



Marine Benthic Communities: Coral Reef Monitoring in Dry Tortugas National Park

2022

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

Coral reef communities within Dry Tortugas National Park (NP), at the western end of the Florida Keys, consist of stony corals, octocorals (e.g., sea fans), sponges, and algae. Reefs support marine biodiversity including fish species, lobsters, sea turtles, and other marine species. Reefs in Dry Tortugas play a vital role for humans by supporting fisheries, fishery nursery areas, tourism, pharmaceutical bio-prospecting, and protection of the islands and Fort Jefferson, among others. Coral reefs are negatively impacted extreme water temperatures that cause “bleaching,” vessel scarring, and major storms, as well as long-term stressors like coral disease, over-fishing, damaging fishing methods, sediment runoff, nutrient enrichment, contaminants, ocean acidification, and abrasion of the 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 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: *Bird Key Reef, Loggerhead Forest, Santa’s Village and additional sites inside and outside the Research Natural Area (RNA)*

The South Florida/Caribbean Network (SFCN) began coral reef monitoring at Bird Key Reef in 2004 in Dry Tortugas NP (Figure 1). Bird Key Reef was selected due to management interest and to compare with historical work and consists of 20 permanent, randomly-selected 10-meter (32.8 feet) transects which are monitored using underwater video. Additional four-transect extensive sites were randomly selected in 2008 to compare trends

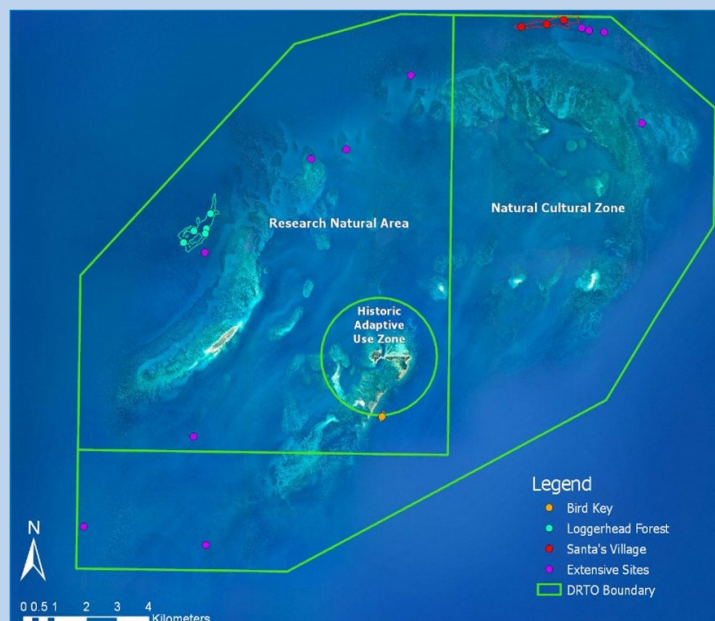


Figure 1. Three long-term index sites are monitored annually and episodically (as needed) by SFCN: Bird Key (19,352 square meters [4.8 acres]); Loggerhead Forest (596,637 square meters [147.4 acres]), and Santa’s Village (371,763 square meters [91.9 acres]). Thirteen more four-transect extensive sites have been monitored inside and outside the RNA since 2008 less frequently.

inside and outside the newly established no-take Research Natural Area (RNA). In 2012, Loggerhead Forest Reef and Santa’s Village Reef were added for focused monitoring due to their unusually high coral cover and diversity. Percent cover of living coral by species, macroalgae, turf algae, crustose coralline algae, octocorals, and sponges are calculated. Data on coral disease, bleaching, water temperature, and long-spined sea urchins are also collected.



Above: Highly diverse and complex coral reef terrace habitat in Dry Tortugas National Park. Photo by Rob Waara.



Status and Trends: Stony Coral Tissue Loss Disease (SCTLD) and Hurricane Ian cause decline in coral cover

Loggerhead Forest and Santa's Village contained the highest percentage of live hard coral cover reported for any Florida reefs (15–30%) in 2012 (Figure 2). However trend analyses through 2022 reveal a significant negative trend in coral cover due to several coral disease outbreaks causing substantial mortality. White Plague coral disease prevalence was 7–18% during 2016 and 2018 disease events. Coral cover was stable for several years thereafter until Stony Coral Tissue Loss Disease (SCTLD), first reported on Florida reefs off Miami in 2014, was documented in the park on May 29, 2021. During monitoring in November 2022, disease prevalence was high (18%) and consequently, coral cover was reduced to historical lows at Bird Key and Loggerhead Forest. Water temperature data shows similar patterns throughout the park except in May and June when cold water events appear to affect western and northern sites more than Bird Key (Figure 3). The cooling effect of Hurricane Ian is also evident in the temperature record. Daily water temperatures were again exceedingly warm, having surpassed the bleaching temperature limit in seven of the last nine summers (Figure 4).

