

## **Interim Project Report (1/30/09)**

### **“A comparative study of Fringing Reefs below Developed v. Undeveloped Watersheds, U.S. Virgin Islands”**

Submitted by:

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#### **Research and Outreach Goals and Objectives:**

The overall research objective of our study is to establish a baseline of data from which to evaluate how development (construction, area of impervious surfaces, dirt roads, septic systems, etc.) in watersheds have impacted the quantity, quality (type), and spatial variability of sedimentation in bays with reefs in St. John, USVI. Our approach has been to collect and compare sediments within and among bays with reefs—two drained by developed watersheds (Fish and parts of the southern portion of Coral Bay) and one drained by a relatively pristine undeveloped watersheds (Great Lameshur). Our outreach goal is to establish ongoing research & educational partnerships between the University of San Diego, the Coral Bay Community Council, the Virgin Islands Environmental Resource Center (VIERS), Clean Islands International, and other local citizen’s groups.

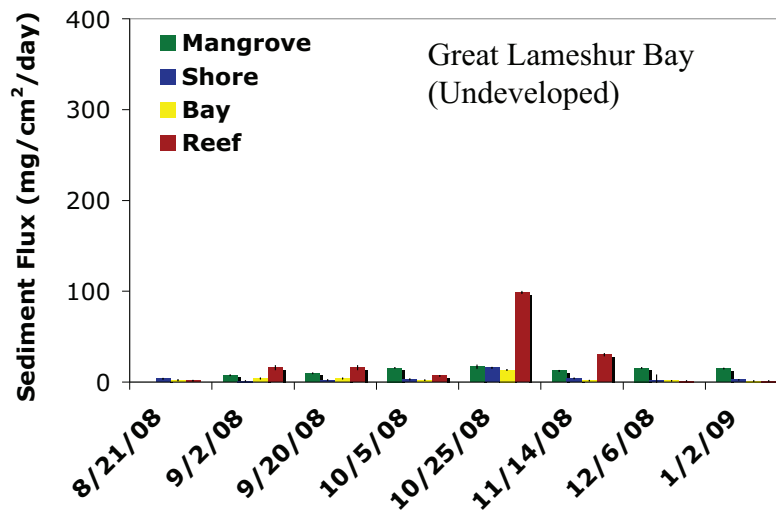
#### **Research Progress to Date:**

From August-December of 2008, we have focus on conducting field and laboratory research to address the following research question:

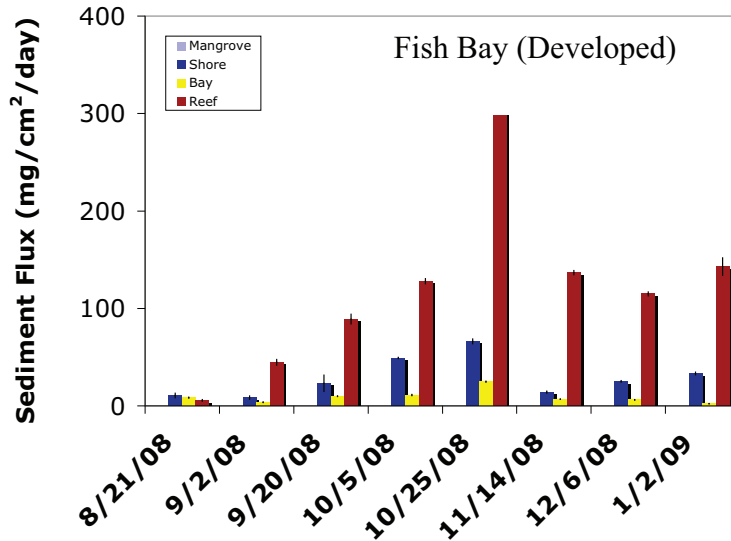
*What is the composition (grain size distribution, organic matter type and quantity, mineralogy, and relative carbonate/siliceous ratio) and quantity (flux rate or concentration) of suspended, settling, and accumulated sediments and how do these characteristics vary spatially within each bay along pathways of sediment dispersal and among the bays?*

