

Site Summaries

RATIONALE

The purpose of this section is to provide a more comprehensive survey of TCRMP site characteristics than can be achieved in the overall data compilations. Each TCRMP monitoring site is each unique and has experienced unique responses to local and global stressors. Given the increase in sites included under this program and the inclusion of more information at each site, such as physical data, this section is designed to provide a summary that highlights the each site's characteristics and serves as a quick reference guide for managers, policy makers, and academics. The duration of surveys at most sites also now provides sufficient data from which to draw conclusions about longer term site dynamics and the processes that might be contributing to recent trajectories of health, development, and degradation.

SITE SUMMMARY ELEMENTS

TCRMP site information is presented in six pages that provide a brief description of the setting and the potential susceptibility to local and global stressors and disturbances. Subsections include a description of (1) the physical environment, (2) the benthic community and (3) the fish community. The benthic data and coral health are updated in each annual report, whereas the fish summaries and physical data are updated periodically.

Benthic community structure is presented as the mean ($\pm$ SE) cover of coral, macroalgae, cyanobacteria, and epilithic algae. Epilithic algal communities are diminutive turf and filamentous algae that cover hardbottom surfaces, whilst macroalgae have identifiable thallus differentiation and structure. Any open hardbottom space is assumed to host an epilithic algal community even if algae cannot be resolved in video images. The loss of coral cover due to the 2005 bleaching event was calculated as the relative change in coral cover from 2005 to 2007, unless otherwise noted for sites not sampled in these years. In addition, the percent recovery from the 2005 bleaching event was calculated as the amount of coral cover regained by 2011 $(\text{Cover}_{2011} - \text{Cover}_{2007})/(\text{Cover}_{2005} - \text{Cover}_{2007})$. Change calculations must be treated with caution for sites where transects were not made

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permanent until after the 2005 bleaching event or where percent cover is low, since the conditions introduce an unknown amount of error.

Benthic community pie charts were constructed from all years of data. The sessile epibenthic animal community includes *Agaricia* spp., *Colpophyllia natans*, *Diploria strigosa*, *Orbicella*¹ spp. (*O. faveolata*, *O. franksi*, + unidentified *Orbicella* spp.), *Orbicella annularis*, *Montastraea cavernosa*, *Porites astreoides*, branching *Porites* species, *Siderastrea siderea*, other corals, sponges, gorgonians. The algae/non-living substrata category includes cyanobacteria, epilithic algae (“DCA”), *Lobophora variegata*, *Dictyota* spp., *Halimeda* spp. crustose coralline algae, and sand/sediment.

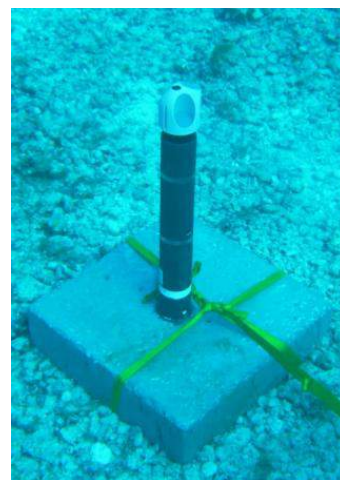
Coral Health is presented as the mean ($\pm$ SE) of coral bleaching prevalence (proportion of population affected) and extent (proportion of colony affected), disease prevalence, and partial mortality prevalence.

PHYSICAL CHARACTERISTICS.

Temperature. Benthic

temperatures were recorded at each site with a HoboTemp™ thermistor data logger (Onset

Computer Corporation, Bourne, Massachusetts). Thermistors were affixed within transects and set to record at intervals of 15 minutes. Records are presented as daily averages across months, February 29th excluded. Each temperature figure includes the climatological monthly maximum mean temperature (28.5°C), and the bleaching threshold temperature (29.5°C) established for the region (NOAA 2006). Data for 2005 was taken from current profilers or federal data sources.



Currents. Water currents were recorded at a subset of sites and

¹ The genus *Orbicella* was formerly named *Montastraea*, but changed in 2012 reflecting an earlier precedence and dissimilarity with *Montastraea cavernosa* (Budd et al. 2012). Some figures in this report may still abbreviate the genus name as “M.”

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times with Nortek Aquadopp™ Acoustic Doppler Current Profilers (ADCPs). Profilers were set in bases on the seafloor and set to record current speed and direction within predefined depth bins above the substrate. The bin closest to the substrate and closest to the coral reef was selected for display. Compass rose figures were developed that show the frequency of current in magnetic directions 0, 22.5, 45, 67.5, 90, 112.5, 135, 157.5, 180, 202.5, 225, 247.5, 270, 292.5, 315, 337.5, 360°. Within each direction the frequency of current speed within bins of 0.1 m s⁻¹ were plotted. For Flat Cay, current data was retrieved with an Aandaraa 2-D current meter that measured current speed and direction directly over the sensor head.

Chlorophyll and Turbidity. Continuous fluorometric measurements of chlorophyll and turbidity were conducted at some sites for short periods (Black Point, Grammanik, Magens Bay). Wetlabs ECOFLNT fluorometers with antifouling bio-wipers were deployed and set to record for one minute at hourly intervals. Water column chlorophyll measurements detect phytoplankton abundance. Fluorometric measurements of chlorophyll are proxies for true chlorophyll concentrations. Direct chlorophyll measurements to calibrate fluorometric measurements have not been conducted at the monitoring sites.

St. John

SITE SUMMARIES

CORAL BAY

Description. The Coral Bay site is atop a patch reef complex at the southeast mouth of Coral Harbor. The reef is a low carbonate build up with high coral diversity. Black Point appears to be a true reef with a well-developed carbonate framework over bedrock. Coral Bay monitoring was initiated in 2011 with two sampling periods.

Outstanding Feature. Coral Bay supports a high diversity of coral and an apparent high rate of coral recruitment.

Threats. Coral Bay is subject to land-based sources of pollution, primarily as sediment influx from the large and steep Coral Bay watershed. Recent restoration activities in the watershed are expected to decrease the sediment influx. Coral Bay may also be threatened by maritime activities within Coral Harbor. Proximity to land makes this site in territorial waters potentially vulnerable to fishing.

