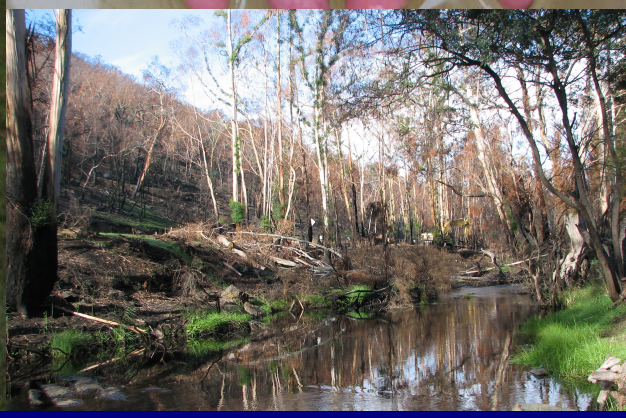
Department of Sustainability and Environment

Population Status of Macquarie Perch, *Macquaria australasica,* in King Parrot Creek, Victoria, in June 2009

R. Ayres

2009



Arthur Rylah Institute for Environmental Research

Confidential Client Report for the Goulburn Broken Catchment Management Authority

Victoria
The Place To Be

Population Status of Macquarie Perch, *Macquaria australasica*, in King Parrot Creek, Victoria, in June 2009

Renae Ayres

Arthur Rylah Institute for Environmental Research
123 Brown Street, Heidelberg, Victoria 3084

June 2009

In partnership with:

Arthur Rylah Institute for Environmental Research
Department of Sustainability and Environment
Heidelberg, Victoria

Report produced by: Arthur Rylah Institute for Environmental Research
Department of Sustainability and Environment
PO Box 137
Heidelberg, Victoria 3084
Phone (03) 9450 8600
Website: www.dse.vic.gov.au/ari

Citation: Ayres, R. (2009). Population status of Macquarie Perch, *Macquaria australasica,* in King Parrot Creek, Victoria, in June 2009. Arthur Rylah Institute for Environmental Research. Confidential Client Report for the Goulburn Broken Catchment Management Authority. Department of Sustainability and Environment, Heidelberg, Victoria.

Front cover photo: (Clockwise) Fyke net set on Calladoon Property, King Parrot Creek; Macquarie perch signage at Draytons Bridge, King Parrot Creek; Macquarie perch collected from King Parrot Creek; Burnt riparian vegetation alongside King Parrot Creek upstream of Flowerdale (R. Ayres).

Authorised by: Victorian Government, Melbourne

Contents

List of tables and figures

List of tables

List of figures

Acknowledgements

This project was funded by the Goulburn Broken Catchment Management Authority and conducted under the Victorian Fisheries permit RP827 and animal ethics permit ARI AEC 07/10.

Local stakeholders, including the Goulburn Broken Catchment Management Authority and the Strath Creek Landcare Group, and local landholders display on-going support and interest in this project and are sincerely thanked for their contributions. Thank you to people who permitted access to site locations via their properties and those who provided historical and anecdotal information on King Parrot Creek.

Joanne Kearns is thanked for providing technical assistance, scientific input and comments on the draft report. Jed Macdonald and Jeremy Hindell are thanked for providing comments on the draft report. Jarod Lyon is acknowledged for managing this project and providing comments on the draft report.

Summary

Macquarie perch is a native freshwater fish, endemic to the midland and upland reaches of the south-east region of the Murray-Darling Basin. The range and abundance of Macquarie perch has declined dramatically over the past century, resulting in fragmented, small and reproductively isolated populations. Macquarie perch is listed as endangered or threatened in Commonwealth, State and Territory legislation. Today, seven Victorian catchments contain populations of Macquarie perch (DSE 2009a); some being natural populations, others are translocated. Several important natural populations of Macquarie perch occur in the Goulburn-Broken catchment, including one remanent population in King Parrot Creek (DSE 2009a).

King Parrot Creek is highly valued by the Goulburn Broken Catchment Management Authority and the local community. Local stakeholders actively undertake activities to rehabilitate and restore degraded sections of King Parrot Creek, which will assist the conservation of this Macquarie perch population. The Goulburn Broken Catchment Management Authority has supported annual surveys of Macquarie perch in King Parrot Creek since 2006.

In February 2009, more than half of the King Parrot Creek catchment was burnt during the 'Black Saturday' bushfires (Kearns 2009). In anticipation that sediment loading may detrimentally impact the Macquarie perch population in King Parrot Creek, 35 individuals were translocated to secure hatchery facilities at Snobs Creek (Kearns 2009). These individuals will be returned to King Parrot Creek when favourable conditions return.

This report documents outcomes of the 2009 assessment of Macquarie perch in King Parrot Creek. Information collected from this assessment builds on information gathered in annual surveys from 2006 to 2008, and provides valuable insight into the impact of the February bushfires on the fish community in King Parrot Creek, particularly the Macquarie perch.

During this survey, 17 Macquarie perch were collected from all five locations along King Parrot Creek. This compares with 16 Macquarie perch collected from the same locations in 2008 and two collected in 2007. Turbidity levels detected at each site had increased compared to past surveys, most likely resulting from sediment loading due to the 'Black Saturday' bushfires. Other water quality parameters remained stable and in an acceptable range. It is likely that King Parrot Creek will be impacted by large increases in sediment loading and flooding for the next 2-3 years until hydrologic function and vegetation recovers (DSE 2009b). Recovery may be delayed further by drought conditions (DSE 2009b).

It is important to continue monitoring the Macquarie perch population in King Parrot Creek to inform management decisions and direct on-ground works. Recommendations relating to future assessments are provided in addition to suggestions of on-ground activities.

1 Background

1.1 Macquarie perch

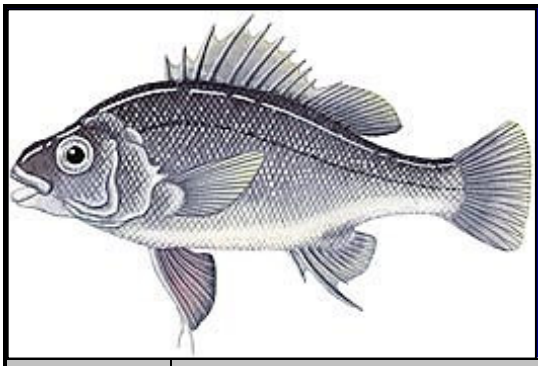
Macquarie perch is a native freshwater fish, endemic to the midland and upland reaches of the south-east region of the Murray-Darling Basin (Victoria, New South Wales, Australian Capital Territory). The biology of Macquarie perch is summarised in Table 1. The range and abundance of Macquarie perch has declined dramatically over the past century, resulting in fragmented, small and reproductively isolated populations. Macquarie perch is listed as endangered or threatened in Commonwealth, State and Territory legislation (Table 1).

