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Northern Zone Rock Lobster (*Jasus edwardsii*) Fishery Status Report 2016/17

A. Linnane, R. McGarvey, J. Feenstra and D. Graske

SARDI Publication No. F2007/000714-11
SARDI Research Report Series No. 968

SARDI Aquatic Sciences
PO Box 120 Henley Beach SA 5022

November 2017

Status Report to PIRSA Fisheries and Aquaculture

PREMIUM FOOD AND WINE FROM OUR CLEAN ENVIRONMENT

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EXECUTIVE SUMMARY

In 2016 (i.e. 1 November 2016 to 31 October 2017), the total allowable commercial catch (TACC) in South Australia's Northern Zone Rock Lobster Fishery (NZRLF) was 360 t. The total reported catch from logbook data (November-May being the period for which the validated logbook data were available at the time of writing this report) was 302.71 t (84% of the TACC). Effort in 2016 was 400,576 potlifts, reflecting a 39% increase from 2011 (287,480 potlifts).

In 2016, catch per unit effort (CPUE; November-April) was 0.77 kg/potlift which above the Trigger Reference Point (TRP) of 0.70 kg/potlift. CPUE has decreased by 29% over the last five seasons with declines observed across broad temporal and spatial scales.

Over the last five seasons, biomass estimates have declined to 1,872 t, the third lowest on record. Current estimates remain below the long-term average for the fishery (approximately 3,000 t) and reflect increasing exploitation rate over the same period. In 2016, the exploitation rate was 17%.

In 2016, the pre-recruit index (PRI), based on catch sampling data (November-March), was 0.46 undersized/potlift which is above the Limit Reference Point (LRP) of 0.30 undersized/potlift. Two of the last four annual estimates of puerulus settlement between 2013 and 2016 were above the long-term average. Using a four-year period from settlement to recruitment to the fishable biomass, this indicates that higher than average recruitment could be expected in both 2017 and 2020.

Based on current CPUE and PRI levels, the harvest strategy decision rules indicated that the TACC should be reduced to 265 t (215 t inner sub-region and 50 t outer sub-region) for the 2017/18 season.

In summary, trends in key indicators suggest that the status of the fishery has declined in recent seasons. Specifically; (i) effort levels have increased by 39% since 2011; (ii) catch rates have declined by 29% over the same period; (iii) declines in CPUE are consistent across broad temporal and spatial scales; and (iv) biomass levels are now close to historically low levels reflecting recent increases in exploitation rates.

As a result, based on a weight-of-evidence approach, the NZRLF is classified as "**transitional-depleting**". This means that current fishing pressure is too high and moving the stock in the direction of being recruitment overfished.

Table 1 Key statistics for the NZRLF

Statistic	2016/17	2015/16
TACC	360 t	360 t
Total commercial catch (Nov-May)	302.7	331.7 t
Total effort (Nov-May)	400,576 potlifts	408,090 potlifts
Commercial CPUE (Nov-Apr)	0.77 kg/potlift	0.83 kg/potlift
Pre-recruit index (Nov-Mar)	0.46 undersized/potlift	0.36 undersized/potlift
Biomass estimate	1,872 t	2,073 t
Exploitation rate	17%	16%
Status	**Transitional-depleting**	**Sustainable**

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

1 INTRODUCTION

This fishery status report updates the 2015/16 stock assessment report for the Northern Zone Rock Lobster Fishery (NZRLF) (Linnane et al. 2017) 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 NZRLF and assess the current status of the resource in relation to the performance indicators provided in the management plan (PIRSA 2014) for the fishery.

As of the 2015 season, fishing in the NZRLF can be undertaken over the 12-month period from 1 November to 31 October of the following year. This status report presents data from 1 November 2016 to 31 May 2017 which is the agreed assessment period for the total allowable commercial catch (TACC) setting. A comprehensive assessment that includes data from all fishing months will be provided in the 2016/17 stock assessment report which is due in July 2018.

2 METHODS

Information on data sources presented in this report are described in Linnane et al. (2017). In brief, the catch and effort data presented are obtained from a mandatory daily logbook program administered by SARDI Aquatic Sciences.

Data from 1 November to 30 April are used to estimate the primary biological performance indicator of catch per unit effort (CPUE). Data from 1 November to 31 March are used to estimate the secondary performance indicator of pre-recruit index (PRI) and are obtained from a voluntary catch sampling program where the escape gaps on all commercial pots are closed. As all lobsters are measured as part of this program, length frequency data are also obtained from catch sampling.

A detailed description of the qR fishery model is provided in McGarvey and Matthews (2001) and Linnane et al. (2017). All model outputs are based on data from 1 June to 31 May. Puerulus sampling is undertaken at four sites in the NZRLF and based on data from 1 July to 31 October.

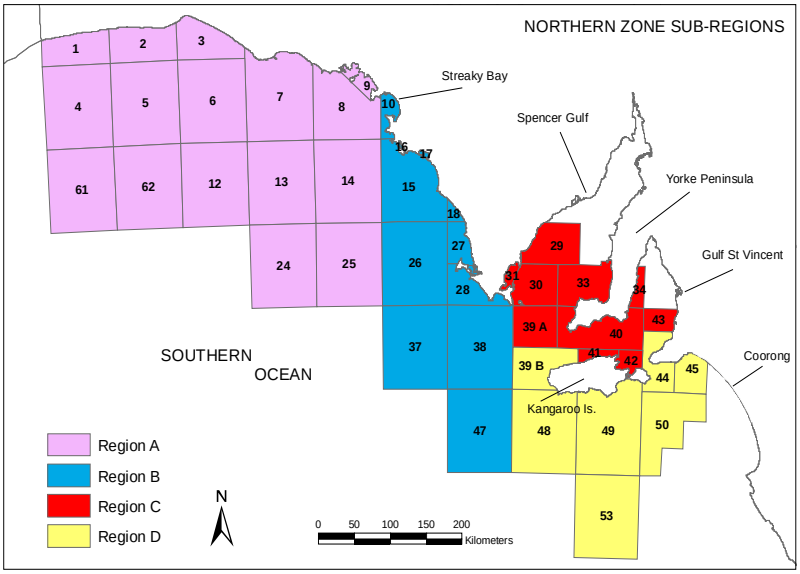

Figure 1 Northern Zone rock lobster fishery Marine Fishing Areas (MFAs) and associated regions.

3 RESULTS

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

3.1.1 Zonal catch and effort

In 2016 (i.e. the 2016/17 season), the TACC in the NZRLF was 360 t which could be caught over the 12-month season from 1 November 2016 to 31 October 2017. The total reported commercial catch from 1 November 2016 to 31 May 2017 was 302.71 t (84% of the TACC with 5 months remaining) (Figure 2).

Effort within the fishery decreased considerably in 2009 when the TACC was reduced to 310 t. In 2016, it was 400,576 potlifts, reflecting a 39% increase from 2011 (287,480 potlifts).

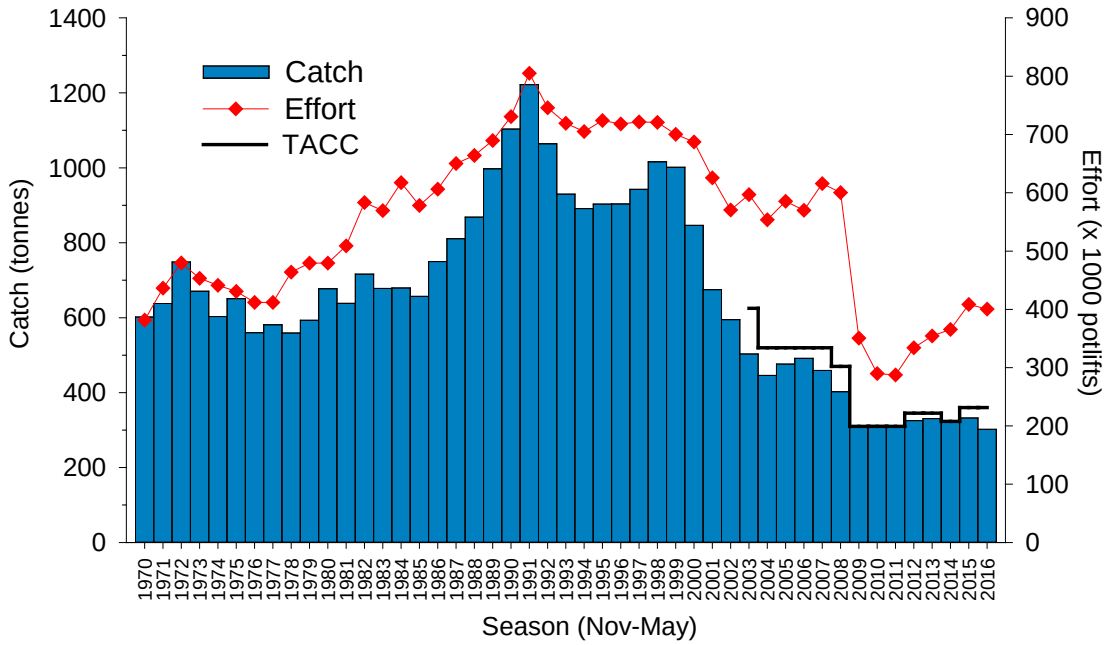

Figure 2 Inter-annual trends in catch and effort in the NZRLF from 1970 to 2016.

