



# ENVIRONMENTAL WATERING IN VICTORIA 2007/08

**Our Water Our Future**

A Victorian Government initiative



# Environmental Watering Sites 2007/08



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# INTRODUCTION

Prolonged drought means Victoria's wetlands, rivers and floodplains – and the plants and animals that live there – are suffering.

The Victorian Government's environmental watering program is keeping key sites alive. Read on to find out more about the 2007/08 program and its results.



## The Situation

Victoria is experiencing the worst drought on record. With each dry year, the effects worsen.

Plants and animals do have mechanisms to survive long droughts, such as native fish retreating to small permanent pools and aquatic plants surviving by slowing growth or persisting as seeds or dormant roots.

However, aquatic ecosystems in Victoria are under stress from people as well as drought.

About one third of river flow in Victoria is used to supply towns and support agriculture. In some rivers more than 70 per cent of flow is diverted in dry years.

This means rivers that could have survived drought in the past are now near the point of collapse. Low flows threaten the survival of native fish, waterbirds, turtles and frogs. In some places River Red Gum trees, some of which are hundreds of years old, are dying.





## What Is Being Done

The Department of Sustainability and Environment (DSE) is working with catchment management authorities, water corporations, the Murray–Darling Basin Authority and Parks Victoria to keep key sites alive.

In these very dry times, the environmental watering program focuses on survival so that when conditions improve, some plants, animals and habitats are still alive to recolonise and recover.

The program manages key sites, which are identified using three objectives.

### *1. Avoid critical loss of threatened species/communities*

Without water, the last populations of some species will be lost. For example, the critically endangered Murray hardyhead fish only survives in four known Victorian sites. It lives in saline wetlands, which must be managed to keep the fish populations alive.

### *2. Avoid irreversible loss or catastrophic events*

The drought means extensive woodlands of River Red Gum trees along the River Murray are near death. Losing the woodlands would be an irreversible loss to the floodplain's ecological character. Prolonged droughts can also lead to large scale fish deaths – considered a catastrophic event that should be avoided if possible.

### *3. Protect refuge areas*

If plants and animals can survive the drought in protected refuge habitats, they will be able to recolonise when flows return. Protecting refuge areas in 2007/08 was about providing habitat and feeding areas for plants and animals. Any breeding that occurred was a bonus.

There are two types of refuge protection: maintaining river reaches, as discussed in the Wimmera and Mackenzie Rivers chapter, and protecting wetlands. A key reason for protecting wetlands is to provide drought refuge to waterbirds, which rely on wetlands to survive. In 2007, the number of waterbirds in south-eastern Australia was less than one third of that in an average year.

## Where the Water Comes From

Environmental water in Victoria comes from two main sources.

In both cases, the use of environmental water does not impact on farmers' water allocations or town water supplies. And in the drought, environmental water allocations are reduced along with other users' allocations.

1.) A small share of Victoria's water is legally set aside as 'environmental entitlements', under the Environmental Water Reserve.

In Victoria's north, the amount of water used from environmental entitlements in 2007/08 was less than 1 per cent of the water available for consumptive use on the Murray and Goulburn rivers.

2.) The Living Murray program provides environmental water to some Victorian sites.

The program is an initiative of the Murray–Darling Basin Ministerial Council. It aims to sustain and restore six Icon Sites along the River Murray, including Victoria's Barmah Forest, Gunbower Forest, Hattah Lakes and Lindsay and Wallpolla islands.

In 2007/08, 2000ML was provided to Gunbower Forest and 4000ML went to the Lindsay and Wallpolla islands complex.

## Other Water Sources

Water held by other entitlement holders can provide some environmental benefits, depending on how it is used.

Water corporations use natural wetlands and waterways to store and deliver water to towns and irrigators. This can be done in such a way so that it helps the environment. It can refresh river reaches en-route to its consumptive purpose and in doing so it can reduce the risk of a catastrophic event, such as fish deaths.

