2006 Graduate Student Symposium
Abstract Volume

Friday October 20, 2006
Karen Steidinger Auditorium

2006 Graduate Student Symposium Schedule

College of Marine Science
University of South Florida, St. Petersburg
Friday October 20, 2006
Karen Steidinger Auditorium

9:00	**Reception**
	Ivan Orlic
9:30	Causes of Variation in the Condition of the Bay Anchovy Within its Juvenile Nursery Habitat
	Cheska Burleson
9:45	Eutrophication and Maintenance of Harmful Algal Blooms
	Natasha Schnitker
10:00	Hypervariation of V-Region Immune-type Gene in Amphioxus
	Kelley Anderson
10:15	Coral Distribution and Abundance around La Blanquilla Island (Venezuela): Effects of Local and Remote Upwelling and of the Orinoco Plume
	Alexa Ramirez
10:30	A Seasonal Comparison to a Past Study of Substrate Preferences of Select Foraminifera in Seagrass Beds of Florida Bay
10:45	**Morning Break**
	James Locascio
11:00	Seasonality of Sound Production and its Relationship to Egg Production in Black Drum (*Pogonias cromis)*
	Terry Fei Fan Ng
11:15	Identification of Novel Pathogenic Viruses by Shotgun Sequencing – Application in Green Turtle Fibropapilloma
	Jennifer Dupont
11:30	Epibenthic Community Snapshots in Time Prior to, During, and One Year After the 2005 Eastern Gulf of Mexico Red Tide Event
12:00	**Lunch Break**
	Sennai Habtes
1:00	The Use of a High Resolution Imaging System to Determine the Composition of Preserved Zooplankton Samples Taken Across a

Tampa Bay Front

Jennifer Mobberley

1:15 Genome Sequence Analysis of a Temperate Bacteriophage from *Halomonas*

Erin Symonds

1:30 Diversity and Distribution of Pathogenic Viruses in the Florida Keys

Kristine DeLong

1:45 Reconstructing 20th Century SST Variability in the Southwest Pacific: A Replication Study Using Multiple Coral Sr/Ca Records From New Caledonia

2:00 **Afternoon Break**

Christopher Maupin

2:30 Fidelity of the Sr/Ca Thermometer in the Caribbean Corals *Montastraea faveolata* and *Siderastrea siderea* and Reconstruction of Sea-surface Temperature Variability in the Tropical Atlantic and Caribbean

Jennifer Flannery

2:45 Gulf of Mexico Moisture Balance Controls Hydrologic Variability on the North American Continent over the Past 1400 Years: A Geochemical Perspective

Seminar Speaker

Immediately Following in MSL @ 3:30

Mark Bush, Florida Institute of Technology in Melbourne
Paleoecology and Climate Change in the Neotropics: The View From a Hotspot

TGIF @ 5:00

Symposium Abstracts (in alphabetical order):

Kelley L. Anderson

Coral Distribution and Abundance around La Blanquilla Island (Venezuela): Effects of Local and Remote Upwelling and of the Orinoco Plume

This thesis will focus on understanding the processes driving zonation in fringing reefs around a small Venezuelan island in the Southern Caribbean. La Blanquilla, located at 11º55'-11º48'N, 64º33'-64º39'W, is an arid island of approximately 10 km diameter with colloquially well known productive fisheries. There are two central hypotheses to be investigated, one that there is a clear difference in the spatial distribution and species composition of coral reefs both horizontally (between the south and west coast) and vertically (between shallow waters of less than 5 m and those deeper than 5 m). Secondly, that careless boat anchoring in coral reefs along the periphery of areas marked as anchorages in nautical charts has led to damage of coral reef communities. A coral coverage map will be produced in collaboration with Venezuelan colleagues from the Universidad Simon Bolivar for the southern and western coasts. The map will be based on field work to validate high resolution satellite imagery. Information will be collected on the species composition of the reefs. During the field effort, reefs will be examined for signs of damage due to improper anchorages. To understand what processes are driving zonation, regional and local satellite-derived sea surface temperature and ocean color will be analyzed to understand seasonal changes, upwelling events and the movement of fresh water from river plumes. In situ temperature will also be collected using thermistors attached to corals over a six month period in both shallow and deep water on the west and east coast. The data will be analyzed to understand if there are consistent differences in the environment which may be driving the zonation in corals. The design and technology used for moorings for yacht anchorages will be studied. If field surveys identify a problem of coral damage by yacht anchorage, a strategy will be developed jointly with the Venezuelan Coast Guard to deploy test moorings at critical anchorage sites around La Blanquilla.