3.1.2 Within-season trends

In 2016, 239 t (79% of total catch) was taken from December through to March (Figure 3). The lowest catch was taken in November (12.5 t) while the highest was landed in January (73 t). Trends in monthly effort generally reflected those of catch.

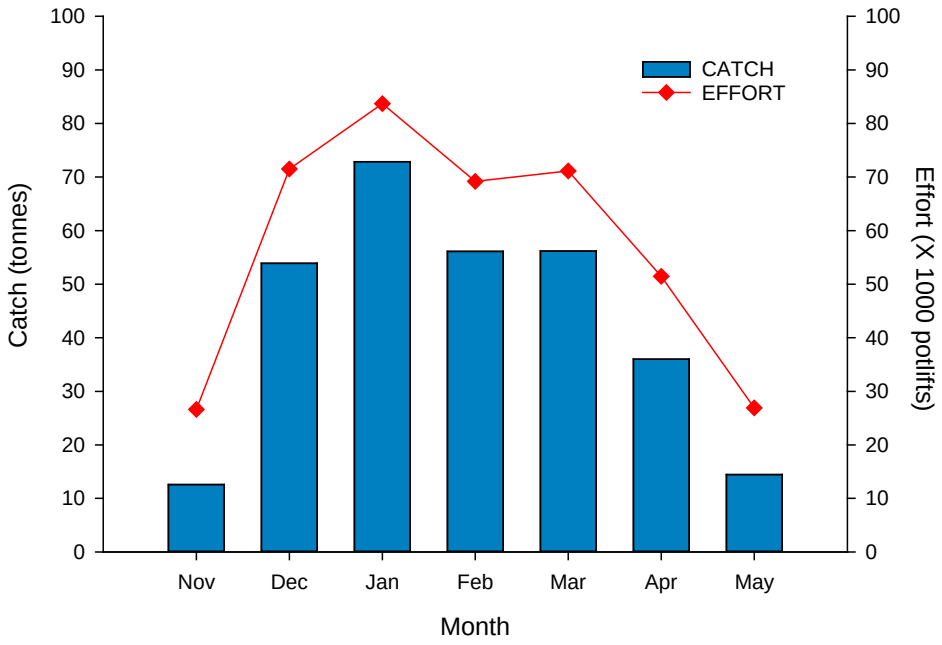

Figure 3 Within-season trends in catch and effort in the NZRLF for the 2016 season.

3.1.3 Regional catch and effort

In 2016, 36% and 42% of the 302.71 t total catch was harvested from Regions B and D, respectively, with 16% taken from Region C (Figure 4). Six percent of the catch was taken in Region A (see Figure 1 for location of regions).

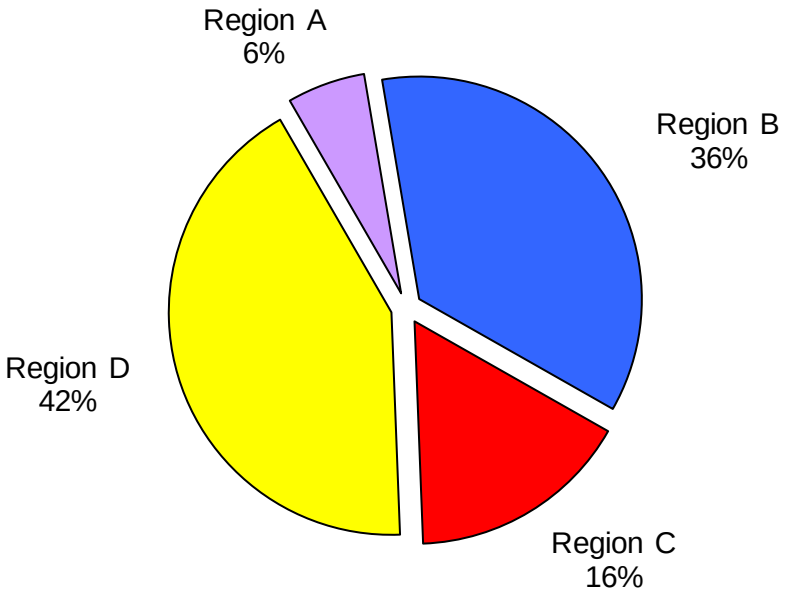

Figure 4 Percentage of total catch from Regions A-D in the NZRLF in 2016 as reported from November to May (see Figure 1).

In 2016, the catch estimates (November to May) were 17 t, 109 t, 49 t and 128 t in Regions A, B, C and D, respectively (Figure 5). With the exception of Region A, annual potlifts have generally increased over the last five to six seasons in the primary regions. In particular, within Region D, effort has increased from 131,929 potlifts in 2009 to 170,316 potlifts in 2016.

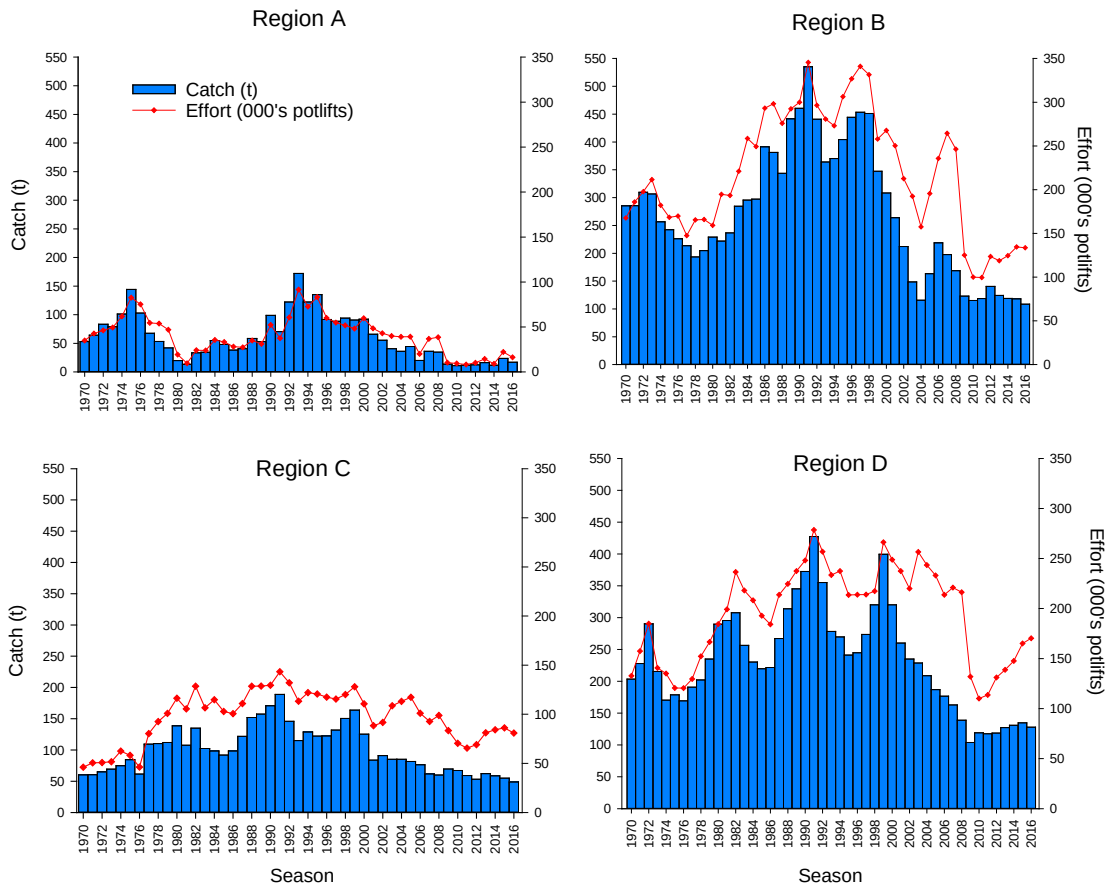

Figure 5 Inter-annual trends in catch and effort (November to May) in the four Regions of the NZRLF between 1970 and 2016 (refer to Figure 1).

