Annual Report of Hawai‘i Wildlife Fund
Hawksbill Nest Monitoring and Research
2011

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2011 Maui Hawksbill Sea Turtle Nesting Activities

Introduction

In the Pacific, little is known about the abundance and distribution of critically endangered hawksbill sea turtles (*Eretmochelys imbricata*). Within the Hawaiian Archipelago, hawksbills predominately nest on Hawai‘i Island. Lower numbers are also known to nest on the islands of Maui, Moloka‘i and O‘ahu, with a statewide estimate thought to be at least fifty reproductive females with only 6-20 of these nesting each year. Hawksbill nesting activities were first documented on Maui in 1991 at Kealia. Hawai‘i Wildlife Fund (HWF) organized a community-based effort to systematically monitor these occurrences in 1996 after a passing car killed a second gravid female (the first happened in 1993) when she wandered onto North Kihei Road, either seeking suitable nesting habitat or disoriented by headlights.

The primary objectives of this monitoring and research are to identify individual nesting hawksbill turtles, take biopsy samples for analysis, determine sizes of these females, the sites they use for nesting, the inter-nesting intervals, the number of nests laid in a season by each female, to relocate nests that may be threatened by tidal flooding, to determine nest success, and to attach transmitters to post-nesting females to track them to their long-term foraging/resting areas. During the course of this research, nesting females, nests and hatchlings are protected against dangers caused by predators, human disturbance, coastal lighting, non-native vegetation, and vehicular traffic.

Methods

Project Activities

Ongoing activities included email announcements/updates to our >800 contacts, public outreach events, multiple turtle fence fixing project days, and marine debris and rubbish cleanups partnering with Kanu Hawai‘i, Community Work Day, Na Kai ‘Ewalu Canoe and Cultural Club, Surfrider Foundation, The Maui Ocean Center, and South Maui Sustainability Group.

Nesting Turtle and Nest Monitoring

Nesting season can begin as early as mid-May, with hatching events stretching into December (although the last nest of the season wasn’t complete until January, 2012). During these months, the USFWS’s Maui Dawn Patrol, a community group of approximately 40 volunteers, walked Maui’s four known South Maui nesting beaches (Kealia, Kalepolepo, Kawililipoa, and Oneloa) early each morning looking for evidence of nesting. This season, HWF also organized daily (early morning) patrols at Oneuli Beach and Little Beach (Makena State Park). Although we have had green and hawksbill nesting events in Hana, we have not organized Dawn Patrols there yet. Once nesting

activity was discovered, a phone tree was activated to advise the Department of Land and Natural Resources Division of Aquatic Resources (DLNR DAR), the United States Fish and Wildlife Service (USFWS), and the Hawai‘i Wildlife Fund (HWF). Each subsequent nesting and hatching event was intensely monitored by HWF. This entailed all-night vigils to find the nesting females, waiting for the females to nest successfully, identifying them and tagging (metal flipper tags on front flippers and PIT tags in rear flippers). When available in collaboration with NOAA-NMFS, a satellite transmitter was harmlessly attached to the turtle's carapace using marine resin and fiberglass and standardized procedures. HWF guarded the nests 24/7 during the course of hatching to ensure each hatchling reached the ocean safely. Three days after the first major emergence of each nest, the nest was excavated to release any trapped hatchlings and to determine overall nest success.

Procedures for tissue sampling of post-nesting hawksbill turtles

The skin sampling region (rear flipper) was deadened with 2% lidocaine hydrochloride and cleaned with betadine prior to sampling. A few mg of tissue were removed with a 6 mm biopsy punch. Samples placed in a ziplock bag were stored on ice in the field, and frozen until subsequent analysis. Straight carapace length, width, and tag information, were recorded. Half of the sample was given to George Balazs (NMFS, Honolulu) for genetic analysis. The other half will be sent to Dr. Jason Turner (UH Hilo) for stable isotope analysis (a continuation of HWF's Shannon Graham's Master's thesis).

