# Standard Procedures for Seagrass Monitoring for the Charlotte Harbor Aquatic Preserves' Seagrass Transect Monitoring Program

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# I. Introduction

## A. Value of Seagrasses

Seagrasses are submerged flowering plants important for sustaining the diversity and health of marine environments, particularly shallow estuaries such as Charlotte Harbor. Seagrasses provide primary food sources as well as shelter, spawning and nursery habitat to a great diversity of aquatic organisms. They also reduce turbidity, facilitate sediment stabilization and aid in nutrient cycling. Within the past two decades, understanding of the value of seagrass has grown significantly. However, despite recognition of their value, documented decline in seagrasses has occurred locally, regionally, and worldwide.

Seagrass distribution and health are primarily determined by salinity and the amount of light penetrating through the water column. Seagrass growth is thus affected by water quality variables such as color and suspended matter, including turbidity and chlorophyll from phytoplankton. Epiphytic growth on the seagrass blades also reduces light available for seagrass growth. Together, these factors largely regulate which seagrass species grow where, to what depths, and at what abundances.

## B. Charlotte Harbor Estuaries Study Area

The Charlotte Harbor estuarine complex, located in Southwest Florida makes up one of the most pristine and productive coastal ecosystems in the state. These seven interconnected estuaries comprise over 170,000 acres of diverse, complex and fragile estuarine habitats. To protect these exceptional coastal resources for future generations to enjoy, the Florida Legislature designated most of the waters within the Charlotte Harbor estuarine complex as Aquatic Preserves.

Regionally, there are six Aquatic Preserves administered by the Florida Department of Environmental Protection. Five of these are managed as the Charlotte Harbor Aquatic Preserves (CHAPs) in Punta Gorda, including: Lemon Bay; Gasparilla Sound – Charlotte Harbor; Cape Haze; Pine Island Sound; and Matlacha Pass. Estero Bay Aquatic Preserve (EBAP) is managed out of an office located on Fort Myers Beach.

Aquatic Preserves are submerged lands with exceptional biological, aesthetic and scientific values managed to sustain their natural resources for the public's continued enjoyment. This goal is accomplished through resource management, resource protection, research, and education.

## C. Need for Seagrass Transect Monitoring

Historically, aerial surveys have been the most widely used tool for mapping seagrasses. In the Charlotte Harbor region, mapping has been conducted by FDEP/FMRI and/or SWFWMD/SWIM since 1982 and by SFWMD since 1999. Aerial surveys are valuable for estimating seagrass locations, acres and broad changes over time. However, to effectively manage the seagrass resources, additional information is needed to determine localized changes over time including seagrass species, abundance, health, and zonation relative to depth and water quality.

One of the resource management goals of the Charlotte Harbor Aquatic Preserves program is to protect and enhance the health and functioning of seagrass habitats. Identifying additional seagrass information provided by long-term transect monitoring is an essential resource management tool. Another major focus of the transect monitoring is to explain the link between water quality and seagrass health. By defining this link, resource managers are more able to predict the response of seagrass to changes in water quality. This information provides the basis for determining and implementing appropriate management practices in the Aquatic Preserves and their watersheds.

## D. Establishment of Program

Preliminary seagrass transect monitoring was conducted in northern Charlotte Harbor and Lemon Bay in 1998 by SWFWMD/SWIM, Sheda Ecological Associates and DEP/CHAPs field staff using SWFWMD/Sheda protocols. During the same year, additional transects were established in southern Charlotte Harbor, Pine Island Sound, Matlacha Pass and San Carlos Bay by DEP/CHAPs and SFWMD Tarpon Bay field staff using the same protocols. Beginning in 1999 all transects throughout these two regions have been monitored annually by FDEP/CHAPs staff, with assistance from agency and citizen volunteers.

Throughout, or directly adjacent to, the five Charlotte Harbor Aquatic Preserves, 50 seagrass transect monitoring sites have been established. The sites were chosen to be widely distributed, representative of seagrass conditions in specific locations, and of adequate length for field personnel to monitor. See Appendix A for a map of sites.

At each site, a “transect” is established along a fixed line from the shallow, shoreward edge of the seagrasses to the deep, waterward edge. See Appendix C for a diagram of a typical transect. Transect lengths vary from approximately 10 to 600 meters throughout the region depending on bathymetry, water clarity and seagrass species. At pre-determined intervals along each transect detailed seagrass species, abundance, and density information is collected using a one square meter “quadrat”.

