

Greenlip Abalone (2016)

Haliotis laevis



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STOCK STATUS OVERVIEW

Jurisdiction	Stock	Fisheries	Stock status	Indicators
Western Australia	Western Australian Area 2 Fishery	WAA2F	Transitional-depleting	Catch, CPUE, catch, length-frequency data, fishery-independent surveys
Western Australia	Western Australian Area 3 Fishery	WAA3F	Transitional-depleting	Catch, CPUE, catch, length-frequency data, fishery-independent surveys
Victoria	Victorian Central Zone Fishery	VCZF	Overfished	Catch
Victoria	Victorian Western Zone Fishery	VWZF	Overfished	Catch
Tasmania	Tasmanian Greenlip Abalone Fishery	TGAF	Transitional-depleting	CPUE
South Australia	South Australian Central Zone Fishery	SACZF	Transitional-depleting	CPUE, fishery-independent surveys
South Australia	South Australian Southern Zone	SASZF	Undefined	catch

	Fishery			
South Australia	South Australian Western Zone Fishery	SAWZF	Sustainable	CPUE, fishery-independent surveys

SACZF South Australian Central Zone Fishery (SA), SASZF South Australian Southern Zone Fishery (SA), SAWZF South Australian Western Zone Fishery (SA), TGAF Tasmanian Greenlip Abalone Fishery (TAS), VCZF Victorian Central Zone Fishery (VIC), VWZF Victorian Western Zone Fishery (VIC), WAA2F Western Australian Area 2 Fishery (WA), WAA3F Western Australian Area 3 Fishery (WA)

STOCK STRUCTURE

Greenlip Abalone is distributed across southern mainland Australia and northern Tasmania. The biological stock structure of Greenlip Abalone has recently been examined[1,2]. Genetic evidence has confirmed that Greenlip Abalone comprise numerous independent biological stocks, but at a spatially broader scale than the biological stock structure evident for Blacklip Abalone[1–3]. There are many biological stocks across Tasmania, Victoria, South Australia and Western Australia. Given the large number of biological stocks, it is not practical to assess each separately.

Here, assessment of stock status is presented at the management unit level—Western Australian Area 2 Fishery, Western Australian Area 3 Fishery, Victorian Central Zone Fishery, Victorian Western Zone Fishery, Tasmanian Greenlip Abalone Fishery, South Australian Western Zone Fishery, South Australian Central Zone Fishery and South Australian Southern Zone Fishery.

STOCK STATUS

South Australian Central Zone Fishery The harvest strategy in the Management Plan for the South Australian Commercial Abalone Fishery[17] produces a catch-weighted determination of stock status for the fishing zone. However, the harvest strategy does not identify performance indicators or reference points for classifying the fishery under the Status of Australian Fish Stocks framework. The reference points described in the harvest strategy were developed as a scoring mechanism for the performance indicators, not as a stock classification tool. While there is some variability among management units, the harvest strategy was developed at a time when the fishery was considered to be stable, and was partly designed to maintain that stability. Reference points are used to score performance indicators, with negative scores for low current values and positive scores for high current values, when assessed against a fixed 20-year reference period (1990–2009). The intent was to prevent the fishery declining to abundance levels in the 1990s, that preceded the large increase in abundance (presumably through strong recruitment) in the 2000s[18–20], whilst simultaneously allowing increased abundance to translate to elevated TACCs. The harvest strategy appears to result in more optimistic assessments of stock status than those from weight-of-evidence methods[18–20]. Concerns with the harvest strategy have resulted in a review that is currently underway. Consequently, in this assessment, nominal commercial CPUE (based on meat weight) and densities from fishery-independent surveys (FIS) are used as the primary indices of Greenlip Abalone abundance for the Western Zone and Central Zone Fishery management units. CPUE can provide a more optimistic index of relative abundance than measures from fishery-independent surveys, because catch rates in dive fisheries have been shown to be hyperstable[18–23]. Decreases in CPUE in abalone fisheries are considered to be a reliable indicator of declines in abalone abundance, but nominal CPUE can underestimate the actual magnitude of the reduction in harvestable biomass[18–20,23]. For the Southern Zone Fishery management unit, commercial catch history and diver observations are

used to inform stock status.

