

Chapter 5 Basin Plan Fish Monitoring Summary (2014/15 – 2023/24): Lachlan Water Resource Planning Area

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Introduction

This report spans 2014/15 to 2023/24 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). This report focusses on the Lachlan Water Resource Planning Area (WRPA) shown in Figure 5.1.

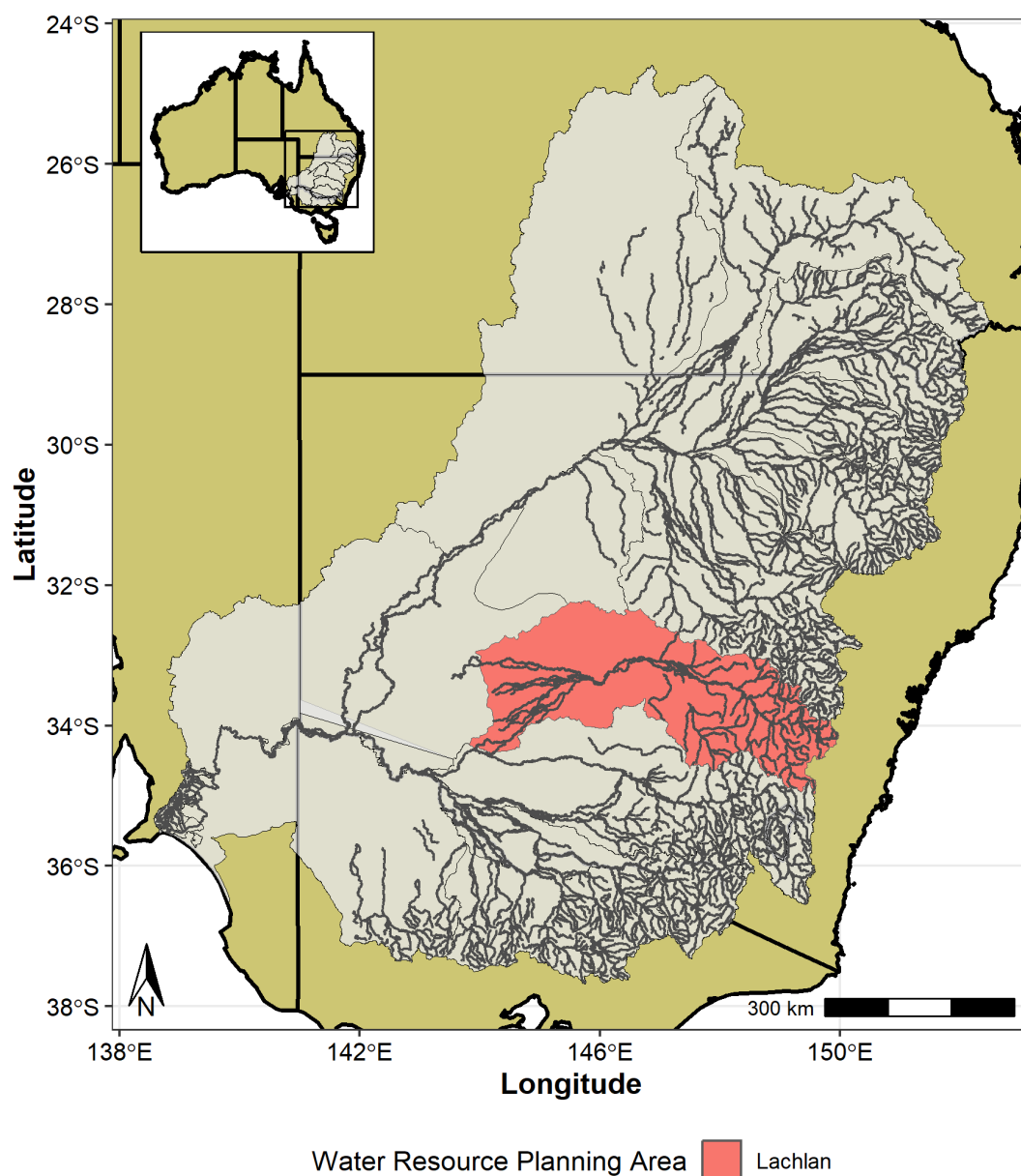


Figure 5.1: Murray-Darling Basin with the key region of this report highlighted. Inset map shows the whole of Australia with a box around the MDB.

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 Lachlan WRPA. 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 (very few were caught in this WRPA during the reporting period)
- Bony herring
- Australian smelt
- Common carp

Population structure information includes length frequency plots of collected 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 WRPA. 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 Lachlan WRPA 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 Lachlan WRPA and greater MDB (excluding the Lachlan WRPA).

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 Lachlan WRPA 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.

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 bait trap samples informing the distribution of small bodied 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 parts of this report compile 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 set in edge margins. Most sampling occurred between the months of September and May.

Table 5.1: Sampling effort (Number of sites sampled) each sampling season in the Lachlan WRPA. 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
2014/2015	21	18	1	40
2015/2016	25	11	0	36
2016/2017	26	18	0	44
2017/2018	25	21	1	47
2018/2019	24	18	2	44
2019/2020	29	15	0	44
2020/2021	20	9	1	30
2021/2022	14	1	0	15
2022/2023	17	3	1	21
2023/2024	19	5	0	24

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 5.33).

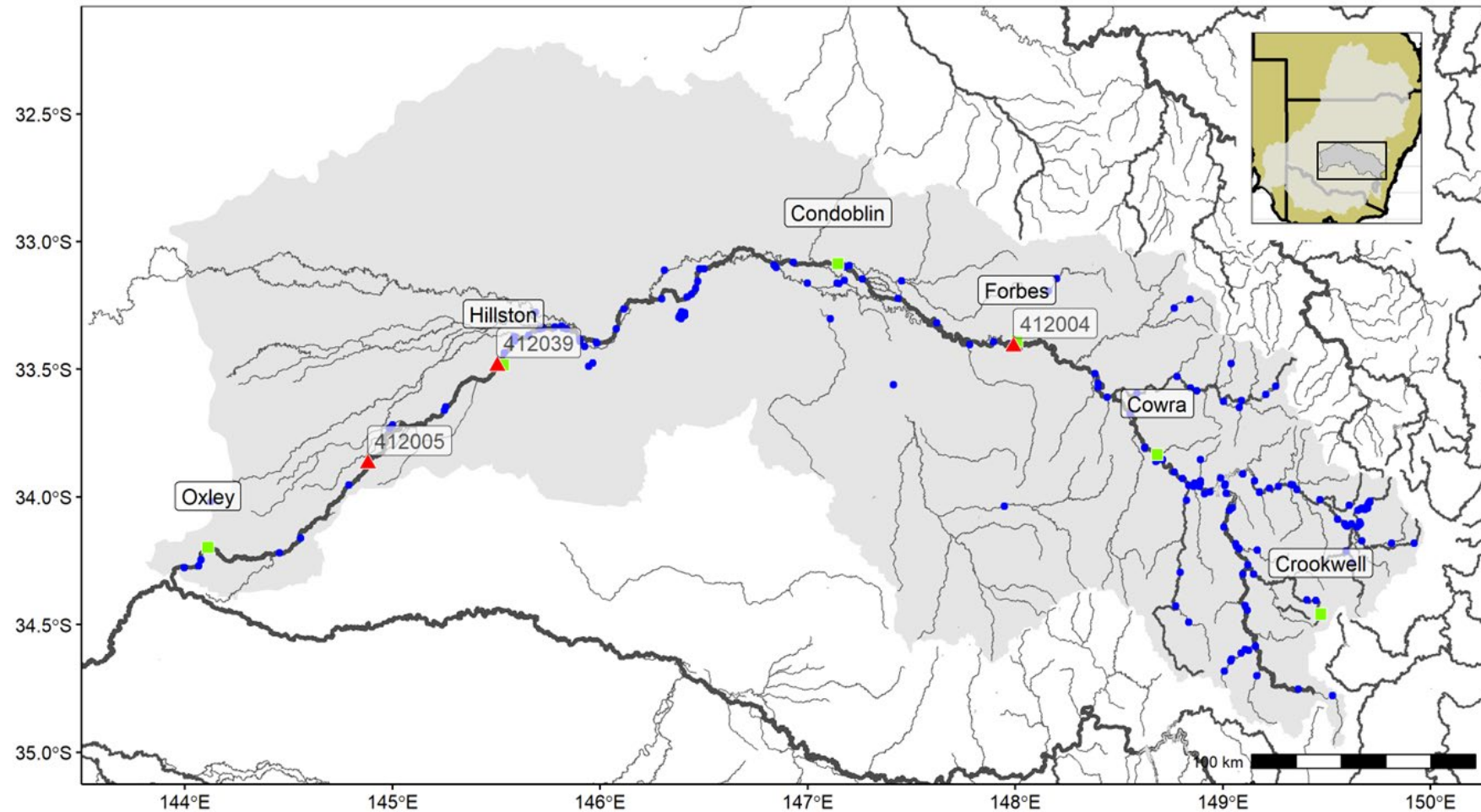


Figure 5.2: Sites (blue dots) sampled during the reporting period in the Lachlan WRPA. Red triangles show key flow gauges along with their gauge ID number. Green squares show key towns. The grey shaded area represents the water resource planning area.

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 whole program in the Lachlan WRPA. Further data on total catch is provided in the Appendix.

Common name	Boat Electrofishing	Backpack Electrofishing	Bait Trap
Australian smelt	1,872	108	1
Bony herring	21,036	30	3
Common carp	15,933	687	990
Freshwater catfish	3	0	0
Golden perch	1,057	0	0
Murray cod	1,032	16	0

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 six key species.

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

Sampling Season	Australian smelt	Bony herring	Common carp	Freshwater catfish	Golden perch	Murray cod
2014/2015	95	1,648	415	1	186	198
2015/2016	67	2,466	591	0	129	123
2016/2017	170	2,264	1,931	0	94	37
2017/2018	249	3,877	591	0	98	38
2018/2019	38	2,171	489	1	131	56
2019/2020	34	353	474	0	154	151
2020/2021	94	684	729	0	141	248
2021/2022	381	790	810	0	26	50
2022/2023	123	571	1,038	0	68	78
2023/2024	32	1,034	876	1	43	76

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, 2014 states it was the warmest year on record, meaning 2014 was the warmest year on record up to and including 2014 but not including more recent years.

2014

New South Wales experienced its warmest year on record in 2014, with several heatwaves and persistently warm conditions across the State. Rainfall was well below average in the northeast, and close to average elsewhere.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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. 2024 was the third-warmest on record for all years since 1910, 1.55 °C above the 1961–1990 average.

Flow Data

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

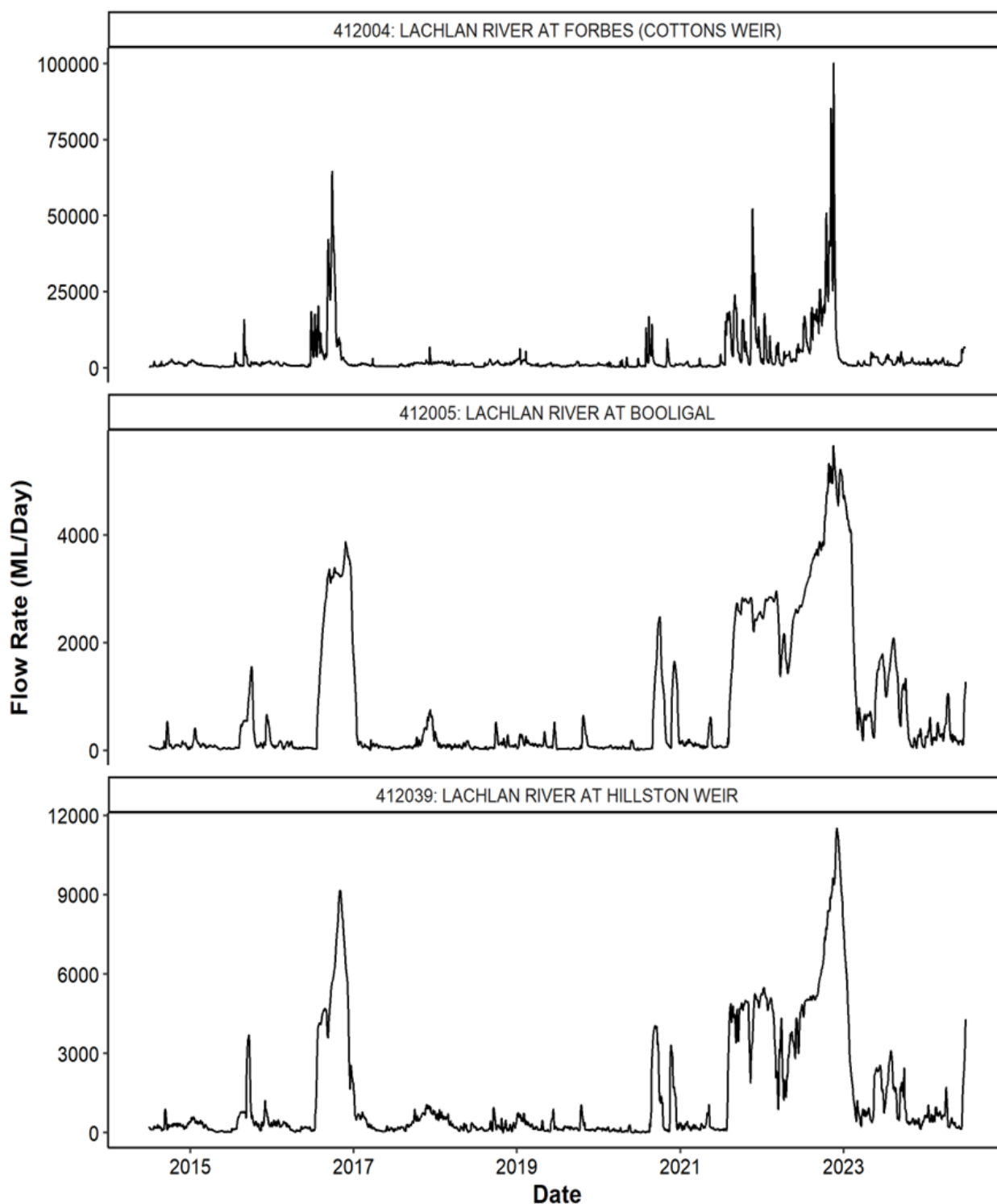


Figure 5.3: Flow data from various gauges in the Lachlan WRP over the reporting period. Gauge locations can be seen on Figure 5.2. Note the differing scales on the y-axis.

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

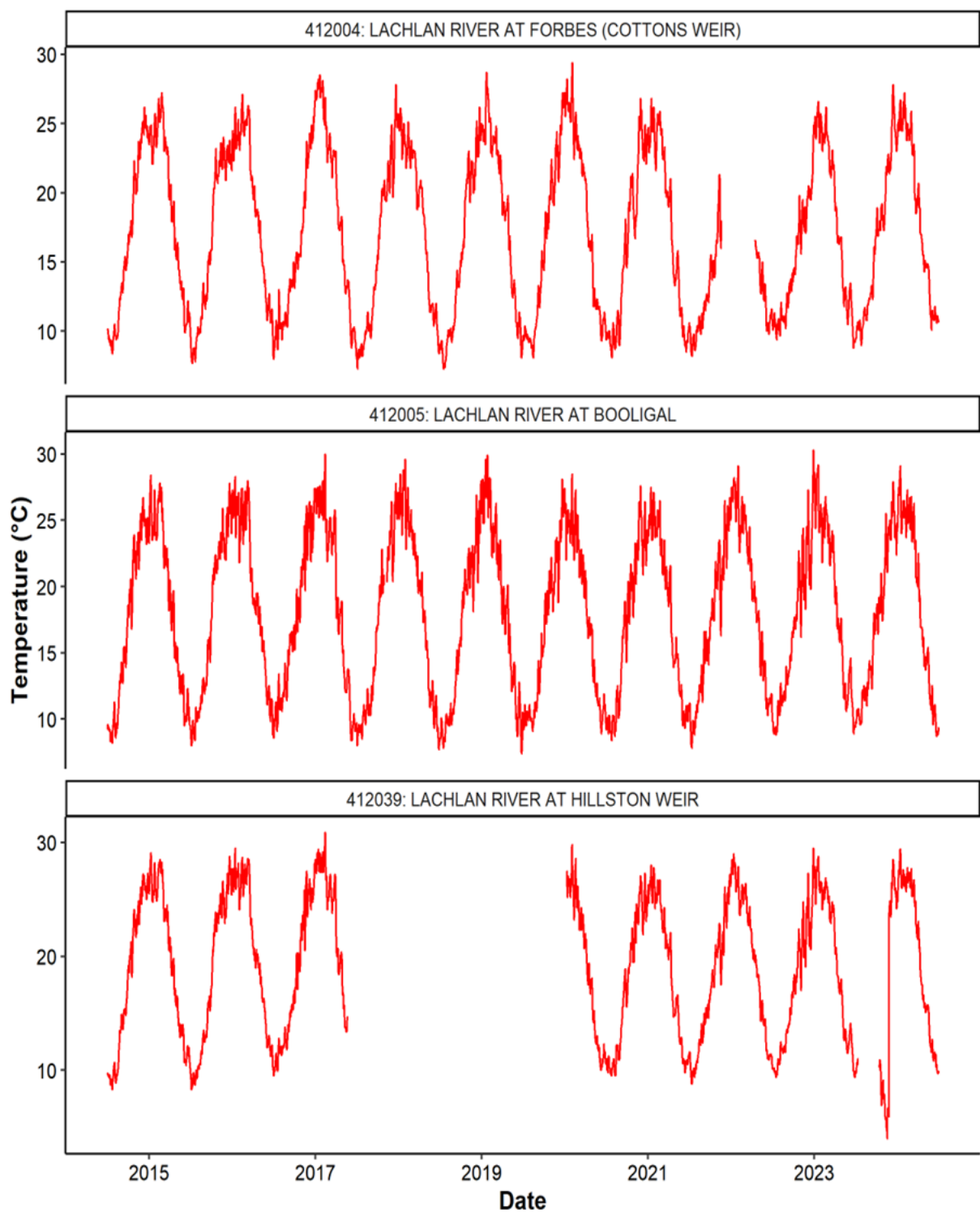


Figure 5.4: Water temperature data from various gauges in the Lachlan WRPA over the reporting period. Gauge locations can be seen on Figure 5.2. Note the differing scales on the y-axis.