- A) Field Sediment sampling and surveys:** In August of 2008 we set up 25 sediment traps at 20 stations for ongoing sediment monitoring at three bays in St. John (10 traps at 7 stations in Fish Bay; 9 traps at 6 stations in Great Lameshur Bay; and 7 traps at 7 stations in Coral Bay). In August (08) and again in January (09) we surveyed the watersheds feeding these bays and established sites for periodic storm water sediment and water collection. Since August of 2008, sediment trap, suspended and bottom sediment sampling collection has been conducted every 21 days at all 20 sampling stations. This sampling continued during Hurricane Omar, which passed near St. John on October 15<sup>th</sup>. Periodic sediment sampling (every 21 days) will continue at these sites through the end of March 2009.
- B) Laboratory sediment analyses & preliminary results:** Analyses of sediment flux rates, sediment composition for trapped, bottom, and suspended sediments is underway in the laboratory at the Virgin Islands Environmental Research Station (VIERS) and at the University of San Diego.
- a. **Sediment Flux:** Figures 1-3 show mean sediment flux rates (in mg/cm<sup>2</sup>/day) determined for each three week sampling period for mangrove, shore, bay, and reef

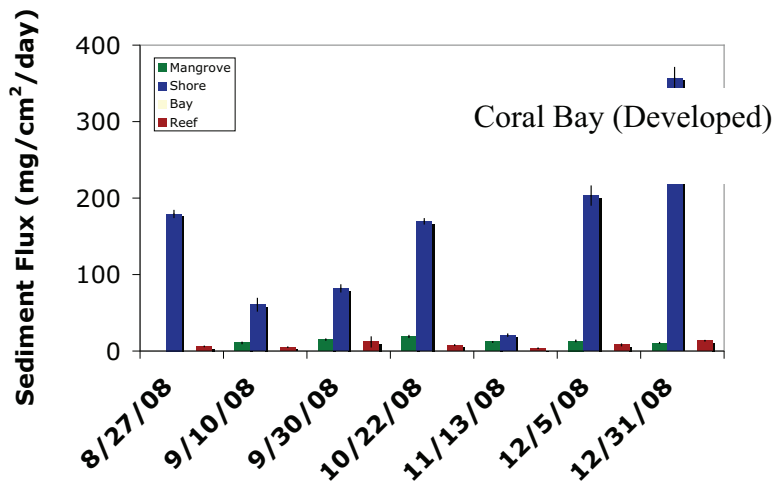
environments at Great Lameshur, Fish, and Coral Bays, respectively for August-December 2008. Our initial results demonstrate that the bays below developed watersheds we monitored (Fish and Coral) were subject to higher sediment flux than was the bay below the undeveloped watershed (Great Lameshur Bay) (Fig.1-3). It is not surprising that the highest flux rates were recorded from the sampling period during which Hurricane Omar passed near St. John (10/15-10/16/09). Our data reveal a marked difference in environmental sedimentation patterns between the two bays below developed watersheds. For most sampling periods, the highest sediment flux rates in Fish Bay were recorded at the reef stations. In contrast, in Coral Bay, the highest sediment flux rates were recorded at the shore stations, with significantly lower flux at the Coral Bay reef stations. We will conduct further analyses of current, wind, rain and watershed parameters to evaluate the source of these temporal and environmental variations in sediment flux.



**Figure 1.** Summary of mean sediment flux rates in mangrove, shore, bay and reef areas of Great Lameshur Bay, an undeveloped bay with relatively low (<20 mg/cm<sup>2</sup>/day) flux rates. Sediment flux was unusually high (up to ~100 mg/cm<sup>2</sup>/day) at the reef stations during the collection period when Hurricane Omar passed over St. John (10/15-10/16/09).



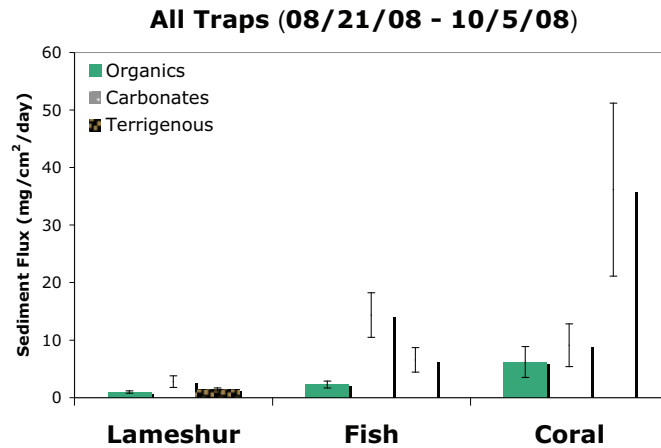
**Figure 2.** Summary of mean sediment flux rates in shore, bay and reef areas Fish, a bay below a developed watershed with relatively high (<40 mg/cm<sup>2</sup>/day) flux rates. Sediment flux was unusually high (up to ~300 mg/cm<sup>2</sup>/day) at the reef stations during the collection period when Hurricane Omar passed over St. John (10/15-10/16/09).



