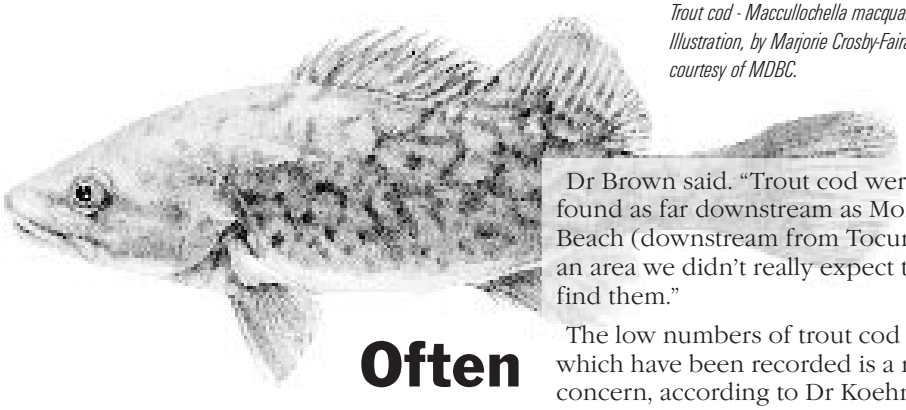

Trout cod - Maccullochella macquariensis. Illustration, by Marjorie Crosby-Fairall, courtesy of MDBC.

Often spotted but rarely seen:

the lament of Murray River trout cod

One of Australia's most endangered native freshwater fish, the trout cod, is still breeding in the lower reaches of the Murray River, a recent scientific survey has found. However, fisheries' scientists are worried that the current level of breeding is unlikely to sustain future populations.

The survey was conducted by NSW Fisheries, the CRCFE and the Freshwater Ecology Division of the Marine and Freshwater Resources Institute (MAFRI) and part-funded by the Australian Nature Conservation Agency's (ANCA) Endangered Species Unit.

About 36 trout cod, including 10 new- season juveniles, were recorded during the cooperative two-week survey which was conducted through a 200km stretch of the river between Yarrawonga and Picnic Point, upstream of Barmah.

A similar survey conducted last year in the Murray River, downstream of Mulwala, found no evidence of breeding in this trout cod population, the last "wild" population known to exist in Australia.

Research scientist with NSW Fisheries and the CRCFE, Dr Paul Brown, said this year's survey was aimed at determining how far downstream from Yarrawonga the "wild" trout cod population extended.

"We were also checking for the presence of recruitment (new juveniles), because last year's results had us worried that the population was no longer breeding,"

Dr Brown said. "Trout cod were found as far downstream as Morgan's Beach (downstream from Tocumwal) - an area we didn't really expect to find them."

The low numbers of trout cod which have been recorded is a real concern, according to Dr Koehn from MAFRI .

"Although it is difficult to determine numbers, the most optimistic estimate would be less than about 3500 fish - not many for the long term viability of an endangered species," he said. "The population is also patchily distributed and it is obvious that successful recruitment is not widespread nor occurring every year."

The survey was conducted at eight sites between Yarrawonga and Murray Bridge using boat electrofishing techniques to gather data such as species, sex, length and weight. Data was also gathered at two other sites which were surveyed last year, so comparisons could be made.

Another disappointing aspect of this year's survey, Dr Brown said, were the "bucket loads of carp recorded".

Dr Brown said while the exact reasons for the decline in trout cod were unknown, it was likely that habitat alteration, such as removing snags, river regulation and dam construction, was partly to blame. Competition from alien species such as carp and illegal fishing activities were other likely causes for the decline of this now protected native.

Dr Paul Brown is now working at MAFRI Snobs Creek Campus. Phone: (057) 74 2217

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WaterShed

contents

The CRC was established under the Commonwealth Government's Cooperative Research Centre Program in July 1993.

The Cooperative Research Centre for Freshwater Ecology provides ecological understanding to improve inland waters by collaborative research, education and resource management.

