Department of Sustainability and Environment

An investigation into the status of Trout Cod (*Maccullochella macquariensis*) and Macquarie Perch (*Macquaria australasica*) in selected reaches of Seven Creek

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GOULBURN BROKEN CATCHMENT MANAGEMENT AUTHORITY

Victoria The Place To Be

An investigation into the status of Trout Cod (*Maccullochella macquariensis*) and Macquarie Perch (*Macquaria australasica*) in selected reaches of Seven Creek

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Front cover photo: Electrofishing team, Seven Creek (Daniel Stoessel)

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Executive summary

As a consequence of the ongoing drought, and recent trends within monitoring data, concerns have been raised as to the status of a trapped portion of the historically translocated Macquarie Perch and Trout Cod populations below Gooram Falls, within Seven Creek. This survey aimed to further assess the extent and severity of the trend.

In addition the status of both species above Gooram Falls, and the status of a Macquarie Perch above the man-made barrier of Polly McQuinns Weir was determined. Furthermore samples were collected to allow the genetic diversity of the Trout Cod population to be determined, and to assess if the EHN virus was present within the resident Redfin population. In order to address the question as to the occurrence and extent of downstream movement of both species, a PIT tag reader was also reinstated.

The study found that:

- The Macquarie Perch and Trout Cod populations continue to decline below Gooram Falls;
- The condition of Macquarie Perch appeared to decline with distance downstream of Gooram Falls;
- Within the middle reach, between Galls Gap Road and Polly McQuinns Weir, Trout Cod and Macquarie Perch appeared from visual observation to be in good health, and to have extensive deep refuge habitat available;
- Macquarie Perch are likely to be locally extinct above Polly McQuinns Weir;
- Introduced species including Carp, and Redfin in particular, are increasingly dominant in the system;
- Low oxygen levels below Gooram Falls is of concern

Catalogued DNA and EHN samples will be processed within the coming year. Maintenance and data acquisition from the PIT tag system will be ongoing.

1 Introduction

Trout Cod (*Maccullochella macquariensis*) and Macquarie Perch (*Macquaria australasica*), were historically distributed throughout the Murray-Darling River system in the south-eastern region of Australia (Allen et al. 2003; Linterman 2007). The abundance and range of both species has declined over the past 50 years to such an extent that only three self sustaining Trout Cod, and nine Macquarie Perch populations now exist within Victoria. Both species as a result have been identified as species of conservation significance at both state and federal levels (Table 1).

Table 1 State and Federal listing of Trout Cod and Macquarie Perch within Victoria

	Victorian Legislation	Federal Legislation
Trout Cod	○ Threatened under the Flora and Fauna Guarantee Act 1988	○ Endangered under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 ○ Critically endangered by the Australian Society for Fish Biology 2004
Macquarie Perch	○ Threatened under the Flora and Fauna Guarantee Act 1988.	○ Threatened under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 ○ Endangered by the Australian Society of Fish Biology (ASFB)

Historical evidence indicates the geographic range of these species commonly overlapped, now coexistance occurs at only a single site within Seven Creek, a small tributary of the Goulburn River. Both species were historicly translocated to the site in an attempt to increase their distribution, and to decrease the risk of extinction (Cadwallader 1981; Reed 1993).

Previous studies of the reach have noted a decline in the complexity of depth and habitat with distance downstream (Saddlier 2004). As a consequence, questions have been raised as to the suitability of the lower section for the resident population of Trout Cod and Macquarie Perch. Despite significant rehabilitation works conducted in 2002 by the Goulburn Broken Catchment Management Authority (GBCMA) to address these concerns, the ongoing drought and low flows has further exacerbated problems related to the extent of available habitat within the creek.

