Hawaiian Green Turtle Nesting Marine Corps Base Hawaii

April 1st – October 31st, 2020

Environmental Compliance & Protection Division, Natural Resources Office

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1.0 Summary

The Hawaiian green turtle, also known as Honu, have 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. During the 2020 season, Honu nesting aboard Marine Corps Base Hawaii (MCBH) was generally very successful with the average clutch size of 74 eggs per nest and an average hatching success of 86%. A total 17 presumed nests were identified and protected aboard MCBH. Twelve nests were cordoned off at Marine Corps Training Area – Bellows (MCTAB). MCTAB had four confirmed nests out of 12 presumed nests. Three nests at North Beach were cordoned off as presumed nests but only one of the three was confirmed to have an egg chamber. We are confident that three or more nests were active at Ft. Hase. However, only two egg chambers were found (HASE R1 & HASE P3; Table 1). Challenges facing nesting Honu aboard MCBH include, light pollution, erosion of the shoreline due to sea level rise, direct conflict with humans and indirect impacts of coastal populations of people. MCBH will continue to improve its Honu nesting program by working closely with, among other partners, the United States Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration (NOAA).

2.0 Acknowledgments

MCBH had 17+ volunteers both on and off base with 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.

A special thanks to all Malama Na Honu volunteers who dedicated their time to collect the data contained in this report. We especially thank Debbie Herrera, Malama 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

The Hawaiian green turtle (*Chelonia mydas*) is a distinct population segment (Figure 1) and is considered threatened under the Endangered Species Act (Seminoff et al. 2015). 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. Major ongoing threats to 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 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.

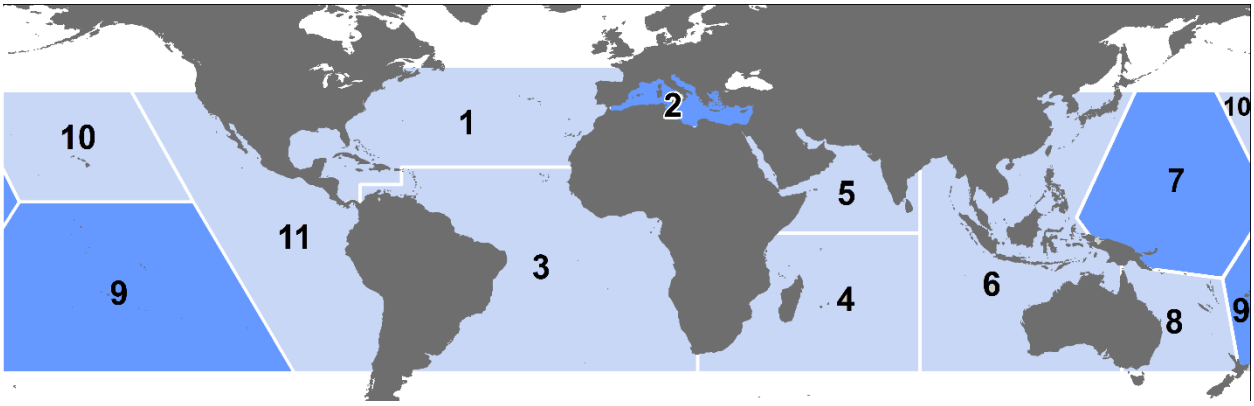

Figure 1: Distinct Population Segments of the Green Sea Turtle (*C. mydas*). Light blue represents threatened populations and dark blue represents endangered populations. 1. North Atlantic, 2. Mediterranean, 3. South Atlantic, 4. Southwest Indian, 5. North Indian, 6. East Indian-West Pacific, 7. Central 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).

Marine Corps Base Hawaii (MCBH) is responsible for stewarding nearly 14 miles of shoreline. Honu nesting aboard MCBH has been documented at Pyramid Rock, North Beach, Fort Hase, and at Marine Corps Training Area Bellows (MCTAB). Other suitable nesting habitat aboard MCBH may include other locations listed in Table 1 and depicted in supplemental figures.

