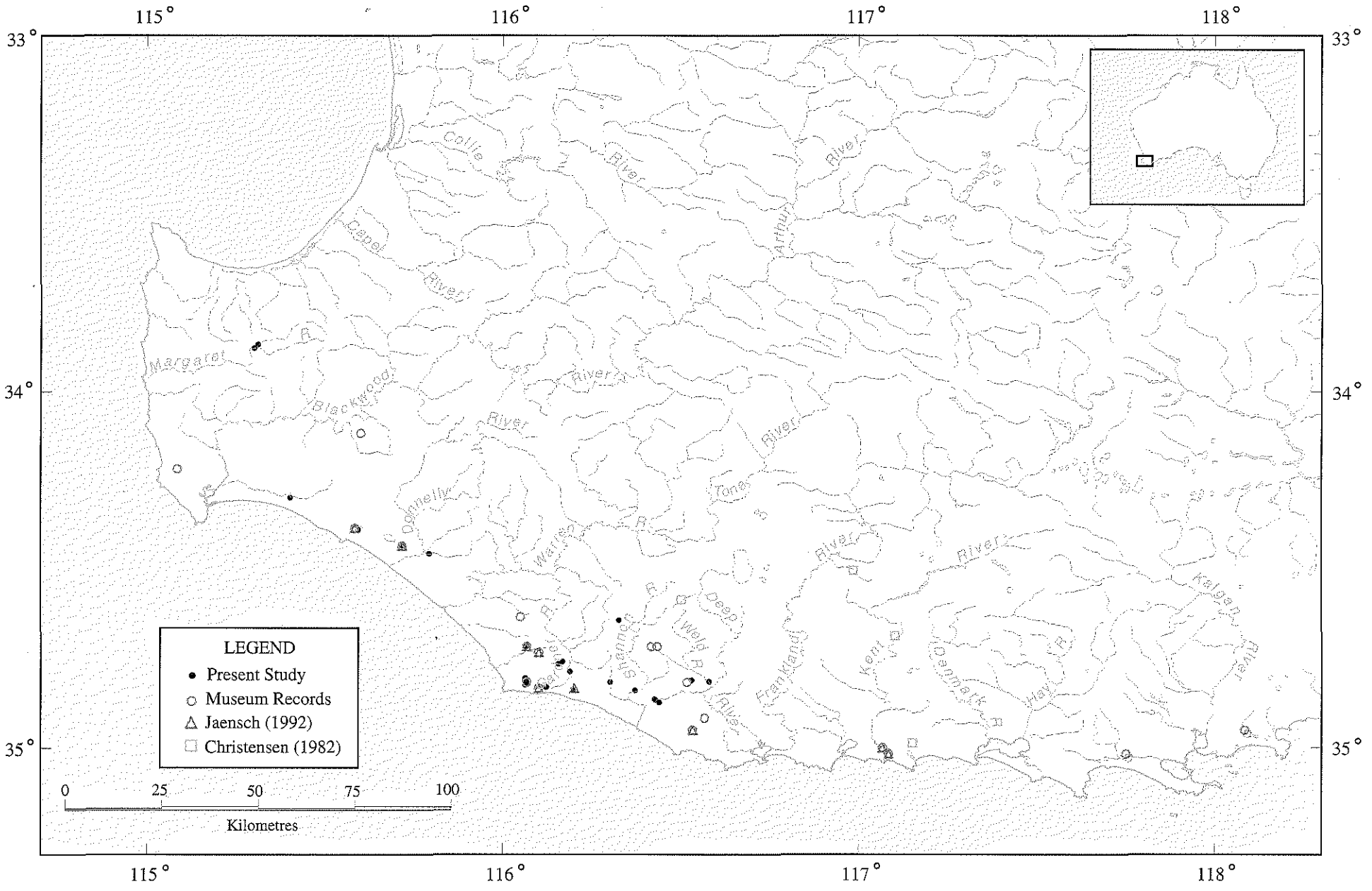

Figure 8 . The distribution of *Nannatherina balstoni* in the south-western corner of Australia.

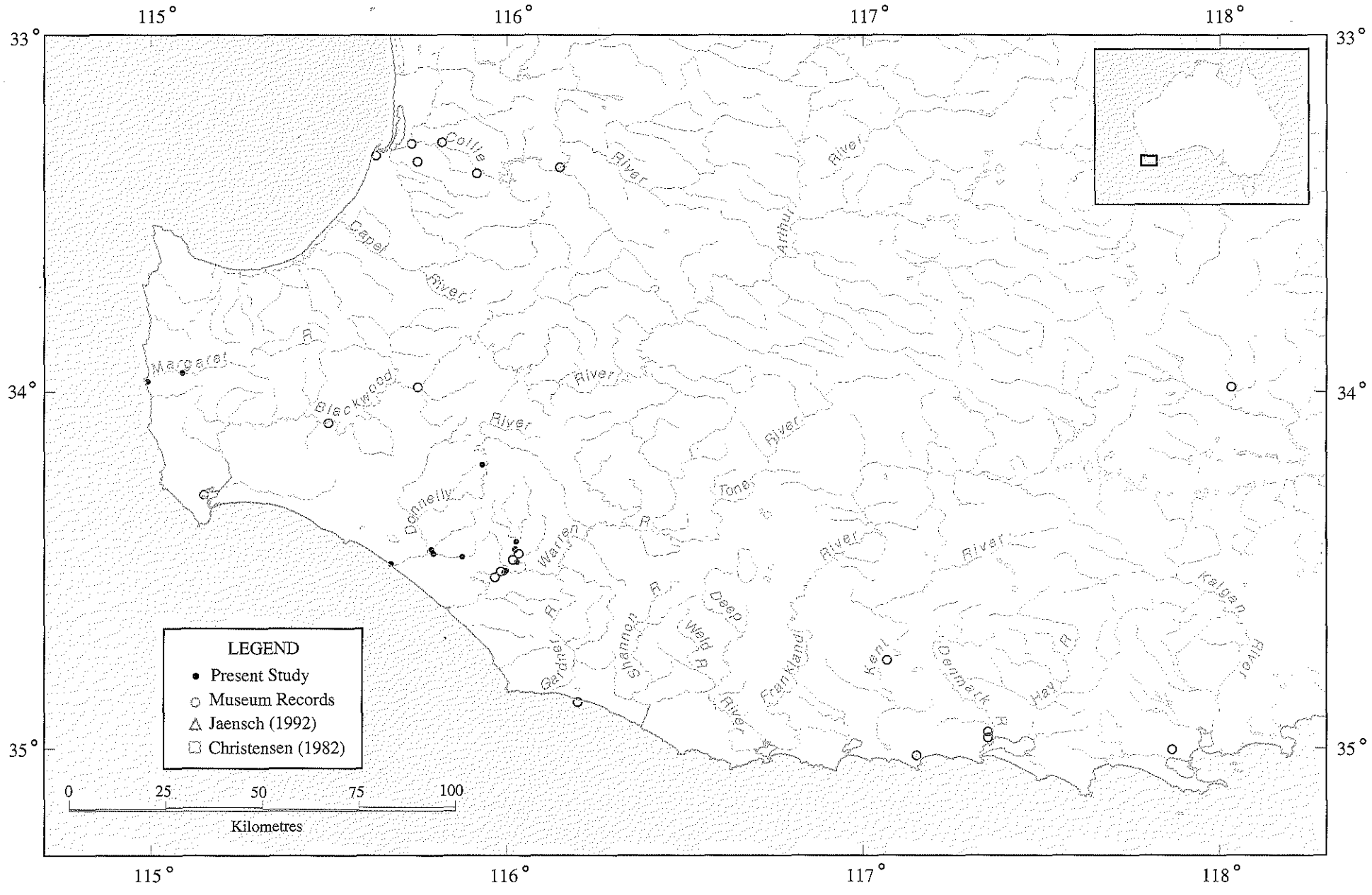

Figure 9 . The distribution of *Geotria australis* (adults) in the south-western corner of Australia

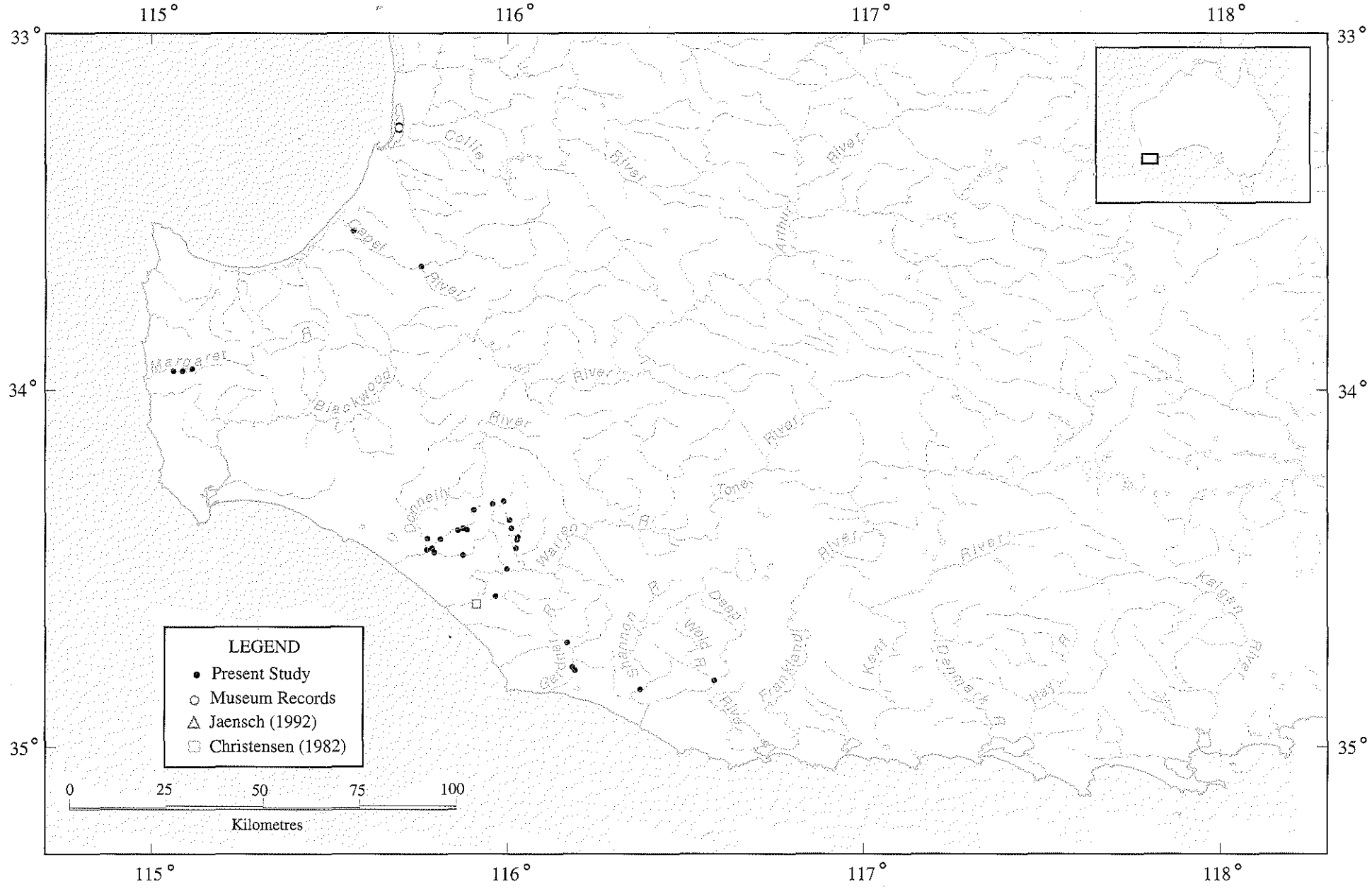

Figure 10 . The distribution of *Geotria australis* (ammocoetes) in the south-western corner of Australia.

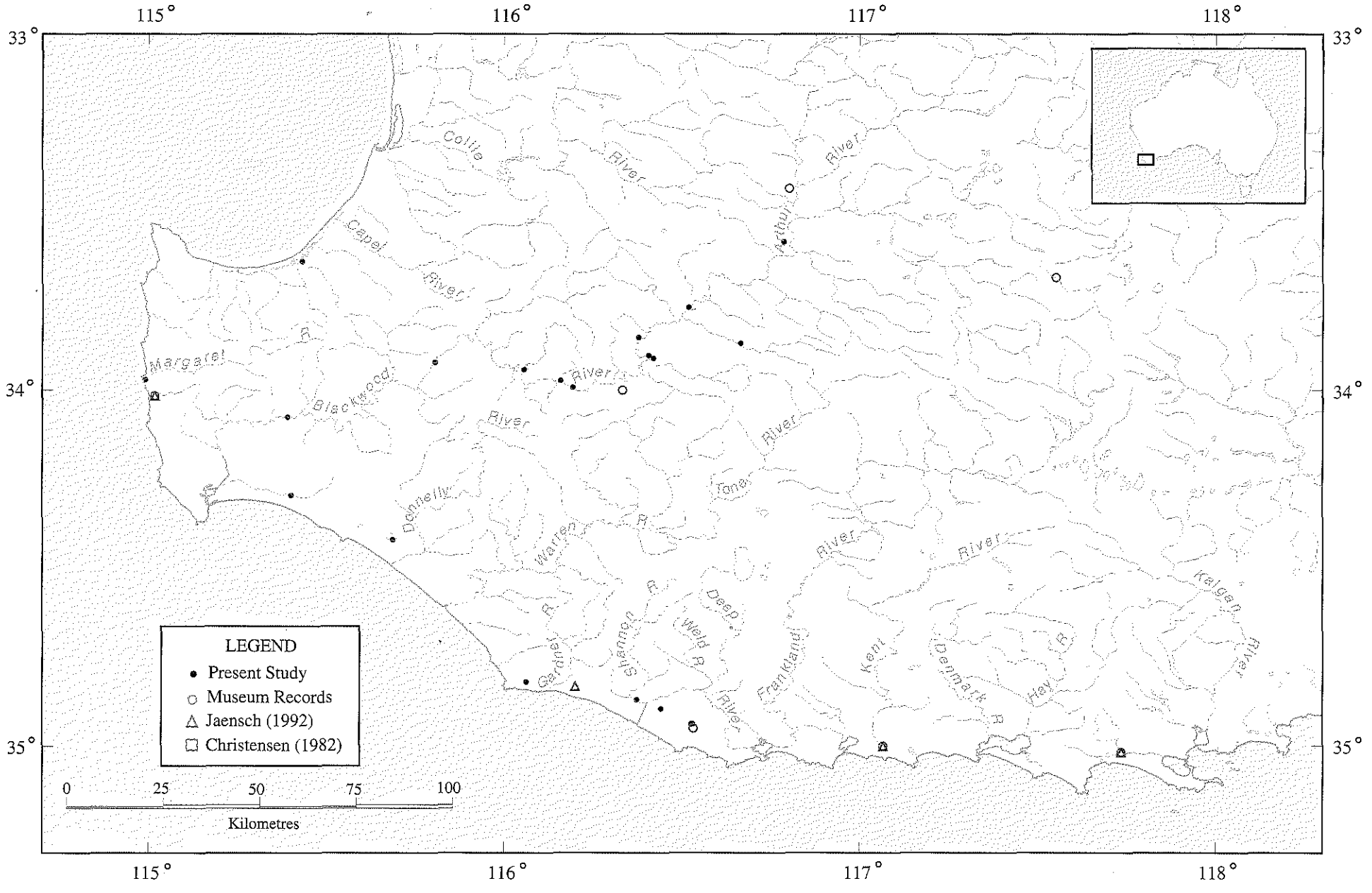

Figure 11 . The distribution of *Leptatherina wallacei* in the south-western corner of Australia.

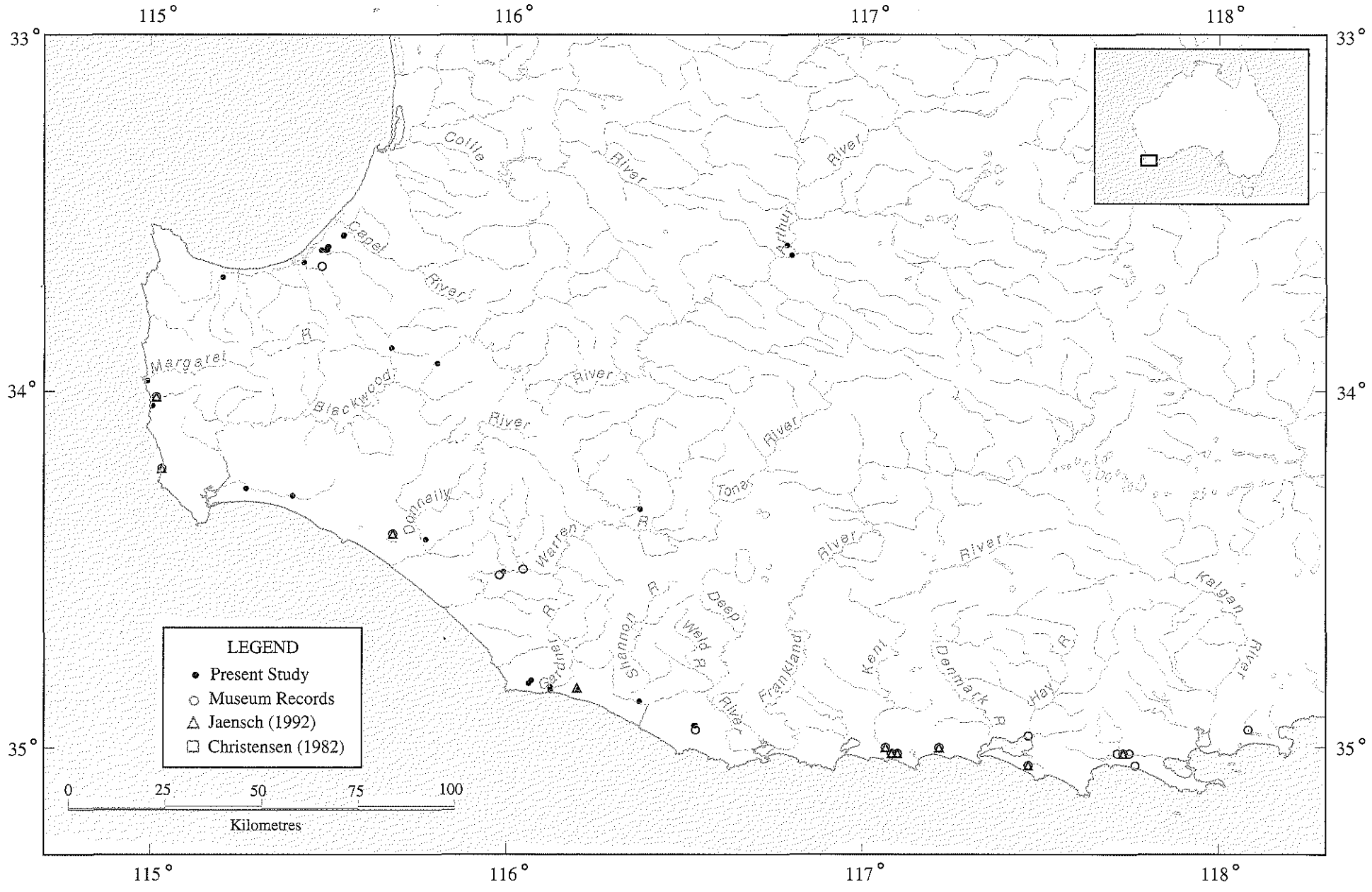

Figure 12 . The distribution of *Pseudogobius olorum* in the south-western corner of Australia.

