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Southern Zone Rock Lobster (*Jasus edwardsii*) Fishery Status Report 2017/18

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

SARDI Publication No. F2007/000715-12
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October 2018

Status Report to PIRSA Fisheries and Aquaculture

SOUTH AUSTRALIA

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Government of South Australia
Primary Industries and Regions SA

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South Australian Research and Development Institute
SARDI Aquatic Sciences
2 Hamra Avenue
West Beach SA 5024

Telephone: (08) 8207 5400
Facsimile: (08) 8207 5415
http://www.pir.sa.gov.au/research

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Author(s):	A. Linnane, R. McGarvey, J. Feenstra and P. Hawthorne
Reviewer(s):	G. Ferguson, J. Earl (SARDI) and A. Jones (PIRSA)
Approved by:	S. Mayfield Science Leader – Fisheries
Signed:	
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EXECUTIVE SUMMARY

The status of South Australia's Southern Zone Rock Lobster Fishery (SZRLF) is determined using a weight-of-evidence analysis under the National Fishery Status Reporting Framework (NFSRF; Flood et al. 2014; Stewardson et al. 2016; unpublished).

In 2017 (i.e. 1 October 2017 to 31 May 2018), the total allowable commercial catch (TACC) in the SZRLF was 1,245.7 t. The total commercial catch from logbook data was 1,245.7 t reflecting the eighth consecutive season that >99% of the TACC has been taken.

Fishing effort in 2017 was 1,021,872 potlifts, a decrease of 21% from 2016 (1,295,715 potlifts) and the third lowest estimate on record. Effort levels have remained relatively stable since 2010 and are currently low in a historical context.

Catch per unit effort (CPUE) of legal and undersized (pre-recruit) lobsters are the main indicators of legal and pre-recruit abundance. In 2017, the CPUE was 1.22 kg/potlift, a 27% increase from 2016 and the highest catch rate since 2006. Current estimates are above the long-term average for the fishery (1.03 kg/potlift) and above the Trigger Reference Point (TRP) of 0.60 kg/potlift.

In 2017, the logbook pre-recruit index (PRI; November-March) was 1.28 undersized/potlift reflecting a 73% increase from the historical low observed in 2015 (0.74 undersized/potlift). The PRI remains below the Limit Reference Point (LRP) of 1.30 undersized/potlift.

Since 2010, SZRLF biomass levels have remained relatively stable. In 2017, the biomass increased to 3,204 t, which is the highest since 2006 and marginally below the long-term average for the fishery (approximately 3,300 t). The exploitation rate in 2017 was 39%.

Puerulus settlement indices (no. of puerulus/collector; PSIs) have been below the long-term average in three of the five years between 2013 and 2017. In 2017, the estimate was 1.76 puerulus/collector, reflecting the third highest PSI over the last decade. Overall, given that the period between settlement and recruitment in the SZRLF is approximately five years, recent PSIs indicate that recruitment to the fishery will be close to the long-term average in the short-to-medium term.

In summary, based on data to the end of the 2017 SZRLF season: (i) the TACC has constrained catch for the eight consecutive season; (ii) catch and effort are currently at, or among, historically low levels; (iii) biomass levels are close to historical averages and exploitation rates have reduced substantially; (iv) CPUE is the highest since 2006 and above the TRP; and (v) PRI estimates have increased.

As a result, based on a weight-of-evidence approach, the SZRLF 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	2017/18	2016/17
TACC	1,245.7 t	1,245.7 t
Total commercial catch	1,245.7 t	1,237.7. t
Total effort	1,021,872 potlifts	1,295,715 potlifts
Commercial CPUE	1.22 kg/potlift	0.96 kg/potlift
Pre-recruit index	1.28 undersized/potlift	1.00 undersized/potlift
Biomass estimate	3,204 t	2,467 t
Exploitation rate	39%	50%
Status	**Sustainable**	**Sustainable**

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

1 INTRODUCTION

This fishery status report updates the 2016/17 stock assessment report for the Southern Zone Rock Lobster Fishery (SZRLF) (Linnane et al. 2018) 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 indicators provided in the management plan (PIRSA 2013) for the fishery. A comprehensive assessment that includes more detailed spatial and temporal analyses will be provided in the 2017/18 stock assessment report that is due in July 2019.

Primary Industries and Regions South Australia (PIRSA) has adopted the National Fishery Status Reporting Framework (NFSRF; Flood et al. 2014) to determine the status of all South Australian fish stocks. This framework has recently been revised by Stewardson et al. (unpublished) and will be released in the 2018 Status of Australian Fish Stocks Report.

2 METHODS

Data sources presented in this report are described in Linnane et al. (2018). In brief, the catch and effort data presented were obtained from a mandatory daily logbook program administered by SARDI Aquatic Sciences. The 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 biological 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 November 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 from July to June. A detailed description of the qR fishery model is provided in McGarvey and Matthews (2001) and Linnane et al. (2018).

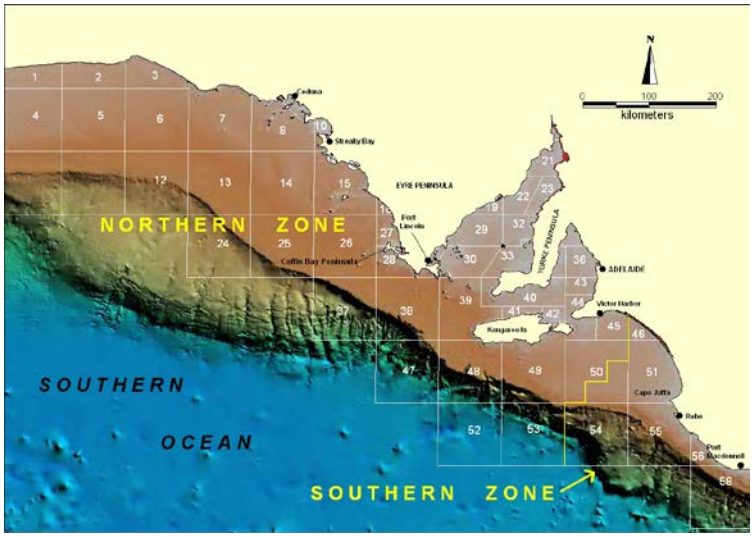

Figure 1 Northern and Southern Zones and Marine Fishing Areas (MFAs) in the South Australian Rock Lobster Fishery.

3 RESULTS

3.1 Catch, effort and catch per unit effort (CPUE)

3.1.1 Zonal catch and effort

In 2017, the total allowable commercial catch (TACC) in the SZRLF was 1,245.7 t and this was fully taken for the eight consecutive season (Figure 2). Fishing effort in 2017 was 1,021,872 potlifts, a decrease of 21% from 2016 (1,295,715 potlifts) and the third lowest estimate on record

