U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Pacific Islands Fisheries Science Center
1845 Wasp Blvd, Building 176 • Honolulu, HI 96818
(808) 725-5707 • Fax: (808) 725-5567

SEA TURTLE TAGGING IN THE NAVAL BASE GUAM AREA

JANUARY 2020

PREPARED FOR THE U.S. NAVAL BASE GUAM
Under Interagency Agreement NMFS-PIC-14-004-0001-000
Conducted under NOAA ESA 10a1A 17022 / 15661

Alexander R. Gaos, Ph.D.
Summer L. Martin, Ph.D.
T. Todd Jones, Ph.D.

Marine Turtle Biology and Assessment Program (MTBAP)
Protected Species Division (PSD)
Pacific Islands Fisheries Science Center (PIFSC)
NOAA Fisheries

Data Report DR-21-007.
Issued 26 July 2021.

https://doi.org/10.25923/50bx-mk61

Recommended document citation:
Gaos AR, Martin SL, Jones TT. 2020. Sea turtle tagging in the Naval Base Guam area. Annual Report prepared for the U.S. Naval Base Guam, Apra Harbor, Guam by NOAA Fisheries, the Marine Turtle Biology and Assessment Group, Protected Species Division, Pacific Islands Fisheries Science Center, Honolulu, Hawaii, under Interagency Agreement. 24 p.

TABLE OF CONTENTS

BACKGROUND

Naval Base Guam is responsible for the management and conservation of threatened and endangered species on Department of Navy (DoN) lands on Guam, including the DoN submerged lands around the island. Green turtles (*Chelonia mydas*) and hawksbill turtles (*Eretmochelys imbricata*) are known to use nearshore waters on DoN submerged lands and in the past, nesting activity by both species has been recorded on beaches on Naval Base Guam. Currently, there is very limited information on the distribution, abundance, and habitat use of federally protected species, particularly sea turtles, on DoN lands on Guam. This lack of information limits management actions to protect sea turtles and assess potential impacts from proposed actions in DoN submerged lands. This project will generate information to address these concerns, meet requirements specifically identified in the Integrated Natural Resources Management Plan (Sikes Act), and maintain compliance with federal requirements (e.g., Endangered Species Act, National Environmental Protection Act). The overall objective of this project is to collect field data and carry out analyses that will enable the DoN and the National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) to better understand the distribution and habitat use of sea turtles on DoN submerged lands, including Apra Harbor. The questions below from the Navy's FY13–15 monitoring plan guide this research.

Guiding questions from the FY13–15 Monitoring Plan

i. Are there locations of greater sea turtle concentration within Apra Harbor and other DoN submerged lands around Guam?

ii. What is the occurrence and/or habitat use of sea turtles in areas within Apra Harbor and other DoN submerged lands around Guam?

Summary of tasks

1. Capture and tag sea turtles on Naval Base Guam
2. Analyze capture and tracking data
3. Prepare interim and final report

Progress on Field Research

Drs. Alexander Gaos, Summer Martin, Camryn Allen, and T. Todd Jones of the NOAA Fisheries Pacific Islands Fisheries Science Center's (PIFSC) Marine Turtle Biology and Assessment Program (MTBAP), together with local partners, conducted marine turtle surveys and in-water captures of green turtles (*Chelonia mydas*) and hawksbill turtles (*Eretmochelys imbricata*) in May 2015, 2016 and 2017, and June 2019. The research mission in May 2017 also included representative Irene Kelly from the Pacific Islands Regional Office (PIRO). During all research trips, turtles were hand-captured, then weighed, measured, biopsied, and tagged [i.e., flipper, Passive integrated transponder (PIT), satellite tracking] in an effort to expand our knowledge of their population demographics, population structure, and fine-scale habitat use. The aforementioned activities were permitted under National Marine Fisheries Service ESA10a1A Take permit #17022, NMFS IACUC SWPI2013-05R and, and Guam Department of Agriculture Research permits SP2013-004 through SC-MPA-19-001. Additionally, biologists from the Guam Department of Agriculture Division of Aquatic and Wildlife Resources (DAWR) were provided with hands-on training on turtle capture and processing. Local partners continue to be engaged and key stakeholders in this collaborative research effort. Many of these activities are part of the broader initiative among NOAA Fisheries, Guam DAWR, Commonwealth of the Northern Mariana Islands Department of Lands and Natural Resources (CNMI DLNR), and the U.S. Pacific Fleet Environmental Readiness Office. The project continues to be successful due to the collaborative effort of these entities, as well as those of the Guam DAWR Office of Law Enforcement and the Apra Harbor Patrol.

In May 2015, in-water surveys and turtle captures were conducted in Apra Harbor and the nearshore waters extending south to Dadi Beach. Survey sites included Gab Gab Beach, Kilo Wharf, Western Shoals, Dadi Beach, and neighboring reef areas. The team deployed each day from the dock on the north side of Apra Harbor on the eastern end of Glass Breakwater. The research vessel was provided by collaborators at Guam DAWR, and DAWR biologists participated in all research efforts. Partners from the CNMI DLNR were also key contributors to this collaborative research project. Additionally, Kevin Brindock (Naval Base Guam partner) joined the field research activities each day. Each day, 3 to 6 turtles were captured and 2 to 5 satellite tags were deployed. Observations of additional turtles were also recorded with locations whenever possible. The team observed a total of 90 turtles, 23 of which were captured, and 16 of which were outfitted with satellite transmitters. One hawksbill turtle was captured and equipped with a satellite tag; all other observations and captures were of green turtles (or "unknown" species for 12 observations). Full morphometric measurements were conducted of all captured turtles. Turtles received Inconel metal flipper tags on the trailing edge of the fore flippers and microchip PIT tags inter-digitally in the rear flippers. The turtle observations are summarized in Table 1, with further details provided in Table 2 and the supplemental tables.

In May 2016, in-water activities were conducted in Apra Harbor at Gab Gab Beach, San Luis Beach, Jade Shoals, and inner Glass Breakwater. The team deployed from the dock on the north side of Apra Harbor again, where a shore-based team was set up for satellite tagging operations and to allow for local partners and Navy media staff to observe and participate. The in-water team observed 25 turtles, 5 of which were captured, and 4 of which were equipped with satellite tags. One of the satellite tags was deployed on a hawksbill turtle (59 cm straight carapace length, SCL) near inner Glass Breakwater; the others were attached to sub-adult green turtles (55 cm mean SCL). The only capture that did not receive a transmitter was a 68 cm SCL hawksbill turtle at Gab Gab Beach as the turtle still had an active transmitter from the previous May 2015 research trip, when it was tagged at the same location. Again, full morphometric measurements were made of all captured turtles and they received Inconel metal flipper tags on the trailing edge of the fore flippers and microchip PIT tags inter-digitally in the rear flippers. The turtle observations are summarized in Table 1, with further details provided in Table 2 and the supplemental tables.

