

What's happening in water research at the University of Adelaide

WATERRESEARCH
Cluster



Water Wednesday INVITATION



Date: October 15 2008, 6.15 – 7.45 pm
Venue: Napier Building, Lecture Theatre 102, North Terrace, University of Adelaide
RSVP: Kate Reinfeld (kate.reinfeld@adelaide.edu.au)
Cost: Open and free to all members of the public, places are limited and bookings are essential.

Life Impact The University of Adelaide

National Water Week 19 -25th October 2008



WATERRESEARCH
Cluster



Water Pitchfest

"Linking water innovators and investors"

INVITATION to innovation



In the lead up to National Water Week the Deputy Vice-Chancellor and Vice-President for Research, Professor Mike Brooks, is delighted to invite you to **Water Pitchfest**, presented by the University of Adelaide and the Water Industry Alliance.

Water solutions from the driest state in the driest inhabited continent

In this issue:

- Special Water Research Cluster Events
- Water Research Cluster News & Activities
- Water News Updates
- Water Droplets Series
- National Water Commission News
- Water Research Cluster Postgraduate Corner
- Water Conference & Seminar Diary

Information on Water Organisation Links, Water Information Links and the Water Research Cluster structure and members have been moved to the updated website www.water.adelaide.edu.au

Exploring Research Potentials

SA Water Project Proposals

The Water Research Cluster has recently been having discussions with SA Water to develop collaborative projects. Members of the Cluster have proposed research projects covering a wide range of important water-related topics, from water quality to water management to aquatic systems and the organisms that live within them.

These University of Adelaide researchers include Elisa Bone, David Chittleborough, Sean D. Connell, Graeme Dandy, Holger Maier, Jose M. Facelli, Jennifer Watling, Jane Prider, Martin Lambert, Wayne Meyer, Jennifer Gardner, Cameron Grant, David Lawry OAM, Ian Musgrave, Friedrich Recknagel, Angus Simpson, David Walker and Scott Mills.

Two of these projects are already scheduled to commence soon, on the condition of finding suitable Honours students. These projects include one involving Dr Ian Musgrave, a senior lecturer in pharmacology, in collaboration with Andrew Humpage of SA Water, and the second project involves Dr Scott Mills, who will make use of the real-time PCR facilities available at SA Water.

Further details regarding these two projects are listed below.

Developmental Neurotoxicity of the Drinking Water Contaminant Saxitoxin

Background

Saxitoxin is most commonly known as a paralytic shellfish toxin that kills people on acute exposure by neuromuscular paralysis due to sodium channel blocking. These toxins are also produced by cyanobacteria and can be present in water used for drinking by humans and livestock.

Here the exposure pattern is chronic long-term or occasional low dose exposure. The toxicological consequences of this pattern of exposure are unknown. It is known that interference with neuronal activity, such as that which can occur with low level neuronal sodium channel blocking, can prevent proper neuronal development. This indicates that one consequence of chronic saxitoxin exposure may be developmental abnormalities of the nervous systems.

Proposal

In collaboration with Andrew Humpage I propose an investigation into the link between chronic saxitoxin exposure and neuronal development using an established model of neurite development, both in the presence and absence of chronic exposure. Neurite extension, arborisation and connectivity will be examined using methods developed in my laboratory.

Outcomes

By studying the neurotoxic effects of chronic saxitoxin exposure we will be able to better understand the impact of algal blooms on the quality of South Australia's Water supply.

This is particularly important for SA Water because saxitoxin-producing *A. circinalis* is prevalent in many South Australian drinking water sources. In doing so this study will aid in the ongoing management of South Australia's drinking water supply by indicating if chronic low level exposure to saxitoxin is likely to have developmental health implications.

Photomicrograph of one of the cryptic species
(Scott Mills)

Real-time PCR Identification of *Brachionus plicatilis*

Background

Of all the Rotifera, none have been more extensively studied than the *B. plicatilis* cryptic species complex. This species had been the primary subject of approximately 750 peer reviewed papers since 1950 to the year ending 2000. In addition, this species is of considerable global economic significance, being used as a source of nutrition for both larval marine finfish and crustacea in aquaculture hatcheries around the world.

While traditionally considered a single cosmopolitan species, recent investigations have shown that this organism is a species complex composed of at least 15 separate species. These 15 species have been identified through genetic studies and only four have been definitively named.

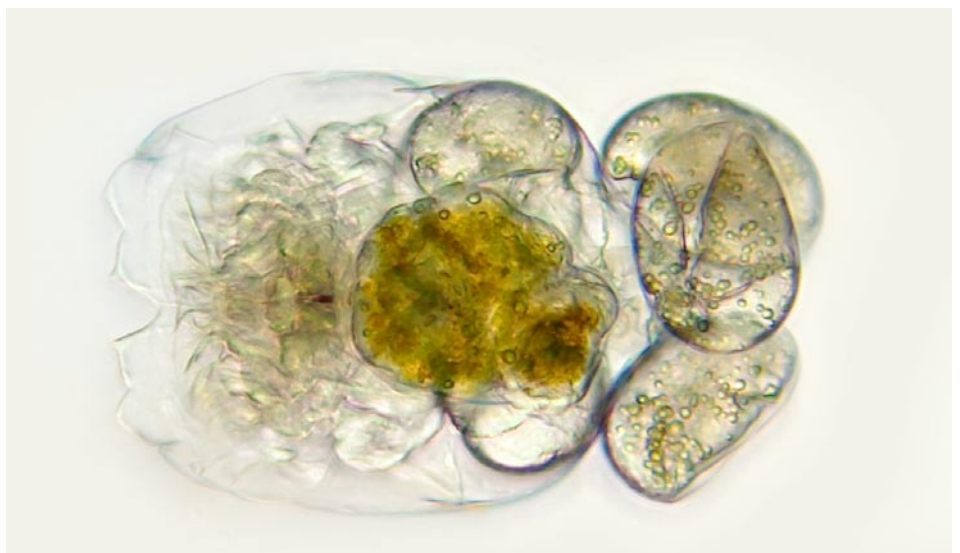
Proposal

The proposed honours program will evaluate the use of real-time PCR as a method of species identification in this cryptic species complex.

Samples have already been collected and I currently have over 800 clonal lineages stored in Ethanol and Formalin. Raw p-distances for a 711bp fragment of the COI gene exhibits between 0.42% and 21.39% across 62 unique haplotypes.

Outcomes

The development of real-time PCR species characterization, for this cryptic species complex, will afford the aquaculture community a cost efficient and rapid tool for the identification of marine rotifers in aquaculture hatcheries.



