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Darling Baaka River Health Project

Fish technical report

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Cover image: NSW DPRID Fisheries staff sampling freshwater fish using boat electrofishing on the Darling-Bakka River. Photo credit: NSW DPIRD Fisheries

Preamble

In response to the 2023 flooding event in the lower Darling-Baaka region, and subsequent fish kills in the Menindee weir pool, a river health and recovery monitoring program (the Darling Baaka River Health Project 'DBRHP') was established. The DBRHP was designed and delivered by the NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW) Science and Insights Division, in partnership with the NSW Environmental Protection Authority (EPA). The DBRHP is delivered under the EPA's Recovery Program for Water Quality Monitoring in the Darling-Baaka and is funded as a Category D recovery measure under the joint Commonwealth and NSW Government Disaster Recovery Funding Arrangements.

A primary goal of the DBRHP is to deliver ecological monitoring of a range of river health indicators to inform community understanding of event recovery, and guide future research and water management of the system. The assessment of river health in the DBRHP is conducted by adapting the River Condition Index (RCI) (DCCEEW 2023) to the unique characteristics of the lower Darling-Baaka River system in order to measure ecosystem health and track recovery post flood. NSW Department of Primary Industries and Regional Development - Fisheries, in collaboration with DCCEEW have been engaged to undertake an assessment of fish communities in the region, to inform the biodiversity condition index within the RCI framework.

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Introduction

The Darling-Baaka River and Menindee Lakes provide critical ecological value for native freshwater fish, serving as essential habitats for species such as Murray cod, golden perch, silver perch, and bony herring. These interconnected waterways act as important breeding, nursery, and refuge areas. The Menindee Lakes function as a crucial floodplain wetland system, supporting fish recruitment by providing sheltered, food-rich environments for juvenile fish. Additionally, the river and lakes sustain a range of aquatic and riparian ecosystems, supporting not only fish but also macroinvertebrates and other aquatic fauna that form the base of the food web. The health of these systems is vital for maintaining and enhancing fish populations and ensuring the long-term sustainability of native freshwater species in the Murray-Darling Basin (MDB).

In March 2023 an estimated 20–30 million fish died in the Darling-Baaka River near the town of Menindee, New South Wales (NSW) because of poor water quality (NSW Chief Scientist 2023). This event was preceded by a prolonged flood, extended drought and previous mass fish deaths in the region (Australian Academy of Science 2019, Jackson and Head 2020, Sheldon et al. 2022). Collectively, these fish death events have had severe ecological consequences, depleting local fish populations and disrupting aquatic food webs in the region (Stocks et al. 2022).

The DBRHP encompasses the Darling-Baaka River and its floodplain from approximately 100 km upstream of Wilcannia down to Wentworth and includes the Great Darling Anabranch. A key project activity is to develop baseline monitoring metrics using the established RCI framework (Healey et al. 2012, NSW DPE 2023). This includes development of a reach-scale biodiversity condition index with fish as a core indicator. The project will deliver an overall report card on the health of the Darling-Baaka River (DCCEEW 2025).

The RCI biodiversity condition index is comprised of several indicators, including the Fish Condition Index. While the RCI outputs are inherently simple (i.e. a fish condition index is generated to capture the overall population health, ranging from 0–100), their calculation including the input data can be quite complex and difficult to interpret. As such, the objective of this current report is to provide detailed information on the status and long-term trends of key freshwater fish species in the region, to aid interpretation and provide context for the RCI scores and native fish status more generally. The outputs presented draw upon data specifically collected for this project, as well historic datasets for some selected species that have been reported elsewhere and are used to add context for the trends reported here.

Methods

Sampling sites

A total of 31 fish sampling sites were selected for this study, with locations chosen based on alignment with historic sampling sites, collection of other aligned indicators for the project, and to ensure spatial coverage over the entire study region (Figure 1). Field sampling was undertaken twice, in both May 2024 (autumn sampling) and again in November/December 2024 (spring sampling). Complementary data from eight additional sites was available in May 2024, bolstering the number of sample sites to n=39 and enabling calculation of a fish condition index (FCI) to be incorporated into the RCI framework for n=5 spatial zones or river reaches (*see* DCCEEW 2025). Data from the additional eight sites included in metric calculation from the May 2024 sampling are excluded further from this report to aid direct seasonal comparisons.

Field data collection

Fish community data was collected from each site using a standardised technique comprising a combination of fixed-effort boat-electrofishing (n=12 operations, each consisting of 90 seconds 'on-time' using a 7.5 kW Smith-Root model GPP 7.5 H/L boat mounted electrofishing unit) and unbaited minnow traps (n=10; 5 mm stretched mesh, dimensions of 250 × 250 × 480 mm and an entry diameter of 50 mm) deployed for a minimum of 1.5 h soak time in edge habitats.

All captured fish were identified to species level and released onsite. Individuals were measured to the nearest mm, and additionally medium-large bodied species weighed to the nearest g. Where large catches of species occurred, a sub-sample of individuals was measured and examined for each gear type. The sub-sampling procedure consisted of firstly measuring all individuals in each operation until at least 50 individuals had been measured in total. The remainder of individuals in that operation were also measured, although any individuals of that species from subsequent operations of that gear type were only counted and not measured. Fish that escaped capture but could be positively identified were also counted and recorded as "observed". Any visible health condition was noted for all individuals measured.

Fish condition index calculations

Fish condition index calculations were based on the fish community status index developed for the Sustainable Rivers Audit (FCI; Davies et al., 2008). Data were first portioned into recruits and non-recruits. Large-bodied and generally longer-lived species (maximum age >3 years) were considered recruits when length was less than that of a one-year-old. Small-bodied and generally short-lived species, that reach sexual maturity in less than one year, were considered recruits when length was less than average length at sexual maturity. Recruitment lengths were derived from published scientific literature or by expert opinion when literature was not available. Eight fish metrics were calculated using the methods described by Robinson (2012). These metrics were subsequently aggregated to produce three indicators (Nativeness, Expectedness and Recruitment), and to derive a single Fish Community Index. Metric and indicator aggregation used Expert Rules analysis in the Fuzzy Logic toolbox of MatLab (The Mathworks Inc. USA) (Davies et al. 2010, Carter 2012). Metrics were calculated at the reach scale, with individual sites aggregated into one of five pre-defined 'reach scale' zones based on delineation by waterbody (i.e. Great Darling Anabranch versus lower Darling-Baaka River) and further by logical separation of reaches by major weirs where site replication allowed. These included Zone 1 – Wilcannia to Lake Wetherall (n=9 sites), Zone 2 – Menindee Main Weir to upstream of Weir 32 (n=7 sites), Zone 3 – Weir 32 to upstream of Pooncarie Weir (n=9 sites), Zone 4 – Pooncarie Weir to Wentworth (n=6 sites), and Zone 5 – Great Darling Anabranch including Tandau Creek (n=8 sites) (Table 1). As reach-scale indices are presented rather than a sub-catchment index, no weighting by stream length was undertaken.

