

# Fisheries

## Status of the Southern Zone Abalone (*Haliotis rubra* and *H. laevigata*) Fishery in 2021/22



O. Burnell, S. Mayfield and A. Hogg

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July 2022

Report for PIRSA Fisheries and Aquaculture



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## EXECUTIVE SUMMARY

This report assesses the status of Blacklip Abalone (*Haliotis rubra*) and Greenlip Abalone (*H. laevigata*; hereafter referred to as 'blacklip' and 'greenlip', respectively) in the Southern Zone (SZ) of the South Australian Abalone Fishery in the 2021/22 fishing season. Blacklip stock status is determined using the Harvest Strategy (HS) from the Abalone Management Plan (PIRSA 2021), that has been designed to deliver outcomes consistent with the national fishery status reporting framework (NFSRF). The HS is not applied to greenlip in the SZ (PIRSA 2021). As the 2021/22 fishing season is incomplete, this assessment considers data between 1 October 2021 and 30 April 2022. These 'provisional data' provide a reliable measure of stock status (see Dent *et al.* 2016).

### Blacklip Abalone

The year-to-date (YTD) blacklip catch of 128.3 t, constituted 97% of the 132 t Total Allowable Commercial Catch (TACC). The key sources of fishery-dependent and fishery-independent data collectively indicated that blacklip stocks were in a healthy position. Estimates of CPUE for most of the spatial assessment units (SAUs) were increasing and were above their target range from the HS. The density of legal sized abalone recorded at key locations during fishery-independent surveys (FIS) have been relatively stable since 2014/15, although remain below the target range in some SAUs. The ongoing discrepancy between these two key indicators is noteworthy (CPUE average HS score 8.4 / 10, FIS average HS score 3.9 / 10), and might reflect several factors, which could be a focus of future research.

Collectively, the available evidence suggests that the harvestable biomass of blacklip stocks in the SZ fishery is stable and/or improving. Current stock levels are sufficient to ensure that future levels of recruitment are adequate, and fishing mortality is appropriately controlled to avoid the stock becoming recruitment impaired. Application of the HS in 2021/22 resulted in a **zone score (i.e. biomass proxy) of 7.70 out of 10** that, in combination with the **zone trend score (i.e. fishing mortality proxy) of 5.10 out of 10** (reflecting an increasing trend), define the stock status for blacklip in the SZ as '**sustainable**'. This is consistent with status classifications since 2016/17 (Burnell *et al.* 2021). The HS zone score of 7.70 translates to a **recommended zonal catch of 141.2 t** for 2022/23, which is 7.0% above the current TACC of 132.0 t.

### Greenlip Abalone

The YTD greenlip catch of 1.40 t was among the lowest levels since the mid-1980s, and consistent with the current low TACC of 1.8 t. Greenlip Abalone is considered a bycatch species in the SZ, and there are insufficient data available to estimate either biomass or fishing mortality, and hence the stock status for this species is classified as '**undefined**' in 2021/22 under the NFSRF (Pidcocke *et al.* 2021). This is consistent with previous status classifications for greenlip (Burnell *et al.* 2021).

Key statistics for the SZ blacklip and greenlip fisheries from 2013/14 to 2021/22 including number of licences; total allowable commercial catch (TACC); total commercial catch (TCC); catch-per-unit-effort (CPUE); and stock status from the weight of evidence using the national fishery status reporting framework (NFSRF) or the Harvest Strategy.

Blacklip						
Season	No. licences	TACC (t)	TCC (t)	CPUE (kg.hr <sup>-1</sup> )	Stock Status (Complete season)	Stock Status (YTD)
2013/14	6	151.5	125.7	100.3	Depleting	
2014/15	6	151.5	134.6	96.8	Depleting	
2015/16	6	126.0	122.6	97.5	Depleting	
2016/17	6	126.0	125.9	99.5	Sustainable	
2017/18	6	126.0	126.3	108.2	Sustainable	
2018/19	6	132.0	131.5	111.0	Sustainable	
2019/20	6	132.0	117.8	109.1	Sustainable*	
2020/21	6	132.0	132.3	105.1	Sustainable*	
2021/22	6	132.0	128.3 <sup>#</sup>	119.2 <sup>#</sup>	TBA in next report	Sustainable <sup>#,*</sup>

Greenlip						
Season	No. licences	TACC (t)	TCC (t)	CPUE (kg.hr <sup>-1</sup> )	Stock Status <sup>^</sup>	
2013/14	6	7.2	3.6	na	Undefined	
2014/15	6	7.2	4.4	na	Undefined	
2015/16	6	6.0	3.8	na	Undefined	
2016/17	6	3.6	3.2	na	Undefined	
2017/18	6	3.6	3.1	na	Undefined	
2018/19	6	1.8	1.9	na	Undefined	
2019/20	6	1.8	1.9	na	Undefined	
2020/21	6	1.8	1.4	na	Undefined	
2021/22	6	1.8	1.4 <sup>#</sup>	na	Undefined	

<sup>#</sup>Year-to-date data for the incomplete 2021/22 Fishing Season as prescribed by the Harvest Strategy. \*Since 2019/20 blacklip stock status has been determined using the Harvest Strategy (PIRSA 2021). Prior to this stock status was determined using the weight-of-evidence from the National Fishery Status Reporting Framework. <sup>^</sup>The Harvest Strategy is not applied to greenlip, instead stock status classifications are determined using the National Fishery Status Reporting Framework.

**Keywords:** Blacklip Abalone, *Haliotis rubra*, Greenlip Abalone, *Haliotis laevigata*, Stock status, Harvest Strategy, South Australia.



## 1. INTRODUCTION

This report assesses the status of Blacklip Abalone (*Haliotis rubra*; hereafter referred to as 'blacklip') and Greenlip Abalone (*H. laevis*; hereafter referred to as 'greenlip') in the Southern Zone (SZ) of the South Australian Abalone Fishery in 2021/22. These reports form part of the South Australian Research and Development Institute (SARDI) Aquatic Sciences ongoing assessment program for this fishery. The most recent stock status for both species in 2019/20 was provided in Burnell *et al.* (2021).

In this report, stock status for blacklip was determined using the Harvest Strategy (HS), which has been designed to deliver stock status outcomes consistent with the national fishery status reporting framework (NFSRF; Pidcocke *et al.* 2021, Table 1-1). The HS used in this report is part of the Management Plan for the South Australian Commercial Abalone Fisheries (PIRSA 2021). The Management Plan specifies annual application of the HS to determine stock status for blacklip and review the Total Allowable Commercial Catch (TACC). The management plan specifies for the SZ that '*year-to-date data derived from the fishing season currently underway will be used (i.e. the assessment will consider data between 1 October in the previous calendar year to the latest available data at the time of the assessment)*' (PIRSA 2021). The HS is not applied to greenlip in the SZ (PIRSA 2021).

**Table 1-1.** Terminology for the status of key Australian fish stocks (from Pidcocke *et al.* 2021).

	Stock status	Description	Potential implications for management of the stock
	Sustainable	Biomass (or biomass proxy) is at a level sufficient to ensure that, on average, future levels of recruitment are adequate ( <i>i.e.</i> recruitment is not impaired) and for which fishing mortality (or proxy) is adequately controlled to avoid the stock becoming recruitment impaired	Appropriate management is in place
	Depleting	Biomass (or proxy) is not yet depleted and recruitment is not yet impaired, but fishing mortality (or proxy) is too high (overfishing is occurring) and moving the stock in the direction of becoming recruitment impaired	Management is needed to reduce fishing mortality and ensure that the biomass does not become depleted
	Recovering	Biomass (or proxy) is depleted and recruitment is impaired, but management measures are in place to promote stock recovery, and recovery is occurring	Appropriate management is in place, and there is evidence that the biomass is recovering
	Depleted	Biomass (or proxy) has been reduced through catch and/or non-fishing effects, such that recruitment is impaired. Current management is not adequate to recover the stock, or adequate management measures have been put in place but have not yet resulted in measurable improvements	Management is needed to recover this stock; if adequate management measures are already in place, more time may be required for them to take effect
	Undefined	Not enough information exists to determine stock status	Data required to assess stock status are needed
	Negligible	Catches are so low as to be considered negligible and inadequate information exists to determine stock status	Assessment will not be conducted unless catches and information increase

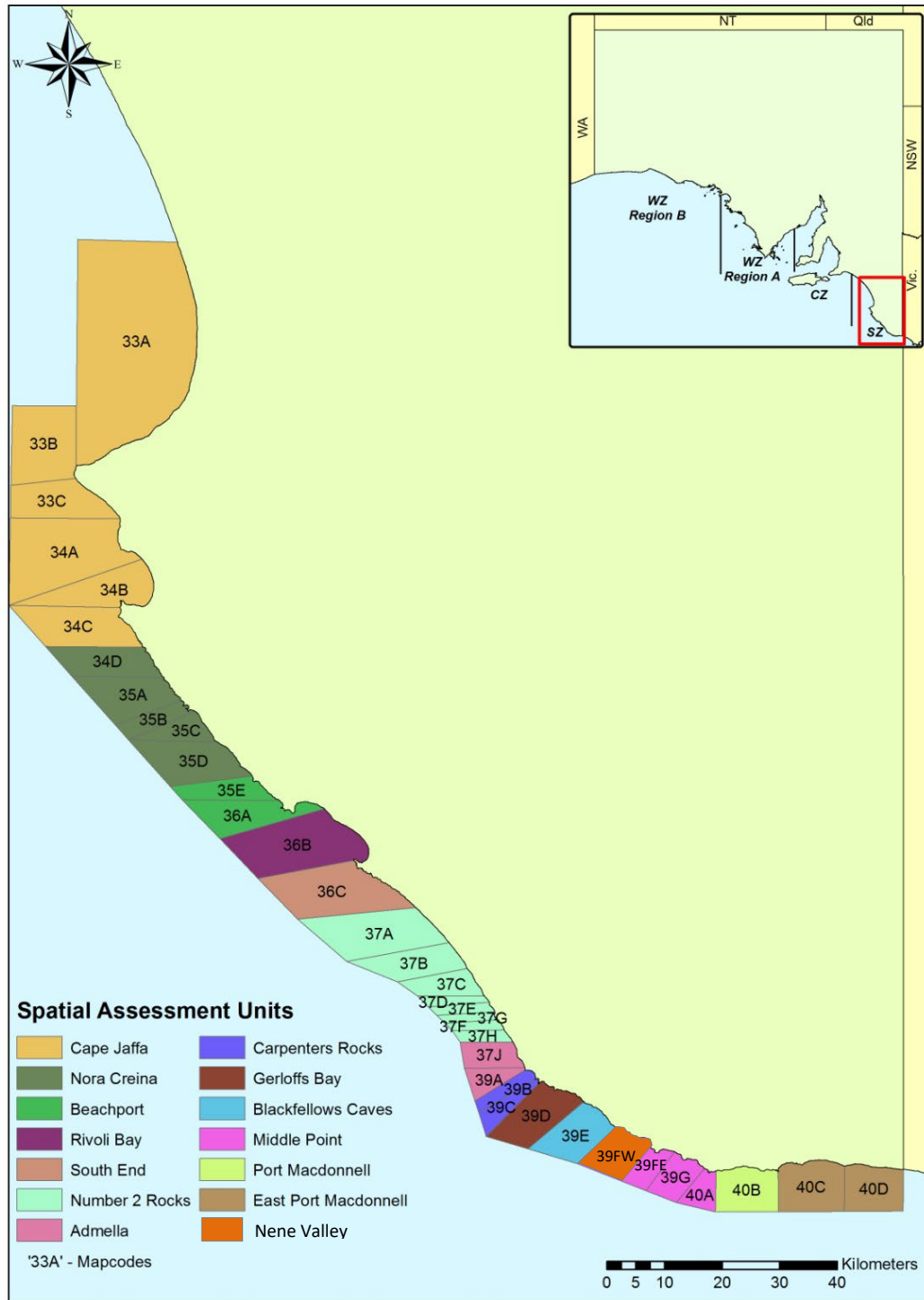
## 2. METHODS

Fishery statistics are provided at two spatial scales: the whole of the SZ and individual Spatial Assessment Units (SAUs; Figure 1). Data are presented by fishing season (currently 1 October to 30 September). In 2021/22, the YTD data are for the incomplete fishing season, spanning 1 October 2021 to 30 April 2022. Fishery-dependent and fishery-independent methods are described briefly below. A greater level of detail is available in the previous stock assessment report (Burnell *et al.* 2021).

### *Fishery-dependent data*

Commercial catch and effort data have been collected since 1968/69 by fishers completing a research logbook for each fishing day.

