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Southern Zone Rock Lobster (*Jasus edwardsii*) Fishery Status Report 2019/20

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

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SARDI Aquatic Sciences
PO Box 120 Henley Beach SA 5022

October 2020

Status Report to PIRSA Fisheries and Aquaculture

SOUTH AUSTRALIA

Government of South Australia
Department of Primary Industries and Regions

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EXECUTIVE SUMMARY

This report assesses the current 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 that is used to determine the status of all South Australian fish stocks.

Up to the 2019 season (i.e. 1 October 2019 to 31 May 2020), the SZRLF total allowable commercial catch (TACC) had been fully taken for nine consecutive seasons. In 2019, the fishery was impacted by the COVID-19 market closure which occurred in late January of 2020. The primary impact was a considerable reduction in catch in February 2020 (6 t in 2020), where normally up to 100 t is landed. Consequently, the 2019 TACC was not fully taken with a total commercial logbook catch of 1,202.4 t (96% of TACC).

Effort required to take the catch was 758,029 potlifts, a decrease of 10% from 2018 (840,572 potlifts). Since 2009 (2,049,961 potlifts), effort has generally declined in the fishery.

Catch per unit effort (CPUE) of legal-sized lobsters (kg/potlift) is the primary biological performance indicator for the fishery. In 2019, the CPUE was 1.59 kg/potlift, reflecting a 65% increase over the last three seasons and the highest catch rate since 2005. Current estimates are above the long-term average for the fishery (1.05 kg/potlift) and the Trigger Reference Point (TrRP) of 0.60 kg/potlift.

The secondary biological performance indicator is the pre-recruit index (PRI; no. of undersized lobsters/potlift). In 2019, the PRI was 1.76 undersized/potlift, reflecting an increase of 138% from 2015 (0.74 undersized/potlift) and the highest since 2002. The PRI in 2019 is 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 three seasons. In 2019, the estimate was 4,182 t, the highest since 2005. This equates to an exploitation rate of 30%, the lowest on record for the fishery. Despite recent increases, egg production on the fishery remains low with 2019 estimates equating to 12% of unfished levels.

The stock status classification for the SZRLF is defined in the Management Plan for the fishery (PIRSA 2020). In 2019, the CPUE of 1.59 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 fishing mortality is being adequately controlled to avoid the stock becoming recruitment impaired.

Table 1 Key statistics for the SZRLF**.**

Statistic	2019/20	2018/19
TACC	1245.7 t	1,245.7 t
Total commercial catch	1202.4 t	1,245.2 t
Total effort	758,029 potlifts	840,572 potlifts
Commercial CPUE	1.59 kg/potlift	1.48 kg/potlift
Pre-recruit index	1.76 undersized/potlift	1.31 undersized/potlift
Biomass estimate	4,182 t	3,896 t
Exploitation rate	30%	33%
Status	**Sustainable**	**Sustainable**

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

1 INTRODUCTION

This fishery status report updates the 2018/19 stock assessment report for the Southern Zone Rock Lobster Fishery (SZRLF) (Linnane et al. 2020) 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 current status of the resource in relation to the performance indicator provided in the Management Plan for the fishery (PIRSA 2020).

Department of Primary Industries and Regions (PIRSA) has adopted the National Fishery Status Reporting Framework (NFSRF; Flood et al. 2014; Stewardson et al. 2018) 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 2019/20 stock assessment report that is due in July 2021.

2 METHODS

Data sources presented in this report are described in Linnane et al. (2020). In brief, the catch and effort data presented were obtained from a mandatory daily logbook program administered by SARDI Aquatic Sciences. The SZRLF fishing season extends from 1 October to 31 May of the following year with all catch and effort data from this period used to estimate the primary performance indicator of catch per unit effort (CPUE). Data are presented by zone and Marine Fishing Area (MFA) (Figure 1).

Data to estimate the secondary performance indicator of pre-recruit index (PRI) were also obtained from logbook data. The October to March period was used as these are the known months where the catchability of undersized lobsters is highest. 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. (2020). In 2019, to remove the impact of the limited catch rate data after January 2020 due to the COVID-19 market closure (see Section 3.1), a data pre-processing model was developed to infer catch rates had the trend (yearly relative level) up to 22 January continued in the 2019/20 season. Effort used in the qR model

input data for 2019 season was subsequently corrected accordingly in both Northern and Southern fishing zones. Details of the model correction method will be given in the full assessment reports for 2019/20 due in 2021.

