April 2002

WaterShed

contents

Getting a Better Bang for the Buck?

by Professor Peter Cullen

How can the Federal Government get a better return on its investments in natural resource management? The National Action Plan for Salinity and Water Quality, a $1.4 billion program jointly funded by the Federal and State Governments has taken 18 months of negotiation, and has not yet started to achieve outcomes on the ground. State and Federal bureaucracies have been established to negotiate with each other, and will presumably soon start investing in regional bureaucracies to negotiate with them. Some people are now asking whether these overheads will consume all available funds, or will something remain for on ground implementation of regional plans? The stand-off is a tricky one. Why should Federal investments go into treating the symptoms of natural resource degradation when the States decline to control the processes causing the damage?

We now hear that the States have decided not to put any funds into the Natural Heritage Trust investments currently being planned. The States also seem to be insisting that NHT funds should go through the States, to the detriment of existing multi-State bodies like the Murray-Darling Basin Commission, or the emerging Lake Eyre Basin Coordinating Group.

Does this mean the partnership model of natural resource investment has run its course, and we need to develop new strategies? Why should the States have any say on how these investments should be made if they are not contributing?

There are many different ways the Commonwealth might invest to get a better outcome for its dollars. Here are three.

Strengthen Basin Organisations

There is clearly a national interest in the multi-State basin organisations that have been established. Managing land and water in these situations has clearly been beyond the capacity of the States without Federal

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assistance. All NHT funds within the Murray-Darling Basin and the Lake Eyre Basin could be through these basin organisations, where the States and Federal Governments between them establish priorities, and all can use a veto power if they wish.

The MDBC is well regarded internationally, but has been having difficulty in getting the States to seriously address land and water issues. It could be turned into a Corporation, where the Directors would have to be qualified for the job, and required by law to act in the interests of the Basin rather than the interest of the States. It could move beyond veto to majority voting, and the meetings could be made public to lift accountability.

Direct Investment

As the regions develop their plans, they could submit them to the Federal Government as investment plans and the Federal Government could invest to achieve specific outcomes. These outcomes might be a reduction in salt or nutrients coming from a catchment, or for protecting biodiversity values. This would move beyond grants to a more contractual outcome where payment might depend on results rather than promises and hope. The States could contribute directly if they shared the objective, they might invest in other elements of the plan or they might find it necessary to assist the regions develop plans that met Federal requirements and so could attract federal funding. There would be little requirement for endless negotiation and no room for cost-shifting.

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

Enter the Water Market

The Federal Government could encourage States to get on and resolve issues of property rights for water as they are required to do under the COAG water reforms, and if they are unable to do this penalise them through the National Competition Council payments.

The problem now is that we have half embraced a market solution to the problem, but have failed to clarify the underlying rights to water that will let a market operate effectively.

Governments need to finish the COAG water reforms and resolve the issue of water property rights. Where farmers have an ongoing legal right to water they should be given clear property rights, which need to be registered just as land titles are registered, and they should be allowed to trade these rights on the water market. They should not be given property rights when they are using water based on annual or short-term licences, which there is no legal requirement to renew. Governments have a responsibility to use taxpayers funds prudently, and endless compensation to anyone who complains is not appropriate.

Federal funds for water could be invested in a National Rivers Corporation that buys water in the market, and invests in infrastructure to reduce wastage, in both cases obtaining water for the environment which could then be released to provide flow regimes based on the best available scientific knowledge. This sort of strategy would not have high overheads, and would probably give the best environmental return for Federal investment in water.

At the moment we seem to be in a gridlock with natural resource management. States have the constitutional responsibility for land and water management, but have failed to deliver sustainability in rural Australia. We need the Federal Government to intervene if we are to address these issues. The past model of joint funding by State and Commonwealth appears to have run its course and the time is right for the Federal Government to explore other ways of getting a better return on its investments.

Creating a Vision for Freshwater Biodiversity

The term biodiversity encapsulates many facets of life, including, plants, animal and micro-organisms, the diversity of genes they contain and the communities they form. The biodiversity of Australian inland waters has suffered substantial losses as a result of urbanisation, unsustainable farming practices, river regulation, pollution, riparian degradation and the impacts of invasive species. But why should this concern us?