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

4.0 Actions taken

During the 2020 nesting season MCBH identified 17 presumed nests on MCBH beaches. 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. All presumed nests were marked with GPS, cordoned off to protect the site and later excavated by USFWS, sub-permittees and MCBH Natural Resources staff. A list of authorized researchers is designated in the USFWS permit (FWSPIFW0-26, TE-039990-26). A nest was designated a "confirmed nest" when a hatchlings are observed emerging from the nest or when the nest chamber is found during an excavation. If a presumed nest is excavated and no chamber is found, it is then deemed a 'false crawl', which are not uncommon. Egg chambers were located and emergence data was successfully collected for seven nests.

MCBH purchased $3,700 in materials needed for managing nesting sites. 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 was cordoned off with high visibility rope. MCBH federal conservation law enforcement officers (CLEOs) played an essential two part role as educators and enforcers. Often working 10 hour shifts over the weekend May – September, they worked day and night interfacing with the community to ensure compliance and protection of Honu nests. Additionally, MCBH conducted outreach and education through social media, beach signs, delivered internal notifications to residents and regular interactions with the public. Natural Resources staff and leadership participated in interviews with various local media outlets and with Marine Corps public affairs.

During the 2020 season, the Natural Resources office enhanced its partnership with the volunteer organization, Malama Na Honu and worked closely with experts from USFWS and NOAA. Guided by the experts, volunteers logged over 1300 hours while assisting with monitoring shorelines, collecting data, documenting changes, and excavating presumed nests. Volunteers walked MCBH beaches 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 seven of the most dedicated volunteers excavated the majority of nests along MCBH shorelines.

Staff from the MCBH Cultural Resources office drafted and sent a letter to the State Historic Preservation Office (SHPO) requesting an expansion of the Area of Potential Effects, regarding nest excavations. SHPO concurred with the determination that no historic properties would be affected allowing us to excavate Honu nests to collect valuable data. We coordinated with the Cultural Resources office to conduct briefings prior to all excavations so that volunteers were informed about the archaeological sites, artifacts that may deposited at the sites, the depths those artifacts might be encountered, and how to identify those archaeological deposits. The briefings also covered what to do if volunteers uncovered any signs of archaeological deposits such as charcoal-colored soil, bones, tools, or human remains, Nest excavation efforts were restricted to existing nest mounds, which were dug out by the sea turtles when depositing their clutch of eggs, minimizing any new disturbance. Lastly, the MCBH turtle nesting management protocol was revised by Natural Resources staff.

5.0 2020 Results

MCBH confirmed at least eight emergences and was able to collect data from seven of them (Table 2). A possible ninth emergence may have occurred at Fort Hase but the emergence epicenter could not be located and confirmed. While the emergence was confirmed for the eighth nest, the egg chamber for that nest could not be found. Therefore, emergence data on these nests could not be collected. Two emergences occurred from nests not previously identified as presumed nests. Three nests had hatchlings disoriented from light pollution including two nests at Fort Hase beach and one on MCTAB's shoreline. MCBH had an average nesting success rate of 85.9% for all confirmed nests in 2020. Nests contained 66 to 90 eggs each. On MCBH beaches, tops of the egg chambers ranged from 40-61 cm below the sand surface.

Table 2: Summary table of all confirmed nests excavated in 2020.

MCBH Site ID	*Number of Eggs*	*Number of Eggs Hatched*	*Number of Live Nestlings*	*Number of Dead Nestlings*	*Nesting success % (Hatched/Laid)*	*Beach*
HASE P 3	64	61	0	0	*95.3*	Fort Hase (Public)
HASE R 1	90	21	0	2	*23.3*	Fort Hase (Restricted)
MCTA 13	66	65	0	0	*98.5*	MCTAB
MCTA 4	85	84	0	0	*98.8*	MCTAB
MCTA 8	67	67	0	0	*100.0*	MCTAB
MCTA 9	73	66	0	0	*90.4*	MCTAB
NOBE 1	76	72	1	0	*94.7*	North Beach
TOTAL	521	436	1	2	N/A	N/A

