

South Florida/Caribbean Network

National Park Service
Inventory and Monitoring Division



Standard Operating Procedure CR12

Conducting Analysis of HD Images—Version 2.1

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Summary

This SOP explains how to display the components/windows necessary for successful image viewing, analysis and data entry. When analyzing dots on images, you will need to open the following three windows:

- Primary screen displaying the HD image in Adobe Photoshop with dots at 100% resolution
- Secondary screen displaying a sliver of the IRMA data entry portal window
- VLC on the second screen playing the movie of the transects you are analyzing, to assist with challenging identifications

The steps listed here are intended to be a guide and not the only way to achieve the desired results.

Revision Log

Revision Date	Author	Changes Made	Reason for Change	New Version #
2002	Jeff Miller, Caroline Rogers	Guide to substrate Identification (in: Miller and Rogers 2002).	Initially this was described in the original Videography protocol Miller and Rogers 2002.	1.00
2005	Jeff Miller	4 Bleaching levels added as comments in analysis.	Previous to the extreme 2005 bleaching event, any bleaching was quantified as labeling a point "BL" in the comments. Once the 2005 event occurred, different levels of bleaching were described with different codes to better describe the range of bleaching that was occurring and the recovery rates.	1.01
2014	Jeff Miller	Formal SOP with detailed pictures of bleaching levels developed.	A formal SOP with pictures was developed to allow better training and consistent identification of the 4 bleaching levels.	1.02
2015	Jeff Miller	SOP written to meet I & M program, organization and format requirements.	Tied to I & M 2.00 version of protocol.	2.0
2020	Jeff Miller	SOP name changed from 12 to CR12. Added steps for the use of IRMA data entry portal.	Renamed according to regional guidance. Updated data entry method.	2.1

Contents

	Page
Equipment or Software needed:.....	4
Procedures.....	4
Identification of Bleaching Levels During Dot Analysis.....	6
Literature Cited	11
Appendix A. Species / Database Codes	12

Equipment or Software needed:

- Desktop computer workstation with two video monitors connected (at least one monitor capable of view HD images)
- Adobe Photoshop (most recent version)
- [NPS IRMA SFCN Coral Reef Monitoring Data Entry Portal](#)
- VLC – movie playing program

Procedures

1. Open Adobe Photoshop.
2. In Windows Explorer, browse to and select the transect images that you are analyzing (project located within “coral_video/video” folder, images located in the site folders within the “coral_video/images” folder). Using the “details” view, sort those images by name such that the highest number image is displayed first and the lowest numbered image name is at the bottom of the list. Press OK to open. This method of selection and sorting opens the images in Adobe Photoshop such that the images are “stacked” with the first image on top of the second, on top of the third, sequentially to the last image.
3. For analysis you want to view the image at 100%. Depending upon your screen size and resolution, the images will open in some fraction of their original size. Adobe Photoshop allows you to have four screen view modes (1) standard, (2) maximized, (3) full, and (4) full with menu bar. Pressing the F key, you can toggle through these modes. Individual analysts will have their preferences; however, the goal is to have 100% image on the screen. A full screen view allows for this however, you can’t see the name of the image and that data is useful to assure the images name matches the database entry window. Other views that allow you to see the name might not show the entire image, without sliding a scroll bar, which will take time. The arrow in the image below (Figure 1) points to the small space by the scroll bar showing a small sliver of the image (where a dot could occur) is not visible.

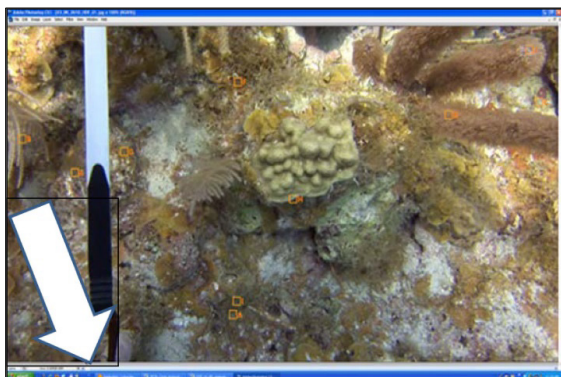


Figure 1. Dotted image displayed on HD monitor.