Also, individual water licence holders sometimes donate water for specific environmental purposes. In 2007/08, a member of the public donated water to help River Red Gum watering at Lindsay Island and to rescue the Eagle Tree – a nesting tree in Gunbower Forest used by white-bellied sea eagles.

## Ongoing Management

The environmental watering program is an ongoing part of river and wetland management in Victoria.

It is a collaborative program that requires careful co-ordination between all agencies – DSE, catchment management authorities, water corporations, Parks Victoria and the Murray–Darling Basin Authority – to decide on the most effective use of the water and to physically deliver it.

Each year, the water needs of sites throughout Victoria are assessed using data on tree health, water quality, fish and bird populations and macro-invertebrates.

The watered sites are monitored to determine the success of watering strategies and to inform future decisions about water use and delivery.

Currently, survival is the focus so that when conditions improve, the environment has the ability to recover from the drought.



Paul O'Connor, Department of Sustainability and Environment.



## Water Sources and Volumes in 2007/08

Sites Watered in 2007/08	Sources of Water						Drought Management Objectives		
	The Living Murray	Victorian River Murray Flora and Fauna Bulk Entitlement	Loddon Bulk Entitlement	Wimmera–Glenelg Bulk Entitlement	Goulburn–Murray Water Source Bulk Entitlement	Donated Water	Avoid Critical Loss of Threatened Species/ Communities	Avoid Irreversible Loss or Catastrophic Events	Provide Refuge Areas
Black Swamp, Goulburn Broken Wetlands		•							•
Kinnairds Swamp, Goulburn Broken Wetlands		•							•
Reedy Swamp, Goulburn Broken Wetlands		•							•
Gunbower Forest	•	•				•			•
Lindsay and Wallpolla islands, Mallee River Red Gums	•	•				•		•	•
Wimmera River				•					•
Round Lake, Murray hardyhead		•					•		
Cardross Lakes, Murray hardyhead		•					•		
Woorinen North Lake, Murray hardyhead					•		•		
Little Lake Boort			•						•
<b>Volume Delivered 2007/08 (ML)</b>	<b>6000</b>	<b>10,432</b>	<b>300</b>	<b>2608<sup>1</sup></b>	<b>*</b>	<b>4</b>			

<sup>1</sup> Carryover water from previous year

\* Delivered as required to maintain suitable water quality and level

# GOULBURN BROKEN WETLANDS

There are more than 1800 wetlands in the catchment of the Goulburn and Broken rivers, in northern Victoria. Wetlands are among the most important and productive ecosystems in Australia.



## The Need for Water

Very few of the Goulburn Broken wetlands currently contain water. Those that do are at a high risk of drying out.

Wetlands are a critical part of ecosystems – they help maintain the general health of waterways, such as rivers and estuaries. They provide homes and breeding grounds to a range of species, including frogs, fish and turtles, and are essential for waterbirds.

Waterbirds rely on wetlands, which provide the plant, fish and invertebrate food they live on. Flooded wetlands provide nesting and protected resting sites that waterbirds need to breed and raise their offspring.

Aerial waterbird surveys have been undertaken in south-eastern Australia since the 1980s. In the last six years, waterbird numbers have been relatively low. In an average year, there are about 500,000 waterbirds in south-eastern Australia. In 2007, this had dropped to 160,000.

Their homes are also under threat. In an average year there are 300,000ha of wetland habitat in south-eastern Australia for waterbirds to feed and breed in. In 2007 there was less than 100,000ha.

By 2008, the only areas along the River Murray with large waterbird populations were South Australia's Coorong and Lower Lakes. Hattah Lakes in Victoria had moderate numbers of waterbirds thanks to environmental watering over the past few years.



## Watering Aims

In 2007/08, water was delivered to three wetlands on the Goulburn and Broken rivers to provide drought refuge areas, mainly for waterbirds. The aim was to provide habitat and feeding areas for the birds at the three sites – Reedy, Black and Kinnairds swamps.