As a result, surveys of the lower reach, between Galls Gap Road Bridge and Gooram Falls, have been conducted annually since 2007 (Stoessel 2007, 2008). This study was primarily a continuation of these monitoring events. In addition, the survey had several secondary aims, which included:

1. To reconfirm the presence of Macquarie Perch and Trout Cod directly upstream of Gooram Falls;
2. To resurvey for the presence of the Macquarie Perch above Polly McQuinns Weir;
3. Tag suitably sized Trout Cod and Macquarie Perch with Passive Integrated Transponders (PIT), and reinstate the instream PIT reader in an attempt to further investigate the extent of downstream movement of Trout Cod and Macquarie Perch;
4. Obtain biological samples to enable the genetic diversity of the Sevens Creek Macquarie Perch and Trout Cod populations to be established in time, and;
5. Collect samples of Redfin (*Perca fluviatilus*) which will enable an investigation into the presence of Epizootic Haematopoietic Necrosis (EHN), a viral disease which effects native fish, within the system to be assessed.

The survey was funded by the Goulburn Broken Catchment Management Authority.Methods and Materials

1.1 Study area

Seven Creek is located in central Victoria. The headwaters of the stream originate in the Strathbogie Ranges approximately 130 km north/north-east of Melbourne (Figure 1). The creek initially flows south-west through predominately granitic country for 35 km, before heading north/north-west through the township of Euroa to meet with the Goulburn River 5 km upstream of Shepparton (Saddlier and Harrington, 1997). The creeks catchment is 80 km long and covers approximately 1600 square kilometres. The stream is relatively narrow (5-7 m wide), having a rock, gravel and sand substrate, with shallow (0-2 m) pools interspersed by rapids and cascades of up to 4 m in height (Douglas *et al.* 1994, Brown et al. 1998).

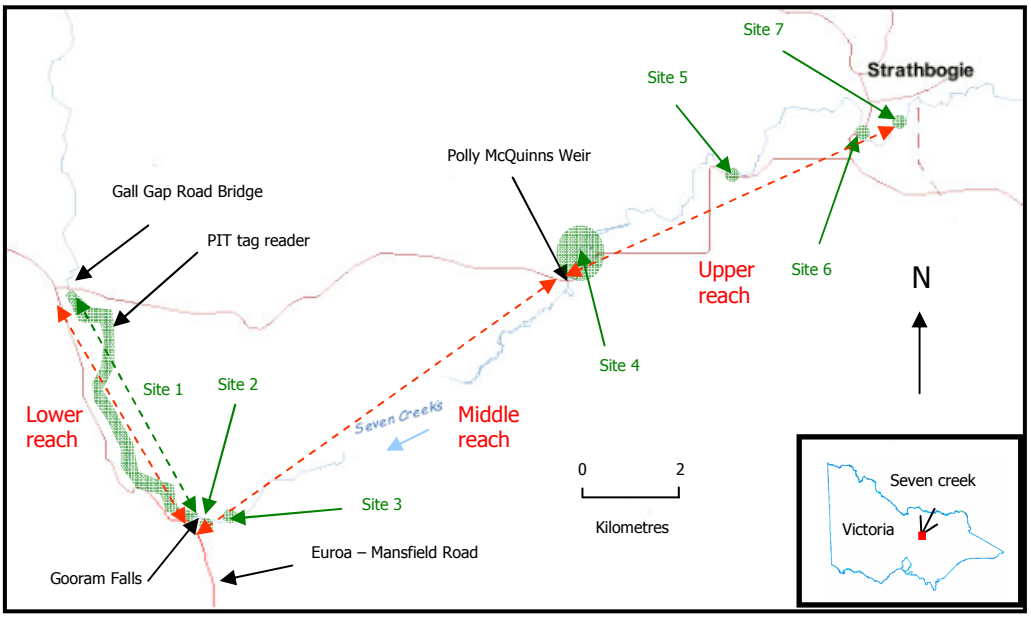

Figure 1 Location of Seven Creek

The stream is divided physically by the natural barrier provided by Gooram Falls. Above this structure the substrate is predominantly rock and boulder based, with high stream velocities and a number of large waterfalls and rock chutes which effectively prevent the upstream movement of fish (Saddlier 2004). Downstream of the falls, however, the stream is characterised by a lower gradient (more characteristic of lowland river systems) and consequently has high levels of deposited coarse sands which are derived from the granite rock upstream (Saddlier 2004).

1.2 Fish survey

Sampling was conducted in three reaches of the stream, between the 7th and the 10th of April 2009 (Figure 1).