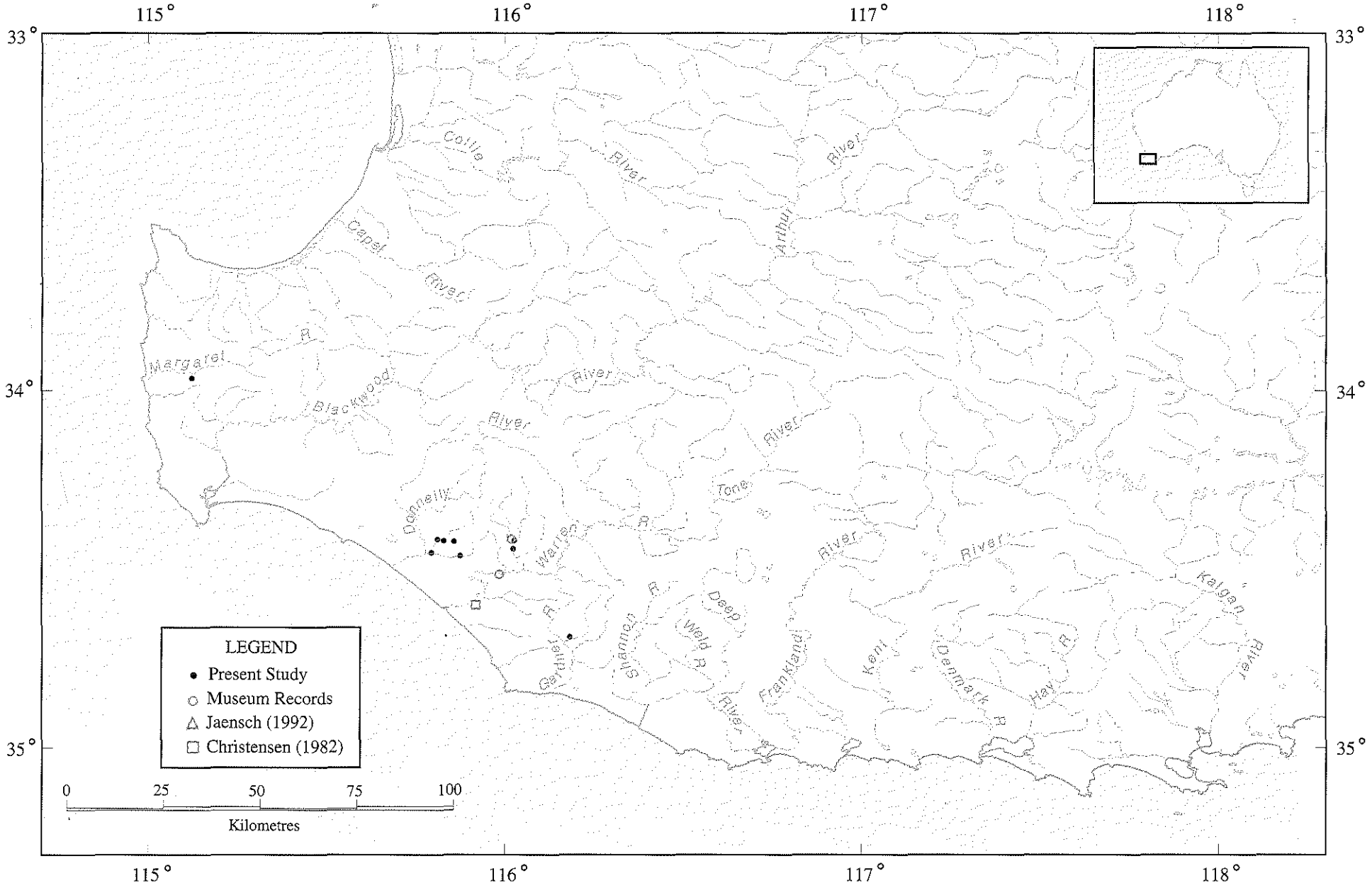

Figure 13 . The distribution of *Oncorhynchus mykiss* and *Salmo trutta* in the south-western corner of Australia.

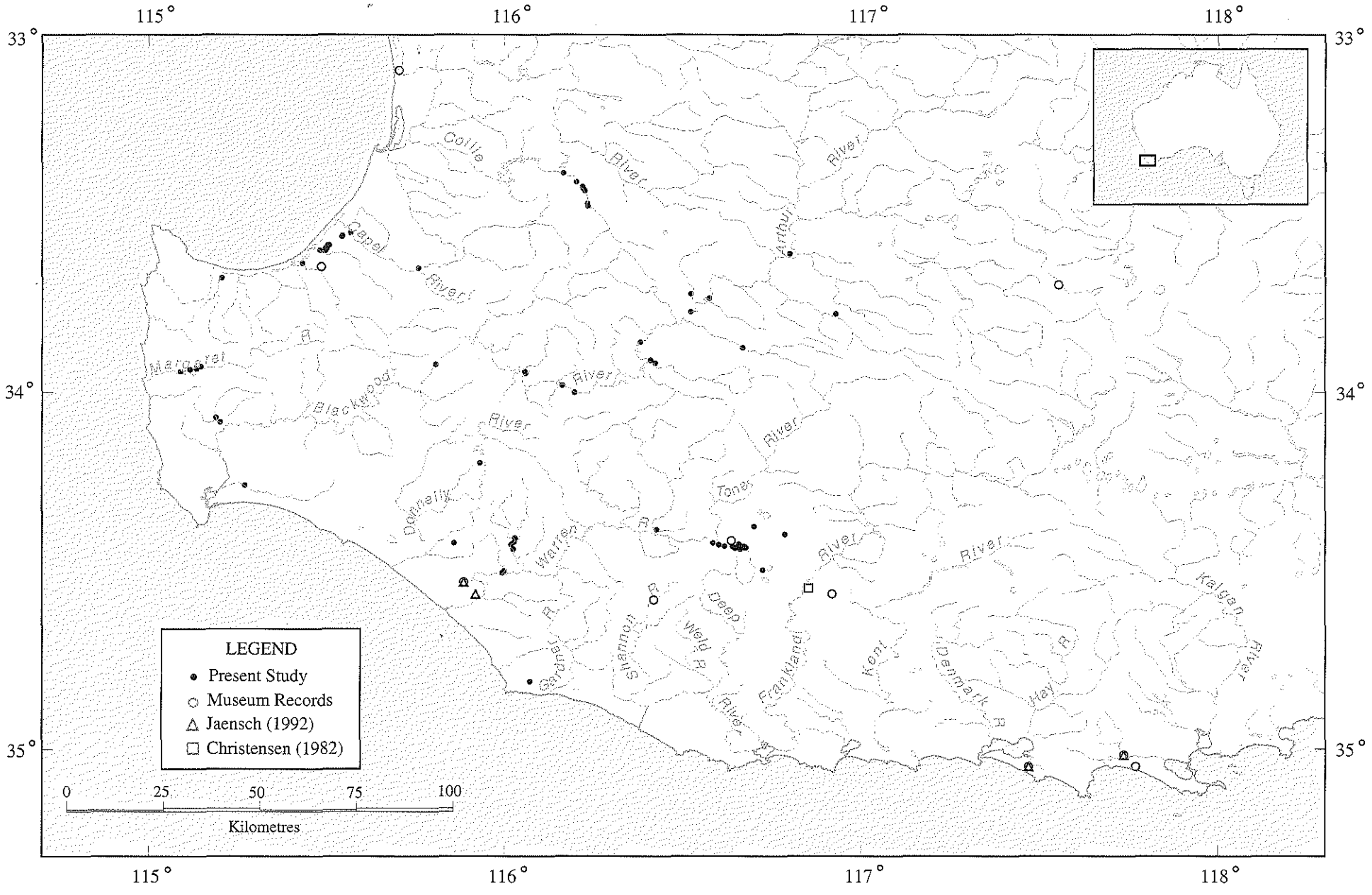

Figure 14 . The distribution of *Gambusia holbrooki* in the south-western corner of Australia.

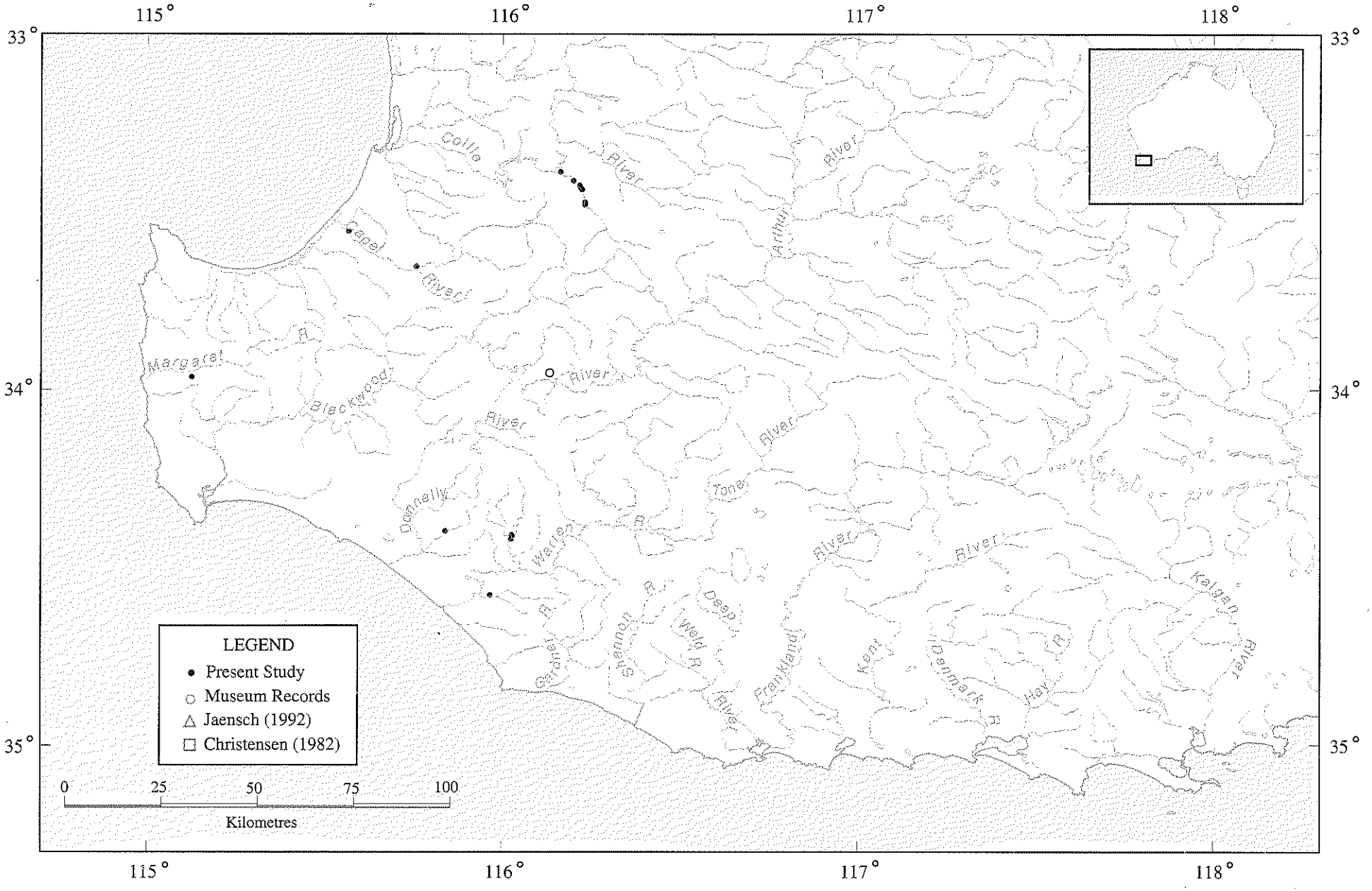

Figure 15 . The distribution of *Perca fluviatilis* in the south-western corner of Australia

Table 1 : Those sites sampled for freshwater fish in the lower south-western corner of Australia and the species present at each site. N.B. *Tb* refers to *Tandanus bostocki*, and similarly, *Ls - Lepidogalaxias salamandroides*, *Go - Galaxias occidentalis*, *Gn - Galaxiella nigrostriata*, *Gm - Galaxiella munda*, *Bp - Bostockia porosa*, *Ev - Edelia vittata*, *Nb - Nannatherina balstoni*, *Ga*(Ad) - Adult *Geotria australis*, *Ga*(am) - ammocoete *Geotria australis*, *Lw - Leptatherina wallacei*, *Po - Pseudogobius olorum*, *As - Afurcagobius suppositus*, Trout sp. - *Oncorhynchus mykiss* and *Salmo trutta*, *Gh - Gambusia holbrooki* and *Pf - Perca fluviatilis*.

Site Number	General Location	Latitude	Longitude	*Tb*	*Ls*	*Go*	*Gn*	*Gm*	*Bp*	*Ev*	*Nb*	*Ga*(Ad)	*Ga*(am)	*Lw*	*Po*	*As*	Trout sp.	*Gh*	*Pf*
	CAPEL WATERSHED																		
A1	Capel River-under railway bridge	33°33.18'	115°34.01'			x							x					x	x
A2	Capel River-south	33°39.16'	115°45.43'			x				x			x					x	x
	ABBA/LUDLOW DRAINAGE																		
B1	Lake 9-RGC	33°33.66'	115°32.62'												x			x	
B2	Lake 10	33°33.74'	115°32.58'												x			x	
B3	Lake 11	33°33.82'	115°32.54'												x			x	
B4	Swamphen Lake	33°35.27'	115°30.39'															x	
B5	Island Lake	33°35.28'	115°30.38'																
B6	Peninsula Lake	33°35.30'	115°30.35'															x	
B7	Paperbark Lake	33°35.31'	115°30.20'																
B8	Wet Woodland	33°35.21'	115°30.20'																
B9	Crinea Creek	33°35.28'	115°30.15'															x	
B10	Cadjeput Pool	33°35.50'	115°30.10'															x	
B11	Taylor's Lake	33°35.70'	115°30.05'															x	
B12	Boulder Lake	33°35.80'	115°30.02'															x	
B13	Tigersnake Lake	33°35.60'	115°30.00'												x			x	
B14	Priessiana Pool	33°35.75'	115°29.90'															x	
B15	Plover Lakes	33°36.00'	115°29.80'							x					x			x	
B16	Pobblebonk Swamp	33°36.15'	115°29.80'												x			x	
B17	Gravel Pool	33°36.20'	115°29.70'			x									x			x	
B18	Stream south of above	33°36.25'	115°29.65'			x			x	x					x			x	
B19	Ludlow Swamp	33°35.80'	115°29.80'			x			x	x					x			x	
B20	Ludlow River-Bridge on Bypass	33°36.20'	115°28.82'			x			x	x					x			x	
B21	Ludlow River-on RGC	33°36.64'	115°29.59'			x													
B22	Ludlow River-Bussell Hwy	33°36.92'	115°29.17'																
B23	Abba River-Bussell Hwy	33°38.95'	115°26.20'																
B24	Abba River-Bridge on Bypass	33°38.30'	115°25.91'			x								x	x				x	
B25	Carbanup River	33°40.78'	115°12.19'			x				x					x				x	
B26	Station Gully Drain-Quindalup Rd	33°39.72'	115°09.30'																
B27	Brake Creek-Molloy Rd(off Sabina)	33°50.59'	115°20.19'																
	MARGARET RIVER WATERSHED																		
C1	Margaret River-Great North Rd(Rapids)	33°52.60'	115°18.01'			x		x	x	x	x								
C2	Margaret R-1.3km from Cane Break Rd	33°51.99'	115°18.64'			x		x			x								
C3	Margaret R-Molloy Rd(North Branch)	33°51.36'	115°20.98'																
C4	Margaret River-Molloy Rd (Main R)	33°53.18'	115°21.55'																
C5	Margaret River-1st Weir	33°56.92'	115°03.83'			x			x	x		x	x					x	
C6	Margaret R-Mouth	33°58.24'	114°59.38'											x	x				
C7	Margaret R-2nd Weir	33°56.89'	115°05.35'			x			x	x		x	x					x	
C8	Margaret R-Margaret R Rd	33°56.53'	115°06.98'			x			x	x			x					x	
C9	Margaret R-Margaret R Rd	33°56.42'	115°08.07'															x	
C10	Margaret R-Margaret R Rd	33°56.03'	115°08.82'			x				x								x	
C11	Margaret R-Margaret R Rd	33°54.77'	115°17.31'			x			x	x									
C12	Margaret R-Cranebreak Picnic Area	33°52.84'	115°16.97'							x									
C13	Margaret R-small stream behind Leeuwin	33°59.95'	115°03.92'			x		x											
C14	Margaret R-Ten Mile Brook Dam	33°57.98'	115°07.38'														x		x
C15	Calgardup Brook, mouth-Redgate Rd	34°02.40'	115°00.16'												x				

Table 1 (cont...)

Site Number	General Location	Latitude	Longitude	*Tb*	*Ls*	*Go*	*Gn*	*Gm*	*Bp*	*Ev*	*Nb*	*Ga*(Ad)	*Ga*(am)	*Lw*	*Po*	*As*	Trout sp.	*Gh*	*Pf*
	BLACKWOOD RIVER WATERSHED																		
D1	Track off Great West Rd-	33°57.60'	115°25.84'																
D2	Another track off above	33°58.80'	115°28.55'																
D3	Rosa Brook	33°58.86'	115°28.68'																
D4	Blackwood R-north of Nannup	33°55.27'	115°48.35'			x								x	x			x	
D5	Blackwood R-Sues Bridge	34°04.54'	115°23.42'			x								x	x	x			
D6	Blackwood R-Alexander Bridge	34°09.86'	115°11.53'	x											x				
D7	St John Brook (Blackwood River)	33°52.70'	115°40.59'			x			x	x					x				
D8	Blackwood R-Walter Willis Rd	34°56.84'	116°03.38'											x				x	
D9	Blackwood R-Tweed Rd	33°58.72'	116°09.54'						x					x				x	
D10	Blackwood R	33°59.89'	116°11.63'			x								x				x	
D11	Blackwood R-Aegers Bridge Rd	33°54.95'	116°25.17'			x								x				x	
D12	Blackwood R-Terry Rd	33°54.47'	116°24.38'			x								x				x	
D13	Blackwood R-Terry Rd	33°51.43'	116°22.66'			x								x				x	
D14	Blackwood R-Arthur River Rd	33°44.57'	116°34.34'															x	
D15	Blackwood R-Gibb Rd	33°43.84'	116°31.23'															x	
D16	Blackwood R-Condinup Crossing Rd	33°46.35'	116°31.07'			x								x				x	
D17	Blackwood R-Arthur River Rd	33°38.49'	116°43.68'																
D18	Towerrinning Lake	33°35.37'	116°47.17'											x	x				
D19	Arthur R-Moodiarup Rd	33°37.13'	116°47.96'			x									x			x	
D20	Balgarup R	33°47.18'	116°55.63'															x	
D21	Lower Bridgetown Rd	33°52.41'	116°40.97'																
D22	Blackwood R-Kulikup Rd & Lower	33°52.39'	116°39.88'			x								x				x	
D23	Chapman Brook	34°04.61'	115°11.31'			x				x								x	
D24	Chapman Brook	34°05.33'	115°12.04'			x			x	x								x	
	SCOTT RIVER WATERSHED																		
E1	Scott River-Brennan Bridge	34°15.58'	115°16.23'															x	
E2	Scott R-Bridge on Milveannup Rd (1)	34°17.56'	115°24.02'			x				x					x				
E3	Scott R- " " " " (2)	34°17.70'	115°24.10'			x				x				x	x	x			
E4	Scott R- " " " " (3)	34°17.80'	115°24.15'			x				x	x				x	x			
E5	Pool 200m south of above	34°17.68'	115°23.87'			x													
E6	Pool 500m south of above	34°17.76'	115°23.50'																
E7	Pool on Scott R Rd-power pole43	34°17.05'	115°13.96'		x	x	x												
E8	Pool (1) on Govenor Broome Rd	34°14.94'	115°26.60'																
E9	Pool (2) " " " "	34°14.94'	115°25.80'																
E10	Pool (3) " " " "	34°14.77'	115°25.10'																
E11	Pool (4) " " " "	34°14.88'	115°23 56'																
E12	Pool (1) on Fouracres Rd	34°18.28'	115°35.05'																
E13	Pool (2) " " "	34°18.32'	115°35.00'																
E14	Pool (3) " " "	34°17.80'	115°33.60'																
E15	Pool on Scott R Rd-power pole 38	34°17.08'	115°14.40'		x	x	x												
E16	" " " -power pole 10	34°16.33'	115°16.17'							x					x				
	LAKE QUITJUP WATERSHED																		
F1	Lake Quitjup	34°23.17'	115°35.66'						x	x	x								
F2	Bolghinup Lake	34°25.22'	115°33.00'																
F3	Pool (1) on Black Point Rd	34°19.98'	115°36.16'																
F4	Pool (2) " " " "	34°18.77'	115°37.89'																
F5	Pool at end of Black Point Rd	34°20.00'	115°38.25'				x												
	LAKE JASPER WATERSHED																		
G1	Lake Jasper	34°25.22'	115°41.19'			x			x	x				x	x	x			

Table 1 (cont...)

