

**GREENER GRASS ON THE OTHER SIDE: SHARING THE SUCCESSES AND
LESSONS LEARNED FROM THE LONGBOAT KEY, FLORIDA SEAGRASS
MITIGATION PROJECT**

Robert M. Baron¹, Christie A. Barrett¹, James K. Linkogle², Charles Callaway³, and Bill Fay⁴

¹Marine Biologist
Coastal Planning & Engineering, Inc.
2481 N.W. Boca Raton Blvd. Boca Raton, FL 33431

²Publics Works Project Manager
Town of Longboat Key
600 General Harris Street
Longboat Key, FL 34228

³President
Callaway Marine Technologies, Inc.
1550 Latham Road Suite 4
West Palm Beach, FL 33409

⁴Engineering Technician
Applied Technology & Management, Inc.
400 S. Australian Avenue, Suite 855
West Palm Beach, FL 33401

ABSTRACT

The Longboat Key canal and bay access dredging activities have impacted seagrass communities within the permitted dredging areas. Five seagrass impact areas within the canals and accesses were not authorized for disturbance under the permit exemption; therefore, the Florida Department of Environmental Protection (DEP) required mitigation for community impacts. The mitigation plan involved harvesting 8-inch diameter (0.0324m^2) seagrass plugs from the impact sites and transplanting them to designated receiver sites. Eight receiver sites were utilized during the mitigation phase of the canal and bay access dredging project. Monitoring was conducted to assess transplant survival, growth, and overall project success. Before plug coalescence was documented each receiver site was surveyed for an estimate of overall plug survival. Plug presence or absence was used to calculate survivability, and was determined by counting the number of live plugs divided by the total number of plugs originally transplanted to each site. At the onset of coalescence, a new sampling protocol was developed in which percent cover was calculated for each site within the receiver sites or between transplants and natural seagrass. Each receiver site was surveyed with random 1m^2 quadrats. After two and a half years of monitoring, transplant survivability within the eight receiver sites was 67%. Seagrasses were comprised of dense areas (690m^2) approximately 7 times larger than those originally planted (98.98m^2). The increase was due to coalescence, growth, and expansion within the suitable receiver sites yielding increases in the overall area of seagrass within Sarasota Bay.

INTRODUCTION

The Longboat Key canal and bay access dredging activities impacted seagrass communities within the permitted dredging areas. Five seagrass impact areas within the canals and accesses were not authorized for disturbance under the permit exemption; therefore, the Florida Department of Environmental Protection (DEP) required mitigation for community impacts. Coastal Planning & Engineering, Inc., (CPE) identified approximately 1.16 acres of seagrass habitat located within the five impact areas during site investigations on March 12, 2002 and May 6-7, 2002. Within the areas of impact, the dominant species was shoal grass (*Halodule wrightii*) intermixed with small amounts of turtle grass (*Thalassia testudinum*) and manatee grass (*Syringodium filiforme*). The mitigation plan involved harvesting 8-inch diameter (0.0324m²) seagrass plugs from the impact sites and transplanting them to designated receiver sites.

Project Implementation

The DEP environmental resource permit, consolidated resource permit and sovereign submerged lands authorization for canal and bay access dredging was issued on August 8, 2002. Monitoring of the receiver sites was scheduled to occur immediately following transplantation activities, quarterly for the first year, semi-annually for the second and third year, and annually for the fourth year following transplanting. Site monitoring included color still and video photography of each transplant area. Tables depicting numbers, spacing, and sizes of each species planted are provided in the Time Zero Monitoring Report. Permanent benchmarks were established using DGPS in each mitigation (receiver) area upon completion of the transplanting and used to revisit each site during the post-construction monitoring events conducted to date.