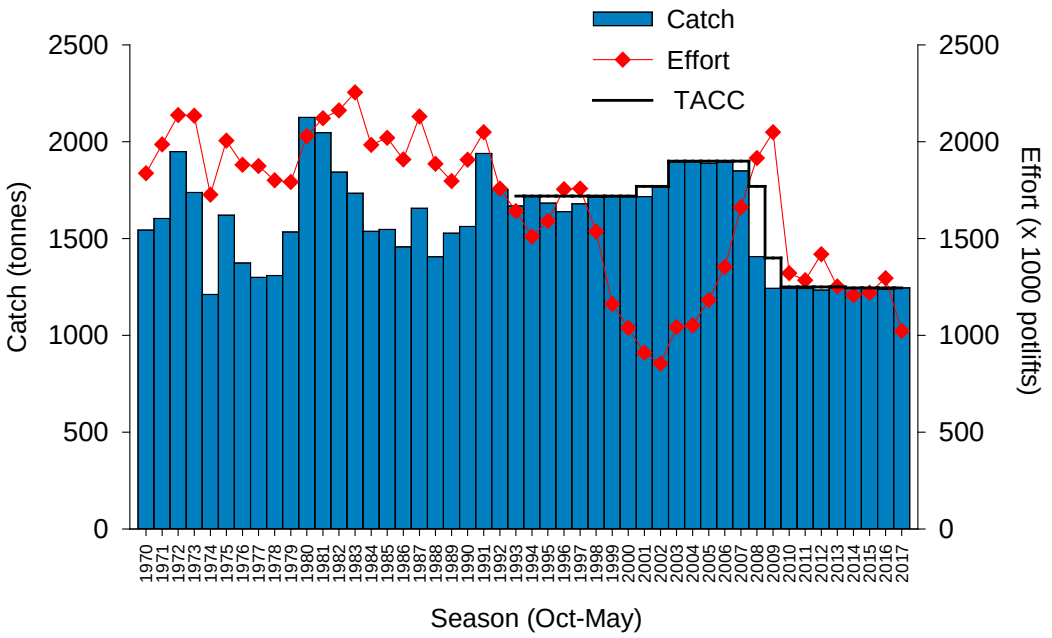

Figure 2 Inter-annual trends in catch and effort in the SZRLF from 1970 to 2017.

3.1.2 Within season trends in catch and effort

In 2017, the highest monthly catches (>250 t) were taken in the first four months of the season from October to January (Figure 3). Effort was highest in October (260,410 potlifts) before steadily decreasing through to April, by which time, the TACC was fully taken.

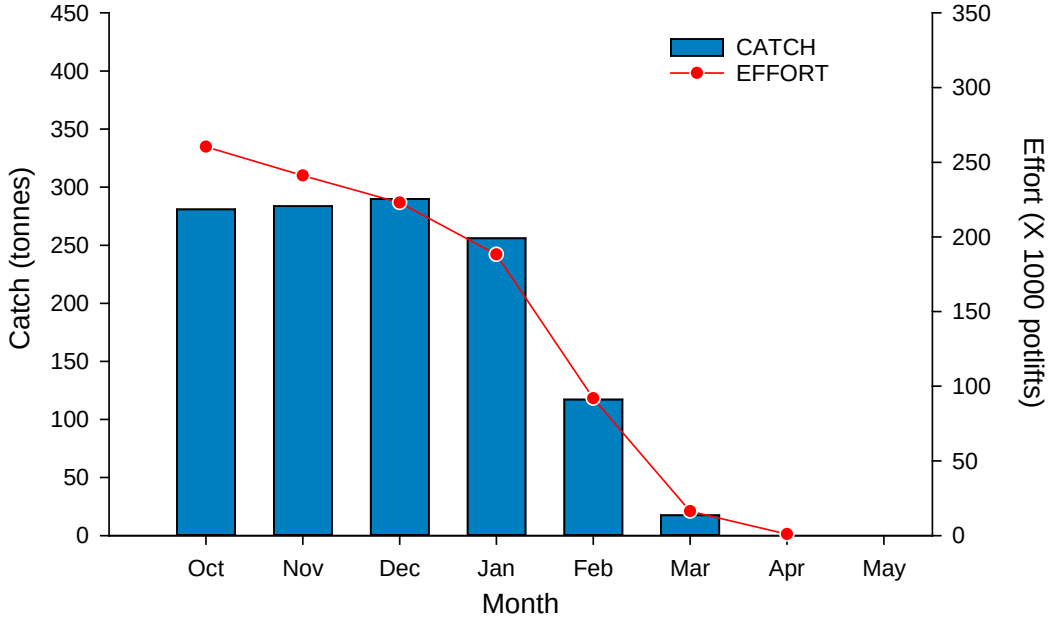

Figure 3 Within season trends in catch and effort in the SZRLF for the 2017 season.

3.1.3 Regional catch and effort

In 2017, 99% of the commercial catch came from four MFAs, i.e. 51, 55, 56 and 58 (Figure 1). Catch was evenly distributed across MFAs 55, 56 and 58 (approximately 33% each), while 1% was taken from MFA 51 (Figure 4).

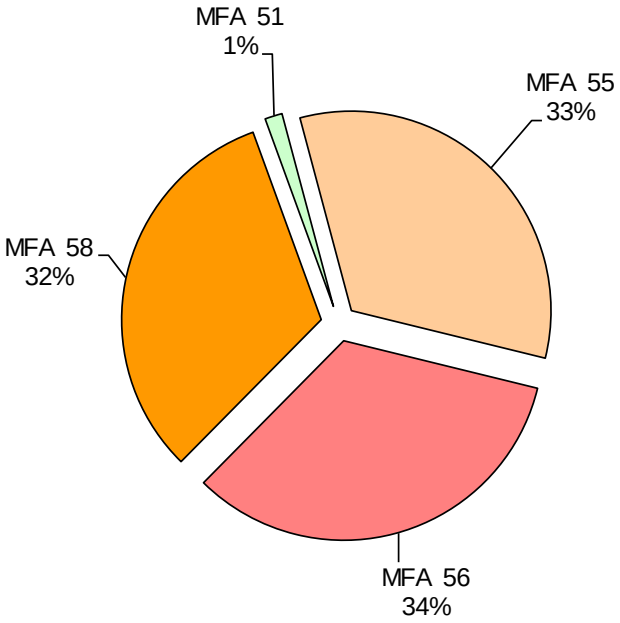

Figure 4 Percentage of total catch taken in the four major MFAs (in terms of tonnage landed) of the SZRLF in 2017.

In 2017, the catch taken in MFAs 51, 55, 56 and 58 was 17 t, 408 t, 415 t and 397 t, respectively (Figure 5). With the exception of MFA 58, effort has generally decreased in all MFAs over the last five seasons. Estimates in 2017 were 17,386, 299,971, 328,838 and 373,811 potlifts in MFAs 51, 55, 56 and 58, respectively.

