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TASMANIAN RECREATIONAL ROCK LOBSTER AND ABALONE FISHERIES: 2021–22 FISHING SEASON

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Executive Summary

This report provides an assessment of the 2021–22 recreational rock lobster and abalone fishing season and continues the time series monitoring trends in these fisheries commenced in the mid-1990s.

The number of licence holders during the 2021–22 season were similar to the number of licence holders of last season (i.e. 2020–21). During 2021–22 almost 18,230 persons held at least one recreational rock lobster licence; a ~2% decrease in licence numbers when compared to 2020–21, and 11,780 persons held a recreational abalone licence; an increase of ~0.3% numbers when compared with 2020–21.

The assessment is provided by a survey involving a random sample of licence-holders who were contacted by telephone prior to the start of the 2021–22 fishing season and invited to participate in a phone-diary survey to monitor their rock lobster and abalone fishing activity between November 2021 and April 2022. A total of 360 respondents completed the survey (61% effective response rate), providing detailed catch and effort information for each fishing trip undertaken. These data were scaled up to represent the activity of all licence-holders.

Rock Lobster

The 2021–22 rock lobster season for all waters outside of the East Coast Stock Rebuilding Zone (ECSRZ) opened on 6th November 2021 and closed on 30th April 2022 in the Eastern region and 31 August 2022 in the Western region. The ECRSZ opened on 4th December 2021, representing the ninth year that a split season opening has been applied in the Eastern region. The split season has operated since November 2013 initially only two weeks apart, then 4–5 weeks since December 2018. Rock lobster fishing activity was monitored up to the end of April, which meant complete coverage of the fishery in the Eastern region but partial coverage of the Western region fishery. Up until the end of April, licenced recreational fishers were estimated to have harvested 79,365 (95% CI: 67,785–89,653) rock lobster, based on 84,288 (95% CI: 70,293–95,294) fisher days of effort. Potting was the dominant method, representing 82% of the effort (days fished) and contributing 67% of the harvest. Dive collection accounted for 17% of the effort and 30% of the harvest, while ring usage contributed 1% of the effort and 3% of the harvest. The state-wide average catch rate was 0.94 lobster per day fished, with daily harvest rates for dive collection (1.70 lobster) more than double that for pots (0.76 lobster).

The rock lobster fishery was concentrated off the east coast with this area accounting for 69% of the harvest (by number). Catches from the north and west coast accounted for a further 12% and 19% of the total, respectively. Conversion of lobster numbers to weight produced a state-wide harvest estimate of 86.3 tonnes for the survey period, with catches from the east coast accounting for 60%, the north coast 16%, and the west coast 23% by weight.

State-wide, 13.7% of the active fishers harvested no legal sized lobsters, 48% harvested 5 or fewer lobsters and just 8.1% took 16 or more lobsters during the survey period. This proportional breakdown was similar when limited to the fishery off the east coast.

Overall, the recreational catch represented about 51% of the total allowable recreational catch (TARC) of 170 tonnes and was equivalent to about 7.1% of the 2021–22 total allowable catch (TAC) of 1221 tonnes, which includes the total allowable commercial catch (TACC) of 1051 tonnes.

A key component of the East Coast Stock Rebuilding Strategy has been the implementation of an east coast recreational catch share amount, set at 35 tonnes for the stock rebuilding zone in 2019–20. The recreational catch for the rebuilding zone in 2021–22 was, estimated at 46.5 tonnes indicating that the catch target was exceeded by about 11.5 tonnes or 32% and compares with "over-catches" ranging between 19–46% in four of the preceding seven seasons. "Under-catches" of between 1–15% were reported in three seasons, two of which occurred in seasons impacted by biotoxin closures (2015–16 and 2017–18), whereas restrictions associated with the COVID-19 pandemic resulted in reduced fishing effort (and catch) in the third season (2019–20). Both catch and effort within the ECRZ has increased since in both the 2020–21 and 2021–22 seasons.

Table ES1. East Coast Stock Rebuilding Zone recreational catches relative to catch targets.

Season	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
Catch target	42 t	42 t	42 t	41 t	40 t	35 t	35 t	35 t
Catch estimate	55.6 t	35.7 t	50.2 t	40.4 t	48.6 t	33.6 t	51.1	46.5
Over/under catch	+13.6 t	- 6.3 t	+ 8.2 t	- 0.6 t	+ 8.6 t	-1.4 t	+ 16.1	+11.5
% over/under catch	+ 32%	- 15%	+ 19%	- 1%	+ 21%	- 4%	+ 46%	+32%

Abalone

The recreational abalone harvest up until the end of April 2022 was estimated at 41,552 (95% CI: 28,440–55,45) individuals, based on 8,772 (95% CI: 6,336–11,646) diver days of effort. Blacklip Abalone accounted for 91% and Greenlip Abalone 9% of the total numbers. In total, 70% of the abalone catch (by numbers) was taken from the east coast, with a further 18% from the north and 13% from the west coasts. The Eastern region daily bag limit of 10 abalone was achieved on about 14% of all dives targeting the species, with an overall average harvest rate of 4.7 abalone per day. By contrast, the Western region daily bag limit of 10 abalone was taken on about 28% of dives.

By converting numbers to weights, the recreational harvest was estimated at 20.1 tonnes, equivalent to 3% of the 2022 TACC (795 tonnes), noting however, the survey only accounts for recreational harvest up until April rather than the full year. There are currently no performance indicators or a TARC for the Tasmanian recreational abalone fishery.

Fisher's Observations

REPORT FISHING SATISFACTION

Fishers were asked a range of questions about the rock lobster and abalone fisheries, key findings include:

- About three-quarters of respondents who fished for rock lobster in 2021-22 indicated that the overall quality of the fishery was about the same or better than in the previous season.

- In relation to satisfaction with catch rates, fishers who dive for rock lobster were more likely to be at least quite satisfied (84%) with the actual catch rates they achieved during the season than pot fishers (68%). Pot fisher satisfaction has increased from 52% in the previous year.

- Based on individual catches, fishers were generally satisfied if they had achieved catch rates averaging at least one lobster per day, whereas most fishers expressed dissatisfaction with catch rates of below 0.5 lobster per day. When method is considered, divers tended to express dissatisfaction with catch rates of under about 1.0 lobster per day, this compared with 0.5 lobster per day for pot fishers.

- About 68% of respondents who fished for abalone in 2021–22 indicated that the overall quality of the fishery was about the same or better than in the previous season and 7% of abalone divers were at least quite satisfied with abalone catch rates.

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1 INTRODUCTION

- Rock lobster and abalone have long represented an important food source for the local Aboriginal population as well as being highly prized by recreational fishers in Tasmania.

- Southern Rock Lobster (*Jasus edwards*ii) and occasionally the Eastern Rock Lobster (*Sagmariasus verreauxi*) are taken by a variety of methods including pots, ring nets and dive collection.

- Two species of abalone, Blacklip Abalone (*Haliotis rubra*) and Greenlip Abalone (*H. laevigata*), are targeted by recreational divers; the former species harvested around the state and dominating the catch and the latter species generally restricted to the north coast and Bass Strait Islands. In addition to recreational importance, rock lobster and abalone support major commercial fisheries in Tasmania, both of which are subject to catch quotas.

- Recreational licences (first introduced in the late 1970s) are required to harvest rock lobster and abalone in Tasmania.

- Recreational licences are issued annually, with the licensing year extending from November to the following October. In a given year, recreational fishers may hold up to three categories of lobster licence (pot, ring and/or dive) and/or an abalone licence[1]. (for licence and fishery limits refer to: https://fishing.tas.gov.au/recreational-fishing)

- A sharp fall in licence numbers was experienced in 2015–16 and 2017–18 largely influenced by closures of parts of the east coast early in the season due to harmful algal blooms (biotoxin events).

- The decline in licence sales in 2019–20 compared with 2018–19 was partially due to the impact of the COVID-19 pandemic (Lyle et al., 2020b). However, during the 2020–21 season, licence numbers rose to levels comparable to the mid-2010s, with abalone licence sales following a similar trend (Lyle et al., 2021).

- Concerns around declining rock lobster stocks in Tasmania were identified in the late 2000s and in 2011–12 east coast stocks were assessed to have hit historically low levels, attributed to a combination of years of below average recruitment and heavy fishing pressure (Hartmann et al., 2013, 2019).

- In order to focus management in the area of most concern, the fishery was split into two regions in 2011 (Fig 1). In the Eastern region bag and possession limits were reduced from 5 to 3 and from 10 to 6, these were further reduced to a big limit of 2, and possession limit of 4 in November 2015.

- A formal stock rebuilding strategy was implemented in 2013 with a goal to rebuild east coast stocks to greater than 20% of the unfished stock level by 2023 (DPIPWE 2013). A key element of this strategy, referred to as the East Coast Stock Rebuilding Strategy (ECSRS), is to limit the average annual total catch (recreational and commercial) off the east coast of Tasmania. This was initially

set to 200 tonnes. However to maintain stock rebuilding this has been reduced, and the recreational notional catch limit has been gradually lowered from the initial 42 tonnes to 35 tonnes for the 2019–20, 2020–21, and 2021–22 licence years.

- In 2016, the Minister for Primary Industries and Water (Tasmania) determined that the catch limit for the east coast stock rebuilding zone (ECSRZ) be split 79% to commercial and 21% to recreational sectors, reflecting the historic proportion of commercial and recreational catches from within the rebuilding zone. In 2019–20, catch targets were further reduced, with 113 tonnes allocated to the commercial fishery and 35 tonnes for the recreational fishery, and has remained unchanged up to, and including the 2021–22 season.

- Since 2013, a split season opening has been applied for the Eastern region, with waters outside of the east coast stock rebuilding zone (ECSRZ) opening on the same date as the Western region (1st November 2020) while opening of the ECSRZ was delayed by five weeks (5th December 2020) as a measure to help constrain recreational catches within the rebuilding zone.

- Since 2013, a split season opening has been applied for the Eastern region, with waters outside of the east coast stock rebuilding zone (ECSRZ) opening on the same date as the Western region (1st November 2020) while opening of the ECSRZ was delayed by 2 weeks from the 2013–14 licensing year and by around a month from 2018–19 as a measure to help constrain recreational catches within the rebuilding zone.

- Rule changes implemented in November 2019 included reduction in the state-wide possession limit to 10 abalone and, for the Eastern Region, a reduction in the daily bag limit to 5 abalone and the introduction of a boat limit of 25 abalone. These were repealed on 9th November 2021, with a statewide bag limit of 10 and possession limit of 20 applying with no boat limit.

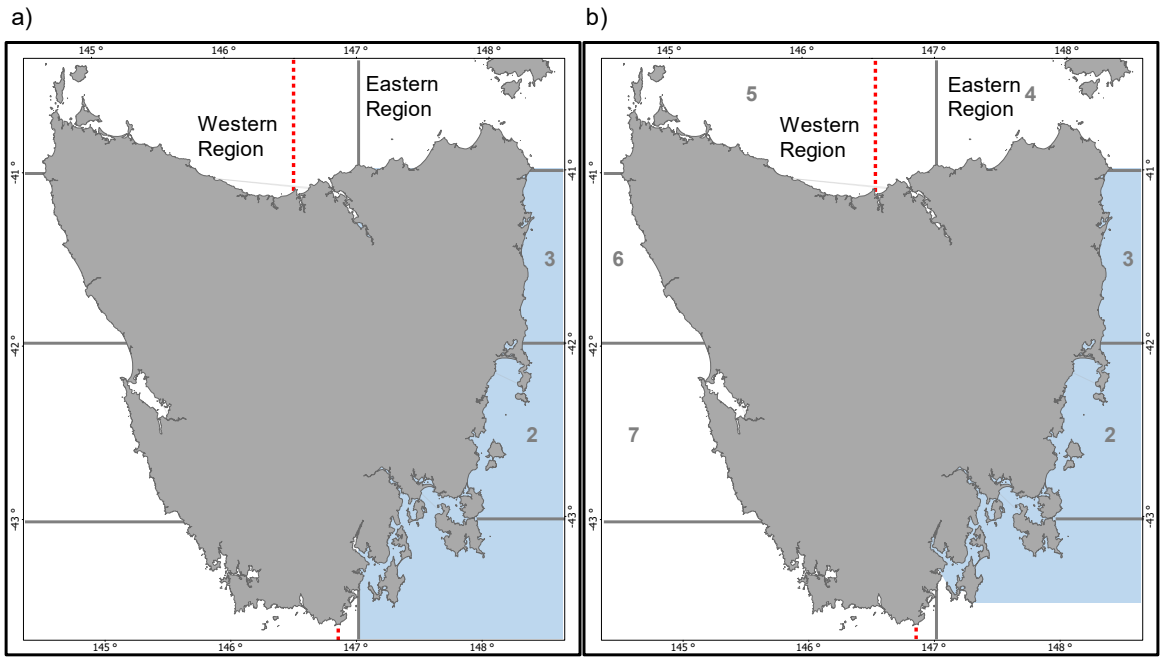

Fig 1. Map of Tasmania showing assessment areas (numbered), stock rebuilding zone (ECSRZ) (shaded) and the Eastern and Western Region boundary (red dotted line): a) ECSRZ that applied between 2013-14 and 2016-17; b) adjusted ECSRZ that applied from 2017-18

This survey represents the seventeenth in a series for rock lobster and the sixteenth for abalone undertaken since 1996. Key objectives include characterisation of the 2021–22 rock lobster and abalone fisheries in terms of participation, fishing effort and catch, with particular focus on the fishery off the east coast.

2 METHODS

The methodology applied was the same as what has been used successfully in previous surveys (please refer to Lyle & Morton 2004, 2006; Lyle & Tracey 2010, 2012, 2014, 2016a,b, 2017; Lyle et al. 2008, 2019a, 2020b, 2021) and independently reviewed by Pollock (2010). The design involves a two-stage process; an initial telephone interview to profile licence-holders and establish eligibility for a telephone-diary survey in which fishing activity is monitored in detail. The diary period included the licensing year up until the closure of the Eastern region rock lobster fishery (i.e. between 1st November and 30th April).

In an effort to quantify any potential fishing outside of the diary period (i.e. during the winter), we asked diarists at the end of the survey how likely it was that they would do any fishing for rock lobster (i.e. for male lobsters in the Western Region until August 31st), or abalone (from April 30th to October 31st). If they answered, “very likely” or “quite likely”, and gave consent to be contacted to report their winter fishing, we conducted follow-up calls at the end of the Western region rock lobster season (August 31st), and abalone season (October 31st). Only 13 participants indicated they were “quite likely” or “very likely” to do any winter fishing, resulting in seven rock lobster fishing events, and five abalone fishing events. Due to the small number of fishers, and resulting events (from four individual fishers), an expansion of the data with any statistical validity was not possible.

3 RESULTS

3.1 Rock Lobster

3.1.1 2021–22 Catch and Effort

Information reported in this and following sections relates to diary survey data provided by fully responding licence holders and is presented as expanded estimates representative of the activities of all recreational rock lobster licence holders between November 2021 and April 2022, inclusive.

An estimated 78.2% (SE 2.4%) of licence holders fished for rock lobster at least once during the fishing season with 67.3% (SE 2.8%) harvesting at least one lobster during the diary period. That is, out of the 18,226 licence-holders, 14,246 actually fished for lobster with 12,273 retaining at least one rock lobster for the period.

Overall, total fishing effort was estimated to be 84,288 fisher days[2] for the period November to April, yielding a total harvest of 79,363 lobster (Table 3). This represented an average harvest rate of 0.94 lobster per day fished. Pots were the most popular fishing method (accounting for 67% of the total harvest) followed by dive collection (30%) and rings (3%) (Table 1). More than four times as many fisher days of effort was spent using pots compared with diving, however, the total pot catch was just over double that taken by divers. This difference reflects the higher average catch rate for divers (1.69 lobster per day) compared to that for potters (0.76 lobster per day). Although ring usage is comparatively low, recreational fishers are permitted to use up to four rings at a time and the method can be very effective, with the average reported catch rate (2.39 lobster per day) higher than for dive collection.

Table 1. Rock lobster effort, harvest and harvest rates for the 2021-22 season up until 30 April. Values in parentheses represent the 95% confidence intervals. Note: since multiple methods can be used on a day, total fishing days may be less than the sum of the method totals

Method	Harvest (no.)	Effort (days)	Mean harvest rate (no. day^{-1})
Pot	52,805 (43,139–63,266)	69,104 (55,758–81,623)	0.76
Dive	23,806 (17,169–32,068)	14,036 (10,817–17,621)	1.70
Ring	2,752 (705–4,293)	1148 (405–1,608)	2.39
Total	**79,365 (67,785–89,653)**	**84,288 (70,293–95,294)**	**0.94**

3.1.2 Regional Catch and Effort

Catch, effort and catch rates by fishing areas are summarised in Table 2 and Fig 2 indicate that the fishery was primarily concentrated on the east coast (Areas 1–3). This combined region accounted for 69% of the total estimated harvest (54,476 lobster) and attracted 86% of the total effort (71,006 fisher days) during the survey period. Area 1 accounted for 40% of the state-wide harvest and 51% the total effort. The north coast (Areas 4–5) accounted for 12% of the harvest (9,876 lobster) and 7% of effort (6,245

[2] A fisher day is defined as a day in which lobster was a nominated target species and/or lobster were caught.

fisher days) while the west coast (Areas 6–8) contributed 18% of the total harvest (15,013 lobster) and 7% of total effort (5,694 fisher days).

Marked regional differences were evident in the proportion of the rock lobster harvest taken by different fishing methods (Fig 3). Pots accounted for the bulk of the harvest in Areas 1–4 (57–93%) and Areas 6–8 (68–69%), while dive collection was the primary capture method in Areas 5 (89%). Only pots were used in our sample in Area 8 (100%)

Mean daily harvest rates were highly variable around the state, ranging from 0.63 lobster per day in Area 3 to 4.16 in Area 8 (Table 2). Stock abundance and fishing pressure (including commercial activity), along with differing regional bag limits and the relative mix of fishing methods used (Fig 3), represent key factors contributing to this regional variability.

