

Final Report

The Research, Protection, and Monitoring of Maui Nui's Nesting and Foraging Hawksbill Populations



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Cover Photo: Main emergence of a nest on Oneloa Beach of approximately 185 hatchlings, on August 15, 2016. Photo by Aimee Lemieux.



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Program Officer: Penny Larin, (808) 725-5057, penny.larin@noaa.gov
Program Office: Fisheries Pacific Islands Region Program Office (PIRO)
Recipient Name: Hawai'i Wildlife Fund, PO Box 790637 Paia, HI 96779
Principal Investigator: Hannah Bernard, 808.280.8124, wild@aloha.net
Project Directors: Cheryl King, Hannah Bernard, Suzanne Canja, and Luke Sundquist

Project Narrative

1. Background

The Hawaiian Islands contain one of the smallest and most isolated populations of hawksbill sea turtles (*Eretmochelys imbricata*) in the world. Little was known of this critically endangered population before the nesting conservation program began on Hawai'i Island in 1989. Although most hawksbill nesting in the archipelago occurs there, a nesting hawksbill was first documented at Kealia Beach on Maui in 1991. Two nesting hawksbills were killed on the adjacent highway in following years, leading to the involvement of Hawai'i Wildlife Fund (HWF) in the Hawksbill Recovery Project in 1996, in collaboration with the National Marine Fisheries Service (NMFS), Hawai'i Department of Land and Natural Resources Division of Aquatic Resources (DLNR/DAR), and with the U. S. Fish and Wildlife Service (USFWS). This project aligns with the NMFS/USFWS Hawksbill Recovery Plan of 1998 to continue efforts to monitor, research, and protect hawksbill sea turtles and their nesting and marine habitats, involve and educate the community about the threats and status of sea turtles, and collect and share data for informed management decisions. This multi-faceted approach contributes to community and global awareness of hawksbills, increased survivorship of hatchlings through maturity, and the long-term recovery of the Hawaiian hawksbill population.

Since HWF began monitoring in 1996, 11 nesting hawksbills have been tagged on Maui and 104 nests have been protected, resulting in around 10,000 successful hatchlings reaching the ocean. Although only a few hawksbills may nest on Maui each year, this contribution is still critical for the isolated Hawaiian population of hawksbills, with an average of 15–25 known nesting females per year in the state. HWF has also collaborated with NMFS in satellite tracking nesting

females to their foraging grounds around Hawai'i Island, Maui, O'ahu, Moloka'i, Kaua'i, and off Johnston Atoll. In addition to satellite tracking, in-water surveys and photo-identification have contributed to the database of over 160 hawksbills across the state, identifying movement patterns and important foraging grounds. HWF involves and educates thousands of individuals on Maui and around the world through social media each year, from local residents to international tourists. This outreach can prevent threats to sea turtles and harmful human behavior, while building public understanding and hawksbill and environmental conservation. Over the last 22 years, HWF has built invaluable connections with agencies and communities, refined research protocols, collected data and knowledge of individual turtles and their locations, and proved the value of our experience and the work of the Hawksbill Recovery Project for years to come.

2. Nesting Project

HWF has been involved in nest monitoring since 1996. The project has grown and intensified over time by identifying and patrolling nesting beaches, tagging new females, and protecting and monitoring all hawksbill nests on south Maui during this grant period. From 2015 to 2017, USFWS was coordinating dawn patrol to check these known nesting beaches each morning between Ma'alaea and Makena. It proved difficult for USFWS to bring the personnel and resources necessary to maintain, coordinate, and communicate for dawn patrol, so HWF took over dawn patrol coordination in the 2018 season. When any dawn patrol volunteer or community member reports a track, nest, or hatchling, HWF staff responded to confirm the activity, protect the nest, and consult on other measures with our agency contacts under the terms of our research permits. These included taping off the nest in areas with human traffic, screening nests in areas of possible predation, spreading pepper powder to deter predators, or relocating nests that are in danger of being inundated by high tide. All nesting and hatching activities were monitored and documented according to established protocols and in active consultation with DNLR and USFWS.

After the first nest of the season was confirmed, HWF staff and volunteers monitored the beach overnight during the intervals when the female may return. This allowed the team to directly observe nesting activity, tag, measure, and identify females, and mitigate any disturbance or endangerment of nesting females while monitoring human activity on the beach at night. Nests were checked regularly during incubation for disturbance, erosion, or other risks and monitored 24/7 around the expected emergence date. This also created opportunities to educate the public around the nests while preventing threats to the hatchlings

including predation by invasive species, entanglement in vegetation and marine debris, disorientation, and desiccation.

Following the main emergence, nest excavations were planned and carried out with Hawai'i DLNR/DAR biologist Skippy Hau and with the coordination and notification of USFWS representatives, which included Courtney Brown, Jon Sprague, Bill O'Neill, and Michelle Bogardus at different points during the grant period. HWF staff involved included Hannah Bernard as the PI throughout the period, Cheryl King as a coordinator in 2015, Suzanne Canja as a coordinator 2016 and 2017, Luke Sundquist as a coordinator in 2016, 2017, and 2018, and Diana Sciambi as a dawn patrol coordinator in 2018, with other HWF staff members sometimes assisting on snorkel surveys, outreach, and other related activities. Penny Larin served as the NOAA Program Officer for this grant, while Irene Kelly was the NOAA Technical Officer, and Alexander Gaos partnered to lead the satellite tagging of the nesting female in 2018. Volunteers were trained before dawn patrol began and throughout the season, where all participating volunteers are given protocols and trained for possible scenarios and proper behavior at the nest and provided with brochures and information to distribute to the public.

HWF staff was present with volunteers every night of camping when activity was expected. Volunteers were trained and managed by staff to stay dark and quiet on the beach and maintain appropriate distance from nesting females and hatchlings during any activity. Volunteers were also prepared for emergences during the day watches, and in ready contact with HWF staff if this occurred. Volunteers and members of the public present at excavations and emergences received explanations of sea turtle life histories and our responsibilities and practices. They were also instructed in the context of our work, to maintain space from the hatchlings especially as they reached the water, to turn off any lights and flash photography, and to not post the locations of nests to social media.

Beyond monitoring of nesting and hatching activity during the nesting season, this project also includes continuous protection of critical habitat, with beach cleanups, fence repair, and dune restoration as necessary. During the offseason, HWF staff checked beach habitats, trained volunteers, and prepared the necessary permits and gear for each nesting season.

3. Foraging Habitat Project

HWF conducted snorkel surveys around Maui year-round in possible hawksbill foraging habitats to identify individuals and their feeding grounds. Locations were chosen where hawksbills have been seen in the past or where pictures and reports of hawksbills are reported by the public, but new locations are also investigated. These surveys allowed staff to educate volunteers on

hawksbill identification and life history, identify individuals and important foraging habitats, and clean reefs and beaches as we worked.

