

St. Thomas

SITE SUMMARIES

BLACK POINT

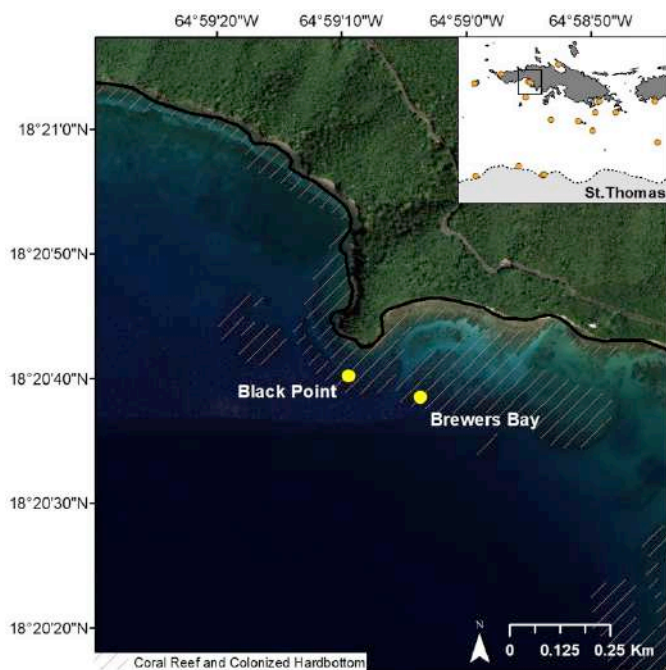
Description. Black Point is a nearshore fringing reef located at the mouth of Brewers Bay along the southwest coast of St. Thomas in water depths of 7 – 17 m. The reef has a sharp break in slope leading to a steep escarpment that terminates in a sediment plain at the reef base. Black Point appears to be a true reef with a well-developed carbonate framework over bedrock.

Black Point has been monitored since 2003, with permanent benthic transects installed in 2007. A ciguatera fish poisoning study with monthly sampling has been ongoing since 2009.

Outstanding Feature. Black Point supports a fish spawning aggregation of striped parrotfish (*Scarus iserti*) with daily afternoon mating at the edge of the upper reef break.

Threats. Black Point is subjected to land-based sources of pollution and tends to have turbid water and overgrowth by heterotrophic organisms, such as sponges. Recreational/artisanal fishers with handline and spear frequently fish this site.

Figure 101. Black Point. (top) Location. (right) A representative photo of the reef.



SITE SUMMARIES

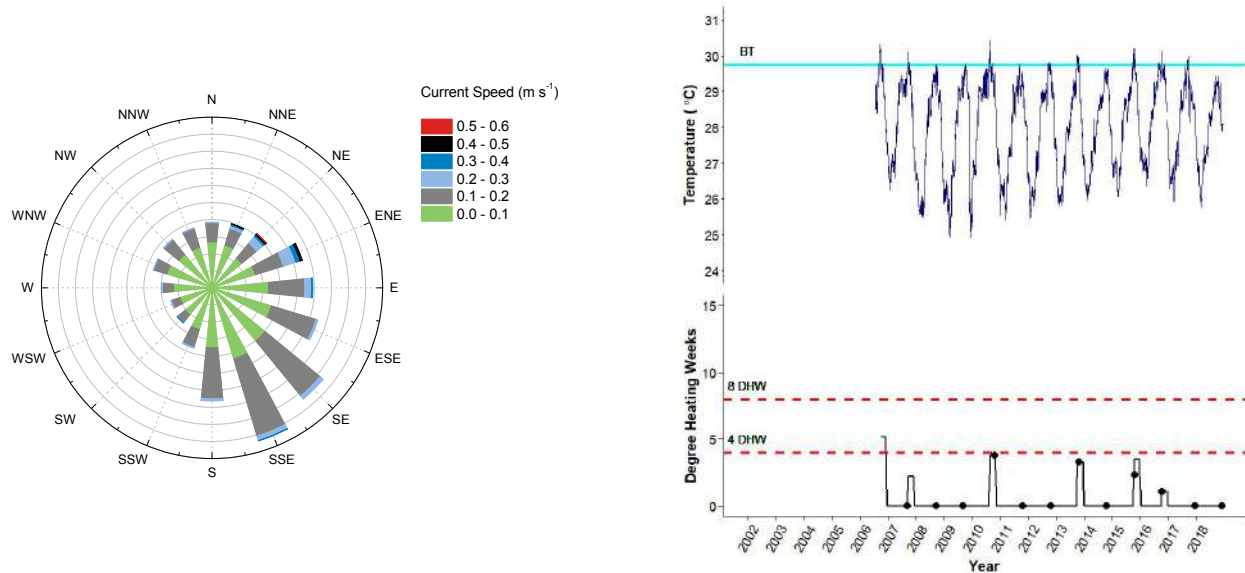


Figure 102. Black point current speed and benthic temperature record (8 m depth).

Physical Characteristics.

Current. Black Point has restricted water flow dominated by weak currents running counter or orthogonally to the left of the dominant wind direction. This may indicate that there is a counter flowing eddy from Perseverance Bay to the west that impinges on the headland. Current data are based on average data taken every 30 min. (11/29/06 to 3/1/2007) and hourly (4/19/07 to 9/5/07).

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

SITE SUMMARIES

Chlorophyll & Turbidity. Chlorophyll tends to be high at Black Point, likely due to inputs of land-based nutrients that fuel pelagic productivity. There also exists a very prominent tidal signature that reflects switching source currents at the reef.

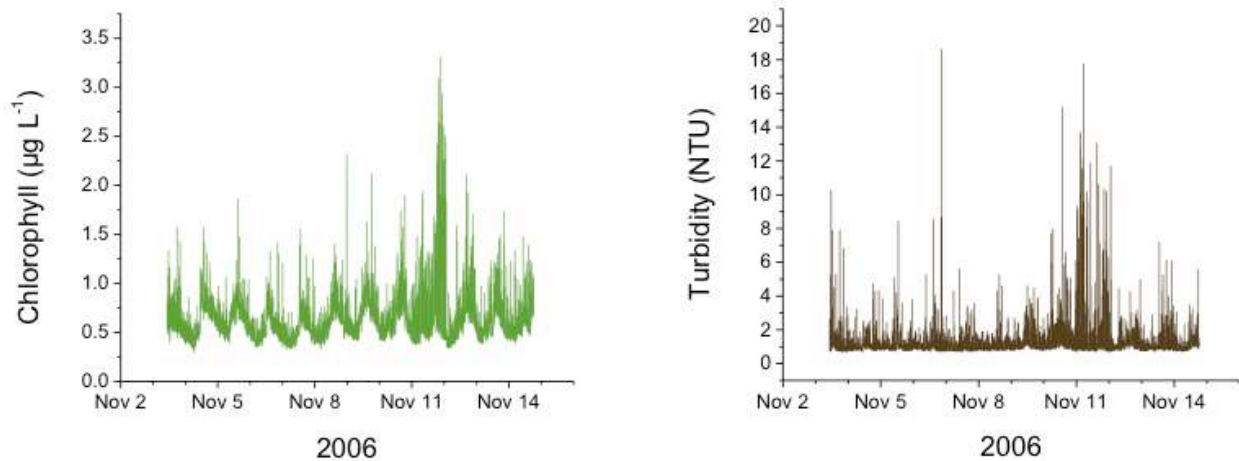


Figure 103. Black Point chlorophyll (left) and turbidity (right) record (16 m depth).

SITE SUMMARIES

Benthic Community. Black Point supports a very diverse coral community with very equal representation by many coral species. However, large colonies (> 100 cm diameter) of *Orbicella annularis* and *Orbicella faveolata* occur on the eastern edge of the site, with a few occurring within transects. This coral community lost 40.5% of its coral cover in the 2005 bleaching event; however, by 2011 it had regained 103.5% of its coral cover. The algal community at Black Point is co-dominated by epilithic algae and the macroalga *Dictyota* spp.

Coral Health. Black Point corals were severely affected during the 2005 bleaching event with nearly all colonies bleached over 100% of the colony surface. The prevalence of coral diseases was moderate with dark spots disease predominating. However, white disease outbreaks occurred at least twice over the sampling period. Old partial mortality became very prevalent after the 2005 coral bleaching event and subsided in the following two years.

SITE SUMMARIES

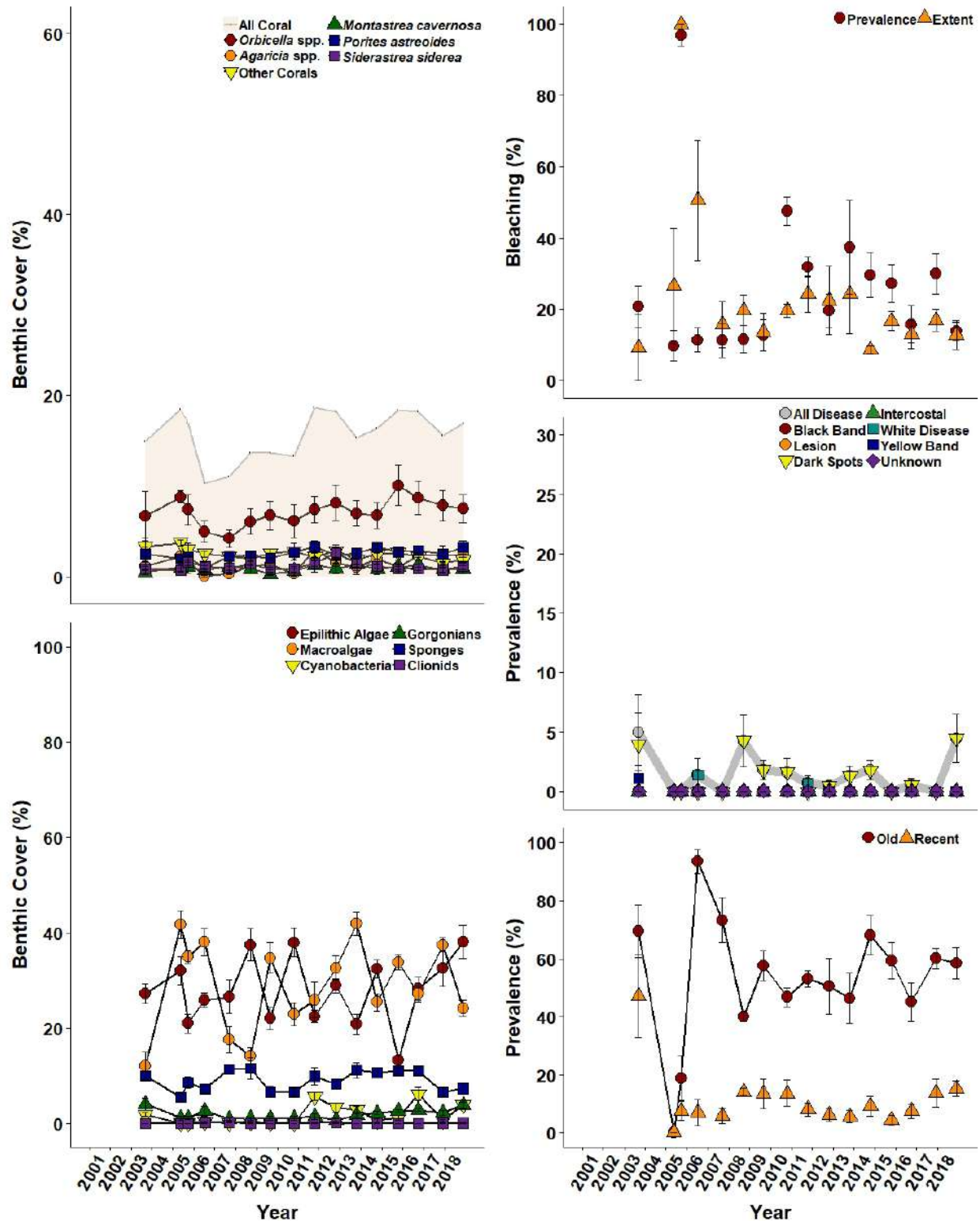


Figure 104. Black Point benthic cover and coral health through time (mean ± SE).

SITE SUMMARIES

Fish Community. Black Point fish abundance is highly dominated by herbivores. Juvenile parrotfish, wrasse and damselfish are numerous. Brown chromis and schools of creole wrasse are equally abundant in the turbid, plankton filled water. In 2018 a very large school of southern sennets shared the water column with these planktivores. The site holds very few large fish, although cubera snapper, Nassau grouper, and yellowfin grouper have been recorded in TCRMP surveys over the years. These rare fish are normally observed near the eastern edge of the site where the reef is undercut and caves have formed. Mutton snapper are seen regularly on roving dives, cruising the bottom of the reef where it meets the sand/hardbottom plain. Hamlets are especially diverse and numerous on Black Point. In the mid to late afternoon, striped parrotfish (*Scarus iserti*) spawn at the western end of the site. They can be seen swimming along the reef edge in large groups beginning in the early afternoon. Spawning goes in to the late afternoon and involves tens of fish. Black Point is close to shore and is not fished by commercial traps often; however, like Brewers Bay reef, divers can swim to the site from the public beach to spearfish. It is notably lacking resident large fish.

SITE SUMMARIES

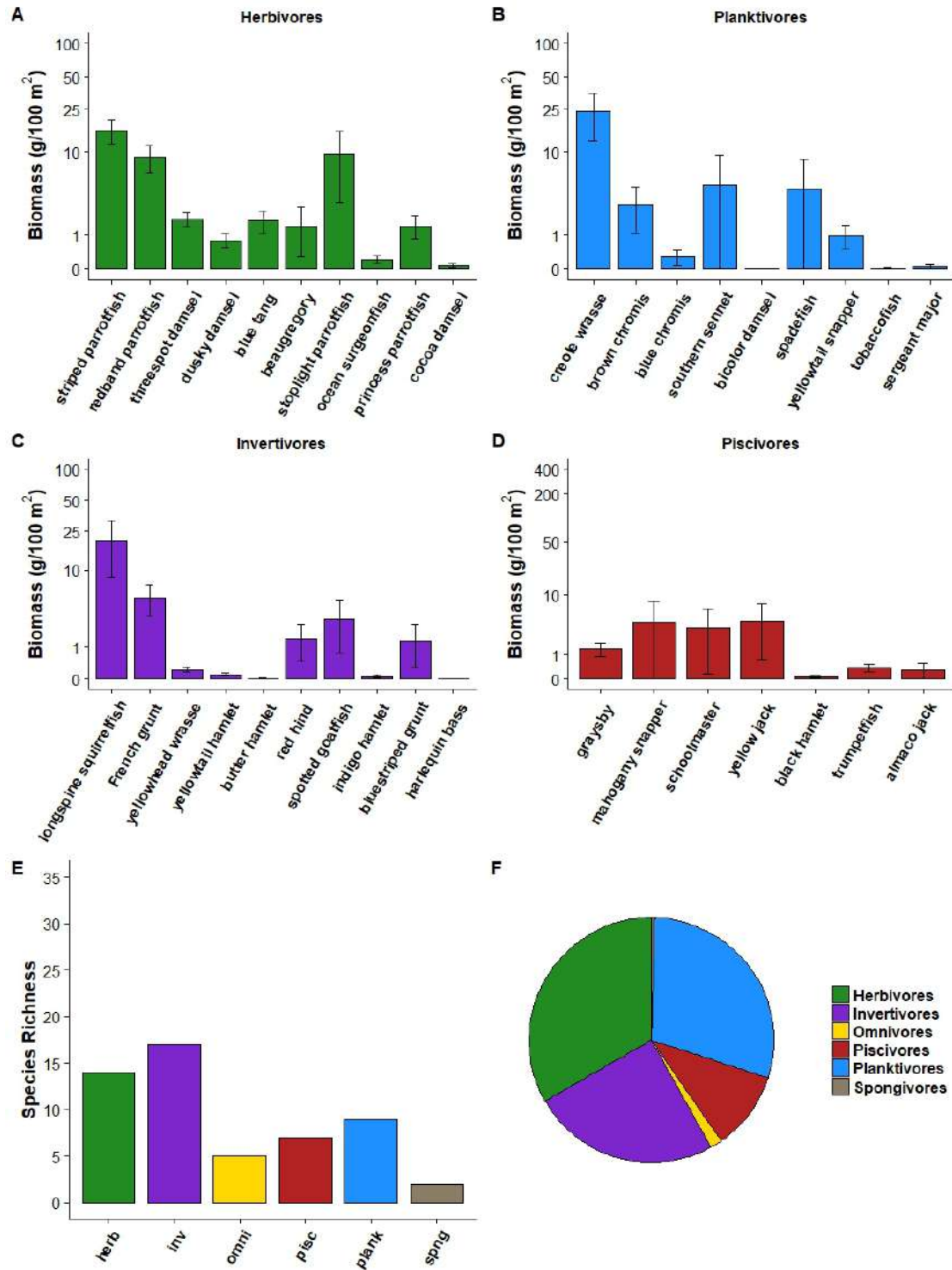


Figure 105. The Black Point fish community as (A-D) average biomass per trophic group with the most common species shown in order on the x-axis, (E) species richness, and (F) relative community composition by total biomass. Note that biomass is a log scale.

SITE SUMMARIES

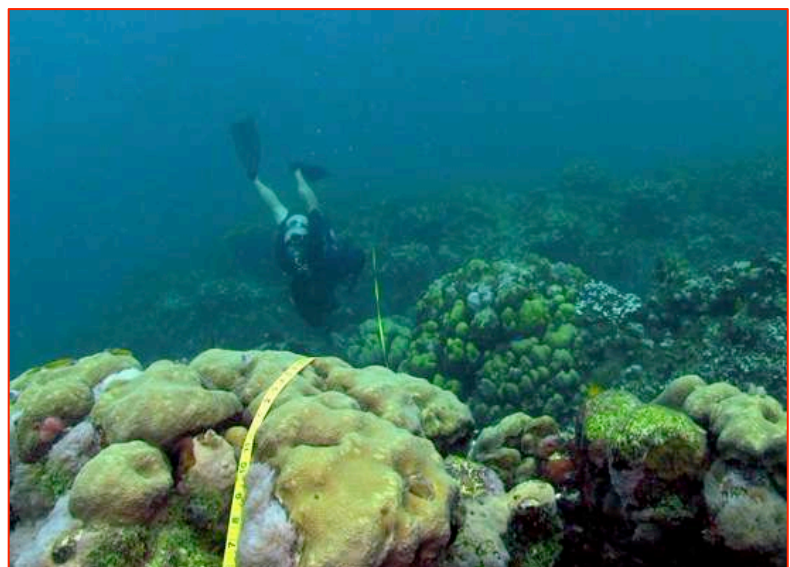
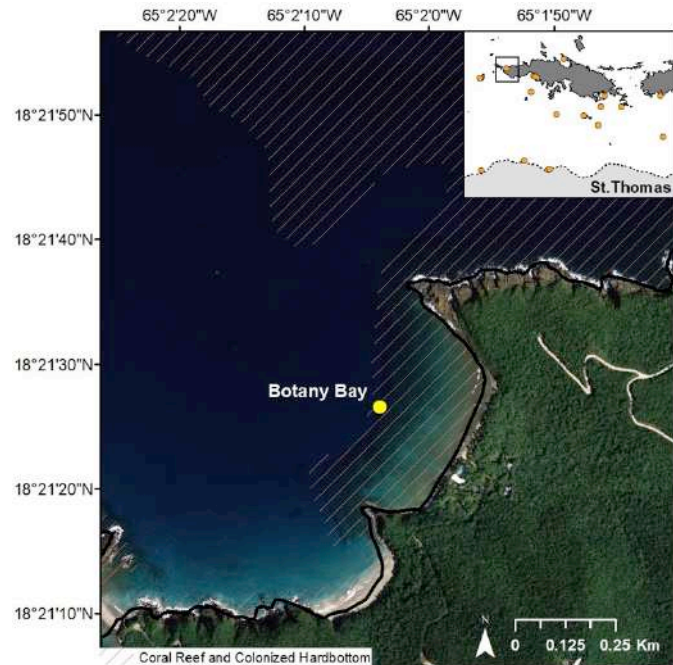
BOTANY BAY

Description. The Botany Bay site is located on the fore slope of a nearshore fringing reef in water depths of 5 – 17 m. The reef crest is a distinct spur-and-groove, with a sharp break in slope leading to an escarpment that terminates in a sand/sediment plain at the reef base. Botany Bay has been monitored since 2002.

Outstanding Feature. Botany Bay supports a diverse and productive reef that is one of the prettiest nearshore reefs in the Virgin Islands.

Threats. Botany Bay is threatened by development of the previously fully vegetated watershed and increased land-based sources of pollution. Cuts in the hillsides for construction of roads for luxury homes has left large areas without vegetation. The area is open to fishing. Increased residential development in the watershed may lead to increased recreational use of the reef, including fishing and collecting. The area is also occasionally impacted by large Atlantic swells, causing breakage of corals.

Figure 106. Botany Bay. (top) Location. (right) A representative photo of the reef.



SITE SUMMARIES

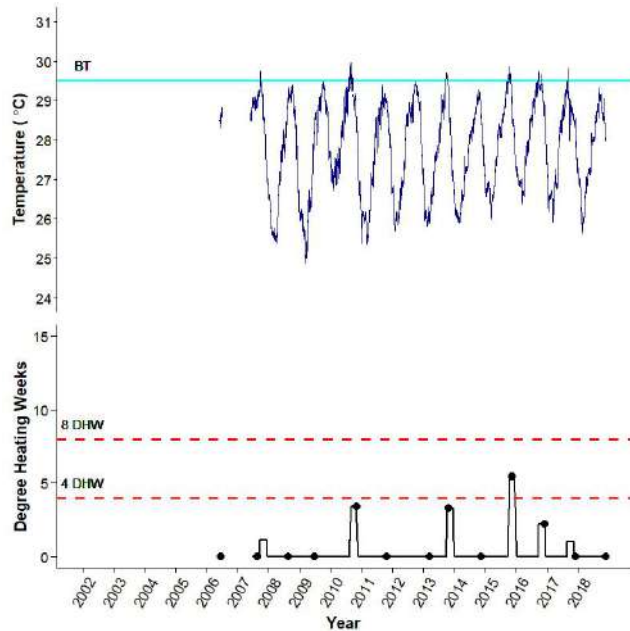


Figure 107. Botany Bay benthic temperature record (11 m depth).

Physical Characteristics.

Current. Currents have not been measured directly at Botany Bay. Unidirectional currents do not tend to be strong. Wave-driven oscillatory currents can impact the reef crest and fore reef. The site is vulnerable to impacts from large Atlantic swells. Many corals were broken and toppled during the 2009 March swell event when offshore swells reached heights to 4 m (Bright et al. 2016).

Temperature. Botany Bay tends to have slightly cooler temperatures than other nearshore sites, likely owing to its open position facing the Atlantic.

Figure 108. A large colony of pillar coral (*Dendrogyra cylindricus*) dislodge, toppled, and diseased after the 2009 swell event (Botany Bay, June 25, 2009).



SITE SUMMARIES

Benthic Community. The Botany Bay site coral community is unique for the dominance of branching *Porites porites*. The site lost 38.9% of its coral cover in the 2005 bleaching event and had regained 10.6% by 2011. However, Botany Bay was heavily impacted by the passage of Hurricane Irma just to the north of St. Thomas on September 6th, 2017. The *P. porites* fields were stripped and *Orbicella* spp. colonies were dislodged or removed. There is a high abundance of gorgonians on the seaward slope exposed to wave swell. The Botany Bay algal community is co-dominated by epilithic algae and the macroalga *Dictyota* spp., which tend to negatively covary.

Coral Health. Bleaching was extremely severe during 2005, with nearly 100% of corals bleached or pale over 100% of their surface. There was also a high prevalence of bleaching in 2002 at an unknown extent and in 2010 at a low extent. Non-thermal stress years have seen variable bleaching. Coral diseases can be high at Botany Bay, with a preponderance of white and dark spots diseases, and lesions that are likely related to white disease. Old partial mortality shows a pattern that is difficult to explain before 2005. During bleaching and afterwards consistent observers have done partial mortality assessments and this data is valid. There was a large increase in old partial mortality after the 2005 bleaching event, then some subsidence and leveling off after 2008. Recent partial mortality was high through most years of monitoring, largely due to biting by territorial damselfish (*Stegastes planifrons* and *S. adustus*; data not shown).

