

Pipi (2016)

Donax deltoides



Greg Ferguson: South Australian Research and Development Institute, **Daniel Johnson:** Department of Primary Industries, New South Wales, **James Andrews:** Department of Economic Development, Jobs, Transport and Resources, Victoria

STOCK STATUS OVERVIEW

Jurisdiction	Stock	Fisheries	Stock status	Indicators
New South Wales	New South Wales	EGF	Undefined	Catch
Victoria	Victoria	BF, OF	Undefined	Catch
South Australia	South Australia	LCF, MSF	Sustainable	Fishery-independent relative abundance, size frequencies

EGF Estuary General Fishery (NSW), LCF Lakes and Coorong Fishery (SA), MSF Marine Scalefish Fishery (SA), BF Bait Fishery (VIC), OF Ocean Fishery (VIC)

STOCK STRUCTURE

Pipi is common on high-energy sandy beaches from southern Queensland to the mouth of the Murray River in South Australia[1] and the distribution may extend further westwards. High genetic variation between populations on either side of Bass Strait indicates at least two biological stocks, with the East Australian Current and South Australian Current acting as key drivers of gene flow on the east and south coasts of Australia respectively[2]. A study of Pipi from Fraser Island, Queensland, to southern New South Wales, indicated a single biological stock over this area, with genetic mixing driven by ocean currents associated with the East Australian Current[1]. For locations west of Bass Strait in South Australia and western Victoria, no evidence of genetic structuring of Pipi has been detected[2]. The degree of larval mixing is thought to be related to spawning and larval duration, although these are poorly understood[2–5]. Although no genetic differences were detected among Pipi populations on beaches along the east coast of Australia, in any given year most recruits are likely to be self-seeded or to come from nearby, adjacent beaches[1]. This is also likely the case for the fisheries located to the west of Bass Strait. Despite the work outlined above, the biological stock delineation of Pipi remains unclear.

Here, assessment of stock status is presented at the jurisdictional level—New South Wales, Victoria, and South Australia.

STOCK STATUS

New South Wales The harvest of Pipi in New South Wales is shared between commercial, recreational and Indigenous fishers. Commercial landings declined from more than 560 tonnes (t) in the 2004–05 financial year to less than 10 t in 2010–11, despite a significant increase in price over this period. The factors contributing to the large-scale decline in New South Wales Pipi populations, including fishing and natural mortality rates, are unknown. In 2011, a six-month closure of the commercial fishery and output controls limiting catch to 40 kg per fisher per day were implemented in an attempt to stabilise the fishery. A minimum legal length of 45 mm is in place to allow spawning to occur before recruitment to the fishery[6]. Commercial landings in recent years have increased to more than 150 t. Uncertainty exists around commercial catch rates as an index of relative abundance due to aggregation of Pipi, catches being limited to 40 kg per fisher per day, and the ability of fishers to relocate among a large number (more than 100) of separate beaches[7]. No other information is available on catch rates, fishing mortality rates or biomass estimates, consequently there is insufficient information to confidently classify the status of this stock.

Estimates of recreational catch are available from the National Recreational and Indigenous Fishing Survey and New South Wales state-wide surveys completed in the 2000–01 and 2013–14 financial years, respectively[8,9]. In 2000–01, the catch from New South Wales was estimated to be 7 t, representing one per cent of total harvest. In 2013–14, the state-wide survey estimated the catch to be 1.3 t, representing less than one per cent of total harvest. In 2000, regulations were implemented to prohibit restrict recreational harvesting of Pipi for human consumption, thus restricting recreational fishers to harvesting for bait only.

On the basis of the evidence provided above, Pipi in New South Wales is classified as an **undefined stock**.

South Australia Indigenous Australians have occupied the Coorong region in south-eastern South Australia for at least 16 000 years and have harvested Pipi (also known as Goolwa Cockles in South Australia) for the past 10 000 years[10]. Middens in the vicinity of the Murray River mouth in South Australia are composed almost exclusively of the shells of adult Pipi[12].

