

CHAPTER 5

Basin Plan Fish Monitoring Summary (2015/16 – 2024/25): Macquarie-Castlereagh Water Resource Planning Area

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5.1 Citation Details

Please cite the overall report when referring to this chapter:

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Report cover image credit: Jason Thiem, NSW DPIRD; Fish images credit: Gunther Schmida

5.2 Acknowledgements

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5.3 Introduction

This report spans 2015/16 to 2024/25 and uses all suitable fish assemblage data collected by NSW DPIRD Fisheries using standardized electrofishing monitoring techniques. The format of the report follows and expands upon the previous reports (Schilling & Crook 2023, 2024, 2025b). This report focusses on the Macquarie-Castlereagh Water Resource Planning Area (WRPA) shown in Figure 5.1.

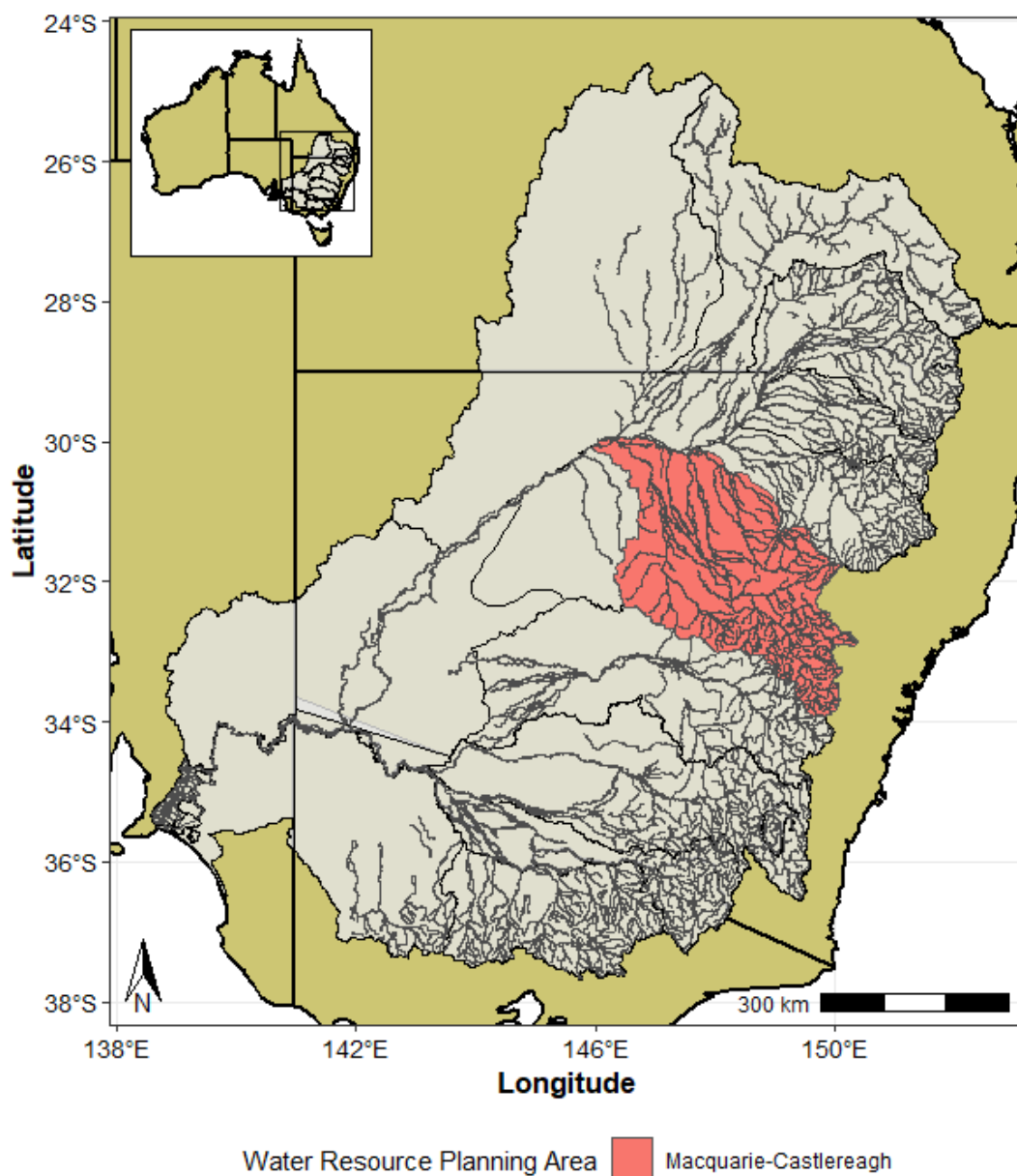


Figure 5.1: Murray-Darling Basin with the key region of this report highlighted. Inset map shows the whole of Australia with a box around the MDB.

5.3.1 What This Report Includes

This report starts with an overview of the standardised monitoring programs including sampling details and statistics. An overview of the hydrological and climatic conditions during the reporting period is also provided as context for interpreting the fish population status data.

Following the introductory sections, we present a summary of *fish diversity* across the Macquarie-Castlereagh WRP. Separate plots for native and alien species show the total number of unique species observed at each site.

The main body of the report provides detailed information on the *population structure, relative abundance, health, and distribution* of six key fish species:

- Murray cod
- Golden perch
- Freshwater catfish
- Bony herring
- Australian smelt
- Common carp

Population structure information includes length frequency plots of observed fish and the proportion of fish classified as Young of the Year (YOY). This information can be used to infer the size structure of populations and the level of recruitment each year. For additional context, we provide a summary table showing any stocking which occurred for the species in each year (if relevant).

Relative abundance and *relative biomass* (a unit-less measure representing the number (or biomass) of fish in an area) information is adapted from the modelled outputs from a more in-depth publication (Crook et al. 2023) which considers all available electrofishing data within the NSW Murray-Darling Basin (MDB). The updated analysis uses generalised linear mixed models to generate annual indices of relative abundance and biomass for each WRP. In this report we present the modelled time series of relative abundance showing the predicted number (or biomass) of fish observed per 90 second shot of electrofishing. The abundance and biomass trends for the Macquarie-Castlereagh WRP are contrasted with the overall NSW MDB dataset. It should be noted that these are modelled estimates of relative abundance/biomass, not absolute abundance/biomass as absolute estimates would require extensive calibration surveys that are not included in the monitoring program.

Health information is provided as a summary of any visible health conditions recorded for the key species. The number of health conditions observed in a fish population is generally reflective of water quality, competition, and many other factors. Fewer observations of health conditions indicate healthier populations. The health conditions detailed are any that were observed as part of the biological measurements taken. We provide a comparison of the prevalence of health conditions in the Macquarie-Castlereagh WRP and greater MDB (excluding the Macquarie-Castlereagh WRP).

Distribution maps are provided for each species to show the observed distribution of each species from electrofishing samples. The distribution maps also show the relative abundance (number of fish observed per 90 seconds of electrofishing) at each site to give an indication of how the population is spread over the landscape.

Finally, the distributions and numbers of *Threatened species* are reported. The report includes threatened species that were recorded by standardised monitoring programs in the Macquarie-Castlereagh WRP during the reporting period.

For each section of the report, we provide a *Summary Statement*. This statement provides a very brief overview of the key messages for each section.

5.3.2 Sampling Methods

Three main methods are used during routine fish monitoring surveys: boat electrofishing, backpack electrofishing and bait traps. This report mainly includes the electrofishing data with the bait traps informing the distribution of small bodied threatened species. The electrofishing was conducted using the standard methodology implemented in the Sustainable Rivers Audit (SRA; Davies et al. 2010). This usually includes 12 shots of 90 seconds “power on” during each sampling event.

As each chapter of this report compiles data from multiple projects, there is some variation in how sites were chosen and the effort of sampling conducted each year (Table 5.1). Details of which projects contributed data to this report can be seen in Table 5.7. At each site, sampling gear was applied as suited to the local conditions with either boat, backpack, or a hybrid of the two, in addition to 10 unbaited bait traps that are set in areas of the sampling reach that are not electrofished. Most sampling occurred between the months of September and May.

Table 5.1: Sampling effort (Number of sites sampled) each sampling season in the Macquarie-Castlereagh WRP. Variation in sampling effort is due to different numbers of projects and interruptions to planned sampling such as flooding, site desiccation, and extreme weather.

Sampling Season	Number of Boat Electrofishing Sites	Number of Backpack Electrofishing Sites	Number of Hybrid Sites	Total
2015/2016	27	12	15	54
2016/2017	34	16	15	65
2017/2018	11	15	13	39
2018/2019	14	21	13	48
2019/2020	5	19	13	37
2020/2021	13	16	1	30
2021/2022	12	19	10	41
2022/2023	23	19	14	56
2023/2024	26	18	12	56
2024/2025	24	9	4	37

The sites sampled during the reporting period are shown in Figure 5.2. A breakdown of sites sampled each sampling season is shown in the Appendix (Figure 5.39).

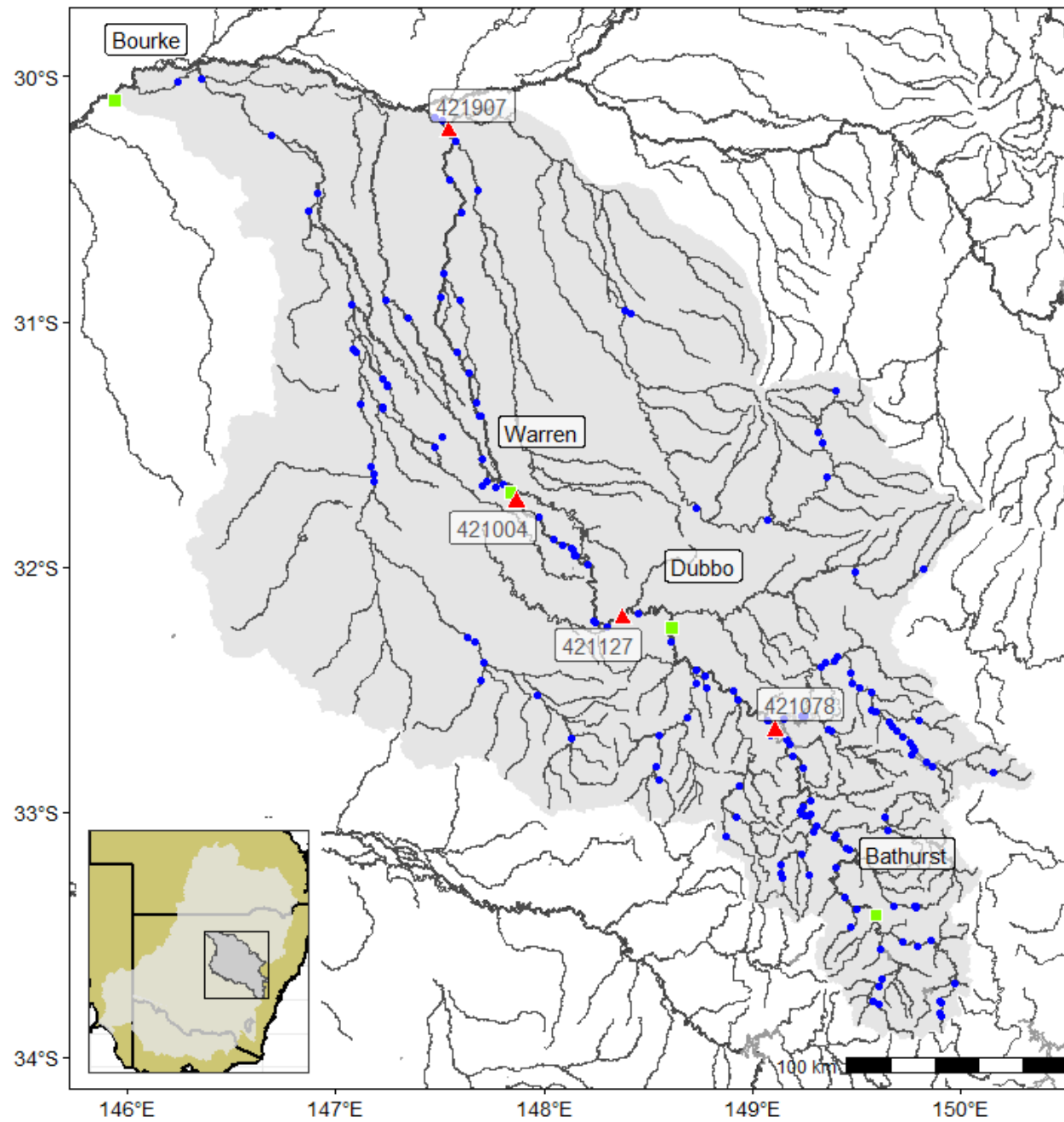


Figure 5.2: Sites (dots) sampled during the reporting period. Red triangles show key flow gauges along with their gauge ID number. Green squares show key towns

Each sampling method has a different effectiveness at sampling each species. Table 5.2 shows the total numbers of each key species caught by each method.

Table 5.2: Number of each key species caught by sample method over the 10 year period. Further data on total catch is provided in the Appendix.

Common name	Backpack Electrofishing	Boat Electrofishing	Bait Trap
Australian smelt	289	1,965	0
Bony herring	174	3,167	11
Common carp	1,165	9,583	696
Freshwater catfish	33	69	0
Golden perch	11	887	2
Murray cod	20	1,414	1

A subset of sampled fish had biological measurements taken during the surveys, including but not limited to length and weight measurements and visual health assessments. Table 5.3 shows the number of biological measurements taken each year for the key species.

Table 5.3: Number of biological measurements taken for the key species each sampling season.

Sampling Season	Australian smelt	Bony herring	Common carp	Freshwater catfish	Golden perch	Murray cod
2015/2016	287	98	894	26	131	269
2016/2017	393	455	2,609	15	235	204
2017/2018	51	127	629	6	39	101
2018/2019	56	44	643	10	38	98
2019/2020	42	26	453	2	12	39
2020/2021	100	60	180	5	26	238
2021/2022	77	119	563	4	111	89
2022/2023	241	257	1,320	11	139	135
2023/2024	85	174	1,085	4	115	124
2024/2025	70	283	603	19	87	143

5.4 Climate Overview

The following is a summary of the climatic conditions during the reporting period in terms of how the observed conditions compare to long term records. These are direct extracts from the [Australian Bureau of Meteorology climate summaries archive](#) and are written in the given year. To interpret, 2019 states it was the warmest year on record, meaning 2019 was the warmest year on record up to and including 2019 but not including more recent years.

5.4.0.1 2015

New South Wales recorded well above average temperatures in 2015. Nights were particularly warm, the sixth-warmest on record for the State. Rainfall was close to average for the state as a whole.

5.4.0.2 2016

2016 was a generally wet, warm year for NSW as a whole, with substantial variability throughout the year and across the state. Following a record-warm start to the year, May to September was the wettest such period on record for NSW, with cooler weather in much of the west of the state. Minimum temperatures were the warmest on record for the State as a whole, with record-warm daytime temperatures on parts of the east coast.

5.4.0.3 2017

The year 2017 was the warmest on record for New South Wales for both mean and daytime temperatures. It was also the State's driest year since 2006. Following the warmest summer on record for the State, heavy rain in March across the east then made way for a very dry winter and start to spring. Winter overnight temperatures were the lowest since 1997, but daytime temperatures remained above average for most of the year, and were the warmest on record overall.

5.4.0.4 2018

2018 was the warmest on record for New South Wales for both mean temperature and mean maximum temperature, whilst the mean minimum temperature was fourth-warmest on record. The year was dominated by very dry conditions, with the third-driest January to September on record. October to December saw some relief from the dry, with above average rainfall across parts of the State. Despite this, New South Wales experienced its sixth-lowest annual rainfall on record; its driest year since 2002.

5.4.0.5 2019

2019 was the driest and warmest year on record for New South Wales. Despite some rain in some months, most of the State received much less rainfall than usual, with the northeast and far west particularly dry. Heatwaves in January brought very high temperatures, and large fires from September onward caused extensive damage and persistent smoke.

5.4.0.6 2020

2020 saw above average temperature and rainfall in New South Wales. Temperatures were above average across the state in most months except during autumn. There was widespread rain during autumn and spring and in December, but early winter and November rain was below average.

5.4.0.7 2021

New South Wales had its 6th wettest year on record, with 2021 rainfall 30% above average. This included significant floods along the east coast in March, and the state's wettest November on record. It was the state's coolest year since 1996, at 0.15 °C above the 1961–1990 average.

5.4.0.8 2022

2022 was exceptionally wet with the state-averaged annual total being the second-highest on record (since 1900) and many sites recording their highest annual totals on record. Maximum temperatures were lower than average with the state-averaged annual maximum temperature being the coolest since 1992. Minimum temperatures were generally warmer than average with the state-averaged annual minimum temperature being 0.73 °C above the 1961–1990 average.

5.4.0.9 2023

The state-averaged rainfall was 22.9% below the 1961-1990 average. Rainfall was above average over small parts of the state's south, west of the Great Dividing Range, while being below average over most of the northern half of the state, especially over parts of the Northern Tablelands, Northern Rivers, Mid-North Coast, and Upper Hunter, where annual rainfall was in the lowest 10% of historical records (since records began in 1900). State-averaged annual maximum temperature was 1.96 °C above the 1961-1990 average, which is the third highest on record.

5.4.0.10 2024

Rainfall totals in 2024 were above average to very much above average for the northern and western areas of the state, as well as central parts of the coast. Totals were below average for large parts of the south-east, as well as small parts of the state's north-east and south-west. Mean maximum temperatures in 2024 were above average to very much above across the state, and highest on record around southern parts of the South West Slopes and Snowy Mountains districts.

5.4.0.11 2025

The 2025 NSW climate summary is not yet available but in early 2026 it will be available [here](#).

5.5 Flow Data

Below shows a summary of flow data from a variety of flow gauges in the Macquarie-Castlereagh WRP (Figure 5.3).

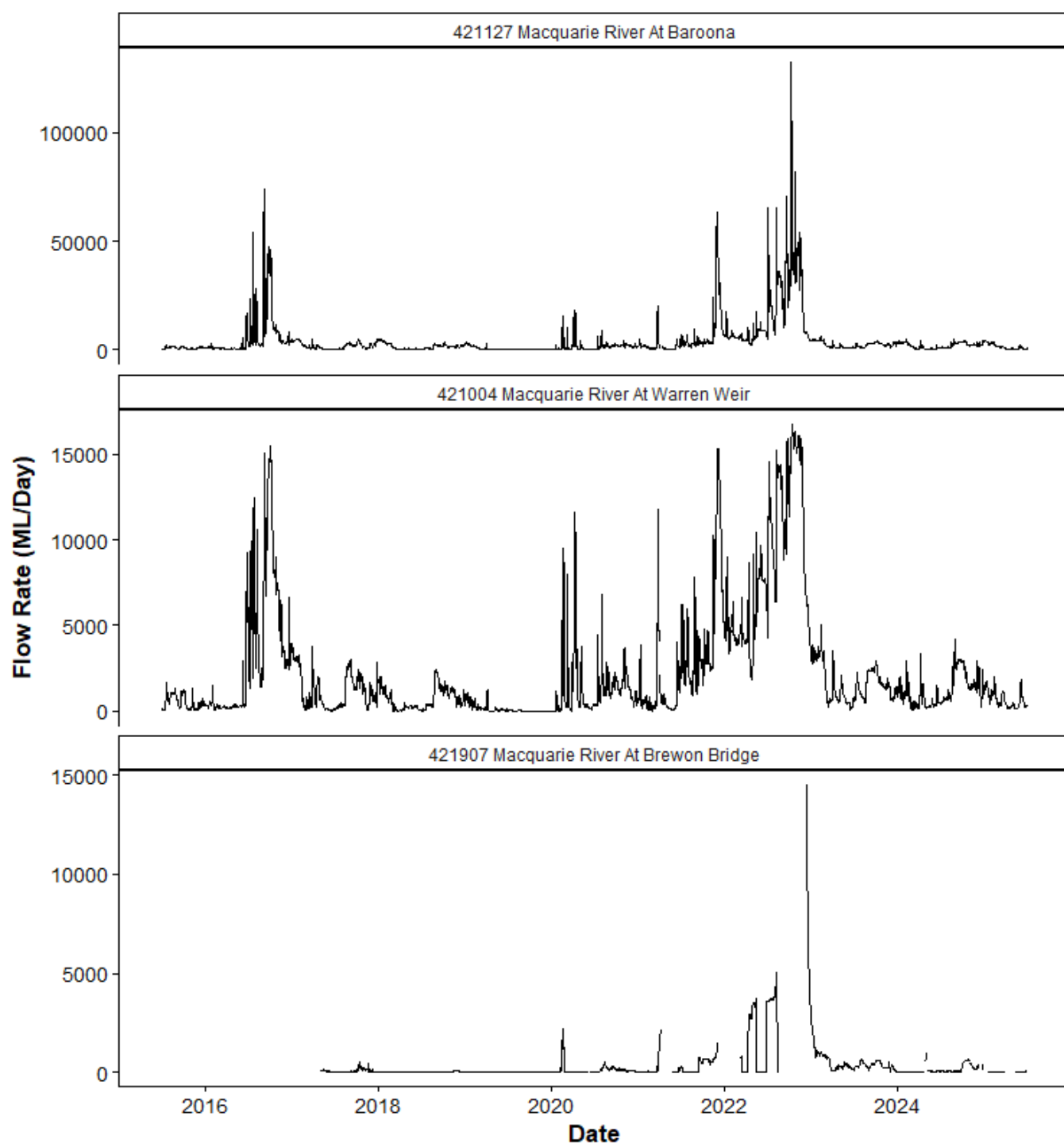


Figure 5.3: Flow data from various gauges in the Macquarie-Castlereagh WRP over the reporting period. Gauge locations can be seen on Figure 5.2. Note the differing scales on the y-axis.

Water temperature data, where available, are also shown in Figure 5.4.

