Department of Primary Industries
Department of Regional NSW

Chapter 8 Basin Plan Environmental Outcomes Monitoring for Fish (2014/15 – 2019/20): Namoi Water Resource Planning Area

Citation Details

Please cite the overall report when referring to this chapter:

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Chapter cover image credit: Hayden Schilling (NSW DPI); Fish images credit: Gunther Schmida

Acknowledgements

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Introduction

This report spans the first series of the Basin Plan Environmental Outcome Monitoring – Fish (BPEOM-F) program, starting in 2014/15 as a pilot and running annually until 2019/2020. This report focusses on the Namoi Water Resource Planning Area (WRPA) shown in Figure 8.1.

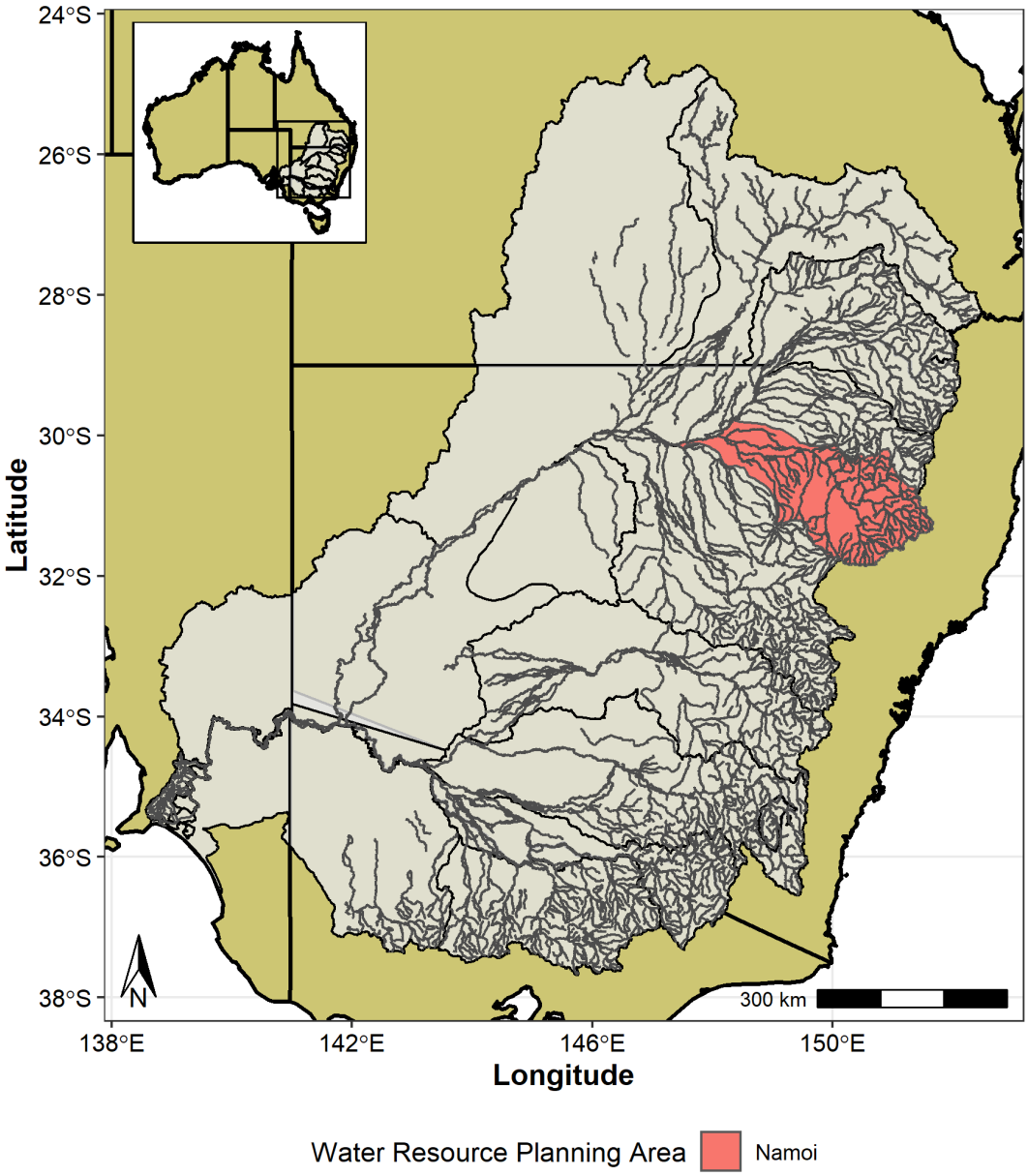

Figure 8.1: Murray-Darling Basin with the key region of this report highlighted. Inset map shows the whole of Australia with a box around the MDB.

What This Report Includes

This report starts with an overview of the BPEOM-F program 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 Namoi 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
- 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 (a unit-less measure representing the number of fish in an area) information is presented based on 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 analysis uses Bayesian generalised additive mixed models to generate time series of relative abundance for each WRPA since the early 1990s. In this report we present the modelled time series of relative abundance showing the predicted number of fish observed per 90 second shot of electrofishing. The abundance trend for the Namoi WRPA is contrasted with the overall NSW MDB dataset. It should be noted that these are modelled estimates of relative abundance, not absolute abundance as absolute abundance estimates require calibration surveys.

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. Healthier fish tend to have increased fecundity and reproductive success. 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 Namoi WRPA and greater MDB (excluding the Namoi WRPA).

Distribution maps are provided for each species to show the observed distribution of each species from the BPEOM-F program (other sampling programs not reported in this report). 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 the BPEOM-F program in the Namoi WRPA during the study 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 were used during the BPEOM-F program: 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). This usually includes 12 shots of 90 seconds “power on” during each sampling event. Sites included in this round of the BPEOM-F program were chosen using a stratified random approach.

Various amounts of sampling effort (number of sites) were conducted for each year of the reporting period (Table 8.1). 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 the 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 8.1: Sampling effort (Number of sites sampled) each sampling season. The number of sites which were planned to be sampled but were dry are shown in brackets and excluded from the sampled count.

Sampling Season	Number of Sites Sampled (Dry Sites)
2014/2015	9 (0)
2015/2016	16 (5)
2016/2017	20 (1)
2017/2018	14 (10)
2018/2019	20 (12)
2019/2020	18 (3)

The sites sampled during the reporting period are shown in Figure 8.2. A breakdown of sites sampled each sampling season is shown in the Appendix (Figure 8.35).

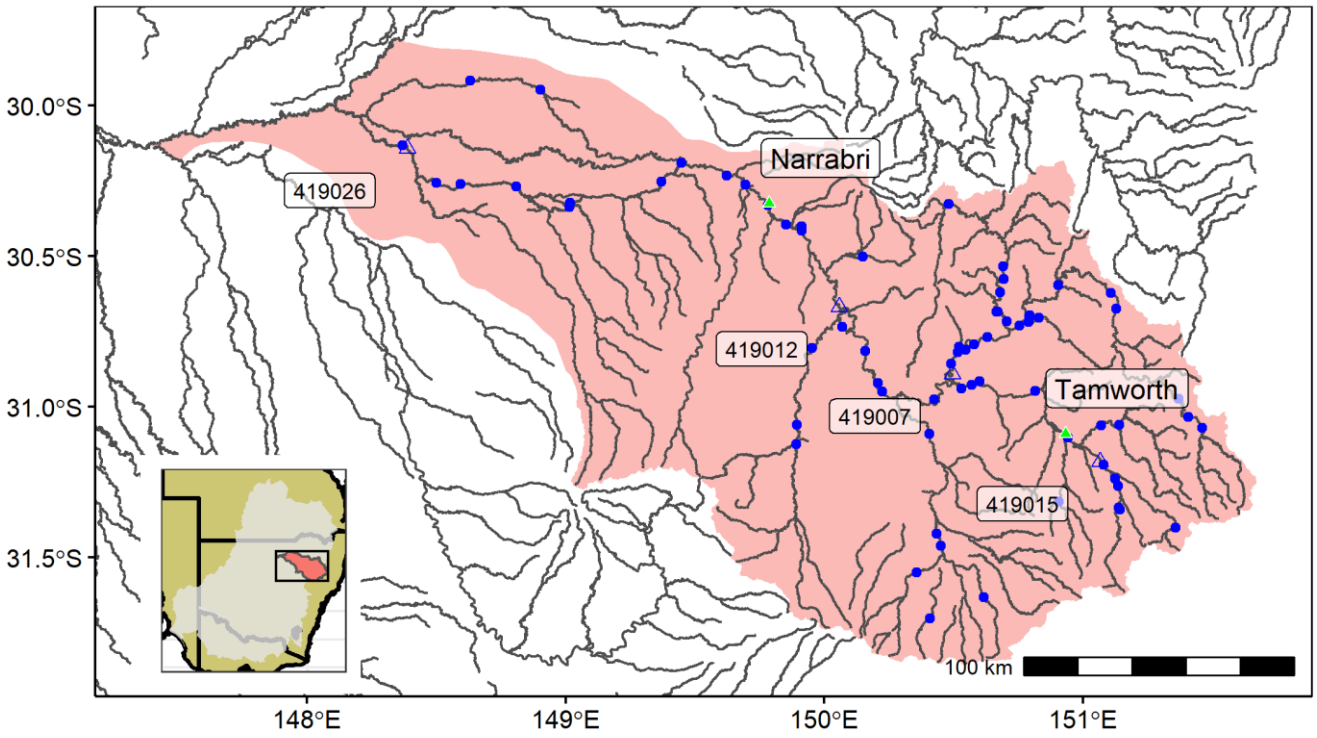

Figure 8.2: Sites (dots) sampled during the BPEOM-F program. Triangles show key flow gauges along with their gauge ID number. Dry sites are not shown.

Each sampling method has a different effectiveness at sampling each species. Table 8.2 shows the total amount of each species caught by each method.

Table 8.2: Number of each key species caught by each sample method over the whole program. Further data on total catch is provided in the Appendix.

Common name	Backpack Electrofishing	Boat Electrofishing	Bait Trap
Murray cod	96	410	0
Golden perch	8	69	0
Freshwater catfish	65	8	0
Bony herring	430	1,012	7
Australian smelt	44	30	0
Common carp	783	1,059	112

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 8.3 shows the number of biological measurements taken each year for the six species.

Table 8.3: Number of biological measurements taken for the key species each sampling season.

	Murray cod	Golden perch	Freshwater catfish	Bony herring	Australian smelt	Common carp
2014/2015	38	5	0	77	3	154
2015/2016	89	15	8	212	30	249
2016/2017	84	12	35	239	12	370
2017/2018	97	8	2	40	0	126
2018/2019	163	6	6	198	1	363
2019/2020	35	31	22	79	28	214

Reference:

Crook D. A., Schilling H. T., Gilligan D. M., Asmus M., Boys C. A., Butler G. L., Cameron L. M., Hohnberg D., Michie L. E., Miles N. G., Rayner T. S., Robinson W. A., Rourke M. L., Stocks J. R., Thiem J. D., Townsend A., van der Meulen D. E., Wooden I., Cheshire K. J. M. (2023) Multi-decadal trends in large-bodied fish populations in the New South Wales Murray–Darling Basin, Australia. *Marine and Freshwater Research* https://doi.org/10.1071/MF23046

Climate Overview

The following is a summary of the climatic conditions during the BPEOM-F program 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. As an example, 2014 states it was the warmest year on record, meaning 2014 was the warmest year on record up to and including 2014 but not the 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.

Flow Data

Below shows a summary of flow data from a variety of flow gauges in the Namoi WRPA (Figure 8.3).

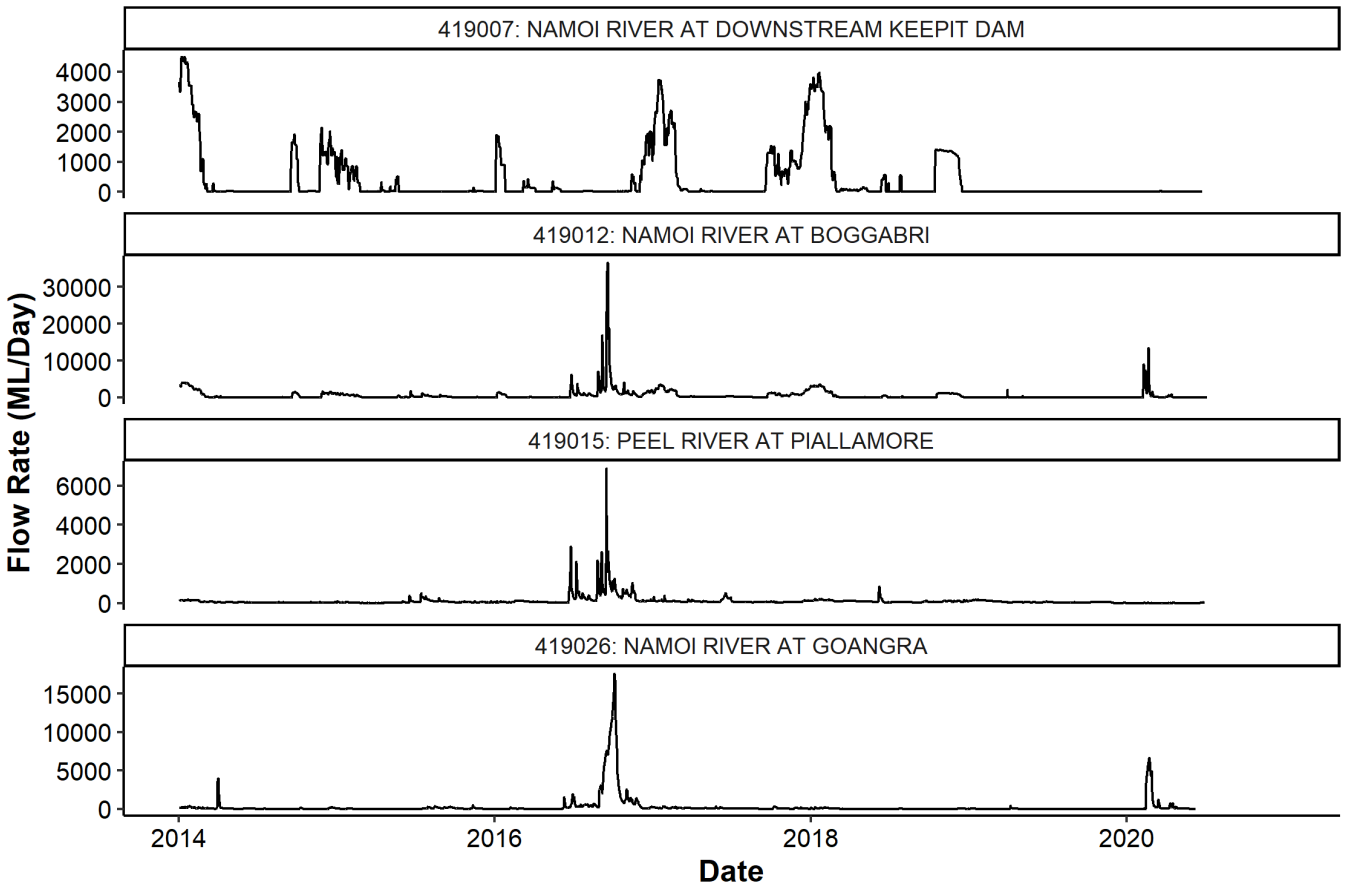

Figure 8.3: Flow data from various gauges in the Namoi WRPA over the reporting period. Gauge locations can be seen on Figure 8.2. Note the differing scales on the y-axis.

Water temperature data, where available, are also shown in Figure 8.4.

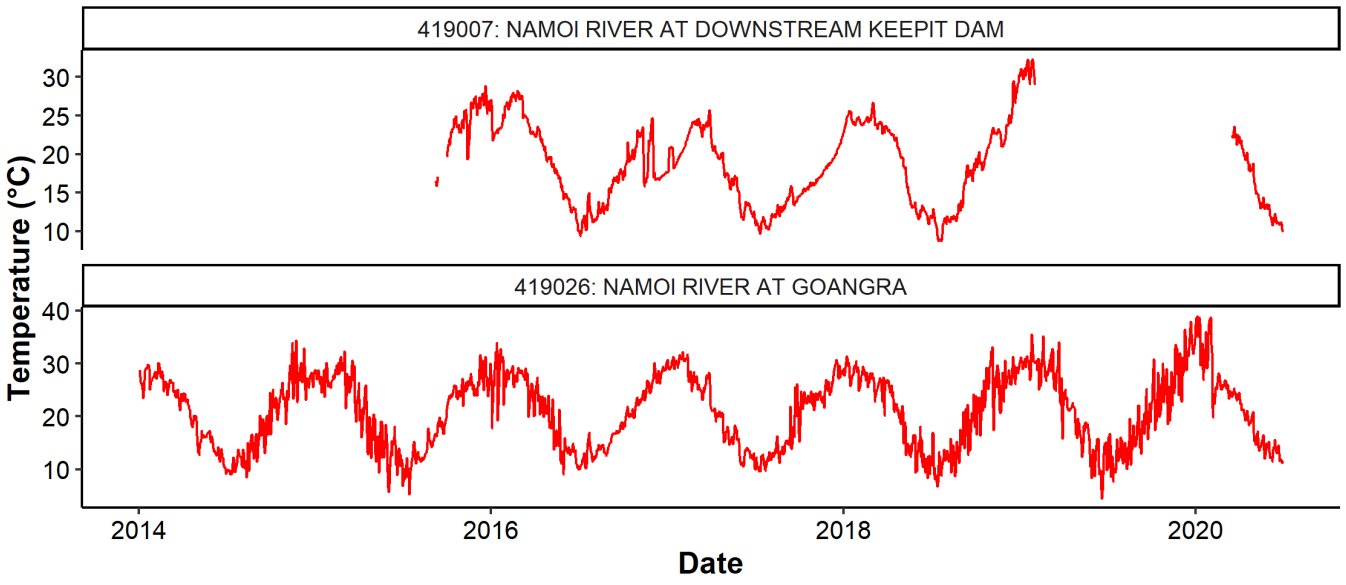

Figure 8.4: Water temperature data from various gauges in the Namoi WRPA over the reporting period. Gauge locations can be seen on Figure 8.2. Note the differing scales on the y-axis.

Species Diversity

A total of 17 fish species were observed across the Namoi WRPA including four alien species. Figure 8.5 shows the number of native and alien species found at each site. The full list of species caught and observed is in Table 8.7.

