

## Status of the Western Zone Blacklip Abalone (*Haliotis rubra*) Fishery in 2013



**B. Stobart, S. Mayfield, J. Dent and D.J. Matthews**

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SARDI Aquatics Sciences  
PO Box 120 Henley Beach SA 5022

**July 2014**

Report to PIRSA Fisheries and Aquaculture

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**Cover photo: Blacklip abalone (*Haliotis rubra*), B. Stobart**

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## EXECUTIVE SUMMARY

This report provides an assessment of the current stock status of *Haliotis rubra* (blacklip abalone; hereafter termed blacklip) in the Western Zone (WZ) of the South Australian Abalone fishery (SAAF). This is the first assessment of the entire WZ following the merger of regions A and B from 1 January 2014.

The assessment is required under the Management Plan for the South Australian Commercial Abalone Fishery which specifies the need for annual application of the harvest strategy to determine stock status and review the total allowable commercial catch (TACC).

The harvest strategy categorised the zonal stock status for WZ blacklip in 2013 as ‘sustainably fished’. The status has not changed since the previous assessment in 2012.

However, the stock status outcome from the harvest strategy – ‘sustainably fished’ – is not consistent with much of the data available for the fishery that suggests blacklip stocks are at their weakest position in over 15 years.

These data include the sequential decline in catch per unit effort (CPUE; the primary index of legal-sized blacklip abundance) across the WZ and in most spatial assessment units (SAUs) since 2006. In most cases, the CPUE in 2013 was substantially below the long-term mean (1990-2009) and/or declining. In addition, current catches from important SAUs such as Drummond, Sheringa and Reef Head are unlikely to be sustainable.

Under the national framework for reporting stock status the WZ Blacklip Abalone Fishery would be classified as “transitional depleting”.

Consequently, there is no evidence that the recent reductions in catch have been adequate to arrest the ongoing declines in the harvestable biomass of blacklip in the WZ fishery and facilitate stock rebuilding.

## 1. INTRODUCTION

The Management Plan for the South Australian Abalone Fishery (PIRSA 2012) requires annual application of the harvest strategy to determine stock status and review the total allowable commercial catches (TACC). In previous reports, the harvest strategy has been applied separately to the two regions in the Western Zone (WZ), with the stock status of blacklip in Region A (Stobart *et al.* 2013) and Region B (Stobart *et al.* 2012a) provided in the most recent stock assessment reports for the fishery.

This report is the first assessment of the combined WZ following the merger of Regions A and B from 1 January 2014. Consequently, the harvest strategy has been applied to all spatial assessment units (SAUs) across the WZ.

The stock status of blacklip in the WZ will be provided at this spatial extent in future, scheduled, stock assessment (2015) and status (2016) reports. These reports form part of the South Australian Research and Development Institutes' (SARDI – Aquatic Sciences) ongoing assessment program for this fishery.

The stock status outcome from the harvest strategy was compared to the traditional, weight-of-evidence analysis because the harvest strategy has only recently been developed.

## 2. METHODS

Methods used to apply the harvest strategy and undertake the weight of evidence assessment are described in Stobart *et al.* (2012b) and PIRSA (2012). Briefly, the status of blacklip in the WZ is derived from a combination of the (1) risk-of-overfishing category for each SAU and (2) importance of that SAU, by catch, to the zone. The risk-of-overfishing category for each SAU is derived from the scoring of six (high importance SAUs) or three (medium importance SAUs) performance indicators using prescribed reference points from a 20-year reference period (1990-2009). To determine the zonal stock status, the risk-of-overfishing score (-2 to +2) for each SAU is multiplied by its proportional contribution to the combined catch, with these values summed. Zone status scores also range between -2 and +2 and are allocated into one of five categories. These are defined as depleted (score  $\leq -1.5$ ), overfished ( $>-1.5$  score  $\leq -0.5$ ), sustainably fished ( $>-0.5$  > score  $\leq 0.5$ ), under fished ( $>0.5$  score  $\leq 1.5$ ) and lightly fished (score  $\geq 1.5$ ).

### 3. RESULTS

#### Temporal patterns in catch, effort and CPUE

##### Western Zone:

Total catches were relatively stable from 1997 to 2009 (Figure 1). From 2009 to 2013 there has been a 13% reduction to the WZ blacklip TACC. This was due to the combined effects of a 6% reduction in the Region A TACC from 2010, and 33% and 25% Region B TACC decreases in 2011 and 2012, respectively. CPUE has declined consistently from 2006 and, in 2013, was at the lowest level since 1996 and 9% below the mean CPUE from 1990-2009 (CPUE<sub>90-09</sub>; the 20-year reference period from which the performance indicators (PIs) are scored).

##### Spatial assessment units:

The distribution of catch among SAUs remained similar between 2012 and 2013, although there was a considerable increase at Point Westall and decreases at Drummond and Avoid Bay. The recent decline in zonal CPUE was evident across most SAUs (Figures 2-12). With the exception of Point Westall, the CPUE in 2013 was below CPUE<sub>90-09</sub> and or declining.

#### Risk of overfishing in SAUs and zonal stock status

In 2013, there were eight high (Drummond, Sheringa, Point Westall, Avoid Bay, Searcy Bay, Reef Head, Ward Island and Anxious Bay) and five medium (Venus Bay, Hotspot, Point Avoid, Baird Bay and Flinders Island; Table 1; Figures 2-10) importance SAUs for blacklip. All remaining SAUs were of low importance (Table 1; Figures 11-12). It was possible to determine the risk of overfishing category for 11 (85%) of these 13 SAUs. The limited data for estimating CPUE in two medium importance SAUs in 2013 (Hotspot and Baird Bay) resulted in the blacklip stocks in these SAUs being categorised as uncertain (Table 1).

Five of the eight high-importance SAUs were assigned a green (Drummond, Sheringa, Point Westall, Searcy Bay and Anxious Bay), one a yellow (Avoid Bay), one a red (Ward Island) and one a dark blue (Reef Head) risk-of-overfishing category (Table 1). Of the three assessable medium importance SAUs, there were two red (Venus Bay and Flinders Island) and one yellow (Point Avoid) risk-of-overfishing categories assigned. The catch-weighted, zonal score was -0.24, defining a '**sustainably fished**' zonal stock status for blacklip in the WZ in 2013 (Table 1).

Table 1. Outcome from application of the harvest strategy described in the Management Plan for the South Australian Abalone Fishery against the blacklip fishery in the Western Zone for 2013. Grey shading identifies the performance indicators and their respective scores. ND indicates no data.

Spatial assessment unit	% contribution to mean total catch (WZ) over the last 10 years (04-13)	Importance	% contribution to catch from high & medium SAU in 2013	CPUE	%TACC	PropLge	Pre-recruit Density	Legal Density	Mortality	Combined PI score	Risk of overfishing	Catch-weighted contribution to zonal score
Drummond	8.0	High	23.35	-4	7	1	-3	-1	2	2	0	0.00
Sheringa	6.2	High	18.18	-6	5	4	-1	-2	-1	-1	0	0.00
Point Westall	4.1	High	10.36	0	1	1	-3	-2	1	-2	0	0.00
Avoid Bay	3.9	High	4.43	0	0	1	-2	-2	0	-3	-1	-0.04
Searcy Bay	3.7	High	7.91	-2	0	0	ND	ND	ND	-2	0	0.00
Reef Head	3.6	High	11.85	-6	8	1	ND	ND	ND	3	1	0.12
Ward Island	3.6	High	3.40	-6	-6	0	0	-2	-2	-16	-2	-0.07
Anxious Bay	3.1	High	5.51	-1	0	0	ND	ND	ND	-1	0	0.00
Venus Bay	3.0	Medium	7.32	-7	-6	2	-	-	-	-11	-2	-0.15
Hotspot	2.8	Medium	-	ND	-6	-1	-	-	-	Uncertain	Not assigned	-
Point Avoid	2.1	Medium	5.66	-5	2	-1	-	-	-	-4	-1	-0.06
Baird Bay	1.5	Medium	-	ND	-8	0	-	-	-	Uncertain	Not assigned	-
Flinders Island	1.4	Medium	2.03	-2	-7	0	-	-	-	-9	-2	-0.04
North Nuyts Archipelago	1.2	Low	-	-	-	-	-	-	-	-	Not assessed	-
Fishery Bay	0.9	Low	-	-	-	-	-	-	-	-	Not assessed	-
The Gap	0.9	Low	-	-	-	-	-	-	-	-	Not assessed	-
Cape Bauer	0.8	Low	-	-	-	-	-	-	-	-	Not assessed	-
Coffin Bay	0.7	Low	-	-	-	-	-	-	-	-	Not assessed	-
Unass WZ RG A	0.7	Low	-	-	-	-	-	-	-	-	Not assessed	-
DEntrecasteaux Reef	0.6	Low	-	-	-	-	-	-	-	-	Not assessed	-
Cape Catastrophe	0.5	Low	-	-	-	-	-	-	-	-	Not assessed	-
Elliston Cliffs	0.5	Low	-	-	-	-	-	-	-	-	Not assessed	-
Waterloo Bay	0.4	Low	-	-	-	-	-	-	-	-	Not assessed	-
South Nuyts	0.4	Low	-	-	-	-	-	-	-	-	Not assessed	-
Memory Cove	0.3	Low	-	-	-	-	-	-	-	-	Not assessed	-
SW Thistle	0.2	Low	-	-	-	-	-	-	-	-	Not assessed	-
Franklin Islands	0.2	Low	-	-	-	-	-	-	-	-	Not assessed	-
NE Thistle	0.1	Low	-	-	-	-	-	-	-	-	Not assessed	-
Taylor Island	0.1	Low	-	-	-	-	-	-	-	-	Not assessed	-
Neptune Islands	0.1	Low	-	-	-	-	-	-	-	-	Not assessed	-
Wedge Island	0.0	Low	-	-	-	-	-	-	-	-	Not assessed	-
Pearson Island	0.0	Low	-	-	-	-	-	-	-	-	Not assessed	-
Greenly Island	0.0	Low	-	-	-	-	-	-	-	-	Not assessed	-
Unass WZ RG B	0.0	Low	-	-	-	-	-	-	-	-	Not assessed	-
Sir Joseph Banks	0.0	Low	-	-	-	-	-	-	-	-	Not assessed	-
<b>Sum</b>	<b>55.8</b>		<b>100.0</b>								<b>Zonal Stock Status</b>	<b>-0.24</b>