All CHAPs seagrass transects are monitored annually, August through October, to ensure data is captured just after the height of the growing season. Three of the CHAP transects (2 in southern Matlacha Pass (MP04 and MP05) and one in San Carlos Bay(SC03)) are monitored quarterly by DEP South District EAR staff. This enables an understanding of the seasonality in seagrass conditions, and aligns transect monitoring efforts with timing of aerial photography.

# II. Field Methods

## A. Preparation

Before initiating field monitoring each season, a schedule is made of what sites will be monitored using optimal tidal conditions (e.g. low slack tide at sites with strong current). Site locations are reviewed using written site descriptions, previous photographs, navigation charts, and data sheets to determine transect locations, lengths, and quadrat locations. GPS locations are reviewed, updated from previous year and printed off. Flagging tape, PVC stakes, and GPS coordinates are utilized to reference site locations and assure repeatability. The monitoring sites are reached using a shallow draft boat. Seagrass observations are made by snorkeling and/or SCUBA depending on water depth. See Appendix D for a list of field monitoring equipment.

## B. Determining Transect Location & Orientation

Once near the site, the defined reference point on shore is located using previous flagging tape, PVC stake and/or known GPS coordinates. The shallow, shoreward point for the transect is then found by measuring the specified distance (called the "offset") and direction from the reference point and/or using GPS coordinates for the zero point PVC stake. The zero point of each transect was determined when the transect was established in 1998 as the baseline, shoreward edge of seagrass growth.

From the zero point, a compass heading, point of reference (e.g. a water tower) and/or GPS coordinates are used to determine the waterward direction of travel along the transect. Please note that for sites located in Charlotte County, the direction of travel from the flagging to the zero point is *perpendicular* to the shore unless otherwise stated on the datasheet. For sites in Lee County, the direction of travel between the flagging and the zero point is aligned directly with the assigned heading of the transect. Each transect is then sampled at regular intervals specified in the site description using a tape measure to determine a known distance between points. See Appendix B for site location information.

## C. Recording Site Reference Data

At each site, the date, crew, start and end time, start and end tide stage, offset (distance from flagging to zero point), general site comments, and weather conditions are recorded on the data sheet. See Appendix G for data sheet.

## D. Determining Tide Stage

Determining tide stage is essential for normalizing water depth measurements for use during data analysis. At the beginning and end of monitoring each transect, tide level (relative to the biological mean high water line) is recorded on the data sheet. Generally, tide stage is measured as the height of the water (in $10^{ths}$ of a foot) above or below the barnacle line on nearby mangrove roots, navigation markers, or dock pilings. Preferably, both tide level readings (before and after monitoring) should be taken from the same location. It is also important to document a mid-tide level if a tidal cycle is completed during the course of the transect monitoring (i.e. if the tide goes through a high or low tide and then returns to the same tide level as it was when first recorded) because this will be reflected in the conversion of depths to mean water. Local tide gauge information is used during data analysis to convert observed water depths to mid-tide conditions.

## E. Determining Quadrat Locations

Sampling is conducted along each transect at regular intervals using a one square meter quadrat. This quadrat is further divided into 100 squares, each 10x10 centimeters, using bungee cord line for use in collecting abundance data. Distances between quadrats range from 10 to 50 meters apart depending on the length of the transect. Quadrat sampling points are marked with PVC stakes and have established GPS coordinates used for reference. Site-specific "repeated" quadrats have been determined to allow for greater long-term consistency in sampling locations and are monitored every year. See Appendix B for number of repeated quadrats per site.

## F. Determining Annual Shallow & Deep Edge of Seagrasses

In addition to sampling the repeated quadrats, seagrass information is collected each year at the observed beginning and end of seagrass bed along each transect. Both end points vary annually and seasonally and can be difficult to determine particularly when seagrass abundance is rare. This info is recorded on the data sheet and noted as the beginning or end of the bed, respectively. Please note that if seagrass begins between the flagging stake and the zero point, that station is denoted with a negative distance from the zero point. At some locations, the end of bed cannot be determined because of safety considerations (snorkeling in channel) or because the water depths remain shallow and the seagrass bed continues to the other shoreline, like in Matlacha Pass.