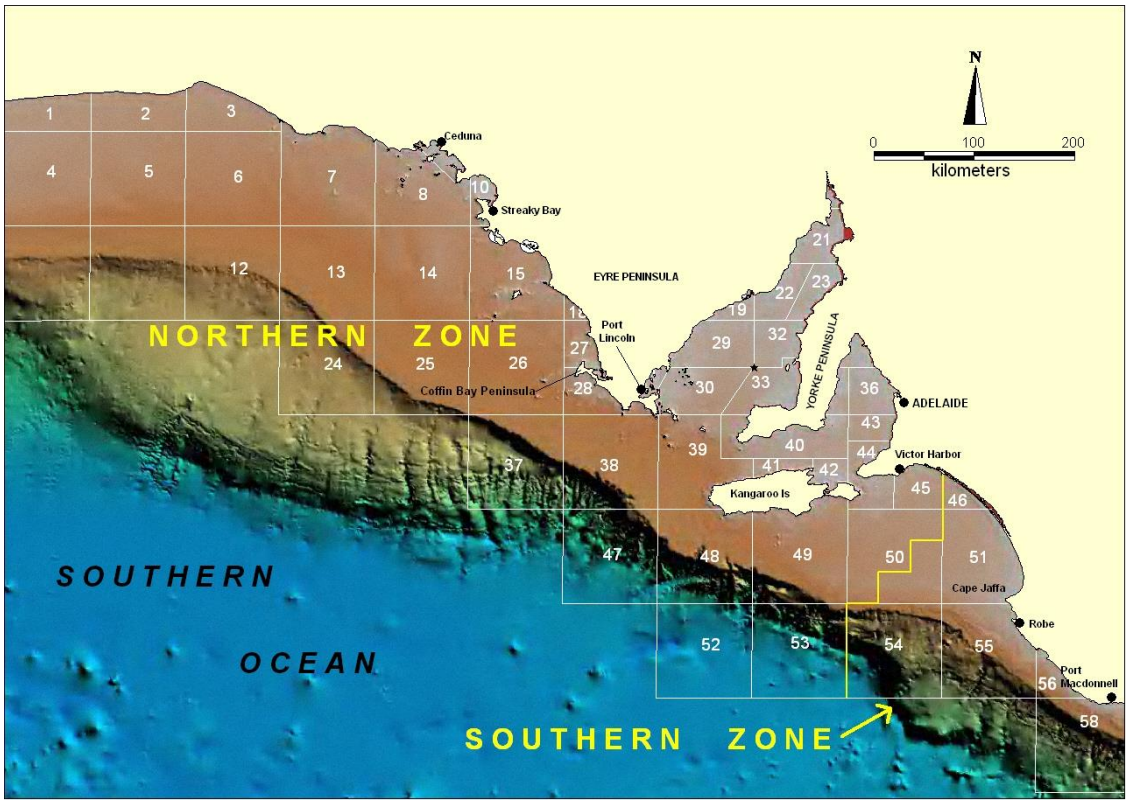

Figure 1 Northern and Southern Zones and Marine Fishing Areas (MFAs) in the South Australian Rock Lobster Fishery.

3 RESULTS

3.1 Commercial catch and effort statistics

A COVID-19 Southern Rock Lobster market closure occurred in January of 2020 which impacted on catch, effort and CPUE outputs. This was particularly evident from February to May and should be taken into consideration when interpreting fishery trends during the latter part of the 2019/20 season.

3.1.1 Zone

In 2019, the TACC in the SZRLF was 1,245.7 t. The total reported logbook catch was 1,202.4 t (96% 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 1,245.7 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 stable since 2010, reflecting the constant TACC level over this period.

Effort required to take the 1,202.4 t catch was 758,029 potlifts, a decrease of 10% from 2018 (840,572 potlifts) (Figure 2a). Since 2009 (2,049,961 potlifts), effort has generally declined in the fishery, with the 2019 estimate being the lowest on record.

In 2019, the nominal legal-sized CPUE was 1.59 kg/potlift, reflecting a 65% increase over the last three seasons (from 0.96 kg/potlift in 2016) and the highest catch rate since 2005 (Figure 2b). Between 2010 and 2016, catch rates remained relatively stable at approximately 1 kg/potlift. The 2019 estimate represents the third time since 2007 that CPUE has been above the long-term average (1.05 kg/potlift). CPUE in 2019 also remains above the TrRP of 0.60 kg/potlift.

Overall, the zonal estimate of the logbook-based PRI shows a long-term decline between 1999 and 2015 (Figure 2c). However, over the last four seasons PRI has increased and in 2019, was 1.76 undersized/potlift, reflecting an increase of 138% from 2015 (0.74 undersized/potlift) and the highest since 2002. The PRI in 2019 is 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). In 2019, the mean weight was 0.89 kg reflects a marginal increase from 0.83 kg in 2017. 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.

