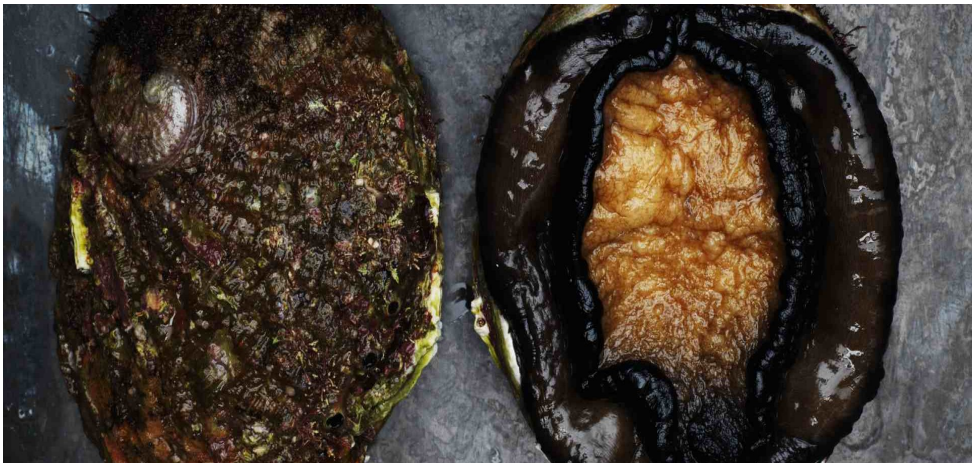
Blacklip Abalone (2018)

Haliotis rubra rubra



Craig Mundy: Institute for Marine and Antarctic Studies, University of Tasmania, **Lachlan Strain**: Department of Primary Industries and Regional Development, Western Australia, **Victorian Fisheries Authority**: Victorian Fisheries Authority, **Rowan Chick**: Department of Primary Industries, New South Wales, **Stephen Mayfield**: South Australian Research and Development Institute, **Ben Stobart**: South Australian Research and Development Institute

STOCK STATUS OVERVIEW

Jurisdiction	Stock	Fisheries	Stock status	Indicators
Western Australia	Western Australia	N/A	Negligible	Catch
New South Wales	New South Wales	NSWAF	Depleting	Catch, CPUE, mean weight, biomass
Victoria	Victoria Central Zone Fishery	VCZF	Depleting	Catch, CPUE, fishery independent surveys
Victoria	Victoria Eastern Zone Fishery	VEZF	Depleting	Catch, CPUE, fishery independent surveys
Victoria	Victoria Western Zone Fishery	VWZF	Sustainable	Catch, CPUE, fishery independent surveys
Tasmania	Tasmania Bass Strait Zone Fishery	TBSZF	Sustainable	Catch, CPUE
Tasmania	Tasmania Central Western Zone Fishery	TCWZF	Depleted	Catch, CPUE
Tasmania	Tasmania Eastern Zone Fishery	TEZF	Depleting	Catch, CPUE
Tasmania	Tasmania Northern Zone	TNZF	Depleting	Catch, CPUE

	Fishery			
Tasmania	Tasmania Western Zone Fishery	TWZF	Sustainable	Catch, CPUE
South Australia	South Australia Central Zone Fishery	SACZF	Depleted	Catch, CPUE
South Australia	South Australia Southern Zone Fishery	SASZF	Sustainable	Catch, CPUE, survey density
South Australia	South Australia Western Zone Fishery	SAWZF	Depleting	Catch, CPUE, survey density

NSWAF New South Wales Abalone Fishery (NSW), SACZF South Australian Central Zone Fishery (SA), SASZF South Australian Southern Zone Fishery (SA), SAWZF South Australia Western Zone Fishery (SA), TBSZF Tasmanian Bass Strait Zone Fishery (TAS), TCWZF Tasmanian Central Western Zone Fishery (TAS), TEZF Tasmanian Eastern Zone Fishery (TAS), TNZF Tasmanian Northern Zone Fishery (TAS), TWZF Tasmanian Western Zone Fishery (TAS), VCZF Victorian Central Zone Fishery (VIC), VEZF Victorian Eastern Zone Fishery (VIC), VWZF Victorian Western Zone Fishery (VIC), N/A Not Applicable (WA)

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. 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 catch and catch per unit effort (CPUE; as kg of abalone harvested per hour). CPUE from individual fishing events is relevant locally but not indicative of status broadly [Parma et al. 2003], and status of the many populations in a management unit cannot be assumed to be trending in the same direction. Thus, the average CPUE across each spatial reporting unit provides the broader perspective for fishery assessment. 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. In some jurisdictions, additional fishery-independent data (density, size composition) are available from underwater research surveys.

