2021 Little Cayman Reef Report Card

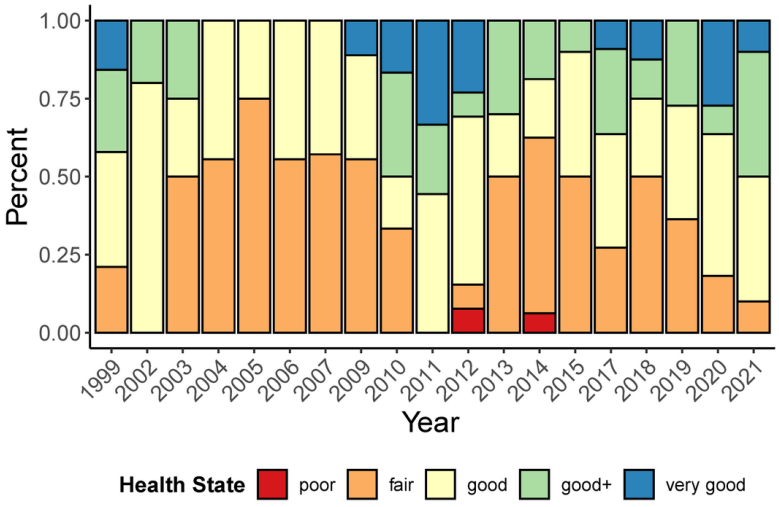

Figure 1: Coral Reef Health State 1999 - 2021

Coral Reef Health State

In 2021, 90% of surveyed reefs were classified as in a "good", "good+", or "very good" state based upon coral cover. This is an encouraging indicator, as fewer sites were classed as "fair" than in recent years, and no sites were classed as "poor". While coral cover remains relatively high, aided by recovering fish populations (including parrotfish), additional indicators outlined below highlight vulnerabilities on Little Cayman's reefs as well.

Fish Biomass Higher Inside of Marine Protected Areas

CCMI's long-term survey data indicate that fish biomass fluctuates from year to year, yet there is significantly higher biomass inside Marine Protected Areas (MPAs) throughout those fluctuations, suggesting that while areas inside and outside the MPAs are impacted by environmental change, this impact is buffered inside the MPAs, allowing more fish and larger fish to thrive. In 2021, fish biomass was 40% higher inside of the MPAs than outside.

