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Status of the Southern Zone Blacklip (*Haliotis rubra*) and Greenlip (*H. laevigata*) Abalone Fisheries in 2016/17

G. Ferguson, S. Mayfield and A. Hogg

SARDI Publication No. F2014/000359-3
SARDI Research Report Series No. 985

SARDI Aquatics Sciences
PO Box 120 Henley Beach SA 5022

July 2018

Report for PIRSA Fisheries and Aquaculture

SOUTH AUSTRALIA

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This publication may be cited as:
Ferguson, G., Mayfield, S., and Hogg, A. (2018). Status of the Southern Zone Blacklip (*Haliotis rubra*) and Greenlip (*H. laevigata*) Abalone Fisheries in 2016/17. Report for PIRSA Fisheries and Aquaculture. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2014/000359-3. SARDI Research Report Series No. 985. 22pp.

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SARDI Publication No. F2014/000359-3
SARDI Research Report Series No. 985

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Date:	4 July 2018
Distribution:	PIRSA Fisheries and Aquaculture, SAASC Library, Parliamentary Library, State Library and National Library
Circulation:	Public Domain

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ACKNOWLEDGEMENTS

Funds for this research were provided by PIRSA Fisheries and Aquaculture (PIRSA), obtained through licence fees. The South Australian Research and Development Institute (SARDI Aquatic Sciences) provided substantial in-kind support. We thank the Southern Zone licence holders and fishers for providing abalone shells that were used for length measurements and for their contribution to our understanding of the information presented in this report. We are grateful to members of the SARDI abalone research group for essential field support including Brian Foureur, Peter Hawthorne, Kylie Odgers, Owen Burnell, Damian Matthews, and other SARDI divers past and present, for essential field support. We thank Angelo Tsolos and Millie Boyle for statistical support. Drs Paul Burch and Jonathan Carroll provided analytical, statistical and programming support. This report was formally reviewed by Dr Belinda McGrath-Steer (PIRSA – Fisheries and Aquaculture), Drs Adrian Linnane and Craig Noell (SARDI Aquatic Sciences) and Professor Gavin Begg (Research Chief, SARDI Aquatic Sciences). The report was formally approved for release by Associate Professor Qifeng Ye (Science Leader, Inland Waters and Catchment Ecology, SARDI Aquatic Sciences).

EXECUTIVE SUMMARY

This report assesses the status of the *Haliotis rubra* (blacklip abalone) and *H. laevigata* (greenlip abalone) stocks in the Southern Zone (SZ) of the South Australian Abalone Fishery (SAAF) in 2016/17. The assessment is required under the Management Plan for the South Australian Commercial Abalone Fishery (PIRSA 2012). The current harvest strategy does not reflect stock performance, and is currently being reviewed. However, results are reported here as this is a requirement under the Plan. Thus, stock status was determined using the weight-of-evidence analysis under the National Fishery Status Reporting Framework (NFSRF; Stewardson *et al*. 2016) as this was considered a more robust approach to determining status.

The SZ blacklip abalone stock was classified as 'transitional depleting' in 2013/14, 2014/15, and 2015/16 with the harvestable biomass declining under high fishing pressure (Mayfield *et al*. 2015; Ferguson *et al*. 2016; 2017). In 2015/16, the total allowable commercial catch (TACC) for blacklip was reduced to 126 t, which was 17% below the TACC of 151.5 t in 2014/15, with this level maintained in 2016/17.

Determining the stock status for 2016/17 was challenging because the data demonstrate conflicting trends among spatial assessment units (SAUs). This was further complicated by recent changes in the management arrangements, including variable minimum legal lengths (*e.g.* reduced in the Gerloffs Bay SAU from 2016/17), the small size and diver changeover in the SZ abalone fishing fleet, and the potential for prevailing weather conditions to influence fishing behaviour. The declining catch rates from the high importance Gerloffs Bay SAU which have occurred at historically low catches, and recent declining catch rates at Port Macdonnell contrast with the recent increases in catch rates in the high importance Number 2 Rocks SAU. Overall, stable and/or small increases in legal density estimates, combined with catch rates stable at relatively high levels in SAUs where the majority of catch is taken, and for the SZ as a whole, suggest that the declines in harvestable biomass identified in previous assessments (*e.g.* Ferguson *et al*. 2016; 2017) have ceased.

Collectively, the available information suggests that, at the current TACC of 126 t, the decline in SZ blacklip stocks observed from 2010/12 to 2015/16 has been arrested. Given that biomass is at a level sufficient to ensure that, on average, future levels of recruitment are adequate (*i.e.* the stock is not recruitment overfished) and that fishing pressure is adequately controlled (*i.e.* no overfishing), the SZ blacklip fishery in 2016/17, at the current TACC of 126 t, is classified as '**sustainable**'. In contrast, the outcome from application of the harvest strategy (PIRSA 2012), required under the Management Plan, classified the fishery as 'overfished'.

The low catch and limited data on greenlip abalone in the SZ prevents reliable determination of stock status or application of the harvest strategy. Consequently, the greenlip stock status in this zone is classified as '**undefined**'. This was the same classification as in previous years.

Key statistics for the SZ blacklip and greenlip fisheries from 2013/14 to 2016/17 including stock status based on (i) the harvest strategy in the Management Plan (HS) and (ii) weight of evidence and the national fishery stock status reporting framework (NFSRF).

		Blacklip					Greenlip			
Season	No. licences	TACC (t)	Catch (t)	$CPUE_{wp0.95}$ ($kg.hr^{-1}$)	Stock Status		TACC (t)	Catch (t)	CPUE ($kg.hr^{-1}$)	Stock Status
					HS	NFSRF				NFSRF
2013/14	6	151.5	126.0	100.3	Sustainably fished	Transitional depleting	7.2	3.6	NA	Undefined
2014/15	6	151.5	135.0	96.8	Sustainably fished	Transitional depleting	7.2	4.4	NA	Undefined
2015/16	6	126.0	122.6	97.5	Over fished	Transitional depleting	6.0	3.7	NA	Undefined
2016/17	6	126.0	125.9	99.5	Over fished	Sustainable	3.6	3.2	NA	Undefined

Keywords: Blacklip abalone, *Haliotis rubra*, Greenlip abalone, *Haliotis laevigata*, Stock status, Harvest strategy, South Australia.

1. INTRODUCTION

This report assesses the status of the *Haliotis rubra* (blacklip abalone, hereafter referred to as 'blacklip') and *H. laevigata* (greenlip abalone, hereafter referred to as 'greenlip') stock in the Southern Zone (SZ) of the South Australian Abalone Fishery (SAAF) in 2016/17. The Management Plan for the South Australian Commercial Abalone Fishery (PIRSA 2012) specifies annual application of the harvest strategy to determine stock status and review the total allowable commercial catch (TACC). The stock status of blacklip and greenlip in the Southern Zone Abalone Fishery in 2015/16 were provided in the most recent stock assessment report for the fishery (Ferguson *et al.* 2017) and will be updated in future, scheduled, stock assessment (2019) and status (2020) reports. These reports form part of the South Australian Research and Development Institute's (SARDI Aquatic Sciences) ongoing assessment program for this fishery. The current harvest strategy does not reflect stock performance (*e.g.* Mayfield *et al.* 2014, 2015; Stobart *et al.* 2014), and is currently being reviewed. Thus, the stock status for both species was determined using the weight-of-evidence analysis within the National Fishery Status Reporting Framework (NFSRF; Stewardson *et al.* 2016). However, as required under the Management Plan, the outcome from application of the harvest strategy (PIRSA 2012) to blacklip abalone in the SZ is also provided.

2. METHODS

A description of the methods used to apply the harvest strategy and the weight-of-evidence assessment, including an assessment of uncertainty, are described in PIRSA (2012) and Ferguson *et al.* (2017). Briefly, the harvest strategy is species-specific, spatially-explicit and comprises several key components. First, spatial assessment units (SAUs) are ranked (high importance SAUs contribute at least 50% of the ranked, cumulative catch over the most recent 10 years; medium importance SAUs contribute to at least the next 30% (i.e. >50% – 80%) of the ranked, cumulative catch). Second, performance indicators (PIs) are used with a series of reference points to determine the risk that the stocks in each SAU are overfished (Appendix 3). Third, the assigned risks that the stocks are overfished are catch-weighted and summed to determine the status of that stock for each zone. The stock status enables the TACC to be set for two years – concurrent with the biennial assessment program – providing that zonal stock status does not change between years.