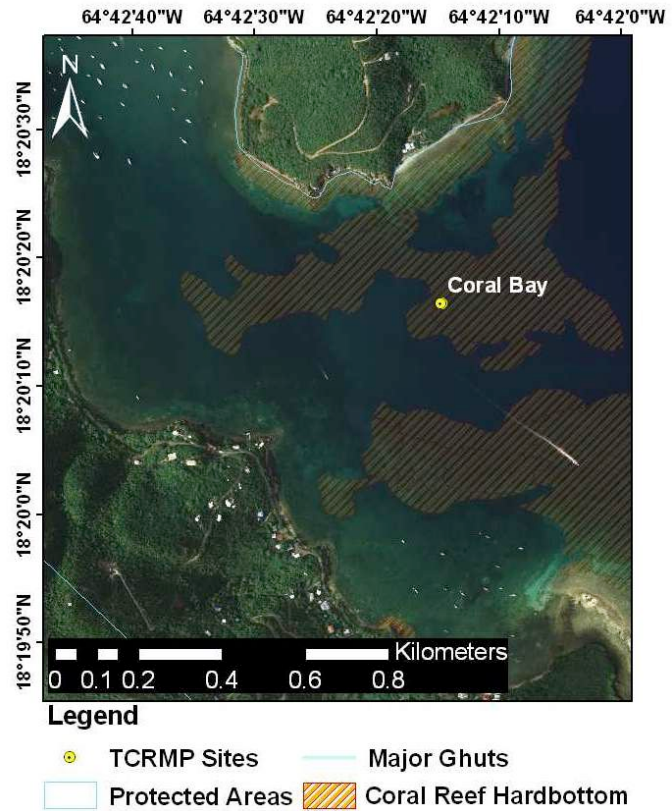
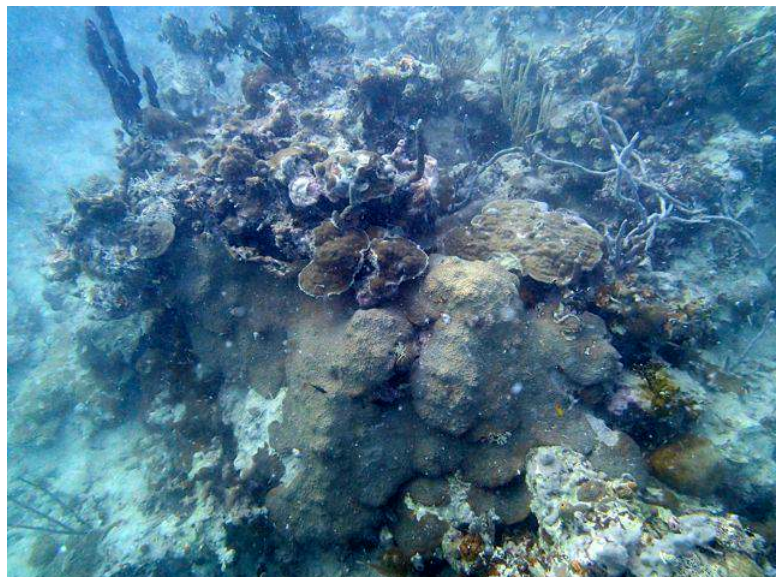


Figure 85. Coral Bay. (top) Location. (right) A representative photo of the reef.



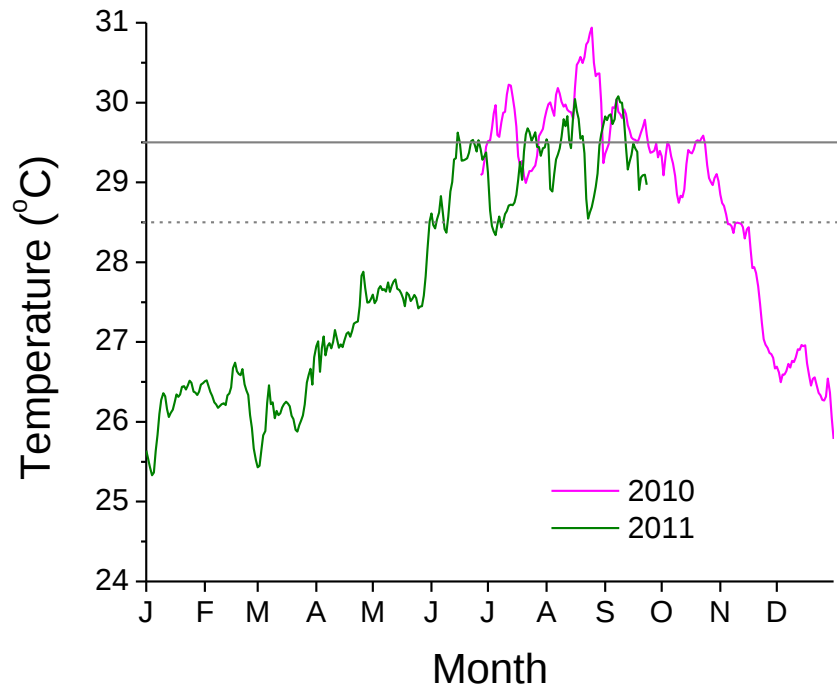


Figure 86. Coral Bay benthic temperature (9 m depth)

Physical Characteristics.

Current. Currents have not been measured by the TCRMP, however, Dr. Sarah Gray (University of San Diego) has measured 2-D near bottom measurements for some years between 2009-2011. Oscillatory currents are expected to be light and only weak unidirectional currents have been experienced.

Temperature. Coral Bay may have restricted water circulation and had very high temperatures during the 2010 bleaching event.

Other. This site and the wider Coral Bay area have been under investigation for land-based sources of pollution impacts since 2009. Projects have been involved terrestrial sediment measurement/modeling, marine sediment flux, coral demographic plots, and biological monitoring. The area has also been involved in water quality monitoring.

SITE SUMMARIES

Benthic Community. Coral Bay has a very diverse coral community, with no clear dominance of cover. In contrast to most sites, the mustard hill coral *Porites astreoides* has the greatest cover among coral species. Sponges and gorgonians are also very common at this site. The algal community is dominated by epilithic algae and a high abundance of crustose coralline algae, with very low abundance of macroalgae. This is surprising at this turbid reef site that likely receives high inputs of particulate and dissolved nutrient sources, and indicates that grazing is quite high. Although fish communities will not be assessed until 2012, there is not a high abundance of herbivorous fish and only the occasional occurrence of *Diadema antillarum*. However, there is a great abundance of the rock boring urchin *Echinometra* spp. that appears to be the dominant grazer. This genus is not monitored in TCRMP protocols, but perhaps should be included in future years.

Coral Health. It is not known how corals were affected by bleaching in 2005. There was a low prevalence of low extent bleaching in 2011. Diseases were not recorded in 2011. Old partial mortality prevalence was low in 2011, but this may partly be explained by the high abundance of small coral colonies that are less prone old partial mortality. Recent mortality had low prevalence in 2011.