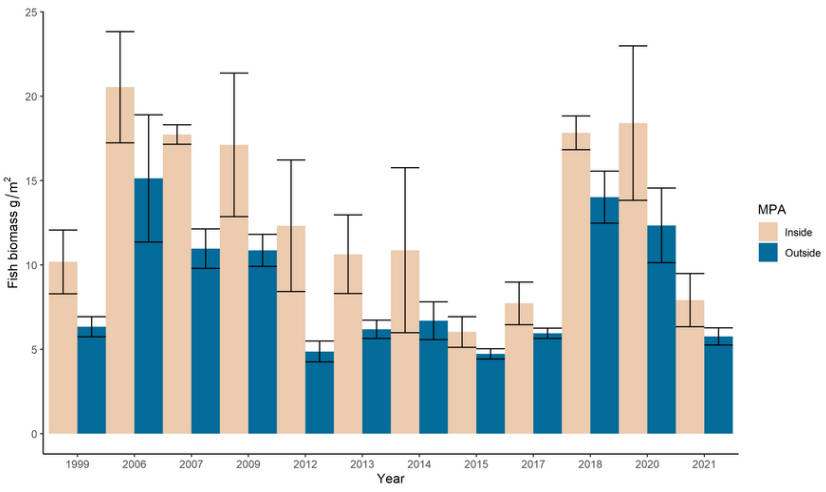

Figure 2: Fish Biomass Inside vs Outside of MPAs

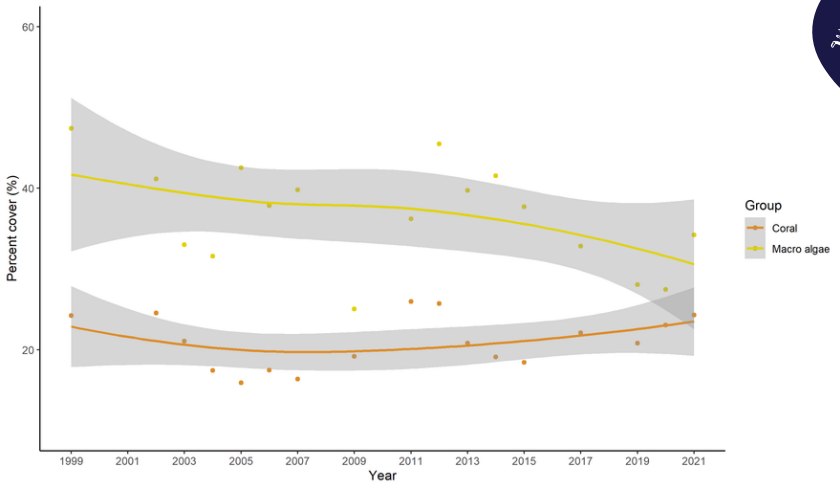

Figure 3: Macroalgal Cover vs. Coral Cover

Macroalgae Decline, Coral Cover Constant

Macroalgae on the reef has declined by 13% since CCMI's original surveys in 1999, which is also a positive indicator for key herbivorous fish populations like parrotfish, which feed on macroalgae. As macroalgae competes with coral for space on the reef, its reduction is an encouraging result of the healthy reef surveys.

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Grouper Density Increase

CCMI's surveys showed a decline in grouper (despite no-take zones at Nassau grouper spawning aggregation sites in season from 2003) until the Cayman Islands enacted greater protections in 2016 aimed at recovery of the population, inclusive of a seasonal blanket closure on Nassau grouper fishing, bag limits, gear restrictions, and size limits. The effects of these protections have been reflected in the surveys, as the grouper population density (all grouper species) has rebounded since that time.

