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Southern Zone Rock Lobster (*Jasus edwardsii*) Fishery Status Report 2015/16

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

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SARDI Aquatic Sciences
PO Box 120 Henley Beach SA 5022

November 2016

Status Report to PIRSA Fisheries and Aquaculture

PREMIUM FOOD AND WINE FROM OUR CLEAN ENVIRONMENT

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EXECUTIVE SUMMARY

In 2015 (i.e. 1 October 2015 to 31 May 2016), the total allowable commercial catch (TACC) in South Australia's Southern Zone Rock Lobster Fishery (SZRLF) was 1,245.7 t. The total commercial catch from logbook data was 1,244.4 t. This is the sixth consecutive season that >99% of the TACC has been taken.

Effort in 2015 was 1,220,317 potlifts, an increase of 1% from 2014 (1,207,123 potlifts). Effort levels have remained relatively stable since 2010 and are currently low in a historical context.

In 2015, catch per unit effort (CPUE) was 1.02 kg/potlift, reflecting a 70% increase over the last six seasons (from 0.60 kg/potlift in 2009). Current CPUE is now at the historical long-term average and above the limit reference point (LRP) of 0.60 kg/potlift.

Over the last six seasons biomass has remained relatively stable at approximately 2,500 t but below the long-term average for the fishery (approximately 3,300 t). The exploitation rate in 2015 was 48%.

While CPUE has increased, two sources of information suggest that conservative TACCs are warranted under existing harvest strategies. In 2015, the pre-recruit index (PRI) of 0.74 undersized/potlift remained below the trigger reference point (TRP) and was the lowest estimate on record.

In addition, four of the last five annual estimates of puerulus settlement between 2010 and 2015 were below the long-term average. Using a five year period from settlement to recruitment to the fishable biomass, this indicates that recruitment from 2015 to 2020 will most likely be below the historical average.

Based on current CPUE and PRI levels the harvest strategy decision rules indicated that the TACC should be retained at 1,245.7 t for the 2016/17 season.

In summary, despite current levels of recruitment, recent management decisions have prevented fishery declines. Specifically; (i) the TACC has constrained catch since 2010; (ii) both catch and effort are currently at, or among, historically low levels; (iii) biomass levels are stable; and (iv) CPUE in 2015 was above the LRP. As a result, based on a weight-of-evidence approach, the SZRLF is classified as "**sustainable**".

Table 1 Key SZRLF statistics for the 2015/16 season.

Statistic	2015/16
TACC	1,245.7 t
Total commercial catch	1,244.4 t
Total effort	1,220,317 potlifts
Commercial CPUE	1.02 kg/potlift
Pre-recruit index	0.74 undersized/potlift
Biomass estimate	2,583 t
Exploitation rate	48%
Status	**Sustainable**

1 INTRODUCTION

This fishery status report updates the 2014/15 stock assessment report for the Southern Zone Rock Lobster Fishery (SZRLF) (Linnane et al. 2016) 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 2015/16 stock assessment report which is due in July 2017.

2 METHODS

Detailed information on data sources of the fishery statistics presented in this report are described in Linnane et al. (2016). In brief, the catch and effort data presented are 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 and all catch and effort data from this period are used to estimate the primary biological performance indicator of catch per unit effort (CPUE).

Data to estimate the secondary performance indicator of pre-recruit index are also obtained from logbook data. The November to March period is used as these are the known months where the catchability of undersized lobsters is highest. As all lobsters are measured as part of this program, length frequency data are also obtained from catch sampling.

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).

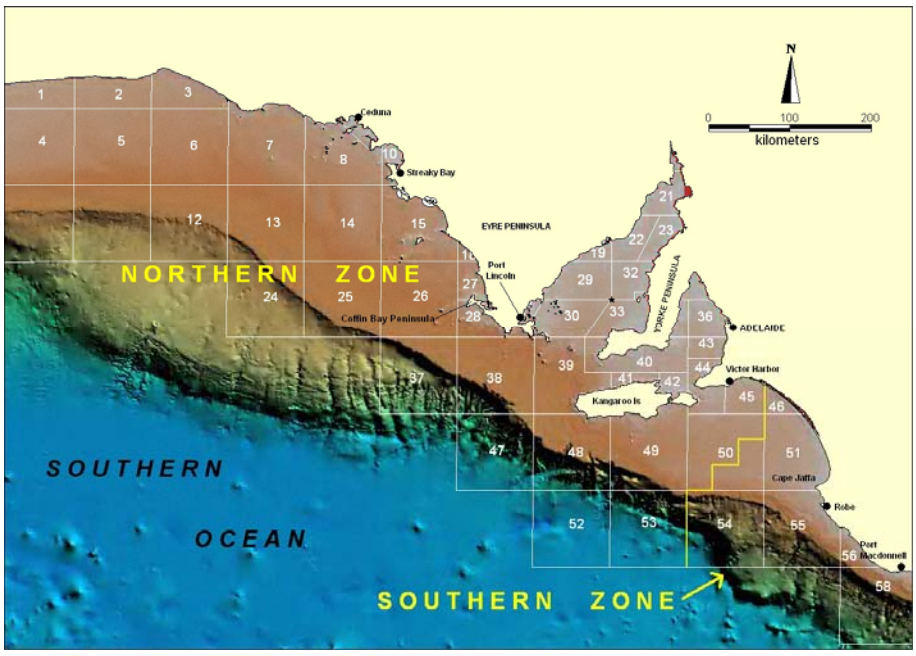

Figure 1 Northern and Southern Zones and Marine Fishing Areas (MFAs) in the South Australian Rock Lobster Fishery.

3 FISHERY STATISTICS

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

3.1.1 Zonal catch and effort

In 2015 (i.e. the 2015/16 season), the total allowable commercial catch (TACC) in the SZRLF was 1,245.7 t. The total reported commercial catch was 1,244.4 t (99% of TACC) (Figure 2). Effort in 2015 was 1,220,317 potlifts, an increase of 1% from 2014 (1,207,123 potlifts). Effort levels have remained relatively stable since 2010 and are currently low in a historical context.

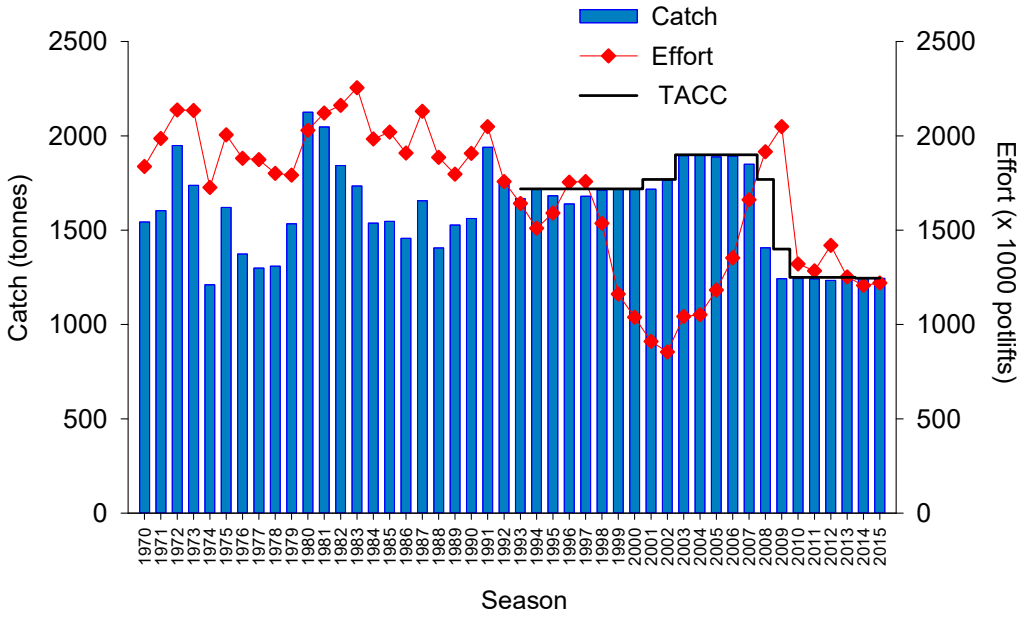

Figure 2 Inter-annual trends in catch and effort in the SZRLF from 1970 to 2015.