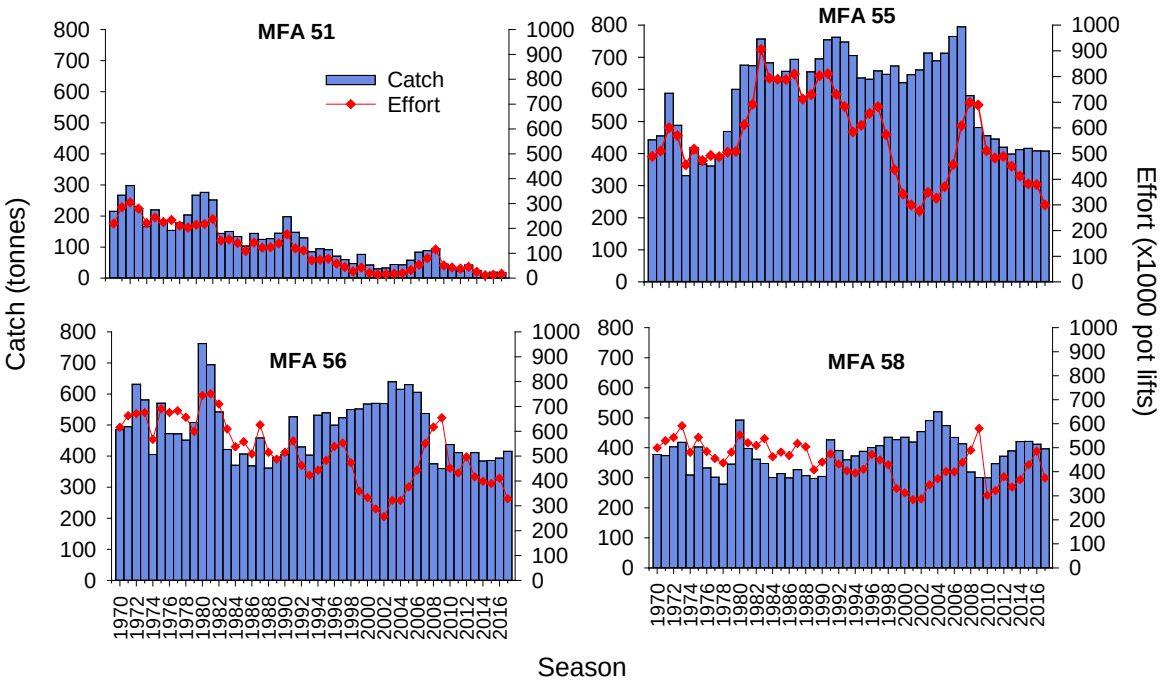

Figure 5 Inter-annual trends in catch and effort in the main Marine Fishing Areas (MFAs) of the SZRLF from 1970 to 2017 (note: alternate seasonal labels on X-axis).

3.1.4 Zonal catch per unit effort (CPUE)

Catch per unit effort (CPUE) declined from a historic peak of 2.06 kg/potlift in 2002 to 0.60 kg/potlift in 2009, a decrease of 71% (Figure 6). However, over the last eight seasons, CPUE has generally increased. In 2017, the CPUE was 1.22 kg/potlift, reflecting a 27% increase from 2016 and the highest catch rate since 2006. Current estimates are above the long-term average for the fishery (1.03 kg/potlift).

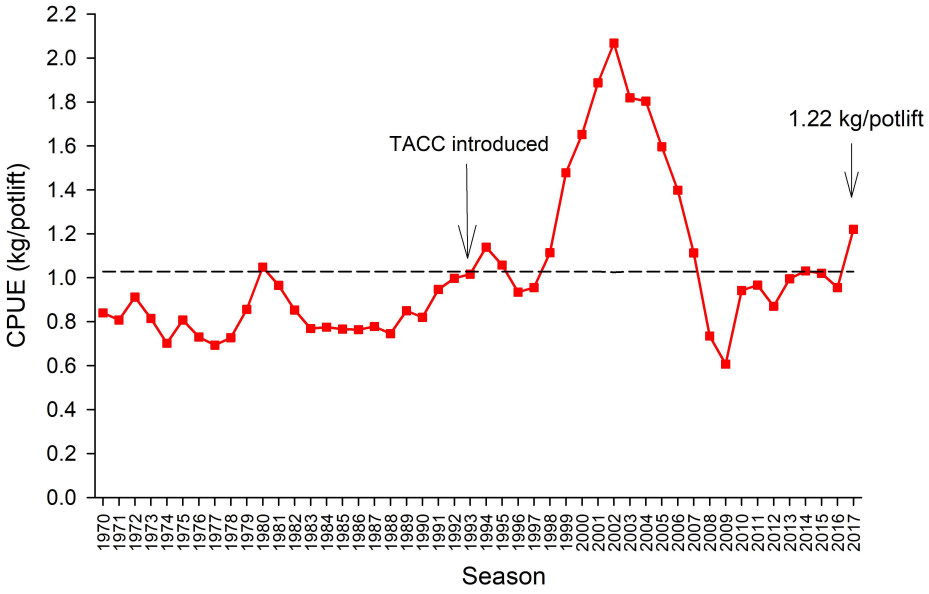

Figure 6 Inter-annual trends in CPUE in the SZRLF between 1970 and 2017. Dashed line represents long-term average.

3.1.5 Within season trends in CPUE

Within season CPUE estimates are generally highest from October to January before decreasing thereafter (Figure 7). In 2017, monthly catch rates were consistently higher across all months of the fishery compared to 2016 (noting that no catch was taken in May of 2017). In 2017, CPUE was highest in January at 1.36 kg/potlift and lowest in April at 0.75 kg/potlift.

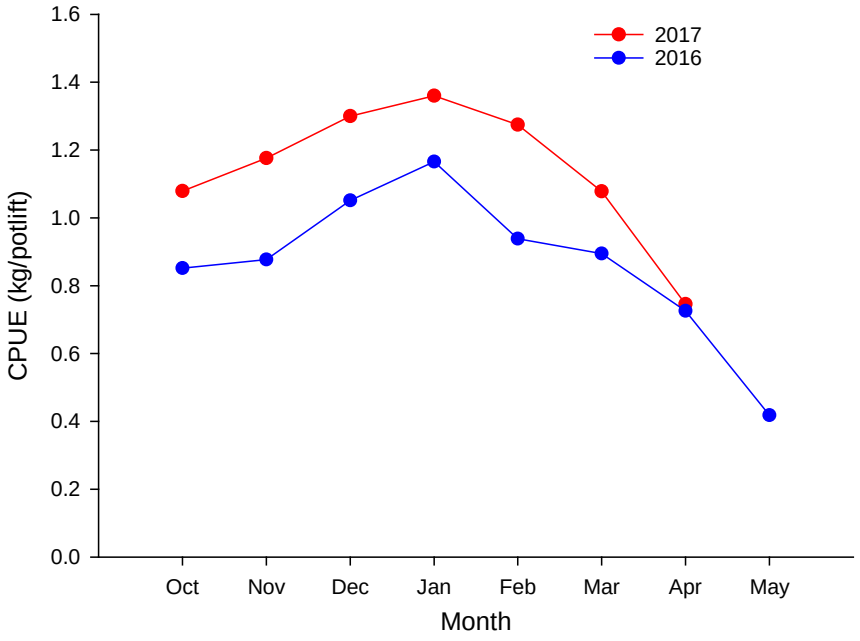

Figure 7 Within season trends in CPUE in the SZRLF during the 2016 and 2017 seasons**.**

3.1.6 Regional CPUE

The trends in CPUE across the major MFAs generally reflect zonal estimates (Figure 8). In 2017, CPUE increased in all MFAs with estimates of 1.45, 1.36, 1.26 and 1.06 kg/potlift in MFAs 51, 55, 56 and 58, respectively.