SITE SUMMARIES

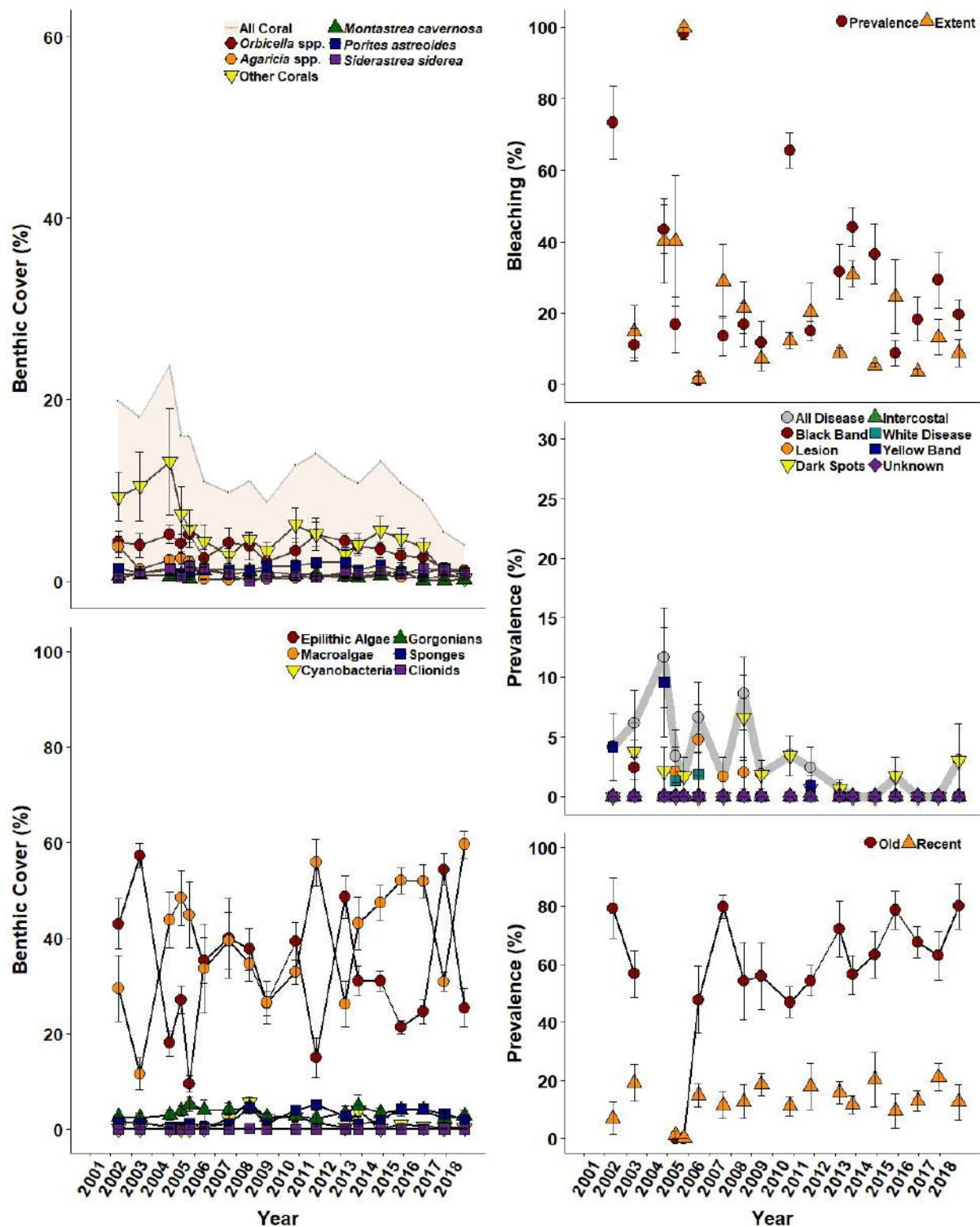


Figure 109. Botany Bay benthic cover and coral health through time (mean $\pm$ SE).

SITE SUMMARIES

Fish Community. The fish community at Botany Bay is fairly typical of well-developed nearshore reefs around St. Thomas. The site is dominated by herbivores, equally split between the four common nearshore parrotfish species (stoplight, queen, redband and striped). In recent years, fish diversity and biomass has declined in Botany Bay, probably due to the continued degradation of the reef. In 2017 however, a Nassau grouper were recorded at the site. Historically red hind and dog snapper contributed to the piscivore trophic guild, however in recent years the major piscivores have been limited to graysby, coney and bar jacks. Coney are especially numerous in Botany Bay. The abundance of yellowtail snapper has also declined, and planktivores are now limited primarily to small chromis and damselfishes. Grunts and wrasses are numerous and diverse at the site, utilizing the variety of resources available for invertivores. Similar to most of the nearshore reefs in the northern USVI's, large jacks and mackerels are nearly absent from the site.

SITE SUMMARIES

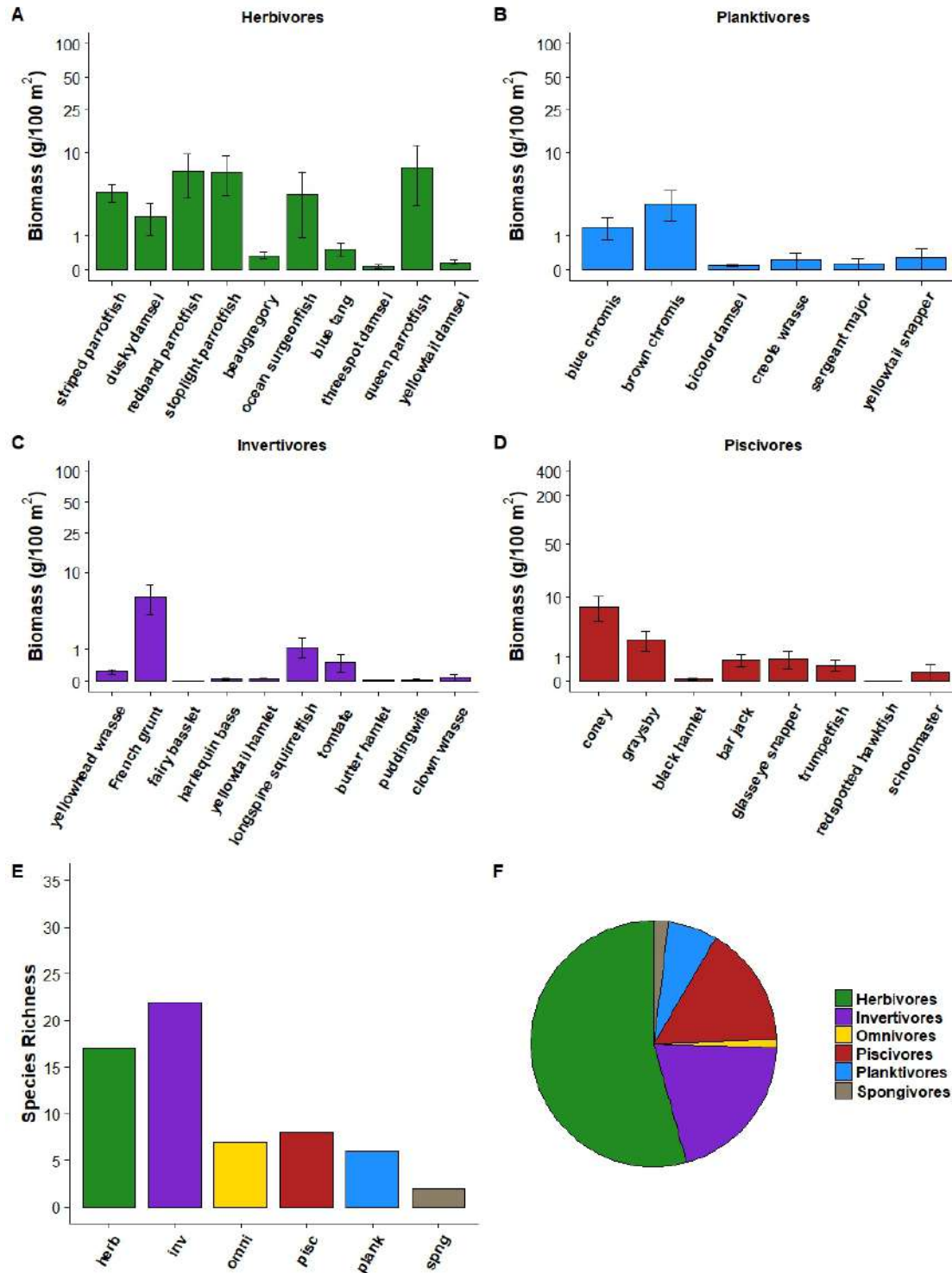
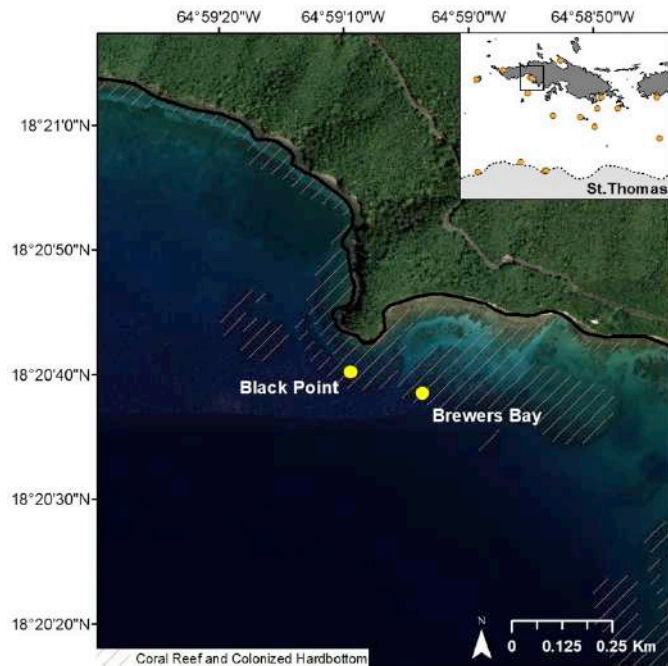


Figure 110. The Botany Bay fish community as (A-D) average biomass per trophic group with the most common species shown in order on the x-axis, (E) species richness, and (F) relative community composition by total biomass. Note that biomass is a log scale.

SITE SUMMARIES

BREWERS BAY

Description. Brewers Bay is a nearshore fringing reef located along the southwest coast of St. Thomas in water depths of 7 – 17 m. Brewers Bay is a very well developed boulder star coral (*Orbicella annularis*) dominated reef. Brewers Bay was initially monitored in 2002/2003, but was abandoned due to its proximity to the Black Point site. It was restarted in 2008 because it was resistant to the 2005 bleaching is one of the best preserved *O. annularis* reefs around St. Thomas.



Outstanding Feature. Brewers Bay is very good example of a nearshore boulder star coral fringing reef and has fared better than other reefs of this type over the 2005 mass coral bleaching event.

Threats. Brewers Bay is subjected to land-based sources of pollution and tends to have turbid water and overgrowth by heterotrophic organisms, such as sponges. Recreational/artisanal fishers frequently fish Brewers Bay with hand line and spear. The site has a great deal of marine debris, including boat hulls, rope, and metal pieces.

Figure 111. Brewers Bay. (top) Location. (right) A representative photo of the reef.



SITE SUMMARIES

Physical Characteristics.

Current. Brewers Bay currents have not been measured directly, but both unidirectional and oscillatory currents are usually very low in magnitude. See also the Black Point physical data, which was taken within 500 m distance.

Temperature. Brewers Bay temperatures have not been recorded directly, but see the Black Point temperature data from less than 300 m horizontal distance. The site has restricted flow and should develop high warm season temperatures.

SITE SUMMARIES

Benthic Community. The Brewers Bay site is highly dominated by the boulder coral *Orbicella annularis* and exhibits the highest coral cover of any nearshore site in the TCRMP, with a coral cover of 32% in 2013. Coral cover was not monitored between 2003 and 2008; however there was a 28.4% decline in cover that could largely be attributed to the 2005 coral bleaching event. The algal community at Brewers Bay is dominated by epilithic algae, with lesser amounts of the macroalga *Dictyota* spp..

Coral Health. Corals at the Brewers Bay site were not monitored for health over the 2005 bleaching event. However, corals exhibited some of the highest prevalence of bleaching during the 2010 coral bleaching event, albeit at a low extent. In other years, bleaching prevalence remained high, with a low extent. Yellow band disease outbreaks were severe and affected the *O. annularis* community in 2002 and 2003. Old partial mortality is a prominent and persistent feature of the large *O. annularis* colonies. Recent mortality is very high and largely attributable to the biting of large populations of the territorial three-spot damselfish (*Stegastes planifrons*; data not shown).

SITE SUMMARIES

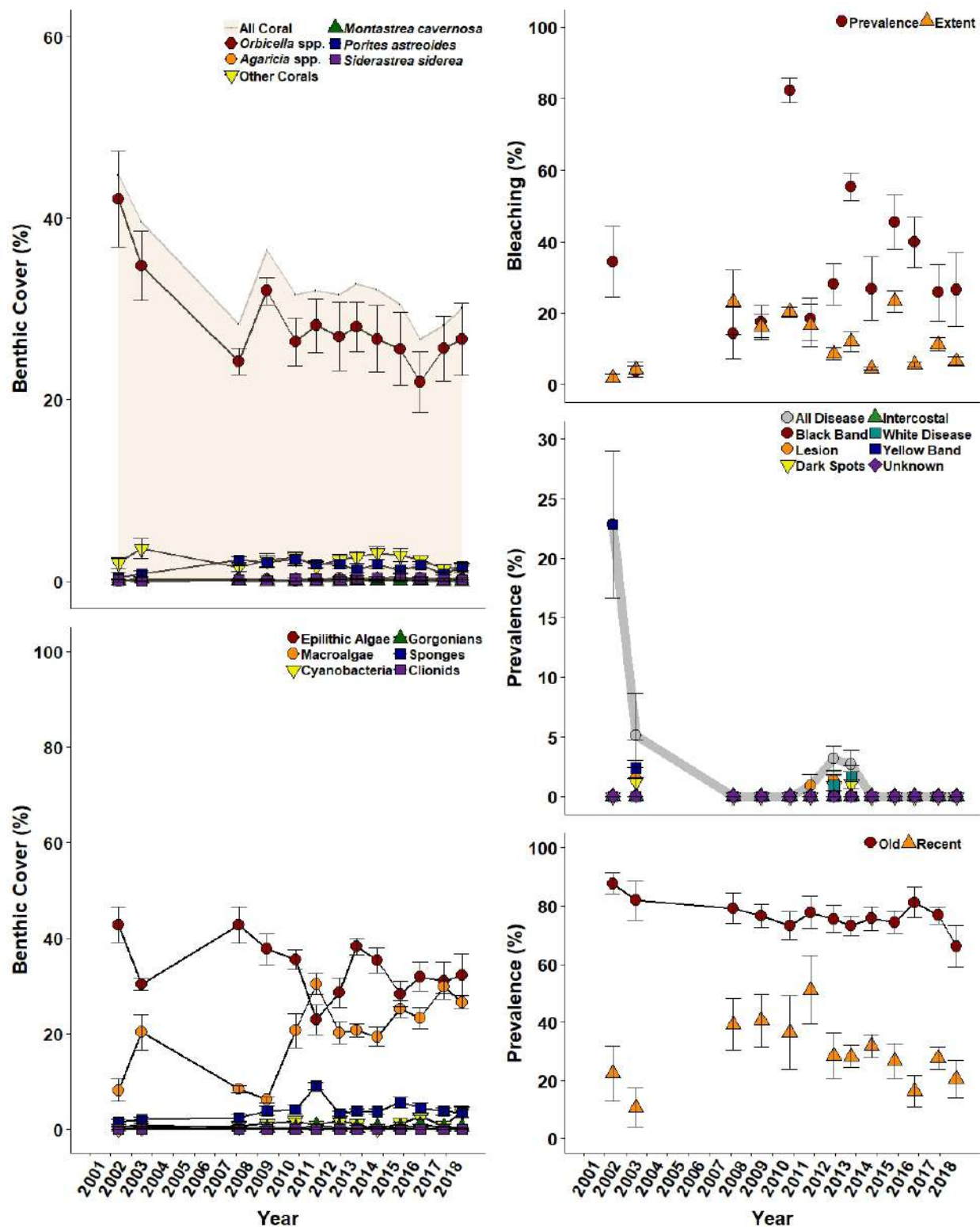


Figure 112. Brewers Bay benthic cover and coral health through time (mean ± SE).

SITE SUMMARIES

Fish Community. Brewers Bay is characterized by a high fish abundance dominated by herbivores. The site holds large numbers of parrotfish. Numerically, the herbivores are dominated by juvenile striped parrotfish that swim over the reef in groups of mixed parrotfish, acanthurids and wrasse. Both yellowhead and bluehead wrasse are prolific and school with the juvenile parrotfish. There are also larger stoplights and queen parrotfish grazing the reef. Piscivores are limited in biomass but are fairly diverse and generally include inshore pelagics such as cero mackerel and bar jacks or yellow jacks. Hamlets (*Hypoplectrus*) are very common and diverse, represented by 6 to 7 species in each annual survey. The occasional large snapper (schoolmaster, dog, mutton, and cubera) are sighted on the reef periphery or around large coral heads. The reef is spearfished regularly, so these sightings are becoming more and more rare. Nassau, black, and yellowfin grouper and the now rare blue and rainbow parrotfish were present in Brewers Bay forty years ago (Rogers 1982). Nassau and yellowfin grouper are rarely seen at the reefs today; the other species are no longer observed.

SITE SUMMARIES

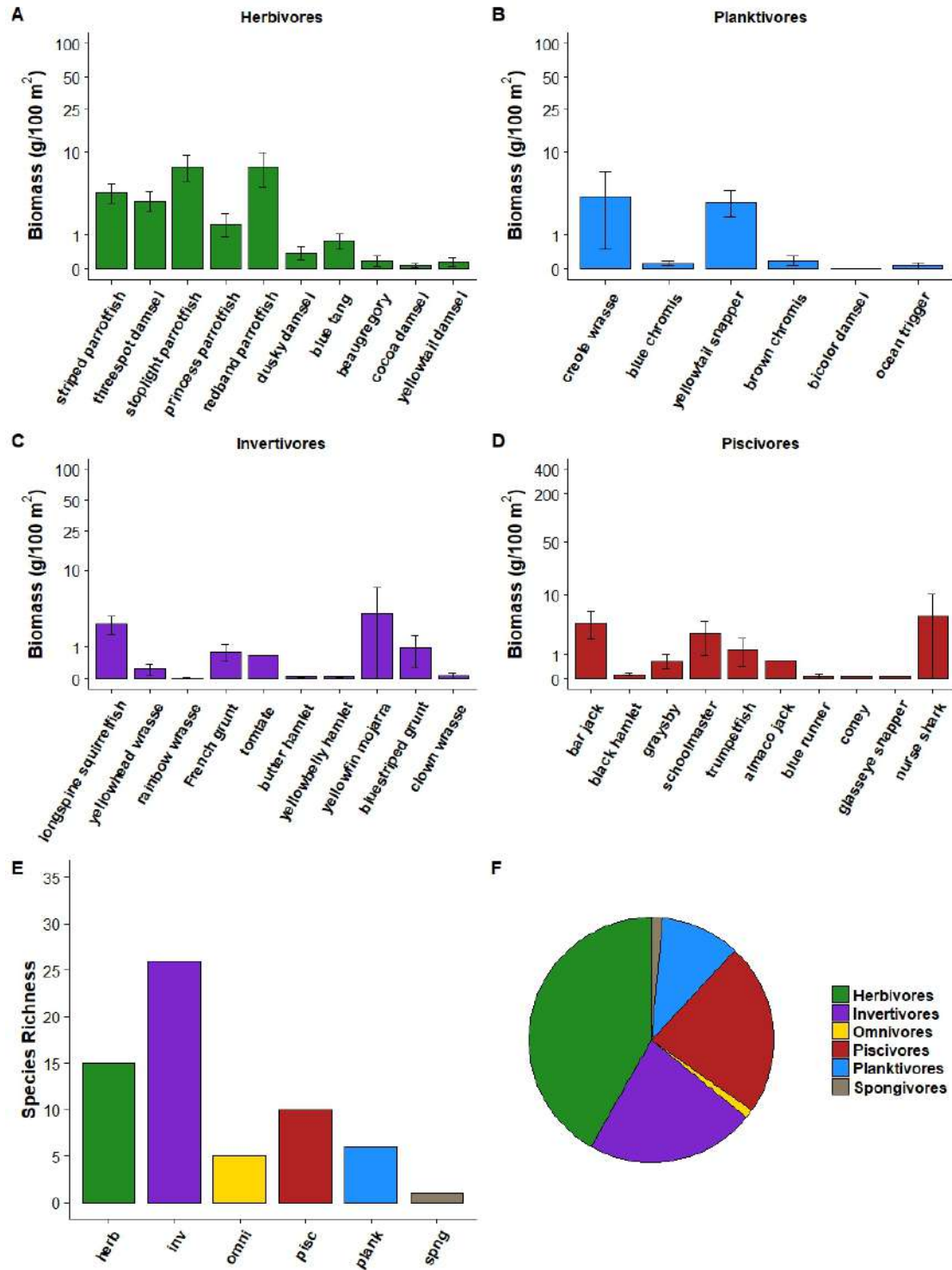
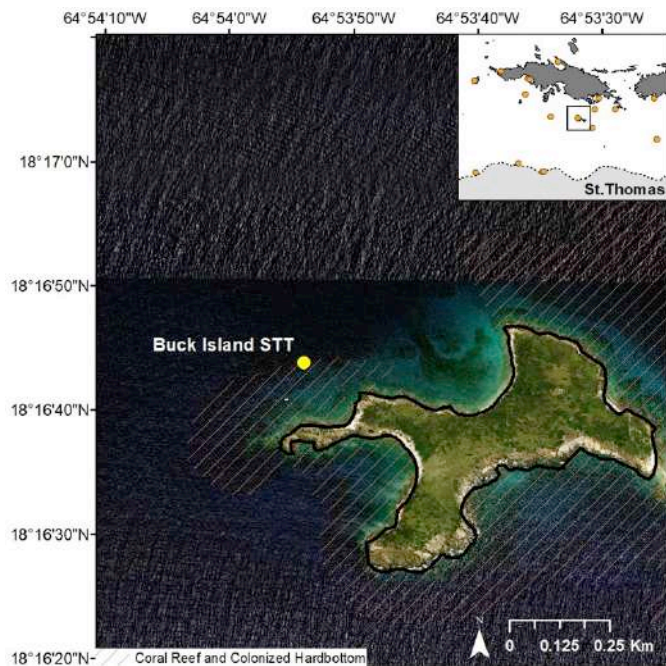


Figure 113. The Brewers Bay fish community as (A-D) average biomass per trophic group with the most common species shown in order on the x-axis, (E) species richness, and (F) relative community composition by total biomass. Note that biomass is a log scale.

SITE SUMMARIES

BUCK ISLAND, ST. THOMAS

Description. Buck Island, St. Thomas is a midshelf reef fringing the northwest coast of an uninhabited offshore island in water depths of 7 – 20 m. The reef has a sharp break in slope leading to a steep escarpment that terminates in a sand/sediment plain at the reef base. The monitoring site is located on that slope. Buck Island, St. Thomas has been monitored since 2005, with permanent benthic transects installed in 2007.



Outstanding Feature. Buck Island, St. Thomas is one of the most important tourist sites in the Virgin Islands, with frequent visitation by cruise ship passengers on day boats.

Threats. Buck Island, St. Thomas is very heavily used as a recreational dive site with the potential for cumulative impacts. The water surrounding Buck Island, St. Thomas is open to fishing. Commercial trap fishermen frequently target this site, and trap strings have been laid over the monitoring transects. Federally protected Nassau Grouper (*Epinephelus striatus*) have been observed within traps at the monitoring site. In addition, derelict traps are common around the site.

Figure 114. Buck Island, St. Thomas.
(top) Location. (right) A
representative photo of the reef.



SITE SUMMARIES

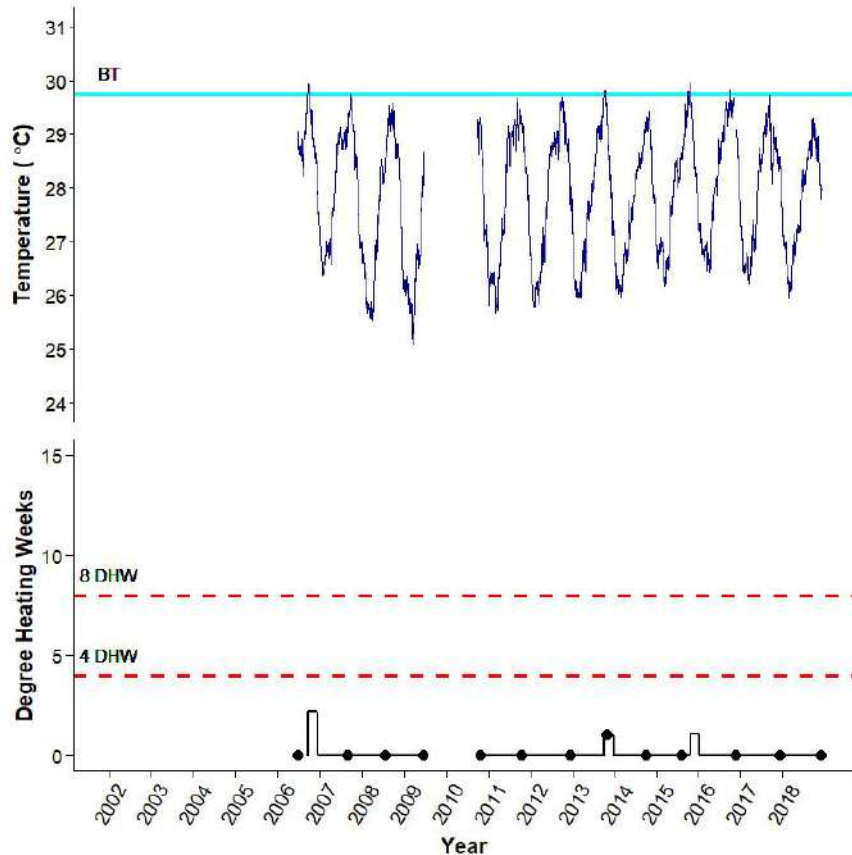


Figure 115. Buck Island, St. Thomas benthic temperature record (12 m depth).