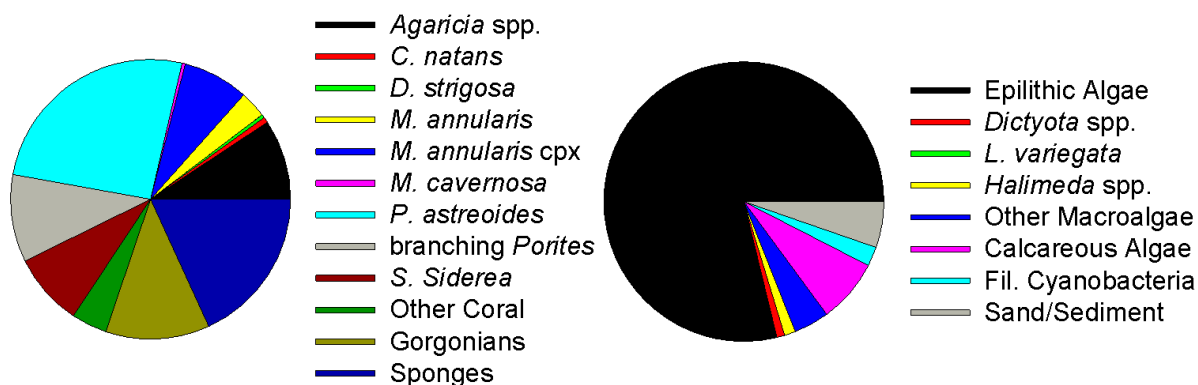


Figure 87. Coral Bay (left) Relative composition of the sessile epibenthic animal community. (right) Relative composition of the algal community and unconsolidated sediment.

CORAL BAY

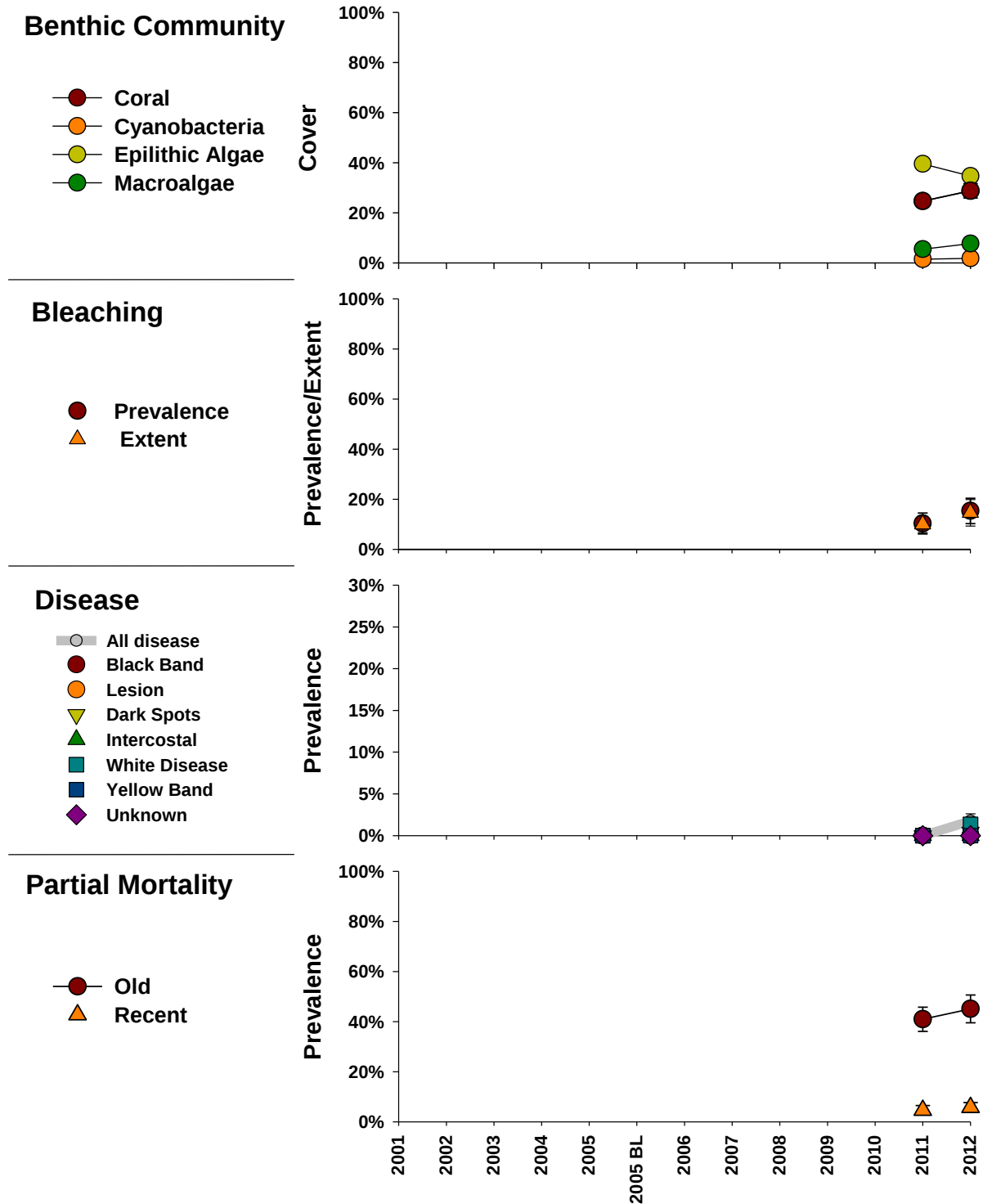
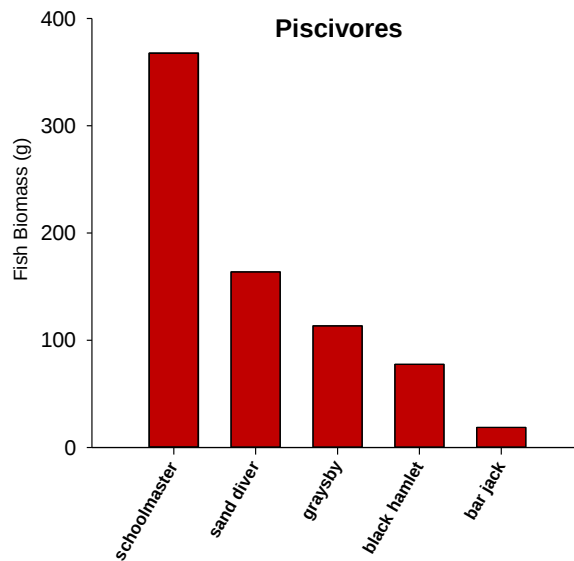
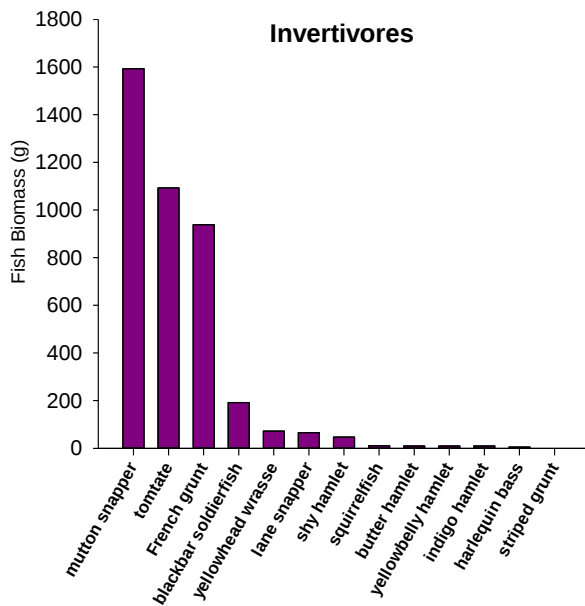
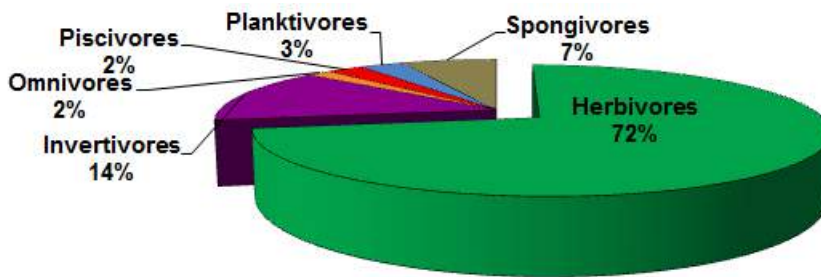
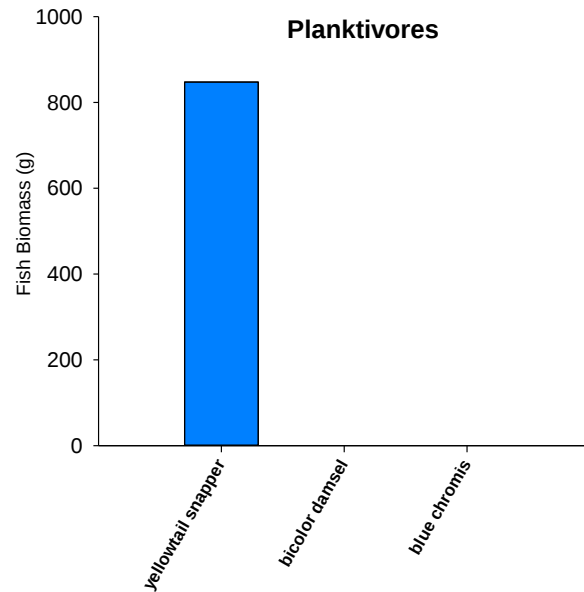
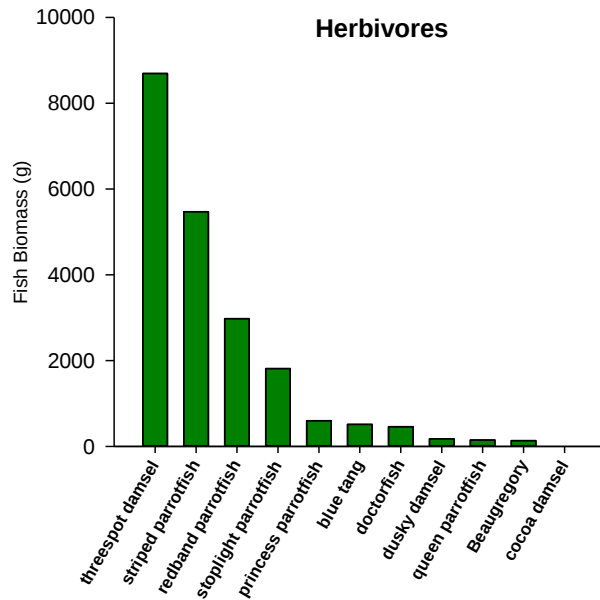