In May 2017, in-water activities were focused on the nearshore waters of Apra Harbor and the reefs just north and south of Apra Harbor. Good weather permitted survey effort on all planned in-water days, with successful operations in a previously unsampled area on the north side of Apra Harbor (Outer Glass Breakwater to Camel Rock, including Piti Bomb Holes). Small boat operations were conducted each day from Seaplane Ramp on the north side of Apra Harbor. Captured turtles were brought back to shore for processing and satellite tagging and released later at their capture sites. The in-water team observed 75 turtles, 29 of which were captured, and 23 of which were equipped with satellite tags. Of the 23 satellite tags, 20 were deployed on green turtles and 3 on hawksbills. Several local partners outside the core research team joined at Seaplane Ramp each day to participate in research activities, engage with the research team, and/or benefit from training opportunities. Navy media personnel also joined the team on throughout the week to take photos and videos and conduct interviews for a local Navy environmental stewardship TV program called "Can you dig it?"

In June 2019 in-water monitoring was undertaken at Gab Gab Beach, Western Shoals, Kilo Wharf, Dadi Beach, Haputo and Double Reef. This was the first year survey efforts were conducted at Haputo and Double Reef, which was facilitated by good weather conditions. Operations were based out of Seaplane Ramp or from Hagatna Boat Basin. The in-water team observed 69 turtles, 14 of which were captured, and 12 of which were equipped with satellite tags. Of the 12 satellite tags, 8 were deployed on green turtles and 4 on hawksbills. Individuals from DAWR, DLNR and University of Guam/SeaGrant participated in research activities. The team was also accompanied by Jennifer Cruce Horeg, the Conservation Resources Program Manager for Naval Facilities Engineering Command (NAVFAC) Marianas, on multiple days.

Table 1. Summary of boat-based snorkel surveys and turtle captures from May 2015 and June 2019. Data include survey dates, site locations, turtle observations (number of individuals), captures, and satellite tag deployments. CM = green turtle (Chelonia mydas); EI = hawksbill turtle (*Eretmochyls imbricata*); UN = unknown turtle species (either green or hawksbill turtle).

		Observations only				Captures (no sat tags)			Captures (sat tags)		
Survey Date	Location	CM	EI	UN	Total	CM	EI	Total	CM	EI	Total
5/19/2015	Apra Harbor (Gab Gab Beach + Western Shoals)	3	-	-	**3**	1	-	1	1	1	**2**
5/20/2015	Apra Harbor (Western Shoals + Kilo Wharf) + Dadi Beach	5	-	-	**5**	1	1	2	3	-	**3**
5/21/2015	Apra Harbor (Western Shoals + Gab Gab)	12	-	6	**18**	1	-	1	2	-	**2**
5/22/2015	Apra Harbor (Gab Gab Beach) + Dadi Beach	10	-	-	**10**	1	-	1	2	-	**2**
5/23/2015	Apra Harbor (Gab Gab Beach + Kilo Wharf) + Dadi Beach	4	2	9	**15**	1	-	1	4	1	**5**
5/24/2015	Apra Harbor (Gab Gab Beach + Kilo Wharf)	16	-	-	**16**	1	-	1	2	-	**2**
	2015 Subtotals	**50**	**2**	**15**	**67**	**6**	**1**	**7**	**14**	**2**	**16**
5/11/2016	Apra Harbor (Jade Shis. + San Luis + Gab Gab + Inner Glass Break.)	10	-	10	**20**	-	1	1	3	1	**4**
	2016 Subtotals	**10**	**-**	**10**	**20**	**-**	**1**	**1**	**3**	**1**	**4**
5/16/2017	Orote Point (Dump)	**9**	**-**	**-**	**9**	**-**	**-**	**-**	**4**	**-**	**4**
5/17/2017	Apra Harbor (Gab Gab + San Luis + Kilo Wharf)	**9**	**-**	**1**	**10**	**-**	**-**	**-**	**3**	**1**	**4**
5/18/2017	Dadi Beach	**1**	**-**	**-**	**1**	**5**	**-**	**5**	**5**	**-**	**5**
5/19/2017	Piti Bomb Holes	**4**	**-**	**-**	**4**	**-**	**-**	**-**	**1**	**-**	**1**
5/22/2017	Piti Bomb Holes	**13**	**-**	**-**	**13**	**-**	**-**	**-**	**6**	**-**	**6**
5/23/2017	Apra Harbor (Inner Glass Break) + Orote Point (Barracuda Rock + Dump)	**5**	**2**	**4**	**11**	**-**	**-**	**-**	**-**	**2**	**2**
	2017 Subtotals	**41**	**2**	**5**	**48**	**5**	**-**	**5**	**19**	**3**	**22**
6/4/2019	Apra Harbor (Spanish Steps + Kilo Wharf)	**15**	**2**	**-**	**17**	**-**	**-**	**-**	**4**	**2**	**6**
6/5/2019	Apra Harbor (Spanish Steps + Kilo Wharf + Western Shoals) + Orote Point (Dump)	**11**	**2**	**-**	**13**	**1**	**1**	**2**	**3**	**-**	**3**
6/7/2019	Double Reef	**5**	**2**	**2**	**9**	**-**	**-**	**-**	**-**	**2**	**2**
6/8/2019	Double Reef + Haputo	**5**	**2**	**-**	**7**	**-**	**-**	**-**	**1**	**-**	**1**
6/9/2019	Double Reef	**6**	**3**	**-**	**9**	**-**	**-**	**-**	**-**	**-**	**-**
	2019 Subtotals	**42**	**11**	**2**	**55**	**1**	**1**	**2**	**8**	**4**	**12**
	2013-2019 Totals	**143**	**15**	**32**	**190**	**12**	**3**	**15**	**44**	**10**	**54**

Summary for Turtles	
Survey days:	*18*
Encounters:	*259*
Captures:	*69*
Satellite tags:	*54*

Progress on Data Analysis

Data analysis and collection has been ongoing since 2015. The PIFSC project staff are currently processing satellite tracking data as they arrive from Collection and Location by Satellite America (CLS America) which collects and stores the

Argos satellite information. These have been organized and analyzed to understand spatial distribution, depth use and temperature profiles for tagged turtles.

The findings presented here provide essential biogeographical context for understanding the spatial distribution and abundance of sea turtles in the Naval Base Guam study area. Furthermore, these data and analyses have helped to inform Critical Habitat for the proposed endangered status for the Central West Pacific distinct population segment from the 5-year review on the global green turtle status by NOAA and USFWS (NMFS and USFWS 2015). They have also informed incidental take statements and impact assessments for NOAA Fisheries ESA Section 7 and Biological Opinion needs.

PIFSC MTBAP staff are currently working on a major manuscript associated with the program, and have set a target publication date for mid-to-late 2021. The manuscript, tentatively titled, “Reef-dwelling turtles of the Mariana Archipelago: fine-scale habitat use revealed by in-water surveys and GPS telemetry,” will provide further analysis of the boat-based surveys and satellite telemetry efforts presented in this study, including in-depth analyses of horizontal, vertical, temporal, and temperature-based habit use. The research will encompass the largest sample size for satellite tracking of juvenile green and hawksbill turtles included in a single study available to date in the scientific literature.