Lower Basin Laboratory opened by Deputy Prime Minister

Australia cannot afford to ignore the Murray-Darling, Deputy Prime Minister, Tim Fischer, said at the recent opening of the Murray-Darling Freshwater Research Centre's Lower Basin Laboratory in Mildura.

Mr Fischer opened the laboratory before an audience of regional politicians, water and natural resource managers, scientists and community representatives.

He commented that the regional and national importance of the new facility was evident in the bipartisan support it had received.

The Lower Basin Laboratory is a community initiative funded by the CRC and 15 local government and water agencies.

Officer in charge of Mildura's Lower Basin Laboratory, Dr Ben Gawne, said the new research facility offered enormous scope to further explore many of the problems that plagued our lowland rivers.

A number of these issues - carp, algal growth and potential control measures, the effects of river regulation, and the importance of interactions between rivers and their floodplains - were discussed by CRCFE scientists at a public seminar held after the laboratory's official opening.

Dr Gawne said that while carp had been blamed for a plethora of the environmental woes degrading our rivers, much of the evidence linking carp to river degradation was circumstantial.

"While we know that carp do affect turbidity as well as aquatic plants, we still know very little about the way carp interact with native fish species and other aspects of river ecology," he said.

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The Deputy Prime Minister, Mr Tim Fischer, unveils a plaque at the Lower Basin Laboratory.

The CRC is a collaborative venture between:

- *ACTEW Corporation*
- *The ACT Government*
- *The Albury-Wodonga Development Corporation*
- *CSIRO Division of Water Resources and Centre for Environmental Mechanics*
- *Gippsland and Southern Rural Water*
- *Goulburn-Murray Rural Water*
- *La Trobe University*
- *Melbourne Water*
- *Monash University*
- *Murray-Darling Basin Commission*
- *Murray-Darling Freshwater Research Centre*
- *NSW Fisheries*
- *University of Canberra*
- *Sydney Water Corporation*
- *Wimmera-Mallee Rural Water*

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Lower Basin Laboratory opened by Deputy Prime Minister

"The lower reaches of the Murray, which is regulated by a suite of weirs, also offers a unique opportunity to study the effects of river regulation. Many of the studies done to date have been limited by lack of replication because they have been conducted in one large river regulated by just one dam or weir."

Dr Gawne said he hoped the laboratory would become a centre for collaborative work on lowland rivers.

"We are interested in establishing links with the University of Adelaide where a lot of work is being conducted on the age structure of carp populations.

Nutrients is another area where collaborative work can be conducted through the CRCFE."

The CRCFE is consulting with regional water authorities and government agencies as well as community groups to determine the laboratory's research agenda which is likely to include algal blooms, the impacts of river regulation, control options for introduced pest species such as carp and the effects of nutrients.

The link between carp and blue-green algae is just one of the potential areas of study for the new lowland river research laboratory.

- *Karen Markwort*

The opening of the Lower Basin Laboratory in Mildura. From left: Chief Executive of Lower Murray Water, Mr Brian Grogan; Officer in Charge of Lower Basin Laboratory, Dr Ben Gawne; Deputy Prime Minister, Mr Tim Fischer; Director of the CRC Freshwater Ecology, Prof Peter Cullen; and Chairman of the CRC, Dr John Langford.

Turbulence in the water industry

From the Director

Director, Prof Peter Cullen.

The water industry is going through a period of great turbulence and uncertainty. Some of the dramatic re-organisation imposed is already showing signs of unravelling. Corporate memory has gone and stories abound about new managers desperately trying to find displaced employees who might remember how to manage their systems in drought, flood or even when major pipes break. The international water industry is recognising the need for capacity building at a time when Australia is going through a period of capacity shrinking.

A number of recent and very public failings of professionalism in the water industry include:

Failing to consider appropriate system boundaries;

Failure to analyse within appropriate time scales;

Failure to understand what is already known;

Poor quality investigation and research;

Advocates rather than analysts;

Inadequate critical review; and

Domination by fashions.

These are serious challenges to the professionalism, and to the standing of people in the water industry. The problems are often due to people operating outside their areas of competence, and not knowing enough about an area to be able to ask critical questions and understand the appropriateness of a proposal in any particular situation. The engineering profession has been brought up on "design manuals", and seem to believe that complex biological systems can be managed the same way, by adding the usual safety margins.