## G. Collecting Seagrass Data at Each Quadrat

At each sampling point along the transect (except the beginning and end), the quadrat is *centered* on the PVC stake. (Where there is scouring due to the PVC stake, the quad is placed to the right of the stake and noted on the datasheet.) At the beginning and end of the grass bed, the quadrat is either placed *forward* or *behind* the grass edge, respectively. This ensures that seagrass data is captured *inside* the transect. Each quadrat is denoted on the data sheet as being at the beginning, middle or end of the seagrass bed.

At each quadrat, water depth, sediment type, species types, abundances, blade lengths, shoot counts, and epiphyte loads are observed and recorded on the data sheet. Water depth is recorded in centimeters and if there are waves, is averaged between the crest and trough of the wave. Sediment is characterized as shelly sand, sand, muddy sand, or mud.

Seagrass abundance is determined for each species, as well as the quadrat as a whole, using the Braun-Blanquet (BB) coverage classes. The coverage classes are defined as follows: **r** = solitary; **+** = few; **1** = <5%; **2** = 5 - 25%; **3** = 26 -50%; **4** = 51 - 75%; and **5** = 76 - 100%. See Appendix E for a diagram of BB abundance classes.

Drift algae (DA) information is also collected at each quadrat where present. This species is given its own species category, abundance, and generally described by type in the species comments section. If the species is not readily identifiable, a sample is placed in a container with water and taken back to the office to ID. Please note that drift algae abundance is not included as part of total quadrat abundance as it generally has a more negative effect on seagrass health rather than a positive one.

After abundances have been determined, short shoot counts are made for each species in a predetermined number of 10 cm squares. See Appendix F for short shoot count pattern. Five representative blade lengths (measured in cm) are recorded for each species. In general, blade lengths should be randomly picked and measured from the beginning of the green base (above the white part of the base) to the tip. For Thalassia, only blades with rounded, healthy, green tips are to be measured. Epiphytes are quantified as clean, light, moderate, or heavy. See Appendix E for epiphyte density category diagram.

## H. Collecting Water Quality & Clarity Data

When the CHAPs Seagrass Monitoring Program was established in 1998, water quality and clarity data were collected at each transect. However, since that time, additional monthly water quality monitoring programs have been established that provide more robust data to use in comparative analysis with the seagrass data. Therefore, collecting water quality data at each site is optional, but recommended. Relevant water quality parameters collected include secchi, photosynthetically active radiation (PAR), dissolved oxygen, salinity, and temperature. The data is collected at the deep edge of the grass bed and at the mid point of the transect if it is longer than 300 meters. Dissolved oxygen, salinity, and temperature are determined at mid water column depth using a YSI or hydrolab data logger. PAR readings are determined using a LI-COR 1400 with two $2\pi$ quantum sensors. If adequate water depth is available, LI-COR readings are taken to capture simultaneous readings underwater by lowering the unit to the greatest depth possible. If the water is less than 1 meter deep, a single sensor is used at 20, 40, 60 & 80 cm depth intervals. An air reading is also recorded to correspond with each water reading.

## I. Estimated Time Needed for Monitoring

The time requirement for field sampling using three people is approximately 2-3 sites per day. An extended total of approximately 25 days are needed for the 50 sites within the CHAPs study area. At least two trained seagrass personnel in the field are needed to ensure protocols are being followed correctly. Additional time is needed to enter the data into the Access data base and conduct analyses, as described below.

## III. Data Management & Uses

Current data management of the CHAPs Seagrass Transect Monitoring data consists of an Access data base where statistical methods are used to analyze the data. This data is shared with other resource management, research and educational institutions.

To date, the Charlotte Harbor Aquatic Preserves have produced two Technical Reports summarizing baseline seagrass health throughout the Charlotte Harbor estuaries from 1999-2006 and 1999-2009. Results have been presented at the Watershed Summit and published in Florida Scientist journal in 2013. Updates to the FWC Seagrass Integrated Monitoring and Mapping (SIMM) Charlotte Harbor chapter, were provided in 2010 and 2014 based on CHAP monitoring data. The Sanibel-Captiva Conservation Foundation, Charlotte Harbor Environmental Center and CHAPs staff have reviewed the seagrass data in relation to water quality and published the results in other Florida Scientist journals. Interestingly, results showed strong correlations between decreasing trends in abundance and salinity, but few correlations with maximum depth of seagrass growth. The Charlotte Harbor National Estuary Program determined mean maximum seagrass depths for each region and used the information to produce resource-based water quality targets throughout the estuaries which in turn led to the development of estuary specific numeric nutrient criteria. These water quality targets were crucial for implementing the region wide and federally approved numeric nutrient criteria, passed by the EPA in 2012. Charlotte Harbor Education Center has also overlaid the CHAPs seagrass transect data with aerial photography of seagrass coverage provided by the regional Water Management Districts. CHAP staff have conducted statistical analyses for the 2007 and 2010 Annual Seagrass Data Summaries. These summaries will be developed as needed to have an up-to-date record of seagrass status and trends throughout the region. Staff have also looked at seagrass trends in Matlacha Pass by site and estuary wide. In the near future, the CHAPs seagrass transect data will be used to prepare an updated CHAPs Technical Report that will compare seagrasses region wide to water quality status and trends.