6.0 Factors Impacting Nest Success/Failure

The Marine Corps allows the public to access MCTAB during the weekend and as part of the licensing agreement between the City & County of Honolulu and MCBH. During the weekend period, some members of the public would violate MCBH's base order and off-road in the Day Use area and adjoining beach, potentially impacting nests and/or nesting adults. Vehicles on the beach pose a substantial immediate risk to nests but also long-term risk associated from the loss of the beach from erosion. Multiple vehicles became stuck on the beach during the 2020 season and some members of the public were cited by law enforcement. Without enforcement, additional members of the community may feel emboldened to drive on the beach.

HASE R1 was regularly inundated by high tides resulting the majority of eggs failing to hatch resulting in low success. As the human race continues to generate additional atmospheric carbon, the warming of the oceans from climate change will drive further sea level rise and potentially 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, potentially posing a long term risk to the species.

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 ques or indicators to navigate to the water. They can confuse manmade sources of light, such as street lamps, with these natural indicators and migrate inland, away from the sea. Light disorientation can result in incidental take. As mentioned above, three nests had hatchlings become disoriented from light pollution. One nest at MCTAB was near one of two City and County of Honolulu bath houses, where lights are left on all night. Two nests at Fort Hase beach had hatchlings disoriented from the many street lights, house lights and running lights that illuminate a recreational trail, as well as the occasional vehicle headlights of nighttime beach goers. While many of these hatchlings were rescued and released to the ocean, many could not be found and likely died. Artificial light sources may also deter adult females exiting the water to lay eggs. Although this was not documented aboard MCBH during the 2020 season.

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 (≥600nm) should reduce the risk of disorienting Honu. However, there is some evidence that even 'turtle safe' lighting can disorient hatchlings, especially when closer than 4m or on a moonless night (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 (Figure 2). Natural Resources staff are currently pursuing multiple mitigation measures to reduce/prevent the disorientation of hatchlings aboard MCBH.