Procedures for tissue sampling of deceased hatchlings

The hatchling's skin sampling region (~5mm from the edge of the front flipper tip) was cut off and removed from a maximum of 3 dead hatchlings per nest. Samples from each hatchling were placed in individual ziplock bags, grouped by nest and frozen. Samples will be sent to Dr. Turner for additional stable isotope analysis, coupled with the female nester analysis.

Results

Maui Nesting Research

No nests were laid on the Dawn Patrolled Kealia, Kawililipoa, Kalepolepo, Little Beach, or Oneuli beaches this season. The first nest was discovered by the Dawn Patrol on the morning of 2011.08.28. A total of four hawksbill nests and zero false crawls were documented on Maui this season, all at Oneloa. HWF discovered a non-tagged female while she was laying her second nest, and HWF was successful in locating and observing her laying the last two nests as well. This turtle did not make any false crawls and her inter-nesting intervals between her last three nests were 18, 19 and 18 nights apart respectively. It is suspected that she is the "mystery" turtle that laid at least two

unobserved nests at Oneloa in 2008, but this cannot be confirmed. After describing her behavior and the circumstances of our encounters with her, her Hawaiian name was created by well-respected kapuna: "Ka honu'ea me uhane niniu" (translated as "The red turtle with the spinning spirit").

The four nests are labeled in succession below:

Tagging and Satellite Transmitter Attachment

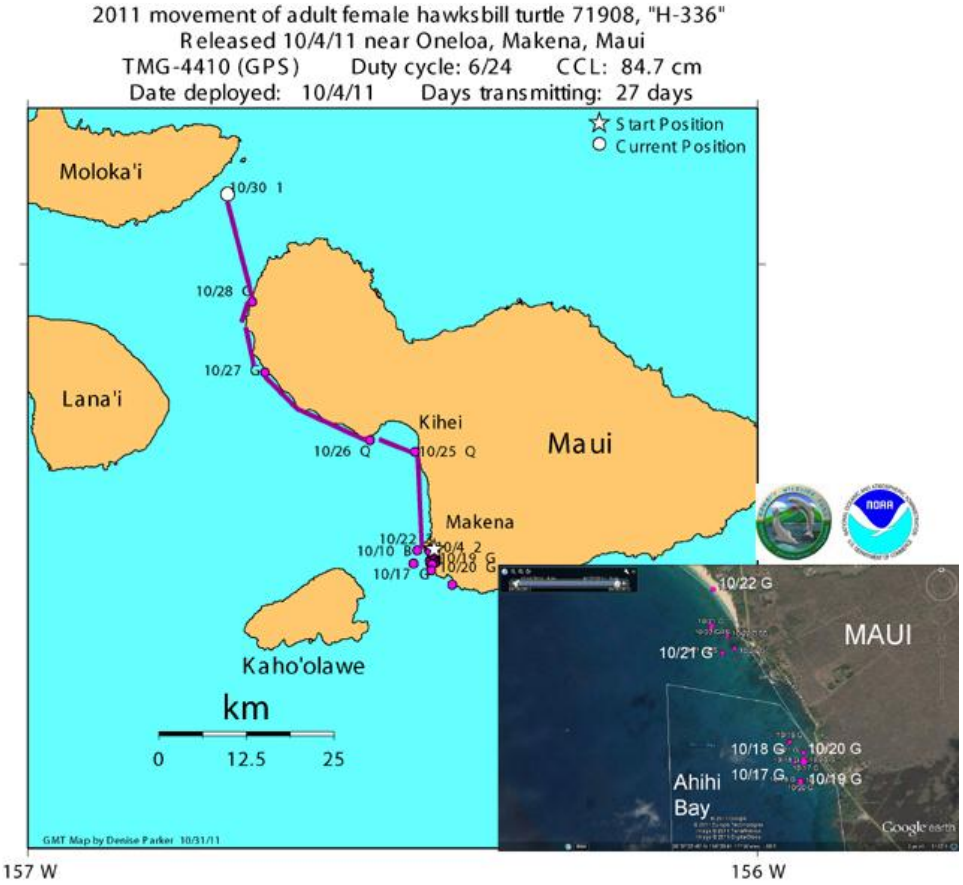
2011.09.14 (Nest 2) C.King flipper tagged the turtle's LFF: H336 / RFF: H337 and P.I.T. in RRF: 470964440D (but it didn't appear to have stayed in as it didn't register when flipper was scanned on 2011.10.03). Small skin biopsy was taken in the left rear flipper (half was given to George Balazs and half will be given to Dr. Jason Turner for future analyses). Carapace measurements (cm):