AWQC Research Interests and Possible Collaborative Projects

SA Water has likewise proposed some interesting project ideas for collaboration with members of the Water Research Cluster. The major research topics put forward by SA Water include: applied chemistry; water treatment; microbiology; wastewater; and general biology research topics such as freshwater ecology, modelling, water management and marine science. Potential collaborating scientists at SA Water include: Christopher Saint, Paul Monis, Mike Burch, Bo Jin, Gayle Newcombe and Mary Drikas.

Water Quality Research Australia

Water Quality Research Australia (WQRA) is a national research centre established as a successor to the CRC for Water Quality and Treatment. WQRA has a focus on research into drinking water, recycled water and wastewater and has its headquarters in Adelaide. The University of Adelaide is one of 42 partners of WQRA which include most of the major urban water utilities in Australia as well as ten Universities. The CEO of WQRA is Jodieann Dawe.

WQRA is currently holding two workshops to identify the key strategic issues for research in its focus areas. It is planned to develop research concepts and full research proposals in key research areas over the next few months. Members of the Water Research Cluster who have made a commitment to contribute research time to WQRA projects are Prof Graeme Dandy, Assoc Prof Justin Brookes, Assoc Prof Bo Jin, Assoc Prof Friedrich Recknagel and Assoc Prof David Chittleborough.

WQRA offers top-up scholarships to postgraduate students as well as summer research scholarships for undergraduate students. Details can be found on their website: www.waterquality.org.au

Palaeoecological Studies - Reconstructing Past Environmental Conditions

Deborah Haynes, David McKirdy, Rachael Skinner (Geology and Geophysics) and John Tibby (Geographical and Environmental Studies) recently provided evidence to the Senate Rural and Regional Affairs and Transport Committee's "Inquiry into water management of the Lower Lakes and Coorong" about the 'natural' (i.e. pre-European) status of Lake Alexandrina and The Coorong.

They argued that flows from the River Murray, rather than frequently entering the Coorong played an important role in keeping the Murray Mouth open and that Lake Alexandrina has been predominantly fresh throughout its history. These interpretations, for the most part, draw upon recently published research (Fluin *et al.*, 2007, *Hydrobiologia*: 591).

Geographical and Environmental Studies (GEST) Honours student, Emily Corkhill has been investigating evidence for aquatic plant loss in Bombah Broadwater, in the coastal Myall Lakes system (NSW). Intriguingly, her data suggests that, rather than loss, there has been an increase in abundance of Charophytes in the system over the past few decades.

Another GEST Honours student, Theresa Myburgh, has been investigating the effect of sedimentation rates on the persistence of waterholes in the Moonie River (northern Murray Darling Basin). Her work shows there have been dramatic increases in sedimentation, with well over 1m of sediment deposited in some water holes in less than 50 years.

Special Water Research Cluster Events

Special events planned for **National Water Week 2008** are **Water Wednesday** and **Water Pitchfest** on **15 and 16 October**, respectively. Speakers for the Water Wednesday seminar, on 15 October, are Minister for the River Murray and Water Security Hon Karlene Maywald, Peter Cosier, Director of the Wentworth Group of Concerned Scientists, and Prof Wayne Meyer of the School of Earth and Environmental Sciences. The theme will be 'How do we reduce diversions from the River Murray and use innovation and science to find clever options for future water management?'

Water Pitchfest, jointly hosted with the **Water Industry Alliance**, will showcase research, innovation and technology to manage water smarter. It will be held on 16 October at the National Wine Centre.

Water Wednesday

Forward

The Deputy Vice-Chancellor and Vice-President for Research, Professor Mike Brooks, is delighted to invite you to the second Water Wednesday for 2008, a forum presented by the Water Research Cluster of the University of Adelaide.

Theme

'How do we use innovation and science to find clever options for future water management?'

Venue

Water Wednesday will be held in the Napier Building, at the University of Adelaide, Lecture Theatre 102. Capacity for this venue is 270 people; guests will need to RSVP (Kate Reinfeld, kate.reinfeld@adelaide.edu.au) to secure a seat.

Program

Exploring all Optic
The Honorable Kar
Minister for the River
Australian State Gov

Impediments to S
Mr Peter Cosier
Director, Wentworth G

Finding Innovative
by 30 to 50%
Professor Wayne M
School of Earth and E
of Adelaide

Your views: Open
Your chance to ask q

Water Pitchfest

Date: Thursday October 16 2008, 4.00 – 7.00 pm
Venue: The Vines, National Wine Centre of Australia
RSVP: admin@waterindustry.com.au
Cost: Free

Theme

"Linking water innovators and investors"

Presented by the Water Industry Alliance and the Water Research Cluster of the University of Adelaide, Pitchfest will provide a forum for ten speakers from academia and industry to present innovative technologies and ideas to stakeholders and investors.

Venue

The event will be held in The Vines at the National Wine Centre of Australia. Presentations will be preceded by and end with a complimentary food and beverage service.

The Pitch

Pitches will be short, four minute, high energy presentations introducing technologies and services. They will introduce innovations and outline the support that is needed for them to mature in Australia's fast growing water industry sector.

For Innovators

Pitchfest provides pitchers with a forum to showcase their ideas and make contacts that could potentially support and further their innovative visions. Registration to secure a place to pitch is \$500.

For Investors

Participants will have the opportunity to hear about cutting edge water technologies and interact with the speakers to discuss potential investment opportunities and applications.

Submission to the Senate Inquiry on The Coorong and Lower Lakes

In Association With: Prof Quentin Grafton, Richard Harvey, Ian Kowalick, Jim McColl, Ilona Millar, Assoc. Prof David Paton, Adj. Assoc. Prof. Keith Walker

Senate Inquiry into Urgent Provision of Water to the Coorong and Lower Lakes

SUMMARY

There is an unfolding environmental disaster and human tragedy in the Murray Darling Basin, mirrored in the Coorong and Lower Lakes. In the Basin, and across much of southern and eastern Australia, dry conditions have persisted for a decade.

Salinity levels in the southern Coorong now exceed the maximum levels tolerated by the plants and animals that underpin the international status of these wetlands, and acid sulphate soils lie ready to be exposed and release acid into the water if lake levels were to continue to fall.

We are also facing an economic emergency, with many businesses and regional communities facing yet another season without water.

The science suggests that the weather patterns in southern Australia have shifted to a dry phase. While the precise role of cyclical changes versus the impact of greenhouse gases remains unclear, changes in the basin are consistent with CSIRO computer modelling of the impacts of increased concentrations of greenhouse gas in the atmosphere.

We must reduce our extractions to (1) correct our over-allocation during a period of plenty, (2) to be more sustainable under climate cycles we have experienced in the past and (3) to adjust to declining water availability under climate change.

