Annual Activities Report for 2018

Native Endangered and Threatened Species Recovery
Surveys, Monitoring, and Research on the Hawksbill Sea Turtle (*Eretmochelys imbricata*), Green Sea Turtle (*Chelonia mydas*), and Olive Ridley Sea Turtle (*Lepidochelys olivacea*)

Federal Fish and Wildlife Permit **TE829250-9**
Hawaiʻi Department of Land & Natural Resources Permit **SAP 2018(56)/2019(68)**

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Introduction

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 nearby highway in following years, leading to the involvement of Hawaiʻi Wildlife Fund (HWF) in the Hawksbill Recovery Project in 1996, in collaboration with the National Marine Fisheries Service (NMFS) and Hawaiʻi Department of Land and Natural Resources Division of Aquatic Resources (DLNR/DAR) 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 in 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. While HWF monitoring activities originally focused on hawksbills, they can also include occasional green sea turtle (*Chelonia mydas*) nests on the North Shore of Maui and the possibility of olive ridley (*Lepidochelys olivacea*) nesting.

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 Hawaiʻi Island, Maui, Oʻahu, Molokaʻi, Kauaʻi, 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 around Maui each year, from local residents to international tourists, removing threats to sea turtles and preventing harmful human behavior, while building public understanding and hawksbill and environmental conservation. 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 their experience and the work of the Hawksbill Recovery Project for years to come.

Methods

Nest Monitoring: HWF monitors most sea turtle nesting activity that occurs on Maui, including possible hawksbill, green, and olive ridley sea turtle nests. Green turtles that nest in west Maui are monitored by DLNR/DAR and hawksbills nesting in east Maui are not actively monitored, although HWF responds to opportunistic reports from this area. Olive ridleys do not typically nest on Maui, but may be monitored by HWF under the terms of this permit. Although USFWS had coordinated dawn patrol volunteers in the past, HWF assumed this role in 2018 since USFWS had a lack of funding and personnel for this aspect of the partnership. When tracks or signs of nesting are found by volunteers or reported by the public in any location, HWF staff confirms and protects the nest in consultation with our agency contacts and under the terms of our research permits. This can include 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.

After the first nest of the season is confirmed, HWF staff and volunteers monitor the beach at nesting intervals when the female may return. This allows the team to directly observe nesting activity, tag, measure, and identify females, and mitigate disturbance or endangerment of nesting females by monitoring human activity on the beach at night. Nests are checked regularly during incubation for disturbance or erosion and monitored 24/7 around the expected emergence date. This creates 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 excavation is planned and carried out with Hawaiʻi DLNR/DAR biologist Skippy Hau with notification of USFWS representatives Courtney Brown and Michelle Bogardus. All nesting and hatching activities are monitored and documented according to established protocols and in active consultation with DNLR and USFWS. Throughout the season, all participating volunteers are trained for possible scenarios and proper behavior at the nest and provided with brochures and information to distribute to the public.

Personnel and Agency Coordination: HWF staff involved this season included authorized individuals Hannah Bernard and Luke Sundquist with Diana Sciambi involved in coordinating dawn patrol. HWF consulted and partnered with Skippy Hau and Michelle Bogardus, while also notifying Courtney Brown and Bill O'Neill of nesting, hatching, and excavating activity. Alexander Gaos of NOAA came to Maui to train and lead in satellite tagging of the single nesting female in 2018. Nesting female handling and observation, including tagging and measurements, was carried out by HWF staff after nesting or as females returned to the water, using red light only when necessary. Hatchlings were observed and protected during their emergence and crawl, and transported to the high tide line using gloves or buckets if they became stranded, disoriented, or were at risk of desiccation. Excavations were carried out in collaboration with Skippy Hau, who collected and sent samples of dead hatchlings, empty shells, and unhatched eggs to NOAA/NMFS/PISC in Honolulu. Live hatchlings found during excavations were allowed to acclimate in a bucket after rescue then released at the high tide line. All data including carapace measurements, tag numbers, nest locations, hatchling numbers, times of activity, and behavior notes were collected in the field notebook, then checked, stored, and shared with the team via email and Google Drive. HWF staff notified and consulted with DNLR and USFWS representatives regarding nesting and monitoring activities via email, text, and phone calls as needed. Human interaction with sea turtles was minimized effectively throughout the season.

