Stock status summary

The information provided in the section below represents summaries consistent with informing a species status determination against criteria for the Status of Australian Fish Stocks. Where data are unavailable or insufficient to reliably inform those criteria, the summary has been populated with 'not applicable' (NA), rather than removing the criteria from this section. This format has been maintained to transparently represent the data available and highlight areas where alternate data sources or analyses may be required to improve species status determination into the future.

Stock structure and biology

Pipis are the largest and most common burrowing bivalve found on dissipative beaches in eastern and southern Australia (Murray-Jones & Ayre 1997). Results of a recent study, which used microsatellite and mitochondrial DNA marker techniques on samples collected from sites along the New South Wales (NSW), Victorian (Vic) and South Australian (SA) coasts, indicated there were three reproductively isolated populations of Pipis (Miller et al. 2013). There is a high level of bidirectional gene flow along the east coast of Australia, resulting in a single panmictic population stretching along the NSW coast and most likely extending as far north as Fraser Island, Queensland (Murray-Jones & Ayre 1997). It is likely, therefore, that Pipis on beaches in NSW comprise a single metapopulation. However, in any given year, most recruits are likely to be self-seeded or come from nearby, adjacent beaches (Murray-Jones 1999).

For the population of Pipis in NSW, the size at which 50% (SAM_{50}) and 95% (SAM_{95}) were sexually mature was 34 and 44 mm, respectively. Growth trajectories from vBGF suggest that it would take 10 months for Pipis in NSW to reach maturity (Murray-Jones 1999). A minimum legal length (MLL) of 45 mm is in place to allow spawning to occur before recruitment to the fishery.

Like other beach clam species worldwide, Pipi are highly fecund, with mature oocytes present in ovaries throughout the year. The number of oocytes of large females range between 2.8 x 10^3 and 7.7 x 10^3, indicating a prolonged spawning season (Murray-Jones 1999). Although some peaks in spawning occur, Murray-Jones (1999) found recruits (<5 mm) in >90% of samples collected monthly over five years, and suggested that because constant larval supply was not limited, considerable mortality must occur following metamorphisis, resulting in pulses of juveniles surviving to establish a definitive year class.

Pipis have a short planktonic larval phase of 2–3 weeks (O'Connor & O'Connor 2011, Gluis & Li 2014). Pipi larvae spawned from artificially fertilised oocytes take approximately 14 days to develop into pediveligers and an extra day for these to settle as spat (O'Connor & O'Connor 2011).

Parasitic infections have been known to cause sterility and mass mortality of some Donacid species (Winter & Hatch 2010). The occurrence of a trematode infecting Pipis was first reported from Stockton Beach in 2014 (Cribb et al. 2017). The impact of this parasite on the persistence and resilience of NSW and potentially broader Australian Pipi populations is not known.

Stock status and assessment method

Based on available trends in catch per unit effort (CPUE) (and assuming CPUE is approximately indicative of abundance) from the commercial fishery for 2009–2017, there has been no decline in abundance of Pipis during this period. The trend in CPUE across these years instead suggests increased abundance. In the majority of years, in each of the four regions examined here, the commercial harvest did not result in declining CPUE across the 5–6 month fishing season, suggesting that fishing mortality was not significantly affecting abundance/biomass. For the instances in which stock-depletion models were applied (i.e. when within-season declines in CPUE were apparent), estimated exploitation rates in two of the regions (Region 1 and Region 4) were within the range of 24–29%. Within-season exploitation rates during four years in Region 3 were greater and in the range of 28–73%.

On the basis of the evidence provided above, Pipi in NSW is classified as a sustainable stock.

When appropriate, depletion models were applied to the catch, effort and CPUE data available for Pipis for each of four Estuary General regions (Regions 1, 2, 3 and 4), for each fishing season (4–7 months duration) during the period 2009 – 2017. The objective was to estimate biomass at the commencement of each season and the depletion of this biomass over the season. Given the reported catch, this then provided an estimate of exploitation rate. Note that the reliability of such estimates and conclusions pertaining to stock/fishery status are dependent on the assumptions underlying the models.

Fishery statistics summary

Reference to ‘year’ in the tables and figures presented refers to the first year of the financial year. For example, 2010 refers to the financial year 2010/11, unless otherwise stated.

