Stock status summary – Estuary Cockle - 2020

This stock status summary presents available information to inform criteria required to determine a stock status consistent with the Status of Australian Fish Stocks reports (www.fish.gov.au)

Where data are unavailable or insufficient to reliably inform the SAFS criteria outlined below this has been indicated by 'NA' in the preceding tables, rather than removing the criteria. This has been done to clearly indicate what data are and are not available for assessment and to highlight areas where alternate or additional data sources or analyses may be required to improve species status determination in the future.

Assessment authors and Year

Chick, R.C. 2020. Stock assessment report 2019 – Estuary General Fishery (Hand Gathering) – Estuary Cockle (*Anadara trapezia*). NSW Department of Primary Industries. Fisheries NSW, Port Stephens Fisheries Institute. 51 pp.

Stock structure

Yardin (1997) describes significant differences in the genetic structure of populations of Cockles over large and small geographic scales (<100 m to 100s km). Further, despite the high potential for gene flow through larval dispersal and panmixis at small and large scales, there is a high degree of genetic heterogeneity among populations, even at a local scale, and the complex population structure is likely supported by discrete ecological processes and the ability of larvae to remain together through to settlement.

The scale of assessment is made at the jurisdictional level (state-wide)

Stock Status and assessment method

On the basis of the evidence provided the NSW Estuary Cockle stock is classified as **undefined**.

A weight-of-evidence approach has been taken to assess the Estuary General Hand Gathering Fishery (EGHG) – Estuary Cockles.

Current understanding of Cockle stock structure indicates that there is a complex of populations, such that functional biological populations are likely to operate at a local scale. Together with a discontinuous time series of commercial fishery effort data, increasingly inaccurate commercial reporting, noisy (low number of fishers) catch and effort series at relevant spatial scales (estuary) and substantial, but unknown levels and distribution of recreational and Indigenous cultural fishing and Illegal, Unregulated and Unreported catches, the assessment method adopted is a weight-of-evidence approach.

Fishery statistics summary

Catch trends

Commercial

Total annual reported commercial catches of Cockles increased from <20 t to >80 t between 1984/85 and 1993/94, peaked at 93.4 t in 1991/92 and declined to 30–55 t.yr^{-1} between 1994/95 and 2001/02. From 2002/03 to 2008/09, annual catches averaged 25 t.yr^{-1}, with the lowest annual catch of 16.3 t recorded in 2008/09. From 2009/10 to 2017/18, annual reported commercial catches generally increased from about 30 t.yr^{-1}, harvested by between two and nine fishers, to annual harvests at levels among historical highs and in excess of 70 t.yr^{-1}, harvested by nine-ten fishers (Figure A1-1). In 2018/19, total reported catch was 49 t, harvested by eight fishers. Importantly, for assessment purposes, from 2013/14, the numbers of records with no reported hourly effort (effort$_{hr}$) have increased substantially (Figure A1-1). Since 2016/17, the percentage of reported catch records with no effort$_{hr}$ has been >50% for each year, with that in 2018/19 being at a record high, of about 60%. Importantly, the pattern of change in the levels of annual catch for the state-wide fishery are not consistent with patterns of catch at smaller spatial scales.