Biodiversity of inland waters is important to the health and prosperity of our society. As well as providing a range of ecosystem services (e.g. the supply of fresh drinking water), it is important for its economic value, as habitat for species of commercial value, for the recreational and tourism opportunities it provides and for its intrinsic value.

Local communities to date have tended to be more concerned with public health than with biodiversity issues (i.e. whether it is safe to swim in a river rather than what lives in it). However, many local governments and communities are willing to support biodiversity conservation initiatives, perhaps because of the services it provides or for its intrinsic value. The challenge is to inform, engage and empower communities so that we can help to conserve biodiversity for present and future generations. As knowledge providers we are faced with the challenge of quantifying, or at least delineating the benefits of biodiversity, so that they can be factored into decision-making at all levels.

The challenge is to inform, engage and empower

Community involvement is essential to the successful conservation of biodiversity. Individuals, community groups (both local and regional) and industry groups all need to play a role. Participatory initiatives such as Waterwatch and the regional and industry-based biodiversity strategies being developed by the Murray-Darling Basin Commission and the Rice-Growers Association achieve some community engagement. However, any participatory initiatives must be coupled with more involvement from individuals and landholders, since their opinions and actions are influenced largely by their peers.

Measuring freshwater biodiversity

Species richness, while a valuable indicator of diversity, has limitations in biodiversity studies because of the time and skills required. To circumvent this difficulty, various surrogate measures are used as the basis for assessment and monitoring, these include:

- Health indicators – species used to measure the impact of pollutants or other disturbances;
- Population indicators – (ie. species or communities) used to assess the population trends of other species ;
- Biodiversity indicators – the number of species from a well-known taxonomic group is used as a surrogate for the number of species that occupy the same range but are poorly known;
- Umbrella species – taxa whose presence delineate the size or type of habitat that should be protected; and
- Flagship species – 'charismatic' species used to attract public attention to conservation issues.

Surrogates have been used for rapid biodiversity assessment in terrestrial systems, but their usefulness in Australian freshwater systems remains largely untested.

What do we hope to achieve?

If there is diversity of opinion on what biodiversity is and how to measure it, there is even greater diversity of opinion on what might be reasonable objectives for biodiversity conservation and restoration. Opinion on suitable goals will depend on whether the context is one of conservation of relatively intact systems or the restoration of degraded systems.

Our vision for biodiversity conservation includes a commitment to "no loss" of species and the maintenance of ecological processes; protect what we have left, restore what we can, and rehabilitate where we can. This may be achieved through:

- A better understanding of the ecosystem services provided for by biodiversity.
- Improving community awareness of the social, economic and environmental value of biodiversity in inland waters.
- Clarify what we mean by biodiversity in operational terms, and develop and test inventory, assessment and monitoring protocols.
- Increased understanding of the factors and processes that regulate biodiversity in freshwater systems.
- Protecting what relatively intact biodiversity we have left in our rivers and wetlands, via a system of National Heritage Rivers or National River Reserves.
- Addressing biodiversity targets under recognised regional, river and catchment planning.

Biodiversity conservation is not simply about protecting the significant areas of biodiversity and endemism. We need assessments of the distribution of biodiversity across basins so that we can identify a comprehensive, representative and adequate framework of areas to serve as a focus for conservation, restoration and rehabilitation initiatives. National Heritage Rivers, RAMSAR Sites, and National Parks should be seen as embedded in this more comprehensive framework.