STOCK STATUS

New South Wales

The New South Wales Abalone Fishery is managed as a jurisdictional stock with a single total allowable commercial catch (TACC), determined by an independent Total Allowable Catch Setting and Review Committee (TACSRC). Assessments rely heavily on fishery-dependent data from commercial fisher's logbooks, including catch, catch rate (kg/hr) and mean weight (catch divided by the number of individual abalone harvested), summarised at a range of spatial scales. More recent assessments have also utilised estimates of legal-size biomass density (kg/Ha) and productive area of reef (i.e. cumulative area fished in the most recent three years) to estimate legal biomass, derived from fine scale GPS logger data and data from logbooks.

Blacklip Abalone stocks in New South Wales are continuing to recover from historical levels of overfishing and over-depletion [Liggins and Upston 2010, TACSRC 2015, 2017]. Recent measures of stock status indicate substantial recovery with a doubling of legal-size biomass between about 2009 and 2014, followed by a decline since 2015 to a level similar to that in 2012 [TACSRC 2017]. These apparent changes in the status of the stock, together with

substantial contrast in historical and recent fishery-dependent measures (notably, catch, biomass and catch rate) provide a basis to infer historical status and reference levels of catch rate (assuming they are comparable) and provide a relative measure of stock abundance through time.

The historical status of stocks, inferred largely from changes in the level of catch rate through time and the overfished status of the stock in the mid-2000s, strongly indicates that stocks were subject to recruitment overfishing and were depleted in the mid-1980s (catch rate less than 20 kg per hour, compared to levels in excess of 30 kg per hour) and that overfishing continued throughout the 1990s to the mid-2000s (catch rate less than 20 kg per hour, with intermittent peaks to less than 25 kg per hour). This period of declining and historically low catch rate occurred during a period of relatively stable catches through the 1990s and a reduction in TACCs during the early-2000s from 305 to 130 tonnes (t). Following a further reduction in TACC to 75 t in 2010, and increases to LMLs, there was a strong recovery in catch rate and mean weight of abalone, particularly from southern areas of the state which provide most of the catch, to levels not previously recorded. In 2010, the catch rate exceeded 30 kg per hour for the first time since the early-1980s and was > 45 kg per hour in 2014. Between 2009 and 2014, estimates of legal-size biomass density (kg per hectare) indicated that there has been a two-fold increase in biomass [TACSRC 2017], and the TACC was incrementally increased to 130 t. On this basis, sustained levels of a catch rate ≤ 30 kg per hour seem appropriate as a reference point below which the stock would be classified as being depleted and recruitment being impaired.

Since 2015, mean weight, catch rate and measures of legal-size biomass from southern areas have shown declines from recent high levels. Estimates of catch rate and legal biomass indicated stocks had declined in 2017 to levels similar to those in 2012 [TACSRC 2017, catch rate ~40 kg per hour). The recent declines in biomass together with changes in catch rate and mean weight from southern areas, indicate current levels of biomass are below a reasonable target for this fishery. Stock declines over the most recent few years can probably be attributed to a combination of continued levels of catch and reduced productivity [TACSRC 2017], resulting in a reduction in abundance in some areas of the coast, particularly north-east facing and historically productive southern coastal areas. This reduction in north-east facing parts of the southern coast is at least partly attributable to extreme sea conditions disturbing habitat and causing mortality in mid-2016. Despite no substantial change in harvest fraction, estimated net production in 2016 and 2017 was close to zero or negative, indicating depletion and overfishing was occurring, whilst productivity between 2010 and 2013 was substantially higher and positive, which supported stock rebuilding for the same harvest fraction [TACSRC 2017].

Additional protection for the fishery has been achieved through several increases in the LML from 100 mm established in 1972, through four increases to 117 mm in 2008, and a proposal to increase the commercial state-wide LML to 119 mm in 2018 and 120 mm in 2019. In the most southern areas of the state, the LML for the commercial fishery was increased to 120 mm in 2010, 123 mm in 2013 and is proposed to increase to 125 mm in 2018.