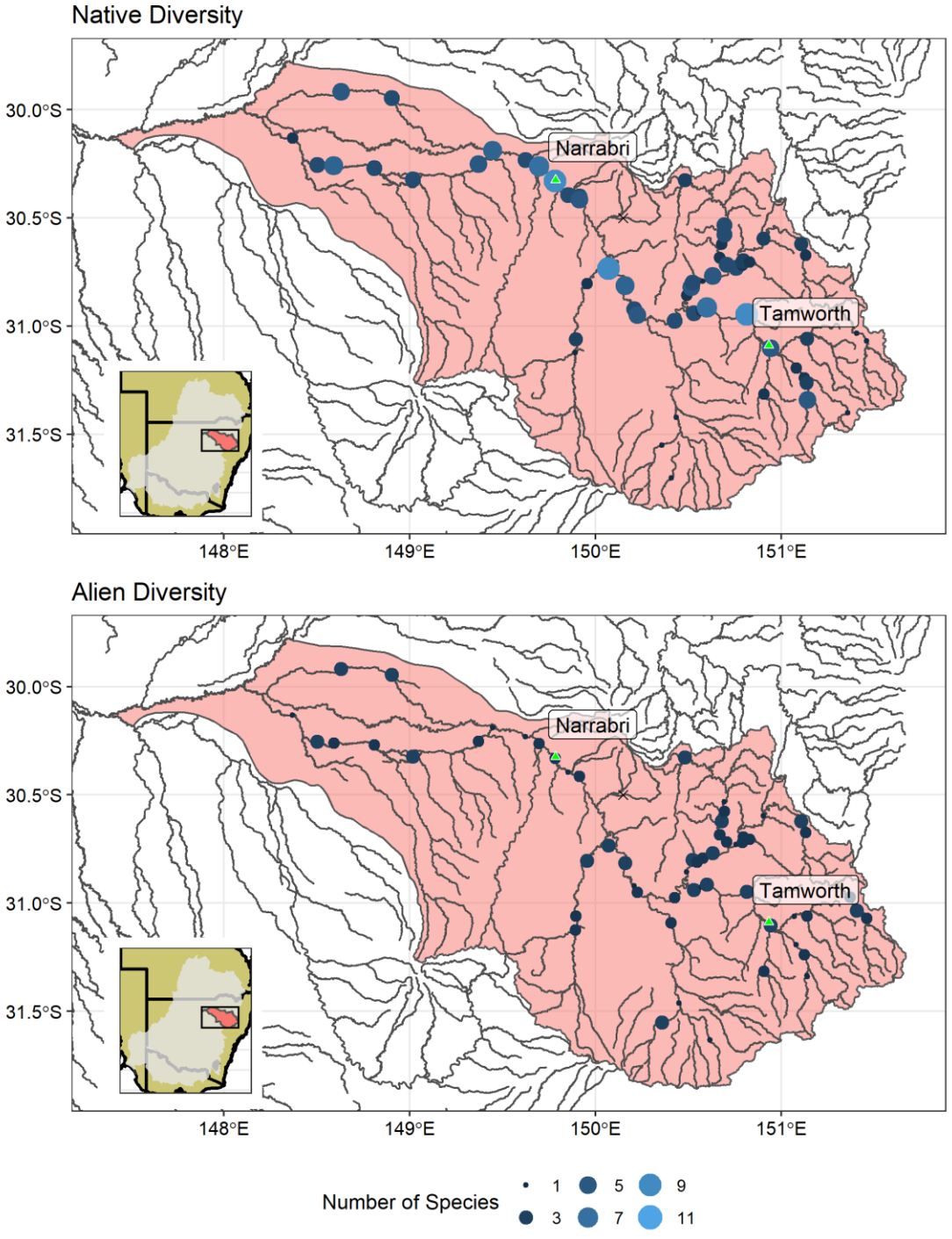

Figure 8.5: Diversity across all sampling sites. Bubble size represents the number of unique species observed at each site across all sampling methods and events. X represents a site that had water and was sampled, but no fish species were caught at all. Dry sites are excluded.

Summary Statement:

Native diversity generally consistent across the Namoi WRPA with slightly lower diversity in the upland areas. Alien diversity was generally consistent across the region.

Murray cod

Population Structure

Figure 8.6 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 27, and 0% to 19% of measured fish within a season.

Overall, during the BPEOM-F program, across all the MDB water resource planning areas, the percentage YOY for Murray cod was 13% (442 out of 3,344).

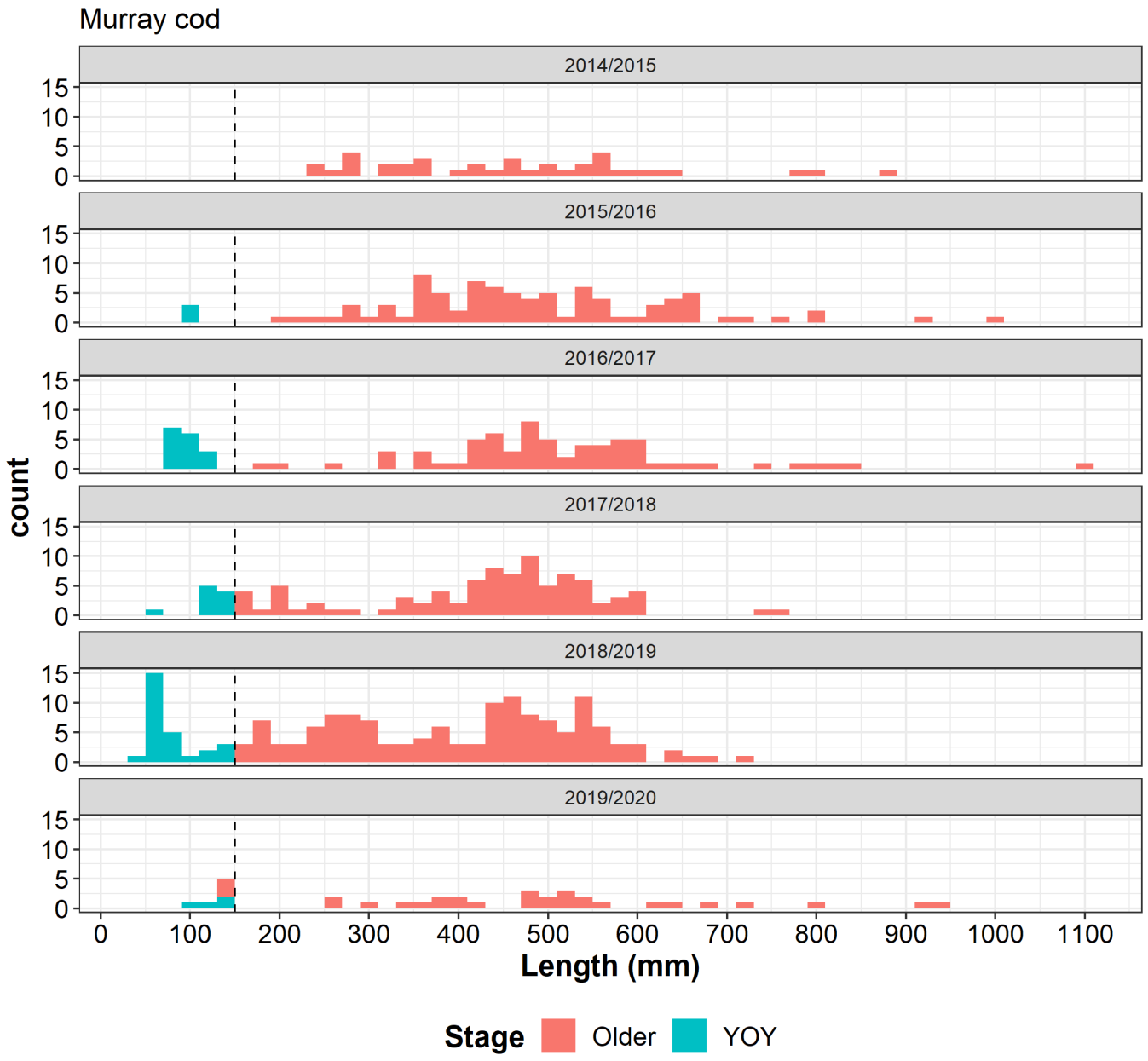

Figure 8.6: Length frequency plots for Murray cod by sampling season. YOY represents Young of the Year fish.

Summary Statement:

Regular recruitment (except 2014/15) but variable numbers of YOY, with a good range of size classes.

Stocking

A total of 227,772 Murray cod were stocked into the waterways of the Namoi WRPA during the reporting period. Of these fish, 169,000 (74%) were stocked into impoundments while 58,772 (26%) were stocked into rivers or creeks. Table 8.4 shows the detailed breakdown of stocking by season, location and life stage while Figure 8.7 shows the locations of stocking.

Table 8.4: Number and life stage of stocked Murray cod each sampling season.

Sampling Season	River/Creek or Impoundment	Life Stage	Number Stocked
2014/2015	Impoundment	Fry	2,000
2014/2015	River/Creek	Fry	14,858
2015/2016	Impoundment	Fry	30,000
2015/2016	River/Creek	Fry	6,494
2015/2016	River/Creek	Sub Adult	100
2016/2017	Impoundment	Fry	117,000
2016/2017	River/Creek	Fingerling	17,494
2018/2019	Impoundment	Fry	20,000
2018/2019	River/Creek	Fry	6,493
2019/2020	River/Creek	Fry	13,333

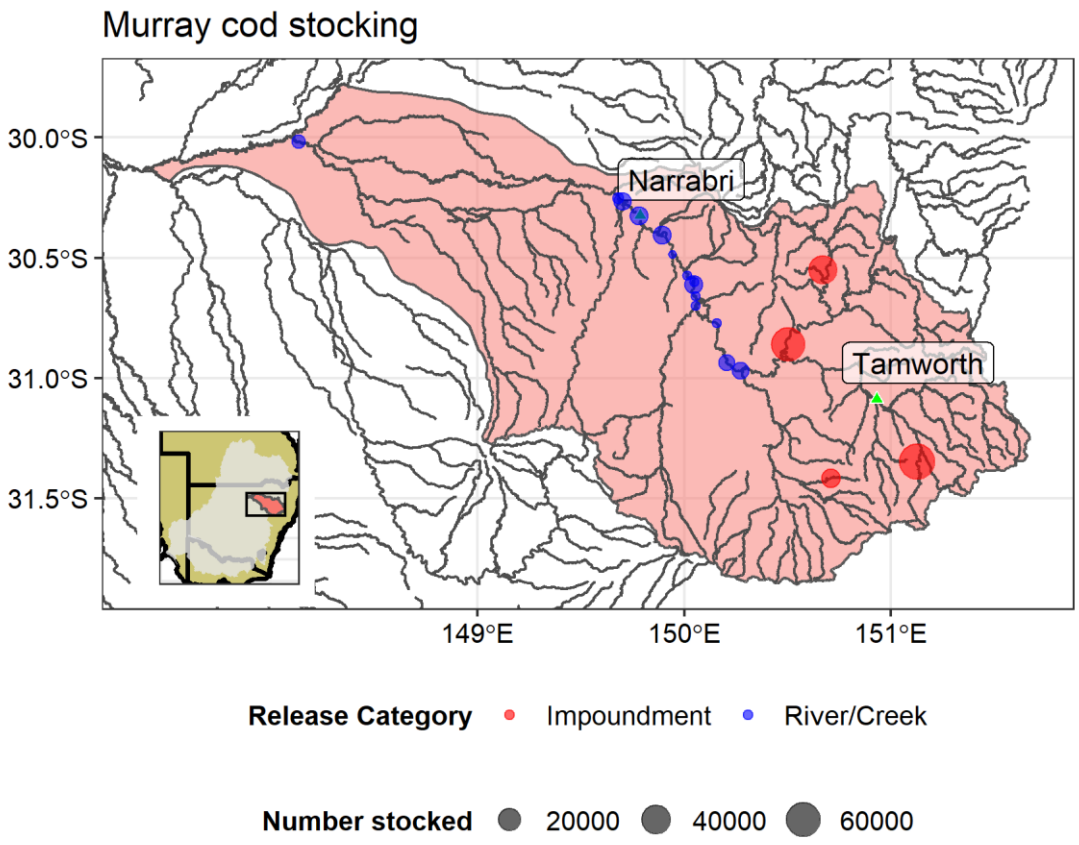

Figure 8.7: Locations of Murray cod stocking. Colours show whether a site was a river/creek site or an impoundment while the size of the point reflects the total number of fish stocked over the reporting period.

Temporal Trends in Abundance

We have modelled the relative abundance of Murray cod since 1994 based on all suitable boat electrofishing data. The left-hand panel of Figure 8.8 shows the abundance trend for the Namoi WRPA and the right-hand panel shows the overall trend across the NSW MDB.

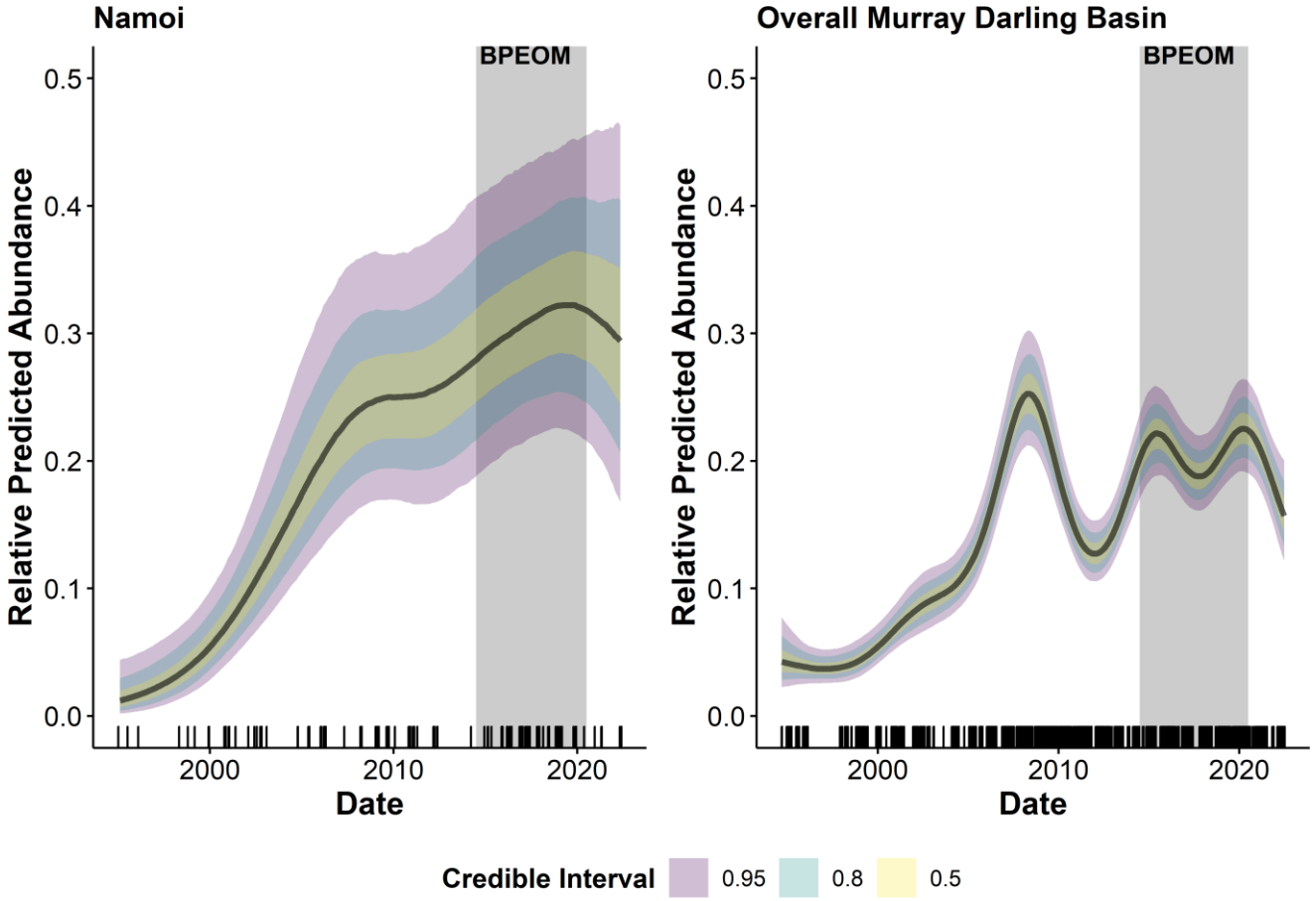

Figure 8.8: Relative abundance of Murray cod in both the Namoi WRPA and the overall NSW MDB. These are model estimates based upon all boat electrofishing data within the NSW DPI Freshwater ecosystem database and are the output of Bayesian generalised additive mixed models. The grey shaded region represents the period during which the BPEOM-F program was run. The black lines on the x-axis represent data coverage while the colours on the figure show various levels of confidence. Note when overlapping, the colours look slightly different due to the transparency and the y-axes vary between chapters of this report.

Summary Statement:

A steady increase in abundance since the 1990s. Relative abundance currently higher than overall abundance across the NSW MDB.

Health

The prevalence of any health issues ranged from 13% of sampled fish in 2017/2018 to 40% of sampled fish in 2018/2019 (Figure 8.9). The most common health issue for Murray cod in the Namoi WRPA was Lerneae, which was observed in a total of 92 fish, corresponding to 18% of all Murray cod measured.

Across the other NSW MDB WRPAs, 16% of Murray cod (528 out of 3,344 Murray cod) showed a health condition (excludes the Namoi WRPA).

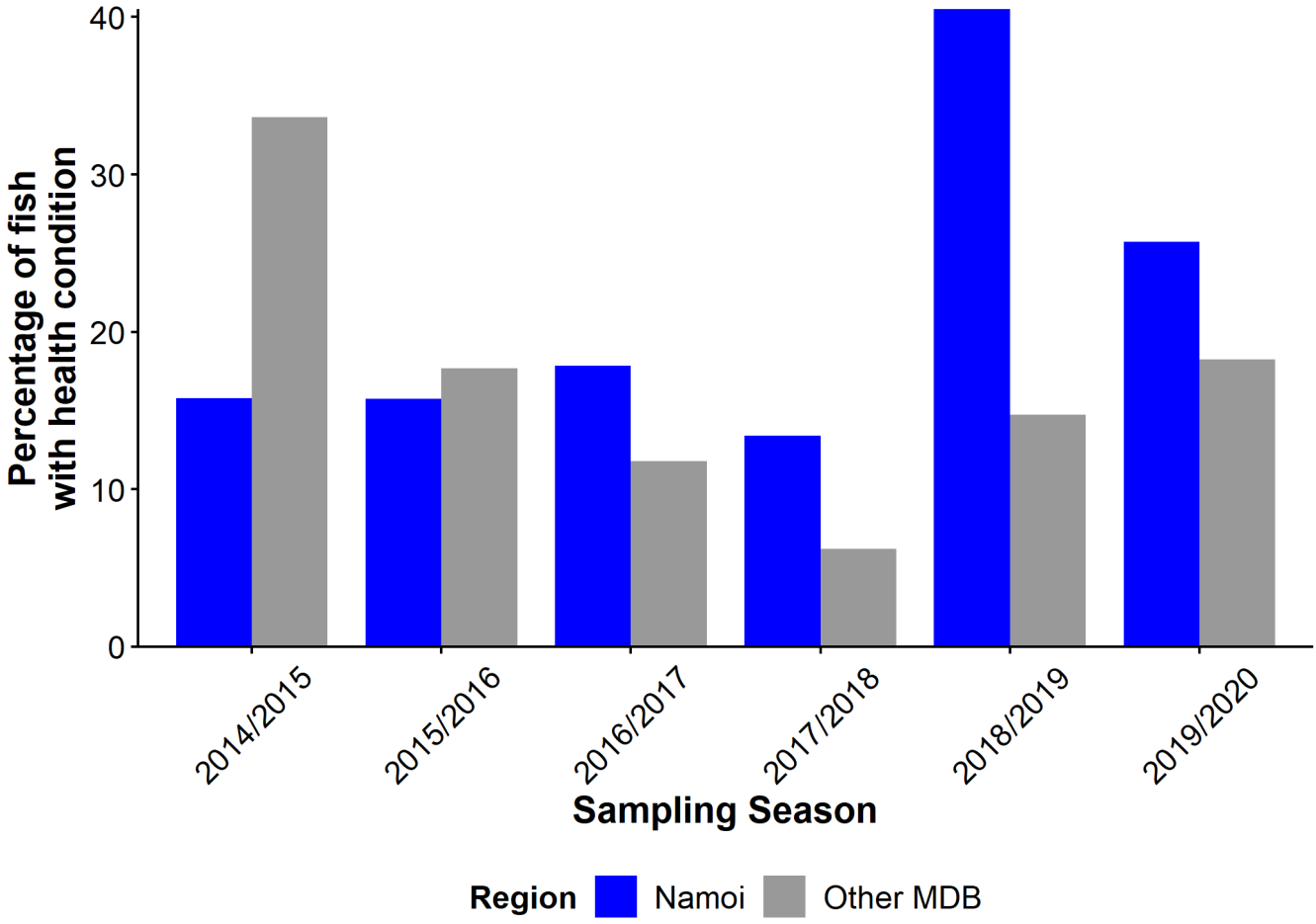

Figure 8.9: Timeseries showing the prevalence of health conditions in Murray cod. Blue shows the region-specific data while the grey shows the average across the other NSW MDB WRPAs.