3.1.2 Within season trends in catch and effort

In 2015, the highest monthly catches (>200 t) were taken in the first four months of the season from October to January (Figure 3). Catch was highest in October at 282.9 t, and lowest in May at 0.4 t. Effort was highest in October at 295,341 potlifts before consistently decreasing as the season progressed.

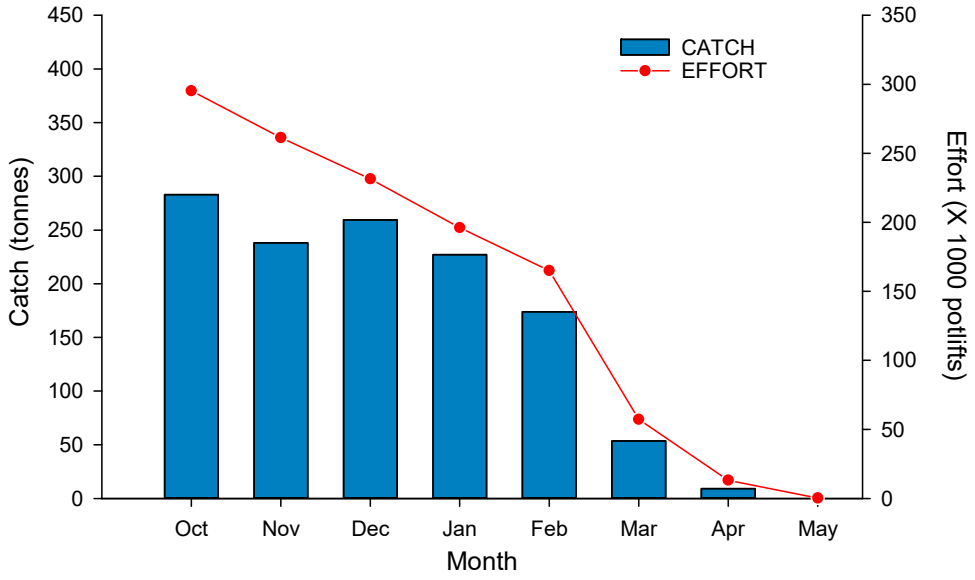

Figure 3 Within season trends in catch and effort in the SZRLF for the 2015 season.

3.1.3 Regional catch and effort

In 2015, 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 32% each), while 2% was taken from MFA 51 (Figure 4).

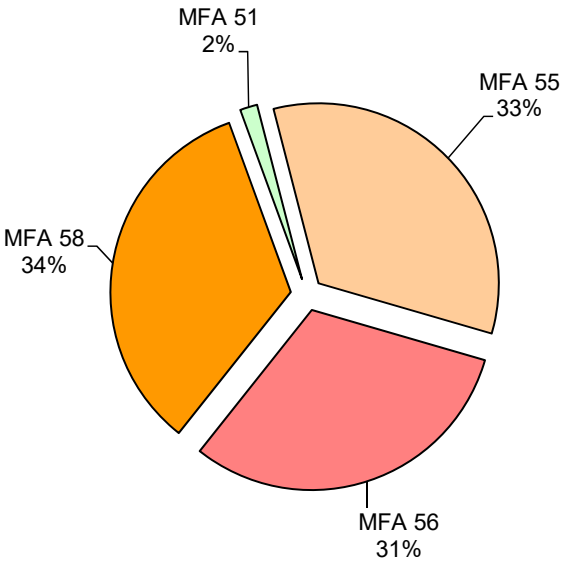

Figure 4 Percentage of total catch taken in the four major MFAs (in terms of tonnage landed) of the SZRLF in 2015.

In 2015, the catch taken in MFAs 51, 55, 56 and 58 was 14 t, 416 t, 386 t and 421 t, respectively (Figure 5). Compared to 2014, effort decreased in all major regions with the exception of MFA 58. Estimates in 2015 were 11,980, 382,155, 389,476 and 429,136 potlifts in MFAs 51, 55, 56 and 58, respectively.

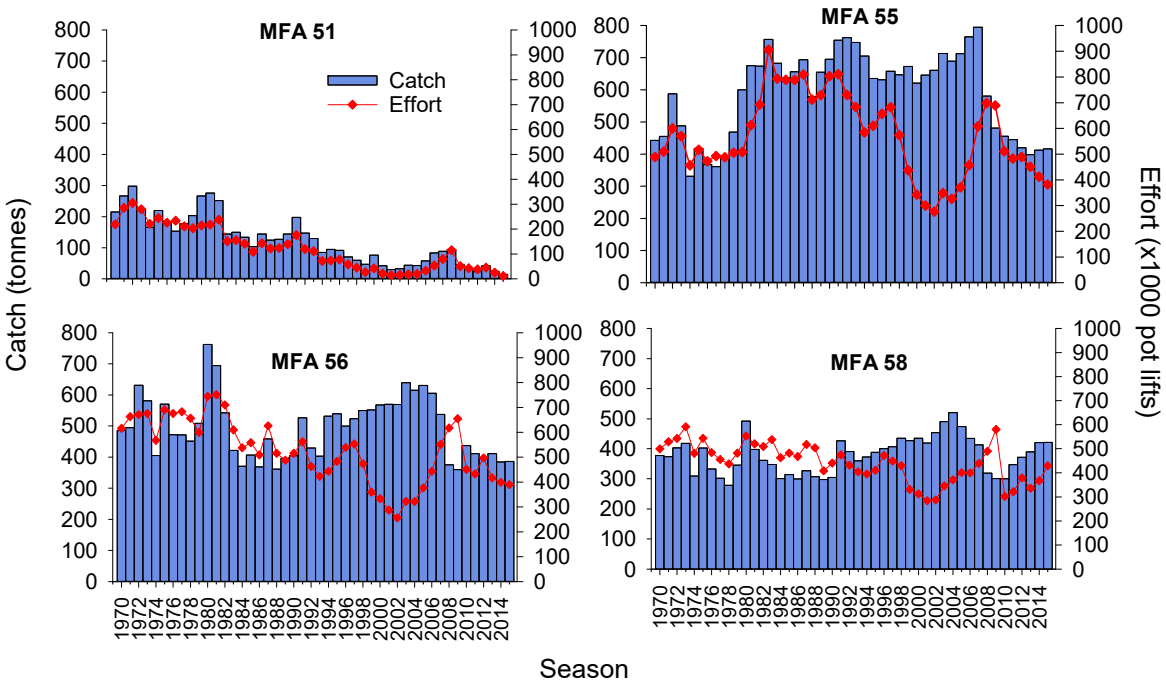

Figure 5 Inter-annual trends in catch and effort in the main Marine Fishing Areas (MFAs) of the SZRLF from 1970 to 2015 (note: alternate seasonal labels on X-axis).

3.1.4 Zonal catch per unit effort (CPUE)

Catch per unit effort (CPUE) declined from 2.06 kg/potlift in 2002 to 0.60 kg/potlift in 2009, a decrease of 71% (Figure 6). Over the last six seasons, with the exception of 2012, CPUE has increased and in 2015 was 1.02 kg/potlift, a 70% increase from 2009. Current estimates are now at the long-term average for the fishery (1.03 kg/potlift).