The commercial fishery for Pipi has been managed under an annual total allowable commercial catch (TACC) since the 2007–08 financial year. Fishers with quota for Pipi from the Lakes and Coorong Fishery (LCF) and the Marine Scalefish Fishery (MSF) operate mainly on the ocean beaches of Youngusband Peninsula, adjacent to the Coorong. Quota holders from the MSF are subject to the same management arrangements (including the annual TACC) as the LCF. Since 2012, the TACC has been determined under the harvest strategy for Pipi, which is described in the *Management Plan for the Lakes and Coorong Fishery*[13]. The harvest strategy uses two biological performance indicators and one economic performance indicator with associated decision rules to recommend a TACC for the following year[13].

The primary biological performance indicator is based on fishery-independent estimates of mean annual relative biomass[14]. In 2006–07, prior to development of the harvest strategy, fishery-dependent information indicated that the Pipi resource had become depleted during the mid to late 2000s[3,14,15]. From the 2009–10 financial year, increasing mean annual relative biomass and increasing complexity of size structures indicate recovery of the resource, following the implementation of conservative TACCs since 2009–10[3,14]. The relative biomass in 2014–15 was six per cent above the previous 5-year average (2010–11 to 2013–14). The above evidence indicates that the biomass of this stock is unlikely to be recruitment overfished.

Estimates of recreational catch are available from telephone-based surveys in

2000–01[16] and 2007–08[17]. In 2000–01, the estimated recreational catch was 22.9 t, representing 1.8 per cent of the total recreational and commercial catch, and in 2007–08 it was 5 t, representing 0.8 per cent of the total recreational and commercial catch[16,17]. In 2013–14, revised methodology, including an on-site survey specific to the Pipi fishery, provided an estimated recreational catch of 33 t, comprising seven per cent of the combined recreational and commercial catch[18]. The recreational and commercial Pipi fisheries are spatially separated and small catches from the recreational fishery are unlikely to affect the overall status in South Australia. A minimum legal length of 35 mm is in place to allow spawning to occur at least once before recruitment to the fishery[3]. The above evidence indicates 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, Pipi in South Australia is classified as a **sustainable stock**.

Victoria

The presence of their shells in middens is evidence that Pipi was harvested historically by Indigenous communities along the Victorian coastline for the past 10 000 years[10]. The harvesting of fish for customary purposes is managed under permit in Victoria, and no permits have been issued for Pipi in recent years. Since 2013, a size limit of 35 mm has applied to the waters of south-western Victoria to the west of Lake Yambuk. In addition to the size limit, management of the recreational fishery includes daily catch limits.

Until 2010–11, the commercial and recreational fisheries of Pipi were directed towards the supply of bait, and fewer than five commercial licences were generally active in any one year, with maximum landings about 2 t per annum. Commercial catches from Discovery Bay have increased over the past few years, but data are limited for the commercial Pipi fishery operating in other parts of Victoria. In 2000–01, the National Recreational and Indigenous Fishing Survey estimated recreational harvest (numbers) from Victoria to be 638 401 Pipi[8], but an estimate of harvest weight was not available. The impacts of recreational harvesting are thought to be localised around beach access points[11]. No other information is available on catch rates, fishing mortality rates or biomass estimates. There is insufficient information available to confidently classify the status of this stock.

On the basis of the evidence provided above, Pipi in Victoria is classified as an **undefined stock**.

BIOLOGY

Pipi biology[3,4,6]

Species	Longevity / Maximum Size	Maturity (50 per cent)
Pipi	South Australia: 3–5 years; 61 mm <u>SL</u> New South Wales: 1–2 years; 75 mm <u>SL</u>	South Australia: ~10 months; 28 mm <u>SL</u> New South Wales: 1 year, 37 mm <u>SL</u>

DISTRIBUTION



Distribution of reported commercial catch of Pipi

TABLES

Commercial Catch Methods	New South Wales	South Australia	Victoria
Hand collection	✓		
Otter Trawl			✓
Rake		✓	
Unspecified		✓	✓

Fishing methods	New South Wales	South Australia	Victoria
Commercial			
Hand collection	✓		
Rake		✓	
Unspecified		✓	✓
Indigenous			
Hand collection	✓	✓	✓
Rake		✓	
Recreational			
Hand collection	✓	✓	✓
Rake		✓	

