



Marine Benthic Communities: Coral Reef Monitoring in Buck Island Reef National Monument

2022



Above: Panoramic view of the mesophotic reef on the Deep Bar site in 2019. NPS photo / Mike Feeley.

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

Coral reef communities within Buck Island Reef National Monument (NM) 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 (i.e. fish traps), sediment runoff, nutrient enrichment, contaminants, and abrasion and fracturing of coral reefs 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: *Mesophotic reef monitoring added to long-term monitoring efforts*

The South Florida/Caribbean Network has monitored two coral reef sites at Buck Island Reef NM: South Fore Reef (est. 2002) and Western Spur & Groove Reef (est. 2000). The network expanded monitoring efforts to a shallow mesophotic reef (~33 meters [108.3 feet]) at the Buck Island Bar in 2017 (Figure 1). All sites were selected based on depth, size of the reef area, composition, complexity of the reef structures, and park management recommendations. Each site consists of permanent, randomly-selected 10 meter (32.8 feet)



Figure 1. Three showing the location of the three coral monitoring sites at Buck Island Reef National Monument (green boundary). South Fore Reef encompasses over 40,000 square meters (430,556 square feet [ft²]) of the forereef that typifies the south side of Buck Island and is a highly complex reef, dominated by Star Coral (*Orbicella* spp. complex). Western Spur and Groove Reef is a 26,365 square meter (283,790 ft²) reef area, typical of the park's northwest waters. Coral cover is relatively low, and made up of low “mounded” corals such as brain corals (*Pseudodiploria* spp.) and mustard hill and finger corals (*Porites* spp.). The Bar site is a large, complex, low-light, shallow mesophotic reef. It is dominated by plating Boulder Star Coral (*Orbicella franksi*) with the highest coral cover observed in this monument.

transects, which are monitored using underwater video. The percent cover of living coral by species, macroalgae, turf algae, crustose coralline algae, octocorals, and sponges is quantified. Additional data on coral disease, bleaching, water temperature, and long-spined sea urchins are also collected.



Status and Trends: Stony disease and coral bleaching three years after Category 5 Hurricane combine to affect Buck Island Reef National Monument coral reef communities

Annual coral reef monitoring was completed at the South Fore Reef and Bar sites in 2022. In 2005–2006, soaring water temperatures were associated with a coral bleaching/disease outbreak followed by catastrophic stony coral mortality, which the reefs have not fully recovered from. The mesophotic Bar reef had a 12-fold increase in average disease lesion size and three times the number of average disease lesions per transect which resulted in a 9% loss of live coral on this site between 2017 and 2019. The extremely virulent widespread Stony Coral Tissue Loss Disease (SCTLD) was first reported inside the west boundary of Buck Island Reef NM in December 2020, and observed at all sites in 2021. In 2022, active SCTLD lesions were abundant at all sites, causing additional decreases in coral cover, particularly at the Bar which experienced a nearly 40% decline in coral cover in the last year alone (Figure 2). Water temperatures from the three Buck Island Reef NM coral monitoring sites are summarized in Figures 3 and 4. Since monitoring began in 2003, warm water temperatures have exceeded the critical bleaching stress threshold (29.5°C [85.1°F]) every year except 2018.