A second manuscript, with a 2022 target date, will focus on producing abundance estimates by integrating the survey data from this study with small boat cetacean surveys (Hill et al. 2016) and presence/absence data collected during underwater towed-diver coral reef surveys (NOAA data). These survey data and analyses document the widespread presence of turtles throughout the Mariana Archipelago, with >1,700 observations. The synthesis of results from in-water surveys, along with data from the first in-water satellite transmitter deployments in this island chain, will advance our understanding of the distribution, relative abundance, and habitat use patterns of the juvenile-dominated green and hawksbill turtle foraging populations throughout the Mariana Archipelago.

Top Left: NOAA researchers worth with the DAWR enforcement vessel/crew, including Guam's Department of Agriculture Director Chelsa Muña-Brecht, to transport captured turtles to the shore-based processing station. **Top Right:** Program collaborators working at the shore-based turtle processing station at Seaplane Ramp. **Bottom Left:** A green turtle equipped with a SPLASH satellite tag. **Bottom Right:** Jennifer Cruce Horeg of NAVFAC releasing a hawksbill turtle equipped with a satellite tag.

METHODS

In-water surveys and capture

The small boat surveys were conducted in the nearshore and coastal waters of Guam, in and around Apra Harbor, as well as in the vicinity of Haputo and Double Reef (Figure 1). When turtles were encountered on surveys they were hand captured while snorkeling or by diving from a slow-moving boat. Hand capture involved free diving (2–25 m) to capture turtles resting/foraging on bottom substrate or in the water column. Turtles were immediately brought to the surface, lifted into the boat and sampled on deck or brought to shore and restrained for processing. All research was authorized under the following permits: NMFS ESA10a1A 17022 / 1556 / 15661, USFWS Recovery Permit TE-72088A-1, IACUC Protocols NMFS SWPI 2013-05, and GUAM Department of Agriculture Special Permit for Scientific Research SP2013-004 through SC-MPA-19-001.

All turtles were tagged with metal inconel tags or 'flipper tags' (Style 681, National Band and Tag Company) using the standard technique described in the Marine Turtle Specialist Group Manual on Research Techniques (Eckert et al. 1999) and with Passive Integrated Transponder (PIT) tags – small (14 mm length x 2 mm diameter) electromagnetically-coded glass-encased "microchips" – Destron Tx 1406L. The inconel flipper tags were attached to the trailing edge of a fore flipper and the PIT tags were injected subcutaneously into the rear flippers. Skin samples were

obtained for DNA and stable isotope analysis. Straight carapace length (SCL) and curved carapace length (CCL) were measured and turtles of appropriate SCL (see Jones et al. 2013) were outfitted with a satellite tags. Turtles with straight carapace length (SCL) > 45 cm and good body condition were equipped with Wildlife Computers SPLASH-297A satellite tags, which have both Fastloc-GPS and Argos location capabilities, as well as temperature and depth sensors. Turtles with SCL between 35 and 45 cm and good body condition were equipped with Wildlife Computers SPOT-311A satellite tags, which have Argos location capabilities and temperature sensors.

Satellite tag attachment followed the drag recommendations of Jones et al. (2011, 2013) and the attachment methods as described in Jones, Martin and Gaos (2018). In short, the attachment area on the carapace was lightly sanded to remove algae and cleaned with denatured ethanol. A 0.75-cm layer of a two-part epoxy (Powers T308) was used to affix the tag to the carapace and a second putty-type epoxy (J.B. WaterWeld) was form-molded over the tag to protect the tag from damage from reef and rock ledges during the course of normal turtle behavior. This tag attachment technique is widely used and works well with reef-dwelling hawksbill and green turtles (Hart et al. 2015). All satellite tags were subsequently covered with a layer of anti-fouling paint (Interlux Ulta Micro Extra or Micron66) to inhibit the attachment of algae and other growth that can cover sensors and interfere with tag operation.

Movement tracks, home range estimates and dive behavior

Argos locations, GPS locations, dive depth, dive duration, and temperature data were obtained in raw form over the Argos system, and processed to produce data ready for analysis. We created tracks for turtles that undertook migrations using GPS locations for those equipped with SPLASH tags and Argos locations for those equipped with SPOT tags. For calculating migration distances and timing of movements, we used the difference in time and distance of path between (i) the last GPS location point (Argos location point for SPOT tags) of a turtle before it began its long-distance movement out of an area and (ii) the first GPS location point (Argos location point for SPOT tags) associated with its arrival at the new location.

Home range estimates were generated using GPS locations for the SPLASH tags due to the increased accuracy of these location points (over Argos). However, we also generated home range estimates for turtles equipped with SPOT tags using Argos locations, omitting the less precise and invalid Argos location classes 0 and Z, respectively (Argos 2008). Home ranges and the associated 50% (core home range) and 95% (overall home range) density volume contours were generated using kernel interpolation with barriers (KIWB). The KIWB method was selected to calculate home range over traditional kernel density estimation (KDE) due to the ability of KIWB to account for land barriers, which is particularly relevant for nearshore marine species as topological features can inadvertently be incorporated into the analysis in traditional KDE analyses (Sprogis et al. 2016). All tracks and density estimates were performed in ArcGIS (ESRI 2012). The data analysis remains preliminary as some of the satellite tags are still transmitting. Final analyses will include the full range of GPS data for additional home range analysis and KIWB estimates.

The KIWB tool is available within the 'Geostatistical Analyst' toolbox section of ArcGIS. Prior to performing a KIWB estimate on a set of GPS or Argos points, we grouped the data by species and tagging location and filtered out (i) all points that occurred within the first 2 days (i.e., 24 hr) of tag deployment (to account for potentially non-normal behavior), (ii) all points erroneously appearing on land, and (iii) all points suggesting a swim speed greater than 5 km per hour. We generated a point density surface with a cell size of 10 m as a necessary intermediate step. Then we used the point density surface and an output cell size of 10 m to construct the KIWB estimate. Using the KIWB estimate, we produced 50% and 95% volume contour polygons to describe the core home range and overall home range, respectively, for turtles pooled by location. We calculated the area of each volume contour polygon (km^2) to quantify core home range and overall home range and allow for qualitative comparisons across sites. The data generated by SPLASH and SPOT tags were analyzed separately due to position accuracy differences between the two models.

Temperature and depth data (SPLASH tags only) were collected every 10 sec and archived by the corresponding tags; these data were then binned across 6-hr periods and sent via satellite transmissions with the Argos and GPS (if applicable) location data when the turtle surfaced. Bins are user-defined and give insights into different aspects associated with dive behavior, including:

- Temperature: the proportion of dives spent at each temperature bin.
- Depth: the proportion of overall dive time spent within each depth bin.
- Max dive depth: the maximum depth bin reached for each dive.
- Dive duration: the time duration bin of each dive.

The temperature, depth, maximum dive depth, and dive duration bins were programmed as follows:

Temperature (°C):	19, 21, 23, 24, 25, 26, 27, 28, 29, 30, 31, 33, 35, >35
Depth (m):	0, 2, 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 100, >100
Max Dive Depth (m):	4, 6, 8, 10, 14, 18, 24, 30, 40, 60, 80, >80
Dive Duration (min) (2013–2017):	1, 2, 3, 4, 5, 10, 15, 20, 25, 30, 40, 50, 60, >60
Dive Duration (min) (2018–2019):	1, 5, 10, 20, 30, 40, 50, 60, 75, 90, 105, 120, 150, >150.