Cheska Burleson and E. Van Vleet

Eutrophication and the Maintenance of Harmful Algal Blooms

Phytoplankton populations are controlled "bottom up" by nutrient limitation. Nitrogen and phosphorous generally limit marine and freshwater environments respectively. In the maintenance phase of a bloom, a combination of new nutrient input and regeneration maintains the population at a carrying capacity. Eutrophication is capable of relaxing "bottom up" population control and raising the carrying capacity, thus sustaining blooms. In addition to increasing the nutrient load, eutrophication can also change the nutrient ratios and dominant nutrient forms. Because nutrient assimilation capabilities and optimal nitrogen to phosphorous ratios are species specific, eutrophication may select for a particular species. Eutrophication can bolster populations and toxic effects of harmful algal bloom (HAB) species in five ways; 1) eutrophication may increase HAB abundance while the relative fraction of total biomass remains constant, 2) the HAB species may dominate by the under increased nutrient regime, 3) the HAB species may dominate under altered nutrient ratios, 4) an altered nutrient regime may increase HAB toxicity, or 5) a HAB species may fill a vacant niche after eutrophication is corrected.

Eutrophication occurs through input by point sources and non-point sources. Generally, the non-point sources, such as runoff, groundwater inflow, and atmospheric deposition are much larger and more difficult to regulate.

Kristine L. DeLong, T.M. Quinn, and F.W Taylor

Reconstructing 20th Century SST Variability in the Southwest Pacific: A Replication Study Using Multiple Coral Sr/Ca Records From New Caledonia

Coral-based climate reconstructions, in contrast with dendroclimatic reconstructions, typically have not used multiple cores from a region to capture and replicate a climate signal largely because of concerns focused on coral conservation, analytical expense, and time constraints. Coral Sr/Ca reproducibility through the 20th century was investigated using multiple coral records, three intra-colony and three inter-colony, from the reefs offshore of the Amédée Island, New Caledonia. The coral Sr/Ca signal at New Caledonia is highly reproducible; the average absolute offset between coeval monthly Sr/Ca determinations between any two coral Sr/Ca time series is 0.036 mmol/mol (~0.65 ˚C), which is less than twice the analytical precision of the coral Sr/Ca measurements. The stack average of the monthly coral Sr/Ca variations and monthly anomalies are significantly correlated with monthly in situ SST (r = -0.95, -0.56, respectively, p < 0.05, n = 304) for the period 1967 to 1992 and

monthly 1º gridded SST data product (r = -0.95, -0.53, respectively, $p < 0.05$, n = 1198) for the period 1900 to 1999. The coral Sr/Ca-SST reconstruction exhibits decadal-scale fluctuations that exceed those observed in the gridded SST time series, which may reflect true differences between the SST at a shallow reef site and those averaged over a 1˚-grid box or they may reflect inadequacies in the methodology used to create the gridded SST product when few observations are available. A warming trend of ~0.65 ºC is observed in the coral Sr/Ca-SST record, which is consistent with estimates of warming of the tropical surface oceans for the 20th century. Monthly coral Sr/Ca records and a seasonally resolved coral $\delta^{18}O$ record from this site share variance in the later half of the 20th century, but this variance is not shared in the early 20th century, suggestive of a change in seawater $\delta^{18}O$. The 20th century trend in the coral $\delta^{18}O$ record is consistent with a 20th century freshening of surface seawater at Amédée.

Jennifer M. Dupont, W. Jaap, and P. Hallock

Epibenthic Community Snapshots in Time Prior to, During, and One Year After the 2005 Eastern Gulf of Mexico Red Tide Event