Summary Statement:

Presence of observable health conditions was moderate to high and has been higher than the rest of the Murray-Darling Basin in the most recent years.

Distribution

Murray cod were recorded at 37 out of 66 sites in the Namoi WRPA. The maximum observed relative abundance at a site was 2.2 fish caught per 90 seconds of electrofishing. Figure 8.10 shows the distribution and relative abundance of Murray cod across the Namoi WRPA.

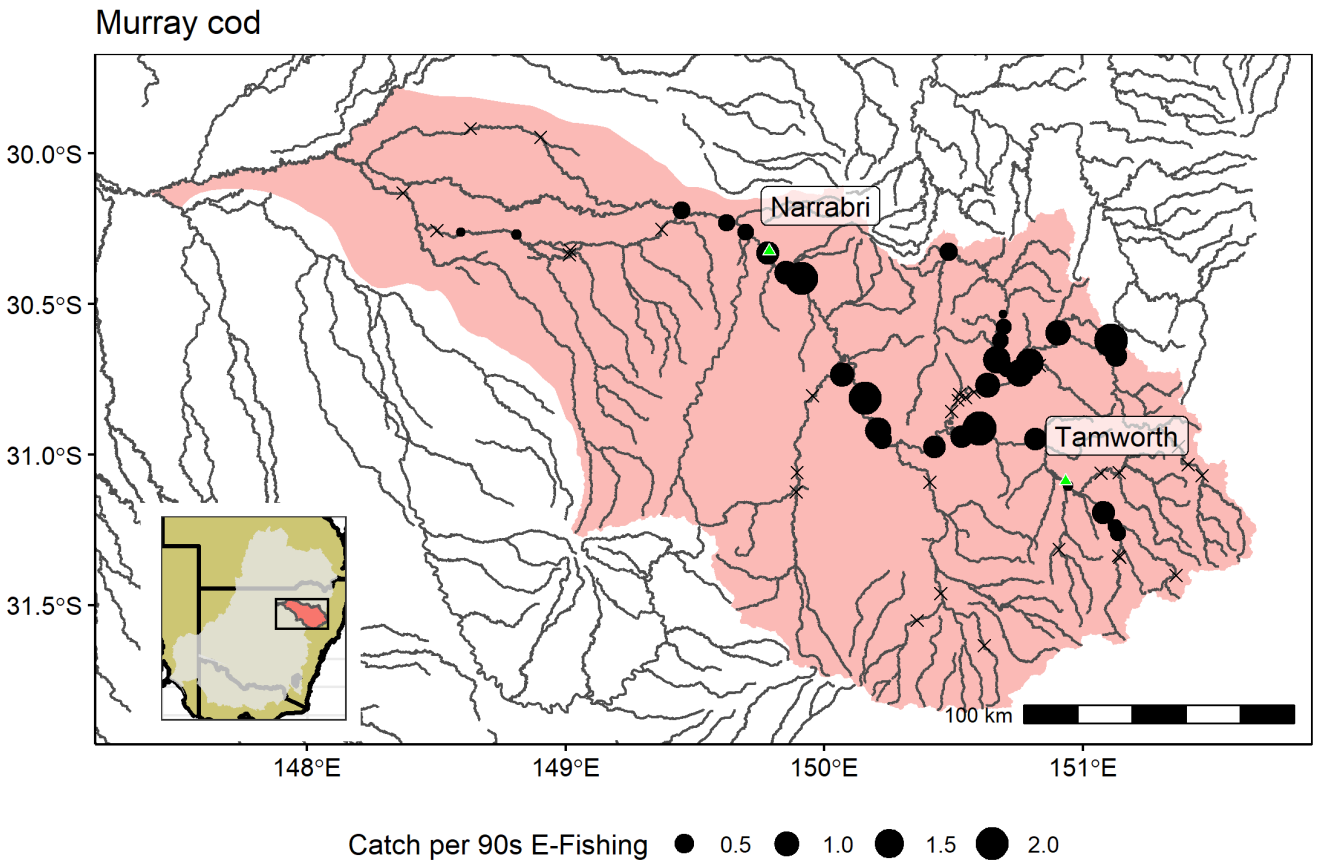

Figure 8.10: Distribution of Murray cod. Filled circles show sites where the species was present, and the size of the circle represents relative abundance. Sites that were sampled with electrofishing but did not contain the species are shown with an X.

Summary Statement:

Murray cod were recorded across the Naomi WRPA but less abundant or absent in western and southern sites.

Golden perch

Population Structure

Figure 8.11 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 2, and 0% to 6% of measured fish within a season.

Overall, during the BPEOM-F program, across all the MDB water resource planning areas, the percentage YOY for Golden perch was 12% (264 out of 2,224).

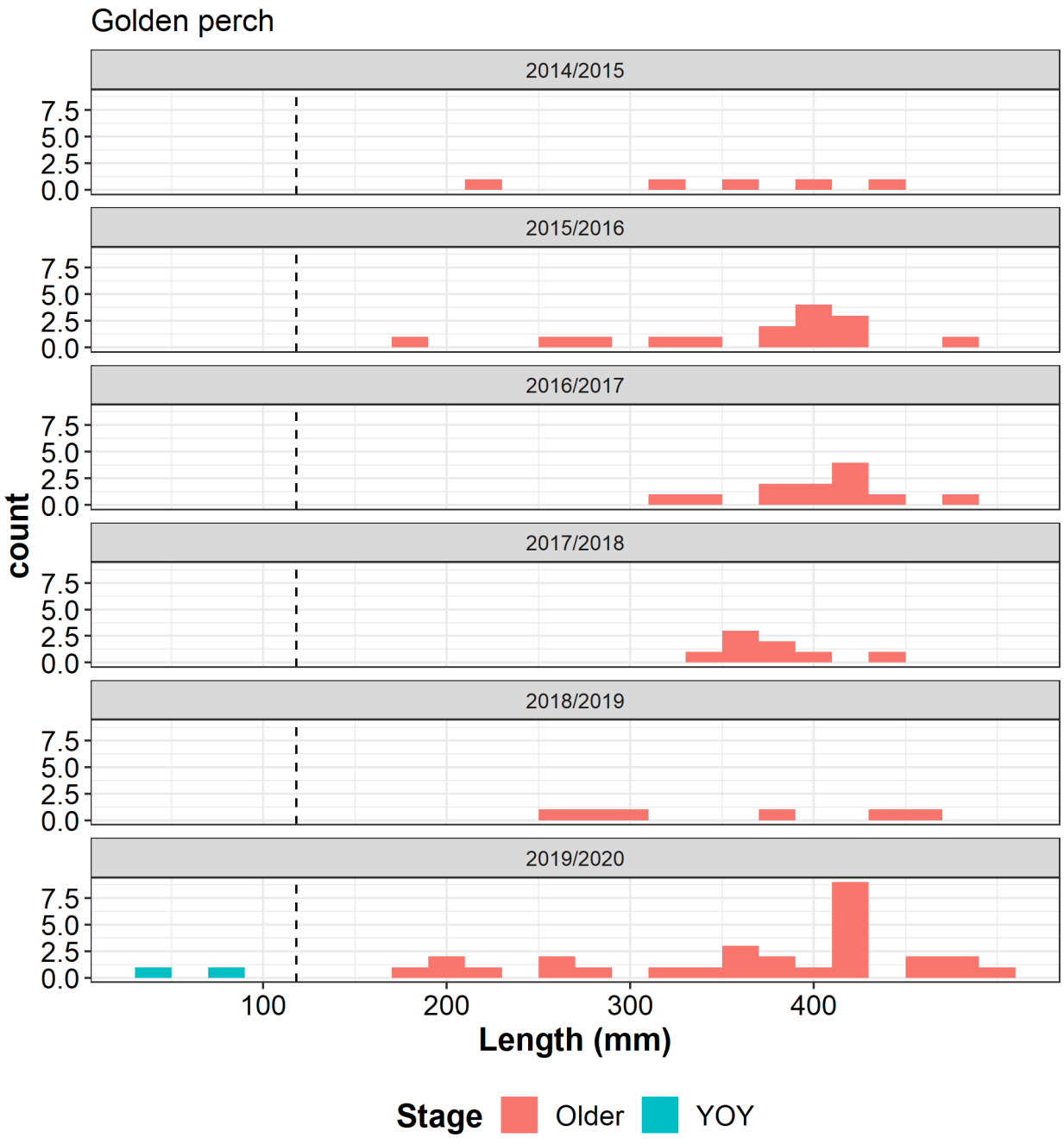

Figure 8.11: Length frequency plots for Golden perch by sampling season. YOY represents Young of the Year fish.

Summary Statement:

Very poor recruitment with YOY only observed in 2019/20 suggesting recruitment limitation in most years. Population consistently dominated by larger (older) individuals.

Stocking

A total of 316,587 Golden perch were stocked into the waterways of the Namoi WRPA during the reporting period. Of these fish, 168,000 (53%) were stocked into impoundments while 148,587 (47%) were stocked into rivers or creeks. Table 8.5 shows the detailed breakdown of stocking by season, location and life stage while Figure 8.12 shows the locations of stocking.

Table 8.5: Number and life stage of stocked Golden perch each sampling season.

Sampling Season	River/Creek or Impoundment	Life Stage	Number Stocked
2014/2015	Impoundment	Fry	3,000
2014/2015	River/Creek	Fry	18,181
2015/2016	Impoundment	Fry	1,000
2015/2016	River/Creek	Fry	58,320
2016/2017	Impoundment	Fry	87,000
2016/2017	River/Creek	Fingerling	35,723
2017/2018	Impoundment	Fry	47,000
2017/2018	River/Creek	Fry	14,363
2018/2019	Impoundment	Fry	30,000
2018/2019	River/Creek	Fry	22,000

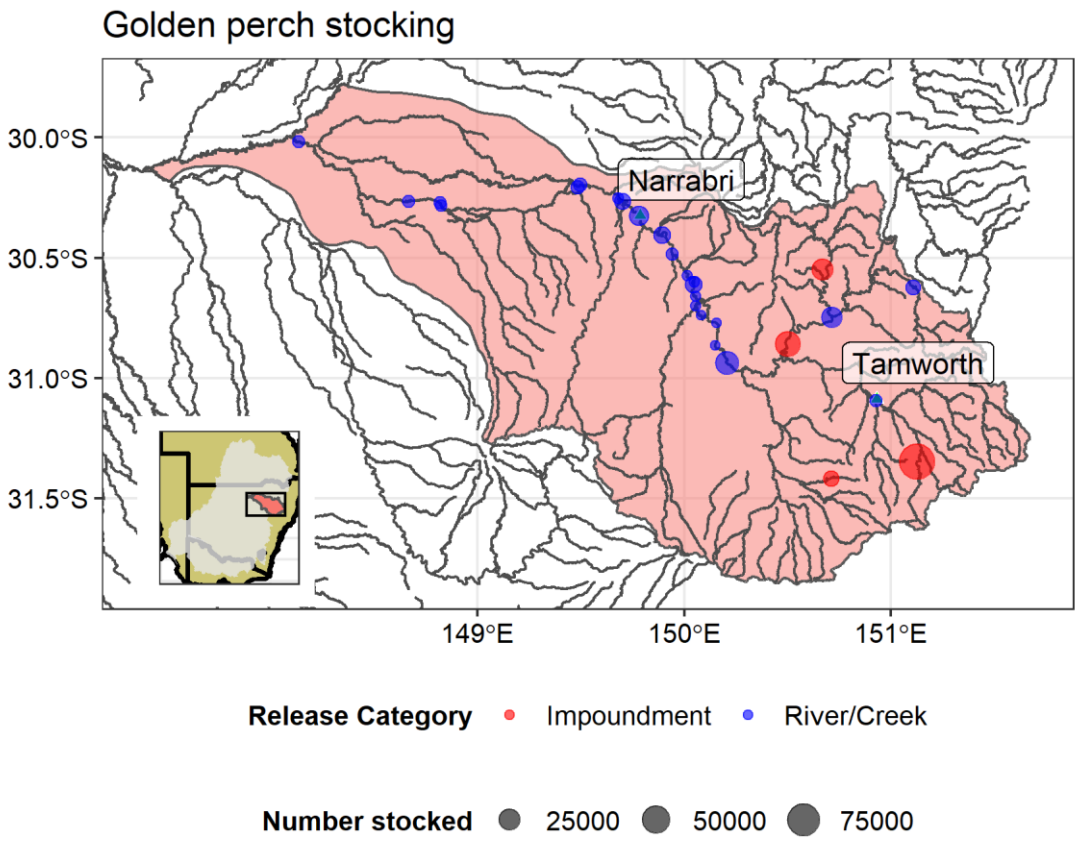

Figure 8.12: Locations of Golden perch stocking. Colours show whether a site was a river/creek site or an impoundment while the size of the point reflects the total number of fish stocked over the reporting period.

Temporal Trends in Abundance

We have modelled the relative abundance of Golden perch since 1994 based on all suitable boat electrofishing data. The left-hand panel of Figure 8.13 shows the abundance trend for the Namoi WRPA and the right-hand panel shows the overall trend across the NSW MDB.

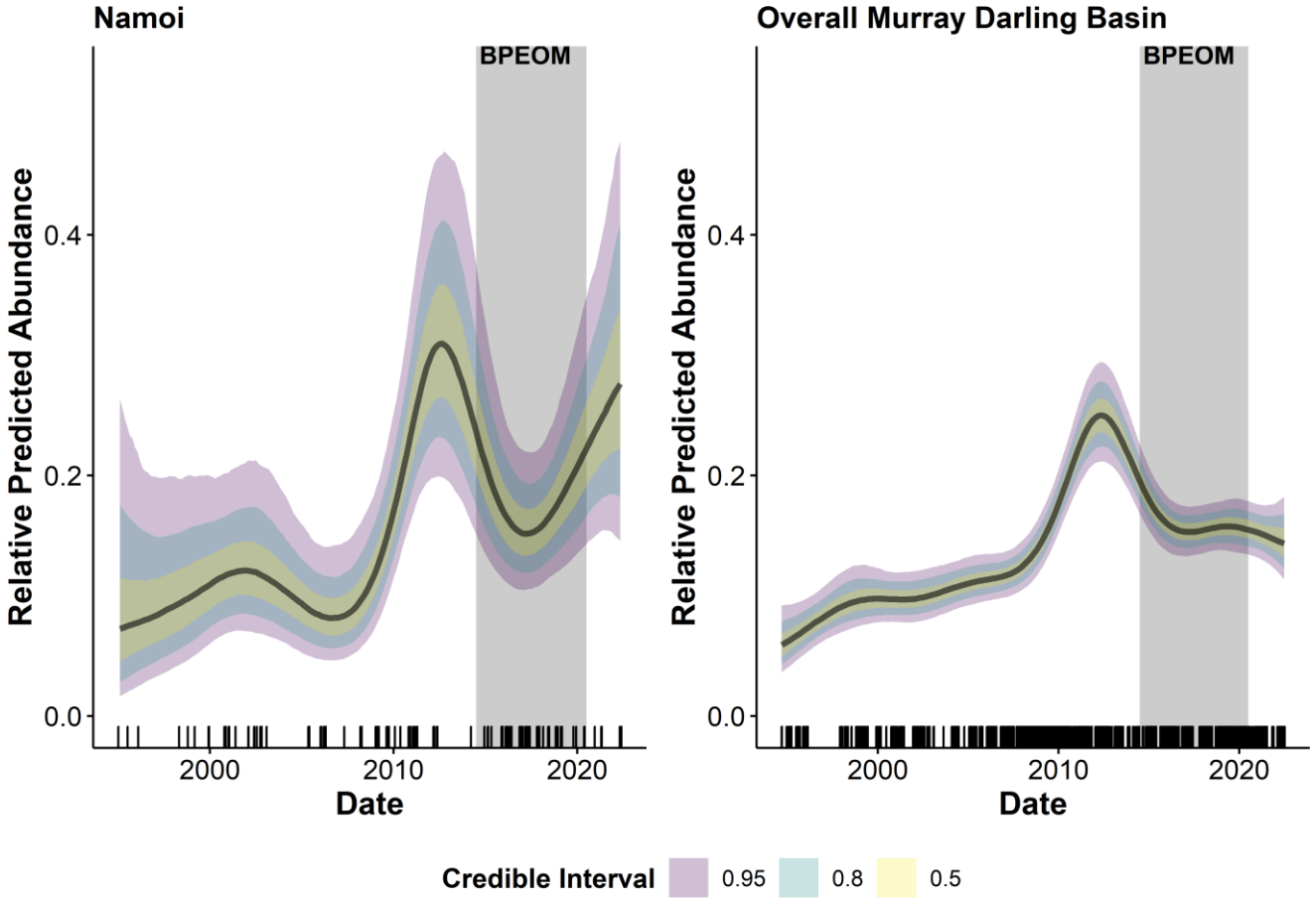

Figure 8.13: Relative abundance of Golden perch in both this valley and the overall Murray-Darling Basin. These are model estimates based upon all boat electrofishing data within the NSW DPI Freshwater ecosystem database and the output of Bayesian generalised additive mixed models. The grey shaded region represents the period during which the BPEOM-F program was run. The black lines on the x-axis represent data coverage while the colours on the figure show various levels of confidence. Note when overlapping, the colours look slightly different due to the transparency and the y-axes vary between chapters of this report.

Summary Statement:

Overall increase in abundance since 1994 with recent fluctuations. Relative abundance higher than the overall abundance across the MDB, which peaked in 2012.

Health

The prevalence of any health issues ranged from 0 % of sampled fish in 2017/2018 to 83% of sampled fish in 2018/2019 (Figure 8.14). The most common health issue for Golden perch in the Namoi water resource planning area was Lerneae, which was observed in a total of 12 fish, corresponding to 16% of all Golden perch measured.

Across the other WRPAs, 33% of Golden perch (738 out of 2,224 Golden perch) showed a health condition (excludes Namoi).

