

**Coastal Habitat Restoration Through Watershed Stabilization  
Monthly Marine Monitoring Progress Report for Coral Bay Sites,  
January 2011**

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During the month of January, 2011, Sarah Gray and field and laboratory research assistants conducted several activities.

**1. USVI/VIERS (Virgin Islands Environmental Resource Station) St. John field research.**

During January, 2011 the USVI team (VIERS research assistant Whitney Sears with help from volunteer & paid community assistants Katie Day, Matt Knoblock, Phil Strenger, Roy Proctor, and Hew Schlereth) conducted sediment trap collection in Coral Bay during one sampling period on January 23<sup>rd</sup>, 2011.

**2. University of San Diego (USD) laboratory research.**

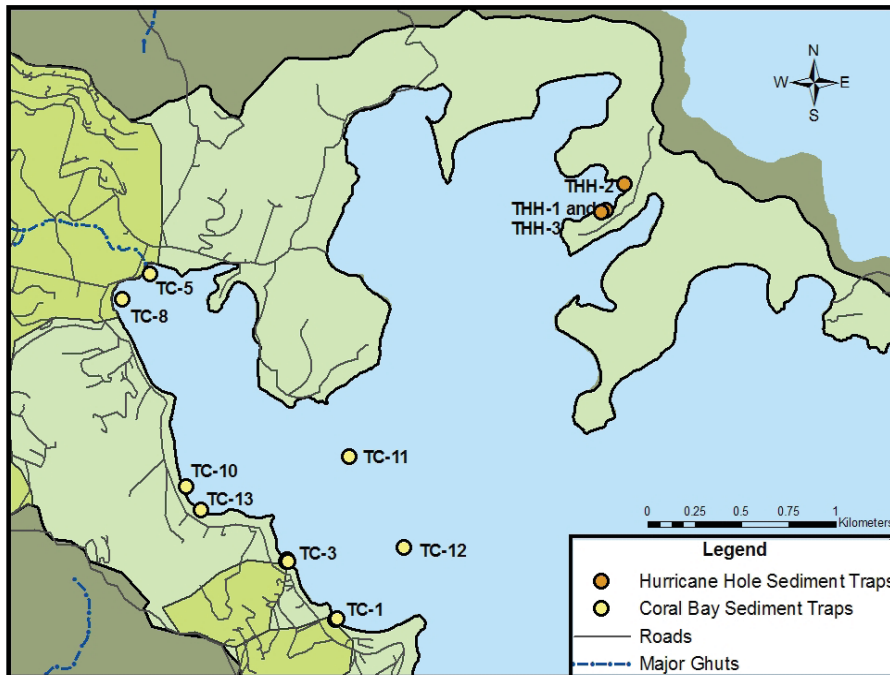
During January, USD laboratory assistant, Amalia Degrood and graduate student, Robert Harrington continued analysis of sediment compositional and textural data for the October-November sampling periods and summarized and graphed the data.

**Preliminary Results.** Sampling locations for ARRA monitoring and supplementary monitoring funded by NOAA Coral Reef Conservation Program are plotted in Figures 1 & 2. Preliminary sediment trap accumulation, sediment composition and compositional sediment accumulation results from data collected from 8/21/09-12/2/10 are plotted in Figures 3-10. Total and terrigenous sediment accumulation was generally higher in the developed locations than in the undeveloped or developed mitigated sites. Within Coral Bay, total sediment trap accumulation rates were highest at the Shipwreck shore site (Figs. 3-8), which is below a developed steep watershed with no mangroves, sediment retention ponds, or mitigation structures. The sediment trap accumulation rates were lowest at two locations in Coral Bay below less or undeveloped watersheds (Plantation Hill TC-10 & TC-13) and Hurricane Hole (THH-1) (Figs. 3-8). For most of the 16-month time series, total and terrigenous sediment accumulation was higher at the Coral Bay reefs than at the Lameshur Bay Reefs (Yawzi & Tektite) (Figs. 3-8). However, during the fall month (Sept.-Nov.) of 2010 higher total and terrigenous sediment accumulation was recorded at the Lameshur Bay reefs. For all environments, the highest total and terrigenous sediment accumulation and proportion were recorded during the fall month (Sept.-Nov.) of 2010 when there were record rains and sediment runoff (Figs. 3-8; 11). Terrigenous accumulation was also high at some locations during December of 2009. During the fall 2010 rainy season, terrigenous sediment accumulation was between 2 and 5.5, 2 and 10,

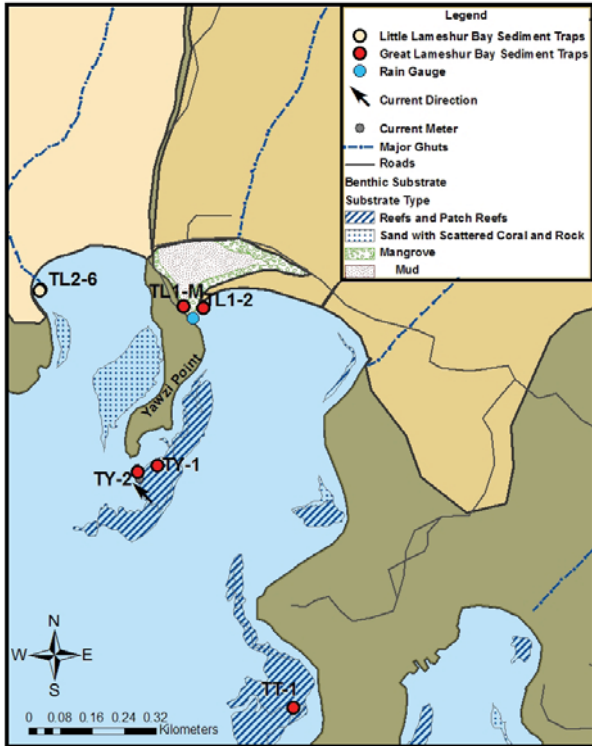
and 4 and 7.5 times higher than the 16-month mean at the mangrove, shore and reef environments, respectively (Figs. 8A-C).

Mean terrigenous sediment accumulation (in  $\text{mg}/\text{cm}^2/\text{day}$ ) was highest at the Shipwreck shore site, below a developed watershed compared to below a developed mitigated (sediment pond) watershed (Calabash) or undeveloped watershed (Lameshur) (Fig 6A). Mean terrigenous accumulation was higher at the Coral Harbor mangrove (below a developed watershed) than at the G. Lameshur mangrove (below an undeveloped watershed) (Fig. 6A). The mean terrigenous accumulation rates at the reef sites in Coral Bay did not differ from the rates in Lameshur Bay reefs (Fig 6A). Comparison of mean terrigenous sediment trap accumulation rates measured at the same locations in 30 cm and 60 cm traps (Fig. 6B) revealed that the shorter 30 cm traps always collected more sediment than then 60 cm traps. This difference between 30 and 60 cm accumulation was less at the undeveloped sites such as Plantation Hill (TC-10) and Hurricane Hole (THH-1) (Fig. 6B). This higher accumulation is due to enhanced resuspension in shallow water. Therefore we will use data from the 60 cm traps to address the objectives.