Species Diversity

A total of 20 fish species were observed across the Lachlan WRPAs including seven alien species. Figure 5.5 shows the number of native species found at each site while Figure 5.6 shows the number of alien species found at each site. The full list of species caught and observed is presented in Table 5.8.

Summary Statement:

Diversity was highest in the central area of the Lachlan region while the alien diversity was generally consistent across the region.

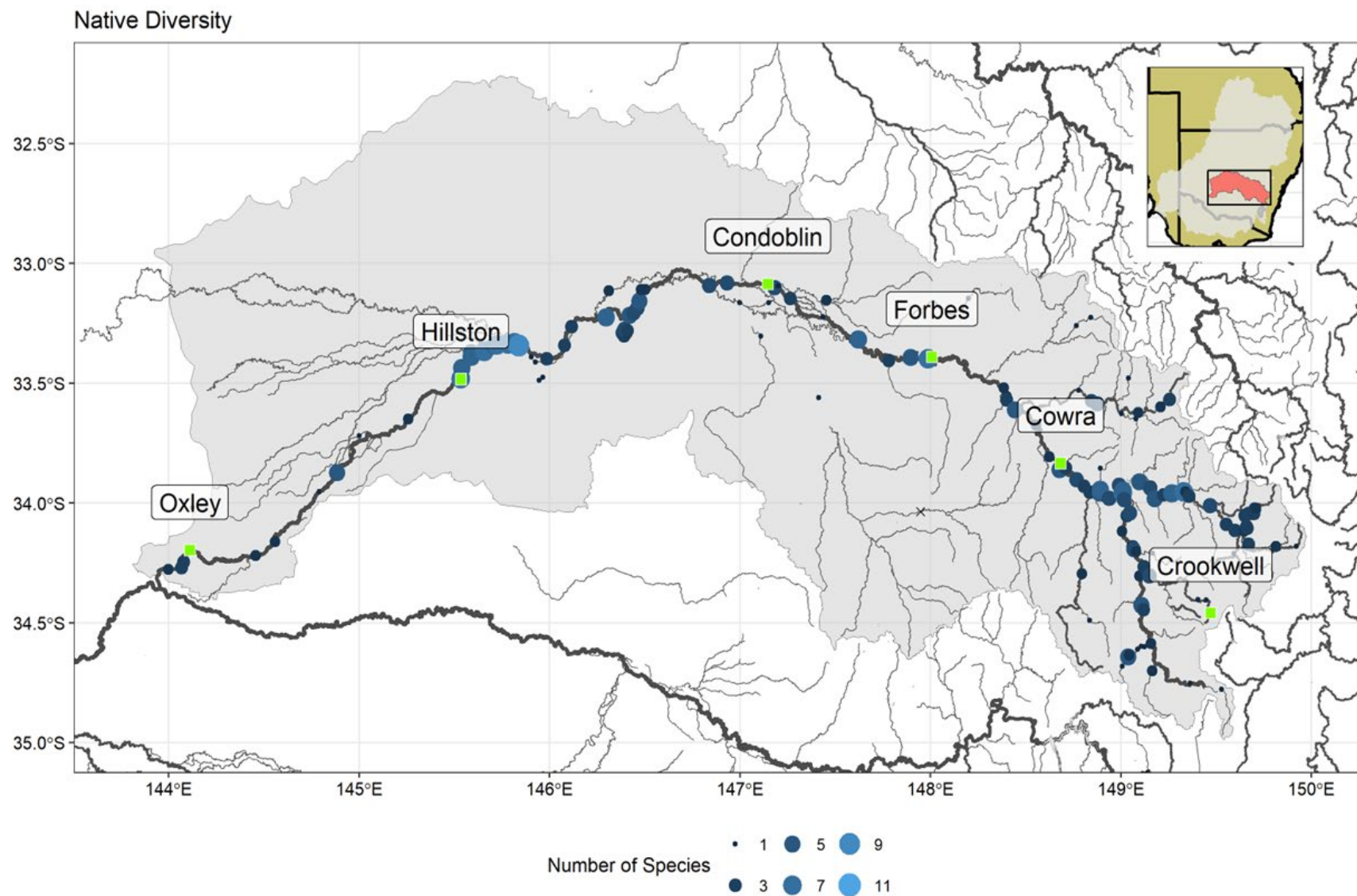


Figure 5.5: Native diversity across all sampling sites in the Lachlan WRPA. Bubble size represents the number of unique species observed at each site across all sampling methods and events. X represents a site that had water and was sampled, but no fish species were caught at all. Dry sites are excluded.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

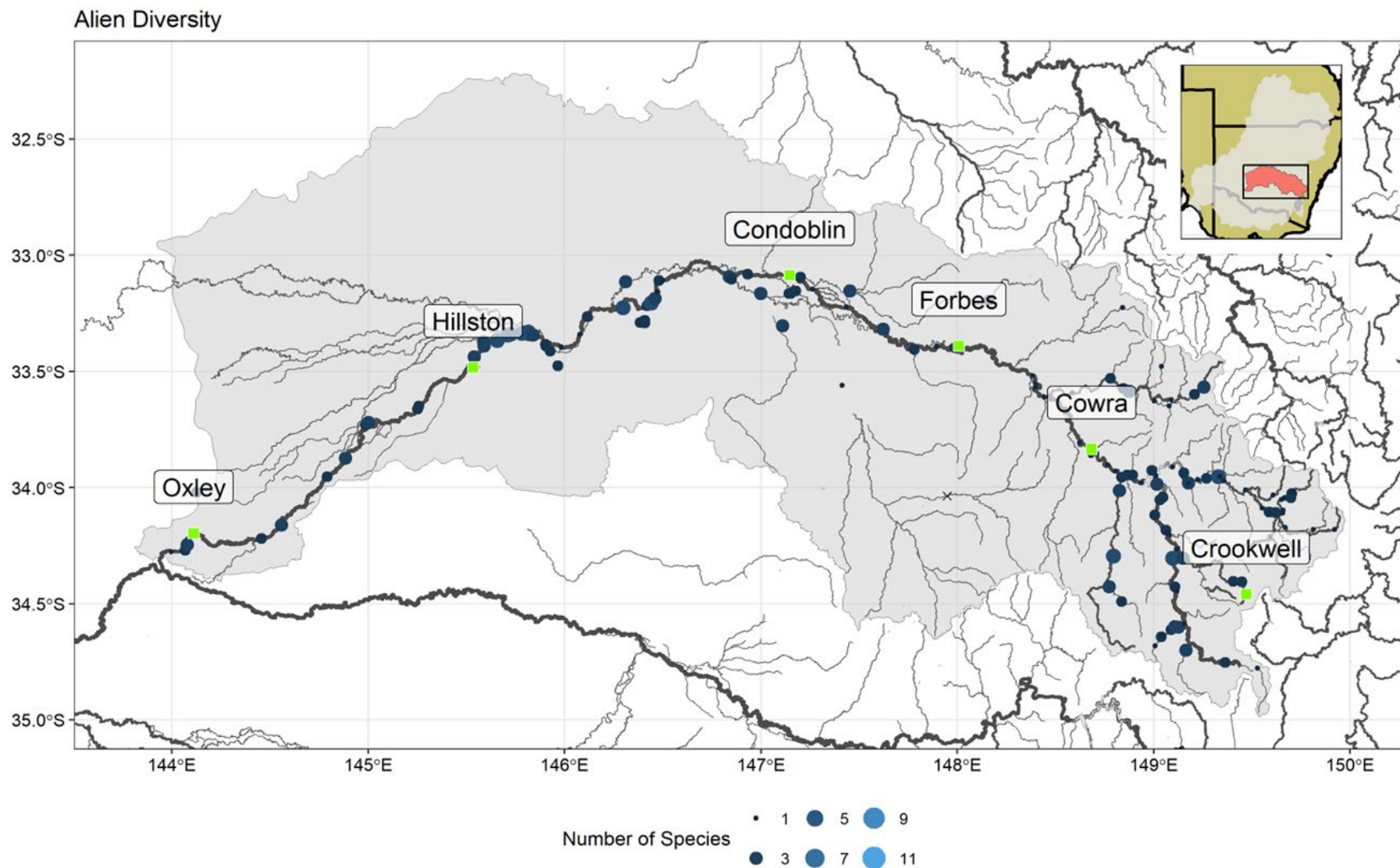


Figure 5.6: Alien diversity across all sampling sites in the Lachlan WRPA. Bubble size represents the number of unique species observed at each site across all sampling methods and events. X represents a site that had water and was sampled, but no fish species were caught at all. Dry sites are excluded.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

Murray cod



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 0 to 69, and 0 % 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 12 % (1,310 out of 10,496).

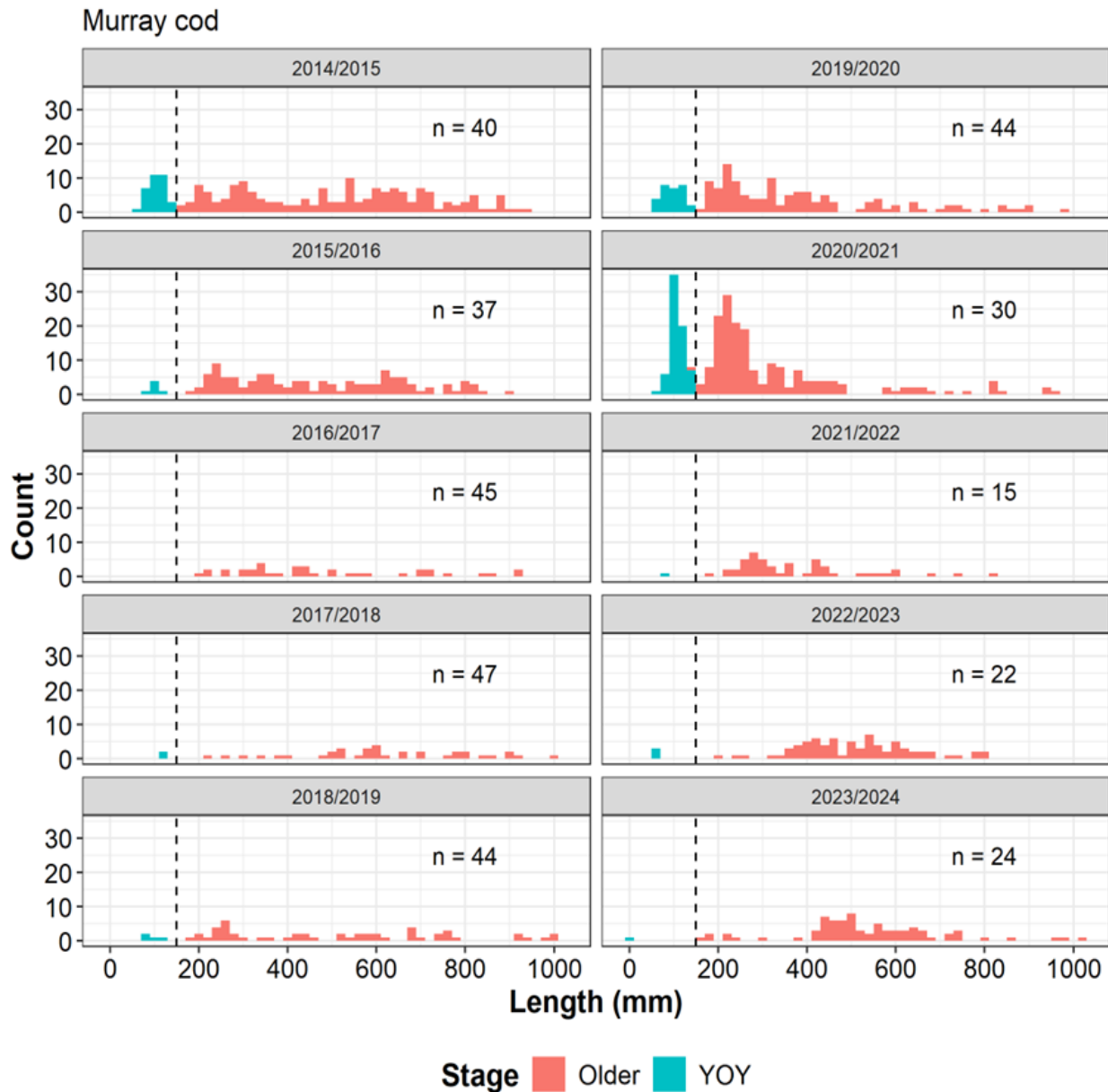


Figure 5.7: Length frequency plots for Murray cod by sampling season in the Lachlan WRPA. YOY represents Young of the Year fish. n shows the number of sites sampled in the WRPA in a sampling season.

Summary Statement:

Sporadic recruitment. A good range of larger fish in all years but very limited evidence of recruitment from 2021/22 onwards.

Stocking

A total of 943,531 Murray cod were stocked into the waterways of the Lachlan WRPA during the reporting period. Of these fish, 839,609 (89 %) were stocked into impoundments while 103,922 (11 %) 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 in the Lachlan WRPA.

Sampling Season	River/Creek or Impoundment	Life Stage	Number Stocked
2014/2015	Impoundment	Fry	43,085
2014/2015	River/Creek	Fry	2,171
2015/2016	Impoundment	Fry	125,000
2015/2016	River/Creek	Fry	9,090
2016/2017	Impoundment	Fry	10,000
2016/2017	River/Creek	Fingerling	13,772
2017/2018	Impoundment	Fry	27,000
2017/2018	River/Creek	Fry	6,000
2018/2019	Impoundment	Fry	33,500
2018/2019	River/Creek	Fry	13,500
2019/2020	Impoundment	Fry	31,688
2019/2020	River/Creek	Fry	20,000
2020/2021	Impoundment	Fry	57,000
2020/2021	River/Creek	Fry	12,000
2021/2022	Impoundment	Fry	194,900
2021/2022	River/Creek	Fry	6,935
2022/2023	Impoundment	Fry	249,500
2023/2024	Impoundment	Fingerling	67,936
2023/2024	River/Creek	Fingerling	20,454

Murray cod stocking

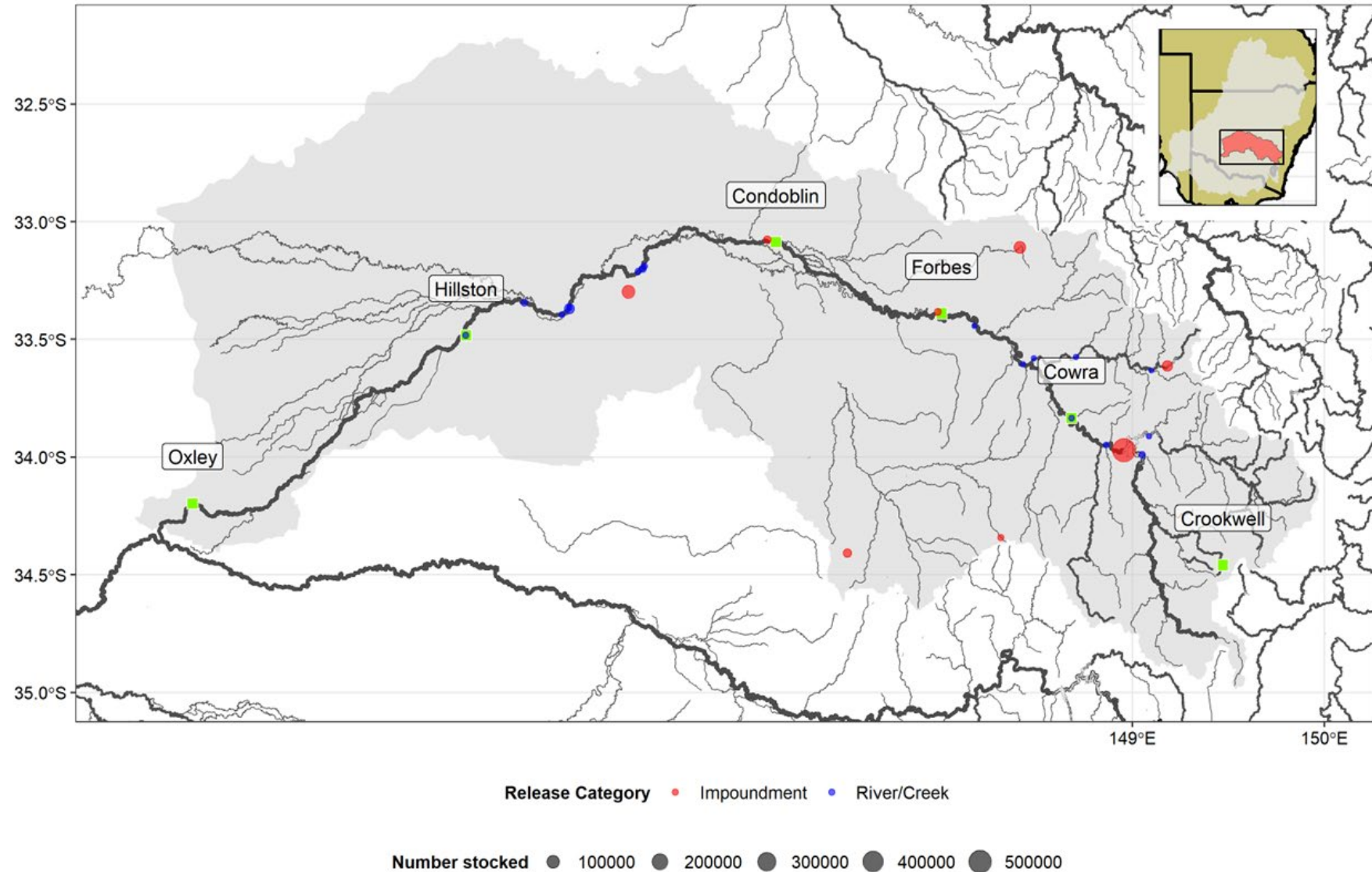


Figure 5.8: Locations of Murray cod stocking in the Lachlan WRPA. Colours show whether a site was a river/creek site or an impoundment, while the size of the point reflects the total number of fish stocked over the reporting period. Green squares represent key towns.

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 Lachlan WRPA and the right-hand panels show the overall trends across the NSW MDB.