The sites were chosen after an aerial and on-ground survey identified areas of most importance to waterbirds, which is indicative of broader wetland productivity and health.

Reedy Swamp is a major flooded shallow wetland in the Shepparton district and provides extensive open water habitat. It is one of the few floodplain wetlands in the district that holds water for long periods and can support a diverse waterbird community.

Kinnairds Swamp is a floodplain wetland off Broken Creek, located north-east of Numurkah. It supports both grassy and wooded wetland habitat.

Black Swamp is a floodplain depression on Nine Mile Creek east of Wunghnu. It provides open water habitat and areas of tall reeds.



## Watering Details

In 2007/08, 1060ML was provided to Reedy, Black and Kinnairds swamps from the Victorian River Murray Flora and Fauna Bulk Entitlement.

The water was delivered at the end of autumn 2008. This allowed time for healthy aquatic vegetation to grow, which is an important part of a drought refuge.

About half the water – 544ML – was gravity fed into Reedy Swamp in May, inundating 130ha of wetlands. This was supplemented by winter rain and drainage inflows so that a depth of more than 0.5m was maintained in the swamp until October 2008.

Between May and June, 426ML was gravity fed into Kinnairds Swamp. The swamp reached a maximum depth of 0.43m and then gradually dried out over spring 2008 when inflows ceased.

The remaining 90ML was pumped into Black Swamp in May, reaching a depth of 0.4m and flooding 16ha.

## Outcomes

The watering stimulated growth of aquatic plants at the three wetlands. This attracted a wide variety of waterbirds and frogs.

Since each wetland is unique, they all responded in different ways.



### *Reedy Swamp*

The largest of the three wetlands, Reedy Swamp supported the most waterbirds following the watering.

When water filled the swamp, terrestrial plants decayed and were replaced by aquatic plants including milfoil, water plantain and lesser joyweed.

The number of waterbirds was highest when the wetland was first flooded with more than 3500 observed, including more than 1500 hardhead ducks.

Grey teals were the most abundant birds, with a population of 1761 in October. Coots, dusky moorhens, and blue-winged shovelers (which are vulnerable in Victoria) were also abundant.

Reedy Swamp attracted a range of other threatened bird species following the watering, including glossy ibis, baillons crakes and musk ducks, all of which are vulnerable in Victoria.

Waterbird breeding is a sign that wetlands are productive. Following the watering, Australian white ibis and black swans bred at Reedy Swamp, as did a number of frog species.

### *Kinnairds Swamp*

The second largest wetland of the three, Kinnairds Swamp, gradually dried out over spring. The watering aim of providing a resting and feeding site for waterbirds in winter was achieved, with 480 waterbirds observed in July. Grey teals and black swans were the most abundant.

The swamp also provided a feeding ground to a number of Latham's snipe, an international migratory bird that depends on feeding in south-eastern Australia.

In July, a pair of brolgas – a waterbird that is vulnerable in Victoria – was observed feeding and a pair of whistling kites nested nearby.

The swamp supported a range of aquatic plants after the watering, including the threatened rigid milfoil. The amount of milfoil covered an area 10 times larger than previously recorded in the State.



### *Black Swamp*

Black Swamp is smaller and shallower than the other two watered sites and therefore supported fewer birds.

The number of waterbirds was highest in October with 138 observed. The most abundant species were black ducks and grey teals.

Peregrine falcons bred and white-bellied sea eagles were observed at the wetland.



# GUNBOWER FOREST



Gunbower Forest is a River Red Gum floodplain ecosystem of the River Murray in central northern Victoria. The forest is on an island of about 20,000ha between the River Murray and Gunbower Creek.

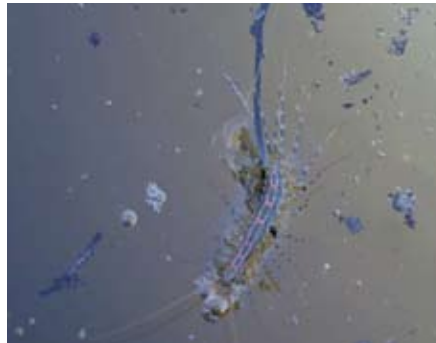
## The Need for Water

River Red Gum forests provide unique and important wetland habitats. The forests' deepest depressions also include semi-permanent wetlands.

