

FRRP's Disturbance Response Monitoring Protocol Modifications Meeting Outline and Notes

Meeting Attendees: Chris Bergh (The Nature Conservancy)
Caitlin Lustic (The Nature Conservancy)
Robert Brumbaugh (The Nature Conservancy)
Steven Smith (RSMAS)
Rob van Woesik (Florida Institute of Technology)
Diego Lirman (RSMAS)
Lauri MacLaughlin (NOAA Florida Keys National Marine Sanctuary)
Joanna Walczak (Florida Department of Environmental Protection)
Karen Bohnsack (Florida Department of Environmental Protection)
Kristi Kerrigan (Florida Department of Environmental Protection)
Brian Walker (NOVA Southeastern University)
Sarah Tanner (Miami Dade)
Shay Viehman (NOAA National Marine Fisheries Service)
Jay Grove (NOAA National Marine Fisheries Service)
Jennifer Stein (Florida Fish and Wildlife Research Institute)

Outline of protocol decisions made during the meeting

Survey Methods:

- 1-Stage; 2-Replicate Transects (at each site)
- 1-Roving diver (5-10 minutes) with a list of target species (at each site)

Consistency with NCRMP:

- NCRMP will make an attempt to conduct their coral demographic surveys during the DRM timeframe between August and October.
- NCRMP will consider adding the 'Paling' distinction to their coral condition data collection starting in 2020.
- NCRMP will use similar disease descriptors as the DRM program at a higher distinction level.
- The DRM program will incorporate Habitat Identification and Rugosity measurements to their data collection.

DRM Data Collection:

- Single depth measurement at each transect
- Keep Presence/Absence of *Diadema antillarum*, *Acropora palmata*, *A. cervicornis* and *Dendrogyra cylindricus*.
- Remove '# of Tissue Isolates' data field
- Remove Presence/Absence and condition of *Millipora* sp.
- Separate '% Disease Recent Mortality' from '% Other Recent Mortality' such as predation, abrasion, etc.
- Add disease descriptor terms to identify disease condition for each colony.
- Use condition codes in the 'Conditions' field to standardize what is entered and allow the codes to be queried within the dataset.

ATTACHMENTS:

1. DRAFT DRM Transect Datasheet
2. DRAFT DRM Roving Diver Datasheet

Meeting Notes**DRM Transition Update**

Chris Bergh (TNC) provided an update and thorough explanation of the recent transition of the DRM program coordination from TNC to FWRI. Essentially, DRM will continue to operate in the same fashion it has in the past but with a different organization coordinating, a few changes to the website and data portal to meet FWRI requirements, and the changes made to the monitoring protocol decided upon during the meeting. The latter would have been changed regardless of the transition. All changes to the website and data portal as well as the protocol modifications decided on below will be reviewed thoroughly during the surveyor trainings conducted every summer prior to the start of the DRM surveys.

Sample Design and Survey Methods

- Steven Smith (RSMAS) conducted a review of the sample design utilized by DRM. Steven explained how we randomly sample the grid file and allocate sites within strata. Steven then provided some additional survey methods (listed below) that we could consider.
 - True 2-Stage sample design where we would have two transects that were randomly chose within the site (grid cell). This would essentially be two separate dives.
 - 1-Stage sample design with replicate transects where we survey two transects that are then averaged or pooled across a site.
 - 1-Stage sample design with one transect per site.
- Currently, with the way we conduct the DRM surveys, two transects within visible range of the other diver, we are essentially sampling the same 'area'. It was intended by the sampling design outlined in Steven's paper, that the two transects be **randomly** surveyed within a site (2-Stage) however this method is more time consuming and would require two separate dives.
- After coming to this realization, Steven Smith took past year's data and compared both methods (2-Stage; two separate transects and 1-Stage; replicate (avg.) transects). What he discovered is that since the two transects we were collecting under the 2-stage design were so close in proximity, the results between the two methods were very similar. Therefore, if we want to still survey two transects, we could analyze them as replicates and still maintain comparability with past years data.
- Seven also compared both the above-mentioned methods with a 1-Stage; 1-transect method and discovered that it could also work but would require an increase in the number of sites visited.
- Collectively, the meeting attendants agreed that the reduced amount of time in the water with 1-transect method would not accommodate completing more sites in a day. Also, the members felt that it was important to maintain consistency with past years' two-transect method.