Several factors have been attributed to the decline of Macquarie perch populations (ACT Government 1999; NSW DPI 2005; Lintermans 2006; Lintermans 2007; DSE 2009a), including:

- Habitat destruction or modification- e.g. removal of snags, loss of riparian vegetation, channelisation, sedimentation, catchment erosion
- Habitat fragmentation - e.g. in-stream barriers, dams and weirs
- Over-fishing
- Reduced water quality - e.g. sedimentation, thermal water pollution, heavy metal pollution
- Changes to natural flow regimes - e.g. in-stream barriers, dams and weirs, water allocations
- Impact of exotic species - e.g. predation, competition, disease- Epizootic Haematopoietic Necrosis Virus (EHNV)

In Victoria, several authors have reviewed the historical and current distribution or abundance of Macquarie perch and noted declines (Cadwallader and Rogan 1977; Cadwallader 1981; Cadwallader and Backhouse 1983; Winstanley 2000; Douglas *et al.* 2002). These reports reinforce the on-going decline of Macquarie perch populations. Today, seven Victorian catchments contain populations of Macquarie perch (DSE 2009a); some being natural populations, others are translocated. Several important natural populations of Macquarie perch occur in the Goulburn-Broken catchment, including one remanent population in King Parrot Creek (DSE 2009a).

Table 1. Biology and conservation status summary for Macquarie perch. Picture: Fish Victoria (2007), Biological information: Harris and Rowland (1996).

<table>
<tr><td>  </td><td>Species name - Macquaria australasica
Common name - Macquarie perch
Other names - silvereye, white-eye, mountain perch, bream, black bream, macca’s</td></tr>
<tr><td>Biology</td><td>• Naturally a riverine species once found commonly in upper reaches of the Murray Darling Basin
• Size range up to 460 mm and 3.5 kg, but more commonly less than 1.5 kg
• Diet of aquatic insects
• Spawns on rocky substrates mid-Oct to mid-Dec when day length increases and water temperatures rise (above 16 °C)
• May migrate during spawning to access suitable habitat
• Lay demersal eggs in running water over gravel beds and amongst stones (up to 32,000)
• Eggs hatch 13-18 days, depending on water temperature</td></tr>
<tr><td>Conservation status</td><td>Commonwealth:
• Environment Protection and Biodiversity Conservation Act 1999, Endangered
• Endangered (ASFB 1998)
Victoria:
• Flora & Fauna Guarantee Act 1988, Threatened
• Endangered (DSE 2003)
• May not be taken from the wild in Victoria, except from Lake Dartmouth, the Upper Coliban River, and the Yarra River according to Victorian fishing regulations 2006.
New South Wales:
• Fisheries Management Act 1994, Endangered
Australian Capital Territory:
• Nature Conservation Act 1980, Endangered</td></tr>
</table>

1.2 King Parrot Creek

The King Parrot Creek catchment is part of the Murray-Darling Basin, covering an area of approximately 430 km^2 (DSE 2007). King Parrot Creek begins in the Great Dividing Range at Mt Disappointment (elevation 800 m) and flows north to its confluence with the Goulburn River near Kerrisdale (elevation 300 m). Stream flows are highly variable, being lowest in March and highest in September (DSE 2007). King Parrot Creek has several tributaries, including the Strath, Pheasant, Chyser, Wallaby, Silver, Stony and Break O'Day Creeks. This region of Victoria was settled in the mid-1800s and was extensively cleared for agriculture until the late 1950s (Macdonald 2008). Local land-use varies from forested and agricultural land in the upper catchment to open farmland in lowland regions. Agricultural land is most commonly used for grazing, viticulture and hobby farming. Several small townships occur within the King Parrot Creek catchment including King Lake West, Hazeldene, Flowerdale and Strath Creek.

In February 2009, more than half of the King Parrot Creek catchment was burnt during the 'Black Saturday' bushfires (Kearns 2009). It is expected that waterways will endure an initial flush of ash and debris, followed by localised flash flooding, and erosion and sediment transfer into main waterways (DSE 2009b). In anticipation that sediment may detrimentally impact the remnant Macquarie perch population in King Parrot Creek, 35 individuals were translocated to a secure hatchery facility at Snobs Creek (Kearns 2009). These individuals will be released into King Parrot Creek when risk from sediment loading is low. However, it is highly likely that the area will be impacted by large increases in sediment loading and flooding for the next 2-3 years until hydrologic function and vegetation recovers (DSE 2009b). Recovery may be delayed further by drought conditions (DSE 2009b).

King Parrot Creek is highly valued by the Goulburn Broken Catchment Management Authority (GBCMA) and the local community. Local stakeholders actively undertake activities to rehabilitate and restore degraded sections of King Parrot Creek, including willow and blackberry removal, native revegetation of riparian zones, controlling stock access via fencing and off-stream watering to improve natural stream flow. These activities contribute to improving habitat conditions for Macquarie perch in King Parrot Creek and may help ensure its conservation.

1.3 Aim

The primary aim of this project was to assess the current population status of Macquarie perch in King Parrot Creek. Information collected from this fish assessment will build on information gathered in annual surveys from 2006 to 2008, and will provide valuable insight into the impact of the February bushfires on Macquarie perch in King Parrot Creek.

2 Site selection and sampling methods

2.1 Site selection

Surveys of Macquarie perch in King Parrot Creek have occurred previously in April 2006, October 2007 (Macdonald 2008) and April 2008 (Kearns 2008) at four identical locations. The sites were selected based on access, the presence of adequate habitat and sufficient water flow and permanency (Macdonald 2008).

Following the 'Black Saturday' bushfires in the upper catchment of King Parrot Creek, Macquarie perch were translocated from King Parrot Creek to a holding facility at Snobs Creek (Kearns 2009). Thirty-five Macquarie perch were captured in a reach spanning 100 m downstream of Burslems Bridge to 1.5 km upstream into Calladoon Property (Kearns 2009).

The June 2009 survey of Macquarie perch in King Parrot Creek included the four sites assessed annually by Macdonald (2008) and Kearns (2008), as well as 900 m of the reach Kearns (2009) sampled in the translocation program, hereafter called Calladoon Property (Table 2; Figure 1).

Water quality attributes were measured in King Parrot Creek at three extra sites all located upstream of Flowerdale (Table 2; Figure 1). These sites were situated in areas affected by the Black Saturday bushfires and were easily accessible.