Catch (t, whole weight) was determined from all daily logbook returns. Catch-per-unit-effort (kg.hr<sup>-1</sup>, whole weight) was estimated as the mean of daily CPUE weighted by the proportion of the target species in the catch. Due to the mixed nature of catches, effort was split pro-rata based on the proportion of each species in the daily catch. Only days with ≥95% of blacklip in the daily catch are included in CPUE estimates. Estimates of CPUE (mean ± se) are not made where <10 fishing events are available in the respective SAU in a given season. Catch rate estimates with no standard error shown represent a running mean CPUE, estimated when there are ≥10 fishing events available across three years (with a minimum of 1 fishing event each year), which are required under the HS (PIRSA 2021). In the 2017/18 season, the fishery transitioned to beach weighing of catch, which results in abalone being weighed earlier and having a slightly greater total weight. This change has not been accounted for in the CPUE estimates. No CPUE estimates are possible for greenlip, as it is primarily a bycatch species, with very few targeted fishing days.



**Figure 1** Spatial assessment units (SAUs) and mapcodes in the Southern Zone Abalone Fishery.

In 2021/22, a new SAU (i.e. Nene Valley) was created by splitting mapcode 39F into a western (i.e. 39FW) and eastern section (39FE; see Figure 1). This new SAU was designed to align with a historical fish down area (FDA), which formerly existed from 1997/98 to 2012/13 and had a lower minimum legal length (MLL) of 110mm, which allowed slow growing and stunted abalone from this area to be harvested by commercial fishers. In 2013/14, this FDA was combined with mapcode 39F within the Middle Point SAU, as part of the spatial management changes. Therefore, prior to 1997/98, and from 2012/13 to 2020/21, logbook data does not discern if fishing events from mapcode 39F took place in 39FW (i.e. Nene Valley SAU) or 39FE (i.e. Middle Point SAU), as there was no management reporting boundary during these periods. Therefore, an alternative approach was devised to allocate catch and effort using Vessel Monitoring System (VMS) location data, which was available for most fishing days since 2012/13. On days where VMS data were available post-2012/13, VMS effort was used to allocate catch and effort pro-rata to either 39FW (i.e. Nene Valley SAU) or 39FE (i.e. Middle Point SAU). On fishing days where VMS data were not available, the catch and effort was split based on the overall ratio from all the fishing events with VMS data between 2013/14 and 2019/20 (i.e. 25.1% of blacklip catch, 82.9% of greenlip catch and 29.8% of total effort were allocated to 39FW, and vice-versa 74.9% of blacklip catch, 17.1% of greenlip catch and 70.2% of total effort were allocated to 39FE). As a result, it was not appropriate to utilise daily data to estimate CPUE. Hence, a ratio estimator (i.e. annual blacklip catch / annual effort) was used to estimate CPUE for the Middle Point and Nene Valley SAUs. No error estimates are made for these CPUE values.

Abalone mean length and length-frequency distributions for each SAU from the commercial shell sampling program are provided.

#### *Fishery-independent data*

Fishery-independent surveys (FIS) are undertaken biennially in five SAUs in the SZ (i.e. Middle Point, Number 2 Rocks, Gerloffs Bay, Nene Valley and Rivoli Bay). A group of survey locations formerly from the Middle Point SAU, are now classified as part of the new Nene Valley SAU, due to their location in mapcode 39FW. The current survey method involves counting all abalone within an area designated by either a leaded line (240 m<sup>2</sup>) or a cross drop (40 m<sup>2</sup>) at a series of consistent locations, and undertaking length-frequency samples at consistent locations, to derive the mean density of legal-sized and sub-legal-sized abalone. The MLL varies from  $\geq 110$  to  $\geq 125$ mm among SAUs (see Burnell *et al.* 2021).

The 2020/21, FIS at two of the three sites within the Middle Point SAU were delayed until 2021/22, and therefore data shown as 2020/21 in Figure 3d, reflects a combination of surveys completed in 2020/21 and 2021/22. The planned 2020/21 FIS at Number 2 Rocks were not completed.

### *Harvest Strategy and stock status determination*

In the HS, each SAU is designated as surveyed (i.e. FIS undertaken), unsurveyed (i.e. no FIS undertaken) or data-limited (PIRSA 2021). The data-limited SAUs are pooled for estimation of CPUE and scoring in the HS (PIRSA 2021).

The HS is based on two Performance Indicators (PIs), CPUE and legal-sized abalone density from the FIS. Performance Indicator scores for each SAU range from 0 to 10, based on comparison with a historical reference period. There are five surveyed SAUs for blacklip in the SZ. However, at Number 2 Rocks, there are insufficient data to generate a FIS reference period for HS scoring. When FIS scores are available, combined SAU scores reflect equal weighting (i.e. 50:50) of the CPUE and FIS PIs. Scores for each SAU are then weighted based on the last 12 years of catch, and summed to a zone score, which represents the biomass proxy from the NFSRF. The slope from the last four zone scores is used to generate a proxy for fishing mortality (i.e. zone trend score). Stock status is determined based on the combination of the zone score and the zone trend score, shown in Table 2-1.

The zone score (i.e. biomass proxy) translates directly to a recommended zonal catch, via a function applied to the target catch level (see PIRSA 2021). The target catch for the SZ blacklip fishery is 132.0 t whole weight. For zone scores between 5 and 7, the recommended zonal catch is equal to the target catch (i.e. no adjustment). For zone scores between 7 and 10, there is a linear increase from 1.0 (i.e. no adjustment) to a maximum of 1.3 (i.e. 30% above the target catch). Consequently, the theoretical maximum recommendable zonal blacklip catch for a score of 10 is 171.6 t (i.e.  $132 \text{ t} \times 1.3 = 171.6 \text{ t}$ ). For a zone score between 5 and 1, the adjustment decreases linearly from 1.0 (i.e. no adjustment) to 0.1 (i.e. 90% below the target catch level). Consequently, the recommended zonal blacklip catch for a score of 1 is 13.2 t (i.e.  $132.0 \text{ t} \times 0.1 = 13.2 \text{ t}$ ). For zone scores  $<1$  the recommended catch is zero.

**Table 2-1.** Potential stock status outcomes from the Harvest Strategy

Status	Zone Score	Zone Trend Score
Sustainable	$\geq 5$	
Sustainable	$< 5$	$\geq 5$
Depleting	$< 5$ & $\geq 1$	$< 5$
Recovering	$< 1$	$\geq 5$
Depleted	$< 1$	$< 5$

### 3. RESULTS

#### Blacklip

##### Fishery Dependent data

##### *Zone catch and CPUE*

Total annual blacklip catches peaked at 186 t in 1992/93 (Figure 2a). After the introduction of the TACC, catches stabilised, and were consistent with the TACC in most fishing seasons. Between 1993/94 and 2010/11, catches averaged 143 t, reaching 151 t in 2011/12, before declining to 118 t in 2019/20. Following three seasons with a record low TACC of 126 t from 2015/16 to 2017/18, it was subsequently increased to the current level of 132 t. As of 30 April 2022, 128.3 t of blacklip had been harvested in the 2021/22 fishing season, representing 97% of 132 t blacklip TACC.

Catch-per-unit-effort has generally increased throughout the history of the fishery (Figure 2a). After peaking at 122 kg.hr<sup>-1</sup> in 2010/11, CPUE declined over four consecutive seasons to a contemporary low of 97 kg.hr<sup>-1</sup> in 2014/15. Thereafter, CPUE has generally increased, reaching 119 kg.hr<sup>-1</sup> in 2021/22.

##### *SAU catch and CPUE*

Over 60% of the catch in 2021/22 was taken from three SAUs, including Number 2 Rocks (29.0 t), Middle Point (23.4 t) and the combined data limited SAUs (28.4 t). Large catches were also harvested from Carpenters Rocks (11.1 t) and Port MacDonnell (10.8 t). The most notable changes to the spatial distribution of catches among the SAUs occurred in 2013/14 associated with the introduction of spatial management. Since 2013/14 consistently lower catches have been harvested from Gerloffs Bay, Rivoli Bay and Nene Valley, with consistently higher catches from Port MacDonnell.

Catch-per-unit-effort estimates for most SAUs increased in 2021/22 and were above the target scoring range. The exception was Gerloffs Bay, where no estimate of CPUE was possible in 2021/22 due to insufficient data. In the three SAUs with the largest catches, CPUE estimates and corresponding HS scores, were among the highest on record, including Number 2 Rocks (137.0 kg.hr<sup>-1</sup> & HS Score of 10), Middle Point (114.1 kg.hr<sup>-1</sup> & HS Score of 9) and data limited SAUs (116.5 kg.hr<sup>-1</sup> & HS Score of 10) (Table 3.1, Figures 3a, 4a, 11a). Likewise, for Carpenters Rocks, the CPUE was among the highest on record (106.1 kg.hr<sup>-1</sup>) and scored 10 in the HS

(Table 3.1, Figure 10a). The lowest CPUE ( $92.0 \text{ kg}\cdot\text{hr}^{-1}$ ) and HS score (5.0) was recorded at Nene Valley (Table 3.1, Figure 7a).

### *SAU commercial catch sampling*

The mean length and length frequency distribution of abalone in the commercial catch varied among years and SAUs. In 2021/22, the most notable trends included an ongoing decline in the mean length of commercial catch at Middle Point, and a gradual increase in the mean length recorded at Rivoli Bay (Figures 3b, 6b). Changes in length frequency distribution in many SAUs reflect changes to the MLL when spatial management was introduced in 2013/14, and the associated ongoing adjustments to MLL thereafter (e.g. Figures 2c, 4c, 5c, 7c, 8c).

### *Fishery-independent data*

Collectively, FIS estimates of legal and sub-legal sized blacklip have remained relatively stable since 2014/15 (Figures 3d, 4d, 5d, 6d, 7d). In 2020/21, a small increase in legal-density was recorded at Middle Point and Rivoli Bay (Figures 3d, 6d), whilst a small decline in legal density was observed at Gerloffs Bay and Nene Valley (Figures 5d, 7d). The FIS consistently yielded a more pessimistic view of stock status than CPUE, with HS scores of 5.0, 1.1, 4.6 and 4.9 out of 10 for Middle Point, Gerloffs Bay, Rivoli Bay and Nene Valley, respectively. The 2020/21 survey planned for Number 2 Rocks was not completed, and there remains insufficient data to generate a reference period for HS scoring in this SAU (Figure 4d). Detailed interpretation of abalone density from all historical and recent FIS are included in Burnell *et al.* (2021).

### *Harvest Strategy – zone score and stock status*

The catch-weighted zone score (i.e. biomass proxy) for 2021/22 was **7.70 out of 10** (Table 3.1, Figure 12). In combination with the zone trend score (i.e. fishing mortality proxy) in 2021/22 of **5.10 out of 10** (reflecting an increasing trend), these define the zonal stock status for blacklip in the SZ in 2021/22 as 'sustainable' (Figure 13). The HS zone score of 7.70 translates to a **recommended zonal catch of 141.2 t** for 2022/23, which is 7.0% above the current TACC of 132.0 t.



## Greenlip

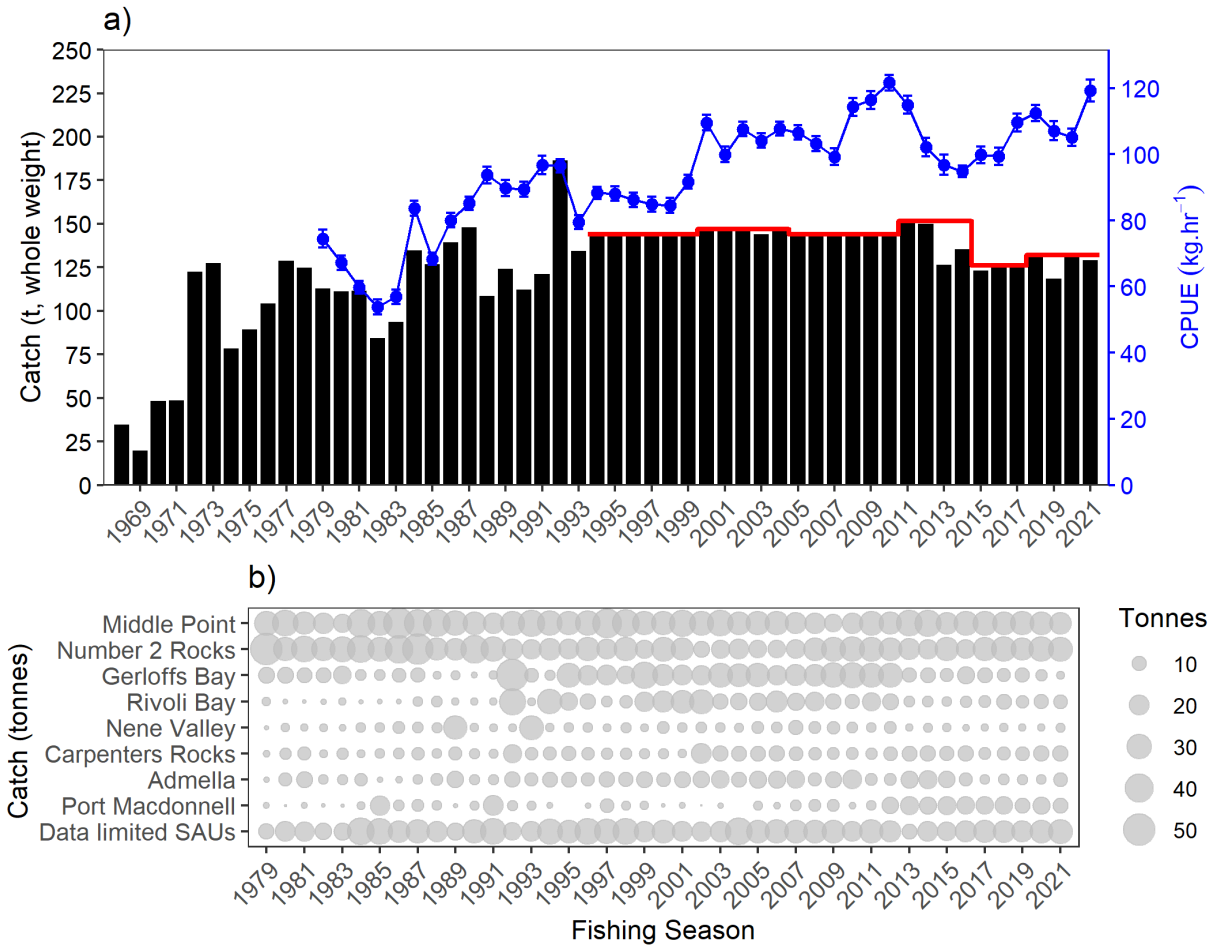
Since 1968/69, when almost 19 t of greenlip was landed, annual greenlip catches in the SZ have remained below 8 t (Figure 14). Throughout the 1990s and 2000s, greenlip catches varied between 2 and 6 t.y<sup>-1</sup>. After reaching 7.2 t in 2011/12, catches of greenlip have been steadily declining over the last decade. In 2018/19, the TACC was reduced to 1.8 t, which has coincided with the lowest catches of greenlip since the mid-1980s. As of 30 April 1.40 t of greenlip had been harvested in the 2021/22 fishing season.