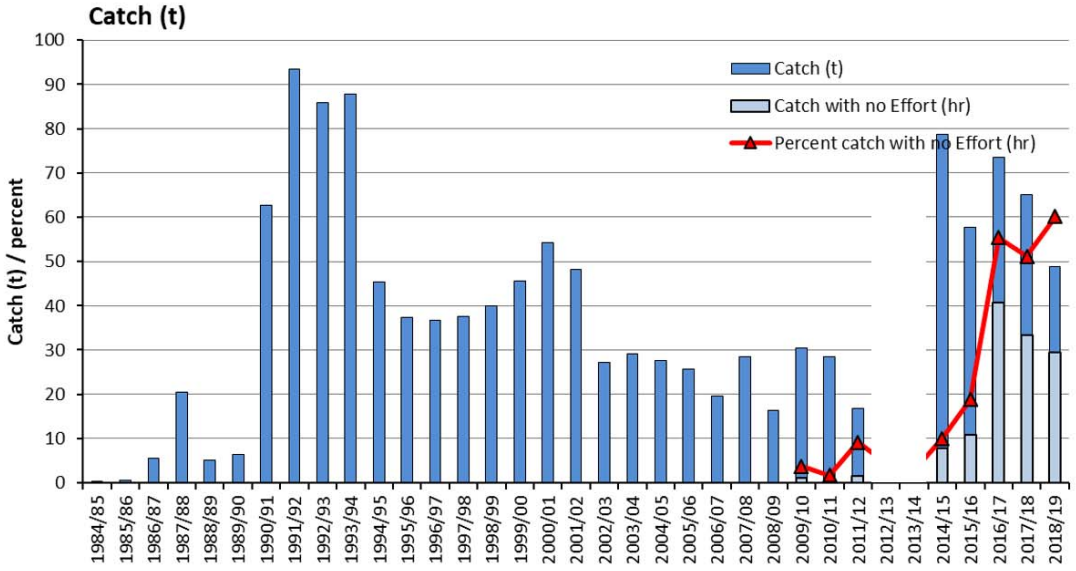

Figure A1 - 1 Annual commercial catch (t) of Estuary Cockle from 1984/85 to 2018/19, catch with no reported effort (hours) and percent of catch with no reported effort (hours), from 2009/10 to 2018/19. Notes: 2011/12 and 2012/13 data are excluded for privacy reasons.

Recreational and Indigenous

Recreational fishers harvest Cockles either for personal consumption or for use as bait. Estimates of recreational catch are unknown. The National Recreational and Indigenous Fishing Survey completed in 2000/01 (Henry and Lyle 2003) and the state-wide NSW recreational fishing survey completed in 2013/14 (West et al. 2015), the harvest of Cockles was restricted to the categories 'Bivalves (other)' and 'Other taxa' respectively. That in 2017/18 (DPI unpublished, preliminary data) indicates a recreational catch of 10 kg – with anecdotal evidence suggesting this substantially underestimates recreational harvest.

Despite the lack of information to quantify the recreational catch and its spatial distribution, there is anecdotal evidence of substantial and increasing levels of recreational catch at various NSW estuaries.

The benefits (and costs) of fishing generally and professional fishing to the cultural, broader social, health, wellbeing and economic value to Indigenous people and communities are substantial (Voyer et al. 2016). Schnierer and Egan (2012) described a case study in NSW of the impact of management changes on the viability of Indigenous commercial fishers and the contribution commercial fishing makes to Indigenous communities. Included in this case study are estimates of the contribution Indigenous commercial fishers make to Indigenous communities, including the contribution of between 5% - 20% of their annual commercial catch. The contribution made to Indigenous communities by commercial fishers was, on average, 9.8% of annual catch and the contribution from broader Indigenous commercial fishers was greater than that made by fishers in the EGHG Fishery, with this being a consequence of hand gathering being a "…traditional skill that is widely practiced by coastal families so they can fulfil their own needs." (Schnierer and Egan 2012). Moreover, Schnierer and Egan (2012) report substantial harvests of hand gathered species (principally Pipi) by Aboriginal fishers that were either not reported in commercial catch records, or reported as 'other' species and went unrecorded as species specific catches and were utilised for personal and community use.

Schnierer (2011) and Schnierer and Egan (2016) describe the estimated annual harvest of Cockles from Indigenous fishers in the northern NSW Tweed region as between 731 and 1810 Cockles, further noting that Cockles were listed as important but not among the top 10 culturally most important species. In addition, Schnierer and Egan (2016) report Indigenous catch of Cockles representing 4.5% of the species occurring in Aboriginal middens at 13 locations along the NSW coast.

Illegal Unregulated and Unreported

The level of Illegal Unregulated and Unreported (IUU) fishing has not been quantified.

There are anecdotal reports of IUU fishing occurring at the scale of estuaries, related to commercial fishers misreporting and recreational fishers exceeding bag limits or fishing without a licence. NSW DPI Fisheries Compliance reports indicate regular seizures of Cockles due to non-compliance.

Effort trends

Commercial

Effort in FisherDays ($effort_{dy}$) prior to 2009/10 is a problematic data series with changes to reporting requirements and challenges in accurately allocating daily effort among species within a fishing method.

