Stock status summary, Estuary General Hand Gathering Fishery – Pipi (*Donax deltoides*) - 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.

Stock assessment – list of indicators	
Year of most recent assessment	2019 – sustainable
Assessment method	Weight of evidence approach, including; standardised catch rates, estimation of within-season depletion of Pipis (Appendix 2) and Catch-MSY model-assisted catch-only assessment (Appendix 3).
Main data inputs	Landed catch -1984/85 to 2018/19. CPUE- kg.hr^{-1} 2009/10 to 2018/19.
Main data inputs (rank) †	Landed catch -1984/85 to 2018/19: [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 2018/19: [2](Medium quality). Historical CPUE compromised by significant reporting changes and inaccuracies in effort data (refer to generic explanation Figure 1 for further detail and Appendix 5).
Key model structure and assumptions	1. Standardised catch rates (using cede v. 0.04) (Haddon 2018). *Assumptions*: that annual catch rates are a relative index of abundance and not unduly influenced by other factors that are not accounted for through standardisation. 2. Depletion models (Appendix 2); *Assumptions*: 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. 3. Catch-MSY model-assisted catch-only assessment (Martell and Froese, 2013) using the 'simpleSA' package in R (Haddon et al. 2018).This uses population productivity (*r*)

Stock assessment – list of indicators	
	and carrying capacity (*K*) parameters of an underlying Schaefer production model, applied to total annual catches, to estimate the ranges in biomass and harvest rate that could have resulted in the annual catches. *Assumptions*: Estimated ranges of the population growth rate parameter (r) and carrying capacity (*K*) of the stock are pre-determined through an assumed resilience; the underlying population biomass model is very generic and simplistic, with parameters that remain constant through time; the model outcomes are quite dependent on the lower bound of *r* selected (Martell and Froese 2013). 'Resilience' was set to low in the Catch MSY model specification, which allows for a possible range in population growth rate (*r*) of 0.1 - 0.6.
Sources of uncertainty evaluated	The effect of four different constant catch scenarios on the 5-year projections of estimated biomass and harvest rate trajectories.

[†] 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	None specified in a formal harvest strategy. For the purposes of this assessment the mean estimated biomass depletion (as a percentage of the estimated maximum biomass, *K*) from modified Catch-MSY analyses (e.g., Martell and Froese 2013) was selected as a proxy.
Biomass limit reference level	None specified in a formal harvest strategy. For the purposes of this stock assessment the values of 20% of estimated maximum biomass for the limit reference point (B_{lim}) and 40% of estimated maximum biomass as the target reference point (B_{targ}) were selected.

Status indicators and limits – reference levels	
Fishing mortality indicator or proxy	None specified in a formal harvest strategy. For the purposes of this stock assessment the estimated harvest rate from modified Catch-MSY analyses was selected.
Fishing mortality limit reference level	None specified in a formal harvest strategy. For the purposes of this stock assessment the estimated harvest rate corresponding to 20% of estimated maximum biomass for the limit reference point (H_{lim}) and the estimated harvest rate corresponding to when the stock is a 40% of estimated maximum biomass for the target reference point (H_{targ}) were selected.
Target reference level	None specified in a formal harvest strategy

Stock assessment results – review of indicators	
Biomass status in relation to limit	Results of the modified Catch-MSY modelling suggest that the current biomass of Pipi in NSW waters is depleted to 34% of the estimated maximum biomass with a 95% confidence interval (CI) of 9% - 49%. This is well below the proxy B_{targ} reference point of 40% of estimated maximum biomass, but above the B_{lim} reference point of 20%.
Fishing mortality in relation to limit	Results of the modified Catch-MSY modelling suggest that the current harvest rate of Pipi is below F_{lim} and either close to or below F_{targ}.
Previous SAFS stock status*	Undefined (Ferguson et al. 2016)
Current SAFS stock status*	Sustainable (Ferguson et al. 2018)