November 2001

contents

Living on Floodplains

by Professor Peter Cullen

In recent years we have learned that rivers are much more than the channel that carries water during low flow periods. The floodplain is an integral part of the river, even though it only connects to the river occasionally. The floodplain, and its associated wetlands, provide a range of ecosystem services on which we all depend.

Floodplain soils are amongst the richest agricultural soils anywhere. They periodically get replenished with silt, nutrients and organic matter during flooding. Periodic flooding is, however, inevitable, and if humans want to settle on floodplains, they need to learn to live with these periodic inundations.

We have built some towns in some pretty stupid places. This has caused unnecessary hardship to many people. Some towns, like Gundagai, have been moved after catastrophic floods. Others have tried to protect themselves by building levees to protect the developments. This can be effective in protecting investment from small to medium floods, but leads to catastrophic losses when the levees fail and major flooding occurs, as we have seen in the Mississippi River in the USA. It is also a strategy which seems to cause significant damage to river health.

We now appreciate that healthy rivers require an adequate flow regime, adequate water quality and appropriate habitat. If all these things are adequate, then we commonly have healthy biological populations of fish, invertebrates and birds.

When we look at rivers, we need to consider:

- the riparian zone which protects stream banks from erosion during high flow, filters materials coming from the catchment and provides food, shade and habitat for fish and other animals. We know the riparian zone is damaged by grazing.

Cooperative Research Centre for Freshwater Ecology

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The Cooperative Research Centre for Freshwater Ecology improves the condition of Australia's rivers, lakes and wetlands

- the upstream-downstream connectivity, which is necessary for breeding of many fish species, and is degraded by weirs and dams.
- the river-floodplain connectivity, which is commonly damaged by levees, or by providing a flow regime that rarely allows flooding.

Floodplains are areas of extraordinary biodiversity. Floodplain waters have 100 - 1000 times the number of organisms found in the river channel. When a floodplain wets, a swarm of tiny creatures emerge from eggs, cysts & burrows in the mud where they have been waiting since the last flood. Algae, invertebrates, insects and fish all burst into life from their resting stages or refuges in floodplain wetlands. Then, commonly, the birds come and after that the floodplain dries and they return to their resting stages.

It is also interesting to think about the primary production in these systems. This is the process by which sunlight creates organic matter via photosynthesis. Under low flow conditions, this might take place on the bottom of shallow streams and in emergent reeds along the bank. As the water rises, it might switch to algae production as light no longer gets to the bottom of the stream. As the water rises across the floodplain it connects with billabongs and other water bodies. Some of the algae seem to survive in the soil, ready to spring to life when wetted. All sorts of organisms erupt into life and move from the river channel and floodplain water bodies to graze on the primary production. Fish commonly swim out onto the floodplain to feed on insects and other food. Floodplains and their wetlands are indeed boom and bust ecosystems.

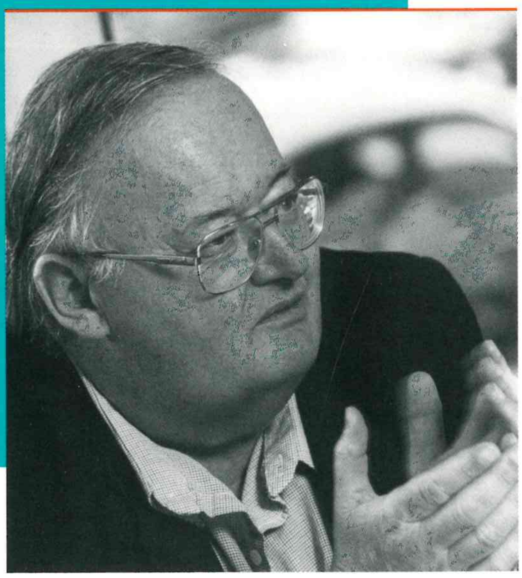
We degrade these ecosystems when we alter the flooding regime by taking excessive water or by building levees to protect developments. While levees protect against the small -medium floods, they are likely to increase damage from large floods, because people have built in inappropriate places, believing they are safe. Some of the enlightened catchment organisations are seeking to remove levees, partly because of the legal liability they incur, but also partly at least because of the ecological liability they incur.