Table 2. Recreational rock lobster effort, harvest and harvest rates by fishing area for 2021–22
Values in parentheses represent the 95% confidence intervals

Area	Harvest (no.)	Effort (fisher-days)	Harvest rate (no. per fisher-day)
1	31,454 (23,619–39,962)	42,211 (31,397–53,260)	0.74
2	13,594 (9,018–18,557)	14,606 (10,317–17,908)	0.93
3	9,426 (5,983–13,646)	14,735 (9,533–20,293)	0.63
4	3,478 (1,936–5,363)	2,730 (1,644–3,961)	1.27
5	6,398 (1,802–12,016)	3,515 (1,482–5,738)	1.82
6	3,651 (1,597–6,172)	2,164 (1,120–3,246)	1.69
7	10,646 (5,202–15,474)	3,358 (1,786–4,797)	3.17
8	716 (0–2,006)	172 (0–451)	4.16

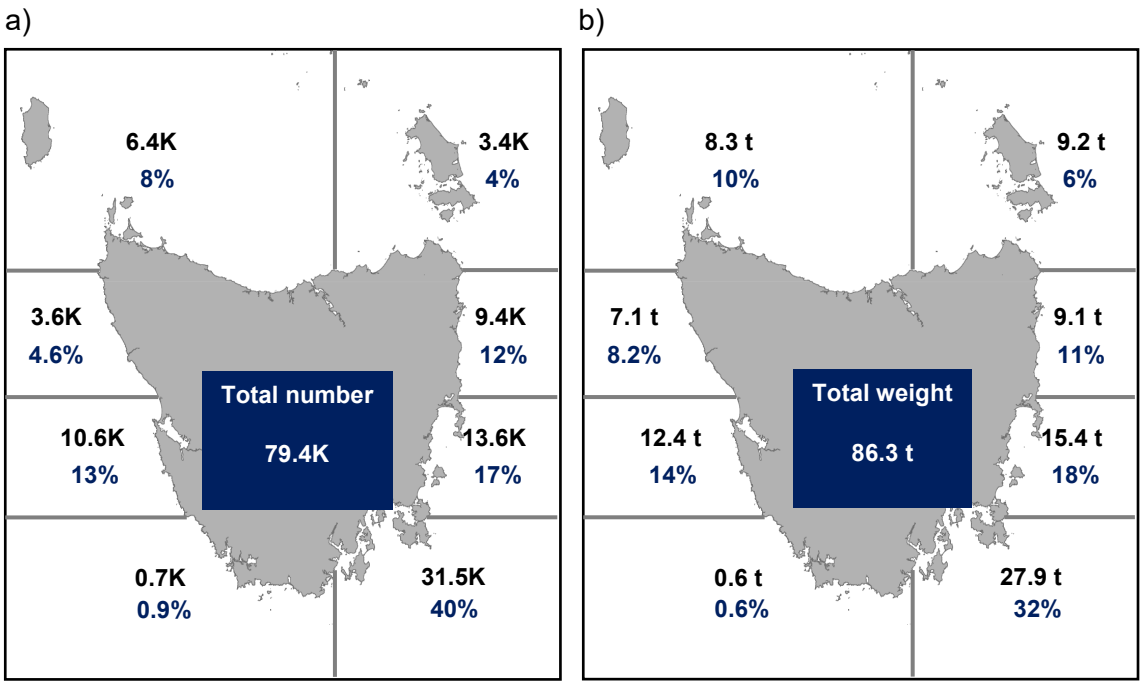

Fig 2. Recreational harvest of rock lobster by assessment area: a) Numbers harvested (in 1000s or K) and proportion (%) of total number; b) Estimated harvest weight and proportion (%) of total weight.

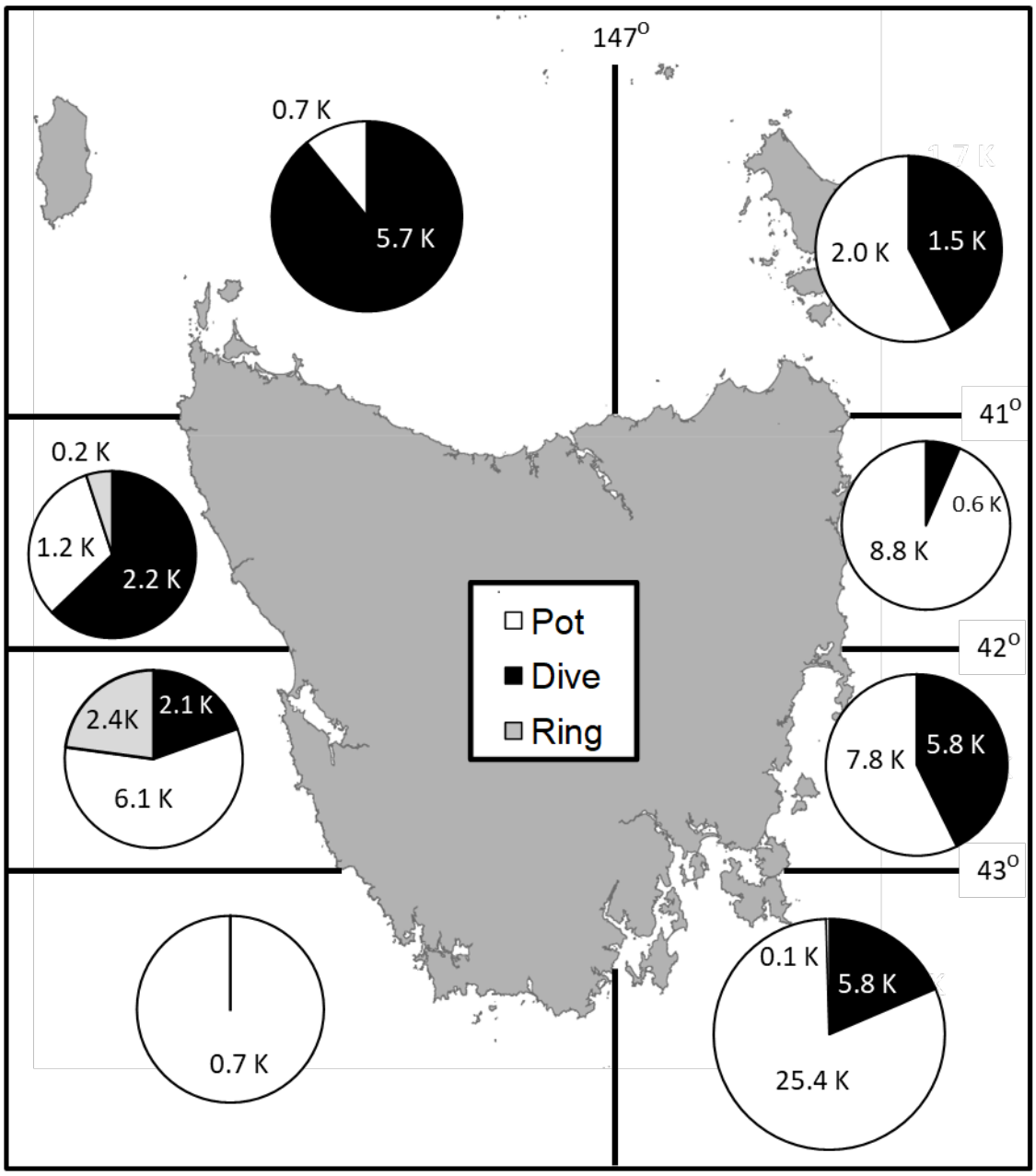

Fig 3. Proportion of regional harvest by fishing method (pie charts).

3.1.3 Southeast Coast

Catch data for Area 1 have been disaggregated into five sub-areas to better describe the spatial characteristics of the fishery in the southeast (Fig 4). Waters surrounding the Tasman Peninsula and Storm Bay (including eastern Bruny Island) accounted for 59% of the harvest by number, with the area to the south of Bruny Island contributing a further 21% of the regional harvest. Norfolk-Frederick Henry Bay and the Derwent Estuary accounted 6.9% and 1.1%, respectively, while comparatively higher catches (10.9%) were reported from the D'Entrecasteaux Channel.

There were also marked regional differences among the proportion of rock lobster taken by different fishing methods, amongst the sub-areas in the Southeast (Fig 4). Dive

catches dominated in the Derwent, and D'Entrecasteaux Channel, whereas pots accounted for the majority of the harvest taken from all other sub-areas. [3]

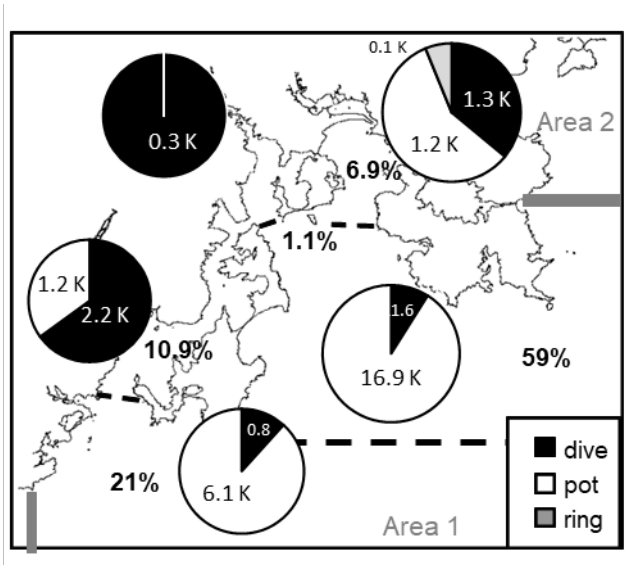

Fig 4. Regional distribution of Area 1 harvest (%) and proportion of harvest by method (pie charts).

3.1.4 Seasonal Catch and Effort

The Western region along with waters north of Eddystone Point and waters south of Bruny Island were opened during the first weekend in November. The remainder of the east coast (the East Coast Stock Rebuilding Zone) was not opened until 4th December. The delay in opening of this key area of the fishery is reflected in the peak in fishing activity occurring in December (Fig 5). Catch and effort levels had fallen dramatically by February and continued to trend downwards to the end of the survey period.

The underlying seasonal pattern of catch and effort in the fishery was influenced most strongly by variation in pot fishing activity, with almost 70% of the pot catch and effort occurring between December and January (Fig 5). Following a sharp decline in fishing activity in February there was a slight increase associated with the Easter holiday period in April, a pattern that is typical for this fishery. Dive activity followed a similar pattern to pot fishing in the December–January period, and total fishing across both methods in the December–January period accounted for 66% of the total harvest (Fig 5).

[3] Note: The Recreational Rock Lobster and Abalone Survey uses a different area for the D'Entrecasteaux channel than the legislated area. For this survey, the D'Entrecasteaux Channel is considered from Southern Esperance Bay directly across to North Satellite Island and from Dennes point and a line to Pearson's Point (includes Dover, and the inside of Bruny Island).

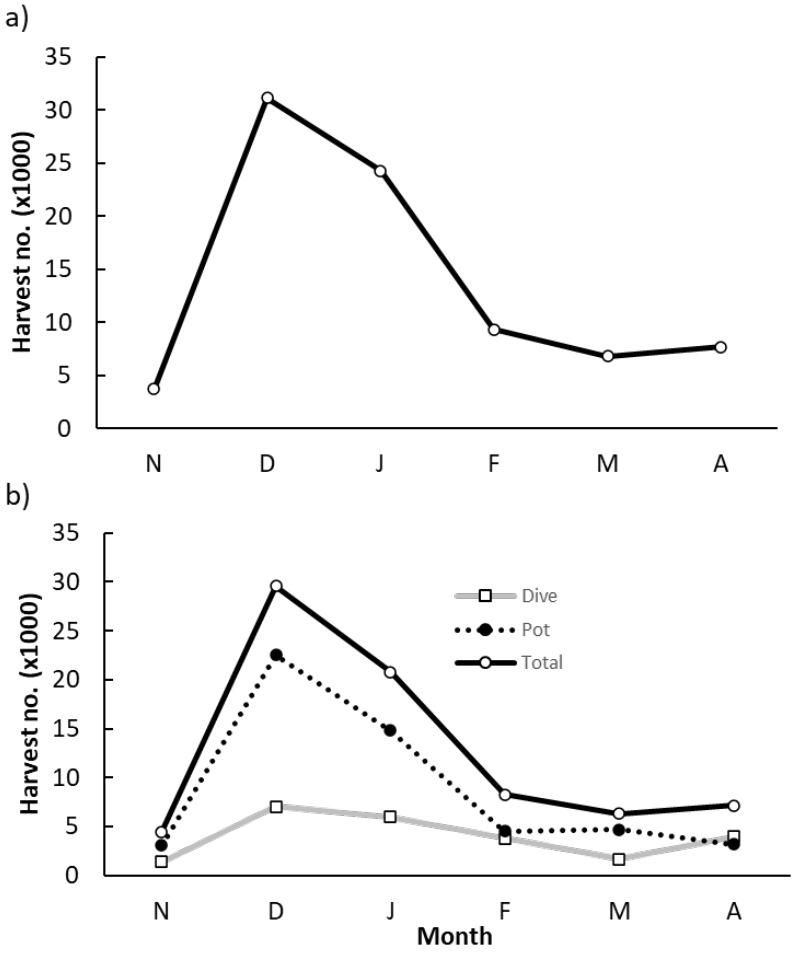

Fig 5. Recreational rock lobster harvest (numbers) and effort (days fished) by month and method for the 2021–22 fishing season.

3.1.5 Daily Harvest

Daily catch distributions differed markedly by fishing method and between management regions (Fig 6). For example, approximately 30–50% of the total pot effort in the Eastern (Areas 1–4) and Western (Areas 5–8) regions resulted in no retained catch. The Eastern region daily bag limit of two lobster was achieved on 19% of the pot-days fished whereas in the Western region 31% of pot-days resulted in catches of at least two lobster, with 11% resulting in the Western region bag limit of five being taken. By contrast, divers had higher success rates, with ~80% of all dives in both regions resulting in the harvest of at least one lobster. The daily bag limit of two lobster was achieved in almost 60% of the Eastern region dives whereas in the Western region divers took at least two lobster in 60% of dives and the daily bag limit of five lobster in 32% (one in three) dives.

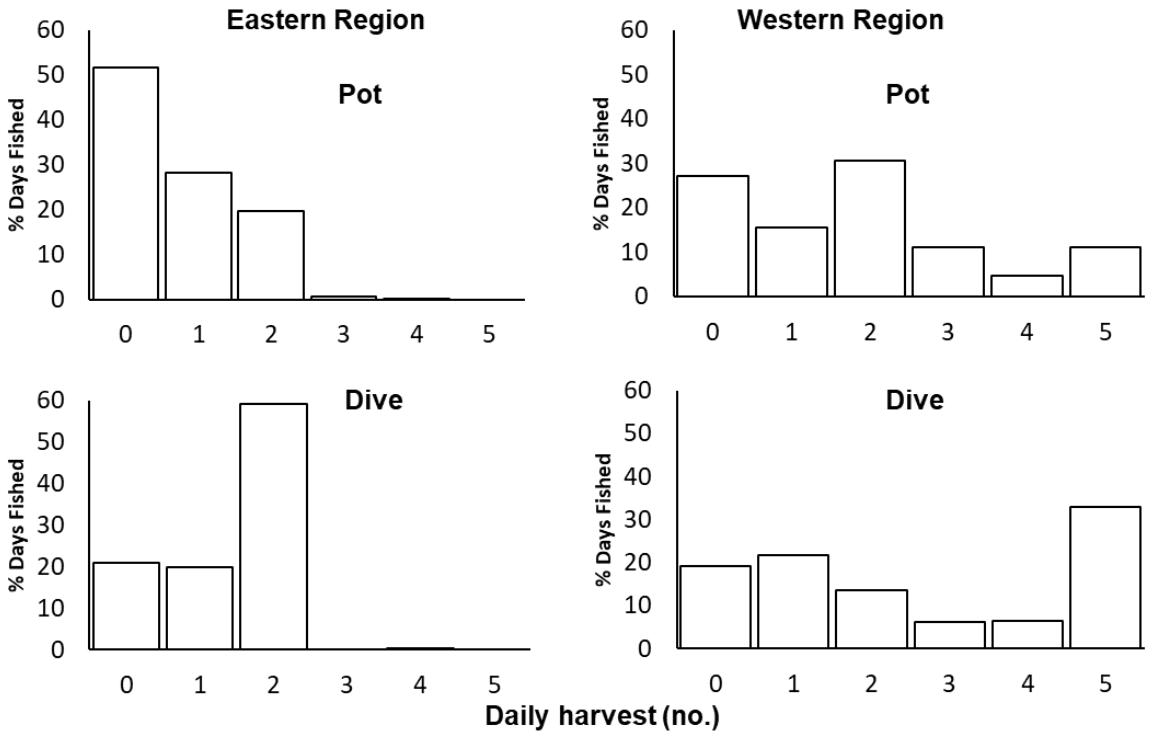

Fig 6. Distribution of daily rock lobster harvest by fishing method and management region.

3.1.6 Individual Seasonal Harvest

Individual season limits for recreational fishers have been flagged as a potential management option to constrain the overall recreational harvest and share the catches more equitably between fishers. It was, therefore, worthwhile to report on the numbers of rock lobster retained by individual fishers up to the end of April (Fig 7). State-wide, 13.7% of the active fishers harvested no legal sized lobsters, 48% harvested 5 or fewer lobsters and just 8.1% took 16 or more lobsters during the survey period. The proportional breakdown was similar when limited to the fishery off the east coast.

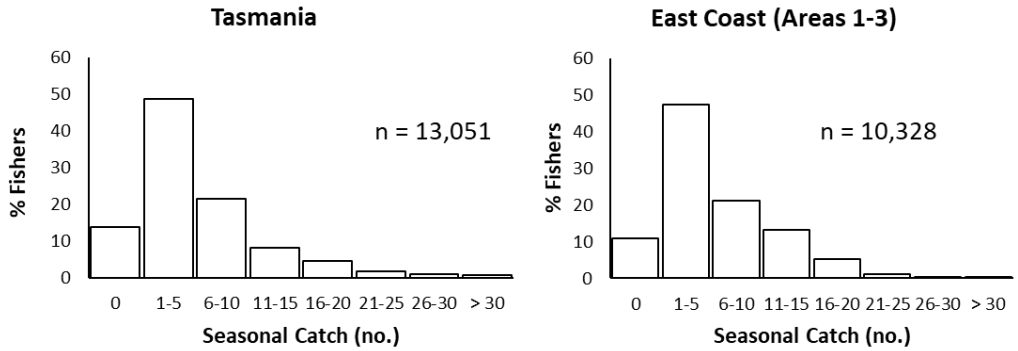

Fig 7. Seasonal harvest of rock lobster for fishers who were active within the east coast (Areas 1–3) and for the whole fishery. n is estimated number of active licence-holders.

3.1.7 Released Catch

A total of 83,661 rock lobster were estimated to have been released from pot catches, equivalent to 1.5 for every retained lobster (52,805). About 82% of pot releases were due the capture of undersized rock lobster, 15% of releases were due to over catch limit, and 3% were discarded dead or damaged or 'in berry'. Although divers release some rock lobster much of this 'sorting' probably occurs underwater and therefore a similar analysis of reasons for release by divers was not attempted.

