June 2002

WaterShed

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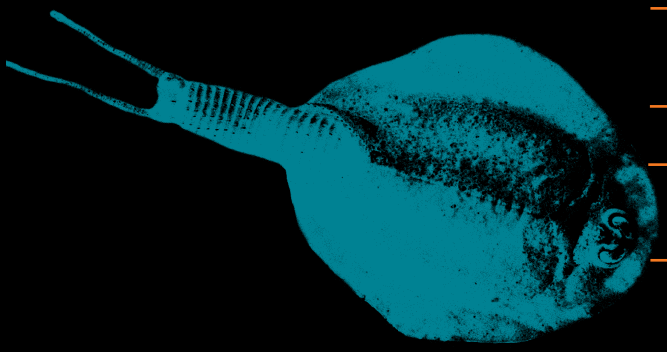

Looking Back, Looking Forward

by Professor Peter Cullen

1 July 1993. The year the CRC for Freshwater Ecology formally started operations. A memorable year for me and for the rest of us involved in those early days. A group of people led by John Langford, Noel Fitzpatrick, Greg Fraser, Graham Allison and Kath Bowmer who were to go and join the first Board. I worked with Barry Hart, Terry Hillman, Peter Breen, John Harris, Sam Lake, Ian Lawrence, David Mitchell, Richard Norris, and Rod Oliver for almost two years to develop the CRC for Freshwater Ecology idea.

We failed in our first bid in 1991, but succeeded in our second attempt in 1992. Putting together the legal contracts that form the CRCFE was a shock. We had developed and presented the ideas in the selection process. We were full of enthusiasm to get going. But the contracts involved lawyers from all the parties to the CRCFE, and their main interest was how to divide up the spoils, or the debts should the CRCFE fail. A very depressing period. But then, like a Canberra early morning fog, the lawyers cleared, and we were away.

We received a lot of help in those early days from other CRCs. In particular the CRC for Catchment Hydrology had succeeded the year before we did, and were generous in their assistance, as were many other CRCs, in what was later to become the CRC Association. The CRC Secretariat in those early days had some people who were very helpful as we all set about making this new model of research funding work.

The power of the CRC model is the ongoing relationship and trust that develops between the research community and the industry users. It is not always an easy relationship, but over time the trust builds as we all realise we can achieve much more working together than we had been able to achieve in isolation.

Our CRC decided early that our vision was to make Australia's inland waters better. An ambitious dream, but one that is possible with the researchers providing knowledge to the managers who are part of the CRC.

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

CRC AUSTRALIA

The research community had many ideas about what we needed to do. We developed a fairly competitive process where external expert reviewers, as well as the industry people on the Board, scrutinised proposals. We never had enough money to do all the good things that people wanted to do, so we had to make tough choices. We appointed a Communications Manager, Karen Markwort, who set about establishing our presence in the media, and laid the groundwork for our extensive series of publications.

After a while we appreciated we had to do more to deliver our knowledge to our industry partners. We appointed our first knowledge broker, Peter Cottingham, who was located in Melbourne in the offices of one of our partners, Melbourne Water. We now have a knowledge exchange team of six responsible for delivering our knowledge, and for listening to the needs of the industry.

We went through a searching review after five years, and had the opportunity of bidding for another seven years of CRC funding. We were again successful.

We have been operating as a CRC for nine years, eleven if you count the two years it took to develop the proposal and get it funded. We are going through a period of rejuvenation, as several of those key staff from the start are retiring or taking on lesser roles, and new people are appointed to carry the CRC forward. Terry Hillman and Ian Lawrence have both retired recently, and now it is my turn to step down as Chief Executive and let others take over.

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

I do so with considerable pride in what we have achieved. Freshwater ecology is now a central plank in the knowledge needed to manage water resources in this country. Not only are we producing and delivering useful knowledge, but also our advice is sought on many issues. Two major pieces of CRC work were considered by the Murray-Darling Basin Ministerial Council at its April meeting – the Snapshot of River Health and the Murray Environmental Flows Project. The media also sees us as a key source of knowledge about water issues.

The CRC is a major contributor to understanding environmental flows. We are at the forefront of developing tools for assessing river health. We are running major projects exploring the ecology of our large lowland rivers. We have been at the forefront of developing water sensitive urban design. Through the Murray-Darling Freshwater Research Centre we have been able to establish regional research capacity at Albury, Mildura and Goondiwindi, all to provide credible scientific advice within those regions.