The catch per unit effort (CPUE) estimation method for the SAAF was reviewed in 2017. Historically, based on a previous review (Burch *et al*. 2011), CPUE was estimated using the catch-weighted mean of daily CPUE where the percentage of blacklip in the catch for each daily record was used as a weighting factor in calculating the arithmetic mean of daily CPUE. Given the key challenge of allocating effort against each species harvested, and the low proportion of catch and effort records reporting greenlip catches in the SZ it was considered, based on the 2017 review, that using only those records when blacklip comprised greater than 95%, provided a better estimate of relative abundance, compared to the method of Burch *et al*. (2011), which used only those records where blacklip catch comprised >30% of the total daily catch ($CPUE_{0.3}$). Furthermore, (1) the effort term used in the calculation was defined as total daily effort multiplied by the proportion of the target species in the daily catch ($CPUE_{wp95}$), which differs from the previous estimation method ($CPUE_{0.3}$) which utilised unadjusted total daily effort (Burch *et al*. 2011); (2) maximum daily CPUE ($kg.hr^{-1}_{raw}$) was increased to 200 $kg.hr^{-1}_{raw}$, compared to the previous value of 150 $kg.hr^{-1}_{raw}$; and (3) the previous maximum daily catch of 1,200 kg was removed. Estimates of $CPUE_{wp0.95}$ were correlated to $CPUE_{0.3}$ (Pearson correlation coefficient: r = 0.88) with little loss in the number of years in which CPUE could be estimated (Appendix 1). Consequently, $CPUE_{wp0.95}$ has been implemented as the estimate of relative abundance of blacklip in the SZ for the zone and SAUs.

Similar to the assessment by Mayfield *et al.* (2015), recent, apparent changes in effective effort have not been quantified or accounted for in this assessment. Consequently, the rate and extent of an increase or decline in abundance, as indicated by changing CPUEs (SZ and SAUs), are likely overestimated or underestimated, respectively. This is a common problem across the Australian abalone fisheries and plans are underway to formally address this deficiency.

Catches, effort and CPUE are presented for fishing seasons which run for 12 consecutive months from 1 September to 31 August, with the exception of the 2016/17 fishing season which was extended to 13 months from 1 September 2016 to 30 September 2017. All data are presented as mean ± standard error (SE) unless otherwise stated.

3. RESULTS

3.1. Blacklip

Spatial and temporal patterns in catch, effort and CPUE

Annual blacklip catches from the SZ were stable from 1994/95 to 2012/13 (145 ± 0.54 $t.y^{-1}$; range 142–151 t) and were approximately 15% greater than those during the previous 25 years comprising the early, formative years of the fishery (Figure 3-1). The catch of 151.3 t in 2011/12 was the second highest on record. Catches declined in subsequent years and, in 2016/17, the catch was 125.9 t from a TACC of 126 t.

Mean annual CPUE increased consistently from 1994/95 (85.0 $kg.hr^{-1}$) to a historically high value in 2010/11 (122.4 $kg.hr^{-1}$; linear regression: r^2=0.81, P<0.05). Whilst remaining among historically high levels, mean annual CPUE declined (21%) to 96.8 $kg.hr^{-1}$ in 2014/15, where after the CPUE has remained stable. It was 99.5 $kg.hr^{-1}$ in 2016/17 (Figure 3-1).

Over the most recent 10 years (2007/08–2016/17), the high importance SAUs of Middle Point (22%), Gerloffs Bay (18%) and Number 2 Rocks (15%) contributed 55% (range 50–61%) to the annual zonal catch, with medium importance SAUs contributing a further 34% (range 26–40%, Table 3-1; Figure 3-2). In recent years, the contribution from high importance SAUs declined from 61% in 2010/11 to 50% in 2016/17. Among the high importance SAUs, contributions to the annual catch from Middle Point increased from 2012/13, whilst those from Gerloffs Bay and Number 2 Rocks decreased. Among medium importance SAUs, contributions from Port Macdonnell, Admella, and Carpenters Rocks increased after 2012/13 whilst those from Rivoli Bay decreased. Similar to the trend of recent redistribution of catches among SAUs, catches were also redistributed among mapcodes within the Middle Point, Number 2 Rocks and Admella SAUs (Appendix 2). Aggregated catches from high importance SAUs (Figure 3-3), declined (21%) from 2012/13 to 2014/15 and remained below 69 $t.y^{-1}$ thereafter, reflecting decreased catches from Gerloffs Bay after 2012/13. In contrast, aggregated catches from medium importance SAUs increased (26%) from 2011/12 to 2012/13, and remained above 41 $t.y^{-1}$ thereafter, reflecting increased catches from Port Macdonnell. Estimates of CPUE for aggregated high importance SAUs declined from 2010/11 to 2013/14 then remained stable at historically high levels to 2016/17, with a similar trend observed for aggregated medium importance SAUs (Figure 3-3). In contrast, CPUE for low importance SAUs declined from 2010/11 to 2013/14 but increased steeply thereafter.

Recent annual catches from two high importance SAUs have declined. Catches from Gerloffs Bay were stable from 2009/10 to 2012/13 (30 $t.y^{-1}$, range 29–31 t), then declined abruptly (~66%), remaining below 11 t from 2013/14 to 2015/16, increasing to 14.2 t in 2016/17. Similarly, annual catches from Number 2 Rocks declined (43%) from a peak of 30 t in 2010/11 to 17 t 2016/17 (Figure 3-4), except for an increase in 2015/16. Among medium importance SAUs, catches from Rivoli Bay declined (57%) from 2012/13 to 2013/14 and remained low (<7 $t.y^{-1}$) to 2016/17 (Figure 3-4). In contrast, catches increased from Carpenters Rocks (70%) and Port Macdonnell (600%) between 2010/11 and 2012/13 and remained relatively stable until 2016/17. Catches from Admella increased (39%) from 2009/10 to 2014/15, then declined (51%) to 2016/17.

Among the high importance SAUs, CPUE generally declined from 2010/11. In Middle Point, CPUE declined consistently (27%) from 2010/11 to 2015/16, before increasing (9%) in 2016/17 (Figure 3-4). Similar trends in CPUE were observed at the mapcode scale within the Middle Point SAU (Appendix 2). A consistent decline (37%) in CPUE also occurred in Gerloffs Bay from 2010/11 to 2016/17 (Figure 3-4). In Number 2 Rocks, CPUE declined (25%) from 2011/12 to 2014/15, then increased (15%) to 2016/17. For medium importance SAUs, where recent CPUE estimates were available (Admella, Carpenters Rocks and Port Macdonnell), CPUE was stable from 2012/13 to 2014/15, but CPUE for Port Macdonnell declined (17%) from 2015/16 to 2016/17 (Figure 3-5). It was not possible to estimate CPUE in recent years for one medium importance SAU (Rivoli Bay), in most years for Port Macdonnell, and for the low importance SAUs (Figure 3-5; Figure 3-6).

Relative to historical values, and indicative of high exploitation rates, proportions of large blacklip in commercial catches were at low levels in two (Middle Point, Gerloffs Bay) of the three high importance SAUs in 2016/17 (Appendix 3). In the remaining high importance SAU (Number 2 Rocks), the proportion of large blacklip increased in 2015/16 and 2016/17. Historically, low estimates of the proportion of large blacklip, occurred in recent years in each of four medium importance SAUs (Rivoli Bay, Admella, Carpenters Rocks and Port Macdonnell). There were insufficient data to estimate the proportions of large blacklip in Rivoli Bay and Admella in 2016/17.

Risk of overfishing in SAUs and zonal stock status

The stock status outcome from application of the harvest strategy is required under the Management Plan (PIRSA 2012). However, the current harvest strategy does not reflect stock performance, is currently being reviewed, and hence stock status was also determined using a weight-of-evidence analysis using the NFSRF (Stewardson *et al*. 2016; see Section 4 – Summary).

Based on the harvest strategy approach, for blacklip in 2016/17 there were three high importance, four medium importance and six low importance SAUs (Table 3-1; Appendix 3). Gerloffs Bay and Middle Point SAUs were assigned to 'red' (highest risk) and 'yellow' risk-of-overfishing categories, respectively (Table 3-1; Appendix 3). The Number 2 Rocks SAU and the assessed medium importance SAUs (Admella and Carpenters Rocks) were assigned to the 'green' risk-of-overfishing category (Table 3-1). The catch-weighted, zonal stock status score was -0.73, defining blacklip in the SZ as 'over-fished'.

