**S1 Table. Key assumptions and rationales behind the 3 criteria used to identify robust sources.** COTS, crown-of-thorns starfish; DHW, degree heating weeks; GBR, Great Barrier Reef.

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| --- | --- | --- |
| **Criterion** | **Assumption** | **Rationale** |
| 1) Reefs need to be strong, consistent sources of larvae | That larval supply among reefs is an ecologically-relevant process for the recolonization of corals after large disturbance events. | a) Larval supply is likely to have the greatest demographic impact when adult population size is low and space is not limiting (i.e., post-settlement density dependence is weakest) [[1](#_ENREF_1)].  b) While genetic measures of gene flow do not reflect specific demographic rates they can identify areas where larval flux is blocked, such as if coral replenishment was solely owing to self-recruitment. Yet, repeated genetic studies of broadcast spawning corals, including those on the GBR, find high levels of gene flow across the system [[2](#_ENREF_2), [3](#_ENREF_3)].  c) Even corals that brood their larvae, which tend to have very limited pelagic durations, exhibit connectivity over scales of 10s to 100s of km within a few generations [[4](#_ENREF_4)].  d) Other high resolution models of larval dispersal on the GBR find that the self-seeding rate of corals is less than 2% [[5](#_ENREF_5)].  e) We note that the importance of larval supply will vary across the GBR and will likely be less important in some degraded inshore environments where post-settlement mortality is likely to be extremely high. Patterns of post-settlement mortality have not yet been mapped. |
| 2) Low risk of thermal stress / coral bleaching | Reefs will not have experienced DHW >6 | a) While some reefs will experience bleaching at around 4 DHW, coral mortality is virtually absent at this stress level [[6](#_ENREF_6)]. Observations from recent bleaching events indicate that coral morality can be expected after a thermal stress of about 6 DHW, but is otherwise low [[7](#_ENREF_7)].  b) It is true that corals experiencing chronically warmer conditions are better acclimated (and perhaps adapted) to severe bleaching conditions when they occur [[8-10](#_ENREF_8)]. Thus, corals used to cooler conditions tend to fare poorly when subjected to severe warming. However, the key element of our criterion is that the selected reefs rarely (if ever) experience such thermal stress. One of the few studies of coral mortality post-bleaching found that while acclimation temperature is a predictor of mortality, the dominant predictor is the magnitude of the stress event (DHW) [[11](#_ENREF_11)]. |
| 3) Low risk of being infected by and transmitting COTS | Model predictions of COTS larvae can be divided into ‘low’ and ‘high’ categories around the mean, yet translate into ecologically important impacts | a) It is widely reported that outbreaks of COTS move as a ‘wave’ down the GBR [[12](#_ENREF_12)]. Such patterns have been shown to be predictable using connectivity models [[13](#_ENREF_13)].  b) The process of COTS’ migration from reef to reef involves new colonisation events, it is likely that larval supply is a key demographic driver [[12](#_ENREF_12), [14](#_ENREF_14), [15](#_ENREF_15)]. Any post-settlement density dependence, such as competition, is likely to be low at this stage of population build up.  c) Comparison of our model predictions with two independent field data sets reveals that COTS densities were more than four times lower and outbreaks nearly 14 times less likely on reefs categorised as having a low risk of importing COTS larvae. |

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