



Hawaiian Green Turtle Nesting Marine Corps Base Hawaii 2024

Environmental Compliance & Protection Division, Natural Resources Office

Table of Contents

#	Title	Pg.
1.0	Summary	1
2.0	Acknowledgments	2
3.0	Background	2
4.0	2024 Results	6
4.1	Nesting Success	6
4.2	MCBH Nests Compared to O'ahu	7
4.3	Current vs Historical Nesting Aboard MCBH	8
4.4	Outreach Success	8
4.5	Notable Events in Chronological Order	8
5.0	Factors Impacting Nesting Success/Failure	9
6.0	Depleted Volunteer Contingency Plan	10
7.0	Detecting Active Nests	11
8.0	Conclusions and Recommendations	11
9.0	Additional Figures and Aerial Images	12
10.0	References	21
11.0	List of Supplementary Documents	21

1.0 Summary

The Hawaiian green turtle (*Chelonia mydas*), also known as the honu, are a distinct population segment of the Pacific and are designated as threatened under the Endangered Species Act (ESA). Honu nesting occurs annually between April-November. The 2024 season proved to be a peak season across the island but also very successful. This season MCBH made additional strides in light mitigation, education & outreach, and progress towards developing a project for Sea Turtle Active Nest Detection using Dogs (STANDD).

Of the 19 confirmed nests at MCBH, a total of 1008 hatchlings emerged from 1327 deposited eggs, an average emergence success rate of 76%. Clutch sizes in 2024 ranged from 65 to 99 eggs with the average being 83 eggs to a clutch. Recent literature from Florida published this year supports project development toward nest detection using dogs. Challenges facing nesting honu aboard MCBH consist of extensive light pollution, erosion of the shoreline due to sea level rise, nest inundation/washover, predation, direct conflict with humans and indirect impacts of coastal development from populations of people. MCBH will continue to improve its honu nesting program by working closely with the Malama I Na Honu, United States Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration (NOAA) as well as other partners.

2.0 Acknowledgments

MCBH has many dedicated volunteers both on and off base as well as support from USFWS, NOAA, and Hawaii Marine Animal Response (HMAR). Volunteers walked the MCBH shorelines multiple times a week monitoring for sign of turtle activity. This work benefits from many caring hands.

A special thanks to all Malama I Na Honu volunteers who dedicated their time to collect the data contained in this report. We especially thank Debbie Herrera, Malama I Na Honu's volunteer coordinator for orchestrating this past season's volunteer effort. She played a critical role in organizing volunteer efforts and directing nest excavations, which will contribute to an overall better understanding of sea turtle species and improved management practices. We thank the USFWS, NOAA and HMAR members for their collaboration on this project. We thank all personnel at S-3 Range Control for working with us and our volunteers.

3.0 Background

Five of the seven sea turtle species can be found in Hawaiian waters. Of the five, the Hawaiian green turtle nests the most often aboard MCBH. The Central North Pacific (Hawai'i) distinct population segment (DPS)(Figure 1) is considered threatened under the Endangered Species Act (Seminoff et al. 2015).

