SAM Programme
Coral Reef & Seagrass Protocol

Site Selection
- At each MPA, set up a minimum of 3 sites with corals (except Ile Coco should do 1-2 sites). (Note that eventually, we should also have 3 sites outside the MPA for comparison).
- Try to have the 3 sites distributed across different parts of the MPA (not close together).
- Select shallow areas (1-3 m deep at low tide) with moderate cover of live corals stretching over at least 40 m of substrate and includes other hard surfaces (e.g. dead coral or granitic rock).

Marking Permanent Coral Reef Transect Sites
- To mark each site, use either rebar pounded into sand or building blocks cemented to bare rock
  - Rebar Method (Preferred method):
    - Cut lengths of rebar to 1.5 m long (2 per site).
    - At the site, first position your transect tape or line over 40 m of coral habitat to make sure you are satisfied with the location and that the line is straight. Make sure the line follows the contour of the bottom going up and down over rocks and corals (do not stretch the line tightly so that it is suspended).
    - At the site, position rebar in sand/rubble habitat near the start of coral habitat.
    - Pound 1 meter into the sand using a mallet or hammer, leaving 0.5 m of rebar exposed.
    - Because the rebar will be hard to find as it gets covered in fleshy algae, make sure you tie brightly covered flagging tape to the top.
    - Extend the line ~41-42 meters from the first point and insert second rebar with flagging.
    - Make sure you get GPS coordinates of each rebar as these may become hard to find. Also record landmarks on shore that will help you locate the site.
  - Building Block method
    - Use this method in sites where there is no loose sand substrate to insert rebar into
    - Use building blocks with holes through the center so that the line or transect can be tied off to these.
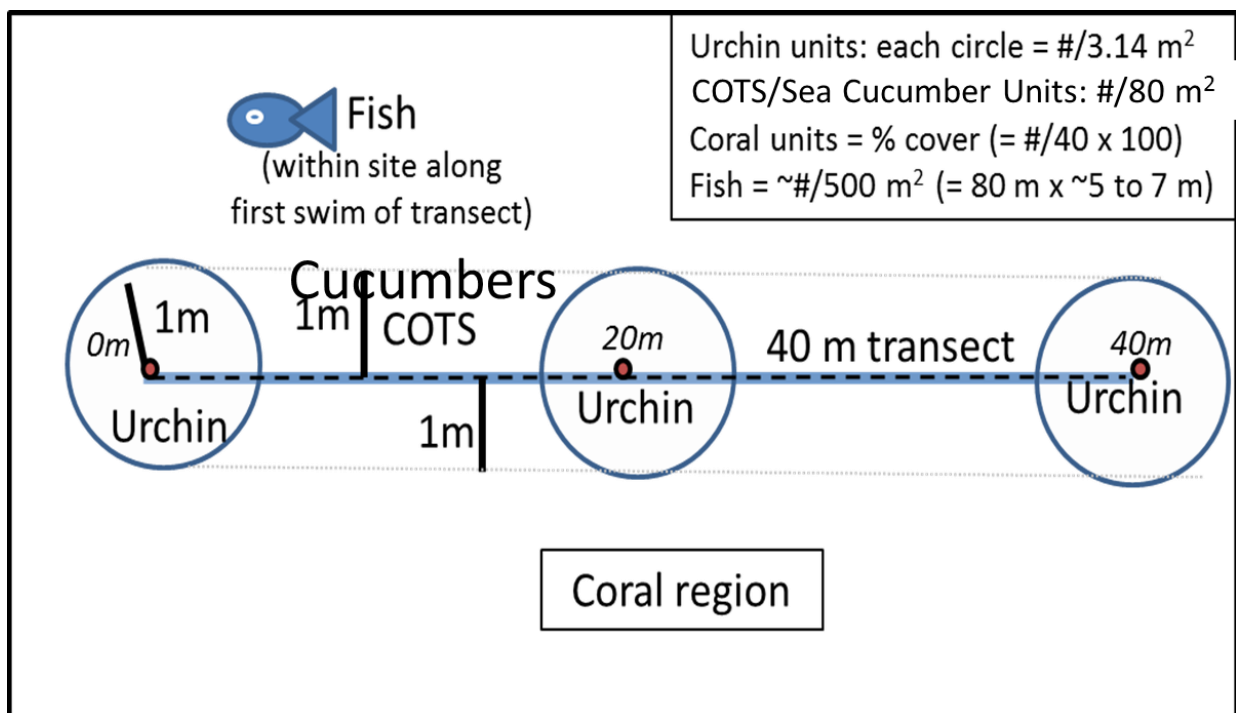
- Make sure you do this set up activity at low tide and during a neap tide when water movement is not too strong.
- At the site, first position your transect tape or line over 40 m of coral habitat to make sure you are satisfied with the location and that the line is straight. Make sure the line follows the contour of the bottom going up and down over rocks and corals (do not stretch the line tightly so that it is suspended).
- At the start of the transect, find an area of bare rock and scrape clean of all algae and sediment with a knife.
- Position the building block in this cleared area so that it is stable.
- On the boat, you should have sand and cement premixed (50:50) with no gravel in the mixture. In a separate basin, mix the cement with seawater so that it is a very dry mixture that can be formed into balls larger than your fist. Make about 9 of this per cement block you are fixing in place.
- Hold a ball in your hand and dive to the block. Quickly slap the ball onto the side of the block where it touches the bottom. Once the ball is in place, do NOT attempt to mold it.
- Place 6-9 blocks around the building block connecting the block to the substrate.
- Leave in place (DO NOT TOUCH BLOCK OR CEMENT) for 24 hours. DO NOT tie transect to this block while cement is wet.
- Follow the same procedure at the other side of the transect line at about 41-42 m.
- After 24 hours, return to the site and check blocks for stability. If needed, add more cement balls to stabilize.
- EVERY MONTH – make sure you check blocks for stability. If loose, it is VERY important you re-fix these in place as loose blocks can slide around with currents and break corals.
- Make sure you get GPS coordinates of each block as these may become hard to find. Also record landmarks on shore that will help you locate the site.