Despite the difficulties currently being experienced in the water industry, there are grounds for optimism. The industry has moved from grudging acceptance of public participation in the seventies, through a period of public involvement in the eighties to a situation where public ownership of land and water problems is dominating the nineties. Landcare and catchment management have shifted the power from large government agencies who were unable to look at the whole system other than the bits in their jurisdiction, to a situation where the community is starting to provide the integrated thinking the professionals have failed to deliver. The professionals are now seen as providers of bits of the jigsaw - important to have the bits, but useless by themselves unless someone can put them together.

This new and emerging role for the professional means we need to change the way we do things. It is no longer good enough to do things within the narrow perspective of an agency or even a State when our actions have wider ramifications, and other players in the water business have the capacity to point out our shortcomings.

These issues provide challenges for all of us.

- Peter Cullen

Scientists get bug-eyed over flow needs for upland rivers

With most of Australia's larger, lowland rivers already dammed, the pressure from water users is turning to the relatively untouched and smaller upland streams. Water ecologists, Shane Brooks and Dr Sam Lake, both from Monash University and the CRCFE, are studying how changing the natural flow in an upland river affects the aquatic insects inhabiting the stream. They hope that their work will provide information that will guide water managers in making environmentally sustainable decisions.

This three and a half year study, funded by the Land and Water Resources Research and Development Corporation (LWRRDC) and the National River Health Program, is one of the most extensive experiments to be conducted on stream flows in Australia, and perhaps the world. Data from more than 4000 sites from throughout Victoria and NSW were analysed before 10 upland streams were randomly selected for the experimental studies. The streams selected included five rivers with relatively constant flows and five with highly variable flows.

"It is a multi-disciplinary project, integrating hydrology, geomorphology and ecology," Shane explained.

"A major goal is to come up with some good, sound scientific ecological data to base environmental flow decisions on," he said. "At the moment water licensing and extraction policies tend to be centred around how much water is in the river and how much water the people want to pump. Everyone says yes, the environment needs some (water allocation), but there is hardly any sound ecological data as to how much water the environment needs and how that water should be delivered."

Aquatic insects are the tools which will provide the necessary ecological data. Many water agencies throughout Australia, including the national Monitoring River Health Initiative, are already using these macroinvertebrates as a sign of river health. By their presence or absence, these insects provide clues as to the ecological impacts resulting from landuse as well as stream management practices such as changing the flows in our rivers.

Paul Reich (left) and Shane Brooks collecting samples of aquatic insects from the Queanbeyan River.

"These insects are vital cogs in the riverine foodchain." Shane said. "Not only do they provide food for larger animals such as fish and platypuses, they also play a cleaning role by consuming organic matter and leaf litter that falls into the stream as well as eating algae."

Using a large portable canvas weir, the experimental work, which is conducted over two days at three sites in each river, includes manipulating the water flow so that it is increased by 300 percent in one section of the river and reduced to just 30 percent in another section.

"Our canvas weir is designed to mimic the kinds of flow fluctuations which could be caused through regulation," Shane pointed out.

The invertebrates in the stream are sampled both before and after installing the weir. Changes in velocity of the stream, depth, turbidity and conductivity are closely monitored while the geology, packing, roughness profile and stability of the streambed are described at each site.

Linking science and community for improved water management

Shane Brooks, Paul Reich and Tony Peake setting up the portable canvass weir in the Queanbeyan River to assess the affect of flow variation on macroinvertebrates.

Previous work conducted by Shane for his PhD thesis revealed that some streams were characteristically stable; that is, the streambed material influenced the impact that high flows had on invertebrate communities.

"When a flood comes down a river with a streambed made up of stable, angular bedrock, the water gushes over the top and pushes the stones down, rather than disturbing them," Shane explained. "As a result the invertebrates living amongst the rocks don't perceive the flood as a disturbance.