Table 2. The location of sites surveyed along King Parrot Creek in 2009. # Denotes locations where only water quality was assessed.

Site	Location	Easting	Northing	Gear type	Date sampled
01	Draytons Bridge on Fairview Rd off King Parrot Creek Rd	344759	5884284	Fyke nets	02/06/2009 - 03/06/2009
				Backpack electrofishing	05/06/2009
02	Moore Rd off of King Parrot Creek Rd (access through Flowerdale), site downstream of Flowerdale, small dirt parking area to one side of road.	348077	5868895	Fyke nets	02/06/2009 - 03/06/2009
				Backpack electrofishing	05/06/2009
03	Richards Bridge on King Parrot Creek Rd near junction with Kerrisdale Rd.	344592	5883617	Fyke nets	01/06/2009 - 02/06/2009
				Backpack electrofishing	05/06/2009
04	Burslems Bridge between King Parrot Ck Rd and Upper King Parrot Ck Rd, just upstream of Strath Creek	343436	5876810	Fyke nets	03/06/2009 - 04/06/2009
				Backpack electrofishing	04/06/2009
05	Calladoon Property, 1.5 km upstream of Draytons Bridge, behind workers' residence on Calladoon Property	343700	5876900	Fyke nets	03/06/2009 - 04/06/2009
				Backpack electrofishing	04/06/2009
06#	King Parrot Creek opposite number 2914 Whittlesea-Yea Rd	348392	5864487		05/06/2009
07#	King Parrot Creek adjacent to Hazeldene General Store	348427	5865458		05/06/2009
08#	Pedestrian bridge off Whittlesea-Yea Rd	348245	5866716		05/06/2009

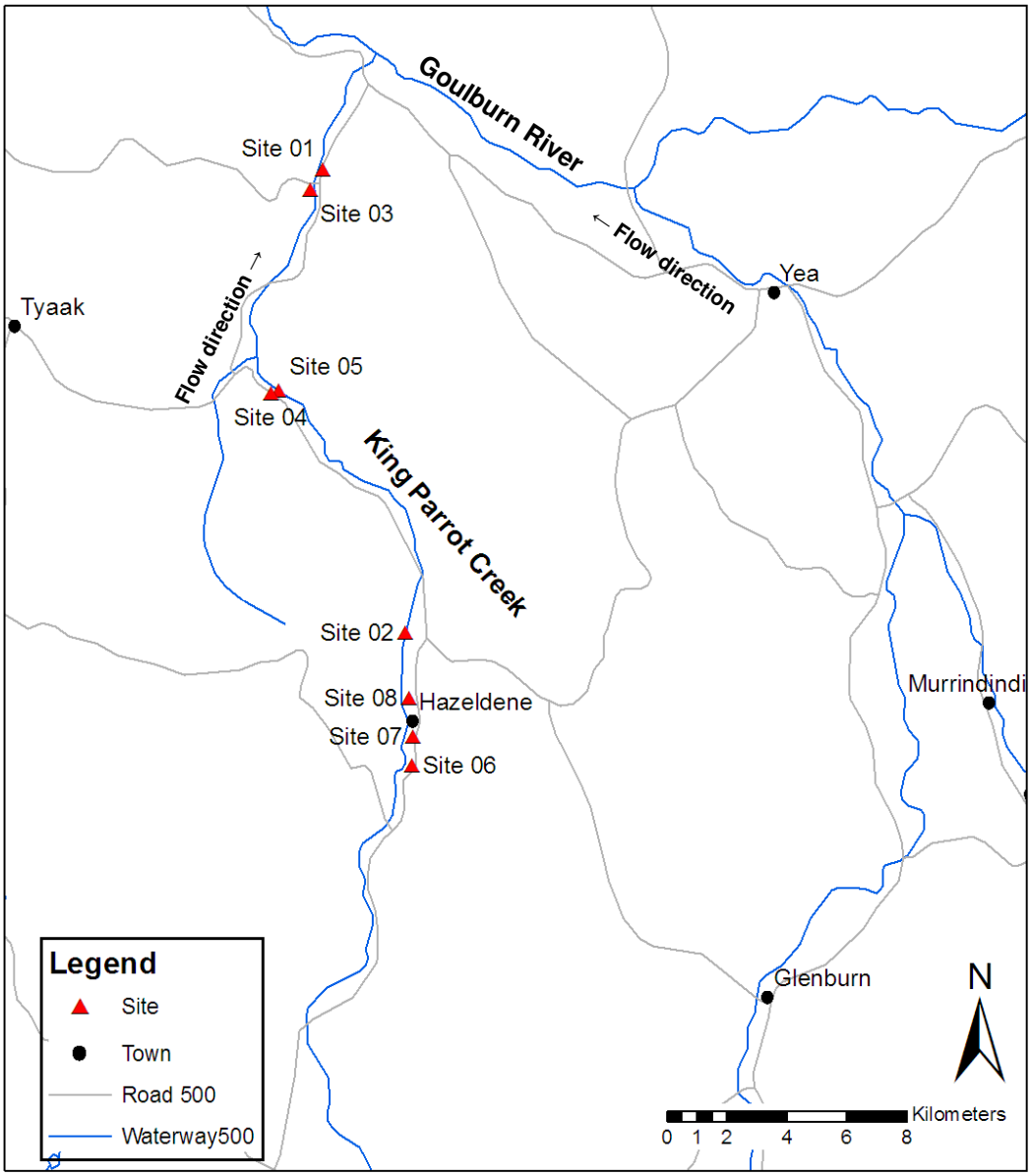


Figure 1. Location of study sites within King Parrot Creek.

2.2 Sampling methods

The sampling methods applied here were consistent with those used by Macdonald (2008) and Kearns (2008). Briefly, fish were surveyed using fyke netting and electrofishing, water quality parameters (conductivity, temperature, dissolved oxygen, turbidity, pH) were measured, and various site and habitat characteristics were recorded.

2.2.1 Fish survey methods

As in Kearns (2008), the fish survey in June 2009 used both fyke netting and backpack electrofishing to catch fish. Only Burslems Bridge, Richards Bridge, Moore Road, Draytons Bridge and Calladoon property were surveyed for fish.

Fyke netting

Ten single-wing fyke nets (5mm mesh size) were set at each site in various habitats, including deep pools and riffle/run sequences. Fyke nets were set across the channel width at 45° angles to the bank, with the cod-end positioned upstream. Consecutive fyke nets were generally set from alternating banks. Floats were used at the cod-end of each fyke net to reduce the risk of drowning any captured mammals and ensure they would be safely held until release. Fyke nets were set late in the afternoon and collected the following morning, with an approximate soak time of 18 hours. Nets were set earlier than in previous annual surveys due to the shorter daylight hours in June, thus the approximate soak time was about five hours longer than in past annual surveys.