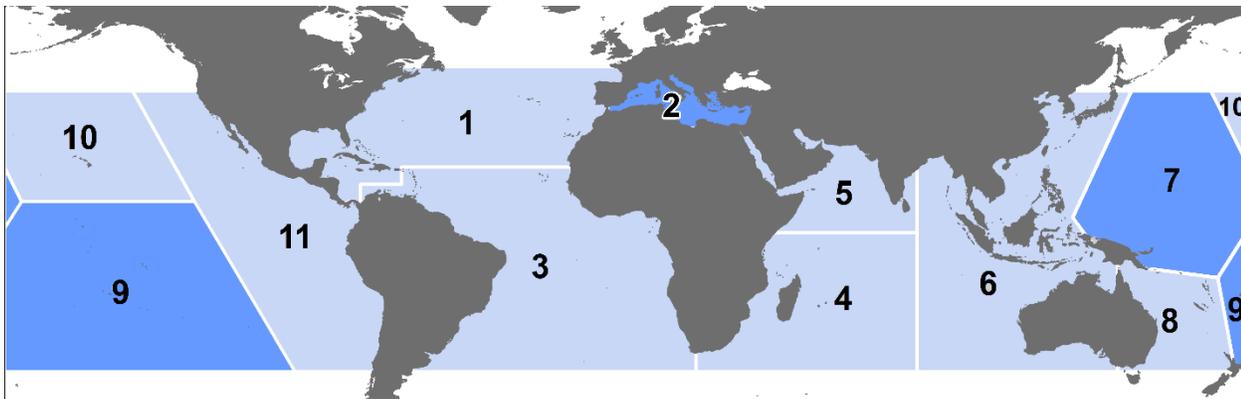


Figure 1: Distinct Population Segments of the Green Turtle (*C. mydas*). **Light blue** represents threatened populations and **dark blue** represents endangered populations. 1. North Atlantic, 2. Mediterranean, 3. South Atlantic, 4. Southwest Indian, 5. North Indian, 6. East Indian-West Pacific, 7. Central West Pacific, 8. Southwest Pacific, 9. Central South Pacific, 10. Central North Pacific, and 11. East Pacific (<https://www.fisheries.noaa.gov/resource/map/green-turtle-distinct-population-segments-map>).

The Hawaiian green turtle, also known as honu and referenced as such hereafter, typically nests from April to November with the peak hatchling emergences between July and August. Females typically lay between four to six nests in a season but do not lay eggs every year but rather every 2-9 years with the average being every 4 years (Balazs et al. 2015). Clutch sizes vary from 50-150 with nests averaging ~92 eggs per clutch. Incubation takes 50-90 days with an average of 66 days in the Hawaiian Archipelago. Sex ratio is temperature dependent with a pivotal temperature of 29.22° C (84.6° F). Females will develop if temperatures are above the pivotal threshold and males will develop if the temperature cooler. It is unclear how climate change and warming oceans will shift these patterns, if at all. Hatchlings usually emerge at night, queued by temperature. Major ongoing threats to the honu include illegal harvest, incidental take from entanglement in commercial fishing gear, vessel strikes, loss of nesting habitat, artificial lighting, and ingestion of plastics. These threats are compounded by the low survivorship of hatchlings and the many years (25+) it takes for a hatchling to reach sexual maturity. These factors make it crucial to maximize nesting success through protective measures in order to reach species recovery. Although we are required by law to protect these threatened species, protecting them also contributes to Marine Corps overall mission readiness by preserving ecosystem services and improving community relations, as well as remaining compliant with federal regulations. Further details on the nesting ecology of sea turtles can be found in the supplemental documents.

Marine Corps Base Hawaii (MCBH) is responsible for stewarding nearly 14 miles (22.5km) of shoreline. Honu nesting aboard MCBH has been documented at Pyramid Rock, North Beach, Fort Hase (Public/Restricted), and at Marine Corps Training Area Bellows (MCTAB). Suitable nesting habitat aboard MCBH may include the following locations listed in Table 1 and depicted in Figure 2.

Table 1. Names and codes of delineated beaches aboard MCBH.

#	CODE	NAME
1	HASE_R	Fort Hase WMA (Restricted)
2	HASE_P	Fort Hase (Public area)
3	FOBE	Fossil Beach
4	PORO	Pond Road Cove Beach
5	NOBE	North Beach
6	PYRO	Pyramid Rock
7	PAKI	Pali Kilo
8	HAKO	Hale Koa/Cabanas beaches
9	MCTA	Marine Corps Training Area Bellows (MCTAB)
10	PRTF	Puuloa Range Training Facility



Figure 2: Beach segments at MCBH Kaneohe Bay. MCTAB and Pu‘uloa RTF are not depicted above.

3.1 Seasonal Preparations

Seasonal preparations included a MCBH volunteer orientation hosted April 11th at the Environmental Compliance & Protection Division office Building 1359. This orientation guides volunteers with specific requirements and procedures for work on base. We also worked with the City & County of Honolulu Parks and Recreation to close overnight camping at MCTAB April 30 – August 3 in anticipation of nesting (Figure 3).



Honolulu Department of Parks and Recreation is at
Bellows Field Beach Park.