Figure 88. Coral Bay benthic cover and coral health through time (mean $\pm$ SE).

SITE SUMMARIES

Fish Community. The Coral Bay site is relatively low in fish diversity, biomass and abundance. Although epilithic algae is prolific, large grazers are nearly absent. Three spot damselfish dominate the group in both abundance and biomass. In 2012 planktivores in the high turbidity habitat were limited to a few juvenile yellowtail snapper and pomocentrids. Although benthic invertivores were more prolific and diverse, only a few individuals comprised each species group. Likewise piscivores had a very low biomass and were limited to a few individuals, most notably the schoolmaster snapper.

CORAL BAY



SITE SUMMARIES

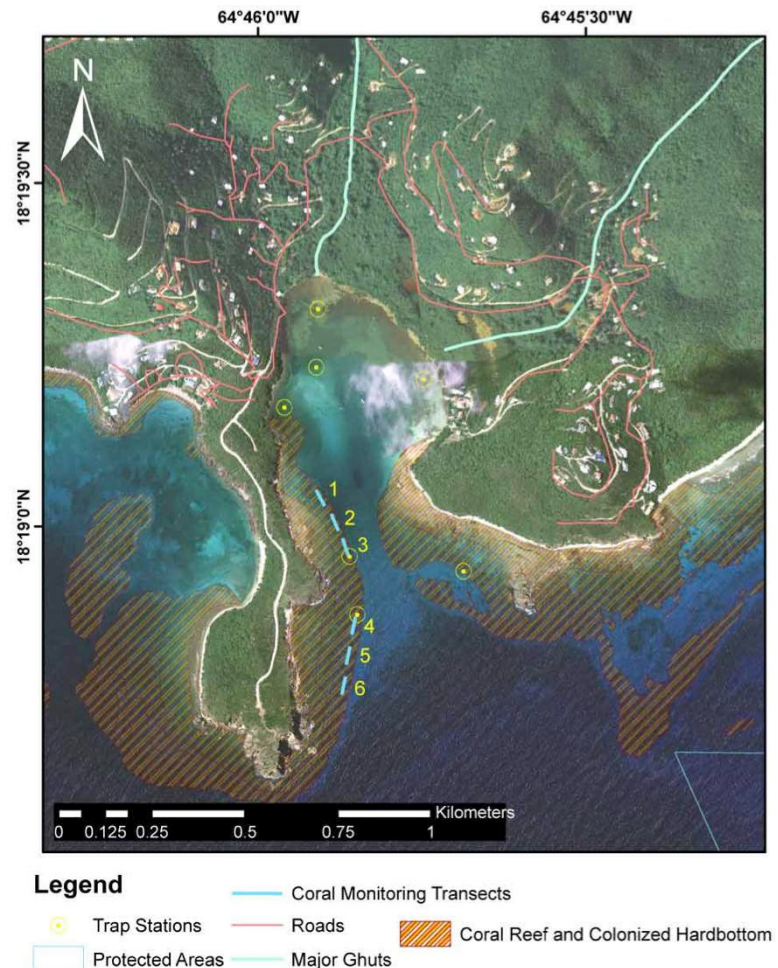
FISH BAY

Description. Fish Bay is a nearshore Fringing Reef in territorial waters. The monitoring site is a sharp edge of a shallow water coral community dropping to sand at 7 m depth. The site has been monitored since 2001.

