March 2001

# WaterShed

contents



# Delivering Ecological Knowledge to the Water Industry

**by Professor Peter Cullen**

*This article is a summary of the opening address for the 2001 Congress of the International Society of Limnology, given by Professor Peter Cullen. The Congress was held in February 2001 at Monash University.*

The CRC exists to generate new knowledge from its research programs, and to deliver that knowledge to the water industry to help them manage our precious water resources. The industry provides significant financial resources to help the CRC meet this aim.

Doing good science and getting it published in the scientific literature is not enough to inform water resource managers. They rarely read the scientific literature, and while this avenue for communicating our findings is critical to quality control and scientific feedback, it is ineffective in delivering new knowledge to the industry.

The CRC and the National Rivers Consortium last year held a workshop to explore how professionals actually find the knowledge they need to do their jobs.

Resource managers describe their problems when seeking knowledge:

- They are very busy with many messages bombarding them;
- All messages are peddling something, and the manager assumes that the knowledge providers' main concern is self-interest – selling something;
- Many of the messages are conflicting;

*continued on page 2*


Cooperative Research Centre for Freshwater Ecology

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

- Is the message based on quality science?
- Do I have the opportunity for dialogue to test my understanding?

Professionals use a variety of strategies in their seeking of knowledge, but some common characteristics are:

- They tend to seek knowledge from someone who is easily accessible and trusted, rather than from a recognised authority in the field;
- They seek until they find the first acceptable answer;
- Often because of time constraints, they give up searching for knowledge relatively quickly and rarely keep searching for the "best" answer;
- They are likely to accept an idea if the sources are consistent - regardless of the authority of source.

Resource managers have indicated that they seek up to date, concise overviews of current understanding of a particular area. This might be in the form of regular updates on issues of concern. The material might be informed and expanded by the findings of current research projects, but the new knowledge must be embedded with the old knowledge in an easily assimilated form. They have indicated they are less interested in plain English summaries of the findings of particular research projects and did not see the individual research project as the appropriate unit of knowledge to transfer to them.

The knowledge exchange function is so important to our survival as a research organisation, and to the management of Australia's water resources that it needs professional attention rather than expecting research scientists to do it as an add on extra. We employ knowledge brokers to do this task.

Knowledge brokers are people with a strong technical base and strong communication skills. They are synthesisers and packagers of knowledge rather than creators of new knowledge. They are motivated by focussing existing knowledge to solve a problem rather than selling their favourite research tool, model or their next set of experiments. They need good people skills, and good project management skills.

Knowledge brokers may be located in the offices of our industry partners where their everyday presence allows trust to develop and where they are readily accessible for discussions. Knowledge brokers may prepare overview materials on emerging or important issues, and these reflect the most up to date scientific understanding of the issue.

Knowledge brokers provide "Joint Problem Solving Workshops" when the industry partner has an issue, but the actual question or the boundaries of the issue are not clear. We put together 2–3 day workshops of 8–15 people, roughly half from industry partners and half from the CRC. These workshops are discussion sessions with few structured presentations. The idea is to develop trust and allow all participants to develop their personal conceptual models of the system of concern. Through this process much richer conceptual models are developed by all participants and real learning takes place. This might lead to the development of a research project or a change in management strategies.

The water industry in Australia invests in our Centre expecting a number of benefits:

- They expect the research projects to focus on relevant issues and to deliver useful knowledge to the industry.
- They need postgraduate and undergraduate training and professional education provided.
- They seek a core of specialists who operate at the cutting edge of their disciplines to be available when needed to advise the industry.
- They seek credibility and validity for their management actions from their partnership in the Centre.

These benefits are not delivered by just publishing our science in the learned journals of the world. That is important and we expect it of our staff. But it is not enough. We must provide relevant knowledge to managers in ways that are easily accessed, understood and synthesised, while taking into account their time constraints and work context. The knowledge exchange model being developed within the CRC is just one approach to dealing with this issue.

# Debugging the Slugs – the Granite Creeks Project

Granite Creeks is a series of small tributaries flowing off the Strathbogie Ranges into the Goulburn River in central Victoria. Through a CRC for Freshwater Ecology (CRCFE) project they have become an important landmark in the quest to understand and restore rural streams degraded by sand slugs. If you add habitat to a stream, will the organisms return and the condition of the stream improve? This is one of the questions the Granite Creeks project aims to answer.