April 3 at 10:37AM · Waimanalo, HI · 🌐

With the return of the sea turtle (honu) nesting period approaching, Marine Corps Base Hawai'i (MCBH) and the Honolulu Department of Parks and Recreation (DPR) are announcing the suspension of overnight at camping for Bellows Field Beach Park from Wednesday, May 1 through Thursday, August 29, 2024.

Permitted camping is scheduled to return for the popular Labor Day Weekend period, beginning Friday, August 30. However, the suspension of overnight camping may be extended should there be an active honu nesting site at the campground. Further updates will be provided as we approach that holiday weekend.

Figure 3. Social media post announcing suspension of overnight camping at MCTAB.

A nest was designated a “presumed nest” when there was adequate evidence to suggest a nest such as a body pit, mound and/or tracks. Presumed nests were marked with GPS, cordoned off to protect the site, and later excavated with USFWS, sub-permittees and MCBH Natural Resources staff (USFWS excavation permit FWSPIFW0-26, TE-039990-26). A nest was designated a “confirmed nest” when a nest chamber was found during the excavation. If a presumed nest is excavated and no chamber is found, it is then deemed a ‘false crawl’, which are not uncommon.

3.2 Partnerships

During the 2024 season, the Natural Resources office enhanced its partnership with the volunteer organization, Malama I Na Honu and hosted a MCBH specific orientation with volunteers on April 1th. We also worked closely with experts from University of Hawaii, USFWS, and NOAA. Guided by the experts, volunteers logged over 790 hours while assisting with monitoring shorelines, collecting data, documenting changes, and excavating presumed nests. Volunteers walked MCBH beaches, approximately 4 miles of beach, 2-3 times a week, often late at night, early in the morning, and during the heat of the day to attain high resolution data, identify nests, and report on-site conditions. Natural Resources staff and the most dedicated volunteers excavated the majority of nests. Excavation data was shared via the ESRI Fieldmaps application with our partner agencies to better understand nesting sea turtles broadly.

3.3 Light Mitigations

Many of the lighting mitigations measures from 2020-2023 were implemented again in the spring of 2024. These include 36 bollard lights covered with plastic shrouds along the Fort Hase Recreational Trail, the exterior wall lights on building 1551 being de-energized, and the 19 amber LED fixtures installed in January 2023 on the Pa Honua neighborhood streetlights, as well as continued relations with key stakeholders such as base Facilities, Hunt Housing, Base Safety, and the Provost Marshall’s Office. A MCBH project is being developed to plant a vegetative barrier between the housing and beach along Fort Hase to mitigate light pollution coming from residential homes. Furthermore, ECPD secured \$100k dollars earmarked for purchase of additional wildlife friendly amber LEDs, base Facilities has purchased 100 fixtures, and will seek to retrofit problematic streetlights such as those depicted in Figure 4 prior to the 2025 season.



Figure 4: A problematic streetlight in the neighborhood overlooking Fort Hase at the base of Ulu‘pau crater. Note the color, brightness, and how the light scatters all directions including into the street side neighbor’s windows.

At MCTAB, although we did not document any nesting, bathhouse lights were de-energized and camping was suspended during the bulk of the nesting season. Prior to the emergence window, if a known nests was susceptible to light pollution, it is protocol for Natural Resources staff to construct a barrier of silt construction fabric to mitigate light disorientation. The barriers were U-shaped and directed hatchlings towards the ocean.

3.4 Outreach Actions

Nests laid at Pyramid Rock beach, North Beach or Fort Hase Public, are eligible for education & outreach events and offer participants a chance to witness real time sea turtle conservation in action with USFWS and volunteers. Events emphasized threats, actions taken by MCBH to mitigate threats, and how sea turtle conservation fits into overall military readiness as well as specific biology of the species. Natural Resources staff worked to keep the Community Planning and Liaison Office abreast of nests at eligible sites and in the emergence window in order to invite target groups. This is especially important during RIMPAC years such as 2024 when leaders from partner nations are able to participate.

MCBH purchased \$3,700 in materials needed for managing nesting sites in 2020 and much of those materials continue to pay dividends. Natural Resources staff designed and commissioned the production of 90 metal signs to be used at marked nests and in the general area of any turtle nesting activity. Each presumed nest in 2024 was cordoned off with corrosion resistant light chain and signs mounted. Additionally, MCBH conducted outreach and education through social media, beach signs, delivered internal notifications to residents and routine interactions with the public.