3.1.8 Size Composition

Diarists reported lengths for 408 pot caught, 129 dive and 6 ring caught rock lobster from around Tasmania. Pot caught rock lobster ranged between 105–243 mm carapace length, when converted to weight this equated to an overall average of 939.8 g per lobster. Dive caught rock lobster had a similar size range,110–255 mm, but were larger on average (1,453 g). Male to female sex ratios for pot (1.0:0.74) and for dive (1.0:0.40) catches indicated that significantly more males than females were retained for both methods. Length frequency distributions by region are presented in Fig 8. Apart from the east coast (Areas 1–3) data were limited and may not be representative.

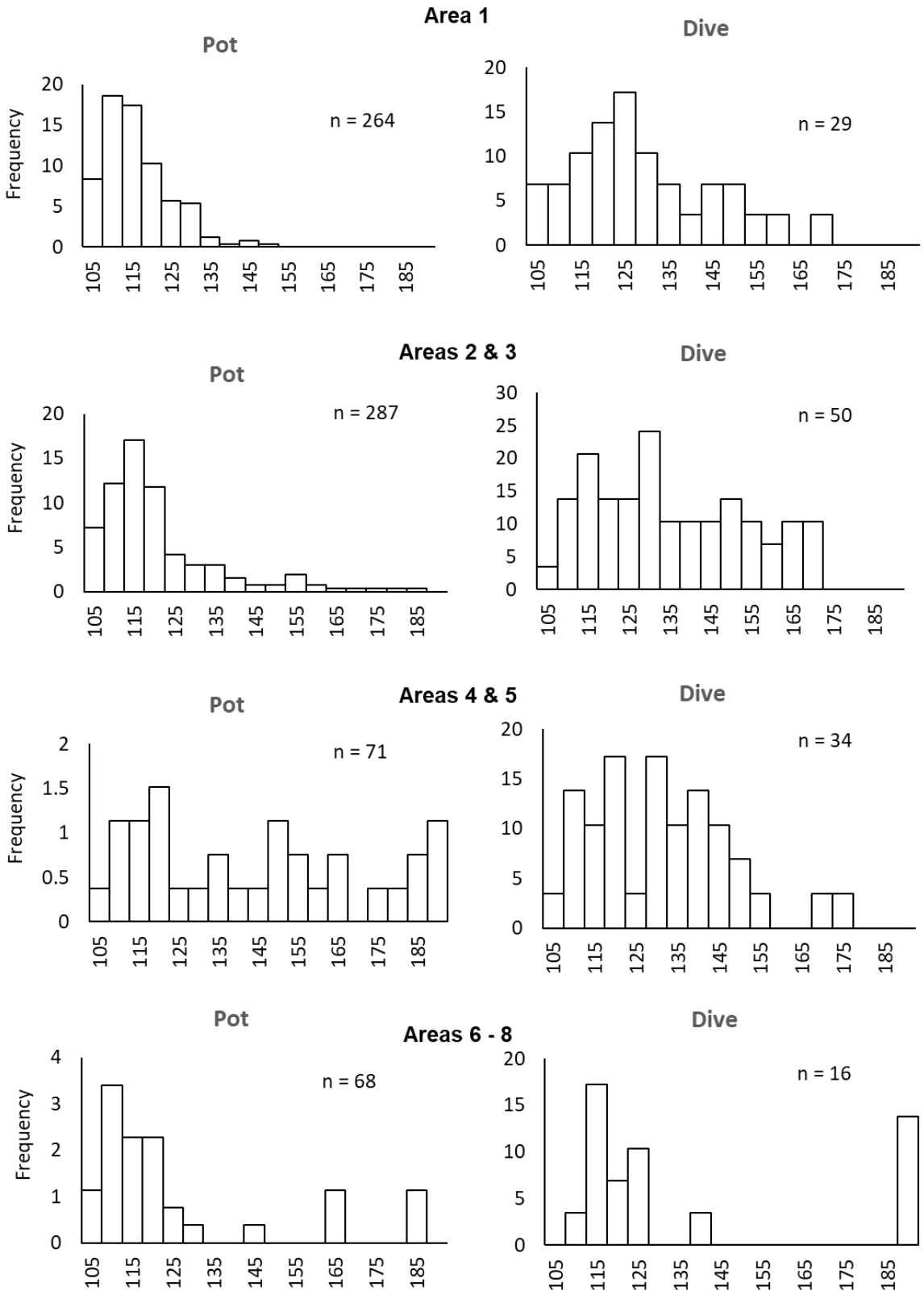

Fig 8. Length frequency distributions by 5 mm size class for recreationally caught rock lobster taken by pot and dive fishing methods by assessment area(s). n is sample size.

3.1.9 Harvest Weights

The weight of the 2021–22 recreational harvest was estimated by multiplying the average rock lobster weights by the numbers harvested by method and area. Average weights by area and method used to determine harvest weights are presented in Table 5.

The state-wide harvest was estimated to be 86.3 tonnes[4], equivalent to 51% of the TARC (170 tonnes). Regional harvest estimates ranged from 27.2 tonnes (Area 1) to less than one tonne (Area 8) (Fig 2b, Table 3). As a proportion of the state-wide recreational harvest, the east coast (Areas 1–3) accounted for 61%, north coast (Areas 4 & 5) 15.9%, and west coast (Areas 6–8) 23.4% of the total weight. As for harvest based on numbers (refer Fig 2a), the importance of the east coast fishery to the recreational sector is clearly evident.

Table 3. Average rock lobster weight (g) by method and estimated harvest (kg) by area.

	Av. weight (g)			%
Area	Pot/Ring	Dive	Harvest (kg)	total
1	821	1184	27,936	32.5
2	946	1380	15,384	17.8
3	946	1380	9,189	10.6
4	1796	1235	5,423	6.3
5	1796	1235	8,294	9.6
6	808	2634	7,138	8.3
7	808	2634	12,395	14.4
8	808	2634	579	0.7
Total			**86,338**	

3.2 Abalone

3.2.1 2021-22 Catch and Effort

Information reported in this and following sections relates to diary survey data provided by fully responding licence holders and is presented as expanded estimates representative of the activities of recreational abalone licence holders between November 2021 and April 2022, inclusive.

During the survey period an estimated 32.1% (SE 3.5%) of abalone licence holders (i.e. 3,786 out of the 11,781 licence-holders) fished for abalone with 29.7% (SE 3.4%) (3,504 persons) harvesting at least one abalone.

The total estimated harvest was estimated to be 41,552 abalone (95% CI: 28,440–55,458), the result of 8,772 fisher days of effort[5]. This represented an average harvest rate of 4.7 abalone for each day fished. Blacklip Abalone dominated the catch,

[4] Any illegal harvest taken by recreational fishers, whether due to fishing whilst unlicensed or catches in excess of legal limits, is not included in the harvest estimates.

[5] A fishing day was defined as one in which Abalone was a nominated target species and/or Abalone were caught.

accounting for 82% of the total catch numbers (38,065) while Greenlip Abalone represented 18% of the state-wide total (6,399) (Table 4).

Table 4. Abalone harvest, effort and harvest rates by fishing area for 2021–22. Values in parentheses represent the 95% confidence intervals, * average weight based on commercial catch sampling data; ** weighted in accordance to the proportion of Blacklip and Greenlip Abalone in the catch and average species weight.

	Harvest (no.)					
Area	**Blacklip Abalone**	**Greenlip Abalone**	**Effort (fisher days)**	**Harvest rate (no. per fisher day)**	**Av. weight (g)***	**Harvest (kg)**
1	16,957 (8,468–27,348)	313 (0–988)	3,675 (2,171–5,365)	4.6	518**	8,496
2	9,437 (3,277–17,462)	-	2,098 (849–3,921)	4.5	517	4,879
3	2,221 (0–5,613)	-	360 (0–774)	6.1	528	1,173
4	1,298 (419–2,421)	1,515 (163–3,832)	759 (331–1,236)	3.7	385**	1,083
5	2,870 (718–5,487)	1,658 (0–4,733)	843 (297–1,582)	5.3	416**	1,882
6	3,381 (433–6,886)	-	751 (150–1,412)	4.5	501	1,694
7	1,899 (0–4,058)	-	286 (0–652)	6.6	501	951
8	-	-	-	-	-	0
Total	**38,065** (25,047–52,407)	**3,487** (873–7,230)	**8,772** (6,336–11,646)	**4.7**		**20,069**

3.2.2 Regional Catch and Effort

Regional catch, effort and harvest rates for abalone are presented in Table 6. The recreational fishery was concentrated off eastern Tasmania, and in particular off the southeast coast (Area 1, 41% total harvest: Fig 9a). Blacklip Abalone were taken from all areas whereas Greenlip Abalone were restricted Areas 1, 4 and 5. Regional harvest rates varied between 3.7 and 6.6 abalone per day, the highest catch rates were in the west (Area 7) of the state.

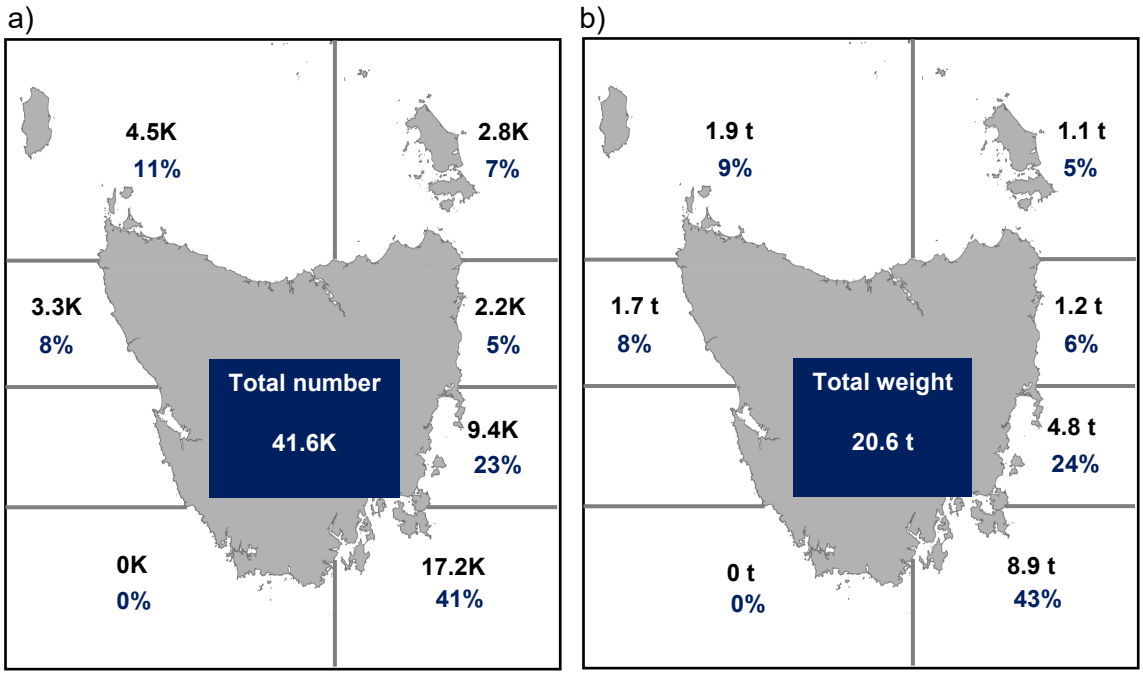

Fig 9. Recreational harvest of abalone by assessment area: a) Numbers harvested (in 1000s or K) and proportion (%) of total number; b) Estimated harvest weight and proportion (%) of total weight.

3.2.3 Seasonal Catch and Effort

The fishery for abalone exhibited a strong seasonal pattern, with catch and effort peaking in January (Fig 10). The traditional peak in catch and effort during November was not evident in 2021 (as was absent in 2020), highlighting the links between the rock lobster and abalone fisheries (the majority of abalone licence-holders also hold rock lobster dive licences). There was also no traditional increase in fishing in April during the Easter break.

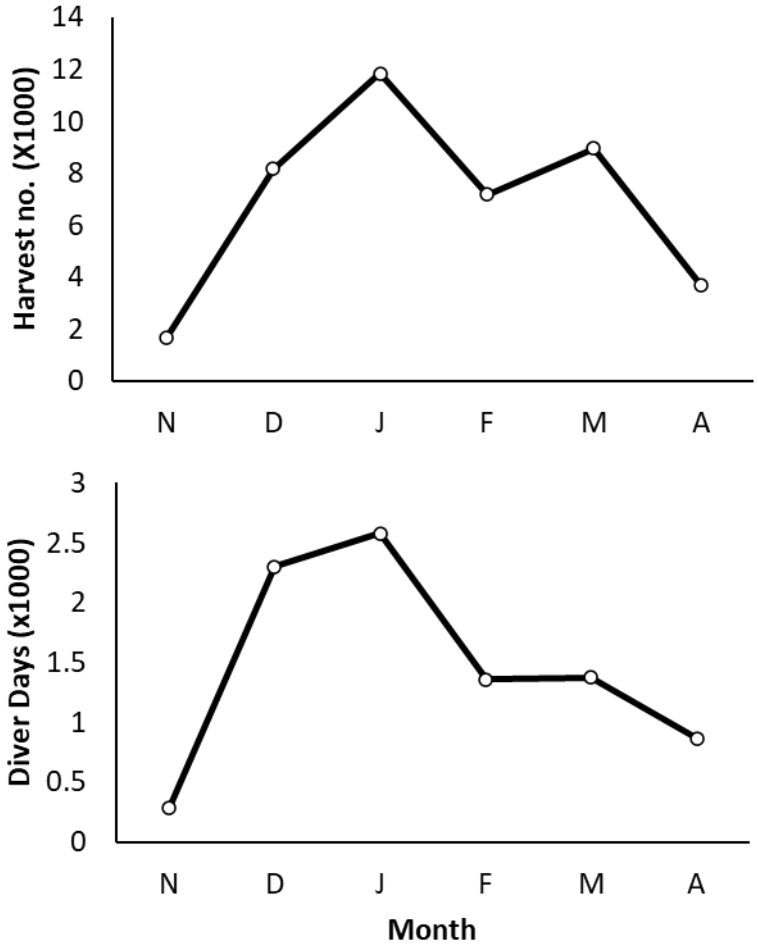

Fig 10. Recreational abalone harvest (numbers) and effort (days fished) by month during the 2021–22 fishing season.

3.2.4 Daily Harvest

The Eastern region daily bag limit of 10 abalone was achieved in about 14% all targeted dives, by contrast the Western Region bag limit of 10 abalone was achieved in just over 28% of dives (Fig 11). However, the sampling strategy was weighted towards respondents likely to fish off the east coast of Tasmania and thus data for the Western Region was limited and thus needs to be treated with caution.

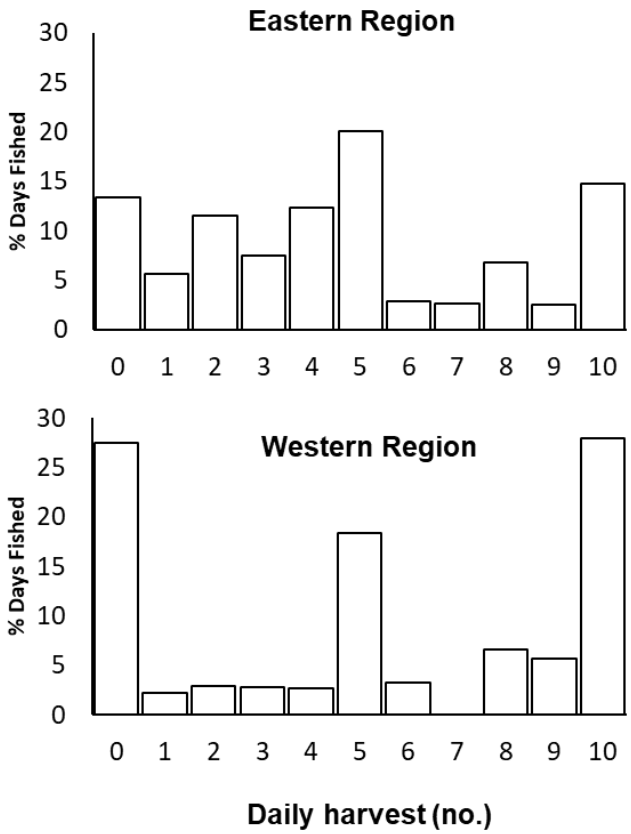

Fig 11. Distribution of daily abalone harvest by management zone for 2021–22 licence holders.

3.2.5 Individual Seasonal Harvest of Abalone

State-wide, 7% of the active fishers harvested no legal sized abalone, 48% harvested 5 or fewer abalone and 16% took 16 or more abalone during the survey period (Fig 12).

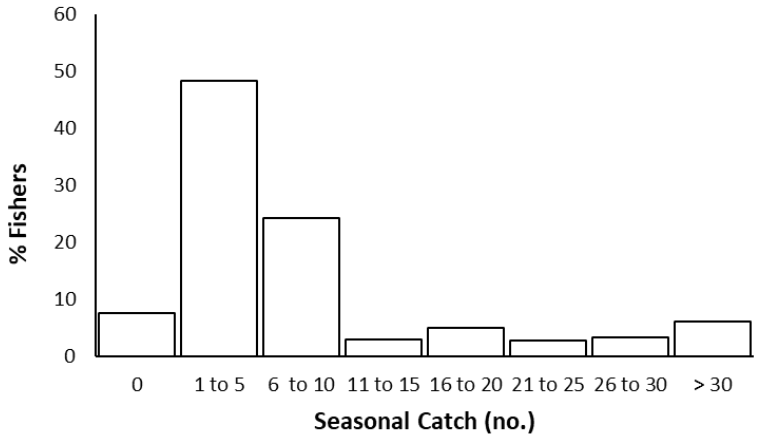

Fig 12. Seasonal harvest of abalone for fishers who were active within the whole fishery. (n = 3,524)

3.2.6 Harvest Weights

Size composition information was not available for recreationally caught abalone. However, based on commercial catch sampling, the average legal-sized abalone by the major fishing regions was estimated to vary between 518 g off the south coast (Area 1) and 381 g off the north coast (Area 4), and 501 off the west coast (Areas 6 and 7) (Table 4). Using these values, the recreational harvest between November and April was estimated to be about 20.1 tonnes. Regionally, harvest estimates ranged from 8.4 tonnes in Area 1 to less than one tonne in Area 7 (Table 4, Fig 9b). The catch for the combined east coast (Areas 1–3) was 14.5 tonnes, the north coast (Areas 4&5) 3.0 tonnes, and the west coast (Areas 6–8) 2.6 tonnes.

3.3 Wash-up survey

3.3.1 General

The overall response rate to the wash-up survey was 83.5% (314 out of an eligible sample of 376)[6].