Site Number	General Location	Latitude	Longitude	*Tb*	*Ls*	*Go*	*Gn*	*Gm*	*Bp*	*Ev*	*Nb*	*Ga*(Ad)	*Ga*(am)	*Lw*	*Po*	*As*	Trout sp.	*Gh*	*Pf*
	DONNELLY RIVER WATERSHED																		
H1	Lake Wilson	34°25.86'	115°42.68'			x			x	x									
H2	Lake Smith	34°25.89'	115°43.05'	x		x			x	x	x								
H3	Swamp adjacent to Lake Smith	34°25.89'	115°43.20'		x		x			x									
H4	Pool (1) on Scott Rd	34°25.50'	115°45.16'		x		x												
H5	Pool (2) " "	34°25.35'	115°45.67'		x		x												
H6	Donnelly River Mouth	34°29.11'	115°40.42'									x							
H7	Donnelly River-Boat Ramp	34°26.84'	115°46.38'			x			x	x			x						
H8	Donnelly River-Bridge on Scott Rd	34°24.93'	115°46.46'										x		x				
H9	Donnelly River-One Tree Bridge	34°12.19'	115°55.82'			x			x	x		x						x	
H10	Fly Brook-Charlie Rd	34°27.24'	115°47.61'			x			x	x	x	x	x				x		
H11	Fly Brook-Fly Brook Rd	34°27.76'	115°52.45'									x	x				x		
H12	Carey Brook-Bridge on Cleave Rd	34°26.54'	115°47.25'			x			x	x		x	x						
H13	Carey Brook-Bridge on Vasse Hwy	34°25.01'	115°48.65'			x			x	x			x				x		
H14	Beedelup Brook-Karri Valley	34°25.35'	115°51.41'														x	x	
H15	Beedelup Brook-Opposite Tobruk Rd	34°25.27'	115°49.68'			x			x	x							x		
H16	Carey Brook-Staircase Rd	34°23.81'	115°50.39'			x			x	x									x
H17	Carey Brook-Steep Rd	34°23.56'	115°51.58'										x						
H18	Carey Brook-Stirling Track and Pile Rd	34°23.24'	115°52.45'										x						
H19	Carey Brook- " " " and Beedelup Rd	34°23.49'	115°53.10'										x						
H20	Carey Brook-Thornhill & Seven Day Rds	34°20.11'	115°54.37'										x						
H21	Carey Brook-Sandy Hill Rd	34°24.27'	115°48.65'			x				x									
H22	Water sign-200m past Boot Rd(on 7day)	34°20.68'	115°47.13'																
H23	Water sign on Seven Day Rd	34°20:60'	115°51.20'																
	WARREN RIVER WATERSHED																		
I1	Warren R-Dombakup Brk-Plantation Rd	34°34.66'	115°57.98'			x			x	x		x	x						x
I2	Yeagerup Lake	34°32.35'	115°52.39'			x			x	x									
I3	Neanup Swamp-Pool at Yeagerup Dunes	34°32.35'	115°51.55'																
I4	Warren River-Bridge on Pemb/North Rd	34°30.42'	115°59.54'			x			x	x		x			x	x		x	
I5	Warren River-King Trout Farm	34°30.10'	115°59.85'			x			x	x		x	x					x	
I6	Lefroy Brook-The Cascades	34°28.60'	116°01.71'			x			x	x		x							
I7	Lefroy Brook-Downstream of trout hatch	34°26.60'	116°01.36'			x			x	x		x	x				x		
I8	Lefroy Dam-Immediately downstream	34°26.41'	116°01.36'									x						x	
I9	Lefroy Dam- " " upstream	34°26.35'	116°01.35'															x	
I10	Middle Weir-Lefroy Brook	34°25.65'	116°01.00'															x	
I11	Lefroy Brook-Broken Bridge	34°25.19'	116°01.53'					x	x	x		x	x				x	x	x
I12	Big Brook Dam-Under downstream bridge	34°24.73'	116°01.71'						x	x			x					x	x
I13	Big Brook Dam-Pool at bottom of dam	34°24.68'	116°01.71'															x	
I14	Big Brook Dam-Actual	34°24.49'	116°01.64'						x									x	x
I15	Bridge Upstream of Big Brook Dam	34°24.26'	116°00.22'																
I16	Bridge south of Jn of 4 & 5 Mile Brooks	34°23.22'	116°00.58'										x						
I17	Four Mile Brook-Channybearup Rd	34°21.84'	116°00.26'										x						
I18	" " " " -Seven Day Rd	34°18.65'	115°59.39'				x			x			x						
I19	Channybearup Brook-Seven Day Rd	34°19.11'	115°57.52'							x			x						
I20	Wilgarup River-Bridge on Cormint Rd	34°21.11'	116°20.73'			x		x	x	x									
I21	Peerup River-Bridge on Muirs Hwy	34°23.41'	116°25.52'			x		x	x	x								x	
I22	Tone River-Bridge on Muirs Hwy	34°24.65'	116°33.10'			x		x	x	x									
I23	Unicup Lake	34°20.65'	116°43.13'			x				x									
I24	Kulunilup Lake	34°20.08'	116°47.06'																
I25	Tone River-Two Mile	34°26.24'	116°36.96'															x	
I26	Tone River-Two Mile	34°26.00'	116°36.00'															x	
I27	Tone River-Wingarup Gully	34°25.68'	116°35.00'															x	
I28	Wilgarup River-Muirs Hwy	34°19.86'	116°22.45'			x			x	x					x	x			

Table 1 (cont...)

Site Number	General Location	Latitude	Longitude	*Tb*	*Ls*	*Go*	*Gn*	*Gm*	*Bp*	*Ev*	*Nb*	*Ga*(Ad)	*Ga*(am)	*Lw*	*Po*	*As*	Trout sp.	*Gh*	*Pf*
	LAKE MUIR WATERSHED																		
J1	Lake Muir	34°26.41'	116°39.58'			x				x								x	
J2	Noobijup lake	34°23.89'	116°47.06'																
J3	Byenup Lagoon	34°29.95'	116°43.36'			x				x								x	
J4	Lake at Jn of Lake Unicup & Pindicup Rds	34°22.57'	116°41.87'			x				x								x	
J5	Cowerup Swamp (Surrounding Pools)	34°26.22'	116°38.68'			x		x		x									
J6	Stream of Lake Muir	34°27.30'	116°47.00'			x			x										
J7	Red Lake	34°26.30'	116°38.33'			x			x									x	
J8	Drain fom Red Lake	34°26.25'	116°39.47'			x			x									x	
J9	Red Lake	34°26.20'	116°39.40'			x			x									x	
J10	Red Lake	34°25.90'	116°39.40'			x			x									x	
J11	Drain-connect Red Lake/Lake	34°26.35'	116°39.07'															x	
J12	Lake Muir-Hanekamp Rd	34°28.30'	116°41.10'																
J13	Lake Muir- " "	34°27.68'	116°41.00'																
J14	Pool adjacent toLake Muir-Hanekamp Rd	34°27.89'	116°41.10'																
J15	Pool adjacent toLake Muir- " "	34°27.97'	116°41.16'																
J16	Pool adjacent toLake Muir- " "	34°28.10'	116°41.29'																
J17	Pool adjacent toLake Muir- " "	34°28.03'	116°41.49'																
J18	Stream adjacent toLake Muir-Muirs Hwy	34°26.41'	116°41.50'															x	
J19	Stream adjacent toLake Muir- " "	34°26.49'	116°41.58'															x	
J20	Pool adjacent toLake Muir- " "	34°26.46'	116°40.32'															x	
J21	Pool adjacent toLake Muir- " "	34°26.46'	116°40.29'															x	
J22	Pool adjacent toLake Muir- " "	34°26.30'	116°40.20'															x	
J23	Pool adjacent toLake Muir-Thomson Rd	34°29.85'	116°38.00'																
J24	Pool adjacent toLake Muir- " " "	34°29.95'	116°37.90'																
J25	Pool adjacent toLake Muir- " " "	34°31.84'	116°38.60'																
J26	Pool adjacent toLake Muir- " " "	34°32.16'	116°38.65'																
	DOGGERUP CREEK WATERSHED																		
K1	Doggerup Creek-Mouth	34°46.75'	115°58.82'							x									
K2	Lake Doggerup	34°42.99'	116°03.88'			x	x			x	x								
K3	Lake Samuel	34°43.77'	116°03.58'			x	x		x	x									
K4	Pool on Malimup Rd (Summertime Track)	34°43.90'	116°02.92'																
K5	Dam on McGeachin's Property	34°42.82'	116°05.22'			x	x		x	x									
K6	Pool (1) on Windy Harbour Rd	34°42.17'	116°06.05'																
K7	Pool (1)-Doggerup Creek Track	34°44.79'	116°04.65'				x												
K8	Pool (2)- " " " " "	34°44.32'	116°04.53'					x											
K9	Pool (3)- " " " " "	34°44.46'	116°03.78'		x		x												
K10	Pool (2) on Windy Harbour Rd	34°42.25'	116°05.98'																
K11	Pool (3) on Windy Harbour Rd	34°48.13'	116°04.46'																
	GARDNER RIVER WATERSHED																		
L1	Gardner River Mouth	34°50.43'	116°07.40'												x				
L2	Blackwater-Pool 1	34°49.82'	116°07.29'			x	x		x	x	x				x				
L3	Blackwater-Pool 2	34°49.82'	116°07.34'			x			x	x	x				x				
L4	Large Swamp on Salmon Beach Rd	34°50.32'	116°00.97'		x														
L5	Pool oppostie L4	34°50.16'	116°00.90'																
L6	Pool adjacent L5	34°50.20'	116°01.05'																
L7	Pool at southern end of Windy Harbour Rd	34°50.24'	116°01.22'		x		x												
L8	Pool 100m south of L9	34°49.60'	116°03.50'		x		x		x	x									
L9	Pool 200m south of L10	34°49.40'	116°03.70'		x	x	x		x	x	x								
L10	Swamp west of L11	34°49.25'	116°03.44'																
L11	Small Lake west of L12	34°49.25'	116°03.66'		x														

Table 1 (cont...)

Site Number	General Location	Latitude	Longitude	*Tb*	*Ls*	*Go*	*Gn*	*Gm*	*Bp*	*Ev*	*Nb*	*Ga*(Ad)	*Ga*(am)	*Lw*	*Po*	*As*	Trout sp.	*Gh*	*Pf*
L12	Pool opposite L13	34°49.23'	116°03.72'		x	x	x		x	x	x			x	x				
L13	Pool 450m south of L14	34°49.17'	116°03.82'		x	x	x		x	x	x								
L14	Pool 50m south of L15	34°48.98'	116°04.05'		x	x	x		x	x	x								
L15	Narrow stream on Windy Harbour Rd	34°48.88'	116°04.12'		x	x	x		x	x	x								
L16	Pool on Windy Harbour Rd	34°48.70'	116°04.20'		x	x	x		x	x	x				x			x	
L17	Meandering Stream-off Windy Harbour Rd	34°48.41'	116°03.77'			x			x	x	x								
L18	Summer pool at western end of L17	34°48.29'	116°03.75'			x	x		x	x	x								
L19	Small Lake 200m north of L17	34°48.47'	116°03.86'				x		x	x									
L20	Pool on Windy Hr Rd-400m N of Chspke	34°40.88'	116°06.64'		x														
L21	1st pool on Chesapeake Rd	34°42.36'	116°07.06'		x		x		x										
L22	Pool near Lake Florence entrance	34°42.63'	116°07.19'		x	x	x												
L23	43.1km from east end of Chesapeake Rd	34°43.18'	116°07.59'		x		x												
L24	42.6km " " " " " " "	34°43.37'	116°07.82'		x		x												
L25	42.4km " " " " " " "	34°43.43'	116°07.85'		x														
L26	42.3km " " " " " " "	34°43.50'	116°07.88'		x														
L27	42.2km " " " " " " "	34°43.55'	116°07.92'		x														
L28	42.1km " " " " " " "	34°43.60'	116°07.95'		x														
L29	Pool 38.2km " " " " " "	34°45.40'	116°09.02'		x		x		x	x									
L30	Pool opposite L29	34°45.38'	116°09.00'		x		x												
L31	Lake Florence	34°44.12'	116°06.06'			x				x									
L32	1st pool on Lower Gardner River Rd	34°45.64'	116°09.03'		x	x	x			x	x								
L33	Pool 37.6km from east end of Chesapeake	34°45.66'	116°09.18'		x		x												
L34	Large pool on Chesapeake Rd	34°45.92'	116°09.36'		x	x	x		x	x	x								
L35	Pool 500m south of L34	34°46.13'	116°09.48'																
L36	Pool 35.8km from east end of Chesapeake	34°46.46'	116°09.67'																
L37	Gardner River-South of bridge	34°47.21'	116°11.32'			x			x	x	x		x						
L38	Gardner River-Bridge	34°46.62'	116°10.87'			x			x	x			x						
L39	Buldania Creek-Gardner River Rd	34°45.46'	116°12.87'			x			x	x									
L40	Una Brook- " " " "	34°43.95'	116°12.14'						x	x									
L41	Gardner River-Laws Track	34°42.49'	116°09.96'						x	x			x						
L42	Boorara Brook-Bettink's	34°41.46'	116°10.85'			x											x		
L43	" " " -Muirillup Rd	34°38.84'	116°13.60'			x			x	x									
L44	" " " -Daubney's (1)	34°38.78'	116°13.69'			x		x	x	x									
L45	" " " - " " (2)	34°38.33'	116°13.63'			x		x	x	x									
L46	" " " - " " (3)	34°37.42'	116°13.37'			x		x		x									
L47	" " " -Jane Block	34°36.35'	116°14.53'					x											
L48	Lake Maringup	34°50.22'	116°11.81'			x			x	x	x				x				
L49	Gravel Pool on Moore's Hut Track	34°50.45'	116°15.05'		x														
L50	Pool on Moore's Hut Track	34°50.54'	116°15.84'		x		x			x									
L51	Pool 4.9km west of Deeside/Chspke Jn	34°49.00'	116°15.51'				x		x										
L52	Pool 50m west of L51	34°49.00'	116°15.45'																
L53	Pool 50m west of L52	34°49.00'	116°15.38'				x												
L54	Pool on Chspke Rd(43.2km from east end)	34°43.25'	116°07.64				x												
L55	Pool on Chspke Rd(21.6km from west end	34°48.76'	116°14.72'																
L56	Small Lake on Lower Gardner River Rd	34°48.99'	116°07.70'		x														
L57	Pool on " " " " " " "	34°47.98'	116°07.90'																
L58	Pool on " " " " " " "	34°47.90'	116°08.02'																
L59	Pool on " " " " " " "	34°47.82'	116°08.09'		x		x												
L60	Pool on " " " " " " "	34°47.48'	116°08.46'		x			x											
L61	Pool on " " " " " " "	34°45.88'	116°08.90'		x			x											
L62	Swamp east Gardner R-Taylor Property	34°37.93'	116°11.84'		x														
L63	Northcliffe Weir	34°38.08'	116°08.23'					x	x	x									

Table 1 (cont...)

