

How healthy river habitats suffer from altered flows



Coombool Swamp, upstream from Renmark, SA, is a typically biodiverse wetland area reliant on the seasonal flooding of the Murray. Willem van Aken

The journey from pristine and unmanaged rivers to today's heavily exploited waterways is largely a story of social and economic values that favoured irrigated agriculture and flow regulation over the natural resources of rivers.

The Murray-Darling system, with its extensive wetlands, once supported thriving commercial fisheries that harvested prized native species like Murray Cod. No longer. The commercial native fishery in NSW was closed in 2001 to protect surviving populations, and now across most of the Murray-Darling Basin only yabbies and carp (a pest species) can be taken commercially.

Freshwater fisheries collapse unless society puts a high value on a river's 'ecosystem services'. When these are neglected in favour of the value of extracted water, decline is inescapable. Dr Peter Gehrke, Research Director, Rivers and Estuaries with CSIRO Land and Water, points out that before development, floods and meagre drought flows were common.

'They were part of what made the river ecosystem tick,' he says.

However, these unreliable flows did not meet the needs of local communities, or in earlier times, river transport. So over the last century, many rivers were tamed to become more predictable water delivery systems. Others, like the Snowy, were diverted.

Now, even limited restoration is socially, financially and politically difficult. It is also technically complex. Drawing on the emerging science of environmental flows, river managers are today trying to mimic natural, climate-driven fluctuations, but with limited water resources. Much depends on the volume and timing of deliberate releases, which will be governed by the ecological objectives and the amount of water that can be spared – perhaps the greatest current wrangle as understanding changes.

Dr Gehrke says detailed field studies will be necessary to guide the repair process. Fortunately the baseline – where

we are now – has been well mapped scientifically. 'Many rivers have experienced large changes in flows,' he says. 'Other typical changes can include the course and channel profile of the river, water quality, vegetation, aquatic habitats, fish movement and species diversity.'

Dr Richard Kingsford, Principal Research Scientist, NSW Department of Environment and Conservation, says river regulation prevents water reaching the floodplains, with serious impacts on biodiversity. 'Small floods that reconnect and inundate floodplain habitats and wetlands are now less common,' he says.

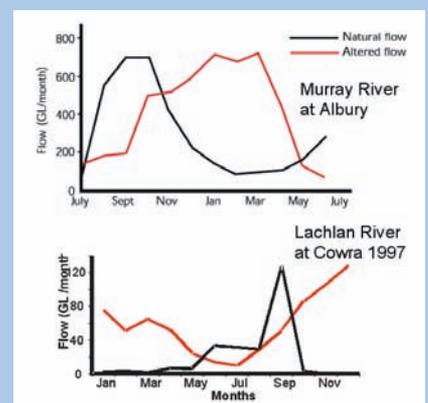
Reduced flows affect fauna

In the Murray-Darling, migrating fish are slowed or blocked by more than 3600 dams, weirs and regulators. Native golden perch and silver perch have become locally extinct upstream of major barriers, such as the Hume Weir. Half of the fish species recorded from the Murray region in New South Wales, and 33% of those from the Darling region, could not be found in recent surveys.

Of 20 species of native fish historically found in the highly regulated Campaspe River, only five remain and only three of

The major changes in river flows have been:

- reduced flow volumes
- fewer low water periods
- changes in the seasonal flow cycle
- reduced variability of flows (to produce a reliable water supply)
- reduced frequency of small floods that reconnect and inundate floodplain habitats and wetlands
- Increased duration of periods between moderate flow events



Natural and altered flow comparisons in the Murray and Lachlan rivers. Source Gehrke.

these breed. Murray crayfish, unfortunately, are now locally extinct in the lower Murray reaches in South Australia.

Water birds and other river fauna are less abundant and species richness has fallen in many wetlands because of fewer breeding opportunities.

Murky waters with excessive nutrients

About 29 million tonnes of sediment enters rivers in the Basin each year – 41 times the natural rate. Phosphorus inputs are about 11 kilotonnes per year – most ending up on floodplains and in reservoirs. Nitrogen inputs are about 80 kilotonnes per year from various forms of erosion. These high nutrient loads fundamentally affect the ecology of river habitats.