Seagrass transplantation activities began on April 14, 2003 and were completed on May 29, 2003. Eight receiver sites were approved by the DEP and utilized during the mitigation phase of the canal and bay access-dredging project. Two of the mitigation receiver sites were located in Sarasota Bay adjacent to Durante Park (Durate Offshore Site and Durante Inshore Site). Four of the remaining six receiver sites were located in Sarasota Bay approximately 500 feet northeast of the Coquina Boat Ramp on the south end of Anna Maria Island. These sites included the Double Propeller Scar, Coquina Site 1, Coquina Site 2, and Coquina Site 3. The Coquina Tidal Creek located directly south of the Coquina boat ramp was the largest receiver site and received the largest number of transplants. A shallow lagoon located within Manatee County's Leffis Key Restoration Site (Leffis Key Lagoon) was the final receiver site. The use of the Leffis Key site was terminated early on May 1, 2003 because DEP representatives felt that fine sediment and poor visibility at the receiver site was unsatisfactory for seagrass transplantation. The 239 transplantation units planted during the morning of May 1, 2003 were left in place and further planting within the lagoon was terminated.

The transplanting activities conducted by Callaway Marine Technologies, Inc., (CMT), began on April 14, 2003 and were completed on May 29, 2003. The project activities began at the donor sites where the transplants were taken using the plugging

device designed by CMT. Eight-inch plugs were excavated from the donor canals and stockpiled underwater at each receiver site in small buckets. The following day transplanting plugs were planted, by hand, within the receiver site. This process was repeated for the duration of the project. The seagrass donor sites were located near the mouth of Canals 34, 38, 40, 41, 42, 44, 46, and 48. A total of 3,055 units were transplanted.

SURVEY METHODOLOGY

The Thirty Month Post-Construction Survival Assessment occurred on December 12 and 13, 2005. CPE located each receiver site using a Trimble AgGPS Global Positioning System (GPS) with Pro Beacon interfaced to the Coastal Oceanographic Hydrographical Data Collection and Processing (HYPACK) program with correction from a U.S. Coast Guard Navigational Beacon. The Trimble Navigation system is designed for moderate precision static and dynamic processing applications. It provides real time and three dimension station coordinates and velocity measurements at a once per second rate. The GPS receives the civilian signal from the Global Positioning System (GPS) NAVSTAR satellites. The locator automatically acquires and simultaneously tracks GPS satellites and precisely measures code phase and Doppler phase shifts and then computes position and velocity based on these changes. The GPS automatically determines time, latitude, longitude, height, and velocity, once per second. Similarly, range rate corrections are computed every second, transmitted to the survey vessel via radio link, and are automatically applied to the onboard GPS receiver. CPE utilized Differential Global Positioning System (DGPS) coordinates (Florida State Plane, West Zone, NAD 83) provided by CMT and verified them with coordinates obtained by CPE during the Time Zero Monitoring (June 2003).

CPE used randomized grid samples (1m^2 quadrats) to survey each receiver site (Photograph 1) (pursuant to Permit No. 58-01637883-002 Seagrass Mitigation Plan [Attachment B] Page 6 of 15). The quadrat method is more suitable for seagrasses that propagate by long runners and do not form a clearly radial growth pattern (e.g., shoal grass) especially after the onset of growth and coalescence (Fonseca, 1993).

The number of samples was based on surveying at least 5% of each site and achieving 10% or less potential experimental error at each site. Twelve samples were characterized within the smallest site (Coquina Site 3: 8.3% potential experimental error), whereas; 151 samples were characterized within one of the largest sites (Coquina Tidal Creek: 0.66% potential experimental error). In each receiver site a 1m^2 quadrat was randomly placed on the substrate and overall percent cover of shoal grass (*Halodule wrightii*) was noted. The random samples were averaged to determine overall percent cover within each site.

STATISTICAL METHODS

Transplant coalescence decreases the ability to count individual plugs thus; survivability could no longer be determined by taking the number of live plugs counted

divided by the total number of plugs at each site. In order to account for plug survivability and coalescence, a sampling protocol was used in which percent cover was determined for each site (beginning in March 2004 during the Third Quarterly Monitoring Event).

A sample size of at least five percent was determined to be adequate because each survey covered at least 5 times the area originally covered with seagrass transplants. In addition, a 5% survey area is substantially more than that used in previous seagrass ecology studies (Fourqurean et al., 2002; Durako et al., 2002). Immediately after planting, each site contained at least 1% (0.92%) area of actual planted seagrass. This value was determined for each site by taking the number of plugs originally planted multiplied by the area of an individual plug (e.g., Coquina Site 3: 163 plugs x $.0324\text{m}^2 = 5.28\text{m}^2$). This value (e.g., 5.28m^2) is the actual area of seagrass transplants within a receiver site at the time of planting. This area divided by the total area of the receiver site yields the actual percent that was initially covered with seagrass (e.g., Coquina Site 3: $5.28\text{m}^2 \div 125\text{m}^2 = 4.2\%$).