The magnitude of the adjustment is massive - beyond anything that has been contemplated before in the Australian community. It will have profound implications for the future of the Coorong and Lower Lakes, for water resource management across the Murray Darling Basin, and the cities, towns and rural communities that rely on the rivers.

If we are to maintain healthy rivers and provide high quality water to produce food, our analysis suggests that the consumptive use of water across the Murray Darling Basin may have to be cut by between 42 and 53 percent below the current cap.

This will require a re-design of our irrigation industries to bring the demand for water into alignment with the greatly reduced supply capacity from the rivers and groundwater.

The Coorong and Lower Lakes

In their current condition, the barrages should not be opened to flood the Lower Lakes with sea water. This would cause irreversible damage. Instead, the Commonwealth should guarantee 300 to 400 GL of river flows into Lake Alexandrina and Lake Albert, to secure a sufficient reserve to maintain lake levels at no lower than -0.4AHD, and thus avoid any significant release of acids this coming summer and autumn.

If it proves that such flows are not available, then as a last resort a 'shandy' process of allowing sea water into Lake Alexandrina should be undertaken. However, this should only occur once acid release is observed, and is not being buffered by existing lake waters, and other techniques of coping with acids are shown to be ineffective. Consideration should also be given to pumping out 50GL of hyper-marine water from the southern Coorong.

The Commonwealth should respond to the crisis in the Coorong and Lower Lakes by establishing a Commission of Inquiry to assess the scientific and engineering options for securing the long-term health of the Coorong and Lower Lakes, including engineering options to downsize the system upstream, and recognising the likely prospects for permanently reduced end of river flows.

An Interim Basin Plan

We can choose to do nothing or we can facilitate and expedite restructuring of our irrigation sector and the system that supplies it so that it continues to produce wealth by using water more efficiently without degrading the rivers upon which this wealth is based. However, in making this choice, we must recognise that there will be significant consequences for all who live and work in the Basin.

Moving quickly will provide water users with the capital they need to restructure their industry. If these reforms drag on for a decade or longer we risk the collapse of irrigated agriculture, causing social dysfunction across the Murray Darling Basin.

Our analysis shows that we need to recover over 4,000 GL of water to have a good chance of securing river health. The total cost sits between \$8 billion and \$9 billion.

The Federal Government has accelerated reforms with the \$12.9 billion Water for the Future program¹ and has now started buying water on the market. This is a significant step forward. It is apparent, however, that these reforms will not deliver the water savings that the science says is needed, nor will they deliver them quickly enough to avert an economic and environmental crisis, because most of the large scale water efficiency measures that were sensible have already been done. The majority of the infrastructure investment projects that were announced in July are therefore likely to fail a cost benefit analysis, in terms of the environmental benefit achieved from the investment².

All investments should be subjected to a common cost benefit test to ensure value for the money invested. The Sustainable Rivers Audit, released in June 2008³, provides a mechanism for assessing value for money, whether it be the purchase of a water entitlement, or funding of infrastructure improvement.

While the water markets will facilitate much of this re-allocation, we will also need a structural adjustment and social process to expedite and foster the transformation.

The current \$5.8 billion investment in infrastructure should be suspended and combined with the \$3.1 billion water buyback program. The combined \$8.9 billion is likely to produce significantly more water for the longer term health of the rivers.

If this program was then brought forward over the next 2 years, through an Interim Basin Plan, it will also provide another important dividend – a social benefit – by contributing a major incentive for structural adjustment.

This is the only way that we will achieve the volumes of water required to meet the needs of our rivers and underpin the long-term viability of our industries and communities who rely on a healthy working river.

CONCLUSION

The inaction of COAG in response to the crisis in the Murray Darling Basin exposes a policy paradox. In her 1984 book "The March of Folly", the American historian Barbara Tuchman examined the tendency, over a long period of history, for governments (and the societies they represent) to act stubbornly and perversely against their own best interests.⁴ Tuchman's definition of folly requires that a reasonable alternative course of action was available and that different people pursued the misguided policy over time.

The current state of the Murray Darling Basin satisfies the conditions to become another chapter in the March of Folly because over a long period a lot of people have acted against their own long-term interest and alternative policies have been available. However, the situation is more serious than the mere folly of acting against our own best interest.

Almost every person is rightly concerned about climate change and the need to urgently deal with it, but somehow we think we can afford to take three years to develop a Basin Plan and several years after that to reduce entitlements to water allocations. This exposes an underlying issue that haunts the COAG agreements. Whilst we have understood that our overuse of the Basin for irrigation has been misguided and unsustainable for decades, as a nation we have done little to manage the problem.⁵

Whilst in the medium term we need a well-researched Basin Plan, we have at hand adequate a priori information in the Murray Darling Basin Commission, the state and federal departments and CSIRO of the urgent need to prepare an Interim Basin Plan.

An Interim Basin Plan could be prepared in a matter of weeks and would give important signals to the market and all users of the Basin on which to begin to plan for the future that confronts us all. We need to treat the matter with greater urgency.

The current indications are this rainfall year may be below average and in any case it will take several years of better than average rainfall to return the system to a water-rich condition. Under climate change such conditions are not expected to persist.

Irrigators are likely to get low allocations for some time and that will bring about painful structural adjustment and hardship. As a nation we can afford to facilitate this change to reduce the hardship and in the process reduce the demand for water.

Dealing with the hardship of structural adjustment and the public interest in the recovery of water for sustainability can begin now.

There are plenty of actions we as a society can take to be more efficient users of water in the Basin and to delay confronting these issues is to continue the delusion. It is an issue for us all to consider not just governments.

We collectively shape the demands on the politicians and we need to be realistic in our expectations of water usage and understand that politicians cannot make it rain.

We all own this issue.

References

- 1 Wong, P., 2008. Water for the Future. Speech to the 4th Annual Australian Water Summit by Senator The Hon Penny Wong, Minister for Climate Change and Water, Sydney, 29-30 April 2008.
- 2 COAG, 2008. Communicate. Council of Australian Governments' Meeting, 3 July 2008, Sydney.
- 3 Davies, P., Harris, J., Hillman, T. and Walker, K., 2008. Sustainable Rivers Audit: A report on the ecological health of rivers in the Murray-Darling Basin, 2004-2007. Prepared by the Independent Sustainable Rivers Audit Group for the Murray-Darling Basin Ministerial Council
- 4 Kowalick, I 2008. 'The Murray Darling Delusion' in The Adelaide Advertiser, 30 July 2008.
- 5 Cosier, P., 2008. COAG Water Reform July 2008: Another 'historic agreement' or real water? Science Media Centre Briefing, Melbourne

The full document is available at:
http://www.wentworthgroup.org/docs/Senate_Submission_Response_to_the_Coorong_Crisis.pdf

MDBC Murray System Drought Update – Sept. 2008

IN BRIEF

System inflows remain critically low. August rainfall was below average and the monthly system inflow of 275 GL was less than a fifth of the long term average of 1,550 GL. The combined inflow for the three winter months (of 670 GL) was the equal 5th lowest in 117 years of records.

