

Aim for 200-300 photos per colony - some may require a tiny bit more (~350) if they are particularly large or the conditions are particularly challenging (i.e. big currents because of tides), but otherwise please try your best to stay within 200-300 photos per colony. Having said that if you feel you have not covered all angles please take some more photos, but then make sure you go over them at night and eliminate any bad or redundant photos.

Things you should NOT do, the tips below are what you should do (in bold the most important):

- Make sure the settings of the camera are correctly set to:
- **LINEAR or MEDIUM field of view (FOV)** (21 mm) - this is the most compatible between GoPro Hero (21.9 mm) 4 and 5 (21 mm) - not WIDE
- ISO min 100, max 400
- Set the date and time correctly on the first day (not so important but it helps),
- Resolution 12 MP, format .tiff (better) or .jpg is fine - do not use raw
- **Time lapse Photo** - this allows you to set the camera to take 1 photo every second - that is what you want, if you feel this is too slow it is OK to change it to 0.5 (this will take a photo every half a second). So **1 frames per second** on the consecutive.
- Make sure that in the GoPro 5 the setting for the **screen to flip is OFF** - if you are taking photos underwater and see the screen image is flipping around then stop - go to the boat and ask someone with dry hands to turn this setting off (you may need to dry your hands and do it yourself).

If you are wondering how to change settings here is some

help: https://gopro.com/content/dam/help/hero5-black/manuals/HERO5Black_UM_ENG_REVC_Web.pdf

And here (towards min 6:00): <https://www.youtube.com/watch?v=QYzvQpnYSK0>

While taking photos (in bold the most common mistakes I found):

- **Avoid other divers in the scene**
- **avoid capturing your own hand or dive gear**
- avoid more than ~30% of the photo being water (you want the coral of interest to take most of the image (about 60% at least)
- avoid getting too close or too far from the coral: so avoid only capturing part of the coral (you want the entire colony in each frame) – this is not essential but it is a rule of thumb to maintain your focal distance – if the coral is large then it is OK to do it by parts as long as there is ~70% overlap in between photos.
- avoid **shadows** or fractals (bright sun rays) - most common shadows are caused by the photographer while hovering over the coral - if you are causing a shadow move backwards and take the photo while extending your arm or change angle, also watch out for the shadow of other divers, the boat- fractals you can't do much, come back to that coral at higher tide or later/earlier in the day, they are worse at midday.

Image capturing procedures for coral colonies in situ (in a reef or a pool/aquarium)

- 1) Ensure the camera is in the following settings (Table 1):

Camera brand and model	Settings
GoPro Hero 5 or 6	<p>Time lapse every 1 second, medium or linear field of view (if corals are larger than ~20 cm in diameter you probably need medium field of view) – unless really deep or murky water then the defaults for everything else should work ok but may need to adjust if the scene is dark.</p> <p>Make sure the camera is not on the rotate screen settings – or else as you move it underwater the orientation of the photos you are taking will change → this makes it almost impossible to create the 3D models</p>

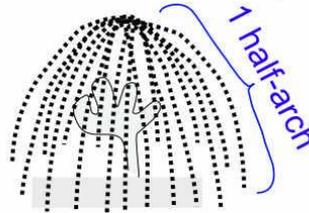
GETTING READY TO TAKE PHOTOS ONCE UNDERWATER

- 2) Ensure there is no fractals (sun ray scatter on the coral surface) if there are fractals and they are really obvious and bright choose a coral that is deeper (at least 1 meter deeper) or return when the sun is low in the sky (early morning or late afternoon) or on a cloudy day to image that coral – bright fractals will most likely result in lack of alignment and no 3D model.
- 3) Place at least 2 rubik cubes as close as possible to the coral without touching the coral or blocking the camera view to the coral (Fig 1 a), ensure there is enough space (~25 cm) for camera to go around the coral (~ 50 cm from coral to ensure entire coral is inside field of view.)

(a) Place rubik cubes near coral colony of interest



(b) Take photos along 16 half-arches (each arch should take 5-10 photos for a small adult coral)



(c) Take photos along 2 spirals going in opposite directions (each spiral should take 15-20 photos)

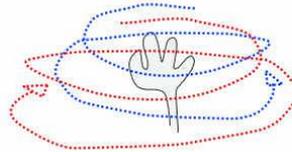


Figure 1

- 4) Ensure the camera is in the correct settings (Table 1), Go Pros sometimes reset when they are turned on/off.

