ACT PARKS and CONSERVATION SERVICE

ORIENTAL WEATHERLOACH *MISGURNUS ANGUILLICAUDATUS* IN THE COTTER RIVER : A NEW POPULATION IN THE CANBERRA REGION

M. LINTERMANS

TECHNICAL REPORT 4

1993

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SEPTEMBER 1993

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ISSN 1320 1069
ISBN 1 86331 183 1

ACT GOVERNMENT

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ACT Parks and Conservation Service
P. O. Box 1119 Tuggeranong ACT 2901

Printed on recycled paper

Acknowledgements

I thank Darren Roso for providing information on the initial sighting of weatherloach in the Cotter River. Keith Williams provided helpful comments on earlier drafts of this report.

A list of other publications produced by the ACT Parks and Conservation Service appears on page 22.

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ABSTRACT

Following a report of weatherloach from a staff member of the ACT Parks and Conservation Service, a survey of the Cotter and Paddys Rivers was carried out. Sixteen sites were sampled by electrofishing and weatherloach were caught at 10 sites.

Other fish species found in conjunction with weatherloach were rainbow trout, brown trout, carp, mosquitofish, mountain galaxias, goldfish and two-spined blackfish.

The weatherloach population is thought to have become established through their use as bait fish by anglers.

The effects of weatherloach on native fish species is unknown and further research should be encouraged to identify these effects.

INTRODUCTION

On February 1 1992 a report was received from a park ranger that a number of oriental weatherloach *Misgurnus anguillicaudatus* had been found under rocks in the Cotter River, Australian Capital Territory (ACT). A survey of the extent of this population in the Cotter and Paddys Rivers was carried out and is reported below. The occurrence of another population of weatherloach in the ACT has been reported previously (Lintermans *et al.* 1990b).

BACKGROUND

M. anguillicaudatus is a sturdy, elongate, bottom dwelling fish of the Family Cobitidae whose preferred habitat is sand or mud into which it can burrow. In Australia it is popularly kept in aquariums as a 'cleaner' fish.

Weatherloach have established feral populations in a number of countries (see Lintermans *et al.* 1990b)

The status of weatherloach in Australia

Weatherloach were first recorded as a feral population in Australia in 1984 (Allen 1984) when they were found in the Yarra River in Victoria. There are now at least six populations in Victoria with the Yarra river containing weatherloach along almost its full length (T. Raadik pers. comm.) Populations of weatherloach have also established in the Wingecarribee River in New South Wales (Burchmore *et al.* 1990), and in a suburban creek near Brisbane (R. Mckay, pers. comm.).
A number of weatherloach were also collected in 1993 from near Corrowa in the upper Murray River drainage in NSW (W. Bennett pers. comm.). However the extent of this population is unknown.

The status of weatherloach in the Canberra region

Weatherloach were first recorded in the ACT in 1980 when a single individual was recorded from Lake Burley Griffin but no breeding population established. Another isolated individual was collected from Ginninderra Creek in 1984 (Figure 1) and by 1988 this population had expanded to occupy more than 25 km of streams (Lintermans *et al.* 1990a).

In late 1989 a staff member of the ACT Parks and Conservation Service reported dipnetting a weatherloach from Tuggeranong Creek sometime between October 1986 and February 1987. A search of the creek in March 1990 failed to locate any weatherloach (Lintermans 1990). However, a subsequent search of the creek in 1991 located a small population of this species (Rutzou 1991).

In November 1992 a population of weatherloach was found in a small tributary of Lake Eucumbene approximately 75 kilometres southwest of Canberra (P. Angel pers. comm.). Weatherloach have since been found in the stomachs of trout caught by anglers in the lake (B. Pratt pers. comm.).