$Effort_{dy}$ increased from <50 days (1984/85–1990/91) to 205 days in 1993/94, before declining to <50 days again in 1996/97. During this period fishers were required to report their catch monthly and effort (in days fished) by gear type, not linked to catch unless only a single gear type was used and then not linked to species catch within a gear type. Therefore, prior to 1997/98 total $effort_{dy}$ reported within the EGHGF cannot be allocated to a species catch and is the total $effort_{dy}$ reported by the EGHG fisher for each month where one method was reported. In 1997/98, 292 days were fished. $Effort_{dy}$ increased 55% to 452 days in 2000/01,

decreased 33% in the following two years to 304 days before increasing substantially each year to the maximum recorded level of 850 days in 2005/06, and subsequently declining each year to a low of 302 days in 2008/09. The substantial changes in days fished between 1996/97 and 2008/09 was concurrent with changes to commercial fishery reporting requirements. During this period the reporting of daily effort by fishing method, linked only to presence or absence of species catch over the month suggests the substantial changes in $effort_{dy}$ are likely not a function of effort to catch Cockles. Rather, the peak in effort reflects changes in effort to catch other species by the same fishing methods (likely Pipis), while also harvesting Cockles in the same month. Therefore, $effort_{dy}$ reported each month by hand gathering has been attributed to each species reportedly harvested that month, including Cockles. In 2009/10, $effort_{dy}$ was 188 days, again concurrent with the introduction of changes in commercial fishery reporting with fishers required to report hours spent hand gathering per fishing day and reporting to finer spatial scales. Since 2009/10, the number of days fished increased to a recent peak, in 2014/15, of 530 days, reflecting a peak in catch. In the last three to four years $effort_{dy}$ has flattened, and in 2018/19 $effort_{dy}$ was 327 days (Figure A1-2).

Effort in reported hours fished ($effort_{hr}$) has changed substantially since 2009/10, averaging 887 hours (range 574–1532 hours). Importantly, within the last three years the level of not reporting $effort_{hr}$ per fishing activity has increased, and in 2018/19, 60% of the reported catch had no attributed $effort_{hr}$. To provide a more probable estimate of recent $effort_{hr}$, average annual $hours.day^{-1}$ from records with hours reported was multiplied by reported annual days fished (Figure A1-2). These data suggest hours harvesting Cockles increased substantially from 2013/14 and was in excess of 1200 $hr.yr^{-1}$ in each year from 2014/15 to 2017/18, peaking at about 1700 hr in 2014/15. In 2018/19, $effort_{hr}$ was about 900 hrs.

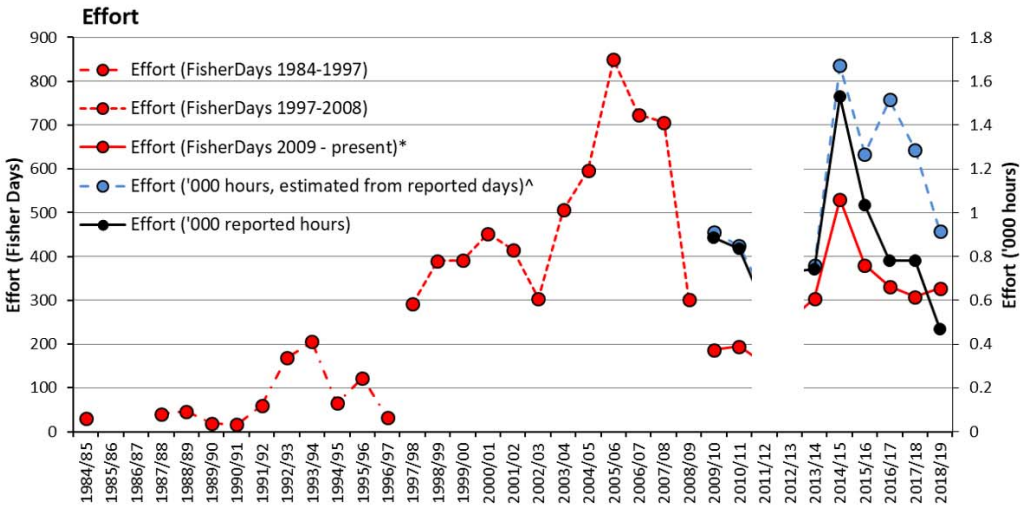

Figure A1 - 2 Annual commercial effort in units of FisherDays* (1984/85 to 2018/19) and hours (2009/10 to 2018/19). Notes: i) 2011/12 and 2012/13 data are excluded for privacy reasons; ii) Changes in reporting requirements limit consistent interpretation of the effort (FisherDays) time series.