The distribution of catch is not uniform throughout the state, with that in the northern area typically contributing ≤ 10 per cent of the total annual catch for at least the last decade. Northern stocks were subject to high exploitation rates through the mid- to late-1980s and early-1990s and were further depleted by mortality associated with infection by the parasite *Perkinsus sp.* [Liggins and Upston 2010, TACSRC 2015] during the 1990s and into the early-2000s. Stocks in this northern area have not demonstrated consistent changes in fishery-dependent data, compared to those generally observed in the south. Relatively low, sporadic catches, together with more variable changes in CPUE and mean weight, likely reflect more isolated fishing events rather than patterns consistent with the northern stock generally [TACSRC 2017].

The evidence presented above indicates that the stock within New South Wales was overfished through the mid-1980s and into the early-2000s. After the early-2000s, management measures supported recovery, as indicated by increases in catch rate and mean weight of abalone in the commercial catch from the mid-2000's to 2015. Recent performance measures indicate the stocks are being depleted [TACSRC 2017]. Recent changes to management measures (TACC reduced to 100 t) and proposals to increase LMLs in 2018 and 2019, provide greater protection to the fishable biomass. Finalising a fishery harvest strategy continues to be an important goal to provide greater certainty in the determination of fishery status and response of management to future changes in the performance of the fishery. To this end, reference points for primary performance measures, principally catch rate, have been proposed and are reported against in annual New South Wales Abalone Fishery stock assessment reports, together with other performance measures described in the draft harvest strategy.

Since about 2015 biomass has declined but is not yet depleted and recruitment is not yet impaired, however, fishing mortality is too high and moving the stock in the direction of becoming recruitment impaired.

On the basis of the evidence provided above, Blacklip Abalone in New South Wales is classified as a **depleting stock**.

South Australia Central Zone Fishery

In 2018, the South Australia Central Zone Fishery (SACZF) was voluntarily closed by industry following successive determinations of depleting stock status since 2013. The TACC was reduced from 6.4 t (meat weight) in 2017 to zero for the 2018 fishing year. The most recent assessment for the SACZF was completed in 2018, reporting up to the conclusion of the 2017 season [Burnell et al. 2018]. The key indicator for biomass and fishing mortality is commercial catch rate (nominal CPUE). A long-term decline in CPUE has been evident since the mid-2000s, despite a reduction in TACCs [Burnell et al. 2018]. Recent catches of 6.2 t and 5.8 t in 2016 and 2017, respectively, were at the lowest levels since 1985 and below the TACC. Since 2015, CPUE has declined substantially, declining by 15 per cent between 2015 and 2016 and by a further 12 per cent between 2016 and 2017 – a decrease of 26 per cent in the CPUE for Blacklip Abalone in the SACZF over two years. The CPUE in 2017 was 18.3 kg per hour, which was the lowest catch rate on record (38 years) and 12 per cent below the next lowest value. The 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 has also been an apparent 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. The above evidence indicates that the biomass of this stock is likely to be depleted and that recruitment is likely to be impaired. 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

In response to a depleting stock status from 2013–14 onwards, the TACC in the South Australia Southern Zone Fishery (SASZF) was reduced from 151 t to 126 t (whole weight) for 2015–16. The most recent assessment for the SASZF was completed in 2018 and reported up to the conclusion of the 2016–17 season (Ferguson et al. 2018). Determining the stock status for 2016–17 was challenging because the data show conflicting trends among spatial assessment units (SAUs), further complicated by recent changes in the management arrangements, including the introduction of finer spatial management from 2013, varying minimum legal lengths across years, the small fleet size and diver changeover, and effects of weather conditions on fishing behaviour [Ferguson et al. 2018]. The primary measures for biomass and fishing mortality are commercial catch rate (CPUE) and fishery-independent surveys of legal-size density. The zonal CPUE for Blacklip Abalone in the SASZF in 2016–17 was 99.5

kg per hour, which was substantially greater than the long-term average of 91.2 kg per hour (1979–80 – 2015–16). The CPUE has also been relatively stable for the past four fishing seasons, following a decline between 2010–11 and 2012–13. Estimates of legal-sized density from fishery-independent surveys have been stable or shown small increases in recent years. 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