South Australian Central Zone Fishery (SACZF) management unit was classified as transitional–depleting in 2014[18]. The CPUE for Greenlip Abalone in the SACZF management unit remained stable from 1979–98 and then increased substantially from 1999–2001, when it reached a peak of 29 kg per hour. CPUE declined between 2002 and 2011 to 22 kg per hour. It has subsequently been relatively stable, at a mean of 23 kg per hour, slightly above the mean CPUE of 20 kg per hour during the 1990s. The legal minimum length of 135 mm should allow several years of spawning to occur before recruitment to the fishery. There has been some evidence of stock improvement/stability over the past 2 years, including stable catches consistent with the TACC, relatively high CPUEs across fishing grounds, increased estimates of harvestable biomass from FIS at Tiparra Reef, historically the key fishing ground, low exploitation rates from a high biomass estimated from FIS in Hardwicke Bay and discovery of new fishing grounds[18]. The above evidence indicates that the stock is unlikely to be recruitment overfished.

However, there is evidence of stocks in a weak position[18]. For Tiparra Reef, this includes current low catches relative to historical catches (partly driven by a catch cap), low and declining sub-legal-sized and pre-recruit Greenlip Abalone density, and high exploitation rate (33 per cent). In West Yorke Peninsula, there are rapid declines (greater than 25 per cent) in CPUE, high exploitation rates and a high ratio of legal-sized to sub-legal-sized Greenlip Abalone in some fishing grounds[18]. There have also been recent declines in catch and/or CPUE in several areas where catches initially increased in response to the shift in effort away from Tiparra Reef[18]. The above evidence indicates that the current level of fishing pressure may ultimately cause the stock to become recruitment overfished. In addition, there are also insufficient data with which to distinguish between the two primary hypotheses (that is, a sustainable rotational fishing strategy versus a sequential depletion of the stocks) explaining the ongoing spatial re-distribution of catch in this fishery[18].

On the basis of the evidence above, the South Australian Central Zone Fishery management unit remains classified as a **transitional–depleting stock**.

**South
Australian
Southern
Zone
Fishery**

The season in this fishery extends from 1 September–31 August of the following year, and this species is typically harvested as a bycatch even though there is a separate Greenlip Abalone TACC. The maximum catch in this fishery was 19 t in 1968–69. Recent Greenlip Abalone catches in the Southern Zone Fishery management unit have generally been small, being about 5 t per season from 2009–10 to 2012–13. The Greenlip Abalone TACC was increased to 7.2 t per year from 2010–11; however, the catch in 2013–14 was only 4 t. Diver observations and the commercial catch history are used when setting annual TACCs, but there is insufficient information available to confidently classify the status of this stock[24].

On the basis of the evidence provided above, the South Australian Southern Zone Fishery management unit is classified as an **undefined stock**.

**South
Australian
Western
Zone
Fishery**

The CPUE for Greenlip Abalone in the South Australian Western Zone Fishery management unit remained relatively stable between 1983 and 1996, and then increased rapidly, reaching a peak in of 24 kg per hour in 2003. From 2003, CPUE decreased substantially to 17 kg per hour in 2014, below the mean value through the 1990s of 18 kg per hour that preceded the increase in abundance and CPUE between 2001 and 2003.

Interpretation of more recent changes in CPUE, and what this indicates about

stock biomass, are complicated by changing spatial and temporal dynamics that have likely changed the relationship between CPUE and Greenlip Abalone abundance[19]. Nonetheless, there is evidence that there has been an improvement in stock status between 2014 and 2015[19]. This evidence includes: 1) a 17 per cent increase in CPUE between 2014 and 2015, the largest interannual change in CPUE in the history of the fishery; 2) consistent increases in CPUE across fishing grounds and seasons; and 3) large Greenlip Abalone dominating the catch across fishing grounds. In addition, the fishing mortality has been reduced through a shift in fishing from summer to autumn[19] and catch reductions of 10.4 per cent (a combination of TACC and voluntary catch reductions) in 2010–15.