The Expectedness index is the proportion of native species that are now found within the relevant catchment and altitudinal zone, compared to a historical reference condition. The index value is derived from two input metrics; the observed native species richness relative to the expected species richness at each site, and the total native species richness observed within the zone over the total number of species predicted to have existed within the zone historically (Robinson 2012). The Nativeness index is the proportion of native compared to alien fishes and is derived from three input metrics; proportion of total biomass that is native, proportion of total abundance that is native and proportion of total species richness that is native (Robinson 2012). The Recruitment index represents the recent reproductive activity of the native fish community, and is derived from three input metrics; the proportion of native species showing evidence of recruitment, the average proportion of sites at which each species captured was recruiting (corrected for probability of capture based on the number of sites sampled), and the average proportion of total abundance of each species that are new recruits (Robinson 2012). The three indicators above are aggregated to generate a weighted (by pre-defined indicator value) overall Fish Condition Index (Carter 2012) that is presented below, with scores based on wording derived for the RCI grades ranging from very poor to very good. These FCI values form a component of the RCI scores reported in the DBRHP report card (DCCEEW 2025).

Table 1 Fish zones and sample sites within each zone.

River reach zone	Fish zone name	Site numbers
Zone 1	Wilcannia to Lake Wetherell	S1–S9 (n = 9)
Zone 2	Menindee weir pool	S10–S14, A, B (n = 7)
Zone 3	Pooncarie North	S15–S20, C, D, E (n = 9)
Zone 4	Pooncarie South	S21–S23, F, H, G (n = 6)
Zone 5	Great Darling Anabranch	S24–S31 (n = 8)

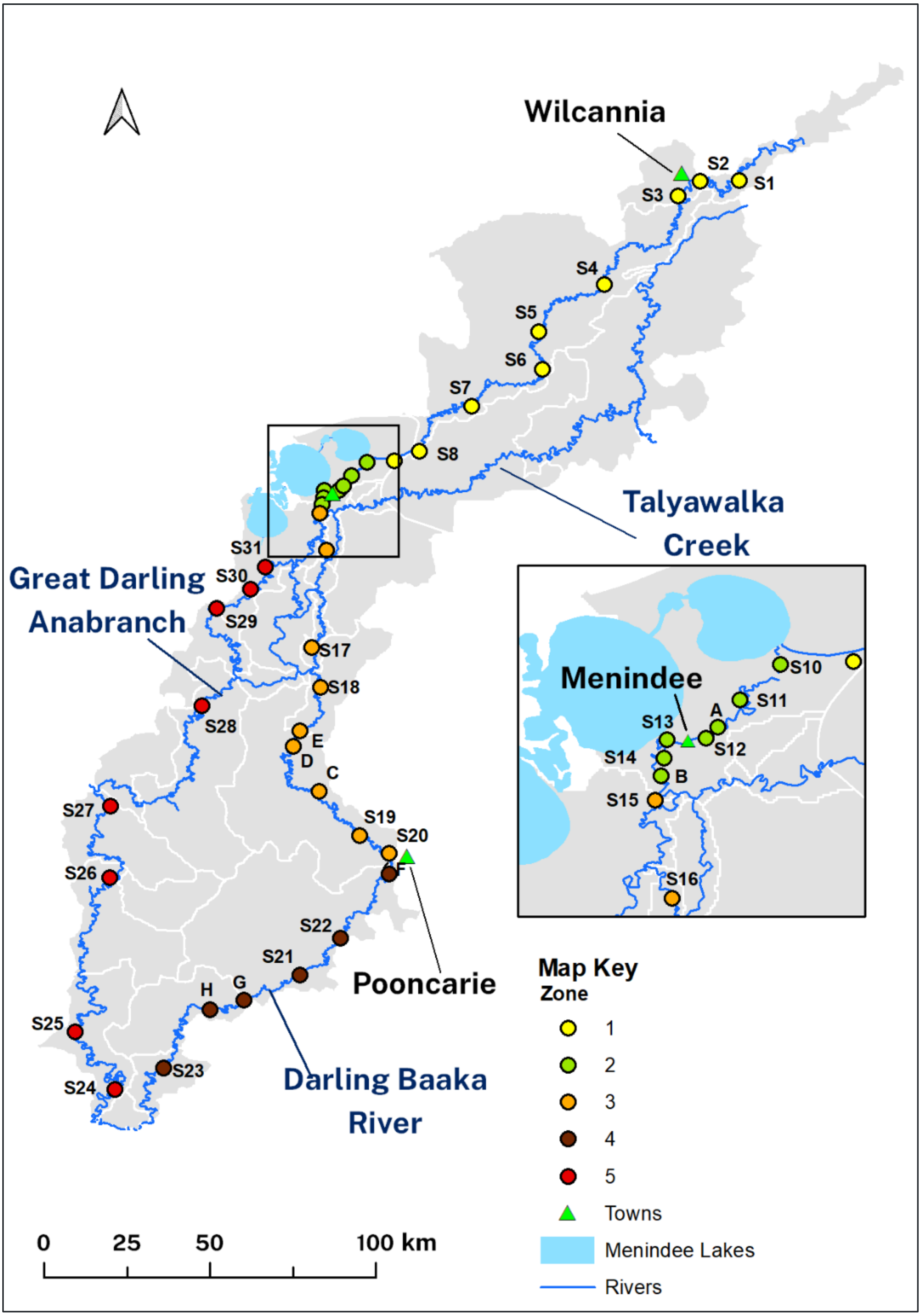

Figure 1. Location of DBRHP fish sampling sites (s1–s31) sampled in Autumn and Spring 2024, and corresponding river reach zone (*see* DCCEEW 2025). Additional sampling sites used in reporting of fish condition index for Autumn 2024 are indicated by letters (A–H) although are not used in any further reporting.

Results

Fish community structure

A total of 5,491 fish were captured across the study, comprising seven native fish species and three alien species (Table 2; Figure 2). In order, bony herring, common carp and carp gudgeon were the most abundant species respectively, regardless of sampling event. The remaining seven species of fish were present at low to moderate abundance. Of these species, silver perch were the only species not captured across both sampling events having only been recorded during the Spring sampling. Eight species of fish were historically predicted to have occurred in the region and were not sampled under the current monitoring, although of these only short-headed lamprey and southern purple-spotted gudgeon have not been detected in the study region in the past 25 years. The remaining six species are either at such a low abundance that they evaded detection, occupy habitats (i.e. floodplain lakes) that were not sampled as part of the current program and/or have a temporally variable distribution associated with drought and flooding cycles (i.e. Hyrtl's catfish presence in the lower Darling-Baaka River (LDBR) is typically associated with flood-dispersal from the northern MDB) (Figure 3).

Individual species catch was highly variable among spatial zones and sampling events (Figure 4). For example, catches of Australian smelt, common carp, goldfish and spangled perch were highest in the Great Darling Anabranch (Zone 5) compared to other zones, particularly in Autumn 2024. In comparison, the highest catches of bony herring, Murray cod, golden perch and silver perch occurred in Zone 4 (the most downstream LDBR zone) and were typically higher in this zone in Autumn than Spring (Figure 4).