In response to a depleting stock status from 2013 onwards, the TACC in the South Australia Western Zone Fishery (SAWZF) was reduced from 89.9 t to 74.6 t (meat weight) in 2016. The total catch was further reduced through a voluntary reduction in catch by the commercial sector from 2015 onwards [Stobart et al. 2017]. The total catch decreased from 82.4 t in 2014 to 66.8 t in 2017, being reduced by 35 per cent from higher, stable catch levels averaging 103 t over the decade ending 2009. The most recent assessment for the SAWZF was completed in 2018 and reported up to the conclusion of the 2017 season [Stobart et al. 2018]. The primary measures for biomass and fishing mortality are commercial catch rate (CPUE) and fishery-independent surveys of legal-sized density. The CPUE for Blacklip Abalone in the SAWZF increased from 22.7 kg per hour in 1979 to more than 31 kg per hour in 2006, the highest level on record. Subsequently, CPUE has decreased each year and, in 2017, was 22.2 kg per hour, 29 per cent below the peak in 2006 and the lowest value on record. With two exceptions, this long-term declining trend occurred across all of the high and medium importance spatial assessment units (SAUs) for the fishery [Stobart et al. 2018]. Estimates of legal-sized density from fishery-independent surveys show general decreases in recent years, matching the decline in CPUE. There is no evidence that the declines in CPUE have been arrested despite the reduced catch. The above evidence indicates that, for the period from 2006 to 2017, the biomass declined and that the current level of fishing mortality is likely 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 **depleting stock**.

Tasmania Bass Strait Zone Fishery

Two different 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 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 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 2017 the zone-wide catch weighted mean SCPUE declined from 91.6 Kg/Hr in 2016 to 82.7 in 2017, compared with 79.1 kg per hour when the zone was established in 2003 [Mundy and McAllister 2018]. However, the zone-wide proxy for biomass is 6.6, well above the LRP, and the zone-wide proxy for fishing mortality is 0.5, just above the TRP for sustainability [Mundy and McAllister 2018].

The above evidence indicates that stocks in the Tasmania Bass Strait Zone are unlikely to be recruitment overfished and that the current level of fishing pressure is unlikely to cause these stocks to become recruitment overfished.

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

Tasmania

The Tasmania Central Western Zone Fishery management unit has a LML of 132

Central Western Zone Fishery

mm. This part of the west coast was underexploited in the early- to mid-2000s [Mundy and McAllister 2018], with fishing concentrated on southern areas where higher beach prices were achievable for the live market. Spatial management measures were used to shift effort into this region in 2009. SCPUE has oscillated over the past 15 years, but has declined rapidly over the past five years, suggesting the biomass has been reduced. During 2012, 127 t was harvested from this area. In response to declining catch rates, the TACC in this management unit was reduced in 2013 to 105.1 t, in 2014 to 73.5 t, in 2015 to 52.5 t, in 2016 to 42 t, and in 2017 to 35 t. The intention was to continue reducing the TACC until there is clear evidence of stock rebuilding [Mundy and McAllister 2018].

The mean SCPUE in 2017 declined further to a historic low of 50.0 kg per hour compared with an SCPUE of 136.5 kg per hour when this zone was created in 2009. The rate of decline in SCPUE since 2012 has been sharp despite five consecutive TACC reductions. By late 2017 there was no evidence of rebuilding and future catch was set at 10 t (a 92 per cent reduction on 2012 catch levels). The 2017 zone-wide proxy for biomass is 0.7, below the LRP, while the proxy for fishing mortality is -2.9, which is below the TRP for sustainability [Mundy and McAllister 2018]. The above evidence indicates that the biomass of this stock is likely to be depleted and that recruitment is likely to be impaired.

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

Tasmania Eastern Zone Fishery

The majority of the Tasmania Eastern Zone Fishery management unit has a 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 2018]. Relative stock biomass in this fishery (estimated using SCPUE as a proxy) has oscillated widely since 1992, with evidence of an approximate eight year cycle [Mundy and McAllister 2018]. Based on declining mean SCPUE between 2000 (76 kg per hour) and 2003 (53.8 kg per hour), the TACC was reduced from 1 190 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 SCPUE 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 late-2010 resulted in a reduced TACC of 721 t for 2011. Mortality (per cent unknown) of abalone in the wild across a large proportion of the Eastern Zone was observed in March 2010, coincident with a marine heat wave. 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 2018].

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. In 2017, the mean SCPUE declined to 56.6 kg per hour. Stock rebuilding observed in several key areas of the Tasmania Eastern Zone in 2014 and 2015 ceased in 2016. In late 2017, industry and the assessment team were concerned about abalone abundance in the areas worst affected by the MHW and winter storm from Cape Pillar to Eddystone Point and imposed a 75 per cent TACC reduction for 2018. Overall, the zone-wide proxy for biomass is 2.5, above the LRP of 1, but the zone-wide proxy for fishing mortality is -0.1, below the TRP for sustainability [Mundy and McAllister 2018].