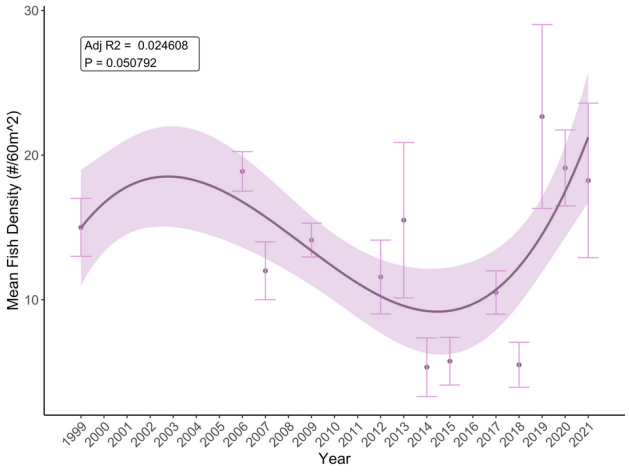

Figure 4: Grouper Population Density 1999 - 2021

Increases for Overall Fish Density, Biomass, and Species Richness

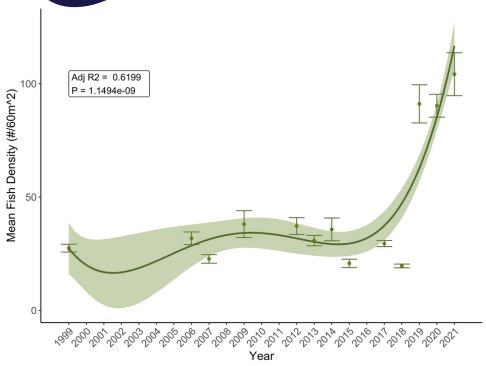

Figure 5: Mean Fish Density 1999 - 2021

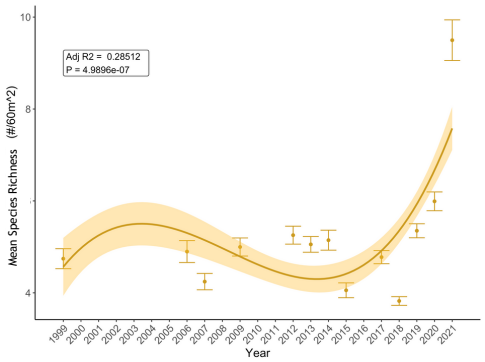

Figure 6: Mean Fish Species Richness 1999 - 2021

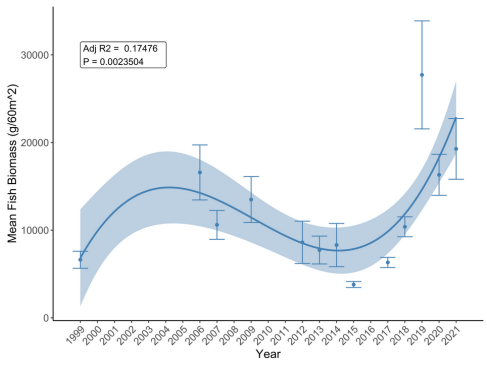

Figure 7: Mean Fish Biomass 1999 - 2021

Increases across total fish density, biomass, and species richness have been recorded following 2016, an apparent ripple effect of the enhanced local protections aimed at Nassau grouper population recovery. This means that we are seeing more fish, larger fish, and a greater diversity of species than in previous years. Major increases in 2020 and 2021 could be further influenced by COVID-19 and reduced overall activity on the reef. How reefs will respond post-Covid will be critical in understanding how much protection is required to maintain this recovery.

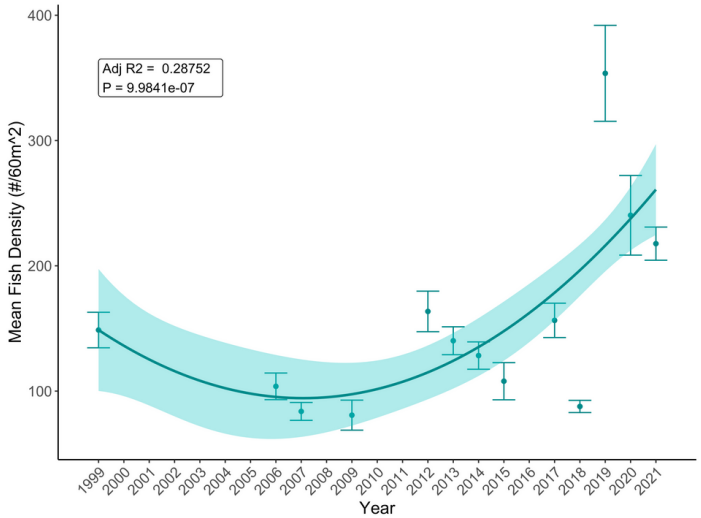

Figure 8: Parrotfish Density 1999 - 2021

Increase in Parrotfish Density

Parrotfish density has increased significantly, which is a positive indicator for reef health as they are key herbivores that feed on algae, which competes for space on the reef with coral. The mean number of parrotfish per transect was 148 parrotfish in 1999 and 218 in 2021, resulting in a 47% increase in density.