4.0 2024 Results

4.1 Nesting success

During the 2024 nesting season MCBH identified 40 presumed nests on MCBH beaches. MCBH confirmed and collected data from 19 nests (Table 2). The majority of activity was along the Fort Hase shoreline with 13 nests in the restricted wildlife management area shoreline, as well as three nests along the public side of Fort Hase and three nests along North Beach. Notably, Pyramid Rock beach had one presumed nest (Figure 5). With no nest chamber confirmed it was marked a false crawl but signifies newly documented activity. In collaboration with the City & County of Honolulu Department of Parks and Recreation, MCTAB overnight camping was suspended May 1st through August 29th. However, no nests were detected during the 2024 season.

Walks began early April and the first nest was detected April 18th. The last nest detected was laid September 8th. MCBH had an average nesting success rate of 75.95% in 2024.

. Due to the close monitoring of our volunteers we know that 1008 of the 1327 eggs deposited aboard MCBH hatched and emerged.



Figure 5: Presumed nest at Pyramid Rock Beach PYRO_1_06/06/2024.

Table 2: Summary table of all 19 confirmed nests excavated in 2024. HASR_2 and HASR_7 were in the same location making it difficult to know which eggs belonged to which nest. HASR_11 had a documented emergence but the egg chamber could not be located.

SPECIES	Beach	Site ID	Date Found (MM/DD/YYYY)	Total Clutch Size	# of Hatchlings Emerg	Emergence Success %	Washover/ Inundation?
Green	Hase (Restricted)	HASR_2	4/21/2024	Unk	Unk	Unk	N
Green	Hase (Public)	HASP_7	5/18/2024	99	87	87.88	N
Green	Hase (Public)	HASP_10	5/22/2024	81	80	98.77	Yes
Green	Hase (Restricted)	HASR_11	6/2/2024	Unk	Unk	Unk	N
Green	Hase (Restricted)	HASR_14	6/3/2024	77	0	0.00	Yes, regular
Green	Hase (Restricted)	HASR_17	6/14/2024	Unk	Unk	Unk	N
Green	Hase (Restricted)	HASR_20	6/17/2024	84	83	98.81	Yes
Green	North Beach	NOBE_6	6/19/2024	92	89	96.74	N
Green	Hase (Restricted)	HASR_21	6/25/2024	83	71	85.54	N
Green	Hase (Restricted)	HASR_22	6/27/2024	80	76	95.00	N
Green	Hase (Restricted)	HASR_24	6/30/2024	85	70	82.35	N
Green	North Beach	NOBE_10	7/5/2024	81	79	97.53	N
Green	Hase (Restricted)	HASR_25	7/7/2024	76	73	96.05	N
Green	Hase (Restricted)	HASR_30	7/13/2024	78	76	97.44	Washover occasional
Green	Hase (Public)	HASP_15	7/17/2024	95	22	23.16	Washover Hurr Hone
Green	North Beach	NOBE_11	7/18/2024	84	83	98.81	N
Green	Hase (Restricted)	HASR_33	7/30/2024	65	61	93.85	N
Green	Hase (Restricted)	HASR_38	9/1/2024	92	57	61.96	N
Green	Hase (Restricted)	HASR_39	9/8/2024	75	1	1.33	Washover frequent
Total				1327	1008	N/A	
Average				82.9375	63	75.95	

4.2 MCBH Nests Compared to O‘ahu’s

O‘ahu had a total of 83 confirmed nests on island in 2024 with 19 of them (22.9%) being aboard MCBH. Total nest failures due to wash over this year make it clear again the threat of sea level rise in the wake of human induced climate change and runaway emissions will remain a sink for deposited eggs.

USFWS conservatively estimates between 2020-2022 O‘ahu’s nesting population totals 26 females (pers. comm). Using some of the same calculations for same years, the Natural Resources Office estimates five to six females are using MCBH habitat. There were 2,877 eggs laid between 2020-2022 aboard MCBH. Divided by a

island mean clutch size of 80 ± 15 yields approximately 36 nests. Further divided by a conservative estimate of six clutches per female, it becomes reasonable to assume MCBH had five to six nesting females for those years.