Common carp dominated the fish biomass in all zones and sampling events, with biomass highest in Zone 2 in Autumn 2024, immediately downstream from Menindee Main Weir (Figure 5). Murray cod, golden perch and bony herring contributed higher relative biomass in Zone 4, particularly during the Autumn sampling event. The biomass contribution from all other species was relatively low, owing to either their small size (and associated weight) or comparatively low catches (Figure 5).

Figure 2 Examples of large bodied native fish captured from the Darling-Baaka River in this project, including (from left to right) silver perch, golden perch and Murray cod. Photo credit: NSW DPIRD Fisheries.

Table 2 Total catch (number of biological measurements in parentheses) of native and alien species captured as part of this current study (pooled by n=31 sites) across two sampling events. Native species with known historical and/or predicted distribution in the region but not captured in this study are included in the species list for context and indicated by zero catch.

	Sampling event	
Native species	May 2024	Nov/Dec 2024
Australian smelt *Retropinna semoni*	130 (130)	37 (37)
bony herring *Nematalosa erebi*	1491 (1211)	1061 (851)
carp gudgeon *Hypseleotris spp*	177 (167)	486 (331)
eel-tailed catfish *Tandanus tandanus*	0	0
flat-headed gudgeon *Philypnodon grandiceps*	0	0
golden perch *Macquaria ambigua*	115 (115)	126 (126)
Hyrtl's catfish *Neosilurus hyrtlii*	0	0
Murray cod *Maccullochella peelii*	13 (13)	12 (12)
Murray-Darling rainbowfish *Melanotaenia fluviatilis*	0	0
olive perchlet *Ambassis agassizii*	0	0
Short-headed lamprey *Mordacia mordax*	0	0
silver perch *Bidyanus bidyanus*	0	5 (5)
Southern purple spotted gudgeon *Mogurnda adspersa*	0	0
spangled perch *Leiopotherapon unicolor*	56 (56)	7 (7)
unspecked hardyhead *Craterocephalus stercusmuscarum fulvus*	0	0
Alien species		
common carp *Cyprinus carpio*	967 (797)	614 (574)
Eastern gambusia *Gambusia holbrooki*	3 (3)	9 (9)
Goldfish *Carassius auratus*	130 (114)	52 (52)

Figure 3 Examples of native species not captured in this project but detected in the region previously, including (clockwise from top left): olive perchlet, Hyrtl's catfish, eel-tailed catfish, and flat-headed gudgeon. Photo credit: Gunther Schmida (used with permission).

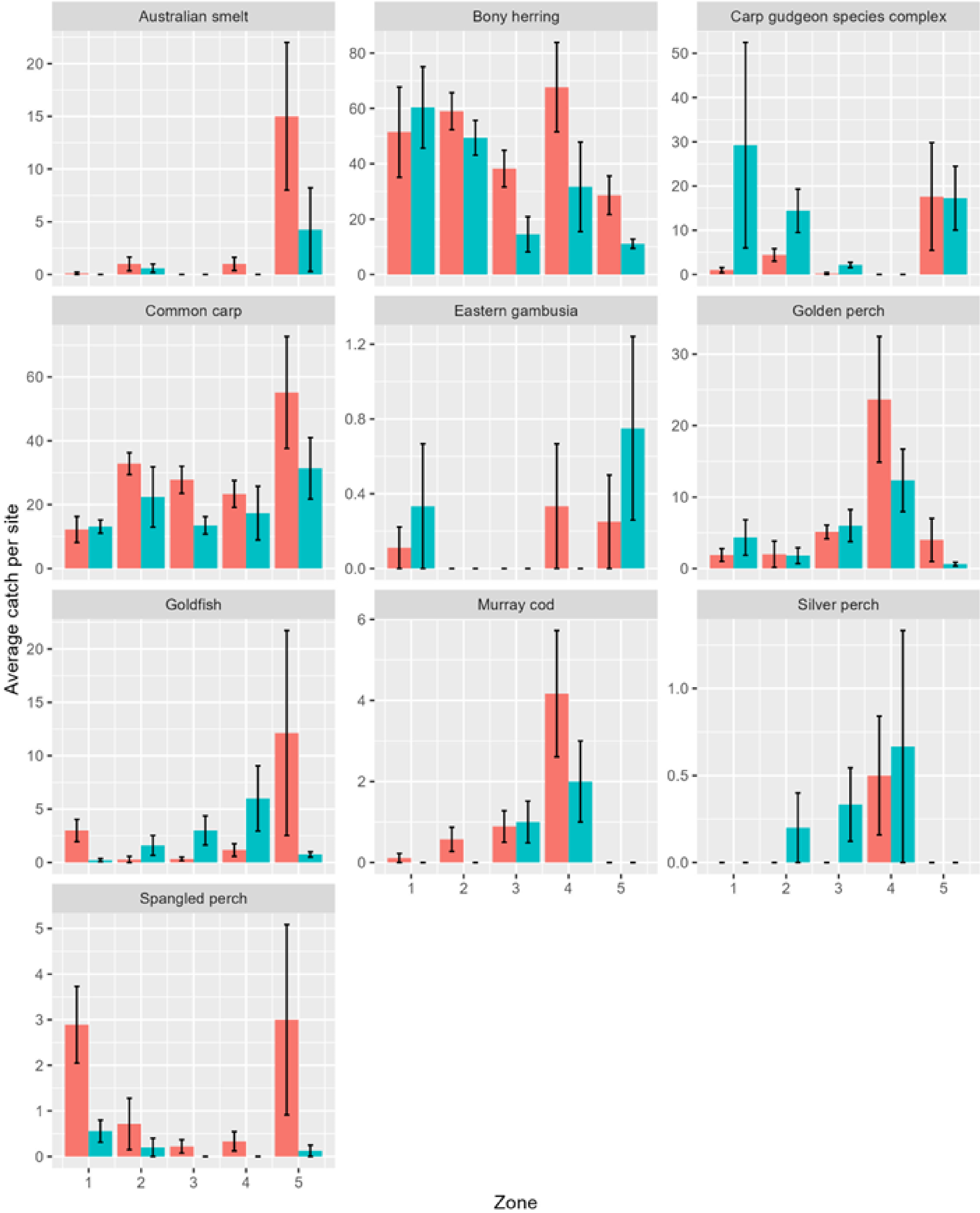

Figure 4 Relative abundance (average catch per site ± SE) of fish captured among different spatial zones (1–5) in the Darling-Baaka River. Different coloured bars represent distinct sampling events undertaken in Autumn 2024 (orange) and Spring 2024 (blue).

