



Marine Benthic Communities: Coral Reef Monitoring in Virgin Islands National Park

2022

Importance: *A critical resource for fisheries, tourism and marine biodiversity*

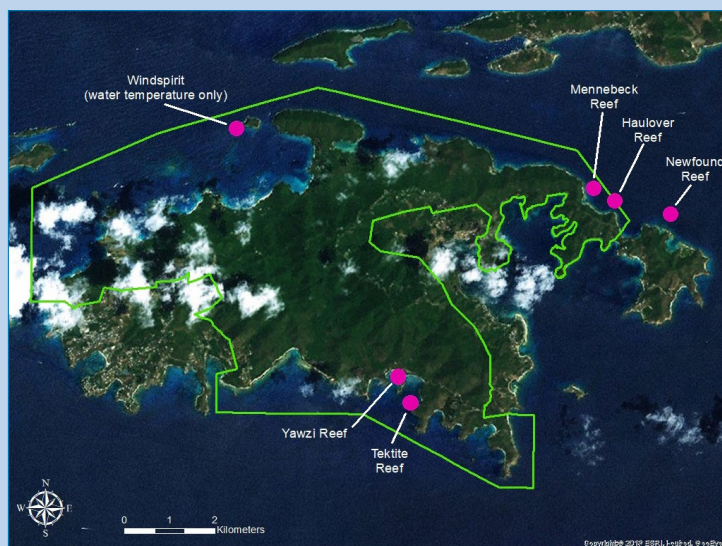
Coral reef communities within Virgin Islands National Park consist of stony corals, octocorals (e.g., sea fans), sponges, and algae. Reefs support incredible marine biodiversity including hundreds of coral and fish species, as well as sea turtles, lobsters and other marine invertebrates. Reefs play a vital role for humans by providing juvenile fish habitats, protecting shorelines from erosion, creating sand for beaches, supporting tourism, and providing a source for pharmaceutical bio-prospecting. Coral reefs are negatively affected by rising seawater temperatures that cause “bleaching,” coral diseases, storms, and ocean acidification. Local stressors include vessel groundings, over-fishing, damaging fishing methods (e.g., fish traps), sediment runoff, nutrient enrichment, contaminants, and abrasion and fracturing of coral reef by debris or careless snorkelers and divers. Due to the importance of coral reef ecosystems to biodiversity and society, and the many threats they currently face, President Bill Clinton established a Coral Reef Initiative through Executive Order 13089 to prioritize the health of coral reefs, including those that fall within National Park boundaries.

Long-term Monitoring: *Five coral monitoring sites*

The South Florida/Caribbean Network (SFCN) annually monitors five coral reef sites in St. John, USVI: Newfound Reef (established 1999), Yawzi Reef (established 1999), Mennebeck Reef (established 2000), Haulover Reef (established 2003), and Tektite Reef (established 2005). Sites were selected based on several criteria including park management recommendations, high initial coral cover, comparability with historic work, and levels of stressors in different watersheds. Each site consists of 20 permanent, randomly selected 10-meter (32.8 feet) transects which are monitored using underwater video. Percent cover of living coral by species, macroalgae, turf algae, crustose coralline algae, octocorals, and sponges is calculated. Data on coral disease, bleaching, water temperature, and long-spined sea urchins are also collected.



Above: Star coral community, *Orbicella annularis*, one of the most abundant corals on Virgin Islands National Park reefs.



Above: The five reefs monitored by the South Florida/Caribbean Network are: Yawzi Reef (7,125 square meters [1.8 acres]), Newfound Reef (13,768 square meters [3.4 acres]), Mennebeck Reef (12,495 square meters [3.1 acres]), Haulover Reef (13,568 square meters [3.4 acres]), and Tektite Reef (18,711 square meters [4.6 acres]). All are foreereef features between 2–20 meters (6.6–65.6 feet) depth. Water temperature is only monitored at the Windspirit site. Green lines indicate park boundaries.



Status and Trends: Stony Coral Tissue Loss Disease causes substantial mortality and reduced coral recovery five years after direct hits by two major Hurricanes (2017)

Despite two major Hurricanes (Irma and Maria) striking St. John in 2017, the most significant factor impacting coral cover has been coral disease. In 2005–2007, coral bleaching and disease led to a loss of more than 60% of the average coral cover at the five monitoring sites. Following this mortality event, coral cover remained constant and at some sites even slowly increased over the next decade. In 2020, an extremely virulent Stony Coral Tissue Loss Disease (SCTLD) spread throughout the park and contributed to a sharp decline in coral cover at four of five SFCN monitoring sites (exception was Yawzi Reef).

The recent coral mortality at the four sites resulted in the lowest coral cover values recorded in the history of our monitoring program (Figure 1). Coverage of coral genera considered highly susceptible to

SCTLD (*Meandrina*, *Colpophyllia*, *Dendrogyra*, *Pseudodiploria*, and *Diploria*) was fairly low across sites since monitoring was initiated, but has declined to nearly zero since the arrival of SCTLD (Figure 2). Moderately susceptible corals (*Orbicella*, *Montastrea*, *Stephanocoenia*, *Siderastrea*), the common reef-building species, have exhibited a nearly 30% decline in coral cover due to SCTLD, driven primarily by the loss of *Orbicella* spp., the dominant coral type on Virgin Islands NP reef monitoring sites. Coral genera considered resistant to SCTLD (*Porites*, *Agaricia*, *Undaria*, *Millepora*, and *Acropora*) have slowly increased in coral cover over the last two decades and remain largely unaffected by SCTLD. Coral reef-depth water temperatures were above the bleaching threshold in 2020 and 2021, causing thermal stress and bleaching on corals. While a direct hit by a strong hurricane can physically damage a reef, storm events reduce water temperature at reef depth and can alleviate thermal stress. In September 2022 when Tropical Storm Fiona passed over Virgin Islands National Park, the water temperature on the reef lowered without causing physical damage (Figure 3).