Physical Characteristics.

Current. Buck Island, St. Thomas currents have not been measured directly. Moderately strong unidirectional currents occasionally influence the site; however, in general currents are very weak.

Temperature. Buck Island, St. Thomas may develop high temperatures. Unfortunately, the temperature probe placed during the 2010 coral bleaching event was lost.

SITE SUMMARIES

Benthic Community. The Buck Island, St. Thomas site coral community is dominated by the boulder star coral (*Orbicella* spp.), but shows high and even representation of other species. Coral cover declined by 23.4% due to the 2005 coral bleaching event and the site had regained 13.4% of this cover by 2011. Among sessile epibenthic animals a high proportion of the community is composed of sponges. The algal community is dominated by epilithic the macroalgae *Dictyota* spp. and *Lobophora variegata*, which are in very high abundance. Typical macroalgal cover is about 50%, but it peaked 70%, largely of ephemeral *Dictyota* after Hurricane Irma on September 6, 2017. *Ramificrasta* spp. is also a very significant space occupier on the upper slope just south of the site, but is largely absent from the TCRMP transects. Filamentous cyanobacteria can also be abundant at times.

Coral Health. The Buck Island, St. Thomas site was severely bleached in the 2005 coral bleaching event, with over 80% of colonies bleached over 100% of the colony surface. Bleaching was also high during the 2010 bleaching event, but at a low extent on colonies. Low prevalence of low-extent bleaching was common in other years of study. Coral diseases were usually low, in prevalence with the striking exception of 2006, when white diseases and lesions consistent with recent white disease reached extremely high prevalence. Old partial mortality increased rapidly after the 2005 bleaching event and then declined steadily in following years.

SITE SUMMARIES

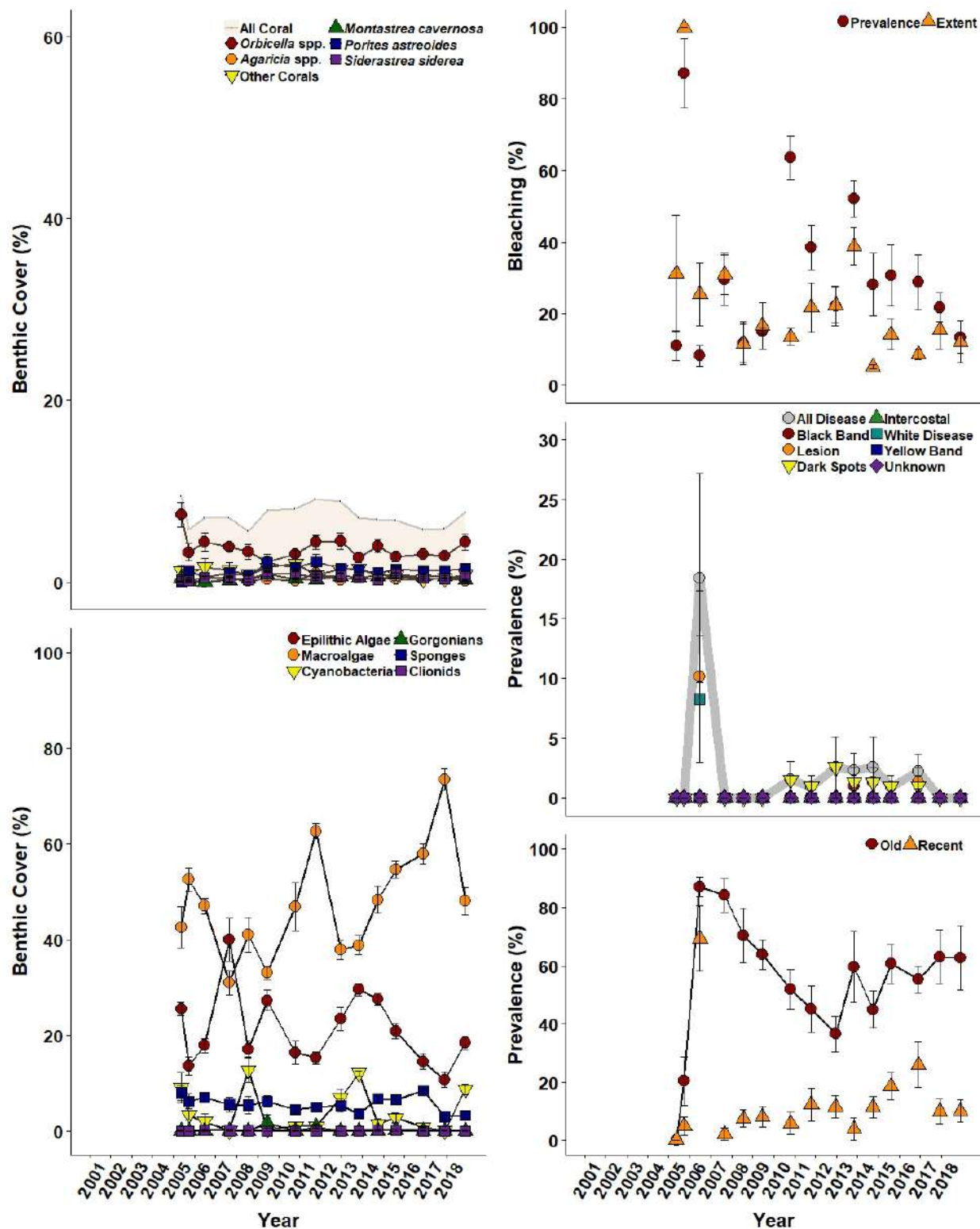


Figure 116. Buck Island, St. Thomas benthic cover and coral health through time (mean $\pm$ SE).

SITE SUMMARIES

Fish Community. The fish community at Buck Island, St. Thomas is very diverse and represents the utilization of many habitats and resources. The site is dominated in biomass by planktivores, primarily yellowtail snapper and creole wrasse. Tourists and commercial dive operators feed fish at Buck Island and gregarious yellowtail snapper are large and numerous. Herbivores are represented by large stoplight parrotfish as well as the other common parrotfish species, blue tang and ocean surgeonfish. Invertivores are diverse and very common. Both spotted and yellow goatfish roam the top of the reef and large wrasses, including the Spanish hogfish and puddingwife, are prolific. In addition to goatfish and wrasses, a variety of grunts inhabit the Buck Island Reef, including French, white, bluestriped, Ceasar, tomtate, and cottonwick. Schoolmaster, grey and mahogany snapper dominate the piscivores community on the site. Occasional pelagic jacks (yellow, almaco and bar) swim in the water column above. Seaward of Buck Island the reef has a steep 10m drop to a sand plain below and numerous species of fish can be seen swimming this deep reef edge including jolthead and saucereye porgies, mutton snapper, white and black margates and Caribbean reef sharks. Two Nassau grouper were observed in belt transects in 2018. No other large groupers have been observed at Buck Island. Although a Territorial Park on land, the area is fished with hook and line, traps, and speargun. It is also a very heavily dove SCUBA and snorkel site.

SITE SUMMARIES

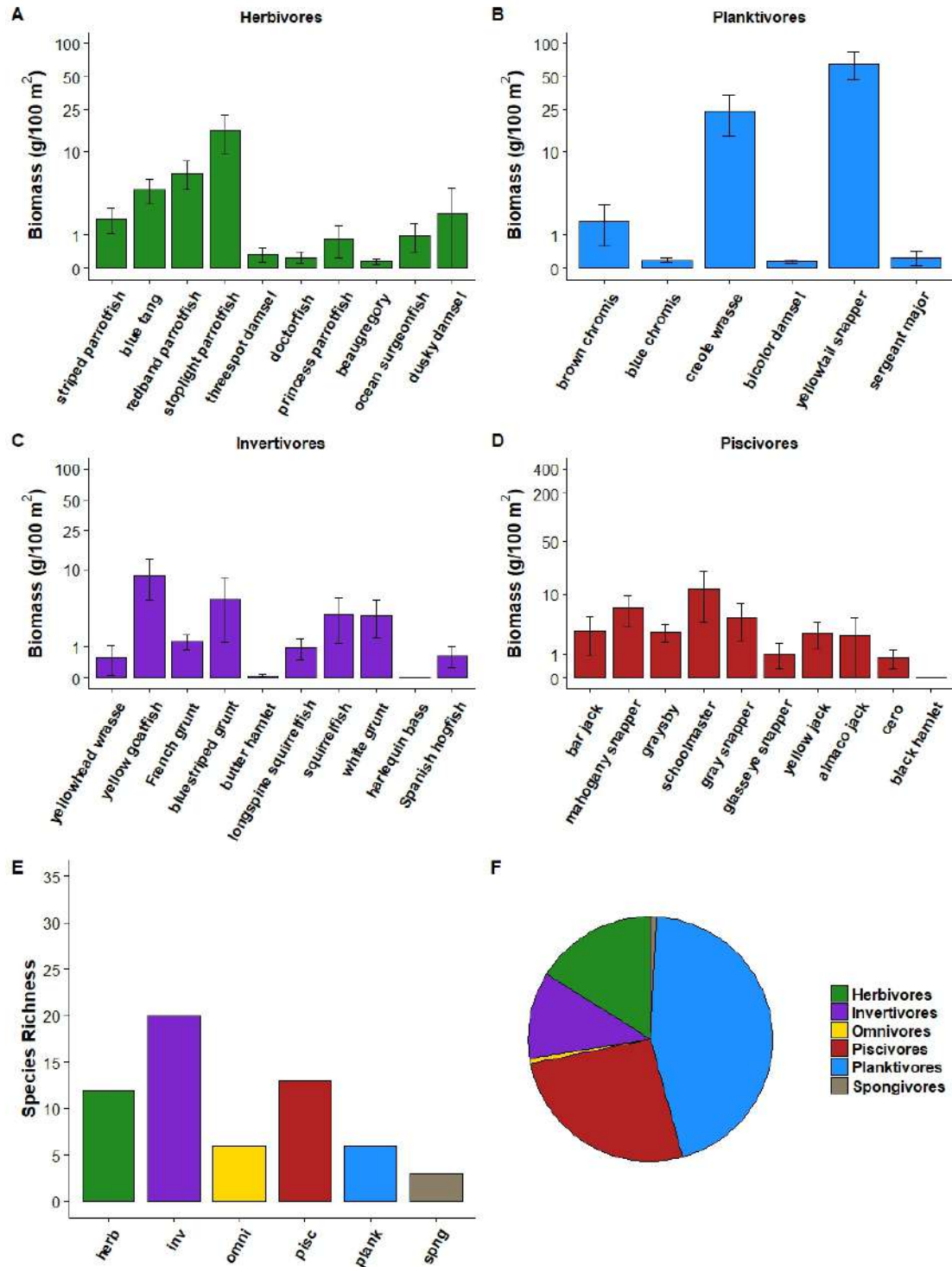


Figure 117. The Buck Island, St. Thomas fish community as (A-D) average biomass per trophic group with the most common species shown in order on the x-axis, (E) species richness, and (F) relative community composition by total biomass. Note that biomass is a log scale.

SITE SUMMARIES

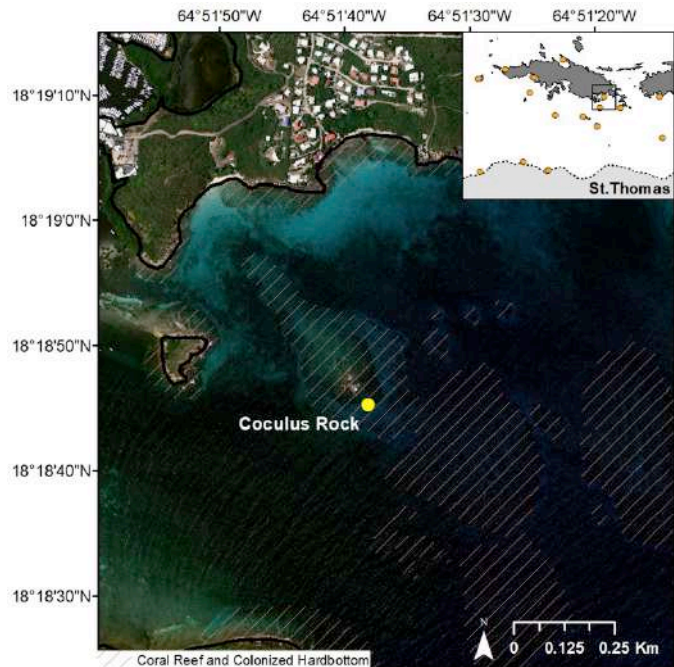
COCULUS ROCK

Description. The Coculus Rock site is a coral community on bedrock and pavement in depths of 4 – 7 m. The reef is formed between emergent rocks and a sand plain at 7m. Coculus Rock has been monitored since 2001, with fish community assessment starting in 2009. A ciguatera fish poisoning study with monthly sampling has been ongoing since 2009.

Outstanding Feature. Coculus Rock is located in the St. Thomas East End Reserve and is closed to taking of reef fishes. The site supports a fish spawning aggregation of redfin parrotfish (*Sparisoma rubripinne*). These 100+ fish engage in daily afternoon mating at southeast reef corner. A ciguatera study with monthly sampling has been ongoing since 2009.

Threats. Coculus Rock is subject to land-based sources of pollution from the large Turpentine Gut drainage of the Tutu watershed and the numerous industrial maritime activities in Benner Bay.

Figure 118. Coculus Rock. (top) Location. (right) A representative photo of the reef showing the aggregation of redfin parrotfish.



SITE SUMMARIES

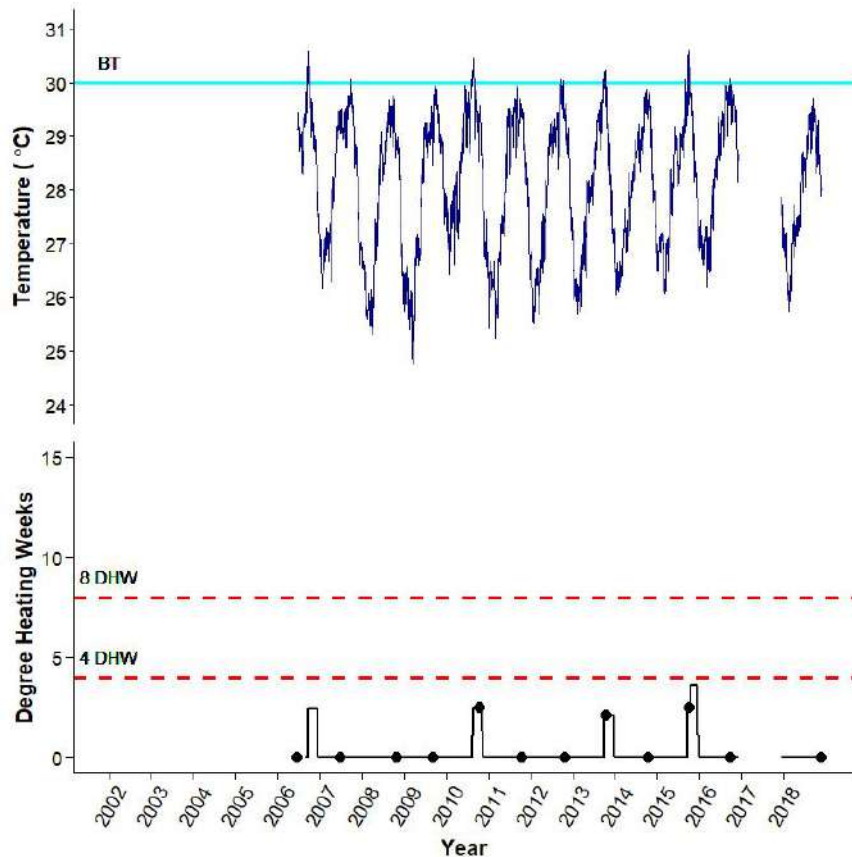


Figure 119. Cocus Rock benthic temperature record (7 m depth).

Physical Characteristics.

Current. Cocus Rock currents have not been measured directly. Only weak unidirectional currents have been experienced. Wave-driven oscillatory currents can be intense from swells coming from the southeast.

Temperature. Cocus Rock can experience very high temperatures during the peak warm season.

SITE SUMMARIES

Benthic Community. The Cocus Rock site is a coral community on bedrock and thin carbonate pavement that supports a very diverse coral community with no dominance by any species. The site lost 10.7% of its coral cover in the 2005 bleaching event, but had regained 76.0% of this lost cover by 2011. Sponges are a very prominent component of the sessile epibenthic animal community. The algal community is co-dominated by epilithic algae and the macroalga *Dictyota* spp., which tend to covary.

Coral Health. Corals at Cocus Rock were relatively moderately impacted by the 2005 coral bleaching event in both prevalence and extent on colonies. This may be due to a coral species assemblage composed of small massive species that tend to be less susceptible to bleaching (Smith et al. 2013b). A modest prevalence of low extent bleaching was also evident in the 2010 coral bleaching event. In years without high thermal stress, there tends to be a relatively high prevalence of bleaching relative to other sites, and prior to 2004 this was at high extent over colonies. Coral diseases, represented almost exclusively by dark spots disease, can be quite high in some years. Old partial mortality has been fairly high and consistent over time, with a slight increase after the 2005 and 2010 bleaching events. Recent partial mortality tends to be quite low in prevalence.

SITE SUMMARIES

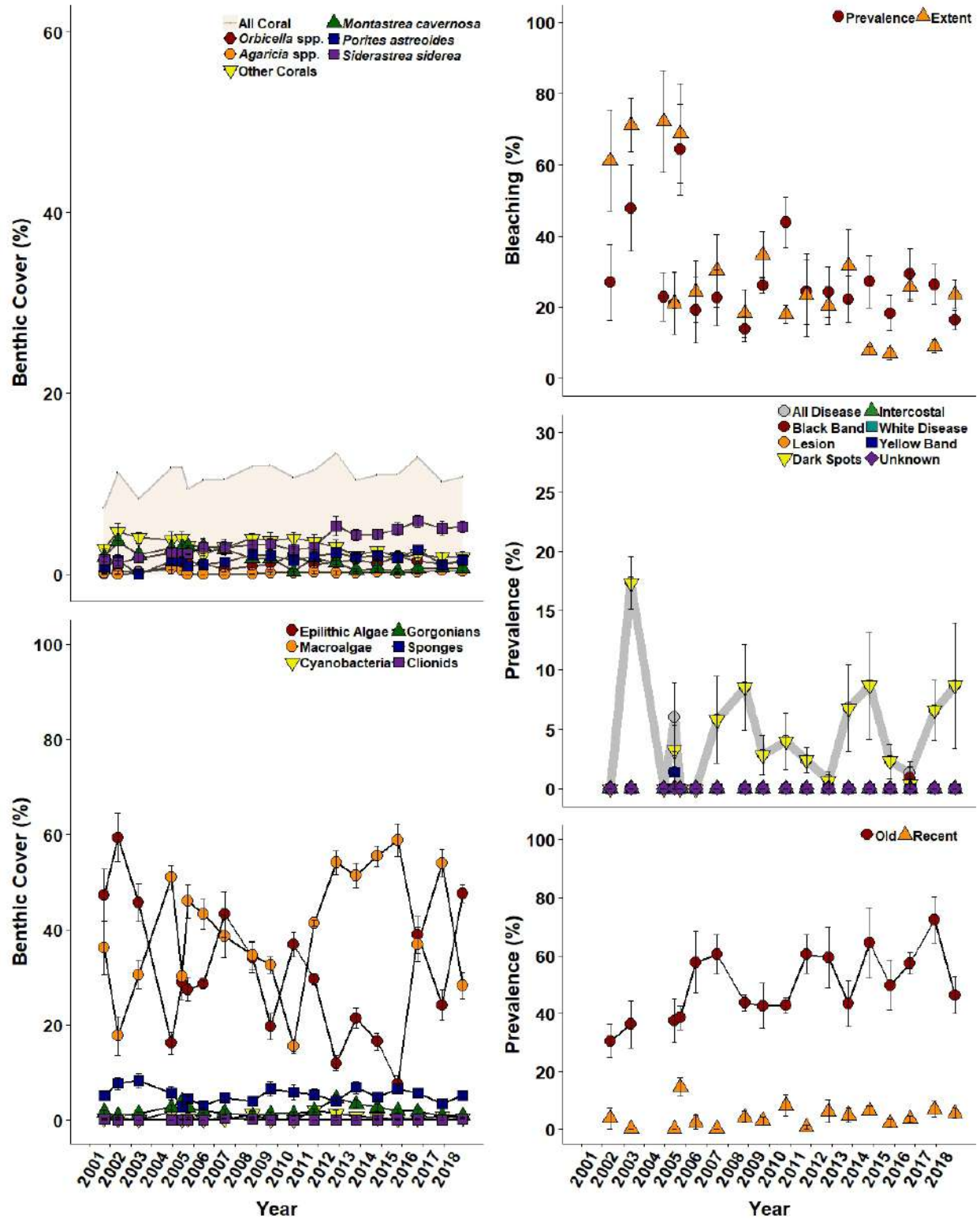


Figure 120. Cocus Rock benthic cover and coral health through time (mean ± SE).

SITE SUMMARIES

Fish Community. The Cocus Rock fish community is interesting in several ways. It represents an inshore promontory that serves as an aggregation and spawning site for yellowtail parrotfish (*Sparisoma rubripinne*) in the afternoon, apparently year round. The top of the bedrock reef, emergent at points, is turbid and rough with breaking waves, but large parrotfish, jacks, doctorfish, and damselfishes swim in the milky, turbulent water. At the bottom of the rock promontory, where coral and bedrock meet the sand, small ledges run along the southeast edge of the reef. Red hind and an occasional Nassau grouper have been observed hiding in the dark of the undercut. There are generally a dozen or more juvenile lobster using the ledges as well. Juvenile grunts can be particularly common at Cocus Rock, “hanging” in large schools on and under limestone rocks and ledges on the western side of the site. Otherwise the fish community inhabiting the steep walled rock and algae covered limestone site is primarily wrasses, juvenile parrotfishes, and acanthurids. Except for the occasional red hind or Nassau grouper, piscivores are limited to juvenile schoolmaster, mahogany and gray snappers. The planktivore guild is dominated in biomass by juvenile yellowtail snapper and the invertivore guild is made up of juvenile grunts and a variety of small wrasses. Cocus Rock is part of the territorial Saint Thomas East End Reserve (STEER) and fishes are protected from all harvest year-round.