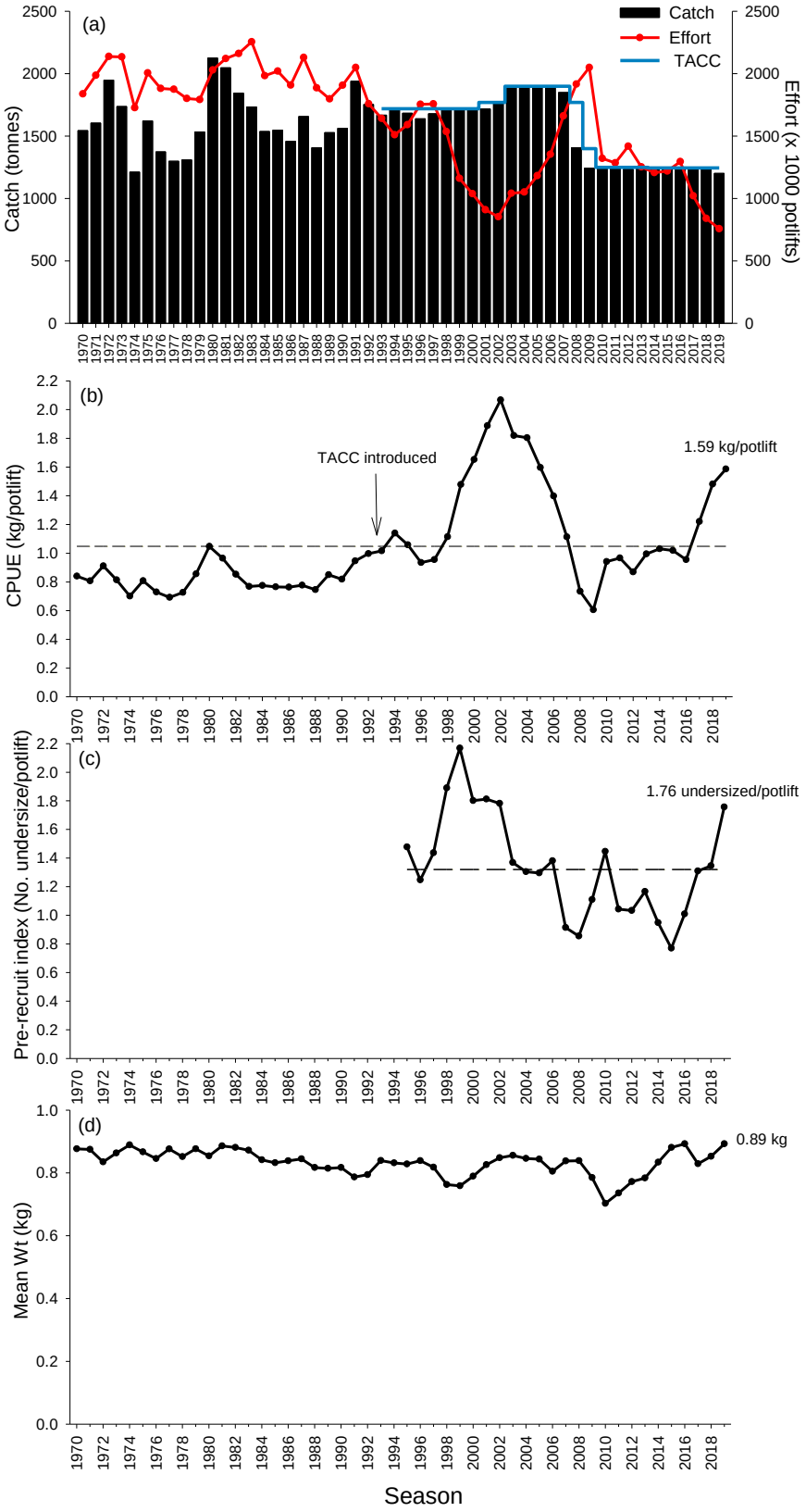

Figure 2 Fishery dependent outputs for the SZRLF. (a) Catch and effort including total allowable commercial catch (TACC) limit; (b) catch per unit effort (CPUE) including long-term average (dashed line); (c) pre-recruit index (PRI) including limit reference point (dashed line); and (d) mean weight.

3.1.2 Within season trends

Within-season commercial catch trends presented here are based on data from 2017 to 2019. 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 the impact of the COVID-19 market disruption closure were particularly evident in within-season catch, effort and CPUE trends in 2019 (Figure 3). The highest catches are taken during spring/summer from November to January (Figure 3a) before declining thereafter.

The market closure occurred in late January of 2020. Consequently, the catch in February decreased to 6 t, where normally up to 100 t are landed (Figure 3a). Catch subsequently increased as market conditions improved between March and May (136 t taken over this period). In 2019, the highest catch was taken in October 2019 (336 t), and the lowest catch in February 2020 (6 t).

Within-season effort levels are largely consistent with those of catch (Figure 3a). In 2019, effort was highest in October (201,968 potlifts) and lowest in February (5,618 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 2019, monthly catch rates were consistently higher from October to January compared to 2018 but decreased considerably in February due to the market closure. Catch rates recovered to levels comparable with 2018 from March to May. In 2019, CPUE was highest in January (1.85 kg/potlift) and lowest in February (1.13 kg/potlift).

In 2019, estimates of PRI were consistently higher across all months compared to previous seasons (Figure 3c). The PRI was highest in October (1.95 undersized/potlift) and lowest in May (1.22 undersized/potlift).

Monthly legal-sized mean weight generally increases as the season progresses with trends broadly similar over the last three seasons (Figure 3d). In 2019, mean weight was lowest in November (0.83 kg) and highest in May (1.04 kg). Care should be taken when interpreting May estimates in 2018 due to low catch levels.