A sand slug is a mass of sand or gravel that has accumulated over long periods due to erosion. They contain coarse particles that drop to the river floor while finer particles stay suspended in the stream. During times of high flow or flood, the sand becomes dislodged enmasse. These sand slugs, which can be thousands of meters long and fill the entire width of a stream, begin a slow, destructive journey, some remaining static for long periods.

*Sand slugs can be disastrous*

Sand slugs can be disastrous. At the extreme, they can change stream direction and drown out the streambed. In the process, they eliminate small pools and riffles, important water sources during dry spells. Large woody debris and snags may become submerged by sand and whole habitats destroyed in the process.

More subtle changes in stream ecology may also occur, such as increased turbidity and reduced flow, altering habitats and impacting negatively on fish and other aquatic plants and animals.

In south-eastern Australia sand slugs are derived predominantly from stream erosion, and are more commonly associated with granite catchments. Granite produces sand-sized particles, perfect for slug development.

The Granite Creeks project is comparing the fauna, catchment condition, channel morphology, wood amounts and hydrology of five streams in the Granite Creeks catchment (representing both sand-impacted and unimpacted streambeds).

The project will shed light on these questions:

- How much sediment is transported from catchments of the Strathbogie Ranges into the streams?
- How effective is adding habitat structure (timber) in restoring degraded streams (notably sand-slugged streams)?
- Does the distance from potential sources of colonists affect restoration?
- How can we monitor and assess stream restoration?

A review of the history of European settlement and land use practices for the Granite Creeks catchment, and an extensive geomorphological assessment have recently been completed by Jennifer Davis and Brian Finlayson as part of the Granite Creeks project. The report from this study, "Sand Slugs and Stream Degradation: The Case of the Granite Creeks, north-east Victoria" is now available.

*Sand dunes migrating along Creightons Creek.*

The historical data provided valuable insights into the state of streams at the time of European settlement and how and why streams have changed over time. Much of this information was provided by local farmers, historical maps, records and diaries.

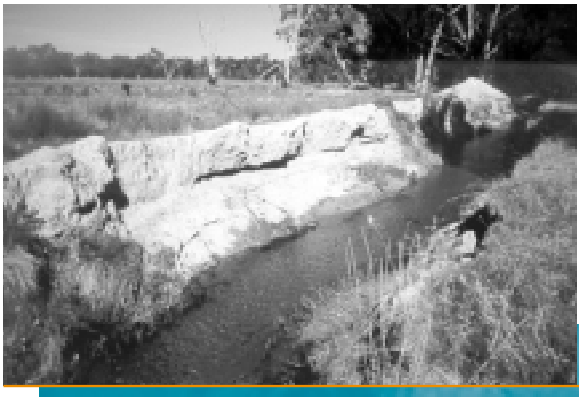
The study also assessed the current condition of the creeks to determine if the processes that influenced change in the past are still active, and whether or not the creeks are stabilising. This involved extensive field inspections to determine where the sediment came from and where it was being deposited.

Dr Jennifer Davis (CRC for Catchment Hydrology), a key researcher in the project states, "informing land owners and other stakeholders about the type of activities that are still causing erosion in the catchment and which activities should be avoided or encouraged, has clear benefits for them. They can then adopt practices to reduce erosion or sedimentation."

"Many of the landholders are affected by waterway condition (stream erosion can affect property access, stock access to water and loss of land) and consequent sedimentation has implications for channel capacity (flooding), channel avulsion (streams changing course) as well as the broader issues of riverine health."

The report stresses the necessity of preventing further erosion in the upland catchments and of providing habitat structure in the lowland sand-impacted sections.

Through major sampling and measuring exercises, other researchers in the Granite Creeks project now have an extensive knowledge of the fauna in the creeks. Restoration work, incorporating local landholders and Landcare groups, will now concentrate on two creeks. The research team intends to place specially designed timber structures in selected sites in sandy streams, then closely monitor colonisation by fish and invertebrates and the effects on other fauna.



*Eroding streambanks in the lower reaches of Creightons Creek.*

The project compliments restoration work being carried out by the CRCFE elsewhere – feeding in valuable information about the most effective ways of adding habitat structure to degraded streams as well as tools for assessing and monitoring restoration efforts.

