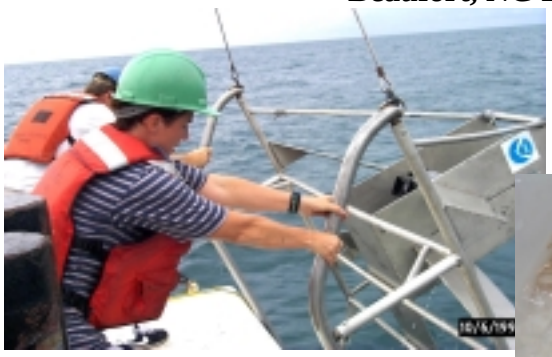
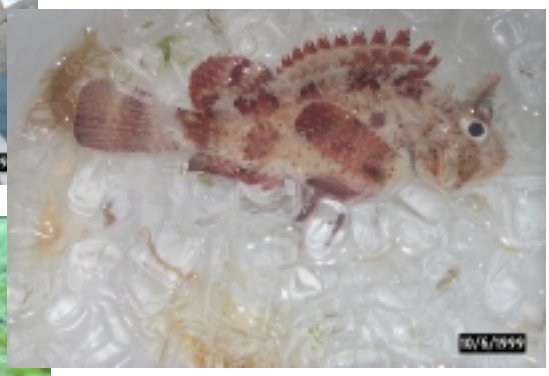
PROGRESS REPORT
ESSENTIAL FISH HABITAT PROJECT:
Deepwater seagrass beds of the west Florida Shelf - an overlooked essential fish habitat

November 10, 1999

National Ocean Service & National Marine Fisheries Service
Center for Coastal Fisheries and Habitat Research
101 Pivers Island Road
Beaufort, NC 28516-9722





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Offshore seagrass beds of the west Florida shelf, an overlooked essential fish habitat

COLLABORATORS

NOAA - Center for Coastal Fisheries and Habitat Research, Beaufort, NC
Dr. John Burke
Dr. Nancy Craig
Dr. Carolyn Currin
Dr. Mark Fonseca (**project coordinator** *mark.fonseca@noaa.gov*)
Mike Greene
Kamille Hammerstrom
Dr. Jud Kenworthy
John Parker
Larry Settle
Harvey Walsh
Paula Whitfield

NOAA - Coastal Services Center, Charleston, SC
Mark Finkbeiner

National Undersea Research Center, Wilmington, NC
Tom Potts, Science Director

STATE OF FLORIDA - Florida Marine Research Institute, St. Petersburg, FL
Marit Alanen
Rebecca Conroy
Dr. Penny Hall
Jitka Hyniova
Manuel Merello

STATE OF FLORIDA - University of South Florida, Biology Department, Tampa, FL
Dr. Susan Bell

STATE OF VIRGINIA - University of Virginia, Environmental Sciences Department, Charlottesville, VA

Arthur Schwarzschild

OVERVIEW

What Is This Resource? - *Halophila* spp. occur worldwide, but some of the rarest examples occur in the U.S. One species, *H. johnsonii*, was the first marine member of the plant kingdom listed as threatened in the U.S. Irrespective of the *Halophila* species under consideration, we know from previous studies that *Halophila spp.* have high growth rates and the highest turnover rate of their tissues of any seagrass known (days as opposed to months or years for better studied seagrasses). *Halophila spp.* also exhibit extraordinary fecundity (often reestablishing from seed every year) and are the only seagrass adapted to living down to ~35 m in many parts of the world. Like other seagrasses, *Halophila spp*. stabilize sediments providing a structural habitat utilized by fisheries organisms. However, unlike other seagrasses that break down slowly (months), their rapid turnover (days) and decomposition provides nutrients that may be quickly mobilized up the food chain, with the potential for supporting significant animal resources. Large numbers of sediment and blade-dwelling prey found in *Halophila* meadows are prime potential food resources for commercially valuable species such as pink shrimp, and serve as a primary nursery for post-larval and juvenile stages of crustaceans and fishes associated with hard bottom areas interspersed throughout this portion of the west Florida shelf. We suspect that this habitat also provides important foraging grounds for commercially and important recreational fishes such as grunts, snappers, grouper and flatfishes.

A New Resource - As part of baseline surveys conducted in the 1980's along the west coast of Florida in preparation for oil and gas exploration, it was discovered there may be more than one million, previously unknown, acres of seagrass beds, composed largely of the genus *Halophila* residing almost exclusively in waters under Federal jurisdiction. If only the preliminary estimate of this new seagrass resource were added to the coastal wetland inventories of the United States, it would constitute a 5 to 10% increase in the coastal wetland acreage of the entire country. Because seagrass beds have always been found to be among the most productive ecosystems on the planet (rivaling sugar cane and corn in their biomass production), the contribution of this habitat to fisheries production on the west Florida shelf is likely to be quite important. Yet, despite the extent of this resource and its close physical association with productive live bottom habitats (rocky outcrops covered with sponges, octocorals, corals, etc.), we are aware of no data describing the contribution of this habitat to the west Florida shelf fishery resources.

What Is Being Done? With support from both NOS and NMFS, we have initiated a study called ***FLASH*** - for the (west) Florida shelf - with a multi disciplinary team of researchers to begin to understand this fascinating system. This is a formidable task - unlike terrestrial systems we cannot easily see what lay around us. What has begun with this study might be considered to be the equivalent of being placed into the middle of an area the size of Yellowstone Park, blindfolded, and asked to determine what lives there, who eats what, where everything is located, and where the animals range! However, the use of an remotely operated vehicle (ROV) supplied by the National Undersea Research Center, towed video arrays, advanced sonar systems, and SCUBA divers using Nitrox gas mixture has allowed us to begin to

penetrate this new frontier - even though it has been within 50 miles of some of the most developed coastline in the country - and begin to answer some of these questions. The team brings a variety of expertise and technologies to bear - including sophisticated Geographic Positioning Systems allowing divers to drop to the seafloor within a meter of their old sampling site, Geographic Information Systems - for recording and charting the precise location of all the resources and sampling, an ROV for searching out the breadth of the resource, multi-depth fishing trawls, real-time video sleds (the 5 x 6 x 6' "*Halophila* Hunter"), high resolution video, plant stress meters, isotopic analysis of plant and animal tissues to determine who has eaten what, and not to mention many, many hours of old-fashioned sample collection, coring, trawling, and simply observing.

