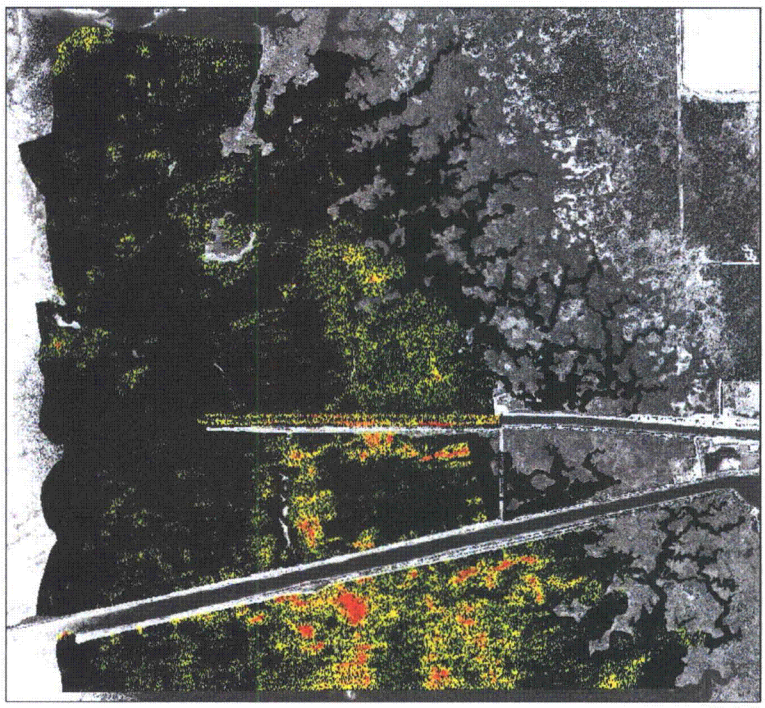

Seagrass Quantification Report for the Area Adjacent to the Crystal River Power Generation Facility, Florida

Data collected: Nov-Dec, 2007
Report: Apr 24, 2008

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Table of Contents

A. Introduction/Project Goals

Progress Energy is a power generating facility that discharges coolant water into a marine costal area containing submerged aquatic vegetation (SAV). The purpose of this study was to estimate the area covered by various species of seagrass, various species of macro algae, and areas with no plant cover, and to compare these results, if possible, to the conclusions of previous studies done in the same area from previous years.

To address these goals, ReMetrix employed several methods of data collection including hydroacoustic transect sampling, point-intercept rake sampling, SCUBA diver random point surveys, and several underwater video random samples. Each method had unique advantages and limitations, but each contributed to an accurate overall estimation of SAV.

B. Study Area Description

The study area encompassed 3,522 acres although 688 acres were inaccessible due to oyster beds, shoals, or very shallow water. A total of 2,842 acres was analyzed for SAV cover. The area had many challenging navigational obstacles such as, sensitive vegetation and corals, shoals, oyster beds, shallow water areas, and manatee. Other challenges of this study area included tide fluctuations greater than three feet, areas with high winds, and water with low visibility.

During data collection, there were several manatee, dolphin and stingray sightings. The majority of these sightings occurred in the area labeled on the map.

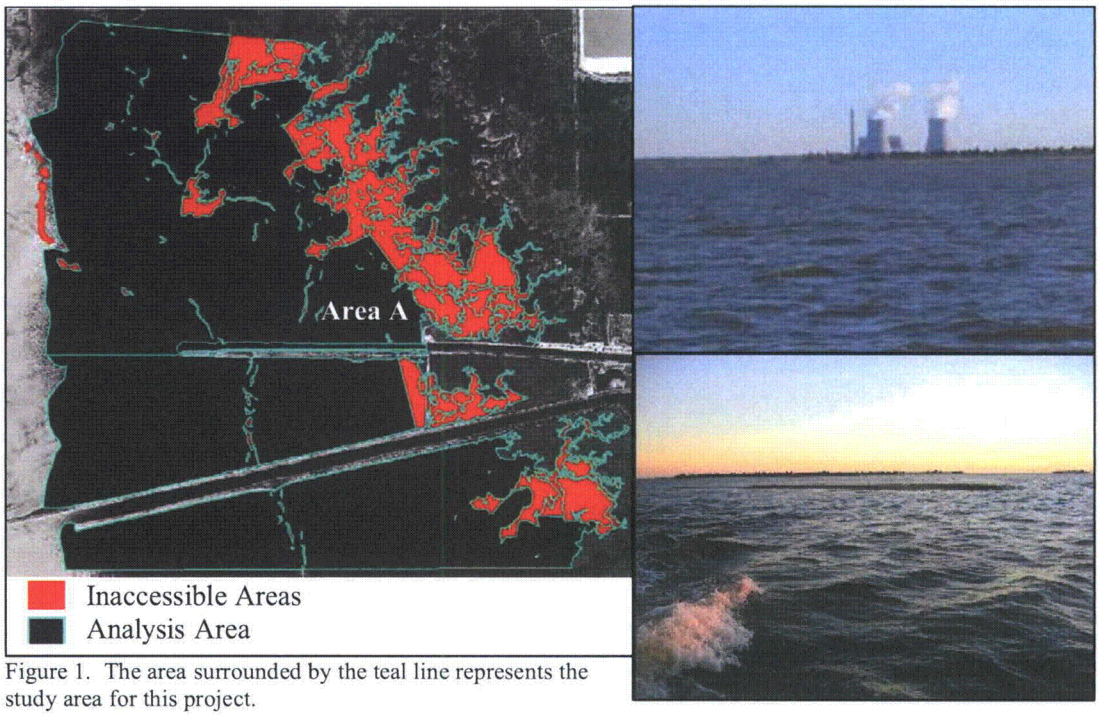


Figure 1. The area surrounded by the teal line represents the study area for this project.

C. Water Quality Sampling

Water quality information was collected at five of the ten diver sites at the same time the diver was in the water. Two sites representative of the average depths found throughout the study area were monitored every other day for the remainder of the study period. Five parameters were collected : water temperature, salinity, turbidity, light transmittance, and water depth.

Water temperature and salinity were measured using a YSI 556 multi-probe system (www.ysilifesciences.com, Figure 2a), turbidity was measured using a LaMotte 2020e portable turbidity meter (www.lamotte.com, Figure 2b); all three measurements were taken 1 foot below the water surface. Light transmittance was measured using a Secchi disk (Figure 2c) and water depth was measured by using a graduated lead line (Figure 2d). Table 1 below shows the breakout of water quality monitoring sites by depth. The full dataset of water quality information can be found in the Appendix.

Table 1. Water Quality Monitoring Sites

Water depth range (meters)	WQ sites sampled
0.5-1.5	1*
1.5-2	1*
2-3	1*
3-4	1*
4-5	1*
Total	**5***

*Sites were sampled every other day throughout the data collection period.

Figure 2a. YSI 556 multi-probe system.

Figure 2b. LaMotte 2020c turbidity meter.

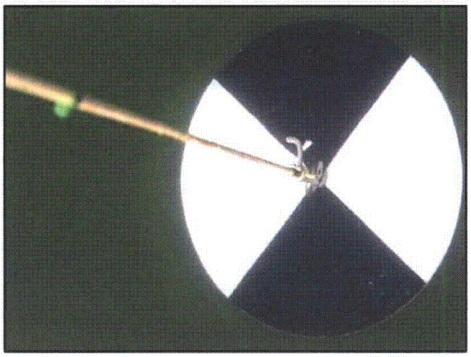


Figure 2c. Secchi disk

Figure 2d. Graduated lead line

D. Hydroacoustic Methodology (Background)

Hydroacoustic data is collected using a digital 420kH BioSonics (www.biosonicsinc.com) transducer mounted on a boat actively linked to DGPS. Transects are driven across the study area while the transducer pings the water column approximately five-to-ten times per second. The data from each ping are linked to a geographic coordinate via the DGPS beacon. Figure 3a depicts this process.

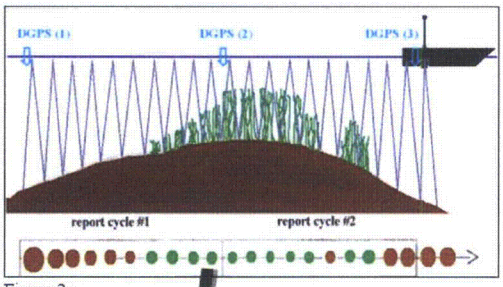


Figure 3a.

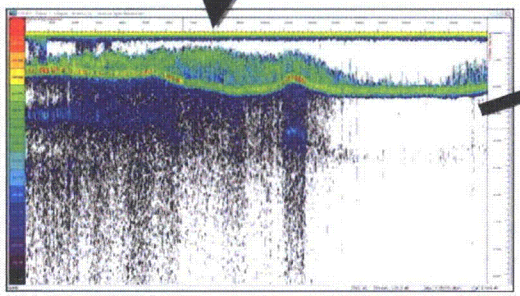


Figure 3b.

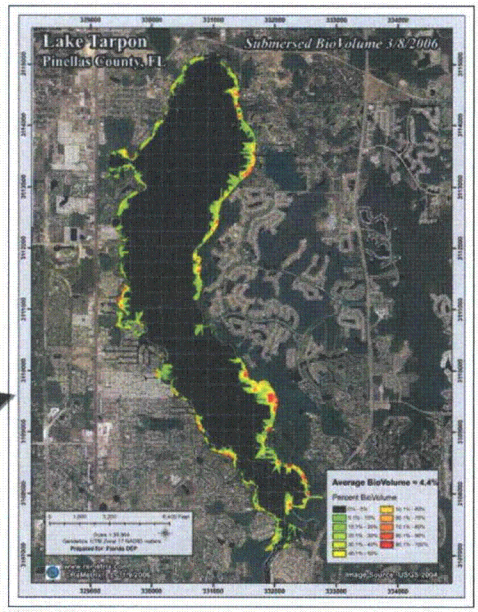


Figure 3c.

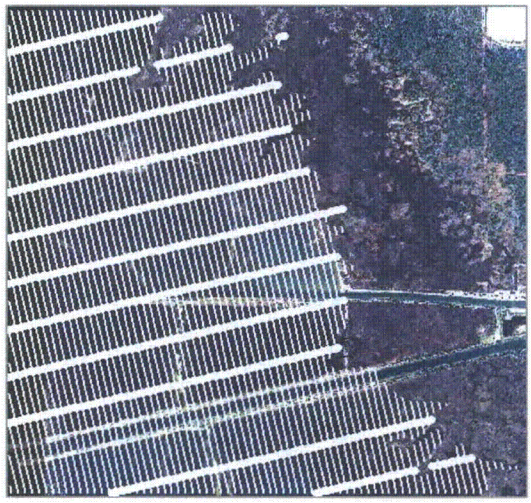
Figures 3a-c. General depiction of the hydroacoustic mapping process. See text for explanations.

The data from each ping contains submerged plant cover and height information as well as the depth to the sediment layer. BioSonics Inc, testing indicates that the hydroacoustic system returns digital samples with greater than 0.013% accuracy every 1.8 centimeters. Figure 3b (above) shows an example of raw acoustic data collected along a sample transect.

Raw acoustic data are processed to filter out noise and calculate statistics, and then exported for viewing in a geographic information system (GIS). Data from all transects is combined in GIS and modeled using a geostatistical GIS extension to produce a vegetative cover estimate, (biocover) maps for the entire study area. Biocover is an estimate of the percentage of the bottom covered with plants. Figure 3c above shows a whole-site biocover model.

ReMetrix collected data from crossing transects oriented WSW to ENE spaced 400-meters apart and SSE to NNW spaced 60-meters apart. This totaled approximately 140 miles of transects collected over the 2,842-acre site. Figure 4 represents the proposed crossing transects used for hydroacoustic sampling of this site.

Figure 4. Crossing transects planned for hydroacoustic data collection totaled approximately 140-miles within the 2,842-acre study area. Closely spaced transects (oriented roughly north-south) were 60-meters apart, and widely spaced transects (oriented roughly east-west) were 400-meters apart.



E. Species Sampling Methodology

Hydroacoustic vegetation sampling alone cannot currently explicitly determine species by their acoustic signatures. For this reason, supplemental physical sampling must be used in order to determine species. ReMetrix used three methods for collecting physical samples: rake samples, underwater video and SCUBA diver surveys.

Rake Sampling Methodology

In areas deeper than three feet, a physical plant sample was collected by throwing a double-sided thatch rake toward the shoreline at each sampling site. A rake tethered to a 25-foot rope was tossed into the water and allowed to sink until it made contact with the bottom. The rake was then slowly dragged along the bottom back toward the boat, (Figure 5a).

In areas shallower than three feet, a rake with a handle was dipped into the water until it made contact with the bottom. Steady pressure was put on the rake handle as it was scraped along the bottom (Figure 5b,c).

Figure 5a. Figure 5b. Figure 5c.

Figures 5a-c. A double-sided thatch rake was used to sample submerged vegetation at 109 sample points.

At least two rake samples were taken at each of 109 sample points (Figure 6). Ninety-one point-intercept sites were located at hydroacoustic transect crossings and 18 off-transect sites were selected randomly to facilitate biocover model accuracy assessment. The data recorded about each sample included species name, relative abundance, density, and latitude and longitude (Table 2). If no plant was found, then "no plant" was recorded as the species name. Photos were taken at most sampling sites where vegetation was found.

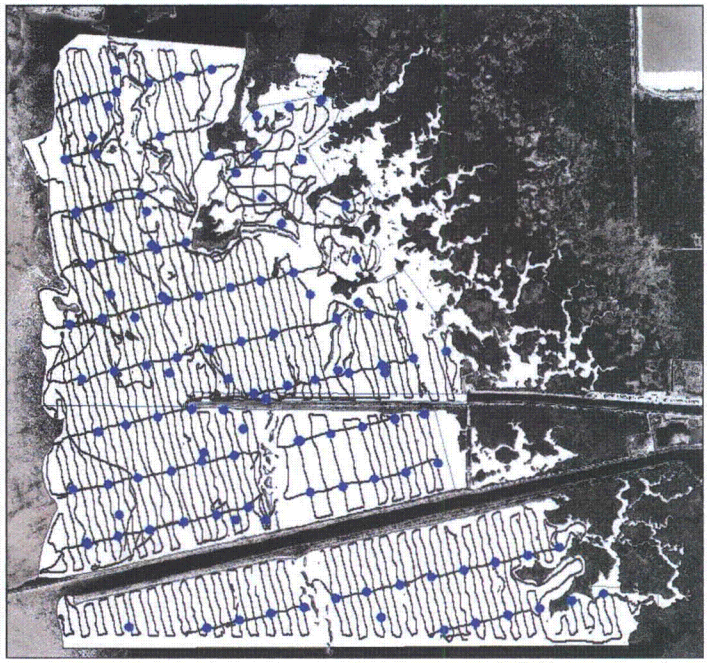


Figure 6. Rake samples were taken at 109 locations (blue points); 91 points were collected at hydroacoustic transect crossings and 18 points were collected off-transects. Point numbers can be found on the Monitoring Sites map in the Appendix.

Relative abundance

Relative abundance is a visual estimation of the proportion of the two rake samples combined for a site that each species represents. For example, if two species were found during a rake sample, one may have represented 75% of the sample and the other may have only represented 25% of the sample. In order to make this estimation quickly in the field, each species' relative abundance was assigned a score placing them in one of five easily discernable ranges. The ranges used in this study are listed in Table 2.

Table 2. Relative abundance scores from two rake samples at each of 109 sample sites were placed into five visually discernable ranges for cover.

Score	% Cover	Description
1	100%	Present as ~100% of sample†
2	75%	Present as ~75% of sample†
3	50%	Present as ~50% of sample†
4	25%	Present as ~25% of sample†
5	5%	Present as ~5% of sample† or less

†sample in this context refers to an aggregate of both samples per physical sample site

Density

Density is the percent of the immediate sample area represented by each species. For example, if only a few stems of a plant were pulled up by the rake, the density would be considered sparse. This estimation was made by gently compressing the combined vegetation sample and placing each species onto a one sided garden rake with graduated tines (Figure 7). The relative density of each species was estimated using four categories representative of the percent of the tines each species covered. Table 3 lists the categories and scale used for this estimation.

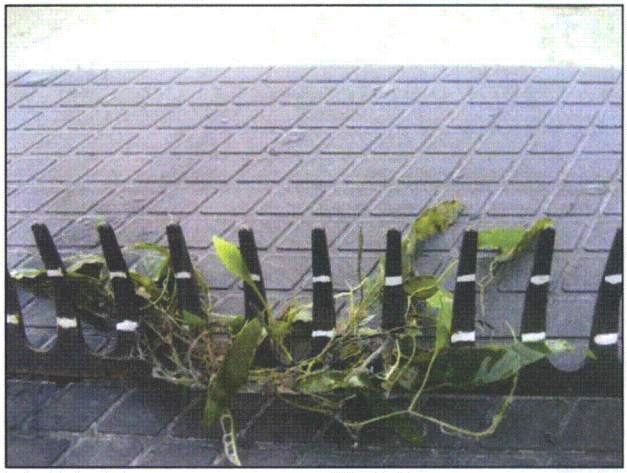


Figure 7. Species density was estimated by gently compressing the sample onto a one-sided garden rake with graduated tines. The white stripes on the tines mark 20% and 60% of the total tine length.

Table 3. Density scale for species found during rake sampling at each of the 109 sample sites estimated from the percent of the rake tines each species covered.

Scale	Name	Description
D	Dense	>60% of rake tines
C	Moderate	20%-60% of rake tines
B	Minor	Up to 20% of rake tines
A	Sparse	1-5 stems

Video Sampling Methodology

A video camera specifically designed for underwater use was affixed to a 12-foot long pole and carefully lowered into the water until it was just above the sediment layer. It was then panned around to find vegetation. When vegetation was observed, the camera was maneuvered to a range where the plants could be identified and held stationary for several seconds (Figure 8a). Thirty-one videos where taken at seventeen different random sampling locations (Figure 8b). ReMetrix encountered adverse environmental conditions that yielded mixed results when attempting to use video sampling as a reliable physical sampling method at some sample site locations.

Figure 8a. When vegetation was found, the video camera was maneuvered to a range where plant identification was possible.

