Hawai‘i Island Hawksbill Turtle Recovery Project 2011 Annual Report

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Introduction

Hawksbill turtles (*Eretmochelys imbricata*, honuʻea or ʻea) are the rarest sea turtle in the Pacific Ocean and are classified as critically endangered on the International Union for Conservation of Nature and Natural Resources Red List (Ballie and Groombridge 1996). Due to predation, alterations to nesting habitat, coastal development, and numerous other limiting factors, the recovery and survival of this species requires immediate management, monitoring, and research actions (National Marine Fisheries Service (NMFS) and United States Fish and Wildlife Service (FWS), 1998).

The objectives of the 2011 Hawaiʻi Island Hawksbill Turtle Recovery Project (HIHTRP) based at Hawaiʻi Volcanoes National Park (HAVO) were: 1) To manage and protect hawksbill sea turtle nesting habitat on the island of Hawaiʻi by monitoring nesting beaches and ensuring hatchlings safely reach the ocean; 2) To collect baseline data on Hawaiʻi's nesting hawksbill population and facilitate informed management decisions; 3) To protect, restore, and manage coastal and ocean resources by controlling non-native predators and vegetation; 4) To implement several of the actions needed to achieve recovery for the hawksbill sea turtle as identified by the FWS and the NMFS 1998 Recovery Plan; 5) To assist recovery and maintenance of healthy and productive coastal and marine ecosystems that benefit society; 6) To promote public stewardship of coastal and marine ecosystems through outreach and interpretation efforts; 7) To survey coastline to identify undocumented nesting habitat;

Funding for the 2011 effort was provided in part by National Park Service - (NPS) HAVO, NMFS Pacific Islands Regional Office (PIRO), Hawaiʻi Natural History Association (HNHA), and FWS Pacific Islands Office, and a donation from The World Turtle Trust (WTT).

At various times throughout 2011, project personnel consisted of one University of Hawaiʻi (UH)-Pacific Cooperative Studies Unit (PCSU) project coordinator, one PCSU project technician, three UH interns, one UH-Hawaiian Internship Program intern, and 26 full-time NPS Volunteers-In-Park (VIPs), and several other part-time volunteers. These personnel contributed various amounts of time to the project, anywhere from several days to six months. Since late May, project personnel provided nearly continuous nightly coverage, recorded field data, controlled non-native predators, and performed on-site interpretation at up to five hawksbill nesting sites while frequently monitoring nine other sites for nesting activities by performing day checks. This report summarizes field activities from May 2011 through December 2011.

Methods

Site monitoring: Nightly/and or daily monitoring was provided at the following sites May through December 2011: ʻĀpua Point, Halapē, Kamehame, Kōloa-Nīnole, and Pōhue Bay. In addition to the sites previously mentioned, day checks were regularly performed at Keauhou, Punaluʻu, Horseshoe, Kahakahakea, Hāliʻipalala, Humuhumu Point, and ʻĀwili Point.

Nesting turtles: Each time a nesting turtle was observed, the times and types of nesting activities were documented. Weather, tide, moon phase, and moon presence were recorded at the time of emergence from the surf. Times of crawls, digs, egg laying, covering, and returning to the ocean

were also recorded. Upon heading back to the ocean, field personnel briefly restrained the turtle to check its tags and ensure that there was a readable tag on each flipper. If the turtle was previously tagged, tag numbers were recorded and if necessary, tags were adjusted. If the turtle had not been previously tagged or if the tag(s) had come off, size 681 inconnel style tags (National Band and Tag Co., Newport, KY) were applied proximal of and adjacent to the first large scale on the posterior edge of the flipper. These tags were supplied by NMFS – Marine Turtle Research Program (MTRP) in Honolulu. Furthermore, if the turtle was untagged, personnel scanned her rear flippers for PIT tags (Passive Integrated Transponder) with a Biomark Pocket Reader. Standard carapace measurements were taken using calipers. All turtles were checked for external injuries and abnormalities. Data collected was used to calculate individual remigration interval, nest-to-crawl inter-nesting interval, nest-to-nest inter-nesting interval, and carapace size. Maps were sketched to show each crawl pattern, false nest location, and nest location.

Nests and hatchlings: Nest sites were marked and identified by date, turtle ID number, turtle tag numbers, observers, and GPS coordinates. In rare situations when a nest was laid in an area characteristically inundated by high tidal cycles, the nest was relocated to an area above the high tidal line immediately after the nesting female returned to the water. Personnel cautiously placed each egg into a container, the dimensions of the original nest chamber were carefully replicated, the eggs returned to the ground, and then covered with damp subsurface sand; the orientation of each egg was carefully maintained throughout the entire process. All dates of hatchling activity were recorded. During the hatchling emergence phase, nests were continuously monitored for signs of activity. During the hatchling emergence, personnel counted hatchlings and ensured their safety to the ocean. Personnel rescued stranded hatchlings led astray by artificial light as well as found in vegetation and cobblestones. Approximately 24 to 72 hours after the main hatchling emergence, all nests were excavated to inventory nest contents and rescue trapped hatchlings within the nest cavity. Data collected was used to calculate incubation period, nest contents, clutch size, and nest hatch success. In addition, as part of a continued collaborative effort, hatchlings and/or embryo sample from each nest excavation were collected and sent to scientists at NMFS for DNA and genetic analysis. As part of another continued collaborative effort with NMFS-MTRP, 11 Hobo Pendant Temperature Light Data Loggers (Part # UA-002-08) were deployed at three beaches. These were used to record both ambient beach temperature and inside incubating nests to research temperature sex determination.

Predator management and nest protection: As in past years, nests were closely guarded throughout the season by field personnel. Small mammal live traps were baited, set, and checked several times daily at ʻĀpua Point, Halapē, Kamehame, and Pōhue Bay to control mongooses (*Herpestes auropunctatus*), rats (*Rattus* sp.), and feral cats (*Felis catus*) for the first half of the nesting season. Captured animals were euthanized humanely using carbon dioxide. This method was recommended by the American Veterinary Association's (AMVA) Panel on Euthanasia (AMVA 2001). The species and sex of each predator was recorded. Wire mesh nest enclosures (screens) were constructed over most of the nests observed at Kōloa and Pōhue Bay to provide further protection from predators, vehicles, and humans. After 45 days of incubation, nest enclosures were cut open or removed to prevent trapping any hatchlings. At Kamehame, we maintained an ungulate fence that protects the nesting habitat from feral pigs (*Sus scrofa*) and cattle (*Bos taurus*).

Basking green turtle monitoring: If a green turtle was observed with fibropapillomatosis or if a stranded individual was found, it was to be removed from the beach and given to the UH-Hilo/NMFS-MTRP Strandings Team.