4.3 Nesting aboard MCBH: Current year vs Historical years

Year	Presumed Nests	Total confirmed nests (n)	Total Eggs laid	Average Emergence success	Total hours volunteered
2019	7	4	250	72.15	5
2020	17	7	521	85.86	1300
2021	31	18	1358	76.08	1267
2022	33	13	998	92.80	592
2023	7	4	266	91.06	785
2024	40	19	1327	75.95	790.45
2025					

Total	135	65	4720	N/A	4739.45
Average	22.50	10.83	786.67	82.32	789.91

9.83 Estimated nesting females aboard MCBH between 2019-2024

4.4 Outreach Success

On June 14th education and outreach efforts reached 28 households in the Pa Honua neighborhood along Fort Hase discussing impacts of cats and artificial lights to wildlife. Those efforts encouraged residents to keep cats indoors and armed them with ways to reduce their light signature during the nesting season. Only two formal education & outreach events were hosted during excavations in 2024. On July 12th we excavated HASP_7 and reached 28 participants. On July 20th we reached 23 during the excavation of HASP_10. We also continued awareness efforts via email, social media, and face to face communication when possible.

4.5 Notable Events in chronological order

1. 15Mar @ 1530 a deceased juvenile honu washed up on Pyramid Rock beach and recovered
2. 18-19Apr Basking green sea turtle at the northern most end of Fort Hase Beach near Middaugh St. (21.445207825893174, -157.7356534289512)
3. 14Jun Education & outreach efforts reach 28 households along the Fort Hase shoreline neighborhood.
4. 24Jun Deceased Green Sea Turtle MCTAB (Figures 9 and 10)
5. 29Jun Disoriented and deceased hatchling HASR (Figure 11)
6. 30Jun Deceased Hawksbill on North Beach (Figures 12 and 13)
7. 11Jul Two disoriented hatchling discovered (Figures 14-17)
8. 12Jul Education & Outreach Event with 28 participants
9. 20Jul Education & Outreach Event with 23 participants
10. 20-21Jul King tides
11. 25Jul Disoriented and deceased hatchling Fort Hase (Figure 18)
12. 29Jul Basking Green Sea Turtle Fort Hase Restricted (Figure 19)
13. 30Jul UH Manoa and Dr. Cynthia Hunter's class performed cursory honu survey in Nu'upia ponds
14. 10Aug2024 Disoriented and deceased hatchling found inside the moving target range (Figure 20).
15. 21Aug2024 Disoriented and deceased hatchling found on Old Mokapu Rd. (Figure 21).

5.0 Factors Impacting Nest Success/Failure

5.1 Sea Level Rise from climate change and Storm Surges



In 2024, six of the 19 confirmed nests were documented to have been washed over by some extent. HASP_15 received washover from Hurricane Hone. Although, no major storms or cyclones made landfall on O‘ahu, the human race continues to generate additional greenhouse gases accelerating the warming of the oceans from climate change. This will drive further sea level rise and impact future nests by inundating eggs. Increased intensity and frequency of storm surges from climate change along with sea level rise will also erode away future nesting habitat, posing a long-term risk to the species. Furthermore, as beachfront property becomes more developed and the seas rise, available nesting habitat in the main islands becomes ever scarce as the Northwest Hawaiian Islands capacity erodes and becomes submerged over the decades. Fort Hase Restricted has received the most consistent nesting since 2019 but the most limited in terms of haul out locations, the beach is very narrow and the area seaward of the beach is rocky. Nests have been observed in tight clusters which could impact survivability of nests laid earlier in the cluster (Figure 6).

Figure 6: Cluster of three chambers discovered Ft. Hase 2024.

5.2 Light Disorientation

Light disorientation occurs when hatchlings emerge from the nest and struggle to find the ocean due to the glow of inland light pollution. Once turtles emerge from the egg chamber, honu hatchlings rely partially on the moon light and horizon as natural cues or indicators to navigate to the water. They can confuse manmade sources of light, such as streetlamps and housing lights, with these natural indicators and migrate inland, away from the sea. Because they have limited energy stores, light disorientation impacts survival and can result in incidental take. Artificial light sources may also deter adult females exiting the water to lay eggs. In 2024, we detected and documented six dead hatchlings as evidence of light disorientation aboard MCBH (Figures 7, 11, 14-17, 18, 20-21).