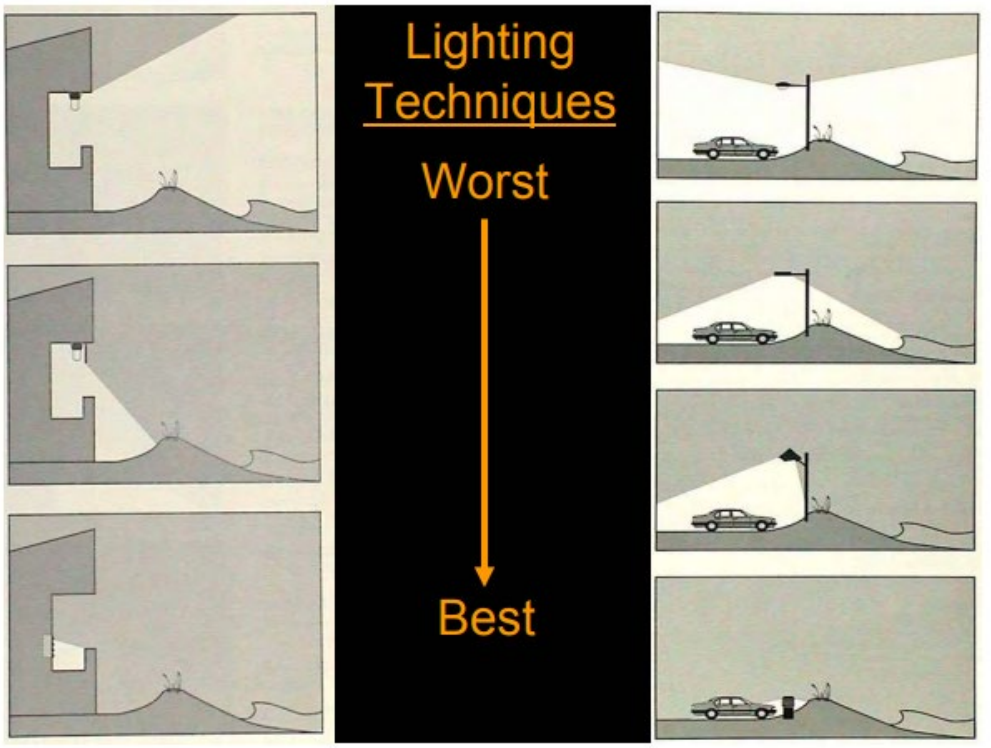

Figure 2: Illustrative methods from worst (top) to best (bottom) lighting techniques.

Outreach and education efforts may also have contributed to the success of this nesting season. Community awareness enabled and encouraged individuals to contact Natural Resources staff after identifying sign of nesting activity. Outreach and education also encourages a more responsive and compliant community when mitigating risks to active nests.

There may be other unknown impacts to nesting success not address here. However, we will continue to implement and improve best management practices to the Honu program. The MCBH turtle nesting protocol can be found as a supplemental document to this report.

7.0 Permitting to Perform Independent Honu Nest Excavations

January 2021 the MCBH Natural Resources Office initiated discussions with USFWS and NOAA on efforts to become research collaborators and excavate Honu nests independently form regulatory agencies. The trigger for this action was a 2019 nest that was not excavated until the 2020 season due to logistical challenges. This may have degraded the quality of data that could have been attained. Additionally, MCBH would benefit in overall mission readiness from this development. By becoming self-sufficient, Natural Resources personnel could excavate nests as soon as possible even in circumstances where oversight agency members were unavailable. USFWS and/or NOAA would benefit from MCBH data even in circumstances when their limited personnel and resources may be stretched thin.

The Natural Resources office is in current talks with USFWS and NOAA on the steps and requirements to have authorized person(s) on the list. In preliminary discussions, we will initiate the

administrative process while seizing any and all training opportunities that arise in the 2021 nesting season.

8.0 Detecting Active Nests

The Natural Resources office is pursuing funding to pilot research that evaluates multiple methods of 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 will be 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.

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 nests (Ermakov et al. 2021; Korczak, Bruder, & Spisani 2016). Natural resources staff may contact the authors of this research to discuss its possible application. However, research specific to Hawai'i will have to be conducted to analysis the use of GPR to detect active Honu nests. Natural Resources staff, USFWS, and GPR contractors will collaborate on a study design and determine from there, if a research recovery permit is necessary. Natural Resources staff are currently pursuing funding for this project.

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). 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. USFWS staff noted the dog would need to be dressed so that it can be distinguished as a research dog and to prevent other dog owners from believing they too can have their dog illegally disturbing a Honu nest. Natural Resources staff are currently pursuing funding for this project.

9.0 Conclusions and Recommendations

Honu nesting aboard MCBH over all was very successful with the average clutch size of 74 eggs/nest and an average hatching success of 86%. 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 mitigation. Detecting active nests with high resolution allows Natural Resources staff to manage

the species more effectively, while minimizing impacts to training. Additionally, the research towards 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. To prevent disorienting Honu hatchlings, Natural Resources staff will continue work with base facilities to implement lighting mitigations with long term goals aimed towards reducing the overall light signature on base and converting all essential lighting to fit International Dark Sky standards. Mitigating on base lighting pollution will also benefit other wildlife species as well as the Honu.

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 retains more sand for current and future marines 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 protection and preservation of sea turtles and their habitat. 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.