HWF staff trained and led groups of 4–10 volunteers during surveys. After orientation and review on land, the team entered the water and lined up perpendicular to shore, evenly spread 5–15 feet apart depending on habitat and conditions. The transects moved parallel to shore in depths ranging from 5–40 feet, surveying the habitat, checking caves and cracks, and stopping to photograph and document any turtles seen during the transect. Although hawksbills were the focus of the survey, green turtles were also counted and noted for their size and the presence or absence of fibropapilloma. Surveys continued for at least one hour, depending on conditions. Time and GPS points are taken at the beginning and end of the survey and at any hawksbill sightings, along with data on the environmental conditions and volunteer participants. Since no handling or take of endangered species occurs during these surveys, individuals and partners involved were limited to HWF and trained volunteers.

Surveys can be an effective way to locate sea turtles, but hawksbill sightings were still rare because of their low numbers around Maui and around the state. Because of this, education and involvement of the public, including snorkelers, SCUBA shops, and tour companies became critical to find new hawksbill habitats and obtain photos for identification and re-sighting of foraging hawksbills. HWF shared educational materials and identification brochures and posters with these organizations, as well as sharing hawksbill sighting information with Cheryl King for the HIhawksbills.org database and other interested partners around the state.

4. Education and Outreach Project

HWF engages in a variety of year-round education efforts and special outreach events and programs. HWF regularly distributes information on sea turtle behavior, responsible marine activities, and reef-safe sunscreen at dive shops, boat companies, and other marine facilities. Hannah Bernard conducted Naturalist Training courses for paddle sport and dive company guides and serves as an on-board naturalist herself in order that guests may better understand and protect the marine environment. HWF staff also conducts week-long volunteer experiences and offers student internships that allow for training and involvement in a variety of conservation activities. Staff and volunteers answer questions for the public and disseminate information during all beach-monitoring activities. Lastly, regular social media posts educate online visitors on animal activity, threats to the environment, and how to contribute to conservation. All of these activities resulted in hundreds of trained volunteers and thousands of



members of the public reached, better educated, and involved in the Hawksbill Recovery Project and its mission.

Performance Narrative

Nesting Project

A. Prepare Maui nesting habitat by fixing the N. Kihei Road turtle fence, conducting beach cleanups, and removing invasive dune vegetation as deemed necessary to eliminate these associated threats.

B. Respond to Maui hawksbill and green nesting events and closely monitor hatching activity to collect biological data and to protect nesting females, active nests, and emerging hatchlings to increase survival.

C. Summarize Maui hawksbill nesting activity each season to provide nesting trend data and make informed management decisions.

D. Summarize all known Maui hawksbill nesting and hatching data from 1991—2018 to greatly increase the knowledge of biological data, nesting habits, positive project impacts, and population outlook.

E. Reports will be presented and made available to the Hawaiian Hawksbill Recovery Team and other Pacific groups for use in recovery plans and management decision.

The nesting project remains one of the top priorities for HWF over the last 22 years and within this grant period over the last four years. Efforts are primarily focused on nesting season, including dawn patrol monitoring beaches from the end of May to the end of September and nest watch on into October, November, or December. However, much of the reporting, fundraising, and preparation for each season occurs throughout the year, including maintenance of habitat. Throughout the last four years HWF staff, interns, and volunteers completed scheduled beach cleanups on nesting beaches and opportunistic cleanups during patrols, monitoring, or educational experiences. This habitat protection also incorporated removing invasive vegetation, especially immediately around nests, and annual examination and repair of the turtle fence along North Kihei Road in partnership with Kealia National Wildlife Refuge (Figure 7).

HWF staff responded to all confirmed or possible nesting events and reports of eggs or hatchlings. In 2018, this also included taking over coordination of dawn patrol on south Maui nesting beaches from USFWS. While nesting numbers remain low, with only one female nesting in three of the four seasons, this coverage facilitated the close monitoring and protection of each egg and hatchling. Dawn and overnight patrols led to resighting two previous nesters and the tagging of two new nesting females, including a satellite tag deployment in 2018 with Alexander Gaos (Figure 9). Vigilance and volunteer support led to thorough data, and improved hatchling survival through mitigation of threats and release of trapped hatchlings after excavations of each nest (Table 1, Appendices 1 and 2). Data was collected from every nesting, nest, and excavation, samples were collected of all dead hatchlings, empty shells, and unhatched eggs to NOAA/NMFS/PISC in Honolulu, while live hatchlings found during excavations were allowed to acclimate in a bucket after rescue then released at the high tide line.

HWF staff closely reviews data from each nest, any concerns offered by volunteers or partners, and ongoing research in the sea turtle community to make the best management decisions and practices possible each season. Individual threats and challenges vary by year, beach, and nest and are discussed in more depth in bi-annual progress reports. These included changes

in personnel internally for HWF and externally with the Maui Hawksbill Team, discussions of protocols, responses, and relocations with USFWS, updates to excavation timelines and procedures, and troubleshooting and improving conditions and management of each nest. Annual findings and results are also shared and discussed with the Hawaiian Hawksbill Recovery Team, which continues to be an effective collaboration of government and non-profit partners. Lastly, HWF staff prepared and presented comprehensive posters reviewing 22 years of results from this project and presented these at the International Sea Turtle Symposium in the spring of 2017 and 2018. Each poster analyzed trends in nesting, hatching, and overall success to improve our understanding of how to best conserve this critically endangered species. These are included below (Figures 3,4) along with graphs updated to include the 2018 data (Figures 5,6).

Table 1. Summary of nesting data from the four seasons covered in the grant period. Additional data and full tag numbers available in Appendices 1 and 2.

| Date | Beach | Female | Tag | Eggs | Hatchlings | Success (%) |
|---------|-------------|--------------|------------------------------------|------------------|------------|-------------|
| 2015 | Kealia | unknown | unknown | N/A, predated | 0 | 0 |
| 8/9/15 | Kealia | unknown | unknown | 137 | 122 | 89.1 |
| 8/24/15 | Kealia | unknown | unknown | 197 | 66 | 33.5 |
| 6/15/15 | Kawililipoa | Sasha | Resight LFF-H329 RFF-missing | 216 | 106 | 49.1 |
| 7/4/15 | Kawililipoa | Sasha | Resight | 220 | 207 | 94.1 |
| 7/23/15 | Kawililipoa | Sasha | Resight | 200 | 112 | 56 |
| 8/10/15 | Kawililipoa | Sasha | Resight | 161 | 0 | 0 |
| 8/25/15 | Kawililipoa | Sasha | Resight | 160 | 0 | 0 |
| 2015 | Palauea | unknown | unknown | 216 | 165 | 76.4 |
| 2015 | Palauea | unknown | unknown | 211 | 129 | 61.1 |
| 2015 | Palauea | unknown | unknown | 187 | 137 | 73.3 |
| 6/13/16 | Big Beach | Orion | Resight RFF-H335 | 191 | 189 | 99.0 |
| 7/2/16 | Big Beach | Orion | Resight | 182 | 181 | 99.5 |
| 7/21/16 | Big Beach | Orion | Resight | 188 | 185 | 98.4 |
| 8/8/16 | Big Beach | Orion | Resight | 180 | 145 | 80.6 |
| 8/26/16 | Big Beach | Orion | Resight | 120 | 116 | 96.7 |
| 6/19/17 | Big Beach | Kaloa Pau | none | 223 | 184 | 82.3 |