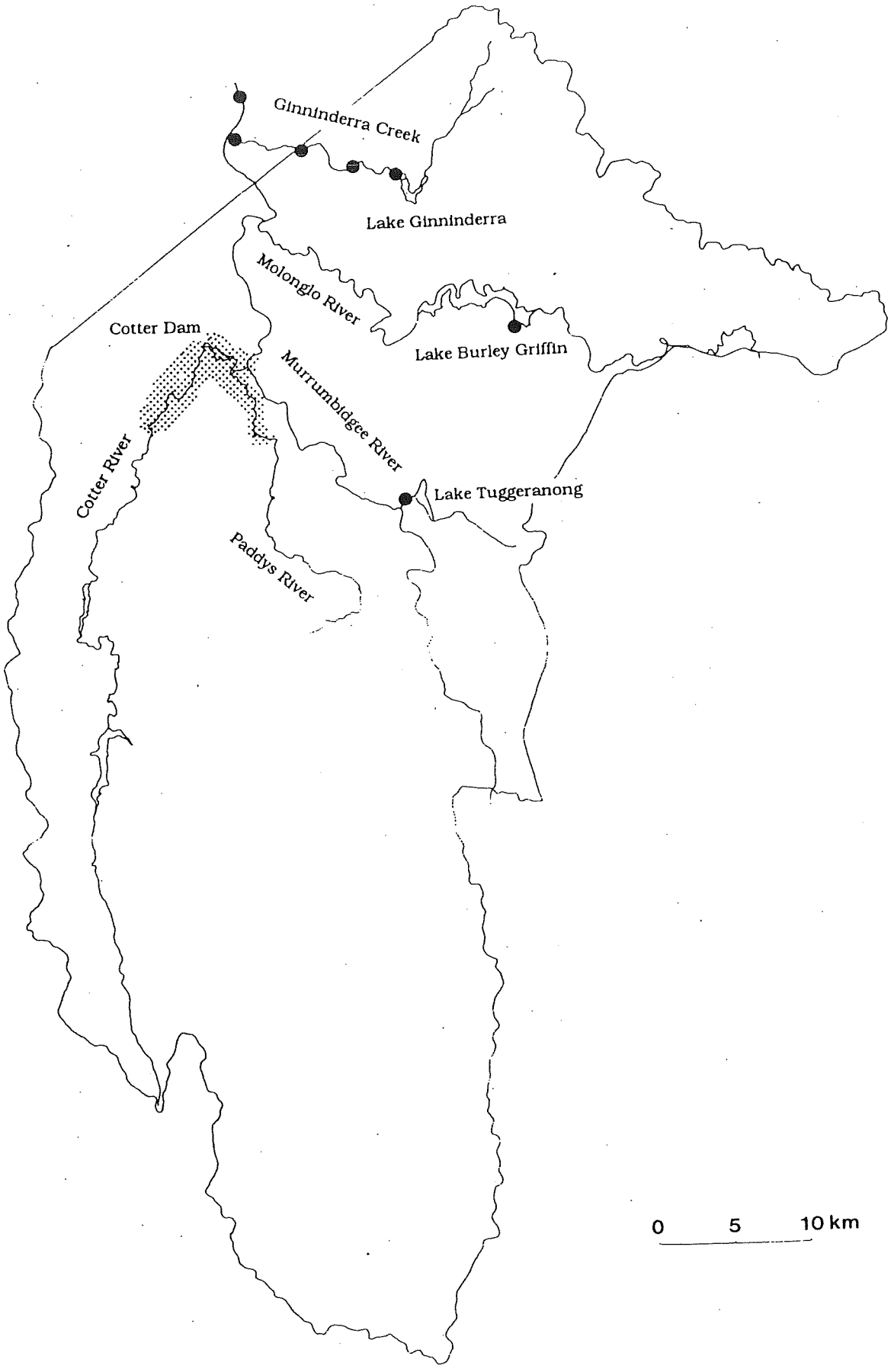

Figure 1. Collection localities of weatherloach from the Canberra region prior to 1992. Stippling shows current study area.

METHODS

A total of 16 sites were sampled between 3 February 1992 and 11 May 1992. Nine sites were sampled on the Cotter River, five on Paddys River, one on the Murrumbidgee River and one on Condor Creek (a tributary of the Cotter River) (Figure 2). All sites were sampled with a Smith-Root backpack electrofisher (Model 12). At the majority of sites where weatherloach were present, all individuals of this species were collected and preserved. At sites 1 and 2, a combined subsample of weatherloach was collected and preserved. Total length was measured to the nearest millimetre for all weatherloach collected. The presence of other fish species at the sampling sites was recorded but no specimens were taken. The physical parameters of each sampling site, such as water depth, stream width, substrate, cover, flow etc. were recorded (Appendix 1).

RESULTS

A total of seven fish species were caught. These were oriental weatherloach, carp *Cyprinus carpio*, mosquitofish *Gambusia holbrooki*, mountain galaxias *Galaxias olidus*, rainbow trout *Oncorhyncus mykiss*, brown trout *Salmo trutta*, two-spined blackfish *Gadopsis bispinosus*, and goldfish *Carassius auratus*. Oriental weatherloach were recorded at 11 sites (Table 1) and were recorded in conjunction with the other six fish species (Table 2).

The highest numbers of weatherloach were recorded at sites 1 and 5, both on the Cotter River. At site 1, more than 50 weatherloach were seen in a stretch of approximately 20 metres of stream, mainly in amongst cobble in the backwater below a weir. At most sites no more than three or four weatherloach were seen in sampling runs ranging from 20 m to 200 m in length.

Weatherloach sampled ranged from 29 mm to 175 mm in length (Figure 3) indicating that a range of age classes was present.

