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Fishery statistics and performance indicators for the South Australian Lakes and Coorong Fishery

J. Earl

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Report to PIRSA Fisheries and Aquaculture

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EXECUTIVE SUMMARY

This report provides a summary of fishery statistics for South Australia's Lakes and Coorong Fishery from 1984/85 to 2015/16. Data are presented for key finfish species harvested within the estuarine large mesh gill net (ELMGN), estuarine small mesh gill net (ESMGN) and freshwater large mesh gill net (FWLMGN) sectors of the fishery, along with an assessment of the recent condition of the environment in which the finfish fishery operates against reference points specified in the fishery's management plan. Fishery statistics are also presented for the bivalve mollusc Pipi (*Donax deltoides*), which is harvested in the nearshore marine environment adjacent the Coorong estuary.

For the ELMGN finfish sector, total catch of Mulloway (*Argyrosomus japonicus*) increased to 73 t in 2015/16 reflecting concurrent increases in targeted catch, effort and catch per unit effort. The Greenback Flounder (*Rhombosolea tapirina*) catch of 4.5 t in 2015/16 was higher than that in 2014/15, while the total Black Bream (*Acanthopagrus butcheri*) catch of 1.9 t in 2015/16 was among the lowest recorded in the fishery. The environmental performance indicator for habitat available to Mulloway in the Coorong estuary for the 2016/17 reporting year (1 February 2016 to 31 January 2017) was 63.3%, which was above the target reference point of 55%.

For the ESMGN finfish sector, the total Yelloweye Mullet (*Aldrichetta forsteri*) catch of 135 t in 2015/16 was 12% higher than that in 2014/15, but remained below the long-term average. The environmental performance indicator for habitat available to Yelloweye Mullet in the Coorong estuary for the 2016/17 reporting year was 69.7%, which was above the target reference point of 50%.

For the FWLMGN finfish sector, total catches of Golden Perch (*Macquaria ambigua*) (77 t), Bony Bream (*Nematalosa erebi*) (389 t) and Common Carp (*Cyprinus carpio*) (392 t) in 2015/16 were marginally lower compared to the previous year. The environmental performance indicator for mean annual water level in the Lower Lakes for the 2016/17 reporting year was 0.72 m, which was above the target reference point of 0.4 m.

For Pipi, annual catches have been constrained by quota since 2009/10. The total Pipi catch of 492 t in 2015/16 was higher than that in 2014/15 presumably due to an increase in the total allowable commercial catch.

1. INTRODUCTION

This is the eleventh annual report that summarises the fishery statistics for the multi-gear and multi-species Lakes and Coorong Fishery (LCF) of South Australia. The aims of the report are to: (i) provide a historical summary of the commercial and recreational fishery statistics for the key species in the LCF; and (ii) assess the recent condition of the environment in which the finfish fishery operates against a suite of reference points. The requirement for these reports is prescribed in the previous (Sloan 2005) and current management plan for the LCF (PIRSA 2015).

The current management plan (hereafter referred to as the 'Management Plan') came into effect on 1 March 2016, and includes a harvest strategy for finfish (PIRSA 2015). This harvest strategy aims to manage the sustainable harvest of finfish relative to environmental conditions – specifically the amount of habitat available to key species for three habitat/gear-based sectors. The sectors are: (i) estuarine large mesh gill net (ELMGN); (ii) estuarine small mesh gill net (ESMGN); and (iii) freshwater large mesh gill net (FWLMGN).

This report summarises the fishery data for seven different finfish species that are taken across the three habitat/gear-based finfish sectors of the LCF (Table 1.1). These are distributed across the 'primary' and 'secondary' species categories defined in the Management Plan (PIRSA 2015), and are consistent with those considered in previous fishery statistics reports (e.g. Earl 2016). Estimates of total catch are presented for several other species, including three listed as 'tertiary' species in the Management Plan (PIRSA 2015).

The finfish harvest strategy uses environmental performance indicators, reference points and decision rules to guide management of the fishery through adjustment of annual total allowable commercial effort (TACE) for each of the three habitat/gear-based sectors. Estimates of the performance indicators for the 2016/17 reporting year (1 February 2016 to 31 January 2017) relative to target, trigger and limit reference points are presented to inform setting of the TACE for the three sectors for the 2017/18 fishing season (financial year).

The report also summarises fishery data for Pipi (*Donax deltoides*), which is a primary species in the Management Plan. A quota management system was introduced for Pipi in 2007/08. In 2013, a harvest strategy was developed for Pipi, which was updated in the current Management Plan. The revised harvest strategy contains performance indicators and associated decision rules for setting annual total allowable commercial catch (TACC). The TACC for Pipi for the 2015/16 fishing season was 500 t, which was 50 t higher than for 2014/15. The Pipi performance indicators will be presented in a stock assessment report due in mid-2017, and are not presented in this report.

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Table 1.1. Primary and Secondary species and latest stock assessment reports for the three habitat/gear-based finfish sectors of the LCF.

Finfish sector	Key species	Stock assessment report
Estuarine large mesh gill net	Mulloway (*Argyrosomus japonicas*) [P] Greenback Flounder (*Rhombosolea tapirina*) [S] Black Bream (*Acanthopagrus butcheri*) [S]	Earl and Ward (2014) Earl and Ye (2016) Earl et al. (2016)
Estuarine small mesh gill net	Yelloweye Mullet (*Aldrichetta forsteri*) [P]	Earl and Ferguson (2013)
Freshwater large mesh gill net	Golden Perch (*Macquaria ambigua*) [P] Bony Bream (*Nematalosa erebi*) [P] Common Carp (*Cyprinus carpio*) [P]	Ferguson and Ye (2012) - -

[P] Primary; [S] Secondary.

2. METHODS

2.1. Fishery statistics

Daily commercial catch and effort data have been collected by LCF fishers since 1 July 1984 and are submitted to SARDI Aquatic Sciences on a monthly basis. Data include catch (kg), effort (fisher days, net-days) for targeted and non-targeted species, and location of the activity.

Annual catch totals for primary, secondary and tertiary species groups are presented for each financial year from 1984/85 to 2015/16. The total catch of each primary species is also presented to show inter-annual catch dynamics. For each primary and secondary species, annual estimates are provided for: (i) total catch by LCF reporting block for 2015/16; (ii) total catch; (iii) targeted catch; (iv) targeted effort; and (v) catch per unit effort (CPUE; targeted catch divided by targeted effort) for the main gear type. CPUE is not presented for Pipi because it is considered a poor indicator of relative abundance for this species (Ferguson et al. 2015). Data relating to less than five licences are not shown as these are considered confidential.

Where available, the total commercial catches for each species were supplemented with recreational catch estimates, sourced from the: (i) National Recreational and Indigenous Fishing Survey from May 2000 to April 2001 (Henry and Lyle 2003), and State-wide telephone/diary surveys of South Australian residents from (ii) November 2007 to October 2008 (Jones 2009) and (iii) December 2013 to November 2014 (Giri and Hall 2015).

2.2. Environmental performance indicators (finfish)

For each of the three finfish sectors, the recent condition of the environment in which the LCF operates was assessed by comparing the environmental performance indicator for the 2016/17 reporting year against target, trigger and limit reference points derived from the 1984/85 to 2012/13 reference period (Table 2.1).

The performance indicators for the ELMGN and ESMGN sectors represent annual estimates of the proportion (%) of the Coorong estuary available to Mulloway (*Argyrosomus japonicus*) and Yelloweye Mullet (*Aldrichetta forsteri*), respectively. These metrics are determined based on the salinity tolerances of the each species, and estimates of salinity at 1 km increments along the longitudinal gradient of the Coorong estuary (Knuckey et al. 2015). Detailed descriptions of the methods used to calculate estimates of the performance indicators and reference points are provided in the Management Plan (PIRSA 2015).