In previous years we have recorded dive durations that lasted longer than the maximum bin (see previous reports), so starting in 2018 we adjusted the dive duration bins. The total time a turtle was in a depth, temperature, or duration bin was averaged, and the data were represented in a histogram providing an average of averages of the life of a tag (transmission days) and across turtles. Several tags deployed at the start of the project (green turtles n=4, hawksbill turtles n=2) had variable depth bin programs and these data were included when feasible. The data were separated by species and we also evaluated potential differences between diurnal and nocturnal time periods.

Sample archiving and analysis

Tissue samples collected for DNA, stable isotope analysis (SIA), and health assessment were sent to analytical laboratory collaborators within NOAA and the National Institute for Standards and Technology (NIST):
1) Genetic and Stable Isotope analysis NOAA, NMFS, Southwest Fisheries Science Center
8901 La Jolla Shores Drive
La Jolla, CA 92037
2) Biological and Environmental Monitoring and Archival of Sea Turtle Tissues
National Institute of Standards and Technology
Hollings Marine Laboratory
331 Fort Johnson Road
Charleston, SC 29412

RESULTS AND DISCUSSION

In-water surveys and capture

The survey tracks, turtle observations by species, turtle captures, and satellite tags deployed by location for the 2015–2019 field seasons can be seen in Figure 1. See Table 1 for a summary of the boat-based snorkel survey effort. A total of 258 turtles were encountered. Of those encounters, 190 turtles were observed but not captured, 15 turtles were captured but not outfitted with a satellite tag, and 53 turtles were captured and outfitted with a satellite tag. For the 190 observations, 75.3% were identified as green turtles, 7.9% as hawksbill turtles, and 16.8% as “unknown” species but either green or hawksbill turtles. Of the 15 turtles captured but released without satellite tags, 80% were green turtles and 20% were hawksbill turtles. For the 53 satellite tags, 83.0% were deployed on green turtles and 17.0% on hawksbill turtles.

Details on dates, locations, and species of all turtle observations, captures, and satellite tag deployments are provided in Table 2 and as supplementary files. Captured green turtles ranged in straight carapace length from 40.0 cm

to 75.0 cm (n = 56; mean = 53.4, SD = 8.5 cm) and captured hawksbills ranged in straight carapace length from 35.7 cm to 71.1 cm (n = 13; mean = 52.3, SD = 11.8 cm). All captured turtles were juveniles or sub-adults for which sex could not be determined using visual observation and morphometric techniques.

The demographic data for green and hawksbill turtle captures in the Naval Base Guam study area are typical for turtles throughout the Marianas Archipelago. Summers et al. (2017) incorporates captures from another study in CNMI with more than 500 captures from 2006 to 2014, suggesting that turtles recruit to the nearshore waters of the Mariana Islands around 34–36 cm SCL and depart to adult foraging and nesting grounds around 78–81 cm SCL. The growth rate analysis from the capture-mark-recapture data estimates residency time of 17 years (13–28 (95% CI)) from recruitment to maturity.

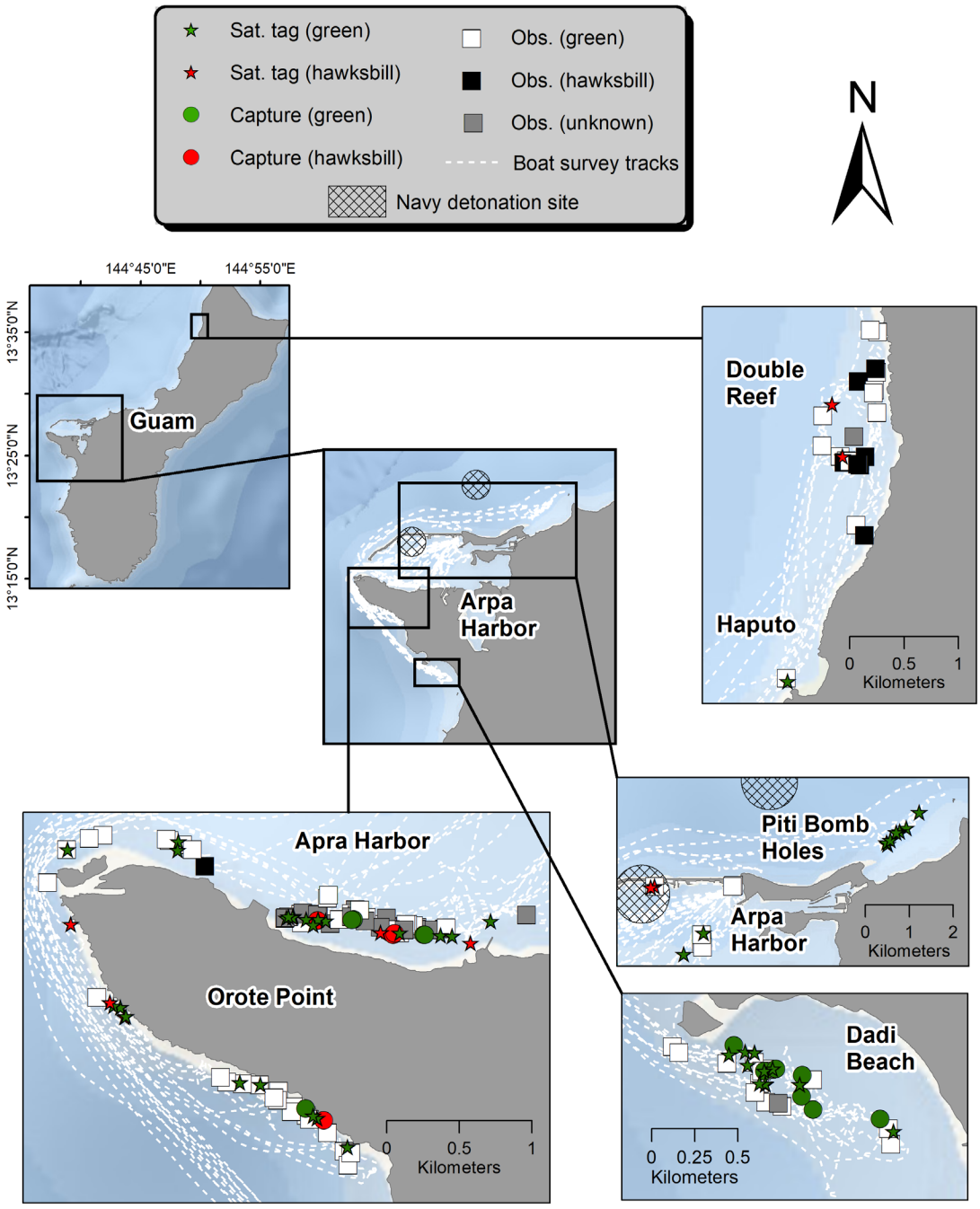

Figure 1. Marine turtle surveys and observations (2015–2016) in the Naval Base Guam area, including Apra Harbor, Orote Point, Dadi Beach, Piti Bomb Holes, Haputo and Double Reef. Symbols differentiate turtle species (green, hawksbill, or unknown) and types of encounters (observation only, capture without satellite tag, and capture with satellite tag deployment). Boat survey tracks depict vessel movement on survey days.

