Fisheries

Southern Zone Rock Lobster (*Jasus edwardsii*) Fishery Status Report 2021/22

A. Linnane, R. McGarvey, J. Feenstra and P. Hawthorne

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SARDI Aquatic Sciences
PO Box 120 Henley Beach SA 5022

November 2022

Status Report to PIRSA Fisheries and Aquaculture

Government of South Australia
Department of Primary Industries and Regions

SARDI
South Australian Research and Development Institute

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EXECUTIVE SUMMARY

This report assesses the status of South Australia's Southern Zone Rock Lobster Fishery (SZRLF) stock and provides the latest estimates of the biological performance indicators (PIs), information in context of the reference points (RPs) and stock status classification described in the Management Plan for the fishery. Stock status was determined using the harvest strategy for the fishery that was developed in alignment with the National Fishery Status Reporting Framework (NFSRF) classification system used to determine the status of all South Australian fish stocks.

Overseas market disruptions have been prevalent across the Southern Rock Lobster industry in South Australia over the last three seasons. To allow for greater fishing flexibility, the 2021 season was extended from 15 September to 30 June (normally 1 October to 31 May). In 2021, the Total Allowable Commercial Catch (TACC) in the SZRLF was 1,334 t. This reflected a regular TACC of 1,320 t plus 14 t of carry-over from the 2020 season. The total reported 2021 logbook catch was 1,327.1 t (99% of TACC).

Effort required to take the 1,327.1 t catch was 767,379 potlifts, a decrease of 1% from 2020 (775,014 potlifts). Since 2009 (2,049,961 potlifts), effort has generally declined in the fishery, with the 2021 estimate being the second lowest on record.

Catch per unit effort (CPUE) of legal-sized lobsters (kg/potlift) is the primary biological performance indicator for the fishery. In 2021, the CPUE was 1.72 kg/potlift, reflecting a 79% increase over the last five seasons and the highest catch rate since 2004. Current estimates are above the long-term average (1.07 kg/potlift) and the Trigger Reference Point (TrRP) (0.60 kg/potlift) for the fishery.

The secondary biological performance indicator is the pre-recruit index (PRI; no. of undersized lobsters/potlift). In 2021, the PRI was 1.54 undersized/potlift, reflecting a 13% decrease over the last two seasons, but remaining above the TrRP of 1.32 undersized/potlift. In the SZRLF, the time taken for pre-recruits to enter the fishable biomass is estimated to be approximately one year.

Model outputs indicate considerable increases in legal-size biomass over the last five seasons. In 2021, the estimate was 4,434 t, the highest since 2004. This equates to an exploitation rate of 31%, one of the lowest on record for the fishery. Egg production in the fishery remains low with 2021 estimates equating to 14% of unfished levels, but with increases in recent seasons.

The stock status classification for the SZRLF is defined in the Management Plan for the fishery (PIRSA 2020). In 2021, the CPUE of 1.72 kg/potlift was above the TrRP of 0.60 kg/potlift. As a result, the SZRLF stock is classified as "**sustainable**". This means that the current level of fishing mortality is being adequately controlled to avoid the stock becoming recruitment impaired.

Table 1 Key statistics for the SZRLF.

Statistic	2021/22	2020/21
TACC	1,334 t	1,289 t
Total commercial catch	1,327.1 t	1,275.5 t
Total effort	767,379 potlifts	775,014 potlifts
Commercial CPUE	1.72 kg/potlift	1.64 kg/potlift
Pre-recruit index	1.54 undersized/potlift	1.58 undersized/potlift
Biomass estimate	4,434 t	4,120 t
Exploitation rate	31%	32%
Egg Production	14%	12%
Status	**Sustainable**	**Sustainable**

Keywords: Rock lobster, Southern Zone, Fishery Status, *Jasus edwardsii*.

1 INTRODUCTION

This fishery status report updates the 2020/21 stock assessment report for the Southern Zone Rock Lobster Fishery (SZRLF) (Linnane et al. 2022) and is part of the SARDI Aquatic Sciences ongoing assessment program for the fishery. The aims of the report are to provide a brief synopsis of information available for the SZRLF and assess the status of the resource in relation to the performance indicator provided in the Management Plan for the fishery (PIRSA 2020).

The Department of Primary Industries and Regions (PIRSA) has adopted the National Fishery Status Reporting Framework (NFSRF; Piddocke et al. 2021) to determine the status of all South Australian fish stocks. The harvest strategy for the SZRLF (PIRSA 2020) was developed in alignment with the NFSRF classification system to allow determination of stock status. A comprehensive assessment that includes more detailed spatial and temporal analyses will be provided in the 2021/22 stock assessment report that is due in July 2023.

In 2021, the TACC in the SZRLF was 1,334 t. This reflected a regular TACC of 1,320 t plus 14 t of carry-over from the 2020 season. To assist with overseas market disruptions, the 2021 season was extended from 15 September to 30 June (normally 1 October to 31 May). While October to May is the agreed assessment period considered for guiding TACC setting, data from all months fished during the 2021 season are presented in this report.

2 METHODS

Data sources presented in this report are described in Linnane et al. (2022). In summary, the catch and effort data presented were obtained from a mandatory daily logbook program administered by SARDI Aquatic Sciences.

The primary biological performance indicator is commercial logbook CPUE (kg of legal sized lobsters/potlift) based on data from October to May, inclusive. A Trigger Reference Point (TrRP) of 0.60 kg/potift is specified in the harvest strategy, below which, exploitation rates (and corresponding TACCs) are reduced considerably (PIRSA, 2020). The secondary indicator is commercial logbook PRI (no. of undersized lobsters/potlift) based on logbook data from October to March, inclusive. TACCs can only be increased if the PRI is above a TrRP of 1.32 undersized/potlift. Data are presented by zone and Marine Fishing Area (MFA) (Figure 1). Length-frequency data were obtained from a fishery-dependent catch sampling program. Puerulus sampling is undertaken at five sites in the SZRLF and based on data collected from July to June.

A detailed description of the qR fishery model is provided in McGarvey and Matthews (2001) and Linnane et al. (2022). The primary outputs from the model are: (i) legal-sized biomass; (ii) egg production; (iii) % unfished egg production; (iv) exploitation rate (fraction of legal-sized biomass harvested); and (v) recruitment. In the 2019/20 season only, the model input total of yearly effort was adjusted to account for COVID market disruption after 22 January 2020.