The contribution of different SAUs to the greenlip catch have varied over time (Figure 14b). Recent contributions from Gerloffs Bay and Rivoli Bay to the total catch have been relatively small in a historical context. Conversely, Nora Creina and Port MacDonnell have supported a higher relative proportion of the greenlip catch in recent years. In many instances, recent changes in the spatial distribution of greenlip catch are consistent with corresponding changes in blacklip catch, as greenlip is taken as bycatch.

The mean length of greenlip in the commercial catch has varied between 142 and 151 mm, with lowest value ever recorded of 142 mm in 2021/22 (Figures 14c, d).

Estimates of total greenlip density at Ringwood Reef in the Rivoli Bay SAU increased to the highest density on record in 2016/17, before declining over the next four seasons to reach the lowest density on record in 2020/21 (Figure 14e).

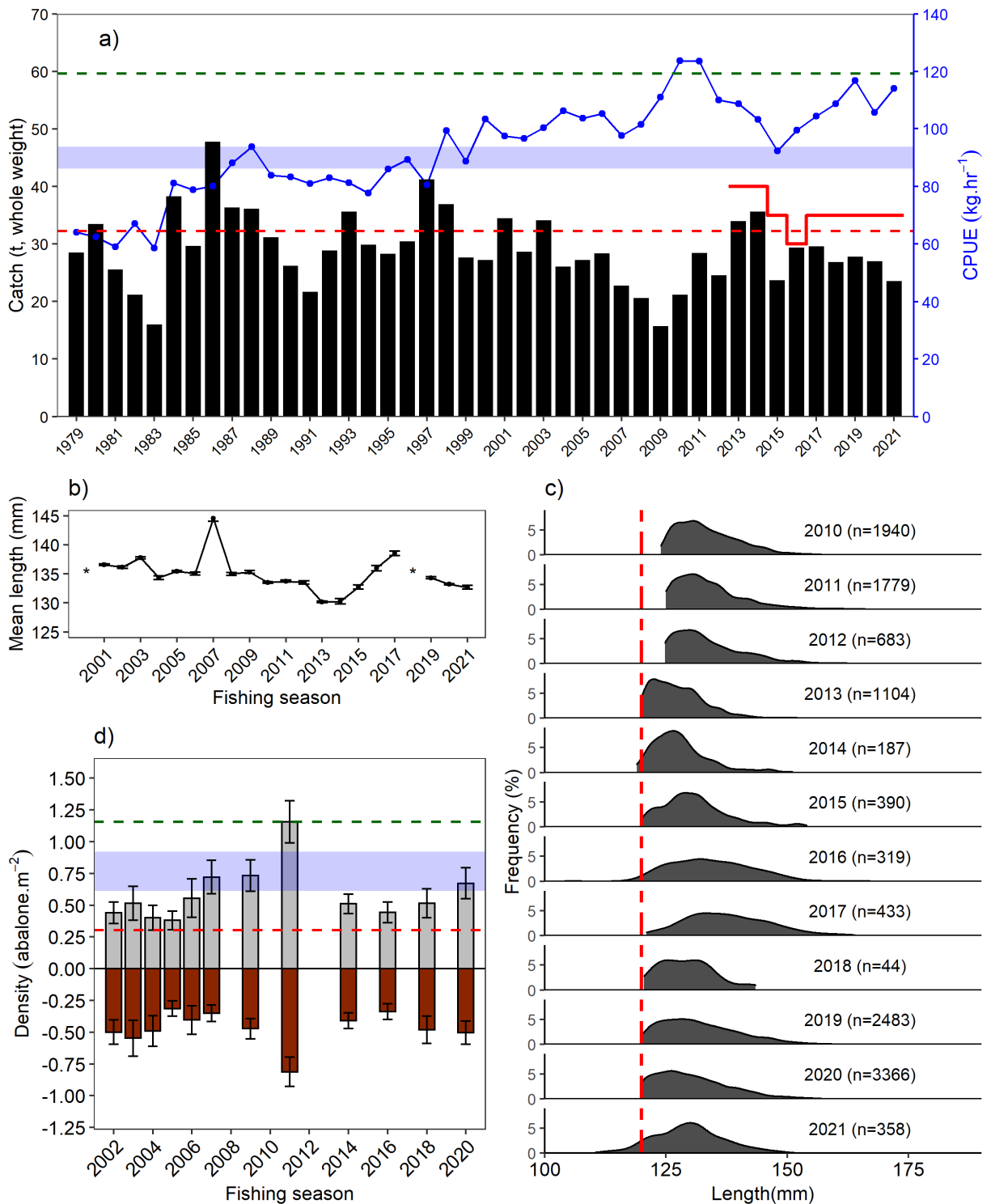
The HS is not applied to greenlip, instead the stock status was determined using the NFSRF (see synthesis and conclusions).



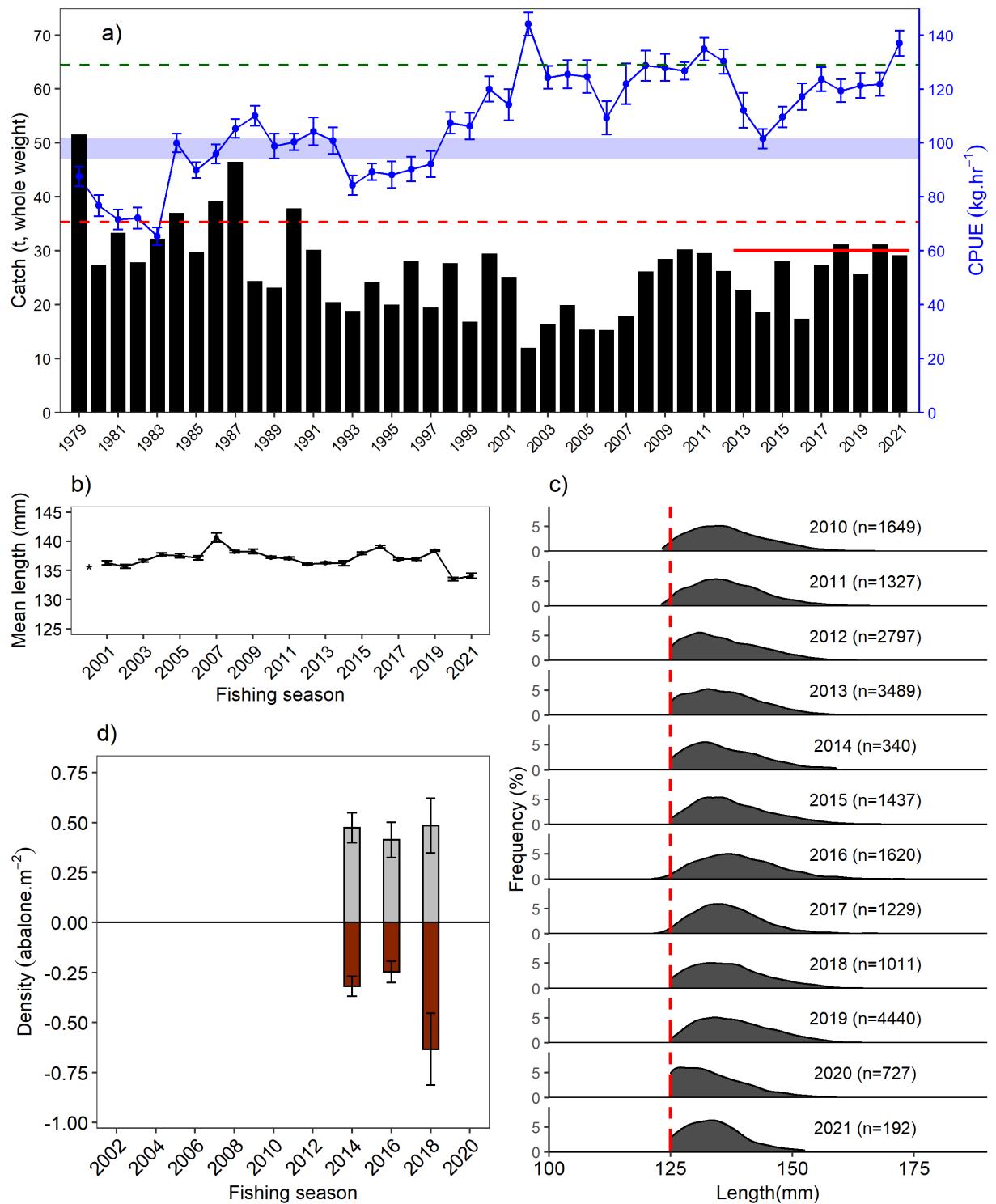
**Figure 2** Zonal catch, CPUE and the distribution of catch among SAUs available from 1969/70 to 2021/22 (denoted 2021) a) Total catch (tonnes, black bars), CPUE ( $\pm$  SE,  $\text{kg}\cdot\text{hr}^{-1}$ , blue line and circles) & TACC (red line) of blacklip in the Southern Zone from 1968/69 to 2021/22 (denoted 2021). b) Bubble plot showing the spatial distribution of the blacklip catch (grey symbols) among each of the SAUs in the SZ from 1979/80 to 2021/22 (data-limited SAUs from the proposed HS are combined).

**Table 3-1.** Outcome of application of the harvest strategy described in the Management Plan for SZ blacklip in 2021/22.