MCBH has made significant cuts to its coastal light signature since 2020 but will continue to work hard to reduce light pollution further. In general, all non-essential lighting near the shoreline should be turned off to avoid incidental take and harm to wildlife. International Dark Sky standards are techniques and/or methods that reduce light pollution while maintaining essential lighting. A rule of thumb for essential lighting is to keep lights “long, shielded, and low.” Using lights with ‘longer’ wavelengths ($\geq 560\text{nm}$) should reduce the risk of disorienting honu. However, there is some evidence that even ‘turtle safe’ lighting can disorient hatchlings, especially when closer than four meters or on a moonless nights (Robertson et al. 2016). Keeping lights shielded ensures light is directed where needed while preventing light glare where it is not needed. Keeping lights ‘low’ refers to low lumens and wattage as well as physically lower to the ground. Lastly, the end of the 2024 season, MCBH began a partnership with Girl Scout Troop 873 and Troop 675 as part of a Gold Award project to source local wood from an invasive species and shape it into slates to fit approximately 100 feet of standard two inch chain link fence. The wood slates would serve as a light barrier along the fence that separates Fort Hase Public and the wildlife management area (Fort Hase Restricted). Any nests laid north of the fence would benefit from the light barrier blocking artificial light sources from Kailua.



Figure 7: Aerial imagery depicting locations in **red diamonds** of four of five disorient hatchlings documented during the 2024 season. Inset photos are oriented in approximation to the orientation of the hatchling when found.

5.3 Education & Outreach

Outreach and education efforts like those conducted on June 14th may also impact nesting success. Community awareness enables and encourages individuals to keep their spaces darker by turning off unneeded lights, closing shades/blinds, and lighting beach fires. Outreach and education may also boost reports forwarded to law enforcement and encourages a self-policing community.

There may be other unknown impacts to nesting success not addressed here. However, we will continue to monitor nesting aboard MCBH, implement adaptive management techniques, and improve best management practices to the honu program.

6.0 Depleted Volunteer Contingency Plan

High resolution data collection is made possible by a small group of dedicated volunteers. Should our relationship wane, collection of high resolution may not be possible, inhibiting our capacity to manage this endangered species effectively. The Natural Resources Office cannot foresee a time when monitoring wouldn't be needed as it is a critical necessity to adaptive management of the natural resources. Nonetheless, should volunteers be lacking, the ECPD Bioscience Tech and Natural Resource Managers will have to use the ATV to monitor North Beach and Pyramid Rock during the season. The full length of Fort Hase (Public & Restricted) would still have to be walked regularly. All beaches should be monitored a minimum of once a week with an emphasis on beaches historically used by nesting females. The Natural Resources Office would have to lean heavily on the detection methods discussed below and an additional support positions would be strongly advised.

7.0 Detecting Active Nests

If MCBH continues to receive increased nesting along its shoreline, honu nests may have the potential to impede training, depending on the density of nesting. Being able to detect active nests will allow Natural Resources staff to minimize the area protected to just ‘confirmed active nests.’ Using multiple methods to eliminate false crawls will be especially useful during large training operations such as RIMPAC, which occurs every two years. Natural Resources staff is in close communication with USFWS during all phases of the projects including design to ensure the success of the research and approvals. This research will be a valuable contribution to the scientific community while enhancing MCBH’s overall mission readiness.

7.1 Ground Penetrating RaDAR (GPR)

Ground penetrating RaDAR (GPR) may be a feasible option to detect active nests and can be applied to presumed nests or possibly to a small area on the beach essential for training. Natural Resources staff members have reviewed the scant research available on the use of GPR to identify active turtle nests (Ermakov et al. 2021; Korczak, Bruder, & Spisani 2016). Natural resources staff have determined a research project specific to Hawai‘i will have to be conducted to analyze the use of GPR in detecting active honu nests. Natural Resources staff, USFWS, and GPR contractors have collaborated on a basic study design and have a project slated for sometime in the future. Under the supervision of USFWS, on July 7, 2021 a contractor visited several HASP nests to see if a signature could be picked up. While preliminary testing was inconclusive but promising, Nest IDs will need to be associated with scans and a scientific analysis conducted.

