

Topographic Complexity Survey Protocol for the U.S. Caribbean and Flower Garden Banks National Marine Sanctuary

National Coral Reef Monitoring Program (NCRMP)
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Introduction

The National Coral Reef Monitoring Program (NCRMP) provides a biennial ecological characterization at a broad spatial scale of general reef condition for reef fishes, corals and benthic habitat (*i.e.*, fish species composition/density/size, benthic cover, and coral density/size/condition). Data collection occurs at stratified random sites where the sampling domain for each region (*e.g.*, Puerto Rico, U.S. Virgin Islands, Flower Garden Banks National Marine Sanctuary [FGBNMS]) is partitioned by habitat type and depth, sub-regional location (*e.g.*, along-shelf position) and management zone. NCRMP will provide broader geographic context to supplement local monitoring efforts and studies of tropical reef ecosystems.

The following protocol pertains to NCRMP topographic complexity surveys conducted in conjunction with reef fish surveys using a 25m x 4m belt transects (Refer to *Belt Transect Fish Survey Protocol for the U.S. Caribbean and Flower Garden Banks National Marine Sanctuary*; Appendix I).

Goal of Topographic Complexity Surveys

The purpose of this survey is to provide information on the topographic complexity (substratum rugosity) of survey locations where reef fish surveys and line point-intercept (LPI) and coral demographic surveys are conducted. The data collection procedure described below captures basic information on the depth range, vertical relief, and surface topography.

Characterization of topographic complexity along a 25m fish transect (Appendix I):

1. *Slope* - Minimum and maximum depth along each 25m transect;
2. *Vertical relief* - Amplitude of substratum relief, recorded as the maximum vertical relief in a 25m x 4m belt transect; and
3. *Surface area topography* - An estimate of the relative proportion of different relief categories for the sample unit (*i.e.*, 100m² belt transect), using six different categories ranging from <0.2m to >2m.

Topographic Complexity Survey Protocols

Minimum/maximum depth and maximum vertical relief measurements are made within the entirety of the 25m x 4m transect. The 24 relief frequency measurements occur along **BOTH** transect sides (starting at meter 24 and 2m out on each transect side).

Data are collected on the following (Appendix II):

1. *Substratum slope* – Using a digital depth gauge, record the maximum and minimum depth of the substratum encountered within the 25m x 4m belt transect (recorded in feet). This information provides the depth range of the sample unit, as well as the potential variability of the substratum in certain habitats such as spur and groove.
2. *Maximum vertical relief* – Using a digital depth gauge or a 0.5 or 1m measuring device, record the maximum vertical relief present in the 25m x 4m belt transect area (recorded in centimeters).
 - a. This is accomplished by measuring the height of the most structurally complex feature in the sample unit, whether a coral head, barrel sponge, side of a coralline spur, or other topographic feature.

Note that gorgonians, branching sponges, and branching *Millepora alcicornis* colonies are NOT included in this measurement.

3. *Surface area topography (relief frequency)* – An estimate of the surface topography of the sample unit (*i.e.*, 25m x 4m fish belt transect) can be accomplished in many ways.
 - a. In locations where a 25m x 4m belt transect is used to sample fishes, the entire transect cannot be easily viewed all at once. Therefore, one approach is to subdivide the 100m² area into smaller subplots (*e.g.*, 2m x 2m areas, n=24 per sample unit in this example), with each subplot scored for the highest hard-bottom relief feature (Figure 1).
 - b. Each 2m x 2m sub-plot is scored for vertical relief using one of the following six categories: <20cm, 20–<50cm, 50–<100cm, 100–<150cm, 150–<200cm and 200cm (Appendix II).
 - c. Looking within each individual sub-plot, measure the highest relief feature (not including “soft complexity” features such as branching gorgonians, sponges, and fire corals) and place a mark in the appropriate relief category on the datasheet.
 - d. Estimate the relative area of the entire sampling unit represented by the six relief categories shown in section 3b.

Example data along a 25m x 4m belt transect, subdivided into 2m x 2m subplots (for ease of sampling; 24 marks recorded on the underwater datasheet)

<u>Category</u>		<u>Frequency (# of 2m x 2m units)</u>	
<20 cm	5	100–<150 cm	2
20–<50 cm	6	150–<200 cm	2
<u>50–<100 cm</u>	<u>10</u>	<u>200 cm+</u>	<u>0</u>
			24

In this example, an estimated 20% of the sample unit had <20cm of relief, 24% had 20–50cm of relief, and so on.