The above evidence indicates that the current level of fishing pressure combined

with environmental effects is likely to cause this stock to become depleted and recruitment to become impaired.

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

Tasmania Northern Zone Fishery

The geographic variability in growth dynamics within the Tasmania Northern Zone is reflected in three different LMLs (120 mm, 127 mm and 132 mm) [Mundy and McAllister 2018]. 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 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. SCPUE varies across different geographic regions within the Northern Zone, but SCPUECW 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 2018]. 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 60.2 kg per hour in 2017 at a TACC of 148 t [Mundy and McAllister 2018]. The rate of decline in SCPUE since 2012 has been sharp, despite consecutive TACC reductions. The zone-wide proxy for biomass is 1.6, marginally above the LRP, while the proxy for fishing mortality is -0.7, which is below the TRP for sustainability [Mundy and McAllister 2018].

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

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

Tasmania Western Zone Fishery

The Tasmania Western Zone Fishery management unit has a 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 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 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 smaller animals less than 160 mm SL, considered to be damaging to the resource at this time, along with long-term declines in SCPUE, led to the zonal restructure and implementation of spatial catch limits set annually for four geographic regions within this zone, to prevent excess catches in response to economic pressures. The TACC in this management unit was reduced in 2009 to 924 t. In 2013, Blocks 7 and 8 were moved from the Central Western Zone back into the Western Zone and the TACC increased to 1001 t, associated with the increased fishing area, but effectively retaining the same level of catch 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, maintained for 2015. In 2016 the TACC was reduced by 123 t to 717 t. In 2015 the mean SCPUECW had declined to 91.9 kg per hour, but by 2017 mean SCPUECW had increased again to 107.5 Kg per hour. The zone-wide proxy for biomass is 3.1, marginally above the LRP, while the proxy for fishing mortality is 2.8, and above the TRP for

sustainability [Mundy and McAllister 2018].

The above evidence indicates that stocks in the Tasmania Western Zone are unlikely to be depleted and that the current level of fishing pressure is unlikely to cause these stocks to become recruitment impaired.

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

Consistent with other Victorian management units, commercial CPUE doubled from about 50 kg per hour in the early 1980s to around 100 kg per hour in the early-2000s. 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, which have been partially attributed to increased exploitable biomass. The introduction of a TACC in the Victoria Central Zone in 1988 was anticipated to improve biomass and contribute to the CPUE increases to some extent. The TACC was stable for more than a decade prior to the introduction of marine parks, 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 has fluctuated between years by up to 8 per cent. The TACC has been set at 274 t for the past two years. Trends in abundance estimated from FIS data were consistent with observed declines in CPUE, showing a major decline since 2003 of approximately 50–60 per cent in the number of pre-recruit and recruits. Both FIS indices have been relatively stable since 2010.

The stable, but relatively low, levels in fishery-independent survey indices indicates that the decline in biomass observed over two decades may have stabilised, but there is no evidence of recovery and commercial CPUE has decreased by 14 per cent during the past decade [VFA 2017a]. However, pre-recruit abundance levels are similar to those for recruits, implying that that reasonable recruitment has been occurring at recent stock levels. The above evidence indicates that the biomass of this stock is unlikely to be depleted and that recruitment is unlikely to be impaired.

Based on this evidence, 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 AVG but has seen impacts from environmental and ecosystem changes such as range expansion by the Long Spined Sea Urchin (*Centrostephanus rodgersii*). These urchins denude reefs of macro-algae, turning the reefs into 'barrens' that are unsuitable for abalone. Significant areas of reef in the Eastern Zone have been rendered unsuitable for abalone due to urchin expansion over the past 20 years [Gorfine et al. 2012]. Industry has a history of stewardship and working with fishery managers to sustain the fishery, including active control of urchins at reefs near Mallacoota for the last eight years. The urchin range extension has led to increased fishing effort on urchin-free reef areas, with increased risk of localised depletion.

In common with other jurisdictions, improvements in fishing methods have also occurred in this management unit and are thought to have contributed to fishing

efficiency-related increases in CPUE from the mid-1990s–early-2000s. The introduction of a TACC in the Victoria Eastern Zone in 1988 was anticipated to improve biomass and contribute to the CPUE increases to some extent. The TACC was stable for more than a decade prior to the introduction of marine parks, probably because catch quotas were not linked to biomass trends at that time [Victorian Department of Natural Resources and Environment 1996].