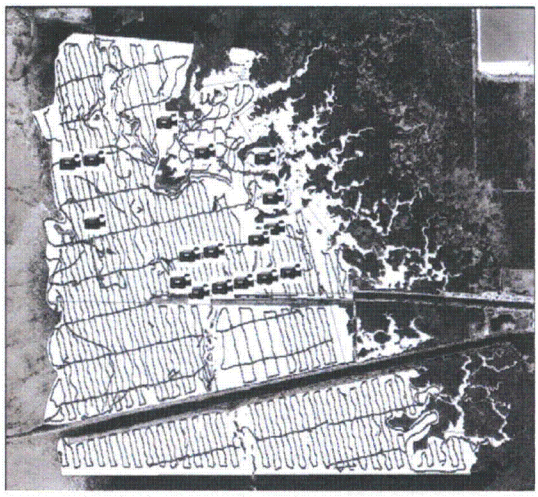


Figure 8b. Thirty-one video clips were made from seventeen random sampling locations (black videocamera symbols), all located north of the discharge canal. Site numbers can be found on the Monitoring Sites map in the Appendix.

SCUBA Diver Survey Methodology

To verify the plant type and growing conditions, a SCUBA diver survey was used. Prior to the diver entering the water, a hydroacoustic pass was made over the site, a DGPS point was taken over the specific diver entry site and a water quality sample was taken. Divers then entered the water to locate submerged plant beds, identify vegetative species present, measure plant heights, estimate percent bottom cover, and characterize overall bed density. Ten diver sites were surveyed (Figure 9).

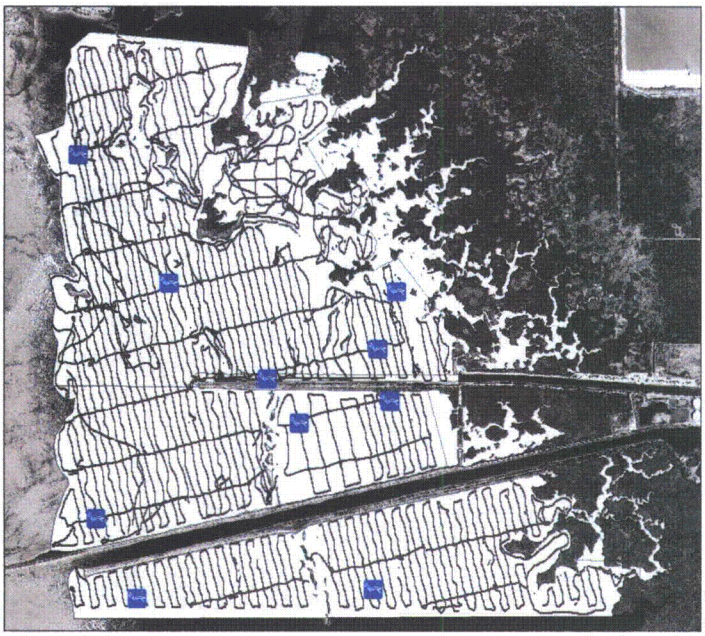


Figure 9. Ten randomly selected SCUBA diver survey points (blue symbols) were sampled between 11/15/2007 and 11/16/2007. Site numbers can be found on the Monitoring Sites map in the Appendix.

Density
Bed density was visually estimated as sparse, low, medium, or high density.

Cover
Percent bottom cover and species composition was measured using the quadrat-cell methodology described by Estevez and Marshal (1995). Once a plant bed was found, a 1-m^2 quadrat subdivided into one hundred 100-cm^2 cells was positioned two to three meters inside the bed's edge (Figure 10). Species name and number of 100 cm^2 cells each species occupied was recorded. A cell was considered populated by a species if at least one rooted stem was found within a cell. The number of populated cells out of 100 is the percent bottom cover for the species. An example of a diver site cover table can be found in Table 4.

Table 4. Genus and number of populated 100 cm^2 cells data from a sample diver site.

	Halodule	*Thalassia*	*Caulerpa* spp.	total seagrass	total rooted SAV
Total count	30	42	27	51	72

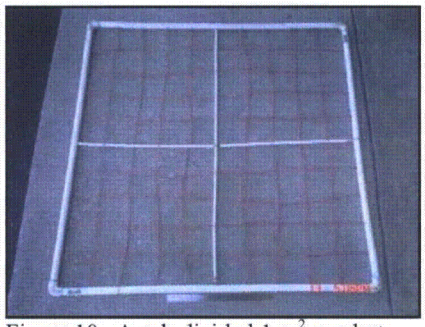


Figure 10. A sub-divided 1-m^2 quadrat assisted divers in estimating species cover.

F. Methodology Discussion

The goal for each of these methods was to help determine species type and cover. Although each successfully accomplished the goal of determining species presence/absence, they each had unique strengths and challenges.

The most time effective method to determine vegetation presence/absence was hydroacoustics. The challenge to using hydroacoustics is that it does not provide species information.

Diver sites were an excellent way to obtain accurate cover and species type without disturbing the vegetation. The drawback to diver sites was time. Diver surveys were too time consuming to sample the entire study area.

Video sample methods were an excellent way to determine if vegetation was growing on the bottom. It had the advantage of providing species identification and the exact latitude and longitude on screen. It was not as time consuming as a diver site, yet seagrass presence/absence could still be confirmed. The primary challenge with this method was determining the exact species due to cloudy or obscured water conditions. Furthermore, since the area the camera could view was small, there were times when the bottom was scanned for several minutes before any plants were detected.

The rake sample method could successfully capture the species type, relative density, and estimate relative abundance. Additionally, this method could be employed while collecting the hydroacoustics making this the least time consuming of all the methods. Another advantage was photos could be taken to document the species and abundance, which could be linked back to a precise spatial location. The primary challenge involved while sampling with the rake method was retrieving a plant sample from the sediment. The only way to verify if the rake sample was missing vegetation was to check the hydroacoustics. If the hydroacoustics indicated plant while rake samples showed no plant, additional rake samples were attempted. Certain seagrass species were missed by rake sampling simply due to plant physiology. Long narrow leaf blades, dense root mats and un-branched structure allowed the rake to "comb" through sparsely populated seagrass stands rather than hooking or snagging the vegetation. For sites where this was true, vegetation was typically pulled up by the anchor, which dug into the soil like a shovel (Figure 11). Anchor samples were recorded as rake samples when these situations arose.

Figure 11. The anchor would occasionally capture vegetation samples in seagrass beds when rake sampling did not.

G. Data Analysis

In order to calculate the area of the project and define an extent for all the data, a study area polygon was created by tracing the water-land interface. This interface was based on digital ortho-rectified quarter-quadrangle (DOQQ) imagery dated 2004 and obtained from the USGS seamless data website (http://seamless.usgs.gov). Islands and obstructions were also isolated from the analysis area in a similar manor. The hydroacoustic data were processed though software that analyzes the return signature to determine the percent biocover.

Continuous and Dot-Density Representations

After processing the hydroacoustic data, spatial data models were made to estimate biocover by interpolating between measured hydroacoustic samples and unsampled areas (Figures 12a and 12b). Both figures communicate slightly different informational contexts about estimated biocover, so both figures are included for discussion. Figure 12a shows the biocover model as a continuous surface, with color gradations indicating the percent biocover at each given location. A continuous biocover surface is the typical map output because the model estimates biocover

values for all geographic space between data transects. However, the seagrass and macroalgae beds within this study area typically occur as patchy cover, not large contiguous beds. For that reason, Figure 12b was created to more intuitively communicate the patchy nature of the beds. Figure 12b shows the exact same biocover model as seen in Figure 12a, but shows it as a gradational dot-density surface instead. Areas of high percentage biocover (reds and oranges on the map) have dots (a.k.a., "beds") spaced very closely together, as one might expect to naturally observe in a high biocover area. Areas of lower percentage biocover (yellows and greens) have dots (beds) spaced further apart, as one might expect to naturally observe in a low biocover area. It is important to note that the coverage statistics for both types of maps are the same; only the display techniques are different. Other figures using the dot-density technique are included in the Appendix.

After the model was completed, assessments for model accuracy were conducted by checking the model against rake samples, diver surveys, and video samples to calculate errors of omission and commission (see Section H).

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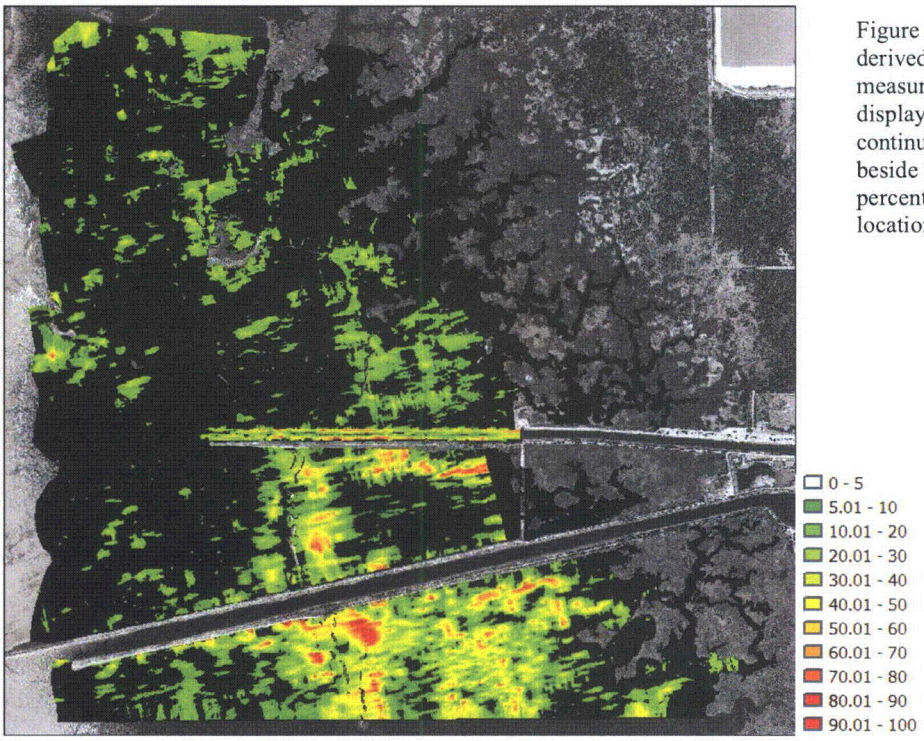

Figure 12a. BioCover model derived from hydroacoustic measures of vegetative cover, displayed as a gradational continuous surface (the legend beside the figure indicates percent biocover at a given location).

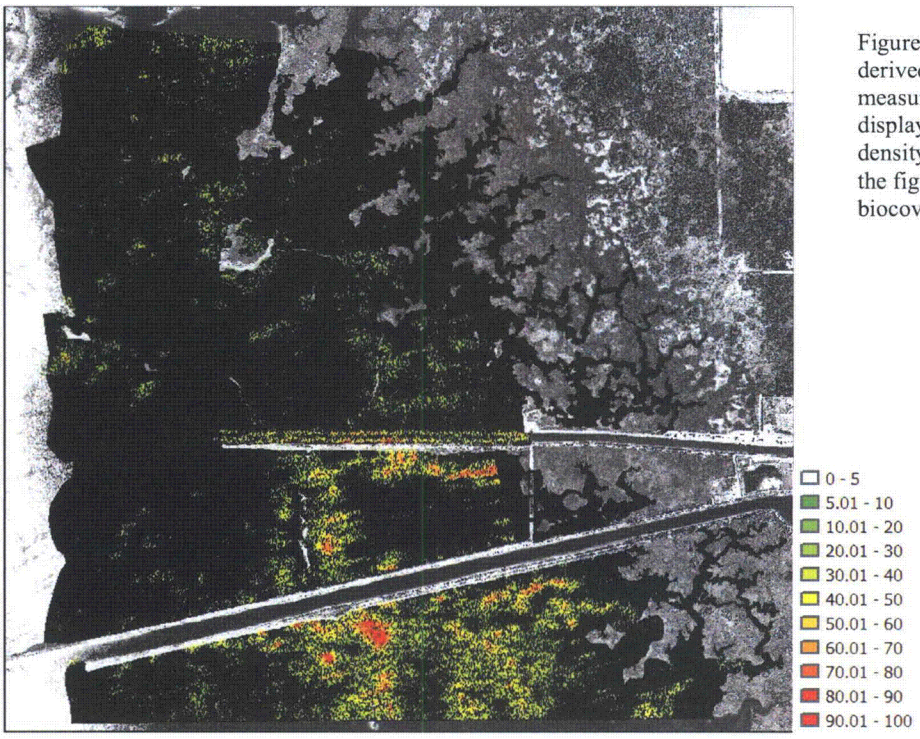

Figure 12b. BioCover model derived from hydroacoustic measures of vegetative cover, displayed as a gradational dot-density surface (the legend beside the figure indicates percent biocover at a given location).

Endpoints of Noise Threshold Settings
A patented software algorithm is used to interpret the amount of submerged vegetation along each hydroacoustic transect. Examples of this process can be seen in the figures labeled "Transect Line 2007*x*" found in Appendix (these show the raw transect data with corresponding interpretations). Noise threshold settings influence how conservatively the algorithm filters noise within the hydroacoustic signal responses. The noise threshold settings are based on established ranges and can be adjusted by the data analyst during data processing. As processing proceeds, the data analyst compares the amount of submerged vegetation interpreted by the algorithm with visual inspection of raw transect data and other field data types. Noise threshold settings are considered acceptable when the data types are in agreement.

For any project, noise threshold settings can fall within an acceptable range based on a variety of environmental and physical factors related to the data collection (e.g., surface noise during data collection, water depth, physical structure and density of the target vegetation, etc.). The acceptable noise threshold settings in this project fell within a small range primarily due to the short, spindly nature of the seagrass blades. The endpoints of the acceptable range are termed 'conservative' settings and 'less conservative' settings. The data models obtained using results within the acceptable range are considered by ReMetrix to be realistic models of the actual submerged vegetation cover in the project area. For that reason, cover models produced from each endpoint of the acceptable range are provided for comparison in Figures 13a ('conservative' thresholds) and 13b ('less conservative' thresholds).

The total biocover for the conservative noise threshold settings is 7.6%. The total biocover for the less conservative noise threshold settings is 10.4%. Table 7 in Section I provides greater detail of specific biocover types for the threshold endpoints.

The total biocover results obtained by the conservative noise threshold settings are used in the statistical calculations discussed in Section H and elsewhere in this report, unless noted otherwise.

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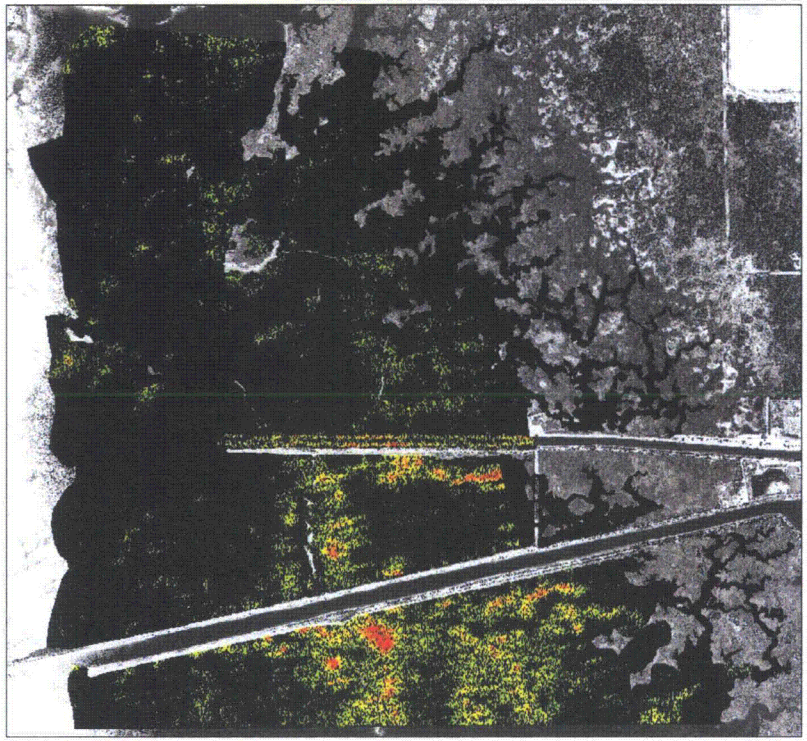


Figure 13a. Map showing the 'conservative' interpretation of total biocover (7.6%) within the project area. (See above section for explanation.)

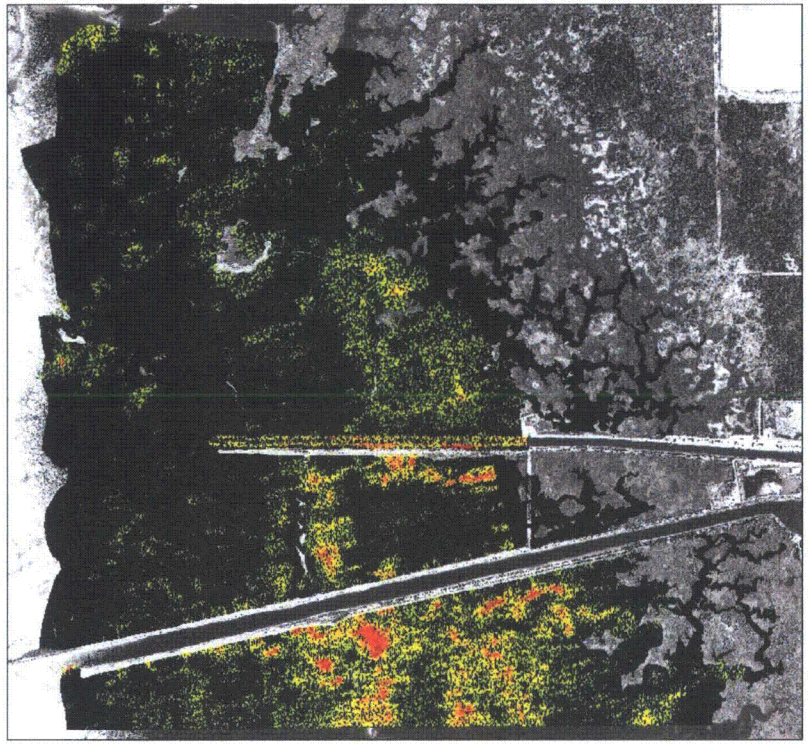


Figure 13b. Map showing the 'less conservative' interpretation of total biocover (10.4%) within the project area. (See above section for explanation.)

H. Accuracy Assessment of the Model

Typical measures for error in models are *omission* and *commission* error. These measures estimate how well a model correlates with actual sample data at the same location. For this analysis, ReMetrix compared all three types of physical sampling results (both as a whole and individually) to the biocover model derived from hydroacoustic transect data as a means for determining model correlation.

We used two 'classes' to develop the error estimate: '*plant*', for where a rake sample or biocover model indicated plant was present, or '*no plant*', where a rake sample or biocover model indicated no plants were present. As a means for explaining a particularly difficult concept we will follow just one comparison through the description, however error was calculated for both 'classes' and both types of error. In the following example, we will use 'plant' rake samples and 'no plant' areas in the model.

