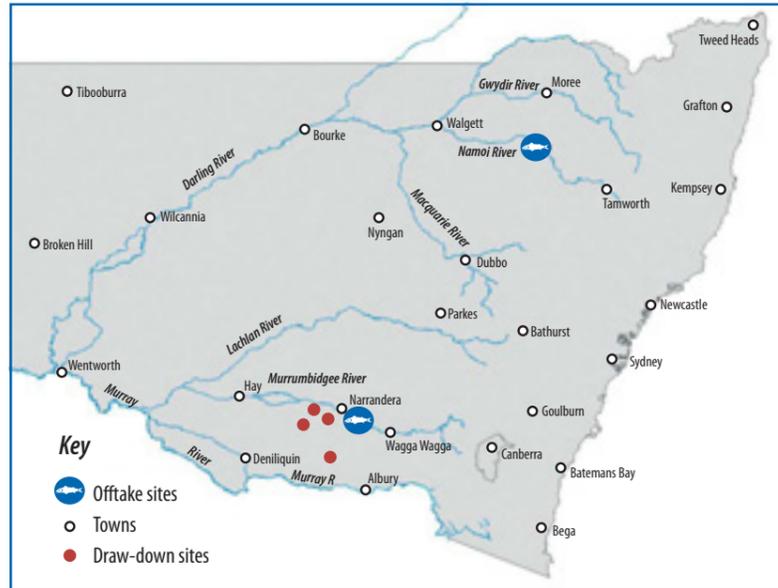


Scientists are using a wide range of scientific collection methods to compare the number of fish that approach the irrigation offtakes with the number that are actually extracted. In addition, the structure of fish communities within irrigation systems is being surveyed to determine species that are able to survive the extraction process. Tagging studies are also being undertaken to determine whether fish are able to return to main river systems after they have been extracted. Tags are yellow and easily visible if a fish is captured. Freshwater anglers are encouraged to report any tagged fish to the NSW DPI tagging hotline on 1800 185 027.

It is anticipated that the results obtained from these studies will be used to help improve management practices for irrigation systems within the Murray-Darling Basin.



Map 1. NSW Murray-Darling basin showing the major river systems involved and relevant study sites.

WHO IS INVOLVED?

The Murray-Darling Basin Commission is funding this project over two years as part of their strategic investment and education program. All scientific research is being collaboratively undertaken by staff from New South Wales Department of Primary Industries at Narrandera and the Australian Cotton Research Institute at Narrabri. Two major industry partners have also generously provided researchers access to their irrigation systems.

IMAGES

Front cover: Irrigation pumps commonly used to extract water within the M-D Basin. A Murray cod is captured then tagged before being released. Typical irrigation canal in the M-D Basin. Inside: Technician checks samples for larvae. Six day old golden perch larvae. One day old trout cod larvae. Irrigation pump typically used throughout the M-D Basin. A large, tagged Murray cod being released into Murray River.

FOR FURTHER INFORMATION

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FURTHER READING

Gilligan, D & Schiller, C. (2003). *Downstream transport of larval and juvenile fish. A final report for the Natural Resources Management Strategy. Project No. NRMS R7019.* NSW Fisheries, Narrandera

Jones, M & Stuart I. (2004). *Impacts of flow regulation structures on fish in Barmah-Millewa forest.* Freshwater Ecology, Arthur Rylah Institute, Heidelberg.

Lintermans, M. & Phillips B. (2003). *Downstream Movements of Fish in the Murray-Darling Basin.* Murray-Darling Basin Commission, Canberra.