1.2.1 Lower reach

The lower reach (site 1) was part of an ongoing annual monitoring program. Fishing was performed in an upstream direction, from Galls Gap Road to Gooram Falls, using a Niwa electrofishing backpack (Figure 1). Captured fish were identified to species, counted, and measured for length (caudal fork length in mm).

1.2.2 Middle reach

Two sites, each 100 m in length, were chosen directly upstream of Gooram Falls from topographic maps prior to field work to reconfirm the presence of Trout Cod and Macquarie Perch within the reach. Site 2 was located 100 m upstream of Gooram Falls and site 3, 500 m upstream (Figure 1,

Table 2). Fishing and subsequent tagging of individuals was conducted as per the monitoring reach (section 2.2.1).

1.2.3 Upper reach

Sites 4 to 7 were surveyed to reconfirm the presence of Macquarie Perch upstream of Polly McQuinns Weir. Historic data from a survey conducted in 1995, which recorded the presence of the species, was sourced from the Victorian Department of Primary Industries (Douglas, unpub.). So as to best target the species and to allow comparison of site data, the sampling method, and the distance fished, where possible, mirrored that of the 1995 survey (Table 2). Captured fish were processed once captured as per section 2.2.1.

Table 2 Site location, distance fished, equipment deployed, and reason for the site inclusion

Stream reach	Site	Site location	Site length (m)	Electrofishing equipment utilised	Pre-existing survey data	Reason for site inclusion
Lower	1	Stream reach between Galls Gap Road Bridge and Gooram Falls	3660	Niwa backpack unit	2007 and 2008	Annual monitoring site
Middle	2	100 m upstream of Gooram Falls	100	Niwa backpack unit	n/a	Reconfirm the presence of Trout Cod and Macquarie Perch upstream of Gooram falls
	3	500 m upstream of Gooram Falls				
Upper	4	Polly McQuinns Weir	1000	Smith-Root® Boat mounted unit	1995	Reconfirm the presence of Macquarie Perch upstream of Polly McQuinns Weir, and collect EHN samples
	5	At Roadside reserve off Polly McQuinns Weir Road	100	Niwa backpack unit		
	6	At bridge on Merton Tames Road				
	7	At bridge on Brookleigh Road				

1.3 Water quality

Electrical conductivity standardized to 25 ºC (µS.cm-1), pH, dissolved oxygen (mg/L), turbidity (NTU) and temperature (ºC) were measured in situ at a depth of 0.2 m below the water surface at the most downstream point of site 1, 4 and 7.

1.4 Collection of biological samples

To ensure the process of DNA collection would not impair individuals, fish less than 100mm in length were excluded from the process. In addition samples of DNA were not taken from any individual identified by the presence of a PIT tag as a recapture, as cataloguing of material from these individuals had occurred over previous years. Of the Trout Cod and Macquarie Perch remaining, approximately 0.5 cm^2 of the caudal fin was removed from each fish, and subsequently placed in an individually numbered vial containing 95% ethanol. These vials were subsequently stored in a freezer, with previous collected DNA from the site.

Redfin were collected for EHN testing from sites 4, 5 and 6 during electrofishing sampling (section 2.3). These were subsequently anesthetised, and frozen whole for future analysis.

1.5 PIT tagging, and reinstatement of reader

Captured Trout Cod and Macquarie Perch were scanned for the presence of a PIT tag. If a tag was detected, the unique identification number and the site or region of capture was recorded, and the fish returned to the water. If a PIT tag was not detected, and the fish was greater than 300mm in length, a tag was injected under the skin on the shoulder region of the fish. The fish was then scanned once again, the new tag identification number recorded, and the fish returned to the water.

As a previous study had utilised PIT technology within Seven Creek (Stoessel, 2007), much of the infrastructure, including aerials and cabling, was present approximately 1 km upstream of Galls Gap Road (Figure 1). Reinstatement of the reader therefore involved minor maintenance of aerials and wiring (Figure 2), and the testing, and subsequent replacement of an industrial personal computer at the site (Figure 3). Once operational, and a PIT tag was within range, the computer recorded the antenna number, PIT tag number, and the date and time of the detection. Data stored on the computer will be downloaded periodically.