Calculating omission error: Of all the physical sampling points indicating plant was found, what proportion of these points lie within a 'no plant' area in the model? In this scenario, a high omission error suggests that the model could be underestimating the amount of plant that is truly present at that location.

Calculating commission error: Of all physical sampling points ('plant' or 'no plant') that lie within a 'no plant' area in the model, what proportion are 'plant' physical sample points? In this scenario, a high commission error suggests that the model could be overestimating the amount of 'no plant' that is truly present at that location.

Table 5 shows omission and commission errors of the model compared to all physical sampling methods combined. The higher 'no plant' omission error would suggest the model may not account for all the non-plant areas that were actually present, however some factors should be taken into consideration. Rake samples were taken from the bow of the boat while the hydroacoustic equipment and GPS antenna were located near the stern of the boat (approximately 18-feet of separation). The typical rake sample was made approximately 20-feet away from the boat. Combining these two distances results in a margin of error up to 38-feet between the nearest hydroacoustic point and the site of rake collection (depending upon the orientation of the boat and the actual rake sample distance at each site). Additionally, the boat may have drifted with currents while video of the bottom was taken so the actual position of the GPS antenna may have not coincided precisely with the location of the video sample or the hydroacoustic sample. Similarly, divers did not necessarily remain directly under the boat (or GPS antenna) while counting plants and therefore diver reference points may not directly relate to hydroacoustic estimates. These positional errors can account for a majority of the error when evaluating the omission and commission statistics (Table 6).

Table 5. Study area-wide BioCover model accuracy estimate without consideration of positional error (38-feet) due to GPS antenna location on the boat relative to the physical sampling location.

			Raster Classification	
		omission error ↓	plant	no plant
All physical samples	plant	17%	62	13
	no plant	62%	36	22
		commission error →	37%	37%

Table 6. Study area-wide BioCover model accuracy estimate after consideration of positional error (38 feet) due to GPS antenna location on the boat relative to the physical sampling location.

			Raster Classification	
		omission error ↓	plant	no plant
All physical samples	plant	0%	75	0
	no plant	62%	36	22
		commission error →	32%	0%

The patchiness or randomness of aquatic vegetation beds, and the characteristics of very low-density vegetation might explain the remaining error. A majority of the areas where the model indicated there was "plant" but physical sampling indicated "no plant" occurred in areas of very low-density vegetation (69% in < 5% cover, 86% in < 10% cover), where the probability of a physical sampling method contacting vegetation was low. No adjustments were made to the model for these areas since the number of hydroacoustic samples (1,116,900) vastly out-numbers the number of physical samples (139 total). After reviewing the hydroacoustic data for many of these areas, ReMetrix confirmed that these zones have low-density plant populations where a limited number of physical samples may have easily missed patchy or sparsely populated plant beds.

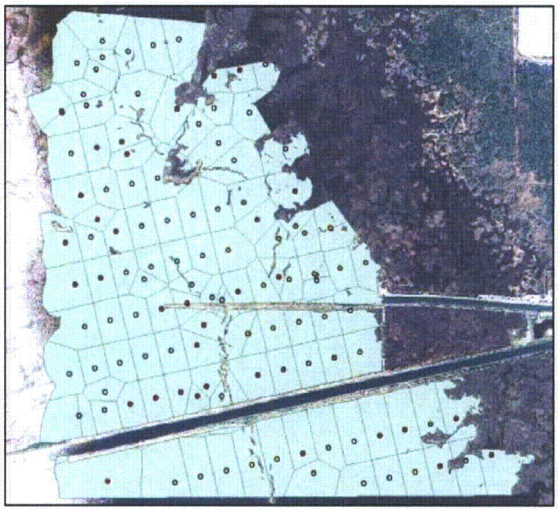
Results of additional error estimates comparing each physical sampling method individually can be found in the Appendix.

I. Vegetation Area Determination

The overarching goal of this project was to determine the number of acres of seagrass. Using the physical samples as a guide, ReMetrix separated vegetated areas in the study area into four classes: seagrass, other, mixed and no plant. Sample sites where *Halodule spp., Syringodium filiforme, Thalassia testudinum,* or *Halophila engelmannii* were found exclusively were placed in the 'seagrass' class. Sample sites where vegetation other than seagrass, e.g. *Caulerpa* or *Udotea*, was found exclusively were classed as 'other'. Sites where both seagrass and other species were found together were classified as 'mixed', and sites where no plants were collected during the rake sample, diver survey, or video sample, were placed into the 'no plant' class.

The second step in this process was to divide the study area into zones which could be labeled one of the four predefined classes. Zone boundaries were made using a method called Thiessen polygons. Thiessen polygons are mathematically defined by the intersections of perpendicular bisectors of the lines between all the sampling sites (Figure 14). Each zone was assigned the class of its corresponding sample site's classification, and the area of vegetation within that zone was calculated.

Figure 14. The study area was divided into Thiessen-polygon-defined zones based upon the spatial location of the sampling sites.



The percent cover within each zone was calculated from the biocover map derived from the hydroacoustic sampling method. The product of the zone area and the mean percent cover within that zone returns the number of acres of vegetation in that zone. Figure 15 shows an example of one zone with tabulated results.

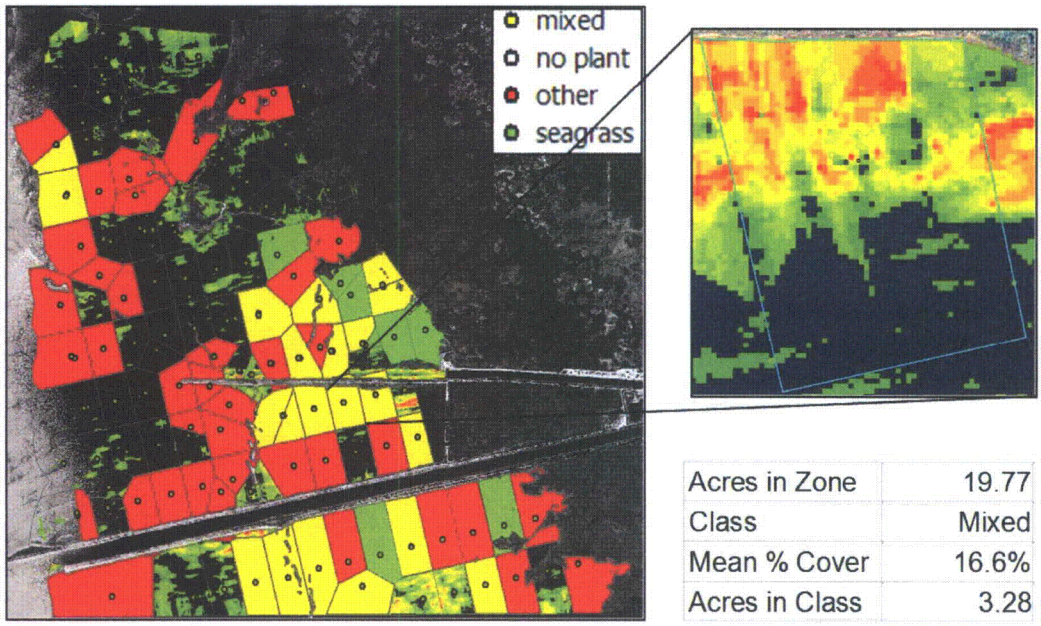


Figure 15. Acres of vegetation in a class were calculated from the area of the zone and the mean percent biocover from the hydroacoustic model.

Acres of each vegetation class by zone were summed to determine the number of acres of seagrass, other, mixed, and no plant classes (Table 7).

Table 7. Vegetation class areas were summed from the acres in class calculated in each zone and percent of the total project acreage was calculated.

Conservative Noise Threshold

Category	Acres	Percent Total Area
seagrass	**16**	**0.56%**
mixed	**81**	**2.85%**
seagrass	*46*	*1.62%*
other	*35*	*1.23%*
other	**65**	**2.29%**
unclassified	**58**	**2.04%**
No plant	**2622**	**92.26%**
Total Area	**2842**	

Less Conservative Noise Threshold

Category	Acres	Percent Total Area
seagrass	**27**	**0.95%**
mixed	**101**	**3.55%**
seagrass	*58*	*2.04%*
other	*43*	*1.51%*
other	**85**	**2.99%**
unclassified	**80**	**2.81%**
no plant	**2549**	**89.70%**
Total Area	**2842**	

It was possible to subdivide the 'mixed' class acres into percent 'seagrass' and 'other' since relative abundance of individual species was recorded. The product of the area of a mixed zone and the corresponding relative abundance for each species yielded the acres of each class (seagrass and other). The model indicated plants were present in a number of 'no plant' zones. Acres of vegetation found within a no plant zone were assigned to a new class named 'unclassified'. The unclassified acreage represented 29% of the total vegetated area so it is important to understand where these unclassified zones occurred. Fifty percent of the unclassified vegetation occurred in just 10% of the no plant classified zones. This means the bulk of the unclassified data occurred in a relatively small number of zones. All six of these zones were surrounded by zones of a defined vegetation type. Based on the classification of adjoining zones, many were likely mixed stands of seagrass (Figure 16). Most likely, the rake sampling was not representative of the whole zone.

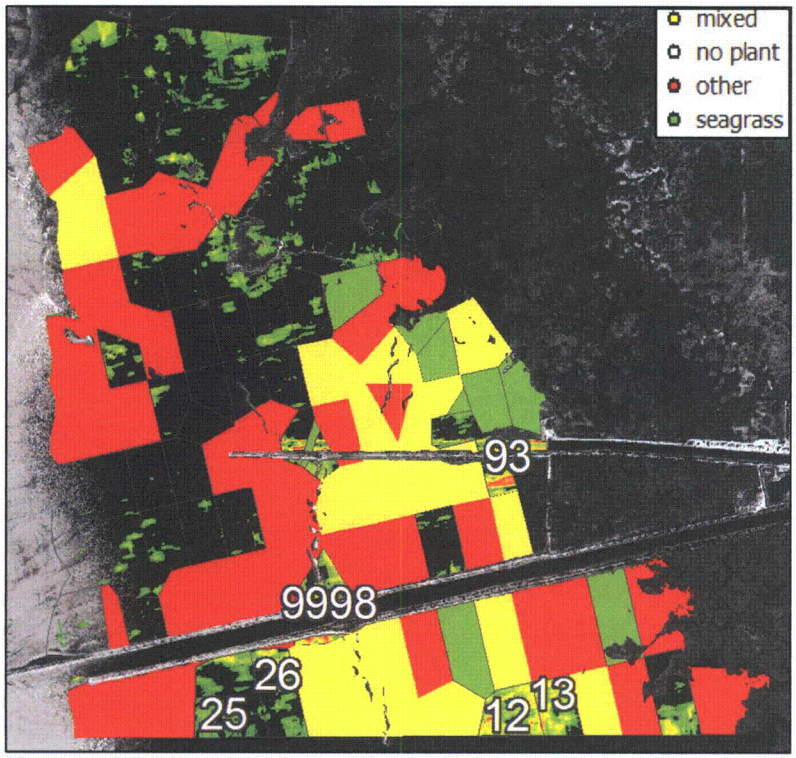


Figure 16. The six 'no plant' zones showing high vegetative cover were most likely 'mixed' zones where a physical sampling method was unable to locate vegetation.

J. Comparison to Previous Work

Broad comparisons were made between 2007 data and the transect data reported in Marshall (2001). The data from 2001 was loaded into a GIS and transects were drawn between the sampling points. Average biocover was calculated from the current model along the 2001 transects in an attempt to compare the same areas. Average cover was tabulated for both 2001 and 2007 (Table 8). There could be several reasons the 2007 results were lower than the 2001 results. First, 2007 data were not sampled along the exact same transects, rather they were based on a segment laid over a model of hydroacoustic data. Both transects 2a and 3w each had two data points that were more than 50 meters from any 2007 sampling locations.

Table 8. Comparisons were made for average cover between 2001 and 2007 along similar transect lines.

Name	2001 Mean	2007 Mean
1N	32.09	6.01
1W	46	1.70
2a	20.25	0.15
2W	39.19	4.90
3W	34.52	4.83
4W	5.28	3.04
5W	0.25	1.66

Another concern when comparing these two sample methods is simply the difference in the sampling methodology used to calculate cover. Comparing quadrats sampled along a transect to a model derived from hydroacoustic transect sampling should be done with careful consideration of how each method calculates percent cover. The 2001 quadrat method estimated plant cover as 1% per 100 cm^2, even if it was very sparsely distributed and repeated every 100 meters along the transect. A transect's average biocover was then calculated by averaging over all cover estimates for that transect. Hydroacoustic sampling records 10 pings per second of plant or no plant and computes an average across 10 pings to make one sample estimate of biocover. This equals one sample per second or roughly one sample per 2.5 meters. These samples are then used to create a model, thereby interpolating a 5-meter grid between samples in all directions. As a example, we investigated video point 9992 located less than 300 ft from a 2001 reported sampling location along transect 4w (Figure 17). The 2001 sample listed *Halodule* at 86% cover, while the 2007 model estimated it at 11% cover.

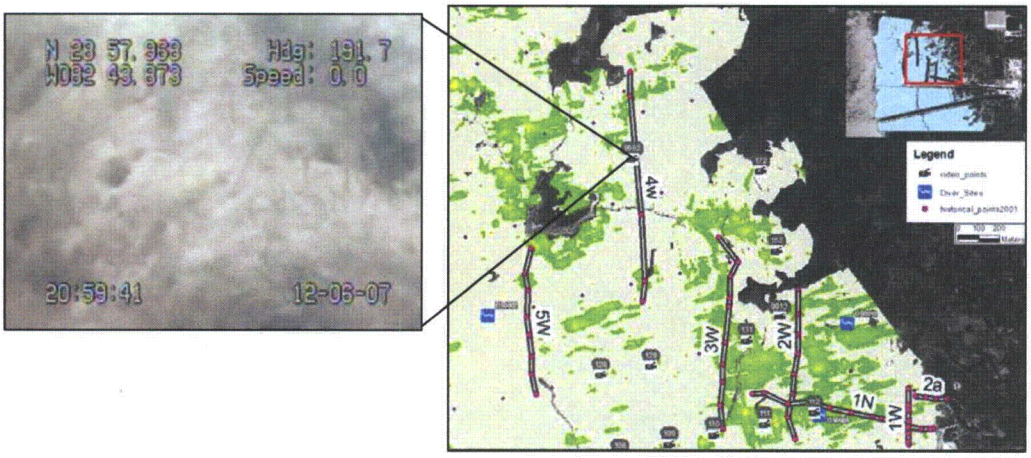


Figure 17. Screen capture of digital underwater video sample (left) showing sparse vegetative cover, with corresponding sample location (right).

<continued on the next page...>

The following illustration (Figure 18) may describe why the average cover comparison from 2001 to 2007 differs so greatly. In the following diagram, a green cell represents a 'plant' cell.

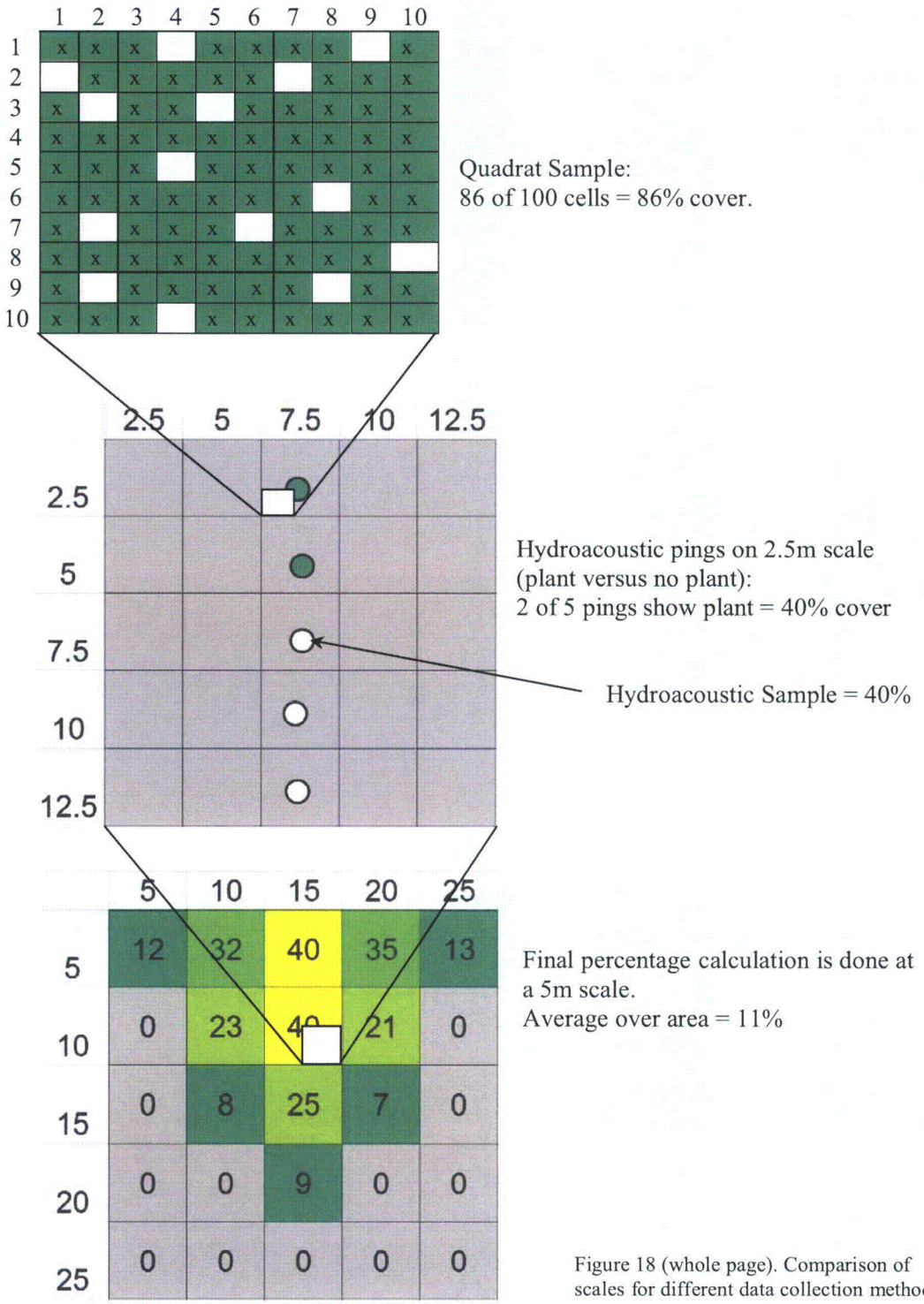


Figure 18 (whole page). Comparison of scales for different data collection methods.