These wetlands are highly productive habitats with diverse plant communities and a variety of invertebrates, fish, frogs and waterbirds. Because of their seclusion and the food they provide, these wetlands are the main breeding sites for colonial nesting waterbirds on the River Murray.

During the prolonged drought, most forest wetlands in Victoria and New South Wales have dried out. Wetland animals have fewer places to find food and breed. Fish, turtles and waterbird populations are declining and are relying on refuge habitats to survive the drought.

In 2007, the number of waterbirds in south-eastern Australia was less than one third of that in an average year.



## Watering Aims

Environmental water was delivered to Gunbower Forest in 2007/08 to protect critical wetland refuge areas.

A small number of Gunbower Forest's diverse wetlands are close to their natural state, making them an ecological reference point for the condition of wetlands across the whole River Murray floodplain.

Watering in the past has maintained these important wetlands, keeping the River Red Gum trees that fringe them healthy, maintaining the plant communities and supporting waterbird breeding events.

Watering in 2007/08 aimed to provide feeding habitat and help maintain waterbird populations during the drought. If bird breeding occurred as a result of the watering, it would be considered a major bonus.



## Watering Details

In 2007/08, 7708ML was provided to Gunbower Forest.

It consisted of 5708ML from the Victorian River Murray Flora and Fauna Bulk Entitlement and 2000ML from The Living Murray program.

The water was delivered between April and May 2008.

The Little Gunbower Wetland Complex received 2300ML over 12 days, released from Gunbower Creek. This achieved a depth of up to 1m in the complex and inundated 310ha. The water lasted throughout spring and into summer.

Releasing 5408ML from Gunbower Creek to the Little Reedy Wetland Complex filled the complex and spilled downstream through the forest to inundate 543ha of the Whistler Wetland Complex.



Left: Mel Tranter, North Central Catchment Management Authority.  
Right: Sharada Ramamurthy, Department of Sustainability and Environment.  
Opposite page, from top: Sharada Ramamurthy, Department of Sustainability and Environment. Kathryn Stanslawski, North Central Catchment Management Authority.

## Outcomes

The watering provided a drought refuge for important plants and animals.

### *Aquatic invertebrates*

Aquatic invertebrates are one of the first food sources to appear in flooded wetlands. In June 2008, the wetlands were quickly colonised by a range of crustaceans and midge larvae. By September, larger invertebrates were common including diving beetles, caddisfly and yabbies.

### *Frogs and turtles*

Turtles started laying eggs soon after the water was delivered. Six frog species have been recorded in the forest in recent years and all were recorded again following the watering. Three species bred in September: peron's tree frogs, common froglets and spotted marsh frogs.

### *Fish*

Nine species of fish, including five native species, were present in the wetlands after the watering. Carp screens stopped large carp entering the Little Gunbower Wetland Complex, which would have reduced the watering's success.

Native fish were prominent in the wetlands. Three native species bred after the watering: carp gudgeon, Australian smelt and unspotted hardyhead.

### *Birds*

The wetlands attracted waterfowl, waders, raptors and colonial nesting waterbirds.

Ducks and grebes were the most abundant with more than 200 birds counted, including mountain ducks and hoary-headed grebes. These birds made use of the open water in the wetlands and the food provided by soft-leaved wetland plants and aquatic invertebrates.

Breeding behaviour was initiated by great egrets but did not continue through to nesting, possibly because the area watered was too small.

### *The Eagle Tree*

A unique part of the Gunbower Forest environmental watering program was a public water donation to rescue the Eagle Tree (pictured).