Site Number	General Location	Latitude	Longitude	*Th*	*Ls*	*Go*	*Gn*	*Gm*	*Bp*	*Ev*	*Nb*	*Ga*(Ad)	*Ga*(am)	*Lw*	*Po*	*As*	Trout sp.	*Gh*	*Pf*
	SHANNON RIVER WATERSHED																		
M1	Pool on Moore's Hut Track	34°50.40'	116°17.03'		x		x		x	x									
M2	Pool " " " " "	34°49.11'	116°16.55'																
M3	Pool on Chesapeake Rd-9.6km west Broke	34°51.32'	116°24.01'																
M4	Shannon River-Bridge on Cheaspeake Rd	34°50.36'	116°22.27'			x		x	x	x	x		x						
M5	" " " -Springbreak Rd	34°52.23'	116°22.37'			x			x	x				x	x				
M6	Upper Shannon R-NE of Dam	34°35.05'	116°24.69'			x				x									
M7	Pool on Chesapeake Rd-19.4km west Broke	34°49.20'	116°18.57'		x	x			x	x									
M8	Pool at Jn of Deeside & Chesapeake Rds	34°49.07'	116°17.99'																
M9	Chesapeake Brook (1)-20.05km W Broke	34°49.07'	116°18.09'			x			x	x									
M10	" " " " (2)- " " " "	34°48.96'	116°18.08'						x	x	x								
M11	" " " " (3)- " " " "	34°48.90'	116°18.07'					x		x									
M12	Pool on Chesapeake Rd-20.2km " "	34°49.09'	116°18.06'																
M13	Pool on Deeside Coast Rd	34°42.92'	116°20.05'																
M14	Pools at Jn of Deeside Coast & Preston Rds	34°38.52'	116°19.63'		x	x	x	x	x	x	x								
M15	Shannon River-Nelson Rd	34°43.19'	116°21.88'																
	BROKE INLET WATERSHED																		
N1	Forth River	34°51.85'	116°25.55'		x	x	x	x	x	x	x								
N2	Small stream 6.6km west of Broke Inlet Rd	34°51.94'	116°25.72'		x	x	x	x	x	x	x								
N3	Pool 6.0km " " " " " "	34°52.12'	116°26.00'																
N4	Pool/small stream 5.2km " " "	34°52.40'	116°26.37'		x	x	x	x	x	x	x								
N5	Pool on Chesapeake Rd 4.2km " "	34°52.77'	116°26.85'																
N6	Small stream on Chesapeake Rd 1.6km "	34°53.68'	116°28.14'			x			x	x									
N7	Pool on Chesapeake Rd 1.3km " " "	34°53.76'	116°28.23'				x												
N8	Pool on Broke Inlet Rd 1.9km N Chspke Rd	34°53.62'	116°29.78'		x		x												
N9	Pool " " " " 1.6km S " "	34°54.75'	116°28.18'		x		x												
N10	Inlet River-Å1km upstream of mouth	34°56.28'	116°31.84'											x	x				
N11	Inlet River-near mouth	34°56.31'	116°31.60'											x	x				
N12	Small stream running into Broke Inlet	34°53.75'	116°26.48'											x	x	x			
	DEEP RIVER WATERSHED																		
O1	Deep River-Bridge on Beardmore Rd	34°49.14'	116°35.52'			x			x	x									
O2	Weld River- " " " " "	34°48.89'	116°34.75'			x		x	x	x	x		x						
O3	Weld river-Wye Rd	34°45.65'	116°30.75'					x	x	x									
O4	Jn Beardmore & South West Hwy	34°48.66'	116°31.82'		x	x	x	x	x	x	x								
O5	Small pools along Beardmore Rd	34°48.67'	116°32.12'		x		x												
O6	Pool on Thomson Rd	34°36.00'	116°41.41'																
O7	Pool on Thomson Rd	34°36.41'	116°41.40'																
O8	Pool on Thomson Rd	34°37.46'	116°41.45'																
O9	Pool on Thomson Rd	34°41.30'	116°42.26'																
O10	Pool on Thomson Rd	34°46.57'	116°42.97'		x		x												
O11	Pool on Thomson Rd	34°46.73'	116°43.07'																
O12	Pool on Thomson Rd	34°47.73'	116°42.91'																
	FRANKLAND RIVER WATERSHED																		
P1	Frankland River-Muirs Bridge	34°28.73'	116°54.00'			x		x	x	x									
P2	Pool on Thomson Rd	34°45.70'	116°43.17'				x												
P3	Pool on Thomson Rd	34°46.89'	116°43.17'																
P4	Pool on Thomson Rd	34°47.03'	116°43.20'																
P5	Pool on Thomson Rd	34°47.22'	116°43.12'				x		x										
P6	Pool on Thomson Rd	34°47.32'	116°42.84'																
P7	Pool on Thomson Rd	34°47.49'	116°42.97'		x		x												
P8	Pool on Thomson Rd	34°47.65'	116°43.20'				x		x										

Table 1 (cont...)

Site Number	General Location	Latitude	Longitude	*Tb*	*Ls*	*Go*	*Gn*	*Gm*	*Bp*	*Ev*	*Nb*	*Ga*(Ad)	*Ga*(am)	*Lw*	*Po*	*As*	Trout sp.	*Gh*	*Pf*
P9	Pool on Thomson Rd	34°47.32'	116°42.84'				x		x										
P10	Wedding Brook	34°50.78'	116°44.25'				x		x										
P11	Elsie Brook	34°51.46'	116°43.43'			x	x		x										
	KENT RIVER WATERSHED																		
O1	Kent River-Pools on Muirs Hwy	34°33.41'	117°10.29'			x		x	x	x									
O2	Camballup Pool	34°32.38'	117°11.33'			x		x	x	x									
	HAY RIVER WATERSHED																		
R1	Hay River-Pools on Muirs Hwy	34°37.81'	117°24.15'			x		x	x	x									
	COLLIE RIVER WATERSHED																		
S1	Collie River-Schultz's Weir	33°23.19'	116°09.78'															x	x
S2	" " " -Collieburn Pool	33°24.66'	116°11.97'			x			x									x	x
S3	" " " -Townsend's Pool	33°25.45'	116°13.00'															x	x
S4	" " " -Cox's Pool	33°25.80'	116°13.13'			x			x	x								x	x
S5	" " " -Round Pool	33°26.16'	116°13.40'			x				x								x	x
S6	" " " -Western Collieries	33°28.34'	116°13.86'			x			x	x								x	x
S7	" " " -Davies' Pool	33°28.75'	116°13.90'			x			x	x								x	x

Table 2 : The sites at which *Lepidogalaxias salamandroides* was captured during the present study, together with those recorded in the collections at the Western Australian Museum, and by Jaensch (1992) and Christensen (1982).

Site Number	General Location	Latitude	Longitude
	SCOTT RIVER WATERSHED		
E7	Pool on Scott R Rd-power pole43	34°17.05'	115°13.96'
E15	Pool on Scott R Rd-power pole 38	34°17.08'	115°14.40'
	DONNELLY RIVER WATERSHED		
H3	Swamp adjacent to Lake Smith	34°25.89'	115°43.20'
H4	Pool (1) on Scott Rd	34°25.50'	115°45.16'
H5	Pool (2) " "	34°25.35'	115°45.67'
	DOGGERUP CREEK WATERSHED		
K9	Pool (3)-Doggerup Creek Track	34°44.46'	116°03.78'
	GARDNER RIVER WATERSHED		
L4	Large Swamp on Salmon Beach Rd	34°50.32'	116°00.97'
L7	Pool at southern end of Windy Harbour Rd	34°50.24'	116°01.22'
L8	Pool 100m south of L9	34°49.60'	116°03.50'
L9	Pool 200m south of L10	34°49.40'	116°03.70'
L11	Small Lake west of L12	34°49.25'	116°03.66'
L12	Pool opposite L13	34°49.23'	116°03.72'
L13	Pool 450m south of L14	34°49.17'	116°03.82'
L14	Pool 50m south of L15	34°48.98'	116°04.05'
L15	Narrow stream on Windy Harbour Rd	34°48.88'	116°04.12'
L16	Pool on Windy Harbour Rd	34°48.70'	116°04.20'
L20	Pool on Windy Hr Rd-400m N of Chspke	34°40.88'	116°06.64'
L21	1st pool on Chesapeake Rd	34°42.36'	116°07.06'
L22	Pool near Lake Florence entrance	34°42.63'	116°07.19'
L23	43.1km from east end of Chesapeake Rd	34°43.18'	116°07.59'
L24	42.6km " " " " " " "	34°43.37'	116°07.82'
L25	42.4km " " " " " " "	34°43.43'	116°07.85'
L26	42.3km " " " " " " "	34°43.50'	116°07.88'
L27	42.2km " " " " " " "	34°43.55'	116°07.92'
L28	42.1km " " " " " " "	34°43.60'	116°07.95'
L29	Pool 38.2km " " " " " "	34°45.40'	116°09.02'
L30	Pool opposite L29	34°45.38'	116°09.00'
L32	1st pool on Lower Gardner River Rd	34°45.64'	116°09.03'
L33	Pool 37.6km from east end of Chesapeake	34°45.66'	116°09.18'
L34	Large pool on Chesapeake Rd	34°45.92'	116°09.36'
L49	Gravel Pool on Moore's Hut Track	34°50.45'	116°15.05'
L50	Pool on Moore's Hut Track	34°50.54'	116°15.84'
L56	Small Lake on Lower Gardner River Rd	34°48.99'	116°07.70'
L59	Pool on " " " " " " "	34°47.82'	116°08.09'
L60	Pool on " " " " " " "	34°47.48'	116°08.46'
L61	Pool on " " " " " " "	34°45.88'	116°08.90'
L62	Swamp east Gardner R-Taylor Property	34°37.93'	116°11.84'
	SHANNON RIVER WATERSHED		
M1	Pool on Moore's Hut Track	34°50.40'	116°17.03'
M7	Pool on Chesapeake Rd-19.4km west Broke	34°49.20'	116°18.57'
M14	Pools at Jn of Deeside Coast & Preston Rds	34°38.52'	116°19.63'
M15	Shannon River-Nelson Rd	34o43.19'	116o21.88'
	BROKE INLET WATERSHED		
N1	Forth River	34°51.85'	116°25.55'
N2	Small stream 6.6km west of Broke Inlet Rd	34°51.94'	116°25.72'
N4	Pool/small stream 5.2km " " "	34°52.40'	116°26.37'
N8	Pool on Broke Inlet Rd 1.9km N Chspke Rd	34°53.62'	116°29.78'
N9	Pool " " " " 1.6km S " "	34°54.75'	116°28.18'

Table 2 (cont...)

Site Number	General Location	Latitude	Longitude
	DEEP RIVER WATERSHED		
O4	Jn Beardmore & South West Hwy	34°48.66'	116°31.82'
O5	Small pools along Beardmore Rd	34°48.67'	116°32.12'
O10	Pool on Thomson Rd	34°46.57'	116°42.97'
P7	Pool on Thomson Rd	34°47.49'	116°42.97'
	MUSEUM RECORDS		
1	Northcliffe1988	34°38'	116°07'
2	1959	34°33'	116°29'
3	1961	34°51'	116°21'
4	1961	34°42'	116°22'
5	Northcliffe1961	34°36'	116°07'
6	1964	34°35'	116°25'
7	Windy Harbour1962	34°50'	116°00'
8	Albany1976	35°01'	117°45'
9	Cane Brake Creek1976	33°50'	115°20'
10	Northcliffe1982	34°38'	116°21'
11	WAlpole1975	34°50'	116°54'
12	Northcliffe1986	34°44'	116°08'
13	" " " "	34°39'	116°08'
14	" " " "	34°48'	116°10'
15	" " " "	34°38'	116°03'
16	Doggerup Creek1986	34°44'	116°04'
17	Lake Samuel1985	34°43'	116°04'
18	Northcliffe1986	34°44'	116°19'
19	" " " "	34°46'	116°05'
20	" " " "	34°39'	116°08'
21	" " " 1988	34°28'	116°07'
	R. JAENSCH (1992)		
12	Lake Doggerup	34°43'	116°04'
	P. CHRISTENSEN (1982)		
4	Nelson Rd	34°43'	116°21'
5	" "	34°41'	116°31'
15	Deeside Coast Rd	34°41'	116°20'
18	South West Hwy	34°56'	116°35'
21	" " " "	34°54'	116°34'
22	" " " "	34°53'	116°33'
23	" " " "	34°48'	116°32'
34	East Brook-Boorara Rd	34°37'	116°17'
48	Richardson Rd	34°38'	116°05'
64	Meerup River-Gurnsey Rd	34°41'	116°04'
74	Pneumonia Rd	34°25'	115°44'
79	Boronia Rd	34°39'	116°50'
82	Middle Rd	34°52'	116°57'
89	Fouracres Rd	34°18'	115°35'
90	" " "	34°18'	115°31'
99	Nornalup Rd	34°39'	116°57'
100	" " "	34°44'	116°57'
101	" " "	34°44'	116°57'
103	" " "	34°50'	117°00'
108	South West Hwy	35°01'	116°53'

Table 3 : The sites at which *Galaxias occidentalis* was captured during the present study, together with those recorded in the collections at the Western Australian Museum, and by Jaensch (1992) and Christensen (1982).

Site Number	General Location	Latitude	Longitude
	CAPEL WATERSHED		
A1	Capel River-under railway bridge	33°33.18'	115°34.01'
A2	Capel River-south	33°39.16'	115°45.43'
	ABBA/LUDLOW DRAINAGE		
B17	Gravel Pool	33°36.20'	115°29.70'
B18	Stream south of above	33°36.25'	115°29.65'
B19	Ludlow Swamp	33°35.80'	115°29.80'
B20	Ludlow River-Bridge on Bypass	33°36.20'	115°28.82'
B21	Ludlow River-on RGC	33°36.64'	115°29.59'
B24	Abba River-Bridge on Bypass	33°38.30'	115°25.91'
B25	Carbanup River	33°40.78'	115°12.19'
	MARGARET RIVER WATERSHED		
C1	Margaret River-Great North Rd(Rapids)	33°52.60'	115°18.01'
C2	Margaret R-1.3km from Cane Break Rd	33°51.99'	115°18.64'
C5	Margaret River-1st Weir	33°56.92'	115°03.83'
C7	Margaret R-2nd Weir	33°56.89'	115°05.35'
C8	Margaret R-Margaret R Rd	33°56.53'	115°06.98'
C10	Margaret R-Margaret R Rd	33°56.03'	115°08.82'
C11	Margaret R-Margaret R Rd	33°54.77'	115°17.31'
C13	Margaret R-small stream behind Leeuwin Estate	33°59.95'	115°03.92'
	BLACKWOOD RIVER WATERSHED		
D4	Blackwood R-north of Nannup	33°55.27'	115°48.35'
D5	Blackwood R-Sues Bridge	34°04.54'	115°23.42'
D7	St John Brook (Blackwood River)	33°52.70'	115°40.59'
D9	Blackwood R-Tweed Rd	33°58.72'	116°09.54'
D10	Blackwood R	33°59.89'	116°11.63'
D11	Blackwood R-Aegers Bridge Rd	33°54.95'	116°25.17'
D12	Blackwood R-Terry Rd	33°54.47'	116°24.38'
D13	Blackwood R-Terry Rd	33°51.43'	116°22.66'
D16	Blackwood R-Condinup Crossing Rd	33°46.35'	116°31.07'
D17	Blackwood R-Arthur River Rd	33°38.49'	116°43.68'
D19	Arthur R-Moodiarup Rd	33°37.13'	116°47.96'
D22	Blackwood R-Kulikup Rd & Lower Bridgetown	33°52.39'	116°39.88'
D23	Chapman Brook	34°04.61'	115°11.31'
D24	Chapman Brook	34°05.33'	115°12.04'
	SCOTT RIVER WATERSHED		
E2	Scott R-Bridge on Milyeannup Rd (1)	34°17.56'	115°24.02'
E3	Scott R- " " " " (2)	34°17.70'	115°24.10'
E4	Scott R- " " " " (3)	34°17.80'	115°24.15'
E5	Pool 200m south of above	34°17.68'	115°23.87'
E7	Pool on Scott R Rd-power pole43	34°17.05'	115°13.96'
E15	Pool on Scott R Rd-power pole 38	34°17.08'	115°14.40'
	LAKE JASPER WATERSHED		
G1	Lake Jasper	34°25.22'	115°41.19'
	DONNELLY RIVER WATERSHED		
H1	Lake Wilson	34°25.86'	115°42.68'
H2	Lake Smith	34°25.89'	115°43.05'
H7	Donnelly River-Boat Ramp	34°26.84'	115°46.38'
H9	Donnelly River-One Tree Bridge	34°12.19'	115°55.82'
H10	Fly Brook-Charlie Rd	34°27.24'	115°47.61'
H12	Carey Brook-Bridge on Cleave Rd	34°26.54'	115°47.25'
H13	Carey Brook-Bridge on Vasse Hwy	34°25.01'	115°48.65'
H15	Beedelup Brook-Opposite Tobruk Rd	34°25.27'	115°49.68'
H16	Carey Brook-Staircase Rd	34°23.81'	115°50.39'
H21	Carey Brook-Sandy Hill Rd	34°24.27'	115°48.65'
	WARREN RIVER WATERSHED		
I1	Warren R-Dombakup Brk-Plantation Rd	34°34.66'	115°57.98'
I2	Yeagerup Lake	34°32.35'	115°52.39'
I4	Warren River-Bridge on Pemb/North Rd	34°30.42'	115°59.54'
I5	Warren River-King Trout Farm	34°30.10'	115°59.85'
I6	Lefroy Brook-The Cascades	34°28.60'	116°01.71'

Table 3 (cont...)

Site Number	General Location	Latitude	Longitude
I7	Lefroy Brook-Downstream of trout hatch	34°26.60'	116°01.36'
I20	Wilgarup River-Bridge on Cormint Rd	34°21.11'	116°20.73'
I21	Peerup River-Bridge on Muirs Hwy	34°23.41'	116°25.52'
I22	Tone River-Bridge on Muirs Hwy	34°24.65'	116°33.10'
I23	Unicup Lake	34°20.65'	116°43.13'
I28	Wilgarup River-Muirs Hwy	34°19.86'	116°22.45'
	LAKE MUIR WATERSHED		
J1	Lake Muir	34°26.41'	116°39.58'
J3	Byenup Lagoon	34°29.95'	116°43.36'
J4	Lake at Jn of Lake Unicup & Pindicup Rds	34°22.57'	116°41.87'
J5	Cowerup Swamp (Surrounding Pools)	34°26.22'	116°38.68'
J6	Stream of Lake Muir	34°27.30'	116°47.00'
J7	Red Lake	34°26.30'	116°38.33'
J8	Drain fom Red Lake	34°26.25'	116°39.47'
J9	Red Lake	34°26.20'	116°39.40'
J10	Red Lake	34°25.90'	116°39.40'
	DOGGERUP CREEK WATERSHED		
K2	Lake Doggerup	34°42.99'	116°03.88'
K3	Lake Samuel	34°43.77'	116°03.58'
K5	Dam on McGeachin's Property	34°42.82'	116°05.22'
	GARDNER RIVER WATERSHED		
L2	Blackwater-Pool 1	34°49.82'	116°07.29'
L3	Blackwater-Pool 2	34°49.82'	116°07.34'
L9	Pool 200m south of L10	34°49.40'	116°03.70'
L12	Pool opposite L13	34°49.23'	116°03.72'
L13	Pool 450m south of L14	34°49.17'	116°03.82'
L14	Pool 50m south of L15	34°48.98'	116°04.05'
L15	Narrow stream on Windy Harbour Rd	34°48.88'	116°04.12'
L16	Pool on Windy Harbour Rd	34°48.70'	116°04.20'
L17	Meandering Stream-off Windy Harbour Rd	34°48.41'	116°03.77'
L18	Summer pool at western end of L17	34°48.29'	116°03.75'
L22	Pool near Lake Florence entrance	34°42.63'	116°07.19'
L31	Lake Florence	34°44.12'	116°06.06'
L32	1st pool on Lower Gardner River Rd	34°45.64'	116°09.03'
L34	Large pool on Chesapeake Rd	34°45.92'	116°09.36'
L37	Gardner River-South of bridge	34°47.21'	116°11.32'
L38	Gardner River-Bridge	34°46.62'	116°10.87'
L39	Buldania Creek-Gardner River Rd	34°45.46'	116°12.87'
L42	Boorara Brook-Bettink's	34°41.46'	116°10.85'
L43	" " " -Muirillup Rd	34°38.84'	116°13.60'
L44	" " " -Daubney's (1)	34°38.78'	116°13.69'
L45	" " " - " " (2)	34°38.33'	116°13.63'
L46	" " " - " " (3)	34°37.42'	116°13.37'
L48	Lake Maringup	34°50.22'	116°11.81'
	SHANNON RIVER WATERSHED		
M4	Shannon River-Bridge on Cheaspeake Rd	34°50.36'	116°22.27'
M5	" " " -Springbreak Rd	34°52.23'	116°22.37'
M6	Upper Shannon R-NE of Dam	34°35.05'	116°24.69'
M7	Pool on Chesapeake Rd-19.4km west Broke	34°49.20'	116°18.57'
M9	Chesapeake Brook (1)-20.05km W Broke	34°49.07'	116°18.09'
M14	Pools at Jn of Deeside Coast & Preston Rds	34°38.52'	116°19.63'
	BROKE INLET WATERSHED		
N1	Forth River	34°51.85'	116°25.55'
N2	Small stream 6.6km west of Broke Inlet Rd	34°51.94'	116°25.72'
N4	Pool/small stream 5.2km " " "	34°52.40'	116°26.37'
N6	Small stream on Chesapeake Rd 1.6km "	34°53.68'	116°28.14'
	DEEP RIVER WATERSHED		
O1	Deep River-Bridge on Beardmore Rd	34°49.14'	116°35.52'
O2	Weld River- " " " " "	34°48.89'	116°34.75'
O4	Jn Beardmore & South West Hwy	34°48.66'	116°31.82'
	FRANKLAND RIVER WATERSHED		
P1	Frankland River-Muirs Bridge	34°28.73'	116°54.00'
P11	Elsie Brook	34°51.46'	116°43.43'

Table 3 (cont...)