Table 2.1. Performance indicators and reference points (RP) for the three finfish sectors of the LCF.

Finfish sector	Performance indicator	Target RP	Trigger RP	Limit RP
Estuarine large mesh gill net	Habitat available to Mulloway (%)	55	24.9	10
Estuarine small mesh gill net	Habitat available to Yelloweye Mullet (%)	50	30.9	10
Freshwater large mesh gill net	Water level in Lake Alexandrina (m, AHD)	0.4	-0.71	-1.2

AHD = Australian Height Datum

2.3. Quality assurance processes

Various quality assurance processes were implemented to ensure the accuracy of this report:

1. Commercial catch and effort data were validated by SARDI's Fisheries Information Services Group based on:
    i. random cross-checking of raw data transferred from commercial catch returns,
    ii. random cross-checking of data entered to the database by trained personnel, and
    iii. automated filters and structured queries built into the fisheries statistics database;
2. Extracted catch and effort data for each species were graphed into their necessary species/gear/time categories and cross-checked with the time-series presented in previous fishery statistics reports (e.g. Earl 2015, 2016);
3. Tabulated fishery data were cross-checked against the computer output; and
4. The report was formally reviewed by two SARDI scientists before approval for publication.

3. RESULTS

3.1. Catch composition

Total production of the LCF has varied considerably over time (Figure 3.1). This variation is mainly attributed to inter-annual variation in total catch of the primary species, as this group has consistently made up >95% of total production over the past three decades. Among the primary species, catches of Bony Bream (*Nematalosa erebi*), Common Carp (*Cyprinus carpio*) and Pipi

have collectively accounted for most (>78%) of the annual catches since 1984/85, with smaller contributions from Yelloweye Mullet, Golden Perch (*Macquaria ambigua*) and Mulloway (Figure 3.1). A summary of total annual catches for twelve LCF species is shown in Appendix 1.
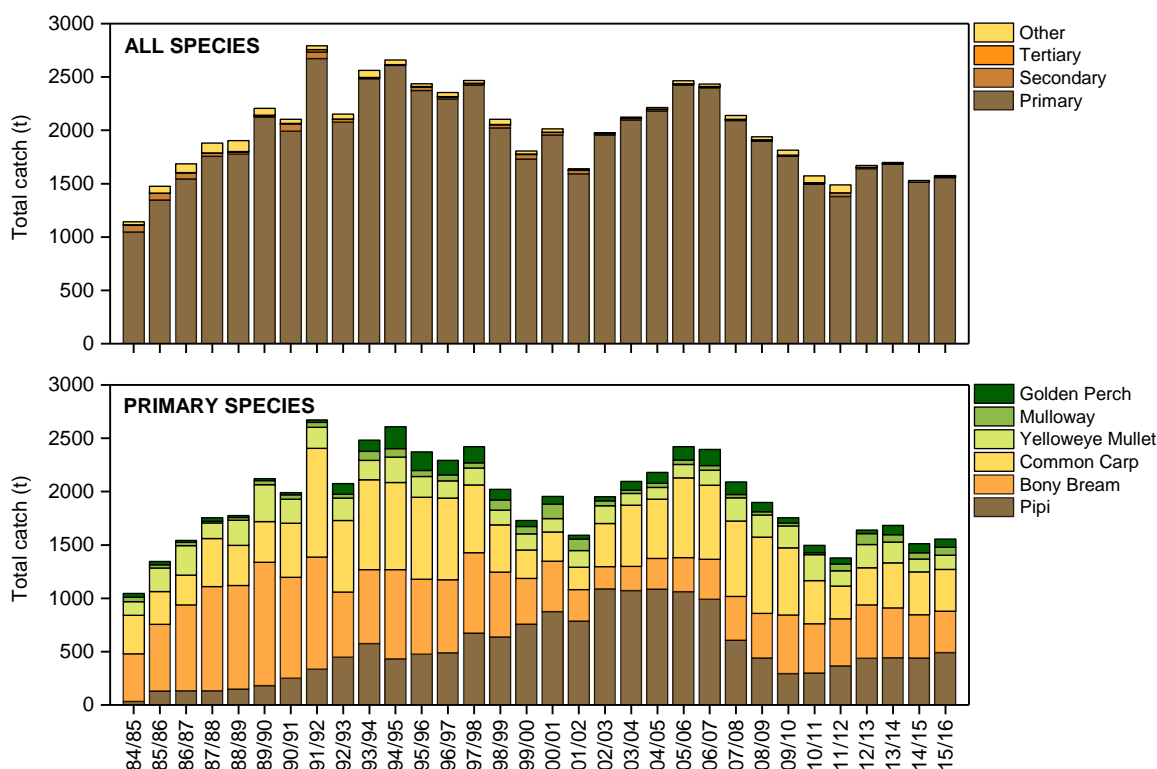
Figure 3.1. Annual commercial catches in the LCF, by species category (top) and individual primary species (bottom).

3.2. Finfish

Estuarine large mesh gill net sector

Fishery statistics

For the ELMGN sector, fishery statistics are presented for Mulloway, Greenback Flounder (*Rhombosolea tapirina*) and Black Bream (*Acanthopagrus butcheri*). For Mulloway, there was an increase in total catch in 2015/16, which occurred concurrently with increases in targeted catch, effort and CPUE (Figure 3.2). A small proportion (4%) of the total Mulloway catch in 2015/16 was taken in marine waters adjacent the Coorong estuary using swinger nets. For Greenback Flounder, annual catches and targeted effort have been highly variable over the past decade (Figure 3.3). The total catch of Greenback Flounder in 2015/16 was higher compared to the previous year, but substantially lower than the relatively high catch in 2011/12. For Black Bream, annual catches have been historically low in most years since 1990/91, reflecting low targeted effort (Figure 3.4).

Mulloway (*Argyrosomus japonicus*)

Figure 3.2. Fishery statistics for Mulloway, including: (A) a map of the LCF catch and effort reporting blocks showing catches during 2015/16; (B) total annual catches for the LCF by habitat (estuarine/marine), and the recreational sector (2000/01, 2007/08, 2013/14); (C) targeted annual catch and effort for large mesh gill nets; and (D) targeted annual CPUE for large mesh gill nets.

Greenback Flounder (*Rhombosolea tapirina*)

Figure 3.3. Fishery statistics for Greenback Flounder, including: (A) a map of the LCF catch and effort reporting blocks showing catches during 2015/16; (B) total annual catches for the LCF and the recreational sector (2000/01, 2007/08, 2013/14); (C) targeted annual catch and effort for large mesh gill nets; and (D) targeted annual CPUE for large mesh gill nets. Crosses indicate confidential data.

Black Bream (*Acanthopagrus butcheri*)

Figure 3.4. Fishery statistics for Black Bream, including: (A) a map of the LCF catch and effort reporting blocks showing catches during 2015/16; (B) total annual catches for the LCF and the recreational sector (2000/01, 2007/08, 2013/14); (C) targeted annual catch and effort for large mesh gill nets; and (D) targeted annual CPUE for large mesh gill nets. Crosses indicate confidential data.