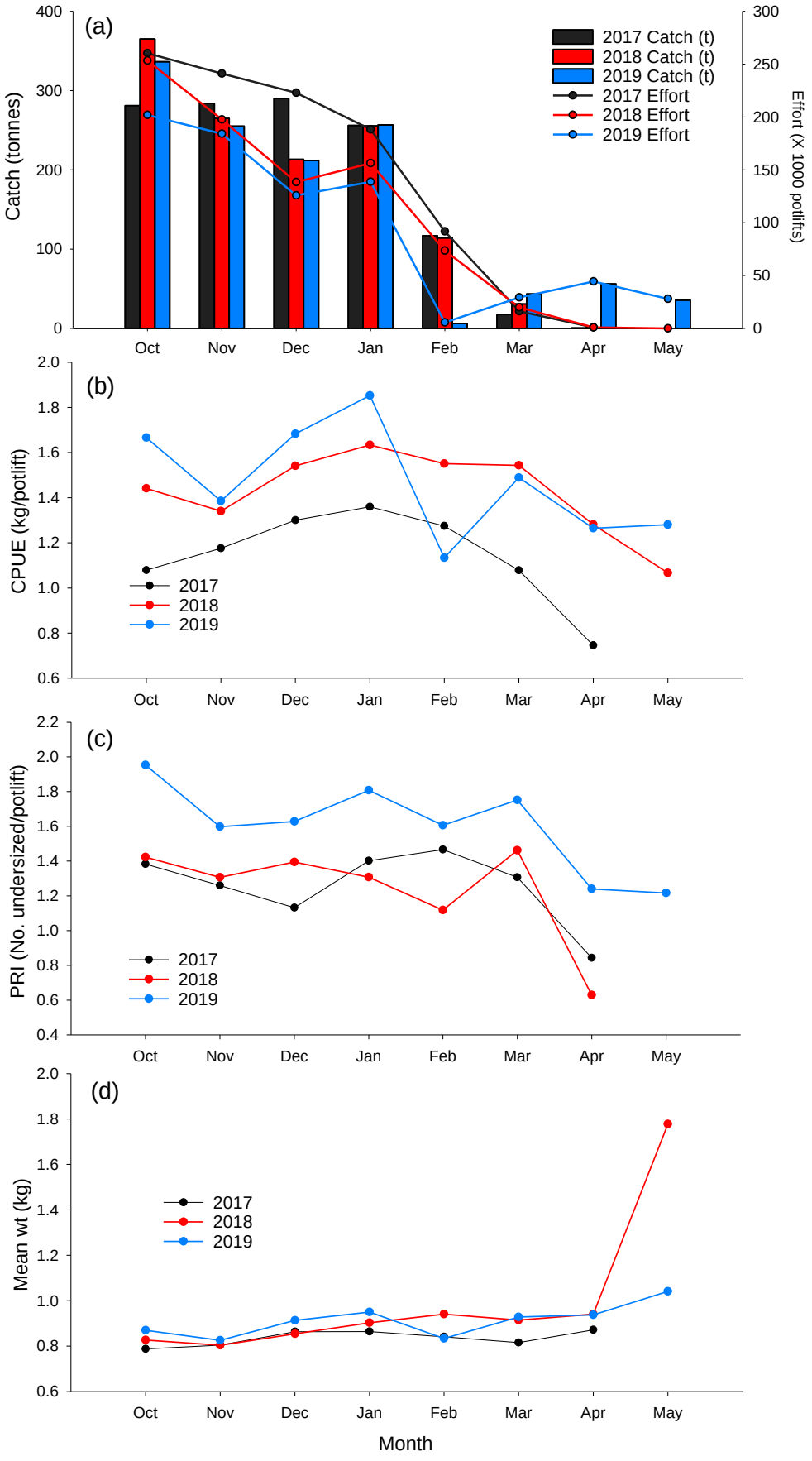

Figure 3 Within-season fishery dependent trends in the SZRLF. (a) Catch and effort; (b) catch per unit effort (CPUE); (c) pre-recruit index (PRI); and (d) mean weight.

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 2019, the catches in MFAs 51, 55, 56 and 58 were 12 t, 451 t, 371 t and 359 t, respectively (Figure 4a).

The zonal decrease in effort in 2019 was observed across all major MFAs. Effort estimates in 2019 in MFAs 51, 55, 56 and 58 were 7,802, 247,571, 230,931, and 267,007 potlifts respectively (Figure 4a). These estimates reflect considerable decreases in effort across all areas, particularly over the last three to four 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 last three seasons, however, catch rates have increased across all major MFAs. In 2019, the estimates in MFAs 51, 55, 56 and 58 were 1.60, 1.82, 1.61 and 1.35 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 increasing in most MFAs over the last four seasons and in 2019 were 0.16, 0.48, 1.88 and 3.03 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 2019, mean weight increased in all areas with estimates in MFAs 51, 55, 56 and 58, being 1.33, 1.07, 0.86 and 0.76 kg, respectively.