Figure 2 PIT tag wiring and aerials present 1km upstream of Galls Gap Road Bridge.

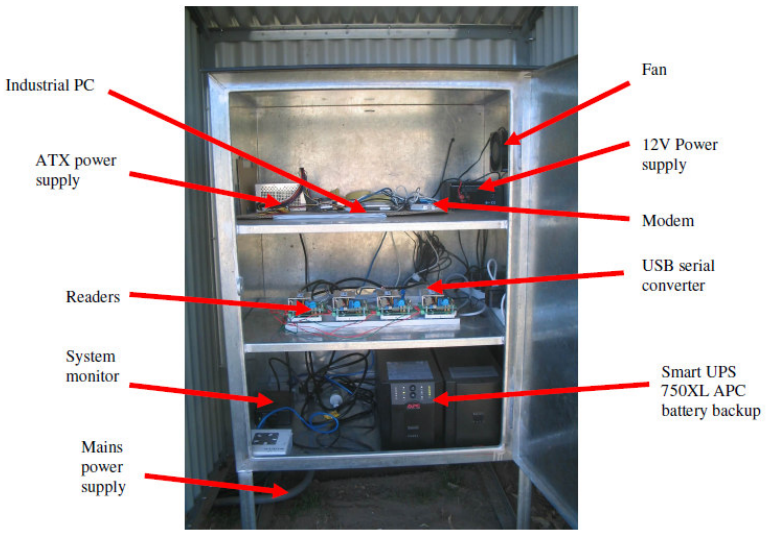

Figure 3 Housed electronic monitoring equipment

2 Results

2.1 Fish survey

In total 347 fish were captured from the three regions and the seven sites fished, 52% (181) of which were native (Table 4). Redfin were the most abundant species captured and/or observed, while Macquarie Perch and Trout Cod were ranked 5th and 7th for commonality (Table 3).

Table 3 Overall numbers captured and observed from all sites

Common name	Scientific name	Number captured	Number observed	Total	Average length (mm)	Length range (mm)
Trout Cod	*Maccullochella macquariensis*	14	5	19	330	62-605
Macquarie Perch	*Macquaria australasica*	15	18	33	289	190-375
Mountain Galaxias	*Galaxias olidus*	46	6	52	75	57-128
Golden Perch	*Macquaria ambigua*	1	0	1	348	n/a
Australian Smelt	*Retropinna semoni*	47	86	133	45	33-65
Southern pygmy Perch	*Nannoperca australis*	55	18	73	46	26-65
River Blackfish	*Gadopsis marmoratus*	3	0	3	161	145-170
Carp*	*Cyprinus carpio*	25	1	26	508	315-680
Redfin*	*Perca fluviatilis*	140	1	141	129	65-397
Brown Trout*	*Salmo trutta*	1	0	1	277	n/a

*alien species

2.1.1 Lower reach

A total of 165 fish were captured at site 1, 115 (70%) of which were native, including seven Trout Cod, 14 Macquarie Perch, 46 Mountain Galaxias, one Golden Perch, and 47 Australian Smelt. The 50 alien freshwater fish captured included 25 Carp and 25 Redfin (Table 4).

Large bodied natives, including Macquarie Perch and Trout Cod, were found to be confined to the upper region of site 1. Field observation suggested that the distribution of Trout Cod in particular was extremely restricted, with the species occurring within only a single pool, located immediately below Gooram Falls (Figure 4). Macquarie Perch captured within the lower to mid section of site 1, commonly had a large number of external parasites (Lernia) present, and were in extremely poor condition. A comparison of data, indicates that virtually all species, excluding Australian Smelt and Redfin, have declined significantly in numbers since previous surveys of the site (Figure 5)

Table 4 Overall numbers, mean length, and length range of fish captured from Galls Gap Rd Bridge to Gooram Falls (site 1)

Common name	Number captured	Number observed	Total	Mean length (mm)	Length range (mm)
Trout Cod	7	3	10	321	62-544
Macquarie Perch	14	3	17	294	190-375
Mountain Galaxias	46	6	52	75	57-128
Golden Perch	1	0	1	348	348
Australian Smelt	47	86	133	45	33-65
Carp*	25	1	26	508	315-680
Redfin*	25	1	26	186	125-330

