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Stony Coral Tissue Loss Disease (SCTLD) Adaptive Management Plan

The **Coral Conservation in the UK Overseas Territories (C-COT)** working group was established in 2021, in response to the emergence of an aggressive and invasive coral disease. The group brings together government departments, non-governmental organisations (NGOs), and academic institutions from the six Caribbean Western Atlantic UK Overseas Territories (OTs): **Anguilla, Bermuda, the British Virgin Islands, the Cayman Islands, Montserrat and the Turks and Caicos Islands.**

The C-COT partnership helps to foster **cross-OT and regional collaboration** with countries in the Caribbean, creating opportunities for learning exchanges, project funding, University connections, and external workshops. It provides working group members with the best available science, management strategies, and shared approaches to address both current and future coral disease outbreaks on their reefs.

"C-COT has been a wonderful tool for bringing together Government and NGOs, researchers, and practitioners. Over the past years, we have been able to work together in ways that were only theoretical before and the success of this working group shows the need for collaborative platforms amongst our territories." – **Alizee Zimmerman, Turks & Caicos Reef Fund**

This **Adaptive Management Plan** aims to:

- **Emphasise** the value and significance of coral reefs in the UKOTs.
- **Highlight** Stony Coral Tissue Loss Disease (SCTLD), its impact and spread.
- **Outline** an Adaptive Management Cycle for dynamic reef ecosystems which allows for continued review and improvements to reef management.
- **Signpost** to C-COT and other regionally developed products including: the SCTLD Treatment Strategy, helping to guide reef managers through the different stages of disease outbreak; and the C-COT Roadmap, outlining future avenues for the group.
- **Examine** the impacts of local pressures on coral reef ecosystems, as well as their significance in contributing to reef resiliency.
- **Introduce** a resilience-based management approach which aims to address multiple threats to reefs, with the overall goal of increasing reef resiliency as well as services provided to local communities.
- **Discuss** successes of C-COT as a collaborative working group.

The Caribbean and Western Atlantic UK Overseas Territories (OTs) are home to some of the world's most spectacular coral reefs, supporting vast amounts of biodiversity and playing a crucial role in local economies.

Coral reef ecosystems benefit more than **44 million people** across the Caribbean[1], delivering ecosystem services such as storm and coastal protection, fisheries, and tourism, which in turn, assure the safety, nutrition, economic security, and health and wellbeing of millions of people. Coral reefs contribute **US$3.4 billion annually** to the economies of Caribbean countries, with **90% of this representing tourism[2].**

Despite this importance, coral reefs are under serious threat, and in the Caribbean, live **coral abundance has declined by 50–80%** since the 1970s[3]. Due to their value and importance to Caribbean communities, it is essential that we work towards careful protection and management.

Stony Coral Tissue Loss Disease (SCTLD) was first found in 2014 on the reefs of Florida[4], but spread rapidly and was first reported in a UKOT in 2019, when it was identified in the Turks and Caicos Islands. The disease causes **extremely high coral mortality rates** and has had a devastating impact since its arrival[4]. Treatment is costly and time consuming, and the direct cause of the disease is still under investigation[4].

SCTLD affects more than **30 hard coral species** in **32 countries/territories** and has resulted in substantial die-offs over multiple coral species[4]. The disease is infectious and waterborne and can be spread by natural **ocean currents[5].** Cross-regionally, it has been suggested that the disease spread is facilitated by **commercial shipping** via contaminated ballast water, biofouling, and sediments[6].

Prevalence and disease mortality vary across reefs and regions, and factors such as **anthropogenically impacted water outflow**[7] and **coastal development**[4] have been shown to have an influence on disease characteristics. Evidence also suggests that a combination of **increased water temperatures, thermal stress, and coral bleaching** can exacerbate disease outbreak prevalence[8].

C-COT is using an **Adaptive Management Cycle** for SCTLD management which allows for continued review, learning and evidence-based improvements to be made (see Figure 1). This approach is recommended for complex and dynamic ecosystems, such as coral reefs, and is especially important when responding to new and emerging threats where management is not well established, as is the case with SCTLD. At the centre of this plan is the need to incorporate a resilience-based approach to management that considers other reef stressors such as climate change (see pages 7 and 8 for more information on reef-resiliency).