The geographic distribution of weatherloach sampled extended along the Cotter River from its confluence with the Murrumbidgee River to an undetermined point between the Condor Creek confluence and site 7 (Figure 2). The distribution of weatherloach in Paddys River is less clear as a long section of the river between sites 13 and 14 is inaccessible due to the steep terrain. Somewhere between these two sites the upstream distribution point of weatherloach is reached.

The preferred habitat of weatherloach in this survey was for slow flowing or slack water in the main channel or for backwaters on the edge of the stream. Areas where organic material was deposited (indicative of slack water) usually contained weatherloach but weatherloach were also found on pebble and cobble substrates and these were the most common substrates available. At site 13, two individuals were found buried in a sand bar in the middle of the channel but surfaced when the electrofisher was activated. Usually open sandy areas were not preferred by weatherloach.

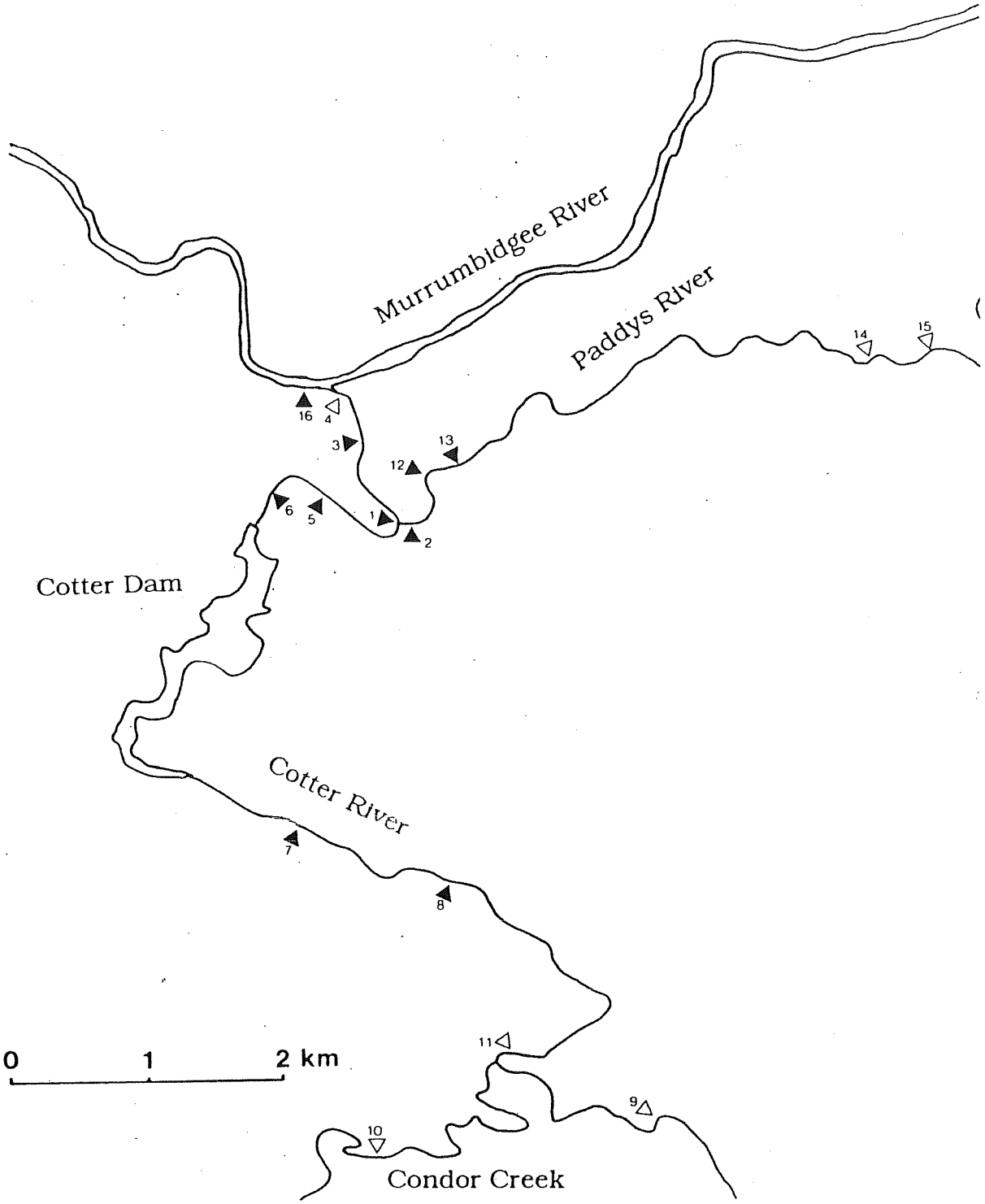

Figure 2. Location of sampling sites in the Cotter and Paddys River system, ACT. Closed symbols indicate where weatherloach were caught, open symbols where weatherloach were not caught.