To date, we have:

- **collected** hundreds of plant, animal, sediment, water column and physical samples on an onshore-offshore transect spanning ~ 120 km for purposes of determining faunal utilization of this resource;
- **extended** the offshore distribution of this seagrass community to up to 120 km in some locations at depths of ~ 30 m - suggesting there may be as much as 2×10^6 acres of this resource..
- **recorded** digital video and acoustic maps of ~ 150 km of seafloor at 1 m resolution, that has shown dramatic seasonal changes in seagrass and algal cover;
- **found** tremendous numbers of grunts, snappers and other fishes that appear to be moving from adjacent live bottom habitat into the *Halophila* and algal meadows at night, much like fish movements that link coral reefs with adjacent seagrass meadows.

We look forward to learning the role of this vast ecosystem as it exists in the larger context of the eastern Gulf of Mexico and its susceptibility to disturbance by humans, thereby allowing us to act as more responsible stewards of our coastal ocean.

NOAA Ship FERREL Cruise FE-99-12, 01-26 June 1999

INTRODUCTION

The NOAA Ship FERREL arrived in Key West, FL on 30 May 1999 to support research objectives of the Center for Coastal Fisheries and Habitat Research (CCFHR) on the southwest Florida continental shelf. Four operational legs were completed: Leg 1) 01-05 June, Leg 2) 06-10 June, Leg 3) 14-19 June and Leg 4) 21-26 June. A total of 17 scientists representing six federal, state and academic institutions participated in the cruise.

OBJECTIVES

Our objectives were to 1) conduct a georeferenced investigation of the offshore extent, abundance, production, fishery utilization and food web linkages associated with the *Halophila* seagrass habitat and 2) to collect ichthyoplankton and hydrographic data along three transects west of Florida Bay in support of ongoing investigations of the recruitment dynamics of grunts and snappers.

Study Area

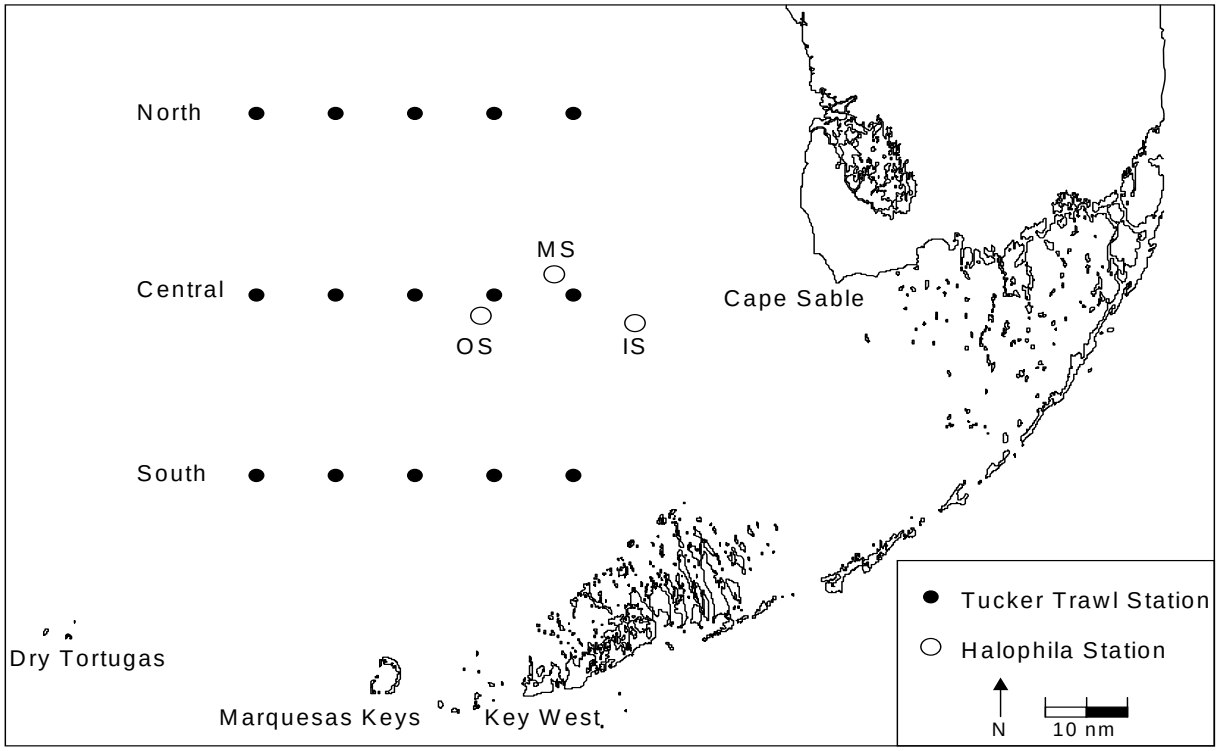

Figure 1. Location of 1 km^2 study sites as of June 1999. OS = offshore, MS = midshore, NS = nearshore.

Table 1. Corner coordinates of 1 km^2 study sites, 10 x 10 m quadrats with sites, and coordinates of ichthyoplankton survey grid. NE = northeast, SE = southeast, SW = southwest, NW = northwest. IS = Inshore , MS = midshore, OS = offshore. Q(1-3) = number of replicate, 10 x 10 m quadrat.