Secchi Disc for Water Clarity
- Conduct the secchi measurement as soon as you get to the site.
- Do NOT do this right over the transect area as the splashing of people will scare away fish.
- Make sure there are no knots in the rope of the secchi disc
- Have 2 people get into the water with the secchi. The person with the best vision should be the one looking at the secchi.
- The person looking at the secchi disc stays in place.
- The other person should hold the secchi disc so that their partner can see the black and white surface. The person holding the disc then should slowly start swimming backward away from their partner.

- The person watching the secchi disc holds the rope and allows it to run out through their hand.
- At the second when the person watching the disc can NO LONGER see the disc, hold the rope firmly so that the person with the disc stops moving away. Move forward and backward to make sure you are at the exact distance where the disc disappears.
- Tie a knot at that point in the rope.
- Take the secchi disc back to the boat and measure the length of the line from the disc to the knot. Record this to the nearest centimeter.
- In the beginning as you are learning, it is a good idea to compare what 2-3 people get for the secchi distance to make sure everybody understands how to do it.

<u>Conducting Benthic Transects</u>

Urchin units: each circle = #/3.14 m^2
COTS/Sea Cucumber Units: #/80 m^2
Coral units = % cover (= #/40 x 100)
Fish = ~#/500 m^2 (= 80 m x ~5 to 7 m)

Fish
(within site along first swim of transect)

Cucumbers
COTS

Urchin · 0m · 1m · 1m · 1m · 20m · Urchin · 40 m transect · 40m · Urchin

Coral region

1) Always start at the same side of the transect, so that the 0 mark is approximately in the same place each time.
2) Tie off the line to the first transect marker. It is important to have a long enough rope before the 0 point on your transect line or rope so that you have space to tie off without covering your 0 mark.
3) As one person is reeling out the line, the other person should be counting fish. At this time, we are only counting triggerfish, peacock groupers, and blackeye rabbitfish. Make sure that the person laying out the line is not getting ahead of the person counting fish as this will scare away the fish. Remain side by side and go slowly.
4) When you reach the 2nd transect marker at 40 m, the fish count is over. No further fish can be counted even if seen.

5) Tie off the transect to the 2nd transect marker, but make sure the line is draped over the bottom, following it up and down. DO NOT tie the line tight so that it is held above the bottom.
6) As you move from the 40 m point to the 0 m point, one person can do the sea urchins, the crown of thorns sea stars (COTS), and the sea cucumber surveys. The second person can do the point counts at each of the 40 points.