- The final decision for the survey methods was to conduct two replicate transects at each site for a 1-Stage sample design.

Roving Diver

- Joanna Walczak (DEP) voiced the need for qualitative disease information from the DRM surveys. The State of Florida needs to know where disease exists/persists on the reef. Joanna advocated for a roving diver survey with a very simple goal of tallying diseased and healthy corals within a brief 5 to 10-minute survey around the survey area. The survey should be restricted to a list of target species that management is currently interested in.
- Steven Smith expressed caution in collecting information that holds potential bias and could not be quantitatively compared over time. Joanna however, assured the members that the state did not need that level of information and simply understanding where disease was present in the species of concern was all the information she needed at this time.
- The meeting attendants agreed to incorporate a 5-10 minute roving diver into the DRM survey methods and will evaluate the value of the data after the 2018 season.
- Jennifer Stein worked with Joanna Walczak and Karen Bohnsack to develop a target species list for the roving diver surveys. The Roving Diver survey will tally only corals > 10 cm. Divers will identify each species as Single (S), Few (F), Many (M) or Abundant (A) within the 'Healthy', 'Diseased' or '100% Recent Mort' columns. That data will be entered into the online data entry system. Further details on the methods and the data entry process will be reviewed thoroughly during the in-person DRM trainings in late summer.

Issues with Finding Appropriate Habitat

- A persisting issue commonly encountered by DRM surveyors is not finding appropriate reef habitat at assigned sites. Partners are finding that many of their assigned sites fall on seagrass or sand and they are left spending valuable time searching for reef.
- Through discussions with Steven Smith, who continually updates the grid file that we draw samples from, it was decided that one method for alleviating this issue was to overlay the points on aerial imagery and manually move them to visible hardbottom within a 50-m radius (the grid cell). However, if visible hardbottom is greater than 50 m from the original point and a survey is performed, that site is now a new 'strategic site' and may not be within the stratum the original point was intended for. Strategic sites are ok but every attempt should be made to keep the site within 50 m of the original point.
- In addition, we can provide a larger set of secondary sample sites to choose from in the case that the primary site does not fall on coral habitat.
- Jennifer Stein will work on moving points to visible hardbottom prior to releasing those points to partners for the season.

Consistency Between NCRMP and DRM Programs

- The NCRMP program is a reef-wide monitoring program that utilizes the same sample design and grid file as the DRM program. In addition, the NCRMP coral demographic in-water survey

methods are very similar to the DRM program. Shay Viehman and Jay Grove of NOAA's National Marine Fisheries Service participated in the meeting in an attempt to generate consistency between the programs' data collection so that the datasets could be merged making a more thorough and robust reef-wide assessment.