And so to the future. It is clear that issues like environmental allocations, measuring river health and salinity targets will be with us for some time. It is likely that biodiversity in freshwater systems will become a greater issue, and provide a focus on introduced pest species as well as conserving natural river systems. The need for integrating decision-making tools is also clear. These issues will require sustained effort, and we are going to have to keep building the intellectual capacity to address them.

The CRC has many wonderful and talented people working within it, all committed to making a difference. We have a strong and confident Board, under the very capable chairmanship of Dr John Langford, to provide leadership. We will shortly have a new Chief Executive. This is an exciting time of change that lets us review our progress and set new goals. The challenge remains a great and exciting one. To make the waterways better.

Making the Most of a Drought: the Campaspe Flow Manipulation Project

by Paul Humphries and Robert Cook

Luciano Serafini and Paul McInnerny pulling fyke nets in the Broken River. Photo: P Humphries

The continuing poor health of the Campaspe River in northern Victoria has prompted a large-scale environmental flows experiment to improve our understanding of how lowland rivers function. This project is unique in its approach and longevity in Australia and internationally.

The project is a partnership between the Murray-Darling Freshwater Research Centre, Monash University, Goulburn-Murray Water and the Marine and Freshwater Resources Institute, Snobs Creek. It has been funded by the CRC for Freshwater Ecology, Land & Water Australia and Environment Australia.

The Campaspe Flow Manipulation Project (CFMP) is an ecosystem-scale, long-term environmental flows experiment which aims to assess the effectiveness of a 'translucent dam' approach to environmental flow allocation. This approach tries to mimic the natural flow patterns but with a reduced volume of water.

The project is structured around a BARI (before/after, reference/impact) design. During the past six years, we have collected five years of 'before' and one year of 'after' data for adult fish, larval fish and macroinvertebrates.

Unfortunately, the weather has delayed the project. With the worst drought in 120 years, the first experimental flow release couldn't begin until May 2001, when the trigger level of 64% capacity was reached in Lake Eppalock. Unpredictable demands for irrigation water, coupled with lower than average rainfalls, mean we are unlikely to reach the trigger level for this year. Despite these setbacks, the project has developed new ideas about how lowland rivers function and new methodologies for sampling.

The project has developed new ideas

Early in the project we tested and justified the use of fish larvae as a potential indicator for the success of an environmental flow. We also developed a new method, the 'Snag-Bag', for sampling macroinvertebrates on snags in lowland rivers.

Our observations in the Campaspe and Broken (our less regulated 'reference' system) rivers have led us to challenge ideas about the importance of the floodplain for fish recruitment[1], and instead highlighted the significance of the river channel environment for this.

The underlying causes for the poor state of the fish fauna of the Campaspe River are only now becoming clear. The fish and macroinvertebrate research findings all point to summer irrigation releases as the likely cause of the fishes' disappearance.

The section of the Campaspe River immediately downstream of Lake Eppalock receives the bulk of the irrigation releases over late spring, through summer and into early autumn. This section differs the most from the lower section, which receives virtually no irrigation releases.

Nowadays, the upper section of the river is more like an upland stream than a lowland river. The higher flows appear to have changed the available habitat and food resources, particularly biofilms. Biofilm is a vital part of the food chain in freshwater – a mixture of algae, fungi and bacteria which grows mostly on stable surfaces like snags. Snags, in this highly altered section of the Campaspe have had a sediment-rich biofilm (characteristic of lowland rivers) replaced by a moss, more typical of areas downstream of dams.

The timing of releases is critically important

The distribution patterns of shrimp and fish are different in the upper parts of the river most affected by irrigation releases. It seems that changed flow regimes have altered the type and quantity of habitat and food resources in this part of the river, making it unfavourable for lowland species of fish or shrimps. Here, the macroinvertebrate fauna consists of several species which aren't found in any of the other sections of the Campaspe or in the Broken River, and several which are usually found in cooler, faster flowing waters.

In the lower section, which receives reduced winter flows and no spring-summer irrigation flows, snags support more extensive sediment and biofilm coverage. There are fewer macroinvertebrate species in this part of the river than in the upper section. But rather than comprising a completely unnatural community, this 'lower assemblage' is probably a subset of the original one.

This project shows that irrigation releases, over periods when flows would have naturally been low, have had marked effects on river plants, animals and organisms. The timing of releases is critically important and must be considered alongside the quantity of those releases. We suspect that the imposition of augmented flows during summer has been as damaging to river ecosystems as the loss of high flows and flooding. The scientific evidence has been mounting for some time. It is well and truly time to act.