Management Methods	New South Wales	South Australia	Victoria

Commercial			
Catch limits		✓	
Gear restrictions	✓	✓	✓
Limited entry	✓	✓	✓
Size limit	✓	✓	✓
Spatial closures	✓	✓	✓
Temporal closures	✓	✓	
Trip limits	✓		
Indigenous			
Bag limits	✓	✓	✓
Section 31 (1)(c1), Aboriginal cultural fishing authority	✓		
Size limit		✓	
Recreational			
Bag limits	✓	✓	✓
Gear restrictions	✓	✓	✓
Possession limit	✓	✓	✓
Seasonal closures		✓	
Size limit		✓	
Spatial closures		✓	✓

Active Vessels	New South Wales	South Australia	Victoria
	39 License in EGF,	15 licence in LCF, 2 Vessel in MSF,	2 Fisher in BF, 8 Fisher in OF,

EGF Estuary General Fishery(NSW)

LCF Lakes and Coorong Fishey (SA)

MSF Marine Scalefish Fishery(SA)

BF Bait Fishery(VIC)

OF Ocean Fishery(VIC)

Catch	New South Wales	South Australia	Victoria

Commercial	111.345t in EGF,	443.108t in LCF,	4.555t in BF, 79.408t in OF,
Indigenous	Unknown	Unknown	
Recreational	1.3t	22.9 t (in 2000), 5 t (in 2007), 33 t (in 2013)	Unknown

EGF Estuary General Fishery (NSW), LCF Lakes and Coorong Fishery (SA), MSF Marine Scalefish Fishery (SA), BF Bait Fishery (VIC), OF Ocean Fishery (VIC),

a Victoria - Indigenous 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 (for example, different catch and size limits, or equipment). The Indigenous category in Table 3 refers to customary fishing undertaken by recognised Traditional Owners. In 2014–15, there were no applications for customary fishing permits to access Pipi.

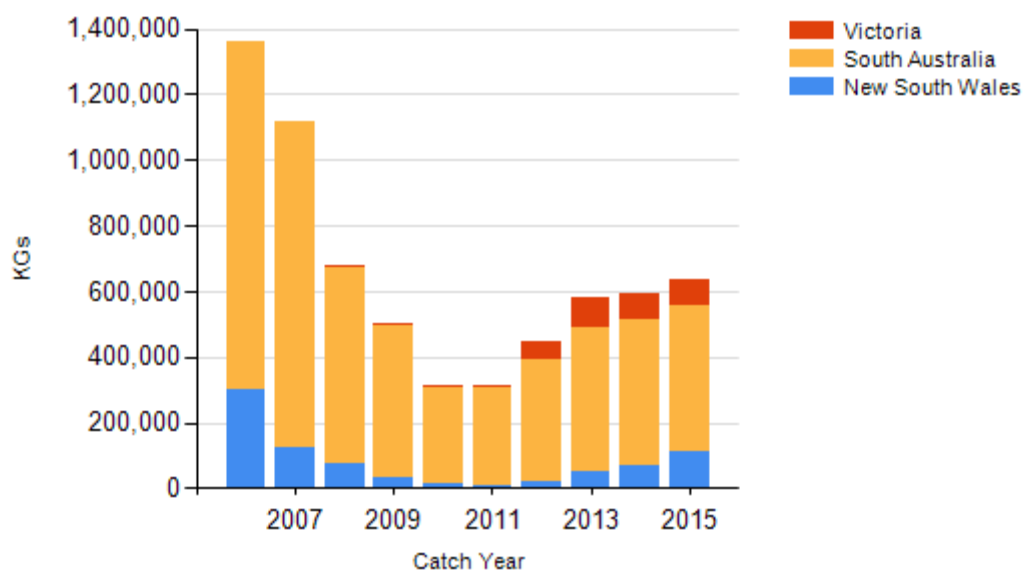
b New South Wales - Indigenous Aboriginal Cultural Fishing Interim Access Arrangement - allows an Indigenous fisher in New South Wales to take in excess of a recreational bag limit in certain circumstances—for example, if they are doing so to provide fish to other community members who cannot harvest themselves.

c New South Wales - Indigenous Aboriginal cultural fishing authority - the authority that Indigenous persons can apply to take catches outside the recreational limits under the Fisheries Management Act 1994 (NSW), section 37(1)(c1) Aboriginal cultural fishing authority.

d Active Vessels Because Pipi is collected from beaches, ‘vessels’ are not used. Hence, numbers of licences and fishers are presented here instead of vessel numbers. Licences refer to the number of licence holders with an endorsement to take Pipi for sale.

e South Australia and Victoria - Commercial (catch) Catches from the MSF in South Australia, and the BF and OF in Victoria cannot be reported separately for confidentiality reasons as there are fewer than five licences.