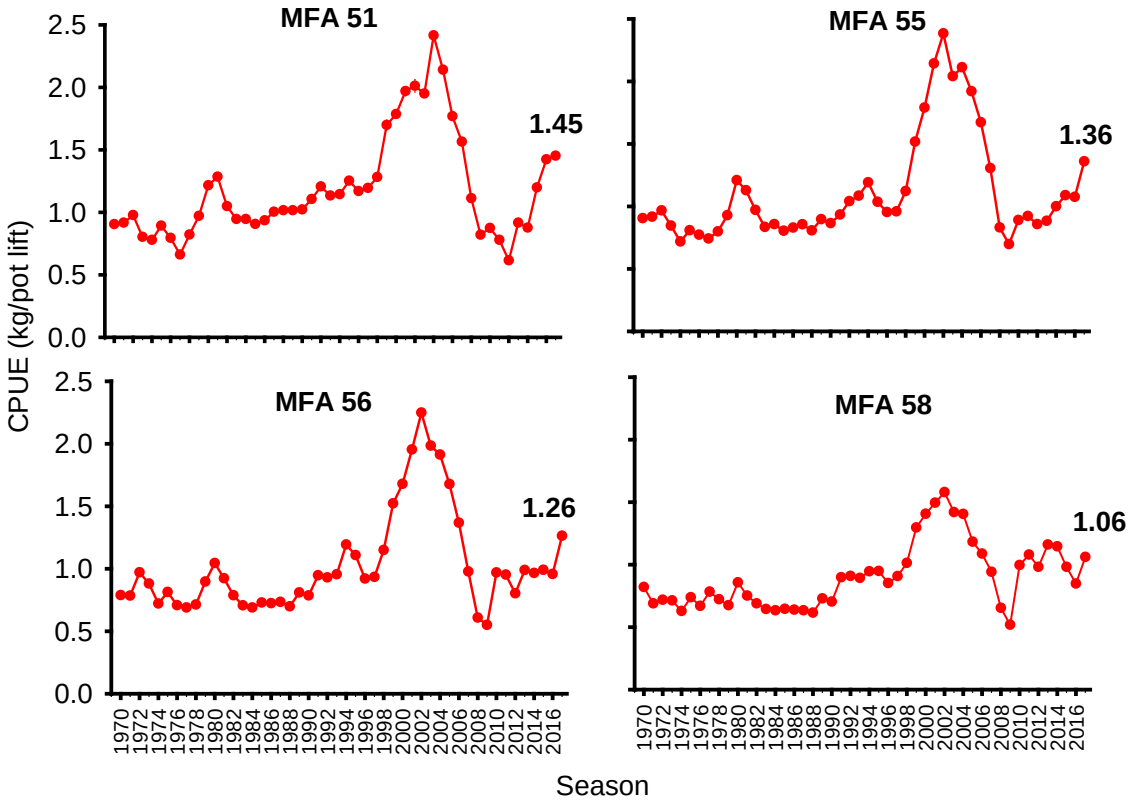

Figure 8 Inter-annual trends in CPUE in the four main MFAs of the SZRLF between 1970 and 2017 (note: alternate annual ticks on X-axis).

3.1.7 Trends in catch by depth

Typically, >75% of the catch has been taken from depths of <60 m since 2003 (Figure 9). In 2017, 88% of the catch was taken from depths of <60 m (35%, 53%, and 12% from depths of 0-30 m, 31-60 m and 61-90 m, respectively). Less than 1 t of catch was taken in >90 m in 2017.

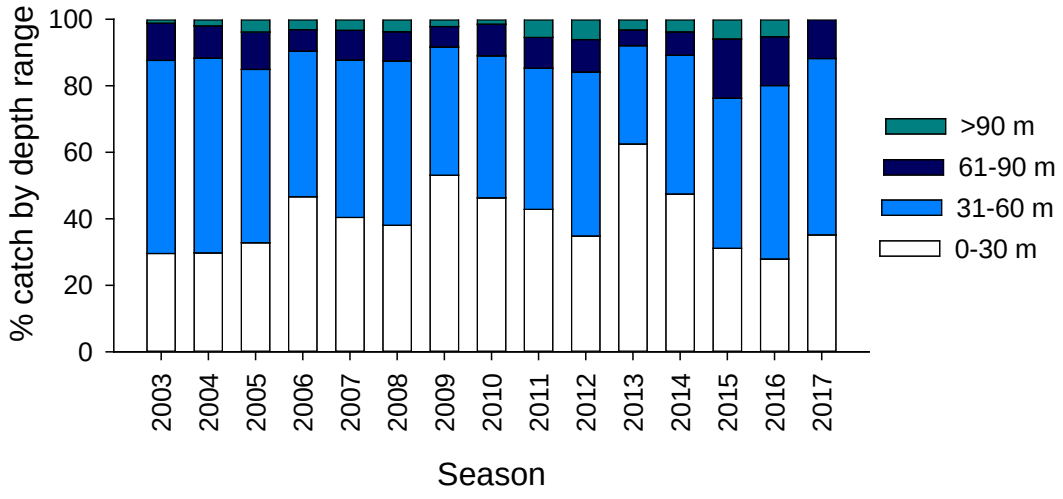

Figure 9 Catch by depth in the SZRLF.

3.1.8 Trends in CPUE by depth

While >75% of the catch is taken from depths of <60 m (Figure 9), CPUE at shallower depths of 0-30 m and 31-60 m are consistently lower than in deeper waters (Figure 10). In 2017, CPUE increased across all depth ranges with the exception of >90 m (but noting the low level of catch in this depth range in 2017). Estimates in 2017 were 1.16, 1.18, 1.71 and 1.24 kg/potlift in 0-30, 31-60, 61-90 and >90 m, respectively.

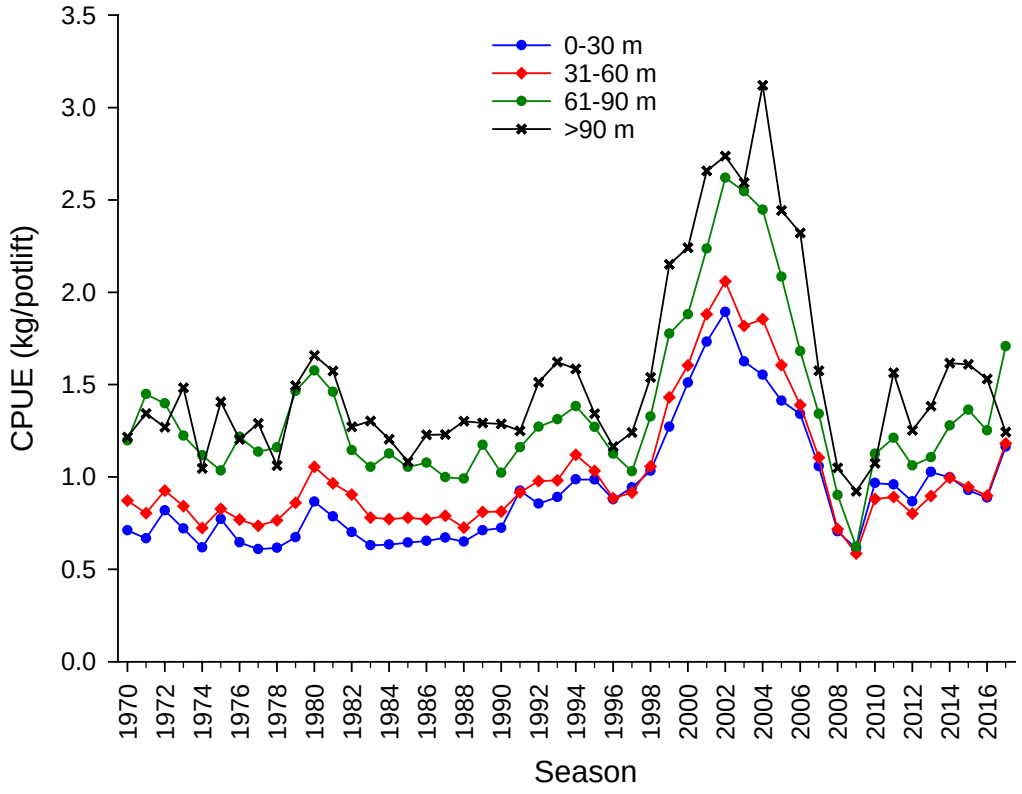

Figure 10 CPUE by depth in the SZRLF from 1970 to 2017.

3.1.9 Average number of days fished

From 2003 to 2009, the average number of days fished per licence increased despite the TACCs declining over the same period (Figure 11). In 2010, the TACC was reduced to 1,250 t and average days fished decreased considerably from 176 to 114 days. In 2017, it was 87 days, the third lowest on record.