At the zonal scale, commercial CPUE increased from about 70 kg per hour after quota introduction in 1989 to a peak of 120 kg per hour in 2012 [VFA 2017b]. It then declined by 21 per cent in 2017 before a 10 per cent increase during the most recent year. Most sub-zonal SMUs units have also shown declines in CPUE since 2012 with a subsequent 10–18 per cent upswing between 2016–17 and 2017–2018. There has been a 10 per cent decrease in CPUE between the most recent five year period and the preceding five year period, notwithstanding the 2017–18 upswing. However, the management unit is not currently considered to be depleted because CPUE indicates that biomass is now close to levels during the mid-1990s to mid-2000s (~ 90 kg per hour).

The fishery-independent survey indices show pre-recruit abundance declined from historically high levels in 1995 by almost 70 per cent in 2015, after which it has remained stable. From 1995–2015, the survey index of recruit abundance declined by 50 per cent and has since remained relatively steady [VFA 2017b]. In response to declining CPUE and survey indices, there has been an incremental reduction of TACCs since 2008–09, from 490 t in that year to 347 t for the current 2018–19 quota year. While there are signs of recent stability in the pre-recruit and recruit survey indices, it is too soon to tell whether this stability will continue, or if the current management arrangements and quota reductions are sufficient to prevent further decline and allow the stock to rebuild. The recent declines in CPUE across much of the management unit are concerning, as is the ongoing vulnerability of the management unit to further habitat loss from urchins. Although the evidence indicates that biomass is declining in the management unit, it is not yet considered to be a depleted stock.

For the periods 1995 to 2015 and 2012 to 2017, fishery independent and dependent performance measures respectively indicate that the biomass declined, but the stock is not yet considered to be depleted and recruitment is not yet impaired. Despite lower quotas, the fishing mortality is currently at a level that the stock is declining. The prospect of ongoing decline is exacerbated by habitat loss, indicating reasonable risk of the fishery becoming recruitment impaired.

Based on the evidence provided above, the Victoria Eastern Zone Fishery management unit is classified as a **depleting stock**.

Victoria Western Zone Fishery

The Western Zone management unit has undergone significant changes over its recent history. Most notable was the impact of an outbreak of Abalone Viral Ganglioneuritis (AVG) in 2006. Industry has worked with fishery managers since that time to respond to the disease outbreak, including development of a draft harvest strategy for the fishery. Abalone mortalities due to the disease severely reduced the biomass and resulted in a major reduction in TACC for this zone from 280 t in 2001–02 to 20 t in 2008–09. While some fishing occurred on uninfected reefs for a period immediately after the disease was first recognised, by 2008 most areas in the Western Zone had been impacted and/or were closed to fishing. These events complicate comparisons between recent and historical fishery-dependent and independent data.

Progression of the disease through the fishery had abated by 2009. This enabled fishers and researchers to conduct a structured fishing program [Mayfield et al. 2011], where divers were assigned precise fishing locations, to gather information and assess the capacity of remaining stocks to support a viable commercial fishery. Only trends in commercial CPUE from 2011 onwards are

used in this assessment, due to the large changes in fishing and management of the fishery that occurred because of the disruptive effects of AVG. Fishing has been kept low since that time by a precautionary TACC set at approximately 50 t. Since SAFS 2016, the TACC has been increased to 70 t reflecting increases in estimates of exploitable biomass of abalone with shell lengths larger than 130 mm. Recent TACCs have been set at around 10 per cent of the estimated biomass of legal-sized abalone [Helidoniotis and Haddon 2014, WADA 2016].

Commercial CPUE for the management unit increased by 73 per cent from 1979–2001, a period influenced by changes in the sophistication of management strategies, change in fishing practice and adoption of improved technology, which led to increased efficiency of the fleet. The introduction of a TACC in the Victoria Western Zone in 1988 was anticipated to improve biomass and is likely to have contributed contribute to the CPUE increases to some extent. The TACC was stable for more than a decade prior to the introduction of marine parks, probably because catch quotas were not linked to biomass trends at that time [Victorian Department of Natural Resources and Environment 1996]. The CPUE during 2001–06 declined slightly, until the 2006 AVG outbreak caused substantial declines in catch and catch rate. In 2007, the highest average annual CPUE on record occurred, most likely due to contraction of fishing grounds to disease-free areas and reversion from previous, larger voluntary size limits to smaller sizes [Gorfine et al. 2008, Mayfield et al. 2011]. After normal fishing practices resumed in 2011 and divers were free to choose where to fish, CPUE increased rapidly until 2013. This increase was likely to have arisen from divers being able to target the more productive reefs again after structured fishing ended. Catch-per-unit-effort during the past two years has been 77 kg per hour, the same as the pre-disease average for the period 1992/93 - 2003/04, and comparable with the other two management units [VFA 2017c].