4. On the secondary monitor, open the IRMA SFCN Coral Reef data entry portal. See SOP CR13 *Coral reef video transect database user's guide—Version 3.0* (SFCN 2025) for details on entering video image data into the database.
5. Reduce the database window to just the narrow amount necessary to see the Point letter, species code, disease, and notes column.
6. Also on the secondary monitor, open the VLC to play the movies of the transect you are analyzing.
7. Adjust the size of the IRMA data entry screen and the VLC movie player such that the analyst has the largest view of the video transect, and enough view of the data entry screen to enter the species code, disease, bleaching and notes, as necessary (Figure 2).

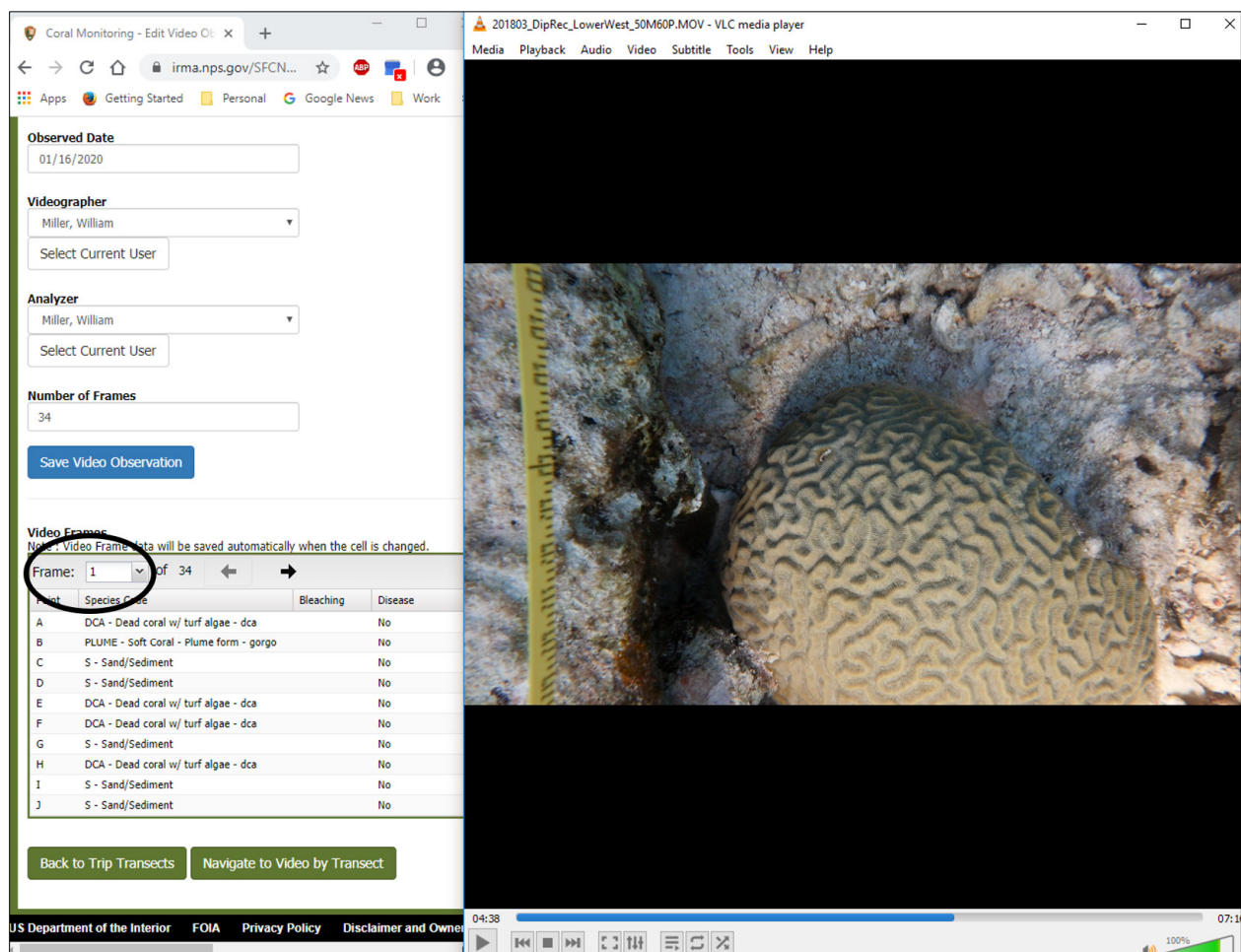


Figure 2. Screen image of IRMA data entry form adjacent to the movie file being displayed in VLC.