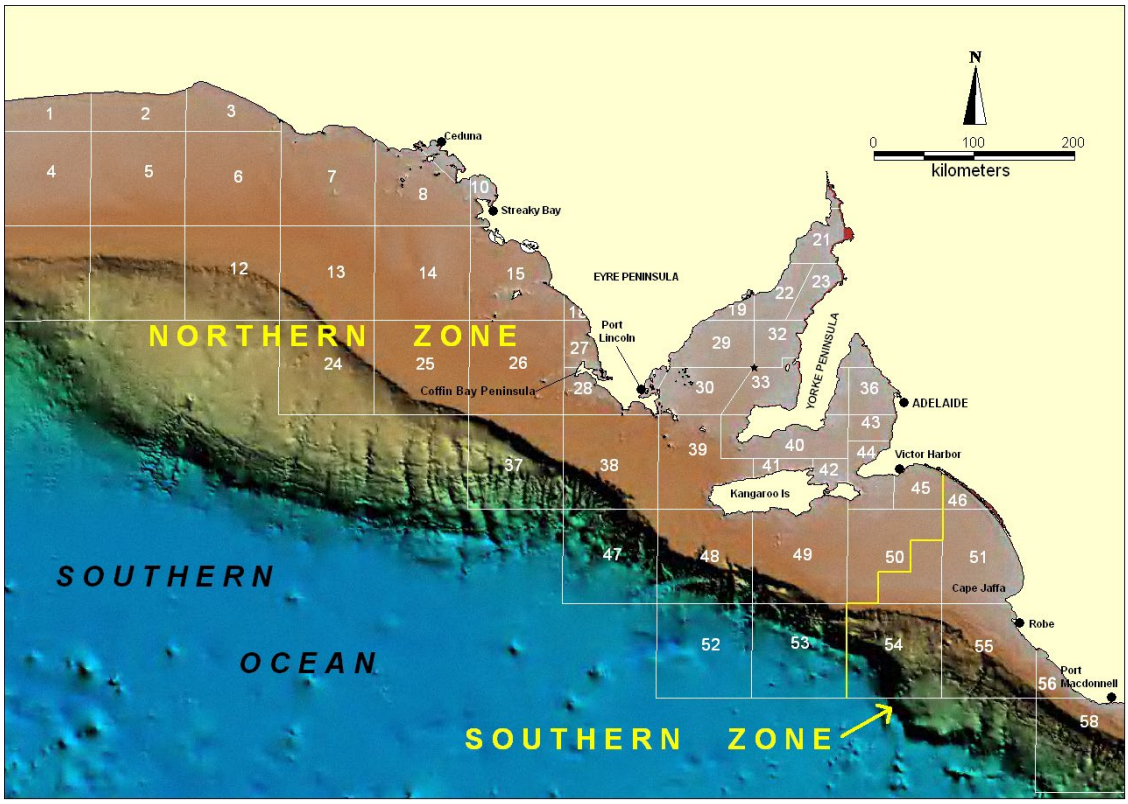

Figure 1 Northern and Southern Zones and Marine Fishing Areas (MFAs) in the South Australian Rock Lobster Fishery.

3 RESULTS

3.1 Commercial catch and effort statistics

It is important to highlight that overseas market disruptions have been prevalent across the Southern Rock Lobster industry in South Australia over the last three seasons. Such disruptions can impact catch, effort and CPUE outputs and therefore should be considered when interpreting fishery trends across recent seasons.

3.1.1 Zone

In 2021, the TACC in the SZRLF was 1,334 t. This reflected a regular TACC of 1,320 t plus 14 t of carry-over from the 2020 season. The total reported logbook catch (September-June) was 1,327.1 t (99% of TACC) (Figure 2a). Current catch levels are low in a historical context and reflect declines in catch and subsequent TACC reductions from 2007 to 2009 (Figure 2a). During this timeframe, the TACC was reduced from 1,900 t to 1,250 t with a further reduction to 1,246 t in 2014 due to the removal of one licence as part of the marine parks voluntary commercial fisheries catch and effort reduction program. Catches have been relatively stable since 2010, reflecting the constant TACC over this period.

Effort required to take the 1,327.1 t catch was 767,379 potlifts, a decrease of 1% from 2020 (775,014 potlifts) (Figure 2a). Since 2009 (2,049,961 potlifts), effort has generally declined in the fishery, with the 2021 estimate being the second lowest on record.

In 2021, the nominal legal-sized CPUE (October-May) was 1.72 kg/potlift, reflecting a 79% increase over the last five seasons (from 0.96 kg/potlift in 2016) and the highest catch rate since 2004 (Figure 2b). Between 2010 and 2016, catch rates remained relatively stable at approximately 1 kg/potlift. The 2021 estimate represents the fifth time since 2007 that CPUE has been above the long-term average (1.07 kg/potlift). CPUE in 2021 also remains above the trigger reference point (TrRP) of 0.60 kg/potlift.

Overall, the zonal estimate of the logbook-based PRI (October-March) shows a long-term decline between 1999 and 2015 (Figure 2c). However, between 2016 and 2019 the PRI increased by 138% to 1.76 undersized/potlift, the highest since 2002. Over the last two seasons, since 2019, the PRI has decreased by 13% and in 2021 was 1.54 undersized/potlift. but remained above the TrRP of 1.32 undersized/potlift. In the SZRLF, the time taken for pre-recruits to enter the fishable biomass is estimated to be approximately one year.

Legal-sized mean weight has remained relatively stable over time ranging between 0.7 and 0.9 kg (Figure 2d). From 2018 to 2020, the mean weight increased to 0.96 kg, the

highest on record, before decreasing to 0.91 in 2021. Variations in mean weight generally reflect long-term patterns of recruitment, with low mean weights resulting from influxes of small lobsters into the fishable biomass and high mean weights resulting from several consecutive years of low recruitment.

