Coral Restoration on Reefs Dominated by Macroalgae: Is the Long-Spined Sea Urchin *Diadema antillarium* the Key to Success?
Linda Walters (U Central Fl.), Teresa Turner (UVI)

**ABSTRACT**

Coral recruitment is a key process in the recovery and maintenance of coral reef ecosystems. Because many reefs around the globe have shifted from coral to algal dominance in recent years, we need to understand if macroalgae are keeping corals from settling and remaining in the ecosystem. This information will help develop successful, cost-effective coral reef protection/restoration strategies that are critical for the USVI, with its tourism-based economy. Walters and colleagues have documented that specific macroalgae prevent *in situ* hard coral recruitment and are contact-toxic to newly settled individuals. Knowing of this negative interaction between certain macroalgae and hard corals at their vulnerable, early stages, we now need to determine if simply preventing contact between the two taxa during this time period is sufficient to restore our reefs. The keystone herbivore *Diadema antillarium* has returned to Caribbean waters in numbers sufficient to address this question. Prior to 1980s, it was easy to locate these nocturnal grazers by the zones of substrate devoid of macroalgae surrounding their crevice dens (day-time hiding locations). Grazed zones are again identifiable. However, now some chemically-defended algae appear to be avoided where food resources are not limiting, while other macrophytes may actually increase in abundance if urchins can afford to be sloppy grazers, with unconsumed fragments recruiting locally. Researchers and resource managers keep suggesting that the return of *Diadema* will shift our reefs back to coral dominance by creating macroalgae-free space for corals to settle and survive through their first months. Our goal is to determine if this is possible by examining *Diadema*-macroalgal interactions. Dr. Walters’ research experience in the Florida Keys documents a wide range of responses of coral larvae and spat to macroalgae; thus, we consider it critical to examine *Diadema*-macroalgal interactions on a species-by-species basis, rather than classifying all species collectively as “macroalgae” or dividing assemblages into a limited number of artificial categories. With assistance from UVI student researchers, we will gather critical baseline data on the abundance, diversity and ecology of *Diadema* and macroalgae in US Virgin Island waters. Laboratory experiments and field observations will look at *Diadema* herbivory to determine if unconsumed species of macroalgae are avoided or settle in locations not accessible to foraging *Diadema*. Simultaneously, we will run trials to determine if *Diadema* is a sloppy eater when macroalgae are limited versus plentiful. Fragments will be enumerated and followed over time for attachment. Mimic fragments will be followed in the field to examine dispersal potential. To begin to address coral-urchin interactions, we will track damage to mimic coral spat (plasticene) to determine the extent of physical and biological (incidental damage) disturbances near and far from urchins. All data collection we propose is straightforward and simple; these criteria are essential for successful research that involves SCUBA, students, and has an ultimate goal of restoration. Rapid, successful data collection will also enable all student and faculty participants to co-author multiple scientific presentations and peer-reviewed manuscripts within the year. The data we will collect on reef biocomplexity and the opportunity to establish new collaborations with local agencies will increase our competitiveness for obtaining external funding from traditional research-based agencies and agencies focused on habitat restoration.