3.3.2 Constraints to Fishing

Diarists who did not report fishing for lobster or abalone were asked, as an open-ended question, about their main reasons for not fishing during the season. Lack of time due to work and/or family commitments was the most cited reason for licenced respondents, followed by injury and health issues and the weather (Fig 13). Lack of time was also the most cited reason for non-renewing licences, with being away from Tasmania of secondary importance (Fig 14).

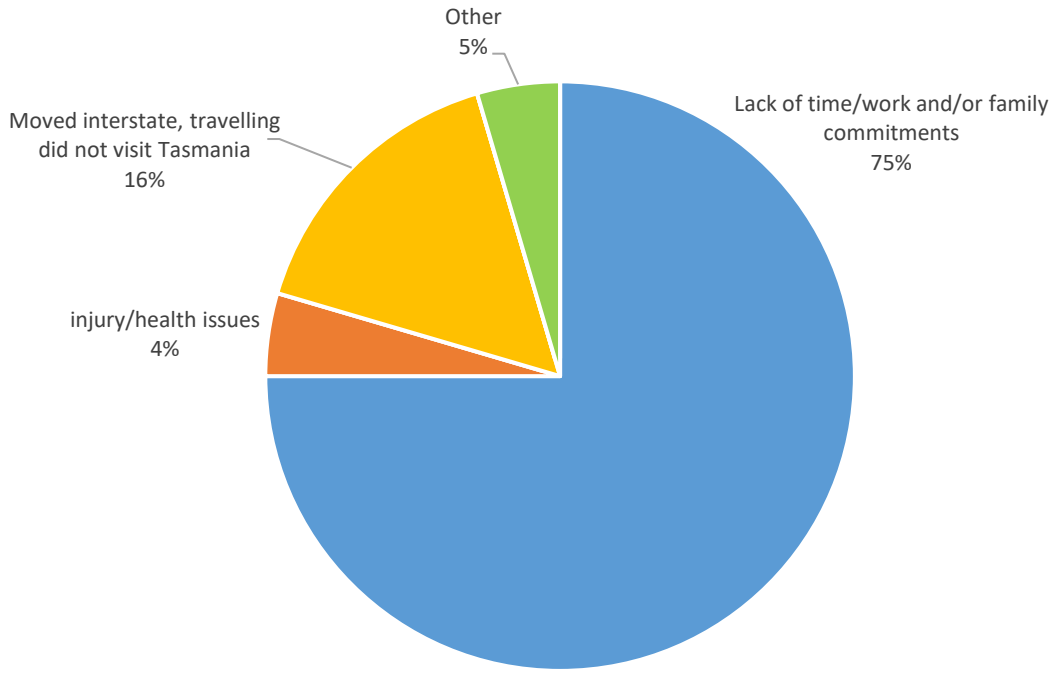

Fig 13. Main reason for not fishing for rock lobster or abalone during 2021-22 season. (Licenced diarists, n = 48)

[6] Eligible respondents were those who completed the diary survey.

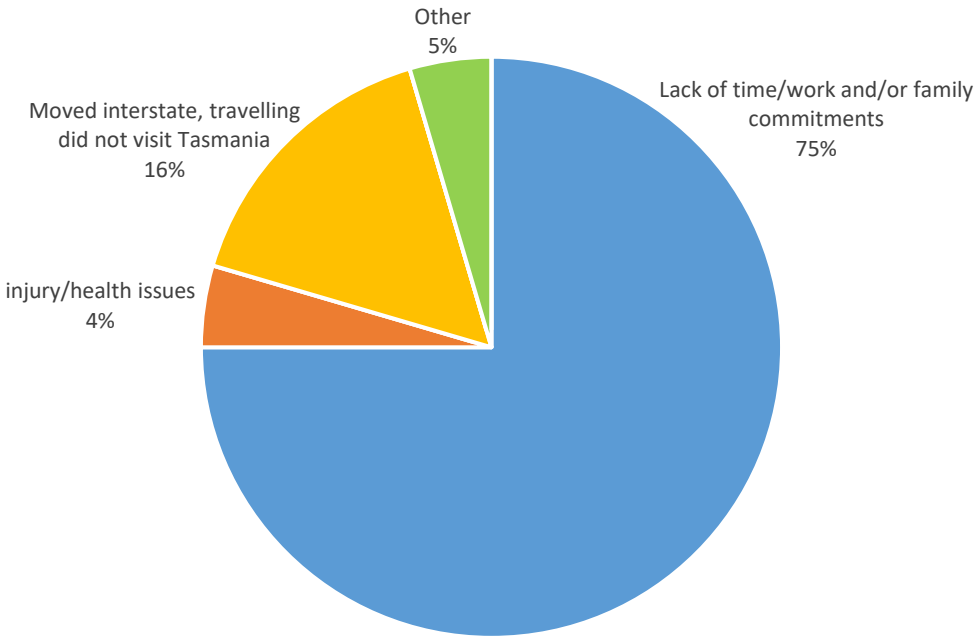

Fig 14. Main reason for not fishing for rock lobster or abalone during 2021-22 season. (Unlicenced diarists, n = 44)

3.3.3 Fishing Quality

3.3.3.1 Rock Lobster

About 76% of respondents who fished for rock lobster during 2021-22 indicated that the overall quality of the fishery was about the same or better than in the previous year (Fig 15). This is a slight increase compared to the same question posed to respondents at the end of the 2020–21 season (Lyle et al., 2021). Fifteen percent (15%) of respondents indicated that the current season was worse than the previous one, is slightly lower that the ~20% respondents when asked the same question in 2020–21 (Fig 15).

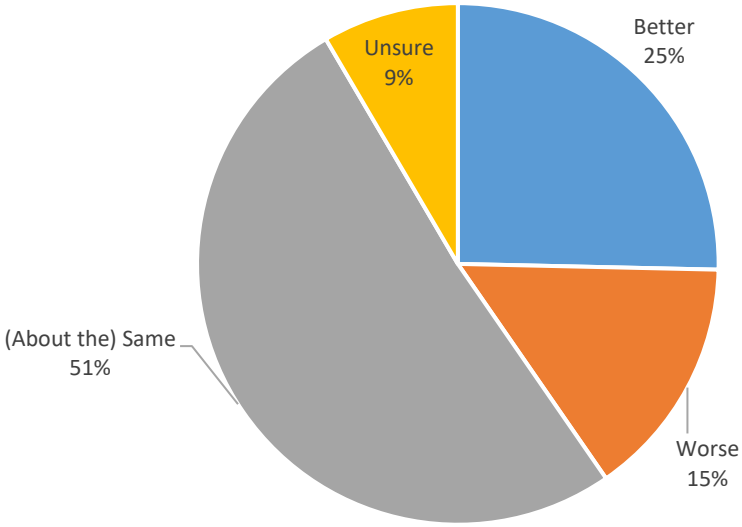

Fig 15. Perceptions about the quality of the rock lobster fishery in 2021-22 relative to respondent's experience in 2020-21 (n = 213).

Diarists who fished for lobster during 2021–22 were asked whether the proportion of trips in which they caught at least one legal sized lobster was higher, lower, or about the same as during the previous season (Fig 16). About 68% of respondents indicated that the proportion of successful trips was about the same or better than in the previous year, 25% reported lower success rates in 2021–22.

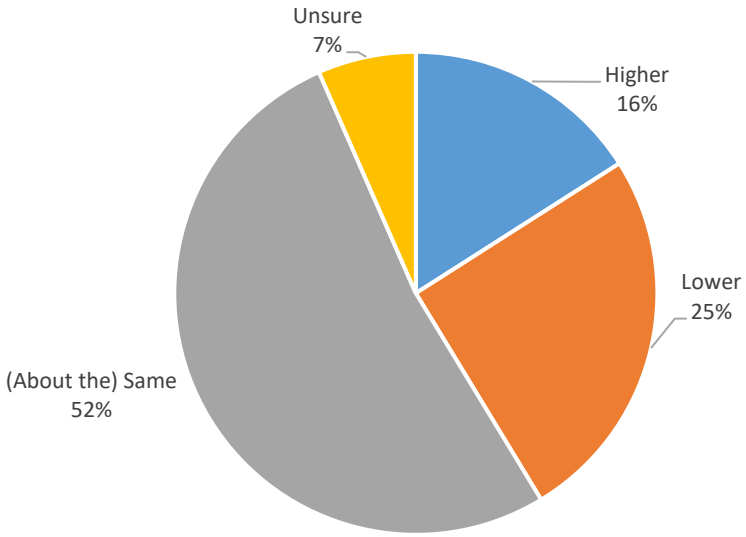

Fig 16. Proportion of rock lobster fishing trips where at least at least one legal sized lobster was caught (i.e. success rate) in 2021-22 relative to the respondent's experience in 2020-21 (n=213).

Respondents who had reported fishing for rock lobster during the survey period were asked whether they were satisfied or not with the actual catch rates (average number of lobsters kept per day fished) they achieved during the 2021–22 season. Overall, 72% of the respondents indicated that they were at least quite satisfied with their catch rates (Fig 17). Based, on fishing method (i.e. main method used), however, it was evident that divers (Fig 18) were more likely to be satisfied (84%) than pot fishers (68%) (Fig 19), which is consistent with the observation that divers tend to have a lower proportion of unsuccessful trips (i.e. zero catch days) and higher daily catches than pot fishers (refer section 3.1.5).

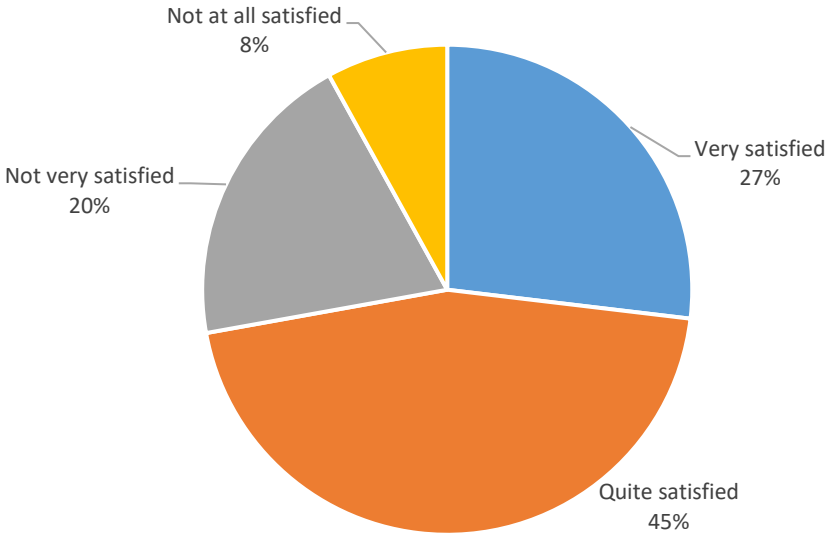

Fig 17. Fisher satisfaction with rock lobster catch rates achieved during 2021–22 season. (n = 213, <1% unsure)

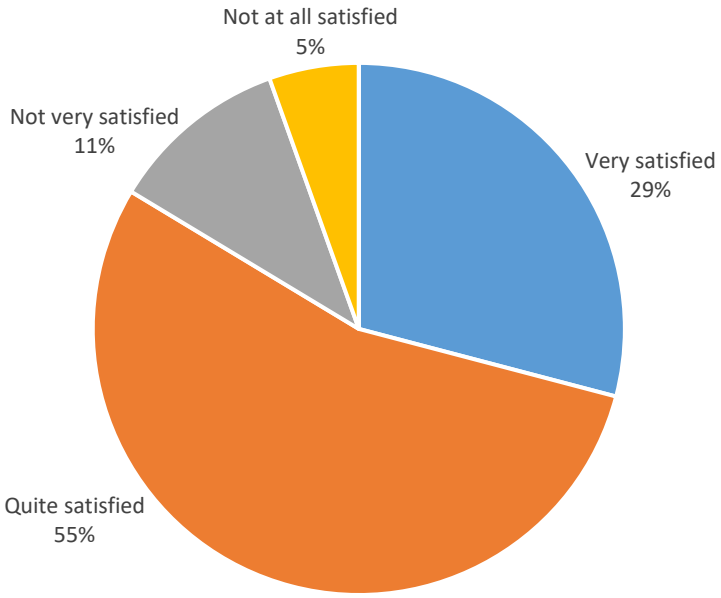

Fig 18. Diver satisfaction with rock lobster catch rates achieved during 2021–22 season. (n = 55)

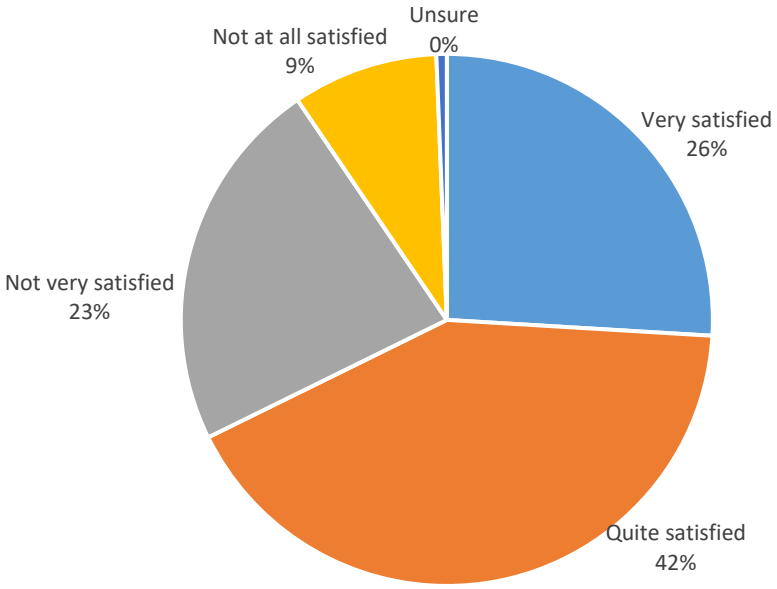

Fig 19. Pot fisher satisfaction with rock lobster catch rates achieved during 2021-22 season. (n = 158)

3.3.3.2 Abalone

Abalone fishers were asked about their perceptions of the fishery in the current season compared to the previous season.

About 68% of respondents who fished for abalone during 2021–22 indicated that the overall quality of the fishery was about the same or better than in the previous season (Fig 20). Almost one quarter of respondents indicated that the current season was worse than the previous one.

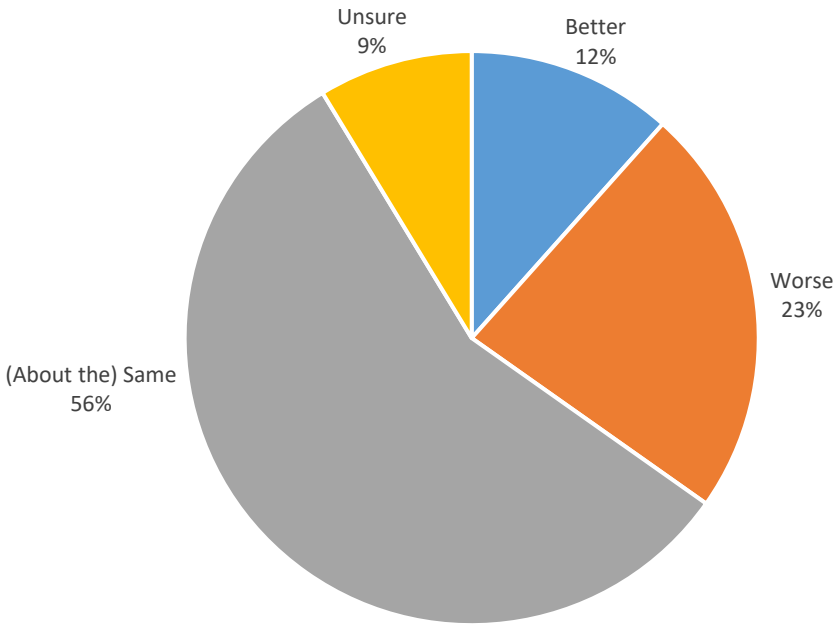

Fig 20. Perception of the overall quality of the abalone fishery in 2021–22 season compared to 2020–21 season. (n = 69)

Diarists who fished for abalone during 2021–22 were asked whether the proportion of trips in which they caught at least one legal sized abalone was higher, lower, or about the same as during the previous season (Fig 21). About 74% of respondents indicated that the proportion of successful trips was about the same or better than in the previous year, 20% reported lower success rates in 2021–22.

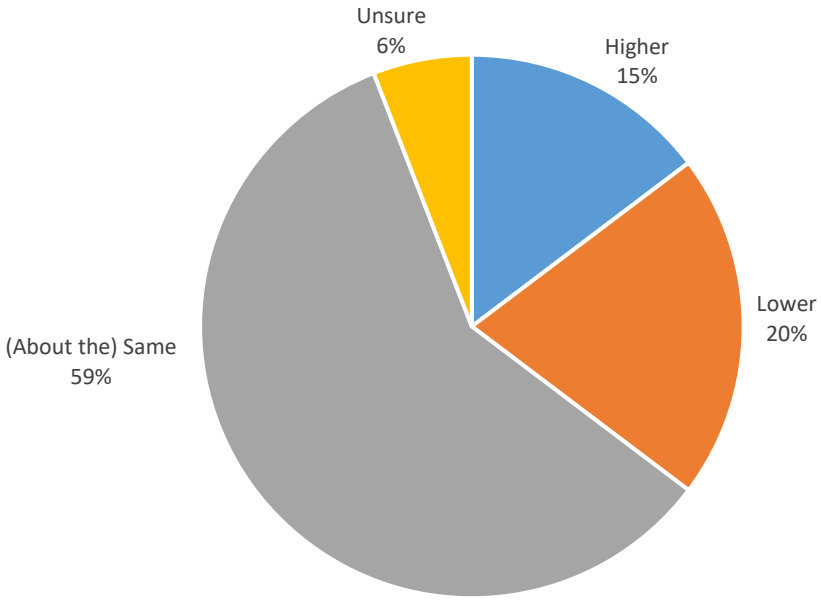

Fig 21. Proportion of abalone fishing trips where at least at least one legal sized abalone was caught (i.e. success rate) in 2021–22 relative to the respondent's experience in 2020–21. (n = 69)

Respondents who had reported fishing for abalone during the survey period were asked whether they were satisfied or not with the actual catch rates (average number of abalone kept per day fished) they achieved during the 2021–22 season. Overall, 75% of the respondents indicated that they were at least quite satisfied with their catch rates (Fig 22).