8. Verify that the frame number is correct before entering data. The frame number is displayed in the middle of the IRMA database main entry form window (Figure 2, circled).

9. The characters A–J in the point column for each frame in the IRMA database correspond to the 10 “dots” on each captured image. Starting with dot A, enter the corresponding benthic category code in the blank space for point A. If the center of the dot falls on a diseased section of coral, enter DCOR in the space provided under species code, then select the “YES” option for disease in the adjacent cell. If you can identify the name of the disease enter that corresponding code into the next adjacent blank cell in the database form.

See the “Guide to Substrate Identification” (Miller and Rogers, 2002; page 32) for more details, and Appendix A for a key to coral and benthic codes.

10. Continue sequentially with species identification and code entry through “dot” J.
11. Upon completion of the analysis of an image, close the image in Adobe Photoshop (using hot key action or by drop-down menu, file close, don’t save any changes) and the next sequential image is displayed.
12. Enlarge that image to 100%.
13. In the IRMA database, move to the next image by pressing the “Enter” key after entering the species code for point “J.” All this can be done without enlarging the window.
14. Enter the data for the next image, and repeat steps 8–13.
15. Use the video for viewing any points that may be a challenge to identify from the captured image alone. Often the perspective of seeing how the “point” changes as the camera moves enables more accurate identification.
16. Optional information can be entered in the NOTES column within the database entry form. Additional information can be noted about a feature under a dot or any feature in the frame.

Identification of Bleaching Levels During Dot Analysis

The intent is to rank the severity of the loss of zooxanthellae by assigning the bleached coral a “level” based on loss of normal coral color. Bleaching can occur from water that is too warm, too cold or from damage by sedimentation. Since 2000, bleaching events associated with warm water temperatures have become nearly an annual occurrence. Variation in bleaching occurs on a regional level (Florida vs. the Caribbean), smaller spatial scale (within the Virgin Islands), or local level (mangroves vs. fore reef; north shore vs. south shore; deep vs. shallow). When bleaching occurs, variation in the severity exists within locations, sites, depths, and among species. We attempt to capture that variation in severity by assigning a “bleaching level” when a dot appears on a coral that is bleached.

Challenges exist when performing this analysis. The analyst is making a judgment regarding a color change from “normal” (Figure 3). Depending upon their experience, they may not know the normal color for the coral. Furthermore, color varies by and within species, and even within a colony in normal conditions. For example, the dominant coral *Orbicella* can be dark brown, brown, green, or

grey. Even in normal conditions, *Orbicella franksi* may have small white patches (where numbers of zooxanthellae are reduced naturally). The analyst should use their best judgment and consult with other divers to obtain similar evaluation when assigning a bleaching level.

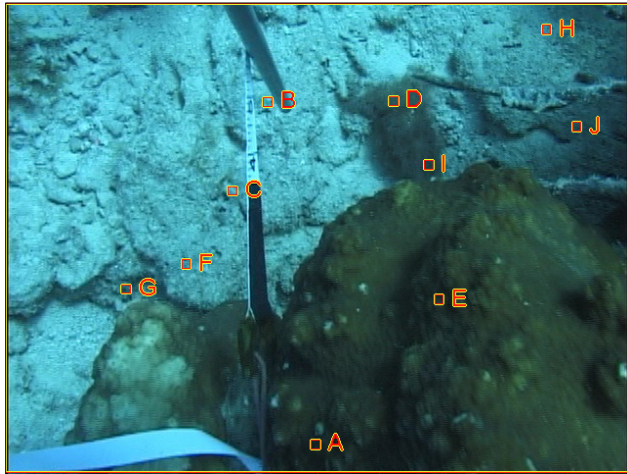


Figure 3. Normal color of *O. franksi*. Dots A and E would not have any bleaching level.

When conducting the dot analysis, when a dot appears on a discolored part of a coral, that is determined to be bleached, the appropriate coral species code is entered as usual. In addition, a bleaching level can be assigned relating to the change in coral from normal color (defined in words and pictures below). This BL# (1–4) is entered into the bleaching column. Recall that as we are making our identification from the exact center of the “dot” (the center of the hollow square for the point count) this bleaching level determination is made based **on that point**, not on the color of the coral tissue on the rest of the colony.