Education and public outreach: Project personnel provided extensive on-site and off-site interpretation to community members in both formal and informal settings. Personnel, volunteers and students from UH-Hilo and the Hawai‘i Youth Conservation Corps participated in overnight camp trips at Kamehame, where they learned about marine turtle conservation and helped with beach monitoring and habitat restoration. Volcano School third grade students, teachers, and parents participated in a beach cleanup and a nest excavation at Kōloa. Informal outreach was performed at all the beaches, especially at Punalu‘u, Kōloa, and Halapē for community members, school groups, and visitors. Turtle brochures were distributed to local residents and visitors by project personnel, and Punalu‘u vendors.

All HAVO coastal backcountry visitors were given hawksbill educational brochures with a sighting report form along with their wilderness camping permit by NPS interpretive rangers. They also received aid and interpretation from project personnel about backcountry protocols, proper leave-no-trace ethics, and sea turtle viewing etiquette. Coastal debris clean-ups were done at each field site. Interpretive signs were replaced or maintained at the various nesting beaches. Project staff provided educational displays at numerous community events including UH Ocean Day and a career technical education event for high school students in Hilo. The coordinator gave presentations at the Pacific Regional Meeting at the International Sea Turtle Symposium in San Diego, CA and at the Mokupāpapa Discovery Center in Hilo, HI.

Results of 2011 Nesting Season (5-1-11 to 12-23-11)

The first signs of nesting activity were found on May 15, 2011. Field coverage extended until the final nest was excavated on December 23, 2011. A total of 63 hawksbill and four green turtle crawls were recorded during this period.

A total of nine tagged adult female hawksbills were observed: two at ‘Āpua Point, three at Kamehame, one at Kōloa, and three at Pōhue Bay. Five of these individual hawksbills were newly tagged (Table 1), while the remaining four individuals were returnees from previous seasons (Table 2). These new recruits bring the number of adult female hawksbills tagged on Hawai‘i Island to 110. In addition, one adult female green turtle (*Chelonia mydas*) was newly tagged at Halapē and nested at Pōhue Bay (Table 3). A total of 29 confirmed hawksbill nests and one green turtle nest were documented on Hawai‘i: six at ‘Āpua Point, nine at Kamehame, three at Kōloa, and 11 hawksbill and one green at Pōhue Bay. In addition, there was evidence of two additional possible nests at Kamehame and four at Kōloa. Adult hawksbill tracks were also documented at Punalu‘u. Of the 30 confirmed sea turtle nests documented, 27 were excavated. None of the nests were translocated this season. Unfortunately, one nest at Pōhue Bay and at least two nests at Kamehame were washed away by high surf. 12 of the nests were screened with wire mesh enclosures to protect them from predators and recreational beach users. An estimated 2,982 hawksbill and 40 green turtle hatchlings are estimated to have safely reached the ocean.

Table 1.
Identification information of newly tagged adult female hawksbills on Hawai‘i Island, HI in 2011.

Project ID#	LFF	RFF	LRF	RRF	Date Tagged	Location
106	3D44	3D45	3D46	2D24	7/5/11	‘Āpua Point
107	2D61	2D62	3D35	3D37	7/23/11	Pōhue
108	2D42	2D41	2D43	2D44	8/12/11	‘Āpua Point
109	3D31	3D32	3D33	3D34	8/21/11	Pōhue
110	8C02	8C01	8C04	8C03	9/22/11	Kōloa

Table 2.
Identification information of returning adult female hawksbills on Hawai‘i Island, HI in 2011.
[ ] = previous tag either fallen off or removed.

Project ID#	LFF	RFF	LRF	RRF	Year Last Observed	Location
37	B-637	B-638	93-M	94-M	2005	Kamehame
63*	[96-M], 3D62	3D60	3D61	97-M	2007	Kamehame, Halapē, Punalu‘u
72	8A98	8A99	445-X	447-X	2006	Pōhue
74	1D46	1D47	1D48	1D49	2009	Kamehame

* Found dead at Punalu‘u.

Table 3.
Identification information of newly tagged adult female green turtle on Hawai‘i Island, HI in 2011.

Project ID#	LFF	RFF	LRF	RRF	Date Tagged	Location
GR 1	3D78	3D79	none	none	7/6/11	Halapē, Pōhue

The cumulative results for hawksbills for the 2011 season are as follows: Nest-to-attempt inter-nesting interval ranged from 18 to 21 days with a mean of 17.7 ± 2.1 days (n=9). Nest-to-nest inter-nesting interval ranged from 19 to 28 days with a mean of 19.8 ± 2.3 days (n=10).

Incubation period ranged from 54 to 77 days with a mean of 58.4 ± 3.6 days (n=18). Clutch size ranged from 80 to 234 eggs with a mean of 159 ± 9.4 eggs (n=26). Including the three nests washed away by the surf, nest hatch success ranged from 0 to 96.4% with a mean of 63.1 ± 6.3% (n=29). Not including the three lost nests, nest hatch success ranged from 9 to 96.4 % with a mean of 70.1 ± 5.5% (n=26). The results for the green turtle nest are discussed in the Pōhue Bay section below.

As in previous seasons, effort to document and protect sea turtles was extensive. However, the amount of field personnel was reduced this year due to budget constraints. From May through December project personnel spent a total of 556 monitoring nights covering four to seven nesting sites for a total of 1,455 worker nights (# of monitoring nights X # of personnel). In addition to nightly monitoring duties, project personnel performed 822 day checks for a total of 1,877 worker days at these and additional sites.

Three nests showed evidence of potential predation. Across all sites, cumulative non-native predator trapping effort consisted of 43 traps baited at five sites on 169 days for a total of 1,881 trap days. This effort resulted in the removal of 109 predators (one animal per 17.3 trap days) across all sites. A total of 53 mongooses and 56 rats were caught at ʻĀpua Point, Halapē, Kamehame, Kōloa, and Pōhue Bay.

Site Summaries:

***ʻĀpua Point*:**
Two newly tagged hawksbills (Turtle ID #s 106 and 108) made a total of 17 crawls that resulted in six confirmed nests at this beach in the backcountry of HAVO.

Turtle ID #106 crawled four times and laid two confirmed nests. Her standard carapace length (SCL) was 86 centimeters (cm). Her nest to crawl inter-nesting interval was 20 days (n=1). While her nest to nest interesting interval was 28 days (n=1). She laid her first nest on June 13 and her second nest on July 12 after false nesting on July 4 and July 7. Several local youth from the Kalapana Fishing Council community group witnessed her nesting event in June.

Turtle ID #108 laid three confirmed nests and likely an additional unobserved nest. She likely made a total of 13 crawls. Her SCL was 80.5 cm. On one nesting crawl, she arrived on the beach at 12:21 pm, the earliest daytime nesting event in project history (Figure 1).

Approximately 788 hatchlings safely reached the ocean from the six excavated nests, including 175 that were rescued by personnel during excavations and numerous others that were assisted over the rocks. Thanks to onsite personnel, only three dead hatchlings were excavated and only one hatchling was found dead on the rocky beach. Most of the nests had successful main emergences with 95 or more hatchlings emerging together. The average incubation time was 58.5 ± 1.2 (n=6) days with a range of 55 to 63 days. The mean clutch size was 158.5 ± 5.9 (n=6) eggs with a range of 146 to 177 eggs. The mean nest hatch success was 83.4 ± 4.2% (n=6) with a range of 67 to 91.1%. In addition, temperature data loggers were deployed in two of the nests.

