AtkinsRéalis

2023 Annual Seagrass Monitoring Report

Sebastian Inlet District

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114 Sixth Avenue, Indialantic, FL 32903

SEBASTIAN INLET SEAGRASS MONITORING PROGRAM

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1. Introduction

In August 2007 the Sebastian Inlet District (SID) completed the construction of a navigation channel connecting Sebastian Inlet from Channel Markers No.18 and 19 westward to the Intracoastal Waterway (ICW). The purpose of this 3,120-ft long, 10.7-acre (5:1 side slope; -9 ft NGVD) channel extension was to provide the growing maritime community with a safe, clearly designated passage to/from the Atlantic Ocean as a matter of public safety and for the future protection of associated aquatic resources. To offset impacts to 3.08 acres of seagrass habitat and 7.62 acres of non-vegetated soft bottom, and pursuant with the U.S. Army Corps of Engineers (USACE) and the Florida Department of Environmental Protection (FDEP) permits SAJ-2002-7868 (IP-TSD) and 05-264486-001, issued March of 2007, the permittee, the SID, provided the following over the course of a five-year (2008-2012) seagrass mitigation and monitoring program (PBS&J 2011, Atkins 2012, Atkins 2013):

1) The recovery of 459 seagrass planting units (179 *Halodule wrightii*; 279 *Syringodium filiforme*; 1 *Halophila johnsonii*; see Figure 1-1 for reference photos) from the proposed channel alignment and subsequent planting of 41 propeller scars (hereafter, “prop scars”), filling an estimated 366.95 m of linear damage.

2) The balance of financial support needed to install the Indian River County Main Relief Canal Pollution Control Structure, estimated at $750,000.00. The structure came online in July 2008.

3) The establishment and/or monitoring of the St. Johns River Water Management District (SJRWMD) fixed seagrass transect No. 51, plus 9 additional transects in the vicinity of the Main Relief Canal Outfall (Vero Beach, Florida). The monitoring protocol and periodicity followed those previously established and utilized by the SJRWMD. Three baseline monitoring events and eight post-activation monitoring events occurred from May 2007- August 2012.

4) The placement of “Caution, Shallow Water, Seagrass Area” signs clearly delineating 145 acres of the flood tidal shoal as seagrass habitat, protecting an initially estimated 110.26 acres (2007) of mixed meadow seagrasses. Current (2022) estimates place this area of live seagrass habitat at 117 acres.

5) The quantification of seagrass coverage within the six designated protected areas (“A” thru “F”) using low-level, high resolution, digital orthophotography.

6) A complete inventory and tracking of annual changes to anthropogenic damage within the protected areas.

7) The successful deployment of 2,031 Sediment Tubes® into 32 previously identified propeller-related scars, including 22 significant “blow-out” features. Work was conducted in partnership with Seagrass Recovery, Inc.

The five-year monitoring program associated with the Sebastian Inlet navigation channel was completed in 2012 (Atkins 2013). However, the SID completed the Sebastian Inlet channel realignment project (FDEP Permit No. 05-264486-005-EM) from May 2012 to July 2012, which corrected the severe angle of the channel west of the shoal by widening the turn. The widening resulted in additional seagrass impacts which were included in the available mitigation from the original channel construction project. The widening project resulted in the continuation of an abbreviated version of the seagrass monitoring program (Atkins 2014). As part of this abbreviated monitoring program, the SID continued to quantify seagrass coverage (#5 above) and inventory and tracked anthropogenic damage (#6 above) within the protected areas on the flood tidal shoal over a period of three years (terminating in 2015) (Atkins 2014, 2015, 2016). The SID contracted Atkins to continue the abbreviated seagrass monitoring program in 2016, 2017, 2018, 2019, 2020, and 2021 with a focus on the quantification of seagrass coverage within the protected areas of the flood tidal shoal (Atkins 2017, Atkins 2018, Atkins 2019a, Atkins 2019b, Atkins 2021, Atkins 2022). During the lead-up to the 2022 seagrass monitoring event, Atkins and SID discussed improvements to the monitoring plan. Shortly before the 2012 realignment, the Indian River Lagoon (IRL) experienced a severe harmful algal bloom and subsequent seagrass die-off which drastically reduced coverage within the monitored protected areas. While the abbreviated monitoring plan has tracked the quantitative area of seagrass regrowth and provided some qualitative data on species composition, little data has been collected on seagrass density. This has become an acute issue since 2021, when the Florida Fish and Wildlife Conservation Commission (FFWCC) declared a statewide Unusual Mortality Event (UME) for the Florida manatee (*Trichechus manatus latirostris*), which has been most severe in the IRL (FFWCC 2023). As such, it was agreed that beginning with the 2022 seagrass monitoring event and continuing into 2023, work would focus effort on obtaining species composition and density data across the six protected shoals. Conversely, changes were made to the collection of data on anthropogenic damage within the protected areas as since 2012 field verification of scars has been limited due to the changes in seagrass density and composition.

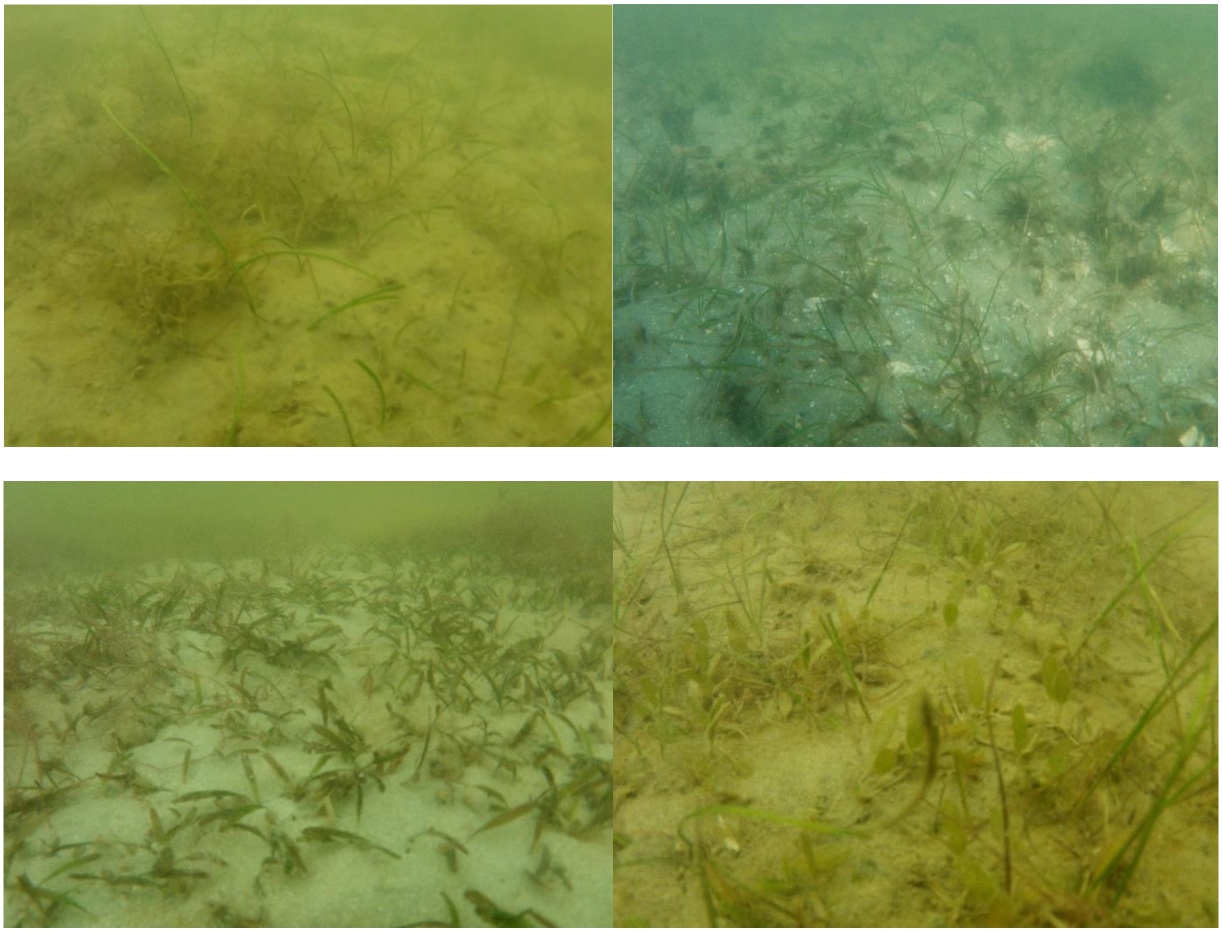


Figure 1-1 – Sebastian Inlet seagrass species – *Syringodium filiforme* (upper left), *Halodule wrightii* (upper right, mixed with *Halophila johnsonii*), *Halophila johnsonii* (lower left), and *Halophila decipiens* (lower right, mixed with *Syringodium filiforme* and *Halodule wrightii*).