	Latitude	Longitude	Reference
Inshore (IS)			
	25○ 3.75199998'N	081○ 33.01999998'W	NE
	25○ 3.25999998'N	081○ 33.28600002'W	SE
	25○ 3.59784918'N	081○ 33.81501228'W	SW
	25○ 4.06000002'N	081○ 33.516'W	NW
	25○ 3.44804502'N	081○ 33.61693848'W	IS-Q1
	25○ 3.8836017'N	081○ 33.23308194'W	IS-Q2
	25○ 3.59395398'N	081○ 33.40096398'W	IS-Q3
Midshore (MS)			
	25○ 7.84000002'N	081○ 43.92700002'W	NE
	25○ 7.37500002'N	081○ 44.33599998'W	SE
	25○ 7.65799998'N	081○ 44.865'W	SW
	25○ 8.12800002'N	081○ 44.52799998'W	NW
	25○ 7.85762352'N	081○ 43.98353958'W	MS-Q1
	25○ 7.75555398'N	081○ 44.65587912'W	MS-Q2
	25○ 7.81021494'N	081○ 44.18980824'W	MS-Q3
Offshore (OS)			
	25○ 4.69142958'N	081○ 54.63562428'W	NE
	25○ 4.2351777'N	081○ 54.32825466'W	SE
	25○ 3.92780796'N	081○ 54.81812508'W	SW
	25○ 4.36004658'N	081○ 55.17352128'W	NW
	25○ 4.3125708'N	081○ 55.03271928'W	OS-Q1
	25○ 4.25777598'N	081○ 54.67067664'W	OS-Q2
	25○ 4.19547'N	081○ 54.55224342'W	OS-Q3

Ichthyoplankton Stations

North Transect	Latitude	Longitude
	25○ 21'N	081○ 42'W
	25○ 21'N	081○ 53'W

	25○ 21’N	082○ 04’W
	25○ 21’N	082○ 15’W
	25○ 21’N	082○ 26’W
Central Transect	25○ 06’N	081○ 42’W
	25○ 06’N	081○ 53’W
	25○ 06’N	082○ 04’W
	25○ 06’N	082○ 15’W
	25○ 06’N	082○ 26’W
South Transect	24○ 51’N	081○ 42’W
	24○ 51’N	081○ 53’W
	24○ 51’N	082○ 04’W
	24○ 51’N	082○ 15’W
	24○ 51’N	082○ 26’W

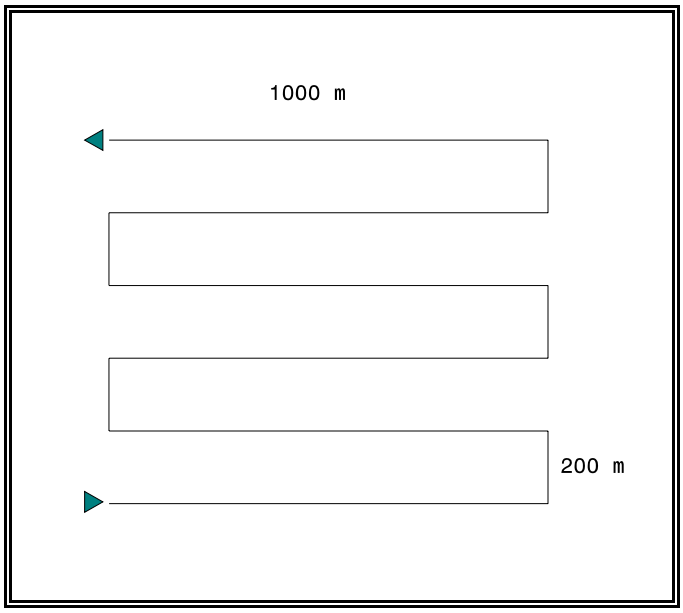

Figure 2. Stylized tow track for video sled mapping.

Station Location and General Survey Work: We located *Halophila* habitat and conducted mapping operations using a towed video sled and a RoxAnn sonar system over three 1 square km stations (Figures 1& 2). The first two legs of the cruise focused on locating and delineating these 1 square km stations and installation of primary productivity stations. During the last two legs, we returned to each 1 square km station and conducted detailed plant and animal collections, including trawling and diver-based sampling.

We transferred the video-based record of seagrass cover at 1 m resolution into a Geographic Information System (GIS: Arc/INFO). We used the GIS to develop maps of seagrass cover and guide the subsequent placement of fish trawls and the permanent plots on the seafloor. Post-mission correction of sled position on the seafloor using offsets from the beacon position on the ship have been conducted (Figure 3) and will be used for cross-calibration with the acoustic mapping (see below).

Acoustic Sensing to Characterize Bottom Types: Single-Beam acoustic sensing is being used to characterize bottom types within the 1 km^2 stations along with the towed videography. The

RoxAnn[tm] system relies on both primary and secondary echoes to determine both bottom hardness and roughness. Using these two parameters a map of bottom types (delineated by hardness, roughness and depth) can be generated (Figure 4). In this effort, the videography will serve as verification data to calibrate the RoxAnn signal. Although it is not likely that the instrument will detect *Halophila* directly, it is expected to identify areas where *Halophila* is likely to exist. It is also expected to show the relationship between *Halophila* stands and adjacent sand and hard-bottom areas. The RoxAnn data will also provide a generalized bathymetric map of each station (Figure 4).

