Fact Sheet

GOYDER INSTITUTE FOR WATER RESEARCH

Response of the Coorong Food Web- Fish

The following technical report associated with the Murray-Darling Basin 2022-23 flood environmental response in the Coorong research program is available at Reports – Goyder Institute.

Coorong fish responded to the 2022-23 flood with a substantial increase in species richness in the North and South Lagoons. There was also evidence of freshwater food resources supplementing fish diets during the flood, and post-flood recovery of macroinvertebrate prey aligned with mullet diet shifts in the Coorong.

PROJECT AIM:

To assess the impact of the 2022-2023 flood in the River Murray on the food web and fish community in the Coorong.

HIGHLIGHTS

- The number of fish species increased post-flood in the North and South Lagoons, corresponding with a substantial reduction in salinity (below 60 g/L in the South Lagoon for the first time since 1998). As salinity began to increase from 2024 in the Coorong, the number of fish species started to reduce in the South Lagoon.
- Fish community changed distinctly after the high flows (2021-22) and flood (2022-23), although with some lag in response in the South Lagoon. There was an increase in the abundance of freshwater species, enhanced recruitment of diadromous species (congolli and galaxias), and greater abundance of sandy sprat, whereas smallmouth hardyhead were more abundant in low flow years, particularly in the southern Coorong.
- A substantial increase in fish biomass for black bream and greenback flounder was reflected by fishery catch rates in 2022-23, likely due to increased estuarine habitat and food resources in the Coorong.
- There was a diet shift of both small (<150 mm total length) and large (>150 mm) yelloweye mullet from detritus and/or crustacean in March 2023 to primarily polychaete worms in December 2023.
- In March 2023, the muscle tissues of small mullet from the Murray Mouth Area and North Lagoon showed consistent carbon isotope ($\delta^{13}C$) values of the basal food resources from the lower River Murray, suggesting increased contribution of freshwater food resources to fish diets during the flood.

This project is part of the South Australian *Healthy Coorong, Healthy Basin* Program, which is jointly funded by the Australian and South Australian Governments. The Goyder Institute for Water Research is a collaborative partnership of the South Australian Government through the Department for Environment and Water, CSIRO, Flinders University, the University of Adelaide and the University of South Australia. Published November 2024.

First Nations Acknowledgement

KEY FINDINGS

Fishes of the Coorong

With increased flows, salinity decreased at all sites in the Coorong and remained relatively low throughout 2023. This led to a substantial increase in fish species richness (number of species) in the North and South Lagoons. Notably, the flood lowered salinity to less than 60 g/L in both lagoons during 2022-23, resulting in the most diverse fish assemblage, including all four functional groups (freshwater, estuarine, marine and diadromous), over the past 15 years.

The fish community changed markedly in the Coorong after the high flows (2021-22) and flood (2022-23). The Murray Mouth Area changed first, with a delayed response in the North Lagoon, followed by the South Lagoon. The post-flood fish community was characterised by increased abundance of freshwater species, enhanced recruitment of diadromous species (congolli and galaxias), and greater abundance of sandy sprat, compared to low flow years in the southern Coorong where the community was more dominated by smallmouth hardyhead. Sandy sprat and smallmouth hardyhead were two most abundant prey species for fish-eating waterbirds and larger fish in the Coorong.

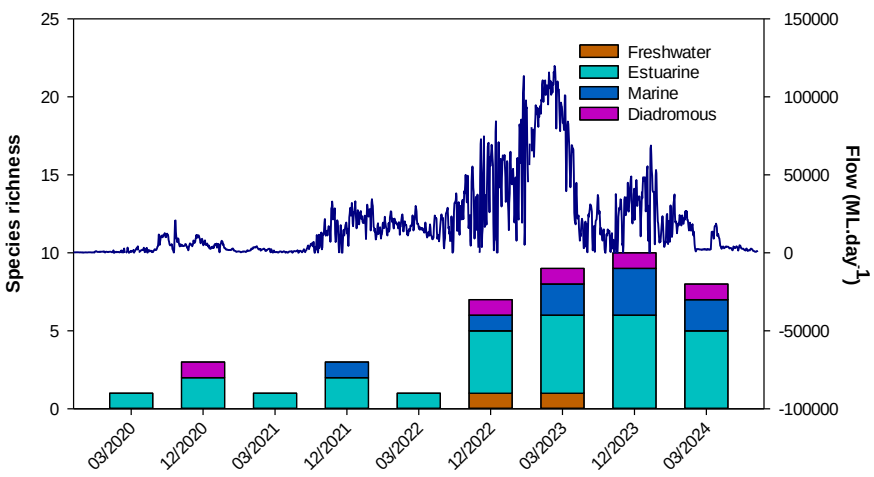

Figure 1. Fish species richness in the South Lagoon of the Coorong by life-history guild against barrage flow. Images: yelloweye mullet (upper) and fish sampling by seine net (lower).