2. Aerial Image Analysis

To assess changes in the submerged aquatic resources within the protected areas or mitigation zone, a Geographic Information System (GIS)-based approach using low-level, digital aerial photography was implemented in June 2007 and has continued annually thereafter. Since 2022, aerial image analysis has had four primary objectives:

1) To quantify the aerial extent of existing seagrasses within the mitigation zone,

2) To assess changes to the spatial distribution and aerial extent of seagrass,

3) To identify visible anthropogenic impacts (i.e., prop scarring) within the mitigation zone, and

4) To field verify (hereafter referred to as “groundtruthing”) the validity of observations made remotely (see Section 3.2).

GPI Geospatial, Inc. (previously Aerial Cartographics of America, Inc.) was selected to supply low-altitude, high-resolution, color imagery for the 500-acre region of the shoal. Unfortunately, during the 2023 assessment period suitable aerials were not obtained due to a combination of persistent poor water clarity and unsuitable weather conditions. Algal blooms were recorded in the IRL north of Sebastian Inlet, which combined with tannins from stormwater discharges created persistent low water column clarity over the shoals. As such, for the 2023 aerial analysis the groundtruthed seagrass polygons obtained from the 2022 field effort were overlaid on the most recent (May 2023; likely Memorial Day weekend due to presence of ~85 recreational boats in Zones D and E) clear satellite images from Google Earth (Figure 2-1). This did not provide imagery at a sufficiently high resolution to attempt seagrass delineation; however, areas outside the previously groundtruthed seagrass polygons which appeared to have darkened shading were marked for investigation in the field. A total of 13 linear transects were placed in GIS across these areas and visited during the field verification or “groundtruthing” exercise (see Section 3 Groundtruthing below).

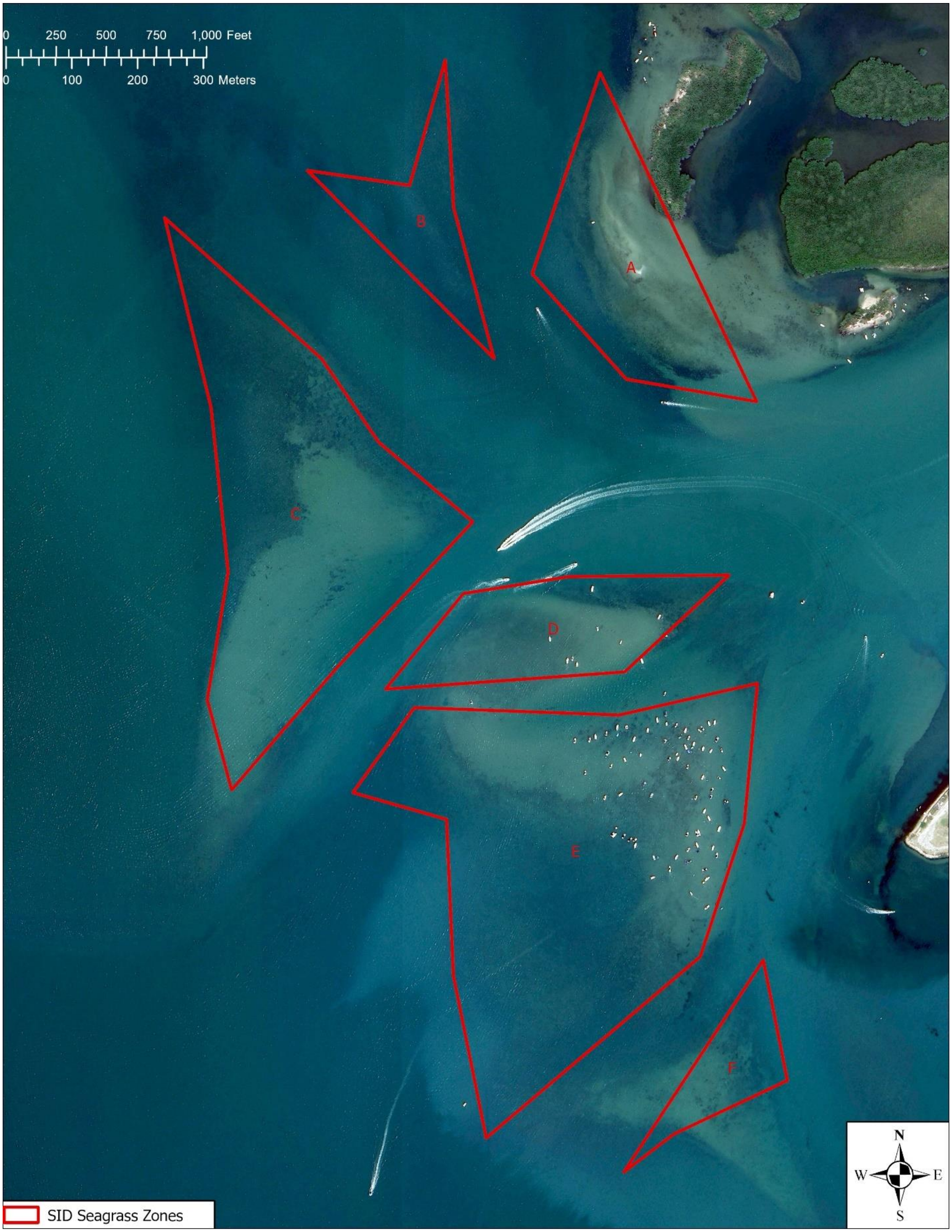


Figure 2-1 – May 2023 Google Earth satellite image with Zones A-F superimposed.

In order to provide species and coverage data, a total of 302 sampling points were placed within seagrass polygons finalized after the 2022 monitoring event; these were given a roughly even spatial distribution. 126 of these locations were carried over from the 2022 monitoring event. The purpose of the sampling points was to eliminate a potential issue with using the uncertainty point and polyline features to record species presence as in previous monitoring events; typically, seagrass density was not recorded at these locations and their primary function (resolution of indistinct aerial signatures) skewed the distribution towards sparser areas within the shoals.

Efforts to delineate scars in recent years have been hampered by the typically sparse seagrass density; additionally, the dominant species present (*Halodule wrightii* and *Halophila johnsonii*) regrow relatively rapidly after a disturbance. As such, this element has been de-emphasized in recent years; in any case the lack of high-resolution aerials in 2023 prevented any delineation and verification of prop scars.

3. Groundtruthing/Field Verification

3.1 Objectives

Any attempt to characterize benthic composition from high-resolution aerial imagery presents a suite of technical challenges, including changing optical properties of water with depth and water density, variations in water constituents across the spatial extent of an image (e.g., tannins), reflections caused by an imperfect water surface, and shadows from taller features. These issues are exacerbated at the Inlet by the confluence of two distinctly different water bodies (i.e., sometimes lower salinity, tannin-rich lagoon water and more saline, comparatively clearer, but at times sand/silt containing, nearshore Atlantic Ocean water), creating a heterogeneous mixture of optical properties over a range of depths. Since 2012, aerial interpretation has also been complicated by the large-scale changes in seagrass composition and density on the shoals; sparse distributions of smaller seagrasses such as *Halodule wrightii* and *Halophila johnsonii* are extremely difficult to distinguish from bare sand and the visual signature of these areas may be from other associated material (e.g. drift algae, cyanobacteria, snail eggs) caught in the blades.

The 2023 monitoring event, after multiple aerial imaging windows failed to produce usable conditions, was conducted from October 9-11, 2023. The sampling of the shoal was guided by a Trimble R1 handheld DGPS unit, interfacing with an iPad Mini 6 handheld tablet running ESRI Field Maps.

The objectives of the 2023 groundtruthing event were to:

1) Field-verify groundtruthing transects of uncertainty encountered during the aerial image analyses,

2) Collect species and overall percent cover data at designated sampling points, and

3) Obtain adjacent seagrass species data for each position visited.