As Australia faces the enormous bill for repairing the damage that we have caused through ignorance, it is important to appreciate that it is more cost effective to stop the degradation beforehand rather than to try and restore ecosystems afterwards. It is better to stop pest species entering our rivers rather than try to eradicate them afterwards. Healthy rivers and floodplains appear much less liable to invasion by pest organisms than degraded systems.

When floodplains flood, sediment, salt and nutrients are spread over the floodplain soils, leading to cleaner water in the channels. The floodplain traps and processes pollutants to protect rivers. Flooding is seen as resetting the system after which floodplain wetlands develop in response to their particular conditions. If large fish are trapped in a floodplain wetland as the flood recedes, then the system that subsequently develops may be very different from one without a large predator.

The CRC is engaged in numerous research projects that provide the scientific direction needed to restore and manage our floodplains. This issue of Watershed features a project on the Cooper Creek floodplain that demonstrates the importance of river and floodplain connectivity.

Floodplains and their rivers are single ecological units that give great wealth to society, if we do not manage them wisely we risk destroying the lifeline upon which this country has prospered.



Professor Peter Cullen, Chief Executive of the CRC for Freshwater Ecology.
Photo: M Ashkanasy, courtesy of Melbourne Water

State of the Rivers Revealed

A newly released report provides, for the first time, a picture of river health across the Murray Darling Basin (MDB). The snapshot report is the first overall assessment of the degree and extent of river health problems in the Basin and as such, offers invaluable direction for management priorities.

"The snapshot gives a very clear message that we need to do something dramatic," said Dr Green, the President of the Murray-Darling Basin Commission.

The Snapshot of Murray-Darling Basin River Condition report was prepared by the Cooperative Research Centre for Freshwater Ecology in collaboration with CSIRO Land and Water and the National Land and Water Resources Audit and funded by the Murray-Darling Basin Commission.

The snapshot assessed 77,000 kilometres of river, from South Queensland to Adelaide, and found that 95 percent of the river suffers environmental degradation. Disturbance to the catchment and changes to nutrient and suspended sediment loads are the greatest contributors to this degradation.

Forty percent of the length of the rivers that were assessed had biota that was significantly impaired. Ten percent of river length was found to be severely impaired, having lost at least 50 percent of the types of aquatic invertebrates (insects, water snails etc) expected to occur there.

Fish populations are in very poor to extremely poor condition throughout the River Murray though in slightly better condition in the lower Darling. Macro-invertebrate communities are generally in poor condition and declining towards the river mouth.

Habitat condition is degraded in much of the Basin, with loss of riparian vegetation and increased sand and gravel bedload being the two main contributors to this degradation. The condition of riparian vegetation along the entire River Murray and lower Darling was assessed as poor with grazing and alterations to the flow regime being the major causes.

The snapshot underlines the importance of managing river health as a mosaic of connected parts rather than as separate, individual components. Focussing on improving one part of river health, such as water quality, without considering other parts of river health, such as flow, plants, animals and habitat, will limit any benefits to the rivers.

We need to do something dramatic

The snapshot also stresses the interconnected nature of rivers between upstream and downstream. In other words, changes made to one part of the river system will have ripple effects in other parts of the river system. For example, most of the suspended sediment is generated in the upland and mid-slope areas of the Basin, but the main impacts are felt in lowland rivers, weir pools and reservoirs where the sediment is stored.

Copies of the Snapshot of Murray-Darling Basin River Condition report can be found on the Murray-Darling Basin Commission web site www.mdbc.gov.au.

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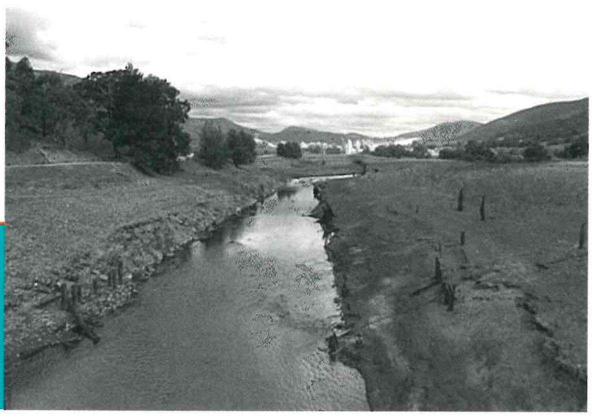

Loss of vegetation and grazing of the riparian zone are just two factors that can impact negatively on river condition. Photo: P Sloane CRCFE

Floodplain Productivity of Dryland Rivers

by Dr Stuart Bunn and Fiona Balcombe

Dryland rivers, such as Cooper Creek in the Channel Country of western Queensland, are renowned for their spectacular episodic floods, which transform their extensive floodplains into vast slow-moving "wetlands" covering thousands of square kilometres. Such flooding is generally considered to be of critical importance for river ecosystem function over large spatial and temporal scales. As well as directly influencing the distribution and abundance of aquatic organisms, flood events are likely to have a profound effect on ecosystem processes at a landscape scale.