Long term fixed transect monitoring is a useful resource management tool in detecting site-specific seagrass changes over time. It allows for documentation of declines or improvements in seagrass species, depth, abundance, density and distribution as well as relationships to water quality. The information will be used to discern between naturally occurring and anthropogenic events which affect the sustainability of the seagrasses. In addition transect monitoring aids in the interpretation of aerial photography and seagrass maps. It will also help determine resource management needs.

## IV. References

Annual Seagrass Data Summary for the Charlotte Harbor Aquatic Preserves Seagrass Transect Monitoring Program (1999-2006). Florida Department of Environmental Protection. Fall 2007.

Charlotte Harbor Aquatic Preserves’ Eleven Year Results of the Seagrass Transect

Monitoring Program (1999-2009). Florida Department of Environmental Protection. Spring 2010.

Development of Water Quality Targets for Charlotte Harbor, Florida using Seagrass Light Requirements. Catherine A. Corbett and Jason A. Hale. FL Scientist, Vol 62, Supplement 2, 2006.

Establishing Baseline Seagrass Health Using Fixed Transects in Charlotte Harbor, FL. Two Year Seagrass Monitoring Summary 1999-2000 Technical Report (1). Elizabeth Staugler & Judith Ott, Florida DEP Charlotte Harbor Aquatic Preserves.

Results of the Florida Department of Environmental Protection, Charlotte Harbor Aquatic Preserves' Seagrass Monitoring Program from 1999-2009. Melynda Brown, Ray Leary, Mary McMurray and Heather Stafford. FL Scientist, publication pending Spring 2013.

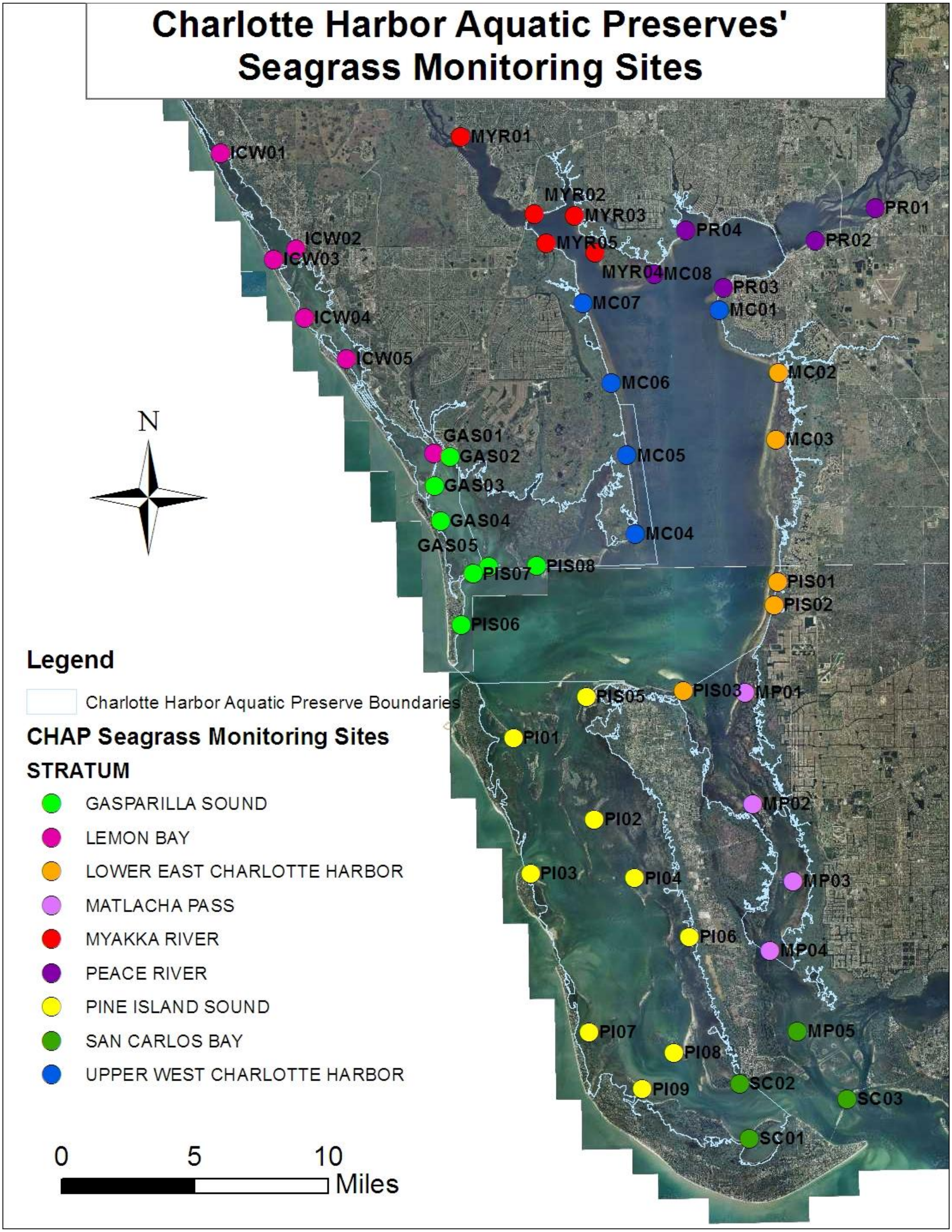
Seagrass Dynamics within the Matlacha Pass Aquatic Preserve Along Fixed Transects (1999-2009). R.E. Leary. NOAA Award # #NA09NOS4190076. Submitted December 31, 2011.