*alien species

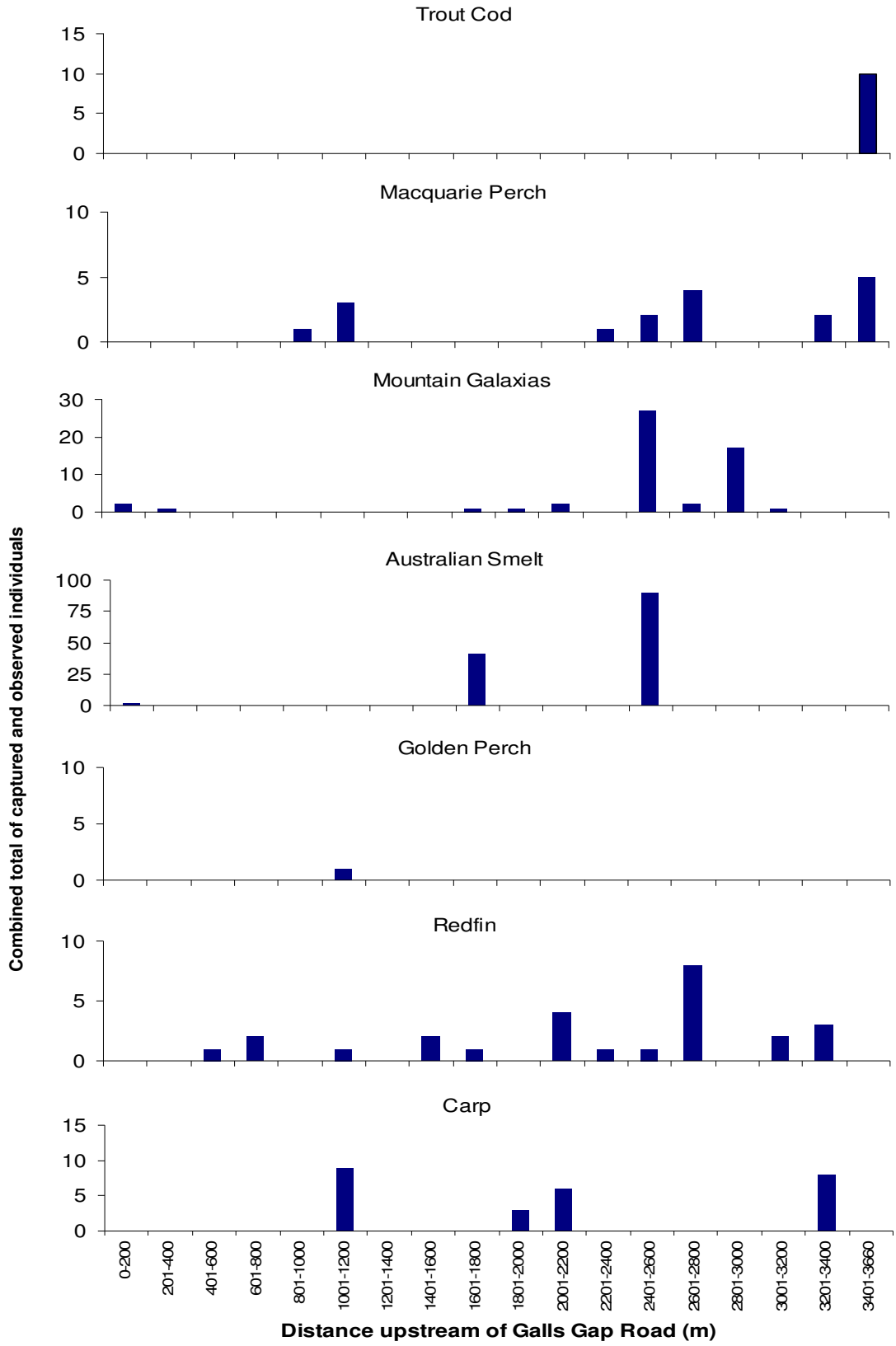

Figure 4 Combined total of captured and observed individuals by species, with distance upstream of Galls Gap Road (site 1)