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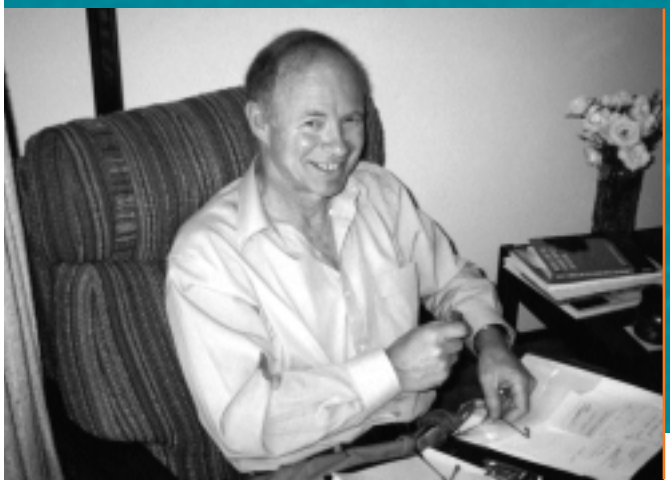
Information in this article was sourced from a paper presented to the World Wildlife Fund, Murray-Darling Basin Visions workshop (October 2001), by Associate professor Arthur Georges and Peter Cottingham of the CRC for Freshwater Ecology, in consultation with Clarrie Hillard (MDBC CAC).

Hemiphlebia mirabilis ***is the world's most primitive dragonfly. It was thought to be extinct, but is now known from six small populations ranging from Yea, in central eastern Victoria to Northern Tasmania. Its habitat is threatened by grazing and burning. It is classified by the IUCN as Vulnerable.***
Photo: John Hawking

Ian Lawrence Retires from the CRCFE



A sign of things to come...perhaps. Ian relaxing at home. Photo: Helen Lawrence

The amenity and quality of lakes and streams in the ACT is due largely to the vision and efforts of Mr Ian Lawrence, who this month retires from the Cooperative Research Centre for Freshwater Ecology. Throughout his career, Ian has developed and implemented strategies for urban stormwater design, ensuring our lakes and streams were suitable for recreational use, while providing wildlife habitat, purifying urban runoff, and retaining a traditional landscape element.

An engineer/planner by trade, Ian was responsible for the development of water resources assessment, planning and management with the Snowy Mountains Hydro-electric Authority, Melbourne & Metropolitan Board of Works, National Capital Development Commission/ACT Planning Authority, and for ACT environmental assessment and planning. He is currently seconded from Environment ACT to the CRC for Freshwater Ecology, and was responsible for the development and management of the Centre's urban water research program.

Throughout his period in the ACT Ian's work focussed on the planning of water resources for sustainability. One of his passions was to ensure that aquatic ecosystem values should be maintained in urban areas. In the mid 1970s, Ian played a key role in the development of multi-objective planning and its application to lakes and streams in Australia. Previously, water resources tended to be managed for a single objective, eg. for irrigation or urban drainage. Ian's approach required explicit recognition of, and planning for, multiple objectives for each stream and river, including natural values. Ian had the vision to perceive that we could and should attempt to maintain the aquatic ecosystems in our urban environment, and the drive to see these changes implemented.

Ian's work in this area commenced in Canberra, a city in which the streams and rivers featured as important design components. Walter Burley Griffin's plan had been realised with construction of Lake Burley Griffin, and with additional major lakes to the north and south: Lakes Ginninderra and Tuggeranong. However the single function of these water resources was to provide a landscape element. Ian's drive and vision was the key factor in the development and implementation of multi-objective plans for these lakes and streams, recognising their critical role in maintaining aquatic habitat, and for protecting water quality in downstream waters, such as the Murrumbidgee River.

Recognising the degrading impact of urban areas on urban lakes and streams, Ian investigated and implemented ways of protecting water quality and aquatic habitats, both within the city and downstream. Thanks to this work, Australia's largest inland city, Canberra, now has such an effective water quality strategy that impact on waters in the ACT and on downstream waters in the Murray–Darling Basin is significantly reduced.

Ian investigated and implemented ways of protecting water quality

The ideas developed by Ian have application well beyond Canberra. In 1990, the ACT Water Strategy Plan, developed largely by Ian, was adopted Australia wide as the standard for State/Territory water strategy planning. Ian was also a major contributor to the recent Australian & New Zealand Guidelines for Fresh & Marine Water Quality 2000 and one of the lead consultants for the Australian Guidelines for Water Quality Monitoring & Reporting 2000.

Ian received the Banksia Foundation Environmental Award

Since his secondment to the CRC for Freshwater Ecology in 1993, Ian has been advising Commonwealth, State and Local Government Authorities on catchment management, water resource and ecology related management issues. Building on research into urban stormwater pollution control ponds and wetland water quality processes, Ian developed wetland models that are now widely used across the water industry. Ian also chaired the National Urban Stormwater Task Group, responsible for drafting the National Urban Stormwater Management Guidelines.