Table 1. Number of weatherloach caught at each sampling site.

Site No.	Location	Grid Reference	Date sampled	Number of loach caught
1	Cotter River at Paddy's River junction	762 886	03/02/92	23+
2	Paddy's River above Cotter River junction	762 884	03/02/92	3
3	Cotter River at campground	767 888	07/02/92	4
4	Cotter River at Murrumbidgee R. confluence	771 889	07/02/92	0
5	Cotter River above Cotter Hotel	763 891	07/02/92	Numerous
6	Cotter River above "Blue Pool"	764 894	07/02/92	4
7	Cotter River at Bracks Hole	739 895	07/02/92	3
8	Pump house above Bracks Hole	735 884	14/02/92	5
9	Cotter River at Vanity's Crossing	716 867	14/02/92	0
10	Condor Creek at Padovan's crossing	714 888	14/02/92	0
11	Cotter River below Vanity's Crossing	723 878	02/03/92	0
12	Paddy's River at ford	764 884	07/05/92	3
13	Paddy's River above ford	765 882	07/05/92	4
14	Paddy's River below Murrays Corner	773 854	07/05/92	0
15	Paddy's River at Murrays Corner	773 846	07/05/92	0
16	Murrumbidgee River at bridge	772 893	11/05/92	1

Table 2. Fish species other than weatherloach caught at each sampling site.

Site	Loach Present	Other Species Present
1	Yes	Carp, mosquitofish
2	Yes	Carp, mosquitofish
3	Yes	Carp, mosquitofish, mountain galaxias
4	No	Carp, mosquitofish, mountain galaxias, goldfish
5	Yes	Mosquitofish, goldfish, brown trout
6	Yes	Mosquitofish, goldfish
7	Yes	Mosquitofish, brown trout, rainbow trout, two-spined blackfish
8	Yes	Two-spined blackfish
9	No	Rainbow Trout, two-spined blackfish
10	No	Brown trout, rainbow trout
11	No	Rainbow trout, two-spined blackfish
12	Yes	Mountain galaxias, rainbow trout
13	Yes	Brown trout, rainbow trout
14	No	Rainbow trout
15	No	Mountain galaxias, rainbow trout
16	Yes	Mosquitofish

