**Supplementary Methods**

During this search *Magallana cuttackensis* and *Magallana gryphoides* were identified as reef-building, however both species are “taxon inquirendum” in the World Register of Marine Species (WoRMS). Aslam et al. (2020) states that *M. gryphoides* is the giant oyster *M. cuttackensis* while Guo et al. (2018) concluded that *M. cuttackensis* is likely *Magallana belcheri*. *M. belcheri* can up to 450mm (Willan et al., 2021) which matches the “giant oyster” description of *M. cuttackensis*. Genetic sequencing of *M. cuttackensis* and *M. gryphoides* both match *M. belcheri* (Li et al., 2017), therefore *M. cuttackensis* and *M. gryphoides* have been counted as the one species *M. belcheri*. Similarly, *Magallana iredalei*, *Magallana lugubris* and *Magallana madrasensis* have been counted as the one species *Magallana bilineata* as this is the accepted species name in WorMS. Invasive species in introduced areas were excluded as they are unlikely to be used for oyster reef-restoration (Harwell et al., 2010).

Reference to *Pinctada* and *Pteria* beds was found in literature, however the term “beds” was used in the context of commercial harvesting grounds (Taylor et al., 1997; Arnaud-Haond et al., 2005; Ostroff, 2020) and most species within these genera settle as individuals and do not form biogenic habitats. For example, *Pinctada maxima* restoration in Vietnam included the release of spat onto a coral reef where they settled as individuals and not gregariously to form biogenic habitats (Tuan and Tuyen, 2021). Most *Pinctada* species and all *Pteria* species were therefore not counted as reef-building as they did not fit our definition of “settling gregariously to form biogenic habitats”. Although some *Pinna* species form biogenic habitats, they settle in soft sediment and do not settle gregariously (Alleway et al., 2015; Rabaoui et al., 2015), thus no *Pinna* species were identified as reef-building by our definition.

*Pinctada albina sugillata* builds reefs in subtropical/temperate South Australia (Alleway et al., 2015), however literature refers to this species as having tropical distributions (O’Connor, 2002; Sanpanich, 2011). We found no evidence of existing reefs in tropical areas. It is unclear whether the South Australian populations of *P. albina sugillata* are an introduced tropical species (and therefore disqualified from our diversity count) or an entirely different species. Further research confirming the identity of this species and its native distribution is needed before *P. albina sugillata* can be confirmed as a tropical, temperate or eurythermal reef-building species. *Pinctada imbricata* has been reported from multiple regions and taxonomic ambiguities for the species remain (Bean et al., 2020) however the species name is accepted in WoRMS and is native to the Caribbean region and has been included in our diversity count (Lodeiros et al., 2002; Romero, 2003).

*Saccostrea glomerata* has been reported in tropical locations (do Amaral and Simone, 2016), however, the northern most limit of its distribution in Queensland, Australia is subtropical (McDougall et al., 2020). *S. glomerata* has both subtropical and temperate distributions in Australia where remnant reefs still exist (Gillies et al., 2020) and it has been described by Lam and Morton (2006) as a “temperate species from the southern hemisphere”. It is therefore likely that *S. glomerata* has been misidentified in the tropics (Angell, 1986) and it has been counted as a temperate species. S*accostrea cucullata* and *Saccostrea scyphophilla* were identified as reef-building, however there is not enough evidence in literature to confirm whether *Saccostrea malabonensis* (Li et al., 2017) and *Saccostrea mordoides* (Cui et al., 2021), previously known respectively as the aforementioned species, are also reef-building, so they have not been counted as reef-building. Lineages of *S. cucullata* and *S. schyphophilla* are denoted with an asterisks\* in **Figure 1** to indicate that there are multiple lineages represented by these names, however they have only been counted once in our diversity estimate (Lam and Morton, 2006; Guo et al., 2018; McDougall et al., 2020).

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