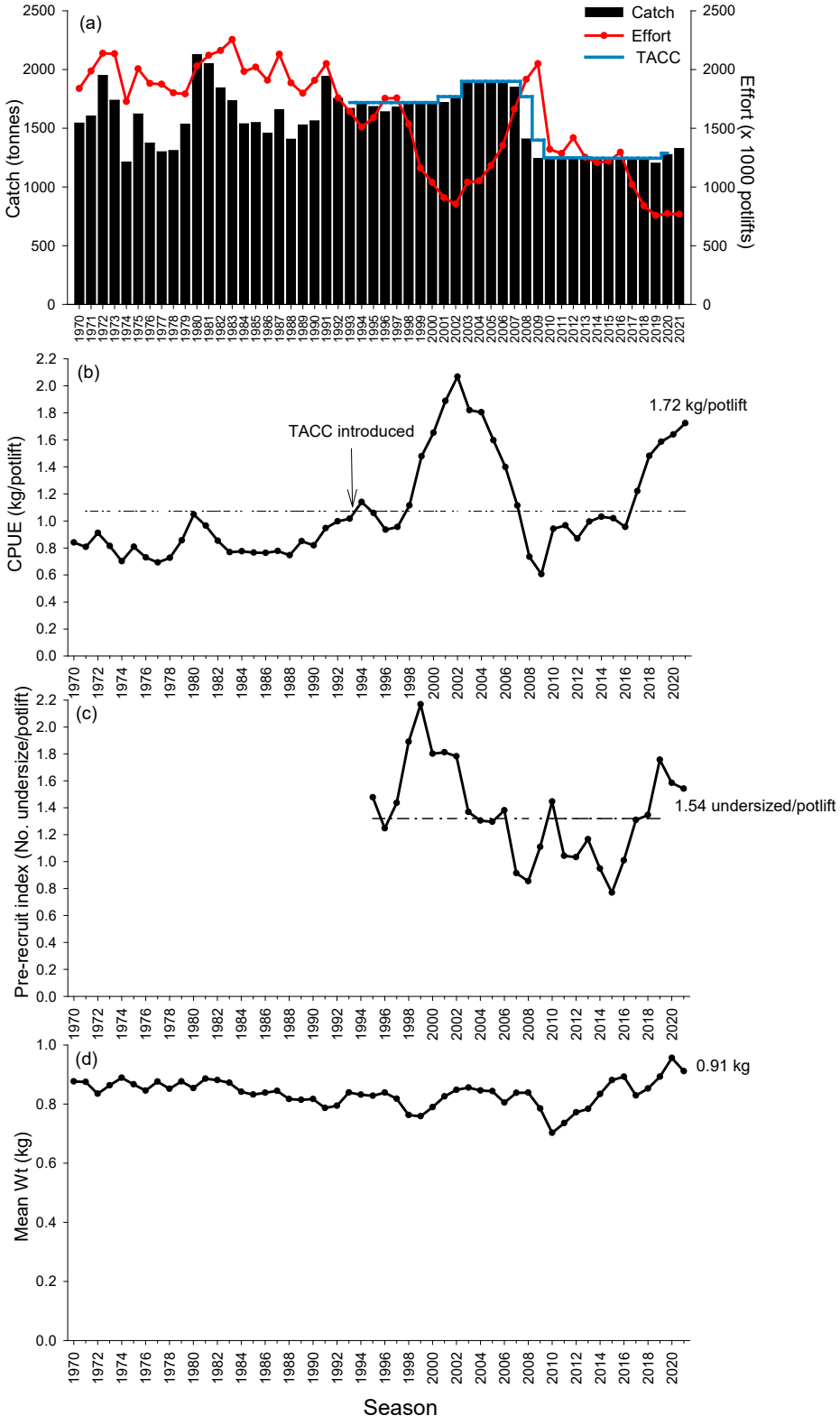

Figure 2 Fishery dependent outputs for the SZRLF. (a) Catch and effort including total allowable commercial catch (TACC) limit; (b) catch per unit effort (CPUE) including long-term average (dashed line); (c) pre-recruit index (PRI) including limit reference point (dashed line); and (d) mean weight.

3.1.2 Within season trends

Within-season commercial catch trends presented here are based on data from 2019 to 2021. Results from earlier seasons are accessed through previously published stock assessment reports (http://pir.sa.gov.au/research/publications/research_reports). In general, within-season trends in catch, effort, CPUE, PRI and mean weight within the SZRLF are consistent through time although market disruptions were evident in within-season catch, effort and CPUE trends in both the 2019/20 and 2020/21 seasons (Figure 3). The highest catches are generally taken during spring/summer from October to January (Figure 3a) before declining thereafter.

The market closures occurred in late January and November of the 2019/20 and 2020/21 seasons respectively. Consequently, the catch in February of the 2019/20 season decreased to 6 t, when normally up to 100 t are landed, while just 39 t were landed in November of the 2020/21 season, when catches are usually >250 t (Figure 3a). The low catch in November resulted in higher catches later in the 2020/21 season, particularly during February (180 t) and March (173 t) compared to previous years. In 2021/22, the highest catch was taken in November (295 t) and the lowest catch in June 2022 (<1 t).

Within-season effort levels are largely consistent with those of catch (Figure 3a). In 2021/22, effort was highest in November (186,223 potlifts) and lowest in June (<1000 potlifts).

Legal-sized CPUE within the fishery is generally highest at the start of the season in spring/summer before decreasing thereafter (Figure 3b). In 2021/22 however, catch rates increased from October through to March (2.27 kg/potlift) and were consistently high across all months compared to recent seasons.

Over the last three seasons estimates of PRI were highest at the start of the season from September to January/February before consistently declining across all months to May thereafter (Figure 3c). The exception was 2021/22, when the PRI was highest in March (2.12 undersized/potlift). Care should be taken when interpreting June and July estimates due to low catch levels.

Monthly legal-sized mean weight generally increases as the season progresses with trends broadly similar over the last three seasons (Figure 3d). In 2021/22, mean weight was lowest in November (0.83 kg) and highest in May (1.01 kg). Care should be taken when interpreting June/July estimates in 2020/21 and 2021/22 due to low catch levels.