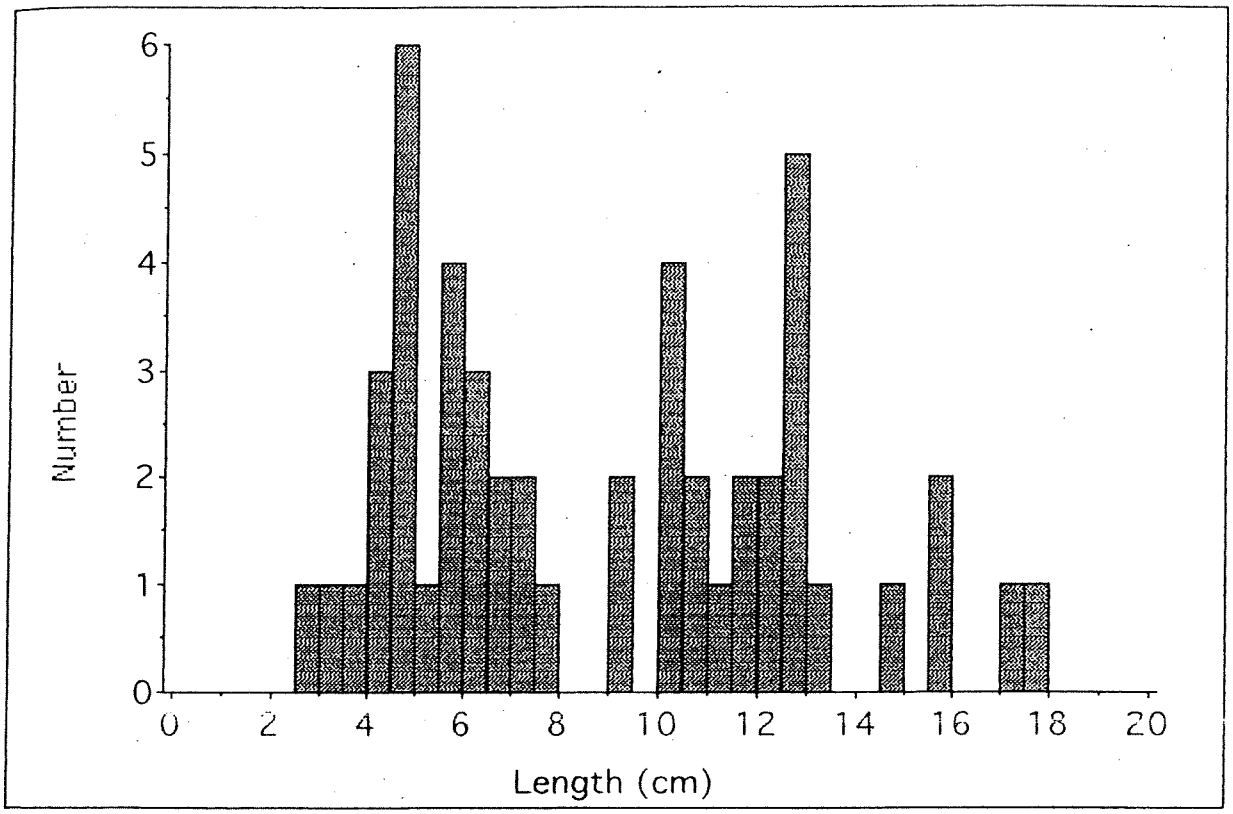

Figure 3. Length frequency of weatherloach collected (all sites combined).

DISCUSSION

This is now the fourth stream system from which weatherloach have been recorded in the ACT. The first record from Lake Burley Griffin in 1980 was an isolated individual as no further specimens have been collected or reported from this water body. All the other stream systems now have self-supporting populations of weatherloach.

The Cotter and Paddys River population is obviously a breeding population as a variety of age categories were collected over a substantial geographic range. The length frequency histogram (Figure 3) shows at least two and possibly three size classes, with peaks at lengths of approximately 50, 100 and 130 millimetres. Weatherloach are reported to be reproductively mature at lengths of approximately 70 mm (Kubota and Matsui 1955), although Sterba (1962) reported weatherloach as being mature at a length of 100 mm long. Lintermans *et al.* (1990b) reported that weatherloach in the Canberra region were sexually mature at between 110 and 120 mm.

The Cotter and Paddys River population occurs both above and below the Cotter Dam with the largest densities occurring below the dam. It is possible the populations above and below the dam represent two separate introductions.

In November 1990 a report was received from an angler that he had caught two rainbow trout at Bracks Hole, both with a single weatherloach in their stomachs. The angler had experience in keeping weatherloach in aquaria and was quite definite that they were not two-spined blackfish. At the time it was assumed that these two weatherloach had been used as bait by other anglers and that the establishment of the species above Cotter Dam was unlikely. The river above the dam is fast flowing with a predominantly boulder/cobble substrate which is quite different to the habitats utilised by weatherloach elsewhere in the ACT (Lintermans *et al.* 1990b).

The use of weatherloach as bait fish was also identified as cause for concern in California (St. Amant and Hoover 1969) although no follow up surveys have been published for this population. Lintermans *et al.* (1990a) also considered that this practice would greatly augment the distribution of the species and it appears likely that this was the mode of introduction in the Cotter River. Bracks Hole is a popular fishing spot and is probably the site of initial release of weatherloach above the dam wall. Weatherloach are easy to collect with a dipnet and are extremely hardy, making transport relatively easy. Their hardy nature and tolerence of a wide range of habitat types would also increase their chances of survival upon release. It is likely that the establishment of weatherloach in Lake Eucumbene is also a result of their use as bait fish.

Below the dam wall weatherloach reach their highest density at the junction of the Cotter and Paddys River (Site 1, Figure 2). The decline in density both upstream and downstream of this site suggests that it is the original release site for the population below the wall. Another possibility is that the habitat at this site is somehow more suitable to weatherloach, thus allowing the species to proliferate at this location. However, the habitat both upstream and downstream appears to be superficially similar. The possibility that the population below the dam originated from downstream displacement of individuals from Bracks Hole is considered unlikely because of the relative scarcity of weatherloach between the dam wall and site 1.

The impacts of weatherloach on native fish species are still unknown although possible impacts have been outlined by Lintermans *et al* (1990b).

Preliminary indications are that weatherloach in the Ginninderra Creek catchment may be excluding mountain galaxias, a native fish species (Lintermans 1991). Mountain galaxias were recorded with weatherloach in the present study but the Cotter River and Ginninderra Creek system are not comparable habitats. The Ginninderra Creek system consists mainly of third and fourth order streams, running through rural or suburban catchments (For a review of stream order classification see Appendix 2.). These streams are generally slow flowing with muddy substrates and are moderately to severely degraded. The Cotter river is a sixth order stream which drains a totally forested catchment and is primarily a moderate to fast flowing, rocky bottomed stream with only minor disturbance and relatively undegraded habitats. The large size and habitat diversity of the Cotter River may allow mountain galaxias to persist in the presence of weatherloach, especially as the preferred habitat for weatherloach of soft bottomed, sluggish water is limited.