There is evidence that some of the component stocks have not similarly improved over the same time period[19]. This includes low fishery independent survey densities at Anxious Bay, the most important Greenlip Abalone fishing ground in this management unit, decreasing harvestable biomass at The Gap, the second most important fishing ground in this management unit, and no evidence of recovery in some fishing grounds where catches have been substantially reduced. Collectively however, the above evidence indicates that current legal-sized Greenlip Abalone abundance is similar to, or higher than, that in the 1990s, and that current exploitation rates have decreased. In addition, the legal minimum length of 145 mm should allow several years of spawning to occur before recruitment to the fishery. The above evidence indicates that the stock is unlikely to be recruitment overfished and that the current level of fishing pressure is unlikely to cause the stock to become recruitment overfished.

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

**Tasmanian
Greenlip
Abalone
Fishery**

The Tasmanian abalone fishery has been quota managed with an annual TACC since 1985. Since 2000, separate TACCs for Greenlip Abalone and Blacklip Abalone have been implemented, with catch caps within the Greenlip TACC applied to four regions within the Greenlip zone. Size Limits vary with a legal minimum length (LML) of 132 mm, 145 mm or 150 mm depending on growth rates, size at maturity and maximum size of populations in different regions. An annual fishery assessment is conducted using fishery-dependent CPUE data, and until 2014 the TACC was determined by an ad-hoc approach using trends in CPUE and industry perceptions on the state of the resource. In the 2012 and 2014 Status of Australian Fish Stocks editions, this fishery was classified as undefined due to the complexities of reporting and apportioning of effort, and hence understanding CPUE, in this mixed species fishery. The fishery-dependent data time series has since been reviewed and revised and a formal process for assigning effort in mixed species fishing events established[12], enabling the development of separate CPUE indices for Greenlip and Blacklip Abalone.

In 2014–15, an empirical harvest strategy (HS) was developed[12,13] and tested by Management Strategy Evaluation (MSE)[14–16]. This HS was applied to the 2015 annual fishery assessment[12]. The HS assesses the fishery performance against target reference points for three performance measures (PM) derived from SCPUE data: 1) current CPUE relative to an agreed target (55th percentile of the annual standardised mean CPUE within the reference period); 2) the 4-year gradient of CPUE (target gradient is zero); and 3) the percent change in SCPUE in the past year (target change is zero). The reference period for the 2015 assessment spans fishery data between 1992 and 2015. A scoring function is applied to the three PMs, resulting in a score between zero and 10, where five is the target score and zero and 10 are the zone-wide lowest and highest values for that PM within the reference period. Weightings are applied to the three PMs 05:0.25:02.5 to provide a combined final score used in the Control Rule. The HS is applied individually to each statistical reporting

block, and a zone score is obtained from the mean block score weighted by block catch. The zone target CPUE PM score is used as a proxy for biomass and the zone gradient CPUE PM score is used as a proxy for fishing mortality, F . A target CPUE score of one is the limit reference point (LRP) defining the boundary between recruitment overfished and transitional–depleting for all Tasmanian management units. This LRP is typically five per cent above the lowest SCPUE observed within the zone during the reference period. A negative zone gradient score gives evidence that fishing mortality is increasing and the magnitude of the gradient provides some information on the magnitude of F . In order to emulate a normal phase plot, five is subtracted from the gradient four PM score to provide a range of negative five–positive five, where the target reference point is zero, and defines the boundary between sustainable and transitional–depleting classifications, but also between transitional–recovering and recruitment overfished. The combination of a negative CPUE gradient and near record low CPUE score represents a cautious proxy for the true recruitment overfished reference point. No reporting blocks have collapsed within the reference period, providing a degree of certainty that the LRP will prevent stock collapse, which is supported by MSE testing of the HS[12].