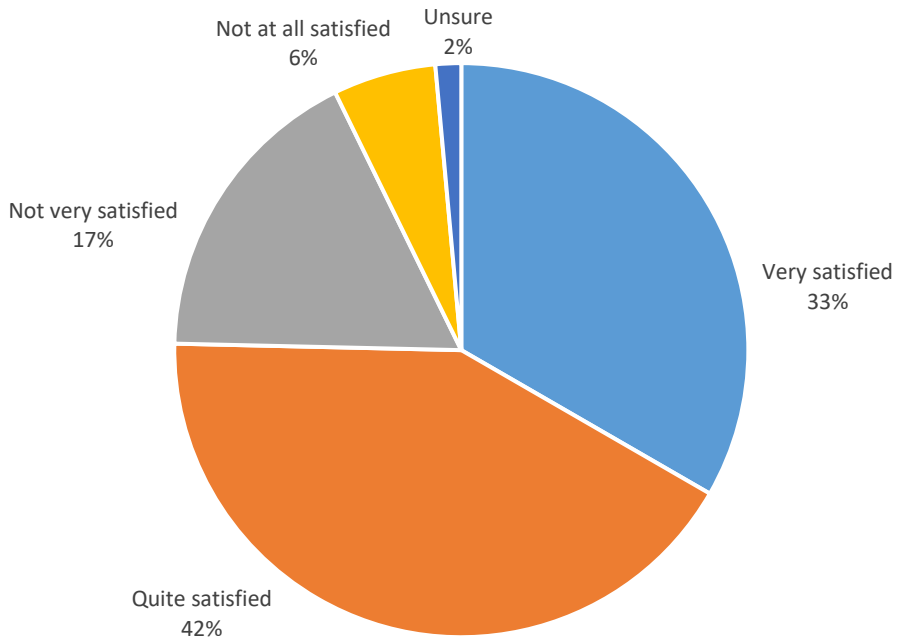

Fig 22. Fisher satisfaction with abalone catch rates achieved during 2021–22 season. (n = 69)

3.3.4 Policing and Enforcement

Out of 222 active fishers who responded to questions about policing, 52 (23.4%) indicated that they had been checked by Marine Police whilst fishing for lobster during 2021–22 (170 or 76.6% were not checked). On-water inspections were reported by 51.9% of those checked while off-water inspections (e.g. at boat ramps) were reported by 40.4% of fishers (note some respondents were subject to on-water and off-water checks).

Of the fishers who were checked by the Marine Police, 42 were checked once only, six were checked on two occasions, three were checked three times and one respondent was inspected four times.

Reported inspection rates for the previous four seasons were generally comparable to the current season, ranging between 15% (2018–19) and 25% in (2017–18).

3.3.5 Fishcare

Respondents were asked about their awareness of the Fishcare Volunteer Program as well as the source of their awareness. Out of the 314 respondents to this question, 148 (47%) indicated that they had heard of the Fishcare Volunteer Program and 157 (50%) were unaware of the program (8 respondents were unsure).

Amongst respondents, the most common sources of awareness of the program was social media and friends and family (Table 5).

Table 5. Information sources where respondents heard about the Fishcare Program.

Source of information	Number of Respondents
Social Media	33
friends & family	28
MAST newsletter	17
AGFEST	17
Tackle Shop	13
Boat Show	12
boat ramp	8
Fishing Clinic	6
Newspaper/TV	6
newsletter	4
email	4
marine police officer	2
internet	2
fishing magazine	2
Other	21
UNSURE	16

Multiple responses allowed

3.3.6 Regulations

3.3.6.1 Source of Information

Respondents were asked how they found out about rock lobster and abalone fishing regulations and were given a list of options to choose from. They could choose multiple options and were asked to say which option was the most useful. Respondents indicated that the printed Sea Fishing Guide and the NRE website were the not only the most common sources of information about fisheries regulations, but the most useful as well (Fig 23, Table 6).

Table 6. Information sources where respondents found information about fisheries regulations**.**

MENTIONED	No.
Sea Fishing Guide (print version)	148
NRE Website	129
Fish Phone App	71
Friends/family	69
Fishing News email alerts (NRE)	60
Fisheries Tas Facebook page	29
Newspaper	16
TV	4
Other	6

Multiple responses allowed

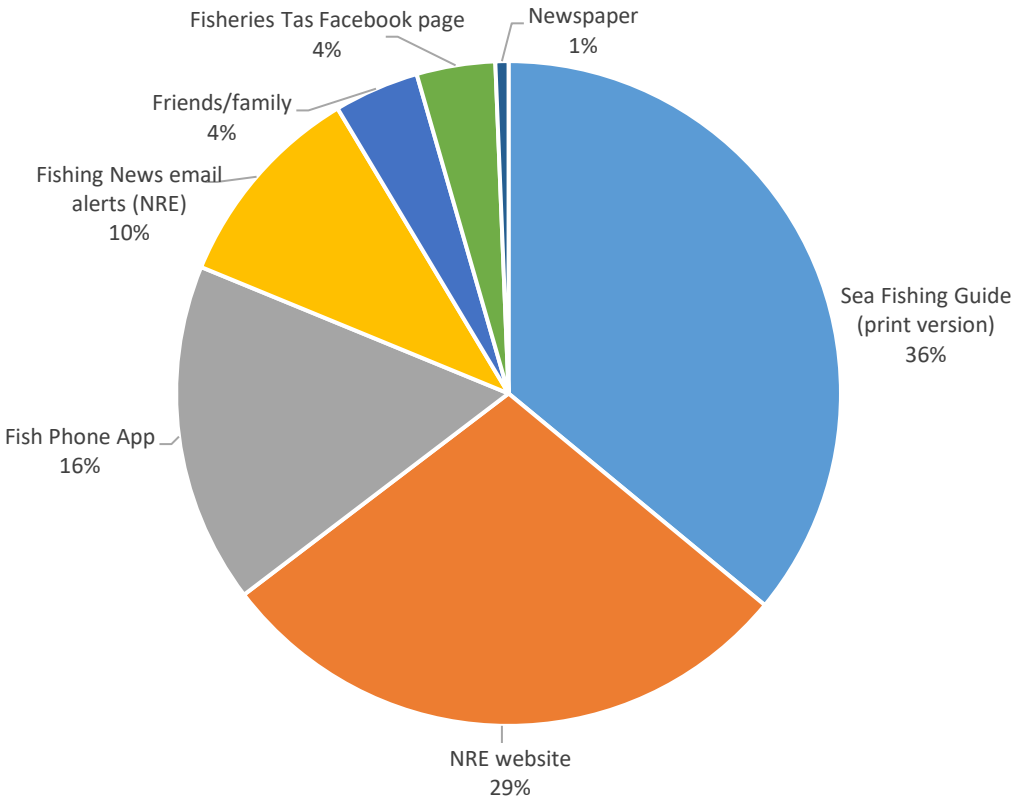

Fig 23. Sources of information for fisheries regulations respondents found most useful. (n = 314)

3.3.6.2 Compliance with Regulations

Respondents were asked to rate how commonly they thought various types of illegal activity occurred (Fig 24). Their perception is that the practice of pulling other fisher's pots and stealing their catch as well as retaining more than the daily lobster bag limit are the most common types of illegal activity.

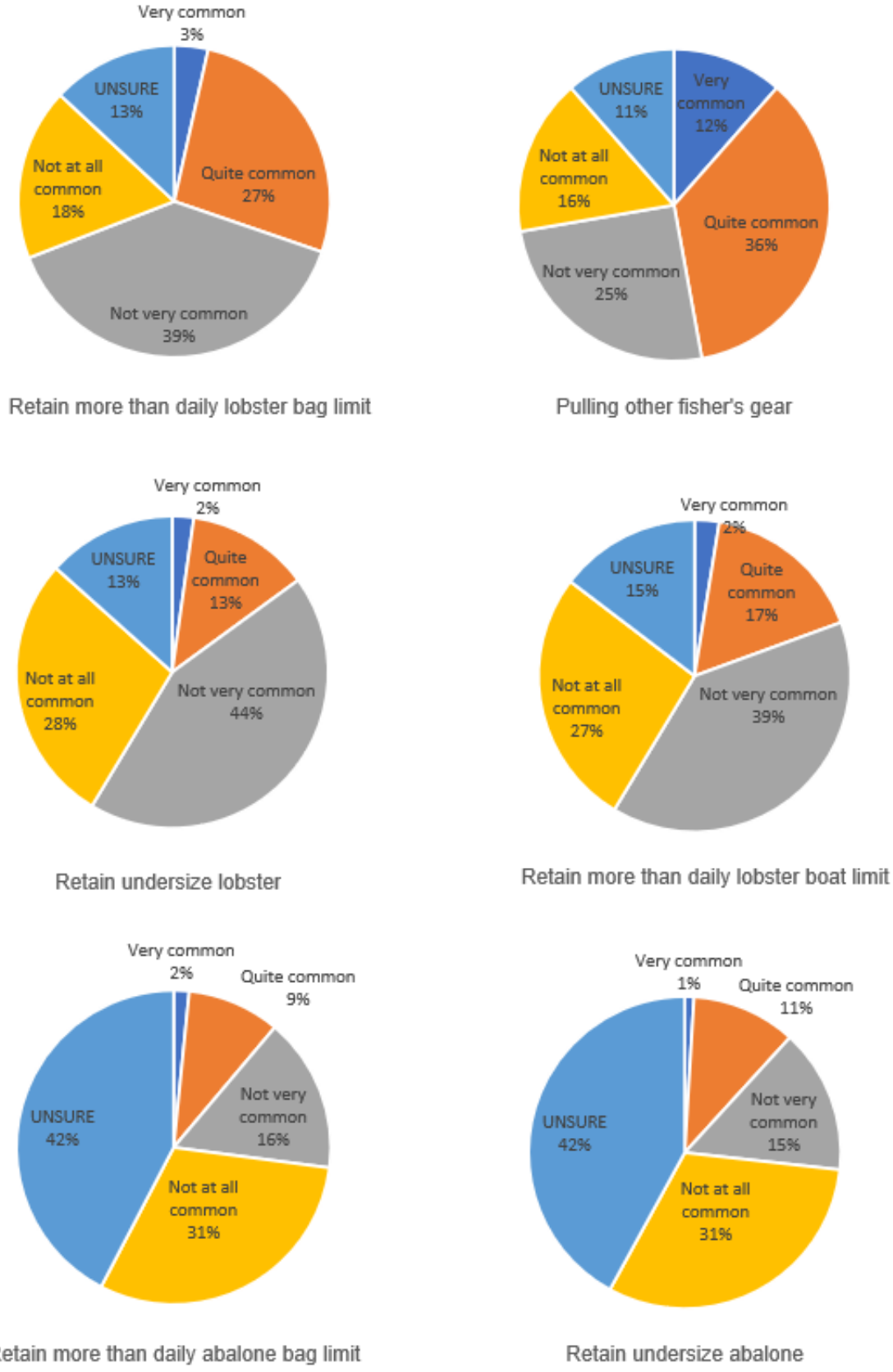

Fig 24. Respondent's perception of how common it is for various illegal activities to occur. (n = 314)

3.3.6.3 Other Fishing and Activities

Respondents were asked whether they conducted other types of fishing in conjunction with fishing for rock lobster or abalone; 41% indicated that they always conduct other kinds of fishing activity when fishing for rock lobster and abalone and 39% indicated that they do so sometimes. 20% of rock lobster and abalone rec fishers said they never or rarely conduct other fishing

Of the respondents who indicated that they do fish for other species when they fish for rock lobster or abalone, hook and line fishing (offshore and inshore), along with squid and game fishing, were the most common types of fishing conducted whilst fishing for rock lobster and abalone (Table 7).

Table 7. Additional fishing methods conducted in conjunction with rock lobster and abalone fishing.

Method	Number	%
Hook and Line (inshore)	183	72.6
Hook and line (offshore)	107	42.5
Squid	63	25.0
Game fishing	45	17.9
Net	34	13.5
Scallop diving	25	9.9
spearfishing	11	4.4
Other	16	6.3

Note multiple responses allowed (n=252)

When asked about fishing their usual fishing group size, most (74%) indicated that they usually fish with between 2 and 4 other people. Nine percent (9%) of respondents indicated that they always fish alone, 19% fish with one other person and 4% fish with 5 or 6 other people (Fig 25).

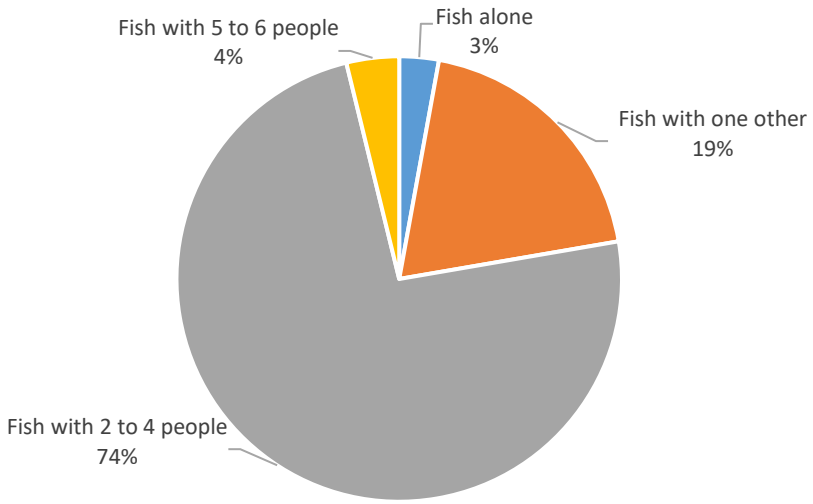

Fig 25. Usual size of respondent's fishing group.
(n = 314)

Respondents were asked whether they would still go fishing if they were unable to fish for rock lobster or abalone. Almost 90% indicated that they would do other kinds of fishing, with 8.3% indicating that they would not fish (1.9% were unsure).

We also asked the type of fishing they would undertake if unable to fish for rock lobster or abalone (Table 8). Inshore hook and line was the most popular response (76%), followed by offshore hook and line (41%) and squid fishing (27%). Game fishing (24%), net fishing (13%) and scallop diving (10.3%) are also important alternate fishing activities.

Table 8. Alternate fishing activities—if unable to fish for rock lobster or abalone

Method	Number	%
Hook and Line (inshore)	214	75.9
Hook and line (offshore)	115	40.8
Squid	76	27.0
Gamefishing	68	24.1
Net	37	13.1
Scallop diving	29	10.3
shark line	13	4.6
spearfishing	11	3.9
Other	13	4.6

N=282, multiple responses allowed

3.3.6.4 Rock Lobster Catch Research Trial

Respondents were asked whether they have heard of the NRE Rock Lobster Monitoring App, if they have used it and where they were made aware of the app. 68% of respondents had not heard about the app, 31% were aware of the app and the remainder were unsure. The most common sources of awareness of the app (Table 9) were other fishers and friends and government publications and government websites.

Table 9. Source of awareness about Rock Lobster Monitoring App.

Source of awareness	No.
Other fishers/friends (word of mouth)	36
Govt Publications	21
Govt Websites	20
Other Social Media	17
Email newsletter	14
Fishing Magazines	10
Govt Social Media	10
Govt Smart Phone App	6
MAST	6
Radio	5
Newspaper	4
Fishing clubs/Associations	4
Other	17
UNSURE	4

N = 96, Multiple responses allowed

We also asked respondents who were aware of the app, but didn't use it, why they didn't use the app (Table 10). The most common reason was that they didn't understand that they could use the app if they were participating in the phone survey and that they didn't download the app. Of the 96 people who had heard of the app, less than 5% used it.

Table 10. Reasons for not using the Rock Lobster Monitoring App.

Why not use App?	No.
Didn't know I could (if participating in phone survey)	17
didn't download App	17
Didn't go Fishing	10
Other	8
I don't have a smartphone	4
Not familiar with Apps or smartphones	3
Other	8
no response	32

N = 96, Multiple responses allowed

4 DISCUSSION

4.1 Catch and Effort

4.1.1 General Trends

The recreational fishery has been monitored using fisher surveys since the mid-1990s during which time rock lobster stock abundances have varied markedly and there have been several management changes, mainly centred on the east coast. State-wide recreational catch, effort and catch rates have declined since the early 2000s, from a peak catch of almost 150 tonnes in 2002–03 (Fig 26). The initial decline occurred despite a steady increase in licence numbers (refer Lyle et al., 2021) and corresponded with a general decline in overall stock abundance (Hartmann et al., 2019) and subsequent changes to management settings introduced as a component of the ECSRS. Overall, the state-wide harvest has not exceeded the TARC allocation of 170 tonnes in any year for which there is survey data. Estimated catches since 2015–16 have been equivalent to half or less of the TARC, though this season has been the highest at 51%.

Abalone catches have also declined since the early 2000s (Fig 27) even though licence numbers continued to grow up until 2008–09 (Lyle et al., 2021). The current harvest estimate has increased slightly (~0.3%) from last season's estimate (11,742 in 2020–21) which was the second lowest since surveys commenced (Table 11). Lower catches in the 2019–20 and 2020–21 seasons were linked to a marked fall in the average catch rate to less than 4 per day (Lyle et al., 2021), itself associated with halving of the Eastern region bag limit (from 10 to 5 abalone per day) in 2019. However, the average catch rate in 2021–22 has increased to 4.7, approximating the old bag limit of 5. However, this year divers reached the new bag limit of 10 in about 14% of all targeted dives in the Eastern region.

Social (e.g. motivations, availability of time, access), biological (e.g. stock size, catch rates) and environmental (weather) factors all play a role in influencing fisher behaviour and highlight the need to understand the dynamics and drivers of this behaviour. For

instance, the proportion of licence-holders who utilised their licences (i.e. fished) has varied between 87% (2000–01) to only 68% (2015–16) for lobster, and 64% (2000–01) to only 31% (2017–18, and this current season) for abalone (Table 11). In the seasons especially impacted by biotoxin closures (2015–16 and 2017–18) and the COVID-19 lockdowns (2019–20, 2020–21) about 30% of rock lobster licence-holders did not fish for lobster, though this proportion has decreased in the current season (22%). Similar to the 2020–21 season, lack of time (due work and/or family commitments), lack of a boat/gear and health/age were the most cited reasons for not fishing for lobster (and not renewing licences) during 2021–22.

Coupled with this trend has been a general decline in the average number of days fished per season by active fishers for both lobster (about 9 down to 5–6 days) and abalone (4 down to about 2.4 days), contributing to declines in average seasonal harvest per fisher (Table 11). Furthermore, daily harvest rates for lobster have declined since the early 2000s (Lyle et al., 2021); this decline being particularly influenced by pot catch rates which fell from 1.0 in 2002–03 to below 0.7 lobster per day in 2015–16 and 2019–20 (Table 11), though there was a small increase in pot catch rates in 2020–21 at 0.82 lobster per day, this number has declined during the current season (0.77 lobster per day).