Satellite tag deployment, tag longevity, horizontal movements, and home range

Tag longevity, calculated from the 53 satellite tags, was less for green turtles compared to hawksbill turtles. For green turtles, tags transmitted data for an average of 174.5 days (SD = 113.2, n = 44 tags), with a minimum of 12 days and a

maximum of 449 days (Table 2). For hawksbill turtles, the average tag life was 250.3 days (SD = 276.0, n = 9 tags), with a minimum of 53 days and a maximum of 743 days. Hawksbill turtle shells are thicker and more keratinized than green turtle shells, which tend to be thinner and oilier; this difference likely contributes to the longer tag retention times observed on hawksbill turtles. Seven tags were still active and transmitting data at the time data were compiled for this report (31 October 2019).

Table 2. Summary of 2015–2019 satellite tags by species and tag type, including foraging habitat location, tag deployment date, Argos ID number, turtle size (SCL), last Argos signal, tag life as transmission days, tag status (on October 31, 2019), 50% (i.e., core home range) and 95% (overall home range) volume contours (sq. km) and mean tag life (days). Yellow highlights tags that were still transmitting data ("active").

Figure	Species - Tag model	Deploy Location	Deploy Date	Sp.	Argos ID	SCL (cm)	Tag Model	Last Signal Argos	Tag Life (Argos days)	Tag Status 10/31/19	Core (50%) home range (sq. km)	Overall (95%) home range (sq. km)	Mean Tag Life (Argos days)
Fig. 2	Green turtles - SPLASH	Apra Harbor/Orote Pt	5/19/2015	CM	149123	47.6	SPLASH	3/11/2016	297	Inactive	0.48	2.65	178
		Apra Harbor/Orote Pt	5/20/2015	CM	149116	56.0	SPLASH	12/31/2015	225	Inactive			
		Apra Harbor/Orote Pt	5/22/2015	CM	149132	60.3	SPLASH	9/15/2015	116	Inactive			
		Apra Harbor/Orote Pt	5/23/2015	CM	149120	58.4	SPLASH	8/7/2015	76	Inactive			
		Apra Harbor/Orote Pt	5/23/2015	CM	149122	54.0	SPLASH	7/9/2015	47	Inactive			
		Apra Harbor/Orote Pt	5/24/2015	CM	149133	55.3	SPLASH	8/12/2015	80	Inactive			
		Apra Harbor/Orote Pt	5/24/2015	CM	149135	61.2	SPLASH	8/5/2015	73	Inactive			
		Apra Harbor/Orote Pt	5/11/2016	CM	149118	60.3	SPLASH	11/8/2016	181	Inactive			
		Apra Harbor/Orote Pt	5/11/2016	CM	149128	50.8	SPLASH	6/27/2016	47	Inactive			
		Apra Harbor/Orote Pt	5/11/2016	CM	149130	54.3	SPLASH	11/7/2016	180	Inactive			
		Apra Harbor/Orote Pt	5/17/2017	CM	171221	54.4	SPLASH	3/10/2018	297	Inactive			
		Apra Harbor/Orote Pt	5/17/2017	CM	171222	44.5	SPLASH	8/9/2018	449	Inactive			
		Apra Harbor/Orote Pt	5/16/2017	CM	166331	45.4	SPLASH	8/7/2018	448	Inactive			
		Apra Harbor/Orote Pt	5/16/2017	CM	166332	52.1	SPLASH	9/20/2017	127	Inactive			
		Apra Harbor/Orote Pt	5/16/2017	CM	166333	52.5	SPLASH	8/10/2017	86	Inactive			

Figure	Species - Tag model	Deploy Location	Deploy Date	Sp.	Argos ID	SCL (cm)	Tag Model	Last Signal Argos	Tag Life (Argos days)	Tag Status 10/31/19	Core (50%) home range (sq. km)	Overall (95%) home range (sq. km)	Mean Tag Life (Argos days)
		Apra Harbor/Orote Pt	5/16/2017	CM	166334	59.4	SPLASH	4/27/2018	346	Inactive			
		Apra Harbor/Orote Pt	6/4/2019	CM	176770	45.4	SPLASH	9/17/2019	105	Inactive			
		Apra Harbor/Orote Pt	6/4/2019	CM	176771	56.8	SPLASH	10/31/2019	149	Active			
		Apra Harbor/Orote Pt	6/4/2019	CM	176772	51.4	SPLASH	10/31/2019	149	Active			
		Apra Harbor/Orote Pt	6/4/2019	CM	176773	54.9	SPLASH	10/31/2019	149	Active			
		Apra Harbor/Orote Pt	6/5/2019	CM	178558	47.1	SPLASH	10/13/2019	130	Inactive			
		Apra Harbor/Orote Pt	6/5/2019	CM	178559	48.7	SPLASH	10/31/2019	148	Active			
		Dadi Beach	5/20/2015	CM	149121	50.8	SPLASH	7/30/2015	71	Inactive	0.26	1.39	163
		Dadi Beach	5/20/2015	CM	149131	55.2	SPLASH	9/28/2015	131	Inactive			
		Dadi Beach	5/21/2015	CM	149117	47.8	SPLASH	8/24/2015	95	Inactive			
		Dadi Beach	5/21/2015	CM	149119	72.0	SPLASH	7/31/2015	71	Inactive			
		Dadi Beach	5/22/2015	CM	149134	65.5	SPLASH	6/3/2015	12	Inactive			
		Dadi Beach	5/23/2015	CM	149124	75.0	SPLASH	7/24/2015	62	Inactive			
		Dadi Beach	5/23/2015	CM	149126	71.0	SPLASH	6/7/2016	381	Inactive			
		Dadi Beach	5/18/2017	CM	171220	67.2	SPLASH	10/3/2017	138	Inactive			
		Dadi Beach	5/18/2017	CM	171223	61.2	SPLASH	5/3/2018	350	Inactive			
		Dadi Beach	5/18/2017	CM	171224	58.1	SPLASH	9/7/2017	112	Inactive			
		Dadi Beach	5/18/2017	CM	171225	50.5	SPLASH	5/20/2018	367	Inactive			
		Haputo	6/8/2019	CM	178561	43.2	SPLASH	10/31/2019	145	Active	0.01	0.08	145
		Piti Bomb Holes	5/19/2017	CM	171226	54.6	SPLASH	5/11/2018	357	Inactive	0.19	1.53	211
		Piti Bomb Holes	5/22/2017	CM	171227	63.9	SPLASH	9/28/2017	129	Inactive			
		Piti Bomb Holes	5/22/2017	CM	171228	63.2	SPLASH	3/11/2018	293	Inactive			
		Piti Bomb Holes	5/22/2017	CM	171229	67.1	SPLASH	1/8/2018	231	Inactive			
		Piti Bomb Holes	5/22/2017	CM	171230	61.6	SPLASH	11/3/2017	165	Inactive			
		Piti Bomb Holes	5/22/2017	CM	171231	54.2	SPLASH	8/30/2017	100	Inactive			