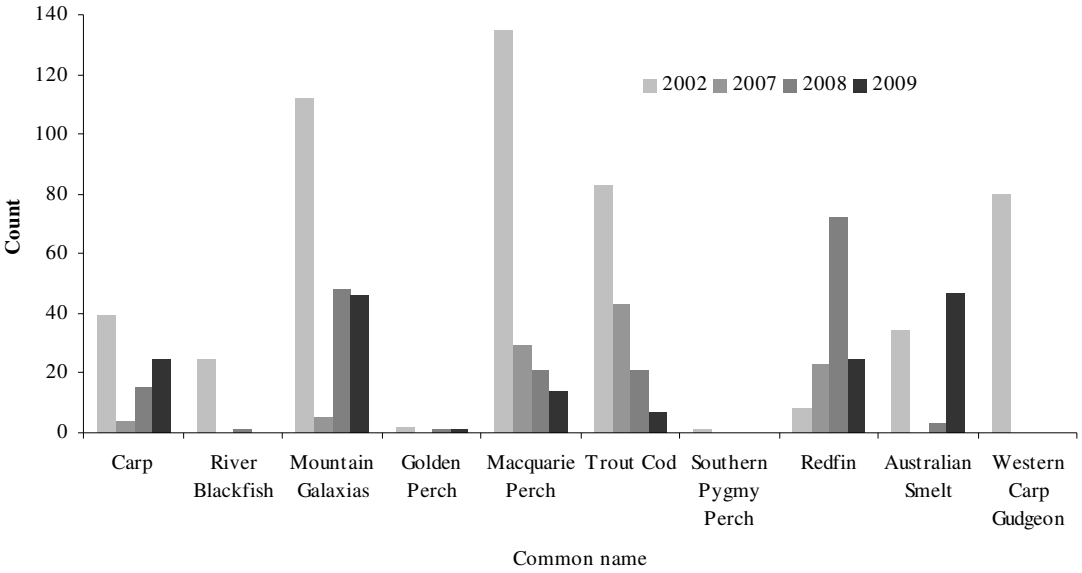

Figure 5 Comparison of site 1 annual capture survey data by species.

2.1.2 Middle reach

A total of seven Trout Cod and one Macquarie Perch were captured within the two sites fished directly above Gooram Falls. No other species were noted from either site during the surveys (Table 5).

Table 5 Overall numbers, mean length, and length range of fish captured directly upstream of Gooram Falls (site 2 and 3)

	Site 2					Site 3				
Common name	**Captured**	**Observed**	**Total**	**mean length (mm)**	**length range (mm)**	**Captured**	**Observed**	**Total**	**mean length (mm)**	**length range (mm)**
Macquarie Perch	0	0	0	n/a	n/a	1	0	1	228	n/a
Trout Cod	5	2	7	327	235-450	2	0	2	368	130-605

2.1.3 Upper reach

In total 174 fish were captured from above Polly McQuinns Weir, 58 (33%) of which were native, including three River Blackfish and 55 Southern pygmy Perch (Table 7). Macquarie Perch and Western carp gudgeon (*Hypseleotris klunzingeri*) were not captured or observed within the upper reach, and it appears likely that Southern Pygmy Perch are no longer present at site 4, 5, and 6 (Figure 6). Alien species, in particular Redfin, dominated the catch in all but the upper most site (site 7). Of the 116 alien freshwater fish, 115 Redfin, and one Brown Trout were collected. The total numbers captured, observed, and the length range and mean length by species is presented in Table 6.