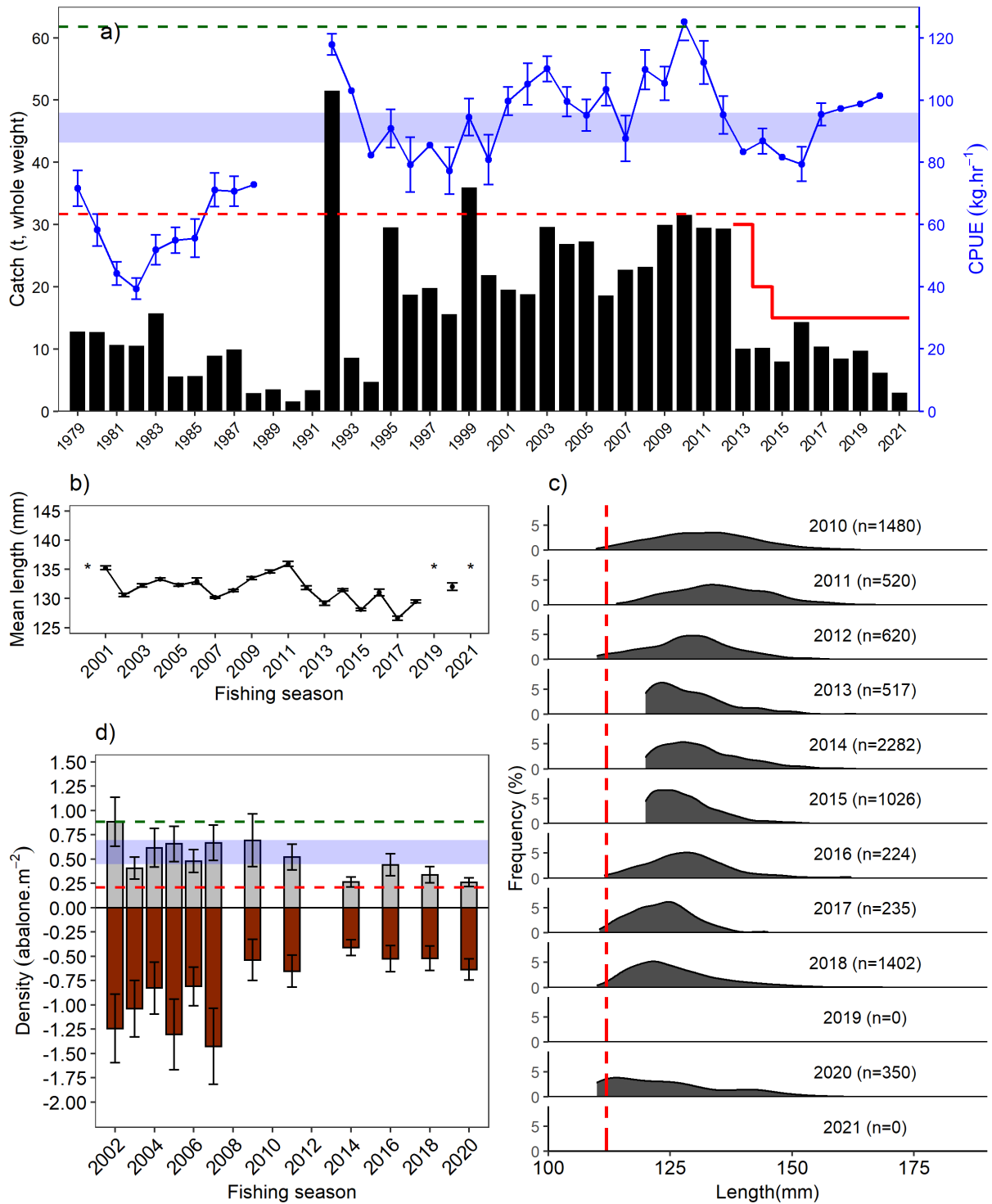
SAU	CPUE ( $\text{kg}\cdot\text{hr}^{-1}$ )	CPUE score	Legal density ( $\text{abs}\cdot\text{m}^{-2}$ )	Legal density score	SAU score	Catch 2021/22 (tonnes)	Proportion of 12year catch	Weighted SAU score
Middle Point	114.1	9.0	0.67	5.0	7.0	23.4	0.21	1.46
Number 2 Rocks	137.0	10.0	-	-	10.0	29.0	0.20	1.99
Data limited SAUs	116.5	10.0	-	-	10.0	28.4	0.17	1.67
Gerloffs Bay	-	-	0.26	1.1	1.1	2.8	0.10	0.11
Port Macdonnell	108.6	7.3	-	-	7.3	10.8	0.09	0.69
Carpenters Rocks	106.1	10.0	-	-	10.0	11.1	0.07	0.71
Admella	103.4	7.6	-	-	7.6	8.8	0.07	0.53
Rivoli Bay	122.3	8.6	0.68	4.6	6.6	8.5	0.06	0.41
Nene Valley	92.0	5.0	0.23	4.9	4.9	3.8	0.02	0.12
							<b>Zone Score</b>	<b>7.70</b>



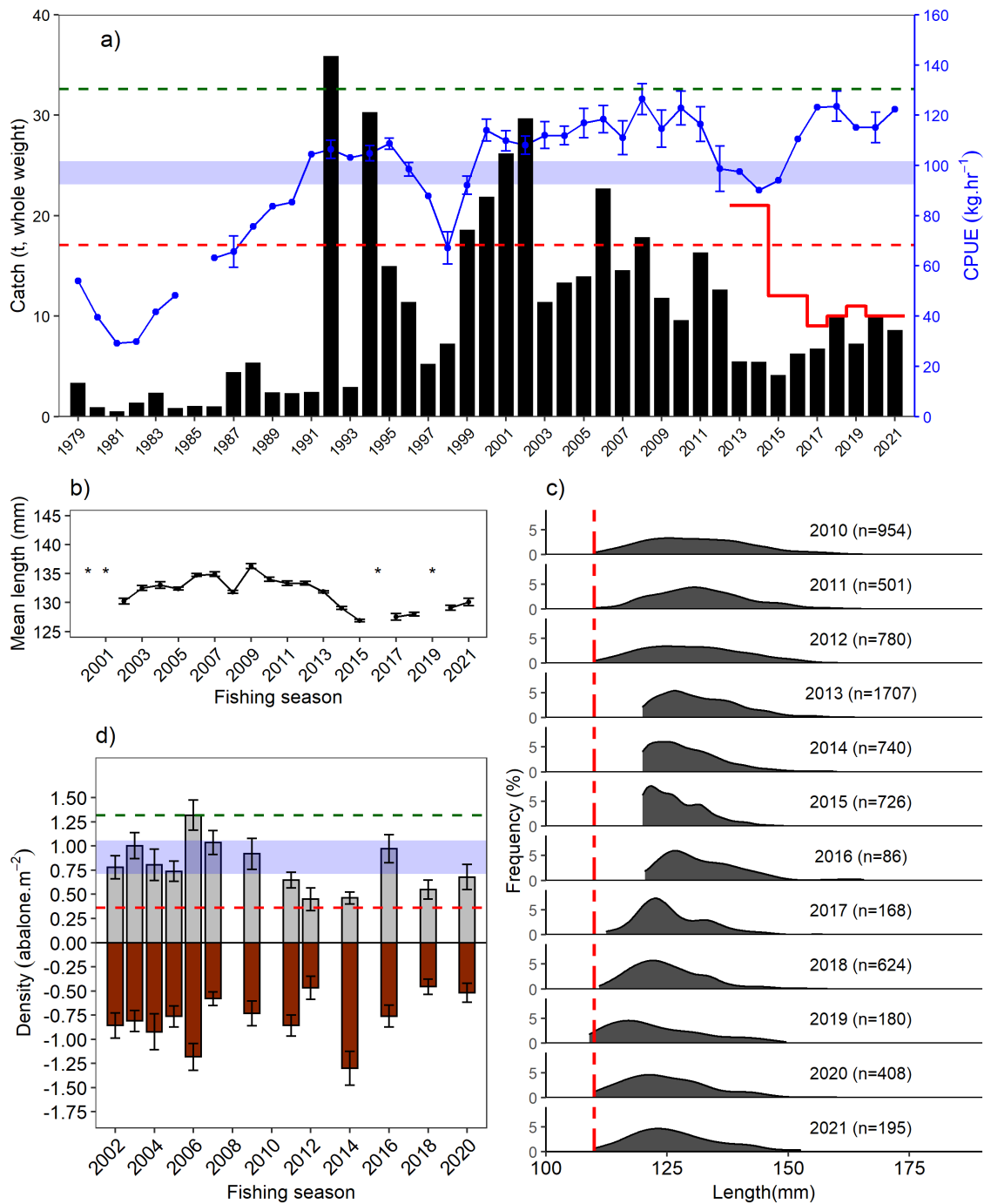
**Figure 3** Middle Point data available from 1979/80 to 2021/22 (denoted 2021): a) Blacklip catch (tonnes, black bars), annual catch cap (tonnes, red line) & CPUE (kg.hr<sup>-1</sup>, blue line/symbols) b) Mean length of blacklip in the commercial catch, \* indicates no data available. c) Estimated distribution of commercial catch from shell sampling, current MLL of 120 mm = dashed red line. d) Density of blacklip (abalone.m<sup>-2</sup>; ± se) counted in transects during fishery-independent surveys. Red and grey bars show blacklip <120 and ≥120 mm SL, respectively. Scoring from the harvest strategy is shown for panels a) and d): Target Range (score of 5, blue shading), upper limit (score of 10, green dashed line), lower limit (score of 0, red dashed line).



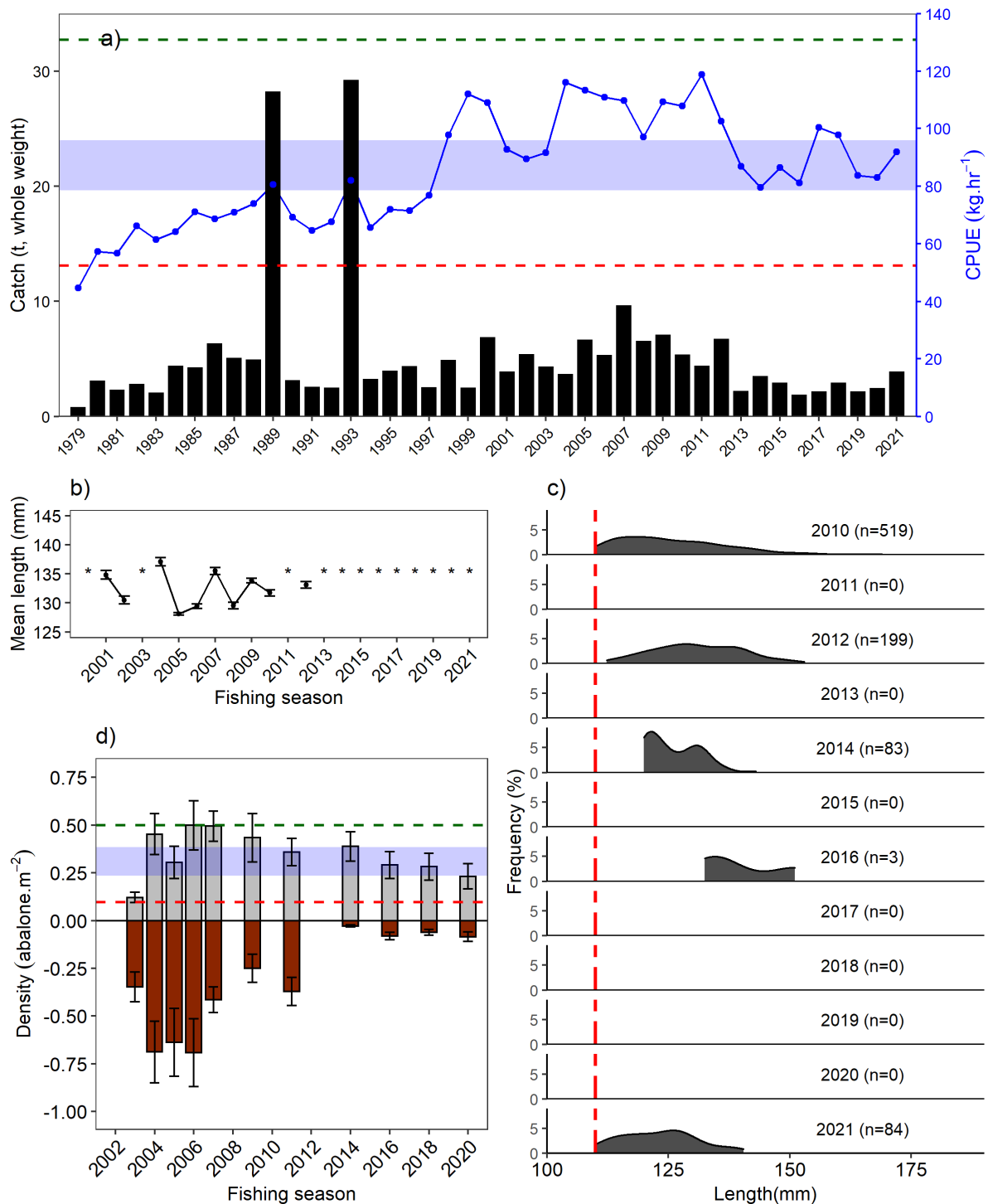
**Figure 4** Number 2 Rocks data available from 1979/80 to 2021/22 (denoted 2021): a) Blacklip catch (tonnes, black bars), annual catch cap (tonnes, red line) & CPUE ( $\pm$  SE, kg.hr<sup>-1</sup>, blue line/symbols) b) Mean length of blacklip in the commercial catch, \* indicates no data available. c) Estimated distribution of commercial catch from shell sampling, current MLL of 125 mm = dashed red line. d) Density of blacklip (abalone.m<sup>-2</sup>;  $\pm$  se) counted in transects during fishery-independent surveys. Red and grey bars show blacklip <125 and  $\geq$ 125 mm SL, respectively. Scoring from the harvest strategy is shown for panel a): Target Range (score of 5, blue shading), upper limit (score of 10, green dashed line), lower limit (score of 0, red dashed line).



