Native Fish Recovery Plan

Gunbower and lower Loddon

PROSPECTUS

NORTH CENTRAL
Catchment Management Authority
Connecting Rivers, Landscapes, People

Invest in the future of native fish and help us create a world-class Murray cod fishery.

The North Central Catchment Management Authority's (CMA's) vision is to restore native fish populations, improve waterway health, and create a world-class native fishery in the Gunbower and lower Loddon region.

The Native Fish Recovery Plan – Gunbower and lower Loddon, involves the large-scale, long-term and holistic rehabilitation of the network of creeks, lagoons, wetlands and floodplains in northern central Victoria.

This area encompasses most of the Torrumbarry Irrigation Area, which grows more than $130 million of agricultural produce a year using some of the most modern irrigation systems in the Murray-Darling Basin. It is supplied by 190km of streams that are wholly managed for water delivery through a system of weirs and channels. This network of streams, lagoons, wetlands and floodplains offers ideal habitat for a host of native fish species including the iconic Murray cod.

BY IMPROVING FLOWS, RESTORING HABITAT AND REMOVING BARRIERS, WE EXPECT NATIVE SPECIES TO RECOVER, RIVER HEALTH TO IMPROVE, AND A THRIVING NATIVE FISHERY TO DEVELOP.


MURRAY-DARLING RAINBOWFISH

WITH YOUR HELP WE CAN MAKE THIS VISION A REALITY.

Working with our partners, recreational fishers, landholders and Traditional Owners, we will:

- Deliver fish-friendly flows without compromising productive irrigated agriculture and the communities that depend on it. These flows can be delivered enroute through three anabranch systems and returned to the Murray River for downstream use – making every drop count…twice!
- Recover existing native fish populations and reintroduce six locally extinct fish species into rehabilitated habitats.
- Create a world-class Murray cod fishery in north central Victoria. Almost half of all recreational fishers target this iconic species, and will travel long distances lured by the prospect of landing a huge Murray cod. Their spending in regional towns will boost the $307 million currently spent each year by recreational fishers in north western Victoria.
- Create local jobs through infrastructure projects including the construction of fishways, and the manufacture and installation of fish exclusion screens for irrigation channels and pumps.
- Improve river health, enhance natural areas and increase ecotourism opportunities.

The problem

IT IS ESTIMATED THAT NATIVE FISH POPULATIONS HAVE DECREASED BY

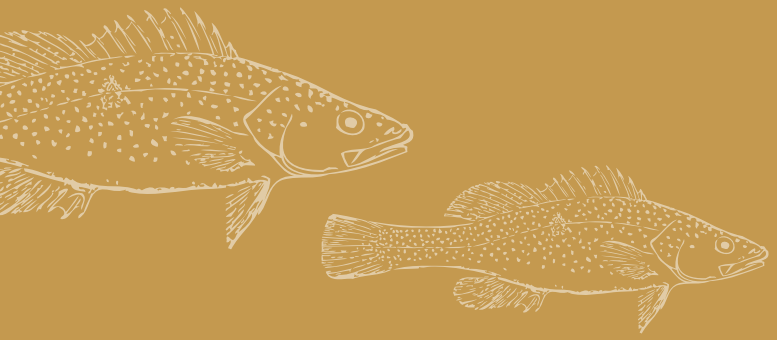
90%

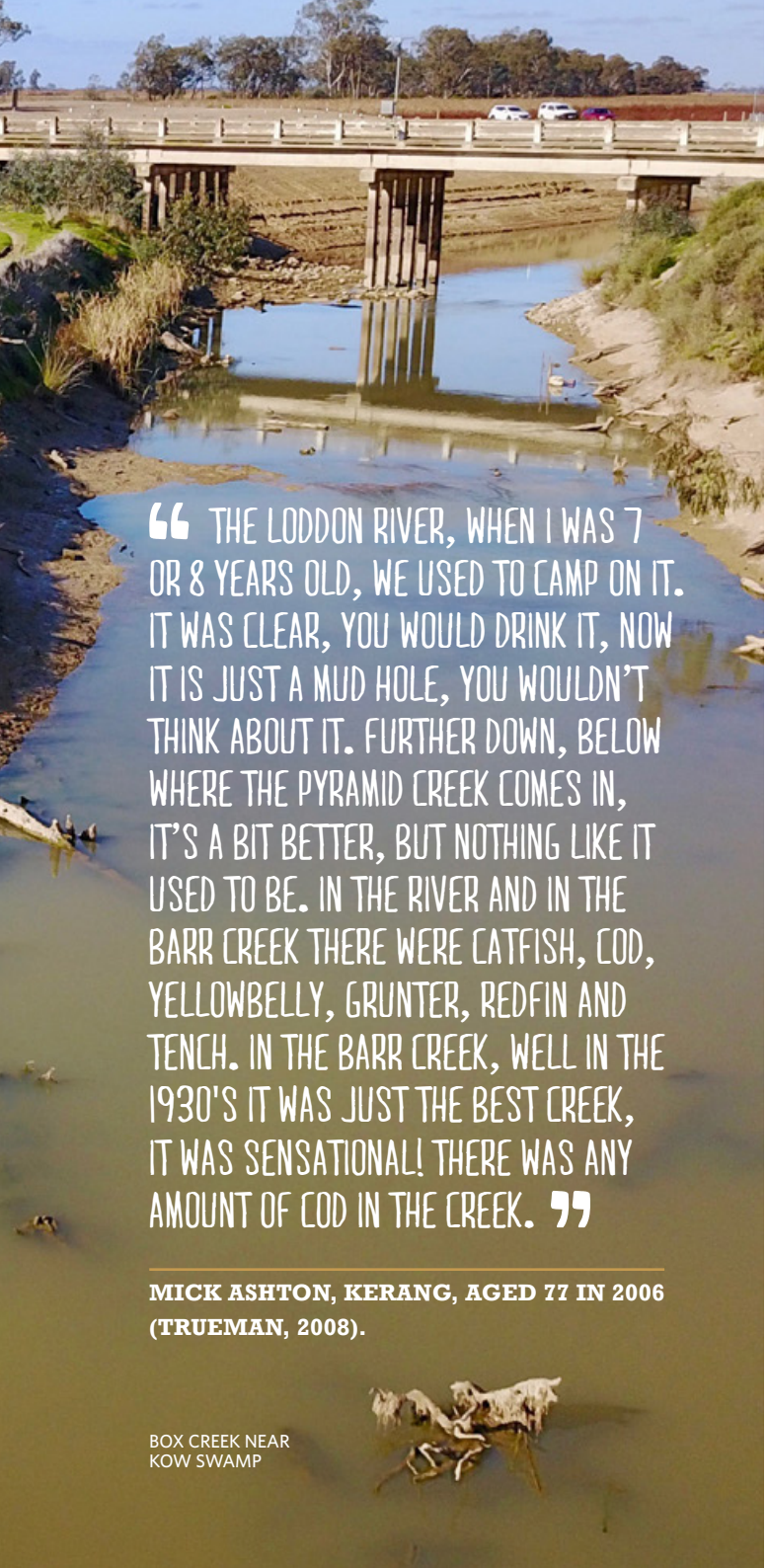
ACROSS THE MURRAY–DARLING BASIN SINCE EARLY EUROPEAN SETTLEMENT.

