Blacklip Abalone (2023)

Haliotis rubra rubra

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STOCK STATUS OVERVIEW

Jurisdiction	Stock	Stock status	Indicators
Western Australia	Western Australia	Negligible	Catch
New South Wales	New South Wales Spatial Management Unit 1	Depleted	Catch, CPUE, mean weight, legal-size biomass
New South Wales	New South Wales Spatial Management Unit 2	Depleting	Catch, CPUE, mean weight, legal-size biomass
New South Wales	New South Wales Spatial Management Unit 3	Depleting	Catch, CPUE, mean weight, legal-size biomass
New South Wales	New South Wales Spatial Management Unit 4	Sustainable	Catch, CPUE, mean weight, legal-size biomass
Victoria	Victoria Central Zone Fishery	Depleting	Catch, CPUE, fishery independent surveys

Victoria	Victoria Eastern Zone Fishery	Depleting	Catch, CPUE, fishery independent surveys
Tasmania	Tasmania Bass Strait Zone Fishery	Sustainable	Catch, CPUE
Tasmania	Tasmania Eastern Zone Fishery	Sustainable	Catch, CPUE
Tasmania	Tasmania Northern Zone Fishery	Sustainable	Catch, CPUE
Tasmania	Tasmania Western Zone Fishery	Sustainable	Catch, CPUE
South Australia	South Australia Central Zone Fishery	Depleted	Catch, CPUE
South Australia	South Australia Southern Zone Fishery	Sustainable	Catch, CPUE, survey density
South Australia	South Australia Western Zone Fishery	Sustainable	Catch, CPUE, survey density

STOCK STRUCTURE

There are substantial difficulties in applying classical stock assessment models to abalone resources, given the possibly large number of stocks in each fishery, and that stock structure in abalone depart substantially from dynamic pool assumptions required by integrated models. In some regions *Haliotis rubra rubra* also displays spatially variable growth rates and maturity curves. All jurisdictions therefore rely on indicators and empirical performance measures. Primarily these are commercial catch and catch per unit effort (CPUE; as kg of abalone harvested per hour). but they can also include commercial catch per area searched (CPUA), and metrics derived from fishery independent surveys, and commercial and fishery-independent size composition. CPUE and similar indicators from individual fishing events are relevant locally but are not indicative of status broadly [Parma et al. 2003], and status of the many populations within a management unit cannot be assumed to be trending in the same direction. Thus, it is only the average CPUE across each spatial reporting unit that provides the broader perspective for fishery assessment. Fishery assessment is usually based on a combination of indicators, and some jurisdictions combine the indicators to give a combined score for stock status. The annual catch by Blacklip Abalone fisheries is generally close to the established total allowable commercial catches (TACCs), with little over-catch or under-catch of the TACC.

STOCK STATUS

New South Wales Spatial Management Unit 1

The New South Wales Abalone Fishery is managed at spatial scales below that of the whole state. A state-wide total allowable commercial catch (TACC) is determined, and management arrangements, including those to spatially partition the TACC, are applied at different levels, typically at the scale of four geographically defined Spatial Management Units (SMUs) or among finer spatial scale reporting areas, that together aggregate to SMUs. Included in these arrangements are a commercial catch limit (within the TACC) for SMU 3 and 4, above which the SMUs are closed to commercial fishing (NSW 2023), and differences in minimum legal length (MLL) in the different SMUs. TACC's were reduced from 333 t p.a. to 75 t p.a. over a decade to 2009-10, increased to 130 t over 5 years to 2015 and was reduced to 100 t p.a. in 2018, where it has been maintained. Assessments of fishery and stock performance are done at the scale of SMU and rely on fishery-dependent data from commercial fisher logbooks, including catch (whole weight, tonnes), catch rate (whole weight, kg per hour) and mean weight (catch divided by the number of abalone harvested) and from GPS logger data integrated with data from logbooks, including measures of legal-size biomass density (kg per hectare) and productive area of reef (i.e. cumulative area fished in the most recent three years) to estimate legal-size biomass.

Fishery-dependent data including, catch, catch rate and legal-size biomass have informed recent changes in stock status and, together with substantial contrast to historical levels, provide information to infer historical status, reference levels of catch rate and a relative measure of stock abundance through time. Temporal trends in state-wide fishery performance, particularly catch rate and legal-size biomass, are similarly reflected at the spatial scale of SMUs, although at different absolute levels i.e., catch rates were at or among historically low levels during the mid-2000s, increasing through 2010, reaching at or among peaks between 2014 to 2016 and declining to 10-year minimums between 2018 to 2019. However, there is no formal harvest strategy describing reference points from which stock status can be directly defined at the SMU scale.

A state-wide minimum legal length (MLL) for blacklip abalone of 100 mm was introduced for the commercial fishery in 1972, increased to 108 mm (1980), 111 mm (1986) and then to 115 mm (1987) and 117 mm (2008) for both the commercial and recreational fishing sectors. The minimum legal length for the commercial fishery increased further to 118 mm (2018) and 120 mm (2019) in SMU 1, 2, and 3, and 120 mm (2010) to 123 mm (2013) to 125 mm (2018) in SMU 4.

SMU 1

Catches declined from >15 t p.a. to <5 t p.a. over the decade from 2000 to 2010, whilst catch rate increased from historically low levels (<20 kg per hour) during the 5 years to 2005-06, to peaks of about 40 kg per hour between 2013 and 2014. Since 2020, low annual catches (1-3 t p.a.) with variable and recently low catch rates (<30 kg per hour) provide little evidence of sustained recovery or stability of stocks [ACN 2023] and even show signs of continued stock decline with relatively low levels of fishing mortality [TAFC 2023].