- NRCMP agreed to conduct their benthic surveys during the DRM survey window between August and October the best they could.
- The data fields that need to be incorporated into NCRMP's data collection to generate consistency with DRM are as follows:
 - Differentiation between Paling (P), Partial Bleaching (PB) and Bleaching (BL). Currently, NCRMP only collects PB and BL. Their program decided that identifying paling on a colony was too subjective and was not included in their data collection. The DRM program feels that identifying paling is an important sign of stress.
 - NCRMP requested that a representative of DRM draft an explanation of the need for documenting paling that they could present to their deciding council. Since they are a national reef monitoring program they have to maintain consistency across jurisdictions and small changes are difficult to implement.
 - Jennifer Stein and Chris Bergh will work together to draft an explanation that NCRMP can bring to their decision council. The outcome will be shared with the FRRP Steering Committee and partners as soon as it is decided.
- Currently, NCRMP only documents the presence / absence of disease without any additional descriptors. The DRM program and the State of Florida are requesting that NCRMP add additional disease descriptors to their data collection to better supplement the DRM disease data and better inform reef managers on the state of the disease outbreak.
 - NCRMP has tentatively agreed to differentiate between tissue loss disease and non-tissue loss disease and further identify if a tissue loss rate is Fast (> 1 cm newly bare skeleton) or Slow (< 1 cm newly bare skeleton).
- The data fields that need to be incorporated into DRM's data collection to generate consistency with NCRMP are as follows:
 - Habitat identification: NCRMP has identified four habitat classifications that they would like DRM surveyors to identify at each site. Those habitat classifications are Isolated Reef, Contiguous Reef Spur and Groove, Contiguous Reef Other, and Reef Rubble. This would be a simple circle option at the top of the datasheet. The meeting attendees agreed that this could be incorporated into the data collection.
 - Rugosity measurements: NCRMP requested that DRM surveyors collect a rugosity measurement within every square meter of the transect (10 msmts). Within each square meter of the transect, measure the highest relief hard bottom feature (not including "soft complexity" feature such as branching gorgonians, sponges, and fire corals). Hard bottom features include coral heads, reef structure, rock, and Barrel Sponges (*Xestospongia muta*). The height measurement is the distance between the lowest point and the highest point within each meter of a transect.

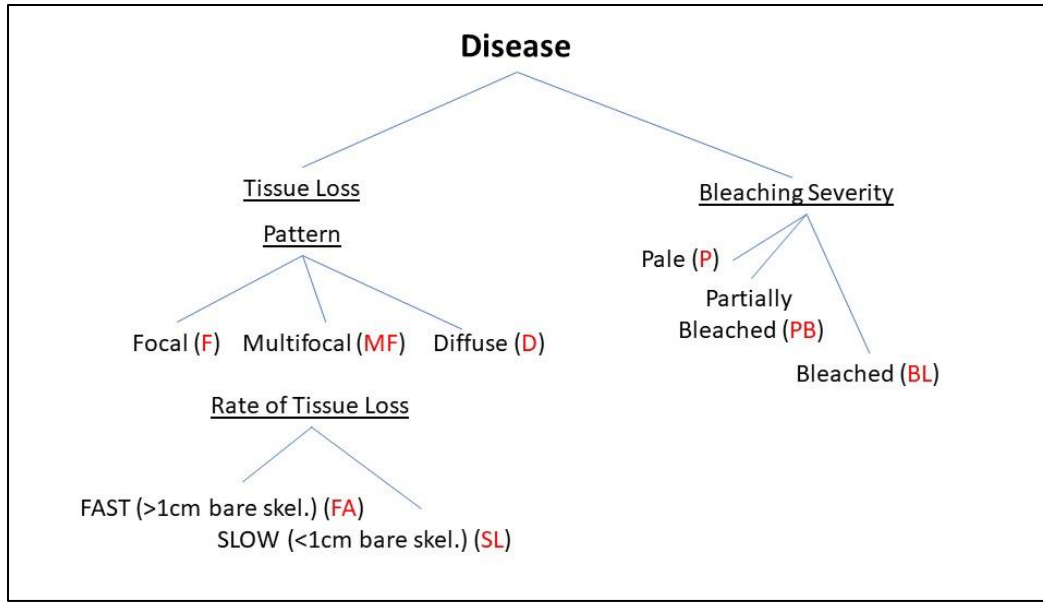
- The meeting attendees agreed on collecting 10 measurements but is contingent upon the trial run of the methods. FWRI performed a trial run of the methods on 4/20/18 and determined that collecting 10 measurements along the transect was manageable and did not take up too much additional time underwater.
- The habitat and rugosity data will aid in refining the grid file and potentially increase the resolution of the grid file over time. This will benefit both the DRM and NCRMP programs.
- The meeting attendees also agreed that collecting one depth measurement at each transect as opposed to two (1 at the beginning and end of each transect) was sufficient.