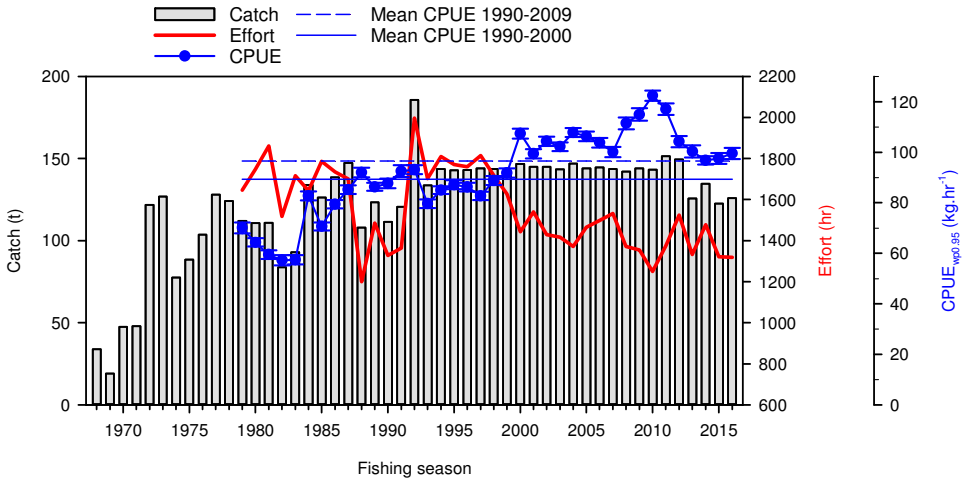

Figure 3-1. Total reported catch (tonnes, black bars), effort (hours, red line), and CPUE$_{wp0.95}$ (kg.hr^{-1}, blue line and dots for blacklip in the Southern Zone from 1968/69 (denoted 1968) to 2016/17.

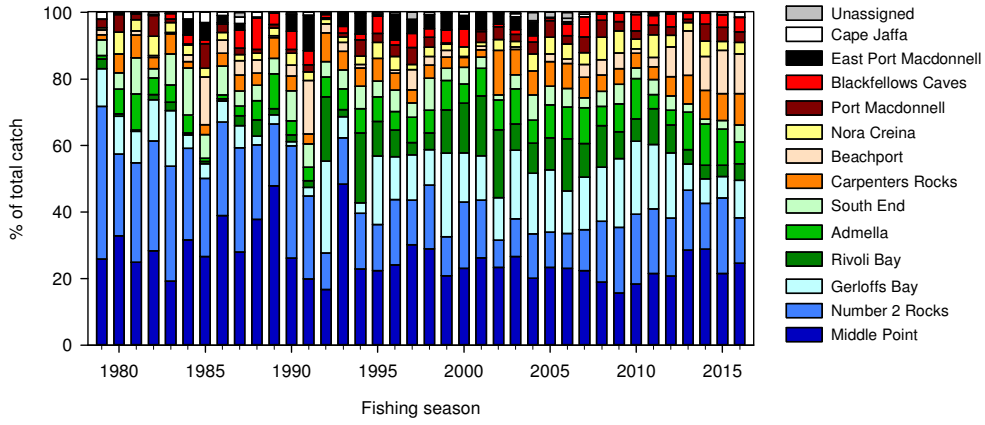

Figure 3-2. Proportional contribution by SAU to total blacklip catches in the SZ from 1979/80 (denoted 1979) to 2016/17.

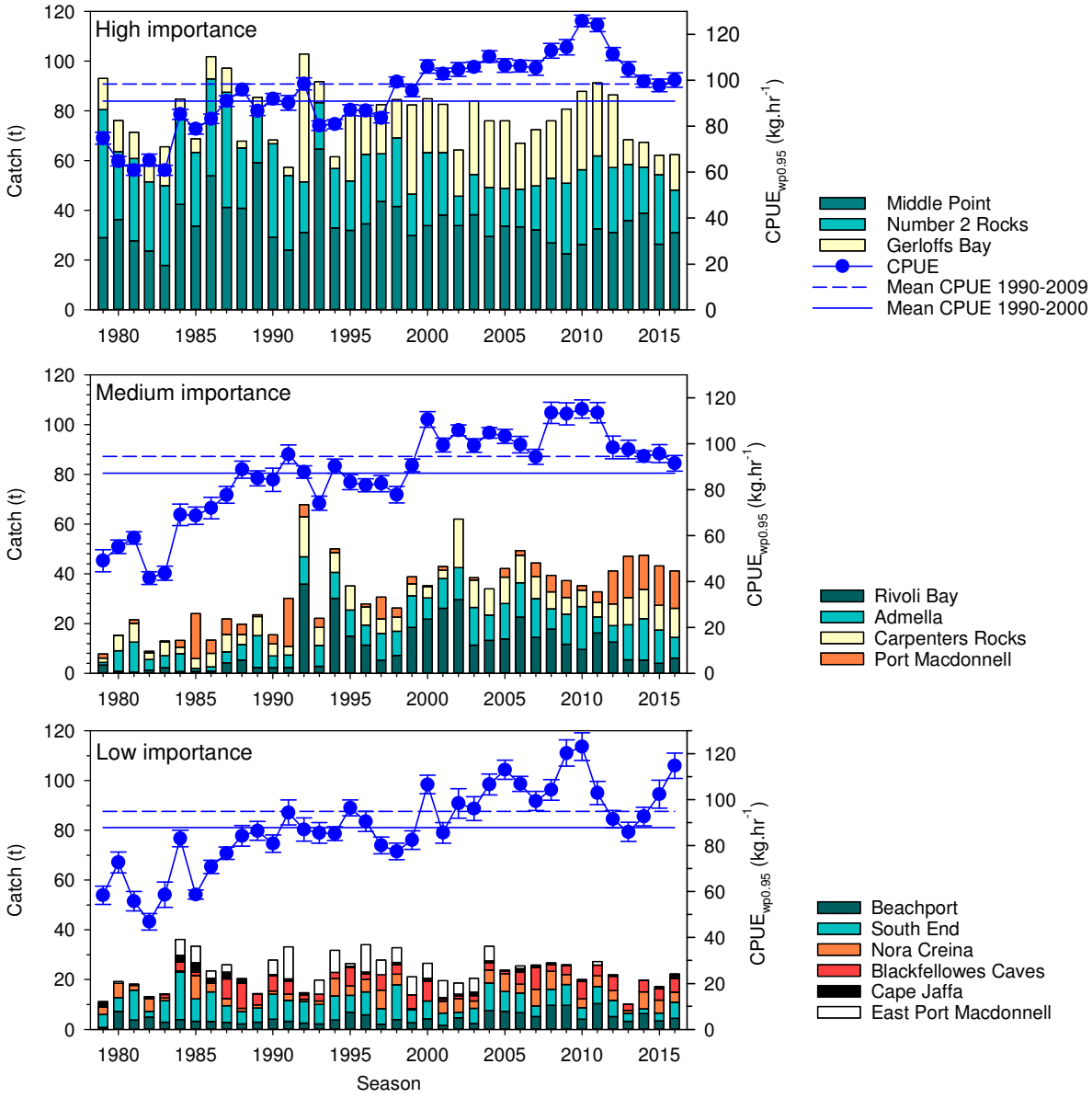

Figure 3-3. Southern Zone blacklip catches and CPUE$_{wp0.95}$ ± SE (blue lines, kg.hr^{-1}) from 1979/80 (denoted 1979) to 2016/17, aggregated by current (2016/17) importance ranking.