Catch from SMU 1 has typically contributed ≤10 percent of the total annual catch over at least the last 12 years. Stocks in SMU 1 were subject to high fishing mortality through the mid-1980s to the early-1990s (250 t reported in 1984 [ACN 2023]), then further depleted by mortality associated with infection

by the protistian parasite, Perkinsus sp., from the 1990s to the early-2000s [Liggins and Upston 2010, TACSRC 2015]. The combination of fishing and mortality associated with Perkinsus suggested stocks in a large proportion of SMU 1 were depleted to less than 10% of virgin abundance [Liggins and Upston 2010]. SMU 1 was closed to all fishing in 2002 [ACN 2023] and areas were reopened over subsequent years, supporting a structured fishing survey of stocks that suggested stocks remained heavily depleted in many areas whilst there were some areas of less depleted stock [ACN 2023, Worthington 2010].

On the basis of the evidence provided above, the NSW Spatial Management Unit 1 stock is classified as a **depleted** stock.

New South Wales Spatial Management Unit 2

SMU 2

Catch from SMU 2 peaked at 230 t in 1983, was >100 t in 2000 and declined to 30-40 t p.a. following reductions in the state-wide TACC (see general text in SMU 1) and, within the last five years, has averaged 29 t p.a. and been at or among historically low levels [ACN 2023]. Further, following moderate MLL changes and state-wide TACC reductions there has been spatial contraction of fishing to the south of SMU 2, with relatively low and sporadic annual catch in the northern half of the SMU.

During this time catch (47 t) and catch rate (~45 kg per hour) peaked in 2015-16, before catch rates dropped sharply, to ~35 kg per hour in 2017-18, catch generally declined, to a low of 16 t in 2020 and has averaged 26 t over the last 3 years. Between 2019 and 2022 catch rates have been relatively stable (~40 kg per hour), at higher MLLs, whilst legal-size biomass density has declined 8% per year [ACN 2023].

Declining and low catches together with increasing MLL and smaller numbers of heavier individual abalone being harvested at stable catch rate and a recent declining index of legal-size biomass suggest stock productivity has reduced. Further, during 2016 a large storm event significantly impacted north-east facing, shallow coastal reefs throughout NSW resulting in large areas of disturbed and damaged habitat, loss of abalone stock and coincided with sharp declines in catch rate and estimates of legal-sized biomass throughout SUM 2 in the following 2-3 years [ACN 2023]. Together with the spatial contraction of fishing to the southern, more productive areas of SMU 2, catches are generally below industry targets and patterns of fishery-dependent indicators of stock abundance suggest stocks throughout SMU 2 are not rebuilding well in response to management changes introduced over the last 5 years, including TACC reduction and MLL increases.

On the basis of the evidence provided above, the NSW Spatial Management Unit 2 stock is classified as a **depleting** stock.

New South Wales Spatial Management Unit 3

SMU 3

Catch from SMU 3 peaked at 140 t in 1983, was >80 t between 1999-2001 and declined to 30-50 t p.a. following reductions in the state-wide TACC (see general text in SMU 1). Since 2005, catch (~50 t), catch rate (<50 kg per hour) and legal-sized biomass density peaked between 2014-16, before dropping sharply from late 2016, with catch rate to a low of ~37 kg per hour in 2018 and legal-size biomass density reaching a low in 2019. Catch rate subsequently increased to ~50 kg per hour in 2020 and declined in 2021 (43 kg per hour) and 2022 (41

kg per hour) [ACN 2023]. The June 2016 storm event impacted a large area (Green Cape) of SMU 3, resulting in habitat damage and loss of abalone stocks and contributed to low measures of fishery and stock performance. Within SMU 3, in response to the loss of stock there was a concentration of catch to areas (Disaster Bay) less affected in the immediately succeeding years, which was reversed from 2018, with relatively high catch rates through to 2020. Subsequent levels of catch from both Green Cape and Disaster Bay have declined sharply, to historically low levels, whilst catch rates have been maintained or increased. Catches in other Areas of SMU 3 have increased, to above industry defined target levels in many years, and catch rates in these areas have declined within the last few years, suggesting fishing mortality is too high to maintain levels of catch. Further, within SMU 3 the 3-year trend in catch rate and legal-sized biomass, used to inform recent status, is declining [ACN 2023].

Recent trends in measures of fishery and stock performance together with loss of stock from extreme storm events in 2016 and the responsive substantial changes in the distribution of catch, generally maintaining SMU level catches from largely reduced areas over the subsequent years, and with that trend being maintained in more recent years, with higher than proposed target catches at recently declining catch rates demonstrates stocks in SMU 3 were recently overfished after the 2016 storm and fishing pressure is too high in areas supporting current high catches.

On the basis of the evidence provided above, the NSW Spatial Management Unit 3 stock is classified as a **depleting** stock.

New South Wales Spatial Management Unit 4

SMU 4

Catch from SMU 4 peaked at 80 t in 1985-86, was 71 t in 2002 and declined to 20-40 t p.a. following reductions in the state-wide TACC. From 2009-10, when the TACC was at its lowest (75 t) and the minimum legal length in SMU 4 was raised to 120 mm (see general text in SMU 1) catch reached a historic low (14 t) before increasing to a recent peak of 40 t in 2017 (TACC 130 t). During this same period of time catch rate generally increased, reaching a peak of ~65 kg per hour in 2015 and legal-sized biomass density peaked in 2017. Catch, catch rate and legal-sized biomass declined through 2018-19 (TAC 100 t), before catch rates and legal-size biomass increased as catch remained relatively low (20 t) in 2020. Catch and catch rates increased through 2021, before declining marginally in 2022 whereas legal-sized biomass continued to decline over this period.

