

APPENDIX

2 Threatened Aquatic Species in the ACT (Listed Under the *Nature Conservation Act 1980* (ACT))

Appendix 2.1

Two-spined Blackfish (*Gadopsis bispinosus*)

In accordance with section 21 of the *Nature Conservation Act 1980*, the **Two-spined Blackfish (*Gadopsis bispinosus*)** was declared a **vulnerable** species on 27 December 1996 (formerly Instrument No. 1 of 1997 and currently Instrument No. 192 of 1998). Section 23 of the Act requires the Conservator of Flora and Fauna to prepare an Action Plan in response to each declaration. The Action Plan requirements are incorporated into this *Aquatic Species and Riparian Zone Conservation Strategy*. This supersedes the original Action Plan (ACT Government 1999a).

Conservation Status (ACT) Vulnerable

Criteria satisfied (ACT Flora and Fauna Committee 1995)

The species is observed, estimated, inferred or suspected to be at risk of premature extinction in the ACT region in the medium-term future, as demonstrated by:

- Current serious decline in population or distribution from evidence based on:
 - direct observation, including comparison of historical and current records.
- Imminent risk of serious decline in population or distribution from evidence based on serious threat from predators, parasites or competitors.
- Seriously fragmented distribution for a species currently occurring over a moderately small range or having a moderately small area of occupancy within its range.

SPECIES DESCRIPTION AND ECOLOGY

The Two-spined Blackfish *Gadopsis bispinosus* is a member of the family Gadopsidae, commonly known as blackfish, which is endemic to south-eastern Australian freshwater habitats. The Gadopsidae contains a single genus, *Gadopsis*, which has two

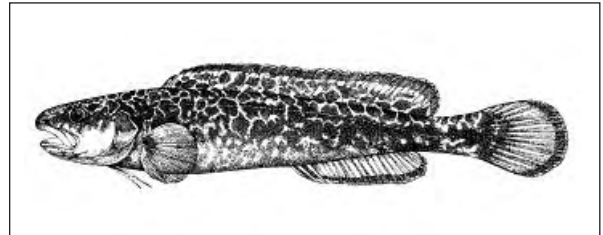


Figure 1: Two-spined Blackfish (*Gadopsis bispinosus*)

species currently described; the Two-spined Blackfish *G. bispinosus* and the River Blackfish *G. marmoratus*. *G. bispinosus* can be distinguished from *G. marmoratus* by the presence of only two (range 1–3) instead of 11 (range 6–13) dorsal fin spines (Sanger 1984). *G. bispinosus* also has a distinct white edge on the dorsal, anal and caudal fins which *G. marmoratus* lacks.

Description

G. bispinosus is a small to medium sized species with a relatively large head with rounded snout (Figure 1). The maximum total length for *G. bispinosus* is 300–350 mm. Most specimens in the Canberra region are less than 250 mm total length (Lintermans 1998a). *G. bispinosus* has a large mouth with fleshy lips, with the upper jaw overhanging the lower. The body is narrow and slightly compressed with long, low dorsal and anal fins. The pelvic fins are reduced to single bifid rays and are jugular in position. The scales are very small and the body heavily coated in slime. The colouration is variable, usually a yellowish-brown at the base, with two to three rows of dark brown blotches running the entire body length and extending onto the dorsal, anal and caudal fins. The ventral surface is uniformly pale to the origin of the anal fin. The outer edges of the dorsal, anal and caudal fins are pale or white, and are often bordered by an intense dark stripe (Jackson *et al.* 1996). Sexes are generally indistinguishable except during the breeding season when gravid females have eggs visible through the body wall.

Habitat

G. bispinosus only occurs in inland drainages of south-eastern Australia, where it is restricted to cool, clear upland or montane streams with abundant instream cover, usually in the form of boulders and cobble (Sanger 1984; Koehn 1987, 1990; Lintermans 1998a).

In contrast, *G. marmoratus* occurs in slower-flowing lowland streams and has a requirement for log debris for spawning. *G. bispinosus* is more often found in the medium to larger streams where there is greater water depth and lower stream velocity. It is not found in the smallest headwater streams (Lintermans and Rutzou 1990a, 1990b; Lintermans unpubl. data).

G. bispinosus is generally found in forested catchments, where there is little sediment input to the stream from erosion or land management practices.

Behaviour and Biology

There has been little published on the behaviour or biology of *G. bispinosus* with most information residing in an unpublished thesis (Curmi 1996) and ongoing research projects (J. Kalish, Division of Botany and Zoology, ANU, pers.comm.). Most of the information for the Canberra region is based on Lintermans (1998a). Life history information is difficult to gather for fish species as they are not easily observed in their aquatic habitats. The dark colouration and patterning of *G. bispinosus* makes it difficult to observe, even in shallow clear streams.

The diet is characterised by a predominance of aquatic insect larvae, particularly mayflies, caddisflies and midges. Terrestrial insects also make up a significant part of the diet, indicating the importance of intact riparian vegetation communities as a food source, for their associated insect fauna that falls onto the water. Young-of-year and juvenile blackfish eat proportionally more mayfly and midge larvae than adult fish, which consume larger items such as caddisfly larvae and terrestrial invertebrates.

Movement of *G. bispinosus* is extremely limited with the home-range of adult fish estimated at approximately 15 metres. Home-ranges are maintained from year to year, with fish thought to avoid the high velocity winter flows by sheltering amongst the rocks and boulders on the stream bed. Home-range in *G. marmoratus* is also limited and is estimated at approximately 20 metres (Koehn 1986).

Breeding is seasonal with egg laying commencing in November, probably induced by a relatively rapid rise in water temperature.

Fecundity is low and is positively correlated with fish length. Females are thought to commence breeding in

their second or third year. Between 80 and 420 eggs are laid (Sanger 1986, 1990; Lintermans 1998a) in a single egg mass but the natural spawning sites are unknown. *G. bispinosus* will lay eggs inside PVC pipes placed into streams, and it is thought that all eggs are released at once, and that each egg mass is from a single female. It is suspected that the natural spawning site is on the underside of boulders or cobble (Lintermans 1998a).

The eggs are large (~3.5 mm diameter), yolky and adhesive, and are guarded by the male fish until the larvae have almost fully exhausted the yolk reserves and are free-swimming. Hatching occurs after approximately 16 days at a water temperature of 15°C, with the large yolk sac remaining inside the ruptured egg membrane, effectively tethering the young to the spawning substrate until the yolk has been consumed (Lintermans 1998a). The larvae have almost fully consumed the yolk after approximately three weeks and then leave the spawning site, with the male guard fish also leaving.