Site Number	General Location	Latitude	Longitude
	KENT RIVER WATERSHED		
Q1	Kent River-Pools on Muirs Hwy	34°33.41'	117°10.29'
Q2	Camballup Pool	34°32.38'	117°11.33'
	HAY RIVER WATERSHED		
R1	Hay River-Pools on Muirs Hwy	34°37.81'	117°24.15'
	COLLIE RIVER WATERSHED		
S2	Collie River-Collieburn Pool	33°24.66'	116°11.97'
S4	" " " -Cox's Pool	33°25.80'	116°13.13'
S5	" " " -Round Pool	33°26.16'	116°13.40'
S6	" " " -Western Collieries	33°28.34'	116°13.86'
S7	" " " -Davies' Pool	33°28.75'	116°13.90'
	MUSEUM RECORDS (Go)		
1	Manjimup	34°14'	116°10'
2	Tambellup	34°02'	117°39'
3	Karridale1931	34°18'	115°05'
4	Pemberton1936	34°27'	116°02'
5	1937	34°07'	117°21'
6	1944	34°25'	115°40'
7	1944	34°19'	115°11'
8	Bridgetown1946	33°57'	116°08'
9	Gnowangerup1947	33°55'	118°00'
10	Tambellup1947	34°02'	117°39'
11	Dumbleyung1947	33°19'	117°38'
12	Mount Barker	34°38'	117°40'
13		34°18'	117°32'
14		33°26'	116°48'
15	Bridgetown1954	33°57'	116°09'
16	1955	34°31'	117°43'
17	Deepdene1957	34°16'	115°04'
18	Karridale1959	34°12'	115°06'
19	Nannup1961	33°59'	115°45'
20	Margaret River Area1961	33°57'	115°04'
21	Greenbushes1964	33°51'	116°03'
22	1962	34°16'	115°14'
23	Kendenup1965	34°29'	117°39'
24	Nannup1974	33°59'	115°38'
25	Pemberton1974	34°27'	116°02'
26	Albany1976	35°01'	117°43'
27	1976	34°10'	115°40'
28	Mayanup1979	34°00'	116°20'
29	1981	34°56'	117°53'
30	1981	34°52'	118°00'
31	Warren R1981	34°25'	116°38'
32	Capel R1978	33°40'	115°50'
33	Ludlow1982	33°45'	115°33'
34	Northcliffe1986-Gardner R	34°39'	116°13'
35	" " " " " "	34°39'	116°06'
36	" " " " " "	34°44'	116°08'
37	" " " " -Warren R	34°31'	115°59'
38	Blackwood R1986	34°07'	115°36'
39	Donnelly R1986	34°12'	115°57'
40	Doggerup Ck1986	34°44'	116°04'
41	Lake Samuel1986	34°43'	116°04'
42	" " " "	34°43'	116°03'
43	Shannon R1986	34°43'	116°22'
44	" " " "	34°35'	116°24'
45	Doggerup Lake1986	34°44'	116°04'
46	1988	34°43'	116°09'
47	Denmark1992	35°00'	117°04'
48	" " "	35°01'	117°05'
49	" " "	35°01'	117°06'
50	Broke Inlet1992	34°57'	116°32'
51	Manjimup1992	34°33'	115°52'
52	" " " "	34°32'	115°53'
53	Nannup1992	34°24'	115°41'

Table 3 (cont...)

Site Number	General Location	Latitude	Longitude
	R. JAENSCH (Go)		
6	Lake Jasper	34°24'	115°41'
9	Yeagerup Lake	34°32'	115°53'
11	Un-named Lake (near 9)	34°33'	115°52'
12	Doggerup Lake	34°43'	116°04'
16	Maringup Lake	34°50'	116°12'
17	Lake East of Broke Inlet	34°57'	116°32'
19	Owingup Swamp	35°00'	117°04'
20	Boat Harbour Lake 1	35°01'	117°05'
22	" " " " 3	35°01'	117°06'
	P. CHRISTENSEN (Go)		
26	Weld R-Soth West Hwy	34°41'	116°31'
31	Una Brook-Gardener River Rd	34°44'	116°12'
40	Lake Yeagerup	34°32'	115°53'
41	Lake Rd	34°31'	115°53'
47	Richardson Rd	34°38'	115°59'
48	" " "	34°38'	116°05'
54	Bevan Rd	34°35'	116°32'
56	Tone River-Muir Hwy	34°24'	116°53'
64	Meerup River-Gurnsey Rd	34°41'	116°04'
99	Nornalup Rd	34°39'	116°57'
111	Muir Hwy	34°29'	116°58'
118	Stan Rd	34°51'	117°21'

Table 4 : The sites at which *Galaxiella nigrostriata* was captured during the present study, together with those recorded in the collections at the Western Australian Museum, and by Jaensch (1992) and Christensen (1982).

Site Number	General Location	Latitude	Longitude
	SCOTT RIVER WATERSHED		
E7	Pool on Scott R Rd-power pole43	34°17.05'	115°13.96'
E15	Pool on Scott R Rd - power pole 38	34°17.08'	115°14.40'
	LAKE QUITJUP WATERSHED		
F5	Pool at end of Black Point Rd	34°20.00'	115°38.25'
	DONNELLY RIVER WATERSHED		
H3	Swamp adjacent to Lake Smith	34°25.89'	115°43.20'
H4	Pool (1) on Scott Rd	34°25.50'	115°45.16'
H5	Pool (2) " "	34°25.35'	115°45.67'
	WARREN RIVER WATERSHED		
I18	Four Mile Brook-Seven Day Rd	34°18.65'	115°59.39'
	DOGGERUP CREEK WATERSHED		
K2	Lake Doggerup	34°42.99'	116°03.88'
K3	Lake Samuel	34°43.77'	116°03.58'
K5	Dam on McGeachin's Property	34°42.82'	116°05.22'
K7	Pool (1)-Doggerup Creek Track	34°44.79'	116°04.65'
K9	Pool (3)- " " " " "	34°44.46'	116°03.78'
	GARDNER RIVER WATERSHED		
L2	Blackwater-Pool 1	34°49.82'	116°07.29'
L7	Pool at southern end of Windy Harbour Rd	34°50.24'	116°01.22'
L8	Pool 100m south of L9	34°49.60'	116°03.50'
L9	Pool 200m south of L10	34°49.40'	116°03.70'
L12	Pool opposite L13	34°49.23'	116°03.72'
L13	Pool 450m south of L14	34°49.17'	116°03.82'
L14	Pool 50m south of L15	34°48.98'	116°04.05'
L15	Narrow stream on Windy Harbour Rd	34°48.88'	116°04.12'
L16	Pool on Windy Harbour Rd	34°48.70'	116°04.20'
L18	Summer pool at western end of L17	34°48.29'	116°03.75'
L19	Small Lake 200m north of L17	34°48.47'	116°03.86'
L21	1st pool on Chesapeake Rd	34°42.36'	116°07.06'
L22	Pool near Lake Florence entrance	34°42.63'	116°07.19'
L23	43.1km from east end of Chesapeake Rd	34°43.18'	116°07.59'
L24	42.6km " " " " " " "	34°43.37'	116°07.82'
L29	Pool 38.2km " " " " " "	34°45.40'	116°09.02'
L30	Pool opposite L29	34°45.38'	116°09.00'
L32	1st pool on Lower Gardner River Rd	34°45.64'	116°09.03'
L33	Pool 37.6km from east end of Chesapeake	34°45.66'	116°09.18'
L34	Large pool on Chesapeake Rd	34°45.92'	116°09.36'
L50	Pool on Moore's Hut Track	34°50.54'	116°15.84'
L51	Pool 4.9km west of Deeside/Chspke Jn	34°49.00'	116°15.51'
L53	Pool 50m west of L52	34°49.00'	116°15.38'
L54	Pool on Chspke Rd(43.2km from east end)	34°43.25'	116°07.64
L59	Pool on Lower Gardner River Rd	34°47.82'	116°08.09'
	SHANNON RIVER WATERSHED		
M1	Pool on Moore's Hut Track	34°50.40'	116°17.03'
M14	Pools at Jn of Deeside Coast & Preston Rds	34°38.52'	116°19.63'
	BROKE INLET WATERSHED		
N1	Forth River	34°51.85'	116°25.55'
N2	Small stream 6.6km west of Broke Inlet Rd	34°51.94'	116°25.72'
N4	Pool/small stream 5.2km " " "	34°52.40'	116°26.37'
N7	Pool on Chesapeake Rd 1.3km " " "	34°53.76'	116°28.23'
N8	Pool on Broke Inlet Rd 1.9km N Chspke Rd	34°53.62'	116°29.78'
N9	Pool " " " " 1.6km S " "	34°54.75'	116°28.18'
	DEEP RIVER WATERSHED		
O4	Jn Beardmore & South West Hwy	34°48.66'	116°31.82'
O5	Small pools along Beardmore Rd	34°48.67'	116°32.12
O10	Pool on Thomson Rd	34°46.57'	116°42.97'
	FRANKLAND RIVER WATERSHED		
P2	Pool on Thomson Rd	34°45.70'	116°43.17'
P5	Pool on Thomson Rd	34°47.22'	116°43.12'
P6	Pool on Thomson Rd	34°47.32'	116°42.84'
P7	Pool on Thomson Rd	34°47.49'	116°42.97'
P8	Pool on Thomson Rd	34°47.65'	116°43.20'

Table 4 (cont...)

Site Number	General Location	Latitude	Longitude
	MUSEUM RECORDS		
1	1964	34°35'	116°25'
2	North Rd1964	34°35'	116°25'
3	Albany1976	34°57'	117°43'
4	Gardner River1977	34°46'	116°05'
5	" " " 1982	34°47'	116°04'
6	" " " " "	34°38'	116°07'
7	" " " 1986	34°44'	116°08'
8	" " " " "	34°39'	116°08'
9	Warren River1986	34°38'	116°03'
10	Lake Samuel1985	34°43'	116°04'
11	Northcliffe1986	34°46'	116°05'
12	Mt Chudalup1986	34°49'	116°04'
13	Lake Doggerup1986	34°44'	116°04'
14	Crystal Springs1977	34°56'	116°35'
15	Gardner River1988	34°28'	116°07'
16	Denmark1992	35°00'	117°04'
17	Broke Inlet	34°57'	116°32'
	R. JAENSCH (1992)		
12	Lake Doggerup	34°43'	116°04'
15	Gardner River Lake	34°50'	116°06'
19	Owingup Swamp	35°00'	117°04'
	P. CHRISTENSEN (1982)		
18	South West Hwy	34°56'	116°35'
19	South West Hwy	34°56'	116°35'

Table 5 : The sites at which *Galaxiella munda* was captured during the present study, together with those recorded in the collections at the Western Australian Museum, and by Jaensch (1992) and Christensen (1982).

Site Number	General Location	Latitude	Longitude
	MARGARET RIVER WATERSHED		
C1	Margaret River-Great North Rd(Rapids)	33°52.60'	115°18.01'
C2	Margaret R-1.3km from Cane Break Rd	33°51.99'	115°18.64'
C13	Margaret R-small stream behind Leeuwin Estate	33°59.95'	115°03.92'
	WARREN RIVER WATERSHED		
I11	Lefroy Brook-Broken Bridge	34°25.19'	116°01.53'
I20	Wilgarup River-Bridge on Cormint Rd	34°21.11'	116°20.73'
I21	Peerup River-Bridge on Muirs Hwy	34°23.41'	116°25.52'
I22	Tone River-Bridge on Muirs Hwy	34°24.65'	116°33.10'
	LAKE MUIR WATERSHED		
J5	Cowerup Swamp (Surrounding Pools)	34°26.22'	116°38.68'
	DOGGERUP CREEK WATERSHED		
K8	Pool (2)-Doggerup Creek Track	34°44.32'	116°04.53'
	GARDNER RIVER WATERSHED		
L44	Boorara Brook-Daubney's (1)	34°38.78'	116°13.69'
L45	" " " - " " (2)	34°38.33'	116°13.63'
L46	" " " - " " (3)	34°37.42'	116°13.37'
L47	" " " -Jane Block	34°36.35'	116°14.53'
L60	Pool on Lower Gardner River Rd	34°47.48'	116°08.46'
L61	Pool on " " " " " " "	34°45.88'	116°08.90'
	SHANNON RIVER WATERSHED		
M4	Shannon River-Bridge on Cheaspeake Rd	34°50.36'	116°22.27'
M11	Chesapeake Brook (3)-20.05km W Broke	34°48.90'	116°18.07'
M14	Pools at Jn of Deeside Coast & Preston Rds	34°38.52'	116°19.63'
	BROKE INLET WATERSHED		
N1	Forth River	34°51.85'	116°25.55'
N2	Small stream 6.6km west of Broke Inlet Rd	34°51.94'	116°25.72'
N4	Pool/small stream 5.2km " " "	34°52.40'	116°26.37'
	DEEP RIVER WATERSHED		
O2	Weld River-Bridge on Beardmore Rd	34°48.89'	116°34.75'
O3	Weld river-Wye Rd	34°45.65'	116°30.75'
O4	Jn Beardmore & South West Hwy	34°48.66'	116°31.82'
	FRANKLAND RIVER WATERSHED		
P1	Frankland River-Muirs Bridge	34°28.73'	116°54.00'
	KENT RIVER WATERSHED		
Q1	Kent River-Pools on Muirs Hwy	34°33.41'	117°10.29'
Q2	Camballup Pool	34°32.38'	117°11.33'
	HAY RIVER WATERSHED		
R1	Hay River-Pools on Muirs Hwy	34°37.81'	117°24.15'
	MUSEUM RECORDS		
1	Northcliffe1960	34°36'	116°07'
2	1962	34°40'	115°14'
3	Fish Creek Pool1964	34°35'	116°25'
4	1961	34°35'	116°24'
5	Pemberton1958	34°22'	116°02'
6	Mount Chudalup1977	34°46'	116°05'
7	Walpole1977	34°46'	116°48'
8	Cane Break Creek1976	33°50'	115°20'
9	Warren1981	34°25'	116°38'
10	Jeffrey Rd1981	34°39'	116°21'
11	Shannon1982	34°39'	116°20'
12	Gardner R1982	34°38'	116°07'
13	Gardner R1986	34°44'	116°08'
14	Blackwood R1986	34°07'	115°36'
15	Doggerup Creek1986	34°44'	116°04'
16	Shannon R-Nelson Rd1986	34°43'	116°26'
17	Shannon R1986	34°39'	116°19'
18	Weld River1986	34°49'	116°31'
19	Inlet River1986	34°55'	116°34'
20	Lake Powell1986	34°57'	117°46'
21	Quinnup1978	34°26'	116°15'
22	Northcliffe1978	34°40'	116°42'
23	" " " "	34°35'	116°32'
24	Shannon1977	34°41'	116°20'
25	Crystal Springs1977	34°56'	116°35'
26	Shannon1978	34°35'	116°30'
27	" " "	34°35'	116°33'
28	Denmark1978	34°50'	117°24'
29	Northcliffe1978	34°35'	116°03'
30	" " " "	34°25'	115°44'
31	Mt Frankland1978	34°50'	116°57'
32	Nile Creek1978	34°51'	117°03'
33	Northcliffe1978	34°35'	116°09'
34	Gardner River1988	34°38'	116°07'

Table 5 (cont...)

Site Number	General Location	Latitude	Longitude
	R. JAENSCH (1992)		
13	Lake Samuel	34°44'	116°04'
	P. CHRISTENSEN (1982)		
6	Nelson Rd	34°42'	116°30'
14	Deeside Coast Rd	34°42'	116°20'
15	" " " "	34°41'	116°20'
24	South West Hwy	34°46'	116°30'
28	Quininup Brook-Cripple Rd	34°30'	116°17'
29	Wheatley Coast Rd	34°26'	116°15'
47	Richardson Rd	34°38'	115°59'
49	Thompson Rd	34°40'	116°42'
53	Deep River-Bevan Rd	34°35'	116°33'
54	Bevan Rd	34°35'	116°32'
55	" "	34°35'	116°30'
56	Tone River-Muir Hwy	34°24'	116°53'
61	Mitchell River-Denbarker Rd	34°50'	117°24'
62	Denbarker Rd	34°55'	117°23'
64	Meerup River-Gurnsey Rd	34°41'	116°04'
67	Rifle Range Rd	34°36'	116°03'
68	" " "	34°35'	116°03'
74	Pnuemonia Rd	34°25'	115°45'
77	Deep River-Beardmore Rd	34°48'	116°35'
81	Middle Rd	34°50'	116°57'
82	" "	34°52'	116°57'
83	Bow River-Middle Rd	34°55'	116°58'
84	Break Rd	34°51'	117°03'
86	Stewart Rd	34°19'	115°42'
88	Fouracres Rd	34°18'	115°35'
89	" " "	34°18'	115°35'
90	" " "	34°18'	115°31'
92	Scott Rd	34°11'	115°16'
93	" "	34°10'	115°16'
100	Nornalup Rd	34°44'	116°57'
102	Kent River-Basin Rd	34°46'	117°03'
103	Nornalup Rd	34°50'	117°00'
105	Kordabup Rd/South West Hwy	34°59'	117°09'
114	Kockelup Rd	34°47'	117°08'
117	Stan Rd	34°48'	117°21'
119	Court Rd	34°20'	115°56'

Table 6 : The sites at which *Bostockia porosa* was captured during the present study, together with those recorded in the collections at the Western Australian Museum, and by Jaensch (1992) and Christensen (1982).