COMMERCIAL CATCH OF 1800LB (818kg) OF MURRAY COD, CAUGHT IN THE MURRAY RIVER IN 1898 WHEN MURRAY COD PROVIDED 75% OF THE FRESH WATER FISH SUPPLIED TO THE MELBOURNE FISH MARKET.

In the Gunbower and lower Loddon area, only 13 of 22 native fish species are still present in the system today. Of these, six are listed under national and/or Victorian legislation as Threatened.

The 400km of streams that snake through the area are working rivers that support irrigated agriculture. This network of waterways once provided ideal habitat for Murray cod and more than 20 other native fish species – and could do again – if we can address the threats that our native fish currently face.





"THE LODDON RIVER, WHEN I WAS 7 OR 8 YEARS OLD, WE USED TO CAMP ON IT. IT WAS CLEAR, YOU WOULD DRINK IT, NOW IT IS JUST A MUD HOLE, YOU WOULDN'T THINK ABOUT IT. FURTHER DOWN, BELOW WHERE THE PYRAMID CREEK COMES IN, IT'S A BIT BETTER, BUT NOTHING LIKE IT USED TO BE. IN THE RIVER AND IN THE BARR CREEK THERE WERE CATFISH, COD, YELLOWBELLY, GRUNTER, REDFIN AND TENCH. IN THE BARR CREEK, WELL IN THE 1930'S IT WAS JUST THE BEST CREEK, IT WAS SENSATIONAL! THERE WAS ANY AMOUNT OF COD IN THE CREEK."

MICK ASHTON, KERANG, AGED 77 IN 2006 (TRUEMAN, 2008).

BOX CREEK NEAR KOW SWAMP

Loss of connectivity

- Four weirs in the project area do not have fishways, preventing fish from moving to colonise new areas or complete spawning migrations.
- Some weirs, due to their design or operation, have devastating impacts, killing or injuring large numbers of native fish and their larvae.
- Diversions for irrigation flows lure fish into channels, taking them out of rivers and creeks and exposing them to increased threats.

Altered flows

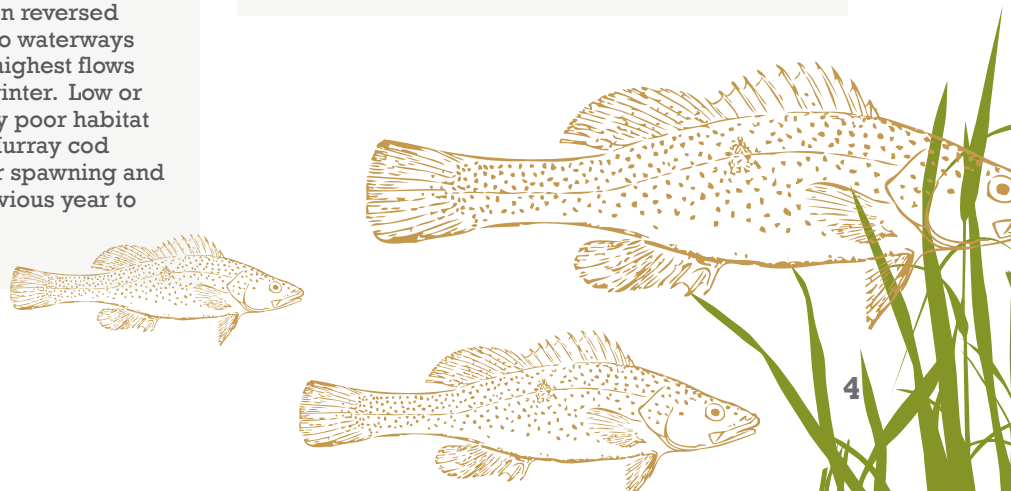
- The network of streams that were once a complex of fast and slow flowing habitats (ideal conditions for species such as Murray cod) are now reduced to a series of slow moving weir pools, with little flow in winter.
- The seasonality of flows has been reversed to cater for irrigation demand, so waterways now typically experience their highest flows in summer and lowest flows in winter. Low or absent winter flows provide very poor habitat at times when species such as Murray cod need flows to build condition for spawning and to enable juveniles from the previous year to survive winter.

Removal of habitat

- Once abundant with snags, large areas of the system have been cleared, removing important habitat for fish to rest, feed and spawn.
- Deep pools that provide important refuge areas during low flows have filled with sediment.
- Trees that provide shade and a food source for native fish have been cleared from the stream banks.
- Livestock graze stream banks, causing erosion and reducing water quality by defecating in the waterway.

Introduced pest species

- Non-native species (such as carp) predate on and compete with, native fish species.



The solution

THE GREAT NEWS IS THAT WE CAN DO SOMETHING TO ADDRESS ALL THE MAJOR FACTORS CONTRIBUTING TO THE DECLINE OF NATIVE FISH.

By improving flows, restoring habitat and removing barriers, we expect native species to recover, river health to improve, and a thriving native fishery to develop.

The Gunbower and lower Loddon system – and the Native Fish Recovery Plan – provide us with a unique opportunity. Because the waterways in this region are an anabranch system, we can deliver targeted flows to improve native fish populations, and then return the water to the Murray River for use downstream.

MAKING EVERY DROP COUNT... TWICE!

THE ICONIC MURRAY COD

Increasing connectivity

- Building fishways at key barriers remaining in the system, for species that need to move long distances to spawn, such as golden and silver perch.
- Replacing undershot weir gates, that kill large numbers of drifting larvae and small fish, with overshot gates that allow safe downstream fish passage.
- Linking lagoon and off-channel habitats to flowing streams to allow dispersal of key species including freshwater catfish, and Threatened small-bodied fish species such as flat-headed galaxias and olive perchlet.

Restoring flows

- Delivering winter base-flows to increase the survival of juvenile fish and improve the condition of pre-spawning fish.
- Smooth out irrigation flows in Gunbower Creek prevent large water fluctuations and to allow nesting species to successfully spawn and to promote diverse aquatic plant communities which serve as nursery areas for larval fish.
- Delivering fish-attractant flows in Pyramid Creek and the Loddon River to encourage fish to move into nursery habitat (such as Kow Swamp).
- Delivering flow pulses to scour silt, inundate benches for food productivity and create quality edge and riparian habitats.
- Exploring options to improve hydrodynamic diversity by operating weir pools at lower levels during the irrigation off-season to increase flowing habitats in the upper section of weir pools.

