

# CONSERVING CRUCIAL CORRIDORS

PAULA D'SANTOS, CLAYTON SHARPE, IAIN ELLIS,  
IRENE WEGENER AND ADAM SLUGGETT FILL IN  
THE DETAILS OF FLOWS BEING PROVIDED FOR  
NATIVE FISH IN THE LOWER DARLING.



LDR reduced to isolated pools (above) due to cease-to-flow conditions (below) from 2013 to August 2016. Photos provided by the authors.



Native fish populations across the Murray–Darling Basin have been adversely effected by river regulation, water extraction and associated habitat loss. Environmental water is increasingly being used to supplement and create crucial flow corridors that native fish need to support their lifecycles.

Environmental water managers in New South Wales are using newly developed ‘flow requirement’ frameworks to help guide their management decisions. The frameworks combine changes in river hydrographs (i.e. the rise and fall of a river flow) with knowledge about how flow supports different aspects of native fish lifecycles (e.g. habitat, spawning, dispersal, and recruitment). This is then applied to day-to-day river operations, using environmental water to achieve the flows required for positive native fish outcomes.

The recent 2016–17 Lower Darling River Native Fish Flow provides an excellent example of putting this approach into practice, with environmental flows developed specifically for Murray Cod and Golden Perch.

## Flows for Murray Cod

The Darling River is one of the world’s most hydrologically variable rivers. The lower 700 kilometres (referred to as the Lower Darling River or LDR) includes the Menindee Lakes, and extends south to the confluence with the Murray River at Wentworth. The LDR is considered a ‘hot spot’ for native fish, supporting strong populations of Golden Perch, Murray Cod and a suite of small-bodied native fish species. Threatened Silver Perch and Freshwater Catfish also persist in the LDR. Flows to the LDR have been highly regulated since the 1960s due to the modification of the Menindee Lakes system for water storage.

Upstream river regulation, storage and extraction in the northern tributaries of the Barwon-Darling system have substantially altered the duration, magnitude and frequency of flows that reach the Menindee Lakes and the LDR. From 2013 to August 2016, the Menindee Lakes system experienced record low inflows. Consequently, cease-to-flow conditions in the LDR prevailed, and the river contracted to a series of isolated pools (see photos above). A lack of replenishing flows and deteriorating water quality threatened the health of the LDR’s native fish stocks, and created unfavourable conditions for spawning and recruitment of the river’s robust Murray Cod population for three consecutive years 2013, 2014 and 2015. (*Note, recruitment in this context refers to survival of fish from tiny larval stages through to adult stages that can potentially breed themselves.*)

When flooding upstream in August 2016 finally led to a recommencement of flows into the Menindee Lakes, environmental water was prioritised to support the LDR Murray Cod population. A project team, lead by the Office of Environment and Heritage and consisting of fish biologists and environmental water managers, developed a flow delivery hydrograph based on the known flow requirements for successful Murray Cod spawning and recruitment (see diagram on following page).

### FOR FURTHER INFORMATION

Paula D’Santos —  
paula.dsantos@environment.nsw.gov.au



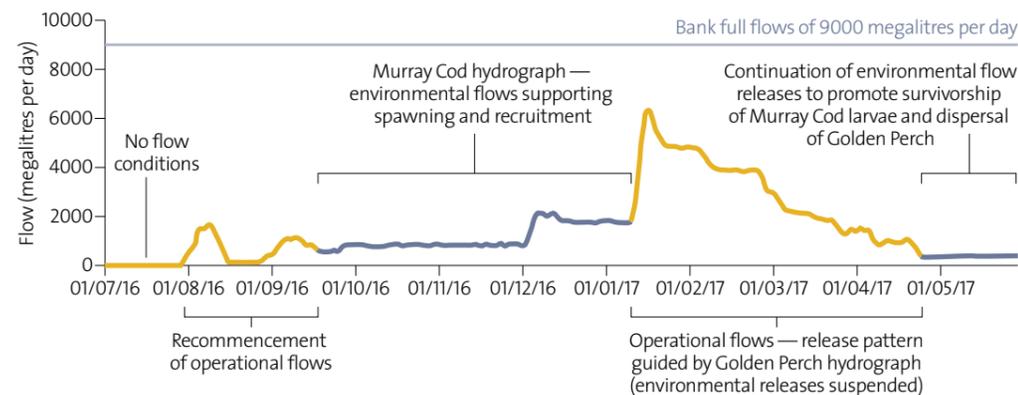
Fine meshed nets (left) set from snags in the river channel were used in the monitoring program to catch drifting Murray Cod larvae (right). Hundreds of larvae were collected at sampling sites throughout the monitoring period, supporting the commitment of environmental water and Murray Cod recruitment. Photos Clayton Sharpe.

