SITE SELECTION PROTOCOL - DRAFT

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J.D. Woodley Photo.

Spatial Terminology:

Operational AREA: An area chosen for the monitoring of a group of target habitats, representative of the Area. (eg Western New Providence, Port Antonio)

Target HABITAT: One of the reef zones chosen for monitoring by CPACC (shallow reef, breaker zone, mixed zone etc)

Monitoring SITE: A place (reef or reefs) at which a target habitat is monitored.

POINT: A survey unit of zero dimensions.

LINE TRANSECT: A survey unit of one dimension.

BELT TRANSECT, QUADRAT: Survey units of two dimensions.

STATION: Location of a permanent transect or quadrat.

A. <u>Operational area</u>

First, decide on the area within which reefs will be monitored.

1. Certain reef types have been selected for long-term monitoring by CPACC Component 5 (windward reef slopes, or more sheltered reefs, such as shallow patches and deeper shelf edges). One or more of these must occur within the operational area.

2. CPACC C5 is about very long-term monitoring of the effects of climate change on coral reefs. Therefore, although it may be inevitable that chosen areas will suffer from some large-scale human influences (eg fishing), existing (and future!) point sources of human disturbance should be avoided.

3. At the same time, logistics will set a limit to the operating distance from a port or field camp. Determine that limit.

4. Find all relevant remotely sensed images (satellite or aerial) or data, charts and maps. Prepare your own map of the operational area.

B. <u>Distribution of coral reefs</u>

Then decide what reef areas are available for monitoring.

1. Determine the distribution of coral reefs (and other habitats) within the operational area. Information can be drawn from the photographs and maps, and from written and oral reports. Oral information should be written down.

2. Plot the distribution of coral reefs (and other major habitats) on your map. With reference to the reefs, indicate emergent features, depth contours and community zonation, if known.

3. CPACC C5 plans to work (eventually) in a number of reef zones (target habitats) to the extent that they are available and important: make sure that they are indicated on your map. We expect to monitor only one or two of the regionally possible target habitats in each Area.

a) Windward reef slopes.

i) Breaker zones, 0-5m depth (if accessible). Of particular interest here is the health of elkhorn coral, *Acropora palmata*, chief architect of important

breakwaters.

ii) Mixed Zone 7-13m depth. This habitat, which is the location of most CARICOMP monitoring Sites, is often dominated by the important frame-builders *Montastraea annularis* and *faveolata*.

Figure 2: Coral reefs at a deapth of 13 - 14m at The Ridge reef, off SW New Providence. J.D. Woodley Photo.

iii) (Not a high priority) The deeper fore-reef at 25-40m, dominated by *Montastraea franksi* and plating *Agaricia* spp.

b) More sheltered reef communities

i) Shallow reefs, 2-10m depth. These may take the form of patch reefs, or fields of aggregated massive corals (such as we saw at Nari Nari and Goulding Cay). They are the equivalent of the Mixed Zone on a windward reef, and are likely to be dominated by *Montastraea annularis* and *faveolata*.

ii) Shelf-edge pinnacle reefs, 12-15m depth, such as The Ridge off SW New Providence.

3. Are there gaps in the picture? If so, plan fieldwork to fill them. This would consist of snorkel swims, manta tows and scuba dives.

4. Manta tows. See descriptions in Rogers et al (1994) and English et al (1997).

C. Selection of reef sites for monitoring

Now decide which reefs shall be monitored. Since the number of Sites will be small, but we shall be generalizing from the data, it is important that each Site is a good representative of the target habitat in question. Moreover, we shall randomly select a number of replicate Sites.

1. Review the reef areas which are candidate Sites for the available Target Habitats. Eliminate any which are clearly unrepresentative, or are not large enough to accomodate enough transects. If we are to select a different random sample of transects on each occasion, there needs to be plenty of space.

2. Make a random choice of three replicates from among that shorter list of Sites.

D. Nature of transects and quadrats

Our monitoring options include:

(1) A number of temporary randomly disposed video belt transects from which we retrieve percent cover by the scoring of random points and, by repeated sampling, time series information at the community and population levels. Limited information on coral population structures could also be obtained.

(2) A (smaller) number of permanent randomly disposed video belt transect stations from which we retrieve percent cover from random points, time series information at the community and population levels, and also try to monitor individual colonies.

(3) A number of small permanent photoquadrat stations (as used by Allan Smith: see Rogers et al (1994), III-33), for better monitoring of individual colonies.

At least for the time being, we propose temporary transects (1) and photo-monitoring of marked coral colonies (3). When the variability of the target habitats is better understood, permanent transects could be selected.

E. **Disposition of transects**

Transects (and photoquadrats) will be disposed randomly within the target habitats at the selected reefs.

i) Length of transects The optimum length will depend on: the point density and number of points per sample (see data analysis); the heterogeneity of the community; the size of the target habitat units; and logistic constraints. Greater length reduces between transect variability. Previous standards have been 10m (chains, with high information density), 20m, 25m or more. For CPACC, we have chosen 20m.

ii) Number of transects This depends on the length of the transects; the heterogeneity of the community; the desired level of statistical rigour; and logistic constraints. Adequacy is commonly tested by coral species discovery curves. Better is the calculation of successive standard errors (Bros & Cowell, 1987). Meanwhile, we have chosen 20. With three replicate sites, that is a lot, but we will be repaid in the ability to compare different Areas, and to detect changes.

iii) Orientation of transects If there is an obvious slope, the orientation of the transects will generally be parallel to the local depth contour. If the slope is gentle or absent, orientation is less important.

iv) Spacing of transects Transects should be spaced out within or between target habitat areas, so that they are as `independent' as possible, depending on logistic constraints. They should be at least 10m apart.

v) Location of transects Temporary random transects do not, of course, have to be permanently marked, nor precisely linear. These are great advantages, since they enable the rapid survey of many transects. While they could be chosen haphazardly, especially if they are in separate target habitat areas, it is better to devise a simple system for selecting random positions, different on each occasion, as follows.

1. If transects are to have a mean spacing about 30m apart, 20 will occupy an area of at least 22,500m^2 (150m square).

2. Superimpose a rectangular grid of at least that size on a map of the target habitat, defined by reef or zone boundaries. If it has to be shorter than 150m in one dimension, maintain the same area by extending the other dimension.

3. Create random percentages by selecting the last two digits of successive telephone numbers from a haphazardly chosen page of a telephone directory. These will be percentage distances along the two dimensions of the grid.

4. Each successive pair of percentages represents the XY co-ordinates of a transect starting point. If one falls within 10m of an earlier point, discard it, and select another.

5. Before each dive, choose a starting point. Plot the bearing and distance of the first transect from that point, and then successive bearings and distances for the next four transects (sufficient for one dive).

6. On arrival at the starting point, use an underwater compass and a tape measure (or count fin kicks) to locate the first transect. And so on. If you arrive in a sand chute, proceed to the nearest reef boundary to lay the transect. Return to the sand chute to plot your course to the next location.

F. <u>**Coral population data**</u>

The video records can also be used to collect data on (a) health, and (b) population size structure of coral species. These could be done simultaneously, but we have not yet worked out the details.

G. Backup method

If the camera is not available, the backup method will be Point Intercept Transects (PIT).

H. Other data

Sea-urchin counts will be made in a 1m-wide belt along each transect.

In a separate C5 study, we will investigate the health of economically important reef breakwaters (even where they are obviously impacted by human disturbance).

Figure 3: Diseased M. Cavernosa colony adjacent to a monitoring transect. J.D. Woodley Photo.