| | | | | | | |
|---------|---|-----------|--------------------|------|------|------|
| 7/7/17 | Big Beach | Kaloa Pau | none | 232 | 120 | 51.7 |
| 7/23/17 | Big Beach | Kaloa Pau | Applied RFF-PI2453 | 231 | 202 | 87.4 |
| 8/9/17 | Big Beach | Kaloa Pau | Resight RFF-PI2453 | 221 | 143 | 64.7 |
| 5/30/18 | Palau'ea | Ole Pau | none | 217 | 125 | 57.6 |
| 6/16/18 | Palau'ea | Ole Pau | none | 207 | 121 | 58.4 |
| 7/4/18 | Palau'ea | Ole Pau | Applied RFF-PI2459 | 211 | 118 | 55.9 |
| 7/21/18 | Palau'ea | Ole Pau | Resight RFF-PI2459 | 222 | 140 | 63.1 |
| 8/6/18 | Palau'ea | Ole Pau | Resight | 165 | 128 | 77.6 |
| Totals | 26 nests from 4 remigrants, 2 newly tagged, and 2 unknown nesters | | | 4705 | 3122 | 66.4 |

Foraging Habitat Project

A. Eighteen annual in-water survey transects to collect additional data points for photo-ID and sight/re-sight, and to assist turtle in trouble when possible.

B. Fibropapillomatosis cases will be recorded and tracked to help assess the statewide impact of this disease and monitor individuals.

C. Statewide in-water individual capture-recapture database (1998-2018) for behaviors, individual identification, spatio-temporal tracking, and abundance estimates.

D. Summarize Maui in-water surveys including habitat and biological data, observations of population threats and potential tagging site recommendation to greatly add to the knowledge of hawksbills in their foraging habitat.

E. Reports will be presented and made available to the Hawaiian Hawksbill Recovery Team and other Pacific groups for use in recovery plans and management decisions.

While the nesting project is valuable and effective in monitoring and protecting females and hatchlings on the beaches, that leaves gaps in understanding and tracking other life stages in the population. The foraging habitat project and dedicated snorkel surveys seek to learn more about hawksbills in the water, especially males and juveniles, find and protect their foraging habitats, and address entanglements and fibropapilloma cases. With

these goals in mind, HWF staff and volunteers completed 55 snorkel surveys from 2015 to 2018 at a rate averaging 18 per year (Table 2, Appendix 3). Snorkel surveys were distributed and spread throughout each year then ultimately planned and completed according to weather, site conditions, and staff and volunteer availability. Surveys were reduced to opportunistic and educational in the 2018 due to the shortening and reduction of grant funding, focus on dawn patrol and nesting season, and limited return on in-water surveys.

Over the 55 formal surveys and many more educational and training snorkel opportunities, only two hawksbills were found and photographed, one new sighting and one resighting (Table 2, Figure 18). Surveys were planned in known hawksbill habitats, around recent sightings, or in possible undiscovered foraging areas. Even in areas with a few known resident hawksbills, like Kahekili Beach, it can be unlikely to find such rare animals within their home range during the span of a single survey. Because of this, community involvement and education became very important in this project, connecting with the education and outreach project. Hawksbill information was distributed to paddling, boating, snorkeling, and diving companies around the island on an annual basis (Table 4), including the brochure (Figure 1), Photo ID guides, and the Hawksbill wanted poster (Figure 2). This outreach led to many community reports and photographs of hawksbills from local employees, customers, and volunteers. These were recorded and shared with Cheryl King for the hihawksbills.org database, which she maintained with the collection of hawksbill sightings and identifications she retained after splitting from HWF.

In addition to direct surveys for hawksbills, staff and volunteers removed significant amounts of line, hooks, and trash from the beach and reef during surveys. Serious fibropapilloma cases and entanglements were also photographed, recorded, and reported to the Maui Stranding Network when appropriate (e.g. Figure 20). Data was compiled and discussed annually to plan upcoming surveys or tagging locations and review local threats and changes.

Table 2. Summary of snorkel surveys data from the four years covered in the grant period. Additional data available in Appendix 3.

| Year | Surveys | Greens | Hawksbills | Hawksbill Location | Type |
|------|---------|--------|------------|--------------------|----------------------------------|
| 2015 | 4 | 5 | 0 | N/A | N/A |
| 2016 | 24 | 133 | 1 | 505 Front Street | First sighting, "Polanui" MUI 54 |
| 2017 | 21 | 168 | 1 | Pu'u Olai | Resighting "Hope" MUI15 |
| 2018 | 6 | 43 | 0 | N/A | N/A |

| | | | | | |
|-------|----|-----|---|----------------------------|-----------------------------------|
| Total | 55 | 349 | 2 | Front Street, Pu'u Olai | 1 first sighting, 1 resighting |
|-------|----|-----|---|----------------------------|-----------------------------------|

Education and Outreach Project

A. Education/outreach efforts on-line and in the form of presentations, talk story sessions, displays, school visits, UH Maui College Naturalist Training Certifications, training and working as naturalists on tour boats and kayaks, as well as direct responses to nesting, basking, stranding, and entanglement events to encourage positive actions to help sea turtles globally.

B. Distribution of HWF and NOAA hawksbill identification flyers and brochures to SCUBA dive company locations and online locations including social media to receive more hawksbill sightings.

C. A summary of the effectiveness of obtaining hawksbill sightings from different sources where they were posted, to make recommendations for more prolific efforts.

D. A summary of volunteer involvements will show this project's reach.

Education and outreach is the third branch of this project, with wide-reaching impacts in involving volunteers, partnering with local businesses, and raising awareness about hawksbill sea turtles (Table 3). First, HWF continued to build its on-site educational components throughout each year of this period with the outreach at Ho'okipa, nesting beaches, surf events, and on snorkel trips in partnership with Kai Kanani Sailing. The impact of these efforts was measured by average annual visitors to these sites, including a wide range of locals and tourists who had access to trained naturalists and educational materials. HWF also held dedicated events and trainings every year, including film screenings, lectures, volunteers trainings, programming for students, and naturalist training for partner companies. These were reported according to attendance or participants, all of whom received training in hawksbill identification and awareness. Lastly, HWF built its social media following from only a few thousand in 2015 to over 15 thousand followers in 2018. These platforms were used to recruit volunteers, educate the public about sea turtles and hawksbill ID, and encourage activism and environmentally responsible behaviors. In addition to regular posts with consistent reach in of thousands of individuals per week, some video content and social media partnerships went viral with over 200 thousand views.

HWF staff educated volunteers and members of the public during responses to reports of tracks, nesting, or other concern about turtle activity. Stranding and

entanglements were shared and addressed in partnership with UH Maui and the Maui Ocean Center of the Maui Stranding Network. HWF also partnered with numerous ocean-based companies to spread and share hawksbill ID information, as discussed under the Foraging Habitat Project above and listed below (Table 4.). These efforts increased throughout the grant period and utilized materials developed with NOAA and the Hawaiian Hawksbill Partners (Figures 1,2). Especially with limited funding for snorkel surveys and rare sightings, these partnerships led to increased community awareness and both new and repeated reports and identifications of hawksbills in foraging habitats. These reports were reviewed and shared with Cheryl King to be added to the database on HIHawksbills.org. Due to the limited return on snorkel surveys, posting and sharing hawksbill ID information online and with dive shops, snorkel companies, and boat tours has become a critical component of raising community awareness of hawksbills and increasing the total number of hawksbill sightings.