Within the last 3-4 years, these SMU-wide patterns have been driven by levels of catch in Areas within SMU 4 that have been at or substantially exceeded industry defined target levels, with this partially in response to a shift in fishing away from areas in SMU 3 that were more substantially impacted by the 2016 storm and where measures of fishery performance were indicating declines. These recent levels of catch, from Areas within SMU 4, have however been taken at or among record high catch rates (>60 kg per hour) and have resulted in a 3-year increasing trend in catch rate throughout the SMU. However, these high catches have resulted in estimates of legal-sized biomass that have declined from among historically high levels to a 4-year low in 2021-22, producing a 3-year declining trend in legal-sized biomass in SMU 4. The contrast in recent measures of catch rate and estimates of legal-sized biomass provide some uncertainty in determination of a stock status. Recent historically high catches (within the period of the current 100 t TACC and 125 mm minimum legal length) harvested at historically high catch rates support a status determination of sustainable at

levels above what would be considered reasonable target levels. However, measures of legal-sized biomass have been declining over the last 3 years, which increases the uncertainty associated with this determination. The persistence of catches above recent high average levels and at record high catch rates would suggest stock productivity increases in this SMU inconsistent with even recent estimates of surplus production within this SMU [ACN 2023], other areas of the NSW Abalone Fishery and other Australian jurisdictions and may suggest factors other than stock abundance influencing these measures of performance. Greater certainty in the determination of stock status would be made where there was stability in the level of catch through time and consistency among changes in measures of catch rate and legal-size biomass.

On the basis of the evidence provided above, the NSW Spatial Management Unit 4 stock is classified as a **sustainable** stock.

South Australia Central Zone Fishery

Following the implementation of a total allowable commercial catch (TACC) in 1990, Blacklip Abalone catches and catch-per-unit-effort (CPUE) in the South Australia Central Zone Fishery (SACZF) were stable for more than a decade, at ~13 t meat weight per year and ~25 kg meat weight per hour, respectively. A long-term decline in CPUE began in the mid-2000s, and despite multiple reductions in TACC from 14.1 to 6.4 t, by 2016 CPUE had declined to 21 kg per hour. In 2017, CPUE declined further to 18 kg per hour, which was the lowest catch rate on record. These declines in catch rate, despite the reduced catches, indicate that recent recruitment levels have been substantially below those that have historically supported substantially larger catches. There had also been a spatial contraction of the fishery, principally into the south-western corner of Kangaroo Island, from a previously broader spatial distribution across the south coast of Kangaroo Island. At the start of the 2018 season, the fishery was closed, with the TACC set at zero, and was classified as 'depleted'. The fishery was subsequently reopened for three fishing seasons from 2019 to 2021, where approx. 1 t of Blacklip Abalone was harvested per season, which was 90% below the average catches from 1979 to 2017.

The most recent assessments for the fishery reported up to the conclusion of the 2021 calendar season [Burnell and Mayfield 2023; Burnell 2023]. The low level of blacklip catch combined with mixed-species fishing means that Blacklip Abalone CPUE estimates from 2019 onward differ substantially from, and cannot be directly compared with, CPUE estimates prior to 2018. Thus, from 2019, the limited data available were inadequate to measure the impact of the 2018 fishery closure.

The above evidence indicates that Blacklip Abalone biomass has been reduced through catch and/or non-fishing effects, such that recruitment is impaired. Adequate management measures are currently in place, but have not yet resulted in measurable improvements.

On the basis of the evidence provided above, the **South Australia Central Zone Fishery management unit** is classified as a **depleted** stock.

South Australia Southern Zone Fishery

Catches of Blacklip Abalone in the South Australia Southern Zone Fishery (SASZF) were consistent around 140 t whole weight throughout the 1990s and 2000s, which followed the introduction of a total allowable commercial catch (TACC) in the early 1990s. Catches peaked at 151 t in the early 2010s, before a number of key indicators of stock performance began to decline across the fishery. There were also widespread abalone mortalities reported across the SASZF as a result of anomalously high water temperatures during the summer of 2012–13, which likely contributed to stock decline. Subsequently, catches declined to an average of 128 t over the last decade, associated with a combination under catch by industry and subsequent TACC reductions. Catches in the two most recent completed fishing seasons (i.e. 2020–21 and 2021–22) were consistent with the current TACC of 132 t whole weight [Burnell and Hogg 2023].

The most recent assessment report for the SASZF was completed in 2023 and reported on year-to-date data (October to April) for the 2022–23 season [Burnell and Hogg 2023]. The season in this fishery currently extends from 1 October to 30 September of the following year. Subsequent to this assessment, Abalone Viral Ganglioneuritis (AVG) has been detected, and mortalities observed, in the eastern part of this fishing zone. AVG has the potential to severely impact stocks (Mayfield et al. 2011).

The primary measures for biomass and fishing mortality are catch-per-unit-effort (CPUE) and fishery independent survey (FIS) of legal-size abalone density [PIRSA 2021]. The CPUE for Blacklip Abalone in the SASZF increased consistently through time, almost doubling between the mid-1980s and 2010–11. Following record high CPUE in 2010–11 (~122 kg whole weight per hour), CPUE declined to ~94 kg per hour in 2014–15, before recovering steadily to reach 117 kg per hour in 2022–23, which is slightly below historical peaks. In 2022/23, estimates of CPUE for 7 out of 9 Spatial Assessment Units (SAUs) were substantially above target levels from the HS. There are four SAUs where FIS are undertaken in the SASZF. Estimates of legal-sized Blacklip Abalone density from the two SAUs with the largest catches (Middle Point and Number 2 Rocks) were at or above target levels. Whereas, in the two SAUs with smaller catches (Gerloffs Bay and Rivoli Bay), legal-sized Blacklip Abalone density was below target levels.

Application of the harvest strategy in 2022–23 resulted in a year-to-date zone score of 7.5 that, in combination with the zone trend score of 5.5 (reflecting an increasing trend), define the stock status for Blacklip Abalone in the SASZF in 2022-23 as 'sustainable'. The above evidence indicates that the biomass of this stock is unlikely to be depleted and that recruitment is unlikely to be impaired. Furthermore, the above evidence indicates that the current level of fishing mortality is unlikely to cause the stock to become recruitment impaired.

