**Methods**

All *Pocillopora* colonies were collected from a neighboring reef off of the island of Moorea, French Polynesia. Procedures for taking high quality photos of coral underwater and image processing to produce 3D reconstructions are outlined in Ferrari et. al. 2017 (5). Coral heads were cemented to a cinderblock anchor using Z-spar marine epoxy. Before photos of each coral were taken, a Rubiks Cube® was measured to the nearest mm on the X,Y and Z axis using calipers determining a known height, length and width of 57 mm. The same Rubiks Cube® was fastened to a lead dive weight and placed adjacent to each coral to act as a known reference for the models and to help the software align overlapping images.

To maximize time and efficiency, photos were taken underwater on SCUBA instead of snorkeling gear with a Canon EOS Rebel T7 and Canon Big Eye Mark 2 lens in an FantaSea FG-16 housing. No strobes or artificial lighting was used to ensure uniform lighting and minimized shadow in each photo. Photos were also edited in Adobe Lightroom before model reconstruction using Agisoft Metashape.

To automate the process for all sixty corals, a script was written in Python to loop through all files and align photos creating tie points generated by the software from overlapping images using high accuracy. Four points were manually selected on the corner of the Rubiks Cube® where three scale bars were created from the four points selected. The known dimensions of 0.057 m were input in the program’s known scale bar distance with an accuracy set to 0.001 m. These distances were later software estimated after camera optimization to ensure scaling accuracy (5). If the difference between the estimated distance value and known distance of 0.057 m was greater than 0.001 m or 1 m which was the accuracy to which we could measure the Rubiks Cube® with calipers, points were reselected, refreshed and optimized and distances re-estimated until the standards were met. The bounding box area was scaled around the coral head, Rubiks Cube®, and cinder block. A second Python script was run on the sparse point cloud data to remove background pixels outside of the bounding box area. Pixels with reprojection error greater than 0.5 pix were removed and a dense cloud, mesh and texture were generated set to high face count and quality. Extra structure including the ground, cinder block, Rubiks Cube®, and Z-Spar® marine epoxy surrounding the coral was manually selected and deleted so that only the coral head remained. Before closing holes in the mesh, the surface area was software estimated. Resulting holes in the model were closed and steps to volume measurements could be continued.

Coral exact volume was calculated from 3D mesh reconstruction in the Agisoft Metashape software.

Besides estimating coral volume and surface area from constructed mesh, a 3D volume measurement of interstitial space or space “available” for organisms to occupy could be calculated from the 3D model. Metashape coral meshes were exported to Meshlab and a maximum convex hull geometry was fit around the coral model using the ‘Convex Hull’ command. ‘Compute Geometric Measures’ command calculated the volume and surface area of the maximum convex hull geometry. A third measurement of interstitial space was determined by subtracting max. convex hull volume (Vconvex hull) from software estimated coral volume (Vcoral) (Neil E. Doszpot et al.)

Three additional morphometric measurements; convexity and sphericity which capture volume compactness and packing which captures how much of an objects surface area is situated internally versus externally, were calculated using the software estimated volume and surface area of the coral and max. convex hull (Neil E. Doszpot et al., Zawada et al.).

Another measurement of interbranch distance was calculated taking the average of five selected branch distances measured on the software model. Two interbranch distances were measured at the base, two in the middle and one at the top of the coral head to account for phenotypic plasticity.

Height, length and width measurements were taken *in situ* during the transplant phase. Coral volume was estimated by calculating its ellipsoid volume from the height, length and width measurements.

Coral associated fish and invertebrates were collected and preserved for later identification for 30 of the 60 corals. Organisms were identified to the lowest species level using a dissecting microscope.

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