The Granite Creeks project leader is Sam Lake (CRCFE). The project team: Dr. Jennifer Davis (CRCCH), Dr. Barbara Downes (Associate member, CRCFE), Alena Glaister (CRCFE), Dr. Brian Finlayson (CRCCH), Ian Rutherfurd (CRCCH), members of Granite Creeks Landcare Group, Justin Sheed and Wayne Tennant (Goulburn-Broken Catchment Management Authority), Pat Feehan (Goulburn-Murray Water), and several other research staff and students.

*A suspended sediment sampler is used to detect the amount of sand in a water sample*

The Granite Creeks report is freely available on the website at http://freshwater.canberra.edu.au, select publications, then technical reports. A hard copy can be ordered by contacting our Albury Office on 02 60582300 (price: $28.00).

**For further information on the project, contact**
**Professor Sam Lake**
**phone: 03 9905 5653**
**email: sam.lake@sci.monash.edu.au**

# Dams and Diversity – Disturbing the Balance

by Dr Richard Marchant

Although dams are widespread in southern Australia, multiple dams have never been studied in a single survey. The effects of their different levels of disturbance on downstream invertebrates (animals without a backbone) communities are unknown. For instance, do all dams cause a similar loss in the richness of downstream invertebrate communities? Are the same taxa (groups of animals) always eliminated or favoured? And is the degree of loss related to changes in downstream hydrology?

The recent advent of predictive models for invertebrate communities of Victorian and NSW rivers (from the AUSRIVAS series of models) enables such an assessment to be made. Using the predictive model, researchers can compare the invertebrates actually found at sites below dams with those predicted to occur at similar but undisturbed sites. The models are based on invertebrate data gathered at over 200 reference or least disturbed sites in each state.

AUSRIVAS (Australian Rivers Assessment Scheme) is a predictive modelling tool developed by the CRC for Freshwater Ecology (CRCFE) and state agencies that enables users to assess the health of a river. The model predicts the number and type of macroinvertebrate (animals without a backbone that can be seen with the naked eye) species likely to be found in an undisturbed area (reference site) and compares this to the number and type found in a disturbed area (test site). Certain species are known to be highly sensitive to disturbance (eg: Elmid beetle larvae), others are very tolerant, (eg: midge larvae) so the species found at each site can provide an important insight into what's happening in the immediate catchment.

*certain species are highly sensitive to disturbance*

Once test sites are matched to reference sites with similar characteristics, the macroinvertebrates expected (E) if there were no environmental stress, can be compared to the macroinvertebrates observed (O). For example, an O/E of 0.7 would indicate that about 30% of the different sorts of animals expected were not collected. The missing animals indicate an unhealthy or stressed river. A healthy or unpolluted river should have an O/E ratio close to one.

In a recent project funded by the CRCFE, sites downstream (usually <0.5km) of 7 dams in Victroria and 12 dams in southern NSW (Fig.1) were sampled in spring and autumn of 1998 and 1999. All dams were

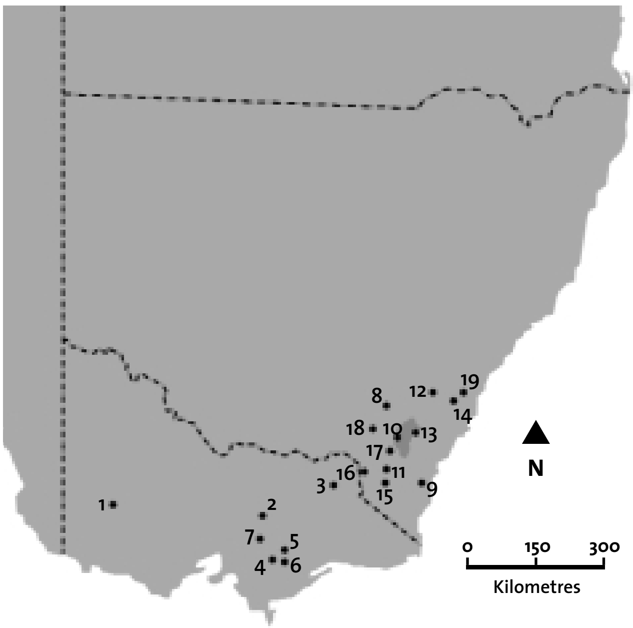



*Fig 1: Sampling sites for the dams study*

*Similar groups of invertebrates recolonised all sites after the disruption of dam building. Tallowa Dam on Shoalhaven River, NSW. Photo: R Marchant* considered large (dam wall > 15m high) and were used for urban water supply, irrigation or generation of hydroelectrictiy. Invertebrate specimens were identified to the family level and the results assessed using combined season AUSRIVAS models i.e. based on data from spring and autumn.