On the basis of the evidence provided above, the South Australia Southern Zone Fishery management unit is classified as a **sustainable stock.**

South Australia Western Zone Fishery

The total commercial catch for Blacklip Abalone has declined by 57 per cent from the stable catch over the decade ending 2012 (which averaged 101 t) to the 2023 total allowable commercial catch (TACC) (43.5 t) meat weight. This decline in catch was the combined effect of TACC reductions and the removal of one licence during the elimination of displaced catch/effort as part of the implementation of state marine parks. The total catch was further decreased by voluntary reductions in catch by the commercial sector from 2015 to 2019 [Stobart et al. 2019, 2020] and in 2021 [Stobart et al. 2021].

The most recent assessment for the SAWZF was completed in 2023 and reported up to the conclusion of the 2022/23 financial year season [Stobart 2023]. The primary performance indicators used to infer biomass and fishing mortality are commercial CPUE and FIS of legal-sized density by financial year [PIRSA 2021]. All reported metrics transitioned to financial year from 2021 onwards to align with the harvest strategy [Stobart et al. 2021]. The CPUE for Blacklip Abalone in the SAWZF increased from 24.4 kg per hour in 1980 to 30.7 kg per hour in 2006, the highest level on record. CPUE then decreased and, in 2019, was 20.0 kg per hour, the lowest value on record. With one exception, the long-term declining trend between 2005 and 2019 occurred across all the high and medium importance SAUs for the fishery [Stobart et al. 2020]. Estimates of legal-sized density from FIS also show general decreases following the late 2000s.

CPUE has subsequently increased to 22.1 kg per hour in 2023 and there has been a stabilisation or increases of legal-sized density, generally matching the observed CPUE trend, except for two important fishing grounds, Drummond South and Avoid Bay that, in 2023, had the lowest legal density on record. The recent increase in CPUE and increases in legal density from three of the five FIS sites suggest that the reductions in catch may have arrested the observed declines in CPUE from 2005 to 2019. The trend reversal in both metrics from 2019 is evidence that, although biomass is low, fishing mortality is likely to be adequately controlled to avoid the stock becoming recruitment impaired. This was reflected in the status change from 'depleting' in 2018/19 to 'sustainable' in 2019/20.

Application of the harvest strategy resulted in a zone score of 3.15 that, in combination with the zone trend score of 5.0 (reflecting a stable trend), define the stock status for Blacklip Abalone in the WZ in the 2022/23 financial year as 'sustainable'.

The above evidence indicates that the biomass of this stock is unlikely to be depleted and that recruitment is unlikely to be impaired. Furthermore, the above evidence indicates that the current level of fishing mortality is unlikely to cause the stock to become recruitment impaired.

On the basis of the evidence provided above the South Australia Western Zone Fishery management unit is classified as a **sustainable stock.**

Tasmania Bass Strait Zone Fishery

Two different legal minimum lengths (LMLs) are in place (110 mm and 114 mm) in this zone, reflecting the variation in growth rates across the fishery. Since the creation of this zone in 2003, catch and standardised catch per unit effort (SCPUE) have been relatively stable. The Bass Strait Zone was closed in 2007 due to concerns around the possible risk of transferring abalone viral ganglioneuritis (AVG) from Victoria to Tasmania and re-opened in 2008. In 2016, the total allowable commercial catch (TACC) for the Bass Strait Zone was increased to 77 t on request from industry based on increasing catch rates and retained for 2017. In 2018, Blocks 48 and 49 were transferred from the Northern Zone to the Bass Strait Zone, with a small increase in TACC, to 91 t. Concerns over some components of this zone triggered several precautionary reductions in TACC and in 2022 was set at 80.5 t. In 2019 the zone-wide catch weighted mean SCPUECW (mean SCPUE across SAUs, weighted by catch) declined from

91.6 Kg/Hr in 2016 to 76.5 in 2019, compared with 79.1 kg per hour when the zone was established in 2003 [Mundy and McAllister 2020]. By 2022 the SCPUECW had improved and was stable at 88.2 Kg/hr. Proxies for Biomass and Fishing Mortality are derived from the Empirical Harvest Strategy outputs, where Biomass is represented by the catch-weighted mean zonal score for the Target CPUE performance measure, and Fishing Mortality is represented by the catch-weighted mean score for the 4-year CPUE gradient score. The zone-wide proxy for biomass is 7.1, well above the limit reference point, and the zone-wide proxy for fishing mortality is 1.7, above the target reference point for sustainability [McAllister and Mundy 2023].

The above evidence indicates that the biomass of stocks in the Tasmania Bass Strait Zone is unlikely to be depleted and that recruitment is unlikely to be impaired. Additionally, the above evidence also indicates that the current level of fishing mortality is unlikely to cause these stocks to become recruitment impaired.

On the basis of the evidence provided above, the Tasmania Bass Strait Zone Fishery management unit is classified as a **sustainable stock**.

Tasmania Eastern Zone Fishery

The majority of the Tasmania Eastern Zone Fishery management unit has a legal minimum length (LML) of 138 mm, while the LML for a small area around Freycinet is set at 145 mm as part of a rebuilding program [Mundy and McAllister 2020]. Relative stock biomass in this fishery (estimated using standardised catch per unit effort (SCPUE) as a proxy) has oscillated widely since 1992, with evidence of an approximate eight-year cycle [Mundy and McAllister 2020]. Based on declining mean SCPUECW (mean SCPUE across SAUs, weighted by catch) between 2000 (76 kg per hour) and 2003 (53.8 kg per hour), the total allowable commercial catch (TACC) was reduced from 1190 t to 857 t in 2002 and to 770 t in 2004 [Tarbath and Mundy 2004]. Subsequent increases in SCPUE and increasing median length of the commercial catch led to increases in the TACC by five per cent in 2008, 2009 and 2010 [Tarbath and Gardner 2011], resulting in a TACC of 896 t by 2010. Between 2007 and 2009, the mean SCPUECW was stable at around 90 kg per hour, but reports from divers suggested the resource was declining in late 2009. Subsequent rapid declines in SCPUE in most SAUs in late 2010 resulted in a reduced TACC of 721 t for 2011. Mortality of abalone in the wild across a large proportion of the Eastern Zone was observed in March 2010; this was coincident with a marine heat wave and the overall mortality from these deaths is unknown. Further rapid decline in SCPUE in 2011 resulted in an additional TACC reduction to 549.5 t for 2012. In 2013, minor reductions in the TACC to 528.5 t were made to address local concerns in one sub-region and held for 2014 and 2015 [Mundy and McAllister 2020].