7.2 Detection Dogs

The use of detection canines could be used to distinguish active nests from false crawls after locating presumed nests. Detection dogs could also be applied to identify active nests not previously identified by volunteers (Witherington et al. 2017). Lindborg, Peruyero, and Witherington demonstrated in 2023 a canine is more accurate and efficient at locating deposited eggs. The Natural Resources office has engaged in preliminary discussions with Conservation Dogs Hawai‘i LLC. Natural Resources Staff, USFWS, and the dog handlers will collaborate on a study design and pilot project. USFWS has confirmed no permit is needed to train the dog using eggs post excavation and that a letter of transfer would allow the handlers to retain eggs to train the dogs, if needed.

Interestingly, dogs have already been used on Maui to detect Hawksbill nests. The dog’s name was Tauzer and was trained in Florida using cloacal mucus fluid under a USFWS Permit. Dogs were on call. Although, that research was very limited, unpublished, and unfinished. In 2022, Conservation Dogs Hawai‘i LLC initiated a pilot study with two dogs using empty eggs shells collected early in the season from North Beach, Fort Hase, and other island locations not aboard MCBH. As a control, sand adjacent to the egg chamber was also collected. After a series of trials and various methods. Egg shells were found to be ultimately ineffective. The pilot study demonstrated the need for good timing of surveys. Calm mornings with low winds will increase accuracy.

8.0 Conclusions and Recommendations

MCBH is becoming regular nesting habitat for these species and it is reasonable to assume nesting will continue as habitat in the northwestern Hawaiian islands erode away due to more frequent and intense storm surges. With a significant portion of O‘ahu’s nesting, the Natural Resources office will continue to improve its honu nesting program by working closely with regulatory entities and collaborators.

Immediate efforts should be targeted towards detecting active nests, outreach & education, and lighting mitigations. Accurately detecting active nests with high fidelity allows Natural Resources staff to manage the species more effectively, while minimizing impacts to training. Additionally, projects contracting GPR and detection dogs to detect active nests would be scientifically valuable and would benefit the species as a whole. Bolstering outreach and education would raise on-base and off-base awareness of the species and its threats. Greater community awareness could have direct impacts such as individual residents mitigating the light pollution

on their property, but could also take the form of indirect impacts such as a self-policing community that reports violations of base policy and take. To prevent disorienting honu hatchlings, Natural Resources staff will continue work with base Facilities to implement lighting mitigations with long-term goals aimed towards converting all essential lighting to fit International Dark Sky standards following the core principles of ‘long, low, and shielded.’ Mitigating on base light pollution will require active participation from base Facilities as well as base Planning but will benefit other wildlife species such as seabirds as well as the honu, effectively solving multiple problems simultaneously. It is also recommended that MCBH continue to enforce federal endangered species laws and base orders with veracity.

Long-term efforts should target shoreline restoration efforts to reduce sediment runoff and beach erosion. Out planting vegetation along the crest of the beach dune should retain more sand for current and future marine units to train on as well as preserving valuable nesting habitat for the honu. These efforts will become even more critical over the coming decades as worsening climate change threatens national security (DoD 2015 & 2019).

MCBH is committed to the protection and preservation of sea turtles and their habitats. MCBH recognizes the value of these natural resources and the role they play in the overall mission readiness of the installation. Natural Resources staff will continue to strengthen partnerships with USFWS, NOAA, HMAR, and Malama Na Honu to better manage sea turtle species, collectively. The Natural Resources staff looks forward to future successful seasons and is committed to implementing adaptive best management practices supported by the latest science.

9.0 Additional Figures



Figure 8: Six of the 12 basking events aboard MCBH in 2024 were along the Ft.Hase Shoreline.



Figure 9: Deceased honu reported by Range Control 24Jun2024 (21.357404, -157.708143).



Figure 10: Deceased honu from Figure 9 measuring 1.7 x 1.2 ft (51.8 x 36.5cm) buried at MCTAB by CLEOs after direction from HMAR.