Extreme bleaching (BL1): stark white—this represents the most extreme level of bleaching (Figures 4 and 5)

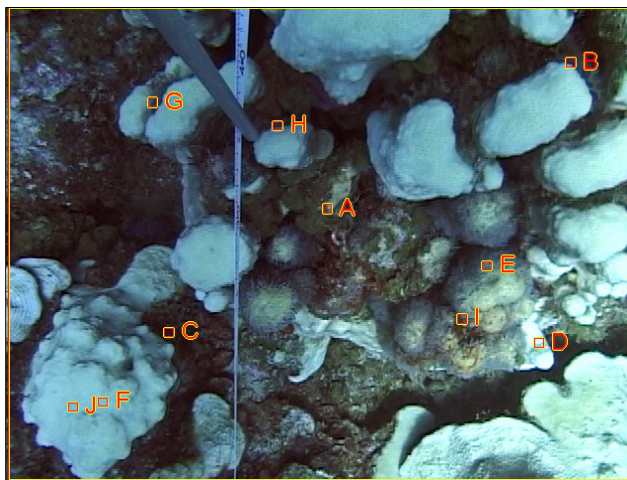


Figure 4. An example of BL1 (dots F and J). Most of the coral in this image is extremely bleached (BL1).

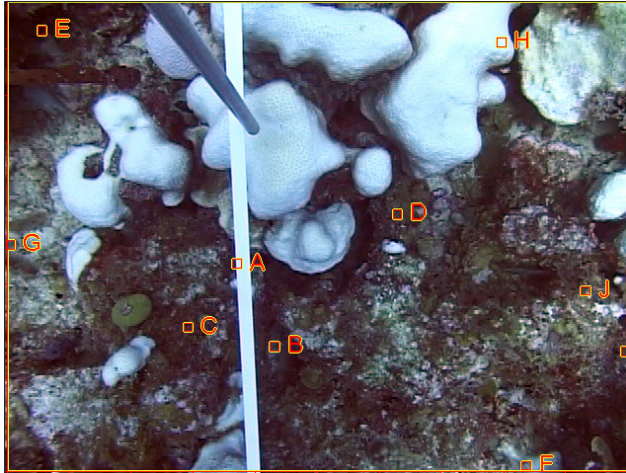


Figure 5. An example of extreme bleaching. Dot H would be categorized as BL1.

Severe bleaching (BL2): very significant loss of color, but some pigment remains. The coral color is nearly white but has some shade of the original color. The corals in this category are much closer to white than to their normal color (Figures 6, 7, and 8).

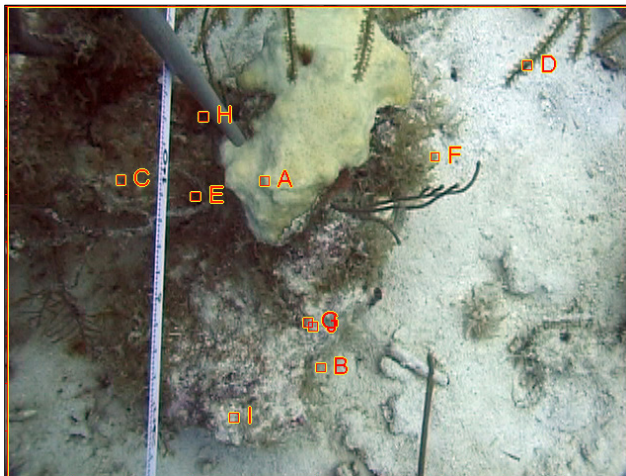


Figure 6. A coral colony showing severe bleaching. Dot A would be noted as BL2.

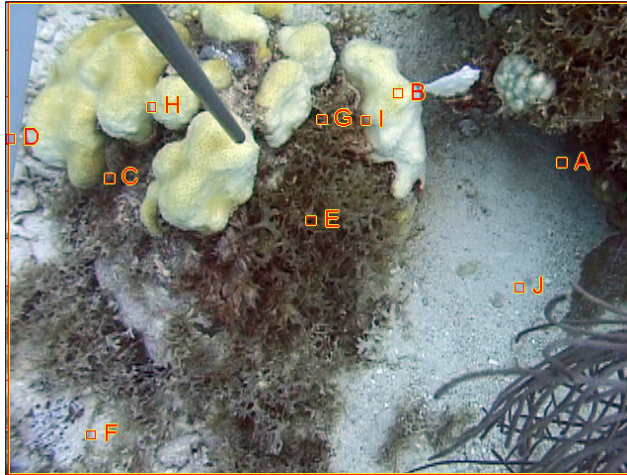


Figure 7. A severely bleached *Orbicella annularis* colony. Points B and H would be classified as BL2.

