WaterShed

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The Cooperative Research Centre for Freshwater Ecology exists to provide the knowledge for the sustainable management of freshwater systems in Australia. Its research program includes: STANDING WATERS AND EUTROPHICATION – FLOWING WATERS – WATER QUALITY & ECOLOGICAL ASSESSMENT – URBAN WATER MANAGEMENT – FISH ECOLOGY – FLOODPLAIN & WETLAND ECOLOGY.

From the Director

Director, Prof Peter Cullen.

In 1995 we held a curriculum workshop where we brought teachers of undergraduate limnology from around Australia to discuss and share how we teach the discipline. We intend to hold another such workshop in 1996.

An ongoing challenge for the CRC and other research providers is getting our message to the industry, and in listening to the industry in establishing our research agenda.

This newsletter is one new mechanism we are establishing to bridge this boundary. Let us know how you like it, and feel free to communicate with project leaders and others where you seek involvement in some of the work reported. – *Peter Cullen*

Welcome to Watershed. This is a new publication put out by the Cooperative Research Centre for Freshwater Ecology to inform people involved with land and water management in Australia of the activities of the CRC.

As we start 1996, it is good to look back at the 2 1/2 years since the CRC was established. We have established a healthy research program across the CRC's six research areas. We have recruited some outstanding staff and the CRC has a momentum and a sense of confidence about where it is going.

The CRC for Freshwater Ecology has a budget between $9-10 million a year, and some 145 staff and students working in its programs. It has major laboratory facilities at the Murray-Darling Freshwater Research Centre in Albury, at the Fisheries Research Institute at Cronulla and Narrandera, at Monash University and at the University of Canberra, and at the CSIRO Centre for Environmental Mechanics.

We have also developed an innovative education program. More than 40 students are enrolled in postgraduate programs on a number of CRC scholarships or scholarship top-ups. We are providing specialist training programs for postgraduates in project management and in scientific publishing.

The CRC is a collaborative venture between:

- *The ACT Government*
- *ACTEW*
- *The Albury-Development Corporation*
- *CSIRO*
- *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*
- *Wimmera Mallee Rural Water*

New laboratories opened by PM

(story P2)

The Prime Minister, Paul Keating, with the staff from the Cooperative Research Centre for Freshwater Ecology at the official opening of the Murray-Darling Freshwater Research Centre's new laboratories.

Chaffey Dam experiment

New laboratories opened by PM

A tour of the new MDFRC laboratories preceded the centre's official opening by the Prime Minister on January 24. Dr Rod Oliver, explained the new techniques being developed by the CRC's Standing Waters and Eutrophication program to assist in the early detection of blue-green algae.

A tour of the new Murray-Darling Freshwater Research Centre laboratories with the Prime Minister provided CRC Program Leaders with the opportunity to discuss the ecology behind issues such as river regulation, environmental flows and toxic algae blooms.

Drs Terry Hillman and Paul Humphries provided details of the CRCFE's work in Floodplain and Wetland Ecology while Dr Rod Oliver explained the research being conducted under the Standing Waters and Eutrophication program.

The official opening of the new laboratories, which followed the tour, was conducted in conjunction with the Prime Minister's "Our Land" Environment Statement at Charles Sturt University in Albury on January 24.

In responding to the Statement, Prof Peter Cullen, said that it provided substantial funding to a number of existing programs that had clearly shown their worth."Now is the time to put the foot on the accelerator and deliver environmental outcomes from these initiatives, rather than inventing yet new initiatives which will take a long time to have an effect," Prof Cullen said.

He also praised the integrated nature of the proposals that ranged from value-added agricultural production to biodiversity maintenance.

"Ongoing funding was announced for the National River Health Program and we remain optimistic of gaining funds to maintain present activity at the MDFRC in Albury and to further develop the lower basin laboratory at Mildura, " he added.

More than 200 people attended the opening including the Minister for the Environment, Senator John Faulkner, and the Minister for Primary Industries and Energy, Senator Bob Collins. CRC staff from sites in Canberra, Melbourne, Narrandera, Sydney and Albury attended. The conservation movement was represented as were rural groups, the water industry, research organisations and universities.

A big thank you to every one who participated in the opening, particularly to Charles Sturt University management and staff who provided facilities as well as cooperation and assistance.

Experimental work aimed at improving water quality in Chaffey Dam near Tamworth is bringing together scientists from a range of disciplines to study the biology, chemistry and physics of the water storage system.

The work, expected to cost $600,000 over three years, is part of the Cooperative Research Centre for Freshwater Ecology's Standing Waters and Eutrophication Program which has been conducting two complementary projects at Chaffey Dam since February.