"In a naturally variable river, small flow fluctuations generated by human activity may not have a big impact because the fauna has adapted to that type of flow regime anyway. In rivers with a constant flow regime, that same management practice may have a much greater impact."

Using the data generated by the summer field work, Shane aims to build a predictive model which will provide water managers with an indication of the type of invertebrates they could expect to find in rivers with variable or constant flow and how those communities would respond to fluctuations in flow.

The model will be based on hydrological parameters derived from flow records and records from instream measurements.

"There is always the chance that we'll find out that the flow regime of rivers really doesn't matter at all," Shane hypothesised. "It may be more important to look at specific site characteristics of different rivers to determine what processes are going on in that river."

In either case, the study, which is due to be completed at the end of 1997, will provide important baseline data which will contribute to the improved future management of Australian freshwater streams.

Bringing science and the community together was the aim of an agreement signed by the Murray-Darling Association and the CRCFE at the Association's 52nd Annual Conference, Murray-Darling Basin World's Best Practice?, held in Barmera, SA.

The Murray-Darling Association (MDA), is a forum through which local government agencies throughout the Murray-Darling Basin can voice environmental, economic and social concerns.

CRCFE Director, Professor Peter Cullen, said the agreement would formalise the effective working relationship that had been established with the MDA.

"To promote the sustainable management of freshwater resources, the CRC must not only research these systems, but pass the knowledge generated onto the people who manage these systems," Prof Cullen said. "The MDA is comprised of many groups and individuals who have a role in the management of freshwater resources within the Murray-Darling Basin."

"The benefits of this agreement are certainly reciprocal because the MDA plays a critical role in ensuring that the CRC is kept in touch with the community's environmental concerns."

General Manager of the MDA, Mr Leon Broster, said access to the latest and most relevant scientific information was essential in making informed decisions on environmental matters.

CRCFE Director, Prof Peter Cullen (seated right) and Murray-Darling Association National President, Mr Max Moor signing a protocol aimed at enhancing community understanding of land and water issues through the provision of scientific information. Standing from left: Mr Neil Andrew, Federal Member for Wakefield and Chairman of the Support Committee for the Establishment of the Lower Basin Laboratory; Senator Robert Hill, Minister for the Environment; Mr David Dalzell, Vice-president MDA; and Dr Ben Gawne, OIC Lower Basin Laboratory, Mildura.

Preventing the blue-green blues

by Simon Torok, Communication Manager CSIRO, Centre for Environmental Mechanics

Understanding the detailed physical processes at work behind thermal stratification in riverine weir pools has led to the development of strategies to control blooms of cyanobacteria, otherwise known as blue-green algae.

A team of scientists investigated the effects of water discharge on thermal stratification and mixing within weir pools, and the resulting effects on algal growth. Drs Ian Webster, Bradford Sherman (CSIRO Centre for Environmental Mechanics and CRCFE), Myriam Bormans (CSIRO CEM), Gary Jones (CSIRO Division of Water Resources) and Rod Oliver (CRCFE) have recently completed the final report on the project, which is part of the CRCFE project, Control Strategies for Cyanobacterial Blooms in Weir Pools.

Control strategies available to river managers were devised based on knowledge of the physical factors influencing the growth and spatial distributions of algal populations. At Maude Weir on the Murrumbidgee River, water discharge rate was found to regulate thermal stratification, which is the key controlling factor in the establishment of algal blooms.

A numerical model of the thermal stratification in Maude Weir was developed, following intensive field measurements. The model was used to investigate the effects of various management strategies on thermal strata and mixing, and consequently on the growth of cyanobacteria.

The research team evaluated four different strategies to manipulate the physical conditions within the weir pool to prevent algal blooms developing. These were by: maintaining an elevated discharge through the weir (between 500 and 1000 megalitres per day), pulsing the weir discharge (increase from 350 to 1500 megalitres per day every three days), releasing water over the weir gate rather than under it, and artificial destratification. The research team also observed that drawing water for human consumption at deep levels of the weir pool reduced the concentrations of algae in the water supply.

