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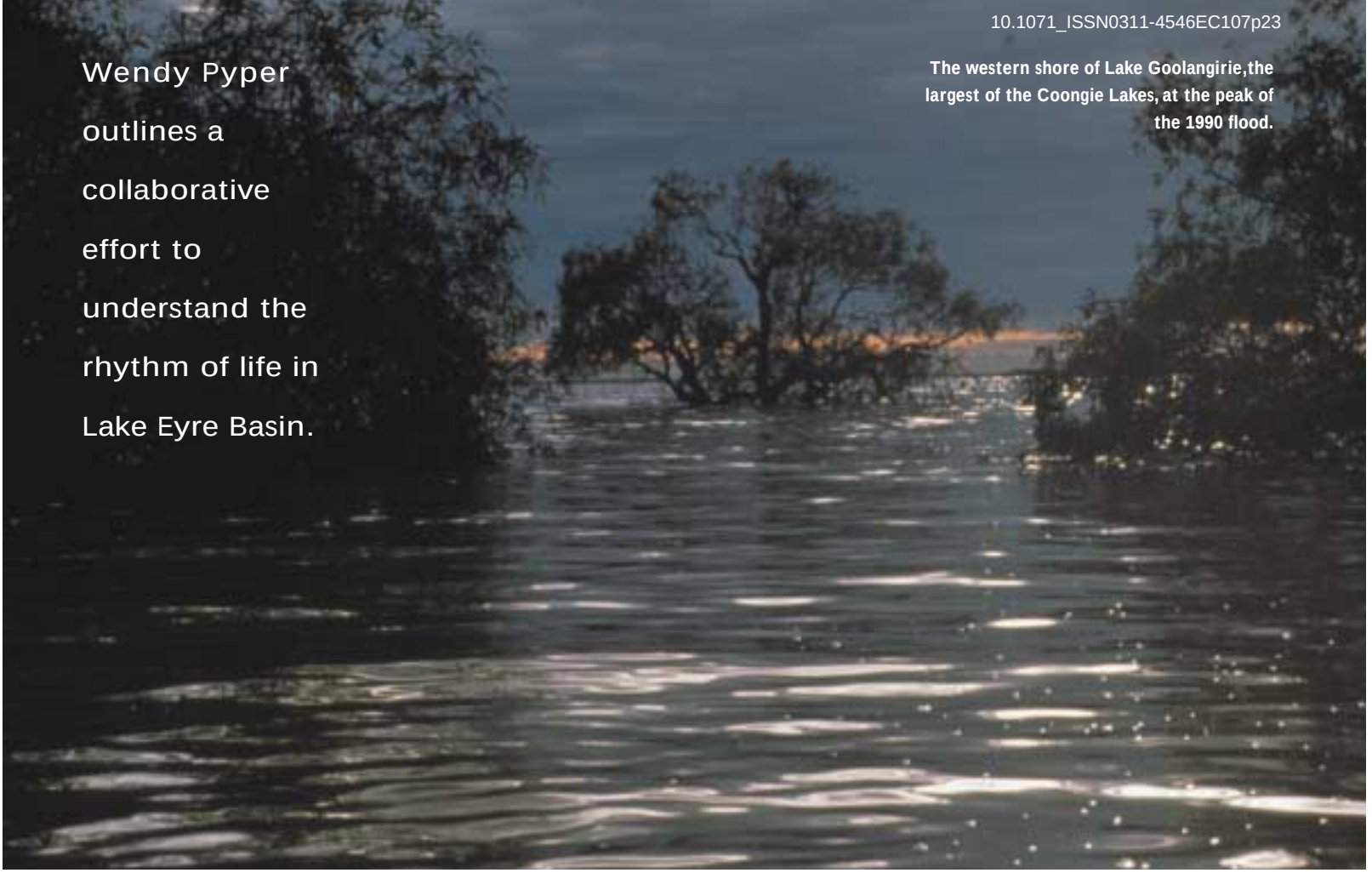
Wendy Pyper outlines a collaborative effort to understand the rhythm of life in Lake Eyre Basin.