Person 1 (does Sea urchins and COTS surveys)
7) For the person doing the sea urchins and COTS, start at the 40 m mark. Place your urchin stone (with 1 m line attached) on top of the 40 m mark. Swim in a circle holding the line and count all the sea urchins between the stone and the tip of the line in the whole 360° circle. Make sure you look under any ledges or overhanging corals. Count urchins in separate categories as large (size of a dinner plate = typically the species *D. savignyi* and *D. setosum*) and small (size of a teacup = typically the species *Echinometra mathaei*). If any part of a sea urchin is under the 1 m line, count that urchin.
8) As you swim from the 40 m mark to the 20 m mark, look for and count COTS and sea cucumbers (all species) on 1 m on either side of the transect. If you see a COTS or a sea cucumber, you can use your 1 m line attached to the stone to determine if it is inside or outside the 1 meter distance from the transect. If any part of the sea star is under the 1 meter line, count it. Make sure you look under all ledges or overhanging corals for COTS that are within 1 m of either side of the transect line.
9) At the 20 m mark, do the same procedure as above (step 7) for sea urchins, searching in a circle with the 1 m line as the radius and the weight on the mark. Make sure you search under coral or rock ledges.
10) As you swim from the 20 m mark to the 0 m mark, repeat the procedure as above (step 8) for COTS and sea cucumbers – searching 1 m on either side of the transect line. When you reach the 0 m mark, record the total number of COTS and cucumbers you saw between the 40 m mark and the 0 m mark. Because you are searching a 40 m x 2 m area, your COTS density will be #/80 m^2.
11) At the 0 m mark, repeat the procedure above (step 7) for sea urchins, searching in a circle. For each sea urchin circle, your area searched is 3.14 m^2 (based on the area of a circle with a 1 m radius = πr^2 = 3.14 x 1^2). After the 0 mark, you should have recorded sea urchin data from 3 circles.

Person 2 (benthic point count)
12) For the person doing the benthic point counts, you can start at the 40 m mark. At each meter mark along the line, record a tick for what is on the bottom of the ocean (the bottom of the ocean is called the benthic substrate). Make sure you look at the point directly under (touching) the meter mark.
13) The categories are (see identification sheet for photographs):
    a. Live coral
    b. Dead coral
    c. Bleached coral (Bright white)
    d. Soft coral

    e. Seaweed (= same thing as fleshy algae)

    f. Coralline algae (pink, orange, or yellowish – covers rocks like paint).

    g. Halimeda (bright great algae that has a skeleton inside)

    h. Rubble

    i. Sand

    j. Seagrass

    k. Other (includes anything not on the list that is attached to the bottom of the ocean. If you find something mobile like a sea urchin or a COTS, move it and look at what is under it.

14) As you record each point, leave your clothes peg at that point so that you know where you left off. Without doing this, it is easy to lose track of where you are.

15) When you reach the 20 m mark, make sure you have 20 points. If not, go back and repeat to avoid mistakes.

16) When you reach the 1 m mark, that is your last point. Make sure you have a total of 40 points. If you have 39-41, it is ok, but try to avoid having more or less than 40 points. If you have less than 39 points or more than 41 points, please redo the point count along the transect.

Seagrass Quadrats

1. Always do at the same site that you have marked with a GPS point

2. Try to choose a seagrass bed that is near the coral reef transect location (in the same part of the MPA). If this is not possible, its ok to choose seagrass beds in other locations, but be sure to not the site name on your datasheet when you start recording your seagrass data.

3. Make sure you put quadrats in the middle, not the edge of the beds.

4. When you get to your established GPS point, throw the quadrat in the same direction (use a compass or a landmark). Always throw in this direction.

5. Complete 4 seagrass quadrats per site. The quadrats should be 0.25 x 0.25 m^2 as measured from the inside. Make sure there are strings tied down the center of each side that divide the quadrat into 4 sections. Make sure the quadrat is weighted (using stones inside the PVC pipes is fine) and that the pipes have holes punched in them to release trapped air.

6. If you throw a quadrat and it lands on the edge of the bed, re-throw it toward the center of the bed. If the quadrat is in the center of the bed, but lands on a patch with sand, this is ok, as long as there is some seagrass in the quadrat. You should never have a quadrat with no seagrass of any species in it.

7. For each of the quadrats, count the number of seagrass stipes in each of the 4 sections, then total them. Do your counts one species at a time and record counts by species (TH = *Thalassia Hemprichii* TC = *Thalasodendron ciliatum*, *Halodule*, and *Syringodium*. I have attached a separate ID guide for seagrass species commonly found in Seychelles.

8. Note that the stipe is like the trunk of a tree – we count the stipes, not the blades (which are like the leaves of a tree).

9. Typically, 2 people will work together to finish a single quadrat, with each person counting 2 of the 4 sections (alternating so that the partner can catch their breath).

10. If it is difficult for you to stay down long enough to count all the stipes from one species in one section, try bringing a short piece of rebar that fits inside one of the sections of the quadrat. Count stipes in a row, and push them a side, and leave the rebar in place to mark where you left off, so you can surface and breath.
11. After you've counted all the species in all 4 sections of the quadrat, count any urchins in the entire quadrat.
12. If you have a camera, it's nice to take a picture of each quadrat. If you do this, after you return from the field, be sure to label the photo with the site name and the date.