NSW GOVERNMENT | Department of Primary Industries

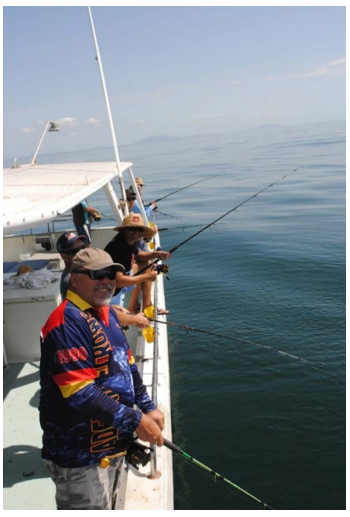
Fisheries Final Report Series | No. 162

NSW Charter Fishery Monitoring 2019/20

Hughes, J. M., Murphy, J. J., Ochwada-Doyle, F. A. and Taylor, M. D.







Published by the NSW Department of Primary Industries

NSW Recreational Fisheries Monitoring Program – Charter Fishery Monitoring 2019/20

NSW DPI – Fisheries Final Report Series No. 162

First published April 2023

ISSN 2204-8669*

More information

Julian Hughes, Fisheries NSW, Sydney Institute of Marine Science, 19 Chowder Bay Road, Mosman, NSW 2088, Australia

www.dpi.nsw.gov.au

Acknowledgments

Funding for this project was provided by the NSW Recreational Fishing Saltwater Trust and the NSW Department of Primary Industries (NSW DPI).

Recreational Fishing Trusts

NSW GOVERNMENT Department of Primary Industries

Cover images: FishBermi Charters, Aaron Puckeridge, Luke Van Lawick, Chantelle Clain, Jason Delamont

*Before July 2004, this report series was published by NSW Fisheries as the 'NSW Fisheries Final Report Series' with ISSN 1440-3544. Then, following the formation of the NSW Department of Primary Industries it was published as the 'NSW Department of Primary Industries – Fisheries Final Report Series' with ISSN 1449-9967. It was then published by Industry & Investment NSW as the 'Industry & Investment NSW – Fisheries Final Report Series' with ISSN 1837-2112. It was then published as the 'NSW Trade and Investment – Fisheries Final Report Series' with ISSN 2204-8669. It is now published as the 'NSW Department of Industry – Fisheries Final Report Series' with ISSN 2204-8669.

Contents

List of tables

List of figures

Acknowledgments

This report would not have been possible without the significant contributions from many people to the Charter Monitoring component of the Recreational Fisheries Monitoring Program (RFMP).

Firstly, we thank the NSW Recreational Fishing Trusts for provision of funding to support ongoing recreational fishing research in NSW through the RFMP.

We are grateful to the 31 charter operators who voluntarily hosted on-board observers, allowing us to collect data on their fishing operations, despite the impacts of floods, bushfires and the COVID-19 pandemic. We also thank the thousands of charter clients who voluntarily participated in on-board observer interviews and surveys of their catches.

We thank the members of the Charter Fishing NSW Working Group for their advice, feedback and support for the Charter Monitoring component of the RFMP.

We thank the dedicated and professional team of on-board observers who worked on charter vessels, sometimes under challenging conditions, collecting the wide variety of data presented here: Kristian Gerathy, Luke Van Lawick, Sophie Johns, Jacson Warner, Aaron Puckeridge, Chantelle Clain, Nick Meadows, Jason Delamont, Daniel Baumann and Adam Wiltshire. All observers developed excellent rapport with charter operators and clients integral to the success of the monitoring program.

The following NSW DPI staff were invaluable to the program:

- Fisheries Managers responsible for the NSW Charter Fishery, Nathan McNamara and Ben Black, for provision of comprehensive information, knowledge and advice on the operations of the NSW Charter Fishing fleet.
- Fisheries Technician Nick Meadows for many hours of tedious data entry and QC.
- Fisheries Resource Assessment Research Leader Michael Lowry, for his valuable inputs during the development of the program and review phases of this report.
- Senior Fisheries Manager Bryan Van Der Walt, for his comments on draft versions of the report.
- Robyn Anthoney, Pamela Gallagher, Rachel Kerma and Julie Rehwinkel for their valuable administrative assistance throughout the project.

NSW Recreational Fisheries Monitoring Program – Charter Fishery Monitoring 2019/20

Principal investigators

Julian M. Hughes, Jeffrey J. Murphy, Faith A. Ochwada-Doyle, Matthew D. Taylor
C/- Port Stephens Fisheries Institute
Locked Bag 1
Nelson Bay, NSW 2315
Tel: 02 4982 1232

Objectives

The objectives of the Charter Fishery Monitoring component of the NSW Recreational Fisheries Monitoring Program are to:

i) Describe spatial and temporal patterns in retained catch and effort for the nearshore charter fishery using data from industry logbooks and on-board observers
ii) Describe observed spatial and temporal patterns in discarded catch
iii) Describe the size composition of observed catches (retained and discarded) for key species caught by the fishery
iv) Describe observed interactions between threatened, endangered and protected (TEP) species and the fishery
v) Describe the demographic characteristics of nearshore charter fishery clientele

Key words

Recreational fishing, charter fishing, logbooks, fishery observers, discarding, wildlife interaction, bycatch, client demographics, size composition

Non-technical summary

A key component of the recreational fishery in NSW is the 'for hire' Charter Fishery, which consists of hundreds of vessels and caters to tens of thousands of fishers. By far the largest part of the NSW Charter Fishery operates in nearshore marine waters – the 'Nearshore Marine Charter Fishery', which targets a diverse range of important recreational fish species. This fleet is monitored using a combination of mandatory industry logbook reporting and an on-board scientific observer program. The primary source of information is derived from logbook data (spatio-temporal retained catch and fishing effort), but this is complemented by targeted independent observer surveys to collect additional relevant information (size composition, rates of discarding, client demographic information and interactions with threatened, endangered and protected (TEP) species). The data collected contributes variously to the assessment and monitoring of key species, state and national reporting frameworks, and socio-economic analyses of the recreational fishing industry.

This report presents key results from the second year of the Charter Fishery Monitoring component of the Recreational Fisheries Monitoring Program (RFMP). Outcomes from the Recreational Fishing Research Survey component of the RFMP are detailed in a separate report (Murphy *et al.* 2022).

Industry Logbooks

State-wide, industry logbooks revealed that 82 charter vessels operated in the nearshore marine charter fishery undertaking 3,623 fishing trips with 24,749 clients in 2019/20. The number of clients per trip ranged from 1 to 19 (mean ± SE, 7.3 ± 0.1). Hours fished during trips ranged from 1 to 12 h with an average (± SE) of 5.8 ± 0.1 h per trip.

The nearshore charter fleet harvested 106,008 individual organisms of 130 different species with just 30 species comprising 95% of the total retained catch. More than half of the catch were made up of Snapper (19.3%), Bluespotted Flathead (19.1%), Grey Morwong (8.6%), Yellowtail Scad (6.3%) and Blue Mackerel (4.2%). An average (± SE) of 29.3 ± 0.4 fish were retained per trip with a mean (± SE) species diversity of 4.3 ± 0.1 species per trip.

On-board Observer Monitoring

Observers were present on 245 nearshore charter trips with 31 operators working out of 18 ports between Ballina and Eden between January 2020 and June 2021. This program was heavily affected by disruptions to charter fishing activity because of the "Black Summer" bushfire disaster and COVID-19 pandemic, and as a consequence observer monitoring commenced and finished later than intended in order to complete planned spatio-temporal observer sampling effort. Nonetheless, observed trips represented 3.7% of the total number of nearshore charter trips reported in industry logbooks to have been undertaken state-wide during this period.

The number of clients per observed trip ranged from 1 to 21 (mean ± SE, 7.6 ± 0.2). Hours fished during observed trips ranged from 1.4 to 8.5 h with an average (± SE) of 5.0 ± 0.1 h per trip. Observers recorded the capture of 15,458 individual organisms of 138 different species with just 34 species comprising 95% of the total observed catch (kept and released). Most organisms caught were kept (66%) with the remaining 34% released. Species observed to be kept in the greatest numbers were Bluespotted Flathead, Snapper, Blue Mackerel, Yellowtail Scad and Grey Morwong. The species observed to be released in the greatest

numbers were Longspine Flathead, Eastern Red Scorpionfish, Sergeant Baker, Yellowtail Kingfish and Redfish.

Observers recorded an average (± SE) of 63.4 ± 2.6 individuals caught per trip. Of this, an average (± SE) of 41.5 ± 2.0 individuals per trip were kept and 21.9 ± 1.3 individuals per trip were subsequently released. Mean (± SE) species diversity of the total catch per trip was 10.7 ± 0.3 species per trip with 7.2 ± 0.2 species per trip kept and 5.2 ± 0.2 species per trip released. Species with low release rates included Pearl Perch, Teraglin, Grey Morwong, Eastern Blackspot Pigfish, Australian Bonito and Ocean Jacket. Species with high release rates included Mado, Longspine Flathead, Longfin Pike Eastern Red Scorpionfish, Barracouta, Sergeant Baker and Yellowtail Kingfish.

The lengths of 14,324 individuals (93%) were measured by on-board observers prior to retention or release. Most (70%) of the retained Bluespotted Flathead catch was within 10 cm of the MLL (33 cm total length – TL) with 9% larger than 50 cm TL. Almost the entire retained Snapper catch (90%) was between the MLL of 30 cm TL (~26 cm fork length – FL) and 40 cm FL, with the remainder larger than 40 cm FL. Most (70%) of the retained Grey Morwong catch was within 10 cm of the MLL of 30 cm TL (~25 cm FL), but 27% were also between 35 and 45 cm FL. Most Yellowtail Kingfish released after capture were smaller than the MLL for the species of 65 cm TL (~57 cm FL) and the majority (79%) of the retained catch were within 10 cm of this length with just 21% larger than 67 cm FL. Most (78%) of retained Teraglin were between the MLL of 38 cm TL (~36 cm FL) and 56 cm FL, and the remaining 22% greater than this length. Most (61%) Pearl Perch were within 10 cm of the MLL of 30 cm TL (~29 cm FL) with the remaining 39% between 39 and 57 cm TL.

Observers monitored wildlife interactions with charter fishing vessels on 94% of observed charter trips. A total of 571 observations recorded 9,713 individual animals across 36 species in the vicinity of charter vessels. These were dominated by seabirds (91% of the total) and marine mammals (dolphins, whales, seals; 9%). Seabirds from 10 families were observed with the most common being Shearwaters and Gulls/Terns. Only 37 direct interactions (involving 135 individuals) with the fishery were observed at a rate of 3.02 interactions per 100 h fishing. Marine mammals were recorded in 9 direct interactions and 28 interactions involved seabirds. Six incidences of bycatch were recorded, involving several species of seabirds becoming entangled in fishing line or hooked, at a bycatch rate of 0.49 events per 100 h fishing.

Demographic data was collected from a total of 1,862 clients on observed charter trips. Charter clients were primarily male (89%), with 11% female. Charter clients ranged in age from 2 to 92 years; most (94%) were adults with similar proportions (~25%) aged between 15 and 29, 30 and 44, and 45 and 59 years. Most (65%) charter clients came from the area local to the charter operation, however 34% came from inland regions of NSW or from interstate. Less than 1% of charter clients came from overseas, including 4 different countries. Seventy four percent of charter clients fished in the previous 12 months and 34% of these had been on a charter trip.

The numbers of individual fish and the species diversity of the retained catch was underestimated when recorded in logbooks compared with the same data collected by independent observers. The data series represented by the biennial monitoring of the NSW Charter Fishery will be crucial for informing recreational fishing-specific Performance Indicators within future multi-sector harvest strategies being developed in NSW.

1.0 Introduction

1.1 Background

1.1.1 Recreational Fishing in NSW

The publicly owned fisheries resources of New South Wales (NSW) are shared among recreational fishers, commercial fishers, charter operators and people practicing traditional Aboriginal fishing. Information from all harvesting sectors are therefore required to ensure effective management of sustainable shared fisheries resources (e.g. Sutinen and Johnston 2003, Crowe *et al.* 2013, Fenichel *et al.* 2013, Ryan *et al.* 2016). The recreational fishery represents an important sector and has been demonstrated to take a significant proportion of the catch of many key species (Henry and Lyle 2003, West *et al.* 2015, Murphy *et al.* 2020, 2022).

Fishing is a popular recreational activity in NSW, with up to ~20% of adult NSW residents participating recreational fishing annually (Henry and Lyle 2003, West *et al.* 2015, Moore *et al.* 2023). Such high participation rates deliver considerable additional value to the NSW community via enhancement of social capital, promotion of stewardship for natural resources, and provision of numerous health benefits (e.g., McPhee 2017, Hyder *et al.* 2018). In addition, the recreational sector is estimated to contribute more than AU$3 billion into the NSW economy each year and supports the equivalent of up to ~33,000 fulltime jobs (McIlgorm and Pepperell 2013, Moore *et al.* 2023).

1.1.2 Charter Fishing in NSW

A key component of the recreational fishery in NSW is the 'for hire' charter sector. The Charter Fishery in NSW involves hundreds of vessels catering to tens of thousands of fishers and operates over 10° latitude in waterbodies ranging from estuaries to offshore marine waters, targeting species ranging from small-bodied finfish and crustaceans to large gamefish (Figure 1). The Charter Fishery provides clients with fishing expertise and vessels to maximise their fishing success across a range of fishing forms and species, and to access areas not normally available to them. Charter businesses are commercial enterprises, but charter clients are subject to the same rules and regulations concerning species size and bag limits as all other recreational fishers in NSW. 'For hire' recreational charter fisheries operate in most industrialised and many developing countries throughout the world (Dell'Apa *et al.* 2015, Lichtkoppler *et al.* 2015, Hughes *et al.* 2021).

The Charter Fishery provides an estimated annual AU$50.2 million into the NSW economy from operators and their clients along with almost 200 fulltime jobs (McIlgorm and Pepperell 2014). The Charter Fishery operates out of more than 30 coastal ports across NSW (Figure 1) with the economic impact of the fishery being greatest in regional areas. There are currently 103 active licenced charter operators in NSW operating under at least one of four endorsement types – "Estuarine Fishing", "Nearshore Bottom and Sportfishing", "Deep Sea Bottom Fishing" and "Gamefishing" – depending on the category of fishing undertaken. By far the largest component of the NSW Charter Fishery in terms of catch and effort is the fleet operating in nearshore marine waters – accessed by licenced charter operators holding a "Nearshore Bottom and Sportfishing" endorsement (hereafter, the "nearshore charter fishery"). There are currently 67 active licenced charter operators in NSW with a "Nearshore Bottom and Sportfishing" endorsement, 20 with an "Estuarine Fishing" endorsement, 12 with a "Deep Sea Bottom Fishing" endorsement and 11 with a "Gamefishing" endorsement (NSW DPI unpublished catch statistics).

1.2 Need

1.2.1 The Recreational Fisheries Monitoring Program (RFMP)

The biological, economic and social importance of the recreational fishery in NSW (see 1.1.1) creates the need for regular and cost-effective broad-scale monitoring. The Recreational Fisheries Monitoring Program (RFMP) collects an ongoing time series of high-quality information on recreational and charter fishing in NSW, to inform key indices of recreational fishery performance. Long-term monitoring of recreational fishing provides information on the magnitude and variability of effort and catch, that contributes to the assessment of stocks, resource allocation and data to evaluate the impact of existing management regulations, and management changes under consideration (e.g., Ochwada-Doyle *et al.* 2021a, b, 2023). The data collected through the RFMP also complements monitoring of other fishing sectors and habitat assets, providing a holistic view of fisheries and aquatic ecosystems within NSW. As NSW transitions to cross-sectoral harvest strategies for many key stocks and fisheries (Fowler *et al.* 2022), the information generated through the RFMP is increasingly critical to framing Performance Indicators and ensuring that the sustained quality of recreational fishing in NSW is maintained.

The RFMP includes a comprehensive citizen-science program that engages with thousands of recreational fishers, who voluntarily provide information on their fishing activities within a rigorously designed scientific framework. There are two main components to the RFMP:

1) Recreational Fishing Research Surveys

   State-wide 12-month telephone-diary surveys of the households of long-term (1 or 3-year duration) NSW recreational fishing licence holders undertaken on a biennial basis.

2) Charter Fishery Monitoring

   A concurrent logbook and on-board observer program to monitor the NSW nearshore charter fishery undertaken on a biennial basis.

1.3 Charter Fishery Monitoring

Monitoring of the NSW Charter Fishery by the RFMP is focussed on the nearshore charter fishery because it is the largest (in terms of vessels, operators and clients), operates state-wide, is generally conducted from large vessels for ease of hosting observers, and targets numerous species of importance to recreational, commercial and charter sectors with requirements for data to be used in monitoring and assessment (see 1.1.2). The primary source of information is derived from logbook data, but this is complemented by targeted independent observer surveys to collect trip-specific information on effort, catch, biological data (fish lengths), rates of discarding, interactions with wildlife species, and demographic information on charter clientele. Focal species are Bluespotted Flathead (*Platycephalus caeruleopuncatus*), Grey Morwong (*Nemadactylus douglasii*), Snapper (*Chrysophrys auratus*), Yellowtail Kingfish (*Seriola lalandi*), Teraglin (*Atractoscion atelodus*) and Pearl Perch (*Glaucosoma scapulare*), but information on all species caught by the nearshore charter fishery are recorded.

Industry logbooks are a cost-effective means of collecting catch and effort information for many commercial and charter fisheries globally (e.g., Dell'Apa *et al.* 2015, Lichtkoppler *et al.* 2015, Ryan *et al.* 2016, Hughes *et al.* 2021). While logbook data often provides a reasonable overview of species composition and relative harvest, logbook data can be subject to several sources of bias

and erroneous reporting (Cotter and Pilling 2007). For example, variable rates of fisher compliance with mandated reporting requirements means that data may not actually reflect total fishing activity or catch. Other sources of bias include inaccurate species identification and variable reporting of interactions with threatened, endangered and protected species (TEPs; Cotter and Pilling 2007). In addition, logbooks may not require the recording of data from discarded catches (Hughes *et al.* 2021).

Use of trained on-board observers are a common means to complement and validate self-reported logbook data, and overcome some of the limitations outlined above (Cotter and Pilling 2007, Chromy *et al.* 2009). On-board observers travelling on fishing vessels can provide high quality data on catch and effort for all retained and discarded species, along with the collection of other data which may influence reported catches. This may include spatio-temporal information on the activity of the fishing vessel, gear used, environmental conditions and habitats fished. Observers may also collect other useful data such as biological data, demographic information from charter clientele (for use in socio-economic analyses), and interactions with TEP species.

A combination of mandatory industry-based logbook and an on-board observer program is therefore used to monitor the nearshore charter fishery within the RFMP.

1.4 Objectives

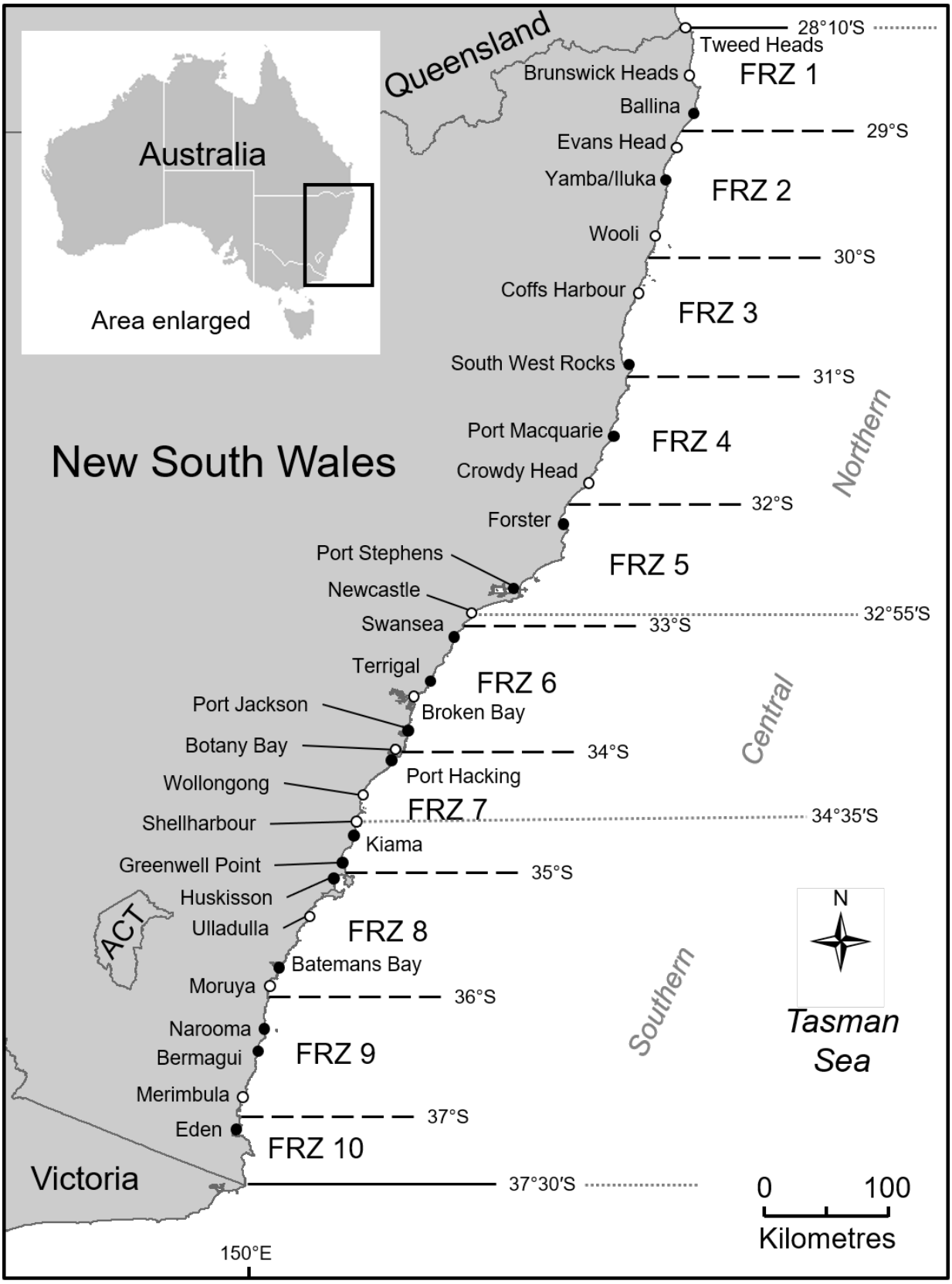
The objectives of the Charter Fishery Monitoring component of the RFMP are to describe state-wide patterns for the nearshore charter fishery in terms of:

i) Spatial and temporal patterns in retained catch, effort and catch rate (from industry logbook data)
ii) Spatial and temporal patterns in retained catch, effort and catch rate (from data collected by on-board observers)
iii) Spatial and temporal patterns in discarding (observer)
iv) Size composition of catches (retained and discarded) for key species caught (observer)
v) Observed interactions between TEP species and the fishery (observer)
vi) The demographic characteristics of nearshore charter fishery clientele (observer)

1.5 Report Structure

The report summarises data at both a state-wide level, as well as providing a region-by-region and seasonal breakdown of catch, effort and catch rates for the nearshore charter fishery. Additional data collected by on-board observers on discarding, biological information, wildlife abundance and interactions, and client demographics are also summarised here.

Figure 1. Map of coastal NSW showing the ten one-degree Fishers Reporting Zones (FRZs; bounded by horizontal dashed lines) against which operators within the NSW Charter Fishery are required to report catch and effort in their mandatory logbooks (see Figure 2). Also shown are the 'Northern', 'Central' and 'Southern' MEMA management regions (bounded by horizontal dotted lines). Ports where the nearshore charter fishery operates (○) and ports where observed trips occurred (●) during 2019/20 are also shown.



2.0 Methods

NSW Charter Fishing operators with a "Nearshore Bottom Fishing and Sportfishing" endorsement were monitored using data collected by their mandatory industry-based logbooks and by voluntarily hosting on-board scientific observers.