Table 6 Overall numbers, mean length, and length range of fish captured upstream of Polly McQuinns Weir (Sites 4, 5, 6 and 7)

	Site 4					Site 5					Site 6					Site 7				
Common name	**Captured**	**Observed**	**Total**	**Mean length (mm)**	**Length range (mm)**	**Captured**	**Observed**	**Total**	**Mean length (mm)**	**Length range (mm)**	**Captured**	**Observed**	**Total**	**Mean length (mm)**	**Length range (mm)**	**Captured**	**Observed**	**Total**	**Mean length (mm)**	**Length range (mm)**
River Blackfish	0	0	0	n/a	n/a	1	0	1	169	n/a	0	0	0	n/a	n/a	2	0	2	158	145-170
Southern pygmy Perch	0	0	0	n/a	n/a	0	0	0	n/a	n/a	0	0	0	n/a	n/a	55	18	73	46	26-65
Redfin*	49	0	49	137	78-397	10	0	10	151	87-325	56	0	56	94	65-220	0	0	0	n/a	n/a
Brown Trout*	0	0	0	n/a	n/a	0	0	0	n/a	n/a	1	0	1	277	n/a	0	0	0	n/a	n/a

*alien species

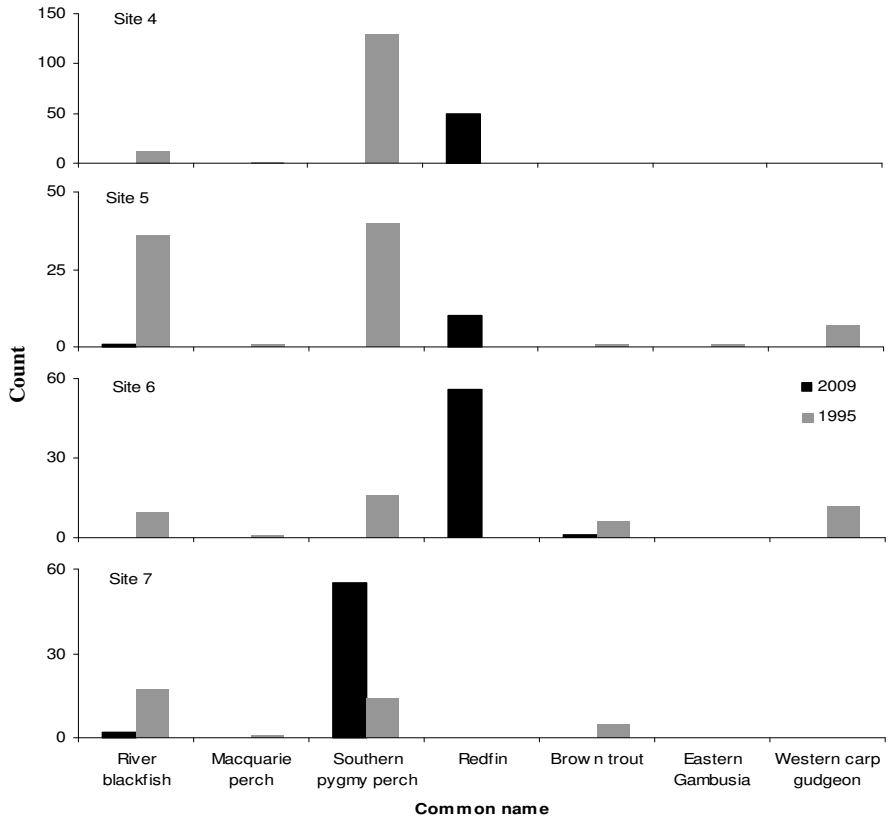

Figure 6 Comparison of site 4, 5, 6, and 7 survey data.

2.2 Water quality

Parameters recorded at the time of the survey indicate that the concentration of dissolved oxygen was comparatively low at the most downstream point of site 1 (Table 7).

Table 7 Water quality parameters

	Electrical conductivity	Dissolved oxygen (mg/L)	Dissolved oxygen (% saturation)	Temperature (ºC)	pH	Turbidity
Site 1	175	5.84	57.2	14.5	7.56	6.6
Site 4	90	9.01	86	12.7	8.05	6
Site 7	87.5	9.78	90	12.5	8.15	12.5

2.3 Collection of biological samples

Finclips for the purpose of DNA analysis were collected from 10 Macquarie Perch, and eight Trout Cod. These samples were subsequently catalogued and added to the store of DNA material previously collected from the site. In addition, a total of 115 Redfin were collected from sites 4, 5, and 6 for future analysis of the presence of the EHN virus.