Figure 1: Turtle ID #108 returns to ocean after rare daytime nesting at ʻĀpua Point, Hawaiʻi Island.

None of the six nests were screened. Non-native predator control efforts resulted in the removal of 29 animals from the nesting area: one male mongoose and 28 rats (20 male and eight female). Trapping effort consisted of six traps set on 59 days for a total of 354 trap days between June 27 and September 26. This is an average of one animal per 12.2 trap days.

In addition, Hawaiian monk seal (*Monachus schauinslandi*) ID# R4DF (tags 4DF/4DE) was observed at ʻĀpua on October 13 (Figure 2).

Figure 2: Hawaiian monk seal ID# R4DF at ʻĀpua Point, Hawaiʻi Island.

We began checking the beach occasionally on April 30 and continued with more frequent monitoring beginning in mid-June and extending until the last nest was excavated on December 23. Between these 238 days, project personnel conducted 132 monitoring nights (329 worker nights) and nine day checks (20 worker days) to monitor and protect the hawksbill nests at ʻĀpua Point.

Keauhou

There was no hawksbill activity documented here in 2011. However, Hawaiian monk seal ID# R4DF was observed on October 1.

In addition, a project volunteer along with a non-native vegetation specialist from HAVO Resources Management Division, trail crew from HAVO Maintenance Division, and the Wilderness Volunteers worked together to remove koa haole (*Leucaena leucocephala*) and other non-native vegetation for four field days in March. This effort reduced the amount of these highly invasive plants at the nesting habitat.

Between April 29 and December 17, project personnel performed 75 daychecks (176 worker days) and spent 8 monitoring nights (14+ worker nights) monitoring Keauhou in 2011. These day checks were performed by personnel monitoring ʻĀpua Point and Halapē during the night.

***Halapē*:**

2011 was the first time in ten seasons that no hawksbill activity was documented at Halapē. However, project personnel observed two other threatened and endangered species here.

One adult female green turtle (ID# GR1) false nested and was tagged (LFF 3D78 RFF 3D79) at this site on July 5 (Figure 3). Her SCL was 94 cm. This is the first time in project history that a nesting green turtle was tagged on Hawai‘i Island beaches.

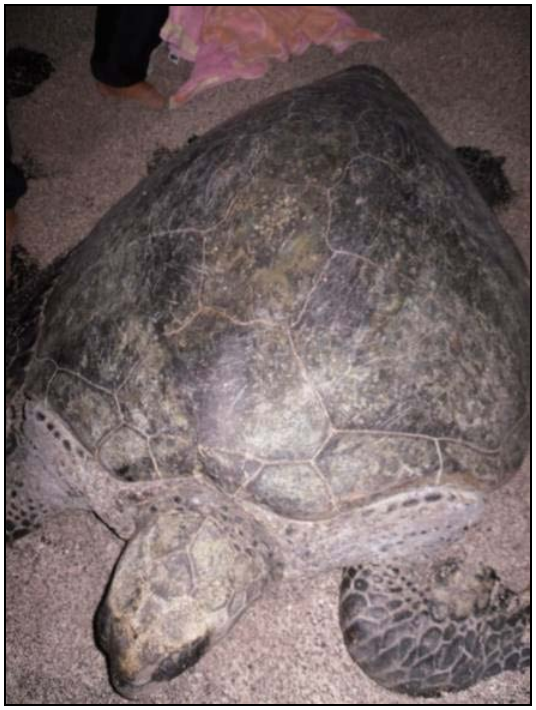

Figure 3: False nesting green turtle at Halapē, Hawai`i Island.

Two Hawaiian monk seals (ID #s R4DF and RB18) were observed at Halapē on multiple days in October (12, 15, 16, 17) and November (5 and 6) (Figure 4: a and b). Seeing two monk seals on one beach is a rare event on Hawai‘i Island.

Figure 4 (a and b): Hawaiian monk seals ID#s R4DF and RB18 at Halapē, Hawai‘i Island.

Non-native predator control resulted in the removal of 15 non-native mammals: four mongooses (3 male and 1 female) and 11 rats (8 male and three female). Trapping effort was seven traps baited on 23 days for a total of 161 trap days. This is an average of one animal per 10.7 trapping days.

Between April 30 and December 17, project personnel performed 47 daychecks (88 worker days) and spent 37 camp nights (84 worker nights) monitoring Halapē and Halapē iki.

***Kamehame*:**
Three remigrant turtles (ID #'s 37, 63, and 74) combined for a total of 22 crawls and laid a total of nine documented nests and at least two additional "possible" nests. We estimate that 660 hatchlings safely reached the ocean from the seven excavated nests. 80 of those hatchlings were rescued during nest excavations.

Turtle ID# 37 was the earliest turtle tagged in project history that was observed during the 2011 season. Turtle ID# 37 was originally tagged at Kamehame in 1997. She returned eight years later in 2005 and again this season after six years. She made six observed crawls and laid at least three confirmed nests.

2011 was Turtle ID# 63's third and final documented nesting season. She had a two year and a five year remigration interval, having been tagged six years earlier in 2005 and returning again in 2007. In 2011, she was rescued from the pond at Punalu'u and nested at Kamehame several days later. Unfortunately she was found dead in Punalu'u Bay (see Punalu'u section for more details). Her only confirmed nest was washed away by high surf.

Turtle ID #74 returned for her third nesting season in five years. Both her remigration intervals are two years, having been tagged in 2007 and returning in 2009. She laid three documented nests this season and likely laid an additional unobserved nest in mid-May.

Between the two turtles that nested multiple times, the mean nest to crawl interesting interval was 20 ± 0.7 days (n=4) with a range of 18 to 21 days. The mean nest to nest interesting interval was 21.3 ± 0.9 days (n=4) with a range of 20 to 24 days.

There were at least two confirmed nests and two "possible" nests washed away by high surf at Kamehame during the 2011 nesting season. These nests were originally laid in areas that did not merit emergency translocation in the naupaka (*Scaevola taccada*) vegetation region above the high tidal line. Unfortunately, record high surf in late August inundated the nests. Another nest was impacted but managed to have a 9% hatch success.

The following are the nest results. Mean incubation time was 66 ± 4.8 (n=4) days with a range of 54 to 77 days. The mean clutch size 209.7 ± 5.0 (n=7) eggs with a range of 196 to 234 eggs. Including the two nests that were washed away, the mean nest hatch success was 35.7 ± 10.6% (n=9) with a range of 0.0 to 92.2%. This also includes another nest that was impacted by the surf and had only a 9% hatch success. Not including the two nests lost to the surf, the mean was 45.9 ± 10.8% with a range of 9 to 92.2%.