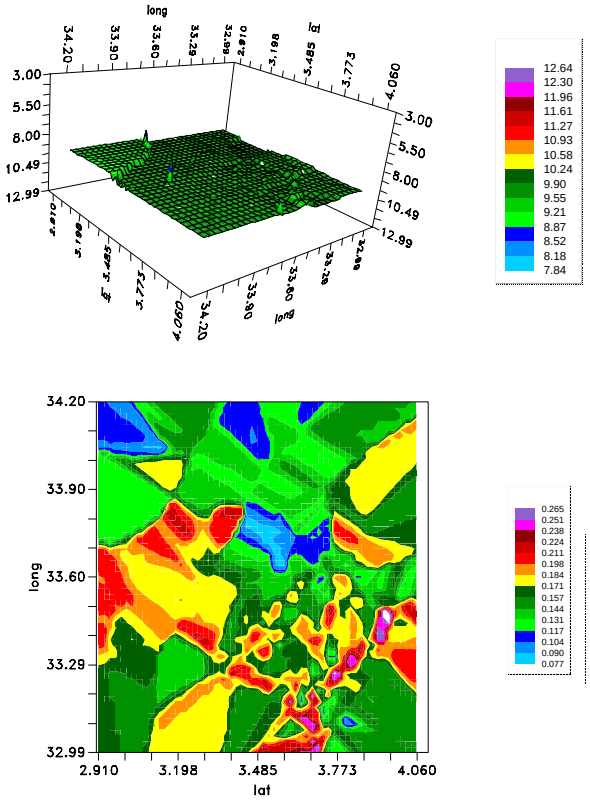

Figure 4. Roxann-derived images of bathymetry (top - color bar in meters) and bottom hardness (bottom - color bar shows relative hardness - warm colors = greater hardness such as live bottom, rocky outcrops whereas cool colors = soft, unconsolidated sediments typically colonized by *Halophila* and macroalgae.

Biological Sampling of the Halophila Community (see Table 2):

Macroflora, microflora and meiofauna: The biological resources associated with the *Halophila* habitat were assessed. Divers systematically surveyed the seafloor within 10 x 10 m plots to determine seagrass cover with 0.0625 m^2 resolution. Replicate plant, sediment, microflora and meiofauna samples were collected using traps and core tubes from each of the 3, 10 x 10m plots per 1 square km station. Seagrass productivity stations were also harvested.

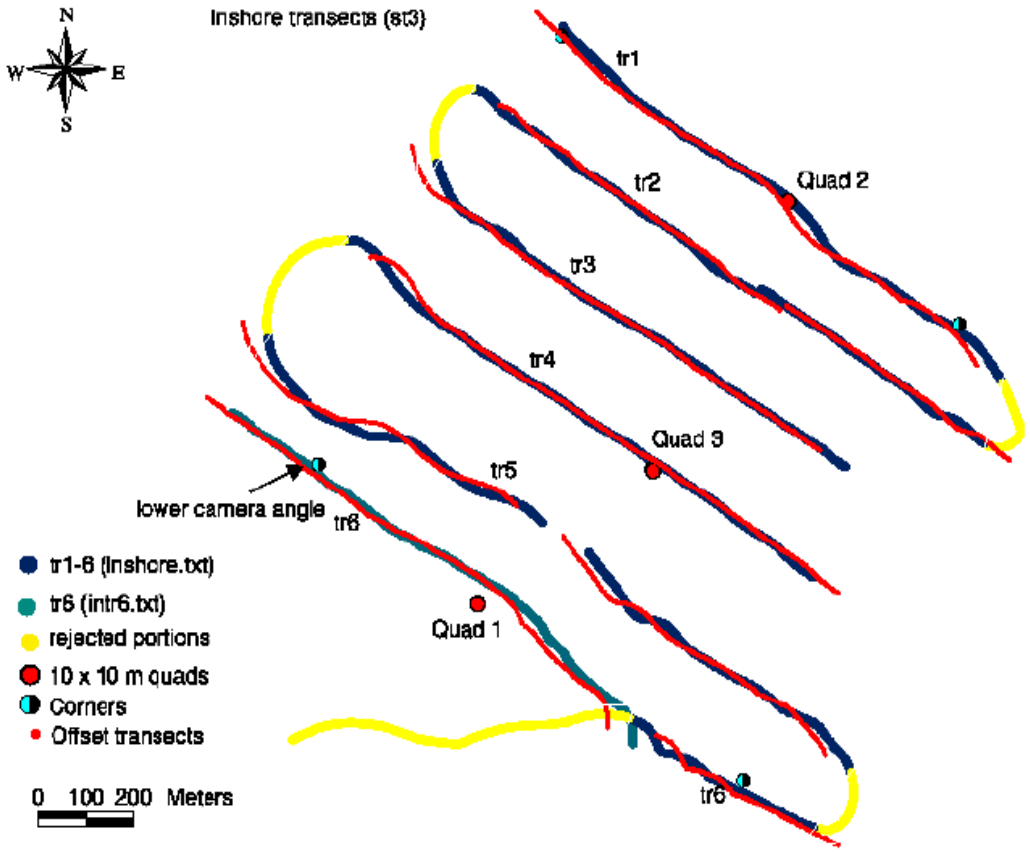

Figure 4. Example of actual transect pattern from nearshore site, showing the recorded tow track, the corrected tow track which accounts for the offset between the position of the sled on the seafloor and the position of the GPS beacon on the ship, and the portions of the tracks that were not used (yellow) on the turns because of difficulty in computing the offsets. Positions of 10 x 10 permanent quadrats is also noted.

Stable Isotope (SI) sampling: At each site, divers collected seagrass, macroalgae, benthic microalgae, phytoplankton and associated biota for stable isotope analysis. Tissue samples from fishes collected during trawling were also obtained for stable isotope analysis.

Red tide: Sampling for resting stages of red tide organisms was conducted by divers in conjunction with other benthic sampling.

Table 2. FLASH sampling effort, June. 1999 (Cruise **FE-99-12**).									
Sample type	**Offshore**			**Midshore**			**Nearshore**		
video map of 1 km^2 site	x			x			x		
3 Niskin bottom casts	x			x			x		
3 surface casts	x			x			x		
light profiles	x			x			x		
fish traps	x			x			x		
gill net				x					
beam trawls	x			x			x		
tucker trawls	x			x			x		
Sample type on individual 10 x 10 m quad basis	**Q1**	**Q2**	**Q3**	**Q1**	**Q2**	**Q3**	**Q1**	**Q2**	**Q3**
coverage mapping	x	x	x	x	x	x	x	x	x
10 chl ***a*** syringes	x	x	x	x	x	x	x	x	x
1 bag of assorted plants for isotopes)	x		x	x		x	x		x
15 meiofaunal samples	x	x	x	x	x	x	x	x	x
10 *H.d.* biomass (25 x 25 cm)	x	x	x	x	x	x	x	x	x
H.d. video	x	x	x	x	x	x	x	x	x
3-5 sed ptcle size cores (incl. some from other samples)	x	x	x	x	x	x	x	x	x
5 sediment depths	x	x	x	x	x	x	x	x	x
1 bag sed for microalgae	x		x	x		x	x		x
productivities	x	x	x	x	x	x	x	x	x

Phytoplankton collection: At each site, we collected seawater from the surface and near bottom for phytoplankton stable isotope analysis, chlorophyll and biomass.