HWF staff also educated and involved many volunteers throughout the season. This included a review of protocols and hawksbill information before every snorkel survey and overnight nest watch, as well as formal trainings for dawn patrol and nest watch volunteers before each nesting season began. Volunteer involvement increased significantly over the grant period, as HWF improved their outreach and developed their protocols to recruit and retain more volunteers each year (Table 5). Over the four years, an estimated 800 volunteers contributed nearly 13 thousand hours to these projects. Many of these volunteers overlapped between different efforts, helping with some combination of dawn patrol, nest watch, snorkel surveys, outreach events, and fundraising during the year. Demographics ranged widely among volunteers groups, including many Maui-based retirees, families that traveled to Maui or volunteered locally together, international travelers, high school and college interns, and like-minded individuals of any gender, race, age, and background who were interested in contributing to hawksbill conservation.

Table 3. Estimated individuals reached by outreach type during the grant period.

| Year | 2015 | 2016 | 2017 | 2018 | Total |
|--------------------------|---------|---------|---------|---------|----------|
| On-site Education | ~40,000 | ~70,000 | ~50,000 | ~45,000 | ~205,000 |
| Event/Training | 280 | 120 | 230 | 110 | 740 |
| Social Media | 3000 | 4600 | 7500 | 15700 | 30,800 |
| Total | ~43,280 | ~74,720 | ~57,730 | ~60,810 | ~236,540 |

Table 4. Companies that received hawksbill ID materials during the grant period.

| |
|------------------------------------|
| Maui Dive Shop |
| Maui Dreams Dive Company |
| B&B Scuba Shop |
| Extended Horizons Scuba Dive Shop |
| Lahaina Divers Dive Shop |
| Maui Diving Scuba and Snorkel Shop |
| Maui's Biggest Little Dive Shop |
| Boss Frog's Snorkel |
| Snorkel Bob's Shop |
| Hawaiian Paddle Sports |
| Ultimate Rafting |
| Paragon Sail |
| Makai Adventures |
| Hawaii Ocean Rafting |
| Trilogy Excursions |
| Pacific Whale Foundation |
| Teralani Sailing |
| Mark Robinson Snorkel |
| Hawaiian Rafting |
| Mike Severns Diving |
| Maui Adventure Cruises |
| Maui Magic |

Table 5. Summary of volunteer numbers and estimated hours in this project.

| Year | Snorkel Volunteers | Nesting volunteers | Total Hours |
|-------|--------------------|--------------------|-------------|
| 2015 | 30 | 80 | 1550 |
| 2016 | 60 | 150 | 3530 |
| 2017 | 120 | 130 | 3700 |
| 2018 | 18 | 220 | 4030 |
| Total | 228 | 580 | 12810 |

Supplementary Links

HWF website: <https://www.wildhawaii.org/>

HWF partners: <https://www.wildhawaii.org/partners.html>

HWF Facebook: <https://www.facebook.com/hawaiiwildlifefund/>

HWF Instagram: <https://www.instagram.com/wildhawaii/>

HWF Twitter: <https://twitter.com/wildhawaii?lang=en>

Sand Cloud video partnership:

<https://www.facebook.com/hawaiiwildlifefund/videos/vl.230752357579653/2157168921216171/?type=1>

Dodo video partnership:

<https://www.facebook.com/DodoImpact/videos/1942236079126809/>

USFWS press release:

<http://www.hawaiinewsnow.com/story/36174232/scientists-relocate-nest-of-200-hawksbill-sea-turtle-eggs-on-maui/>

USFWS blog: <http://usfwspacific.tumblr.com/post/164608773445/emergency-rescue-saves-endangered-sea-turtle-nest>

USFWS video partnership:
<https://www.facebook.com/usfws/videos/10155654357915775/>

Maui Time press release: <https://mauitime.com/news/science-and-environment/how-you-can-help-protect-nesting-sea-turtles-during-nesting-season-on-maui/>

Hawaiian Paddle Sports Blog and video:
<https://hawaiianpaddlesports.com/maui/non-profit/hawksbillproject/>

Akaku Upstairs Film Screening:
<https://vimeo.com/238346271?cjevent=28f65d76108a11e9804b01530a1c0e13>

Akaku Maui Community Radio interview:
<https://www.facebook.com/KAKU885FM/videos/451966541993221/>

Conclusion

Research around the state continues to develop our understanding of the small Hawaiian hawksbill population and how to conserve it. Since monitoring on Maui began in 1996, hawksbill nesting numbers have remained low with no significant changes (Figure 6). Each year is extremely variable, ranging from 0–4 females and 0–12 nests per year. Nesting activity has been observed on six different nesting beaches on the south coast of Maui, including the first recorded identification of nests on Palau‘ea Beach in 2015. During this grant period, at least 6 females nested on these known beaches on Maui. This included at least 2 unseen females in 2015, a 17 year remigrant in 2015, a female remigrating for the 5th time in 2016, and newly tagged females in 2017 and 2018 (Table 1). While nesting numbers average close to just one female and four nests per year, we continue to observe remigrants and new individuals laying nests on Maui. Continued nest monitoring efforts will seek to protect these tagged females and their nests to contribute to hatchling success and survival.

The south Maui nesting beaches are spread along nearly 15 miles of coastline, with each nest posing unique challenges to volunteers and threats to nesting females and hatchlings. At the northern end, Kealia Beach has had the

lowest average success, with some nests having no successful or live hatchlings. This beach has severe erosion, runoff, and pollution, as well as heavy human and vehicle traffic. Kealia was also the site where two females were killed on the adjacent highway in the 90s, before monitoring began and the turtle fence was built. At the opposite end of this 15-mile stretch of coastline is Oneloa Beach, also known as Big Beach at Makena State Park, one of the best-maintained and protected nesting habitats on the island. The beach is wide, largely undeveloped, and closed to the public at night. However, Oneloa is still threatened with invasive predators and vegetation, human use and beach modification, lights and debris, and natural processes like erosion and storms. Between these two extremes, Kalepolepo, Kawilipipoa, and Palau'ea are all open to the public and bordering residential areas in Kihei. Nests on these beaches have had varied success, each dealing with limited suitable habitat due to erosion, vegetation, and human activities. Each nesting beach on Maui experiences some level of human impacts in addition to the natural challenges that nesting hawksbill females and hatchlings must overcome.