Figure	Species - Tag model	Deploy Location	Deploy Date	Sp.	Argos ID	SCL (cm)	Tag Model	Last Signal Argos	Tag Life (Argos days)	Tag Status 10/31/19	Core (50%) home range (sq. km)	Overall (95%) home range (sq. km)	Mean Tag Life (Argos days)
		Piti Bomb Holes	5/22/2017	CM	171232	60.3	SPLASH	12/7/2017	199	Inactive			
Fig. 3	Green turtles - SPOT	Apra Harbor/Orote Pt	5/17/2017	CM	166350	40.3	SPOT	8/16/2017	91	Inactive	9.11	76.98	122
		Apra Harbor/Orote Pt	6/5/2019	CM	171262	41.4	SPOT	9/29/2019	116	Inactive			
		Dadi Beach	5/18/2017	CM	166349	40.0	SPOT	10/24/2017	159	Inactive			
Fig. 4	Hawksbill turtles - SPLASH	Apra Harbor/Orote Pt	5/19/2015	EI	149125	68.2	SPLASH	5/31/2017	743	Inactive	0.15	1.15	417
		Apra Harbor/Orote Pt	5/23/2015	EI	149127	53.5	SPLASH	10/7/2015	137	Inactive			
		Apra Harbor/Orote Pt	5/11/2016	EI	149129	58.6	SPLASH	5/3/2018	722	Inactive			
		Apra Harbor/Orote Pt	6/4/2019	EI	176769	46.0	SPLASH	8/10/2019	67	Inactive			
		Double Reef	6/7/2019	EI	176774	43.5	SPLASH	10/31/2019	146	Active	0.04	0.21	146
		Double Reef	6/7/2019	EI	178560	42.3	SPLASH	10/31/2019	146	Active			
Fig. 4	Hawksbill turtles - SPOT	Apra Harbor/Orote Pt	5/23/2017	EI	166356	45.9	SPOT	10/28/2017	158	Inactive	8.21	44.65	97
		Apra Harbor/Orote Pt	5/23/2017	EI	166352	40.3	SPOT	8/12/2017	81	Inactive			
		Apra Harbor/Orote Pt	6/4/2019	EI	171265	35.7	SPOT	7/27/2019	53	Inactive			

The KIWB estimates and volume contours in Figures 2–4 elucidate the general habitat use and core use areas for turtles tagged in each location based on their horizontal movements. Of the 53 satellite devices deployed, two were not included in this analysis due to lack of sufficient data. KIWB estimates revealed high site fidelity and limited movements for both green and hawksbill turtles (Figures 2–4). Seven tags were still active and transmitting data on 31 October 2019, all of which were deployed in 2019 (Table 2).

For SPLASH tags, the core home range area (50% KIWB volume contour) was geographically concentrated for both green and hawksbill turtles, but slightly larger for the former (mean = 0.23 km^2, SD = 0.19 km^2, range = 0.01–0.48 km^2) compared to the latter (mean = 0.10 km^2, SD = 0.07 km^2, range = 0.04–0.15 km^2). Overall home ranges (95% KIWB volume contour) were also larger for green turtles, which used an average area of 1.41 km^2 (SD = 1.05 km^2, range = 0.08–2.65 km^2), compared to an average area of 0.68 km^2 (SD = 0.67 km^2, range = 0.21–1.15 km^2) for hawksbills. These geographic comparisons will be tested statistically in the final analysis of these data. Additionally, we recognize that the home ranges and core use areas reported here are potentially influenced by our groupings of tags and the geographical span of deployment locations within a group. We are currently working through these issues in a more robust analysis which models each turtle's movement path and calculates its individual habitat use statistics prior to calculating group statistics for a given deployment location. That analysis will be introduced in future reports and publications.

Not surprisingly, both core and overall home ranges were much larger for green and hawksbill turtles equipped with SPOT tags, compared to those equipped with SPLASH tags (Figures 2–4, Table 2). The core and overall home range areas for green turtles equipped with SPOT tags was 9.11 km^2 and 76.98 km^2 , respectively, compared to 8.21 km^2 and 44.65 km^2, respectively, for hawksbill turtles. Despite the decreased accuracy of home ranges calculated from SPOT tags, these tag models are extremely useful to identify the general residency areas and important habitats of younger life-stage turtles.

