

DETAILED REEF MONITORING METHODS

Banyan Tree Marine Labs



BANYAN TREE
GLOBAL FOUNDATION

BANYAN TREE LONG MONITORING PROGRAM

As a socially responsible business, Banyan Tree was established with the core value of sustainable development. Banyan Tree's monitoring programs contribute to the sustainable use and development of its properties, by setting baselines and detecting changes in the ecosystem and environment.

Conservation of the environment relies on knowledge of which resources are present, how much, and how they change in space and time. Thus the methods described herein have been selected as simple measures of organism abundance and diversity as common measures of habitat quality. These methods are commonly employed and have been selected for their ease of collection and interpretation and to maximise comparability with other monitoring data globally.



METHODS

Once per year in October, benthic composition, structural complexity and select fish and invertebrate communities are surveyed on 20 x 5m fixed transects. House reefs of Angsana Ihuru and Banyan Tree Vabbinfaru and Angsana Velavaru are surveyed at four locations (North, South, East and West) at three depths: 1m (top reef), 5m (upper slope) and 10m (middle slope). An additional eight 20 x 5m transects are conducted on each nearby reef (locations below), all surveys on comparative reefs are conducted at 5m. Each transect is separated by a 5m gap which is not surveyed.

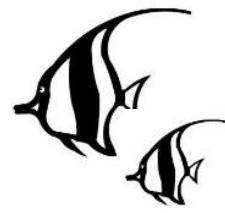
Reef locations in North Maldives

No.	Reef Name	Northing	Easting
1	Banyan Sandbank	4.366578	73.4082
2	Huvafen Sandbank	3.339654	73.3852
3	Coral Garden	4.346594	73.4251
4	Reef NW of Vabbin	4.322774	73.4088
5	Reef NE of Vabbin	4.319147	73.4294
6	Ihuru	4.305595	73.4165
7	Vabbinfaru	4.307841	73.4238
8	Reef W of Baros	4.291454	73.4071
9	Japanese Garden	4.302687	73.4330
10	Reef E of Baros	4.285321	73.4389

Reef locations in South Maldives

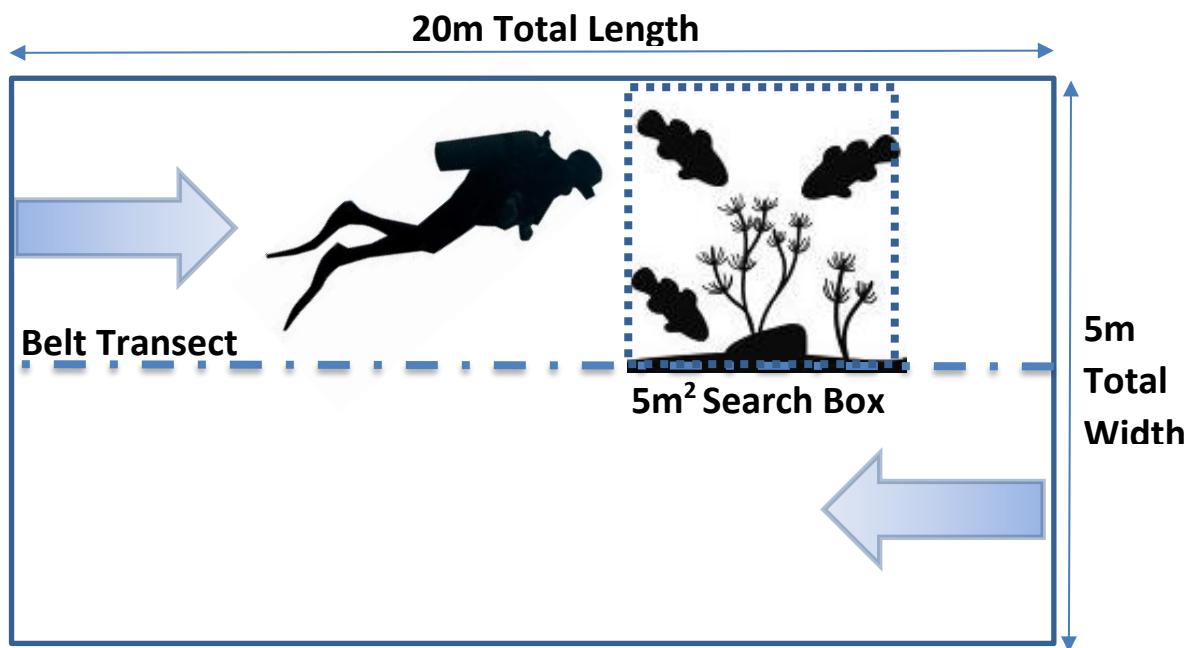
No.	Reef Name	Northing	Easting
1	Velavaru	2.98302	73.02044
2	Vilu Reef	3.00969	72.99604
3	Bandidhoo	2.94000	72.99120
4	Meedhoo	2.99909	73.00512
5	Lhohi	2.98200	73.01765
6	Udhoo	2.97276	72.99151
7	Fandhoo	2.98047	73.01534
8	Potato	3.00975	72.99693

FISH COMMUNITY



1. The fish surveyor attaches the transect tape to the reef, being careful not to damage any live coral.
2. Fish are surveyed 2.5m either side of the transect using an instantaneous count, ensuring the diver swims slowly, at a set pace.
3. Fish that are in the transect area are counted, but fish that enter later are not.
4. Larger individuals are counted on the first pass, whilst laying out the transect. After this, one side of the transect is searched, under all ledges and holes for smaller fish and then swim back along the other side.