During this grant period, predation and human interference was effectively minimized with thorough volunteer monitoring and extensive education. Erosion, debris, and vegetation still proved to have some of the greatest impacts on the nest outcome and hatchling survival, making excavation and sometimes relocation all the more crucial. These threats seem to become more widespread and pressing year by year, requiring vigilance, ongoing management, and creative solutions. Suitable nesting habitat becomes more difficult to find between sea level rise, erosion, invasive vegetation, and human development. All of these changes and threats can make nesting and hatching more difficult, causing more false crawls, threatened nests, and trapped hatchlings. Still, the Hawksbill Recovery Project makes a significant difference with dedicated time and efforts for the survival of individual hatchlings and success of each nest. In many cases, nest protection, volunteer monitoring, and excavation may more than double the hatchling success of a nest. This was calculated by looking at the percentage of hatchlings that required direct intervention to survive, through egg relocation, rescue from entanglement, predators, or heat during their crawl, and release after excavation. Without these efforts, these hatchlings would not have survived, not to mention the preemptive prevention of human impacts and predation during incubation. Overall hatchling success has increased significantly over the last 22 years, with some of the greatest percentage success occurring during this grant period, averaging 66% but reaching as high as 95% in 2016 (Figure 5, Table 1). Dedicated monitoring, volunteer coverage, and increased awareness contributed to an estimated 3122 successful hatchlings during these last four years of an estimated 10,000 over 22 years.

Nesting monitoring and conservation remains critical to this population, but is only one branch of this project dedicated to that part of the hawksbill life cycle.

Snorkel surveys, photo ID, and hawksbill education help to fill in the gaps of knowledge and protection for juveniles, male hawksbills, and all the stages between hatching and nesting. Snorkel surveys have had limited efficacy in finding such rare individuals, but have still led to discovering and resighting individuals around Maui (Table 2). Maui has a plethora of daily water-based activities and professionals, including boating, paddling, diving, and snorkeling communities (Table 4). Outreach to these communities has proven effective, both in creating a larger network for identifying hawksbills in the water and in training them as naturalists and responsible conservationists. This collaboration with local companies, visitors, HIhawksbills.org, and the statewide Hawaiian Hawksbill Recovery Team improves the understanding of hawksbill foraging behavior and habitat and continues to shape the focus of our conservation efforts.

Educational outreach is integrally tied to all aspects of this project and may have the broadest impact on the public and the environment. Building community awareness of hawksbills, their rarity, and their threats creates new volunteers and concerned citizens and can prevent potential anthropogenic effects. These individuals may participate in dawn patrol, nest watch, and snorkel surveys, and report hawksbill track or photos that they may find outside of our activities or see on social media. This outreach also improves hawksbill nesting and foraging habitat through formal events, like beach cleanups and volunteer trainings, and through positive individual behaviors and sustainable lifestyle changes. On-site educational displays, materials, and naturalists, planned events and programs, along with social media outreach and partnerships are able to impact tens of thousands of individuals every year and connect them with hawksbills, their environment, and the goals of this project (Table 3).

HWF has been able to continue this program for 22 years through the dedicated staff, supportive partners, and countless volunteers who bring their time, skills, and resources to the project. Over 200 volunteers participated in the project for each of the last 3 years, with an estimated total of nearly 13,000 hours donated. This project has a clear impact on hawksbills and humans, through direct conservation efforts with nesting, studying foraging habitat and individual ID, spreading information and appreciation of hawksbills, and an immeasurable influence for environmental conservation.

HWF remains committed to continuing the Hawksbill Recovery Project in the future. Funding limits the personnel, resources, and scope available to the project each year. Although the majority of the project is supported by volunteer time, in-kind donations, and expenses absorbed by HWF, NOAA grants have enabled HWF to fund a full-time coordinator, which increased the coverage and scope of hawksbill monitoring and the overall reach of the project. We continue to search for grants, local partners, and ongoing fundraisers to maintain this effort. This project has been

longstanding before NOAA funding and will remain feasible after this grant, although there may be reductions in budget and sacrifices of staff, time, and resources available for the Hawksbill Recovery Project.

HWF will continue to work with nesting and foraging hawksbills and educational outreach on Maui. We are already recruiting interns and volunteers and pursuing possible funding sources for next season in order to prepare, monitor, and preserve the habitat and hawksbills. With community awareness, new and remigrating females, and increased hatching success, this small nesting population remains resilient. Hawksbills' high age at maturity, low survival rate, and increasing number of anthropogenic threats necessitate continual research and protection for their gradual recovery. Hawai'i Wildlife Fund and all the Hawaiian Hawksbill Recovery Project Partners have made a difference and must continue their work for the survival and future of the species.

Figures

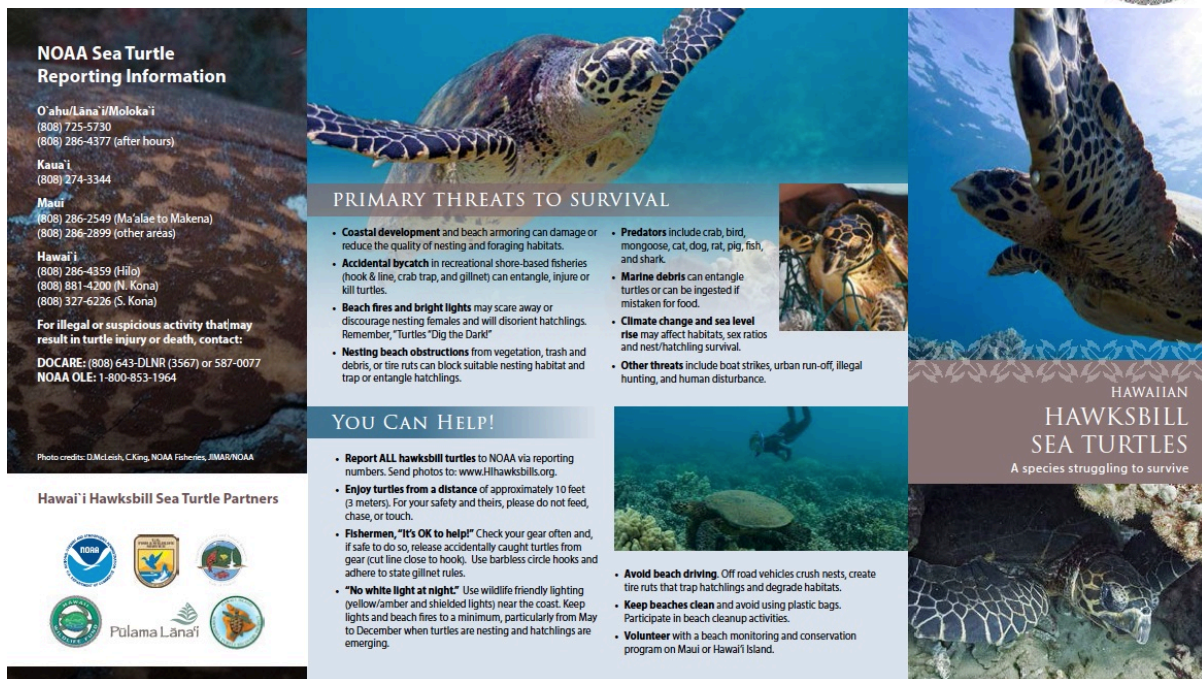


Figure 1.a. Hawaiian hawksbill sea turtle brochure, as distributed at events, training, and nesting sites to volunteers and the public.