Water in storages such as Chaffey Dam typically stratifies into layers according to temperature; with the warmer layers nearer the surface. It is in these warm surface layers that toxic blue-green algae thrive. Both experiments are based on mixing the dam's temperature layers using a 100kw compressor and 700m of pipe to bring water from the bottom of the reservoir to the top.

Led by Dr Bradford Sherman from CSIRO's Centre for Environmental Mechanics (CEM), the Destratification and Water Quality project is aimed at understanding the capabilities and limitations of bubble plume destratification systems in controlling the growth of blue-green algae in reservoirs. The work will test what Dr Sherman calls "the intermittent disturbance hypothesis" which is based on disrupting the pattern of algae succession so that blue-green algae, which are generally the last in the succession of algae species, are not given the opportunity to dominate the system.

Dr Phillip Ford, also from the CSIRO's CEM, is leading the other experiment, The Role of Suspended Particles/Colloids and Bottom Sediments in Modifying the Bioavailability of Phosphorus. This experiment looks at the effect of oxidation on sediment-phosphorus interactions; nutrient dynamics as a result of the variation in oxygen-status of the water column; and the effect of the interplay between these two processes on blue-green algal blooms in reservoirs.

An important component of the work is research on the physiological changes of algae as a result of destratification which is being conducted by a team led by Dr Rod Oliver from the Murray-Darling Freshwater Research Centre (MDFRC). This work is based on identifying nutrient and light limitation of algal growth.

spans a range of disciplines

The experimental work at Chaffey is being conducted with the cooperation of the Department of Land and Water Conservation (DLWC) who are assisting in the operation of the destratification unit, collecting samples and analysing data as well as providing historical water quality data from the site.

The work is aimed at improving knowledge about the dynamics of water storage systems which will lead to improved management practices and water quality in dams throughout Australia.

While destratification systems have been in use in Australian water storages for at least 15 years, they have not been overwhelmingly successful in improving water quality, according to Dr Sherman.

Six field trips have taken place at Chaffey so far , the first in February 1995 to collect baseline data before operating the destratification unit for the first time since 1981. Other trips were conducted in March, September, October and December 1995 and January 1996. The compressor was operated for four to five weeks between the trips in autumn and spring 1995 and is now in operation following the January expedition.

Throughout February 1995 a diverse range of algae including green and blue-green algae and flagellates were present in the reservoir. The blue-green algae dominated during March and persisted until the winter months. During September there were low numbers of diatoms and green algae. The density of green algae increased during November and December and was then rapidly replaced by high numbers of flagellates during January.

Water samples were taken from the dam on each occasion and spiked with phosphorus and nitrogen. Two comparative techniques were used to identify nutrient limitation in the samples; bottle experiments and the Nutrient Induced Fluorescence Technique (NIFT).

In bottle experiments the growth of algae continues until a nutrient is depleted. Bottle experiments indicated that nitrogen was the first nutrient to be depleted during February and March whereas phosphorus was the first during September, October, December and January. The NIFT Technique provides an immediate indication of nitrogen or phosphorus deficiency in freshly collected algae. The NIFT results indicated that nitrogen was the limiting nutrient during February, whereas no nutrients were identified as immediately limiting during the latter field trips.

DR BRADFORD SHERMAN

Measuring bottom sediments at Chaffey Dam, near Tamworth.

The pattern which has emerged is one of nitrogen as the limiting nutrient during autumn and phosphorus as the limiting nutrient during spring and early summer.

Since drought had kept Chaffey Dam to about 13,000 megalitres, or 23% of its capacity, and there had been no significant inflow into the storage for a couple of years, the major source of nutrients in the system was the sediments, Dr Sherman pointed out.

Being situated at the top of the catchment, it was unlikely that Chaffey's rich nutrient loads were solely because of human activities, but rather a result of its location on a rich floodplain, he said

It has been found that the artificial destratification unit is incapable of mixing the dam thoroughly, even in early spring, when the temperature differential in the top and bottom water layers was not as great as during the summer months.

Dr Sherman is interested in testing the use of an impeller, a 6m diameter inverted propeller, to push the surface water to the bottom. He estimates an impeller would be about ten times more efficient in achieving satisfactory mixing of the water layers.

PhD Profile

In a bid to broaden our understanding of the alien carps' habitat preferences and the processes at which their populations are maintained at different densities, Patrick Driver is studying the population ecology and dynamics of this pest species.