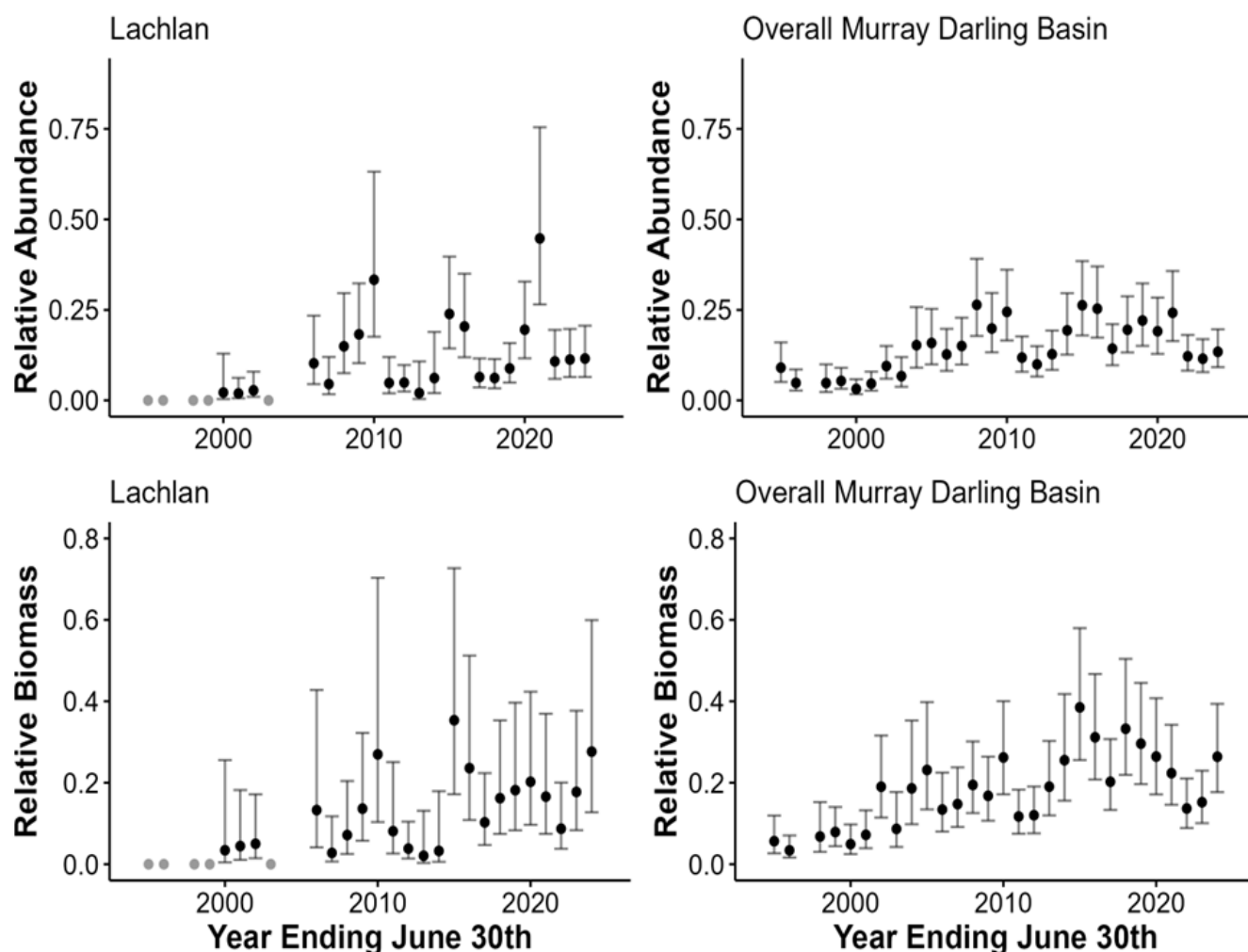


Figure 5.9: Relative abundance and biomass of Murray cod in both the Lachlan WRPA and the overall NSW MDB. These are model estimates based upon all boat electrofishing data within the NSW DPIRD Freshwater ecosystem database and the output of generalised linear mixed models. Error bars show the 95 % confidence intervals around the estimates. Grey dots show years where sampling was conducted by no Murray cod caught and therefore there is no estimate of error around the index.

Summary Statement:

An overall increase in abundance since the 1990s. Abundance has declined recently from a peak in 2020/21 but biomass appears to be increasing. Relative abundance and biomass similar to the overall NSW MDB.

Health

The prevalence of any health issues ranged from 2 % of sampled fish in 2020/2021 to 62 % of sampled fish in 2022/2023 (Figure 5.10). The most common health issue for Murray cod in the Lachlan WRPAs was *Lernaea*, which was observed in a total of 151 fish, corresponding to 14 % of all Murray cod measured.

Across the other NSW MDB WRPA, 16 % of Murray cod (1,645 out of 10,496 Murray cod) showed a health condition (excludes the Lachlan WRPAs).

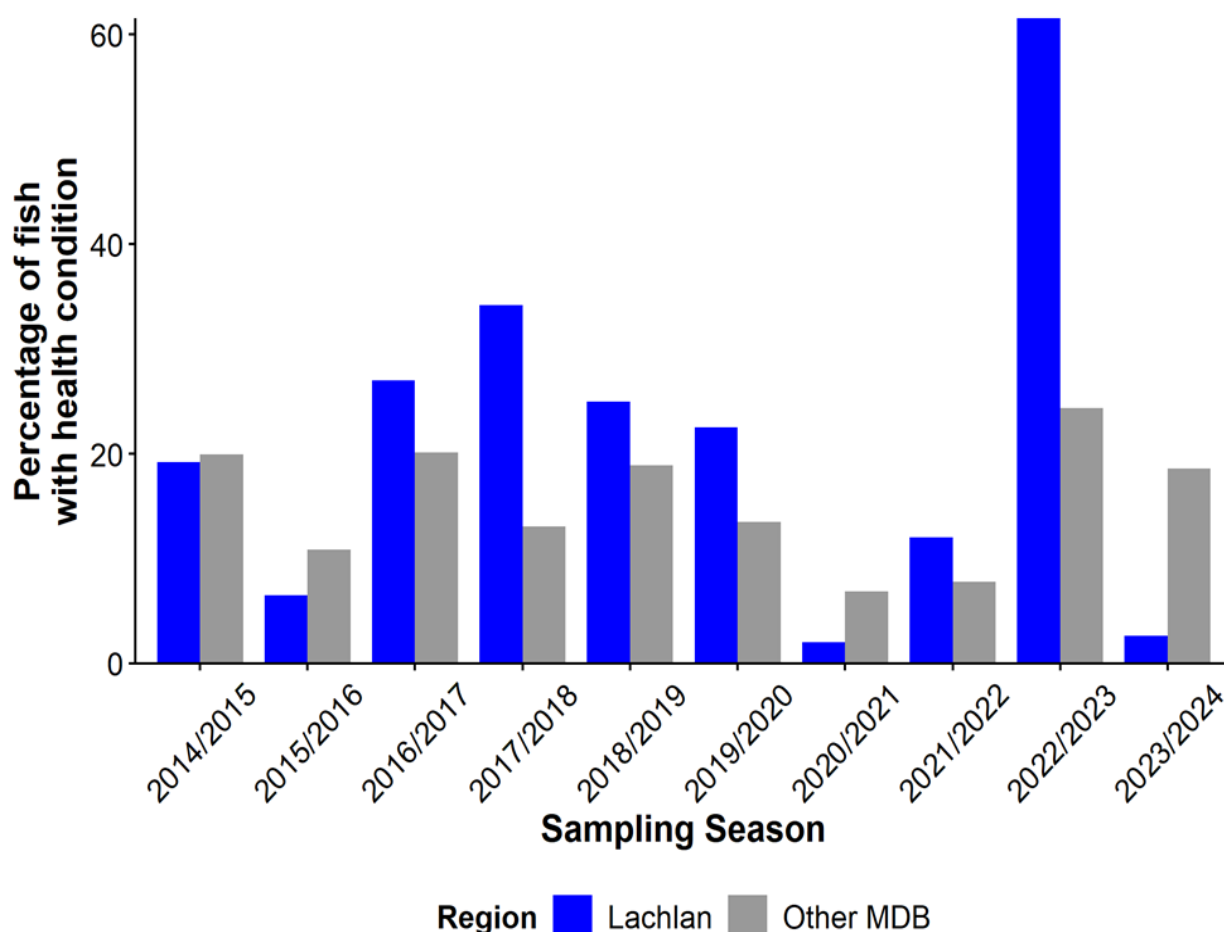


Figure 5.10: Timeseries showing the prevalence of health conditions in Murray cod. Blue shows the region-specific data while the grey shows the average across the other NSW MDB WRPA.

Summary Statement:

Presence of observable health conditions was moderate to high across most years and higher than the overall Murray-Darling Basin in most years. There was a low level of observed health issues in 2023/24.

Distribution

Murray cod were recorded at 52 out of 168 sites in the Lachlan WRPA from 2013/14 to 2023/24. The maximum observed relative abundance at a site was 1.3 fish caught per 90 seconds of electrofishing. Figure 5.11 shows the distribution and relative abundance of Murray cod across the Lachlan WRPA.

Summary Statement:

Murray cod were recorded across the Lachlan WRPA but less abundant or absent in west of Hillston.

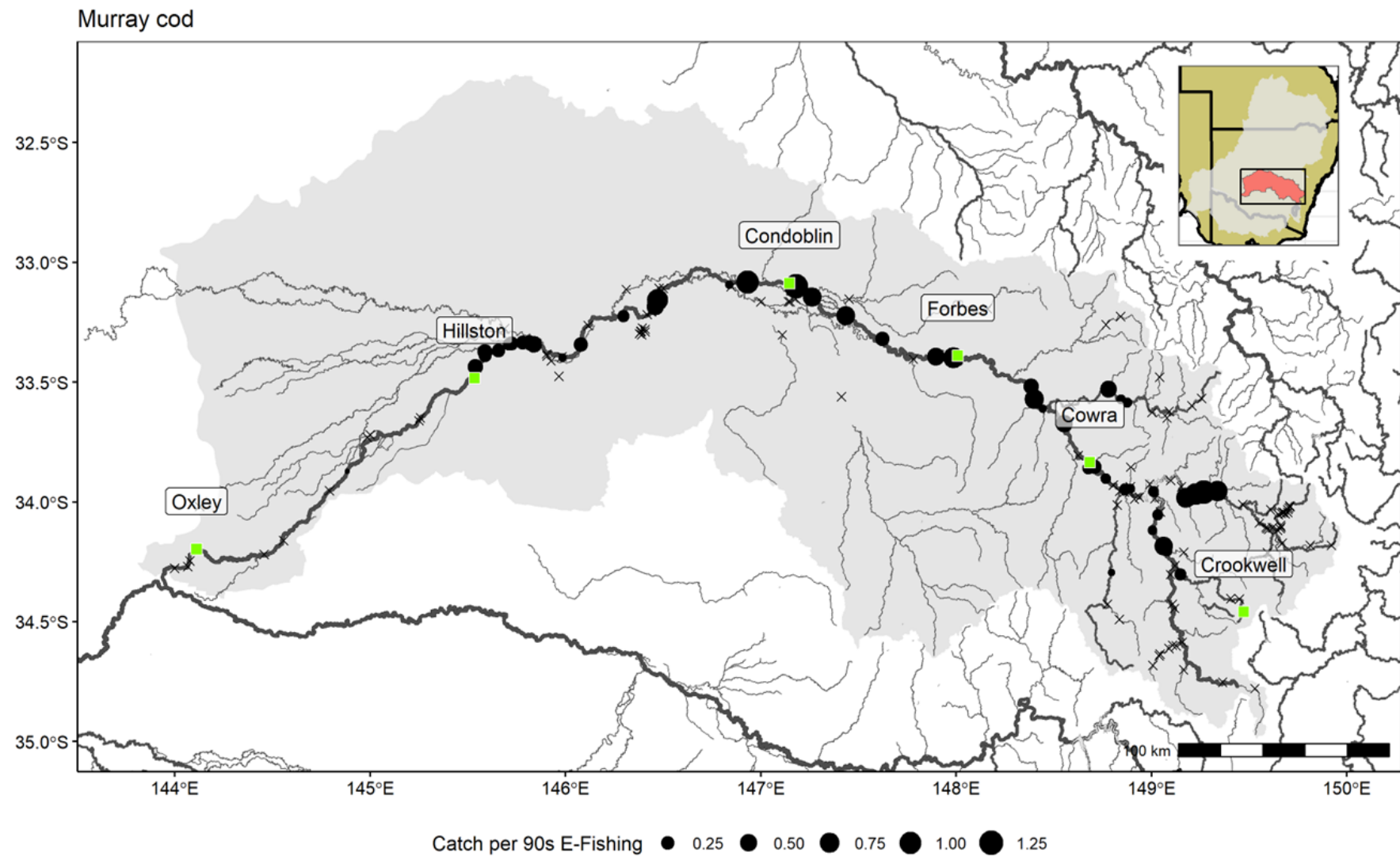


Figure 5.11: Distribution of Murray cod sampled from 2013/14 to 2023/24 in the Lachlan WRPA. Filled circles show sites where the species was present, and the size of the circle represents relative abundance. Sites that were sampled with electrofishing but did not contain the species are shown with an X. Green squares represent key towns.

Golden perch



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 4, and 0 % to 12 % of measured fish within a season, with a mean percentage YOY of 2 %.

Overall, during the reporting period, across all the MDB water resource planning areas, the percentage YOY for Golden perch was 9 % (641 out of 7,229).

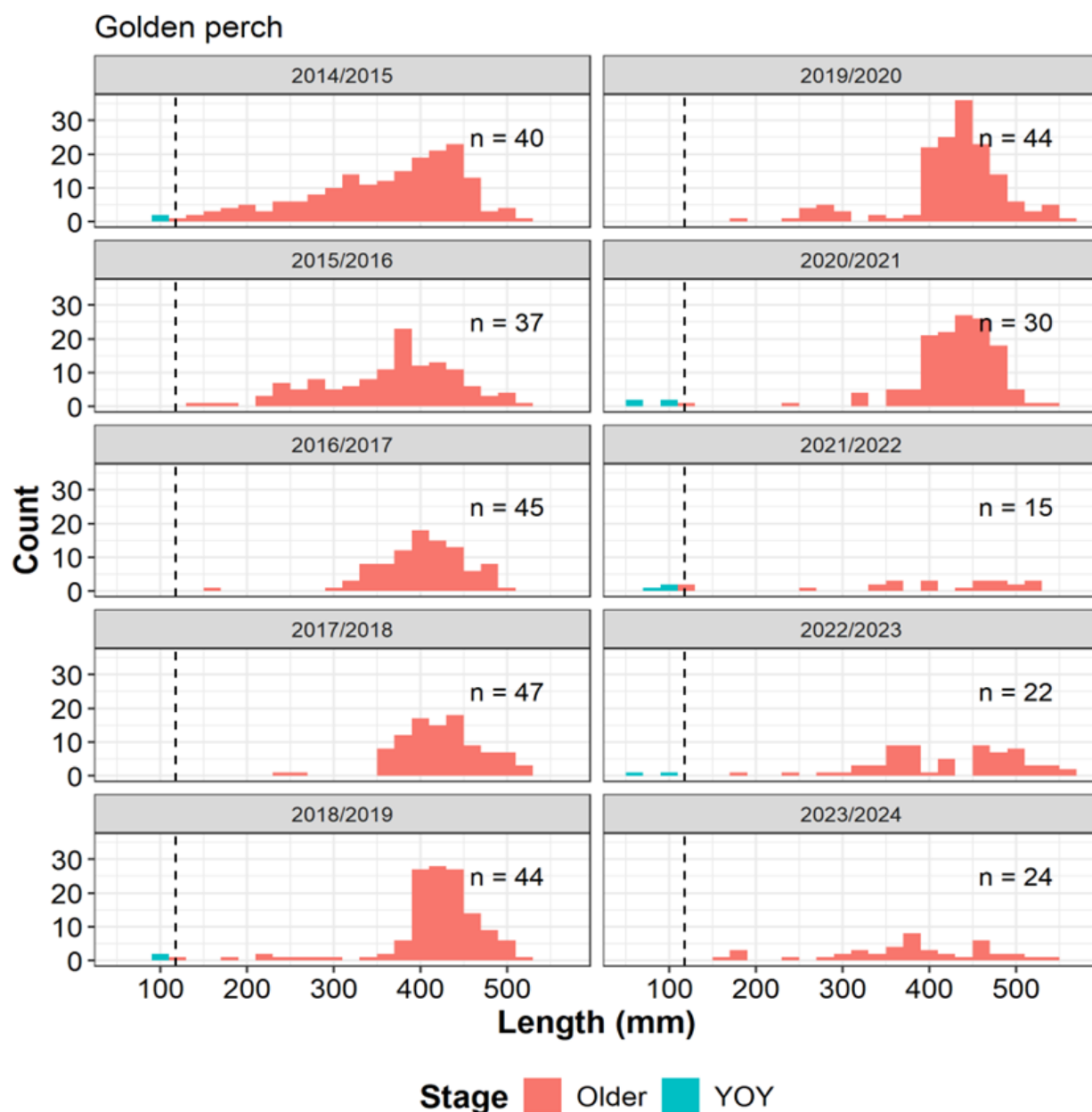


Figure 5.12: Length frequency plots for Golden perch by sampling season in the Lachlan WRPA. YOY represents Young of the Year fish. n shows the number of sites sampled in the WRPA in a sampling season.

Summary Statement:

The population consistently has a high proportion of large fish. Recruitment appears to be limited with only very small numbers of YOY collected. Small numbers of YOY were observed from 2020/21 to 2022/23 but no YOY were collected in 2023/24.

Stocking

A total of 1,051,492 Golden perch were stocked into the waterways of the Lachlan WRPA during the reporting period. Of these fish, 865,374 (82.3 %) were stocked into impoundments while 186,118 (17.7 %) 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 in the Lachlan WRPA.

