

FRRP Coral Bleaching In-water Rapid Assessment Protocol 2009

Site Selection

All sites will be predetermined by The Nature Conservancy or University of Miami/RSMAS and GPS coordinates will be assigned to each dive team in advance. The FRRP approach is a probabilistic survey design using randomized 2-stage stratification appropriate for population census and prevalence. The primary sampling unit is a 'site' defined as a 200m x 200m cell and the secondary sampling unit is a 'transect' defined as 1x10 m belt transect. At a minimum the survey design calls for 2 sites per reef 'strata' and two replicate transect per site. More sites are allocated to higher variability strata such as patch reefs. The strata have been developed and refined over the past two years and is based on subregional divisions, cross shelf divisions, habitat type, and bathymetry. This stratification framework continues to be revisited each year and is being iteratively improved to more accurately describe how reef community types are organized.

Each survey site will have a primary and secondary set of GPS coordinates (first attempt to locate coral habitat at the primary coordinates- search an area of 100 m radius around the GPS point. If any suitable (non-soft bottom) habitat is found, drop a float and anchor the boat. If no suitable area is found within the 200x200 m cell, then go to the secondary location (within the same zone) and repeat the procedure. If the secondary site is either too far away or also unsuitable, go to an area known to have hardbottom/reef with THE SAME FRRP ZONE and survey that location- (If the site is not within 200 m of the primary or secondary coordinate, when you log into www.FRRP.org to record the data, it will assign a site number which denotes a strategic location instead of a randomly selected site).

Once at the proper site, it is critical that the exact location of the actual survey (transect locations) be recorded using a GPS. Drop a float at the site based on the numbers and then try and anchor or attach to a mooring ball as close as possible. For 2008, we are also encouraging teams to use a small weighted float to make transect locations less biased- lower or throw two weighted line when you are near the suitable reef survey are. Before doing this, you should adjust the length of the buoy line to be similar to the water depth. Swim down to the weight end of the line and start your transect from that location by laying out the line. When you are done with the benthic survey (2 transects per site), you should record the GPS location of the buoy.

Benthic Survey

1. At each site, record the following information on your UW datasheet before each dive. (We strongly suggest that each team member fills in every category.)

- Name of recorder (use four letter codes- first two initials of first name, first two initials of last name. Example: John Smith= JOSM)
- Date as day with two digits/abbreviation of month/year with two digits;
- Latitude; As determined by dGPS.
- Longitude;As determined by dGPS.
- FRRP site code ID number

- Reef Zone/Habitat (e.g. reef crest, reef front, spur and groove, etc.) (note- if the reef zone/habitat surveyed appears different than predicted, please describe the actual reef zone/habitat following the survey)

2. In Time Start, record the time at which you start the first transect.

Haphazardly lay the 10-m transect line just above the reef surface. Make sure the line is taut.

Note: Be sure to avoid and don't cross the other transect that is being set by a second surveyor. Lines should be at least 5m apart so data from the each transect are not autocorrelated, which can happen if you are too close and features of one transect impact the other (big corals for example). Stay away from the edges of the reef. Also try to avoid areas with abrupt changes in slope, deep grooves, large patches of sand or unconsolidated coral rubble. Swim without looking down at the bottom as you unreel the line.

Each transect can be surveyed in two “passes” of the transect line as follows:

First Pass

| Parameter | Method |
|--------------|---|
| None | Lay out and straighten line. |
| 2006 request | Record presence/absence of any acroporid corals (outside of belt) |

Second Pass

| Parameter | Method |
|---|---|
| Stony Coral Density | ID species all corals \geq 4cm within the 10x 1m belt transect |
| For scleractinian corals record the following | |
| Coral Size | Max. length and height to nearest cm |
| Coral Partial Mortality | % “recently dead” and “old dead” of the total surface area per colony |
| Tissue isolates | Number of isolated tissue fragments on colony. |
| Coral Bleaching | Score any visible bleaching on the colony- use codes ((P-PB,BL) per colony |
| Coral Disease | Identify any coral disease on the colony- use disease codes (BB=black band) |
| Comments | Make a note of any overgrowths, predation, or other sources of recent mortality |
| For hydrocorals (e.g, fire corals) only record the following | |
| Coral Bleaching | Score bleaching by code (P-PB,BL) per colony within the belt transect |

First pass:

3. Swim a belt transect along the 10-m line. Tie the first end of the transect line off to a dead piece of coral, fire coral, gorgonian, or other feature that is not living coral. Once at the end of the

transect (past the 10m mark), pull tightly and securing the line. Note the depth at the start and the end of the transect line (0m and 10m).