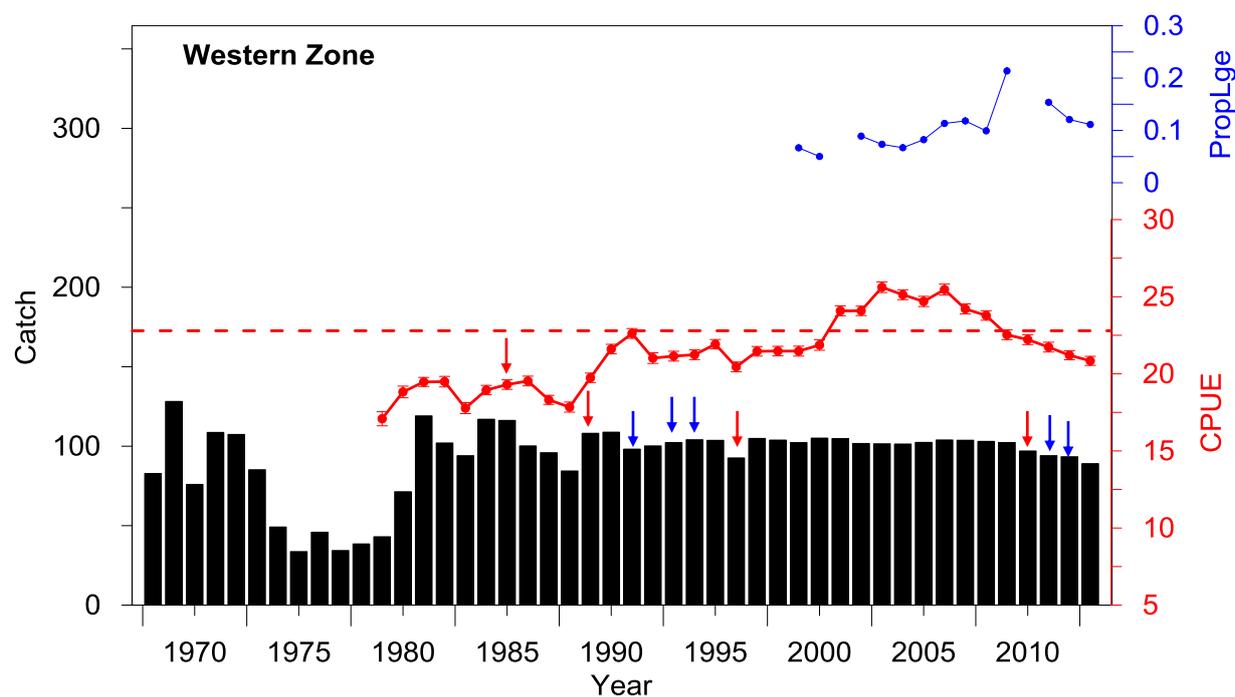


Figure 1. Catch (t, meat weight; black bars) of blacklip from the Western Zone from 1968 to 2013. CPUE  $\pm$  se (kg.hr<sup>-1</sup>) and PropLge are shown in red and blue lines, respectively. Red dashed lines show CPUE<sub>90-09</sub>. Red arrows indicate implementation (1985) and amendment (1989, 2006 and 2010) of the TACC in Region A, blue arrows indicate implementation (1991) and amendment (1993, 1994, 2011 and 2012) of the TACC in Region B.

Drummond

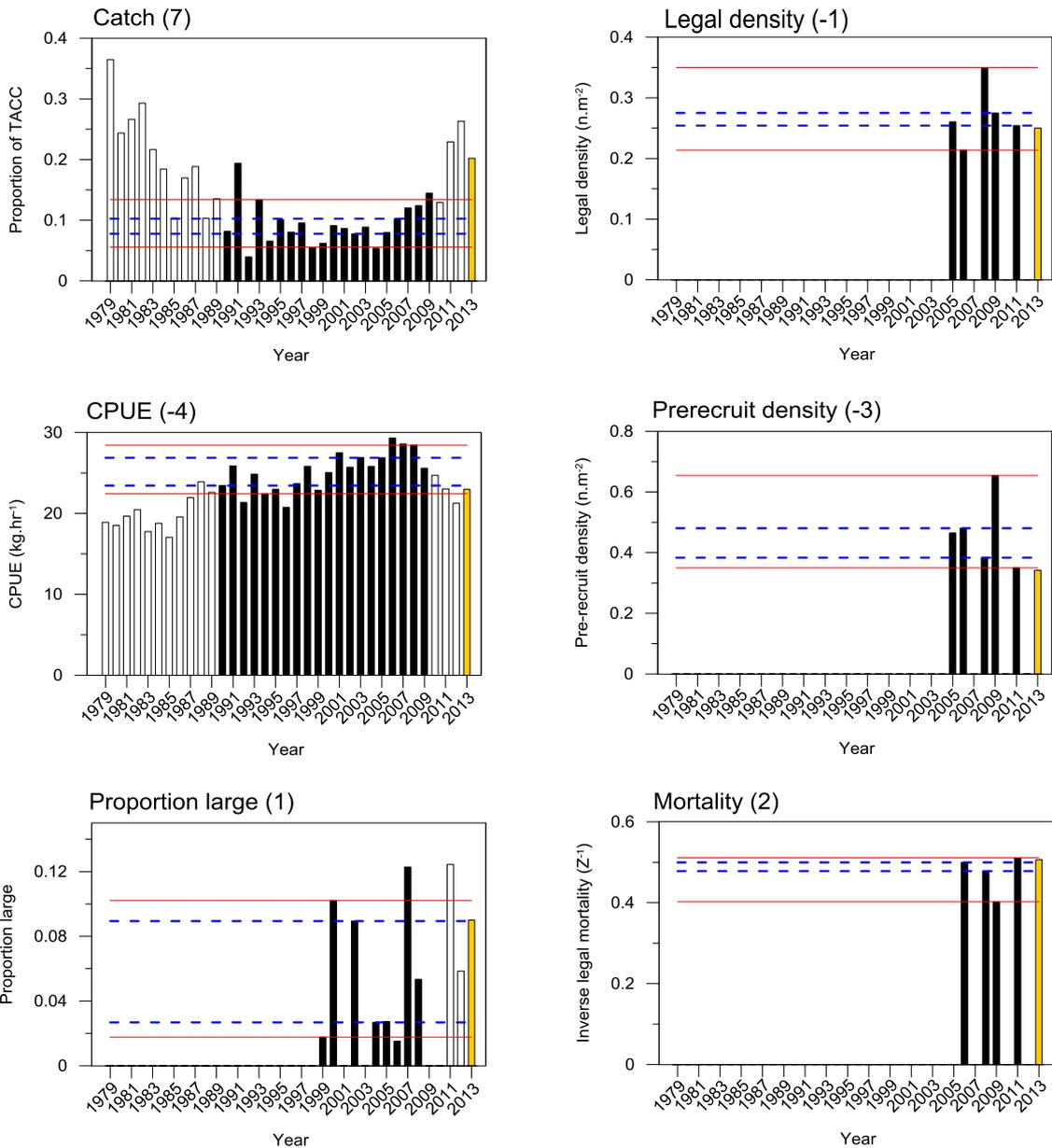


Figure 2. Drummond (high importance). Performance indicators catch (proportion of TACC), CPUE (kg.hr<sup>-1</sup>), PropLge, legal density (n.m<sup>-2</sup>), pre-recruit density (n.m<sup>-2</sup>), mortality (Z) and scores from the harvest strategy in brackets. Red and blue lines are upper and lower limit and target reference points, respectively. Black bars describe the data and time over which the reference points were calculated, open bars describe the measures of the PI outside the reference period and orange bars the data and year subject to assessment for each PI, i.e. the score-year.