2.1 Industry Logbook

Catch and effort reporting in the mandatory NSW DPI Charter Fishing Logbook is described in detail in Hughes *et al.* (2021). Here, logbook data are aggregated to correspond with the three NSW Marine Estate Management Authority (MEMA) management regions – 'Northern', 'Central' and 'Southern' (Figure 1), which is the current framework under which management and reporting for the NSW Marine Estate is conducted. These regions are also used in the RFMP Recreational Fishing Research Survey (Murphy *et al.* 2020, 2022).

2.2 On-board Observer Monitoring

The 2017/18 on-board observer monitoring program (Hughes *et al.* 2021) was focused on collecting biological data on Bluespotted Flathead, Grey Morwong, Snapper and Yellowtail Kingfish. These species are caught in greatest numbers in FRZs 6-9, therefore the on-board observer monitoring program for 2017/18 was restricted to these zones. The observer monitoring program for 2019/20 was expanded state-wide (Figure 1), permitting the collection of data from the state's coastal waters, and also encompassed the distributions of two additional key recreational species caught by the nearshore charter fishery, Pearl Perch and Teraglin.

2.2.1 Sampling design

On-board observer monitoring of the nearshore charter fishery was stratified according to a two-factor matrix which assigned available observer trips state-wide across the ten one-degree-latitude FRZs and four seasons between November 2019 and October 2020 according to spatio-temporal retained catch recorded in mandatory industry logbooks for the previous three financial years (2015/16 – 2017/18; Table 1, Figure 1). Budget for this work dictated that a maximum of 200 observer trips could be monitored.

On-board observer monitoring occurred on selected vessels originating from certain ports within NSW (Figure 1). Not all vessels and ports were observed during each season as a result of variable rates of voluntary operator participation, availability of observer staff, and weather conditions. The program was also heavily affected by disruptions to charter fishing activity as a result of the "Black Summer" bushfire disaster and COVID-19 pandemic (Murphy *et al.* 2022). As a consequence, observer monitoring commenced and finished later than planned, running from January 2020 until June 2021, in order to complete the planned spatio-temporal observer sampling effort (Table 1).

Table 1. Two-factor matrix used to assign available observer sampling effort across the ten one-degree-latitude Fisher Reporting Zones (FRZs – Figure 1) and four seasons in 2019/20. Sampling effort was determined by spatio-temporal fishing catch recorded in mandatory industry logbooks between 2015/16 and 2017/18.

Fisher Reporting Zone	Spring	Summer	Autumn	Winter	Total
FRZ 1	1	0	1	1	**3**
FRZ 2	7	5	7	6	**25**
FRZ 3	3	3	2	2	**10**
FRZ 4	2	1	2	1	**6**
FRZ 5	2	4	3	1	**10**
FRZ 6	12	11	10	8	**41**
FRZ 7	10	11	12	8	**41**
FRZ 8	3	7	3	2	**15**
FRZ 9	8	21	16	4	**49**
FRZ 10	0	0	0	0	**0**
Total	**47**	**63**	**56**	**33**	**200**

2.2.2 Catch, effort and biological data collection

On each charter trip observed, the observer identified and counted all individual fish caught and recorded whether they were kept or released. Where possible, all individuals caught were measured as either fork length (FL – for fish with a forked caudal fin) or total length (TL – for fish with a rounded or pointed caudal fin) to the nearest 0.5 cm below the actual length.

2.2.3 Wildlife abundance and interactions with the fishery

Wildlife observation data was collected during a randomly selected 5-minute period during each fishing event during a trip, in which all wildlife in the vicinity of charter fishing vessels were recorded (Hughes *et al.* 2021). For the purposes of collecting wildlife observation data, an individual fishing event was defined as the period of time when fishing gear was being actively deployed at each location, so there could be multiple events in a single charter trip. Wildlife observed at each fishing event were identified to species where possible. Where accurate identification to species level was not possible, identification to higher order taxonomic groups (family or order) were made. Abundance counts were made of observed individuals.

Data was also collected on all incidences of bycatch as well as any direct interactions between wildlife and gear engaged in fishing that occurred during observed trips, including species identification, details of the interaction and fate (including life status if known). Direct interactions were defined as those that could result in bycatch (e.g., depredating hooked fish from lines, removing bait, eating released fish or discarded bait).

2.2.4 Demography of charter clientele

Observers also collected demographic data on charter clientele voluntarily provided by participants during observed trips. This data included age, postcode or suburb of residence, observed sex, whether the charter was for a fishing club, and how often the person went fishing and participated in charter trips (over the previous 12 months). 'Local' was defined as a suburb or postcode within a 30 km radius of the departure port for regional areas, and within a 20 km radius for urban areas. The number of clients who were unwilling or unable to provide information was also recorded.

3.0 Results

3.1 Industry Logbook

3.1.1 Effort

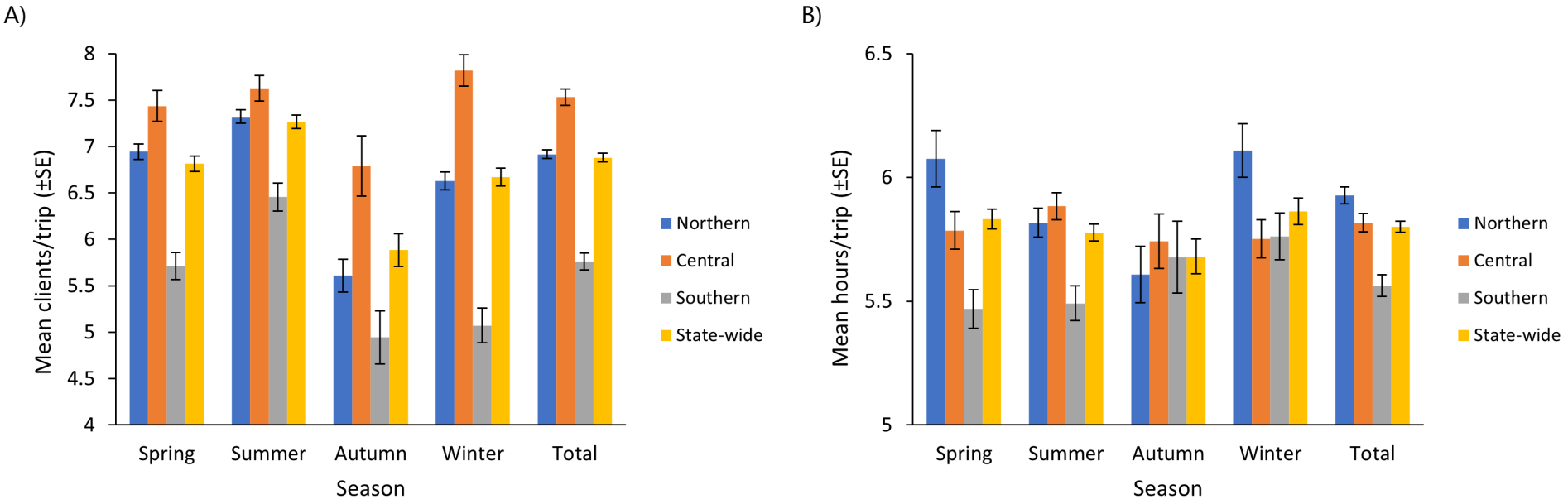
State-wide, a total of 24,749 clients took 3,623 trips with 82 nearshore charter fishery operators in 2019/20, which included a total of 21,004 hours fishing. The number of clients per trip ranged from 1 to 19 (mean ± SE, 7.3 ± 0.1; Figure 2A). Hours fished during trips ranged from 1 to 12 hours with an average (± SE) of 5.8 ± 0.1 hours per trip (Figure 2B).

Most state-wide charter trips occurred in the Northern (1,520; 42%) and Central (1,300 trips; 36%) regions, with less undertaken in the Southern region (803 trips; 22%; Table 2, Appendix 1). Overall, more charter trips occurred in spring (1,059; 29%) and summer (1,434; 40%) with fewer recorded in winter (808; 22%), and just 322 (9%) in autumn; a pattern which was consistent across all regions (Table 2, Appendix 2).

The highest mean (± SE) number of clients per trip occurred in the Central region (7.5 ± 0.1) with smaller numbers of clients per trip recorded in the Northern region (6.9 ± 0.1) with just 5.8 ± 0.1 clients per trip in the Southern region (Figure 2A). Overall, the number of clients per trip was highest in summer (7.3 ± 0.1) and lowest in autumn (5.9 ± 0.2) with a similar number of clients per trip recorded in spring and winter (6.8 ± 0.1 & 6.7 ± 0.1, respectively; Figure 2A). This pattern was similar across regions, except in the Southern region where the fewest clients per trip occurred in both autumn and winter.

Overall, the mean (± SE) number of hours fished per trip was highest in the Northern and Central regions (5.9 ± 0.1 & 5.8 ± 0.1 h per trip, respectively) and lowest in the Southern region (5.6 ± 0.1 h per trip; Figure 2B). Similarly, mean hours fished per trip was higher in winter (5.9 ± 0.1) and lowest in autumn (5.7 ± 0.1), with 5.8 ± 0.1 h per trip recorded in both spring and summer (Figure 2B).

Figure 2. Seasonal variation in: A) the mean (± SE) number of clients per trip, and B) the mean (± SE) hours fished per trip, in the nearshore charter fishery in each of the MEMA management regions across the four seasons recorded by industry logbooks in 2019/20. Number of trips per season and region can be found in Table 4.



3.1.2 Catch

3.1.2.1 State-wide

State-wide, operators within the nearshore charter fishery retained 106,008 individual organisms of 130 different species in 2019/20 (Table 2, Appendices 1 & 2). Thirty species comprised 95% of the total retained catch; the other 100 species caught contributing the remaining 5% (Appendices 1 & 2). The species harvested in the greatest numbers state-wide were Snapper (20,498 individuals), Bluespotted Flathead (20,266), Grey Morwong (9,147), Yellowtail Scad (*Trachurus novaezelandiae*; 6,627) and Blue Mackerel (*Scomber australasicus*); 4,400); these five species making up approximately 57% of the total retained catch (Table 2, Appendices 1 & 2).

3.1.2.2 Regional patterns

Catch varied between the reporting regions with the highest number of individuals retained in the Northern region (44,020) and the lowest in the Southern region (25,587) with 36,401 retained in the Central region (Table 2, Appendix 1). Species diversity of the retained catch was similarly highest in the Central and Northern regions (98 and 90 species, respectively) with far fewer species recorded in the Southern region (76 species; Table 2, Appendix 1).

The three most abundant species overall, Snapper, Bluespotted Flathead and Grey Morwong, made up a combined 46, 44 and 53% of the retained catch in the Northern, Central and Southern regions, respectively (Table 2, Appendix 1). Despite the overall dominance of these species, there was some variation in species contribution to retained catches across regions (Table 2). Snapper made a higher contribution to the catch in the Northern region (30%) than in the Southern or Central regions (14 and 9%, respectively; Table 2, Appendix 1). This pattern was also seen for Bluespotted Flathead with contribution to recorded logbook catch in the Southern and Central regions (25 and 22%, respectively), far higher than in the Northern region (14%). For Grey Morwong, contribution to catches ranged from 2% in the Northern region to 12% in the Central region and 14% in the Southern region. For other important species like Silver Sweep (*Scorpis lineolata*), Ocean Jackets (*Nelusetta ayraud*), Redfish (*Centroberyx affinis*) and Yellowtail Kingfish, catches were higher in the Central and Southern regions than in the Northern region (Table 4). Conversely, catches of Teraglin, Pearl Perch and Venus Tuskfish (*Choerodon venustus*) were greater in the Northern region than further south (Table 2, Appendix 1).

3.1.2.3 Seasonal patterns

Overall, the highest number of individuals were retained during summer (42,542) and the lowest during autumn (8,582), with 30,448 and 24,436 individuals retained in spring and winter, respectively (Table 2, Appendix 2). Species diversity of the retained catch was also lower in autumn (79 species) than in winter, spring and summer (96, 93 and 104 species; Appendix 2). For most species, retained state-wide catches were also considerably lower in autumn than during the rest of the year (Table 2, Appendix 2).

For the species which contributed most to overall logbook catches, there was considerable temporal variation between seasons. Snapper and Bluespotted Flathead dominated the recorded catch recorded year-round (19% each, respectively), however their seasonal contribution to recorded catches ranged from 16% in summer-autumn to 22-23% in winter-spring for Snapper, and conversely, 15-18% in winter-spring to 22-25% in summer-autumn for Bluespotted Flathead

Table 2. Number of seasonal trips recorded, and numbers retained by the nearshore charter fishery for the top ten species, and total catch of all species, in the Northern, Central and Southern MEMA regions (Figure 1) recorded in industry logbooks during 2019/20.

Northern Region					
Season	**Spring**	**Summer**	**Autumn**	**Winter**	**Total**
Number of trips	*448*	*586*	*107*	*379*	*1520*
Species					
Snapper	4560	4331	682	3818	13391
Bluespotted Flathead	1494	1988	510	1929	5921
Yellowtail Scad	905	2197	120	1228	4450
Teraglin	1030	1736	273	527	3566
Blue Mackerel	580	1329	294	356	2559
Pearl Perch	829	845	80	594	2348
Flathead (other)	462	486	110	653	1711
Dusky Flathead	359	610	67	267	1303
Venus Tuskfish	497	351	55	372	1275
Grey Morwong	304	386	87	263	1040
…					
All individuals Sub-total	**12699**	**16144**	**2707**	**12470**	**44020**

Central Region					
Season	**Spring**	**Summer**	**Autumn**	**Winter**	**Total**
Number of trips	*355*	*560*	*128*	*257*	*1300*
Species					
Bluespotted Flathead	1536	4433	838	1218	8025
Grey Morwong	1326	1580	495	1130	4531
Snapper	967	1175	360	921	3423
Ocean Jacket	677	762	309	560	2308
Yellowtail Scad	127	1716	40	14	1897
Sweep	763	687	144	295	1889
Yellowtail Kingfish	535	832	108	395	1870
Redfish	464	564	138	292	1458
Southern Maori Wrasse	535	461	81	354	1431
Blue Mackerel	92	834	13	40	979
…					
All individuals Sub-total	**9218**	**16460**	**3573**	**7150**	**36401**

Southern Region					
Season	**Spring**	**Summer**	**Autumn**	**Winter**	**Total**
Number of trips	*256*	*288*	*87*	*172*	*803*
Species					
Bluespotted Flathead	2304	2722	808	486	6320
Snapper	1285	1139	319	941	3684
Grey Morwong	1337	1091	267	881	3576
Ocean Jacket	296	870	8	163	1337
Tiger Flathead	426	548	199	90	1263
Yellowtail Kingfish	111	373	228	219	931
Flathead (other)	335	196	-	358	889
Blue Mackerel	151	487	37	187	862
Sweep	240	322	6	157	725
Redfish	240	207	19	158	624
…					
All individuals Sub-total	**8531**	**9938**	**2302**	**4816**	**25587**
Total number of trips	*1059*	*1434*	*322*	*808*	*3623*
All Individuals Grand Total	**30448**	**42542**	**8582**	**24436**	**106008**

(Table 2, Appendix 2). The contribution of Grey Morwong to recorded logbook catches was more temporally consistent ranging from 7% in summer to 9-10% throughout the rest of the year. Excluding autumn, which had by far the lowest number of retained individuals and species diversity, other species which showed considerable seasonal variation in contribution to logbook catches were Blue Mackerel, Silver Sweep, Ocean Jackets, Teraglin and Yellowtail Scad (Table 2, Appendix 2).

Other species made a smaller, but more consistent contribution to recorded logbook catches between most seasons excluding autumn. These included 'other' Flathead (Platycephalidae), Ocean Jackets, Yellowtail Kingfish, Sergeant Baker (*Latropiscis purpurissatus*), Redfish, Sixspine Leatherjacket (*Meuschenia freycineti*) and Southern Maori Wrasse (*Ophthalmolepis lineolatus*) (Table 2, Appendix 2).

3.1.3 Catch rates

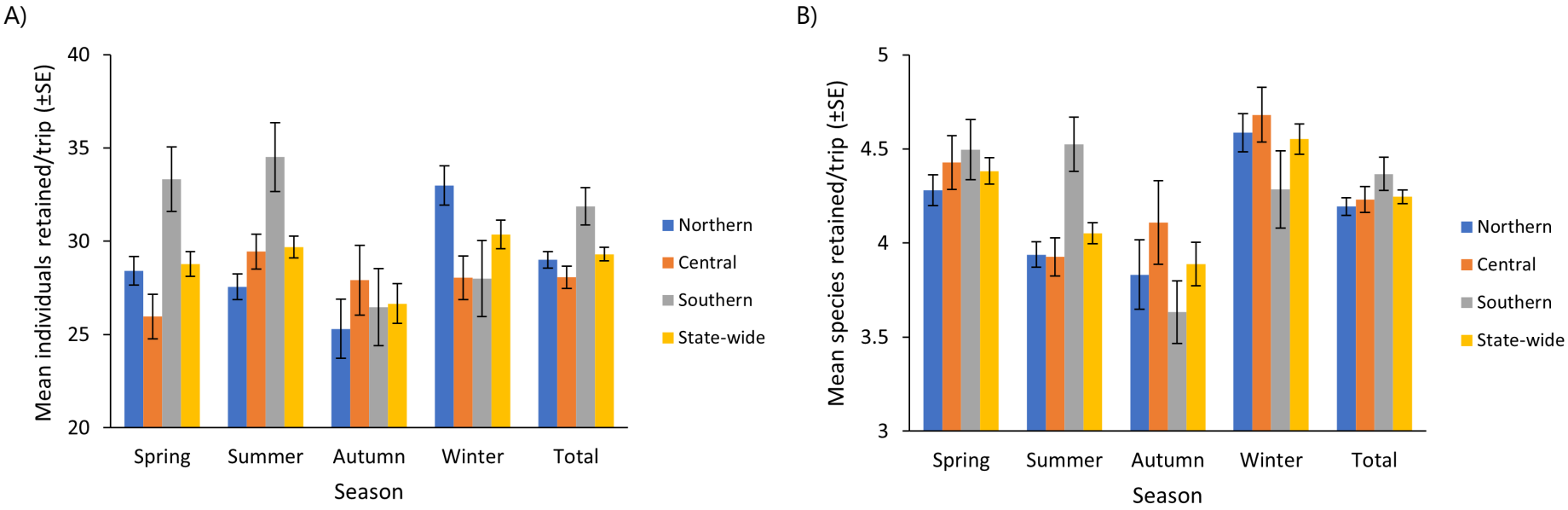
3.1.3.1 Individuals per trip

In the 3,623 nearshore charter fishing trips undertaken in NSW during 2019/20, logbook data showed that an average of 29.3 ± 0.4 fish were retained per trip (Figure 3A). Overall, the mean number of individuals retained per trip were slightly higher in winter (30.4 ± 0.8), spring (28.8 ± 0.7) and summer (29.7 ± 0.6) than in autumn (26.7 ± 1.1; Figure 3A). The mean catch rate was also strongly influenced by region with overall more individuals retained per trip in the Southern region (31.9 ± 1.0) than in the Central or Northern regions (28.1 ± 0.6 and 29.0 ± 0.5 individuals per trip, respectively; Figure 3A).

3.1.3.2 Species per trip

State-wide mean species diversity in the retained catch per nearshore charter trip in 2019/20 was 4.3 ± 0.1 species per trip (Figure 3B). The mean number of species retained per trip varied spatially with the number of species per trip retained in the Northern and Central regions (4.2 ± 0.1 species per trip), lower than in the Southern region (4.4 ± 0.1; Figure 3B). On average, more species made up the retained catch per trip in winter and spring (4.6 ± 0.1 & 4.4 ± 0.1 species per trip, respectively) than in summer and autumn (4.1 ± 0.1 & 3.9 ± 0.1 species per trip, respectively; Figure 3A). This seasonal pattern was consistent across all regions (Figure 3B).

Figure 3. Seasonal variation in: A) the mean (± SE) number of individuals retained per fishing trip, and B) the mean (± SE) number of species retained per fishing trip, in the nearshore charter fishery in each of the MEMA management regions across the four seasons recorded by industry logbooks in 2019/20. Number of trips per season and region can be found in Table 2.



3.2 On-board Observer Monitoring

3.2.1 Adherence to sampling design

Of the 200 observer days planned in the two-factor sampling matrix (Table 1), 245 nearshore charter trips (123%) were successfully observed between January 2020 and June 2021 (Table 3). Observer trips were taken with 31 individual charter operators working out of 17 ports between Ballina (28°52'S, 153°34'E) and Eden (37°04'S, 149°54'E; Figure 1). Adherence to the sampling design varied both spatially and temporally; deviance from the original design was due primarily to variable rates of voluntary operator participation, vessel capacity restrictions, observer availability and trip cancellations (resulting from weather conditions and mechanical failures). The program was also heavily affected by disruptions to charter fishing activity as a result of the "Black Summer" bushfire disaster and COVID-19 pandemic (Murphy *et al.* 2022). As a consequence, observer monitoring commenced and finished later than planned, running from January 2020 until June 2021, in order to complete the planned spatio-temporal observer sampling effort (Tables 1 & 3).

Table 3. Actual observed trips carried out across the ten one-degree-latitude Fisher Reporting Zones (FRZs – Figure 1) and four seasons between January 2020 and June 2021. Planned trips to be observed by FRZ and season are given in parentheses.

Fisher Reporting Zone	Spring	Summer	Autumn	Winter	Total
FRZ 1	11 (1)	1 (0)	9 (1)	0 (1)	**21 (3)**
FRZ 2	3 (7)	6 (5)	4 (7)	8 (6)	**21 (25)**
FRZ 3	3 (3)	7 (3)	6 (2)	5 (2)	**21 (10)**
FRZ 4	5 (2)	5 (1)	6 (2)	6 (1)	**22 (6)**
FRZ 5	4 (2)	4 (4)	1 (3)	4 (1)	**13 (10)**
FRZ 6	18 (12)	18 (11)	18 (10)	6 (8)	**60 (41)**
FRZ 7	16 (10)	16 (11)	5 (12)	3 (8)	**40 (41)**
FRZ 8	3 (3)	3 (7)	2 (3)	1 (2)	**9 (15)**
FRZ 9	11 (8)	19 (21)	5 (16)	0 (4)	**35 (49)**
FRZ 10	0 (0)	3 (0)	0 (0)	0 (0)	**3 (0)**
Total	**74 (47)**	**82 (63)**	**56 (56)**	**33 (33)**	**245 (200)**

Overall, more trips were observed state-wide (123%) than originally planned. More than 100% of the planned observer trips were carried out in FRZs 1, 3-6 and 10, however less than 100% of planned trips were observed in FRZs 2 and 7-9 (Table 3). By adjusting the timing of the program, the number of charter trips observed in all seasons were at least 100% of those originally planned (Table 3).

3.2.2 Proportion of reported charter trips observed

Overall, observed trips accounted for 3.7% of the total number of nearshore charter trips reported to have been undertaken state-wide between January 2020 and June 2021 from information recorded in industry logbooks (Table 4). Observer coverage was lowest in winter (2.8% of trips), and highest in spring when 5.5% of charter trips had an observer on-board. Even though the most observed trips occurred in summer (82), the proportion observed was only 3.3% of the total trips taken (2,505). Fifty-six trips were observed in autumn at a rate of 3.3% of reported trips. The highest proportion (4.4%) of charter trips observed occurred in the Southern region, with a smaller proportion observed in Northern and Central regions (3.8 & 2.9%, respectively; Table 4).

Table 4. Percentage of reported nearshore charter trips observed across the three MEMA management regions (see Figure 1) across the four seasons between January 2020 and June 2021. Total trips reported by the nearshore charter fishery were derived from information recorded in industry logbooks for the same period.