The tree is one of the largest and oldest River Red Gums in the forest. It has a girth of 11m and is 50m tall. It is believed to be more than 1000 years old. In the past, white-bellied sea eagles have nested there and more recently the tree has been used by wedge-tailed eagles for nesting.

The tree has shed most of its leaves and is in danger of dying because of the drought.

A concerned member of the public donated 1ML and the community rallied together to save the tree. Local State Emergency Service members created a bank with sandbags to hold the water around the tree. The Gannawarra Shire provided tankers to cart the water to the tree between January and April 2008.

Before watering, the tree's canopy had declined to 20 per cent. After the watering, the canopy increased to 40 per cent, giving the tree a much greater chance of surviving the drought.



# MALLEE RIVER RED GUMS

The River Murray in north-western Victoria has an extensive floodplain. Lindsay, Wallpolla and Mulcra islands, west of Mildura, form part of the floodplain. These islands are Living Murray Icon Sites.

## The Need for Water

Historically, River Red Gum floodplains have been sustained by regular natural flooding. The majority of this flooding occurs in spring, allowing the trees to flower and put on new growth.

In the past seven years, the River Murray has experienced an unprecedented period of low flows. The floodplains have not been naturally flooded since a small flood in 2000.

In 2007, Monash University research showed 87 per cent of River Red Gums in the Mallee region were declining or dead.

Without water, the trees will continue to decline. This would mean irretrievable loss of both the iconic trees and the habitats they provide for a vast range of plant and animal life.

River Red Gum trees grow more than 20m tall and can live for more than 1000 years.

They provide homes for animals, including hollows for bird nesting, snags for fish habitat, and nectar and pollen for birds and insects.

The trees also surround wetlands that are key refuges for frogs, fish and waterbirds. Threatened species including growling grass frogs, regent parrots and barking owls have all been observed in these areas.



This page: Stressed River Red Gum trees on Wallpolla Island before and after watering. Photos by Bram Mason, Brett Ians and Associates. Opposite page, photos by Mallee Catchment Management Authority staff. Top and bottom middle: Andy Wise. Right: Bob Merlin. Left: Peter Kelly.



## Watering Aims

Environmental water was provided to the islands to prevent irretrievable loss of River Red Gum trees – a key component of the floodplains – and to provide drought refuge for floodplain flora and fauna.

The aim was to water stressed sections of the trees along creeks and wetlands to prevent further decline in their condition. The sites had been watered in the past and had responded positively with new growth. These sites – covering 560ha or 2.5 per cent of River Red Gums in the Mallee region – have been chosen because of their strategic locations and feasibility of water delivery. This means they can be managed through the drought with the limited amount of environmental water.



## Watering Details

In May and June 2008, 7003ML of water was provided to meet environmental objectives.

It was pumped to floodplain anabranches and wetlands on the islands, covering 560ha in total.

The water was sourced from existing environmental entitlements. The Living Murray program, which provides water to support six Icon Sites along the River Murray, contributed 4000ML and the Victorian River Murray Flora and Fauna Bulk Entitlement provided 3000ML.

An extra 3ML, donated by a member of the public, was pumped to a small but valuable 830sq m section of floodplain at Buxton's Bend near Karadoc.



## Outcomes

The watering resulted in extensive new growth on the trees and provided significant refuge habitat for waterbirds, frogs, fish and turtles. See the photos on page 12 for an example of the results.

Birds were attracted to the area from the start of June, with hardhead ducks and Australasian shovelers both observed. Frogs such as spotted marsh frogs and peron's tree frogs; and native fish, including flat-headed gudgeon and Australian smelt were also observed.

The trees that were watered fringe 132km of creek lines. Soon afterwards, they began showing new growth. The number of dead trees in areas that haven't been watered has increased every year since monitoring began in 2005.



# WIMMERA AND MACKENZIE RIVERS

The Wimmera River is located in western Victoria and receives run-off from the northern slopes of the Great Dividing Range. The river flows across the Wimmera Plain through Horsham and north from Dimboola to Lake Hindmarsh.