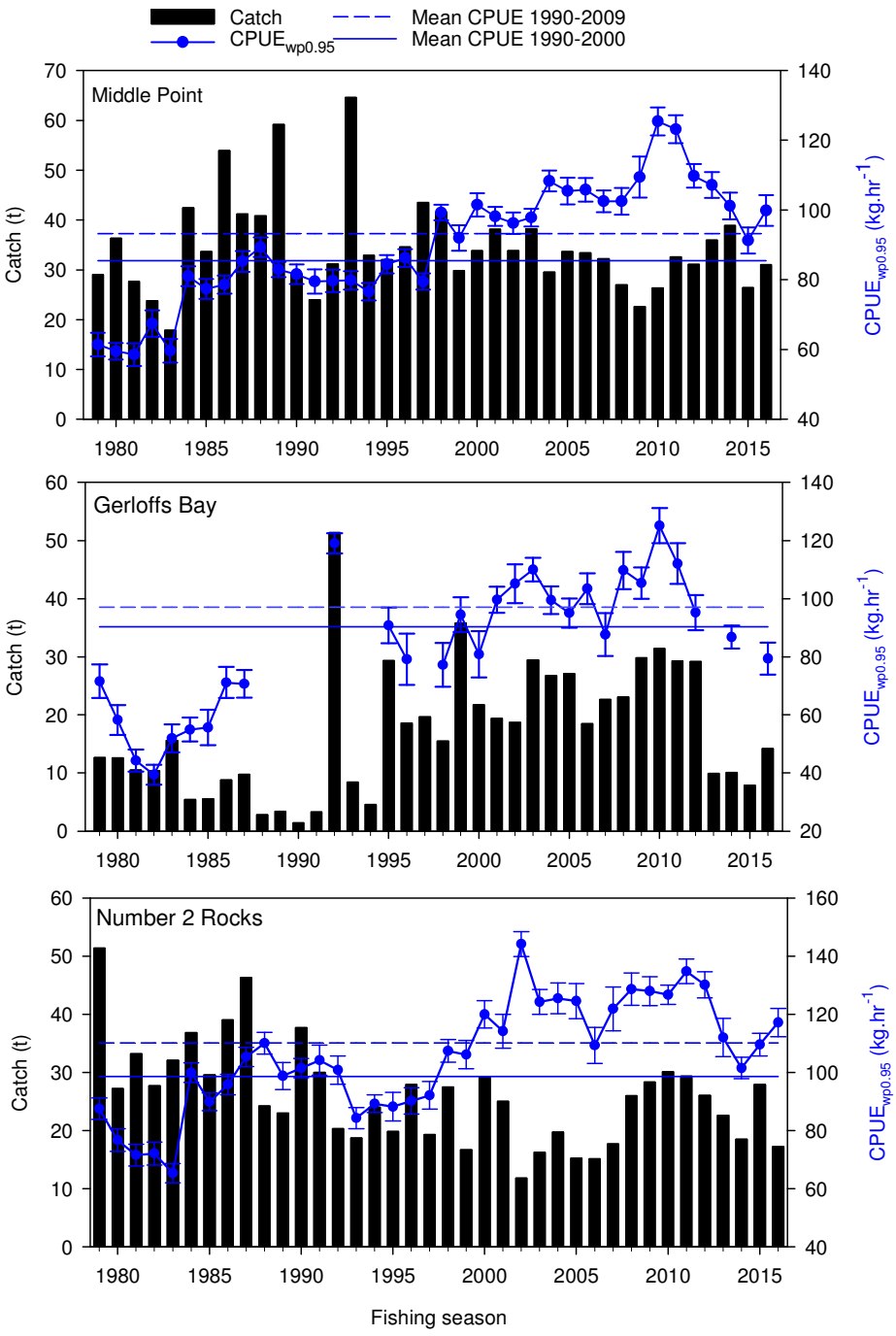

Figure 3-4. Reported catch (black bars, t) and CPUE$_{wp0.95}$ ± SE (blue lines, kg.hr^{-1}) for high importance SAUs in 2016/17: Middle Point, Gerloffs Bay and Number 2 Rocks, from 1979/80 (denoted 1979) to 2016/17.

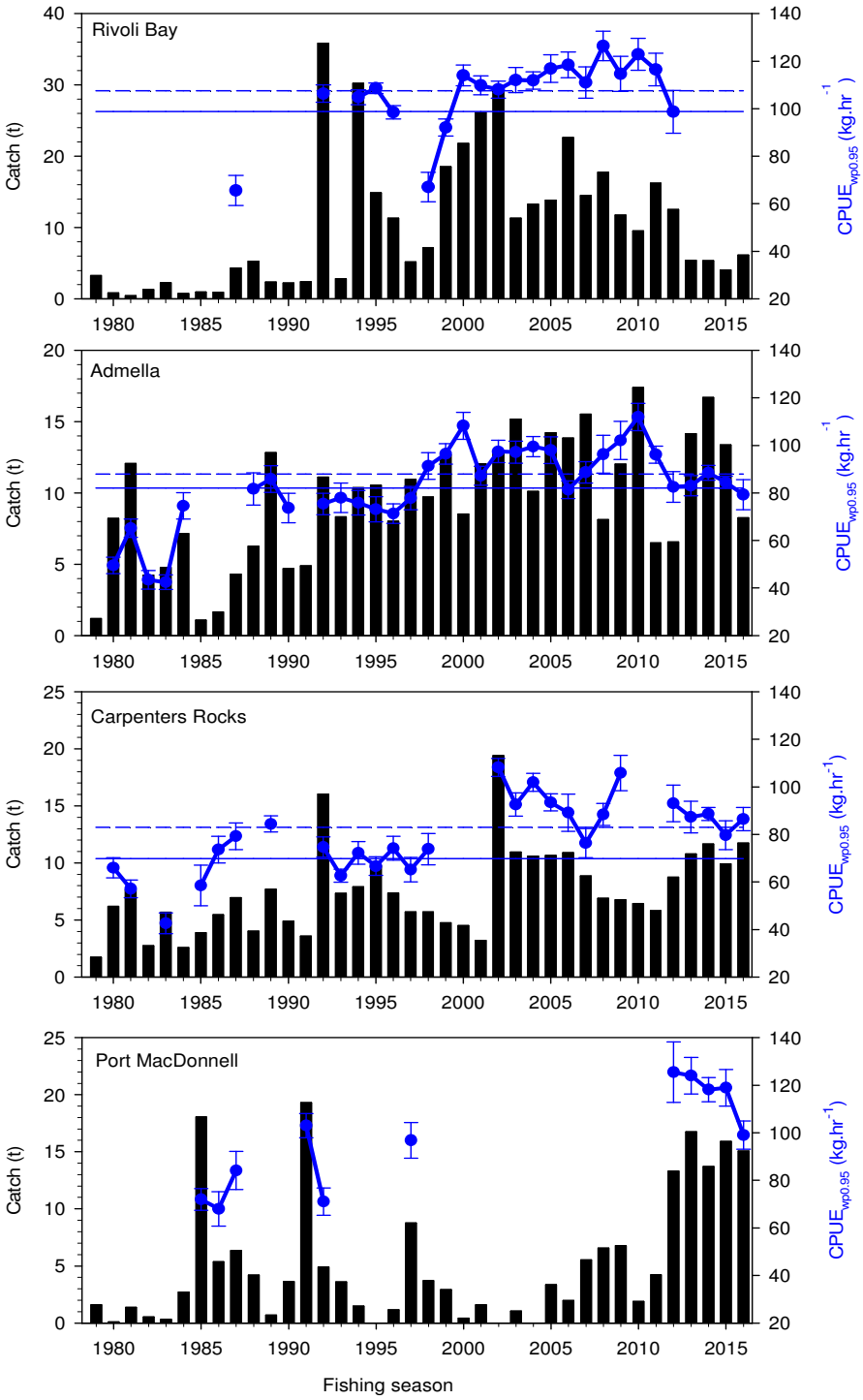

Figure 3-5. Reported catch (black bars, t) and CPUE$_{wp0.95}$ ± SE (blue lines, kg.hr^{-1}) for medium importance SAUs in 2016/17: Rivoli Bay, Admella, Carpenters Rocks, and Port Macdonnell, from 1979/80 (denoted 1979).

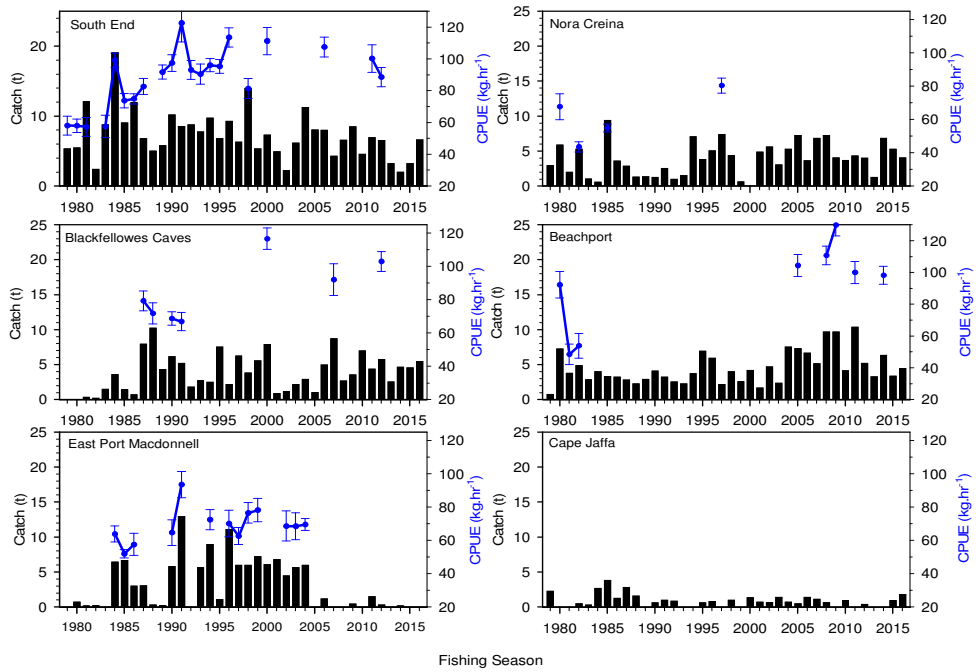

Figure 3-6. Reported catch (black bars, t) and $CPUE_{wp0.95}$ ± SE (blue line, $kg.hr^{-1}$) for blacklip for low importance SAUs: South End, Blackfellowes Caves, East Port Macdonnell, Nora Creina, Beachport, and Cape Jaffa from 1979/80 (denoted 1979) to 2016/17.

3.2. Greenlip

From 1968/69, when almost 19 t of greenlip was landed, greenlip catches have generally been small (Figure 3-6). In 2015/16, the TACC was reduced to 6 t and, in 2016/17, further reduced to 3.6 t with catches of 3.7 t and 3.2 t in 2015/16 and 2016/17, respectively. Prior to 2014/15, most of the catch was harvested from the Gerloffs Bay and Rivoli Bay SAUs.