1. *Recruitment*: the survival of young fish.

For more information about this project, please contact :
Dr Paul Humphries
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email: paul.humphries@csiro.au

Relatively unregulated rivers like the Broken River provide important benchmarks and can be used as a reference system. Photo: C Merrick

Charting New Waters: Peter Cullen Leaves the CRCFE

Peter Cullen at the lake

Peter Cullen, Professor of Resource and Environmental Science at the University of Canberra and founding Director of the CRC for Freshwater Ecology, steps down this month as Chief Executive of the CRC for Freshwater Ecology, a position he has held since its establishment in 1993.

A graduate in agriculture and education from the University of Melbourne, Peter was quick to immerse himself in the art of teaching. From 1973 through to his appointment in 1987 as Dean of Applied Science at the University of Canberra, Peter inspired many students to choose a career in natural resource management and was instrumental in establishing one of the country's first aquatic science courses.

A lifelong fascination with water, coupled with a strong foundation in agriculture, fostered in Peter a passion for the application of science in better informing natural resource management. While his formal agricultural training had given him an understanding of the fabric of rural communities, he felt it did not adequately deal with the impacts of agriculture on the environment, or indeed, explain how landscapes respond to agricultural activities.

When the opportunity arose to establish the CRC for Freshwater Ecology, Peter and his colleagues seized it. "The idea of a collaborative framework linking research with the water industry was a captivating idea. Industry now view this partnership as vital, and an understanding of ecological issues is critical to the success of many of these organisations. One of the very powerful things about the CRC model is the development of trust and ongoing learning relationships between parties. Industry are able to learn about the needs and culture of research, and scientists are able to learn about industry needs," Peter said.

As President of FASTS, (Federation of Australian Scientific and Technological Societies) the peak body representing professional scientists, Peter had enormous influence. He presented the public face of much of Australian science through media activities, as well as talking to many scientific societies and conferences. He also provided major input to PMSEIC (the Prime Minister's Science, Engineering and Innovation Council) on salinity and biodiversity issues. As Chief Executive of the CRCFE he has been an influential adviser to federal and state governments and a respected commentator on environmental issues. He has also been influential in persuading governments to address such major issues as dryland salinity, water quality, biodiversity, river health and environmental flows.

Peter's many achievements are reflected in the awards he has received, directorships and membership of numerous boards and committees. Last year he received the Prime Minister's Environmentalist of the Year Award.

"I've always loved water, it's been a constant thread through both my personal, recreational and professional life. I'm passionate about it."

One of his greatest contributions lies in the area of education and knowledge delivery. As Peter said in a recent interview, "I believe my biggest personal contribution has been in the delivery of knowledge. We understood the need for media and communications to familiarise the public and the professions with what we were doing in the CRC, but this wasn't sufficient. We needed to better advise our stakeholders on a technical level and this led to the evolution of the knowledge broker concept. This strengthened the links between the producers of the knowledge and the users of this knowledge. I believe it has put this CRC ahead of the pack."

I believe my biggest personal contribution has been in the delivery of knowledge

For Peter the idea of scientists and industry working cooperatively has been very exciting. "We all bring different skills, and see different opportunities in any given situation, and to see people develop enough trust to come together and share what may seem like unusual ideas, and have those views challenged, is both remarkably productive and insightful. It is productive because it may just jolt your own assumptions and you just might get a glimpse of what that window of opportunity might be."

Peter's rise to one of the most influential positions in the Australian water industry wasn't planned, "...rather a series of well-timed opportunities" developed by someone with a sharp intellect and exceptional vision. Peter's commitment to improving the health and sustainability of Australia's waterways is outstanding. He will be missed by all within the CRCFE and we wish him well.

Peter leaves the CRCFE to pursue other opportunities. He will, however, retain an interest in the CRCFE and may be contacted by email at: cullen@lake.canberra.edu.au

Shield shrimp, Triops australiensis australiensis

The creature feature for this issue is the shield shrimp, *Triops australiensis australiensis*:

Class: Crustacea
Order: Notostraca
Family: Triopsidae

Found in inland ephemeral pools, shield shrimps swim near the bottom, creeping and burrowing into the soft sediment where the adults lay their eggs. As the pools dry out, the eggs lie dormant until the next rain, when they hatch out and recommence the life cycle.