Sampling Season	River/Creek or Impoundment	Life Stage	Number Stocked
2014/2015	Impoundment	Fry	41,629
2014/2015	River/Creek	Fry	84,167
2015/2016	Impoundment	Fry	41,000
2016/2017	Impoundment	Fry	140,000
2016/2017	River/Creek	Fingerling	45,452
2017/2018	Impoundment	Fry	158,200
2017/2018	River/Creek	Fry	26,999
2018/2019	Impoundment	Fry	85,000
2019/2020	Impoundment	Fry	74,545
2019/2020	River/Creek	Fry	10,000
2020/2021	Impoundment	Fry	103,000
2020/2021	River/Creek	Fry	12,000
2021/2022	Impoundment	Fry	11,200
2022/2023	Impoundment	Fry	94,860
2023/2024	Impoundment	Fingerling	115,940

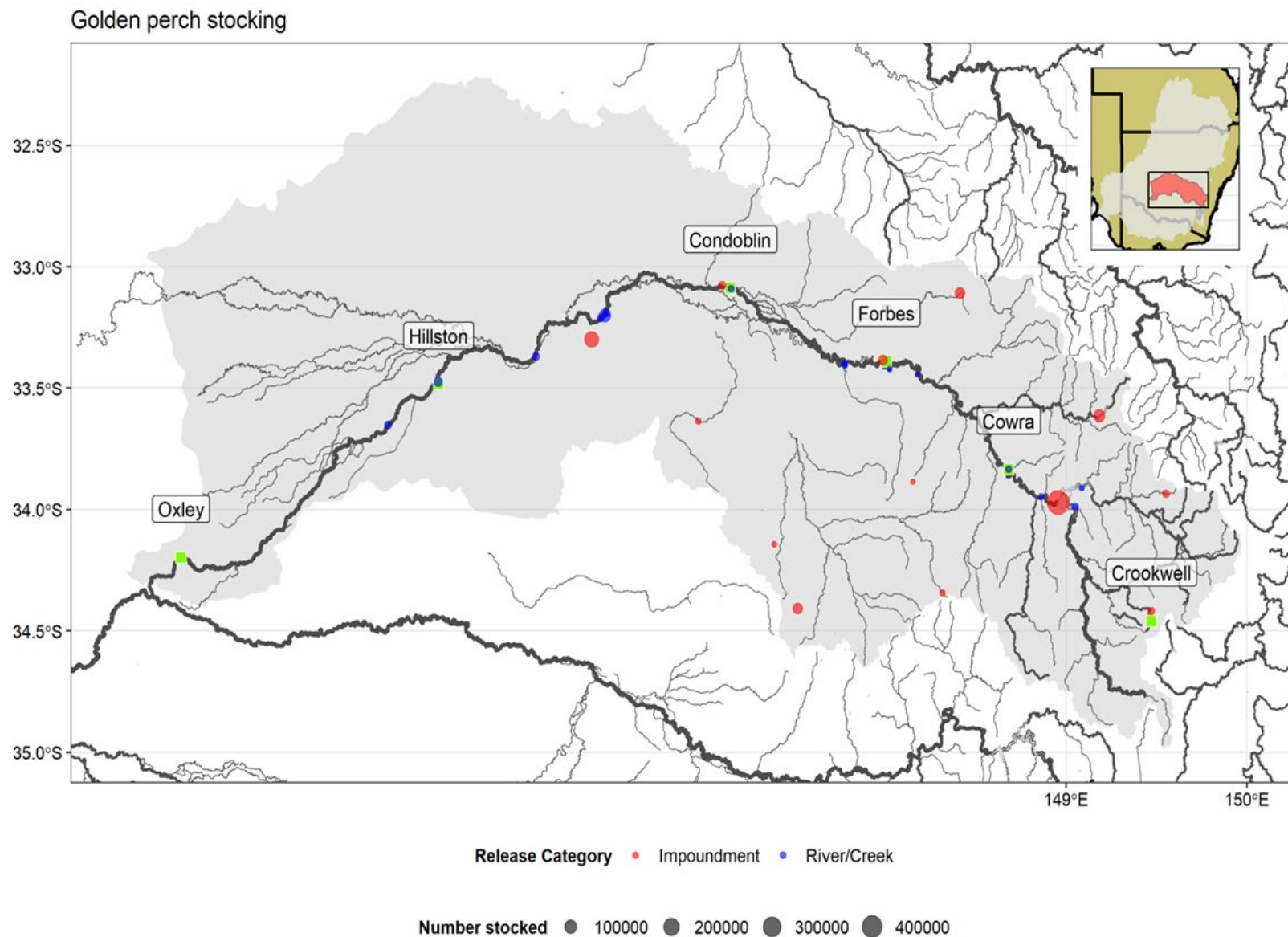


Figure 5.13: Locations of Golden perch stocking in the Lachlan WRPA. Colours show whether a site was a river/creek site or an impoundment, while the size of the point reflects the total number of fish stocked over the reporting period. Green squares represent key towns.

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 Lachlan WRPA and the right-hand panels show the overall trends across the NSW MDB.

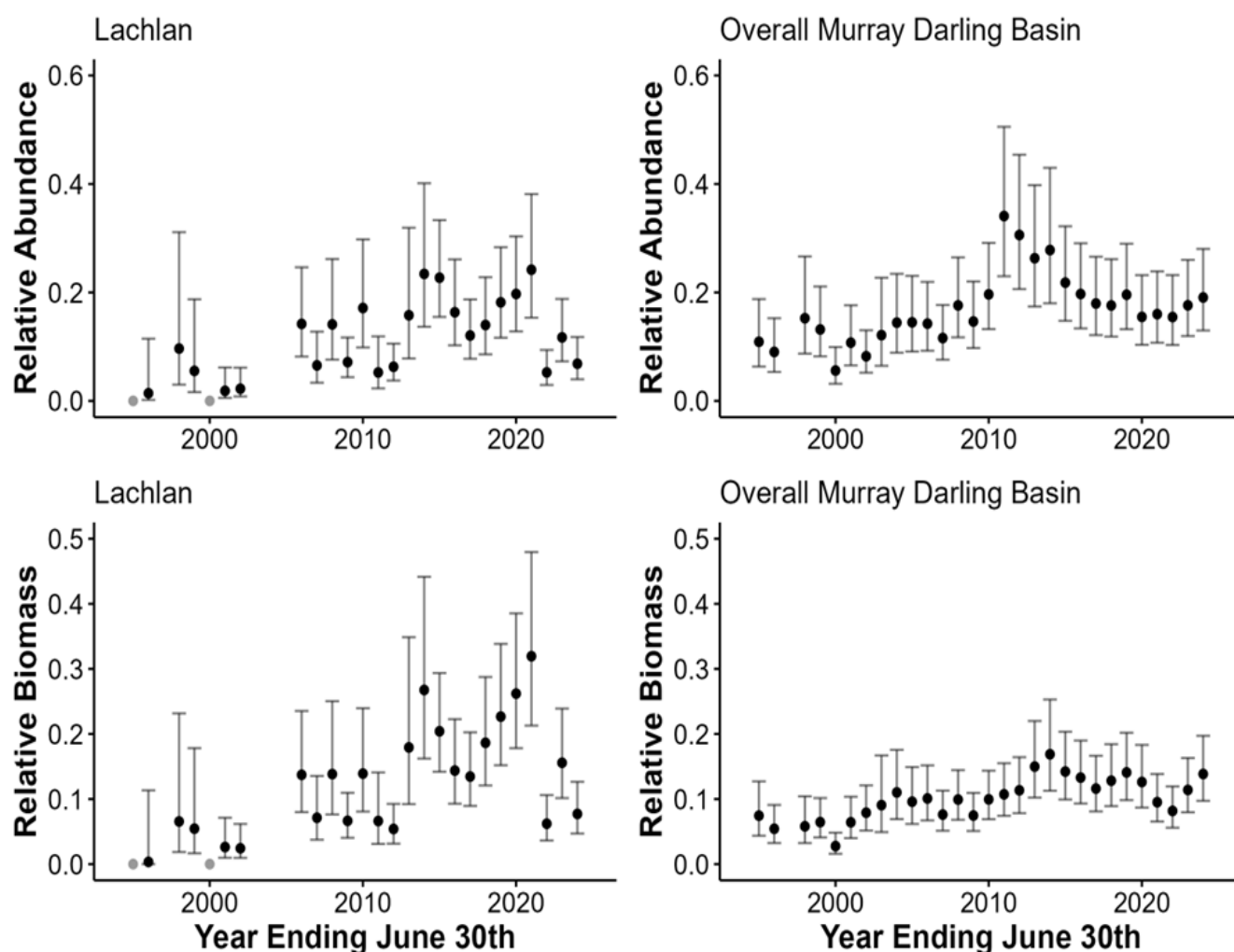


Figure 5.14: Relative abundance and biomass of Golden perch in both the Lachlan WRPA and the overall NSW MDB. These are model estimates based upon all boat electrofishing data within the NSW DPIRD Freshwater ecosystem database and the output of generalised linear mixed models. Error bars show the 95 % confidence intervals around the estimates. Grey dots show years where sampling was conducted by no Golden perch caught and therefore there is no estimate of error around the index.

Summary Statement:

Abundance and biomass likely higher than the mid-1990s but both have declined sharply since 2020/21 and are currently lower than the overall Murray-Darling Basin.

Health

The prevalence of any health issues ranged from 1 % of sampled fish in 2020/2021 to 65 % of sampled fish in 2017/2018 (Figure 5.15). The most common health issue for Golden perch in the Lachlan water resource planning area was *Lernaea*, which was observed in a total of 278 fish, corresponding to 26 % of all Golden perch measured.

Across the other WRPAs, 25 % of Golden perch (1,792 out of 7,229 Golden perch) showed a health condition (excludes Lachlan).

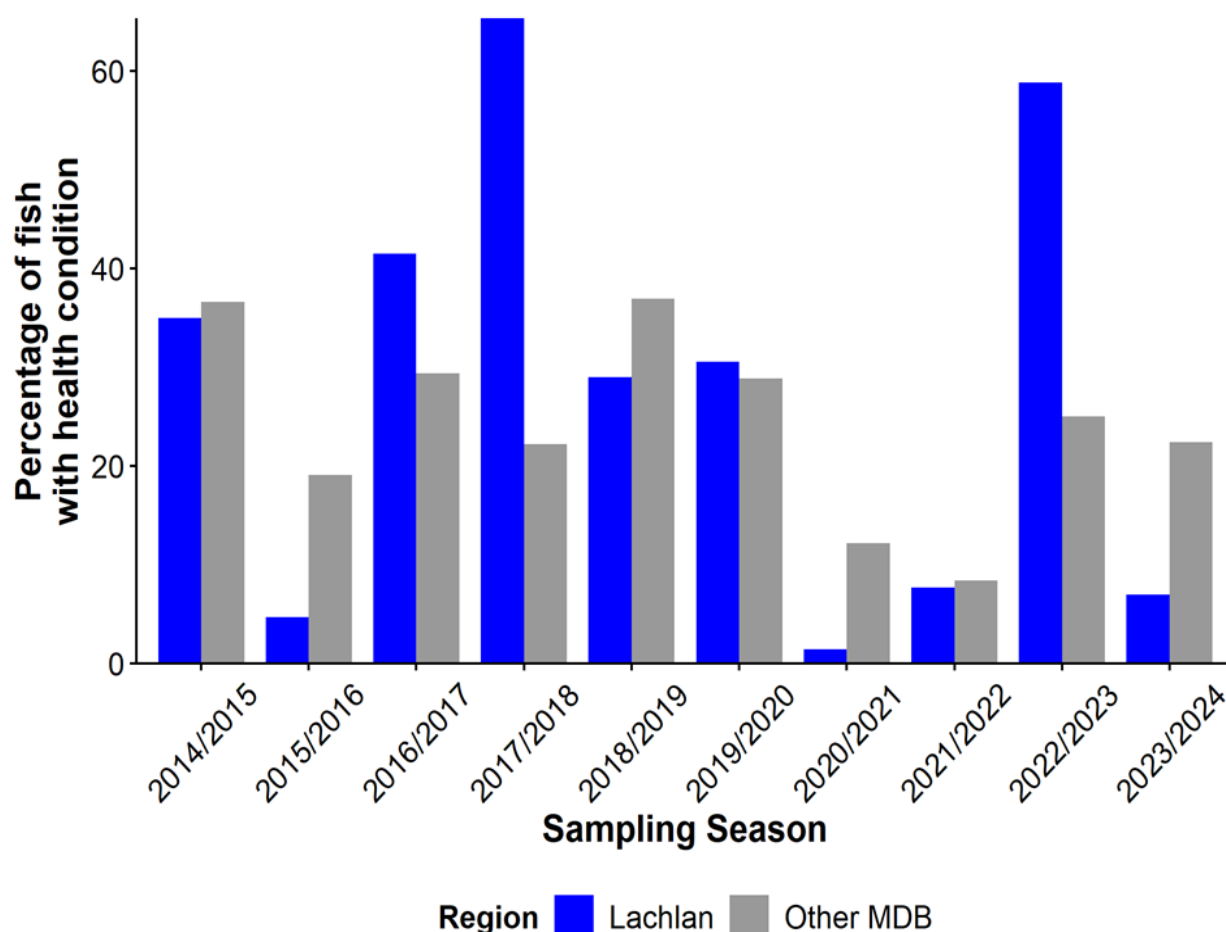


Figure 5.15: Timeseries showing the prevalence of health conditions in Golden perch. Blue shows the region-specific data while the grey shows the average across the other NSW MDB WRPAs.

Summary Statement:

The presence of observable health conditions for Golden perch in the Lachlan was variable but generally tracked the average across the rest of the NSW Murray-Darling Basin except for 2017/18 and 2022/23 when it was significantly higher.

Distribution

Golden perch were recorded at 50 out of 168 sites in the Lachlan WRPA from 2013/14 to 2023/24. The maximum observed relative abundance at a site was 1.3 fish caught per 90 seconds of electrofishing. Figure 5.16 shows the distribution and relative abundance of Golden perch across the Lachlan WRPA.

Summary Statement:

Golden perch were generally present across the Lachlan region.

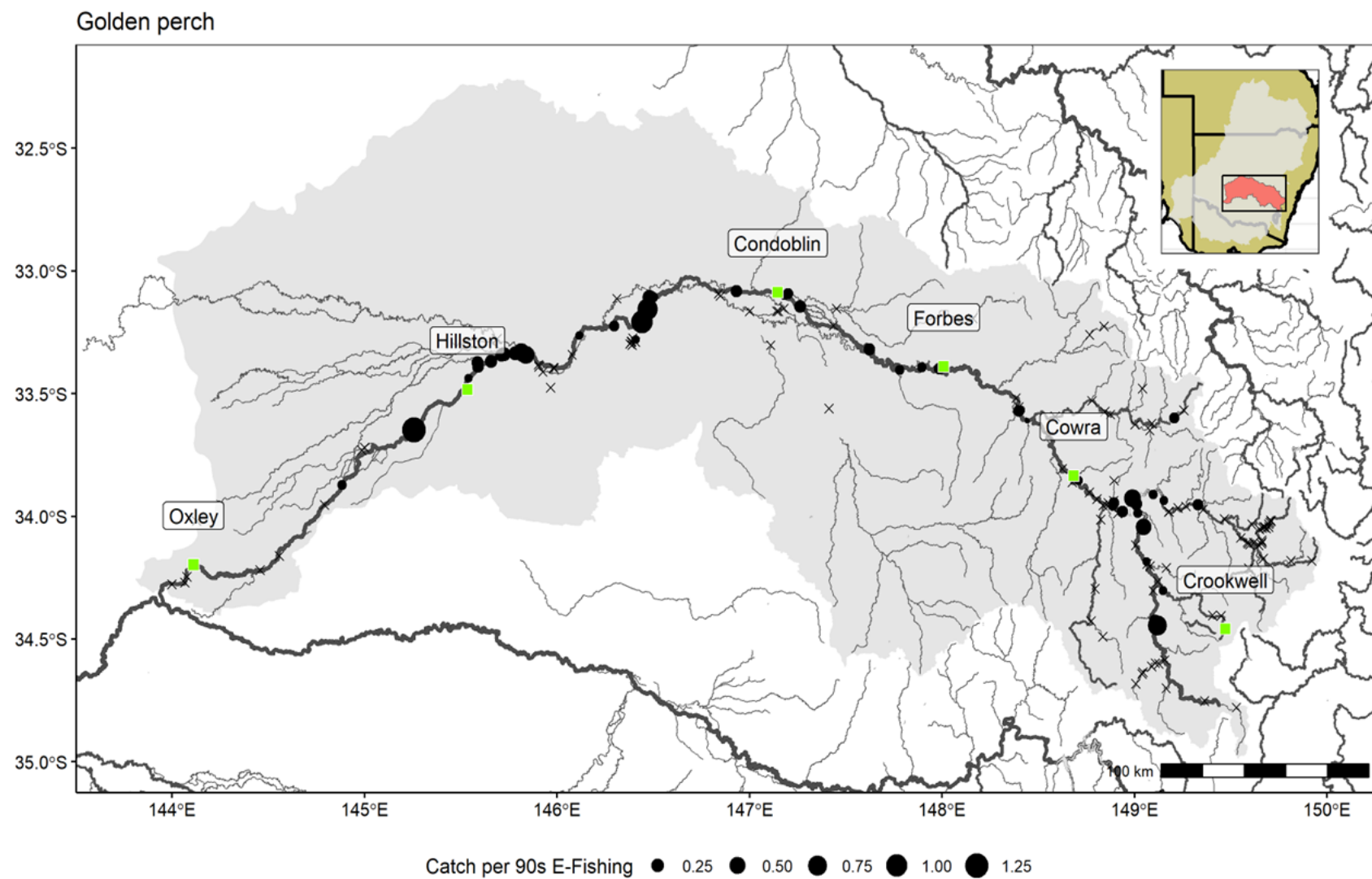


Figure 5.16: Distribution of Golden perch sampled from 2013/14 to 2023/24 in the Lachlan WRPA. Filled circles show sites where the species was present, and the size of the circle represents relative abundance. Sites that were sampled with electrofishing but did not contain the species are shown with an X. Green squares represent key towns.

Freshwater catfish



Summary Statement:

Only three Freshwater catfish were caught in the Lachlan WRPA during the reporting period. Two fish were caught in Lake Wyangala. A 39 cm individual in 2014/15 and a 25 cm individual in 2018/19. A 56 cm individual was caught in 2023/24 at Wallanthery in the Lachlan River. None of the fish showed any health conditions. Overall, Freshwater catfish in the Lachlan WRPA are likely severely restricted in abundance and distribution.

Bony herring



Population Structure

Figure 5.17 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 8 to 1,327, and 1 % to 43 % of measured fish within a season, with a mean percentage YOY of 19 %.

Overall, during the reporting period, across all the MDB water resource planning areas, the percentage YOY for Bony herring was 26 % (9,926 out of 38,327). Bony herring are not a stocked species.