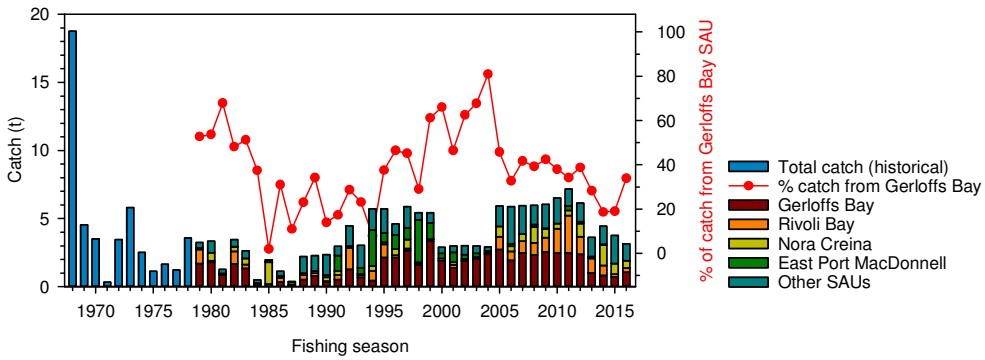

Figure 3-7. Reported catch (tonnes) of greenlip in the SZ from 1968/69 (denoted 1968) to 1978/79, and catches from Gerloffs Bay, Rivoli Bay, Nora Creina Bay and East Port Macdonnell SAUs from 1979/80 to 2016/17. The percentage of the greenlip catch harvested from the Gerloffs Bay SAU is also shown (red line).

Table 3-1. Outcome from application of the harvest strategy described in the Management Plan for the South Australian Commercial Abalone Fishery against the blacklip fishery in the SZ. Grey shading identifies the performance indicators and their respective scores. Colours identify risk of overfishing, ordered from highest to lowest risk: red (-2), yellow (-1), green (0), blue (+1), and light blue (+2).

Spatial assessment unit	%Contribution to mean total catch (SZ) over last 10 years (2007/08-2016/17)	Importance	%Contribution to catch from high & medium SAU in 2016/17	CPUE	%TACC	%Large	Pre-recruit density	Legal density	Mortality	Combined PI score	Risk of overfishing	Catch-weighted contribution to zonal score
Middle Point	21.0	High	38.5	0	0	0	-4	0	0	-4	-1	-0.39
Gerloffs Bay	14.5	High	17.3	-3	-4	-8	-4	0	0	-19	-2	-0.35
Number 2 Rocks	16.6	High	19.8	0	0	1	-	-	-	1	0	0.00
Rivoli Bay	8.2	Medium	-	ND	-4	-1	-	-	-	Uncertain	Undefined	-
Admella	8.5	Medium	10.1	0	0	-1	-	-	-	-1	0	0.00
Carpenters Rocks	6.0	Medium	14.3	0	5	-7	-	-	-	-2	0	0.00
Port Macdonnell	5.9	Medium	-	ND	8	-	-	-	-	Uncertain	Undefined	-
Beachport	4.4	Low	-	-	-	-	-	-	-	-	Not assessed	
South End	3.7	Low	-	-	-	-	-	-	-	-	Not assessed	
Blackfellows Caves	3.3	Low	-	-	-	-	-	-	-	-	Not assessed	
Nora Creina	3.2	Low	-	-	-	-	-	-	-	-	Not assessed	
Sum	**95.3**		**100.0**									
											Zonal stock status	-0.73

4. SUMMARY

The harvest strategy for the South Australian Abalone Fishery (PIRSA 2012) is currently under review following concerns that it does not reflect stock performance (*e.g.* Mayfield *et al.* 2014; Mayfield *et al.* 2015; Stobart *et al.* 2014). The stock status outcome from application of the harvest strategy is, however, required under the Management Plan (PIRSA 2012). For 2016/17, the outcome was 'over-fished'. However, as this outcome is inconsistent with recent stock performance, stock status was also determined using a weight-of-evidence analysis under the NFSRF (see below; Stewardson *et al*. 2016). This is considered a more robust approach to determining status and is the approach used for reporting on the performance of the stock (see Mayfield *et al.* 2014; Mayfield *et al.* 2015; Stobart *et al.* 2014).

Blacklip comprises 97% (126 t) of the total (combined blacklip and greenlip) abalone TACC for the SZ (129.6 t), which highlights the importance of this species in this zone. The SZ blacklip abalone stock was classified as transitional depleting in 2013/14, 2014/15, and 2015/16 as fishing pressure was too high and the harvestable biomass was declining (Mayfield *et al*. 2015; Ferguson *et al*. 2016; 2017). In 2015/16, the TACC for blacklip was reduced to 126 t which was 17% below the TACC of 151.5 t in 2014/15, with this level maintained in 2016/17.

Determining the stock status for 2016/17 was challenging because the data demonstrate conflicting trends among some SAUs. For example, the declining catch rates from the high importance Gerloffs Bay SAU which have occurred at historically low catches, and recent declining catch rates at Port Macdonnell contrast with the recent increases in catch rates in the high importance Number 2 Rocks SAU. Additional complexities were recent changes in the management arrangements, including the introduction of finer spatial management in 2013 (i.e. SAUs), variable minimum legal lengths (*e.g.* reduced MLL in the Gerloffs Bay SAU from 2016/17), the small size and diver changeover in the SZ abalone fishing fleet, and the potential for prevailing weather conditions to influence fishing behaviour. Overall, catch rates at relatively high levels in several SAUs and for the SZ, combined with stable and/or small increases in legal density estimates, suggest that the declines in harvestable biomass identified in previous assessments (Mayfield *et al*. 2015; Ferguson *et al*. 2016; 2017) have ceased following reduced catches.

Collectively, the available information suggests that, at the current TACC of 126 t, the decline in SZ blacklip stocks observed from 2010/12 to 2015/16 has been arrested. Given that biomass is at a level to ensure adequate future recruitment and that fishing pressure is adequately controlled, the SZ blacklip fishery in 2016/17 is classified as '**sustainable**' (NSFRF; Stewardson *et al*. 2016). The low catch and limited data on greenlip abalone in the SZ prevents reliable determination of stock status with this stock consistently being classified as 'undefined'.

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6. APPENDIX 1 – COMPARISON OF BLACKLIP CPUE ESTIMATES

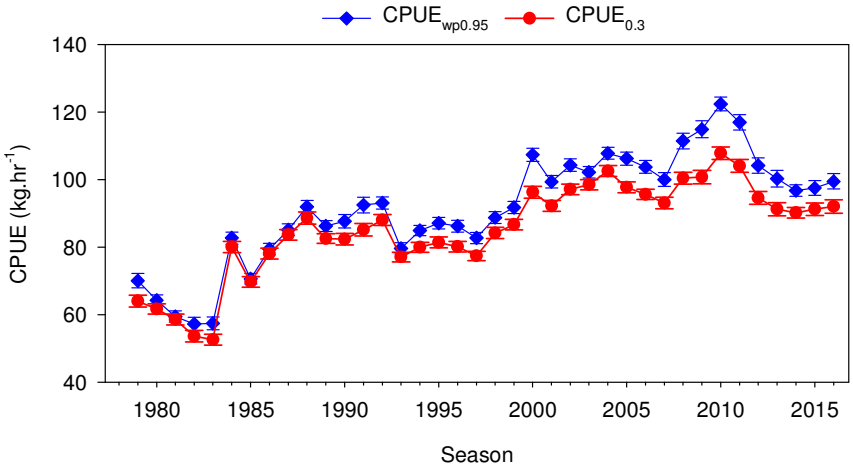

Figure A1.1. Relative abundance of blacklip based on two measures of CPUE: CPUE$_{wp0.95}$, including days when blacklip comprised ≥95% of the daily catch; and CPUE$_{0.3}$, including days when blacklip comprised ≤30% of the daily catch.

