Long-term monitoring and protection of a rare nesting population of hawksbill sea turtles (Eretmochelys imbricata) on Maui: trends and developments from 20 years of research

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Purpose

Hawksbill sea turtle nesting numbers have remained precariously low in Maui over the last 21 years of research and conservation. What determines their success in nesting on South Maui beaches? What factors threaten their survival? How can the Hawksbill Recovery Project make a significant contribution to the survival of the next generation?

Background

Hawksbill sea turtles (Eretmochelys imbricata) have been protected under the Endangered Species Act since 1978 and became listed as critically endangered globally by IUCN in 1996. The adult population in Hawai‘i remains on the brink of extinction due to natural and anthropogenic threats, including historical harvest for their shell. Nesting observations, foraging studies, and satellite tracking have shown that the Hawaiian hawksbill population is confined to short island migrations. The Hawaiian Archipelago is the most remote land mass in the world, with isolated populations of hawksbill and green sea turtles (Chelonia mydas). The Hawaiian green sea turtle population has increased significantly in past decades, while hawksbill numbers remain low, estimated to consist of only 50-100 mature females.

Results

2016 Season:
- 2016 was one of the most successful nesting seasons on Maui in 21 years of monitoring, despite having only one nesting female
- Nicknamed “Orion,” this female has laid 24 total nests since she was first tagged in 2001, making her the most prolific nester on the island
- Each nesting season has had a higher mean hatching success, with 816 hatchlings from 861 eggs in 2016, or 95% (Figure 2)

Nesting Beaches:
- Beach conditions also contributed to hatching success in 2016
- Orion nested on Oneloa Beach, which is in a protected state park
- The two other females who nested on Oneloa also had high mean hatching success, with 83% in 2008 (n=2) and 95% in 2011 (n=4)
- Beach conditions consist of a wide range of variables, from substrate quality and temperature to invasive species and other human impacts
- The three most popular nesting beaches on Maui differ greatly in these conditions and their hatching success (Figure 3)
- Oneloa Beach is a wide, sandy beach in a state park, where it is separated from car traffic and closed to the public at night, with no commercial development and minimal artificial light
- Kawilihipa Beach runs along the center of the town of Kihei, where the coastline has been developed for residential and recreational uses during the day and night with artificial light and invasive vegetation
- Kealia Beach is a thin beach running along the highway north of Kihei, with heavy traffic and high levels of runoff, erosion, and chemical pollution leading to many entirely undeveloped nests
- Six nests have been relocated from Kealia to Kawilihipa or within Kawilihipa with limited success, as three remained undeveloped and three had hatching success under 50%

Conclusions

- Hawksbills face many threats, especially human impacts on their nesting beaches like artificial light, pollution, and development
- Conservation efforts can mitigate several of these threats with methods including beach cleanups, public education, invasive species removal, and volunteer nest protection
- Some degraded and eroded beaches are irreparably damaged and have significantly lower hatching success (Figure 3)
- Successful nesting beaches must be maintained and protected, like Oneloa Beach in Makena State Park
- Unsuccessful beaches like Kealia Beach can be studied and improved, but may require nest relocations if habitat continues to decline and erode from human activity and sea level rise
- With less than 10 known hawksbills females nesting on Maui, every female and hatchling is critical to the continued survival of this population
- Hatching success may increase with female age, size, and experience (Figure 2) and be maximized by nest monitoring
- No significant increases to the Maui population (Figure 4) may be due to the long generation time to reach maturity of 17-22 years
- Continued nest monitoring, combined with habitat protection and community involvement, may help this vulnerable population survive and increase in the next generation

Acknowledgements

Special thanks to NOAA/Pacific Islands Regional Office for funding this project, and to our partners at U.S. Fish and Wildlife Service, Hawai‘i Department of Land and Natural Resources and Division of Aquatic Resources, Cheryl King, and our team past and present at Hawai‘i Wildlife Fund, especially all of our volunteers, and to the International Sea Turtle Symposium and all of their supporting donors, including The Shared Earth Foundation, The Leatherback Trust, Disney’s Animals, Science, and Environment, International Seafood Sustainability Foundation, Sirtrack and Lotek, George Balazs, Frank Paladino, and CLS America.

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