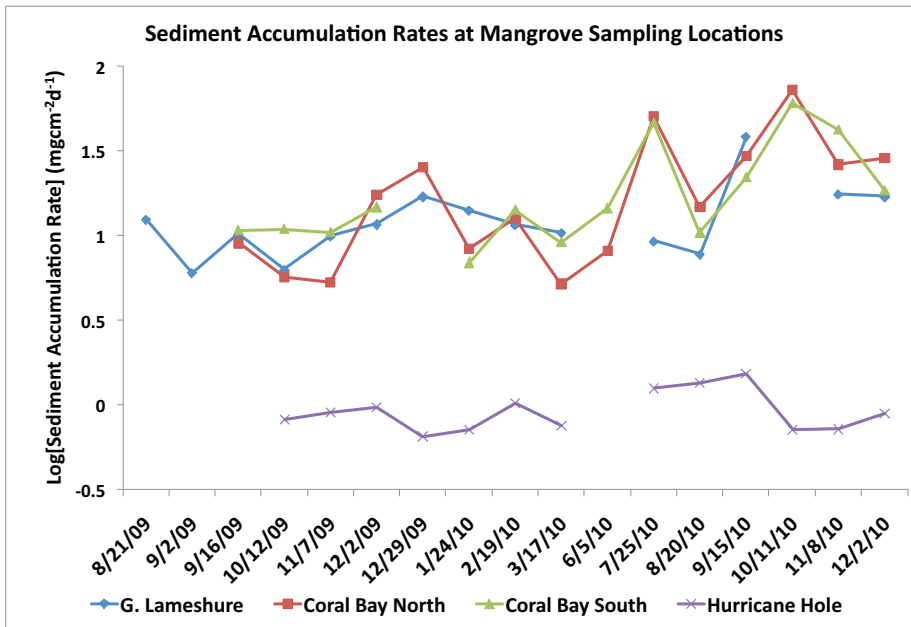
Textural (grain size) characteristics of the sediments are presented in Figures 10-11A-C. Sediments at most sites were comprised of less than 10% clay, between 20-50% silt and between 30-80% sand. Sediment generally coarsened during the fall rainy season of 2010 in all environments (Fig. 10A-C).



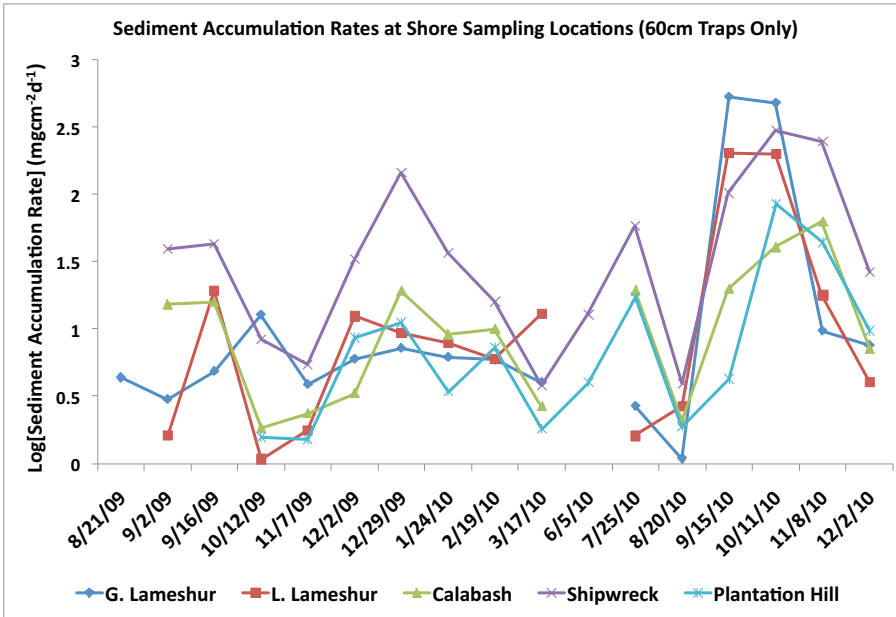
**Figure 1.** Map of Coral Bay and Hurricane Hole showing the sediment trap/sampling locations. The watersheds above TC-5, TC-8, TC-1 and TC-3 are developed. TC-10 and TC-13 are below Plantation Hill, a watershed with minimal development. Three environments are represented: a) mangroves: HH-1, HH-2, HH-3, TC-5 & TC-8; b) shore: TC-1, TC-3, TC-10, TC-13, and c) reefs: TC-11 & TC-12.



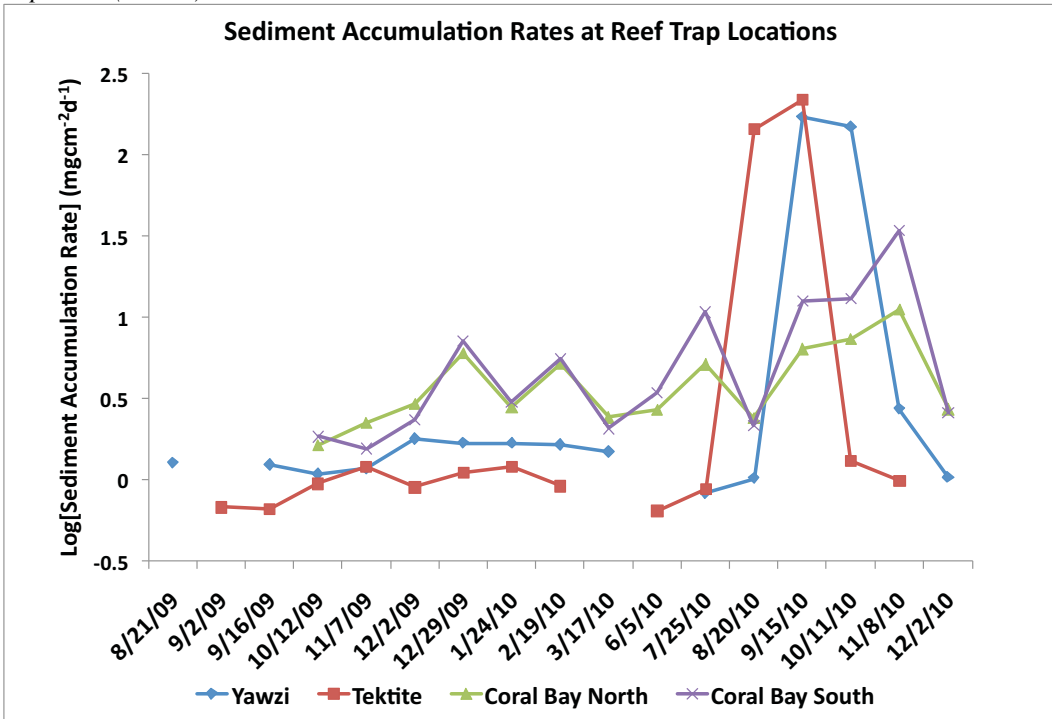
**Figure 2.** Map of Great and Little Lameshur Bay below undeveloped watersheds in the Virgin Islands National Park. Three environments are represented: a) mangroves: TL1-M, b) shore: TC-1, TC-3, TL1-2, TL2-6, and c) reefs: Yawzi Point: TY-1, TY2, Tectite: TT-1.