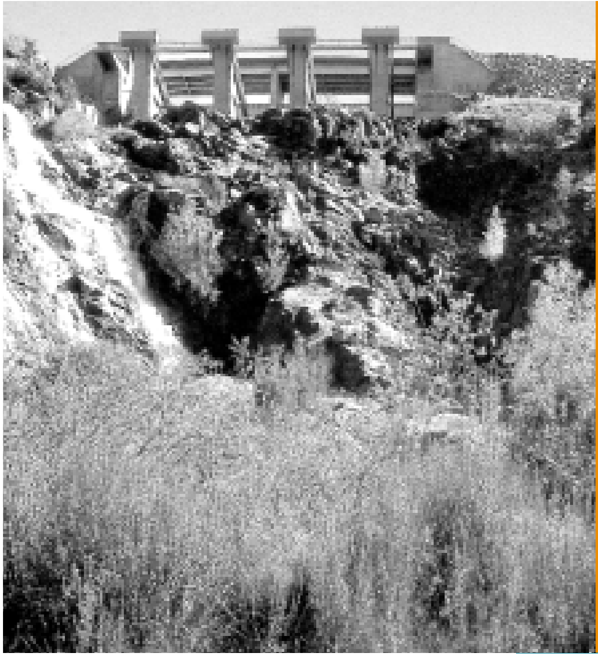
Outputs from the models consisted of:

- a list of the groups of invertebrates you would expect to find at each site;
- the probability of them occurring at each site; and
- the ratio of numbers of observed taxa to numbers of expected taxa (O/E ratios) for each site.

In addition, data were obtained on current and historic or natural flow volumes downstream of the dam. These data enabled the degree of deviation from the natural hydrological pattern to be quantified using an index of annual proportional flow deviation (APFD developed by Tony Ladson of the CRC for Catchment Hydrology).

O/E scores averaged 0.63 for the 7 Victorian sites and 0.62 for the 12 NSW sites suggesting that about 40% of the families that were predicted to occur had been eliminated below dams. There was no correlation between these O/E scores and APFD (r=0.16, Fig.2). Indeed the highest score (0.85) had one of the highest levels of hydrological deviation and generally O/E varied over a narrow range (~0.5 - 0.7) irrespective of APFD, which ranged from 1.8 to 6.0. The lowest O/E score (0.38) occurred at the single site where water quality was intermittently low. Poor water quality was not recorded at other sites.

At all sites taxa such as worms (Oligochaeta), midge larvae (Chironominae and Orthocladiinae), water mites (Hydracarina), various caddis larvae (Hydropsychidae and Hydrobiosidae) and certain Gripopterygid stonefly nymphs and Baetid mayfly nymphs were predicted to occur and were observed (these taxa are tolerant of the altered conditions produced by dams). On the other hand Leptophlebiid and Coloburiscid mayfly nymphs, Elmid and Psephenid beetle larvae, and a number of other families (e.g. Tipulidae, Corydalidae, Leptoceridae, Glossosomatidae, Conoesucidae, Calocidae) were commonly predicted but were seldom observed (intolerant taxa). In addition, some taxa with a low likelihood of



*About 40% of the families of invertebrates predicted to occur below the dams had been eliminated. Jindabyne Dam on Snowy River, NSW. Photo: R Marchant*

occurring were found more frequently than expected, e.g. Ecnomid caddis larvae, Ceinid shrimps, suggesting that these taxa were favoured by the altered conditions.

In short, the tolerant and intolerant taxa varied little across sites. Similar taxa recolonised all sites after the disruption caused by dam building had ceased. It has been suggested that dams act as barriers to drifting invertebrates, curtailing a major source of colonists from upstream refuges. Thus river reaches immediately downstream of dam walls may be permanently alienated from many potential colonists. This seems to be the common factor causing the observed reduction in fauna at each site.