Stuart Bunn of the CRC for Freshwater Ecology and Peter Davies (University of Western Australia) are currently studying the potential importance of aquatic production associated with large flood events on dryland rivers. They propose that during extended periods of inundation, aquatic primary production on these inundated floodplains may be an important source of organic carbon for aquatic and even terrestrial food consumers. This project is supported by Environment Australia under the Environmental Flows Initiative, Queensland Natural Resources and Mines, and includes several other CRC staff from Griffith University (including Fiona and Stephen Balcombe, Michelle Winning, James Udy and Frances D'Souza).

diversion is likely to have a profound impact on ecosystem processes

The project team intensively sampled the Cooper Creek floodplain during a 1:14 year return flood, during late summer 2000. A major goal was to quantify primary production in the open water and on inundated soils and this was measured *in-situ* using Perspex metabolism chambers. Metabolism was initially dominated by respiration (i.e. P/R<1) but rates of primary production increased with increasing flood duration and the system soon switched to be a major producer of carbon (i.e. P/R>1). At the height of the flood (which covered over 13,000 km^2), one day of algal production was estimated to be equivalent to about 80 years of production in the permanent waterholes during the dry. Algae growing on the floodplain may therefore represent a substantial source of labile (easily altered) carbon that is potentially available for both aquatic and terrestrial consumers.

Floodplain inundation was accompanied by a proliferation of aquatic invertebrates, especially small crustaceans. Ten species of fish, including larvae, juveniles and adults of several species, were recorded on the floodplain with an average biomass of over 1.0 tonne per km^2. Samples of aquatic invertebrates, fish, terrestrial and aquatic detritus, algae and terrestrial invertebrates were collected for food web analysis.

Sorting the catch from a fyke net. Photo: Robert Ashdown

Trawling for fish on the floodplain near Windorah western Qld. Photo: Robert Ashdown

The diets of all fish species were dominated by aquatic sources but with a greater range of dietary items among species than that recorded during the dry. Preliminary stable isotope data are consistent with the view that much of the fish biomass is ultimately derived from algal sources. Additional work is currently underway to confirm this finding using other biomarkers.

These findings highlight the importance of the connectivity of large river channels and their floodplains during flood events. However, instead of observing an increase in the importance of terrestrial sources of organic carbon to aquatic consumers (as one might predict), the inundated floodplain of the Cooper appears to be a major source of aquatic production. Some of this floodplain production undoubtedly returns to river waterholes as fish biomass once floodwaters recede. However, given the small area of permanent waterholes (3.2km^2) in the region compared with the inundated floodplain (several thousand km^2), much of the aquatic production must either be exported downstream, retained on the floodplain or immediately consumed (e.g. by water birds).

Changing the extent, duration and frequency of flood events through water harvesting or other forms of flow diversion is likely to have a profound impact on ecosystem processes in dryland rivers. The rates of aquatic primary production are high and the spatial extent of inundation so great, that this could also represent a significant contribution to production at the landscape scale. Using satellite imagery and changes in production rates (on floodplains during the flood and in waterholes during the dry) from previous floods we hope to estimate the consequences of changes in the flow regime.

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The sign says it all-the Cooper in flood 2000. Photo: Robert Ashdown

Identifying the Weakest Link: Adaptive Management of the Reintroduction of a Threatened Fish

John McKenzie bids farewell to a trout cod before returning it to the stream. As part of the monitoring program fish are caught, measured, weighed, tagged and released unharmed. Photo: Tim O'Brien.

The Australian native freshwater fish species, trout cod, was once widely distributed throughout the Murray Darling Basin. The species is now listed as critically endangered and the last successfully breeding natural population occurs in a 200km stretch of the Murray River. This CRC for Freshwater Ecology project combines a broad range of modelling and ecological skills to assess why reintroduction programs for the species are meeting with limited success.

