Resilience of chronically disturbed coral reef ecosystems: Comparing Bikini and Rongelap Atolls five decades after nuclear testing

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Coral reefs are severely threatened ecosystems; even optimistic scenarios predict a global demise of coral reef ecosystems as we know them within a lifetime. Large scale disturbances as likely to be associated with climate change are unprecedented in history, thus rendering prognosis’s of the likely response of coral reef biodiversity and functioning speculation at best. Pacific low-lying islands are particularly threatened, but there are few sites where an ecosystem response to large-scale disturbance can be tested. The atolls of Bikini and Rongelap in the Marshall Islands were both victims of the nuclear testing era. While tests were carried out on Bikini, Rongelap was exposed to nuclear fallout from Bikini tests, making both atolls unsuitable for habitation. We compare the fate of disturbed and undisturbed coral reefs after 50 years of existence without humans, allowing inference about a best-case recovery of coral reefs from large scale chronic disturbances. Five decades after a series of nuclear tests began, we provide evidence that 70% of the Bikini Atoll zooxanthellate coral assemblage is resilient to large-scale anthropogenic disturbance. We found that 28 coral species may be locally extinct at Bikini. Of these losses, 16 species are obligate lagoonal specialists and 12 have wider habitat compatibility. We suggest the highly diverse Rongelap Atoll to the east of Bikini may have contributed larval propagules to facilitate the resilience of coral biodiversity in the absence of additional anthropogenic threats. Coral and fish communities exhibit substantial difference between atolls, indicating that recovered communities may exhibit different assemblages than their undisturbed neighbours, or that 5 decades recovery time is insufficient to restore communities.