3.1.4 Zonal CPUE

With the exception of marginal increases in 2005 and 2006, CPUE (November-April) in the NZRLF decreased from 1999 (1.49 kg/potlift) to 2008 (0.67 kg/potlift; the lowest on record) (Figure 6). Over the next two seasons, CPUE increased and in 2010 and 2011 was 1.08 kg/potlift, which was the highest since 2000 (1.23 kg/potlift). However, over the last five seasons, CPUE has again decreased and in 2016 was 0.77 kg/potlift, reflecting a 29% decline since 2011 and third lowest estimate on record.

In the NZRLF, the period between settlement and recruitment to the fishable biomass is approximately four years. Therefore, the recent declines in CPUE are likely to reflect lower than average levels of puerulus settlement observed from 2007 to 2012 (Figure 11).

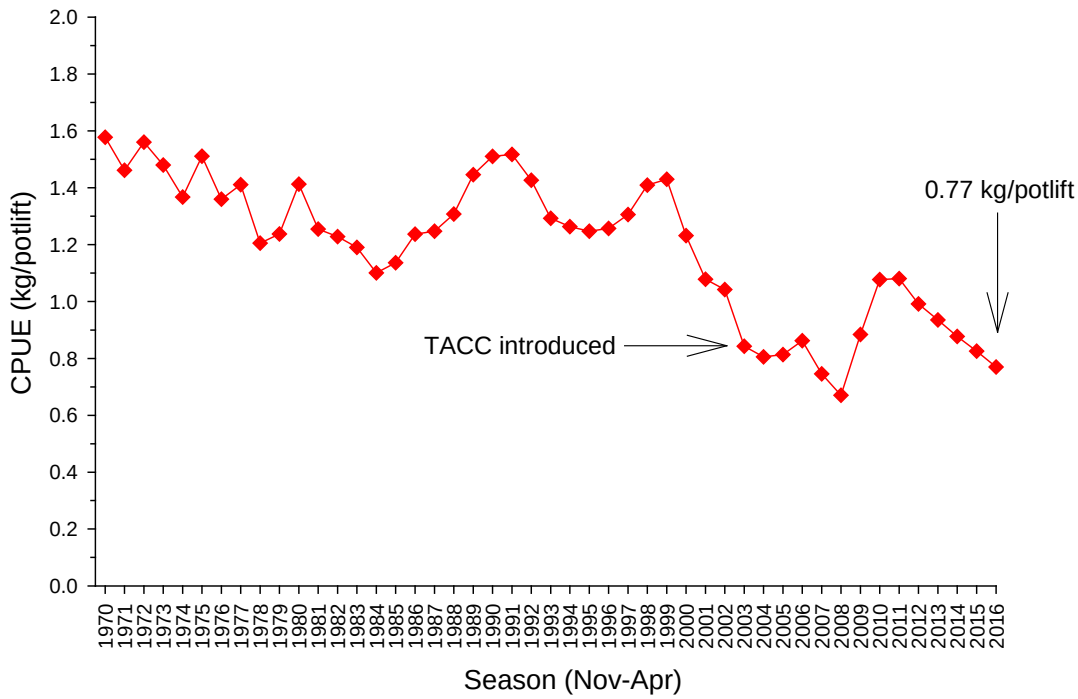

Figure 6 Inter-annual trends in zonal CPUE (November to April) in the NZRLF between 1970 and 2016.

3.1.5 Within-season trends in CPUE

The reduction in CPUE over the last five seasons has been largely consistent across all months of the fishery (Figure 7). In particular, consecutive declines were observed across the high catch months from December through to March (see Figure 3). In 2016, CPUE was highest in January at 0.87 kg/potlift and lowest in November at 0.47 kg/potlift.

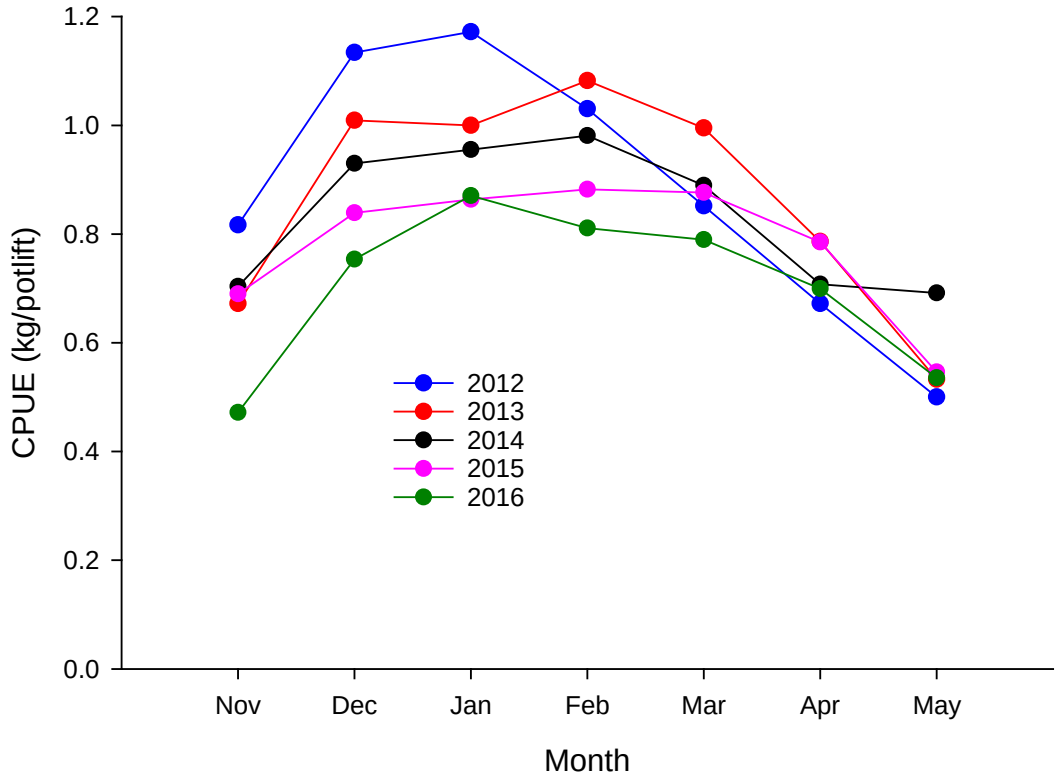

Figure 7 Within-season trends in CPUE in the NZRLF from 2012 to 2016 seasons.

3.1.6 Regional CPUE

Regional trends in CPUE (November-April) (Figure 8) broadly reflect the zonal pattern (Figure 6). CPUE generally decreased in each of the four major regions from 1999 to 2010 before increasing over the next two seasons. However, with the exception of Region A, over the last five to six seasons, CPUE has decreased in all areas. In 2016, estimates in Regions A, B, C and D were 1.13, 0.83, 0.62 and 0.76 kg/potlift, respectively. These estimates are at, or close to, historical lows for the time series.