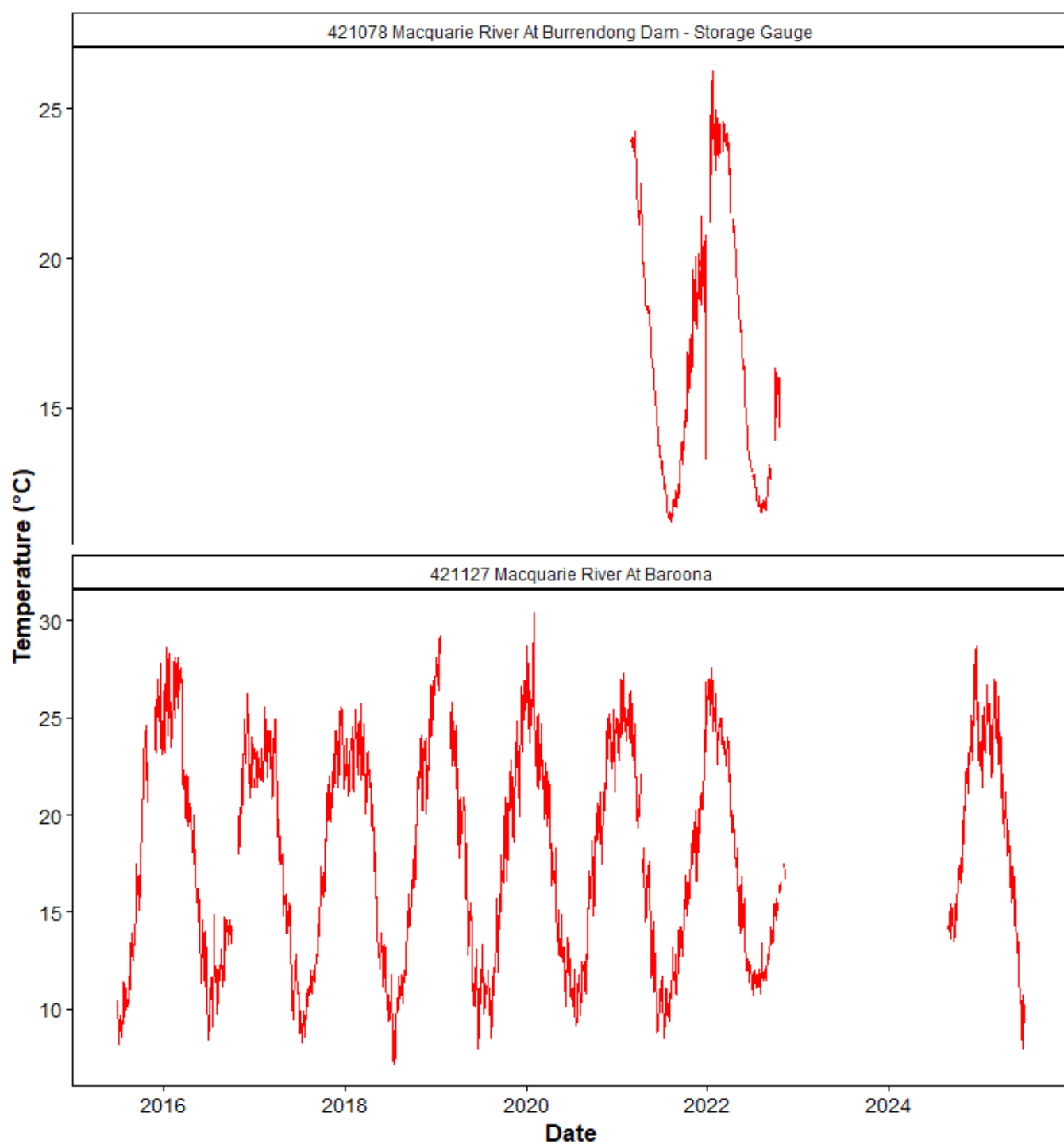


Figure 5.4: Water temperature data from various gauges in the Macquarie-Castlereagh WRP over the reporting period. Gauge locations can be seen on Figure 5.2. Note the differing scales on the y-axis.

5.6 Species Diversity

A total of 25 fish species were observed across the Macquarie-Castlereagh WRPA including seven alien species. Figure 5.5 shows the number of native and alien species found at each site. The full list of species caught and observed is presented in Table 5.8.

5.6.0.1 Summary Statement:

Native diversity was highest in the central area of the Macquarie-Castlereagh region while the alien diversity was generally consistent across the region.

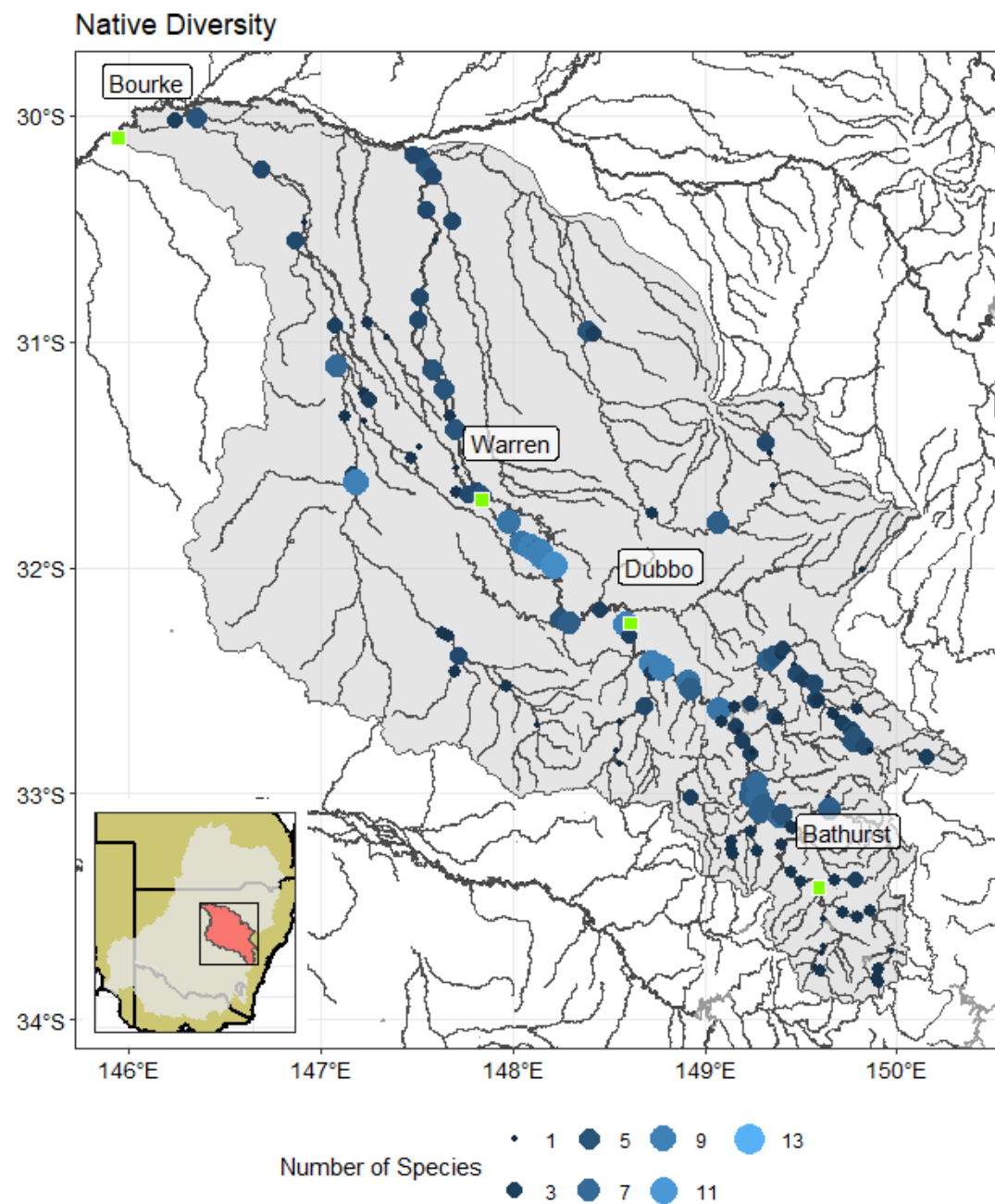


Figure 5.5: Native diversity across all sampling sites. Bubble size represents the number of unique species observed at each site across all sampling methods and events. X represents a site that had water and was sampled, but no fish species were caught at all. Green squares show key towns. Dry sites are excluded.

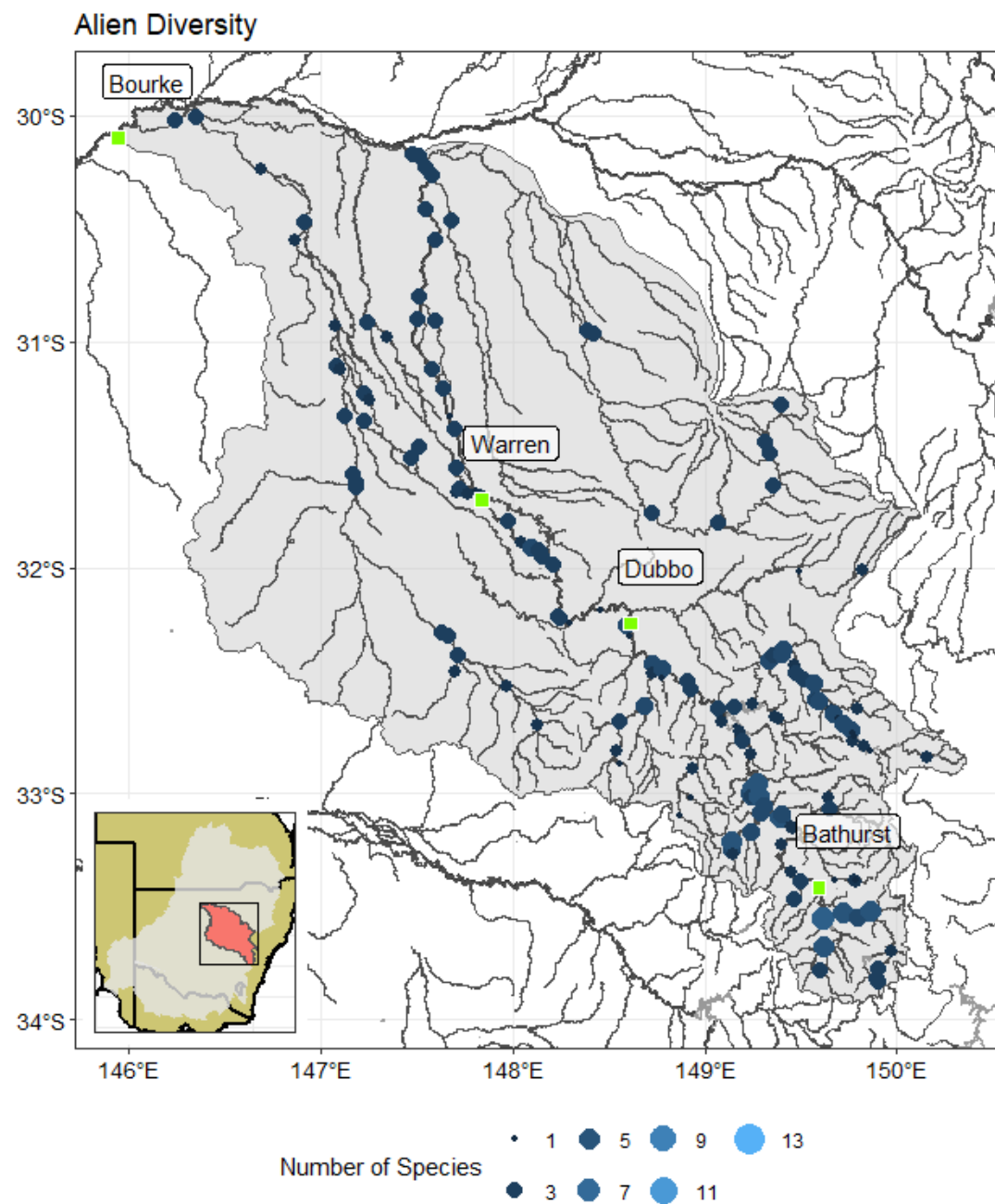


Figure 5.6: Alien diversity across all sampling sites. Bubble size represents the number of unique species observed at each site across all sampling methods and events. X represents a site that had water and was sampled, but no fish species were caught at all. Green squares show key towns. Dry sites are excluded.

5.7 Murray cod



5.7.1 Population Structure

Figure 5.7 shows the observed length frequency plot for Murray cod for each of the sampling seasons. The observed numbers of Young of the Year (YOY) ranged from 2 to 67, and 1% to 28% of measured fish within a season, with a mean percentage YOY of 9%.

Overall, during the reporting period, across all the MDB water resource planning areas, the percentage YOY for Murray cod was 11% (1,144 out of 9,991).

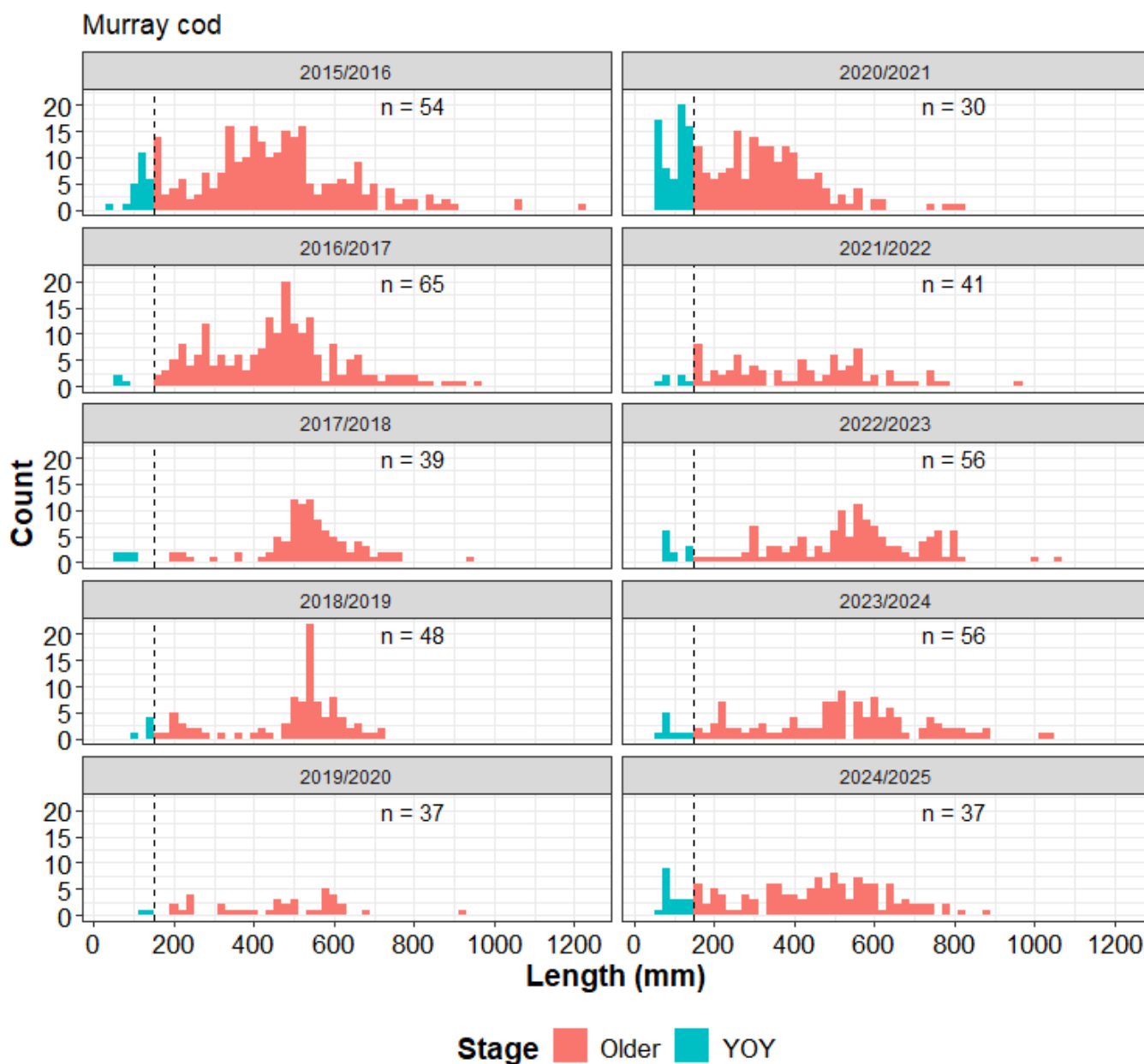


Figure 5.7: Length frequency plots for Murray cod by sampling season. YOY represents Young of the Year fish. n shows the number of sampling events in each season. Note some stages may appear either side of the cut-off line due to binning of data in the histogram.

5.7.1.1 Summary Statement:

Low levels of recruitment evident in most years with stronger recruitment in 2015/16 and 2020/21. A good range of size classes in most years. Evidence of recruitment and a wide range of size classes in 2024/25.

5.7.1.2 Stocking

A total of 2,543,178 Murray cod were stocked into the waterways of the Macquarie-Castlereagh WRPAs during the reporting period. Of these fish, 1,518,231 (60%) were stocked into impoundments while 1,024,947 (40%) were stocked into rivers or creeks. Table 5.4 shows the detailed breakdown of stocking by season, location and life stage while Figure 5.8 shows the locations of stocking.

Table 5.4: Number and life stage of stocked Murray cod each sampling season.

Sampling Season	River/Creek or Impoundment	Life Stage	Number Stocked
2015/2016	Impoundment	Fry	59,000
2015/2016	River/Creek	Fry	35,621
2016/2017	Impoundment	Fingerling	48,957
2016/2017	Impoundment	Fry	197,000
2016/2017	River/Creek	Fingerling	30,229
2016/2017	River/Creek	Fry	10,000
2017/2018	Impoundment	Fry	14,274
2017/2018	River/Creek	Fry	37,629
2018/2019	Impoundment	Fry	47,000
2018/2019	River/Creek	Fry	26,583
2019/2020	Impoundment	Fry	60,000
2019/2020	River/Creek	Fry	13,792
2020/2021	Impoundment	Fry	115,200
2020/2021	River/Creek	Fry	170,320
2021/2022	Impoundment	Fry	408,800
2021/2022	River/Creek	Fry	218,000
2022/2023	Impoundment	Fry	353,000
2022/2023	River/Creek	Fingerling	218,000
2022/2023	River/Creek	Fry	96,932
2023/2024	Impoundment	Fingerling	52,000
2023/2024	River/Creek	Fingerling	35,893
2024/2025	Impoundment	Fingerling	163,000
2024/2025	River/Creek	Fingerling	131,948

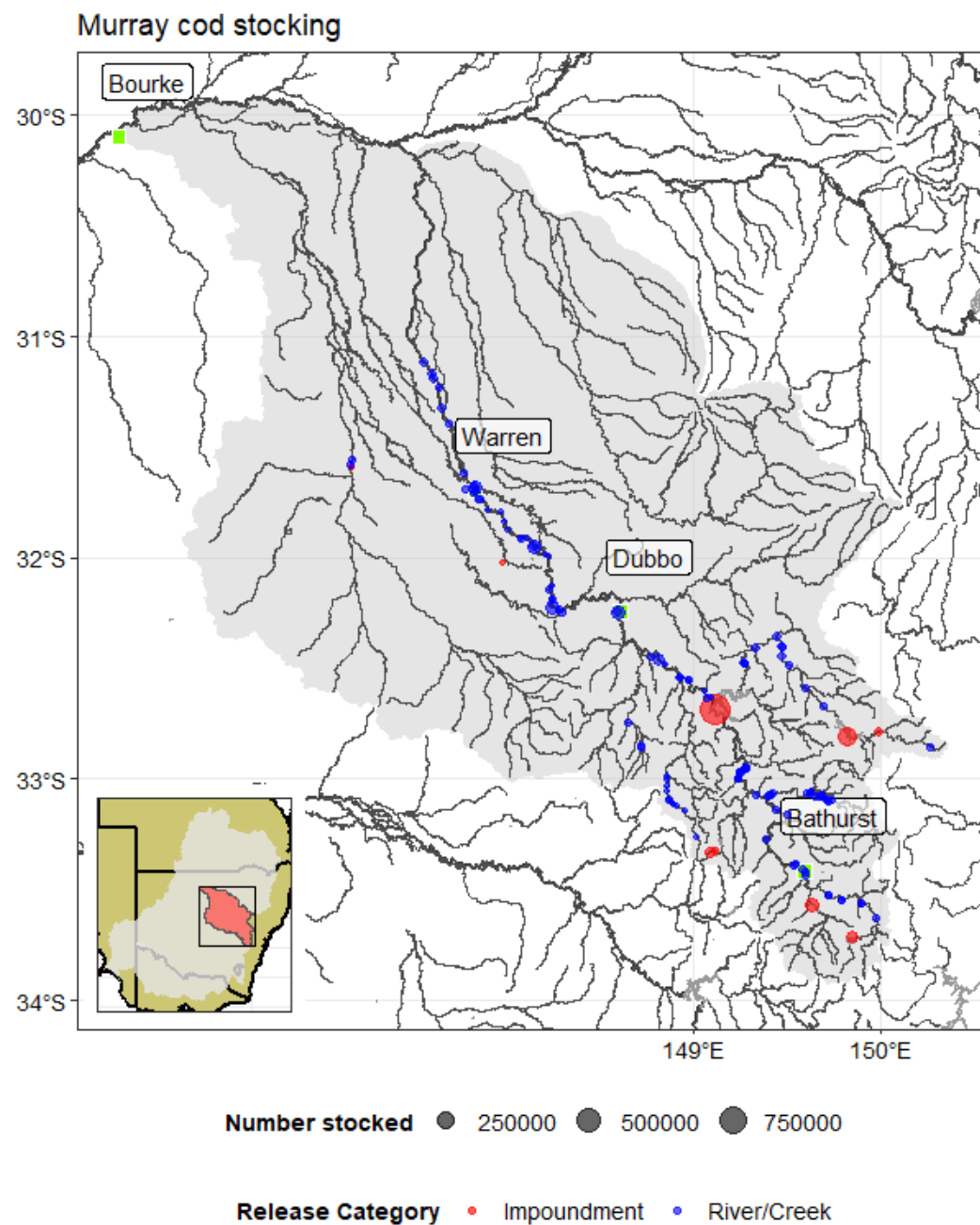


Figure 5.8: Locations of Murray cod stocking. Colours show whether a site was a river/creek site or an impoundment, while the size of the point reflects the total number of fish stocked over the reporting period. Green squares show key towns.

5.7.2 Temporal Trends in Abundance

The relative abundance and biomass of Murray cod since 1994 was modelled based on all suitable boat electrofishing data. The left-hand panels of Figure 5.9 show the abundance and biomass trends for the Macquarie-Castlereagh WRPA and the right-hand panels show the overall trends across the NSW MDB.