Andrew Bruce and Ian Wooden (rear of boat), Narrandera Fisheries Centre; Justen Simpson, University of Canberra (front) and PhD student, Patrick Driver, "fishing" for carp on Lake Moodemere near Rutherglen. The carp were relocated to artificial ponds in Benalla for a three month experiment.

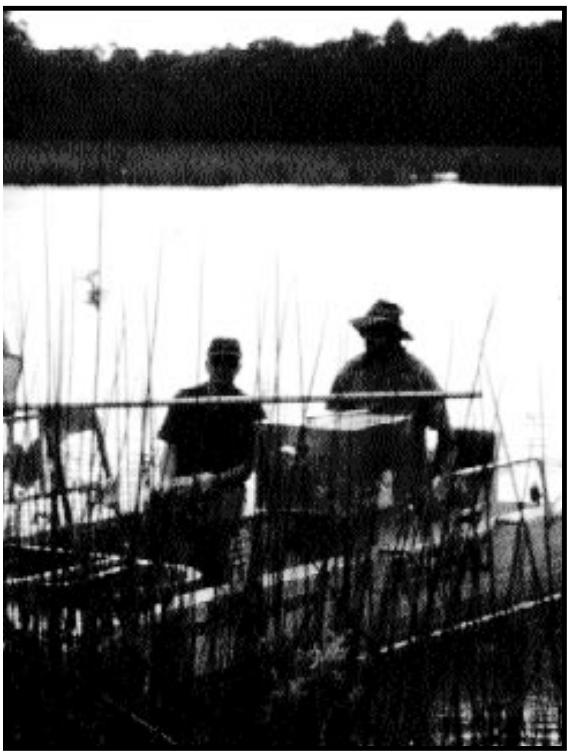
Patrick's project, Factors affecting carp *(Cyprinus carpio)* population density in lotic waters of NSW, also examines the impact carp have on their habitat including its physical and chemical features as well as the community structure of aquatic insects.

Recent field work has been conducted at Lake Moodemere where about 150 carp were captured and relocated to experimental ponds at Benalla.

This experimental phase of the project is aimed at determining the effect carp densities have on water chemistry and the freshwater invertebrate community.
The relocated carp were weighed and measured and then distributed between six high and low density treatment which were replicated three times.

The high density treatments, based on 600kg per hectare, included a pond of large fish, another of small fish and a pond with a mixture of small and large fish.

Lowland river research laboratory



The low density treatments, based on 300kg per hectare, included a pond of large fish, another of small fish and a pond with no fish.

Throughout the three-month experiment, Patrick will sample algal growth and the macroinvertebrate composition of the water on a monthly basis. Nutrient analysis of the water will also be conducted. This data will be analysed against data collected prior to the fish being added to the ponds.

Patrick hopes the results of the experiment may be applied to data being gathered in conjunction with the NSW Rivers Survey, which is being conducted by the CRCFE and NSW Fisheries.

Patrick is based at the University of Canberra. His supervisors are Dr John Harris (NSW Fisheries), Assoc Prof Richard Norris (University of Canberra) and Dr Gerry Closs (La Trobe University, Wodonga).

The CRCFE will establish a research laboratory in Mildura to investigate algal growth, river productivity and management of the Menindee Lakes system.

The CRCFE Board has agreed to allocate $100,000 a year to the facility to match funds committed by the local organisations over a three-year term.

The proposal to establish the laboratory was developed by the Support Committee for the Establishment of a Lower Basin Laboratory, chaired by SA Member for Wakefield, Mr Neil Andrew. Negotiations are now underway to develop a contract which commits the local councils, water authorities, regional groups and the CRC to financially support the laboratory for an initial three years, commencing in 1995/96.

Lower Murray Water has agreed to make suitable accommodation available for the Lower Murray-Basin Laboratory during its first five years, thus removing the expense of constructing a new building.

The Federal Government as well as the NSW, Victorian and South Australian governments have been asked to support the proposal and provide additional funds for the venture.

Staff recruitment for the laboratory, which will operate as part of the Murray-Darling Freshwater Research Centre, has commenced.

CRC Web Site

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

Biological monitoring refines

The CRCFE has won a $192,000 National River Health Program contract to develop predictive models for river health based on aquatic insects and other invertebrates.

The 14 month contract, which will be conducted by Assoc Prof Richard Norris, is aimed at providing State agencies throughout Australia with a common platform for assessing river health.

The contract will both benefit from and add to the biological monitoring work conducted by the CRCFE under its Water Quality and Ecological Assessment Program.