A harmful algal bloom (red tide) disturbance occurred off the west coast of Florida in 2005. The disturbance resulted in massive fish kills and collapse of the epibenthic communities in depths less than 25 meters. Red tide toxins and hypoxia were detected in the water column (surface to 20 m). There is a robust body of information on the etiology of red tide, fish community response, and human health issues, however, there is virtually no quantitative information on epibenthic community recovery following a red tide disturbance. An ongoing monitoring study of benthic algae and invertebrate recruitment and succession on artificial reef structures provided a focused time series (2005 to 2006) before, during, and after the red tide disturbance. The investigation utilized digital photographs and benthic cover analysis to document the changes in the epibenthic communities. Mortality, recruitment, and coral bleaching metrics were temporally compared. The 2005 red tide and hypoxia caused radical changes in community structure. Change in biotic cover attributes was significant (ANOSIM Test, R = 0.85; p = 0.1%). Bleached *Cladocora arbuscula* (scleractinian corals) and dead/diseased Porifera increased between March 2005 and August 2005. One year after the red tide (July 2006) successional algal communities composed primarily of *Caulerpa spp.* and other macroalgae, had successfully recruited at most of the monitoring stations (40-93% cover). *Cladocora arbuscula* corals regained their zooxanthellae and a few *Diadema antillarum* were observed at the stations. Despite the negative impacts on these benthic communities, the 2005 red tide did not extirpate all of the organisms, and recovery time periods may not be as prolonged as postulated in earlier studies.

Terry Fei Fan Ng

Identification of Novel Pathogenic Viruses by Shotgun Sequencing – Application in Green Turtle Fibropapilloma

Diseases amongst marine organisms are prevalent, but many of the infections have unknown causative agents. Current methods used to identify pathogenic viruses are PCR, immunologic assays and cell cultures, but they are limited to the diagnosis of previously identified viruses. Although there are repeated reports of infection caused by unknown agents, identification of those viruses is not achievable due to the limitations of the current methods. Therefore, we propose to identify novel viral pathogens using shotgun sequencing, which can obtain sequence from and identify viruses without the need for any prior knowledge of the viruses.

Fibropapillomatosis (FP) is a neoplastic disease affecting many endangered/threatened sea turtle species like green turtles (*Chelonia mydas*), loggerhead (*Caretta caretta*), and olive ridley turtles (*Lepidochelys olivacea*). It induces tumors in turtles' skin, eyes, oral cavity, carapace and visceral organs, and in turn causes problems in their locomotion, vision, organ functions and even survival. The prevalence of FP has been increasing over the past four decades, and is suggested to be a potential threat to the long-term survival of marine turtles. Studies have only shown that herpesviruses are *associated* with FP, but it has not been confirmed to be the causative agent, due to an inability to culture this virus in the laboratory. There are still debates on what cause FP and thus it provides a testing ground for the shotgun sequencing method. The investigation is two-fold. First, traditional PCR will be used to confirm the presence of herpesvirus DNA in an external turtle fibropapilloma. Second, viral particles will be purified from the fibropapilloma and shotgun sequencing will be performed, allowing for recovery of viral DNA sequence, including the known herpesvirus and possibly novel viruses. The result will provide a working example how shotgun sequencing can be applied to identify novel viruses in animal samples.

Jennifer A. Flannery

Gulf of Mexico Moisture Balance Controls Hydrologic Variability on the North American Continent over the Past 1400 Years: A Geochemical Perspective

The timing and phasing of variations in hydrologic conditions between the North American (NA) continent and the Gulf of Mexico (GOM) during the Late Holocene are useful to understanding current and future responses to natural and anthropogenic climate changes. The Pigmy Basin in the northern GOM is ideally situated to record inputs from the Mississippi River (MR), and, thus, can provide a coherent, decadal-scale assessment of oceanic and continental responses to changing hydrologic conditions over NA and in the GOM. This study focuses on the sedimentary record spanning the last 1400 years (determined from seven AMS ^{14}C dates calibrated to calendar years) and utilizes a multi-proxy approach incorporating organic and inorganic geochemical analyses and sedimentological parameters to define intervals of varying continental inputs and to assess changes in the moisture balance (E/P) within the GOM.

Results show multi-decadal episodes of significantly increased terrestrial inputs and enhanced MR discharge (flood intervals) centered at 500 yrs BP and 1000 yrs BP that coincide with intervals of increased $\delta^{18}O$ seawater (determined from paired analyses $\delta^{18}O$ and Mg/Ca on the white variety of the planktonic foraminifer *Globigerinoides ruber)* indicative of higher salinity recorded in the Pigmy Basin. Episodes of lower continental inputs (i.e. drought intervals) at 150, 850 and 1400 yrs BP are associated with decreased salinity in the GOM. Since the continental inputs and salinity variations coincide, we hypothesize that hydrologic variability recorded over the NA continent is directly dependent on the moisture balance (E/P) over the sub-tropical GOM. For example, increased evaporation over the GOM leads to enhanced precipitation over the NA continent. The resulting increase in freshwater input to the GOM via MR discharge is confined to the coastal regions whereas terrigenous sediment is transported to intraslope basins. Changes in solar and atmospheric circulation forcings will be invoked to discuss the climatological significance of wet and dry events over the NA continent.