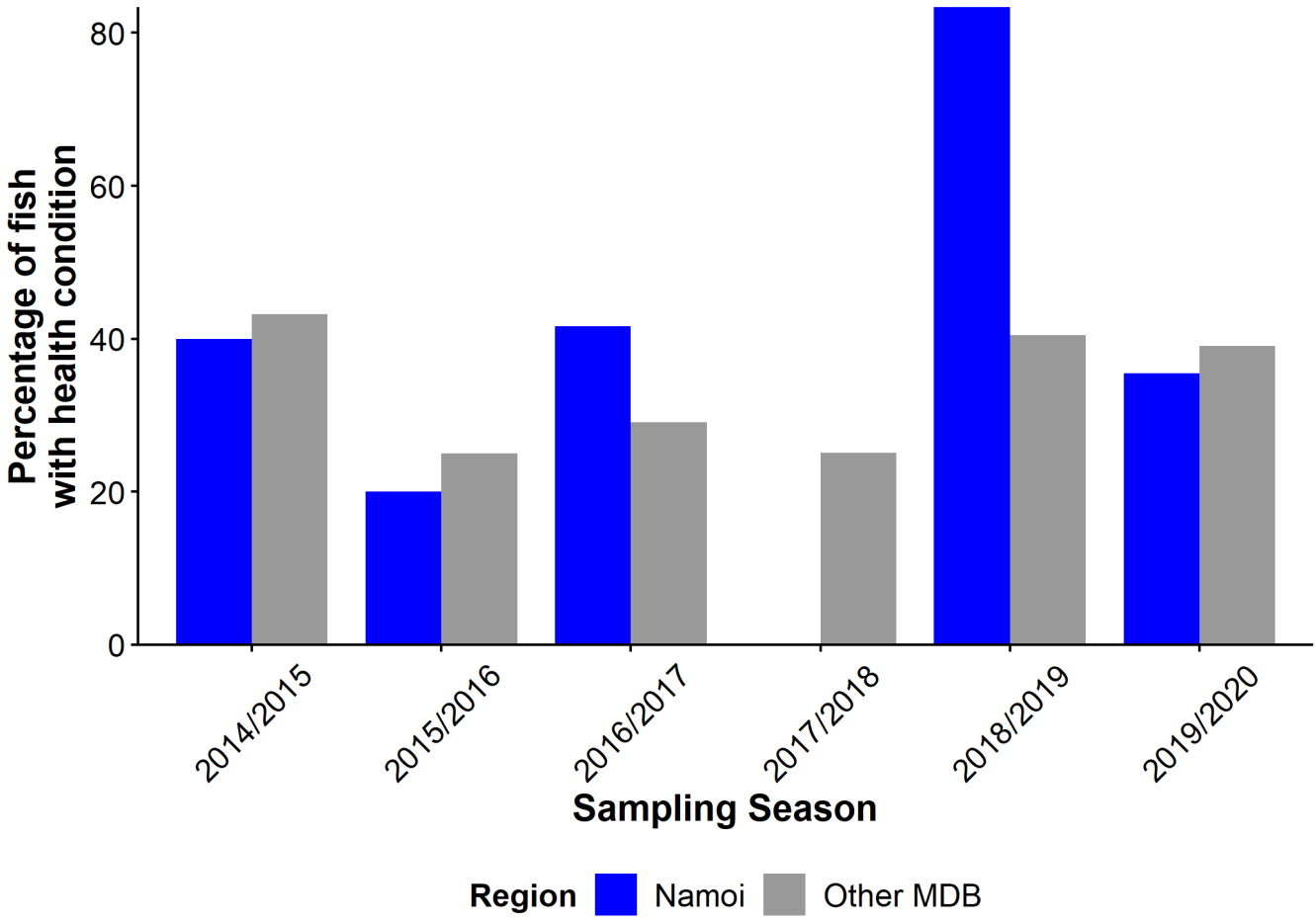

Figure 8.14: Timeseries showing the prevalence of health conditions in Golden perch. Blue shows the region-specific data while the grey shows the average across the other NSW MDB WRPAs.

Summary Statement:

The presence of observable health conditions for Golden perch was moderate to high and generally similar to the average across the rest of the Murray-Darling Basin except for 2018/19 when it was very high in the Namoi WRPA.

Distribution

Golden perch were recorded at 21 out of 66 sites in the Namoi WRPA. The maximum observed relative abundance at a site was 1.4 fish caught per 90 seconds of electrofishing. Figure 8.15 shows the distribution and relative abundance of Golden perch across the Namoi WRPA.

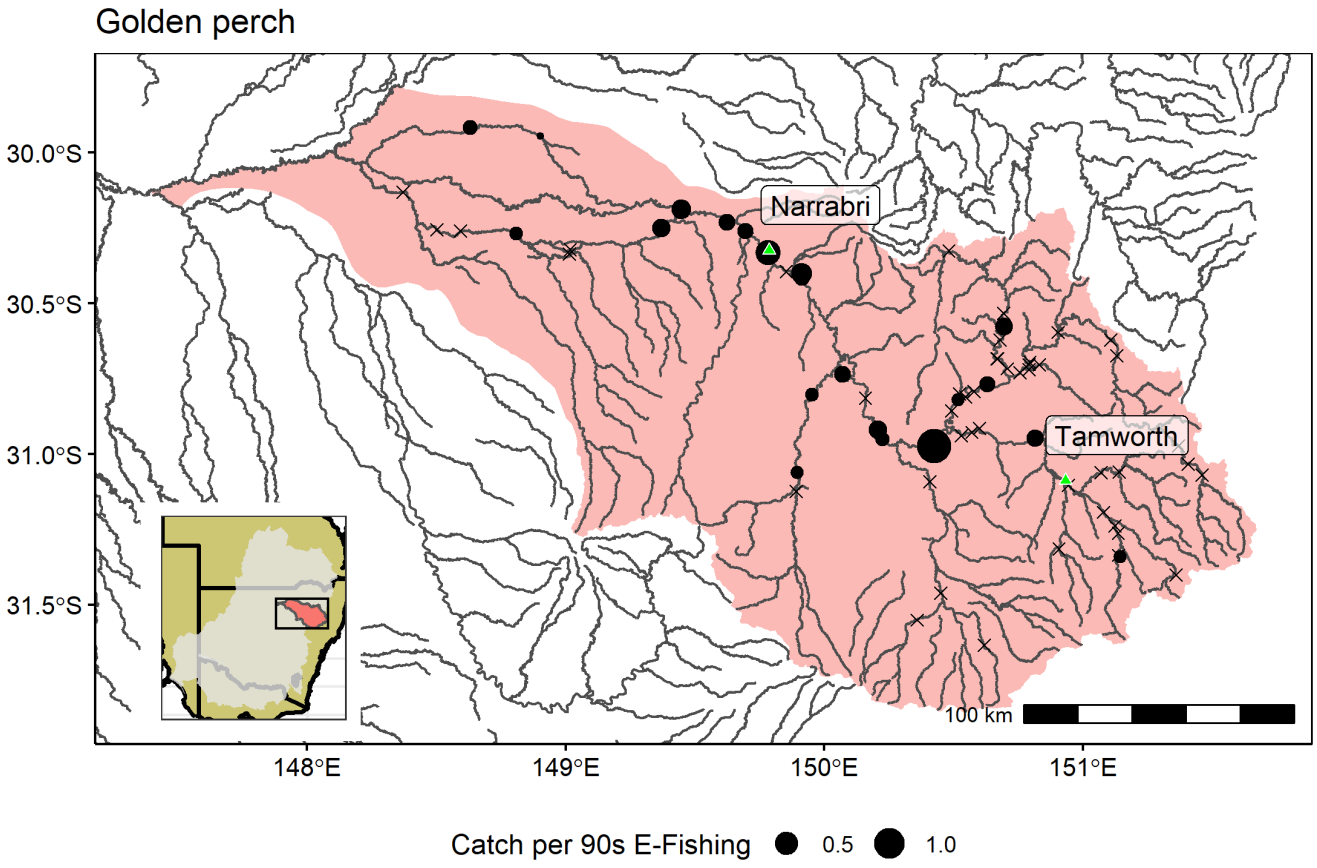

Figure 8.15: Distribution of Golden perch. Filled circles show sites where the species was present, and the size of the circle represents relative abundance. Sites that were sampled with electrofishing but did not contain the species are shown with an X.

Summary Statement:

Golden perch were found across the central region of the Namoi WRPA and were absent or in low abundance in the south-east.

Freshwater catfish

Population Structure

Figure 8.16 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 31, and 0% to 89% of measured fish within a season.

Overall, during the BPEOM-F program, across all the MDB water resource planning areas, the percentage YOY for Freshwater catfish was 40% (231 out of 571).

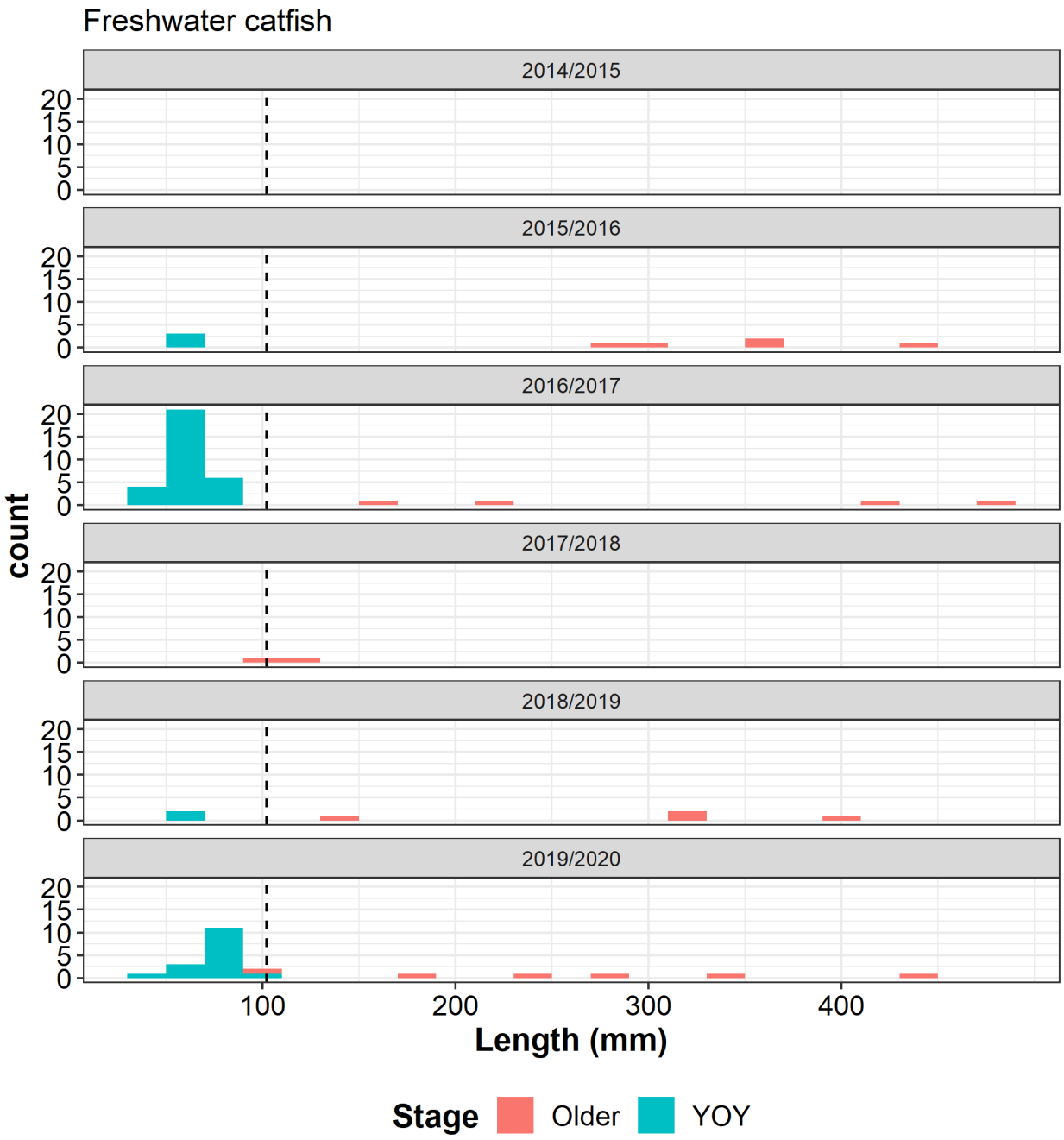

Figure 8.16: Length frequency plots for Freshwater catfish by sampling season. YOY represents Young of the Year fish.

Summary Statement:

Recruitment observed in most years but highly variable, population comprised mainly of small fish (less than 200mm) with larger fish only present in small numbers in most years. No Freshwater catfish were caught in 2014/15.

Temporal Trends in Abundance

We have modelled the relative abundance of Freshwater catfish since 1994 based on all suitable boat and backpack electrofishing data. The left-hand panel of Figure 8.17 shows the abundance trend for the Namoi WRPA and the right-hand panel shows the overall trend across the NSW MDB.

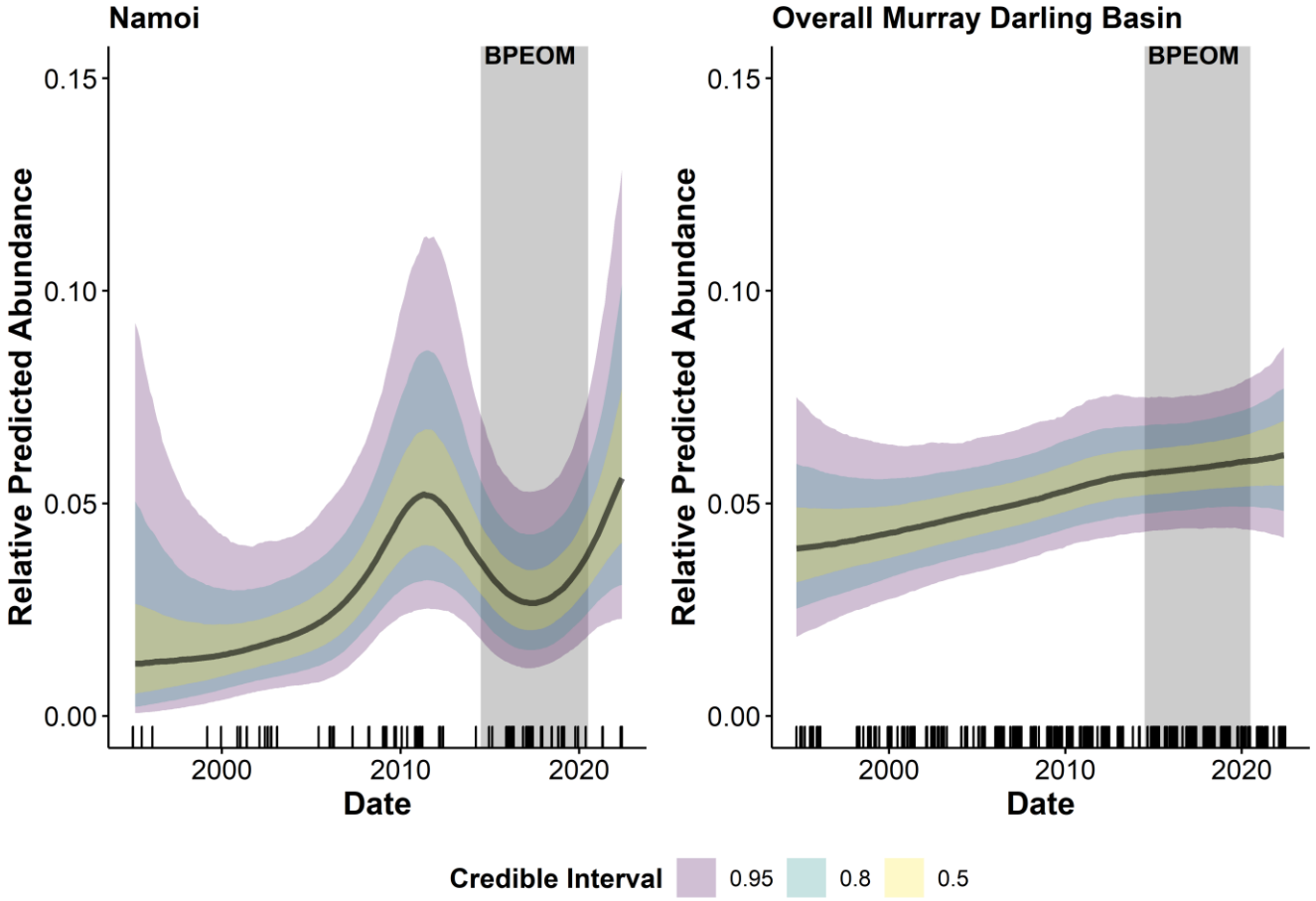

Figure 8.17: Relative abundance of Freshwater catfish in both this valley and the overall Murray-Darling Basin. These are model estimates based upon all electrofishing data within the NSW DPI Freshwater ecosystem database and the output of Bayesian generalised additive mixed models. The grey shaded region represents the period during which the BPEOM-F program was run. The black lines on the x-axis represent data coverage while the colours on the figure show various levels of confidence. Note when overlapping, the colours look slightly different due to the transparency and the y-axes vary between chapters of this report.

Summary Statement:

A likely increase in abundance since 1994 with a downturn during the BPEOM period. Current relative abundance similar to the overall abundance across the MDB, which has shown a minor increasing trend since the 1990s.

Health

The prevalence of any health issues ranged from 0% of sampled fish in most years to 3% of sampled fish in 2014/2015 (Figure 8.18). The most common health issue for Freshwater catfish in the Namoi water resource planning area was Fungus, which was observed in a total of 1 fish, corresponding to 1% of all Freshwater catfish measured.

Across the other WRPAs, 1% of Freshwater catfish (7 out of 571 Freshwater catfish) showed a health condition (excludes Namoi).