The majority of the Cotter River is not ideal habitat for weatherloach (based on current knowledge of weatherloach in the Canberra region) but small sections of river such as the pool above Vanitys Crossing would provide refugia or staging posts once colonised. Paddys River appears more suited to weatherloach because of its lower altitude (slower flows and higher temperatures) and predominantly rural catchment.

The distribution of weatherloach between sites 13 and 14 on Paddys River (Figure 1) is still imprecisely known and should be investigated as soon as possible to allow accurate monitoring of the rate of spread of the species in future years.

CONCLUSIONS

The weatherloach population in the Cotter and Paddys River is well established and is now the third such population in the ACT and the fourth from the Canberra region. Whilst efforts should still be made to educate the public (and in particular anglers) of the potential environmental effects of releasing unwanted exotic fish, it is obvious that this species is now firmly entrenched in our waterways.

RECOMMENDATIONS

(i) Research into the interaction between weatherloach and native fish species should be encouraged.

(ii) A pamphlet aimed primarily at anglers should be produced and distributed through tackle shops, shop-fronts etc. The pamphlet would include a picture of weatherloach and a message not to distribute the species through use as bait, etc.

(iii) The spread of the Cotter and Paddys Rivers weatherloach population should be monitored.

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APPENDIX 1. Descriptions of sites sampled.

Note: (i) All grid references are from map sheet 8627-11-N
(ii) Stream width is not necessarily a measure of the stream area sampled

SITE NO. : 1 SITE NAME : Cotter River at Paddys River junction

GRID REFERENCE : 762 886 ALTITUDE : 470 m

STREAM ORDER : 6 STREAM LENGTH SAMPLED : 50 m

STREAM WIDTH (AVERAGE) : 8-12 m

STREAM DEPTH (CM):
MAXIMUM : 20 MINIMUM : 75 AVERAGE : 25

FLOW VELOCITY : still at weir, medium in channel SHADE (%):35

COVER : Very good, accumulations of *Casuarina cunninghamiana* needles and sticks

SUBSTRATE : cobble/pebble

OVERSTOREY VEGETATION : *Casuarina cunninghamiana*

AQUATIC VEGETATION : Algal mat

SITE NO. : 2 SITE NAME : Paddys River above Cotter River confluence

GRID REFERENCE : 762 884 ALTITUDE : 470 m

STREAM ORDER : 5 STREAM LENGTH SAMPLED : approx 20 m

STREAM WIDTH (AVERAGE) : 11 m

STREAM DEPTH (CM):
MAXIMUM : 60 MINIMUM : 15 AVERAGE : 20

FLOW VELOCITY : slow/medium SHADE (%) : 40

COVER : good, accumulation of *Casuarina cunninghamiana* needles

SUBSTRATE : sand with scattered cobble

OVERSTOREY VEGETATION : *Casuarina cunninghamiana, Acacia dealbata*

AQUATIC VEGETATION : nil

SITE NO. : 3 SITE NAME : Cotter River at campground

GRID REFERENCE : 767 888 ALTITUDE : 470 m

STREAM ORDER : 6 STREAM LENGTH SAMPLED : 30 m

STREAM WIDTH (AVERAGE) : 12 m

STREAM DEPTH (CM):
MAXIMUM : 45 MINIMUM : 15 AVERAGE : 25

FLOW VELOCITY : slow SHADE (%) : 75

COVER : good, some accumulations of *Casuarina cunninghamiana* needles

SUBSTRATE : cobble/pebble with sandy patches

OVERSTOREY VEGETATION : *Casuarina cunninghamiana*

AQUATIC VEGETATION : nil

SITE NO. : 4 SITE NAME : Cotter River at Murrumbidgee confluence

GRID REFERENCE : 771 889 ALTITUDE : 470

STREAM ORDER : 6 STREAM LENGTH SAMPLED : 100 m

STREAM WIDTH (AVERAGE) : 14 m

STREAM DEPTH (CM):
MAXIMUM : 38 MINIMUM : 15 AVERAGE : 22

FLOW VELOCITY : medium SHADE (%) : 15

COVER : good (from substrate)

SUBSTRATE : cobble/rock bar

OVERSTOREY VEGETATION : *Casuarina cunninghamiana*

AQUATIC VEGETATION : nil

SITE NO. : 7 SITE NAME : Cotter River at Bracks Hole

GRID REFERENCE : 739 895 ALTITUDE : 500 m

STREAM ORDER : 6 STREAM LENGTH SAMPLED : 200 m

STREAM WIDTH (AVERAGE) : 14 m

STREAM DEPTH (CM):
MAXIMUM : 50 MINIMUM : 15 AVERAGE : 25

FLOW VELOCITY : fast/medium SHADE (%) : 20

COVER : very good (from substrate)