Improving habitat

- Fencing livestock out of stream banks to reduce nutrient inputs and siltation of deep pool habitats.
- Revegetating stream banks to provide fish food sources, timber recruitment for future instream habitat, shade and roots to stabilise stream banks and provide habitat for fish.
- Installing instream woody habitat structures such as snag piles and fish havens (constructed log stacks) to provide resting habitat, high productivity feeding sites, cover for ambush predators, and spawning sites for species like Murray cod and river blackfish.

Addressing threats

- Making the most of the proposed carp virus release by exploring options to manage carp in Gunbower Forest lagoons through strategic screening and wetland drying.
- Installing screens on irrigation channels and pumps to prevent fish being lost from the breeding population, or from being drawn into pumps and injured or killed.

MURRAY COD ARE RECRUITING IN GUNBOWER CREEK THANKS TO TARGETED ENVIRONMENTAL FLOWS

CASE STUDY: MURRAY COD SPAWNING AND RECRUITMENT FLOWS

Until recently, the population of Murray cod in Gunbower Creek had been declining, with juvenile fish in barely detectable numbers during regular fish surveys. One major issue was the large daily flow variability during the spring irrigation season coinciding with the Murray cod spawning season.

High flow variability affects Murray cod by interrupting courtship, nest establishment, spawning and larval survival. During winter when the creek is drawn down in the irrigation-off season, fish are concentrated in remaining pools with little available habitat and high predation rates, leading to very low recruitment into the population.

North Central CMA worked with fish ecologists, Goulburn-Murray Water and the Commonwealth and Victorian environmental water holders to plan and deliver a large fish spawning hydrograph in Gunbower Creek in 2013/14. The water regime involved a spring spawning/recruitment steady-state flow that used water for the environment to smooth out irrigation flows to prevent large water fluctuations, while increasing hydrodynamic diversity in Murray cod reaches. Following this, a winter connection flow was delivered to increase the available habitat for young-of-year fish, increase food resources, and provide areas of shelter from predation. This watering regime was highly efficient, using very small amounts of environmental water, at minimal cost, without disrupting irrigation water supply.

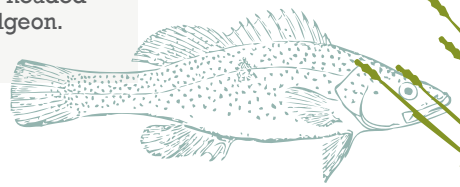
Monitoring confirmed that during October to December, Murray cod larvae were observed in three age cohorts, indicating there had been at least three successful spawning events throughout the managed flow. Monitoring in 2015 found first-year Murray cod recruits in the creek for the first time in eight years. More recently, fish surveys have indicated that greater numbers of fish, as well as a more diverse range of ages are surviving longer and benefiting from consecutive environmental flows. Local anglers are reporting that more Murray cod are being caught in the creek than they can remember.

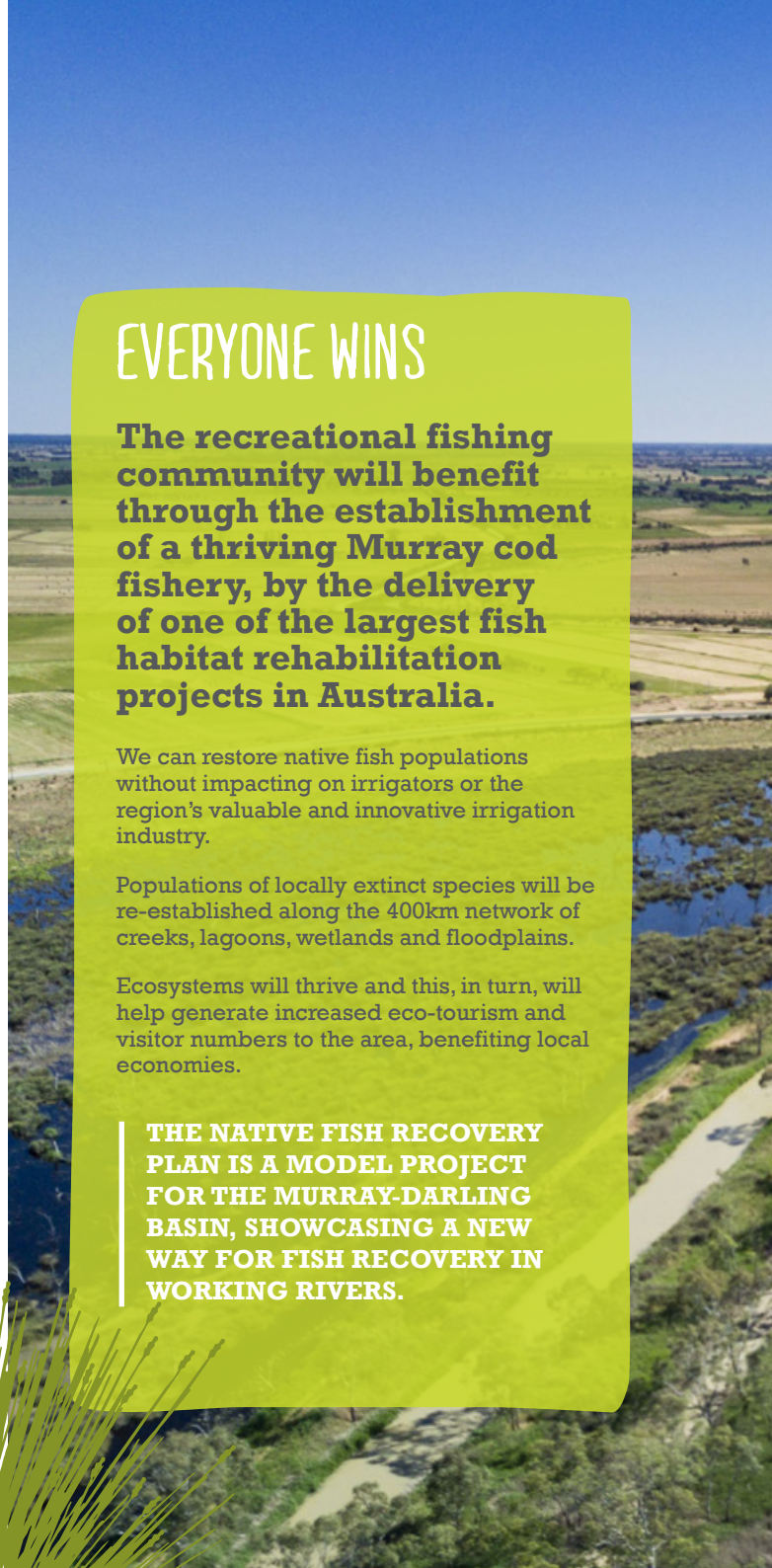
A plan for recovery

THE NATIVE FISH RECOVERY PLAN – GUNBOWER AND LOWER LODDON WAS DEVELOPED IN PARTNERSHIP WITH LEADING FISH ECOLOGISTS.