In the upper Cotter River, *G. bispinosus* is known to be host to a small (~5mm) Glossiphonid leech of unknown species. Numerous small red bite marks are often observed on mature fish, although the leeches are rarely seen (Lintermans unpubl. data). Leeches are extremely rare on Australian freshwater fish species with only one other instance of leech attack documented (Cadwallader 1978b). *G. bispinosus* in the upper Cotter River are also known to carry the native parasitic fluke *Phyllodistomum magnificum* (Cribb 1987) which has been recorded in the bladder of infected animals (Lintermans unpubl. data).

DISTRIBUTION

There is little information on the historical distribution of *G. bispinosus* owing to the relatively recent description of the species. All descriptions made prior to 1984 referred to 'blackfish', with no distinction being made between *G. bispinosus* and *G. marmoratus*. Museum collections have revealed only four specimens of *G. bispinosus* collected prior to the late 1970s, all being from the Canberra region. Two were collected from the Goodradigbee River catchment in 1931, one from the Geehi River in Kosciuszko National Park in 1975, and the other from the Murrumbidgee River (ACT) in 1962 (Lintermans 1998a).

Historical Distribution

There is little historical information to assess whether the distribution of the species has changed over time. However, the distinct and different habitat preferences of the two inland blackfish species (*G. bispinosus* and

northern *G. marmoratus*) facilitate interpretation of some of the old literature records of 'blackfish'.

The records of blackfish from the Snowy River system (Llewellyn 1983; Tuma c1963; Tilzey 1969) can be assumed to be southern *G. marmoratus* as this is the only blackfish species found in coastal drainages. Both Stead 1908 (in Ogilby 1913) and Whitley (1964) note that blackfish were reportedly introduced into the Snowy River system but the origin of these introductions (and hence the species involved) were not mentioned.

Macleay (1885) commented on a specimen of *Gadopsis* sp. collected from the 'Little River near Yass'. The Little River is a local name for the Goobarragandra River where *G. bispinosus* was collected recently (Lintermans 1998a). Stead (1908) records the distribution of blackfish in NSW as 'the upland streams of the southern highland' but does not provide precise localities. However, some years later (in Ogilby 1913) Stead lists the 'Yarrangobilly River, Jounama Creek, Goobarragandra River, Adjungbilly Creek and other feeders of the Tumut River, the Tumut itself, the Upper Murrumbidgee, the Upper Snowy and its feeders...'. All of these streams with the exception of the upper Snowy and its tributaries would probably refer to *G. bispinosus*.

There are anglers' records of blackfish captures, probably of *G. bispinosus*, from the Yarrangobilly River prior to the early 1960s (Lintermans 1998a). Recent surveys in the Yarrangobilly River failed to locate any blackfish.

Similarly, there were a number of anglers' records of blackfish from the Goodradigbee drainage, with two specimens of *G. bispinosus* (collected in 1931) lodged in the Australian Museum. Four sites on the Goodradigbee River itself were sampled (Lintermans 1998a) but no blackfish were caught. A further five sites on tributary streams were sampled with *G. bispinosus* recorded in low numbers at one site on Micalong Creek, the collection locality of the 1931 specimen. As with the Yarrangobilly River, the

Goodradigbee River contains excellent habitat for *G. bispinosus* but the species now appears to be largely absent or present in low numbers only.

Blackfish were known to be present in the Murrumbidgee River in the ACT until the 1960s (Jorgensen 1983; Greenham 1981) although their specific identity was unknown (Lintermans 1991a). The last reported capture of a blackfish in the Murrumbidgee in the ACT was in the mid-1970s (Lintermans 1998a). The only blackfish specimen known from the Murrumbidgee River in the ACT is of *G. bispinosus* and this is the only blackfish species known from the ACT and immediate surrounds. It is reasonable to assume that this was the only blackfish species present in the Murrumbidgee River. No blackfish have been recorded in the Murrumbidgee River in the ACT since the mid 1970s, although the species still occurs in the headwaters of the river (NSW Fisheries unpubl. data).

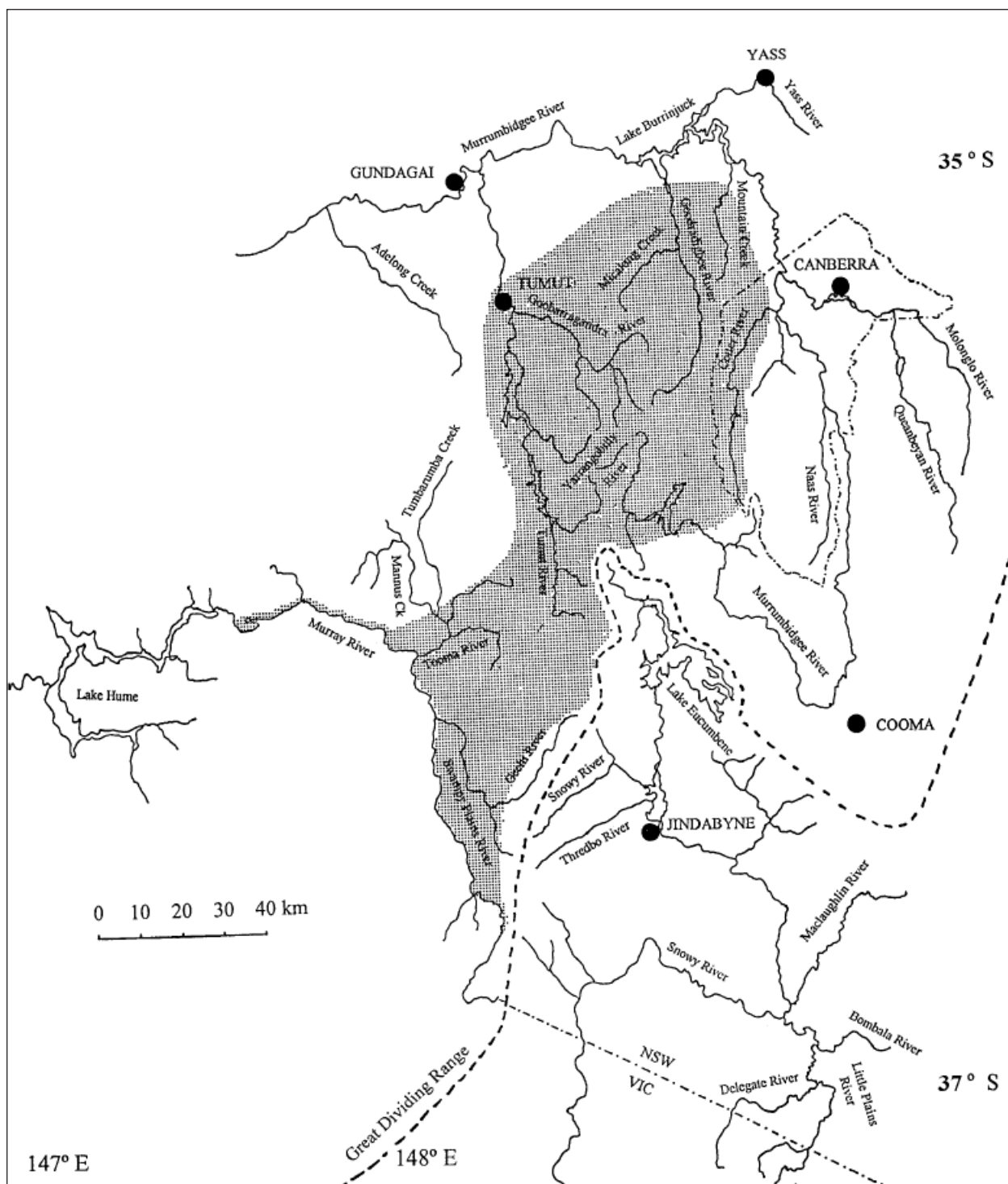
Present Distribution

The present distribution of the species covers a narrow band from north-eastern Victoria, extending through south-eastern NSW to the ACT, which is at the northern extremity of its range (Koehn 1990; Lintermans and Rutzou 1990a; Lintermans 1998a) (Figure 2).