SITE SUMMARIES

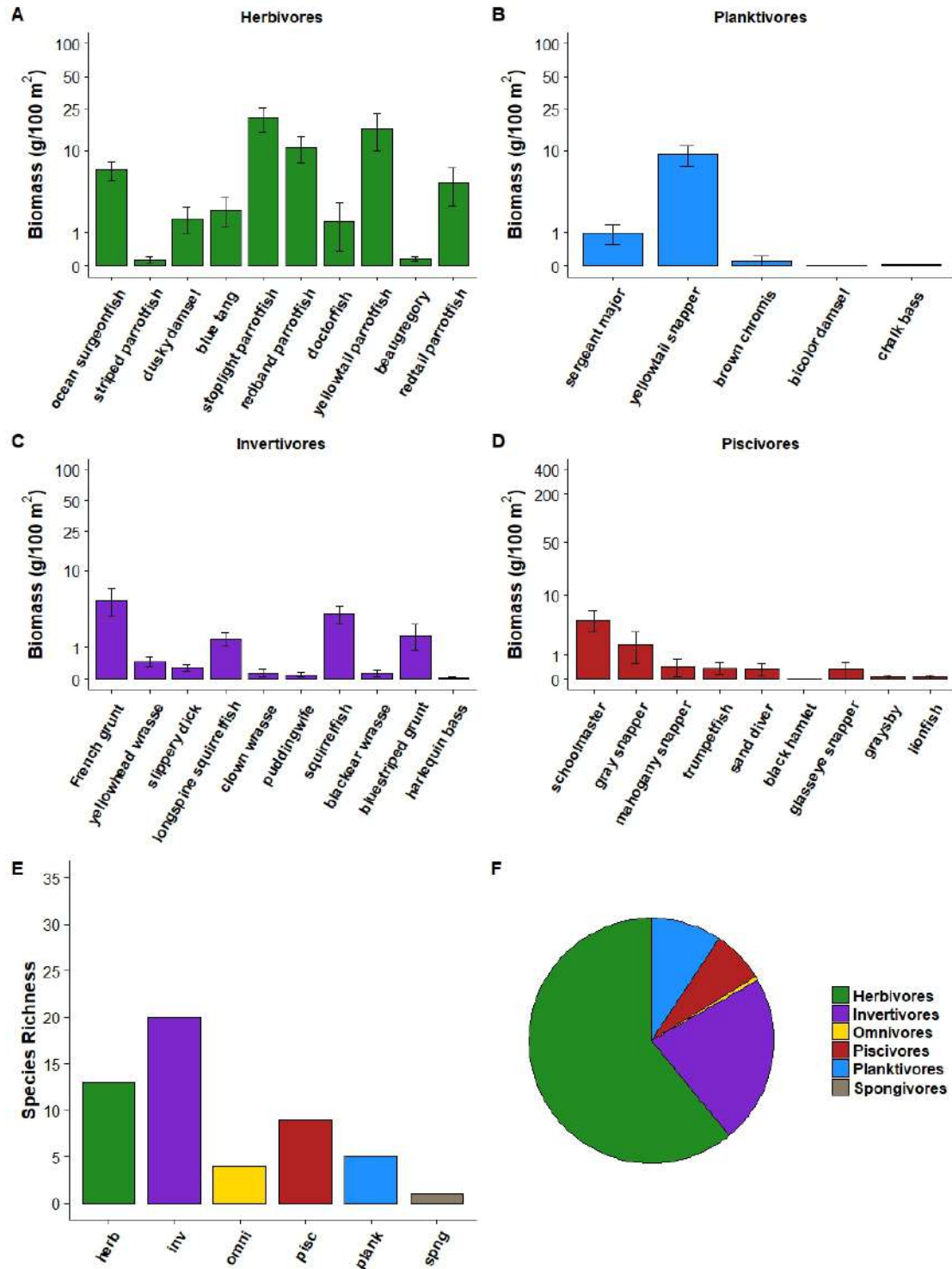


Figure 121. The Cocus Rock fish community as (A-D) average biomass per trophic group with the most common species shown in order on the x-axis, (E) species richness, and (F) relative community composition by total biomass. Note that biomass is a log scale.

SITE SUMMARIES

COLLEGE SHOAL

Description. College Shoal is part of a mesophotic bank located in the Red Hind Marine Conservation District (est. 1999) in depths of 28 – 33 m. The densely populated coral reef is surrounded by continuous reef structure dominated by star corals (*Orbicella* spp.). College Shoal has been monitored since 2003, with permanent benthic transects installed in 2007.

Outstanding Feature. College Shoal is notable for possessing high water clarity, relatively strong currents, a high density of corals (>30% coral cover), and a great abundance of fishes, including commercially important groupers and snappers. College Shoal is one of the most aesthetically pleasing reefs for diving due to its relatively pristine condition, high coral abundance, and high fish abundance.

Threats. College Shoal has experienced coral white diseases at chronically high levels (> 1% prevalence). This reef also supports a high abundance of the invasive Indo-Pacific Lionfish (*Pterois volitans*).

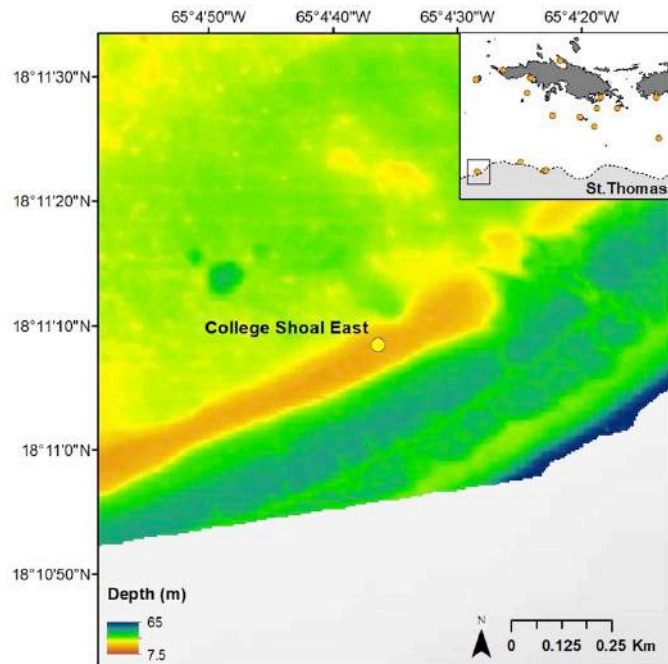


Figure 122. College Shoal. (top) Location. (right) A representative photo of the reef.



SITE SUMMARIES

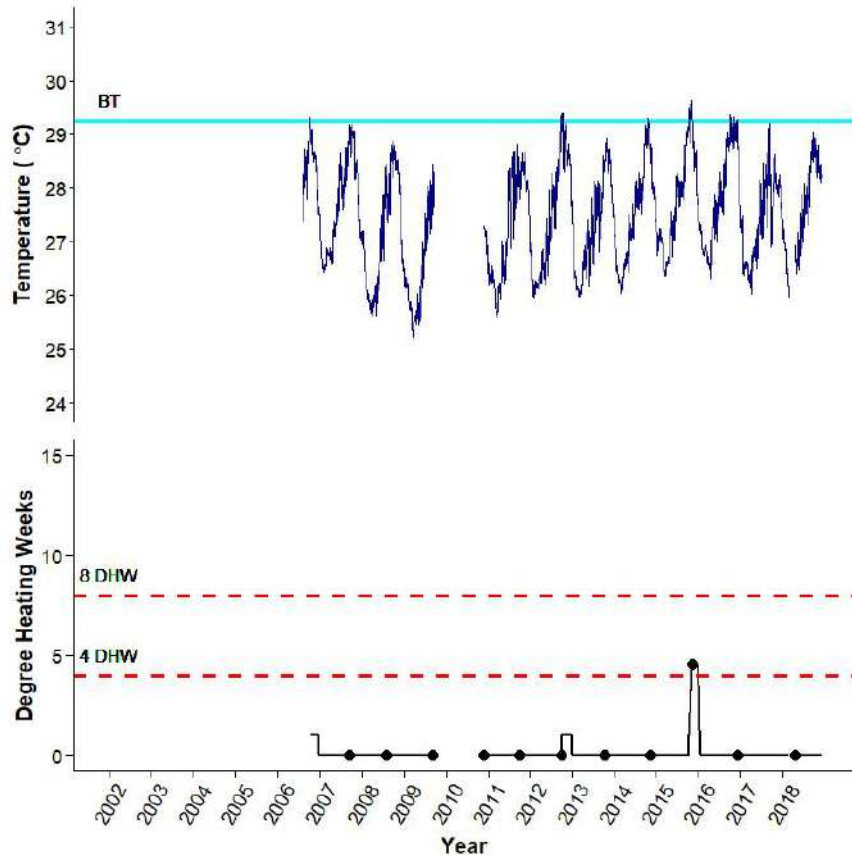


Figure 123. College Shoal benthic temperature record (29 m depth).

Physical Characteristics.

Currents. Although not measured directly, College Shoal has strong unidirectional driven currents that seem to be tidally driven and follow a pattern of increasing strength during spring tides. Current data has been collected and will be presented in a future report.

Temperature. Benthic temperatures are ameliorated in the warm season by the proximity of the thermocline. The presence of the thermocline causes temperatures that are cool and diurnally variable from May to October. Unfortunately, the thermistor re-initialized improperly in 2009 and the 2010 coral bleaching event temperatures were missed at this site.

SITE SUMMARIES

Benthic Community. College Shoal is among the TCRMP sites with the highest coral cover (38.2% in 2011) and, similar to other bank mesophotic sites south of the St. Thomas, is dominated by the boulder star coral (*Orbicella* spp.). This site lost only 10.1% of its coral cover in the 2005 bleaching event, but had not regained cover since then (-1.3%); however, these estimates have some additional error since transects were not made permanent until 2007. Sponges and gorgonians are in very low relative abundance. The algal community is dominated by the macroalga *Lobophora variegata* and lesser representation by epilithic algae. There is also a relatively high proportion of crustose coralline algae.

Coral Health. College Shoal bleached at a relatively low prevalence during the 2005 mass coral bleaching event, although corals that were bleached tended to lose color over their entire surface. The 2010 coral bleaching event had no apparent effect above background bleaching levels. Bleaching in years without thermal stress tends to be moderate. Diseases were dominated by white disease, which reached very high prevalence after the 2005 bleaching event, with an outbreak that lasted for two years in 2006 and 2007. This disease was again very prevalent in 2011 after the 2010 bleaching event, even without apparent thermal bleaching. Old partial mortality was elevated on corals after the mortality from the 2005 bleaching event, and this level has remained stable through 2011. Recent partial mortality is always relatively high, much of it attributable to fish bites.

SITE SUMMARIES

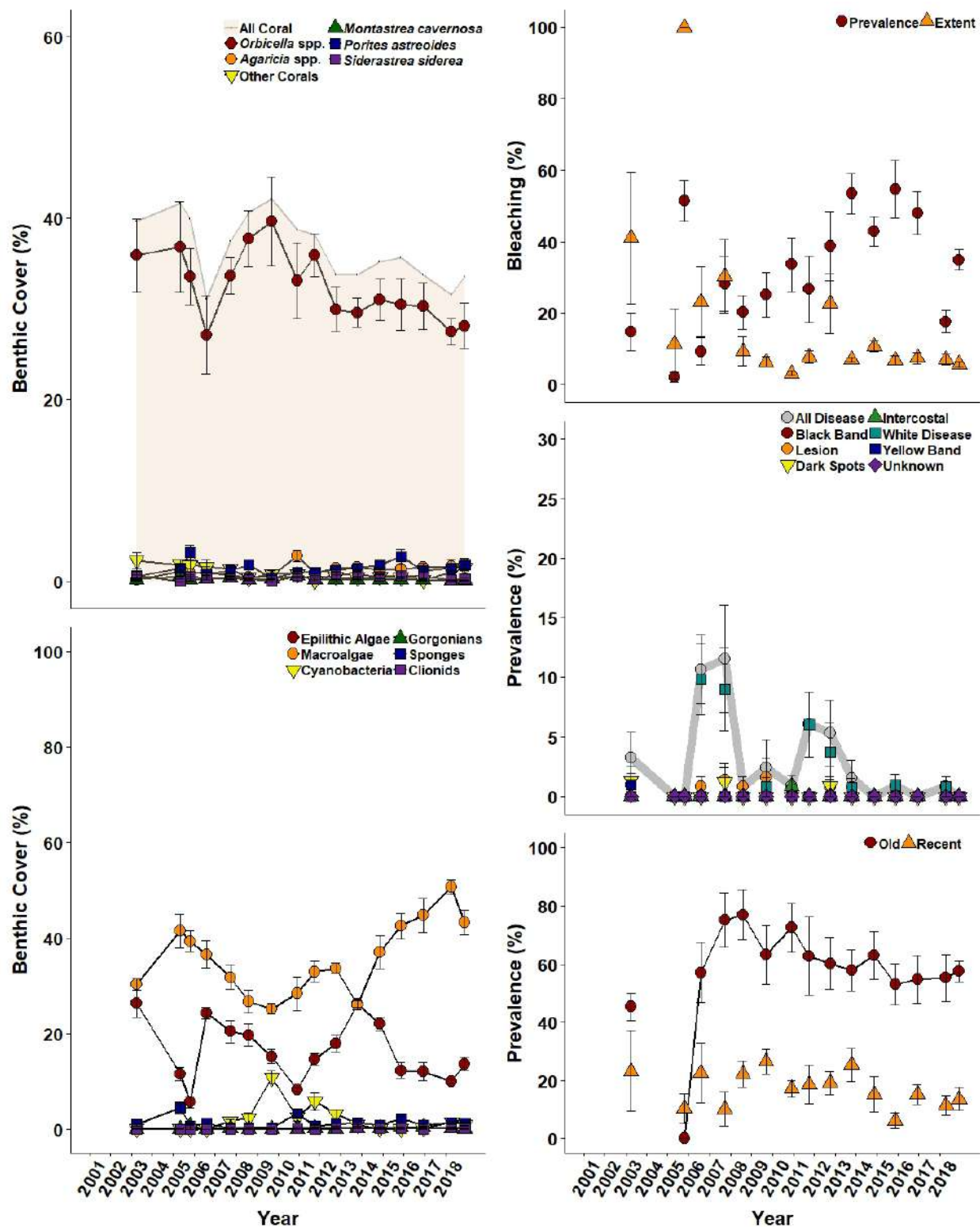


Figure 124. College Shoal benthic cover and coral health through time (mean $\pm$ SE).

SITE SUMMARIES

Fish Community. College Shoal is characterized by a high overall fish abundance and diversity, and an especially high planktivore biomass. Large planktivorous species including ocean triggerfish, Atlantic spadefish, black jacks, and yellowtail snapper contribute to this biomass, as well as large schools of the smaller creole wrasse and boga. The mesophotic, high coral cover reef supports more herbivores than the deeper Hind Bank FSA and Grammanik Bank FSA sites. This guild is split equally between the common parrotfish species (princess, striped, redband, stoplight and queen) and the blue tang and ocean surgeonfish. Piscivores have a relatively high relative biomass as well, made up primarily of jacks, mackerels, barracuda and large snappers. Invertivores are diverse but contribute much less biomass to the community composition, College Shoal lies within the Marine Conservation District (MCD) and is protected year round from all fishing. Nassau, yellowfin, and yellowmouth grouper are occasionally observed on the site and tiger grouper are seen there regularly.

SITE SUMMARIES

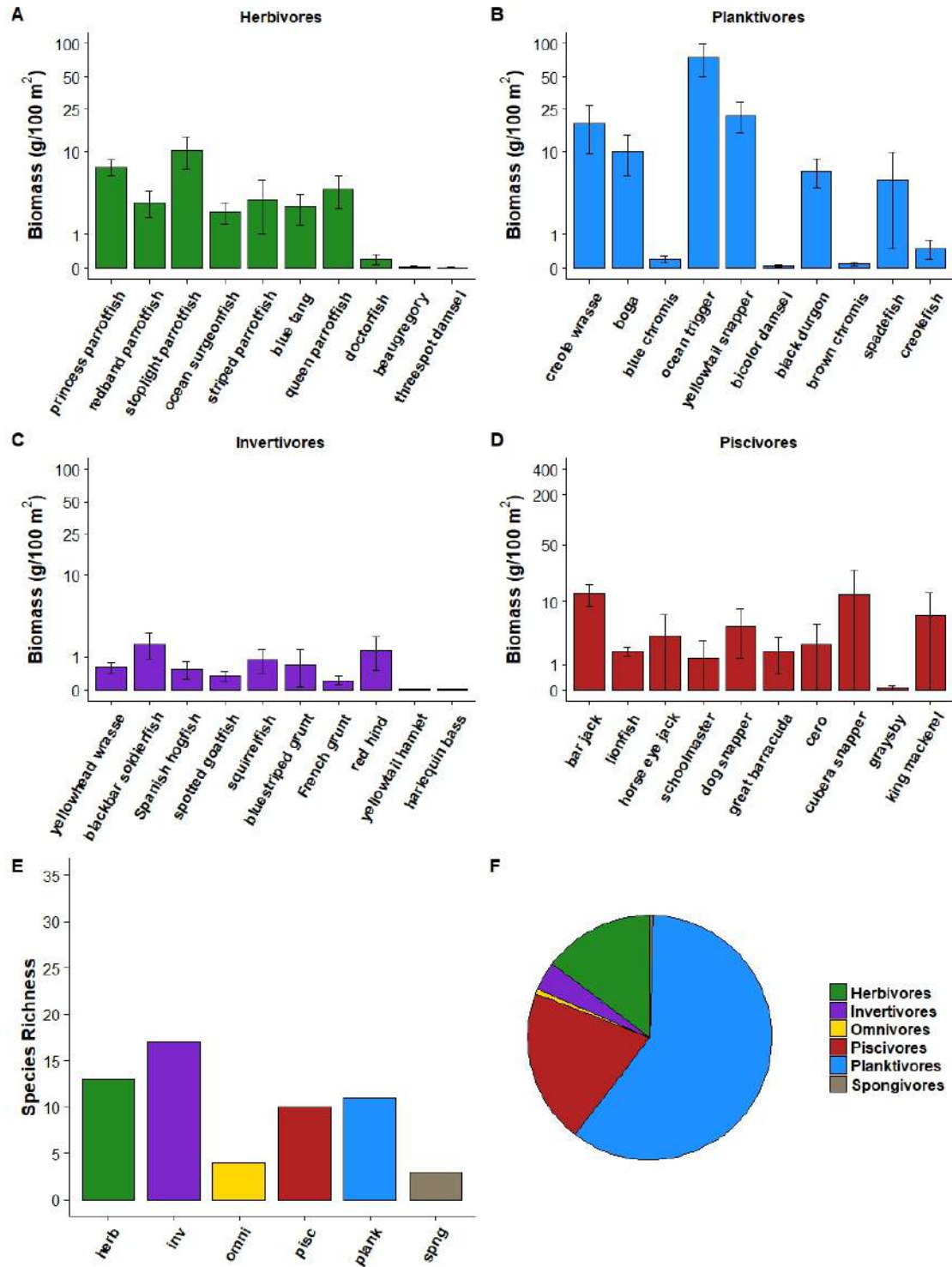


Figure 125. The College Shoal fish community as (A-D) average biomass per trophic group with the most common species shown in order on the x-axis, (E) species richness, and (F) relative community composition by total biomass. Note that biomass is a log scale.

SITE SUMMARIES

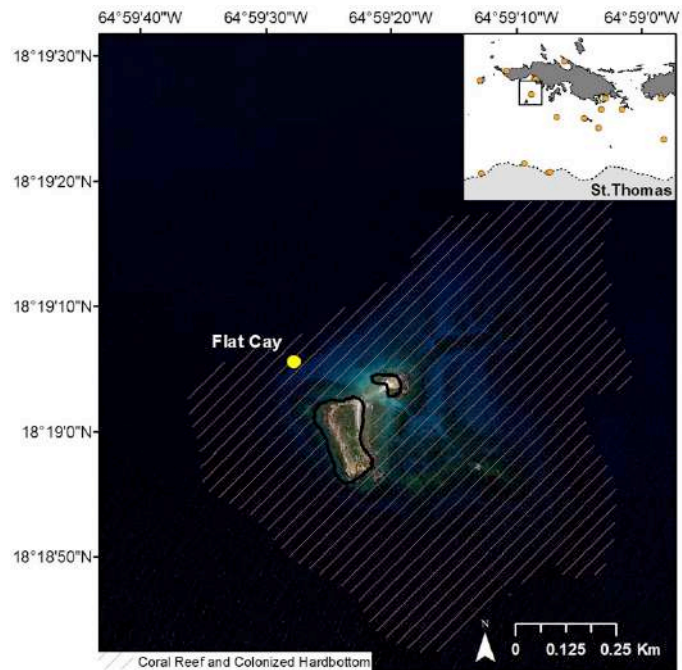
FLAT CAY

Description. This monitoring site wraps around the northwest corner depths of Flat Cay in depths of 10 – 17 m. Flat Cay has been monitored since 2003, with permanent benthic transects installed in 2007. A ciguatera fish poisoning study with monthly sampling has been ongoing since 2009.

Outstanding Feature. Flat Cay supports a lush coral community, including dense populations of the endangered elkhorn and staghorn corals (*Acropora* spp.) outside the TCRMP monitoring site. The site is a popular tourist dive site and is an important site for research by local and international investigators.

Threats. Flat Cay is down current of industrial port activities and a major sewage outfall. Mollusks, including the commercially important queen conch (*Strombus gigas*) show sterility (imposex) as a likely result of exposure to hormone mimics released from boat hulls coated with marine antifouling paint containing Tributyltin (Strand et al. 2009). The area experiences heavy fishing and damage from anchoring within the reef.

Figure 126. Flat Cay. (top) Location. (right) A representative photo of the reef.



SITE SUMMARIES

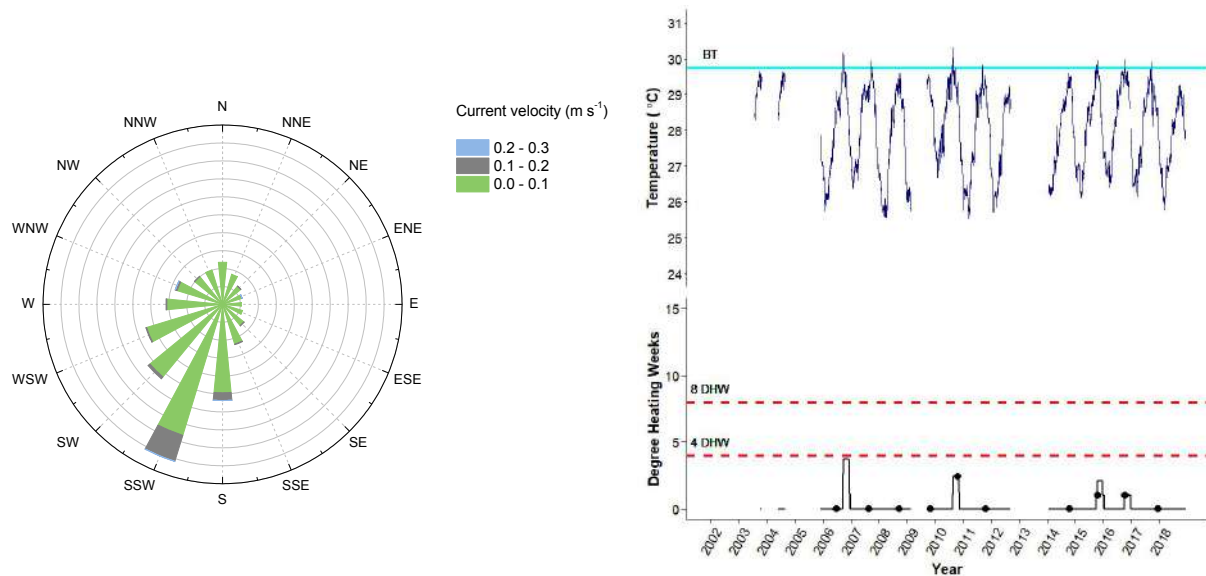


Figure 127. Flat Cay benthic current speed (left) and temperature record (right) (14 m depth).

Physical Characteristics.

Current. The benthic current at the Flat Cay site is weak and dominated by a south-southwesterly flow. This may be an effect of the wrapping of the generally westward and occasionally strong surface current. Currents were measured with an Aandaraa 2-D current meter measuring 1m above the seafloor.

Temperature. Flat Cay experiences moderate warming for a shallow water site and rapid cooling with the passage of tropical storms.

SITE SUMMARIES

Benthic Community. Flat Cay supports a diverse coral community with dominance of boulder star corals (*Orbicella* spp.). The sessile epibenthic animal community also shows a high abundance of sponges. The site lost a moderate 21.9% of cover in the 2005 bleaching event and had regained 159.3% of this cover by 2011. A caveat is that transects were not made permanent until 2007. Epilithic algae and the macroalga *Dictyota* spp., with lesser amounts of *Lobophora variegata*, dominate the algal community. Sand in pockets between coral also makes up a fair amount of the non-living substrate.

Coral Health. Corals were severely affected during the 2005 coral bleaching event, with over 90% of corals bleached at 100% extent of the colony surface. Bleaching was also moderately prevalent in the 2010 bleaching event, but at low extent. Coral diseases, particularly dark spots disease can be very prevalent at Flat Cay. There was an unusual outbreak of black band disease in 2004. This disease is rare at the depths of Flat Cay. White disease was somewhat prevalent after the 2005 bleaching. Old partial mortality increased rapidly after the 2005 bleaching event and has not decreased in the intervening years. Recent mortality can be moderate and is due to a variety of causes.