Electrofishing

Electrofishing was conducted using a Smith Root® model 12B backpack electrofisher (300 volts & 60 Hertz) following the Sustainable Rivers Audit standard protocol (MDBC 2007). The operator fished in an upstream direction, fishing all accessible habitats, with an assistant following the operator to collect all stunned fish.

2.2.2 Site information

Photographs were taken of each site, including key habitat areas where Macquarie perch were captured.

The following data were recorded at each site:

- Site name and location (GPS coordinates taken at site entry or access point)
- Sample date
- Prevailing weather conditions
- Water quality - conductivity, temperature, dissolved oxygen, pH and turbidity
- Substrate description - bedrock, boulder, cobble, pebble, gravel, sand and silt or clay
- Average water depth and channel width
- Bank structure - undercut, eroded, rocky ledge
- Percent of emergent and submerged vegetation
- Percent of woody debris or snags
- Surrounding land use
- Local and point source pollutants
- Riparian vegetation characteristics

2.3 Data collection and analysis

All fish captured during the 2009 survey were individually identified and examined prior to release. Data collected for each fish included:

- Species
- Fork length (mm) or total length (mm), as appropriate.
- Weight (g) (Macquarie perch only)
- Condition (parasites, lesions, body colour, fin damage)
- Habitat associations at location of capture

Pressure was gently applied in a downward motion to the anal area of brown trout and rainbow trout individuals collected to check their reproductive condition, i.e. whether they were running ripe males or gravid females.

Sterilised surgical scissors were used to cut a small fin clip (~4 mm) from the tip of the caudal fin of each Macquarie perch collected for future genetic analysis. Labelled individual fin clips were preserved in 100% ethanol and later stored at -20°C. Genetic analysis can provide important information on, for example, genetic integrity, population structure and migration, which may aid conservation efforts of Macquarie perch.

Information on the species captured during the June 2009 survey was collated and summarised to describe species diversity and abundance at each site. Data presented has not been adjusted by time spent fishing, e.g. net soak time. A length-frequency histogram was created for Macquarie perch to describe the size structure of the population. Results were compared to those of past annual surveys (Macdonald 2008; Kearns 2008).

3 Results

3.1 Site descriptions

Site 01 – Draytons Bridge

Figure 2. Site 01 Draytons Bridge: view looking upstream from downstream of Draytons Bridge (top left); deep pools where Macquarie perch were captured (top right); dense stands of blackberries choking the creekline (bottom right).

Water quality	Conductivity (µs/cm)	Temperature (°C)	Dissolved oxygen (mg/L)	pH	Turbidity (NTU)
	166.3	11.6	87.9	6.93	7.8
Site description	The site was approximately 1200 m long and consisted of several pools connected by riffles and runs. The average wetted width was 8 m. Maximum water depth was greater than 2 m and average water depth was approximately 1 m. The reach contained frequent areas of large woody debris and diverse substrate of bedrock, boulders, cobbles and silt. There were heavy loads of sediment covering substrate which rapidly settled following disturbance. Riparian vegetation contained well developed native trees with dense understorey of blackberries. Surrounding land use consisted of grazing farmland.				

Site 02 – Moore Rd

Figure 3. Site 02 Moore Road: fyke net 1 (cod end right of image) and fyke net 2 (cod end left of image) set in large pool (top left); view from bottom of large pool area extending ~200 m upstream (top right); channel habitat and burnt riparian vegetation (bottom left).

Water quality	**Conductivity (µs/cm)**	**Temperature (℃)**	**Dissolved oxygen (mg/L)**	**pH**	**Turbidity (NTU)**
	139.9	11.5	9.3	7.73	11.1
Site description	The site reach was approximately 900 m long and consisted of one large main pool followed by a riffle, a deep channel and a series of shallower pools separated by riffles and runs. The average wetted width was 10 m. Maximum water depth was greater than 2 m and average depth was approximately 1.4 m. The site contained good complexity of in-stream habitat, with few areas of emergent vegetation and woody debris. Substrate was generally bedrock and silt in pool areas and cobbles and boulders in riffles. There were heavy loads of sediment covering the substrate which rapidly settled following disturbance. Riparian vegetation predominately contained exotic willows and dense stands of blackberries. Some areas of riparian vegetation had been affected by bushfire. Surrounding land use consisted of grazing farmland.				

Site 03 - Richards Bridge

Figure 4. Site 03 Richards Bridge: downstream of Richards Bridge looking upstream (top left); deep pool and large woody debris habitat (top right); dense stands of blackberries bordering riffle and pool habitat (bottom left).

Water quality	Conductivity (µs/cm)	Temperature (°C)	Dissolved oxygen (mg/L)	pH	Turbidity (NTU)
	168.4	11.9	7.00	6.66	14.5
Site description	The site reach covered approximately 1000 m downstream of Richards Bridge and consisted of five large pools connected by riffles and runs. The average wetted width was 15 m. Maximum water depth was greater 2 m and average water depth was approximately 1 m. Surrounding land use was farmland. The substrate consisted mainly of gravel and silt in pools and cobbles and boulders in riffles. There were heavy loads of sediment covering substrate which rapidly settled following disturbance. The site was bounded by farmland, tall native trees and understorey of patches of blackberries.				

Site 04 - Burslems Bridge

Figure 5. Site 04 Burslems Bridge: fyke net 1 (cod end right of image) and fyke net 2 (cod end left of image) set just upstream of Burslems Bridge (top left); pool habitat immediately below a riffle where two Macquarie perch were captured in a fyke net (top right); pool habitat shaded by willows (bottom left).

Water quality	Conductivity (µs/cm)	Temperature (℃)	Dissolved oxygen (mg/L)	pH	Turbidity (NTU)
	152.5	13.6	11.4	7.81	11.2
Site description	The site reach was approximately 1000 m, consisting of several deep pools connected by riffles and runs. The site was sampled approximately 100 m upstream and 900 m downstream of Burslems bridge. The average wetted width was 8 m. Maximum depth was greater than 2 m and average depth was approximately 1.4 m. The site contained occasional areas of woody debris. Riparian vegetation, predominately large willows, wattles and blackberries, shaded the aquatic habitat. Revegetation of the riparian zone was evident. The substrate was generally bedrock and silt in the pools with cobbles and boulders in riffles.				

Site 05 – Calladoon Property

Figure 6. Site 05 Calladoon Property: deep pools (left) and riffle/run habitat (right) at Calladoon Ppoperty. Both images display revegetated riparian habitat.