Dam cold water

The water released from the bottom of dams can be too cold for fish to thrive. For example, in the Macquarie River during summer, when typical water temperatures hover around 25°C, the temperature in the river downstream of Burrendong Dam is around 13°C. These chilly conditions persist for over 300 km downstream. Researchers estimate that up to 3000 km of river channel in the Basin is affected by water that is too cold for fish to breed.

An open mouth?

The state of the Murray mouth has assumed symbolic significance as a sign of the condition of the river. But it is more than that, according to Dr Ben Gawne,



The White-faced Heron, one of many water bird species that frequent healthy river habitats. Rosemary McArthur

Natural flows are vital for floodplain wetlands

Floodplain wetlands are sites of rich biodiversity, relying on flows from rivers. In 2000 Dr Richard Kingsford from the NSW Department of Environment and Conservation, reviewed the condition of four key floodplain wetlands for which he had good data: Barmah–Millewa Forest and Moira Marshes, Chowilla floodplain, Macquarie Marshes, and the Gwydir



Dead gums on a dry floodplain of the Murray River upstream from Renmark, SA.

Greg Rinder, CSIRO Land and Water.

Director of the Murray-Darling Freshwater Research Centre in Albury. ‘Some species need to move between the estuary and the open sea,’ he says. ‘There are also benefits in relieving salt build-up in Coorong waters, and in reducing flood risks.’

However, Dr Gawne and Dr Gehrke say that keeping the mouth open with powerful environmental flows alone would require vastly more water than is available. ‘The mouth closed periodically under natural conditions, so it is unrealistic to try to keep it open permanently now, and environmental flows are certainly not the tool for that job,’ Dr Gehrke says.

The Murray-Darling Basin Commission supports a combination of flows and dredging to maintain tidal conditions in the Coorong estuary at the Murray’s mouth.

How are tropical rivers doing?

Unlike their southern counterparts, many tropical catchments are almost unchanged. A few have been extensively developed and are now the focus of environmental management efforts – the Ord, Burdekin and Fitzroy (Qld) for example. Tropical rivers have not been researched thoroughly,

wetlands. All are part of the national reserve system and are listed as Wetlands of International Importance.

Dr Kingsford found that dams, diversions and river management have reduced flooding, altering the size of the wetlands, leading to the death or poor health of aquatic species. There have been changes in aquatic vegetation, reduced vegetation health, declining numbers of water birds, and falling native fish and invertebrate populations.

More than half of floodplain wetlands on developed rivers may no longer flood. Of all the river basins in Australia, the Murray-Darling Basin is the most affected. Some floodplain wetlands are now permanent storages, changing their plant and animal populations.

Dr Kingsford concludes that to avoid further loss of wetlands, better understanding of the interaction between river flows and floodplain ecology is essential. He recommends deeper investigations into the ecological impacts of management practices.

More information: Kingsford, RT. (2000). Ecological impacts of dams, water diversions and river management on floodplain wetlands in Australia, *Austral Ecology* 25, 109–127.

despite their economic and ecological significance.

The Northern Prawn Fishery, Australia’s largest Commonwealth-managed fishery, depends on estuarine habitats to maintain prawn populations. ‘If we develop tropical rivers as we have the Murray-Darling, it would not be surprising if the prawn fishery or other coastal fisheries declined,’ Dr Gehrke says.

A forum on tropical rivers held in Darwin early in 2004 affirmed an urgent need for more intense research into Australia’s tropical river systems. Development pressures are likely to grow in the next 10–20 years.

● **David Horwood**

More information:

What is the Status of River Health in the Murray-Darling Basin?
www.clw.csiro.au/priorities/hot_issues/murray_river_health/index.html
 Williams, J, Bowmer, KH and Gascoigne, HL (2004). Healthy rivers and catchments. In *Water Innovation: A New Era for Australia*. (Ed. K Bowmer). CL Creations, NSW.
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