Box 11.

Stony coral tissue loss disease (SCTLD) - novel threats to coral reefs

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In 2014, a new threat to the integrity of coral reefs emerged in Florida and was termed stony coral tissue loss disease (SCTLD). SCTLD affects more than 30 coral species, and colonies of highly susceptible species can die within weeks. Given the large number of species affected, the rapid spread of the disease across reefs and regions, and the temporal persistence of the disease (6 years and still going), this disease outbreak is the most lethal disturbance ever recorded in the Caribbean[1,2,3]. The rapid spread of SCTLD across the Caribbean has reef scientists, managers, and the general population highly concerned. Reports have now registered for the Western Caribbean, Bahamas, Puerto Rico, the US Virgin Islands and the Lesser and Greater Antilles (https://www.agrra.org/coral-disease-outbreak/). Population losses range from > 90% on highly susceptible species to <10% in less affected species[1,2,3]. Stony coral diversity, density, and amount of live tissue correspond with differential SCTLD susceptibility and have resulted in significant changes in the structure and composition of coral communities, further impairing the integrity of coral reefs across the entire geography of the regions that have been impacted.

The emergence of the disease occurred in association with a severe thermal bleaching event and a dredging project, at ground zero, in a highly impacted, urban reef area[3]. However, subsequent studies have found no clear link between high water temperatures and the spread or prevalence of SCTLD[4] s. Ecological (e.g. coral density and composition) and environmental conditions, including nutrient concentrations and turbidity, are likely to influence disease prevalence and progression.

Given the intensity of this emerging threat, SCTLD has also been the target of unprecedented research efforts to determine the cause and ecology of the disease, and intervention efforts to minimize mortality from the disease. Although the modes of transmission and specific causative agents are not yet fully understood, the disease is clearly transmitted through

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seawater, bacteria are involved at some level in disease progression[5], and viruses of the algal symbionts have been reported in pathological studies. Complex interactions of primary and secondary pathogens are likely involved.

Despite a lack of definitive disease causation, novel and effective, if labor-intensive interventions have been developed and applied to stop disease progression. Topical amoxicillin (antibiotic) embedded in a silicon-based paste and applied to the lesion margins can arrest tissue loss along the treated margin in multiple coral species[6,7,8]. Still, new lesions can appear on the same colony over time, and repeated treatments are commonly required[7,8,9]. There has also been some benefit demonstrated from applying endemic probiotic bacteria (of the genus *Pseudoalteromonas*) in arresting disease progression. Unfortunately, the expense and labour-intensity of these interventions likely put them beyond reach for widespread implementation in many affected regions. Local responses to SCTLD outbreaks have also involved local communities in disease surveillance and 'strike teams', ramping up of genetic archiving[10] (Grosso-Becerra et al. 2021) and restoration activities. In some cases, unaffected colonies from areas ahead of the disease front have been removed to captivity to provide material for future repopulation efforts.

Figure 1. map showing the spread of SCTLD in the Caribbean showing where it is absent (green) versus present (red). Source: Kramer, P.R., Roth, L., and Lang, J. 2019. Map of Stony Coral Tissue Loss Disease Outbreak in the Caribbean. www.agrra.org. ArcGIS Online. [29 September 2021].

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Figure 2. disease front on Meandrina meandrites

Figure 3. SCTLC infecting multiple adjacent colonies and multiple lesions on individual colonies. Photos: Lorenzo Alvarez.