The TACC for the Tasmanian Greenlip Abalone Fishery has been stable at around 140 t since 2000, with only minor variation in the proportion of the TACC harvested from each of the four regions (King Island, North West, North East and Furneaux). In 2015, the zone-wide catch-weighted block mean SCPUE_{ew} was 62.6 kg per hour, compared to 60.4 kg per hour in 1999, prior to the introduction of separate Greenlip Abalone TACC. The regional SCPUE is close to the target SCPUE in two of the four regions; the Furneaux Group region is above the target and the King Island region is below the target. The current North West SCPUE of 72 kg per hour is close to the CPUE target (75 kg per hour), but has been declining rapidly since 2012 (91 kg per hour). Half of the catch cap in this region is taken from an area where the LML is set at 132 mm. With an increasing beach price offered for larger Greenlip Abalone, selective fishing for larger animals has become common place, with a negative effect on catch rates (greater handling and search time), potentially distorting SCPUE trends in this region. The King Island SCPUE has been declining for several years, although in 2015 SCPUE is above 50 kg per hour and moving towards the CPUE target of 65 kg per hour. King Island has the largest LML (150 mm) and assumed to provide greater protection of spawning biomass. Changes from a winter to late-summer (lower weight/length) fishing season in recent years and increased selective fishing are thought to have had more influence over the SCPUE trend and HS outcomes than actual changes in biomass[12]. However, until these factors are included in the CPUE standardisation, as a precautionary approach this stock is considered to be declining from a sustainable position. The zone-wide proxy for biomass is 4.1 and above the LRP, and the zone-wide proxy for F is negative 1.2 and below the TRP for sustainability.

The above evidence from the Tasmanian commercial Greenlip Abalone fishery indicates that the biomass of this stock is not recruitment overfished. The above evidence indicates that the current level of fishing pressure is likely to cause the stock to become recruitment overfished.

On the basis of the evidence provided above, the Tasmanian Greenlip Abalone Fishery management unit is classified as a **transitional–depleting stock**.

**Victorian
Central
Zone
Fishery**

The Victorian Abalone Fishery Management Plan[7] does not identify a performance indicator or a reference point below which the fishery would be defined as recruitment overfished. In the absence of this key performance indicator, catch history and historical surveys are used to make inferences about stock status.

Greenlip Abalone continues to comprise a small component of the commercial Abalone catch which, in the Victorian Central Zone Fishery management unit, mostly comprises Blacklip Abalone. A study in 1996 concluded that the resource had by that time failed to recover from overfishing during the 1960s–70s when annual catches reached 50 tonnes (t), despite very small catches during ensuing decades[8]. The TACC has remained unchanged at 3.4 t since 2009[9] and, although some recovery of the stock is expected following these large reductions in catch, the fact that the TACC is not reached indicates that recovery is at best limited. The above evidence indicates that the stock is likely to be recruitment overfished.

There is no reliable information about fishing effort for Greenlip Abalone which makes it difficult to determine trends in fishing pressure and relative abundance through the use of indicators such as CPUE. Overall, the above evidence indicates that current fishing pressure is constrained by management to a level that should allow the stock to recover from its recruitment overfished state. However, measurable improvements are yet to be detected.

On the basis of the evidence provided above, the Victorian Central Zone Fishery management unit is classified as an **overfished stock**.

**Victorian
Western
Zone
Fishery**

Population abundance and size structure estimates from data collected during the late-1980s–90s indicated that the stock was small and mostly concentrated in Portland Bay[8]. Surveys conducted almost a decade later showed potential for a limited fishery on Julia Bank[10], as well as Minerva and Hospital Reefs[11].

Prior to the implementation of the 2002 Victorian Abalone Fishery Management Plan, a TACC of 280 t was allocated for both Greenlip and Blacklip Abalone combined. The reported catches for Greenlip Abalone were small, with an average annual catch of only 100 kg during 2001–05. A separate Greenlip Abalone TACC of 4.2 t was set for the 2006–07 quota year (1 April–31 March) and maintained for the next 2 years. During this period, the TACC was caught.

