

Southern Spring Flow 2019 to Enhance Murray River Productivity



A healthy river is vital for the well-being of floodplain and river ecosystems. Food and nutrients that are essential to supporting the riverine ecosystem, can be picked up and carried by flows moving across floodplains and back into the river. Particularly in dry years, water for the environment plays an important role in maintaining floodplain and sustaining river health. Increased flows also inundate low lying areas of rivers and wet riverbanks. This provides ideal conditions for the growth of microscopic algae and animals like zooplankton, which are important sources of food for native fish and other animals.

Southern Spring Flow 2019

In Spring 2019, as part of a [Southern Spring Flow 2019 event](#), water for the environment was released from Hume Dam to provide benefits along 2,000 km of the Murray River. Flow rates targeted 15,000 megalitres/day downstream of Yarrawonga for six weeks and were timed to align with operational flows and environmental flows from the Goulburn, creating a pulse down the Murray River. The flow event inundated around 25% of the Barmah-Millewa Forest then travelled down the length of the river to the end of the system in the Coorong in South Australia.



River Murray at Swan Hill during 2019 Southern Spring Flow
Inset picture: Zooplankton sampling

What was measured

To understand how the Southern Spring Flow event influenced productivity along the length of the Murray River two complementary monitoring programs were carried out (Figure 1).

- In the first program, field measurements were taken each week along the Murray at 21 sites for 15 weeks to determine the concentrations and loads of carbon, nutrients and algae (measured as the amount of chlorophyll-a present) as these are the basic materials that supply energy for food webs.
- The second program measured numbers of zooplankton by sampling fortnightly at six of the 21 sites over the same 15 week period. Zooplankton are microscopic animals that feed on the algae and bacteria and are an important source of food for juvenile native fish such as silver perch, golden perch and Murray cod.

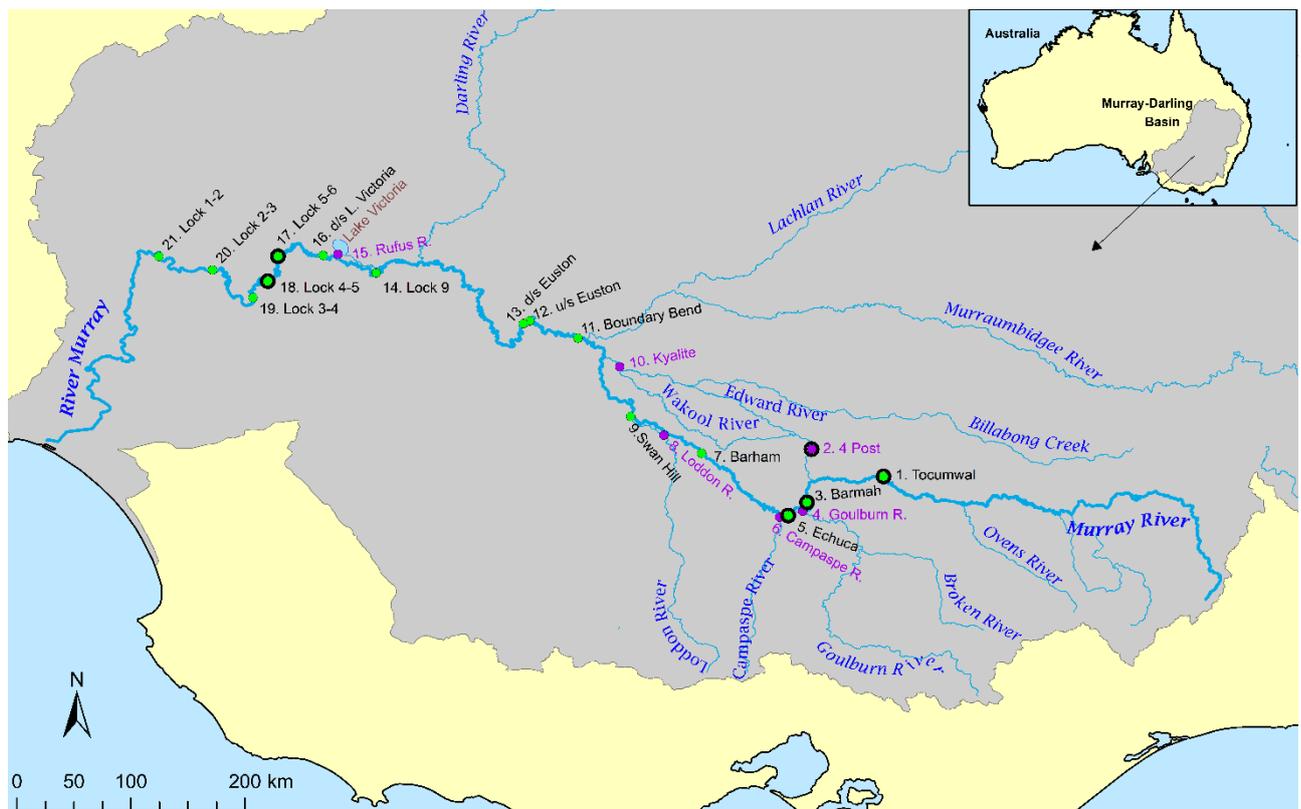


Figure 1. Sampling locations (green dots = main river sites; purple dots = tributary sites near confluences; dots with dark circles show sites where zooplankton sampled).