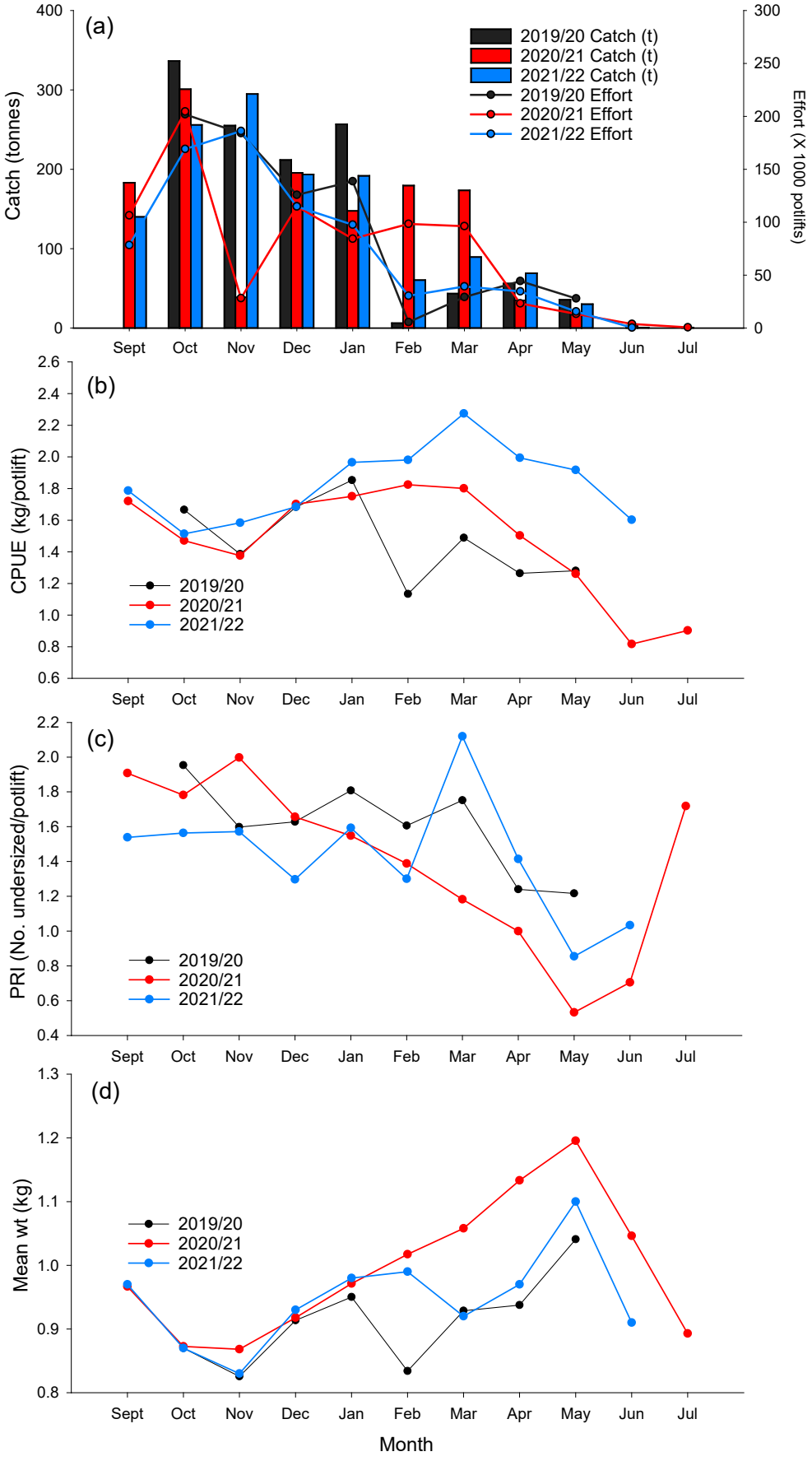

Figure 3 Within-season fishery dependent trends in the SZRLF. (a) Catch and effort; (b) catch per unit effort (CPUE); (c) pre-recruit index (PRI); and (d) mean weight.

3.1.3 Spatial trends

Over 95% of the catch in the SZRLF is taken from MFAs 55, 56 and 58 (Figure 1). Historically, MFA 51 was a more important area, but its contribution has decreased in recent seasons. This partially reflects the fact that lobsters harvested from MFA 51 are generally larger in size and have a lower market value given the preference for smaller individuals by overseas markets. In 2021, the catches in MFAs 51, 55, 56 and 58 were 57 t, 496 t, 415 t and 355 t, respectively (Figure 4a).

In 2021, compared to 2020, effort increased in MFAs 51 and 55 but decreased in MFAs 56 and 58. Effort estimates in 2021 in MFAs 51, 55, 56 and 58 were 34,877, 306,454, 248,736, and 175,737 potlifts, respectively (Figure 4a). Overall, effort estimates reflect considerable decreases in effort across all areas, particularly over the last four to five seasons.

Trends in CPUE are temporally consistent across MFAs (Figure 4b). Following considerable declines between 2002 and 2009, catch rates remained relatively stable between 2010 and 2016. Over the next four seasons, however, catch rates have generally increased across all major MFAs. In 2021, compared to 2020, CPUE increased in MFAs 51, 56 and 58 but decreased in MFA 55. The 2021 estimates in MFAs 51, 55, 56 and 58 were 1.60, 1.62, 1.67 and 2.01 kg/potlift respectively.

Spatial estimates of the logbook-based PRI indicate that the number of undersized/potlift is consistently lower in the northern regions of the SZRLF (i.e. MFAs 51 and 55) compared to the southern regions (i.e. MFA 56 and 58) (Figure 4c). Estimates have been either stable or increasing in most MFAs over recent seasons. In 2021, the estimates were 0.37, 0.50, 1.89 and 3.11 undersized/potlift, in MFAs 51, 55, 56 and 58 respectively.

Rock lobster legal-sized mean weight decreases with increasing latitude from the mouth of the Murray River (MFA 51) to the Victoria/South Australia border (MFA 58) (Figure 4d). It is most variable in MFA 51 but generally consistent across other MFAs. In 2021, compared to 2020, mean weight decreased in all areas except MFA 58. In 2021, the estimates in MFAs 51, 55, 56 and 58, were 1.19, 1.10, 0.84 and 0.78 kg, respectively.