Its implementation will involve the following key actions:

- Providing flows that are more suitable for fish, while meeting irrigation requirements.
- Delivering flows to small permanent wetlands and billabongs.
- Building fishways on the last four of 11 weirs in the project area, reconnecting fish passage in 400km of waterways with 530km of open Murray River.
- Creating fish passage between lagoons, Gunbower Creek and the Murray River to recover iconic species including freshwater catfish.
- Optimising existing fishways to maximise their effectiveness at passing fish of all sizes.
- Installing irrigation screens across four main irrigation channels to prevent the loss of native fish.
- Re-establishing populations of locally extinct olive perchlet, southern pygmy perch, flat-headed galaxias and southern purple-spotted gudgeon.
- Assisting the recovery of trout cod and freshwater catfish through stocking or translocation.
- Investigating the ideal snag density for the main waterways in the project area and installing snags to improve instream habitat.
- Investigating options to re-create deep pools and restore hydrodynamic diversity – the mix of fast and flowing sections, eddies and backwaters that native fish need to thrive.
- Fencing off riverbanks and installing off-stream watering points for livestock and replanting native species.
- Undertaking robust monitoring to inform actions required and track recovery.





EVERYONE WINS

The recreational fishing community will benefit through the establishment of a thriving Murray cod fishery, by the delivery of one of the largest fish habitat rehabilitation projects in Australia.

We can restore native fish populations without impacting on irrigators or the region's valuable and innovative irrigation industry.

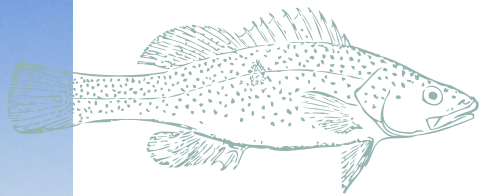
Populations of locally extinct species will be re-established along the 400km network of creeks, lagoons, wetlands and floodplains.

Ecosystems will thrive and this, in turn, will help generate increased eco-tourism and visitor numbers to the area, benefiting local economies.

> **THE NATIVE FISH RECOVERY PLAN IS A MODEL PROJECT FOR THE MURRAY-DARLING BASIN, SHOWCASING A NEW WAY FOR FISH RECOVERY IN WORKING RIVERS.**

The time to act is now.

AERIAL VIEW OF HIRD SWAMP



WHY HERE?

The geography of the Gunbower and lower Loddon area presents the perfect opportunity to link more than 400km of waterways with 530km of open Murray River. Because the waterways in this area are anabranches of the Murray River, flows can be delivered once for native fish and then be returned to the Murray River for downstream use.

The project area consists of a network of regionally, nationally and internationally important streams, lagoons, Ramsar wetlands and floodplain habitats. Significant investment has already been made to rehabilitate the Gunbower Forest floodplain and wetlands, and to remove a number of key barriers to fish movement. We can capitalise on this investment by removing the remaining barriers in the system, improving flows for fish, restoring instream and stream bank habitat, and reducing threats.

> **BY IMPLEMENTING THE NATIVE FISH RECOVERY PLAN, WE CAN BUILD ON THE AREAS ESTABLISHED RECREATIONAL FISHING AND ECOTOURISM INDUSTRIES, CREATE A WORLD CLASS MURRAY COD FISHERY, ENHANCE THE AREAS WATERWAYS AND WETLANDS, AND STIMULATE LOCAL ECONOMIES.**

WHY NOW?

Now is the time to implement the Native Fish Recovery Plan, to halt declines in native fish populations, reverse local extinctions and set a new direction for native fish in northern Victoria and the southern Murray-Darling Basin.

The proposed carp virus will provide a once-in-a-lifetime opportunity for native fish, just as rabbit Calicivirus provided a recovery window for native vegetation. However, the carp virus will not be a silver bullet and we need to make the most of a carp bust with a native fish boom.

Two decades of research have filled in the gaps in our knowledge of native fish biology and eight years of good seasons since the Millennium Drought have reduced pressures on farmers and the environment.

COHUNA CARP CATCH 2016

NATIVE FISH RECOVERY PLAN. COME ON THE JOURNEY OF RECOVERY.

Irrigation channels are a one-way trip for native fish. When fish move into channels, they are effectively lost from the breeding population and exposed to a greater number of threats.

Dams and weirs block fish from moving up and down stream to access new habitats, find food and breed. Weir pools reduce flowing water habitat preferred by species like Murray cod.

Stock increase nutrients in waterways, trample riparian vegetation, cause bank erosion, and lead to infilling of deep pools with sediment.

Willows can take over river banks, blocking up waterways, increasing siltation, and causing water quality problems when they drop masses of leaves during winter.

Carp uproot water plants and increase turbidity. Other pest species such as redfin perch feed on small native fish.

Planting native species on stream banks prevents erosion, improves water quality, and creates fish habitat through snags and tree roots.

Fencing protects river banks from wandering stock, improves water quality and allows native vegetation to flourish.

Increased fish populations leads to better fishing opportunities, increased tourism and people connecting with nature.

Environmental flows increase food and habitat availability as well as providing important cues for fish movement and spawning.

Fallen logs provide instream habitat for fish to breed, rest and feed.

Self-cleaning irrigation screens mean that more fish stay in rivers, and irrigators can benefit from reduced debris loads, allowing more efficient irrigation practices to be adopted.

Fishways and overshot weirs allow fish to safely move upstream and downstream.

WITH YOUR HELP, WE CAN IMPROVE OUR WATERWAYS TO SUPPORT MORE FISH FOR FUTURE GENERATIONS.

Invitation to partner

WE NEED YOUR INVESTMENT TO MAKE THIS PLAN A REALITY.

We can recover native fish populations through the Native Fish Recovery Plan by improving flows, restoring habitat, increasing connectivity and addressing threats.

If your organisation shares the vision we do – to recover native fish populations in the Murray-Darling Basin, increase local jobs and tourism and create a world-class Murray cod fishery in northern Victoria – consider the value of the following projects to your organisation and the contribution you could offer.

Many of our projects will involve partnerships with local industries, Traditional Owners, local Landcare and volunteer groups to deliver on-ground works. You are invited to strengthen these partnerships and work with us to deliver large scale and enduring changes for native fish populations in northern Victoria.

SILVER PERCH

Increasing connectivity
COST $27,000,000

- Removing all major barriers to fish movement throughout the project area and connecting 400km of streams and wetlands to 530km of open Murray River.
- Building new fishways at Koondrook, Taylors Weir and Dehnes Weir and assessing and enhancing existing fishways including Gunbower Weir.
- Creating new links and fishways between lagoons, creeks, and the Murray River.
- Building a new regulator at the National Channel with a fishway and overshot gates.