Water quality	Conductivity (µs/cm)	Temperature (°C)	Dissolved oxygen (mg/L)	pH	Turbidity (NTU)
	158.61	13.3	8.47	7.92	10.5
Site description	The site reach was approximately 900 m and started 1.5 km upstream of Burslems Bridge behind the workers residence on Calladoon Property. The site consisted of several deep pools connected by riffles and runs. The average wetted width was 8 m. Maximum depth was greater than 2 m and average depth was approximately 1.2 m. Habitat complexity at the site was good, consisting of frequent woody debris, emergent vegetation and various substrates, including bedrock, boulders, cobbles, pebbles and silt. There were heavy loads of sediment covering the substrate which rapidly settled following disturbance. High nutrient levels were evident by masses of green algae in the water column. Revegetation of the riparian zone was evident. This site has undergone extensive native revegetation and weed removal. Calladoon Property is mainly farmland, however areas along the creekline are managed to protect and enhance King Parrot Creek.				

Site 06 – King Parrot Creek opposite number 2914 Whittlesea-Yea Road

Figure 7. Site 06 King Parrot Creek opposite number 2914 Whittlesea-Yea Road: upstream (left) and downstream (right) views displaying burnt riparian vegetation.

Water quality	Conductivity (µs/cm)	Temperature (℃)	Dissolved oxygen (mg/L)	pH	Turbidity (NTU)
	139.9	10.9	10.86	6.99	6.00
Site description	The site was bordered by farmland and previously forested land that was severely impacted by bushfire. Significant works had been undertaken in riparian areas to remove unstable burnt vegetation. Banks consisted mainly of bare mineral earth. The site consisted of long pools and riffles. Wetted width was approximately 10 m. Substrate was a mixture of large bedrock, boulders and cobbles covered by silt and sediment.				

Site 07 – King Parrot Creek adjacent to Hazeldene General Store

Figure 8. Site 07 King Parrot Creek adjacent to Hazeldene General Store: upstream (left) and downstream (right) of bridge to Whittlesea-Yea Road.

Water quality	Conductivity (µs/cm)	Temperature (℃)	Dissolved oxygen (mg/L)	pH	Turbidity (NTU)
	122.4	11.0	11.37	7.04	8.6
Site description	Water quality was assessed adjacent to Hazeldene General Store upstream of the bridge connecting to Whittlesea-Yea Road. The site was bordered by Hazeldene General Store and residential area, and the Whittlesea-Yea Road. Forest on the adjacent hillside to the creek line had been significantly burnt by the Black Saturday bushfires and works were being undertaken on the banks to remove unstable burnt vegetation. The site consisted of a series of pools and riffles/runs. Wetted width was approximately 12 m but narrowed downstream of the bridge. Substrate was a mixture of large bedrock, boulders and cobbles.				

Site 08 – Pedestrian bridge off Whittlesea-Yea Road

Figure 9. Site 08 Pedestrian bridge off Whittlesea-Yea Road: looking upstream (left) and downstream (right) from the pedestrian bridge.

Water quality	Conductivity (µs/cm)	Temperature (°C)	Dissolved oxygen (mg/L)	pH	Turbidity (NTU)
	139.3	10.8	8.50	7.00	11.5
Site description	Water quality was assessed in a pool just upstream of the pedestrian bridge. The adjacent land use to the site was farmland and the Whittlesea-Yea Road. Upstream riparian vegetation was significantly impacted by bushfires. Approximate wetted width was 8 m but narrowed further downstream. Substrate consisted mainly of cobbles covered by large amounts of silt, particularly accumulating in still water areas. Large shallow pools occurred upstream and connected to riffles downstream.				

3.2 Fish diversity and abundance in King Parrot Creek

A total of 128 fish representing four native and three exotic species were collected during the survey, plus seven yabbies and four platypus (Table 3). The greatest abundances of fish were captured at Richards Bridge (42) and Moore Road (41), respectively. While a large number of fish were collected at Moore Road, the species richness was low (3). Richards Bridge and Calladoon Property had the highest diversity of fish species; six were recorded at each location. Draytons Bridge had the lowest abundance and diversity of fish collected with two individuals representing two species.

Brown trout was the most abundant species collected, followed by Macquarie perch, river blackfish and rainbow trout (Table 3). Seventeen Macquarie perch were collected from all sites; they were most abundant at Richards Bridge and Burslems Bridge, respectively. Exotic brown trout occurred at four locations and were most abundant at Moore Road and Richards Bridge respectively. River blackfish and rainbow trout occurred at three sites, and were most abundant at Calladoon Property. Of the 89 brown tout and rainbow trout collected, 18 were running ripe males and 3 were gravid females (Figure 10).

Fyke netting collected 72 fish, whilst 58 fish were collected via electrofishing. Brown trout were the most abundant species collected using either gear type, but were more frequently collected when electrofishing. Fyke netting was more effective at collecting Macquarie perch than electrofishing. The two Macquarie perch collected via electrofishing, one each at Calladoon Property and Burselms Bridge were recaptured from fyke netting samples cleared earlier that day. They were discernable by the fin clip and identical length and weight measurements. These two Macquarie perch were removed from total fish counts.

Figure 10. A female brown trout collected at Richards Bridge. The black arrow indicates excreted eggs visible on the measuring board near the base of the caudal peduncle.

Table 3. Total number of individuals captured per species and per site in King Parrot Creek in June 2009. * Denotes Non-native/exotic species. # Denotes Macquarie perch recaptures- deducted from totals.

SITE		01- Draytons Bridge	02- Moore Road	03- Richards Bridge	04- Burslems Bridge	05- Calladoon Property	TOTAL per species	TOTAL per gear type	
Common name	**Species name**							**Fyke**	**EF/BP**
Macquarie perch	*Macquaria australasica*	1	2	6	5	3	17	17	2#
River blackfish	*Gadopsis marmoratus*	0	0	1	1	7	9	7	2
Two-spined blackfish	*Gadopsis bispinosus*	0	4	0	0	0	4	4	0
Flathead gudgeon	*Philypnodon grandiceps*	0	0	3	0	1	4	0	4
Brown trout*	*Salmo trutta*	0	35	27	12	6	80	37	43
Rainbow trout*	*Oncorhynchus mykiss*	0	0	3	2	4	9	3	6
Redfin perch*	*Perca fluviatilis*	1	0	2	1	1	5	4	1
Common yabby	*Cherax destructor*	4	0	3	0	0	7	0	7
Platypus	*Ornithorhynchus anatinus*	2	1	0	1	0	4	4	0
TOTAL per site		8	42	45	23	23	**141**	76	65
TOTAL per gear type									
Fyke		4	26	22	17	16	85		
EF/BP		4	16	23	6	7	56		

3.2.1 Comparison with 2006, 2007 and 2008 survey results

The overall number of fish collected in 2009 was less than that collected in 2008, but greater than that collected in 2006 and 2007 (Macdonald 2008; Kearns 2008). The number of Macquarie perch collected during 2009 (17) is very similar to that collected in 2008 (16). Greater numbers of Macquarie perch were collected in 2009 compared to during 2007 (2), but less than that caught during 2006 (31) (Macdonald 2008; Kearns 2008). The total number of brown trout collected has dramatically increased between 2006 and 2009. The species composition of fish collected has remained similar throughout the years (Macdonald 2008; Kearns 2008).