Seagrass Monitoring Protocols- Summer 1998 results. Prepared by Scheda Ecological Associates, Inc. for the Southwest Florida Water Management District, Surface Water Improvement and Management (SWIM) Program. October 1998.

Seagrass Species Composition and Distribution Trends in Relation to Salinity Fluctuations in Charlotte Harbor, Florida. Jaime M.Greenawalt-Boswell, Jason A. Hale, Katie S. Fuhr, and Judith A. Ott. FL Scientist, Vol 62, Supplement 2, 2006.

Seagrass Transect Monitoring Design. Florida Department of Environmental Protection Charlotte Harbor Aquatic Preserves. Fall 1999.

Appendix A: Map of CHAPs Seagrass Monitoring Sites

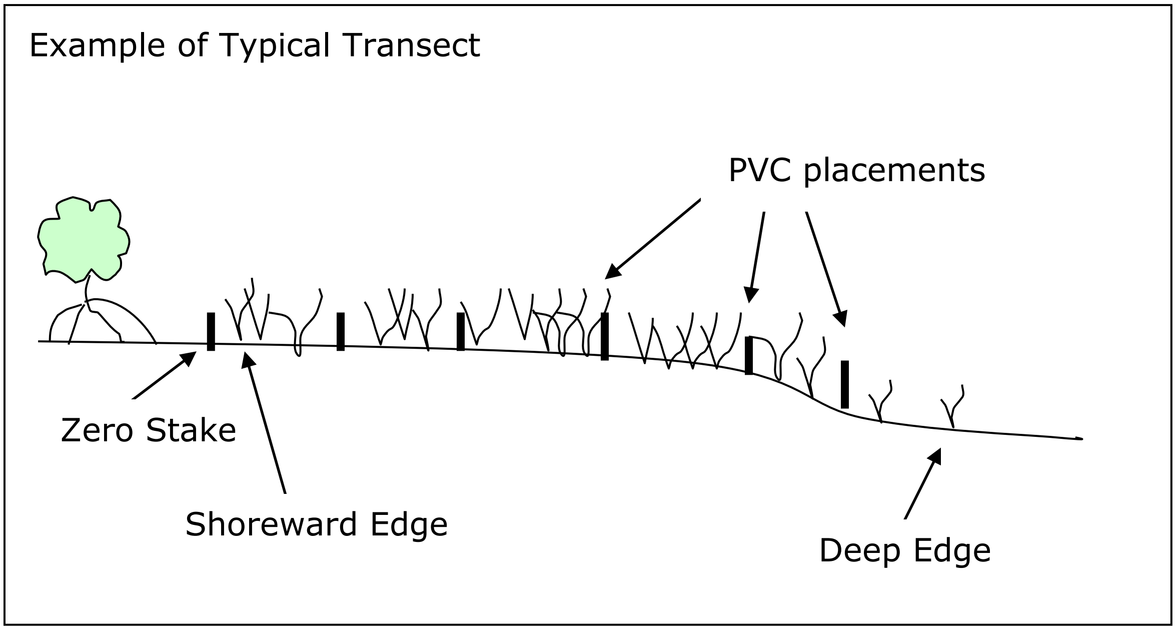


Appendix B: Table of CHAPs Seagrass Monitoring Site Locations

| FDEP Charlotte Harbor Aquatic Preserves | | | | | | |
|---|---|---|---|---|---|---|
| Seagrass Transect Monitoring Sites | | | | | | |
| | GPS Coordinates | | | | Approx | # of Repeated |
| Site | Latitude | | Longitude | | Length | Quadrats |
| GAS01 | 26 | 49.943 | -82 | 16.279 | 30 | 3 |
| GAS02 | 26 | 49.845 | -82 | 15.652 | 50 | 6 |
| GAS03 | 26 | 48.909 | -82 | 16.260 | 210 | 6 |
| GAS04 | 26 | 47.747 | -82 | 16.059 | 210 | 5 |
| GAS05 | 26 | 46.253 | -82 | 14.338 | 300 | 6 |
| ICW01 | 26 | 59.865 | -82 | 23.937 | 170 | 4 |
| ICW02 | 26 | 56.702 | -82 | 21.228 | 35 | 4 |