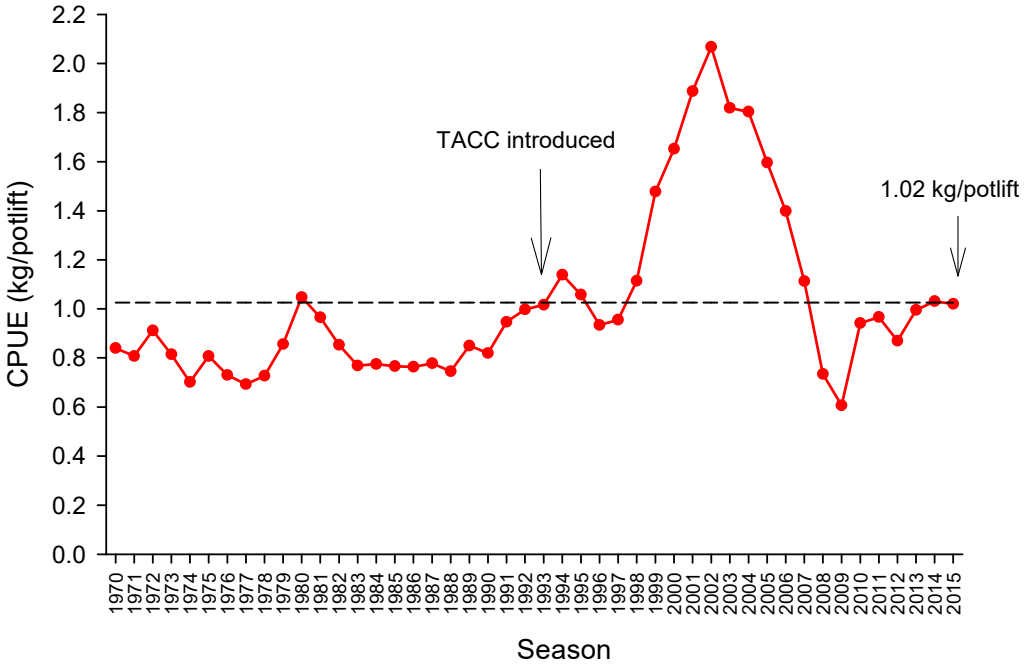

Figure 6 Inter-annual trends in CPUE in the SZRLF between 1970 and 2015. Dashed line represents long-term average.

3.1.5 Within season trends in CPUE

Within season CPUE estimates are generally highest from October to January before decreasing thereafter (Figure 7). With the exception of November, monthly CPUE values in 2015 were close to, or marginally above, those in 2014. In 2015, CPUE was highest in May at 1.29 kg/potlift, however this was based on a low catch of just 0.4 t.

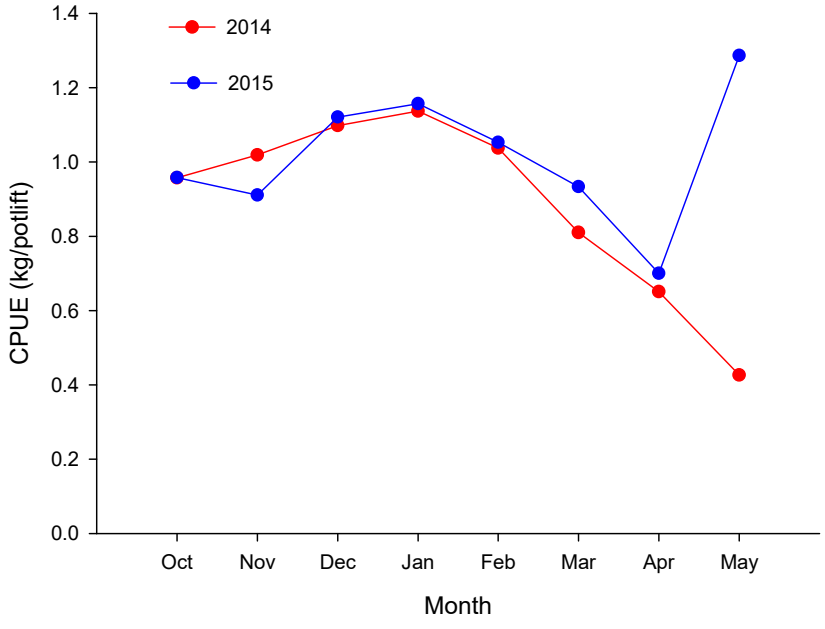

Figure 7 Within season trends in CPUE in the SZRLF during the 2014 and 2015 seasons**.**

3.1.6 Regional CPUE

The trends in CPUE across the major MFAs generally reflect zonal estimates (Figure 8). In 2015, with the exception of MFA 58, CPUE increased in all areas with estimates of 1.20, 1.09, 0.99 and 0.98 kg/potlift in MFAs 51, 55, 56 and 58, respectively.

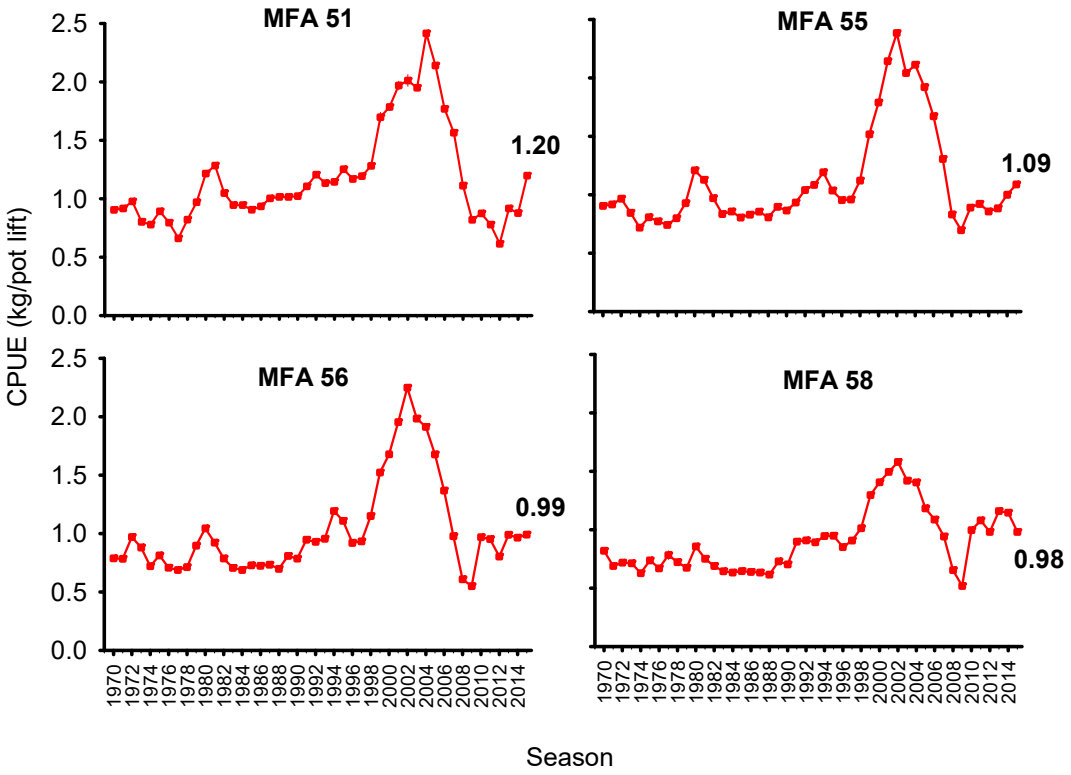

Figure 8 Inter-annual trends in CPUE in the four main MFAs of the SZRLF between 1970 and 2015 (note: alternate annual ticks on X-axis).

3.1.7 Spatial trends in catch by depth

Over the last seven seasons >75% of the catch has been taken from depths of <60 m (Figure 9). In 2015, the proportion of catch taken in 0-30 m, 31-60 m, 61-90 m and >90 m was 31%, 45%, 18% and 6%, respectively. Notably, the proportion of catch taken in 0-30 m in 2015 was lower than in recent seasons while the catch in 61-90 m increased.

