GB George Balazs

Fri 3/31/2023 6:12 AM

East Island, 5 years later: Shifts in key demographic parameters for Hawaiian green sea turtles (honu) following the loss of their primary nesting island

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From 1973-2015, NOAA's Marine Turtle Biology and Assessment Program (MTBAP) in Hawai'i carried out baseline monitoring of green sea turtle (honu) nesting activity at the population's primary nesting site, East Island, at Lalo (French Frigate Shoals) in the remote Papahānaumokuākea Marine National Monument. In 2015, a status review of the population found it was highly vulnerable as 96% of nesting was concentrated at a single, low elevation site. As a result, from 2016-2018, MTBAP began collecting more holistic and contemporary data at East and nearby Tern Island, respectively, to improve NOAA-produced population models and trend analyses. We employed intensive monitoring efforts to saturate tag females and (basking) males as well as generate data on vital rates and hatching productivity.

Alarmingly, in 2018, East Island was completely washed away by a hurricane. Nesting surveys are now only conducted on Tern Island, a WWII-era former airport with dilapidated structures and crumbling seawalls that entrap and kill nesting females and hatchlings each year. With the inability to monitor honu abundance at the index nesting beach for this population, MTBAP's data collection approaches now include quantifying the consequences of the turtles' shift to suboptimal habitat (e.g., nest success, entrapment rates).

Here we present updates to the project in light of these new challenges, including changes to demographic parameters and neophyte abundance at Lalo.

Changes in nesting demographics (i.e., nest success, clutch frequency, inter-nesting interval) on East and Tern Islands were analyzed before and after the hurricane to understand honu plasticity to disturbance events. For example, mean hatching and emergence success decreased by 20% and 17%, respectively. As the atoll's largest remaining island, lower nest success on Tern Island may have grave implications for population recovery.

As a result of the long-term efforts to tag nesting females at East Island (i.e., since 1973), many of the turtles observed nesting on East Island in 2017-2018 had been previously tagged. In contrast, when MTBAP increased survey effort on Tern Island starting in 2017, a majority (>80%) of the turtles tagged had never been tagged before. The higher abundance of "new" neophyte turtles at Tern Island indicates limited movement (i.e., strong nesting site fidelity) of tagged nesting turtles between East and Tern Islands prior to Hurricane Walaka. These findings also suggest that historical data collection efforts which focused primarily on East Island may have led to underestimates of the nesting sub-population utilizing Tern Island (and other islets in the atoll).

The results of this project are critical inputs for the assessment and conservation of this entire population and may shed light on changes in vital rates coinciding with habitat loss in other locations around the world.

GB George Balazs

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All eggs in one poor quality basket: assessing Hawaiian green sea turtle (honu) resilience in light of climate change impacts

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The Hawaiian green sea turtle, or honu, primarily reproduces at one small (93 km^2) and remote atoll known as Lalo (French Frigate Shoals). Historical evidence suggests most (96%) honu make a reproductive migration (~700 km) from the main Hawaiian Islands (MHI) to Lalo to nest and bask on multiple islets within the atoll. Lalo is low-lying (e.g., <2 m above sea level), making it particularly susceptible to climate impacts. From 1963 to 2004, the size of islets within the atoll decreased from a combined total of 41.7 to 15.1 hectares. Subsequently, in 2018, two critical nesting islets were lost due to natural erosion (Trig Island) and a hurricane (East Island). Prior to its destruction, East Island hosted ~50% of annual nesting honu (maximum 880 nesting females/year), and while it has since re-accreted substantially (1.4 hectares), preliminary evidence suggests the "new" habitat is of much lower quality due to the island's lower elevation and dynamic nature as well as the observation of washed out nests. Combined with the sea level rise and increased storm severity associated with ongoing climate change, there is concern that East Island will not be viable nesting habitat in the future. Tern Island is the largest islet (10.3 hectares) and represents one of the only remaining reliable landmasses for egg incubation where nesting habitat is not dynamic throughout the season. To assess the resilience of honu to the drastic change of their primary nesting beach, a plan was hatched to determine whether females would continue to seek out East Island and lay their eggs in one (poor quality) 'basket' or seek to lay eggs elsewhere within the atoll. This was accomplished via two tactics. Firstly, adult females that previously nested on East Island were captured while basking on beaches within the MHI, and their reproductive status was assessed via (1) a portable ultrasound device to visualize ovarian follicles and (2) blood total solids/protein and testosterone concentration. In 2021 and 2022, four females were satellite tagged prior to their reproductive migration from the MHI. Secondly, eight females that previously nested on East Island were satellite tagged while basking on East Island prior to the peak of the nesting season to assess nesting beach fidelity after arriving at Lalo. Out of the 12 satellite tagged females, two only used East Island, six used both East Island and other islets (including Tern Island), while four turtles used both East Island and other islets (excluding Tern Island) to bask and nest. These findings suggest honu are capable of using multiple nesting habitats and provide hope for honu resiliency to the ongoing habitat impacts in Lalo. Nonetheless, the long-term stability and quality of the available nesting habitat in Lalo remains unclear and raises important management concerns. Given this context, our unique study has significant implications for the conservation of this threatened green sea turtle population and is relevant for other sea turtle populations facing similar threats.