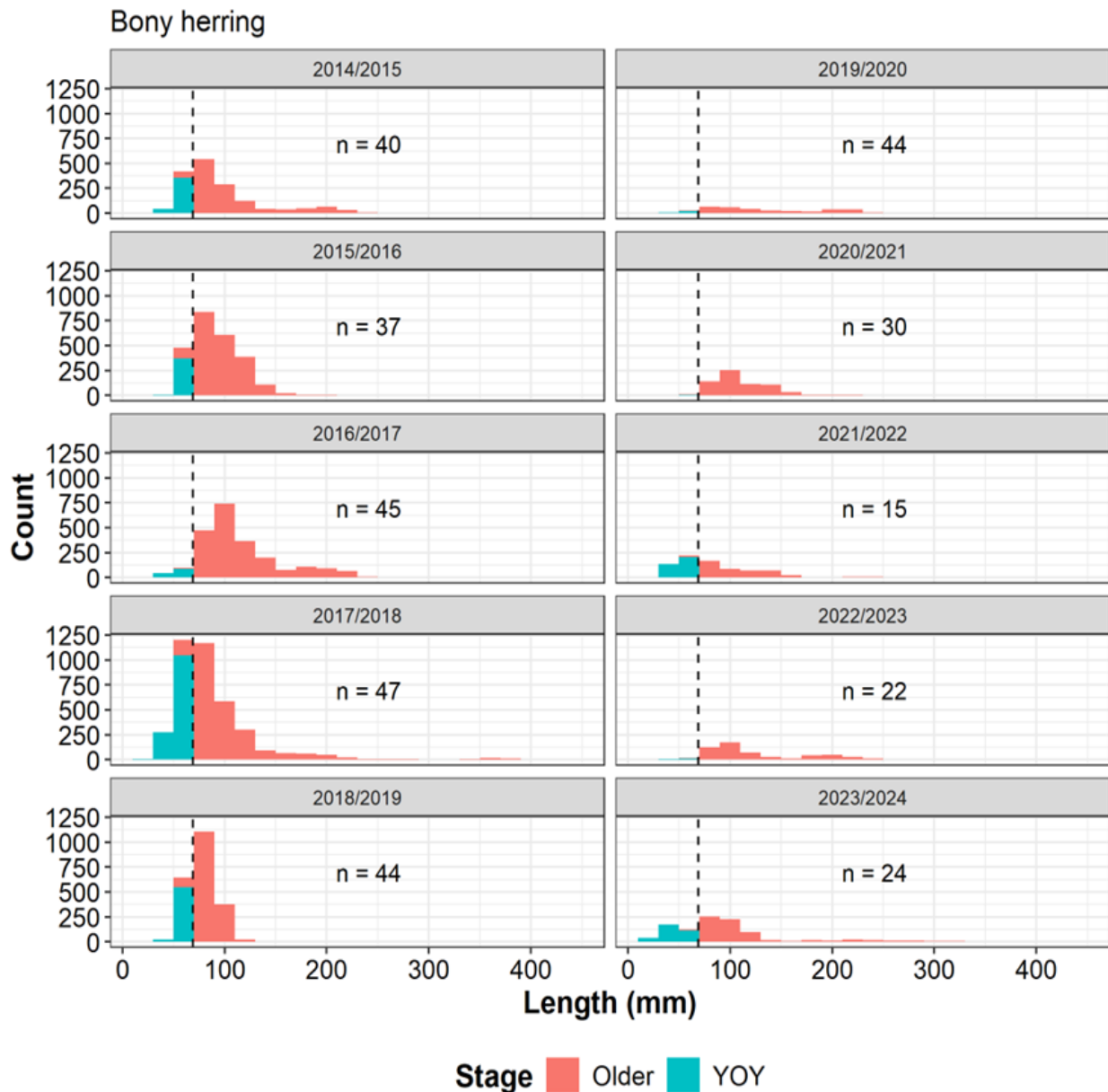


Figure 5.17: Length frequency plots for Bony herring by sampling season in the Lachlan WRPA. YOY represents Young of the Year fish. n shows the number of sites sampled in the WRPA in a sampling season.

Summary Statement:

Regular recruitment prior to 2019/20 with good recruitment only observed in 2021/22 and 2023/24 since. Some larger individuals evident in both 2022/23 and 2023/24.

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 5.18 show the abundance and biomass trends for the Lachlan WRPA and the right-hand panels show the overall trends across the NSW MDB.

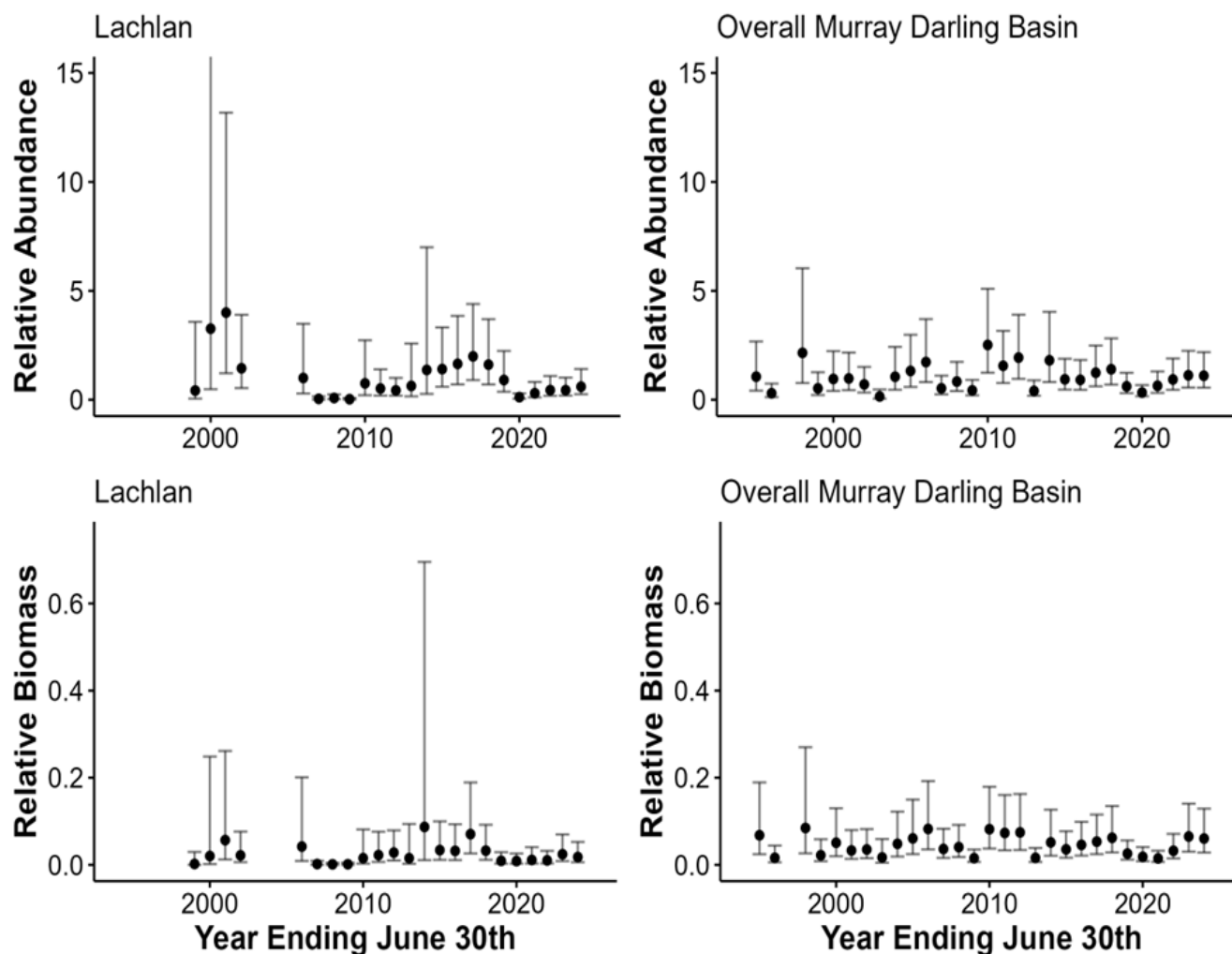


Figure 5.18: Relative abundance and biomass of Bony herring in both the Lachlan WRPA and the overall NSW MDB. These are model estimates based upon all boat electrofishing data within the NSW DPIRD Freshwater ecosystem database and the output of generalised linear mixed models. Error bars show the 95 % confidence intervals around the estimates.

Summary Statement:

Fluctuations in both abundance and biomass but both have likely declined from peaks in 2000/01 and 2017/18. Abundance and biomass are slightly lower than the overall NSW MDB.

Health

The prevalence of any health issues ranged from 0 % of sampled fish in 2020/2021 to 4 % of sampled fish in 2022/2023 (Figure 5.19). The most common health issue for Bony herring in the Lachlan WRPAs was Wounds, which was observed in a total of 28 fish, corresponding to <1 % of all Bony herring measured.

Across the other NSW MDB WRPA, 1.35 % of Bony herring (517 out of 38,328 Bony herring) showed a health condition (excludes the Lachlan WRPAs).

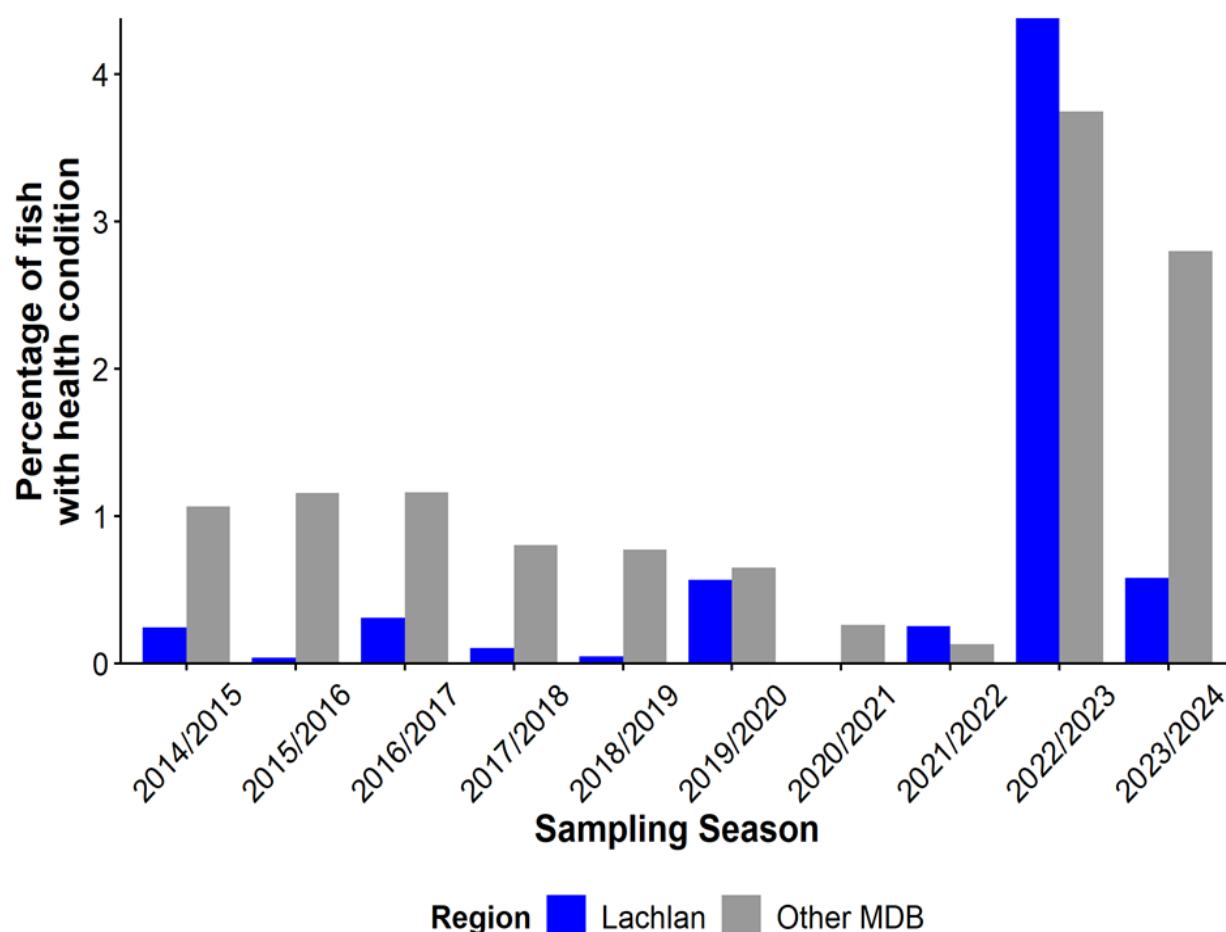


Figure 5.19: Timeseries showing the prevalence of health conditions in Bony herring. Blue shows the region-specific data while the grey shows the average across the other NSW MDB WRPA.

Summary Statement:

Presence of observable health conditions was generally very low but much higher in 2022/23 reflecting an increase across the NSW MDB. The proportion of observed health issues was lower in the Lachlan compared to the rest of the NSW MDB in 2023/24.

Distribution

Bony herring were recorded at 38 out of 168 sites in the Lachlan WRP from 2013/14 to 2023/24. The maximum observed relative abundance at a site was 25.7 fish caught per 90 seconds of electrofishing. Figure 5.20 shows the distribution and relative abundance of Bony herring across the Lachlan WRP.

Summary Statement:

Bony herring appear to be largely restricted to the western Lachlan WRP with very few occurrences east of Condobolin.

Bony herring

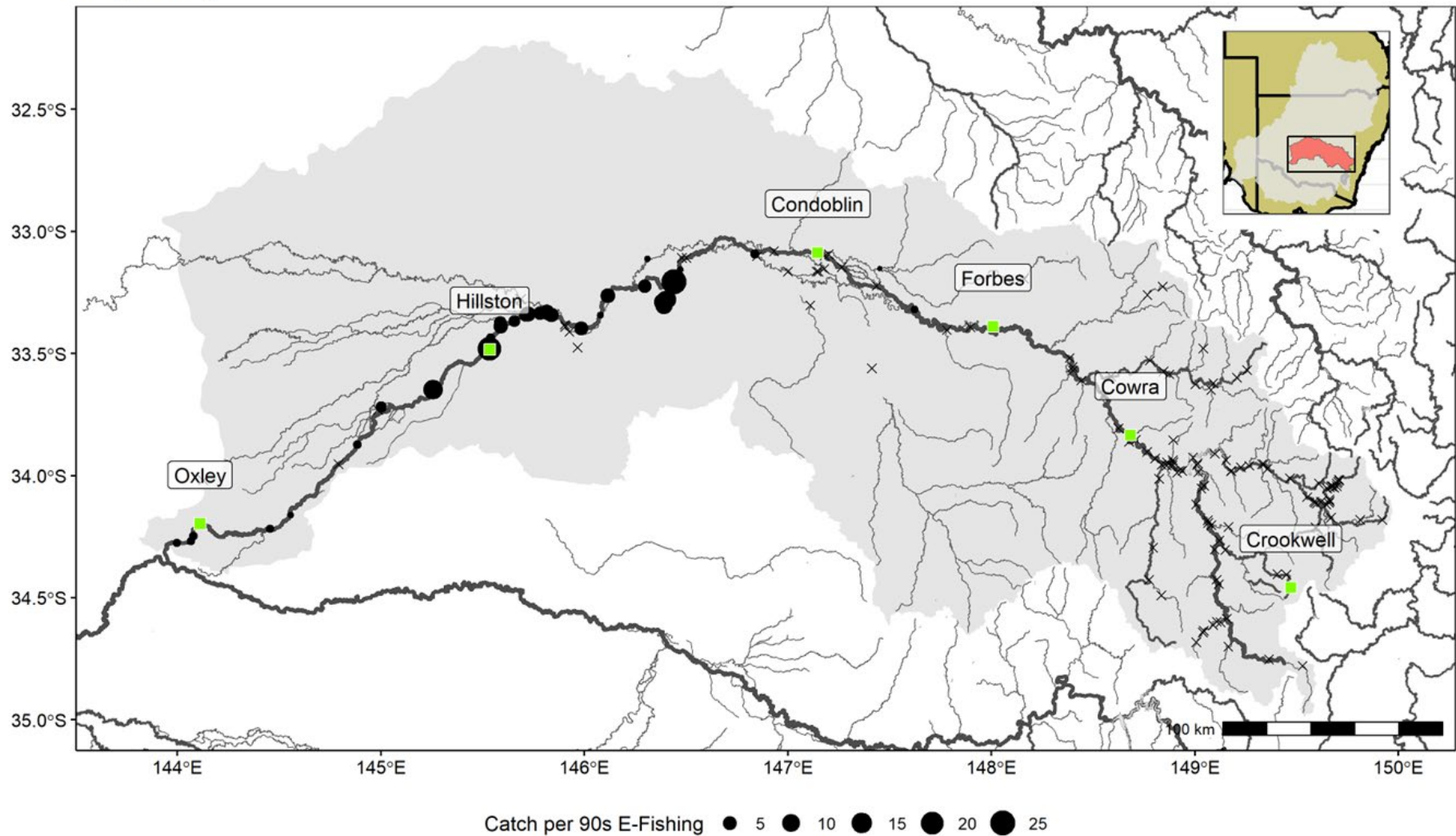


Figure 5.20: Distribution of Bony herring sampled from 2013/14 to 2023/24 in the Lachlan WRPA. Filled circles show sites where the species was present, and the size of the circle represents relative abundance. Sites that were sampled with electrofishing but did not contain the species are shown with an X. Green squares represent key towns.

Australian smelt



Population Structure

Figure 5.21 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 0 to 206, and 0 % to 83 % of measured fish within a season, with a mean percentage YOY of 22 %.

Overall, during the reporting period, across all the MDB water resource planning areas, the percentage YOY for Australian smelt was 42 % (11,165 out of 26,645). Australian smelt are not a stocked species.