Environmental performance indicator

The ELMGN performance indicator for habitat available to Mulloway in the Coorong estuary was 63.3% for the 2016/17 reporting year, which was above the target reference point of 55% (Figure 3.5).
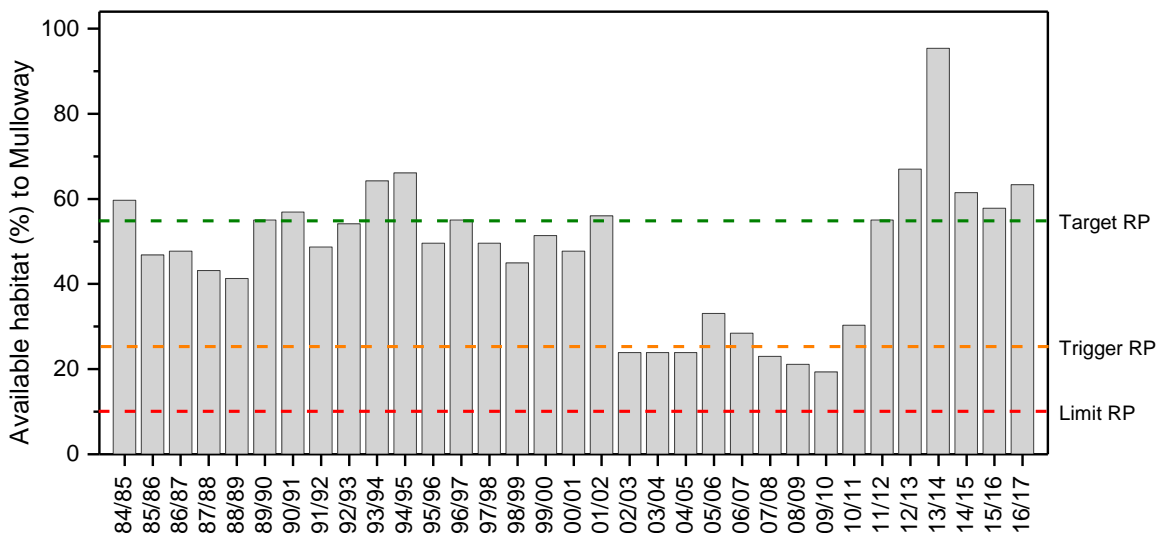
Figure 3.5. Estimates of the ELMGN performance indicator for habitat available to Mulloway in the Coorong estuary from 1984/85 to 2016/17 (reporting years), showing target, trigger and limit reference points (RP).

Estuarine small mesh gill net sector

Fishery statistics

For the ESMGN sector, fishery statistics are presented for Yelloweye Mullet. In 2015/16, total catch for Yelloweye Mullet increased marginally from the relatively low level in 2014/15, despite a decline in annual targeted effort (Figure 3.6). This increase in catch was associated with an increase in CPUE for small mesh gill nets.

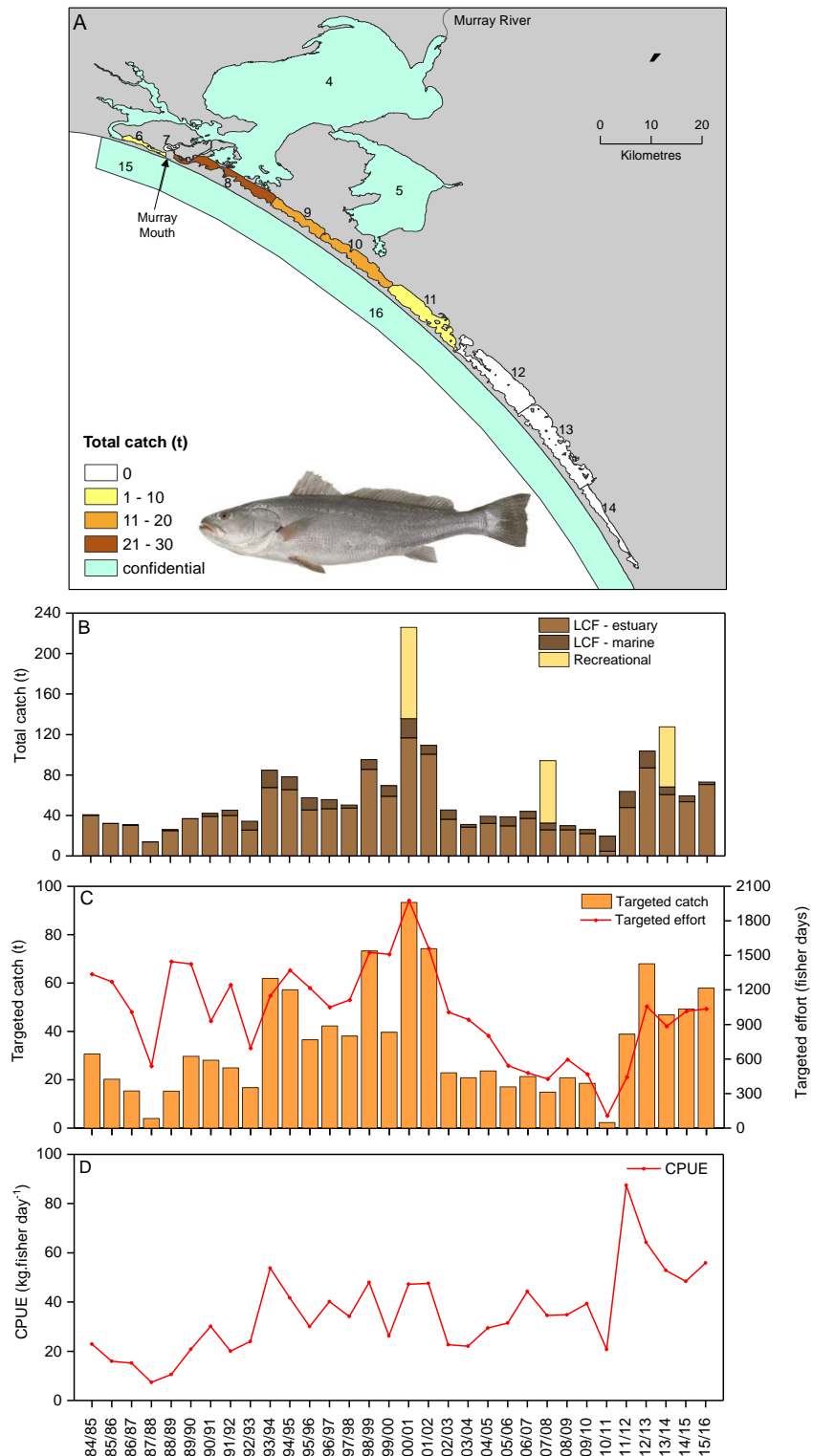## Yelloweye Mullet (*Aldrichetta forsteri*)

Figure 3.6. Fishery statistics for Yelloweye Mullet, including: (A) a map of the LCF catch and effort reporting blocks showing catches during 2015/16; (B) total annual catches for the LCF and the recreational sector (2000/01, 2007/08, 2013/14); (C) targeted annual catch and effort for small mesh gill nets; and (D) targeted annual CPUE for small mesh gill nets.