Volunteer Involvement: HWF staff held volunteer training and orientation events before dawn patrol began, with protocol refreshers at the nest later in the season. 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. All volunteers received protocols for nesting patrols and nest watch and had access to additional hawksbill information to release to the public. 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.

Additional Activity: Beyond monitoring of nesting and hatching activity, the nesting project includes continuous protection of nesting habitat, including beach cleanups, fence repair, and dune restoration as necessary. During the offseason, HWF checks beach habitats, trains volunteers, and prepares the necessary permits and gear for each nesting season.

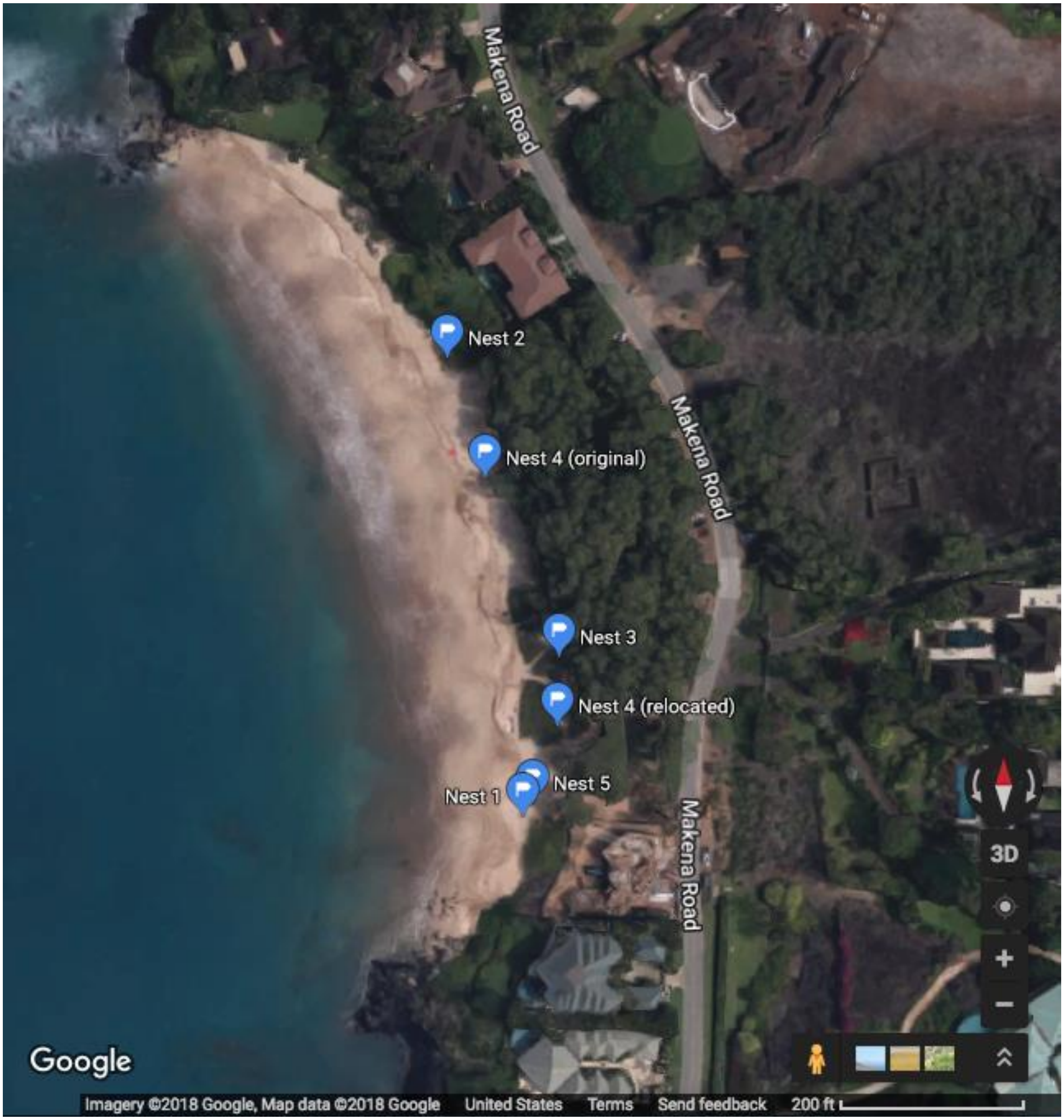

Figure 1. Nesting Activity in 2018. All activity by hawksbill sea turtle female "Ole Pau" (PI2459), on Palauʻea Beach in Wailea. Image by Google.