Targeting flows
COST $250,000

- Researching options to improve flow diversity and monitor the effectiveness of interventions for native fish populations and river health.

Improving habitat
COST $6,000,000

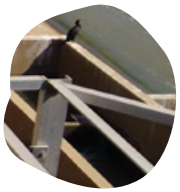
- Protecting and enhancing 245km of river bank and streamside vegetation.
- Installing an additional 80 snag complexes and recreating deep pool habitat.
- Rehabilitating wetlands for Threatened species introductions.

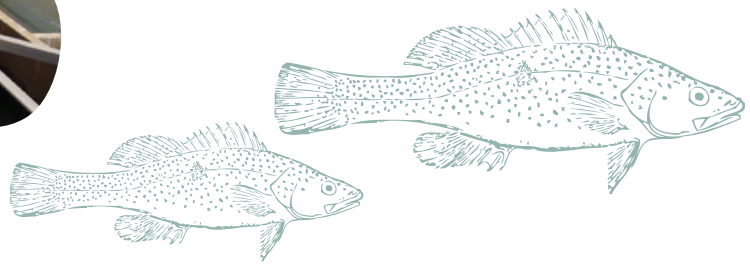
Addressing threats
COST $6,000,000

- Developing and implementing a carp management plan for Gunbower Forest.
- Reintroducing six Threatened fish species.
- Creating a win-win for irrigators and fish by installing self-cleaning fish screens at the major irrigation channel diversions in the Torrumbarry Irrigation Area and trialling innovative pump screens.

THE PLAN IS A MODEL FOR NATIVE FISH RECOVERY ACROSS THE MURRAY-DARLING BASIN. IMPLEMENTING THE PLAN IS A SOLID ECONOMIC INVESTMENT. RECREATIONAL FISHING CURRENTLY BRINGS MORE THAN $307 MILLION TO NORTH WEST VICTORIA ANNUALLY. INVESTING $39.5 MILLION INTO OUR NATIVE FISH RECOVERY PLAN WILL DRAMATICALLY IMPROVE NATIVE FISH POPULATIONS, INCREASE RECREATIONAL FISHING AND GROW LOCAL ECONOMIES.

VERTICAL SLOT FISHWAY AT TORRUMBARRY WEIR





FISHWAYS

KOONDROOK FISHWAY - A GOLDEN OPPORTUNITY FOR PERCH RECOVERY

The Koondrook Weir is near the junction of the Gunbower Creek and Murray River and currently blocks fish movement between the two systems. Electrofishing and tagging studies have shown that when Gunbower Creek passes end-of-system flows into the Murray River, golden perch congregate at Koondrook regulator in large numbers, seeking to access more than 120km of prime fish habitat.
A concept design for a vertical slot fishway is complete. This project will see the detailed design and construction of a fishway that will vastly increase fish populations in the creek.

TARGET: $4.5 MILLION

CONNECTING THE LODDON, GUNBOWER AND LITTLE MURRAY ANABRANCH SYSTEMS

Four fishways have been built on the fish highway between Little Murray River, Loddon River, Pyramid Creek and Kow Swamp. Only two barriers stand between reconnecting the lower Loddon system to Gunbower Creek - Taylors Weir and Dehnes Weir on Taylors Creek. This project will design and construct a vertical slot fishways on each of these structures to allow fish that have matured in the highly productive Kow Swamp to move upstream and into the Gunbower system.

TARGET: $4.7 MILLION

RECREATING LINKS BETWEEN GUNBOWER CREEK AND LAGOONS

This project will create new links and fishways at Splatts Lagoon, Turners Lagoon, Phyland Lagoon, Upper Gunbower Lagoon, Longmore Lagoon, Gum Lagoon and Stoney Crossing to allow native fish to move laterally between the creek and lagoons, and add new access routes to and from the Murray River. This is especially important for linking up and recovering remnant populations of the vulnerable freshwater catfish.

TARGET: $5.1 MILLION

COMPLETING THE LOOP: FISH PASSAGE AT THE NATIONAL CHANNEL HEADWORKS

The National Channel Headworks are the largest remaining barrier in the Torrumbarry Irrigation Area. The current structure has no fishway, preventing movement of fish upstream into the Murray River.
It has an undershot (bottom opening) gate and a large drop, and the resulting high water pressure kills fish and larvae moving downstream from the Murray River.
This project will create safe fish passage both up and downstream and complete the loop of more than 400km of streams connected to the Murray River for fish movement.

TARGET: $12 MILLION

CASE STUDY: BUILDING FISHWAYS

Four fishways have been constructed at major barriers on the 'fish highway' between the Murray River and Kow Swamp, a large and productive nursery area for native fish. This has connected 180km of the Little Murray River, lower Loddon River and Pyramid Creek to 530km of open Murray River downstream of Torrumbarry Weir – a stronghold for golden and silver perch in the southern Murray-Darling Basin. Attraction flows, delivered from Pyramid Creek and the Loddon River, have resulted in huge numbers of fish including golden and silver perch, Murray cod and bony bream moving through the system into Kow Swamp through the recently constructed Box Creek Fish Lock. Re-snagging with 32 snag complexes in Box-Pyramid Creek has provided resting points and food for fish along their journey.

Electrofishing and fish tagging studies have shown that there is a significant accumulation of golden and silver perch at Koondrook Weir when Gunbower Creek has high flow into the Murray River. A fishway at Koondrook, combined with end-of-system flows, would attract large numbers of golden and silver perch into 60km of excellent habitat in Gunbower Creek below Cohuna Weir.

INSTREAM HABITAT


INSTREAM WOODY HABITAT REINSTATEMENT

RE-SNAGGING THE GUNBOWER CREEK

Gunbower Creek has a diversity of habitats including deep pools, fast and slower flowing areas, beds of aquatic plants and productive benches. However, the upstream section of the creek and the National Channel leaving Torrumbarry Weir pool has very low instream woody habitat available for golden and silver perch and few spawning sites for trout cod and Murray cod. Woody habitat densities and pool depths in Gunbower Creek have been mapped, so that re-snagging can be targeted for the range of species that rely on snags for moving, feeding and breeding. When the Koondrook fishway is constructed, large numbers of golden and silver perch will enter the system. It will be critical to provide woody habitat to increase the carrying capacity of the creek and sustain their populations. This project will reinstate 45 large woody habitat complexes in the upstream section of Gunbower Creek, while ensuring that irrigation water delivery is not impacted.