Environmental performance indicator

The ESMGN performance indicator for habitat available to Yelloweye Mullet in the Coorong estuary was 69.7% for the 2016/17 reporting year, which was above the target reference point of 50% (Figure 3.7).
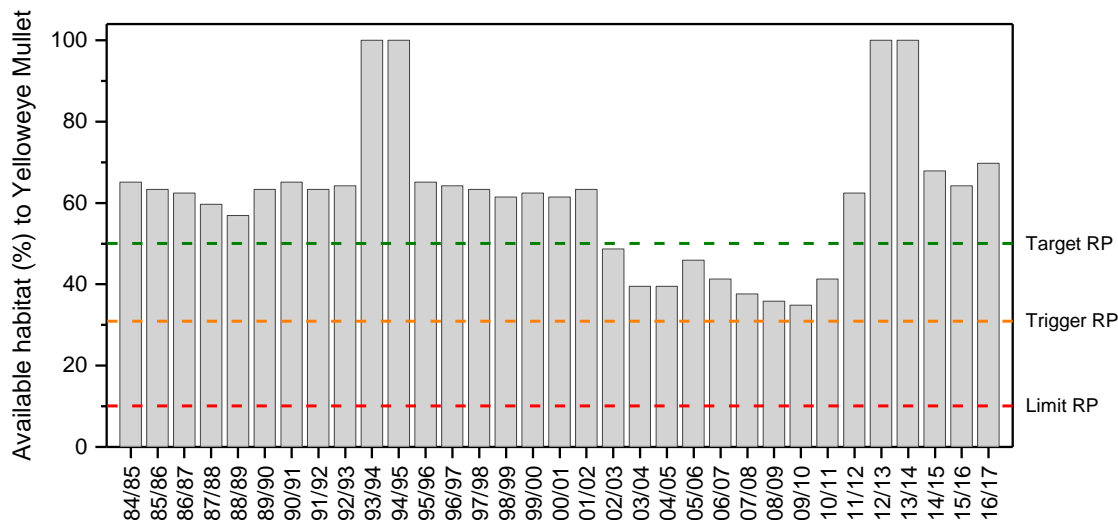
Figure 3.7. Estimates of the ESMGN performance indicator for habitat available to Yelloweye Mullet in the Coorong estuary from 1984/85 to 2016/17 (reporting years), showing target, trigger and limit reference points (RP).

Freshwater large mesh gill net sector

Fishery statistics

For the FWLMGN sector, fishery statistics are presented for Golden Perch, Bony Bream and Common Carp. For Golden Perch, estimates of total catch, and targeted catch and effort were marginally lower in 2015/16 than in 2014/15, while there was a marginal increase in CPUE (Figure 3.8). For Bony Bream, the total catch of 389 t in 2015/16 was within the range of annual catches since 2001/02 (212–550 t), although it has progressively declined over the past four years (Figure 3.9). For Common Carp, there was a marginal decline in total catch in 2015/16, which was associated with a decline in targeted catch and CPUE (Figure 3.10).