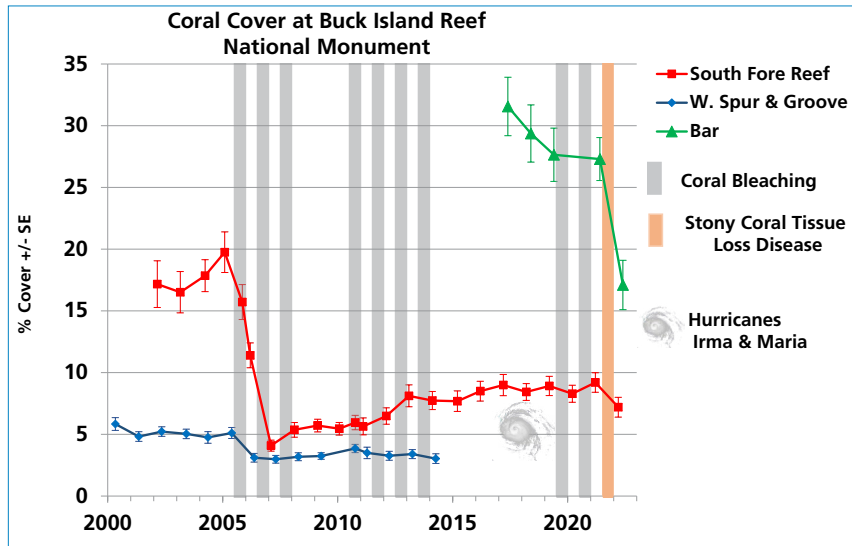


Figure 2. Mean live annual stony coral cover ($\pm$ SE) at Buck Island Reef NM sites: South Fore Reef, Western Spur and Groove Reef (last sampled in 2014), and Buck Island Bar (initiated in 2017). Note that coral bleaching occurs when coral under stress lose their symbiotic algae and look white or “bleached.” **2005–2007:** Coral bleaching/disease event caused greater than 60% decline in coral cover among study sites. **2010–2013; 2019–2020:** Coral bleaching events with no significant coral cover loss **2017:** Category 5 Hurricanes Irma and Maria pass over area causing no significant decline in coral cover **2021–2022:** Widespread mortality from Stony Coral Tissue Loss Disease.

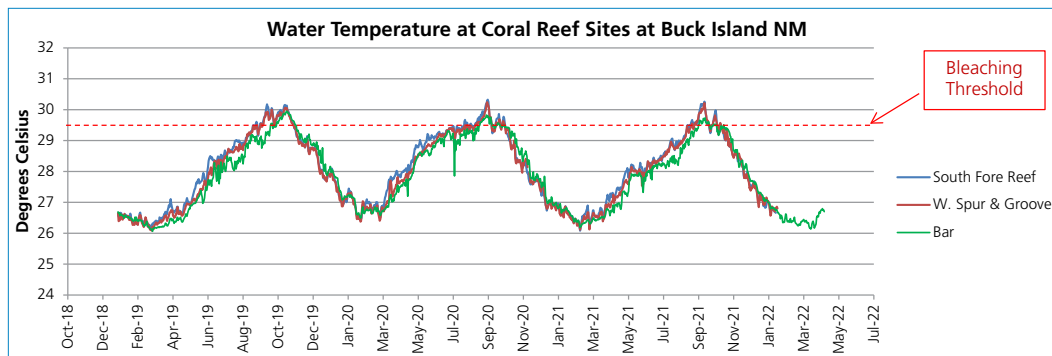


Figure 3. Buck Island Reef National Monument water temperature summary graph showing data from the three coral monitoring sites since 2018. A bleaching stress threshold of 29.5°C (85.1°F) is shown.

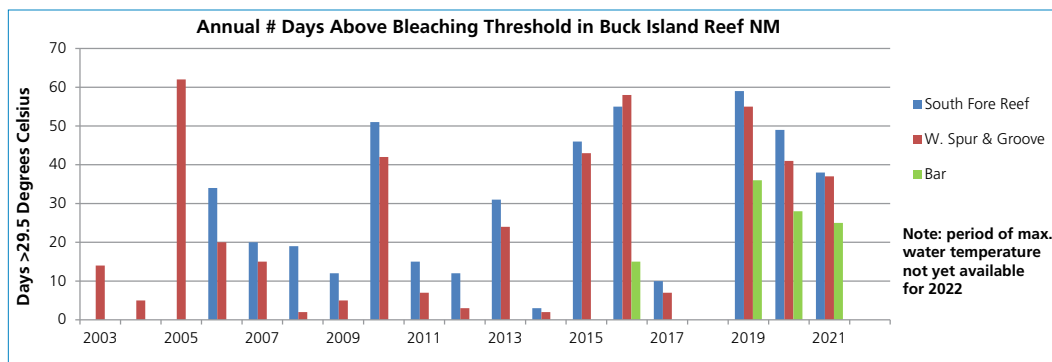


Figure 4. The total number of days in a year that mean daily water temperature was above the bleaching stress threshold of 29.5°C (85.1°F). 2018 was the only year since this record began (2003) in which no daily average exceeded the bleaching threshold. **Note:** 2022 data for period of thermal maximum is not yet available.