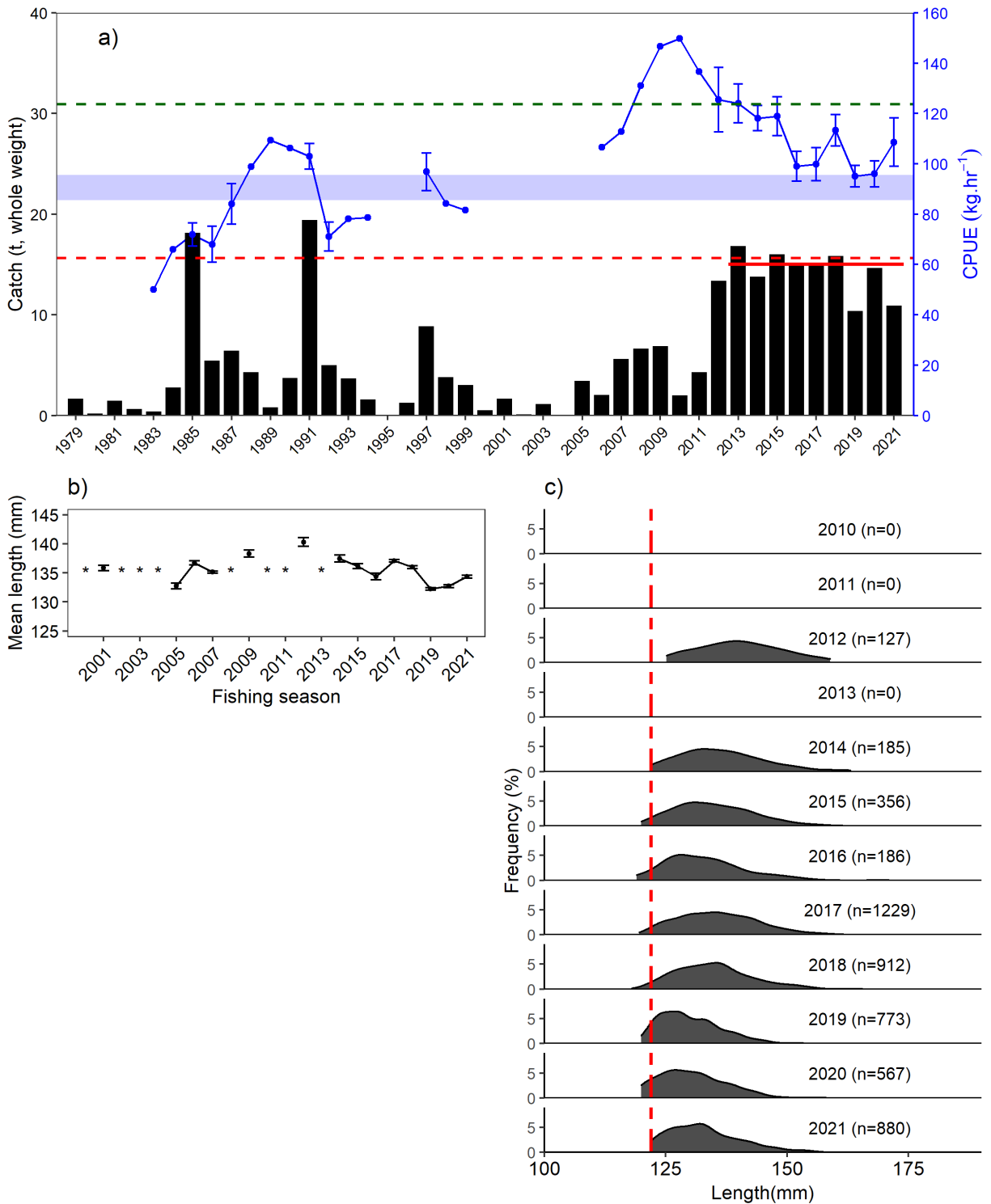
**Figure 5** Gerloffs Bay data available from 1979/80 to 2021/22 (denoted 2021): a) Blacklip catch (tonnes, black bars), annual catch cap (tonnes, red line) & CPUE ( $\pm$  SE, kg.hr<sup>-1</sup>, blue line/symbols) b) Mean length of blacklip in the commercial catch, \* indicates no data available. c) Estimated distribution of commercial catch from shell sampling, current MLL of 112 mm = dashed red line. d) Density of blacklip (abalone.m<sup>-2</sup>;  $\pm$  se) counted in transects during fishery-independent surveys. Red and grey bars show blacklip <112 and  $\geq$ 112 mm SL, respectively. Scoring from the harvest strategy is shown for panels a) and d): Target Range (score of 5, blue shading), upper limit (score of 10, green dashed line), lower limit (score of 0, red dashed line).



**Figure 6** Rivoli Bay data available from 1979/80 to 2021/22 (denoted 2021): a) Blacklip catch (tonnes, black bars), annual catch cap (tonnes, red line) & CPUE ( $\pm$  SE, kg.hr<sup>-1</sup>, blue line/symbols) b) Mean length of blacklip in the commercial catch, \* indicates no data available. c) Estimated distribution of commercial catch from shell sampling, current MLL of 110 mm = dashed red line. d) Density of blacklip (abalone.m<sup>-2</sup>;  $\pm$  se) counted in transects during fishery-independent surveys. Red and grey bars show blacklip <110 and  $\geq$ 110 mm SL, respectively. Scoring from the harvest strategy is shown for panels a) and d): Target Range (score of 5, blue shading), upper limit (score of 10, green dashed line), lower limit (score of 0, red dashed line).

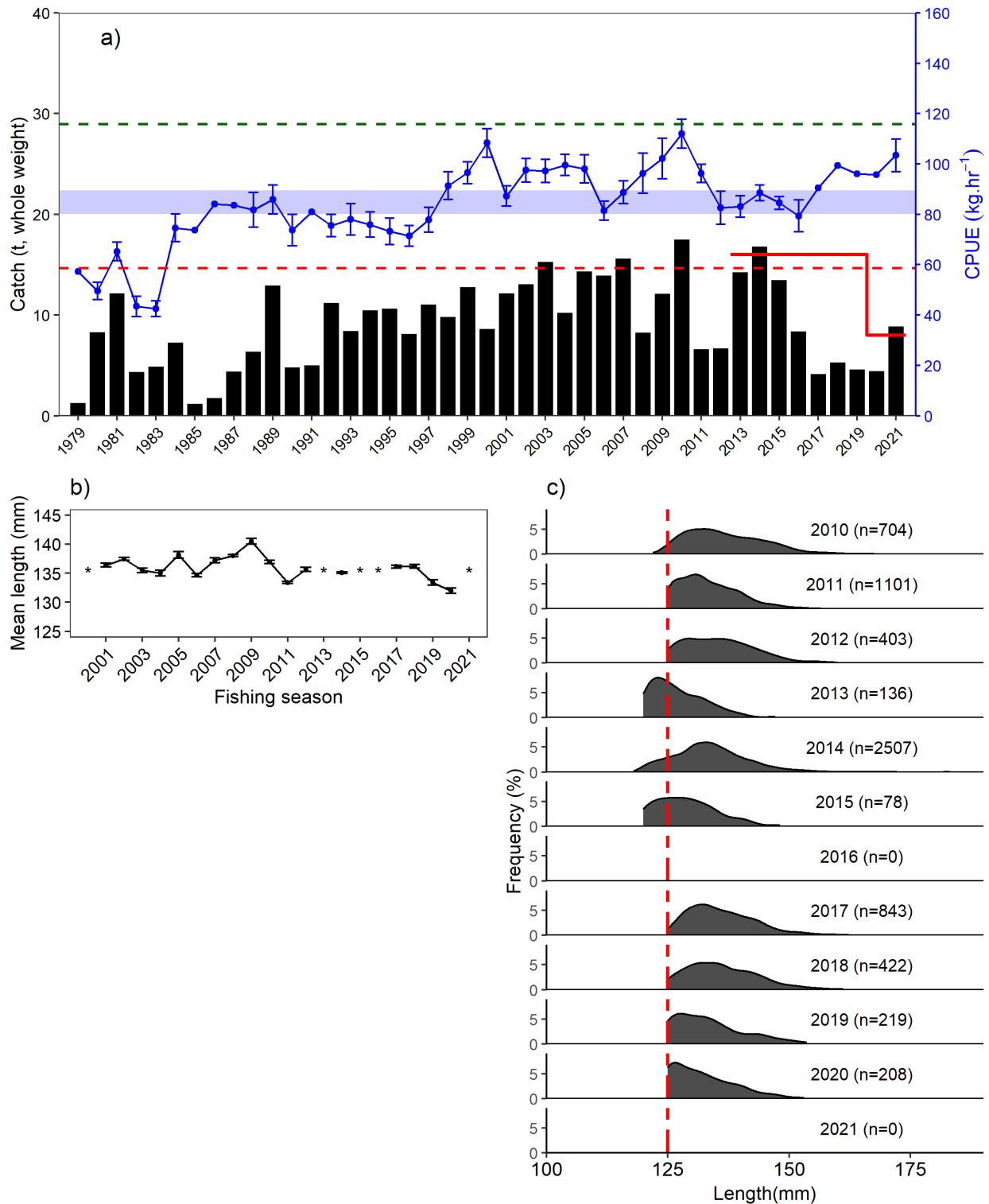


**Figure 7** Nene Valley data available from 1979/80 to 2021/22 (denoted 2021): a) Blacklip catch (tonnes, black bars), & CPUE (kg.hr<sup>-1</sup>, blue line/symbols) b) Mean length of blacklip in the commercial catch, \* indicates no data available. c) Estimated distribution of commercial catch from shell sampling, current MLL of 110 mm = dashed red line. d) Density of blacklip (abalone.m<sup>-2</sup>; ± se) counted in transects during fishery-independent surveys. Red and grey bars show blacklip <110 and ≥110 mm SL, respectively. Scoring from the harvest strategy is shown for panels a) and d); Target Range (score of 5, blue shading), upper limit (score of 10, green dashed line), lower limit (score of 0, red dashed line).

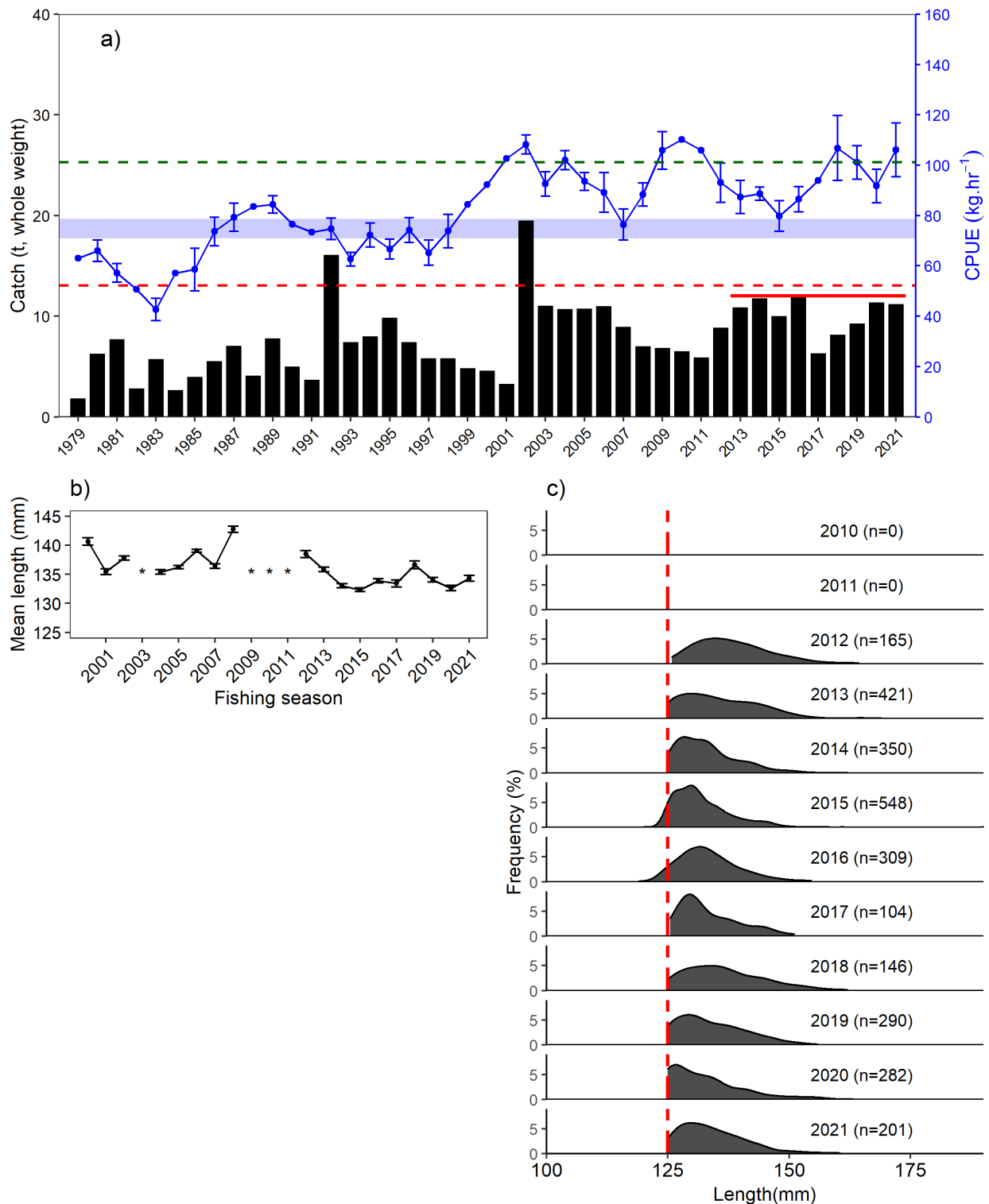


**Figure 8** Port MacDonnell data available from 1979/80 to 2021/22 (denoted 2021): a) Blacklip catch (tonnes, black bars), annual catch cap (tonnes, red line) & CPUE ( $\pm$  SE,  $\text{kg}\cdot\text{hr}^{-1}$ , blue line/symbols) b) Mean length of blacklip in the commercial catch, \* indicates no data available. c) Estimated distribution of commercial catch from shell sampling, current MLL of 122 mm = dashed red line. Scoring from the harvest strategy is shown for panel a): Target Range (score of 5, blue shading), upper limit (score of 10, green dashed line), lower limit (score of 0, red dashed line).