10.0 References

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11.0 MCBH Nesting Maps

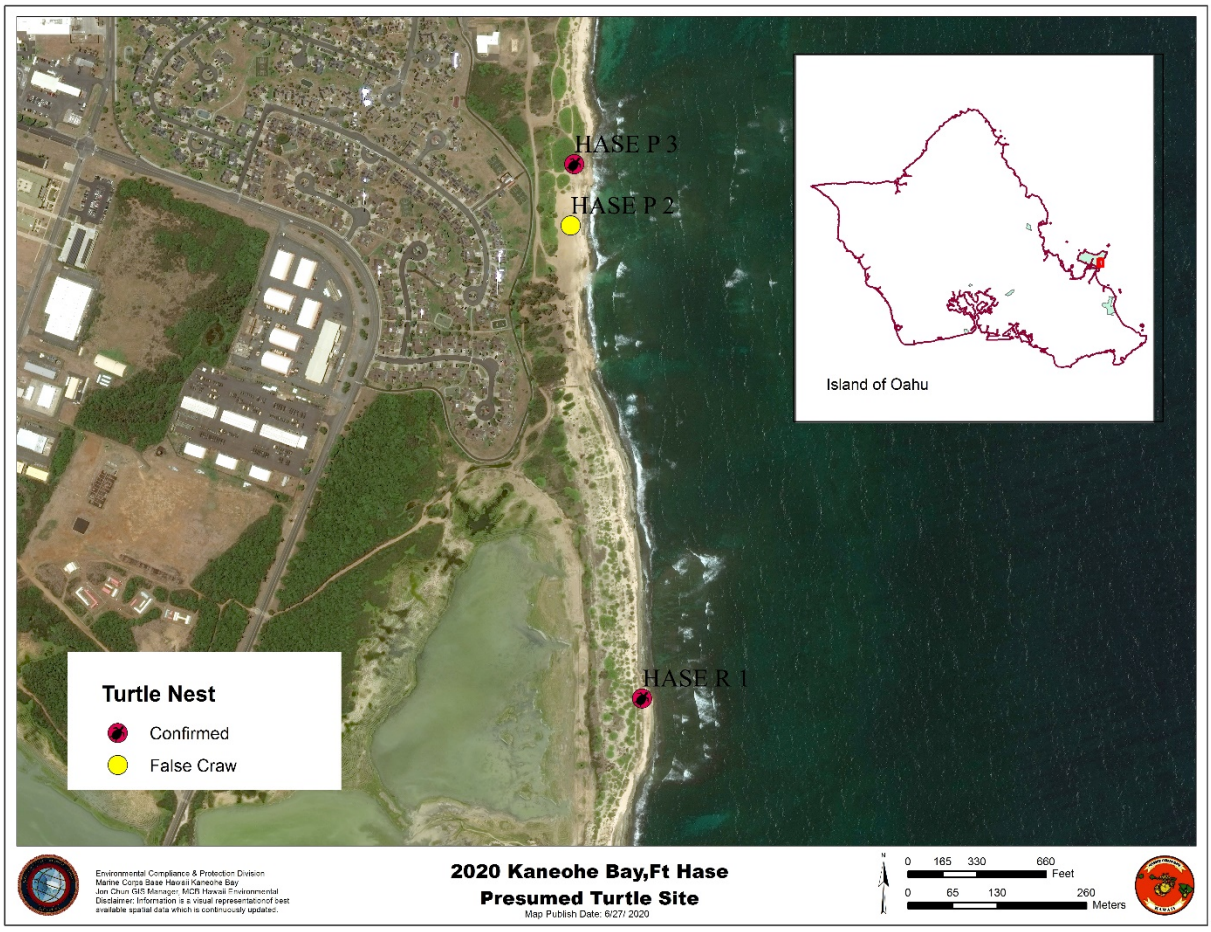

Figure 3: Ft. Hase shoreline with confirmed nests and false crawls during the 2020 nesting season. Aerial image includes the public side to the north and the restricted area inside the wildlife management area.

Figure 4: Aerial image of North Beach depicting confirmed nests and false crawls during the 2020 season.

