2005 Report on Maui's Hawksbill Sea Turtle Activities

USFWS Permit TE-89250-3

Hawai'i Hawksbill Recovery Project

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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 organized a community-based effort to systematically monitor these occurrences in 1996 after a passing car killed a second gravid female when she wandered onto North Kihei Road, either seeking suitable nesting habitat or disoriented by headlights.

The primary objectives of this research are to identify individual nesting hawksbill turtles, determine sizes of these females, the sites they use for nesting, the internesting intervals, the number of nests laid in a season by each female, to relocate nests that may be threatened by tidal flooding, 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 human disturbance, coastal lighting, non-native vegetation, predators, and vehicular traffic.

Methods

Nesting season can begin as early as mid-May, with hatching events stretching into December. During these months, the Dawn Patrol, a community group of approximately 30 volunteers, walks Maui’s three known nesting beaches (Kealia, Kawililipoa and Oneloa) early each morning looking for evidence of nesting. Once this has been discovered, a phone tree is 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 is intensely monitored by HWF. This typically entails all-night vigils waiting for the females to nest successfully, and guarding the nests during the course of hatching to ensure each hatchling reaches the ocean safely. Three days after the first major emergence of each nest, the nest is excavated to release any trapped hatchlings and to determine overall nest success.

The real concern, as it has been every season, was that turtles would crawl onto North Kihei Road and get run over by passing vehicles (see cover page photo). The dune

fence that is supposed to keep turtles off the road was not completely replaced (as it still desperately needs to be), and the newest areas already had large missing pieces in which a turtle could easily have crawled through and reached the road. Since this land is Alexander and Baldwin's, the only action that HWF could take was to try to repair the fence as much as possible. HWF also stationed volunteers at these large gaps and patrolled the beach all night in attempt to locate the turtle to make sure she didn't approach the road.

Activities under this permit in 2005 were conducted only on the island of Maui, where a single turtle was taken. The Dawn Patrol first discovered false crawl tracks from the evening of August 8th at Kealia (also known as Sugar Beach). This turtle returned the next evening (Aug. 9th) in which she was thought to have nested since she did not return on any subsequent evenings. Seventeen nights later she made two false crawls in the vicinity of her first attempts. She returned on the next night (Aug. 27th) for another attempt in which she spent over 2½ hours in the dunes. Although a tell-tale nest site couldn't be found, since she did not return the next few evenings it was again thought that she had nested. Twenty days later she laid a confirmed clutch, and it was relocated (by DLNR DAR, USFWS and HWF) to Kawililipoa Beach using the Hawksbill Nest Relocation Protocols finalized on August 7, 2001.

After the completion of what we thought was her second nest on the evening of Aug. 27th, this hawksbill was taken for VHF radio transmitter and time-depth recorder (TDR) attachment. We restrained her in a 4-walled plywood/carpeted "corral" and confirmed her to be the Kealia nester who laid 4 nests in 2000 (tagged left H332 & right H333 in 2000). Carapace measurements were also taken. After her third nest on Sept. 16th, the radio transmitter and TDR were removed and one satellite transmitter (supplied by George Balazs, NOAA, NMFS Honolulu) was attached to her carapace. These operations were conducted by Cheryl King, assisted by Mary Grady and Suzanne Canja, and supervised by William Gilmartin. The turtle incurred no injuries as a result of restraint.

Results & Discussion

This is the second hawksbill known to return to Maui in a subsequent year to nest since the establishment of Hawai'i Wildlife Fund's Hawksbill Recovery Project and the associated tagging that began in 1997. This hawksbill, which was named "Ho'olele" or "Lele" for short, was not seen since 2000, which would equate to a five-year remigration interval. In 2000, she laid 4 nests, with 4 "false crawls". Her first nest that was found was laid on August 18th in 2000, compared to August 9th this season. Her internesting intervals in 2000 were 20, 16 and 20 days, and 18 and 20 days this season (even though only one nest was found, on the 20th day after her previous cycle's false crawl). Her curved carapace length (CCL) measurements increased from 91 cm to 94.1 cm. But her curved carapace width (CCW) measurements decreased from 82 cm in 2000 to 80.7 cm in 2005 (likely due to variances in measuring techniques). Her straight carapace length and width (SCL and SCW) measurements were taken for the first time this season: 86.6

and 65.2 cm. Her metal flipper tags were secure and in good condition. No signs of fibropapillomatosis or external injuries were detected.