The FIS data from 2003 onwards clearly show the impact of the AVG mortalities. Survey abundance indices for both pre-recruits and recruits showed 32 per cent and eight per cent less abundance respectively in 2018, compared with the pre-disease averages during 1995–2006 [VFA 2017c]. Since 2010 pre-recruit abundance has increased more than three-fold and recruit abundance has increased by 75 per cent since 2008 [VFA 2017c]. During the past year the former has again decreased by six per cent and the latter by 21 per cent. This might mean that the recovery has reached its zenith, but further years of independent monitoring will be required before this can be determined. The above evidence indicates that the biomass of the stock is unlikely to be depleted, and that AVG did not disrupt the fundamental breeding and juvenile recruitment processes.

Fishery-dependent and independent information indicate that the management unit has been stable since 2011, although at a much lower biomass than pre-AVG. The recent stability of the commercial CPUE under the higher LML of 130 mm, combined with stability of the fishery-independent pre-recruit and recruit survey indices, indicate that the current management arrangements are constraining fishing pressure sufficiently to avert decline in exploitable biomass. Signs are now evident of an increase in pre-recruit abundance during recent years, indicating that the stock has been rebuilding despite progressive increases in TACC [VFA 2017c].

The above evidence indicates that the biomass of this stock is unlikely to become further depleted than was caused by AVG, and that current recruitment is unlikely to be impaired. Although the stock is not expected to be able to support pre-AVG catch levels in the short to medium term, the above evidence indicates that the current level of fishing pressure is unlikely to cause the stock to become recruitment impaired.

Based on the evidence provided above, the Victoria Western Zone Fishery management unit is classified as a **sustainable stock**.

Western Australia

Stock status for Blacklip Abalone in Western Australia is reported as Negligible due to very low 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 thought to be misreporting of Brownlip Abalone catch.

BIOLOGY

Blacklip Abalone biology [Officer 1999, Shepherd 1973, 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

Commercial Catch Methods	New South Wales	South Australia	Tasmania	Victoria	Western Australia
Diving	✓	✓	✓	✓	
N/A					✓

Fishing methods				
	New South Wales	South Australia	Tasmania	Victoria
Commercial				
Diving	✓	✓	✓	✓
Indigenous				
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				
Effort limits				✓
Gear restrictions				✓
Licence				✓
Limited entry	✓	✓	✓	✓
Size limit	✓	✓	✓	✓
Spatial closures	✓		✓	✓
Total allowable catch	✓	✓	✓	✓
Indigenous				
Bag limits		✓		
Customary fishing permits			✓	
Native Title	✓			
Section 37 (1d)(3)(9), Aboriginal cultural fishing authority	✓			
Size limit		✓	✓	
Recreational				
Bag and possession limits			✓	
Bag limits	✓	✓		✓
Gear restrictions				✓
Licence	✓			✓

Size limit	✓	✓	✓	✓
Spatial closures	✓			✓
Temporal closures				✓

Active Vessels			
	New South Wales	**South Australia**	**Victoria**
	31 Fishing Business Owner in NSWAF,	6 Licences in SASZF, 22 Licences in SAWZF,	34 Licence Holders in VCZF, 23 Licence Holders in VEZF, 14 Licence Holders in VWZF,

NSWAF New South Wales Abalone Fishery(NSW)

SASZF South Australian Southern Zone Fishery(SA)

SAWZF South Australia Western Zone Fishery(SA)

VCZF Victorian Central Zone Fishery(VIC)

VEZF Victorian Eastern Zone Fishery(VIC)

VWZF Victorian Western Zone Fishery(VIC)

Catch					
	New South Wales	**South Australia**	**Tasmania**	**Victoria**	**Western Australia**
Commercial	127.364t in NSWAF,	17.4958t in SACZF, 119.31t in SASZF, 200.506t in SAWZF,	75.244t in TBSZF, 34.012t in TCWZF, 440.17t in TEZF, 145.577t in TNZF, 696.995t in TWZF,	314.907t in VCZF, 355.649t in VEZF, 64.4433t in VWZF,	
Indigenous	Unknown	Unknown	Unknown	None	
Recreational	Unknown	0.1t	36 t	Unknown	

