

Long-term monitoring and protection of a rare nesting population of hawksbill sea turtles (Eretmochelys imbricata) on Maui: trends and developments from 21 years of research

> Luke Sundquist, Suzanne Canja, Hannah Bernard, and Bill Gilmartin Hawai'i Wildlife Fund



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 1996.¹ The adult population in Hawai'i remains on the brink of extirpation 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 inter-island migrations.² 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**.³

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 hatchling success, with 816 hatchlings from 861 eggs in 2016, or 95% (Figure 2)

Mean Hatchling Success by Season for Orion

Results Continued

Historical Data:

- 9 nesting females have been tagged on Maui since 1996
- 6 have remigrated, while 3 were seen during just one nesting season
- Yearly totals of **nests and females have not changed significantly**

Females and Nests per Year, 1996-2016

h	
.2	
∩ -	





Figure 2. Mean hatchling success by season for Orion, nesting on Oneloa Beach. n=22, Linear regression ANOVA (least square means) p<0.05.

Nesting Beaches:

- Beach conditions also contributed to hatchling 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 hatchling 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



Figure 4. Total confirmed females and nests by year, n=90 nests from at least 12 females. Linear regression ANOVA (least square means) p>0.05.

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

Figure 1. Map of known consistent hawksbill nesting areas in the Hawaiian Archipelago. The largest nesting population is found on the southern coast of the Big Island of Hawai'i (10-20 nesting females per year), with a smaller consistent nesting population on the southern coast of Maui (0-5 nesting females per year) and intermittent nesting on eastern Maui and other islands (0-2 nesting females per year).

The Hawksbill Recovery Project began nest monitoring on Maui in 1996 as a partnership between volunteers with the non-profit Hawai'i Wildlife Fund, U.S. Fish and Wildlife Service, and the Hawai'i Department of Land and Natural Resources Division of Aquatic Resources. The objectives of this project include protecting nesting females and hatchlings, identifying individual turtles and biological trends, preserving beach and foraging habitats, and educating and involving the public in hawksbill conservation. Volunteers patrol beaches for tracks at dawn, while staff and volunteers camp out to encounter, measure, and tag nesting females, then mark, protect, and monitor nests through hatching and excavation. Although over 6000 hatchlings have been protected through this program on Maui, very few of those may survive to reach maturity. Without dedicated protection, research, and conservation, hawksbills could disappear from Maui by the next generation.

- The three most popular nesting beaches on Maui differ greatly in these conditions and their hatchling 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
- **Kawililipoa 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 Kawililipoa or within Kawililipoa with limited success, as three remained undeveloped and three had hatchling success under 50%



- Some degraded and eroded beaches are irreparably damaged and have significantly lower hatchling 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
- Hatchling 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 years⁴
- 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.

SERVICE

Mean Hatchling Success by Beach

References

1. Mortimer J.A., Donnelly M. (2008). *Eretmochelys imbricata*, 2008 IUCN Red List of Threatened Species. Retrieved from www.iucnredlist.org 2. Parker D.M., Balazs G.H., King C., Katahira L., Gilmartin W. (2009). Short-range movements of post-nesting hawksbill turtles (*Eretmochelys imbricata*) from nesting to foraging areas within the Hawaiian Islands. *Pac Sci* 63:371-382 3. Seitz W.A., Kagimoto K.M., Luehrs B., Katahira L. (2012). Twenty years of conservation and research findings of the Hawai'i Island Hawksbill Turtle Recovery Project, 1989-2009. Technical Report 178. The Hawai`i-Pacific Islands Cooperative Ecosystem Studies Unit & Pacific Cooperative Studies Unit, University of Hawai`i. 117 pp. & personal communication 4. Snover M.L., Balazs G.H., Murakawa S.K.K., Hargrove S.K., Rice M.R., Seitz W.A. (2012). Age and growth rates of Hawaiian hawksbill turtles (Eretmochelys imbricata) using skeletochronology. *Mar. Biol.* 160: 37-46.





Author Contact: Luke Sundquist, Hawai'i Wildlife Fund, lukes.hwf@gmail.com