Season	**Spring**		**Summer**		**Autumn**		**Winter**		**Total**	
Region	***No. trips***	**Observed (%)**	***No. trips***	**Observed (%)**	***No. trips***	**Observed (%)**	***No. trips***	**Observed (%)**	***No. trips***	**Observed (%)**
Northern	*583*	4.46	*885*	2.60	*564*	4.61	*523*	4.39	*2552*	3.84
Central	*480*	4.79	*935*	2.46	*608*	2.96	*434*	1.84	*2454*	2.93
Southern	*278*	8.99	*687*	5.24	*508*	2.36	*237*	0.84	*1707*	4.39
Total	***1341***	**5.52**	***2507***	**3.27**	***1680***	**3.33**	***1194***	**2.76**	***6710***	**3.65**

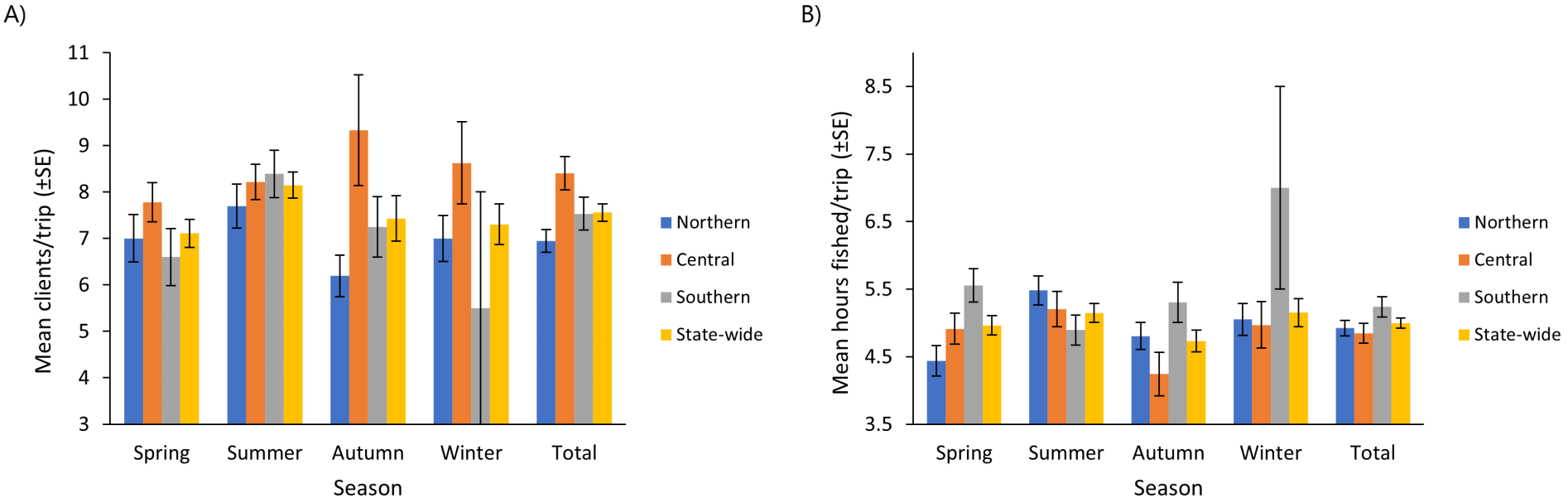
3.2.3 Effort

State-wide, 245 observed trips with 31 nearshore charter fishery operators were observed between January 2020 and June 2021, which included a total of more than 1,225 hours fishing. A total of 1,851 clients were present on observed trips, and ranged between 1 and 21 with an average (± SE) of 7.6 ± 0.2 clients per trip (Figure 4A). Hours fished during trips ranged from 1.4 (curtailed due to poor weather) to 8.5 hours with an average (± SE) of 5.0 ± 0.1 hours per trip (Figure 4B).

The highest mean (± SE) number of clients per observed trip occurred in the Central region (8.4 ± 0.4) with smaller numbers of clients per trip recorded in the Northern and Southern regions (7.0 ± 0.2 & 7.5 ± 0.4 clients per trip, respectively) (Figure 4A). Overall, the number of clients per observed trip was higher in summer (8.4 ± 0.5) than in spring, autumn and winter (7.1 ± 0.3, 7.4 ± 0.5 & 7.3 ± 0.3 clients per trip, respectively; Figure 4A). This pattern was similar across regions, except in the Central region where the highest clients per trip occurred in autumn.

Overall, the mean (± SE) number of hours fished per trip was higher in the Southern region (5.2 ± 0.2) than in the Northern and Central regions (4.9 ± 0.1 & 4.8 ± 0.2 h per trip, respectively; Figure 4B). Mean hours fished per trip was similar in spring, summer and winter (5.0 ± 0.2, 5.2 ± 0.1 & 5.2 ± 0.2 h per trip, respectively) and lowest in autumn (4.7 ± 0.2 h per trip; Figure 4B). However, this seasonal pattern was not consistent across regions.

Figure 4. Seasonal variation in: A) the mean (± SE) number of clients per trip, and B) the mean (± SE) hours fished per trip, in each of the MEMA management regions across the four seasons observed between January 2020 and June 2021. Number of trips per season and region can be found in Table 5.



3.2.4 Catch – total, kept and released

3.2.4.1 State-wide

On-board observers recorded the capture of 15,458 individual organisms of 138 different species state-wide (Table 7, Appendices 3 & 4). Just 34 species comprised 95% of the total observed catch; the other 104 species caught contributing the remaining 5% (Table 5, Appendices 3 & 4). The species observed caught in the greatest numbers state-wide were Bluespotted Flathead (1,746 individuals), Snapper (1,520), Blue Mackerel (1,334), Yellowtail Scad (1,102) and Longspine Flathead (*Platycephalus grandispinisis*; 1,075); these species comprised ~44% of the total observed catch.

Of the organisms caught, most (65.5%) were kept (10,126 individuals consisting of 105 species; Table 5, Appendices 3 & 4). Just 32 species comprised 95% of the total kept catch; the other 73 species caught contributing the remaining 5% (Table 5, Appendices 3 & 4). The species observed to be kept in the greatest numbers were Bluespotted Flathead (1,632 individuals), Snapper (1,327), Blue Mackerel (1,214), Yellowtail Scad (887) and Grey Morwong (658); these species comprised ~57% of the kept catch.

The remaining 34.5% (5,332 individuals comprising 101 species) were subsequently released. Just 33 species comprised 95% of the total released catch; the other 68 species caught contributing the remaining 5% (Table 5, Appendices 3 & 4). The species observed to be released in the greatest numbers were Longspine Flathead (955 individuals), Eastern Red Scorpionfish (726), Sergeant Baker (469), Yellowtail Kingfish (389) and Redfish (301); these species comprised ~53% of the released catch.

3.2.4.2 Regional patterns

Observed total catch varied between the MEMA management regions with highest number of individuals recorded in the Southern region (6,382 individuals) and consisting of 71 different species (Table 5, Appendix 3). The lowest number of individuals (3,383) were recorded in the Central region across 90 different species. In the Northern region 5,693 individuals of 95 different species were recorded (Table 5, Appendix 3).

The observed kept catch varied similarly between the reporting regions with highest number of individuals kept recorded in the Southern region (4,416 individuals) consisting of 56 different species (Table 5, Appendix 3). The lowest number of individuals (1,825), but highest number of species (70) kept were recorded in the Central region. The number of individuals kept recorded in the Northern region was 3,885 and was comprised of 64 different species (Table 5, Appendix 3).

The observed released catch also varied similarly between the reporting regions with highest number of released individuals recorded in the Southern region (1,966) consisting of 52 different species (Table 7, Appendix 3). The lowest number of released individuals (1,558), comprising 58 species were recorded in the Central region. The number of released individuals recorded in the Northern region was 1,808 and was made up of the highest number of species (70; Table 5, Appendix 3).

Several of the most important species in the fishery as a whole were shown to make a relatively consistent contribution to catches recorded across all regions. These included Bluespotted Flathead, Snapper, Blue Mackerel, Sergeant Baker, Redfish, Silver Sweep and Southern Maori Wrasse (Table 5, Appendix 3). For most species however, there was considerable spatial variation in their contribution to observed catches between regions. For example, the contribution of Longspine Flathead to catches was much lower in the Northern and Southern regions (2 & 6%, respectively), than in the Central region (17%; Table 5, Appendix 3). Similarly, Southern Sand Flathead (*Platycephalus bassensis*) made a higher contribution to the observed catches taken from the Southern region (8%) than in the Northern and Central regions (0% in each). Conversely, Teraglin, Pearl Perch and Venus Tuskfish (2, 3 & 2%, respectively) were important in the Northern region, but were not recorded in the other regions (0% in each).

Table 5. Top ten species and total individuals caught, % of catch released, and number of trips taken in each MEMA management region (Figure 1) and season recorded by on-board observers between January 2020 and June 2021.

Northern Region										
Season	**Spring**		**Summer**		**Autumn**		**Winter**		**Overall**	
No. trips observed	*26*		*23*		*26*		*23*		*98*	
Species	**Total**	**Release %**	**Total**	**Release %**	**Total**	**Release %**	**Total**	**Release %**	**Total**	**Release %**
Snapper	289	6.6	220	7.3	134	0.0	182	1.1	825	4.5
Yellowtail Scad	45	2.2	207	4.3	120	19.2	376	0.5	748	4.7
Bluespotted Flathead	284	17.6	68	13.2	148	0.0	56	0.0	556	10.6
Eastern Red Scorpionfish	92	92.4	114	97.4	92	100.0	121	97.5	419	96.9
Blue Mackerel	57	1.8	189	11.1	43	27.9	67	0.0	356	9.6
Redfish	41	97.6	234	53.4	15	93.3	10	70.0	300	62.0
Sergeant Baker	92	73.9	72	91.7	67	79.1	54	98.1	285	84.2
Pearl Perch	40	0.0	70	0.0	67	1.5	11	0.0	188	0.5
Silver Sweep	30	70.0	46	63.0	35	94.3	58	98.3	169	82.8
Ocean Jacket	14	7.1	5	80.0	4	25.0	141	0.0	164	3.7
…										
All individuals Sub-total	**1422**	**30.1**	**1628**	**35.3**	**1176**	**34.0**	**1467**	**27.6**	**5693**	**31.8**

Central Region										
Season	**Spring**		**Summer**		**Autumn**		**Winter**		**Overall**	
No. trips observed	*23*		*23*		*18*		*8*		*72*	
Species	**Total**	**Release %**	**Total**	**Release %**	**Total**	**Release %**	**Total**	**Release %**	**Total**	**Release %**
Longspine Flathead	144	93.1	84	100.0	157	99.4	125	88.0	510	94.9
Bluespotted Flathead	113	9.7	78	5.1	88	0.0	51	0.0	330	4.5
Ocean Jacket	124	1.6	138	5.1	3	33.3	6	0.0	271	3.7
Snapper	89	43.8	115	40.9	31	25.8	32	3.1	267	35.6
Yellowtail Scad	141	58.9	51	72.5	21	19.0	38	57.9	251	58.2
Redfish	64	67.2	52	38.5	23	73.9	43	0.0	182	44.0
Sergeant Baker	52	73.1	40	60.0	61	60.7	24	33.3	177	60.5
Eastern Red Scorpionfish	89	73.0	22	72.7	42	85.7	17	82.4	170	77.1
Grey Morwong	22	9.1	77	0.0	11	0.0	21	0.0	131	1.5
Blue Mackerel	73	4.1	33	3.0	9	0.0	12	0.0	127	3.1
…										
All individuals Sub-total	**1255**	**46.9**	**952**	**37.8**	**685**	**58.5**	**491**	**42.4**	**3383**	**46.1**

Southern Region **Season** *No. trips observed*	**Spring** *25*		**Summer** *36*		**Autumn** *12*		**Winter** *2*		**Overall** *75*	
Species	**Total**	**Release %**	**Total**	**Release %**	**Total**	**Release %**	**Total**	**Release %**	**Total**	**Release %**
Bluespotted Flathead	422	6.9	314	1.0	70	11.4	54	0.0	860	4.7
Blue Mackerel	497	8.7	281	7.5	72	25.0	1	0.0	851	9.6
Southern Sand Flathead	125	6.4	290	22.8	65	18.5			480	17.9
Snapper	166	28.3	163	8.0	80	1.3	19	0.0	428	14.3
Yellowtail Kingfish	37	29.7	266	82.7	123	48.8			426	68.3
Grey Morwong	127	7.9	182	1.6	64	3.1	14	0.0	387	3.9
Longspine Flathead	120	80.0	180	70.6	59	84.7	18	55.6	377	75.1
Southern Maori Wrasse	155	18.7	120	15.8	31	58.1	11	9.1	317	21.1
Reef Ocean Perch	129	42.6	118	37.3	54	68.5			301	45.2
Eastern Red Scorpionfish	137	74.5	71	78.9	44	54.5	3	100.0	255	72.5
…										
All individuals Sub-total	**2602**	**27.2**	**2658**	**33.1**	**959**	**35.0**	**163**	**26.4**	**6382**	**30.8**
Total no. trips observed	*74*		*82*		*56*		*33*		*245*	
All Individuals Grand Total	**5279**	**32.7**	**5238**	**34.7**	**2820**	**40.3**	**2121**	**30.9**	**15458**	**34.5**

3.2.4.3 Seasonal patterns

Considerable temporal variation in the total observed catch was also evident with the highest number of individuals recorded in spring (5,279 individuals) and summer (5,238), and lower catches observed in autumn (2,820) and winter (2,121; Table 5, Appendix 4). The species diversity of observed kept catches was also highest in summer (95 species) and lowest in winter (65 species) with 81 and 85 species recorded in spring and autumn, respectively (Table 5, Appendix 4).

Temporal variation in the observed kept catch similarly occurred with the highest number of individuals kept recorded in spring (3,555 individuals) and summer (3,423) with lower catches observed in autumn (1,683) and winter (1,465; Table 5, Appendix 4). The species diversity of observed kept catches was highest in autumn (74 species) and lowest in winter (49 species) with 63 and 70 species recorded kept in spring and summer, respectively (Table 5, Appendix 4).

The observed released catch also showed temporal variation with the highest number of individuals recorded in spring (1,724 individuals) and summer (1,815) and lower catches observed in autumn (1,137) and winter (656; Table 5, Appendix 4). The species diversity of observed released catches was also highest in spring (58 species) and summer (66 species) with fewer species recorded in autumn and winter (54 & 40 species, respectively; Table 5, Appendix 4).

Several of the most important species overall were shown to make a relatively consistent contribution to catches recorded across all seasons. These included Bluespotted Flathead, Snapper, Blue Mackerel, Grey Morwong, Sergeant Baker, Redfish, Silver Sweep and Southern Maori Wrasse (Table 5, Appendix 4). For other species however, there was considerable temporal variation in their contribution to observed catches between seasons (Table 5, Appendix 4). Yellowtail Scad made a much larger contribution to observed catches in winter (19.5%) in comparison with the rest of the year (mean 5.4%; Table 5, Appendix 4). Similarly, Ocean Jackets made a much smaller contribution to observed catches in autumn (0.1%) compared with the rest of the year (mean 5.0%). Yellowtail Kingfish also contributed <1% to observed catches in spring, but an average of 4.5% through the rest of the year.

3.2.5 Catch rates – total, kept and released

3.2.5.1 Individuals per trip

In the 245 state-wide fishing trips observed between January 2020 and June 2021, an average of 63.4 ± 2.6 individuals per trip was caught (Figure 5A). Of this, an average of 41.5 ± 2.0 individuals per trip were kept and 21.9 ± 1.3 individuals per trip were subsequently released.

Overall, the mean number of individuals caught per trip were higher in the Southern region (85.1 ± 5.7 individuals per trip) than in the Northern and Central regions (58.7 ± 3.0 & 46.3 ± 3.9 individuals per trip, respectively; Figures 5B-D). Catch rate was also strongly influenced by season with the mean number of individuals caught per trip lower in autumn (50.4 ± 4.8) than in spring, summer and winter (71.3 ± 5.5, 63.9 ± 4.2 & 66.3 ± 5.8 individuals per trip, respectively; Figure 5A). The catch rate for kept and released individuals was generally consistent with this pattern across all regions and seasons (Figures 8B-D). This temporal pattern of lowest catch per trip occurring in winter was consistent across all regions (Figures 5B-D).

3.2.5.2 Species per trip

State-wide, mean species diversity of the total catch per nearshore charter trip was 10.7 ± 0.3 species per trip (Figure 6A). Of this, an average of 7.2 ± 0.2 species per trip were kept and 5.3 ± 0.2 species per trip were released. This pattern of higher mean number of species kept than released per trip was consistent across all seasons and regions observed (Figures 6A-D).

Overall, the mean number of species caught per trip was higher in the Southern region (13.1 ± 0.6 species per trip) than in the Central or Northern regions (9.1 ± 0.4 & 10.8 ± 0.4 species per trip, respectively; Figures 6B-D). Average numbers of species kept and released per trip were consistent with this pattern (Figures 6B-D).

There was very little temporal variation in the average number of species caught per trip with total species per trip slightly higher in spring (12.1 ± 0.5 species per trip) than in summer, autumn and winter overall (9.5 ± 0.4, 10.6 ± 0.6 & 10.7 ± 0.8 species per trip, respectively; Figure 6A). This pattern was generally consistent for all regions (Figures 6B-D).

3.3 Discarding

3.3.1 State-wide

Overall, of the 15,458 individual organisms observed to be caught state-wide between January 2020 and June 2021, 5,333 (34.5%) were subsequently released (Table 5, Appendices 3 & 4). For species caught in the greatest numbers (those making up 95% of the total catch), the proportions released varied considerably between species. Species with high release rates included Mado (*Atypichthys strigatus*; 99%), Longspine Flathead (89%), Longfin Pike (*Dinolestes lewini*; 87%), Eastern Red Scorpionfish (*Scorpaena jacksoniensis*; 86%), Barracouta (*Thyrsites atun*; 75%), Sergeant Baker (71%), Yellowtail Kingfish (67%), and Silver Sweep (65%) (Table 5, Appendices 3 & 4). In comparison, species with low release rates included Pearl Perch (1%), Teraglin (2%), Grey Morwong (3%), Eastern Blackspot Pigfish (*Bodianus unimaculatus*; 3%), Australian Bonito (*Sarda australis*; 5%), Ocean Jacket (6%), Bluespotted Flathead (7%) and Blue Mackerel (9%) (Table 5, Appendices 3 & 4).

3.3.2 Regional & seasonal patterns

The percentage of the recorded catch released after capture varied seasonally with 40.3% of the catch released in autumn, but just 30.9% released in winter, with 32.7 and 34.7% released in spring and summer, respectively (Table 5, Appendix 4). There was also some spatial variability with 46.1% of the catch released in the Central region, compared with 31.8 and 30.8% in the Northern and Southern regions, respectively (Table 5, Appendix 3).

Figure 5. Mean (±SE) number of individuals discarded and retained per fishing trip in each of the MEMA management regions across the four seasons observed between January 2020 and June 2021: A) State-wide, B) Northern region, C) Central region, and D) Southern region. Number of trips observed per season and MEMA management region can be found in Table 5.

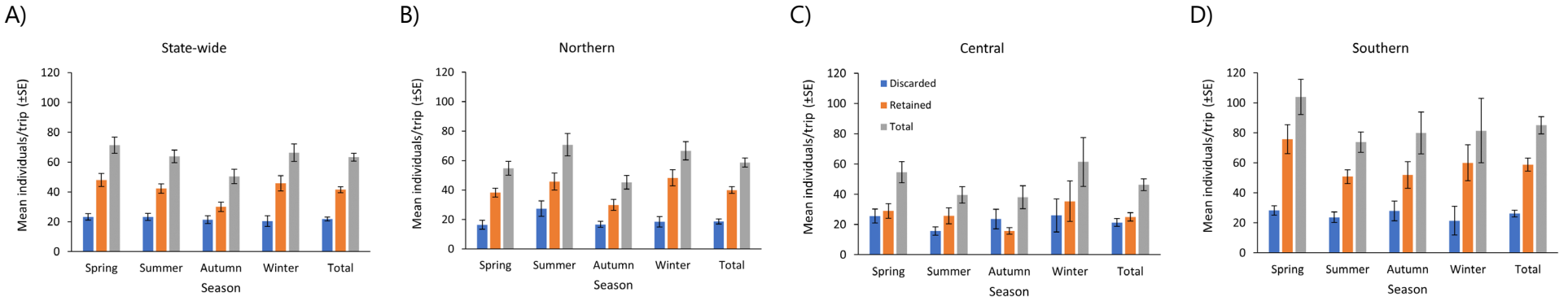
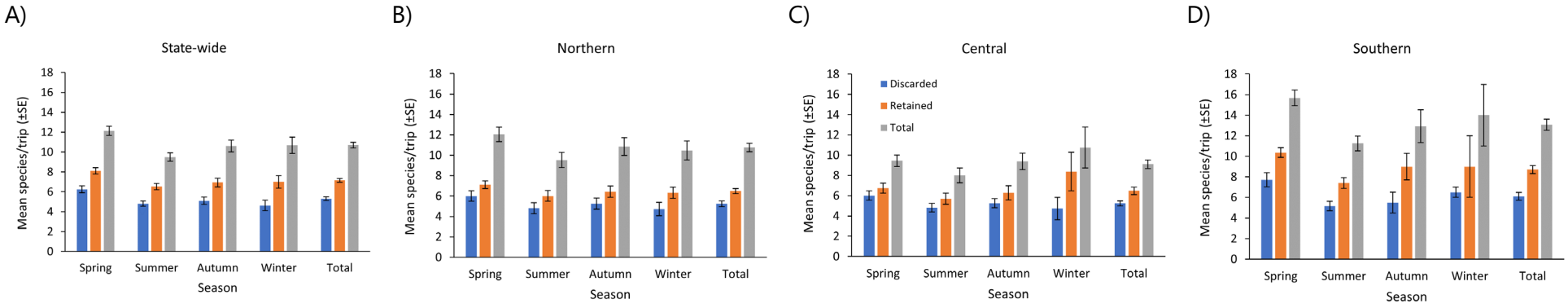


Figure 6. Mean (±SE) number of species discarded and retained per fishing trip in each of the MEMA management regions across the four seasons observed between January 2020 and June 2021: A) State-wide, B) Northern region, C) Central region, and D) Southern region. Number of trips observed per season and MEMA management region can be found in Table 5.



3.4 Length composition of observed catches

Overall, of the 15,458 individual organisms observed to be caught state-wide between January 2020 and June 2021, the lengths of 14,324 (93%) were measured by on-board observers prior to retention or release. High percentages of the six key species caught were measured with 96% of the 1,820 Bluespotted Flathead, 100% of the 1,520 Snapper, 99% of the 678 Grey Morwong, 88% of the 571 Yellowtail Kingfish, and 100% of the 189 Pearl Perch and 135 Teraglin caught. Of the other species contributing 95% of the total observed catch, the size composition of some were recorded in high percentages and large numbers (e.g., 96% of the 1,117 Longspine Flathead, 92% of the 848 Eastern Red Scorpionfish, 99% of the 664 Sergeant Baker, 98% of the 661 Redfish, 100% of the 583 Ocean Jackets, 94% of the 481 Southern Sand Flathead and 99% of the 452 Silver Sweep). Due primarily to *in situ* use for bait, some species also caught in large numbers had a much smaller percentage of their catch measured (e.g., 67% of 1,334 Blue Mackerel and 50% of 1,102 Yellowtail Scad).

3.4.1 Key species

The length compositions of the retained and released components of the catch of key species is shown in Figure 7. The majority of the 115 Bluespotted Flathead released after capture (7% of total) were a result of the mandated minimum legal length (MLL) of 33 cm TL for the species. Consequently, the majority (75%) of the retained catch was within 10 cm of this length with just 3% larger than 50 cm TL (Figure 7A). The largest Bluespotted Flathead recorded was 64 cm TL.

Thirteen percent of the Snapper caught were subsequently released, again primarily because of the MLL of 30 cm TL (~26 cm FL) for the species. As a result, a large proportion of the retained catch (90%) was between 26 and 40 cm FL. Just 9% of the retained catch (120 individuals) were recorded to be larger than 40 cm FL – up to the largest Snapper caught of 81 cm FL (Figure 7B).