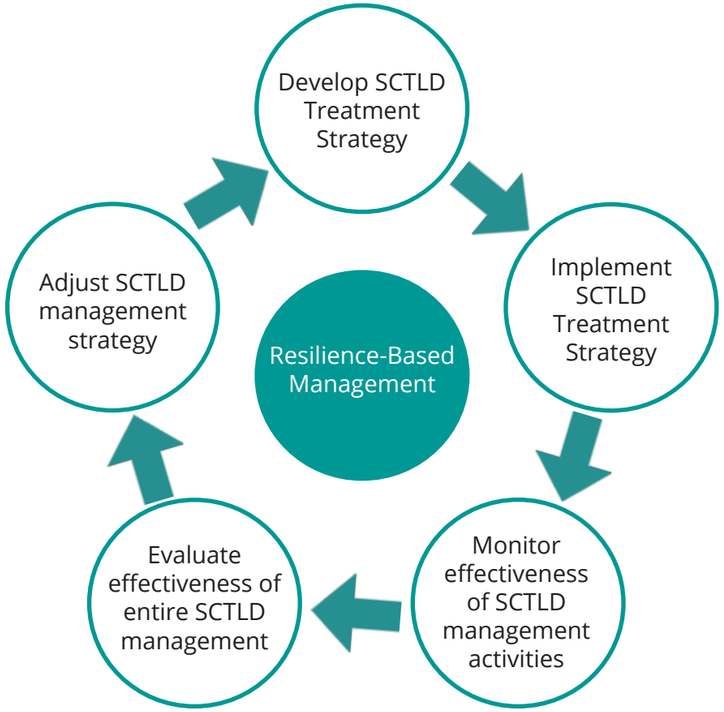


Figure 1. Adaptive Management Cycle with a central, resilience-based approach.

C-COT has developed a **Treatment Strategy**, summarising options for reef managers through the various stages of a SCTLD outbreak. This Strategy (see page 12 for a link to the Strategy) uses evidence from C-COT and other practitioners from across the Caribbean region to outline the most effective treatment options, and is updated as new knowledge becomes available. A summary of the suggested steps to be taken before, during and after SCTLD invasion are provided in Figure 2 below.

Pre-Invasion

- Legal preparation
- Training
- Baseline monitoring
- Vulnerable site identification
- Development of decision criteria for assessing risk (biological and anthropological)
- Communication to develop an “early warning network”

Initial Invasion

- Community engagement
- Implementation of biosecurity actions to stop spread
- Monitoring
- Implementation of management actions (site closures, treatment)

SCTLD Outbreak

- Implementation of intervention protocol (treatment)
- Monitoring to evaluate spread and treatment effectiveness (spatial and temporal decisions)
- Long-term managment (e.g. reduction in fishing pressure on herbivores and other reef stressors, rescue, restoration, etc.)

Figure 2. Suggested steps to be taken before, during, and after SCTLD invasion.

While SCTLD and other coral diseases are a serious threat to reefs worldwide, their impact is further compounded by factors such as **rising sea temperatures, pollution, destructive fishing, coastal development, invasive species, and vessel groundings[6].** Coral reefs are dynamic ecosystems that react and recover differently to the pressures of human activities. The severe bleaching event seen on Caribbean reefs in 2023, now confirmed to be the fourth global bleaching event in history, was a stark reminder that ocean warming can rapidly reverse any coral recovery made through treatments and restoration activities[9].

A **Resilience-Based Management approach** uses knowledge of current and future pressures on ecosystems, incorporating this into the **prioritisation, implementation, and adaption** of management actions. This approach aims to address multiple threats, including SCTLD, with the overarching aim of increasing resilience of coral reefs, and the local communities that depend on them.