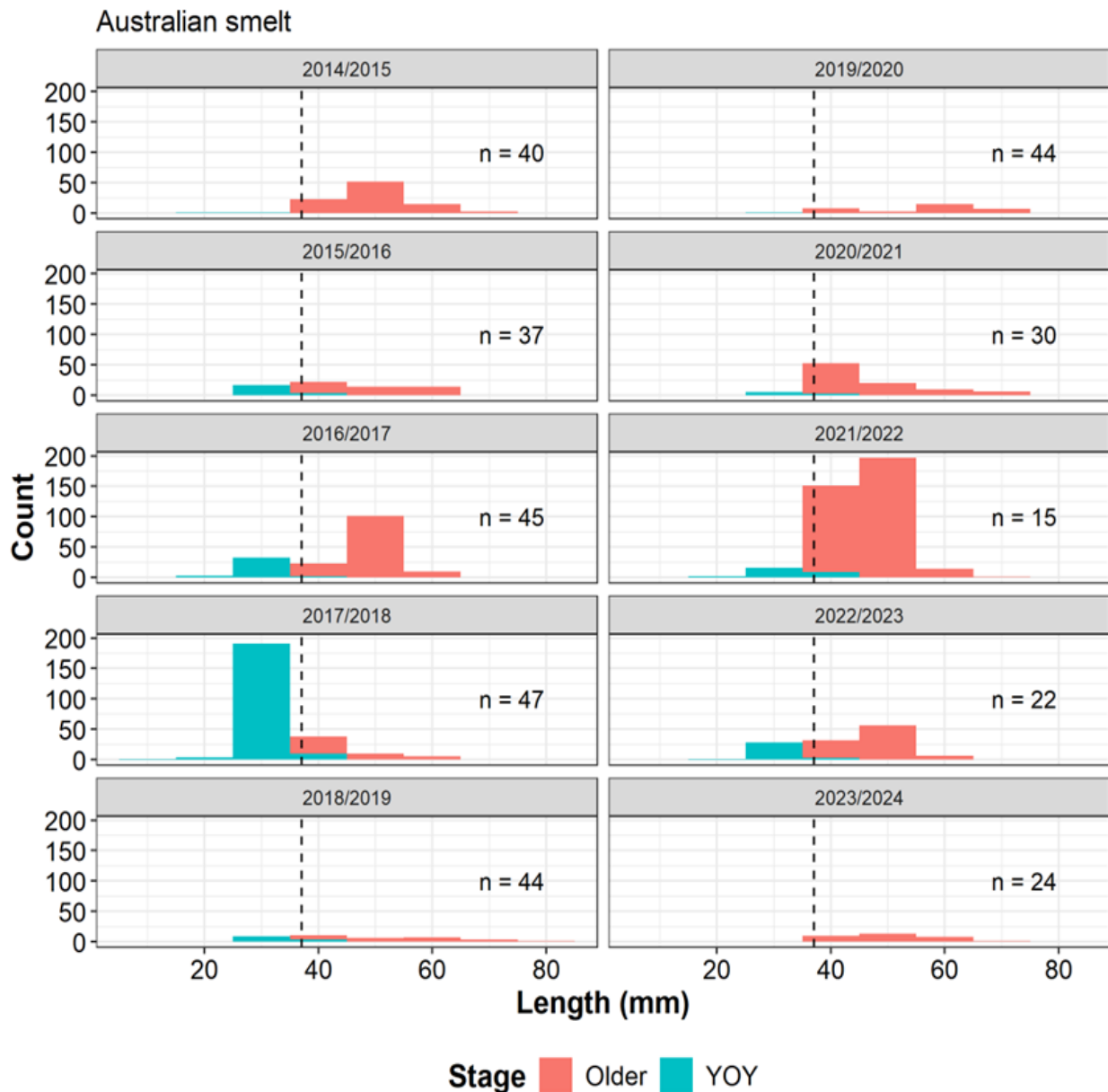


Figure 5.21: Length frequency plots for Australian smelt by sampling season in the Lachlan WRPA. YOY represents Young of the Year fish. n shows the number of sites sampled in the WRPA in a sampling season.

Summary Statement:

Low levels of recruitment in most years but evidence of a large recruitment event in 2017/18. No observed YOY in 2023/24 suggesting poor recruitment.

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 5.22 show the abundance trends for the Lachlan WRPA and the right-hand panel show the overall trend across the NSW MDB.

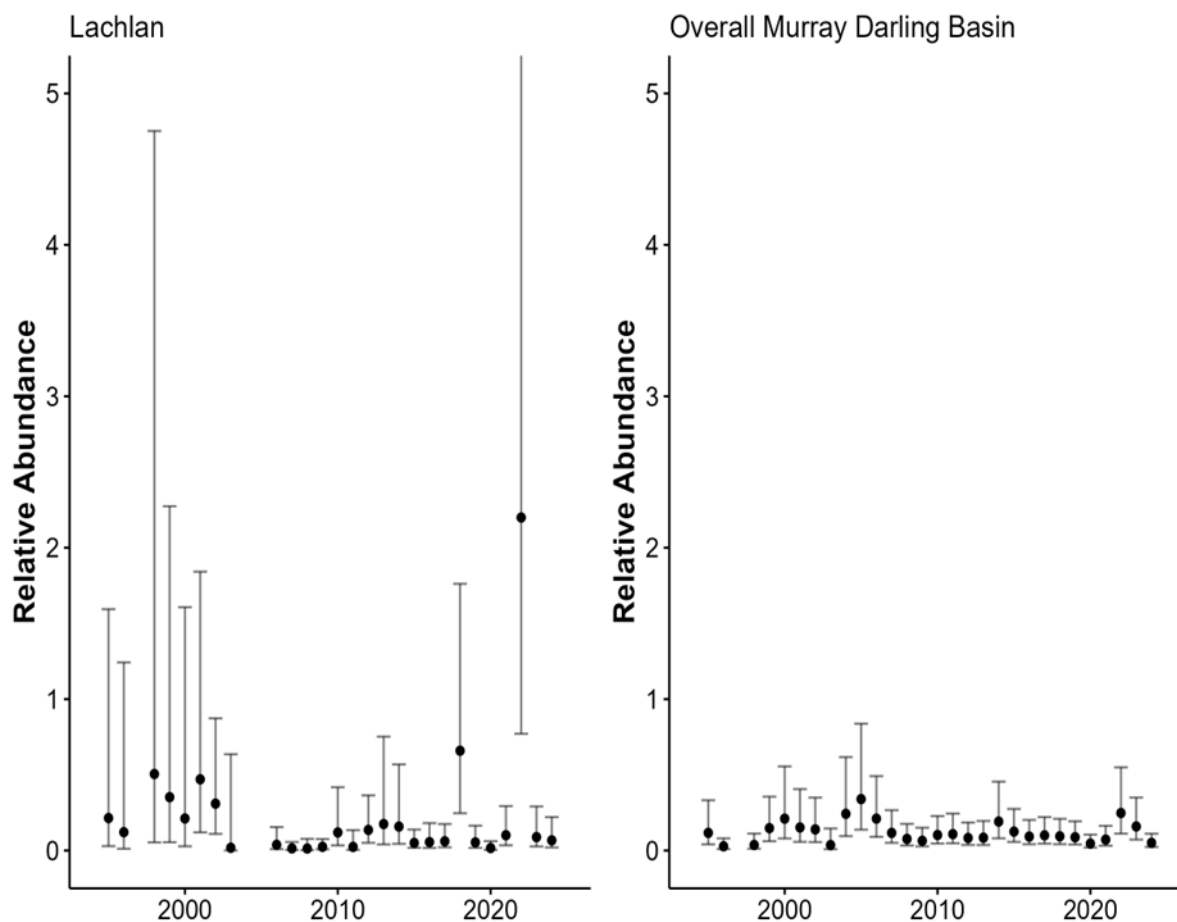


Figure 5.22: Relative abundance of Australian smelt in both the Lachlan WRPA and the overall NSW MDB. These are model estimates based upon all boat electrofishing data within the NSW DPIRD Freshwater ecosystem database and the output of generalised linear mixed models. Error bars show the 95 % confidence intervals around the estimates. No modelling of biomass was done for Australian smelt.

Summary Statement:

Large fluctuations in relative abundance with recent peaks in 2017/18 and 2021/22. Current abundance is low and similar to overall abundance across the NSW MDB.

Health

The prevalence of any health issues ranged from 0 % of sampled fish in 2014/2015 to 6 % of sampled fish to 2019/2020 (Figure 5.23). The most common health issue for Australian smelt in the Lachlan WRPA was *Lernaea*, which was observed in a total of 5 fish, corresponding to <1 % of all Australian smelt measured.

Across the other NSW MDB WRPA, 1 % of Australian smelt (168 out of 26,646 Australian smelt) showed a health condition (excludes the Lachlan WRPA).

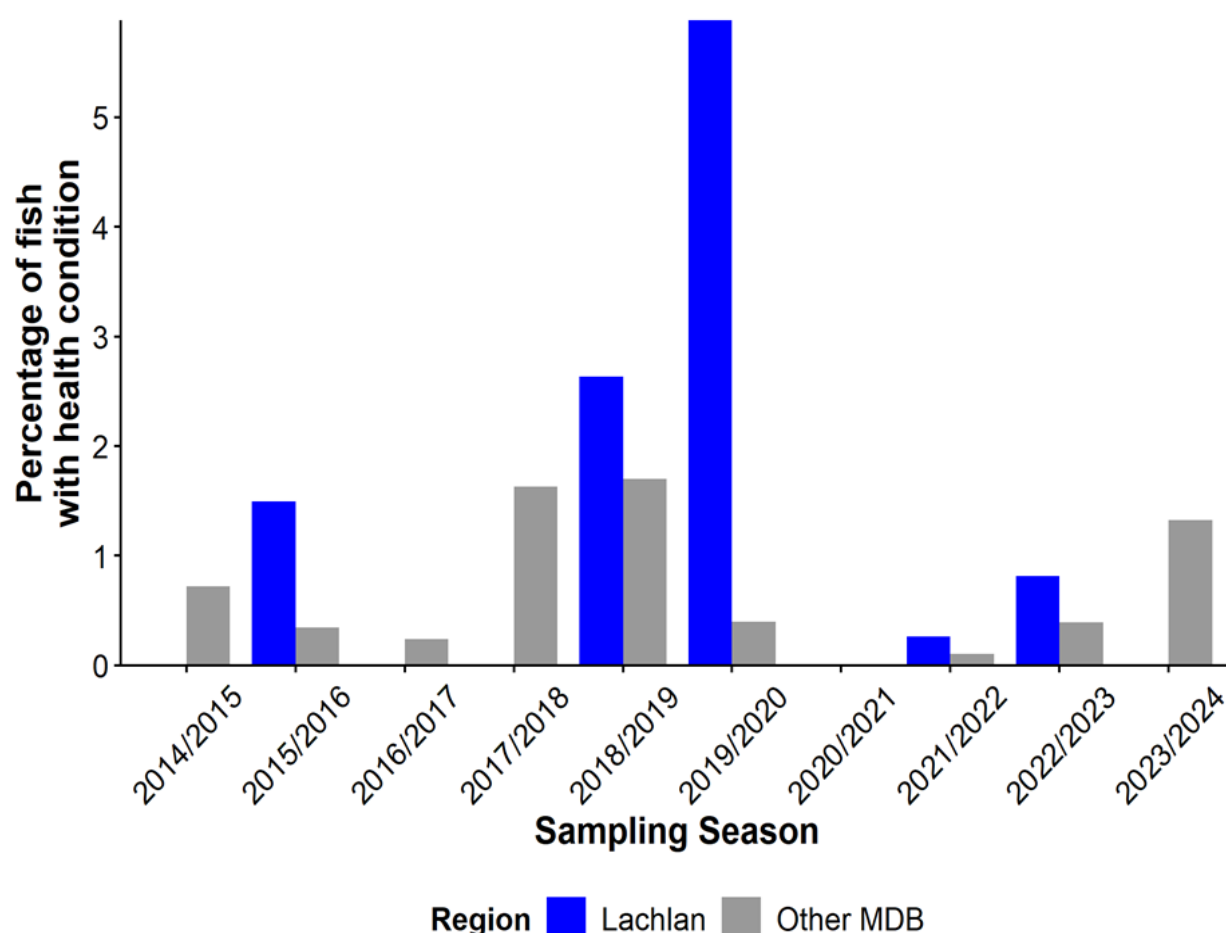


Figure 5.23: Timeseries showing the prevalence of health conditions in Australian smelt. Blue shows the region-specific data while the grey shows the average across the other NSW MDB WRPA.

Summary Statement:

Australian smelt in the Lachlan WRPA generally had very low levels of observable health issues except for 2019/20 where levels were moderate.

Distribution

Australian smelt were recorded at 65 out of 168 sites in the Lachlan WRPA from 2013/14 to 2023/24. The maximum observed relative abundance at a site was 47.7 fish caught per 90 seconds of electrofishing. Figure 5.24 shows the distribution and relative abundance of Australian smelt across the Lachlan WRPA.

Summary Statement:

Australian smelt were across the Lachlan WRPA with highest densities observed in the eastern upland area.

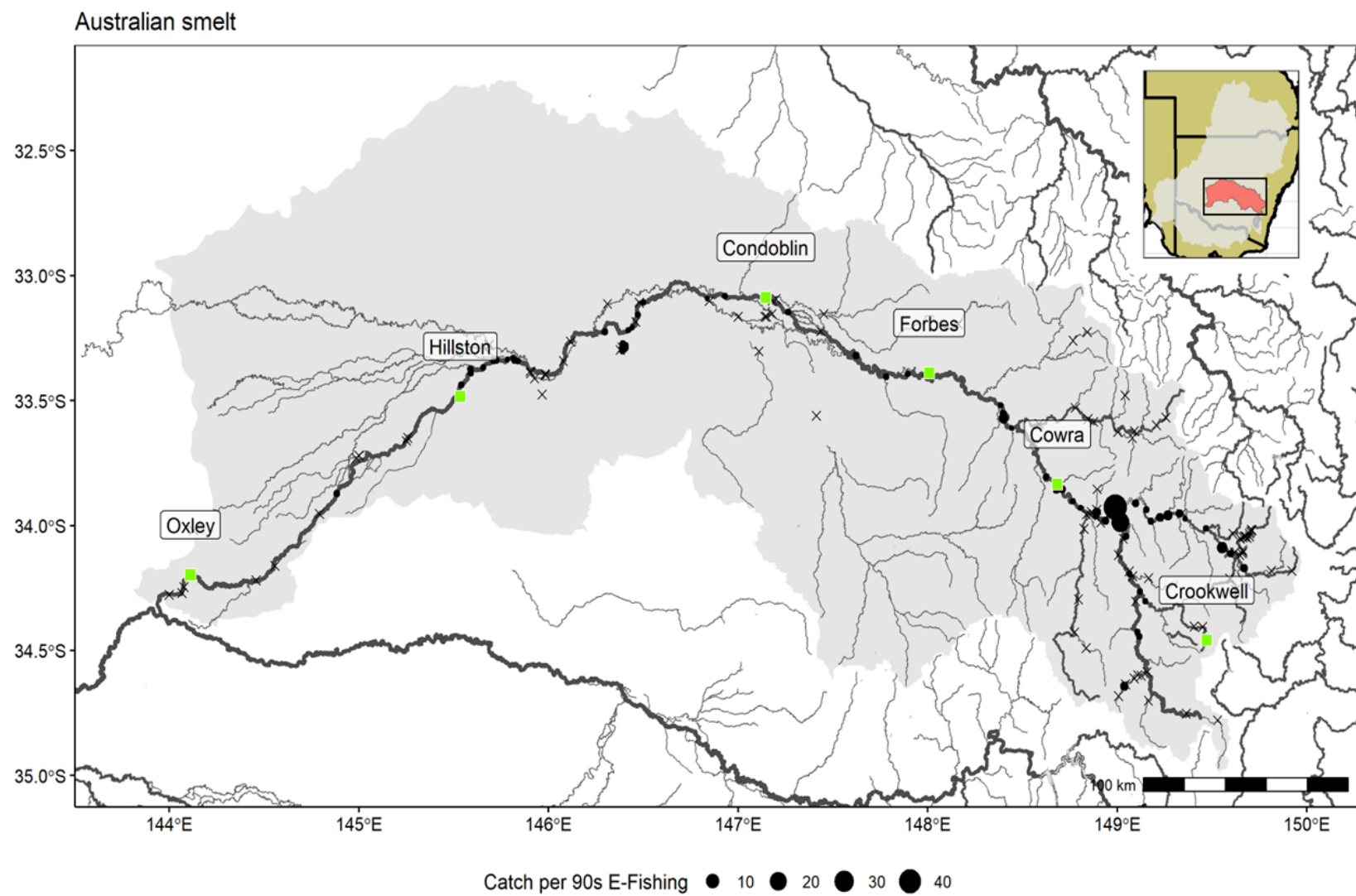


Figure 5.24: Distribution of Australian smelt sampled from 2013/14 to 2023/24 in the Lachlan WRPA. Filled circles show sites where the species was present, and the size of the circle represents relative abundance. Sites that were sampled with electrofishing but did not contain the species are shown with an X. Green squares represent key towns.

Common carp



Population Structure

Figure 5.25 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 27 to 1,682, and 7 % to 87 % of measured fish within a season, with a mean percentage YOY of 46 %.

Overall, during the reporting period, across all the MDB water resource planning areas, the percentage YOY for Common carp was 55 % (31,195 out of 56,546). Common carp are not a stocked species.