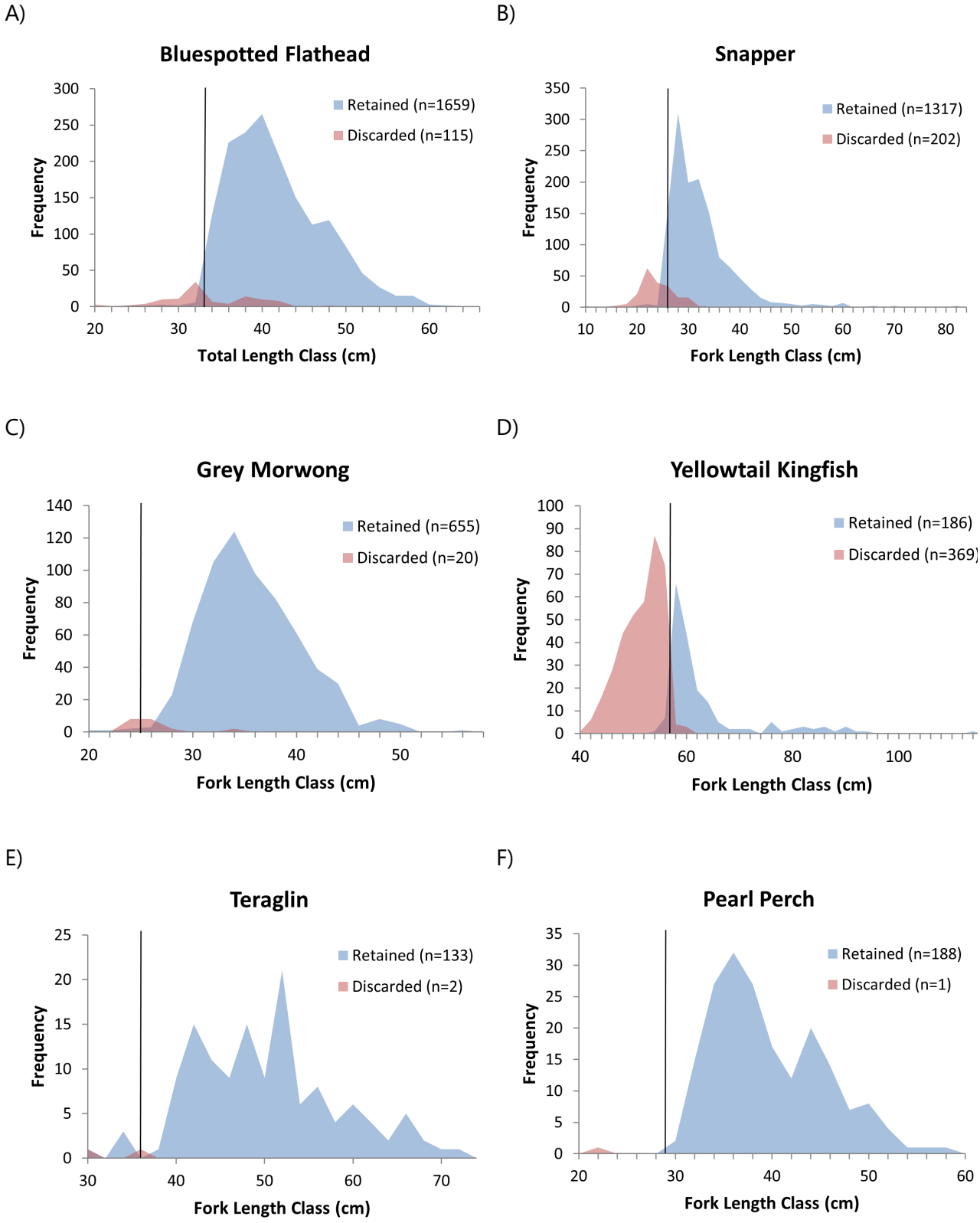
Very few Grey Morwong were released after capture (just 20 individuals, 3%), mostly those smaller than the MLL of 30 cm TL (~25 cm FL). A large proportion of the retained catch (76%) was within 10 cm of this length, but a considerable proportion of the retained catch (23%) was greater than this length (Figure 7C). The largest Grey Morwong recorded was 54 cm FL.

More Yellowtail Kingfish were released after capture (67%) than were retained (33%), as a result of being smaller than the MLL for the species of 65 cm TL (~57 cm FL; Figure 7D). The smallest Yellowtail Kingfish recorded were just 32 cm FL and 42% of the released catch were <50 cm FL (Figure 7D). The majority (79%) of the retained catch were within 10 cm of the MLL with the remainder >67 cm FL. The largest Yellowtail Kingfish recorded was 114 cm FL.

Almost all Teraglin caught were retained (99%) with just 2 individuals recorded released (Figure 7E). Most of the retained catch (78%) was between the MLL of 38 cm TL (~36 cm FL) and 56 cm FL, with the remaining 22% greater than this length up to the largest Teraglin recorded of 72 cm FL (Figure 7E).

Similarly, 99% of Pearl Perch were retained with a single individual recorded to have been released (Figure 7F). More than half of the retained catch (61%) was within 10 cm of the MLL of 30 cm TL (~29 cm FL), with the remaining 39% comprising individuals between 39 cm FL and 57 cm TL (Figure 7F).

Figure 7. Length frequency distributions of the retained (blue) and discarded (red) catch for key species recorded by on-board observers between January 2020 and June 2021 state-wide: A) Bluespotted Flathead, B) Snapper, C) Grey Morwong, D) Yellowtail Kingfish, E) Teraglin and F) Pearl Perch. *n* is sample size. Vertical black lines are the MLL for each species, respectively.



3.5 Wildlife interactions

Of the 245 observer trips undertaken between January 2020 and June 2021 state-wide, wildlife observations and records of interactions with charter fishing vessels were made on 231 trips (94%). Overall, a total of 571 observations were made from charter fishing vessels recording a total of 9,713 individuals consisting of 36 species (Table 6). The most commonly observed group were seabirds with 8,842 individuals (~91% of the total), followed by marine mammals (dolphins, whales, seals) with 868 individuals (~9% of the total, along with two elasmobranchs (Tiger Shark *Galeocerdo cuvier* and unidentified eagle ray) and one marine reptile (Green Turtle *Chelonia mydas*) (Table 6).

3.5.1 Seabirds

Twenty-seven species of seabirds from 10 families were positively identified, including four albatross species (Diomedeidae), four gull, noddy and tern species (Lardiae), three skuas (Stercorariidae), eight petrel, prion and shearwater species (Procellariidae), two storm petrels (Oceanitidae), one gannet (Sulidae), one pelican (Pelecanidae), two cormorants (Phalacrocoracidae), one oystercatcher (Haematopodidae) and one eagle (Accipitridae) (Table 6).

Shearwaters (Procellariidae) were the most abundant group recorded with 4,354 individuals (49% of all birds) recorded (Table 6). The next most abundant group were gulls, noddies and terns (Laridae) with 3,650 individuals (41%) recorded. All other groups contributed the remaining 10% of individuals recorded (Table 6). The most abundant species identified were Silver Gull *Chroicocephalus novaehollandiae* (Laridae) with 2,181 individuals recorded (25% of all birds), followed by 1,806 Short-tailed Shearwater (20%) *Ardenna tenuirostris* (Procellaridae), 1,387 Crested Tern (16%) *Sterna bergii* (Laridae) and 976 Flesh-footed Shearwater (11%) *A. carneipes* (Procellariidae; Table 6).

State-wide there was a strong seasonal pattern in seabird abundance with the highest number of birds recorded in spring (5,084 individuals, 57% of the total) and the lowest recorded in winter (329 individuals, 4%), with 2,422 (27%) recorded in summer and 1,007 recorded in autumn (11%; Table 6, Figure 11A). This pattern was driven by high seasonal abundances of the two most commonly recorded seabird groups, petrels, prions and shearwaters (Procellariidae), and gulls, noddies and terns (Laridae) (Table 6, Figure 8A). Southern storm petrels (Oceanitidae) were also far more abundant in summer (512 individuals recorded), than over the rest of the year (58 individuals recorded; Table 6, Figure 8A). Small numbers of gannets (Sulidae), skuas (Stercorariidae), cormorants (Phalacrocoracidae), albatrosses (Diomedeidae) and sea eagles (Accipitridae) were recorded consistently throughout the year.

Table 6. Seasonal abundance of wildlife recorded by observers from nearshore charter vessels between January 2020 and June 2021 state-wide.

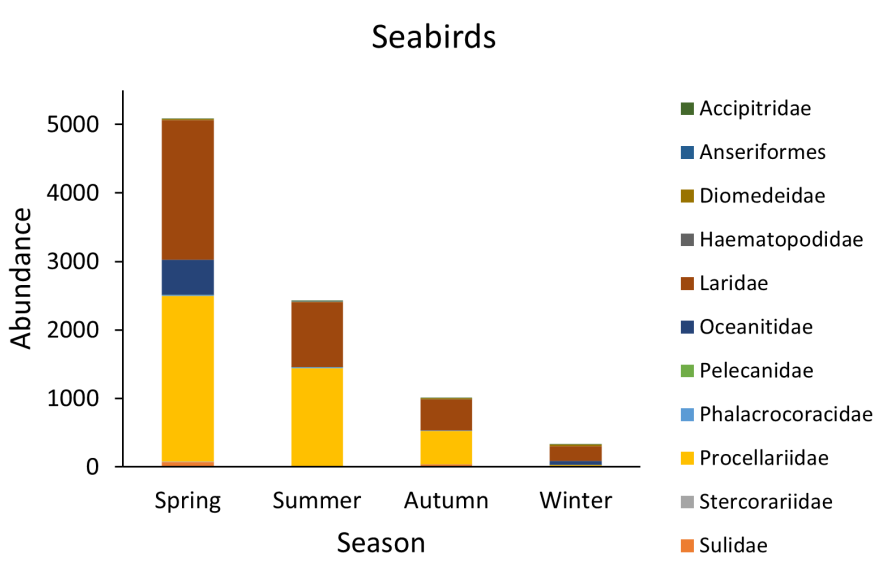
Taxon	Spring *(n = 71 trips)*	Summer *(n = 81 trips)*	Autumn *(n = 51 trips)*	Winter *(n = 30 trips)*	Total *(n = 231 trips)*
Birds (Aves)					
Albatrosses (Diomedeidae)	**9**	**16**	**18**	**22**	**65**
Black-browed Albatross *Thalassarche melanophris*	3	9	10	8	30
Buller's Albatross *T. bulleri*	1				1
Shy Albatross *T. cauta*	5	4	6	3	18
Yellow-nosed Albatross *T. cauteri*				1	1
Unidentified albatross		3	2	10	15
Gulls, noddies and terns (Laridae)	**2038**	**947**	**448**	**217**	**3650**
Silver Gull *Chroicocephalus novaehollandiae*	1219	470	353	139	2181
Crested Tern *Sterna bergii*	792	470	53	72	1387
White Tern *Gygis alba*		2			2
Little Tern *Sternula albifrons*	18	5	42	5	70
Unidentified tern	5				5
Unidentified gulls, noddies and terns	4			1	5
Skuas (Stercorariidae)	**2**	**4**	**3**		**9**
Pomarine Jaeger *Stercorarius pomarinus*		4	2		6
Great Skua *S. skua*			1		1
South Polar Skua *S. maccormicki*	2				2
Petrels, prions and shearwaters (Procellariidae)	**2420**	**1427**	**490**	**17**	**4354**
Antarctic Petrel *Thalassoica antarctica*		1			1
Black-winged Petrel *Pterodroma nigripennis*		120			120
Gould's Petrel *P. leucoptera*	4				4
Cape Petrel *Daption capense*	1	1	2		4
White-chinned Petrel *Procellaria aequinoctialis*		38	1		39
Flesh-footed Shearwater *Ardenna carneipes*	418	337	221		976
Short-tailed Shearwater *A. tenuirostris*	1285	399	122		1806
Wedge-tailed Shearwater *A. pacifica*	12	4	7	10	33
Unidentified shearwater	699	500	137	2	1338
Unidentified giant petrel *Macronectes* sp.				5	5
Unidentified petrel		1			1

Taxon	Spring *(n = 71 trips)*	Summer *(n = 81 trips)*	Autumn *(n = 51 trips)*	Winter *(n = 30 trips)*	Total *(n = 231 trips)*
Unidentified petrels, prions and shearwaters	1	26			27
Southern storm petrels (Oceanitidae)	**512**		**3**	**55**	**570**
White-bellied Storm Petrel *Fregetta grallaria*	300		1	55	356
White-faced Storm Petrel *Pelagodroma marina*	212		2		214
Gannets and Boobies (Sulidae)	**75**	**9**	**20**	**14**	**118**
Australian Gannet *Morus serrator*	75	9	20	14	118
Pelicans (Pelecanidae)	**1**	**1**			**2**
Australian Pelican *Pelecanus conspicillatus*	1	1			2
Cormorants and shags (Phalacrocoracidae)	**19**	**11**	**5**	**3**	**38**
Great Cormorant *Phalacrocorax carbo*			1		1
Pied Cormorant *P. varius*	8	6	3	3	20
Unidentified cormorant	11	5	1		17
Oystercatchers (Haematopodidae)			**2**		**2**
Sooty Oystercatcher *Haematopus fuliginosus*			2		2
Ducks, geese and swans (Anseriformes)		**2**			**2**
Unidentified ducks, geese and swans		2			2
Eagles, hawks, kites and harriers (Accipitridae)	**8**	**1**	**2**	**1**	**12**
White-bellied Sea Eagle *Haliaeetus leucogaster*	8	1	2	1	12
Unidentified birds		4	16		20
Total birds	**5084**	**2422**	**1007**	**329**	**8842**
Mammals (Mammalia)					
Baleen Whales (Mysticeti)	**110**		**12**	**144**	**266**
Humpback Whale *Megaptera novaeangliae*	106		12	142	260
Sei Whale *Balaenoptera borealis*				2	2
Southern Minke Whale *B. bonaerensis*	2				2
Southern Right Whale *Eubalaena australis*	1				1

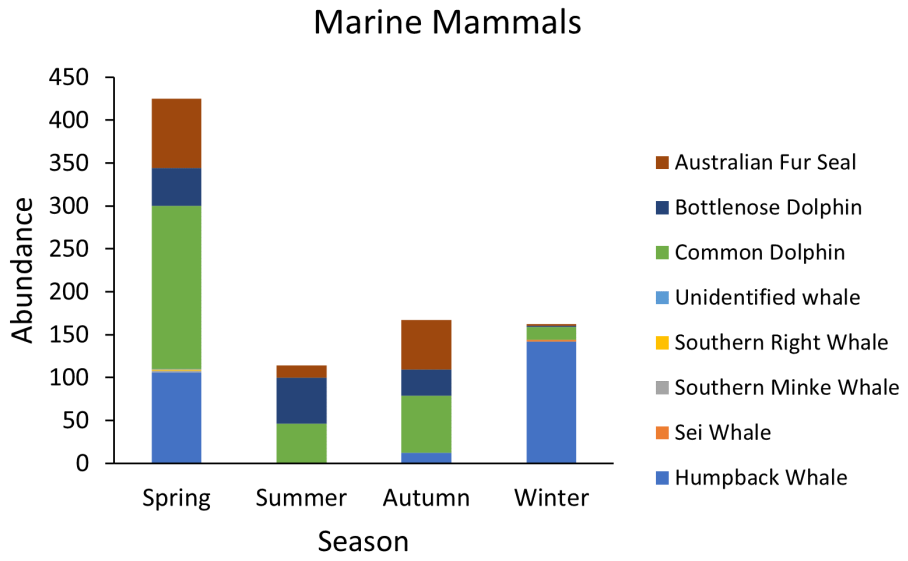
Taxon	Spring *(n = 71 trips)*	Summer *(n = 81 trips)*	Autumn *(n = 51 trips)*	Winter *(n = 30 trips)*	Total *(n = 231 trips)*
Unidentified whale	1				1
Oceanic Dolphins (Delphinidae)	**234**	**100**	**97**	**16**	**447**
Common Dolphin *Delphinus delphis*	190	46	67	15	318
Bottlenose Dolphin *Tursiops truncatus*	44	54	30	1	129
Eared Seals (Otariidae)	**81**	**14**	**58**	**2**	**155**
Australian Fur Seal *Arctocephalus pusillus dorsiferus*	81	14	58	2	155
Total mammals	**425**	**114**	**167**	**162**	**868**
Sharks, Skates and Rays (Elasmobranchii)					
Eagle Rays (Myliobatidae)				**1**	**1**
Unidentified eagle ray				1	1
Whaler Sharks (Carcharhinidae)			**1**		**1**
Tiger Shark *Galeocerdo cuvier*			1		1
Total elasmobranchs			**1**	**1**	**2**
Reptiles (Reptilia)					
Sea Turtles (Cheloniidae)		**1**			**1**
Green Turtle *Chelonia mydas*		1			1
Total reptiles		**1**			**1**
Grand Total	**5509**	**2537**	**1175**	**492**	**9713**

Figure 8. Seasonal abundance of A) Seabirds, and B) Marine mammals, recorded by observers from nearshore charter vessels between January 2020 and June 2021 state-wide. Common names for families can be found in Table 6.

A)



B)



3.5.2 Marine Mammals

Seven species of marine mammals were positively identified, including Common Dolphins *Delphinus delphis* and Bottlenose Dolphins *Tursiops truncatus* (Delphinidae), Humpback Whales *Megaptera novaeangliae*, Sei Whales *Balaenoptera borealis,* Southern Minke Whales *B. bonaerensis* and Southern Right Whales *Eubalaena australis* (Mysticeti), and Australian Fur Seals *Arctocephalus pusillus dorsiferus* (Otariidae) (Table 6).

Dolphins were the most abundant marine mammals with 447 individuals recorded, either Common Dolphins or Bottlenose Dolphins (Table 6). Two hundred and sixty-six whales, primarily Humpback Whales, and 155 Australian Fur Seals were also recorded (Table 6). Abundance of marine mammals was highly seasonal with far more individuals (425) recorded in spring than in summer (114), autumn (167) or winter (162; Table 6, Figure 8B). This pattern was primarily driven by high abundances of Common Dolphins, Humpback Whales and Australian Fur Seals (Table 6, Figure 8B). Humpback Whales were also recorded in large numbers in winter, in much smaller numbers in autumn and not at all in summer. Australian Fur Seals, Common Dolphins and Bottlenose Dolphins were recorded in all seasons, but were much more abundant in spring, summer and autumn than in winter (Table 6, Figure 8B).

3.5.3 Interactions

Overall, 9,713 individual animals were observed in the vicinity of charter fishing vessels during the study period state-wide, however only 37 events (comprising 135 individuals) were recorded where wildlife directly interacted with the fishery at a rate of 3.02 interactions per 100 h fishing (Table 7). These interactions occurred on 37 trips out of the 245 observed at a rate of 15.1% of trips. Direct interactions with the fishery were recorded in summer (17 occasions), autumn (9 occasions) and spring (11 occasions), but none were recorded in winter (Table 7). Marine mammals were recorded in 9 direct interactions (0.75 interactions per 100 h fishing) and 28 interactions involved seabirds (2.28 interactions per 100 h fishing).

3.5.4 Bycatch

Six incidences of bycatch were recorded, involving several species of seabirds becoming entangled in fishing line (two Flesh-footed Shearwaters and one Australian Gannet) or hooked, either in the mouth (one Black-browed Albatross and one Australian Gannet) or on the body (one Flesh-footed Shearwater; Table 7). All individuals were released alive. This represents a bycatch rate of 0.49 individuals per 100 h fishing. In addition, three Australian Fur Seals were hooked after either eating baited hooks (n=2), or whilst depredating hooked fish (n=1; Table 7).

Table 7. List of the 37 direct interactions between wildlife (n=135) and nearshore charter vessels recorded by observers between January 2020 and June 2021 state-wide. * denotes bycatch events recorded.

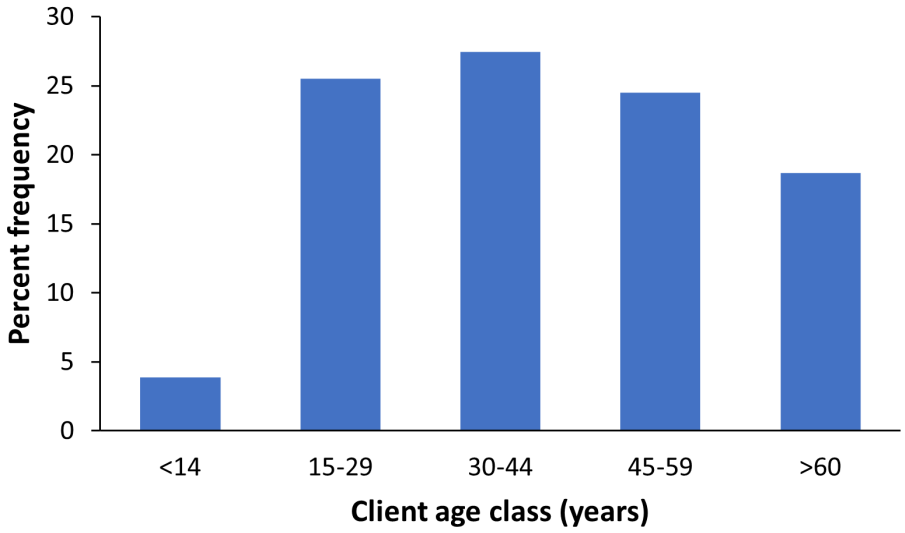
Season	Event date	Species	Family	Count	Details
Summer	15/01/2020	Unidentified shearwater	Procellariidae	2	Eating discarded bait
Summer	15/01/2020	Unidentified shearwater	Procellariidae	3	Eating discarded bait
Summer	17/01/2020	Unidentified shearwater	Procellariidae	2	Eating discarded bait
Summer	17/01/2020	Unidentified shearwater	Procellariidae	5	Eating discarded bait
Summer	22/01/2020	Short-tailed Shearwater	Procellariidae	1	Eating discarded bait
Summer	12/02/2020	Short-tailed Shearwater	Procellariidae	3	Eating discarded bait
Summer	12/02/2020	Short-tailed Shearwater	Procellariidae	12	Eating discarded bait
Summer	23/02/2020	Wedge-tailed Shearwater	Procellariidae	2	Eating discarded bait
Autumn	22/03/2020	Flesh-footed Shearwater	Procellariidae	1	Eating discards
Autumn	28/04/2020	Flesh-footed Shearwater	Procellariidae	15	Eating discarded bait
Spring	11/10/2020	Pied Cormorant	Phalacrocoracidae	1	Eating discards
Spring	24/10/2020	Flesh-footed Shearwater	Procellariidae	10	Eating discarded bait
Spring	30/10/2020	Flesh-footed Shearwater	Procellariidae	10	Eating discards
Spring	3/11/2020	Common Dolphin	Delphinidae	2	Chasing hooked fish
Spring	18/11/2020	Silver Gull	Laridae	16	Eating discards
Spring	21/11/2020	Flesh-footed Shearwater	Procellariidae	1	Eating discarded bait
Spring	22/11/2020	Unidentified shearwater	Procellariidae	7	Eating discards
Spring	26/11/2020	Silver Gull	Laridae	16	Eating discards
Spring	26/11/2020	Australian Fur Seal	Otariidae	2	Baited hook swallowed
Spring	27/11/2020	Australian Fur Seal	Otariidae	1	Removing bait
Spring	28/11/2020	Flesh-footed Shearwater	Procellariidae	2*	Entangled in fishing line, released alive
Summer	11/12/2020	Unidentified cormorant	Phalacrocoracidae	1	Eating discards
Summer	28/01/2021	Unidentified cormorant	Phalacrocoracidae	1	Eating discards
Summer	19/02/2021	Australian Fur Seal	Otariidae	2	Depredation of hooked fish
Summer	19/02/2021	Australian Fur Seal	Otariidae	1	Hooked depredating hooked fish
Summer	20/02/2021	Flesh-footed Shearwater	Procellariidae	2	Depredation of hooked fish
Summer	21/02/2021	Australian Fur Seal	Otariidae	1	Depredation of hooked fish
Summer	26/02/2021	Black-browed Albatross	Diomedeidae	1	Depredation of hooked fish
Summer	26/02/2021	Black-browed Albatross	Diomedeidae	1*	Baited hook swallowed, released alive
Summer	28/02/2021	Australian Fur Seal	Otariidae	1	Depredation of hooked fish
Autumn	1/03/2021	Australian Fur Seal	Otariidae	1	Depredation of hooked fish
Autumn	2/03/2021	Black-browed Albatross	Diomedeidae	3	Eating discards and discarded bait
Autumn	8/03/2021	Flesh-footed Shearwater	Procellariidae	1*	Foul hooked, released alive
Autumn	8/03/2021	Australian Gannet	Sulidae	1*	Entangled in fishing line, released alive
Autumn	2/04/2021	Wedge-tailed Shearwater	Procellariidae	2	Eating discarded bait
Autumn	7/04/2021	Australian Gannet	Sulidae	1*	Baited hook swallowed, released alive
Autumn	7/04/2021	Australian Fur Seal	Otariidae	1	Eating discards
Totals	**37 events**	**8 species**	**7 families**	**135**	**individuals**

3.6 Demography of charter clientele

Demographic data on the number of clients per trip, their sex and whether they were a member of a fishing club was collected via direct observation and trip booking information from a total of 1,862 clients on the 245 nearshore charter trips observed between January 2020 and June 2021 state-wide. Additional demographic data specific to client age, recreational and charter fishing activities and residence was collected during interviews with observers from 1,835 clients (98.5% of total). Non-participation in interviews with observers was primarily due to motion sickness.

