

# ARE DRONES A VIABLE TOOL FOR MONITORING MARINE MEGAFAUNA IN MANGROVE CREEKS: A COMPARISON BETWEEN DRONE AND SNORKELLING SURVEYS

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## INTRODUCTION

Understanding animal distribution can support conservation efforts. Drones are proving to be viable resources for this goal: they provide high resolution visual data and can access areas that are difficult to reach by foot or boat (Duffy et al. 2017). While drones have been utilized in terrestrial environments, they have not been used as frequently in the marine realm (Kiszka et al 2016). As such, we do not know how viable these devices are for monitoring marine species.

In Eleuthera we have the perfect habitat for monitoring marine megafauna (large marine animals): mangrove creeks. These are saltwater inlets that are populated by mangrove trees. These habitats also allow us to test the practicality for using drones in marine environments. Mangrove creeks are highly biodiverse and ecologically important (Harborne et al. 2015); their roots create complex structures that allow animals to hide within them. Other factors like sun glare, ripples, substrate composition and water visibility may affect the drones ability to see animals living within the creeks.

The primary objective of our project is to assess the practicality of monitoring megafauna with drones in mangrove creeks. We compared drone surveys to the more conventional snorkel surveys by looking at the duration and animals seen in each survey. This will help provide guidelines for future research to determine which species of megafauna are best seen by drones.

## METHODS

- We focused on two mangrove creeks: Page Creek and Kemps Creek (Fig. 1).



Fig. 1. Maps of the two mangrove creeks surveyed in this study. Yellow dotted lines represent the pathways taken by snorkel surveys, blue dotted lines represent pathways taken by drone surveys.

- Drone surveys conducted along a pre planned flight path at an altitude of 12 m and a speed of 6 km/h.
- Immediately after the drone survey, a snorkeling survey was conducted.
- During drone and snorkeling surveys, we recorded the abundance of several key megafauna species as well as the duration of the survey.
- We reviewed drone footage as a group and recorded the same information as our snorkel survey.
- The footage was reviewed a second time to ensure no organisms were missed.
- The key megafauna species were: bonefish, Caribbean whiptail stingray, houndfish, lemon shark, and barracuda (Fig. 2)
- Barracuda was divided into juvenile and adult due to their differing habitat preferences.



Fig. 2. The five key megafauna species of which we recorded the presence during drone and snorkelling surveys.

## RESULTS

- Lemon sharks and bonefish were more commonly spotted on drone surveys than snorkelling surveys (Fig.3a, b)
- Houndfish and Caribbean whiptail stingray were equally spotted by both methods.
- Barracuda, both juvenile and adult, were more commonly spotted on snorkeling surveys than drone surveys.
- Drone surveys were more time efficient than snorkel surveys (Fig. 3c).

