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TITLE: Predator Crown-of-Thorns Starfish (*Acanthaster planci*) Outbreak, Mass Mortality of Corals, and Cascading Effects on Reef Fish and Benthic Communities

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ABSTRACT:

Outbreaks of the coral-killing seastar *Acanthaster planci* are intense disturbances that can decimate coral reefs. These events consist of the emergence of large swarms of the predatory seastar that feed on reef-building corals, often leading to widespread devastation of coral populations. While cyclic occurrences of such outbreaks are reported from many tropical reefs throughout the Indo-Pacific, their causes are hotly debated, and the spatio-temporal dynamics of the outbreaks and impacts to reef communities remain unclear. Based on observations of a recent event around the island of Moorea, French Polynesia, we show that *Acanthaster* outbreaks are methodic, slow-paced, and diffusive biological disturbances. *Acanthaster* outbreaks on insular reef systems like Moorea's appear to originate from restricted areas confined to the ocean-exposed base of reefs. Elevated *Acanthaster* densities then progressively spread to adjacent and shallower locations by migrations of seastars in aggregative waves that eventually affect the entire reef system. The directional migration across reefs appears to be a search for prey as reef portions affected by dense seastar aggregations are rapidly depleted of living corals and subsequently left behind. Coral decline on impacted reefs occurs by the sequential consumption of species in the order of *Acanthaster* feeding preferences. *Acanthaster* outbreaks thus result in predictable alteration of the coral community structure. The outbreak we report here is among the most intense and devastating ever reported. Using a hierarchical, multi-scale approach, we also show how sessile benthic communities and resident coral-feeding fish assemblages were subsequently affected by the decline of corals. By elucidating the processes involved in an *Acanthaster* outbreak, our study contributes to comprehending this widespread disturbance and should thus benefit targeted management actions for coral reef ecosystems.

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