Dive Behaviors and Movements

In 2000, her internesting and post-nesting locations were not discovered, but this season both were found. Between nests she swam approximately two miles to the southeast offshore of the Kealia Resort (191 N. Kihei Rd.). This is the smallest distance compared to any of the other four previously tracked hawksbills (1997, 1998, 1999, and 2004). The other Kealia nester that has been tracked was "Hapa" in 1997. She utilized waters off of the Hawaiian Islands Humpback Whale National Marine Sanctuary (726 S. Kihei Rd), which is approximately one mile to the south of the Kealia Resort. The farthest internesting migration was made by 2004 Oneloa nester, "Orion". She was found to frequent the waters out to Nakaohu Pt., approximately 16 miles (~24 km) southeast of Oneloa, towards Nu‘u Bay.

HWF researchers were able to monitor Lele's movements from the Kealia Resort and off of the nesting beach with the radio tracking gear. The time-depth recorder provided additional information in greater detail (Table 1). The overall mean depth was 12.1 meters with a range of 4 to 25 m (mode and median: 13 m). Her maximum submergence interval was 1:42:15 with a mean of 0:50:19. She remained at the surface to breathe for approximately two minutes.

Her behaviors and locations before the third nesting cycle were monitored using VHF radio tracking gear. This data collection revealed that she returned to Kealia Beach in the middle of the 17th night of her internesting cycle (as we lost her signal from the Kealia Resort but could hear her offshore of Kealia Beach). Unlike at the Kealia Resort, she exhibited highly irregular diving activities offshore of Kealia Beach. This indicated that she was not simply resting in one location.

After (what we thought was) her third nest, she swam approximately 150 miles to the Hamakua Coast of the Big Island (Figure 1). The readings from the satellite transmitter were inconsistent and not highly reliable, therefore her exact route and travel time could not be determined. But it took her approximately 10 days to swim these ~150 miles to the Hamakua Coast from Kealia. This equates to a roughly estimated travel time of 15 miles/day (~0.63 miles/hr if she swam continuously). It took Hapa (1997 Kealia nester) approximately eight days to travel this distance to the Hamakua Coast. This equated to ~18.8 miles/day and a ~0.8 miles/hour constant swimming speed.

As of January 2006, Lele's satellite transmitter was still working and she was still off of the Hamakua Coast. Five of the other nine tracked females (nesting on Maui and Big Island) have traveled to this same coastline as well, providing further evidence of the significance of this area for the conservation of hawksbills. Three of the remaining satellite-tracked nesting females have traveled to the windward coasts of Maui (from the Big Island), Moloka‘i and O‘ahu (from Maui).

Another new discovery this season was the sighting of a female hawksbill that had been tagged after nesting at Pohue Beach on the Big Island this season. A Hawai‘i Wildlife Fund volunteer read her tag numbers while snorkeling at Kahekili (Airport Beach) on the west side of Maui north of Ka‘anapali. Ursula Keuper-Bennett and Peter Bennett had given this hawksbill the name “Ake” back in 1999 (http://www.turtles.org). She has been seen fairly regularly in this and the Honokowai area since then, so it is interesting to have connected her to the Big Island. This makes the complete nesting-to-foraging ground history complete for ten Hawai‘i nesters, five from Maui and five from the Big Island.

Hatchling Success and Nest Relocation

HWF permittees and volunteers conducted nightly vigils at each of her three nest locations from day 55 until day 70 when they were excavated. No hatchlings emerged from any of the nests. No eggs were found after extensive digging at the first two excavations. Her four nests in 2000 had similar outcomes, as two of them were not found and in the other two no hatchlings emerged. No information for 2000 is available on the stages of development that the hatchlings died in.

The third nest that was relocated to Kawililipoa Beach in hopes of better hatching success contained 224 eggs. George Balazs (NOAA, NMFS) examined the eggs and did not detect any signs of development. Further analyses will be undertaken that may answer this question, but at this point it is impossible to say whether they were not fertilized to begin with, or there was something reproductively wrong with her or any mate(s) she found. There are no obvious reasons as to why this nest was not successful. All persons involved with the relocation process adhered to the protocols, which were adopted from other nest relocation projects. The beach site was selected for its success with nests in the past, and the original nest cavity was replicated. All eggs were carefully taken out and put back into the new nest in the right order and orientation. The nest was moved well before the timeframe that the risk of embryonic death due to movement became a factor, and the eggs were not jostled.