Following a reduction in Blacklip Abalone catches due to the occurrence of abalone viral ganglioneuritis during 2006–07 and in response to a population survey of Greenlip Abalone on Minerva and Hospital reefs[11], the TACC was increased to 16 t for 2009–10. A catch of 18.9 t was taken in the 2010 calendar year and an average catch of 14.8 t per year was taken during the period 2009–11. These catches were not sustained and annual catch declined to 7 t by 2012–13, with the TACC being decreased by 50 per cent between 2011 and 2012, in response to declining catches. The TACC was subsequently set at zero in 2013[9], and has remained at zero since then, following expressions of concern by industry that levels of fishing pressure had been too high, and that precautionary measures were required to allow the stock to rebuild (minutes from TACC Forum on 4 February 2013). This reduction in fishing mortality is expected to lead to a rebuilding of the stock, but there is some uncertainty about whether this is occurring and, if so, to what extent. There have been anecdotal reports from industry that the abundance of Greenlip Abalone is increasing. In the absence of recent fishery or survey data, it is not possible to provide evidence that Greenlip Abalone are recovering. The above evidence indicates that current fishing pressure is constrained by management to a level that should allow the stock to recover from its recruitment overfished state. However, measurable improvements are yet to be detected.

On the basis of the evidence provided above, the Victorian Western Zone Fishery management unit is classified as an **overfished stock**.

**Western
Australian
Area 2
Fishery**

Catches in the Western Australian Area 2 and Area 3 Abalone Fisheries are controlled by a total allowable commercial catch (TACC), set by the harvest control rule defined in the Abalone Resource of Western Australia Harvest Strategy 2016–21[4]. The harvest control rule uses a 3-year moving average of standardised catch per unit effort (SCPUE) as the key performance indicator against specified limit, threshold and target reference levels, with the threshold being a level at which additional management action should be considered to prevent decline towards the limit. The fishery is defined as recruitment overfished if the SCPUE is below the limit reference level, which is set at two-thirds of the lowest SCPUE observed (threshold level) in each management area during the specified reference period of recruitment stability in the commercial fishery (1992–2006)[4,5].

In the Western Australian Area 2 Fishery (WAA2F), the SCPUE for Greenlip Abalone has fluctuated between the target and threshold reference levels since 1995. A declining trend in SCPUE towards the threshold reference level has been observed post 2010–11, with a marked decline in 2015 resulting in the SCPUE now being below the threshold, but above the limit reference level. Sub-area analysis of raw catch rate, average meat weight per individual and length-frequency distributions from catch sampling, are consistent with the recent decline in the SCPUE trend[5,6]. Fishery-independent surveys show evidence of a decline in juvenile (40–80 mm), recruit (145+ mm) and total densities, but not outside of historical ranges[5,6]. The fishery has a legal minimum length of 140 mm, which allows 2–5 years of spawning to occur before recruitment to the fishery. The effect of above-average water temperatures on the abalone stocks since 2011 may have reduced recruitment and/or growth and needs to be assessed further. The above evidence indicates that the biomass has declined, but the stock is not yet considered to be recruitment overfished (indicator not below the limit reference level).

A recent review of the harvest control rule and reference levels in the Western Australian abalone fisheries (2015) indicated that a more conservative approach was required, and management action has subsequently been implemented in the WAA2F (TACC at 60 per cent of long-term commercial sustainable harvest level)[4,5]. The reductions in catch quota under the revised harvest control rule have reduced the fishing mortality, and the effect of these will be monitored annually to determine if the reductions are sufficient to ultimately prevent the stock becoming recruitment overfished.

On the basis of the evidence provided above, the Western Australian Area 2 Fishery management unit is classified as a **transitional–depleting stock**.