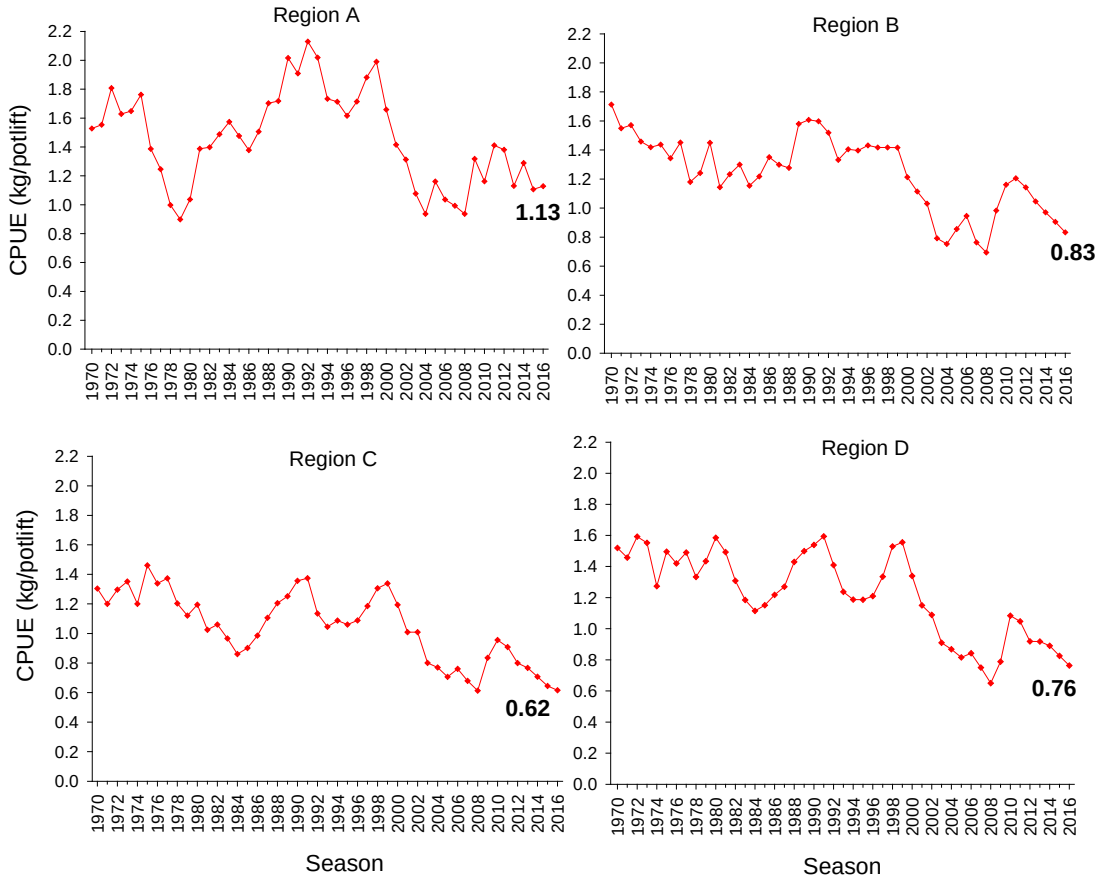

Figure 8 Inter-annual trends in regional CPUE (November to April) in the NZRLF between 1970 and 2016.

3.1.7 Annual mean weight

Fluctuations in the mean weight of rock lobsters caught in each fishing season likely reflects inter-annual variations in the number of lobsters recruiting to legal size (Figure 9). Over the last six seasons, the mean weight of lobsters has generally increased reflecting declines in recruitment which has ultimately translated into decreases in CPUE both zonally and regionally. In 2016, the mean weight was 1.17 kg, which was among the highest on record.

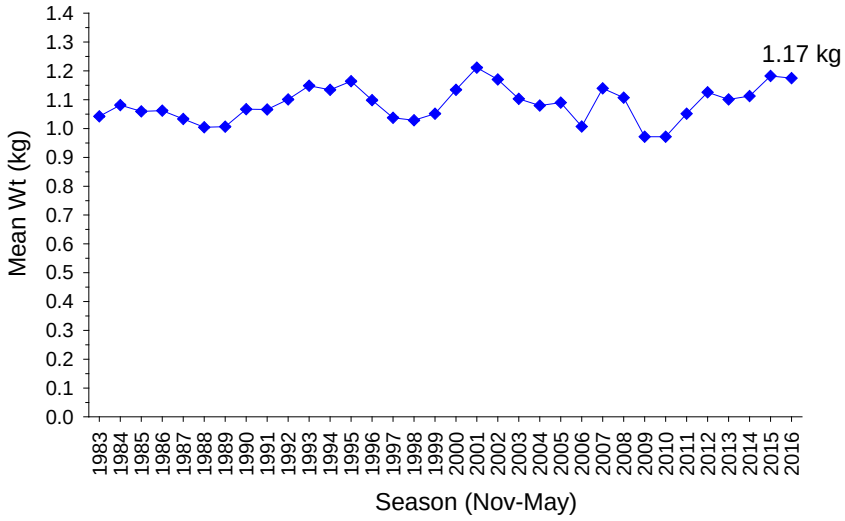

Figure 9 Inter-annual trends in mean lobster weight in the NZRLF (November to May) from 1983 to 2016.

3.1.8 Average number of days fished

The average number of days fished/licence decreased from 184 days in 1997 to 144 days in 2002 (Figure 10). This decrease reflects direct limitations on the number of fishable days prior to the introduction of quota in 2003. In the five years following the introduction of quota, the number of days fished remained relatively stable between 150 and 160 days. In 2009, the TACC was reduced from 470 to 310 t and the average number of days fished decreased to 84 days in 2010. Over the last six seasons, the estimate has increased to 133 days in 2016. The recent increase is likely to relate, in part, to increases in TACC from 310 t to 345 t in 2012, and from 323.2 to 360 t in 2015 (Figure 2).

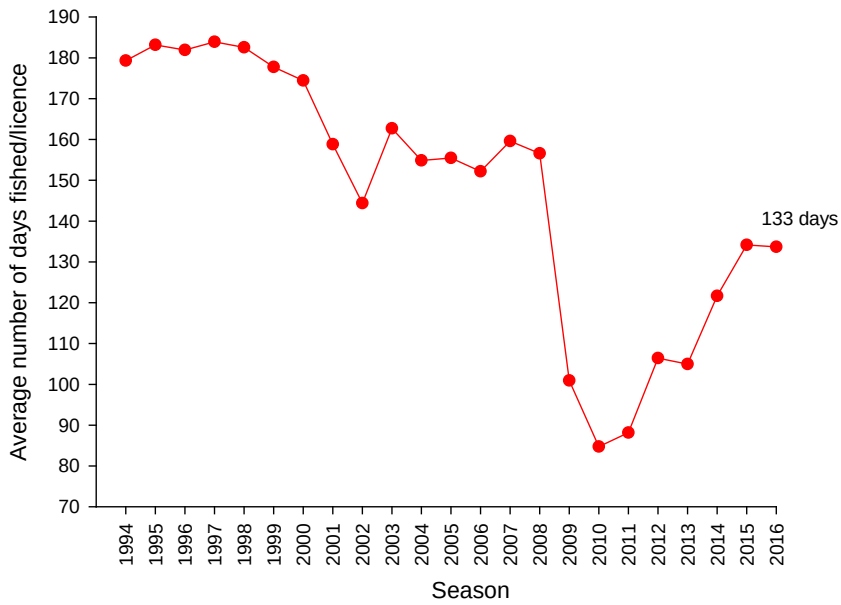

Figure 10 Average numbers of days fished per licence from 1994 to 2016 in the NZRLF.

3.2 Puerulus settlement index (PSI)

Annual estimates of puerulus settlement index (PSI) in the NZRLF have been highly variable (Figure 11). PSIs were high in 2002, 2005 and 2006, but from 2007 to 2015, with the exception of 2013, annual settlement has been below the long-term average (0.37 puerulus/collector). In 2016, the PSI was 0.44 puerulus/collector which is above both mean and median estimates. In the NZRLF, the estimated period between settlement and recruitment to the fishery is four years. As a result, higher than average recruitment could be expected in both 2017 and 2020.

