

South Florida/Caribbean Network

National Park Service
Inventory and Monitoring Division



Standard Operating Procedure SEA05

Field Methods—Version 1.1

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Purpose

This standard operating procedure (SOP) describes the procedures for performing a Braun-Blanquet (BB) survey in seagrass habitat. The procedure described is consistent with Dunton et al. (2011); however, the BB cover scores are recorded according to the methods described in Fourqurean et al. (2001).

Revision Log

Revision Date	Author	Changes Made	Reason for Change	New Version #
3/31/2021		Format update	Format update	1.1

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Equipment List

Following is a list of equipment (in addition to standard dive equipment and boat gear) needed to conduct this protocol:

- Dive buoy and GPS with a line and reel assembly
- 4 50 × 50 centimeter (19.7 × 19.7 inches [in]) PVC quadrats with each 10 centimeters (3.9 in) marked with alternating paint (2 per diver)
- 2 underwater still cameras (1 for each diver)
- 2 rulers (1 for each diver); clipboards with metric rulers on the side are acceptable
- Clipboards
- Dive pencils
- Field data sheets
- 2 probing sticks over 1 meter (3.28 feet [ft]) long, marked at the 1 meter (3.28 ft) length.

Procedures

Preparation for Sampling in Addition to Standard Dive Gear and Boat Preparation

1. Prior to sampling, print out data sheets and assemble all gear.
2. Ensure 10 centimeters (3.9 in) markings on PVC quadrats are still readable. Otherwise touch up paint as necessary.
3. Ensure dive buoy and reel assembly are working properly.
4. Ensure the still camera housing o-rings are properly greased per manufacturer's instructions and are watertight.
5. Ensure cameras are functioning properly, batteries are charged and memory cards are empty.
6. Confirm that all divers have undergone training and meet accuracy standards described in SOP SEA06 *Training*—Version 1.1 (SFCN 2022a).

Navigating to Each Sample Site

- Navigate to within 10 meters (3.9 in) of the pre-established random coordinate (latitude, longitude) using a Global Positioning System. The intent is that despite drift, the actual quadrat samples are within 50 meters (164 ft) of the pre-established random coordinate and are within the map polygon.

Placement of BB Quadrats

- Record the site number using the YY### format described in SOP SEA04 *Sample Allocation*—Version 1.1 (SFCN 2022b), diver name, and diver number (normally “1” or “2”) and date/time on the datasheet before diving.
- Site photos: Diver “1” is designated to take site characteristic photos and marks “Y” under “site picture.” Other divers mark “N” in that field.
- Deploy divers with a buoy, reel and attached GPS unit.
- Each diver haphazardly deploys two 0.25 square meter (2.7 square feet [ft²]) quadrats by throwing them at random directions away from the body. No effort is made to toss the quadrats a certain distance or direction (it is a haphazard placement) within the constraint that final quadrat locations must be within 50 meters (164 ft) of the pre-established random coordinate and must be within the seagrass map polygon.
- Each diver follows the two quadrats until they settle to the bottom.
- In the event water visibility is poor, the divers may deploy the quadrats after submerging, when the benthos is clearly visible. This will prevent a diver from losing sight of the quadrat and not being able to find it again.
- If a quadrat lands on hard-bottom the quadrat will be tossed again. If no soft bottom habitat is available at the site, the survey is aborted and an alternate site within the same stratum is selected to replace it.

General Site Survey

- Water depth: record the water depth at the site in feet
- Water temperature: record in °F
- Current: circle the appropriate option
 - None: do not have to fin kick to stay in place
 - Moderate: must frequently fin kick to stay in place
 - Strong: must constantly fin kick to stay in place
- Visibility: Record maximum horizontal visibility distance in meters.
- Photos—the designated diver takes the site pictures; each diver takes field sheet and quadrat pictures as described below (any underwater camera may be used for this purpose):
 - Most cameras have a standard picture or “underwater” setting that is appropriate for all pictures; however, it is important to make sure the automatic flash settings are turned off and that neither the panoramic or close-up settings are being used.

- Diver “1” takes one picture of the data sheet (Figure 1) with the site number and date visible, and one picture in each of four directions to record visual information for the site.
- Each diver takes a picture of the field datasheet (Figure 1) which includes the site number, date and the first quadrat number so the pictures can be associated with that quadrat.
- Each diver takes a picture from directly above the first quadrat being surveyed. All four sides of the quadrat should be included within the photos. Check the zoom setting to ensure the camera is completely “zoomed out.” Move back from the quadrat far enough to capture the entire quadrat as described.
- Repeat steps “c” and “d” for the second quadrat.