TARGET: $240,000

COMPLETING THE RE-SNAGGING OF THE FISH HIGHWAY: BOX AND TAYLORS CREEK

Box Creek and Taylors Creek, either side of Kow Swamp, are important recreational fishing areas and support large numbers of migrating fish during flow pulses in the irrigation season. Both streams are almost devoid of woody habitat. This project will reinstate a further 10 snag complexes as resting points for migrating golden and silver perch, building on the success of re-snagging already completed in the Pyramid Creek.

TARGET: $50,000

FISH HAVENS FOR THE LAGOONS

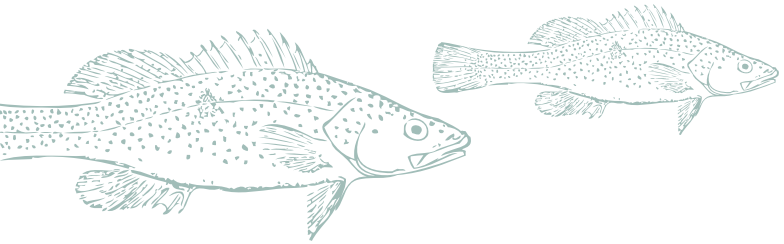
The Gunbower lagoons provide important off-channel habitats for freshwater catfish, as well as a range of wetland specialist fish species. This project will seek to partner with Traditional Owners to construct and reinstate woody habitat structures (fish havens) for native fish populations in Gunbower lagoons.

TARGET $100,000

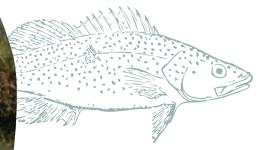
CASE STUDY: RE-SNAGGING WATERWAYS

Murray cod need hard places such as timber to lay their adhesive eggs. They also use woody habitat as cover from predators, as ambush sites, and territorial markers. In 2006, Australia's largest re-snagging project was undertaken, with 4450 snags reinstated in the Murray River between Hume Damn and Lake Mulwala. Fish ecologists from the Arthur Rylah Institute undertook a seven-year mark and recapture monitoring program at up to 424 sites per year to determine not only whether fish aggregated at the snags, but whether the entire population increased because of more available habitat. They found a three-fold increase in the Murray cod population, owing to an increased carrying capacity.

North Central CMA has recently installed 32 snag complexes (comprised of more than 300 individual snags) in Pyramid Creek. A study of the macroinvertebrates (water bugs) at re-snagged sites has shown that their abundance has increased three-fold compared with control sites (meaning more food for fish). While comprehensive fish monitoring is yet to be undertaken, electrofishing and angler catches at the snag complexes has shown that the snags are already providing homes for some large Murray cod and golden perch.




A LARGE MURRAY COD FOUND UNDER REINSTATED WOODY HABITAT IN PYRAMID CREEK

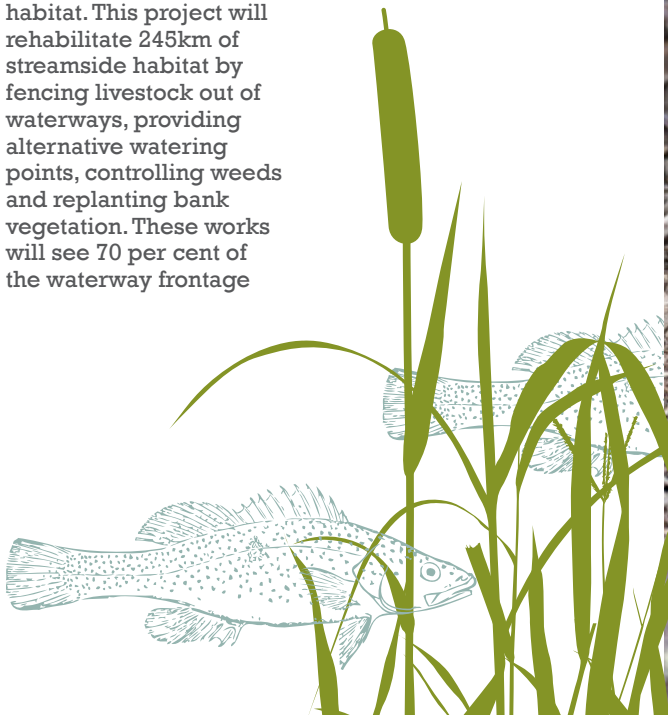


STREAMBANK HABITAT

PROTECTING AND ENHANCING STREAM BANKS

Healthy bank vegetation and stream edges are critical for native fish. Streamside vegetation provides shade, food supply and habitat though root masses, undercuts, and falling timber for adult fish. Larval and juvenile fish rely on aquatic plants, productive benches and trailing bank vegetation as nursery habitat. This project will rehabilitate 245km of streamside habitat by fencing livestock out of waterways, providing alternative watering points, controlling weeds and replanting bank vegetation. These works will see 70 per cent of the waterway frontage in the Torrumbarry Irrigation Area protected. The project will also trial methods to improve the edge nursery habitat for larval fish and recreate historic deep pools that have infilled with silt to create refuge for large-bodied fish such as Murray cod.

TARGET: $3.5 MILLION



IRRIGATION SCREENS

NUMBER 3 CHANNEL REGULATOR AT THE COHUNA WEIR POOL - THE INSTALLATION SITE OF AUSTRALIA'S FIRST SELF-CLEANING IRRIGATION DIVERSION SCREEN

SCREENING THE KOONDROOK CHANNELS

When water is diverted from natural waterways into gravity fed irrigation channels, fish are trapped, not able to return to the breeding population in the river, and very few fish survive when channels are drained for maintenance over winter months. This project will screen the offtakes for the Number 4 and 5 Channels in Koondrook (which divert irrigation water from the Koondrook Weir pool). Screening of these offtakes will be especially important when the Koondrook Weir fishway is built and provides passage for fish to move upstream from the Murray River into the Gunbower Creek through the Koondrook Weir pool.

TARGET: $2.5 MILLION

SHOWCASING PUMP SCREENS: A WIN-WIN FOR ANGLERS AND IRRIGATORS

This project will showcase three self-cleaning pump screens in Gunbower Creek and Little Murray River to demonstrate how they successfully prevent fish and platypus injury or death from being drawn into pumps. The project will quantify benefits for irrigators resulting from increased pumping efficiencies and reduced electricity and labour costs associated with blockages. Cohuna was the birthplace of irrigation in Victoria, and can be the birthplace of best practice irrigation screening in Australia.