Conclusions & Future Conservation Recommendations

Orion (Oneloa 2001 and 2004) was the first and Lele is the second known tagged hawksbill to return to Maui for another nesting cycle since 1997 when tagging began. Four nesters have not returned that we know of. This lack of recaptures could be partly due to the fact that there are barely enough people to reliably patrol the three known nesting beaches, and nests are going undetected and/or unreported on other beaches. Hawksbills have been known to nest in sporadic locations elsewhere in the world, which may be the case for Hawaiian hawksbills as well. Larry Katahira of the National Park Service has reported that a handful of Big Island hawksbills have switched nesting beaches within and among seasons, to beaches that are sometimes 11 miles apart. Orion switched to a totally new beach for her fifth nest in 2004 and no one reported seeing her tracks. This illustrates the need for an increase in the number of patrolled beaches coupled with more public education. Although Kealia’s characteristics (highly eroded,

prone to high winds and tides) often make it difficult to detect evidence of nests, it is also a possibility that Lele nested elsewhere prior to the first tracks being detected. The south shore from Kihei to Makena should be prioritized for the expansion of these patrols due to the proximity to Kealia, Kawililipoa and Oneloa.

Tracking the adult females during their internesting and post-nesting migrations continues to provide useful insight into their lives that wouldn't be possible without this technology, especially since this equipment continues to be perfected. The additional information that was gleaned by the time-depth recorder (TDR) this season was extremely valuable. This was the first TDR deployed on a hawksbill in Hawai'i, and should certainly be coupled with the VHF/satellite transmitters in the future. Obtaining a satellite-linked TDR is the next objective so that dive profiles during the migration back to the foraging grounds can be obtained. This will also provide dive information, which can be translated into foraging tactics, once at the foraging grounds. These are just two gray areas that persist in Hawaiian hawksbill biology.

Eventually the Crittercam© will become small and inexpensive enough to use. This device can be applied to the turtle early in the nesting season to hopefully show mating interactions with other hawksbills. And being able to see what they are seeing when deciding to come ashore to nest would be very insightful and helpful to conservation efforts. Once they leave the nesting grounds, we could also learn what species they are choosing to forage on, as well as the quantity.

Figuring out why the hatchling success has been so low for so long at Kealia should be a priority. This relocation attempt that was made was a positive step in this direction. Receiving the feedback on the eggs from George Balazs was essential and hopefully will be standard protocol in the future. Since this particular clutch did not show any signs of development, it seems that there was something reproductively wrong instead of sand incubation problems. But, with such a small sample size these results are inconclusive. Sand samples have been taken at each nest since the beginning of this project. Having these samples analyzed is the other phase of this project, which will be completed if funding is secured.

Determining the sand incubation temperature of each nest laid on Maui would be an important project to undertake. Placing a number of small temperature data loggers into the sand surrounding each nest can accomplish this. Information obtained from these loggers throughout the duration of incubation coupled with genetic analysis can determine the sex ratio, which is temperature-dependent, of hatchlings produced. 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 population.

The issue of what to do with weak hatchlings has been ongoing for several years now, and is still not resolved. On Maui, the Maui Ocean Center has agreed to work with interested parties on ways to help rehabilitate these hatchlings. This would only be a temporary situation until they can be released, and they would not be on public display.

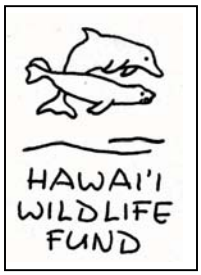
Many details need to be ironed out for this to happen- everything from what to feed them to where they should be released. Disease transmission is the biggest concern. Sound protocols must be researched thoroughly and amended to the original protocol.

Again, the biggest priority for the upcoming nesting season should be the completion of the Kealia fence repair to keep nesting hawksbills from being run over on North Kihei Road. Not only does it need to be replaced with the recycled plastic fence (that Kealia National Wildlife Refuge has had since the late 1990s), it ideally should be relocated *mauka* of the existing location of the sand fence, which is too close to the high tide line in many areas. This will increase the available nesting habitat as much as possible on this highly eroded beach. Unfortunately, this is Alexander and Baldwin land, with the negotiations by USFWS Kealia Pond National Wildlife Refuge out of HWF's hands. The idea of rerouting the road around the Kealia Refuge, obviously the best solution, should be proposed again.

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 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. But, the actual numbers of nesting hawksbills on Maui are not increasing (Fig. 2). And the annual mean hatching success for Maui's nesting beaches remains low with a range of 0% to 72.3% (Fig. 3). 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 survey report and attached exhibits fully and accurately represent our work.