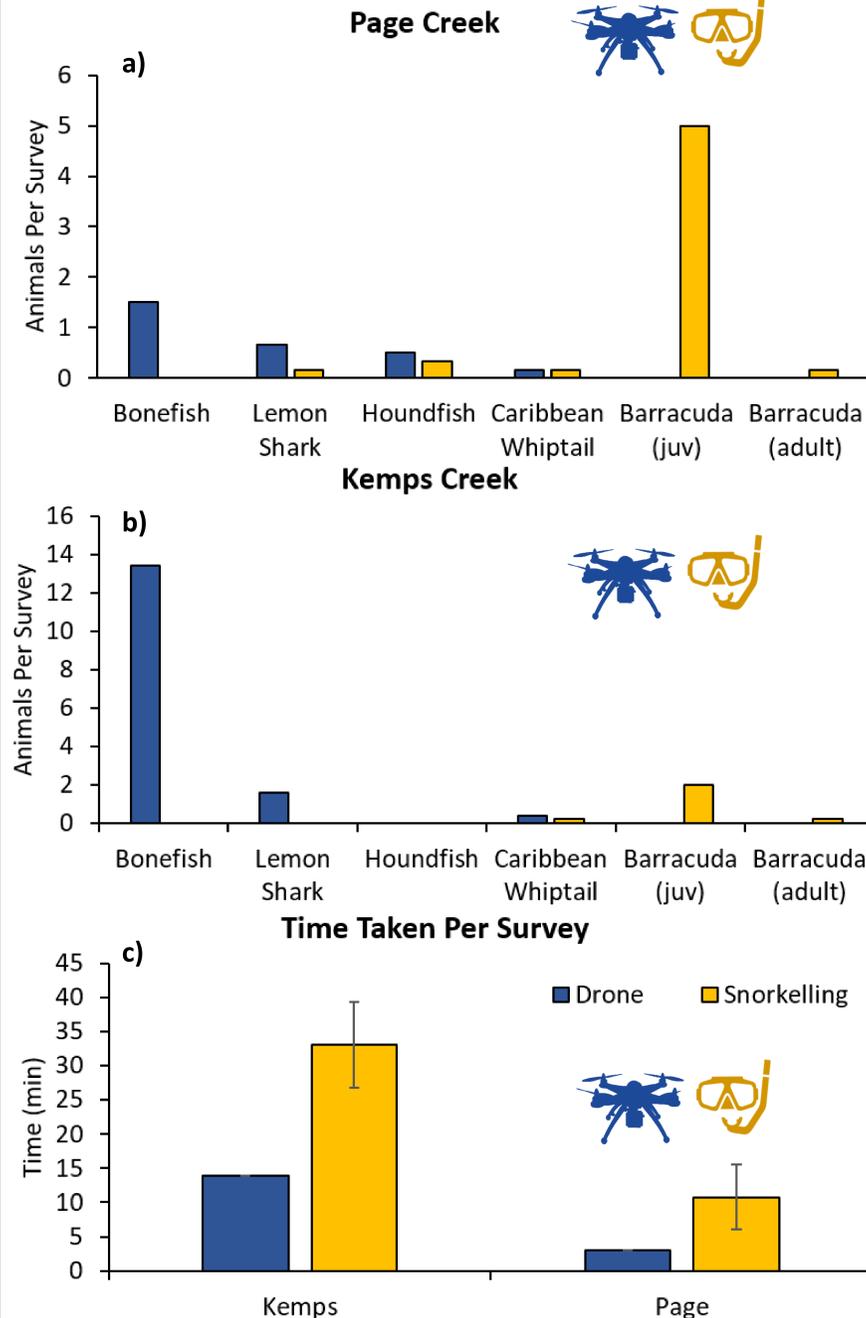


Fig. 3. a) Number of animals seen per drone, in blue, and snorkelling, in yellow, survey in Page Creek. b) Number of animals seen per drone, in blue, and snorkelling, in yellow, survey in Kemps Creek. c) Time taken to conduct drone, in blue, and snorkelling, in yellow, surveys in Page and Kemps Creek.

## DISCUSSION

These different survey methods vary in their capacity for spotting the different species investigated in our study. For example, lemon sharks and bonefish are better spotted by drone surveys, while barracudas are more commonly seen by snorkeling surveys. We hypothesize that lemon sharks and bonefish, which are known to be skittish, are better seen by drones due to the quiet nature of the survey. In contrast, barracuda, which tend to reside within the mangrove roots, cannot be detected by the aerial view of the drone, but can be easily seen during snorkel surveys.

These findings suggest that although snorkel surveys are a common method of measuring the biodiversity within mangrove creeks, previously conducted snorkel surveys may have underrepresented various species. In disparity, drones are an efficient and effective way to assess the distribution of marine megafauna that are highly visible from an aerial viewpoint. Thus, when conducting drone surveys it is important to take the habitat and the behavior of the study species into account. With regards to the study species that were equally spotted with both methods, we would still recommend using a drone because of its time efficiency.

In conclusion, drones can be a versatile way to monitor various species within marine environments (Fig. 4).

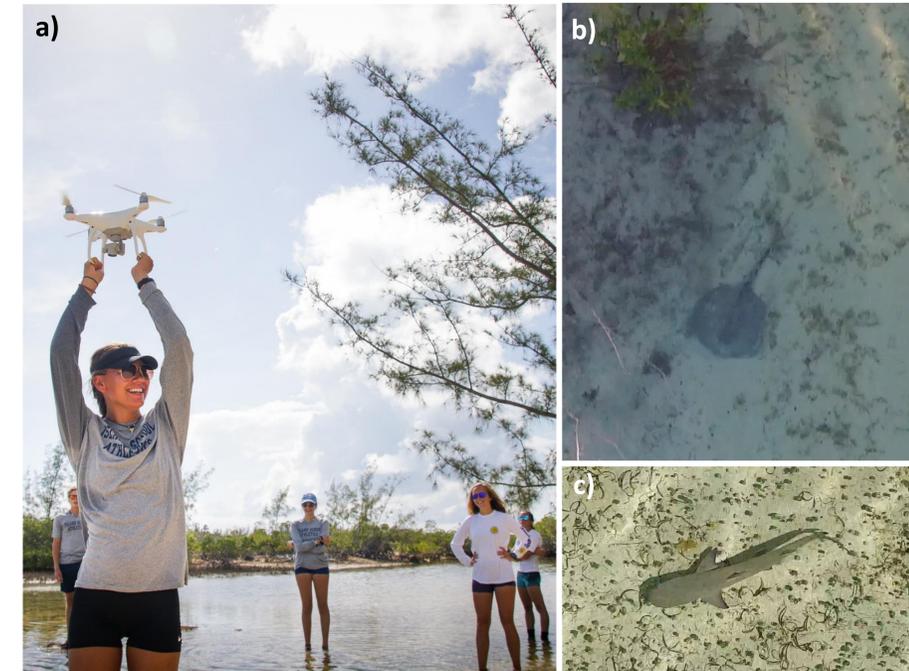


Fig. 4. a) Preparing the drone for launch in Page Creek. b) Drone footage of Caribbean whiptail stingray. c) Drone footage of a lemon shark.

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