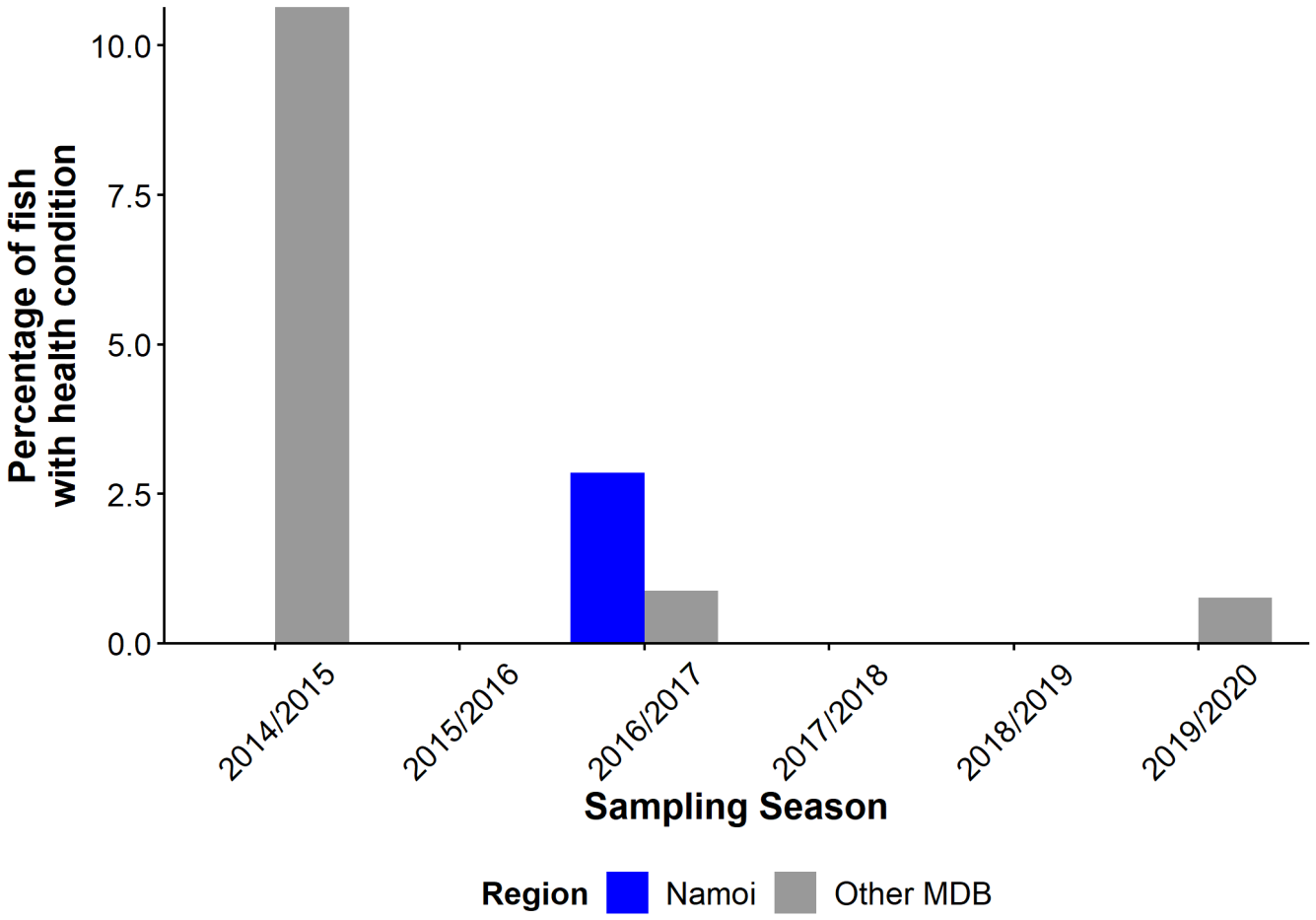

Figure 8.18: Timeseries showing the prevalence of health conditions in Freshwater catfish. Blue shows the region-specific data while the grey shows the average across the other NSW MDB WRPAs.

Summary Statement:

The presence of observable health conditions for Freshwater catfish in the Namoi was very low, like the overall NSW MDB.

Distribution

Freshwater catfish were recorded at 16 out of 66 sites in the Namoi WRPA. The maximum observed relative abundance at a site was 1.6 fish caught per 90 seconds of electrofishing. Figure 8.19 shows the distribution and relative abundance of Freshwater catfish across the Namoi WRPA.

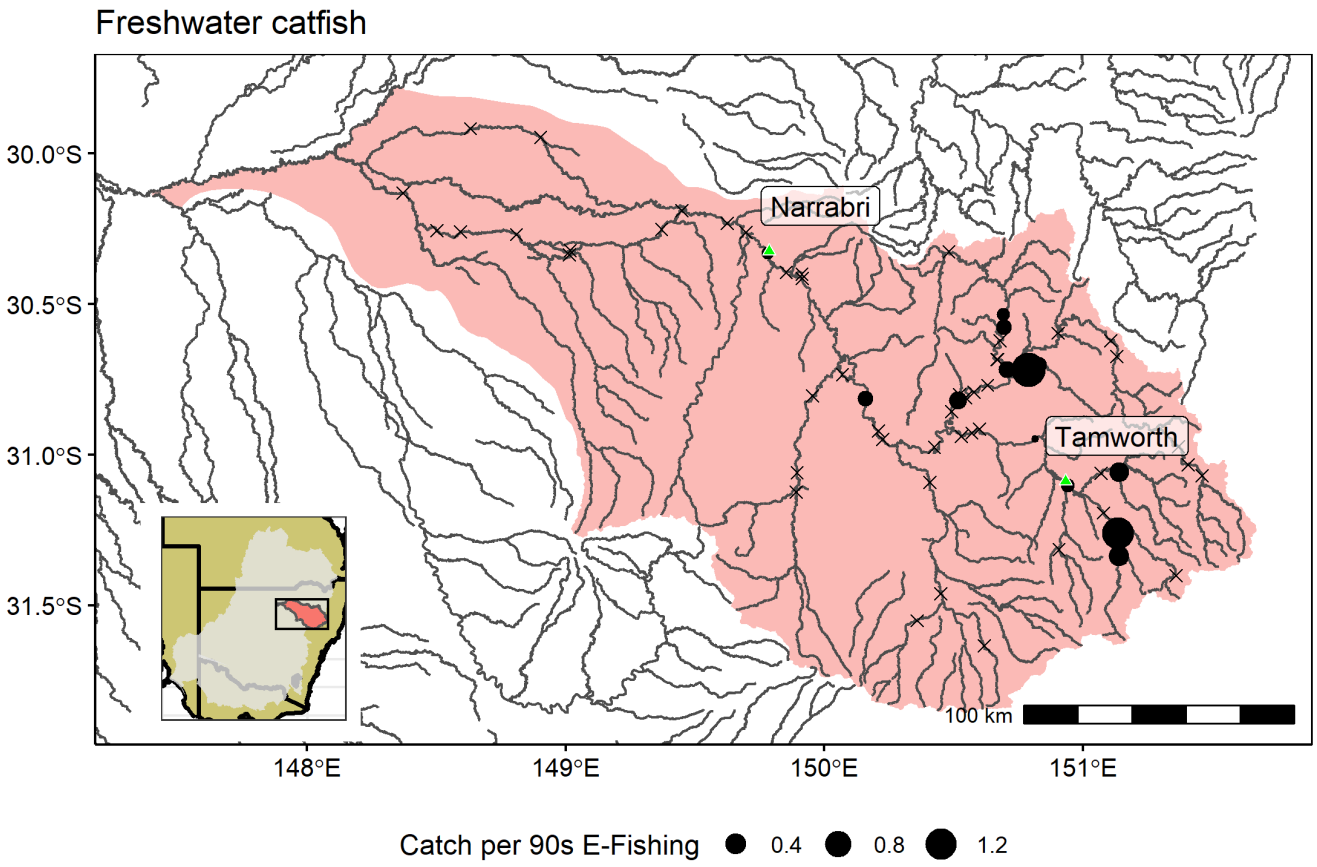

Figure 8.19: Distribution of Freshwater catfish. Filled circles show sites where the species was present, and the size of the circle represents relative abundance. Sites that were sampled with electrofishing but did not contain the species are shown with an X.

Summary Statement:

Freshwater catfish restricted to the eastern region of the Namoi WRPA, being rare or absent in the western reaches of the valley.

Bony herring

Population Structure

Figure 8.20 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 0 to 110, and 0% to 56% of measured fish within a season.

Overall, during the BPEOM-F program, across all the MDB water resource planning areas, the percentage YOY for Bony herring was 31 % (4,788 out of 15,553). Bony herring are not a stocked species.

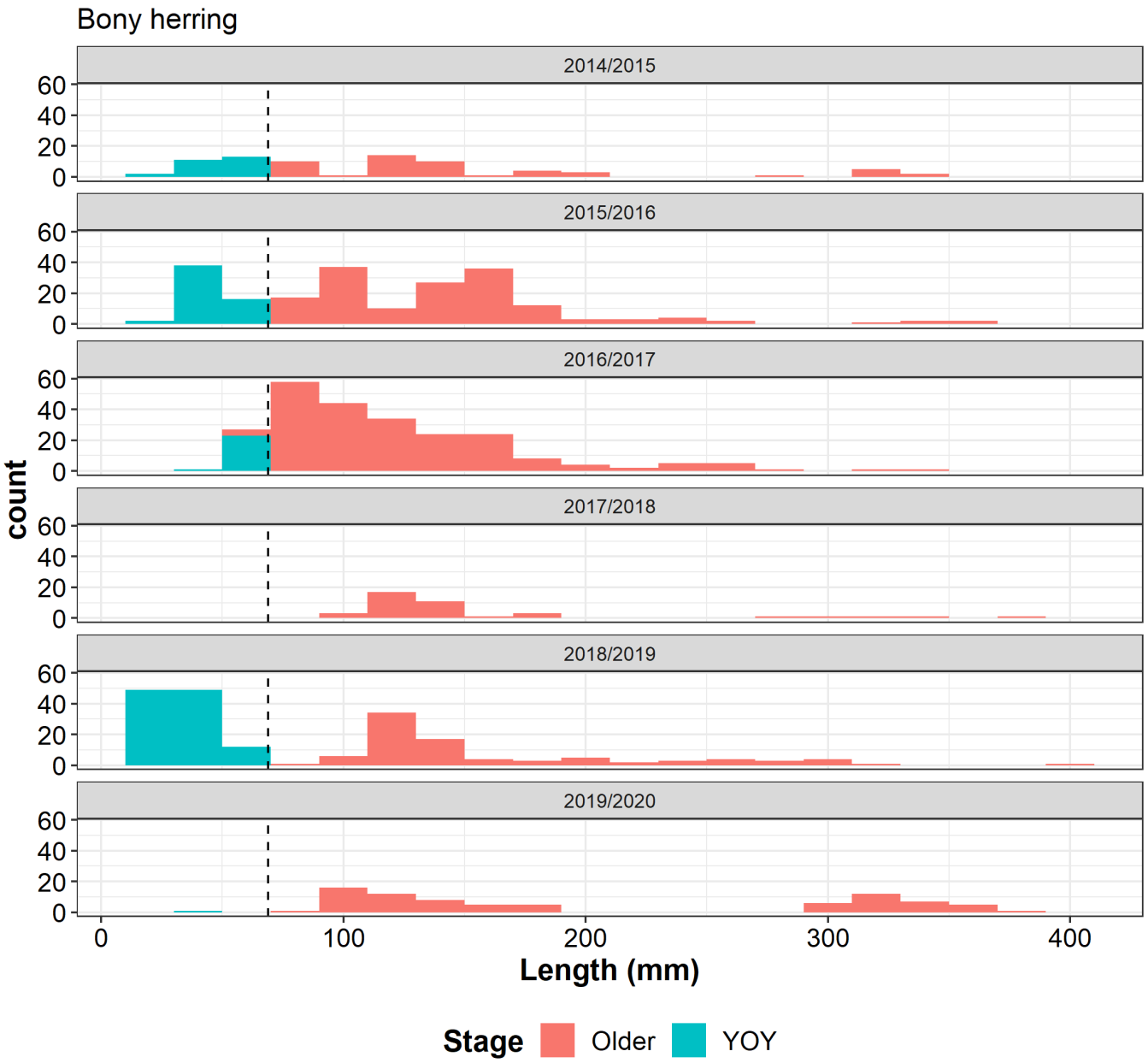

Figure 8.20: Length frequency plots for Bony herring by sampling season. YOY represents Young of the Year fish.

Summary Statement:

Evidence of recruitment most years although it is variable with no YOY observed in 2017/18 and few YOY observed in 2019/20, suggesting recruitment failures in some years.

Temporal Trends in Abundance

We have modelled the relative abundance of Bony herring since 1994 based on all suitable boat electrofishing data. The left-hand panel of Figure 8.21 shows the abundance trend for the Namoi WRPA and the right-hand panel shows the overall trend across the NSW MDB.

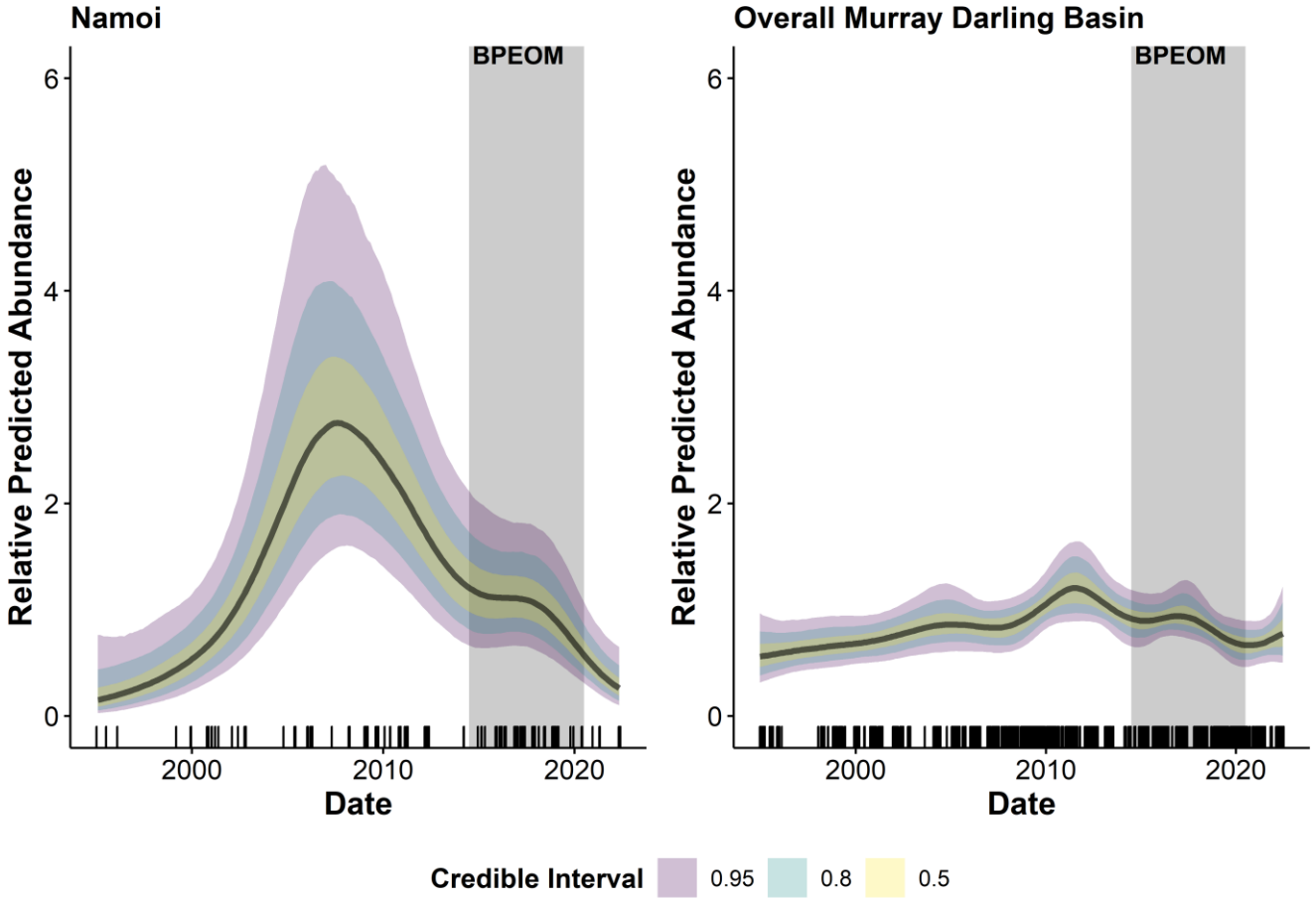

Figure 8.21: Relative abundance of Bony herring in both the Namoi WRPA and the overall NSW MDB. These are model estimates based upon all boat electrofishing data within the NSW DPI Freshwater ecosystem database and the output of Bayesian generalised additive mixed models. The grey shaded region represents the period during which the BPEOM-F program was run. The black lines on the x-axis represent data coverage while the colours on the figure show various levels of confidence. Note when overlapping, the colours look slightly different due to the transparency and the y-axes vary between chapters of this report.

Summary Statement:

Abundance increased to ~2008 but has since declined back to 1990s levels. Current relative abundance lower than the overall abundance across the NSW MDB.

Health

The prevalence of any health issues ranged from 0% of sampled fish in 2014/2015 to 3% of sampled fish in 2019/2020 (Figure 8.22). The most common health issue for Bony herring in the Namoi WRPA was Lesions, which was observed in a total of 3 fish, corresponding to <1% of all Bony herring measured.

Across the other NSW MDB WRPAs, 1 % of Bony herring (184 out of 15,553 Bony herring) showed a health condition (excludes the Namoi WRPA).

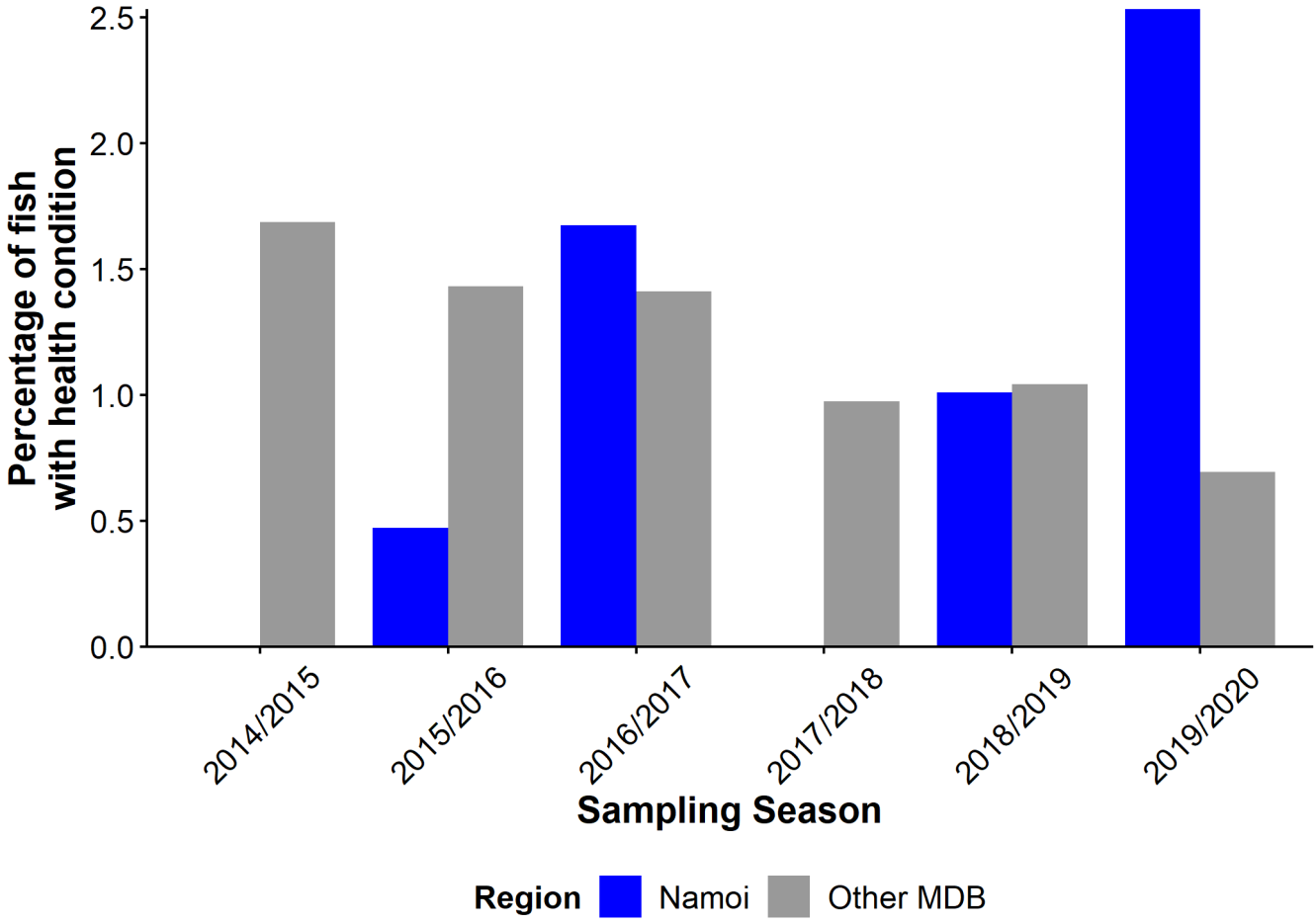

Figure 8.22: Timeseries showing the prevalence of health conditions in Bony herring. Blue shows the region-specific data while the grey shows the average across the other NSW MDB WRPAs.