In the two years ending August 2008, Murray system inflows were 3,540 GL which is just over half of the previous two year minimum prior to this drought (6,800 GL in 1943-45).

Storage levels also remain extremely low. Active storage in the Murray system is only 1,690 GL (or 20 % of capacity), which is well below the August long term average of 5,600 GL (or 62 % capacity).

A persistent rainfall deficiency during the past 7 years, particularly in the alpine areas, has been the main cause for the record low inflows to the Murray system. Above average temperatures have exacerbated the situation.

A target flow of 900 ML/day along the Murray past Wellington, combined with local rainfall and reduced evaporative losses during the winter months, has allowed the water level in Lake Alexandrina to gradually rise to its current level of -0.26 m AHD (or 1.0 m below Full Supply Level). This has provided some short term relief and has delayed the potential for acidification. However, with the arrival of warmer weather in spring, evaporative losses will start to increase, and the water level is expected to start falling again.

The outlook for the Murray system remains very serious. Critical human needs can now be met through to next winter but water available for irrigation remains very low. Prospects for the coming season are dependent on rainfall and run-off that is yet to happen. Water use is likely to be well below average and similar to the last two years.

Even with above average rainfall in the coming months, inflows would likely remain well below average. Recovery of the system is likely to take several years of above average rainfall.

The full update is available at:
http://www.mdbc.gov.au/data/page/1366/Drought_Update_Issue_15_-_September_2008.pdf

Water News Updates

It is abundantly clear that the top water-related items being featured in the news, particularly in South Australia, pertain to the River Murray. The following articles exemplify what has been happening in recent weeks.

Nick Xenophon attacks John Brumby at River Murray rally



A sign of the times. A rally for the Murray River was held in Victoria Square, Sunday, 28 September. The event was organised by the Greens and featured brief addresses by Senator Sarah Hanson-Young, Senator Nick Xenophon, Assoc Prof David Paton and Prof Di Bell.

Nick Xenophon has launched a blistering attack on the Victorian Premier, likening his call for responsible water use to Osama bin Laden demanding world peace.

Senator Xenophon made the remark in an address to several hundred protesters gathered in Adelaide's Victoria Square for a rally to save the River Murray

Victorian Premier John Brumby on Friday said the SA Government's \$67 million plan to help desperate irrigators buy water was inappropriate and would drive up water prices for other irrigators.

"When John Brumby tries to lecture us about responsible water policy, it's a bit like Osama bin Laden calling for world peace," Senator Xenophon told the rally.



Independent Senator Nick Xenophon launches a scathing attack on Victorian Premier John Brumby.

He pointed out that Mr Brumby had held up the Council of Australian Governments (COAG) Murray-Darling agreement and was behind Victoria's proposed north-south pipeline that would suck 75 gigalitres annually from the Murray-Darling Basin.

"The eastern states don't understand how dire the situation is in South Australia," Senator Xenophon said.

"This is not about state against state ... because we all want the same thing.

"We want one river system with one set of rules."

Greens Senator Sarah Hanson-Young spearheaded the Victoria Square rally, calling on the Commonwealth to find and buy the required 60 gigalitres to ensure the future of the Lower Lakes.

She said the Senate Inquiry into Water Management in the Lower Lakes and Coorong which is due to report this week found about 1500 gigalitres was currently available from upstream farmers and other sources through the water market.



Greens Senator Sarah Hanson-Young fires up the Rally, demanding urgent Commonwealth action in finding the water required to save the Lower Lakes and Coorong.

"The water is there - go and get it. Ensure that we can save our (Lower) Lakes and our Murray," Ms Hanson-Young said.

"Sixty gigalitres for the Lower Lakes and the Coorong shouldn't be that hard to find.

She said the inquiry findings needed to be acted on by experts now.

"The Coorong cannot be written off as collateral damage caused by decades of mismanagement."

Also speaking at the rally was Dr David Paton from the University of Adelaide and Professor Di Bell, a candidate in the recent Mayo by-election.



Assoc Prof David Paton expounds upon current scientific knowledge of the River Murray, Lower Lakes and Coorong.

SA Water Security Minister Karlene Maywald was interstate today and did not attend the rally. Federal Water Minister Penny Wong was also absent.

Source: Jordanna Schriever and AAP, The Advertiser 28 September

Photos: Eric Nicholson



If fish could talk, "The Coorong Needs Water Now".

Rann hits back

Premier Mike Rann has hit back at criticism from his Victorian counterpart saying his government has led the way in working to save the Murray. Victorian Premier John Brumby earlier today accused South Australia of increasing the cost of water for farmers with a plan to buy water on the open market. The SA Government this week announced the \$67 million plan aimed at keeping permanent horticulture plantings such as citrus and vines alive along the River Murray.

"The South Australian Government putting money into the market to buy temporary water for their irrigators, all that's doing, of course, is pushing up the price for other irrigators, including those in Victoria," Mr Brumby told reporters. "So it's not a policy that we believe is appropriate policy."

But Mr Rann has made no apologies for standing up for struggling irrigators by underwriting water to keep permanent plantings alive. "This is an essential investment to maintain hundreds of millions of dollars worth of living infrastructure," he said. The premier said unlike Victoria, South Australia is also on track to meet its targets under the Living Murray initiative and has been easing reliance on the Murray by building a desalination plant in Adelaide. He said in contrast, the Victorian government's Sugarloaf pipeline will take 75 billion litres of water from the Murray.—AAP

Source: Indaily 26 September

Govt's Riverland rescue plan

The State Government will underwrite critical water allocations to keep permanent horticulture plantings such as citrus and vines alive along the River Murray. Premier Mike Rann said today the scheme could cost up to \$67 million but was essential for the future of the state's Riverland region. "If we don't take these steps, the financial and social costs will be substantial - losing permanent plantings could cost \$1.5 billion and 3,500 jobs," he said. Under the scheme, to take effect if water allocations don't improve by June next year, the government would buy water on the open market for irrigators lacking enough water to keep their perennial plantings alive. River Murray irrigators in SA currently receive 11 per cent of their entitlements, which the government said was not enough to keep permanent plantings alive.—AAP

Source: Indaily 23 September

Lakes safe til next winter: Maywald

A freshwater solution may yet be found to avert a decision to flood South Australia's ailing Lower Lakes with sea water to prevent them turning acidic, a Senate inquiry has heard. Scientists and the Australian Greens are demanding more urgent action from the federal government to save the entire Murray-Darling Basin from what they predict could be economic, social and environmental disaster. But their solution, to cut water usage by more than half and accelerate water buybacks, would devastate regional Australia, irrigators have warned.