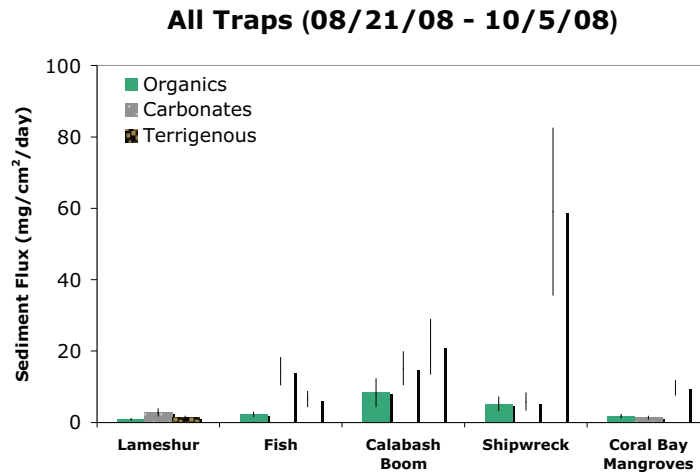
**Figure 3.** Summary of mean sediment flux rates in mangrove, shore, bay and reef areas in Coral Bay, a bay below a developed watershed with extremely high (<100 mg/cm<sup>2</sup>/day) sediment flux rates at the shore locations.

- b. **Sediment Composition:** Analyses of sediment composition has been completed for sediment samples collected for the first four sampling periods of 2008 (August-October 5<sup>th</sup>) and is summarized in Figures 4-5 below. These preliminary data show a marked difference in the relative sediment composition between bays. While carbonate is the predominant component of sediments in Fish and Great Lameshur Bays, terrigenous sediment predominates in Coral Bay (Fig. 4). Within Coral Bay, mean terrigenous

sediment flux rates are higher at the Shipwreck site, where there are no sedimentation ponds or other sediment mitigation measures in place than at the Calabash Boom site where sedimentation ponds and fences have been constructed to block sediment input into the nearshore waters (Fig. 5). However, terrigenous sediment flux is higher at both Shipwreck and Calabash Boom sites than at the Coral Bay mangrove sites (Fig. 5). In spite of high terrigenous flux at the shore stations in Coral Bay, the reef stations at Coral Bay have not recorded higher terrigenous flux than at the reef sites at Fish Bay. Further analyses will investigate possible causes for these spatial differences in terrigenous sediment flux.



**Figure 4.** Summary of mean sediment composition (from 8/21/09-10/5/09) for Great Lameshur Bay, below an undeveloped watershed and Fish and Coral Bays below developed watersheds.



**Figure 5.** Summary of mean sediment composition (from 8/21/09-10/5/09) showing variable sediment compositions between the Calibash Boom, Shipwreck and Mangrove sites in Coral Bay compared to Fish and Lameshur Bays.

**Outreach Progress to Date:**

- A) **Coral Bay Community Council & Coral Bay Community.** We have conducted several meetings with the Coral Bay Community Council about our research. We have joined their

EPA watershed management CARE grant team. They believe the data from this project will provide valuable information that they can use to better manage and implement storm water runoff and sediment mitigation within their watershed. Coral Bay Community Council encouraged us to expand our sediment-sampling program to include additional sites within Coral Bay and have demonstrated a commitment to our program by providing volunteers to help with the field research. In partnership with the Coral Bay Community Council, we submitted a grant proposal for continued research and outreach activities for 2009-2010. They sponsored two public outreach meeting where we publicly presented our preliminary research. This research was reported on by USVI web and news media (<http://www.onepaper.com/stjohnvi/?v=d&i=&s=News:Local&p=1223614121>) and an article in the *St. John Tradewinds* Newspaper. (see attached newspaper article based on the 1/15/09 public meeting).

- B) Virgin Islands Environmental Research Station (VIERS).** This grant has fostered the establishment of a joint research volunteer position at VIERS and has strengthened the partnership between USD and VIERS/Clean Islands International.