3.3 Condition and size distribution of Macquarie perch

All 17 Macquarie perch collected were considered in good condition, with no evidence of parasites, lesions, pale body colour or fin damage.

Lengths of Macquarie perch ranged between 68 mm and 242 mm (Figure 11), with an average length of 164 mm, whilst the weight range of Macquarie perch captured varied between 12 grams and 258 grams, with average weight of 89 grams. The majority of Macquarie perch were greater than 150 mm but less than 180 mm. Macquarie perch collected at Burselms Bridge and Calladoon Property exhibited greatest variation in length, whilst multiple individuals collected within other sites were all of similar length. Macquarie perch caught at Richards Bridge and Draytons Bridge were the same length. The largest and smallest individual Macquarie perch, in regards to both weight and length, were collected at Calladoon Property.

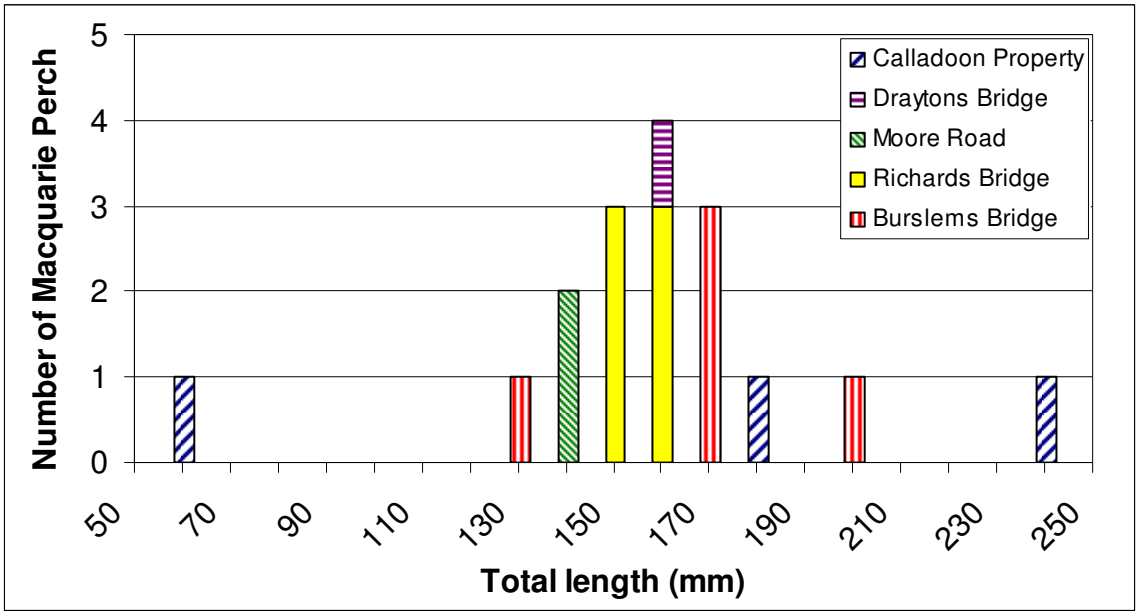


Figure 11. Size distribution of Macquarie perch collected in King Parrot Creek in June 2009 (n=17).

3.3.1 Comparison with 2006, 2007 and 2008 survey results

In 2006, 90% of the 31 Macquarie perch caught were considered in good condition, whilst 10% were infested with the external parasite Anchor worm (*Lernea spp*.) (Macdonald 2008). No external parasites were visible on Macquarie perch collected in 2007 and 2008 (Macdonald 2008; Kearns 2008). Good general condition of Macquarie perch has been observed in 2007, 2008 and 2009.

The size of Macquarie perch captured during 2006 ranged between 150 – 380 mm; in 2007, 260-280 mm; and in 2008, 72 - 363 mm with the majority less than 120 mm (Macdonald 2008; Kearns 2008). Since 2006, largely small sized Macquarie perch (< 200mm) have been collected. Between 2008 and 2009, the average size of Macquarie perch collected increased from 121 mm to 164 mm, because fewer individuals < 120 mm were collected in 2009.

4 Discussion

The key findings from the 2009 survey of King Parrot Creek were:

1. **Macquarie perch are present within King Parrot Creek**
2. **The total number of Macquarie perch collected in King Parrot Creek in June 2009 is similar to 2008, greater than 2007, but lower than 2006**
3. **Possible recruitment of Macquarie perch detected**

The total number of Macquarie perch collected in King Parrot Creek in June 2009 (17) is similar to April 2008 (16), greater than in October 2007 (2), but less than April 2006 (31). It was surprising to collect such a large number of Macquarie perch in the June 2009 survey considering large sediment loads have been washed into King Parrot Creek since the 'Black Saturday' bushfires. Local residents and landcare groups described that the initial sediment load 'turned the creek black'. Additionally, a large number of Macquarie perch (35) had been recently translocated from King Parrot Creek in February 2009. The Macquarie perch collected in June 2009 have either remained in the creek and survived the initial sediment slug resulting from the bushfires, or have recently migrated into the system. It is interesting to note that large numbers of Macquarie perch were collected from Richards Bridge and Burslems Bridge in June 2009. This is consistent with past annual surveys and suggests that these locations are a stronghold for the King Parrot Creek Macquarie perch population. Extensive revegetation has occurred at Burslems Bridge and further upstream on Calladoon Property. Previous blackberry spraying was evident at Richards Bridge during past surveys (Macdonald 2008). Thus, riparian vegetation rehabilitation may benefit Macquarie perch.

The overall good body condition of the Macquarie perch observed in June 2009 suggests that individuals were not stressed. However, during the Macquarie perch translocation in February 2009, some individuals exhibited signs of physical stress (cloudy eyes, pale colouration) likely due to environmental conditions (Kearns 2009). Macquarie perch appear to be recovering from stressful ambient conditions resulting from Black Saturday.