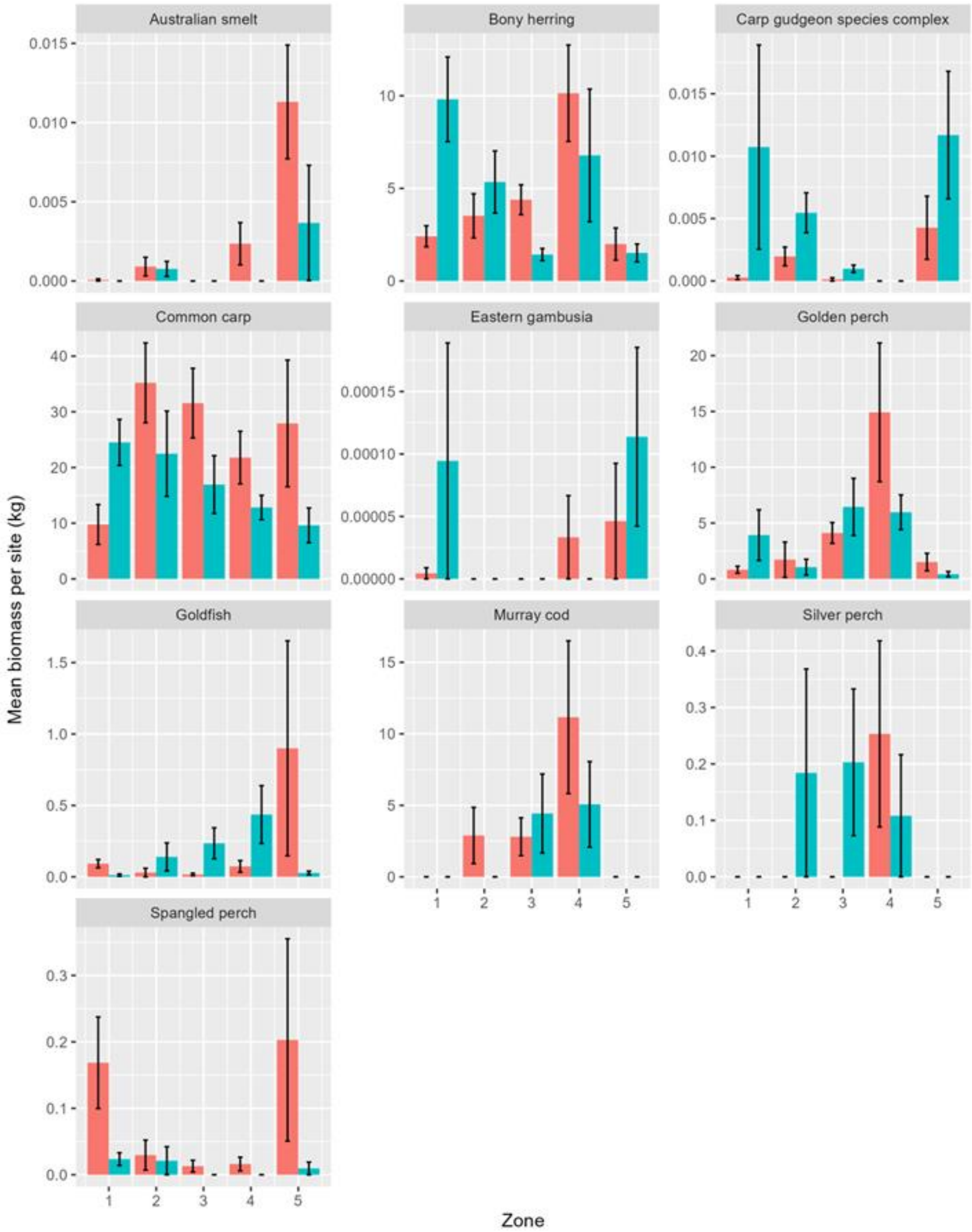

Figure 5 Relative biomass (average biomass per site ± SE) of fish captured among different spatial zones (1–5) in the Darling-Baaka River. Different coloured bars represent distinct sampling events undertaken in Autumn 2024 (orange) and Spring 2024 (blue).

The size frequency distribution (Figure 6, Figure 7) provides insight into population structure for different species, in combination with the relative abundance and biomass estimates presented in Figure 4 and Figure 5. For example, common carp relative abundance was highest in Zone 5 (Great Darling Anabranch; Figure 4) in each sampling event, although relative biomass was typically lower in this zone, particularly during Spring 2024 (Figure 5). This was due to a high proportion of recent recruits (i.e. young-of-the-year indicated by shading left of the dashed vertical line in Figure 6) in Zone 5 during Spring 2024 and few larger individuals (Figure 6).

Recent recruits of bony herring, common carp, and goldfish were detected across most sampled zones during the project (Figure 6). Recent recruits of small-bodied species were also commonly recorded which was expected given they're typically short-lived (Figure 7). The lack of recent recruits of spangled perch (Figure 7) is unsurprising given the species likely recruited on preceding flood-events and dispersed downstream on the flood pulse.

The presence of small size classes of golden perch, but not young-of-year recruits, is consistent with previously documented spawning and recruitment on preceding flow events (i.e. 2020–2023) and their dispersal away from the Lakes into river habitats (Figure 6). Few Murray cod and silver perch were captured, making inference into their size structure problematic, although Murray cod rarely inhabit the Great Darling Anabranch, populations are particularly low upstream of the Lakes, and the LDBR population has suffered severe declines impacting all size classes resulting from a series of fish kill events.

To provide temporal and spatial context for the results already presented, the long-term trends in relative abundance and biomass are included (from Schilling and Crook 2025) for four commonly occurring medium to large-bodied species: Murray cod, golden perch, bony herring and common carp (Figures 8–11).

From this, small fluctuations are apparent over the time series for the relative abundance and biomass of Murray cod in the LDBR, and at times both the relative abundance and biomass exceed that of the overall MDB (Figure 8). More recently, repeated fish kills have depleted Murray cod stocks which is reflected in the current data and long-term trends.

Likewise, fluctuations are apparent for the long-term trends in LDBR golden perch populations, although major changes are related to episodic recruitment resulting from the breaking of the Millenium Drought (Figure 9). Recent localised population impacts have likely been buffered by replacement of fish from the Menindee Lakes and both the northern and southern MDB, given the repeated high flow events, associated strong recruitment in the Lakes and subsequent opportunities for dispersal.

Similarly, bony herring (Figure 10) and common carp (Figure 11) demonstrate substantial population fluctuations associated with episodic recruitment, with common carp population responses in both the LDBR and more broadly the entire MDB closely linked to high flow and flooding cycles.

Figure 6 Size frequency distribution of medium and large-bodied fish captured in the Darling-Baaka River, separated by spatial zone (1–5). Different colours represent distinct sampling events undertaken in Autumn 2024 (orange) and Spring 2024 (blue). Dashed vertical lines represent approximate size at one year of age.