Sheringa

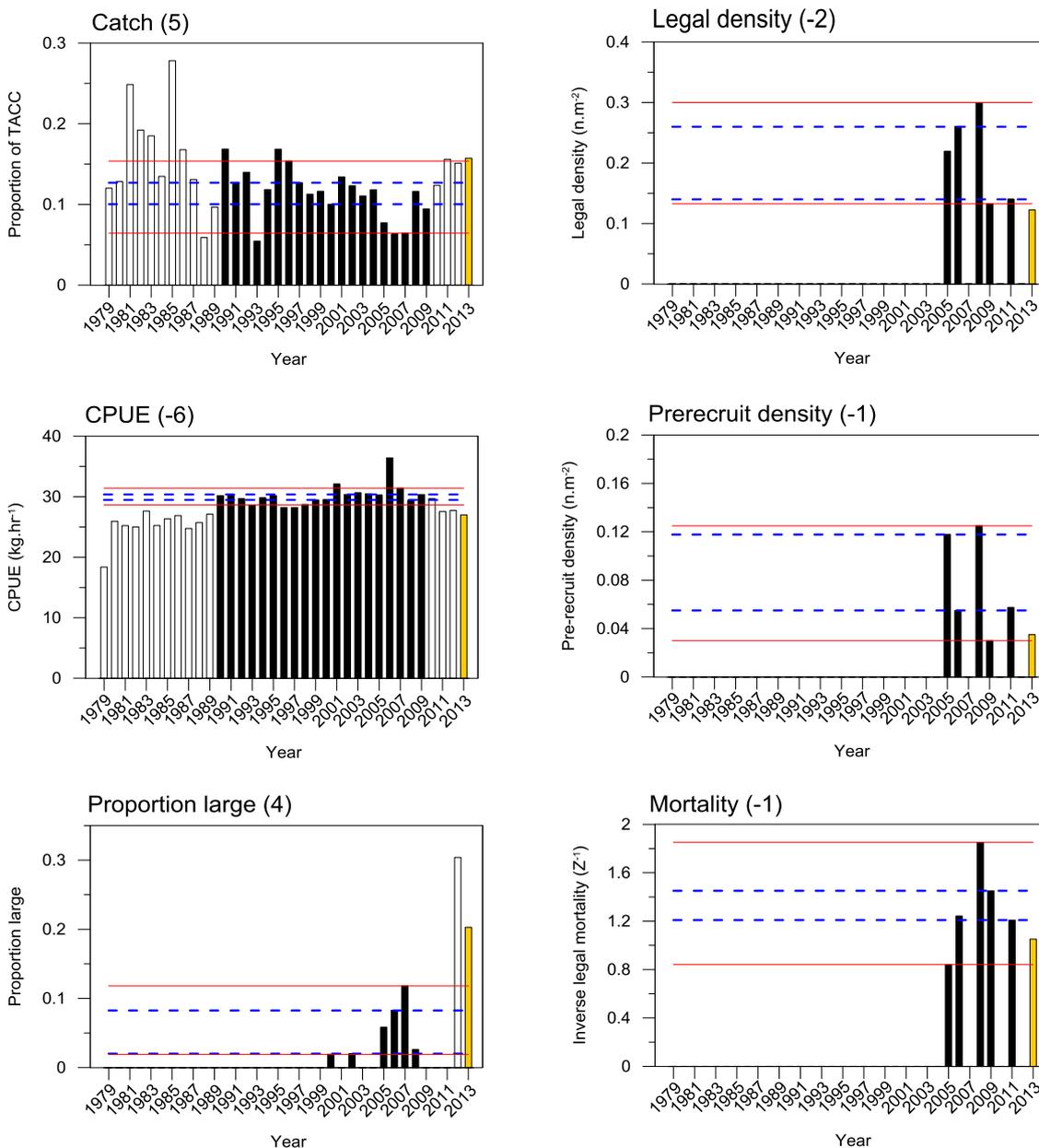


Figure 3. Sheringa (high importance). Performance indicators catch (proportion of TACC), CPUE (kg.hr<sup>-1</sup>), PropLge, legal density (n.m<sup>-2</sup>), pre-recruit density (n.m<sup>-2</sup>), mortality (Z) and scores from the harvest strategy in brackets. Red and blue lines are upper and lower limit and target reference points, respectively. Black bars describe the data and time over which the reference points were calculated, open bars describe the measures of the PI outside the reference period and orange bars the data and year subject to assessment for each PI, i.e. the score-year.

Point Westall

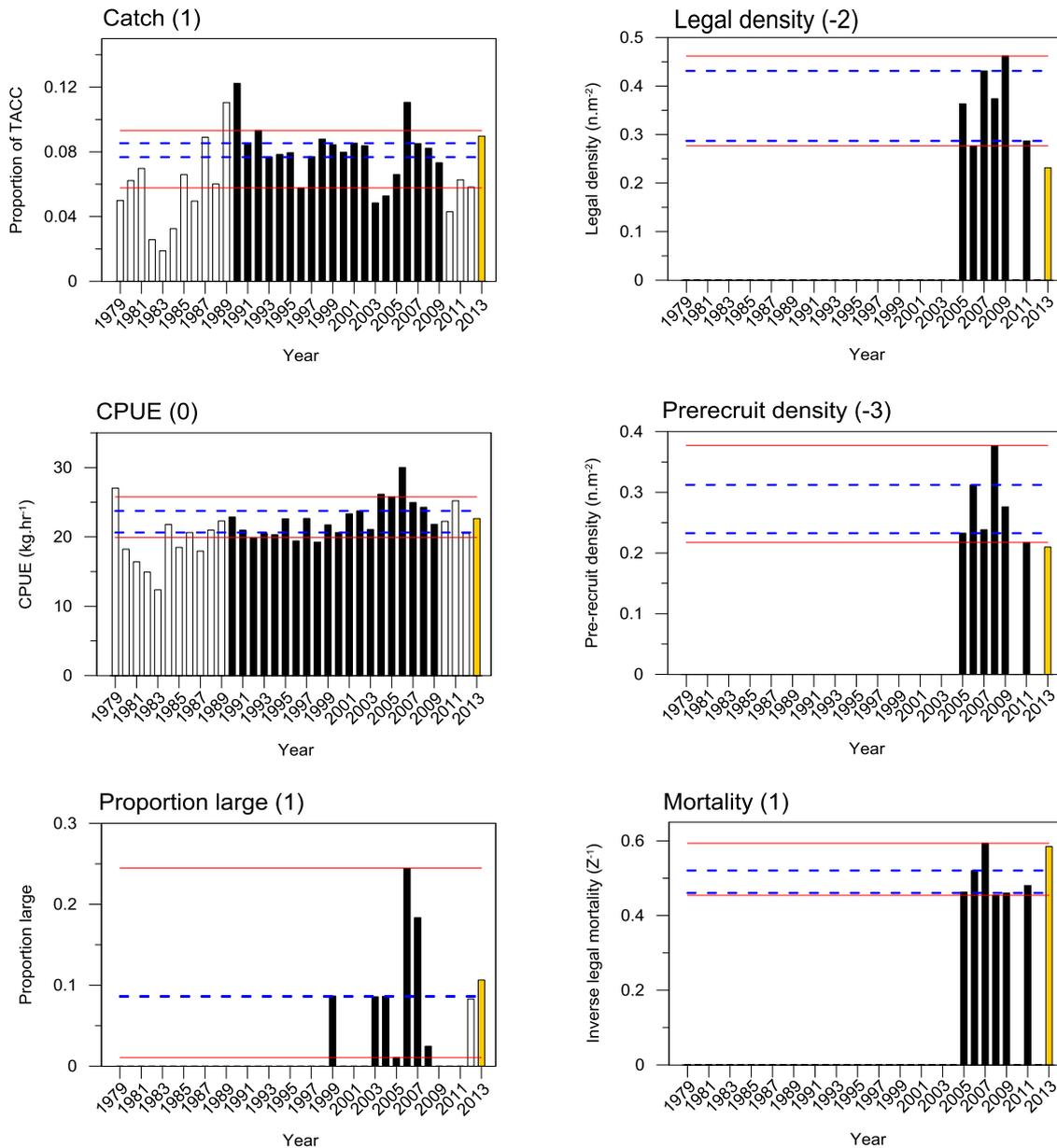


Figure 4. Point Westall (high importance). Performance indicators catch (proportion of TACC), CPUE (kg.hr<sup>-1</sup>), PropLge, legal density (n.m<sup>-2</sup>), pre-recruit density (n.m<sup>-2</sup>), mortality (Z) and scores from the harvest strategy in brackets. Red and blue lines are upper and lower limit and target reference points, respectively. Black bars describe the data and time over which the reference points were calculated, open bars describe the measures of the PI outside the reference period and orange bars the data and year subject to assessment for each PI, i.e. the score-year.

Avoid Bay

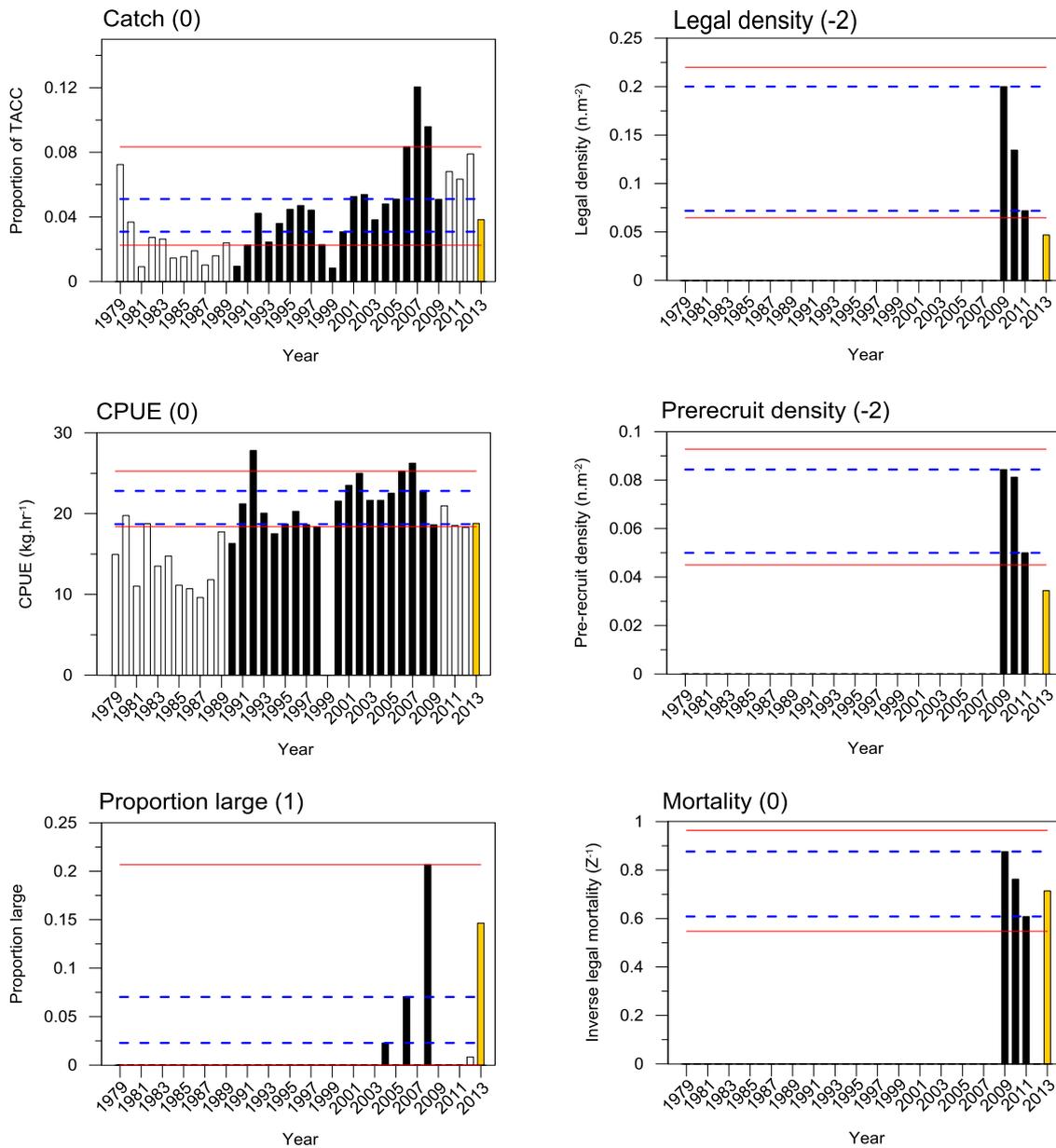


Figure 5. Avoid Bay (high importance). Performance indicators catch (proportion of TACC), CPUE (kg.hr<sup>-1</sup>), PropLge, legal density (n.m<sup>-2</sup>), pre-recruit density (n.m<sup>-2</sup>), mortality (Z) and scores from the harvest strategy in brackets. Red and blue lines are upper and lower limit and target reference points, respectively. Black bars describe the data and time over which the reference points were calculated, open bars describe the measures of the PI outside the reference period and orange bars the data and year subject to assessment for each PI, i.e. the score-year.