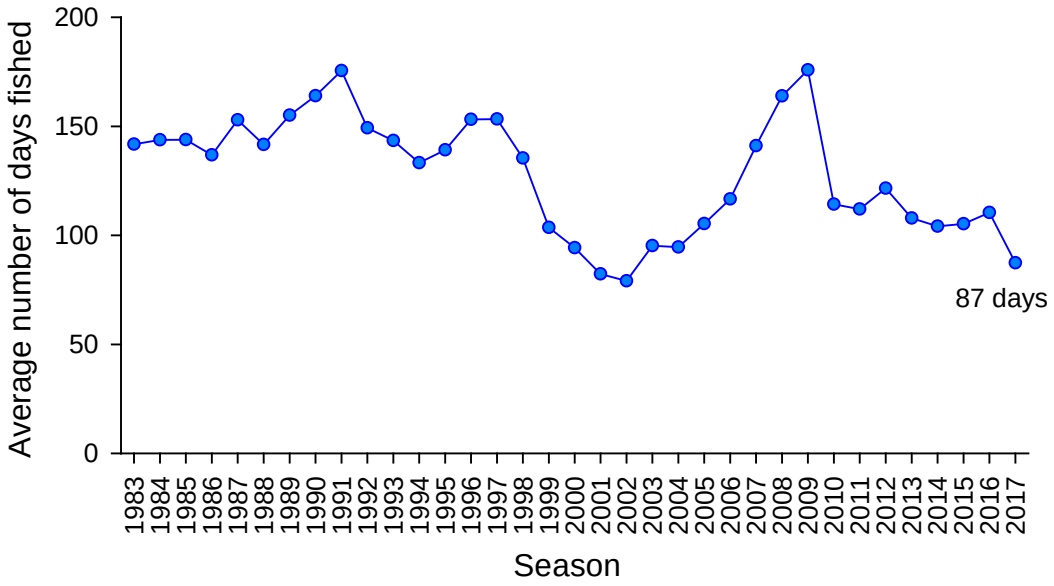

Figure 11 Mean number of days fished/licence holder from 1983 to 2017 in the SZRLF.

3.1.10 Annual mean weight

Fluctuations in the mean weight of lobsters harvested can reflect variations in the number of lobsters recruiting to legal size and long-term changes in mortality rate and thus overall stock structure (Figure 12). In 2017, the mean weight decreased for the first time in seven seasons to 0.83 kg. As with CPUE, mean weight estimates can be influenced by high-grading where smaller individuals are preferentially retained by fishers (see Figure 14).

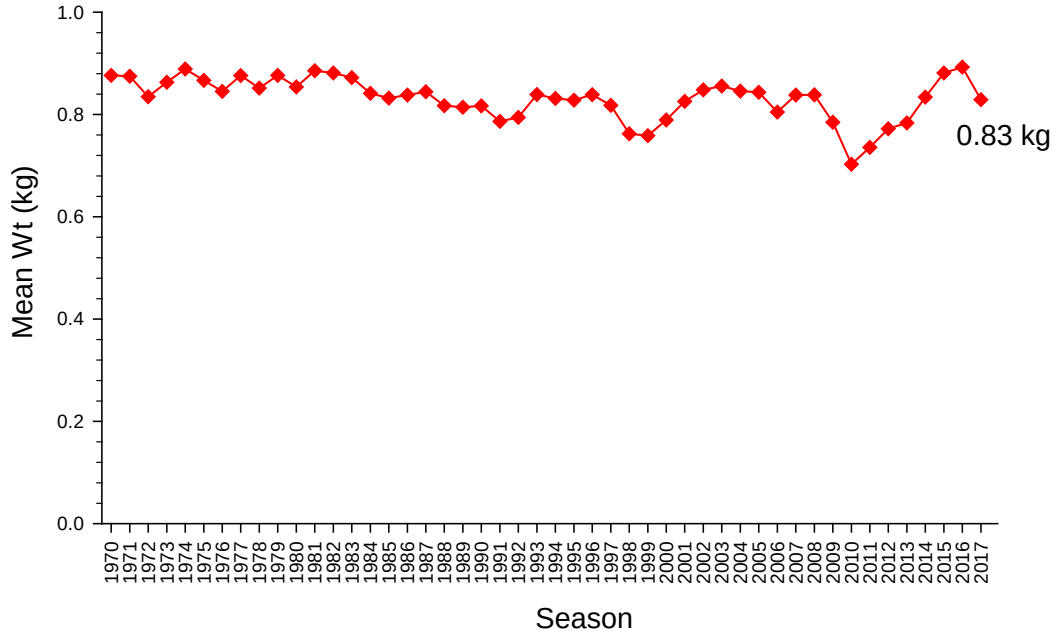

Figure 12 Inter-annual trends in mean lobster weight in the SZRLF from 1970 to 2017.

3.1.11 Within season trends in mean weight

In the SZRLF, mean lobster weight generally tends to increase as the season progresses (Figure 13). In 2017, estimates were broadly similar across all months being highest in April at 0.87 kg and lowest in October at 0.79 kg.

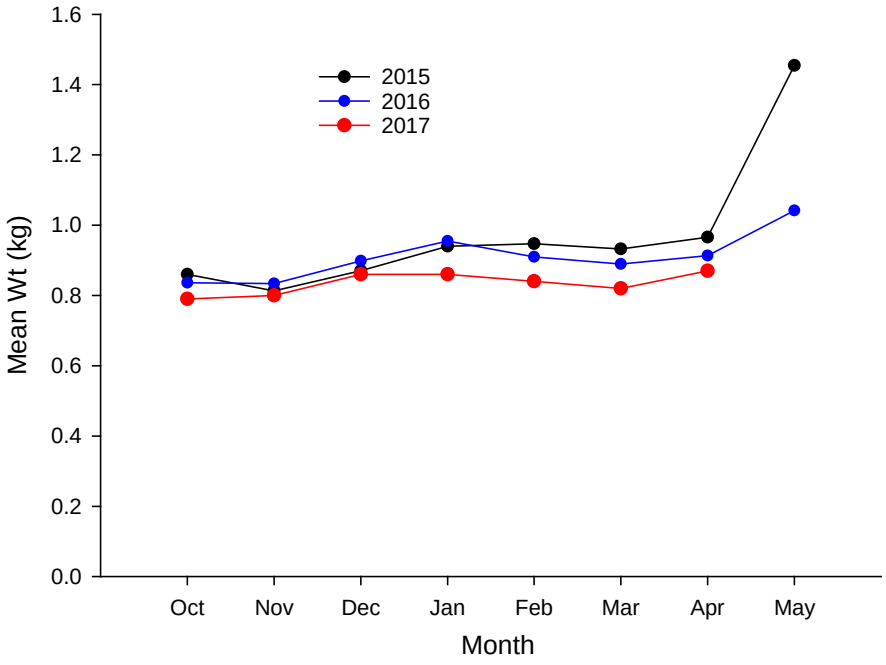

Figure 13 Within season trends in mean weight in the SZRLF over the last three seasons.

3.1.12 High-grading

Levels of high-grading (i.e. tonnage of lobsters returned to the water due to unsuitable size, colour or physical damage) exceeded 100 t between 2003 and 2006 (Figure 14). Since then, estimates have considerably decreased, and in 2017, 25 t of lobsters were high-graded. Since the recording of high-grading in logbooks is undertaken on a voluntary basis, estimates are likely to be conservative.