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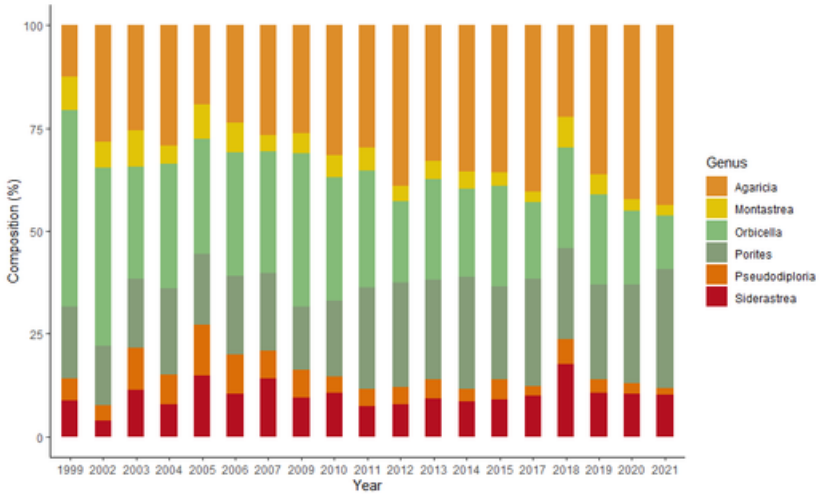
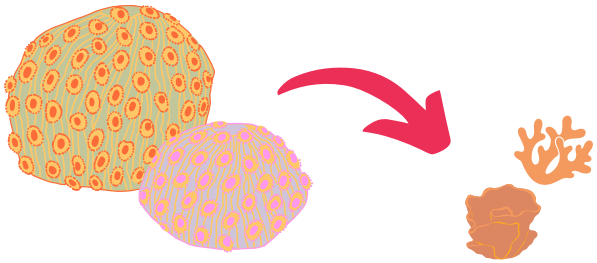


Figure 9: Shift in Coral Species

Shift in Coral Species: Larger to Smaller

Composition of the coral community on the reef has shifted over time, from reefs dominated by massive boulder corals, such as Orbicella spp., to smaller corals such as Agaricia spp. and Porites spp. This shift away from boulder coral species is reflective of a trend seen throughout the Caribbean region.



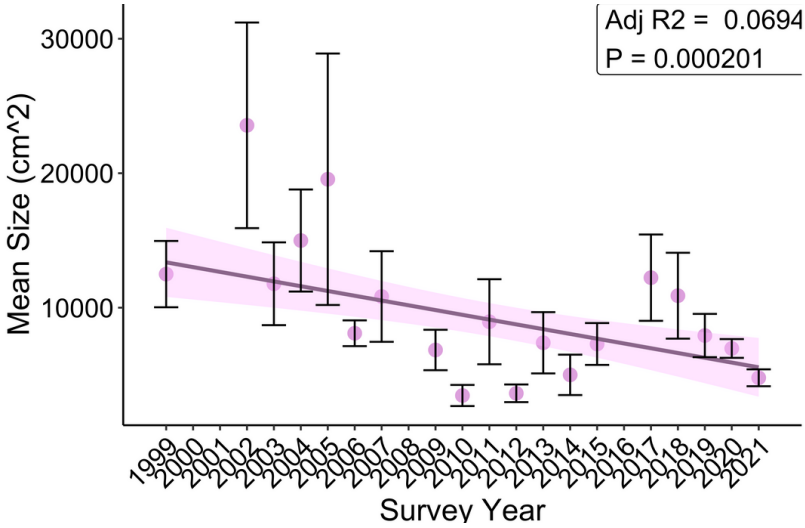


Figure 10: Decrease in Coral Surface Area 1999 - 2021

Decrease in Coral Surface Area

The mean surface area of corals surveyed by researchers has decreased by 60%, from 12,496 cm2 in 1999 to 4,786 cm2 in 2021. This smaller size is reflective of the shift in coral species and may indicate that the reef structure is less complex and less capable of providing important ecosystem functions like serving as a storm break.

Decline in Coral Recruits

There has been a significant decrease in the total number of coral recruits, or baby corals, noted in CCMI's surveys, which may suggest a vulnerable population. The total number of recruits declined by 83% from 2006 to 2021. Orbicella recruits are almost entirely absent, which reflects the Caribbean-wide trend for this genera. There have also been no Montastrea recruits recorded in CCMI's survey data after 2017. If current patterns persist and the adult population is impacted by a mortality event (I.e., bleaching or disease), they are unlikely to recover quickly due to low rates of recruitment.

