

Subaerial exposure of coral reefs during spring low tides in the eastern Pacific

Juan C Mejía-Rentería ¹, Gustavo A Castellanos-Galindo ^{1,2,3*},
Juan D Osorio-Cano ⁴, Elisa Casella ²

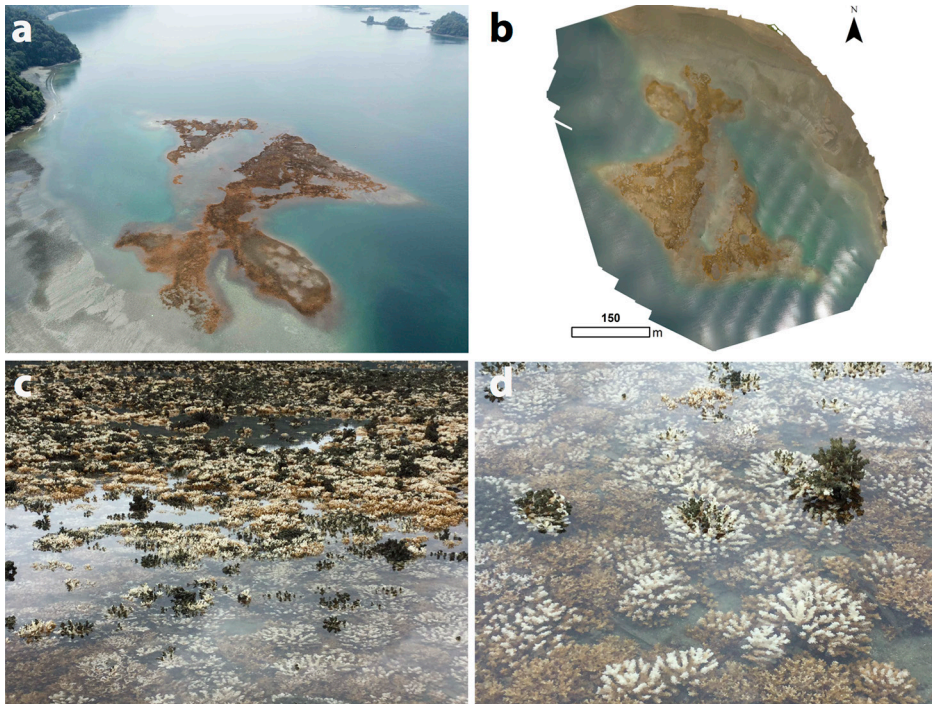
¹ Ecomanglares, Departamento de Biología, Universidad del Valle, Cali, Colombia.

² Leibniz Centre for Tropical Marine Research (ZMT), Bremen, Germany.

³ Current address: Smithsonian Tropical Research Institute (STRI), Panama.

⁴ OCEANICOS, Department of Geosciences and Environment, Universidad Nacional de Colombia, Medellín, Colombia.

* Corresponding author email: <gustavo80@yahoo.com>.



Extreme low tides that expose corals to air can be damaging for coral reefs (Castrillón-Cifuentes et al. 2017). In meso- and macrotidal coasts of the world (including the eastern Pacific) this is a common phenomenon (Eakin and Glynn 1996, Rosser and Veron 2011, Glynn et al. 2017). La Chola reef (6°0'40.072"N, 77°20'51.157"W) at Utría National Park is the best developed coral reef of the continental Colombian Pacific coast, dominated by *Pocillopora* spp. (López-Victoria and Zapata 2018). In the strongest spring tide cycle of 2019 (reaching -0.61 m at low tide, according to the Colombian Institute of Hydrology, Meteorology and Environmental Studies—IDEAM), La Chola reef was exposed at low tide during four consecutive days (19–22 February) between 9:00 and 12:00 for approximately 1 hr every day (coral subaerial exposure during low tides at night may have also occurred in this period of time). The first signs of subaerial exposure were observed on 19

February when the IDEAM prediction of low tide was -0.34 m. During these events, the coral reef was photographed with consumer-grade drones (DJI Mavic and Phantom 4; Fig. 1A) and a georeferenced orthomosaic of the approximately 9 ha coral reef area was generated using photogrammetry (258 pictures taken at 100 m and processed with Agisoft Photoscan; Fig. 1B). Almost 45% (approximately 3.9 ha) of the coral reef was exposed to air on 21 and 22 February. The photographs on 22 February also showed bleached corals (Fig. 1C–D); this was a result of the first days of subaerial exposure, and revealed corals covered by algae suggesting past air exposures.

The corals of La Chola reef at Utría National Park are an example of very resistant cnidarians that are exposed to a multitude of stressful factors including sedimentation, El Niño warming episodes, and subaerial exposure during extreme low tides, as reported here. When exposure to air occurs around midday, as in this case, coral mortality can be amplified due to solar heating, desiccation, and actinic damage (Glynn et al. 2017). These corals may have a high conservation and research value (Camp et al. 2018), helping to broaden our knowledge of the future of coral reef ecosystems in the Anthropocene. Monitoring the recovery and physiological responses of these corals after subaerial exposures could provide insights of their resilience to such disturbances.

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