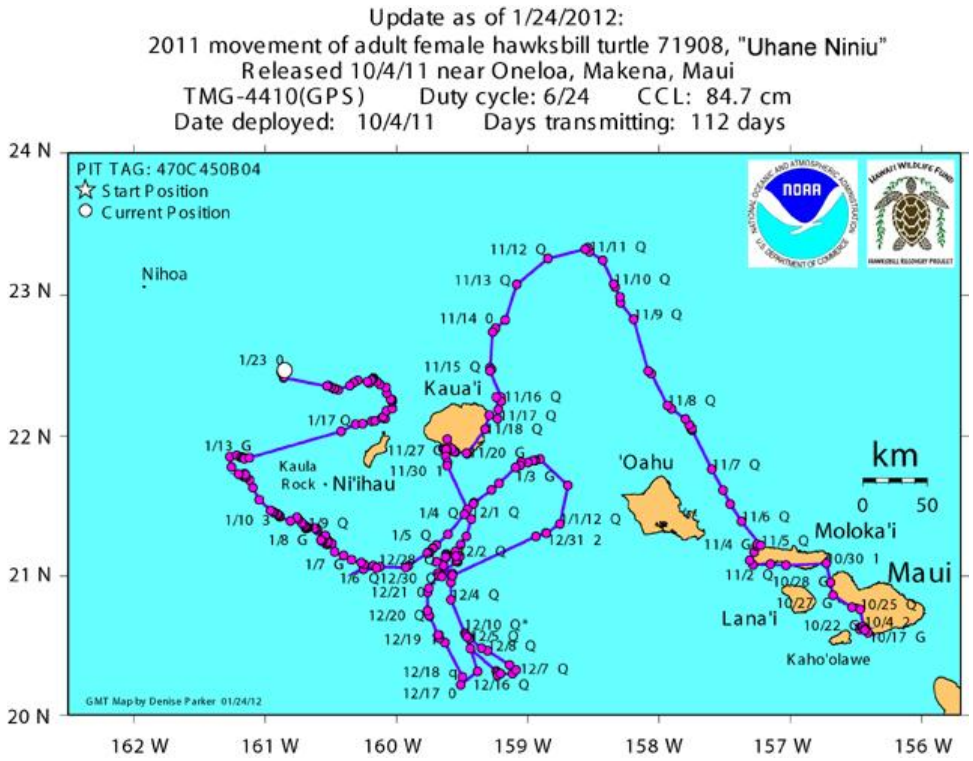
CCL= 84.7
CCW= 81.5
SCL= 79.6
SCW= 67.9

2011.10.03 (Nest 3) C.King and H.Bernard applied one satellite tag to the turtle's carapace: TMG-4410(GPS) and P.I.T. in RRF: 470C450B04 and LRF: 470B4D7E21.

Although satellite telemetry data have its accuracy shortfalls, data collected during H336's inter-nesting period showed that she inhabited an area near 'Ahihi Bay, just to the south of Oneloa ~2/3 of a mile. No dive data are available to determine her

behavior during this time. She left the Oneloa area after laying her 4th nest on 2011.10.21, traveled the leeward coast of Maui, crossed the Pailolo Channel to Molokaʻi, where she also traveled close to the leeward coast and western coast. She left the northwestern coast of Molokaʻi on 2011.11.05 and swam northwest almost 300 km before turning to the southwest and swimming approximately 150 km until she reached the eastern coast of Kauaʻi. She spent nearly two weeks near shore and then on 2011.11.30, she swam offshore and has not returned to any islands since (as of 2012.01.24).