Three of the confirmed nests were screened later in the season to protect them from predators after the trapping program was suspended. Attempted nest predation was observed on several occasions. Feral cat tracks were observed around one of the nests and a small hole was dug. Another nest appeared to have rat tracks around it.

Non-native predator control resulted in the removal of 46 mammals: 41 mongooses (37 male and 4 female) and five male rats. Trapping effort was 20 traps baited on 61 days for a total of 1,220 trapping days (one animal per 26.5 trap days).

We also continued with habitat restoration again this season. Personnel worked with Hawai‘i Youth Conservation Corps students on two field trips to remove non-native vegetation, koa haole (*Leucaena leucocephala*) and Christmas berry (*Schinus terebinthifolius*) from the nesting habitat in preparation for sea level rise and to help relieve nest overcrowding. The youth were able to witness the first hatchlings of the season.

In addition to hawksbills, two other threatened and endangered species were observed utilizing Kamehame beach during 2011. As always, green turtles regularly bask on the beach. However, prior to this season we never documented any of them attempting to nest. On June 17, a green turtle was observed false nesting on two separate crawls. It is unknown for sure if this is the same green turtle that false nested at Halapē and nested at Pōhue. Hawaiian monk seals were observed resting on the beach on at least three days. Hawai‘i Island born male ID# RB18 was observed on August 4 and August 25 (Figure 5). Female interisland traveler “Makaiwi” ID# R4DF was also spotted here on October 3.

Figure 5: Hawaiian monk seal (ID # RB18) resting on Kamehame beach, Hawai‘i Island.

Between May 15 and December 11, project personnel performed 28 daychecks (54 worker days) and spent 105 monitoring nights (304 worker nights) monitoring Kamehame beach.

***Punalu‘u*:**

While there was not any confirmed nests documented at Punalu‘u in 2011, there was some very noteworthy hawksbill activity. There was a rumor that several turtles had gone into the pond after the March 3rd tsunami. In June, personnel observed a turtle in the pond with fishing line attached. It was reported to NMFS-UH Strandings Team. Subsequently, Turtle ID #63 was rescued from the pond and released to the ocean by George Balazs and UH-Hilo professors and

students on June 29 (Figure 6). Her SCL was 88.8 cm. This turtle was the heaviest hawksbill ever weighed in Hawai‘i at 310 pounds (140.6 kg). After being rescued from the pond and featured on the cover of the *Ka‘ū Calendar* she went to Kamehame to nest on 7-10.

Figure 6: Hawksbill ID#63 is released to the ocean after being rescued from the pond at Punalu‘u, Hawai‘i Island. (Photo by J. Coney).

Unfortunately, a lifeguard at Punalu‘u discovered her lifeless body floating in the bay on August 4 (Figure 7). We recovered the carcass and deposited it with UH-Hilo Strandings Team. It was later shipped to George Balazs at NMFS-PIFSC. On August 29, Dr. Thierry Work of U.S. Geological Survey Biological Resources Division conducted a necropsy. Dr. Work concluded that “this animal was morbidly obese, but a definitive cause of death could not be confirmed”.

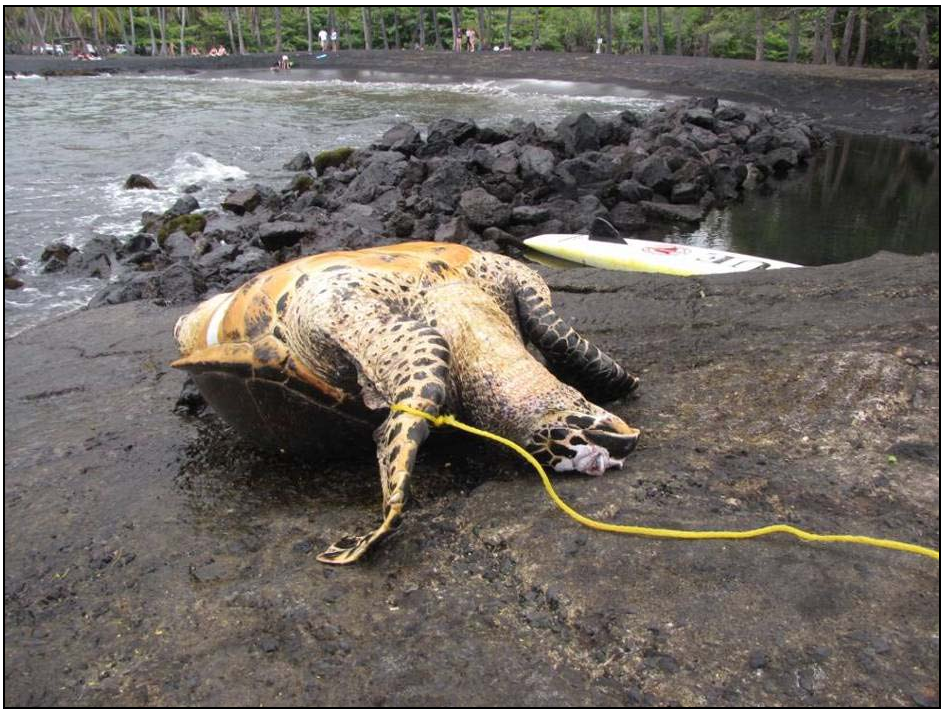

Figure 7: Turtle ID #63's body was recovered on August 4 at Punalu'u, Hawai'i Island.

On the morning of August 18 (weeks after the recovery of ID #63's body) adult female hawksbill tracks were observed in front of the rock wall at the vacation rental house. It is suspected that the turtle that crawled at Punalu'u went to nearby Kōloa since tracks and digs were found there on August 19 (see next section).

Between June 7 and December 10, project personnel performed 148 daychecks (342 worker days) and spent 11 monitoring nights (25 worker nights) monitoring Punalu'u beach for nesting activity and educating beach users.

Horseshoe Bay:
Personnel checked this small pocket beach for signs of hawksbill activity on 160 days (348 worker days) between June 7 and December 10 and did not document any activity.

Kōloa:
Hawksbill nesting was documented at this small pocket beach near Punalu`u for the second season in a row. A total of seven crawls were documented. Three confirmed nests were discovered and there were four additional possible nests. One newly tagged adult female hawksbill (Turtle ID #110) was observed false nesting on one occasion. It is likely that she laid at least one of the unobserved confirmed nests several days later.

Based on track observations and internesting interval data, it is a possibility that two different hawksbills crawled at this beach. Evidence of the first crawl was found on July 13 and resulted in a confirmed nest that hatched out on September 17. Incubation was approximately 66 days.

In 2010, the three nests had bleak hatch success. Deposited in the naupaka-sand interface, these nests were subjected to water from regular high tides. However, the tsunami event of March 2011 reduced the naupaka vegetation and thus this nest was laid on higher ground. The nest had a successful 77.4% hatch success.