Fishery statistics provided in the following tables represent summaries consistent with informing a species status determination against criteria for the Status of Australian Fish Stocks. Importantly, prior to 1997/98, effort units (days) were not linked to catch on monthly catch returns. Effort (days) during this period is attributed only where a single fishing method was reported each month. Further, between 1997/98 and 2008/09 (inclusive) fishers reported monthly catch and effort (days). From 2009/10, daily catch and effort (hours) metrics have been required to be reported monthly.

Catch information

Commercial

Total annual reported commercial catches of Pipi steadily increased from 15 to 80 t

Catch information

between 1984/85 and 1988/89, and then increased rapidly to a peak of 670 t in 2000/01. Catches exceeded 250 t yr^{-1} from 1996/97 to 2005/06 and then rapidly declined to 9 t in 2010/11. Total reported commercial landings of Pipi in 2017 (1 June – 31 December) were 122 t (Fig. 1).

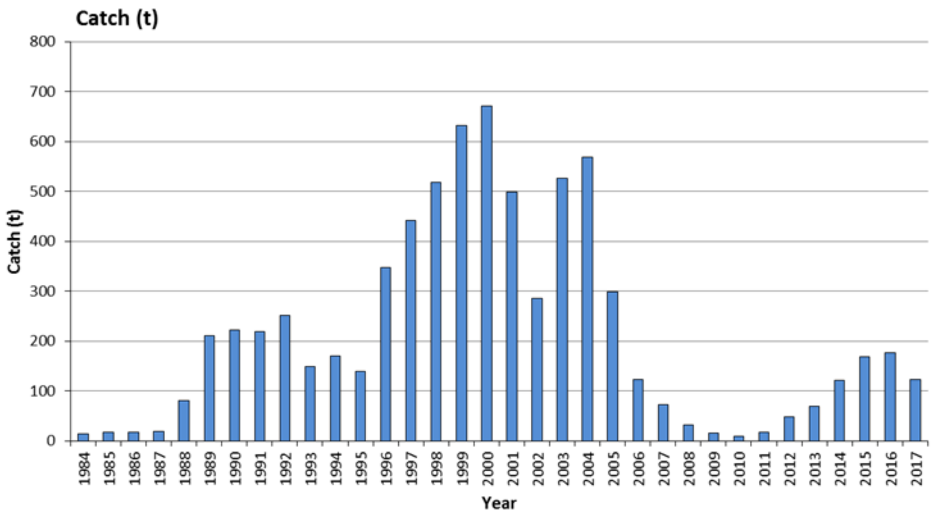

Figure 1 Annual reported commercial Pipi catch (t) from 1984/85 to 2016/17

Recreational/Indigenous

Estimates of statewide recreational harvest are available from the National Recreational and Indigenous Fishing Survey and NSW statewide surveys completed in the 2000/01 and 2013/14 financial years, respectively (Henry & Lyle 2003, West et al. 2015). In 2000/01, the catch from NSW was estimated to be 7 t (1, 076, 765 ± 169, 937 Pipis), representing 1% of total harvest. In 2013/14, the statewide survey estimated the catch to be 1.3 t (87, 760 ± 31, 272 Pipis), representing <1% of total harvest. In the absence of recent data from recreational fishing surveys for Pipi, an average length derived from NSW commercial length data was weight-transformed to obtain the mean weight of Pipis. This mean was then applied to the recreational harvest numbers to estimate recreational harvest weight. In 2000, regulations were implemented to prohibit recreational harvesting of Pipi for human consumption, thus restricting recreational fishers to harvesting for bait only.

No estimates of statewide recreational harvest are available during the period of peak commercial harvest (1998–2000), or prior to the implementation of regulations that restricted harvest for ‘bait only’. However, a logbook study of commercial fishers, an onsite bus-route survey of recreational fishers in 1996/97 (Murray-Jones & Steffe 2000), gave an estimate for the total harvest from Stockton Beach of 237.7 t per year, of which >80% (191.2 t) was taken by commercial harvesters, 18% (43.1 t) by recreational food harvesters, and less than 2% (3.4 t) by anglers for bait.

For at least 10,000 years, Pipis have been an important source of food for Indigenous people in south-east Australia, and are the most common shell in middens in this region (Murray-Jones 1999). The historical harvest from this sector (pre-2000) is unknown. Onsite

Catch information

interviews of Indigenous fishers in the Tweed Heads region (northern NSW) estimated an annual Pipi harvest of 3,056–7,380 individuals (Schnierer 2011).