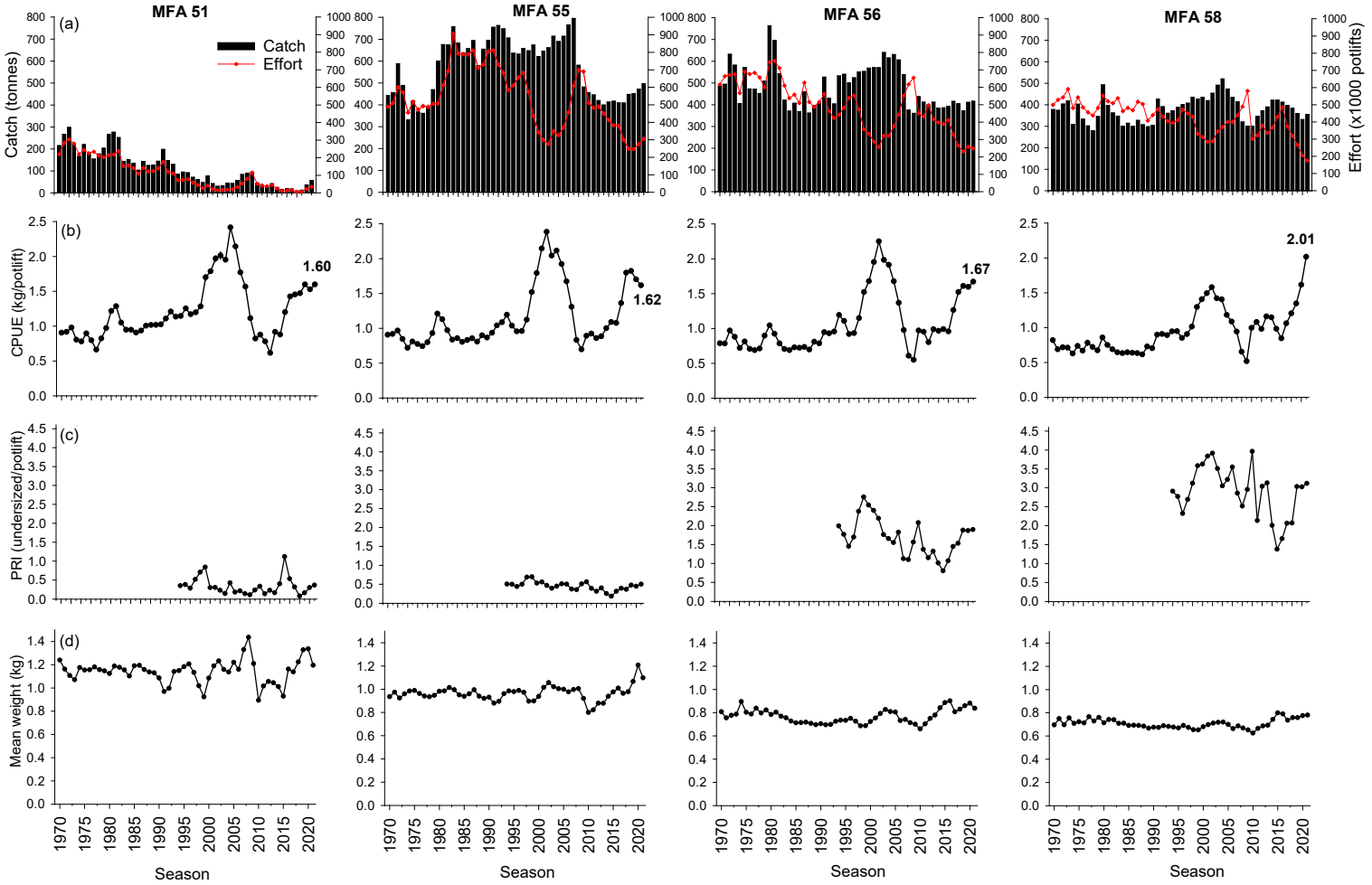

Figure 4 Spatial fishery dependent trends in the SZRLF. (a) Catch and effort (Sept-July); (b) catch per unit effort (CPUE) (Oct-May); (c) pre-recruit index (PRI) (Oct-Mar); and (d) mean weight (Sept-July).

3.1.4 Additional indices

3.1.4.1 Ovigerous (spawning) females

In 2021, the catch rate of ovigerous (spawning) lobsters (September to June) was 0.47 spawners/potlift, the fifth highest estimate on record (Figure 5a). In line with overall declines in legal-sized lobster catch rates (Figure 2b), the CPUE of spawners decreased from 2002 to a historical low of 0.05 spawners/potlift in 2010. Since then, the index has been variable, but with notable increases in recent seasons. It is important to note that as October was closed for the 2010 season, the CPUE for spawning lobsters in that season is likely to be underestimated since October is commonly the highest catch month for ovigerous individuals.

3.1.4.2 Predation mortality

The maori octopus (*Pinnoctopus cordiformis*) is the primary predator of lobsters within commercial fishing pots (Brock and Ward 2004). As a result, both the catch rate of octopus and dead lobsters are highly correlated (Figure 5b; $R^2 = 0.63$). The number of dead lobsters/potlift has been variable through time ranging from 0.09 dead/potlift (2009) to 0.28 dead/potlift (2021).

The highest octopus catch rate was observed in 2000 at 0.05 octopus/potlift, with the lowest in 2017 at 0.008 octopus/potlift (Figure 5b). In 2021, the estimate was 0.03 octopus/potlift.

3.1.4.3 Average days fished

In 2021, the average number of days fished in the SZRLF was 57 (S.E. 19 days), the lowest estimate on record (Figure 5c). This index is a proxy for overall fishing effort and largely reflects trends in annual potlifts within the fishery (Figure 2a). From 2004 to 2009, the average number of days fished increased by 86% from 94 to 175, the highest on record, despite reductions to the TACC from 1,900 t to 1,400 t over the same period. In 2010, the TACC was reduced to 1,250 t and the average numbers of days fished decreased by 35% to 114 days, the lowest since 2005 (105 days). In 2013, the TACC was further reduced to 1245.7 t under the marine parks voluntary commercial fisheries catch and effort reduction program. In 2021, the TACC was increased to 1.320 t.

3.1.4.4 High-grading

In 2021, the estimate of high-grading (i.e. legal-sized lobsters returned to the water due to low market value) in the SZRLF was 57 t (Figure 5d). From 2003 to 2006, based on voluntary catch returns, the weight of lobsters high-graded exceeded 100 t annually.

However, 2020 was the second season since 2008, that the estimates have exceeded 30 t. The decrease between 2003 and 2008 likely reflects overall declines in legal-sized catch rate across the fishery over this period (Figure 2b). It should be highlighted that overall reported values in logbooks are probably conservative, since high-grade estimates are recorded on a voluntary basis.