Searcy Bay

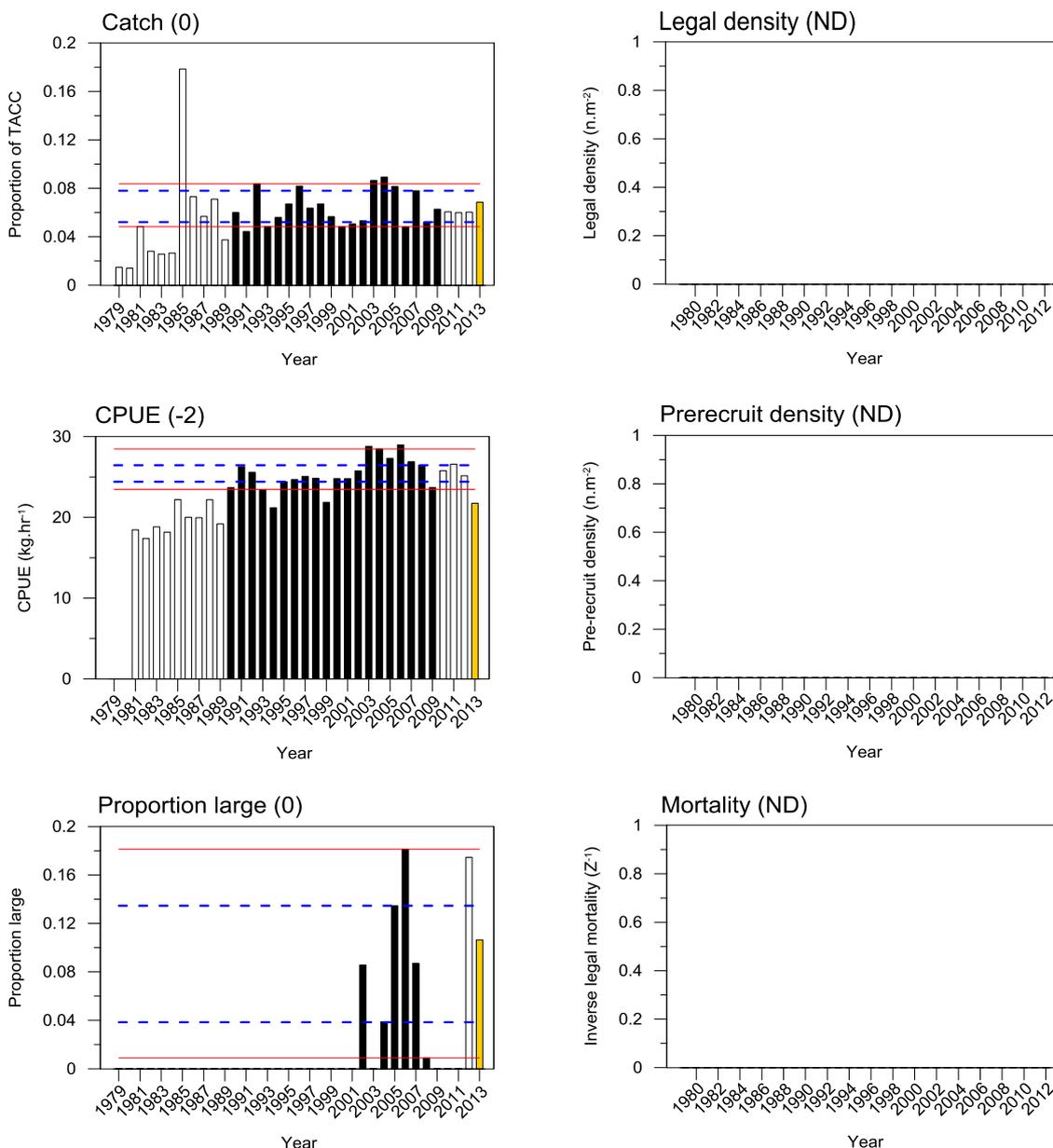


Figure 6. Searcy Bay (high importance). Performance indicators catch (proportion of TACC), CPUE (kg.hr<sup>-1</sup>), PropLge, legal density (n.m<sup>-2</sup>), pre-recruit density (n.m<sup>-2</sup>), mortality (Z) and scores from the harvest strategy in brackets. Red and blue lines are upper and lower limit and target reference points, respectively. Black bars describe the data and time over which the reference points were calculated, open bars describe the measures of the PI outside the reference period and orange bars the data and year subject to assessment for each PI, i.e. the score-year. ND indicates no data.

Reef Head

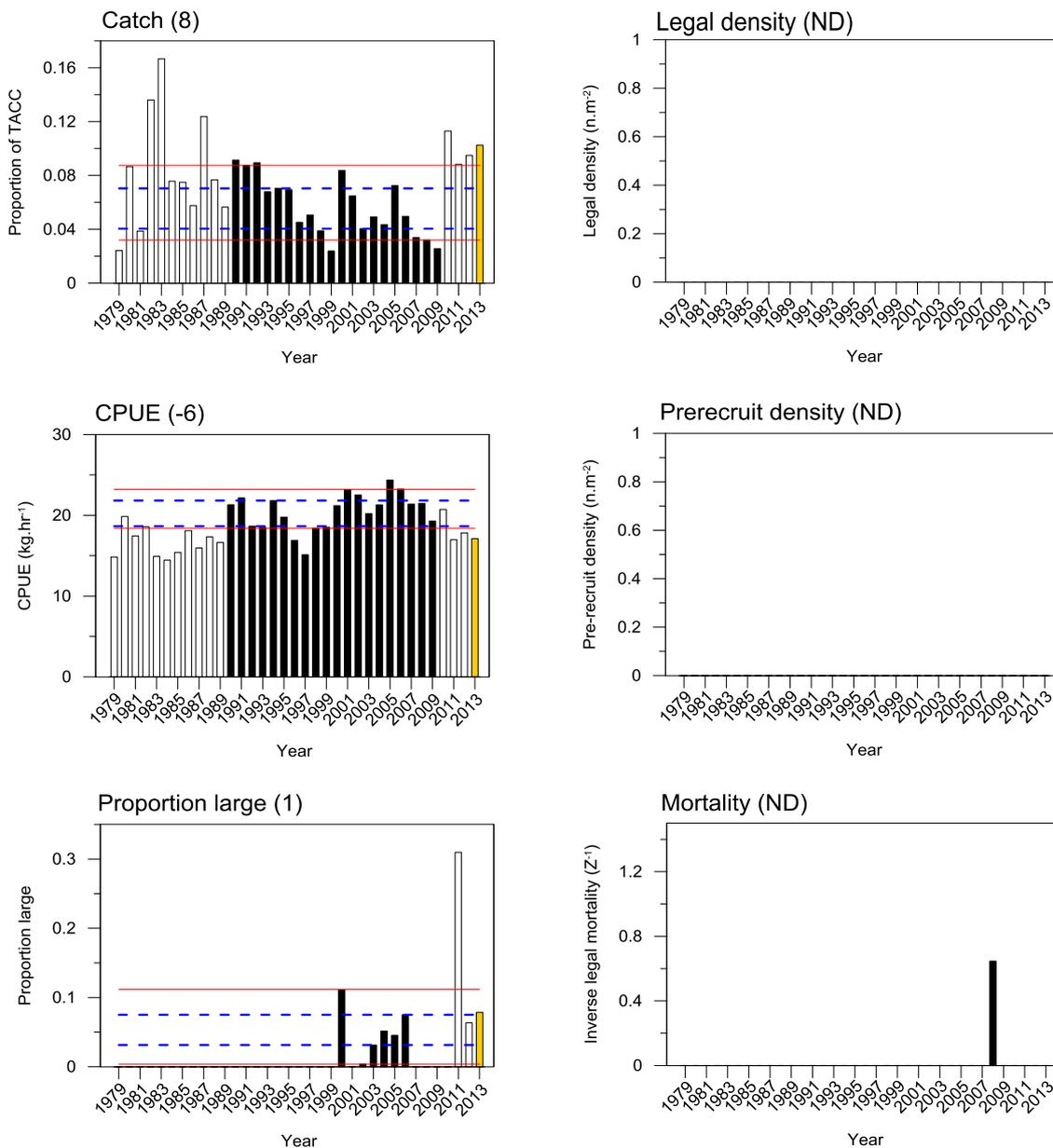


Figure 7. Reef Head (high importance). Performance indicators catch (proportion of TACC), CPUE (kg.hr<sup>-1</sup>), PropLge, legal density (n.m<sup>-2</sup>), pre-recruit density (n.m<sup>-2</sup>), mortality (Z) and scores from the harvest strategy in brackets. Red and blue lines are upper and lower limit and target reference points, respectively. Black bars describe the data and time over which the reference points were calculated, open bars describe the measures of the PI outside the reference period and orange bars the data and year subject to assessment for each PI, i.e. the score-year. ND indicates no data.