Vascular plants: TTEStudinum SFILiforme HWRIghtii HDECiptions HENGelmannii HSTIpulacea RMARitima HJOHnsonii = STOTal												
Calc. Green: HALImeda UDOTea PENIcillus RHIPocephalus ACETabularia NEOMeris CYMOpolia = CGTOTal												
Green: CAULerpa BATOpHora AVRAinvillea DASYcladus Green OTHer (GOTH) = GTOTal												
Red: LAURencia Red OTHer (ROTH) CROther = RTOTal Brown: SARGassum DICTyota Brown OTHer (BOTH) = BTOTal												
Sponges (SPO) Corals (CORALU) Gorgonians (GO) Other (O)												
ABUNDANCE		0.1 = 1 shoot; 0.5 = 2-5 shoots; 1 = 0-5% cover; 2 = 5-25%; 3 = 25-50%; 4 = 50-75%; 5 = 75-100%										
SUBSTRATE TYPE		MUD Sandy-Mud Muddy-Sand SAnd Coarse Shell Halimeda-Hash RuBble Live Coral ROck										
Site #:		Date:		Diver:			Depth (ft):		Temp:		Habitat:	
											USVI: Dense Sparse	
Site picture? Y / N		Time:		Current: None Mod Strong			Vis (ft):				Florida: Cont. Discont. Bare	
Quad #	Sub/Depth	Taxon	Canopy	Cover	# of Q. Conch in 7.5m radius? (write 0 if none)	Quad #	Sub/Depth	Taxon	Canopy	Cover	Notes	
	/						/					
	/						/					
	/						/					
	/						/					
	/				Mostly.... (circle one)		/					
	/				Adult / Juv		/					
	/				Seagrass species @ site (circle)		/					
	/						/					
	/				TTES SFIL		/					
	/				HWRI HDEC		/					
	/				HENG HSTI		/					
	/				RMAR HJOH		/					

Site #:		Date:		Diver:			Depth (ft):		Temp:		Habitat:	
											USVI: Dense Sparse	
Site picture (Y / N)		Time:		Current: None Mod Strong			Vis (ft):				Florida: Cont. Discont. Bare	
Quad #	Sub/Depth	Taxon	Canopy	Cover	# of Q. Conch in 7.5m radius? (write 0 if none)	Quad #	Sub/Depth	Taxon	Canopy	Cover	Notes	
	/						/					
	/						/					
	/						/					
	/						/					
	/				Mostly.... (circle one)		/					
	/				Adult / Juv		/					
	/				Seagrass species @ site (circle)		/					
	/						/					
	/				TTES SFIL		/					
	/				HWRI HDEC		/					
	/				HENG HSTI		/					
	/				RMAR HJOH		/					

Figure 1. Example of a field data sheet.

- Site description: seagrass distribution and seagrass species within 7.5 meter (24.6 ft) radius of reel and buoy
 - Record all seagrass species present on the site by circling species codes
 - Record distribution of seagrass on the site
 - Dense (Virgin Islands): greater than or equal to 50% seagrass cover.
 - Sparse (Virgins Islands): less than 50% seagrass cover.
 - Continuous (Florida): continuous beds of any shoot density habitat with 10% or more cover of seagrass.
 - Discontinuous (Florida): isolated, semi-round patches or elongated areas of seagrass in a matrix of unconsolidated sediment (other soft-bottom) or hard-bottom.
 - Any other information such as blowouts or propeller scars.
- Queen Conch present: only *Lobatus gigas* is recorded
 - Write the number of Queen Conch present within a 7.5 meter (24.6 ft) radius area originating from the reel and buoy (deployed at the site).
 - Circle whether the majority of Queen Conch seen are “Adult” or “Juv” (for juveniles)
- Notes: take note of any relevant and significant site observations such as:
 - Boat propeller scarring
 - Anchor damage
 - Significant unidentified physical damage to seagrass
 - Significant amount of anthropogenic debris
 - Epiphyte presence and type
 - Any other information that the observer may deem relevant

Quadrat Characteristics (Only One Measurement per Quadrat)

- Quadrat number:
 - Enter the respective quadrat numbers
 - Diver “1” performs quadrat “1” and “2”
 - Diver “2” performs quadrat “3” and “4”

- In the event three or more divers perform a survey at the same site, each extra diver enters the consecutive quadrat numbers (Diver “3” performs quadrat “5” and “6”, and so forth)
- Substrate type within the quadrat:
 - Sandy-Mud (SM) = primarily mud with some sand in it
 - Muddy-Sand (MS) = primarily sand with some mud in it
- **Note:** If you pick up a clump in your hand and squeeze and it holds together, it is SM; if it falls apart, it is MS.
 - Mud (MU)
 - Sand (SA)
 - Rock (RO)
 - Live Coral (LC)
 - Halimeda Hash (HH) = sediment primarily composed of dead *Halimeda* sp. oatmeal-like leaf segments
 - Coarse Shell (CS)
 - Rubble (RB)
- Taxon: record the code for each taxon present within the quadrat
- Braun-Blanquet:
 - A quadrat made of PVC plastic tube 0.5 meter (1.6 ft) on a side (0.25 square meter [2.7 ft²]) is used to delineate the area inside the quadrat for each survey. These quadrats are deployed earlier (“Placement of BB quadrats,” above), and sampled at this point.
 - List all seagrass and macroalgae species and “total” seagrass occurring in the quadrat in the “Taxon” box.
 - Record a score based on the cover of each species and “total” score for all seagrass in that quadrat in the respective “Cover” box. Cover, as defined for this purpose, is the fraction of the total quadrat area that is obscured by a particular species when viewed from directly above. Species cover can range between 0 and 5, the maximum BB score (Table 1). At a site, however, the sum of all taxon BB values can be greater than 5, because of the relatively broad cover ranges for each BB value and the fact that seagrass canopies are three dimensional.