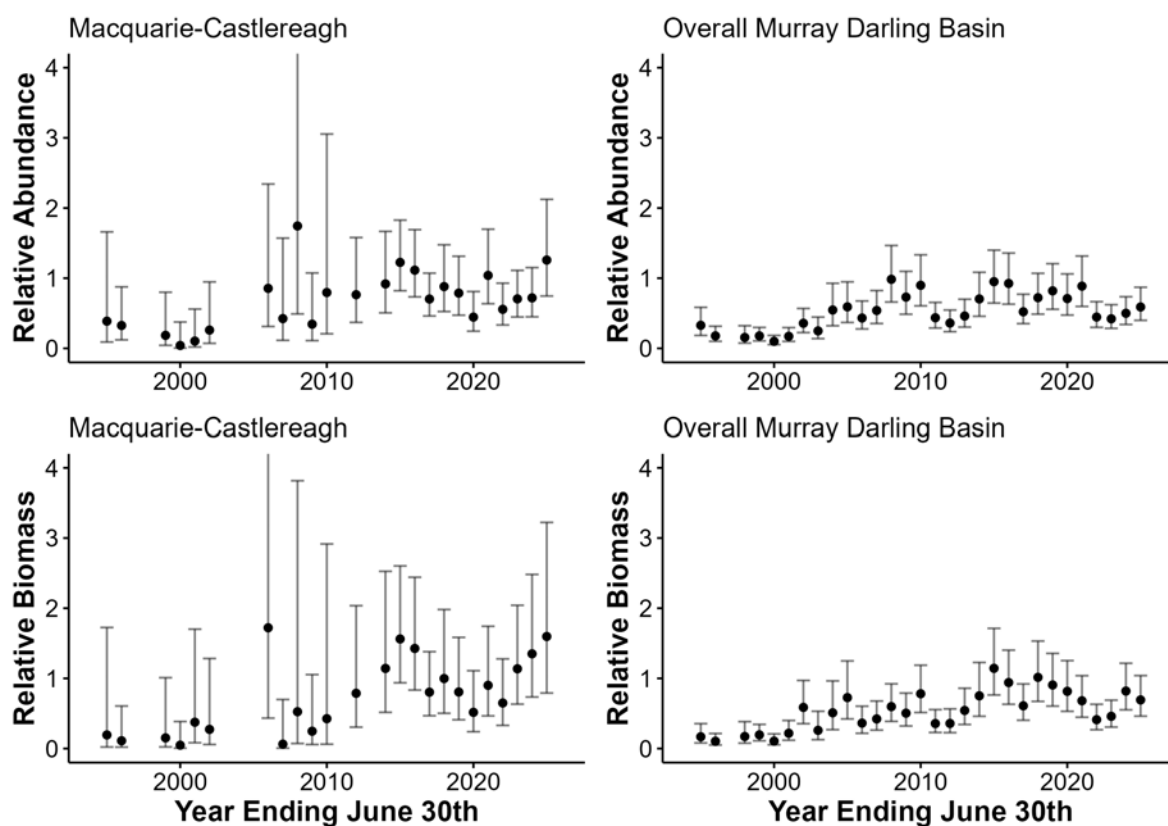


Figure 5.9: Relative abundance and biomass of Murray cod in this WRPA and the overall NSW MDB. These are model estimates based upon all boat electrofishing data within the NSW DPIRD Freshwater ecosystem database and the output of generalised linear mixed models. Error bars show the 95% confidence intervals around the estimates. Some error bars may be truncated for clarity.

5.7.2.1 Summary Statement:

An overall increase in abundance and biomass since the 1990s. Both abundance and biomass have been relatively stable since the mid 2010s, with both abundance and biomass currently trending upwards.

5.7.3 Health

The prevalence of any health issues ranged from 8% of sampled fish in 2024/2025 to 71% of sampled fish in 2018/2019 (Figure 5.10). The most common health issue for Murray cod in the Macquarie-Castlereagh WRPAs was the presence of the parasite *Lernaea*, which was observed in a total of 465 fish, corresponding to 32% of all Murray cod measured.

Across the other NSW MDB WRPA, 12% of Murray cod (1,170 out of 9,991 Murray cod) showed a health condition (excludes the Macquarie-Castlereagh WRPAs).

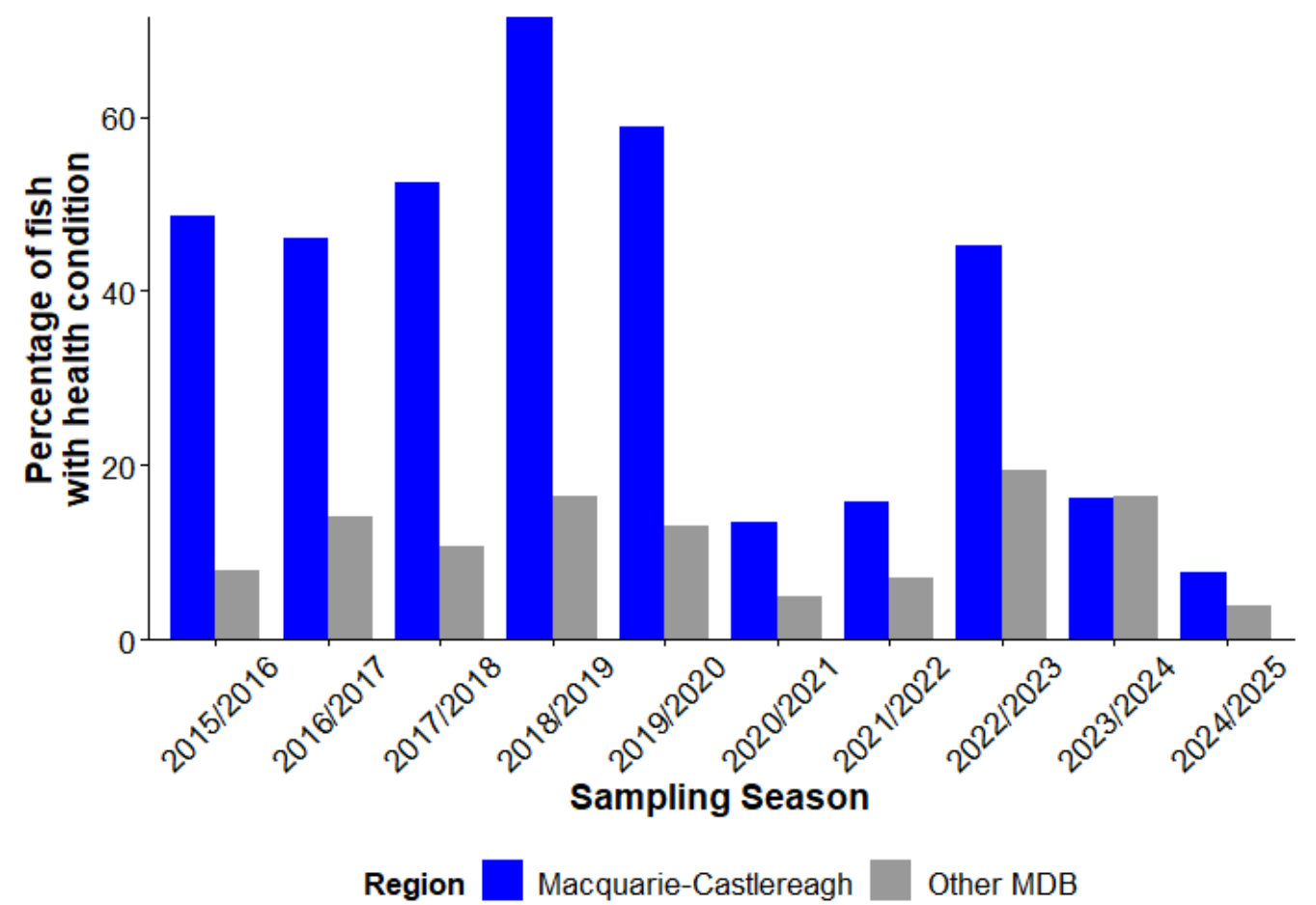


Figure 5.10: Timeseries showing the prevalence of health conditions in Murray cod. Blue shows the region-specific data while the grey shows the average across the other NSW MDB WRPA.

5.7.3.1 Summary Statement:

Presence of observable health conditions ranged from low to high across years and higher than or equal to the overall Murray-Darling Basin in all years with a possible decreasing trend. There was a low level of observed health issues in 2024/25.

5.7.4 Distribution

Murray cod were recorded at 52 out of 166 sites in the Macquarie-Castlereagh WRP. The maximum observed relative abundance at a site was 1.6 fish caught per 90 seconds of electrofishing. Figure 5.11 shows the distribution and relative abundance of Murray cod across the Macquarie-Castlereagh WRP.

5.7.4.1 Summary Statement:

Murray cod were recorded across the central and southern portion of the Macquarie-Castlereagh WRP but less abundant or absent in north-western and south-eastern sites..

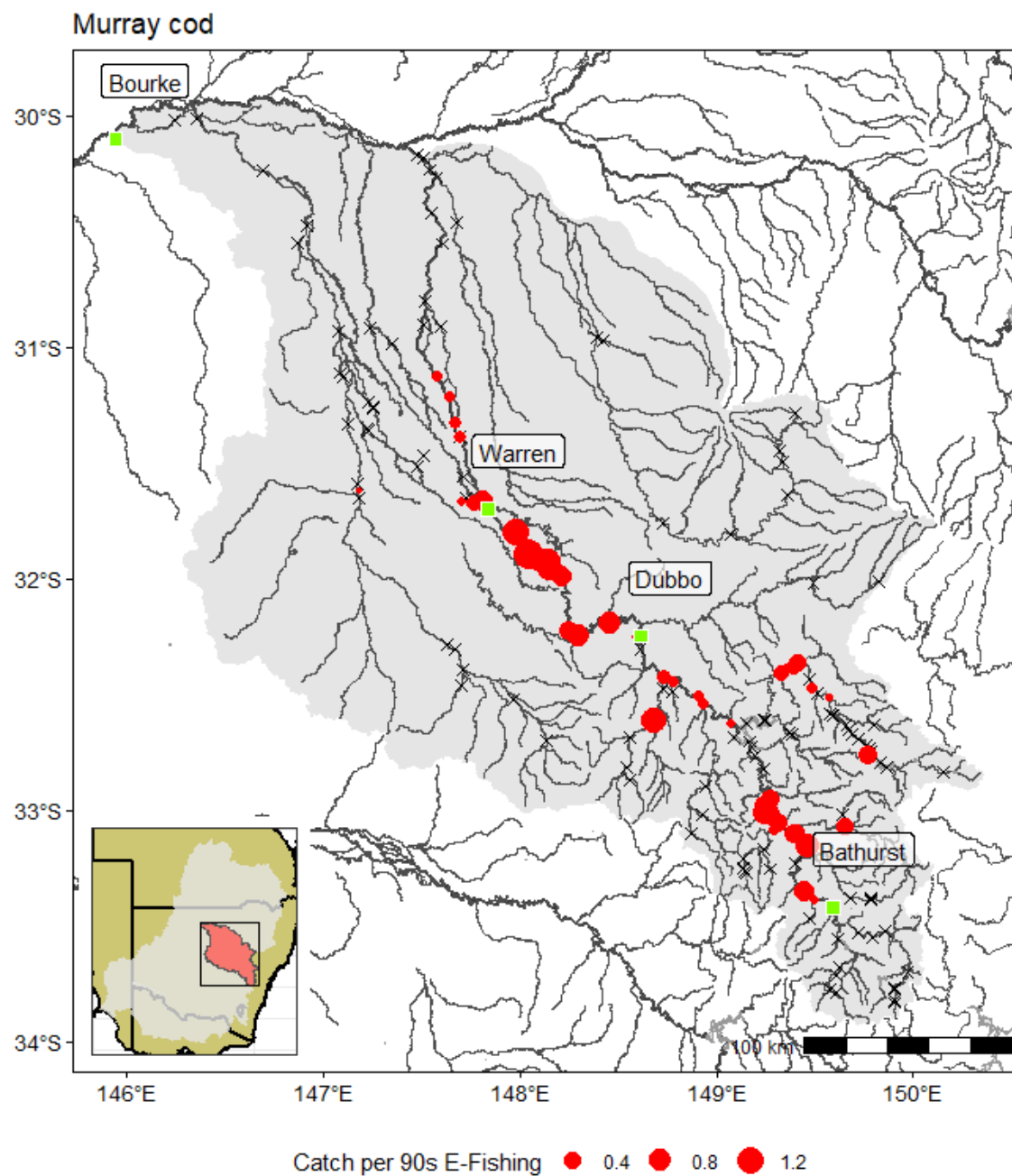


Figure 5.11: Distribution of Murray cod. Filled circles show sites where the species was present, and the size of the circle represents relative abundance. Sites that were sampled with electrofishing but did not contain the species are shown with an X. Green squares show key towns.

5.8 Golden perch



5.8.1 Population Structure

Figure 5.12 shows the observed length frequency plot for Golden perch for each of the sampling seasons. The observed numbers of Young of the Year (YOY) ranged from 0 to 72, and 0% to 31% of measured fish within a season, with a mean percentage YOY of 6%.

Overall, during the reporting period, across all the MDB water resource planning areas, the percentage YOY for Golden perch was 8% (639 out of 7,966).

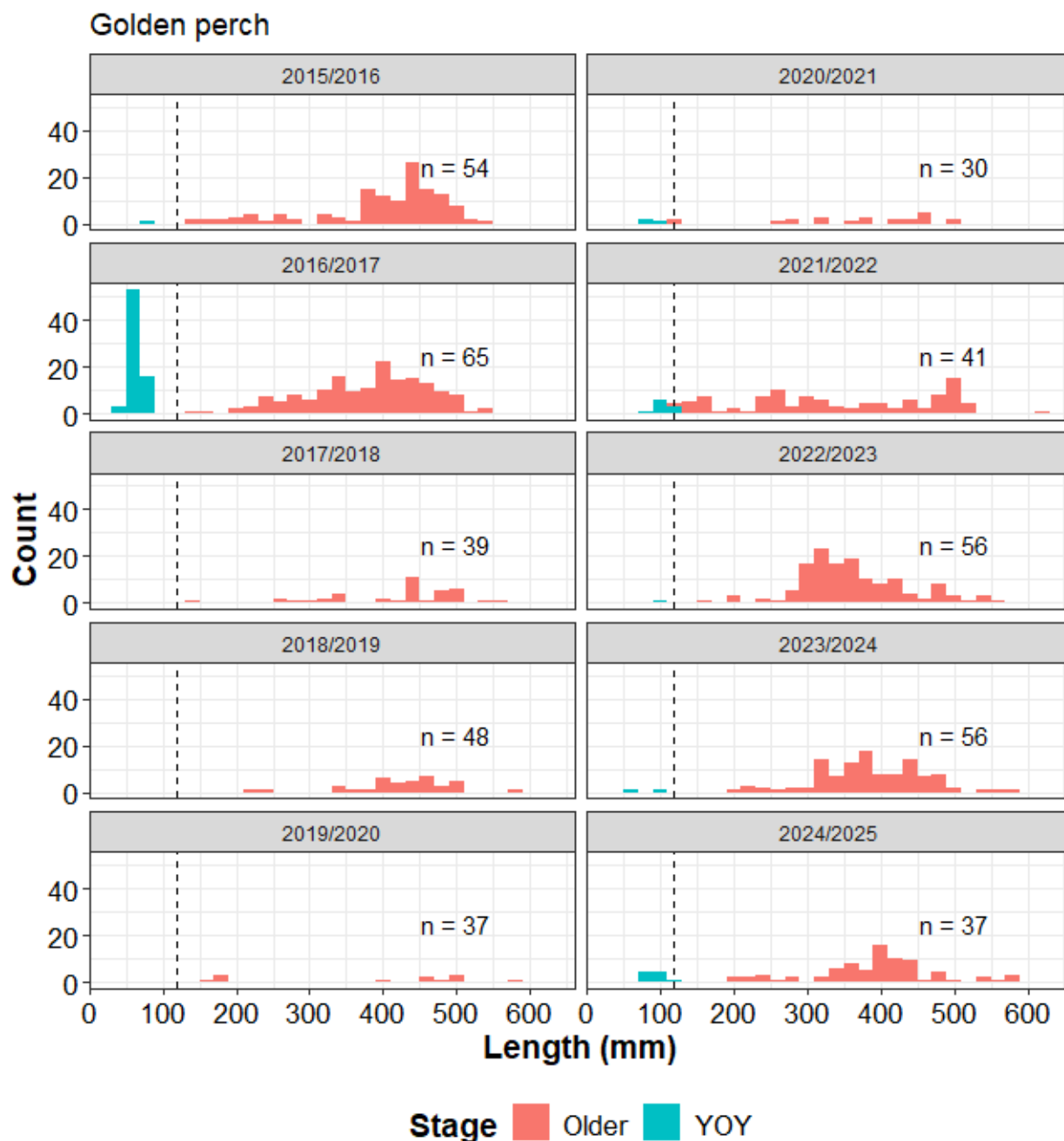


Figure 5.12: Length frequency plots for Golden perch by sampling season. YOY represents Young of the Year fish. n shows the number of sampling events in each season. Note some stages may appear either side of the cut-off line due to binning of data in the histogram.

5.8.1.1 Summary Statement:

The population was comprised of mainly larger fish. Recruitment appears to be sporadic with multiple years of recruitment failure including 2015/16, 2017/18 – 2019-2020 and 2022/23. Some evidence of recruitment in 2024/25.

5.8.1.2 Stocking

A total of 2,556,961 Golden perch were stocked into the waterways of the Macquarie-Castlereagh WRP during the reporting period. Of these fish, 1,710,058 (66.9%) were stocked into impoundments while 846,903 (33.1%) were stocked into rivers or creeks. Table 5.5 shows the detailed breakdown of stocking by season, location and life stage while Figure 5.13 shows the locations of stocking.

Table 5.5: Number and life stage of stocked Golden perch each sampling season.

Sampling Season	River/Creek or Impoundment	Life Stage	Number Stocked
2015/2016	Impoundment	Fry	104,058
2015/2016	River/Creek	Fry	64,807
2016/2017	Impoundment	Fry	103,500
2016/2017	River/Creek	Fingerling	26,393
2017/2018	Impoundment	Fry	135,000
2017/2018	River/Creek	Fry	5,000
2018/2019	Impoundment	Fry	91,000
2018/2019	River/Creek	Fry	9,375
2019/2020	River/Creek	Fry	63,666
2020/2021	Impoundment	Fry	360,000
2020/2021	River/Creek	Fry	236,376
2021/2022	Impoundment	Fry	224,000
2021/2022	River/Creek	Fry	128,792
2022/2023	Impoundment	Fry	328,000
2022/2023	River/Creek	Fry	123,364
2023/2024	Impoundment	Fingerling	139,000
2023/2024	River/Creek	Fingerling	82,808
2024/2025	Impoundment	Fingerling	225,500
2024/2025	River/Creek	Fingerling	106,322

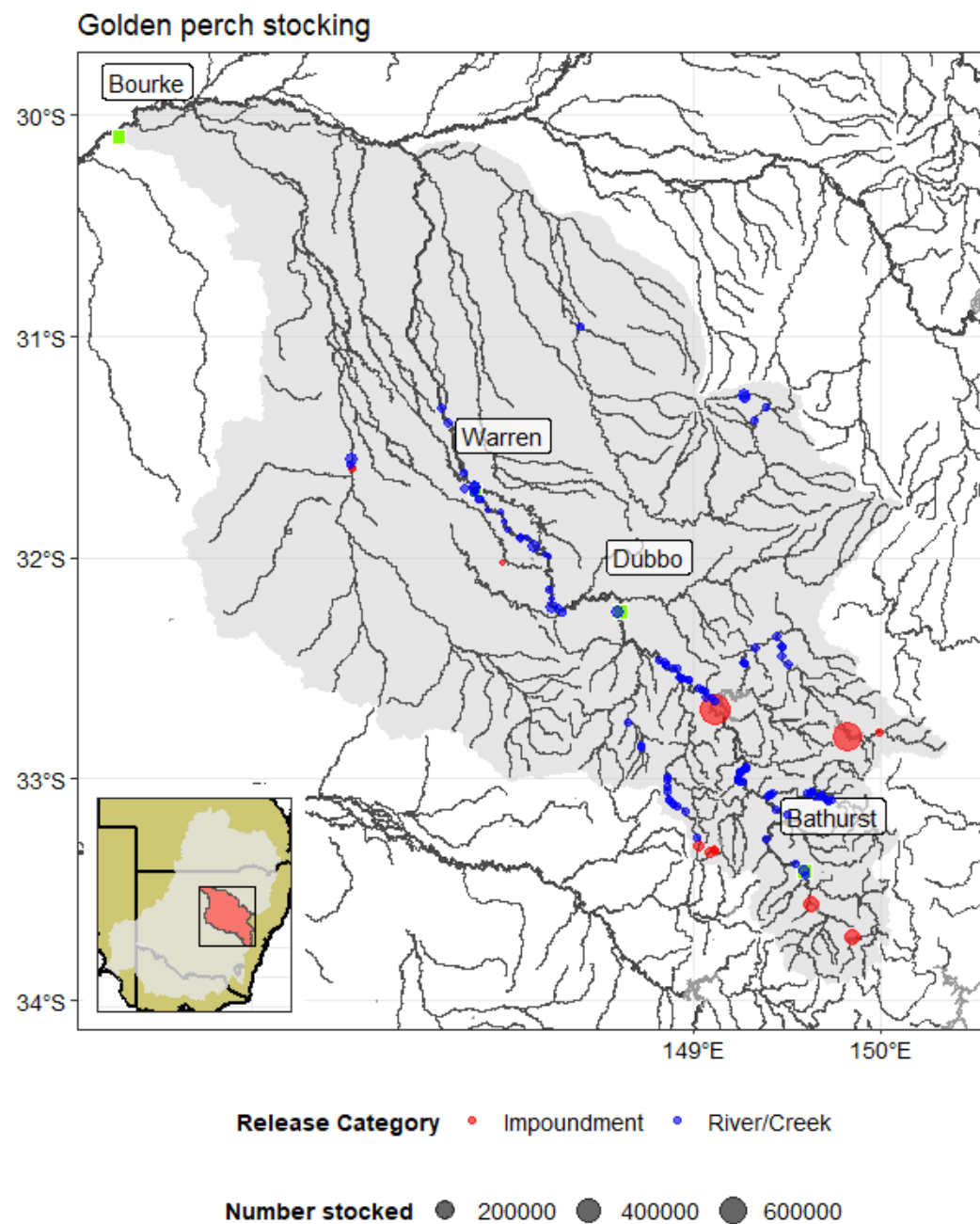


Figure 5.13: Locations of Golden perch stocking. Colours show whether a site was a river/creek site or an impoundment, while the size of the point reflects the total number of fish stocked over the reporting period. Green squares show key towns.

5.8.2 Temporal Trends in Abundance

The relative abundance and biomass of Golden perch since 1994 was modelled based on all suitable boat electrofishing data. The left-hand panels of Figure 5.14 show the abundance and biomass trends for the Macquarie-Castlereagh WRPA and the right-hand panels show the overall trends across the NSW MDB.