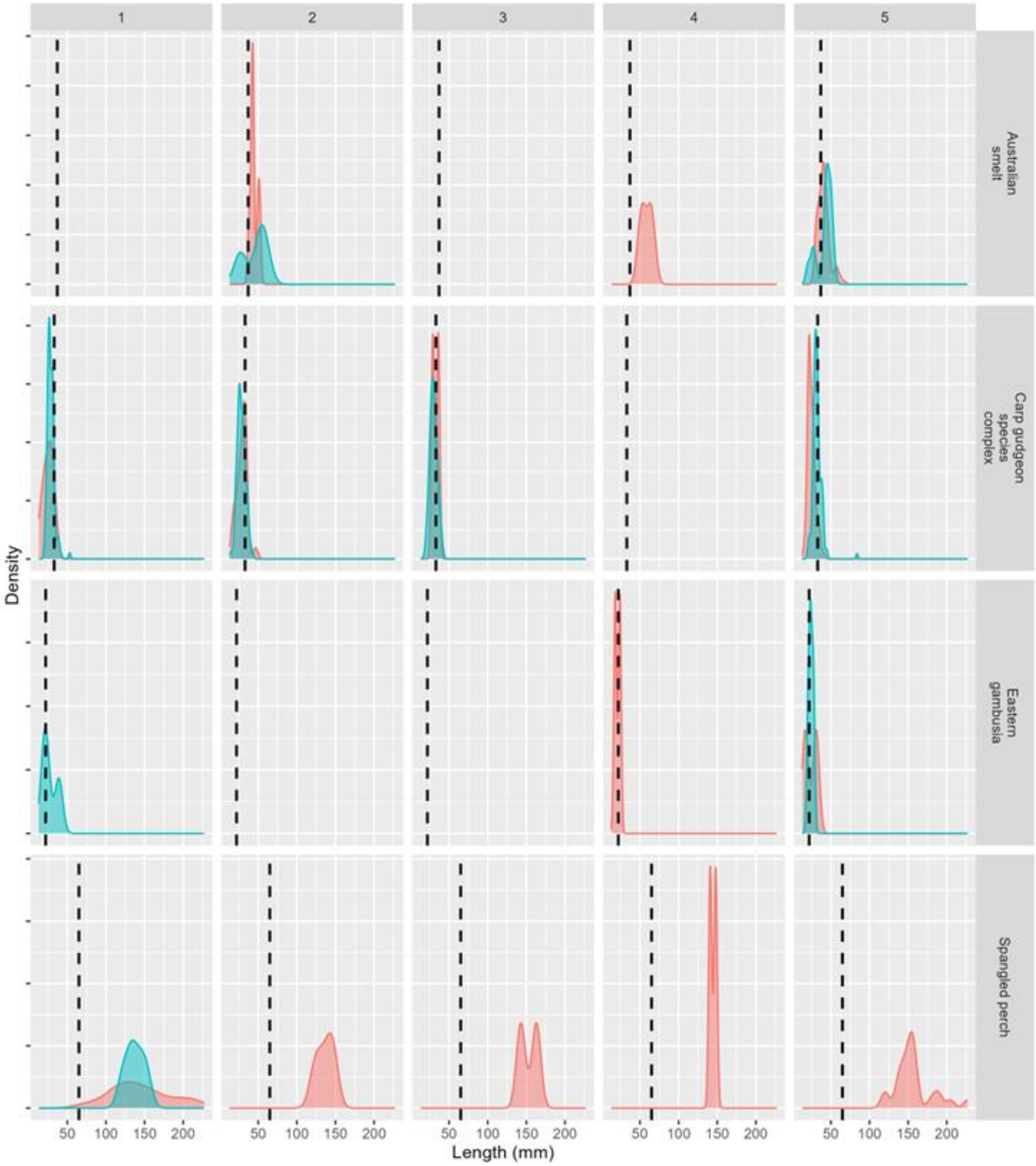

Figure 7 Size frequency distribution of small-bodied fish captured in the Darling-Baaka River, separated by spatial zone (1–5). Different colours represent distinct sampling events undertaken in Autumn 2024 (orange) and Spring 2024 (blue). Dashed vertical lines represent approximate size at sexual maturity.

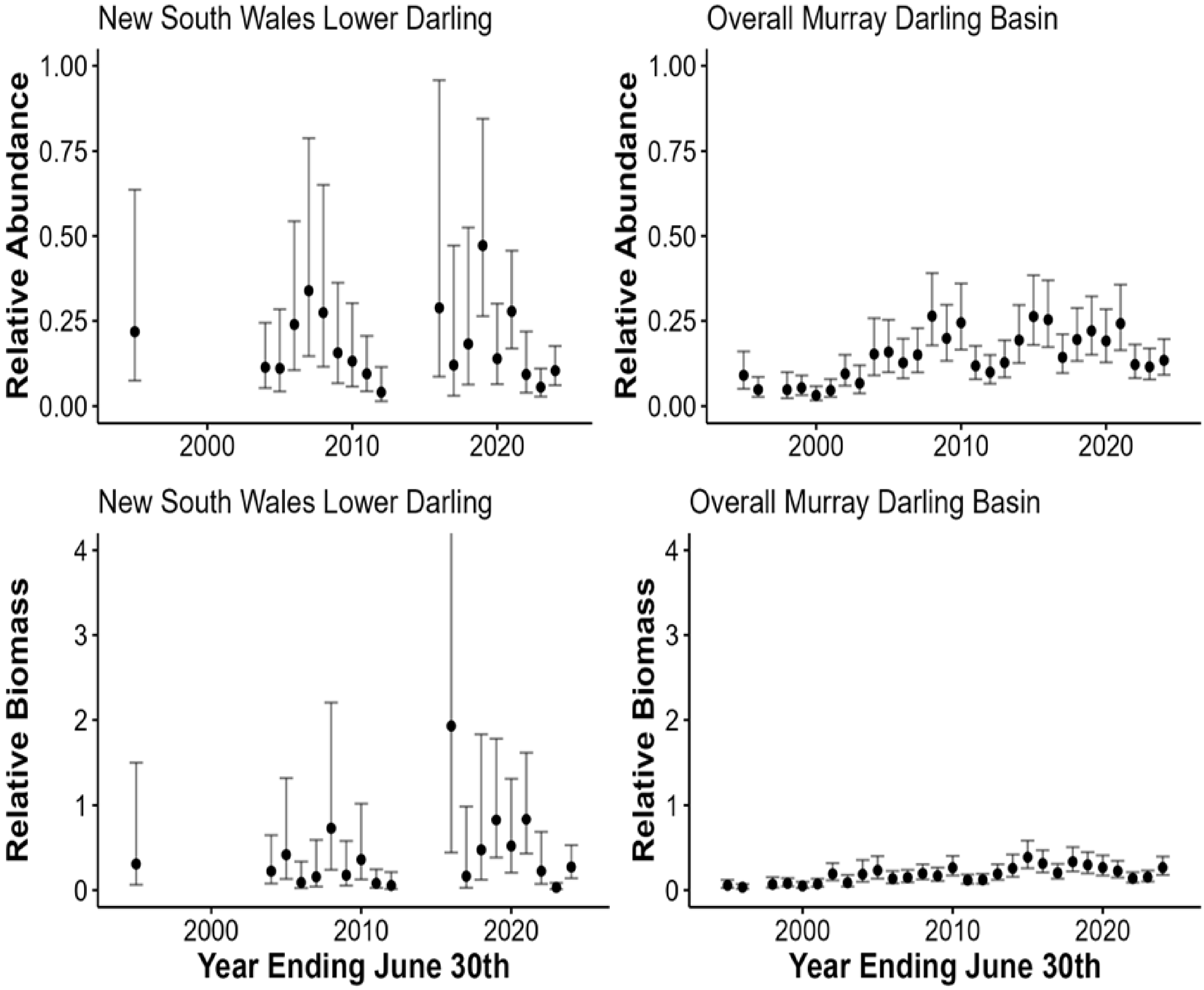

Figure 8 Long-term relative abundance and biomass of Murray cod in both the New South Wales Lower Darling WRPA and the overall NSW MDB. These are model estimates based upon all boat electrofishing data within the NSW DPIRD Freshwater ecosystem database and the output of generalised linear mixed models. Error bars show the 95% confidence intervals around the estimates. Source: (Schilling and Crook 2025).