Recently, Ian participated in an international Environmental Symposium, co-hosted by the ACT Government and Beijing Municipal Environment Protection Bureau (BMEPB). One outcome of the symposium was the decision by BMEPB to adopt best practice environmental models for urban stormwater in the lead up to the Beijing Olympics.

Ian's ideas have been ahead of his time, and he has had the drive to see them realised within Australia and internationally. The extent of his achievements were recognised when he received the Banksia Foundation Environmental Award for Outstanding Individual Achievement in 2001.

Ian retires in April after a distinguished career spanning 40 years; he will spend some months travelling the Australian outback, but will continue his involvement in some capacity with the CRCFE.

Those of us working with Ian will miss his calming influence and his professional support. For those seeking some final words of wisdom or to wish him well in his retirement, Ian can be contacted at:

Email: lawrence@lake.canberra.edu.au

Material for this article was sourced from Ian's colleagues in the CRCFE and in Environment ACT.

Lake Burley Griffin: The amenity value of Canberra's lakes and streams is due in large part to Ian's vision and efforts.
Photo: Ian Lawrence

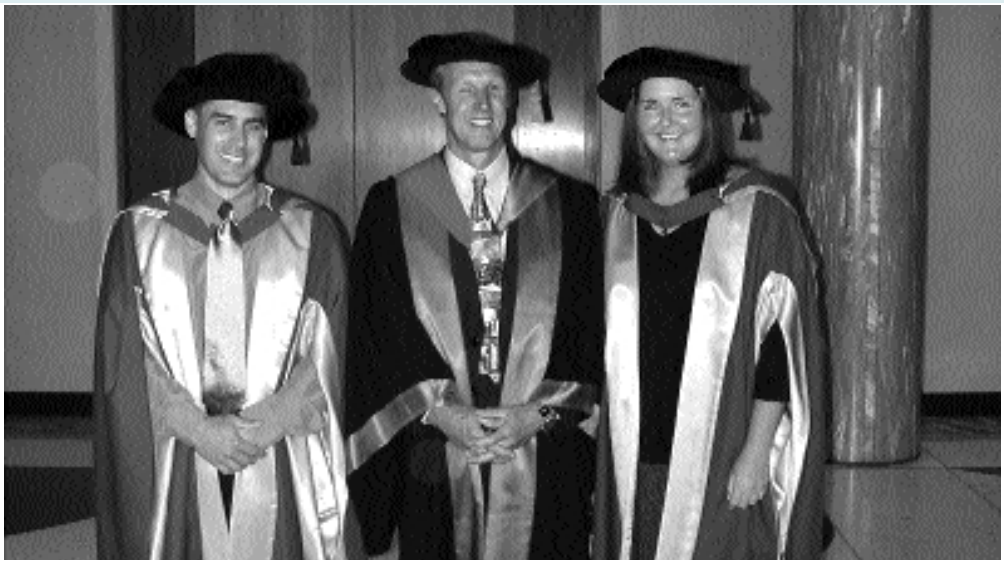
PhD students applauded

Melissa Parsons and Glenn Brown of the CRC for Freshwater Ecology have recently been awarded PhDs from the University of Canberra.

Melissa's PhD, funded by the CRCFE, and supervised by Associate Professors Richard Norris and Martin Thoms brought together the fields of geomorphology and aquatic ecology. Melissa's innovative study described the relationships between aquatic animals and their physical environment at a variety of spatial scales. Her work is important for understanding how physical features of rivers, that can be easily altered by humans, are related to the ecology of rivers on which we rely. International presentations and the examination of her thesis all produced accolades. Melissa is sought both nationally and internationally for her expertise and will soon leave for an overseas appointment.