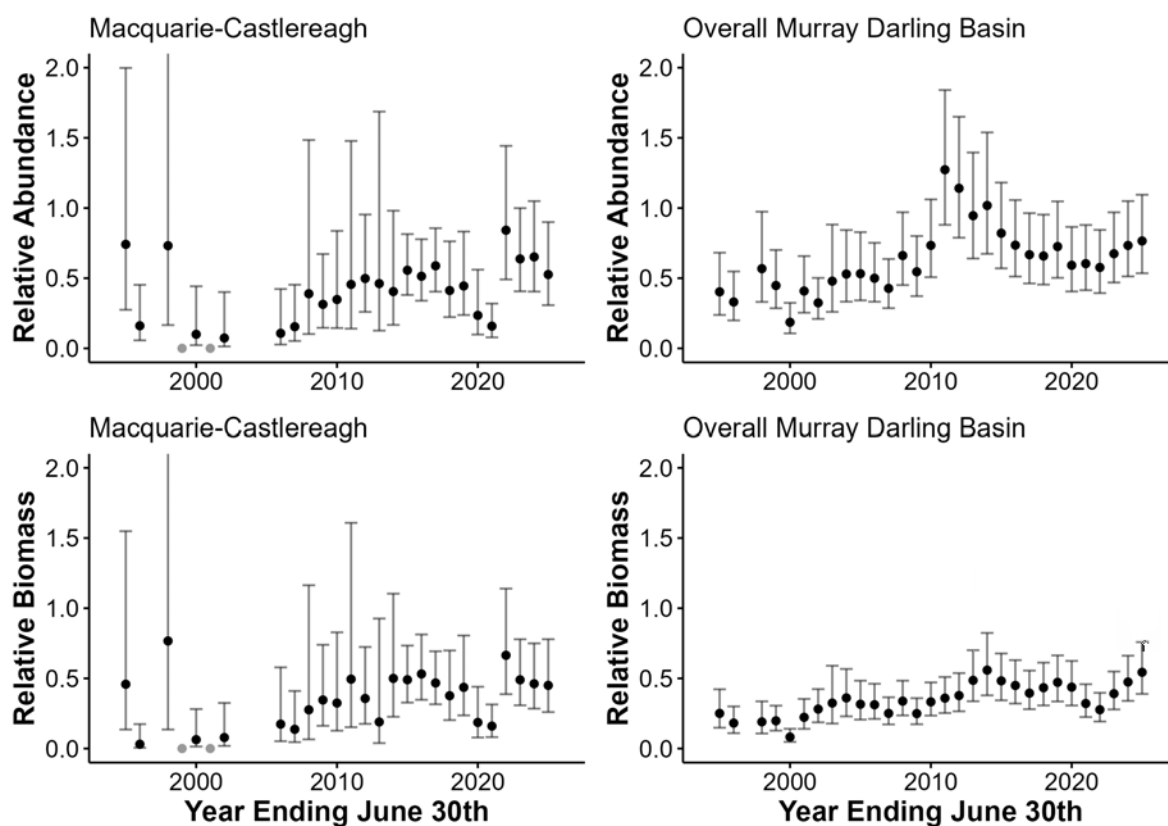


Figure 5.14: Relative abundance and biomass of Golden perch in both this WRPA and the overall Murray-Darling Basin. These are model estimates based upon all boat electrofishing data within the NSW DPIRD Freshwater ecosystem database and the output of generalised linear mixed models. Error bars show the 95% confidence intervals around the estimates. Some error bars may be truncated for clarity.

5.8.2.1 Summary Statement:

For Golden perch in the Macquarie-Castlereagh, there is evidence of an overall increase in abundance and biomass since the early 2000s. Both abundance and biomass increased from low levels since 2021. Relative abundance and biomass are approximately equal to the overall NSW Murray-Darling Basin.

5.8.3 Health

The prevalence of any health issues ranged from 8% of sampled fish in 2024/2025 to 83% of sampled fish in 2019/2020 (Figure 5.15). The most common health issue for Golden perch in the Macquarie-Castlereagh water resource planning area was the presence of the parasite *Lernaea*, which was observed in a total of 142 fish, corresponding to 15% of all Golden perch measured.

Across the other WRPA's, 23% of Golden perch (1,823 out of 7,966 Golden perch) showed a health condition (excludes Macquarie-Castlereagh).

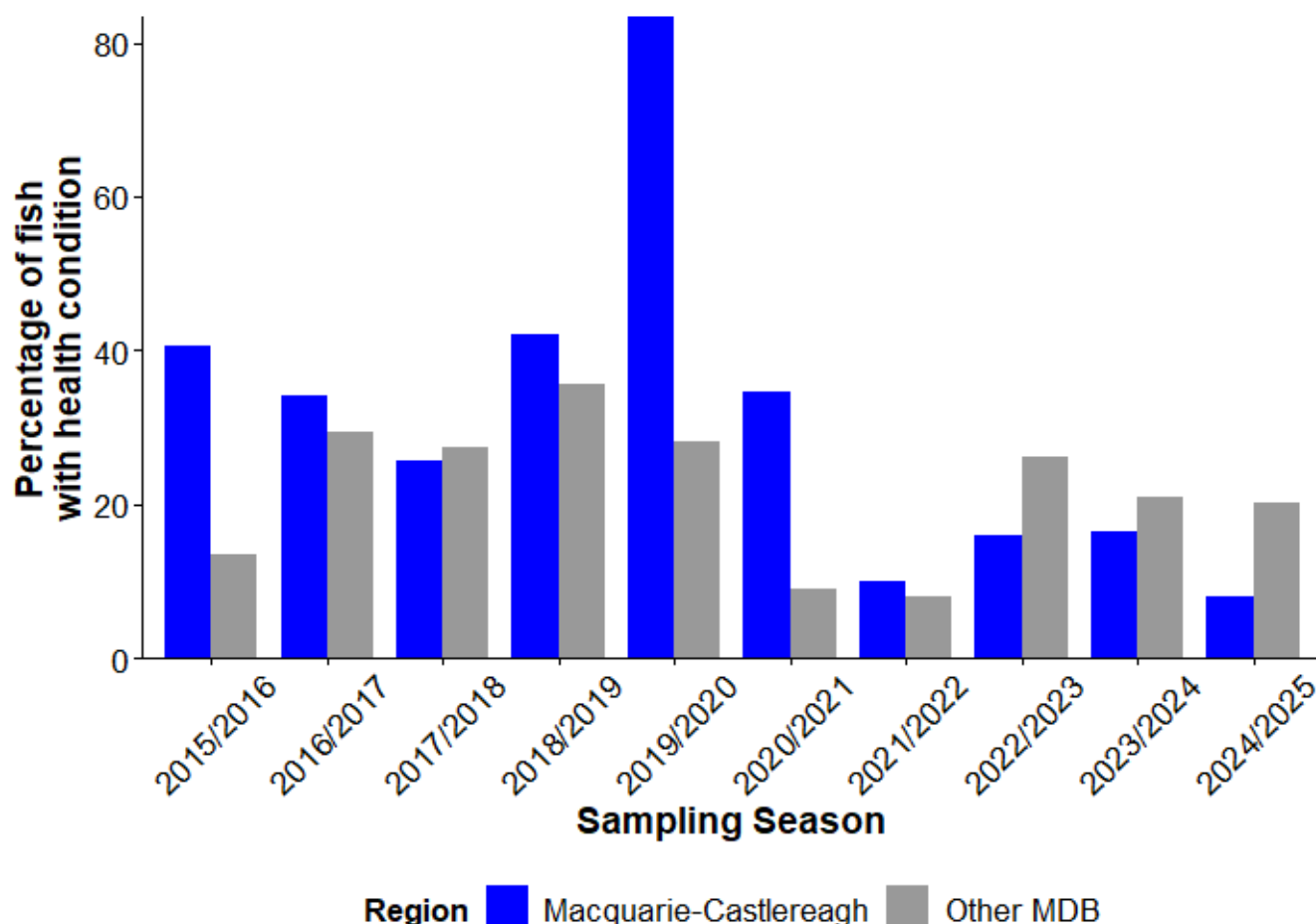


Figure 5.15: Timeseries showing the prevalence of health conditions in Golden perch. Blue shows the region-specific data while the grey shows the average across the other NSW MDB WRPA's.

5.8.3.1 Summary Statement:

The presence of observable health conditions for Golden perch in the Macquarie-Castlereagh was moderate to high and generally tracked the average across the rest of the NSW Murray-Darling Basin except for 2019/20 when it was significantly higher. There is a possible decreasing trend in observed health conditions.

5.8.4 Distribution

Golden perch were recorded at 77 out of 166 sites in the Macquarie-Castlereagh WRP. The maximum observed relative abundance at a site was 2 fish caught per 90 seconds of electrofishing. Figure 5.16 shows the distribution and relative abundance of Golden perch across the Macquarie-Castlereagh WRP.

5.8.4.1 Summary Statement:

Golden perch were generally present across the Macquarie-Castlereagh region except for upland sites in the far south-east.

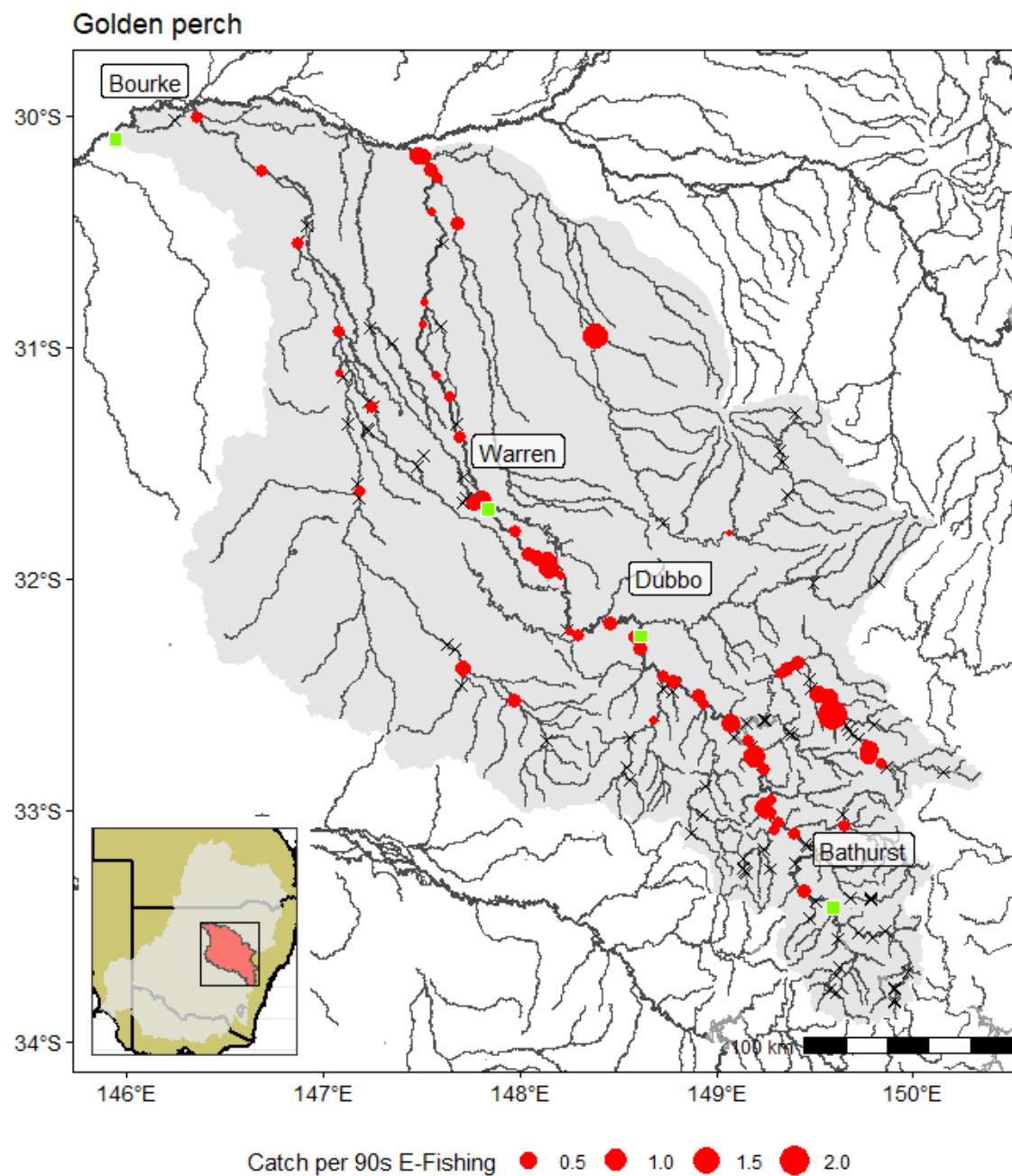


Figure 5.16: Distribution of Golden perch. Filled circles show sites where the species was present, and the size of the circle represents relative abundance. Sites that were sampled with electrofishing but did not contain the species are shown with an X. Green squares show key towns.

5.9 Freshwater catfish



5.9.1 Population Structure

Figure 5.17 shows the observed length frequency plot for Freshwater catfish for each of the sampling seasons. The observed numbers of Young of the Year (YOY) ranged from 0 to 13, and 0% to 64% of measured fish within a season, with a mean percentage YOY of 20%.

Overall, during the reporting period, across all the MDB water resource planning areas, the percentage YOY for Freshwater catfish was 39% (435 out of 1,113).

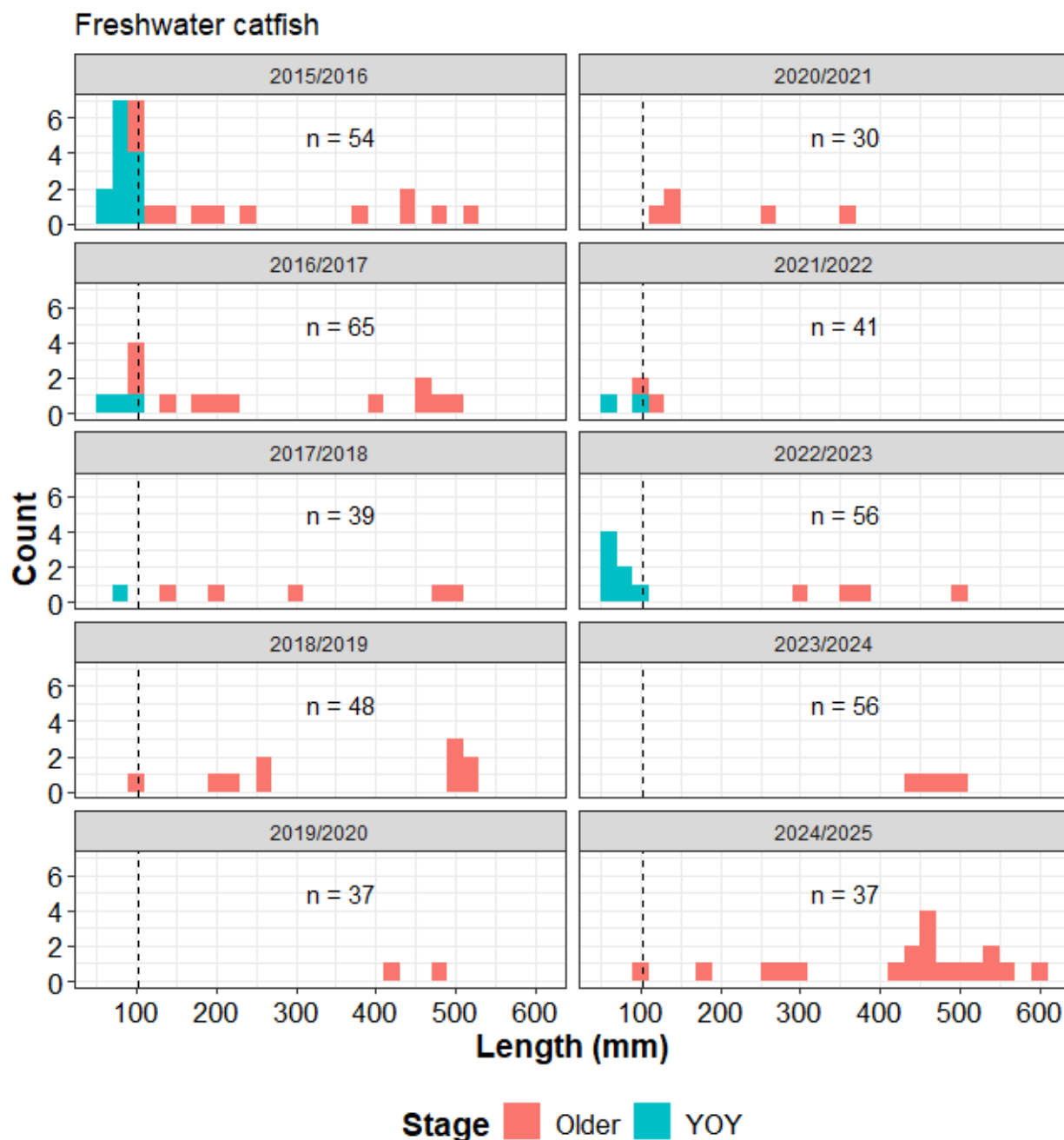


Figure 5.17: Length frequency plots for Freshwater catfish by sampling season. YOY represents Young of the Year fish. n shows the number of sampling events in each season. Note some stages may appear either side of the cut-off line due to binning of data in the histogram.

5.9.1.1 Summary Statement:

Sporadic recruitment with possible recruitment failure from 2018/19 – 2020/21, in 2023/24 and possibly in 2024/25. A large range of size classes were observed in 2024/25.

5.9.2 Temporal Trends in Abundance

The relative abundance and biomass of Freshwater catfish since 1994 was modelled based on all suitable boat electrofishing data. The left-hand panels of Figure 5.18 show the abundance and biomass trends for the Macquarie-Castlereagh WRPAs and the right-hand panels show the overall trends across the NSW MDB.

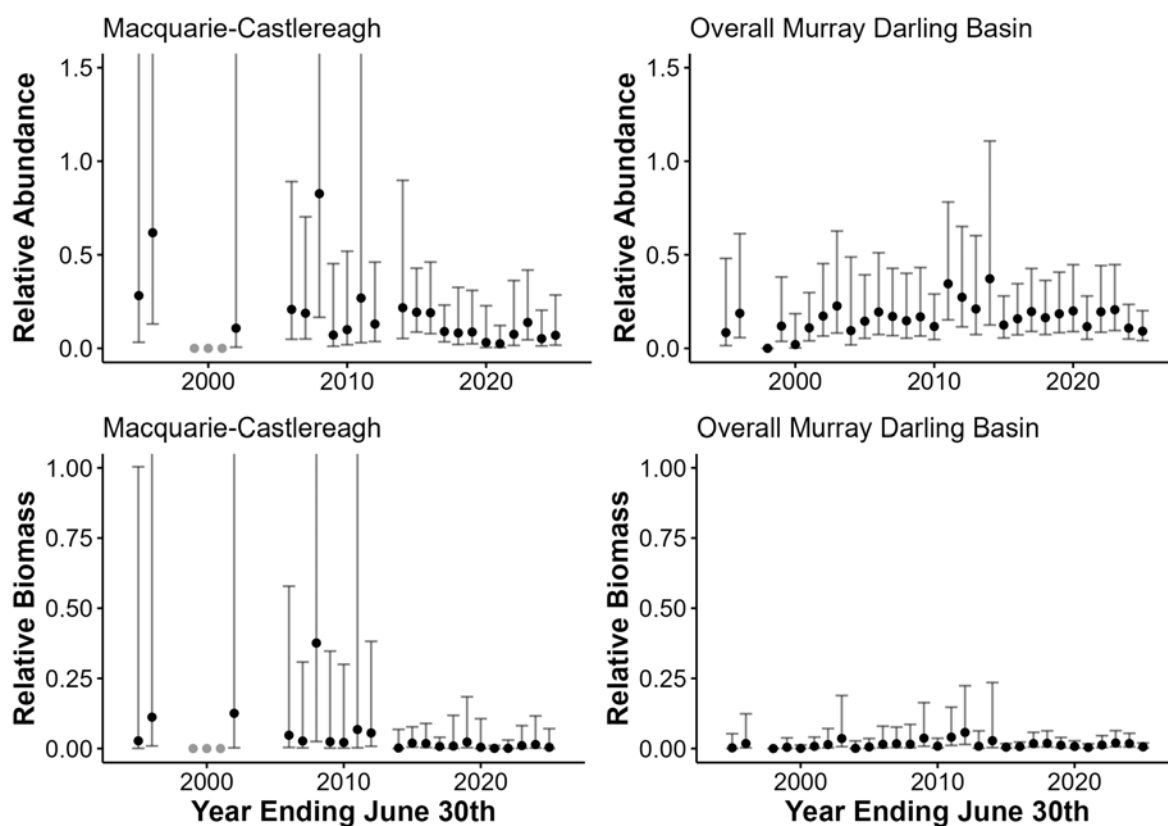


Figure 5.18: Relative abundance and biomass of Freshwater catfish in both this WRPAs and the overall Murray-Darling Basin. These are model estimates based upon all boat electrofishing data within the NSW DPIRD Freshwater ecosystem database and the output of generalised linear mixed models. Error bars show the 95% confidence intervals around the estimates. Some error bars may be truncated for clarity.

5.9.2.1 Summary Statement:

Abundance and biomass are both low in the Macquarie-Castlereagh WRPAs and have likely declined since the 2000s. Abundance and biomass are comparable to the overall NSW MDB.

5.9.3 Health

The prevalence of any health issues ranged from 0% of sampled fish in 2018/2019 to 17% of sampled fish in 2017/2018 (Figure 5.19). The most common health issue for Freshwater catfish in the Macquarie-Castlereagh water resource planning area was the presence of the parasite *Lernaea*, which was observed in a total of 6 fish, corresponding to 6% of all Freshwater catfish measured.

Across the other WRPA's, 1% of Freshwater catfish (14 out of 1,113 Freshwater catfish) showed a health condition (excludes Macquarie-Castlereagh).