3.2 Methods

A total of 13 groundtruthing transects were placed during the aerial image analysis (see Figure 2-1), typically to either confirm the edge of a seagrass bed or to evaluate a larger area of uncertainty. These groundtruthing transects were uploaded to ESRI Field Maps. Biologists performed a broad assessment of the bottom type along these transects including seagrass species identification (where applicable). The polyline feature class was then appended on site. In certain instances, point data were also collected along the transects to signal a change in benthic composition (e.g., seagrass presence/absence or seagrass species observed).

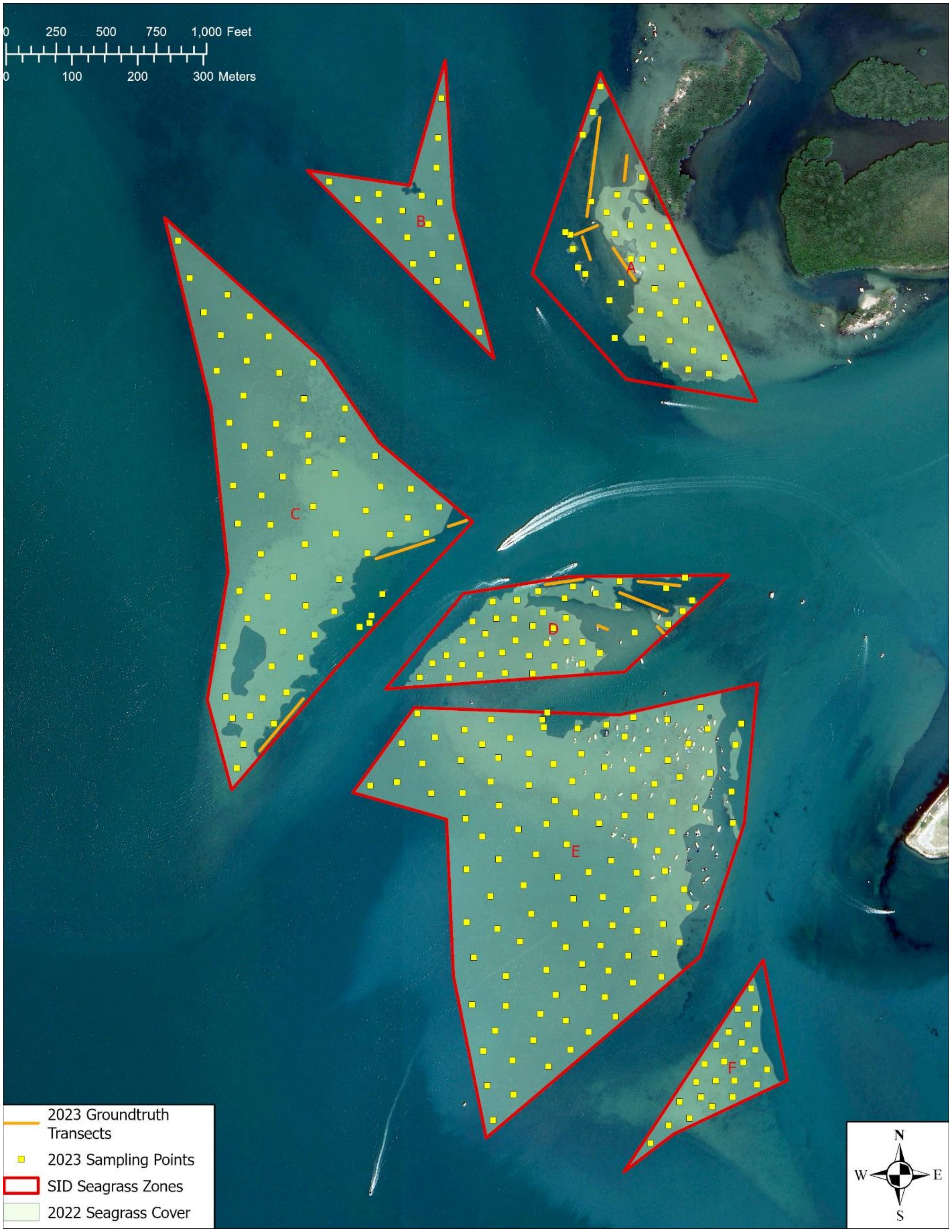
A particular challenge during the post-bloom recovery has been gathering qualitative and quantitative data on seagrass composition on the shoals. In previous years, seagrass species composition (but not density) has been recorded at all GPS point, line, and polygon features collected in the field. The problem is that as part of the groundtruthing process, these locations tend to be concentrated in areas where the visual signature of seagrass is not evident or unclear in aerial images, creating an uneven sampling distribution. Even the addition of random sampling points across the shoals, which were used in the 2020 and 2021 monitoring events, tended to be "washed out" by the number of points recorded when verifying uncertain visual signatures or delineating seagrass beds in the field. As a result, while the previous dataset does provide some useful qualitative data on seagrass species distribution across the shoals, there is little to no quantitative data on seagrass density and the quantitative species abundance data in some years is skewed. Zone A in particular can be difficult to delineate from aerial images and large numbers of groundtruth points tend to be clustered on this shoal.

Seagrass percent cover data (both overall and by species) was collected at 302 sampling points on the shoals, with a roughly even spatial distribution within the field-verified 2022 seagrass polygons and a minimum provision of one quadrat per polygon. Within the sampling points, seagrass coverage would be quantified as a whole and by species within a 1 meter by 1 meter area using Braun-Blanquet scoring (Table 3-1). This allowed for a rapid assessment of total and species-specific seagrass coverage at each point.

In-water visibility during the field effort was consistent at approximately 3-5 ft, with prevailing overcast conditions throughout October 9 and the morning of October 10 (Figure 3-1). Cloud cover cleared in the afternoon of October 10 through October 11. As updated high-resolution aerials were not available, visibility was not conducive to mapping, and the weather forecast for October 12 and 13 was unfavorable for boating operations, a concerted effort was not made to update the edges of the 2022 seagrass polygons aside from collecting seagrass start and stop points along the preset groundtruthing transects.

Table 3-1 – Braun-Blanquet Scoring Definitions

Braun-Blanquet Score	Coverage
0	No seagrass present
0.1	Single shoot present
0.5	2-5 shoots present, < 1% cover
1	> 5 shoots present, < 1% cover
2	5-25% cover
3	25-50% cover
4	50-75% cover
5	75-100% cover



0 250 500 750 1,000 Feet
0 100 200 300 Meters
A
B
C
D
E
F
2023 Groundtruth Transects
2023 Sampling Points
SID Seagrass Zones
2022 Seagrass Cover
N
W
E
S

Figure 3-1 – 2022 seagrass polygons, 2023 quadrat sampling points, and 2023 groundtruth transects.

Figure 3-2 – Field conditions as viewed on the surface from Zone C looking east-northeast on morning of October 9, 2023 (left) and on the bottom of Zone D (right).

3.3 Results

All positions identified during the image analysis and verified in the field to contain seagrass (266 out of 302 sampling points and 5 out of 12 transects), as well as additional seagrass data collected during the groundtruthing event (9 points), were sampled for benthic composition. While in previous years seagrass species composition would be analyzed using the total number of visited features, this approach can skew the dataset. Groundtruthing question points (including points collected as part of the field mapping effort) and transects are more likely to be placed at the edges of seagrass beds, in areas where seagrass cover is sparse, and/or in areas dominated by diminutive species, causing disproportionate oversampling of these areas.

Of the 323 sampling points, groundtruthing transects, and groundtruth points, 280 (86.69%) contained seagrass (Figure 3-3). Species-specific data revealed that ~57.5% of the sites that contained seagrass were monospecific patches of seagrass, including *Halodule wrightii* (53.57%), *Halophila johnsonii* (1.43%), *Syringodium filiforme* (1.07%), and *Halophila decipiens* (1.43%). The remaining ~42.5% consisted of species combinations, including *Halodule wrightii*/*Halophila johnsonii* (the predominant species combination at 23.57%), *Halodule wrightii*/*Halophila decipiens* (4.64%), *Syringodium filiforme*/*Halodule wrightii* (4.29%), *Syringodium filiforme*/*Halodule wrightii*/*Halophila johnsonii* (3.57%), *Syringodium filiforme*/*Halodule wrightii*/*Halophila decipiens* (2.5%), and *Halodule wrightii*/*Halophila johnsonii*/*Halophila decipiens* (2.14%). Overall, *Halodule wrightii* was present in 94.64% of locations containing seagrass, while *Syringodium filiforme* was present in 12.86% and *Halophila johnsonii* in 31.79%. Of note was that *Halophila decipiens*, typically a minor component of the seagrass community on the shoals, was present in 12.14% of locations containing seagrass.