**Western
Australian
Area 3
Fishery**

Catches in the Western Australian Area 3 Abalone Fishery (WAA3F) are managed by the same process as described above in the Western Australian Area 2 Abalone Fishery and defined in the Abalone Resource of Western Australia Harvest Strategy 2016–21[4]. The SCPUE for Greenlip Abalone in the WAA3F fluctuated between the target and threshold reference levels during the period 2002–12. Since 2013, the SCPUE has declined to below the threshold, but remains above the limit reference level. Sub-area analysis of raw catch rate, average meat weight per individual and length-frequency distributions from catch sampling, support the decline seen in the SCPUE trend[5,6]. Fishery-independent surveys show evidence of a recent decline in juvenile (40–80 mm), recruit (145+ mm) and total densities but not outside of historical ranges[5,6]. The fishery has a legal minimum length of 140 mm which allows 2–5 years of spawning to occur before recruitment to the fishery. The effect of above-average water temperatures on the abalone stocks since 2011 needs to be assessed further. The above evidence indicates that the biomass has declined, but the stock is not yet considered to be recruitment overfished (indicator not

below the limit reference level).

A recent review of the harvest control rule and reference levels in the Western Australian abalone fisheries (2015) indicated that a more conservative approach was required, and management action has subsequently been implemented in the WAA3F (TACC at 73 per cent of long-term commercial sustainable harvest level)[4,5]. The reductions in catch quota under the revised harvest control rule have reduced the fishing mortality, and the effect of these will be monitored annually to determine if the reductions are sufficient to ultimately prevent the stock becoming recruitment overfished.

On the basis of the evidence provided above, the Western Australian Area 3 Fishery management unit is classified as a **transitional–depleting stock**.

BIOLOGY

Greenlip Abalone biology[16,18]

Species	Longevity / Maximum Size	Maturity (50 per cent)
Greenlip Abalone	20 years; 200 mm <u>SL</u>	3–5 years; 70-120 mm <u>SL</u>

DISTRIBUTION



Distribution of reported commercial catch of Greenlip Abalone

TABLES

Commercial Catch Methods	South Australia	Tasmania	Victoria	Western Australia
Diving	✓	✓	✓	
Various				✓
Fishing methods				

	South Australia	Tasmania	Victoria	Western Australia
Commercial				
Diving	✓	✓	✓	
Various				✓
Indigenous				
Diving	✓	✓		✓
Recreational				
Diving	✓	✓	✓	✓

Management Methods				
	South Australia	Tasmania	Victoria	Western Australia
Commercial				
Limited entry	✓	✓	✓	✓
Size limit	✓	✓	✓	✓
Total allowable catch	✓	✓	✓	✓
Indigenous				
Bag limits	✓	✓		✓
Size limit	✓	✓		✓
Recreational				
Bag limits	✓	✓	✓	✓
Size limit	✓	✓	✓	✓

Active Vessels				
	South Australia	Tasmania	Victoria	Western Australia
	6 license in SACZF, 6 license in SASZF, 22 license in SAWZF,	58 Vessel in TGAF,	16 Fisher in VCZF, 0 Vessel in VWZF,	10 Vessel in WAA2F, 10 Vessel in WAA3F,

SACZF South Australian Central Zone Fishery(SA)

SASZF South Australian Southern Zone Fishery(SA)

SAWZF South Australian Western Zone Fishery(SA)

TGAF Tasmanian Greenlip Abalone Fishery(TAS)

VCZF Victorian Central Zone Fishery(VIC)

VWZF Victorian Western Zone Fishery(VIC)

WAA2F Western Australian Area 2 Fishery(WA)

WAA3F Western Australian Area 3 Fishery(WA)