Golden Perch (*Macquaria ambigua*)
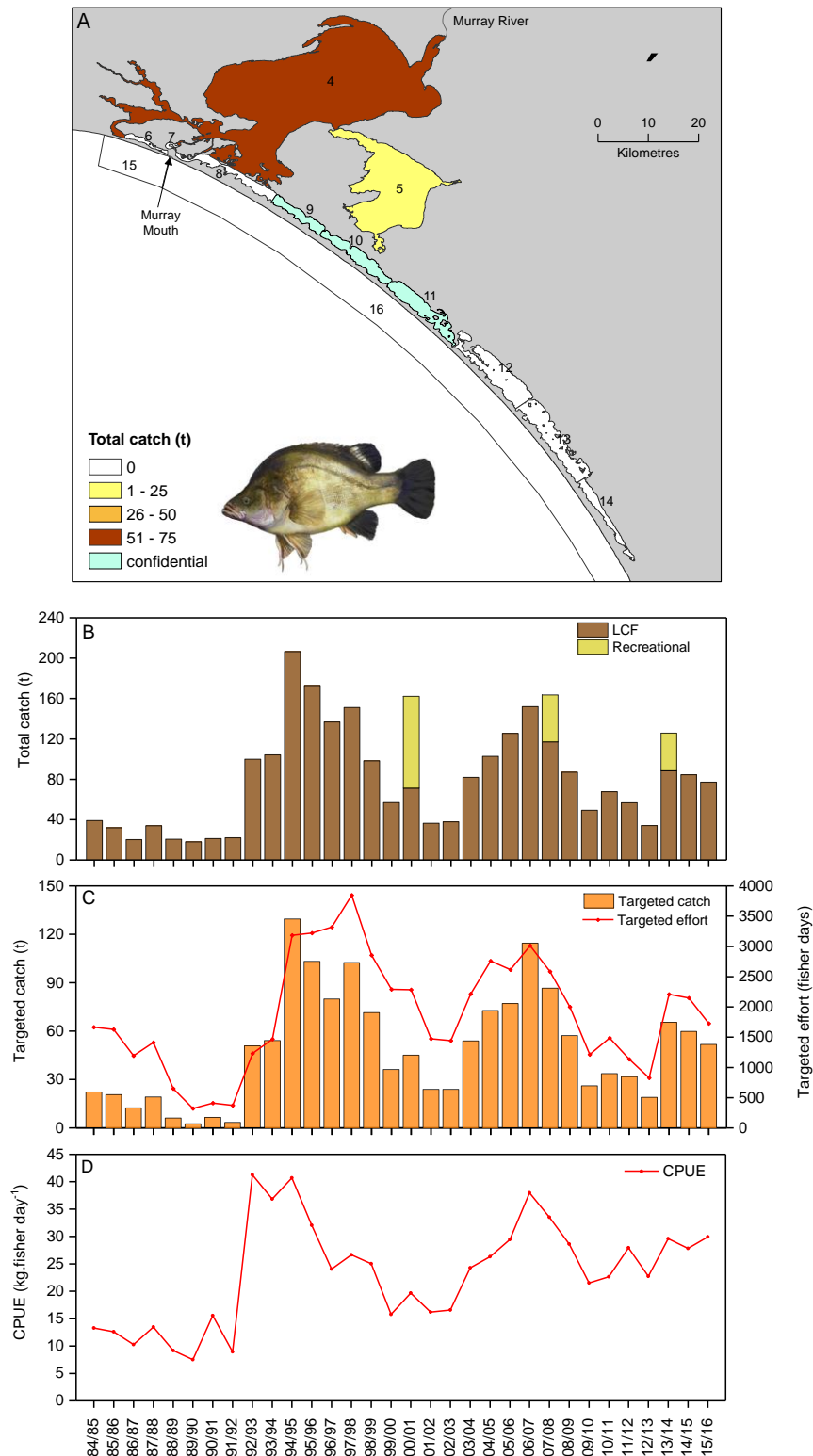
Figure 3.8. Fishery statistics for Golden Perch, including: (A) a map of the LCF catch and effort reporting blocks showing catches during 2015/16; (B) total annual catches for the LCF and the recreational sector (2000/01, 2007/08, 2013/14); (C) targeted annual catch and effort for large mesh gill nets; and (D) targeted annual CPUE for large mesh gill nets.
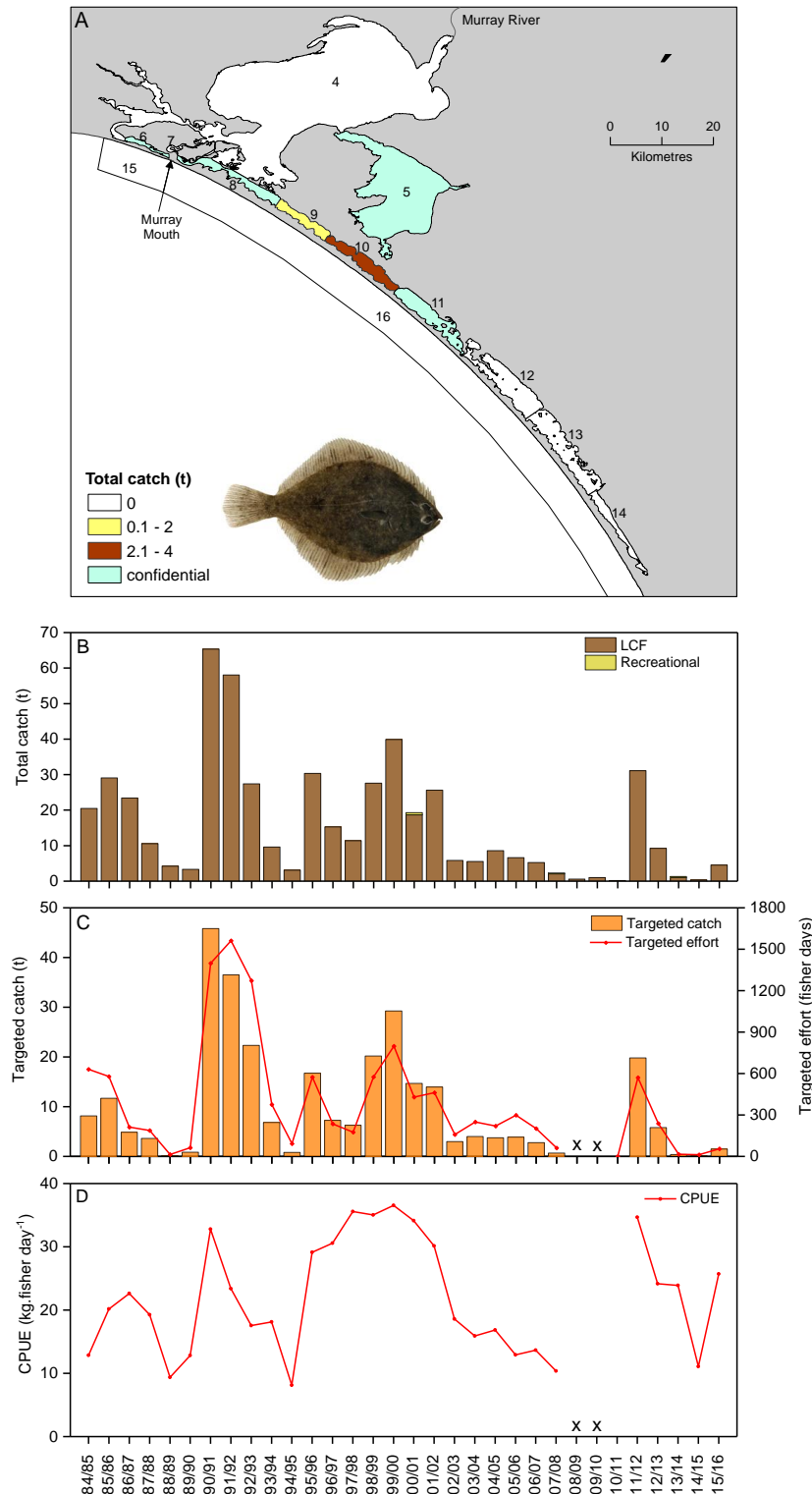
Bony Bream (*Nematalosa erebi*)
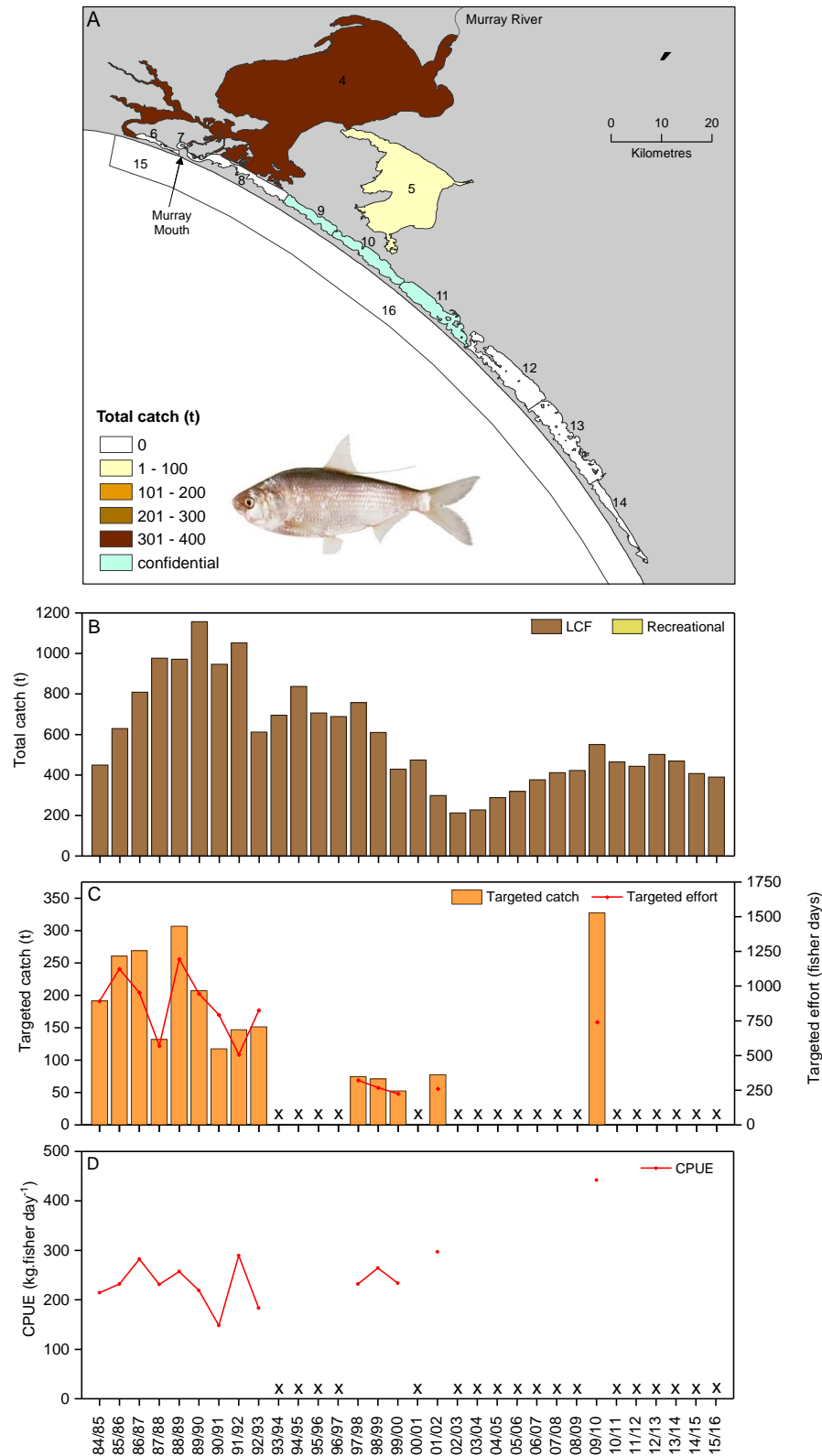
Figure 3.9. Fishery statistics for Bony Bream, including: (A) a map of the LCF catch and effort reporting blocks showing catches during 2014/15; (B) total annual catches for the