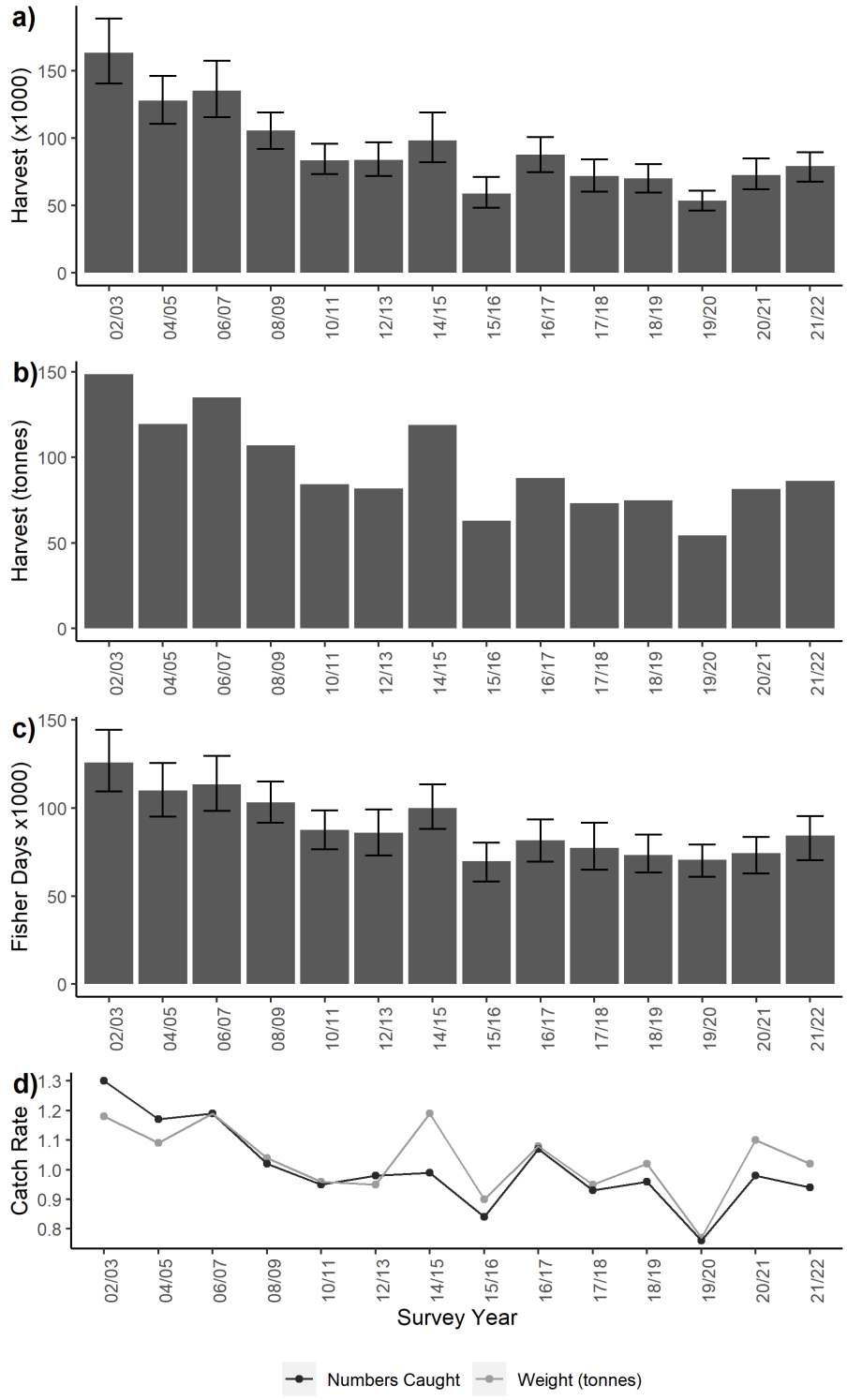

Fig 26. Tasmanian recreational rock lobster fishery: a) estimated state-wide harvest (numbers); b) estimated state-wide harvest (tonnes); c) effort (fisher days) by fishing season; d) and average catch rate (number per fisher-day). Error bars indicate 95% confidence intervals.

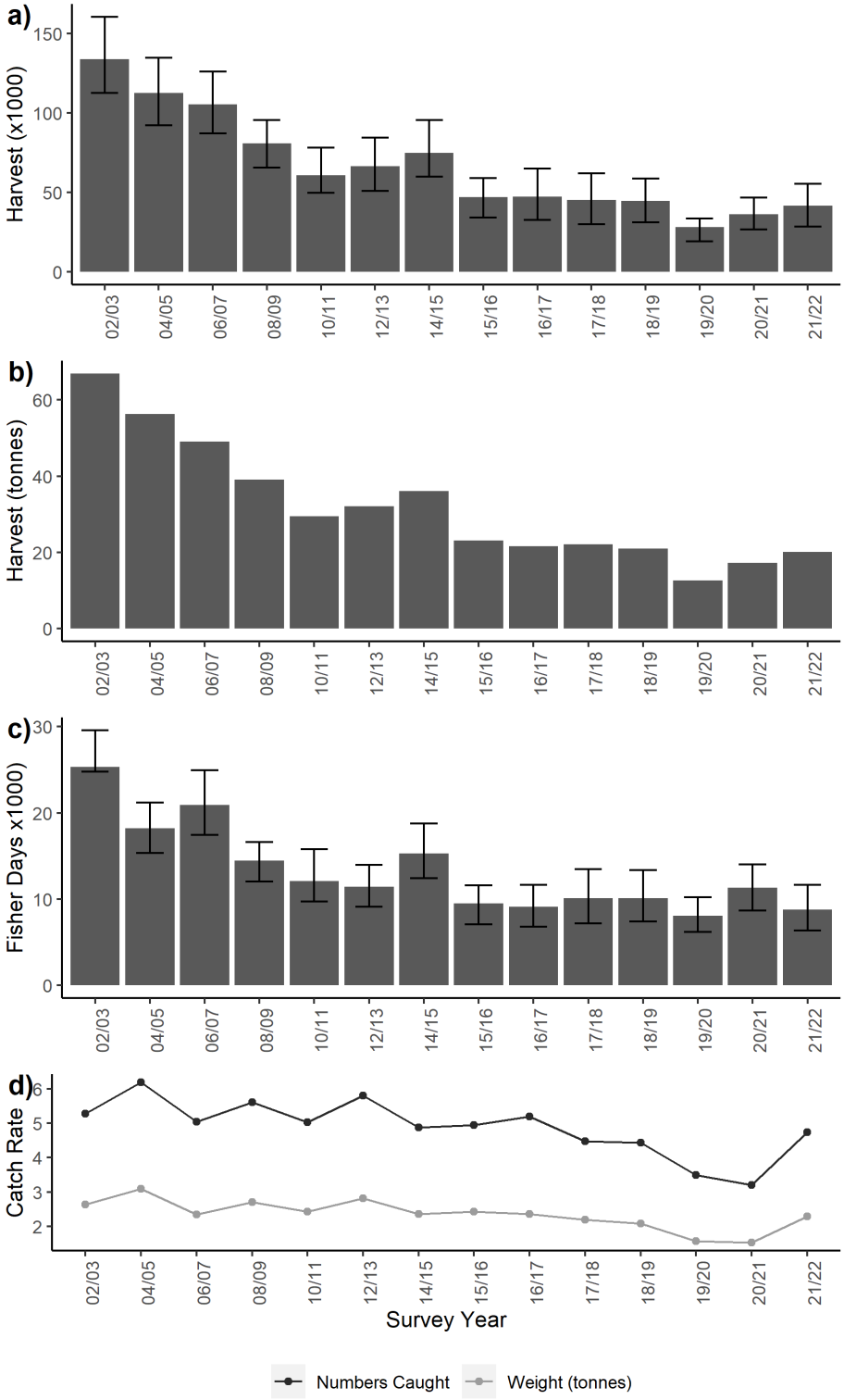

Fig 27. Recreational abalone fishery: a) estimated state-wide harvest (numbers); b) estimated state-wide harvest (tonnes); c) effort (fisher days) by fishing season; d) and average catch rate (number per fisher-day). Error bars indicate 95% confidence intervals.

Table 11. Number of rock lobster and abalone licence holders, estimated number and proportion who fished, total and average harvest and effort per fisher by year and average daily harvest rates. * part year (Nov–Apr); nd not determined

	Licence year														
	2000-01	2002-03	2004-05	2006-07	2008-09	2010-11	2012-13	2014-15	2015-16*	2016-17*	2017-18*	2018-19*	2019-20*	2020-21*	2021-22*
Rock lobster															
No. licence holders	13,265	15,580	16,710	20,008	21,351	19,519	18,185	19,306	16,810	18,009	17,162	18,080	17,182	18,520	18,226
% fished	86.5	88.4	81.9	78.4	75.2	71.7	76.0	75.4	68.4	76.0	69.9	73.2	70.4	71.1	77.6
No. active fishers	11,408	14,308	13,679	15,687	16,050	13,997	13,814	14,552	11,500	13,686	12,004	13,239	12,090	13,168	14,143
Harvest (no.)	128,219	163,454	127,987	135,592	105,538	83,472	83,772	98,442	58,805	87,650	72,009	70,100	53,655	72,751	79,365
Harvest (kg)	116,509	148,526	119,354	135,067	107,027	84,261	81,849	118,996	63,022	87,941	73,187	74,982	54,345	81,606	86,338
Av. no. per active fisher	11.2	11.4	9.4	8.6	6.6	6.0	6.1	6.8	5.1	6.4	6.0	5.3	4.4	5.5	5.6
Fisher days	100,866	125,898	109,788	124,305	103,985	87,617	85,849	101,699	69,920	81,690	77,209	73,327	70,473	74,453	82,945
Av. days per active fisher	8.8	8.8	8.0	7.9	6.5	6.3	6.2	7.0	6.1	6.0	6.4	5.5	5.8	5.7	5.9
Av. daily harvest (no.)	1.27	1.30	1.17	1.09	1.01	0.95	0.98	0.97	0.84	1.07	0.93	0.96	0.76	0.98	0.96
Av. daily pot-harvest (no.)	0.87	1.00	0.90	0.94	0.75	0.68	0.78	0.71	0.65	0.87	0.74	0.74	0.62	0.82	0.77
Av. daily dive-harvest (no.)	2.61	2.30	2.31	2.15	2.27	2.36	1.83	1.92	1.61	1.90	1.59	1.67	1.27	1.49	1.77
Abalone															
No. licence holders		9,272	10,133	12,514	12,976	11,972	11,157	12,084	10,509	11,035	10,797	11,127	10,600	11,742	11,781
% fished		63.5	55.8	52.3	38.8	36.3	42.0	42.4	37.9	33.5	30.7	35.9	31.5	37.7	31.1
No. active fishers		5,853	5,653	6,542	5,033	4,349	4,682	5,126	3,896	3,695	3,313	3,990	3,341	4,420	3,664
Harvest (no.)		133,711	112,571	105,515	81,021	60,943	66,438	74,769	47,113	47,522	45,142	44,740	28,150	36,168	41,552
Harvest (kg)		66,857	56,283	49,022	39,024	29,438	32,138	36,047	23,081	21,590	22,124	20,963	12,642	17,212	20.601
Av. no. per active fisher		22.8	19.9	16.1	16.1	14.0	14.2	14.6	12.1	12.9	13.6	11.2	8.4	8.2	11.3
Fisher days		25,342	18,185	23,201	14,445	12,117	11,428	15,110	9,548	9,136	10,079	10,081	8,064	11,302	8,772
Av. days per active fisher		4.3	3.2	3.5	2.9	2.8	2.4	2.9	2.5	2.5	3.0	2.5	2.4	2.6	2.4
Av. daily harvest (no.)		5.28	6.19	4.55	5.61	5.03	5.81	4.95	4.93	5.20	4.48	4.44	3.49	3.20	4.74

4.1.2 Fishing Methods

Pots have consistently represented the main method used to catch rock lobster and apart from 2000-01, have accounted for 58–67% of the total harvest numbers in each of the years surveyed (Fig 28). Dive methods have typically accounted for about a third (28.7–44%) of the harvest in all seasons. The reason for the apparent increase in the dive harvest proportion in (i.e. 44%) in 2000/01 was unclear and has not been evident in subsequent seasons. Rings represent a minor component of the fishery (1.5–6.1%).

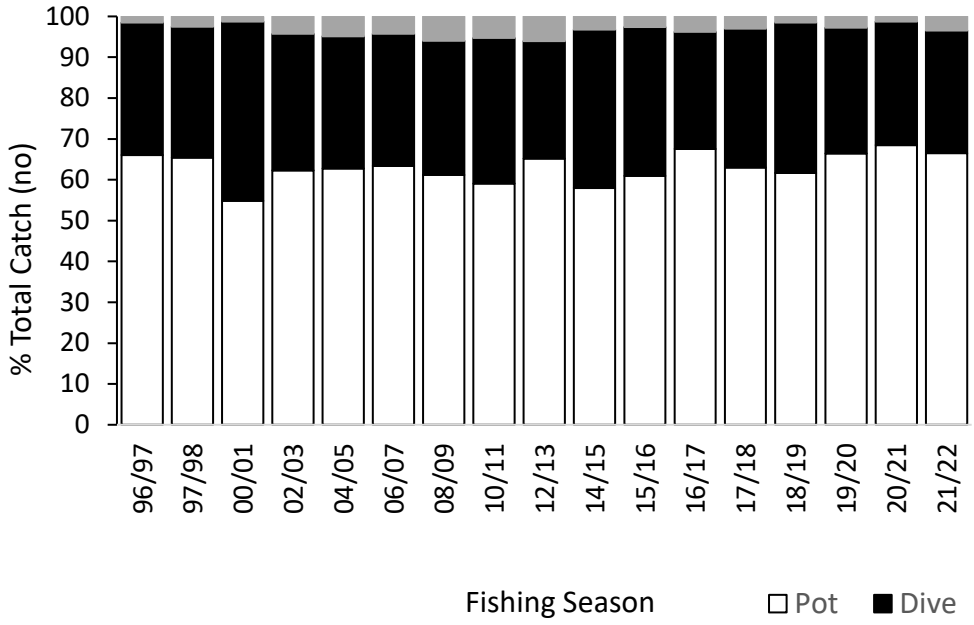

Fig 28. Proportion of the rock lobster harvest by method and fishing season

4.1.3 Catch Rates

Catch per unit effort represents an important metric in assessing fishery performance; as an indicator of stock biomass, economic performance in commercial fisheries and, an indicator of recreational satisfaction against which fishery performance could be assessed (Lyle et al., 2014, 2016a,b, 2017, 2019a, 2020b). Pot catch rates are dependent upon lobster availability and catchability (behaviour), and therefore are more likely to be responsive to trends in rock lobster abundance. Therefore, the trend in pot catch rates over the past decade has been consistent with changes in rock lobster population biomass (Hartmann et al., 2019, Lyle et al., 2021).

The average daily harvest rate during 2021–22 for pots (0.76 lobster) was slightly lower than the 2020–21 year of 0.86 which was (with the exception of 2016–17), higher than levels experienced in all years since 2008–09, despite the fact that higher daily bag limits applied in seasons prior the 2015–16 season (Lyle et al., 2021). This suggests that pot catch rates have remained largely insensitive to these bag limit changes, confirmed by two decades of survey data indicating that daily catches of two or more lobster per pot day are relatively rare (Table 11).

By contrast, as divers actively search for lobster and are able to maintain catch rates by increasing search times such that a relatively high proportion of trips achieve the bag

limits. Dive catch rates for lobster have tended to fluctuate without obvious trend, apart from the reduction in catch rate to below 2.0 lobsters per day since 2012–13 which corresponded with the reduction in the Eastern region bag limit. This season's average daily harvest number for divers was 1.77 lobsters per day—the highest since 2016–17 (Table 11).

Apart from the last two seasons, abalone catch rates have fluctuated without obvious trend through time, reflecting the fact that many divers regularly attain the bag limit. The average daily harvest rate increased by 48% (at 4.7 abalone per day) during the 2021–22 season, compared to the 2020–21 season which was the lowest on record (3.2 abalone per day. The decrease in 2020–21 was likely caused by the bag limit reduction applied to the fishery in 2020 (Lyle et al., 2021), followed by a subsequent increase in daily catch rate when the bag limit was repealed.

Bag limits represent a key management strategy to constrain recreational rock lobster and abalone catches in Tasmania. As bag limits have a less obvious impact on pot catches, with only a small proportion of pot effort resulting in bag limits being achieved (i.e. 19% and 11% of effort in the Eastern and Western regions for the 2021–22 season respectively). By contrast, bag limits had a more obvious impact on dive catches, with 60% of the dive effort in the Eastern region and 32% of the dive effort in the Western region resulting in the bag limits being achieved.

4.1.4 Regional Patterns

The recreational rock lobster and abalone fisheries are concentrated off the southeast and east coasts of Tasmania, with Areas 1–3 accounting for 69 and 70% of the harvest (by number), respectively. The intensity of the fishing activity off the southeast and east coasts reflects a combination of factors, including sheltered and accessible waters and proximity to major population and holiday centres.

Catches from the north coast (Areas 4 & 5) were higher than off the west coast (Areas 6–8) for abalone (18% from the north coast, and 13% from the west coast), but this trend was reversed for rock lobster (12% from the north coast and 20% from the west coast). Due to the relatively low effort in the north and west coasts compared to the east coast, catch and effort in the north and west coast have historically been variable. Factors such as accessibility of suitable reef habitat off the north coast (apart from the Bass Strait islands), and exposure to unfavourable sea conditions and limited access points off the west coast, contribute to the lower levels of recreational fishing pressure observed in those regions. Despite this, this region representing a very significant area for both commercial rock lobster and abalone fisheries (Hartmann et al., 2019, Mundy & McAllister 2019).

There is considerable regional variability in the relative importance of the various rock lobster fishing methods. Pot catches clearly dominate the harvest off the southeast and east coasts, whereas dive collection is the dominant method off the north west coast. Pots, dive collection, and rings are each locally important in the west coast areas. Such method-based regional differences are consistent with patterns observed in previous seasons (Lyle 2000, 2008, 2018, Forward & Lyle 2002, Lyle & Morton 2004, 2006, Lyle & Tracey 2010, 2012, 2014, 2016a,b, 2017, Lyle et al., 2019a; 2020b, 2021).