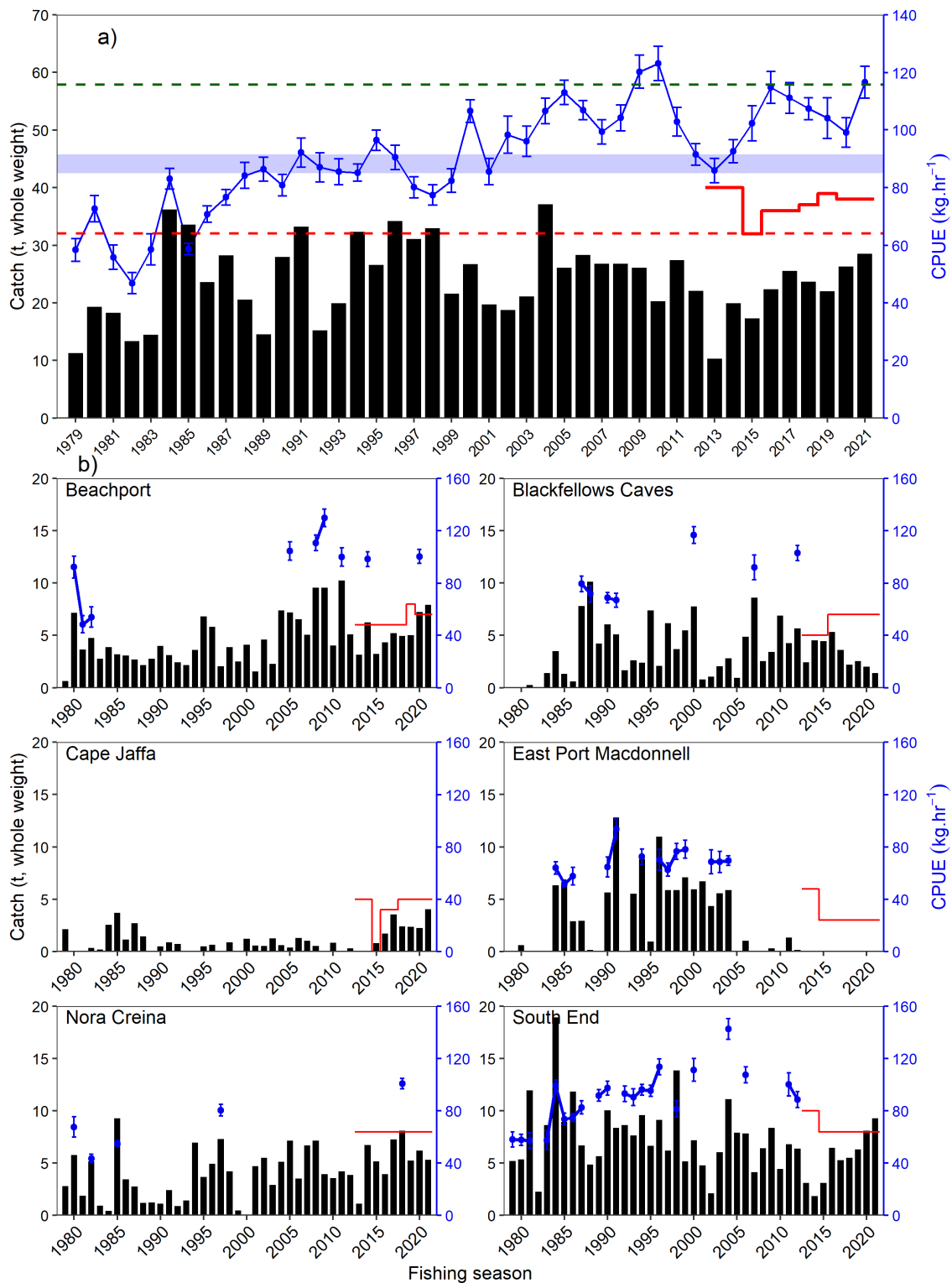




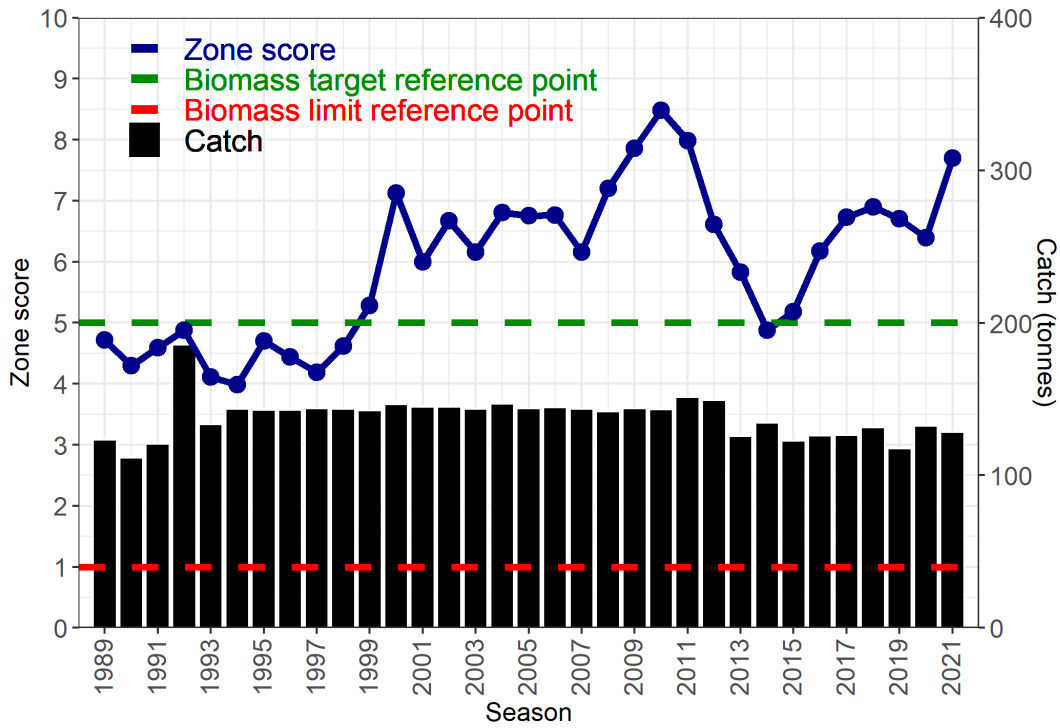
**Figure 9** Admella data available from 1979/80 to 2021/22 (denoted 2021): a) Blacklip catch (tonnes, black bars), annual catch cap (tonnes, red line) & CPUE ( $\pm$  SE, kg.hr<sup>-1</sup>, blue line/symbols) b) Mean length of blacklip in the commercial catch, \* indicates no data available. c) Estimated distribution of commercial catch from shell sampling, current MLL of 125mm = dashed red line. Scoring from the harvest strategy is shown for panel a): Target Range (score of 5, blue shading), upper limit (score of 10, green dashed line), lower limit (score of 0, red dashed line).



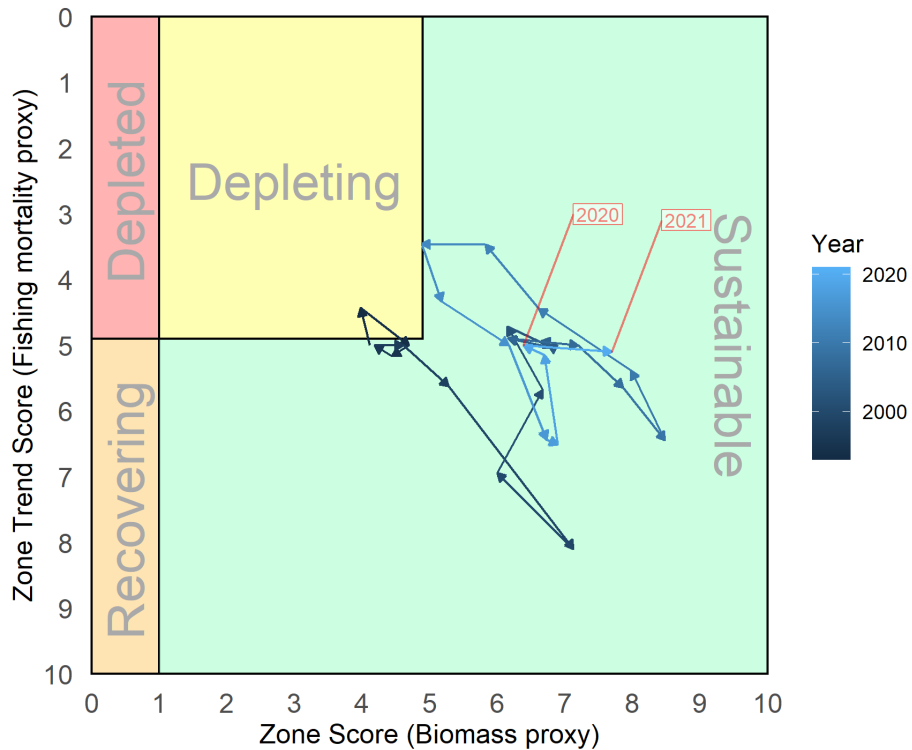
**Figure 10** Carpenters Rocks data available from 1979/80 to 2021/22 (denoted 2021): a) Blacklip catch (tonnes, black bars), annual catch cap (tonnes, red line) & CPUE ( $\pm$  SE, kg.hr<sup>-1</sup>, blue line/symbols) b) Mean length of blacklip in the commercial catch, \* indicates no data available. c) Estimated distribution of commercial catch from shell sampling, current MLL of 125mm = dashed red line. Scoring from the harvest strategy is shown for panel a): Target Range (score of 5, blue shading), upper limit (score of 10, green dashed line), lower limit (score of 0, red dashed line).



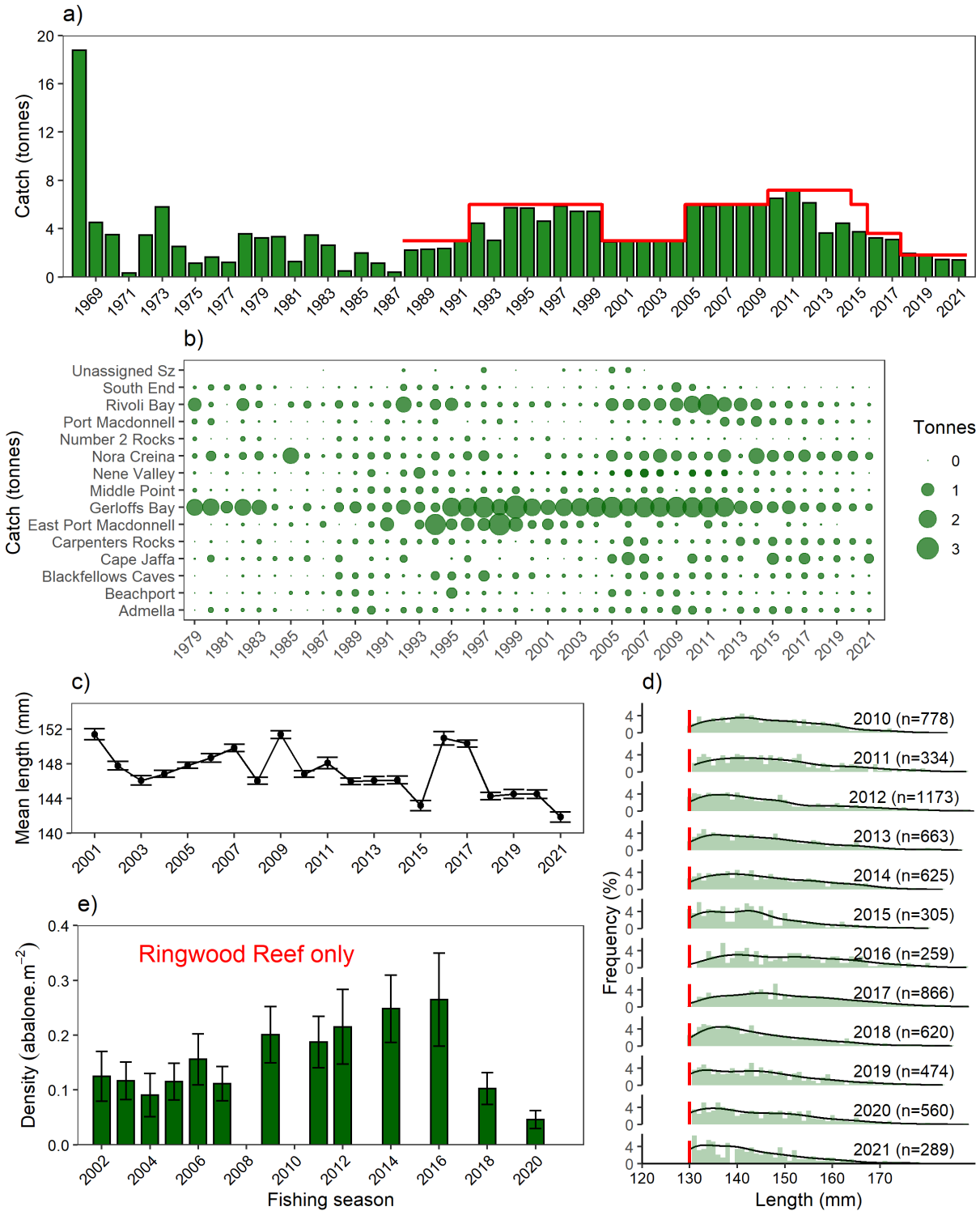
**Figure 11** Data limited SAUs data available from 1979/80 to 2021/22 (denoted 2021) a) Combined blacklip catch (tonnes, black bars), combined annual catch cap (tonnes, red line) & combined CPUE ( $\pm$  SE, kg.hr<sup>-1</sup>, blue line/symbols). b) Beachport, Blackfellows Caves, Cape Jaffa, East Port MacDonnell, Nora Creina and Southend SAUs.