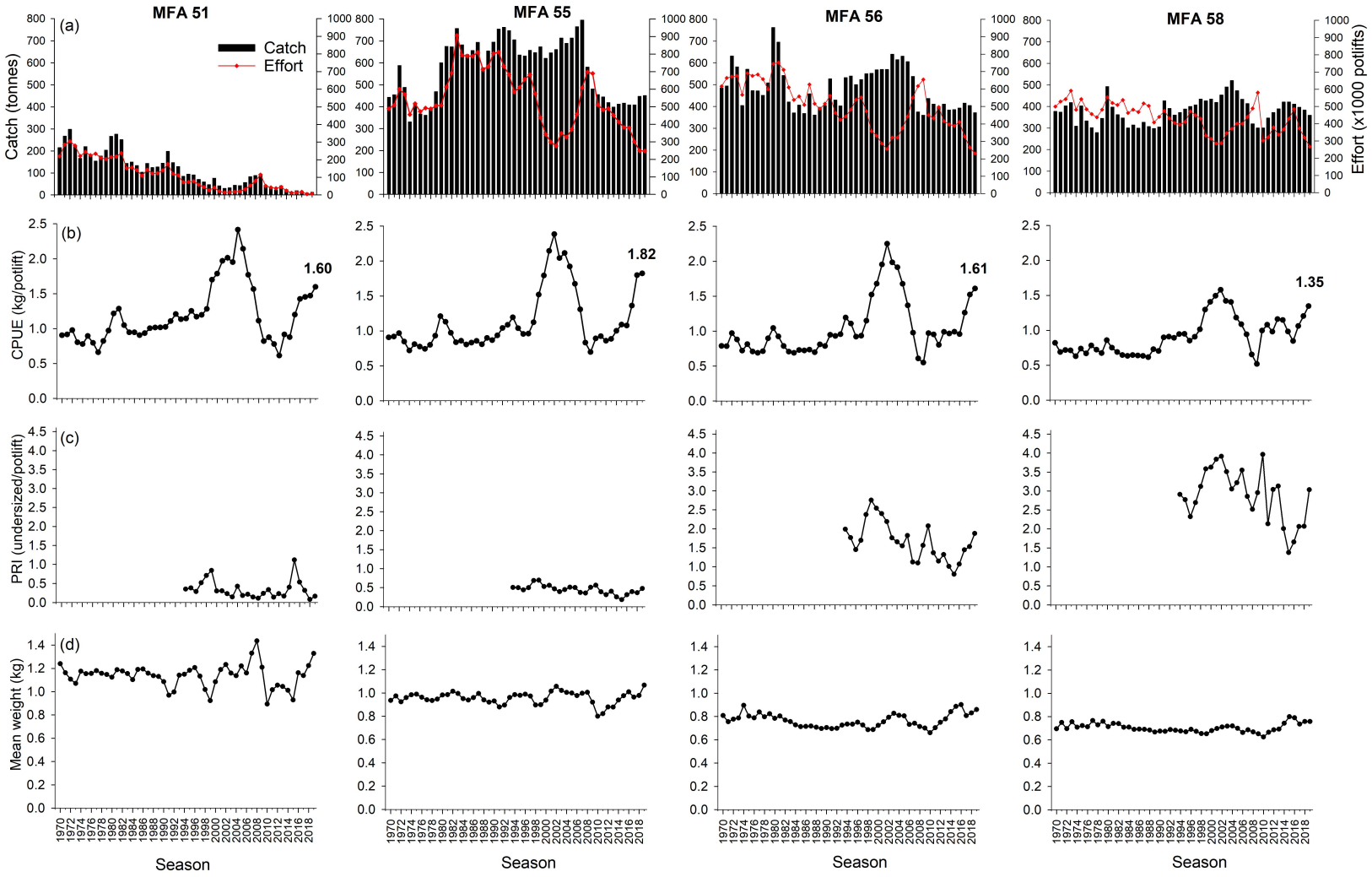

Figure 4 Spatial fishery dependent trends in the SZRLF. (a) Catch and effort; (b) catch per unit effort (CPUE); (c) pre-recruit index (PRI); and (d) mean weight.

3.1.4 Additional indices

3.1.4.1 Ovigerous (spawning) females

In 2019, the catch rate of ovigerous (spawning) lobsters was 0.52 spawners/potlift, the 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, with notable increases over the last three 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; $R^2 = 0.65$). The number of dead lobsters/potlift has been variable through time ranging from 0.09 dead/potlift (2009) to 0.27 dead/potlift (2004). In 2019, the estimate was 0.22 dead/potlift.

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 2019, the estimate was 0.02 octopus/potlift, which is the one of the lowest on record for the fishery.

3.1.4.3 Average days fished

In 2019, the average number of days fished in the SZRLF was 63, 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. The TACC has remained at this level over the last seven seasons.

3.1.4.4 High-grading

In 2019, the estimate of high-grading (i.e. legal-sized lobsters returned to the water due to low market value) in the SZRLF was 43 t (Figure 5d). From 2003 to 2006, based on voluntary catch returns, the amount of lobsters high-graded exceeded 100 t annually.

However, 2019 was the first season since 2008, that the estimates have exceeded 30 t. The decrease between 2003 and 2008 is likely to reflect 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 likely to be conservative, since high-grade estimates are recorded on a voluntary basis.