The MacKenzie River is a tributary in the Grampians, which joins the Wimmera River at Horsham.

## The Need for Water

The Wimmera River has not experienced significant natural flows for the past 12 years.

The deep pools along the length of the river are the only remaining habitat for aquatic fauna. As the pools dry up, they are becoming smaller, more saline and critically low in oxygen.

Pools in the MacKenzie River are also drying up. As this happens, low flows threaten the habitat of platypus and other aquatic fauna. Vegetation along the banks of the river is stressed and dying.



The Wimmera River before environmental water was provided (left) and after (right). Photos on both pages by: Mark Toomey, Wimmera Catchment Management Authority.



## Watering Aims

Environmental water was delivered to the Wimmera River in 2007/08 to protect drought refuge areas.

The water was provided to protect the river's permanent pools, which support a significant freshwater catfish population. This species is endangered in Victoria. Protecting these refuges is critical in allowing the river's fish community to recover after the drought.

The release of water reduced the pools' salinities and raised their water levels, giving fish more opportunities to survive.

Water was provided to the MacKenzie River to maintain pools and muddy banks that platypus depend on. The MacKenzie River bottlebrush, which is known only at this location, received water to ensure the unique plant population survives.

## Watering Details

In 2007/08, 2600ML was released to meet the Wimmera River's environmental objectives.

The river directly received 860ML in September and October 2007. The release was made from Taylors Lake – a storage on the Wimmera-Mallee channel system, about 16km upstream of Horsham.

The river also received 1740ML in September and October 2007, which was put into the MacKenzie River at Rocklands Channel so that it would flow into the Wimmera.

A further 8ML was released specifically for the upper MacKenzie River in May 2008.

## Outcomes

### *The Wimmera River*

The environmental water provided the first flow in the river since water was last released in summer 2004/05. The photos on page 14 show a section of the Wimmera River before and after the 2007 watering.

The watering benefited the Wimmera River 60km from the Taylors Lake outlet to near Natimuk. This is the reach of the river where the best quality, and therefore most important, refuges remain.

The watering significantly increased the depth of pools, with some rising 1m. The snags and reed beds at the fringes of the pools, which fish require for shelter and breeding habitat, were inundated.

Some pools that had dried out were refilled and now provide additional aquatic habitat.

The salinity of several important pools was reduced. Pool salinity at Norton Creek, Barr's Road and Quantong was reduced by 50 per cent, and salinity at Longerenong Weir went from 14,000EC to 2000EC.

Fish deaths, which occurred further down the river, did not occur in the section that received environmental water.

The water did not extend down the Wimmera River as far as predicted because the river bed was so dry. The water was unable to reach significant pools further downstream, which are exposed to high groundwater salinities and are unlikely to have any surviving freshwater native fish.

### *The MacKenzie River*

The MacKenzie River benefited from the environmental water directed at the Wimmera River but released into the MacKenzie. This water sustained the river's unique bottlebrush plant. Drought-stressed shrubs along the banks of the river produced new flowers and up to a metre of new growth.

It also benefited from the 8ML released specifically for the upper reach of the MacKenzie River. This water protected permanent habitat in the upper reaches during a period when releases to Horsham's water supply were stopped for works in the Mt Zero Channel.

# MURRAY HARDYHEAD

The Murray hardyhead is a nationally threatened fish found in the saline river wetlands of the southern Murray–Darling Basin. The drought has put it at serious risk because inflows to these wetlands have decreased. Victoria has launched a program to save the species from extinction.

## The Need for Water

The Murray hardyhead is a small, silvery fish that grows to about 8cm. It lives in shallow saline wetlands. When inflows decrease, the wetlands become smaller, warmer and more saline. Very high salinities pose a threat to the fish and the invertebrates on which they feed.

The species is critically dependent on the success of breeding events each year. Individuals live for a maximum of 18 months, so breeding failures will extinguish the population. The fish lay their eggs in the water plant *Ruppia*. In spring and summer, water levels must be high enough to submerge *Ruppia* beds.