Figure 3-3 depicts the total Braun-Blanquet scores and distributions for all seagrass species across the shoals along with areas of seagrass expansion identified by groundtruth transects. Figures 3-4, 3-5, 3-6, and 3-7 depict the Braun-Blanquet scores and distributions for *Syringodium filiforme*, *Halodule wrightii*, *Halophila johnsonii*, and *Halophila decipiens* respectively. The total average Braun-Blanquet score for all seagrass species across all quadrats was between 2 and 3; scores in Zone B averaged between 3 and 4, scores in Zone E averaged between 2 and 3, and scores in Zones A, C, D, and F averaged around 2 (5 to 25%).

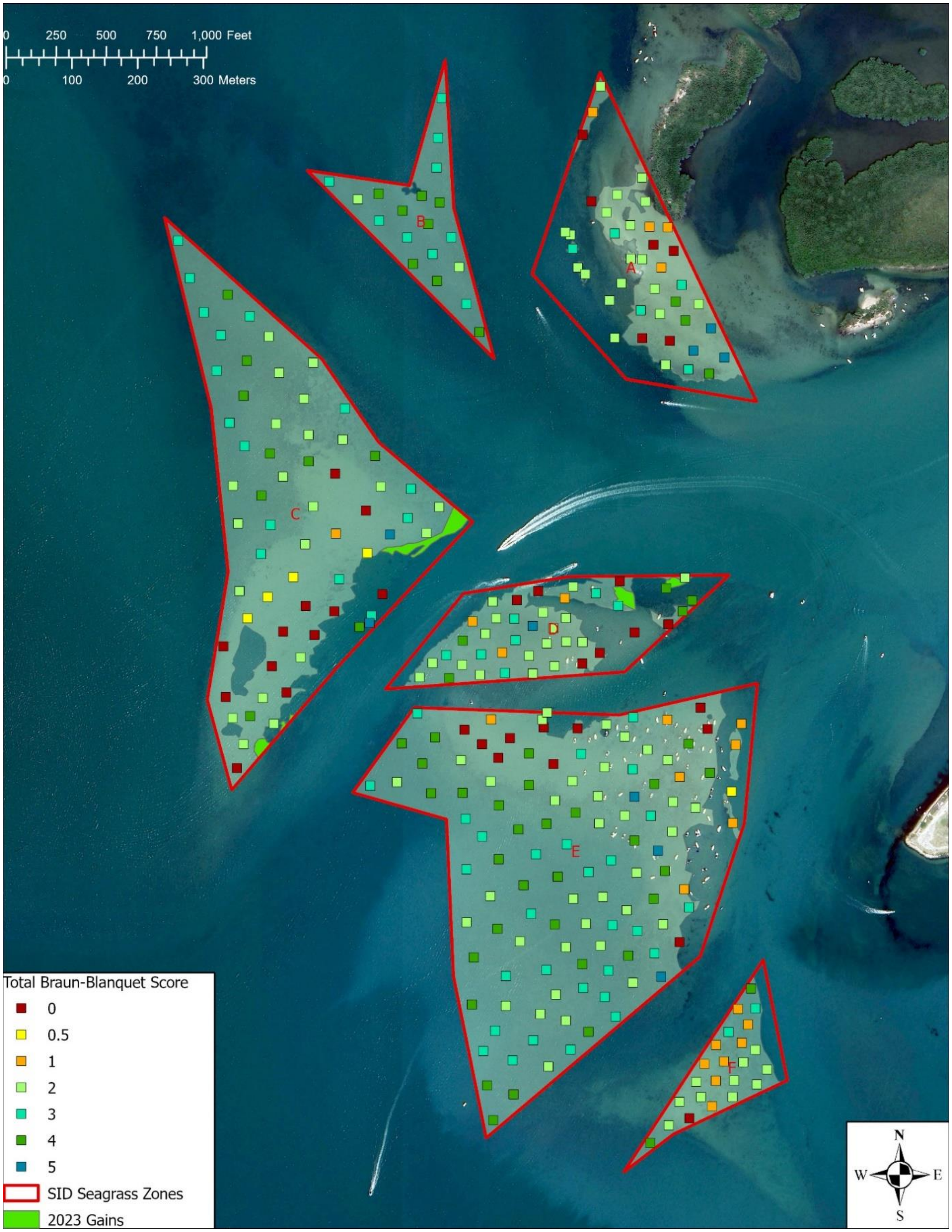


Figure 3-3 – Total Braun-Blanquet scores for all seagrass species with areas of gain identified by groundtruth transects.

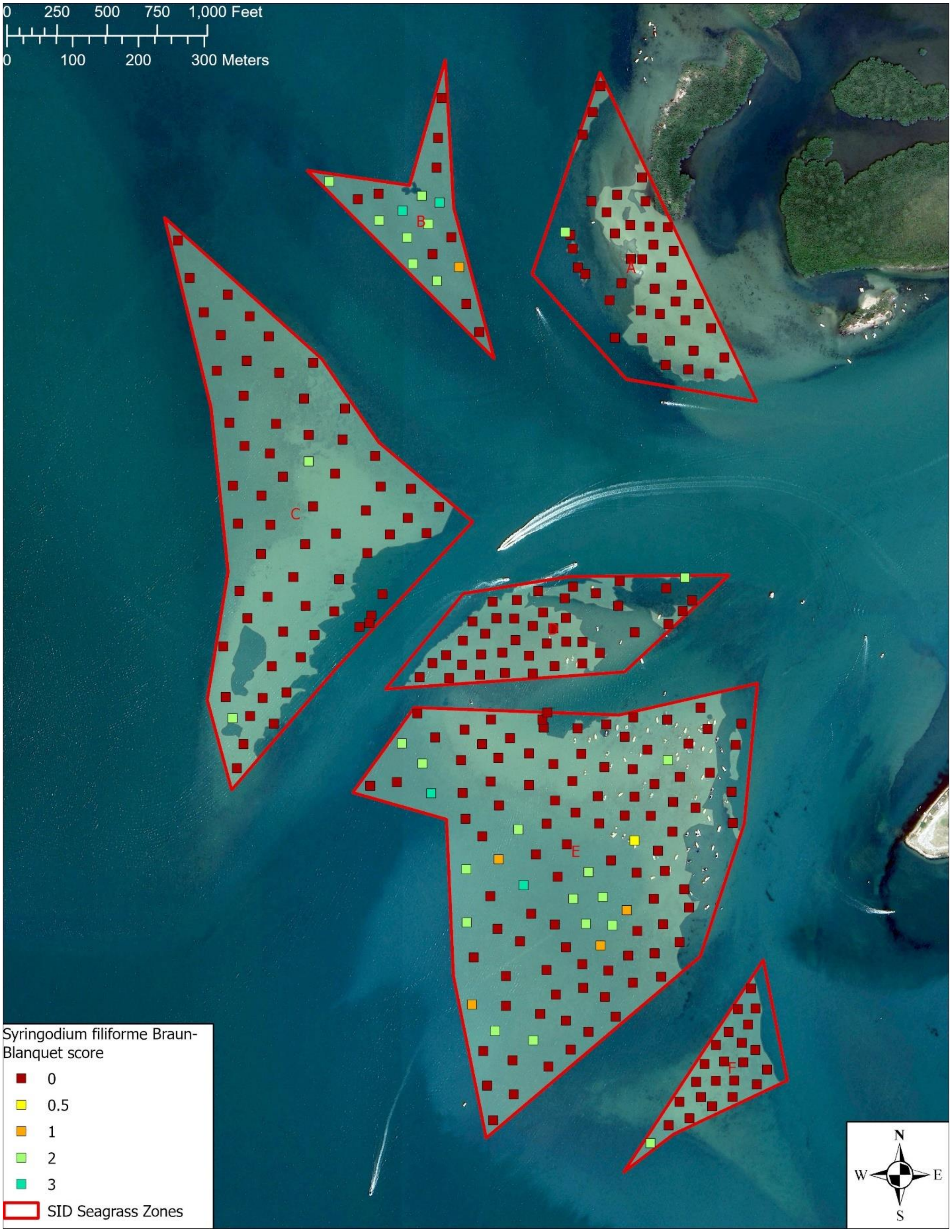


Figure 3-4 – Braun-Blanquet scores for *Syringodium filiforme*.