GB George Balazs

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Using mototool marks to monitor post-release behavior of stranded green sea turtles (Chelonia mydas) on Maui

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Moto-tool marks are a tagging method using an alphanumeric etching on the costal scutes of sea turtles. The marks can be used to monitor migratory patterns, distribution, and post-release behavior of sea turtle rehabilitation patients. The mark has proven to be a cost-effective and accessible method to involve the community in sea turtle conservation efforts in the Hawaiian Islands. Under a collaborative agreement with NOAA Fisheries, Maui Ocean Center Marine Institute (MOCMI) maintains a stranding response hotline and responds to more than two hundred sick, injured, expired, or distressed sea turtles on the island of Maui each year. Stranding causes include interactions with fishing gear, shark predation, vessel strikes, buoyancy disorders, disease, geographical entrapment, and unknown causes. MOCMI staff biologists, interns, and volunteers respond to stranding reports to assess the animal's condition. Once evaluated, recovered sea turtles are either cleared for immediate release or admitted to MOCMI's rehabilitation center for treatment and long-term care. Upon release, each turtle receives Passive Integrated Transponder (PIT) tags in their hind flippers and an alpha-numeric etching on the fourth costal scute. Traditionally, external flipper tags have been the most widespread tagging practice to gain insight into post-release behavior. Both PIT and flipper tags are viable options but require the capture of each turtle for identification. MOCMI has adopted moto-tool marking, a non-invasive and cost-effective method for marking stranded turtles. This method was first practiced in 1990 in Hawai'i (Balazs 1992) and includes a high-speed (20,000 rpm) dremel moto-tool and the application of non-toxic paint. MOCMI's moto-tool mark contains an "MA" for the island of Maui and a number, up to three digits following, which is etched into the carapace with a dremel. The groove is then filled in with white non-toxic paint. This mark will last anywhere from six months to one year, depending on the overall growth rate of the turtle (Balazs 1992). The mark is visible and easily identifiable from afar. Through MOCMI's re-sighting program and NOAA Honu Count Program, the community is encouraged to identify marked turtles and report them to MOCMI's website, social media channels and RespectWildlife@noaa.gov. Since beginning the sea turtle re-sighting program in 2020, MOCMI has received 1202 reports. One hundred ninety-seven individual turtles make up these 1202 re-sightings; 33 of the 197 turtles were long-term rehabilitation patients. Four cases (MA09, MA72, MA100, and M108) were selected to highlight the importance of reporting post-release activities of sea turtle patients by community members. Select cases include a severe entanglement resulting in amputation, an entanglement that did not require amputation, a long-term rehabilitation patient, and a stranded sea turtle that was cleared for immediate release. We selected these cases due to the variety of stranding severities and for the numerous times they have been re-sighted. The use of a moto-tool mark to monitor sea turtle rehabilitation patients has provided significant insight into post-release behaviors and provides an opportunity to engage the community in sea turtle conservation efforts.

GB George Balazs

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***Honu Count: Using Shell-etchings and Community Science to Track and Monitor the Central North Pacific Green Sea Turtle Population**

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The abundance of the Central North Pacific Distinct Population Segment of Hawaiian green sea turtles (honu) has largely been determined by counting the number of females nesting within Lalo (French Frigate Shoals Atoll). This atoll is located approximately 1,000 km northwest of the main Hawaiian Islands (MHI) within the Papahānaumokuākea Marine National Monument. Honu make round trip migrations from foraging grounds in the MHI to nesting grounds in Lalo, where The National Oceanic and Atmospheric Administration (NOAA) has administered an ongoing honu monitoring program since 1973. To better identify from afar, NOAA scientists use "motos," an alpha-numeric identifier temporarily etched onto the carapace with a mototool and painted with non-toxic white paint. Since motos can last for 6-12 months, the public can identify honu within the MHI, which inspired the creation of a Citizen Science project.

In 2017, NOAA's Pacific Island Fisheries Science Center's Marine Turtle Biology and Assessment Program launched The Honu Count Project, which facilitates public reporting on sightings of honu with motos around the MHI. The initial focus of Honu Count was to generate information on migration routes from Lalo to the MHI, as well as identify key foraging grounds at the latter. Honu of all size-classes around the MHI are also given a moto, which assists with tracking post-rehabilitation status, monitoring movements and foraging habitat for the overall population. From 2017-2021, approximately 2,643 motos have been applied to honu; 1,942 (73%) motos were applied at Lalo and the remaining 701 (27%) were applied within the MHI. A total of 612 reports were received from over 200 members of the public of 193 individual honu. The majority (n = 171) of the observed motos had been applied within the MHI and were re-observed within the region. However, 22 sightings were of honu originally tagged at Lalo and re-sighted within the MHI. Of these 22 sightings, 10 were reported on Maui, 7 on Oahu and 3 on Kauai. The final 2 sightings were reported with not enough information to determine the location.

Honu Count has evolved from hotline, to email, and now enters a new phase that will increase reporting and streamline data collection from the public. This past year, we developed an online survey format using the Esri product ArcGIS Survey123. This easy-to-use survey provides the public with a direct link where they can report sightings and input the latitude and longitude of a sighting on a map, improving the accuracy of the location. This can then be analyzed using various tools in ArcGIS or exported for use in other software (e.g., R Programming). The survey link is embedded into a newly developed website created to promote the project, give instructions on how to report sightings, and provide additional information. This evolution of Honu Count with a new survey format and website will continue to increase Honu Count's ability to generate invaluable data on population conservation, foraging habitat, and migration routes, all while improving NOAA's engagement with the public.