In alignment with this approach, C-COT developed a **Reef-Resilience Framework**, outlining the linkages between select human activities (driving forces of environmental change), resulting pressures, state of the environment, potential impacts, and response options (management activities). Some of the priority local pressures determined and their environmental impacts are detailed on page 8 and visualised on pages 9 and 10.

Prioritised Local Pressures	State of Environment
Pollution/sewage introduction: Industry, waste and wastewater management, tourism, boating, shipping, cruising, coastal development.	Poor water quality, toxins in nearshore environment.
Loss of key species: Fishing activity.	Reduced fish spawning aggregations, loss of fish biomass, herbivore loss (increased algal growth), loss of top predators.
Pathogen/invasive species introduction: Wastewater management, ballast discharge from boating, shipping and cruising.	Coral disease spread, ecosystem imbalance, competition between species, loss of endemics, sea urchin die-off.
Sedimentation: Industry, agricultural runoff, coastal development, artificial beach construction.	Poor water quality, shading/smothering of corals, coral disease spread.
Nutrient influx: Agricultural runoff, waste and wastewater management, landfill waste.	Coral disease spread, algae growth.
Direct damage to reef: Tourism, boating, shipping, cruising, coastal development, fishing activity.	Habitat loss, reduced coral cover, reduced reef structure.
Habitat loss: Coastal development, tourism.	Loss of coastal wetlands and mangroves, reduced fish spawning aggregations.

Loss of Ecosystem Services

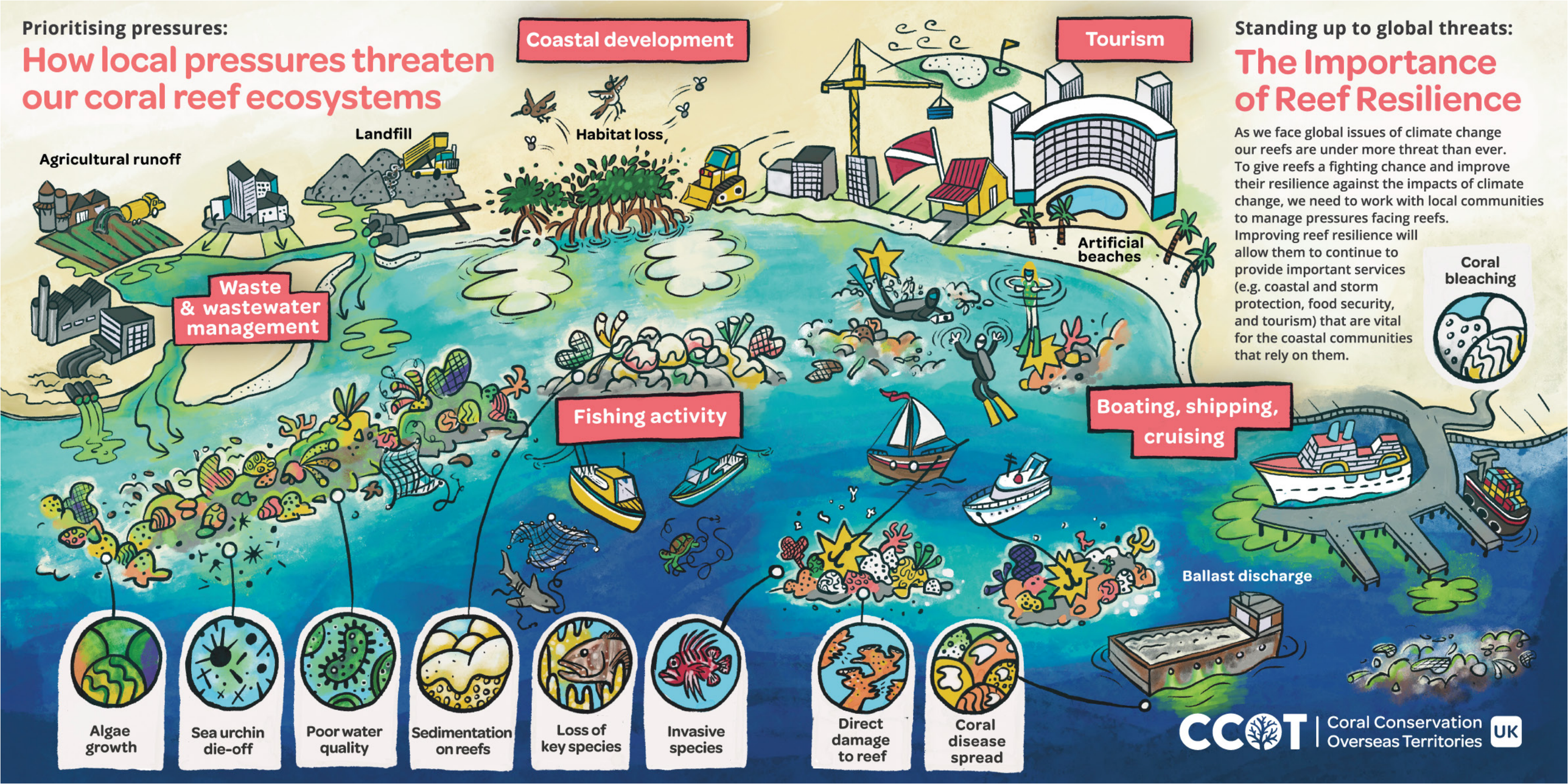
Impact on the production and success of fisheries **(affecting food security and income).**