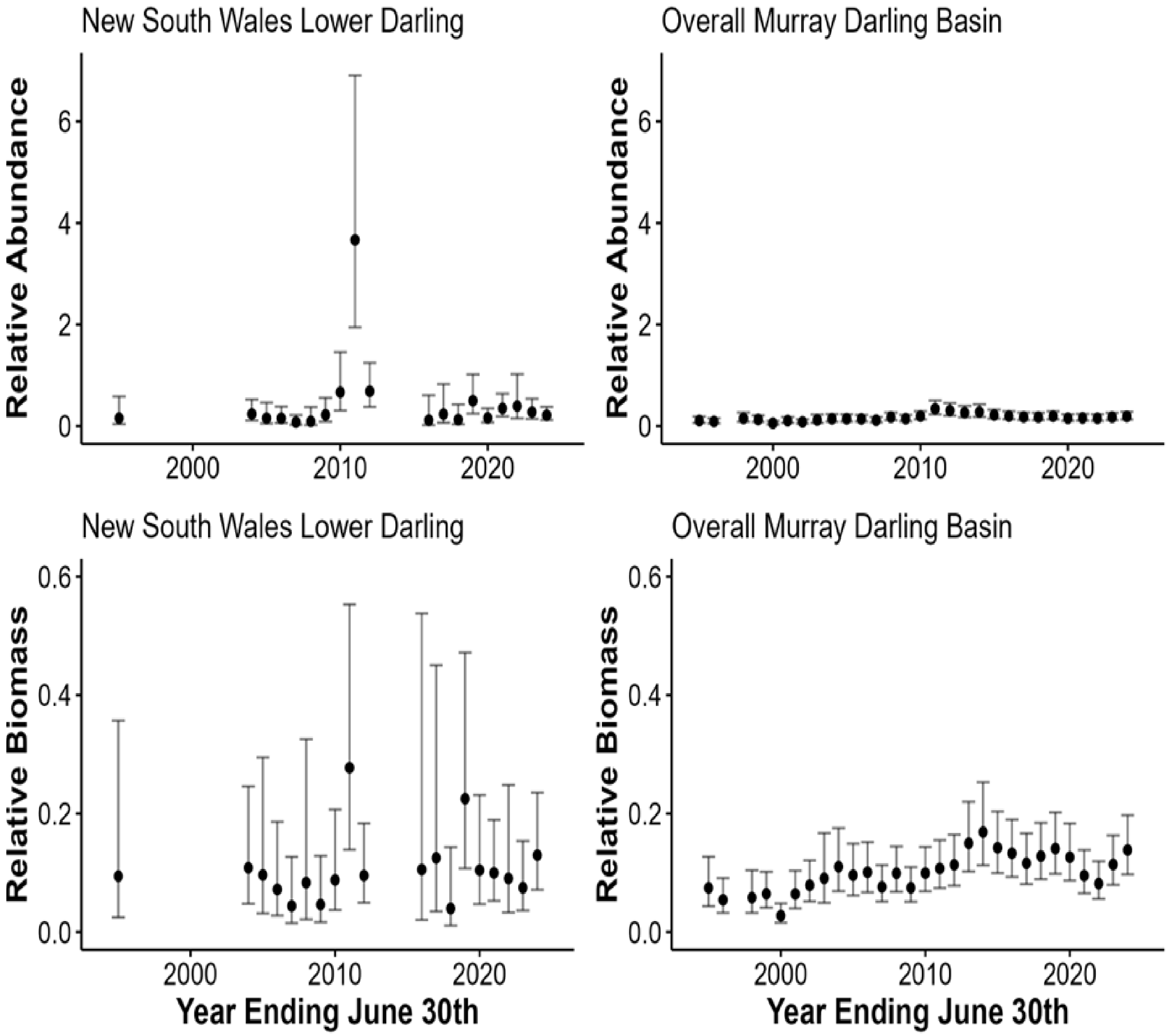

Figure 9 Long-term relative abundance and biomass of golden perch in both this valley and the overall Murray-Darling Basin. These are model estimates based upon all boat electrofishing data within the NSW DPIRD Freshwater ecosystem database and the output of generalised linear mixed models. Error bars show the 95% confidence intervals around the estimates. Source: (Schilling and Crook 2025).