South Australian River Murray Minister Karlene Maywald told a Senate committee hearing today the freshwater levels in Lake Alexandrina and Lake Albert had improved following localised rainfall. "We believe there is every chance that we can see our way through to next winter," she said. "If we are able to get another winter and the inflows that could occur during that period of time we think we can have a freshwater solution to the lakes," she said. Earlier, the Australian Greens backed the Wentworth Group of Concerned Scientists who said the lakes needed 300 to 400 gigalitres of freshwater to stem damage from rising acidity levels.

Ms Maywald described that suggestion as "misinformed", saying the lakes need only 60 gigalitres of water to get them through to the middle of next year. "The need to send 300 to 400 gigalitres down to the lower lakes to see it evaporate over summer is nonsense," she said. "No amount of robbing Peter to pay Paul is going to meet the needs right across the basin at the moment. We are in the grips of the most severe drought we've ever seen on record in the Murray-Darling Basin since we've started taking records, 117 years ago." It was time so-called experts accepted there was no quick-fix, she said.—AAP

Source: Indaily 19 September

Experts offer urgent river plan

Stephanie Peatling, 20 September

Scientists and economists who campaigned on the plight of the Murray-Darling river system at the start of the decade returned to Canberra yesterday to declare they could devise a rescue plan for the river in weeks.

More: <http://www.smh.com.au/news/environment/experts-offer-urgent-river-plan/2008/09/19/1221331207041.html>

Source: Kylee's Klippings 22 September

Govt lacks tools to fix Murray

The Federal Government lacks the knowledge to solve the crisis facing the Murray-Darling Basin, a top water expert said today, as South Australia pledged to hand its powers over the water system to the Commonwealth. Professor Mike Young today said the basin had been managed by a confused system "designed to crash". An expert must be appointed to oversee plans to save the parched basin, the professor of water economics and management at the University of Adelaide said after giving evidence to a Senate committee inquiry in Adelaide into the lower basin.

"We need a governance regime that is designed to work on outcomes and to fix this problem very quickly." Prof Young, a member of the Wentworth Group of Concerned Scientists, told the inquiry the River Murray suffered from a governance crisis. Prof Young said scientists knew how to develop a system for the basin to cope with adversity "but we need permission from the parliament of Australia to do it". He said "downsizing and reconfiguring the whole system" must be examined. A 10 per cent rainfall reduction would result in a fall of between 30 per cent and 50 per cent of run-off into the basin, he said.

The South Australian Government today promised to introduce legislation into parliament in the current session to hand its Murray River powers to the Commonwealth. Outlining the government's agenda, Governor Kevin Scarce said the Murray was experiencing its most severe drought in recorded history and had to be managed as a national asset. The legislation will give effect to the agreement signed by the Council of Australian Governments in July.—AAP

Source: Indaily 10 September

Water allocations to double

South Australia's River Murray irrigators will have their water allocations almost doubled next month. Allocations would rise from the current six per cent to 11 per cent from October 1, the SA government said today. SA Water Security Minister Karlene Maywald said the increase was made possible by a small improvement in the volume of water available to the state. Ms Maywald said 280 gigalitres of inflows were recorded last month, well below the long-term August average of 1550 gigalitres. In October last year, SA irrigators had allocations of 16 per cent.—AAP

Source: Indaily 15 September

Weir on hold as water levels rise

A decision to build a temporary weir across the lower reaches of the Murray River in South Australia is on hold because of improved conditions in the lower lakes.

River Murray Minister Karlene Maywald said today local rainfall and rainfall in the Mt Lofty Ranges during winter had increased water levels.

Conditions in Lake Alexandrina had improved from 0.47 metres below sea level to 0.25 metres, while Lake Albert was now at 0.2 metres below sea level after dropping to 0.5 metres at one stage.

"Conditions in the lower lakes and River Murray inflows will continue to be monitored closely to inform the government's decision-making process," Ms Maywald said.

The government has been considering building a temporary weir at Wellington, south-east of Adelaide, to help maintain water supplies for Adelaide and for towns along the river.

However, communities around the lower lakes have opposed the move, fearful of environmental damage.

Preparation work has been underway for some time but the government has maintained it would not build the weir unless it was absolutely necessary.

Ms Maywald said the trigger point for construction was now considered to be if water levels in Lake Alexandrina fell to one metre below sea level.--AAP

Source: Indaily 19 September

Farmers' watery disappointment

Queensland farmers say they are surprised and disappointed by their state government's decision to "gift" 10.6 billion litres of water to the ailing Murray-Darling river system. They also expressed concern the water might not make it through the NSW irrigation system and into South Australia. The Queensland Government today announced that the state would provide, without cost, 10.6 billion litres of water to the severely-stressed system, as a gift from Queensland. The reallocation will include eight billion litres of Warrego River water allocations which last year were earmarked for auction to farmers. By comparison, the purchase of Toorale Station by the federal and NSW governments will return an average of 20 billion litres a year to the system.--AAP

Source: Indaily 12 September

\$50 million for new water research alliance

Minister for Climate Change and Water, Senator Penny Wong, today launched a joint initiative between the Bureau of Meteorology and CSIRO that will be the largest water information research project in the southern hemisphere.

More: <http://www.environment.gov.au/minister/wong/2008/mr20080904.html>

Source: Kylee's Klippings 7 September

Senate inquiry to hear radical water remedy

Siobhain Ryan, 19 September

The influential Wentworth Group of Concerned Scientists is expected to call for a radical overhaul of irrigation and cuts to water allocations in the Murray-Darling Basin at a Senate inquiry in Canberra today.

More: <http://www.theaustralian.news.com.au/story/0,25197,24368857-5013169,00.html>

Source: Kylee's Klippings 22 September

Climate impacts on Basin native fish to be studied

A study on the impact of climate change on native fish will boost the Murray-Darling Basin Commission's (MDBC) already successful range of fish programs.

More: <http://www.mdbc.gov.au/data/page/29/MR-native-fish-forum-2008.pdf>

Source: Kylee's Klippings 15 September

Govt water buyback reaches new phase

A new Government tender to purchase water from irrigators to help restore the health of Murray-Darling Basin rivers and wetlands will open next Monday.

More: <http://theland.farmonline.com.au/news/nationalrural/agribusiness-and-general/general/govt-water-buyback-reaches-new-phase/1266238.aspx?src=enews>

Source: Kylee's Klippings 15 September

Signs of life in drought-hit wetlands

Alex Parry, 5 September

River red gums have been sprouting in the Banrock Station wetlands next to the Murray, in the South Australian Riverland.