Vagile Macrofauna: Larval and juvenile fishes and meiofauna utilizing the *Halophila* beds were sampled. Fish samples were collected with a modified 1-m Tucker Trawl sled and a 2-m beam trawl, working across each of the 1 square km stations. Additional fish samples were obtained with experimental gill nets and juvenile fish traps.

Haemulid/Lutjanid Recruitment: Ichthyoplankton was sampled with a Tucker Trawl sled at 15 stations along three transects. A CTD profile was made at each station.

RESULTS

In the first two legs of the cruise, we used a Remotely Operated Vehicle (ROV) graciously loaned to us by the National Undersea Research Center (NURC) in Wilmington, and a tow operated vehicle (TOV) from the Coastal Services Center (CSC) to establish large search perimeters on the seafloor. From those ROV and TOV searches, we established three, 1 km^2 study areas located along a ~ 30 mile inshore - offshore (east - west) transect, extending to about 45 miles offshore. This transect is located about 40 miles north of Key West and coincides with historical surveys of larval fishes by our lab (Figure 2). The stations are located in ~35, 45, and 65 feet of water - all have mixtures of sand, hard bottom and extensive seagrass *(Halophila decipiens)* beds, as well as macroalgae. We towed the video sled with its digital cameras about 21,000 m along the seafloor, showing a 1 m swath along that distance with < 1 cm resolution, all within those three study areas. All video was geographically referenced both in our onboard Geographic Information System and on each frame of the video. Staff from the Coastal Services Center (CSC) simultaneously mapped these areas using Roxann™ sonar to determine depth, bottom roughness and hardness. They towed ~ 50,000 m. We conducted cross calibrations of the towed digital video, the Roxann and diver surveys on the seafloor in a controlled survey experiment. Also, within each 1 km^2 station, we placed 3, randomly located 10 x 10m quadrats on the seafloor, marked with DGPS (< 1m accuracy) and with permanent corner stakes embedded in the seafloor. We logged many dives (as many as 20 a day among the 8 scientist party), mostly breathing Nitrox at the two deeper sites as a safety precaution and to extend bottom time. At each of these 10 x 10 m quadrats, divers mapped the area with 0.0625 m2 accuracy for cover. By using the DGPS, we were able to place divers back on these sites often within a meter of the permanent marker on the seafloor. We collected samples for not only our work, but other cooperators, including genetic structure of the seagrasses. In order to put the function of these beds in perspective with our previous, more extensive work using the Hydrolab in St. Croix, we established plots of tagged seagrass for primary production measures which were retrieved after ~ 2 weeks of seagrass growth.

During the last two legs we conducted sampling for sediment depth, sediment particle size, sediment organic content, seagrass biomass, seagrass morphology, seagrass life history, seed production, sediment seed bank, meiofauna (sediment and seagrass blade), benthic microalgae, red tide resting cysts, crepuscular and nighttime beam trawls and diel tucker trawls (along DGPS paths established from the mapping so we know what benthos the gear is sampling), fish traps, and fish census by video transect. Larval fishes were collected from each of the three Halophila stations. A total of 36 samples (24 bottom and 12 oblique) were obtained. Demersal and benthic fishes and macroinvertebrates were collected at each station. A total of 30 beam trawls were conducted during

crepuscular and evening hours. Two gill net sets were made on the mid-shelf station and two fish trap arrays were deployed on each of the sites. Sorting and identification of the samples is in progress at CCFHR. In order to succinctly tie (and partition) the production of the seagrass, plankton and macro and microalgae to their role as fish habitat, we conducted an extensive suite of sampling for stable isotope analysis (C, N, S) and potentially, compound specific isotopic analysis as well.

Haemulid/Lutjanid Recruitment: During Leg 3, a total of 45 depth-stratified ichthyoplankton samples were collected from 15 stations on three transects on the southwest Florida continental shelf. Sorting and identification of samples is in progress at CCFHR. Hydrographic profiles were obtained at each station with a SBE-19 CTD.

FIO Ship Suncoaster Cruise 17- 25 August 1999

INTRODUCTION

The Florida Institute of Oceanography (FIO) Ship SUNCOASTER disembarked from st. Petersburg, FL on 17 August 1999 to support EFH research objectives of the CCFHR on the southwest Florida continental shelf. One 10 - day operational leg was completed using EFH grant funds and matching time by FIO, between was completed 26 August 1999. A total of 17 scientists representing six federal, state and academic institutions participated in the cruise

OBJECTIVES

Our objectives were to 1) to conduct a limited re-sampling (given the 10 day length of the cruise) of seagrass and associated biota over at least three stations on the west Florida shelf as part of a georeferenced investigation of the offshore extent, abundance, production, fishery utilization and food web linkages associated with the *Halophila* seagrass, macroalgae and live bottom habitats, and 2) to collect ichthyoplankton and hydrographic data along three transects west of Florida Bay in support of ongoing investigations of the recruitment dynamics of grunts and snappers.

OPERATIONAL PLANS:

Station Location and General Survey Work: Corner coordinates for the original three, 1 km^2 stations (NE=northeast, etc.), and the three 10 x 10 m permanent benthic quadrats within each site (Q1-3) are given in Table 1. Coordinates for the ichthyoplankton sampling are also contained in Table 1. Sampling was conducted at those stations.