The research team is based at the Arthur Rylah Institute and includes John Koehn, Andrew Bearlin, Charles Todd, Simon Nicol and Sabine Shreiber.

Trout cod have undergone a dramatic decline in both range and abundance over the last fifty years due largely to the effects of habitat degradation, overfishing, altered temperature and flow regimes and competition from introduced species. The establishment of another population has occurred only once, when 50 fish were translocated from the Goulburn River and released into the lower reaches of Seven Creeks, Vic. in 1921 and 1922. Both the Murray River and Seven Creeks populations are considered at high risk to local extinction and one focus of the recovery efforts has been to establish another self-sustaining population by releasing hatchery-produced fingerlings and yearlings.

Reasons for the apparent lack of success in managing this endangered species are likely to be varied. At present management options are restricted to releasing young fish, in particular fingerlings. Strategies such as altering the number of fingerlings released and the frequency of releases can affect population growth – yet the effects of these potentially different strategies have never been tested.

Management is complicated further by the natural variability in environmental conditions, (this can range from habitat fluctuations or catastrophes that may cause local extinctions), natural variability in fish breeding, variability in management actions and of course the ever present reality of limited financial resources. Some of these uncertainties can be reduced through scientific research, but others are likely to remain. So the question remains how to manage environmental issues in the face of all these uncertainties?

Adaptive Management (AM) is a process that aims to incorporate such uncertainties into current management decisions, while providing a structured way of updating management as our environmental knowledge increases. AM incorporates scientific methodologies in the planning and implementation of specific management strategies. This advises management and may also allow us to learn more about the connection between ecology and management.

One of the essential ingredients in AM involves getting the stakeholders of a management issue together and representing our knowledge of the issue in the form of a model. For trout cod, a model has been constructed that incorporates the current knowledge of population dynamics of this species. This population model can then be used to compare the outcomes of different management scenarios in terms of potential future population sizes.

catastrophes that may cause local extinctions

The advantage with modelling is that a variety of alternative management options can be explored and the outcomes of these simulations used to inform management of the implications of on-ground applications. This project involved simulating a range of different management options, such as introducing different numbers of fish at different times, mimicking catastrophes that could potentially wipe out a population, at the same time as mimicking different management strategies ('hedging' versus 'big bang' fish introductions).

The project has identified that our ability to monitor fish numbers is the weakest link in the management of trout cod using current management regimes. Simulating management strategies showed that differences in fish numbers arose from different management scenarios (given the current population model). However, when monitoring was simulated as well (incorporating a range of realistic estimates of variability in monitoring using boat electrofishing) it was not possible to detect differences in population numbers arising from different management scenarios. Therefore, it is not possible to assess the success of current reintroduction programs for trout cod.

The next stage of this project will include further aspects of the adaptive management cycle, in particular a more intensive investigation of the way that introduction success can be identified and measured. The CRC for Freshwater Ecology is strategically placed to facilitate an AM process, with a cooperative environment already existing between researchers and managers. Intensive collaboration between scientists and managers in the formulation of management goals and in the design and implementation of an AM process is crucial to successful completion of individual steps within an adaptive management cycle.

The project has identified the value of simulating management actions prior to their implementation. The model enabled rapid identification of the likely impediments to successful trout cod management, a process that may have taken years to complete with on-ground management approaches.

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Boat electrofishing is an important method used for monitoring fish populations. Photo: Sabine Schreiber

Southern Impact: Adelaide University joins the CRC for Freshwater Ecology

Adelaide University has had an informal association with the Cooperative Research Centre for Freshwater Ecology (CRCFE) via its freshwater school since the CRC was established in 1993. This association was recently formalised when the University became a partner of the CRC. Following is an introduction to the people and the research being conducted by the Adelaide team.

Two Adelaide University staff are now formally part of the CRC – they are Associate Professors George Ganf and Keith Walker, both from the Department of Environmental Biology. Six PhD students also join the CRC they are Sue Gehrig, Jason Nicol, Mark Siebentritt, Amy George, Sue Graham and Ben Smith.

Research focuses on the River Murray and its floodplain as well as the deflation lakes associated with the Darling River (a project co-supervised with Ben Gawne of CRCFE Mildura). Current areas of research include wetland plant communities, environmental flow management and recruitment of aquatic plants and animals.