Site Number	General Location	Latitude	Longitude
	ABBA/LUDLOW DRAINAGE		
B18	Stream south of above	33°36.25'	115°29.65'
B19	Ludlow Swamp	33°35.80'	115°29.80'
B20	Ludlow River-Bridge on Bypass	33°36.20'	115°28.82'
	MARGARET RIVER WATERSHED		
C1	Margaret River- Great North Rd(Rapids)	33°52.60'	115°18.01'
C5	Margaret River-1st Weir	33°56.92'	115°03.83'
C7	Margaret R-2nd Weir	33°56.89'	115°05.35'
C8	Margaret R- Margaret R Rd	33°56.53'	115°06.98'
C11	Margaret R- Margaret R Rd	33°54.77'	115°17.31'
	BLACKWOOD RIVER WATERSHED		
D7	St John Brook (Blackwood River)	33°52.70'	115°40.59'
D9	Blackwood R-Tweed Rd	33°58.72'	116°09.54'
D24	Chapman Brook	34°05.33'	115°12.04'
	LAKE QUITJUP WATERSHED		
F1	Lake Quitjup	34°23.17'	115°35.66'
	LAKE JASPER WATERSHED		
G1	Lake Jasper	34°25.22'	115°41.19'
	DONNELLY RIVER WATERSHED		
H1	Lake Wilson	34°25.86'	115°42.68'
H2	Lake Smith	34°25.89'	115°43.05'
H7	Donnelly River-Boat Ramp	34°26.84'	115°46.38'
H9	Donnelly River-One Tree Bridge	34°12.19'	115°55.82'
H10	Fly Brook-Charlie Rd	34°27.24'	115°47.61'
H12	Carey Brook-Bridge on Cleave Rd	34°26.54'	115°47.25'
H13	Carey Brook-Bridge on Vasse Hwy	34°25.01'	115°48.65'
H15	Beedelup Brook-Opposite Tobruk Rd	34°25.27'	115°49.68'
H16	Carey Brook-Staircase Rd	34°23.81'	115°50.39'
	WARREN RIVER WATERSHED		
I1	Warren R-Dombakup Brk-Plantation Rd	34°34.66'	115°57.98'
I2	Yeagerup Lake	34°32.35'	115°52.39'
I4	Warren River-Bridge on Pemb/North Rd	34°30.42'	115°59.54'
I5	Warren River-King Trout Farm	34°30.10'	115°59.85'
I6	Lefroy Brook-The Cascades	34°28.60'	116°01.71'
I7	Lefroy Brook-Downstream of trout hatch	34°26.60'	116°01.36'
I11	Lefroy Brook-Broken Bridge	34°25.19'	116°01.53'
I12	Big Brook Dam-Under downstream bridge	34°24.73'	116°01.71'
I14	Big Brook Dam-Actual	34°24.49'	116°01.64'
I20	Wilgarup River-Bridge on Cormint Rd	34°21.11'	116°20.73'
I21	Peerup River-Bridge on Muirs Hwy	34°23.41'	116°25.52'
I22	Tone River-Bridge on Muirs Hwy	34°24.65'	116°33.10'
I28	Wilgarup River-Muirs Hwy	34°19.86'	116°22.45'
	LAKE MUIR WATERSHED		
J6	Stream of Lake Muir	34°27.30'	116°47.00'
J7	Red Lake	34°26.30'	116°38.33'
J8	Drain from Red Lake	34°26.25'	116°39.47'
J9	Red Lake	34°26.20'	116°39.40'
J10	Red Lake	34°25.90'	116°39.40'
	DOGGERUP CREEK WATERSHED		
K3	Lake Samuel	34°43.77'	116°03.58'
K5	Dam on McGeachin's Property	34°42.82'	116°05.22'
	GARDNER RIVER WATERSHED		
L2	Blackwater-Pool 1	34°49.82'	116°07.29'
L3	Blackwater-Pool 2	34°49.82'	116°07.34'
L8	Pool 100m south of L9	34°49.60'	116°03.50'
L9	Pool 200m south of L10	34°49.40'	116°03.70'
L12	Pool opposite L13	34°49.23'	116°03.72'
L13	Pool 450m south of L14	34°49.17'	116°03.82'
L14	Pool 50m south of L15	34°48.98'	116°04.05'
L15	Narrow stream on Windy Harbour Rd	34°48.88'	116°04.12'
L16	Pool on Windy Harbour Rd	34°48.70'	116°04.20'
L17	Meandering Stream-off Windy Harbour Rd	34°48.41'	116°03.77'
L18	Summer pool at western end of L17	34°48.29'	116°03.75'
L19	Small Lake 200m north of L17	34°48.47'	116°03.86'
L21	1st pool on Chesapeake	34°42.36'	116°07.06'
L29	Pool 38.2km from east end of Chesapeake	34°45.40'	116°09.02'
L34	Large pool on Chesapeake Rd	34°45.92'	116°09.36'
L37	Gardner River-South of bridge	34°47.21'	116°11.32'
L38	Gardner River-Bridge	34°46.62'	116°10.87'
L39	Buldania Creek-Gardner River Rd	34°45.46'	116°12.87'
L40	Una Brook- " " " "	34°43.95'	116°12.14'
L41	Gardner River-Laws Track	34°42.49'	116°09.96'
L43	Boorara Brook-Muirillup Rd	34°38.84'	116°13.60'
L44	" " " -Daubney's (1)	34°38.78'	116°13.69'
L45	" " " - " " (2)	34°38.33'	116°13.63'
L48	Lake Maringup	34°50.22'	116°11.81'
L51	Pool 4.9km west of Deeside/Chspke Jn	34°49.00'	116°15.51'

Table 6 (cont...)

Site Number	General Location	Latitude	Longitude
	SHANNON RIVER WATERSHED		
M1	Pool on Moore's Hut Track	34°50.40'	116°17.03'
M4	Shannon River-Bridge on Cheaspeake Rd	34°50.36'	116°22.27'
M5	" " " -Springbreak Rd	34°52.23'	116°22.37'
M7	Pool on Chesapeake Rd-19.4km west Broke	34°49.20'	116°18.57'
M9	Chesapeake Brook (1)-20.05km W Broke	34°49.07'	116°18.09'
M10	" " " " (2)- " " " "	34°48.96'	116°18.08'
M14	Pools at Jn of Deeside Coast & Preston Rds	34°38.52'	116°19.63'
	BROKE INLET WATERSHED		
N1	Forth River	34°51.85'	116°25.55'
N2	Small stream 6.6km west of Broke Inlet Rd	34°51.94'	116°25.72'
N4	Pool/small stream 5.2km " " "	34°52.40'	116°26.37'
N6	Small stream on Chesapeake Rd 1.6km "	34°53.68'	116°28.14'
	DEEP RIVER WATERSHED		
O1	Deep River-Bridge on Beardmore Rd	34°49.14'	116°35.52'
O2	Weld River- " " " " "	34°48.89'	116°34.75'
O3	Weld river-Wye Rd	34°45.65'	116°30.75'
O4	Jn Beardmore & South West Hwy	34°48.66'	116°31.82'
	FRANKLAND RIVER WATERSHED		
P1	Frankland River-Muirs Bridge	34°28.73'	116°54.00'
P5	Pool on Thomson Rd	34°47.22'	116°43.12'
P8	Pool on Thomson Rd	34°47.65'	116°43.20'
P9	Pool on Thomson Rd	34°47.32'	116°42.84'
	KENT RIVER WATERSHED		
Q1	Kent River-Pools on Muirs Hwy	34°33.41'	117°10.29'
Q2	Camballup Pool	34°32.38'	117°11.33'
	HAY RIVER WATERSHED		
R1	Hay River-Pools on Muirs Hwy	34°37.81'	117°24.15'
	COLLIE RIVER WATERSHED		
S2	Collie River-Collieburn Pool	33°24.66'	116°11.97'
S4	" " " -Cox's Pool	33°25.80'	116°13.13'
S6	" " " -Western Collieries	33°28.34'	116°13.86'
S7	" " " -Davies' Pool	33°28.75'	116°13.90'
	MUSEUM RECORDS		
1	Albany1916	34°56'	117°54'
	1935	34°30'	115°59'
3	Pemberton1937	34°27'	116°02'
4	Bridgetown1947	33°56'	116°05'
5	Dumbleyung1947	33°19'	117°38'
6	Grasmere1947	35°01'	117°45'
7	1948	34°59'	117°44'
8	1951	34°50'	117°41'
9	1953	34°39'	117°54'
10		34°56'	118°00'
11	Fish Creek Pool1964	34°35'	116°25'
12	Shannon river Dam1959	34°35'	116°24'
13	Albany1964	35°01'	117°41'
14	Pemberton1964	34°28'	116°01'
15	Boranup1959	34°16'	115°05'
16	Busselton	33°39'	115°29'
17	Nannup1974	33°59'	115°38'
18	Albany1976	35°01'	117°45'
19	" " "	34°57'	117°43'
20	" " "	35°01'	117°43'
21	1981	34°56'	117°53'
22	1981	34°25'	116°38'
23	Jeffrey Rd1981	34°39'	116°21'
24	Shannon1982	34°39'	116°20'
25	Ludlow1982	33°45'	115°33'
26	Northcliffe1986	34°39'	116°13'
27	" " " "	34°38'	116°03'
28	Nannup1986	34°07'	115°36'
29	Lake Samuel1985	34°43'	116°04'
30	" " " 1986	34°43'	116°03'
31	Northcliffe1986	34°43'	116°22'
32	Shannon River-Nelson Rd1986	34°43'	116°26'
33	Northcliffe1986	34°39'	116°19'
34	" " " "	34°46'	116°05'
35	Mt Chudalup1986	34°49'	116°04'
36	1986	34°35'	116°24'
37	Weld River1986	34°49'	116°31'
38	Elleker1986	34°57'	117°46'
39	Lake Doggerup1986	34°44'	116°04'
40	1978	33°40'	115°42'
41	Northcliffe1988	34°38'	116°07'
42	Albany1992	35°01'	117°16'
43	Denmark1992	35°00'	117°13'
44	" " "	35°00'	117°04'
45	" " "	35°01'	117°05'
46	" " "	35°01'	117°06'

Table 6 (cont...)

Site Number	General Location	Latitude	Longitude
47	Broke Inlet1992	34°57'	116°32'
48	Manjimup1992	34°50'	116°06'
49	" " " "	34°44'	116°06'
50	" " " "	34°34'	116°55'
51	" " " "	34°32'	115°53'
52	" " " "	34°26'	115°43'
53	Nannup1992	34°24'	115°41'
54	" " "	34°23'	115°35'
55	Darkin	34°20'	116°44'
	R. JAENSCH (1992)		
5	Lake Quitjup	34°23'	115°35'
6	Lake Jasper	34°24'	115°41'
7	Lake Wilson	34°26'	115°43'
8	Lake Smith	34°26'	115°43'
9	Yeagerup Lake	34°32'	115°53'
A4	Warren River Oxbow	34°34'	115°55'
12	Doggerup Lake	34°43'	116°04'
13	Lake Samuel	34°44'	116°04'
14	Lake Florence	34°44'	116°06'
15	Gardner River Lake	34°50'	116°06'
16	Maringup Lake	34°50'	116°12'
17	Lake East of Broke Inlet	34°57'	116°32'
19	Oingup Swamp	35°00'	117°04'
20	Boat Harbour Lake 1	35°01'	117°05'
22	" " " " 3	35°01'	117°06'
23	Reserve 12046 Lake	35°00'	117°13'
24	Lake Williams	35°01'	117°16'
	P. CHRISTENSEN (1982)		
5	Nelson Rd	34°41'	116°31'
8	Off " "	34°43'	116°26'
14	Deeside Coast Rd	34°42'	116°20'
20	Inlet River-South West Hwy	34°55'	116°34'
22	South West Hwy	34°53'	116°33'
23	South West Hwy	34°48'	116°32'
24	" " " "	34°46'	116°30'
25	" " " "	34°44'	116°30'
28	Quininup Brook-Cripple Rd	34°30'	116°17'
29	Wheatley Coast Rd	34°26'	116°15'
39	Lake Yeagerup	34°32'	115°52'
41	Lake Rd	34°31'	115°53'
42	Ritters Rd	34°30'	115°53'
45	Richardson Rd	34°36'	115°57'
47	" " "	34°38'	115°59'
48	" " "	34°38'	116°05'
49	Thompson Rd	34°40'	116°42'
51	Elsie Brook-Thompson Rd	34°51'	116°43'
53	Deep River-Bevan Rd	34°35'	116°33'
55	Bevan Rd	34°35'	116°30'
56	Tone River-Muir Hwy	34°24'	116°53'
59	Denbarker Rd	34°45'	117°29'
61	Mitchell River-Denbarker Rd	34°50'	117°24'
63	Summertime Track	34°44'	116°04'
64	Meerup River-Gurnsey Rd	34°41'	116°04'
65	Rifle Range Rd	34°37'	116°01'
67	" " "	34°36'	116°03'
68	" " "	34°35'	116°03'
70	Vasse Hwy	34°18'	115°46'
77	Deep River-Beardmore Rd	34°48'	116°35'
80	Boronia Rd	34°39'	116°51'
81	Middle Rd	34°50'	116°57'
83	Bow River-Middle Rd	34°55'	116°58'
84	Break Rd	34°51'	117°03'
87	Black Pt Rd	34°18'	115°40'
90	Fouracres Rd	34°18'	115°31'
92	Scott Rd	34°11'	115°16'
93	" "	34°10'	115°16'
106	South West Hwy	34°59'	117°12'
107	" " " "	34°59'	117°18'
111	Muir Hwy	34°29'	116°58'
112	" "	34°30'	116°59'
113	Kent River-Bevan Rd	34°41'	117°06'
115	Denmark River-Kockelup Rd	34°47'	117°13'
117	Stan Rd	34°48'	117°21'
119	Court Rd	34°20'	115°56'

Table 7 : The sites at which *Edelia vittata* was captured during the present study, together with those recorded in the collections at the Western Australian Museum, and by Jaensch (1992) and Christensen (1982).

Site Number	General Location	Latitude	Longitude
	CAPEL WATERSHED		
A2	Capel River-south	33°39.16'	115°45.43'
	ABBA/LUDLOW DRAINAGE		
B15	Plover Lakes	33°36.00'	115°29.80'
B18	Stream south of above	33°36.25'	115°29.65'
B19	Ludlow Swamp	33°35.80'	115°29.80'
B20	Ludlow River-Bridge on Bypass	33°36.20'	115°28.82'
B25	Carbanup River	33°40.78'	115°12.19'
	MARGARET RIVER WATERSHED		
C1	Margaret River-Great North Rd(Rapids)	33°52.60'	115°18.01'
C5	Margaret River-1st Weir	33°56.92'	115°03.83'
C7	Margaret R-2nd Weir	33°56.89'	115°05.35'
C8	Margaret R-Margaret R Rd	33°56.53'	115°06.98'
C10	Margaret R-Margaret R Rd	33°56.03'	115°08.82'
C11	Margaret R-Margaret R Rd	33°54.77'	115°17.31'
C12	Margaret R-Cranebreak Picnic Area	33°52.84'	115°16.97'
	BLACKWOOD RIVER WATERSHED		
D7	St John Brook (Blackwood River)	33°52.70'	115°40.59'
D23	Chapman Brook	34°04.61'	115°11.31'
D24	Chapman Brook	34°05.33'	115°12.04'
	SCOTT RIVER WATERSHED		
E2	Scott R-Bridge on Milyeannup Rd (1)	34°17.56'	115°24.02'
E3	Scott R- " " " (2)	34°17.70'	115°24.10'
E4	Scott R- " " " " (3)	34°17.80'	115°24.15'
E16	Pool on Scott River Rd - power pole 10	34°16.33'	115°16.17'
	LAKE QUITJUP WATERSHED		
F1	Lake Quitjup	34°23.17'	115°35.66'
	LAKE JASPER WATERSHED		
G1	Lake Jasper	34°25.22'	115°41.19'
	DONNELLY RIVER WATERSHED		
H1	Lake Wilson	34°25.86'	115°42.68'
H2	Lake Smith	34°25.89'	115°43.05'
H3	Swamp adjacent to Lake Smith	34°25.89'	115°43.20'
H7	Donnelly River-Boat Ramp	34°26.84'	115°46.38'
H9	Donnelly River-One Tree Bridge	34°12.19'	115°55.82'
H10	Fly Brook-Charlie Rd	34°27.24'	115°47.61'
H12	Carey Brook-Bridge on Cleave Rd	34°26.54'	115°47.25'
H13	Carey Brook-Bridge on Vasse Hwy	34°25.01'	115°48.65'
H15	Beedelup Brook-Opposite Tobruk Rd	34°25.27'	115°49.68'
H16	Carey Brook-Staircase Rd	34°23.81'	115°50.39'
H21	Carey Brook-Sandy Hill Rd	34°24.27'	115°48.65'
	WARREN RIVER WATERSHED		
I1	Warren R-Dombakup Brk-Plantation Rd	34°34.66'	115°57.98'
I2	Yeagerup Lake	34°32.35'	115°52.39'
I4	Warren River-Bridge on Pemb/North Rd	34°30.42'	115°59.54'
I5	Warren River-King Trout Farm	34°30.10'	115°59.85'
I6	Lefroy Brook-The Cascades	34°28.60'	116°01.71'
I7	Lefroy Brook-Downstream of trout hatch	34°26.60'	116°01.36'
I11	Lefroy Brook-Broken Bridge	34°25.19'	116°01.53'
I12	Big Brook Dam-Under downstream bridge	34°24.73'	116°01.71'
I18	Four Mile Brook -Seven Day Rd	34°18.65'	115°59.39'
I19	Channybearup Brook-Seven Day Rd	34°19.11'	115°57.52'
I20	Wilgarup River-Bridge on Cormint Rd	34°21.11'	116°20.73'
I21	Peerup River-Bridge on Muirs Hwy	34°23.41'	116°25.52'
I22	Tone River-Bridge on Muirs Hwy	34°24.65'	116°33.10'
I23	Unicup Lake	34°20.65'	116°43.13'
I28	Wilgarup River-Muirs Hwy	34°19.86'	116°22.45'
	LAKE MUIR WATERSHED		
J1	Lake Muir	34°26.41'	116°39.58'
J3	Byenup Lagoon	34°29.95'	116°43.36'
J4	Lake at Jn of Lake Unicup & Pindicup Rds	34°22.57'	116°41.87'
J5	Cowerup Swamp (Surrounding Pools)	34°26.22'	116°38.68'
	DOGGERUP CREEK WATERSHED		
K1	Doggerup Creek-Mouth	34°46.75'	115°58.82'
K2	Lake Doggerup	34°42.99'	116°03.88'
K3	Lake Samuel	34°43.77'	116°03.58'
K5	Dam on McGeachin's Property	34°42.82'	116°05.22'
	GARDNER RIVER WATERSHED		
L2	Blackwater-Pool 1	34°49.82'	116°07.29'
L3	Blackwater-Pool 2	34°49.82'	116°07.34'
L8	Pool 100m south of L9	34°49.60'	116°03.50'
L9	Pool 200m south of L10	34°49.40'	116°03.70'
L12	Pool opposite L13	34°49.23'	116°03.72'
L13	Pool 450m south of L14	34°49.17'	116°03.82'
L14	Pool 50m south of L15	34°48.98'	116°04.05'
L15	Narrow stream on Windy Harbour Rd	34°48.88'	116°04.12'
L16	Pool on Windy Harbour Rd	34°48.70'	116°04.20'
L17	Meandering Stream-off Windy Harbour Rd	34°48.41'	116°03.77'
L18	Summer pool at western end of L17	34°48.29'	116°03.75'
L19	Small Lake 200m north of L17	34°48.47'	116°03.86'
L29	Pool 38.2km from east end of Chesapeake	34°45.40'	116°09.02'
L31	Lake Florence	34°44.12'	116°06.06'
L32	1st pool on Lower Gardner River Rd	34°45.64'	116°09.03'
L34	Large pool on Chesapeake Rd	34°45.92'	116°09.36'
L37	Gardner River-South of bridge	34°47.21'	116°11.32'
L38	Gardner River-Bridge	34°46.62'	116°10.87'

Table 7 (cont...)