Ward Island

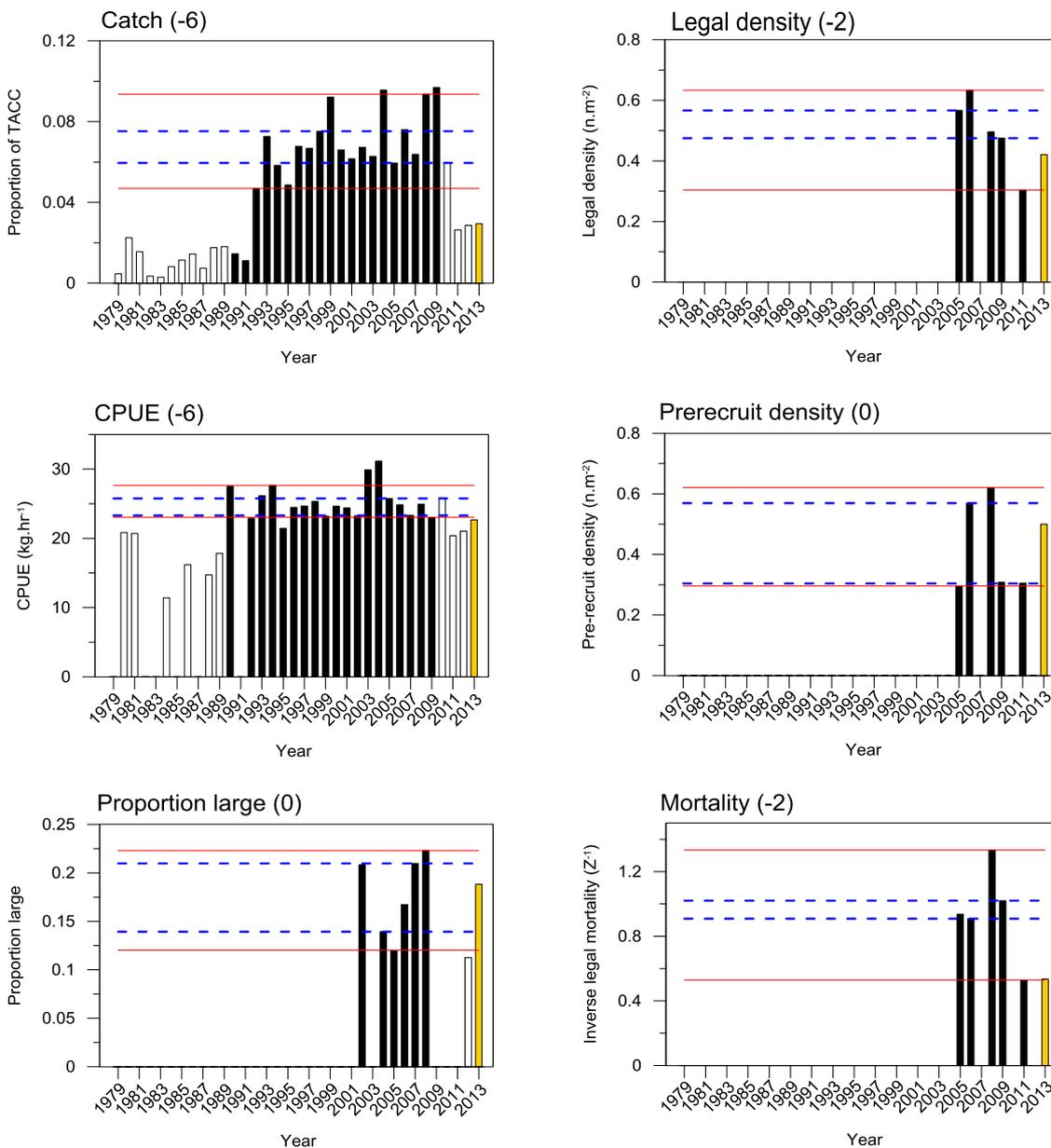


Figure 8. Ward Island (high importance). Performance indicators catch (proportion of TACC), CPUE ( $\text{kg}\cdot\text{hr}^{-1}$ ), PropLge, legal density ( $\text{n}\cdot\text{m}^{-2}$ ), pre-recruit density ( $\text{n}\cdot\text{m}^{-2}$ ), mortality ( $Z$ ) and scores from the harvest strategy in brackets. Red and blue lines are upper and lower limit and target reference points, respectively. Black bars describe the data and time over which the reference points were calculated, open bars describe the measures of the PI outside the reference period and orange bars the data and year subject to assessment for each PI, i.e. the score-year.

Anxious Bay

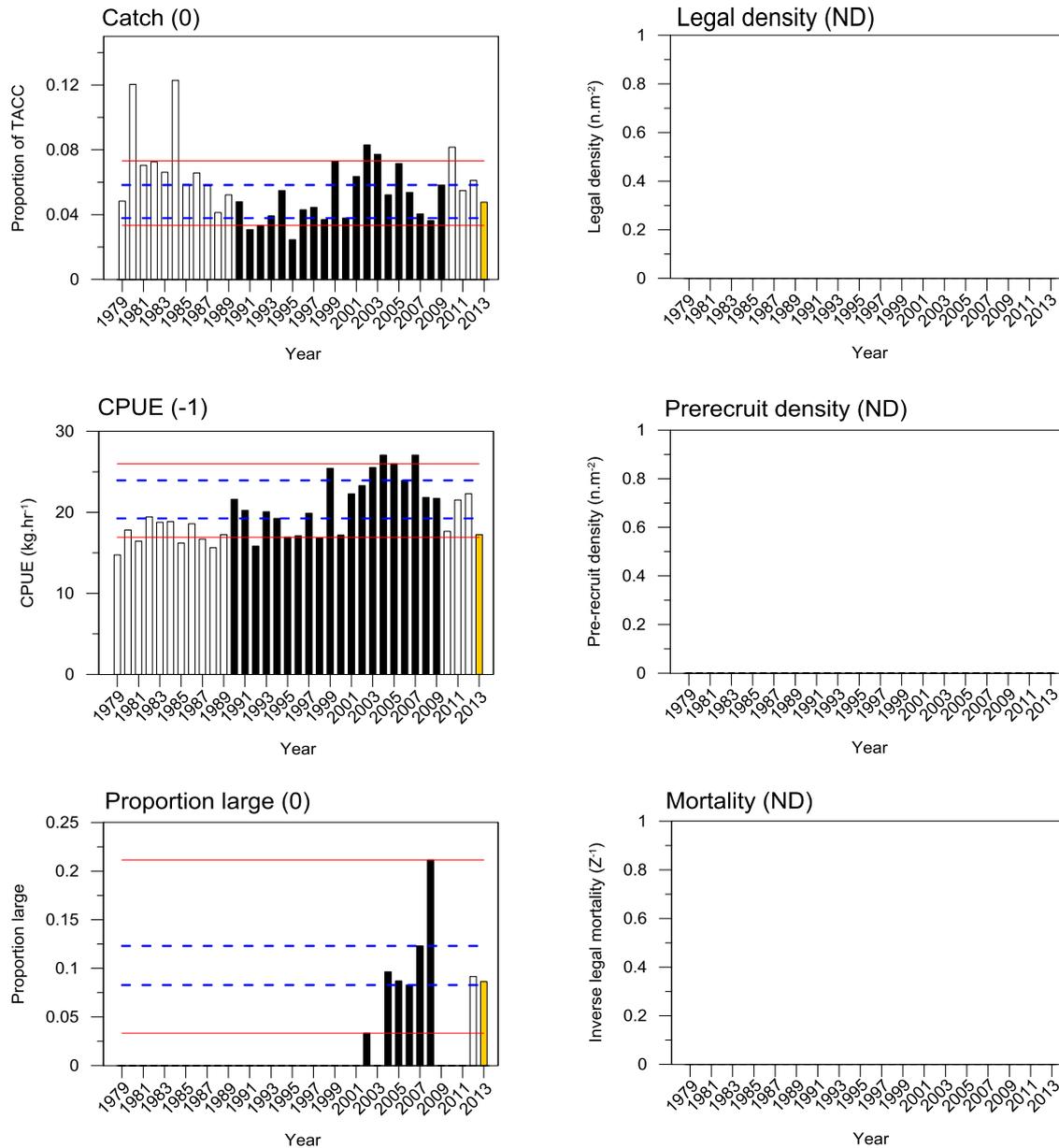


Figure 9. Anxious Bay (high importance). Performance indicators catch (proportion of TACC), CPUE (kg.hr<sup>-1</sup>), PropLge, legal density (n.m<sup>-2</sup>), pre-recruit density (n.m<sup>-2</sup>), mortality (Z) and scores from the harvest strategy in brackets. Red and blue lines are upper and lower limit and target reference points, respectively. Black bars describe the data and time over which the reference points were calculated, open bars describe the measures of the PI outside the reference period and orange bars the data and year subject to assessment for each PI, i.e. the score-year. ND indicates no data.