Biomass increased in key fishery species in the Coorong, including black bream and greenback flounder with a considerable rise in catch-per-unit-effort in 2022-23. Reduce salinity, increased estuarine habitat and food resources, particularly in the North and South Lagoons, benefited fish populations in the Coorong.

Investigating fish diets – Yelloweye mullet

Identifying what fish eat and quantifying the composition of food items that make up a fish's diet can be done by directly examining stomach contents. Yelloweye mullet are a highly valued Coorong fish species and have a diverse diet including microcrustaceans, amphipods, polychaetes, detritus and vegetation (Figure 2). A study focusing on the diet of yelloweye mullet showed a clear post-flood shift from March 2023 to December 2023, owing to the increased consumption of polychaete worms in December.

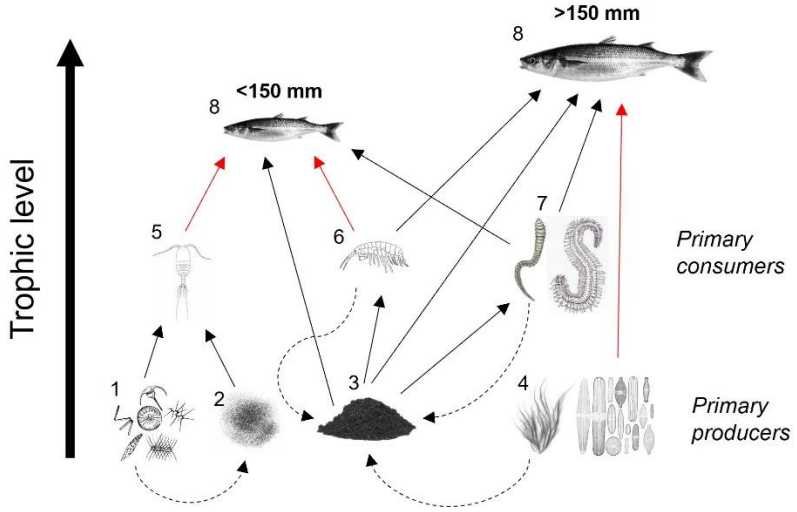

Figure 2. Conceptual food web diagram of the Coorong during high flows in March and December 2023, focusing on main trophic links for small (<150 mm) and large (>150 mm) yelloweye mullet. Red trophic links show the key differences in diet of the two size classes. Food items are (1) phytoplankton, (2) suspended particulate organic matter, (3) benthic detritus, (4) vegetation, (5) microcrustaceans, (6) benthic macro-crustaceans, (7) polychaetes and (8) yelloweye mullet.

Chemical tracing of item origins in fish muscle

When we eat food, it is converted into building muscles and bone to maintain our bodies. Food can differ in its chemical make-up depending on where it comes from (e.g. from the land, from the sea). Carbon and Nitrogen are two important elements that are a staple part of all 'food' for humans, fish, plants, birds and can easily be traced through ecosystem food webs by their different 'signatures' at trophic levels. Carbon originating from different sources (e.g. primary producers) can show different values.

In this study, carbon (δ13C) observed in the muscle tissue of small yelloweye mullet (<150 mm) in the Murray Mouth Area and North Lagoon during March 2023 was consistent with that for primary producers from the lower River Murray (-22 to -32 ‰), suggesting that small mullet diets were being supplemented with foods of freshwater origins (Figure 3). Interestingly, this appeared not to be the case for larger yelloweye mullet (>150 mm) whose carbon values were similar to prior to the flood period of March 2012.

Figure 3. Images of primary producers from the lower River Murray.

PROJECT TEAM: **University of Adelaide:** Luke Mosley, Michelle Waycott, Emily Leyden, Brett Thomas; **Flinders University:** Sabine Dittmann; **PIRSA-SARDI:** Qifeng Ye, Jason Nicol; **Goyder Institute:** Bryony Cotterell, Alec Rolston.

REFERENCE: Qifeng Ye, Jason Nicol

CONTACT: **E** enquiries@goyderinstitute.org

This project was completed from August 2023 - March 2024.