The most significant marine heat wave ever recorded on the east coast of Tasmania peaked in March 2016, with mortalities observed along the central and southern east coast [Oliver et al. 2017, Oliver et al. 2018]. In June 2016, a significant winter storm with the largest swells recorded in a 36 year time series impacted stocks on coastlines exposed to a north-easterly direction [Mundy and Jones 2017], with immediate impacts on abalone availability. Stock rebuilding observed in several key areas of the Tasmania Eastern Zone in 2014 and 2015 ceased in 2016. In late 2017, there was concern about abalone abundance in the areas worst affected by the marine heat wave and winter storm from Cape Pillar to Eddystone Point and a 75 per cent TACC reduction was imposed for 2018. The SCPUE improved through 2018 and 2019, and in 2019 the mean SCPUECW had increased to 62.6 kg per hour. In the absence of recovery of

populations north of Cape Pillar triggered closure of five key reporting blocks in 2020, and those blocks remain closed in 2022 [McAllister and Mundy and McAllister 2023]. In 2022 the mean SCPUECW (excluding closed blocks) had improved to 83.2 kg per hour. Proxies for Biomass and Fishing Mortality are derived from the Empirical Harvest Strategy outputs, where Biomass is represented by the catch-weighted mean zonal score for the Target CPUE performance measure, and Fishing Mortality is represented by the catch-weighted mean score for the 4-year CPUE gradient score. Overall, the zone-wide proxy for biomass is 6.8, above the limit reference point of 1, and the zone-wide proxy for fishing mortality is 2.5, above the target reference point for sustainability [McAllister and Mundy 2023].

The above evidence indicates that the biomass of stocks in the Tasmania Eastern Zone is unlikely to be depleted and that recruitment is unlikely to be impaired. The above evidence also indicates that the current level of fishing mortality is unlikely to cause these stocks to become recruitment impaired.

On the basis of the evidence provided above, the Tasmanian Eastern Zone Fishery management unit is classified as a **sustainable stock**.

Tasmania Northern Zone Fishery

The geographic variability in growth dynamics within the Tasmania Northern Zone is reflected in three different legal minimum lengths (LMLs) (120 mm, 127 mm and 132 mm) [Mundy and McAllister 2020]. Regional catch and catch rates have varied between 2000 and 2015 as a function of changing market preference and adaptive management, including effort redistribution and change in LML. The majority of abalone landed from this zone are traditionally unsuited to the live market, and are processed for canned or frozen markets. In 2008, the first of two industry-driven experimental fisheries to improve fish quality commenced in Block 5 with a reduction in LML from 132–127 mm and a 50 t increase in catch, and a second industry-driven experimental fishery commenced in Block 49 in 2011, increasing the total allowable commercial catch (TACC) for the Northern Zone to a peak of 402.5 t. This initiative was not successful [Jones et al. 2014] and has had longer-term negative impacts on biomass. Standardised catch per unit effort (SCPUE) varies across different geographic regions within the Northern Zone, but the catch-weighted SCPUECW (mean SCPUE across SAUs, weighted by catch) for the zone has fallen in all the key fishing grounds targeted in the industry program over the past five years despite TACC reductions every year from 2012 to 2017 [Appendix D, Mundy and McAllister 2020]. In 2018, Blocks 48 and 49 were transferred out of the Northern Zone an into the Bass Strait Zone, while Sub-Blocks 6A, 6B, 6C were transferred out of the Central Western Zone and into the Northern Zone. A small decrease in TACC associated with this restructure was made, independent of TACC reductions based on Harvest Strategy outcomes. The mean SCPUECW in 2007 prior to the industry experiments was 93.1 kg per hour at a TACC of 280 t, compared with a mean SCPUECW of 54.7 kg per hour in 2019 at a TACC of 98t [Mundy and McAllister 2020]. The rate of decline in SCPUE from 2012 to 2017 was sharp, despite consecutive TACC reductions. In 2018 SCPUECW improved and that improvement continued in 2019. In 2022 the SCPUEcw increased to 78.6 Kg/hr, a further improvement from 69.1 Kg/Hr in 2021, and a substantial improvement since 2015 (54.6 Kg/hr) [McAllister and Mundy 2023]. The SAFS approach of considering trends across entire stocks masks sometimes signfiicant changes within a Zone. Continued declines in the King Island fishery required further TACC reductions, and in 2022 the Northern Zone TACC was set at 59.5 t.

Proxies for Biomass and Fishing Mortality are derived from the Empirical Harvest Strategy outputs, where Biomass is represented by the catch-weighted mean

zonal score for the Target CPUE performance measure, and Fishing Mortality is represented by the catch-weighted mean score for the 4-year CPUE gradient score. The zone-wide proxy for biomass is 5.7, above the limit reference point, while the proxy for fishing mortality is 2.9, which is marginally above the target reference point for sustainability [McAllister and Mundy 2023].

The above evidence indicates that the biomass of stocks in the Tasmania Northern Zone is unlikely to be depleted and that recruitment is unlikely to be impaired. The above evidence also indicates that the current level of fishing mortality is unlikely to cause the stock to become recruitment impaired.

On the basis of the evidence provided above, the Tasmania Northern Zone Fishery management unit is classified as a **sustainable stock**.