*Effort (FisherDays) (a) for July 2009 to present was estimated from the number of distinct fishing dates entered on daily catch returns for each fisher in each month where the method was used, irrespective of whether the species was reported on those days, to be consistent with earlier reporting; (b) for July 1997 to June 2009, was taken from the number of days fished hand gathering as entered on monthly catch returns; and (c) for July 1984 to June 1997, limited to catch records where only a single fishing method was entered on a monthly catch return. Therefore, joining the dots from 1996/97 to 1997/98 or 2008/09 to 2009/10 may not be an accurate representation of changes in catch rate across these years.

Recreational and Indigenous

There are no data describing the recreational fishing effort expended in harvesting Estuary Cockle.

Schnierer (2011) report the total effort of Aboriginal fishers based in the Tweed region was recorded to be 542 hours or 92 days. Cultural catch of Cockles by Aboriginal people in the Tweed region has occurred for many generations and was seen to be important in delivering benefits to the community.

Catch rate information

Commercial

Catch per FisherDay ($CPUE_{dy}$) is a problematic metric to define and interpret prior to 2009/10, for reasons outlined for the $effort_{dy}$ time series. Relatively low $CPUE_{dy}$ throughout the early to mid-2000s is likely a function of EGHG days fished being allocated to relatively lower levels of Cockle catch per month, where Cockles and other species (likely Pipis) were caught by the same method in the same month, in addition to reductions in $CPUE_{dy}$ reflecting similarly declining Cockle abundance. However, the time series of annual catches suggests large biomasses had been removed from fished populations over the previous 20 years, so changes in catch rate are complicated by challenges in defining targeted fishing effort and any changes in abundance.

$CPUE_{hr}$ has been calculated as the average of daily $CPUE_{hr}$, excluding records with zero catch or effort and where daily reported $CPUE_{hr}$ was <10 and >200 $kg.hr^{-1}$. These rules have resulted in the exclusion of about 25% of all daily records since 2009/10 and between 4% and 53% of daily records in any individual year. In 2016/17, 2017/18 and 2018/19, 53%, 41% and 49% of daily records were excluded, respectively. Further, due to the substantial proportion of commercial records not reporting effort in recent years, the alternate $CPUE_{hr}$ series was generated, using estimated annual hours as the product of average annual $hours.day^{-1}$, from records with hours reported, and reported days fished per year.

From 2009/10 to 2011/12, $CPUE_{hr}$ decreased to 28 $kg.hr^{-1}$, before returning to levels generally >40 $kg.hr^{-1}$ in the years following. From 2012/13, $CPUE_{hr}$ has been relatively stable, averaging 45 $kg.hr^{-1}$.and seemingly depressed by the exclusion of records with no $effort_{hr}$ reported. The alternate $CPUE_{hr}$ series, inferred from an $effort_{hr}$ series, being the product of average daily hours and reported daily records per year, suggests a similar trend in recent years at a slightly elevated level. Importantly, and as similarly described for fishery-wide levels of catch, change in levels of fishery-wide effort and $CPUE_{hr}$ are not necessarily consistent with patterns at smaller spatial scales.