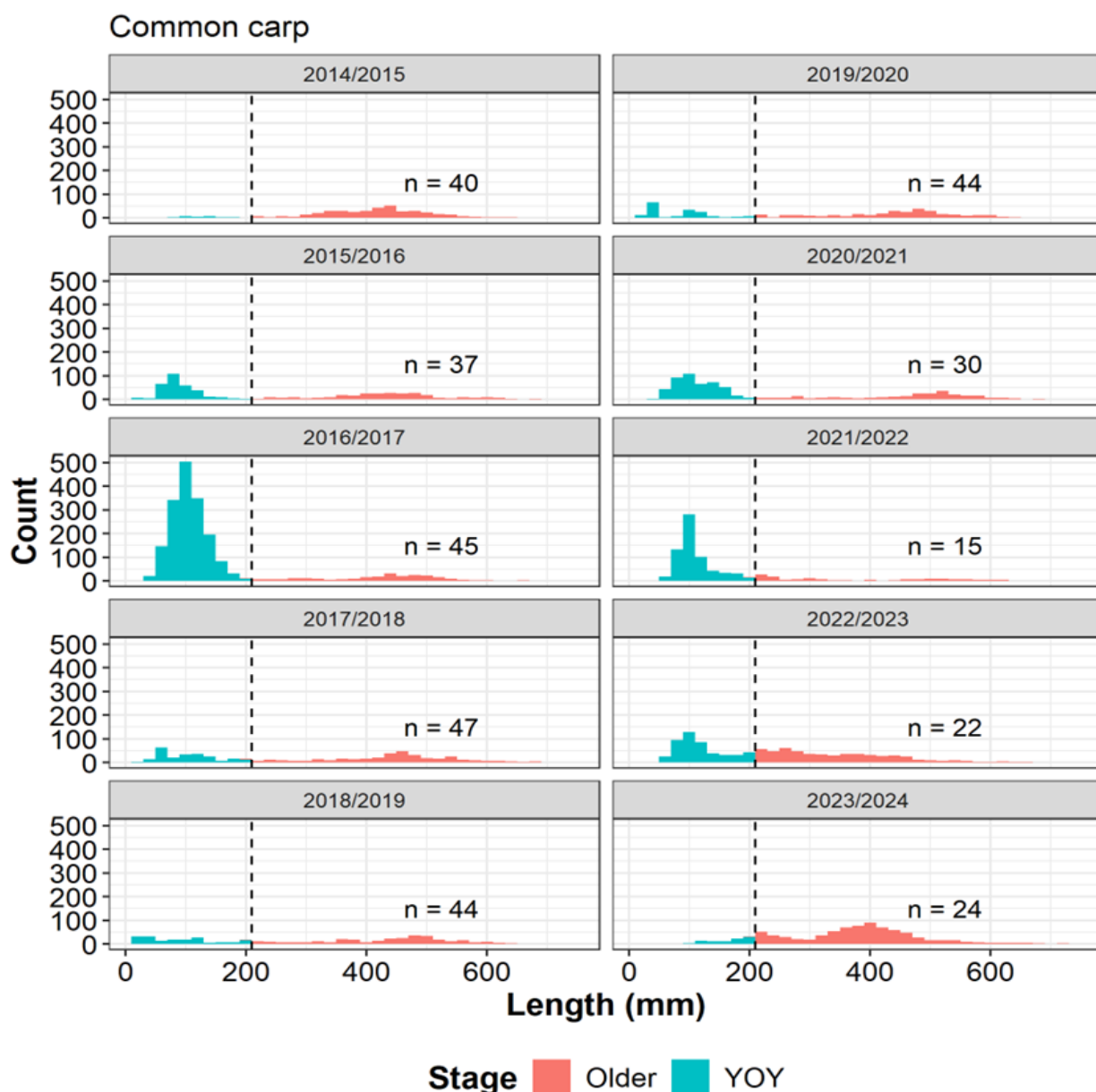


Figure 5.25: Length frequency plots for common carp by sampling season in the Lachlan WRPA. YOY represents Young of the Year fish. n shows the number of sites sampled in the WRPA in a sampling season.

Summary Statement:

Variable recruitment a strong peak in 2016/17 and moderate recruitment in 2020/21, 2021/22, and 2022/23. Large fish (>500 mm) present in all years. Low recruitment in 2023/24 with evidence of multiple year classes in the population.

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 5.26 show the abundance and biomass trends for the Lachlan WRPA and the right-hand panels show the overall trends across the NSW MDB.

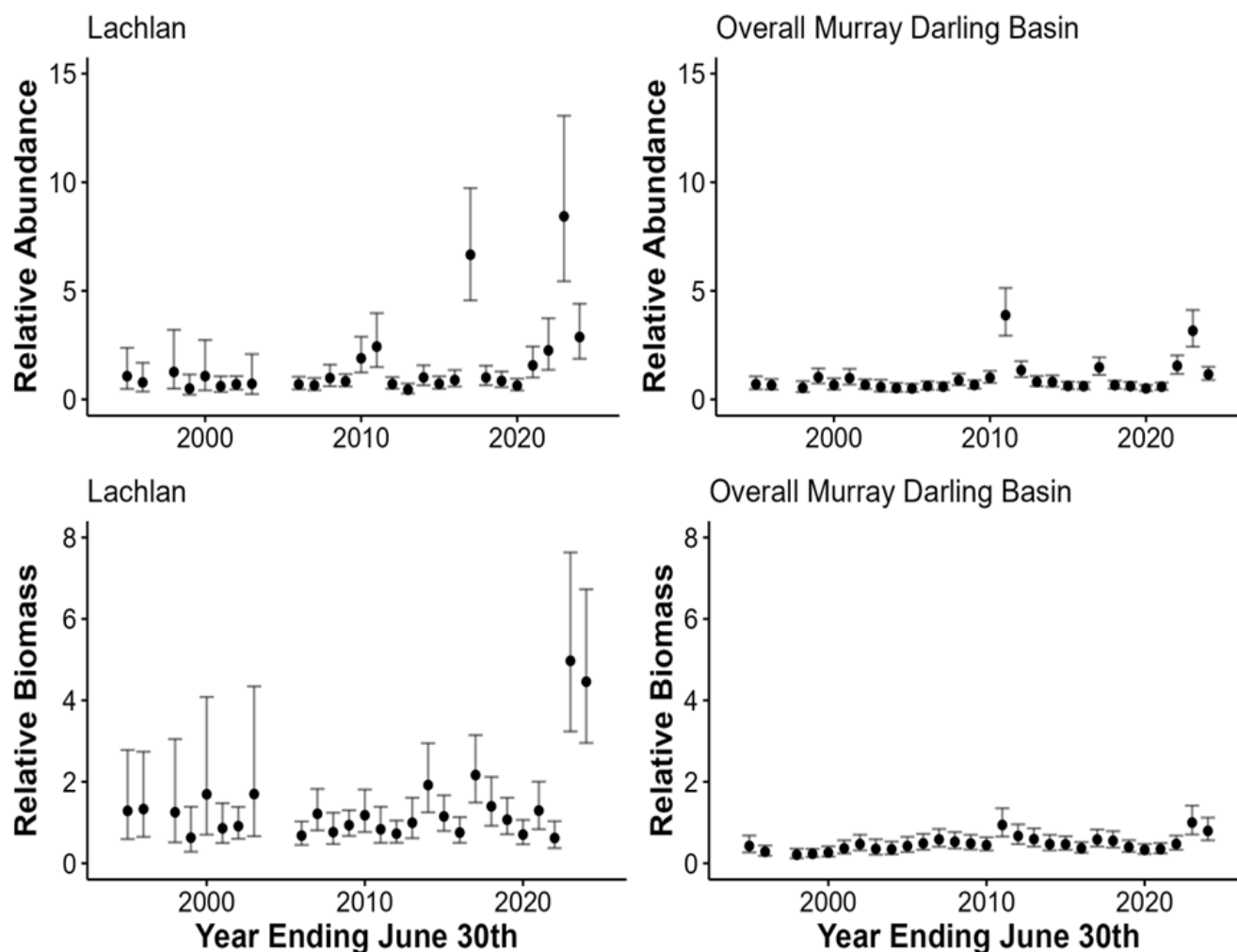


Figure 5.26: Relative abundance and biomass of Common carp in both this valley and the overall Murray-Darling Basin. These are model estimates based upon all electrofishing data within the NSW DPIRD Freshwater ecosystem database and the output of generalised linear mixed models. Error bars show the 95 % confidence intervals around the estimates.

Summary Statement:

For Common carp in the Lachlan, there is evidence of an increase since the mid 1990s. Recent years of strong recruitment have seen increases in both abundance and biomass. Abundance is now falling to pre-increase level but biomass has not fallen. Relative abundance and biomass is higher compared to the overall abundance across the NSW Murray-Darling Basin.

Health

The prevalence of any health issues ranged from 1 % of sampled fish in 2021/2022 to 8 % of sampled fish in 2014/2015 (Figure 5.27). The most common health issue for Common carp in the Lachlan water resource planning area was *Lernaea*, which was observed in a total of 128 fish, corresponding to 2 % of all Common carp measured.

Across the other WRPA's, 4 % of Common carp (2,141 out of 56,546 Common carp) showed a health condition (excludes Lachlan).

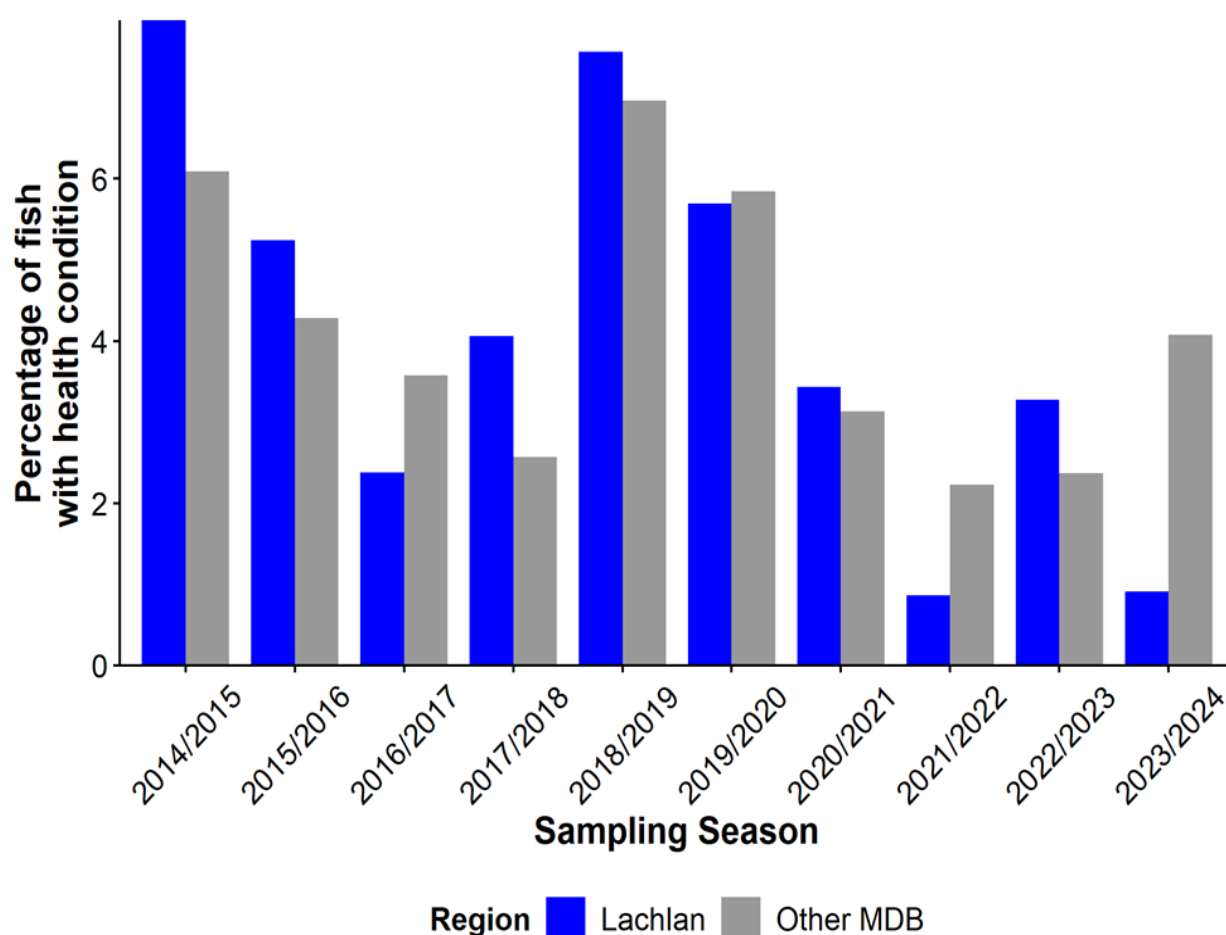


Figure 5.27: Timeseries showing the prevalence of health conditions in Common carp. Blue shows the region-specific data while the grey shows the average across the other NSW MDB WRPA's.

Summary Statement:

The presence of observable health conditions for Common carp in the Lachlan was low and generally tracked the wider NSW MDB. 2023/24 showed a low level of health issues.

Distribution

Common carp were recorded at 120 out of 168 sites in the Lachlan WRPA from 2013/14 to 2023/24. The maximum observed relative abundance at a site was 23.1 fish caught per 90 seconds of electrofishing. Figure 5.28 shows the distribution and relative abundance of Common carp across the Lachlan WRPA.

Summary Statement:

Common carp were found in relatively high abundance across the Lachlan region.

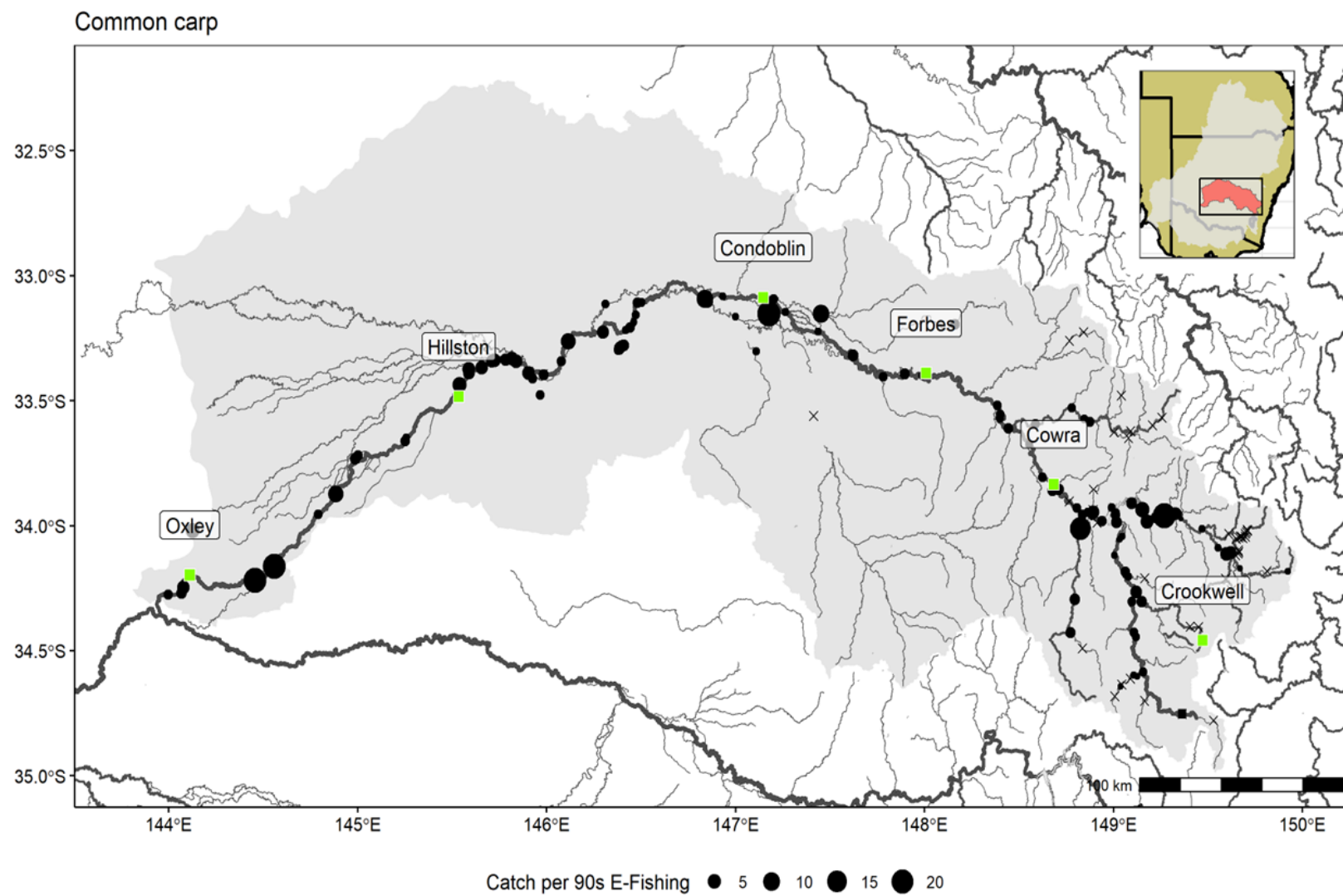


Figure 5.28: Distribution of Common carp sampled from 2013/14 to 2023/24 in the Lachlan WRP. Filled circles show sites where the species was present, and the size of the circle represents relative abundance. Sites that were sampled with electrofishing but did not contain the species are shown with an X. Green squares represent key towns.

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 during standardised electrofishing surveys in the Lachlan 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. (* = FMA, # = EPBC)

Species	Common name	Total caught (observed)
<i>Bidyanus bidyanus</i>	Silver perch ^{*#}	24 (2)
<i>Maccullochella peelii</i>	Murray cod [#]	1,048 (285)
<i>Macquaria australasica</i>	Macquarie perch ^{*#}	111 (14)
<i>Tandanus tandanus</i>	Freshwater catfish [*]	3 (0)

Note: Olive perchlet have been observed in and near Lake Brewster via other sampling methods.

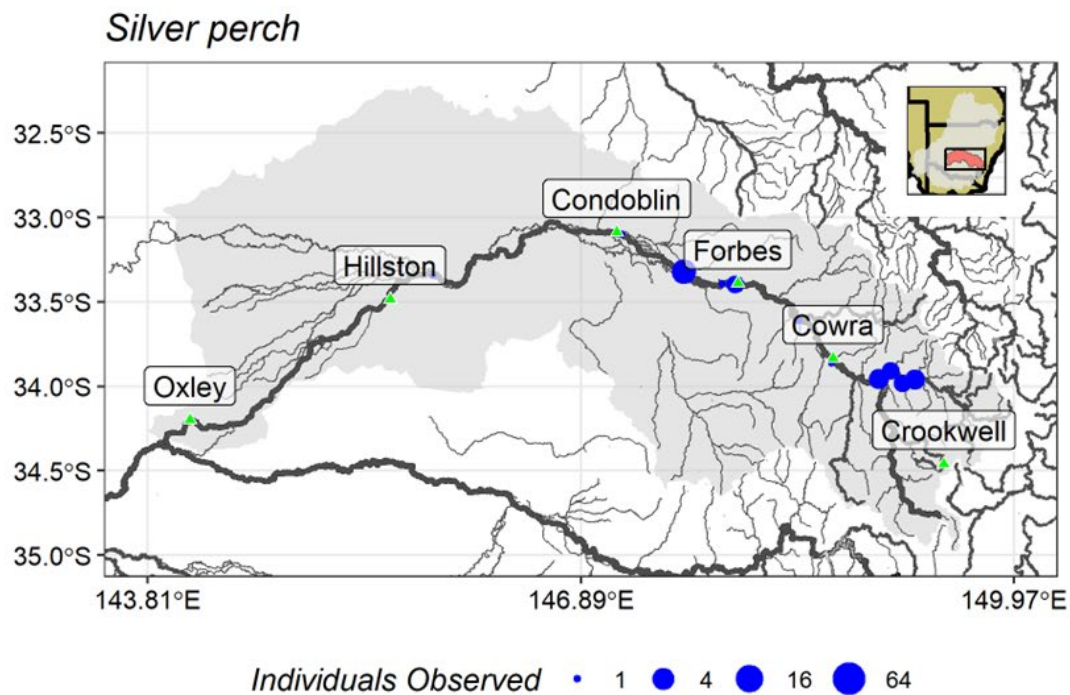


Figure 5.29: Distribution of the observed threatened species sampled from 2013/14 to 2023/24 in the Lachlan WRP. Filled circles show sites where the species was present, and the size of the circle represents number of observed individuals abundance.

