

eyes in the sky

HELP SEA TURTLE RESEARCH

By ERIC ANGEL RAMOS

As the sun peeks over the ocean horizon, a group of scientists and volunteers begin their morning patrols along a remote beach. They are searching for the scratchy signs of turtle nesting activity. They are accompanied by a small remote-controlled quadcopter drone, buzzing high above their heads. It glides over kilometers of shoreline in minutes and returns by itself to a preset base with images that will be rapidly processed to reveal nesting activity from high altitudes. This could be a common scene in the near future as the conservation world is transformed by the use of drones—also called unmanned aerial vehicles (UAVs)—for monitoring terrestrial and marine ecosystems.

The conservation and management of migratory marine megafauna is costly and challenging. Sea turtles such as the leatherback travel thousands of kilometers in a single year between their foraging and nesting habitats in tropical and subtropical regions. This migration creates challenges for researchers and others who are attempting to estimate turtle abundance or to elucidate threats to their survival.

The use of small manned aircraft, such as biplanes or helicopters, to perform aerial surveys has long been a standard practice in monitoring populations of marine megafauna. The higher the eye, the more it can see. But those flights are generally costly, and engine noise can adversely affect animals' behavior during low flybys.

Small, maneuverable, inexpensive, and no louder than the hum of a beehive, drones provide a solution to the deficits of manned flight surveys. One person, acting from land or boat, can easily deploy and operate a drone without aid, either guiding the UAV by remote control or sending it on an autonomous preprogrammed mission with a preset return point. The unsupervised drone will fly, collect data, and then come home to land by itself. A stabilized high-resolution camera is used to gather imagery from on high, which allows for species identification and observation of marine animals from a range of altitudes.

UAVs are already being used in this way around the world. Scientists from the National Oceanic and Atmospheric Administration (NOAA) deploy custom-built hexacopters to examine the reproductive health of killer whales in the North Pacific and to collect genetic samples from the exhalations of sperm whales off New Zealand. Moreover, images acquired from UAVs deployed in the Antarctic are being used to remotely measure the weight and size of leopard seals.

Traditionally, monitoring of sea turtle nesting relies on observers walking long hours along often remote nesting beaches. With the aid of UAVs, performing those sweeps is a lot easier. On the beaches of Sint Maarten, rangers from the Nature Foundation pilot a low-cost remote-controlled drone to conduct daily turtle monitoring activities. A short flight saves hours of searching and reduces the likelihood of disturbing nesting females or trampling freshly laid nests. Their drone will help to identify the species that frequent their beaches during the breeding season. It will even assess threats to the turtles: sources of pollution, illegal harvesting of turtles and their eggs, and

degradation of beach habitat by coastal development. Equipped with a small light and with a low risk of disturbance, their drone could even monitor the beaches at night when female turtles are actively nesting.

The use of UAVs will benefit turtle observers at sea as well as on land. Scientists at the Inwater Research Group, in collaboration with NOAA's Florida Keys National Marine Sanctuary, are preparing to use UAVs during their boat-based transects of foraging grounds of the green sea turtle. The UAVs may greatly improve the accuracy of the team's turtle counts, particularly in cases with too many turtles for observers to reliably count on their own. Green turtles at this location also tend to be boat-shy, fleeing from research vessels before observations can be made. Quieter, less-invasive UAVs may solve this problem.

Of course, all methods have their drawbacks. Surface glare and variations in water depth and clarity may interfere with turtle identification when using an airborne camera. Polarizing filters on the cameras' lenses may help to overcome glare, but turtle identification at depths greater than 6 meters (20 feet) may still require unusually calm sea conditions.

Before designing a drone research program, each research team must carefully consider the merits of the various UAVs available. Copter-style drones, propelled with multiple rotors, are highly maneuverable, typically small, and easily portable, and they can hover stably while changing altitudes, but they provide only 20 minutes or so of flight time per battery. Fixed-wing airframes modeled after small planes or gliders can travel long distances for upward of an hour, but they lack the ability to hover in place and typically require more space for landing.

As UAV technology develops, sea turtle research will benefit from the proliferation of customizable drones as costs drop and capabilities skyrocket. Drones for conservation are here to stay, and the unique perspective they can give us shows a vast potential for elucidating the lives of sea turtles and other marine megafauna. In the capable hands of scientist-pilots working from the beach or by boat, drones are a remarkable tool that will enable ever-smarter marine conservation. ■



Researchers prepare a quadcopter drone for aerial surveys in Turneffe Atoll, Belize. © KATHI KOONTZ AT LEFT: The researchers' boat can be seen above seagrass habitat in this image captured by a quadcopter drone during research in Turneffe Atoll, Belize. © ERIC ANGEL RAMOS