An extensive survey of the NSW southern highlands (Lintermans 1998a) located *G. bispinosus* in the following stream systems:

- the upper Murray, including the lower reaches of the Swampy Plains, Tooma and Geehi Rivers;
- the upper Tumut system, including the lower reaches of the Goobarragandra River;
- the Goodradigbee River;
- Mountain Creek; and
- the upper Murrumbidgee River between Yaouk and Cooma.

In the ACT, the species is now found only in the Cotter River catchment upstream of the Cotter Dam.




 Distribution of Two-spined Blackfish

Figure 2: Distribution (1998) of Two-spined Blackfish in the ACT Region

(Source: Redrawn from Lintermans 1998a)

Appendix 2.2

Trout Cod (*Maccullochella macquariensis*)

In accordance with section 21 of the *Nature Conservation Act 1980*, the **Trout Cod** (*Maccullochella macquariensis*) was declared an **endangered** species on 27 December 1996 (formerly Instrument No. 1 of 1997 and currently Instrument No. 192 of 1998). Section 23 of the Act requires the Conservator of Flora and Fauna to prepare an Action Plan in response to each declaration. The Action Plan requirements are incorporated into this *Aquatic Species and Riparian Zone Conservation Strategy*. This supersedes the original Action Plan (ACT Government 1999b).

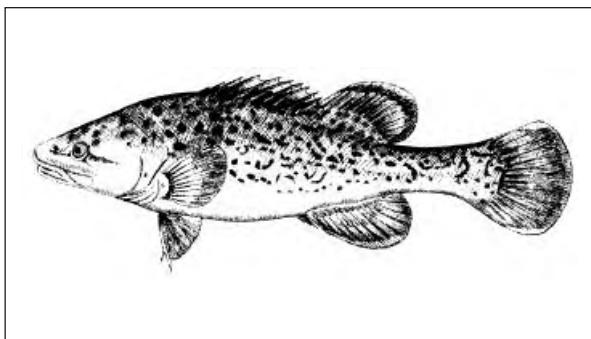


Figure 1: Trout Cod (*Maccullochella macquariensis*)

Conservation Status (ACT) Endangered

Criteria satisfied (ACT Flora and Fauna Committee 1995)

The species is known or suspected to occur in the ACT region and is already recognised as endangered or presumed extinct in an authoritative international or national listing.

The species is observed, estimated, inferred or suspected to be at risk of premature extinction in the ACT region in the near future, as demonstrated by:

- Current severe decline in population or distribution from evidence based on:
 - direct observation, including comparison of historical and current records;
 - severe decline in rate of reproduction or recruitment; severe increase in mortality; severe disruption of demographic or social structure; and
 - very high actual or potential levels of exploitation or persecution.

SPECIES DESCRIPTION AND ECOLOGY

The Trout Cod *Maccullochella macquariensis* is a member of the Percichthyidae, which contains the Australian freshwater basses and cods. The family contains two genera in eastern Australia: *Maccullochella* and *Macquaria*. Other species in the genus *Maccullochella* include the well known Murray Cod (*M. peelii peelii*), the nationally threatened Mary River Cod (*M. peelii mariensis*) and Eastern Freshwater Cod (*M. ikei*). *M. macquariensis* is similar in appearance to *M. peelii peelii* and was only formally recognised as a distinct species in the 1970s (Berra and Weatherley 1972).

Description

M. macquariensis is a large elongate deep-bodied fish (Figure 1), slightly laterally compressed and very similar to *M. peelii peelii*. The dorsal profile of the head is straight whereas in *M. peelii peelii*, it is concave. The mouth is terminal and large with the gape extending to behind the posterior of the eye. The upper jaw overhangs the lower jaw whereas in *M. peelii peelii*, the lower jaw is equal or protruding. The dorsal colouration is generally blue-grey with small dark grey to black spots or dashes, extending to the lower sides. The ventral surface is light grey to white. Adult and juvenile *M. macquariensis* have a dark stripe through the eye.

In contrast, the dorsal colouration of *M. peelii peelii* is typically olive-green to yellow-green with dark mottling (rather than spotting) extending to the lower sides. *M. peelii peelii* juveniles may have a dark eye stripe but it rarely persists in fish greater than 150 mm total length.

Maximum size of *M. macquariensis* is 16 kilograms and approximately 700 mm but fish over 3 kilograms are rare.

Habitat

The historical habitat preferences of *M. macquariensis* were never documented and the rivers where the species formerly occurred have probably changed dramatically since the species inhabited them. The two localities where the species currently survives and breeds are quite different in character. The Murray River from Yarrowonga to Cobram is a large (60–100 m wide), slow flowing and deep (>3 m) river with a sand, silt and clay substrate, and contains abundant snags and woody debris. Seven Creeks (Victoria) is a relatively narrow (5–7 m wide) stream having a rock, gravel and sand substrate. The pools are generally less than 2 m deep and are interspersed by rapids and cascades (Douglas *et al.* 1994).

The physical characteristics of the Murrumbidgee River in the ACT are intermediate between Seven Creeks and the Murray River. In general, it appears that *M. macquariensis* adults are essentially a pool-dwelling, cover-seeking fish.

Behaviour and Biology

There has been little published on the behaviour or biology of *M. macquariensis* with much information residing in ongoing research projects. The most comprehensive summary of information is by Douglas *et al.* (1994) from which much of the following information is taken.

The species is a carnivorous, top-order predator with the diet including freshwater crustaceans such as yabbies, crayfish and shrimp, as well as fish and aquatic insects. In Bendora Reservoir they have been recorded as eating yabbies, mudeyes, blackfish and the occasional frog.