Using Artificial Plants to Enhance Native Fish Populations in the Broken River

by Drs Chester Merrick, Rod Oliver and Paul Humphries

The loss of underwater plants in many rivers has been suggested as a possible reason for the continuing loss of native fish from many lowland rivers. The plants' demise is mostly due to failing river health. Researchers from the CRC for Freshwater Ecology, Murray-Darling Freshwater Research Centre, are testing the supposition that providing artificial plants in the Broken River in Victoria will increase the numbers of larval and juvenile fish by improving food and habitat availability.

This project is funded by the Natural Heritage Trust through the AFFA Murray-Darling Fish Rehab Program and by the Goulburn-Broken Catchment Management Authority.

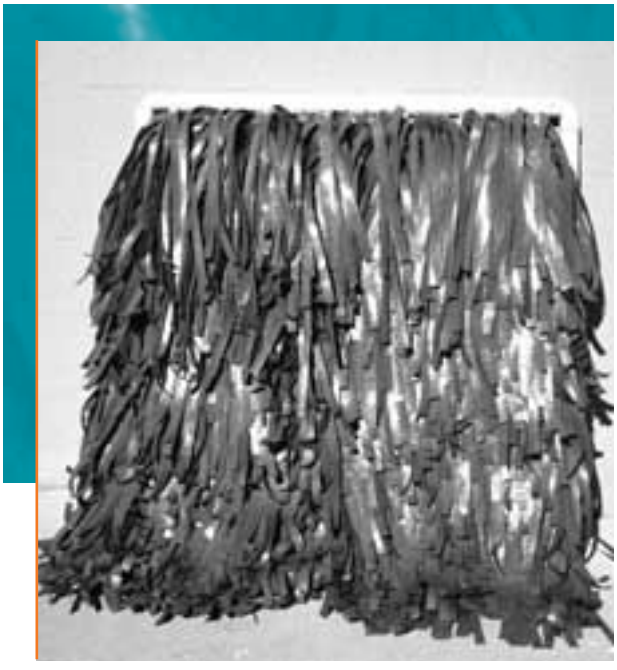
Rehabilitation of lowland rivers often involves restoring critical habitat for fish and there is a perception that snags are the most important type of fish habitat. Small fish, however, are often found near underwater plants in both freshwater and marine environments. These plants provide shelter from currents and predators. The leaves and stems of underwater plants provide a stable surface for algae to grow on, an important food source for small animals such as invertebrates, which are then eaten by small fish. Underwater plants, called submerged macrophytes, can provide over ten times more surface area for algal growth than the area of riverbed they occupy.

The widespread loss of underwater plants from many Australian lowland rivers is attributed to the causes of continuing river degradation, such as:

- eroding riverbanks leading to large sand slugs moving down the river and burying plants;
- increasing turbidity or muddiness reducing the amount of light available for plant growth on the river bed;
- increasing nutrient loads which cause excessive algal growth on the underwater plants which, in turn, can smother and kill them; and
- changes in seasonal flow patterns and water quality brought about by river damming and regulation.

River damming and regulation has been implicated as a major reason for the widespread decline in native fish populations in many Australian lowland rivers. River regulation may have an impact on both the reproduction and the survival of the young native fish, but the mechanisms behind the impacts remain, for the most part, unexplained. One possible contribution to the decline in native fish populations may be via the loss of submerged macrophytes.

Small fish are often found near underwater plants



Can the use of artificial plants, like the one shown here, increase the numbers of young fish in a river?
Photo: C Merrick

Paul Humphries sampling fish in the Broken River, Victoria, to see whether artificial plants improve food and habitat availability for young fish. Photo: C Merrick

A CRC for Freshwater Ecology research team, based at the Murray-Darling Freshwater Research Centre in Albury, is testing the supposition that providing artificial plants in the Broken River in Victoria will increase the numbers of larval and juvenile fish by improving food and habitat availability. Because the required quantities of natural submerged plants are not available within the project time frame, the team is using artificial plants made from plastic. The artificial plant mimics *Vallisneria* spp. or ribbon weed, which is a common and widespread underwater plant, native to Australia. Artificial plants enable experimental replication and easy manipulation of characteristics such as patch size and stem density.

Underwater plants can provide over ten times more surface area for algal growth than the area of riverbed they occupy

The project will:

- measure changes in riverine primary productivity, invertebrate numbers and larval and juvenile fish numbers resulting from the installation of the artificial plants;
- assess whether artificial plants increase the numbers of larval and juvenile fish; and
- identify the major food sources for fish during their development.