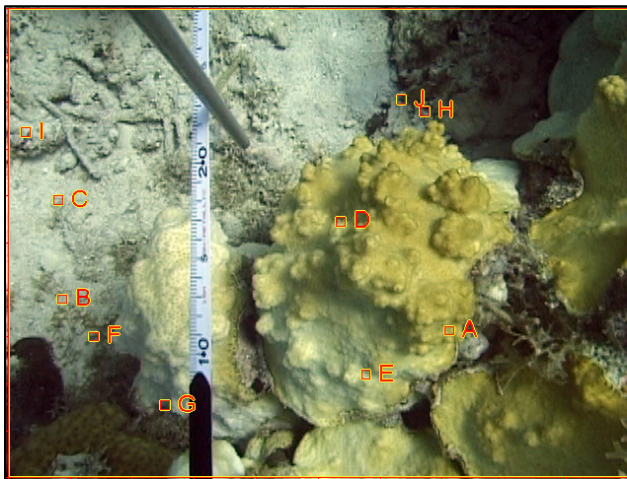


Figure 8. Bleached video capture of *O. franksi*. In this case, Dots A and D would be BL2 as they have very slight shades of the original color. Dot E is likely BL2 but viewing the higher resolution image would help clarify this classification.

Moderate bleaching (BL3): moderate color loss (Figures 9 and 10). With this “middle” bleaching level, it is very difficult for the analyst to determine if the coral is closer to white (BL2) or normal color (BL4). This category falls very much in the middle of that color gradient.

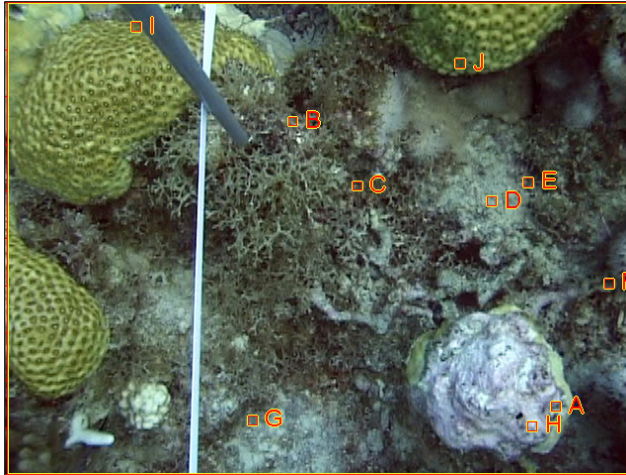


Figure 9. A video image captures of *Montastraea cavernosa* colonies. Dots I and J would be classified as BL3.

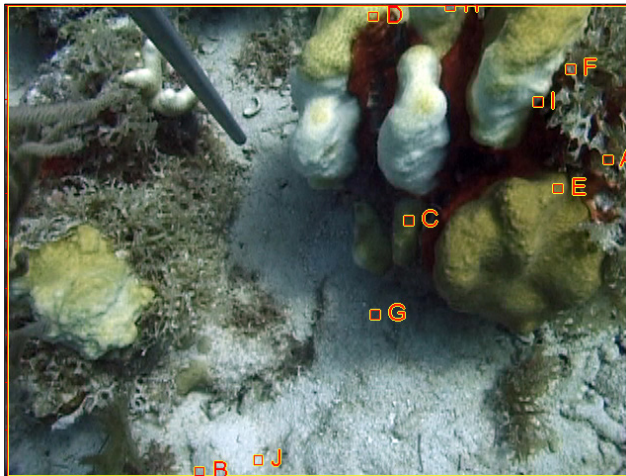


Figure 10. *Orbicella annularis* colony showing multiple bleaching levels. No dot falls on BL1, but they are the white columns. Dot D is BL2. Dot H (partially obscured) is likely BL3, and Dot E is BL4.

Slight bleaching (BL4): slight color loss; most of the original color remains, but the colony is paler than normal. This represents the least severe level of bleaching (Figure 11).