Given the lack of correlation between changes in flow volume and O/E scores there may be little that can be done to rehabilitate invertebrate communities immediately downstream of a dam, apart from ensuring adequate water quality to prevent even further disruption. Practices used to ensure adequate water quality include aeration and discharge from the top layer of the dam. Full recovery does not seem possible without removal of the dam itself.

**For further information, contact Dr Richard Marchant**
**phone: 03 83417433**
**email: march@mov.vic.gov.au**

# Conserve and Discover – Conservation Genetics and the Southern Pygmy Perch

Southern pygmy perch (Nannoperca australis) are small native fish found in freshwaters of the Murray-Darling River system, along a coastal band from south-east South Australia to eastern Victoria and including northern Tasmania. Once common in Victoria, New South Wales, Tasmania and South Australia, their numbers have dropped since European settlement, particularly in the Murray-Darling system (especially in the Murrumbidgee where they are thought to be extinct).

Competition from introduced species such as redfin, trout, gambusia and carp, as well as disruption to habitat and river flow have led to population fragmentation and local extinctions for the Southern pygmy perch.

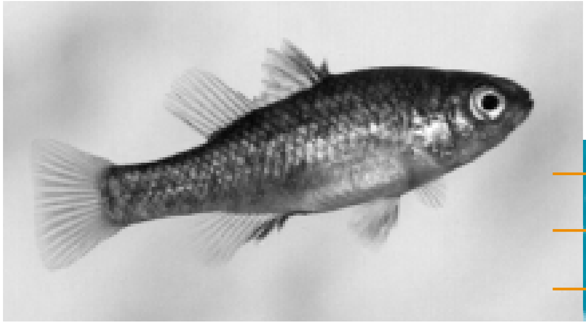
Southern pygmy perch are carnivorous, feeding mainly on small crustaceans and insect larvae and growing to an average of 65mm in length. They play a very important role in mosquito control, eating waterborne mosquito larvae. Commonly found in small, slow-flowing streams and still vegetated habitats, such as billabongs, irrigation ditches and other types of wetlands, the southern pygmy perch is proving a model fish for molecular based research.

***enables us to predict likely outcomes for a species***

Michael Hammer is a Conservation Officer with Native Fish Australia (SA), a recently established research and conservation group for native fishes. Based at the University of Adelaide, under the supervision of Associate Professor Keith Walker (CRC Freshwater Ecology) and Mark Adams (SA Museum Evolutionary Biology Unit), Michael is completing his honours degree on the molecular systematics and conservation biology of this vulnerable species. The research is also supported through the Natural Heritage Trust by the Fisheries Rehabilitation Program.

Previously, there were six known species of Nannoperca (pygmy perch) in Australia, four occurring in southeastern waters. All species have suffered the same threatening processes and the southern pygmy perch, while common in some regions is locally vulnerable in the Mount Lofty Ranges near Adelaide and parts of NSW.

Michael's study began with national fieldwork across thirty sites in Qld, SA, NSW, Vic, WA and Tas, the known range for the family Nannopercidae. Allozyme electrophoresis (a technique that looks at protein differences between individuals) was used to differentiate



*Pygmy Perch* (Nannoperca sp.) *Genetic studies have revealed what appear to be two new species of pygmy perch. Photo: M Hammer*

*Ewans pygmy perch (*Nannoperca variegata*) a vulnerable species found in Victoria.*
*Photo: M Hammer*

levels of genetic diversity between populations. Using this method Michael was able to define the amount of genetic variation within and between species. As might be expected, species in Qld and WA were quite distinct from those in the southern states, while the vulnerable Nannoperca variegata was quite distinct from its local relatives. He also discovered high levels of variation within N. Australis.

Michael says "One of the exciting outcomes of the research is the discovery of what appears to be at least one and potentially two new species of pygmy perch, one in Victoria and one in Tasmania. Allozyme studies indicate that both populations are very distinct from the southern pygmy perch. Although not the immediate focus of research further morphological analysis will be carried out to complement the genetic studies".