The western shore of Lake Goolangirie, the largest of the Coongie Lakes, at the peak of the 1990 flood.

Channel Vision

Thirty days is a long time to spend up to your waist in river water. At first, the experience provides welcome relief from the outback sun. But it's not long before the fine suspension of colloidal clay sucks the moisture from your skin.

For scientists studying the bounty of these waters, however, the crocodilian transformation is one they're willing to endure. To ease the ordeal, the Channel country has some of the most spectacular scenery on offer.

'It's a curious combination of great beauty and wilderness, and appalling discomfort,' says freshwater icthyologist, Dr Jim Puckridge.

Puckridge, from Adelaide University's Department of Environmental Biology, is the scientific leader of a project that aims to model the response of flora and fauna to flow patterns in the major rivers that drain the Lake Eyre Basin.

The Environmental flow requirements for Australian arid zone rivers project, also known as ARIDFLO, involves 10 institutions and research organisations, including the South Australian Department for Water Resources, CSIRO, the Australian National University and the Murray Darling Freshwater Research Centre.

Results of the ARIDFLO project will help scientists and natural resource

Researchers sample the biodiversity of waterways in the Channel country for the ARIDFLO project.

Bottom: The western shore of Lake Maroopootanie, one of the most rarely flooded lakes in the Coongie Lakes complex, in 1990. Terrestrial daisies and acacias line the shore.

Below: The great egret, a waterbird species severely affected by regulation in the Murray River Basin.

Rosemary McArthur

managers to understand the relationships between flow patterns in unregulated arid zone rivers, and the condition of the resident flora and fauna.This understanding will inform community and government debate, and decisions concerning future proposals to regulate the flow of inland rivers, or extract water for irrigation.

'By establishing relationships between the biota and hydrology, we'll be able to predict the impact of water extraction or river regulation,' Puckridge says.

'This research has to be done in the rivers themselves, rather than by extrapolating from what happens in rivers elsewhere, as the Lake Eyre Basin rivers are quite different and the biota is differently adapted.'

Information from the project could also guard against the mistakes that plague other river systems developed without this type of knowledge.

Into the interior

Puckridge has led a band of volunteers, scientists and staff on four expeditions to the arid-zone rivers of South Australia during the past two years.

Along the Neales River, Cooper Creek and the Diamantina River, the team has counted, collected and catalogued fish, invertebrates, zooplankton, waterbirds and riparian vegetation. A Queensland team lead by Vanessa Bailey has repeated this sampling in the upper reaches of the Diamantina River and Cooper Creek.

The field research conducted in April last year coincided with one of the largest floods in the basin since 1990, and a generated a flurry of fish activity. Initially, this was somewhat surprising.

'It has always been assumed that fish breed in summer, but I saw a number of species breeding right through winter as the floods came through,' Puckridge says.

'This demonstrates an unexpected degree of opportunism, but it makes sense. If fish have a chance to breed and produce good offspring, they're not going to wait another 10 years for a summer flood.'

As the floods subside, changes in community structure, species abundance, behaviour, health and breeding success are driven by changes in river flow.

'We're continuing to follow the course of these floods and their recession, and observe biological responses to a wide range of the flow events occurring in these systems,' Puckridge says.

Water and birds

The floodwaters of April 2000 also triggered a flurry of breeding activity among more than 45 species of waterbirds, according to Julian Reid of CSIRO Sustainable Ecosystems.

Reid is documenting the species richness and abundance of waterbirds in the

Top: The red-legged stilt, one of many waterbird species being surveyed from ground and sky.

Above: River redgums on the north-west branch of Cooper Creek, upstream of Coongie Lake.

wetlands of the Channel country, and the correlation between breeding and changes in flooding along the river. He is also looking at a range of waterbodies, from deep channels to broad, open lakes, to see whether different waterbirds favour or prefer different environments.

The study requires two types of survey. The first is a ground-based survey using binoculars and a notepad, where Reid documents waterbird species, their numbers, habitat details and any signs of breeding.