This easily accessible site allowed us to conduct an outreach event. With the successful nest hatch several nights earlier, we were able to conduct a nest excavation with the students, teachers, and parents of the Volcano School of Arts and Science Third Grade. 14 hatchlings were rescued and released (Figure 8). In addition, the students helped pick up rubbish along the shoreline.

Figure 8: Rescued hatchlings are released with 3rd grade students at Kōloa, Hawai'i Island.

The last confirmed nest was laid on September 26 and the last nest excavated was on December 18.

The following are the nest results for the three confirmed and excavated nests at Kōloa in 2011. The only incubation time known was 66 days. The mean clutch size was 140 ± 30.2 eggs (n=3) with a range of 80 to 176 eggs. The mean hatch success was 64.6 ± 11.6% (n=3) with a range of 41.5 to 77.4%. An estimated 260 hatchlings are believed to have reached the ocean from the three nests. 54 live hatchlings were rescued during these excavations and only five dead hatchlings were excavated. An additional 113 hatchlings were assisted to the ocean across rocks after emerging on their own.

Kōloa has a high density of non-native predators and human recreational use. Only one of the three nests was screened to protect it from predators and people. This was the only nest where the location of eggs was confirmed prior to hatching. The nest cage was opened on 45 days incubation to prevent trapping any hatchlings if they came out early. After the screen was opened, evidence of mongoose predation was observed. A dig was observed on top of the nest

and several partially developed eggs were found in the naupaka broken open and partially eaten. Mongoose tracks were observed several more times near the nest. In response, three traps were set around the nest for nine days (27 trap days) and eight non-native animals were removed: seven mongooses (four male and three female) and one female rat. This is an average of one animal per 3.4 trap days.

In addition to hawksbills, a Hawaiian monk seal was observed on the beach on October 7.

Worker effort to monitor and protect hawksbills at Kōloa consisted of 80 day checks (197 worker days) and 96 monitoring nights (209 worker nights) between June 7 and December 18, 2011.

Nīnole:
Although no hawksbill activity was documented, two Hawaiian monk seals were observed hauled out on Nīnole beach on August 26. Personnel performed 154 daychecks (367 worker days) monitoring this site for activity between June 7 and December 10.

Kāwā Bay and Kaʻiliʻili:
Due to a conflict over legal ownership of these sites, personnel did not monitor these sites for the third season in a row. It is suspected that one of the unobserved turtles from Kōloa may have utilized one of these sites.

***Kahakahakea and Hāliʻipalala*:**
Personnel who were monitoring Pōhue Bay at night also conducted 58 daychecks (140 worker days) to look for signs of activity at Kahakahakea and Hāliʻipalala between May 26 and December 10. No evidence of nesting activity was observed on these occasional visits.

***Pōhue Bay*:**
With three hawksbills and one green, Pōhue had the largest number of nesting turtles, nests, and hatchlings documented at any site on Hawaiʻi Island in 2011. These nesting turtles made a combined total of 16 crawls. One remigrant hawksbill (Turtle ID #72) and two newly tagged hawksbills (Turtle ID #s 107 and 109) laid 11 confirmed nests. We estimate that 1,277 hatchlings reached the ocean from the 10 nests excavated (Figure 9). 261 live hatchlings were rescued during the 10 excavations and only two were found dead. Most of the rescued hatchlings were trapped in the nest chamber and would have died without assistance.

In addition to hawksbills, the green turtle (ID #GR1) tagged at Halapē nested here as well (Figure 10). This is the first documented case of a nesting green turtle on Hawaiʻi Island.

Evidence of early season nesting was documented in recent seasons. However, in 2011 the first documented nest was laid on July 10 and the first documented nest hatch was on September 10. The last nest was laid on October 21, and the last nest excavated was on December 18.

Figure 9: Hatchlings race to the sea during a rare daytime main emergence at Pōhue, Hawai‘i Island.

Turtle ID #72 was on a five year remigration interval, having been tagged in 2006. She laid four confirmed nests. Her SCL was 77 cm. Her nest to crawl internesting interval was 18.5 ± 0.5 days (n=2) and her nest to nest interval was 20 ± 1.0 days (n=3). Turtle ID #107 laid one observed nest and Turtle ID #109 laid two observed nests. Both turtles likely laid more nests as there were four additional unobserved nests.

Figure 10: First documented nesting green turtle on Hawai‘i Island at Pōhue, July 12, 2011.

The green turtle nest was laid on July 12. It successfully hatched out on September 10. The incubation time was 60 days. The nest was excavated on September 12. The clutch size was 50 eggs. The hatch success was 80% with 40 hatchlings reaching the sea (Figure 11) including six hatchlings that were trapped in roots and rescued during excavation.

Figure 11 (a and b): Six green turtle hatchlings were rescued from roots during the excavation at Pōhue, Hawai‘i Island.

The results for the hawksbill nests are as follows: Ten of the 11 hawksbill nests were excavated. One of the nests was washed away by high surf. The mean incubation was 61.1 ± 1.0 (n=7) days with a range of 57 to 65 days. The mean clutch size was 145.4 ± 8.5 (n=10) eggs with a range of 97 to 174 eggs. The mean nest hatch success (not including the nest that was washed away) was 87.6 ± 3.5% (n=10) with a range of 59.5 to 96.4%. The mean nest hatch success (including the nest lost to the surf) was 79.6 ± 8.6% (n=11) with a range of 0 to 96.4%.

Eight of the 12 nests were screened. The other four nests were not screened because the exact location of the eggs was not known until time of hatching. Trapping effort was seven traps set on 17 days for a total of 119 trapping days. Predator control resulted in the removal of 11 non-native rats (1 animal per 10.8 trap days). None of the nests were documented being predated although a rat was observed crawling on top of a nest and mongoose and cat tracks were observed on the beach.

In addition to hawksbill and green turtles, a pod of spinner dolphins (*Stenella longirostris*) was frequently observed utilizing the bay. A Hawaiian monk seal was also observed swimming in the bay on September 6.

Project personnel spent a total of 167 monitoring nights (490 worker nights) and five day checks (17 worker days) at Pōhue between May 25 and December 19, 2011.

***Humuhumu Point and ʻĀwili Point (Road to the Sea)*:**
Personnel assigned to monitor Pōhue also performed 58 daychecks (128 worker days) to monitor the hawksbill nesting beaches at Humuhumu Point and ʻĀwili Point between June 5 and December 16, 2011. No evidence of nesting activity was observed on these occasional visits.

Other Threatened and Endangered Species Activities:
As discussed in the site summaries, a green sea turtle was observed false nesting at Kamehame and Halapē. She successfully nested at Pōhue. Personnel also observed Hawaiian monk seals (*Monachus schauinslandi*) on several occasions hauled out at ʻĀpua Point, Keauhou, Halapē, Kamehame, and Nīnole. A monk seal was also observed swimming in Pōhue Bay. One seal was identified as ID#: R4DF. Her nickname is "Makaiwi". According to NMFS, she was originally tagged on Kauai in 2007 and has a history of interisland travel, spending most of her time between Oahu and Hawaiʻi with brief stints on Molokai and Maui. She was also observed at hawksbill nesting beaches during the 2010 season. The other seal observed was ID# RB18. This male was born on Hawaiʻi Island in 2007.