_____	_____
William Gilmartin	Date
_____	_____
Cheryl King	Date



List of Tables and Figures

Table 1. Descriptive diving statistics (between Lele's 2nd and 3rd nest cycles) obtained from a time-depth recorder (TDR).

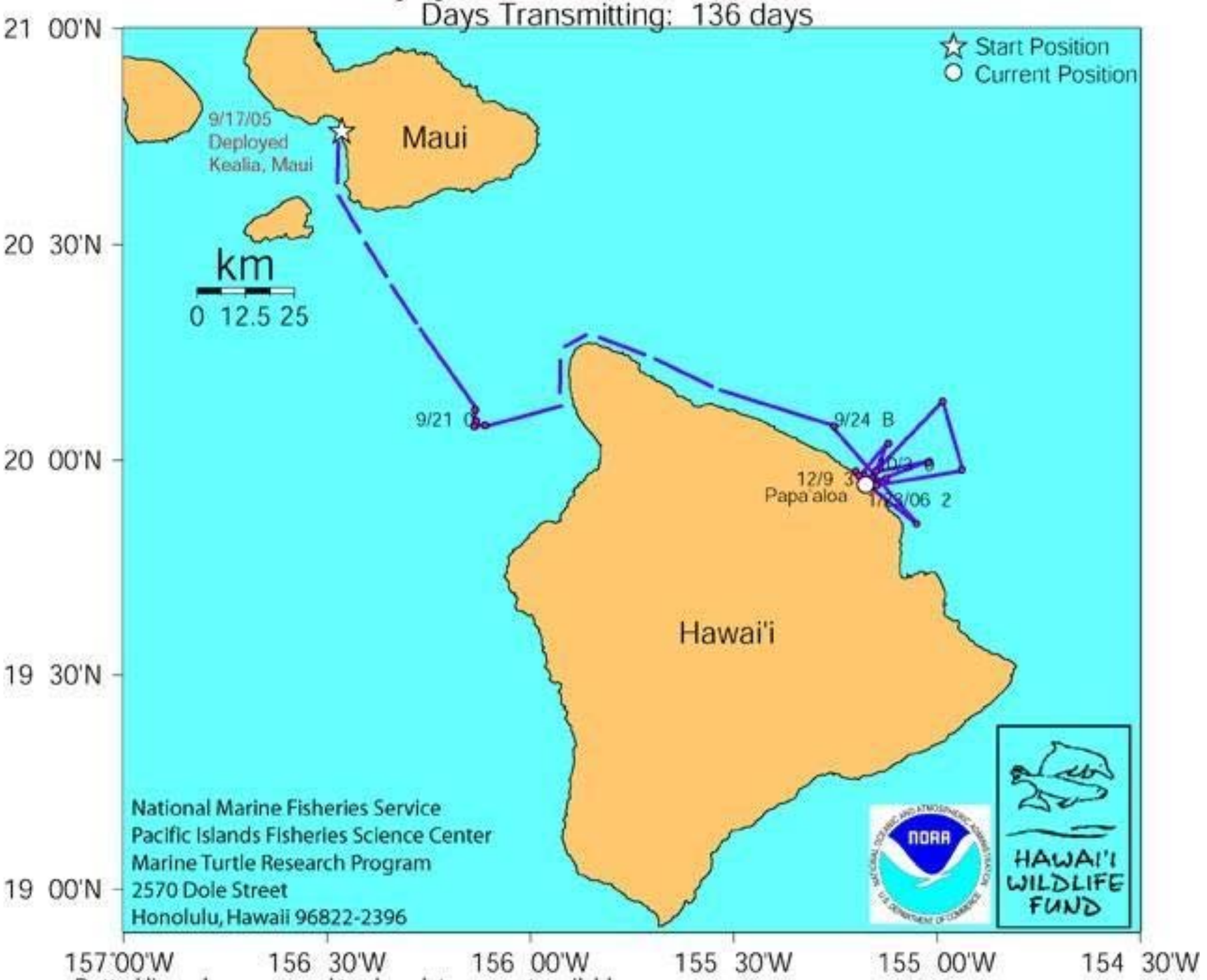
Depth (m)	
Mean	12.1
Median	13.0
Mode	13.0
Minimum	4.0
Maximum	25.0

Submergence Intervals	
Mean	0:50:19
Median	0:58:30
Mode	0:04:30
Minimum	0:00:25
Maximum	1:42:15

Bottom Time	
Mean	0:44:49
Median	0:54:50
Mode	0:03:20
Minimum	0:00:05
Maximum	1:40:45

Surface Intervals	
Mean	0:02:24
Median	0:01:30
Mode	0:01:20
Minimum	0:00:00
Maximum	2:18:35

Figure 1. 2005-2006 Post-nesting movement of Hawksbill turtle 53751, Lele
ST-20 Duty cycle: 6 hrs on, 48 hrs off SCL: 86.6 cm
Days Transmitting: 136 days



Dotted lines show assumed track as data was not available,
Pink circles are actual positions

GMT Map by Denise Parker 01/24/06

Figure 2. Summary of Maui's Hawsbill Nesting Activities (1991-2005).