SUBSTRATE : boulder/cobble/pebble

OVERSTOREY VEGETATION : *Pinus radiata, Acacia melanoxylon*

AQUATIC VEGETATION : nil

SITE NO. : 8 SITE NAME : pump station above Bracks Hole

GRID REFERENCE : 735 884 ALTITUDE : 520

STREAM ORDER : 6 STREAM LENGTH SAMPLED : 40 m

STREAM WIDTH (AVERAGE) : 11 m

STREAM DEPTH (CM):
MAXIMUM : 80 MINIMUM : 25 AVERAGE : 45

FLOW VELOCITY : medium/fast SHADE (%) : 10

COVER : good (from substrate)

SUBSTRATE : boulder/pebble

OVERSTOREY VEGETATION : *Pinus radiata*

AQUATIC VEGETATION : nil

SITE NO. : 5 SITE NAME : Cotter River above Cotter Hotel

GRID REFERENCE : 763 891 ALTITUDE : 470

STREAM ORDER : 6 STREAM LENGTH SAMPLED : 20

STREAM WIDTH (AVERAGE) : 7 m

STREAM DEPTH (CM):
MAXIMUM : 35 MINIMUM : 10 AVERAGE : 22

FLOW VELOCITY : still SHADE (%) : 80

COVER : (very good from substrate and accumulations of *casuarina cunninghamiana* needles)

SUBSTRATE : cobble

OVERSTOREY VEGETATION : *Casuarina cunninghamiana*

AQUATIC VEGETATION : nil

SITE NO. : 6 SITE NAME : Cotter River above 'Blue Pool'

GRID REFERENCE : 764 894 ALTITUDE : 475 m

STREAM ORDER : 6 STREAM LENGTH SAMPLED : 20 m

STREAM WIDTH (AVERAGE) : 10 m

STREAM DEPTH (CM):
MAXIMUM : 65 MINIMUM : 10 AVERAGE : 40

FLOW VELOCITY : still SHADE (%) : 90

COVER : very good, accumulations of *Casuarina cunninghamiana* needles and branches

SUBSTRATE : cobble/sand

OVERSTOREY VEGETATION : *Casuarina cunninghamiana*

AQUATIC VEGETATION : nil

SITE NO. : 9 SITE NAME : Cotter River at Vanitys Crossing

GRID REFERENCE : 716 867 ALTITUDE : 570 m

STREAM ORDER : 6 STREAM LENGTH SAMPLED : 140 m

STREAM WIDTH (AVERAGE) : 13 m

STREAM DEPTH (CM):
MAXIMUM : 100 MINIMUM : 15 AVERAGE : 25

FLOW VELOCITY : slow/still SHADE (%) : 30

COVER : Excellent (from substrate and abundant leaf litter)

SUBSTRATE : cobble/pebble with large sand bar covered in leaf litter

OVERSTOREY VEGETATION : *Eucalyptus spp., Acacia dealbata, Acacia melanoxylon*

AQUATIC VEGETATION : nil

SITE NO. : 10 SITE NAME : Condor Creek at Padovans Crossing

GRID REFERENCE : 714 888 ALTITUDE : 590 m

STREAM ORDER : 5 STREAM LENGTH SAMPLED : 60 m

STREAM WIDTH (AVERAGE) : 5 m

STREAM DEPTH (CM):
MAXIMUM : 100 MINIMUM : 12 AVERAGE : 30

FLOW VELOCITY : slow SHADE (%) : 40

COVER : very good, abundant leaf litter

SUBSTRATE : cobble/pebble

OVERSTOREY VEGETATION : *Pinus radiata, Eucalyptus spp., Acacia melanoxylon*

AQUATIC VEGETATION : algal mat

SITE NO. : 11 SITE NAME : Cotter River (backwater) below Vanitys Crossing

GRID REFERENCE : 723 878 ALTITUDE : 550 m

STREAM ORDER : 6 STREAM LENGTH SAMPLED : 50+ m

STREAM WIDTH (AVERAGE) : 6 m

STREAM DEPTH (CM):
MAXIMUM : 100 MINIMUM : 20 AVERAGE : 50

FLOW VELOCITY : still SHADE (%) : 60

COVER : very good (from substrate and organic deposits)

SUBSTRATE : boulder/cobble overlain with fine layer of silt

OVERSTOREY VEGETATION : *Pinus radiata, Eucalyptus spp., Leptospermum spp.*

AQUATIC VEGETATION : nil

SITE NO. : 12 SITE NAME : Paddys River at ford

GRID REFERENCE : 764 884 ALTITUDE : 470

STREAM ORDER : 5 STREAM LENGTH SAMPLED : 30 m

STREAM WIDTH (AVERAGE) : 11 m

STREAM DEPTH (CM):
MAXIMUM : 80 MINIMUM : 10 AVERAGE : 50

FLOW VELOCITY : still SHADE (%) : 30

COVER : moderate, scattered patches of *Casuarina cunninghamiana* needles and twigs