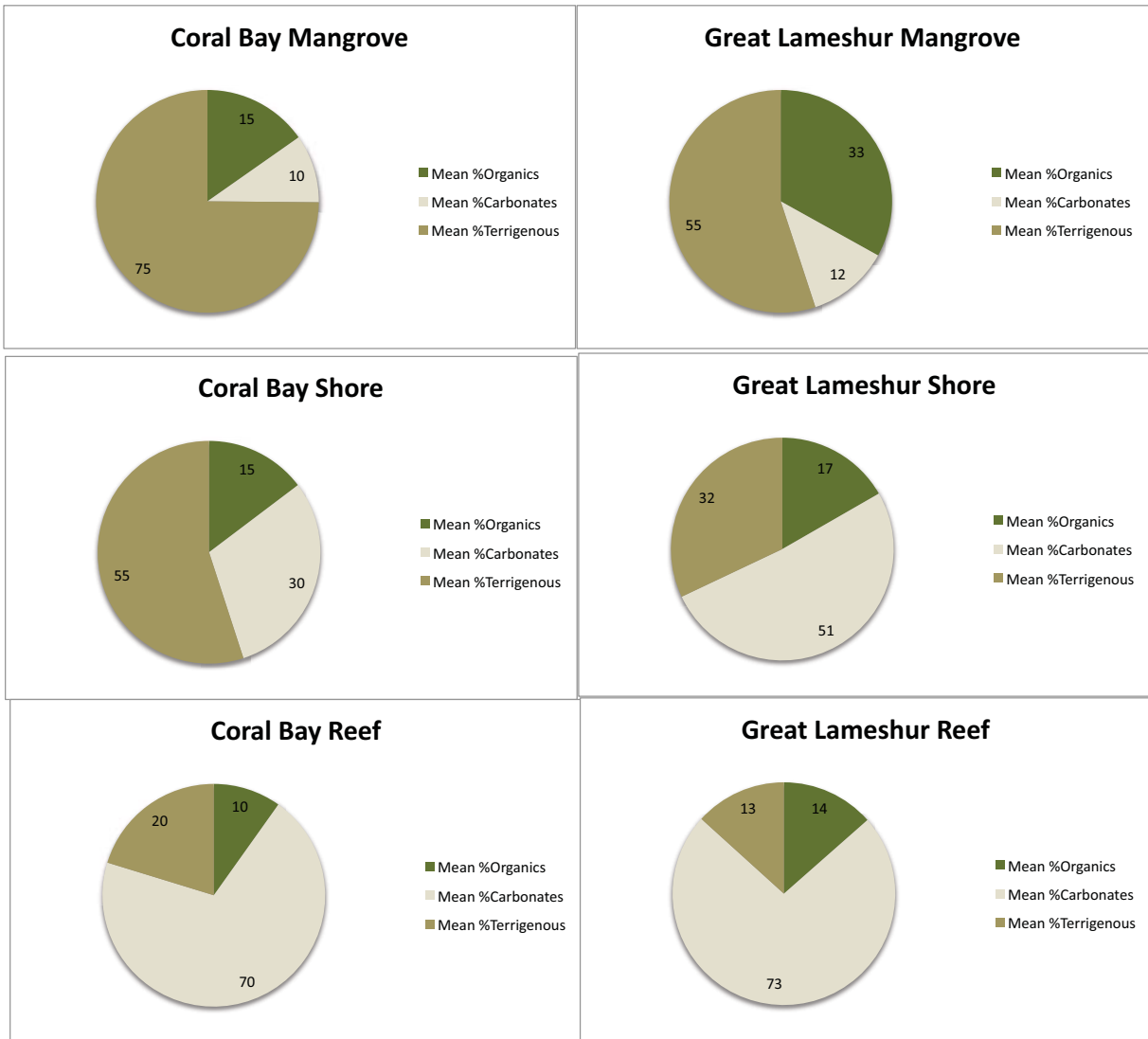
**Figure 3A.** Total sediment accumulation in  $\text{mg}/\text{cm}^2/\text{day}$  (log scale) at mangrove sites for every 26-day sampling period from 8/21/09-12/2/10. Sediment accumulation was lowest at Hurricane Hole throughout the 16-month period. Highest sediment accumulation was recorded during the fall month (Sept.-Nov.) of 2010 when there were record rains and sediment runoff.



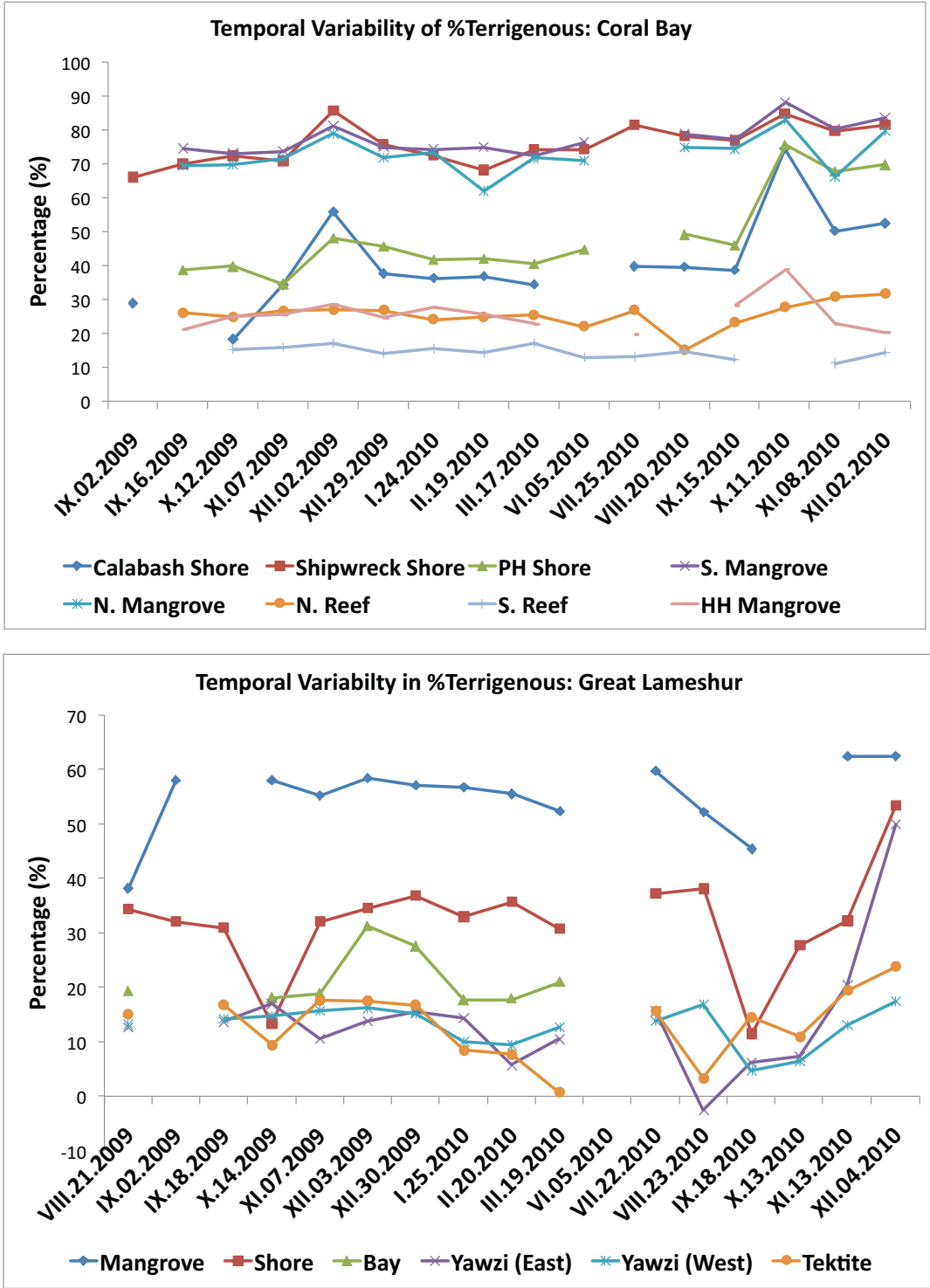
**Figure 3B.** Total sediment accumulation in  $\text{mg}/\text{cm}^2/\text{day}$  (log scale) at shore sites (60 cm traps only) for every 26-day sampling period from 8/21/09-12/2/10. Sediment accumulation was highest at the Shipwreck site (TC- 3B) for most sampling periods. Highest sediment accumulation was recorded during the fall months (Sept.-Nov.) of 2010 when there were record rains and runoff and during Nov. & Dec. of 2009 at Shipwreck (TC-3B).