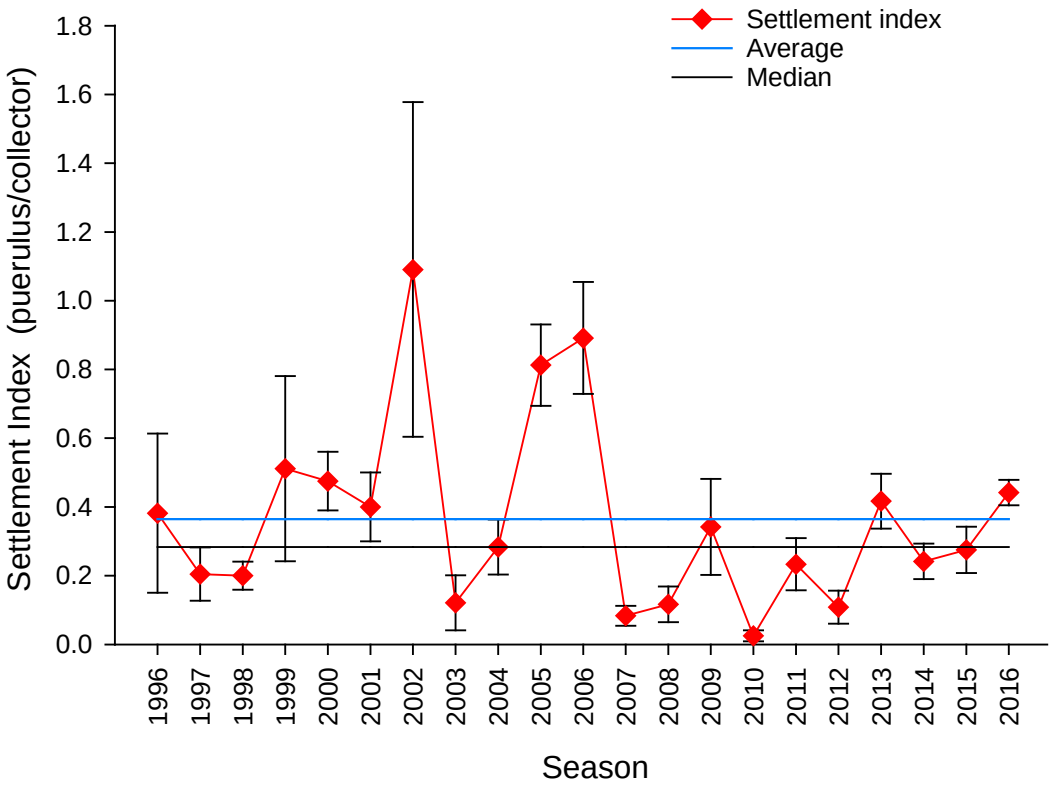

Figure 11 Puerulus settlement index (PSI) (mean ±SE) in the NZRLF from 1996 to 2016.

3.3 Pre-recruit index (PRI)

3.3.1 Zonal pre-recruit index

The PRI (November to March) based on logbook data is under-estimated due to the mandatory introduction of escape gaps in 2003 (Figure 12). As a result, PRI in the NZRLF is now estimated from the catch sampling program where fishers are allowed to close the escape gaps in up to three pots. In addition, when an observer is on-board the vessel, all escape gaps can be closed.

In 2016 (November to March), catch sampling PRI was 0.46 undersized/potlift, reflecting an increase of 71% since 2014 (0.21 undersized/potlift). In the NZRLF, the time taken for pre-recruits to enter into the fishable biomass is estimated to be approximately one year.

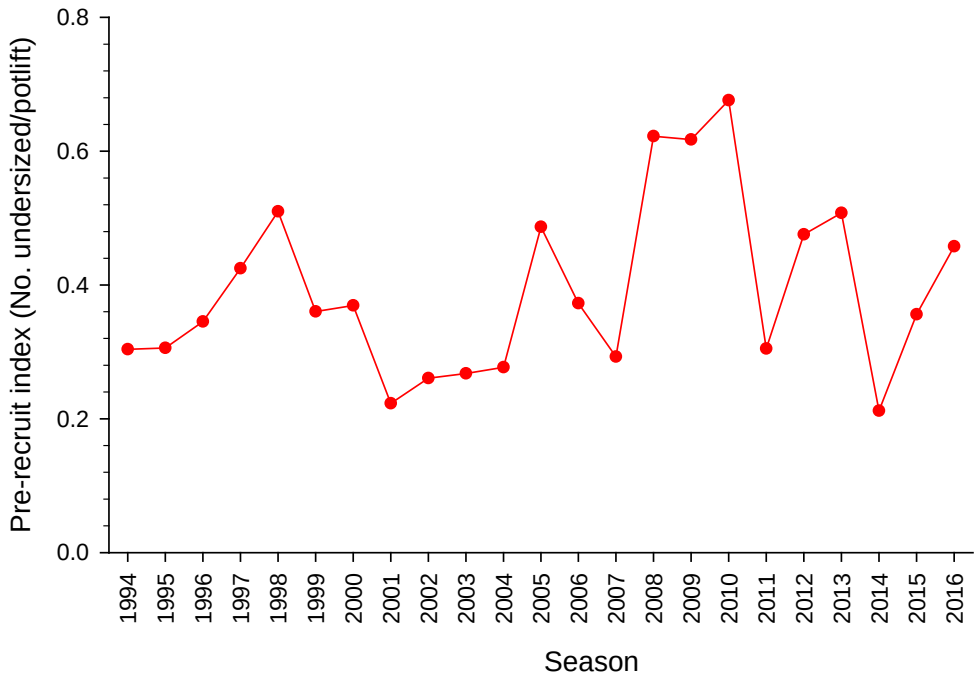

Figure 12 Voluntary catch sampling derived pre-recruit index (PRI) from 1994 to 2016 (November-March inclusive).

3.3.2 Regional pre-recruit index

The zonal increase in PRI in 2016 reflected increases in all of the major regions in the fishery with the exception of Region A. In 2016, regional PRI estimates (November to March) were 0.00, 0.26, 0.48 and 0.65 undersized/potlift in Regions A, B, C and D, respectively (Figure 13).