Second pass:

4. As you swim from one end of the transect line to the other, assess the cover, size and condition of each stony coral that is 4 cm in length or greater and for which any live or dead part of its skeleton is within 1 m of the transect line. Lay down the 1 m measuring pole perpendicular to the transect for scale. Try to work the same side of a transect line.

a. Identify stony corals to species and record using four letter species codes.

b. For all scleractinian corals measure the x, z dimensions of the colony with the 0.5 m measuring bar (or tape): *i.e.* the maximum diameter (x) of the outward-facing colony surface (perpendicular to the axis of growth) as seen from above in planar view, and the maximum height (z) (parallel to the axis of growth) as seen from the side of the colony. Record these measurements to the nearest cm.

Note: Colony boundaries can be difficult to recognize when parts of the coral have died and are overgrown by other organisms—particularly other colonies of the same species. Look for connected live tissues, connected skeletal deposits above a common base, and at the size and color of separated polyps.

Colonies derived from new recruits:

- 1) *Live tissue, generally concentric with clear edge boundaries. Often have a raised “lip” at edges approximately 1-2 mm above underlying substrate/old dead coral.*
- 2) *Upward growth, branching evident.*
- 3) *Underlying substrate is very old dead.*

Colonies derived from resheeting:

- 1) *Live, often with preferred growth in one direction, edges on at least one side often “merge” with underlying substrate/dead coral.*
- 2) *Live tissue rarely displays upwards growth (branching) except at tips.*

c. Estimate the partial mortality (old and recent) of the whole colony surface. Try to round your percentage to the nearest 5% unless it is very small or very large, in which case try to round to the nearest whole number (e.g., 1%, 97%).

"Old dead" is defined as any non-living parts of the coral in which the corallite structures are either gone or covered over by organisms that are not easily removed (certain algae and invertebrates). If it is entirely “old dead”, indicate this on your data sheet as 100% “old death”, as long as you can identify it to either to the species (e.g., *Acropora palmata* by gross morphology; *Montastraea cavernosa* by polyp size and shape) or to the genus (e.g., *Diploria* by size of meandering ridges and valleys).

Note: In some cases, a coral may be partially or completely overgrown by one of the species of brown, zooxanthellate clionid sponges. If you look closely you will observe the in/ex- current holes of the sponge and sponge tissue instead of live coral polyps. If

you can see the coral skeleton beneath the sponge, and are able to identify it to genus or even species, include the affected area in your estimate of “old death” and note “Cliona overgrowth” in the corresponding Comments box.

"Recently dead" is defined as any non-living parts of the coral in which the corallite structures are either white and still intact or slightly eroded but identifiable to species. Recently dead skeletons may be covered by sediment or a thin layer of turf algae.

Note: How to assess corals that are detached from the substratum:

- i. If it has recently fallen, the length, height and % mortality should be measured as if it were still upright; write “fallen” in comments box.*
- ii. A detached but wedged coral should be marked as “wedged” in the comments section (as it is likely to remain in this position for an extended period). If it has been fallen for long enough to have reoriented to grow upward in its new position, the “new” maximum length and maximum width should be measured, and the new outward-facing surface used for calculating % mortality.*

- e. Scan over the surviving portions of the ENTIRE coral colony for any DISEASES and/or BLEACHED tissues present.
- f. Characterize any DISEASES by the following color categories:

BB = Black band
WB = White band (*Acropora* only)
WS = White patches/white pox/patchy necrosis (*Acropora* only)
WP = White plague
YB = Yellow-band/yellow-blotch
RB = Red band
UK = Unknown

For more information about coral diseases see the disease cards (Bruckner & Bruckner 1998) or one of the following web sites:

<http://www.unep-wcmc.org/marine/coraldis/cd/index.htm>
http://www.coral.noaa.gov/coral_disease/

Characterize any BLEACHED tissues as approximate severity of discoloration:

blank = No bleaching
P = Pale (discoloration of coral tissue)
PB = Partly Bleached (patches of fully bleached or white tissue)
BL = Bleached (tissue is totally white, no zooxanthallae visible)

Many severely bleached corals are translucent, but you can still see the polyp tissues above the skeleton. Bleached tissues should not be included with the “recently dead” estimates.

Note: It is important to be able to differentiate between tissues that are alive but look white because they are bleached and white, recently dead skeletons.

- g. For Milleporid species (*Millepora alcironis* and *Millepora complanata*) that are 4 cm or greater within the belt transect, you only need to record the presence of each colony and the degree of bleaching.
9. You should complete two transects per site. After surveying, either transcribe slates to paper and then enter data to spreadsheet, or enter data into spreadsheet and print out a copy. Enter your data into ww.frrp.org. according to the prompts in the website. Please check your data to verify its accuracy then close the site.