Outstanding Feature. Fish Bay inner transects (1 – 3) are heavily sediment impacted, which outer transects (4-6) support large boulder star corals (*Orbicella faveolata*).

Threats. Fish Bay subjected to land-based sources of pollution and tends to have turbid water and overgrowth by macroalgae on inner transects. This site may also be vulnerable to fishing impacts.

Figure 89. Coral Bay. (top) Location. (right) A representative photo of the reef.



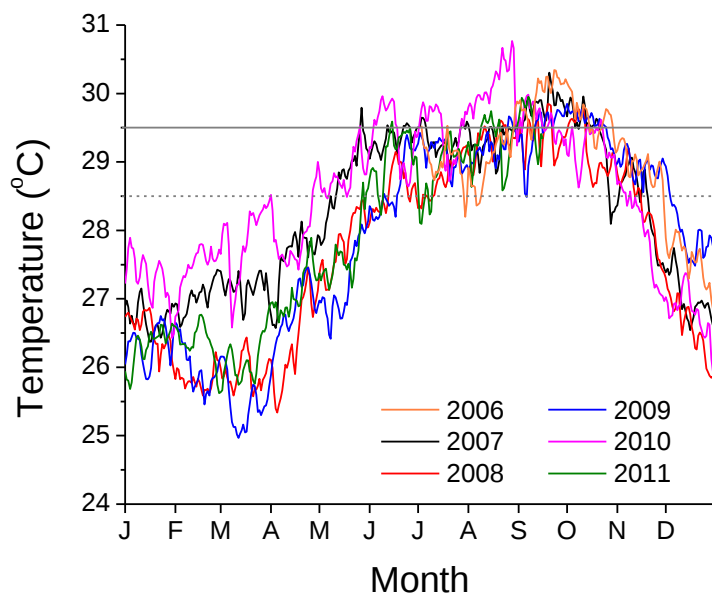


Figure 90. Fish Bay benthic temperature record (6m depth).

Physical Characteristics.

Current. Fish Bay currents have not been measured directly by the TCRMP. Unidirectional currents are mild to slack. Because of the southeast exposure, wave driven oscillatory currents can be quite intense, particularly on the outer transects.

Temperature. Fish Bay has relatively high mean temperatures and was very far over the local bleaching threshold in 2010.

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Benthic Community. The coral community of Fish Bay is dominated by the boulder star coral *Orbicella* spp.. In particular, large (>2m wide) colonies of *O. faveolata* are common on the seaward transects (4-6). The inner transects (1-3) are mostly depauperate of coral (< 4% cover as of 2011). The site lost 37.1% of its cover due to the 2005 coral bleaching event, but had regained 136.1% of cover by 2011. Gorgonians are also very common on the wave-washed outer transects. The algal community is dominated by equal parts epilithic algae and the macroalgae *Dictyota* spp. The site also has a high abundance of *Halimeda opuntia*, which can be very abundant on inner transects closest to land-based sources of pollution.

Coral Health. Fish Bay corals were very severely affected in the 2005 with 100% of corals showing almost 100% bleaching. Bleaching is also normally high at this site even in years without thermal stress, a likely consequence of sediment and macroalgal interactions. Diseases, particularly dark spots disease and white disease can have very high prevalence at Fish Bay. Old partial mortality did increase after the 2005 coral bleaching event, with a decline in 2010 and resurgence in 2011. Recent partial mortality can also be relatively high compared with other sites, largely as the results of bites from site-attached damselfish (*Stegastes* spp.).

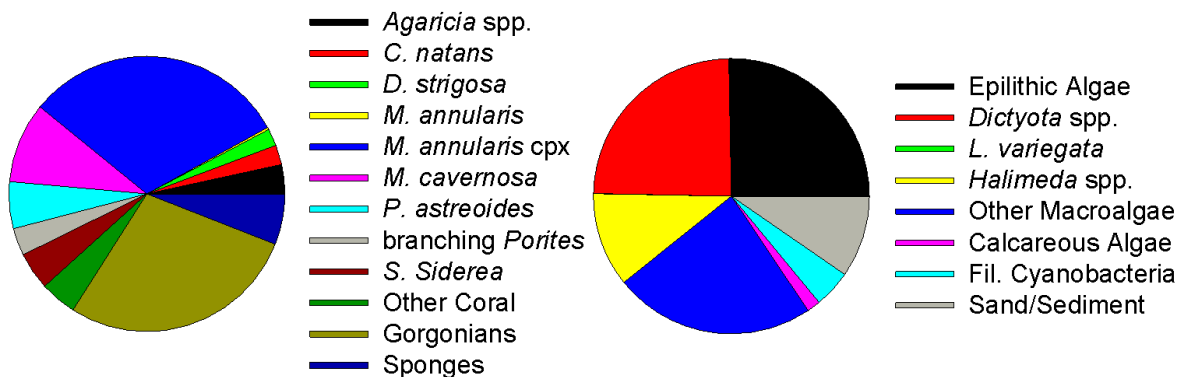


Figure 91. Fish Bay (left) Relative composition of the sessile epibenthic animal community. (right) Relative composition of the algal community and unconsolidated sediment.