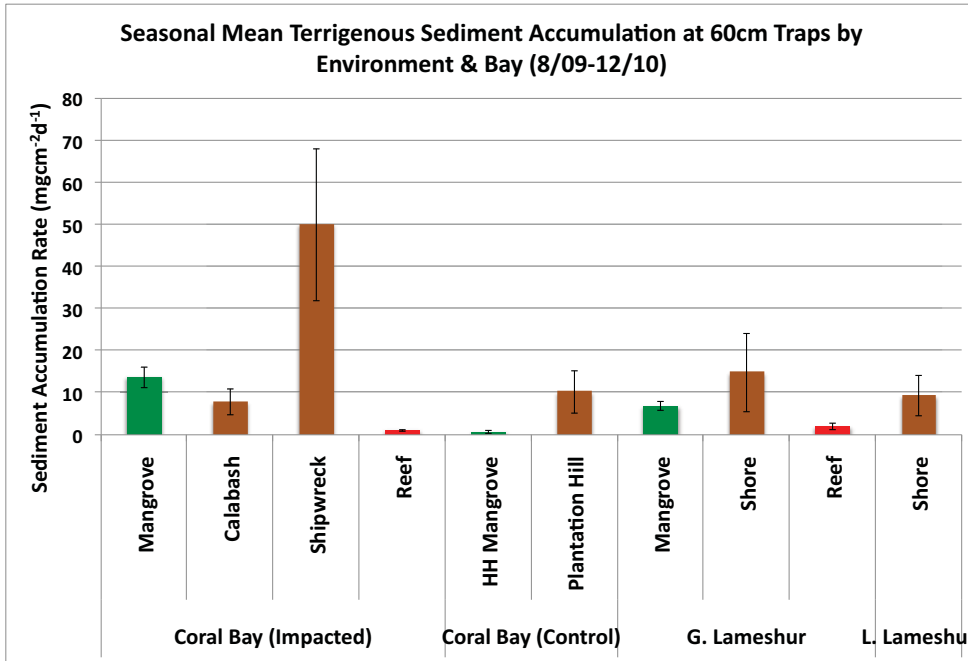
**Figure 3C.** Total sediment accumulation in  $\text{mg}/\text{cm}^2/\text{day}$  (log scale) at reef sites for every 26-day sampling period from 8/21/09-12/2/10. For most of the 16-month time series, sediment accumulation was higher at the Coral Bay reefs than at the Lameshur Bay Reefs (Yawzi & Tektite). Highest sediment accumulation was recorded at the Lameshur Bay reefs during the fall month (Sept.-Nov.) of 2010 when there were record rains and runoff.



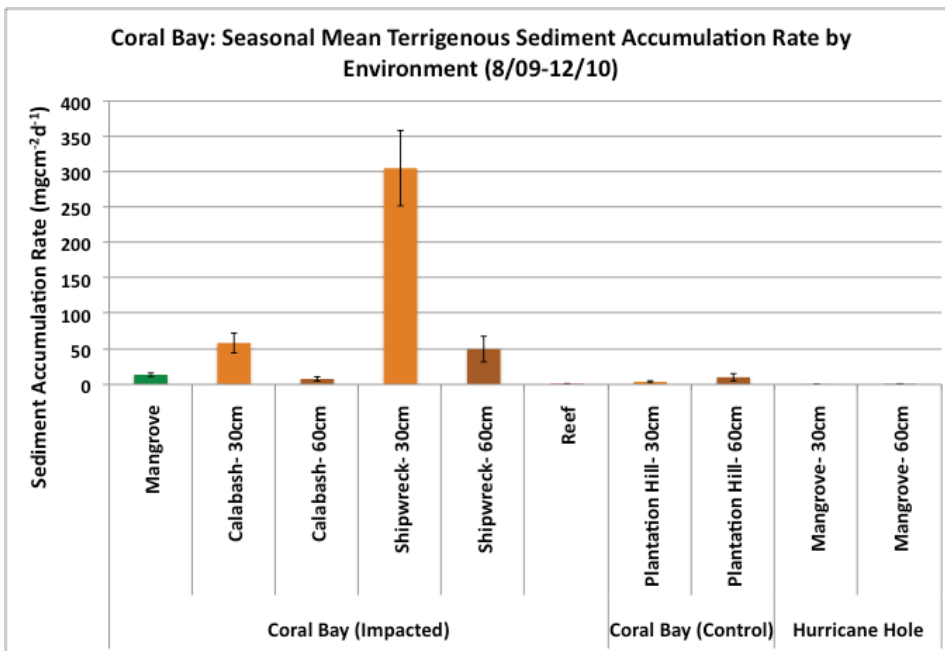
**Figure 4.** Mean sediment composition (% organic, % carbonate, % terrigenous) for the 16-month sampling season from 8/21/09-12/2/10 for each environment in each bay. The seasonal mean % terrigenous sediment decreased offshore and was greatest in all environments in Coral Bay (developed watershed) compared to Great Lameshur Bay (undeveloped watershed).