Freshwater research has been conducted at Adelaide University since the mid 70's following the appointment of George, Keith, Mike Geddes, John Bishop and, of course, Bill Williams. It was at this time that government was beginning to recognise the importance of freshwater as a "Limit to Growth" but they were less interested in freshwaters as ecosystems. George Ganf pursued his interests in phytoplankton, and how the high turbidity levels in the Murray influenced productivity. Along with Rod Oliver, Sandy Kinnear, Chester Merrick and Simon Stone, new techniques were developed to measure the density of phytoplankton. This work continues as part of the current CRCFE, where research on the biology of phytoplankton and macrophytes will assist the CRCFE to make well informed management recommendations.

One of Keith's research interests is the ecology of freshwater mussels. The two common species in the Lower Murray are variously adapted to still or slow-flowing water and their ecology provides insights into the ways that the river and its floodplain have been changed by flow regulation. The mussel work was the nucleus for much more wide-ranging studies on other animal and plant groups, with the environmental effects of flow regulation as a consistent theme.

Research by the Ganf/Walker groups in the early 90's explored the idea that water regime is a key factor in the composition of regional wetland plant communities, and that plants could be categorised broadly as those that 'rest' in response to changes in water level and others that 'react' by producing new growth. The 'Rest or React Hypothesis', was the genesis for PhD projects by Stuart Blanch and Marcus Cooling. Stuart's work demonstrated the consequences of changing water regimes for the distribution of plants along the margins of the Murray's weir pools. This work is now being extended to wetlands by Mark Siebentritt. The present cohort of Adelaide CRCFE students includes Mark, Sue Gehrig (ecology of willows), Amy George (recruitment in floodplain eucalypts), Jason Nicol (Menindee lakes seedbanks) and Ben Smith (early life history of carp).

Keith and several students are presently absorbed in the complex, topical issues of environmental flow management and the idea, shared by other CRCFE colleagues, that we need to understand better the link between flow variability and recruitment to plant and animal populations.

Links between the CRCFE and the CRC for Water Quality and Treatment have also been established and the focus is on Cyanobacteria, thermal stratification and turbulence – do the dissipating eddies operate at

George Ganf (L), Keith Walker (R) and six students are now formally part of the CRC for Freshwater Ecology.
Photo: University of Adelaide

the scale of the organism? Why does *Anabaena* spp. dominate the plankton of the Murray but *Microcystis* in many reservoirs? Why do both occur in the Torrens Lake? Why do blooms suddenly crash? David Cenzato is looking at programmed cell death as a possible mechanism.

Cross-disciplinary collaborations are viewed as a vital component of research and to this end both George and Keith have forged ties with Martin Lambert, a hydraulic engineer in the Department of Civil & Environmental Engineering. If some of the Murray's problems are legacies of over-zealous engineering in the past, the solutions may lie in a renewed alliance between ecologists and engineers.

One of the great benefits George and Keith see in their CRCFE association is that their students are able to network with colleagues in other laboratories, and to draw upon the other kinds of support offered by the CRCFE.

FOOTNOTE

Other 'freshwater people' in the department not formally tied to CRCFE include Michael Geddes, who is increasingly involved in marine fisheries research with SARDI, and Jim Puckridge, who leads the ARIDFLO project. Peter Hudson and Russ Shiel (recently retired from CRCFE Albury) are also part of the Aridflo team. In other departments there are Peter Gell, in the Department of Geographic & Environmental Studies, and Friedrich Recknagel in the Department of Soil & Water.

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Watershed

by
Ticky Fullerton
ABC Books Sydney 2001

Reviewed by Dr John Whittington

Ticky Fullerton's book, Watershed [ABC Books, Sydney 2001] takes the reader on a thought provoking journey of vision, incompetence, optimism and greed as it traces the plight of Australia's most vital resource – water. By skilfully weaving together hundreds of quotes, Fullerton allows water users, politicians, environmentalists, scientists, bureaucrats, media commentators and business leaders to have their say. And they do – often with astonishing frankness.