Catch				
	South	Tasmania	Victoria	Western

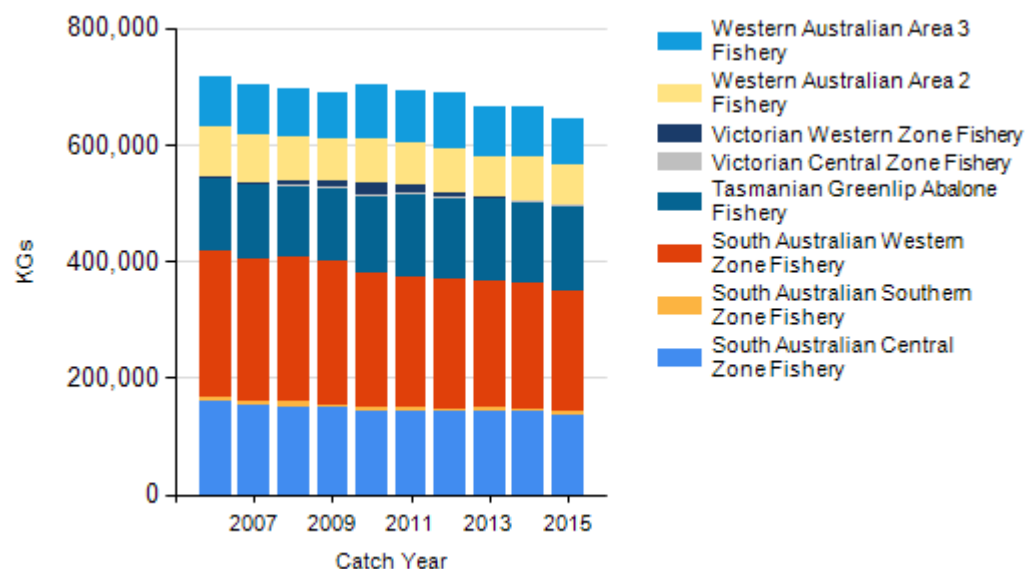
	Australia			Australia
Commercial	137.211t in SACZF, 4.96524t in SASZF, 206.637t in SAWZF,	143.969t in TGAF,	4.05132t in VCZF,	66.8327t in WAA2F, 79.1132t in WAA3F,
Indigenous	Unknown	Unknown	0t	Unknown
Recreational	Unknown	Unknown	Unknown	8t

SACZF South Australian Central Zone Fishery (SA), SASZF South Australian Southern Zone Fishery (SA), SAWZF South Australian Western Zone Fishery (SA), TGAF Tasmanian Greenlip Abalone Fishery (TAS), VCZF Victorian Central Zone Fishery (VIC), VWZF Victorian Western Zone Fishery (VIC), WAA2F Western Australian Area 2 Fishery (WA), WAA3F Western Australian Area 3 Fishery (WA),

a Victoria – Indigenous (catch) In Victoria, regulations for managing recreational fishing are also applied to fishing activities by Indigenous people. Recognised Traditional Owners (groups that hold native title or have agreements under the Traditional Owner Settlement Act 2010 [Vic]) are exempt (subject to conditions) from the requirement to hold a recreational fishing licence, and can apply for permits under the Fisheries Act 1995 (Vic) that authorise customary fishing (e.g. different catch and size limits, or equipment). The Indigenous category in Table 3 refers to customary fishing undertaken by recognised Traditional Owners. In 2012–13, there were no applications for customary fishing permits to access Greenlip Abalone.

b Indigenous Subject to the defence that applies under Section 211 of the Native Title Act 1993 (Cth), and the exemption from a requirement to hold a recreational fishing licence, the non-commercial take by indigenous fishers is covered by the same arrangements as that for recreational fishing.

CATCH CHART



Commercial catch of Greenlip Abalone - note confidential catch not shown

EFFECTS OF FISHING ON THE MARINE ENVIRONMENT

- Because Greenlip Abalone is hand selected by commercial divers operating from vessels that seldom anchor, the fishery has limited direct physical impact on the environment. There is also substantial evidence that the ecosystem effects of removing abalone are minimal[23–25].

ENVIRONMENTAL EFFECTS on Greenlip Abalone

- Southward and westward strengthening of the warm East Australian Current into the relatively cold inshore waters in Tasmania has changed near-shore community structure and productivity, primarily through expansion of the range of the urchin *Centrostephanus rodgersii* from New South Wales to Tasmania[26–28]. This has resulted in localised depletions of abalone populations and a reduction in the habitat available for abalone[29,30].

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