All fish are counted and size estimated to the nearest centimetre. Most fish are identified to family only, but some species should be recorded.



INVERTEBRATE COMMUNITY



The presence and abundance of key invertebrates is necessary as they are indicators of fishing on reefs and are important ecologically.

1. Invertebrates are recorded in the same way as the fish (2.5m either side of the transect).
2. All species are counted, only giant clam have size estimated.
3. Species recorded are as follows:
 - **Arthropods:** – popular in aquarium trade
 - Banded coral shrimp
 - Lobster
 - **Urchins:** – important grazers on reefs
 - Long spined
 - Pencil
 - Collector
 - **Starfish:** important corallivores
 - COT
 - PIN
 - **Molluscs:**
 - Triton – important predator of COT
 - Giant clam – previously collected for food, estimate size
 - **Sea cucumbers:** - all collected for food
 - Redfish
 - Greenfish
 - Pinkfish

BENTHIC COMMUNITY



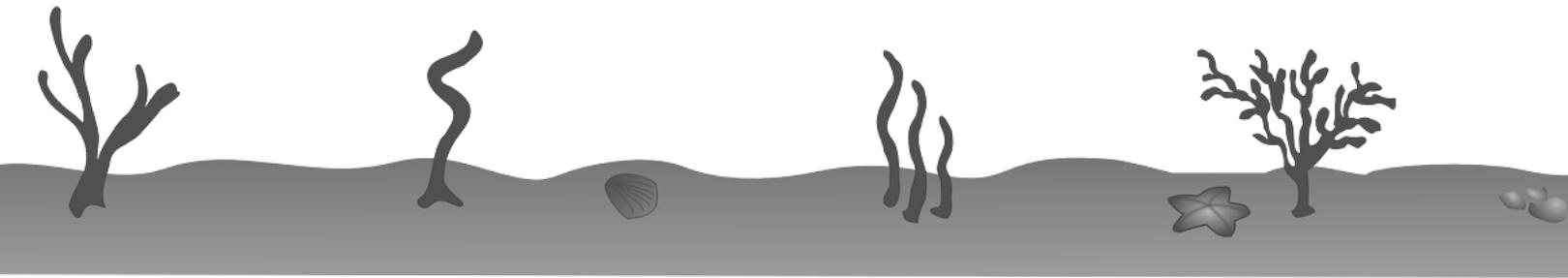
The benthic categories have been modified from Reef Check to provide additional functional information on reef health condition and change.

1. Benthic measurements are taken every 50cm along the 20m transect tape.
2. Benthic cover is not recorded at 0cm due to bias associated with attachment of the transect to the substrate.
3. The categories recorded are as follows:
 - **Hard coral** separated by:
 - a. Growth form: Branching, finger, boulder, plate, encrusting and all other coral.
 - b. State: live, dead, or (turf) algae. All dead coral is termed as “rock” under reef check.
 - **Dead (recent)** refers to recently killed coral – i.e. coral that is white or recently died due to any reason (e.g. bleaching, disease, corallivory).
 - **Soft coral and zoanthids** (colonial anemones)
 - **Macroalgae:** any algae bigger than 3cm in length/height
 - **Turf:** any algae smaller than 3cm in length/height
 - **CCA:** coralline algae: primarily halimeda or other algae that contributes towards sand after death
 - **Cyanobacteria:** fine hair like algae-looking substance. If you wave your hand it detaches from the substrate.
 - **Sponge**
 - **Rock:** all rock on the reef is dead coral. This category refers to rock that cannot easily be identified to coral growth form.
 - **Rubble:** pieces of rock less than 15cm in length.
 - **Sand:** if you pick it up, it sinks.
 - **Silt:** if you pick it up, it stays suspended in the water for a short while.
 - **Other:** anemones, trash, tunicates etc.

COMPLEXITY

Complexity is recorded both as surface roughness (rugosity) and reefscape complexity.

1. **Rugosity** measurements are taken by draping a 10m brass chain over the substrate.
2. The total linear distance covered is recorded off the transect tape.
3. The relationship between the linear distance covered by the chain and the actual length gives you the 'rugosity score'.
4. **Reefscape complexity** is recorded on a visual scale from 0-5, with 0 indicating flat reefs with no structure and 5 indicating complex reefs with vertical relief, ledges and overhangs.



CORAL RECRUITMENT

Corals start life as larvae drifting with the current until a suitable location is found to settle. The number of recruits is used as an indicator of reef recovery after a disturbance such as bleaching.

1. 50 x 50 cm quadrats are placed at 0, 5, 10, 15 and 20m either side of the transect.
2. Photos are taken of each quadrat and the number of coral recruits present in each quadrat are counted at a later date from the pictures.
3. The available space for recruits to settle on is calculated as a percentage.