Site Number	General Location	Latitude	Longitude
L39	Buldania Creek-Gardner River Rd	34°45.46'	116°12.87'
L40	Una Brook- " " " "	34°43.95'	116°12.14'
L41	Gardner River-Laws Track	34°42.49'	116°09.96'
L43	Boorara Brook-Muirillup Rd	34°38.84'	116°13.60'
L44	" " " -Daubney's (1)	34°38.78'	116°13.69'
L45	" " " - " " (2)	34°38.33'	116°13.63'
L46	" " " - " " (3)	34°37.42'	116°13.37'
L48	Lake Maringup	34°50.22'	116°11.81'
L50	Pool on Moore's Hut Track	34°50.54'	116°15.84'
	SHANNON RIVER WATERSHED		
M1	Pool on Moore's Hut Track	34o50.40'	116o17.03'
M4	Shannon River-Bridge on Cheaspeake Rd	34o50.36'	116o22.27'
M5	" " " -Springbreak Rd	34o52.23'	116o22.37'
M6	Upper Shannon R-NE of Dam	34o35.05'	116o24.69'
M7	Pool on Chesapeake Rd-19.4km west Broke	34o49.20'	116o18.57'
M9	Chesapeake Brook (1)-20.05km W Broke	34o49.07'	116o18.09'
M10	" " " " (2)- " " " "	34o48.96'	116o18.08'
M11	" " " " (3)- " " " "	34o48.90'	116o18.07'
M14	Pools at Jn of Deeside Coast & Preston Rds	34o38.52'	116o19.63'
	BROKE INLET WATERSHED		
N1	Forth River	34°51.85'	116°25.55'
N2	Small stream 6.6km west of Broke Inlet Rd	34°51.94'	116°25.72'
N4	Pool/small stream 5.2km " " "	34°52.40'	116°26.37'
N6	Small stream on Chesapeake Rd 1.6km "	34°53.68'	116°28.14'
	DEEP RIVER WATERSHED		
O1	Deep River-Bridge on Beardmore Rd	34°49.14'	116°35.52'
O2	Weld River- " " " " "	34°48.89'	116°34.75'
O3	Weld river-Wye Rd	34°45.65'	116°30.75'
O4	Jn Beardmore & South West Hwy	34°48.66'	116°31.82'
	FRANKLAND RIVER WATERSHED		
P1	Frankland River-Muirs Bridge	34°28.73'	116°54.00'
	KENT RIVER WATERSHED		
Q1	Kent River-Pools on Muirs Hwy	34°33.41'	117°10.29'
Q2	Camballup Pool	34°32.38'	117°11.33'
	HAY RIVER WATERSHED		
R1	Hay River-Pools on Muirs Hwy	34°37.81'	117°24.15'
	COLLIE RIVER WATERSHED		
S4	Collie River-Cox's Pool	33°25.80'	116°13.13'
S5	" " " -Round Pool	33°26.16'	116°13.40'
S6	" " " -Western Collieries	33°28.34'	116°13.86'
S7	" " " -Davies' Pool	33°28.75'	116°13.90'
	MUSEUM RECORDS		
1	Busselton1912	33°39'	115°24'
2	Albany1916	34°56'	117°54'
3	Pemberton1935	34°30'	115°59'
4	Pemberton1936	34°27'	116°02'
5	1944	34°25'	115°40'
6	1945	33°50'	116°24'
7	1945	34°45'	117°04'
8	Grasmere1947	35°01'	117°45'
9	Dumbleyung1947	33°19'	117°38'
10	1947	34°18'	117°32'
11	1948	34°59'	117°44'
12	Cranbrook1949	34°18'	117°33'
13	1950	33°47'	115°58'
14	1957	34°16'	115°04'
15	Bridgetown1958	33°57'	116°09'
16	1961	33°22'	116°09'
17	Pemberton1964	34°28'	116°01'
18	Fish Creek Pool1964	34°35'	116°25'
19	Shannon River Dam1959	34°35'	116°24'
20	Margaret River Area1961	33°57'	115°04'
21	1961	33°22'	116°09'
22	1961	33°06'	115°42'
23	1962	34°16'	115°14'
24	1963	34°59'	117°44'
25	1967	34°57'	118°08'
26	Nannup1974	33°59'	115°38'
27	Hardy Inlet1975	34°17'	115°09'
28	Albany1976	35°01'	117°45'
29	Albany1976	34°57'	118°05'
30	1976	34°10'	115°40'
31	1981	34°56'	117°53'
32	1981	34°25'	116°38'
33	Northcliffe1986	34°39'	116°13'
34	Northcliffe1986	34°44'	116°08'
35	Northcliffe1986	34°39'	116°05'
36	Northcliffe1986	34°38'	116°03'
37	Northcliffe1986	34°31'	115°59'
38	Blackwood River1986	34°07'	115°36'
39	Donnelly River1986	34°13'	115°56'
40	Doggerup Creek1986	34°44'	116°04'
41	Lake Samuel1986	34°43'	116°04'
42	Shannon River1986	34°43'	116°22'
43	Shannon River1986	34°43'	116°26'
44	Shannon River1986	34°39'	116°19'
45	Northcliffe1986	34°46'	116°05'
46	Mt Chudalup1986	34°49'	116°04'
47	1986	34°35'	116°24'
48	Weld River1986	34°49'	116°31'

Table 7 (cont...)

Site Number	General Location	Latitude	Longitude
49	Elleker-Lake Powell1986	35°03'	117°46'
50	" " " " "	34°57'	117°46'
51	Albany1986	34°58'	118°06'
52	1978	33°40'	115°42'
53	Boranup1965	34°09'	115°02'
54	Albany1992	35°03'	117°28'
55	Albany 1992	35°01'	117°16'
56	Denmark1992	35°00'	117°13'
57	" " "	35°00'	117°04'
58	" " "	35°01'	117°05'
59	" " "	35°01'	117°06'
60	Broke Inlet1992	34°57'	116°32'
61	Manjimup1992	34°50'	116°06'
62	" " " "	34°44'	116°06'
63	" " " "	34°44'	116°04'
64	" " " "	34°43'	116°04'
65	" " " "	34°34'	116°55'
66	" " " "	34°33'	115°52'
67	" " " "	34°32'	115°53'
68	" " " "	34°26'	115°43'
69	Nannup1992	34°24'	115°41'
70	" " " "	34°23'	115°35'
	R. JAENSCH (1992)		
5	Lake Quitjup	34°23'	115°35'
6	Lake Jasper	34°24'	115°41'
7	Lake Wilson	34°26'	115°43'
8	Lake Smith	34°26'	115°43'
9	Yeagerup Lake	34°32'	115°53'
11	Un-named Lake(near 9)	34°33'	115°52'
A4	Warren River Oxbow	34°34'	115°55'
12	Doggerup Lake	34°43'	116°04'
13	Lake Samuel	34°44'	116°04'
14	Lake Florence	34°44'	116°06'
15	Gardner River Lake	34°50'	116°06'
16	Maringup Lake	34°50'	116°12'
17	Lake East of Broke Inlet	34°57'	116°32'
19	Oingup Swamp	35°00'	117°04'
20	Boat Harbour Lake 1	35°01'	117°05'
22	" " " " 3	35°01'	117°06'
23	Reserve 12046 Lake	35°00'	117°13'
24	Lake Williams	35°01'	117°16'
25	Lake Saide	35°03'	117°28'
	P. CHRISTENSEN (1982)		
1	Ant Pool	34°44'	116°24'
4	Nelson Rd	34°43'	116°21'
5	" "	34°41'	116°31'
6	" "	34°42'	116°30'
7	Off " "	34°42'	116°29'
14	Deeside Rd	34°42'	116°20'
17	South West Hwy	34°58'	116°36'
20	Inlet River	34°55'	116°34'
23	South West Hwy	34°48'	116°32'
24	Suth West Hwy	34°46'	116°30'
27	Shannon R	34°35'	116°24'
30	Gardner R Rd	34°43'	116°12'
32	Buldania Creek	34°46'	116°13'
33	Boorara Brook	34°41'	116°12'
38	Barker Rd	34°31'	115°54'
39	Lake Yeagerup	34°32'	115°52'
41	Lake Rd	34°31'	115°53'
42	Ritters Rd	34°30'	115°53'
46	Off Richardson Rd	34°37'	115°58'
47	Richardson Rd	34°38'	115°59'
48	Richardson Rd	34°38'	116°05'
51	Elsie Brook, Thompson Rd	34°51'	116°43'
53	Deep River, Bevan Rd	34°35'	116°33'
56	Tone River, Muirs Hwy	34°24'	116°53'
59	Denbarker Rd	34°45'	117°29'
61	Mitchell River	34°50'	117°24'
64	Meerup River	34°41'	116°04'
65	Rifle Range Rd	34°37'	116°01'
66	" " "	34°37'	116°01'
68	" " "	34°35'	116°03'
69	Barlee Brook	34°13'	115°45'
70	Vasse Hwy	34°18'	115°46'
76	Weld River-Beardmore Rd	34°37'	116°34'
77	Deep River- " " "	34°48'	116°35'
78	Frankland River-Caldyanning Rd	34°39'	116°48'
83	Bow River-Middle Rd	34°55'	116°58'
85	Barlee Brook-Stewart Rd	34°19'	115°42'
86	Stewart Rd	34°19'	115°42'
87	Black Pt Rd	34°18'	115°40'
90	Fouracres Rd	34°18'	115°31'
93	Scott Rd	34°10'	115°16'
96	Myalgelup Rd	34°33'	116°43'
99	Nornalup Rd	34°39'	116°57'
105	Kordabup Rd	34°59'	117°09'
107	Suth West Hwy	34°59'	117°18'
111	Muirs Hwy	34°29'	116°58'
113	Kent River-Bevan Rd	34°41'	117°06'
114	Kockelup Rd	34°47'	117°08'
115	Denmark river-Kockelup Rd	34°47'	117°13'

Table 8 : The sites at which *Nannatherina balstoni* was captured during the present study,together with those recorded in the collections at the Western Australian Museum, and by Jaensch (1992) and Christensen (1982).

Site Number	General Location	Latitude	Longitude
	MARGARET RIVER WATERSHED		
C1	Margaret River-Great North Rd(Rapids)	33°52.60'	115°18.01'
C2	Margaret R-1.3km from Cane Break Rd	33°51.99'	115°18.64'
	SCOTT RIVER WATERSHED		
E4	Scott R-Bridge on Milyeannup Rd (3)	34°17.80'	115°24.15'
	LAKE QUITJUP WATERSHED		
F1	Lake Quitjup	34°23.17'	115°35.66'
	DONNELLY RIVER WATERSHED		
H2	Lake Smith	34°25.89'	115°43.05'
H10	Fly Brook-Charlie Rd	34°27.24'	115°47.61'
	DOGGERUP CREEK WATERSHED		
K2	Lake Doggerup	34°42.99'	116°03.88'
	GARDNER RIVER WATERSHED		
L2	Blackwater-Pool 1	34°49.82'	116°07.29'
L3	Blackwater-Pool 2	34°49.82'	116°07.34'
L9	Pool 200m south of L10	34°49.40'	116°03.70'
L12	Pool opposite L13	34°49.23'	116°03.72'
L13	Pool 450m south of L14	34°49.17'	116°03.82'
L14	Pool 50m south of L15	34°48.98'	116°04.05'
L15	Narrow stream on Windy Harbour Rd	34°48.88'	116°04.12'
L16	Pool on Windy Harbour Rd	34°48.70'	116°04.20'
L17	Meandering Stream-off Windy Harbour Rd	34°48.41'	116°03.77'
L18	Summer pool at western end of L17	34°48.29'	116°03.75'
L32	1st pool on Lower Gardner River Rd	34°45.64'	116°09.03'
L34	Large pool on Chesapeake Rd	34°45.92'	116°09.36'
L37	Gardner River-South of bridge	34°47.21'	116°11.32'
L48	Lake Maringup	34°50.22'	116°11.81'
	SHANNON RIVER WATERSHED		
M4	Shannon River-Bridge on Cheaspeake Rd	34°50.36'	116°22.27'
M10	Chespeake Brook (2)- 20.05km W Broke Inlet Rd	34°48.96'	116°18.08'
M14	Pools at Jn of Deeside Coast & Preston Rds	34°38.52'	116°19.63'
	BROKE INLET WATERSHED		
N1	Forth River	34°51.85'	116°25.55'
N2	Small stream 6.6km west of Broke Inlet Rd	34°51.94'	116°25.72'
N4	Pool/small stream 5.2km " " "	34°52.40'	116°26.37'
	DEEP RIVER WATERSHED		
O2	Weld River- Bridge on Beardmore Rd	34°48.89'	116°34.75'
O4	Jn Beardmore & South West Hwy	34°48.66'	116°31.82'
	MUSEUM RECORDS		
1	Grasmere1947	35°01'	117°45'
2	1962	34°13'	115°05'
3	Albany1976	34°57'	118°05'
4	Northcliffe1981	34°43'	116°25'
5	Northcliffe1986-Warren R	34°38'	116°03'
6	Nannup1986-Blackwood R	34°07'	115°36'
7	Nelson Rd1986-Shannon R	34°43'	116°26'
8	Mt Chudalup1986	34°49'	116°04'
9	Walpole1986-Weld R	34°49'	116°31'
10	Walpole1986-Inlet R	34°55'	116°34'
11	Denmark1992	35°00'	117°04'
12	Denmark1992	35°01'	117°05'
13	Broke Inlet1992	34°57'	116°32'
14	Manjimup1992	34°50'	116°06'
15	Manjimup1992	34°44'	116°06'
16	Manjimup1992	34°43'	116°04'
17	Manjimup1992	34°26'	115°43'
18	Nannup1992	34°23'	115°35'
	R. JAENSCH (1992)		
5	Quitjup Lake	34°23'	115°35'
8	Lake Smith	34°26'	115°43'
12	Doggerup Lake	34°43'	116°04'
14	Lake Florence	34°44'	116°06'
15	Gardner River Lake	34°50'	116°06'
16	Maringup Lake	34°50'	116°12'
17	Lake East of Broke Inlet	34°57'	116°32'
19	Owingup Swamp	35°00'	117°04'
20	Boat Harbour Lake 1	35°01'	117°05'
	P. CHRISTENSEN (1982)		
55	Bevan Rd	34°35'	116°30'
105	Kordabup Rd/South West Hwy	34°59'	117°09'
112	Muir Hwy	34°30'	116°59'
113	Kent R-Bevan Rd	34°41'	117°06'

Table 9 : Those sites at which adults of *Geotria australis* were captured during the present study, together with those recorded in the collections at the Western Australian Museum.

Site Number	General Location	Latitude	Longitude
	MARGARET RIVER WATERSHED		
C5	Margaret R-1st Weir	33°56.92'	115°03.83'
C7	Margaret R-2nd Weir	33°56.89'	115°05.35'
	DONNELLY RIVER WATERSHED		
H6	Donnelly River Mouth	34°29.11'	115°40.42'
H9	Donnelly River-One Tree Bridge	34°12.19'	115°55.82'
H10	Fly Brook-Charlie Rd	34°27.24'	115°47.61'
H11	Fly Brook-Fly Brook Rd	34°27.76'	115°52.45'
H12	Carey Brook-Bridge on Cleave Rd	34°26.54'	115°47.25'
	WARREN RIVER WATERSHED		
I4	Warren River-Bridge on Pemb/North Rd	34°30.42'	115°59.54'
I5	Warren River-King Trout Farm	34°30.10'	115°59.85'
I6	Lefroy Brook-The Cascades	34°28.60'	116°01.71'
I7	Lefroy Brook-Downstream of trout hatch	34°26.60'	116°01.36'
I8	Lefroy Dam-Immediately downstream	34°26.41'	116°01.36'
I11	Lefroy Brook-Broken Bridge	34°25.19'	116°01.53'
	MUSEUM RECORDS		
1	Collie1912	33°22'	116°09'
2	Collie1916	33°18'	115°44'
3	Harvey	33°23'	115°55'
4	Pemberton	34°27'	116°02'
5	Dardanup1951	33°21'	115°45'
6	Roelands1936	33°18'	115°49'
7	Bunbury	33°20'	115°38'
8	1939	33°59'	118°02'
9	1939	34°30'	115°59'
10	Nannup1941	33°59'	115°45'
11	1945	34°45'	117°04'
12	1945	34°05'	115°30'
13	Hardy Inlet1949	34°17'	115°09'
14	Denmark1951	34°57'	117°21'
15	Pemberton1961	34°28'	116°01'
16	Denmark1968	34°58'	117°21'
17	Parry Inlet1972	35°01'	117°09'
18	Pemberton1974	34°31'	115°58'
19	Gardner River1982	34°52'	116°12'
20	Albany1982	35°00'	117°52'

Table 10 : The sites at which ammocoetes of *Geotria australis* were captured during the present study, together with those ecorded in the ollections at the Western Australian Museum, and by Christensen(1982).

Site Number	General Location	Latitude	Longitude
	CAPEL WATERSHED		
A1	Capel River-under railway bridge	33°33.18'	115°34.01'
A2	Capel River-south	33°39.16'	115°45.43'
	MARGARET RIVER WATERSHED		
C5	Margaret R-1st Weir	33°56.92'	115°03.83'
C7	Margaret R-2nd Weir	33°56.89'	115°05.35'
C8	Margaret R-Margaret R Rd	33°56.53'	115°06.98'
	DONNELLY RIVER WATERSHED		
H7	Donnelly River-Boat Ramp	34°26.84'	115°46.38'
H8	Donnelly River-Bridge on Scott Rd	34°24.93'	115°46.46'
H10	Fly Brook-Charlie Rd	34°27.24'	115°47.61'
H11	Fly Brook-Fly Brook Rd	34°27.76'	115°52.45'
H12	Carey Brook-Bridge on Cleave Rd	34°26.54'	115°47.25'
H13	Carey Brook-Bridge on Vasse Hwy	34°25.01'	115°48.65'
H17	Carey Brook-Steep Rd	34°23.56'	115°51.58'
H18	Carey Brook-Stirling Track and Pile Rd	34°23.24'	115°52.45'
H19	Carey Brook- " " " and Beedelup Rd	34°23.49'	115°53.10'
H20	Carey Brook-Thornhill & Seven Day Rds	34°20.11'	115°54.37'
	WARREN RIVER WATERSHED		
I1	Warren R-Dombakup Brk-Plantation Rd	34°34.66'	115°57.98'
I5	Warren River-King Trout Farm	34°30.10'	115°59.85'
I7	Lefroy Brook-Downstream of trout hatch	34°26.60'	116°01.36'
I11	Lefroy Brook-Broken Bridge	34°25.19'	116°01.53'
I12	Big Brook Dam-Under downstream bridge	34°24.73'	116°01.71'
I16	Bridge south of Jn of 4 & 5 Mile Brooks	34°23.22'	116°00.58'
I17	Four Mile Brook-Channybearup Rd	34°21.84'	116°00.26'
I18	" " " " -Seven Day Rd	34°18.65'	115°59.39'
I19	Channybearup Brook-Seven Day Rd	34°19.11'	115°57.52'
	GARDNER RIVER WATERSHED		
L37	Gardner River-South of bridge	34°47.21'	116°11.32'
L38	Gardner River-Bridge	34°46.62'	116°10.87'
L41	Gardner River-Laws Track	34°42.49'	116°09.96'
	SHANNON RIVER WATERSHED		
M4	Shannon River-Bridge on Cheaspeake Rd	34°50.36'	116°22.27'
	DEEP RIVER WATERSHED		
O2	Weld River-Bridge on Beardmore Rd	34°48.89'	116°34.75'
	P. CHRISTENSEN (1982)		
43	Warren River-Lewin Rd	34°36'	115°55'

Table 11 : The sites at which *Leptatherina wallacei* was captured during the present study, together with those recorded in the collections at the Western Australian Museum, and by Jaensch (1992).