2.4 Reinstatement of the PIT tag reader

Three Macquarie Perch and five Trout Cod were tagged during the survey. An additional four Macquarie Perch, and three Trout Cod were found to have pre-existing PIT tags present. Once the equipment was operational (22/04/09), testing showed that any tagged fish swimming to within 0.6m of either aerial, or alternatively through them, would be detected.

3 Discussion

Virtually all species, excluding Australian Smelt and Redfin, have declined significantly in abundance since previous surveys of the lower section (Saddlier 2002; Stoessel 2007 & 2008). In particular, Macquarie Perch numbers were noted to have been declined by 87% (118 individuals) since 2002 (Saddlier 2002). In addition, Southern Pygmy Perch *Nannoperca australis*, and Western Carp Gudgeon *Hypseleotris klunzingeri* have not been recorded at the site since this time (Saddlier 2002).

Despite the stream flowing at the time of the study, field observations indicated that the extent of habitat, flow, and depth had declined markedly from previous years within the lower section. Additional reports from a local landholder suggest that the creek had ceased flowing altogether towards the end of the 2008-2009 summer. Likely as a consequence the water quality within the lower reach was extremely poor, with unusually low dissolved oxygen levels recorded.

Reduced oxygen may be tolerated by fish in the short term, however, prolonged exposure has been shown to result in stress, and the eventual death of fish (Burton et al. 1980; Plante et al. 1998). Evidence of such stress was observed, including infestation of external parasites and poor condition in several Macquarie Perch captured within the lower system. It is likely therefore that low flows, reduced oxygen, a decline in habitat and the presence of Redfin within the reach, is responsible for the ongoing decline of Trout Cod and Macquarie Perch downstream of Gooram Falls.

Within the middle reach, captured Trout Cod and Macquarie Perch appeared from visual observation to be in good condition, a result which is thought largely due to the availability of extensive deep refuge habitat, and the lack of Redfin within this reach. As Redfin are however found both upstream and downstream, the arrival of Redfin at the site is inevitable in the near future, the consequences of which are likely to be to the detriment of the resident Macquarie Perch and Trout Cod population within the reach.

Above Polly McQuinns Weir, the recent survey provides good evidence that the introduction of Redfin has resulted in both a significant reduction in the number and diversity of natives. Despite historic evidence of the presence of Macquarie Perch and Western carp gudgeon (*Hypseleotris klunzingeri*) within the region, no fish of either species were captured or observed. In addition, Southern pygmy Perch were not located at site 4, 5, and 6 and it is likely therefore that these species are now locally extinct from the region. Overall, the contraction of distribution and abundance of natives is of considerable concern. If such trends continue the long term future of resident native species within the system will be further jeopardised.

Catalogued DNA and EHN samples will be processed within the coming year. A report on the findings will be written at that time. Although it is likely that the genetic diversity of the population is rather narrow as a consequence of its physical isolation, any proposed immediate stocking of the system to increase the genetic diversity of the Trout Cod population should be undertaken with caution, as the extent of suitable habitat, resources, and water quality within the system is declining.

Maintenance and data acquisition from the PIT tag system will be ongoing. As results at this time are extremely preliminary, and current flows within the system are highly restrictive to fish passage, no conclusions can be drawn. A further report in 2009-2010 will therefore present the findings of the movement of Macquarie Perch and Trout Cod within the system.

4 Conclusions

- The historic Macquarie Perch population above Polly McQuinns Weir likely no longer exists;
- Trout Cod and Macquarie Perch numbers have declined significantly below Gooram Falls;

- Habitat, connectivity and water quality of the system has declined with the ongoing drought and low flows;
- Invasive species (i.e. Carp and Redfin) have become increasingly widespread and dominant in the system; and,
- A decline in native diversity has occurred throughout the stream reach.

5 Future considerations

- It would be beneficial to monitor water quality (particularly dissolved oxygen) in the system within the upcoming summer, and to investigate potential sites suitable for short and long term translocation; and,
- As it appears that the ongoing drought will have increasing implications on water quantity and quality able to be supplied to the system, it would be timely to attempt to establish additional populations elsewhere within the Goulburn catchment where water supply is more assured.

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