Survivability Calculations:

The number of plugs per site divided by the total area of the receiver site yields the theoretical value of random samples initially covered with seagrass (e.g., Coquina Site 3: $163 \text{ plugs} \div 125\text{m}^2 = 1.3\text{plugs}/\text{m}^2$). Using Coquina Site 3 as an example, every random sample (since the previous value was >1) had to have at least 0.01% (actual percentage of one shoot of a seagrass transplant within a 1m^2 area) *Halodule wrightii* cover to be classified as having 100% survivability. Remaining consistent with previous surveys, a plug was considered surviving as long as one living shoot was present within the transplant. Based on the actual data, 3 random samples (out of 12 total samples) had at least 0.01% cover therefore; the Coquina Site 3 is given a 25% calculated survivability value. A potential experimental error does exist based on the number of random samples per site (total area potentially covered [100%] \div number of actual samples per site). The potential experimental error for each site is less than 10%.

THIRTY MONTH POST-CONSTRUCTION SURVIVAL ASSESSMENT

Weather during the thirty month post-construction monitoring survey, which took place on December 12 and 13, 2005, was favorable. Conditions were sunny and cool. Air temperature ranged from 50°F to 68°F . Water temperature was approximately 62°F to 67°F . Underwater visibility was excellent at all receiver sites.

Durante Offshore Site Thirty Month Survival Assessment

During the planting phase of the seagrass mitigation project, 207 shoal grass (*Halodule wrightii*) transplants were planted within the 405m^2 Durante Offshore receiver site. Each transplant was initially 8 inches in diameter (0.0324m^2) therefore; the actual area of seagrass (immediately after planting) was 7m^2 and represented a maximum of 1.66% of the total area within the receiver site. During the third quarter assessment seagrass coverage had increased to 78m^2 or 19.26% of the site and by the one year survey

(summer) coverage had increased further to 127m². Seagrass coverage, however, had decreased from the one-year survey during the eighteen month assessment (35m²) (winter). Six months later, during the twenty-four month survey (summer), seagrass coverage increased to 71 m². Coverage again decreased during the thirty month survey to 56 m². Twenty random 1m² quadrats were sampled within the offshore site to assess 5% of the receiver site (potential experimental error of 5% was determined based on the 20 samples surveyed within the receiver site). An average of 13.9% of the 20 samples was covered with *Halodule wrightii* (Photograph 2). One hundred percent survivability was calculated. The southern boundary of the site had the largest areas of *Halodule wrightii* which had coalesced with the surrounding natural seagrass.

Durante Inshore Site Thirty Month Survival Assessment

Two hundred and eighteen units were transplanted within the 364m² receiver site. Each transplant was initially 8 inches in diameter (0.0324m²) therefore; the actual area of seagrass (immediately after planting) was 7m² or 1.94% of the entire receiver site. Eighteen 1m² quadrats were randomly sampled to assess 5% of the of the receiver site (potential experimental error of 5.5% was determined based on the 18 samples surveyed within the receiver site). Fifty-five percent survivability was calculated within the 18 samples during the survey. An average of 0.3% shoal grass (*Halodule wrightii*) was recorded within the site, which decreased from the 13.6% shoal grass coverage reported during the twenty-four month monitoring event. The decrease in the average percent of *Halodule wrightii* may be due, in part, to a winter “die-back”/thinning-out associated with colder temperatures during winter months.