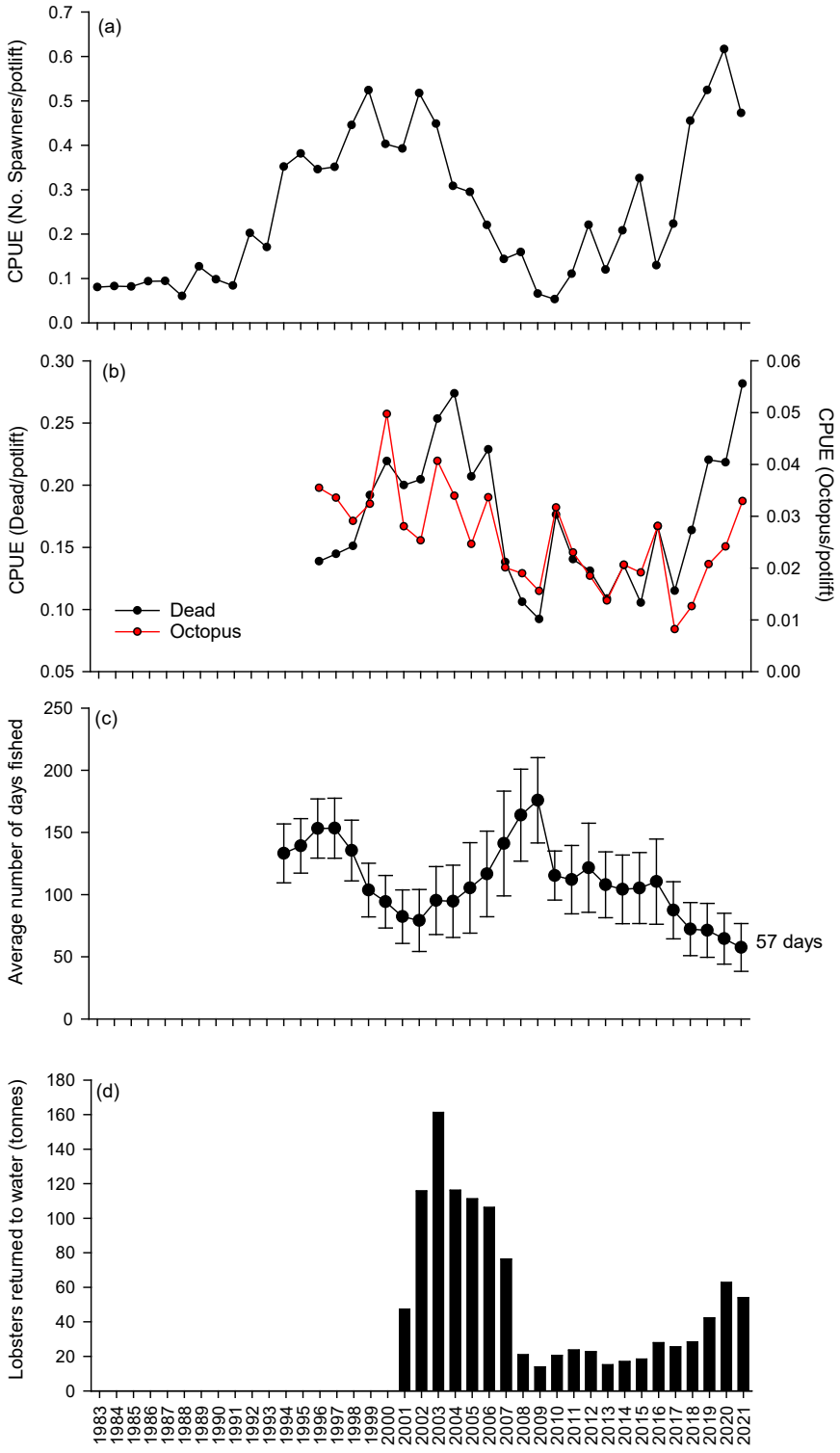

Figure 5 Additional fishery-dependent indices in the SZRLF. (a) Catch rate of spawning lobsters; (b) predation mortality and predatory octopuses; (c) average number of days fished; and (d) levels of high-grading.

3.2 Puerulus settlement index

In the SZRLF, the period between settlement and recruitment into the fishable biomass is estimated to be about five years, while undersized individuals are observed in catches after approximately four years. Between 2016 and 2021, with the exception of 2016, puerulus settlement indices (PSIs; no. of puerulus/collector) have been near or above the long-term averages (Figure 6), indicating that recruitment to the fishery is likely to be close to the long-term average in the short-to-medium term. In 2021, the estimate was 2.09 puerulus/collector.