SITE SUMMARIES

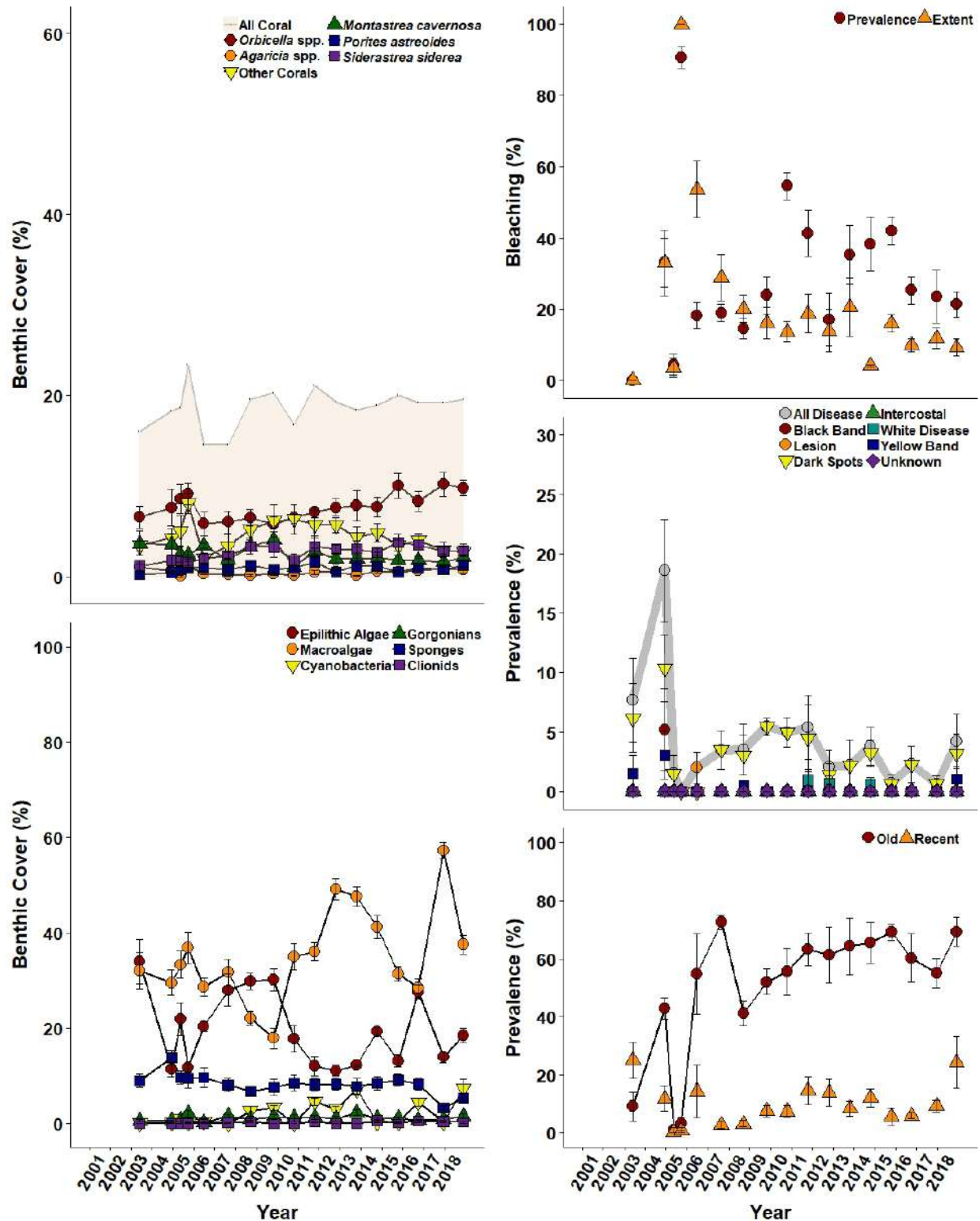


Figure 128. Flat Cay benthic cover and coral health through time (mean $\pm$ SE).

SITE SUMMARIES

Fish Community. Flat Cay is characterized by a large diversity of fish evenly distributed across trophic guilds. There is generally a high biomass of planktivores due to relatively high densities of yellowtail snapper and large schools of chromis and creole wrasse. Invertivores are very diverse and common, reflecting the huge variety of resources available in the sand and hard bottom bordered reef community. Herbivores make a relatively moderate contribution to community composition and are equally represented by the common parrotfishes and acanthurid species. Schools of tiny juvenile parrotfish are prevalent mixed with yellowhead wrasse and juvenile acanthurids across the reef. A variety of jacks frequent the site and dominate the piscivore trophic guild. In 2018 a king mackerel was observed on as transect. Very occasional large groupers (Nassau, yellowfin, black) have been observed on Flat Cay over the past eight years. The occurrence of black grouper in 2017 is notable; this species is extremely rare throughout the territory. In 2018 three subadult Nassau grouper were found on the site. Where the reef meets the sand seaward, large schools of white, French and blue-striped grunts, as well as gray snapper, squirrelfish, and goatfish swim. Small reef sharks are seen out over the sand regularly and in 2018 a hammerhead was observed cruising the edge of the reef. The Flat Cay reef is heavily used as a recreational dive site and spearfishing occurs there regularly.

SITE SUMMARIES

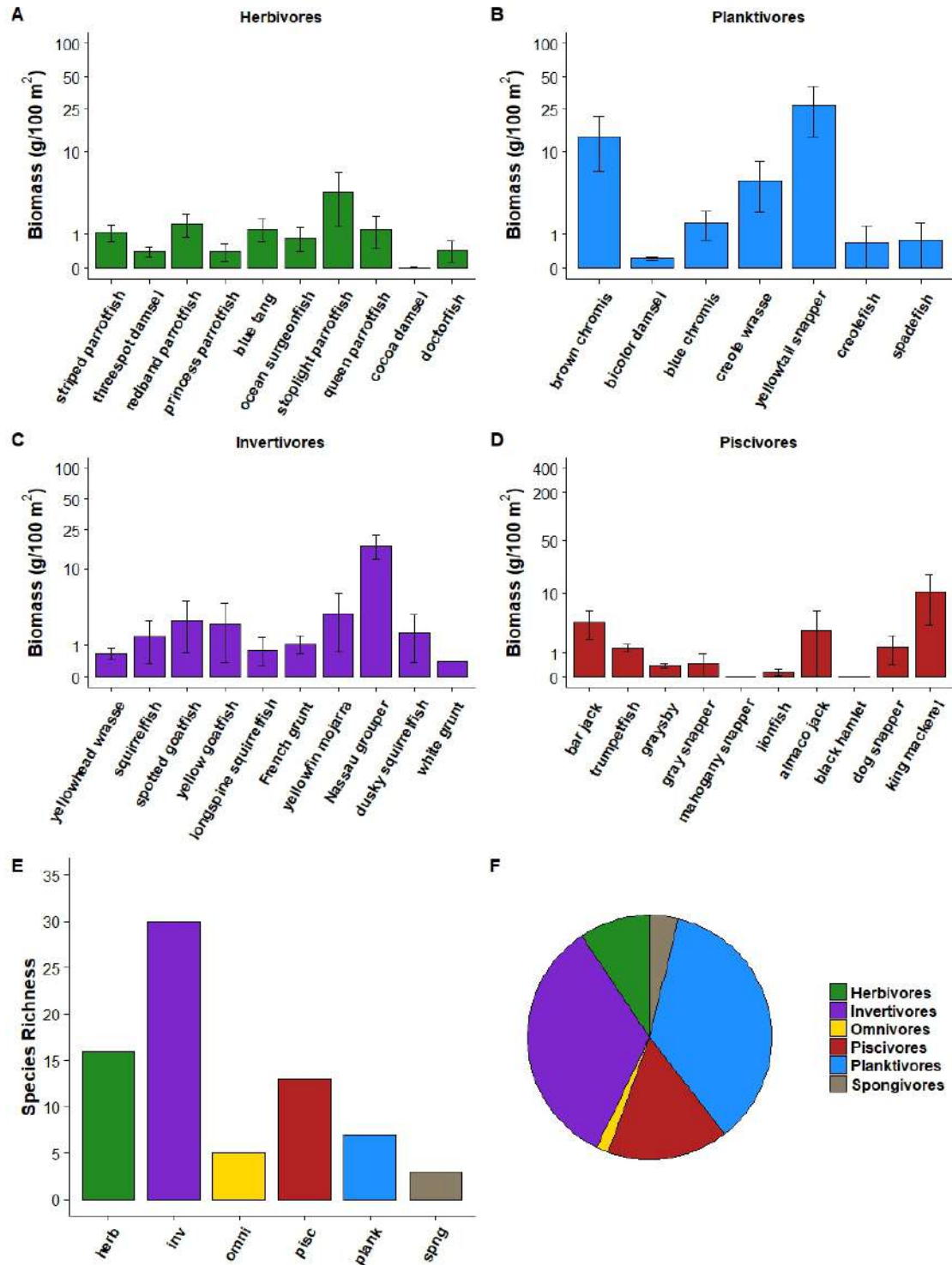


Figure 129. The Flat Cay fish community as (A-D) average biomass per trophic group with the most common species shown in order on the x-axis, (E) species richness, and (F) relative community composition by total biomass. Note that biomass is a log scale.

SITE SUMMARIES

GINSBURGS FRINGE

Description. Ginsburgs Fringe is a lower mesophotic lettuce coral (*Agaricia undata*.) reef at depths of 60-75 m (established in 2011). The reef is on a steep escarpment dropping into the abyssal Virgin Islands trough.

Outstanding Feature. Ginsburgs Fringe had the highest 2011 coral cover among all TCRMP monitoring sites (44%), with living colonies of lettuce corals over 6m (20') wide. This site is the epicenter of a multispecies fish spawning aggregation, including the threatened Nassau grouper (*Epinephelus striatus*). The site name honors the father of comparative sedimentology and mesophotic coral studies, Dr. Robert N. Ginsburg.

Threats. Although little is known about conditions in deep mesophotic lettuce coral reefs, Lettuce corals at these depths are potato chip thin at edges and fragile. Reef claw-type anchors appear to be responsible for a 50% drop in coral cover in the last few years. The site is being heavily invaded by red lionfish (*Pterois volitans*).

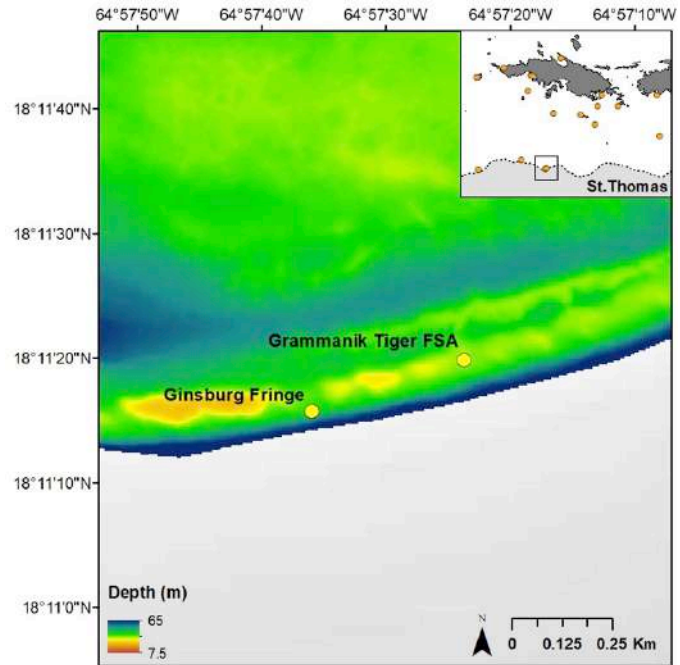


Figure 130. Ginsburgs Fringe. (top) Location. (right) A representative photo of the reef showing whorled lettuce coral colonies up to 7m in width and research diver filming permanent transect in background (Nov. 13, 2015).



SITE SUMMARIES

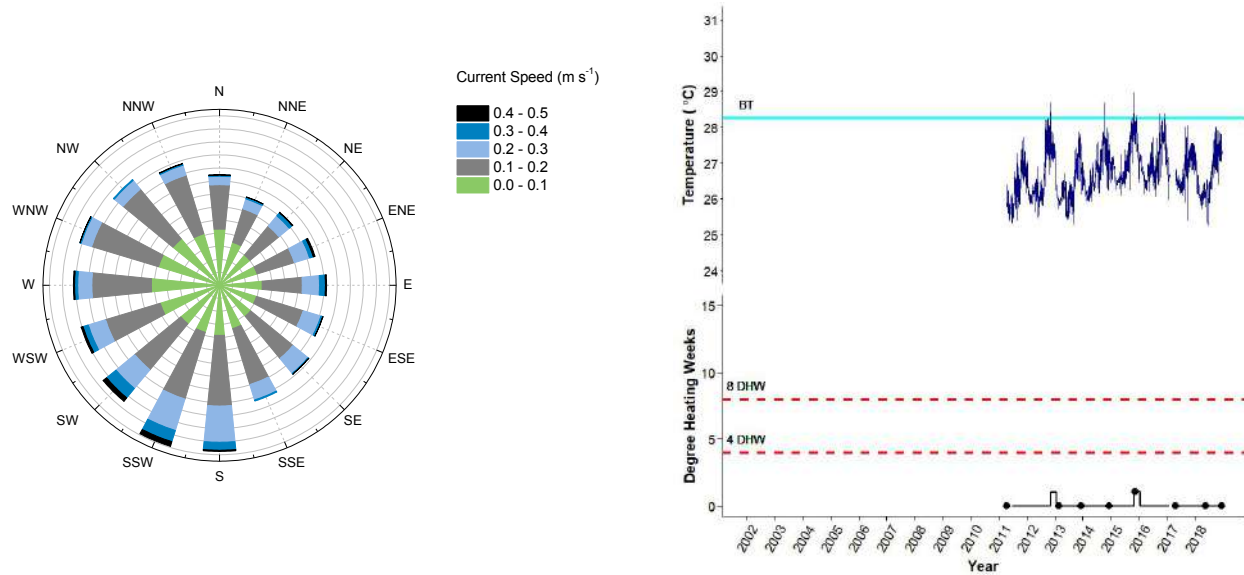


Figure 131. Ginsburgs Fringe current speed (50 m depth) and benthic temperature (63 m depth). BT = bleaching threshold ; DHW = degree heating weeks.

Physical Characteristics.

Current. Currents have been measured above the site in 50 m depth. There is a strong offshelf-downwelling (southward) that occurs just above the site, potentially carrying larvae and heterotrophic food supplies to the site.

Temperature. Temperatures are much cooler at Ginsburgs Fringe than any other TCRMP site, but still quite suitable for healthy Caribbean stony corals. There is no established empirical bleaching threshold for Ginsburgs Fringe. The site showed bleaching in 2012 (Smith et al. 2016a), suggesting it was above at least 4 DHW. Since this is not reflected in the modeled DHW, it suggests that the bleaching threshold is lower than predicted.

SITE SUMMARIES

Benthic Community. The coral community at Ginsburgs Fringe is almost exclusively lettuce corals of the genus *Agaricia*. Among the agariciid genus, the rank abundance of species is *A. undata* (30.8% absolute cover), *A. grahamae* (8.2%), and *A. lamarcki* (2.3%), with no colonies of *A. agaricites* and *A. fragilis* occurring in transects. These species identifications are tentative as voucher specimens have not been collected. Although not well represented in cover, individual colonies of *Montastraea cavernosa* and *Siderastrea siderea* also occur at the site. The site has experienced extreme loss of coral cover (65%), likely due to anchoring (Smith et al. 2019b). The algal community is dominated by the macroalga *Lobophora variegata*, which is surprising for these depths, and epilithic algae. Crustose coralline algae are also in high abundance, as well as a variety of unidentified algal species, including what appears to be *Peyssonnelia iradescens* (Ballantine and Ruiz 2010).

Coral Health. Coral health is not directly monitored at Ginsburgs Fringe due to the depth and difficulties assessing colonies greater than 3m width. However, some observations have been made. What appears to be warm season bleaching has been observed (Smith et al. 2016a; Smith et al. 2019b). Colonies have a fair degree of partial mortality and recent mortality is very common. In some cases it appears that shaded colony portions die back due to lack of light. The corallivorous snail, *Coralliophila abbreviata*, has been observed feeding on lettuce corals.

SITE SUMMARIES

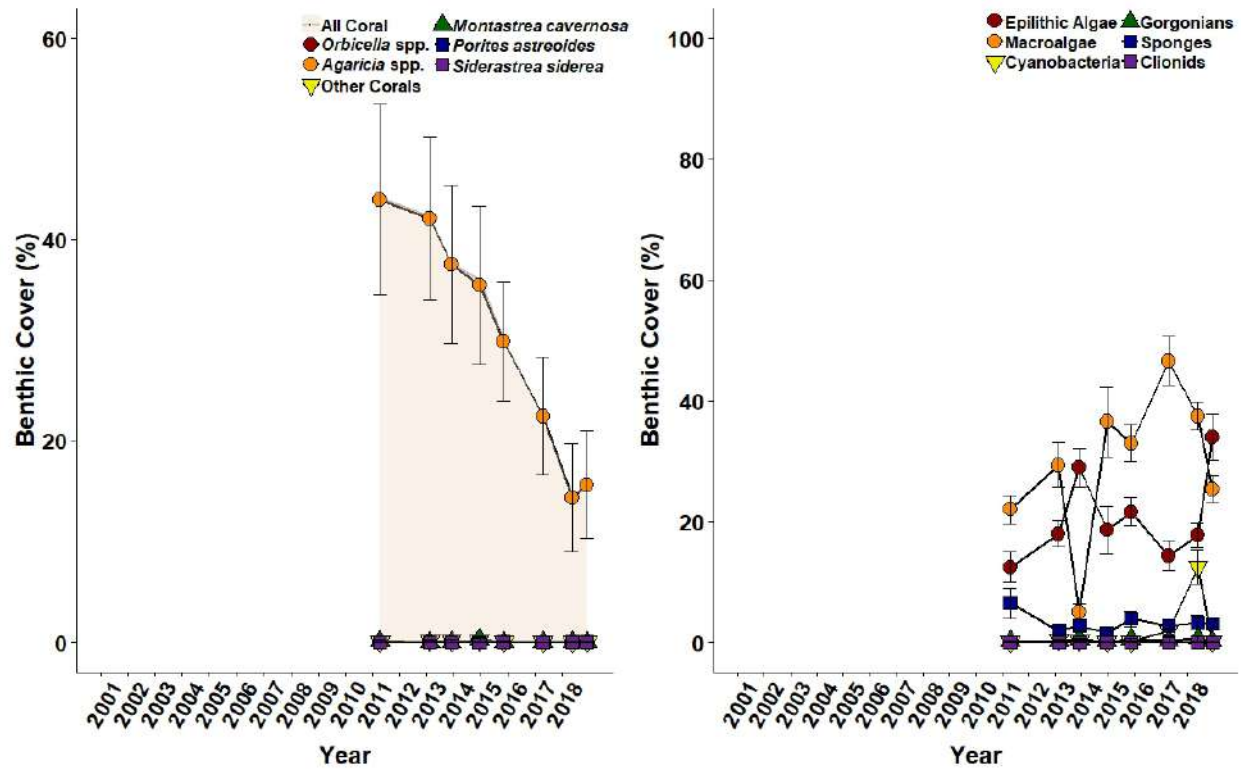


Figure 132. Ginsburgs Fringe benthic cover through time (mean $\pm$ SE).

SITE SUMMARIES

Fish Community. Fish abundance, biomass and diversity are low on Ginsburgs fringe, the deep mesophotic lettuce coral reef. Herbivores are in notably low abundance and piscivores make up the bulk of fish biomass encountered. Blackfin snapper, a deeper water species, are the most common piscivore. Dog snapper are occasionally observed, and in 2018 a yellowmouth grouper was seen on a transect. In 2016 lionfish were abundant on the deepwater shelf edge site. They were not observed in the following two years, however only four transects were completed each year. Deep-water fishes, including cherubfish and sunshinefish are found on Ginsburgs Fringe in addition to the blackfin snapper. During the grouper spawning aggregation period in the winter and spring months, large groups of Nassau and yellowfin grouper have been observed spawning over the reef at depths between 46-65 m. Historically, black grouper were caught off this reef in the spawning season, but they have not been observed spawning here in the last 25 years (Edmond Bryan, commercial fishermen).

SITE SUMMARIES

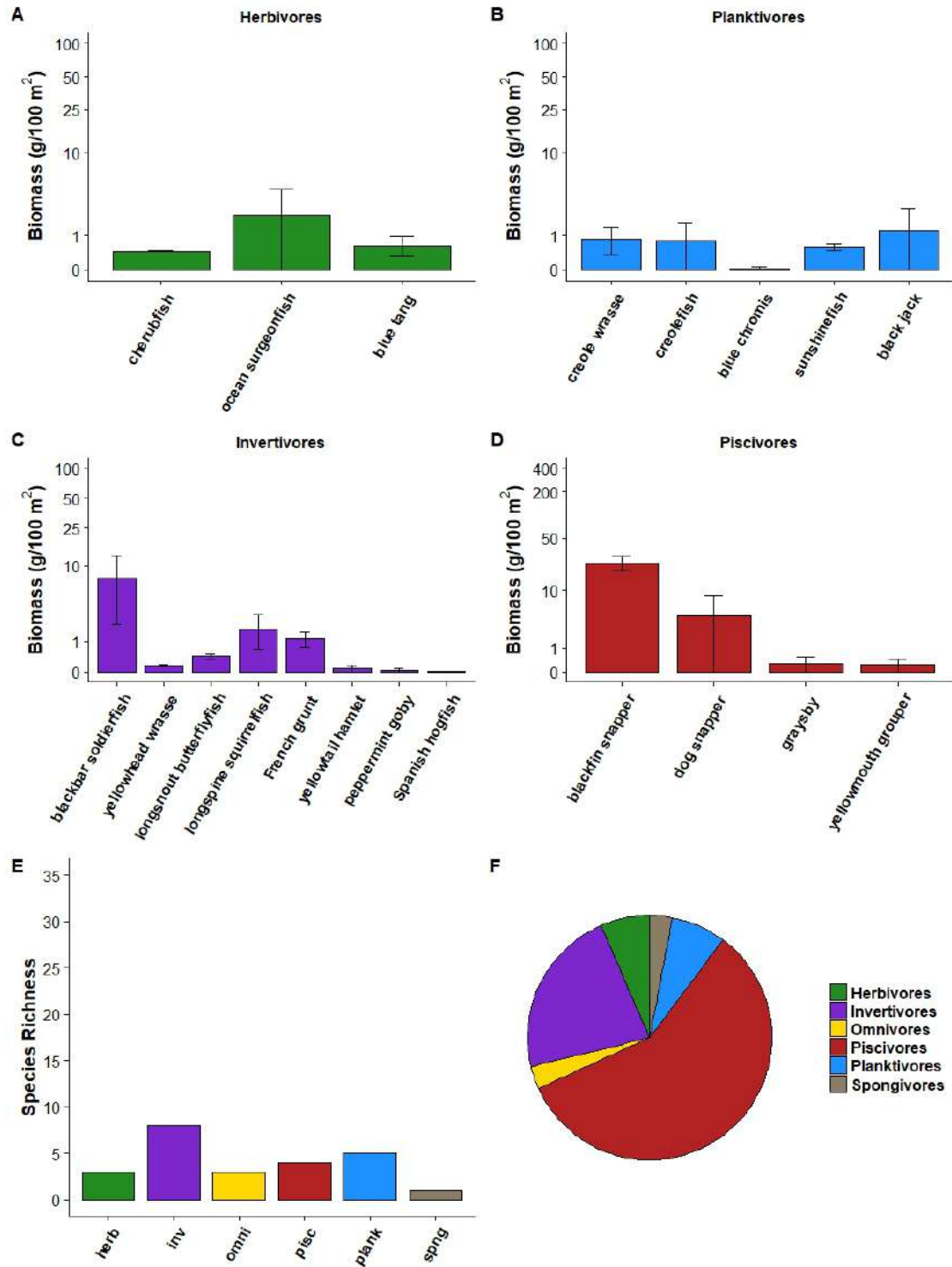


Figure 133. The Ginsburgs Fringe fish community as (A-D) average biomass per trophic group with the most common species shown in order on the x-axis, (E) species richness, and (F) relative community composition by total biomass. Note that biomass is a log scale.