More: <http://www.abc.net.au/news/stories/2008/09/05/2356017.htm?section=justin>

Source: Kylee's Klippings 7 September

Adelaide flush with water: report

Adelaide could be supplied with enough water without relying on the Murray or a desalination plant, a new report says. Prepared by environmental consultants Jake Bugden and Richard Clark, and released today by the Greens, the report said sustainable options could supply enough water to more than cover the city's needs. It calls for changes to the State Government's priorities with more investment in managing water demand and stormwater harvesting. Those options could supply more water, faster and cheaper than the proposed new desalination plant and the planned expansion of the Mount Bold reservoir in the Adelaide Hills.

"The Rann Government is making some very poor water choices," said Greens MP Mark Parnell. "Instead of grabbing water from elsewhere, or using crazy amounts of electricity artificially manufacturing it, we should be doing much, much better with the clean water that falls onto the Adelaide plains from the sky." Mr Parnell said Adelaide faced a major water crisis without significant, above average rains over the next 12 months. But the report showed the city was blessed with an extensive aquifer network that could store large amounts of water for future use.

In their report, Bugden and Clark said improving the management of water demand could save Adelaide 64 gigalitres annually while effective stormwater harvesting could provide another 60gl. They said existing catchments could provide 82gl while recycling and the greater use of home rainwater tanks could supply a further 21gl. Those measures would provide Adelaide with an annual supply of 227gl, above the city's current use of 216gl. Bugden and Clark said their strategy would allow for Adelaide to be weaned off the River Murray and would reduce an energy-hungry desalination plant to an option of last resort.--AAP

Source: Indaily 9 September

Radical plan to downsize the Murray

Jamie Walker, 6 September

Water guru Mike Young has devised a drastic response to the crisis gripping the Murray-Darling: downsize the river system to cut loose irrigated areas and wetlands.

More: <http://www.theaustralian.news.com.au/story/0,25197,24302069-2702,00.html>

Source: Kylee's Klippings 7 September

Sustainability the key to solving Murray crisis

The spectacle of the Australian federal and state governments scrambling to respond to the rapid decline of the Murray-Darling Basin marks a new low in national public discourse and policy development.

That this response is coming at the last ecological minute is consistent with the way governments in this country have always ignored the long-term integrity of our environmental systems. The willingness of premiers to use state rights for electoral advantage, at the expense of the river system as a whole, is beyond contempt.

The grip on governments at all levels of commercial interests in the basin, with the sole priority of returns to shareholders in the current financial year, is little different now from the first allocations more than a century ago. In the middle of all of this, the basin dies a not-so-slow death.

Any coherent way forward must be based on the recognition of a simple fact: that the record low inflows to the basin of the past decade represent, in all probability, the new stable rainfall regime.

This is not a drought, not even “the worst drought in history”. We want to call it a drought because droughts have an end: this doesn’t have an end. It is highly unlikely that there will be a return to the old rainfall regimes. The changes in flows are being driven by climate change.

Almost all the models derived from the Intergovernmental Panel on Climate Change scenarios identify south-east Australia as one of the global regions most likely to experience a drying trend.

The only deviation of actual from predicted trends so far is that the timeline is shortening. Current allocations, based on past flow regimes, are not calibrated to current, let alone future, conditions.

That’s not to say that allocations under the old flow regime were sustainable either: it’s been evident for decades that too much water was being abstracted from the basin.

Now, however, under climate change the misallocations have risen to levels that are causing the collapse of the entire basin, environmentally, economically and socially.

The policy implication is straightforward: the whole system of allocations, and the values and valuations on which they are based, must be reconfigured.

The biophysical framework of that exercise must be the new and predicted flows under

climate change.

The environmental flows necessary to preserve healthy river basin ecosystems (in their permanently altered state) represent the limiting boundaries of the new allocations: it should now be entirely obvious that without a healthy river basin there are no values – environmental, economic, or social – to distribute. Once the required levels of environmental flows are secured, the residual flows must be allocated.

This is no small task. A number of conditions must be met for such a program to be carried through successfully: The basin must in all aspects – environmental, economic, social and political – be placed under one federally-based authority.

Under that governance structure the Basin must be managed as a whole, from tributaries to main rivers, upstream and downstream, headwaters to ocean. There must be no state rights of management or veto: the states must transfer all rights in the basin to the Federal Government.

The basin is a national asset and must be handled nationally, without the inevitably parochial interference of the four states. One does not want to underestimate the political will needed to accomplish this co-ordinated legislative and regulatory task, or its present deficiency.

The environmental flows required for a healthy basin under climate regime must be agreed upon by the scientific community and regularly reviewed. Within these constraints, residual flows must be allocated to the economic and social uses and users. This must be achieved by local and regional cooperative deliberations among stakeholders. Considerations of equity must be integral to the process. As far as possible, local communities must be given the freedom to generate potential solutions that carry real value to them, and to make choices among these solutions.

Where local economic resources are not sufficient to achieve the necessary changes, they must be supplemented by central transition or restructuring funds made available with the support of the Australian community at large.

Proposed solutions that don’t address the underlying central cause of the degradation of the basin –over-allocation - should be resisted. Excepted are those actions which can buy time without being seen as a solution in themselves. Water buybacks and releases are an obvious example, because they are consonant with the integrated

governance structure outlined above. But big engineering schemes proposed as solutions should be rejected. As a people we have looked favourably on such schemes, perhaps out of a deep-rooted, though irrational, belief in the ultimate ability of science and technology to solve any problem, or a misplaced sense of national belief, or both. The Snowy River Scheme stands as a discredited monument to such thinking – a scheme whose economic benefits were finely calculated but whose immense environmental impact and costs were hardly considered, and only recently recognised as having any limited legitimate claim on the Snowy’s flows.

Thus, despite my often-stated respect for Kenneth Davidson, I don’t support his proposal of a pipeline from Tasmania to the Lower Lakes. It’s an idea driven by a sense of urgency. But even if, as is highly doubtful, it could be built within a short period, it would only provide yet another excuse not to address the wholesale governance and management changes that are required.

And the environmental impacts at the Tasmanian end are far from understood or costed. The time is past for imposing such grandiose engineering on natural systems: history in Australia has shown that our underlying ignorance of the environmental systems on which they are imposed is profound and that such schemes therefore inevitably create more environmental problems than they solve. There is no alternative but to grasp the daunting challenge at its roots and work, as quickly as possible, towards a truly sustainable solution – one informed by the precautionary principle and strong risk assessment, and devised and implemented by the people most directly affected.