TAKING PHOTOS

- 5) Take a photo of the tag that ids the coral (assuming corals are tagged)
- 6) Image the coral following a hemispheric trajectory with 8-16 half-arches around the coral (imagine 8-16 pizza slices) – the exact number of arches will depend on the size of the coral – the larger the coral the higher the number of arches. Each arch should take photos with about 80% overlap from the photos in the previous arch. Start on top of the coral looking straight down at it and continue down along a half-arch (Fig. 1b), take approximately 5-10 photos down each line. Once you complete the 16 passes you should have taken between 100-200 photos.
- 7) Take another ~20 photos in a spiral trajectory starting from the top of the coral and looking downwards, tilt the camera to ensure the entire coral colony and rubik cubes are in the frame (Fig 1c in blue). Repeat a second time but spiralling in the opposite direction (Fig 1c in red).

Imaging procedures for creating 3D models of coral colonies in situ to measure growth.

Renata Ferrari r.ferrari@aims.gov.au

- 8) Check all the photos for bad photos, this is most effective if you check them as you are taking them, for example looking at the screen at the beginning and end of each arch or continuously. Look for:
 - a. Reflection from the surface (i.e. if the camera was pointing slightly upwards sometimes you get the surface and reflection if it is glassy and you are shallower than 3 m, and or get the sun right into the lense which makes the coral dark and is not good).
 - b. Frames that did not capture the entire coral + rubik cubes (these should be in most of the photos, ~75% at least).
 - c. VERY blurry photos
 - d. Photos with “interfering objects” such as fins, fingers, hands etc.
- 9) Replace/retake any bad photos – tip it is possible to look at the display screen as you are taking the photos, this will improve the quality of the photos especially in the first photo shoots as you get used to the way the camera works.
- 10) Take a photo of your hand or the skye at the end of the photo shoot to make it easier to organize photos when you download them.
- 11) Load photos into computer and back them up to the server and/or hard drives (according to your team’s practice). Go to processing in Photoscan instructions to process into 3D models (you will need a Photoscan Pro license). Or talk to Renata Ferrari for alternatives on processing.

EXAMPLES OF GOOD PHOTOS



Imaging procedures for creating 3D models of coral colonies in situ to measure growth.

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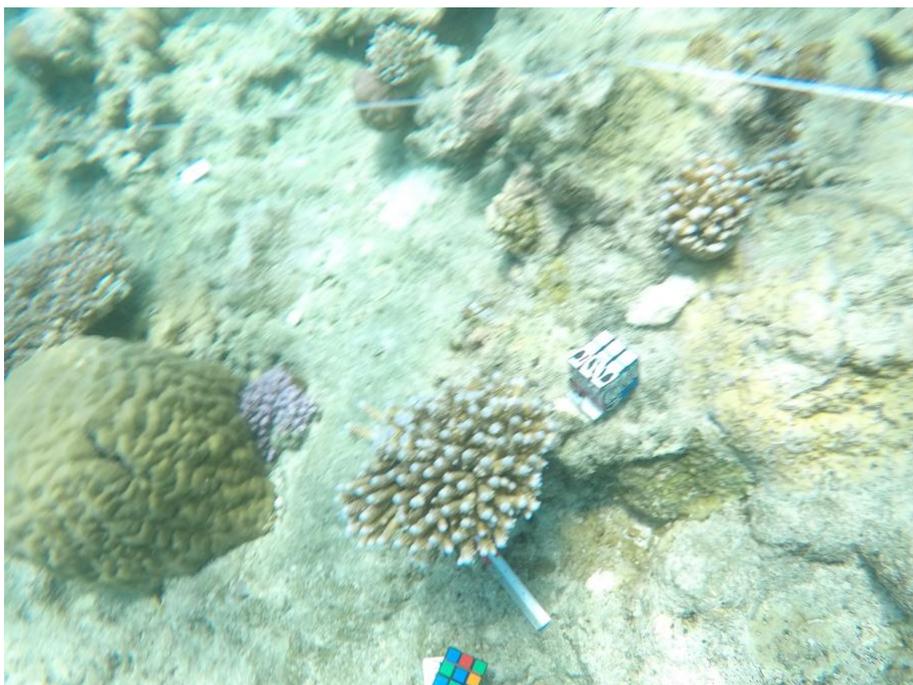
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EXAMPLES OF BAD PHOTOS

Interfering objects:



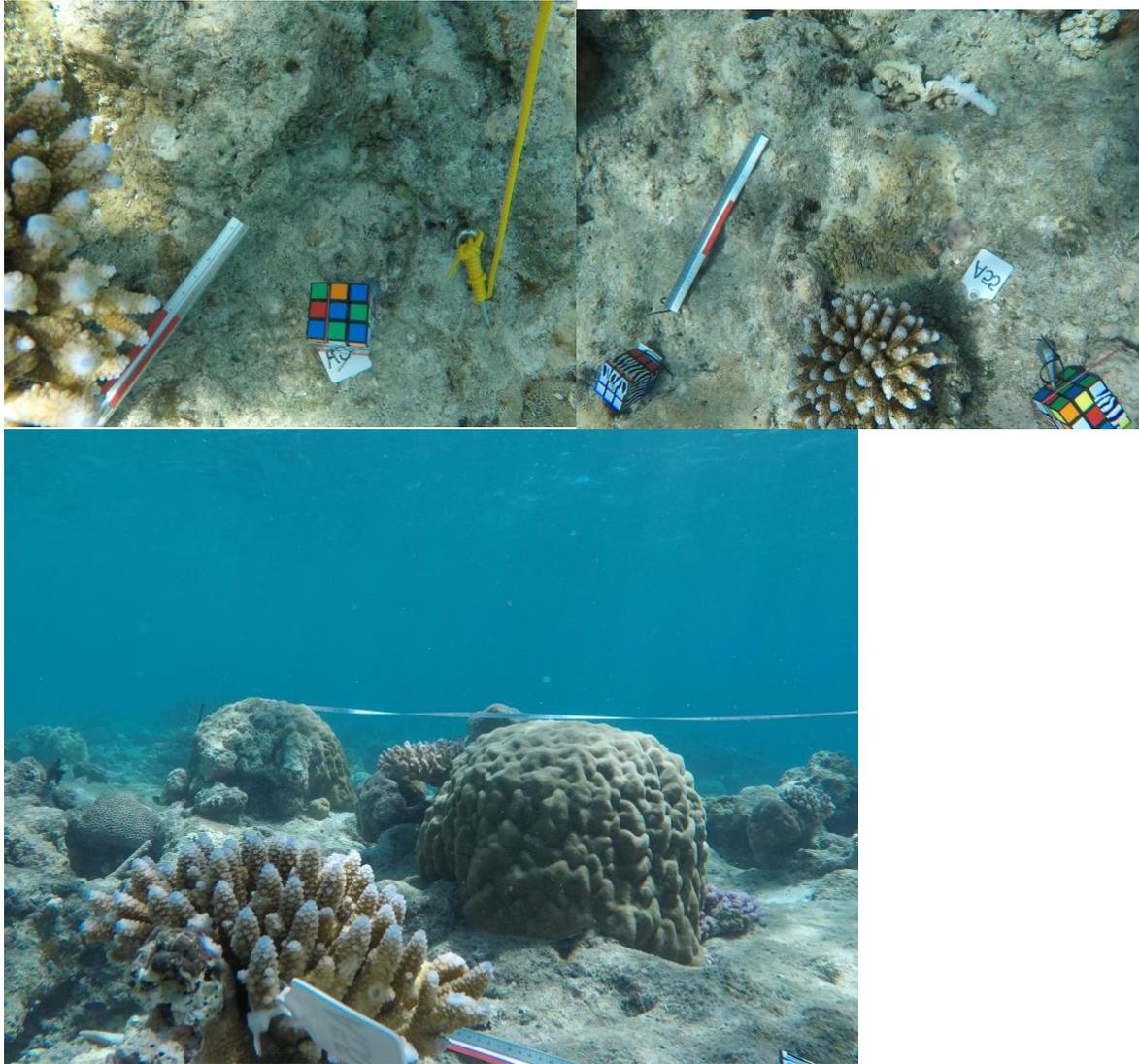
Blurry photos:



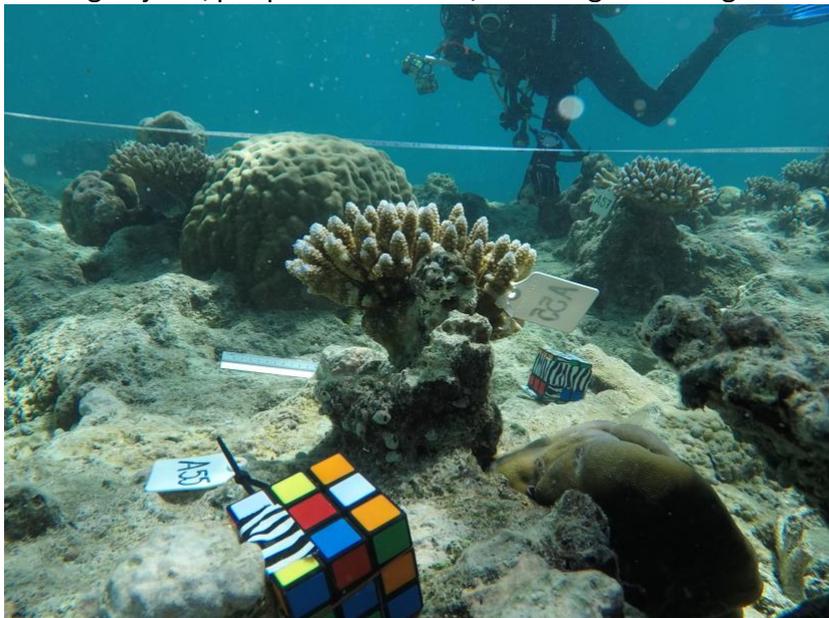
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Not entire coral colony in the scene:

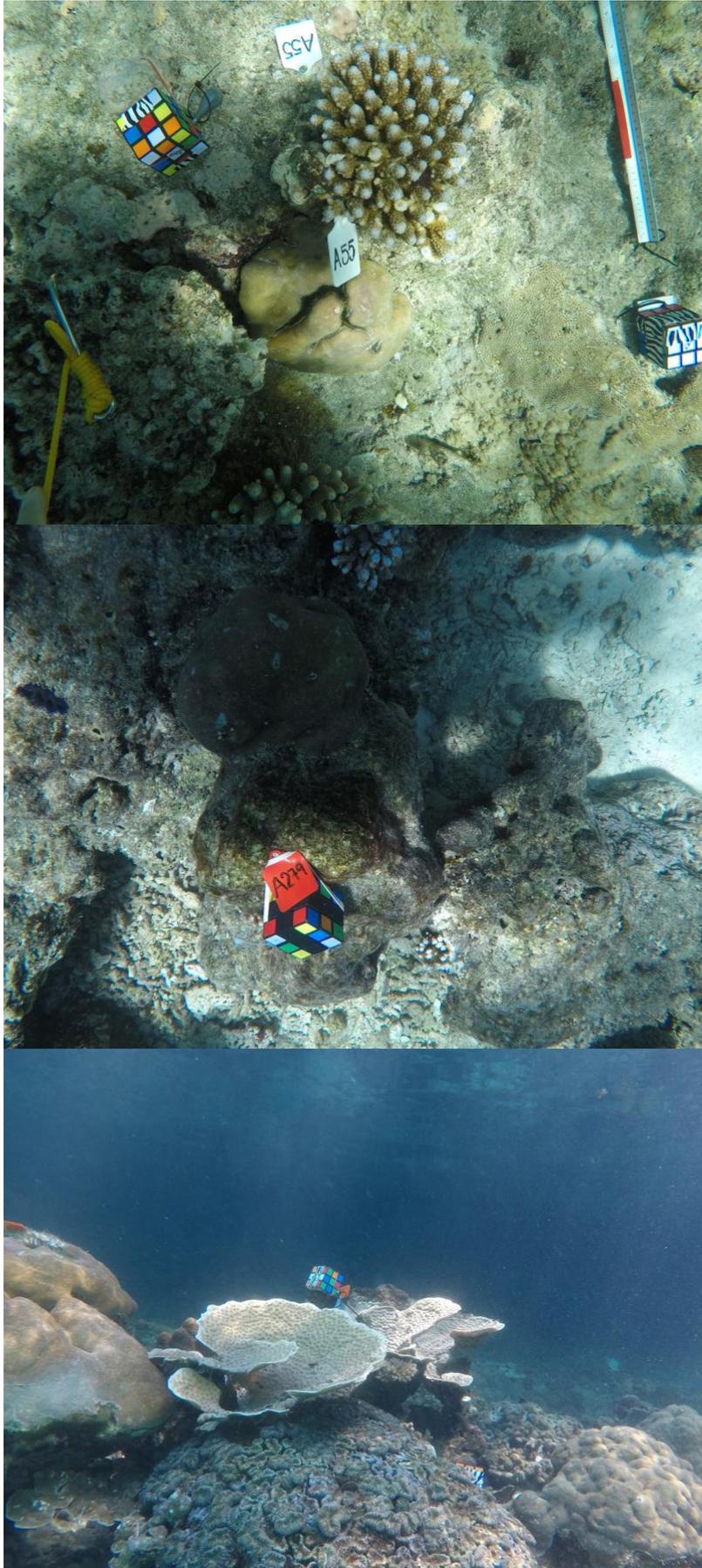


Moving objects/people in the scene/including the background:



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Shadows or sun rays on the coral of interest:



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UPSIDE DOWN PHOTOS