Results

Nesting: No nesting green sea turtles or olive ridley sea turtles were reported or observed by HWF in 2018. Dawn patrol volunteers patrolled the six known hawksbill nesting beaches on south Maui throughout the season and HWF staff responded to all crawls, nesting, and hatchling reports. Over 80 volunteers participated in dawn patrol, completing 732 daily patrols. Five hawksbill nests were confirmed on Palauʻea Beach in 2018 from one previously untagged female (Figure 1, Table 1). Tracks from nesting at nest 1 were not seen or reported, so this nest was not found and monitored until hatchling tracks were reported on July 29th. Nest 2 was the first nest observed and reported just after 8pm on June 16th, 2018 by local security guards at Palauʻea Beach, by way of Cheryl King. The untagged nesting female was seen by Cheryl King and the nest was confirmed by HWF staff when they responded to the call that evening. Overnight monitoring was planned for her return and she was seen again when she emerged to nest on July 4th, with staff and volunteers present to observe and protect her. After nesting, she was restrained at 2:44AM in a turtle box for measurements, Inconel and PIT tagging (Tables 2,3), and satellite tagging with Alexander Gaos (Figure 2). Once she was successfully tagged and the epoxy had cured, she was released and returned to the water at 5:25AM. She was again observed successfully nesting on July 21st, but laid her nest in vegetation close to the high tide line. When HWF staff returned the next day to mark and protect the nest, it was being flooded as an unusually high tide reached over the bank and repeatedly washed over the vegetation and nest. After consultation with Skippy Hau and Michelle Bogardus, the nest was relocated to a safe location nearby as quickly as possible according to relocation protocols (Figures 4–7). Nest 5 was observed and protected by staff and volunteers when it was laid on August 6th. Dawn patrol continued at Palauʻea and other known nesting beaches through the end of September, but no other tracks, nests, or hatchlings were observed. The nesting hawksbill female was named "Ole Pau" according to the day on the Hawaiian moon calendar when she was first tagged.

Table 1. Nesting data for 2018, all nests laid by Ole Pau on Palauʻea Beach.

Date	Nest	GPS points	Observed activity	Time	Returned to water
5/30/18	Nest 1	20.66967, -156.44272	crawl found	unknown	unknown
6/16/18	Nest 2	20.67104, -156.44296	emerging	~8pm	~10pm
7/4/18	Nest 3	20.67015, -156.44261	emerging	12:40	5:25 (tagged)
7/21/18	Nest 4 (original)	20.67068, -156.44284	digging	21:40	22:58
7/22/18	Nest 4 (relocated)	20.66994, -156.44261	NA	16:40 (begin)	18:03 (done)
8/6/18	Nest 5	20.66971, -156.44269	crawling	22:45	0:23

Table 2. Inconel and PIT tag numbers for Ole Pau, taken after nest 3 on July 4th, 2018.

Flipper	Tag
RFF	PI2459
LFF	PI2460
LRF	982000190553926
RRF	982000190552533

Table 3. Measurements for Ole Pau, applied after nest 3 on July 4th, 2018.

Measurement	cm
CCL	94.6
CCLmin	93.8
CCW	85.2
SCL	87.5
SCLmin	86.7
SCW	66.6

Hatching: With the exception of nest 1, all five nests were marked and screened against predation within the first day of nesting and monitored 24/7 around the expected emergence date. Nest 1 was monitored once hatchling tracks were reported on July 29th until the excavation on July 31st (Figures 8,9). 140 volunteers spent over 3150 hours patrolling and monitoring the nests. Nests were not found to be disturbed by predators after predation, but feral cats, rats, and mongoose were often seen in the area in addition to off-leash dogs. Ghost crabs were also a major predator for hatchlings as they made their way to the water and required constant vigilance with intervention and protection for hatchlings. Vegetation was another threat to hatchling survival, since Palauʻea Beach has very little suitable habitat between the high tide line and vegetated areas. Each nests had some level of vegetation management, ranging from clearing loose vines to prevent entanglement around the nest to thick roots and matting trapping hatchlings within nests 1, 2, and 3 (Figures 10,11). Storm events and swells also threatened nests, requiring close observation during multiple nearby hurricanes, relocation of nest 4 (Figures 3-7), and barricading against massive surf around nest 5 during the last day of hatching as Hurricane Walaka passed by to the west (Figure 14).