It would be foolish to think that this is likely to be accomplished at all, in the current political realities, let alone in time to save many of the basin’s ruined ecosystems; but something may be done. In any case we have no choice: this is the path we must take, if we, let alone our children and grandchildren, want to have any kind of river at all.

Dr Geoff Wells is academic director of the new graduate program in Sustainable Business at the International Graduate School of Business, University of South Australia. He is an active researcher in sustainable business through UniSA’s Sustainable Communities Research & Innovation Cluster.

Source: Dr Geoff Wells, The Independent Weekly 2 September

Push to buy water to save the lakes

The lower lakes of the Murray could be saved if the Rudd Government were prepared to buy up temporary or annual water leases.

Wayne Meyer, chairman of Natural Resources Science at the University of Adelaide, argues that there is enough water in the Murray-Darling river system to cover the lakes and prevent an ecological disaster.

While welcoming the Government's move last week to increase purchases of permanent water in the northern part of the Murray-Darling Basin, he said that water would not bring immediate benefit.

"Any of that permanent water entitlement they're buying back is unlikely to be able to deliver for quite a long time," Professor Meyer said.

The Government's approach, so far, has been to purchase permanent water entitlements.

Professor Meyer said buying temporary water licences would allow for swift action.

"There is enough water in the system just to get a coverage of water on the lakes to minimise the risk of acidification," he said.

"There is enough water within the Menindee system, and you could probably buy enough further upstream, if they went into the temporary market."

A spokeswoman for federal Water Minister Penny Wong said: "The Murray-Darling Basin Commission advises that the existing strategy to protect Lake Albert from acidification by pumping water from Lake Alexandrina is proving effective. We are expecting further advice on next steps over coming weeks from the commission."

Kelvin Montagu, knowledge exchange manager with the Co-operative Research Centre for Irrigation Futures, said it was vital the situation in the lower lakes be addressed quickly.

"COAG has the promise of fixing it in the longer term, but if we let it go this summer, then we are going on an irreversible pathway," he said.

"Decisions we make in the next few months we can't go back on, so if we let the sea water in, or it goes acid sulphate, they will have implications for the next generation."

Lake Alexandrina is 0.3m below sea level. The tipping point, one metre below sea level, is likely to be reached next June.

Dr Montagu said there was an opportunity for irrigators to enter the environmental services market, and sell their water, on the temporary market, to save the lower lakes.

He said there was a "huge range of estimates" of the amount of water required to cover the lakebed - varying from 100 to 600 gegalitres.

"Last year, on the temporary market there was 220GL traded, so you start to think 100GL is not that way out there."

Dr Montagu said the purchased water could be shandied (mixed) with sea water. "If you go from fresh water to salt water in a few months, then the ecosystem is going to go into shock. If you can shandy that water, then it won't be quite so bad."

He said he had discussed the possibility of temporarily trading water to save the lower Lakes with Gwydir River irrigators.

"They were quite receptive, if someone could put \$500/ML on the table, to thinking about selling their water on a temporary basis. That is a damn sight better than they will get for cotton."

The Murray-Darling Basin Commission estimated that, at the end of June, more than 810GL of water was in private storages.

"There was big flood down the Darling last summer," Dr Montagu said. "If that had gone through the system, the lower Murray wouldn't be in the state it is in now."

He said there were good reasons for storing the floodwaters in the Menindee lakes, "but we have to appreciate the consequences. So we have to look at what role can the north play now."

Dr Montagu said irrigators were worried about the impact of selling water, and losing the flow-on financial benefits to their communities.

*Source: Asa Wahlquist,
The Australian 18 August*

Basin wetlands assessed for acid-sulfate soils

More than 1000 wetlands throughout the Murray-Darling Basin, including 16 RAMSAR-listed sites, will be assessed to determine the risk posed to them by acid sulfate soils, the Murray-Darling Basin Commission has announced today

More: <http://sl.farmonline.com.au/news/nationalrural/agribusiness-and-general/general/basin-wetlands-assessed-for-acidsulfate-soils/1270986.aspx>

Source: Kylee's Klippings 15 September

Greens push for Murray inquiry

A proposed Senate inquiry to deliver more water to the Coorong and the lower lakes of the River Murray would focus on emergency action, Greens leader Bob Brown said today. Visiting the lakes, near the Murray's mouth in South Australia, Senator Brown released proposed terms of reference for the Senate committee investigation. "The Murray lakes and Coorong wetlands cannot be allowed to die," he said. "The Greens, through the Senate committee system, will assist Prime Minister (Kevin) Rudd to identify how much water is available, how the Federal Government can obtain it, how it can be transported down the river and any barriers to making it happen."

Under the proposed terms of reference the Senate's Rural and Regional Committee would report back no later than September 30. It would investigate the volume of water which could be provided into the Murray-Darling system to replenish the lower lakes and Coorong, including options for sourcing and delivering the water. The committee would consider possible incentive and compensation schemes for current water holders, options for the once-off compulsory acquisition of water and any likely transmission losses and the most efficient and effective strategies to manage the delivery of water. The Greens will move for the Senate inquiry on August 26. South Australian independent Senator Nick Xenophon has agreed to co-sponsor the motion.--AAP

Source: Indaily 21 August

Murray-Darling rescue could sacrifice \$1b in crops: Wong

The Federal Government has been told more than \$1 billion of crops might be lost as a trade-off to save the Murray-Darling Basin.

More: <http://www.abc.net.au/news/stories/2008/09/03/2353977.htm>

Source: Kylee's Klippings 3 September

Murray River 'cancer' creeps northward

Pia Akerman, 30 August

The "cancer" of the Murray -- acid sulphate soils -- has spread to the river system's northern catchments in Queensland where up to 200 sites are under investigation by scientists.

More: <http://www.theaustralian.news.com.au/story/0,25197,24264492-5006784,00.html>

Source: Kylee's Klippings 3 September

Record low inflows keep Basin in serious drought

The outlook for the Murray system remains grim with winter inflows of 670 GL the equal 5th lowest in 117 years of records.

More: http://www.mdbc.gov.au/data/page/29/MR-Drought_Update_September_2008-doc.pdf

Source: *Kylee's Klippings 3 September*

Senators criticise record Qld water take

A record water take from the Murray-Darling Basin by Queensland irrigators is further evidence of the need to manage water resources on a national basis, the Greens say.

Greens South Australian Senator Sarah Hanson-Young said the Murray-Darling basin was in a state of emergency and it was time to stop the bickering across state borders.

"In 1901 we agreed to become a federation of states and in doing that we signed up to the Commonwealth constitution and we said that we would be managing our resources in the best interests of all people," she told ABC Radio.

"In this case we're not managing the system in the best interests of people and we're definitely not managing the river in the best interests of the river.

"We need a different approach, we need a change from business as usual."