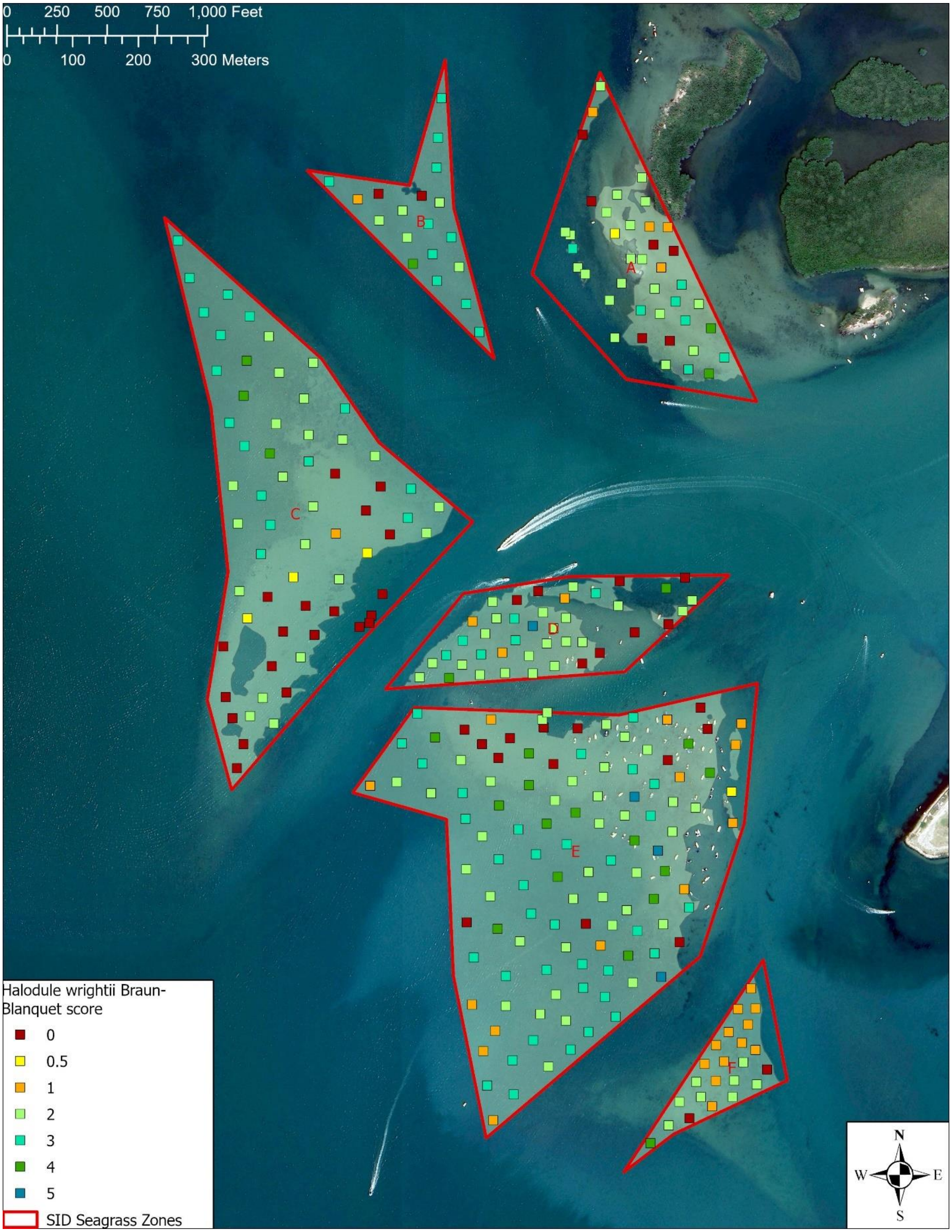


Figure 3-5 – Braun-Blanquet scores for *Halodule wrightii*.

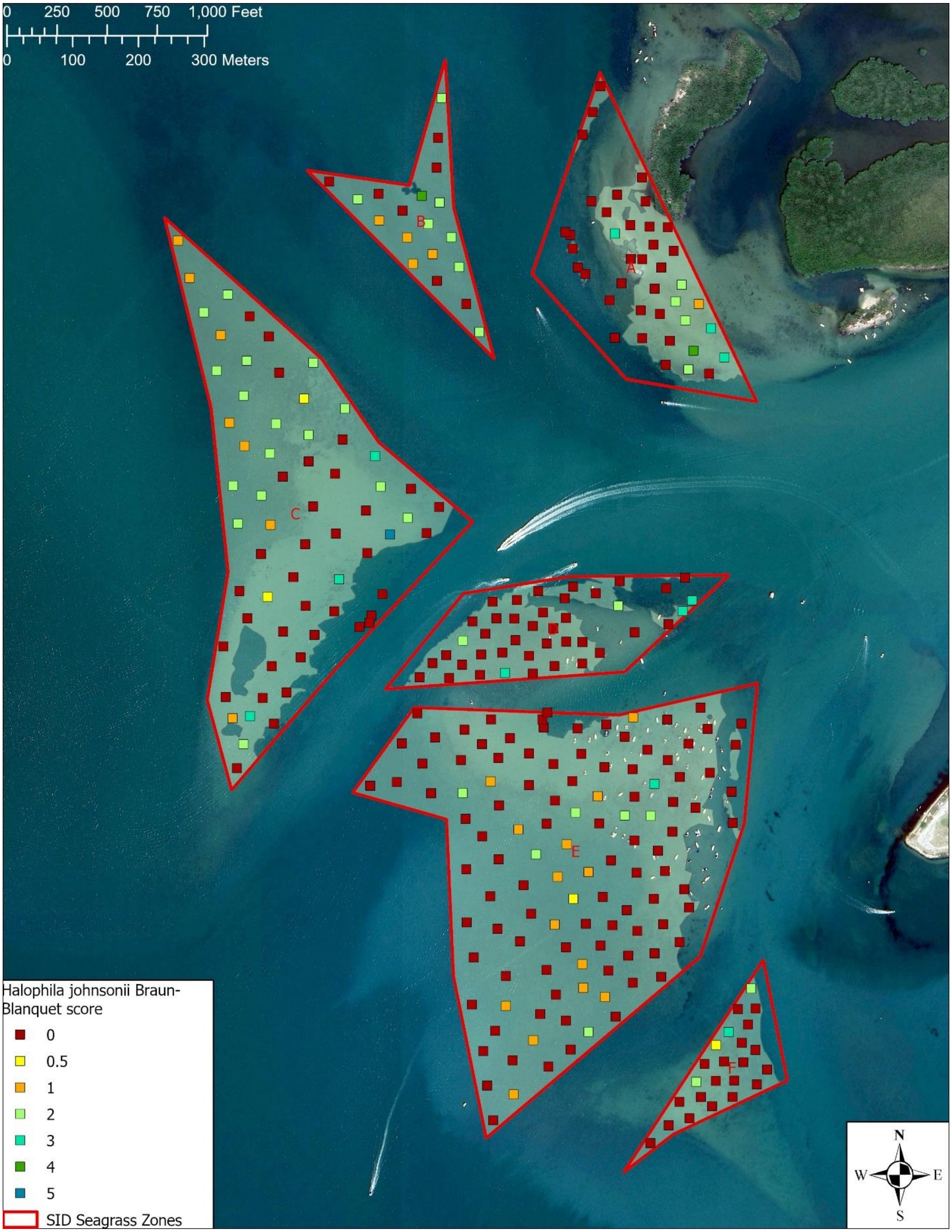


Figure 3-6 – Braun-Blanquet scores for *Halophila johnsonii*.