Dr Bradford Sherman and Mr Garry Miller, of the CSIRO Centre for Environmental Mechanics, take measurements near Maude Weir on the Murrumbidgee River. Photo: CSIRO

These strategies disrupt the development of thermal strata within the water column of the weir pools, potentially stopping blue-green algae blooms. All of the strategies, based on the field observations and numerical model, offer potential benefits for managing algal blooms. The team plans to test the strategies at the weir pool in future work.

CRC Web Site

http://lake.canberra.edu.au/crcfe

Promoting community monitoring of river health

Developing training methods for community groups in collecting useful water quality assessment data is the aim of a project being conducted by CRC Honours student, Nirvana Searle.

Nirvana is working with volunteers from Landcare and Waterwatch groups in the ACT's Ginninderra catchment to develop a community biological monitoring program that will produce data that may be used by government agencies in the assessment of stream health.

The program is based on biological assessment techniques using macro-invertebrates, unlike many community water monitoring programs that are mainly concerned with chemical tests.

"Biological monitoring using macro-invertebrates is becoming an increasingly popular method for assessing water quality," Nirvana said. "The sampling can be conducted relatively quickly and without expensive technical equipment; and importantly, it's also fun. Hence, it is a method ideally suited to community groups.

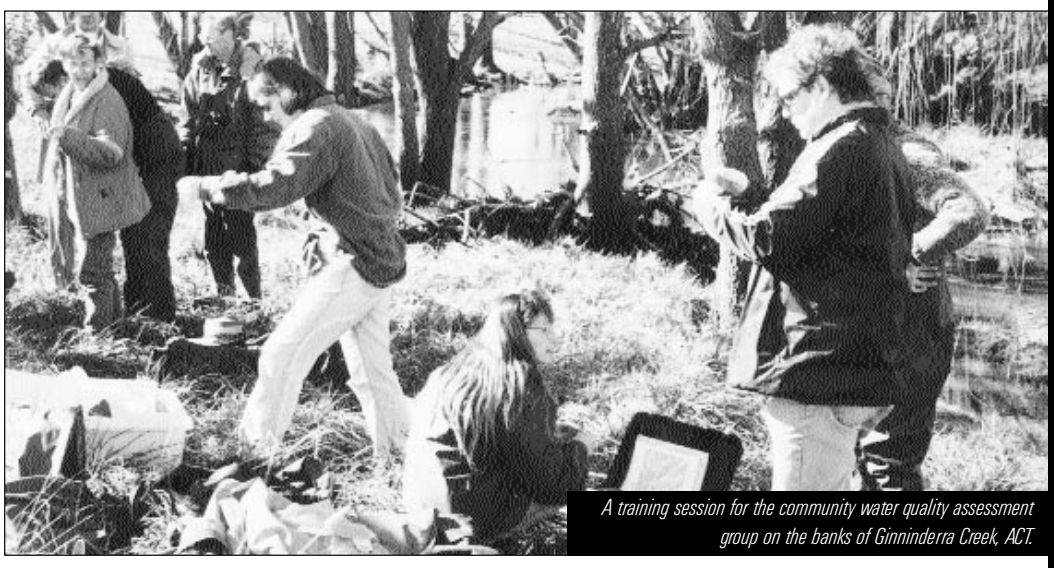
"One of the key benefits is that it is often easier for community groups to monitor local streams which government agencies haven't got the resources to focus on. Most importantly, it is an exellent educational tool as it promotes awareness about water issues within the community."

Five training sessions provide the volunteers with a background to water monitoring, particularly biological monitoring; the importance of habitat assessment and how it is done; how to sample effectively; and how to process a sample in the laboratory. The training also includes sessions on forming objectives, selecting sites, identifying macroinvertebrates and interpreting and presenting data.

Evaluating both the training methods and the data produced is a key aspect of the program. The volunteers will also be involved with assessment of the training program.

The project has the support of the ACT Government which has contributed $3000 towards the purchase of one chemical and five biological sampling kits.

Nirvana said the program, if successful, could be used as a prototype for other community monitoring programs.



A training session for the community water quality assessment group on the banks of Ginninderra Creek, ACT.

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