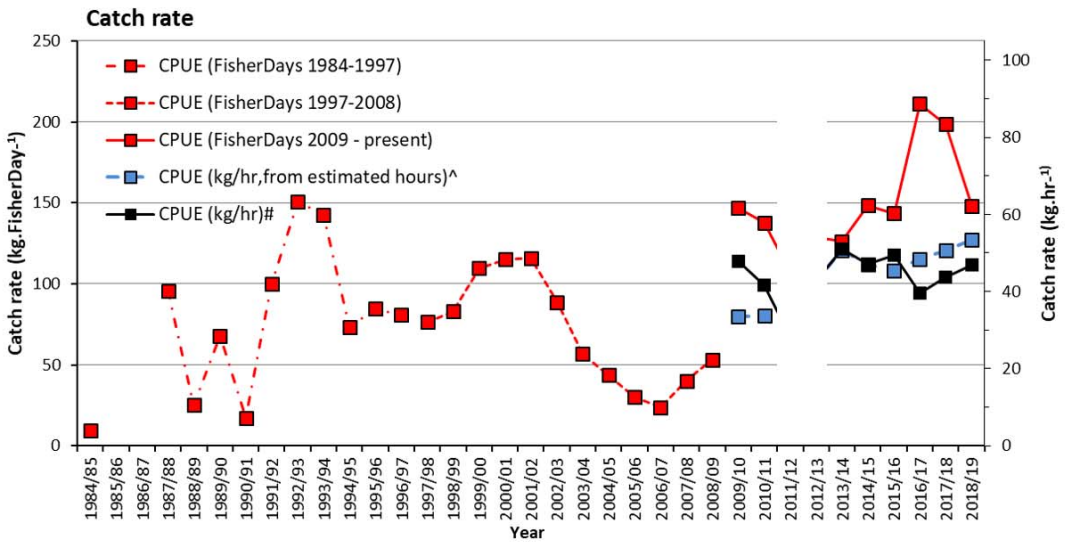

Figure A1 - 3 Annual commercial catch rate in units of kg.FisherDays^{-1}* (1984/85 to 2018/19) and kg.hr^{-1}# (2009/10 to 2018/19). Notes: i) changes in reporting requirements limit consistent interpretation of the kg.FisherDays^{-1} time series; ii) 2011/12 and 2012/13 data are excluded for privacy reasons.

#CPUE (kg.hr^{-1}) calculated from average daily CPUE (kg.hr^{-1}), excluding records with no catch or no effort or catch rate <10 or >200 kg.hr^{-1}, ^CPUE (kg.hr^{-1} from estimated hours) is the quotient of annual reported catch and estimated hours.

Stock assessment methodology	
Year of most recent assessment	2020 – **undefined**
Assessment method	Review of indicators (weight of evidence)
Main data inputs	Catch – 1984/85 to 2018/19 $CPUE_{dy}$ – kg.FisherDay^{-1} 2009/10 to 2018/19 $CPUE_{hr}$ – kg.hr^{-1} 20009/10 to 2018/19
Main data inputs (rank) †	Catch – 1984/85 to 2018/19: (medium quality), long historical time series, but some reporting changes and likely misreporting, limited quality control/error validations $CPUE_{dy}$ – kg.FisherDay^{-1} 1984/85 to 2018/19: (low quality) compromised by significant reporting changes and inaccuracies in effort data. $CPUE_{hr}$ – kg.hr^{-1} 2009/10 to 2018/19: (low quality) compromised by limited internal quality assurance, the small number and changes in active fishers per year and spatial distribution of catch.

Stock assessment methodology	
Key model structure and assumptions	NA – no quantitative, model-based approach was used in this assessment.
Sources of uncertainty evaluated	Known or likely uncertainties in the key indicators were taken into consideration in ranking of the quality of key indicators, and in reaching a conclusion regarding stock status.

† Main data inputs (rank)

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, 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	
Biomass indicator or proxy	NA - no formal indicators or reference points determined
Biomass limit reference level	NA – no biomass limits or targets have been set
Fishing mortality indicator or proxy	NA - no formal indicators or reference points determined
Fishing mortality limit reference level	NA – no fishing mortality limit has been set
Target reference level	NA – no fishing mortality targets have been set

Stock assessment results – review of indicators	
Biomass status in relation to limit	NA - no biomass limits or targets have been set

Stock assessment results – review of indicators	
Fishing mortality in relation to limit	NA – No fishing mortality limit has been set
Previous stock status	Undefined
Current stock status	Undefined

Qualifying comments

Defining the status of the Estuary Cockle resource with any level of reasonable certainty is not possible due to various issues relating to the unavailability and/or inaccuracy of available data, from all fishing sectors.

NSW catch and effort logbook data vary spatially and temporally across different eras, delineated by changes in fisher reporting requirements and other management changes that affect the continuity of these data. Commercial fishery statistics are sourced from a small number of commercial operators. Variation in the composition of fishers through time can influence differences in measures of fishery-dependent data and their use for inferring fishery performance and stock status, such that changes in these measures may not relate to biological performance of the stock. Further, the accuracy of reporting commercial fishing activity, including levels of catch and effort as well as the spatial scale of reporting can have substantial effects on patterns in these data through time and among estuaries. Change in annual catch at the whole fishery level does not reflect that at smaller spatial scales. Further, data reporting at small (estuarine) scales is highly variable and these data often suffer from poor reporting (e.g. non-reporting of effort data).

There are no recreational or Aboriginal fishery data available to reliably quantify the level of harvest or effort from these sectors. Anecdotal evidence and limited studies describing small-scale spatial and temporal patterns of fishing by some sectors of the fishery indicate that fishing activities other than commercial fishing may make a substantial contribution to the levels of fishing mortality on Cockles, particularly at a local scale.

Similarly, it is not possible to quantify the level of IUU catch.

Environmental factors likely affect changes in the abundance and biological performance of Cockles and these factors likely vary among estuaries through time. The paucity of data and limitations and uncertainty in much of the available data disqualifies the determination of a stock status other than undefined.