SITE SUMMARIES

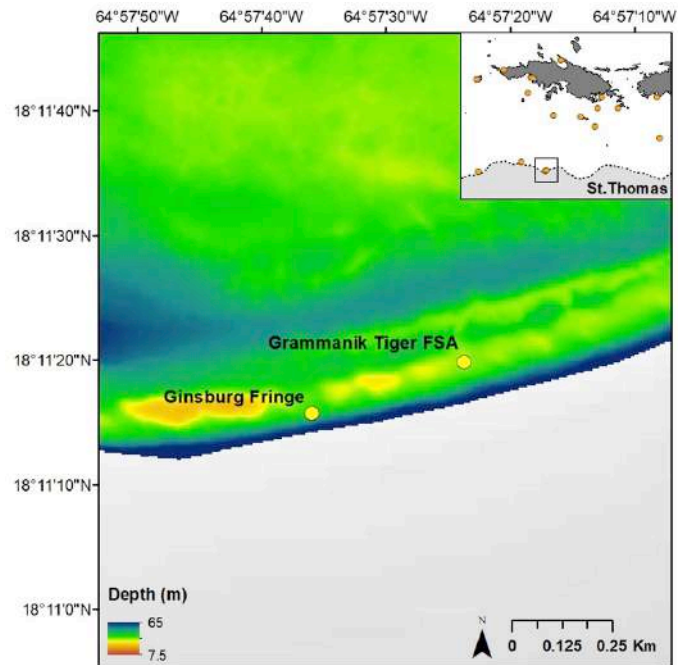
GRAMMANIK TIGER

Description. The Grammanik Tiger monitoring site is a primary bank mesophotic reef in depths of 37 – 41m. Star corals (*Orbicella* spp.) dominate the reef structure. Grammanik Tiger has been monitored since 2003, with permanent transects installed in 2007.

Outstanding Feature. The Grammanik Tiger monitoring site supports a dense coral community that is a staging area for annual multi-species fish spawning events, including the threatened Nassau grouper (*Epinephelus striatus*).

Threats. Although the Grammanik Tiger site and surrounding dense reefs are somewhat buffered from high thermal stress, but they are susceptible to chronic coral white diseases. Periodic disease outbreaks follow coral bleaching events. The Indo-Pacific lionfish (*Pterois volitans*) has formed dense populations within the study area and may be affecting native fish populations.

Figure 134. Grammanik Tiger (top) Location. (right) A representative photo of the reef.



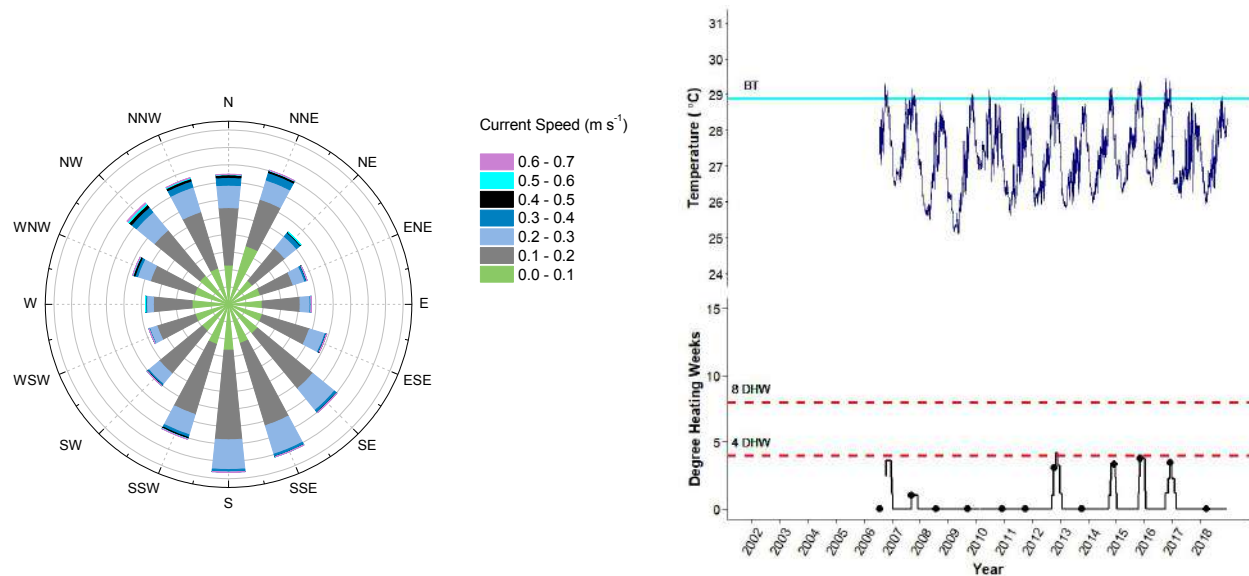


Figure 135. Grammanik Tiger benthic currents speed and temperature record (38 m depth).

Physical Characteristics.

Current. Unidirectional benthic currents at the Grammanik Tiger site are generally north-south, with the strongest current from the north-northeast to the northwest. Currents are typically weak to moderate, but occasionally reach strengths greater than 30 cm s^{-1} . Current speeds are based on near-continuous ADCP deployments from February 2005 to April 2009, with measurements at 30 or 60 minute intervals. Oscillatory currents are nil at this depth, with the possible exception of long period swells generated by tropical storms, although this has not been measured.

Temperature. Benthic temperatures at Grammanik Tiger are ameliorated by the passage of tidally driven internal tides in the warm season (May-November). Inter-annual variability creates temperatures that can be up to 2°C different for the same Julian Day. The Grammanik Tiger site is a prime example of how cooler temperatures at depth decrease the coral bleaching threshold by acclimation and lead to potential bleaching even in moderate temperatures relative to shallow reefs (Smith et al. 2016a).

SITE SUMMARIES

Benthic Community. Boulder star corals (*Orbicella* spp.) dominate the coral community of the Grammanik Tiger site; however, there is representation by a high number of other species that are also present in shallow water reefs. Grammanik Tiger lost only 5.4% of its coral cover in the 2005 bleaching event, but had not regained any cover (-129.6%) by 2011. A caveat is that transects were not made permanent until 2007. Other prominent members of the sessile epibenthic animal community are sponges. The macroalga *Lobophora variegata* and epilithic algae dominate the algal community. There are also a relatively high proportion of crustose coralline algae and various other macroalgae species.

Coral Health. Corals at Grammanik Tiger were very affected by bleaching in 2005, but were underestimated in surveys conducted when thermal stress was only about half (4 degree heating weeks) what it eventually reached (Smith et al. 2016a). The 2010 bleaching event was sampled at the peak (4 degree heating week) but was not detectible above background bleaching levels. High prevalence of bleaching in normal years is due largely to granular bleaching of *Orbicella* spp., where pigmented spots are surrounded by bleached areas. Coral diseases are very prevalent with high representation of white disease. Yellow band disease was reported at high prevalence in the first years of monitoring. Old partial mortality was low, but increased rapidly after the 2005 coral bleaching event. Recent partial mortality is very high and is caused by disease lesions, predations, and fish bites.

SITE SUMMARIES

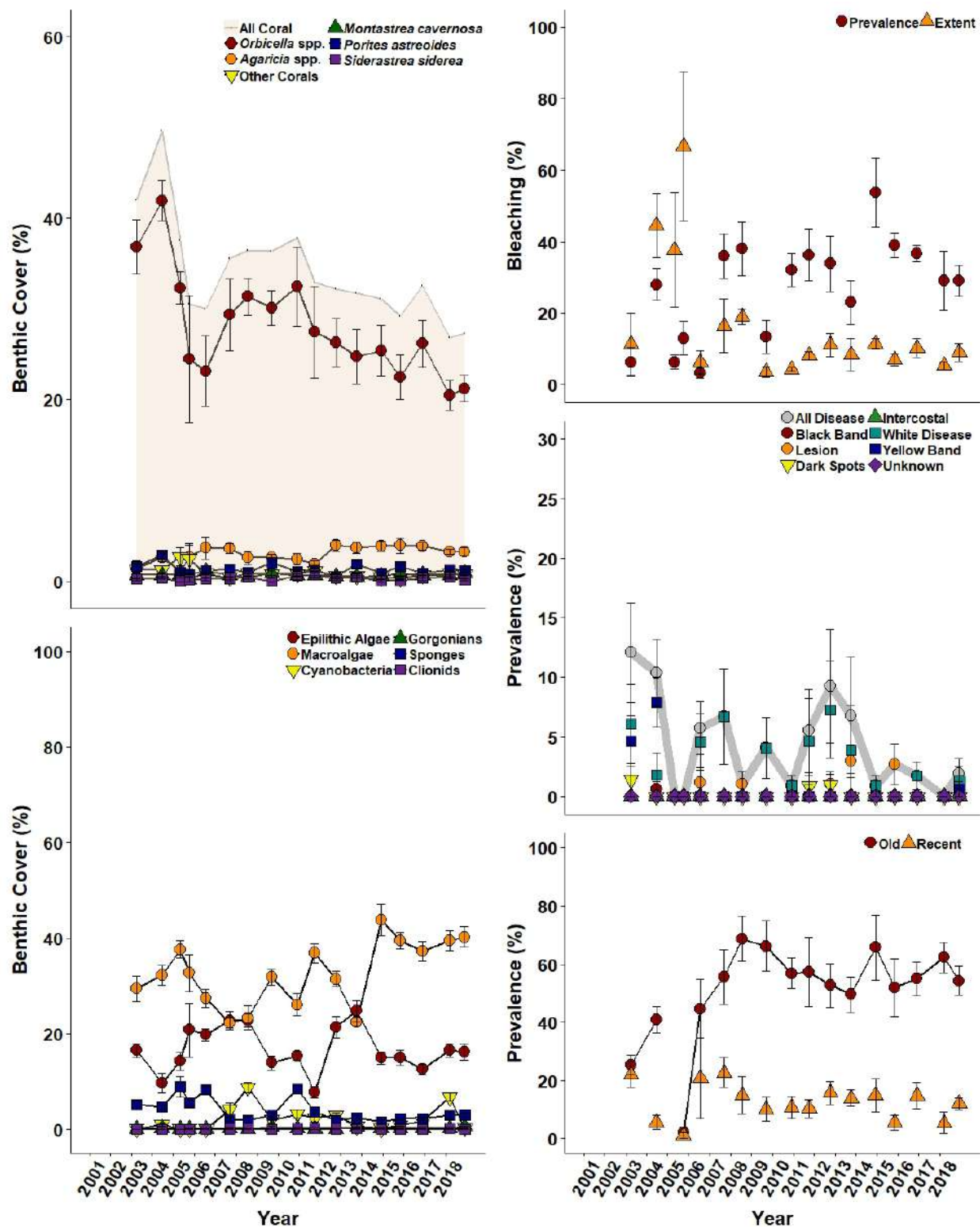


Figure 136. Grammanik Tiger benthic cover and coral health through time (mean $\pm$ SE).

SITE SUMMARIES

Fish Community. The Grammanik Tiger site supports less herbivores and a greater number of piscivores than the more shallow sites in the TCRMP. It is a staging area for the spawning site of several species of grouper and snapper and is within 0.5 km of that aggregation area. Given the annual range of spawning across multiple species on the site, surveys often coincide with the occurrence of fish aggregations, particularly those species with protracted spawning seasons (e.g., cubera and schoolmaster snapper). This drives up the relative piscivore biomass, however on the Grammanik Bank there are pelagic jacks as well as resident large grouper and snapper that are rarely found on near or offshore reefs of the USVI. Nassau, yellowfin, yellowmouth, and tiger grouper are present during non-spawning periods at the Grammanik Bank. This reef is protected from traps year round, and from all fishing gear from February through April. Sitting on the Puerto Rican shelf edge, with upwelling and strong tidal flow, planktivores dominate the relative community composition. Huge schools of creole wrasse and boga contribute to the large planktivore biomass. Black jacks, black surgeon and yellowtail snapper are also very common on this shelf edge site. The herbivore guild is generally dominated by large adult stoplight parrotfish. During some years the chub is found in small schools on the site, grazing on *Lobophora* and contributing significantly to herbivore biomass. Juvenile parrotfish and doctorfish are relatively uncommon on this and all the northern USVI mesophotic sites. Wrasse are also notably uncommon. In recent years the invasive red lionfish has become very prolific at the Grammanik Bank, with greater than ten individuals commonly observed on any given dive. Although fishing pressure is low, potential lionfish predators are in relatively high abundance at the site, however they do not appear to be controlling the invasive fish. As well as large groupers and snappers, lemon, Caribbean reef and bull sharks are seen frequently on the reef. Nurse sharks and Nassau grouper have been observed killing and eating lionfish that had been collected to be tagged and were caged under clear nets on the bottom. Predators overturned the nets and ate the lionfish, so there is hope that this behavior occurs without the aid of divers.

SITE SUMMARIES

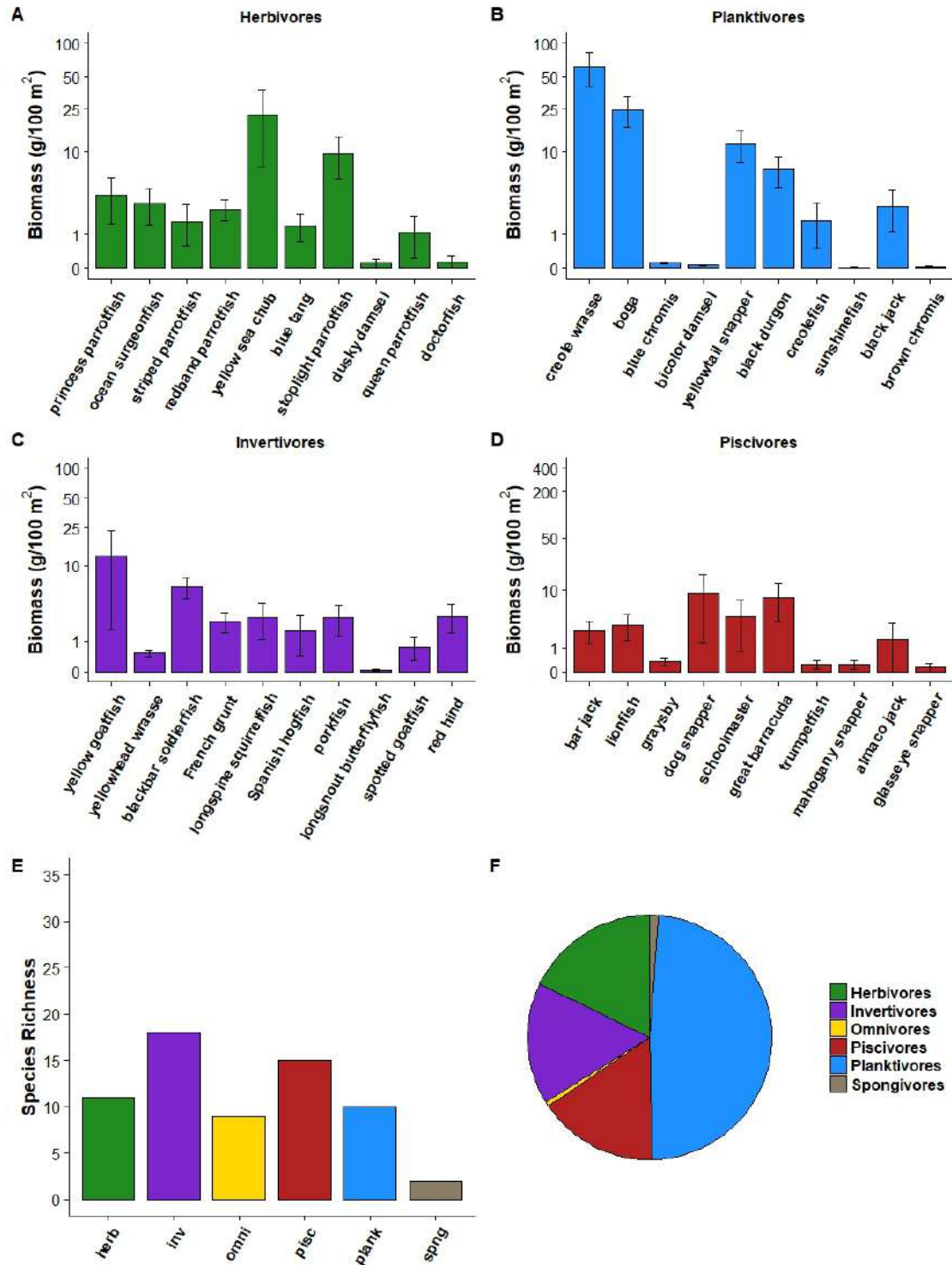


Figure 137. The Grammanik Tiger fish community as (A-D) average biomass per trophic group with the most common species shown in order on the x-axis, (E) species richness, and (F) relative community composition by total biomass. Note that biomass is a log scale.

SITE SUMMARIES

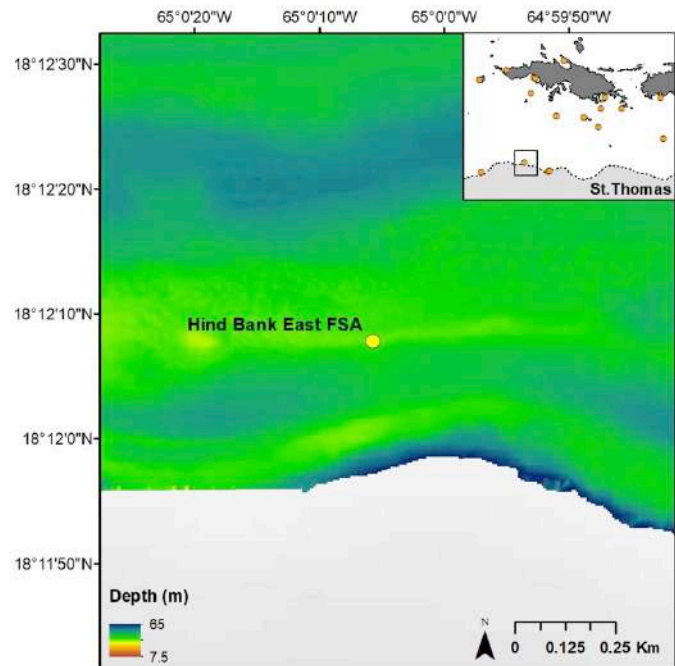
HIND BANK

Description. The Hind Bank is a mesophotic tertiary bank in depths of 38 – 42 m. The reef is part of a patchy complex of star coral (*Orbicella* spp.) dominated reefs that stretch across the eastern Red Hind Marine Conservation District. The Hind Bank has been monitored since 2003, with permanent benthic transects installed in 2007.

Outstanding Feature. The Hind Bank is within a no-take marine reserve and fish populations are recovering and robust. The Hind Bank monitoring site hosts a multispecies spawning aggregation, including a recovering population of the commercially important red hind grouper (*Epinephelus guttatus*).

Threats. The Hind Bank and surrounding dense reefs are somewhat buffered from high thermal stress, but they are susceptible to chronic coral white diseases. Periodic disease outbreaks follow high thermal stress. The Indo-Pacific lionfish (*Pterois volitans*) has formed dense populations within the study area and may be affecting native fish populations.

Figure 138. Hind Bank (top) Location. (right) A representative photo of the reef.



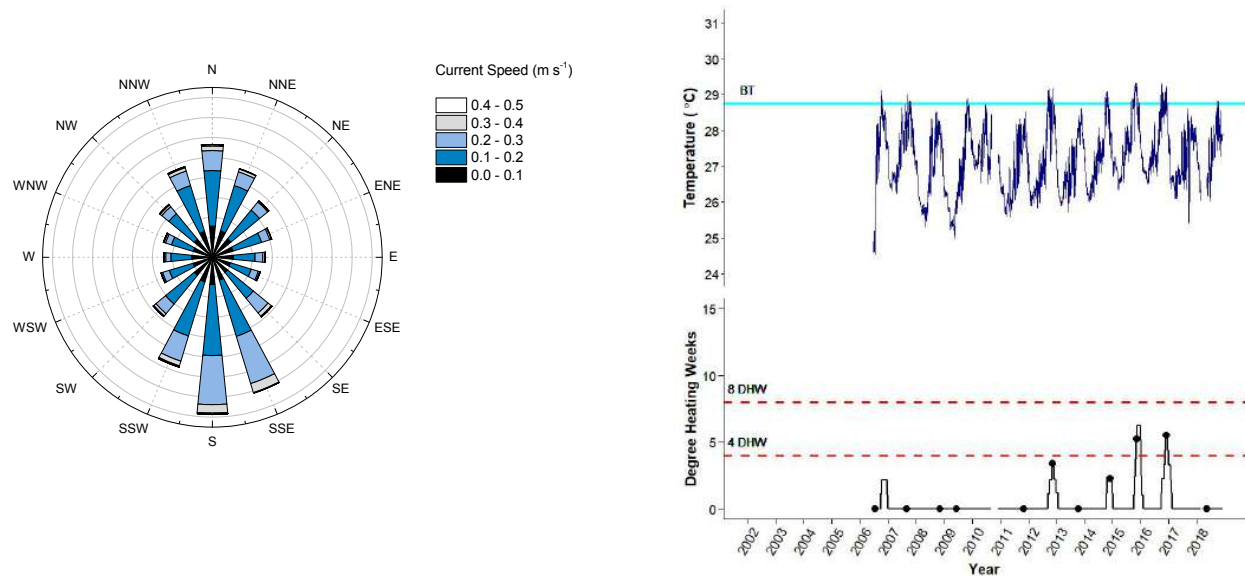


Figure 139. (top) Hind Bank benthic current speed (40m depth). (bottom) Benthic temperature record at 40 m depth.

Physical Characteristics.

Current. Hind Bank has moderately strong unidirectional near-benthic currents that are dominated by a north to south components. Currents can be moderate to strong ($>20\text{cm s}^{-1}$). Current speeds are based on near-continuous ADCP deployments from February 2005 to May 2012, with measurements at 30 or 60 min. intervals. Oscillatory currents are not known from the Hind Bank.

Temperature. Temperatures show much evidence of internal tides in the warm season and are notably cooler than shallow water sites in the upper mixed layer and nearshore embayments.

SITE SUMMARIES

Benthic Community. The Hind Bank site is dominated by boulder star corals (*Orbicella* spp.), but also has a high abundance of lettuce corals (*Agaricia* spp.). The Hind Bank site lost 21.8% of its coral cover in the 2005 bleaching event, but had regained 71.4% of this cover by 2011. The algal community is co-dominated by epilithic algae and the macroalga *Lobophora variegata*. There is also high representation of crustose coralline algae and other unidentified macroalgal species.

Coral Health. Bleaching during the 2005 event was underestimated because sampling occurred before the peak in heat stress. The prevalence of bleaching was higher during the 2010 coral bleaching event. In later years, the high prevalence of moderate prevalence, low colony extent bleaching was often associated with granular bleaching. This bleaching pattern shows pigmented spots surrounded by bleached tissue. Coral diseases are common at the Hind Bank and may be increasing. White disease was the dominant disease, and 2011 showed a peak of disease signs. In 2009 there was a high prevalence of intercostal mortality syndrome, which is only known from mesophotic coral reefs (Smith et al. 2010b). Old partial mortality increased after the 2005 bleaching event and the high prevalence was not reduced until 2011. Recent partial mortality prevalence is often high and reflects the impacts of disease and predation.

SITE SUMMARIES

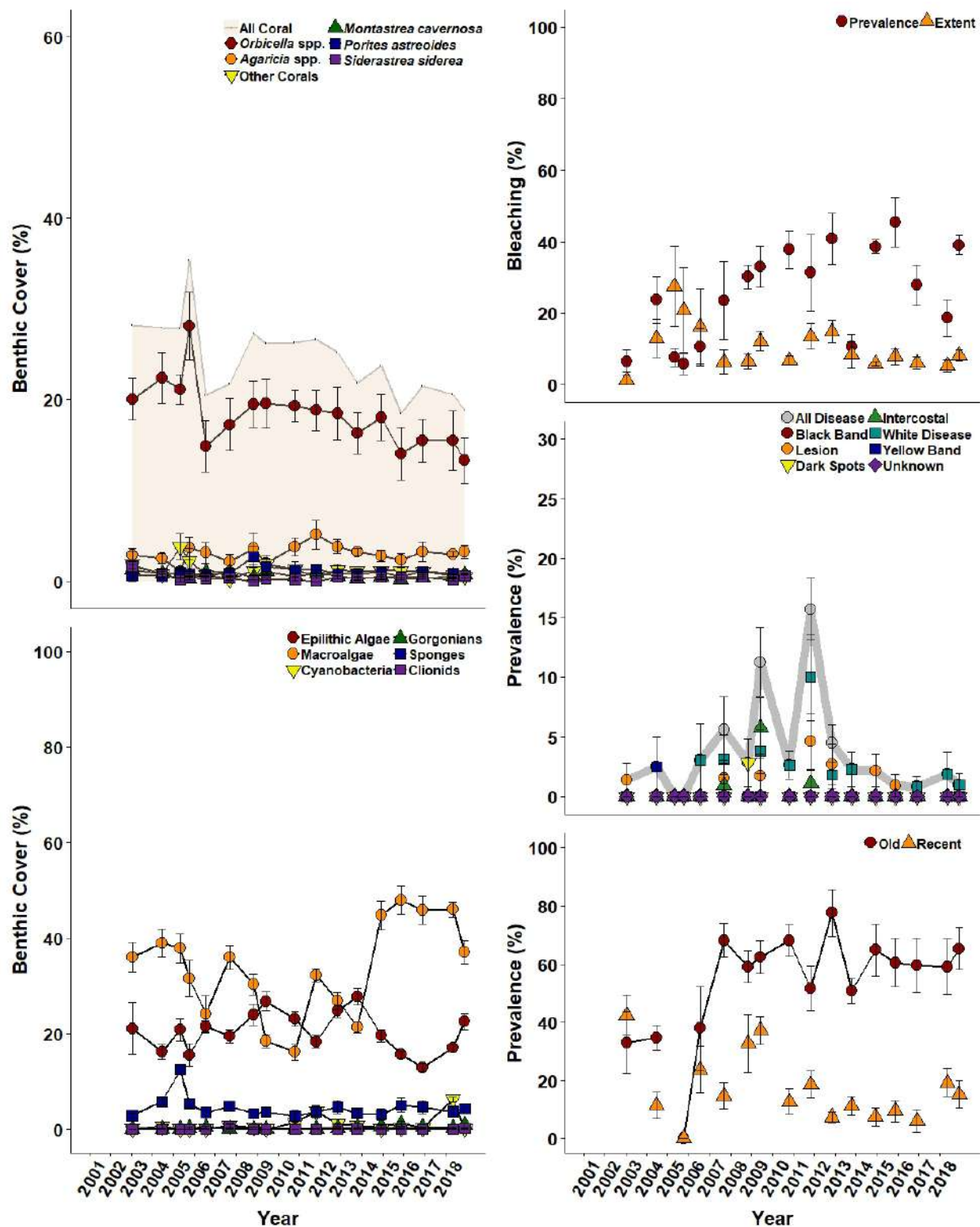


Figure 140. Hind Bank benthic cover and coral health through time (mean $\pm$ SE).