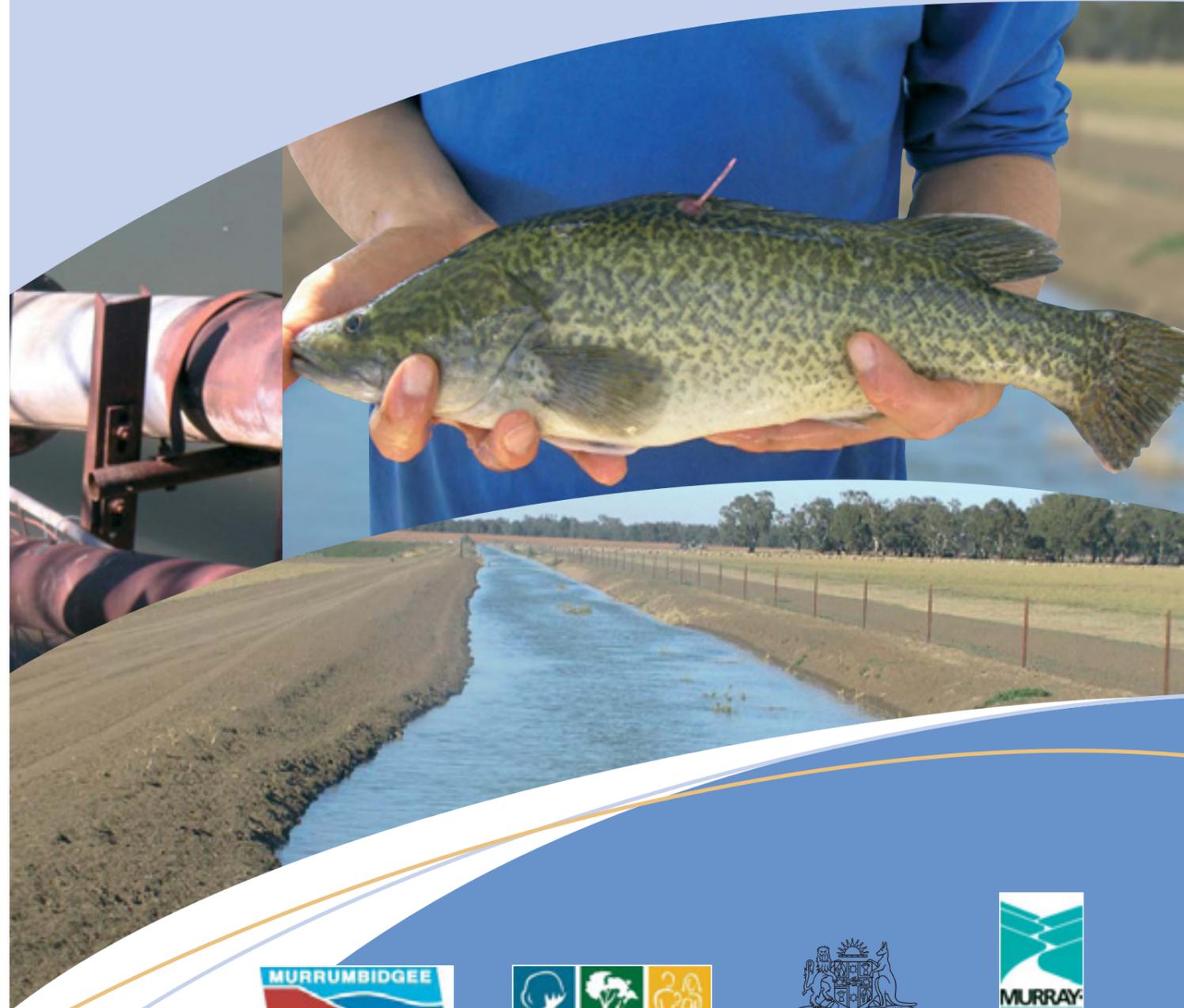
McDowell, R.M. (1996). *Freshwater Fishes of South-Eastern Australia.* Second Edition. Reed Books, Australia.

MDBC. (2004). *Native Fish Strategy for the Murray-Darling Basin 2003-2013.* Murray-Darling Basin Commission, Canberra.

O'Connor, J., O'Mahony, D., O'Mahony, J. (2003). *Downstream Movement of Adult Murray Darling Fish Species.* Freshwater Ecology, Heidelberg.

Thorncraft, G & Harris J.H. (2000). *Fish Passage and Fishways in New South Wales: A Status Report.* NSW Fisheries, Sydney.

Native Fish in irrigation supply offtakes



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NSW DEPARTMENT OF
PRIMARY INDUSTRIES





IRRIGATION IN THE MURRAY-DARLING BASIN

The provision of water for irrigation is essential for many farmers and communities throughout Australia. In particular, irrigated agriculture forms a large and financially important industry, which produces 50% of all profit derived from Australian primary production. The Murray-Darling Basin is Australia's most important agricultural region, and is often termed 'Australia's food bowl'. Within the Basin, over 1.4 million hectares of crops and pastures are irrigated every year including rice, wool, sheep, dairy produce, oil seed, corn, cotton, barley, wheat, grapes, citrus and vegetables, for both domestic and overseas markets. Overall, it contains 42% of all Australian farms.

In order to adequately service these crops, approximately 10,232 Gigalitres (GL) of water are annually diverted from rivers within the Murray-Darling Basin, including water transferred from the Snowy River. Such large scales of water extraction could potentially have damaging effects on riverine ecosystems but any potential environmental impacts are currently unknown.

WATER DIVERSION TYPES

There are two major types of water extraction methods used in the Murray-Darling Basin, canal systems and direct pumping, and each could have different impacts on aquatic fauna.

1. Irrigation canals/channels and creeks

This type of water diversion is more common throughout the southern reaches of the basin where rivers generally experience high average annual flows, that are regulated by controlled releases from large on-river storages. In order to get this water to irrigators, many regulatory weirs were specifically constructed on main river channels and are operated to either deliver or gravitate water into canals and effluent creek systems. Water users can then either directly siphon or pump water out of these canals and creeks to areas where it is needed. In some areas, the amount of water diverted into canal systems can represent over half the actual river flow.