Like *M. peelii peelii*, *M. macquariensis* is believed to form pairs and spawn annually, usually in spring and probably in response to increasing day-length and water temperature. The fertilised eggs are adhesive, demersal, opaque and 2.5–3.6 mm in diameter. It is thought that the eggs are laid on a hard substrate such as submerged logs, clay banks or rocks. The eggs hatch 5–10 days after fertilisation at 20°C with newly hatched larvae being approximately 6–9 mm total length. Larvae begin feeding about 10 days after hatching.

The species reaches sexual maturity when younger and smaller (3–5 years, 0.75–1.5 kg) than *M. peelii peelii* (4–6 years, 2–2.5 kg).

It has been suggested that *M. macquariensis* was more common in the cooler, upper reaches of rivers (Cadwallader and Backhouse 1983) but there is little evidence to support this suggestion. Certainly the one remaining natural population in the Murray River below Yarrowonga does not fit this model. In the Murray River, *M. macquariensis* is usually found associated with snags and wood debris in areas of relatively fast flowing current. Unpublished research suggests that the species prefers deeper, faster water than *M. peelii peelii* in this location (J. Koehn pers. comm.). In Seven Creeks, larger *M. macquariensis* individuals are often found in the deeper pools but smaller fish have also been captured amongst boulders, logs and other cover in shallower waters.

DISTRIBUTION

M. macquariensis was once widespread in the southeastern region of the Murray–Darling Basin with records from the Murray, Murrumbidgee and Macquarie rivers in New South Wales/Australian Capital Territory and the Goulburn, Broken, Campaspe, Ovens, King, Buffalo and Mitta Mitta rivers in Victoria (Berra and Weatherley 1972; Cadwallader and Gooley 1984; Cadwallader 1977; Greenham 1981).

In the Canberra region, the last recorded capture of the species was from the Gigerline Gorge on the Murrumbidgee River in the late 1970s (Lintermans *et al.* 1988). The report of *M. macquariensis* from the Molonglo River (Merrick and Schmida 1984) appears to be an error as no reliable record from this locality is known. Recent fish surveys of the Murrumbidgee River in the ACT have failed to locate *M. macquariensis* (Lintermans 1995a, 1997, 1998b, unpubl. data).

There are now only two self-supporting populations remaining, one in the Murray River below Yarrowonga and the other in Seven Creeks above Euroa in Victoria. The Seven Creeks population is the result of translocations of ‘cod’ from the Goulburn River in 1921 and 1922 (Douglas *et al.* 1994).

As part of a national recovery plan, *M. macquariensis* is being artificially bred by both the New South Wales and Victorian fisheries agencies (Ingram and Rimmer 1992). The cod are then being stocked into streams (and some reservoirs) within the former range of the species. Two sites in the ACT have been stocked: 8750 fish were released into Bendora Reservoir in 1989–90 (Lintermans 1995b) and 34 500 were released into the Murrumbidgee River at Angle Crossing in 1996–1998.

The species has also been released in the Murrumbidgee River at a number of sites.

These include:

- two sites near Cooma;
- one site below Adaminaby;
- one site near Gundagai; and
- one site near Wagga Wagga.

The locations of sites stocked with *M. macquariensis* in the ACT region are shown in Figure 2.

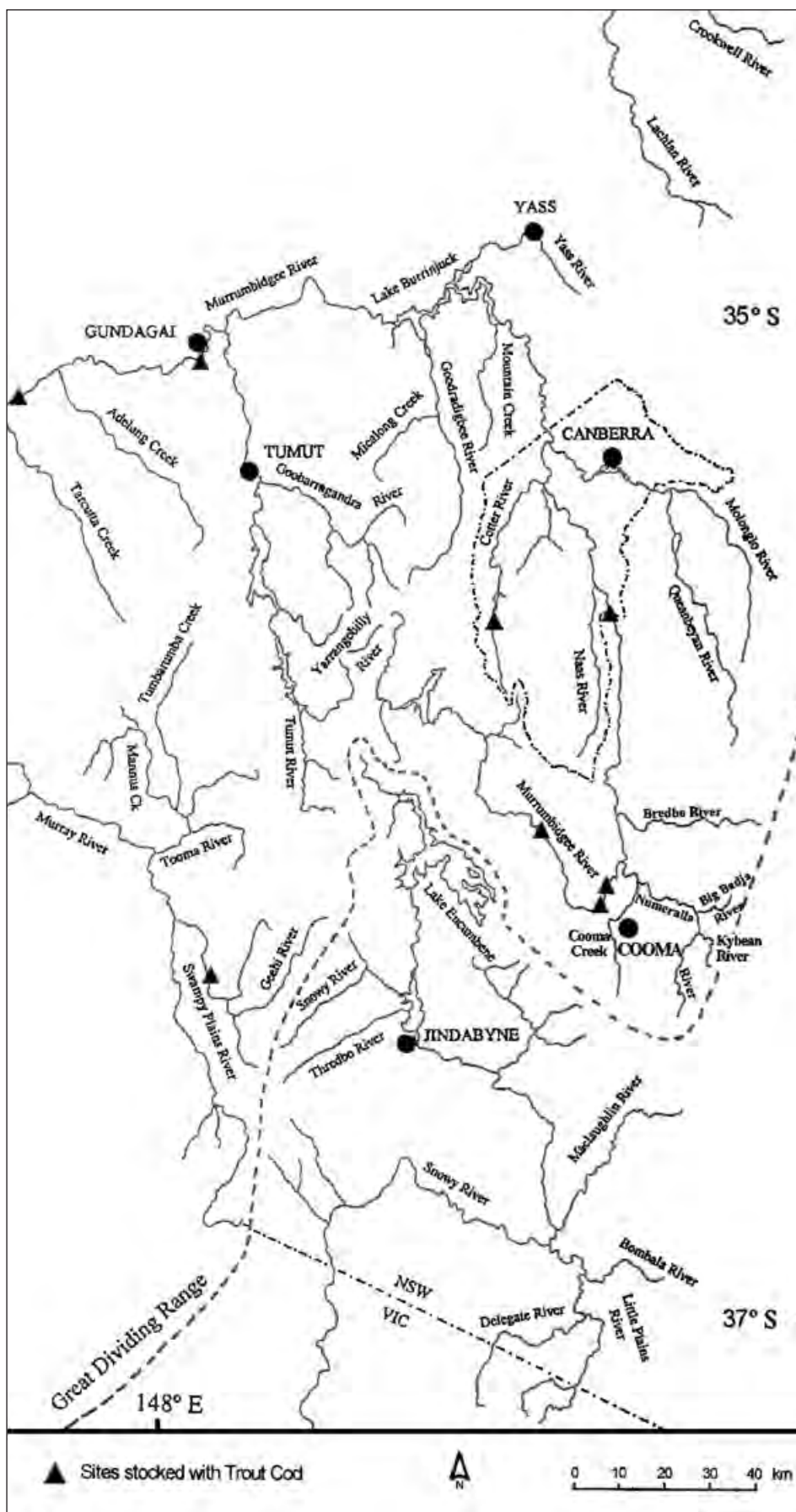


Figure 2: Locations of Sites Stocked with Trout Cod in the ACT and Region

Appendix 2.3

Macquarie Perch (*Macquaria australasica*)

In accordance with section 21 of the *Nature Conservation Act 1980*, the **Macquarie Perch (*Macquaria australasica*)** was declared an **endangered** species on 27 December 1996 (formerly Instrument No. 1 of 1997 and currently Instrument No. 192 of 1998). Section 23 of the Act requires the Conservator of Flora and Fauna to prepare an Action Plan in response to each declaration. The Action Plan requirements are incorporated into this *Aquatic Species and Riparian Zone Conservation Strategy*. This supersedes the original Action Plan (ACT Government 1999c).

