The Role of Heterotrophy in Coral Reef Resilience to Climate Change

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Coral reefs are among the most productive yet vulnerable ecosystems on Earth. While the association between reef-building corals and their photosynthetic symbionts underpins their success in shallow tropical waters, it also drives their sensitivity to climate stress and contributes to global reef decline. Heterotrophy—the direct consumption of plankton and organic matter—offers a complementary nutritional pathway that buffers corals against bleaching and other stressors when symbiont-derived energy is compromised. Increasing evidence suggests that heterotrophy is not an exception but rather a central feature of coral survival, as many reefs develop outside oligotrophic waters. However, the capacity of heterotrophy to support resilience remains less explored compared to autotrophy, and species- and habitat-level differences are poorly resolved. Here, I present data from individuals to ecosystems in Taiwan, demonstrating the widespread reliance on the heterotrophic pathway across multiple scales. I further argue that recognizing heterotrophy as a fundamental axis of coral physiology and reef functioning is crucial for understanding how coral reefs may respond to climate change. Finally, I highlight key knowledge gaps—particularly the origin and availability of food sources, the role of water flow, and spatiotemporal variability in plankton—that must be addressed to better predict and conserve resilient reef communities.