Glen Brown's PhD, funded by Kosciusko Thredbo Pty Ltd and the APA was supervised by Associate Professors Richard Norris and Bill Maher. The study considered the ecological responses of the Thredbo River to the addition of nutrients from sewage. Glen was able to design and deploy channels in the river and devised a way to stop animals grazing on the algae that grows in response to these nutrients. Glen created a system using electricity from cattle fence chargers that stunned aquatic animals, causing them to wash away from the site. This work on using electricity and on methods to assess algal growth in rivers has already been published in two renowned international science journals. His work is informing management decisions on sewage discharge to alpine rivers. Glenn is currently employed by the Queensland Environmental Protection Agency.

Melissa collecting sediment for her research
Photo: CRCFE



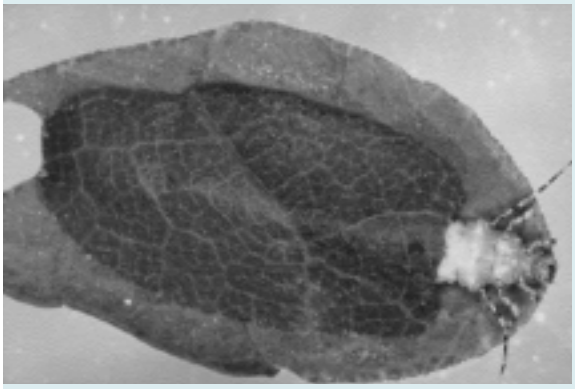
L to R, Glen Brown, Richard Norris and Melissa Parsons after the graduation ceremony in December.
Photo: CRCFE

DO C_4 PLANTS CONTRIBUTE TO THE AQUATIC FOOD WEBS IN STREAMS?

Joannne Clapcott, MSc.

The riparian zone is believed to contribute a significant amount of energy (organic carbon) to the food web of streams and rivers. Clearing of native riparian vegetation for the production of sugarcane in south east Queensland has dramatically altered the type of plant matter entering streams. Joanne Clapcott has recently completed her Masters degree at the Centre for Catchment and In-Stream Research, Griffith University, under the supervision of Professor Stuart Bunn. Results indicate that such changes in riparian vegetation affect the amount and type of food available and consequently alter aquatic food webs.

Native riparian vegetation of streams in southeast Queensland is typically comprised of C_3 plants such as river redgum, black box, and water gum. Much of this vegetation however has been extensively cleared for the cultivation of sugar cane (*Saccharum* spp.), a C_4 plant. Simultaneously there has been an increase in the occurrence of exotic (C_4) weeds such as invasive para grass (*Urochloa mutica*). Para grass was introduced to Australia from England for use as a productive pasture grass and to help control bank erosion. Having evolved in tropical Africa, it is subject to proliferation, particularly in wet-dry tropics, and is now a major weed in disturbed stream channels of northern New South Wales and Queensland. Para grass and other C_4 grasses often out compete most C_3 grasses.



*Caddisfly larvae (*Anisocentropus kirramus*), an important shredder in streams, consumes it's own case of native leaf litter in preference to introduced sugar cane or para grass.*
Photo: John Hawking

The different photosynthetic pathway used by 'C_3' and 'C_4' plants gives rise to different natural carbon isotope ratios (C^{12} and C^{13}). Isotopes are variants of the same element but with different numbers of neutrons. Because stable carbon isotopes show little change from source to consumer, this allows tracing of their 'isotopic signatures' throughout food webs. This study used differences in the isotopic signatures of C_3 and C_4 plants to determine if exotic grasses were being eaten by aquatic organisms and thus contributing to the food web in a subtropical Queensland stream.

In previous studies, animals that eat aquatic plants or detritus have not been observed to assimilate C_4 carbon, this is despite the fact that C_4 plants are often the most productive and conspicuous components of aquatic systems. So why don't aquatic invertebrates eat C_4 plants? Do C_4 plants have physical or chemical properties that prevent their consumption by aquatic invertebrates? Or, do aquatic consumers simply prefer C_3 organic matter?

Laboratory and field experiments examining leaf litter breakdown showed that shredders, such as caddisfly larvae, most often attributed with the invertebrate processing of leaf litter, showed a strong preference for C_3 plants. This preference was so strong that under forced conditions the caddisfly *Anisocentropus kirramus* was observed to eat it's own case (of C_3 material) in preference to para grass or sugar cane. Isotopic examination of plant material and invertebrates showed not only an invertebrate preference for C_3 plants, but also a lack of assimilation of C_4 plant material.