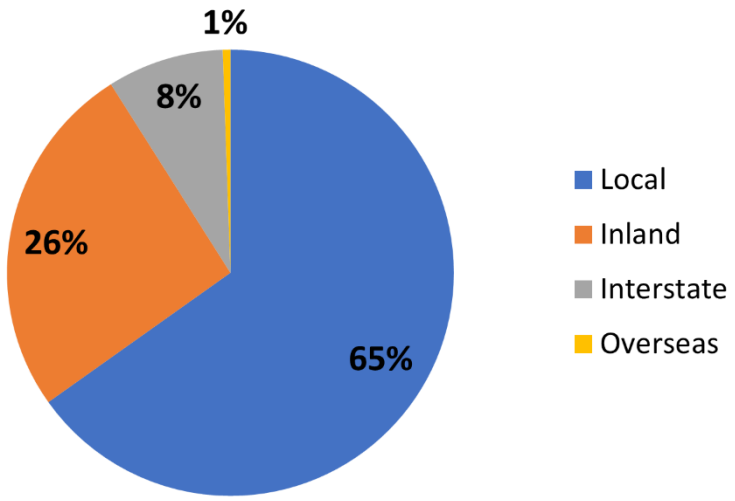
Overall, charter clients were primarily male (89.0%), with 11.0% female. Charter clients ranged in age from 2 to 92 years with the majority (93.6%) being adults (≥18 years old). Similar proportions of charter clients were aged between 15 and 29 (26%), 30 and 44 (28%) and 45 and 59 years (25%; Figure 9). Nineteen percent of clients were older than 60 years of age.

Figure 9. The age of charter clients recorded in interviews with on-board observers between January 2020 and June 2021 state-wide (n = 1,835).



Most (65%) charter clients came from the area local to the charter operation, however 34% came from inland regions of NSW or from interstate (Figure 10). Less than one percent of charter clients (n=7) came from overseas, including Canada, Germany, Ireland, and the United Kingdom. Seven percent of charter clients were members of one of 15 different fishing clubs recorded.

Figure 10. The residence of charter clients recorded in interviews with on-board observers between January 2020 and June 2021 state-wide (n = 1,835).



Seventy four percent of charter clients fished in the previous 12 months and 34% of these had been on a charter trip. Of these clients who had fished in the previous 12 months, 36% had fished for more than 20 days (Table 8). A further 32% fished for between 5 and 19 days with another 33% saying that they had fished for less than 5 days in the previous year.

In terms of charter fishing, 76% said they had spent less than 5 days charter fishing in the previous 12 months (Table 8) with 20% charter fishing for between 5 and 14 days. Just 3% said they had been charter fishing for more than 15 days in the previous year. The average number of charter days fished by clients in the previous 12 months was 3.7 ± 0.2 days with a maximum of 27 days.

Table 8. The number of days charter clients had been recreational fishing and charter fishing in the previous 12 months in interviews with on-board observers.

Number of days fished	Recreational fishing (%)	Charter fishing (%)
<5	32.5	76.1
5-9	13.6	10.1
10-14	13.7	10.3
15-19	4.6	2.8
>20	35.5	0.6

4.0 Discussion

Information presented via monitoring of the nearshore charter fishery in NSW demonstrates that the sector to provide important contributions to total catches for some species as well as important social and economic services to coastal communities throughout the state. Within the RFMP, observer monitoring on nearshore charter vessels also represents a key companion dataset to the biennial Recreational Fishing Research Surveys (e.g., Murphy *et al.* 2020, 2022) allowing the numbers of fish recorded in the survey to be converted into weight via length data collected from key recreational fish species caught by the charter fishery.

4.1 Logbook catch and effort

Total species and number of individuals recorded in logbooks in 2019/20 state-wide (~106,000 individuals of 138 species) were substantially lower than that recorded in logbooks for 2017/18 (~151,000 individuals from 146 species; Hughes *et al.* 2021), or that recorded in an earlier spatially restricted pilot study (~49,000 individuals of 109 species from six ports; Gray & Kennelly 2016). These contrasting temporal patterns in catch and effort likely highlights the impact that the COVID-19 pandemic and "Black Summer" bushfire disaster had on the operations of the NSW nearshore charter fishery in 2019/20, compared with 2017/18. Logbook data for 2019/20 revealed that patterns in catch and effort in the nearshore charter fishery varied considerably with latitude, with a gradient of increasing fishing effort (number of trips) and retained catch (number of individuals) recorded with decreasing latitude. Patterns in retained catch also mirrored those reported in the 2019/20 Recreational Fishing Research Survey (Murphy *et al.* 2022). Temporal patterns saw greatest catch and effort in spring-summer than in autumn-winter in 2019/20. The opposite pattern was seen in logbook data for 2017/18 with decreasing catch and effort seen with decreasing latitude, and higher catch and effort occurring in summer-autumn than in winter-spring (Hughes *et al.* 2021). This contrast in spatio-temporal patterns in catch and effort likely highlights the impact that the "Black Summer" bushfire disaster had on coastal communities and businesses, and operation of the nearshore charter fishery, which was particularly severe on the NSW South Coast during autumn 2019/20 (DPIE 2020).

Logbook data for 2019/20 indicated the top five species retained state-wide were Snapper, Bluespotted Flathead, Grey Morwong, Yellowtail Scad and Blue Mackerel, similar to those recorded in 2017/18 (Bluespotted Flathead, Snapper, Grey Morwong, Blue Mackerel and 'other' Flathead; Hughes *et al.* 2021). By contrast, in a pilot study carried out between December 2014 and November 2015, the top five species recorded in logbooks operating out of six ports during this time were Grey Morwong, Bluespotted Flathead, Snapper, Ocean Jackets and Redfish (Gray & Kennelly 2016), with Blue Mackerel the tenth-most important species and Yellowtail Scad not recorded in the top twenty species retained. The smaller numbers of these two species recorded in logbooks during this period were considered to be an artefact of their *in situ* use as bait, which was not quantified by operators (Gray & Kennelly 2016).

4.2 Comparison of logbook and observer data

Data collected by onboard observers is valuable in comparison with information collected by fishers in mandatory logbooks, thus enabling independent validation and identification of any

biases if present (Cotter & Pilling 2007, Chromy *et al.* 2009). This allows logbook data to be corrected for, or adjusted as required, for its potential use in monitoring, assessment, management, and by industry. As a consequence of the impact of the COVID-19 pandemic and the "Black Summer" bushfire disaster on the operations of the NSW charter fishery, the commencement of the charter observer monitoring program was postponed to January 2020, and extended to June 2021, in order to complete the planned spatio-temporal observer sampling effort (Table 1). As a result, data collected in logbooks for the 2019/20 financial year and that collected by observers were not in exact temporal alignment.

Nonetheless, comparison of state-wide effort data from the two sources revealed that the number of clients per trip recorded in logbooks were similar to those recorded by observers (7.3 ± 0.1 & 7.6 ± 0.2 clients per trip, respectively). Conversely, the number of hours fished per trip recorded in logbooks were higher (5.8 ± 0.1) than the number of hours fished per trip recorded by observers (5.0 ± 0.1). This pattern was similarly identified in previous pilot monitoring of a subset of the NSW nearshore charter fishery in 2017-18 (Hughes *et al.* 2021) and 2014-15 (Gray & Kennelly 2016), with the number of clients per trip recorded being similar between the two data sources, but the number of hours fished lower when recorded by observers than in logbooks.

In terms of state-wide catch data, the number of retained individuals per trip recorded in logbooks (29.3 ± 0.4) was considerably lower than the same information recorded by observers (41.5 ± 2.0 individuals per trip). Similarly, the species diversity of the retained catch as recoded in logbooks was just 4.3 ± 0.1 species per trip, whereas the species diversity of the retained catch recorded by observers was 7.2 ± 0.2 species per trip. A very similar pattern was previously reported in 2017-18 (Hughes *et al.* 2021), where the state-wide catch per trip consisted of 33.2 ± 0.4 individuals and 4.5 ± 0.1 species per trip, respectively, compared with an observed retained catch of 47.1 ± 2.6 individuals and 8.0 ± 0.3 species per trip, respectively. A clear indicator of bias is therefore identified in an underestimate of the numbers of individual fish and the species diversity of the retained catch recorded in logbooks, when evaluated against data collected by independent observers.

The top five species recorded retained state-wide in logbooks and by observers were similar in this study (logbook: Snapper, Bluespotted Flathead, Grey Morwong, Yellowtail Scad, Blue Mackerel; observer: Bluespotted Flathead, Snapper, Yellowtail Scad, Blue Mackerel, Longspine Flathead). Longspine Flathead is not required to be reported in logbooks, instead captured within the species group 'other' Flathead (see Appendices 1 & 2). Although the species' ranks of importance were different in each dataset, the consistency in species composition between the two sources was similarly also found in earlier pilot studies using NSW nearshore charter vessels operating out of six ports (Gray & Kennelly 2016) or over a smaller spatial scale (Terrigal – Narooma; Hughes *et al.* 2021).

4.3 Discarding

Most organisms caught were kept (66%) with the remaining 34% discarded in 2020-21, an identical release rate to that recorded in 2017-18 (Hughes *et al.* 2021), and similar to that recorded in 2014-15 (38%; Gray & Kennelly 2016). Species with highest (Mado, Longspine Flathead, Longfin Pike, Eastern Red Scorpionfish, Barracouta, Sergeant Baker) and lowest (Pearl Perch, Teraglin, Grey Morwong, Eastern Blackspot Pigfish, Australian Bonito, Ocean Jacket)

discard rates recorded in this study were similar to those recorded in 2014-15 and 2017-18 (Gray & Kennelly 2016, Hughes *et al.* 2021).

4.4 Length composition of observed catches for key species

For key species targeted by the fishery (Bluespotted Flathead, Snapper, Grey Morwong, Yellowtail Kingfish, Teraglin, Pearl Perch), most of the retained catch (61-90%) was within 10 cm of their respective MLLs. A very similar pattern where the majority of retained individuals for some of the same key species was within 10 cm of the MLL was also recorded in 2017-18 (Hughes *et al.* 2021) and 2014-15 (Gray & Kennelly 2016). This pattern was also similar to those documented for Snapper, Grey Morwong and Bluespotted Flathead in the coastal trailer boat fishery (Steffe & Murphy 2011) and the commercial ocean trap and line fishery (Stewart & Hughes 2008).

4.5 Wildlife abundance and interactions

The number of observations, species diversity and counts of individuals in the vicinity of charter vessels in 2020-21 state-wide (571 observations, 36 species, ~9,700 individuals) was far greater than for an earlier pilot study undertaken over a much smaller part of the NSW coast (Terrigal – Narooma) between October 2017 and September 2018 (482 observations, 28 species, ~3,600 individuals; Hughes *et al.* 2021, 2022). Despite this, seabirds were by far the most abundant group observed in both studies, contributing ~90% of all wildlife observed (mainly Shearwaters and Gulls/Terns), followed by marine mammals (seals, dolphins and whales). A similarly low rate of direct interactions between wildlife and the fishery was also recorded in 2017-18 (5.20 per 100 h fishing) compared with that reported here for 2020-21 (3.02 per 100 h). Rates of bycatch were also similarly low in the current study (0.49 per 100 h fishing) compared with that recorded in 2017-18 (0.16 per 100 h; Hughes *et al.* 2021, 2022).

4.6 Demography of charter clients

Charter clients were predominantly (~90%) male, and this has not changed historically from previous observer studies (Gray & Kennelly 2016, Hughes *et al.* 2021) or that reported in off-site recreational fishing surveys in NSW (e.g., West *et al.* 2015, Murphy *et al.* 2020, 2022). The percentage of charter clients from the area local to the charter operation (65%) declined compared with 2017-18 (81%), however the percentage of clients from inland regions of NSW or from interstate (34%) increased compared with 2017-18 (14%; Hughes *et al.* 2021). Less than 1% of charter clients came from overseas in 2020-21, whereas 5% of charter clients came from overseas in 2017-18. These changes in client residence between the two periods are likely due to restrictions to overseas travel in place due to the COVID-19 pandemic during 2020-21.

4.7 Recommendations

Industry logbook data represents a potentially cost-effective means of collecting retained catch and catch rate information for key recreational species harvested by the fishery, however if these metrics are going to be used for monitoring and assessment purposes (e.g., Fowler *et al.* 2022), a

periodic independent observer program will be key to evaluate and adjust for any bias identified in logbook data.

The data series represented by the biennial monitoring of the NSW Charter Fishery has already been identified as a key emerging data series for informing recreational fishing-specific Performance Indicators within multi-sector harvest strategies (Fowler *et al.* 2022). Such a developing time series will be crucial in the development of future harvest strategies for key recreational fish stocks and species in NSW.

As well as evaluation of industry logbooks, independent observer monitoring of the NSW nearshore charter fishery provides an opportunity to collect additional information complementary to that collected by logbooks for use in assessment and management of NSW's fisheries resources. Such information includes species composition of discards and rates of discarding, the lengths of retained and discarded catch, and assessment of impacts on non-target species, and demographic information collected on charter clientele for provision to industry.

5.0 References

Chromy, J. R., S. M. Holland, and R. Webster. (2009). Consultants' Report: For-Hire Recreational Fisheries Surveys. Submitted to the For-Hire Work Group, National Marine Fisheries Service, March 2009.

Cotter, A. J. R., & Pilling, G. M. (2007). Landings, logbooks and observer surveys: Improving the protocols for sampling commercial fisheries. Fish & Fisheries, 8: 123–152.

Crowe F.M., Longson I.G. and Joll, L.M. (2013). Development and implementation of allocation arrangements for recreational and commercial fishing sectors in Western Australia. Fisheries Management and Ecology 20: 201–210.

Dell'Apa, A., Knight, E., Overton, A. S., Landry, C. E., Dumas, C. F., Whitehead, J. C., & Herstine, J. H. (2015). The North Carolina charter boat fishery changing with the times: A comparative analysis of the catch composition (1978 and 2007–2008). Fisheries, 40: 222–233.

DPIE (2020) NSW Fire and the Environment 2019–20 Summary; Biodiversity and landscape data and analyses to understand the effects of the fire events. Department of Planning, Industry and Environment, NSW

Fenichel, E.P., Gentner B. and Arlinghaus, R. (2013). Normative considerations for recreational fishery management: a bioeconomic framework for linking positive science and normative fisheries policy decisions. Fisheries Management and Ecology, 20: 223–233.

Fowler, A.M., Ochwada-Doyle, F.A., Dowling, N.A., Folpp, H., Hughes, J.M., Lowry, M.B., Lyle, J.M., Lynch, T.P., Miles, N.G., Chick, R.C. (2022). Integrating recreational fishing into harvest strategies: linking data with objectives. ICES Journal of Marine Science 79: 285-307.

Gray, C. A., & Kennelly, S. J. (2016). First implementation of an independent observer program for the Charter Boat Industry of NSW: data for industry-driven resource sustainability. Fisheries Research and Development Corporation Project 2014/036 Final Report. WildFish Research, ISBN 978-0-9941504-9-3. 71 pp.

Henry, G.W. and Lyle, J.M. (2003). The National Recreational and Indigenous Fishing Survey. Fisheries Research and Development Corporation, Project No. 99/158. Canberra, Australia: Australian Government Department of Agriculture, Fisheries and Forestry.

Hyder, K., Weltersbach, M.S., Armstrong, M., Ferter, K., Townhill, B., Ahvonen, A., Arlinghaus, R., Baikov, A., Bellanger, M., Birzaks, J. and Borch, T., *et al.* (2018). Recreational sea fishing in Europe in a global context—Participation rates, fishing effort, expenditure, and implications for monitoring and assessment. Fish and Fisheries, 19(2): 225-243.

Hughes, J.M., Johnson, D.D., Murphy, J.J. and Ochwada-Doyle, F.A. (2021). The NSW Recreational Fisheries Monitoring Program, Charter Fishery Monitoring, 2017/18, Fisheries Final Report Series No. 159, Department of Primary Industries (NSW Government), NSW.

Hughes, J.M., Johnson, D.D., Collins, D., Ochwada-Doyle, F.A., Murphy, J.J. (2022). Factors affecting seabird abundance and interaction with the nearshore 'for hire' recreational charter fishery in New South Wales, Australia. Aquatic Conservation: Marine & Freshwater Research 32: 385-399.

Lichtkoppler, F., O'Keefe, D. M., Lucente, J., & Gabriel, T. (2015). The great lakes charter fishing industry: 2002 to 2011. Fisheries, 40: 200–212.

McIlgorm, A. and Pepperell, J. (2013). Developing a cost-effective state-wide expenditure survey method to measure the economic contribution of the recreational fishing sector in NSW in 2012. A report to the NSW Recreational Fishing Trust, NSW Department of Primary Industries, November 2013. Produced by the Australian National Centre for Ocean Resources and Security (ANCORS), University of Wollongong.

McIlgorm, A. and J. Pepperell (2014). An economic survey of the Recreational fishing charter boat industry in NSW. A report to the NSW Department of Primary Industries by Dominion Consulting Pty Ltd.

McPhee, D.P. (2017). Urban Recreational Fisheries in the Australian Coastal Zone: The Sustainability Challenge. Sustainability 2017, 9, 422.

Moore, A., Schirmer, J., Magnusson, A., Keller, K., Hinten, G., Galeano, D., Woodhams, J., Wright, D., Maloney, L. (2023). National Social and Economic Survey of Recreational Fishers 2018-2021. Fisheries Research and Development Corporation, Project No. 2018-161. Canberra, Australia: Fisheries Research and Development Corporation, Australian Bureau of Agricultural and Resource Economics, University of Canberra.

Murphy, J.J., Ochwada-Doyle, F.A., West, L.D., Stark, K.E. and Hughes J.M. (2020). Survey of recreational fishing in NSW, 2017/18, Fisheries Final Report Series No. 158, Department of Primary Industries (NSW Government), NSW.

Murphy, J.J., Ochwada-Doyle, F.A., West, L.D., Stark, K.E., Hughes J.M. and Taylor, M.D. (2022). Survey of recreational fishing in NSW, 2019/20, Fisheries Final Report Series No. 161, Department of Primary Industries (NSW Government), NSW.

Ochwada-Doyle, F.A., Stark, K.A., Hughes, J.M., Murphy, J.J., Lowry, M.B., West, L.D. (2021a). Temporal and regional variation in catch across an extensive coastal recreational fishery: Exploring the utility of survey methods to guide and assess spatio-temporal management initiatives. PLoS ONE 16: e0254388.

Ochwada-Doyle, F.A., Miles, N.G., Stark, K.A., Hughes, J.M., Murphy, J.J., Lowry, M.B., West, L.D. (2021b). Spatial variation in species-specific catch and size structures across a large-scale and diffuse freshwater recreational-only fishery. Fisheries Management & Ecology 29: 1–15.

Ochwada-Doyle, F.A., Hughes, J.M., Fowler, A.M., Murphy, J.J., Stark, K.A., Lowry, M.B., West, L.D., Taylor, M.D. (2023). Quantifying the potential impact of reducing recreational harvest limits on the catch of a key marine species using off-site angler survey data. ICES Journal of Marine Science 80(2): 295–307.

Ryan, K.L., Trinnie, F.I., Jones, R., Hart, A.M. and Wise, B.S. (2016). Recreational fisheries data requirements for monitoring catch shares. Fisheries Management and Ecology, 23: 218-233.

Stewart, J., and Hughes, J.M. (2008). Determining appropriate sizes at harvest for species shared by the commercial trap and recreational fisheries in New South Wales. FRDC Project No. 2004/035, NSW Department of Primary Industries – Fisheries Final Report Series, No. 97, ISSN 1449-9967, 282pp.

Steffe, A.S., and Murphy, J.J. (2011). Recreational fishing surveys in the Greater Sydney Region. Fisheries Final Report Series No. 131, 122pp.

Sutinen, J.G. and Johnston, R. (2003). Angling management organizations: integrating the recreational sector into fishery management, Marine Policy, 27, issue 6, 471-487.

West, L.D., Stark, K.E., Murphy, J.J., Lyle, J.M. and Ochwada-Doyle, F.A. (2015). Survey of Recreational Fishing in New South Wales and the ACT 2013/14, Fisheries Final Report Series No. 149, Department of Primary Industries (NSW Government), NSW.