Summary Statement:

Presence of observable health conditions was low overall and generally similar to the rest of the NSW MDB for all but one season when it was higher (2019/20).

Distribution

Bony herring were recorded at 29 out of 66 sites in the Namoi WRPA. The maximum observed relative abundance at a site was 27 fish caught per 90 seconds of electrofishing. Figure 8.23 shows the distribution and relative abundance of Bony herring across the Namoi WRPA.

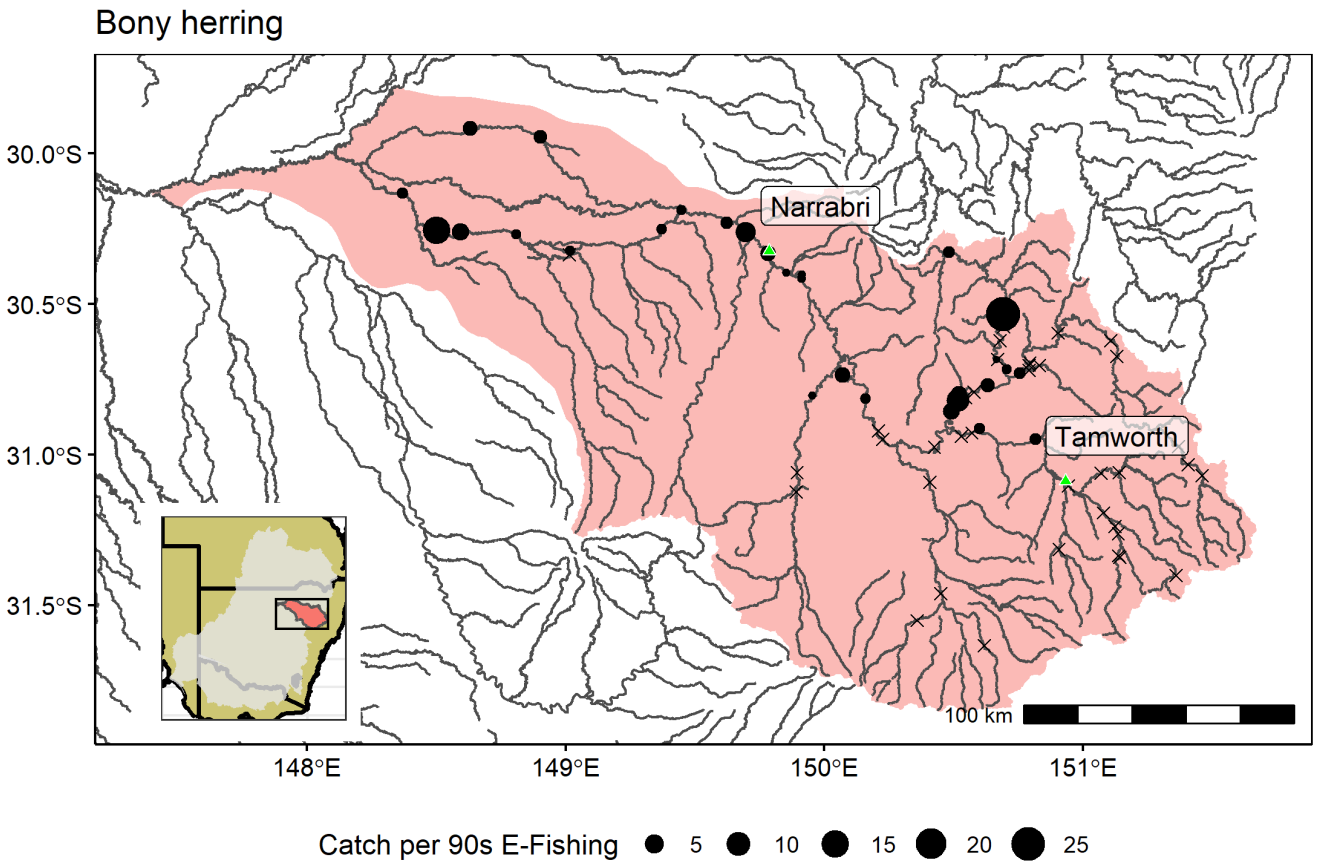

Figure 8.23: Distribution of Bony herring. Filled circles show sites where the species was present, and the size of the circle represents relative abundance. Sites that were sampled with electrofishing but did not contain the species are shown with an X.

Summary Statement:

Bony herring were recorded across the Namoi WRPA but less abundant or absent in eastern and upland sites.

Australian smelt

Population Structure

Figure 8.24 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 1 to 28, and 7% to 100% of measured fish within a season.

Overall, during the BPEOM-F program, across all the MDB water resource planning areas, the percentage YOY for Australian smelt was 42% (3,506 out of 8,333). Australian smelt are not a stocked species.

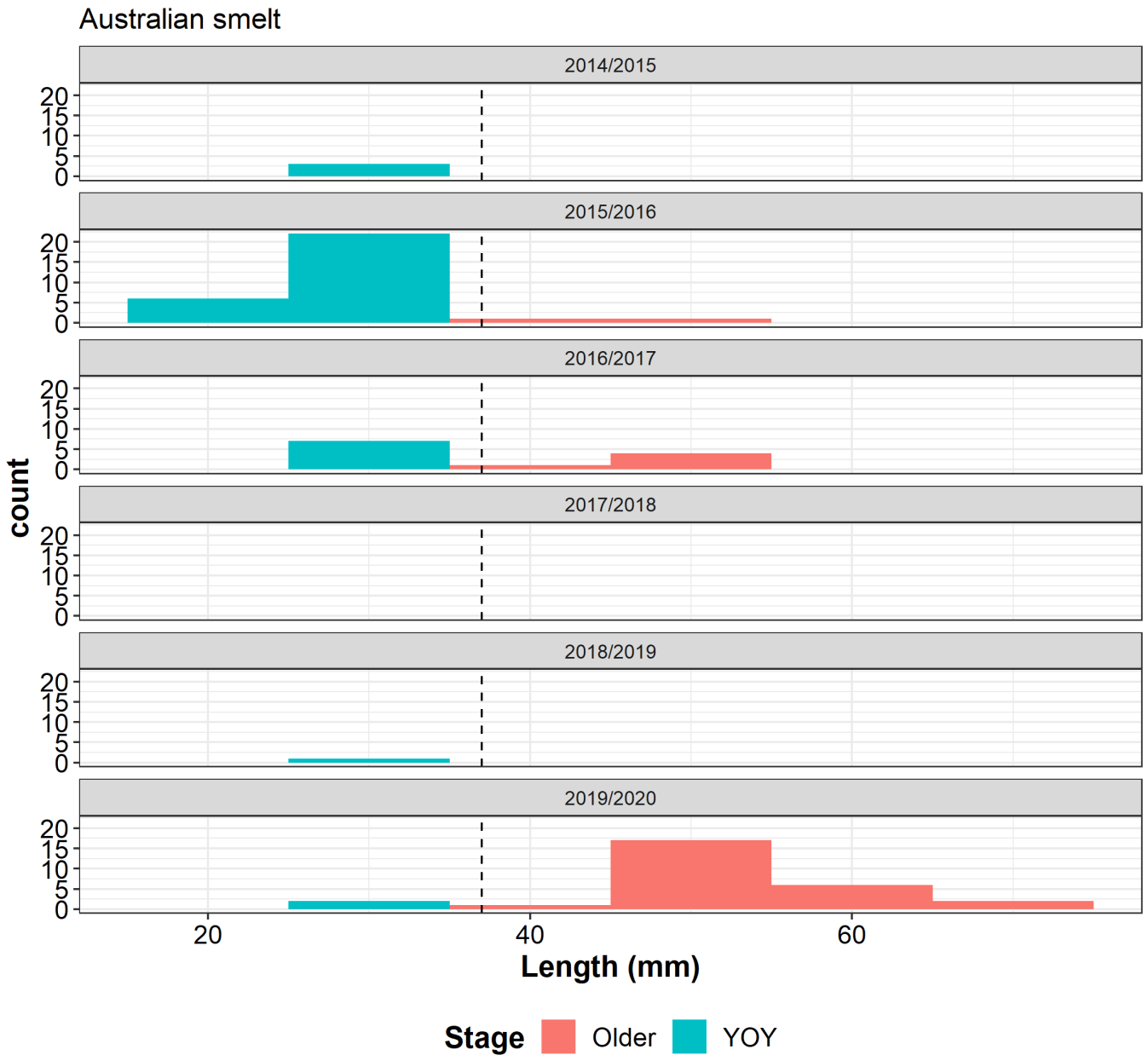

Figure 8.24: Length frequency plots for Australian smelt by sampling season. YOY represents Young of the Year fish.

Summary Statement:

Evidence of recruitment most years although zero Australian smelt were caught in 2017/18. Adults observed in three of the six years.

Temporal Trends in Abundance

We have modelled the relative abundance of Australian smelt since 1994 based on all suitable boat electrofishing data. The left-hand panel of Figure 8.25 shows the abundance trend for the Namoi WRPA and the right-hand panel shows the overall trend across the NSW MDB.

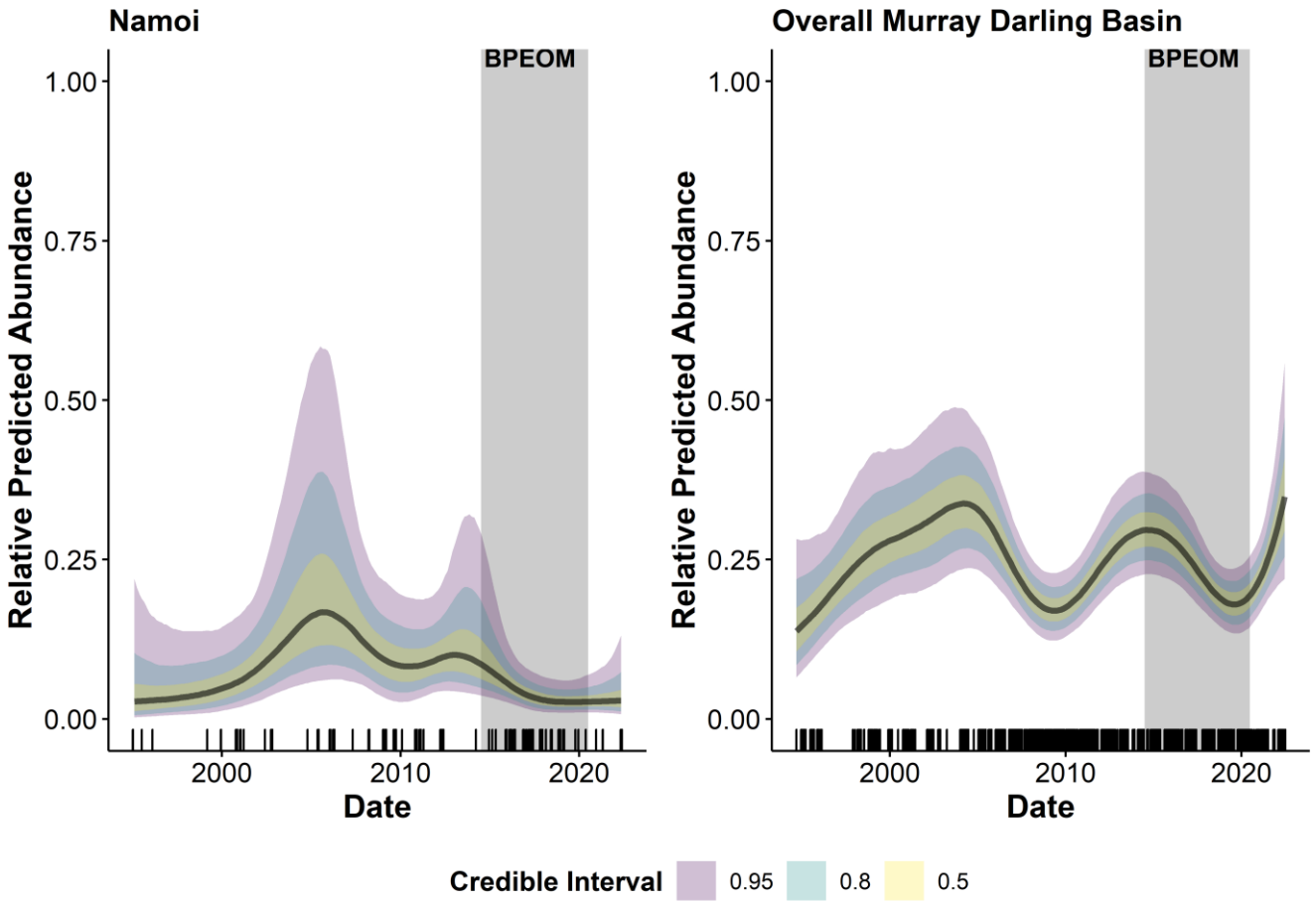

Figure 8.25: Relative abundance of Australian smelt in both the Namoi WRPA and the overall NSW MDB. These are model estimates based upon all boat electrofishing data within the NSW DPI Freshwater ecosystem database and the output of Bayesian generalised additive mixed models. The grey shaded region represents the period during which the BPEOM-F program was run. The black lines on the x-axis represent data coverage while the colours on the figure show various levels of confidence. Note when overlapping, the colours look slightly different due to the transparency and the y-axes vary between chapters of this report.

Summary Statement:

No evidence of overall changes in abundance although abundance was higher between 2000 and 2015. Relative abundance in the Namoi is substantially lower than the overall NSW MDB.

Health

No health issues were observed in any Australian smelt within the Namoi WRPA (Figure 8.26).

Across the other NSW MDB WRPAs, 1% of Australian smelt (53 out of 8,333 Australian smelt) showed a health condition (excludes the Namoi WRPA).

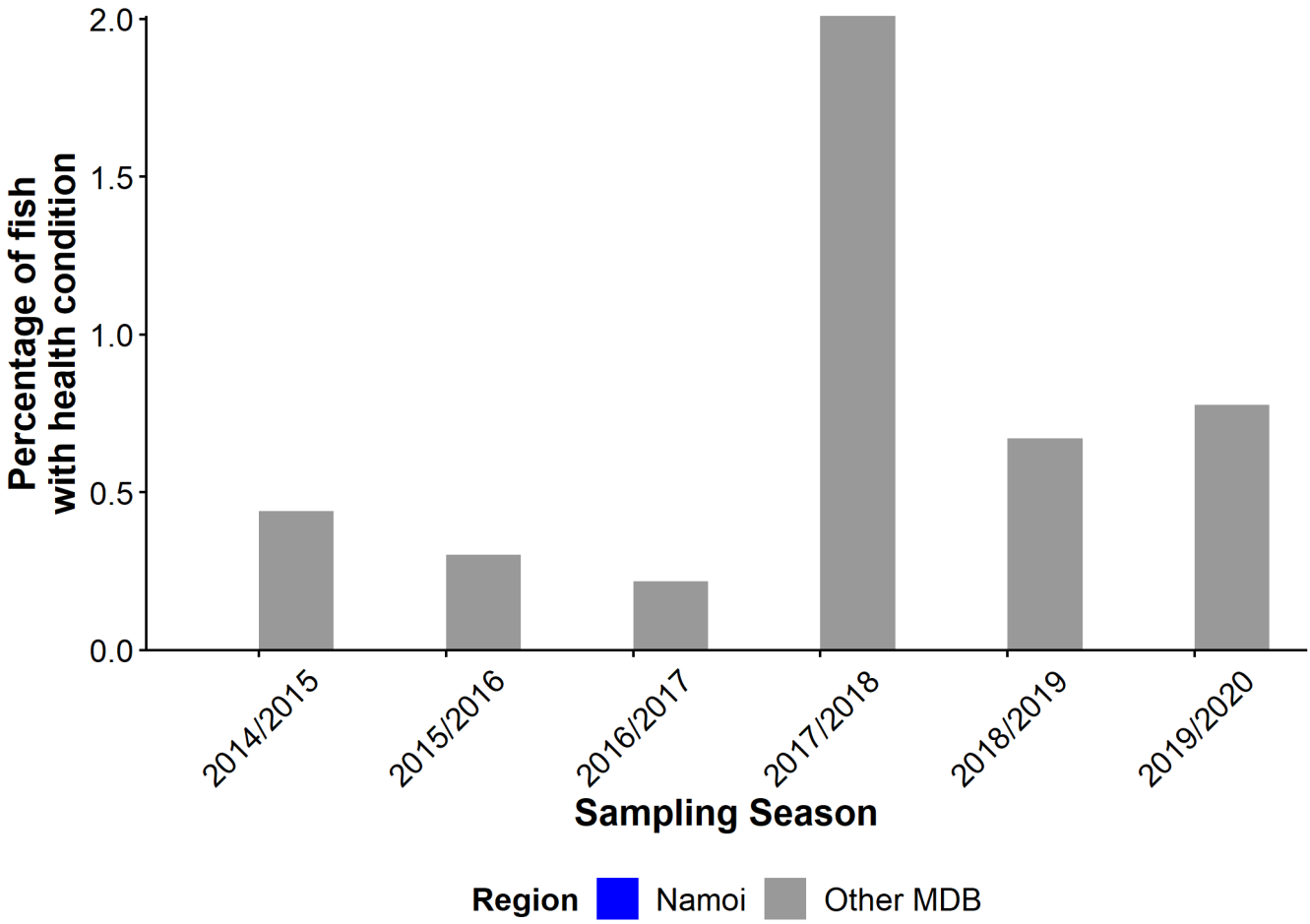

Figure 8.26: Timeseries showing the prevalence of health conditions in Australian smelt. Blue shows the region-specific data while the grey shows the average across the other NSW MDB WRPAs.

Summary Statement:

No health conditions were observed for Australian smelt in the Namoi WRPA.

Distribution

Australian smelt were recorded at 13 out of 66 sites in the Namoi WRPA. The maximum observed relative abundance at a site was 1 fish caught per 90 seconds of electrofishing. Figure 8.27 shows the distribution and relative abundance of Australian smelt across the Namoi WRPA.

