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Application of drones as a multiscale monitoring tool for inaccessible shallow tidal coral reef environments

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Technological advancement, and increased availability of data and processing platforms is occurring concurrently with the ecological demand for global baselines and rapid monitoring of coral reefs. Drones have increased the ability to capture very fine-scale spatial and temporal data of the environment. However, their capability to provide data useful for scientific analysis is dependent, in the first instance, on collection strategies. Here we explore the use of drones as a mapping and monitoring tool for shallow reef environments periodically exposed by tides. These reef environments can be extensive, highly diverse, have considerable conservation value, and are impacted by a range of both anthropocentric and natural disturbances. These type of reef systems provide challenges for mapping and monitoring as there often too shallow for boat and dive access yet provide a very hazardous environment to access on foot (an activity which can also damage the reef structure).

In this study, we focus on shallow intertidal areas of the Rowley Shoals, a remote group of atolls located in north-west Australia. Here, we analysed over 13,900 photos captured over 20 days and across 13 sub-locations to investigate the impact of drone altitude (and image capture height) in coral classification analysis. We investigate the trade-off required of drones due to battery and visual line of sight legal requirements, that is, area coverage (cm v km) versus pixel resolution, in relation to providing systematic environmental baseline and monitoring data.

Currently, typical multi-rotor drones have a sub hour battery life which limits their ability to cover moderate-to-large areas at very fine spatial resolution. In this study we captured data at set altitudes ranging 10m – 60m to assess the difference in data derived at different heights, assessing differences in classification error between the varied altitude captured data in order to analyse drone utlisation in the marine environment. In doing so, we also provide insight into the impact of wind, and tidal conditions on data quality. Drone's show considerable promise as a mapping and monitoring tool in in these environments. To add to this application we develop guidelines for best practices and focus on development areas for increased precision, accuracy, and quality of data in the marine environment.