6.0 Appendices

Appendix 6.1

Numbers of individuals of each species retained by the nearshore charter fishery in each MEMA management region and state-wide as recorded in industry logbooks during 2019/20. ±

Common name	Species name/s	Region			
		Northern	Central	Southern	Total
	No. trips	*1520*	*1300*	*803*	*3623*
Snapper	*Chrysophrys auratus*	13391	3423	3684	20498
Bluespotted Flathead	*Platycephalus caeruleopunctatus*	5921	8025	6320	20266
Grey Morwong	*Nemadactylus douglasii*	1040	4531	3576	9147
Yellowtail Scad	*Trachurus novaezelandiae*	4450	1897	280	6627
Blue Mackerel	*Scomber australasicus*	2559	979	862	4400
Ocean Jacket	*Nelusetta ayraud*	458	2308	1337	4103
Teraglin	*Atractoscion atelodus*	3566	16		3582
Yellowtail Kingfish	*Seriola lalandi*	709	1870	931	3510
Sweep	*Scorpis lineolata*	365	1889	725	2979
Flathead (other)	Platycephalidae - undifferentiated	1711	240	889	2840
Pearl Perch	*Glaucosoma scapulare*	2348	172	64	2584
Southern Maori Wrasse	*Ophthalmolepis lineolatus*	440	1431	579	2450
Redfish	*Centroberyx affinis*	78	1458	624	2160
Tiger Flathead	*Platycephalus richardsoni*	119	761	1263	2143
Eastern Pigfish	*Bodianus unimaculatus*	256	901	467	1624
Dusky Flathead	*Platycephalus fuscus*	1303	202	75	1580
Leatherjacket (other)	Monacanthidae - undifferentiated	490	443	406	1339
Venus Tuskfish	*Choerodon venustus*	1275		33	1308
Silver Trevally	*Pseudocaranx georgianus*	407	464	90	961
Sergeant Baker	*Latropiscis purpurissatus*	18	660	238	916
Australian Bonito	*Sarda australis*	133	552	35	720
Sixspine Leatherjacket	*Meuschenia freycineti*	159	328	213	700
Eastern Red Scorpionfish	*Scorpaena jacksoniensis*	234	188	213	635
Eastern School Whiting	*Sillago flindersi*	26	556	31	613
Sweetlips	Haemulidae - undifferentiated	2	516	85	603
Ocean Reef Perch	*Helicolenus percoides*		29	559	588
Mahi Mahi	*Coryphaena hippurus*	416	150	3	569
School Mackerel	Scombridae - undifferentiated		423	129	552
Marbled Flathead	*Platycephalus marmoratus*	279	168	34	481
Longfin Pike	*Dinolestes lewini*	5	233	159	397
Barracouta	*Thyrsites atun*	4	94	259	357
Deepsea Ocean Perch	*Helicolenus* spp.	10	173	146	329
Moses' Snapper	*Lutjanus russellii*	208	65	12	285
Southern Calamari	*Sepioteuthis australis*		143	117	260
Crimsonband Wrasse	*Notolabrus gymnogenis*	124	44	89	257
Jackass Morwong	*Nemadactylus macropterus*	3	43	176	222
Eastern Orange Perch	*Lepidoperca pulchella*	22	45	155	222

Common name	Species name/s	Region			
		Northern	Central	Southern	Total
	No. trips	*1520*	*1300*	*803*	*3623*
Amberjack	*Seriola dumerili*	196	6		202
Tailor	*Pomatomus saltatrix*	68	125		193
Goldspot Pigfish	*Bodianus perditio*	106	72	13	191
Yellowfin Pigfish	*Bodianus flavipinnis*	5	41	134	180
Samson fish	*Seriola hippos*	140	31		171
Estuary Leatherjacket (rough/fanbelly)	*Scobinichthys granulatus* & *Monacanthus chinensis*	2	40	109	151
Longfin Perch	*Caprodon longimanus*	4	42	101	147
Mulloway	*Argyrosomus japonicus*	134	13		147
Gummy Shark	*Mustelus antarcticus*	77	22	36	135
Fusiliers, Tropical Snappers & Slopefishes	Caesionidae, Lutjanidae & Symphysanodontidae - undifferentiated	128			128
Bastard Red Cod	*Pseudophycis breviuscula*	5	117		122
Red Gurnard	*Chelidonichthys kumu*	12	58	26	96
Spotted Mackerel	*Scomberomorus munroi*	85	8	2	95
Tarwhine	*Rhabdosragus sarba*	74	13		87
Jack Mackerel	*Trachurus declivis*			74	74
Banded Rockcod	*Epinephelus ergastularius*	28		28	56
Common Blacktip Shark	*Carcharhinus limbatus*	55			55
Australian Salmon	*Arripis trutta*		41	10	51
Smooth Flutemouth	*Fistularia commersonii*		48		48
Blacksaddle Goatfish	*Parupeneus spilurus*	44	3		47
Bar Rockcod	*Epinephelus septemfasciatus*	11	27	2	40
Flounders	Paralichthyidae - undifferentiated	10	26	3	39
Spanish Mackerel	*Scomberomorus commerson*	38			38
Eastern Wirrah	*Acanthistius ocellatus*	4	31	1	36
Maori Rockcod	*Epinephelus undulatostriatus*	35			35
Gemfish	*Rexea solandri*		20	14	34
Cobia	*Rachycentron canadum*	30	1		31
Hussar	*Lutjanus adetii*	8		22	30
Sand Whiting	*Sillago ciliata*		25	5	30
Black Bream	*Acanthopagrus butcheri*	28	1		29
Southern Bluefin Tuna	*Thunnus maccoyii*			28	28
Crimson Snapper	*Lutjanus erythropterus*			27	27
Bluethroat Wrasse	*Notolabrus tetricus*		11	16	27
Skipjack Tuna	*Katsuwonus pelamis*		17	10	27
John Dory	*Zeus faber*	4	20	3	27
Green Jobfish	*Aprion virescens*	27			27
Mackerel Tuna	*Euthynnus affinis*	15	2	5	22
Bigeye Ocean Perch	*Helicolenus barathri*	18			18
Unidentified		3	5	9	17
Latchet	*Pterygotrigla polyommata*		5	11	16
Eastern Blue Groper	*Achoerodus viridis*	5	10	1	16
Spanner Crab	*Ranina ranina*	16			16
Silver Dory	*Cyttus australis*		2	12	14
Parrotfish	Scaridae - undifferentiated	13	1		14

Common name	Species name/s	Region			
		Northern	Central	Southern	Total
	No. trips	*1520*	*1300*	*803*	*3623*
Shortfin Mako	*Isurus oxyrinchus*	1	5	5	11
Spotted Armour Gurnard	*Satyrichthys rieffeli*		9	2	11
Yellowfin Bream	*Acanthopagrus australis*	3	8		11
Leaping Bonito	*Cybiosarda elegans*	11			11
Red Mullet	Mullidae - undifferentiated	5	5		10
Blue-Eye Trevalla	*Hyperoglyphe antarctica*	5	2	1	8
Bluestriped Goatfish	*Upeneichthys lineatus*	1	7		8
Trumpeter Whiting	*Sillago maculata*		7		7
Maori Octopus	*Octopus maorum*		7		7
Wahoo	*Acanthocybium solandri*	7			7
Stingrays/Stingarees	Myliobatiformes - undifferentiated		6		6
Eastern Shovelnose Ray	*Aptychotrema rostrata*	1	5		6
Rainbow Runner	*Elagatis bipinnulata*	5	1		6
Bluespotted Goatfish	*Upeneichthys vlamingii*		4	1	5
Silver Drummer	*Kyphosus sydneyanus*	1	4		5
Sea Mullet	*Mugil cephalus*	4	1		5
Largetooth Beardie	*Lotella rhacina*		3	1	4
School Shark	*Galeorhinus galeus*	3		1	4
Mirror Dory	*Zenopsis nebulosa*			3	3
Southern Herring	*Herklotsichthys castelnaui*			3	3
Blue Warehou	*Seriolella brama*			3	3
Red Morwong	*Cheilodactylus fuscus*		1	2	3
Rock Blackfish	*Girella elevata*		3		3
Bigeye Trevally	*Caranx sexfasciatus*	3			3
Eastern Fiddler Ray	*Trygonorrhina fasciata*		3		3
Yellowfin Tuna	*Thunnus albacares*			2	2
Bronze Whaler	*Carcharhinus brachyurus*		1	1	2
Pink Ling	*Genypterus blacodes*	1		1	2
Longtail Tuna	*Thunnus tonggol*	2			2
Cuttlefish (other)	Sepiida - undifferentiated		2		2
Longfin Mako	*Isurus paucus*		2		2
Frigate Mackerel	*Auxis thazard*		2		2
Broadnose Shark	*Notorynchus cepedianus*	2			2
Spangled Emperor	*Lethrinus nebulosus*	2			2
Gould's Squid (Arrow)	*Nototodarus gouldi*		2		2
Snook	*Sphyraena novaehollandiae*			1	1
Dart	*Trachinotus coppingeri & T. blochii*	1			1
Giant Trevally	*Caranx ignobilis*	1			1
Albacore	*Thunnus alalunga*		1		1
Gloomy Octopus	*Octopus tetricus*	1			1
Rock Ling	*Genypterus tigerinus*		1		1
Shark Ray	*Rhina ancylostoma*		1		1
Rosy Snapper	*Pristipomoides filamentosus*	1			1
Sole (other)	Soleidae - undifferentiated		1		1
Hapuku	*Polyprion oxygeneios*		1		1
Freespine Flathead	*Ratabulus diversidens*		1		1
Bass Groper	*Polyprion americanus*		1		1

Common name	Species name/s		Region			
			Northern	Central	Southern	Total
		No. trips	*1520*	*1300*	*803*	*3623*
Smooth Hammerhead	*Sphyrna zygaena*		1			1
Red Bullseye	*Priacanthus macracanthus*		1			1
Total			**44020**	**36401**	**25587**	**106008**

Appendix 6.2

State-wide numbers of individuals of each species retained by the nearshore charter fishery in each season as recorded in industry logbooks during 2019/20. Species names are given in Appendix 1.

Common name	Season				
	Spring	Summer	Autumn	Winter	Total
No. trips	*1059*	*1434*	*322*	*808*	*3623*
Snapper	6812	6645	1361	5680	20498
Bluespotted Flathead	5334	9143	2156	3633	20266
Grey Morwong	2967	3057	849	2274	9147
Yellowtail Scad	1036	4063	280	1248	6627
Blue Mackerel	823	2650	344	583	4400
Ocean Jacket	1081	1662	328	1032	4103
Teraglin	1031	1747	276	528	3582
Yellowtail Kingfish	836	1327	385	962	3510
Sweep	1075	1204	177	523	2979
Flathead (other)	831	703	222	1084	2840
Pearl Perch	913	943	86	642	2584
Southern Maori Wrasse	851	810	121	668	2450
Redfish	721	810	174	455	2160
Tiger Flathead	724	827	256	336	2143
Eastern Pigfish	499	542	137	446	1624
Dusky Flathead	419	709	165	287	1580
Leatherjacket (other)	498	239	41	561	1339
Venus Tuskfish	497	384	55	372	1308
Silver Trevally	400	126	39	396	961
Sergeant Baker	313	287	84	232	916
Australian Bonito	40	437	208	35	720
Sixspine Leatherjacket	211	179	50	260	700
Eastern Red Scorpionfish	122	278	30	205	635
Eastern School Whiting	177	218	37	181	613
Sweetlips	23	351	87	142	603
Ocean Reef Perch	250	217	58	63	588
Mahi Mahi	14	431	80	44	569
School Mackerel	44	487	6	15	552
Marbled Flathead	180	190	18	93	481
Longfin Pike	122	185	30	60	397
Barracouta	179	106	28	44	357
Deepsea Ocean Perch	120	32	38	139	329
Moses' Snapper	86	99	15	85	285
Southern Calamari	58	42	81	79	260
Crimsonband Wrasse	60	111	8	78	257
Eastern Orange Perch	51	131	4	36	222
Jackass Morwong	92	72	26	32	222
Amberjack	52	17	10	123	202
Tailor	40	100	18	35	193
Goldspot Pigfish	67	34	13	77	191
Yellowfin Pigfish	68	26		86	180
Samson fish	48	66	12	45	171
Estuary Leatherjacket (rough/fanbelly)	63	55		33	151

Common name		Season				
		Spring	Summer	Autumn	Winter	Total
	No. trips	*1059*	*1434*	*322*	*808*	*3623*
Mulloway		32	45	8	62	147
Longfin Perch		68	56		23	147
Gummy Shark		46	43	11	35	135
Fusiliers, Tropical Snappers & Slopefishes		49	39	1	39	128
Bastard Red Cod		45	41	4	32	122
Red Gurnard		23	46	14	13	96
Spotted Mackerel			87	8		95
Tarwhine		27	32	2	26	87
Jack Mackerel		21	42		11	74
Banded Rockcod		21	13	11	11	56
Common Blacktip Shark		11	11	1	32	55
Australian Salmon		13	33	5		51
Smooth Flutemouth				48		48
Blacksaddle Goatfish		21	10	4	12	47
Bar Rockcod		11	19	4	6	40
Flounders		9	11	1	18	39
Spanish Mackerel			36	1	1	38
Eastern Wirrah		3	23		10	36
Maori Rockcod		14	10		11	35
Gemfish		13	11		10	34
Cobia		4	20	1	6	31
Hussar		4	23		3	30
Sand Whiting		20	10			30
Black Bream		12	9	1	7	29
Southern Bluefin Tuna					28	28
John Dory		15	9	3		27
Bluethroat Wrasse		11	7		9	27
Crimson Snapper		27				27
Green Jobfish		6	7	1	13	27
Skipjack Tuna			10	4	13	27
Mackerel Tuna		7	6	9		22
Bigeye Ocean Perch		18				18
Unidentified		6	2	6	3	17
Latchet		2	11		3	16
Spanner Crab		8			8	16
Eastern Blue Groper		7	1	3	5	16
Silver Dory		10	1		3	14
Parrotfish		6	3	3	2	14
Yellowfin Bream		2	7		2	11
Shortfin Mako		2	2	1	6	11
Spotted Armour Gurnard		1	5	2	3	11
Leaping Bonito				11		11
Red Mullet		1	2	3	4	10
Blue-Eye Trevalla			6	2		8
Bluestriped Goatfish		1	5	1	1	8
Trumpeter Whiting		7				7
Maori Octopus			7			7
Wahoo				7		7
Stingrays/Stingarees		2	4			6
Eastern Shovelnose Ray			5		1	6

Common name		Season				
		Spring	**Summer**	**Autumn**	**Winter**	**Total**
	No. trips	*1059*	*1434*	*322*	*808*	*3623*
Rainbow Runner		1	3	1	1	6
Bluespotted Goatfish			2		3	5
Silver Drummer			1		4	5
Sea Mullet			3	1	1	5
Largetooth Beardie					4	4
School Shark		1			3	4
Rock Blackfish			3			3
Red Morwong			2		1	3
Mirror Dory		2	1			3
Southern Herring			3			3
Blue Warehou					3	3
Bigeye Trevally		3				3
Eastern Fiddler Ray		1	2			3
Yellowfin Tuna					2	2
Longtail Tuna					2	2
Cuttlefish (other)		1	1			2
Longfin Mako		2				2
Bronze Whaler			1		1	2
Frigate Mackerel			1	1		2
Broadnose Shark				2		2
Pink Ling			1		1	2
Spangled Emperor					2	2
Gould's Squid (Arrow)			1	1		2
Dart				1		1
Snook					1	1
Giant Trevally		1				1
Albacore					1	1
Gloomy Octopus			1			1
Rock Ling		1				1
Shark Ray			1			1
Rosy Snapper		1				1
Sole (other)			1			1
Hapuku				1		1
Freespine Flathead			1			1
Bass Groper					1	1
Smooth Hammerhead			1			1
Red Bullseye					1	1
Total		**30448**	**42542**	**8582**	**24436**	**106008**

Appendix 6.3

All species caught, % of catch released and number of trips taken by on-board observers by MEMA management region (Figure 1) between January 2020 and June 2021.

MEMA Management Region		Northern		Central		Southern		Overall	
	No. trips observed	*98*		*72*		*75*		*245*	
Common name	**Species name/s**	**Total**	**Release %**	**Total**	**Release %**	**Total**	**Release %**	**Total**	**Release**
Bluespotted Flathead	*Platycephalus caeruleopunctatus*	556	10.6	330	4.5	860	4.7	1746	6.5
Snapper	*Chrysophrys auratus*	825	4.5	267	35.6	428	14.3	1520	12.7
Blue Mackerel	*Scomber australasicus*	356	9.6	127	3.1	851	9.6	1334	9.0
Yellowtail Scad	*Trachurus novaezelandiae*	748	4.7	251	58.2	103	33.0	1102	19.5
Longspine Flathead	*Platycephalus grandispinisis*	108	100.0	590	95.6	377	75.1	1075	88.8
Eastern Red Scorpionfish	*Scorpaena jacksoniensis*	419	96.9	170	77.1	255	72.5	844	85.5
Grey Morwong	*Nemadactylus douglasii*	160	1.9	131	1.5	387	3.9	678	2.9
Sergeant Baker	*Latropiscis purpurissatus*	285	84.2	177	60.5	202	60.4	664	70.6
Redfish	*Centroberyx affinis*	300	62.0	182	44.0	164	21.3	646	46.6
Ocean Jacket	*Nelusetta ayraud*	164	3.7	271	3.7	145	14.5	580	6.4
Yellowtail Kingfish	*Seriola lalandi*	137	64.2	8	75.0	426	68.3	571	67.4
Southern Sand Flathead	*Platycephalus bassensis*			1	0.0	480	17.9	481	17.9
Silver Sweep	*Scorpis lineolata*	169	82.8	80	48.8	203	57.1	452	65.3
Southern Maori Wrasse	*Ophthalmolepis lineolatus*	44	38.6	48	20.8	317	21.1	409	23.0
Reef Ocean Perch	*Helicolenus percoides*	4	100.0	52	65.4	301	45.2	357	48.7
Silver Trevally	*Pseudocaranx georgianus*	43	67.4	115	49.6	85	8.2	243	38.3
Mado	*Atypichthys strigatus*	97	100.0	42	92.9	102	100.0	241	98.8
Tiger Flathead	*Platycephalus richardsoni*	7	0.0	20	20.0	171	31.6	198	29.3
Pearl Perch	*Glaucosoma scapulare*	188	0.5			1	0.0	189	0.5
Longfin Perch	*Caprodon longimanus*	8	25.0	64	6.3	64	17.2	136	12.5
Teraglin	*Atractoscion atelodus*	124	1.6	11	0.0			135	1.5
Eastern Blackspot Pigfish	*Bodianus unimaculatus*	67	1.5	11	9.1	41	4.9	119	3.4
Barracouta	*Thyrsites atun*	46	100.0	10	50.0	58	58.6	114	74.6

MEMA Management Region		Northern		Central		Southern		Overall	
	No. trips observed	*98*		*72*		*75*		*245*	
Common name	**Species name/s**	**Total**	**Release %**	**Total**	**Release %**	**Total**	**Release %**	**Total**	**Release**
Sea Pikes	Sphyraenidae - undifferentiated	34	5.9	14	71.4	60	76.7	108	53.7
Venus Tuskfish	*Choerodon venustus*	101	11.9					101	11.9
Marbled Flathead	*Platycephalus marmoratus*	38	28.9	13	0.0	35	11.4	86	17.4
Crimsonband Wrasse	*Notolabrus gymnogenis*	41	36.6	30	33.3	8	75.0	79	39.2
Eastern School Whiting	*Sillago flindersi*	7	71.4	41	34.1	30	46.7	78	42.3
Longfin Pike	*Dinolestes lewini*	16	81.3	54	88.9			70	87.1
Australian Bonito	*Sarda australis*	26	11.5	32	0.0	8	0.0	66	4.5
Tailor	*Pomatomus saltatrix*	49	38.8	16	12.5	1	0.0	66	31.8
Australian Sardine	*Sardinops sagax*	54	0.0					54	0.0
Mahi Mahi	*Coryphaena hippurus*	37	37.8	16	93.8			53	54.7
Wirrah	*Acanthistius* spp.	28	64.3	8	37.5	8	87.5	44	63.6
Red Gurnard	*Chelidonichthys kumu*	2	100.0	5	20.0	36	50.0	43	48.8
Tarwhine	*Rhabdosragus sarba*	24	58.3	9	11.1	1	0.0	34	44.1
Moses Sea Perch	*Lutjanus russellii*	28	28.6	6	0.0			34	23.5
Mulloway	*Argyrosomus japonicus*	27	7.4	2	100.0			29	13.8
Sixspine Leatherjacket	*Meuschenia freycineti*	6	16.7	8	0.0	14	7.1	28	7.1
Sea Perch	Scorpaenidae, Lutjanidae, Serranidae & Callanthiidae - undifferentiated			14	100.0	14	35.7	28	67.9
Dusky Whaler	*Carcharhinus obscurus*	27	0.0					27	0.0
Samson Fish	*Seriola hippos*	19	0.0	4	50.0	2	0.0	25	8.0
Banded Seaperch	*Hypoplectrodes nigroruber*			8	100.0	15	73.3	23	82.6
Hussar	*Lutjanus adetii*	22	95.5					22	95.5
Lizardfish	*Synodus* spp.	22	100.0					22	100.0
Bluespotted Goatfish	*Upeneichthys vlamingii*	12	41.7	3	66.7	6	33.3	21	42.9
Butterfly Perch	*Caesioperca lepidoptera*			17	100.0	3	100.0	20	100.0
Eastern Wirrah	*Acanthistius ocellatus*	1	100.0	19	94.7			20	95.0
Amberjack	*Seriola dumerili*	20	0.0					20	0.0
Blackbanded Seaperch	*Hypoplectrodes annulatus*	7	100.0	1	100.0	10	90.0	18	94.4
Snook	*Sphyraena novaehollandiae*	17	0.0					17	0.0
Velvet Leatherjacket	*Meuschenia scaber*	1	100.0	3	33.3	11	81.8	15	73.3

MEMA Management Region		Northern		Central		Southern		Overall	
	No. trips observed	*98*		*72*		*75*		*245*	
Common name	**Species name/s**	**Total**	**Release %**	**Total**	**Release %**	**Total**	**Release %**	**Total**	**Release**
Gummy Shark	*Mustelus antarcticus*	9	0.0	3	33.3	3	33.3	15	13.3
Eastern Fiddler Ray	*Trygonorrhina fasciata*	1	100.0			13	100.0	14	100.0
Blacktip Shark	*Carcharhinus limbatus*	14	35.7					14	35.7
Variegated Lizardfish	*Synodus variegatus*	14	100.0					14	100.0
Red Bigeye	*Priacanthus macracanthus*	10	0.0	3	66.7			13	15.4
Bigeye Ocean Perch	*Helicolenus barathri*	12	0.0	1	0.0			13	0.0
Deepwater Flathead	*Platycephalus conatus*	13	0.0					13	0.0
Banded Rockcod	*Epinephelus ergastularius*	9	44.4			3	0.0	12	33.3
Jackass Morwong	*Nemadactylus macropterus*			1	0.0	10	0.0	11	0.0
Bonito	*Sarda australis & S. orientalis*			10	0.0			10	0.0
Snakefish	*Gempylus serpens*	8	100.0	2	50.0			10	90.0
Maori Rockcod	*Epinephelus undulatostriatus*	9	22.2					9	22.2
Australian Salmon	*Arripis trutta*			9	0.0			9	0.0
Halfbanded Seaperch	*Hypoplectrodes maccullochi*			3	100.0	6	100.0	9	100.0
Blue Morwong	*Nemadactylus valenciennesi*			1	0.0	8	12.5	9	11.1
Sand Whiting	*Sillago ciliata*			2	0.0	7	42.9	9	33.3
Eastern Orange Perch	*Lepidoperca pulchella*					7	71.4	7	71.4
Surf Bream	*Acanthopagrus australis*	3	66.7	4	0.0			7	28.6
Fan-Bellied Leatherjacket	*Monacanthus chinensis*	4	100.0	3	66.7			7	85.7
Australian Blacktip Shark	*Carcharhinus tilstoni*	6	0.0					6	0.0
Dusky Flathead	*Platycephalus fuscus*	2	0.0	4	0.0			6	0.0
Blacktip Reef Shark	*Carcharhinus melanopterus*	6	0.0					6	0.0
Largetooth Flounder	*Pseudorhombus arsius*			6	0.0			6	0.0
Latchet	*Pterygotrigla polyommata*			1	0.0	5	0.0	6	0.0
Brownspotted Wrasse	*Notolabrus parilus*	5	100.0					5	100.0
Frigate Mackerel	*Auxis thazard*	2	0.0	3	33.3			5	20.0
Southern Fiddler Ray	*Trygonorrhina dumerilii*	1	100.0	3	33.3	1	100.0	5	60.0
Purple Flying Gurnard	*Dactyloptena orientalis*	1	0.0			4	75.0	5	60.0
Goatfishes	Mullidae - undifferentiated	4	50.0					4	50.0
Smalltooth Flounder	*Pseudorhombus jenynsii*			3	0.0	1	0.0	4	0.0