RESULTS

Biological Sampling of the *Halophila* Community:

Within each of the three original 1 km^2 stations, we re-surveyed the three randomly located 10 x 10m quadrats on the seafloor. Previous DGPS waypoints for each quadrat were highly accurate and allowed each quadrat to be located within minutes of dive teams entering the water at all depths. We logged > 30 dives over the course of the cruise - Nitrox was used exclusively at the two deeper sites as a safety precaution and to extend bottom time. At each of these 10 x 10 m quadrats, divers mapped the area with 1 m^2 accuracy. Sampling was also conducted for a wide variety of ecological parameters (see Table 1), including sediment particle size, sediment organic content, seagrass biomass, seagrass morphology, seagrass life history, seed production, sediment chlorophyll ***a***, meiofauna (sediment and seagrass blade), benthic microalgae, gill nets, beam trawls and tucker trawls (along DGPS paths established from the mapping so we know what benthos the gear is sampling). As before, we conducted an extensive suite of sampling for stable isotope analysis (C, N, S) and potentially, compound specific isotopic analysis as well.

Haemulid/Lutjanid Recruitment: Either a single Tucker trawl tow, composed of three nets, or an oblique bongo tow was made at each of the stations on the larger sampling grid (Table 1). Sorting and identification of samples is in progress at CCFHR. Hydrographic profiles were obtained at each station with a SBE-19 CTD.

Table 2. FLASH sampling effort, August 1999 (Suncoaster Cruise).									
Sample type	**Offshore**			**Midshore**			**Nearshore**		
3 Niskin bottom casts	x			x			x		
3 surface casts	x			x			x		
light profiles	x			x			x		
gill net							x		
beam trawls	x			x			x		
tucker trawls	x			x			x		
Sample type on individual 10 x 10m quad basis	**Q1**	**Q2**	**Q3**	**Q1**	**Q2**	**Q3**	**Q1**	**Q2**	**Q3**
coverage mapping	x	x	x	x	x	x	x	x	x
10 chl ***a*** syringes	x	x	x	x	x	x	x	x	x
1 bag of assorted plants for isotopes)	x	x	x	x	x	x	x	x	x
15 meiofaunal samples	x	x	x	x	x	x	x	x	x
10 *H.d.* biomass (25 x 25 cm)	x	x	x	x	x	x	x	x	x
3-5 sed ptcle size cores	x	x	x	x	x	x	x	x	x

NOAA Ship FERREL Cruise FE-00-01-BL 01-28 October 1999

INTRODUCTION

The NOAA Ship FERREL arrived in Key West, FL on 02 Oct 1999 to support research objectives of the Center for Coastal Fisheries and Habitat Research (CCFHR) on the southwest Florida continental shelf. Four operational legs were completed: Leg 1) 03-08 Oct, Leg 2) 10-15 October, Leg 3) 18-22 October and Leg 4) 24-28 October. A total of 17 scientists representing six federal, state and academic institutions participated in the cruise.

OBJECTIVES

Our objectives were to 1) to complete the seasonal profile of this community by re-sampling seagrass and associated biota over at least three stations on the west Florida shelf as part of a georeferenced investigation of the offshore extent, abundance, production, fishery utilization and food web linkages associated with the *Halophila* seagrass, macroalgae and live bottom habitats, and 2) to collect ichthyoplankton and hydrographic data along three transects west of Florida Bay in support of ongoing investigations of the recruitment dynamics of grunts and snappers. Most objectives were met while some were limited due to the passage of Hurricane Irene and subsequent high seas associated with cold fronts. However, the passage of Irene after we had conducted initial surveys during leg 1 and part of leg 2 provided an opportunity to determine the effects of such a storm on the study areas.

OPERATIONAL PLANS:

Station Location and General Survey Work: Corner coordinates for the original three, 1 km^2 stations (NE=northeast, etc.), and the three 10 x 10 m permanent benthic quadrats within each site (Q1-3) are given in Table 1. Below are the ~ center coordinates for the new 1 km^2 stations.

***Halophila* Stations**	Latitude	Longitude
Way Inshore (WIS)	25○03.51.9744N	081○21.18.6437W
Way Offshore (WOS)	25○06.00.3505N	082○14.44.4915W

RESULTS

Biological Sampling of the *Halophila* Community:

We towed the video sled with its digital cameras ~ 48,000 m along the seafloor, showing a 1 m swath along that distance with < 1 cm resolution. All three of the previously delineated 1 km^2 study areas were thus surveyed before and after the passage of Hurricane Irene. In addition, two new 1 km^2 stations (Way Offshore and Way Inshore) were surveyed by video sled (Figure 5). All video was geographically referenced both in our onboard Geographic Information System and on each frame of the video. Also, within each of the three original 1 km^2 stations, we re-surveyed the