Tasmania Western Zone Fishery

The Tasmania Western Zone Fishery management unit has a legal minimum length (LML) of 140 mm. In 1993–99, the majority of the Western Zone was under-fished (catches ranging from 500–750 t) with effort concentrated in the Eastern Zone where a higher beach price could be achieved. This resulted in substantial accumulation of biomass and high catch rates (1993 mean catch-weighted standardised CPUE (SCPUECW) 104.5 kg per hour; 1999 mean SCPUECW 163.0 kg per hour). With the introduction of zones in 2000–01 to manage the distribution of effort, the Western Zone total allowable commercial catch (TACC) was elevated to 1260 t [Mundy and McAllister 2018], and remained at this level through to 2008, with mean SCPUECW declining to below 130 kg per hour. Widespread selective fishing for animals less than 160 mm SL, along with long-term declines in standardised catch per unit effort (SCPUE) in most SAUs, led to a further zonal restructure in 2009 with a new Central West Zone containing blocks 6, 7 and 8 previously managed under the Western Zone. Additionally, spatial catch limits were set annually for four geographic regions , to prevent excess catches in response to economic pressures. The TACC was also reduced in 2009 to 924 t. In 2013, Sub-Block 6D, and Blocks 7 and 8 were moved from the Central Western Zone back into the Western Zone and the Zone TACC increased to 1001 t, associated with the increased fishing area, but effectively retaining the same level of catch across blocks 6D, 7 to 13 as in 2012 [Tarbath and Mundy 2014]. In 2013, mean SCPUECW declined to 111.7 kg per hour triggering a TACC reduction to 840 t in 2014, and maintained for 2015. In 2016 the TACC was again reduced by 123 t to 717 t, and minor improvements in SCPUECW were observed in 2018. In 2019 the SCPUECW declined to 91.1 Kg per hour, the lowest catch rate on record for this zone. Continued declines through 2019 and the formal introduction of the Harvest Strategy resulted in significant TACC reductions for 2021 and 2022, with the TACC reduced to 339.5 t in 2022. Catch reductions have led to two consecutive years of improvement in SCPUECW and in 2022 was 106.8 Kg/Hr, and increase of 15.7 Kg per hour from 2019.

Proxies for Biomass and Fishing Mortality are derived from the Empirical Harvest Strategy outputs, where Biomass is represented by the catch-weighted mean zonal score for the Target CPUE performance measure, and Fishing Mortality is represented by the catch-weighted mean score for the 4-year CPUE gradient score. The zone-wide proxy for biomass is 3.0, above the limit reference point of 1.0, while the proxy for fishing mortality has improved to 1.9, and abovethe target reference point for sustainability [McAllister and Mundy McAllister 2023].

The above evidence indicates that stocks in the Tasmania Western Zone are likely to be depleted and that recruitment is likely to be impaired. The above evidence also indicates that current fishing mortality is constrained by

management to a level that should allow the stock to recover from its recruitment impaired state; however measurable improvements are yet to be detected.

On the basis of the evidence provided above, the Tasmania Western Zone Fishery management unit is classified as a **sustainable stock**.

Victoria Central Zone Fishery

Blacklip Abalone commercial catch per unit effort (CPUE) doubled from about 50 kg per hour in the early 1980s to around 100 kg per hour in the early 2000s, a pattern consistent throughout the state. The increase is thought to be at least partly due to changes in fishing practices that improved fishing efficiency [VFA 2017a]. Similar patterns have been observed during the same period in the other Australian Blacklip Abalone jurisdictions, and have been partially attributed to increased exploitable biomass. The introduction of a total allowable commercial catch (TACC) in the Victoria Central Zone in 1988 was expected to improve biomass and contribute to CPUE increases to some extent. The TACC was stable for more than a decade prior to the introduction of marine parks which reduced the available fishing grounds, probably because catch quotas were not linked to biomass trends at that time [Victorian Department of Natural Resources and Environment 1996].

Since the peak in the early 2000s CPUE has shown a declining trend, and by 2017–18 was almost one quarter lower at 74 kg per hour. Some of the smaller short-term fluctuations in CPUE during the past decade may be attributable to increases and decreases in abalone size limits. The abalone viral ganglioneuritis (AVG) outbreak west of Cape Otway contributed to a 50 t decline in catches and probably reduced catch rates to some extent. The TACC was reduced substantially from 620 t in 2006–07 to 285 t in 2010–11, following which it fluctuated between years by up to 8 per cent. Landings in 2021/22 were 241.4 t, 96% of the TACC [Dixon et al. 2023].

Trends in abundance estimated from fishery-independent survey (FIS) data were consistent with observed declines in CPUE, showing a major decline since 2003 of approximately 50–60 per cent in the relative abundance of sub-legal sized (pre-recruit) and legal-sized (recruit) abalone. Both of these FIS indices have been relatively stable since 2010, with recruit abundance increasing for the last three years. Although there are no prescribed reference points for these fishery-independent indicators of stock status, a draft harvest strategy specifies CPUE reference points with limits ranging from 40–50 kg per hour, thresholds from 60–70 kg per hour, and targets from 70–130 kg per hour among 11 of the 12 defined spatial management units (SMU) for which the Central Zone fishery is regulated [Dixon et al. 2023]. In the absence of recent catches, the Port Phillip Bay SMU was excluded. Current CPUE values in 2021/22 were between 49.5–89.5 kg per hour among the SMU, all above the limit reference points but with three below their respective thresholds and none above the target [Dixon et al. 2023].

The stable, or slightly increasing, abundances observed in FIS indices indicate that the decline in biomass observed over two decades may have stabilised, or possibly begun to reverse, but on balance, the stocks across the zone appear to be depleting, particularly over longer time frames, which is how the information must be interpreted given uncertainties in both CPUE and FIS abundances [Dixon et al. 2023]. Importantly, however, pre-recruit abundance levels are similar to those for recruits, implying that reasonable recruitment has been

occurring at recent stock levels. The current challenge facing the fishery is ensuring that the spatial distribution of catch is aligned with catch targets that reflect the biological productivity of the resource and enable stocks to rebuild.