"The next phase of the project will use this genetic information as the basis for within-species studies, with specific reference to defining locally endangered stocks in the Mount Lofty Ranges near Adelaide. This information will be used in conjunction with field-based life history information to determine species status, current range, potential threats and management options. Once we have this information we are then in a position to do a Population Viability Analysis (PVA). PVA enables us to predict likely outcomes for a species as conditions change, based on life history and environmental data".

A very practical outcome of this research is the application of PVA and molecular genetics to the development of a local species recovery plan. This involves the development of conservation strategies for fish stocks or Evolutionary Significant Units (a fish population or group of populations) with the aim of conserving their genetic diversity. Genetic diversity is important because in the short term, greater diversity represents greater fitness, and in the long term, the greater the genetic diversity the more variability there is in a population. This diversity is critical as it contains the evolutionary potential of the species.

***greater diversity represents greater fitness***

Molecular level studies are also capable of defining genetic distances between populations, thus providing us with a way of calculating the evolutionary time frame. It can also highlight genetic variation that once lost locally, can't simply be replaced with stocks from other areas.

Molecular systematics is an exciting field with a rapidly changing technology and while it has been applied to other species of fish including catfish, golden perch and desert gobies this is the first family level study of a large fish group using this technique. This study may provide the basis for molecular based studies in other fish groups and populations.

**For further information, please contact**
**Michael Hammer**
**phone: 08 8303 6115**
**email: michael.hammer@student.adelaide.edu.au**

# Floods, Floodplains and 'Flood-runners'

by Glenn Wilson

Floodplains are dynamic features of dryland river landscapes in the Murray-Darling Basin. Flooding along dryland rivers can inundate the adjacent floodplain within days, sparking dramatic increases in aquatic productivity and changes in nutrient cycling. Flow regulation has reduced the number of high-level overbank floods in many catchments, placing greater emphasis on the need to understand the dynamics of low to medium level flooding and its significance in space and time.

Anabranches are side channels or water courses that break out from the main channel at low to medium flood levels, flow through the floodplain, and rejoin it downstream. Also called 'flood-runners', their role in the ecology of dryland rivers is poorly understood. Anabranches connect with the main channel at varying heights in the bank profile. They also vary in length, from cryptic depressions of only several hundred metres to small rivers (e.g. Boomi) of over 100 kilometres.

Despite this diversity, all anabranches rely on flooding to replenish their water supply, and experience long periods of low flow or even dry conditions between floods. This suggests that anabranches may accumulate high loads of organic matter (e.g. leaf litter) and dense populations of plankton. Furthermore, their calmer conditions when inundated may also promote stronger survival of fish larvae. In concert, these possibilities suggest that anabranches may be a critical source of material driving dryland riverine food webs and biodiversity. These ideas remain largely untested in Australia.

The new Northern Laboratory of the Murray-Darling Freshwater Research Centre in Goondiwindi is ideally located to undertake research on the ecology of anabranches. Anabranches of varying structure are common in catchments such as the Border Rivers and Condamine-Balonne. This summer, the Northern Laboratory will begin the first in a series of collaborative projects investigating the importance of anabranches as a source of carbon (organic matter) and animal recruitment for riverine ecosystems.

Heather McGinness will begin investigations into the role of anabranches as carbon sources as part of her PhD project with the CRC for Freshwater Ecology, "Habitat heterogeneity and carbon dynamics in semi-arid floodplain river systems". Heather will focus her research around flood events that connect anabranches with the main channel. At this stage the study will focus on the Macintyre River system on the border of New South Wales and Queensland. This area features a large number of anabranches, and is also highly regulated, producing high predictability of flood flows that connect anabranches with the main river channel.

*Anabranches~ critical for biodiversity*

Heather's research will involve pre, during and post-flood monitoring of the large scale pools, inputs and outputs of total organic carbon, particulate organic carbon and dissolved organic carbon in each of several anabranches and in the adjacent main channel.

*Rivers are recharged with a massive dose of organic material when floodplains are inundated during floods. Macintyre River, Queensland. Photo: G Wilson*

*Floods dramatically change the nature of lowland rivers, sometimes raising the flow speed by several orders of magnitude. Macintyre River, Goondiwindi, Queensland during October and November 2000. Photo: G. Wilson*

The project will also assess the potential impact of hydrological fragmentation of anabranches upon carbon availability and transfer to the riverine ecosystem. The work will concentrate on a series of anabranches between Goondiwindi and Mungindi, and Heather will work from the Northern Laboratory during the field work components of the project.