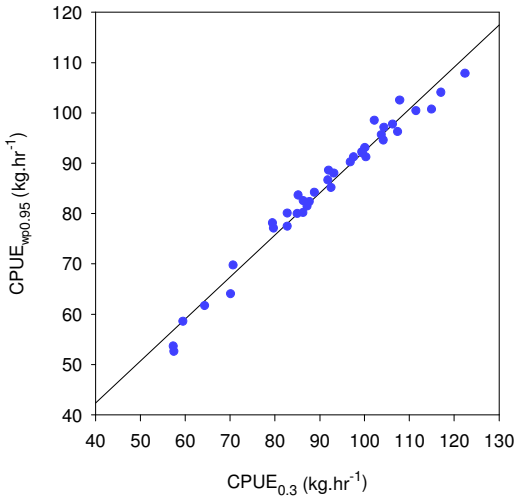

Figure A1.2. Comparison of two measures of CPUE for blacklip: CPUE$_{wp0.95}$, including days when blacklip comprised ≥95% of the daily catch; and CPUE$_{0.3}$, including days when blacklip comprised ≤30% of the daily catch. (Pearson Correlation coefficient r = 0.88)

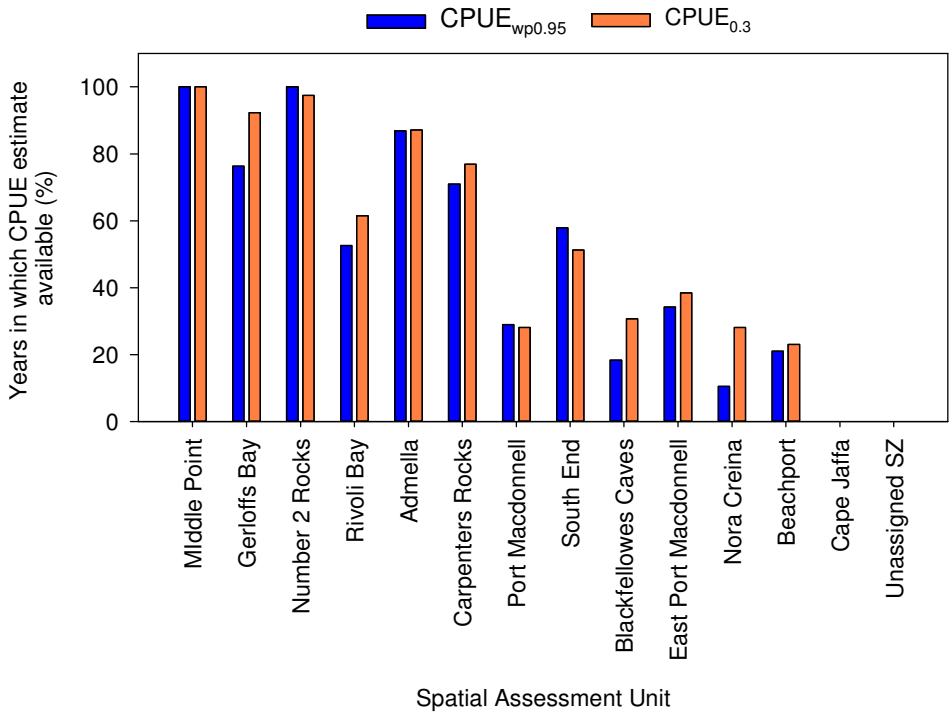

Figure A1.3. Comparison of two measures of CPUE for blacklip showing the percentage of years (n=39) in which CPUE was estimable for high, medium and low importance SAUs: CPUE$_{wp0.95}$, including days when blacklip comprised ≥95% of the daily catch; and CPUE$_{0.3}$, including days when blacklip comprised ≤30% of the daily catch. Also shown is current (2016/17) importance ranking for each SAU.

7. APPENDIX 2 – CATCH AND CPUE BY MAPCODE FOR HIGH AND MEDIUM IMPORTANCE SAUS

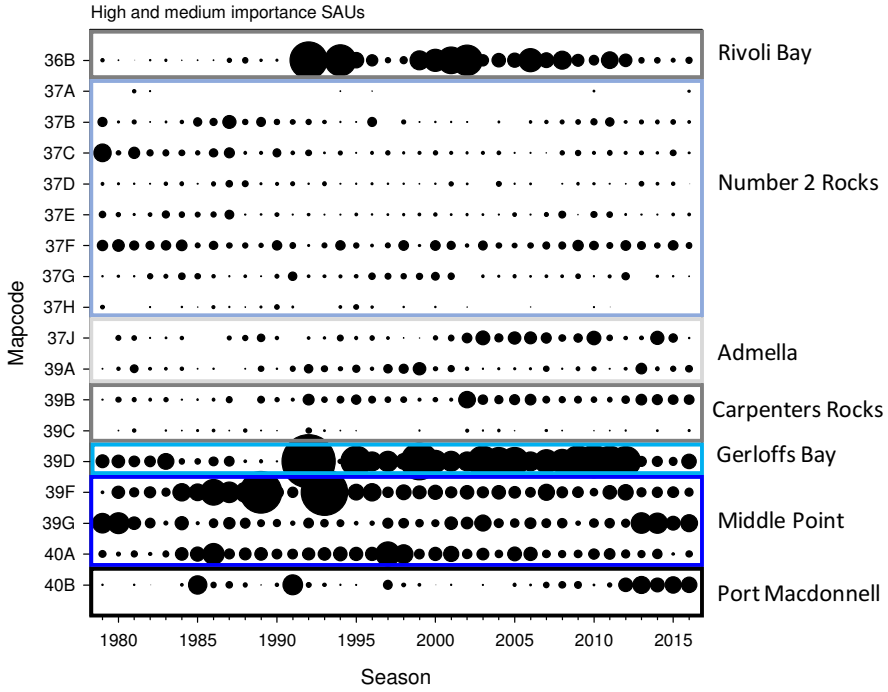

Figure A2-1. Catch distribution among mapcodes for high and medium importance SAUs in the SZ blacklip fishery.

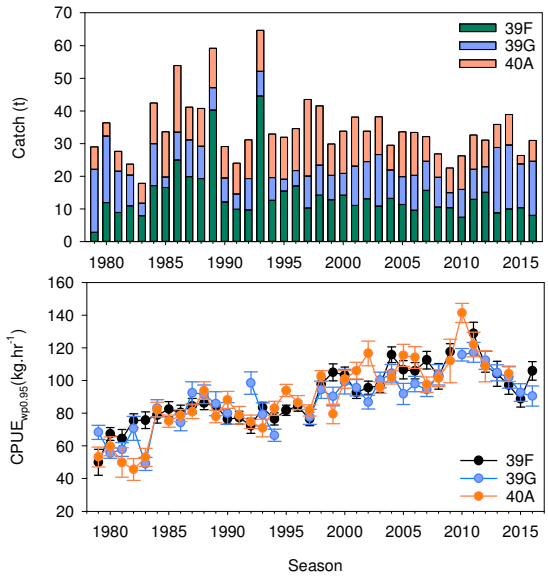

Figure A2-2. (A) Catch by mapcode, and (B) CPUEwp$_{0.95}$ by mapcode, for the high importance Middle Point SAU.

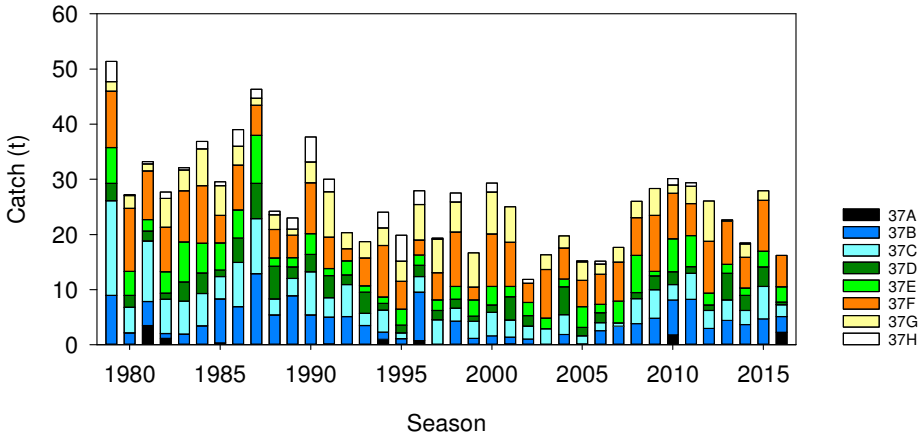

Figure A2-3. Catch by mapcode for the high importance Number 2 Rocks SAU.

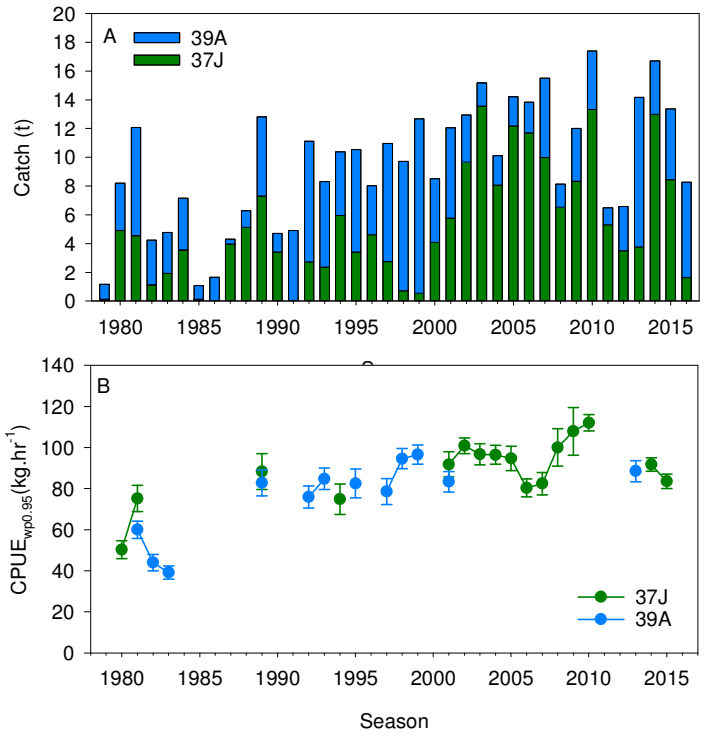

Figure A2-4. (A) Catch by mapcode, and (B) CPUE$_{wp0.95}$ by mapcode, for the medium importance Admella SAU.