| ICW03 | 26 | 56.369 | -82 | 22.036 | 300 | 8 |
| ICW04 | 26 | 54.458 | -82 | 20.944 | 25 | 3 |
| ICW05 | 26 | 53.102 | -82 | 19.425 | 140 | 5 |
| MC01 | 26 | 54.518 | -82 | 5.743 | 50 | 6 |
| MC02 | 26 | 52.445 | -82 | 3.623 | 335 | 7 |
| MC03 | 26 | 50.254 | -82 | 3.767 | 690 | 14 |
| MC04 | 26 | 47.252 | -82 | 8.943 | 160 | 4 |
| MC05 | 26 | 49.810 | -82 | 9.211 | 620 | 13 |
| MC06 | 26 | 52.188 | -82 | 9.733 | 490 | 10 |
| MC07 | 26 | 54.799 | -82 | 10.749 | 350 | 8 |
| MC08 | 26 | 55.734 | -82 | 8.134 | 230 | 5 |
| MP01 | 26 | 42.002 | -82 | 5.026 | 60 | 6 |
| MP02 | 26 | 38.364 | -82 | 4.799 | 120 | 4 |
| MP03 | 26 | 35.814 | -82 | 3.386 | 270 | 6 |
| MP04 | 26 | 33.557 | -82 | 4.262 | 85 | 3 |
| MP05 | 26 | 30.891 | -82 | 3.310 | 580 | 12 |
| MYR01 | 27 | 0.301 | -82 | 15.126 | 30 | 4 |
| MYR02 | 26 | 57.750 | -82 | 12.473 | 145 | 4 |
| MYR03 | 26 | 57.680 | -82 | 10.987 | 150 | 4 |
| MYR04 | 26 | 56.466 | -82 | 10.252 | 150 | 5 |
| MYR05 | 26 | 56.752 | -82 | 12.060 | 130 | 3 |
| PI01 | 26 | 40.629 | -82 | 13.529 | 25 | 3 |
| PI02 | 26 | 37.925 | -82 | 10.607 | 40 | 5 |
| PI03 | 26 | 36.178 | -82 | 12.982 | 60 | 5 |
| PI04 | 26 | 35.988 | -82 | 9.167 | 40 | 5 |
| PI06 | 26 | 34.030 | -82 | 7.188 | 30 | 4 |
| PI07 | 26 | 30.985 | -82 | 10.903 | 90 | 4 |
| PI08 | 26 | 30.269 | -82 | 7.811 | 130 | 3 |
| PI09 | 26 | 29.086 | -82 | 9.005 | 470 | 10 |

