Drones confirm importance of Costa Rican waters for sea turtles

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Olive Ridley sea turtles come ashore to nest at Ostional National Wildlife Refuge in Costa Rica. Credit: Vanessa Bézy, University of North Carolina at Chapel Hill

Hundreds of thousands of sea turtles come ashore to lay their eggs during mass-nesting events at Ostional National Wildlife Refuge on Costa Rica's Pacific coast, making it one of the most important nesting beaches in the world.

Now aerial drones are giving scientists deeper insights into just how important the beach and its nearshore waters are.

Using a fixed-wing drone to conduct aerial surveys of olive ridley sea turtles in waters off Ostional during four days in August 2015, scientists from Duke University and the University of North Carolina at Chapel Hill (UNC-CH) estimate turtle densities there may reach as high as 2,086 animals per square kilometer during peak nesting season.

"These are extraordinary numbers, much higher than any of us anticipated," said Seth Sykora-Bodie, a PhD student at Duke's Nicholas School of the Environment, who co-led the study with Vanessa Bézy, a PhD candidate at UNC-CH.

"Our findings confirm drones can be used as a powerful tool to study sea turtle abundance at sea, and reveal incredible densities of turtles in Ostional's nearshore habitat," said Bézy. "The development of this methodology provides vital new insights for future conservation and research."

Equipping the drone with a high-resolution digital camera with near-infrared vision and flying it just 90 meters above the ocean expanded the field of view and significantly increased image clarity, allowing the researchers to detect many turtles swimming just below the water's surface. Observers relying only on visual sightings made from boats could easily miss these submerged animals because of their angle of view and the clarity of the water, Sykora-Bodie said.

The researchers published their peer-reviewed paper Dec. 18 in *Scientific Reports*. It is the first study to use unmanned aerial systems (UAS), or drones, to estimate the abundance of sea turtle populations.

Traditionally, scientists have collected this type of abundance data using mark-and-recapture studies, in-water surveys, and censuses of turtles observed on nesting beaches. These methods can be costly and time-consuming, incur potential risks to both the observers and the animals, and increase the likelihood that turtles may be missed or double-counted.

The new pilot study shows that using camera-equipped drones provides a safe, cost-effective and scientifically robust alternative.

"Because of the clarity of the images we can collect, and the greater flexibility we have in where, when and how we collect them, this approach provides us with better data for understanding population status and trends, which can then be used to inform management decisions and develop conservation measures tailored to individual populations, locations and time frames," Sykora-Bodie said.

Olive ridleys are classified as vulnerable on the IUCN Red List of Threatened Species. One of the chief threats they face is being accidentally caught and killed by hooks and other fishing gear used by longline and trawl fisheries.

To conduct the newly published study, researchers from Duke's Marine Robotics and Remote Sensing Labflew an eBee senseFly fixed-wing drone equipped with a near-infrared camera over a three-kilometer stretch of nearshore water twice daily—morning and evening—on four consecutive days during a mass-nesting event, or arribada, in August 2015. By analyzing the captured images, they identified 684 confirmed turtle sightings and 409 probable sightings.

Using methods that scientists regularly employ for estimating the population abundance of marine species based on surface sightings in traditional surveys, Sykora-Bodie and his colleagues then calculated a low-end daily estimate of up to 1,299 turtles per square kilometer in the surveyed area, and a high-end estimate of up to 2,086 turtles. Long-term surveys, coupled with further research on olive ridleys' dive profile—how deep they dive, and how long they remain under water—will be needed to refine these estimates.

More information: Seth T. Sykora-Bodie et al, Quantifying Nearshore Sea Turtle Densities: Applications of Unmanned Aerial Systems for Population Assessments, *Scientific Reports* (2017). DOI: 10.1038/s41598-017-17719-x

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