Figure 1.b. Side b of brochure.





NOAA



WANTED



Information on Hawksbill Turtles (Honu`ea)

REPORT ALL HAWKSBILL SIGHTINGS TO:
hihawksbills.org or
respectwildlife@noaa.gov

HAWKSBILL OR GREEN? How to tell the difference

DID YOU KNOW that two species of sea turtles live in Hawaiian coastal waters? Green turtles are common, but hawksbill turtles are rare. Less than 25 hawksbill turtles nest each year, compared with 500–800 green turtles.

Learn the difference between the two species and report any hawksbill sightings!



ALL sightings of baby turtle hatchlings are important.

HAWKSBILL / HONU`EA *Eretmochelys imbricata*



Narrow head and pointed beak



4 pre-frontal scales
(between eyes)

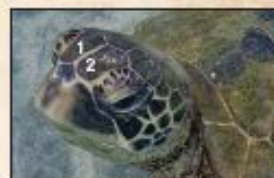


Shell: serrated edges

GREEN / HONU *Chelonia mydas*



Rounded head



2 pre-frontal scales
(between eyes)



Shell: smooth edges

★ Report injured/dead sea turtles to the state-wide marine animal reporting hotline: 888-256-9840 ★



Pulama Lānaʻi



Figure 2. Hawksbills wanted poster, the result of collaboration between the Hawaiian Hawksbill Recovery Partners and NOAA, distributed in 2018.

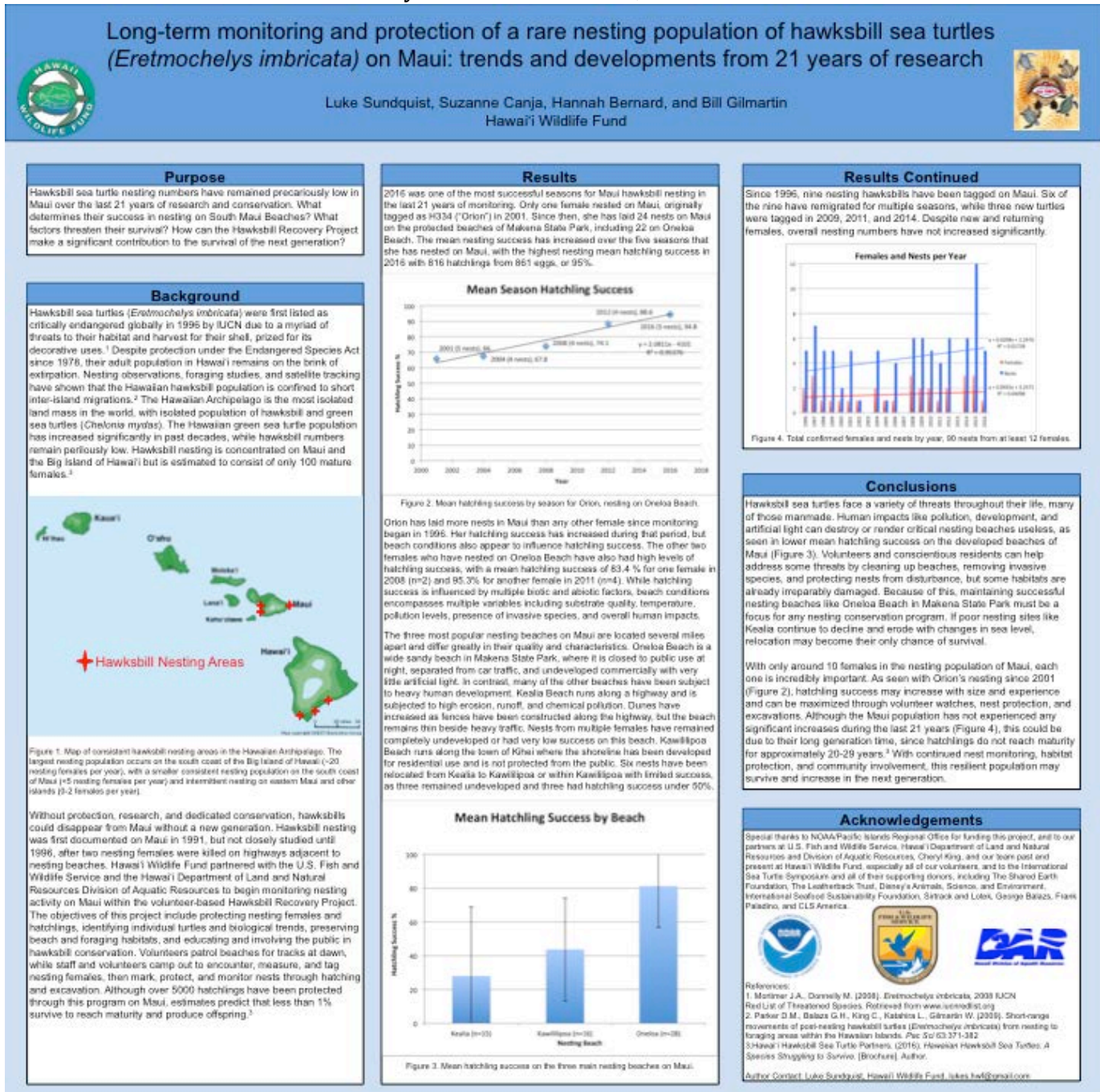




Figure 3. Research poster developed and presented by HWF for the International Sea Turtle Symposium in 2017 in Las Vegas, Nevada.

Factors in Historical Hatchling Production and Implications for Nesting Hawksbill Sea Turtles (*Eretmochelys imbricata*) on Maui

Luke Sundquist and Hannah Bernard
Hawai'i Wildlife Fund

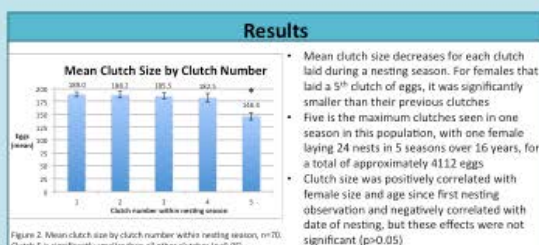
Purpose

Hawksbill sea turtles have been protected and studied during nesting on Maui for decades. However, this small population has not experienced any significant recovery. We examined 22 years of data from 91 nests for trends and effects of natural variables and human impacts on clutch size, incubation time, hatchling success, hatchling production, and nesting population.

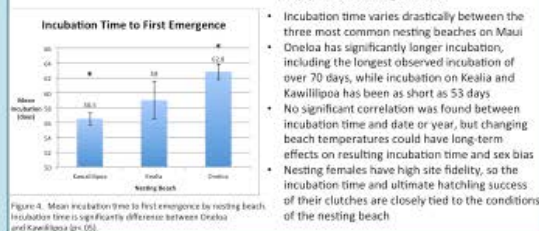
Background

Hawksbill sea turtles have been listed as critically endangered across the globe by the IUCN since 1996.¹ The nesting population on Maui represents a portion of the small, isolated population of hawksbills in the Hawaiian Archipelago.² Hawai'i Wildlife Fund partnered with state and federal agencies in 1996 to research and protect this population.³ Since then, this community volunteer-based project has identified and patrolled six nesting beaches along the south coast of Maui, tagged 10 nesting females, and monitored 91 nests. Annual observations vary, without any activity some years but a mean of 1.3 females and 4.2 nests per year over the 22 year period. These nests have led to over 9000 live hatchlings, but numbers of females, nests, and hatchlings per year have not increased significantly over this period.