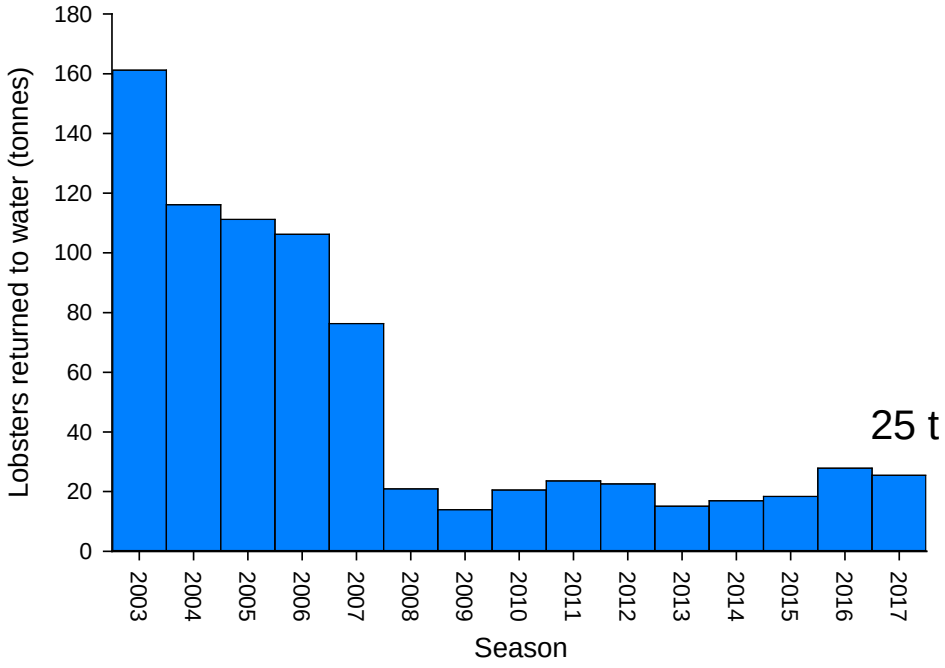

Figure 14 Tonnage returned to the water due to high-grading in the SZRLF from 2003 to 2017.

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. Between 2013 and 2017, three of the last five puerulus settlement indices (no. of puerulus/collector; PSIs) have been below the long-term average (Figure 15). In 2017, the estimate was 1.76 puerulus/collector, reflecting the third highest PSI over the last decade. Undersized individuals are generally observed in catches approximately four years after settlement. Overall, recent PSIs indicate that recruitment to the fishery will be close to the long-term average in the short-to-medium term.

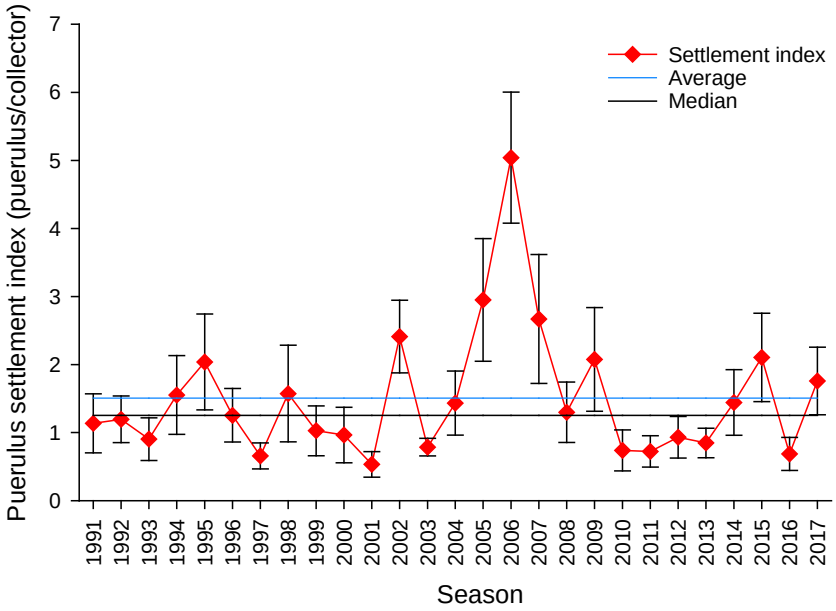

Figure 15 Puerulus settlement index (PSI) (mean ±SE) in the SZRLF from 1991 to 2017.

3.3 Pre-recruit index (PRI)

3.3.1 Zonal pre-recruit index

With the exception of increases in 2009 and 2010, the zonal estimate of the logbook-based PRI shows a consistent long-term decline (Figure 16). Specifically, the PRI decreased from 2.1 undersized/potlift in 1999 to 0.74 undersized/potlift in 2015, which was the lowest estimate on record. Over the last two seasons, the estimate has increased and in 2017 was 1.28 undersized/potlift. In the SZRLF, the time taken for pre-recruits to enter the fishable biomass is estimated to be approximately one year.

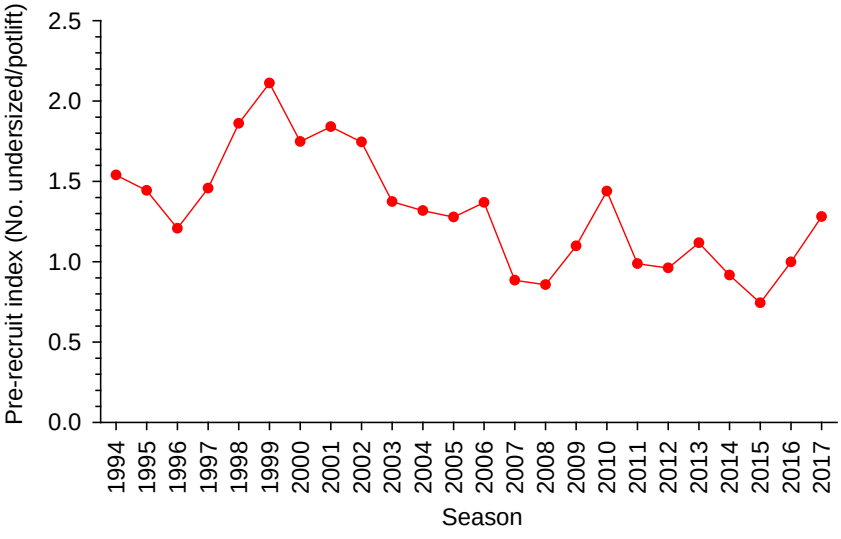

Figure 16 Logbook derived PRI from 1994 to 2017 (November–March inclusive).

3.3.2 Regional pre-recruit index

Regional estimates indicate that the PRI 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 17). With the exception of MFA 51, the zonal increase in PRI in 2017 was observed across all the major MFAs. In 2017, estimates were 0.29, 0.38, 1.44 and 1.95 undersized/potlift in MFAs 51, 55, 56 and 58 respectively.

Figure 17 Interannual trends in regional PRI in the SZRLF from 1994 to 2017.

3.4 Length frequency data

Patterns in length frequency distributions obtained through the catch sampling program have been broadly similar over the last three seasons (Figure 18). Notably, the percentage of lobsters measured below the minimum legal size of 98.5 mm carapace length (CL) increased from 24% to 37% between 2015 and 2017, reflecting the increase in pre-recruit abundance over the same period (Figure 16).