Illegal, unregulated and unreported (IUU)

The level of illegal, unregulated and unreported (IUU) fishing has not been quantified.

Effort information

Commercial

Effort$_{dy}$ increased from fewer than 500 days (1984/85–1998/99) to a maximum of 5,610 days in 2001/02 then declined to 523 days in 2010/11. From 2011, effort$_{dy}$ increased to 4,911 days in 2016/17 and was 3,485 days in 2017/18. Following the introduction of daily reporting, fishers have been required to report hours spent hand gathering per fishing day. From a minimum of 1,802 hours in 2010/11, effort$_{hr}$ increased to 13,688 hours in 2015/16 and was 9,504 hours in 2017/18 (Fig. 2).

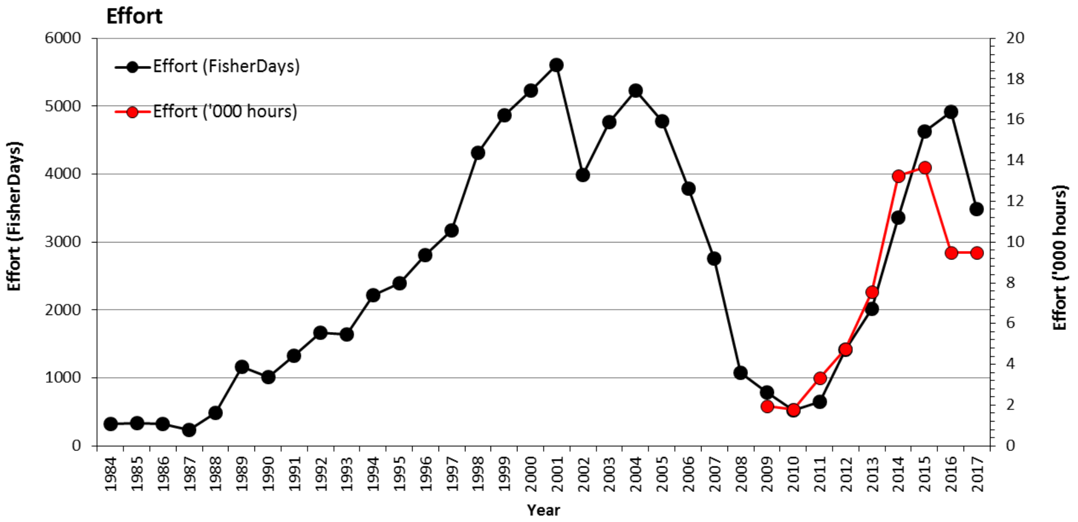

Figure 2 Annual reported commercial effort for Pipi in units of FisherDays (1984/85 to 2016/17) and hours (2009/10 to 2016/17). Note: changes in reporting requirements limit consistent interpretation of the effort (FisherDays) time series

Recreational/Indigenous

Prior to the implementation of regulations that prohibited recreational harvesting of Pipi for human consumption, catch and effort by recreational food harvesters was significantly greater than anglers for bait (Murray-Jones & Steffe 2000). Recreational harvesting by food gatherers accounted for approximately 85% (102,228 collector-hrs) of the combined effort for all sectors of 120,650 collector-hrs, with 4% (4,794 collector-hrs) spent by bait gatherers

Effort information

(Murray-Jones & Steffe 2000).

Catch rate information

Commercial

$CPUE_{dy}$ increased from less than 100 kg.day^{-1} (1984/85–1987/88) to a maximum of 218 kg.day^{-1} in 1990 then declined to 58 kg.day^{-1} in 1995/96. From 1996/97 to 2000/01, CPUEdy exceeded 100 kg.day^{-1} then rapidly declined to 17 kg.day^{-1} in 2010/11. The trend in $CPUE_{hr}$ is similar to that of $CPUE_{dy}$ (2009/10–2017/18). From a minimum of 5.0 kg.hr^{-1}, $CPUE_{hr}$ increased to 18.6 kg.hr^{-1} in 2016/17 and was 12.9 kg.hr^{-1} in 2017/18 (Fig. 2).