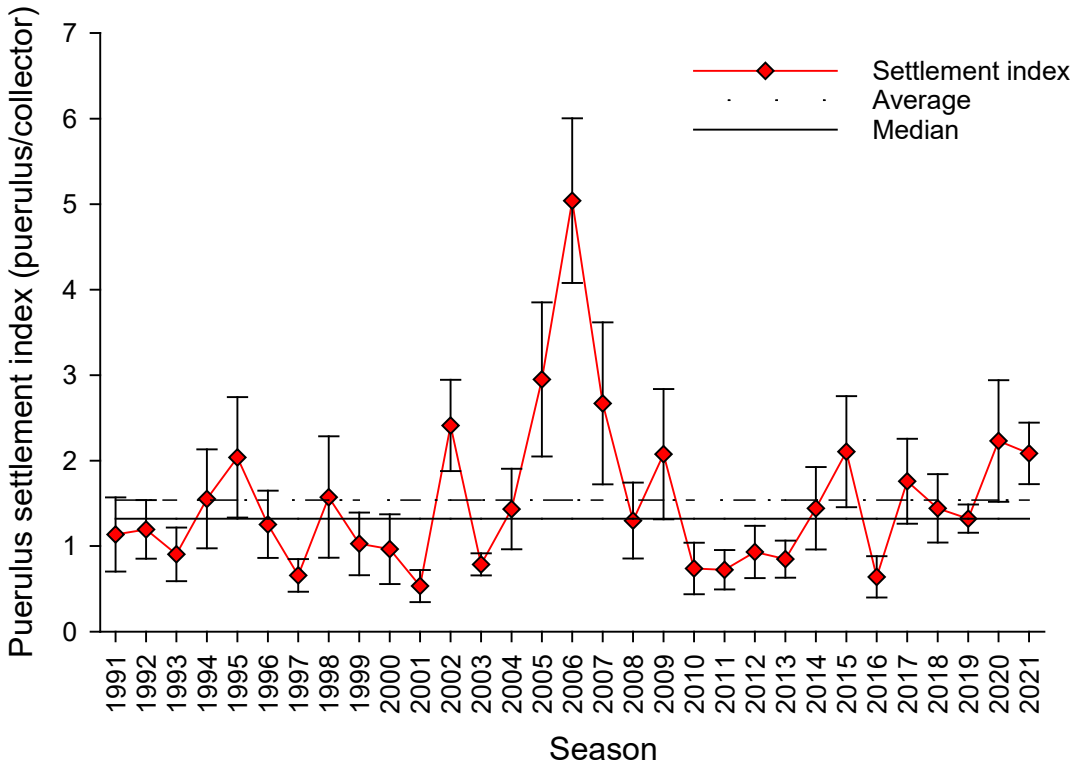

Figure 6 Puerulus settlement index (PSI) (mean ±SE) in the SZRLF from 1991 to 2021.

3.3 Length frequency data

Since 1991, up to 26,000 lobsters have been measured annually in the SZRLF as part of the voluntary catch sampling program. The number measured is proportional to the level of participation in the program with data presented as number of lobsters/100 potlifts. In this report, length frequency data are presented from 2012-2021. Earlier length frequency distributions are available in published stock assessment reports (http://pir.sa.gov.au/research/publications/research_reports).

Male lobsters, which generally grow faster and reach larger sizes than females, range between 70 and 200 mm carapace length (CL). In contrast, few females are larger than 150 mm CL. In 2021, a total of 9,795 lobsters were sampled. Length-frequency data obtained through the voluntary catch sampling program over the last two

seasons (Figure 7) support recent trends in pre-recruit indices (Figure 2c). Notably, the percentage of lobsters measured below the minimum legal size (MLS) of 98.5 mm CL decreased from 39% to 35% between 2020 and 2021, reflecting the decrease in undersized catch rate over the same period.

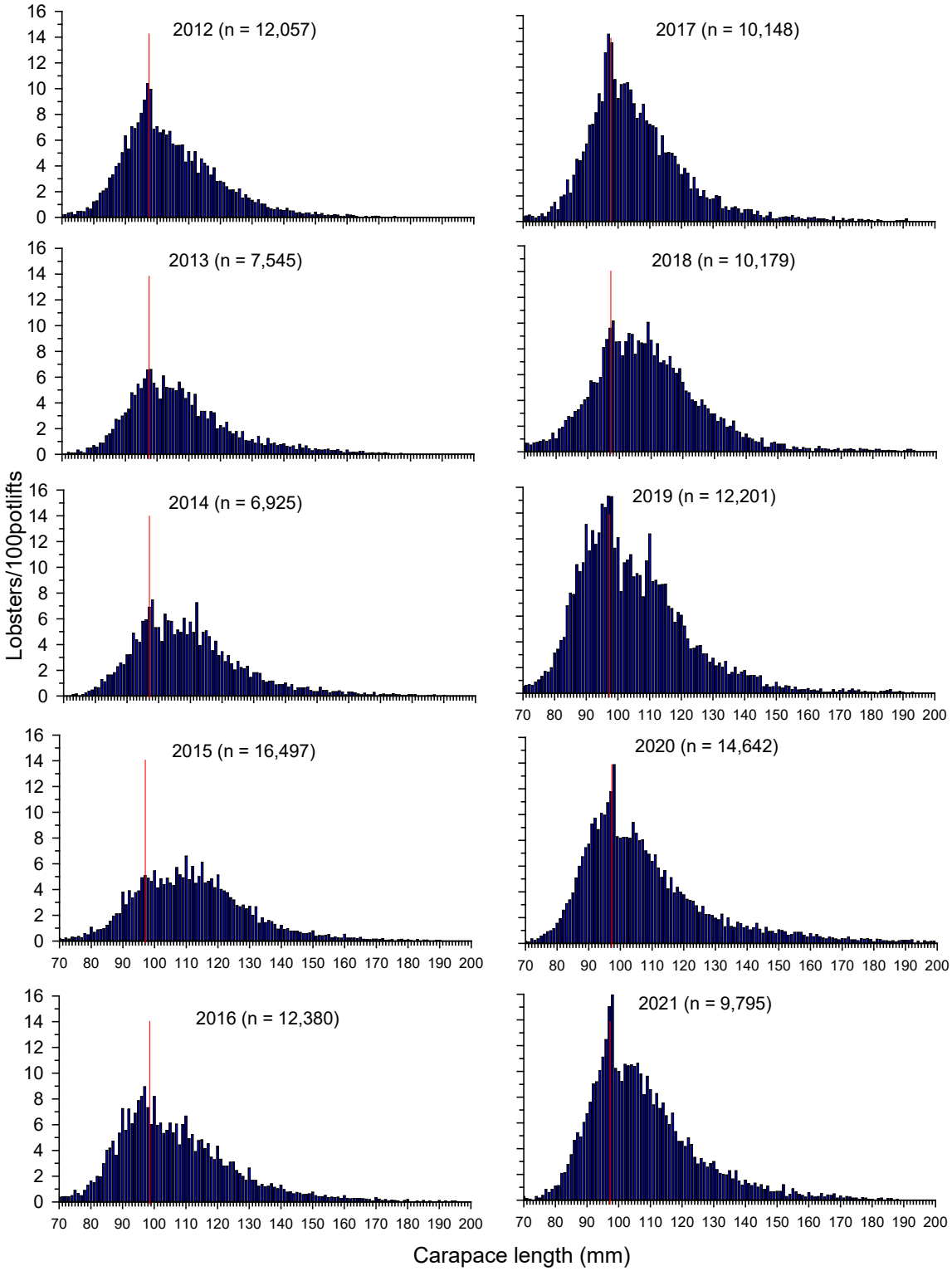

Figure 7 Length frequency distributions of male and female lobsters combined in the SZRLF from 2012 to 2021 (red line indicates MLS at 98.5 mm CL).

3.4 qR Model outputs

From 2002 to 2009, estimates of legal-sized biomass in the SZRLF decreased by 69% from approximately 5,200 t to 1,600 t (Figure 8a). Between 2010 and 2016, biomass remained relatively stable at approximately 2,500 t. Over the last five seasons it has increased and in 2021, the estimate was 4,434 t, the highest since 2004.