SITE SUMMARIES

Fish Community. Like the Grammanik Bank, the Hind Bank is characterized by a high number and biomass of piscivorous fish. The site is within the Marine Conservation District (MCD) and is protected year round from all fishing, except surface trolling. It is the spawning site for several species including red hind, mutton snapper, tiger grouper, and schoolmaster snapper. It is also a corridor for large snappers and groupers swimming to and from the Grammanik Bank to spawn. Surveys often coincide with the occurrence of schoolmaster snapper, which has a protracted spawning season. Although this drives up the relative piscivore biomass, there are also jacks, large barracuda, and resident groupers and snappers that contribute. Occasional to common large groupers include the Nassau, yellowfin, tiger and yellowmouth. Herbivore biomass is relatively low on the Hind Bank, as on other mesophotic sites. Herbivores are dominated by adult or semi-adult princess, redband and stoplight parrotfish. Queen parrotfish are also commonly observed. Juvenile parrotfish are absent from the site. Benthic invertivores are dominated by blackbar soldierfish, queen triggerfish and goatfish. The site is surrounded by sand and hardbottom areas, supporting a variety of benthic resources for invertebrates. Plantivores observed at the Hind Bank vary with tide and current. Creole wrasse can be seen in large schools or may be absent. Large yellowtail snapper are generally present. Other planktivores found at the Hind Bank include the black jack, black durgon, boga and creolefish. Mesophotic species such as the fairy basslet, sunshinefish, and longsnout butterflyfish are also common. The red lionfish has become a regular resident of the reef and large sharks are seen occasionally.

SITE SUMMARIES

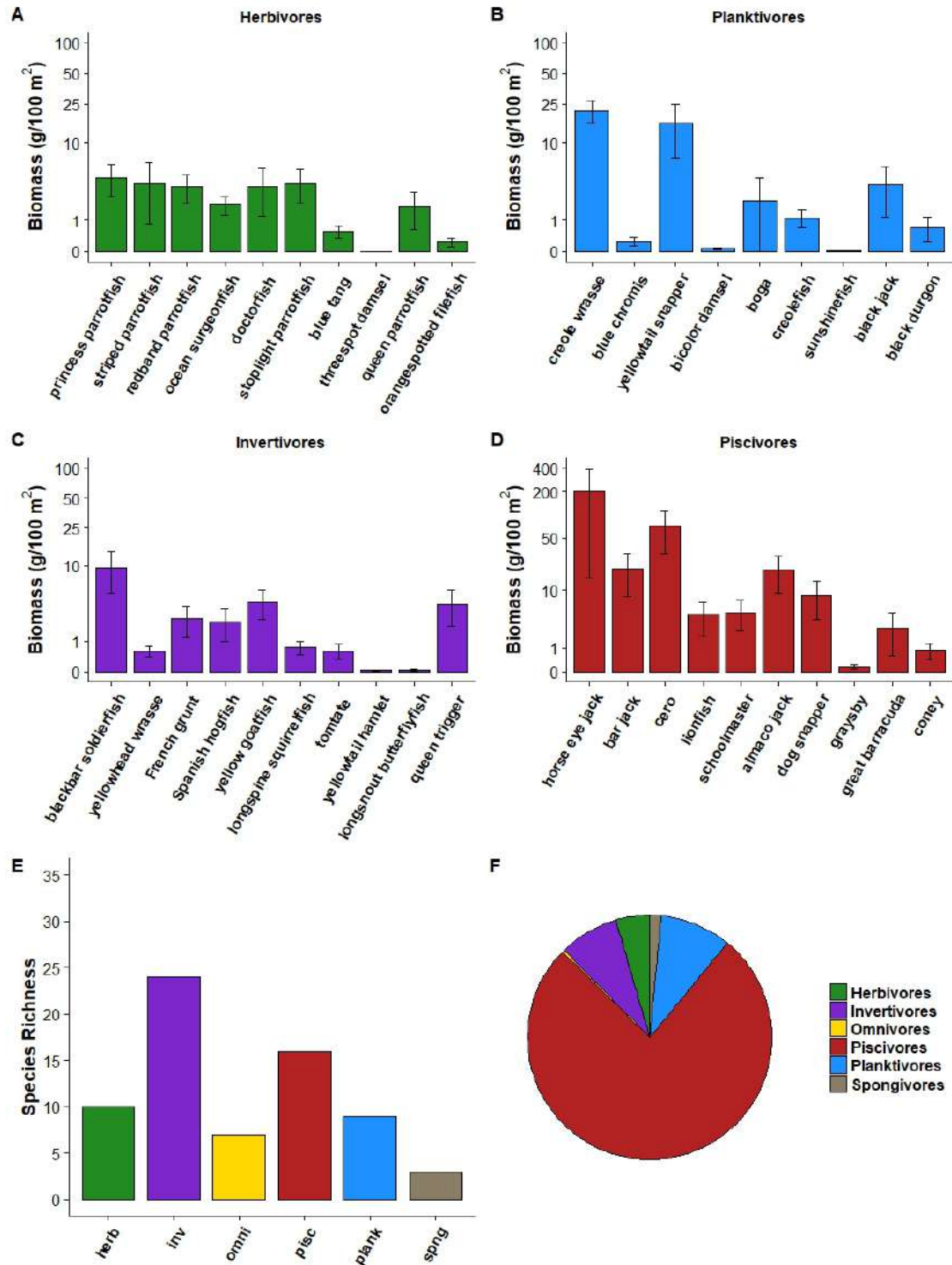


Figure 141. The Hind Bank East fish community as (A-D) average biomass per trophic group with the most common species shown in order on the x-axis, (E) species richness, and (F) relative community composition by total biomass. Note that biomass is a log scale.

SITE SUMMARIES

LITTLE SAINT JAMES

Description. The Little St. James site is a midshelf hardbottom reef in depths of 16-22 m. The site is a patch reef surrounded by sand/rhodolith plain. Little St. James has been monitored since 2005, with permanent benthic transects installed in 2007.

Outstanding Feature. The Little St. James site is just outside the St. Thomas East End Reserve and supports occasional high densities of snappers, grunts, and queen trigger.

Threats. Commercial fisherman target the Little St. James site and active and derelict fish traps are in high abundance. The site is down-current of development on Little St. James Island and is potentially threatened by land-based source of pollution.

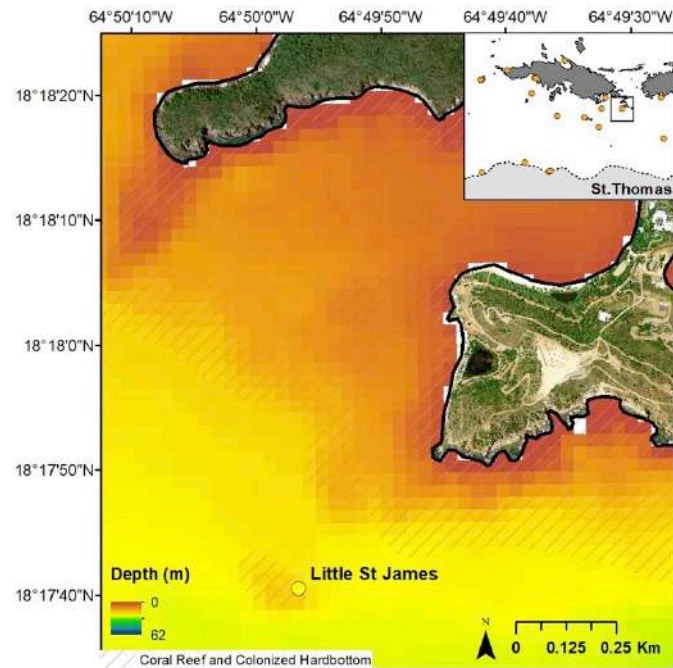


Figure 142. Little St. James. (top) Location. (right) A representative photo of the reef with derelict fish trap



SITE SUMMARIES

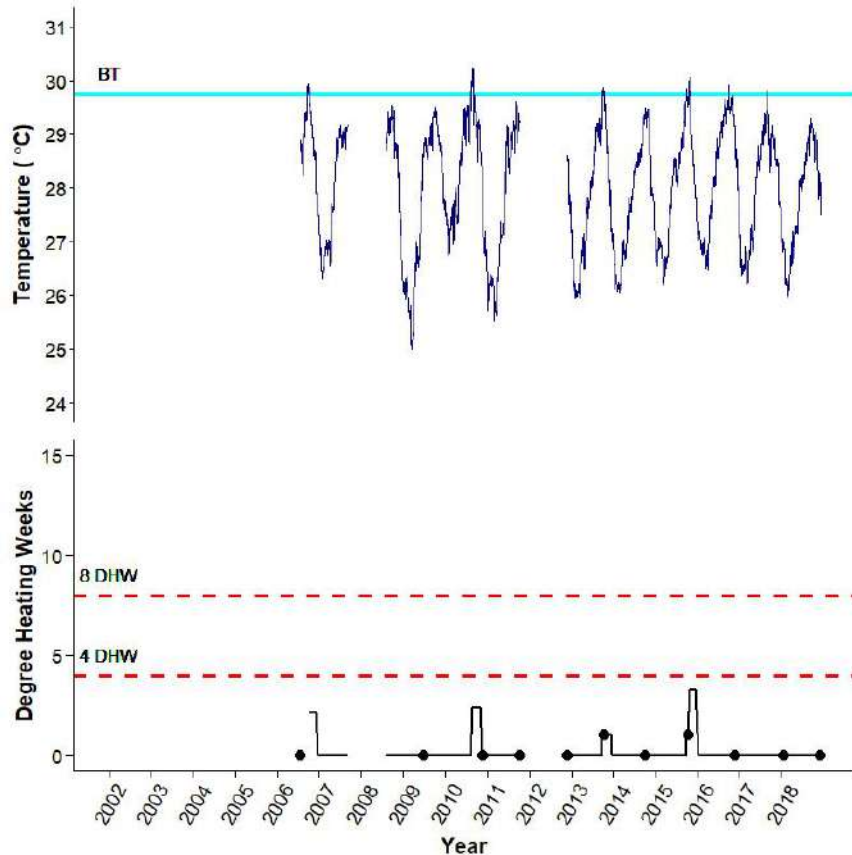


Figure 143. Little St. James benthic temperature record (19 m depth).

Physical Characteristics.

Current. Currents have not been directly measured at St. James. Unidirectional benthic currents have only been weak during monitoring. Strong wave-driven oscillatory currents may take place, as evidenced by the high proportion of gorgonians and *Sargassum* spp. at the site.

Temperature. Benthic temperatures at St. James can be high during warm years, such as 2010.

SITE SUMMARIES

Benthic Community. The sparse coral community of the Little St. James site is diverse.

There is a high proportion of rare species, such as *Eusmilia fastigiatum*, *Madracis* spp., and *Mycetophyllia* spp.. The site lost 16.5% of coral cover in the 2005 bleaching event but had apparently regained 376.2% of this loss by 2011. This large increase above bleaching losses may be explained by the fact that transects were not made permanent until 2007 and were then sited in areas with the densest coral. The sessile epibenthic community overall is largely composed of sponges and gorgonians. The algal community is dominated by the macroalgae *Dictyota* spp. and the *Sargassum* spp.. *Lobophora variegata* and epilithic algae are also in high proportional abundance.

Coral Health. The coral community at Little St. James was highly affected by the 2005 coral bleaching event, with all corals assessed completely bleached. Half the corals were affected by low extent bleaching in 2010. Low-level bleaching is a common feature of the site. Diseases are less common, with the exception of a white disease outbreak that preceded the coral bleaching event in June 2005. Dark spots disease can also be common. Old partial mortality increased rapidly after the 2005 bleaching event. Recent partial mortality is not very prominent.

SITE SUMMARIES

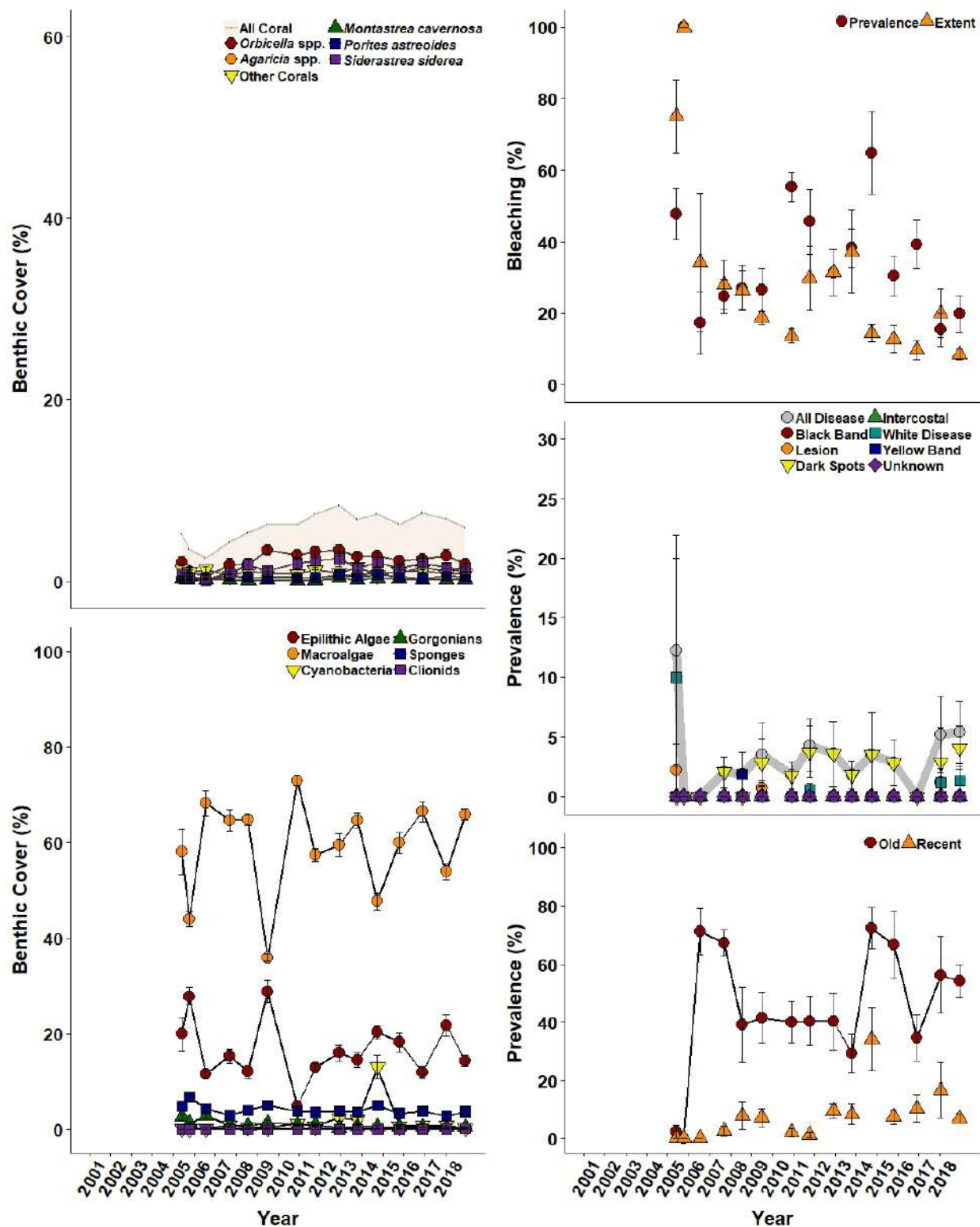


Figure 144. Little St. James benthic cover and coral health through time (mean ± SE).

SITE SUMMARIES

Fish Community. The fish community of Little St. James differs from those of the more developed reef habitats, representing both a coral reef and hard bottom fish community. Queen triggerfish and mutton snapper are far more common on Little St. James than on other TCRMP sites. Large, adult hind and goatfish are also very common. These benthic invertivores are indicative of hard bottom/sandy sites. During parts of the year, grunts (French and white) have been observed in huge numbers and may use the site for spawning. The spongivores (angelfish) are well represented. Bar jacks, yellow jacks and almaco jacks are very common swimming in the water column at the Little St. James site, contributing to the high overall piscivore biomass. Schoolmaster, gray, and mahogany snapper are also common. All six of these species are considered ciguatoxic in this area and are not targeted by hook and line, trap, or spear fishermen. Herbivores are dominated by the tangs and surgeonfish, which swim and graze the site in large mixed schools. Most notable is the queen triggerfish population, which holds both large numbers and variable sizes of fish at Little St. James. Lobster are also relatively dense and generally observed on both transects and roving dives. The Little St. James reef is outside of the boundaries of the St. Thomas East End Reserve and fish traps are observed regularly on the site, presumably fishing for lobster and queen triggerfish.

SITE SUMMARIES

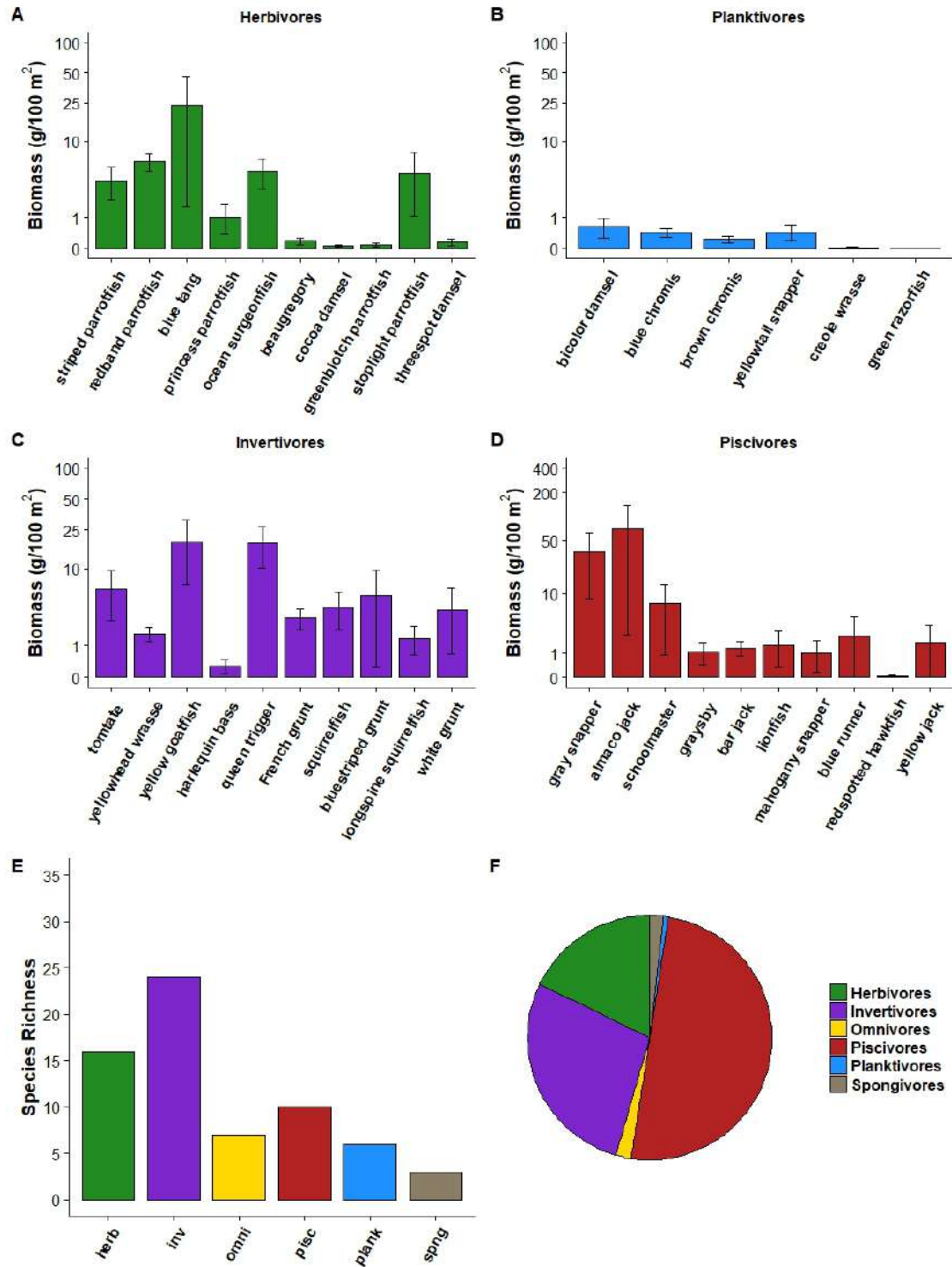


Figure 145. The Little St. James fish community as (A-D) average biomass per trophic group with the most common species shown in order on the x-axis, (E) species richness, and (F) relative community composition by total biomass. Note that biomass is a log scale.

SITE SUMMARIES

MAGENS BAY

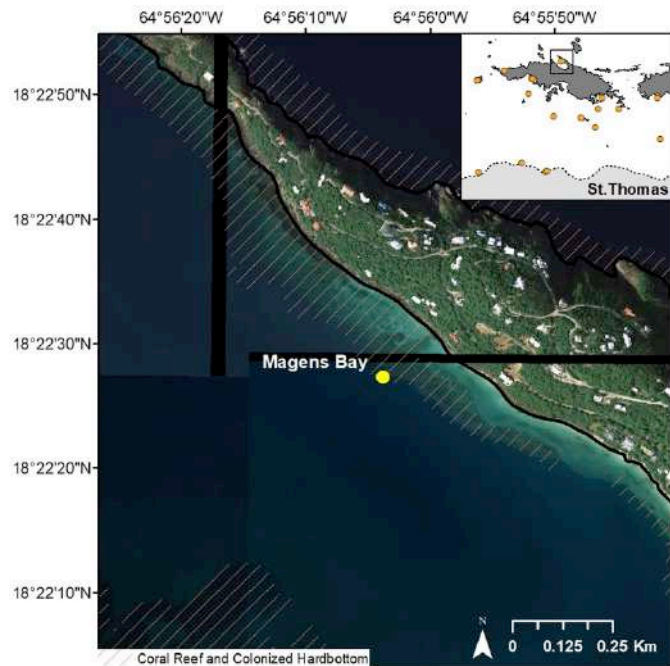
Description. The Magens Bay site is a nearshore fringing reef located along Peterborg Point in depths of 7 – 14 m. The reef has a sharp break in slope leading to a steep escarpment that terminates in a sand/sediment plain at the reef base. Magens Bay has been monitored since 2001.

Outstanding Feature. The Magens Bay site is a well-protected northside St. Thomas reef near one of the most popular tourist beaches in the Caribbean.

Threats. Magens Bay is in a highly enclosed embayment receiving a very large and developed watershed. Sediment run-off is high and deposition on reefs is favored by slow current speeds. The turbidity after rain and swell events can be extreme in the bay and water visibility is often less and 3m. In addition, leaky septic systems may impair bay waters.

Recreational/artisanal fishers frequently fish this site with hand line and spear.

Figure 146. Magens Bay. (top) Location. (right) A representative photo of the reef.