This program work, which uses the aquatic invertebrates as biological indicators of stream health, is a large integrated project which takes in several CRCFE sites including the University of Canberra, the Museum of Victoria, the Murray-Darling Freshwater Research Centre, Monash University and Melbourne Water. Collaborative work is being conducted through the project with Environment Canada and the University of Ontario, Canada. Strong links have already been formed with the Monitoring River Health Initiative, a key part of the National River Health Program (NRHP) which was established by the Federal Government in 1992 to establish a national approach to issues such as monitoring the water quality of Australia's rivers and streams and environmental flows. In addition to assisting the Victorian EPA with analysis of data, the CRCFE has conducted biological monitoring in the ACT and developed a predictive model which may be adopted by management agencies throughout Australia to assist in determining the health of waterways.

Project leader, Assoc Prof Norris, said invertebrates could, by their presence or absence, provide valuable information about the health of streams. Some invertebrates, such as worms, could thrive even in degraded waters. Others however, were very sensitive to pollutants, such as wastes causing low oxygen levels, and needed relatively pristine conditions to survive.

The monitoring system identifies a number of reference sites, or near pristine sites, which are then matched with habitat types. The invertebrates found at representative habitat types within these sites are then compared to those found at test sites where water quality is a concern.

"The use of reference site groups, based on habitat types, is a major feature of the approach which was developed independently in the US and the UK," Norris said. "This approach has only recently been adopted in Australia. Much of our work focuses on refining methods of data collection and analysis. "

A series of tests conducted by the CRCFE found that invertebrates living in the same habitat but at different sites were more similar than animals living in different habitats within sites.

"Sampling just a couple of representative habitat types, such as riffles and edges, is sufficient to provide robust monitoring data," Norris said.

CRCFE Honours students have conducted other tests such as comparing the efficacy of sorting and identifying animals in the field compared to subsampling in the laboratory. This test revealed an obvious bias to larger animals when samples were sorted in the field. Also compared was the effect of different subsample sizes. While the CRCFE took the conservative approach and chose 200 animals for its initial subsamples, experiments soon showed that a subsample of 100 animals was sufficient to produce reliable results from the predictive model.

CRCFE Joint Urban Program Leader, Dr Peter Breen, has also been successful in obtaining a Land and Water Resources Research Development Corporation (LWRRDC) grant for the urban component of the National River Health Program.

work methods for Aussie conditions

The 18 month, $100,000 grant is to develop a predictive model for urban streams. The project will be conducted jointly by Breen and Norris and includes further collaboration with the Victorian EPA.

The outputs from both contracts will apply the scientific work being done by the CRCFE to water quality management. This application of science to management issues was a fundamental goal in establishing the centre.

University of Canberra summer student, Phil Sloane, conducting biological monitoring work in Kosciusko National Park.

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billabong mammal survey

A two-day survey was conducted to investigate the fauna inhabiting the environs of the billabongs on the Ovens floodplain.

The collaborative survey was organised by Alan Chick from the Murray-Darling Freshwater Research Centre to provide additional information to the Floodplain and Wetland project, Spatial and Temporal Variation in Trophic Structure of Billabongs.

The survey team included Melissa Walsh, CSIRO, Griffith and Sue Pretty from the Department of Land and Water Conservation, Albury, both of whom have experience in mammal trapping. Charles Sturt University PhD student, Alexander Herr, provided expertise in bat trapping. CRC Honours student, Amber Parkinson, who is studying the Avian Use of Billabongs and Woodlands on the Ovens River, also joined the team.

Two billabongs were surveyed over two nights using Elliott and harp net bat traps. Spotlighting was conducted for one hour both evenings at three billabongs and 96 hairtubes were distributed around the three sites and collected three weeks later.

While weather did not favour the expedition there was some success with the capture of both a forest bat and a lesser long-eared bat. Calls from Goulds wattle bat, a little forest bat and a chocolate wattle bat were also recorded.

The spotlighting exercise revealed a total of 25 brushtailed possums and one koala, one juvenile sugar glider, one white-striped mastif bat, and one unidentified animal.

The mammal survey will be repeated during the summer and next autumn and winter.

Now in its second year, the billabong project is surveying 10 billabongs on the Ovens floodplain which span a range of sizes and depths, as well as macrophyte assemblages. It is aimed at identifying a generalised classification for billabongs in order to develop management strategies to preserve the ecological variability and biodiversity of these waterbodies.

The billabong project is led by Dr Terry Hillman from the Murray-Darling Freshwater Research Centre and Dr Gerry Quinn from Monash University.

Sue Pretty, From the Department of Land and Water Conservation, and Alan Chick, Murray-Darling Freshwater Research Centre,
setting Elliot traps for the mammal survey conducted near

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