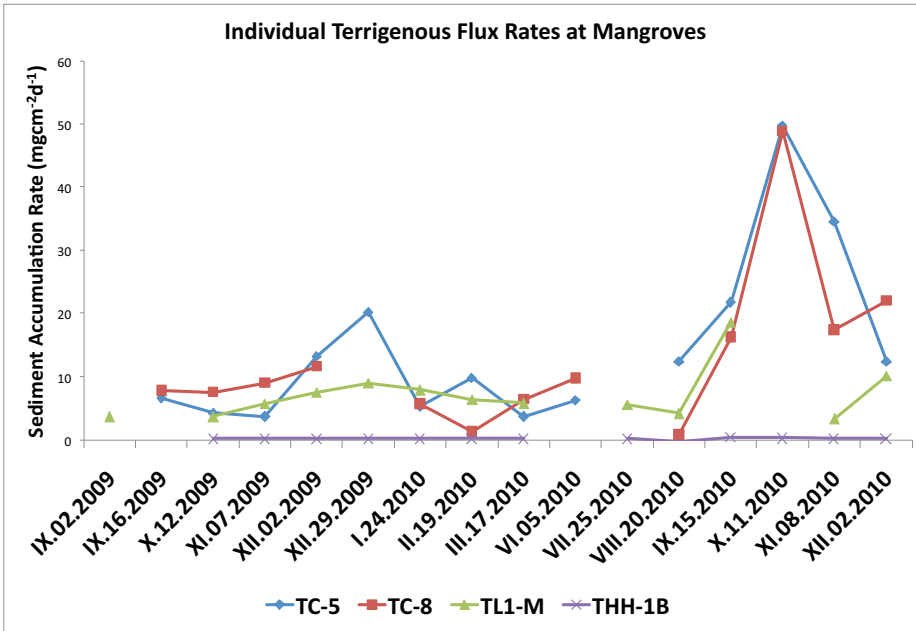
**Figure 5.** Variation in % terrigenous sediment for each 26-day sampling period from 8/21/09-12/2/10 at Coral Bay and Hurricane Hole (ABOVE) and Great Lameshur Bay (BELOW). Terrigenous % was highest at the mangrove and shore sites and lowest at the reef sites. Terrigenous % varied little at the Coral Bay reef sites over the 16 month sampling season. The proportion of terrigenous sediment was higher at the north reef (TC-11) than the south reef (TC-12) in Coral Bay. It is notable that the proportion of terrigenous sediment at the developed Shipwreck shore site (TC-3) was higher than at the shore sites at Plantation Hill (undeveloped), and Calabash Boom (developed but with a sediment retention pond).



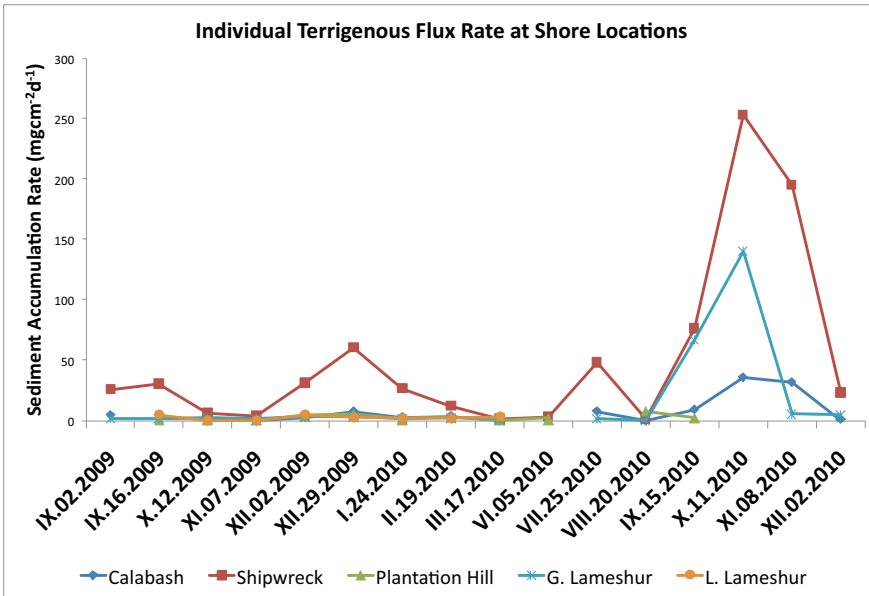
**Figure 6A.** Mean terrigenous sediment accumulation for the period 8/21/09-12/2/10 at all sites. Shore sites are shown in brown, mangrove in green and reef sites in red. Mean terrigenous sediment accumulation was highest at the Shipwreck shore site, below a developed watershed compared to below developed mitigated (sediment pond) watersheds (Calabash) or undeveloped watershed (Lameshur). Mean terrigenous accumulation was higher at the Coral Harbor mangrove (below a developed watershed) than at the G. Lameshur mangrove (below an undeveloped watershed). The mean terrigenous accumulation rates at the reef sites in Coral Bay did not differ from the rates in Lameshur Bay reefs.



**Figure 6B.** Mean terrigenous sediment accumulation for the period 8/21/09-12/2/10 showing higher accumulation inshore sites that were 30 cm above the seafloor than those that were 60 cm above the seafloor. This higher accumulation is due to enhanced re-suspension in shallow water.

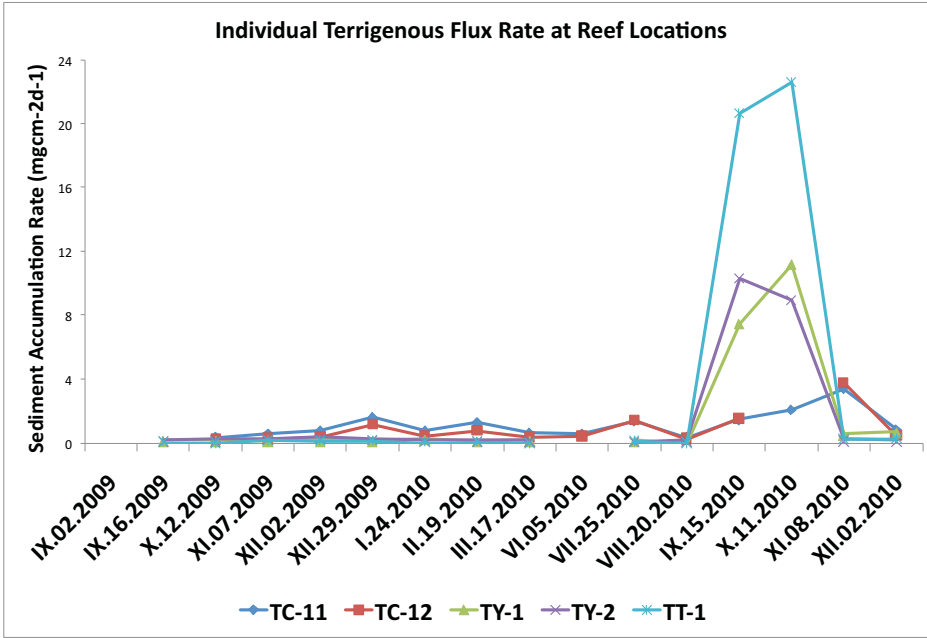


**Figure 7A.** Variation in terrigenous sediment accumulation (in  $\text{mg}/\text{cm}^2/\text{day}$ ) for each 26-day sampling period from 8/21/09-12/2/10 at all mangrove sites. Total terrigenous sediment accumulation was highest at the Coral Harbor (TC-5 & TC-8) sites (developed watershed) for most sampling periods and lowest at the Hurricane Hole sites (undeveloped watershed). Terrigenous accumulation was highest during December of 2009 and especially during Oct. and Nov. of 2010, when there were record rains and runoff.