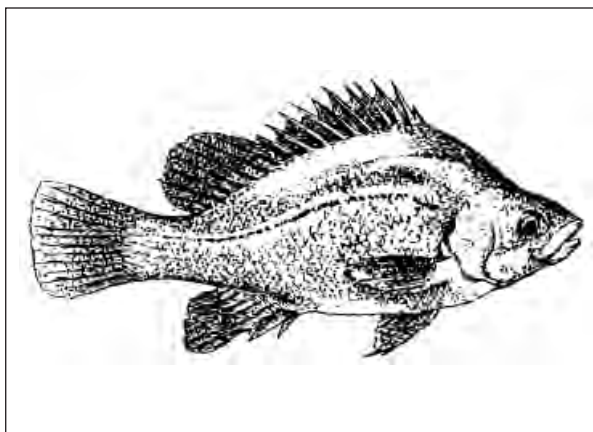


Figure 1: Macquarie Perch (*Macquaria australasica*)

Conservation Status (ACT) Endangered

Criteria Satisfied (ACT Flora and Fauna Committee 1995)

The species is observed, estimated, inferred or suspected to be at risk of premature extinction in the ACT region in the near future, as demonstrated by:

- Current severe decline in population or distribution from evidence based on:
 - direct observation, including comparison of historical and current records.
 - severe decline in rate of reproduction or recruitment; severe increase in mortality; severe disruption of demographic or social structure.
 - severe decline in quality or quantity of habitat.
 - very high actual or potential levels of exploitation or persecution.
 - severe threats from herbivores, predators, parasites, pathogens or competitors.

SPECIES DESCRIPTION AND ECOLOGY

Macquarie Perch *Macquaria australasica* is a member of the Percichthyidae which contains the Australian freshwater basses and cods. Other species in the family include the well-known Murray Cod (*Maccullochella peelii peelii*) and the nationally endangered Trout Cod (*Maccullochella macquariensis*). The genus *Macquaria* contains the popular angling species Golden Perch (*M. ambigua*), Australian Bass (*M. novemaculeata*) and Estuary Perch (*M. colonorum*).

Description

M. australasica is a moderately-sized, deep-bodied, laterally-compressed fish with large white eyes (Figure 1). The predominant body colour is grey to black on the dorsal and lateral surfaces with a whitish ventral surface. Colouration is variable between populations with some coastal populations being quite mottled (McDowall 1980; Merrick and Schmida 1984). The lateral line is obvious and there are conspicuous open pores on the lower jaw. Adult specimens possess a distinct 'humped back' and the tail is rounded.

The maximum size is 3.5 kg but fish over 1 kg are uncommon.

Habitat

The preferred habitat is cool, shaded, upland streams with deep rocky pools and substantial cover. The species will also survive well in impoundments with suitable feeder streams in which to breed. The species now seems to be confined to the upper reaches of catchments (Cadwallader 1981) that are more natural and less affected by agriculture and sedimentation.

Behaviour and Biology

Macquaria australasica are reported to live for up to 10 years (Battaglione 1988). Males reach sexual maturity at two years of age and 210 mm total length, and females at three years and 300 mm total length (Harris and Rowland 1996). Fish in reservoirs undertake a spawning migration into inflowing rivers. Fish gather in schools before spawning which can last several weeks (Battaglione 1988). Spawning occurs in late spring/summer when water temperatures reach approximately 16.5°C with fish depositing eggs above riffles or fast-flowing sections of river. The eggs are then washed downstream where they lodge in gravel or rocky areas until hatching.

Fecundity is approximately 31 000 eggs per kilogram of fish weight (Cadwallader and Rogan 1977), with females carrying up to 110 000 eggs (Battaglione 1988). Mature eggs are 1 to 2 mm in diameter and cream coloured. After fertilisation the eggs swell to approximately 4 mm diameter and are amber coloured

(Battaglione 1988). Larvae hatch in 10–11 days at water temperatures of 15–17°C (Gooley 1986) with the larvae being about 7 mm long upon hatching (Battaglione 1988).

The diet of *M. australasica* consists predominantly of small benthic aquatic insect larvae, particularly mayflies, caddisflies and midges. Shrimps, yabbies, dragonfly larvae and molluscs are also eaten (McKeown 1934; Cadwallader and Eden 1979; Butcher 1945; Battaglione 1988; Lintermans unpubl. data).

DISTRIBUTION

M. australasica is typically found in the cooler, upper reaches of the Murray–Darling river system in Victoria, New South Wales and the Australian Capital Territory. The species was introduced into some coastal drainages in the late 1800s and early 1900s. There are also some natural coastal populations in New South Wales, notably the Nepean, Hawkesbury and Shoalhaven rivers. A morphometric and genetic study in the mid 1980s suggested there were three distinct stocks of *M. australasica*, with the Murray–Darling populations being distinct from a Shoalhaven stock and a Hawkesbury stock (Dufty 1986). It was considered that these three stocks were distinct species (Dufty 1986). This study has never been published and so the conservation status of *M. australasica* has been unclear for some years. This Action Plan only relates to the Murray–Darling stock of *M. australasica*, and does not deal with the two coastal forms.

In the ACT, *M. australasica* is restricted to four rivers, the Murrumbidgee, Molonglo, Paddys and Cotter rivers. In the Cotter River, the species is restricted to the lower section of the river from its junction with the Murrumbidgee up to Vanitys Crossing (including Cotter Reservoir). Anecdotal reports indicate that the species did occur further upstream on the Cotter but has now disappeared from this area and appears unable to pass the high concrete causeway built at Vanitys Crossing in the late 1970s (Lintermans 1991). In 1985 a total of 41 individuals was removed from Cotter Reservoir as it was drained for maintenance of the dam wall. These fish were released into Bendora Reservoir but this translocation attempt appears to have failed (Lintermans unpubl. data).