In line with declines in lobster biomass, egg production estimates decreased by 52% from approximately 720 billion in 2002 to 347 billion in 2009 (Figure 8b). After remaining stable from 2010 to 2016 egg production has increased over the last five seasons and in 2021 was estimated at approximately 619 billion. Egg production estimates are low equating to 14% of unfished levels but with increases in recent seasons (Figure 8c).

Exploitation rate increased from approximately 35% in 2002 to 79% in 2009 (Figure 8d) in response to decreasing biomass over the same period (Figure 8a). Exploitation rate decreased considerably in 2010 and has continued to gradually decline since. In 2021, it was 31%, one of the lowest estimates on record.

Outputs from the qR model indicate that recruitment to the fishery declined from approximately 4 million individuals in 1999 to 1 million in 2008, a decrease of 75% (Figure 8e). Since then, the estimate has been variable and in 2021 was approximately 2.2 million individuals. Trends in recruitment from the qR model are highly correlated with PRI estimates from logbook data (1995-2021) (R^2=0.79).

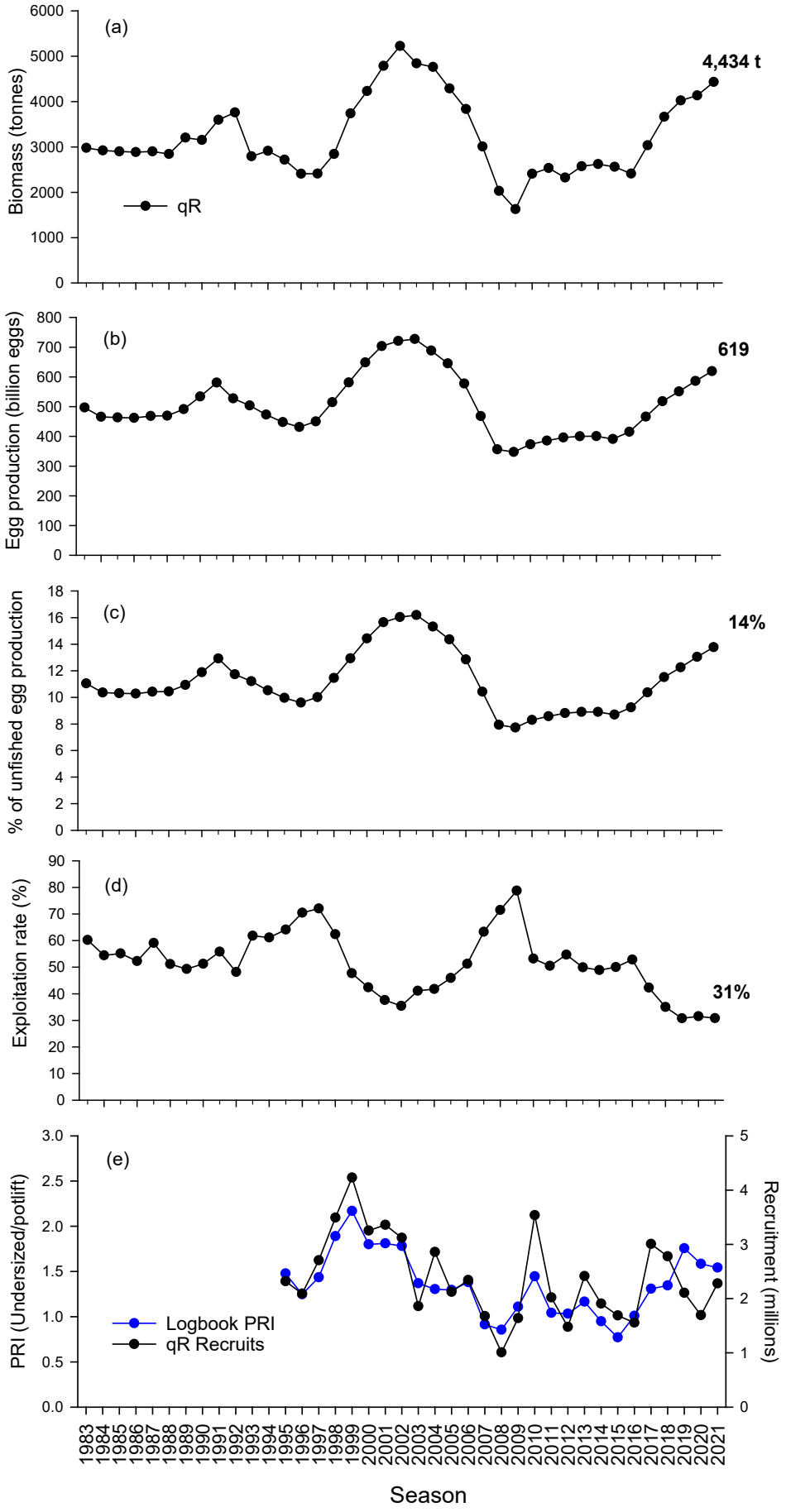

Figure 8 Fishery model outputs for the SZRLF. (a) Legal-size biomass; (b) Egg production; (c) % of unfished egg production; (d) Exploitation rate; and (e) Recruitment.

4 SUMMARY AND STOCK STATUS

Overseas market disruptions have been prevalent across the Southern Rock Lobster industry in South Australia over the last three seasons. This is evidenced by catches of <50 t in February and November of 2020 when normally catch ranges from 100 – 250 t.

Despite these disruptions, there remains clear evidence to suggest that the status of the SZRLF has continued to improve in recent seasons. Specifically; (i) biomass levels have increased and exploitation rate is one of the lowest on record; (ii) CPUE is the highest since 2004 and above the TrRP; and (iii) the PRI is above the TrRP.

The stock status classification for the SZRLF is defined in the Management Plan for the fishery (PIRSA 2020) using the primary performance indicator (Table 2). In 2021, the CPUE was 1.72 kg/potlift, which is above the TrRP of 0.60 kg/potlift. As a result, the SZRLF stock is classified as "**sustainable**". This means that the current fishing mortality is being adequately controlled to avoid the stock becoming recruitment impaired.

Table 2 Stock status classification for the SZRLF.

Commercial Catch Rate (kg/potlift)	Status
≥ 0.6	Sustainable
< 0.6	Depleting or Recovering
≤ 0.4	Depleted

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