Sennai Habtes

The Use of a High Resolution Imaging System to Determine the Composition of Preserved Zooplankton Samples Taken Across a Tampa Bay Front

Zooplankton populations are characterized by high temporal and spatial variability in most environments. It is therefore necessary to collect large numbers of samples over long time periods and geographical scales in order to determine biomass, community composition, and other quantitative data. This facilitates the need for new technology to allow more rapid sampling and determination of zooplankton communities over relevant time scales and geographical distributions. The use of imaging systems and sensors on remote and mobile platforms is one such source of new technology. Here we discuss a new use for a particular type of sensor, the Sipper (Shadowed Image Particle Profiler and Evaluation Recorder). The SIPPER is an *in situ* marine imaging system utilizing high-speed digital line scan cameras for the collection of a continuous picture of microscopic marine particles ranging in size from 200 μm to several centimeters. The system allows for the sizing, identification, quantification, and spatial recording of semi-transparent and opaque particles. (Remsen, 2004)

In order to investigate the physical and biological mechanisms that lead to the formation, maintenance, and dispersion of hot spots (regions of enhanced biological activity) in the region of a tidal intrusion front located on the East side of the Sunset Skyway Bridge in the Tampa Bay estuary, the Tampa Bay Hotspot Field effort was created to do a host of different sampling procedures across the frontal system during the summer of 2005.

As a part of this sampling program we conducted one minute surface tows with a 333 μm mesh plankton net with a 0.5 m mouth. Twenty samples were taken over a two kilometer transect that ran across the general area of the tidal intrusion front. These preserved samples were then analyzed by microscope and by the SIPPER high resolution zooplankton imaging system to determine the zooplankton abundance, biomass, taxonomic composition, and size distributions across the front.

James Locascio and D. Mann

Seasonality of Sound Production and its Relationship to Egg Production in Black Drum (*Pogonias cromis)*

Males of many fish species produce sound associated with courtship and spawning. Acoustic surveys can therefore be used to document the timing and location where spawning occurs. Long Term Acoustic Recording Systems (LARS) were deployed in residential canals of southwest Florida during winter/early spring months of 2004 – 2006. Seasonal patterns of sound production by black drum peaked in Feb – March consistent with the documented spawning season for this species. On nine evenings (4 pair of consecutive nights and a single night) during the 2006 season, surface plankton tows were conducted hourly from 1800 to 0400 to compare egg production with sound production. Thus far egg developmental stage and time of spawning have been estimated for each of these samples. Variables including photoperiod, temperature, and time to hatching will be used to explain the variability in spawning times. Egg densities will be estimated and compared to sound levels between nights and within nights. Egg and larval densities will also be used to construct mortality curves.

Christopher R. Maupin, K.H. Kilbourne and T.M. Quinn

Fidelity of the Sr/Ca Thermometer in the Caribbean Corals *Montastraea faveolata* and *Siderastrea siderea* and Reconstruction of Sea-surface Temperature Variability in the Tropical Atlantic and Caribbean

The Caribbean Sea is an ideal location for proxy reconstruction of sea-surface temperature (SST) variability in order to extend the short (~140 yrs) instrumental record. The instrumental record of the Caribbean region exhibits modes of climate variability with potentially global implications, such as Western Hemisphere Warm Pool variability and multidecadal oscillations. Reconstructions of SST beyond historical data may allow a more detailed understanding of these climate processes. Skeletal Sr/Ca variations in *Porites* corals have been used as a proxy to extend the instrumental record of SST in the tropical Pacific, but an analogously robust proxy species has not yet been demonstrated in the tropical Atlantic and Caribbean regions. Here we show that the Sr/Ca ratios of aragonite from the skeleton of the Caribbean coral, *Montastraea faveolata*, growing off of the southern coast of Puerto Rico, exhibit poor reproducibility and little agreement with local SST, therefore eliminating this extremely long-lived coral (200-300 years) as a practically useful archive of local SST. In lieu of these results, we also show the potential for skeletal Sr/Ca variations from another long-lived Caribbean species of coral, *Siderastrea siderea*, to act as paleoclimate proxy for local SST. A core from a large colony of *S. siderea* collected from the Dry Tortugas during the summer of 1993 demonstrates clear seasonal cycles that are highly correlated with gridded and modeled *in situ* SST data (r = -0.91 for each) from the interval of 1986-1993. A high degree of reproducibility both intra-colonially and inter-colonially will give confidence that the coral is recording a consistent environmental signal, and a verification interval will provide evidence for the fidelity of the Sr/Ca thermometer in *S. siderea* as a tool for reconstructing SST prior to the instrumental record in regions that are climate "hotspots", such as the northern Caribbean.