As hatchlings emerged, holes and crab burrows were filled in and any people and obstructions on the beach were moved to create an open path from the nest to the water. Staff and volunteers also prevented human disturbance at the nest by educating fisherman and recreational beach users about threats to sea turtles, especially the impacts of noise and light at night. Hatchlings were only assisted when necessary in the event of disorientation, entanglement, or other imminent threats to their survival. Emergences at night or during cooler parts of the day often did not require any intervention, only following and watching to ensure the hatchlings crawled safely to the water. Groups and lone hatchlings that emerged during the day when the sand was too hot for them to crawl into the water on their own often required relocation to the high tide line to prevent desiccation.

Excavations: All excavations were completed with Skippy Hau either first thing in the morning or in the evening with hatchlings released after dark, in order to minimize the heat and crowds on the beach during the excavation and release. Nests were excavated 2–4 days after first emergence and at least 24 hours after the main emergence, with discussion on a case-by-case basis according to the nest conditions, pace of nest activity, and number of hatchlings emerged or expected in the nest. This allowed the majority of hatchlings to emerge naturally on their own, but rescued those that couldn't in order to increase the success of each nest due to their critically endangered status. Hatchling emergences, excavation results, and overall success (defined as live hatchlings in the ocean/total eggs) varied widely between nests based on conditions (Tables 4,5). The first emergence of nest 1 was not observed, but most hatchlings made it into the water before the excavation

(~90/125) with a total success of 58% (Figures 8,9). Nests 2 and 3 both had large numbers of hatchlings trapped in the nest, 54 and 78 respectively, due to the dense vegetation and heavy roots and grass found above and inside the nest (Figures 10,11). After excavation, they had similar success compared to the first nest (58% and 56%), but these numbers would have been much lower without excavation. Nest 4 was relocated due to inundation approximately 19 hours after it was laid to an area cleared of vegetation with less roots under the surface, and ended up being the most successful of the first four nests at 63% with a single emergence of approximately 60 hatchlings and 44 hatchlings released at excavation (Figures 3–7). Nest 5 was laid closer to the water with surface vines that were easily cleared and almost no deep roots around the nest, leading to a mass emergence of over 100 hatchlings and the highest success of the season with 78% of the eggs resulting in hatchlings in the ocean (Figures 12,13). In total, approximately 632 hatchlings successfully made it into the ocean out of 1022 eggs for a 62% success, including 209 live hatchlings released after excavation (Table 5). Each nest included unhatched eggs (227 total) and dead hatchlings, but only 23 dead hatchlings overall. Very few of these dead hatchlings looked viable or had come close to emergence, as excavations were conducted before hatchlings would be likely to die of desiccation or dehydration in the nest. 11 hatchlings were pipped and live but not fully emerged or with fully absorbed yolk sacs, and these were kept for overnight observation in a dark and cool bucket if they were not active or crawling and released the following night. Overall, nest location, vegetation, and substrate seemed to have a large effect on hatchling success, while nest protection, monitoring, and excavation contributed to the survival of many hatchlings that otherwise would not have made it into the ocean. No sea turtles were harmed or killed by activities conducted under this permit.

Table 4. Emergence data for 2018, all nests from Ole Pau on Palauʻea Beach.

Date laid	Date of first Activity	Time of Depression	Time of First Emergence	# in First Emergence	Other emergences
~5/29/18	~7/27/18	unknown	unknown	unknown	7/30 (10), 7/31 (19)
6/16/18	8/10/18	20:00 (8/10)	11:28 (8/12)	1	8/12 (31), 8/13 (14), 8/14 (16), 8/15 (3)
7/4/18	9/1/18	1:00	2:00	6	9/1 (6), 9/2 (7), 9/3 (10)
7/21/18	9/12/18	<18:00	9/13 0:02	6	9/13 (5), 9/15 (~75), 9/16 (9)
8/6/18	10/3/18	4:35	6:22	~100	10/3 (23)

Table 5. Excavation data and final hatchling success for 2018.