SITE SUMMARIES

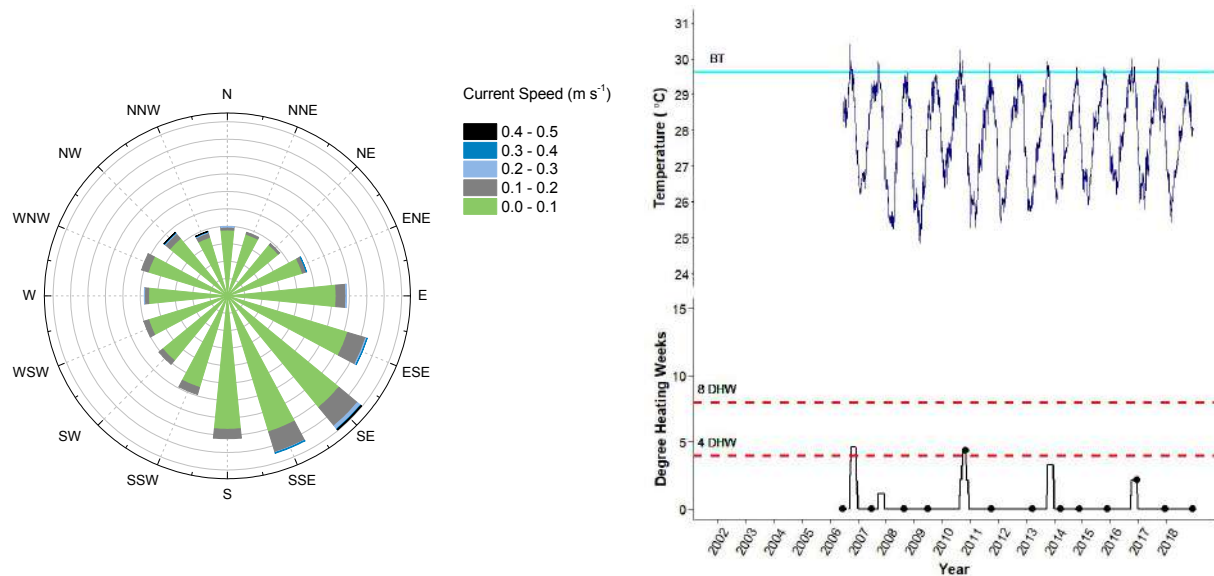


Figure 147. Magens Bay current speed and benthic temperature record (9 m depth).

Physical Characteristics.

Current. Magens Bay has restricted water flow dominated by weak currents running counter or orthogonally to the left of the dominant wind direction. This may indicate that there is a counter flowing eddy. Current data are based on average data from Dec. 2006-Oct. 2007 7.5 m above the sensor head.

Temperature. Magens Bay has low circulation, but temperatures are kept cooler by exposure to the Atlantic.

SITE SUMMARIES

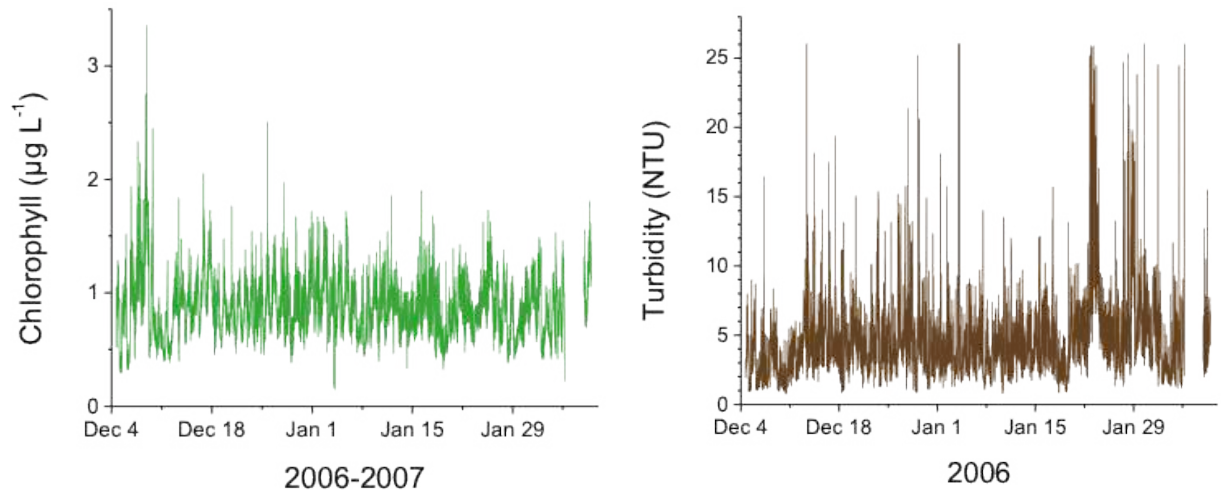


Figure 148. Mogens Bay chlorophyll (left) and turbidity (right) record (16 m depth).

Chlorophyll & Turbidity. Mogens Bay is susceptible to very high chlorophyll and turbidity values indicating very high productivity that is likely fueled by terrestrial run-off. Turbidity reduces light penetration and reduces the depth limits for coral growth and water column productivity favors heterotrophic organisms, such as sponges and gorgonians.

SITE SUMMARIES

Benthic Community. The sparse coral community at Magens Bay is very diverse, with no real dominance by any one species. The site lost 12.4% of its coral cover in the 2005 bleaching and has continued to lose coral, with a cover loss of 33.1% from 2005 pre-bleaching to 2011. Gorgonians and then sponges dominate the sessile epibenthic community. Epilithic algae and the macroalga *Dictyota* spp. dominate the algal community. Filamentous cyanobacteria are also common. There is a high proportion of sand/sediment around corals at the Magens Bay site.

Coral Health. Corals were highly affected by the 2005 bleaching event, with about 80% of all corals about 80% affected across the colony surface. This site also showed a strong response to the 2010 bleaching event with about 60% of corals bleached at a low extent. Diseases can be high and are dominated by dark spots disease. Old partial mortality increased after the 2005 bleaching event and then declined, with a slight increase from 2009 to 2011. Recent partial mortality is common at the Magens Bay site, largely as the result of biting by territorial damselfish (*Stegastes* spp.; data not shown).

SITE SUMMARIES

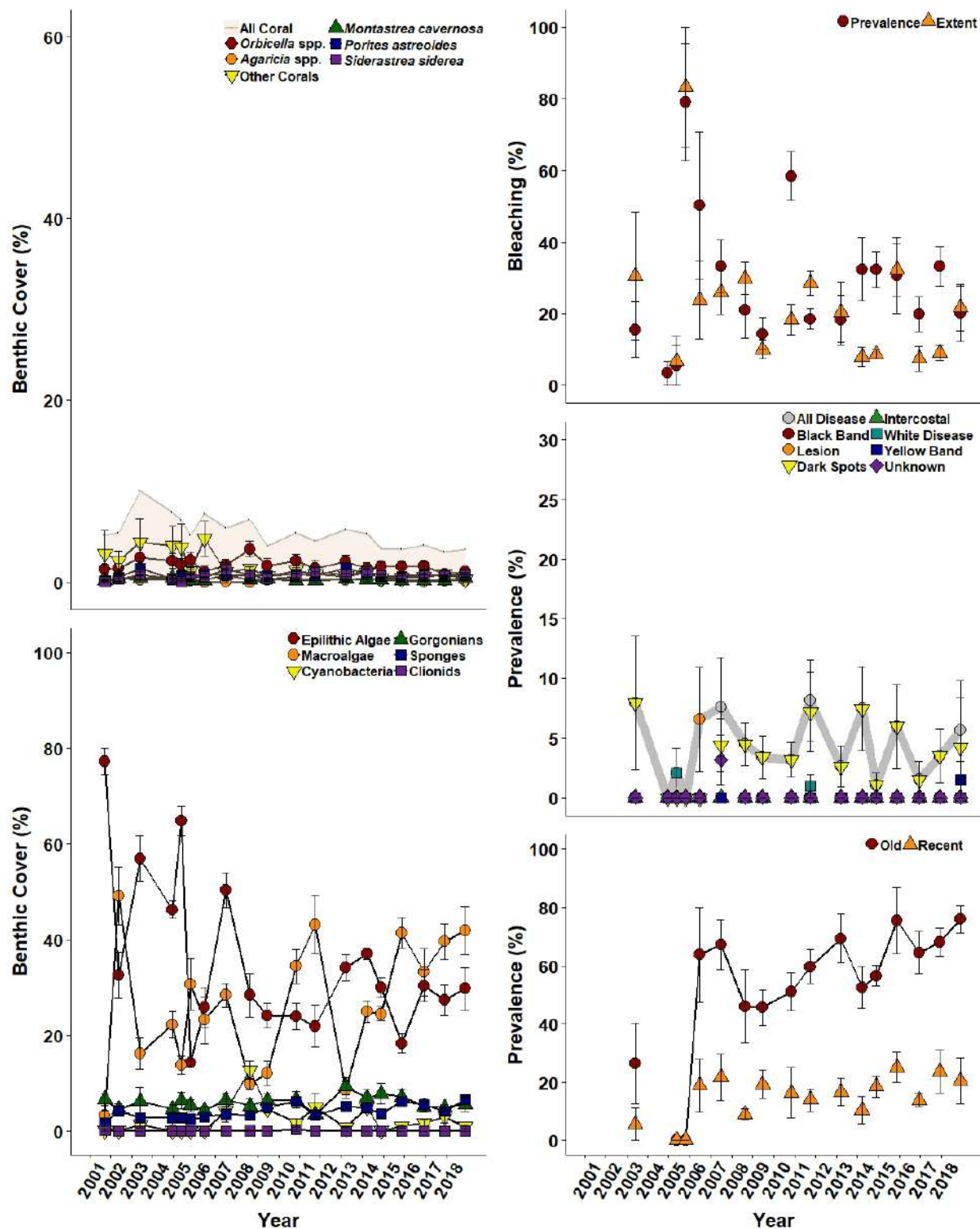


Figure 149. Magens Bay benthic cover and coral health through time (mean ± SE).

SITE SUMMARIES

Fish Community. Magens Bay once supported its own rich fishery and was the notorious site of the only fatality by shark attack recorded in St. Thomas (Randall 1963a). The days of large, commercially important fish in Magens Bay have been gone since the 1970's; however, the bay is adjacent to the deep Puerto Rican shelf to the north and large sharks are known to frequent the bay. Tiger sharks are still caught commonly off either point defining the bay to the east or west. Anecdotally, hammerheads mate in the middle of Magens Bay during one moon phase of the year, and along the mile long sandy beach it is not uncommon to see young of the year reef sharks swimming in the clear water, suggesting that the deep protected bay is the pupping ground for at least one species of shark. Along the reef on the eastern edge of the bay (the TCRMP monitoring site) large fish are rare, and herbivores make up the bulk of the fish biomass. On the reef edge, mahogany and lane snapper are found, along with grunts, goatfish, and larger parrotfishes. The top of the reef holds schools of wrasse mixed with juvenile parrotfish, along with high densities of damselfish (mainly bicolor) and juvenile yellowtail snapper. In 2017 a juvenile Nassau grouper was seen on a transect in Magens Bay. No other large groupers or snappers have been observed there throughout the survey period, although trap fishing does not occur in the bay anymore.

SITE SUMMARIES

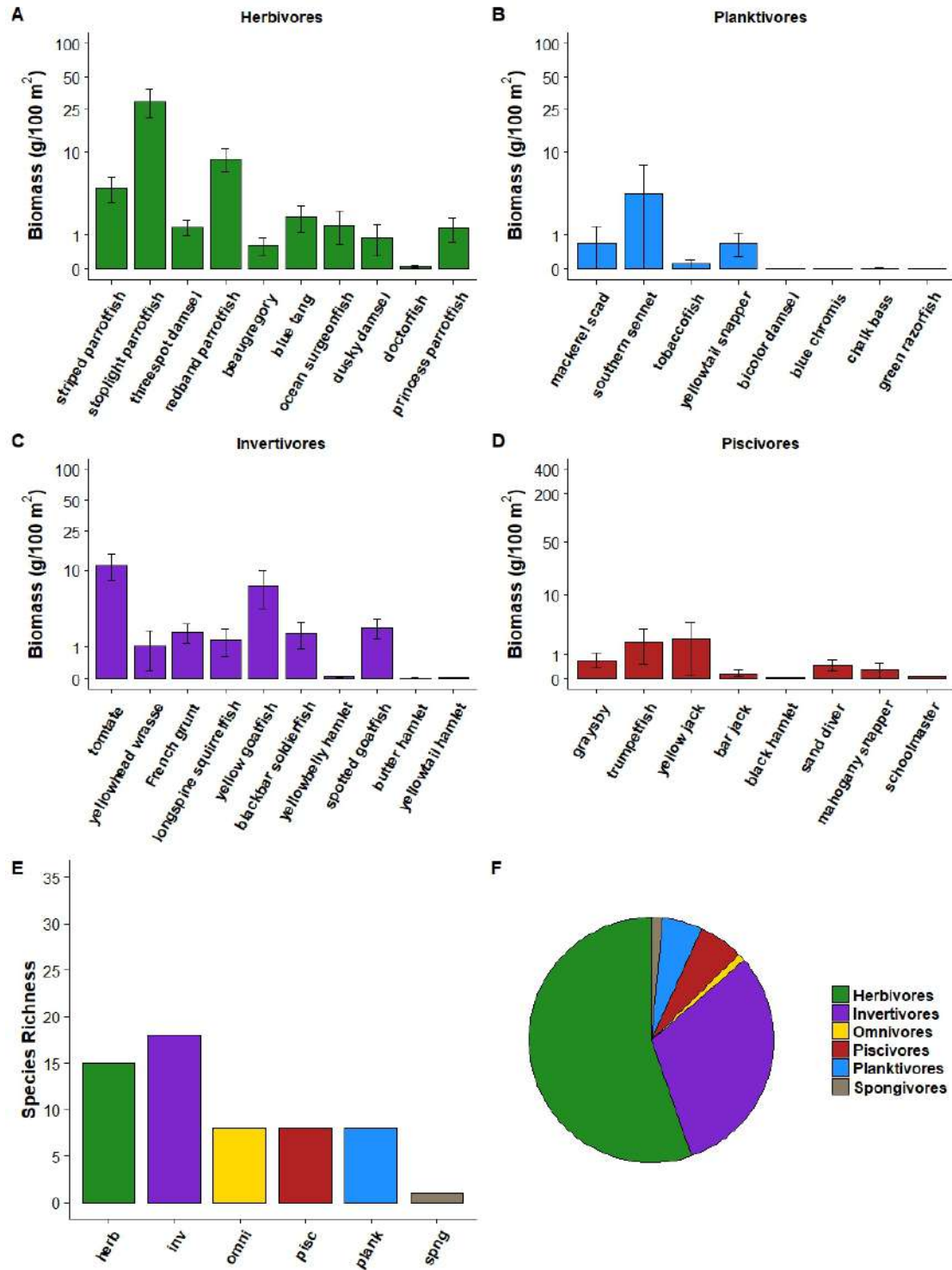


Figure 150. The Magens Bay fish community as (A-D) average biomass per trophic group with the most common species shown in order on the x-axis, (E) species richness, and (F) relative community composition by total biomass. Note that biomass is a log scale.

SITE SUMMARIES

SAVANA ISLAND

Description. The Savana Island site is a midshelf fringing reef facing the Atlantic Ocean to the northwest in depths of 5 – 17 m. The reef is a well-developed coral community atop bedrock, with some insipient carbonate accumulation. Savana has been monitored since 2003, with permanent benthic transects installed in 2007.

Outstanding Feature. Savana harbors behemoth colonies of boulder star coral (*Orbicella faveolata*) and a diverse and abundant fish community.

Threats. Savana is threatened the invasive algae *Ramircrusta* sp. (identification provisional) and by warming ocean temperatures, as *O. faveolata* can be susceptible to bleaching, disease, and partial mortality. The area is also open to fishing and the occasional accumulation of debris can be seen.

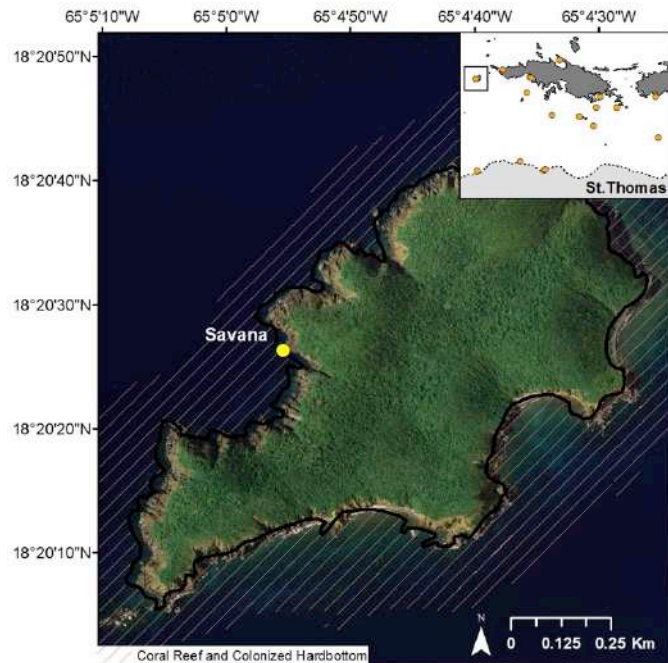


Figure 151. Savana.
(top) Location. (right)
A representative
photo of the reef
showing large colonies
of *Orbicella faveolata*
(Nov. 17, 2015).



SITE SUMMARIES

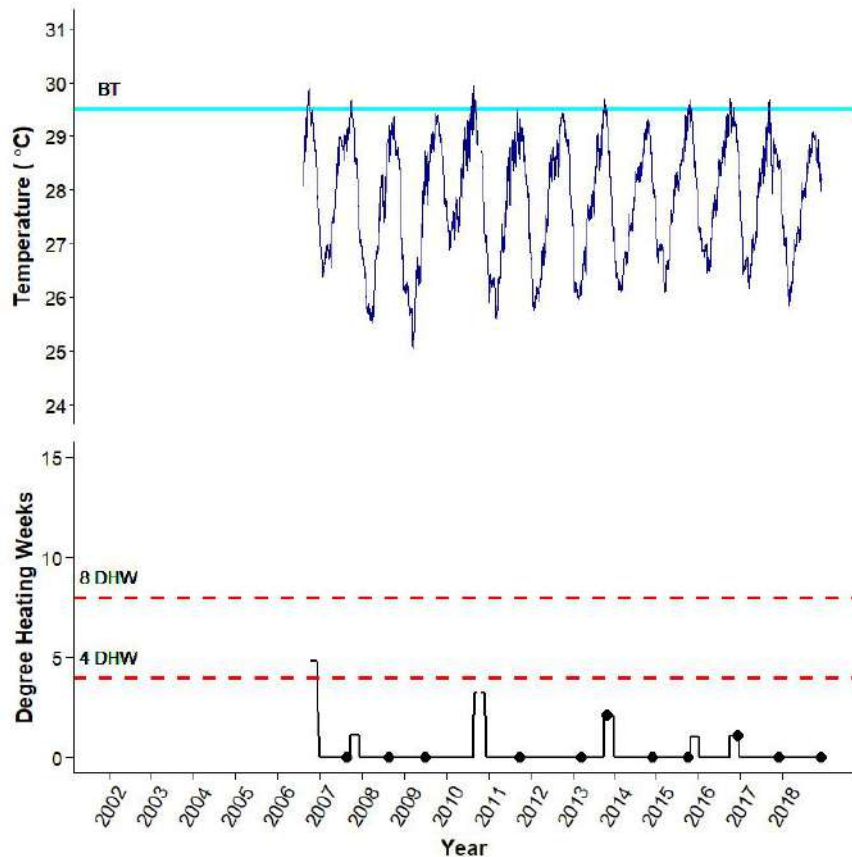


Figure 152. Savana benthic temperature record (10 m depth).

Physical Characteristics.

Current. Currents have not been measured directly at Savana. Strong unidirectional currents can influence the surface near the site. Wave-driven oscillatory currents are common and occasionally strong.

Temperature. Savana has temperatures cooler than other shallow sites, likely due to the proximity of the open Atlantic Ocean.

SITE SUMMARIES

Benthic Community. Boulder star corals, predominately large (>2m wide) colonies of *Orbicella faveolata*, dominate the coral community at the Savana monitoring site. The site lost 45.2% of its coral cover in the 2005 bleaching event. Coral cover has continued to decline, rather than recover, and this is related to a striking increase in the red encrusting algae *Ramicrosta* sp. to over 60% cover (this is responsible for the spike in “macroalgae” in benthic cover after 2005). This algae overtops coral edges leading a slow, creeping mortality. Gorgonians and sponges are also prominent components of the sessile epibenthic animal community.

Coral Health. The coral community at Savana was highly affected in the 2005 bleaching event, with 80% of corals affected on almost 90% of the colony surface. Bleaching was also very prominent in 2006, but at a lower extent. Bleaching was moderate during the 2010 bleaching event, with over 50% of colonies bleached at a low extent. Coral diseases can reach high prevalence and are diversely represented. Particularly noticeable is the dramatic outbreak of white disease in 2006. Dark spots disease has also affected a high proportion of corals from 2008 onwards. Old partial mortality increased markedly after the 2005 coral bleaching event and has declined only slightly. Recent partial mortality after the 2005 coral bleaching event was unprecedented for any site.

SITE SUMMARIES

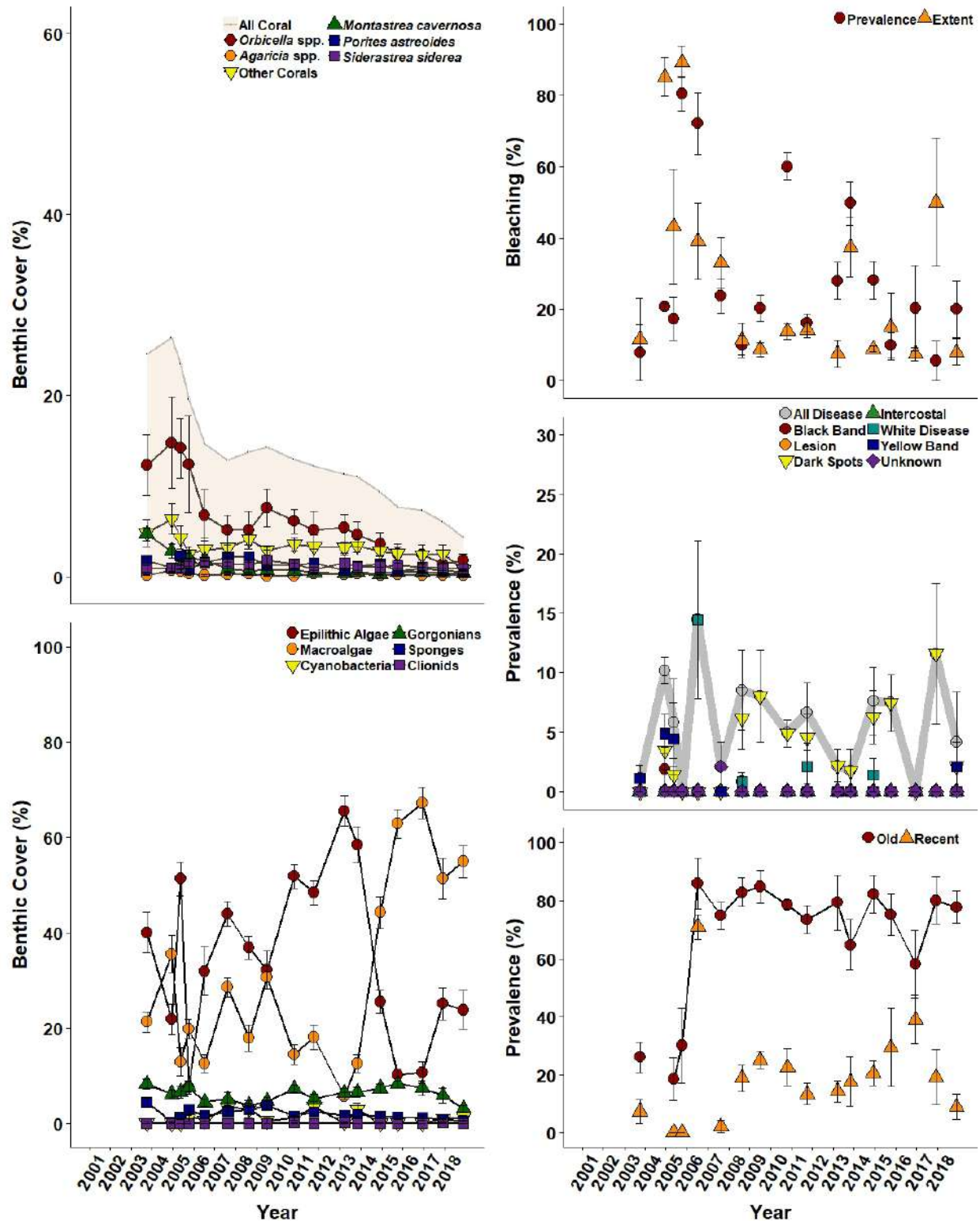


Figure 153. Savana Island benthic cover and coral health through time (mean $\pm$ SE).