The above evidence indicates that the biomass of this stock is unlikely to be depleted and that recruitment is unlikely to be impaired. For the period 2009/0–2021/22 the biomass declined, but the stock is not yet considered to be recruitment impaired. Evidence based on the pre-recruit abundance index indicates that reasonable recruitment has been occurring at recent stock levels [Dixon et al. 2023].

On the basis of the evidence provided above, the Victoria Central Zone Fishery management unit is classified as a **depleting stock.**

Victoria Eastern Zone Fishery

The Eastern Zone management unit was not affected by abalone viral ganglioneuritis (AVG) but has experienced impacts from environmental and ecosystem changes such as increasing abundance of the Longspined Sea Urchin (*Centrostephanus rodgersii*). These urchins denude reefs of macro-algae, turning them into 'barrens' that are unsuitable for abalone, with significant areas of reef in the Eastern Zone having been affected by urchins in this manner over the past 20 years [Gorfine et al. 2012]. It is also likely that reproductive capacity has been reduced by habitat loss caused directly by the increased density of urchins [Bell 2020]. Industry has a history of stewardship and working with fishery managers to sustain the fishery, including active control of urchins for more than ten years. However, increasing abundance of urchins may have led to an increased concentration of fishing effort on urchin-free reef areas, with an increased associated risk of localised depletion.

In common with other jurisdictions, improvements in fishing methods (e.g. transition to live-boating) have also occurred in this management unit and are thought to have contributed to fishing efficiency-related increases in catch per unit effort (CPUE) from the mid-1990s to early 2000s. The introduction of a total allowable commercial catch (TACC) in the Victoria Eastern Zone in 1988 was expected to improve biomass and contribute to CPUE increases to some extent. The TACC was stable for more than a decade prior to the introduction of marine parks which reduced the available fishing grounds, probably because catch quotas were not linked to biomass trends at that time [Victorian Department of Natural Resources and Environment 1996].

The Eastern Zone catch was relatively stable from 1992 to 2002, ranging from 431 to 445 t per quota year before increasing to 480 t in 2003. Catch was maintained at this level until 2008 and has slowly declined thereafter. Landings in 2020/21 were 282.3 t, the lowest on record, with the TACC being under-caught as a result of COVID restrictions and market conditions. In 2021/22, landings increased to 357.0 t, with the inclusion of a carryover from the previous seasons' under-caught TACC [Dixon et al. 2022].

Standardised CPUE significantly increased from 1992 to 2011, before significantly declining over five years from 2011 to 2016, then increasing again from 2016 to 2019. In 2020/21, CPUE reduced, which was at least partially a result of market demand for large, live abalone, and CPUE increased in 2021/22. Current CPUE values in 2021/22, for all seven Spatial Management Units (SMU), are well above the limit reference point of 50 kg per hour specified throughout the Eastern Zone, as well as SMU threshold and target reference points specified in a draft harvest strategy, that vary respectively between 70–80 kg per hour and 100–130 kg per hour [Dixon et al. 2022]. However, a review of CPUE

standardisation, and the reliability of catch rate as a proxy for biomass more generally, has revealed that CPUE is likely to be relatively unreliable in this fishery [Dixon et al. 2022].

In contrast with the CPUE trends, the fishery-independent survey indices show that pre-recruit abundance has declined by almost 70 per cent from historically high levels in 1995. The survey index of recruit abundance declined by 50 per cent and has since remained relatively stable in most SMU [Dixon et al. 2022]. However, a review of the fishery independent surveys is currently underway with preliminary indications that the fishery has since moved inshore following the depletion of deeper areas and thus the fishery independent surveys may provide limited information on the biomass of the stock where much fishing is currently concentrated [Dixon et al. 2022].

Given the uncertainties around both CPUE and the fishery independent surveys, there is considerable uncertainty in the trajectory of the biomass in the Victorian Eastern Zone management unit [Dixon et al. 2022]. However, it is apparent that there have been significant declines in biomass over the last 2–3 decades, and recent landings have not been consistent with targets meaning several SMU have received a disproportionally high level of fishing pressure [Dixon et al. 2022] and are therefore likely to have experienced further declines in biomass. Coupled with the effects of increased urchin abundance, the available evidence indicates that the biomass of Blacklip Abalone in the Victorian Eastern Zone management unit is still declining, but not to the extent that the stock could be considered to have become depleted or recruitment impaired.

On the basis of the evidence provided above, the Victoria Eastern Zone Fishery management unit is classified as a **depleting stock**.

Western Australia

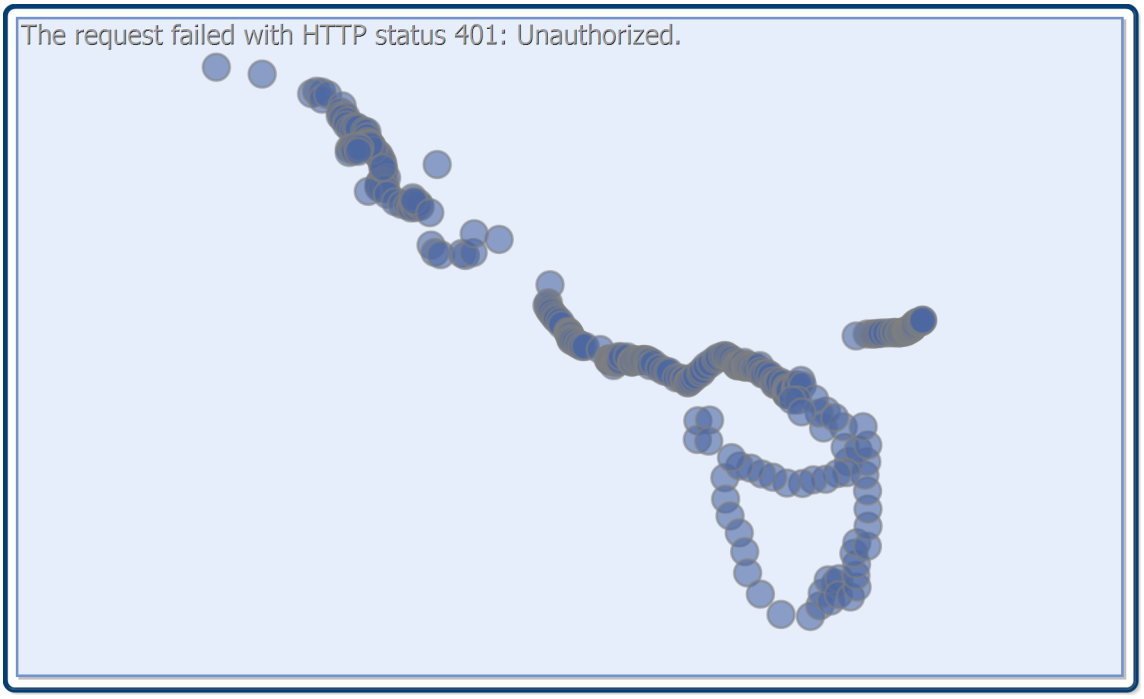
Stock status for Blacklip Abalone in Western Australia is reported as **Negligible** due to very low historical catches by this jurisdiction. The Blacklip Abalone stock is not targeted by commercial fishers and not recorded by charter operators. There has been a very small amount of historical catch reported by the recreational sector, but this is misreporting of Brownlip Abalone catch.