Records from the Molonglo River are scarce and in recent times have only been from the lower end of the river below Lake Burley Griffin. The discharge of

treated effluent from the Lower Molonglo Water Quality Control Centre since 1978 is likely to provide a chemical barrier that discourages dispersal of some native fish species from the Murrumbidgee to the Molonglo River. Scrivener Dam now prevents upstream movement of fish species from the lower Molonglo and effectively restricts access to the majority of the Molonglo River. It is likely that *M. australasica* historically occurred in the middle to upper reaches of the river but was almost certainly eliminated along with almost all other fish species due to heavy metal pollution from the Captains Flat mines. A fish survey in 1992–93 of the Molonglo River catchment from above Captains Flat to Lake Burley Griffin failed to locate the species (Lintermans unpubl. data).

The species has been recorded from along the entire length of the Murrumbidgee River in the ACT (Greenham 1981; Environment and Recreation unpubl. data) although more recent fish surveys by Environment ACT recorded no individuals in 1994, one in 1996 and one in 1998 (Lintermans 1995a, 1997, 1998b, unpubl. data).

The status of *M. australasica* in Paddys River is unknown as the only records from this stream are based on the results of angler interviews summarised in Greenham (1981). Environment and Recreation has not yet surveyed this catchment, however it is considered unlikely that a significant population occurs in this drainage given the lack of any angler records since the early 1980s.

In the Canberra region, *M. australasica* is also known from five other locations. These are:

- a small remnant population in the Queanbeyan River immediately upstream of Googong Reservoir;
- a population of unknown size in Burrinjuck Dam and the lower Goodradigbee River;
- a small population in the Lachlan River near Wyangla Dam;
- a population of unknown size in the Abercrombie River below Crookwell; and
- a population of unknown size in the Murrumbidgee River near Cooma.

The locations of current and unconfirmed records of *M. australasica* in the ACT region are shown in Figure 2.

Appendix 2.4

Murray River Crayfish (*Euastacus armatus*)

In accordance with section 21 of the *Nature Conservation Act 1980*, the **Murray River Crayfish (*Euastacus armatus*)** was declared a **vulnerable** species on 27 December 1996 (formerly Instrument No. 1 of 1997 and currently Instrument No. 192 of 1998). Section 23 of the Act requires the Conservator of Flora and Fauna to prepare an Action Plan in response to each declaration. The Action Plan requirements are incorporated into this *Aquatic Species and Riparian Zone Conservation Strategy*. This supersedes the original Action Plan (ACT Government 1999d).

Conservation Status (ACT) Vulnerable

Criteria satisfied (ACT Flora and Fauna Committee 1995)

The species is observed, estimated, inferred or suspected to be at risk of premature extinction in the ACT region in the medium-term future, as demonstrated by:

- Current serious decline in population or distribution from evidence based on:
 - direct observation, including comparison of historical and current records.
 - a serious decline in quality and quantity of habitat.
 - high actual or potential levels of exploitation or persecution.

SPECIES DESCRIPTION AND ECOLOGY

The Murray River Crayfish *Euastacus armatus* belongs to the family Parastacidae, which includes all the freshwater crayfish within the southern hemisphere. The family contains nine genera and approximately 100 species. The two largest genera are *Cherax* which contains the Common Yabby (*Cherax destructor*), Marron (*C. tenuimanus*) and Redclaw (*C. quadricarinatus*), and *Euastacus* which contains the spiny crays. The genus *Euastacus* includes several large crayfish species of which *E. armatus* is the largest. It is reportedly the second largest freshwater crayfish in the world, growing to 3 kg (Geddes 1990). There are 21 species of *Euastacus* known from New South Wales (Merrick 1995) but this number will increase as several new species are in the process of being described. In the Australian Capital Territory, there are three described species: *E. armatus*; *E. crassus* that lives predominantly in streams; and *E. rieki* that lives mainly in upland bogs.

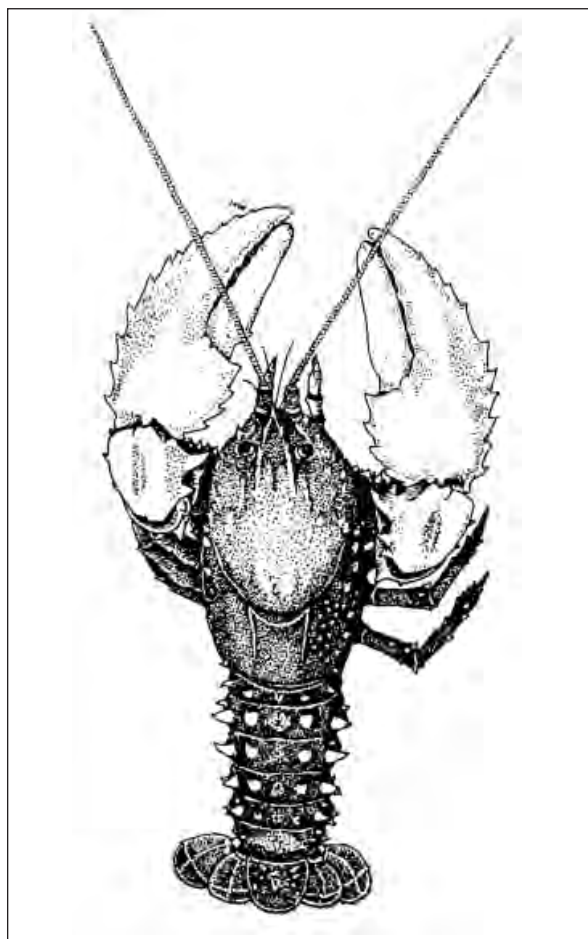


Figure 1: Murray River Crayfish (*Euastacus armatus*)

Description

Adults average 20 to 30 cm in total length and are identified by their large white claws and ornately spined abdomen (Figure 1). The dorsal carapace colour is dark or medium green or brown, sometimes slightly tinged blue. The abdominal segments are laterally slightly tinged blue/green with the abdominal spines pale orange, cream or white. In small individuals, the claws are not white but are mottled green and yellow.

Habitat

E. armatus inhabits large and small streams in a variety of habitats including cleared pasture and dry and wet sclerophyll forests at altitudes from close to sea level to over 700 m ASL (Morgan 1986).

The species prefers faster flowing cool water habitats of the main channels of rivers, in contrast to the Yabby, which prefers slow warm water and billabongs.

Behaviour and Biology

E. armatus individuals do not reach sexual maturity until they are quite large (15 to 20 cm total length) and between six and nine years old. The larger individuals previously caught in the Murray River may have been from 20-50 years of age, but fishing pressure makes it unlikely that individuals will survive to that age now (Geddes 1990).

Between 500 and 1000 eggs are produced in late autumn and are carried on setae attached to the swimmerets under the female's abdomen throughout the winter months. Hatching occurs in spring or summer with the young remaining attached to the female for a short time (Department of Agriculture NSW 1984; Geddes 1990). The species is omnivorous, eating mainly vegetation, and scavenged fish and other animals.

E. armatus is active throughout the coldest months, from May until October when water temperatures are below 20°C (Geddes 1990).