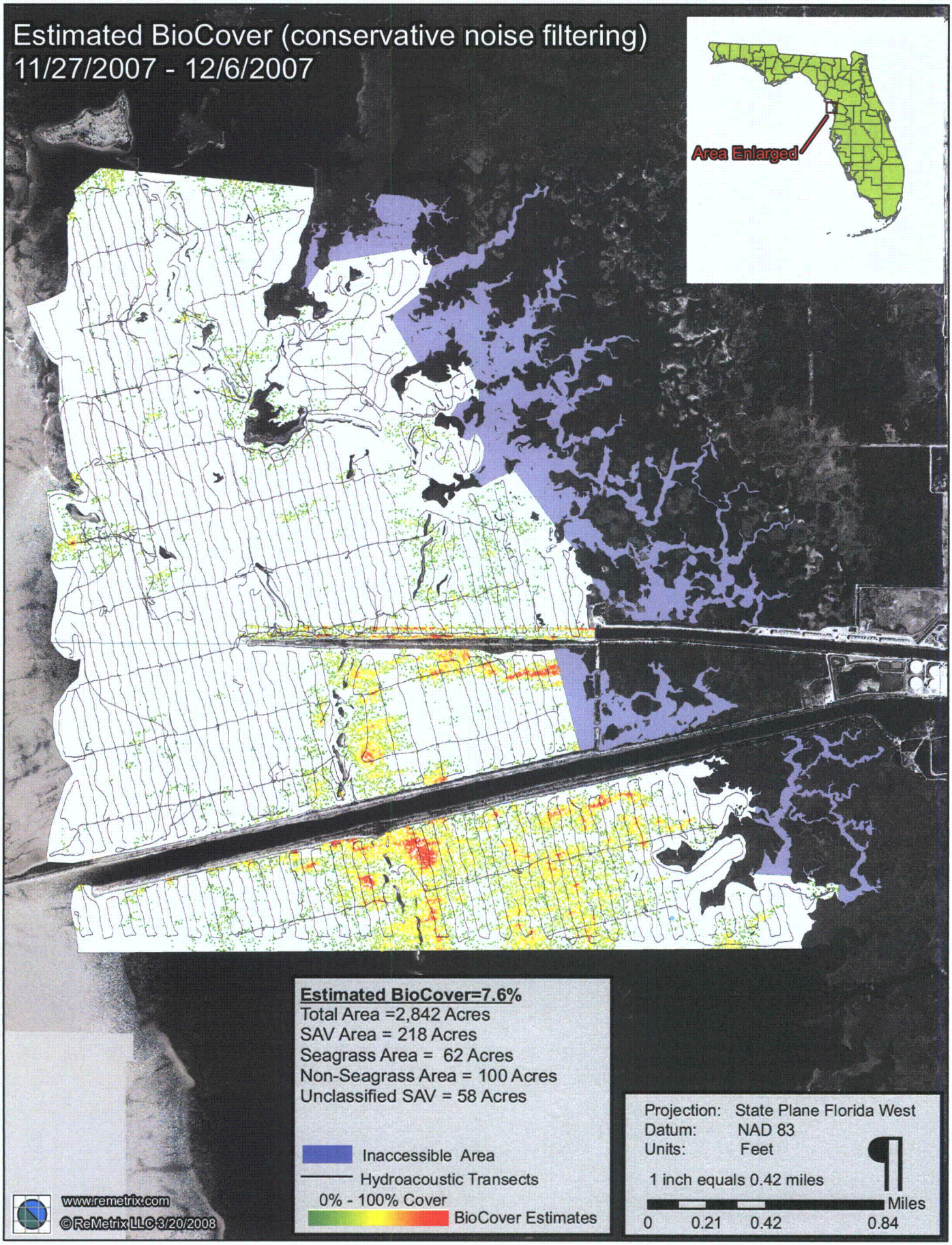
Furthermore, transects 1W, 1N, 3W, and 4W don't appear to be sampled on 100-meter intervals. This indicates there may have been some post-directed sampling used for the 2001 data, which may have greatly influenced the average cover for the transect.

REFERENCES CITED

Estevez, E.D., and Marshal, M. J., 1995. *1995 Summary Report for: Crystal River 3 Year NPDES Monitoring Project*, Mote Marine Laboratory, Sarasota, FL, 131 p.

Marshall, M.J., 2001. *Seagrass Survey: November 2001 Resurvey at the Florida Power Crystal River Generating Facility*, Coastal Seas Consortium, Inc., Bradenton, FL, 19 p.

Appendix


Estimated BioCover (conservative noise filtering)
11/27/2007 - 12/6/2007
Area Enlarged
Estimated BioCover=7.6%
Total Area =2,842 Acres
SAV Area = 218 Acres
Seagrass Area = 62 Acres
Non-Seagrass Area = 100 Acres
Unclassified SAV = 58 Acres
Inaccessible Area
Hydroacoustic Transects
0% - 100% Cover
BioCover Estimates
Projection: State Plane Florida West
Datum: NAD 83
Units: Feet
1 inch equals 0.42 miles
Miles
0 0.21 0.42 0.84
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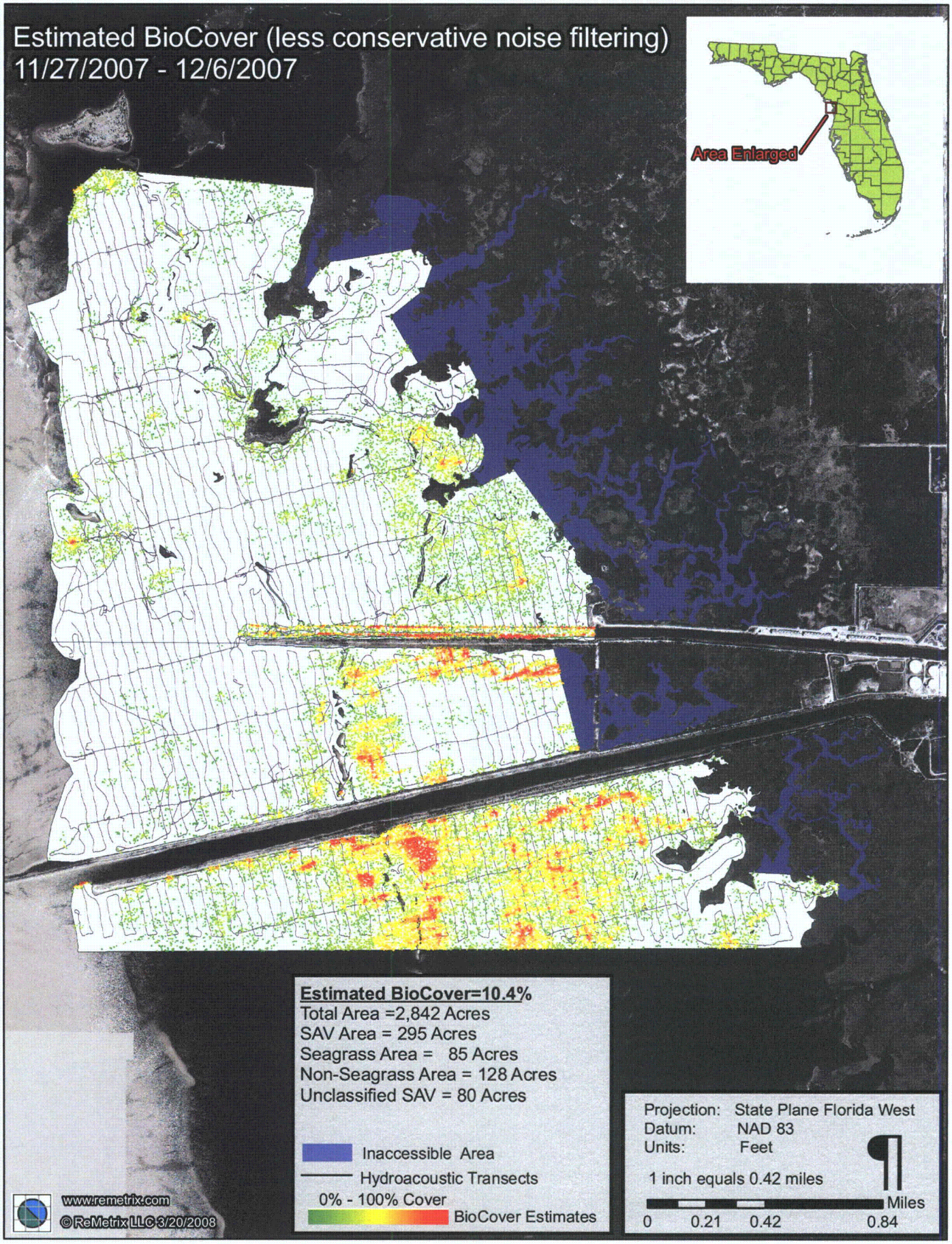
Estimated BioCover (less conservative noise filtering)
11/27/2007 - 12/6/2007
Area Enlarged
Estimated BioCover=10.4%
Total Area =2,842 Acres
SAV Area = 295 Acres
Seagrass Area = 85 Acres
Non-Seagrass Area = 128 Acres
Unclassified SAV = 80 Acres
Inaccessible Area
Hydroacoustic Transects
0% - 100% Cover
BioCover Estimates
Projection: State Plane Florida West
Datum: NAD 83
Units: Feet
1 inch equals 0.42 miles
Miles
0 0.21 0.42 0.84
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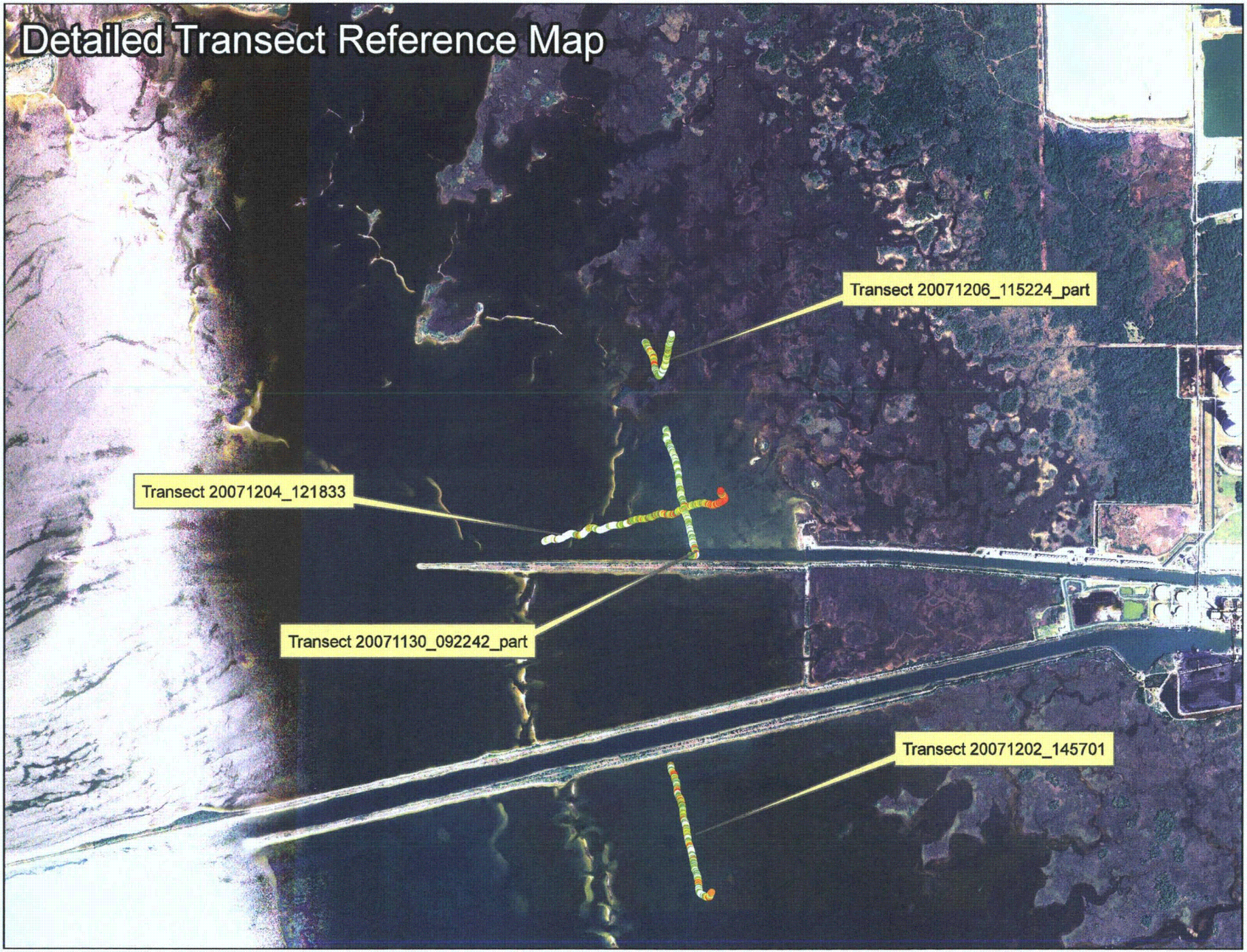
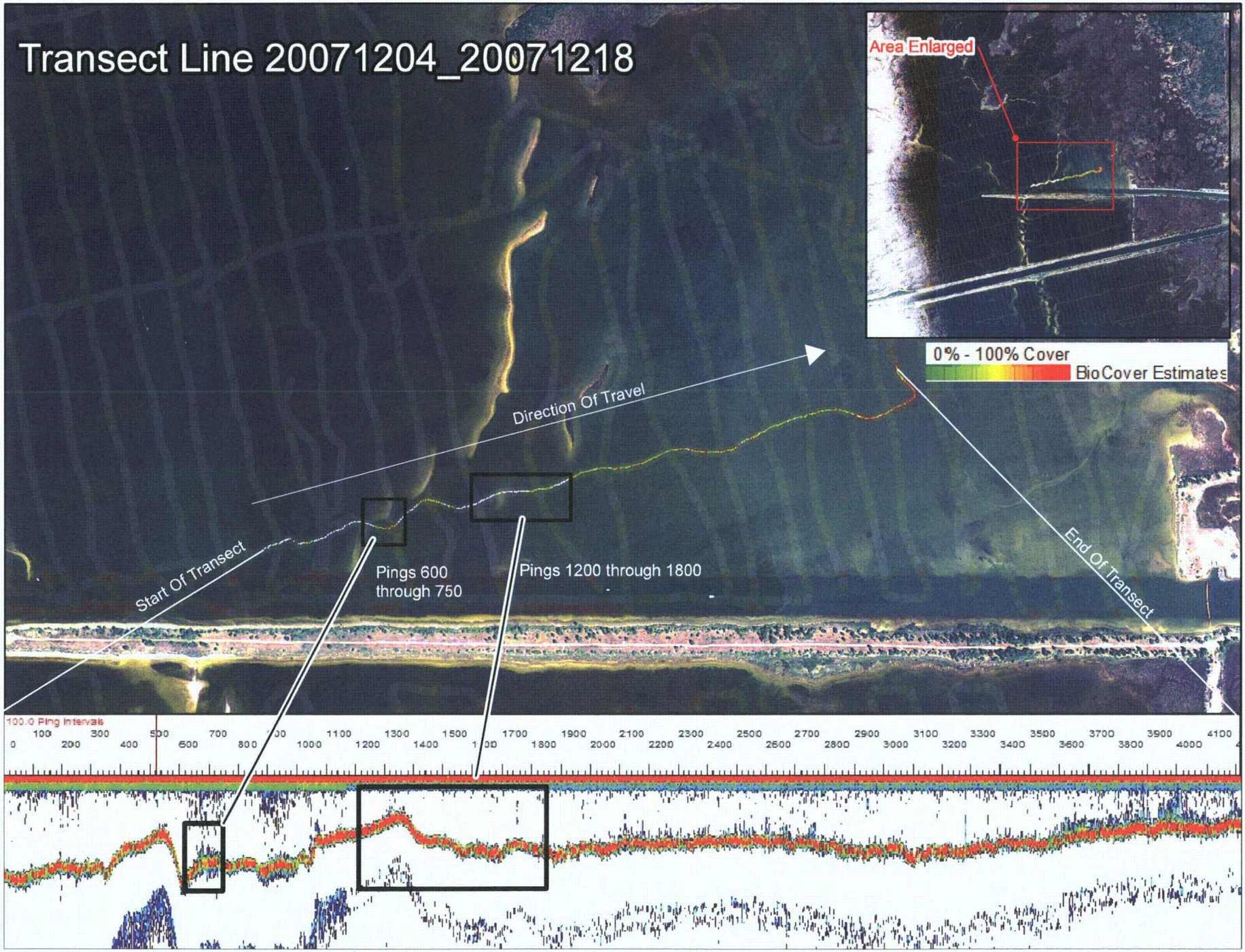
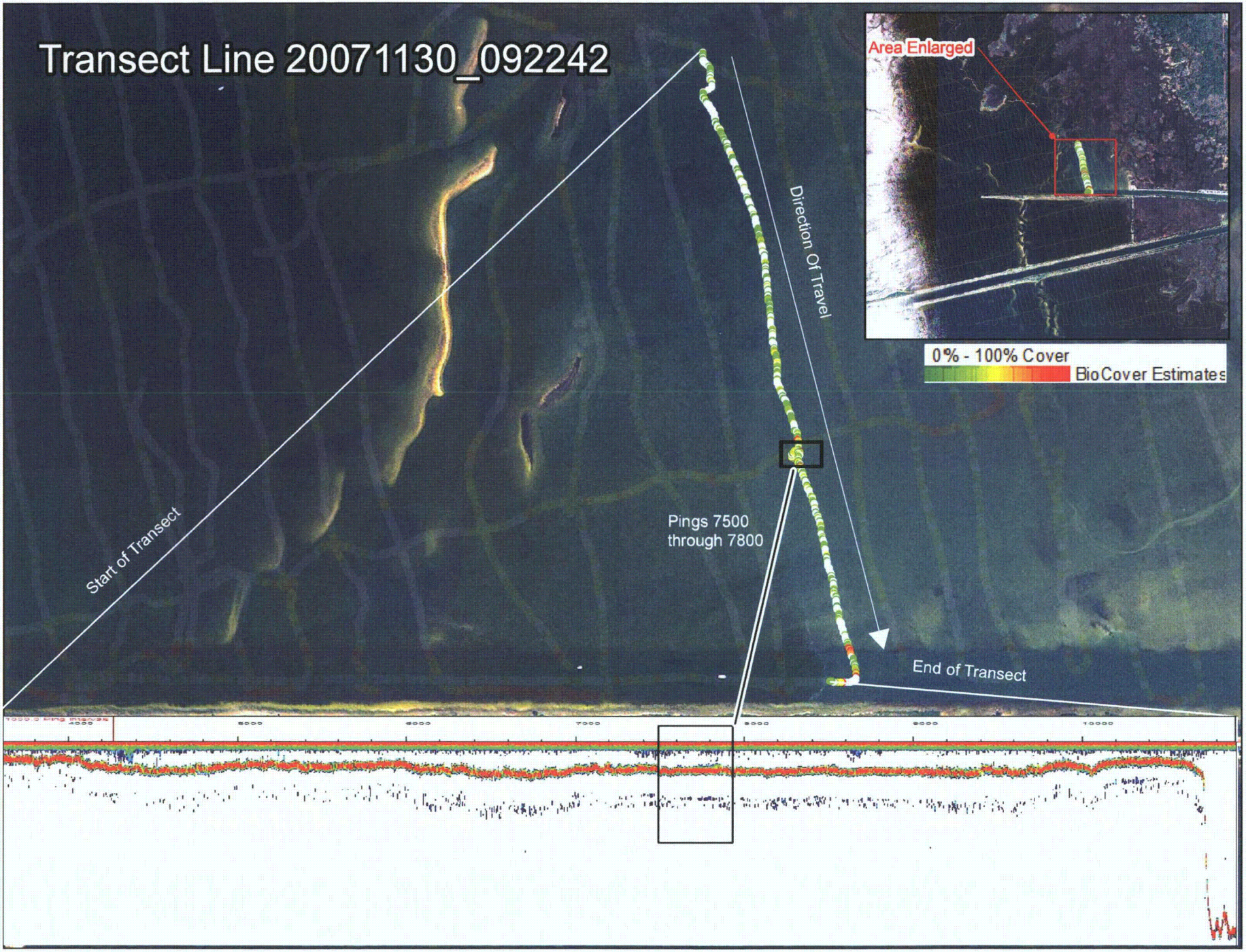
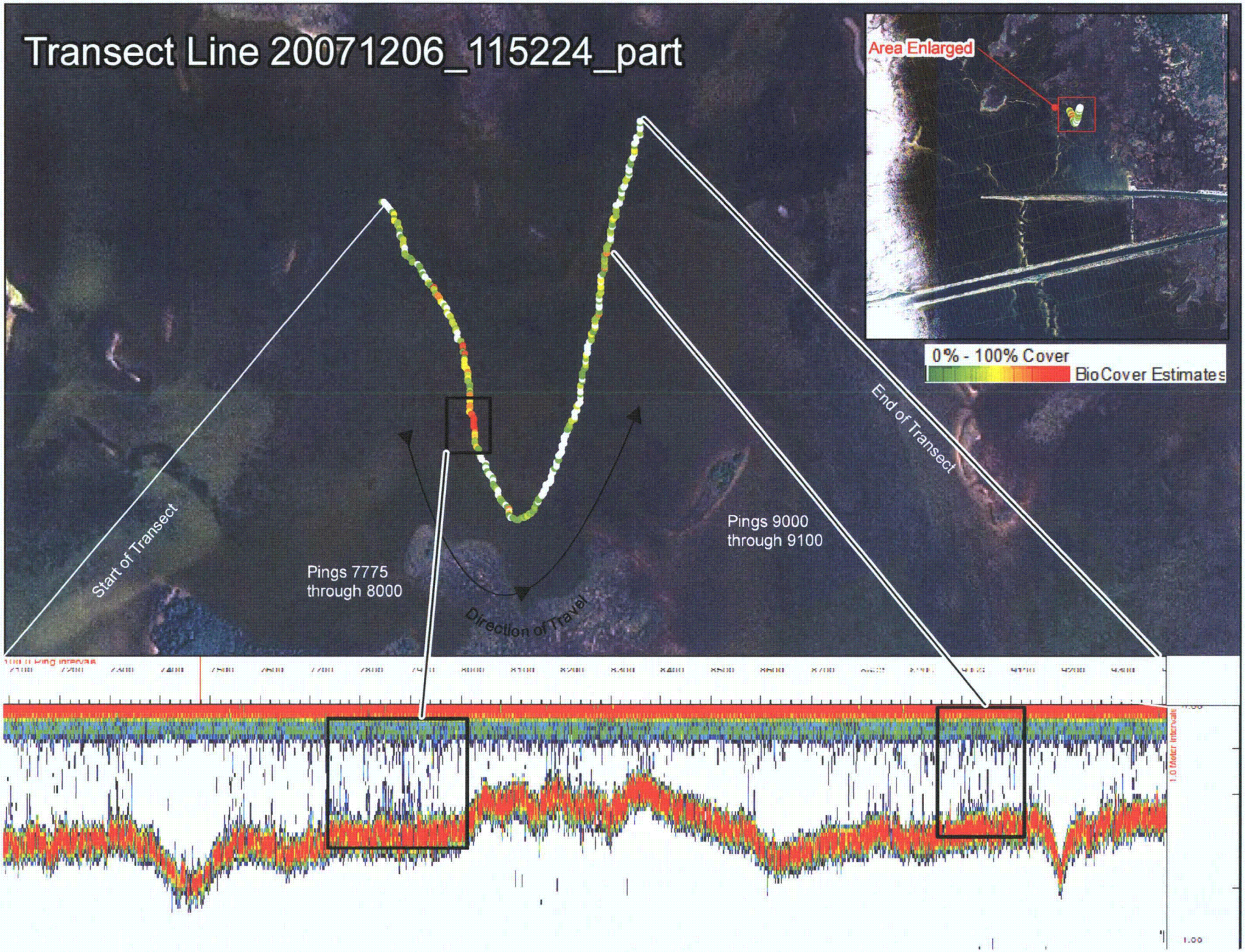
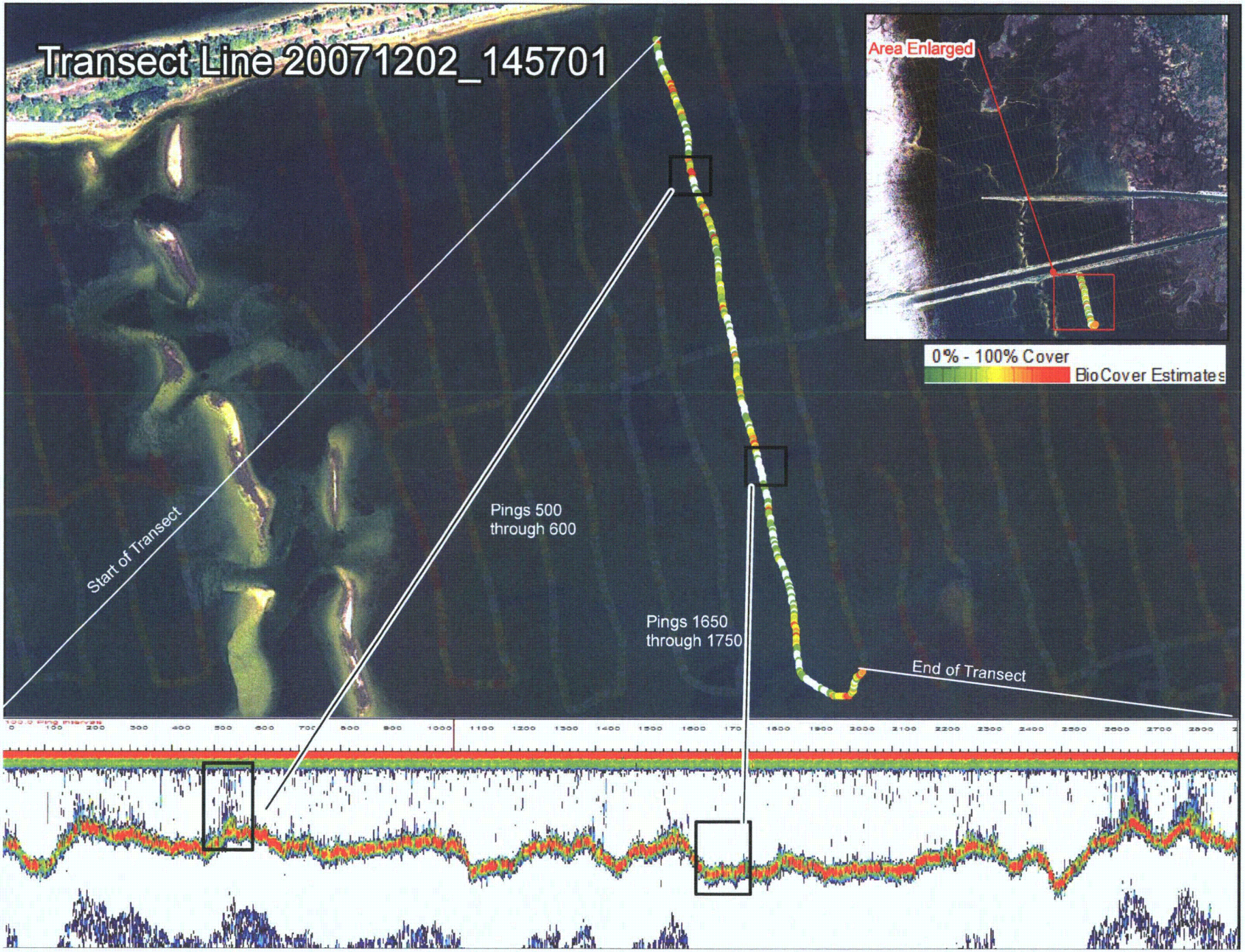
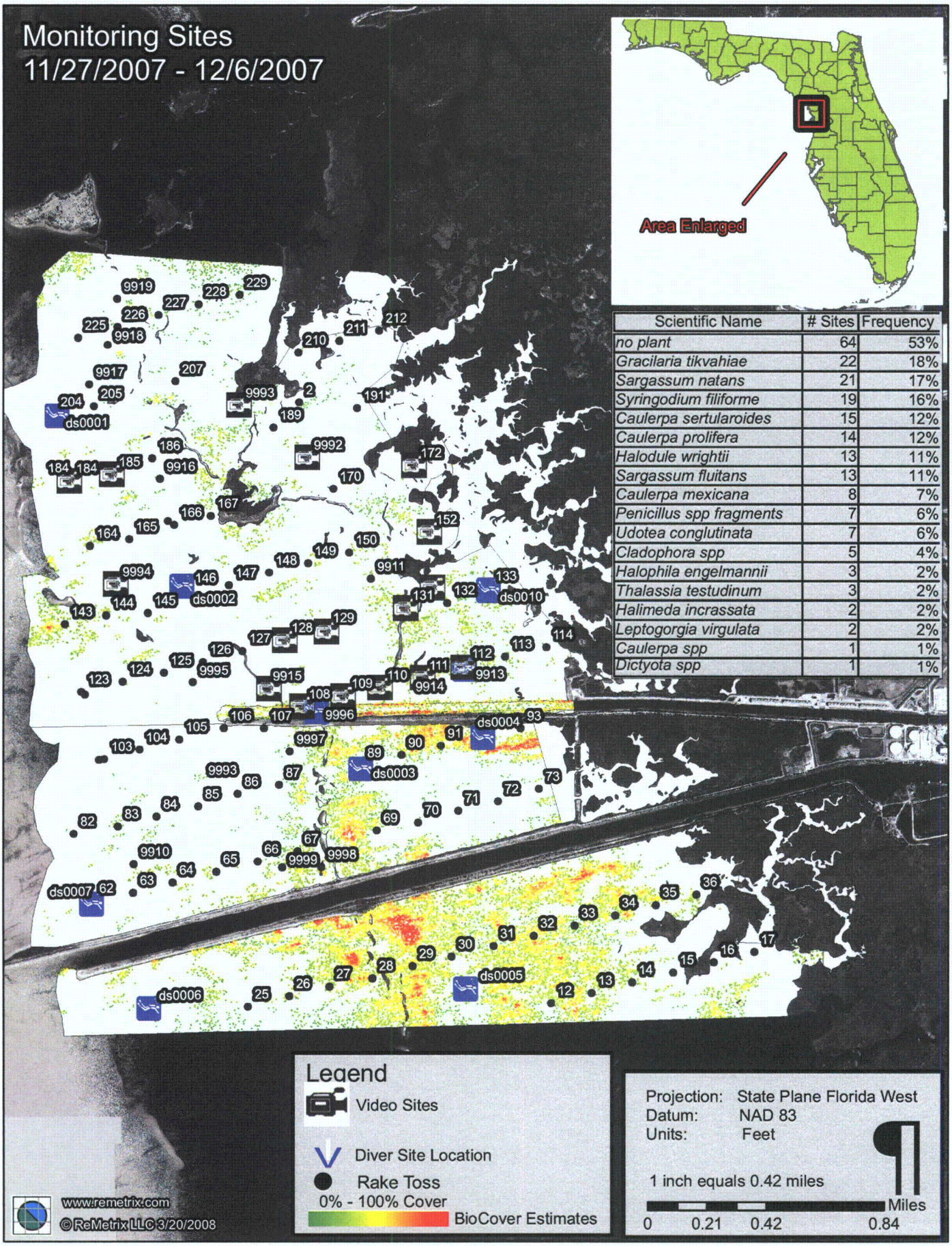