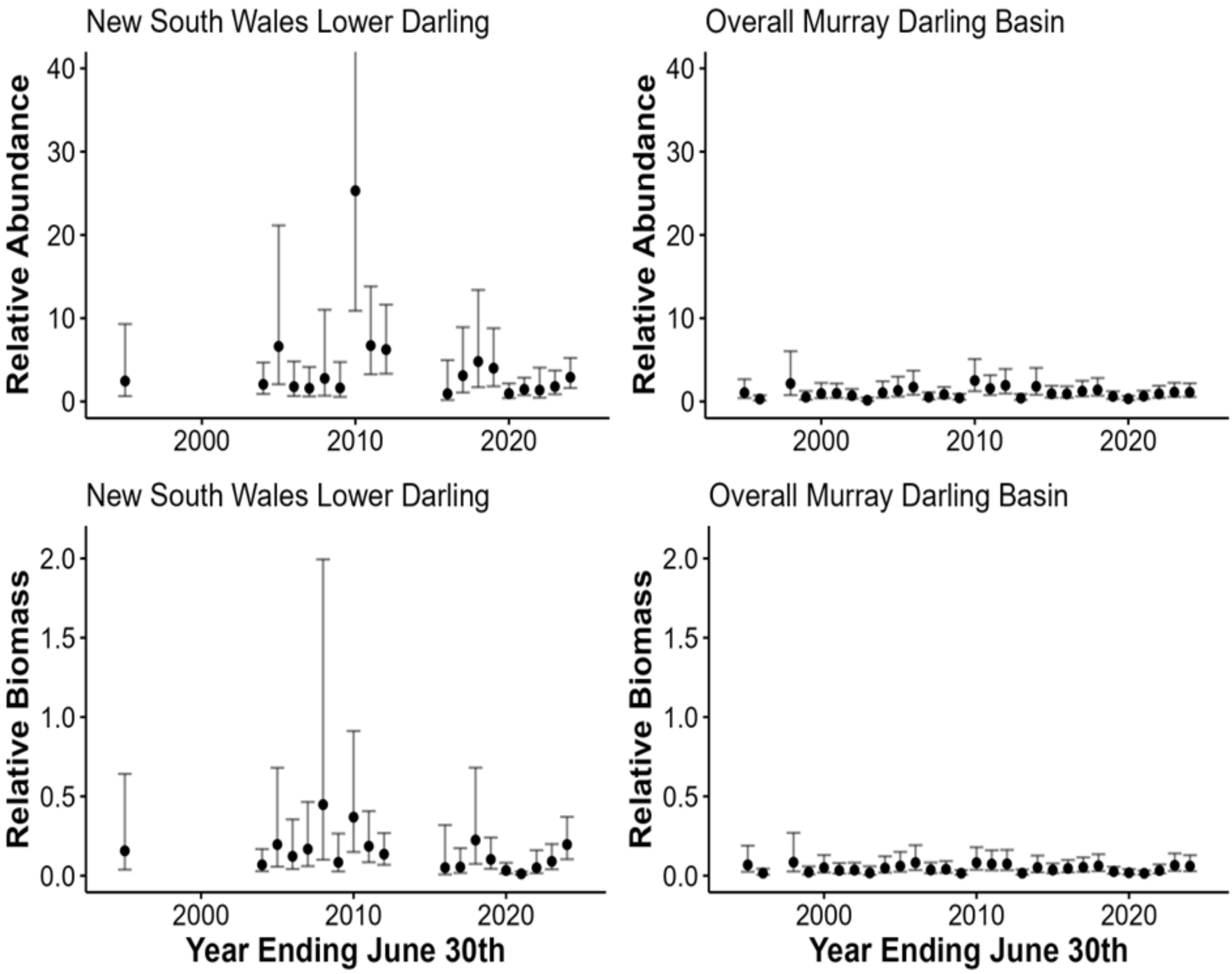

Figure 10 Long-term relative abundance and biomass of bony herring in both the New South Wales Lower Darling WRPA and the overall NSW MDB. These are model estimates based upon all boat electrofishing data within the NSW DPIRD Freshwater ecosystem database and the output of generalised linear mixed models. Error bars show the 95% confidence intervals around the estimates. Note some error bars are truncated for clarity. Source: (Schilling and Crook 2025).

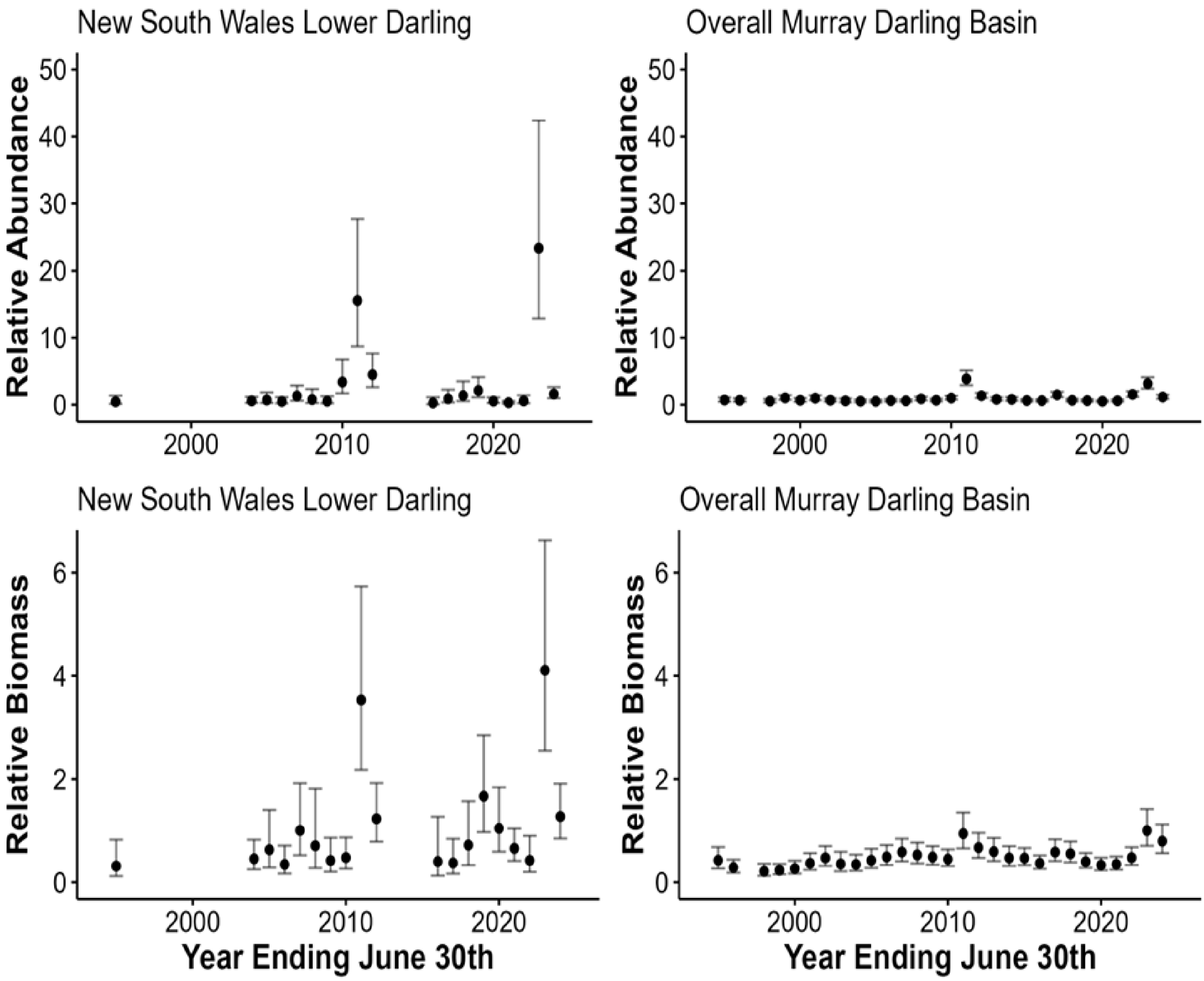

Figure 11 Long-term relative abundance and biomass of common carp in both this valley and the overall Murray-Darling Basin. These are model estimates based upon all electrofishing data within the NSW DPIRD Freshwater ecosystem database and the output of generalised linear mixed models. Error bars show the 95% confidence intervals around the estimates. Source: (Schilling and Crook 2025).

Fish health

Visible health conditions were predominantly apparent on golden perch, Murray cod and silver perch, in comparison to all other species (Table 3), with the proportions generally comparable to prevalence for the same species across the overall MDB (Schilling and Crook 2025). The anchorworm Lernaea was the most common health condition noted (Figure 12, Table 4), with minimal variation among sampling events in terms of infestation rate (data not presented). Other less commonly observed health conditions included lesions on common carp and fungus on bony herring (Table 4).

Table 3 Prevalence of visible health conditions on fish captured in the Darling-Baaka River, pooled for sampling events undertaken in both Autumn and Spring 2024.