**Figure 12** Zone score plot for SZ blacklip between 1989/90 and 2021/22 (denoted 2021). Zone score (blue symbols and line), biomass target reference point (green line), biomass limit reference point (red line) and catch (black bars, tonnes).



**Figure 13.** Phaseplot indicating changes in SZ blacklip stock status between 1993/94 and 2021/22 (denoted 2021).



**Figure 14** Greenlip data available from 1968/69 to 2021/22 (denoted 2022): a) Greenlip catch (tonnes, coloured bars) & TACC (red line). b) Bubble plot showing the spatial distribution of the catch (green symbols) by SAU. c) Mean length of greenlip in the commercial catch. d) Estimated distribution of commercial catch from shell sampling, MLL of 130mm = dashed red line. e) Density of greenlip (abalone.m<sup>-2</sup>; ± se) counted in transects during fishery-independent surveys at Ringwood Reef.

#### 4. SYNTHESIS AND CONCLUSIONS

There are several limitations to the data for blacklip and greenlip presented in this report. Firstly, the influence of spatial management, including SAU-specific MLLs and catch caps that are reviewed annually, complicate the interpretation of fishery dependent data, particularly CPUE. Secondly, in the 2017/18 season, the fishery transitioned to beach weighing of catch, which is likely to have consequences for CPUE, because abalone are weighed earlier and hence have a slightly greater total weight. These changes have not been incorporated into CPUE estimates. Finally, while FIS provide detailed information for specific key locations within the fishery, extrapolation of these trends to the overall stock is problematic.

##### **Blacklip Abalone**

This is the first application of the HS to determine stock status of blacklip utilising YTD data (PIRSA 2021). There is a high level of confidence in this approach, given over 97% of 2021/22 blacklip TACC was harvested between 1 October 2012 and 30 April 2022. Previous analyses (Dent *et al.* 2016) have also demonstrated the reliability of YTD data as a predictor for the final (full season) CPUE estimates. Nevertheless, some subtle changes in CPUE values for key SAUs, and subsequently the zone score and trend in zone score are expected. The magnitude of these changes will be assessed in the next report for the fishery (due mid-2023).

In 2021/22, estimates of fishery-dependent CPUE for most SAUs were increasing, and exceeded the target range from the HS. Legal density from the FIS scored comparatively lower. However, abalone densities from these key locations have been relatively stable since 2014/15. The ongoing discrepancy between these two key indicators (i.e. CPUE average HS score 8.4 / 10, FIS average HS score 3.9 / 10) could reflect a combination of spatial management and changes to the MLL; beach weighing of catch; the respective reference periods in the HS; and the effects of increased fleet efficiency on CPUE, among other factors.

Application of the HS in 2021/22 using the YTD data resulted in a **zone score of 7.70 out of 10** that, in combination with the **zone trend score of 5.10 out of 10** (reflecting an increasing trend), define the stock status for blacklip in the SZ in 2021/22 as '**sustainable**', which is consistent with classifications since 2016/17. Following six consecutive sustainable classifications, blacklip stocks in the SZ fishery appear strong and current catches appear sustainable. The current position of this stock is encouraging, particularly given the widespread mortalities that occurred in this fishery in 2012/13, and sustained declines in blacklip catches across many abalone fisheries in southern Australia (Pidcock *et al.* 2021).

Current research priorities for the SZ fishery include (1) development of potential spatial PIs from the VMS data; and (2) exploring the scoring inconsistency between CPUE and FIS scores in the HS. There is also a need to re-consider the definition of a data limited SAU in the next review of the SZ HS, given a significant portion of the catch (28.4%) is currently being obtained from these combined SAUs.

### **Greenlip Abalone**

The stock status of greenlip in the SZ under the NFSRF in 2021/22 is '**undefined**', and there are insufficient data available to estimate either biomass or fishing mortality. Given the low abundance and low catches of greenlip, and its harvest primarily as a bycatch species, the classification is likely to remain undefined. Likewise, there is no framework to assign status for this species under the Harvest Strategy (PIRSA 2021). Declining catches over the last decade potentially reflect a combination of declines in abundance, and/or the indirect influence of blacklip spatial management changes that were introduced in 2013/14.

## 5. REFERENCES

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- Dent, J., Mayfield, S., Stobart B. and Carroll, J. (2016). Setting quotas using provisional data: a case study from the South Australian abalone fisheries. *New Zealand Journal of Marine and Freshwater Research* 50(3):1-18.
- Piddocke, T., C. Ashby, K. Hartmann, A. Hesp, P. Hone, J. Klemke, S. Mayfield, A. Roelofs, T. Saunders, J. Stewart, B. Wise and J. Woodhams (eds) 2021, Status of Australian fish stocks reports 2020, Fisheries Research and Development Corporation, Canberra.
- PIRSA (2021) Management Plan for the South Australian Commercial Abalone Fisheries. Primary Industries and Regions South Australia, Adelaide. 51 pp. [abalone-management-plan.pdf \(pir.sa.gov.au\)](#)



**Appendix 1. Summary tables**

**Table A1-1** Blacklip catches (tonnes) by season from Spatial Assessment Units in the Southern Zone abalone fishery.

Season	Admella	Beachport	Blackfellows Caves	Cape Jaffa	Carpenters Rocks	East Port Macdonnell	Gerloffs Bay	Middle Point	Nene Valley	Nora Creina	Number 2 Rocks	Port Macdonnell	Rivoli Bay	South End	Unassigned SZ	Combined Data Limited SAUs
1979/80	1.2	0.7	0.1	2.2	1.7	0.0	12.7	28.3	0.7	2.9	51.4	1.6	3.3	5.3	0.0	11.2
1980/81	8.2	7.2	0.0	0.0	6.2	0.7	12.6	33.3	3.0	5.8	27.2	0.1	0.8	5.4	0.0	19.2
1981/82	12.1	3.7	0.3	0.0	7.6	0.1	10.5	25.4	2.3	2.0	33.2	1.4	0.4	12.0	0.0	18.1
1982/83	4.2	4.8	0.2	0.4	2.7	0.1	10.4	21.0	2.8	5.2	27.7	0.5	1.3	2.3	0.0	13.2
1983/84	4.8	2.8	1.5	0.3	5.7	0.1	15.6	15.9	2.0	1.0	32.1	0.3	2.3	8.7	0.0	14.3
1984/85	7.2	4.0	3.6	2.6	2.6	6.4	5.4	38.2	4.3	0.5	36.9	2.7	0.8	19.0	0.0	36.1
1985/86	1.1	3.3	1.4	3.8	3.9	6.6	5.5	29.5	4.2	9.4	29.6	18.0	1.0	9.0	0.0	33.4
1986/87	1.6	3.2	0.7	1.2	5.5	3.0	8.8	47.7	6.3	3.5	39.0	5.4	0.9	11.9	0.0	23.5
1987/88	4.3	2.8	7.9	2.8	7.0	3.0	9.8	36.2	5.0	2.8	46.3	6.4	4.3	6.8	2.1	28.1
1988/89	6.3	2.2	10.2	1.5	4.0	0.2	2.8	36.0	4.9	1.3	24.2	4.2	5.3	4.9	0.0	20.4
1989/90	12.8	2.9	4.3	0.0	7.7	0.2	3.4	31.0	28.2	1.3	23.0	0.7	2.3	5.7	0.0	14.4
1990/91	4.7	4.1	6.1	0.6	4.9	5.7	1.4	26.1	3.1	1.2	37.7	3.6	2.2	10.1	0.0	27.8
1991/92	4.9	3.2	5.2	1.0	3.6	12.9	3.2	21.5	2.5	2.5	30.0	19.3	2.4	8.5	0.0	33.1
1992/93	11.1	2.5	1.8	0.8	16.0	0.0	51.4	28.7	2.4	1.0	20.3	4.9	35.8	8.7	0.4	15.1
1993/94	8.3	2.2	2.7	0.0	7.3	5.6	8.4	35.5	29.2	1.5	18.7	3.6	2.8	7.7	0.0	19.8
1994/95	10.4	3.7	2.5	0.0	7.9	8.9	4.6	29.7	3.2	7.0	24.0	1.5	30.2	9.7	0.4	32.2
1995/96	10.5	6.9	7.5	0.6	9.7	1.0	29.4	28.1	3.9	3.8	19.9	0.0	14.9	6.7	0.0	26.4
1996/97	8.0	5.9	2.2	0.7	7.4	11.0	18.6	30.3	4.3	5.0	27.9	1.2	11.3	9.2	0.0	34.0
1997/98	11.0	2.1	6.2	0.0	5.7	5.9	19.6	41.1	2.5	7.4	19.3	8.8	5.2	6.3	3.0	30.9
1998/99	9.7	4.0	3.8	0.9	5.7	5.9	15.4	36.8	4.8	4.3	27.5	3.7	7.2	13.9	0.0	32.8
1999/00	12.7	2.6	5.5	0.0	4.8	7.2	35.8	27.5	2.4	0.6	16.7	2.9	18.5	5.3	0.4	21.5
2000/01	8.5	4.2	7.8	1.3	4.5	6.0	21.7	27.0	6.8	0.0	29.3	0.4	21.8	7.3	0.0	26.6
2001/02	12.1	1.6	0.8	0.7	3.2	6.8	19.4	34.4	3.8	4.8	25.0	1.6	26.1	4.9	0.0	19.5
2002/03	12.9	4.7	1.1	0.6	19.4	4.4	18.7	28.5	5.3	5.6	11.8	0.0	29.6	2.2	0.1	18.6
2003/04	15.2	2.3	2.1	1.3	11.0	5.6	29.5	34.0	4.2	3.0	16.3	1.0	11.3	6.1	0.4	21.0
2004/05	10.1	7.5	2.9	0.7	10.6	5.9	26.7	25.9	3.6	5.2	19.7	0.0	13.2	11.2	3.6	37.0
2005/06	14.2	7.3	1.0	0.4	10.7	0.0	27.1	27.0	6.6	7.2	15.2	3.3	13.9	8.0	2.1	26.0
2006/07	13.8	6.6	4.9	1.4	10.9	1.1	18.5	28.2	5.3	3.6	15.1	2.0	22.6	7.9	2.6	28.1
2007/08	15.5	5.1	8.7	1.1	8.9	0.0	22.6	22.6	9.6	6.8	17.7	5.5	14.5	4.2	0.8	26.7
2008/09	8.1	9.6	2.6	0.6	6.9	0.1	23.0	20.5	6.5	7.2	26.0	6.6	17.8	6.5	0.0	26.7
2009/10	12.0	9.6	3.5	0.0	6.8	0.4	29.8	15.6	7.0	4.0	28.3	6.8	11.7	8.4	0.0	26.0
2010/11	17.4	4.1	6.9	0.9	6.4	0.0	31.4	21.0	5.3	3.6	30.1	1.9	9.5	4.5	0.0	20.1
2011/12	6.5	10.3	4.3	0.0	5.8	1.4	29.3	28.3	4.3	4.3	29.4	4.2	16.2	6.9	0.0	27.3
2012/13	6.6	5.2	5.7	0.4	8.8	0.2	29.2	24.4	6.7	3.9	26.1	13.3	12.5	6.5	0.0	21.9
2013/14	14.2	3.2	2.5	0.0	10.8	0.1	9.9	33.8	2.1	1.2	22.6	16.7	5.4	3.2	0.0	10.2
2014/15	16.7	6.3	4.6	0.0	11.7	0.1	10.0	35.5	3.4	6.8	18.5	13.7	5.4	1.9	0.0	19.8
2015/16	13.4	3.3	4.5	0.9	9.9	0.0	7.9	23.5	2.9	5.2	27.9	15.9	4.1	3.2	0.0	17.1
2016/17	8.3	4.4	5.4	1.8	11.8	0.1	14.2	29.2	1.8	4.0	17.2	15.1	6.2	6.5	0.0	22.2
2017/18	4.1	5.3	3.7	3.6	6.2	0.2	10.3	29.4	2.1	7.3	27.1	15.0	6.7	5.3	0.0	25.4
2018/19	5.2	5.0	2.3	2.5	8.1	0.0	8.3	26.7	2.9	8.2	31.0	15.8	10.0	5.6	0.0	23.5
2019/20	4.5	5.1	2.6	2.5	9.2	0.0	9.6	27.6	2.1	5.3	25.4	10.3	7.2	6.4	0.0	21.9
2020/21	4.3	7.3	2.1	2.3	11.3	0.0	6.1	26.8	2.4	6.3	31.0	14.5	9.8	8.2	0.0	26.2
2021/22	8.8	8.0	1.5	4.1	11.1	0.0	2.8	23.4	3.8	5.4	29.0	10.8	8.5	9.4	0.0	28.4

**Table A1-2** Blacklip CPUE by season from Spatial Assessment Units in the Southern Zone abalone fishery. Blank cell indicates estimate not available for that season.