DRM Data Fields Under Considerations

- It was decided to keep the fields that mark the presence / absence of *Diadema antillarum*, *Acropora cervicornis*, *A. palmata* and *Dendrogyra cylindrus*. The attendees agreed that it was important to keep documenting these important species.
- Collecting the number of tissue isolates per colony was eliminated from the data collection.
- Collecting the abundance and condition of *Millipora* sp. was eliminated from the data collection.
- It was also proposed to eliminate the field '% Old Mortality' and only measure the live tissue of each colony along the transects. It was decided that if the field was eliminated and not measured it would change the metric of the colony data collected during past surveys. Therefore, the field % Old Mortality was kept.

Disease Descriptor Data Fields

- Due to the continued coral disease outbreak, the DRM program, along with other monitoring programs, are working towards documenting disease in a fashion that will aid disease research. By identifying a coral disease by the way it manifests on a coral as opposed to a single disease name, we can better inform those researching the causes and effects it has on coral species.
- The terms agreed upon during the meeting are as follows in the below figure.



- Band was eliminated as a Tissue Loss pattern as it was too similar to a 'Focal' lesion.
- Rate of tissue loss was reduced to two categories: Slow and Fast. The term 'Slow' replaced 'Chronic' defined as < 1cm of recent tissue loss. Both Subacute and Acute were combined and re-termed 'Fast'. Fast is defined as recent tissue loss > 1 cm.
 - Jennifer Stein discussed this with both Greta Aeby and Ester Peters to assure that these 'rate of tissue loss' categories meet the needs of coral disease researchers. Both Greta and Ester agreed that these categories are appropriate for a rapid assessment such as DRM and still provide good information about the rate of tissue loss.
- Describing the tissue loss Margin was eliminated in an effort to keep the DRM survey as a rapid assessment. The attendees decided that detail beyond pattern and rate was better documented by the long-term fate tracking programs such as CREMP and SECREMP.
- Recent mortality was broken into two parts: % Disease Recent Mortality and % Other Recent Mortality. 'Other' refers to non-disease related recent mortality from predation, abrasion, sediment cover, etc.
- Pale, Partial Bleaching and Bleaching were moved into their own column as they have been in the past. Discolored was taken out and added as a selection in the 'Conditions' column.
- All disease descriptor 'Codes' will be written out at the base of the datasheet or somewhere along the margins for surveyors to reference underwater.
- Again, to restate, NCRMP has tentatively agreed to differentiate between tissue loss disease and non-tissue loss disease and further identify if a tissue loss rate is Fast (> 1 cm) or Slow (< 1 cm).
- The revised DRAFT datasheets for both the DRM transect and DRM roving diver surveys are included as attachments to this document. Final versions of the datasheets will be distributed at the DRM in-person trainings and will be posted to the DRM website once it is launched in early summer.