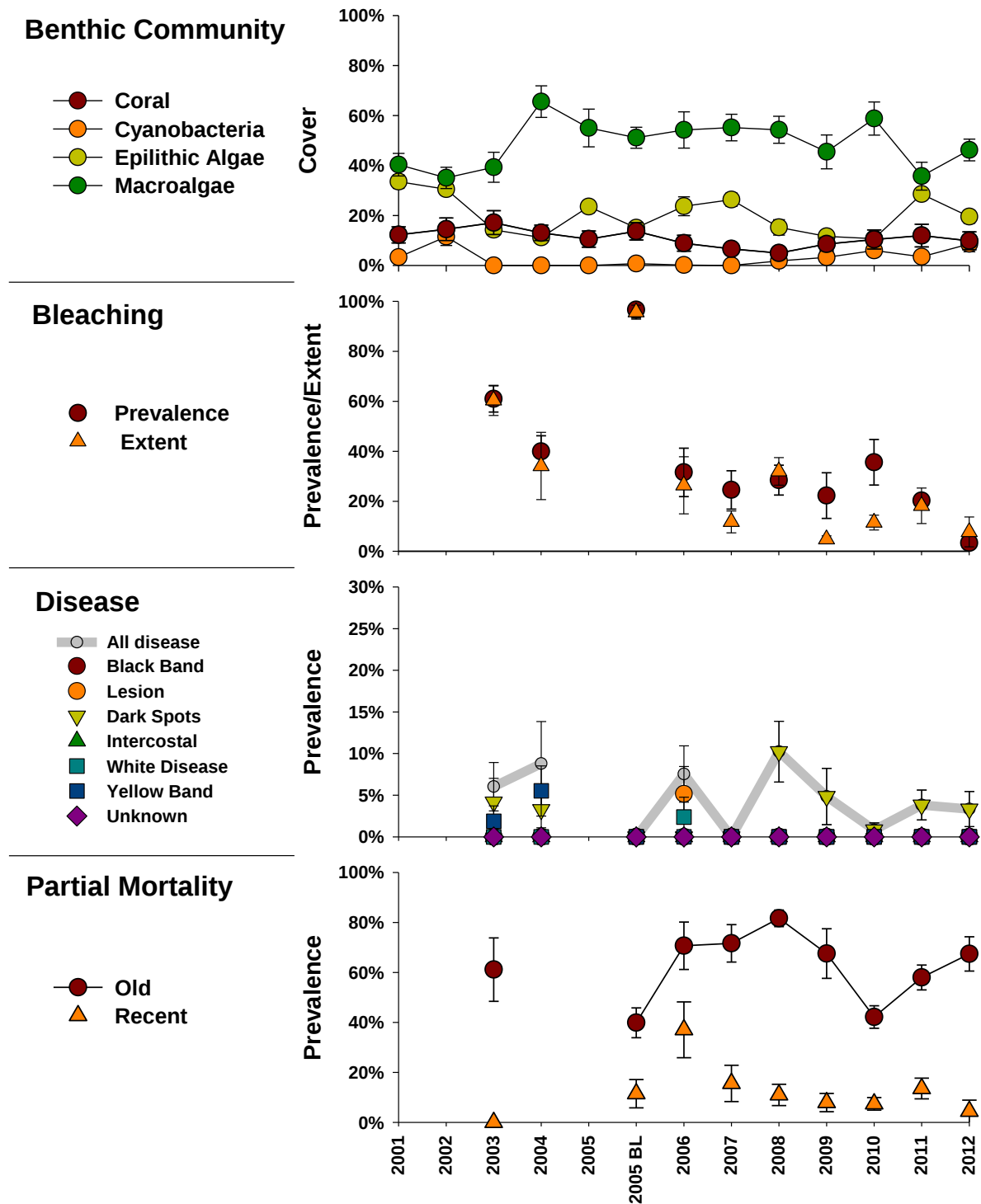
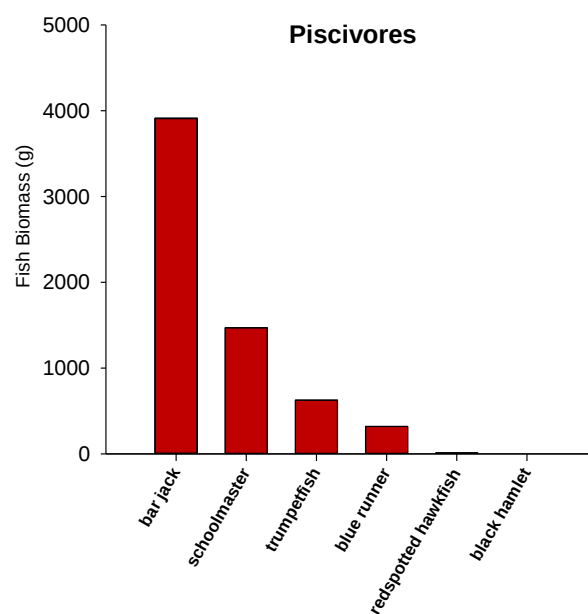
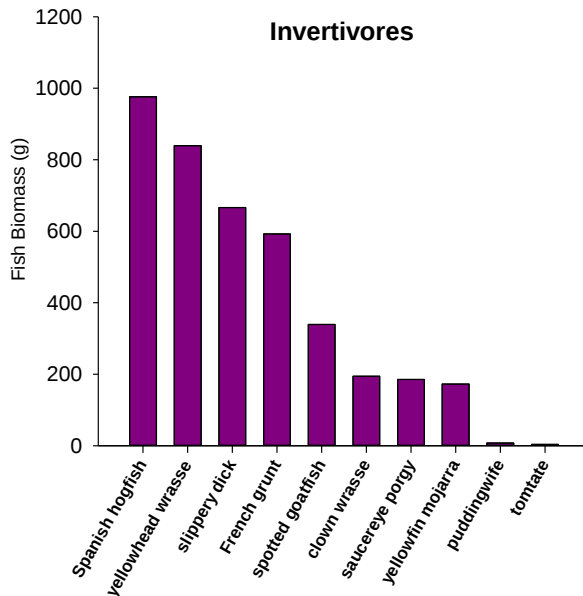
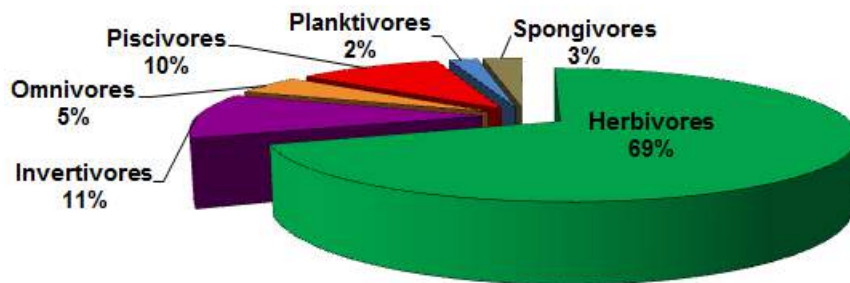
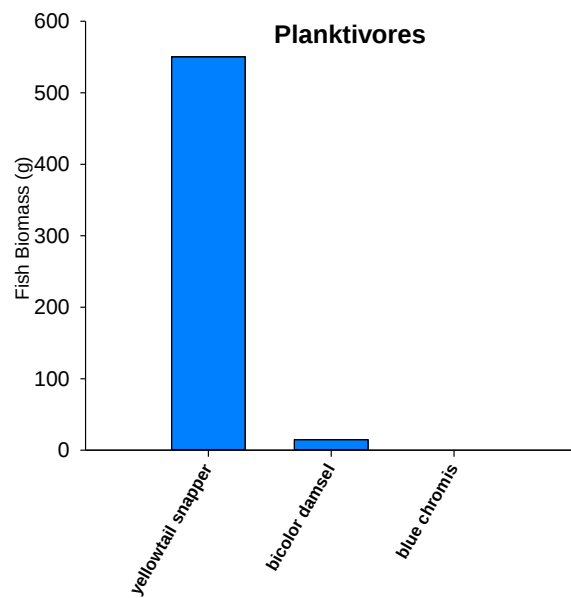
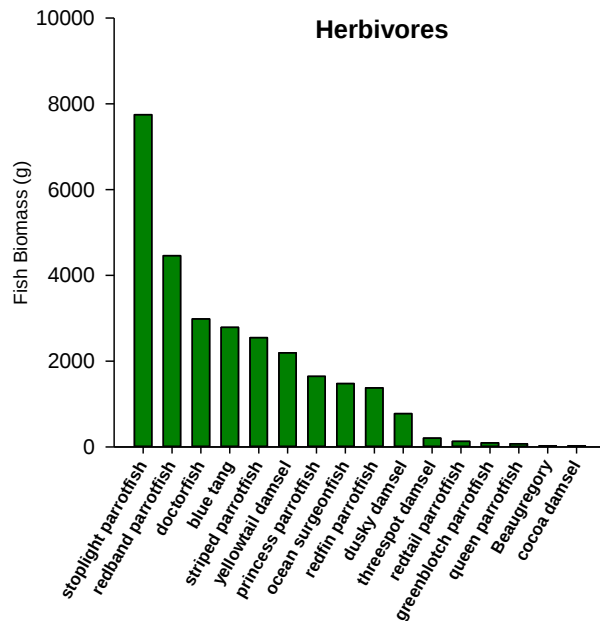


Figure 92. Fish Bay benthic cover and coral health through time (mean $\pm$ SE).