| | | | | | | |
|---|---|---|---|---|---|---|
| PIS01 | 26 | 45.595 | -82 | 3.770 | 395 | 6 |
| PIS02 | 26 | 44.844 | -82 | 3.900 | 560 | 12 |
| PIS03 | 26 | 42.010 | -82 | 7.369 | 250 | 7 |
| PIS05 | 26 | 41.923 | -82 | 10.819 | 85 | 4 |
| PIS06 | 26 | 44.340 | -82 | 15.383 | 170 | 4 |
| PIS07 | 26 | 46.018 | -82 | 14.903 | 160 | 4 |
| PIS08 | 26 | 46.240 | -82 | 12.585 | 10 | 3 |
| PR01 | 26 | 57.772 | -81 | 59.984 | 10 | 2 |
| PR02 | 26 | 56.741 | -82 | 2.182 | 125 | 6 |
| PR03 | 26 | 55.229 | -82 | 5.585 | 225 | 5 |
| PR04 | 26 | 57.128 | -82 | 6.923 | 160 | 4 |
| SC01 | 26 | 27.409 | -82 | 5.115 | 270 | 7 |
| SC02 | 26 | 29.231 | -82 | 5.449 | 165 | 5 |
| SC03 | 26 | 28.650 | -82 | 1.520 | 105 | 3 |

# Appendix C: Diagram of Typical Seagrass Monitoring Transect

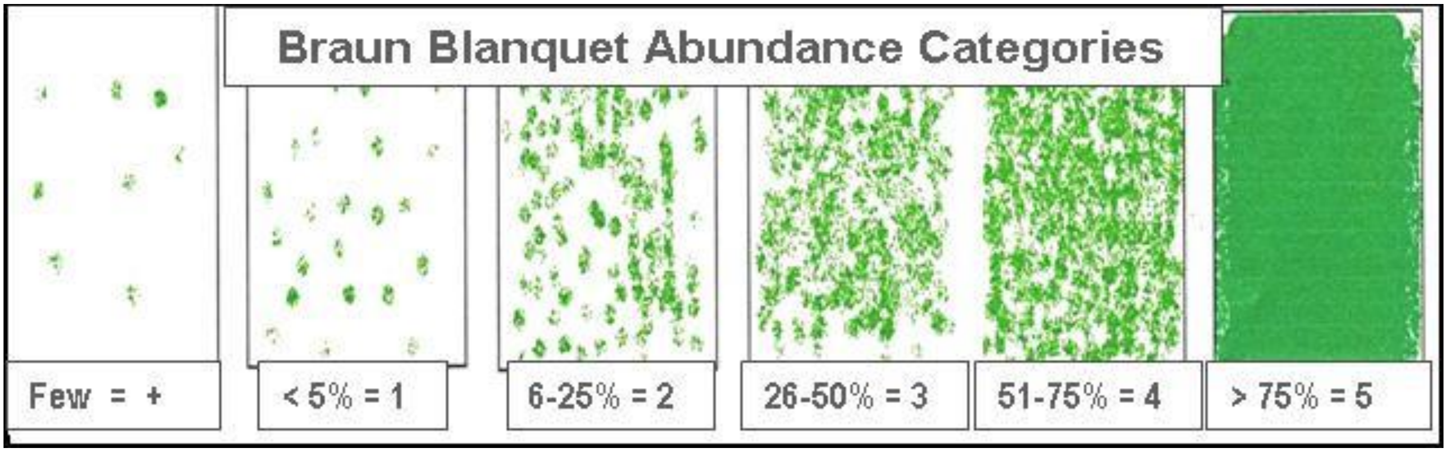


# Appendix D: Seagrass Field Monitoring Equipment Checklist

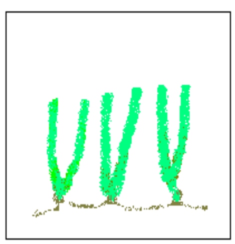
Trimble (GPS) unit
Tide info
Site datasheet copies from last year
Flagging tape
Clipboard with side ruler
Blank data sheets on waterproof paper
Pen/Pencil/Sharpener
Navigation charts
Dive flag
Dive Float with line & weight
Depth pole (secondary pole optional)
Tape measure (100m)
1 M quadrat
Transect Field Book (maps/photos/descriptions/GPS coordinates)
Snorkel Gear (Mask/snorkel/fins/booties/weight belts & extra weights)
Dive Gear (BCD/Tank/Regulator)
Extra PVC stakes/mallet
Digital camera/UW casing
YSI (or hydrolab)
Compass
Secchi Disk
Binoculars
Drinking water
Sunscreen
LI-COR (extra batteries)