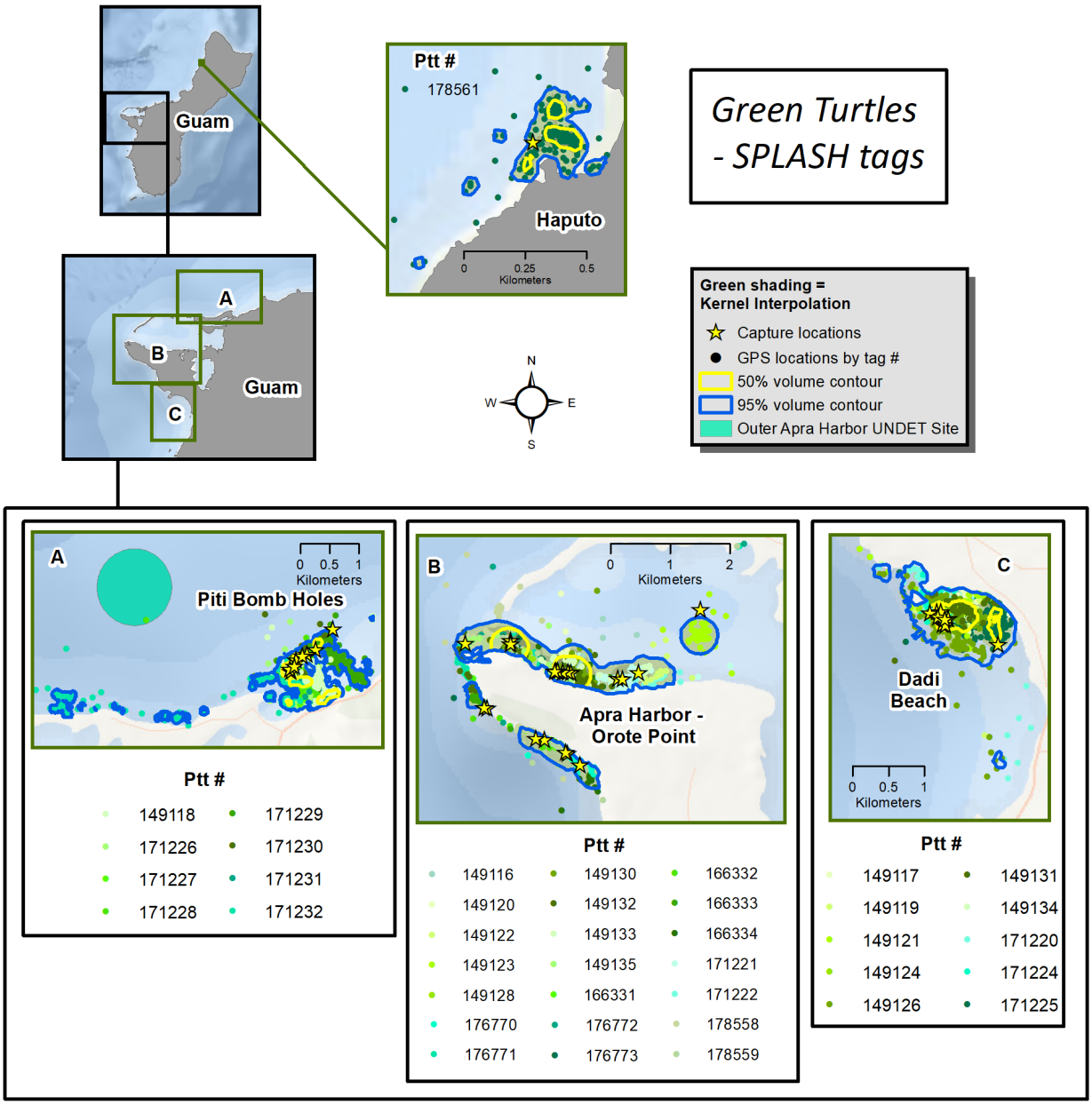

Figure 2. Habitat use map for green turtles equipped with SPLASH tags in the vicinity of Apra Harbor and Haputo, Guam. GPS location data were analyzed using a Kernel Interpolation with Barriers method. Darker shades of green indicate higher density of points, with the 50% (core home range) and 95% (overall home range) volume contours outlined in yellow and blue, respectively.

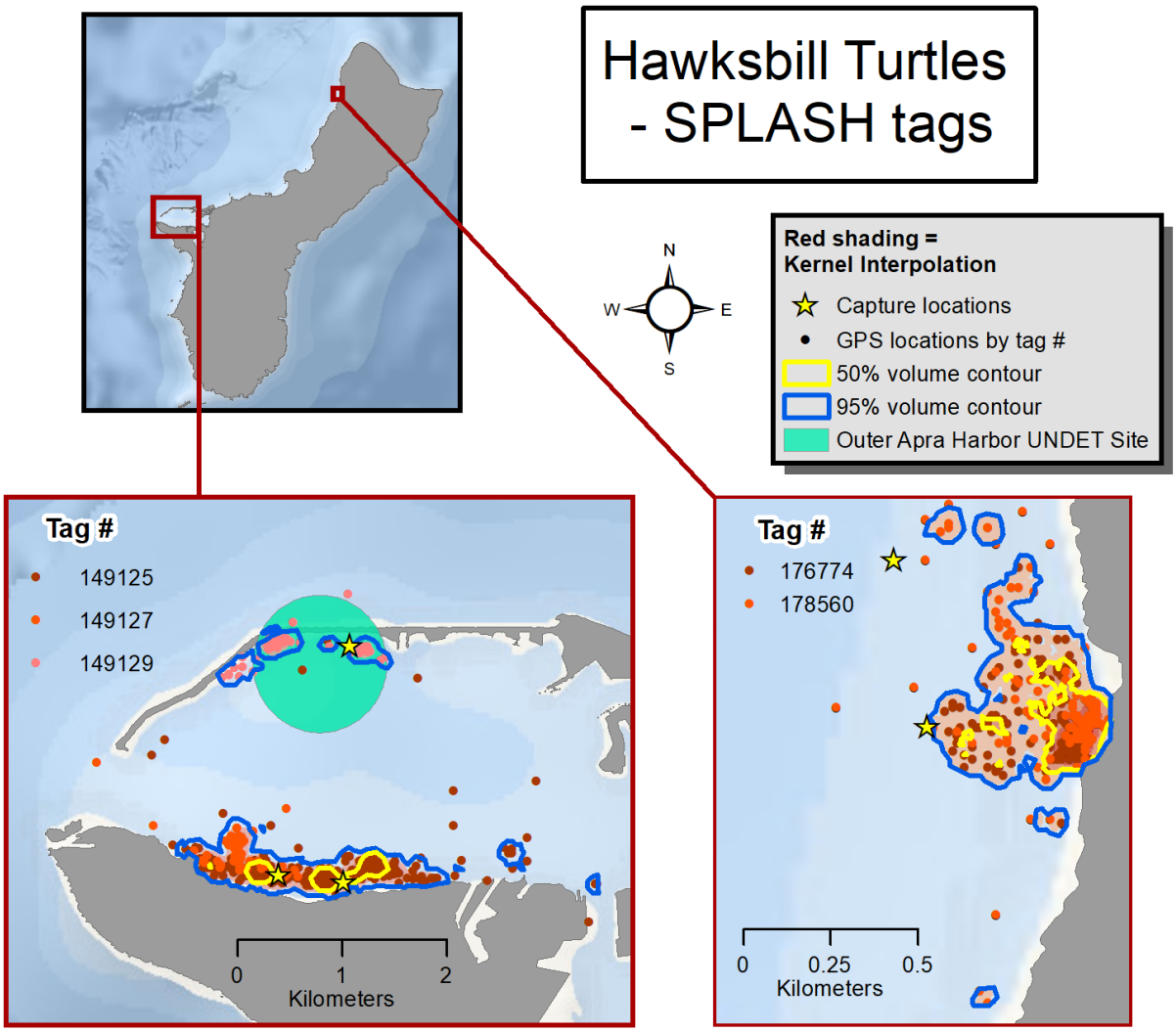

Figure 3. Habitat use map for hawksbill turtles equipped with SPLASH tags in Apra Harbor and Double Reef, Guam. GPS location data were analyzed using a Kernel Interpolation with Barriers method. Darker shades of red indicate higher density of points, with the 50% (core home range) and 95% (overall home range) volume contours outlined in yellow and blue, respectively.