Coquina Double Propeller Scar Thirty Month Monitoring Survival Assessment

During the planting phase of the seagrass mitigation project, 1,096 shoal grass (*Halodule wrightii*) transplants were planted within the 2,339m² Coquina Double Propeller Scar receiver site. Each transplant was initially 8 inches in diameter (0.0324m²) therefore; the actual area of seagrass immediately after planting was 22m² and represented a maximum of 0.92% of the total area within the receiver site. Coverage during the thirty month survey (138m²) decreased from the twenty-four month survey (470m²). One hundred and seventeen random 1m² quadrats were sampled within the propeller (prop) scar to assess 5% of the of the receiver site (potential experimental error of 0.85% was determined based on the 117 samples surveyed within the receiver site). An average of 5.9% of the 117 samples was covered with *Halodule wrightii*. One hundred percent survivability was calculated within 117 samples during the survey. Many of the original plugs have coalesced with the naturally occurring turtle grass (*Thalassia testudinum*) and shoal grass (*Halodule wrightii*) (Photograph 3). The edges of the receiver site have filled in the previously bare areas of the propeller scar, which is no longer distinguishable from the surrounding seagrass bed in much of the site. The remainder of the site, including a large portion of the adjacent turtle grass (*Thalassia testudinum*), was “thinned-out” and brown.

Coquina Site 1 (Southwest) Thirty Month Survival Assessment

CMT originally transplanted 234, 8-inch diameter (0.0324m^2) plugs within the 312m^2 Coquina Site 1 receiver site. The area covered by these plugs immediately after planting was 8m^2 and represented a maximum of 2.43% of the total area within the receiver site. During the thirty month assessment, seagrass coverage was 37m^2 . Sixteen random samples (1m^2 quadrats) were used to assess 5% of the receiver area with a potential experimental error of 6.3%. An average of 12.0% of the 16 samples was covered by *Halodule wrightii*. The calculated percent survivability remained 100% as noted during the twenty-four month monitoring event. Several areas around the perimeter of the site had healthy communities of *Halodule wrightii*.

Coquina Site 2 (East) Thirty Month Survival Assessment

Eighteen random 1m^2 quadrats were used to survey 5% of the receiver site (potential experimental error of 5.6%). CMT originally planted 236, 8-inch diameter (0.0324m^2) plugs within a 356m^2 area at Coquina Site 2. The total maximum area covered by transplanted seagrass at the time of planting was 8m^2 , which was a maximum of 2.15% of the receiver area. An average of 1.8% cover of seagrass was calculated from the percent cover assessed in the 18 quadrats. The overall area covered with seagrass increased from 0.6m^2 , recorded during the twenty-four month assessment, to 6.3m^2 during the thirty month (December 2005) assessment (Photograph 4). Calculated survivability was approximately 50%.

Coquina Site 3 (North) Thirty Month Survival Assessment

Ten percent of the Coquina Site 3 Receiver Site was surveyed using 12 random 1m^2 quadrats (potential experimental error of 8.33%). Originally 163, 8-inch diameter plugs were planted within the 125m^2 receiver site. The area covered by these plugs immediately after planting was 5m^2 representing a maximum of 4.22% of the total area. No change in seagrass coverage was noted during the thirty month survey (0.31m^2). Seagrass encompassed 0.25% of the total area within Coquina Site 3. The calculated percent survivability remained 25% during the thirty month event. A small area of shell hash was present during the planting phase of the project. Areas of shell hash underlying a shallow layer of sand were also noted during the third quarter, one-year, eighteen month, twenty-four month, and thirty month survey and may explain the poor transplant survivability.

Coquina Tidal Creek Thirty Month Survival Assessment

During the initial transplantation, 1,096, 8-inch diameter (0.0324m^2) plugs were planted within the $3,019\text{m}^2$ receiver site. The area covered with seagrass immediately after planting was 36m^2 and represented a maximum of 1.18% of the total area within the receiver site. During the one-year assessment (summer), seagrass coverage had increased to $1,347\text{m}^2$ or 44.6% of the site. Six months later, during the eighteen month survey (winter) coverage had decreased slightly to $1,136\text{m}^2$ or 37.6% of the site. During the

twenty-four month survey (summer) coverage had increased to 1,241m². During the thirty month survey (winter) seagrass coverage had decreased to 450m². One hundred and fifty one 1m² quadrats were used (potential experimental error of 0.66%) at the Coquina Tidal Creek site to assess 5% of the receiver site area. An average of 14.9% cover of *Halodule wrightii* was attained from the 151 random samples. Most of the *Halodule wrightii* communities in the center and mouth of the creek had coalesced and were flourishing; although many areas were covered by dense clusters of the mangrove upside-down jelly (*Cassiopea xamachana*) (Photograph 5). Other areas were covered by loose, floating macroalgae, whereas some areas of sessile macroalgae had grown in and around portions of seagrass. Although there was a decrease in overall coverage, survivability of transplanted plugs at the Coquina Tidal Creek site continued to be 100%.