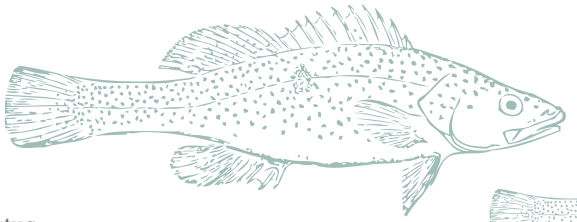
TARGET: $300,000

CASE STUDY: SCREENING IRRIGATION CHANNEL5

Studies in Queensland's Condamine catchment have recorded more than 12,000 native fish being removed by a single 300mm diameter pump over a nine-hour period. In Victoria, work by the Arthur Rylah Institute highlighted the extent of fish losses in gravity fed diversions in the Murray Valley and Torrumbarry Irrigation areas. In electrofishing surveys of 59 irrigation channel sites, more than 10,000 fish from 10 native species were collected. Of particular concern for recreational anglers was the number of Murray cod entering channels predominantly as juveniles, and golden perch which appeared to be entering channels mostly as adults. In a tagging project undertaken in Gunbower Creek, 20 per cent of tagged young-of-year and adult golden perch were found to enter irrigation channels, with none recorded to return.

Fish loss to irrigation channels is a global issue, but there are well established solutions. In the USA and Europe, self-cleaning screens are used to limit fish movement into channels, hydroelectric power stations and pump houses. In some places legislation requires screening, which has resulted in the innovation of varied designs for a range of different situations. Preliminary screen design criteria have been created for Murray-Darling fishes, with laboratory and field trials estimating that if applied correctly, screens could reduce the loss of fish from our rivers by over 90 per cent. As well as protecting native fish the screens will reduce the cost of pump operation and maintenance. Currently pumps need to be regularly backwashed, sometimes daily.

North Central CMA is installing Australia's first self-cleaning irrigation channel screen to prevent fish losses into the Number 3 Channel at Cohuna. A detailed monitoring plan will assess the effectiveness of the screen in stopping fish eggs, larvae, juveniles and adults entering channels.



THREATENED SPECIES REINTRODUCTION

BRINGING BACK THE LITTLE GUYS

Four small-bodied wetland specialist fish species that were once common in the Gunbower and lower Loddon area are now locally extinct. These are southern pygmy perch, purple-spotted gudgeon, olive perchlet and flat-headed galaxias. Because they are now only found in a handful of isolated populations across the Murray-Darling Basin and have poor dispersal ability, they are unlikely to return to the Gunbower and lower Loddon system on their own.

Projects such as the Big Little Four Project in South Australia have shown that reintroduction of small-bodied wetland fish into rehabilitated or surrogate habitats can be successful. This project will identify source populations and suitable wetlands in Gunbower Forest, undertake works to reduce threats and repair habitat in target wetlands, translocate and monitor populations of the four reintroduced fish species.

TARGET: $340,000

RETURN OF CATFISH AND THE TROUT COD

Freshwater catfish was once common in the Gunbower Creek, Gunbower lagoons, Kow Swamp and the lower Loddon River. By the 1920s, catfish were in very low abundance, and presently they only exist in a handful of small and fragmented populations. Trout cod were also historically present in the Loddon River and Gunbower Creek. This project seeks to recover the fragmented populations of these two species by translocating catfish into Gunbower Creek lagoons and stocking trout cod into high quality channel habitats throughout the project area.

TARGET: $170,000

CONTROLLING PEST SPECIES

Six invasive fish species are present in the Torrumbarry Irrigation Area. Of these, carp, gambusia and redfin perch have the largest impact on native fish, particularly small-bodied wetland specialists. This project will implement a carp management plan in Gunbower Forest and take advantage of the proposed carp virus release. It will also implement controls to manage invasive fish species in permanent wetlands supporting reintroduced threatened fish.

TARGET: $300,000

CASE STUDY: TROUT COD BACK FROM THE BRINK OF EXTINCTION

Trout cod was previously widespread in river channel habitats of the southern Murray-Darling Basin. By the late 1980s, monitoring showed that the range of the species had contracted to just two small populations, one downstream of Lake Mulwalla on the Murray River, and a translocated population in a 10km reach of the Seven Creeks in the Goulburn catchment. The species was facing extinction, largely due to habitat degradation such as river de-snagging and historic over fishing.

Three national trout cod recovery plans were developed and implemented over 18 years, including actions such as fishing regulations and enforcement, angler education, targeted habitat reinstatement and captive breeding and re-stocking programs. Because of these dedicated management actions trout cod is no longer in decline. The species range is expanding, and genetically robust self-sustaining populations exist throughout large sections of its former range.

Trout cod was historically present in the mid-Murray and Gunbower Creek systems, but is now very rarely seen. With full implementation of the Native Fish Recovery Plan, including fish friendly flows, habitat reinstatement, and trout cod re-stocking, we can expect to see recovery of this iconic fish species in the project area.

Key fish species for recovery in the region

Estimated Population Change (EPC):

Slight decline

Moderate decline

Major decline

Predicted Recovery (PR):

Slight increase

Moderate increase

Major increase

Estimates and predictions are based upon a fully implemented plan.

Murray cod
Maccullochella peelii

Status: *EPBC (Vulnerable), Vic FFG listed*

EPC:
PR:

Murray cod is the largest freshwater fish in Australia, growing up to 1800mm. They prefer deeper water with boulders, logs, undercut banks and overhanging vegetation.

Murray cod is an ambush predator; eating fish, crayfish and frogs. Spawning occurs during spring following mating and nest selection. Stable flows are needed during this time to prevent nest abandonment. Large, adhesive eggs are deposited into hard surfaces such as rocks and logs. The males guard the eggs during incubation. Hatching occurs in 5-13 days and larvae drift downstream in the current.

Natural populations occur in the low and mid-elevation streams of the Murray-Darling Basin. Murray cod populations started to decline in the 1920s due to overfishing, habitat destruction, river regulation and the removal of woody habitat.

Trout cod
Maccullochella macquariensis

Status: *EPBC Endangered, Vic FFG listed*

EPC:
PR:

Trout cod is a large carnivorous species and can grow up to 500mm (maximum size is about 850 mm). Prefers rapidly flowing streams, with logs and debris over rocky gravel bottoms. Larger fish occur in deeper sections.

Their diet comprises fish, yabbies, mudeyes, aquatic insect larvae and freshwater prawns. Spawning occurs in late spring and large eggs are deposited on hard substrates such as logs and rocks.

Threats include predation of juveniles by alien fish species such as redfin and trout, habitat degradation, the removal of woody habitat, sedimentation and clearing of riparian vegetation. River regulation and cold-water pollution also pose a threat.

Golden perch
Macquaria ambigua

Status: *Vic advisory listed for wild populations (near threatened)*

EPC:
PR:

Golden perch is a medium to large fish growing to 400mm (maximum size is about 760 mm). It prefers lowland areas, with deep, slow-flowing pools, logs and overhanging vegetation. Diet consists of shrimp, yabbies, small fish and bottom dwelling aquatic insects.

Spawning occurs during floods in spring and summer when water temperatures exceed 20°C. Adults migrate upstream, at times well over 1,000 km during the breeding season. A female can lay up to 500,000 large, semi-buoyant eggs, which drift downstream. Hatching occurs after 1-2 days. Recruitment success of this species is related to floodplain inundation.