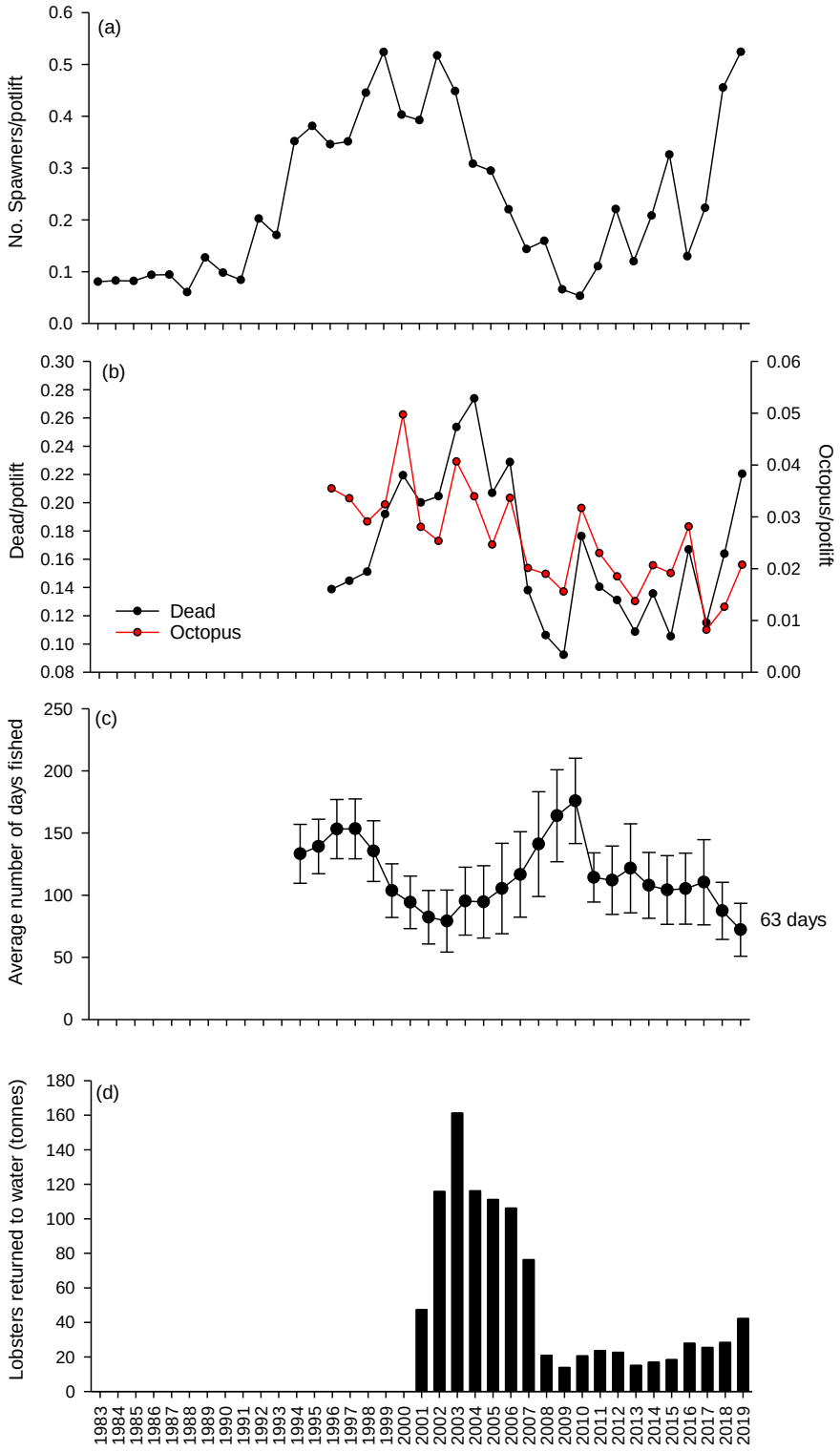

Figure 5 Additional fishery-dependent indices in the SZRLF. (a) Catch rate of spawning lobsters; (b) predation mortality; (c) average number of days fished; and (d) levels of high-grading.

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 2014 and 2019, with the exception of 2016, puerulus settlement indices (PSIs; no. of puerulus/collector) have been near the long-term averages (Figure 6), indicating that recruitment to the fishery will be close to the long-term average in the short-to-medium term. In 2019, the estimate was 1.32 puerulus/collector.

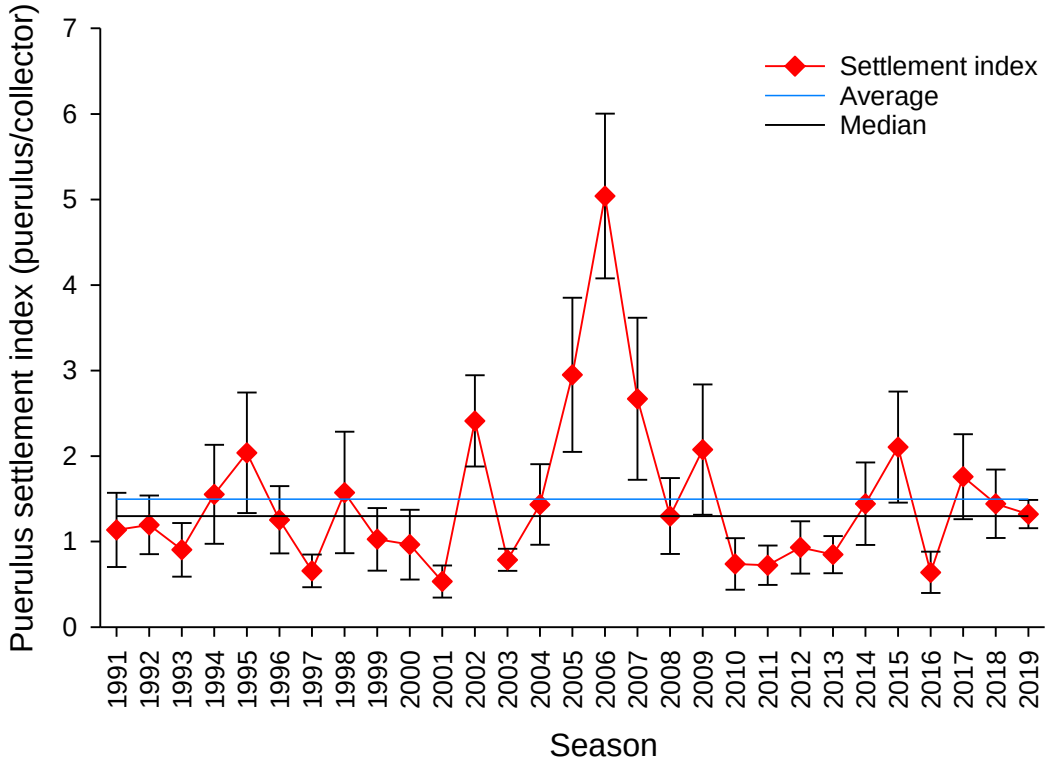

Figure 6 Puerulus settlement index (PSI) (mean ±SE) in the SZRLF from 1991 to 2019.