Jennifer Mobberley, N. Authement, A. Segall, and J.H. Paul

Genome Sequence Analysis of a Temperate Bacteriophage from *Halomonas aquamarina*

We have sequenced the genome of a temperate phage infecting a *Halomonas aquamarina* strain isolated from surface waters in the Gulf of Mexico. The phage, named HAP-1, was a double stranded DNA phage 40,350 base pairs long. HAP-1 was composed of 57 Open Reading Frames, 32 of which remain completely unidentified based on GenBank similarity. The genome was organized into a group of structural assembly genes followed by a group of replicative genes. Although no integrase gene was found, the HAP-1 contained other features which are typical of lysogeny modules, including phage repressor in a part of the genome that was in reverse orientation to the rest of the genome, and a. The HAP-1 genome also contained a protelomerase and a partioning protein which may allow the phage to exist as a plasmid-like linear genome with hairpin ends. Studies are currently underway to determine if the prophage integrates into the host genome or exists as a plasmid, to confirm sequence data with protein characterization, and to determine the activity of the protelomerase. The *H. aquamarina* prophage HAP-1 is one of the few temperate marine phage genomes to be sequenced to date, and it will contribute to our knowledge of lysogeny in the ocean.

Ivan Orlic

Causes of Variation in the Condition of the Bay Anchovy Within its Juvenile Nursery Habitat

The bay anchovy, *anchoa mitchilli*, is a keystone species in the trophic structure of estuaries and rivers in the Tampa Bay ecosystem, commonly linking zooplankton to piscivores and other higher consumers. Perhaps the most abundant fish species in most US east coast and Gulf of Mexico estuaries, bay anchovy tend to broadcast their planktonic eggs in association with river plumes, followed by juveniles migrating into rivers, from where they return as adults. Under the common assumption that fish condition factor, given by length-specific weight, is an indicator of nutritional and health status, a four year time series of weight and standard length has been developed for this species in the Alafia and Hillsborough rivers. Within- and between-river condition variation is analyzed. Within-river, temporal variation in condition will be used to assess potential physical controls, of which seasonal temperature cycles, as expected, are critical. Inter-river differences may help elucidate effects of contrasting land use (and nutrient loading) in addition to hydrologic regime in these rivers. Finally, N stable isotopes will be used to investigate the possibility that differences in trophic ecology across seasons might explain some of the remaining condition variation.

Julie N. Richey, R.Z. Poore, B.P. Flower and T.M. Quinn

Natural Climate Variability Over the Last 1400 Years from Gulf of Mexico Sediments

The current interglacial period, or Holocene, has traditionally been viewed as a climatically stable period with an unprecedented rapid warming over the last 100 years. As detailed historical and climate proxy records with annual to multidecadal resolution become available from a number of regions, it is becoming clear that the amplitude of natural climate variability may be larger than previous estimates suggest. Recurring changes in climate such as the Little Ice Age (~1500_{AD}-1850_{AD}) and Medieval Warm Period (600_{AD} -1400_{AD}) had profound social and economic effects on human populations that were more than an order of magnitude smaller in number than today's 6.5 billion. In order to prepare for future climate events of this scale, it is necessary to determine the magnitude, forcing mechanisms, and regional manifestations of natural climate variability on human time-scales.

We have generated a decadal resolution 1400-year record of sea-surface temperature (SST) and inferred salinity from the Pigmy Basin in the Gulf of Mexico (GOM). The Pigmy Basin is an ideal depositional setting for recording changes in sea surface parameters as well as hydrologic changes on the North American continent via the influence of the Mississippi River. The SST and salinity records were generated using paired Mg/Ca and $\delta^{18}O$ analyses on the planktonic foraminifera *Globigerinoides ruber* (both pink and white varieties). Results of this study indicate that GOM SST was as warm or warmer at 1000 yrs BP than the modern SST, and SSTs during the LIA were up to 2.5ºC cooler than today. These large temperature responses observed in the GOM are forced by relatively minor variations in insolation, indicative of an extremely sensitive climate system. Future anthropogenic-related variability must be evaluated within the context of expected natural climate variability.