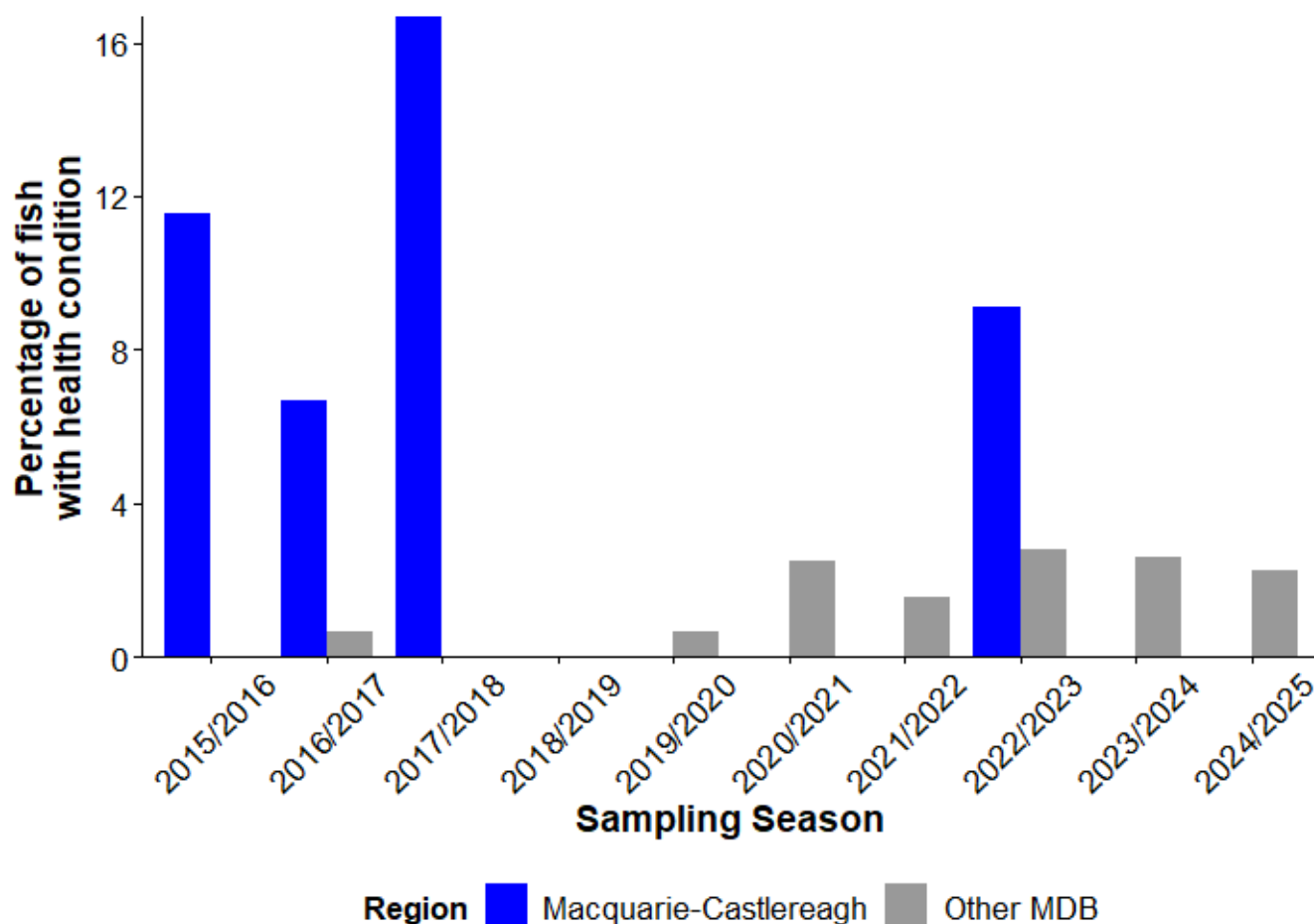


Figure 5.19: Timeseries showing the prevalence of health conditions in Freshwater catfish. Blue shows the region-specific data while the grey shows the average across the other NSW MDB WRPA's.

5.9.3.1 Summary Statement:

The presence of observable health conditions for Freshwater catfish in the Macquarie-Castlereagh was overall low – moderate and above the level observed in the other areas of the NSW MDB (when health issues were observed). No health issues were observed in 2024/25.

5.9.4 Distribution

Freshwater catfish were recorded at 27 out of 166 sites in the Macquarie-Castlereagh WRP. The maximum observed relative abundance at a site was 1 fish caught per 90 seconds of electrofishing. Figure 5.20 shows the distribution and relative abundance of Freshwater catfish across the Macquarie-Castlereagh WRP.

5.9.4.1 Summary Statement:

Freshwater catfish were generally restricted to the central and upland areas of the Macquarie-Castlereagh WRP.

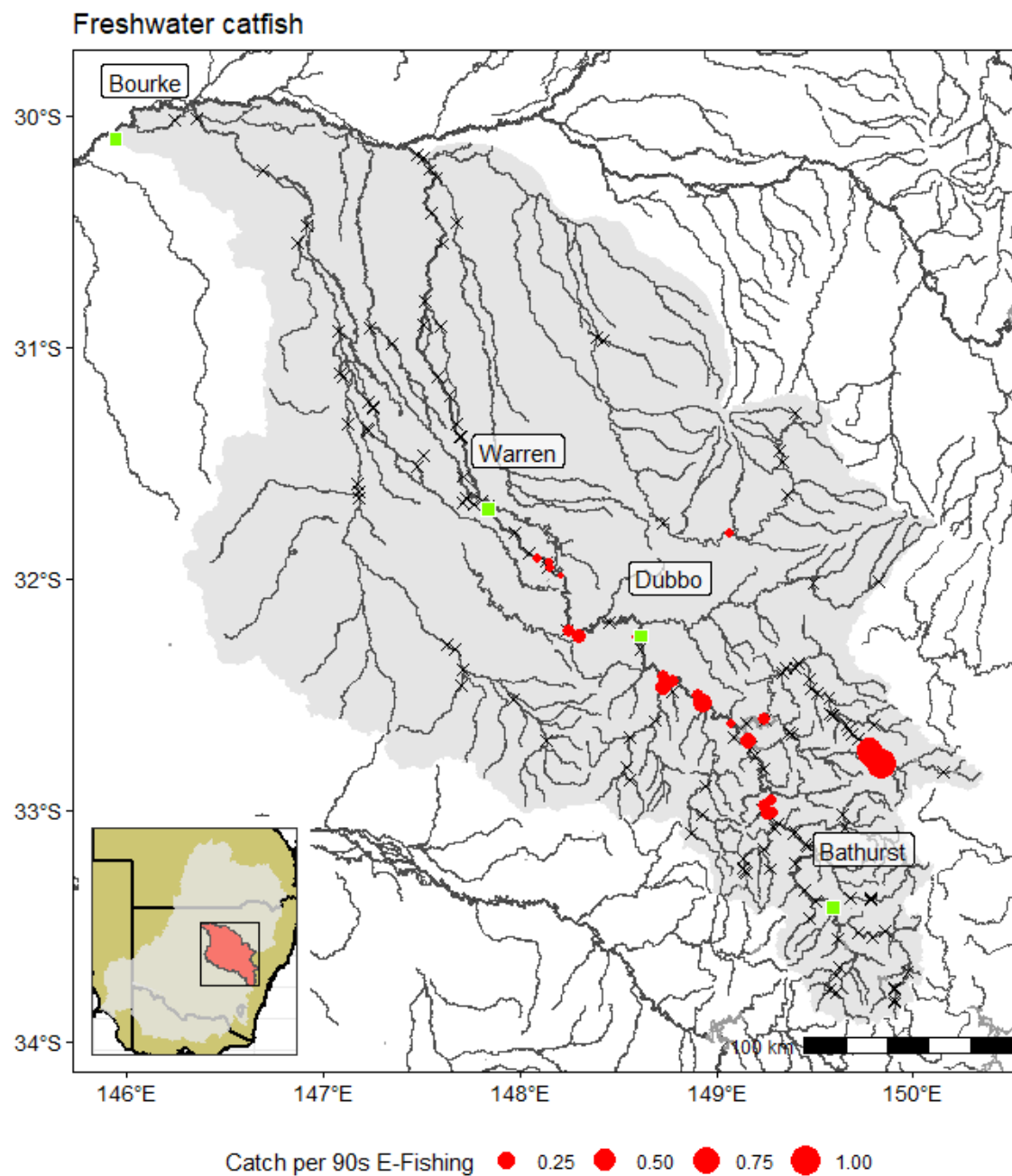


Figure 5.20: Distribution of Freshwater catfish. Filled circles show sites where the species was present, and the size of the circle represents relative abundance. Sites that were sampled with electrofishing but did not contain the species are shown with an X. Green squares show key towns.

5.10 Bony herring



5.10.1 Population Structure

Figure 5.21 shows the observed length frequency plot for Bony herring for each of the sampling seasons. The observed numbers of Young of the Year (YOY) ranged from 10 to 73, and 5% to 65% of measured fish within a season, with a mean percentage YOY of 25%.

Overall, during the reporting period, across all the MDB water resource planning areas, the percentage YOY for Bony herring was 25% (13,288 out of 53,940). Bony herring are not a stocked species.

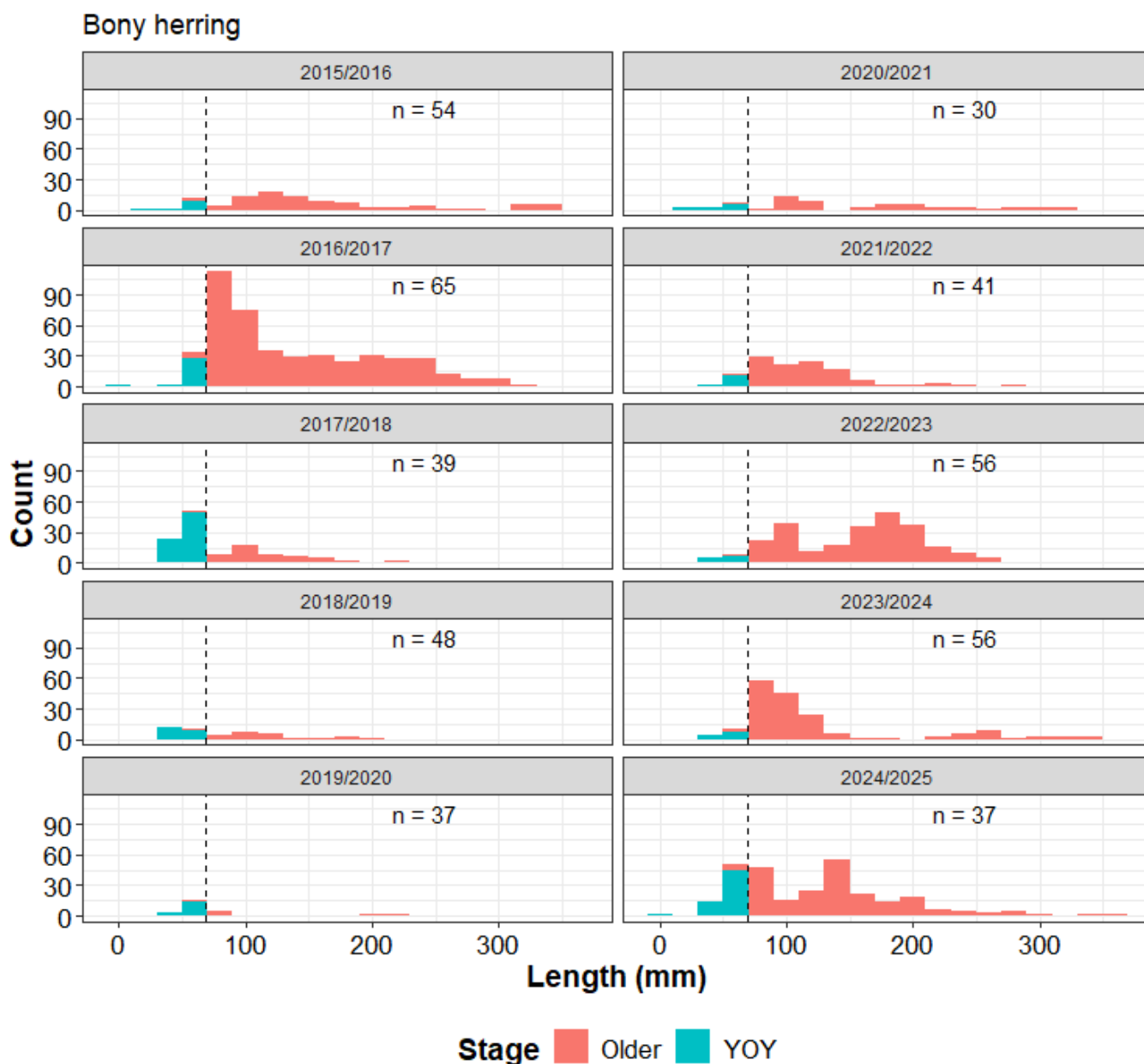


Figure 5.21: Length frequency plots for Bony herring by sampling season. YOY represents Young of the Year fish. n shows the number of sampling events in each season. Note some stages may appear either side of the cut-off line due to binning of data in the histogram.

5.10.1.1 Summary Statement:

Regular recruitment with variable numbers of YOY. Evidence of recruitment in 2024/25 with multiple size classes evident.

5.10.2 Temporal Trends in Abundance

The relative abundance and biomass of Bony herring since 1994 was modelled based on all suitable boat electrofishing data. The left-hand panels of Figure 5.22 show the abundance and biomass trends for the Macquarie-Castlereagh WRPA and the right-hand panels show the overall trends across the NSW MDB.

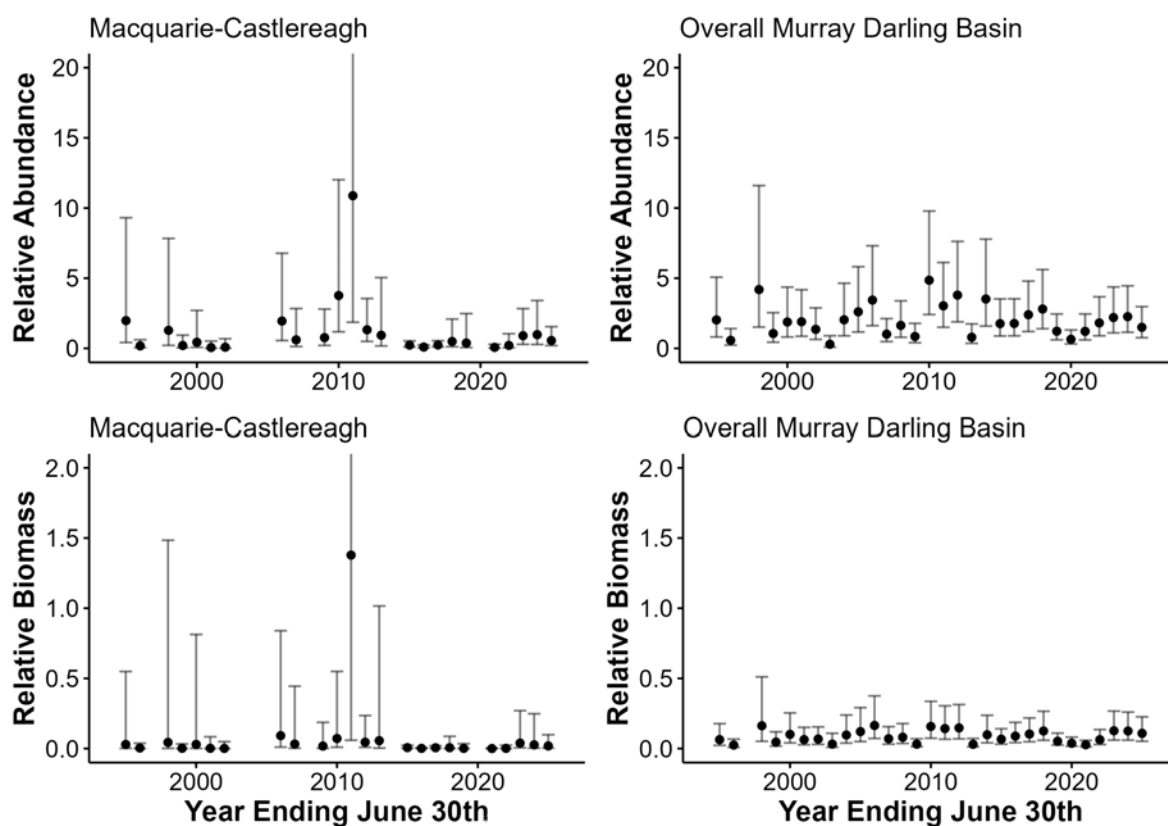


Figure 5.22: Relative abundance and biomass of Bony herring in both this WRPA and the overall NSW MDB. These are model estimates based upon all boat electrofishing data within the NSW DPIRD Freshwater ecosystem database and the output of generalised linear mixed models. Error bars show the 95% confidence intervals around the estimates. Some error bars may be truncated for clarity.

5.10.2.1 Summary Statement:

Variable abundance and biomass comparable to the wider NSW MDB. There may have been a slight decrease in the most recent year.

5.10.3 Health

The prevalence of any health issues ranged from 0% of sampled fish in 2017/2018 to 6% of sampled fish in 2016/2017 (Figure 5.23). The most common health issue for Bony herring in the Macquarie-Castlereagh WRPAs was Fungus, which was observed in a total of 10 fish, corresponding to 1% of all Bony herring measured.

Across the other NSW MDB WRPA, 1% of Bony herring (635 out of 53,942 Bony herring) showed a health condition (excludes the Macquarie-Castlereagh WRPAs).

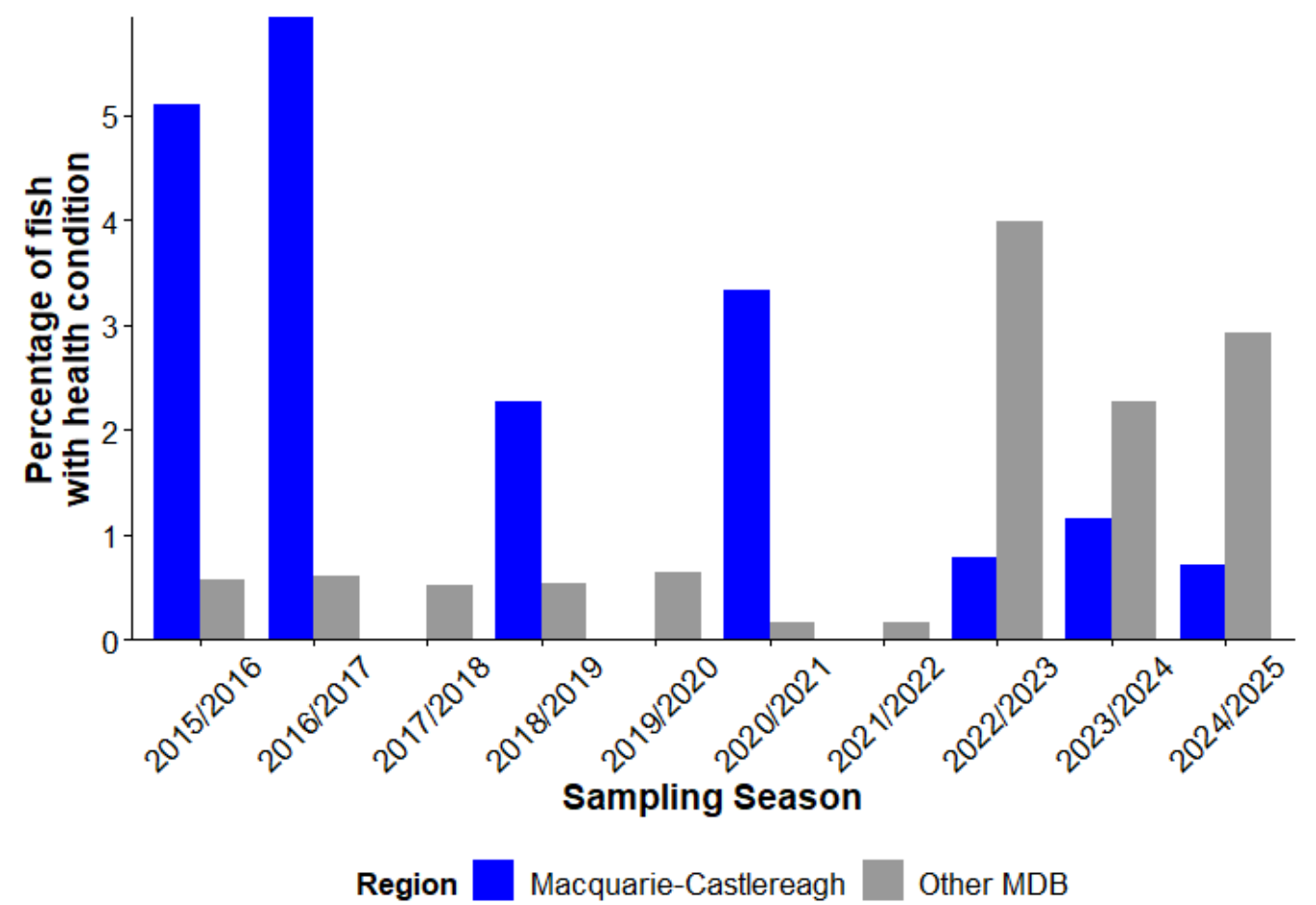


Figure 5.23: Timeseries showing the prevalence of health conditions in Bony herring. Blue shows the region-specific data while the grey shows the average across the other NSW MDB WRPA.

5.10.3.1 Summary Statement:

Presence of observable health conditions was generally low. Low proportion of health issues in 2024/25 compared to the rest of the NSW MDB.

5.10.4 Distribution

Bony herring were recorded at 37 out of 166 sites in the Macquarie-Castlereagh WRP. The maximum observed relative abundance at a site was 14.8 fish caught per 90 seconds of electrofishing. Figure 5.24 shows the distribution and relative abundance of Bony herring across the Macquarie-Castlereagh WRP.

5.10.4.1 Summary Statement:

Bony herring appear to be mainly restricted to the northern Macquarie-Castlereagh WRP with very few occurrences south of Dubbo.

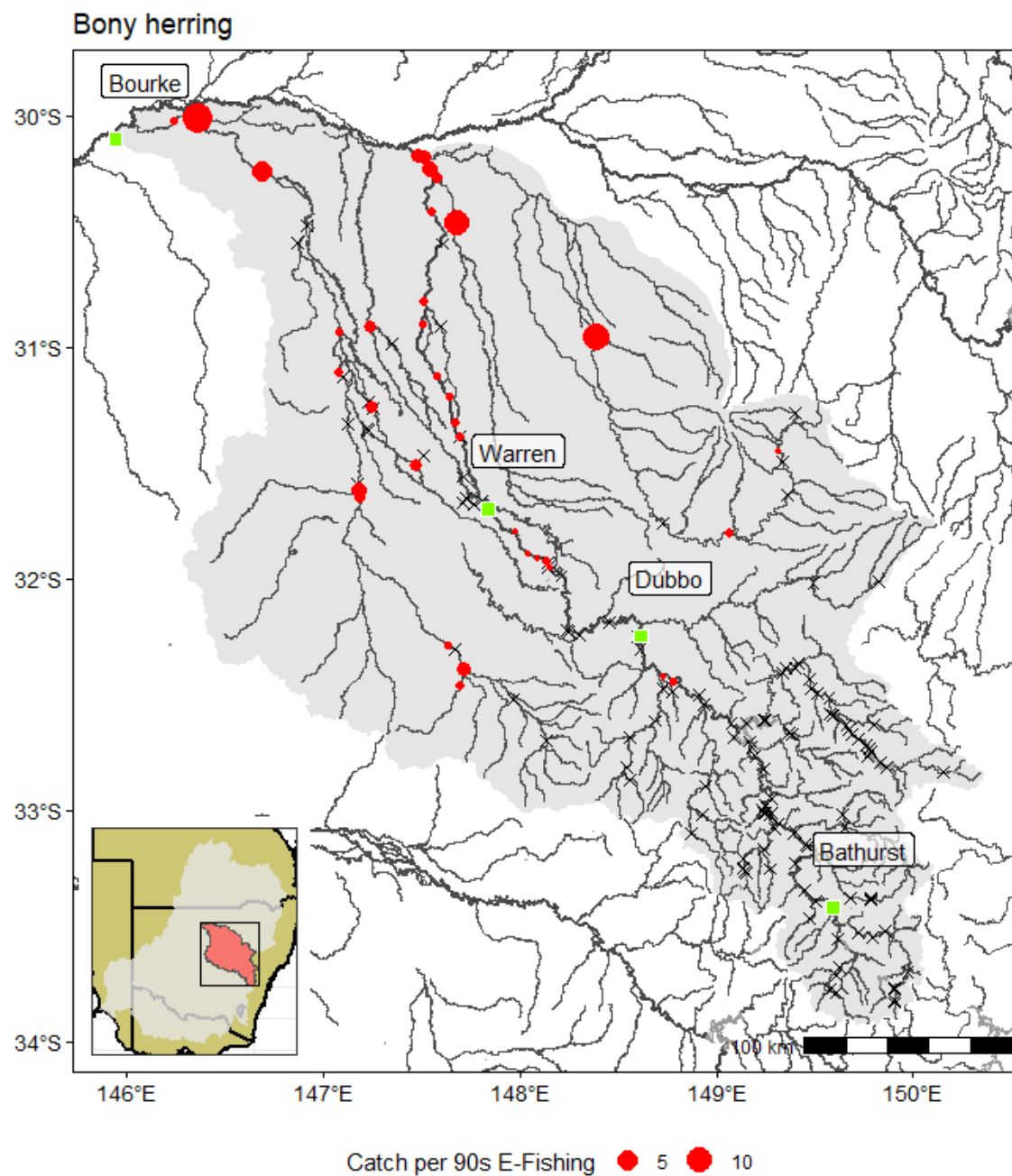


Figure 5.24: Distribution of Bony herring. Filled circles show sites where the species was present, and the size of the circle represents relative abundance. Sites that were sampled with electrofishing but did not contain the species are shown with an X. Green squares show key towns.