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 2011-2019. 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 2019, a total of 12, 201 lobsters were sampled with a 45:55 male:female sex ratio. 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 increased from 28% to 43% between 2018 and 2019, reflecting the considerable increase in undersized catch rate over the same period.

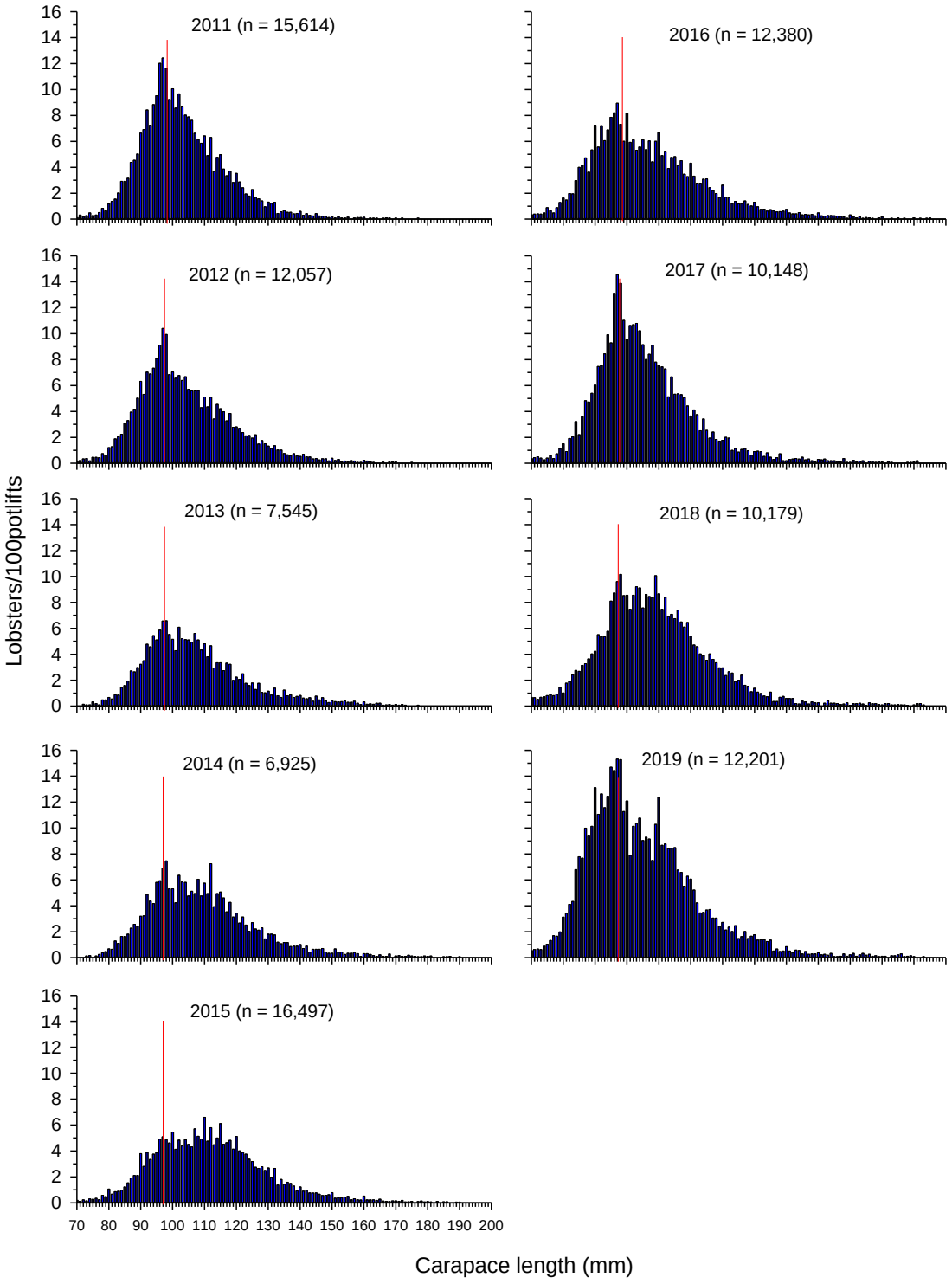

Figure 7 Length frequency distributions of male and female lobsters combined in the SZRLF from 2011 to 2019 (red line indicates MLS at 98.5 mm CL).

3.4 qR Model outputs

From 2002 to 2009, estimates of legal-sized biomass in the SZRLF decreased by 65% from approximately 5,500 t to 1,900 t (Figure 8a). Between 2010 and 2016, biomass remained relatively stable at approximately 2,700 t. Over the last three seasons it has increased and in 2019, the estimate was 4,182 t, the highest since 2005.

In line with declines in lobster biomass, egg production estimates decreased by 52% from approximately 720 billion in 2003 to 345 billion in 2009 (Figure 8b). After remaining stable from 2010 to 2016 egg production has increased over the last three seasons and in 2019 was estimated at approximately 556 billion. Egg production estimates are low in a historical context equating to 12% of unfished levels but with increases in recent seasons (Figure 8c).