MEMA Management Region		Northern		Central		Southern		Overall	
	No. trips observed	*98*		*72*		*75*		*245*	
Common name	**Species name/s**	**Total**	**Release %**	**Total**	**Release %**	**Total**	**Release %**	**Total**	**Release**
Shortfin Mako	*Isurus oxyrinchus*			1	0.0	3	0.0	4	0.0
Brushtooth Lizardfish	*Saurida undosquamis*	2	0.0	2	50.0			4	25.0
Sweep	*Scorpis lineolata & S. aequipinnis*			4	100.0			4	100.0
Sea Mullet	*Mugil cephalus*			4	75.0			4	75.0
Eastern Shovelnose Ray	*Aptychotrema rostrata*			2	50.0	2	100.0	4	75.0
Flatheads	Platycephalidae - undifferentiated	4	0.0					4	0.0
Mackerel	Scombridae - undifferentiated					3	0.0	3	0.0
Smooth Hammerhead	*Sphyrna zygaena*	2	100.0			1	100.0	3	100.0
Green Moray	*Gymnothorax prasinus*	1	100.0	2	100.0			3	100.0
Ornate Wobbegong	*Orectolobus ornatus*	1	100.0			2	100.0	3	100.0
Blacksaddle Goatfish	*Parupeneus spilurus*			1	0.0	2	0.0	3	0.0
Rock Ling	*Genypterus tigerinus*					3	100.0	3	100.0
Bronze Whaler	*Carcharhinus brachyurus*	2	50.0	1	0.0			3	33.3
Silver Dory	*Cyttus australis*	2	100.0			1	100.0	3	100.0
Conger Eels	Congridae - undifferentiated	3	100.0					3	100.0
Mackerel Tuna	*Euthynnus affinis*	2	0.0	1	0.0			3	0.0
Striped Marlin	*Kajikia audax*					2	50.0	2	50.0
Largetooth Beardie	*Lotella rhacina*					2	0.0	2	0.0
Bar Rockcod	*Epinephelus septemfasciatus*	1	0.0	1	100.0			2	50.0
Blind Shark	*Brachaelurus waddi*			2	100.0			2	100.0
Frogfishes	Batrachoididae - undifferentiated	2	100.0					2	100.0
Bearded Rock Cod	*Pseudophycis barbata*			1	100.0	1	0.0	2	50.0
Draughtboard Shark	*Cephaloscyllium laticeps*			2	100.0			2	100.0
Port Jackson Shark	*Heterodontus portusjacksoni*	1	100.0	1	100.0			2	100.0
Southern Calamari	*Sepioteuthis australis*			2	0.0			2	0.0
Australian Spotted Catshark	*Asymbolus analis*	2	100.0					2	100.0
Stingrays	Myliobatiformes - undifferentiated					1	100.0	1	100.0
Theodore's Threadfin Bream	*Nemipterus theodorei*	1	0.0					1	0.0
Orange Spotted Catshark	*Asymbolus rubiginosus*					1	100.0	1	100.0
Shark Sucker	*Echeneis naucrates*	1	100.0					1	100.0

MEMA Management Region		Northern		Central		Southern		Overall	
	No. trips observed	*98*		*72*		*75*		*245*	
Common name	**Species name/s**	**Total**	**Release %**	**Total**	**Release %**	**Total**	**Release %**	**Total**	**Release**
Freckled Porcupinefish	*Diodon holocanthus*			1	0.0			1	0.0
Pigfishes	*Bodianus* spp.			1	0.0			1	0.0
Stripey	*Microcanthus strigatus*	1	100.0					1	100.0
Eastern Blue Groper	*Achoerodus viridis*	1	0.0					1	0.0
Black Marlin	*Istiompax indica*	1	100.0					1	100.0
Collared Carpetshark	*Parascyllium collare*	1	100.0					1	100.0
Rusty Jobfish	*Aphareus rutilans*	1	0.0					1	0.0
Southern Conger	*Conger verreauxi*	1	100.0					1	100.0
Barred Grubfish	*Parapercis allporti*			1	0.0			1	0.0
Southern Eagle Ray	*Myliobatis tenuicaudatus*					1	100.0	1	100.0
Gemfish	*Rexea solandri*			1	0.0			1	0.0
Eastern Smooth Boxfish	*Anoplocapros inermis*	1	100.0					1	100.0
Skipjack Tuna	*Katsuwonus pelamis*			1	0.0			1	0.0
Greenback Flounder	*Rhombosolea tapirina*					1	0.0	1	0.0
Redlined Seaperch	*Caesioperca* sp.			1	0.0			1	0.0
Cobia	*Rachycentron canadum*	1	0.0					1	0.0
Flying Gurnards	Dactylopteridae - undifferentiated					1	0.0	1	0.0
Common Stingaree	*Trygonoptera testacea*					1	100.0	1	100.0
Three-Barred Porcupinefish	*Dicotylichthys punctulatus*			1	100.0			1	100.0
Spot-Tail Perchlet	*Plectranthias maculicauda*	1	100.0					1	100.0
Foxfish	*Bodianus frenchii*	1	0.0					1	0.0
Spotted Mackerel	*Scomberomorus munroi*	1	0.0					1	0.0
Scalloped Hammerhead	*Sphyrna lewini*					1	0.0	1	0.0
Squids	Loliginidae- undifferentiated					1	0.0	1	0.0
Starry Puffer	*Arothron stellatus*			1	100.0			1	100.0
Eastern Striped Grunter	*Pelates sexlineatus*			1	100.0			1	100.0
Lunartail Bigeye	*Priacanthus hamrur*	1	100.0					1	100.0
Total		**5693**	**31.8**	**3383**	**46.1**	**6382**	**30.8**	**15458**	**34.5**

Appendix 6.4

All species caught, % of catch released and number of trips taken by season recorded by on-board observers between January 2020 and June 2021. Species names are given in Appendix 3.

Season	**Spring**		**Summer**		**Autumn**		**Winter**		**Overall**	
No. trips observed	*74*		*82*		*56*		*33*		*245*	
Common name	**Total**	**Release %**	**Total**	**Release %**	**Total**	**Release %**	**Total**	**Release %**	**Total**	**Release %**
Bluespotted Flathead	819	11.0	460	3.5	306	2.6	161	0.0	1746	6.5
Snapper	544	19.3	498	15.3	245	3.7	233	1.3	1520	12.7
Blue Mackerel	627	7.5	503	8.5	124	24.2	80	0.0	1334	9.0
Yellowtail Scad	215	46.5	291	17.2	182	22.5	414	5.8	1102	19.5
Longspine Flathead	282	87.9	290	81.7	313	96.8	190	87.9	1075	88.8
Eastern Red Scorpionfish	318	79.2	211	88.6	178	85.4	141	95.7	848	85.6
Grey Morwong	198	7.1	325	1.2	98	2.0	57	0.0	678	2.9
Sergeant Baker	220	66.4	190	76.8	171	64.9	83	79.5	664	70.6
Redfish	167	56.9	357	45.1	68	55.9	54	13.0	646	46.6
Ocean Jacket	210	6.7	208	10.1	14	14.3	148	0.0	580	6.4
Yellowtail Kingfish	39	28.2	364	84.3	131	45.8	37	18.9	571	67.4
Southern Sand Flathead	125	6.4	291	22.7	65	18.5			481	17.9
Silver Sweep	120	51.7	150	70.7	91	53.8	91	85.7	452	65.3
Southern Maori Wrasse	193	18.1	129	17.1	53	50.9	35	28.6	410	22.9
Reef Ocean Perch	161	47.8	142	42.3	54	68.5			357	48.7
Silver Trevally	113	31.9	45	22.2	47	57.4	38	52.6	243	38.3
Mado	76	100.0	70	100.0	66	95.5	29	100.0	241	98.8
Tiger Flathead	113	21.2	76	39.5	3	0.0	6	66.7	198	29.3
Pearl Perch	41	0.0	70	0.0	67	1.5	11	0.0	189	0.5
Longfin Perch	47	4.3	56	14.3	32	18.8	1	100.0	136	12.5
Teraglin	24	8.3	30	0.0	50	0.0	31	0.0	135	1.5
Eastern Blackspot Pigfish	50	4.0	31	3.2	21	0.0	17	5.9	119	3.4

Season	Spring		Summer		Autumn		Winter		Overall	
No. trips observed	*74*		*82*		*56*		*33*		*245*	
Common name	**Total**	**Release %**	**Total**	**Release %**	**Total**	**Release %**	**Total**	**Release %**	**Total**	**Release %**
Barracouta	53	69.8	26	92.3	6	0.0	29	82.8	114	74.6
Sea Pikes	38	21.1	46	89.1	20	35.0	4	50.0	108	53.7
Venus Tuskfish	53	13.2	1	0.0	38	13.2	9	0.0	101	11.9
Marbled Flathead	39	25.6	20	10.0	15	13.3	12	8.3	86	17.4
Crimsonband Wrasse	32	43.8	5	20.0	10	40.0	32	37.5	79	39.2
Eastern School Whiting	17	88.2	23	30.4	16	25.0	22	31.8	78	42.3
Australian Bonito	8	0.0	54	5.6	12	0.0	2	0.0	76	3.9
Longfin Pike	37	91.9	14	92.9	15	66.7	4	100.0	70	87.1
Tailor	35	20.0	1	0.0	16	18.8	14	78.6	66	31.8
Australian Sardine			17	0.0	37	0.0			54	0.0
Mahi Mahi	16	43.8	21	47.6	16	75.0			53	54.7
Wirrah	24	41.7	5	100.0	4	75.0	11	90.9	44	63.6
Red Gurnard	22	63.6	6	0.0	9	44.4	6	50.0	43	48.8
Tarwhine	8	62.5	3	66.7	10	50.0	13	23.1	34	44.1
Moses Sea Perch	11	18.2	6	0.0	17	35.3			34	23.5
Mulloway	4	0.0	1	0.0	7	28.6	17	11.8	29	13.8
Sixspine Leatherjacket	11	9.1	6	16.7	6	0.0	5	0.0	28	7.1
Sea Perch			28	67.9					28	67.9
Dusky Whaler	1	0.0			25	0.0	1	0.0	27	0.0
Samson Fish	7	0.0			16	12.5	2	0.0	25	8.0
Banded Seaperch	17	82.4	5	100.0	1	0.0			23	82.6
Hussar	12	100.0			10	90.0			22	95.5
Lizardfish					22	100.0			22	100.0
Bluespotted Goatfish	3	66.7	6	33.3	8	62.5	4	0.0	21	42.9
Butterfly Perch	20	100.0							20	100.0
Eastern Wirrah	17	100.0	2	50.0	1	100.0			20	95.0
Amberjack	4	0.0	11	0.0	1	0.0	4	0.0	20	0.0
Blackbanded Seaperch	9	100.0	3	100.0	4	75.0	2	100.0	18	94.4

Season	Spring		Summer		Autumn		Winter		Overall	
No. trips observed	*74*		*82*		*56*		*33*		*245*	
Common name	**Total**	**Release %**	**Total**	**Release %**	**Total**	**Release %**	**Total**	**Release %**	**Total**	**Release %**
Snook			17	0.0					17	0.0
Gummy Shark	1	0.0	4	25.0	6	0.0	4	25.0	15	13.3
Velvet Leatherjacket	11	81.8	1	100.0	2	50.0	1	0.0	15	73.3
Blacktip Shark	5	0.0	5	60.0	2	0.0	2	100.0	14	35.7
Eastern Fiddler Ray	5	100.0	6	100.0	2	100.0	1	100.0	14	100.0
Variegated Lizardfish					14	100.0			14	100.0
Red Bigeye			2	100.0	1	0.0	10	0.0	13	15.4
Deepwater Flathead	4	0.0	4	0.0	4	0.0	1	0.0	13	0.0
Bigeye Ocean Perch							13	0.0	13	0.0
Banded Rockcod	2	0.0	9	44.4	1	0.0			12	33.3
Jackass Morwong	5	0.0	6	0.0					11	0.0
Snakefish					10	90.0			10	90.0
Blue Morwong			9	11.1					9	11.1
Halfbanded Seaperch			1	100.0	8	100.0			9	100.0
Maori Rockcod	5	0.0	1	0.0	2	50.0	1	100.0	9	22.2
Australian Salmon	1	0.0	6	0.0	2	0.0			9	0.0
Sand Whiting	5	20.0	4	50.0					9	33.3
Fan-Bellied Leatherjacket			3	66.7			4	100.0	7	85.7
Eastern Orange Perch					7	71.4			7	71.4
Surf Bream	4	25.0	2	0.0	1	100.0			7	28.6
Latchet	1	0.0	2	0.0	2	0.0	1	0.0	6	0.0
Largetooth Flounder			1	0.0	5	0.0			6	0.0
Blacktip Reef Shark							6	0.0	6	0.0
Australian Blacktip Shark							6	0.0	6	0.0
Dusky Flathead			5	0.0	1	0.0			6	0.0
Southern Fiddler Ray			1	100.0	3	33.3	1	100.0	5	60.0
Purple Flying Gurnard	1	0.0	4	75.0					5	60.0
Brownspotted Wrasse	2	100.0					3	100.0	5	100.0

Season	Spring		Summer		Autumn		Winter		Overall	
No. trips observed	*74*		*82*		*56*		*33*		*245*	
Common name	**Total**	**Release %**	**Total**	**Release %**	**Total**	**Release %**	**Total**	**Release %**	**Total**	**Release %**
Frigate Mackerel					3	33.3	2	0.0	5	20.0
Shortfin Mako	3	0.0	1	0.0					4	0.0
Sweep			4	100.0					4	100.0
Eastern Shovelnose Ray	2	100.0	1	100.0	1	0.0			4	75.0
Sea Mullet			4	75.0					4	75.0
Brushtooth Lizardfish			2	0.0	2	50.0			4	25.0
Flatheads			4	0.0					4	0.0
Smalltooth Flounder			3	0.0			1	0.0	4	0.0
Goatfishes	2	100.0			2	0.0			4	50.0
Smooth Hammerhead	1	100.0	2	100.0					3	100.0
Bronze Whaler	1	0.0	1	100.0	1	0.0			3	33.3
Ornate Wobbegong	1	100.0	2	100.0					3	100.0
Silver Dory	1	100.0	2	100.0					3	100.0
Conger Eels	1	100.0					2	100.0	3	100.0
Green Moray	1	100.0					2	100.0	3	100.0
Rock Ling	1	100.0	1	100.0	1	100.0			3	100.0
Blacksaddle Goatfish	1	0.0	2	0.0					3	0.0
Mackerel	3	0.0							3	0.0
Mackerel Tuna			1	0.0	1	0.0	1	0.0	3	0.0
Draughtboard Shark			2	100.0					2	100.0
Striped Marlin			2	50.0					2	50.0
Bar Rockcod							2	50.0	2	50.0
Australian Spotted Catshark			2	100.0					2	100.0
Largetooth Beardie					2	0.0			2	0.0
Frogfishes					2	100.0			2	100.0
Bearded Rock Cod			1	100.0	1	0.0			2	50.0
Blind Shark	2	100.0							2	100.0
Southern Calamari					2	0.0			2	0.0

Season	Spring		Summer		Autumn		Winter		Overall	
No. trips observed	*74*		*82*		*56*		*33*		*245*	
Common name	**Total**	**Release %**	**Total**	**Release %**	**Total**	**Release %**	**Total**	**Release %**	**Total**	**Release %**
Port Jackson Shark							2	100.0	2	100.0
Gemfish			1	0.0					1	0.0
Three-Barred Porcupinefish			1	100.0					1	100.0
Eastern Striped Grunter			1	100.0					1	100.0
Orange Spotted Catshark					1	100.0			1	100.0
Flying Gurnards			1	0.0					1	0.0
Black Marlin			1	100.0					1	100.0
Eastern Smooth Boxfish			1	100.0					1	100.0
Cobia					1	0.0			1	0.0
Collared Carpetshark	1	100.0							1	100.0
Shark Sucker					1	100.0			1	100.0
Rusty Jobfish	1	0.0							1	0.0
Southern Conger							1	100.0	1	100.0
Stingrays			1	100.0					1	100.0
Southern Eagle Ray			1	100.0					1	100.0
Stripey	1	100.0							1	100.0
Pigfishes							1	0.0	1	0.0
Eastern Blue Groper	1	0.0							1	0.0
Scalloped Hammerhead					1	0.0			1	0.0
Redlined Seaperch			1	0.0					1	0.0
Foxfish	1	0.0							1	0.0
Theodore's Threadfin Bream					1	0.0			1	0.0
Freckled Porcupinefish							1	0.0	1	0.0
Skipjack Tuna					1	0.0			1	0.0
Spotted Mackerel					1	0.0			1	0.0
Greenback Flounder	1	0.0							1	0.0
Squids			1	0.0					1	0.0
Common Stingaree							1	100.0	1	100.0

Season	**Spring**		**Summer**		**Autumn**		**Winter**		**Overall**	
No. trips observed	*74*		*82*		*56*		*33*		*245*	
Common name	**Total**	**Release %**	**Total**	**Release %**	**Total**	**Release %**	**Total**	**Release %**	**Total**	**Release %**
Starry Puffer							1	100.0	1	100.0
Lunartail Bigeye	1	100.0							1	100.0
Barred Grubfish			1	0.0					1	0.0
Spot-Tail Perchlet					1	100.0			1	100.0
Total	**5279**	**32.7**	**5238**	**34.7**	**2820**	**40.3**	**2121**	**30.9**	**15458**	**34.5**

Other titles in this series

No. 1 Andrew, N.L., Graham, K.J., Hodgson, K.E. and Gordon, G.N.G., 1998. Changes after 20 years in relative abundance and size composition of commercial fishes caught during fishery independent surveys on SEF trawl grounds. Final Report to Fisheries Research and Development Corporation. Project no. 96/139.

No. 2 Virgona, J.L., Deguara, K.L., Sullings, D.J., Halliday, I. and Kelly, K., 1998. Assessment of the stocks of sea mullet in New South Wales and Queensland waters.

No. 3 Stewart, J., Ferrell, D.J. and Andrew, N.L., 1998. Ageing Yellowtail (*Trachurus novaezelandiae*) and Blue Mackerel (*Scomber australasicus*) in New South Wales.

No. 4 Pethebridge, R., Lugg, A. and Harris, J., 1998. Obstructions to fish passage in New South Wales South Coast streams. 70pp.

No. 5 Kennelly, S.J. and Broadhurst, M.K., 1998. Development of by-catch reducing prawn-trawls and fishing practices in NSW's prawn-trawl fisheries (and incorporating an assessment of the effect of increasing mesh size in fish trawl gear). 18pp + appendices.

No. 6 Allan, G.L. and Rowland, S.J., 1998. Fish meal replacement in aquaculture feeds for silver perch. 237pp + appendices.

No. 7 Allan, G.L., 1998. Fish meal replacement in aquaculture feeds: subprogram administration. 54pp + appendices.

No. 8 Heasman, M.P., O'Connor, W.A. and O'Connor, S.J., 1998. Enhancement and farming of scallops in NSW using hatchery produced seedstock. 146pp.

No. 9 Nell, J.A., McMahon, G.A. and Hand, R.E., 1998. Tetraploidy induction in Sydney rock oysters. 25pp.

No. 10 Nell, J.A. and Maguire, G.B., 1998. Commercialisation of triploid Sydney rock and Pacific oysters. Part 1: Sydney rock oysters. 122pp.

No. 11 Watford, F.A. and Williams, R.J., 1998. Inventory of estuarine vegetation in Botany Bay, with special reference to changes in the distribution of seagrass. 51pp.

No. 12 Andrew, N.L., Worthington D.G., Brett, P.A. and Bentley N., 1998. Interactions between the abalone fishery and sea urchins in New South Wales.

No. 13 Jackson, K.L. and Ogburn, D.M., 1999. Review of depuration and its role in shellfish quality assurance. 77pp.

No. 14 Fielder, D.S., Bardsley, W.J. and Allan, G.L., 1999. Enhancement of Mulloway (*Argyrosomus japonicus*) in intermittently opening lagoons. 50pp + appendices.

No. 15 Otway, N.M. and Macbeth, W.G., 1999. The physical effects of hauling on seagrass beds. 86pp.

No. 16 Gibbs, P., McVea, T. and Louden, B., 1999. Utilisation of restored wetlands by fish and invertebrates. 142pp.

No. 17 Ogburn, D. and Ruello, N., 1999. Waterproof labelling and identification systems suitable for shellfish and other seafood and aquaculture products. Whose oyster is that? 50pp.

No. 18 Gray, C.A., Pease, B.C., Stringfellow, S.L., Raines, L.P. and Walford, T.R., 2000. Sampling estuarine fish species for stock assessment. Includes appendices by D.J. Ferrell, B.C. Pease, T.R. Walford, G.N.G. Gordon, C.A. Gray and G.W. Liggins. 194pp.

No. 19 Otway, N.M. and Parker, P.C., 2000. The biology, ecology, distribution, abundance and identification of marine protected areas for the conservation of threatened Grey Nurse Sharks in south east Australian waters. 101pp.

No. 20 Allan, G.L. and Rowland, S.J., 2000. Consumer sensory evaluation of silver perch cultured in ponds on meat meal based diets. 21pp + appendices.

No. 21 Kennelly, S.J. and Scandol, J. P., 2000. Relative abundances of spanner crabs and the development of a population model for managing the NSW spanner crab fishery. 43pp + appendices.

No. 22 Williams, R.J., Watford, F.A. and Balashov, V., 2000. Kooragang Wetland Rehabilitation Project: History of changes to estuarine wetlands of the lower Hunter River. 82pp.

No. 23 Survey Development Working Group, 2000. Development of the National Recreational and Indigenous Fishing Survey. Final Report to Fisheries Research and Development Corporation. (Volume 1 – 36pp + Volume 2 – attachments).

No.24 Rowling, K.R and Raines, L.P., 2000. Description of the biology and an assessment of the fishery of Silver Trevally *Pseudocaranx dentex* off New South Wales. 69pp.

No. 25 Allan, G.L., Jantrarotai, W., Rowland, S., Kosuturak, P. and Booth, M., 2000. Replacing fishmeal in aquaculture diets. 13pp.

No. 26 Gehrke, P.C., Gilligan, D.M. and Barwick, M., 2001. Fish communities and migration in the Shoalhaven River – Before construction of a fishway. 126pp.

No. 27 Rowling, K.R. and Makin, D.L., 2001. Monitoring of the fishery for Gemfish *Rexea solandri*, 1996 to 2000. 44pp.

No. 28 Otway, N.M., 1999. Identification of candidate sites for declaration of aquatic reserves for the conservation of rocky intertidal communities in the Hawkesbury Shelf and Batemans Shelf Bioregions. 88pp.

No. 29 Heasman, M.P., Goard, L., Diemar, J. and Callinan, R., 2000. Improved Early Survival of Molluscs: Sydney Rock Oyster (*Saccostrea glomerata*). 63pp.

No. 30 Allan, G.L., Dignam, A and Fielder, S., 2001. Developing Commercial Inland Saline Aquaculture in Australia: Part 1. R&D Plan.

No. 31 Allan, G.L., Banens, B. and Fielder, S., 2001. Developing Commercial Inland Saline Aquaculture in Australia: Part 2. Resource Inventory and Assessment. 33pp.

No. 32 Bruce, A., Growns, I. and Gehrke, P., 2001. Woronora River Macquarie Perch Survey. 116pp.

No. 33 Morris, S.A., Pollard, D.A., Gehrke, P.C. and Pogonoski, J.J., 2001. Threatened and Potentially Threatened Freshwater Fishes of Coastal New South Wales and the Murray-Darling Basin. 177pp.

No. 34 Heasman, M.P., Sushames, T.M., Diemar, J.A., O'Connor, W.A. and Foulkes, L.A., 2001. Production of Micro-algal Concentrates for Aquaculture Part 2: Development and Evaluation of Harvesting, Preservation, Storage and Feeding Technology. 150pp + appendices.

No. 35 Stewart, J. and Ferrell, D.J., 2001. Mesh selectivity in the NSW demersal trap fishery. 86pp.

No. 36 Stewart, J., Ferrell, D.J., van der Walt, B., Johnson, D. and Lowry, M., 2001. Assessment of length and age composition of commercial Kingfish landings. 49pp.

No. 37 Gray, C.A. and Kennelly, S.J., 2001. Development of discard-reducing gears and practices in the estuarine prawn and fish haul fisheries of NSW. 151pp.

No. 38 Murphy, J.J., Lowry, M.B., Henry, G.W. and Chapman, D., 2002. The Gamefish Tournament Monitoring Program – 1993 to 2000. 93pp.

No. 39 Kennelly, S.J. and McVea, T.A. (Ed), 2002. Scientific reports on the recovery of the Richmond and Macleay Rivers following fish kills in February and March 2001. 325pp.

No. 40 Pollard, D.A. and Pethebridge, R.L., 2002. Report on Port of Botany Bay Introduced Marine Pest Species Survey. 69pp.