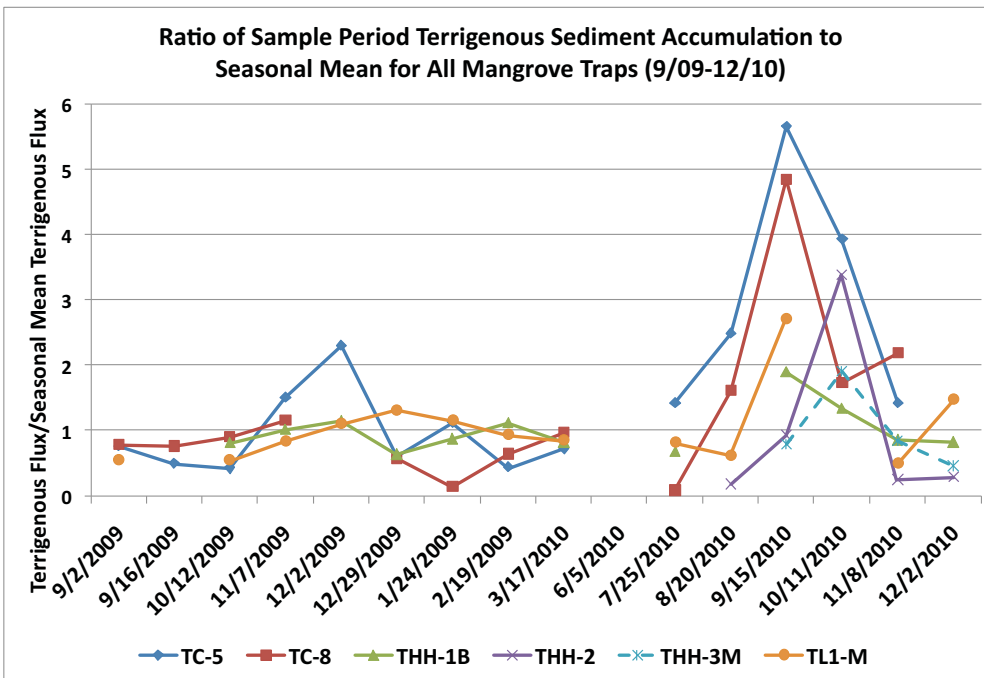


**Figure 7B.** Variation in terrigenous sediment accumulation (in  $\text{mg}/\text{cm}^2/\text{day}$ ) for each 26-day sampling period from 8/21/09-12/2/10 at all 60-cm trap height shore sites. Total terrigenous sediment accumulation was highest at the Shipwreck site (TC-3) (developed watershed) and lowest below the undeveloped (Lameshur [TL1-2], Plantation Hill [TC-10]) or developed & mitigated (Calabash Boom [TC-1]) watersheds. Terrigenous accumulation was highest during December of 2009 and especially during the fall months (Sept.-Nov.) of 2010, when there were record rains and runoff.