LCF and the recreational sector (2000/01, 2007/08, 2013/14); (C) targeted annual catch and effort for large mesh gill nets; and (D) targeted annual CPUE for large mesh gill nets. Crosses indicate confidential data.
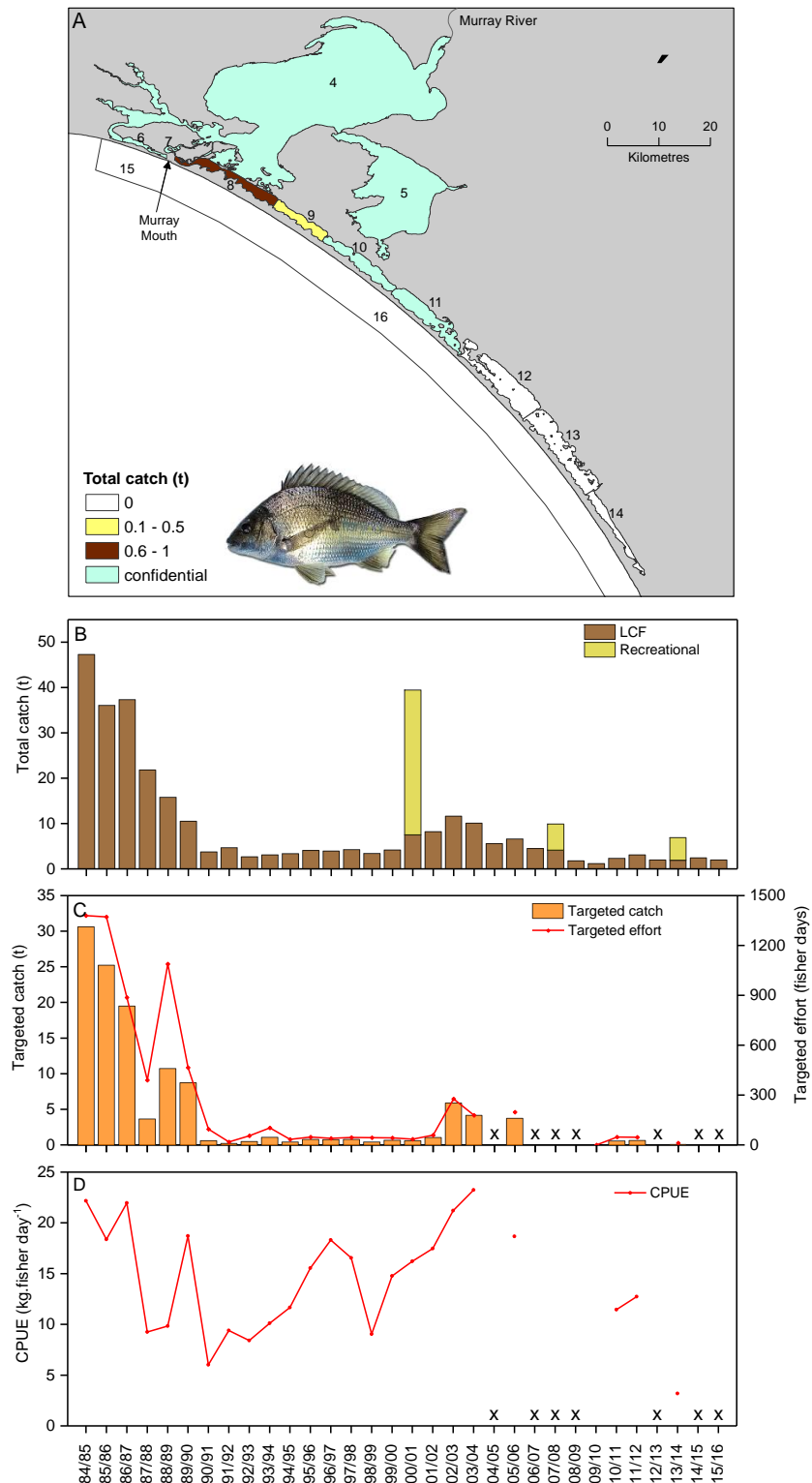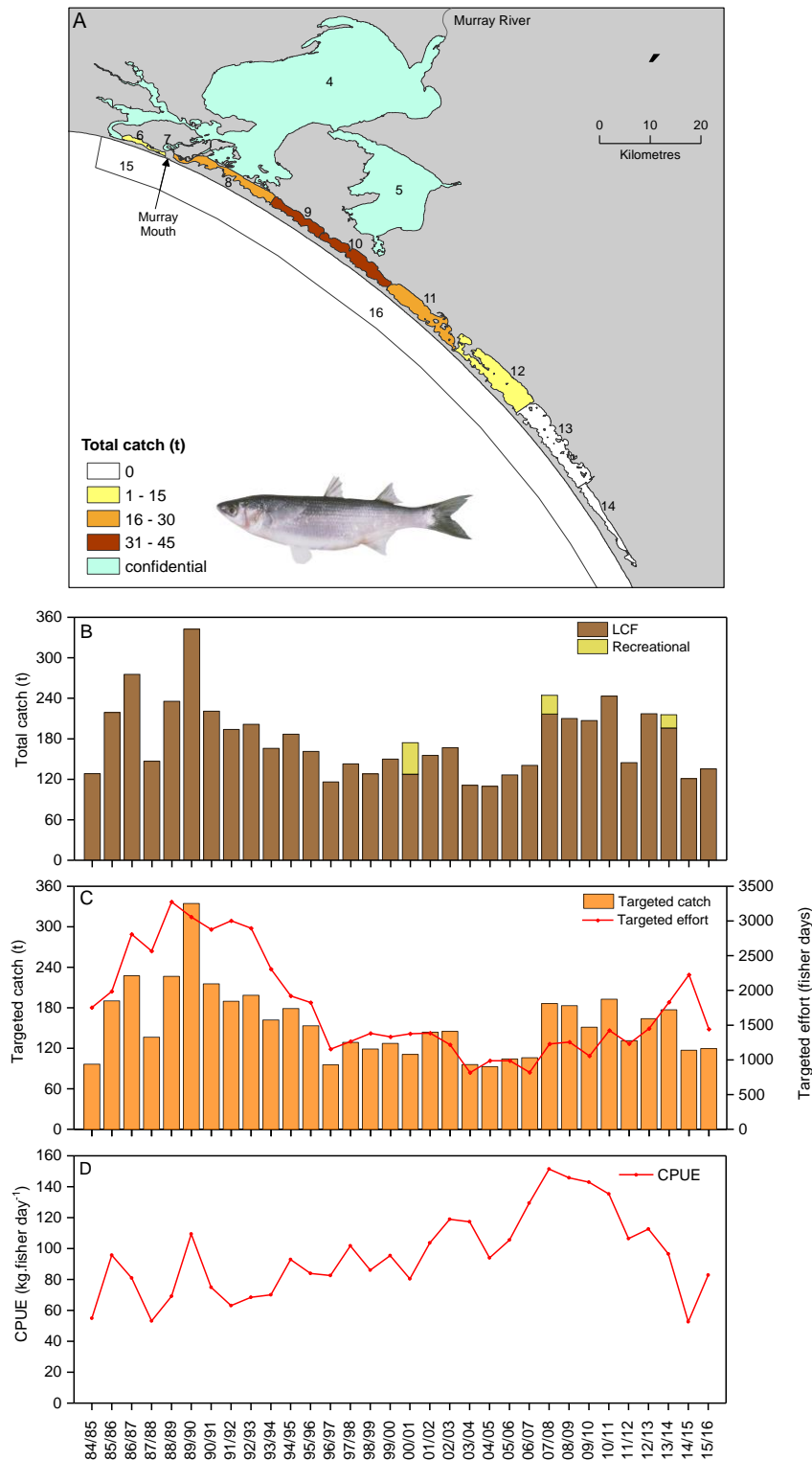
Common Carp (*Cyprinus carpio*)
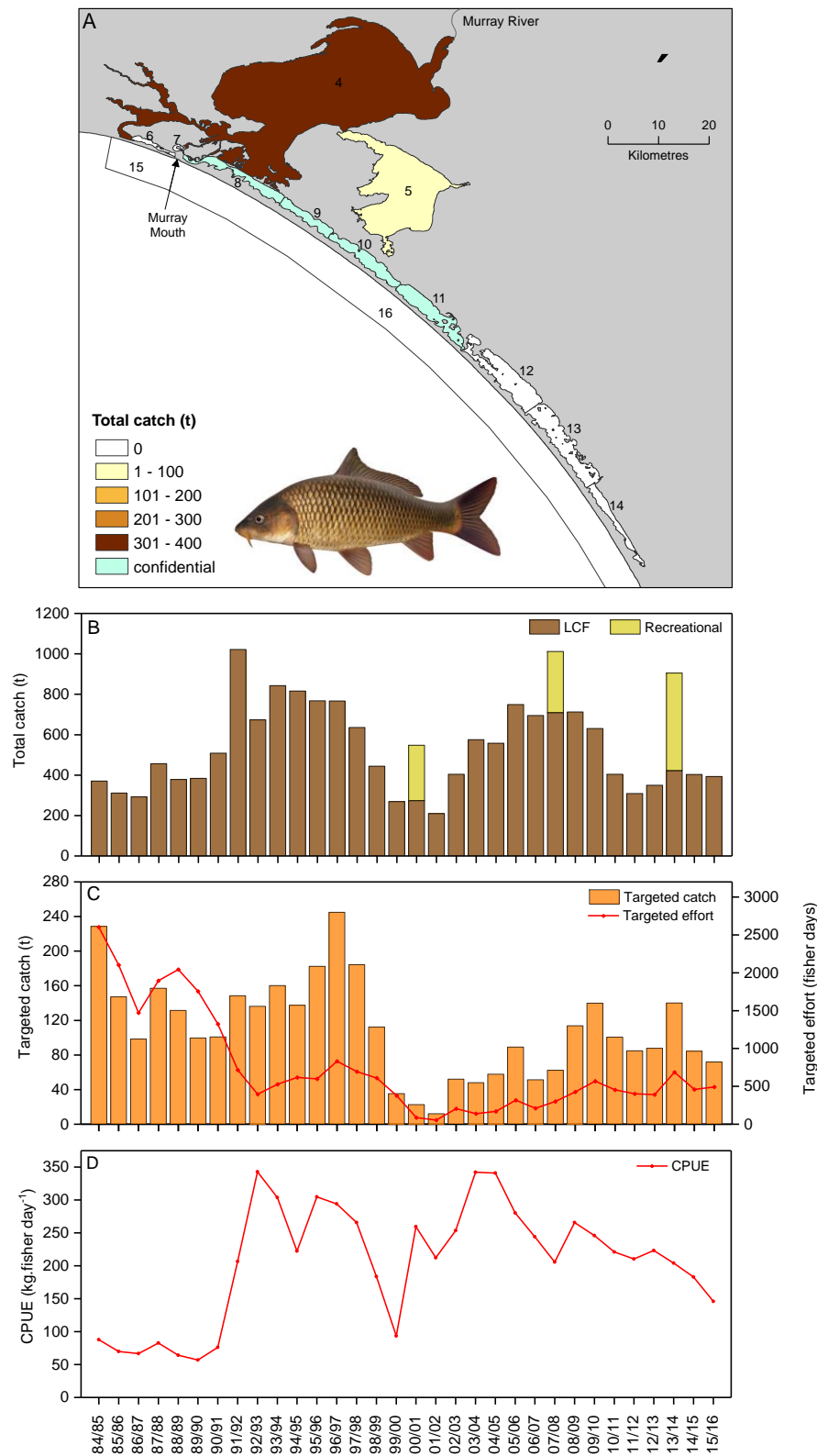
Figure 3.10. Fishery statistics for Common Carp, including: (A) a map of the LCF catch and effort reporting blocks showing catches during 2015/16; (B) total annual catches for the LCF and the recreational sector (2000/01, 2007/08, 2013/14); (C) targeted annual catch and effort for large mesh gill nets; and (D) targeted annual CPUE for large mesh gill nets.