Figure 11: Disoriented Hatchling in HASR (21.43091841, -157.7370443) pickle weed found by Kimo Rogala 26Jun2024, orientation SSE.+



Figure 12: Sunday 30Jun2024 Lance Bookless reported deceased Hawksbill (*Eretmochelys imbricata*) washed up on North Beach (21.45621, -157.75331) with fishing line wrapped around its neck. The carcass was later recovered by HMAR.



Figure 13: Up close photo of Hawksbill from Figure 12 showing fishing line entanglement.



Figure 14: 11July2024 Dead hatchling reported by Victoria USDA North Paakai (21.43795066653195, -157.73738353817302).



Figure 15: Same hatchling from Figure 14 now showing larger field of view and orientation SW.

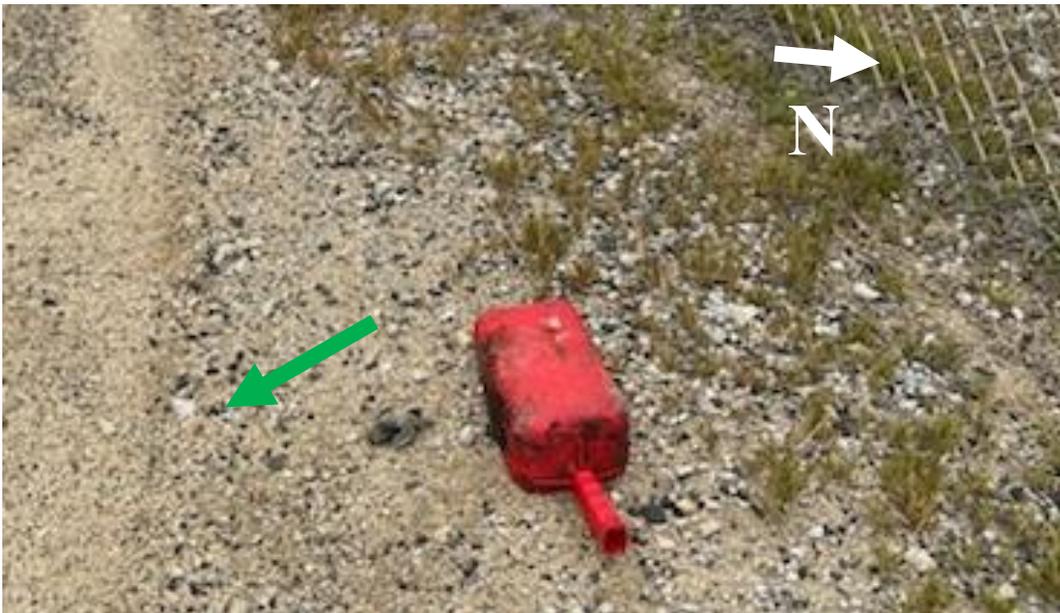


Figure 16: Deceased hatchling found 11Jul2024 by Brett Carter (USDA) at the intersection of Old Mokapu Rd (21.429717559313282, -157.74155904510937), oriented SE.



Figure 17: Up close image of deceased hatchling from Figure 16 showing state of hatchling decay.



Figure 18: Disoriented and deceased hatchling found by Victoria (USDA) 25Jul2024 adjacent to the Pa Honua neighborhood Fort Hase (21.43778429, -157.7376373), not 30ft away from the other hatchling from 11 July.



Figure 19: Basking honu Fort Hase Restricted July 29, 2024.



Figure 20: Disoriented and deceased hatchling found inside the moving target range (21.43020913, -157.7378072) Aug 10, 2024, oriented SW.



Figure 21: Disoriented and deceased hatchling found on Old Mokapu Rd. (21.4299357, -157.741665) 21Aug2024, oriented SW.

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11.0 List of Supplemental Documents (available upon request)

1. Sea Turtle Ecology_CONDENSED
2. MCBH turtle nest protocol
3. USFWS Emergence Guidelines
4. USFWS Permit (TE-039990-26)
5. Section 106 Letter to State Historic Preservation Office
6. Nu'upia Ponds Hawaiian Green Sea Turtle Survey UHM Marine Bio Class July 2024