- Height of seagrass canopy: record one average measurement for each seagrass taxon ignoring the tallest 20% of the leaves:
 - Canopy height is defined as the average length of the longest blade on each of three or four seagrass shoots, as measured from the substrate to the tip of the leaf.
- Sediment depth within the quadrat:
 - Push the sediment stick into the ground as far as possible. If you encounter resistance, try to push through it. Record in centimeters, rounded to the nearest 5 centimeters (2 in).

Table 1. Braun-Blanquet (BB) cover scores.

Score	Cover
0	Taxon absent from quadrat
0.1	Taxon represented by a solitary shoot
0.5	Taxon represented by a few (2–5) shoots
1	Taxon represented by many (>5) shoots, less than 5% cover
2	Taxon represented by many (>5) shoots, 5–25% cover
3	Taxon represented by many (>5) shoots, 25–50% cover
4	Taxon represented by many (>5) shoots, 50–75% cover
5	Taxon represented by many (>5) shoots, 75–100% cover

It is important to write legibly when recording data; the information will be subject to QA/QC by others who will need to correctly interpret the written data. These raw data are also held as historical records that should be equally legible to future researchers.

- Score the Braun-Blanquet (BB) cover values for each benthic species as described above.
- When recording a taxon and cover score for a “general” alga (BOTH, GOTH, ROTH, CGTO), write the species of the taxon in the “taxon” or “notes” column (ex: BOTH = 1 = Dictyota) (Table 2).
- Totals are taken for seagrass, calcareous green algae, green algae, red algae, and brown algae. The totals are NOT additive, as a quadrat with a PENI of “1” and a HALI of “1” does not necessarily score a GTOT of “2.”

Table 2. Species Codes.

Taxa Group	Scientific Name	Code
Seagrasses	<i>Thalassia testudinum</i>	TTES
	<i>Syringodium filiforme</i>	SFIL
	<i>Halodule wrightii</i>	HWRI
	<i>Halophila decipiens</i>	HDEC
	<i>Halophila engelmannii</i>	HENG
	<i>Halophila stipulacea</i>	HSTI
	<i>Ruppia maritima</i>	RMAR
	<i>Halophila johnsonii</i>	HJOH
	Seagrass total	STOT
Calcareous Green Algae	Halimeda sp.	HALI
	Udotea sp.	UDOT
	Penicillus sp.	PENI
	Rhipocephalus sp.	RHIP
	Acetabularia sp.	ACET
	Neomeris sp.	NEOM
	Cymopolia sp.	CYMO
	Calcareous green total	CGTO
Green Algae	Caulerpa sp.	CAUL
	Batophora sp.	BATO
	Avrainvillea sp.	AVRA
	Dasycladus sp.	DASY
	Green other	GOTH
	Green total	GTOT
Red Algae	Laurencia sp.	LAUR
	Red other	ROTH
	Calcareous red other	CROT
	Red total	RTOT
Brown Algae	Sargassum sp.	SARG

Taxa Group	Scientific Name	Code
	<i>Dictyota</i> sp.	DICT
	Brown other	BOTH
	Brown total	BTOT
Other Taxa	Sponges	SPO
	Corals	CORALU
	Gorgonians	GO
	Other	O

Post-Field Work

All equipment, data sheets and cameras must be rinsed at the end of each field day. Dried datasheets are stored in a data folder until they can be returned to the office and scanned. Each day all photos must be downloaded from camera memory cards. All photos are taken primarily for QA/QC purposes if a review of the quadrat or site characteristics are needed. All files are renamed and stored on the SFCN server under the respective park folder located at Z:\SFCN\Vital_Signs\Seagrass\images as follows:

1. Sampling mission folder naming convention: YYYYMM_PPPP (e.g., 201806_BISC)
2. Individual site subfolder naming convention: PPPP_YY### (e.g., BISC_18131)
3. Individual picture naming convention according to photo type (site characterization or quadrat); where “SC00” is the site characterization slate picture and site pictures are “SC01,” “SC02,” “SC03” and “SC04”; Quadrat slate pictures are “QTS1” through “QTS4,” and quadrat pictures are “QT01” through “QT04”:
 - a. YYYYMM_PPPP_YYSSS_SC0# (e.g., 201806_BISC_18131_SC00)
 - b. YYYYMM_PPPP_YYSSS_QTS# (e.g., 201806_BISC_18131_QTS1)
 - c. YYYYMM_PPPP_YYSSS_QT0# (e.g., 201806_BISC_18131_QT03)

Literature Cited

- Dunton, K., W. Pulich, and T. Mutchler. 2011. A seagrass monitoring program for Texas coastal waters: multiscale integration of landscape features with plant and water quality indicators. Final Report, Contract No. 0627. Coastal Bend Bays & Estuaries Program, Corpus Christi, Texas.
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