In summary, it appears that C_4 plants do not contribute to the aquatic food webs of streams in south east Queensland. If allochthonous carbon (i.e. carbon derived from outside the stream – usually in the riparian zone) is the major source of energy for aquatic food webs, then changes in riparian vegetation are likely to affect the structure of the stream ecosystem. It is hoped these results will be used to determine the effects of converting whole catchments to sugarcane, cornfields or pasture, and aid in the development of management practices for subtropical Queensland catchments.

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Talking Point

by Professor Gary Jones

Since the mid-90s, the COAG water reform process has provided scientists with an opportunity to support the development of state and federal government policies on healthy river management. In the main, the ecological knowledge provided has centred on key threatening processes to river health, and on ecological principles underpinning better river operations and floodplain management.

Often this has been done through scientific collectives – expert reference panels or special working groups – that have provided advice on, for example, the key attributes of a healthy river flow regime. Generally speaking, getting agreement among scientists on threatening processes and ecological principles is not a formidable task. Nevertheless, it is one that requires much discussion and dialogue, and the development of trust, among those involved.

In the new decade, we are rapidly moving into the implementation phase of the water reforms, with impetus being provided by Natural Heritage Trust Mk.II and the National Action Plan on Salinity & Water Quality. River management groups are drafting plans that encompass resource allocation decisions and performance targets on environmental flows, biodiversity, salinity, wetland management, etc. Consequently, the knowledge challenges before our scientists are considerably different than they were a decade ago. We are now being asked for answers to quite specific management questions. For example,"Exactly what volume of environmental water is required to attain a healthy river condition, and how should that water be released to ensure maximum ecological benefit?" or "Do we need to protect all parts of a river's floodplain or can we just focus on certain icon wetlands and forests?"

Informing this new process is a real challenge. Knowledge-wise, it is a significant step from ecological principles to quantitative cause and effect relationships, predictive ecological models and risk-based decision support systems.

For now, we should continue to draw on collective ecological opinion to inform decision making. To do otherwise would be counter productive, at least in the short to medium term. To help develop and support such processes, next month the CRCFE will publish a review of the scientific (expert) panel approach to determining environmental flow allocations.

For major resource allocation decisions with wide ranging economic and social implications, a broader approach to collective knowledge might be appropriate. Some groups are suggesting that a 'Deliberative Poll' model could be useful. Recall the one held a couple of years back on the Australian Republic question. Such polls could bring together government and community stakeholders, along with professional researchers, technical staff in agencies, and community 'natural historians'. The latter being those people whose years of local observations have provided them with a valid understanding of how their part of the river functions.

In addition, new quantitative decision making systems are needed to enable scientists to deliver ecological predictions to stakeholders with clear statements about uncertainty, and the likelihood that a specified management action will be successful. One scientific strategy could be to develop or adopt quantitative mathematical techniques for communicating risk and probability in complex ecological decision making processes. Such mathematical models are used in other fields of endeavour, for example, in economics. The new CRCFE 'Ecological Risk Assessment' Project is currently exploring and developing some related techniques in Bayesian statistics.

Whichever suite of approaches we adopt, it is clear that scientists will need to rapidly adapt to the new knowledge needs being articulated by management organisations and regional river management groups.

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SideStream

Dr Margaret Brock Appointed as Program Leader

The CRCFE is pleased to announce the appointment of Dr Margaret Brock of the Department of Land and Water Conservation as Program Leader for the CRCFE's Conservation Ecology Research Program. Margaret, a specialist in wetland ecology and salinity impacts, replaces Associate Professor Arthur Georges, who did not reapply for the position. Margaret's appointment highlights the CRC's commitment to our industry partners and further enhances our efforts to bring agency perspectives to the CRCFE.

CRCFE Advises on International Benchmarking Study

ACTEW Corporation has launched a major study into Australia's water resources. The international benchmarking study will assess world's best practice and develop strategic directions for the future. The scope of the study has been developed by the CRC for Freshwater Ecology and other eminent water and business professionals.