Murray hardyhead were once widespread through lowland river systems in northern Victoria, South Australia and New South Wales. Populations were once in the millions but numbers are now believed to be in the low thousands. The species has not been recorded in recent times in New South Wales, and the South Australian populations are at serious risk.

In 2007, there were four known sites with Murray hardyhead in Victoria: Lake Hawthorn and Basin 1 of Cardross Lakes near Mildura, and Round Lake and Woorinen North Lake near Swan Hill.

If the species became extinct, it would be the first fish extinction in Australia since European settlement, and the first vertebrate extinction since the 1940s.

## Watering Aims

In October 2007, the Department of Sustainability and Environment launched an emergency watering plan to save the Murray hardyhead from extinction.

The plan included using environmental water to protect Murray hardyhead populations in three sites by maintaining water quality and habitat conditions over summer and into the following year.

It also involved setting up a captive breeding program in Mildura because protecting only three sites is a minimum meaning the species is still at risk.

## Watering Details

In 2007/08, 664ML was provided for Murray hardyhead in two lakes, from the Victorian River Murray Flora and Fauna Bulk Entitlement. Round Lake received 518ML. A section of Basin 1 in Cardross Lakes received 146ML from the same bulk entitlement. The small area was sectioned off to protect the fish while maximising the use of the water. Water was also pumped to the area from other lakes in the Cardross system.

Woorinen North Lake received water under the environmental obligations of Goulburn Murray Water's Source Bulk Entitlement. Releases are made throughout the year to keep the lake within the target depth and salinity levels.



Water was not provided to Lake Hawthorn because modelling indicated it would not be the most efficient way of using the limited water available.

### **Outcomes**

Murray hardyhead populations in Round Lake, Woorinen North Lake and the section of Cardross Lakes responded well to the environmental water. The breeding program has also been a success so far. Relocation of the fish is currently being planned.

#### *Watered Sites*

Monitoring of the three watered sites is done to assess the health of the Murray hardyhead populations and to see if the fish are breeding – critical to a population's survival since each fish only lives for 18 months.

In Spring 2007, the Murray hardyhead population in Basin 1 at Cardross Lakes was in decline. Following environmental watering, the population stabilised. Young adults were present in autumn 2008, indicating the fish bred over the summer of 2007/08. Monitoring indicates the fish have disappeared from the remainder of the Cardross Lakes system, which did not receive environmental water.

Murray hardyhead spawned at Woorinen North Lake after receiving environmental water, and subsequent monitoring indicated the population increased over summer 2007/08.

The release of water to Round Lake effectively managed salinity levels. Invertebrate monitoring indicated that the food supply for Murray hardyhead was maintained. The population spawned in spring 2007 and by autumn 2008 mid-sized adults were dominant.

#### *Lake Hawthorn*

Conditions deteriorated at Lake Hawthorn, which did not receive any environmental water. Salinity exceeded 80,000EC in November - more saline than sea water. Salinities have since remained above 50,000EC. By autumn 2008, the invertebrate food sources for the fish had virtually disappeared. While a small number of Murray hardyhead were found to have survived without additional water, this population is not expected to survive the 2008/09 summer.

### **The Future**

Ongoing dry conditions in the Murray-Darling Basin mean more environmental water will be needed at Cardross, Woorinen North and Round lakes to prevent extinction of Murray hardyhead.

The captive breeding program will also continue to boost fish numbers and reduce the risk of extinction.



# LITTLE LAKE BOORT

Little Lake Boort is a floodplain wetland of the Loddon River, located in the township of Boort in northern Victoria. The Loddon River flows north from the Great Dividing Range, across riverine plains to join the River Murray near Swan Hill.

## The Need for Water

The lower Loddon floodplain has numerous wetlands, which are filled by high river flows. The wetlands are critical to the region's biodiversity. They support fish, waterbirds and threatened plant communities.