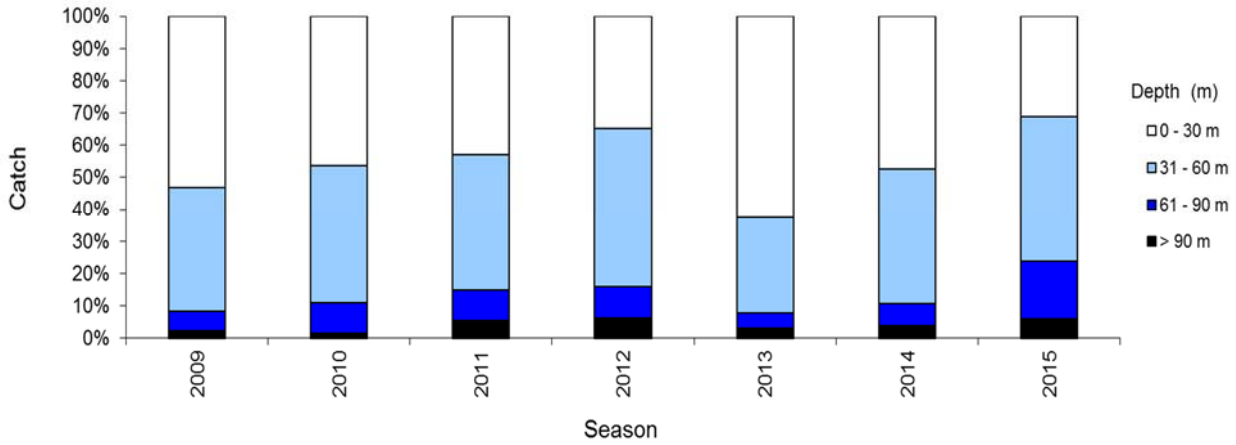

Figure 9 Catch by depth in the SZRLF over the last seven seasons.

3.1.8 Spatial 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 2015, CPUE decreased across all depth ranges except 61-90 m. Estimates were 0.93, 0.95, 1.36 and 1.61 kg/potlift in 0-30, 31-60, 61-90 and >90 m, respectively.

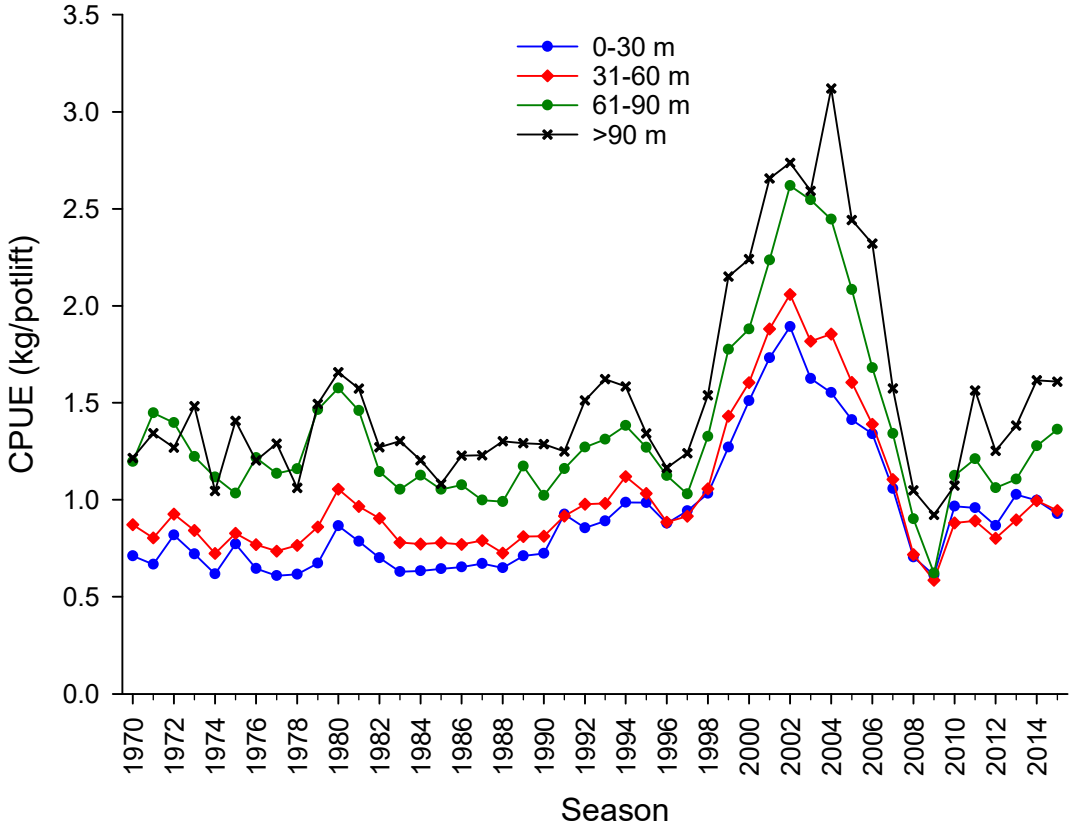

Figure 10 CPUE by depth in the SZRLF from 1970 to 2015.

3.1.9 Average number of days fished

From 2003 to 2009, the average number of days fished per licence holder increased despite declining TACCs over the same period (Figure 11). In 2010, the TACC was reduced to 1,250 t and the estimate decreased considerably from 176 to 114 days. Over the last five seasons the average numbers of days fished has marginally decreased and in 2015 was 104 days.

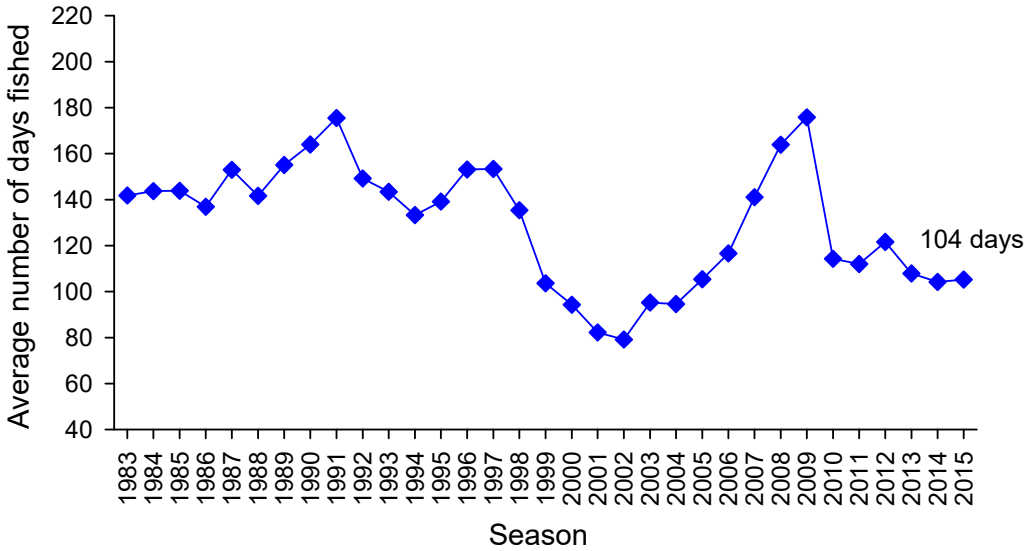

Figure 11 Mean number of days fished/licence holder from 1983 to 2015 in the SZRLF.

3.1.10 Annual mean weight

Fluctuations in the mean weight of lobsters can reflect variations in the number of lobsters recruiting to legal size (Figure 12). Over the last five seasons the mean weight of lobsters in the fishery has increased and in 2015 was 0.88 kg. As with CPUE, mean weight estimates can be influenced by high-grading where smaller individuals are preferentially retained by fishers (see Figure 14).