Artificial plants have been installed into sites on the Broken River, Victoria, where populations of ten native, and four introduced fish species are known to occur and spawning times are well understood. The larval and juvenile fish associated with the artificial plants will be sampled by electro-fishing and invertebrates will be sampled by sweep netting and a trap sampler. Control samples will be taken from unvegetated areas immediately upstream, as well as from artificial plants without frames. Naturally occurring remnant submerged plant beds will also be sampled for comparison with artificial plants.

This project may show that submerged plants increase the number of young fish. If so, this new knowledge can guide river management practices, and lowland rivers can, in the future, be managed in ways that better sustain submerged plants and fish. If the project finds that providing submerged plants does increase the number of young fish, knowledge about this connection should be made available to water resource managers, regional catchment management groups and other interested parties.

For more information, please contact:
Dr Chester Merrick
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Email: chester.merrick@csiro.au

The 2002 Rotary Murray-Darling School of Freshwater Research

Immersed in the moment; Phil Suter and John Hawking show by example. Photo courtesy of the Border Mail.

Some comments from this year's students in the Freshwater Research School:
"I had the time of my life"..."Truly enjoyed it, and would recommend anyone attending future courses...a great place to meet new friends and to grow your ideas for the future."..."I never thought environmental science could be so interesting, so it is a definite possible pathway"..."I have seen what a job in that area would involve, and I've made new friends".

Participants in this year's Rotary Murray-Darling School of Freshwater Research, all Year 11 students, worked in teams to solve an environmental problem, with support from leading scientists. The students looked at the Kiewa River from the Bogong High Plains to the Murray River to determine its health. By combining this problem solving approach with intensive support and advice, the students gained a realistic and fun introduction to freshwater science.

I never thought environmental science could be so interesting

Due to high demand, two schools were run concurrently in April in Albury: 26 participants at the Murray-Darling Freshwater Research Centre, and 23 at Charles Sturt University. The 49 participants included students from as far away as Mt Martha, Murray Bridge, Young, Tamworth, Castlemaine, Hopetoun, Rochester and Canberra.

Some of the staff and students attending the School. Photo: M Copland

Follow-up surveys of past participants show that many students have chosen to study environmental science as a result of their positive experiences in the Schools.

Ms Sarie Los said that taking part in the Murray-Darling Freshwater Research School in Year 11 helped her choose her future career. "Part of the camp was research and problem solving and I thought 'this looks really interesting, I could do this as a job'," she said.

After the Freshwater Research School, Ms Los changed her Year 12 subjects to include environmental science. This year, Ms Los won a Snowy Hydro scholarship and began a Bachelor of Science degree in environmental management and ecology.

The School is sponsored by the Rotary Club of Albury, the CRC for Freshwater Ecology, and Norse Skog, and staffed by scientists from The Murray-Darling Freshwater Research Centre (MDFRC), Charles Sturt University and La Trobe University.

For further information, visit the CRC for Freshwater Ecology's website at http://freshwater.canberra.edu.au, choose What's New, then follow the prompts for the Rotary Murray-Darling School of Freshwater Research.

Talking Point

by Professor Gary Jones

The aim of 'Talking Point' is to raise some of the key issues and challenges facing the CRC's Knowledge Exchange program. One of our important tasks is to work with CRC researchers to synthesise organisational ecological knowledge on critical waterway management issues. This year we have started a major new publication – the River Management Series – to deliver organisational knowledge to regional river management groups. In this edition, I would like to introduce the Knowledge Exchange staff responsible for delivering these and other CRC Knowledge Exchange (KE) outcomes.

Michelle Bald – Knowledge Broker (Mildura). Michelle has a Bachelor of Science (Honours in Botany) and a PhD in wetland ecology. Before joining the KE team in 2001, Michelle had worked as a TAFE lecturer and an interpretive officer with the National Parks and Wildlife Service (SA). She works closely with regional natural resource management agencies and the Mildura community to improve the understanding and management of freshwater ecosystems.

Peter Cottingham – Knowledge Broker (Melbourne). Peter has a Bachelor of Applied Science (biochemistry major) and a Master of Science in wetlands and water treatment. Before joining the KE team in 1998, Peter had accumulated 14 years experience as an environmental consultant and researcher of inland and coastal waters. He has helped to co-ordinate much of the CRC's consulting activities and has managed a number of river management scientific panels.