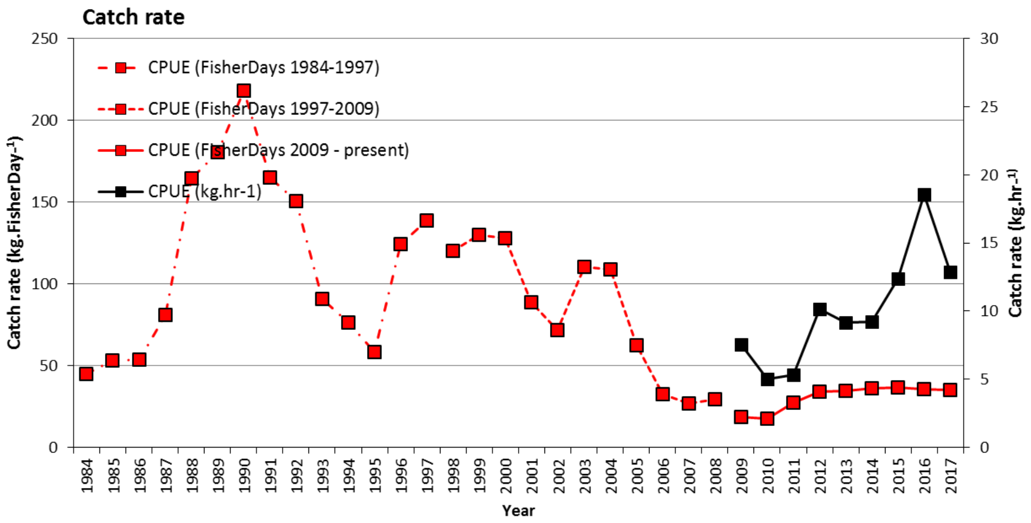

Figure 3 Annual reported commercial catch rate of Pipi (kg.FisherDay^{-1} from 1984/85 to 2016/17 and kg.hr^{-1} from 2009/10 to 2016/17). Note: changes in reporting requirements limit consistent interpretation of the catch per FisherDay time series

Stock assessment methodology (risk assessment methodology) (list of indicators)

Year of most recent assessment	2018 – Sustainable
Assessment method	Weight of evidence, including; estimation of within-season depletion of Pipis

Stock assessment methodology (risk assessment methodology) (list of indicators)	
Main data inputs	Landed catch – 1984/85 to 2016/17 CPUE – $kg.hr^{-1}$ 2009/10 to 2016/17
Main data inputs (rank)[1]	Landed catch – 1984/85 to 2016/17:[2] (Medium quality), long historical time series, but some reporting changes and likely misreporting, limited quality control/error validations CPUE – $kg.hr^{-1}$ 20009/10 to 2017/18:[2] (Medium quality). Historical CPUE compromised by significant reporting changes and inaccuracies in effort data
Key model structure and assumptions	Depletion models; i) a closed population (no recruitment, natural mortality, immigration or emigration); (ii) constant catchability; (iii) sufficient removals such that CPUE is substantially reduced; (iv) equal vulnerability of individuals to capture; (v) independence of units of effort and (vi) the assumptions associated with linear regression
Sources of uncertainty evaluated	NA

Status indicators and limits reference levels	
Biomass indicator or proxy	NA
Biomass limit reference level	NA
Fishing mortality indicator or	NA

1 – High Quality: data have been subjected to documented quality assurance and peer review processes, are considered representative and robust and provide a high level of confidence to support fisheries management decisions.

2 – Medium quality: data have been subjected to some internal quality assurance processes, and have some documented limitations, but are still considered sufficiently accurate and informative to be useful to inform management decisions with some caveats.

3 – Low quality: data have been subjected to limited or no quality assurance processes, may be compromised by unknown or documented limitations that have not been fully explored, but are considered the best available information and require a high level of precaution to be exercised when interpreted to inform management decisions.

Status indicators and limits reference levels	
proxy	
Fishing mortality limit reference level	NA
Target reference level	NA

Stock assessment results (risk assessment results) (results of review of indicators)	
Biomass status in relation to limit	NA
Fishing mortality in relation to limit	NA
Previous Status of Australian fish stocks (SAFS) stock status	Undefined (Ferguson et al. 2014)
Current SAFS stock status	Undefined (Ferguson et al. 2016)

Fishery interactions
Nil

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