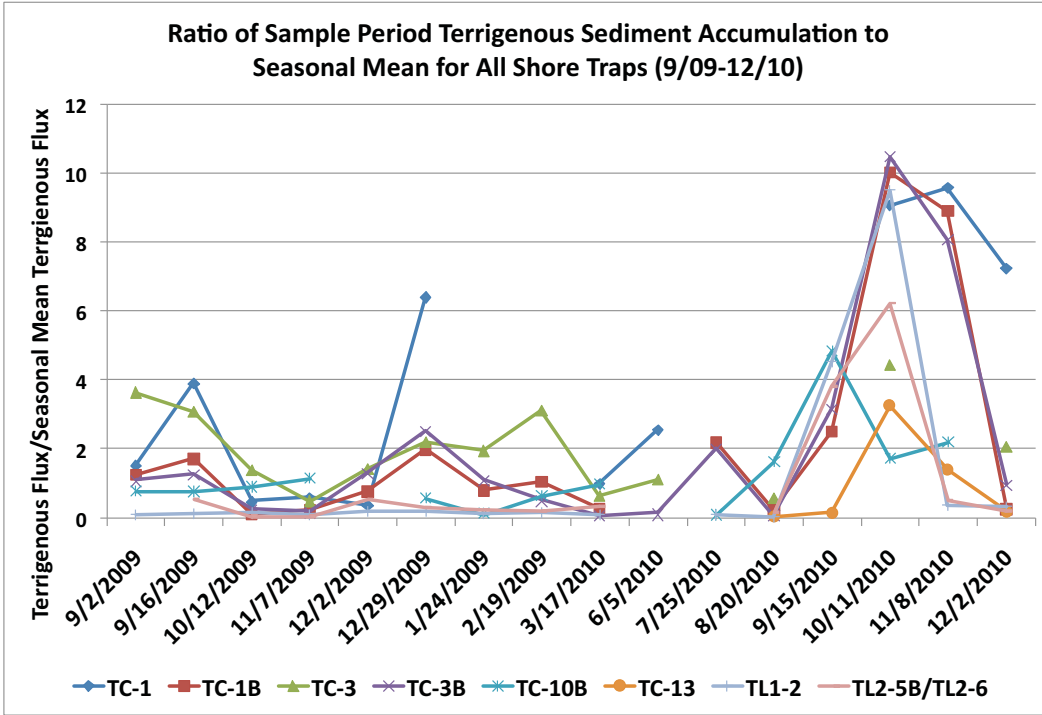




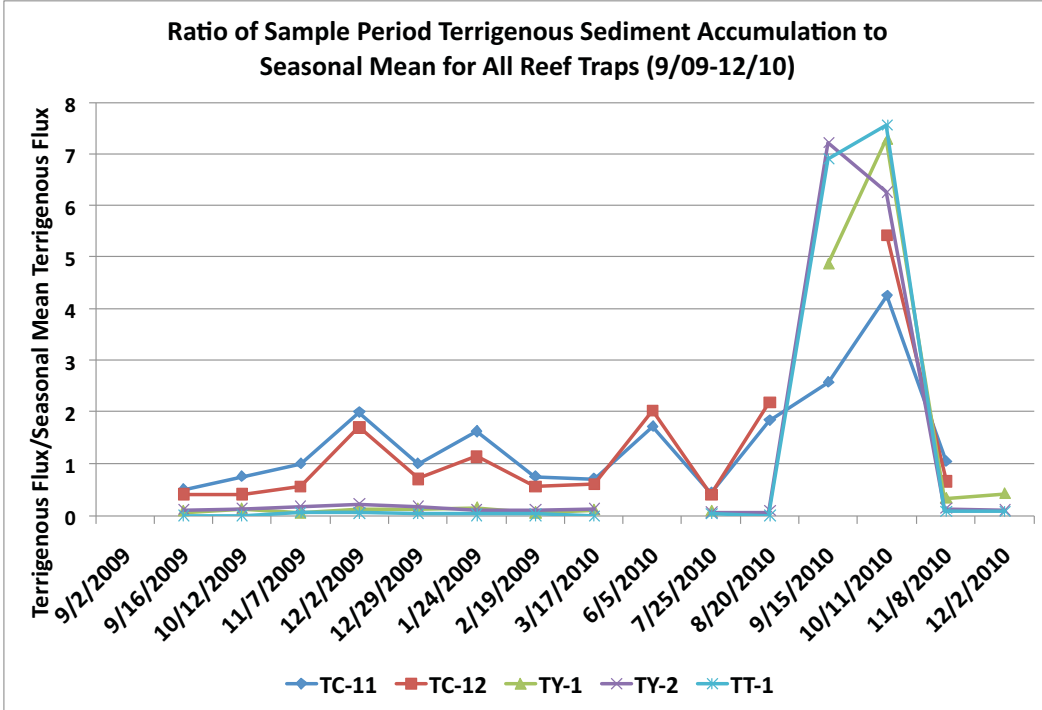
**Figure 7C.** Variation in terrigenous sediment accumulation (in mg/cm<sup>2</sup>/day) for each 26-day sampling period from 8/21/09-12/2/10 at all reef sites. Terrigenous sediment accumulation was much lower at the reef than at the mangrove or shore locations. Terrigenous sediment accumulation was slightly higher at the Coral Bay reefs, TC-11 & TC-12 (below developed watersheds) for most of the time series. An exception was during the fall months (Sept.-Nov.) of 2010, when there were record rains and runoff and unusually high terrigenous accumulation at the Lameshur reefs (TY-1, TY-2 & TT-1).



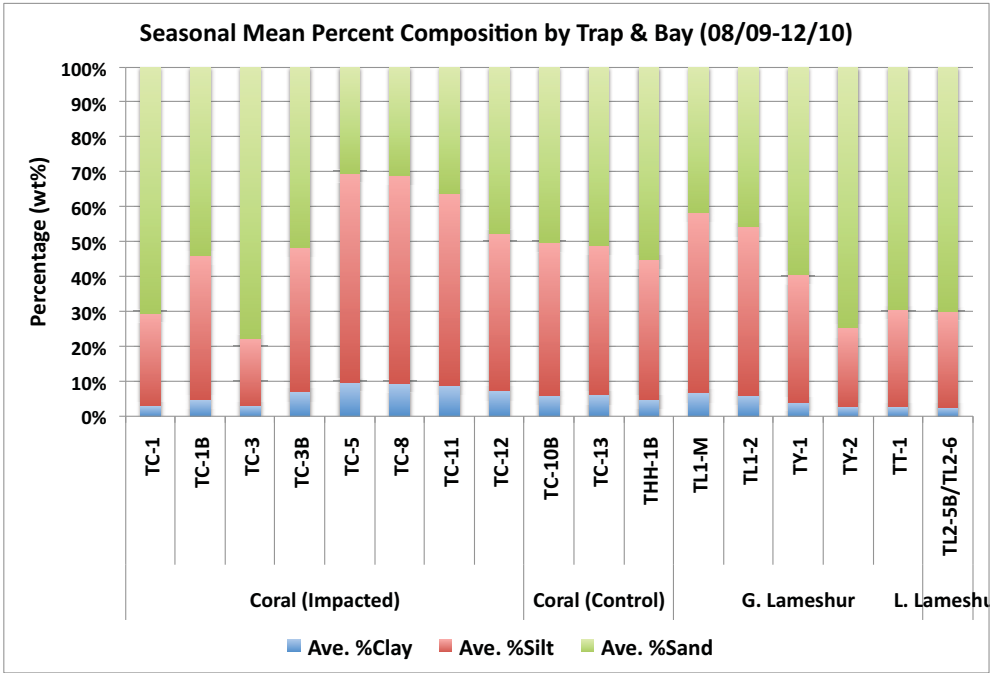
**Figure 8A.** Ratio of terrigenous accumulation during the sampling period to the 16-month mean terrigenous accumulation rate at the mangrove sites (30 cm traps are shown as dashed lines). Terrigenous sediment accumulation was between 2 and 5.5 times higher than the 16-month mean during the fall 2010 rainy season in the mangroves.



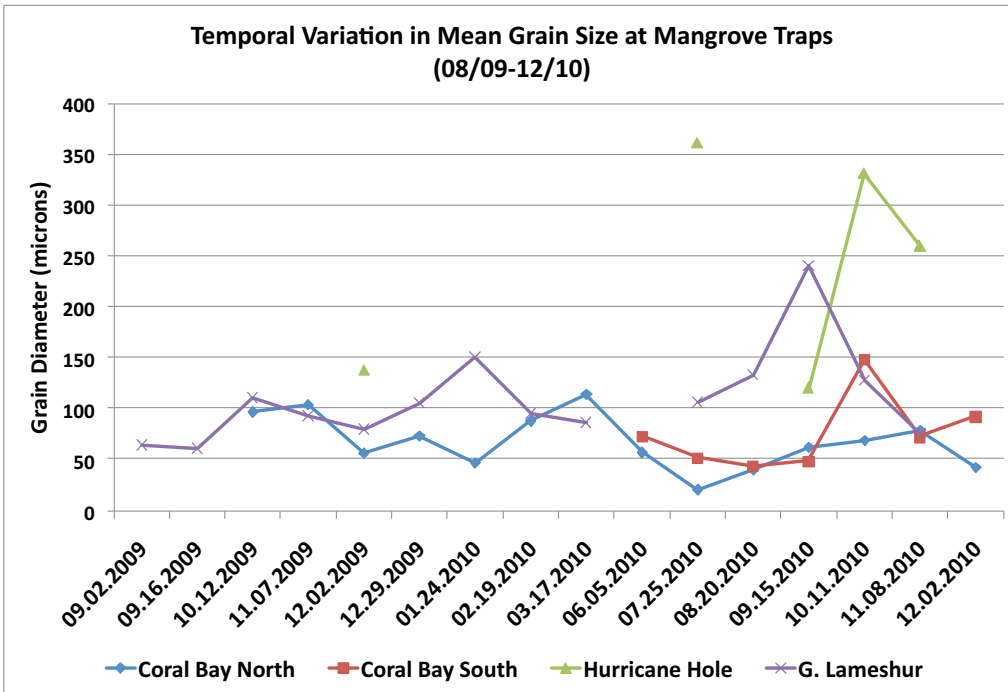
**Figure 8B.** Ratio of terrigenous accumulation during the sampling period to the 16-month mean terrigenous accumulation rate at the shore sites. Terrigenous sediment accumulation was between 2 and 10 times higher than the 16-month mean during the fall 2010 rainy season at the shore sites.