Fullerton's message is clear – the way we currently use water is not sustainable. We are at a watershed. She rightly argues that the choices we make over the next few years will determine whether Australia has a healthy environment or one that continues in a downward spiral of degradation. However, as Fullerton observes, most Australians are unaware of the hard choices about our water future which, she argues, is the unforgivable sin of Australian society. I believe there is little doubt that water reform will continue to be slow and difficult until we all understand the problems and why they need fixing. If everybody read Watershed, reform would be no less painful, but it might be a darn sight quicker and more effective.

Watershed should ruffle a few feathers. A disturbing, but recurring theme is bureaucratic incompetence. Fullerton has chosen to highlight a few examples – some rural and some urban. Her description of the management of the 1998 Sydney's Crytosporidium Water Crisis makes for hilarious reading – if only it were not so serious. But as Fullerton shows, we can learn from our mistakes. A legacy of the Sydney Water crisis is a strengthened resolve to manage the whole water cycle – from the catchment to the sea.

Through Watershed, Fullerton argues the blame for the environmental crises in many of our rivers lies not so much with the water users, but with successive governments whose policies have sanctioned and promoted unsustainable use. The social, economic and environmental consequences of the policy of deliberate 'over-allocation' of water are described. There are examples of communities being ripped apart as they fight amongst each other for what they have been led to believe is their rightful allocation of water – allocations that governments could never fully supply. In the meantime the environment continues to degrade. As John Grabbie, manager of a major cotton irrigation farm on the Condamine-Balonne is quoted "...if the river is being destroyed, it is destroyed because irrigators are doing what they were told to do (by government)".

We are at a Watershed

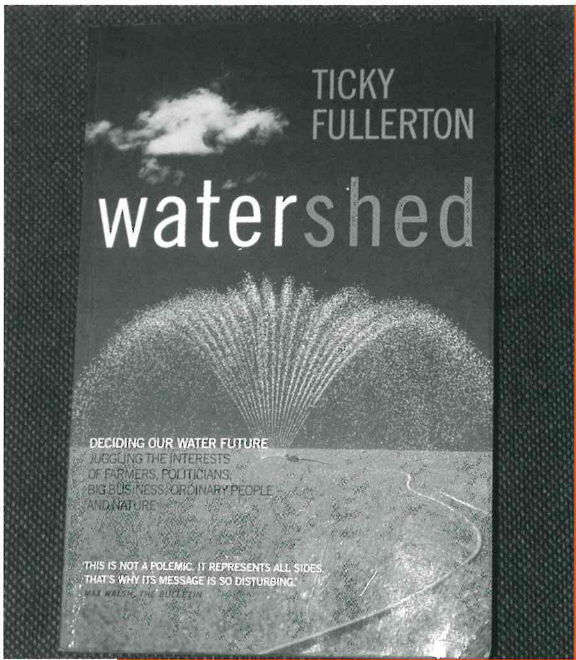
There are also tales of modern day cowboys whose actions, from slip ups with pesticides to shonky water deals, cause great harm to both the environment and the reputation of their industries. Perhaps Watershed might convince the majority of responsible irrigators to publicly speak out against the cowboys that do give their industry a dirty name.

Watershed is not simply a depressing catalogue of intractable problems. Fullerton describes a maturing irrigation industry that is attempting to tackle the serious environmental issues of rising water tables, salinity and environmental flows – which she rather annoyingly calls 'duck and fish water'. But in my experience, progress is still too slow and too reactive.

Interviews with key business leaders and media commentators, like Richard Pratt and Alan Jones, show that there is a latent passion to do something positive for both the environment and regional economies. Creative and exciting ways of renovating existing irrigation schemes are discussed. The on-going debate of whether to build more dams in the north and pipe the water south is put on the table. Fullerton does not judge these schemes. It is left to the reader to draw their own conclusions. Given our poor track record the reader should question the sustainability of the more grandiose schemes. It is my opinion that we may have the resolve to get it right for both the user and the environment, but we don't have the knowledge. And that knowledge will not come without investment.

What is needed for water reform, argues Fullerton and most of those interviewed in the book, is strong national leadership. Victoria's former Premier, Jeff Kennett argues, "its got to be the Prime Minister ... otherwise it will not go anywhere." Richard Pratt is looking elsewhere, "I'm not sure if he's a statesman or a politician, but I'm looking at a group of people beyond the politician ... maybe the hidden face of the establishment, they are the leaders and they have to be the leaders of the country".