BIOLOGY

Blacklip Abalone biology [Shepherd 1973, Officer 1999, Tarbath et al. 2001, Tarbath and Officer 2003]

Species	Longevity / Maximum Size	Maturity (50 per cent)
Blacklip Abalone	20–50 years, 150–220 mm SL	~ 5 years, 80–130 mm SL

DISTRIBUTION



Distribution of reported commercial catch of Blacklip Abalone

TABLES

Fishing methods				
	New South Wales	South Australia	Tasmania	Victoria
Commercial				
Diving	✓	✓	✓	✓
Recreational				
Diving	✓	✓	✓	✓

Management Methods				
	New South Wales	South Australia	Tasmania	Victoria
Charter				
Bag limits				✓
Gear restrictions				✓
Licence				✓
Size limit				✓
Spatial closures				✓
Temporal closures				✓

Commercial				
Gear restrictions	✓			✓
Individual transferable quota	✓			
Licence				✓
Limited entry		✓	✓	✓
Limited entry (licensing)		✓		
Marine park closures	✓			
Size limit			✓	✓
Size limits	✓	✓		
Spatial closures	✓	✓	✓	✓
Total allowable catch	✓	✓	✓	✓
Recreational				
Bag and possession limits	✓		✓	
Bag limits				✓
Bag/boat limits		✓		
Gear restrictions	✓			✓
Licence	✓			✓
Marine park closures	✓			
Size limit	✓		✓	✓
Size limits		✓		
Spatial closures	✓			✓
Temporal closures				✓

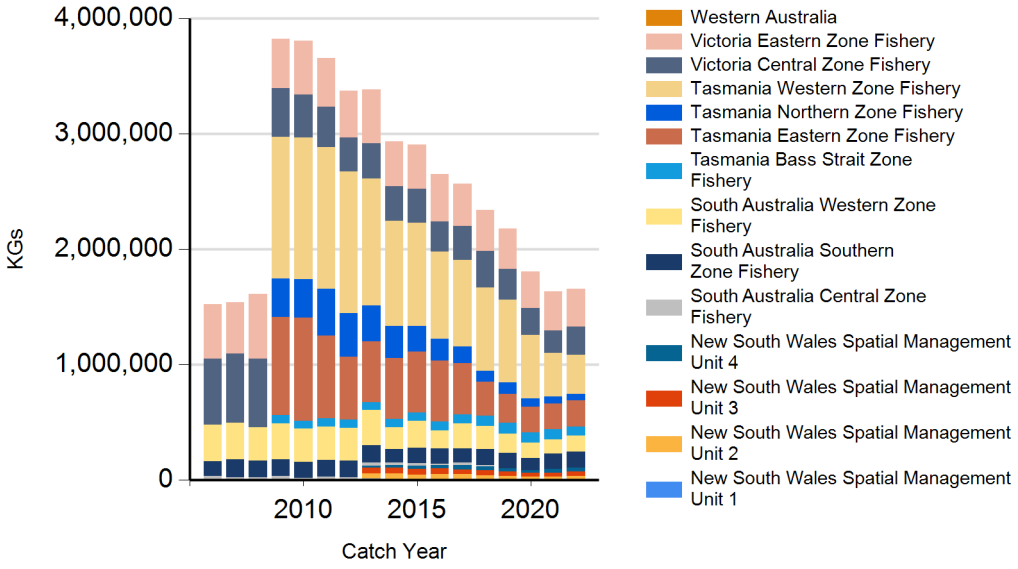
Catch					
	New South Wales	**South Australia**	**Tasmania**	**Victoria**	**Western Australia**
Commercial	104.487 t	277.89 t	703.5 t	570.9 t	0 t
Indigenous	Unknown	Unknown	Unknown	None	

Recreational	Unknown	0.1t	36 t	Unknown	

New South Wales – Indigenous (Management Methods)
https://www.dpi.nsw.gov.au/fishing/aboriginal-fishing

Victoria – Indigenous (Management Methods) A person who identifies as Aboriginal or Torres Strait Islander is exempt from the need to obtain a Victorian recreational fishing licence, provided they comply with all other rules that apply to recreational fishers, including rules on equipment, catch limits, size limits and restricted areas. Traditional (non-commercial) fishing activities that are carried out by members of a traditional owner group entity under an agreement pursuant to Victoria's *Traditional Owner Settlement Act 2010* are also exempt from the need to hold a recreational fishing licence, subject to any conditions outlined in the agreement. Native title holders are also exempt from the need to obtain a recreational fishing licence under the provisions of the Commonwealth's *Native Title Act 1993*.

CATCH CHART



Commercial catch of Blacklip Abalone - note confidential catch not shown

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