Attachment 1. DRAFT DRM Transect Datasheet

DRM Code:			Surveyor:			Rugosity Msmts: 1. 2.				Presence / Absence:			Habitat: Isolated Reef	
Lat:			Transect: 1 / 2			3. 4. 5. 6.				Diadema			Contiguous Reef Spur and Grv.	
Long:			Shared? Y / N			7. 8. 9. 10				DCYL APAL ACER			Contiguous Reef Other	
Date:			Buddy:			Tissue Loss Disease				Site Depth:			Reef Rubble	
Species Code	Width (cm)	Height (cm)	Bleaching P, PB, BL	% Old Mort	Other % Recent Mort	Disease % Recent Mort	TL Pattern F, MF, D	TL Rate Fast, Slow	Disease Condition(s)	Other Condition(s)	Scientific Name	Sp. Codes		
											<i>Acropora cervicornis</i>	APAL		
											<i>Acropora palmata</i>	ACER		
											<i>Dendogrya cylindrus</i>	DCYL		
											<i>Colpophyllia natans</i>	CNAT		
											<i>Agaricia lamarcki</i>	ALAM		
											<i>Dichocoenia stokesi</i>	DSTO		
											<i>Diploria labyrinthiformis</i>	DLAB		
											<i>Eusmilia fastigiata</i>	EFAS		
											<i>Favia fragum</i>	FFRA		
10											<i>Helioseris cucullata</i>	HCUC		
											<i>Isophyllia spp</i>	ISOP		
											<i>Madracis decactis</i>	MDEC		
											<i>Madracis formosa</i>	MFOR		
											<i>Madracis auretenra</i>	MAUR		
											<i>Manicina areolata</i>	MARE		
											<i>Meandrina meandrites</i>	MMEA		
											<i>Millepora alcicornis</i>	MALC		
											<i>Millepora complanata</i>	MCOM		
											<i>Montastraea cavernosa</i>	MCAV		
20											<i>Mussa angulosa</i>	MANG		
											<i>Mycetophyllia spp</i>	MYCE		
											<i>Oculina sp.</i>	OCUL		
											<i>Orbicella annularis</i>	OANN		
											<i>Orbicella faveolata</i>	OFAV		
											<i>Orbicella franksi</i>	OFRA		
											<i>Porites astreoides</i>	PAST		
											<i>Porites branneri</i>	PBRA		
											<i>Porites divaricata</i>	PDIV		
											<i>Porites furcata</i>	PFUR		
30											<i>Porites porites</i>	PPOR		
											<i>Pseudodiploria clivosa</i>	PCLI		
											<i>Pseudodiploria strigosa</i>	PSTR		
											<i>Scolymia spp.</i>	SCOL		
											<i>Siderastrea radians</i>	SRAD		
											<i>Siderastrea siderea</i>	SSID		
											<i>Solenastrea bourmoni</i>	SBOU		
											<i>Solenastrea hyades</i>	SHYA		
											<i>Stephanocoenia intersepta</i>	SINT		
											<i>Undaria agaricites</i>	UAGA		
40											Unidentified coral	UNHC		
											Other Site Notes:			
50														

Bleaching Severity - Pale (P); Partially Bleached (PB); Bleached (BL)

Tissue Loss Pattern - Focal (F); Multifocal (MF); Diffuse (D)

Tissue Loss Rate - Fast >1 cm bare skel. (FA); Slow <1 cm bare skel. (SL)

Disease Conditions - Unknown Disease (UNK); KNOWN Diseases (WPL, WBD, WPX, RTL, DSD, YB, BB/RB); Discolored (DC) Other Conditions - Predation (PRD); Overgrowth and Interaction (OGI); Abrasion (ABR); Sediment Cover (SC); Clionid sp. (CLN); Mucus (MUC)

Attachment 2. DRAFT DRM Roving Diver Datasheet

	Surveyor:	DRM Code:	Count only those corals > 10 cm	
	Date:	Survey time (min.s):	Single, Few (2-10), Many (11-30), Abundant (>30)	
	Species	Healthy Looking Colonies	Actively Diseased Colonies	100% Recently Dead Colonies
10 cm	<i>Colphophyllia natans</i>			
	<i>Meandrina meandrites</i>			
	<i>Montastrea cavernosa</i>			
	<i>Orbicella faveolata</i>			
	<i>Pseudodiploria strigosa</i>			
	<i>Siderastrea siderea</i>			
	Surveyor:	DRM Code:	Count only those corals > 10 cm	
	Date:	Survey time (min.s):	Single, Few (2-10), Many (11-30), Abundant (>30)	
	Species	Healthy Looking Colonies	Actively Diseased Colonies	100% Recently Dead Colonies
	<i>Colphophyllia natans</i>			
	<i>Meandrina meandrites</i>			
	<i>Montastrea cavernosa</i>			
	<i>Orbicella faveolata</i>			
	<i>Pseudodiploria strigosa</i>			
	<i>Siderastrea siderea</i>			