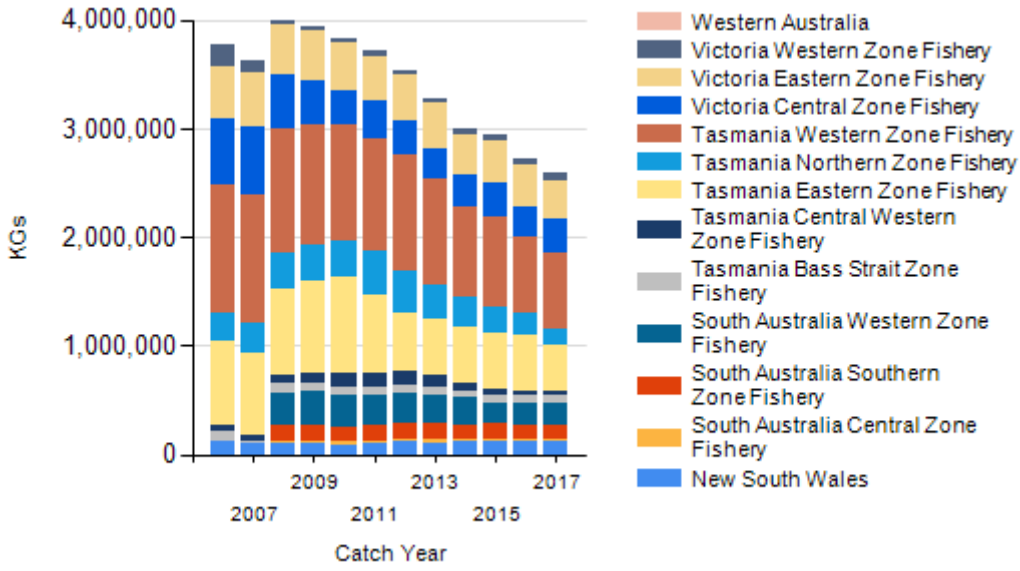
NSWAF New South Wales Abalone Fishery (NSW), SACZF South Australian Central Zone Fishery (SA), SASZF South Australian Southern Zone Fishery (SA), SAWZF South Australia Western Zone Fishery (SA), TBSZF Tasmanian Bass Strait Zone Fishery (TAS), TCWZF Tasmanian Central Western Zone Fishery (TAS), TEZF Tasmanian Eastern Zone Fishery (TAS), TNZF Tasmanian Northern Zone Fishery (TAS), TWZF Tasmanian Western Zone Fishery (TAS), VCZF Victorian Central Zone Fishery (VIC), VEZF Victorian Eastern Zone Fishery (VIC), VWZF Victorian Western Zone Fishery (VIC), N/A Not Applicable (WA),

New South Wales – Indigenous (Management Methods) (a) The Aboriginal cultural fishing authority is the authority that Indigenous persons can apply to take catches outside the recreational limits under the *Fisheries Management Act 1994* (NSW), Section 37 (1d)(3)(9), Aboriginal cultural fishing authority; (b) In cases where the *Native Title Act 1993* (Cth) applies fishing activity can be undertaken by the person holding native title in line with S.211 of that Act, which provides for fishing activities for the purpose of satisfying their personal, domestic or non-commercial communal needs. In managing the resource where native title has been formally recognised, the native title holders are engaged with to ensure their native title rights are respected and inform management of the State's fisheries resources.

Victoria – **Indigenous (Management Methods)** In Victoria, regulations for managing recreational fishing may not apply to fishing activities by Indigenous people. Victorian traditional owners may have rights under the Commonwealth's *Native Title Act 1993* to hunt, fish, gather

and conduct other cultural activities for their personal, domestic or non-commercial communal needs without the need to obtain a licence. Traditional Owners that have agreements under the *Traditional Owner Settlement Act 2010* (Vic) may also be authorised to fish without the requirement to hold a recreational fishing licence. Outside of these arrangements, Indigenous Victorians can apply for permits under the *Fisheries Act 1995* (Vic) that authorise fishing for specific Indigenous cultural ceremonies or events (for example, different catch and size limits or equipment).

CATCH CHART



Commercial catch of Blacklip Abalone - note confidential catch not shown

EFFECTS OF FISHING ON THE MARINE ENVIRONMENT

ENVIRONMENTAL EFFECTS on Blacklip Abalone

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