CATCH CHART



Commercial catch of Pipi - note confidential catch not shown

EFFECTS OF FISHING ON THE MARINE ENVIRONMENT

- Since commercial and recreational fishers collect Pipi either by hand or using hand rakes, the fishery has limited physical impact on the environment, although the impacts of on-beach mechanical grading are unknown. Pipi are a food source for Pied Oystercatchers (*Haematopus longirostris*) in New South Wales and South Australia, with high Pipi densities related to higher densities of Pied Oystercatchers[19,20]. Relatively high levels of recreational and commercial vehicle traffic (more than 20 vehicles per day) have been identified as having the potential to affect populations of Pipi on sandy beaches on the eastern Australian coast[21]. In South Australia, relatively low levels of vehicle traffic (fewer than 10 vehicles per day, including commercial vehicles) occur on Younghusband Peninsula where the commercial fishery is located. Higher levels of vehicle traffic may occur on the Sir Richard Peninsula where the recreational fishery is located[20].

ENVIRONMENTAL EFFECTS on Pipi

- Populations of Pipi are known to display large natural fluctuations in abundance due to high spatial and temporal variability in recruitment and mortality[14,22]. Climatic and oceanographic conditions experienced by populations of Pipi on the eastern and southern Australian coastlines are likely to differ greatly, so that spatial and temporal fluctuations in abundance, and the underlying mechanisms driving these fluctuations, also differ. Additionally, habitat supporting Pipi fisheries in New South Wales comprises a large number of discrete beaches (more than 100) compared to a smaller number of beaches in Victoria and one large beach (more than 60 km) in South Australia.
- Mortality events have been recorded for populations of Pipi. For example, in 1984, an estimated 2.5 million, mostly adult Pipi were found dead on Goolwa Beach, west of the mouth of the Murray River[23]. It was postulated that an extended period of low salinity following flooding from the Murray River may have resulted in mortality due to osmotic stress or starvation[23,24].
- During the peak spawning season (September–October), the prevailing currents in south-eastern South Australia flow in a north-westerly direction[4]. Because larvae may remain in the plankton for at least 14 days after spawning[4,5] changes to the nearshore currents during the spawning period may impact recruitment to the beach.

References

1	Murray-Jones SE and Ayre, DJ 1997, High levels of gene flow in the surf bivalve <i>Donax deltooides</i> (Bivalvia: Donacidae) on the east coast of Australia, <i>Marine Biology</i> , 1(128): 83–89. DOI: 10.1007/s002270050071.
2	Miller, AD, Versace, VL, Matthews, TG, Montgomery, S and Bowie, KC 2013, Ocean currents influence the genetic structure of an intertidal mollusc in southeastern Australia—implications for predicting the movement of passive dispersers across a marine biogeographic barrier, <i>Ecology and Evolution</i> , 3(5): 1248–1261. DOI: 10.1002/ece3.535.
3	Ferguson, GJ 2013, <i>Pipi</i> (<i>Donax deltooides</i>) <i>Stock Assessment</i> , report for Primary Industries and Regions South Australia Fisheries and Aquaculture, publication F2007/000550-1, South Australian Research and Development Institute, Adelaide.
4	King, MG 1976, <i>The life-history of the Goolwa Cockle</i> , <i>Donax</i> (Plebidonax) <i>deltooides</i> , (Bivalvia: Donacidae), on an ocean beach, South Australia, South Australian Department of Agriculture and Fisheries, Adelaide.
5	Ghuis, M and Li, X 2014, <i>Developing clam aquaculture in Australia: a feasibility study on culturing Donax deltooides and Katelaysia rhytiphora on intertidal and subtidal leases in South Australia</i> . South Australian Research and Development Institute (Aquatic Sciences), FRDC Final Report 2009/208.
6	Murray-Jones, S 1999, <i>Conservation and management in variable environments: the surf clam</i> , <i>Donax deltooides</i> , PhD thesis, University of Wollongong.
7	Gray, C 2016, <i>Optimising the collection of relative abundance data for the pipi population in New South Wales</i> . FRDC Project No 2012/018, Wildfish Research, Sydney, Australia.