Natasha R. Schnitker, L. Dishaw, and G.W. Litman

Hypervariation of V-Region Immune-type Gene in Amphioxus (*Branchiostoma floridae*)

The adaptive immune system of jawed vertebrates is a very complex system highly evolved to recognize antigens and does not exist earlier in evolutionary development. So from where did the highly adaptive ability evolve? Amphioxus (*Branchiostoma floridae*), a cephalochordate, is a good proxy for the last common invertebrate ancestor of vertebrates. Developmental genetics studies of amphioxus have shown many homologous genes between amphioxus and common vertebrate model systems. The *B. floridae* genome has been found to contain at least one family of highly diversified genes that structurally resemble the v-region of immunoglobulins found in vertebrate immune systems. Using polymerase chain reaction, the diversity of the amphioxus v-region was analyzed in n=30 individuals. This resulted in over 60 unique amino acid sequence haplotypes. Six of the individuals were used for matings to further the understanding of how the hypervariability was occurring. Male and female pairings produced embryos that were raised to metamorphosis and then frozen for genetic analysis. All amino acid sequences from the embryos were found to be identical to either the mother or father's v-region repertoire. With knowledge that the inheritance of this gene is Mendelian, further research is needed to determine what is generating the variability in these regions.

Erin Symonds

Diversity and Distribution of Pathogenic Viruses in the Florida Keys

The distribution and diversity of viruses in coastal marine environments has the potential to be an important variable in evaluating water quality as well as human and marine organism health risks. Currently no baseline data describing naturally occurring viral groups in the Florida Keys exists; thus, the use of viruses as a monitoring tool is not plausible. The goal of my project is to determine the diversity and distribution of ten unique viral groups in the Florida Keys from seawater, sediment, and coral mucus samples collected in the upper Florida Keys and the Dry Tortugas. The viral families, infecting both humans and marine organisms, under investigation are: Adenoviridae, Herpesviridae, Papillomaviridae, Poxviridae, Parvoviridae, Reoviridae, Birnaviridae, Caliciviridae, Paramyxoviridae, and Hepadnaviridae. These viral families will be identified by comparing the sequences of positive PCR products from purified environmental viral samples to those found in GenBank. By establishing a baseline understanding of the distribution and diversity of these viruses in the Florida Keys, it will be possible to use viruses in water quality assessments as a means to better understand the effects of specific pollution events and future anthropogenic influences. Funding for this research is provided by the EPA.

Alexa Ramirez

A Seasonal Comparison to a Past Study of Substrate Preferences of Select Foraminifera in Seagrass Beds of Florida Bay

In the spring of 1999 a study of abundance and phytal substrate preferences of 2 larger forams and other smaller foraminiferal species was conducted in a seagrass bed off of the Keys Marine Lab on Long Key (Fujita and Hallock, 1999). I intend to do a comparable experiment to examine fall foraminiferal assemblages. Foraminifera are frequently used today as health indicators for near shore environments; the presence/absence and abundance of certain species indicate water quality as a result of the concentration of nitrogen and phosphorus, heavy metals and/or dissolved oxygen. Since, in shallow carbonate environments, foraminifers are found to live almost exclusively on phytal substrate, whereas surface sediments are mainly comprised of discarded and dead tests, ten algal and seagrass species commonly found within seagrass beds will be collected, as outlined in Fujita and Hallock's study. The two expectedly dominant species of symbiont-bearing foraminifers are *Archaias angulatus* and *Sorites orbiculus*. *A. angulatus* is known to prefer highly epiphytized substrates and low wave action. Flat, long-lived macrophytes where semi-permanent to permanent attachment is possible are preferred by *S. orbiculus*. As there has yet to be a major hurricane through the Keys in 2006, a relatively undisturbed representation of species assemblage on these phytal substrates should be present. The goal of this study, when combined with previous work, is to observe the seasonal change in foraminiferal assemblage within a seagrass bed, providing a measure of annual variability.

2006 GSS Coordinators

Kristy Uhlenbrock
Marianne Dietz