SUBSTRATE : sand with scattered cobble

OVERSTOREY VEGETATION : *Casuarina cunninghamiana*

AQUATIC VEGETATION : nil

SITE NO. : 13 SITE NAME : Paddys River above ford

GRID REFERENCE : 765 882 ALTITUDE : 470 m

STREAM ORDER : 5 STREAM LENGTH SAMPLED : 30 m

STREAM WIDTH (AVERAGE) : 10 m

STREAM DEPTH (CM):
MAXIMUM : 75 MINIMUM : 15 AVERAGE : 45

FLOW VELOCITY : slow SHADE (%) : 15

COVER : poor

SUBSTRATE : sand with scattered cobble and rock bar

OVERSTOREY VEGETATION : *Casuarina cunninghamiana* and scattered *Salix spp.*

AQUATIC VEGETATION : nil

SITE NO. : 14 SITE NAME : Paddys River below Murrays Corner

GRID REFERENCE : 773 854 ALTITUDE : 525 m

STREAM ORDER : 5 STREAM LENGTH SAMPLED : 40 m

STREAM WIDTH (AVERAGE) : 7 m

STREAM DEPTH (CM):
MAXIMUM : 80 MINIMUM : 30 AVERAGE : 50

FLOW VELOCITY : slow SHADE (%): 60

COVER : good (from substrate)

SUBSTRATE : large pebble with protruding boulders

OVERSTOREY VEGETATION : *Casuarina cunninghamiana*

AQUATIC VEGETATION : nil

SITE NO. : 15 SITE NAME : Paddys River at Murrays Corner

GRID REFERENCE : 773 846 ALTITUDE : 530

STREAM ORDER : 5 STREAM LENGTH SAMPLED : 50 m

STREAM WIDTH (AVERAGE) : 10 m

STREAM DEPTH (CM):
MAXIMUM : 28 MINIMUM : 8 AVERAGE : 15

FLOW VELOCITY : medium SHADE (%) : 60

COVER : good from substrate

SUBSTRATE : cobble/pebble with sand bar on corner

OVERSTOREY VEGETATION : *Casuarina cunninghamiana*

AQUATIC VEGETATION : patches of *Myriophyllum spp.*

SITE NO. : 16 SITE NAME : Murrumbidgee River under bridge

GRID REFERENCE : 772 893 ALTITUDE : 470 m

STREAM ORDER : STREAM LENGTH SAMPLED : 80 m

STREAM WIDTH (AVERAGE) : 25 m

STREAM DEPTH (CM):
MAXIMUM : 50 MINIMUM : 10 AVERAGE : 20

FLOW VELOCITY : slow SHADE : nil

COVER : good (from substrate)

SUBSTRATE : rock bar with cobble/pebble and sandy patches

OVERSTOREY VEGETATION : *Casuarina cunninghamiana*

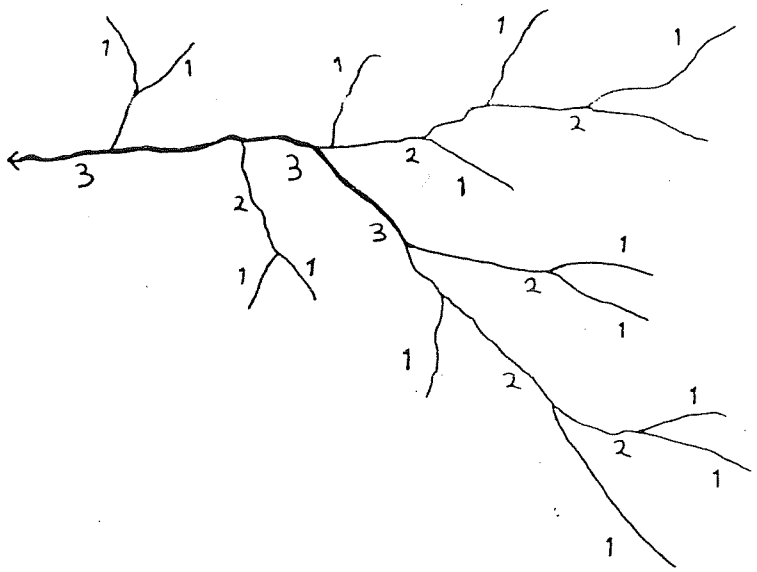
AQUATIC VEGETATION : nil

APPENDIX 2

Explanation of Stream Orders.

Drainage analysis incorporates a classification system for describing streams. Small headwater streams of a river system are called first order streams, and higher orders are allocated wherever streams of equal order join (see below). The entry of low order streams into higher order streams does not affect the classification of the higher order streams.

The allocation of stream orders gives a very broad indication of the size of a stream and enables comparisons to be made between streams in a system.



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