8	Henry, GW and Lyle, JM 2003, <i>The national recreational and Indigenous fishing survey</i> , Fisheries Research and Development Corporation, Canberra.
9	West, LD, Stark, KE, Murphy, JJ, Lyle, JM and Ochwada-Doyle, FA 2015, <i>Survey of recreational fishing in New South Wales and the ACT, 2013/14</i> . Fisheries Final Report Series No. 149. NSW Department of Primary Industries, Wollongong.
10	Godfrey, MCS 1989, Shell midden chronology in SW Victoria, <i>Archaeology in Oceania</i> , 24: 65–69. DOI: 10.1002/j.1834-4453.1989.tb00213.x.
11	Lewis, Z, Khageswor, G, Versace, VL and Scarpaci, C 2012, Applying stock indicators for assessment of a recreational surf clam (<i>Donax deltoides</i>) fishery in Victoria, Australia, <i>Journal of the Marine Biological Association of the United Kingdom</i> , 1–7. DOI: .
12	Luebbers, RA 1978, <i>Meals and menus: a study of change in prehistoric coastal settlements in South Australia</i> , PhD thesis, Australian National University, Canberra.
13	PIRSA 2016, <i>Management Plan for the South Australian Commercial Lakes and Coorong Fishery</i> . Primary Industries and Regions South Australia (Fisheries and Aquaculture), Adelaide.
14	Ferguson, G, Ward, TM and Gorman, D 2015, Recovery of a surf clam <i>Donax deltoides</i> population in southern Australia: successful outcomes of fishery-independent surveys. <i>North American Journal of Fisheries Management</i> , 35:1185–1195. DOI:10.1080/02755947.2015.1091408.
15	Ferguson, G and Mayfield, S 2006, <i>The South Australian Goolwa cockle (Donax deltoides) Fishery</i> , fishery assessment report to Primary Industries and Resources South Australia Fisheries, South Australian Research and Development Institute (Aquatic Sciences), Report RD06/005-1, Adelaide.
16	Jones, K and Doonan, AM 2005, <i>2000–01 national recreational and Indigenous fishing survey: South Australian regional information</i> , South Australian fisheries management series, paper 46, Primary Industries and Resources South Australia, Adelaide.
17	Jones, K 2009, <i>South Australian recreational fishing survey 2007/08</i> , South Australian fisheries management series, paper 55, Primary Industries and Resources South Australia, Adelaide.
18	Giri, K and Hall, K 2015, <i>South Australian recreational fishing survey 2013–14</i> . Fisheries Victoria Internal Report Series No. 62, Victoria.
19	Owner, D and Rohweder, DA 2003, Distribution and habitat of Pied Oystercatchers (<i>Haemotopus longirostris</i>) inhabiting ocean beaches in northern New South Wales, <i>Emu</i> , 103:163–169.
20	Jones, GK 2016, Changes in distribution and abundance of Australian Pied and Sooty Oystercatchers on highly disturbed beaches of the south-eastern Fleurieu Peninsula, South Australia, <i>Stilt</i> , 68:31–39.
21	Schlacher, TA, Thompson, LMC and Walker, SJ 2008, Mortalities caused by off-road vehicles (ORVs) to a key member of sandy beach assemblages, the surf clam <i>Donax deltoides</i> , <i>Hydrobiologia</i> , 610: 345–350. DOI: 10.1007/s10750-008-9426-9.
22	McLachlan, A, Dugan, JE, Defeo, O, Ansell, AD, Hubbard, DM, Jaramillo, E and Penchaszadeh, PE 1996, Beach clam fisheries, <i>Oceanography Marine Biology Annual Review</i> , 34:163–232.
23	Clarke, SM 1985, Fish kill—cockles, <i>SAFIC</i> , 9(1): 12.
24	King, M 1985, A review of the Goolwa Cockle, <i>SAFIC</i> , 9(5): 14.