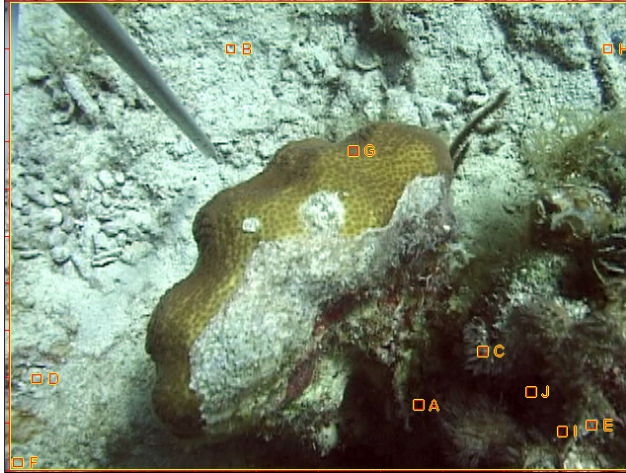


Figure 11. A colony of *O. faveolata* with Dot G exhibiting BL4 coloration.

Literature Cited

Miller, J., and C. Rogers. 2002. Using videography to monitor coral Reefs. U.S. Geological Survey Technical Report. Available at: <https://irma.nps.gov/DataStore/Reference/Profile/2205314> (last accessed April 2025).

South Florida/Caribbean Network (SFCN). 2025. Coral reef video transect database user's guide—Version 3.0. South Florida/Caribbean Network Standard Operating Procedure NPS/SFCN/SOP—CR13. South Florida/Caribbean Network, Palmetto Bay, Florida. Available at: <https://irma.nps.gov/DataStore/Reference/Profile/2309552> (last accessed April 2025).

Appendix A. Species / Database Codes

Table 1. Species / Database Codes.

Species Category	Species Name	Code
General Coral Species	<i>Acropora cervicornis</i>	ACER
	<i>Acropora palmata</i>	APAL
	<i>Acropora prolifera</i>	APRO
	<i>Agaricia</i> spp.	AGAR
	<i>Agaricia fragilis</i>	AFRA
	<i>Agaricia grahamae</i>	AGRA
	<i>Agaricia lamarcki</i>	ALAM
	<i>Agaricia undata</i>	AUND
	<i>Colpophyllia natans</i>	CNAT
	<i>Dendrogyra cylindrus</i>	DCYL
	<i>Dichocoenia stokesii</i>	DSTO
	<i>Diploria labyrinthiformis</i>	DLAB
	<i>Eusmilia fastigiata</i>	EFAS
	<i>Favia fragum</i>	FFRA
	<i>Helioseris cucullata</i>	HCUC
	<i>Isophyllia rigida</i>	IRIG
	<i>Isophyllia sinuosa</i>	ISIN
	<i>Madracis</i> spp.	MADR
	<i>Madracis aurentenra</i>	MAUR
	<i>Madracis decactis</i>	MDEC
	<i>Madracis formosa</i>	MFOR
	<i>Madracis pharensis</i>	MPHA
	<i>Madracis senaria</i>	MSEN
	<i>Manicina areolata</i>	MARE
	<i>Meandrina jacksoni</i>	MJAC
	<i>Meandrina meandrites</i>	MMEA

Species Category	Species Name	Code
	<i>Montastraea cavernosa</i>	MCAV
	<i>Mussa angulosa</i>	MANG
	<i>Mycetophyllia</i> spp.	MYCE
	<i>Mycetophyllia aliciae</i>	MALI
	<i>Mycetophyllia danaana</i>	MDAN
	<i>Mycetophyllia ferox</i>	MFER
	<i>Mycetophyllia lamarckiana</i>	MLAM
	<i>Oculina diffusa</i>	ODIF
	<i>Orbicella</i> spp.	ORBI
	<i>Orbicella annularis</i>	OANN
	<i>Orbicella faveolata</i>	OFAV
	<i>Orbicella franksi</i>	OFRA
	<i>Porites astreoides</i>	PAST
	<i>Porites branching</i> spp.	PORI
	<i>Porites branneri</i>	PBRA
	<i>Porites divaricata</i>	PDIV
	<i>Porites furcata</i>	PURF
	<i>Porites porites</i>	PPOR
	<i>Pseudodiploria</i> spp.	PSEU
	<i>Pseudodiploria clivosa</i>	PCLI
	<i>Pseudodiploria strigosa</i>	PSTR
	<i>Scolymia</i> spp.	SCOL
	<i>Scolymia cubensis</i>	SCUB
	<i>Scolymia lacera</i>	SLAC
	<i>Siderastrea</i> spp.	SIDE
	<i>Siderastrea radians</i>	SRAD
	<i>Siderastrea siderea</i>	SSID
	<i>Solenastrea</i> spp.	SOLE
	<i>Solenastrea bournoni</i>	SBOU