Summary Statement:

24 Silver perch were caught during the reporting period across 12 sites in the Lachlan and Abercrombie Rivers. Individuals were observed in all sampling years except 2023/24.

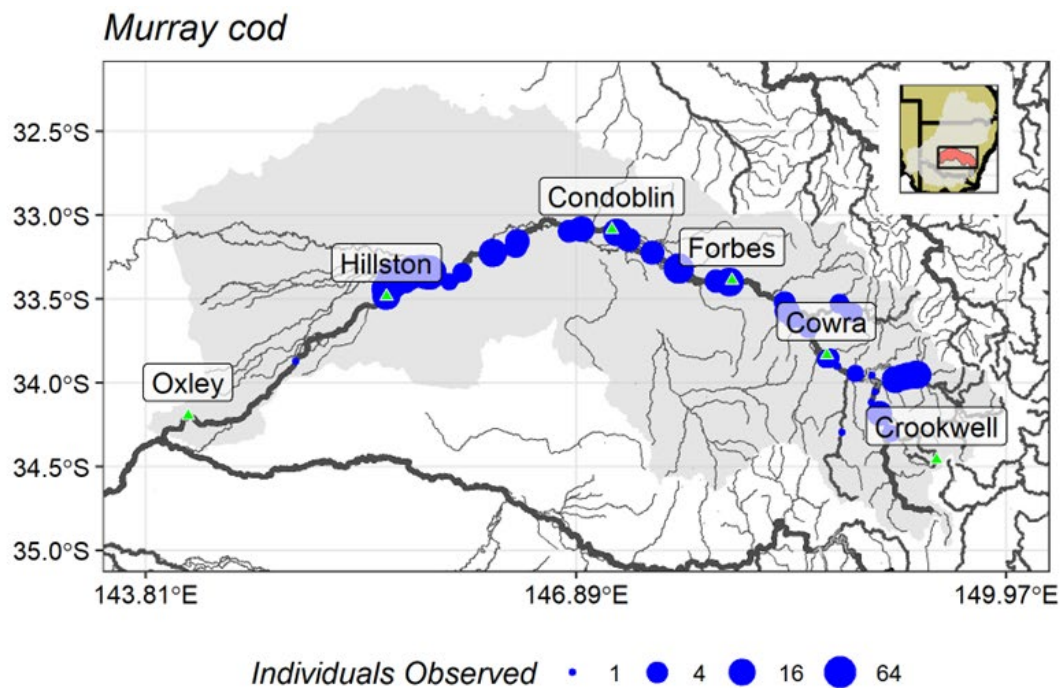


Figure 5.30 Distribution of the observed threatened species sampled from 2013/14 to 2023/24 in the Lachlan WRP. Filled circles show sites where the species was present, and the size of the circle represents number of observed individuals abundance. Note the lower image shows a juvenile Murray cod.

Summary Statement:

Murray cod were widespread across the Lachlan WRP and were particularly common in the Lachlan River. A total of 1,048 individuals were caught over the reporting period with individuals observed in each sampling season.

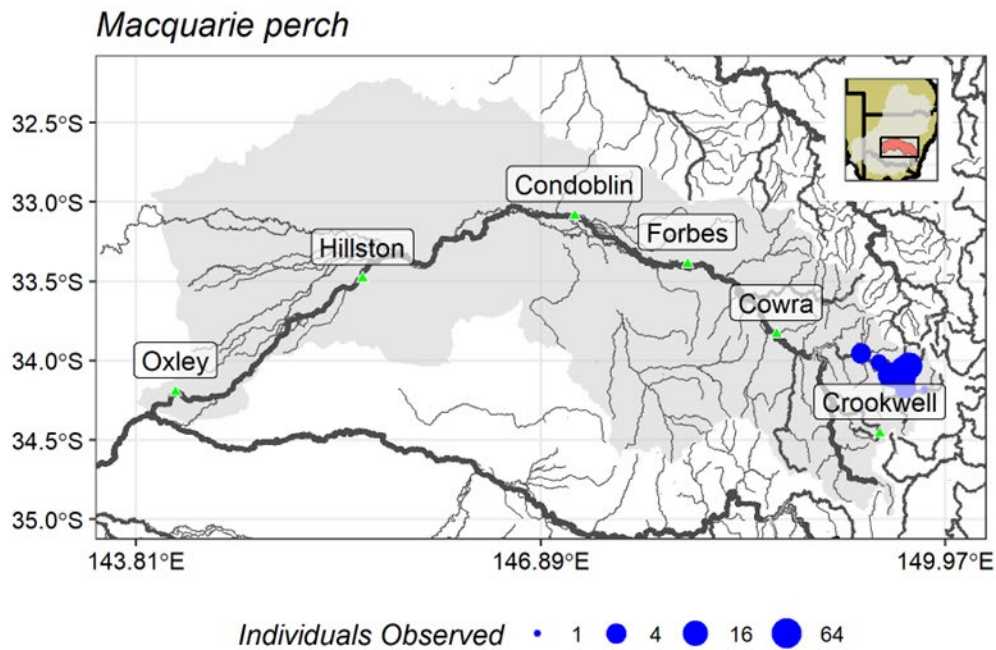


Figure 5.31: Distribution of the observed threatened species sampled from 2013/14 to 2023/24 in the Lachlan WRP. Filled circles show sites where the species was present, and the size of the circle represents number of observed individuals abundance.

Summary Statement:

111 Macquarie perch were caught during the reporting period across 19 sites in the eastern upland area (Abercrombie and Retreat Rivers). No Macquarie perch were caught after 2019/20. Macquarie perch were stocked in the Lachlan WRP from 2010/11 – 2014/15. Sampling effort has decreased with only four samples (across two of the sites where Macquarie perch were observed) have been taken since 2019/2020.

Freshwater catfish

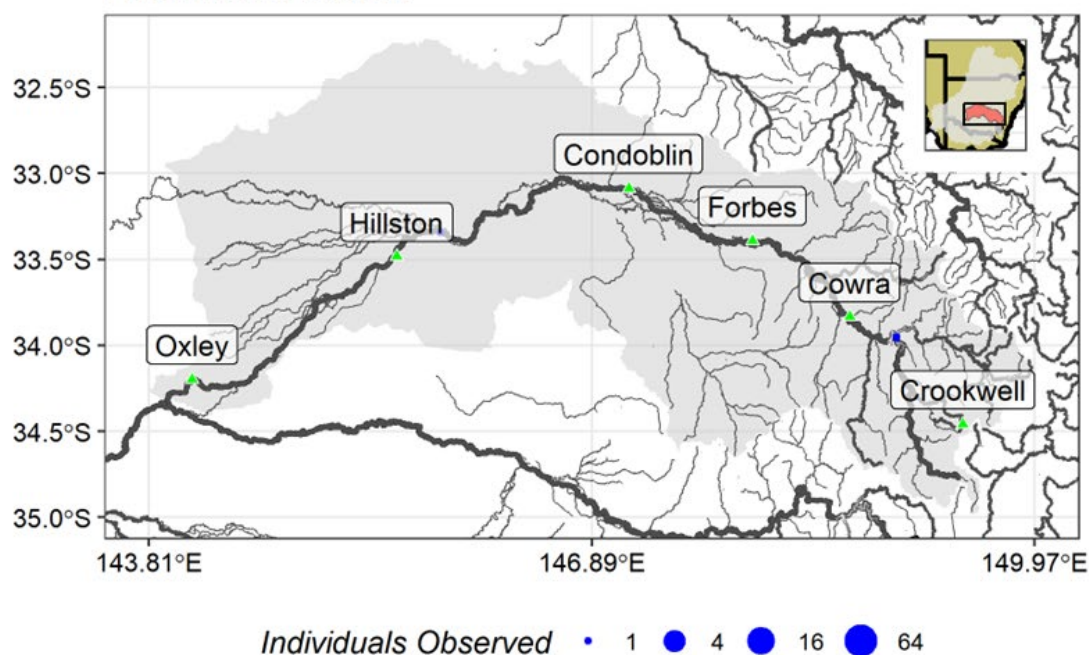


Figure 5.32: Distribution of the observed threatened species sampled from 2013/14 to 2023/24 in the Lachlan WRPA. Filled circles show sites where the species was present, and the size of the circle represents number of observed individuals abundance.

Summary Statement:

Only three Freshwater catfish were caught in the Lachlan WRPA during the reporting period. Further details are given in the Freshwater catfish section of the report.

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	2014/2015, 2015/2016, 2016/2017, 2017/2018, 2018/2019, 2019/2020	109
Basin Plan Environmental Outcomes Monitoring 2	2022/2023, 2023/2024	28
Carp Biomass Project (NCCP)	2017/2018	6
Carp herpes virus investigation	2015/2016, 2016/2017	11
Lachlan Long Term Intervention Monitoring	2014/2015, 2015/2016, 2016/2017, 2017/2018, 2018/2019, 2019/2020, 2020/2021, 2021/2022, 2022/2023, 2023/2024	100
Lachlan Macquarie Perch Rescue	2014/2015, 2015/2016, 2016/2017, 2017/2018, 2019/2020	59
Macquarie perch surveys	2018/2019, 2020/2021	10
Monitoring, Evaluating and Reporting - Inland	2014/2015	1
Murray-Darling Basin Fish Surveys	2014/2015, 2015/2016, 2016/2017, 2017/2018, 2018/2019, 2019/2020, 2021/2022, 2022/2023, 2023/2024	53
Olive perchlet surveys	2015/2016	3
Three Dams	2020/2021	19

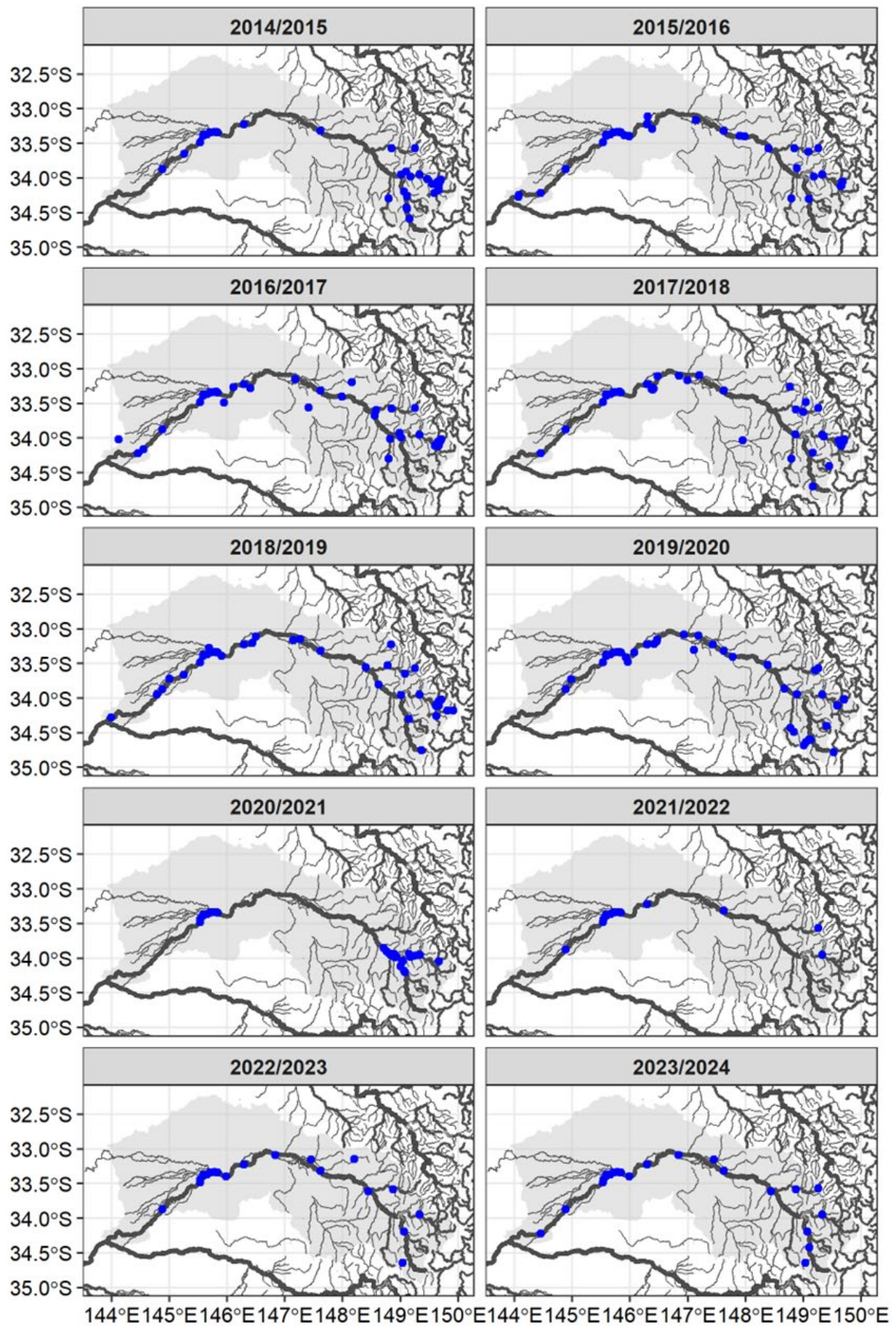


Figure 5.33: Sites sampled and included in this report by sampling season in the Lachlan WRPA. Dry sites are not shown.

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 Lachlan WRPA were: Olive perchlet, Darling hardyhead, Murray hardyhead, Flat-headed galaxias, Spangled perch, Trout cod, Murray-Darling rainbowfish, Southern purple-spotted gudgeon, Southern pygmy perch and Dwarf flathead gudgeon. 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 in the Lachlan WRPA.

Common name	Expected from modelling	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24
Australian smelt	YES	95	67	805	249	38	34	94	444	123	32
Bony herring	YES	1,815	3,820	2,442	6,667	2,837	353	686	837	574	1,038
Brown trout	YES	5	0	19	38	0	30	0	0	0	0
Carp-gudgeon species complex	YES	897	796	253	265	263	292	231	213	53	269
Common carp	NA	415	599	7,085	590	487	474	940	1,108	4,306	1,606
Common carp - Goldfish hybrid	NA	0	0	15	0	0	0	0	0	0	0
Eastern gambusia	NA	210	104	490	641	662	519	40	233	15	7
Flathead gudgeon	YES	57	21	94	9	10	71	46	23	5	4
Freshwater catfish	YES	1	0	0	0	1	0	0	0	0	1
Galaxias spp	NA	0	0	258	1,221	78	16	0	0	5	0
Golden perch	YES	183	124	94	98	130	152	141	26	66	43
Goldfish	NA	13	85	89	44	103	116	37	60	224	248
Macquarie perch	YES	62	4	24	13	1	7	0	0	0	0
Mountain galaxias	YES	2,603	477	397	404	847	129	95	0	2	14
Murray cod	YES	198	124	36	36	55	149	247	50	77	76
River blackfish	NA	0	0	0	0	16	0	0	0	2	0
Rainbow trout	YES	3	1	1	4	2	0	0	0	0	0
Redfin	YES	2	1	32	85	100	11	0	2	6	6
Silver perch	YES	4	3	2	1	3	2	6	1	2	0
Unspecked hardyhead	YES	7	19	15	18	0	5	5	105	1	7

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

Table 5.9: Total catch of each species by sampling method in the Lachlan WRPA.

Common name	Backpack Electrofishing	Bait Trap	Boat Electrofishing
Australian smelt	108	1	1,872
Bony herring	30	3	21,036
Brown trout	91	0	1
Carp-gudgeon species complex	182	2,993	357
Common carp	687	990	15,933
Common carp - Goldfish hybrid	0	0	15
Eastern gambusia	1,471	641	809
Flathead gudgeon	19	112	209
Freshwater catfish	0	0	3
Galaxias spp	1,244	318	16
Golden perch	0	0	1,057
Goldfish	78	1	940
Macquarie perch	108	0	3
Mountain galaxias	4,265	689	14
Murray cod	16	0	1,032
River blackfish	18	0	0
Rainbow trout	10	0	1
Redfin	29	3	213
Silver perch	0	0	24
Unspecked hardyhead	0	0	182

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 Lachlan WRPAs were: Darling hardyhead, Murray hardyhead, Flat-headed galaxias, Spangled perch, Trout cod, Murray-Darling rainbowfish, Southern purple-spotted gudgeon, Southern pygmy perch and Dwarf flathead gudgeon. 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 Lachlan WRPAs. Note these include projects with sampling not representative of the community and the data should be used with caution.

Common name	Expected from modelling	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24
Australian smelt	YES	96	67	806	279	38	44	94	566	146	32
Bony herring	YES	1,855	3,853	2,463	8,455	2,865	353	689	852	575	1,071
Brown trout	YES	9	0	19	38	0	30	0	0	0	0
Carp gudgeon species complex	YES	957	6,397	596	4,482	627	3,116	453	6,458	414	335
Common carp	NA	416	650	8,156	802	508	479	946	1,125	4,521	1,609
Common carp - Goldfish hybrid	NA	0	0	15	0	0	0	0	0	0	0
Eastern gambusia	NA	481	717	1,468	1,201	854	1,700	270	315	544	22
Flathead gudgeon	YES	57	33	95	9	15	84	83	1,588	10	4
Freshwater catfish	YES	2	0	0	0	1	0	0	0	0	1
Galaxia spp	NA	0	0	272	1,221	78	16	0	0	5	0
Golden perch	YES	201	135	108	291	135	152	142	26	66	43
Goldfish	NA	13	86	92	56	103	119	37	62	231	248
Macquarie perch	YES	109	16	36	45	12	74	0	0	0	0
Mountain galaxias	YES	2,705	544	397	404	847	129	96	0	2	14
Murray cod	YES	198	127	36	41	55	149	247	50	77	76
River blackfish	NA	0	0	0	0	42	0	0	0	2	0
Olive perchlet	YES	0	126	0	0	0	0	0	0	0	0
Rainbow trout	YES	3	1	1	4	2	0	0	0	0	0

Common name	Expected from modelling	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24
Redfin	YES	2	2	33	142	135	19	0	2	11	6
Silver perch	YES	4	3	2	1	3	2	6	1	2	0
Unspecked hardyhead	YES	7	22	15	18	0	6	6	111	3	7

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