Nest Monitoring

All nests were monitored before the dates of suspected emergences. No hatchlings emerged naturally from the first nest, so it was excavated after waiting until night #70 of incubation. It was suspected that high waves that washed over the nest one day after it was laid contributed to the sand compaction and subsequent entrapment of the hatchlings. This appeared to be the case when we searched for the nest, as the hatchlings had emerged from their eggs but were in a compacted area towards the surface. Our assistance yielded 159 live hatchlings (but beachgoers found a dead hatchling that washed ashore, which was presumably the one that had been released that day after being held for two nights so it could absorb its yolk sack).

Nests #2 and #3 were laid in the native ʻakiʻaki grasses, so the grasses in the hatchlings' paths were temporarily covered with sand during the hatching window and then uncovered after the excavations (with no harm to the ʻakiʻaki). The first major emergence of nest #2 occurred just before sunrise of night #69, and only 12 live hatchlings remained at the excavation three nights later. The elaborate root systems likely contributed to no natural emergence from nest #3, but upon excavating on night #74 there were 175 live hatchlings that were ready to be released. Three out of the four hatchlings that still had small yolk sacks died before the yolk sacks were absorbed enough to be released.

Nest watching was also needed when the hatchlings emerged during the day because they were more susceptible to dehydration/sand burns and were more visible to predators or human disturbance. Oneloa is a very popular beach, and even with lifeguards present we had to be there to escort the hatchlings to the ocean during nest #4's daytime emergences. Myna birds became an issue for the first time in this project's existence, as they persistently tried to approach hatchlings during an early morning large emergence. They could have harmed the hatchlings if we weren't there to chase them away (especially when the hatchlings flipped over on their backs).

Nest Success

Date	Nest #	Inter-nest Interval	Nest Excavation	Clutch Size	Hatching Success	Hatchling Success	LatLong	
2011.08.27	Nest 1	^	2011.11.05	170 eggs	93.5%	92.9%	20^0 63144"N	156^0 44631"W
2011.09.14	Nest 2	18 days	2011.11.25	165 eggs	99.4%	98.2%	20^0 63035	156^0 44525
2011.10.03	Nest 3	19 days	2011.12.16	186 eggs	97.8%	94.6%	20^0 63025	156^0 44521
2011.10.21	Nest 4	18 days	2012.01.02	155 eggs	98.1%	95.5%	20^0 63364	156^0 44913

H336's average clutch size from her four nests was 169, with a range from 155-186 eggs. Oneloa's incubation environment was very high quality, as only 19 eggs out of a total of 676 eggs didn't hatch. All of the eggs, none of which were opened on Maui, were sent to George Balazs (NOAA-NMFS) for embryo development analyses. A total of 644 (95.3% of the eggs laid) live hatchlings crawled to the ocean safely. Having a total of only 13 dead hatchlings in 4 nests was the best success rate of all 21 of Maui's nesting seasons. "Hatching success" was calculated by the number of empty egg shells divided by the total number of eggs. "Hatchling success" took into account the number of hatchlings that died by deducting them from the amount of empty shells for a true live hatchling success rate. As shown in the table above, both hatchling and hatching success ranged between 92.9% and 99.4% for the four nests, which was very high.

Deceased Hatchling Sampling

A total of seven deceased hatchlings' flippers were sampled (one from nest #1, three from nest #3 and three from nest #4). Samples will be given to Dr. Turner for future analyses.

Sand Temperature Analysis

Information obtained from temperature data loggers during incubation coupled with dead hatchling necropsies can approximate the sex ratio of hatchlings produced. Sex-determination is temperature dependent so if the egg's temperature is over a certain

degree the hatchling will be female, but if it's below it will develop to be male. This pivotal temperature has not been determined for Hawaiian hawksbills. Predicting whether the majority of hatchlings are males or females would provide insight into the reproductive potential for the future population.

We buried small temperature loggers in the nest chamber of nest #2 and near the other three known nests, all at ~10-20" depth. The data from the temperature loggers will be assessed by NOAA-NMFS. The relatively cool temperatures predicted (because of the long incubation periods) may have contributed to such successful incubation success.