What did we find

The Southern Spring Flow event produced some good ecological outcomes and as expected, productivity responses varied all along the river.

✚ The Southern Spring Flow generated a pulse of carbon and nitrogen to the Murray and Edward/Kooley Rivers downstream of Barmah-Millewa Forest. The increase in carbon and nutrients transferred from the floodplain (Figure 2) to the river provided a boost in energy to support riverine food webs.

✚ The peak inputs of carbon, nitrogen and chlorophyll-a to the Murray River were in October 2019 during the latter stages of the Southern Spring Flow event.

- Inundation of Barmah-Millewa Forest floodplain provided ideal conditions for zooplankton to grow, with the flows then transporting zooplankton from the floodplain to the main river channel (Figure 3, left plot), providing an increase in food available for fish.
- A small, short-lived increase in carbon and nitrogen was detected at some of the mid-Murray sites.
- While the Southern Spring Flow didn't generate any measurable changes in carbon and nutrient concentrations in the lower Murray River, it did stimulate a short-lived increase in the number of zooplankton (Figure 3, right plot). This was most likely due to wetting of low-lying areas along the edges of the river, which provided ideal conditions for the growth of zooplankton which can then be swept into the main channel.

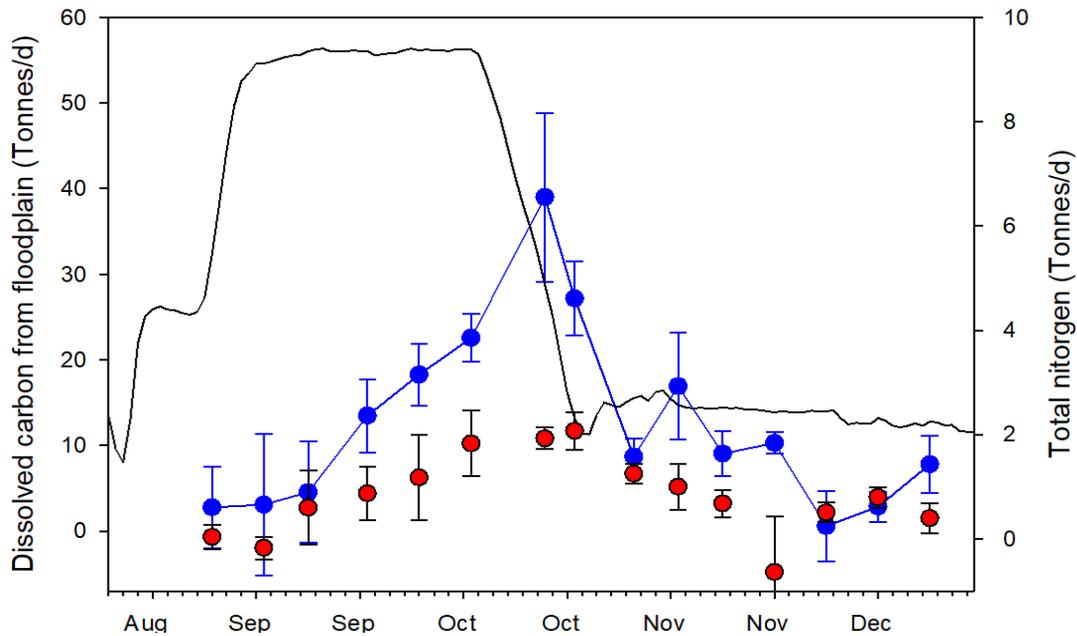


Figure 2. Transfer of dissolved carbon (blue dots) and total nitrogen (red dots) from Barmah- Millewa forest to the Murray River. The black line shows the spring flow at Yarrawonga on the Murray River in New South Wales.