Through Watershed, Fullerton has laid down a challenge, but the question remains 'who will provide the leadership to tackle Australia's vital water issues'?



SideStream

Taxonomic Workshop

The 14th taxonomic workshop organised by the CRCFE and MDFRC will be held at the Lake Hume Resort, Albury 5th-6th February 2002. For more details of the workshop and registration enquiries contact MDFRC on 02 6058 2300 or email John Hawking on hawkingj@mdfrc.canberra.edu.au.

Snapshot of Murray-Darling Basin River Condition Released

A newly released report provides, for the first time, a picture of river health across the Murray Darling Basin (MDB). *The Snapshot of Murray-Darling Basin River Condition* report was prepared for the MDBC by the CRCFE, in collaboration with CSIRO Land and Water and the National Land and Water Resources Audit Office.

The snapshot assesses 77,000km of river and found that 95 percent of the river system suffers from degradation. Forty percent of the length of the rivers that were assessed had biota that was significantly impaired.

A brief overview of the report appears in this issue (p.3.) Copies of the report can be found on the Murray-Darling Basin Commission web site. For further information, contact Richard Norris on 02 6201 2543; email: norris@lake.canberra.edu.au

Publications

Norris, *et al. Snapshot of the Murray-Darling Basin River Condition*. Report to the Murray-Darling Basin Commission September 2001. This report is available on the MDBC website at: www.mdbc.gov.au.

A new brochure is available, *Fish of the Menindee Lakes*. This brochure provides images and a brief description of the native and introduced species that inhabit these important breeding grounds. A brief description of the ecological requirements of each species is included. Copies of the brochure are available from the CRCFE Mildura Laboratory on 03 5023 6224.

The CRC for Freshwater Ecology Annual Report 2000-2001 is complete and can be obtained by contacting the CRC on 02 6201 5371.

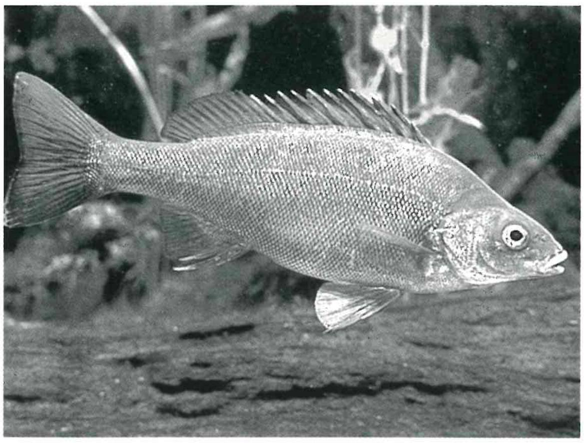


Photo: Courtesy the Murray-Darling Basin Commission

The creature feature for this issue is the silver perch (*Bidyanus Bidyanus*)

Family: Terapontidae
Genus: *Bidyanus*
Species: *Bidyanus*

Silver perch occur throughout most of the Murray-Darling river system, except in cool mountain streams. They are considered vulnerable by the IUCN largely due to the effects of weirs and dams. A migratory species preferring fast flowing waters, silver perch migrate upstream to spawn, females laying up to 300,000 eggs. Adults may grow to 400mm in length and feed on aquatic insects, molluscs, earthworms and green algae.

CRCFE web site:
http://freshwater.canberra.edu.au

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The Cooperative Research Centre for Freshwater Ecology was established and supported under the Australian Government's Cooperative Research Centre Program.

The CRCFE is a collaborative venture between:

- ACTEW Corporation
- CSIRO Land and Water
- Department of Land and Water Conservation, NSW
- Department of Natural Resources and Environment, Victoria
- Environment ACT
- Environment Protection Authority, NSW
- Environment Protection Authority, Victoria
- Goulburn-Murray Rural Water Authority
- Griffith University
- La Trobe University
- Lower Murray Water
- Melbourne Water
- Monash University
- Murray-Darling Basin Commission
- Natural Resources and Mines, Queensland
- Sunraysia Rural Water Authority
- Sydney Catchment Authority
- University of Adelaide
- University of Canberra

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Watershed is produced by the CRC for Freshwater Ecology Knowledge Exchange Team. Unless otherwise stated, all articles are written by Lynne Sealie and Leane Regan.

Design & Production: Graphic Ark Pty Ltd, Canberra