The study encompasses the entire water cycle from catchment through to sewerage treatment. More information on the study can be obtained by contacting Paul Jenkins, Chief Executive, ACTEW Corporation. Phone: 02 6248 3531.

Lower Basin Laboratory to Remain in Mildura

The Lower Basin Laboratory of the CRC for Freshwater Ecology is to remain in Mildura. The Victorian Minister for State and Regional Development announced a $2.5 million dollar Regional Infrastructure Development Grant to La Trobe University for the construction of the new laboratories.

In announcing the decision, Peter Cullen, Chief Executive of the CRCFE thanked regional communities in NSW, Victoria and South Australia for their support. The involvement of Sunraysia Rural Water, Lower Murray Water and the community has been fundamental in the decision to remain in Mildura.

Review of Scientific Panels used to determine Environmental Flows

Scientific Panels have been used extensively in eastern Australia to conduct river health assessments, develop management plans and undertake water allocation/environmental flow studies. Peter Cottingham and Gary Howell (DNRE) have prepared a discussion paper exploring some of the issues related to the formation and conduct of Scientific Panels.

This discussion paper also formed the basis of a workshop held in Melbourne on the 3rd December 2001.

For a copy of the discussion paper or information about the review contact Peter Cottingham at: peter.c@enterprise.canberra.edu.au

River Symposium 2002

The Fifth International River Management Symposium will be held in Brisbane from September 3–6. The theme for the conference is: 'The scarcity of water – the future of rivers, the future of water.'

Session topics will include dams – the effect on river-side communities; removal of dams – is it the answer; irrigation; reducing water consumption and climate change and rivers. For more information contact: RiverFestival Pty Ltd, Tel: 07 3846 7444; Email: conference@riverfestival.com.au. Website: www.river-festival.com.au

New Technical Report

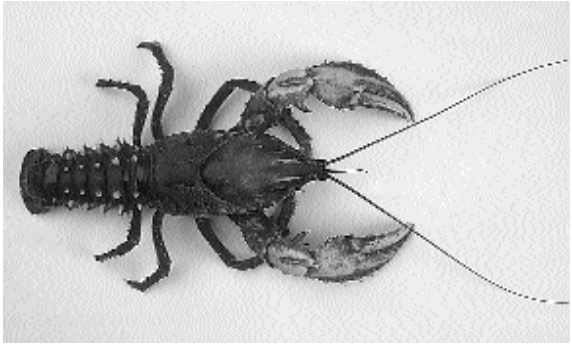
Cottingham, P., Hannan, G., Hillman, T., Koehn, J., Metzling, L., Roberts, J., Rutherford, I. (2001) Report of the Ovens River Scientific Panel on the Environmental Condition and Flows of the Ovens River. CRCFE Technical Report 9/2001.

Cottingham, P., Stewardson, M.,Roberts, J., Metzling, L., Humphries, P., Hillman, T., Hannan, G. (2001) Report of the Broken River Scientific Panel on the Environmental Condition and Flows of the Broken River and Broken Creek. CRCFE Technical Report 10/2001.

Georges, A. and Cottingham, P., (2002) Biodiversity in Inland Waters – Priorities for its Protection and Management: Recommendations from the 2001 Fenner Conference on the Environment. CRCFE Technical Report 1/2002.

The above reports are available on the CRCFE website at: http://freshwater.canberra.edu.au

Whittington, J., Coysh, J., Davies, P., Dyer, F., Gawne, B., Lawrence, I., Liston, P., Norris, R., Robinson, W., Thoms, M. (2001) Development of a Framework for the Sustainable Rivers Audit. A Report to the Murray-Darling Basin Commission. Technical Report 8/2001. This report is available on the MDBC website at: www.mdbc.gov.au



Murray crayfish

The creature feature for this issue is the Murray crayfish:

Class: Crustacea
Family: Parastacidae
Genus: *Euastacus*
Species: *armatus*

Growing to an average length of 300 mm, this omnivore takes from 6 to 9 years to reach maturity. Once abundant throughout the Murray and the Murrumbidgee Rivers, the Murray crayfish is now uncommon in the lower Murray system.

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

Comments, ideas and contributions are welcome and can be made to:

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- 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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