Declining coral reef health **(affecting tourism and overall reef value).**

Impacted reef integrity **(loss of coastal and storm protection).**

Prioritising pressures:

How local pressures threaten our coral reef ecosystems



Standing up to global threats:

The Importance of Reef Resilience

As we face global issues of climate change our reefs are under more threat than ever. To give reefs a fighting chance and improve their resilience against the impacts of climate change, we need to work with local communities to manage pressures facing reefs. Improving reef resilience will allow them to continue to provide important services (e.g. coastal and storm protection, food security, and tourism) that are vital for the coastal communities that rely on them.

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Coastal communities play an integral role in the protection of coral reefs, and understanding how local, regional, and international management actions can contribute to safeguarding our reefs is crucial.

The C-COT group brings together representatives from the UKOT coastal communities, striving to build upon regional knowledge that already exists, while connecting groups with external resources, to better equip OTs in protecting valued marine ecosystems. While the group has already accomplished a great amount in: training individuals on disease response and monitoring, building regional networks, sourcing funding for treatment efforts, developing OT-specific coral reef action plans, etc., reef pressures continue to persist. With high ambitions, and a desire to be an example of successful partnership in the region, the C-COT group has developed a Roadmap document, outlining priority focus areas for the future of the group.

"The collaboration has been fantastic and rewarding, it bolstered our resolve to find some meaningful solutions. But a more important and immediate benefit was learning first-hand what the TCI had experienced! Putting that into practice meant we were confidently able to mount our own treatment plan much quicker than would have been possible otherwise." – **Tim Austin, Cayman Islands Department of Environment**

CCOT SCTLD Treatment Strategy

CCOT Roadmap

With sustainability in mind, this booklet has been printed on recycled paper.

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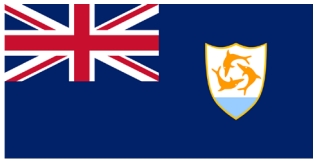
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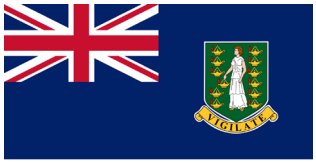
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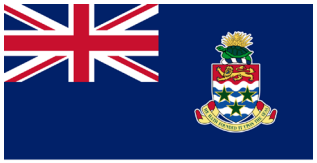
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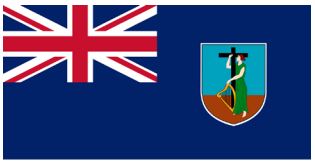
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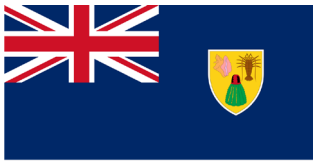
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