4.1.4.1 Historical Regional Patterns

4.1.4.1.1 Rock Lobster Catch and Effort

Across most management assessment areas, there has been a decrease in both catch and effort of rock lobster (all methods pooled) since at least the 2002–03 season (Fig 29), noting that as catch and effort in the north (assessment areas 4 and 5) and west coast (assessment areas 6–8) is relatively low, these estimates should be interpreted with caution. However, as the majority of catch and effort has historically been concentrated in assessment areas 1–3, understanding historical patterns by region is warranted. As the majority of catch and effort are concentrated in assessment area 1 in particular, patterns observed across the entire Tasmanian fishery are largely derived from catch and effort in this region. Catch in assessment area 1 peaked in 2006–07 at 61,185 (95% CI: 47,012–78,296), to a low in both 2015–16 (21,375; 95% CI: 14,334–29,313) and 2020–21 (31,454; 95% CI: 23,619–39,962), linked to biotoxin closures and COVID-19 restrictions, similar to patterns seen when data has been pooled across the fishery (Fig 26). However, since 2006–07, effort has exceeded catch, leading to reduced (though variable) catch rates in assessment area 1 (Fig 30). Effort (fisher days) in assessment area 1 peaked in 2006–07 at 52,174 days (95% CI: 40,941–65,045), and has been variable, albeit lower since then (Fig 29) but has been on an upward trajectory since the end of COVID-19 restrictions (i.e. 2020–21 and 2021–22). Historical catch rates remain high on the west coast, though proportional effort and harvest remain low for this region (Fig 29, Fig 30).

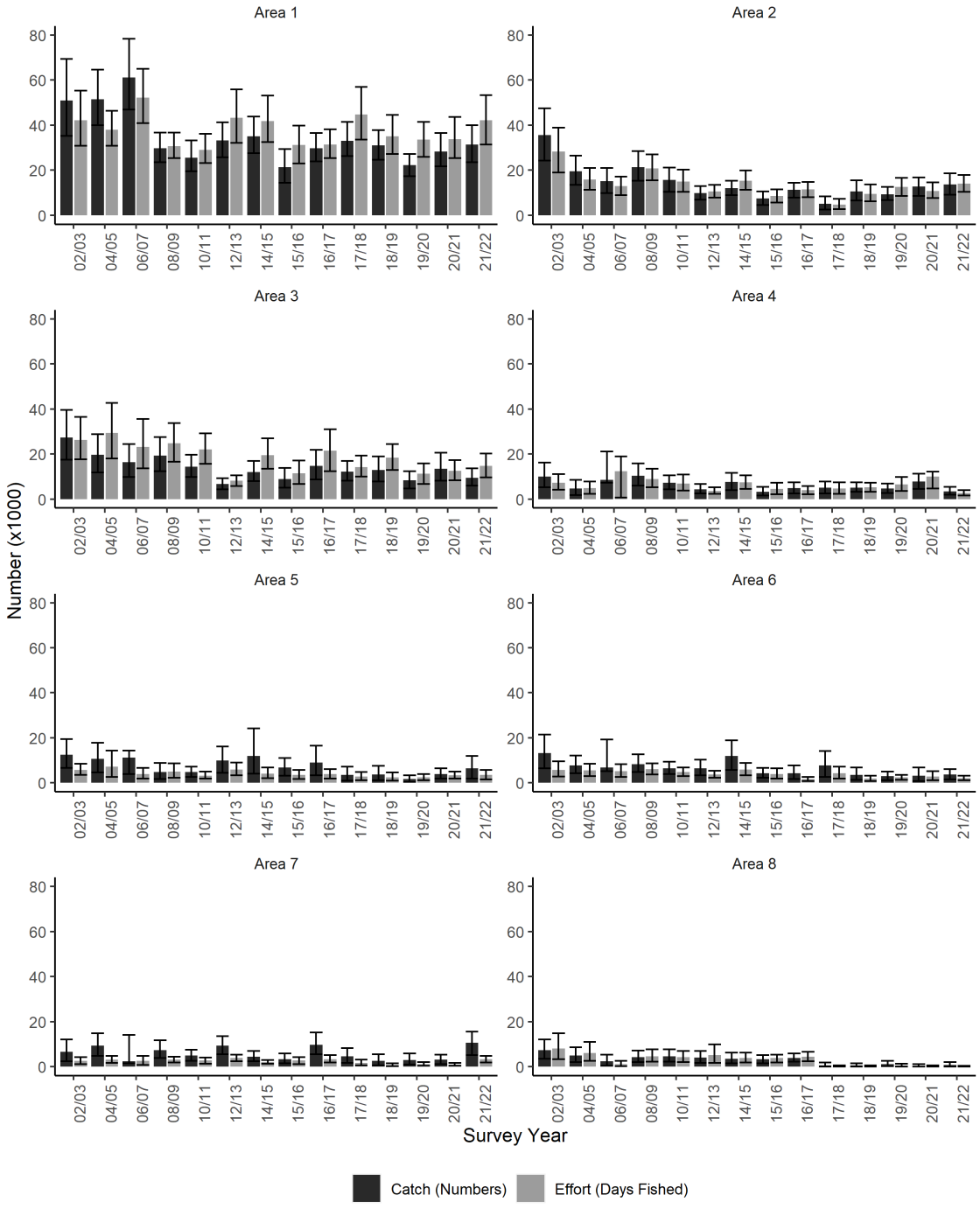

Fig 29. Recreational rock lobster fishery: Catch (numbers: dark grey) and effort (days fished: light grey) by survey year by management assessment area (1–8). Error bars indicate 95% confidence intervals.

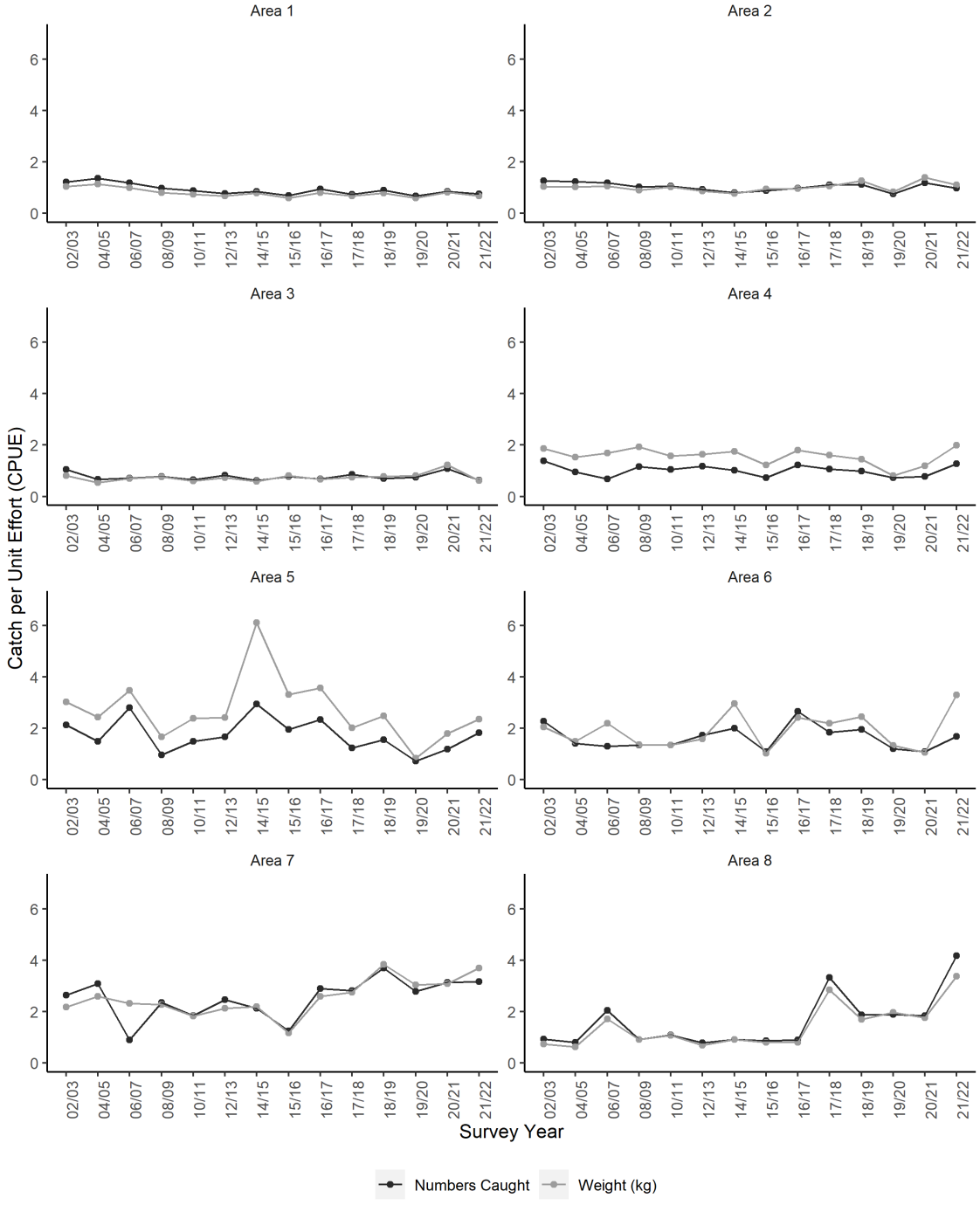

Fig 30. Recreational rock lobster fishery: Catch rates by numbers caught (dark grey) and weight (light grey) by survey year by management assessment area (1–8).

4.1.4.1.2 Rock Lobster Historical Size Distribution

The size composition of lobster on the east coast (i.e. assessment areas 1–3) have remained relatively stable from the pot fishery (Fig 31, Fig 32), however, there has been an increase in the frequency of lobsters > 135 mm measured from dive methods from 2016–17 season–onwards (Fig 31, Fig 32).

Historical size composition of lobsters on the north and west coasts have been variable, most likely attributed to the low sample size of lobsters measured in these regions (Fig 33, Fig 34).

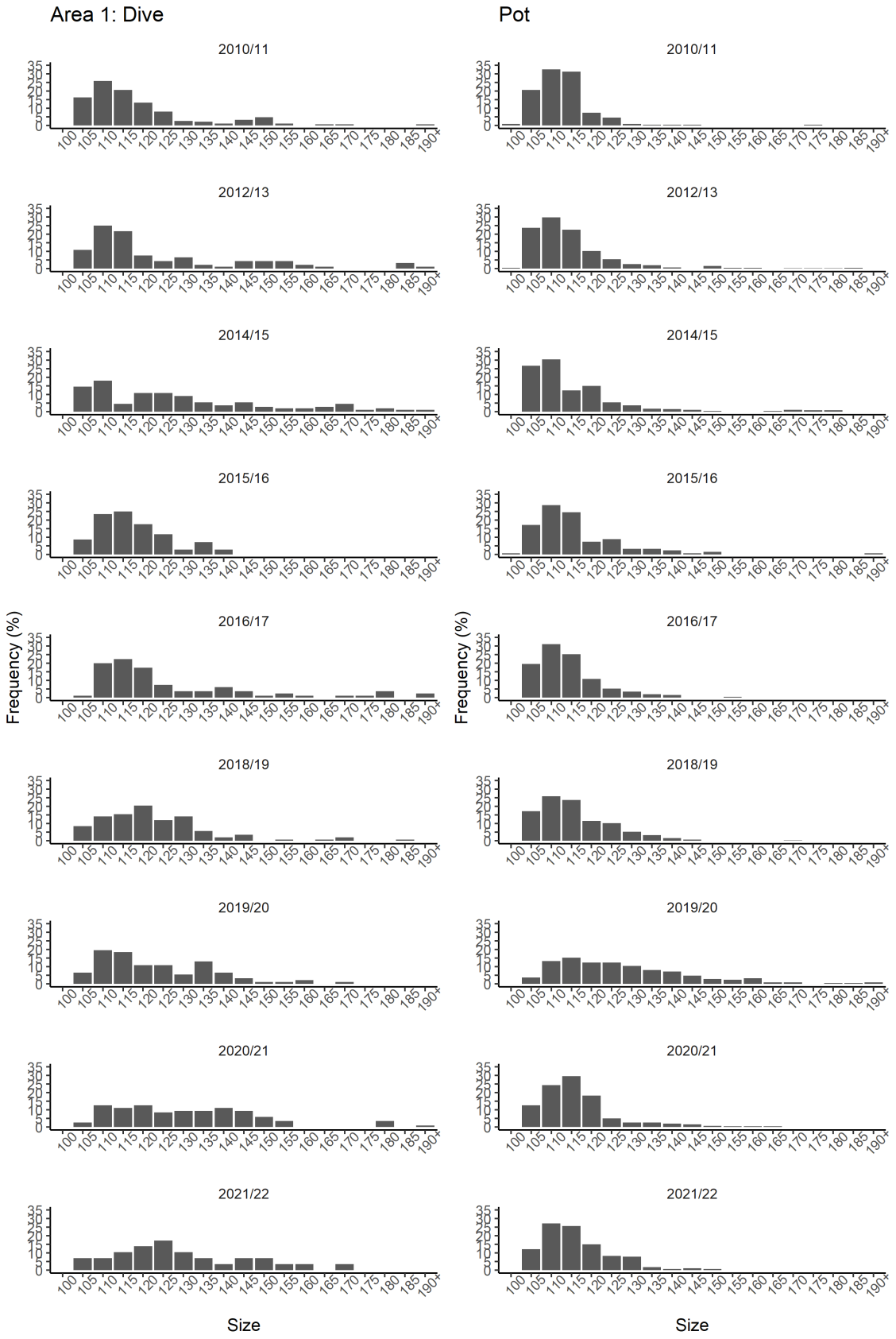

Fig 31. Size composition (i.e. length vs frequency) of rock lobster through time by dive and pot methods in management assessment area 1.

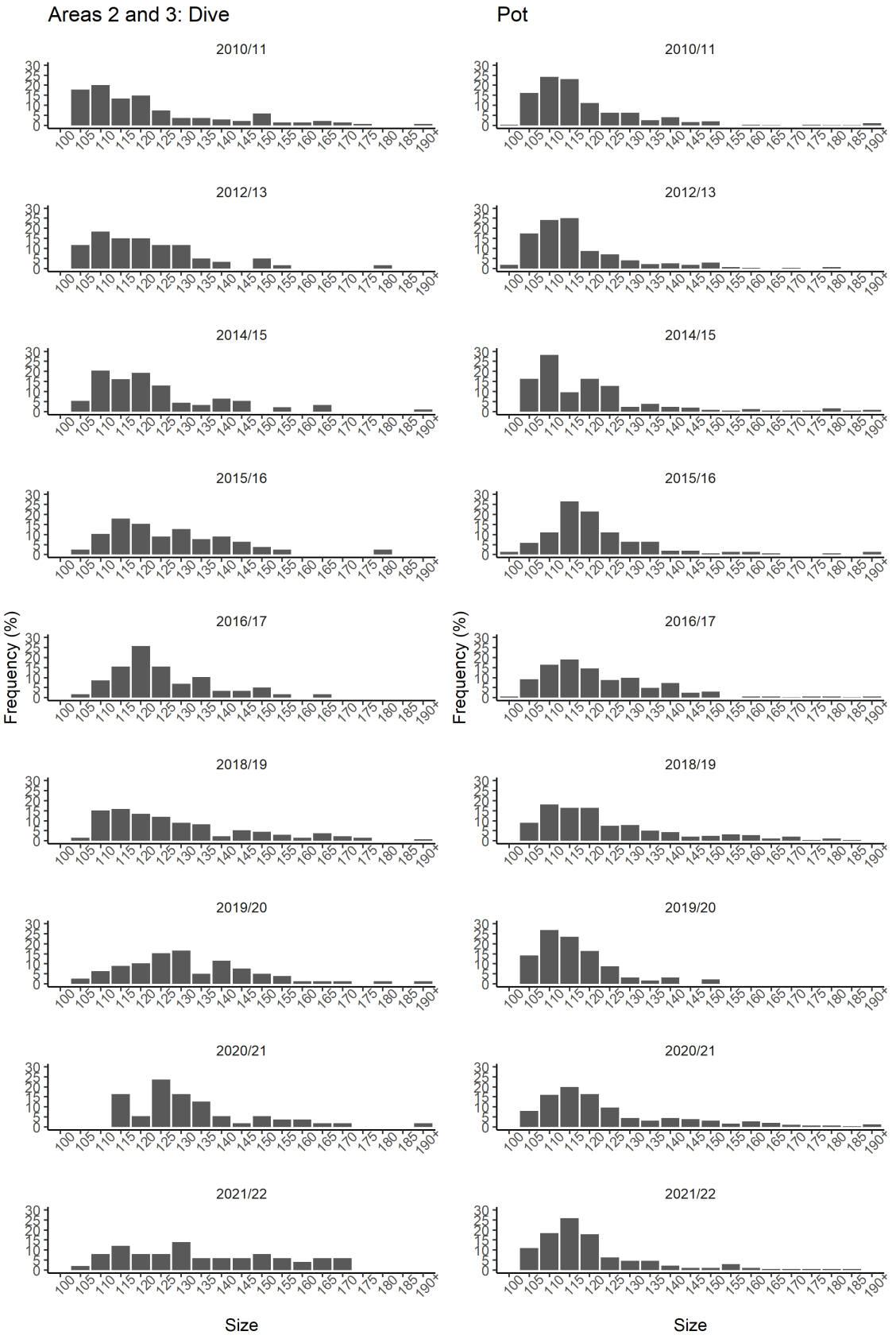

Fig 32. Size composition (i.e. length vs frequency) of rock lobster through time by dive and pot methods in management assessment areas 2 and 3.