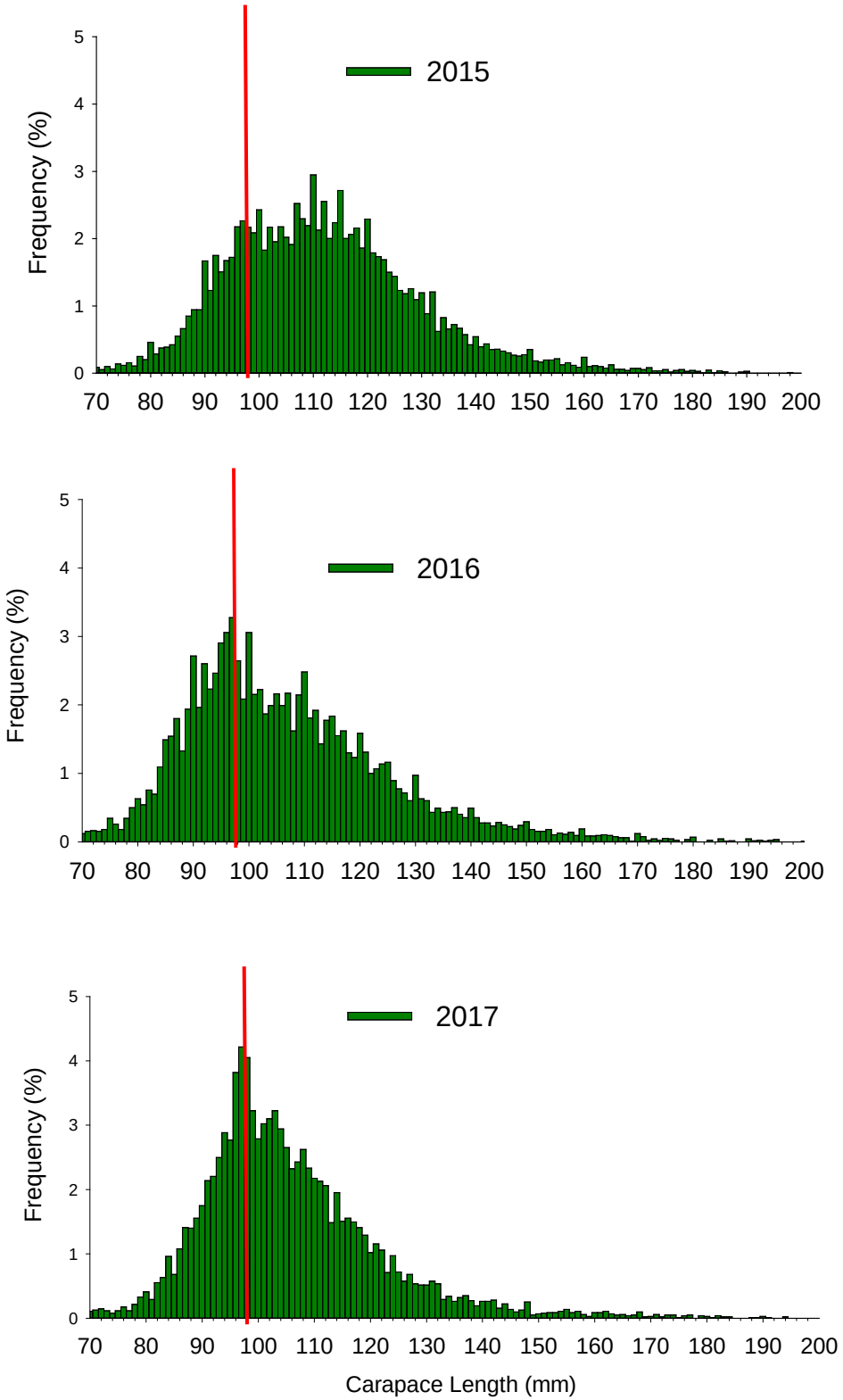

Figure 18 Length frequency data of male and female lobsters (combined) sampled during the voluntary catch sampling program from 2015 to 2017. Red line denotes minimum legal size (98.5 mm CL).

3.5 qR Model outputs

3.5.1 Biomass

From 2002 to 2009, estimates of legal-sized biomass, as determined by the qR stock assessment model, decreased by 65% from 5,282 t to 1,846 t (Figure 19). In 2010, biomass increased and over the next six seasons remain relatively stable. In 2017, the biomass increased to 3,204 t, which is the highest since 2006 and marginally below the long-term average for the fishery (approximately 3,300 t).

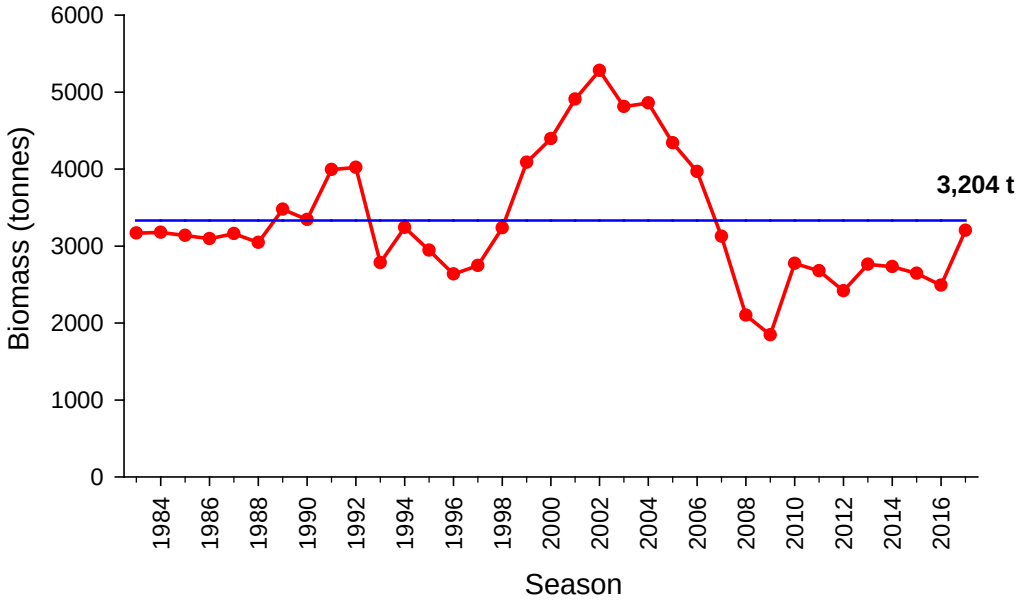

Figure 19 Estimates of biomass for the SZRLF as obtained from the qR fishery model. Blue line represents long-term average.

3.5.2 Egg production

In line with declines in lobster biomass, egg production estimates decreased by 52% from 684 billion in 2003 to 331 billion in 2009 (Figure 20). Over the last eight seasons, egg production has generally increased, and in 2017 was estimated at 447 billion. As with legal sized biomass, current estimates are now marginally below the long-term average for the fishery (477 billion).

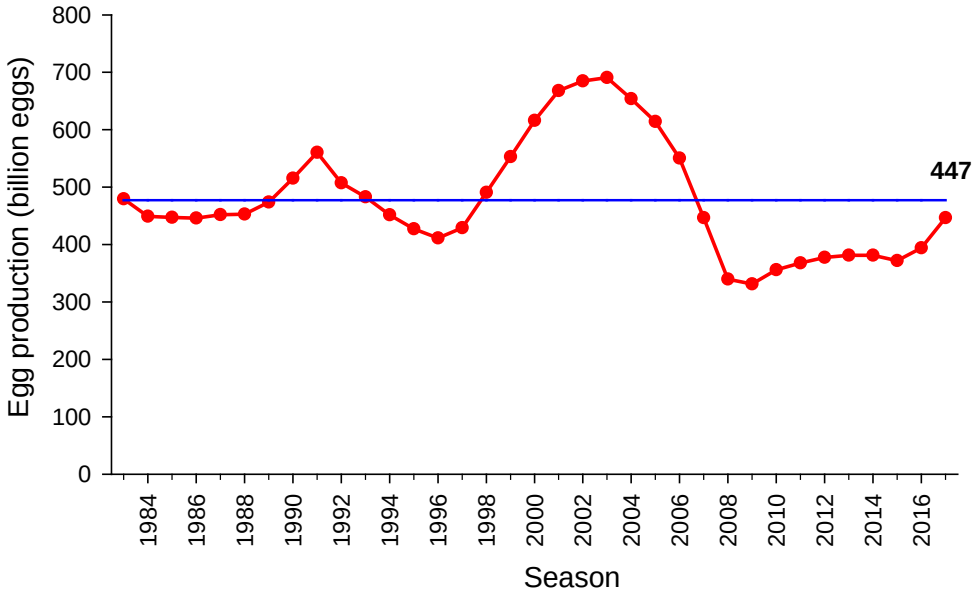

Figure 20 Estimates of egg production for the SZRLF as obtained from the qR fishery model. Blue line represents long-term average.