Additionally, the coordinator discovered a dead beaked whale in a tide pool while surveying coastline near South Point in June (Figure 12). Biologists from NOAA- PIFSC came to collect samples from the carcass.

Figure 12: Beaked whale found near South Point, Hawai‘i Island.

Other Collaborations:
As in previous seasons, HIHTRP collected samples from excavated nests (including the green turtle) and will be depositing them with the NMFS-PIFSC and SWFSC to be used for genetic analysis to establish the stock structure of the population. An inventory with the number and description of all samples collected and deposited is included in Appendix A. In addition, NMFS-PIFSC provided 11 Hobo Pendant Temperature Light Data Loggers (Part # UA-002-08) that were deployed in nests and as controls at three nesting sites for temperature dependent sex ratio research.

Discussion

Individual Turtles Use of Multiple Beaches:
As in previous seasons, at least one individual adult female was documented utilizing a different beach from where she was originally tagged in a previous year (Turtle ID # 63). This individual was originally tagged at Kamehame in 2005. She was then observed crawling at Kamehame and Halapē in 2007. In 2011 she was removed from the pond at Punalu‘u, then nested at Kamehame, before she was found dead at Punalu‘u. This turtle illustrated the furthest distance between multiple nesting beaches recorded at approximately 37 kilometers. These repeated findings each season continue to emphasize that the entire coastline, not strictly individual beaches, needs to be managed with consideration for nesting turtles.

***Newly Tagged Turtles*:**
For the second season in a row, five new recruits were tagged in 2011 (Figure 13). This brings the total number of adult females tagged on the Island of Hawai‘i since 1991 to 110. Of the 110

nesting turtles that HIHTRP has tagged in 20 years, 51 individuals have been tagged in the past seven years.

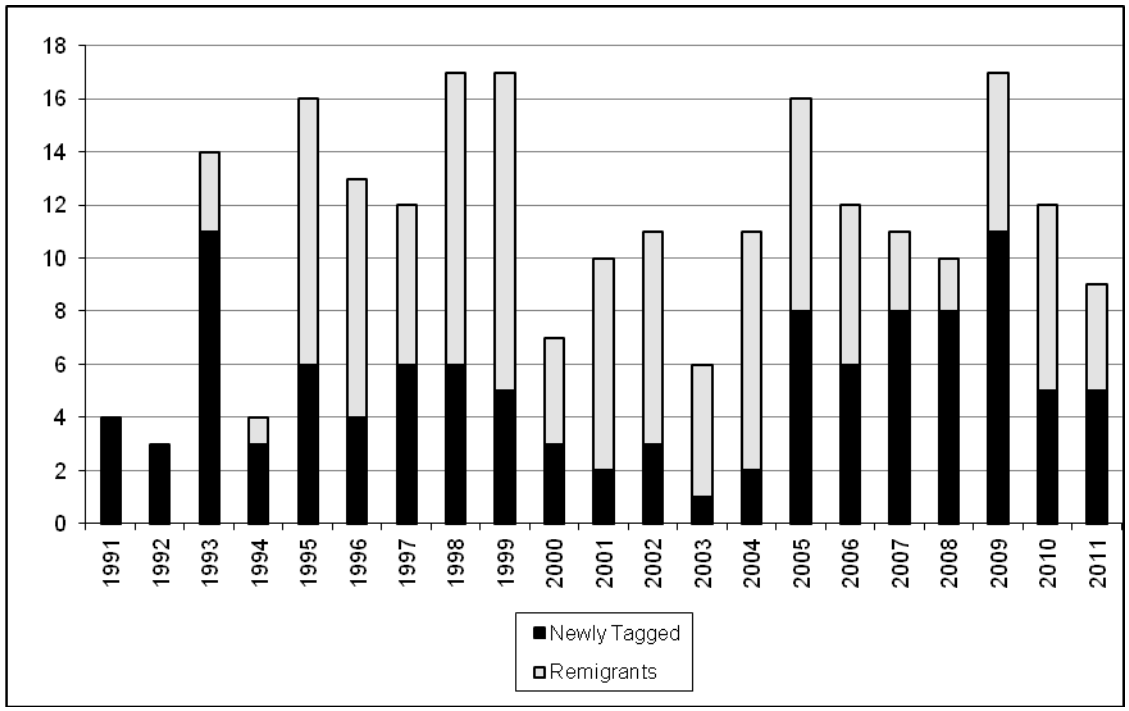

Figure 13: Number of newly tagged compared to remigrant hawksbills by year, 1991-2011, Hawai‘i Island, HI.

Threats:

***Nest Inundation*:**

Project protocol is to only translocate a nest if it is in imminent danger. This situation did not occur in 2011. However, at least two nests at Kamehame and one nest at Pohue were lost to record high surf. As mentioned in the Kōloa section, all three nests there in 2010 were unsuccessful due to tidal immersion. The naupaka vegetation was reduced following the tsunami in March therefore allowing nesting females access to higher ground. As a result, the nests at Kōloa were not inundated and had normal hatch successes.

Predation:

Due to sensitive issues, the trapping effort was reduced later in the season. Evidence of predation was subsequently documented on several occasions. At Kamehame, it appeared that a cat may have dug up a few eggs from a nest. In addition, it is suspected that rats may have dug into a nest as well. At Kōloa, mongooses impacted a nest. These observations reiterate the need for continued non-native predator control and nest caging in order to protect all the eggs.

Conclusion/Recommendations

This year marks the 22nd season of HIHTRP, one of the longest continuous studies of hawksbills in the world. Project success this season was measured by: 1) Project personnel provided nightly

coverage at three to five beaches and consistently checked others while documenting nesting activity at six beaches; 2) A total of nine nesting hawksbill turtles were observed; 3) We continued to see new recruits entering into the nesting population with five newly tagged individuals. These new recruits bring the total tagged since 1991 to 110; 4) 29 hawksbill nests were documented and protected. This brings the total number of documented nests since 1989 to over 768; 5) Approximately 3,000 hatchlings are estimated to have safely reached the ocean, bringing the estimated total since 1989 to over 86,000; 6) Minimal eggs were documented as depredated on by predators this season at beaches with continuous coverage and minimal hatchlings were found dead on the beach; 7) A green sea turtle was tagged and nested. This was the first documented green sea turtle nesting on the island of Hawai‘i; 8) Educational outreach efforts continued to generate support for sea turtle and coastal conservation from local community members and project partners; 9) We added to over 12 years of hawksbill genetic samples by collecting 79 samples from 27 nests and recovering one adult female; 10) We made 11 temperature data logger recordings to further aid temperature sex determination research. 11) Over 25 volunteers and interns gained field experience that will aid in them in future careers in conservation.