Common name	Proportion with visible health issues (number)
Australian smelt	1% (167)
bony herring	1% (2062)
carp gudgeon	0% (498)
golden perch	33% (244)
Murray cod	32% (25)
silver perch	40% (5)
spangled perch	10% (63)
common carp	6% (1377)
Eastern gambusia	0% (12)
goldfish	5% (166)

Figure 12 A golden perch captured from the Great Darling Anabranch in Spring 2024 with substantial numbers of Lernaea (anchorworm), a common parasite. Photo credit: NSW DPIRD Fisheries.

Table 4 Number of visible health conditions noted for fish sampled in the Darling-Baaka River in Autumn and Spring 2024.

		Visible health condition				
Sampling event	Common name	Deformity/ Emaciated	Fungus	Lernaea	Lesions/Ulcers/ Wounds	Other
Autumn 2024	Australian smelt			1		
	bony herring		11	1	1	
	golden perch			31		
	Murray cod			7		
	spangled perch		3	1		
	common carp	1		10	14	
Spring 2024	bony herring	3	4		6	1
	golden perch	2		44	4	
	Murray cod			1		
	silver perch			2		
	spangled perch			2		
	common carp	1	2	44	13	
	goldfish	1		1	7	
Total		8	20	145	45	1

Fish Condition Index

The fish condition status index calculations indicate the fish communities are experiencing stress across the entire study area (Table 5). All zones in the Darling-Baaka River recorded fish condition indicator values less than 19, indicating that the fish communities present are in very poor condition. The Great Darling Anabranch zone recorded a marginally better fish condition indicator value of 35, placing it at the lower boundary of the poor condition grade.

Table 5 Fish zones and sample sites within each zone.

River reach zone	Fish zone name	FCI score (± SE) (maximum 100)	Condition
Zone 1	Wilcannia to Lake Wetherell	15.7 (2.0)	Very poor
Zone 2	Menindee weir pool	15.9 (1.8)	Very poor
Zone 3	Pooncarie North	10.0 (1.2)	Very poor
Zone 4	Pooncarie South	19.9 (1.8)	Very poor
Zone 5	Great Darling Anabranch	35.5 (1.7)	Poor

Discussion

As part of the DBRHP, native fish population health in the Darling-Baaka River was classified as very poor, with the Great Darling Anabranch classified as poor (*see* DBRHP technical report (DCCEEW 2025). The information provided in this report provides an additional level of detail as to the current size structure, relative abundance, biomass and expected species of fish in the region.

A combination of a relatively low abundance and biomass of native fish species, high abundance and biomass of alien species, poor recent recruitment and numerous 'missing' species all contribute to the low observed fish condition index values. Although the data and reporting framework used in the present study has been collected and analysed for this specific purpose, none of this represents new information. The impacts of poor water quality culminating in a series of recent fish kills and the associated impacts on native fish populations has been well documented (Australian Academy of Science 2019, Jackson and Head 2020, Sheldon et al. 2022, NSW Chief Scientist 2023). These recent impacts have compounded historical native fish declines resulting from changes to the flow regime including substantial water extraction, barriers to fish passage, changes in land-use, removal of instream habitat, introduced species and overfishing (Koehn and Lintermans 2012).

Of particular concern is the low abundance of Murray cod in the region. Murray cod populations in the lower Darling-Baaka have suffered substantial declines following repeated fish kills, and this is reflected by long-term population trends, a truncated size distribution and lack of recent recruitment. Given the species is relatively sedentary, and exhibits localised spawning and recruitment, stocking and/or translocation (rather than immigration from the Murray River) is required for population recovery (Thiem et al. 2022). Indeed, Murray cod spawning and recruitment has been demonstrated to respond positively to delivered river flows and targeted flow management in both the lower Darling River (Stuart et al. 2021a, Stuart et al. 2023) and elsewhere (Stuart et al. 2019, Tonkin et al. 2021). As such, prevention of any further detrimental impacts on the local population is critical for population recovery and to maximise outcomes from improved management activities, including water management.

In contrast, golden perch populations in the Darling-Baaka region show no discernible long-term declines despite also being impacted by recent fish kills. Golden perch recruitment events are typically associated with high flow events and flooding, and numerous recruitment events following sequences of high flows from in the region 2020–2023 have been reported (Stuart et al. 2021a, Stuart et al. 2023, Stuart et al. 2024). Further, riverine populations are supplemented via dispersal from the Menindee Lakes nursery habitats as well as immigration from the Murray River (Thiem et al. 2022, Stuart et al. 2024). Indeed, the local production of golden perch from the Darling-Baaka not only re-supplies this river system, but through active dispersal of juveniles and adults can contribute to populations in numerous parts of the northern and southern MDB (Zampatti et al. 2018, Zampatti et al. 2019, Zampatti et al. 2021, Stuart et al. 2024).

Few silver perch were captured in the current study, and the species is listed under IUCN criteria as Near Threatened (Gilligan et al. 2019). Silver perch populations have undergone substantial historical declines in the Murray-Darling Basin, which is particularly apparent upstream from Menindee Main weir throughout the northern mainstem and tributary rivers. Regular recruitment is still observed in the Murray River (Tonkin et al. 2019), with immigration into the lower Darling-Baaka from the Murray contributing most individuals as opposed to localised recruitment (Thiem et al. 2022). The lack of fish passage at Menindee Main Weir outside of decadal flood cycles and Lake

Wetherell Regulator during river operations currently limits population expansion into the northern MDB.

Common carp were the second most abundant species (behind bony herring) in the Darling-Baaka, exhibiting the highest biomass across all zones and seasons, and demonstrating a strong localised recruitment response in the Great Darling Anabranch following a period of winter shutdown in flows and subsequent start up in Spring 2024. Long-term trends in recruitment typically track flood cycles, both regionally and across the entire MDB, with regional peaks in abundance and biomass corresponding to the last two flood events more than a decade apart. Once carp exceed a density threshold >80 kg/ha (which is exceeded 97% of the time in large rivers in the MDB), substantial impacts occur including decreases in macrophytes and macroinvertebrates, and increases in nitrogen, phosphorus and turbidity (Stuart et al. 2021b, Fanson et al. 2024). These impacts result in negative effects on food webs, aquatic habitat and a range of fish and other water-dependent fauna.

Numerous native fish species predicted to historically occur in the Darling-Baaka were not sampled in the current project. Two of these species, short-headed lamprey and southern purple spotted gudgeon, have not been sampled in the region in recent decades. The remaining six species are either at such a low abundance that they evaded detection, occupy habitats that were not sampled as part of the current project (i.e. floodplain lakes) and/or have a temporally variable distribution associated with drought and flooding cycles. For example, olive perchlet have recently (in the past 5 years) been captured in both the Menindee Lakes and LDBR, although in low abundance and likely as a result of dispersal during high flows from upstream populations. Similarly, Hyrtl's catfish were detected post-flood in the Great Darling Anabranch and their presence in the region is typically associated with flood-dispersal from the northern MDB. In contrast, numerous small bodied species respond positively to lower in-channel flows including Murray-Darling rainbowfish and unspecked hardyhead (Bice et al. 2014, Stocks et al. 2021), with recent elevated flows spanning 2020–2023 providing suboptimal habitat for these species.

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