Detailed Transect Reference Map
Transect 20071206_115224_part
Transect 20071204_121833
Transect 20071130_092242_part
Transect 20071202_145701


Transect Line 20071204_20071218
Area Enlarged
0% - 100% Cover
BioCover Estimates
Direction Of Travel
Start Of Transect
Pings 600
through 750
Pings 1200 through 1800
End Of Transect
100.0 Ping Intervals


Transect Line 20071130_092242
Area Enlarged
0% - 100% Cover
BioCover Estimates
Direction Of Travel
Start of Transect
Pings 7500
through 7800
End of Transect

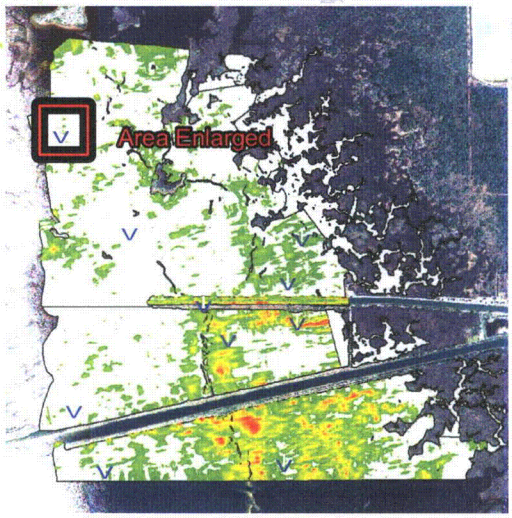

Transect Line 20071206_115224_part
Area Enlarged
0% - 100% Cover
BioCover Estimates
Start of Transect
End of Transect
Pings 7775
through 8000
Pings 9000
through 9100
Direction of Travel

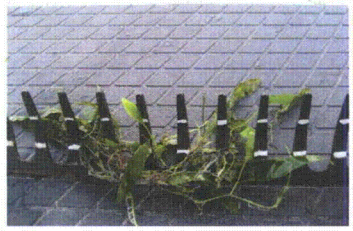

Transect Line 20071202_145701
Area Enlarged
0% - 100% Cover
BioCover Estimates
Start of Transect
Pings 500
through 600
Pings 1650
through 1750
End of Transect



Scientific Name	# Sites	Frequency
no plant	64	53%
Gracilaria tikvahiae	22	18%
Sargassum natans	21	17%
Syringodium filiforme	19	16%
Caulerpa sertularoides	15	12%
Caulerpa prolifera	14	12%
Halodule wrightii	13	11%
Sargassum fluitans	13	11%
Caulerpa mexicana	8	7%
Penicillus spp fragments	7	6%
Udotea conglutinata	7	6%
Cladophora spp	5	4%
Halophila engelmannii	3	2%
Thalassia testudinum	3	2%
Halimeda incrassata	2	2%
Leptogorgia virgulata	2	2%
Caulerpa spp	1	1%
Dictyota spp	1	1%

Sample Method Comparison
Diver Site I / Rake Toss #204





Water Quality Information	
NAME	DS0001
Water Temp (deg C)	22.9
Sample Date	11/15/2007
Sample Time	12:25PM
Turbidity (ntu)	5.09
Salinity (ppt)	25.9
Secchi Depth (ft)	5
Physical Depth (ft)	5
Tide Level	L2:25PM
Water Depth (m)	1.5-2m

Bed Characteristics	
Size	Not defined; scattered
Plant Height	6 inches
Bottom Coverage	23%
Bed Density	Sparse

Species Chart		
Sample Method	Cover	Species Present
Diver Sample	3 cells	*Gracilaria tikvhiae*
Diver Sample	20 cells	*Caulerpa prolifera*
Rake Toss	>60% of rake tines	*Caulerpa prolifera*
Hydroacoustic Model	5%	

Legend

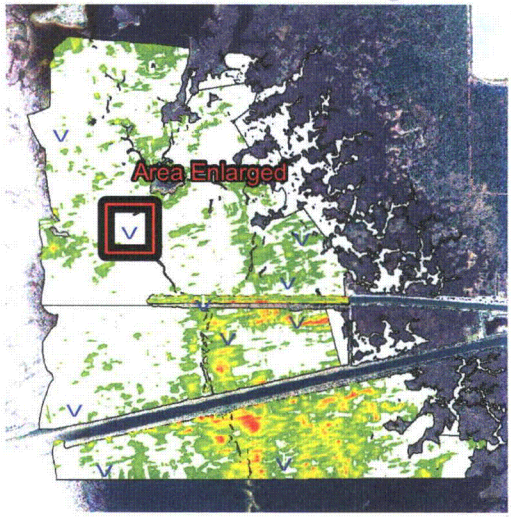
- Diver Site Location
- Rake Toss
- 0% - 100% Cover
- Hydroacousitc Points

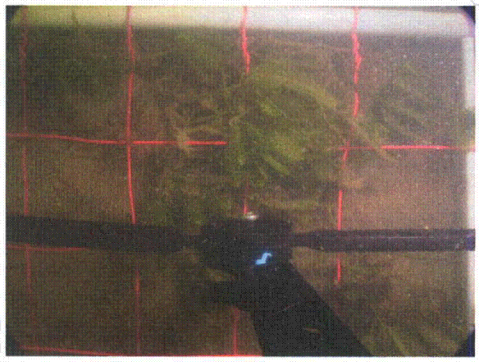
Projection: State Plane Florida West
Datum: NAD 83
Units: Feet