Based on our findings during the 2011 and previous seasons, we make the following recommendations:

1) ***Monitor and protect all potential nesting sites.***

Our priority remains on intensively monitoring and managing beaches that have the most documented activity and the greatest threats to hatchling survival. However, given the overall small number of nesting events in any given season (e.g. <60) all known nesting beaches need to be monitored and managed, regardless of their activity levels so as to maximize nest success. Long term monitoring of annual nesting is crucial for determining the status of the population. Because of ongoing threats by predators, invasive non-native plants and human activities, beaches that have been identified as nesting habitat need to be consistently managed every year.

2) ***Continue to survey for and identify new nesting beaches.***

There are many potential nesting beaches on the island of Hawai‘i for which no nesting activity has been documented. These include beaches with unconfirmed nesting activity reported by community members. Systematic follow-up monitoring to revisit sites or confirm nesting reports is often challenging because of a lack of access, personnel, or resources. In addition, the time between nesting remigration intervals for a female (two to ten seasons) requires that beaches be surveyed continuously for several years before nesting can be documented. We need to continue to work with landowners to gain access to these sites. For example, we had hoped to monitor and manage Wai‘ahukini and Kā‘iliki‘i since 2008. However, all access to Wai‘ahukini or anywhere in the ahupua'a of Pākini Nui West is currently off-limits.

3) ***Explore ways to improve nest success at particular sites.***

The threats caused by non-native vegetation, predators, and human activities need to be addressed at each site. For example:

***‘Āpua Point*:**

Having onsite personnel continuously monitoring this site during nesting season continues to be essential to save the lives of hatchlings that would otherwise become stranded and die on the

cobblestone beach. Non-native plants, particularly mauna loa vine (*Carnavalia cathartica*) need to be regularly controlled to protect the nesting habitat and prevent roots from trapping hatchlings.

Halapē:

Nest hatch success is typically below average in comparison to other beaches. Nests at Halapē often incubate for shorter durations (<55 days) and produce trickles of hatchlings that occasionally emerge during hot daylight hours instead of during lower temperatures such as at night or in early morning. Day time emergence increases hatchling exposure to dehydration and desiccation. Incubation time may or may not be a factor in trickle emergences and low hatch successes. We have worked in collaboration with NMFS and Dr. Thane Wibbels deploying temperature data loggers in order to better understand the relationship between temperature, incubation time, and hatch success. Shading and/or watering the nests at Halapē should be considered to possibly increase hatch success. Continued management to control invasive plants, predators, and human activity is strongly recommended. The popularity of this site for backcountry campers requires careful onsite management to protect turtles while educating campers. To prevent overcrowding of nest sites, the park should consider the possibility of reducing the amount of campers during heavy nesting seasons.

Kamehame

Throughout much of our monitoring history, nest overcrowding has been an issue because there is only a small area of suitable nesting substrate. The foremost problem with nest overcrowding results in nesting females digging up an existing nest and destroying viable eggs. On several occasions this season, nesting females were pulled away from locations where they were digging up an existing nest. Pulling a nesting female off an existing nest could discourage turtles from nesting, but is necessary to protect viable eggs. As mentioned in previous reports, it is possible that nest overcrowding could possibly be improved by cutting additional "turtle nesting trails" into the naupaka. The naupaka-sand interface habitat becomes crowded with nests, especially towards the end of the season. We cut four openings into the naupaka that provided nesting habitat above the high tide line (Figure 14). The turtles responded by nesting in these openings. We also improved habitat by removing alien plants that take over and form impenetrable roots making successful nesting difficult. We are also planning on moving the ungulate fence further back to make more room for nesting turtles and in preparation for sea level rise if funding can be found. This fence proved to be critical in protecting the nests and habitat during the severe drought the last two years. Without the fence, the cattle would have eaten all the naupaka and trampled all the nests.

Figure 14: "Turtle Trail" opening cut into naupaka to allow nesting females access to higher ground and to relieve nest overcrowding at Kamehame, HI.

Punalu'u:

Light pollution at Punalu'u could be reduced in three simple ways: education, changing light fixtures, and shielding existing light from the beach. Educational measures could include installing a large interpretive sign possibly at the south end of the beach (along an outside wall of the pavilion for example) that contained information not only about light pollution, but also about the history of the beach, the biology of sea turtles, the differences between greens and hawksbills, as well as threats and mitigations. With this conglomerate of information, the interpretive sign (and brochures) would hopefully not only help visitors realize the importance that Punalu'u plays in the Ka'ū community, but also evoke a sense of concern, awareness and knowledge from residents and visitors alike. Other educational opportunities could include holding informational sessions or lectures that would teach homeowners, community members, and anyone else in attendance specifically how to reduce light pollution. Also, installing other basic signs or stickers with a simple slogan (i.e., "Keep Sea Turtles In The Dark") near the light switch in the pavilion for example, could influence the general public to turn off the lights. Finally, having onsite interpretive staff could serve to educate people and reduce conflicts between wildlife and humans.

The presently utilized white to yellow light could be changed to light visible to the human eye, but undetectable to hawksbills. Witherington and Martin (2000) noted that most turtles cannot detect red light (620-750nm), and thus recommended changes could include installing light of this wavelength in order to make the beach safe for both humans and turtles. Floodlights on the vacation rental house should be replaced with shielded downlights, illuminating only the stairs as needed for safety. The existing artificial light at the county beach park pavilion could be shielded with a screen or window that would block the light from polluting the beach. The shields could be installed so that pavilion users, for example, could open them during the day,

thus enabling a beach view, but be able to close them at night, thus preventing turtles from being drawn southward along the beach.

It is important to note that reducing light pollution at Punalu‘u must be considered a shared effort not only because the beach is heavily used by the local public, but also because it is a main tourist attraction along the Ka’ū coast. Implementing and maintaining changes that reduce light pollution will require regular cooperation and communication between multiple groups including: HIHTRP, private landowners, state, federal and county agencies, community groups, and tourists. In 2010 HIHTRP met with beach residents and FWS and NMFS personnel to begin discussions on ways to work together to improve the light pollution problem. It is recommended that FWS continue to work with the County of Hawaii and beach residents to apply for funding that will help facilitate a project to retrofit existing lights at Punalu’u, especially in the pavilion and the parking lot at the south end of the beach park and at residences.

Kōloa

The tsunami event in March 2011 reduced the amount of vegetation on the beach at Kōloa. This allowed nesting females access to higher ground. As a result, all three nests in 2011 were left *in situ* and had healthy emergences. Previously in 2010, all three nests were failures, most likely due to repeated exposure to salt water during high tides. In 2003, all four nests were translocated because of their proximity to the high tideline. In 2004, three nests were left *in situ* and had above average hatch successes. Based on previous seasons of observations, any nest that is not laid in the vegetation should be translocated to higher ground. However, now that females can nest in higher ground, nest translocations may not be as necessary. In addition, heavy recreational use and high density of predators requires onsite personnel to protect all nests here.