SITE SUMMARIES

Fish Community. The Fish Bay fish community is typical of a nearshore reef habitat that receives moderate to heavy sedimentation. The site is dominated by herbivores that include all of the common Caribbean parrotfishes, large schools of mixed acanthurids and herbivorous pomocentrids. Planktivores in the turbid water are limited to juvenile yellowtail snapper and a few small pomocentrids. Benthic invertivores and piscivores are slightly more diverse and abundant but are dominated by wrasses and jacks respectively. Large serranids and lutjanids are absent from Fish Bay although occasional juvenile lemon sharks are seen in the murky water, where adult females are known to pup.

FISH BAY



SITE SUMMARIES

MERI SHOAL

Description. Meri Shoal is an offshore mesophotic coral bank 30 m depth. The reef is located four miles south of St. John and is on the southernmost of two impressive midshelf coral banks. The reef is dominated by interlocking colonies of boulder star corals (*Orbicella* spp.). The reef top is very flat coral plain. The site is named for Dr. Meri Whitaker, former director of the VI EPSCoR Program who passed away in 2009. Meri Shoal has been monitored since 2005.

Outstanding Feature. Meri Shoal has the highest star coral abundance of any site in the TCRMP and is bathed in clear, clean water.

Threats. Meri Shoal is vulnerable to fishing impacts, as it is outside any marine protected area. The high density of corals may make this sight vulnerable to disease impacts.

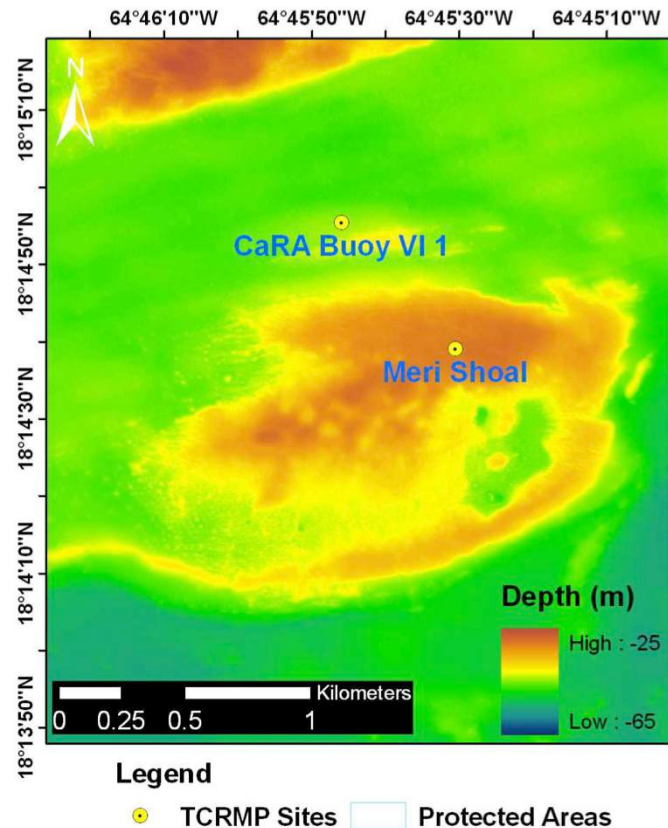


Figure 93. Meri Shoal. (top) Location. (right) A representative photo of the reef during the 2005 coral bleaching event (Oct. 6, 2005). The brain coral in the foreground is 1.8m wide.



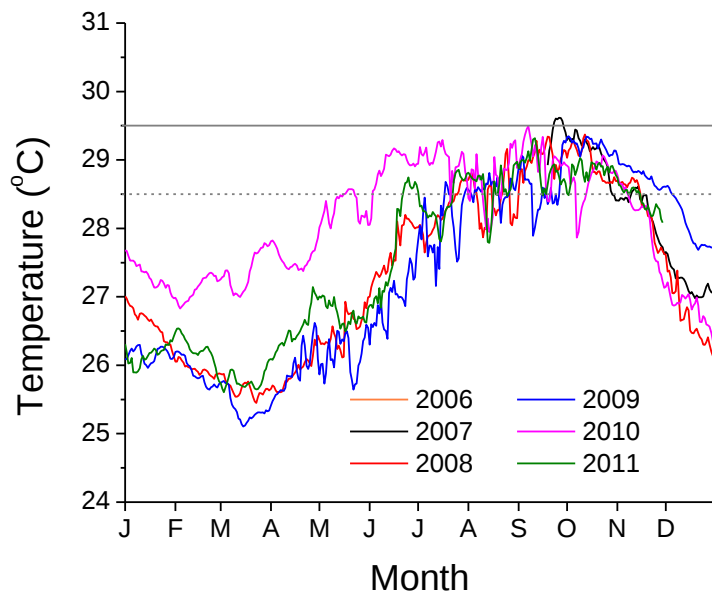


Figure 94. Meri Shoal benthic temperature record (30m depth).

Physical Characteristics.

Current. Currents have not been measured directly at the Meri Shoal site, although the Caribbean Regional Association buoy VI 1 is located within 700 m and its downward focused ADCP has been recording data since April 2011.

Temperature. Black Point has low circulation and relatively high mean temperatures with very low day to day variability.

SITE SUMMARIES

Benthic Community. The Meri Shoal site is exceptional for its domination by boulder star corals (*Orbicella* spp.). Cover of this and other coral species was exceptionally high when the site was first monitored during the 2005 coral bleaching event, but declined by 36.0% after bleaching and had not recovered any cover as of 2011 (-9.6%). Surprisingly given the high coral cover, the algal community is dominated by *Lobophora variegata* and not epilithic algae and there has been a trend of increasing macroalgal cover since 2008.