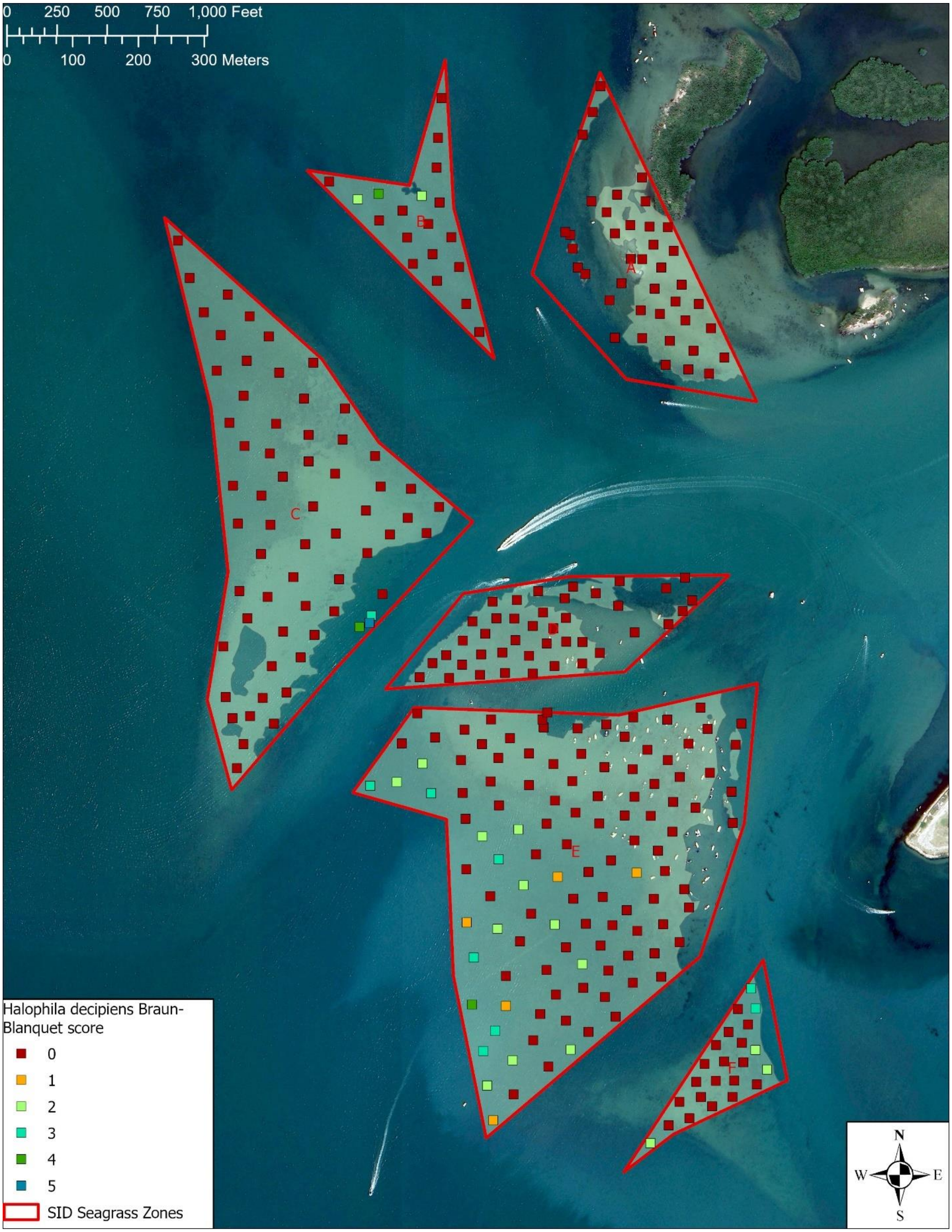


Figure 3-7 – Braun-Blanquet scores for *Halophila decipiens*.

4. Discussion

4.1 2022-2023 Seagrass Data

From 2021 to 2022, Atkins documented a net decrease in seagrass coverage of 6.03 acres across the six marked flood tide shoals (Zones A-F). Almost half of this (2.88 acres) was from Zone D, with another 2.06 acres lost from Zone C, 1.09 acres from Zone E, and 0.86 acres from Zone F. As updated aerials were not available for the 2023 monitoring event and in-water visibility was poor, estimation of seagrass acreage changes from 2022 was not possible to a degree of reasonable confidence. However, the collected quadrat and transect data can be used to infer where advancement and recession of the seagrass bed boundaries has occurred. Clusters of zero-score quadrats indicate possible barren areas in the southern interior of Zone C as well as portions of Zones D and E; however, groundtruthing transects also documented seagrass gains along the southeast channel-facing edge of Zone C and the northeastern end of Zone D, indicating revegetation of some of the 2021-2022 acreage losses.

Seagrass presence by species within sampling quadrats is shown in Figure 4-1. Notably, quadrat data indicates a distinct decrease in *Halophila johnsonii* on the shoals (from being present in 55.86% of quadrats in 2022 to 30.45% in 2023); this is to be expected as Sebastian Inlet is towards the north end of its range and the growing season for the species is considered to end on September 30; areas where *Halophila johnsonii* comprised the primary coverage may have died back by the time of the field effort. Notably, in 2023 1.5% of seagrass quadrats contained monospecific assemblages of *Halophila johnsonii*, compared to 12.6% in 2022.

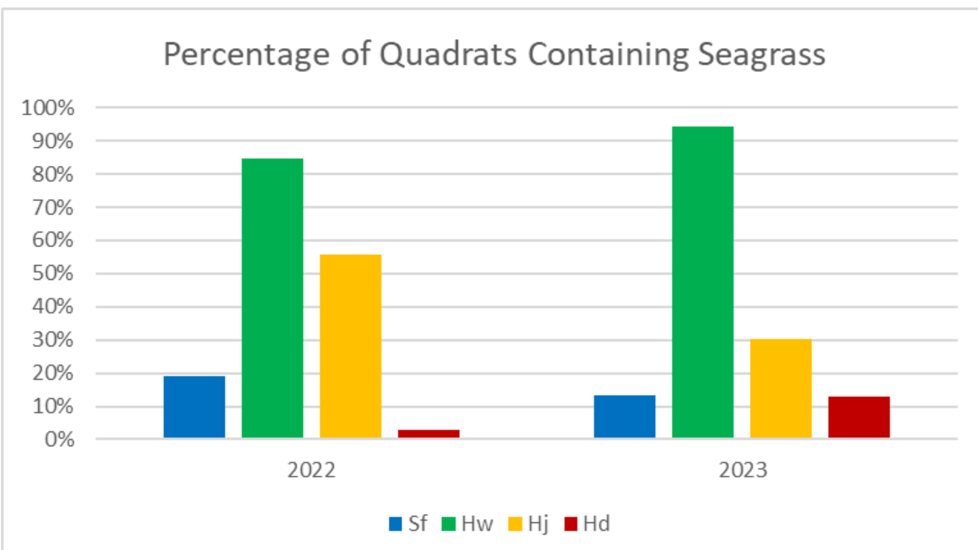


Figure 4-1 – 2022 (n=111) and 2023 (n=266) seagrass abundance within sampling quadrats by species. Sf = *Syringodium filiforme*, Hw = *Halodule wrightii*, Hj = *Halophila johnsonii*, and Hd = *Halophila decipiens*.

While gain/loss analysis of seagrass acreage was not possible, a presence/absence comparison could be done for the 126 sampling quadrat locations carried over from 2022 to 2023. While it should be noted that there is likely some spatial error in the exact square meter of area examined between years (due to potential for variation in GPS location in the field and placement of the quadrat relative to the exact point), this can provide some indication of changes on the shoal. In total, of the 126 quadrat locations sampled in both 2022 and 2023, 10 locations showed presence of seagrass where it had been absent in 2022, 15 locations showed absence of seagrass where it had been present in 2022, and 101 locations had no absolute presence/absence change in seagrass between 2022 and 2023. Half of the gains (5) were in Zone A, with one in Zone B and two each in Zones C and D. The majority of loss locations were in Zones C (7) and E (5), with one in Zone A and two in Zone D. When examining the 15 quadrat locations where seagrass was present in 2022 and absent in 2023, five were quadrats that in 2022 had a Braun-Blanquet score of 3, three each had Braun-Blanquet scores of 2, 1, and 0.5, and one had a Braun-Blanquet score of 0.1 (single shoot of seagrass in quadrat). Seven quadrats were monospecific *Halodule wrightii*, four were monospecific *Halophila johnsonii*, and four contained both *Halodule wrightii* and *Halophila johnsonii* (with three locations having the same individual Braun-Blanquet scores for each species and one with a majority *Halophila johnsonii* score). When looking at average Braun-Blanquet score changes across all 2022-2023 quadrats and all species, there was an overall negative average change in total Braun-Blanquet scores, largely driven by the average negative change in *Halophila johnsonii* Braun-Blanquet scores.

During the summer and early fall of 2023, the observed issues with water column clarity (attributable to stormwater releases and algal blooms north of Sebastian Inlet, the latter reported near Eau Gallie) raised concerns that another seagrass die-off could be triggered. In part, the late (early October) date of the groundtruth phase was aimed at reporting on the full extent of any adverse impacts. Overall, almost 87% of the 302 quadrat sampling locations within the mapped 2022 seagrass polygons contained seagrass. While quadrat data indicates some barren areas have appeared since the summer of 2022, this may be due to seasonal changes in seagrass coverage; furthermore, groundtruth transect data indicates expansion of seagrass in some areas. Therefore, while it seems probable there was some net acreage loss of seagrass between 2022 and 2023 (particularly in Zones C and E), overall change appears to have been limited.