5.11 Australian smelt



5.11.1 Population Structure

Figure 5.25 shows the observed length frequency plot for Australian smelt for each of the sampling seasons. The observed numbers of Young of the Year (YOY) ranged from 2 to 182, and 4% to 46% of measured fish within a season, with a mean percentage YOY of 23%.

Overall, during the reporting period, across all the MDB water resource planning areas, the percentage YOY for Australian smelt was 43% (10,558 out of 24,419). Australian smelt are not a stocked species.

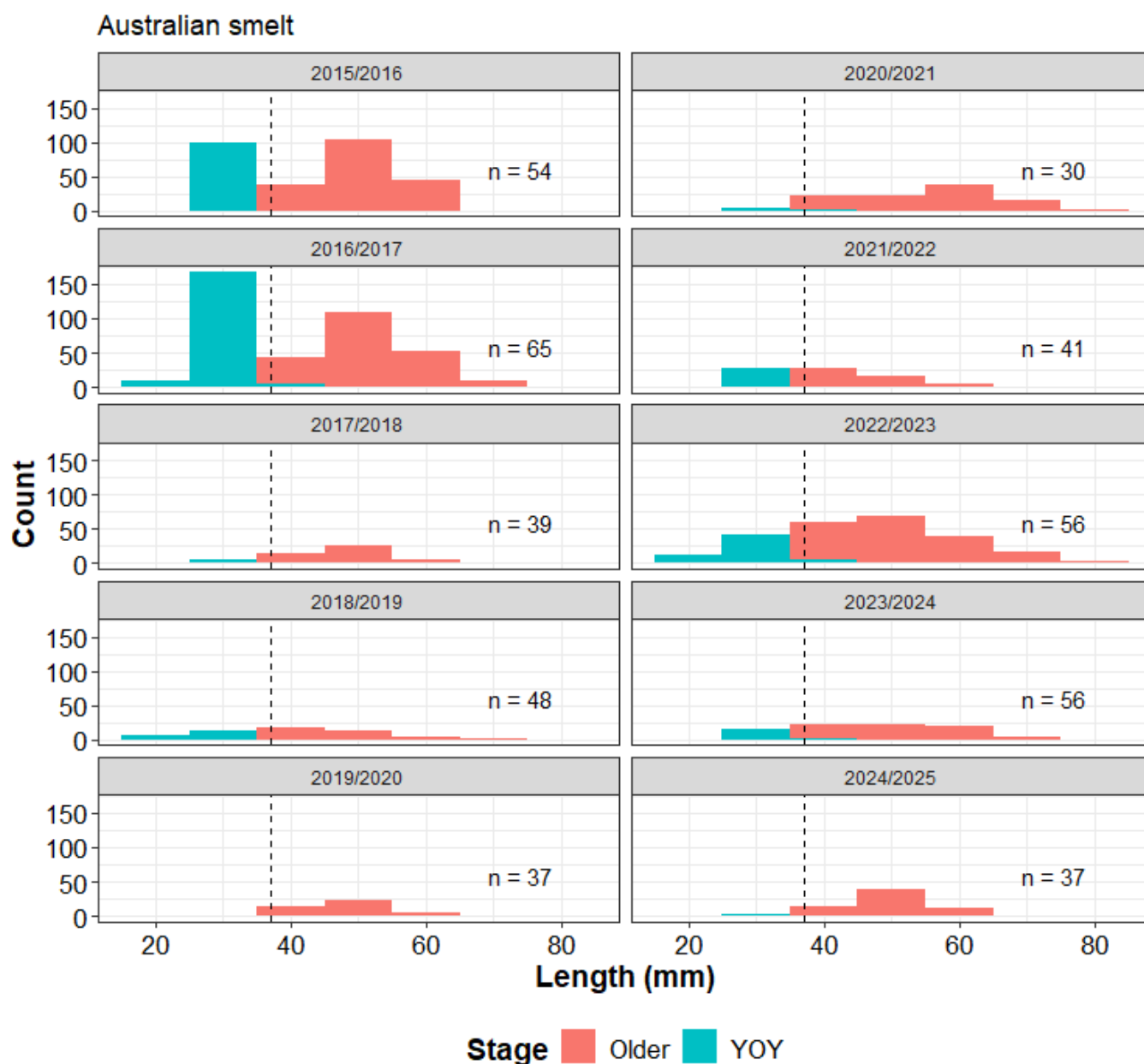


Figure 5.25: Length frequency plots for Australian smelt by sampling season. YOY represents Young of the Year fish. n shows the number of sampling events in each season. Note some stages may appear either side of the cut-off line due to binning of data in the histogram.

5.11.1.1 Summary Statement:

Regular recruitment but evidence of large recruitment events in 2015/16 and 2016/17. Low recruitment in 2024/25.

5.11.2 Temporal Trends in Abundance

The relative abundance of Australian smelt since 1994 was modelled based on all suitable boat electrofishing data. The left-hand panel of Figure 5.26 show the abundance trends for the Macquarie-Castlereagh WRPA and the right-hand panel show the overall trend across the NSW MDB.

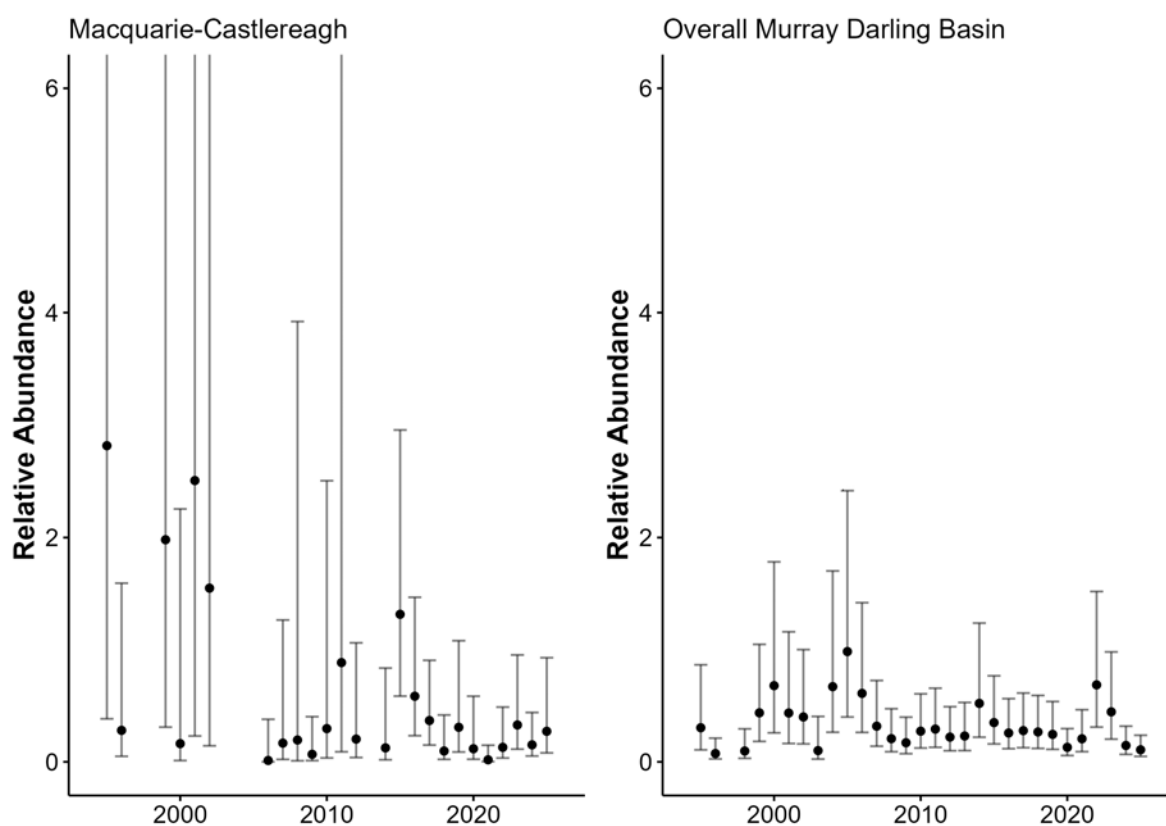


Figure 5.26: Relative abundance of Australian smelt in both this WRPA and the overall NSW MDB. These are model estimates based upon all boat electrofishing data within the NSW DPIRD Freshwater ecosystem database and the output of generalised linear mixed models. Error bars show the 95% confidence intervals around the estimates. No modelling of biomass was done for Australian smelt. Some error bars may be truncated for clarity.

5.11.2.1 Summary Statement:

Highly variable abundance but there is some evidence that abundance has declined since 2015. Abundance is similar to or slightly higher than the overall NSW MDB.

5.11.3 Health

The prevalence of any health issues ranged from 0% of sampled fish in 2017/2018 to 1% of sampled fish in 2016/2017 (Figure 5.27). The most common health issue for Australian smelt in the Macquarie-Castlereagh WRPAs was Lesions, which was observed in a total of 3 fish, corresponding to <1% of all Australian smelt measured.

Across the other NSW MDB WRPA, <1% of Australian smelt (146 out of 24,421 Australian smelt) showed a health condition (excludes the Macquarie-Castlereagh WRPAs).

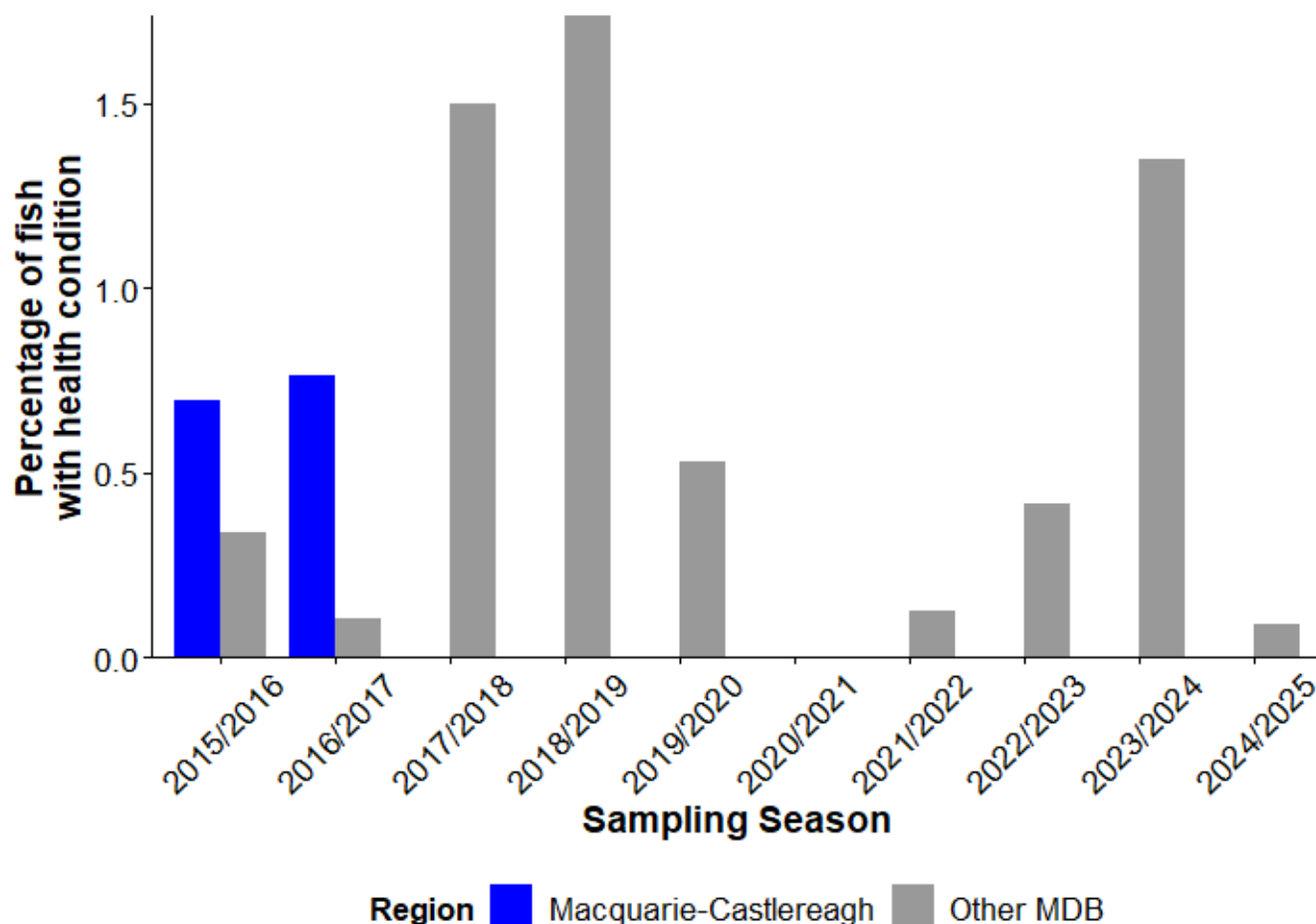


Figure 5.27: Timeseries showing the prevalence of health conditions in Australian smelt. Blue shows the region-specific data while the grey shows the average across the other NSW MDB WRPA.

5.11.3.1 Summary Statement:

Very few health issues were recorded in Australian smelt in the Macquarie-Castlereagh and none in recent years.

5.11.4 Distribution

Australian smelt were recorded at 64 out of 166 sites in the Macquarie-Castlereagh WRP. The maximum observed relative abundance at a site was 7.3 fish caught per 90 seconds of electrofishing. Figure 5.28 shows the distribution and relative abundance of Australian smelt across the Macquarie-Castlereagh WRP.

5.11.4.1 Summary Statement:

Australian smelt were mostly observed across the southern half of the Macquarie-Castlereagh WRP with very few observations in the northern region.

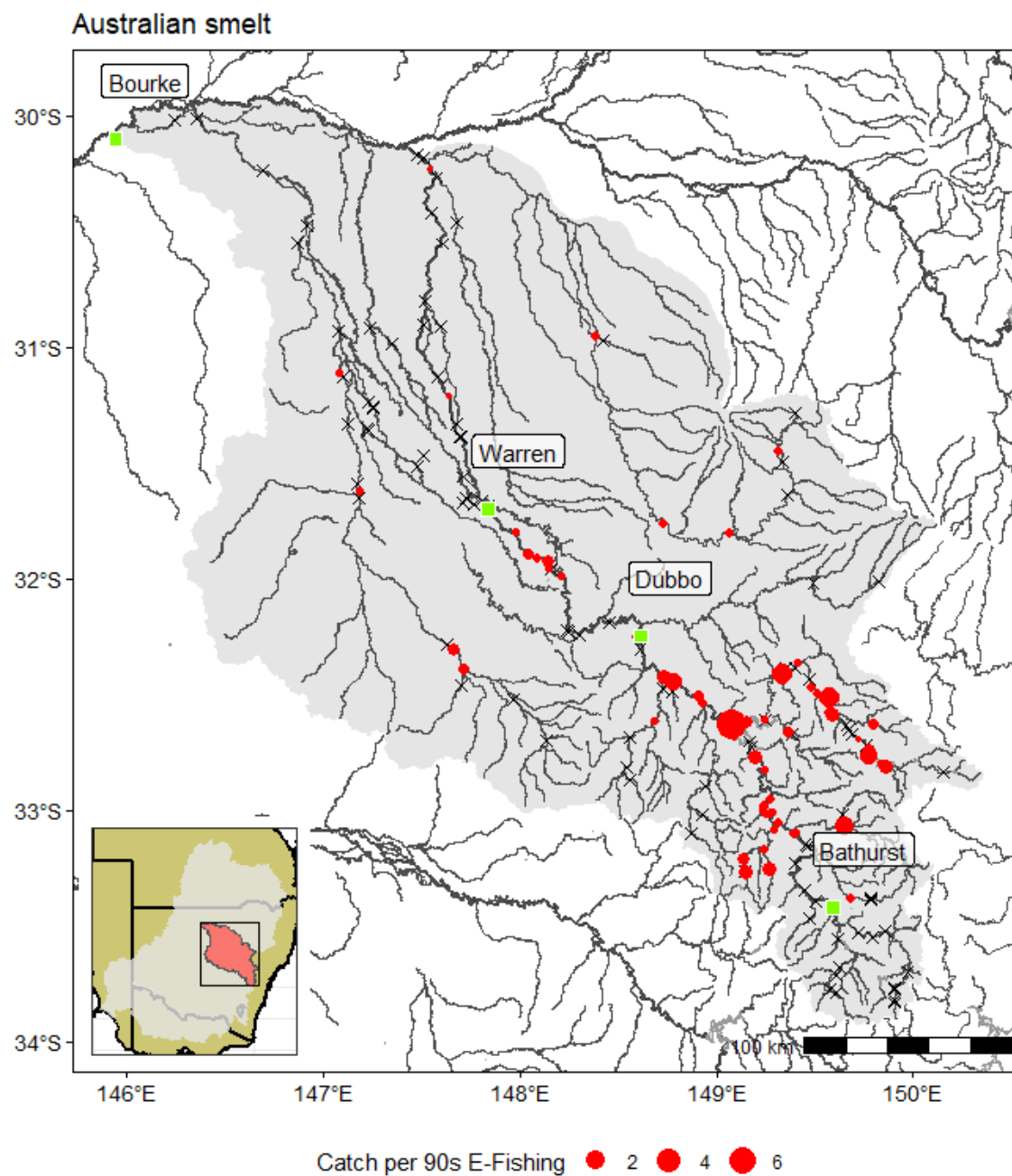


Figure 5.28: Distribution of Australian smelt. Filled circles show sites where the species was present, and the size of the circle represents relative abundance. Sites that were sampled with electrofishing but did not contain the species are shown with an X.

5.12 Common carp



5.12.1 Population Structure

Figure 5.29 shows the observed length frequency plot for Common carp for each of the sampling seasons. The observed numbers of Young of the Year (YOY) ranged from 59 to 1,926, and 5% to 74% of measured fish within a season, with a mean percentage YOY of 34%.

Overall, during the reporting period, across all the MDB water resource planning areas, the percentage YOY for Common carp was 56% (32,487 out of 57,989). Common carp are not a stocked species.

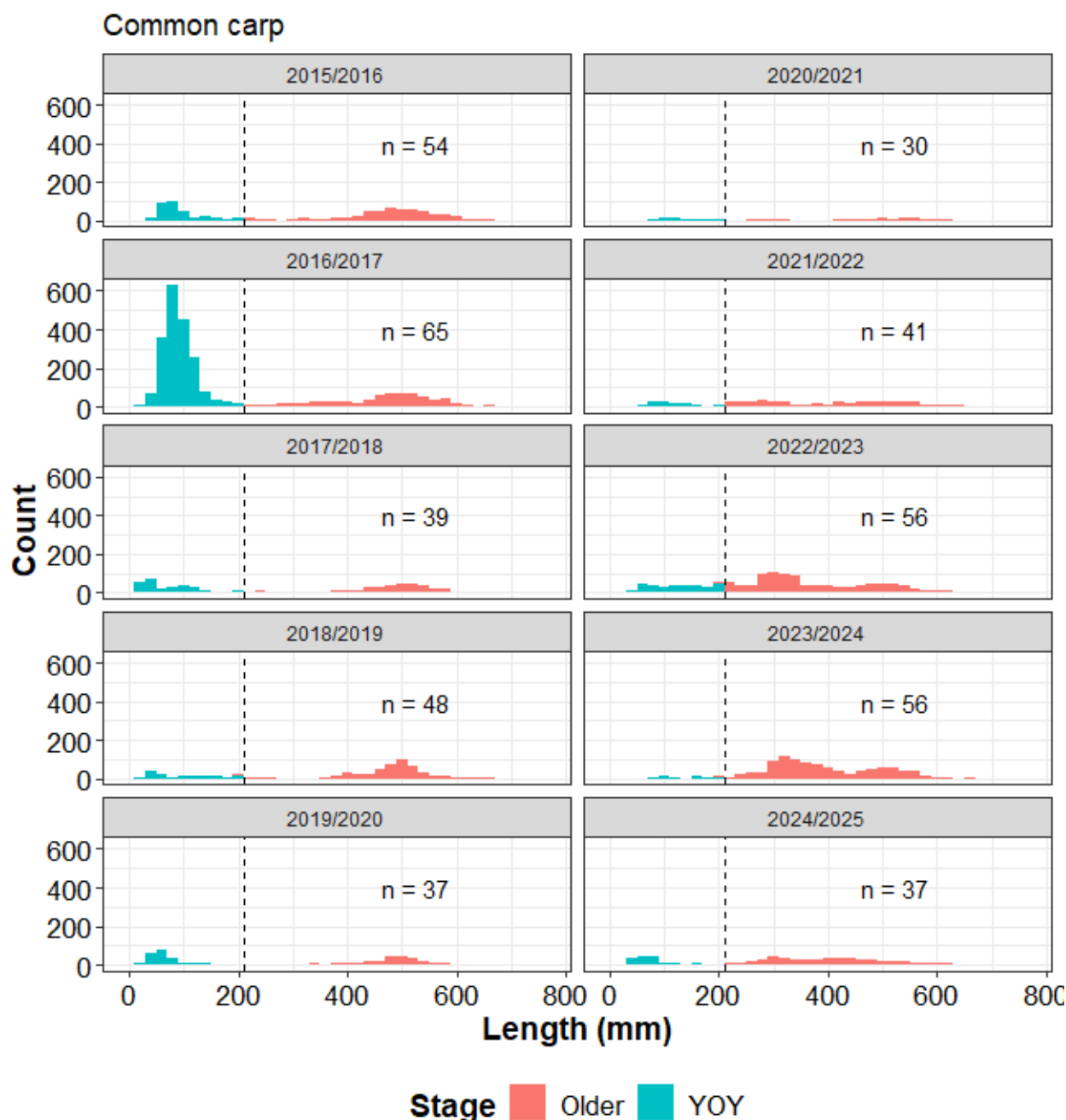


Figure 5.29: Length frequency plots for common carp by sampling season. YOY represents Young of the Year fish. n shows the number of sampling events in each season. Note some stages may appear either side of the cut-off line due to binning of data in the histogram.