Discussion and Conclusion

It is encouraging that this new nester, H336, has appeared this season at such a high quality nesting beach such as Oneloa. Including H336, HWF has now tagged eight nesting hawksbills since 1997 and most have returned to nest again. H334 "Orion" (Oneloa 2001, 2004 and 2008) was the first, H332 "Lele" (Kealia 2000 and 2005) was the second, H330 "Hōkūlele" (Kawililipoa 1999 and 2006) was the third, H340 "Kolohe" (Kealia 2002 and 2009) was the fourth, and H326 "Hapa" (Kealia 1997 and 2010) was the fifth known tagged hawksbill to re-migrate to Maui for another nesting season after being tagged. The survivorship of one tagged nester from 1998 (H329 "Sasha" at Kawililipoa) is particularly in question since she has not returned to nest that we know of. Hapa's return after 13 seasons gives hope that Sasha will come back as well.

This season, we expanded Dawn Patrol coverage to Oneuli and Little Beach, just in case H336, or any other nester, nested elsewhere besides Oneloa. This is a positive step, as these areas would be likely choices for Oneloa nesters since they are the closest surrounding beaches. H336 was very regular and precise in utilizing Oneloa though. Nest #2 and #3 were within 50 yards of each other, south of where nests have been documented in the past. Given these new locations and the high foot/atv traffic, the nests were flagged off for the first time at Oneloa. This management strategy was successful since no nests were harmed by humans or animals, which was a potential concern that accompanies drawing attention to the area by roping it off. HWF's 24/7 presence during the timeframe of hatchling emergences was crucial to ensuring that the hatchlings reached the ocean safely.

Ongoing Hawksbill Conservation Issues

Unfortunately, there are many well-lit roads that run very close to much of Maui's coastline, so if hawksbills (or any other turtle species) choose these areas to nest there is a real concern for their safety, their hatchlings' safety, as well as that of passing motorists. Although erecting turtle fences along every roadside beach is recommended, it is obviously impractical due to the resources involved. It's impossible to darken vehicle headlights, so solutions to these problems on a beach by beach basis should be considered before another valuable nesting turtle is killed.

Again, the urgent and critical priority for the upcoming nesting season must be the completion of the Kealia fence replacement or repair to keep nesting hawksbills from being run over by passing vehicles on North Kihei Road. Only half of the permanent recycled plastic fence was installed in 2008 and even though funding for the rest of the fence was secured through the County of Maui, it expired before being used by The Kealia National Wildlife Refuge. Sections of the new fence are inadequate at stopping the turtles (they can crawl under or over it) so until the special posts are pounded in, extensions are built, and the rest of the fence is ordered and installed, HWF will have to continue to fix a large part of the dilapidated fenceline. This has unnecessarily cost HWF thousands of dollars and valuable time.