4.2 Long-Term (2010-2023) Changes

The Sebastian Inlet flood tide shoals have undergone a drastic change in seagrass cover over the past decade (Figure 4-2). Prior to 2011, the dominant seagrass species on the shoals were *Syringodium filiforme* (present in approximately 67% of locations visited in 2010) and *Halodule wrightii* (present in approximately 53% of locations visited in 2010). *Halophila johnsonii* was only present in 2% of the seagrass locations sampled in 2010 (PBS&J 2011). Seagrass coverage was estimated at nearly 112 acres; seagrass density was not recorded at the time but both aerial and in situ field photographs show dense, thick grass beds. The following year coverage dropped to approximately 81 acres, with seagrass losses most evident on the west side of Zone C (Atkins 2012). *Syringodium filiforme* continued to be the dominant species, being identified in 89% of locations visited, while *Halodule wrightii* was only present in approximately 18% of locations visited. In 2012 seagrass coverage fell to approximately nine acres, with Zones B and F essentially defoliated, Zones C and D reduced to small patches, and continuous grass pockets in the shallows of Zone A and the northeast tip of Zone E (Atkins 2013). This widespread loss of seagrass is believed to have been the result of a large-scale phytoplankton bloom lasting from early spring to late fall 2011; while the Sebastian Inlet area was less affected than other parts of the IRL, cyanobacteria rafts were observed throughout the shoals during the 2011 field event (Atkins 2012).

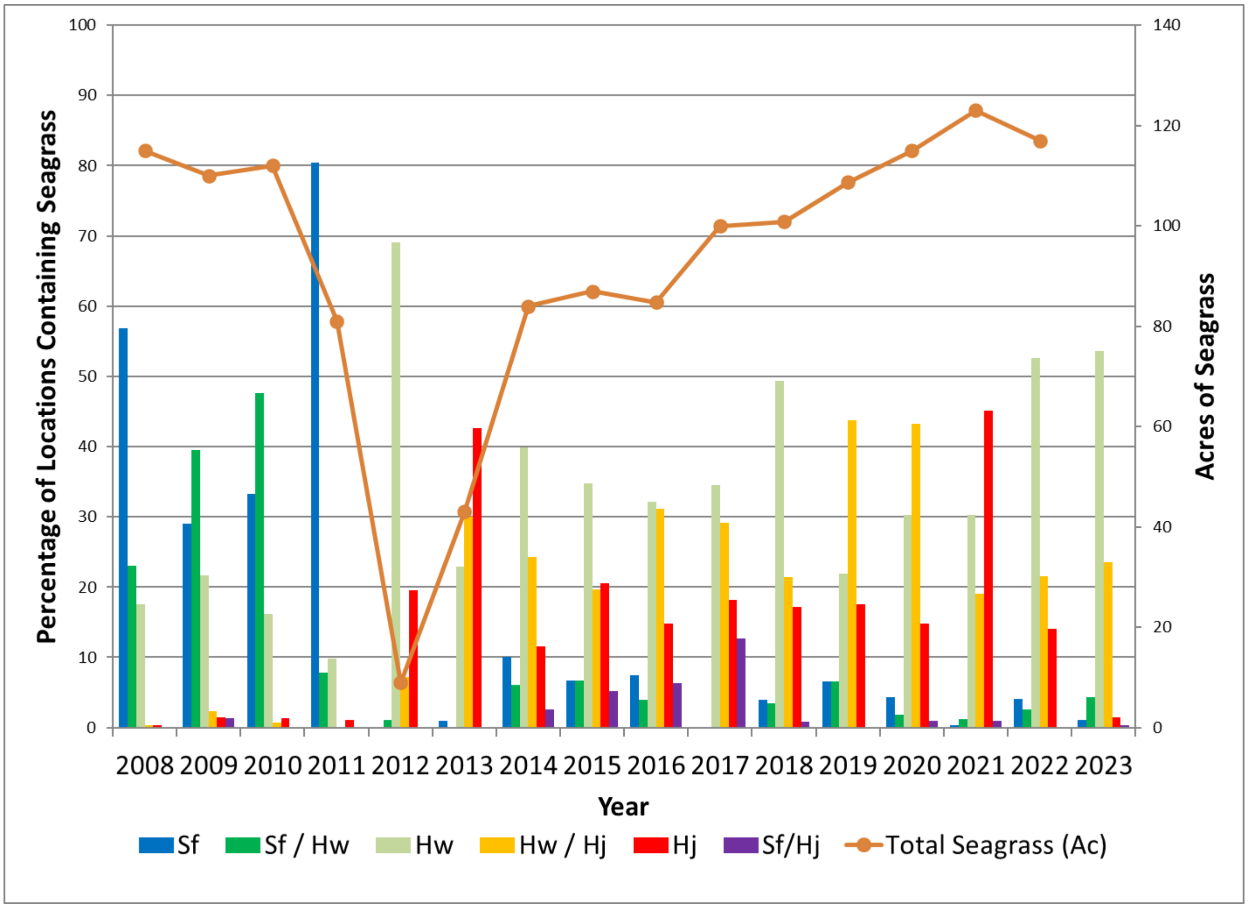


Figure 4-2 – Seagrass abundance by species assemblages, 2008-2023. Sf = *Syringodium filiforme*, Hw = *Halodule wrightii*, Hj = *Halophila johnsonii*, and Hd = *Halophila decipiens*. Total seagrass acreage provided for 2008-2022; 2023 acreage data not obtained.

Despite the widespread loss of seagrass acreage in 2011-2012, in 2013 and 2014 a rapid recovery of seagrass acreage on the shoals occurred, plateauing in 2014-2016 and then continuing a general upward trend from 2016 onwards. The 2021 aerial delineation and groundtruthing survey results indicated that total seagrass coverage across Zones A-F had exceeded the acreage present in 2010 prior to the die-off, with 123 acres of seagrass mapped (Atkins 2022). Since 2012, *Syringodium filiforme* has typically featured in an extremely small percentage of seagrass locations sampled (23% or less, with some years as low as 1-5%). In 2023 *Syringodium filiforme* was found in 35 of 266 (13.16%) sampling quadrats containing seagrass.

As previously noted, seagrass species data collection since 2008 has typically been compiled from groundtruth points and transects, which have the potential to skew sampling towards the edges of seagrass beds and sparsely vegetated areas. This can be seen when comparing Figures 4-1 (compiled from 2022 and 2023 quadrat data only) and 4-3 (compiled from all points sampled); the former figure shows a decrease in the percentage of locations containing *Syringodium filiforme* between 2022 and 2023 while the latter figure appears to show the opposite, due to the inclusion in 2022 of large numbers of mapping points. While analyzing all points is necessary to compare data for all years, going forward from 2022 the quadrat data series will allow for a more consistent year-to-year comparison. This is critical particularly for monitoring changes in the presence of *Syringodium filiforme*, which prior to 2012 was the primary seagrass component on the shoals. While the decrease in percentage of locations containing *Syringodium filiforme* from 2022 to 2023 is notable, this may be an artifact of the decrease in visibility or error margin in quadrat placement and 2024 data will be needed to confirm if this is a trend.