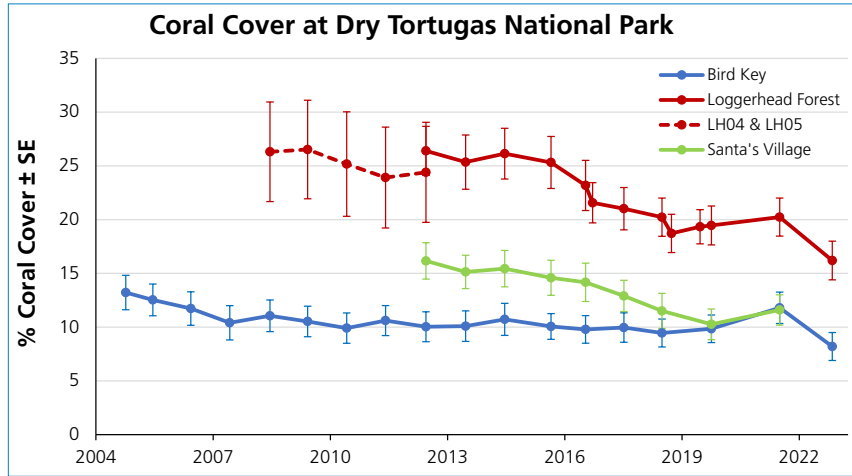


Figure 2. Average live coral cover ($\pm$ SE) at index sites in Dry Tortugas National Park. Using data from 2005–2022, we detected a statistically significant negative trend in live coral cover for all three reefs surveyed by the South Florida/Caribbean Network. Stony coral tissue loss disease in 2021 and Hurricane Ian (Category 3) in September 2022 caused additional damage and reduced live coral cover. The hurricane caused structural damage by toppling coral heads and deposited sediment on shallow reefs such as Bird Key. Note: From 2008–2012 data is only available from two sites at Loggerhead Forest.

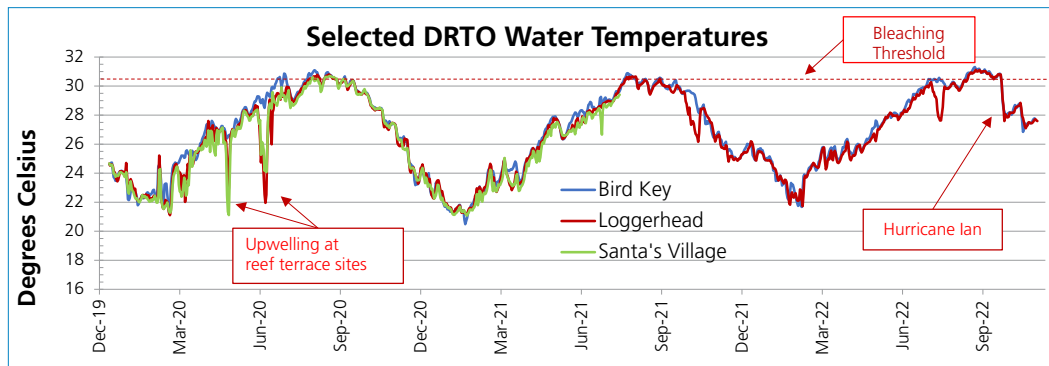


Figure 3. Dry Tortugas National Park mean daily water temperature from 2019–2022 at Bird Key, Loggerhead, and Santa's Village sites. Cold upwelling at the reef terrace communities (Loggerhead and Santa's Village) can be seen in May and June in 2020. Hurricane Ian caused a drop in water temperature well below the bleaching threshold of 30.5°C (86.9°F; top red dashed line) in September 2022.

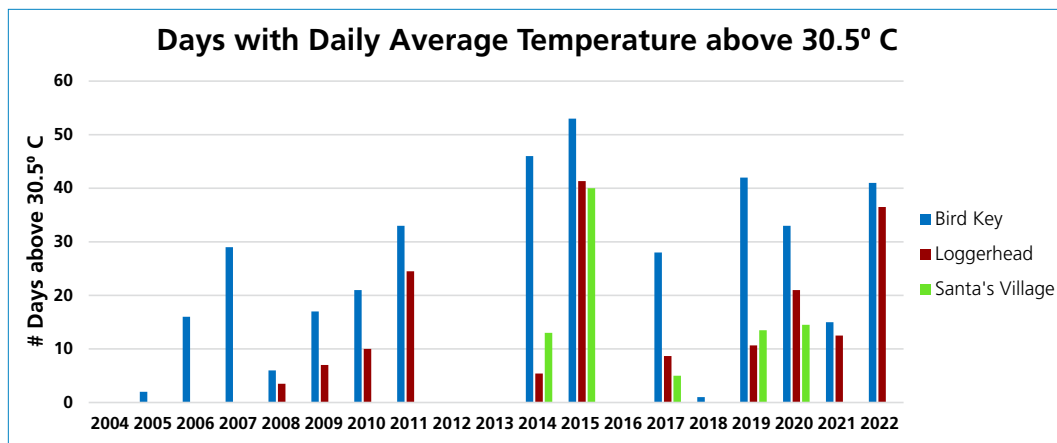


Figure 4. Annual number of days daily mean temperature exceeded the coral bleaching stress threshold. Note: period of maximum water temperature not yet available for 2021–2022 at Santa's Village.