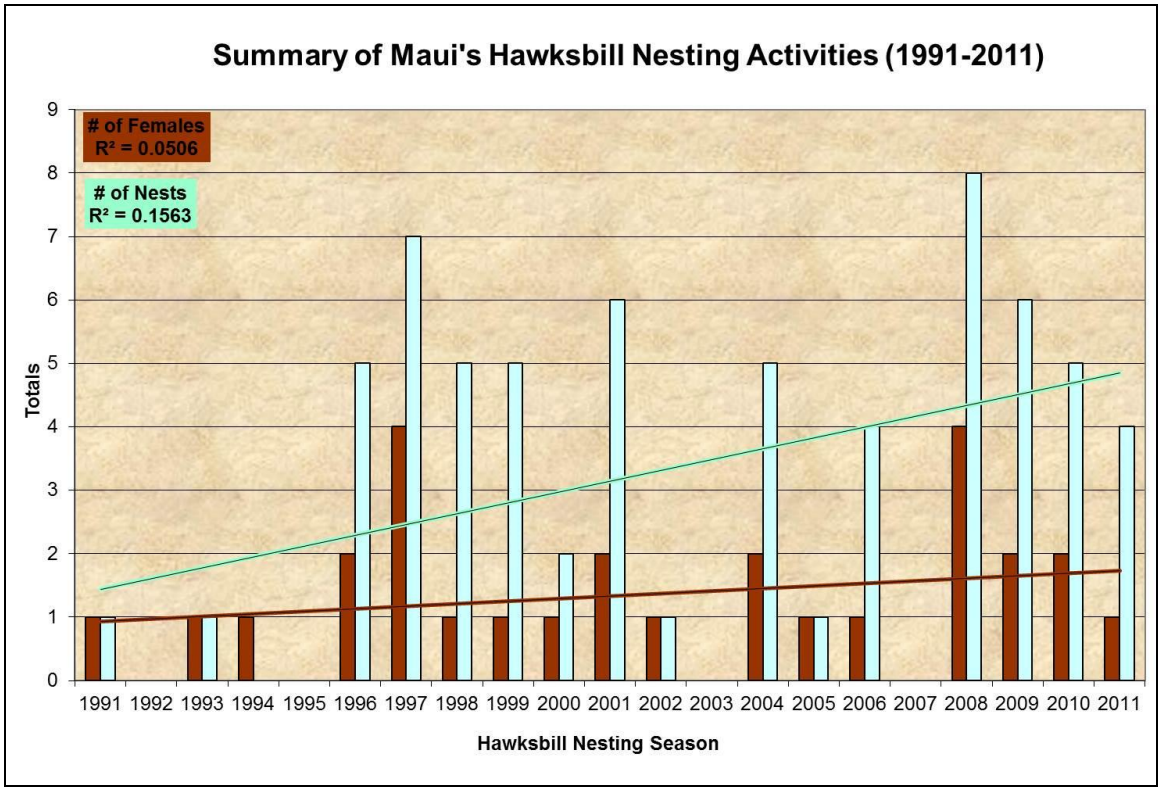
Not only does the whole fenceline need to be fully replaced with the recycled plastic fence material, it ideally should be relocated mauka of the existing location of the sand fence, which is too close to the high tide line in some areas. This will increase the available nesting habitat as much as possible on this highly eroded beach. Unfortunately, this is Alexander and Baldwin land, and we can only presume the negotiations by The Kealia Pond National Wildlife Refuge will continue. The idea of rerouting the road around the Kealia Refuge, obviously the best solution, should be proposed again.

The newly formed Maui Canoe Club has signed a contract with A&B and taken up residency along the southernmost stretch of Kealia, towards the Kealia Condominium. They have erected fences that are reasonably acceptable (saving us money and time) and cleaned up the area by displacing many of the homeless who had been abusing the area. They hopefully will become valuable partners again next season.

Knowing that there are development issues at Kealia, a highly degraded habitat to begin with, demands that we become proactive in ensuring that no more clutches are lost. Therefore, the future relocation of nests from Kealia warrants further discussion. As we stated after the successful 2009 season, our recommendations are that if nests are laid at Kealia where egg development has been unsuccessful (all northwestern sites) then they should be relocated to the 2009 southeastern, successful Kealia nest spots. It's unfortunate that the lack of a State permit and the removal of this possibility from our Federal permit didn't allow us to practice this management solution this season, as the perfect opportunities were there. Another idea is to test at least one clutch (after leaving a control in situ) in a controlled incubator environment, which can in theory eliminate Kealia sand issues altogether. More research and strategizing will be done concerning this topic before next season.

A tremendous effort is ongoing to understand and protect Maui's few nesting hawksbills, and without it the survivorship of these turtles would certainly be jeopardized further. This volunteer-run, community-based project has saved adults and hatchlings from a gauntlet of threats. The intensified monitoring of each nesting and hatching event has also greatly improved the dataset for these occurrences. As of yet, the actual numbers of nesting hawksbills on Maui are not increasing significantly (*see figure below*). With a critically endangered species at such risk, more resources need to be

funneled in this direction. And, innovative research methodologies should be explored to further our knowledge of all aspects of this species' life history to aid in its protection.



We certify that the information in this report fully and accurately represents our work. Excavation nest numbers still must be verified by NOAA-NMFS, so the ones used here are unofficial.

William Gilmartin

Cheryl King

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