The second is an aerial survey, where Reid and his colleague Roger Jaensch, from Wetlands International, count birds in 5 km by 100 m transects. Using aerial photography, satellite imagery, other maps and some assumptions, they then scale up the counts to generate population estimates for the larger inundated area.

Reid's survey work has been assisted by information provided by pastoralists and other residents. As the ARIDFLO project is being run in some of the most hydrologically variable and poorly studied river systems, this local knowledge has a critical role in the project.

'Many pastoralists and people in the local communities along these rivers have a wealth of knowledge acquired from years of observation. They have been of invaluable assistance to the waterbird surveys and provided information about river flows and floods, which would not be available any other way,' Reid says.

Reid's survey data will be used to produce a model of waterbird response, which he hopes will be predictive for the Channel Country region. In terms of managing wetlands and river flows for waterbirds however, he emphasises the need for a continental approach.

'Although we're studying a vast area, and seeing a huge response to the flooding, the wetlands in other parts of Australia are still vital to the overall management and conservation of waterbirds,' he says. 'As central Australia dries up, a lot of birds will presumably die and some will move to more reliable wetlands in the peripheral parts of Australia.'

Falls and flows

In tandem with the biological research, University of Melbourne hydrologist Justin Costelloe has used water depth loggers, satellite imagery and local knowledge from pastoralists to estimate the movement of water through the basin's river systems.

With these data, Costelloe will generate a computer model that predicts river flow under different rainfall conditions. This will provide the biologists with information on the patterns of water flow through their sample sites, including flow volumes, inundation frequencies and the residence time of the water in floodplains, wetlands and river channels.

Riparian revelations

PERENNIAL woody vegetation, such as river red gums, tea trees and coolibahs, can provide an insight into the long-term hydrological regime of rivers.

Julian Reid of CSIRO Sustainable Ecosystems is using information about riparian vegetation to help categorise wetland types at study sites used in the ARIDFLO project. The information will also help him understand waterbird responses over the longer-term hydrological regime, as opposed to the annual variability.

'While waterbirds respond to present water levels, preferring to feed in the shallow, productive and less frequently inundated parts of the floodplain, a lot of them can only breed in extensively vegetated areas,' Reid says. 'But suitable patches of vegetation – the larger areas of lignum, coobah and coolibahs – only occur where the longer-term water supply is more assured and flooding occurs regularly.'

'These pockets are vital to the continued breeding success of many of the larger species of waterbirds, such as the egrets, spoonbills, herons, ibis, darter and cormorants, which have been hardest hit by river regulation and water extraction in the Murray-Darling Basin.'