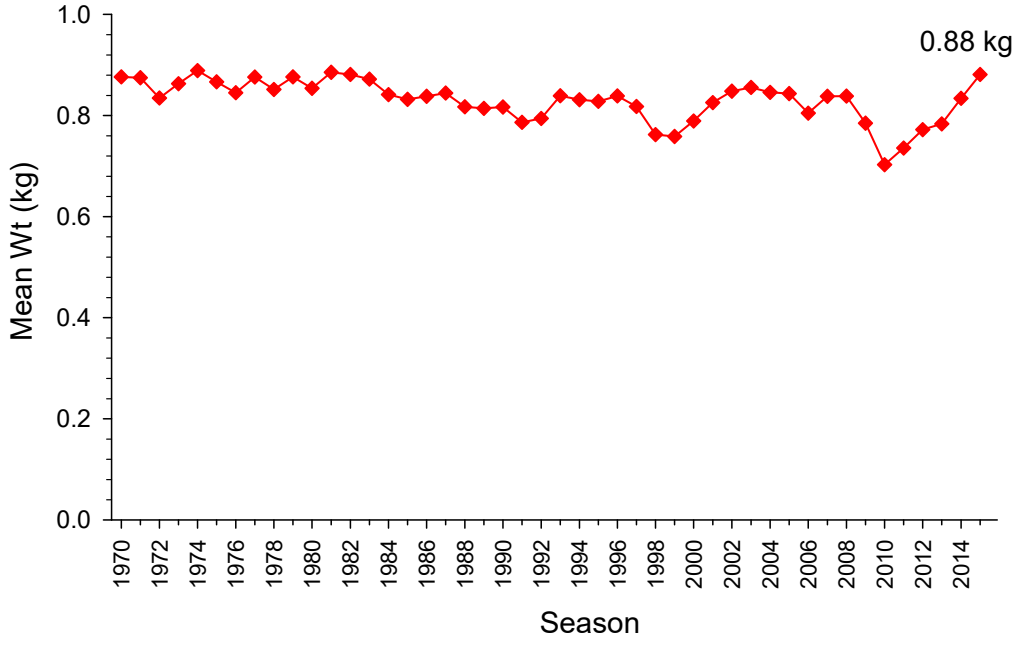

Figure 12 Inter-annual trends in mean lobster weight in the SZRLF from 1970 to 2015.

3.1.11 Within season trends in mean weight

In the SZRLF, mean lobster weight tends to increase as the season progresses and in 2015 was consistently higher across all months of the season compared to previous years (Figure 13). The estimate was lowest in November at 0.81 kg and highest in May at 1.45 kg, noting that the May estimate is derived from just 0.4 t.

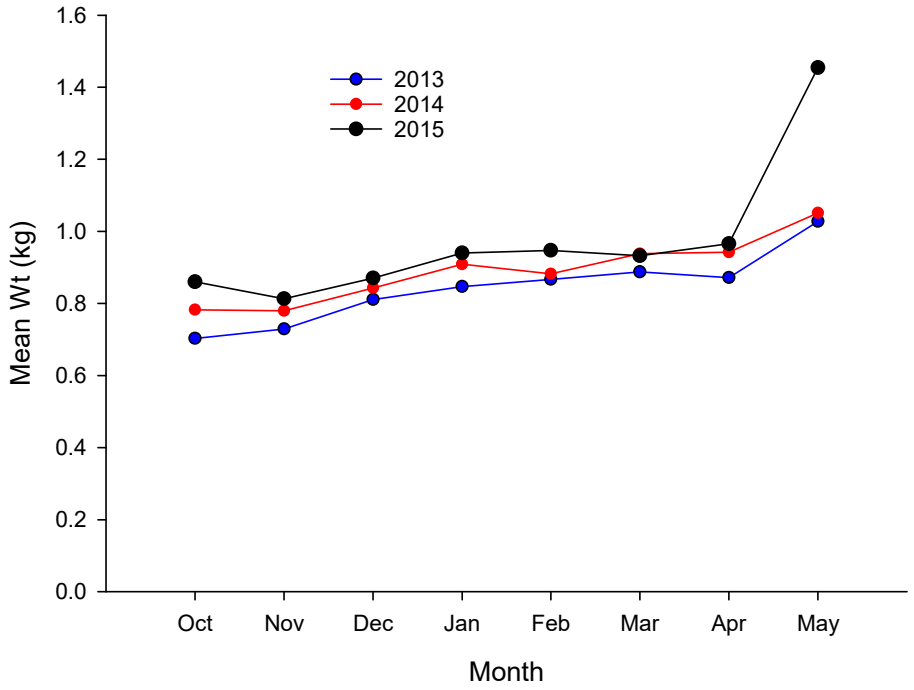

Figure 13 Within season trends in mean weight in the SZRLF over the last three seasons.

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 steadily decreased, and in 2015, 18.3 t of lobsters were returned to the water. Since the recording of high-grades in logbooks is undertaken on a voluntary basis, estimates are likely to be conservative.

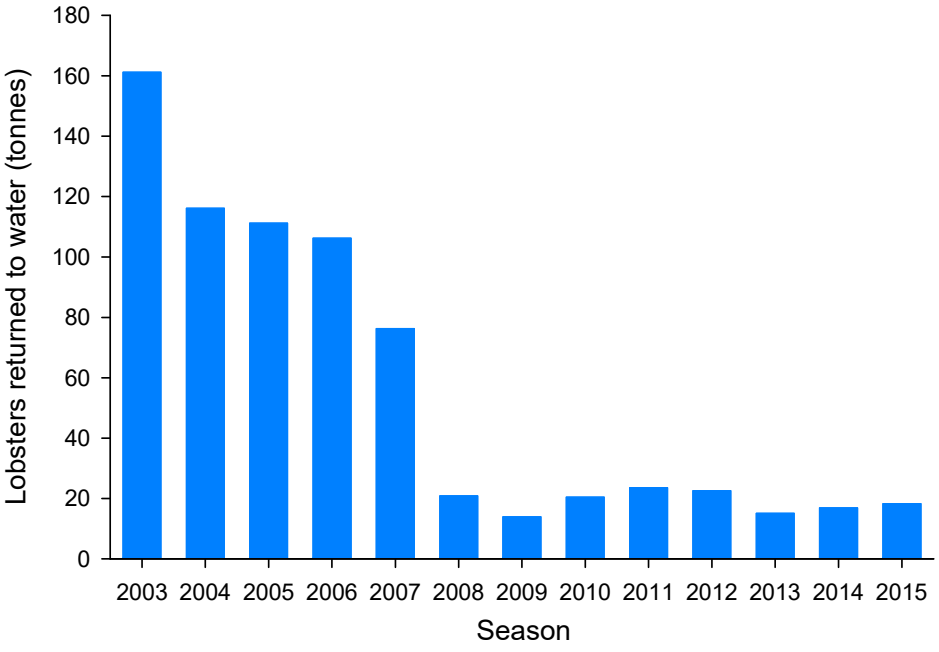

Figure 14 Tonnage returned to the water due to high-grading in the SZRLF from 2003-2015.

3.2 Puerulus settlement index

Four of the last six puerulus settlement indices (PSIs) have been below the long-term average (1.50 puerulus/collector) (Figure 15). In 2015, the estimate was 2.11 puerulus/collector, reflecting an increase over the last two seasons. In the SZRLF, the estimated period between settlement and recruitment into the fishable biomass is estimated to be about 5 years. Undersized individuals are generally observed in catches approximately 4 years after settlement. Overall, these results indicate that recruitment to the fishery may be below average in the short-to-medium term.

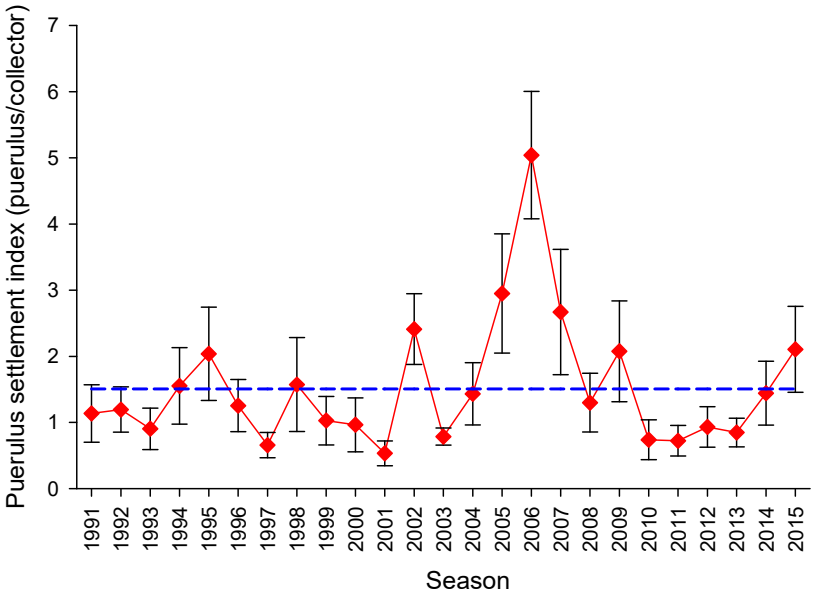

Figure 15 Puerulus settlement index (PSI) (mean ±SE) in the SZRLF from 1991 to 2015. Dashed blue line represents long-term average.