Season	Admella	Beachport	Blackfellows Caves	Cape Jaffa	Carpenters Rocks	East Port Macdonnell	Gerloffs Bay	Middle Point	Nene Valley	Nora Creina	Number 2 Rocks	Port Macdonnell	Rivoli Bay	South End	Combined Data Limited SAUs
1978/79	75.5				75.4		68.9	81.3	57.3		87.6		62.0		83.7
1979/80	57.3				63.0		71.6	64.1	44.6		87.5		54.0	58.0	58.4
1980/81	49.6	92.2			66.0		58.2	62.4	57.2	67.7	76.7		39.6	57.9	72.7
1981/82	65.2	48.5			57.1		44.3	59.0	56.6		71.6		29.1	57.2	55.8
1982/83	43.4	53.9			50.7		39.4	67.1	66.2	43.6	72.1		29.8		46.8
1983/84	42.5				42.6		51.9	58.6	61.5		65.3	50.0	41.6	57.5	58.6
1984/85	74.6				57.1	63.9	54.9	81.1	64.2		100.0	65.9	48.3	99.2	83.1
1985/86	73.6				58.5	52.0	55.6	78.8	71.1	54.8	89.9	71.9		73.7	58.7
1986/87	84.1				73.6	57.6	71.1	80.1	68.6		95.8	68.0	63.2	74.9	70.8
1987/88	83.5		79.4		79.2		70.7	88.1	70.9		105.4	84.1	65.6	82.6	76.7
1988/89	81.7		71.8		83.5		72.8	93.9	74.0		110.1	98.9	75.6		84.2
1989/90	85.8				84.4			83.8	80.6		98.8	109.4	83.7	91.7	86.4
1990/91	73.7		68.7		76.5	64.7		83.4	69.2		100.4	106.2	85.4	97.4	80.9
1991/92	80.9		66.9		73.4	93.5		81.0	64.7		104.2	103.0	104.4		92.2
1992/93	75.4				74.7		117.9	83.0	67.6		100.8	71.1	106.3	93.0	87.0
1993/94	78.0				62.6		103.0	81.3	82.1		84.3	78.1	103.0	90.4	85.5
1994/95	75.9				72.3	72.5	82.4	77.7	65.6		89.3	78.6	104.8	96.0	85.2
1995/96	73.2				66.7		90.8	86.0	72.0		88.2		108.6	95.3	96.4
1996/97	71.4				74.2	70.1	79.2	89.4	71.5		90.2		98.5	113.5	90.5
1997/98	77.8				65.2	62.6	85.5	80.6	76.9	80.4	92.1	96.8	87.8		80.1
1998/99	91.3				73.8	76.5	77.3	99.4	97.9		107.4	84.2	67.1	81.3	77.5
1999/00	96.5				84.3	78.2	94.5	88.8	112.1		106.2	81.6	92.1		82.4
2000/01	108.3		116.6		92.2		80.9	103.4	109.0		120.0		114.0	111.2	106.6
2001/02	87.2				102.6		99.6	97.5	92.8		114.2		109.8		85.6
2002/03	97.5				108.2	68.6	105.2	96.7	89.5		144.1		108.0		98.4
2003/04	97.2				92.6	68.5	110.0	100.5	91.6		124.3		112.0		96.1
2004/05	99.5				101.9	69.5	99.5	106.3	116.0		125.5		111.9	142.5	106.7
2005/06	98.0	104.4			93.5		95.1	103.7	113.4		124.6		116.8		113.0
2006/07	81.4				89.1		103.4	105.3	110.9		109.3	106.6	118.4	107.4	106.9
2007/08	88.7		92.0		76.4		87.7	97.7	109.7		121.9	112.9	111.0		99.4
2008/09	96.3	110.6			88.4		109.7	101.6	97.1		128.6	131.1	126.3		104.3
2009/10	102.1	129.8			105.8		105.4	111.0	109.3		128.0	146.6	114.6		120.3
2010/11	112.0				110.1		125.1	123.7	107.9		126.7	149.8	122.8		123.1
2011/12	96.1	100.0			105.9		112.1	123.5	118.8		134.8	136.7	116.4	100.2	102.9
2012/13	82.5		103.0		93.0		95.2	110.1	102.6		130.2	125.5	98.7	88.5	91.5
2013/14	83.0				87.3		83.4	108.7	86.8		112.0	124.0	97.5		85.9
2014/15	88.5	98.2			88.6		86.8	103.3	79.6		101.5	118.1	90.1		92.7
2015/16	84.5				79.7		81.6	92.4	86.5		109.6	118.9	94.0		102.4
2016/17	79.3				86.4		79.4	99.6	81.1		117.2	99.0	110.5		114.8
2017/18	90.4				93.9		95.4	104.4	100.4		123.6	99.8	123.2		111.1
2018/19	99.3				106.7		97.3	108.7	97.8	100.6	119.3	113.3	123.5		107.4
2019/20	96.1				101.0		98.7	116.8	83.7		121.3	95.1	115.1		104.1
2020/21	95.8	100.3			91.7		101.4	105.8	83.1		121.8	96.0	115.0		99.1
2021/22	103.4				106.1			114.1	92.0		137.0	108.6	122.3		116.5

**Table A1-3** Greenlip catches (tonnes) by season from Spatial Assessment Units of the Southern Zone abalone fishery

Season	Admella	Beachport	Blackfellows Caves	Cape Jaffa	Carpenters Rocks	East Port Macdonnell	Gerloffs Bay	Middle Point	Nene Valley	Nora Creina	Number 2 Rocks	Port Macdonnell	Rivoli Bay	South End	Unassigned SZ
1979/80	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.1	0.0	0.1	0.1	0.2	1.0	0.0	0.0
1980/81	0.1	0.0	0.0	0.3	0.0	0.0	1.8	0.0	0.0	0.6	0.0	0.2	0.1	0.2	0.0
1981/82	0.1	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.1	0.0	0.0	0.0	0.2	0.0
1982/83	0.1	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.0	0.3	0.1	0.1	0.9	0.2	0.0
1983/84	0.1	0.0	0.0	0.1	0.1	0.0	1.4	0.0	0.0	0.4	0.1	0.0	0.3	0.1	0.0
1984/85	0.1	0.0	0.0	0.1	0.0	0.0	0.2	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
1985/86	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.0	0.0	1.6	0.0	0.0	0.2	0.0	0.0
1986/87	0.0	0.1	0.0	0.2	0.0	0.0	0.3	0.0	0.0	0.1	0.0	0.0	0.3	0.0	0.0
1987/88	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
1988/89	0.1	0.2	0.3	0.3	0.1	0.0	0.5	0.2	0.0	0.2	0.1	0.1	0.3	0.0	0.0
1989/90	0.2	0.3	0.2	0.0	0.2	0.0	0.8	0.1	0.1	0.2	0.1	0.0	0.2	0.0	0.0
1990/91	0.4	0.1	0.1	0.1	0.1	0.2	0.3	0.3	0.3	0.3	0.1	0.0	0.1	0.0	0.0
1991/92	0.0	0.0	0.1	0.0	0.1	1.2	0.5	0.2	0.0	0.3	0.1	0.1	0.3	0.0	0.0
1992/93	0.2	0.0	0.0	0.3	0.2	0.0	1.3	0.1	0.2	0.2	0.1	0.0	1.6	0.2	0.0
1993/94	0.2	0.0	0.0	0.0	0.1	0.5	0.7	0.3	0.7	0.1	0.1	0.0	0.1	0.1	0.0
1994/95	0.1	0.0	0.4	0.0	0.2	2.7	0.5	0.2	0.2	0.4	0.1	0.1	0.7	0.2	0.0
1995/96	0.1	0.7	0.4	0.0	0.2	0.7	2.1	0.2	0.2	0.1	0.0	0.0	1.0	0.0	0.0
1996/97	0.0	0.0	0.1	0.2	0.0	1.1	2.1	0.1	0.0	0.4	0.1	0.0	0.2	0.1	0.0
1997/98	0.1	0.1	0.7	0.0	0.1	0.9	2.7	0.2	0.1	0.6	0.0	0.1	0.1	0.1	0.1
1998/99	0.0	0.0	0.1	0.0	0.1	3.1	1.6	0.1	0.1	0.1	0.0	0.1	0.1	0.0	0.0
1999/00	0.1	0.0	0.2	0.0	0.0	1.2	3.3	0.3	0.1	0.0	0.0	0.0	0.1	0.0	0.0
2000/01	0.0	0.0	0.2	0.0	0.0	0.4	1.9	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
2001/02	0.1	0.0	0.0	0.0	0.1	0.7	1.4	0.1	0.0	0.2	0.1	0.0	0.2	0.0	0.0
2002/03	0.1	0.0	0.1	0.0	0.2	0.3	1.9	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0
2003/04	0.1	0.0	0.0	0.1	0.1	0.3	2.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
2004/05	0.1	0.0	0.0	0.0	0.0	0.1	2.4	0.1	0.0	0.1	0.0	0.0	0.1	0.0	0.0
2005/06	0.2	0.3	0.0	0.5	0.1	0.0	2.7	0.1	0.1	0.7	0.0	0.0	0.9	0.1	0.2
2006/07	0.2	0.2	0.2	1.0	0.5	0.2	1.9	0.1	0.3	0.4	0.1	0.0	0.7	0.0	0.1
2007/08	0.2	0.0	0.3	0.5	0.3	0.0	2.5	0.2	0.4	0.5	0.0	0.0	0.9	0.0	0.0
2008/09	0.1	0.3	0.2	0.1	0.1	0.2	2.3	0.2	0.3	1.1	0.0	0.0	0.9	0.1	0.0
2009/10	0.4	0.2	0.2	0.0	0.1	0.0	2.6	0.0	0.1	0.6	0.0	0.3	1.0	0.5	0.0
2010/11	0.4	0.0	0.2	0.5	0.1	0.0	2.5	0.2	0.2	0.4	0.0	0.1	1.8	0.2	0.0
2011/12	0.2	0.1	0.2	0.2	0.1	0.3	2.5	0.2	0.2	0.4	0.0	0.0	2.8	0.0	0.0
2012/13	0.0	0.1	0.1	0.2	0.1	0.2	2.4	0.2	0.2	1.0	0.0	0.4	1.3	0.0	0.0
2013/14	0.2	0.1	0.0	0.1	0.4	0.0	1.0	0.1	0.1	0.1	0.0	0.3	1.1	0.0	0.0
2014/15	0.2	0.0	0.1	0.0	0.2	0.0	0.8	0.1	0.2	1.5	0.0	0.6	0.7	0.0	0.0
2015/16	0.3	0.0	0.1	0.8	0.4	0.0	0.7	0.1	0.1	0.8	0.0	0.2	0.2	0.0	0.0
2016/17	0.3	0.0	0.2	0.2	0.2	0.1	1.1	0.1	0.1	0.5	0.0	0.2	0.3	0.0	0.0
2017/18	0.1	0.1	0.2	0.7	0.3	0.0	0.4	0.0	0.0	0.8	0.0	0.2	0.2	0.0	0.0
2018/19	0.1	0.0	0.2	0.1	0.2	0.0	0.5	0.0	0.1	0.4	0.0	0.2	0.2	0.0	0.0
2019/20	0.1	0.0	0.1	0.2	0.2	0.0	0.4	0.1	0.0	0.6	0.0	0.0	0.1	0.0	0.0
2020/21	0.1	0.1	0.0	0.1	0.2	0.0	0.3	0.0	0.0	0.6	0.0	0.1	0.1	0.0	0.0
2021/22	0.1	0.0	0.0	0.5	0.1	0.0	0.3	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0