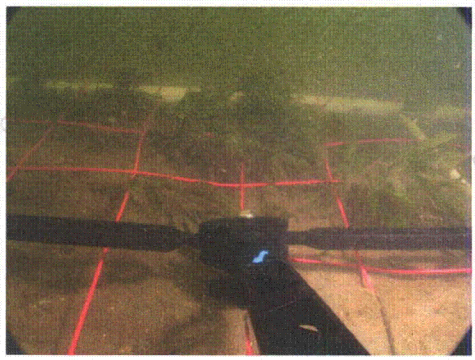
1 inch equals 59 feet

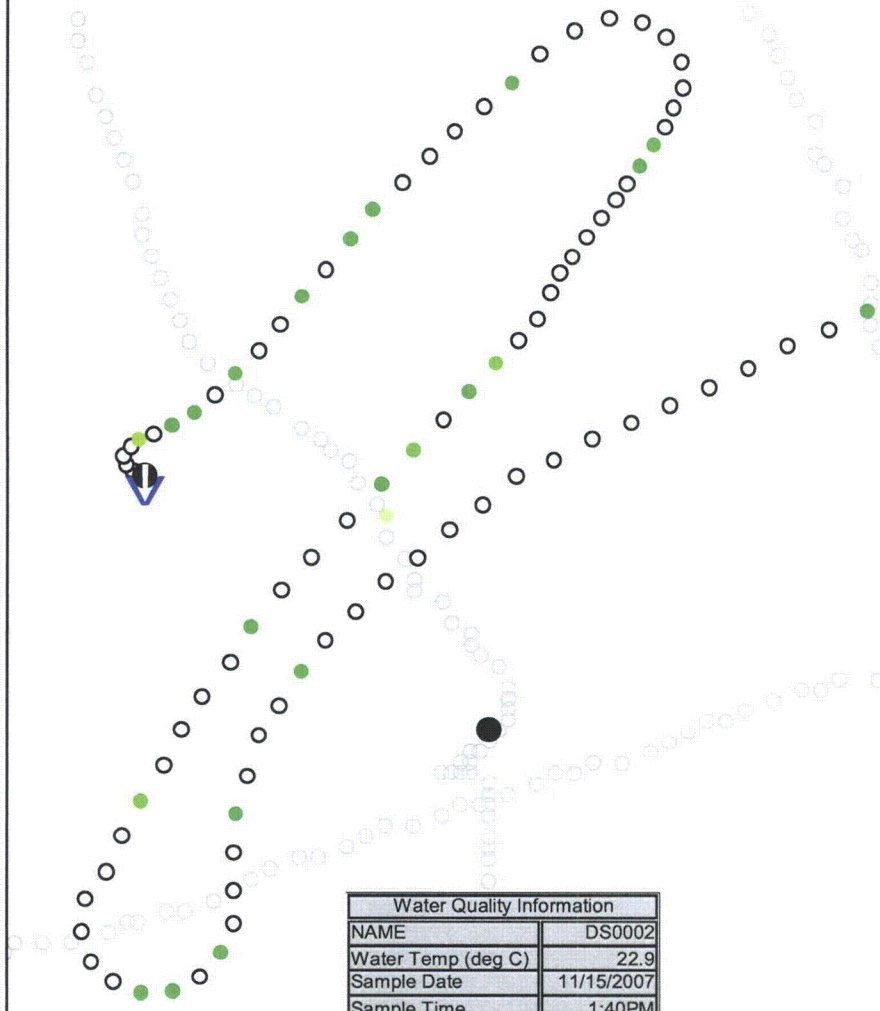
0 29.5 59 118 Feet

Sample Method Comparison
Diver Site II / Rake Toss #146









Water Quality Information	
NAME	DS0002
Water Temp (deg C)	22.9
Sample Date	11/15/2007
Sample Time	1:40PM
Turbidity (ntu)	3.94
Salinity (ppt)	29.1
Secchi Depth (ft)	3.6
Physical Depth (ft)	3.9
Tide Level	L2:25PM
Water Depth (m)	1-1.5m

Bed Characteristics	
Size	Not defined; scattered
Plant Height	1 foot
Bottom Coverage	22%
Bed Density	Sparse

Species Chart		
Sample Method	Cover	*Species Present*
Diver Sample	22 cells	*Caulerpa sertularoides*
Rake Toss	0%	*No Plant*
Hydroacoustic Model	0%	

Legend

Diver Site Location

Rake Toss

0% - 100% Cover

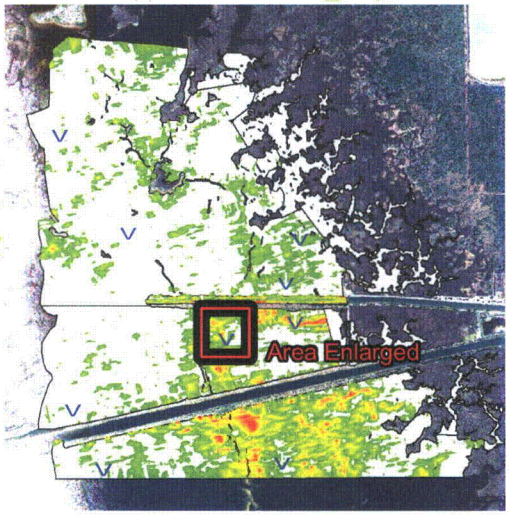
Hydroacousitc Points

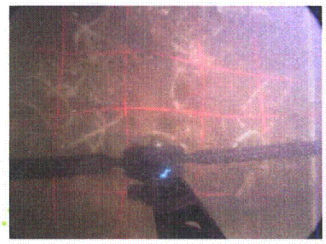
Projection: State Plane Florida West
Datum: NAD 83
Units: Feet

1 inch equals 59 feet

0 29.5 59 118 Feet

Sample Method Comparison
Diver Site III / Rake Toss #89





Water Quality Information	
NAME	DS0003
Water Temp (deg C)	22.4
Sample Date	11/15/2007
Sample Time	3:43PM
Turbidity (ntu)	9.44
Salinity (ppt)	29.9
Secchi Depth (ft)	2.7
Physical Depth (ft)	3.8
Tide Level	L2:25PM
Water Depth (m)	1-1.5m

Bed Characteristics	
Size	Large
Plant Height	1 foot
Bottom Coverage	100%
Bed Density	High

Species Chart		
Sample Method	Cover	*Species Present*
Diver Sample	68 cells	*Syringodium filiforme*
Diver Sample	51 cells	*Gracilaria tikvahiae*
Rake Toss	>60% of rake tines	*Gracilaria tikvahiae*
Rake Toss	>60% of rake tines	*Caulerpa sertularoides*
Rake Toss	>60% of rake tines	*Udotea conglutinata*
Rake Toss	20%-60% of rake tines	*Syringodium filiforme*
Rake Toss	>60% of rake tines	*Caulerpa sertularoides*
Rake Toss	>60% of rake tines	*Sargassum natans*
Hydroacoustic Model	37%	

Legend

Diver Site Location

Rake Toss

0% - 100% Cover

Hydroacousitc Points

Projection: State Plane Florida West
Datum: NAD 83
Units: Feet

1 inch equals 59 feet

0 29.5 59 118 Feet

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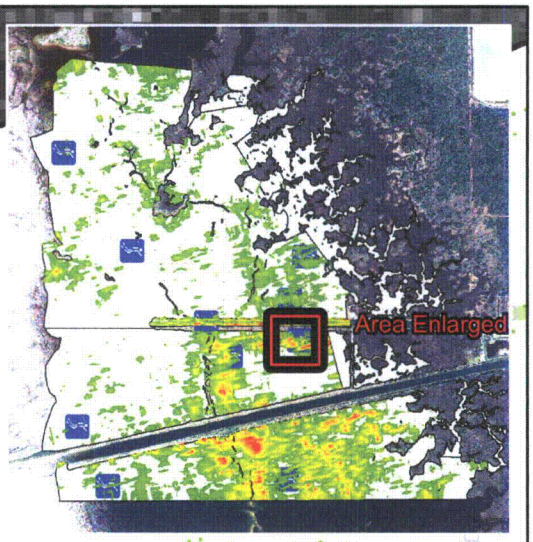
Sample Method Comparison
Diver Site IV / No Rake Toss



NAME	DS0004
Water Temp (deg C)	23.2
Sample Date	11/15/2007
Sample Time	4:38PM
Turbidity (ntu)	9.37
Salinity (ppt)	29.9
Secchi Depth (ft)	1.5
Physical Depth (ft)	1.8
Tide Level	L2:25PM
Water Depth (m)	0.5-1m

Bed Characteristics	
Size	Large
Plant Height	1 foot
Bottom Coverage	100%
Bed Density	High

Species Chart		
Sample Method	Cover	*Species Present*
Diver Sample	86 cells	*Syringodium filiforme*
Diver Sample	24 cells	*Caulerpa mexicana*
Diver Sample	10 cells	*Gracilaria tikvahiae*
Diver Sample	7 cells	*Halimeda incrassata*
Diver Sample	4 cells	*Swargassum fluitans*
Hydroacoustic Model	23%	

Legend

Diver Site Location

Rake Toss

0% - 100% Cover

Hydroacousitc Points

Projection: State Plane Florida West
Datum: NAD 83
Units: Feet

1 inch equals 59 feet

Feet

0 29.5 59 118

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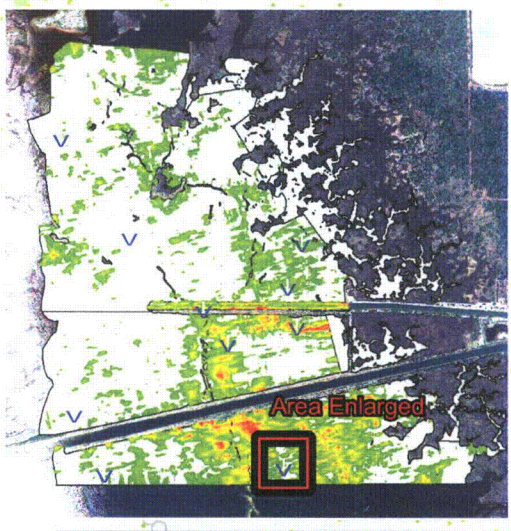
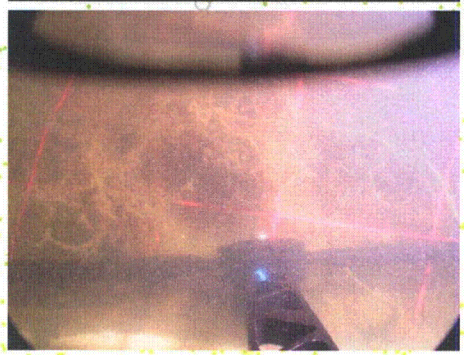
Sample Method Comparison
Diver Site V / No Rake Toss





NAME	DS0005
Water Temp (deg C)	16.2
Sample Date	11/16/2007
Sample Time	12:05PM
Turbidity (ntu)	3.62
Salinity (ppt)	27.6
Secchi Depth (ft)	0.9
Physical Depth (ft)	0.9
Tide Level	L3:20PM
Water Depth (m)	0.5-1m

Bed Characteristics	
Size	Not defined; scattered
Plant Height	1 foot
Bottom Coverage	95%
Bed Density	Medium

Species Chart		
Sample Method	Cover	Species Present
Diver Sample	61 cells	*Syringodium filiforme*
Diver Sample	34 cells	*Gracilaria tikvahiae*
Hydroacoustic Model	5.00%	

Legend

V Diver Site Location

● Rake Toss

0% - 100% Cover

Hydroacousitc Points

Projection: State Plane Florida West
Datum: NAD 83
Units: Feet

1 inch equals 59 feet

Feet

0 29.5 59 118

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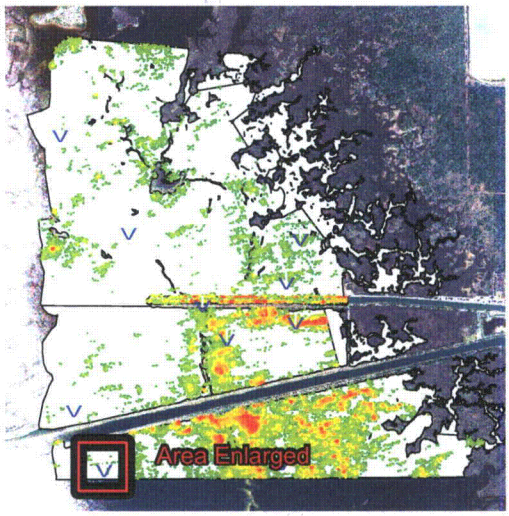
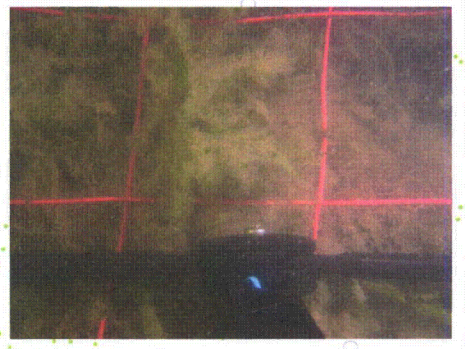
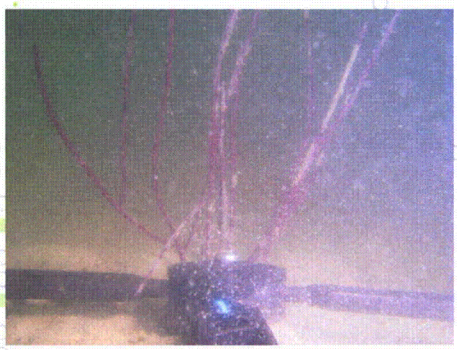
Sample Method Comparison
Diver Site VI / No Rake Toss







NAME	DS0006
Water Temp (deg C)	16.9
Sample Date	11/16/2007
Sample Time	1:22PM
Turbidity (ntu)	2.55
Salinity (ppt)	30.9
Secchi Depth (ft)	3.6
Physical Depth (ft)	3.6
Tide Level	L3:20PM
Water Depth (m)	1-1.5m

Bed Characteristics	
Size	Not defined; scattered
Plant Height	1 foot
Bottom Coverage	100%
Bed Density	Medium

Species Chart		
Sample Method	Cover	Species Present
Diver Sample	2 cells	*Dictyota sp.*
Diver Sample	7 cells	*Halimeda incrassata*
Diver Sample	6 cells	*Udotea conglutinata*
Diver Sample	45 cells	*Sargassum natans*
Diver Sample	8 cells	*Leptogorgia virgulata*
Diver Sample	47 cells	*Caulerpa mexicana*
Diver Sample	7 cells	*Caulerpa sertularoides*
Hydroacoustic Model	8%	

Legend

Diver Site Location

Rake Toss

0% - 100% Cover

Hydroacousitc Points

Projection: State Plane Florida West
Datum: NAD 83
Units: Feet

1 inch equals 59 feet

Feet

0 29.5 59 118

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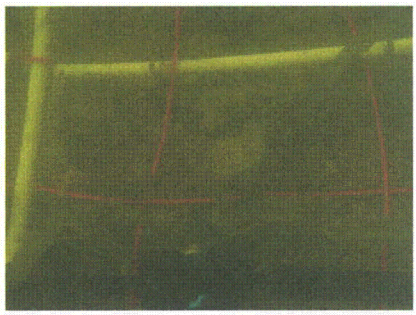
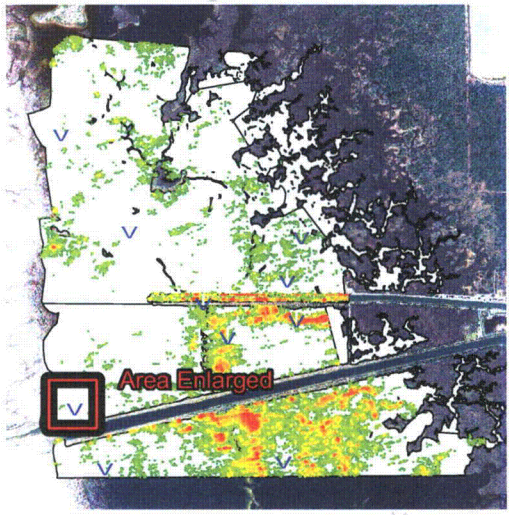
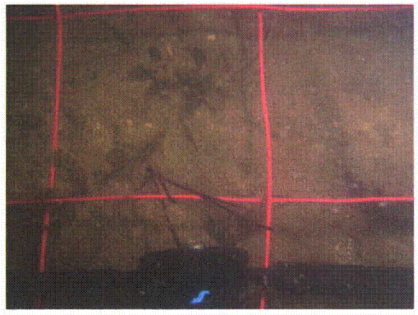
Sample Method Comparison
Diver Site VII / Rake Toss #62







NAME	DS0007
Water Temp (deg C)	19.3
Sample Date	11/16/2007
Sample Time	2:55PM
Turbidity (ntu)	4.09
Salinity (ppt)	29.8
Secchi Depth (ft)	3.9
Physical Depth (ft)	5.5
Tide Level	L3:20PM
Water Depth (m)	1.5-2m

Bed Characteristics	
Size	No defined; scattered
Plant Height	6 inches
Bottom Coverage	65%
Bed Density	Medium

Species Chart		
Sample Method	Cover	Species Present
Diver Sample	62 cells	*Caulerpa mexicana*
Diver Sample	2 cells	*Leptogorgia virgulata*
Diver Sample	2 cells	*Sargassum natans*
Rake Toss	0%	*No Plant*
Hydroacoustic Model	8%	

Legend

Diver Site Location

Rake Toss

0% - 100% Cover

Hydroacousitc Points

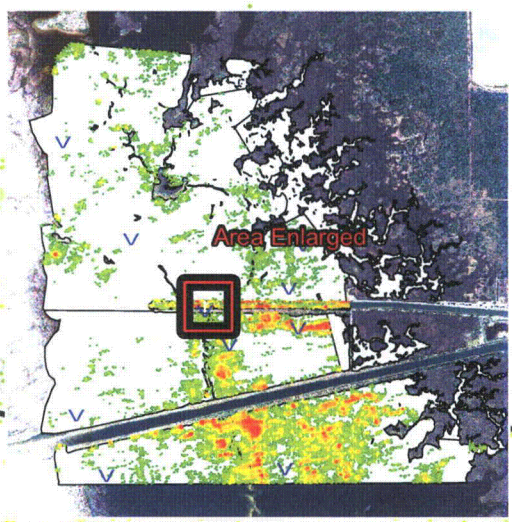
Projection: State Plane Florida West
Datum: NAD 83
Units: Feet