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 has decreased from 2.1 undersized/potlift in 1999 to 0.74 undersized/potlift in 2015, which was the lowest on record. In the SZRLF, the time taken for pre-recruits to enter the fishable biomass is estimated to be approximately one year.

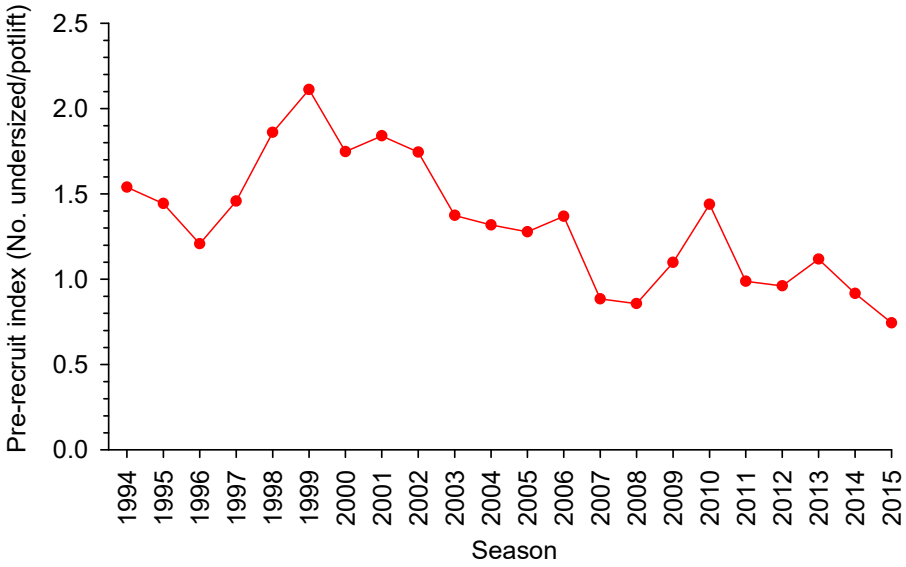

Figure 16 Logbook derived PRI from 1994-2015 (November–March inclusive).

3.3.2 Regional pre-recruit index

Regional estimates of the logbook based PRI (Figure 17) 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). The zonal decline in PRI in 2015 was largely driven by decreases in MFAs 56 and 58 with estimates of 0.78 and 1.29 undersized/potlift, respectively. With the exception of MFA 51, where PRI increased to 1.19 undersized/potlift (the highest on record), all areas are now at historical lows based on current time series.

Figure 17 Interannual trends in regional PRI in the SZRLF from 1994-2015.

3.4 Length frequency data

Patterns of lobster length frequency obtained from data collected through the catch sampling program have been broadly similar over the last four seasons (Figure 18). The exception is the increase in the proportion of larger lobsters >110 mm carapace length (CL) observed in 2015. Specifically, 50% of all lobsters measured were above this size in 2015, compared to between 32-43% in previous seasons.

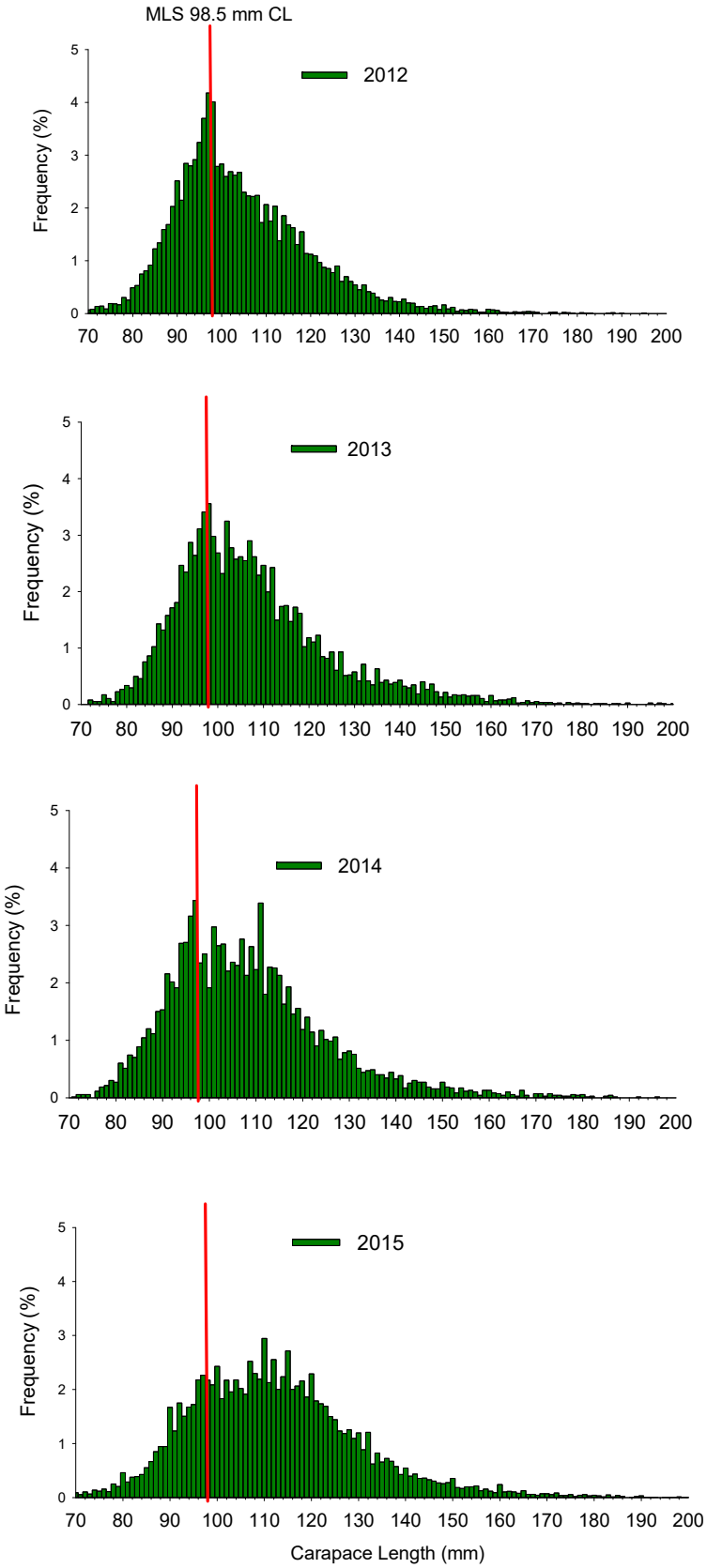

Figure 18 Length frequency data of both male and female lobsters sampled during the voluntary catch sampling program from 2012-2015. MLS = minimum legal size.

4 qR MODEL OUTPUTS

4.1 Biomass

From 2002 to 2009, estimates of legal sized biomass, as determined by the qR stock assessment model, decreased by 65% from 5,190 t to 1,811 t (Figure 19). In 2010, biomass increased and over the last six seasons has remained relatively stable. In 2015, the estimate was 2,583 t. Current estimates remain below the long-term average for the fishery (approximately 3,300 t).