This 'Murray Cod hydrograph' was implemented using environmental water sourced from The Living Murray program and the Commonwealth Environmental Water Holder. A monitoring program, funded by the Commonwealth Environmental Water Office, was implemented to evaluate the hydrograph. Specifically, the monitoring assessed if Murray Cod in the LDR spawned in association with the environmental flow, and evaluated the intensity of spawning and the distribution of spawning effort from Menindee to Wentworth. The monitoring information was used to refine and optimise ongoing environmental flow delivery in 2016 and 2017.

The Murray Cod hydrograph helped reinstate flow connectivity and hydrodynamic diversity (i.e. 'fast' as well as 'slower' flowing areas) to the LDR channel. It also increased the availability of submerged habitat for nesting sites (like snags), and primed the river for a boost in productivity, generating food for the predicted Murray Cod larvae.

Monitoring indicated that the intensity of Murray Cod spawning in spring 2016 was extremely high, with hundreds of larvae collected at sampling sites (compared to a handful of larvae sampled in previous years), and the distribution of spawning effort was over hundreds of kilometres downstream of Menindee. In response, the environmental flow was increased to inundate dry low-lying benches in the channel to further increase food availability and nursery habitat for these larvae (see photos above). Environmental flows were continued throughout the 2017 autumn and winter period, with the aim of maintaining habitat and feeding opportunities for the 2016 Murray Cod cohort. Continued monitoring will document the strength of recruitment (survival and growth) of these young, and further evaluate the success of the 2016–17 Murray Cod hydrograph in the LDR.

Murray Cod and Golden Perch conceptual hydrograph. Lower Darling River (Weir 32) environmental flow releases 2016/17.



Large numbers of Golden Perch juveniles collected in the Menindee Lakes in December 2016, provided the basis for commitment of environmental water, and created an opportunity for these young fish to disperse from the lakes and recruit to the Lower Darling, the Darling Anabranch and Murray River populations. Photos Clayton Sharpe.



### Flows for Golden Perch

A conceptual model for Golden Perch breeding in the Darling River developed by ecologist Clayton Sharpe was used as the basis from which environmental flows could be delivered to support recruitment opportunities in the LDR and dispersal in to the Murray River and connected streams. The model predicted three key aspects:

1. Golden Perch spawning would occur in response to the winter 2016 flood event in the Barwon-Darling river system from the Border Rivers to Menindee.
2. Strong recruitment was likely to occur in the productive ephemeral nursery habitats of the Menindee Lakes.
3. Flows from the Menindee Lakes into the LDR, and the Darling Anabranch, would act as dispersal 'corridors' for juvenile perch (~four months age) to move into the River Murray system, and thereby support recruitment of Golden Perch populations to the Murray River and connected streams.

Monitoring of the Menindee Lakes in December 2016 confirmed the model's first two predictions of the presence of juvenile Golden Perch, in high numbers, and provided evidence to support the delivery of environmental water to the LDR (see photos above).

Environmental water releases following on from the Murray Cod flows discussed earlier were continued through autumn 2017 to support the dispersal of juvenile Golden Perch from the Menindee Lakes nursery habitat, throughout the LDR, from Menindee to Wentworth. Simultaneously, environmental flow releases in the Darling Anabranch provided another crucial 'corridor' to connect the Menindee Lakes with the Murray River system.

### Protecting and maintaining crucial corridors

Recent research examining natal origins (akin to birth places) of native fish has indicated that Darling River derived Golden Perch are an important contributor to populations in the Southern Connected Murray-Darling Basin. Populations sampled in 2014 in the lower and mid-Murray, as well as in the Edward-Wakool River systems, were dominated by a cohort of Golden Perch that originated from the Darling River during the 2009 flood flows.

The 2016/17 Lower Darling River Native Fish Flow has highlighted the important role that the Darling River plays in the ecology of Golden Perch and Murray Cod—both important recreational angling species. From a management perspective it emphasises the need for protecting particular flows in the Barwon-Darling River system that support spawning and downstream transport of larvae, the function of the Menindee Lakes as key nursery areas for Golden Perch recruitment and the importance of providing opportunities to connect with other Southern Basin populations. The project also highlights the critical role carefully planned environmental flows can play in supporting Murray Cod spawning and dispersal throughout the Lower Darling River—a particularly important outcome in light of the devastating fish kills which occurred in the summer months of 2016 throughout the Murray River system.