Leffis Key Lagoon Thirty Month Survival Assessment

During the planting phase of the seagrass mitigation project, 239 shoal grass (*Halodule wrightii*) transplants were planted within the 344m² Leffis Key Lagoon Receiver Site. Each transplant was initially 8 inches in diameter (0.0324m²) therefore; the actual area of seagrass (immediately after planting) was 8m² and represented a maximum of 2.25% of the total area within the receiver site. The Leffis Key Receiver Site had previously exhibited poor abiotic conditions incapable of supporting healthy seagrass. During previous monitoring events seagrass plugs were not located therefore random sampling had not been performed. In June 2004 eight small areas of *Halodule wrightii* were observed, as a result random sampling (for percent cover) was completed during subsequent surveys. Two live plugs were located in the middle of the receiver site and two larger areas of *Halodule wrightii* were located on the southwest side of the receiver site during the survey. Seagrass coverage increased to 17m² within the 344m² site during the twenty-four month survey. Six months later, during the thirty month survey coverage decreased to less than one meter squared (0.2%). Seventeen 1m² quadrats were used (potential experimental error of 5.88%) to assess 5% of the receiver site. An average of 0.06% cover of *Halodule wrightii* was attained from the 17 random samples. Survivability of the seagrass plugs was determined to be approximately 8%, which is a decrease from the previously calculated 17% survivability. Clusters of the mangrove upside-down jelly (*Cassiopea xamachana*) were noted within the site.

Overall survivability was at its highest (99%) during the 30-day monitoring (June/July 2003). Survivability began to noticeably decrease in the fall (October 2003) with 85% calculated survivability during the first quarterly monitoring and continued to decrease further (51%) in the winter (January 2004; Table 1). Winter is when seagrass naturally dies back, and may be exposed during extreme low spring tides. Low calculated total survivability during the first and second quarterly surveys may reflect a seasonal and reversible decline. Other factors such as poor visibility, cover of seagrass by drift algae, epiphytes and/or leaf litter, bioturbation, sediment incompatibility and underestimates in survivability from the previous methodology employed may have also contributed to the decrease in the calculated transplant survivability. During the third monitoring event in March 2004 the overall survivability began to increase (60%) and this increase was again observed during the fourth quarterly assessment (June 2004)

(74%). The increase can be attributed to many factors including coalescence, slightly improved seasonal conditions, and the methodology used to document seagrass presence within the receiver sites. Overall survivability remained consistent during the eighteen month survey (73%) (winter) and twenty-four month survey (71%) (summer). Six months later, during the thirty month survey (winter) a slight decrease in survivability (67%) was noted.

Five of the eight receiver sites remained consistent with the twenty-four month post-construction survival assessment. The single increase occurred within Coquina Site 2 (Table 1). Increased survivability at only one site may be attributed to a seasonal shift to winter conditions preventing persistent seagrass growth at seven of the eight sites.

Table 1
Town of Longboat Key, FL
Seagrass Mitigation Project
First Quarterly, Second Quarterly, Third Quarterly, One-Year, 18-Month Post, 24-
Month, and 30-Month Post-Construction
Survival Comparison

Receiver Site	Estimated % Survivability First Quarterly Monitoring October 2003	Estimated % Survivability Second Quarterly Monitoring January 2004	Estimated % Survivability Third Quarterly Monitoring March 2004	Estimated % Survivability One Year Monitoring June 2004	Estimated % Survivability 18-Month Monitoring December 2004	Estimated % Survivability 24-Month Monitoring June 2005	Estimated % Survivability 30-Month Monitoring December 2005
Coquina Tidal Creek	99	50	100	100	100	100	100
Leffis Key Lagoon	0	0	0	0	33	17	8
Coquina Site 1	100	93	92	100	100	100	100
Coquina Site 2	90	37	0	75	42	25	50
Coquina Site 3	52	26	0	17	42	25	25
Double Prop Scar	99	99	100	100	100	100	100
Durante Inshore	91	22	91	100	100	100	55
Durante Offshore	85	49	100	100	63	100	100
Project Average	85	51	60	74	73	71	67

Leffis Key Lagoon and The Durante Inshore Site yielded decreases in both calculated survivability and area of seagrass coverage.