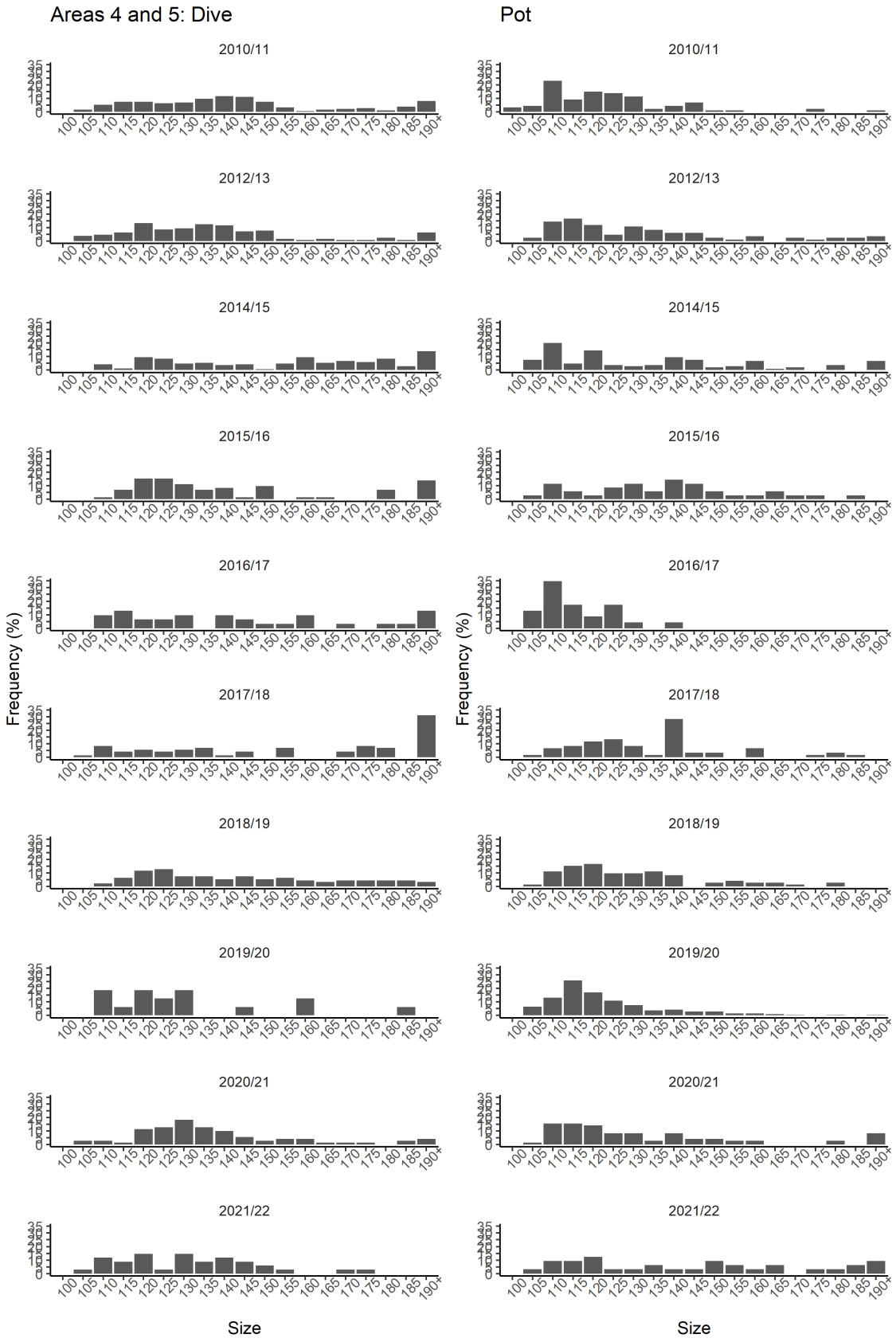

Fig 33. Size composition (i.e. length vs frequency) of rock lobster through time by dive and pot methods in management assessment areas 4 and 5.

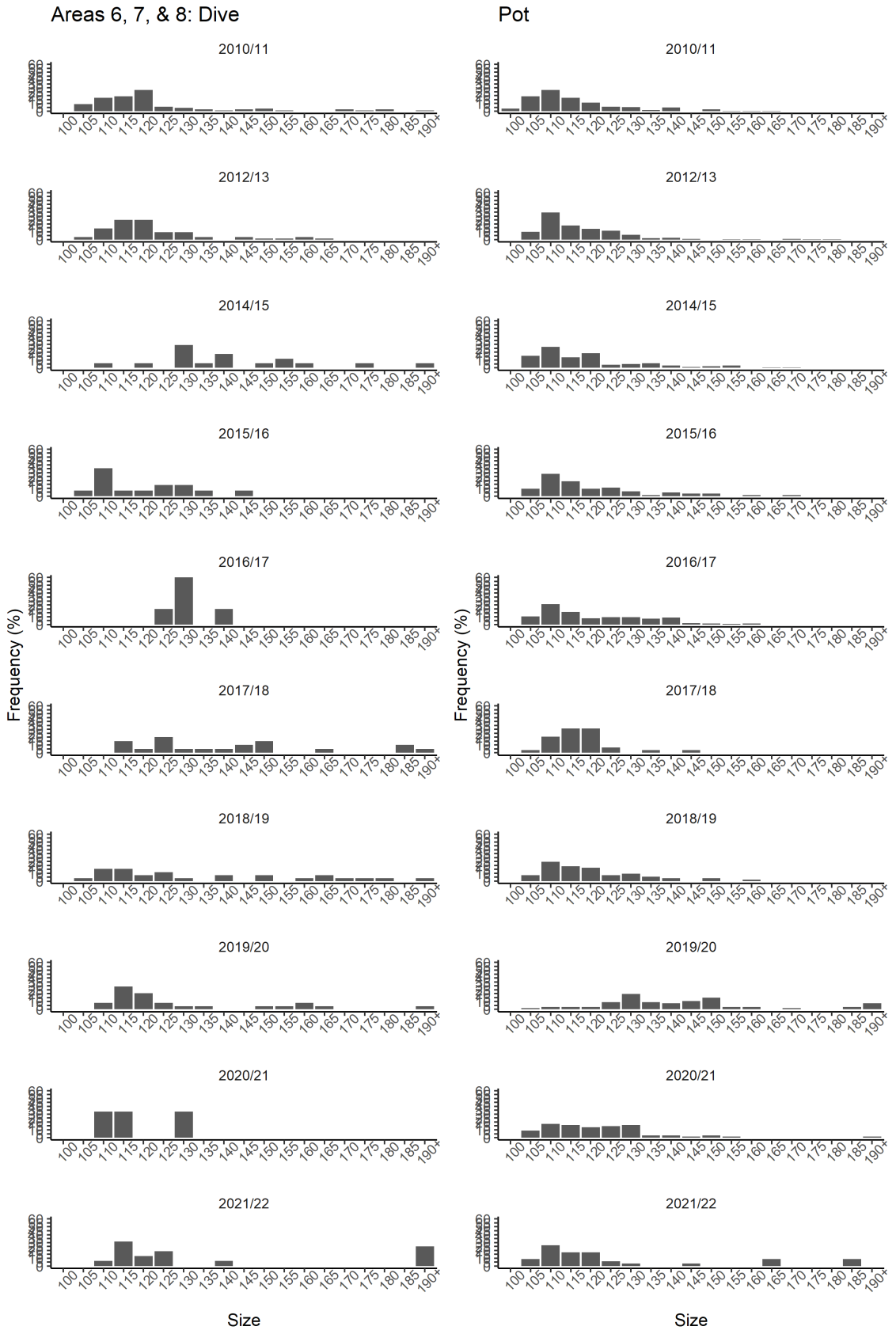

Fig 34. Size composition (i.e. length vs frequency) of rock lobster through time by dive and pot methods in management assessment areas 6 to 8.

4.1.4.1.3 Abalone

Similar to the rock lobster fishery, the majority of catch and effort for abalone has been concentrated to the east coast, and in particular, assessment area 1 (Fig 35). Estimated catch (numbers) from assessment area 1, have declined by 88% from the 2004–05 to 2020–21 seasons. However, effort (fisher days) has not undergone such a drastic decline—only a 55% decline in fisher days between the 2002–03 to 2021–22 seasons (Fig 35). As such catch rates of abalone in assessment area 1 have been declining from 2002–03 to 2020–21, however, have increased during this survey year (driven by higher catch, and not decreased effort compared to 2020–21: Fig 36). Catch and effort in the north (assessment area 4 and 5) and west coasts (assessment area 6–8) historically have been variable, and this pattern is likely driven by the historically relatively small sample sizes in these regions, and thus catch, effort and catch rates should be interpreted with caution.

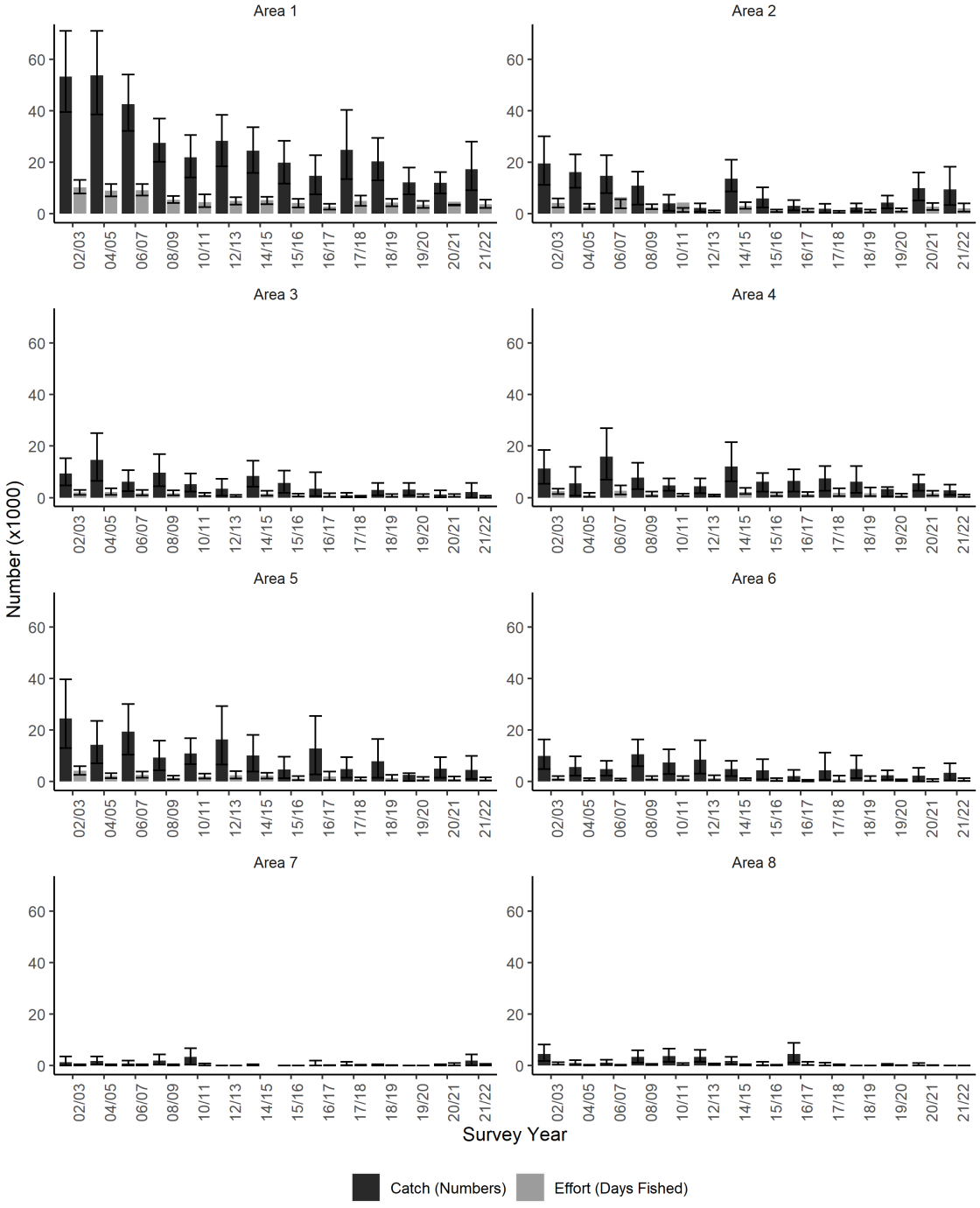

Fig 35. Recreational abalone fishery: Catch (numbers: dark grey) and effort (days fished: light grey) by survey year by management assessment areas (1–8). Error bars indicate 95% confidence intervals.

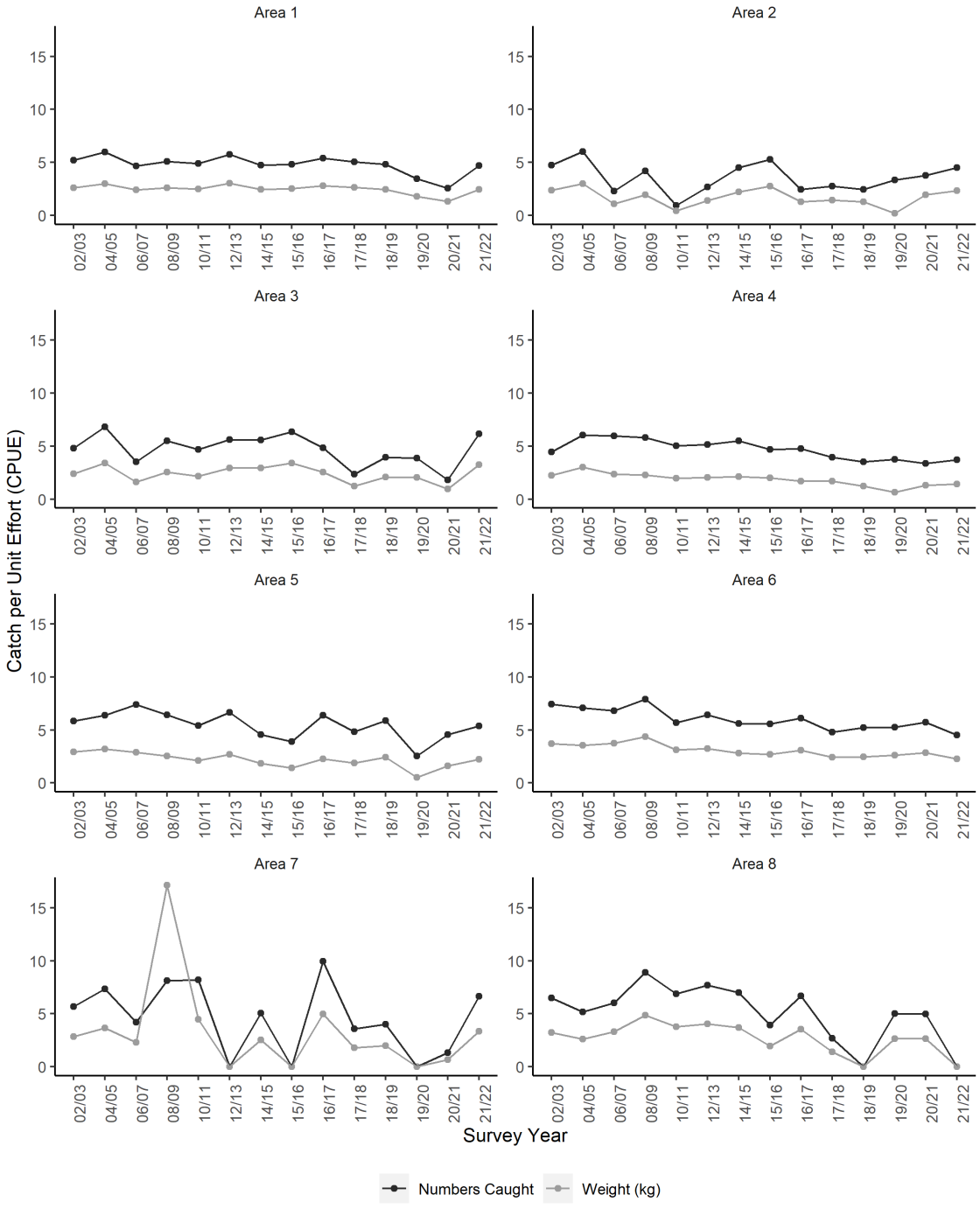

Fig 36. Recreational rock lobster fishery: Catch rates by numbers caught (dark grey) and weight (light grey) by survey year by management assessment areas (1–8).

4.2 Management Implications

The 2021–22 rock lobster harvest estimate of 86.3 tonnes represented 51% the TARC (170 tonnes) and was equivalent to 7.1% of the 2020-21 TAC[7] (1,220.7 tonnes). Although this survey did not cover fishing activity that may have occurred between May and August (noting that the Eastern region is closed during that period), previous

[7] Total Allowable Catch: TACC plus TARC

surveys have consistently indicated that recreational effort during the winter months is low and catches generally account for less than 5% of the seasonal totals.

The east coast (Areas 1–3) catch of 52.5 tonnes compares with previous estimates for the region in the past five years, ranging from 36.7 tonnes in 2015–16 to 57.4 tonnes in 2020–21; where relatively lower catches in 2015–16 and 2019–20 were influenced by widespread biotoxin closures and COVID-19 travel restrictions and lockdowns.

In 2018 the east coast stock rebuilding zone was amended to exclude waters south of Bruny Island, thereby focusing the rebuilding strategy in the area where stocks are in poor condition (DPIPWE 2018). A consequence of this reduced area has been that the target catch level for the recreational sector within the ECSRZ was set at 35 tonnes for 2019–20, 2020–21 and 2021–22.

In 2019-20, the total estimated catch was 33.6 tonnes—indicating that the notional catch share target was not exceeded, and many fishers reported that the COVID-19 restrictions had impacted the amount of fishing they did and therefore higher catches might be expected under more normal conditions (Lyle et al., 2020b). This notion proved to be true as in 2020–21, when COVID-19 restrictions were eased, an estimated 51.1 tonnes was taken from within the ECSRZ. It is possible that COVID-19 had an opposite effect in 2020–21, where lockdown measures eased, however other restrictions were maintained (e.g. interstate travel was still restricted), potentially increasing the popularity of fishing (in the absence of other recreational activities during the pandemic).

Though this year, as restrictions were further eased to closer to a 'business as usual' scenario, the estimated harvest in the ECSRZ in the 2021–22 season was slightly less at 46.5 tonnes (Table 12).

In practice, recreational ECSRZ catches have exceeded the notional catch shares in most years since 2014-15, exceptions being under-catches in 2015–16, 2017–18 and 2019–20. (Table 12). In each of these years, however, external factors (biotoxin closures during peak fishing periods and COVID restrictions) resulted in marked reductions in recreational effort (and catch), suggesting that management settings alone have been insufficient to constrain east coast catches to within recreational catch targets.

Table 12. East Coast Stock Rebuilding Zone recreational catches relative to catch targets.

Season	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
Catch target	42 t	42 t	42 t	41 t	40 t	35 t	35 t	35 t
Catch estimate	55.6 t	35.7 t	50.2 t	40.4 t	48.6 t	33.6 t	51.1	46.5
Over/under catch	+13.6 t	- 6.3 t	+ 8.2 t	- 0.6 t	+ 8.6 t	-1.4 t	+ 16.1	+ 11.5
% over/under catch	+ 32%	- 15%	+ 19%	- 1%	+ 21%	- 4%	+ 46%	+ 32%

Monitoring this fishery through time has revealed that the recreational sector is highly responsive in terms of the number of active fishers (more so than the number of licence-holders) and individual fishing activity levels in relation to changing lobster abundance (refer Table 11). As catch rates are expected to improve under the stock rebuilding strategy it is likely that more individuals will go fishing and fish more often for lobster, representing a major challenge for management in constraining the recreational catch to within the east coast catch share.

The recreational abalone harvest estimate of 20.1 tonnes was equivalent to 3% of the 2022 TACC (795 tonnes), indicating that the recreational fishery represents a minor component of the Tasmanian Abalone Fishery based on catches. While there are no

management performance indicators relating to the recreational abalone fishery, there is a need to explicitly include recreational catches into on-going stock assessment and future management of the fishery. This is particularly important since recreational fishers may continue to fish areas even when abalone densities are low, risking localised depletion (Lyle et al., 2021).

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