In lowland rivers such as the Murray and lower Murrumbidgee, the species constructs burrows in the clay river banks for shelter. In the upland rivers with stony beds such as the Tumut, Goobarragandra and upper Murrumbidgee, the species tends to use the interstitial spaces between boulders and cobbles on the river bed for shelter.

DISTRIBUTION

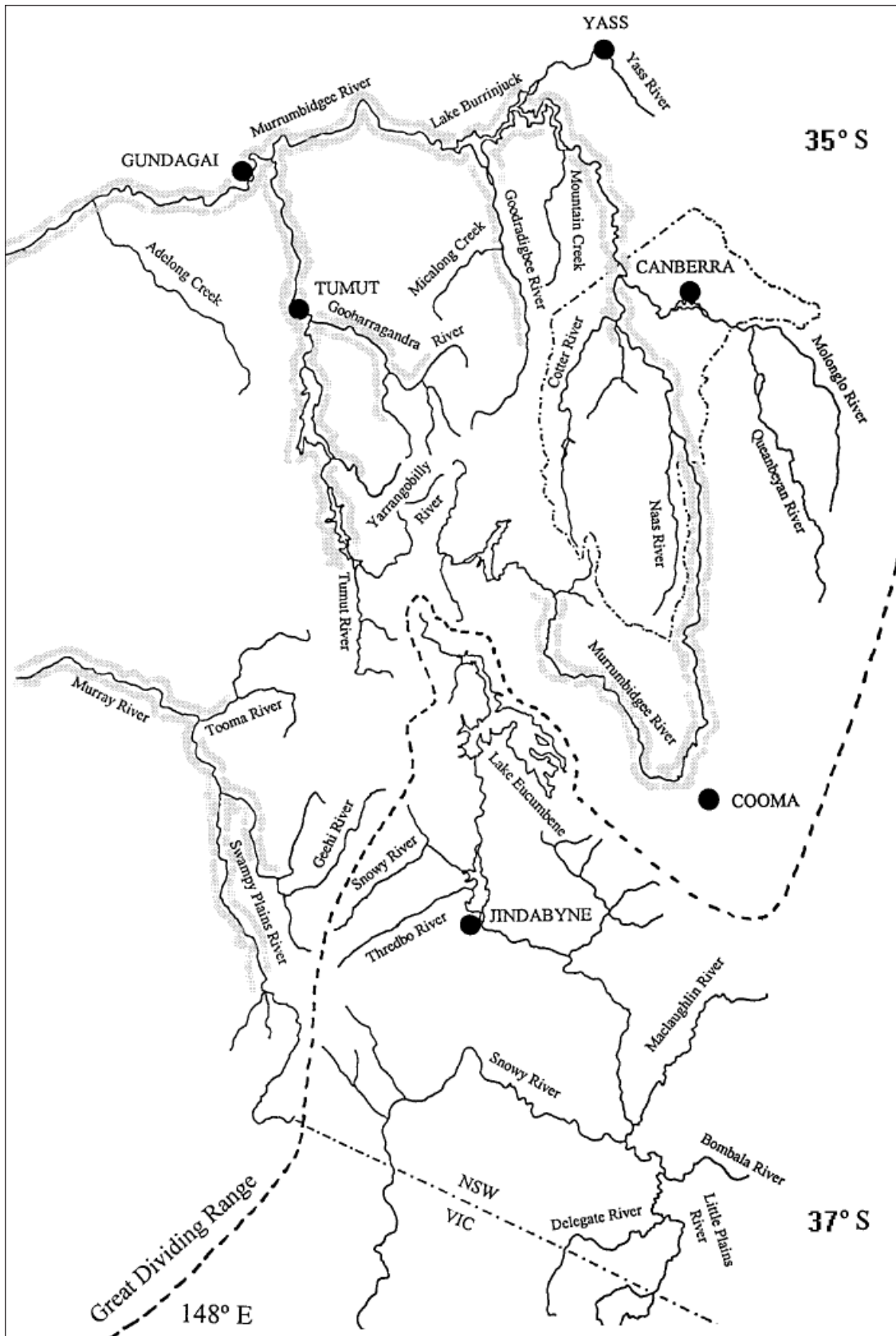
E. armatus has the largest geographic range of any of the spiny crayfish in Australia. While most spiny crayfish are restricted to the cooler, montane streams, the range of *E. armatus* extends into the warmer, lower reaches of the Murray-Darling Basin. Prior to the 1950s, the species was found in the Murray River for most of its length in South Australia and New South Wales, as well as occurring in its major tributaries in Victoria and New South Wales (with the exception of the Darling River). Its range extended over 800 km east-west and approximately 450 km north-south, with the most northerly record of the species near Kandos, 160 km west of Newcastle (Morgan 1986).

Within the ACT, *E. armatus* is mainly found in the Murrumbidgee River (Figure 2). The only other streams in the ACT in which the species has been reported are the Cotter River (Morgan 1986; Hogg 1990) and Paddys River (D. Roso pers. comm.). The report of this species from small montane streams in the ACT (NCDC 1984) is most likely to be an error and probably refers to the closely related *E. crassus*.

E. armatus is still known to occur in the section of the Cotter River below Cotter Dam. A report of the species being caught at Bracks Hole, upstream of Cotter Dam in the mid 1970s (W. Meredith pers. comm.) is unconfirmed and no recent reports are known from this area. Another spiny freshwater crayfish *E. crassus* is known to occur in the Cotter system (Lintermans unpubl. data) and misidentification of the two species by anglers is possible. Morgan (1986) records *E. armatus* from the Cotter River but does not give precise collection locality data.

In recent years in the ACT, it is suspected that *E. armatus* has been illegally translocated by anglers into a number of lakes and ponds. Water bodies in which it is suspected that the species has been introduced include Lake Ginninderra, Lake Burley Griffin, dams at the Canberra racecourse and ponds at Technology Park in Bruce. It is also likely that Murray River Crayfish have been translocated into the Yass River near Sutton in NSW. The origin of stock for most of these translocations appears to be impoundments on the Tumut River, particularly Blowering Reservoir and Jounama Pondage.

In the Canberra region, *E. armatus* is known to inhabit the Tumut and Goobarragandra River systems, with occasional reports from the Goodradigbee River (Morgan 1986; Lintermans unpubl. data). A single newspaper report from 1991 (*Queanbeyan Age* 6 May 1991) records them from the Queanbeyan River. The species was historically present in the Yass River (Bennett 1834), although its current status in this waterway is unknown. The species is also known from Lake Burrinjuck on the Murrumbidgee River downstream from Canberra.