Amanda Kotlash – Knowledge Broker (Sydney). Amanda has a Bachelor of Applied Science and a Master of Natural Resources (major in river health assessment). Before joining the CRCFE in 2000 Amanda worked with AWT-Sydney Water, and Blue Mountains City Council. Amanda is based at the Sydney Catchment Authority (SCA) head office in Penrith and has primary responsibility for servicing our NSW partners – SCA, DLWC and EPA.

Lynne Sealie – Communications Manager (Canberra). Lynne has 20 years experience in communications and higher education, with degrees in Science (zoology major) and Social Administration, and is currently undertaking a Master in Science Communications. Before joining the CRC in 1999, Lynne worked as a TAFE lecturer and an international education manager at two universities. She is responsible for CRCFE publications, media and the web site.

John Whittington – Knowledge Broker (Canberra). John has a Bachelor of Science (Honours in Botany) and a PhD in algal ecology. Before joining the KE team in 1999 he spent several years as a research scientist with the State University of New York (Buffalo), University of Tasmania, and the MDFRC Albury. John has led the development of several KE knowledge synthesis documents including "Sustainable Rivers: the Cap and Environmental Flows".

Other members of the team who contribute significant time to Knowledge Exchange as an in-kind contribution to the CRC are: John Hawking (MDFRC, Albury), and Glenn Wilson (Northern Basin Laboratory, Goondiwindi).

For further information, please contact:
Professor Gary Jones
Phone: 02 6201 5167
Email: gjones@enterprise.canberra.edu.au

SideStream

New River Management Guides for Catchment Management Groups

The CRC for Freshwater Ecology is producing a new River Management Series of guides for catchment managers and catchment management groups. Part 1 in the series, titled "Conserving Natural Rivers" by Peter Cullen, is now available on the CRCFE website at http://freshwater.canberra.edu.au. Go to the 'Publications' page, choose Books and Guides and scroll down to the guides. Part 2 of the series, titled "Assessing River Condition Using Existing Data" will be up on the website in July.

Stakeholders Advise the CRC on Future Research

The CRCFE held a one-day stakeholders workshop in April to inform its triennial research planning process. The workshop brought together key representatives from 26 organisations across the Australian water industry, including private business, government organisations, statutory authorities and non-government organisations.

The aim of the workshop was to ensure that our current and future research outcomes deliver the knowledge needed to achieve the best possible environmental outcomes for our stakeholders. Some of the key points emerging from the workshop included the need for tools to support policy (from farm-scale to basin-wide); metrics to assess river health; and accessible information for users. For more information about the workshop contact Gary Jones on 02 6201 5167; Email: gjones@enterprise.canberra.edu.au

International Symposium on Dragonflies

All dragonfly enthusiasts, amateur or professional, are welcome to attend the 3rd World Dragonfly Association International Symposium of Odonatology at the La Trobe University Campus, Beechworth, Victoria, from 8th to 13th January 2003. John Hawking of the MDFRC/CRCFE will host the meeting which is expected to attract about 150 participants. For more information about the symposium visit the WDA website at http://powell.colgate.edu/wda/Australia/Home_page.htm or contact John Hawking on Email: john.hawking@csiro.au

Snags Guidelines Being Updated

Stuart Bunn and Peter Cottingham are coordinating a technical update of the Land & Water Australia large woody debris (snags) guidelines. This update will include new insights and information gleaned from research and management experience over the last 5 years. It will provide a framework, along with technical information, to guide managers who seek to reinstate large woody debris to river and floodplain systems.

Stuart Bunn, Sam Lake, John Koehn and Simon Nicol from the CRCFE have all contributed to the update. For further information, contact Stuart Bunn on 07 3875 7407, S.Bunn@mailbox.gu.edu.au, or Peter Cottingham on 03 9235 7221, peter.c@enterprise.canberra.edu.au

New on the Website

The following talks, presented by Professor Peter Cullen, are now available on the CRCFE website. Go to the 'What's New' page of the CRCFE website and click on 'Latest Activities'.

- The High Road or the Low Road: Choosing a Future for the Murray-Darling Basin. After dinner address to the Corowa Centenary Celebrations. 11th April 2002.
- Living with Water-Sustainability in a Dry Land: Adelaide Festival of the Arts, Getting it Right Symposium. 11-12th March 2002.
- Environmental Aspects of Sustainability. Presentation to the Australian Academy of Science: Transitions to Sustainability Symposium. 3rd May 2002.

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

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

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- 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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