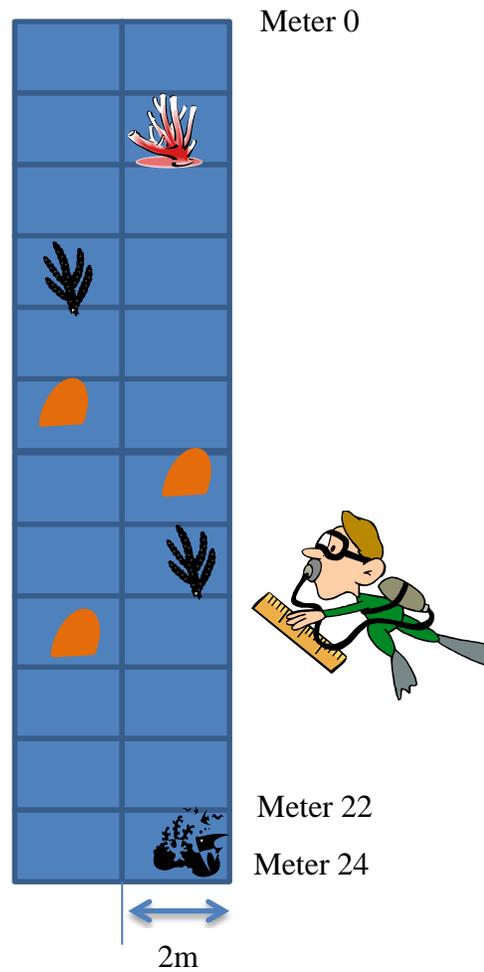
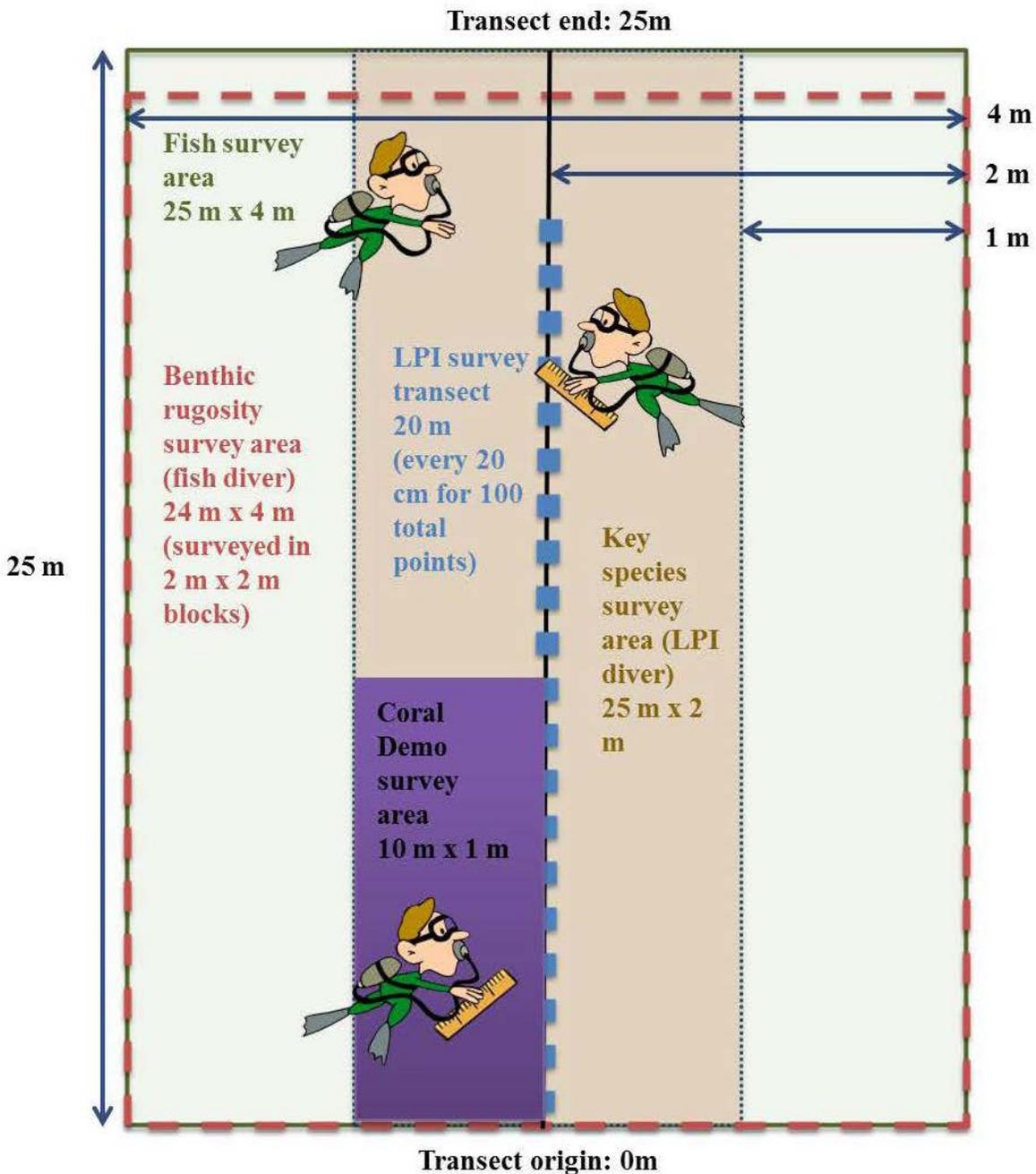


Figure 1. Example of the 2m x 2m grids for measuring topographic complexity along a 25-m x 4-m belt transect survey area for reef fishes in the U.S. Virgin Islands, Flower Garden Banks and Puerto Rico.

Appendix I.

Diagram of all surveys

Diagram of all surveys indicating size of each respective survey area. Fish, LPI, and Coral Demographics will be surveyed as the divers move out away from the transect origin. Other invertebrates (e.g., spiny lobster, queen conch, long-spined sea urchins) and topographic complexity will be surveyed as the divers return to the transect origin.



Appendix II.

Template of datasheet used for fish and topographic complexity methodologies.

Fish Census Datasheet

Fish Diver	Site ID	DEMO Diver 2	Heading		Reason (circle)			
LPI Diver	Date	Checked by	Orig.		Depth Current HB Rule			
Demo Diver	Time	Entered by	Alt.					
Fish ID	<5	5-10	10-15	15-20	20-25	25-30	30-35	>35
1								
2								
3								
4								
5								
6								
7								
8								
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Topography: 25 x 4m		Rugosity: 24 x 4m (bin by 2m x 2m)						
Min depth (ft)		<20 cm		100 - <150 cm				
Max depth (ft)		20 - <50 cm		150 - <200 cm				
Max Vert Ht (cm)		50 - <100 cm		200+ cm				