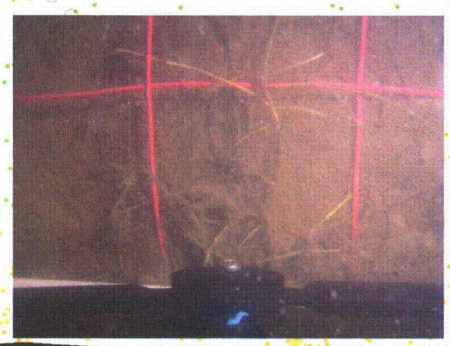
1 inch equals 59 feet

Feet

0 29.5 59 118

Sample Method Comparison
Diver Site VIII / Rake Toss #9996





NAME	DS0008
Water Temp (deg C)	18.3
Sample Date	11/16/2007
Sample Time	3:38PM
Turbidity (ntu)	5.42
Salinity (ppt)	27.6
Secchi Depth (ft)	3.9
Physical Depth (ft)	11.7
Tide Level	L3:20PM
Water Depth (m)	3-4m

Bed Characteristics	
Size	Not defined; scattered
Plant Height	6 inches
Bottom Coverage	42%
Bed Density	Medium

Species Chart		
Sample Method	Cover	Species Present
Diver Sample	42 cells	*Halodule wrightii*
Rake Toss	0%	*No Plant*
Hydroacoustic model	16%	

Legend

Diver Site Location

Rake Toss

0% - 100% Cover

Hydroacousitc Points

Projection: State Plane Florida West
Datum: NAD 83
Units: Feet

1 inch equals 59 feet

Feet

0 29.5 59 118

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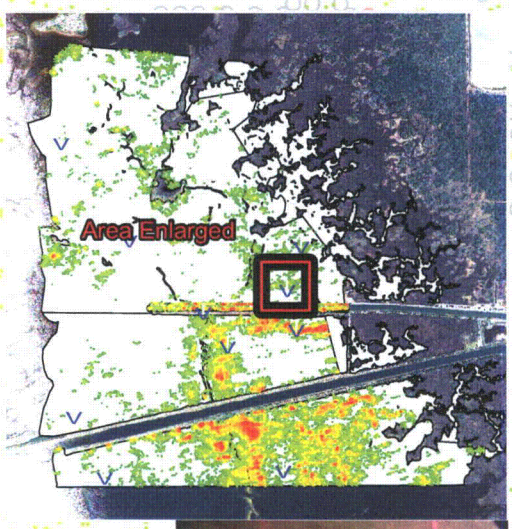
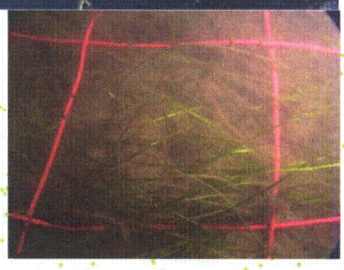
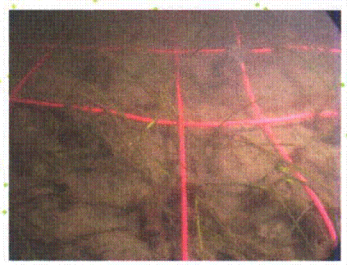
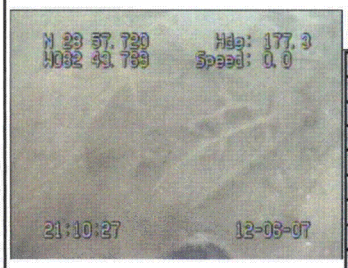
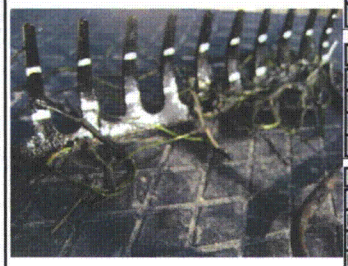
Sample Method Comparison
Diver Site IX / Rake Toss #9913; Video 112 / Rake Toss 112











NAME	DS0009
Water Temp (deg C)	26.9
Sample Date	11/16/2007
Sample Time	4:19PM
Turbidity (ntu)	7.62
Salinity (ppt)	31.8
Secchi Depth (ft)	1.8
Physical Depth (ft)	2
Tide Level	L3:20PM
Water Depth (m)	0.5-1m

Bed Characteristics	
Size	Large
Plant Height	6 inches
Bottom Coverage	100%
Bed Density	High

Species Chart

Sample Method	Cover	Species Present
Diver Sample	100 cells	*Halodule wrightii*
Rake Toss 9913	0%	*No Plant*
Rake Toss 112	5 stems- 20%	*Syringodium filiforme*
Video Site	20% - 40%	*Syringodium filiforme*
Video Site	1 - 5 stems	*Caulerpa sertularoides*
Hydroacoustic Model	19%	

Legend

- Diver Site Location
- Rake Toss
- 0% - 100% Cover
- Hydroacousitc Points

Projection: State Plane Florida West
Datum: NAD 83
Units: Feet

1 inch equals 59 feet

Feet
0 29.5 59 118

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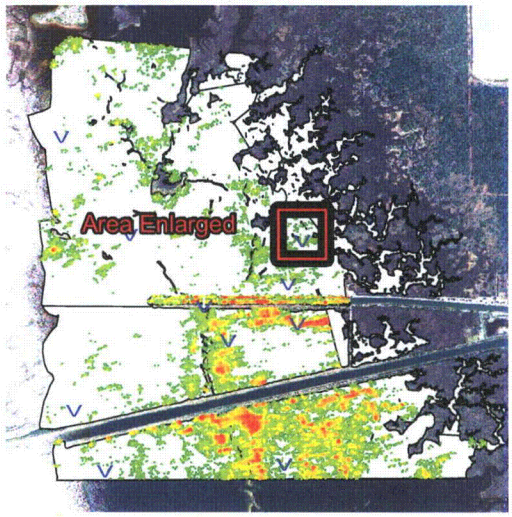
Sample Method Comparison
Diver Site X / Rake Toss #133



NAME	DS0010
Water Temp (deg C)	26.5
Sample Date	11/16/2007
Sample Time	5:00PM
Turbidity (ntu)	13.6
Salinity (ppt)	31.9
Secchi Depth (ft)	1.7
Physical Depth (ft)	1.7
Tide Level	L3:20PM
Water Depth (m)	0.5-1m

Bed Characteristics	
Size	Large
Plant Height	1 foot
Bottom Coverage	100%
Bed Density	Dense

Species Chart		
Sample Method	Cover	Species Present
Diver Sample	98 cells	*Halodule wrightii*
Diver Sample	2 cells	*Sargassum fluitans*
Rake Toss	5 stems - 20%	Halodule wrightii
Rake Toss	5 stems - 20%	Sargassum natans
Hydroacoustic Model	7%	

Legend

Diver Site Location

Rake Toss

0% - 100% Cover

Hydroacousitc Points

Projection: State Plane Florida West
Datum: NAD 83
Units: Feet

1 inch equals 32 feet

Feet

0 16 32 64

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APPENDIX – Calculations of Biocover Model Accuracy

BioCover model error estimates for combined physical sampling points and comparisons of the three different physical sampling methods individually. The total physical sample point count does not match the sum of the individual sampling methods points since there were a number of cases where two or more methods were used for sampling a single location and the results did not match, (one indicated 'plant' the other indicated 'no plant'). In these instances only the sample where 'plant' was found was used in the 'all' analysis since 'plant' was indeed found at the location. *See Section H of the report for a discussion of interpreting these tables.*

All types without 38 foot margin of error

			Raster	
		omission error ↓	plant	no plant
all	plant	17.3%	62	13
	no plant	62.1%	36	22
		commission error →	36.7%	37.1%

Rake only without 38 foot margin of error

			Raster	
		omission error ↓	plant	no plant
Rake	plant	14.8%	46	8
	no plant	61.0%	36	23
		commission error →	43.9%	25.8%

All types with 38 foot margin of error

			Raster	
		omission error ↓	plant	no plant
all	plant	0.0%	75	0
	no plant	62.1%	36	22
		commission error →	32.4%	0.0%

Rake only with 38 foot margin of error

			Raster	
		omission error ↓	plant	no plant
Rake	plant	0.0%	54	0
	no plant	61.0%	36	23
		commission error →	40.0%	0.0%

Diver only
without 38 foot margin of error

			Raster	
		omission error ↓	plant	no plant
Diver	plant	0.0%	9	0
	no plant		0	0
		commission error →	0.0%	

Video only
without 38 foot margin of error

			Raster	
		omission error ↓	plant	no plant
Video	plant	41.7%	7	5
	no plant	80.0%	4	1
		commission error →	36.4%	83.3%

Diver only
with 38 foot margin of error

			Raster	
		omission error ↓	plant	no plant
Diver	plant	0.0%	9	0
	no plant		0	0
		commission error →	0.0%	

Video only
with 38 foot margin of error

			Raster	
		omission error ↓	plant	no plant
Video	plant	0.0%	12	0
	no plant	80.0%	4	1
		commission error →	25.0%	0.0%

off-transect only
without 38 foot
margin of error

			Raster	
		omission error ↓	plant	no plant
off-transect only	plant	16.7%	10	2
	no plant	60.0%	6	4
		commission error →	37.5%	33.3%

off-transect only
with 38 foot
margin of error

			Raster	
		omission error ↓	plant	no plant
off-transect only	plant	0.0%	12	0
	no plant	60.0%	6	4
		commission error →	33.3%	0.0%

Site Name	LAT	LON	WaterTemp (C)	Sample Date	Sample Time	Turbidity (ntu)	Salinity ppn	Secchi Depth (ft)	Physical Depth (ft)	Tide Level	Water Depth
DS0001	+28.9754524	-82.7532661	22.9	11152007	12:25PM	5.09	25.9	5	5	L2:25PM	1.5-2m
DS0002	+28.9661273	-82.7455230	22.9	11152007	1:40PM	3.94	29.1	3.6	3.9	L2:25PM	1-1.5m
DS0003	+28.9569691	-82.7355315	22.4	11152007	3:43PM	9.44	29.9	2.7	3.8	L2:25PM	1-1.5m
DS0004	+28.9584628	-82.7283993	23.2	11152007	4:38PM	9.37	29.9	1.5	1.8	L2:25PM	0.5-1m
DS0005	+28.9453151	-82.7293885	16.2	11162007	12:05PM	3.62	27.6	0.9	0.9	L3:20PM	0.5-1m
DS0006	+28.9445241	-82.7487268	16.9	11162007	1:22PM	2.55	30.9	3.6	3.6	L3:20PM	1-1.5m
DS0007	+28.9500012	-82.7514686	19.3	11162007	2:55PM	4.09	29.8	3.9	5.5	L3:20PM	1.5-2m
DS0008	+28.9597790	-82.7380978	18.3	11162007	3:38PM	5.42	27.6	3.9	11.7	L3:20PM	3-4m
DS0009	+28.9619191	-82.7292325	26.9	11162007	4:19PM	7.62	31.8	1.8	2	L3:20PM	0.5-1m
DS0010	+28.9658914	-82.7278804	26.5	11162007	5:00PM	13.6	31.9	1.7	1.7	L3:20PM	0.5-1m
DS0002	+28.9661273	-82.7455230	22.1	11282007	3:47PM	2.40	31.6	3.2	4.9	L1:46PM	1-1.5m
DS0008	+28.9597790	-82.7380978	23.9	11282007	4:55PM	3.11	33.8	4.1	10.4	L1:46PM	3-4m
DS0002	+28.9661273	-82.7455230	23.8	11302007	5:18PM	3.03	31.4	3.2	5	L3:27PM	1-1.5m
DS0008	+28.9597790	-82.7380978	25.3	11302007	5:11PM	2.34	31.4	3.6	5.5	L3:27PM	3-4m
DS0002	+28.9661273	-82.7455230	23.8	12022007	4:48PM	2.65	32.4	3.8	4.5	L5:12PM	1-1.5m
DS0008	+28.9597790	-82.7380978	25.7	12022007	4:40PM	2.22	32.4	3.5	6.5	L5:12PM	3-4m
DS0002	+28.9661273	-82.7455230	19.0	12042007	4:38PM	2.10	27.9	3.4	4.1	L6:53PM	1-1.5m
DS0008	+28.9597790	-82.7380978	21.7	12042007	5:03PM	2.89	34.1	3.2	3.6	L6:53PM	3-4m
DS0002	+28.9661273	-82.7455230	21.9	12062007	4:53PM	2.22	33.8	4.0	4.2	L8:04PM	1-1.5m
DS0008	+28.9597790	-82.7380978	23.2	12062007	3:14pm	3.58	33.9	3.2	5.1	L8:04PM	3-4m

Site	Scientific Name	Common Name	Date	Abundance	Injury	Density	Notes	Latitude	Longitude
2	*no plant*	no plant	12/4/2007	.	.	.		28.975850	-82.738910
12	*no plant*	no plant	12/5/2007	.	.	.	na	28.944482	-82.724638
13	*no plant*	no plant	12/6/2007	.	.	.	na	28.944981	-82.722238
14	*Gracilaria tikvahiae*	edible drift alga	12/5/2007	2	1	2	na	28.945496	-82.719842
14	*Sargassum natans*	gulfweed drift alga	12/5/2007	2	1	2	na	28.945496	-82.719842
14	*Halophila engelmannii*	stargrass	12/5/2007	5	1	3	na	28.945496	-82.719842
15	*Gracilaria tikvahiae*	edible drift alga	12/5/2007	1	1	4	na	28.945980	-82.717438
16	*no plant*	no plant	12/5/2007	.	.	.	na	28.946479	-82.715038
17	*Gracilaria tikvahiae*	edible drift alga	12/5/2007	5	1	1	na	28.946978	-82.712638
25	*no plant*	no plant	11/29/2007	.	.	.		28.944540	-82.742460
26	*no plant*	no plant	11/29/2007	.	.	.		28.945060	-82.740040
27	*Caulerpa sertularoides*	feather caulerpa	12/2/2007	3	.	2		28.945530	-82.737650
27	*Sargassum natans*	gulfweed drift alga	12/2/2007	2	.	2		28.945530	-82.737650
27	*Sargassum fluitans*	gulfweed drift alga	12/2/2007	4	.	2		28.945530	-82.737650
27	*Caulerpa prolifera*	grass caulerpa	12/2/2007	5	.	0		28.945530	-82.737650
27	*Syringodium filiforme*	manatee grass	12/2/2007	1	.	4		28.945530	-82.737650
28	*Gracilaria tikvahiae*	edible drift alga	12/2/2007	4	.	1		28.945910	-82.735130
28	*Syringodium filiforme*	manatee grass	12/2/2007	1	.	1		28.945910	-82.735130
28	*Syringodium filiforme*	manatee grass	12/2/2007	3	.	0		28.945910	-82.735130
28	*Sargassum fluitans*	gulfweed drift alga	12/2/2007	5	.	1		28.945910	-82.735130
29	*Gracilaria tikvahiae*	edible drift alga	12/2/2007	2	.	2		28.946510	-82.732750
29	*Syringodium filiforme*	manatee grass	12/2/2007	3	.	3		28.946510	-82.732750
30	*Caulerpa mexicana*	feather calulerpa	12/2/2007	1	.	2		28.946970	-82.730450
31	*Syringodium filiforme*	manatee grass	12/2/2007	1	1	3		28.947490	-82.727970
32	*Gracilaria tikvahiae*	edible drift alga	12/5/2007	1	1	1	na	28.947986	-82.725588
32	*Thalassia testudinum*	turtle grass	12/5/2007	4	1	5	na	28.947986	-82.725588
33	*Sargassum natans*	gulfweed drift alga	12/5/2007	2	1	2	na	28.948486	-82.723188
33	*Gracilaria tikvahiae*	edible drift alga	12/5/2007	2	1	2	na	28.948486	-82.723188
33	*Sargassum fluitans*	gulfweed drift alga	12/5/2007	2	1	2	na	28.948486	-82.723188
34	*Gracilaria tikvahiae*	edible drift alga	12/5/2007	1	1	4	na	28.948985	-82.720788
35	*Syringodium filiforme*	manatee grass	12/5/2007	2	1	4	na	28.949484	-82.718388
35	*Thalassia testudinum*	turtle grass	12/5/2007	2	1	4	na	28.949484	-82.718388
36	*Caulerpa prolifera*	grass caulerpa	12/5/2007	.	.	.	na	28.949984	-82.715988
36	*Gracilaria tikvahiae*	edible drift alga	12/5/2007	.	.	.	na	28.949984	-82.715988
62	*no plant*	no plant	11/28/2007	.	.	.		28.950140	-82.751500
63	*no plant*	no plant	11/28/2007	.	.	.		28.950530	-82.749110
64	*Caulerpa sertularoides*	feather caulerpa	11/28/2007	3	.	2		28.951030	-82.746770
64	*Sargassum natans*	gulfweed drift alga	11/28/2007	3	.	2		28.951030	-82.746770
64	*Sargassum fluitans*	gulfweed drift alga	11/28/2007	3	.	0		28.951030	-82.746770
65	*Sargassum fluitans*	gulfweed drift alga	11/28/2007	2	.	2		28.951540	-82.744190
66	*Caulerpa sertularoides*	feather caulerpa	11/28/2007	3	.	2		28.952040	-82.741770
66	*Penicillus sp. fragments*	shaving brush plant	11/28/2007	3	.	4		28.952040	-82.741770
67	*Sargassum natans*	gulfweed drift alga	11/28/2007	3	.	2		28.952530	-82.739410
67	*Sargassum fluitans*	gulfweed drift alga	11/28/2007	2	.	1		28.952530	-82.739410
67	*Gracilaria tikvahiae*	edible drift alga	11/28/2007	4	.	1		28.952530	-82.739410
67	*Caulerpa mexicana*	feather calulerpa	11/28/2007	.	.	.		28.952530	-82.739410
69	*Penicillus sp. fragments*	shaving brush plant	12/4/2007	1	.	2		28.953540	-82.734740
70	*Caulerpa sertularoides*	feather caulerpa	12/4/2007	3	.	1		28.953930	-82.732290
70	*Penicillus sp. fragments*	shaving brush plant	12/4/2007	2	.	2		28.953930	-82.732290
71	*no plant*	no plant	12/4/2007	.	.	.		28.954500	-82.729920
72	*no plant*	no plant	12/4/2007	.	.	.		28.954960	-82.727570