No. 41 Pollard, D.A. and Pethebridge, R.L., 2002. Report on Port Kembla Introduced Marine Pest Species Survey. 72pp.

No. 42 O'Connor, W.A, Lawler, N.F. and Heasman, M.P., 2003. Trial farming the akoya pearl oyster, *Pinctada imbricata*, in Port Stephens, NSW. 170pp.

No. 43 Fielder, D.S. and Allan, G.L., 2003. Improving fingerling production and evaluating inland saline water culture of Snapper, *Pagrus auratus*. 62pp.

No. 44 Astles, K.L., Winstanley, R.K., Harris, J.H. and Gehrke, P.C., 2003. Experimental study of the effects of cold water pollution on native fish. 55pp.

No. 45 Gilligan, D.M., Harris, J.H. and Mallen-Cooper, M., 2003. Monitoring changes in the Crawford River fish community following replacement of an effective fishway with a vertical-slot fishway design: Results of an eight year monitoring program. 80pp.

No. 46 Pollard, D.A. and Rankin, B.K., 2003. Port of Eden Introduced Marine Pest Species Survey. 67pp.

No. 47 Otway, N.M., Burke, A.L., Morrison, NS. and Parker, P.C., 2003. Monitoring and identification of NSW Critical Habitat Sites for conservation of Grey Nurse Sharks. 62pp.

No. 48 Henry, G.W. and Lyle, J.M. (Ed), 2003. The National Recreational and Indigenous Fishing Survey. 188 pp.

No. 49 Nell, J.A., 2003. Selective breeding for disease resistance and fast growth in Sydney rock oysters. 44pp. (Also available – a CD-Rom published in March 2004 containing a collection of selected manuscripts published over the last decade in peer-reviewed journals).

No. 50 Gilligan, D. and Schiller, S., 2003. Downstream transport of larval and juvenile fish. 66pp.

No. 51 Liggins, G.W., Scandol, J.P. and Kennelly, S.J., 2003. Recruitment of Population Dynamacist. 44pp.

No. 52 Steffe, A.S. and Chapman, J.P., 2003. A survey of daytime recreational fishing during the annual period, March 1999 to February 2000, in Lake Macquarie, New South Wales. 124pp.

No. 53 Barker, D. and Otway, N., 2003. Environmental assessment of zinc coated wire mesh sea cages in Botany Bay NSW. 36pp.

No. 54 Growns, I., Astles, A. and Gehrke, P., 2003. Spatial and temporal variation in composition of riverine fish communities. 24pp.

No. 55 Gray, C. A., Johnson, D.D., Young, D.J. and Broadhurst, M. K., 2003. Bycatch assessment of the Estuarine Commercial Gill Net Fishery in NSW. 58pp.

No. 56 Worthington, D.G. and Blount, C., 2003. Research to develop and manage the sea urchin fisheries of NSW and Eastern Victoria. 182pp.

No. 57 Baumgartner, L.J., 2003. Fish passage through a Deelder lock on the Murrumbidgee River, Australia. 34pp.

No. 58 Allan, G.L., Booth, M.A., David A.J. Stone, D.A.J. and Anderson, A.J., 2004. Aquaculture Diet Development Subprogram: Ingredient Evaluation. 171pp.

No. 59 Smith, D.M., Allan, G.L. and Booth, M.A., 2004. Aquaculture Diet Development Subprogram: Nutrient Requirements of Aquaculture Species. 220pp.

No. 60 Barlow, C.G., Allan, G.L., Williams, K.C., Rowland, S.J. and Smith, D.M., 2004. Aquaculture Diet Development Subprogram: Diet Validation and Feeding Strategies. 197pp.

No. 61 Heasman, M.H., 2004. Sydney Rock Oyster Hatchery Workshop 8 – 9 August 2002, Port Stephens, NSW. 115pp.

No. 62 Heasman, M., Chick, R., Savva, N., Worthington, D., Brand, C., Gibson, P. and Diemar, J., 2004. Enhancement of populations of abalone in NSW using hatchery-produced seed. 269pp.

No. 63 Otway, N.M. and Burke, A.L., 2004. Mark-recapture population estimate and movements of Grey Nurse Sharks. 53pp.

No. 64 Creese, R.G., Davis, A.R. and Glasby, T.M., 2004. Eradicating and preventing the spread of the invasive alga *Caulerpa taxifolia* in NSW. 110pp.

No. 65 Baumgartner, L.J., 2004. The effects of Balranald Weir on spatial and temporal distributions of lower Murrumbidgee River fish assemblages. 30pp.

No. 66 Heasman, M., Diggles, B.K., Hurwood, D., Mather, P., Pirozzi, I. and Dworjanyn, S., 2004. Paving the way for continued rapid development of the flat (angasi) oyster (*Ostrea angasi*) farming in New South Wales. 40pp.

ISSN 1449-9967 (NSW Department of Primary Industries – Fisheries Final Report Series)

No. 67 Kroon, F.J., Bruce, A.M., Housefield, G.P. and Creese, R.G., 2004. Coastal floodplain management in Eastern Australia: barriers to fish and invertebrate recruitment in acid sulphate soil catchments. 212pp.

No. 68 Walsh, S., Copeland, C. and Westlake, M., 2004. Major fish kills in the northern rivers of NSW in 2001: Causes, Impacts & Responses. 55pp.

No. 69 Pease, B.C. (Ed), 2004. Description of the biology and an assessment of the fishery for adult longfinned eels in NSW. 168pp.

No. 70 West, G., Williams, R.J. and Laird, R., 2004. Distribution of estuarine vegetation in the Parramatta River and Sydney Harbour, 2000. 37pp.

No. 71 Broadhurst, M.K., Macbeth, W.G. and Wooden, M.E.L., 2005. Reducing the discarding of small prawns in NSW's commercial and recreational prawn fisheries. 202pp.

No. 72. Graham, K.J., Lowry, M.B. and Walford, T.R., 2005. Carp in NSW: Assessment of distribution, fishery and fishing methods. 88pp.

No. 73 Stewart, J., Hughes, J.M., Gray, C.A. and Walsh, C., 2005. Life history, reproductive biology, habitat use and fishery status of Eastern sea garfish (*Hyporhamphus australis*) and river garfish (*H. regularis ardelio*) in NSW waters. 180pp.

No. 74 Growns, I. and Gehrke, P., 2005. Integrated Monitoring of Environmental Flows: Assessment of predictive modelling for river flows and fish. 33pp.

No. 75 Gilligan, D., 2005. Fish communities of the Murrumbidgee catchment: Status and trends. 138pp.

No. 76 Ferrell, D.J., 2005. Biological information for appropriate management of endemic fish species at Lord Howe Island. 18 pp.

No. 77 Gilligan, D., Gehrke, P. and Schiller, C., 2005. Testing methods and ecological consequences of large-scale removal of common carp. 46pp.

No. 78 Boys, C.A., Esslemont, G. and Thoms, M.C., 2005. Fish habitat and protection in the Barwon-Darling and Paroo Rivers. 118pp.

No. 79 Steffe, A.S., Murphy, J.J., Chapman, D.J. and Gray, C.C., 2005. An assessment of changes in the daytime recreational fishery of Lake Macquarie following the establishment of a 'Recreational Fishing Haven'. 103pp.

No. 80 Gannassin, C. and Gibbs, P., 2005. Broad-Scale Interactions Between Fishing and Mammals, Reptiles and Birds in NSW Marine Waters. 171pp.

No. 81 Steffe, A.S., Murphy, J.J., Chapman, D.J., Barrett, G.P. and Gray, C.A., 2005. An assessment of changes in the daytime, boat-based, recreational fishery of the Tuross Lake estuary following the establishment of a 'Recreational Fishing Haven'. 70pp.

No. 82 Silberschnieder, V. and Gray, C.A., 2005. Arresting the decline of the commercial and recreational fisheries for Mulloway (*Argyrosomus japonicus*). 71pp.

No. 83 Gilligan, D., 2005. Fish communities of the Lower Murray-Darling catchment: Status and trends. 106pp.

No. 84 Baumgartner, L.J., Reynoldson, N., Cameron, L. and Stanger, J., 2006. Assessment of a Dual-frequency Identification Sonar (DIDSON) for application in fish migration studies. 33pp.

No. 85 Park, T., 2006. FishCare Volunteer Program Angling Survey: Summary of data collected and recommendations. 41pp.

No. 86 Baumgartner, T., 2006. A preliminary assessment of fish passage through a Denil fishway on the Edward River, Australia. 23pp.

No. 87 Stewart, J., 2007. Observer study in the Estuary General sea garfish haul net fishery in NSW. 23pp.

No. 88 Faragher, R.A., Pogonoski, J.J., Cameron, L., Baumgartner, L. and van der Walt, B., 2007. Assessment of a stocking program: Findings and recommendations for the Snowy Lakes Trout Strategy. 46pp.

No. 89 Gilligan, D., Rolls, R., Merrick, J., Lintermans, M., Duncan, P. and Kohen, J., 2007. Scoping knowledge requirements for Murray crayfish (*Euastacus armatus*). Final report to the Murray Darling Basin Commission for Project No. 05/1066 NSW 103pp.

No. 90 Kelleway, J., Williams. R.J. and Allen, C.B., 2007. An assessment of the saltmarsh of the Parramatta River and Sydney Harbour. 100pp.

No. 91 Williams, R.J. and Thiebaud, I., 2007. An analysis of changes to aquatic habitats and adjacent land-use in the downstream portion of the Hawkesbury Nepean River over the past sixty years. 97pp.

No. 92 Baumgartner, L., Reynoldson, N., Cameron, L. and Stanger, J. The effects of selected irrigation practices on fish of the Murray-Darling Basin. 90pp.

No. 93 Rowland, S.J., Landos, M., Callinan, R.B., Allan, G.L., Read, P., Mifsud, C., Nixon, M., Boyd, P. and Tally, P., 2007. Development of a health management strategy for the Silver Perch Aquaculture Industry. 219pp.

No. 94 Park, T., 2007. NSW Gamefish Tournament Monitoring – Angling Research Monitoring Program. Final report to the NSW Recreational Fishing Trust. 142pp.

No. 95 Heasman, M.P., Liu, W., Goodsell, P.J., Hurwood D.A. and Allan, G.L., 2007. Development and delivery of technology for production, enhancement and aquaculture of blacklip abalone (*Haliotis rubra*) in New South Wales. 226pp.

No. 96 Ganassin, C. and Gibbs, P.J., 2007. A review of seagrass planting as a means of habitat compensation following loss of seagrass meadow. 41pp.

No. 97 Stewart, J. and Hughes, J., 2008. Determining appropriate harvest size at harvest for species shared by the commercial trap and recreational fisheries in New South Wales. 282pp.

No. 98 West, G. and Williams, R.J., 2008. A preliminary assessment of the historical, current and future cover of seagrass in the estuary of the Parramatta River. 61pp.

No. 99 Williams, D.L. and Scandol, J.P., 2008. Review of NSW recreational fishing tournament-based monitoring methods and datasets. 83pp.

No. 100 Allan, G.L., Heasman, H. and Bennison, S., 2008. Development of industrial-scale inland saline aquaculture: Coordination and communication of R&D in Australia. 245pp.

No. 101 Gray, C.A and Barnes, L.M., 2008. Reproduction and growth of dusky Flathead (*Platycephalus fuscus*) in NSW estuaries. 26pp.

No. 102 Graham, K.J., 2008. The Sydney inshore trawl-Whiting fishery: codend selectivity and fishery characteristics. 153pp.

No. 103 Macbeth, W.G., Johnson, D.D. and Gray, C.A., 2008. Assessment of a 35-mm square-mesh codend and composite square-mesh panel configuration in the ocean prawn-trawl fishery of northern New South Wales. 104pp.

No. 104 O'Connor, W.A., Dove, M. and Finn, B., 2008. Sydney rock oysters: Overcoming constraints to commercial scale hatchery and nursery production. 119pp.

No. 105 Glasby, T.M. and Lobb, K., 2008. Assessing the likelihoods of marine pest introductions in Sydney estuaries: A transport vector approach. 84pp.

No. 106 Rotherham, D., Gray, C.A., Underwood, A.J., Chapman, M.G. and Johnson, D.D., 2008. Developing fishery-independent surveys for the adaptive management of NSW's estuarine fisheries. 135pp.

No. 107 Broadhurst, M., 2008. Maximising the survival of bycatch discarded from commercial estuarine fishing gears in NSW. 192pp.

No. 108 Gilligan, D., McLean, A. and Lugg, A., 2009. Murray Wetlands and Water Recovery Initiatives: Rapid assessment of fisheries values of wetlands prioritised for water recovery. 69pp.

No. 109 Williams, R.J. and Thiebaud, I., 2009. Occurrence of freshwater macrophytes in the catchments of the Parramatta River, Lane Cove River and Middle Harbour Creek, 2007 – 2008. 75pp.

No. 110 Gilligan, D., Vey, A. and Asmus, M., 2009. Identifying drought refuges in the Wakool system and assessing status of fish populations and water quality before, during and after the provision of environmental, stock and domestic flows. 56pp.

ISSN 1837-2112 (Industry & Investment NSW – Fisheries Final Report Series)

No. 111 Gray, C.A., Scandol. J.P., Steffe, A.S. and Ferrell, D.J., 2009. Australian Society for Fish Biology Annual Conference & Workshop 2008: Assessing Recreational Fisheries; Current and Future Challenges. 54pp.

No. 112 Otway, N.M. Storrie, M.T., Louden, B.M. and Gilligan, J.J., 2009. Documentation of depth-related migratory movements, localised movements at critical habitat sites and the effects of scuba diving for the east coast Grey nurse shark population. 90pp.

No. 113 Creese, R.G., Glasby, T.M., West, G. and Gallen, C., 2009. Mapping the habitats of NSW estuaries. 95pp.

No. 114 Macbeth, W.G., Geraghty, P.T., Peddemors, V.M. and Gray, C.A., 2009. Observer-based study of targeted commercial fishing for large shark species in waters off northern New South Wales. 82pp.

No. 115 Scandol, J.P., Ives, M.C. and Lockett, M.M., 2009. Development of national guidelines to improve the application of risk-based methods in the scope, implementation and interpretation of stock assessments for data-poor species. 186pp.

No. 116 Baumgartner, L., Bettanin, M., McPherson, J., Jones, M., Zampatti, B. and Kathleen Beyer., 2009. Assessment of an infrared fish counter (Vaki Riverwatcher) to quantify fish migrations in the Murray-Darling Basin. 47pp.

No. 117 Astles, K., West, G., and Creese, R.G., 2010. Estuarine habitat mapping and geomorphic characterisation of the Lower Hawkesbury river and Pittwater estuaries. 229pp.

No. 118 Gilligan, D., Jess, L., McLean, G., Asmus, M., Wooden, I., Hartwell, D., McGregor, C., Stuart, I., Vey, A., Jefferies, M., Lewis, B. and Bell, K., 2010. Identifying and implementing targeted carp control options for the Lower Lachlan Catchment. 126pp.

No. 119 Montgomery, S.S., Walsh, C.T., Kesby, C.L and Johnson, D.D., 2010. Studies on the growth and mortality of school prawns. 90pp.

No. 120 Liggins, G.W. and Upston, J., 2010. Investigating and managing the *Perkinsus*-related mortality of blacklip abalone in NSW. 182pp.

No. 121 Knight, J., 2010. The feasibility of excluding alien redfin perch from Macquarie perch habitat in the Hawkesbury-Nepean Catchment. 53pp.

No. 122 Ghosn, D., Steffe, A., Murphy, J., 2010. An assessment of the effort and catch of shore and boat-based recreational fishers in the Sydney Harbour estuary over the 2007/08 summer period. 60pp.

No. 123 Rourke, M. and Gilligan, D., 2010. Population genetic structure of freshwater catfish (*Tandanus tandanus*) in the Murray-Darling Basin and coastal catchments of New South Wales: Implications for future re-stocking programs. 74pp.

No. 124 Tynan, R., Bunter, K. and O'Connor, W., 2010. Industry Management and Commercialisation of the Sydney Rock Oyster Breeding Program. 21pp.

No. 125 Lowry, M., Folpp, H., Gregson, M. and McKenzie, R., 2010. Assessment of artificial reefs in Lake Macquarie NSW. 47pp.

No. 126 Howell, T. and Creese, R., 2010. Freshwater fish communities of the Hunter, Manning, Karuah and Macquarie-Tuggerah catchments: a 2004 status report. 93pp.

No. 127 Gilligan, D., Rodgers, M., McGarry, T., Asmus, M. and Pearce, L., 2010. The distribution and abundance of two endangered fish species in the NSW Upper Murray Catchment. 34pp.

No. 128 Gilligan, D., McGarry, T. and Carter, S., 2010. A scientific approach to developing habitat rehabilitation strategies in aquatic environments: A case study on the endangered Macquarie perch (*Macquaria australasica*) in the Lachlan catchment. 61pp.

No. 129 Stewart, J., Hughes, J., McAllister, J., Lyle, J. and MacDonald, M., 2011. Australian salmon (*Arripis trutta*): Population structure, reproduction, diet and composition of commercial and recreational catches. 257 pp.

ISSN 1837-2112 (Fisheries Final Report Series)

No. 130 Boys, C., Glasby, T., Kroon, F., Baumgartner, L., Wilkinson, K., Reilly, G. and Fowler, T., 2011. Case studies in restoring connectivity of coastal aquatic habitats: floodgates, box culvert and rock-ramp fishway. 75pp.

No. 131 Steffe, A.S. and Murphy, J.J., 2011. Recreational fishing surveys in the Greater Sydney Region. 122pp.

No. 132 Robbins, W.D., Peddemors, V.M. and Kennelly, S.J., 2012. Assessment of shark sighting rates by aerial beach patrols. 38pp.

No. 133 Boys, C.A. and Williams, R.J., 2012. Fish and decapod assemblages in Kooragang Wetlands: the impact of tidal restriction and responses to culvert removal. 80pp.

No. 134 Boys, C.A, Baumgartner,L., Rampano, B., Alexander, T., Reilly, G., Roswell, M., Fowler, T and Lowry. M. 2012. Development of fish screening criteria for water diversions in the Murray-Darling Basin. 62pp.

No. 135 Boys, C.A, Southwell, M., Thoms, M., Fowler, T, Thiebaud, I., Alexander, T. and Reilly, G. 2012. Evaluation of aquatic rehabilitation in the Bourke to Brewarrina Demonstration Reach, Barwon-Darling River, Australia. 133pp

No. 136 Baumgartner, L., McPherson, B., Doyle, J., Cory, J., Cinotti, N. and Hutchison, J. 2013. Quantifying and mitigating the impacts of weirs on downstream passage of native fish in the Murray-Darling Basin. 79pp.

No. 137 Boys, C.A, Baumgartner, B., Miller, B., Deng, Z., Brown, R. and Pflugrath, B. 2013. Protecting downstream migrating fish at mini hydropower and other river infrastructure. 93pp.

No. 138 Hughes, J.M. and Stewart, J. 2013. Assessment of barotrauma and its mitigation measures on the behaviour and survival of Snapper and Mulloway. 152pp.

No. 139 Ochwada-Doyle, F.A., McLeod, J., Barrett, G., Clarke, G. and Gray, C.A., 2014. Assessment of recreational fishing in three recreational fishing havens in New South Wales. 29pp.

No. 140 Walsh, C. T., Rodgers, M. P., Thorne, N. J. and Robinson, W. A., 2013. Thermoshock Fish Mortality Investigation. 32pp.

No. 141 Boys, C.A., Navarro, A., Robinson, W., Fowler, T., Chilcott, S., Miller, B., Pflugrath, B., Baumgartner, L.J., McPherson, J., Brown, R. and Deng, Z., 2014. Downstream fish passage criteria for hydropower and irrigation infrastructure in the Murray-Darling Basin. 119pp.

No. 142 Cameron, L., Baumgartner, L. and Miners, B., 2012. Assessment of Australian bass restocking in the upper Snowy River. 102pp.

No. 143 Walsh, C., Rodgers, M., Robinson, W. and Gilligan, D., 2014. Evaluation of the effectiveness of the Tallowa Dam Fishway. 89pp.

ISSN 2204-8669 (Fisheries Final Report Series)

No. 144 Ghosn, D.L., Collins, D.P. and Gould, A., 2015. The NSW Game Fish Tournament Monitoring Program 1994 to 2013: A summary of data and assessment of the role and design. 200pp.

No. 145 Boys, C., 2015. Changes in fish and crustacean assemblages in tidal creeks of Hexham Swamp following the staged opening of Ironbark Creek floodgates. 47pp.

No. 146 Jordan, A., and Creese, R. 2015. Ecological Background to the Assesment of Shore-Based Recreational fishing on Ocean Beaches and Rocky Headlands in Sanctuary Zones in mainland NSW Marine Parks. 114pp.

No. 147 Glasby, T.M. and West, G., 2015. Estimating losses ofPosidonia australisdue to boat moorings in Lake Macquarie, Port Stephens and Wallis Lake. 30pp.

No. 148 Macbeth, W.G. and Gray, C.A., 2016. Observer-based study of commercial line fishing in waters off New South Wales. 151p.

No. 149 West, L.D., Stark, K.E., Murphy, J.J., Lyle, J.M. and Ochwada-Doyle, F.A., 2016. Survey of Recreational Fishing in New South Wales and the ACT, 2013/14. 150p.

No. 150 Stocks, J.R., Scott, K.F., Rodgers, M.P., Walsh, C.T., van der Meulen, D.E. and Gilligan, D., 2016. Short-term intervention monitoring of a fish community response to an environmental flow in the mid and lower Macquarie River: 2014/2015 watering year. 109p.

No. 151 Hohnberg, D., Duncan, M., Graham, P., Asmus, M. and Robinson, W., 2016. Koondrook-Perricoota Forest Fish Condition Monitoring 2015. 43p.

No. 152 Duncan, M., Robinson, W. and Doyle, J., 2016. Improved fish passage along the Nepean River as a result of retrofitting weirs with vertical-slot fishways. 110p.

No. 153 Knight, J.T., 2016. Distribution and conservation status of the endangered Oxleyan pygmy perch *Nannoperca oxleyana* Whitley in New South Wales. 88p.

No. 154 NSW Department of Primary Industries, 2017. NSW North Coast Shark-Meshing Trial Final Report. 63p.

No. 155 Becker, A., Lowry, M., Taylor, M. and Folpp, H., 2017. Assessment of the Sydney offshore artificial reef. 103p.

No. 156 Forbes, J.P., Steffe, A.S., Baumgartner, L.J. and Westaway, C., 2017. Preliminary assessment of the Lake Eucumbene summer recreational fishery 2015/16. 31p.

No.157 NSW Department of Primary Industries., 2018. Second NSW North Coast Shark-Meshing Trial Final Report. 71p.

No.158 Murphy, J.J., Ochwada-Doyle, F.A., West, L.D., Stark. K.E. and Hughes, J.M., 2020. Survey of recreational fishing in NSW, 2017/18. 223p.

No.159 Hughes, J.M., Johnson, D.D., Murphy, J.J. and Ochwada-Doyle, F.A., 2021. The NSW Recreational Fisheries Monitoring Program, Charter Fishery Monitoring, 2017/18. 97p.

No. 160 Miles, N. G., Butterfield, T., Rohan, M., and Westaway, C., 2022. Preliminary assessment of the recreational fishery in the Murray River near the trout cod spawning closure. NSW Department of Primary Industries, Nelson Bay, Fisheries Final Report Series No. 160.

No. 161 Murphy, J. J., Ochwada-Doyle, F. A., West, L. D., Stark, K. E., Hughes, J. M., and Taylor, M. D., 2022. Survey of recreational fishing in NSW, 2019/20. NSW Department of Primary Industries, Nelson Bay, Fisheries Final Report Series No. 161. 80p.

No.162 Hughes, J.M., Murphy, J.J., Ochwada-Doyle, F.A., and Taylor, M.D., 2023. NSW Charter Fishery Monitoring, 2019/20. NSW Department of Primary Industries, Nelson Bay, Fisheries Final Report Series No. 162. 78p.