

# Stony Coral Tissue Loss Disease

## Enfermedad de la Pérdida de Tejido de Coral Duro

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First discovered in Florida in 2014, stony coral tissue loss disease (SCTLD) is a highly virulent, contagious disease known to affect at least 22 species of scleractinian corals.<sup>1-3</sup> SCTLD is characterized by focal or multifocal areas of tissue loss that typically progress from the edge of a colony or as white patches within otherwise healthy tissue, leaving white skeleton that becomes quickly (3-7 days) colonized by algae.<sup>2,3</sup> This disease has led to unprecedented rates of live coral cover loss across the Caribbean, to the extent that recovery is uncertain and long-term ecological damage is inevitable.<sup>2,4-10</sup> SCTLD was first detected in Puerto Rico in Culebra in October 2019. From October to November 2019, surveys in Tamarindo Chico reef showed an increase in SCTLD prevalence from 4% to 50%.<sup>11</sup> This fast-moving disease is now widespread throughout Puerto Rico's eastern, northern and southern coasts, and has even been recorded in mesophotic reef systems (ranging from 23 to 50 meters depth) off of Vieques.<sup>12</sup> Due to the high mortality rates and fast spread of this disease, it remains one of the greatest current threats to Puerto Rican reefs. Although the pathogen or pathogens have not yet been identified, both laboratory and field based studies have found an antibiotic treatment of amoxicillin to be effective at halting SCTLD lesions,<sup>13-17</sup> providing evidence that bacteria play a role in pathogenesis. Research has also found microbial differentiation between healthy and diseased corals, including significant correlations between SCTLD and the presence of *Rhodobacterales* and *Rhizobiales* bacteria, as well as evidence of a possible co-infection related to the bacteria *Vibrio coralliilyticus*.<sup>18-21</sup> Transmission electron microscopy revealed evidence that SCTLD may be related to a viral disease affecting the zooxanthellae (algae symbionts living within coral polyps), which eventually causes coral host death.<sup>22</sup> Rapid field-based sequencing techniques developed in the US Virgin Islands identified microbial bioindicators of SCTLD in diseased corals and nearby seawater.<sup>23</sup> The relationship between SCTLD and environmental and anthropogenic factors is not fully understood. The disease onset in Florida occurred around the same time as a dredging event and a thermally induced bleaching event, although there is no confirmed link between these events and the disease outbreak.<sup>2,4,24-32</sup> Factors that have been found to impact SCTLD manifestation include location, host species, the nature of the lesion, the amount of time the colony has been infected, the amount of remaining live tissue on the colony, the colony size, season, water temperature, and site characteristics such as depth, habitat type, species diversity, coral cover and proximity to a high density of septic tanks.<sup>2,3,10,12,26,33-41</sup> SCTLD is contagious and generally spreads through direct contact with diseased tissue or facilitated by medium depth ocean currents.<sup>1,18,24,25,39,42,43</sup> It is theorized that ballast water discharge from ships may also explain the rapid and haphazard spread of SCTLD across the Caribbean.<sup>10,43,44</sup> Corallivorous fish such as the four-eye butterflyfish have been found to predate selectively on SCTLD lesions, possibly impacting transmission.<sup>45</sup> Current intervention efforts focus on applying an antibiotic treatment mixed in a specially formulated paste

to lesions and rescuing healthy corals for future restoration. Other intervention methods are also being investigated, such as probiotic treatments.<sup>42,46,47</sup>