Other work being planned will examine the export of fish larvae and planktonic crustaceans from anabranches in relation to flow conditions. Otoliths (ear-bones) will be used to track the source of larval fish (main channel versus anabranch) as well as the timing of spawning activity in relation to flow height.

**For further information, contact**
**Glenn Wilson**
**phone: 07 4671 6134**
**email: glenn.wilson@dnr.qld.gov.au**

**Heather McGinness**
**phone: 02 6201 2360**
**email: Heather_McGinness@enterprise.canberra.edu.au**

The feature creature for this issue:
**Class** Insecta (insects)
**Order** Hemiptera (aquatic bugs)
**Family** Corixidae

Commonly found along the edges of slow-flowing or still waters, water boatmen feed on organic material of either plant or animal origin. Also called 'lesser boatmen' or 'corixas'. Many fish feed on water boatmen and they are an important part of the diet of Macquarie Perch, an endangered native fish.

# SideStream

## New CRCFE staff

Professor Gary Jones has commenced as Director of Knowledge Exchange and Education, based at the CRCFE in Building 15, University of Canberra. Gary joins the CRC from CSIRO Land and Water and can be contacted on: 02 6201 5168; email: gjones@lake.canberra.edu.au

Charles Robinson has commenced as Chief Administration Officer for the CRCFE. He is based at the CRCFE in Building 15, University of Canberra and can be contacted on: 02 6201 5267; email: crobinson@enterprise.canberra.edu.au

Amanda Kotlash is the Centre's new Knowledge Broker, based in the Sydney Catchment Authority's Penrith Offices. Contact details to be advised.

## AUSRIVAS Practitioners Skilled Up

The CRC held a Training and Accreditation Workshop in November for AUSRIVAS practitioners, including agency and WaterWatch representatives from each state.

For further information, please contact Sue Nichols on: 02 6201 5408.

## The Report of the River Murray Scientific Panel on Environmental Flows Now Available

The Report of the River Murray Scientific Panel on Environmental Flows is now available in print from the Murray Darling Basin Commission. Members of the Scientific Panel were: Andy Close, Terry Hillman, Gary Jones, John Koehn, Jane Roberts, Phil Suter and Martin Thoms. The printed report can be ordered from Damien Woods at the MDBC on: 02 6279 0141; email: info@mdbc.gov.au

## New CRCFE Publications

A colour brochure on the CRC for Freshwater Ecology can now be ordered from the MDFRC at Albury on: 02 6058 2310; email: enquiries@mdfrc.canberra.edu.au

New Technical Report: Development of Relationships between Flow and River Health - Outcomes of a Joint Cooperative Research Centre for Freshwater Ecology and Queensland Department of Natural Resources Workshop. Available only on the web at http://freshwater.canberra.edu.au

New Technical Report: Sand Slugs and Stream Degradation: The Case of the Granite Creeks, north-east Victoria by Jennifer Davis and Bryan Finlayson. Technical Report no. 7/2000. Available on the web at http://freshwater.canberra.edu.au or $28.00 printed report from: 02 6058 2310; email: enquiries@mdfrc.canberra.edu.au

New Technical Report: Quantifying Nutrient-Algae Relationships in Freshwater Systems — Outcomes of a Workshop held at Monash University on the 8th August 2000 by Peter Cottingham and Barry Hart et al. Technical Report no. 8/2000. Available on the web at http://freshwater.canberra.edu.au or free printed report from: 02 6058 2310; email: enquiries@mdfrc.canberra.edu.au

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

Lynne Sealie
Communication Manager
CRC for Freshwater Ecology
Building 15
University of Canberra ACT 2601
Tel: 02 62015424
Fax: 02 62015038
Email: lsealie@enterprise.canberra.edu.au
WWW: http://freshwater.canberra.edu.au

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, Queensland
- 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
- Sunraysia Rural Water Authority
- Sydney Catchment Authority
- University of Canberra

Items in Watershed may be reproduced without prior permission provided they are reproduced in full and the source acknowledged.

Design & layout: Simon Yates, SYGA Pty Ltd