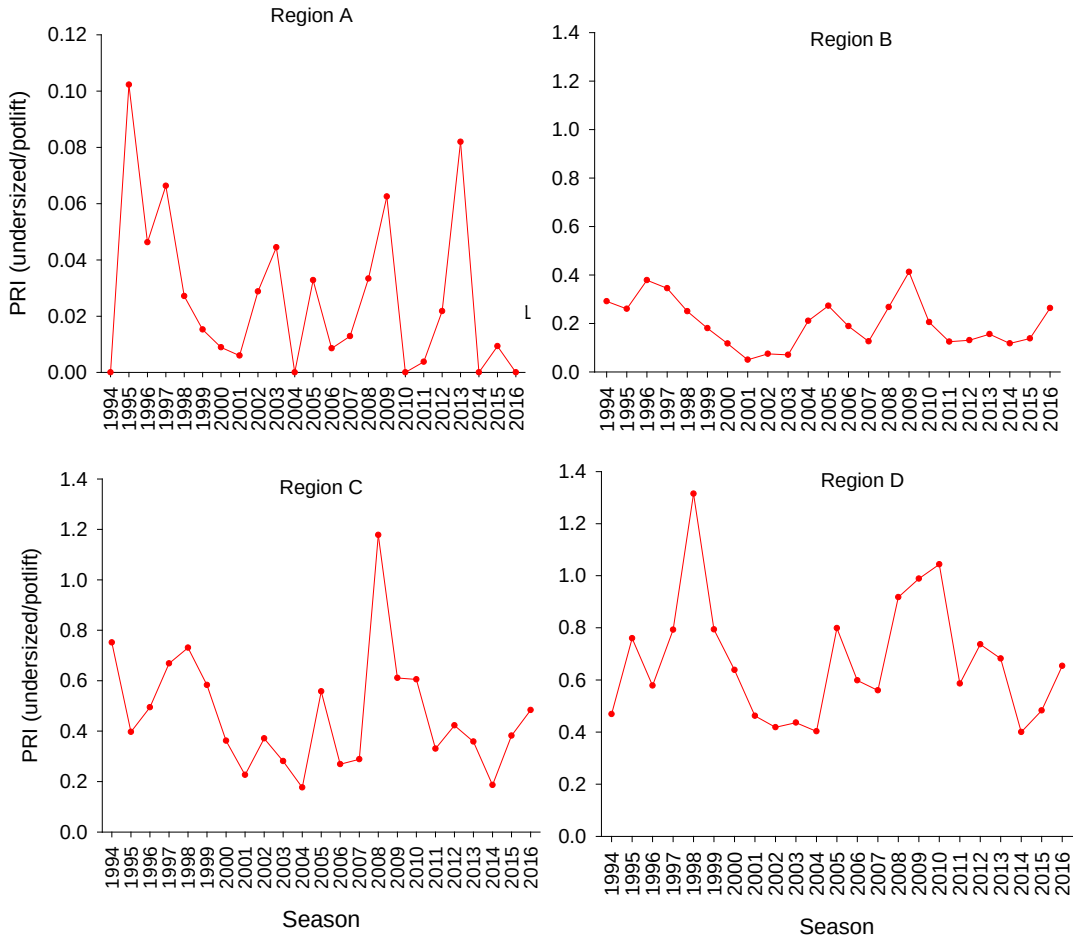

Figure 13 Inter-annual trends in regional PRI in the NZRLF from 1994 to 2016 based on voluntary catch sampling data (November to March). Note that the scale of y-axis in Region A differs from other regions.

3.4 Length frequency

In 2016, 54% of all lobsters measured as part of the catch sampling program were within the 105 to 150 mm carapace length (CL) size range (Figure 14). Approximately 37% of lobsters in 2016 were below the minimum legal size (MLS; 105 mm CL), compared to 27% in 2015, reflecting the increase in PRI over the same period.

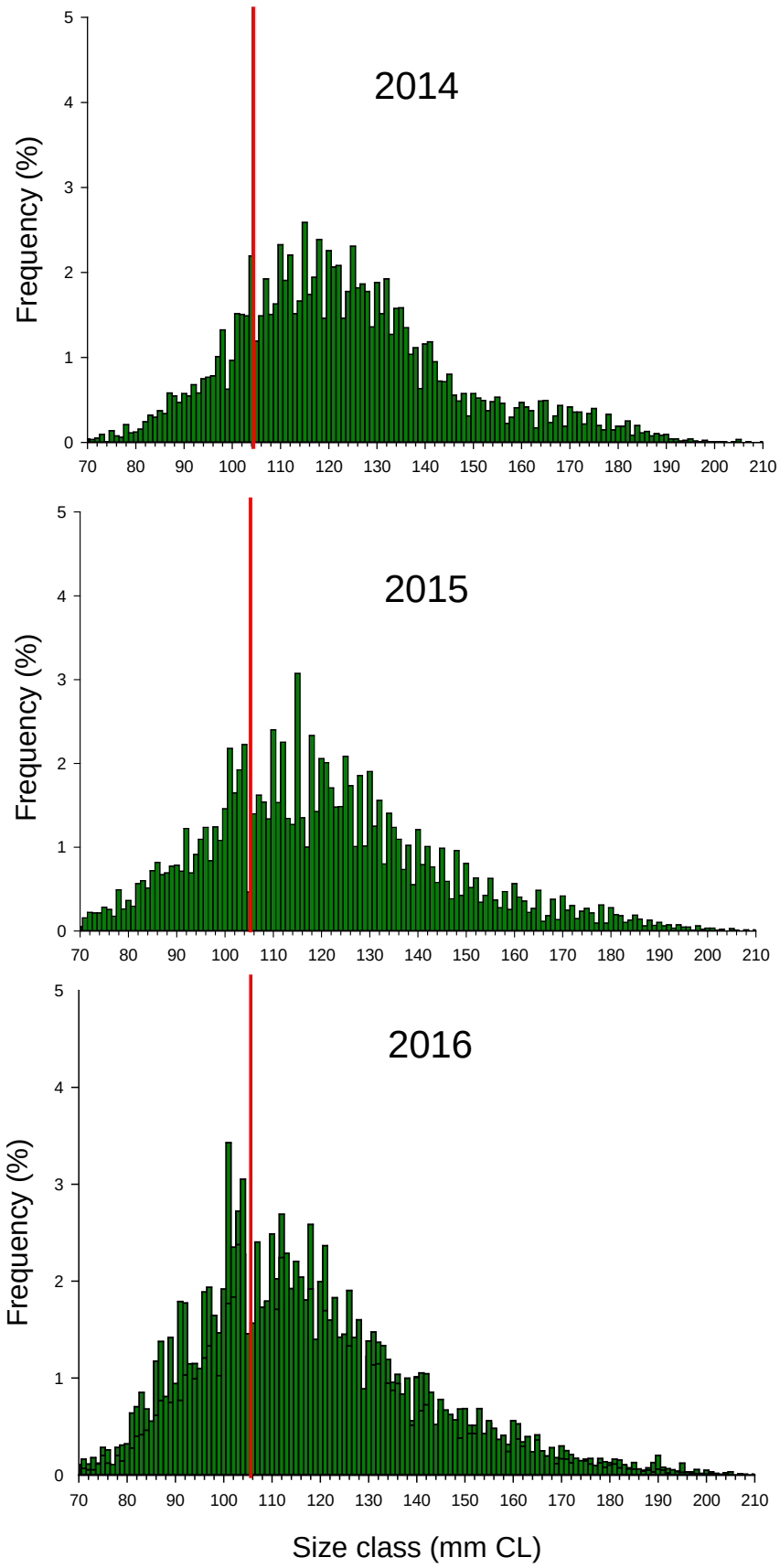

Figure 14 Length frequency data of male and female lobsters (combined) sampled during the voluntary catch sampling program over the last three seasons. Red line represents minimum legal size (MLS) at 105 mm CL.

3.5 qR Model outputs

3.5.1 Biomass

Estimates from the qR stock assessment model indicate a general decline in lobster biomass in the NZRLF from the late 1980s to 2008 (Figure 15). Over the next two seasons biomass increased and remained relatively stable from 2010 to 2013 before gradually decreasing to 1,872 t in 2016, the third lowest on record. Current estimates remain below the long-term average for the fishery (approximately 3,000 t).

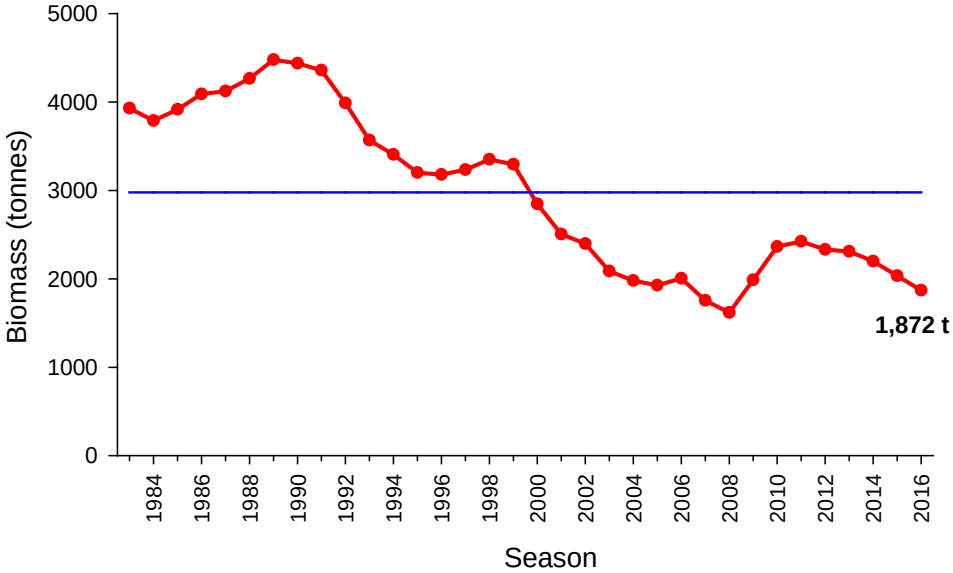

Figure 15 Estimates of biomass for the NZRLF as obtained from the qR fishery model. Blue line represents long-term average.