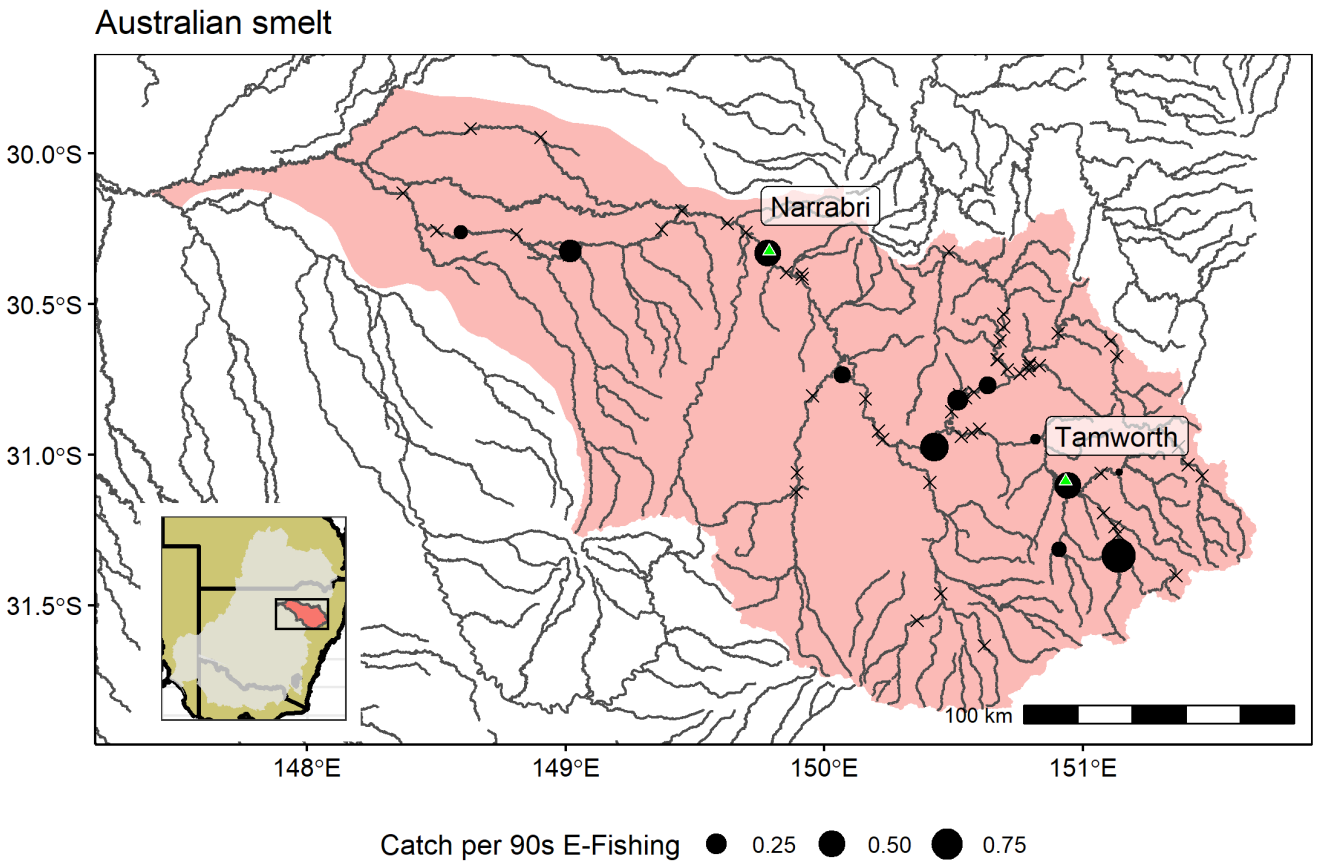

Figure 8.27: Distribution of Australian smelt. Filled circles show sites where the species was present, and the size of the circle represents relative abundance. Sites that were sampled with electrofishing but did not contain the species are shown with an X.

Summary Statement:

Australian smelt were recorded across the Namoi WRPA but were less abundant or absent in the western and north-eastern reaches.

Common carp

Population Structure

Figure 8.28 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 39 to 268, and 31% to 78% of measured fish within a season.

Overall, during the BPEOM-F program, across all the MDB water resource planning areas, the percentage YOY for Common carp was 57% (11,148 out of 19,667). Common carp are not a stocked species.

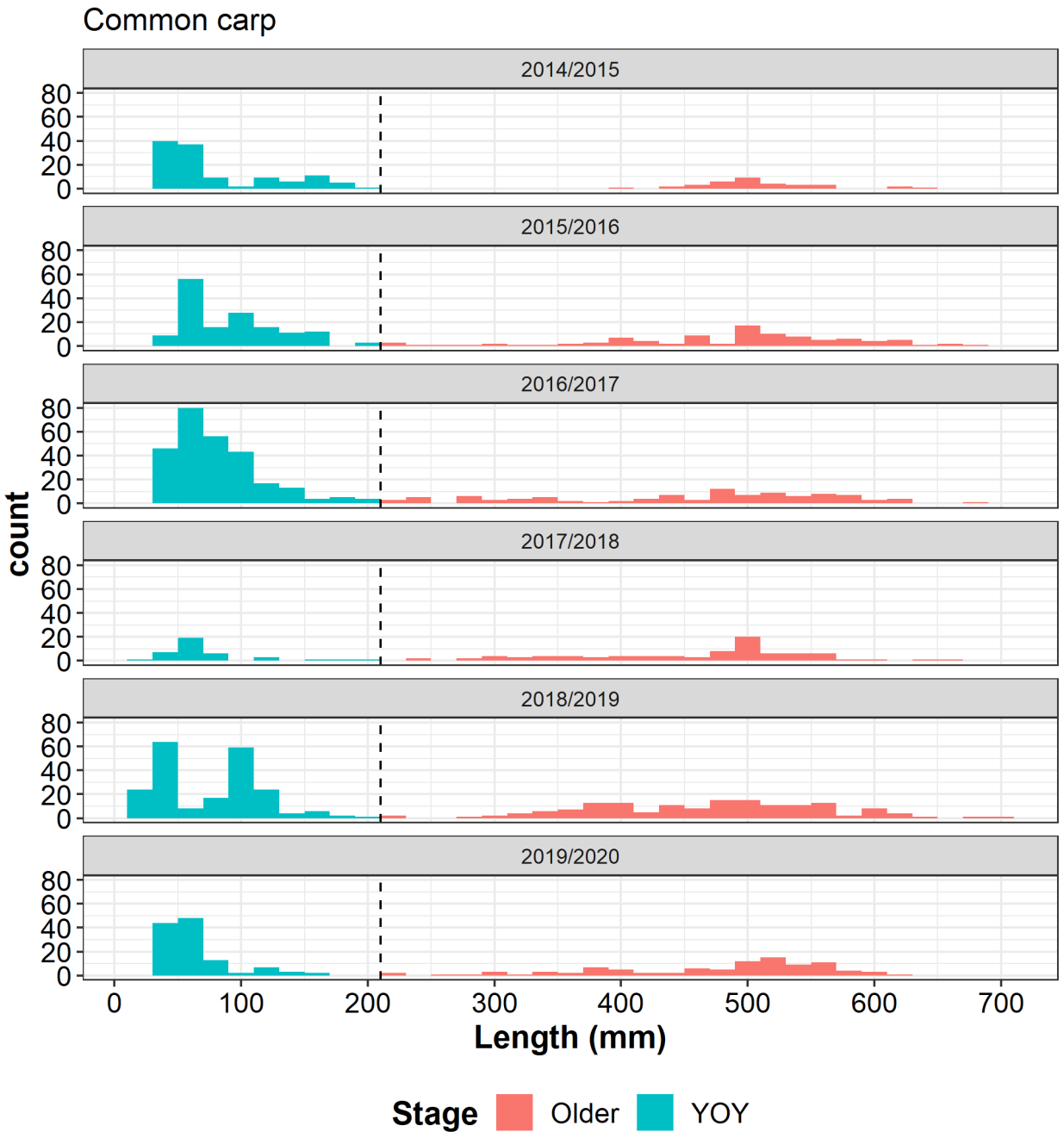

Figure 8.28: Length frequency plots for common carp by sampling season. YOY represents Young of the Year fish.

Summary Statement:

Regular recruitment and a wide range of size classes in all years.

Temporal Trends in Abundance

We have modelled the relative abundance of Common carp since 1994 based on all suitable boat and backpack electrofishing data. The left-hand panel of Figure 8.29 shows the abundance trend for the Namoi WRPA and the right-hand panel shows the overall trend across the NSW MDB.

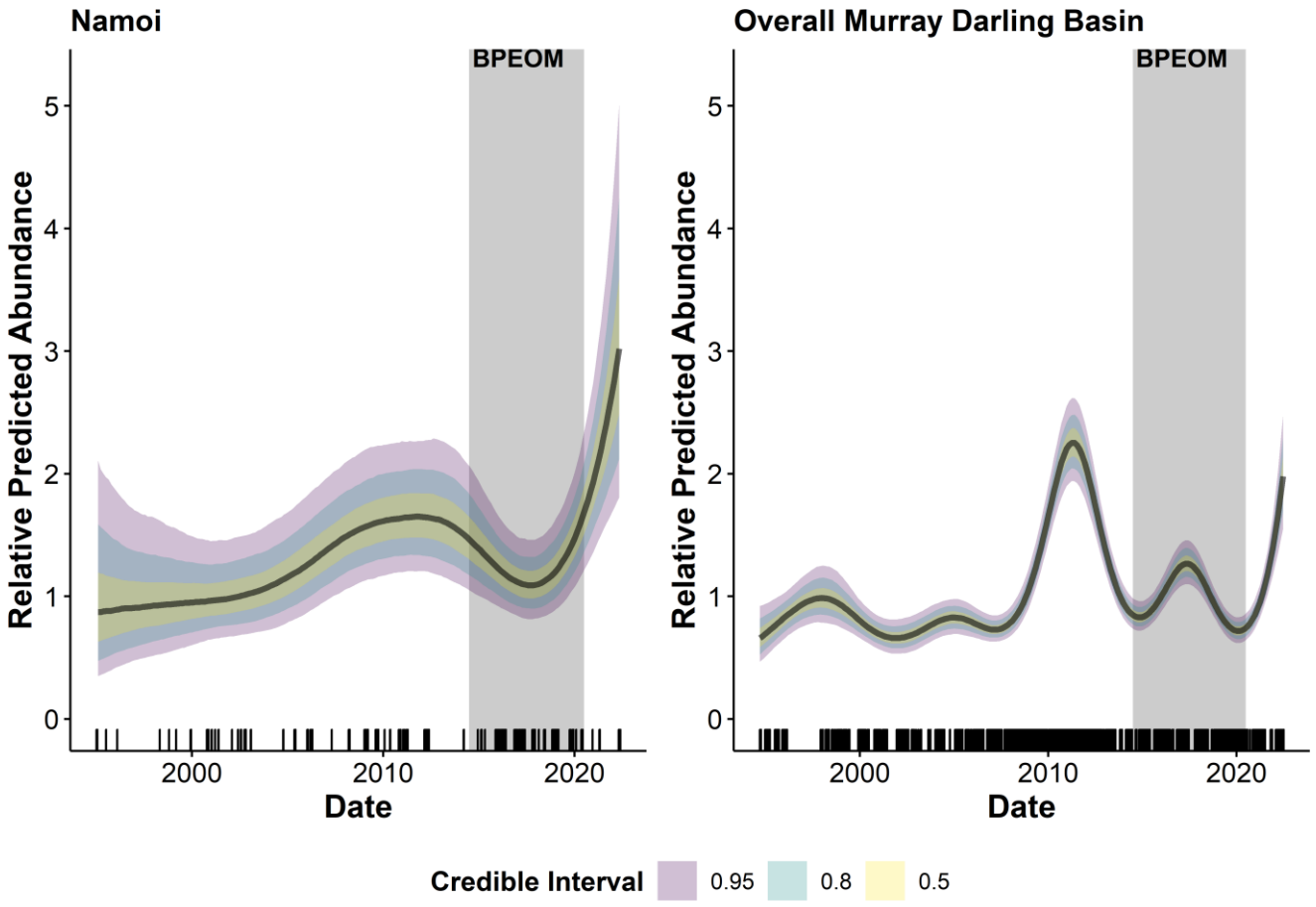

Figure 8.29: Relative abundance of Common carp in both this valley and the overall Murray-Darling Basin. These are model estimates based upon all electrofishing data within the NSW DPI Freshwater ecosystem database and the output of Bayesian generalised additive mixed models. The grey shaded region represents the period during which the BPEOM-F program was run. The black lines on the x-axis represent data coverage while the colours on the figure show various levels of confidence. Note when overlapping, the colours look slightly different due to the transparency and the y-axes vary between chapters of this report.

Summary Statement:

Increased abundance since 1994 driven by an increase in recent years. Relative abundance slightly higher than the overall abundance across the NSW MDB, which peaked in approximately 2012.

Health

The prevalence of any health issues ranged from 2% of sampled fish in 2015/2016 to 7% of sampled fish in 2018/2019 (Figure 8.30). The most common health issue for Common carp in the Namoi water resource planning area was Lerneae, which was observed in a total of 30 fish, corresponding to 2% of all Common carp measured.

Across the other WRPAs, 6% of Common carp (1,102 out of 19,668 Common carp) showed a health condition (excludes Namoi).

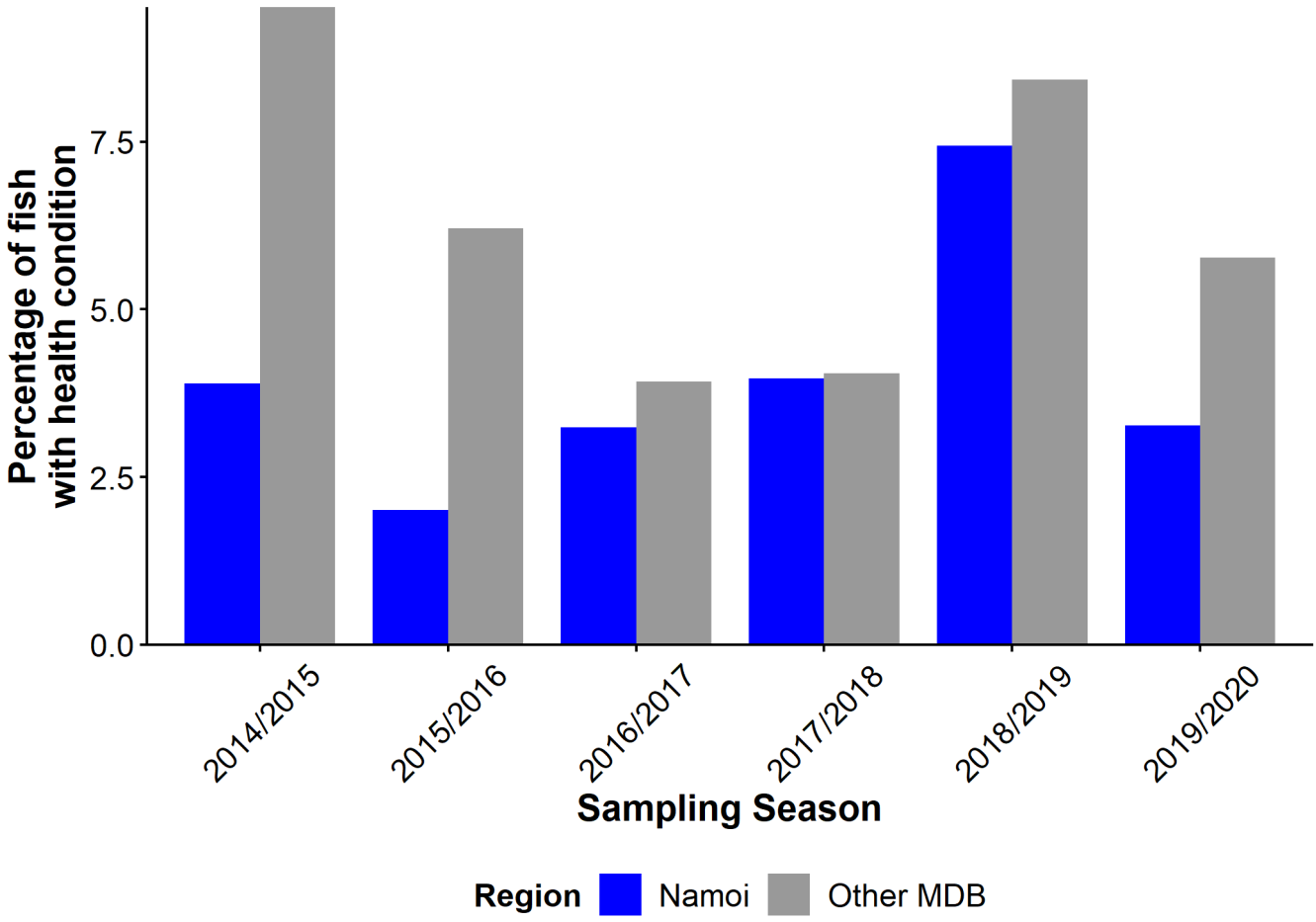

Figure 8.30: Timeseries showing the prevalence of health conditions in Common carp. Blue shows the region-specific data while the grey shows the average across the other NSW MDB WRPAs.

Summary Statement:

Presence of observable health conditions in the Namoi WRPA was low and generally lower than the overall NSW Murray-Darling Basin.

Distribution

Common carp were recorded at 55 out of 66 sites in the Namoi WRPA. The maximum observed relative abundance at a site was 16 fish caught per 90 seconds of electrofishing. Figure 8.31 shows the distribution and relative abundance of Common carp across the Namoi WRPA.

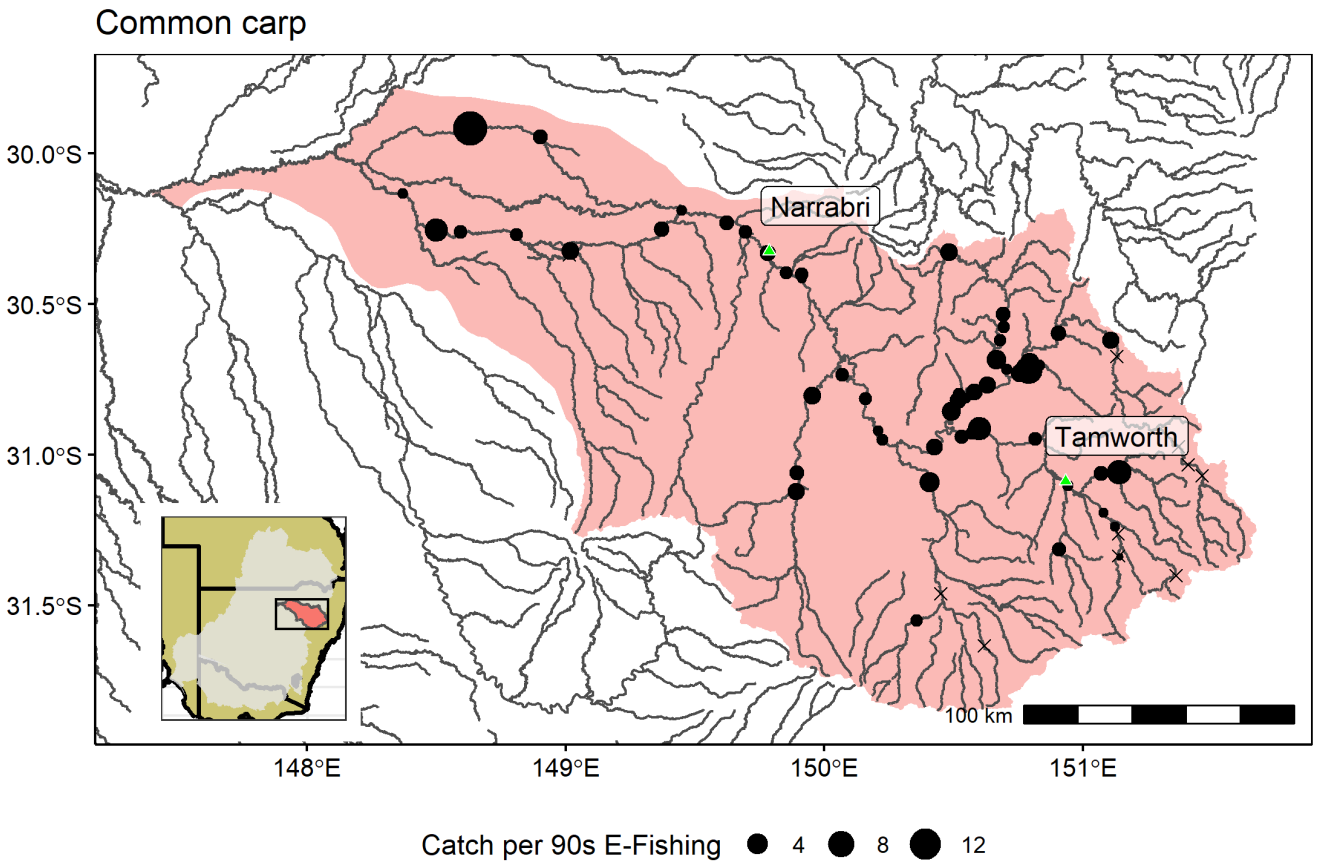

Figure 8.31: Distribution of Common carp. Filled circles show sites where the species was present, and the size of the circle represents relative abundance. Sites that were sampled with electrofishing but did not contain the species are shown with an X.