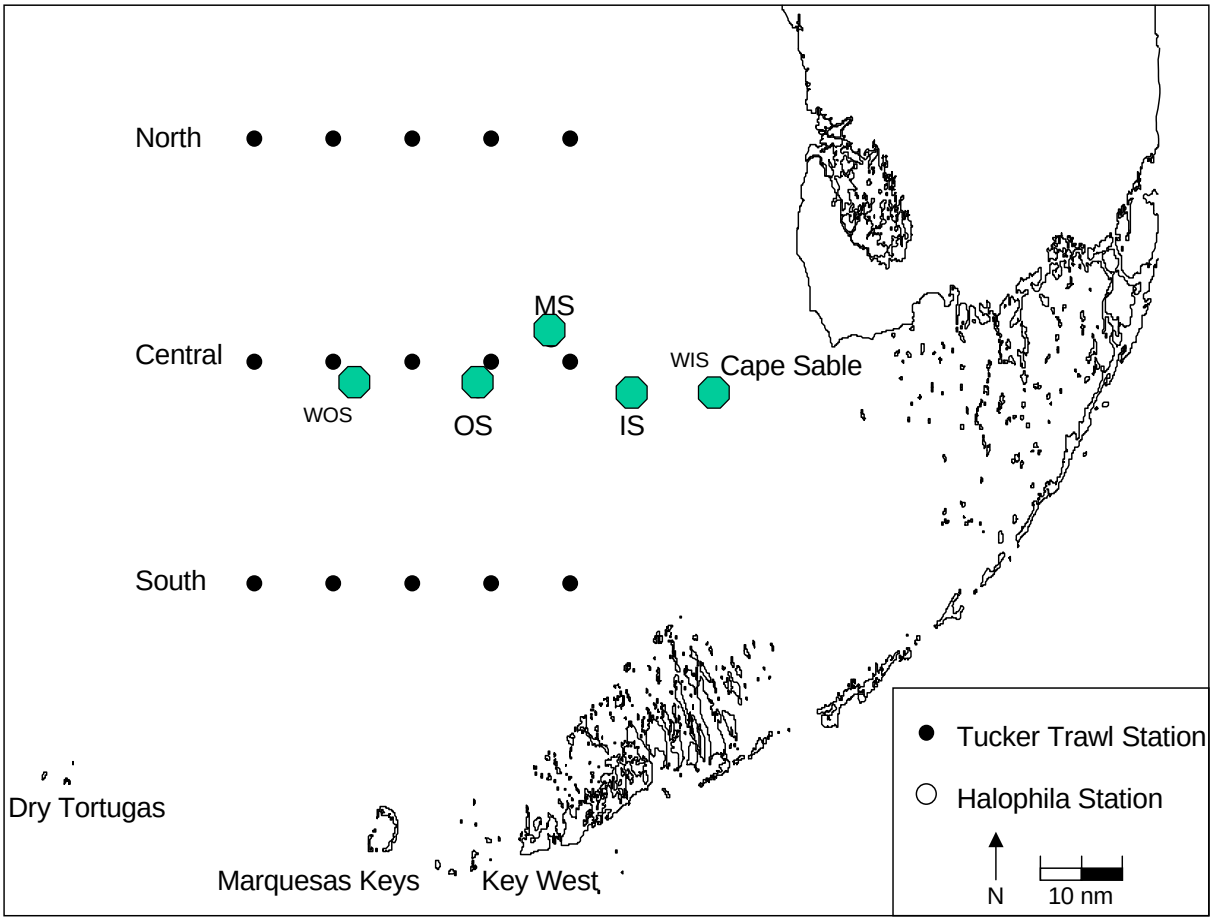

Figure 5. Locations of 1 km^2 study sites as of October 1999. WOS = way offshore, OS = offshore, MS = midshore, NS = nearshore, WIS = way inshore.

three randomly located 10 x 10m quadrats on the seafloor. New runway stakes were installed to facilitate re-mapping. Previous DGPS waypoints for each quadrat were highly accurate and allowed each quadrat to be located within minutes of dive teams entering the water at all depths. We logged 91 dives over the course of the cruise - Nitrox was used exclusively at the two deeper sites as a safety precaution and to extend bottom time. At each of these 10 x 10 m quadrats, divers mapped

the area with 1 m^2 accuracy for cover using a Braun-Blanquet technique. We established plots of tagged seagrass for primary production measures at the nearshore station but these were lost in the passage of Hurricane Irene.

Sampling was also conducted for a wide variety of ecological parameters (see Table 1), including sediment depth, sediment particle size, sediment organic content, seagrass biomass, seagrass morphology, seagrass life history, seed production, sediment seed bank, meiofauna (sediment and seagrass blade), benthic microalgae, crepuscular and nighttime beam trawls and diel tucker trawls (along DGPS paths established from the mapping so we know what benthos the gear is sampling), gill nets and fish census by video transect. Demersal and benthic fishes and macroinvertebrates were collected at each station. A total of ~20 beam trawls were conducted during crepuscular and evening hours. Gill net sets were made on the nearshore station. Sorting and identification of the samples is in progress at CCFHR. In order to succinctly tie (and partition) the production of the seagrass, plankton and macro and microalgae to their role as fish habitat, we conducted an extensive suite of sampling for stable isotope analysis (C, N, S) and potentially, compound specific isotopic analysis as well.

The passage of Hurricane Irene presented a unique opportunity to examine the impact of such a storm on our study area. Hurricane force winds passed directly over the study area between legs 2 and 3 (Figure 6). Therefore, a number of samples were re-taken to perform a before/after comparison of the storm effects (Table 1).

Haemulid/Lutjanid Recruitment: During Leg 4, a total of 21 samples (14 bottom and 7 oblique) of depth-stratified ichthyoplankton samples were collected from 7 of the 15 stations on two of the three transects on the southwest Florida continental shelf. Sorting and identification of samples is in progress at CCFHR. Hydrographic profiles were obtained at each station with a SBE-19 CTD.

Gear Impact: We planned to select replicate areas at the mid-shelf station to conduct gear impact studies on the benthos using several gear types. Gear was to have been deployed in both *Halophila*/algae habitat or hard bottom areas, marked with a buoy and towed a short distance (~ 100 m), and the stop position of the gear marked also by buoy. Divers were then to set permanent