Site Number	General Location	Latitude	Longitude
	ABBA/LUDLOW DRAINAGE		
B24	Abba River-Bridge on Bypass	33°38.30'	115°25.91'
	MARGARET RIVER WATERSHED		
C6	Margaret R-Mouth	33°58.24'	114°59.38'
	BLACKWOOD RIVER WATERSHED		
D4	Blackwood R-north of Nannup	33°55.27'	115°48.35'
D5	Blackwood R-Sues Bridge	34°04.54'	115°23.42'
D8	Blackwood R-Walter Willis Rd	34°56.84'	116°03.38'
D9	Blackwood R-Tweed Rd	33°58.72'	116°09.54'
D10	Blackwood R	33°59.89'	116°11.63'
D11	Blackwood R-Aegers Bridge Rd	33°54.95'	116°25.17'
D12	Blackwood R-Terry Rd	33°54.47'	116°24.38'
D13	Blackwood R-Terry Rd	33°51.43'	116°22.66'
D16	Blackwood R-Condinup Crossing Rd	33°46.35'	116°31.07'
D18	Towerrinning Lake	33°35.37'	116°47.17'
D22	Blackwood R-Kulikup Rd & Lower Bridgetown	33°52.39'	116°39.88'
	SCOTT RIVER WATERSHED		
E3	Scott R- Bridge on Milyeannup Rd (2)	34°17.70'	115°24.10'
	LAKE JASPER WATERSHED		
G1	Lake Jasper	34°25.22'	115°41.19'
	GARDNER RIVER WATERSHED		
L12	Pool opposite L13	34°49.23'	116°03.72'
	SHANNON RIVER WATERSHED		
M5	Shannon River-Springbreak Rd	34°52.23'	116°22.37'
	BROKE INLET WATERSHED		
N10	Inlet River-Å1km upstream of mouth	34°56.28'	116°31.84'
N11	Inlet River-near mouth	34°56.31'	116°31.60'
N12	Small stream running into Broke Inlet	34°53.75'	116°26.48'
	MUSEUM RECORDS		
1		33°26'	116°48'
2	Kukerin1964	33°09'	118°01'
3	Katanning1964	33°41'	117°33'
4	Mayanup1979	34°00'	116°20'
5	Albany1992	35°01'	117°44'
6	Denmark1992	35°00'	117°04'
7	Manjimup1992	34°57'	116°32'
8	Augusta/Margaret R1992	34°01'	115°01'
	R. JAENSCH (1992)		
3	Devil's Pool	34°01'	115°01'
16	Lake Maringup	34°50'	116°12'
19	Owingup Swamp	35°00'	117°04'
27	Lake Powell	35°01'	117°44'

Table 12 : The sites at which *Psuedogobius olorum* was captured during the present study, together with those recorded in the collections at the Western Australian Museum, and by Jaensch (1992).

Site Number	General Location	Latitude	Longitude
	ABBA/LUDLOW DRAINAGE		
B1	Lake 9-RGC	33°33.66'	115°32.62'
B2	Lake 10	33°33.74'	115°32.58'
B3	Lake 11	33°33.82'	115°32.54'
B13	Tigersnake Lake	33°35.60'	115°30.00'
B15	Plover Lakes	33°36.00'	115°29.80'
B16	Pobblebonk Swamp	33°36.15'	115°29.80'
B17	Gravel Pool	33°36.20'	115°29.70'
B18	Stream south of above	33°36.25'	115°29.65'
B19	Ludlow Swamp	33°35.80'	115°29.80'
B20	Ludlow River-Bridge on Bypass	33°36.20'	115°28.82'
B24	Abba River-Bridge on Bypass	33°38.30'	115°25.91'
B25	Carbanup River	33°40.78'	115°12.19'
	MARGARET RIVER WATERSHED		
C6	Margaret R-Mouth	33°58.24'	114°59.38'
C15	Calgardup Brook, mouth-Redgate Rd	34°02.40'	115°00.16'
	BLACKWOOD RIVER WATERSHED		
D4	Blackwood R-north of Nannup	33°55.27'	115°48.35'
D5	Blackwood R-Sues Bridge	34°04.54'	115°23.42'
D7	St John Brook (Blackwood River)	33°52.70'	115°40.59'
D18	Towerrinning Lake	33°35.37'	116°47.17'
D19	Arthur R-Moodiarup Rd	33°37.13'	116°47.96'
	SCOTT RIVER WATERSHED		
E2	Scott R-Bridge on Milyeannup Rd (1)	34°17.56'	115°24.02'
E3	Scott R- " " " " (2)	34°17.70'	115°24.10'
E4	Scott R- " " " " (3)	34°17.80'	115°24.15'
E16	Pool on Scott River Rd-power pole 10	34°16.33'	115°16.17'
	LAKE JASPER WATERSHED		
G1	Lake Jasper	34°25.22'	115°41.19'
	DONNELLY RIVER WATERSHED		
H8	Donnelly River-Bridge on Scott Rd	34°24.93'	115°46.46'
	WARREN RIVER WATERSHED		
I4	Warren River-Bridge on Pemb/North Rd	34°30.42'	115°59.54'
I28	Wilgarup River-Muirs Hwy	34°19.86'	116°22.45'
	GARDNER RIVER WATERSHED		
L1	Gardner River Mouth	34°50.43'	116°07.40'
L2	Blackwater-Pool 1	34°49.82'	116°07.29'
L3	Blackwater-Pool 2	34°49.82'	116°07.34'
L12	Pool opposite L13	34°49.23'	116°03.72'
L16	Pool on Windy Harbour Rd	34°48.70'	116°04.20'
L48	Lake Maringup	34°50.22'	116°11.81'
	SHANNON RIVER WATERSHED		
M5	Shannon River-Springbreak Rd	34°52.23'	116°22.37'
	BROKE INLET WATERSHED		
N10	Inlet River-Å1km upstream of mouth	34°56.28'	116°31.84'
N11	Inlet River-near mouth	34°56.31'	116°31.60'
N12	Small stream running into Broke Inlet	34°53.75'	116°26.48'
	MUSEUM RECORDS		
1	1964	34°58'	117°28'
2	1959	34°30'	116°03'
3	Busselton1972	33°39'	115°29'
4	Albany1976	35°01'	117°45'
5	" " "	35°01'	117°43'
6	" " "	34°57'	118°05'
7	Northcliffe1986	34°31'	115°59'
8	Lake Powell1986	35°03'	117°46'
9	Albany1992	35°01'	117°44'
10	" " "	35°03'	117°28'
11	Denmark1992	35°00'	117°13'
12	" " "	35°00'	117°04'
13	" " "	35°01'	117°05'
14	" " "	35°01'	117°06'
15	Manjimup1992	34°57'	116°32'
16	Nannup1992	34°24'	115°41'
17	Augusta/Margaret River1992	34°13'	115°02'
18	" " " " " " "	34°01'	115°01'
	R. JAENSCH (1992)		
3	Devil's Pool	34°01'	115°01'
4	Lake Davies	34°13'	115°02'
6	Lake Jasper	34°24'	115°41'
16	Lake Maringup	34°50'	116°12'
19	Owingup Swamp	35°00'	117°04'
20	Boat Harbour Lake 1	35°01'	117°05'
22	" " " " 3	35°01'	117°06'
23	Reserve 12046 Lake	35°00'	117°13'
25	Lake Saide	35°03'	117°28'
27	Lake Powell	35°01'	117°44'

Table 13 : The sites at which the trout species, *Onchorhynchus mykiss* and *Salmo trutta,* were captured during the present study, together with those recorded in the collections at the Western Australian Museum, and by Christensen (1982).

Site Number	General Location	Latitude	Longitude
	MARGARET RIVER WATERSHED		
C14	Margaret R-Ten Mile Brook Dam	33°57.98'	115°07.38'
	DONNELLY RIVER WATERSHED		
H10	Fly Brook-Charlie Rd	34°27.24'	115°47.61'
H11	Fly Brook-Fly Brook Rd	34°27.76'	115°52.45'
H13	Carey Brook-Bridge on Vasse Hwy	34°25.01'	115°48.65'
H14	Beedelup Brook-Karri Valley	34°25.35'	115°51.41'
H15	Beedelup Brook-Opposite Tobruk Rd	34°25.27'	115°49.68'
	WARREN RIVER WATERSHED		
17	Lefroy Brook-Downstream of trout hatch	34°26.60'	116°01.36'
I11	Lefroy Brook-Broken Bridge	34°25.19'	116°01.53'
	GARDNER RIVER WATERSHED		
L42	Boorara Brook-Bettink's	34°41.46'	116°10.85'
	MUSEUM RECORDS		
1	Pemberton1986	34°25'	116°01'
2	Northcliffe1986	34°31'	115°59'
	P. CHRISTENSEN (1982)		
43	Lewin Rd	34°36'	115°55'

Table 14: The total numbers of trout, *Oncorhynchus mykiss* and *Salmo trutta*, stocked into public waters in the south-west of Australia between 1985 and 1994. N.B. * refers to trout released in vibert boxes by the Western Australian Trout Fishing Association (Tasmanian stock). This information was provided by the Fisheries Department of Western Australia.

Waterbody	Stock	Age	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Total number of trout stocked in rivers in the south-west of Australia	*O. mykiss*	Ova							28 000			
		Fry	209 000	3 000	63 000		83 000	174 000	112 000	160 000	228 000	225 000
		Yearlings	22 000	6 800	1 000	4 000	4 000	2 000	1 400	3 000	13 000	17 000
		X-brood			2 700						600	
	S. trutta	Ova										
		Fry							* 9 000			
		Yearlings			1 700							
		X-brood										
Total number of trout stocked in dams in the south-west of Australia	*O. mykiss*	Ova						25 000		60 000		
		Fry	47 000		38 000		25 000	50 000	20 000	40 000	50 000	60 000
		Yearlings	9 400	12 000	9 200	6 800	6 800	11 000	9 200	5 000	12 000	11 000
		X-brood							500	800	1 800	1 300
	S. trutta	Ova							* 35 000			
		Fry							* 10 000			
		Yearlings			500							
		X-brood										
Total number of trout stocked in public waters in the south-west of Australia	*O. mykiss*	Ova						25 000	28 000	60 000		
		Fry	256 000	3 000	101 000		108 000	224 000	132 000	200 000	278 000	285 000
		Yearlings	31 400	18 800	10 200	10 800	10 800	13 000	10 600	8 000	25 000	28 000
		X-brood			2 700				500	800	2 400	1 300
	S. trutta	Ova	* 35 000						* 35 000			
		Fry							* 19 000			
		Yearlings			2 200							
		X-brood										

Table 15 : The sites at which *Gambusia holbrooki* was captured during the present study, together with those recorded in the collections at the Western Australian Museum, and by Jaensch (1992) and Christensen (1982).

Site Number	General Location	Latitude	Longitude
	CAPEL WATERSHED		
A1	Capel River-under railway bridge	33°33.18'	115°34.01'
A2	Capel River-south	33°39.16'	115°45.43'
	ABBA/LUDLOW DRAINAGE		
B1	Lake 9-RGC	33°33.66'	115°32.62'
B2	Lake 10	33°33.74'	115°32.58'
B3	Lake 11	33°33.82'	115°32.54'
B4	Swamphen Lake	33°35.27'	115°30.39'
B6	Peninsula Lake	33°35.30'	115°30.35'
B9	Crinea Creek	33°35.28'	115°30.15'
B10	Cadjeput Pool	33°35.50'	115°30.10'
B11	Taylor's Lake	33°35.70'	115°30.05'
B12	Boulder Lake	33°35.80'	115°30.02'
B13	Tigersnake Lake	33°35.60'	115°30.00'
B14	Priessiana Pool	33°35.75'	115°29.90'
B15	Plover Lakes	33°36.00'	115°29.80'
B16	Pobblebonk Swamp	33°36.15'	115°29.80'
B17	Gravel Pool	33°36.20'	115°29.70'
B18	Stream south of above	33°36.25'	115°29.65'
B19	Ludlow Swamp	33°35.80'	115°29.80'
B20	Ludlow River-Bridge on Bypass	33°36.20'	115°28.82'
B24	Abba River-Bridge on Bypass	33°38.30'	115°25.91'
B25	Carbanup River	33°40.78'	115°12.19'
	MAGARET RIVER WATERSHED		
C5	Margaret River-1st Weir	33°56.92'	115°03.83'
C7	Margaret R-2nd Weir	33°56.89'	115°05.35'
C8	Margaret R-Margaret R Rd	33°56.53'	115°06.98'
C9	Margaret R-Margaret R Rd	33°56.42'	115°08.07'
C10	Margaret R-Margaret R Rd	33°56.03'	115°08.82'
	BLACKWOOD RIVER WATERSHED		
D4	Blackwood R-north of Nannup	33°55.27'	115°48.35'
D8	Blackwood R-Walter Willis Rd	34°56.84'	116°03.38'
D9	Blackwood R-Tweed Rd	33°58.72'	116°09.54'
D10	Blackwood R	33°59.89'	116°11.63'
D11	Blackwood R-Aegers Bridge Rd	33°54.95'	116°25.17'
D12	Blackwood R-Terry Rd	33°54.47'	116°24.38'
D13	Blackwood R-Terry Rd	33°51.43'	116°22.66'
D14	Blackwood R-Arthur River Rd	33°44.57'	116°34.34'
D15	Blackwood R-Gibb Rd	33°43.84'	116°31.23'
D16	Blackwood R-Condinup Crossing Rd	33°46.35'	116°31.07'
D19	Arthur R-Moodiarup Rd	33°37.13'	116°47.96'
D20	Balgarup R	33°47.18'	116°55.63'
D22	Blackwood R-Kulikup Rd & Lower Bridgetown	33°52.39'	116°39.88'
D23	Chapman Brook	34°04.61'	115°11.31'
D24	Chapman Brook	34°05.33'	115°12.04'
	SCOTT RIVER WATERSHED		
E1	Scott River-Brennan Bridge	34°15.58'	115°16.23'
	DONNELLY RIVER WATERSHED		
H9	Donnelly River-One Tree Bridge	34°12.19'	115°55.82'
H14	Beedelup Brook-Karri Valley	34°25.35'	115°51.41'
	WARREN RIVER WATERSHED		
I4	Warren River-Bridge on Pemb/North Rd	34°30.42'	115°59.54'
I5	Warren River-King Trout Farm	34°30.10'	115°59.85'
I8	Lefroy Dam-Immediately downstream	34°26.41'	116°01.36'
I9	Lefroy Dam- " " upstream	34°26.35'	116°01.35'
I10	Middle Weir-Lefroy Brook	34°25.65'	116°01.00'
I11	Lefroy Brook-Broken Bridge	34°25.19'	116°01.53'
I12	Big Brook Dam-Under downstream bridge	34°24.73'	116°01.71'
I13	Big Brook Dam-Pool at bottom of dam	34°24.68'	116°01.71'
I14	Big Brook Dam-Actual	34°24.49'	116°01.64'
I21	Peerup River-Bridge on Muirs Hwy	34°23.41'	116°25.52'
I25	Tone River-Two Mile	34°26.24'	116°36.96'
I26	Tone River-Two Mile	34°26.00'	116°36.00'
I27	Tone River-Wingarup Gully	34°25.68'	116°35.00'
	LAKE MUIR WATERSHED		
J1	Lake Muir	34°26.41'	116°39.58'
J2	Noobijup lake	34°23.89'	116°47.06'
J3	Byenup Lagoon	34°29.95'	116°43.36'
J4	Lake at Jn of Lake Unicup & Pindicup Rds	34°22.57'	116°41.87'
J5	Cowerup Swamp (Surrounding Pools)	34°26.22'	116°38.68'
J7	Red Lake	34°26.30'	116°38.33'
J8	Drain fom Red Lake	34°26.25'	116°39.47'
J9	Red Lake	34°26.20'	116°39.40'
J10	Red Lake	34°25.90'	116°39.40'
J11	Drain-connect Red Lake/Lake Muir/Cowerup Sw	34°26.35'	116°39.07'
J18	Stream adjacent toLake Muir-Muirs Hwy	34°26.41'	116°41.50'
J19	Stream adjacent toLake Muir- " "	34°26.49'	116°41.58'
J20	Pool adjacent toLake Muir- " "	34°26.46'	116°40.32'
J21	Pool adjacent toLake Muir- " "	34°26.46'	116°40.29'
J22	Pool adjacent toLake Muir- " "	34°26.30'	116°40.20'

Table 15 (cont...)

Site Number	General Location	Latitude	Longitude
	GARDNER RIVER WATERSHED		
L16	Pool on Windy Harbour Rd	34°48.70'	116°04.20'
	COLLIE RIVER WATERSHED		
S1	Collie River-Schultz's Weir	33°23.19'	116°09.78'
S2	" " " -Collieburn Pool	33°24.66'	116°11.97'
S3	" " " -Townsend's Pool	33°25.45'	116°13.00'
S4	" " " -Cox's Pool	33°25.80'	116°13.13'
S5	" " " -Round Pool	33°26.16'	116°13.40'
S6	" " " -Western Collieries	33°28.34'	116°13.86'
S7	" " " -Davies' Pool	33°28.75'	116°13.90'
	MUSEUM RECORDS		
1	1964	34°35'	116°25'
2	1961	33°06'	115°42'
3	Katanning1971	33°42'	117°33'
4	Busselton1972	33°39'	115°29'
5	1981	34°25'	116°38'
6	Lake Powell1986	35°03'	117°46'
7	Albany1992	35°01'	117°44'
8	" " "	35°03'	117°28'
9	Manjimup1992	34°34'	116°55'
10	" " "	34°32'	115°53'
	R. JAENSCH (1992)		
9	Lake Yeagerup	34°32'	115°53'
A4	Warren River Oxbow	34°34'	115°55'
25	Lake Saide	35°03'	117°28'
27	Lake Powell	35°01'	117°44'
	P. CHRISTENSEN (1982)		
97	Frankland River-Myalgelup	34°33'	116°51'

Table 16 : The sites at which *Perca fluviatilis* was captured during the present study, together with those recorded in the collections at the Western Australian Museum.

Site Number	General Location	Latitude	Longitude
	CAPEL WATERSHED		
A1	Capel River-under railway bridge	33°33.18'	115°34.01'
A2	Capel River-south	33°39.16'	115°45.43'
	MARGARET RIVER WATERSHED		
C14	Margaret R-Ten Mile Brook Dam	33°57.98'	115°07.38'
	DONNELLY RIVER WATERSHED		
H16	Carey Brook-Staircase Rd	34°23.81'	115°50.39'
	WARREN RIVER WATERSHED		
I1	Warren R-Dombakup Brk-Plantation Rd	34°34.66'	115°57.98'
I11	Lefroy Brook-Broken Bridge	34°25.19'	116°01.53'
I12	Big Brook Dam-Under downstream bridge	34°24.73'	116°01.71'
I14	Big Brook Dam-Actual	34°24.49'	116°01.64'
	COLLIE RIVER WATERSHED		
S1	Collie River-Schultz's Weir	33°23.19'	116°09.78'
S2	" " " -Collieburn Pool	33°24.66'	116°11.97'
S3	" " " -Townsend's Pool	33°25.45'	116°13.00'
S4	" " " -Cox's Pool	33°25.80'	116°13.13'
S5	" " " -Round Pool	33°26.16'	116°13.40'
S6	" " " -Western Collieries	33°28.34'	116°13.86'
S7	" " " -Davies' Pool	33°28.75'	116°13.90'
	MUSEUM RECORDS		
1	Bridgetown1937	33°57'	116°08'