Summary Statement:

Recorded across the Namoi WRPA except for a few upland sites.

Threatened Species

The following table (Table 8.6) 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 Namoi Water Resource Planning Area during the BPEOM program. A list of all threatened fish species observed by NSW DPI Fisheries (as part of any sampling program in any area) is provided in Table 8.9.

Table 8.6: Listed species which were observed in this region during the BPEOM-F program. (* = FMA, # = EPBC)

Species	Common name	Total caught (observed)
Bidyanus bidyanus	Silver perch*#	3 (1)
Maccullochella peelii	Murray cod#	506 (160)
Tandanus tandanus	Freshwater catfish*	73 (25)

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

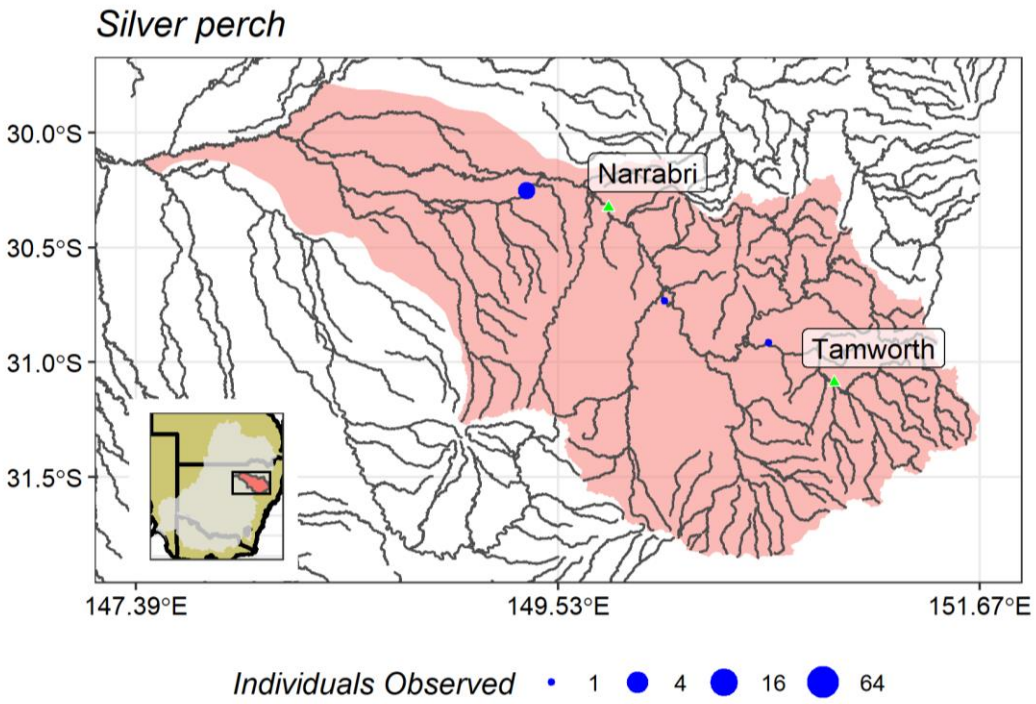

Figure 8.32: Distribution of Silver perch. Filled circles show sites where the species was present and the size of the circle represents number of observed individuals abundance.

Summary Statement:

Four silver perch were caught across three sites in the Namoi and Peel Rivers.

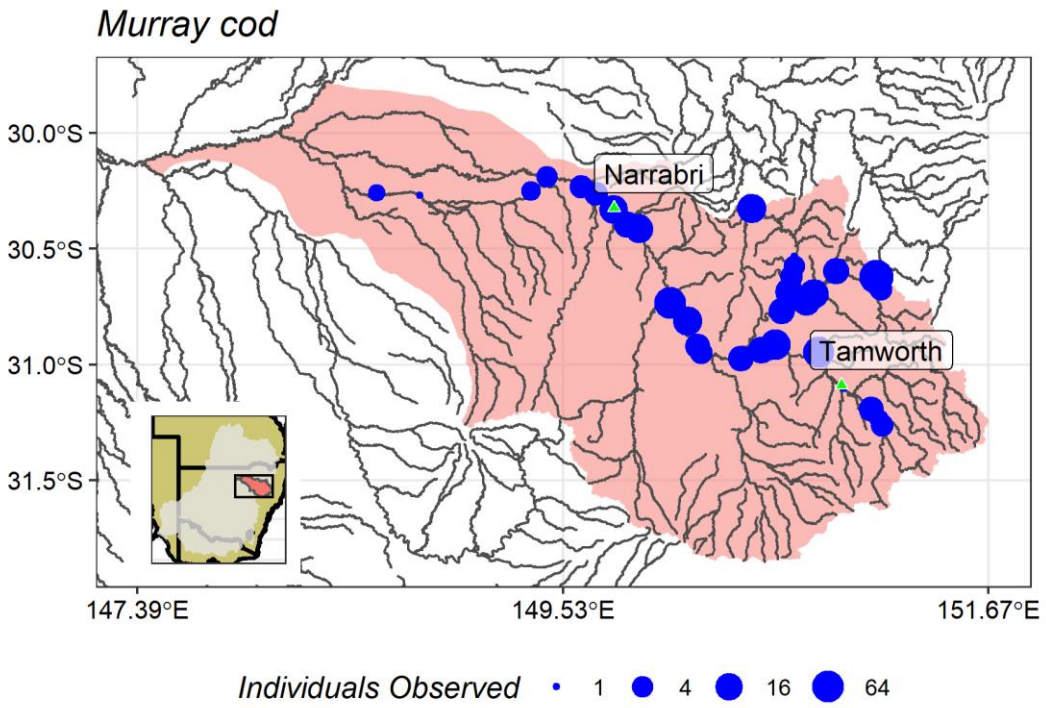

Figure 8.33: Distribution of Murray cod. Filled circles show sites where the species was present and the size of the circle represents number of observed individuals abundance. Note the bottom image shows a juvenile Murray cod.

Summary Statement:

A total of 666 Murray cod were caught across 38 sites widely distributed across the Namoi WRPA.

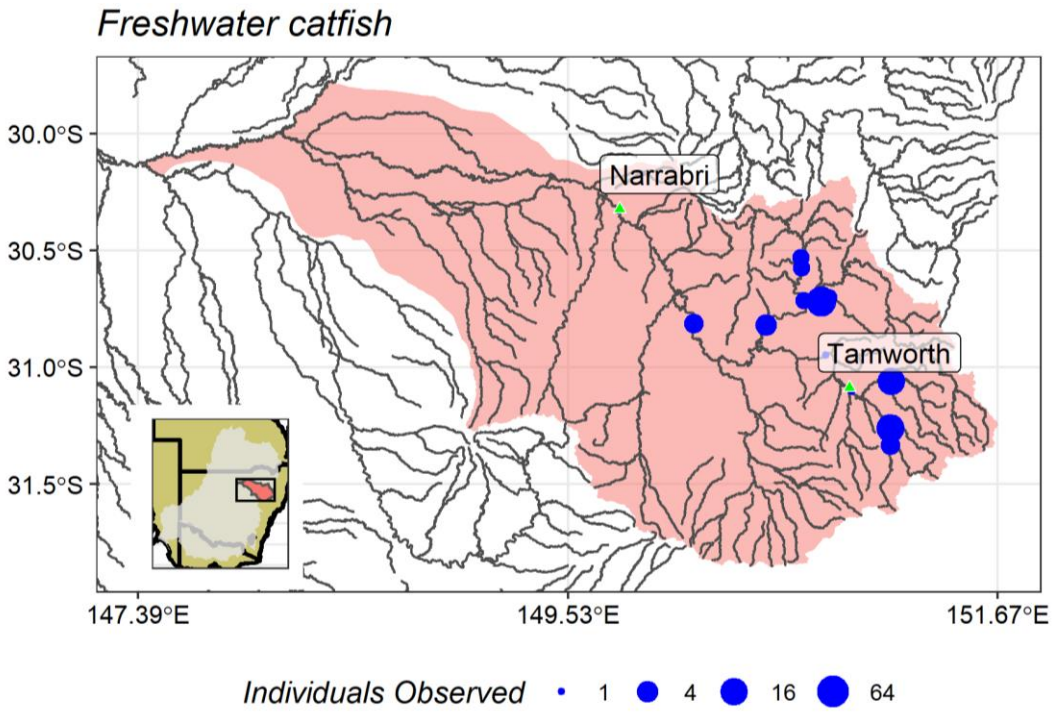

Figure 8.34: Distribution of Freshwater catfish. Filled circles show sites where the species was present and the size of the circle represents number of observed individuals abundance.

Summary Statement:

A total of 98 Freshwater catfish were caught across 17 sites in the Namoi region, mostly in the eastern areas.

Appendix

Figure 8.35 shows the locations of sites sampled in each sampling season.

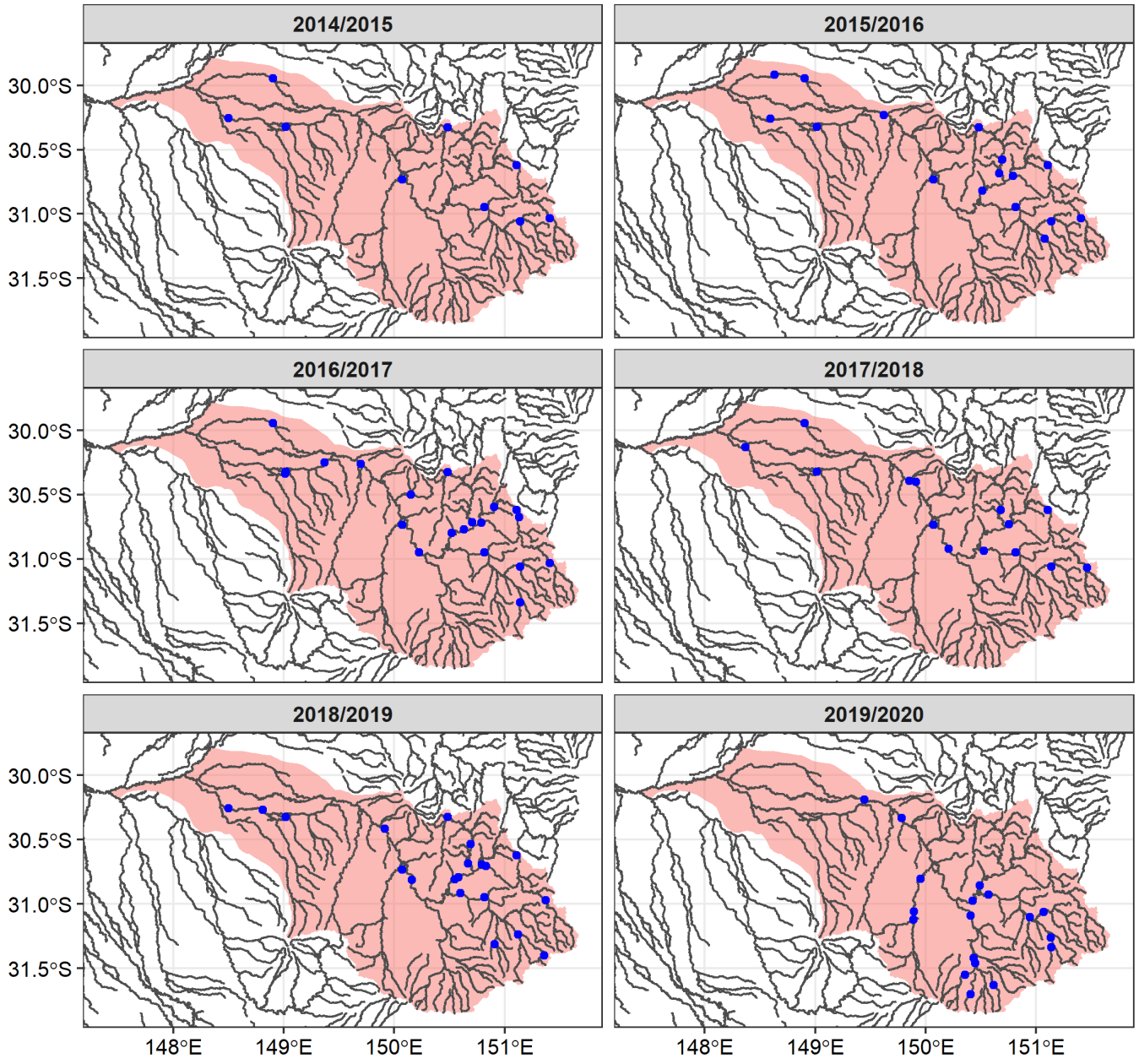

Figure 8.35: Sites sampled during the BPEOM-F program by Sampling Season. Dry sites are not shown.

Table 8.7 shows all fish species detected during this survey period as part of BPEOM-F. Note there are variations in effort between sampling seasons so this information should be considered in conjunction with Table 8.1. 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 BPEOM sampling in the Namoi WRPA were: Olive perchlet, Macquarie perch, Southern purple-spotted gudgeon, Dwarf flathead gudgeon, Redfin, Brown trout. 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 full list of species observed during this period across all programs is in Table 8.10.

Table 8.7: Total number caught of each species by sampling season.

Common name	Expected from modelling	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Australian smelt	YES	3	30	12	0	1	28
Bony herring	YES	77	275	239	40	739	79
Carp-gudgeon species complex	YES	933	1,356	2,438	67	3,372	576
Common carp	NA	211	322	594	126	487	214
Darling hardyhead	YES	0	0	3	0	0	0
Eastern gambusia	NA	552	921	1,021	252	1,481	109
Freshwater catfish	YES	0	8	35	2	6	22
Golden perch	YES	5	15	12	8	6	31
Goldfish	NA	62	101	63	22	174	21
Mountain galaxias	YES	0	0	0	1	0	0
Murray-Darling rainbowfish	YES	3	11	9	7	12	6
Murray cod	YES	38	89	84	97	163	35
Rainbow trout	YES	2	3	0	0	0	0
River blackfish	NA	35	41	3	1	7	0
Silver perch	YES	0	0	2	0	1	0
Spangled perch	YES	14	15	7	8	32	27
Unspecked hardyhead	YES	7	4	21	4	15	6

The following table summarises the sampling methods by which each species was caught (Table 8.8).

Table 8.8: Total catch of each species by sampling method.

Common name	Backpack Electrofishing	Bait Trap	Boat Electrofishing
Australian smelt	44	0	30
Bony herring	430	7	1,012
Carp-gudgeon species complex	1,068	7,515	159
Common carp	783	112	1,059
Darling hardyhead	0	0	3
Eastern gambusia	1,758	1,806	772
Freshwater catfish	65	0	8
Golden perch	8	0	69
Goldfish	181	4	258
Mountain galaxias	1	0	0
Murray-Darling rainbowfish	15	3	30
Murray cod	96	0	410
Rainbow trout	0	0	5
River blackfish	1	0	86
Silver perch	0	0	3
Spangled perch	62	6	35
Unspecked hardyhead	22	11	24

Table 8.9: Listed threatened species recorded in the Murray-Darling Basin (from the NSW DPI 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
Ambassis agassizii	Agassiz's glassfish, olive perchlet, western New South Wales population	NA	Endangered Population
Bidyanus bidyanus	Silver Perch, Bidyan	Critically Endangered	Vulnerable
Craterocephalus fluviatilis	Murray Hardyhead	Endangered	Critically Endangered
Galaxias rostratus	Flathead Galaxias, Beaked Minnow, Flat-headed Galaxias, Flat-headed Jollytail, Flat-headed Minnow	Critically Endangered	Critically Endangered
Galaxias tantangara	Stocky Galaxias	NA	Critically Endangered
Maccullochella macquariensis	Trout Cod	Endangered	Endangered
Maccullochella peelii	Murray Cod	Vulnerable	NA
Macquaria australasica	Macquarie Perch	Endangered	Endangered
Mogurnda adspersa	Southern Purple Spotted Gudgeon	NA	Endangered
Nannoperca australis	Southern Pygmy Perch	Vulnerable	Endangered
Tandanus tandanus	Freshwater catfish, eel tailed catfish, Murray-Darling Basin population	NA	Endangered Population

Table 8.10 shows all fish 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 BPEOM sampling in the Namoi WRPA were: Olive perchlet, Macquarie perch, Southern purple-spotted gudgeon, Dwarf flathead gudgeon, Redfin, Brown trout. 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 BPEOM-F during this period is in Table 8.7.

Table 8.10. Total catch of each species by all sampling programs and all methods in the region. Note these include projects with sampling not representative of the community and the data should not be interpreted.

Common name	Expected from modelling	2014/2015	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020
Australian smelt	YES	3	335	28	42	1	28
Bony herring	YES	77	1,021	1,639	1,026	777	79
Carp-gudgeon species complex	YES	933	5,742	2,877	149	3,714	576
Common carp	NA	212	918	895	374	657	214
Darling hardyhead	YES	0	0	3	0	0	0
Eastern gambusia	NA	552	2,592	1,076	264	1,481	109
Freshwater catfish	YES	0	8	35	2	6	22
Golden perch	YES	5	59	129	114	68	31
Goldfish	NA	62	484	96	37	177	21
Mountain galaxias	YES	0	0	0	1	0	0
Murray-Darling rainbowfish	YES	3	111	65	117	20	6
Murray cod	YES	38	146	118	141	194	35
Rainbow trout	YES	2	3	0	0	0	0
River blackfish	YES	35	41	3	1	7	0
Silver perch	YES	0	0	3	8	2	0
Spangled perch	YES	14	131	52	39	32	27
Unspecked hardyhead	YES	7	5	29	34	20	6