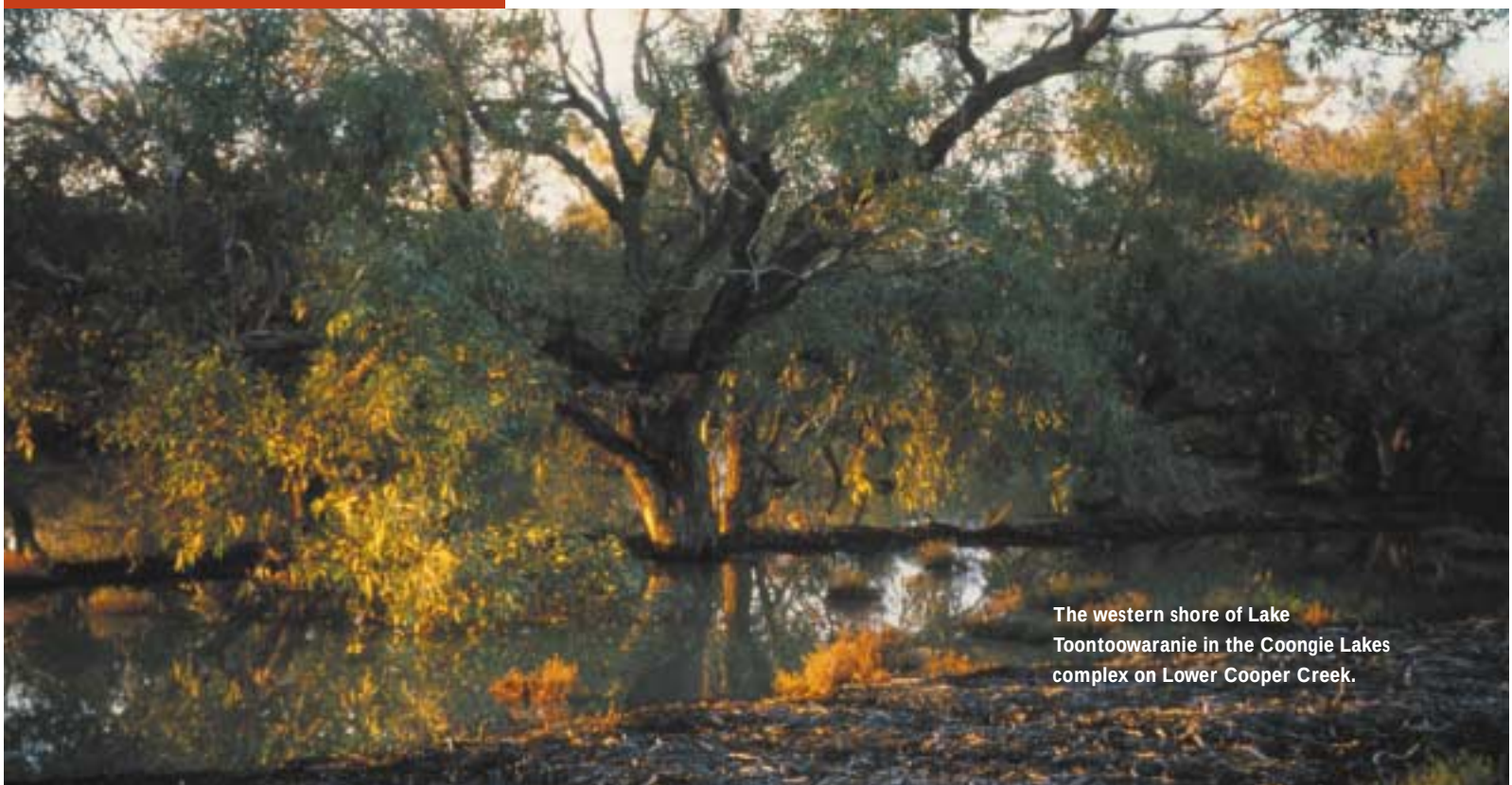
One of the many channels in the internal delta, Tirrawarra Swamp, on the north-west branch of the Cooper Creek.

'My model will generate hydrological data, which the biologists will add to their own information on biological community structure, abundance, behaviour and so on,' Costelloe says. 'They will then look for patterns or relationships between the biological and hydrological data using artificial neural networks and other modelling techniques.'

The ARIDFLO project is funded by the Environmental Flows Initiative (National River Health Program) with funds from the Natural Heritage Trust and managed by the SA Department for Water Resources. The multi-disciplinary team engaged in the project also includes scientists and staff from the Queensland Department of Natural Resources and Mines, and the Queensland Environmental Protection Agency.

Abstract: Changes in the patterns of flow or 'hydrology' of a river affect the resident flora and fauna. To understand how hydrology affects ecology, scientists are studying the flow of unregulated rivers in various stages of flood and drought, and the responses of fish, waterbirds, riparian vegetation, microinvertebrates and zooplankton. Information on species richness, abundance, behaviour, health and breeding will then be used to produce models that predict the response of different organisms to different flows. This information is essential for estimating the impacts of hydrological changes on biota, which would occur if the rivers were regulated or exploited for irrigation.

Keywords: Aridflo, biological sampling, fish, river flow, hydrology, biological models, waterbirds, wetlands.



The western shore of Lake Toontoowaranie in the Coongie Lakes complex on Lower Cooper Creek.