The growth rate of Macquarie perch is influenced by a number of factors such as location, climate, altitude and water temperature (Macdonald 2008). The growth rates for Macquarie perch described in Harris and Rowland (1996), Gibson (2005) and Appleford *et al.* (1998) suggest that the majority of Macquarie perch collected in this survey are within two years of age, because they are < 200 mm, thus they were likely spawned in spring 2006. The smallest individual (68 mm) collected at Calladoon Property may be a new recruit from a later spawning event in 2007 or 2008, which suggests that Macquarie perch are reproducing in the system. Furthermore, the largest individual (242 mm) collected from Calladoon Property may be three years of age, recruited in spring 2005. Therefore at least three separate year classes may be present within the King Parrot Creek. Only one size class is present at Moore Road, Richards Bridge and Draytons Bridge, whilst Calladoon Property and Burslems Bridge have up to three size classes suggesting that reproduction may be occurring at or near to these locations. Extensive rehabilitation has occurred at these sites which may contribute to creating favourable habitat for reproduction. However, growth stunting of Macquarie perch in King Parrot Creek has been previously detected (Kearns 2008), thus caution should be applied with the interpretation of these results.

The total abundance of fish collected in June 2009 was lower than in 2008, but higher than in 2006 and 2007 (Macdonald 2008; Kearns 2008). In 2009, native fish represented only 34% of the total fish abundance, opposed to 61% in 2008, largely due to the absence of small native taxa. The

major differences between the 2008 and 2009 surveys was the dramatic decline in the number of fish collected from Draytons Bridge, the virtual absence of flatheaded gudgeons and the increase in the number of brown trout. Additionally, carp and mountain galaxias were not collected in 2009. A study by Lyon and O'Connor (2008) on the impact of the 2003 bushfires on fish populations in the Ovens and Buckland River catchments reported that immediately after the sediment slug, fish abundances fell by between 95- 100%. Fish abundances took up to 36 months to return to, or exceed, pre-bushfire abundances (Lyon and O'Connor 2008). It is possible that a similar situation has occurred in King Parrot Creek. Sediment slugs appear to have had a severe adverse impact on the abundance and diversity of the King Parrot Creek fish community, particularly small native fish, resulting in their decline and/or absence during this survey period. Alternatively, seasonal changes in ambient conditions may influence fish behaviour and migration, which would inturn influence catch rate. For example, Macquarie perch are known to make short, annual upstream spawning migrations during mid to late spring, cued by increasing day length and temperature (Appleford *et al.* 1998). Brown trout are stimulated to migrate upstream to spawn by a rise in stream flow in combination with decreased water temperature and reduced day length (Tilzey 1999). Male brown trout generally run earlier than females (Tilzey 1999). The timing of this survey coincided with brown trout reproductive migrations. Many brown trout collected were running ripe males, indicating that they have formed established, self-sustaining populations in King Parrot Creek. The increased activity of brown trout is likely to have caused them to be easier to capture and thus they were collected in greater numbers compared to previous years. Consistent with past surveys, brown trout was the dominant exotic fish species collected. It is important to note that carp were not collected in the 2009 survey, suggesting that they have not increased in numbers.

There is no obvious explanation why fish numbers have declined at Draytons Bridge. Fish abundance at Draytons Bridge was similar to 2007 results (Macdonald 2008). The sampling methods employed in June 2009 were consistent with Kearns (2008). Kearns (2008) collected 39 fish from Draytons Bridge, of which flatheaded gudgeons were the dominate taxa. In 2006, 28 fish were captured, mainly being Macquarie perch and brown trout. Future monitoring is required to determine whether the fish community at Draytons Bridge is generally impoverished or whether this is a result of some other factor, e.g. seasonal differences, sediment loading, or other potential threats.

Kearns (2008) commented that the application of smaller mesh sized fyke nets and electrofishing at all sites in the 2008 survey, compared to 2006 and 2007, enhanced catch effectiveness, particularly for smaller size fish. Unfortunately few small native fish were collected in this survey to support her findings. In the June 2009 survey, fyke netting collected 72 fish opposed to 58 fish electrofishing. Both methods were effective at capturing each taxa, except flatheaded gudgeons which were only collected during electrofishing. Macquarie perch were more receptive to fyke netting opposed to electrofishing. This could be because different habitats are sampled with the different gear types, rather than differences due to the gear itself. Thus, the application of both gear types is warranted to obtain a thorough representation of the fish community in King Parrot Creek.

Water quality parameters remained consistent with past annual surveys, with the exception of increased turbidity levels recorded at each site. The increase in turbidity results from sediment loading of the system due to the recent bushfires. Turbidity levels increased further downstream, suggesting that the sediment loads continue to accumulate and move down the system. Sediment loading can also alter water quality by decreasing dissolved oxygen levels, altering pH and increasing nutrient levels, including phorphorus and nitrogen (Kearns 2009). Importantly, the dissolved oxygen and pH levels detected were within their normal range. An increase in nutrient levels was evident at some sites, e.g. Calladoon Property, by the presence of algae in the water

column. Changes in water quality will likely be an on-going threat to Macquarie perch in King Parrot Creek until the catchment recovers from bushfire damage. Sediment loading is of particular concern because it not only influences water quality, but it may also effect Macquarie perch survival by influencing the availability of spawning habitat and smothering eggs.

5 Recommendations

The potential impact of the Black Saturday bushfires on the King Parrot Creek Macquarie perch population is of great concern for the survival of this population and the species in general. Future monitoring of the King Parrot Creek Macquarie perch population is required to improve decision-making on the management of the species and to identify and prioritise on-ground actions.

Future fish assessments in King Parrot Creek should occur at the five locations sampled in 2009 to ensure consistency with past surveys and to build upon existing knowledge. It is important to include Calladoon Property in subsequent surveys to determine when it is suitable to release the translocated Macquarie perch back into the system. Ongoing fish monitoring at Calladoon Property will be required thereafter to assess the survival of released individuals. The fish community could also be monitored at sites further above Flowerdale to assess the recovery of the fish community in extensively burnt areas.

An additional survey should be conducted in early November 2009 to determine the impact of the September high flow events and sediment loads on the Macquarie perch, prior to the summer period. Annual April surveys should be resumed in 2010 to ensure consistency in the timing of past surveys.

DSE and GBCMA managers are recommended to implement the bushfire recovery and rehabilitation actions noted in DSE (2009b) that influence the survival of Macquarie perch in King Parrot Creek. Such actions may include ongoing water quality monitoring, replanting of riparian vegetation, fencing riparian areas and providing temporary shade structures along sections of small creeks where no shade is currently available.