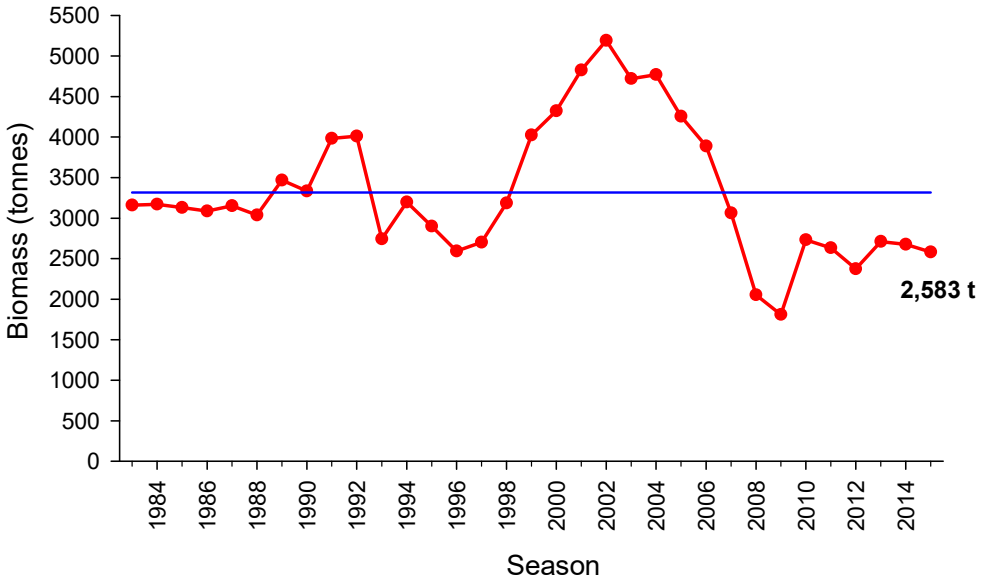

Figure 19 Estimates of biomass for the SZRLF as obtained from the qR fishery model. Blue line represents long-term average.

4.2 Egg production

In line with declines in lobster biomass, egg production estimates decreased by 52% from 680 billion in 2003 to 326 billion in 2009 (Figure 20). Over the last six seasons, egg production has remained relatively stable and in 2015 was estimated at 368 billion. As with legal sized biomass, current estimates are below the long-term average for the fishery (475 billion).

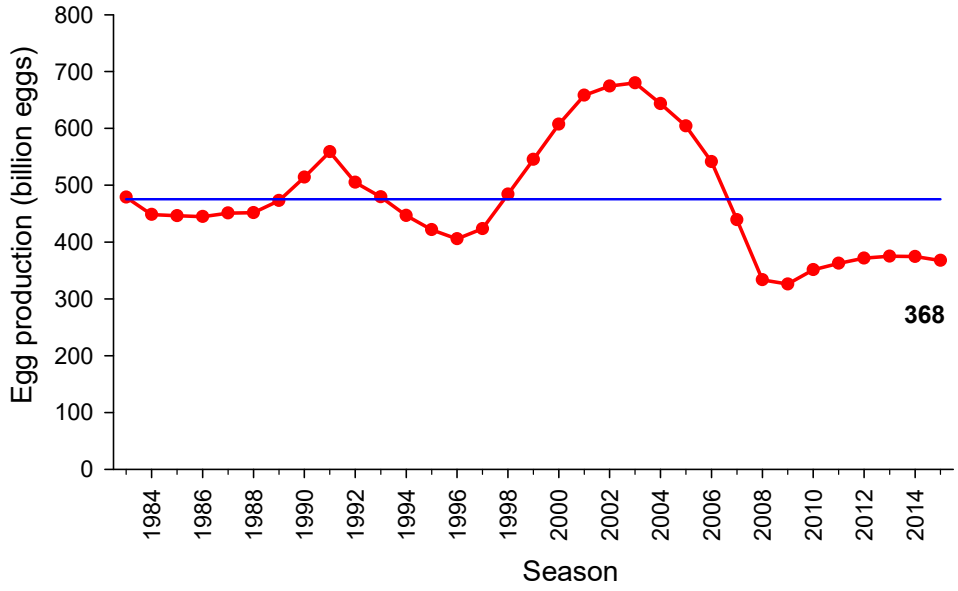

Figure 20 Estimates of egg production for the SZRLF as obtained from the qR fishery model. Blue line represents long-term average.

4.3 Percent of virgin egg production

Model outputs for the 2015 season indicate that egg production equated to 9% of virgin levels (Figure 21).

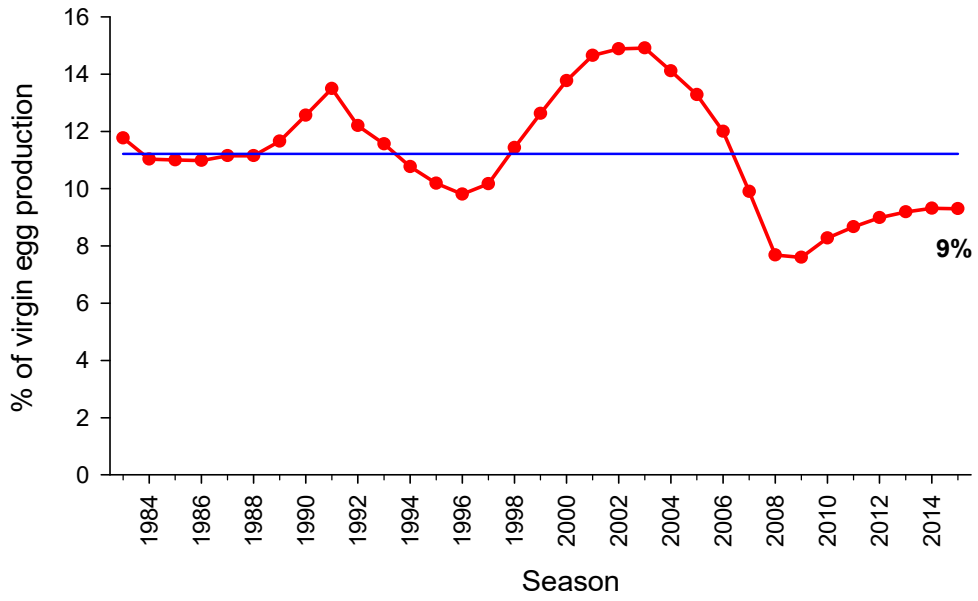

Figure 21 Estimates of % of virgin egg production for the SZRLF as obtained from the qR fishery model. Blue line represents long-term average.

4.4 Exploitation rate

Exploitation rate increased from 34% in 2002 to 69% in 2009 (Figure 22) in response to decreasing biomass over the same period (Figure 19). Exploitation rates decreased in 2010 and over the last six seasons have remained relatively stable. In 2015, the estimate was 48%.

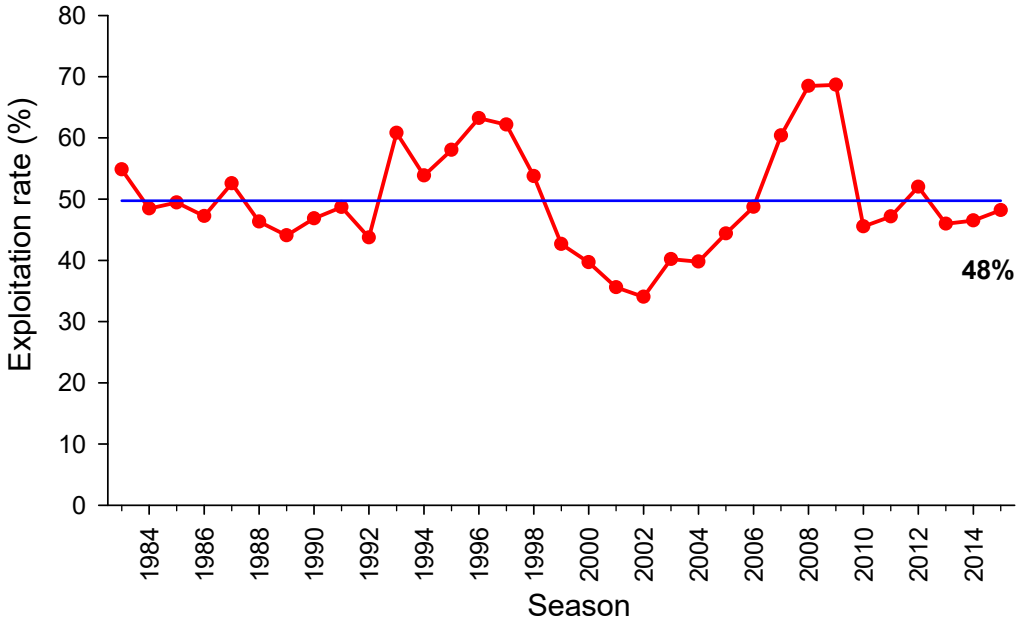

Figure 22 Estimates of exploitation for the SZRLF as obtained from the qR fishery model. Blue line represents long-term average.