Overall percent survivability of Coquina Tidal Creek, Coquina Site 1, Coquina Site 3, Coquina Double Prop Scar, and the Durante Offshore Site remained unchanged from the June 2005 assessment. Survivability during both the twenty-four month and thirty month assessments remained 100% (with the exception of Coquina Site 3 where survivability remained 25%). Although calculated survivability remained generally unchanged, overall seagrass coverage decreased at six of the eight receiver sites. Coquina Site 3 continued to support minimal seagrass (0.3m²) and Coquina Site 2 yielded an increase in coverage (6m²).

Survivability decreased slightly from the twenty-four month survey, and there was a decrease in the overall area of seagrass coverage (Table 2). The decrease (statistically insignificant (ANOVA, $p > 0.05$)) may be attributed to a variety of factors. Although previously not as dramatic, seagrass coverage has experienced winter “die-back”/“thinning-out” (e.g., One-Year to Eighteen Month Post-Construction Survey: 2,116m² to 1,801m²). This was shown to be a seasonal and reversible decline and overall coverage rebounded during the twenty-four month survey (1,955m²). The colder air/water temperature and increased fresh water influx may have caused the decline. Dense coverage of the mangrove upside-down jelly (*Cassiopea xamachana*) at two of the receiver sites may have also contributed to the decline by preventing sun penetration to the light dependant seagrass. The thirty month survey was the first time that such a large quantity of the mangrove upside-down jelly have been observed in any of the eight receiver sites. Submerged, black, degrading mangrove leaves have been shown to induce settlement and metamorphosis of planula larvae of *Cassiopea xamachana* (Fleck and Fitt, 1999). The active hurricane season of 2005 may have contributed to the decrease preventing growth and expansion of seagrass during the late summer months. Hurricane force winds may have removed significant amounts of mangrove leaves from the bordering trees depositing them into the adjacent receiver sites, in turn providing adequate conditions/substrate for settling *Cassiopea xamachana*. In addition to the hurricane season, Southwest Florida experienced extensive and persistent phytoplankton blooms/red tides which may have reduced water-column light penetration causing seagrass mortality (FWRI, 2005). In summary, the decrease in overall seagrass coverage most likely resulted from a combination of all of the previously described factors.

Based on percent cover, 67% survivability was estimated for all eight receiver sites. Although the calculated survivability is currently less than 75%, the overall surviving seagrass are comprised of dense areas approximately seven times larger than those originally planted. Seventy-five percent of the initial area of seagrass (99m²) planted within all eight receiver sites is 74m². After 30 months of monitoring, the sites show a total combined area of 690m² of seagrass. The increase is due to coalescence, growth, and expansion within the suitable receiver sites and natural seagrass may have also grown into existing receiver sites yielding increases in the overall area of seagrass. A combination of the surviving transplants and natural seagrass expansion into the sites shows the success of planting in suitable receiver sites.

CONCLUSION

After 30 months of monitoring it is possible to determine which sites and site characteristics are less suitable and should not be used for future transplantation. Leffis Key Lagoon, Coquina Site 2, Coquina Site 3, and Durante Inshore are four receiver sites proving to be the least suitable sites for seagrass survival although some (Table 2) are showing signs of improved growth and expansion. The poor suitability of the Leffis Site was noted during planting and poor survivability was anticipated. The Leffis Key Lagoon Site has an extremely muddy substrate and the slightest disturbance results in turbid water unsuitable for adequate sunlight penetration. Water flow is also a concern in the Leffis Site. The “new areas” of seagrass growth are located on the southwest edge of

the site and the rest of the site remains seagrass free and may not receive adequate water exchange. Coquina Site 2 and Coquina Site 3 have similar survivability that may be due to bioturbation and unsuitable sediment characteristics.

The suitable sites had existing natural seagrass in or directly adjacent to the area prior to transplantation activities. Future seagrass mitigation projects should utilize such areas (i.e. propeller scars) to promote growth and “kick start” re-growth in an already suitable seagrass habitat. In an environment rich with seagrass habitat such as Sarasota Bay, open areas with no seagrass should be considered incapable of supporting transplants since natural seagrass is not already established. The abiotic and biotic conditions as well as the ecology of a potential receiver site must be thoroughly studied before seagrass transplants are introduced to a potentially unstable habitat.