Species Category	Species Name	Code
	<i>Solenastrea hyades</i>	SHYA
	<i>Stephanocoenia intersepta</i>	SINT
	<i>Tubastraea aurea</i>	TAUR
	<i>Undaria</i> spp.	UNDA
	<i>Undaria agaricites</i>	UAGA
	<i>Undaria humilis</i>	UHUM
	<i>Undaria tenuifolia</i>	UTEN
	<i>Antipatharia</i> (Black coral)	ANTI
	<i>Millepora</i> spp.	MILL
	<i>Millepora alcicornis</i>	MALC
Other Coral Codes	<i>Millepora complanata</i>	MCOM
	<i>Millepora squarrosa</i>	MSQU
	<i>Stylaster roseus</i>	SROS
	Unknown coral juvenile spp.	CORJU
	Unknown adult coral spp.	CORALU
Gorgonian Species and Forms	Diseased coral	DCOR
	<i>Briareum asbestinum</i>	BASB
	<i>Encrusting gorgonian</i>	ENGO
	<i>Erythropodium caribaeorum</i>	ECAR
	Plume form	PLUME
	Rod form	ROD
	Sea fan	FAN
	Whip form	WHIP
	All other and unknown gorgonians	GO
Sponge Species and Forms	Ball sponge	BALL
	Barrel/vase sponge	BASP
	Boring sponge	BOSP
	<i>Clionia</i> spp.	CLIO
	Encrusting sponge	ENSP

Species Category	Species Name	Code
Zoanthid Species and Generic Codes	Rope sponge	ROPE
	Tube sponge	TUBE
	All other and unknown sponges	SPO
	<i>Palythoa</i> spp.	PALY
	<i>Zoanthus</i> spp.	ZOAN
	Other zoanthids	ZO
Macroalgal Species, Genus, and Generic Codes	<i>Amphiroa</i> spp.	AMPH
	<i>Cladophora</i> spp.	CLAD
	<i>Cyanobacteria</i>	CYAN
	<i>Dictyota</i> spp.	DICT
	<i>Halimeda</i> spp.	HALI
	<i>Liagora</i> spp.	LIAG
	<i>Lobophora variegata</i>	LVAR
	<i>Microdictyon</i> spp.	MICRO
	<i>Peysonnalia</i> spp.	PEYS
	<i>Sargassum</i> spp.	SARG
	<i>Ramicrosta</i> spp.	RAMI
	Other macroalgae	MACA
	<i>Coralline algae</i>	CALG
	Dead coral with turf algae	DCA
Seagrass Species, Genus, and Generic Codes	<i>Halodule wrightii</i>	HWRI
	<i>Halophila</i> spp.	HALOP
	<i>Halophila stipulacea</i>	HSTI
	<i>Syringodium filiforme</i>	SFIL
	<i>Thalassia testudinum</i>	TTES
	Other seagrass	SEAG
Inorganic substrate components	Boulder	B
	Sand	S
	Rubble	R

Species Category	Species Name	Code
Non-substrate entities	Pavement	P
	Shadow	SHADOW
	Equipment	EQUIP
	Tape	TAPE
	Wand	WAND
	Slate	SLATE
Other live organisms	Anemones	ANEM
	Corallimorpharians	CMOR
	Tunicates	TUN
	Worms	WORM
	Other organisms	O
	Unknown benthic entities	UNK
Coral Diseases	Black band disease	BB
	Stony Coral Tissue Loss Disease	SCTLD
	White band disease	WB
	White Blotch	WBLO
	White Plague	WPL
	White Pox	WPX
	Yellow Band	YB
	Dark Spot	DS
	Dark Spot – Type 1	DS1
	Dark Spot – Type 2	DS2
Coral Bleaching	Dark Spot – Type 4	DS4
	Bleaching Level 1	BL1
	Bleaching Level 2	BL2
	Bleaching Level 3	BL3
	Bleaching Level 4	BL4