Environmental performance indicator

The FWLMGN performance indicator for mean water level in the Lower Lakes was 0.72 m for the 2016/17 reporting year, which was above the target reference point of 0.4 m (Figure 3.11).
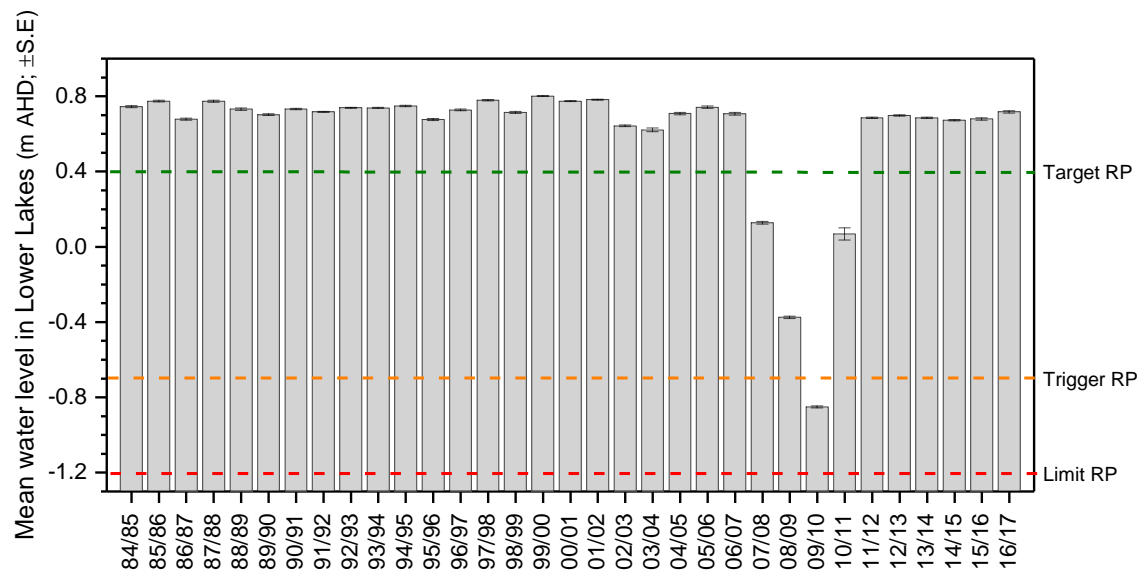
Figure 3.11. Estimates of the FWLMGN performance indicator for mean water level in the Lower Lakes from 1984/85 to 2016/17 (reporting years), showing target, trigger and limit reference points (RPs).