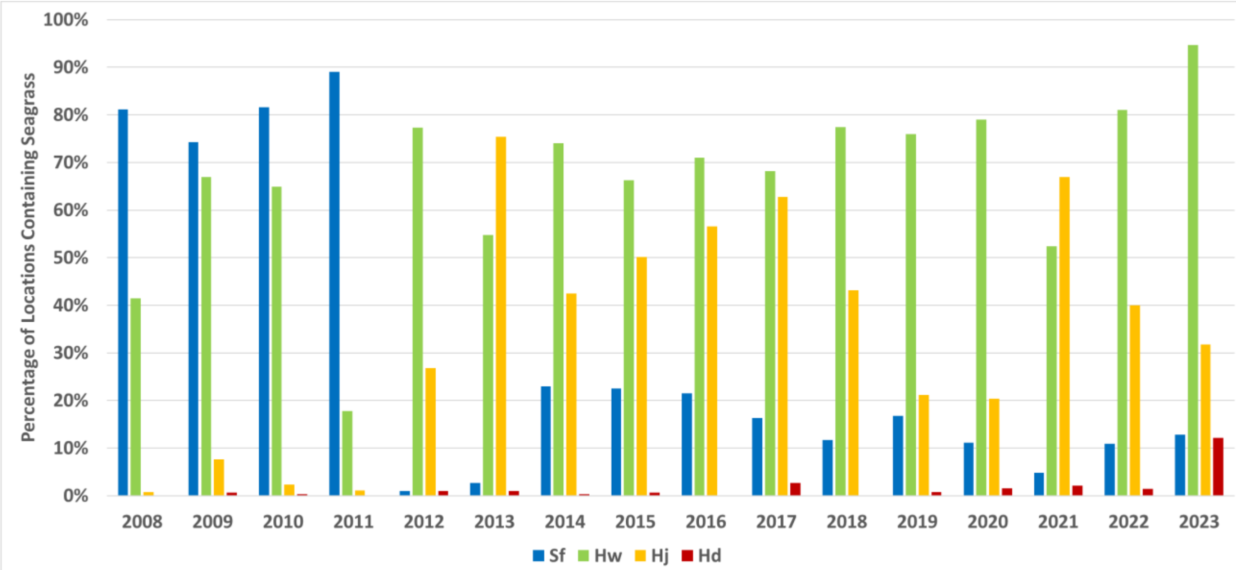


Figure 4-3 – Seagrass abundance by species, 2008-2023. Sf = *Syringodium filiforme*, Hw = *Halodule wrightii*, Hj = *Halophila johnsonii*, and Hd = *Halophila decipiens*.

The changes to seagrass density and species composition since 2011-2012 have likely affected the overall seagrass biomass available on the shoals. *Syringodium filiforme* has cylindrical blades which can grow to approximately 18 inches in length; *Halodule wrightii* and *Halophila johnsonii* both have flat blades that are significantly shorter (~1 inch maximum in the case of *Halophila johnsonii*). As such, while the overall seagrass acreage may have returned to or exceeded pre-2011 totals, the average density (25-50% per the 2022 quadrat sampling data) and reduced coverage of *Syringodium filiforme* likely represents an exponential reduction in seagrass biomass from prior to 2011. This is of particular note since the 2021 declaration of an Unusual Mortality Event (UME) for the Florida manatee population, with 637 manatee deaths recorded statewide in 2020, 1,101 in 2021, and 800 in 2022 (FFWCC 2023). From 2020 to 2022, the largest shares for each year (173 in 2020, 358 in 2021, and 346 in 2022) were recorded in Brevard County waters. While the FFWCC and U.S. Fish and Wildlife Service are still investigating the UME, starvation is currently believed to have been the key driver of this mortality event. During the winter of 2022-2023 FFWCC instituted a pilot program of providing supplemental food to manatees in the northern IRL at the Florida Power and Light power plant; as of December 1, 2023, FFWCC reports that there are "adequate" seagrass foraging resources in Mosquito Lagoon and that there is no indication that manatees in the area are in a poor or compromised condition due to malnutrition. As such, FFWCC is not planning on resuming supplemental feeding in the northern IRL (FFWCC 2023). As of December 8, 2023, the statewide 2023 mortality was 518 individuals, with Brevard County's 47 recorded mortalities being the second highest in the state (after Lee County at 110 recorded).

5. 2024 Shoal and Channel Monitoring

The 2023 shoal monitoring effort demonstrated the importance of obtaining clear aerials and of scheduling the field effort during the summer, which respectively allow for tracking of spatial changes in seagrass coverage and field verification of seagrass coverage during the peak growing season for *Halophila johnsonii* under optimal weather conditions. While these elements were not present for the 2023 monitoring event, the abbreviated groundtruthing using quadrat sampling points and a relatively small number of groundtruth transects provided useful data on the distribution, density, and composition of seagrasses on the shoals. While planning is still in progress for the 2024 monitoring event, provided clear aerial images can be obtained, it may be preferable to continue emphasizing quadrat data collection by carrying over the number and distribution of quadrats from 2023, with some adjustments made based on aerial interpretation. If possible, an attempt will be made to correlate visual signatures on the aerial images with average percent coverage and species assemblages, allowing for a more fine-scale assessment of changes in the quality and diversity of seagrass acreage on the shoals.

The next maintenance dredging of Sebastian Inlet is scheduled for 2025. As such, the 2024 monitoring event will include 46 monitoring transects along the sand trap and channel. Of these, twelve of the channel transects cross into Zones C and D on their respective channel sides (Figure 5-1). In addition to their purpose of documenting the seagrass coverage near the channel limits prior to construction, the seagrass edges and quadrat coverage can be incorporated into the shoal monitoring data.

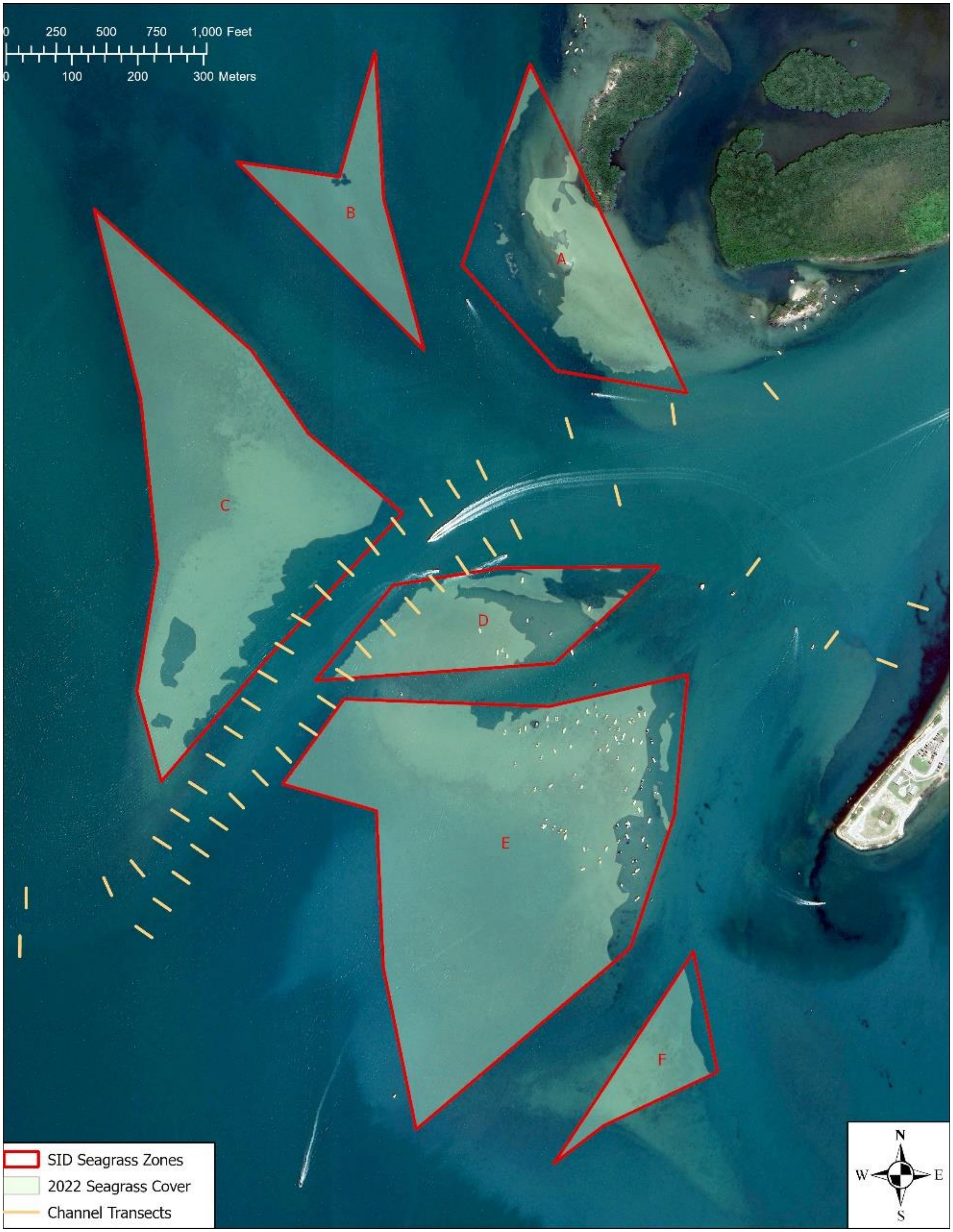


Figure 5-1 – Channel monitoring transects.

APPENDICES

Appendix A. Literature Cited

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