5.12.1.1 Summary Statement:

Variable recruitment with a very strong peak in 2016/17. Large fish (>500 mm) present in all years. Moderate recruitment in 2024/25 with evidence of multiple year classes in the population.

5.12.2 Temporal Trends in Abundance

The relative abundance and biomass of Common carp since 1994 was modelled based on all suitable boat electrofishing data. The left-hand panels of Figure 5.30 show the abundance and biomass trends for the Macquarie-Castlereagh WRPA and the right-hand panels show the overall trends across the NSW MDB.

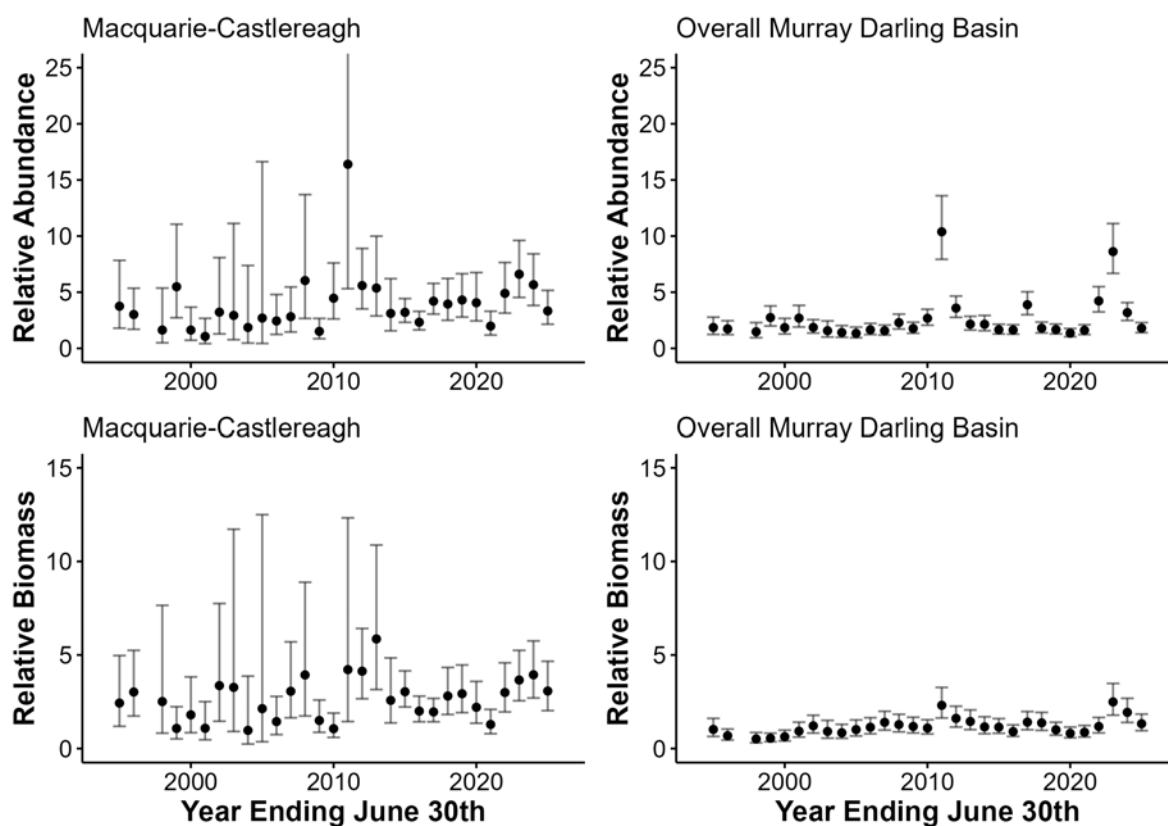


Figure 5.30: Relative abundance and biomass of Common carp in both this valley and the overall Murray-Darling Basin. These are model estimates based upon all electrofishing data within the NSW DPIRD Freshwater ecosystem database and the output of generalised linear mixed models. Error bars show the 95% confidence intervals around the estimates. Some error bars may be truncated for clarity.

5.12.2.1 Summary Statement:

Abundance and biomass are likely both approximately equal to or slightly higher than the 1990s. Some evidence that abundance and biomass are declining from a recent peak in 2023. Recent abundance similar to, or slightly higher, than overall NSW MDB. Recent biomass higher than overall NSW MDB.

5.12.3 Health

The prevalence of any health issues ranged from 1% of sampled fish in 2024/2025 to 18% of sampled fish in 2018/2019 (Figure 5.31). The most common health issue for Common carp in the Macquarie-Castlereagh water resource planning area was the presence of the parasite *Lernaea*, which was observed in a total of 397 fish, corresponding to 4% of all Common carp measured.

Across the other WRPA's, 3% of Common carp (1,771 out of 57,991 Common carp) showed a health condition (excludes Macquarie-Castlereagh).

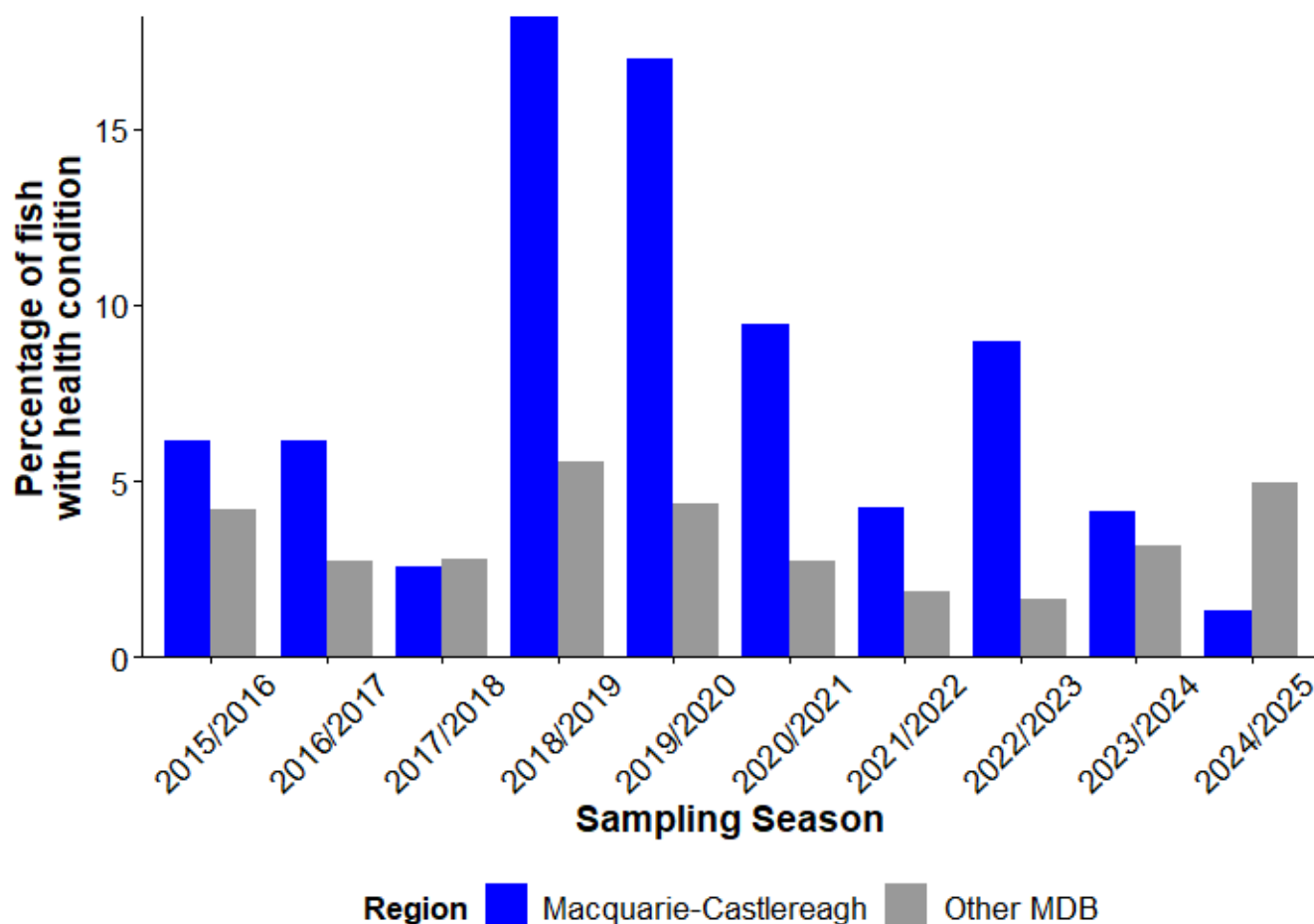


Figure 5.31: Timeseries showing the prevalence of health conditions in Common carp. Blue shows the region-specific data while the grey shows the average across the other NSW MDB WRPA's.

5.12.3.1 Summary Statement:

The presence of observable health conditions for Common carp in the Macquarie-Castlereagh was low to moderate and but generally higher than the wider NSW MDB. 2024/25 showed a low level of health issues.

5.12.4 Distribution

Common carp were recorded at 140 out of 166 sites in the Macquarie-Castlereagh WSPA. The maximum observed relative abundance at a site was 37 fish caught per 90 seconds of electrofishing. Figure 5.32 shows the distribution and relative abundance of Common carp across the Macquarie-Castlereagh WSPA.

5.12.4.1 Summary Statement:

Common carp were found in relatively high abundance across the Macquarie-Castlereagh region.

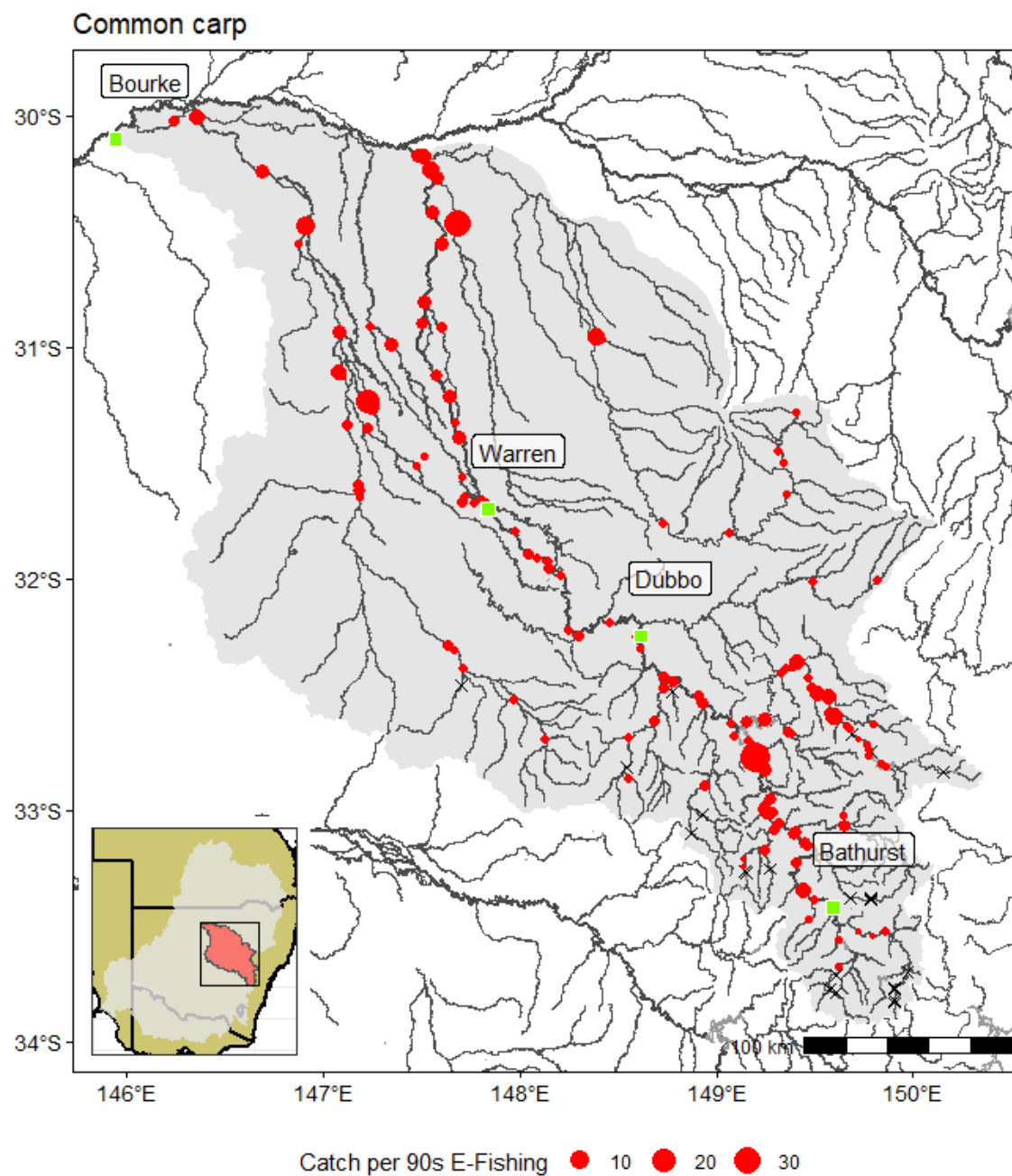


Figure 5.32: Distribution of Common carp. Filled circles show sites where the species was present, and the size of the circle represents relative abundance. Sites that were sampled with electrofishing but did not contain the species are shown with an X. Green squares show key towns.

5.13 Threatened Species

The following table (Table 5.6) shows the fish species listed under either the *NSW Fisheries Management Act 1994* (FMA) or the *Commonwealth Environmental Protection and Biodiversity Conservation Act 1999* (EPBC) which were observed in the Macquarie-Castlereagh Water Resource Planning Area during the reporting period. A list of all threatened fish species observed by NSW DPIRD Fisheries (as part of any sampling program in any area) is provided in Table 5.10.

Table 5.6: Listed species which were observed in this region during the sampling period.

Species	Common name	Total caught	Total observed (not caught)
<i>Ambassis agassizii</i>	Olive perchlet	41	3
<i>Bidyanus bidyanus</i>	Silver perch	13	2
<i>Maccullochella macquariensis</i>	Trout cod	5	0
<i>Maccullochella peelii</i>	Murray cod	1,435	477
<i>Macquaria australasica</i>	Macquarie perch	3	0
<i>Tandanus tandanus</i>	Freshwater catfish	102	16

The following pages provide more information on where each species was caught.

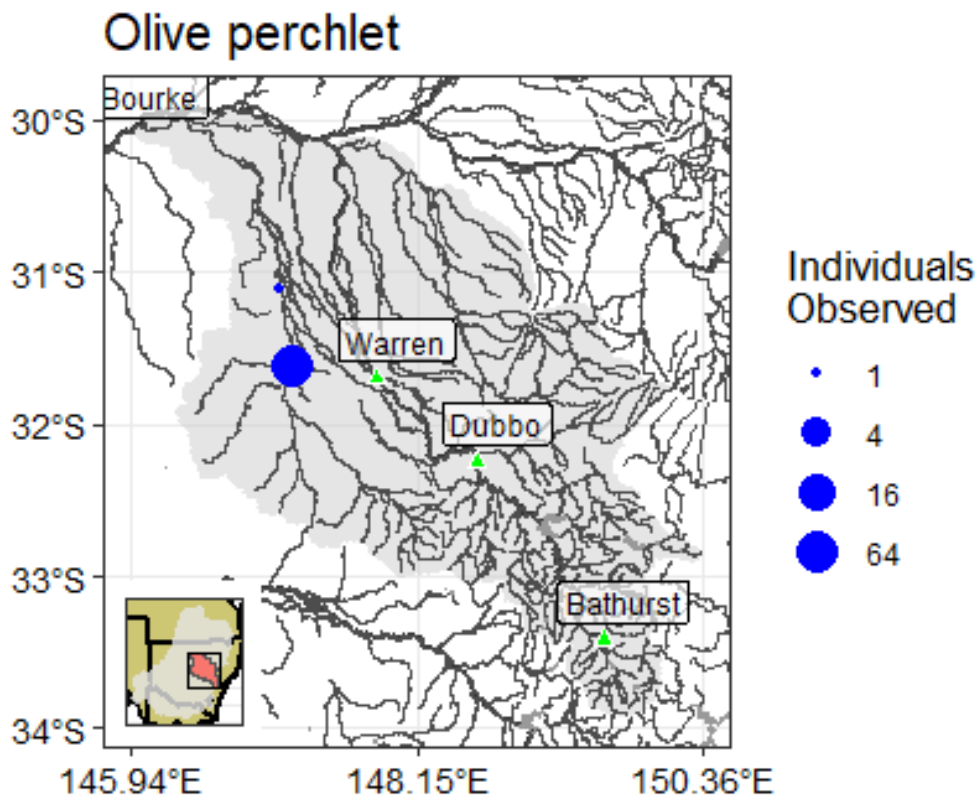


Figure 5.33: Distribution of the observed threatened species. Filled circles show sites where the species was present, and the size of the circle represents number of observed individuals abundance. Green triangles show key towns.

5.13.0.1 Summary Statement:

A total of 41 Olive perchlet were caught across two sites in the Bogan River as part of standardised monitoring. No individuals were observed in 2021/22, 2023/24 and 2024/25.

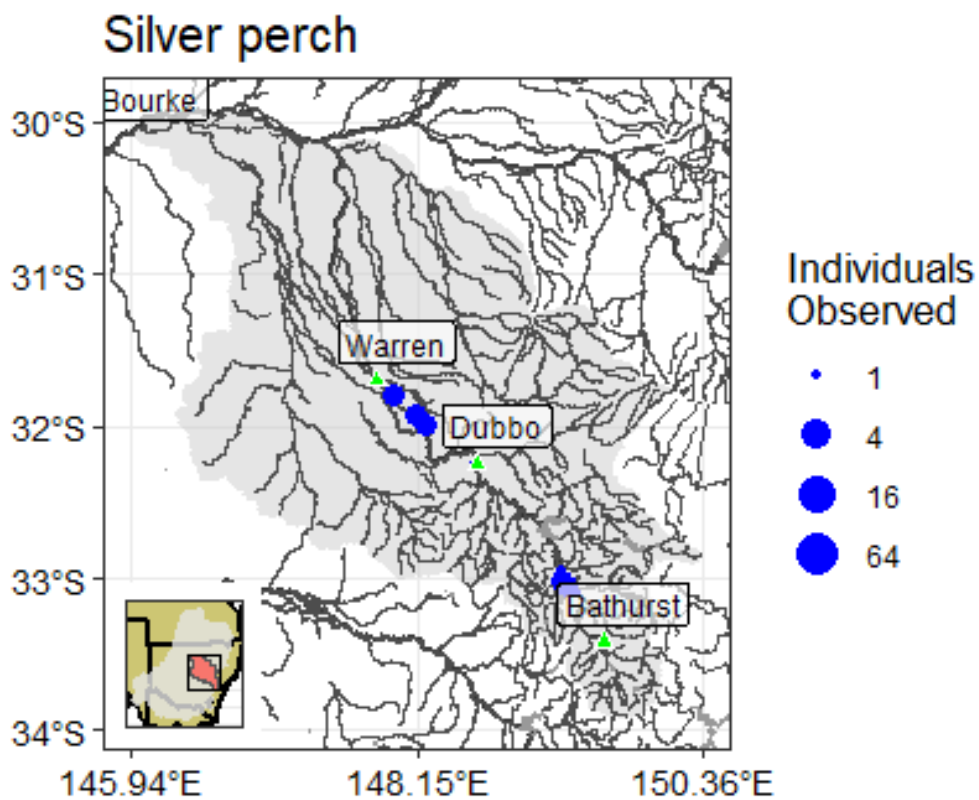


Figure 5.34: Distribution of the observed threatened species. Filled circles show sites where the species was present, and the size of the circle represents number of observed individuals abundance. Green triangles show key towns.

5.13.0.2 Summary Statement:

13 Silver perch were caught across the reporting period across 8 sites in the Macquarie River and Little Bald Creek. Individuals were observed in all years except 2018/19, 2019/20 and 2022/23.

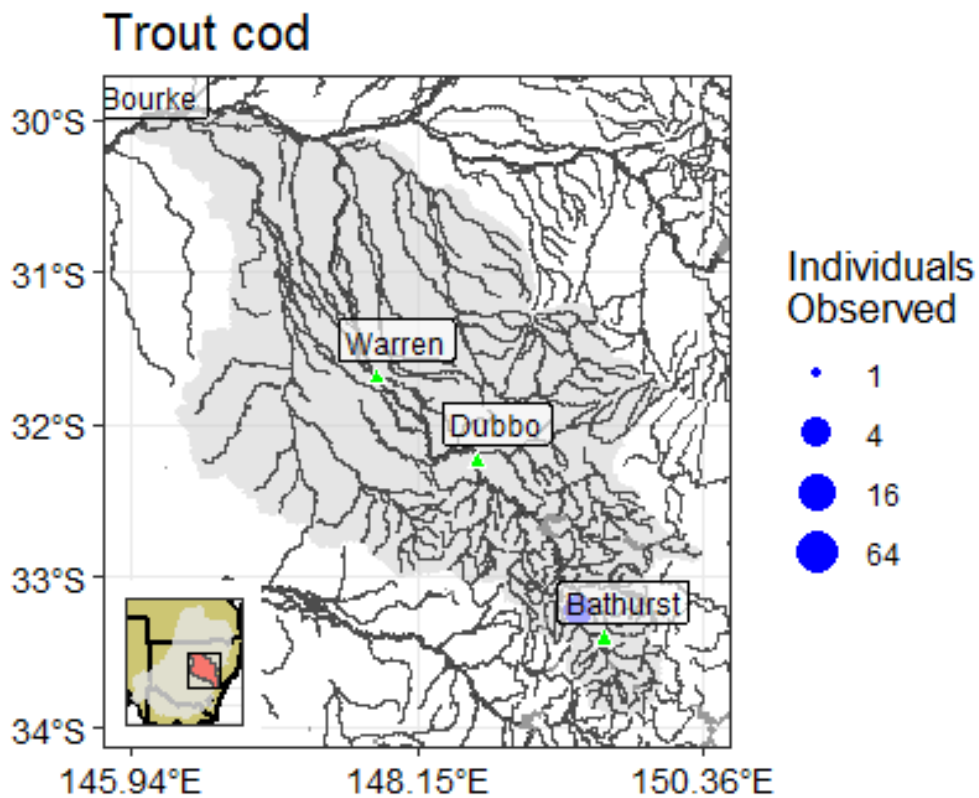


Figure 5.35: Distribution of the observed threatened species. Filled circles show sites where the species was present, and the size of the circle represents number of observed individuals abundance. Green triangles show key towns.

5.13.0.3 Summary Statement:

Trout cod were observed in 2015/16 (n= 5) in the Macquarie River. Trout cod have not been recorded in this WRPA since 2016.