Riparian vegetation improvement, particularly blackberry removal and native replanting, is required at locations along King Parrot Creek, including Draytons Bridge, Moore Road and bushfire affected regions. Riparian vegetation is highly important for providing quality habitat for fish. Land managers should encourage private landowners and community groups to revegetate areas through the use of government incentives and grants.

Local community members and landholders support the rehabilitation of King Parrot Creek and take ownership for the conservation of its Macquarie perch population. It is important to keep these stakeholders well informed of the results of this survey and any proposed management actions to foster compliance, understanding and continuing support.

In 2003, bushfires in the Australian Capital Territory impacted the Macquarie perch population in the Cotter River. ACT managers may provide guidance from their experiences conserving the Cotter River Macquarie perch population after the fires. One action implemented involved altering the Cotter River flow regime to remove sediment and create spawning habitat to promote successful breeding of Macquarie perch (Environment ACT 2004). This involved three, 6-day events of high flow in August and October/November 2003 and February 2004, and resulted in successful spawning and recruitment of Macquarie perch. Consideration should be given to whether the actions implemented in the ACT may be feasible and warranted for King Parrot Creek.

References

ACT Government. (1999). Macquarie Perch (*Macquaria australasica*): An endangered species. Action Plan No. 13. Environment ACT, Canberra.

Appleford, P., Anderson, T. A. and Gooley, G. J. (1998). Reproductive cycle and gonadal development of Macquarie perch *Macquaria australasica* Cuvier (Pisces: Percichthyidae), in Lake Dartmouth and tributaries of the Murray-Darling Basin, Victoria, Australia. Marine *and Freshwater Research* **49**: 163-169.

ASFB. (1998). Australian threatened fishes – 1998 supplement. Australian Society for Fish Biology Newsletter 28(2): 30-37.

Cadwallader, P. L. (1981). Past and present distributions and translocations of Macquarie perch *Macquaria australasica* (Pisces: Percichthyidae), with particular reference to Victoria. *Proceedings of the Royal Society of Victoria* **93**: 23-30

Cadwallader, P. L. and Rogan, P. L. (1977). The Macquarie perch, *Macquaria australasica* (Pisces: Percichthydae), of Lake Eildon, *Victoria Australian Journal of Ecology* **2**: 409-418.

Cadwallader, P.L. and Backhouse, G.N. (1983). *A Guide to the Freshwater Fish of Victoria*. Victorian Govenment Printing Office: Melbourne, Australia.

Douglas, J., Giles, A. and Strongman, R. (2002). Lake Dartmouth Multi-species Fisheries Assessment. *Marine & Freshwater Resources Institute Freshwater Fisheries Report No.* **02/2**. Department of Natural Resources and Environment, Victoria

DSE. (2003). Advisory list of threatened vertebrate fauna in Victoria – 2003. Department of sustainability and Environment, Victoria, East Melbourne, Victoria.

DSE. (2009a). Draft Flora and Fauna Guarantee Action Statement for Macquarie perch *Macquaria australasica.*http://www.dse.vic.gov.au/CA256F310024B628/0/DCED1C2A5DAF04DACA257489000C014B/$File/Macquarie+Perch+draft+AS+23_6_08.pdf

DSE. (2007). King Parrot Creek Flow Management Plan Fact Sheet. Department of Sustainability and Environment, East Melbourne.

DSE. (2009b). Kilmore East-Murrindindi Complex North Fire; Emergency Stabilization and Rehabilitation Plan. Prepared by Victorian Interagency Rehabilitation Group and USA Burned Area Emergency Response Team – Gasser. Department of Sustainability and Environment, Alexandra.

Environment ACT. (2004). *ACT Water Report 2003-2004*. Environment ACT, Canberra.

Fish Victoria. (2007). Freshwater Fin Fish (native) Perch, Macqaurie. www.fishvictoria.com, 2007.

Gibson, P. (2005). Macquarie perch. *Macquaria australasica*, Cuvier & Valenciennes. A review of the literature. New South Wales Fisheries.

Harris, J.H. and Rowland, S.J. (1996). Family Percichthyidae: Australian freshwater cods and basses. Pp. 150-163. In: McDowall, R.M. (ed.). *Freshwater fishes of South-Eastern Australia* (second edition). Reed Books, Sydney.

Kearns, J. (2008). An assessment of the status of Macquarie perch, *Macquaria australasica*, in King Parrot Creek, Victoria. Confidential client report prepared for the Goulburn Broken

Catchment Management Authority. Department of Sustainability and Environment, Heidelberg.

Kearns, J. (2009). Translocation of Macquarie perch, *Macquaria australasica,* in King Parrot Creek, Victoria. Confidential Client Report prepared for Department of Sustainability and Environment Biodiversity and Ecosystem Services (Bushfire Section), Heidelberg, Victoria.

Lintermans, M. (2006). The re-establishment of endangered Macquarie perch *Macquaria australasica* in the Queanbeyan River, New South Wales, with an examination of dietary overlap with alien trout. Technical report. CRC for Freshwater Ecology, Canberra.

Lintermans, M. (2007). *Fishes of the Murray-Darling Basin: an introductory guide*. Murray Darling Basin Commission, Canberra ACT.

Lyon, J. P. and O'Connor, J. P. (2008). Smoke on the water: Can riverine fish populations recover following a catastrophic fire-related sediment slug? *Austral Ecology*, 33, 794-806.

Macdonald, A. (2008). An assessment of the status of Macquarie perch, *Macquaria australasica*, in King Parrot Creek, Victoria in 2006 and 2007. . Arthur Rylah Institute for Environmental Research, Confidential Client Report. Department of Sustainability and Environment, Heidelberg.

MDBC. (2007). Sustainable Rivers Audit Protocols: Approved Manual for Implementation Period 4: 2007-2008. Murray-Darling Basin Commission, Canberra.

NSW DPI. (2005). *PRIMEFACT 9 Macquarie perch.* NSW Department of Primary Industries, Port Stephens.

Tilzey, R.D.J. (1999). Environmental cues in the reproductive migrations of brown trout (*Salmo trutta*) in Lake Eucumbene, New South Wales. In: Hancock, D.A., Smith, D.C. and Koehn, J.D. (ed.). *Australian Society for Fish Biology, Fish Movement and Migration, Bendigo, Victoria 28-29 September 1999 Workshop proceedings*.

Winstanley, R. (2000). Macquarie perch - 1998. Inland Fisheries and Habitat Assessment Group. *Fisheries Victoria Assessment Report No*. 25. MAFRI