Most of the freshwater wetlands have been dry for the past five years because of the drought and exceptionally low flows in the Loddon River. Except Little Lake Boort – the only remaining wetland with water between Laanecoorie and Kerang, a distance of more than 128km.

## Watering Aims

Environmental water was provided to Little Lake Boort in 2007/08 to maintain the wetland as a critical drought refuge area, mainly for waterbirds.

## Watering Details

In 2007/08, 300ML from the Loddon River Environmental Reserve Bulk Entitlement was provided to Little Lake Boort. In February 2008, 100ML was released and the rest was provided at the end of the irrigation season in May.

## Outcomes

The environmental watering raised the wetland level and flooded the fringing vegetation.

Little Lake Boort attracted more than 30 bird species, including large wading birds such as nankeen night herons, straw-necked ibis and sacred ibis. These birds feed on frogs, yabbies and tadpoles and their presence indicates a productive wetland ecosystem.

Royal spoonbills, yellow billed spoonbills and red-necked avocets were present after the watering. Black swans were attracted to the area to feed on the water plants growing on the lake bed. Fish in the lake also provided food for pelicans.

Several threatened species were recorded in the Black Box woodland surrounding the lake, including birds such as grey-crowned babblers and bush stone-curlews as well as carpet pythons.



# OTHER WATER SOURCES



As well as environmental entitlements, there are other ways that water can be provided to benefit the environment. Water and environmental managers throughout Victoria are working closely together to find innovative ways to do this.

## River Management in a Dry Climate

Catchment management authorities and water corporations have been working together to minimise risks to the environment resulting from the dry conditions, even in rivers where drought has forced critical human needs to be the focus.

Where possible, they have been using innovative methods to protect sites that are identified under the three environmental watering criteria.

One method is to redirect consumptive water to maintain fish habitat while on the way to fulfilling its consumptive purpose.

Another method is to keep a small amount of environmental water in storage, when environmental flows have to be redirected to meet critical human needs during drought. The water kept aside is to respond to any water quality issues that arise from the reduction in environmental flows.



## Campaspe River – Black Water Event

Following significant rainfall in December 2007 in the mid-Campaspe catchment, the Campaspe River rose between Eppalock and Echuca.

The rainfall generated significant overland flow, causing numerous smaller tributaries, such as Mount Pleasant Creek, to begin flowing. The tributary flows delivered a lot of organic material to the Campaspe River, causing bacteria levels to rise and a black water event to occur.

The photo on the left shows the black water event at Avonmore Bridge, while the one on the right shows a return to normal conditions.

A black water event is characterised by black coloured water with low oxygen levels – fatal for fish and other aquatic life.

In this case, a catastrophic fish death event was avoided because 220ML of water was released from Lake Eppalock.

The North Central Catchment Management Authority provided half the water from an environmental reserve. The reserve was created after passing flows in the catchment were reduced so water could be used for critical human needs.

Goulburn–Murray Water provided the other half of the water because its stock and domestic users in the area would have been affected by a black water event.

## Broken Creek – Inter-valley Transfer

In 2002, a major fish death occurred at Rice's Weir in Broken Creek – 179 Murray cod deaths were reported. Since then, options have been investigated to reduce the risk of a catastrophic fish death event occurring again.

In 2007/08, discussions with Goulburn–Murray Water, Murray–Darling Basin Commission and Goulburn Broken Catchment Management Authority resulted in consumptive water from the Murray and Goulburn rivers being redirected down the lower sections of Broken Creek during summer to prevent any fish death events.

The diverted water prevented catastrophic events at Broken Creek that summer, and still fulfilled its original purpose with no negative impacts on consumptive use.



## Macalister River

Old inefficient infrastructure in the Macalister Irrigation District is being modernised. Some of the resulting water savings have been used to help the environment. In autumn/winter 2008, 3000ML of environmental water was released into the river to support fish populations, including flat-headed gudgeon, southern pygmy perch, river blackfish, Australian grayling, Australian smelt and tupong, as well as short-finned and long-finned eels.