2. Pump systems

Rivers within northern regions of the Basin are relatively isolated, with lowland regions of reduced slope, high evaporation rates and variable (and often unpredictable) flow patterns. Therefore, the construction of on-river storages is not always viable and the direct pumping of water from main river channels is more widely adopted. Extracted water is usually deposited into privately owned off-river storages and re-directed, on a 'needs-basis', to areas where water is required. Although the size and shape of irrigation pumps can vary substantially, some can be up to 600mm in diameter and extract over 5 megalitres (ML) an hour.

FISH OF THE MURRAY-DARLING BASIN

A total of 55 freshwater fishes inhabit the Murray-Darling Basin. Of these, eight are not found anywhere else. Some species, such as the Murray cod and Golden perch, historically supported extremely profitable recreational and commercial fisheries but have experienced dramatic declines in range and abundance since European settlement. Although many factors are thought responsible, the extraction of large volumes of water is thought to be one of the main contributors.

Extracting large volumes of water could potentially alter many variables that affect fish such as river flow, temperature, channel shape, erosion, turbidity and salinity. In particular, changes to any of these factors (especially river flow and temperature) could affect natural cues for migrations that are important for native fish to spawn, find new habitat and forage for food. These effects could be substantial because at least 14 species are known to make long-distance migrations (upstream or downstream) in order to complete various aspects of their life cycle.

Some species have a life-cycle stage where larvae can drift hundreds of kilometres downstream shortly after hatching. This drifting behaviour is extremely important for larvae to disperse away from the hatching site. Given that larvae are generally poor swimmers, they tend to go wherever the current takes them.

POTENTIAL IMPACTS ON NATIVE FISH

Fish species within the Murray-Darling Basin exhibit different behaviour during different life stages. Therefore, it is possible that irrigation practices will impact native fish in several different ways (See table 1).

Possible impacts	Channels/ canals	Pumps	Being investigated
Extraction/diversion of larvae	✓	✓	✓
Extraction/diversion of juvenile fish	✓	✓	✓
Extraction/diversion of adult fish	✓	✓	✓
Injuries to fish	✗	✓	✓
Sudden temperature variations	✓	✗	✓
Fish left stranded without water	✓	✗	✓
Fish exposed to low dissolved oxygen levels	✓	✗	✗
Passage of fish through regulators	✓	✗	✓
Extracted fish return to river systems	unknown	unknown	✓

Table 1. Summary of the potential impacts of different methods of water extraction on fish and whether they are being investigated as part of this project.

Scientists have previously thought that fish and other organisms could be removed from main rivers and streams, at areas where water is diverted into canal and creek systems. As most irrigation occurs over the warmer months of the year, which coincides with spawning and migration periods, there is an increased chance of fish being extracted. If fish do become extracted, there may be few opportunities for them to return to the river systems.

Many researchers have also suggested that fish larvae (and juveniles) could be directly extracted by pumping systems. In addition, adult native fish may also be pumped, or injured, if they accidentally enter the intake areas. Overseas research determined that passage

through irrigation pumps could increase the possibility of injuries such as de-scaling, fin, eye and head damage.

In Australia however, little is known about how fish respond to irrigation diversion, or what happens if they are extracted. Therefore, determining whether fish live and breed successfully within irrigation channels, or are injured or killed during this process, is essential to develop effective management practices to reduce any possible adverse impacts. NSW Department of Primary Industries (NSW DPI) is currently undertaking research to try and answer some of these questions to help protect and enhance our native fish.

WHAT IS BEING DONE AND HOW IS IT BEING ASSESSED?

NSW DPI is currently undertaking collaborative research with the Australian Cotton CRC and Murrumbidgee Irrigation to quantify whether fish are removed from main river systems as a result of water extraction. Specifically, the research team want to identify:

- which species are most susceptible to extraction
- whether different size classes are impacted
- if the susceptibility to extraction varies at different times of the year
- what happens to fish once they are extracted.

To answer these questions, scientists will be collecting fish from two key sites in the Murray-Darling Basin (Map 1). One site is an open irrigation canal in the Murrumbidgee catchment called Bundidgerry Creek, which supplies the Murrumbidgee Irrigation Area with water. The site is typical of irrigation canals in southern regions and at times, receives much of the flow in the Murrumbidgee River.

The second site was chosen to investigate the potential impacts of irrigation pumps within the Namoi River Catchment. Two pump sites are being investigated and each has the capacity to extract up to 15 ML per hour. Both pump sites are typical methods of water extraction in northern reaches of the Murray-Darling Basin.