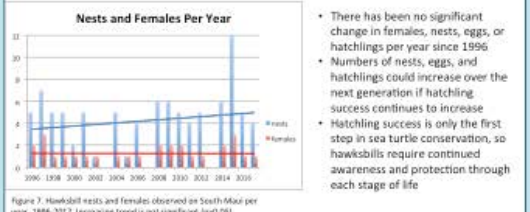
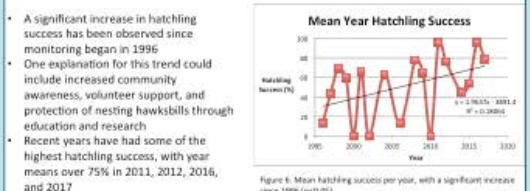
Staff and volunteers conduct dawn patrols to search for tracks and night patrols to encounter females throughout each nesting season. Nests are marked, covered, and monitored, tagging, morphometric, and excavation data is collected, and females and hatchlings are observed and protected while they are on the beach and make their way into the ocean. This small population offers a unique opportunity for a thorough and intensive study of each female and hatchling and the threats to their success. We reviewed variables including female size, age since first nesting observation, date of nest, year of nest, beach conditions, and human intervention to see how they shape hatchling production. By better understanding the threats to this hawksbill population and the variables and the factors in their recovery, we can learn how to best conserve them on Maui and apply these lessons throughout their global range.



- Curved carapace length (CCL) and curved carapace width (CCW) both tend to increase with age since first observation for nesting females, but the correlation was not significant (p>0.05).
- Females measured between 80.6 and 97.2 cm long and 74.2 and 88.7 cm wide, with intervals between nesting seasons ranging from 3 to 17 years.



- Hatchling success varies dramatically by female, with some females averaging over 95% success while others have laid multiple clutches without any successful hatchlings.
- Hatchling success is closely tied to beach choice and environmental conditions, so unsuccessful clutches could be due to female fecundity and behavior or to characteristics of the nesting beach.
- Hatchling success was not significantly correlated with female age since first nesting observation, clutch number, or date, although success tends to be lower later in the nesting season.



Conclusion

Data from Hawai'i Wildlife Fund's Hawksbill Sea Turtle Recovery Project revealed several trends from the last 22 years of research. Females can continue to grow and nest for at least 17 years after reaching sexual maturity, but their age and size do not have a significant effect on clutch size or hatchling survival. These nesting females may lay up to 5 viable clutches per year over multiple nesting seasons, for thousands of total eggs from one individual. The incubation time and success of these clutches is influenced by biotic and abiotic factors, including conditions and threats present on the nesting beach and intervention and protection by volunteers. Hawksbill sea turtles are faced with invasive predators, pollution, habitat loss, beach development, and global warming, but have shown resilience and longevity. As this project continues, it encounters and resolves new obstacles, finding solutions through commitment, partnerships, and community awareness. Although there has not yet been a significant increase in this population, continued dedication and conservation can prevent its loss and enable its recovery on Maui.

Acknowledgements

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References

- Mortimer J.A., Donnelly M. (2008). *Eretmochelys imbricata*, 2008 IUCN Red List of Threatened Species. Retrieved from www.iucnredlist.org.
- Parker D.M., Bolazo G.J., King C., Katschis L., Gilman 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.
- Mangel J.C., Bernard H., Carja S., Hau S., Smith K., Williams S. (2000). Summary of Hawksbill Turtles (*Eretmochelys imbricata*) Nesting on Maui, Hawaii from 1991 to 1996. Kala, H.J., and T. Whittels, compilers. Proceedings of the Nineteenth Annual Symposium on Sea Turtle Biology and Conservation. U.S. Dept. Commerce. NOAA Tech. Memo. NMFS-SEFSC-443, 291 p.

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

Figure 4. Research poster developed and presented by HWF for the International Sea Turtle Symposium in 2018 in Kobe, Japan.

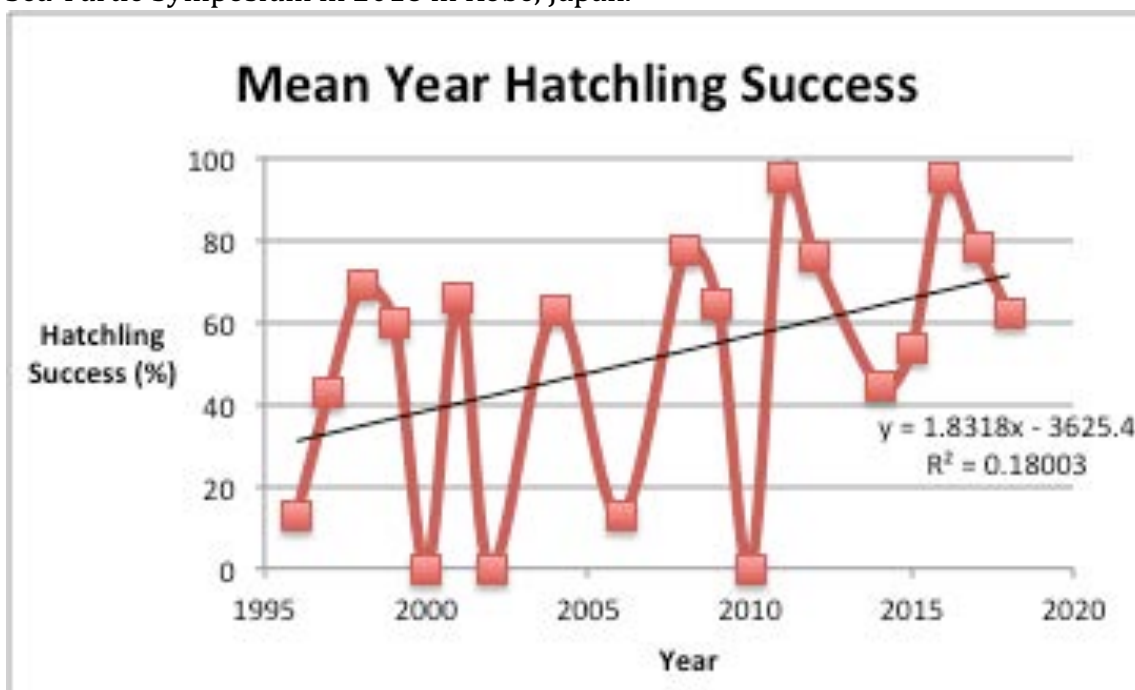


Figure 5. Mean hatchling success percentages by year since monitoring began in 1996, updated through 2018, showing high variability and a positive trend.