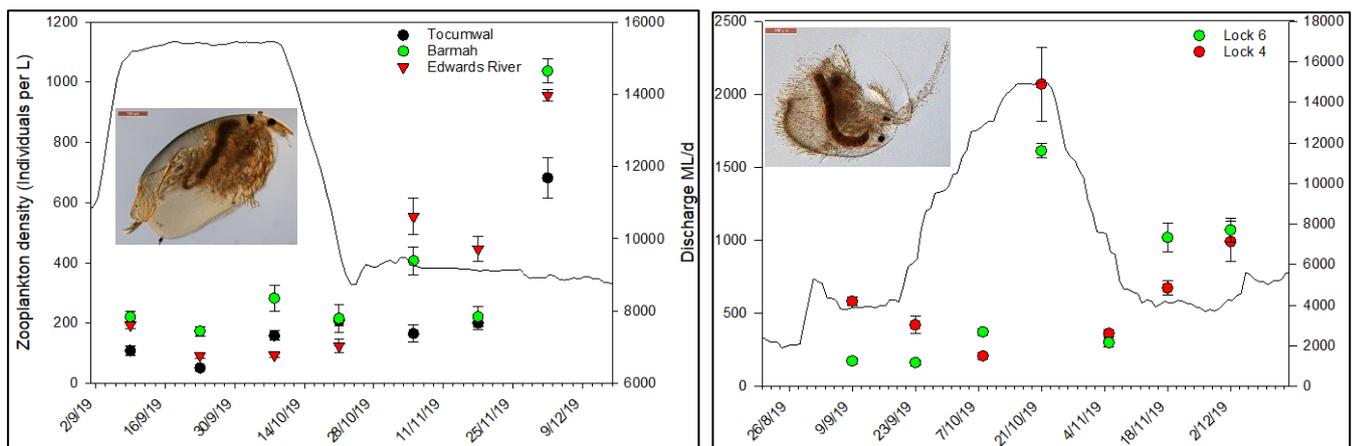


Figure 3. Dots show the changes in zooplankton (inset bugs) density in the Murray River upstream at Tocumwal and downstream of the Barmah-Millewa Forest at Edwards River and Barmah township (left) and lower-Murray (right).

What did we learn about improving productivity outcomes

- River productivity immediately downstream of the Barmah-Millewa Forest increased as a result of the 2019 Southern Spring Flow event. The benefits to other parts of the Murray River were limited by the small size of the flow, which was mostly in-channel and only inundated a small amount of low-lying areas such as riverbanks, benches and slow-flowing backwaters.
- Larger flow events that inundate larger areas of the floodplain and more low-lying areas of the river channel are likely to increase productivity by increasing the amount of carbon and nutrients transferred to the river and increasing areas available for zooplankton to grow.
- Coordinating successive inundation of forest floodplains along the Murray River would promote productivity in the mid-Murray River, increasing the amount of food available for native fish. Coordinating flows in the Murray River with tributary flows could also help boost river productivity.
- The inability to detect increases in carbon associated with the Southern Spring Flow in the lower Murray River suggests that any carbon that was produced by the flows was incorporated into the food web at the same rate it was being produced.
- High zooplankton numbers in the lower Murray River corresponded with the peak of the Spring Flow event although high numbers were short lived. It is likely that the higher flows wetted edges of the river, creating favourable conditions for reproduction of zooplankton, which were then swept into the flowing water downstream.
- Further understanding of zooplankton response to different sized flows, management activities such as weir pool manipulations and timing of water delivery is required to determine how to generate a much longer-lived population of zooplankton as a food resource for fish.

The 2019 Southern Spring Flow event was a joint coordinated watering action by the Commonwealth Environmental Water Holder, Victorian Environmental Water Holder, NSW Department of Planning, Industry and Environment, SA Department for Environment and Water, Murray-Darling Basin Authority as manager of The Living Murray, Goulburn-Broken CMA, North Central CMA, WaterNSW and Goulburn Murray Water.

Read the reports

Rees GN, Biswas TK, McInerney P, Nielsen D, Joehnk K, Pengelly J, Furst D, Watts R, Liu X, Ye Q (2020) Monitoring productivity outcomes of the 2019 River Murray channel multi-site water for the environment event – carbon and nutrient loads. Report prepared to the Murray-Darling Basin Authority.

Furst, D., Ye, Q., Bice, C., McInerney, P., Biswas, T., Rees, G. and Watts, R. (2020). Zooplankton response to a multi-site environmental watering event during spring 2019 in the River Murray. A report to the Commonwealth Environmental Water Office, Canberra. Project number: CEWO- 2000007157.

Collaborators:

1 July 2020.



As Australia's national science agency and innovation catalyst, CSIRO is solving the greatest challenges through innovative science and technology.

CSIRO. Unlocking a better future for everyone.

Contact us
1300 363 400
+61 3 9545 2176
csiroenquiries@csiro.au

For further information
CSIRO Land & Water
Gavin Rees
+61 2 60519381
Gavin.Rees@csiro.au