Kāwā Bay and Ka‘ili‘ili:

As mentioned in previous reports, access and management of hawksbill habitat at these sites is extremely challenging due to sensitive cultural and political issues. In addition to marginal habitat and high density of non-native predators, human activities pose significant threats to nesting hawksbills. Management practices need to be implemented immediately to reflect the ecological significance of the site. Therefore, signs should be posted to thoroughly educate visitors and promote stewardship. Limiting vehicular access on the nesting habitat is high priority for conservation. Non-native predator control needs to be regularly performed during the nesting season. Reducing the impacts from artificial lighting also needs to be implemented during the season. The State and the County of Hawai‘i will need to work with beach residents and implement the necessary measures to protect this valuable nesting habitat.

Humuhumu Point, (Road to the Sea)‘Āwili Point and Manukā

To manage the recreational impact, we determined that at these sites it would be very difficult to keep the current road alignment while permanently blocking off vehicular access to the nesting habitat and still allowing access to fishing grounds along the coast. However, some simple steps could be taken to protect some of the nesting habitat and nests at these sites without closing the road. Boulders or some similar barricades could prevent trucks from driving on most of the beach where the turtles nest. Future work needs to be done with the landowner, the State of Hawai‘i, to change the course of the roads to solve this problem and install permanent barriers if we are to protect the nesting habitat from vehicular traffic.

4) ***Secure long-term funding for the project.***

From 1989 to 1992, the project was initiated by HAVO Resources Management Division with minimal funds and coverage, usually incidental to other HAVO backcountry programs. Since then the project has slowly grown into a partnership between government agencies, private landowners, educational institutions, non-profit organizations, and community members. Over recent years was through NPS, HNHA, NMFS-PIRO, and FWS grants, and donations from WTT. Securing adequate funding in the face of rising operating costs continues to be a challenge each season. We are working to adapt so that we can continue our efforts with less resources without having to reduce our monitoring efforts. However, in 2011 we were forced to reduce our efforts due to inadequate funding and will be forced to reduce our efforts in 2012.

5) ***Strengthen partnerships.***

We need to further strengthen our partnerships with private landowners, state, federal, and county agencies, educational institutions, non-profits, and community groups to find funding and to better manage coastal ecosystem integrity and promote responsible stewardship of coastal resources. For example, the beach at Humuhumu Point (Kahuku) is for sale and on the Hawai‘i County Open Space List. We need to continue partnering and applying for the funds to purchase this site at the federal and state level.

6) ***Continue with education and outreach efforts.*** Building support among the community is imperative for the long-term success of the project. In particular, increasing public awareness on the harmful impacts of off-road vehicles, trash, artificial lights and predators is needed to reduce incompatible human actions during critical nesting periods.

7) ***Additional analysis of long-term data sets.*** A University of Hawai‘i technical report entitled “Twenty Years of Conservation and Research Findings of the Hawai‘i Island Hawksbill Turtle Recovery Project, 1989-2009” (Seitz, et. al. 2012) was finally completed and published online at http://manoa.hawaii.edu/hpicesu/techr/178/default.htm in January 2012. Additional research and analysis of the data is planned over the next few years to better understand population dynamics and evaluate differences in nesting occurrence and nest success among sites and years, including the influence of local environmental factors on hatchling nest success.

Most of our management actions and recommendations are high priority actions as identified in the 1998 Recovery Plan for U.S. Pacific Populations of the Hawksbill Turtle by the NMFS and the USFWS. According to the Plan, “…The recent discovery of significant numbers of nesting hawksbills on the Hilo coast of Hawai‘i is perhaps the only positive sign in an otherwise bleak picture. With virtual protection and an aggressive management plan in place, the Hawaiian hawksbills stand the best chance for recovery…”.

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World Turtle Trust, Three Mountain Alliance and ʻImi Pono no ka ʻĀina, Yamanaka Enterprises Inc., Nani Kahuku ʻĀina LLC, Hawaiʻi State Department of Land and Natural Resources, The Nature Conservancy of Hawaiʻi, University of Hawaiʻi at Hilo, Hawaiʻi Wildlife Fund, Kaʻū High School, The Trust for Public Land, Hawaiʻi County, Kupu and Americorps, and the Big Island ohana.

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Appendix A: Specimens (n=80) collected by HIHTRP on Hawai‘i Island 2011.

Hawaii Island Hawksbill Turtle Recovery Project: Contact Will Seitz (808) 985-6090
Eretmochelys imbricata* and *Chelonia mydas
collected under permits USFWS TE-739923-6 and Hawai‘i DLNR SAP-2011-31
Island of Hawaii, 2011 Season
Submitted to NOAA-NMFS Pacific Islands Fisheries Science Center, Honolulu, HI. February 2012

Specimen #	Location	Tag #s LFF/RFF	Turtle ID	# Hatchlings	# Partially Developed	# Pipped	Total Specimens
1	‘Āpua Point	3D44/3D45	106	2	0	1	3
2	‘Āpua Point	3D44/3D45	106		3		3
3	‘Āpua Point	2D42/2D41	108	2	0	2	4
4	‘Āpua Point	2D42/2D41	108			3	3
5	‘Āpua Point	2D42/2D41	108		2	1	3
6	‘Āpua Point	2D42/2D41	108	0	3	0	3
7	Kamehame	B-637/B-638	37	3	0	0	3
8	Kamehame	B-637/B-638	37		1	2	3
9	Kamehame	B-637/B-638	37	3	0	0	3
10	Kamehame	1D46/1D47	74	3	0	0	3
11	Kamehame	1D46/1D47	74	2			2
12	Kamehame	1D46/1D47?	74?	3			3
13	Kamehame	UNK	UNK	3			3
14	Kōloa	8C02/8C01?	110?		2		2
15	Kōloa	8C02/8C01?	UNK-110?	2		1	3
16	Kōloa	8C02/8C01?	UNK-110?	4	0	0	4
17	Pōhue	8A98/8A89	72	0	3	0	3
18	Pōhue	8A98/8A89	72	1	1	1	3
19	Pōhue	8A98/8A89	72		3		3
20	Pōhue	2D61/2D62	107	1		2	3
21	Pōhue		72 or 109?		2	1	3
22	Pōhue	3D31/3D32	109			3	3
23	Pōhue	3D31/3D32?	109?	0	3	0	3
24	Pōhue	3D31/3D32	109	0	2	1	3
25	Pōhue		UNK		3		3
26	Pōhue		UNK			3	3
27	Pōhue	2D52/2D54	GR1*		1		1
28	Punalu‘u	3D62/3D60	63**	1 Adult Female			1
			TOTALS: **1 adult**	**29**	**28**	**21**	**80**

*=*Chelonia mydas*, **=entire adult female recovered

Appendix B: Map of confirmed hawksbill nesting habitat on Hawai‘i Island.