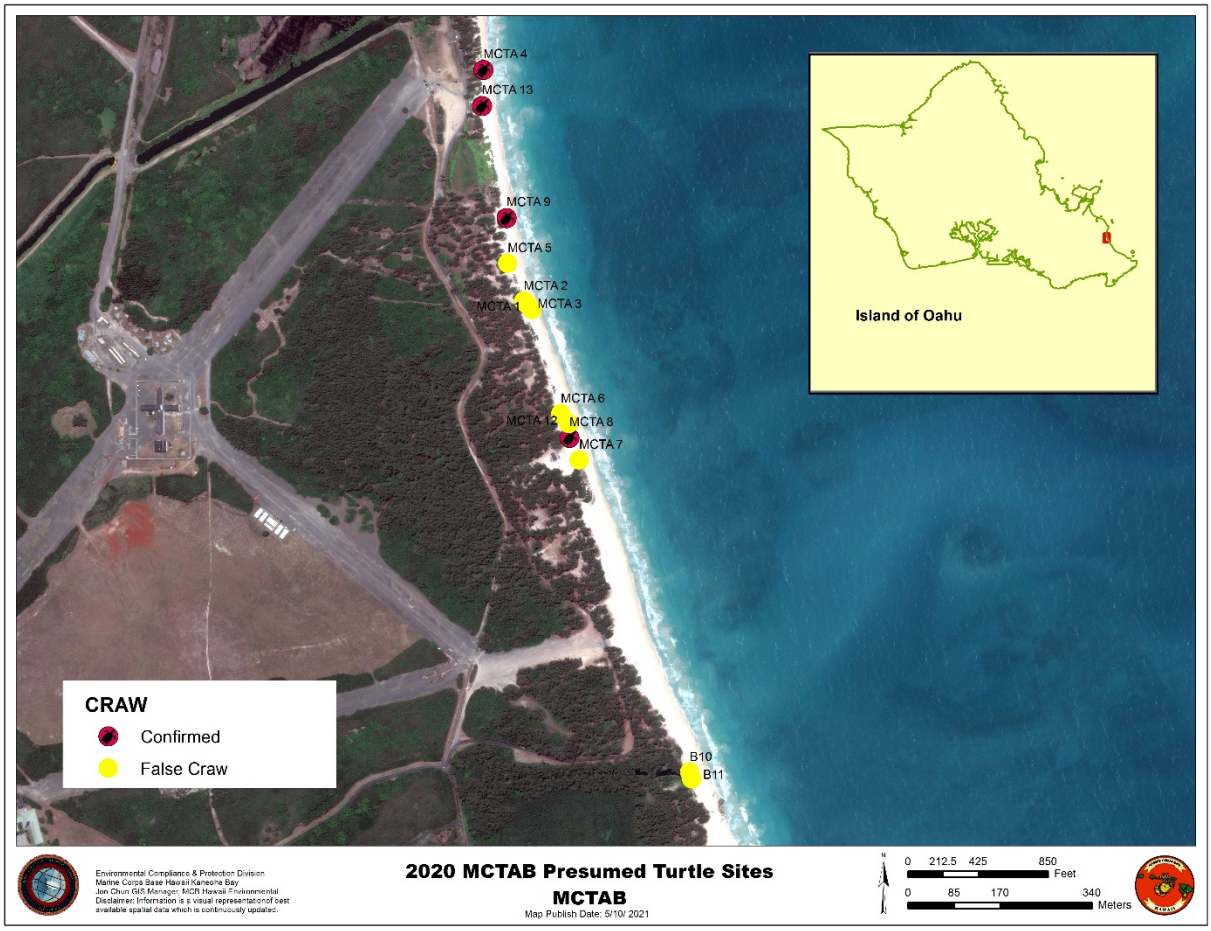

Figure 5: Aerial image of false crawls and confirmed nests during the 2020 season at Marine Corps Training Area Bellows (MCTAB). B10 and B11 are technically on the Nike site managed by the Air Force.

12.0 Supplemental Documents

1. Sea Turtle Ecology_CONDENSED
2. MCBH turtle nest protocol
3. USFWS Emergence Guidelines
4. USFWS Permit ()
5. Section 106