8. APPENDIX 3 – HARVEST STRATEGY PLOTS AND PI SCORES

Middle Point

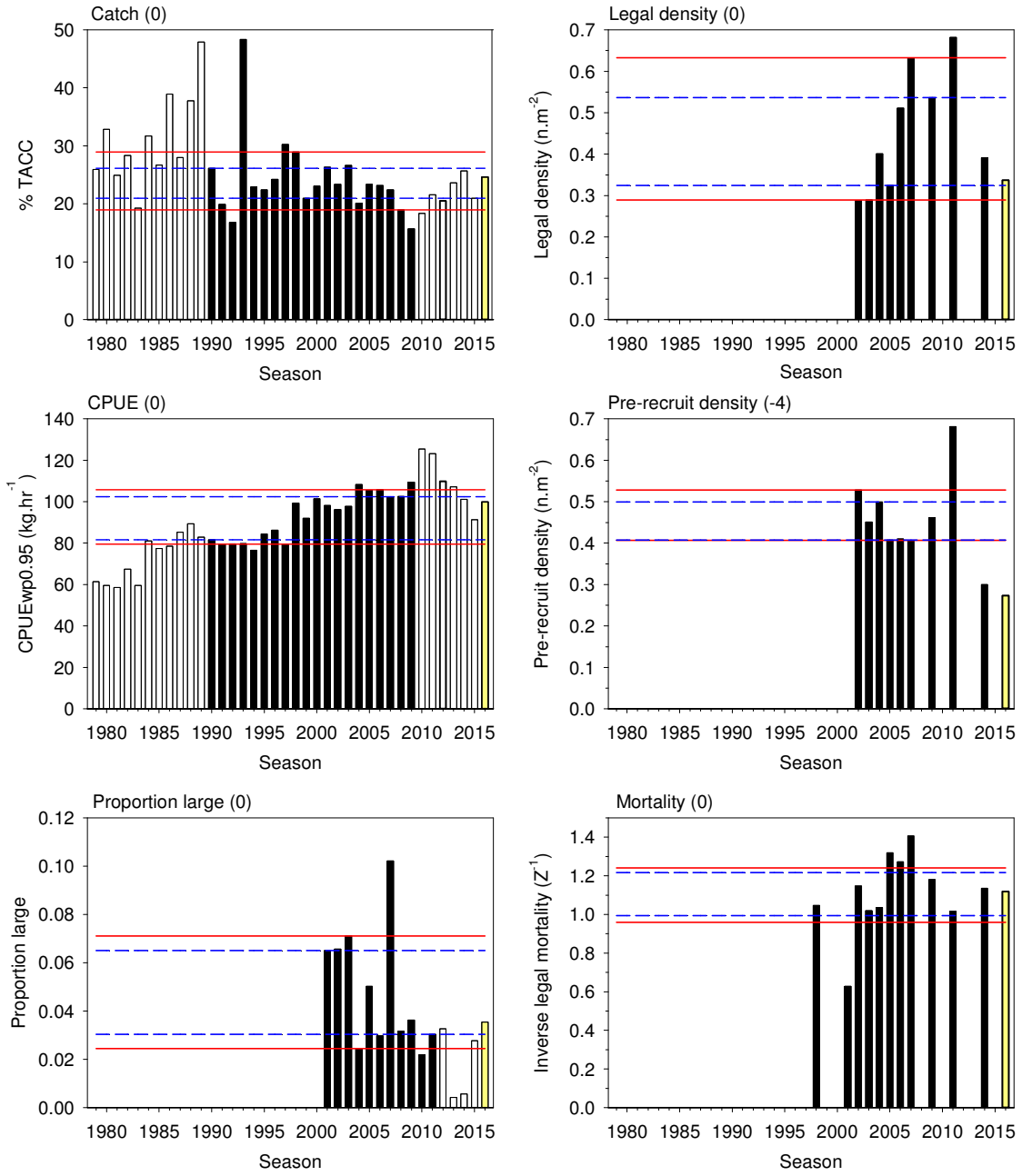

Figure A3.1. Middle Point SAU (high importance). Performance indicators (and scores from the harvest strategy to determine the risk of being overfished) and upper and lower target (red lines) and limit (blue dashed lines) reference points. Black bars show the data and time over which the reference points were calculated. Open bars describe measures of the PI outside of the reference period. Yellow bars indicate the data and year subject to assessment for each PI *i.e.* the score-year.

Gerloffs Bay

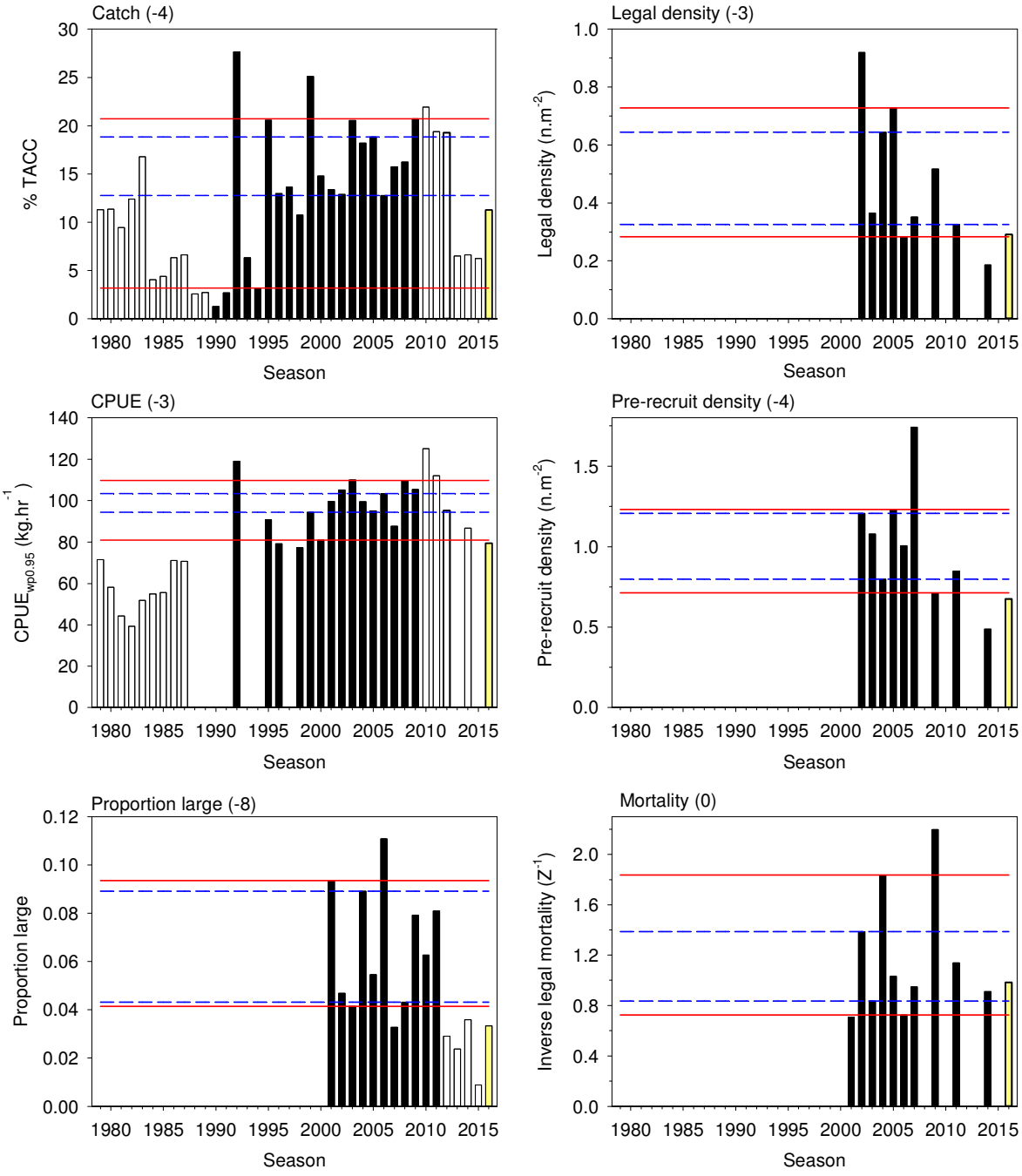

Figure A3.2. Gerloffs Bay SAU (high importance). Performance indicators (and scores from the harvest strategy to determine the risk of being overfished) and upper and lower target (red lines) and limit (blue dashed lines) reference points. Black bars show the data and time over which the reference points were calculated. Open bars describe measures of the PI outside of the reference period. Yellow bars indicate the data and year subject to assessment for each PI *i.e.* the score-year.