Excavation	total eggs	empty shells	unhatched	dead in nest	pipped dead	pipped live	live in nest	hatchlings to water	success %
7/31/18 7:00	217	122	31	5	55	5	32	125	0.5760368664
8/15/18 8:00	207	116	57	2	32	1	54	121	0.5845410628
9/3/18 18:00	211	110	66	3	30	5	78	118	0.5592417062
9/16/18 18:00	222	152	42	12	28	0	44	140	0.6306306306
10/5/18 7:30	165	129	31	1	5	0	1	128	0.7757575758
TOTALS	1022	629	227	23	150	11	209	632	0.6183953033

Photo Documentation of Permitted Activities

Figure 2. Ole Pau with new drying satellite tag after laying nest 3 on July 4th, 2018.

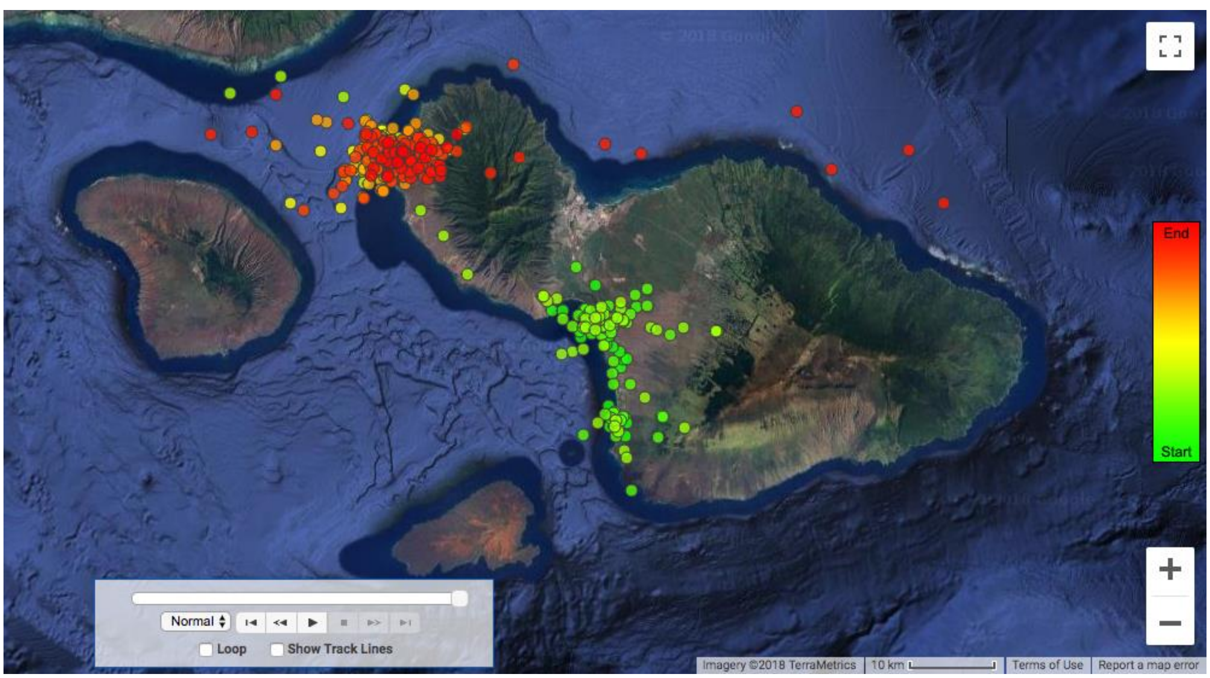

Figure 3. Satellite track of Ole Pau, active and updated as of November 1, 2018.
Image courtesy of Alex Gaos.

Figure 4. Original location of nest 4, as inundated by high tide on July 22nd.

Figure 5. Egg removal during relocation of nest 4 after inundation, July 22nd, 2018.

Figure 6. Egg placement into new nest location during relocation, July 22nd, 2018.

Figure 7. Nest 4 relocated, screened, and taped, July 22nd, 2018.

Figure 8. Excavation and sorting of samples at nest 1, July 31st 2018.

Figure 9. Hatchling release with onlookers after excavation at nest 1, July 31st, 2018.

Figure 10. Excavation of nest 3 with bushes, thick roots, and many trapped live hatchlings, September 3rd, 2018.

Figure 11. Hatchlings emerge in the nest as they are freed from grass and roots during the excavation of nest 3, September 3rd, 2018.

Figure 12. Emergence of a single hatchling from nest 5, October 3rd, 2018.

Figure 13. Hatchlings crawling into the ocean after the mass emergence of ~100 hatchlings from nest 5, October 3rd 2018.

Figure 14. Volunteers help barricade nest 5 between emergence and excavation in the face of storm swells from Hurricane Walaka on October 4th, 2018.