Site	Scientific Name	Common Name	Date	Abundance	Injury	Density	Notes	Latitude	Longitude
72	*Caulerpa sertularoides*	feather caulerpa	12/4/2007	3	.	2		28.954960	-82.727570
73	*Gracilaria tikvahiae*	edible drift alga	12/4/2007	4	.	1		28.955580	-82.725150
73	*Syringodium filiforme*	manatee grass	12/4/2007	5	.	1		28.955580	-82.725150
73	*Sargassum natans*	gulfweed drift alga	12/4/2007	2	.	1		28.955580	-82.725150
73	*Gracilaria tikvahiae*	edible drift alga	12/4/2007	4	.	1		28.955580	-82.725150
82	*no plant*	no plant	11/28/2007	.	.	.		28.953610	-82.752540
83	*no plant*	no plant	11/29/2007	.	.	.		28.953950	-82.749940
84	*no plant*	no plant	11/29/2007	.	.	.		28.954440	-82.747680
85	*no plant*	no plant	11/29/2007	.	.	.		28.954940	-82.745200
86	*no plant*	no plant	11/28/2007	.	.	.		28.955560	-82.742890
87	*Caulerpa sertularoides*	feather caulerpa	11/29/2007	2	.	2		28.955990	-82.740440
87	*Sargassum natans*	gulfweed drift alga	11/29/2007	5	.	2		28.955990	-82.740440
87	*Caulerpa mexicana*	feather calulerpa	11/29/2007	4	.	2		28.955990	-82.740440
89	*Gracilaria tikvahiae*	edible drift alga	12/4/2007	2	.	1		28.956960	-82.735630
89	*Caulerpa sertularoides*	feather caulerpa	12/4/2007	2	.	1		28.956960	-82.735630
89	*Udotea conglutinata*	Udotea spp	12/4/2007	5	.	1		28.956960	-82.735630
89	*Syringodium filiforme*	manatee grass	12/4/2007	5	.	2		28.956960	-82.735630
89	*Caulerpa sertularoides*	feather caulerpa	12/4/2007	5	.	1		28.956960	-82.735630
89	*Sargassum natans*	gulfweed drift alga	12/4/2007	5	.	1		28.956960	-82.735630
90	*Syringodium filiforme*	manatee grass	12/4/2007	3	.	2		28.957460	-82.733210
90	*Caulerpa sertularoides*	feather caulerpa	12/4/2007	3	.	3		28.957460	-82.733210
91	*Syringodium filiforme*	manatee grass	12/4/2007	5	.	1		28.957920	-82.730880
91	*Gracilaria tikvahiae*	edible drift alga	12/4/2007	3	.	2		28.957920	-82.730880
91	*Caulerpa mexicana*	feather calulerpa	12/4/2007	3	.	2		28.957920	-82.730880
93	*no plant*	no plant	12/4/2007	.	.	.		28.958770	-82.726200
103	*no plant*	no plant	11/29/2007	.	.	.		28.957480	-82.750690
103	*no plant*	no plant	12/4/2007	.	.	.		28.957430	-82.750990
104	*no plant*	no plant	11/29/2007	.	.	.		28.957950	-82.748600
105	*no plant*	no plant	11/29/2007	.	.	.		28.958460	-82.746260
106	*Sargassum natans*	gulfweed drift alga	11/29/2007	.	.	4		28.959010	-82.743640
107	*Sargassum natans*	gulfweed drift alga	11/29/2007	1	.	4		28.958970	-82.741270
108	*no plant*	no plant	11/29/2007	.	.	.		28.960000	-82.738950
108	*no plant*	no plant	12/6/2007	.	.	.	too deep, but I couldn't really see bottom to verify	28.960083	-82.739000
109	*no plant*	no plant	11/29/2007	.	.	.		28.960600	-82.736490
109	*Caulerpa prolifera*	grass caulerpa	12/6/2007	1	1	4	not a whole lot here, but enough to see on video	28.960583	-82.736583
110	*Halodule wrightii*	shoal grass	11/29/2007	1	.	3		28.960990	-82.734290
110	*Sargassum natans*	gulfweed drift alga	11/29/2007	4	.	4		28.960990	-82.734290
110	*Halodule wrightii*	shoal grass	11/29/2007	1	1	1		28.961000	-82.734400
111	*Halodule wrightii*	shoal grass	11/29/2007	1	.	4		28.961460	-82.731800
111	*Halodule wrightii*	shoal grass	12/6/2007	2	.	3		28.961478	-82.731900
111	*Sargassum natans*	gulfweed drift alga	12/6/2007	4	8	3		28.961478	-82.731900
111	*Gracilaria tikvahiae*	edible drift alga	12/6/2007	4	.	4		28.961478	-82.731900
112	*Syringodium filiforme*	manatee grass	11/29/2007	1	.	3		28.962060	-82.729410

Site	Scientific Name	Common Name	Date	Abundance	Injury	Density	Notes	Latitude	Longitude
112	*Syringodium filiforme*	manatee grass	12/6/2007	2	.	2	mostly manatee or shoal grass	28.962000	-82.729483
112	*Caulerpa sertularoides*	feather caulerpa	12/6/2007	5	.	4		28.962000	-82.729483
113	*Syringodium filiforme*	manatee grass	12/2/2007	1	.	4		28.962520	-82.727030
114	*Syringodium filiforme*	manatee grass	12/3/2007	1	.	4		28.962980	-82.724600
123	*no plant*	no plant	11/29/2007	.	.	.		28.960860	-82.751770
123	*Caulerpa sertularoides*	feather caulerpa	12/4/2007	2	.	2		28.961010	-82.751990
123	*Sargassum natans*	gulfweed drift alga	12/4/2007	5	.	2		28.961010	-82.751990
124	*Sargassum natans*	gulfweed drift alga	11/29/2007	2	.	2		28.961512	-82.749540
124	*Cladophora spp*	filamentous algae	11/29/2007	4	.	1		28.961512	-82.749540
124	*Caulerpa prolifera*	grass caulerpa	11/29/2007	4	.	1		28.961512	-82.749540
125	*no plant*	no plant	11/29/2007	.	.	.		28.961950	-82.747110
126	*no plant*	no plant	11/28/2007	.	.	.		28.962490	-82.744790
127	*no plant*	no plant	11/30/2007	.	.	.		28.963030	-82.742460
128	*no plant*	no plant	11/29/2007	.	.	.		28.963560	-82.739900
128	*no plant*	no plant	12/6/2007	.	.	.		28.963550	-82.739967
129	*Udotea conglutinata*	Udotea spp	11/29/2007	2	.	1		28.964040	-82.737530
129	*Udotea conglutinata*	Udotea spp	12/6/2007	2	0	0		28.963950	-82.737500
129	*Halodule wrightii*	shoal grass	12/6/2007	2	0	0		28.963950	-82.737500
129	*Sargassum fluitans*	gulfweed drift alga	12/6/2007	2	0	0		28.963950	-82.737500
131	*Halodule wrightii*	shoal grass	11/29/2007	2	.	1		28.965040	-82.732800
131	*Sargassum fluitans*	gulfweed drift alga	11/29/2007	2	.	4		28.965040	-82.732800
131	*Halodule wrightii*	shoal grass	12/6/2007	1	1	1	site looked to be mostly dominated by shoal grass on video	28.965100	-82.732817
131	*Thalassia testudinum*	turtle grass	12/6/2007	4	1	3	saw a few blades of what looked like turtle grass on video	28.965100	-82.732817
132	*Syringodium filiforme*	manatee grass	11/29/2007	1	.	3		28.965330	-82.730380
133	*Halodule wrightii*	shoal grass	12/2/2007	3	.	3		28.966040	-82.727930
133	*Sargassum natans*	gulfweed drift alga	12/2/2007	3	.	4		28.966040	-82.727930
143	*Caulerpa sertularoides*	feather caulerpa	11/29/2007	4	.	1		28.964550	-82.752890
143	*Udotea conglutinata*	Udotea spp	11/29/2007	4	.	1		28.964550	-82.752890
143	*Caulerpa prolifera*	grass caulerpa	11/29/2007	4	.	0		28.964550	-82.752890
143	*Sargassum natans*	gulfweed drift alga	11/29/2007	3	.	1		28.964550	-82.752890
143	*Gracilaria tikvahiae*	edible drift alga	11/29/2007	3	.	1		28.964550	-82.752890
143	*Caulerpa mexicana*	feather calulerpa	11/29/2007	3	.	1		28.964550	-82.752890
143	*Caulerpa prolifera*	grass caulerpa	11/29/2007	4	.	1		28.964550	-82.752890
144	*no plant*	no plant	11/29/2007	.	.	.		28.964960	-82.750460
145	*Sargassum natans*	gulfweed drift alga	11/29/2007	1	.	0		28.965050	-82.747990
146	*no plant*	no plant	11/28/2007	.	.	.		28.966180	-82.745590
147	*no plant*	no plant	11/29/2007	.	.	.		28.966410	-82.743210
148	*no plant*	no plant	11/29/2007	.	.	.		28.967030	-82.740820
149	*no plant*	no plant	11/29/2007	.	.	.		28.967490	-82.738530
150	*Syringodium filiforme*	manatee grass	12/2/2007	1	.	3		28.968020	-82.736100

Site	Scientific Name	Common Name	Date	Abundance	Injury	Density	Notes	Latitude	Longitude
152	*Caulerpa spp*	caulerpa	12/6/2007	1	.	4	hardly any plant only one small sprig. Video point	28.969000	-82.731367
152	*no plant*	no plant	12/6/2007	.	.	.		28.969000	-82.731367
164	*Caulerpa sertularoides*	feather caulerpa	11/29/2007	2	.	1		28.968560	-82.751350
164	*Sargassum natans*	gulfweed drift alga	11/29/2007	3	.	1		28.968560	-82.751350
164	*Gracilaria tikvahiae*	edible drift alga	11/29/2007	3	.	1		28.968560	-82.751350
164	*Gracilaria tikvahiae*	edible drift alga	11/29/2007	4	.	1		28.968560	-82.751350
165	*no plant*	no plant	11/29/2007	.	.	.		28.968880	-82.749020
166	*no plant*	no plant	11/28/2007	.	.	.		28.969780	-82.746740
166	*no plant*	no plant	11/29/2007	.	.	.		28.969570	-82.746370
167	*no plant*	no plant	11/29/2007	.	.	.		28.970010	-82.744210
170	*no plant*	no plant	12/2/2007	.	.	.		28.971320	-82.736980
172	*no plant*	no plant	12/6/2007	.	.	.	no plant rake toss	28.972518	-82.732240
172	*no plant*	no plant	12/6/2007	.	.	.	no plant video sample point	28.972483	-82.732200
184	*Halophila engelmannii*	stargrass	11/30/2007	2	.	3		28.972010	-82.752440
184	*Caulerpa prolifera*	grass caulerpa	11/30/2007	1	.	3		28.972010	-82.752440
184	*Halophila engelmannii*	stargrass	11/20/2007	4	.	4	stargrass maybe from video	28.971950	-82.752483
184	*Cladophora spp*	filamentous algae	11/20/2007	4	.	4	hairy plant	28.971950	-82.752483
184	*Sargassum fluitans*	gulfweed drift alga	11/20/2007	4	.	4		28.971950	-82.752483
184	*Caulerpa prolifera*	grass caulerpa	11/20/2007	4	.	4		28.971950	-82.752483
185	*no plant*	no plant	11/29/2007	.	.	.		28.972280	-82.749930
185	*Udotea conglutinata*	Udotea spp	12/6/2007	1	1	4	video Sample Point 185 Hardly any veg at all	28.972250	-82.749967
186	*Penicillus sp. fragments*	shaving brush plant	11/28/2007	1	.	4		28.973050	-82.747590
189	*no plant*	no plant	12/2/2007	.	.	.		28.974560	-82.740450
191	*no plant*	no plant	12/2/2007	.	.	.		28.975510	-82.735520
204	*Caulerpa prolifera*	grass caulerpa	11/30/2007	1	.	1		28.975420	-82.753330
205	*no plant*	no plant	11/29/2007	.	.	.		28.975820	-82.750970
207	*no plant*	no plant	12/4/2007	.	.	.		28.977040	-82.746160
210	*Cladophora spp*	filamentous algae	12/2/2007	.	.	0		28.978460	-82.738910
211	*Cladophora spp*	filamentous algae	12/2/2007	.	.	.		28.979040	-82.736500
212	*no plant*	no plant	12/2/2007	.	.	.		28.979530	-82.734150
225	*no plant*	no plant	11/29/2007	.	.	.		28.979400	-82.751850
226	*no plant*	no plant	11/28/2007	.	.	.		28.979930	-82.749520
227	*no plant*	no plant	11/29/2007	.	.	.		28.980510	-82.747100
228	*no plant*	no plant	11/29/2007	.	.	.		28.981030	-82.744730
229	*no plant*	no plant	11/29/2007	.	.	.		28.981480	-82.742320
9910	*no plant*	no plant	12/6/2007	.	.	.	na	28.951983	-82.749051
9911	*Sargassum fluitans*	gulfweed drift alga	12/6/2007	.	.	.	na	28.966620	-82.734857
9912	*Halodule wrightii*	shoal grass	12/6/2007	.	.	.	na	28.966114	-82.731204
9912	*Halodule wrightii*	shoal grass	12/6/2007	1	1	3	very sparse vegetation	28.966133	-82.731217
9913	*no plant*	no plant	12/6/2007	.	.	.	na	28.961489	-82.729168

Site	Scientific Name	Common Name	Date	Abundance	Injury	Density	Notes	Latitude	Longitude
9914	*Sargassum fluitans*	gulfweed drift alga	12/6/2007	.	.	.	na	28.961709	-82.732746
9915	*Penicillus sp. fragments*	shaving brush plant	12/6/2007	.	.	.	na	28.961050	-82.740933
9915	*no plant*	no plant	12/6/2007	.	.	.		28.961050	-82.740933
9916	*Cladophora spp*	filamentous algae	12/6/2007	.	.	.	na	28.971991	-82.747158
9917	*no plant*	no plant	12/6/2007	.	.	.	na	28.976953	-82.751248
9918	*no plant*	no plant	12/6/2007	.	.	.	na	28.979026	-82.750109
9919	*no plant*	no plant	12/6/2007	.	.	.	na	28.981367	-82.749518
9992	*no plant*	no plant	12/6/2007	.	.	.	no plant video site	28.972970	-82.738483
9992	*no plant*	no plant	12/6/2007	.	.	0	plant toss no plant	28.972970	-82.738483
9993	*Caulerpa prolifera*	grass caulerpa	12/6/2007	.	.	.		28.975756	-82.742440
9993	*Caulerpa prolifera*	grass caulerpa	12/6/2007	.	.	.	video sample no plant on rake	28.956170	-82.742717
9994	*Penicillus sp. fragments*	shaving brush plant	12/6/2007	.	.	.	na	28.966532	-82.749896
9994	*Penicillus sp. fragments*	shaving brush plant	12/6/2007	1	.	44		28.966567	-82.749850
9995	*no plant*	no plant	12/6/2007	.	.	.	noplant	28.961437	-82.745408
9996	*no plant*	no plant	12/6/2007	.	.	.	na	28.959769	-82.738068
9997	*Sargassum natans*	gulfweed drift alga	12/6/2007	.	.	.	na	28.957730	-82.739777
9997	*Udotea conglutinata*	Udotea spp	12/6/2007	.	.	.	na	28.957730	-82.739777
9997	*Caulerpa prolifera*	grass caulerpa	12/6/2007	.	.	.	na	28.957730	-82.739777
9998	*no plant*	no plant	12/6/2007	.	.	.	na	28.951697	-82.738041
9999	*Caulerpa prolifera*	grass caulerpa	12/6/2007	.	.	.	na	28.951717	-82.740340
ds0001	*Caulerpa prolifera*	grass caulerpa	11/15/2007	.	.	.	20%	28.975452	-82.753266
ds0001	*Gracilaria tikvahiae*	edible drift alga	11/15/2007	.	.	.	3%	28.975452	-82.753266
ds0002	*Caulerpa sertularoides*	feather caulerpa	11/15/2007	.	.	.	22%	0.000000	0.000000
ds0003	*Syringodium filiforme*	manatee grass	11/15/2007	.	.	.	68%	28.956969	-82.735532
ds0003	*Gracilaria tikvahiae*	edible drift alga	11/15/2007	.	.	.	51%	28.956969	-82.735532
ds0004	*Syringodium filiforme*	manatee grass	11/15/2007	.	.	.	86%	28.958463	-82.728399
ds0004	*Caulerpa mexicana*	feather caulerpa	11/15/2007	.	.	.	24%	28.958463	-82.728399
ds0004	*Gracilaria tikvahiae*	edible drift alga	11/15/2007	.	.	.	10%	28.958463	-82.728399
ds0004	*Halimeda incrassata*	Halimeda spp	11/15/2007	.	.	.	7%	28.958463	-82.728399
ds0004	*Sargassum fluitans*	gulfweed drift alga	11/15/2007	.	.	.	4%	28.958463	-82.728399
ds0005	*Syringodium filiforme*	manatee grass	11/16/2007	.	.	.	34%	28.945315	-82.729389
ds0007	*Caulerpa mexicana*	feather calulerpa	11/16/2007	.	.	.	65%	28.950001	-82.751469
ds0007	*Leptogorgia virgulata*	sea whip	11/16/2007	.	.	.	2	28.950001	-82.751469
ds0007	*Sargassum natans*	gulfweed drift alga	11/16/2007	.	.	.	2	28.950001	-82.751469
ds0008	*Halodule wrightii*	shoal grass	11/16/2007	.	.	.	42%	28.959779	-82.738098
ds0009	*Halodule wrightii*	shoal grass	11/16/2007	.	.	.	100%	28.961919	-82.729233
ds0010	*Halodule wrightii*	shoal grass	11/16/2007	.	.	.	100%	28.965891	-82.727880
ds0010	*Sargassum fluitans*	gulfweed drift alga	11/16/2007	.	.	.	2%	28.965891	-82.727880
ds0005	*Gracilaria tikvahiae*	edible drift alga	11/16/2007	.	.	.	61%	28.945315	-82.729389
ds0006	*Dictyota sp.*		11/16/2007	.	.	.	2cells	0.000000	0.000000
ds0006	*Halimeda incrassata*	Halimeda spp	11/16/2007	.	.	.	7 cells	0.000000	0.000000
ds0006	*Udotea conglutinata*	Udotea spp	11/16/2007	.	.	.	6 cells	0.000000	0.000000
ds0006	*Sargassum natans*	gulfweed drift alga	11/16/2007	.	.	.	45 cells	0.000000	0.000000
ds0006	*Caulerpa mexicana*	feather caulerpa	11/16/2007	.	.	.	47 cells	0.000000	0.000000
ds0006	*Caulerpa sertularoides*	feather caulerpa	11/16/2007	.	.	.	7 cells	0.000000	0.000000
ds0006	*Leptogorgia virgulata*	sea whip	11/16/2007	.	.	.	8 cells	0.000000	0.000000