3.5.2 Egg production rate

Due to decreasing biomass, egg production in the NZRLF has also decreased since the 1980s (Figure 16). In 2016, total egg production was estimated to be 196 billion eggs, reflecting declines over the last five seasons and below the long-term average for the fishery (352 billion).

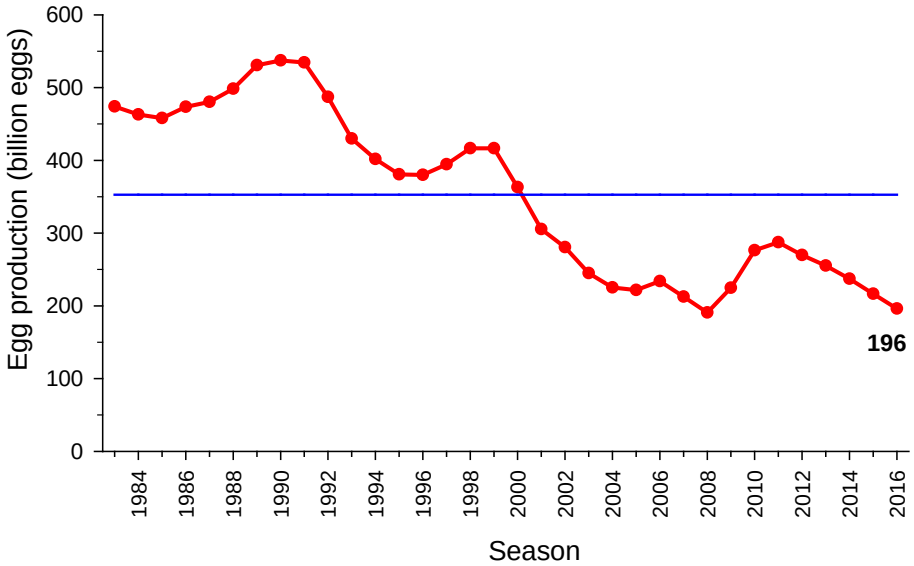

Figure 16 Estimates of egg production for the NZRLF as obtained from the qR fishery model. Blue line represents long-term average.

3.5.3 Percentage of virgin egg production

In 2016, egg production in the NZRLF equated to 21% of virgin egg production (Figure 17).

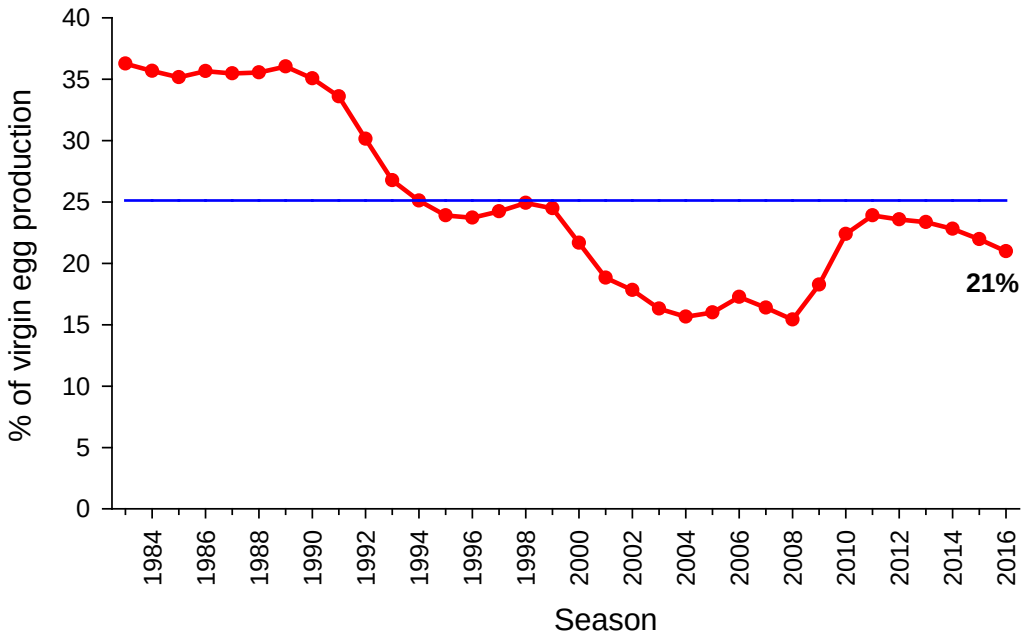

Figure 17 Estimates of percentage virgin egg production for the NZRLF as obtained from the qR fishery model. Blue line represents long-term average.

3.5.4 Exploitation rate

With the decrease in TACC to 310 t in 2009 (see Figure 1), the exploitation rate was reduced considerably (Figure 18). Over the last five seasons exploitation rate has increased to 17% but remains below the long-term average of 22%.

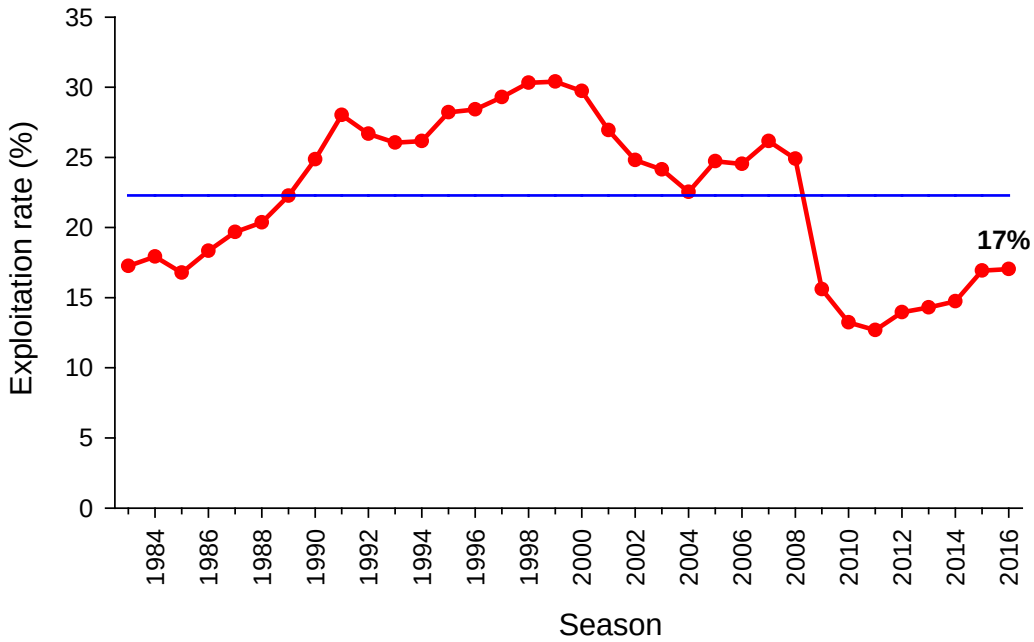

Figure 18 Estimates of exploitation rate in the NZRLF as obtained from the qR fishery model. Blue line represents long-term average.

3.5.5 Recruitment

Model estimated recruitment in the NZRLF has been highly variable (Figure 19). Over the last five seasons recruitment levels have been low and in 2016 was estimated at 0.28 million recruits.