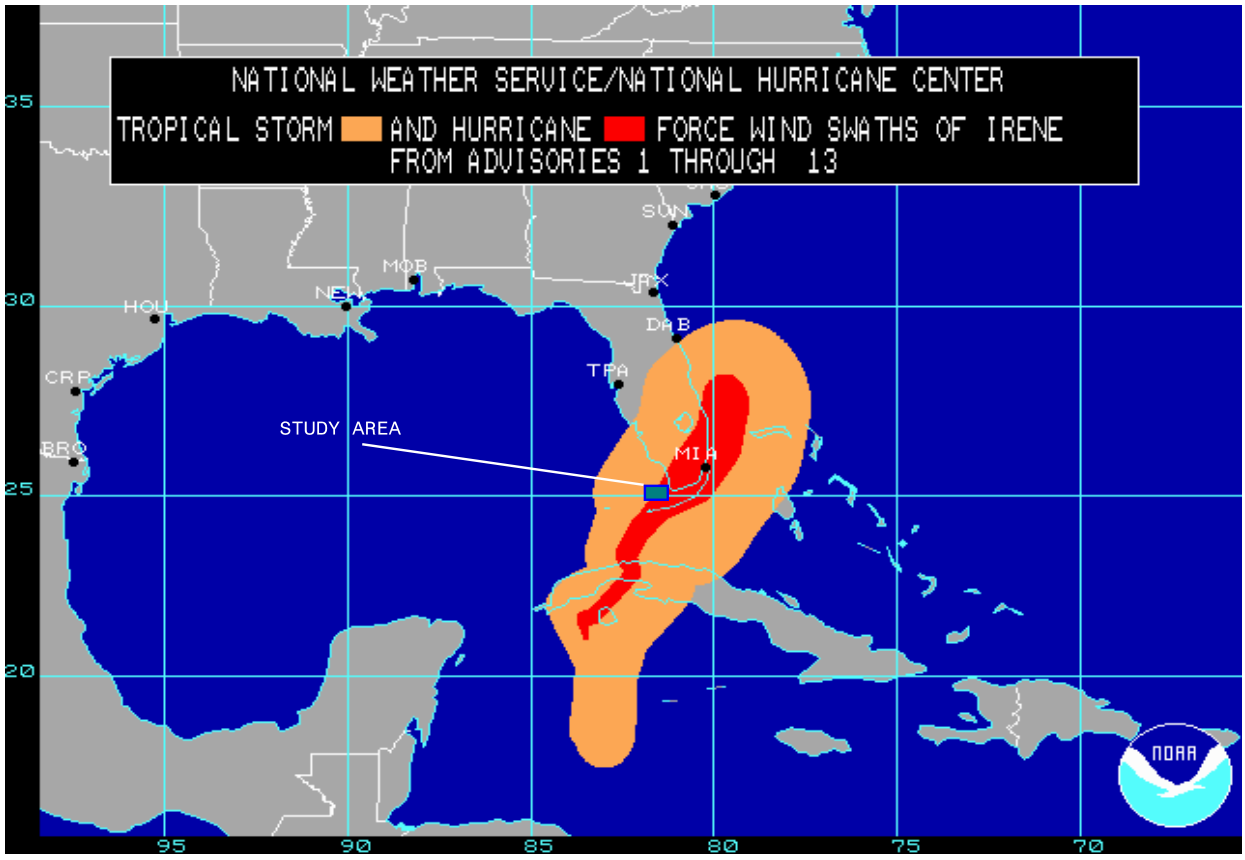

Figure 6. Distribution of Hurricane Force winds from passage of Irene. Box = approximate location of study area

benthic markers and conduct injury assessments within the tow tracks. This work was postponed until July 2000 because of bad weather.

Injury Recover and Geometric Model validation: Replicate plots were cleared within the *Halophila* habitat, varying both size and shape of plots. Regrowth of *Halophila* was to be measured as a function of area and perimeter in order to validate injury recovery models for other seagrass species in association with the Damage Assessment and Restoration Program. Plots were severely damaged by the passage of Hurricane Irene and no data were collected; the experiment is planned to be re-run in July 2000.

Ancillary data: Incident radiation, a measure of water clarity, GIS track of beam trawl tows, water temperature and irradiance data, especially irradiance at the sediment surface were collected periodically. Hydrographic data was be collected using a SBE-19 CTD at each beam trawl and Tucker trawl station.

Table 3. FLASH sampling effort, Oct. 1999 (Cruise F-00-01-BL):'x' = sampled before Hurricane Irene passed through the area on Oct 15, 1999. 'x/a' = done before and after Hurricane Irene; 'a' = sampled only after Irene; ***nf*** = sampling attempted but targets not to be found; ***if*** = sampling attempted but insufficient amounts found.

Sample type	**Way Off-shore**	**Way Near-shore**	**Offshore**			**Midshore**			**Nearshore**		
video map of 1 km^2 site	**a**	x	x			x			x/a		
3 Niskin bottom casts		x (2)	x			x			x		
3 surface casts		x (1)	x			x			x		
light profiles	**a**	x	x			x			x/a		
gill net									x		
beam trawls			x			x			x		
tucker trawls											
Sample type on individual 10 x 10m quad basis			**Q1**	**Q2**	**Q3**	**Q1**	**Q2**	**Q3**	**Q1**	**Q2**	**Q3**
Braun-Blanquet mapping			x		x		x	x	x/a	x/a	x/a
10 chl ***a*** syringes			x		x		x	x	x/a	**a**	**a**
3 large macrofauna / seed cores			x		x		x	x	x/a	x/a	x/a
1 bag of assorted plants for isotopes)			***nf***		***nf***		x	***if***	x		x
									3rd from beam trawl		
15 meiofaunal samples (5 sed only at OS - no *H.d.* biomass)			x		x		x	x	x/a	**a**	**a**
10 *H.d.* biomass (25 x 25 cm)							x	x	x/a	**a**	**a**
H.d. video									x		

10 algal biomass (25 x 25 cm)	x		***nf***		x	x	x/a	**a**	**a**
cont'd: **Sample type on individual 10 x 10m quad basis**	**Q1**	**Q2**	**Q3**	**Q1**	**Q2**	**Q3**	**Q1**	**Q2**	**Q3**
algal video							x		
sediment porewater cores							x		x/a
5 sed nutrient cores (FMRI)	**a**		**a**		**a**	**a**	x	**a**	x
3-5 sed ptcle size cores (incl. some from other samples)	x		x		x	x	x/a	x/a	x/a
5 sediment depths							**a**	**a**	**a**
1 bag sed for microalgae	x		x		x	x	x		x
Injury geometry							**a**	**a**	**a**
Inj geometry *H.d.* and bare sediment meiofaunal cores								x	x
productivities (none recovered after Irene)							x	x	x
Carbon - Nitrogen - Sulfur stable isotopes of *H.d.* (FMRI)					**a**	**a**	x	**a**	x
H.d. carbohydrate - Rhizomes (FMRI)					**a**	**a**	x	**a**	x