Distribution of Murray River Crayfish

Figure 2: Distribution (1998) of Murray River Crayfish in the ACT Region

Appendix 2.5

Silver Perch (*Bidyanus bidyanus*)

In accordance with section 21 of the *Nature Conservation Act 1980*, the **Silver Perch (*Bidyanus bidyanus*)** was declared an **endangered** species on 4 September 2001 (Instrument No. 192 of 2001). Section 23 of the Act requires the Conservator of Flora and Fauna to prepare an Action Plan in response to each declaration. The Action Plan requirements are incorporated into this *Aquatic Species and Riparian Zone Conservation Strategy*. This supersedes the original Action Plan (ACT Government 2003).

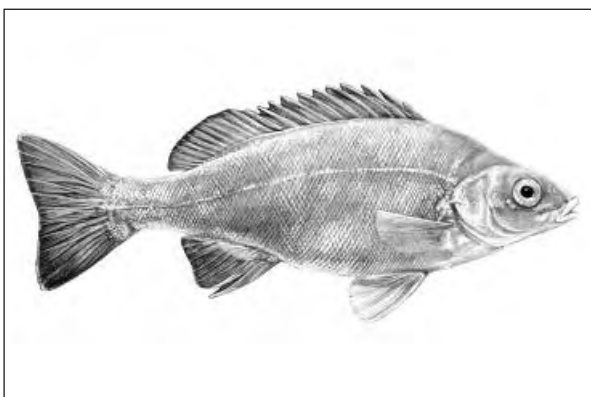


Figure 1: Silver Perch (*Bidyanus bidyanus*)

Conservation Status (ACT) Endangered

Criteria Satisfied (ACT Flora and Fauna Committee 1995)

The species is observed, estimated, inferred or suspected to be at risk of premature extinction in the ACT region in the near future, as demonstrated by:

- Current severe decline in population or distribution from evidence based on:
 - direct observation, including comparison of historical and current records.
 - severe decline in rate of reproduction or recruitment; severe increase in mortality; severe disruption of demographic or social structure.
 - severe decline in quality or quantity of habitat.
 - very high actual or potential levels of exploitation or persecution.
 - severe threats from herbivores, predators, parasites, pathogens or competitors.

SPECIES DESCRIPTION AND ECOLOGY

The Silver Perch *Bidyanus bidyanus* is a member of the family Terapontidae, which contains the freshwater grunters or perches. The family contains a total of about 22 species in eight genera in Australian freshwaters, of which one species, the Silver Perch, is found in the ACT and surrounding area. The majority of terapontids occur in northern Australian streams.

Description

B. bidyanus is a moderate to large fish (maximum length of about 500 mm and a maximum weight of around 8 kg) which commonly reaches 300–400 mm and 0.5–1.5 kg in rivers (Figure 1). The body is elongate and slender in juvenile and immature fish, becoming deeper and compressed in adults. The head is relatively small, jaws are equal in length, and eyes and mouth are small. The scales are thin and small (compared to Macquarie Perch or Golden Perch) and the tail is weakly forked. The lateral line follows the profile of the back. Colour is generally silvery grey to black on the body, with the dorsal, anal, caudal fins also grey. The pelvic fins are whitish (Merrick 1996, Merrick & Schmida 1984).

Habitat

B. bidyanus is found over a broad area of the Murray–Darling Basin and is often found in similar habitats to Murray Cod (*Maccullochella peelii*) and Golden Perch (*Macquaria ambigua*), that is, lowland turbid rivers. There are some reports that suggest that *B. bidyanus* prefers faster, open water, but the general scarcity of information on the habitat preferences of the species makes generalisation difficult. The species is not found in the cool, fast-flowing, upland rivers of the Murray–Darling Basin.

Behaviour and Biology

B. bidyanus is slow-growing and long-lived in rivers, with a greatest age of 17 years recorded from the Murray River and 27 years recorded from Cataract Dam. A 1.4 kg fish could be 17 years old (Mallen-Cooper *et al.* 1995, 1997). Growth rates in dams are much faster with a 2.3 kg fish from Googong Reservoir being approximately 6 years old (M. Lintermans unpublished data).

B. bidyanus matures at 3–5 years and spawn in spring and summer after an upstream migration. They school in large numbers during the upstream migration and research conducted at Torrumbarry Weir demonstrated that large numbers of immature fish were part of this migration (Mallen-Cooper *et al.* 1997).

This species is bred artificially in a number of government and commercial hatcheries and is widely stocked in farm dams and reservoirs, however, it rarely

breeds in impoundments. The species is of considerable interest for its potential as an aquaculture species (Kibria *et al.* 1998).

B. bidyanus is omnivorous, consuming aquatic plants, snails, shrimps and aquatic insect larvae. Reports that the species becomes mainly herbivorous once they reach lengths of 250 mm are incorrect, at least for lake populations, as their diet in Googong Reservoir shows little change with fish size (M. Lintermans unpublished data).

DISTRIBUTION

Formerly widespread over much of the Murray Darling Basin (excluding the cooler upper reaches), the species has declined over most of its range. Numbers of *B. bidyanus* moving through a fishway at Euston Weir on the Murray River have declined by 93% between 1940 and 1990 (Mallen-Cooper 1993). The ACT probably represented the upstream limit of the species distribution in the Murrumbidgee catchment, but it could not be considered as a vagrant because it was a regular component of the recreational fishery.

In the Canberra region the species has been recorded from the Murrumbidgee River where numbers recorded in a fish trap at Casuarina Sands between 1980 and 1991 declined noticeably from the mid-1980s (Lintermans 2000a). Monitoring of the Murrumbidgee fishery in the ACT since 1994 has failed to capture any *B. bidyanus* (Lintermans 1995a, 1997, 1998b). In the last decade there have been a small number of angler reports of *B. bidyanus* from the Murrumbidgee River in the ACT.

Formerly a 'run' of *B. bidyanus* from Lake Burrinjuck migrated upstream to the lower reaches of the Murrumbidgee River in the ACT in spring/summer, but this migration has not been recorded since the late 1970s/early 1980s (Lintermans 2000a). In the ACT, *B. bidyanus* has not been recorded further upstream than Kambah Pool (Lintermans 2000a). There have been occasional angler reports of *B. bidyanus* from the Murrumbidgee River at Bredbo, but these are thought to have originated from releases into local farm dams.

Greenham (1981) reported anecdotal angler records of *B. bidyanus* from the Molonglo River in the 1940s and 1950s but no contemporary records are known from this river (other than stocked fish). There are no records of the species from the Paddys, Naas, or Gudgenby Rivers. There are occasional angler records of *B. bidyanus* from the Queanbeyan River below Googong Reservoir but these fish are assumed to be stocked fish displaced downstream from the reservoir.

In the Canberra region *B. bidyanus* is also known from four other locations. These are:

- a stocked population in Googong Reservoir on the Queanbeyan River;
- a stocked population in the Yass weir pool on the Yass River;
- a stocked population in Lake George; and
- a population of unknown size in Burrinjuck Dam (which is supplemented/maintained by stocking by NSW Fisheries).

B. bidyanus is also regularly stocked into farm dams by landholders in the Canberra region.