STUDENT SHEET

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Coral biodiversity and climate change

Summary

Corals are simple, colonial animals living in symbiosis with algae that photosynthesise inside their bodies. This partnership powers reef growth on a scale visible from space, but it's also the coral's Achilles' heel when the sea gets too warm.

Climate-driven marine heatwaves are causing more frequent coral bleaching (heat-stressed corals expel their algae and can starve). Major bleaching events in 2016, 2017, 2020, 2022 and 2024 have led to shrinking coral populations.

Because corals can't move, their main route back to healthy populations is mass spawning, but bleaching-driven population loss creates a second, compounding problem: an Allee effect, where sparser colonies release egg and sperm bundles into water, but the sperm becomes too diluted for fertilisation to succeed.

To test this, fieldwork on the Great Barrier Reef and Pacific reefs used floating mesh collectors to capture spawn and measure fertilisation rates directly, finding that success collapses rapidly with distance: roughly 30% at close range, under 10% at 10 metres apart, and almost none at 20 metres.

The conclusion is that corals need to be within about 2–4 metres of a spawning neighbour to reproduce successfully, far closer than expected. This gives restoration projects a concrete, local lever: boosting coral density just enough to restore natural reproduction, even as climate change reduces populations overall.

Key concepts

- Coral symbiosis with algae - the source of reef productivity and heat vulnerability
- Coral bleaching - heat causes expulsion of algae, weakening or killing the coral
- Mass spawning - synchronised release of egg and sperm bundles, fertilised externally at the surface
- Allee effect - low population density reduces fertilisation success, compounding decline
- 2–4 metre spacing threshold - a concrete, field-tested target for coral restoration

Discussion prompts

1. The same symbiosis that builds reefs visible from space is described as the coral's "Achilles' heel." Why might a trait that's so successful in one context become a fatal weakness in another?

2. The Allee effect means that even corals which survive bleaching can still decline further simply because there are fewer of them nearby. What does this suggest about tipping points and thresholds in ecosystems more generally?

3. This research turns “how far apart can corals be?” into a very practical restoration question. What are the benefits and limits of this kind of local, hands-on intervention compared with tackling climate change at a global scale?

4. Major bleaching events in Australia occurred in 2016, 2017, 2020, 2022 and 2024. What does this pattern suggest about how much time reefs have to recover between heatwaves, and what might that mean for their long-term survival?

5. This lecture pairs a global problem (climate change) with a local, testable solution (restoring coral density). Is this a hopeful model for tackling other climate impacts, or does it risk giving false reassurance about a much bigger problem?