3.5.3 Exploitation rate

Exploitation rate increased from 33% in 2002 to 67% in 2009 (Figure 21) in response to decreasing biomass over the same period (Figure 19). Exploitation rate decreased in 2010, and in 2017, the estimate was 39%, which is below the long-term average for the fishery of 49%.

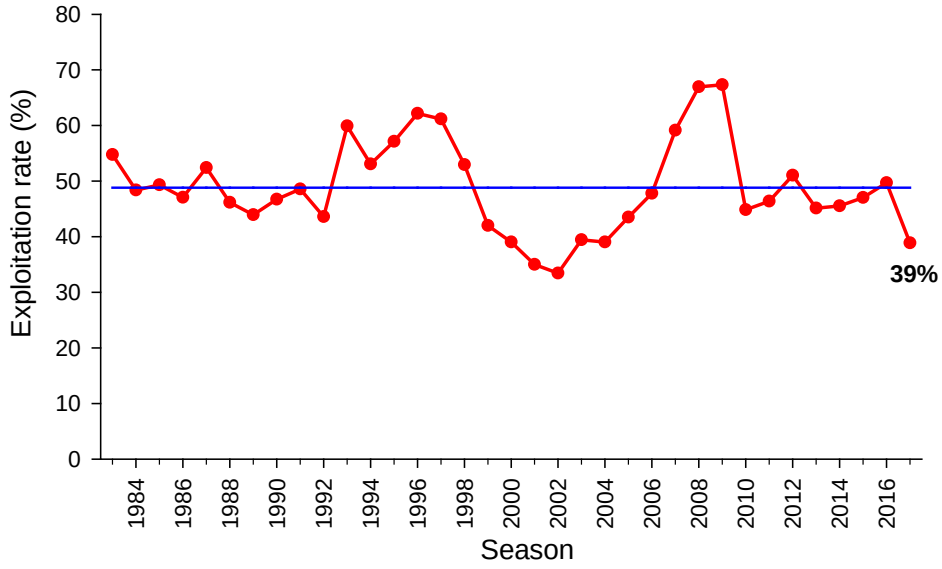

Figure 21 Estimates of exploitation for the SZRLF as obtained from the qR fishery model. Blue line represents long-term average.

3.5.4 Recruitment

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 22). Since then, the estimate has been variable and in 2017 was 2.9 million individuals which is above the long-term average of 2.3 million.

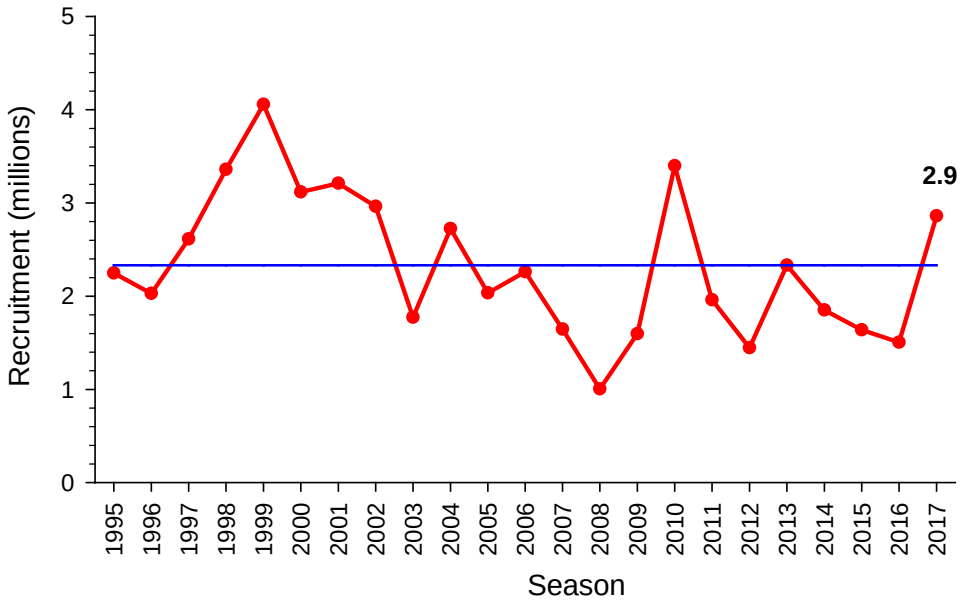

Figure 22 Estimates of recruitment for the SZRLF as obtained from the qR fishery model. Blue line represents long-term average.

3.6 Biological performance indicators

The SZRLF harvest strategy describes multiple performance indicators to monitor the performance of the fishery (PIRSA 2013). Broadly, the harvest strategy aims to target a sustainable exploitation rate based on historical fishery performance using two fishery-dependent indicators.

The primary indicator is commercial logbook CPUE (kg of legal sized lobster/potlift) based on data from October to May, inclusive. The secondary indicator is a commercial logbook PRI (no. of undersized lobsters/potlift) based on data from November to March, inclusive.

CPUE bands, which equate to target exploitation rates, are specified in the harvest strategy for the fishery (PIRSA 2013). To set a TACC for the upcoming season, the harvest strategy decision rules are applied to CPUE from the previous season. A Trigger Reference Point (TRP) of 0.60 kg/plotift is specified, below which, exploitation rates (and corresponding TACCs) are reduced considerably. TACCs can only be increased if the PRI is above a Limit Reference Point (LRP) of 1.30 undersized/potlift.

In 2017, the CPUE was 1.22 kg/potlift which is above the TRP. The PRI was 1.28 undersized/potlift which is below the LRP.

4 SUMMARY

In 2017, the SZRLF TACC was fully taken for the eight consecutive season. Over this period, fishery status has improved with CPUE increasing from 0.60 kg/potlift in 2009 to 1.22 kg/potlift in 2017. Current CPUE is above the long-term average and the highest since 2006. Effort levels are among the lowest in the history of the fishery.

The estimate of legal-size biomass was relatively stable from 2010 to 2016. In 2017, the legal-size biomass increased to 3,204 t, which is the highest since 2006. As a result, exploitation rates have decreased (39% in 2017) and are now below the long-term average.

In 2017, PRI increased for the second consecutive season but remains below the LRP for the fishery.

In summary, based on data to the end of the 2017 SZRLF season: (i) the TACC has constrained catch for the eight consecutive season; (ii) catch and effort are currently at, or among, historically low levels; (iii) biomass levels are close to historical averages and exploitation rates have reduced; (iv) CPUE is the highest since 2006 and above the TRP; and (iv) estimates of PRI have increased.

As a result, based on a weight-of-evidence approach, the SZRLF is classified as "**sustainable**". This means that the current fishing mortality is being adequately controlled to avoid the stock becoming recruitment impaired.

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