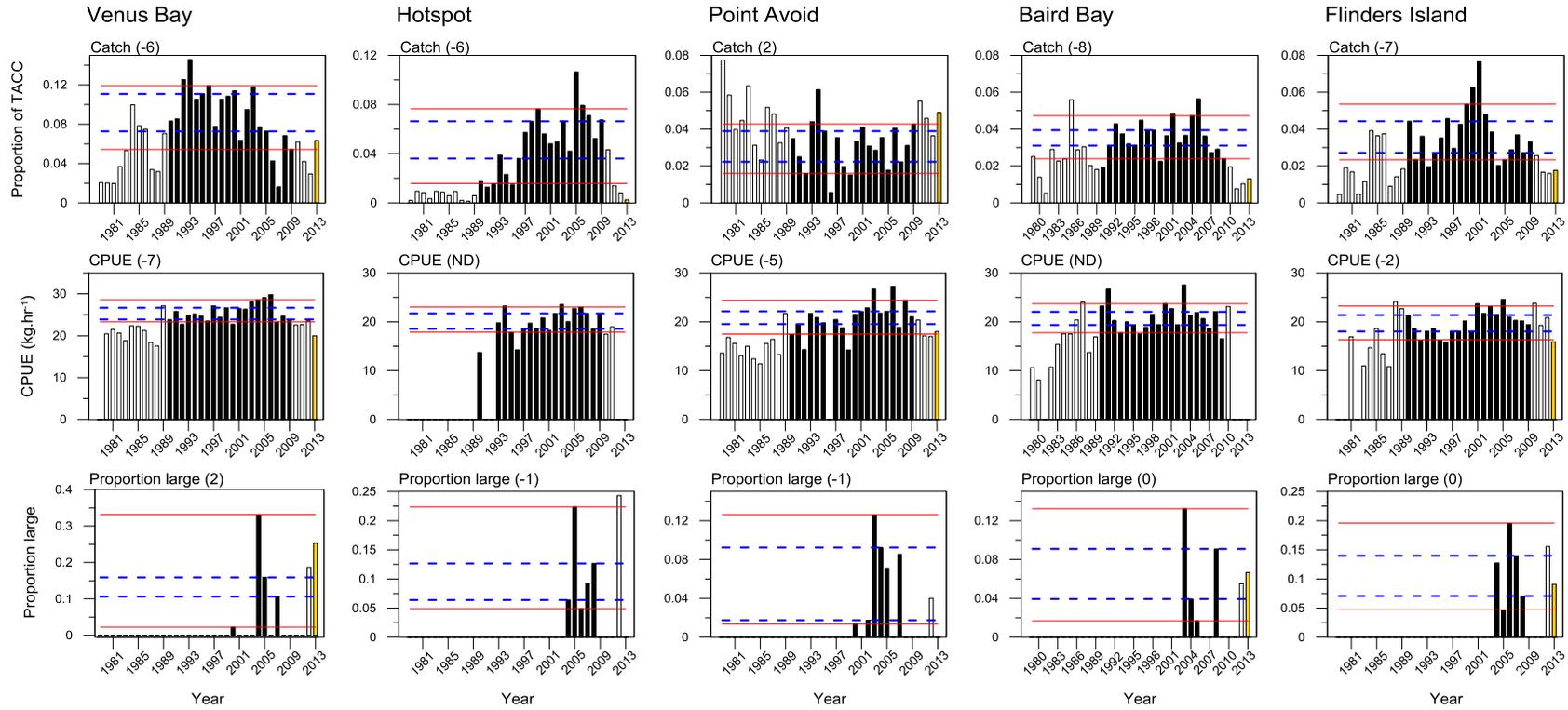


Figure 10. Venus Bay, Hotspot, Point Avoid, Baird Bay, Flinders Island (medium importance). Performance indicators catch (proportion of TACC), CPUE ( $\text{kg}\cdot\text{hr}^{-1}$ ), PropLge and scores from the harvest strategy in brackets. Red and blue lines are upper and lower limit and target reference points, respectively. Black bars describe the data and time over which the reference points were calculated, open bars describe the measures of the PI outside the reference period and orange bars the data and year subject to assessment for each PI, i.e. the score-year. ND indicates no data.

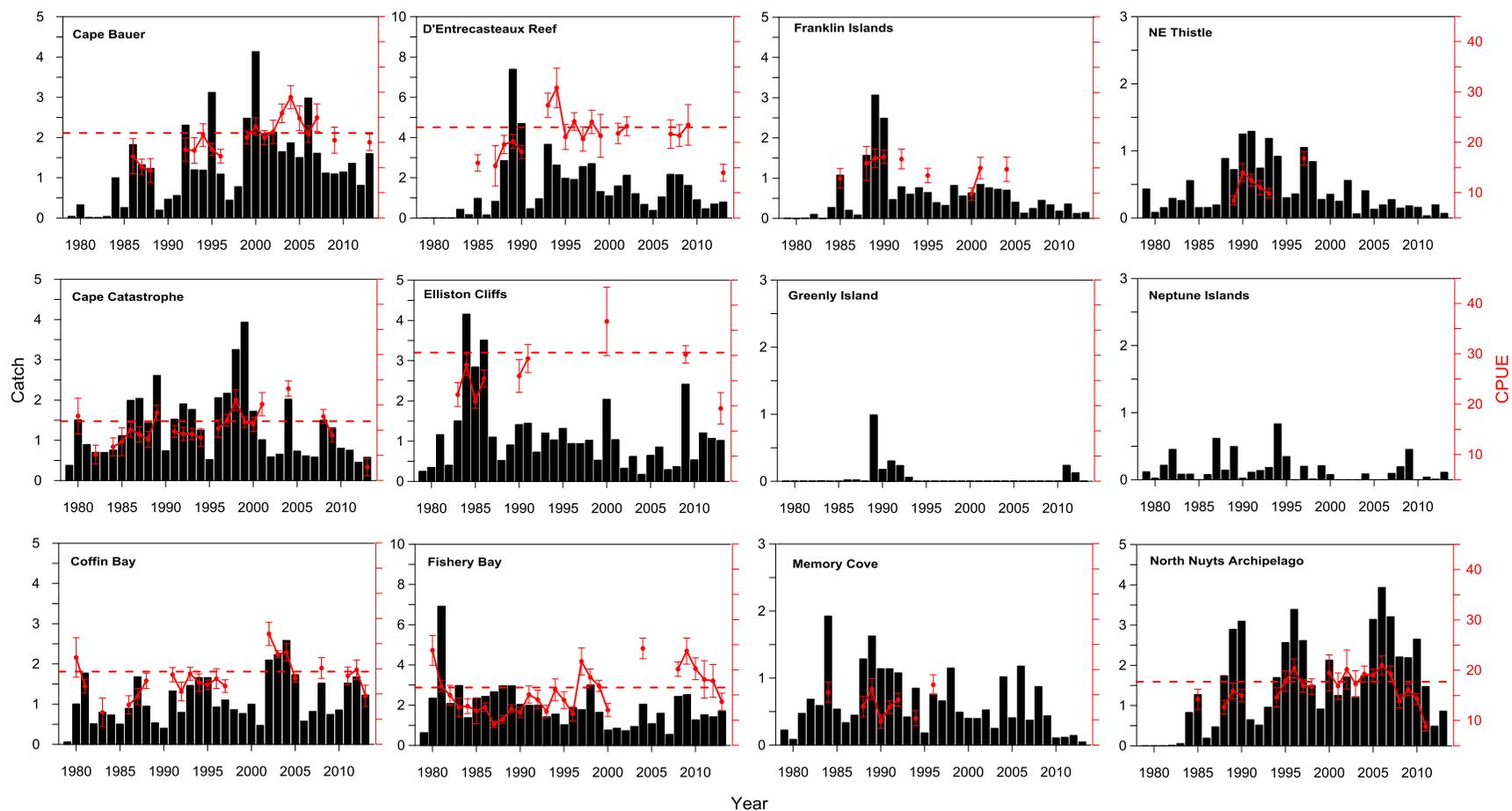


Figure 11. Catch (t, meat weight; black bars) of blacklip from low importance SAUs Cape Bauer, Cape Catastrophe, Coffin Bay, D'Entrecasteaux Reef, Elliston Cliffs, Fishery Bay, Franklin Islands, Greenly Island, Memory Cove, NE Thistle, Neptune Islands and North Nuyts Archipelago from 1979 to 2013. CPUE  $\pm$  se ( $\text{kg}\cdot\text{hr}^{-1}$ ) is shown in red. Red dashed lines show CPUE<sub>90-09</sub> where applicable. Note catch scales vary among graphs.