Her comments followed a Queensland government report which revealed irrigators took record amounts of water from the Murray-Darling Basin over the past year.

The Queensland Department of National Resources and Water reported that irrigators took 1.014 million megalitres from the system in 2007-08, compared to the previous record of 815,000 megalitres in 2003-04.

Independent Senator Nick Xenophon likened the water take to putting four starving men in a room with a loaf of bread and having one eat it all before throwing his mates the crumbs.

Senator Xenophon also called on the federal government to intervene and ensure the equitable sharing of water along the river system.

"I want them to do the right thing by the entire river system," he said.

"It's not right that you have one part of the river system that is in virtual flood and the other part that is going to die.

"That, to me, is not what a river system should be about."--AAP

Source: *Indaily 21 August*

Water Research Cluster Postgraduate Corner

The Water Research Cluster hosts a quarterly forum for postgraduates who are studying water-related topics, to provide opportunities for building networks and contacts, and to experience alternative techniques and fields of research.

Next Water Research Cluster Postgraduate Forum

The Glenelg to Adelaide Park Lands Recycled Water Project – A Waterproofing Adelaide Initiative

Field Excursion: Date and Location TBC

For more information, contact:
eric.nicholson@adelaide.edu.au

The National Water Commission is an independent statutory body whose role is to drive water reform.

The September 2008 edition of the National Water Commission's newsletter, *Distilled*, is now available at: http://www.nwc.gov.au/resources/documents/Distilled_September_2008.pdf

The August 2008 edition of the National Water Commission's newsletter, *Distilled*, is available at: <http://www.nwc.gov.au/www/html/862-edition-31--august-2008.asp>

Further information on National Water Commission news is available at: <http://www.nwc.gov.au/www/html/171-subscribe.asp>

Further action required on water for the environment

The National Water Commission has announced that the protection of threatened water-dependent ecosystems, including the recovery of over-allocated systems, continues to be a major challenge in implementing the National Water Initiative (NWI).

In a position statement released at a feature session at Riversymposium on the role of science in setting sustainable environmental allocations, the Commission called for action on six priorities for the future management of water-dependent ecosystems.

Chair of the Commission, Ken Matthews, said that national guidelines for determining environmentally sustainable levels of the extraction are still lacking and a national inventory of over-allocated systems is also not in place.

"Under current conditions, many significant water-dependent ecosystems are under threat. In most jurisdictions we need to improve the security of environmental water holdings and manage our precious environmental water more effectively.

Australia can do better in protecting our environmental assets even during this time of drought and changing climate conditions, by ensuring that science is more effectively taken into account in water planning.

Recognising existing knowledge gaps, the Commission has invested in a range of projects to support good decisions about environmental water and inform environmental water plans. However, improved knowledge alone will not ensure that environmental outcomes are achieved.

It must be recognised that whilst science can make a substantial contribution to our water planning processes, it is not our scientists who ultimately make the policy choices that determine water allocations. Decisions should be science-rich, but cannot necessarily be science-determined.

The Commission urges all parties to the NWI to play their part in promoting the enduring objective of managing water-dependent ecosystems to best effect', said Mr Matthews.

More information can be found at: <http://www.nwc.gov.au/www/html/863-further-action-required-on-water-for-the-environment.asp?intSiteID=1>

Source: *National Water Commission 1 September 2008*

Water quality needs improvement

The South Australian Government says more needs to be done to protect the water quality for dolphins in Adelaide's Port River, the only pod known to exist within a major city anywhere in the world. About 30 dolphins live in the Port River and Barker Inlet in Adelaide's northern suburbs with the area declared a dolphin sanctuary.

The South Australian Government today released the first management plan for a sanctuary, including measures to protect the mammals from intentional harm as well as protecting water quality. SA Environment Minister Jay Weatherill said the discharge of excess nutrients, pollutants and ballast water impacted on the food chain and the dolphin pod's habitat.--AAP

Source: *Indaily* 26 September



Adelaide's Port River dolphins... given extra protection.
(Environment Dept)

Water Droplet Series

Prof Mike Young and Jim McColl continue to produce their series of Droplets, which are short discussion papers on water management issues. These Droplets explore ideas and propositions which, if developed further, might improve water use. Ideas are explored from a fundamental perspective. That is, they consider the building blocks and concepts that one might begin using if no constraints are assumed.

Droplet No 13 explores options for improving the management of connected groundwater and surface water systems:

Grounding connectivity: Do rivers have aquifer rights?

"It is better to be approximately right rather than comprehensively wrong."

In this Droplet, the following questions have been addressed:

How should entitlements be defined and allocations made when ground and river water systems are connected?

Should river entitlement holders or the river be given an entitlement to the other resource?

Is trade between ground and surface water systems possible?

How should any impact of climate change be managed?

Earlier Droplets on the development of a Sustainable Cap, new legislative arrangements, urban water trading, water governance, water interception, water accounting, water trading and stormwater management can be read at www.myyoung.net.au.

Comments are welcome. The aim is to encourage people to think differently about water management. If you would like to subscribe to the Droplet list, send an email to droplets@adelaide.edu.au or go to the website at www.myyoung.net.au

Please note that the August 2008 newsletter included a droplet installment also called Droplet No 13 which discussed, **"A future-proofed Basin"**. This Droplet is now listed as No 14 at the Droplet website: www.myyoung.net.au.

Mike Young is Professor of Water Economics and Management, School of Earth & Environmental Sciences, University of Adelaide and CSIRO Water for a Healthy Country Flagship

Conference & Seminar Diary

International Symposium on Efficient Groundwater Resources Management (IGS-TH 2009)

Bangkok, Thailand 16 – 21 February, 2009

Theme: The Challenge of Quantity and Quality for a Sustainable Future

www.igsth2009.com

International Conference on Implementing Environmental Water Allocations

Port Elizabeth, South Africa 23 - 26 February, 2009

THEME: International conference to promote the sustainable use of rivers, wetlands, estuaries and groundwater - Making it happen! Objective: Identifying and critiquing global trends in the implementation of environmental water allocations.

www.wrc.org.za

H2009 – 32nd Hydrology and Water Resources Symposium - 'Adapting to Change'

Newcastle, Australia 30 November – 2 December, 2009

More information about the call for abstracts, paper submission, online registration, etc will be available shortly and will be linked from this web page. Check the "Conference Timeline" link for approximate dates of deadlines in the meantime.

www.h2009.org.au

The Water Research Cluster newsletter is published once every two months.

The latest version is uploaded to the Water Research Cluster website (<http://water.adelaide.edu.au>). To receive a copy of the newsletter in printed form, send an email to eric.nicholson@adelaide.edu.au with the words **Subscribe Newsletter** in the Subject heading.

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