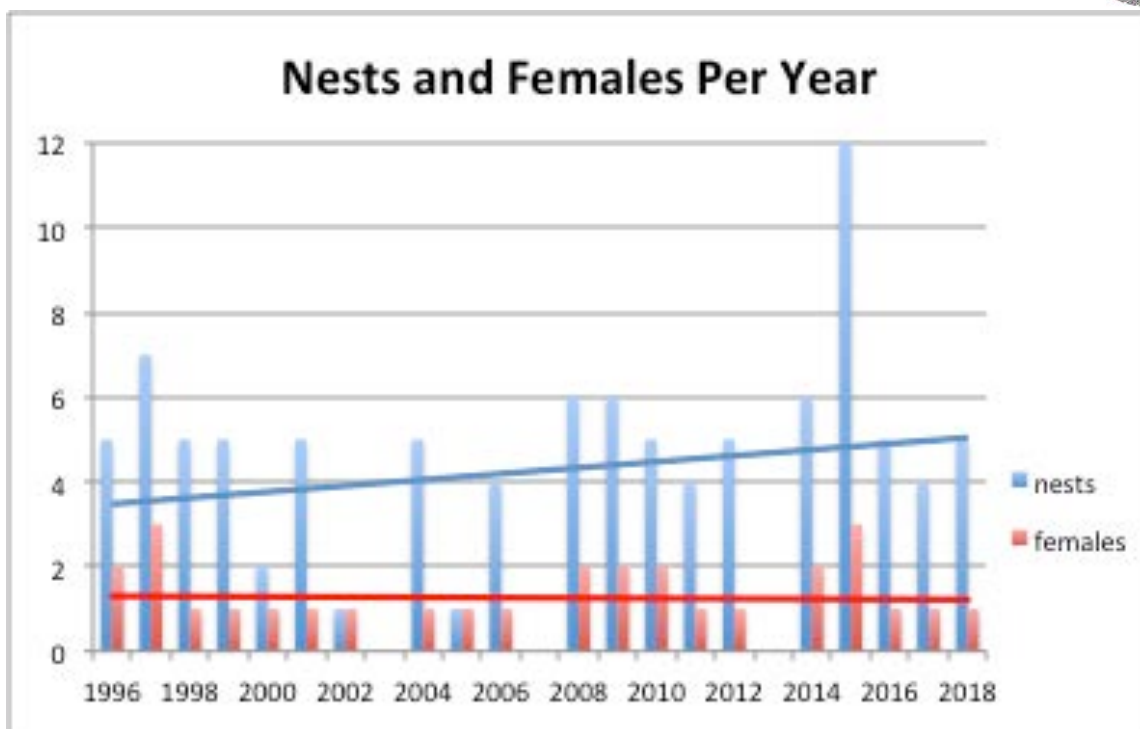


Figure 6. Number of nests and females per year since monitoring began in 1996 and updated through 2018, showing no significant change during that period.



Figure 7. Hawai'i Wildlife Fund interns pose after repairing a section of the turtle fence along Kealia Beach with USF&W and adding a sign to educate the public, May 24th 2017.



Figure 8. Hawksbill track and on Oneloa Beach, June 20th, 2017, Photo by Rick Long.



Figure 9. “Ole Pau” with new drying satellite tag after laying a nest on July 4th, 2018.



Figure 10. Nest relocation on Palau'ea Beach, July 22nd, 2018.



Figure 11. The same nest after it was relocated, screened, and taped, July 22nd, 2018.



Figure 12. Skippy Hau explains the excavation protocol to volunteers and guests before an excavation on September 26, 2016. Photo by John Rodarte.



Figure 13. Luke Sundquist and Skippy Hau excavate and prepare hatchlings for release, October 5th, 2017.



Figure 14. Excavation and sorting of eggs and samples, July 31st 2018.



NOAA



Figure 15. Hatchlings being released at the high tide line after excavation by Luke Sundquist and Skippy Hau, October 5th, 2017.



Figure 16. Excavated hatchlings crawl down to the water while volunteers and members of the public observe on September 26, 2016. Photo by Aimee Lemieux.



Figure 17. Some members of the Maui Hawksbill Team on August 18, 2016. From left to right: HWF Executive Director Hannah Bernard, local volunteer Tim Lara, Project Co-Coordinator Luke Sundquist, USF&W volunteer Rick Long, Project Co-Coordinator Suzanne Canja, and DLNR/DAR Biologist Skippy Hau. Photo by Aimee Lemieux.



Figure 18. Adult female hawksbill “Hope” (MUI15), photographed during a snorkel survey near Oneuli Beach on November 25.



Figure 19. Volunteers observe a sub-adult green sea turtle found during a snorkel survey at Makena Landing, July 13th, 2017.



Figure 20. A green with a tumor and line entanglement on its right front flipper at Kalepolepo, seen and reported to the Maui stranding network, November 3rd, 2017.



Figure 21. Luke Sundquist going over turtle track identification for Dawn Patrol volunteer training, May 31st, 2018.

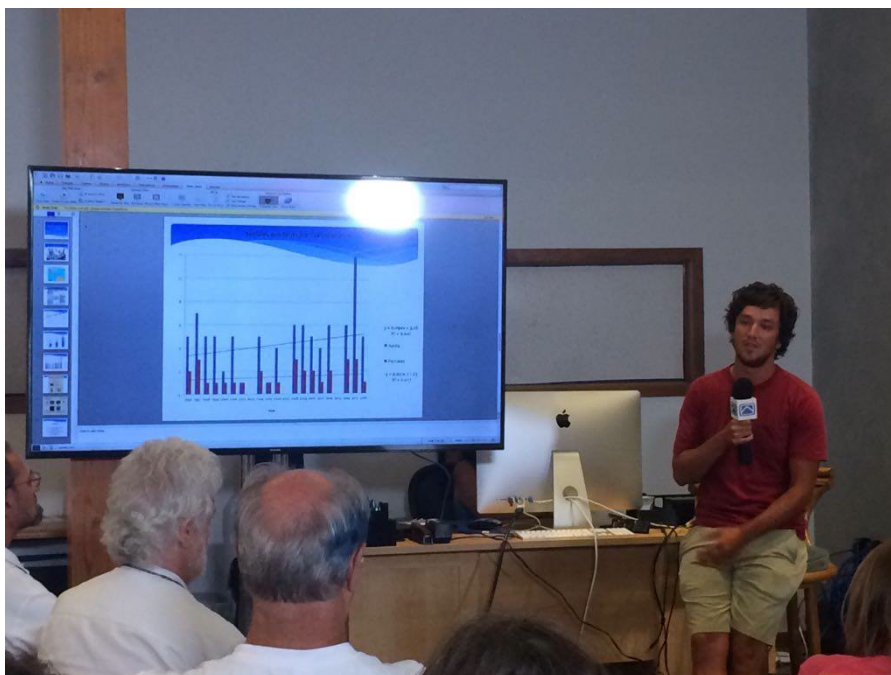


Figure 22. Luke Sundquist presents hawkbill data, graphs, and background during film screening of “Red Turtle Rising” at Akaku Upstairs in Kahului, July 13, 2017.