The species is widespread but declining, and is heavily supplemented by stocking in Victoria. Key threats include barriers to migration and recolonisation posed by weirs and dams, river regulation and cold-water pollution.

Silver perch
Bidyanus bidyanus

Status: *EPBC (Critically endangered), Vic FFG Listed*

EPC:
PR:

Silver perch is a medium-sized fish, growing to around 350 mm (maximum is about 500 mm). It prefers lowland, turbid and slow-flowing rivers and is an omnivorous species eating mainly aquatic plants, snails, shrimps and aquatic insect larvae.

Spawning is related to flow and occurs during spring after a long upstream migration. The species was once common throughout the Murray-Darling Basin, except in the upper reaches. It is still locally abundant in areas of the mid-Murray; however, its distribution is patchy. Key threats include river regulation and instream barriers, which disrupt spawning movements, and interactions with alien species such as redfin.

Freshwater catfish
Tandanus tandanus

Status: Vic *FFG Listed*

EPC:
PR:

Freshwater catfish is a medium-sized species, growing to 500 mm (maximum size is about 900 mm). It prefers slow flowing streams, lakes and lagoons and is usually associated with sand or gravel substrates with fringing vegetation. Catfish are opportunistic carnivores feeding mainly on shrimps, freshwater prawns, yabbies and small fish.

Spawning occurs during spring and summer when water temperatures reach 20–24°C. Large, non-adhesive eggs are laid on pebbles, gravel and coarse material which are arranged into a circular nest. The male remains at the nest to fan, clean and guard the eggs.

Historically common in the Murray-Darling Basin, the species has declined significantly since the late 1970s. Threats include alien species such as carp and redfin, cold-water pollution, barriers to movement, changes to natural flows, sedimentation and elevated salinity levels.

River blackfish
Gadopsis marmoratus

Status: *Regionally declining*

EPC:
PR:

River blackfish is an opportunistic carnivore; growing to 200-250mm (maximum size is about 600mm). It prefers clear, gently flowing streams with good in-stream cover such as large woody habitat, aquatic vegetation or boulders.

It is found in a range of habitats, from upland and lowland small creeks to large rivers. It consumes aquatic insect larvae, crustaceans, terrestrial insects that fall or land on the water surface, and occasionally other fish.

Spawning occurs during spring and summer when temperatures exceed 16°C. Large demersal and adhesive eggs are usually laid inside hollow logs, although rocks and undercut banks are sometimes used. Habitat modification such as riparian zone degradation, de-snagging and river regulation are likely to have impacted river blackfish.

Murray–Darling rainbowfish
Melanotaenia fluviatilis

Status: Vic *FFG Listed*

EPC:
PR:

Murray-Darling rainbowfish is a small laterally compressed fish, reaching 70mm (maximum size is about 110mm). It prefers slow flowing rivers, wetlands and billabongs and is often associated with grassy banks or submerged logs and branches where spawning occurs. Diet consists of aquatic and terrestrial invertebrates and some algae. Spawning occurs during spring to summer when temperatures reach 20°C. Small eggs are laid in batches of 5-20, 3-4 times a day for several days. The eggs sink and adhere to aquatic plants. Threats include predation on adults by redfin perch, predation on larvae by eastern gambusia, cold water pollution and loss of aquatic vegetation.

Southern pygmy perch
Nannoperca australis

Status: *Vic Advisory listed (northern populations)*

EPC:
PR:

Southern pygmy perch is a small laterally compressed fish, with a small mouth, reaching 60mm (maximum size is 85mm). It prefers slow flowing or still water with dense aquatic vegetation and is usually found in streams, channels and billabongs.

Its diet consists mainly of zooplankton and small insect larvae. Spawning occurs from spring to early summer when water temperatures reach 16˚C. Maturity is generally reached in the first 12 months. This species may live up to five years. Females produce up to 4,200 round, transparent and non-adhesive eggs, which are scattered on aquatic vegetation.

Formerly known to occur in the Murray and lower Murrumbidgee catchments, it is now thought to have disappeared from most locations in New South Wales and is patchily distributed from the Broken, Ovens, Campaspe, Goulburn, Kiewa, Mitta Mitta, Loddon and Wimmera basins.

Southern purple-spotted gudgeon
Mogurnda adspersa

Status: Vic *FFG Listed*

EPC:
PR:

Purple-spotted gudgeon is an attractive fish growing to 120mm (maximum size is about 150mm). The species inhabits rivers, creeks and billabongs, and is usually found in quiet or slow-flowing sections over rocks or among vegetation.

Its diet consists of small fish, aquatic invertebrates, worms and tadpoles. Spawning occurs in summer when water temperatures exceed 20°C. Females deposit several batches of adhesive eggs on rocks, logs or solid surfaces, and the male guards and fans the eggs.

The species has significantly declined in the Murray-Darling Basin. Threats include predation from alien species such as trout, redfin and eastern gambusia, habitat alteration, cold water pollution and changes to flow.

Flat-headed galaxias
Galaxias rostratus

Status: *EPBC (Critically endangered)*

EPC:
PR:

Flat-headed galaxias is a small, slender bodied species with a flattened head that reaches 80mm length (maximum is about 146mm). It is found in still or slow flowing water on the margins of lakes, billabongs and streams. The species usually swims mid-water over rock and sandy substrates and is often found close to, or among, aquatic plants. It predominately feeds on aquatic insects and micro-crustaceans.

Spawning occurs from late winter to early spring when temperatures reach 9-14°C. It is not known if the species migrates for spawning. Individuals mature within their first year. Eggs are round and slightly adhesive and are scattered randomly to the substrate.

Historically, this species was common to the southern Murray-Darling Basin. Possible threats include competition with and predation by introduced species such as redfin , trout and eastern gambusia, river regulation, cold water pollution and in-stream barriers.

Olive perchlet
Ambassis agassizii

Status: Vic *FFG Listed*

EPC:
PR:

Olive perchlet is a small, semi-transparent wetland specialist species that inhabits rivers, creeks, ponds and swamps. It was once widespread throughout the Murray Darling Basin but has suffered large-scale decline.

Olive perchlet feed on a range of zooplankton and aquatic and terrestrial insects. It is usually found in slow-flowing or still waters, in sheltered areas such as overhanging vegetation, aquatic macrophyte beds, logs and dead branches.

Spawning occurs from October to December, when water temperatures increase to about 23°C. Females lay up to 700 eggs, attached to aquatic plants and rocks on the streambed.

Key threats include predation by eastern gambusia and redfin, habitat degradation particularly loss of aquatic plants from carp and water regulation, cold water pollution and water level fluctuations.

VICTORIA State Government

NORTH CENTRAL Catchment Management Authority
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VR FISH

GOULBURN-MURRAY WATER

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