Descubierto por primera vez en Florida en 2014, la enfermedad de la pérdida de tejido de coral duro (SCTLD, por sus siglas en inglés) es una enfermedad altamente virulenta y contagiosa que afecta al menos 22 especies de corales duros.<sup>1-3</sup> La SCTLD se caracteriza por áreas focales o multifocales de pérdida de tejido que típicamente progresan desde el borde de una colonia o como manchas blancas dentro de tejido sano, dejando un esqueleto blanco que se coloniza rápidamente (3-7 días) con algas.<sup>2,3</sup> Esta enfermedad ha provocado tasas sin precedentes de pérdida de cobertura de coral vivo a través del Caribe, al nivel de que la recuperación es incierta y el daño ecológico a largo plazo es inevitable.<sup>2,4-10</sup> La SCTLD se detectó por primera vez en Puerto Rico en Culebra en octubre de 2019. De octubre a noviembre de 2019, los estudios en el arrecife de Tamarindo Chico documentaron un aumento en la prevalencia de la SCTLD de 4% al 50%.<sup>11</sup> Esta enfermedad de rápido movimiento ahora está en las costas este, norte y sur de Puerto Rico, incluso en sistemas de arrecifes mesofóticos (que van desde 23 a 50 metros de profundidad) cerca de Vieques.<sup>12</sup> Debido a las altas tasas de mortalidad y la rápida propagación de esta enfermedad, sigue siendo una de las mayores amenazas actuales para los arrecifes de Puerto Rico. Aún no se ha identificado el patógeno o los patógenos que causan la SCTLD, sin embargo, tanto los estudios de laboratorio como los de campo han encontrado que un tratamiento con antibióticos de amoxicilina es eficaz para detener las lesiones de SCTLD,<sup>13-17</sup> que es evidencia que las bacterias son relevantes para la patogenicidad de la SCTLD. Investigaciones encontraron diferenciación microbiana entre corales sanos y enfermos, incluyendo correlaciones significativas entre SCTLD y la presencia de bacterias *Rhodobacterales* y *Rhizobiales*, así como evidencia de una coinfección posible relacionada con la bacteria *Vibrio coralliilyticus*.<sup>18-21</sup> La microscopía electrónica de transmisión reveló evidencia de que la SCTLD puede estar relacionado con una enfermedad viral que afecta a las zooxantelas (algas simbióticas que viven dentro de los pólipos de coral), que eventualmente causa la muerte del coral.<sup>22</sup> Las técnicas de secuenciación rápida basadas en el campo desarrolladas en las Islas Vírgenes identificaron bioindicadores microbianos de SCTLD en corales enfermos y en el agua cercana.<sup>23</sup> La relación entre la SCTLD y los factores ambientales y antropogénicos aún no está clara. El inicio de la enfermedad en Florida ocurrió cerca de la ocurrencia de un evento de dragado en Florida y con un evento de blanqueamiento debido al aumento en la temperatura superficial del mar, no obstante, no se puede confirmar que existe una relación entre estos eventos y el brote de la enfermedad.<sup>2,4,24-32</sup> Los factores que se ha encontrado que afectan la manifestación de SCTLD incluyen la ubicación, la especie de coral, la caracterización de la lesión, la cantidad de tiempo que la colonia ha estado infectada, la cantidad de tejido vivo restante, el tamaño de la colonia, la temporada, la temperatura del agua, y las características del sitio como la profundidad, la diversidad de especies, la cobertura de coral, el tipo de hábitat y la proximidad a una alta densidad de fosas sépticas.<sup>2,3,38-41,10,12,26,33-37</sup> La SCTLD es contagiosa y generalmente se propaga por contacto directo con tejido enfermo o facilitadas por las corrientes oceánicas de profundidad media.<sup>1,18,24,25,39,42</sup> Se teoriza que las descargas de agua de lastre de barcos también podría explicar la propagación rápida y aleatoria por el Caribe.<sup>10,43,44</sup> Se ha descubierto que los peces coralívoros, como el foureye butterflyfish, son depredadores selectivos de las lesiones de SCTLD, lo que posiblemente afecte la transmisión.<sup>45</sup> Actualmente, los esfuerzos de intervención se enfocan en aplicar un tratamiento con antibióticos mezclado en una pasta especialmente formulada a las lesiones, así como el rescate de corales para futuras restauraciones. También se están probando tratamientos alternativos, como los probióticos.<sup>42,46,47</sup>

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