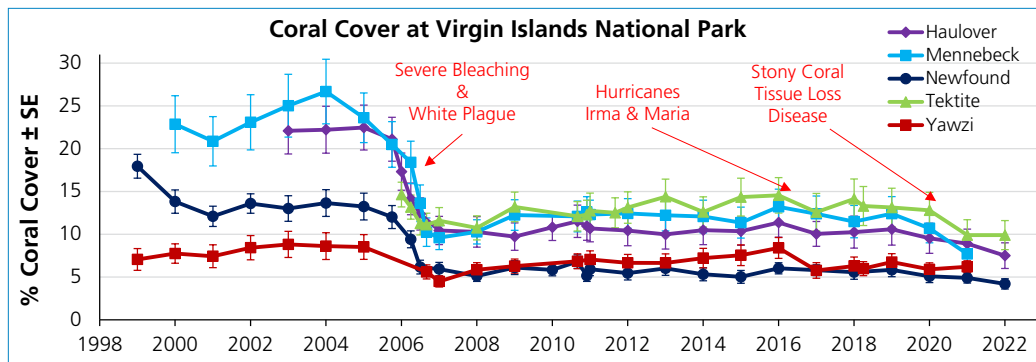


Figure 1. Trends in mean annual stony coral cover ($\pm$ SE) and notable events at index sites in Virgin Islands National Park. The most common stony coral is Boulder Star Coral (*Orbicella* spp. complex) although Yawzi Reef also has relatively high amounts of Mustard Hill Coral (*Porites astreoides*), Finger Coral (*P. porites*), and Massive Starlet Coral (*Siderastrea siderea*).

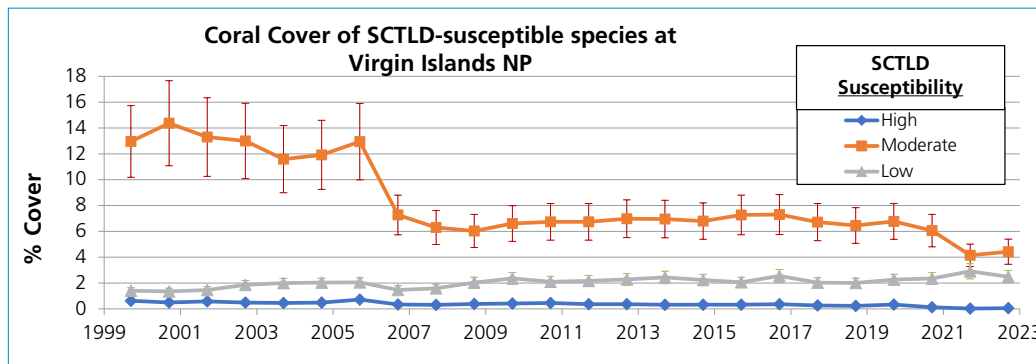


Figure 2. Percent live coral cover ($\pm$ SE) of species exhibiting variable susceptibilities to SCTLD: high (*Meandrina*, *Colpophyllia*, *Dendrogyra*, *Pseudodiploria*, *Diploria* spp.), moderate (*Orbicella*, *Montastrea*, *Stephanocoenia*, *Siderastrea*, spp.), and low (*Porities*, *Agaricia*, *Undaria*, *Millepora* spp.).

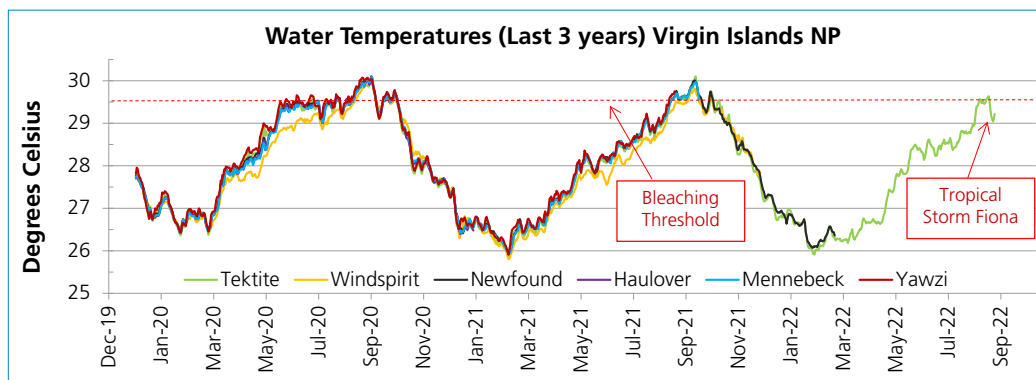


Figure 3. Virgin Islands National Park water temperature data from six sites at reef depth using underwater data loggers over the last three years. Monitoring of water temperature at Yawzi and Windspirit was initiated in 1990, Newfound in 1991, Haulover in 1998, and Mennebeck and Tektite in 2005. Note: bleaching threshold 29.5°C (85.1°F).