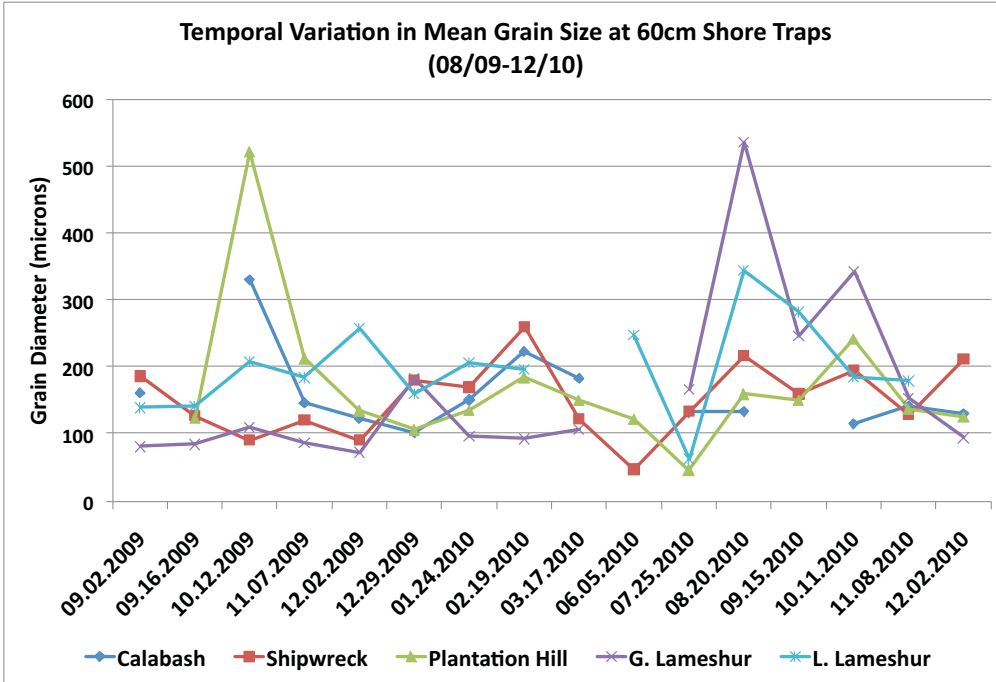
**Figure 8C.** Ratio of terrigenous accumulation during the sampling period to the 16-month mean terrigenous accumulation rate at the reef sites. Terrigenous sediment accumulation was between 4 and 7.5 times higher than the 16-month mean during the fall 2010 rainy season at the reef sites, with the highest fall terrigenous flux occurring at the Lameshur Bay reefs.



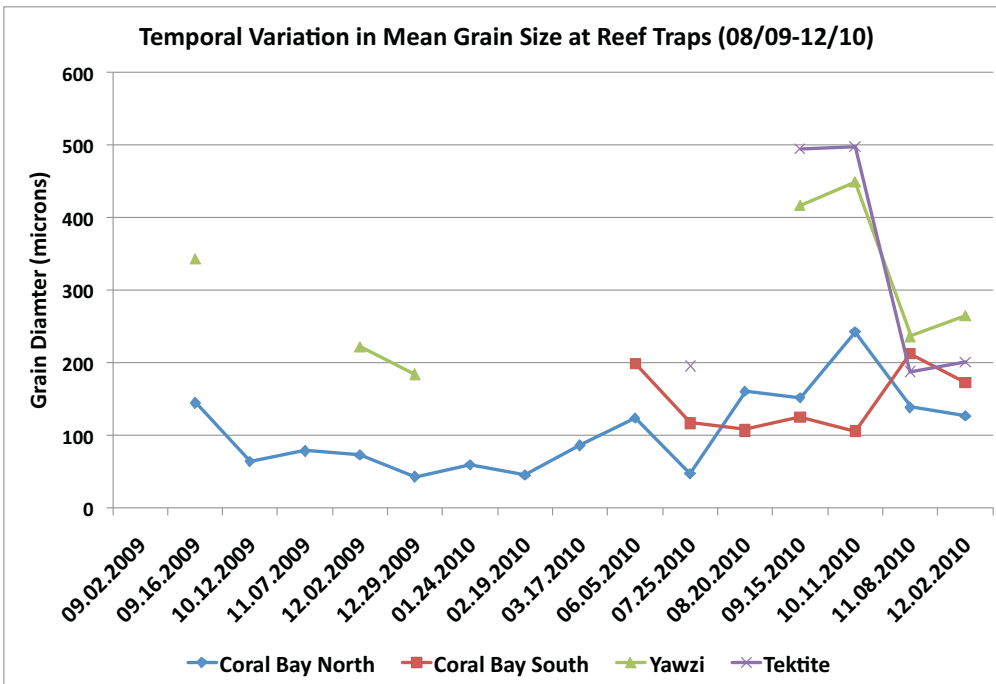
**Figure 9.** Mean texture (grain size) distributions of the sediments at each site for the 16 month field season. Sediment at most sites was comprised of less than 10% clay, between 20-50% silt and between 30-80% sand.



**Figure 10A.** Mean sediment grain size (in microns) at the mangrove sites for each sample period from 9/2/09-12/2/10. The mean grain size was very fine sand for most of the season. During the fall 2010 mean grain size coarsened to fine to medium sand at three of the four sites.



**Figure 10B.** Mean sediment grain size (in microns) at the shore site for each sample period from 9/2/09-12/2/10. The mean grain size was fine sand (125-250 microns) for most of the season. During the Oct. of 2009 mean grain size at Plantation Hill (TC-10) coarsened to coarse sand (500-1000 microns) and in the fall 2010 mean grain size at Lameshur shore sites coarsened to medium or coarse sand (250-1000 microns).



**Figure 10C.** Mean sediment grain size (in microns) at the reef site for each sample period from 9/2/09-12/2/10. Mean grain size at the Lameshur Bay reefs was generally coarser (fine-medium sand) than at the Coral Bay North reef, which trapped very fine sand for most of the season and then coarsened to fine sand during the fall of 2010.



**Figure 11.** Images of the effects of terrestrial runoff. Above left: brown sediment plume in Coral Bay following 10/7/10 storm (photo by Matt Knoblock); Above right: landslide south of Coral Bay on 10/9/10 (photo by Matt Knoblock) . Below left: Sediment plum in Little Lameshur Bay following 7/21/10 storm (photo by Whitney Sears); Below right: runoff in the gut above South Plantation Hill during the 10/7/10 storm Matt Knoblock).