3.3. Pipi (*Donax deltoides*)

Fishery statistics

The LCF harvests Pipi from nearshore marine waters adjacent the Coorong estuary (Figure 3.12). Commercial catches of Pipi exceeded 1,000 t for several years during the late 1990s and early 2000s, but have been constrained by quota since 2009/10. The total catch of 492 t taken in 2015/16, which includes small contributions from two Marine Scalefish Fishery (MSF) licences, was the highest catch since 2007/08, largely a result of an 11% increase in TACC from 2014/15. Catch data from the MSF are not presented due to data confidentiality.
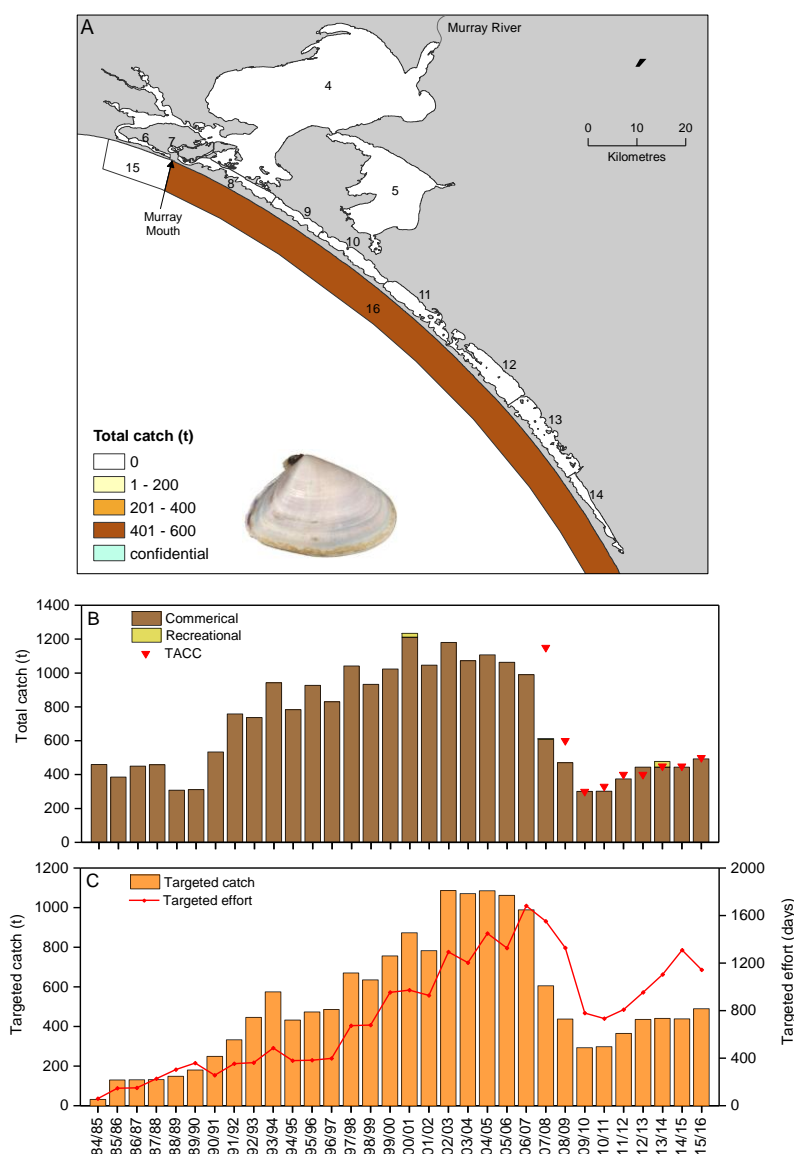
Figure 3.12. Fishery statistics for Pipi, including: (A) a map of the LCF catch and effort reporting blocks showing catches during 2015/16; (B) total annual catches for the LCF and MSF (combined) and the recreational sector (2000/01, 2007/08, 2013/14); and (C) targeted annual catch and effort for cockle rakes (LCF only). Note: (i) total catch was constrained by the TACC from 2009/10 to 2015/16; and (ii) total catch for 2012/13 was higher than the TACC due to a shift in the quota period from calendar years to financial years.

4. SYNTHESIS

In this report, a summary of the annual fishery statistics was presented for key finfish species harvested within the three habitat/gear-based sectors of the LCF (i.e. ELMGN; ESMGN and FWLMGN) and the bivalve mollusc Pipi, which is harvested in the nearshore marine environment adjacent the Coorong estuary. For the ELMGN sector in 2015/16, total catches of Mulloway and Greenback Flounder were slightly higher than in the previous year, while the Black Bream catch remained low. For the ESMGN sector, the total catch of Yelloweye Mullet was marginally higher in 2015/16 compared to 2014/15 consistent with an increase in CPUE. For the FWLMGN sector, catches of Golden Perch, Bony Bream and Common Carp were marginally lower in 2015/16 than in the previous year. For Pipi, the total catch of 492 t in 2015/16 was higher than that in 2014/15 presumably due to an increase in the TACC.

For the three finfish sectors, the estimate of the environmental performance indicator for the 2016/17 reporting year was assessed against the target, trigger and limit reference points used in the finfish harvest strategy (PIRSA 2015) to inform setting the TACE for the 2017/18 fishing season. All three environmental performance indicators for 2016/17 were above their respective target reference point (Table 4.1).

Table 4.1. Environmental performance indicators and reference points (RP) for the three habitat/gear-based finfish sectors of the LCF in 2016/17.

Finfish sector	Performance indicator	Target RP	Trigger RP	Limit RP	2016/17 estimate
Estuarine large mesh gill net	Habitat available to Mulloway (%)	55	24.9	10	63.3%
Estuarine small mesh gill net	Habitat available to Yelloweye Mullet (%)	50	30.9	10	69.7%
Freshwater large mesh gill net	Water level in Lake Alexandrina (m AHD)	0.4	-0.71	-1.2	0.72 m

With the recent recovery of Long-nosed Fur Seal (*Arctocephalus forsteri*) populations in South Australia (Shaughnessy et al. 2015), interactions with gill nets used by fishers of the LCF have increased (Mackay et al. 2016). Interactions typically involve the seals eating fish caught in gill nets, which can result in loss of catch and damage to fishing gear. Uncertainty surrounds the impacts of seal interactions on the LCF, as levels of discarding of seal-damaged finfish and catch losses attributable to seal interactions have not been quantified. This knowledge gap may be addressed with data collected as part of the Fisheries Research and Development Corporation project: '*Developing alternative strategies for managing seal-fisher interactions in the South Australian Lakes and Coorong Fishery'* (Project No. 2016-001).

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APPENDIX

Table A.1. Summary table showing total commercial catches by financial year for fourteen LCF species defined as 'primary', 'secondary', 'tertiary' or 'other' species in the Management Plan (PIRSA 2015). Total catches for Pipi includes LCF and MSF catches. Crosses indicate confidential data. Abbreviations: W.A. Salmon = Western Australian Salmon (*Arripus trutta*); Aust. Herring = Australian Herring (*Arripus georgianus*).

	Primary						Secondary		Tertiary			Other
	Mulloway	Yelloweye Mullet	Golden Perch	Bony Bream	Common Carp	Pipi	Greenback Flounder	Black Bream	Snapper	W.A. Salmon	Aust. Herring	Redfin Perch
84/85	41	128	89	449	370	459	20	47	0	1	0	15
85/86	32	219	62	629	311	385	29	36	x	2	0	52
86/87	31	277	64	808	292	449	23	37	0	1	0	54
87/88	14	147	63	977	456	457	10.5	22	0	2	0	72
88/89	26	235	95	972	378	308	4.2	16	x	4	0	92
89/90	37	346	133	1157	383	311	3.3	10	0	8	x	59
90/91	42	224	164	947	508	533	65	3.7	0	4	x	37
91/92	45	198	157	1053	1021	758	58	4.7	0	23	x	32
92/93	34	210	279	612	673	737	27	2.6	0	3	0	40
93/94	85	181	299	695	842	942	10	3.1	0	1	x	69
94/95	78	239	286	838	816	783	3	3.3	x	x	0	44
95/96	57	195	292	706	767	927	30	4	0	5	0	24
96/97	56	161	235	688	767	829	15	3.9	0	3	0	30
97/98	50	158	190	757	635	1041	11	4.3	1	4	0	22
98/99	95	139	154	609	444	932	28	3.4	1	3	0	45
99/00	69	150	97	429	269	1024	39.9	4.1	2	4	0	24
00/01	136	127	173	474	274	1211	18.6	7.5	0	2	0	25
01/02	109	155	97	299	210	1046	25.6	8.2	0	1	0	10
02/03	45	167	64	212	404	1180	5.8	11.6	0	1	x	6
03/04	31	111	82	228	575	1073	5.5	10	x	2	0	9
04/05	39	110	103	287	558	1108	8.5	5.5	0	4	0	11
05/06	39	127	125	319	749	1062	6.6	6.6	0	3	0	23
06/07	44	141	152	376	694	990	5.2	4.7	1	4	0	16
07/08	32	216	117	411	709	607	2	4	0	6	0	29
08/09	30	210	87	422	713	470	0.5	1.8	0	10	0	28
09/10	26	207	49	550	630	301	1	1.1	3	10	0	41
10/11	19	243	68	464	404	301	0.1	2.3	3	8	0	61
11/12	64	144	57	443	308	374	31.1	3	1	1	0	68
12/13	103	217	34	502	349	443	9.2	1.9	x	1	0	12
13/14	68	196	88	469	422	444	1	1.9	x	0	0	8
14/15	59	121	85	407	403	443	0.3	2.4	0	1	0	14
15/16	73	135	77	389	392	492	4.5	1.9	0	3	0	12