Conclusion

Hawksbill nesting numbers on Maui have remained low since monitoring began in 1996. 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 Palauʻea Beach in 2015. This newly tagged nesting female "Ole Pau" in 2018 could be the same female from 2015, since the female was not seen or tagged that year. 2016 and 2017 also both included observations of only one nesting female, those seasons on Oneloa Beach, a remigrant in 2016 and a neophyte nester in 2017. While nesting numbers remain low each year, averaging just over one female and five nests per year, some of the 11 tagged females have remigrated in addition to the two new females the last two years. Continued efforts will hopefully protect these tagged females and their nests for years to come and see an increase in successful hatchlings and newly mature females coming to nest.

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 females and years yielding 0% success and no live hatchlings from nests there. This beach has severe erosion, runoff, and pollution, as well as heavy human and vehicle traffic. Kealia was also the site where two females killed on the adjacent highway in the 90s, before monitoring began and the turtle fence was built. At the southern end of this 15-mile stretch 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. Each beach on Maui experiences some level of human impacts in addition to the natural challenges that nesting hawksbill females and hatchlings must overcome.

At Palauʻea beach this year, predation and human interference was effectively minimized with thorough volunteer monitoring and education. Erosion and vegetation still proved to have impacts on the success of nest locations and hatchlings, making excavation and sometimes relocation all the more crucial. These threats seem to become more widespread and common year by year, and will require vigilance, new responses, and ongoing solutions. Suitable nesting habitat becomes more difficult to find between sea level rise, erosion, invasive vegetation, and human development. Even just since 2015, Palauʻea Beach has been affected with increased development and new houses along the road and the spread of vegetation along the sand and over nesting habitat. 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 can make a great difference with dedicated time and efforts, leading to increased success year after year, 632 hatchlings this season, and over 10,000 over the past 22 years.

HWF has been able to continue this program for 22 years through the committed staff, countless volunteers, and supportive partners that make it happen. This season over 200 volunteers participated in dawn patrol and nest watch for over 4000 hours, enabling the close observation and protection of all five nests. Along with the collaboration with Skippy Hau and the DLNR, the support of Michelle Bogardus and the USFWS team, the care taken by the security guards at Palauʻea Beach, and our local partners and donors, the Hawksbill Recovery Project continues to make a difference and contribution in the survival of this species on Maui.

We advise to continue the ongoing communication and collaboration between Hawaiʻi Wildlife Fund, Hawaiʻi Department of Land and Natural Resources Division of Aquatic Resources, U.S. Fish and Wildlife Service, and our community of volunteers. We will continue to share our data and plans, collaborating with our partners and communicating as nesting events occur through text and email. We hope to continue to discuss scenarios and responses with USFWS to work towards a "best practices" document with our upcoming discussion with Eldridge Naboa. These ongoing conversations will allow HWF staff and volunteers to be readily prepared for each threat and contingency that may be encountered during the nesting season.

Each nest should be marked, peppered, and screened against predation as needed soon as possible due to the extensive presence of mongoose and other mammalian predators along the coast. Screens are removed when 24/7 watch begins before the expected emergence date. Since this is a low density nesting population in a highly developed area, other threats may continue to arise as beaches change through natural processes and human use and development. Specific nests and areas may require short-term or long-term solutions, including monitoring foot or vehicle traffic, erecting barriers between nests and roads or potentially hazardous areas, and dimming or covering lights close to nests on a case-by-case basis. For example, the dunes and fence along Kealia Beach require regular attention and annual repairs before nesting season begins and increased monitoring during the season, especially if a female is nesting on Kealia.

HWF will also continue its hawksbill education programming through social media, special events, distributing information, and answering questions during excavations and nest watches. This allows us to address potential anthropogenic threats, build the understanding of hawksbills and awareness of their recovery program in the community, and sign up new volunteers. HWF continues to recruit interns and volunteers and pursue additional funding sources for next season in order to prepare, monitor, and preserve habitat and hatchlings for the critically endangered hawksbill sea turtle population. With community awareness, new and remigrating females, and increased hatching success, this small nesting population remains resilient. Hawksbills' high age at maturity and low survival rate necessitate continual research and protection for their gradual recovery. Hawaiʻi Wildlife Fund and all the Hawksbill Recovery Project Partners around Hawaiʻi must continue their work for the survival of the species.