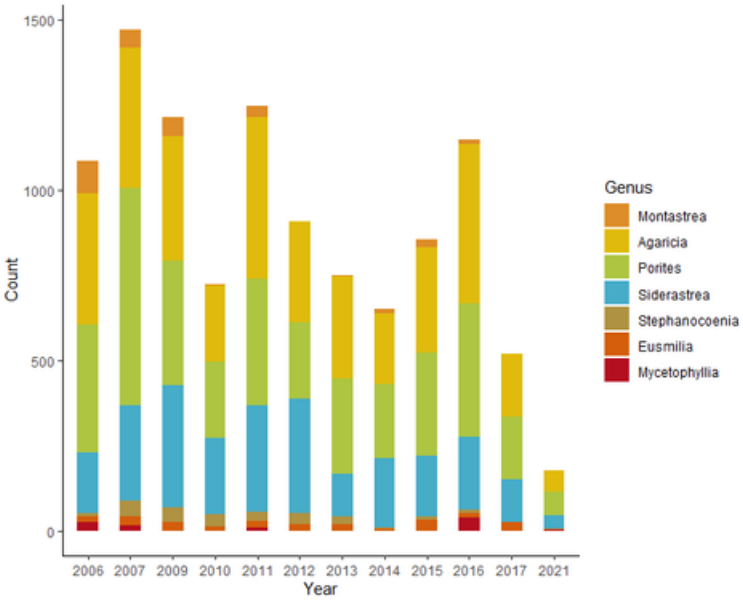


Figure 11: Decline in Coral Recruits 2006 - 2021

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Summary

While Little Cayman's reefs are subject to the same global pressures that reefs elsewhere face, strong local protections buffer the impact of those threats. Protections and low human impact have had a greater influence on fishes, which have shown significant signs of populations in recovery. CCMI's surveys of Little Cayman's reefs indicate that with appropriate management policies, coral reefs may be able to recover and display resilience to compounding pressures from regional and global threats. The data also demonstrates the vulnerability of corals, for as they are slow-growing and unable to move (as many fish may do to seek refuge from stress events), they are not able to rebound or respond to stress events as quickly. Investigating mechanisms of coral resiliency is crucial to understanding how corals may survive in the changing climate and future threats.

Explanation of Figures

Fig. 1: Coral reef health state based upon coral cover of surveyed reefs, based upon the following thresholds: poor = 0-5%, fair = 6-10%, good = 11-20, good + = 21-40, very good = >40%
Fig. 2: Fish biomass (g/m2) inside vs. outside Marine Protected Areas (p = 0.02)
Fig. 3: Percent cover of coral and percent cover of macroalgae 1999 - 2021
Fig. 4: Mean density (total #/site) of all grouper species by year. Significant correlation found using a 3rd degree polynomial regression (a = 0.05).
Fig. 5: Mean density (#/60m2 +/- SE) of all fish by year. Significant correlation found using a 3rd degree polynomial regression (a = 0.05).
Fig. 6: Mean fish biomass (g/60m2 +/- SE) by year. Significant correlation found using a 4th degree polynomial regression (a = 0.05).
Fig. 7: Mean species richness (# of species) per transect (60m2) with standard error. Significant correlation found using a 3rd degree polynomial regression (a = 0.05).
Fig. 8: Mean density (total #/site) of all parrotfish species by year. Significant correlation found using a 3rd degree polynomial regression (a = 0.05)
Fig. 9: Percent composition of surveyed coral, consisting of top six contributing genera
Fig. 10: Mean size (surface area in cm2) of coral surveyed 1999 - 2021
Fig. 11: Top seven contributing genera, total count surveyed per year, 2006 - 2021 (coral recruit counts not conducted pre-2021)

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ABOUT CCMI

CCMI is dedicated to conducting and facilitating research, education, and outreach that will sustain marine diversity for future generations. Our vision is a world with vibrant oceans and healthy coral reefs. We will make this vision a reality by undertaking cutting edge, impactful research and transforming this research into conservation and education initiatives which will serve to bridge the gap between knowledge and action. CCMI is a US 501(c)3 nonprofit organization (ID# 22-3609293), a UK charity (#1104009) and Cayman Islands nonprofit (NP-03).

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