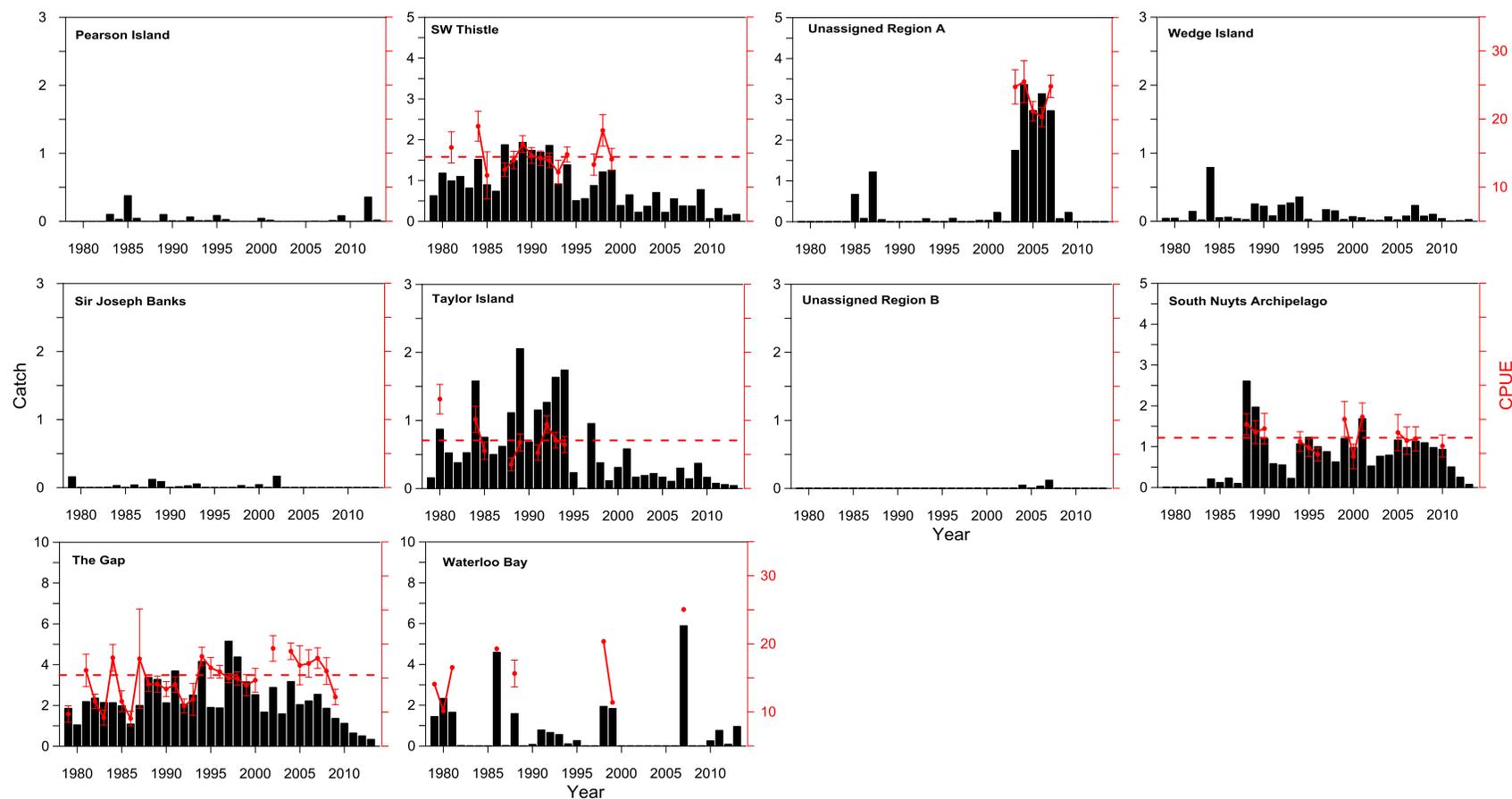


Figure 12. Catch (t, meat weight; black bars) of blacklip from low importance SAUs Pearson Island, Sir Joseph Banks, The Gap, SW Thistle, Taylor Island, Waterloo Bay, Unassigned Region A, Unassigned Region B, Wedge Island and South Nuyts Archipelago from 1979 to 2013. CPUE  $\pm$  se (kg.hr<sup>-1</sup>) is shown in red. Red dashed lines show CPUE<sub>90-09</sub> where applicable. Note catch scales vary among graphs.

#### 4. SUMMARY

The harvest strategy for the South Australian Abalone Fishery (PIRSA 2012) is the current tool for setting TACCs in this fishery. This harvest strategy is used to adjust TACCs in response to changing abalone populations, monitored using biological performance indicators (PIs) in SAUs of high and medium importance. In 2013, application of the harvest strategy to determine stock status for the WZ was based on 13 SAUs distributed throughout the fishery. This number of SAUs provided a good representation of fished stocks when compared with other zones such as the Central Zone that rely on fewer SAUs for the assessment (Chick and Mayfield 2012).

The catch-weighted, zonal stock status score for blacklip from the harvest strategy was -0.24, defining this species in the WZ as “**sustainably fished**”. As this is the first assessment following the merging of regions A and B the harvest strategy was retrospectively applied to 2012 to determine where stock status across the WZ had changed between years. The catch-weighted zonal score for the WZ in 2012 was -0.40 (“**sustainably fished**”; Table A1) confirming there was no change in zonal stock status between 2012 and 2013.

The outcome of the harvest strategy for the WZ – “**sustainably fished**” – is in contrast with the weight-of-evidence approach because low current CPUEs, the principal relative index of blacklip abundance, suggest stocks are at their weakest position since 1996 (Figures 1-12). The CPUE for the WZ has been declining consistently since 2006 and, in 2013, was 9% below CPUE<sub>90-09</sub> and below the average value for the 1990s, prior to the period of elevated blacklip abundance (Stobart *et al.* 2013). The recent decline in CPUE was also consistent amongst SAUs. Most of the reduction in the WZ CPUE was attributable to decreases in those SAUs previously comprising Region A (Figure A1). There was no change in zonal stock status for blacklip in Region A between 2012 (“**sustainably fished**”; Stobart *et al.* 2013) and 2013 (“**sustainably fished**”; Table A2). The CPUE across those SAUs from Region B has increased markedly in recent years (Figure A1), suggesting the 50% reduction in the Region B TACC has been effective in initiating stock rebuilding. Based on the weight-of-evidence approach, the WZ blacklip stocks would be classified as “**transitional depleting**” using the national stock status categorisation framework (Flood *et al.* 2012). Consequently, there is no evidence that the recent reductions in WZ catch have been adequate to arrest the ongoing declines and facilitate stock rebuilding (Stobart *et al.* 2013). In addition, current catches in most SAUs, including some from which substantial catches have been harvested in recent years may not be sustainable.

## 5. REFERENCES

Chick, R. C. and Mayfield, S. (2012). Central Zone Abalone (*Haliotis laevigata* & *H. rubra*) Fishery. Fishery Assessment report for PIRSA Fisheries and Aquaculture. South Australian Research and Development Institute (Aquatic Sciences), SARDI Publication No.F2007/000611-4 SARDI Research Report Series No. 654. 67pp.

Flood, M., Stobutzki, I., Andrews, J., Begg, G., Fletcher, W., Gardner, C., Kemp, JU., Moore, A., O'Brien, A., Quinn, R., Roach, j., Rowling, K., Sainsbury, K., Saunders, T., Ward, T. and Winning, M. (eds) (2012). Status of key Australian fish stock report 2012. Fisheries Research and Development Corporation, Canberra, Australia, 419p.

PIRSA (2012). Management Plan for the South Australian Commercial Abalone Fishery. Adelaide. Primary industries and Regions South Australia Fisheries and Aquaculture. [http://www.pir.sa.gov.au/\\_data/assets/pdf\\_file/0004/12982/Abalone\\_Fishery\\_Management\\_Plan\\_-\\_September\\_2012\\_.pdf](http://www.pir.sa.gov.au/_data/assets/pdf_file/0004/12982/Abalone_Fishery_Management_Plan_-_September_2012_.pdf) 85pp.

Stobart, B., Mayfield, S., Dent, J. and Matthews, D. J. (2012a). Western Zone Abalone (*Haliotis laevigata* and *H. rubra*) Fishery (Region B). Fishery Stock Assessment Report to PIRSA Fisheries and Aquaculture. South Australian Research and Development Institute (Aquatic Sciences). Adelaide. SARDI Publication No. F2010/000389-2. SARDI Research Report Series No. 661. 32pp.

Stobart, B., Mayfield, S., Dent, J. and Matthews, D. J. (2013). Western Zone Blacklip Abalone Fishery (*Haliotis rubra*) Fishery (Region A). Fishery Stock Assessment Report to PIRSA Fisheries and Aquaculture. South Australian Research and Development Institute (Aquatic Sciences). Adelaide. SARDI Publication No. F2007/000561-5. SARDI Research Report Series No. 738. 71pp.

Stobart, B., Mayfield, S., Dent, J., Matthews, D. J. and Chick, R. C. (2012b). Western Zone Abalone (*Haliotis rubra* and *H. laevigata*) Fishery (Region A). Fishery Stock Assessment Report to PIRSA Fisheries and Aquaculture. South Australian Research and Development Institute (Aquatic Sciences). Adelaide. SARDI Publication No. F2007/000561-4. SARDI Research Report Series No. 660. 118pp.

## 6. APPENDIX

Table A1. Outcome from application of the harvest strategy described in the Management Plan for the South Australian Abalone Fishery against the blacklip fishery in the Western Zone for 2012. Grey shading identifies the performance indicators and their respective scores. ND indicates no data.

Spatial assessment unit	% contribution to mean total catch (WZ) over the last 10 years (03-12)	Importance	% contribution of catch from high & medium SAU in 2012	CPUE	%TACC	PropLge	Pre-recruit Density	Legal Density	Mortality	Combined PI score	Risk of overfishing	Catch-weighted contribution to zonal score
Drummond	7.4	High	29.98	-3	7	0	-3	-1	2	2	0	0.00
Sheringa	6.0	High	17.20	-4	3	2	-1	0	-1	-1	0	0.00
Avoid_Bay	3.9	High	8.99	-3	3	-1	-2	-2	0	-5	-1	-0.09
Point_Westall	3.8	High	6.63	-1	-5	-1	-3	-2	1	-11	-2	-0.13
Searcy_Bay	3.8	High	6.87	0	0	1	ND	ND	ND	1	0	0.00
Ward_Island	3.7	High	3.26	-4	-4	-2	0	-2	-3	-15	-2	-0.07
Reef_Head	3.3	High	10.81	-4	6	0	ND	ND	ND	2	0	0.00
Venus_Bay	3.3	High	3.35	-5	-6	1	ND	ND	ND	-10	-2	-0.07
Anxious_Bay	3.3	High	6.96	0	1	0	ND	ND	ND	1	0	0.00
Hotspot	3.1	Medium	-	ND	-4	2	-	-	-	Uncertain	Not assigned	-
Point_Avoid	2.0	Medium	4.14	-4	0	0	-	-	-	-4	-1	-0.04
Baird_Bay	1.6	Medium	-	ND	-7	0	-	-	-	Uncertain	Not assigned	-
Flinders_Island	1.5	Medium	1.82	0	-5	1	-	-	-	-4	-1	-0.02
North_Nuyts_Archipelago	1.2	Medium	-	ND	-2	-1	-	-	-	Uncertain	Not assessed	-
The_Gap	1.0	Low	-	-	-	-	-	-	-	-	Not assessed	-
Fishery_Bay	0.9	Low	-	-	-	-	-	-	-	-	Not assessed	-
Cape_Bauer	0.8	Low	-	-	-	-	-	-	-	-	Not assessed	-
Coffin_Bay	0.8	Low	-	-	-	-	-	-	-	-	Not assessed	-
Unassigned_WZ_RG_A	0.8	Low	-	-	-	-	-	-	-	-	Not assessed	-
D'Entrecasteaux_Reef	0.6	Low	-	-	-	-	-	-	-	-	Not assessed	-
Cape_Catastrophe	0.5	Low	-	-	-	-	-	-	-	-	Not assessed	-
South_Nuyts_Archipelago	0.5	Low	-	-	-	-	-	-	-	-	Not assessed	-
Elliston_Cliffs	0.5	Low	-	-	-	-	-	-	-	-	Not assessed	-
Waterloo_Bay	0.4	Low	-	-	-	-	-	-	-	-	Not assessed	-
Memory_Cove	0.3	Low	-	-	-	-	-	-	-	-	Not assessed	-
SW_Thistle	0.2	Low	-	-	-	-	-	-	-	-	Not assessed	-
Franklin_Islands	0.2	Low	-	-	-	-	-	-	-	-	Not assessed	-
Taylors_Island	0.1	Low	-	-	-	-	-	-	-	-	Not assessed	-
NE_Thistle	0.1	Low	-	-	-	-	-	-	-	-	Not assessed	-
Neptune_Islands	0.0	Low	-	-	-	-	-	-	-	-	Not assessed	-
Wedge_Island	0.0	Low	-	-	-	-	-	-	-	-	Not assessed	-
Pearson_Island	0.0	Low	-	-	-	-	-	-	-	-	Not assessed	-
Greenly_Island	0.0	Low	-	-	-	-	-	-	-	-	Not assessed	-
Unassigned_WZ_RG_B	0.0	Low	-	-	-	-	-	-	-	-	Not assessed	-
Sir_Joseph_Banks	0.0	Low	-	-	-	-	-	-	-	-	Not assessed	-
<b>Sum</b>	<b>55.8</b>		<b>100.0</b>								<b>Zonal Stock Status</b>	<b>-0.41</b>