## Appendix E: Diagrams of Seagrass Abundance & Epiphyte Density Categories

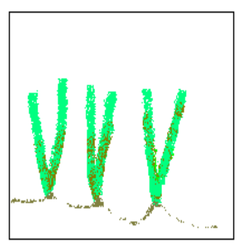
**Braun-Blanquet Seagrass Coverage Class System**



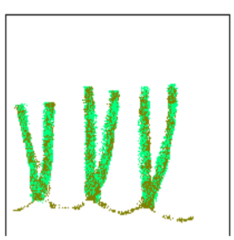

**Epiphyte Density Categories**



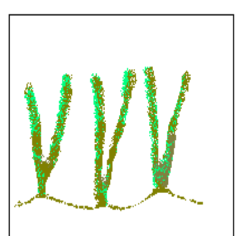
1 = Clean



2 = Light



3 = Moderate



4 = Heavy

# Appendix F: Diagram of Seagrass Shoot Count Patterns

| BB % Cover | RAI | # of compressed 10x10 cells |
|---|---|---|
| < 5% | 1 | 0-20 |
| 5 – 25% | 2 | 21-30 |
| 26 – 50% | 3 | 31-50 |
| 51 – 75% | 4 | 51-75 |
| 76 – 100% | 5 | 76-100 |

- Determine Shoot Count:

  If RAI equals:
  - **1**, count the number of shoot within the entire 1m$^2$ quadrat
  - **2**, count the number of shoots in 30 squares (2 diagonals and one across)
  - **3**, count the number of shoots in 20 squares (2 diagonals)
  - **4**, count the number of shoots in 10 squares (1 diagonal)
  - **5**, count the number of shoots in 5 squares (every other square along the diagonal)

Relative abundance = 2

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| x | | | | | | | | | x |
| | x | | | | | | | x | |
| | | x | | | | | x | | |
| | | | x | | | x | | | |
| | | | | x | x | | | | |
| x | x | x | x | x | x | x | x | x | x |
| | | | x | | | x | | | |
| | | x | | | | | x | | |
| | x | | | | | | | x | |
| x | | | | | | | | | x |

Relative abundance = 3

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| x | | | | | | | | | x |
| | x | | | | | | | x | |
| | | x | | | | | x | | |
| | | | x | | | x | | | |
| | | | | x | x | | | | |
| | | | | x | x | | | | |
| | | | x | | | x | | | |
| | | x | | | | | x | | |
| | x | | | | | | | x | |
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Relative abundance = 4

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| | x | | | | | | | | |
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Relative abundance = 5

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# Appendix G: CHAPs Seagrass Transect Monitoring Data Sheet

| | | | |
|---|---|---|---|
| Date: / /2012 | Wind Dir: N / NE / NW / S / SE / SW / E / W | Observers: MB, MM, ATM | Tide Start: FT ↑↓ MHW |
| Site # | Wind Sp: Calm / 0-4 / 5-10 / 11-15 / 16-20 / >20 | Compass Heading: | Tide End: FT ↑↓ MHW |
| Offset from Flagging ______ m | Seas: Calm / R / LC / MC / HC | Site Comments: | |
| | Cloud Cover %: 0 / 1-25 / 26-50 / 51-75 / 76-99 / 100 | | |

| Station (m) | Repeat Quad (y/n) | Stake Found (y/n) | Time | Depth (cm) | Sedi-ment | Total Abund | Species | Species Abund | Shoot Count | Blade Lengths (5) (cm) | | | | | Epi Density | Epi Type | Bed | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | : | | | | | | | | | | | | | | | |
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| **Water Chemistry** Sonde: YSI 85 SN: 05D1086 | WQ Depth (m) | DO (mg/l) | Salinity (ppt) | Temp ($^{o}C$) | Secchi (m) | Location along transect | **Snorkelers** start time end time | **Divers** start time end time | | **Data Recorder** |
|---|---|---|---|---|---|---|---|---|---|---|
| Time : | | | | | | | | total depth | | |

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|---|---|
| Species: (H) Halodule, (R) Ruppia, (T) Thalassia, (S) Syringodium, (HE) Halophilia, (AA) Attached Algae, (DA) Drift Algae | |
| BB Abundance cover: r = solitary,+ = few, 1 = < 5% , 2 = 5-25% , 3 = 26-50%, 4 = 51-75%, 5 = 76-100% | Bed: B = Beginning, M = Middle, E = End |
| Epiphyte Density: 1 = clean / none, 2 = light, 3 = moderate, 4 = heavy | Sediment: 1 = shelly sand, 2 = sand, 3 = muddy sand, 4 = muck |