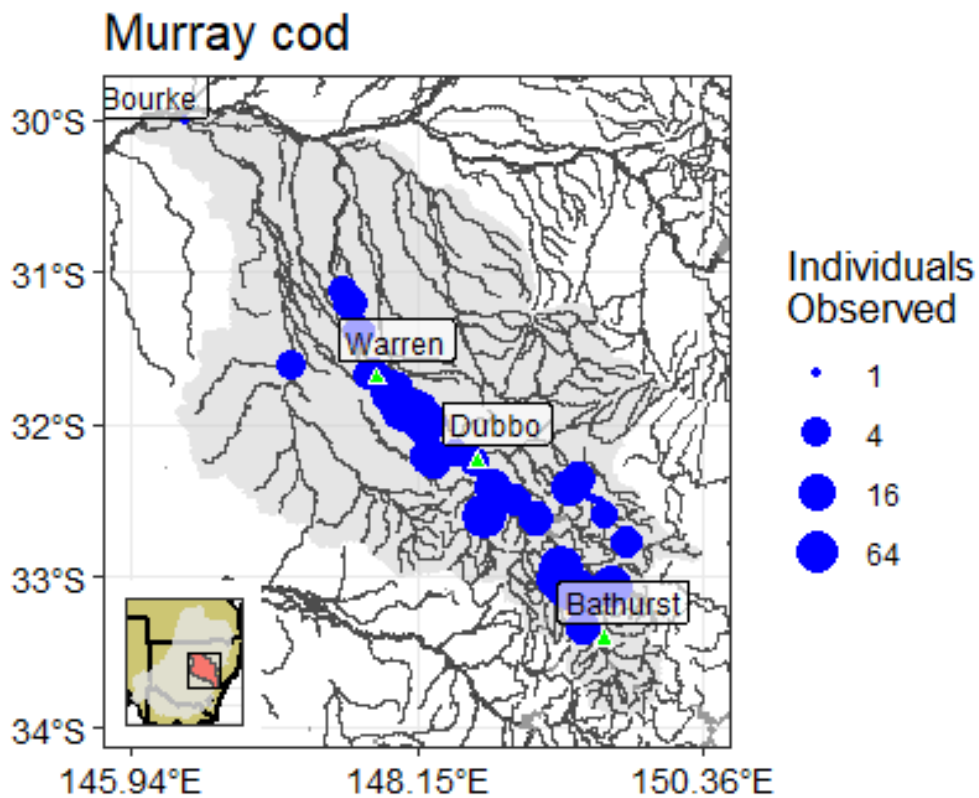


Figure 5.36: Distribution of the observed threatened species. Filled circles show sites where the species was present, and the size of the circle represents number of observed individuals abundance. Green triangles show key towns.

5.13.0.4 Summary Statement:

Murray cod were widespread across the Macquarie-Castlereagh WRPA, and were particularly common in the Macquarie River. A total of 1,573 individuals were caught over the reporting period with individuals observed in each sampling season.

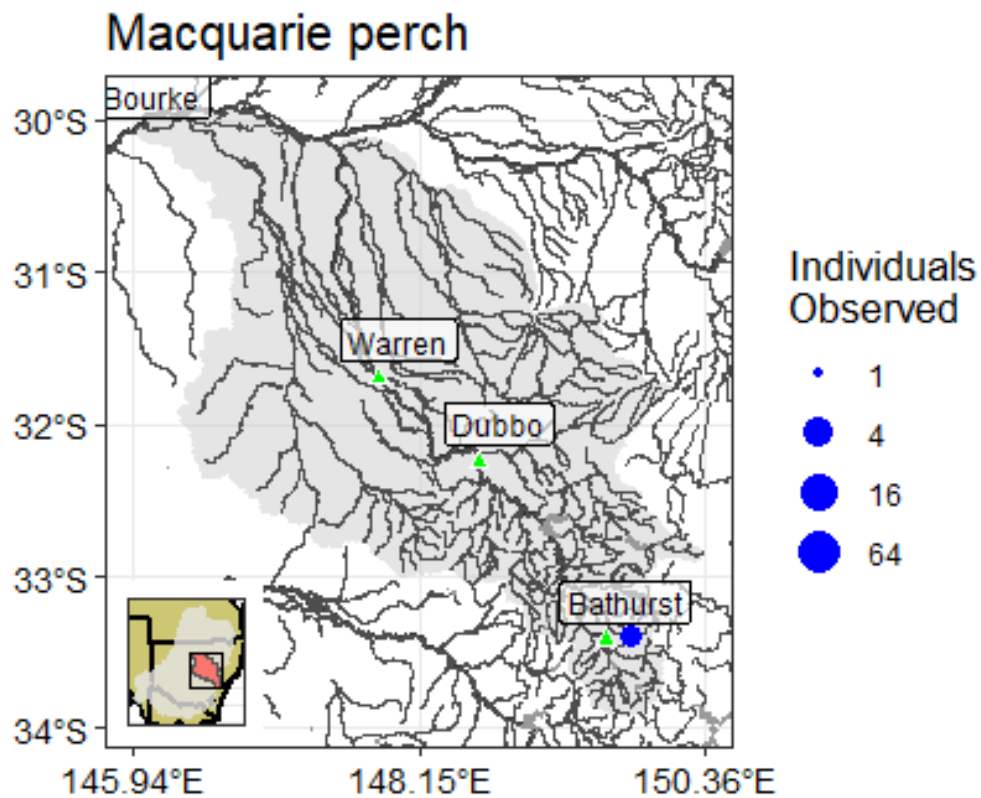


Figure 5.37: Distribution of the observed threatened species. Filled circles show sites where the species was present, and the size of the circle represents number of observed individuals abundance. Green triangles show key towns.

5.13.0.5 Summary Statement:

One Macquarie perch was caught in 2020/21 and two Macquarie perch were caught in 2021/22.

Freshwater catfish

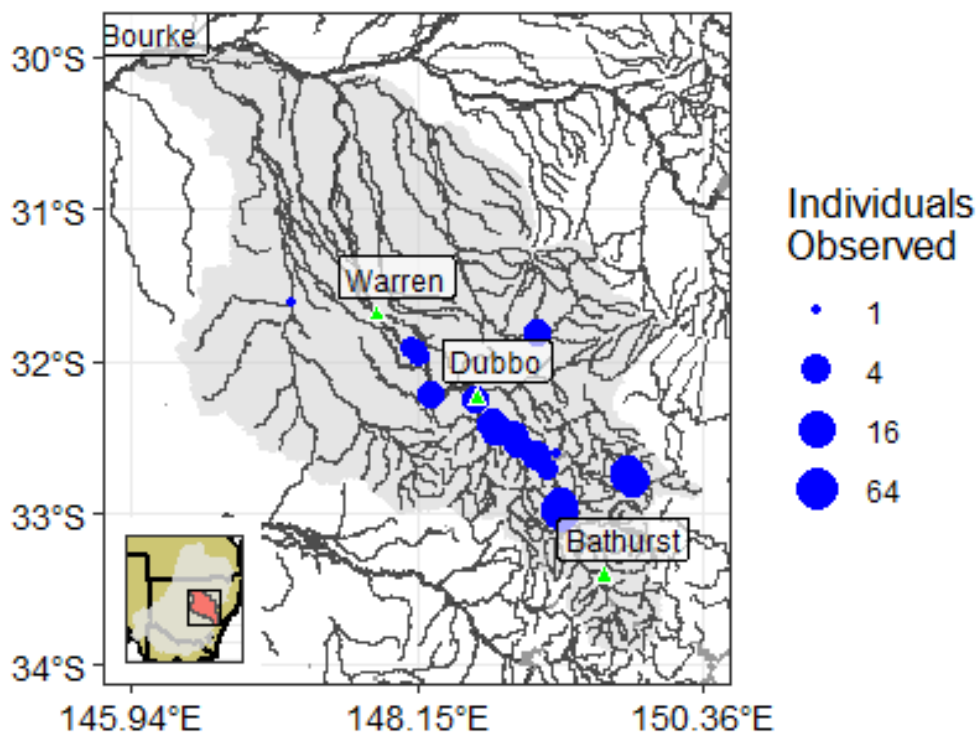


Figure 5.38: Distribution of the observed threatened species. Filled circles show sites where the species was present, and the size of the circle represents number of observed individuals abundance. Green triangles show key towns.

5.13.0.6 Summary Statement:

Freshwater catfish were caught in all sampling years (total=102) across the central and southern half of the Macquarie-Castlereagh WRPA. Most individuals were in the Macquarie River.

5.14 Appendix

This report contains data from the projects listed in Table 5.7.

Table 5.7: Projects included in this report. Sampling Events show the total number of sampling events included from each project. Sampling Seasons shows which sampling seasons each project contributed data to.

Project Name	Sampling Seasons	Sampling Events
Basin Plan Environmental Outcomes Monitoring	2015/2016, 2016/2017, 2017/2018, 2018/2019, 2019/2020, 2020/2021	174
Basin Plan Environmental Outcomes Monitoring 2	2021/2022, 2022/2023, 2023/2024, 2024/2025	55
Carp Biomass Project (NCCP)	2017/2018	1
Carp herpes virus investigation	2015/2016, 2016/2017	11
FlowMER2.0	2024/2025	19
Golden perch Macquarie migration pathways	2022/2023	4
Macquarie River eflow response monitoring	2020/2021, 2021/2022, 2022/2023, 2023/2024	27
Macquarie perch surveys	2020/2021, 2021/2022, 2022/2023	5
Monitoring, Evaluating and Reporting - Inland	2015/2016, 2016/2017	7
Murray-Darling Basin Fish Surveys	2015/2016, 2016/2017, 2017/2018, 2018/2019, 2019/2020, 2020/2021, 2021/2022, 2022/2023, 2023/2024, 2024/2025	80
Orange Pipeline assessment	2015/2016, 2016/2017, 2017/2018, 2018/2019, 2019/2020, 2021/2022, 2022/2023, 2023/2024	109
Recreational Fishing Assessments in NSW	2018/2019, 2019/2020, 2020/2021, 2021/2022, 2022/2023, 2023/2024, 2024/2025	95
Screens for streams	2020/2021	10

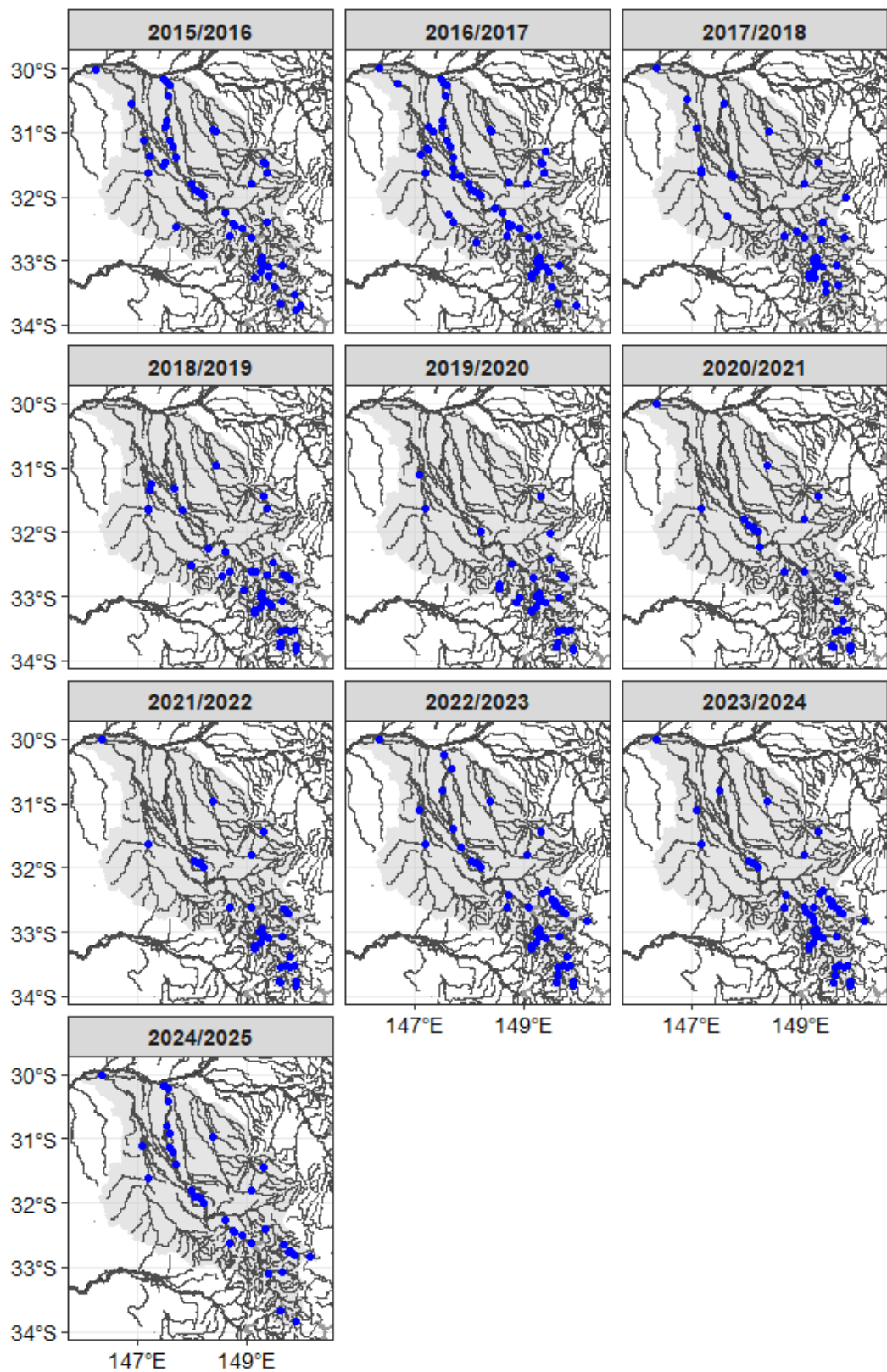


Figure 5.39: Sites sampled and included in this report by sampling season. Dry sites are not shown.

Table 5.8 shows all species detected during this survey period as part of standardised monitoring projects (see Table 5.7). Note there are variations in effort between sampling seasons so this information should be considered in conjunction with Table 5.1. The Expected from Modelling column identifies species which are possible to occur based upon MaxENT habitat modelling (likelihood threshold > 0.33; NA represents no modelling was undertaken). Species that were possible from the modelling but not observed during standardised sampling in the Macquarie-Castlereagh WRPAs were: Darling hardyhead, Flat-headed galaxias, Southern purple-spotted gudgeon, Southern pygmy perch, Hyrtl's catfish. It should be noted that the MaxENT modelling models habitat availability and is not always a reliable index of abundance, it merely indicates possible distribution based upon habitat. A full list of species observed during this period across the standardised monitoring protocols and sampling methods is presented in Table 5.11.

Table 5.8: Total number caught of each species by sampling season. Sampling season refers to the July-June ending June 30th of the specified year.

Common name	Expected from modelling	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Australian smelt	YES	383	988	51	56	42	100	84	395	85	70
Bony herring	YES	97	1,179	153	44	26	61	155	483	375	779
Brown trout	YES	3	12	0	14	32	60	132	102	32	8
Carp gudgeon species complex	YES	1,481	1,296	1,061	1,021	389	1,446	66	78	107	254
Common carp	NA	893	3,652	712	639	636	185	611	2,114	1,371	631
Common carp - Goldfish hybrid	NA	5	2	3	7	0	0	3	4	13	0
Dwarf flathead gudgeon	YES	1	0	2	0	0	0	0	0	0	0
Eastern gambusia	NA	3,104	4,758	1,518	1,335	701	380	59	728	380	253
Flathead gudgeon	YES	139	244	192	127	90	9	4	32	314	99
Freshwater catfish	YES	26	15	6	10	2	5	4	11	4	19
Galaxias spp	NA	0	0	0	0	0	0	0	0	149	0
Golden perch	YES	128	211	39	37	12	25	109	137	115	87
Goldfish	NA	147	4,391	239	61	72	45	80	455	151	572

(continued)

Common name	Expected from modelling	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Macquarie perch	YES	0	0	0	0	0	1	2	0	0	0
Mountain galaxias	YES	126	39	130	148	348	151	234	181	44	172
Murray cod	YES	270	199	101	97	39	239	89	134	124	143
Murray-Darling rainbowfish	YES	139	135	3	1	0	36	4	0	13	94
Northern river blackfish	YES	0	0	0	0	5	2	0	5	3	0
Olive perchlet	YES	7	2	1	1	15	13	0	2	0	0
Rainbow trout	YES	27	13	4	117	67	121	138	181	34	0
Redfin	YES	156	840	67	111	49	2	355	163	107	11
Silver perch	YES	4	2	2	0	0	1	1	0	1	2
Spangled perch	YES	21	79	9	2	0	14	54	78	10	101
Trout cod	YES	5	0	0	0	0	0	0	0	0	0
Unspecked hardyhead	YES	107	192	16	15	53	30	32	105	20	57

The following table summaries the sampling methods for each species caught (Table 5.9).

Table 5.9: Total catch of each species by sampling method.

Common name	Backpack Electrofishing	Bait Trap	Boat Electrofishing
Australian smelt	289	0	1,965
Bony herring	174	11	3,167
Brown trout	334	0	61
Carp gudgeon species complex	2,151	4,055	993
Common carp	1,165	696	9,583
Common carp - Goldfish hybrid	0	0	37
Dwarf flathead gudgeon	2	0	1
Eastern gambusia	7,777	3,864	1,575
Flathead gudgeon	218	159	873
Freshwater catfish	33	0	69
Galaxias spp	149	0	0
Golden perch	11	2	887
Goldfish	686	59	5,468
Macquarie perch	3	0	0
Mountain galaxias	1,553	7	13
Murray cod	20	1	1,414
Murray-Darling rainbowfish	4	0	421
Northern river blackfish	12	0	3
Olive perchlet	0	8	33
Rainbow trout	683	0	19
Redfin	245	107	1,509
Silver perch	1	0	12
Spangled perch	91	22	255
Trout cod	5	0	0
Unspecked hardyhead	5	3	619

Table 5.10: Listed threatened species recorded in the Murray-Darling Basin (from the NSW DPIRD Fisheries Freshwater Ecosystem research database). Species are listed under either the NSW Fisheries Management Act 1994 (FMA) or the Commonwealth Environmental Protection and Biodiversity Conservation Act 1999 (EPBC)

Genus, species	Common Name	EPBC Status	FMA Status
<i>Ambassis agassizii</i>	Agassiz's glassfish, olive perchlet, western New South Wales population	NA	Endangered Population
<i>Bidyanus bidyanus</i>	Silver Perch, Bidyan	Endangered	Vulnerable
<i>Craterocephalus fluviatilis</i>	Murray Hardyhead	Endangered	Critically Endangered
<i>Galaxias rostratus</i>	Flathead Galaxias, Beaked Minnow, Flat-headed Galaxias, Flat-headed Jollytail, Flat-headed Minnow	Critically Endangered	Critically Endangered
<i>Galaxias tantangara</i>	Stocky Galaxias	NA	Critically Endangered
<i>Maccullochella macquariensis</i>	Trout Cod	Endangered	Endangered
<i>Maccullochella peelii</i>	Murray Cod	Vulnerable	NA
<i>Macquaria australasica</i>	Macquarie Perch	Endangered	Endangered
<i>Mogurnda adspersa</i>	Southern Purple Spotted Gudgeon	NA	Endangered
<i>Nannoperca australis</i>	Southern Pygmy Perch	Vulnerable	Endangered
<i>Tandanus tandanus</i>	Freshwater catfish, eel tailed catfish, Murray-Darling Basin population	NA	Endangered Population

Table 5.11 shows all species detected during this survey period across all programs and methods. Due to variations in project methods protocols, this data is presented only to give a complete list of species observed in the region. The Expected from Modelling column identifies species which are possible to occur based upon MaxENT habitat modelling (likelihood threshold > 0.33; NA represents no modelling was undertaken). Species that were possible from the modelling but not observed during standardised sampling in the Macquarie-Castlereagh WRPAs were: Darling hardyhead, Flat-headed galaxias, Southern purple-spotted gudgeon, Southern pygmy perch. It should be noted that the MaxENT modelling actually models habitat availability and is not always a reliable index of abundance, it merely indicates possible distribution based upon habitat. A list of species caught as part of standardised monitoring during this period is in Table 5.8.

Table 5.11: Total catch of each species by all sampling programs and all methods in the region. Sampling season refers to the July-June ending June 30th of the specified year. Note these include projects with sampling not representative of the community and the data should be interpreted with appropriate caution.

Common name	Expected from modelling	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Australian smelt	YES	511	995	51	56	42	110	84	396	100	70
Bengal sergeant	NA	0	0	0	0	0	0	0	3	0	0
Bony herring	YES	103	1,349	153	44	26	194	155	510	375	779
Brown trout	YES	3	12	0	14	32	60	132	102	32	8
Carp gudgeon species complex	YES	1,511	1,660	1,061	1,021	389	2,710	66	82	112	423
Common carp	NA	914	3,689	712	639	636	331	649	2,498	1,428	632
Common carp - Goldfish hybrid	NA	5	2	3	7	0	0	3	4	13	0
Dwarf flathead gudgeon	YES	1	0	2	0	0	0	0	0	0	0
Eastern gambusia	NA	3,169	5,273	1,518	1,335	701	2,535	59	729	387	534
Flathead gudgeon	YES	228	260	192	127	90	33	4	218	314	257
Freshwater catfish	YES	27	26	6	10	2	241	20	15	40	20
Galaxia spp	NA	0	0	0	0	0	0	0	0	149	0
Golden perch	YES	129	245	39	37	12	29	115	330	223	218

(continued)

Common name	Expected from modelling	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Goldfish	NA	147	4,760	239	61	72	327	80	469	154	572
Hyrtl's catfish	YES	0	1	0	0	0	0	0	3	0	0
Macquarie perch	YES	0	0	0	0	0	1	2	0	0	0
Mountain galaxias	YES	126	40	130	148	348	151	234	181	44	172
Murray cod	YES	286	199	101	97	39	1,051	148	157	200	147
Murray-Darling rainbowfish	YES	176	136	3	1	0	48	4	0	15	169
Northern river blackfish	YES	0	0	0	0	5	2	0	5	3	0
Olive perchlet	YES	7	2	1	1	15	13	0	2	0	0
Rainbow trout	YES	27	13	4	117	67	121	138	181	34	0
Redfin	YES	156	840	67	111	49	2	355	163	108	11
Silver perch	YES	4	2	2	0	0	1	1	7	1	2
Spangled perch	YES	21	119	9	2	0	14	54	256	12	101
Tamar Goby	NA	0	0	0	0	0	0	0	2	0	0
Trout cod	YES	5	0	0	0	0	0	0	0	0	0
Unidentified fish	NA	0	0	0	0	0	5	0	4	0	0
Unspecked hardyhead	YES	230	234	16	15	53	280	32	108	45	91

5.14.1 References

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