Table A2. Outcome from application of the harvest strategy described in the Management Plan for the South Australian Abalone Fishery against the blacklip fishery in the Region A for 2013. Grey shading identifies the performance indicators and their respective scores. ND indicates no data.

Spatial assessment unit	% contribution to mean total catch (WZ) over the last 10 years (04-13)	Importance	% contribution to catch from high & medium SAU in 2013	CPUE	%TACC	PropLge	Pre-recruit Density	Legal Density	Mortality	Combined PI score	Risk of overfishing	Catch-weighted contribution to zonal score
Drummond	7.98	High	23.35	-4	7	1	-3	-1	2	2	0	0.00
Sheringa	6.20	High	18.18	-6	3	4	-1	-2	-1	-3	-1	-0.18
Point Westall	4.06	High	10.36	0	1	1	-3	-2	1	-2	0	0.00
Avoid Bay	3.93	High	4.43	0	0	1	-2	-2	0	-3	-1	-0.04
Searcy Bay	3.70	High	7.91	-2	0	0	ND	ND	ND	-2	0	0.00
Reef Head	3.60	High	11.85	-6	8	1	ND	ND	ND	3	1	0.12
Ward Island	3.58	High	3.40	-6	-6	0	0	-2	-2	-16	-2	-0.07
Anxious Bay	3.12	High	5.51	-1	0	0	ND	ND	ND	-1	0	0.00
Venus Bay	2.96	Medium	7.32	-7	-6	2	-	-	-	-11	-2	-0.15
Hotspot	2.79	Medium	-	ND	-6	-1	-	-	-	Uncertain	Not assigned	-
Point Avoid	2.09	Medium	5.66	-5	2	-1	-	-	-	-4	-1	-0.06
Baird Bay	1.53	Medium	-	ND	-8	0	-	-	-	Uncertain	Not assigned	-
Flinders Island	1.38	Medium	2.03	-2	-7	0	-	-	-	-9	-2	-0.04
Fishery Bay	0.91	Low	-	-	-	-	-	-	-	-	Not assessed	-
The Gap	0.89	Low	-	-	-	-	-	-	-	-	Not assessed	-
Cape Bauer	0.85	Low	-	-	-	-	-	-	-	-	Not assessed	-
Coffin Bay	0.75	Low	-	-	-	-	-	-	-	-	Not assessed	-
Unass WZ RG A	0.69	Low	-	-	-	-	-	-	-	-	Not assessed	-
Cape Catastrophe	0.53	Low	-	-	-	-	-	-	-	-	Not assessed	-
Elliston Cliffs	0.48	Low	-	-	-	-	-	-	-	-	Not assessed	-
Waterloo Bay	0.45	Low	-	-	-	-	-	-	-	-	Not assessed	-
Memory Cove	0.27	Low	-	-	-	-	-	-	-	-	Not assessed	-
SW Thistle	0.21	Low	-	-	-	-	-	-	-	-	Not assessed	-
NE Thistle	0.10	Low	-	-	-	-	-	-	-	-	Not assessed	-
Taylor Island	0.09	Low	-	-	-	-	-	-	-	-	Not assessed	-
Neptune Islands	0.06	Low	-	-	-	-	-	-	-	-	Not assessed	-
Wedge Island	0.04	Low	-	-	-	-	-	-	-	-	Not assessed	-
Pearson Island	0.03	Low	-	-	-	-	-	-	-	-	Not assessed	-
Greenly Island	0.02	Low	-	-	-	-	-	-	-	-	Not assessed	-
Sir Joseph Banks	0.00	Low	-	-	-	-	-	-	-	-	Not assessed	-
<b>Sum</b>	<b>53.3</b>		<b>100.0</b>								<b>Zonal Stock Status</b>	<b>-0.42</b>

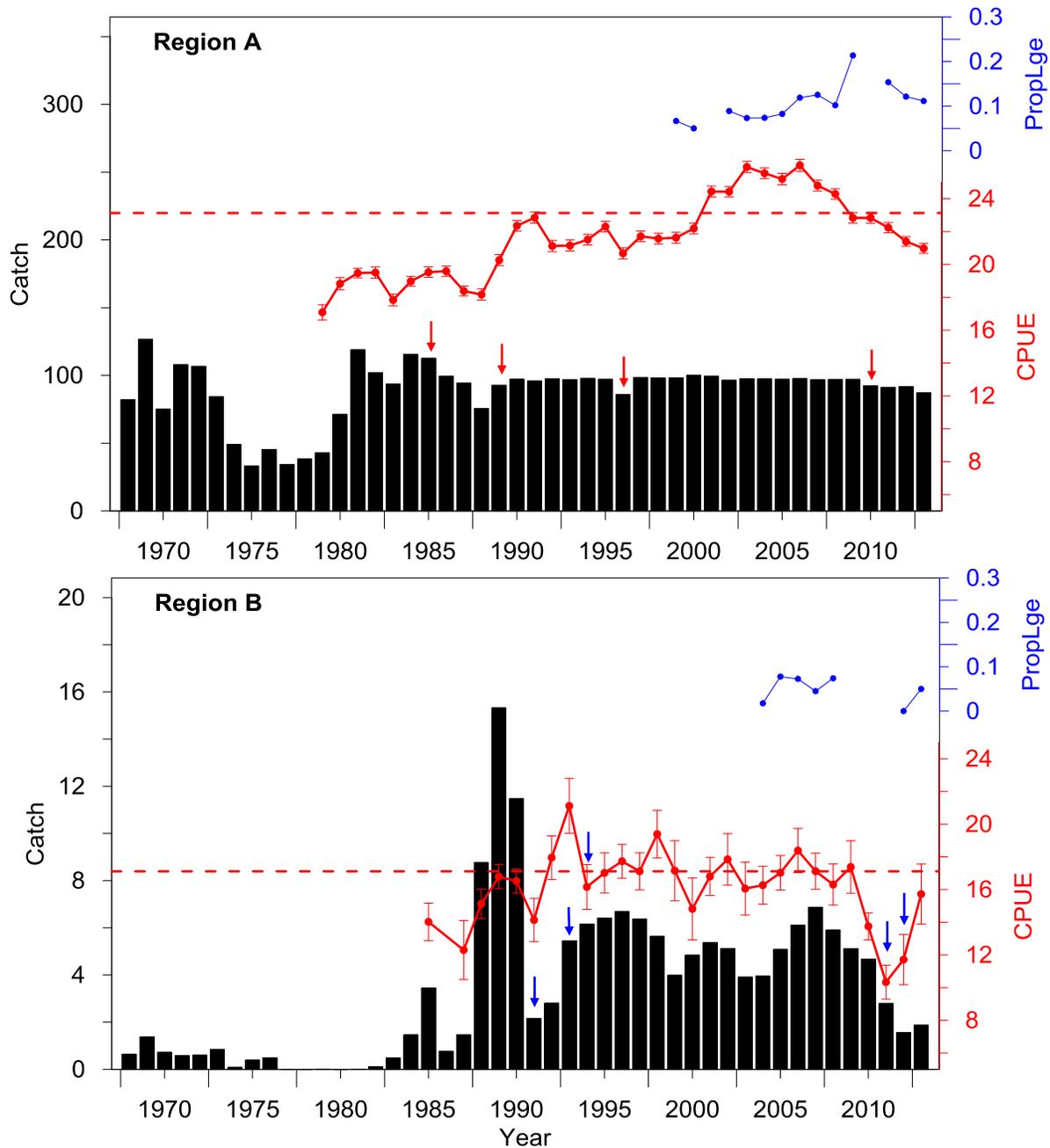


Figure A1. Catch (t, meat weight; black bars) of blacklip from regions A and B of the Western Zone from 1968 to 2013. CPUE  $\pm$  se ( $\text{kg}\cdot\text{hr}^{-1}$ ) and PropLge are shown in red and blue lines, respectively. Red dashed lines show CPUE<sub>90-09</sub>. Red arrows indicate implementation (1985) and amendment (1989, 2006 and 2010) of the TACC in Region A, blue arrows indicate implementation (1991) and amendment (1993, 1994, 2011 and 2012) of TACC in Region B.