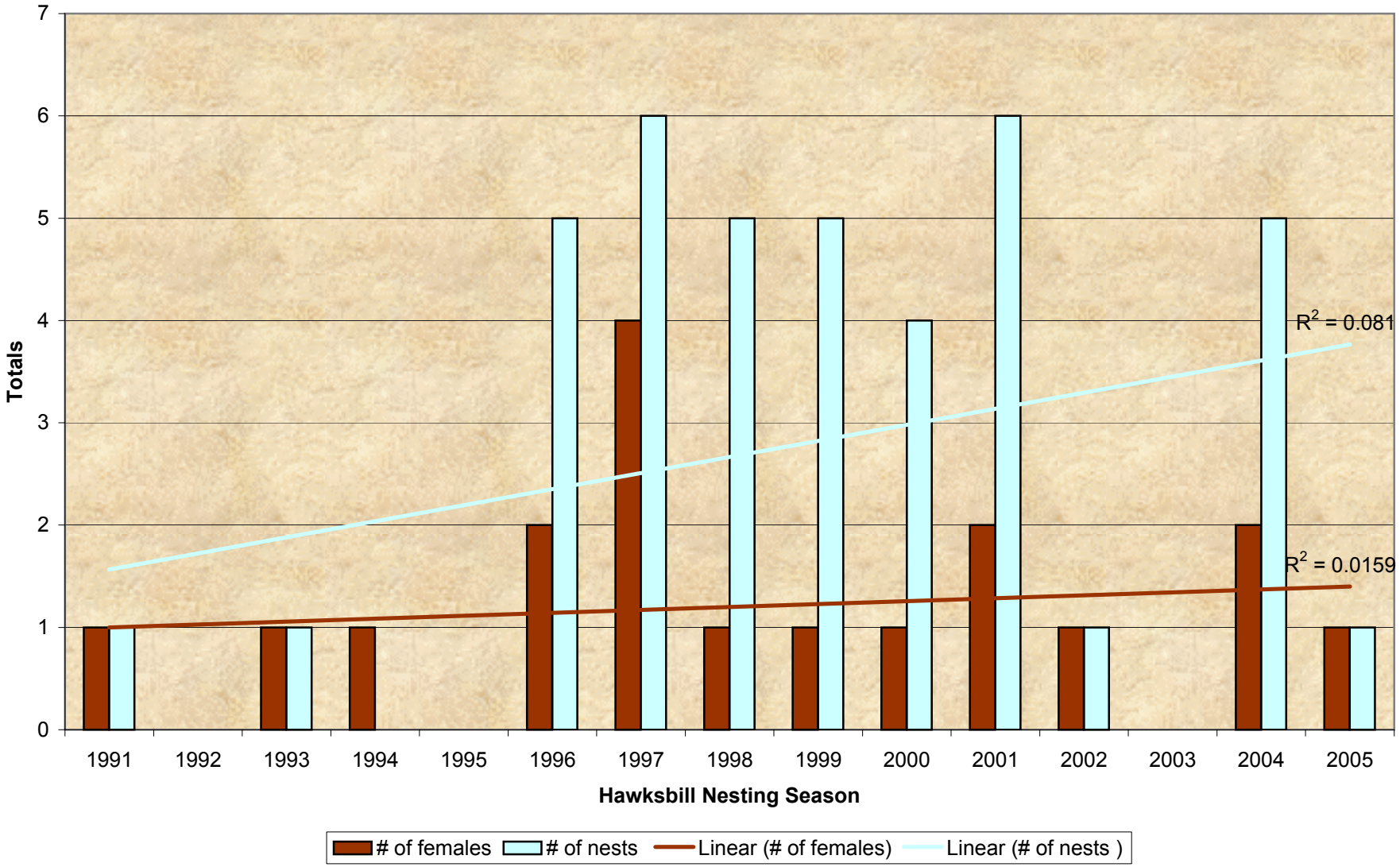


Figure 3. Mean Hatching Success of Maui's Hawksbill Nests (1996-2005).