Number Two Rocks

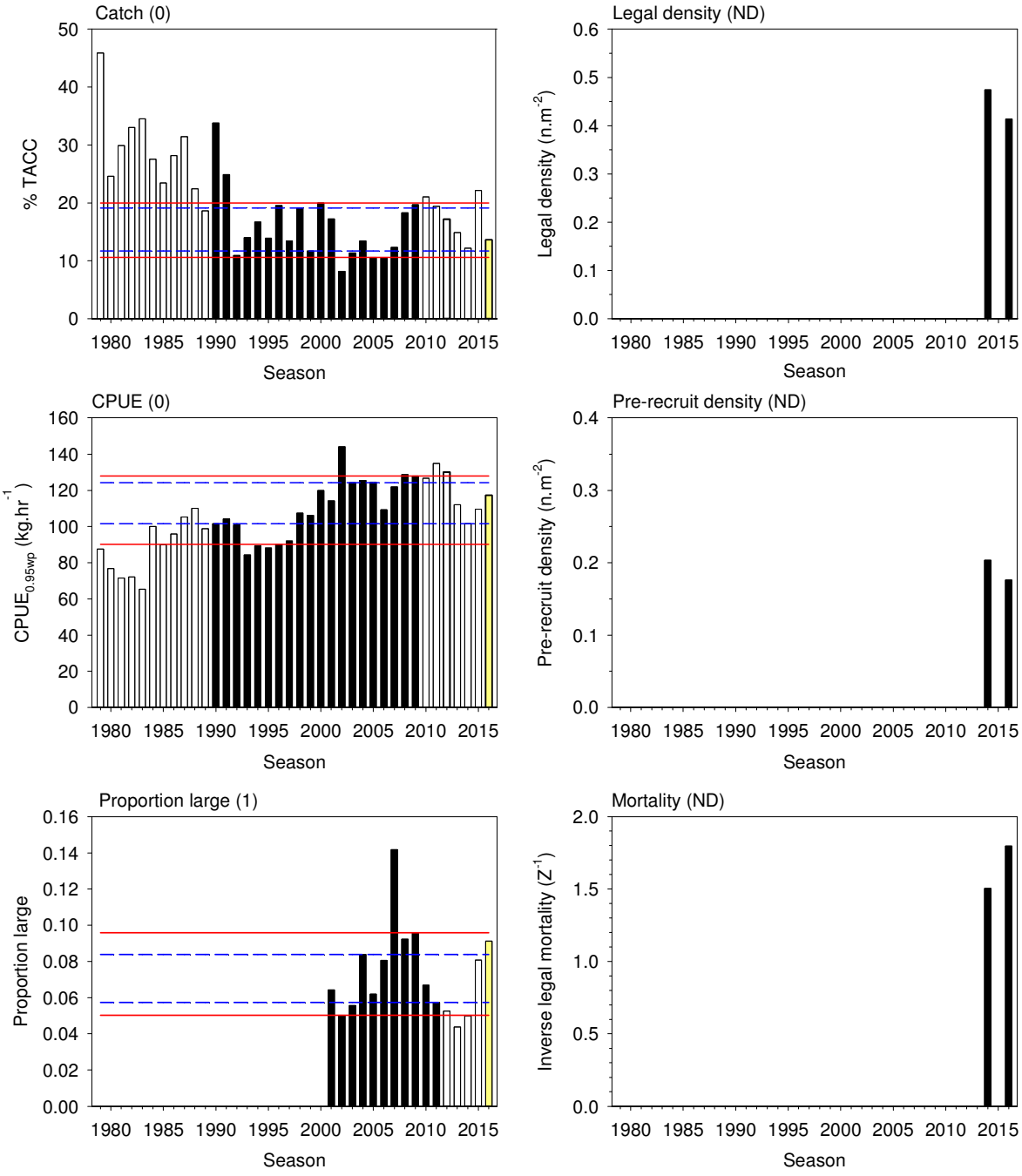

Figure A3.3. Number 2 Rocks SAU (high importance). Performance indicators (and scores from the harvest strategy to determine the risk of being overfished) and upper and lower target (red lines) and limit (blue dashed lines) reference points. Black bars show the data and time over which the reference points were calculated. Open bars describe measures of the PI outside of the reference period. Yellow bars indicate the data and year subject to assessment for each PI *i.e.* the score-year.

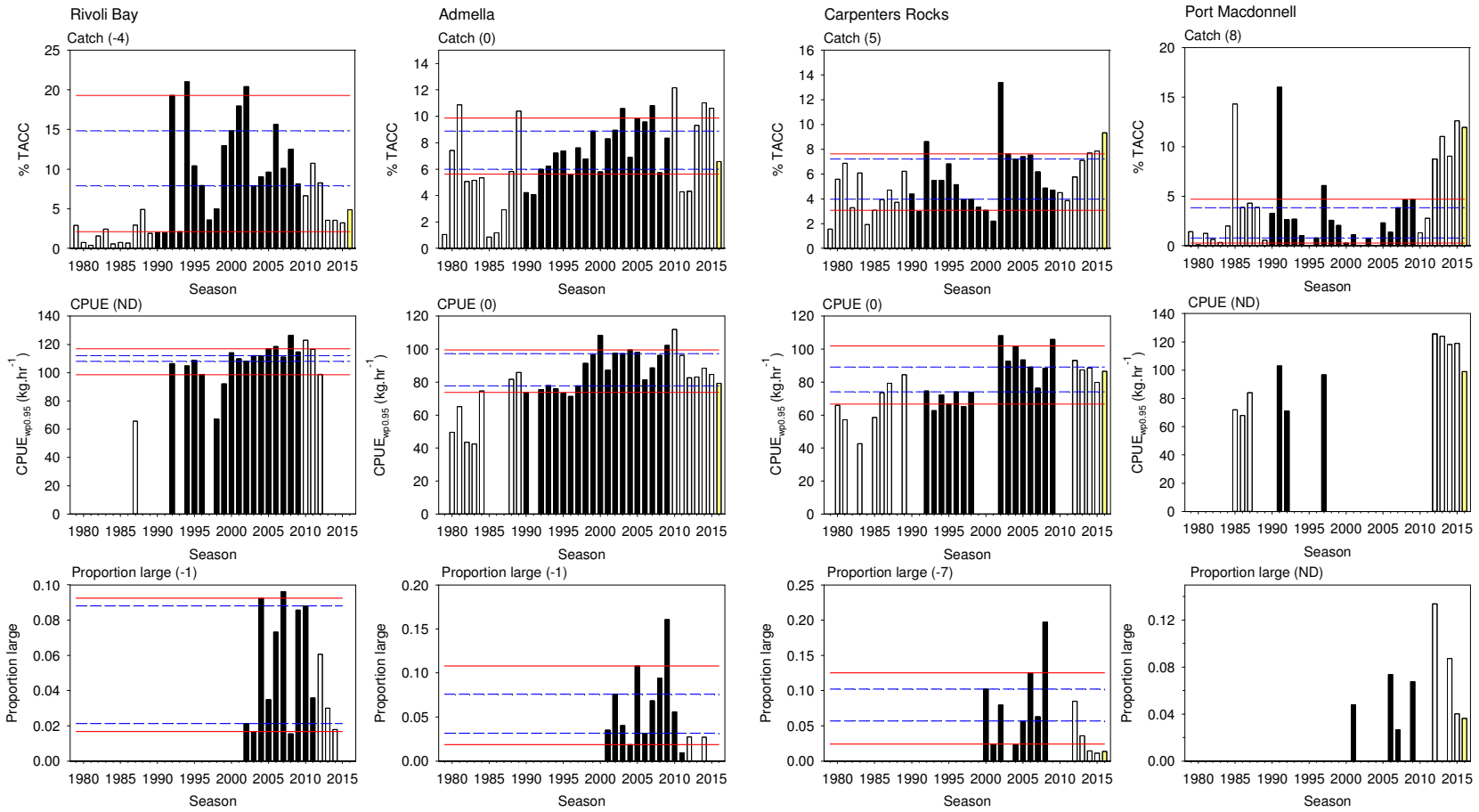

Figure A3.4. Rivoli Bay, Admella, Carpenters Rocks and Port Macdonnell SAUs (medium importance). Performance indicators (and scores from the harvest strategy to determine the risk of being overfished) and upper and lower target (red lines) and limit (blue dashed lines) reference points. Black bars show the data and time over which the reference points were calculated. Open bars describe measures of the PI outside of the reference period. Yellow bars indicate the data and year subject to assessment for each PI *i.e.* the score-year