Exploitation rate increased from approximately 33% in 2002 to 66% 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 2019, it was 30%, 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 2019 was approximately 2.1 million individuals. Trends in recruitment from the qR model are highly correlated with PRI estimates from logbook data (1995-2019) (R^2=0.84).

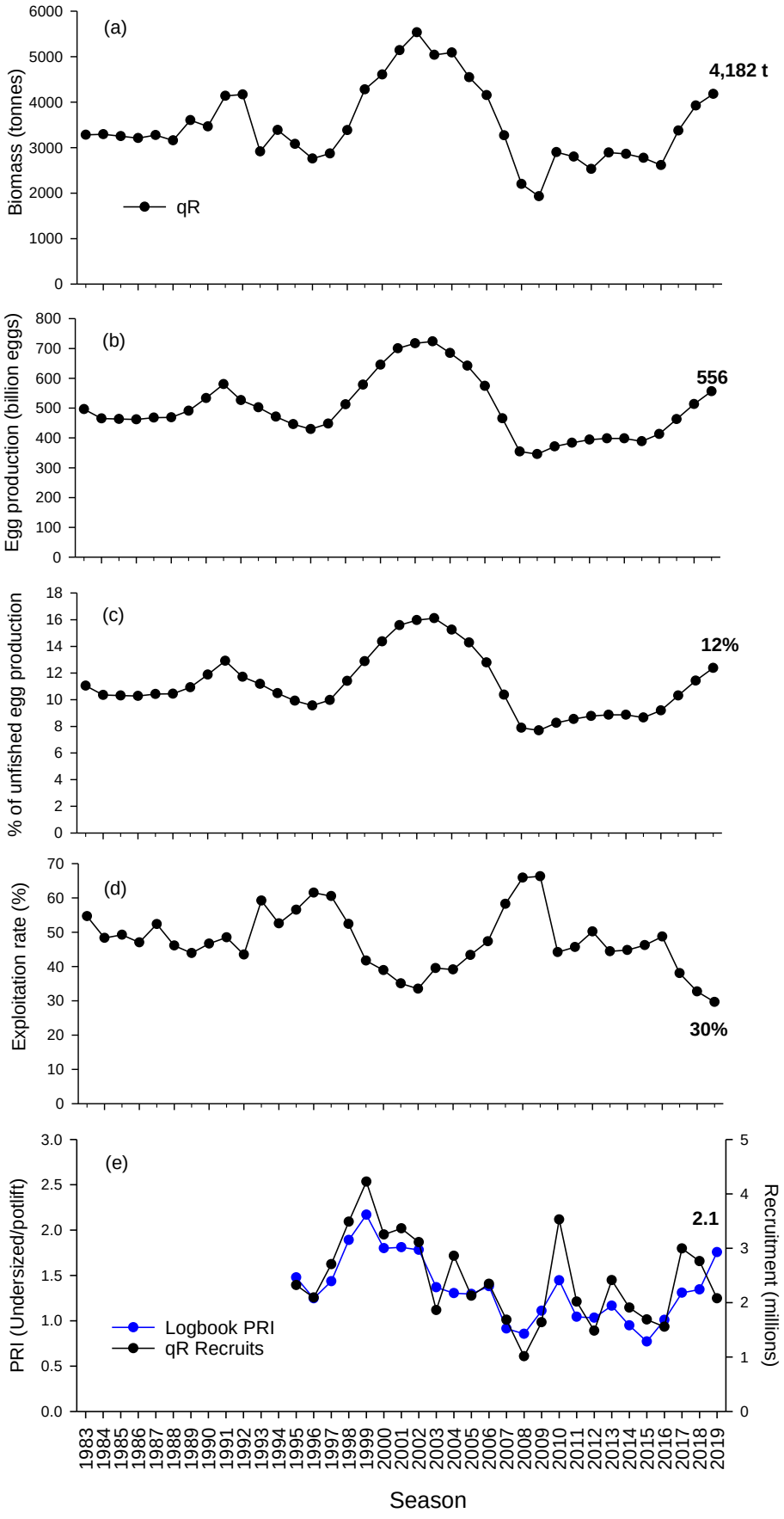

Figure 8 Fishe ry model outputs for the SZRLF. (a) Legal-size biomass; (b) Egg production; (c) % of unfished egg production; (d) Exploitation rate; and (e) Recruitment.

3.5 Biological performance indicators

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/plotift 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 data from October to March, inclusive. TACCs can only be increased if the PRI is above a TrRP of 1.32 undersized/potlift.

4 SUMMARY AND STOCK STATUS

Up to 2019, the SZRLF TACC had been fully taken for nine consecutive seasons. The COVID-19 market disruption closure began in late January of 2020 and had a considerable impact on catch, effort and CPUE trends during the 2019 season. Specifically, catch in February of 2020 was reduced to 6 t where normally up to 100 t of lobster are landed. A partial reopening of the markets after February resulted in increased catch between March and May (136 t), where catch levels are normally minimal due to the TACC having being fully taken. Consequently, the low CPUE estimate in February (and to some extent, in the following months), is considered to be the consequence of market influences, rather than a reduction in lobster abundance.

Despite, the market disruption in 2019 impacting on the fishery, there is clear evidence to suggest that the status of the SZRLF has improved in recent seasons. Specifically; (i) biomass levels have increased and exploitation rate is the lowest on record; (ii) CPUE is the highest since 2005 and above the TrRP; and (iii) the PRI has increased and 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 2019, the CPUE was 1.59 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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