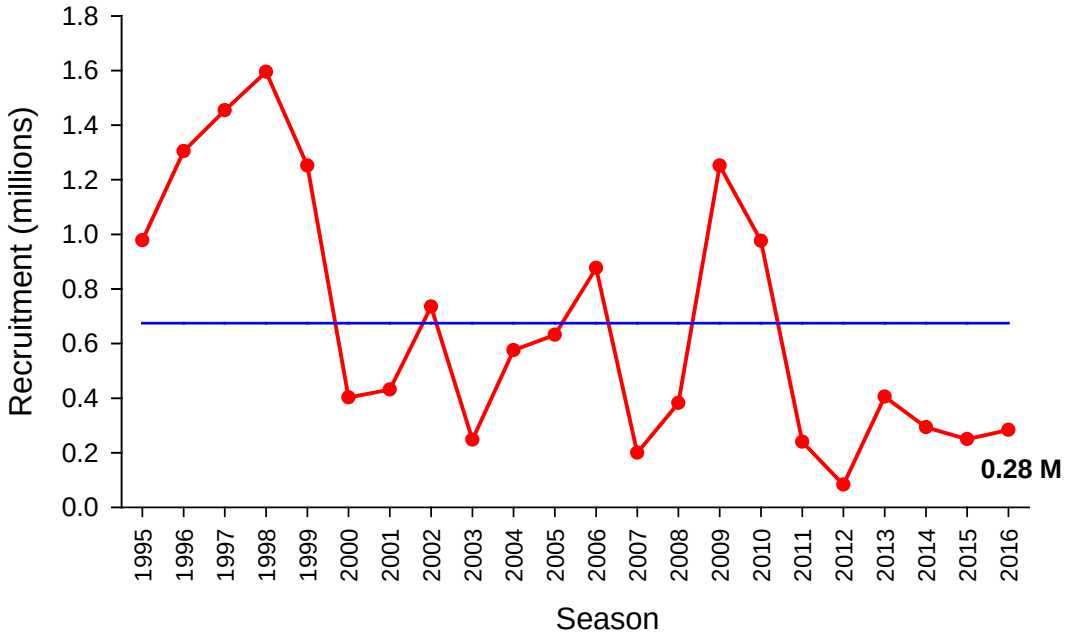

Figure 19 Estimates of recruitment as obtained from the qR fishery model. Blue line represents long-term average.

3.6 Biological performance indicators

The NZRLF harvest strategy describes multiple performance indicators to monitor the performance of the fishery (PIRSA 2014). Broadly, the harvest strategy aims to target a sustainable exploitation rate based on historical fishery performance based on two fishery-dependent indicators.

The primary indicator is commercial logbook CPUE (kg of legal sized lobster/potlift) based on data from November to April, inclusive. The secondary indicator is commercial catch sampling PRI (number of undersized lobsters/potlift) based on data from November to March, inclusive.

Spatial management of the fishery was introduced in 2015 based on inner and outer sub-regions (Figure 20). Separate TACCs are set in each sub-region, levels of which were informed from the outcomes of a dedicated Fisheries Research and Development Corporation (FRDC) project which investigated spatial and temporal management options for the fishery (Linnane et al. 2016).

CPUE bands, which equate to target exploitation rates, are specified in Table 2. To set a TACC for the upcoming season, the decision rules described in the harvest strategy are applied to the CPUE from the previous season. A Trigger Reference Point (TRP) of 0.70 kg/plotift is used, 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 0.30 undersized/potlift.

In 2016, the CPUE was 0.77 kg/potlift which is above the TRP. The PRI was 0.46 undersized/potlift which was above the LRP. Collectively, these indicate a 265 t TACC (215 t in the inner sub-region and 50 t in the outer sub-region) for the 2017/18 season.

Table 2 TACC levels at various catch per unit effort (CPUE) rates for both the inner and outer sub-regions of the NZRLF. *****When a TACC is recommended based on a CPUE range of 0.8-1.0kg/potlift, if CPUE is less than 0.9kg/potlift for two consecutive years, the TACC will drop to that corresponding to the next lowest CPUE range level (0.7-0.8 kg/potlift).

CPUE (kg/potlift)	Inner TACC	Outer TACC	Total TACC
<0.5	0t	0t	0t
0.5-0.55	43t	13t	56t
0.55-0.6	93t	27t	120t
0.6-0.65	150t	43t	193t
0.65-0.7	170t	46t	216t
0.7-0.8	215t	50t	265t
0.8-1.0*	300t	60t	360t
>1.0	300t	80t	380t

4 SUMMARY

Despite historically low levels of catch in the NZRLF, trends in key indicators suggest that the status of the fishery has continued to decline in recent seasons. Specifically; (i) effort levels have increased by 39% since 2011 and (ii) catch rates have declined by 29% over the same period. In 2016, the CPUE estimate was the third lowest on record and close to the TRP; (iii) declines in CPUE are consistent across broad temporal and spatial scales; (iv) biomass levels are now close to historically low levels reflecting recent increases in exploitation rates.

As a result, based on a weight-of-evidence approach, the NZRLF is classified as "**transitional-depleting**". This means that current fishing pressure is too high and moving the stock in the direction of being recruitment overfished.

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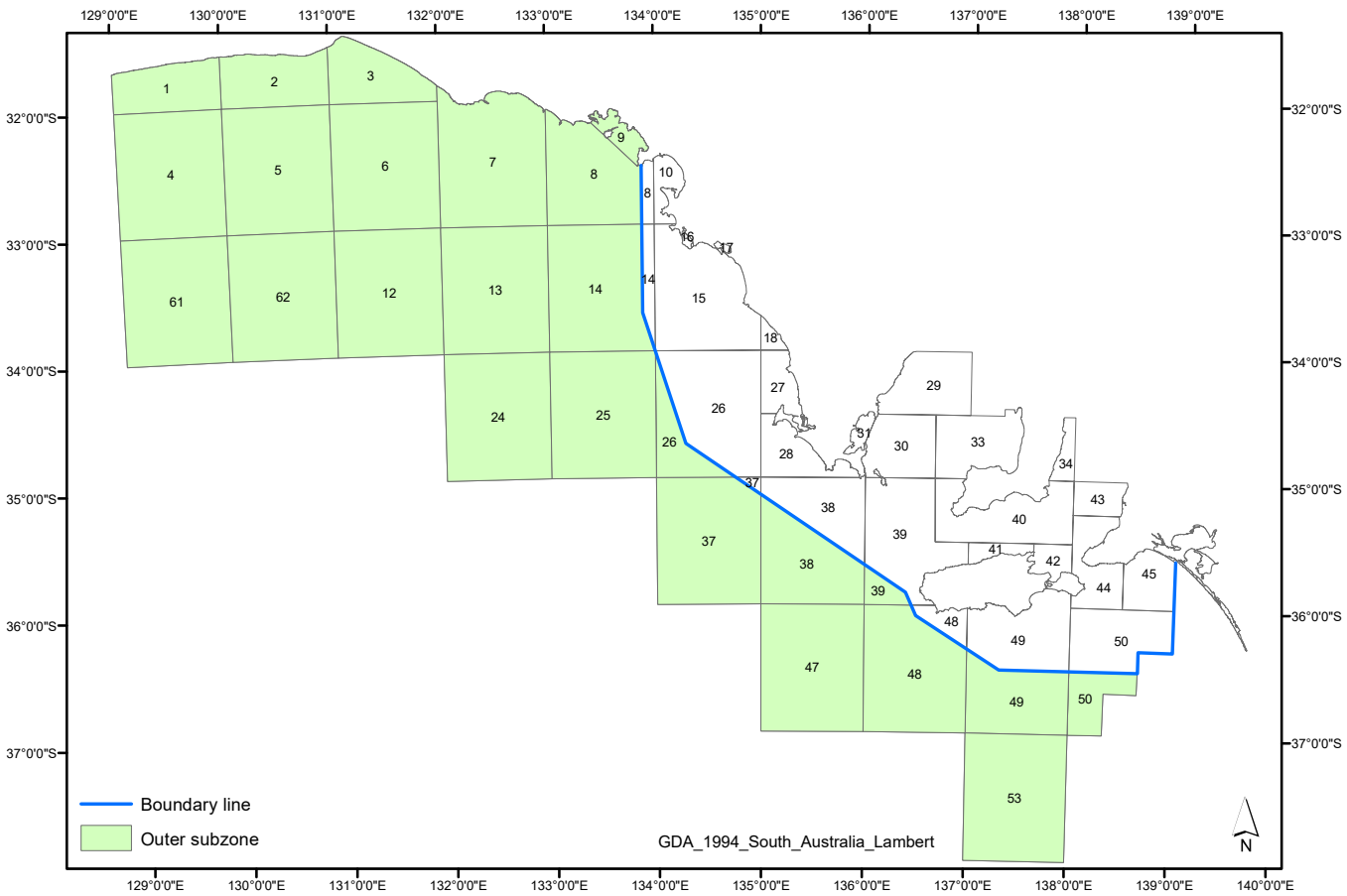

Figure 20 Northern Zone sub-regions and Marine Fishing Areas in the South Australian Rock Lobster Fishery.