Overall transplantation of seagrass plugs within the eight receiver sites remains a success 2.5 years after transplantation. The total area of seagrass is seven times larger than originally planted.

Table 2
Town of Longboat Key, FL
Seagrass Mitigation Project
Time Zero, Third Quarterly, One-Year, 18-Month,
24-Month, and 30-Month Post-Construction
Seagrass Coverage

Receiver Site	Total Area (m ²)	Total Area of Seagrass Time Zero* June 2003 (m ²)	Total Area of Seagrass Third Quarter March 2004 (m ²)	Total Area of Seagrass One-Year June 2004 (m ²)	Total Area of Seagrass 18-Month December 2004 (m ²)	Total Area of Seagrass 24-Month June 2005 (m ²)	Total Area of Seagrass 30-Month December 2005 (m ²)
Coquina Tidal Creek	3019	36	776	1347	1136	1241	451
Leffis Key Lagoon	344	8	0	0	9	17	0.2
Coquina Site 1	312	8	46	49	82	106	37
Coquina Site 2	356	8	0.4	6	1	0.6	6
Coquina Site3	125	5	0	0.2	0.6	0.3	0.3
Double Prop Scar	2339	22	452	515	515	470	138
Durante Inshore	364	7	17	73	23	49	1.2
Durante Offshore	405	7	78	127	35	71	56
Total	7264	99	1371	2116	1801	1955	690

Notes:

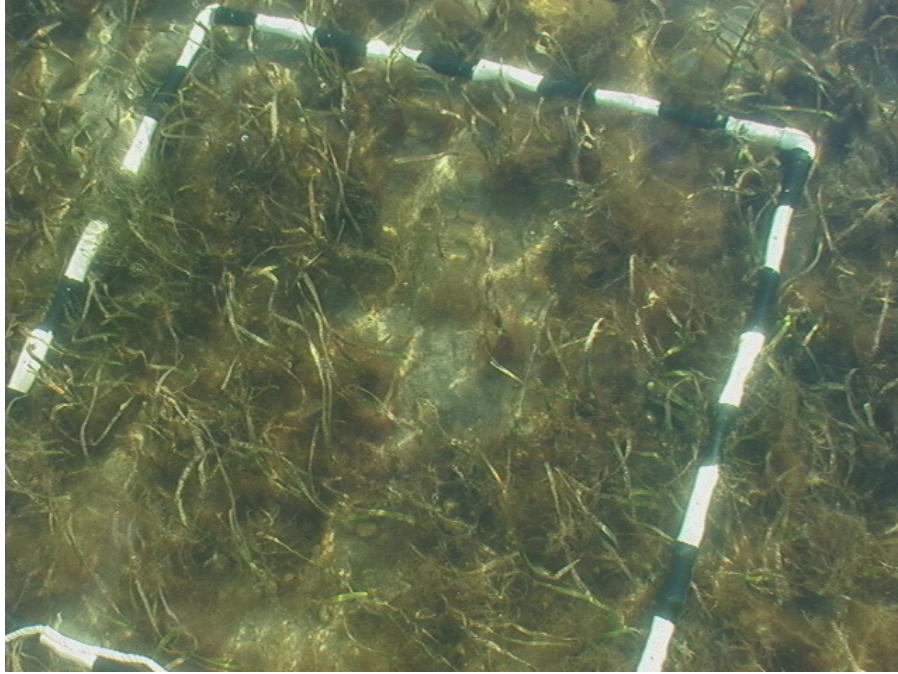
* source plugs each = 0.0324m²



Photograph 1. Randomized grid samples (1m² quadrats) were used to survey seagrass coverage at each receiver site.



Photograph 2. A sample within the Durante Offshore Site is shown above.



Photograph 3. Many of the transplants have coalesced within the Double Propeller Scar Receiver Site.



Photograph 4. Coquina Site 2 was the only site to yield an increase in seagrass during the thirty month survey.



Photograph 5. Dense clusters of the mangrove upside-down jelly (*Cassiopea xamachana*) had formed “carpets” covering seagrass within portions of the Coquina Tidal Creek.

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