4.5 Recruitment

Outputs from the qR model indicate that recruitment to the fishery generally declined from approximately 4 million individuals in 1999 to 1 million in 2008, a decrease of 75% (Figure 23). Since then, the estimate has been variable and in 2015 was 1.6 million individuals.

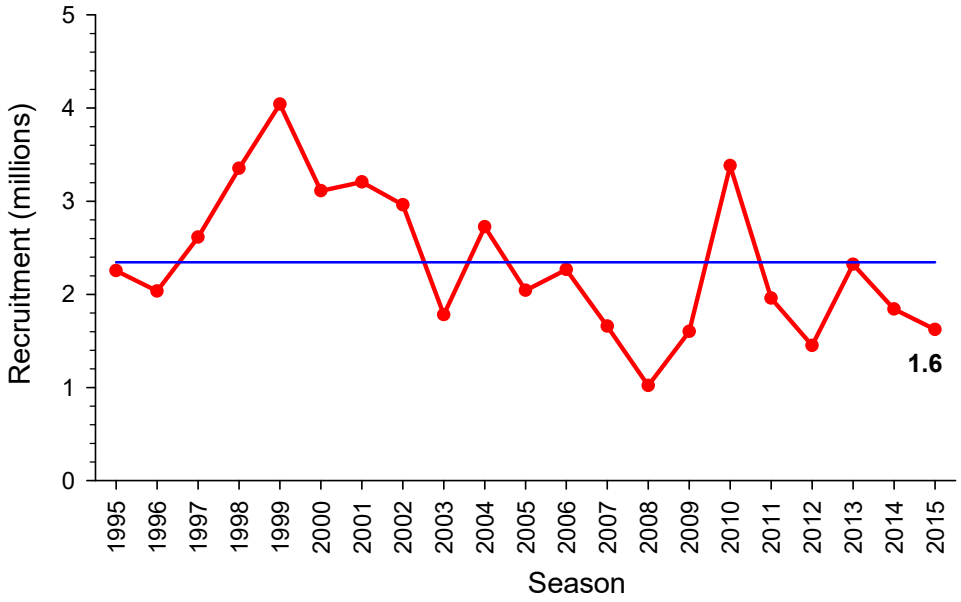

Figure 23 Estimates of recruitment for the SZRLF as obtained from the qR fishery model. Blue line represents long-term average.

5 BIOLOGICAL PERFORMANCE INDICATORS

5.1 Reference Points

The harvest strategy in the SZRLF management plan (PIRSA, 2013) details limit reference points (LRPs) for the primary biological performance indicator of CPUE and a trigger reference point (TRP) for the secondary biological performance indicator of PRI. In 2015, this strategy was amended with a number of changes implemented in relation to TACC levels at specific levels of CPUE (Table 2). This included a TACC cap of 1245.7 t for catch rates above 0.8 kg/potlift in both the 2014/15 and 2015/16 seasons and an upper LRP of 0.60 kg/potlift.

Table 2 TACC levels at various catch per unit effort (CPUE) based on the amended harvest strategy for the SZRLF.

CPUE (kg/potlift)	TACCs (tonnes)	
	2014/15 & 2015/16	2016/17, 2017/18 & 2018/19
>1.3	1245.7	1494.8
1.2-1.3	1245.7	1494.8
1.1-1.2	1245.7	1320.4
1.0-1.1	1245.7	1320.4
0.9-1.0	1245.7	1245.7
0.8-0.9	1245.7	1245.7
0.7-0.8	946.7	946.7
0.6-0.7	896.9	896.9
0.55-0.6	812.2	812.2
0.5-0.55	638.8	638.8
0.45-0.5	480.3	480.3
0.4-0.45	336.8	336.8
0.35-0.4	209.3	209.3
0.3-0.35	96.7	96.7
<0.3	0.0	0.0

5.1.1 Primary Indicator: Catch per unit effort (CPUE)

In 2015, the CPUE was 1.02 kg/potlift, which was above the upper LRP.

5.1.2 Secondary Indicator: Pre-recruit index (PRI)

The secondary indicator of fishery performance is PRI, derived from logbook data (November to March inclusive), with a TRP of 1.3 undersized/potlift (Figure 24). In 2015, the PRI was 0.74 undersized/potlift which is below the TRP. The TRP has been breached in eight of the last nine seasons. The harvest strategy decision rules require that PRI is above the TRP to consider a TACC increase from one year to the next.

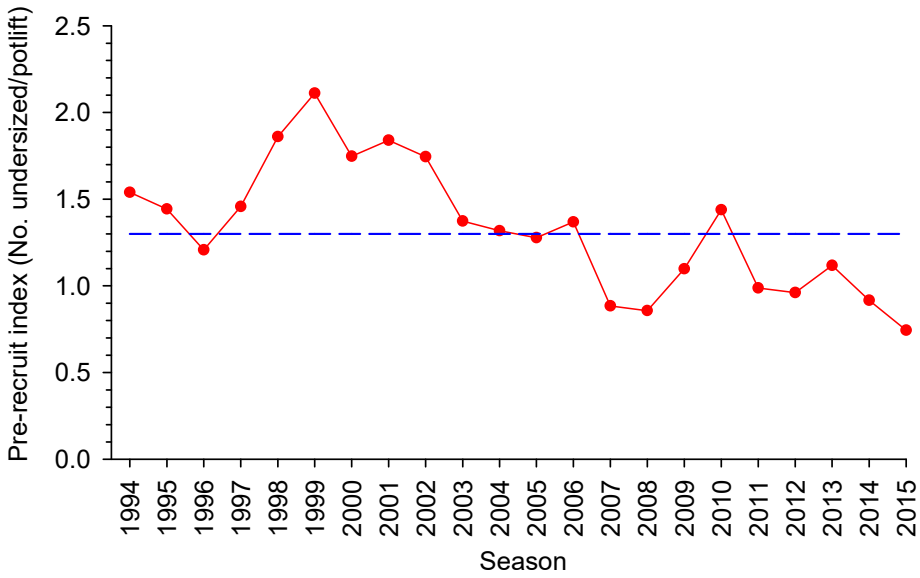

Figure 24 Inter-annual trends in pre-recruit index (PRI) in the SZRLF from 1994 to 2015 based on logbook data. Dashed line represents trigger reference point (1.30 undersized/potlift).

5.2 Implications for management

The harvest strategy decision rules indicate that the TACC be retained at 1,245.7 t for the 2016/17 season.

6 SUMMARY

In 2015, the SZRLF TACC was fully taken for the sixth consecutive season. Over the last six seasons, fishery status has improved with CPUE increasing from 0.60 to 1.02 kg/potlift. Current CPUE is at the long-term average and effort levels are among the lowest in the history of the fishery.

Despite recent increases in CPUE, two sources of information confirm that conservative TACCs are warranted under existing harvest strategies. In 2015, the pre-recruit index of 0.74 undersized/potlift remained below the TRP and was the lowest on record. In addition, four of the last six settlements between 2010 and 2015 have been below the long-term average.

In summary, despite current levels of recruitment, recent management decisions have prevented fishery declines. Specifically; (i) the TACC has constrained catch since 2010; (ii) both catch and effort are currently at, or among, historically low levels; (iii) biomass levels are stable and (iv) the CPUE in 2015 was above the LRP. As a result, based on a weight-of-evidence approach, the SZRLF is classified as "**sustainable**".

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