Coral Health. Coral bleaching was relatively high for a mesophotic site during the coral bleaching event in 2005. Bleaching was again at high prevalence, but low extent in the thermal stress of 2010. However, low-extent bleaching at moderate prevalence is a persistent feature of Meri Shoal. Disease, particularly white disease and lesions that are likely the remnants of white disease, are highly prevalent, particularly in years following high thermal anomalies, such as 2006 and 2011. Old partial mortality climbed steeply from the 2005 coral bleaching event onwards and reached very high levels by 2006. Recent partial mortality has also been consistently high as the result of white disease and disease lesions.

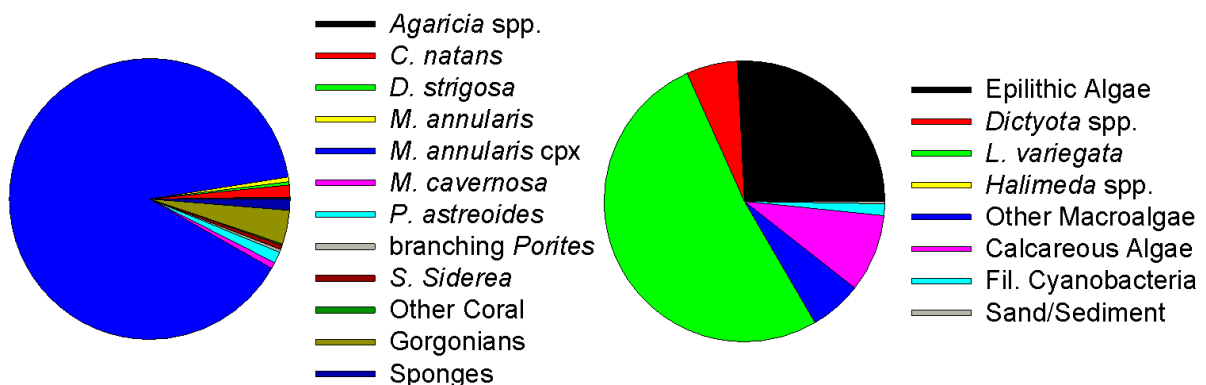


Figure 95. Meri Shoal (left) Relative composition of the sessile epibenthic animal community. (right) Relative composition of the algal community and unconsolidated sediment.

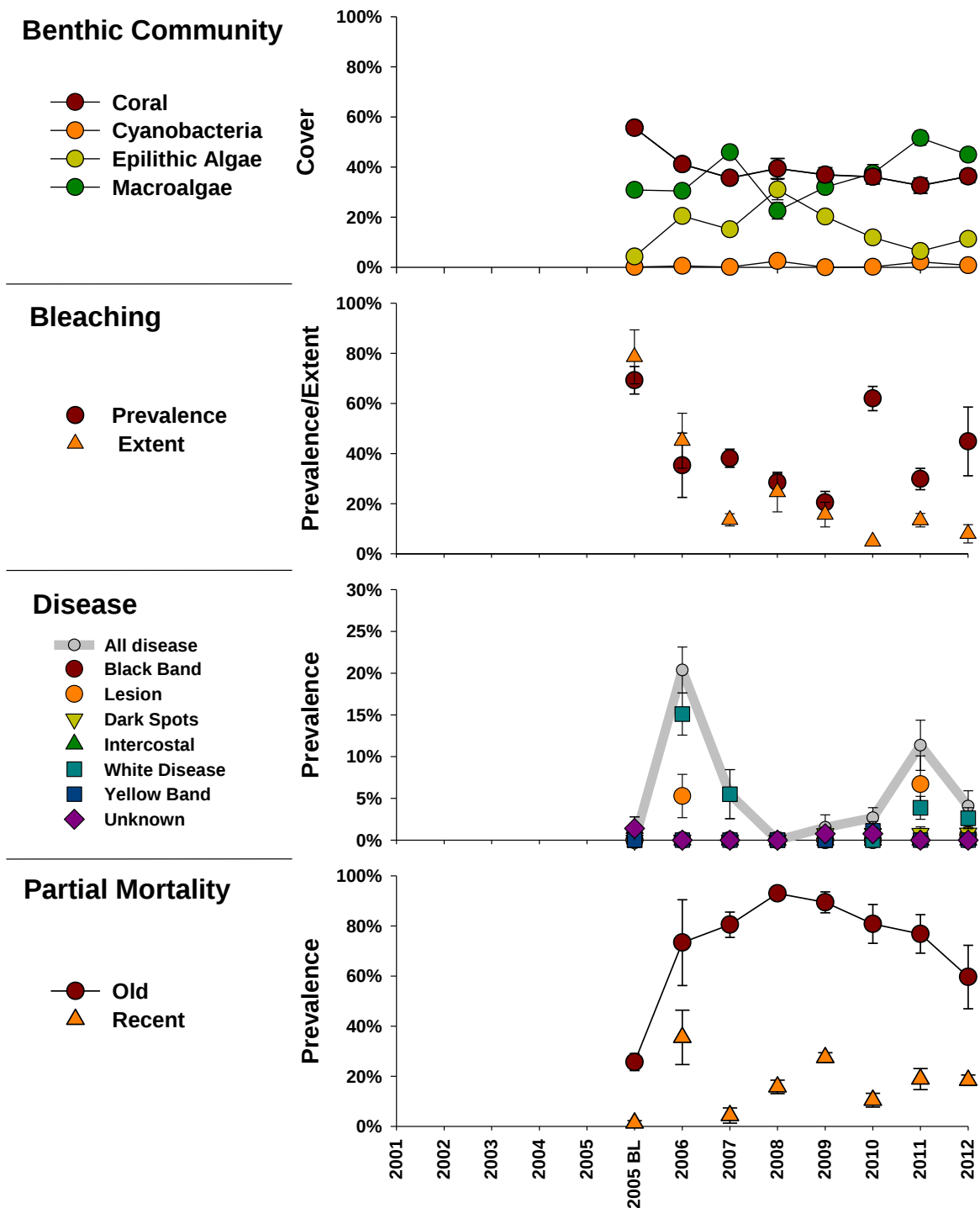


Figure 96. Meri Shoal benthic cover and coral health through time (mean $\pm$ SE).

SITE SUMMARIES

Fish Community. Meri Shoal is a beautiful site in deep water on the mid-shelf off St. John, and holds a dynamic fish community of high biomass. Important planktivores include the very prolific creole wrasse, feeding on tiny jellyfish, invertivore larvae and phytoplankton, and the black surgeon, primarily a zooplankton feeder. Herbivores observed on the site include large stoplight parrotfish, all of the common smaller parrotfish, and all three acanthurids. Queen triggerfish and red hind are both common. In 2012 a tiger grouper was observed on a belt transect and another on a roving dive. A Nassau grouper was also observed on a roving dive. These are exciting encounters as the site is not near a spawning aggregation area and is not protected from traps or any type of fishing. Jacks, mackerals and barracuda are also regularly observed in the water column at Meri Shoal.

MERI SHOAL