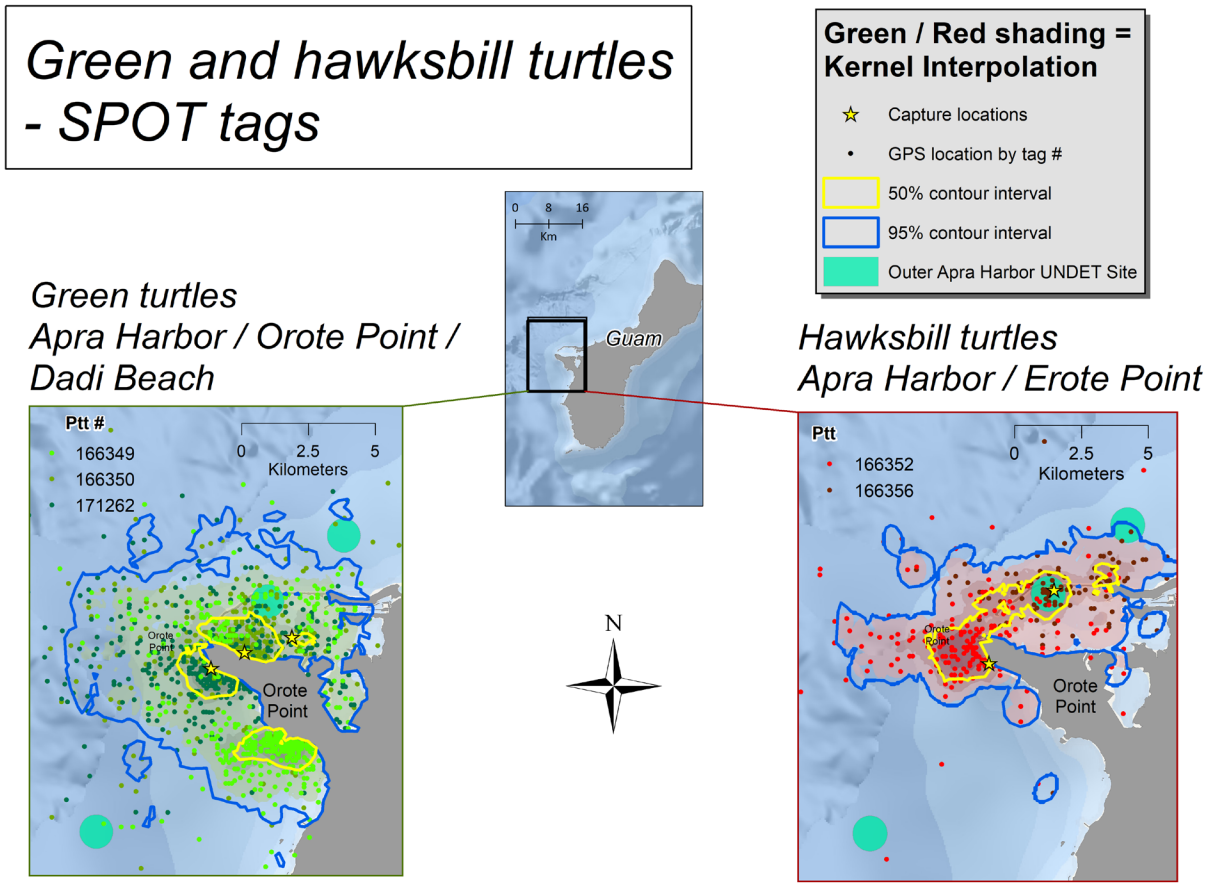

Figure 4. Habitat use map for green turtles (left inset) and hawksbill turtles (right inset) equipped with SPOT tags in and around Apra Harbor, Guam. Argos location data were analyzed using a Kernel Interpolation with Barriers method. Darker shades of red indicate higher density of points, with the 50% (core home range) and 95% (overall home range) volume contours outlined in yellow and blue, respectively.

Dive behavior and vertical movement

Dive patterns suggest that both green and hawksbill turtles spend most of their time in waters shallower than 25 m (Figures 5 and Figure 6), and it is possible that habitat partitioning may exist between the two species. Binned depth data from the tags suggest both species used similar depths, with an average depth of 10.1 m for green turtles and 10.4 m for hawksbill turtles.

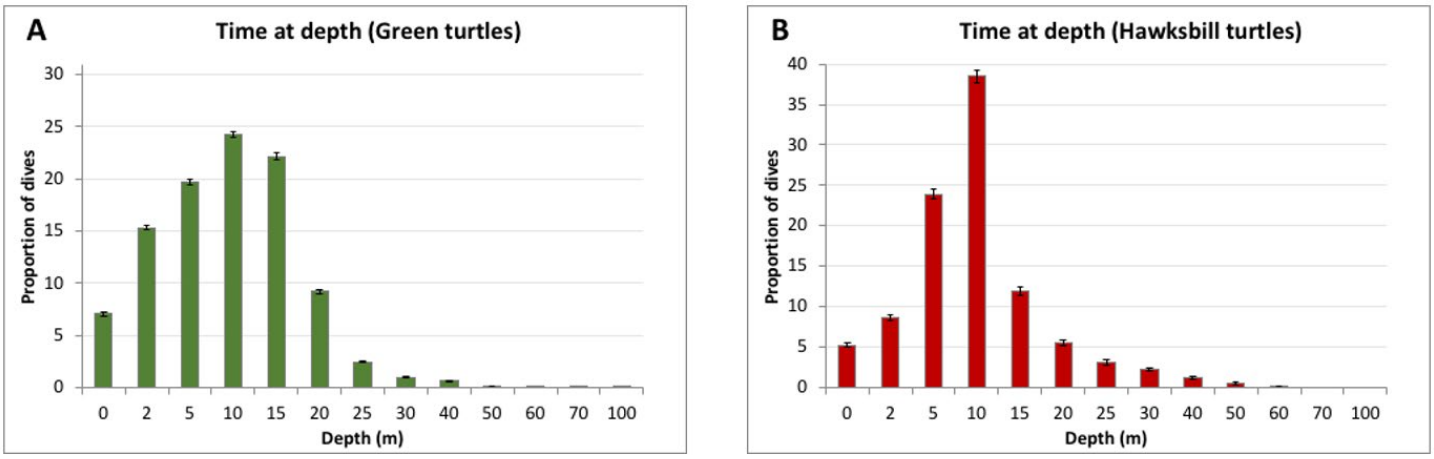

Figure 5. Proportion of time-at-depth profiles for 41 green turtles (A) and 5 hawksbill turtles (B) in the study area in 2015–2019.

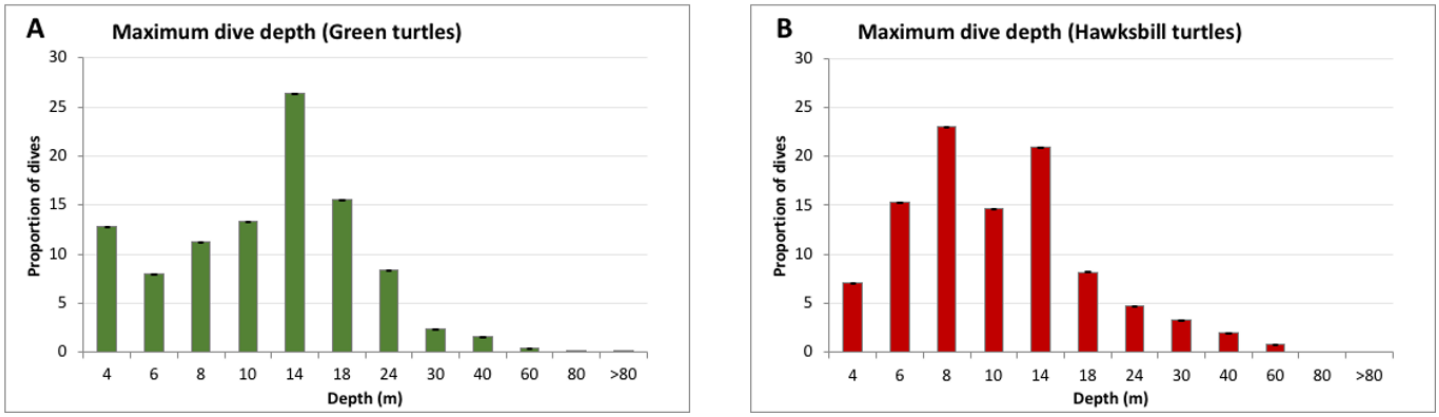

Figure 6. Maximum dive depth profiles for 41 green turtles (A) and 5 hawksbill turtles (B) in the study area in 2015–2019.

Green and hawksbill turtles primarily use waters with temperatures of 28–33 °C, but hawksbill turtles spent more time in slightly warmer waters, with 31.0% of their time in waters of 31 °C, compared to 20.6% for green turtles (Figure 7). In general hawksbill turtles prefer warmer waters than their green turtle counterparts and it is likely that hawksbills are actively seeking out slightly warmer waters during the day (Gaos et al. 2012).

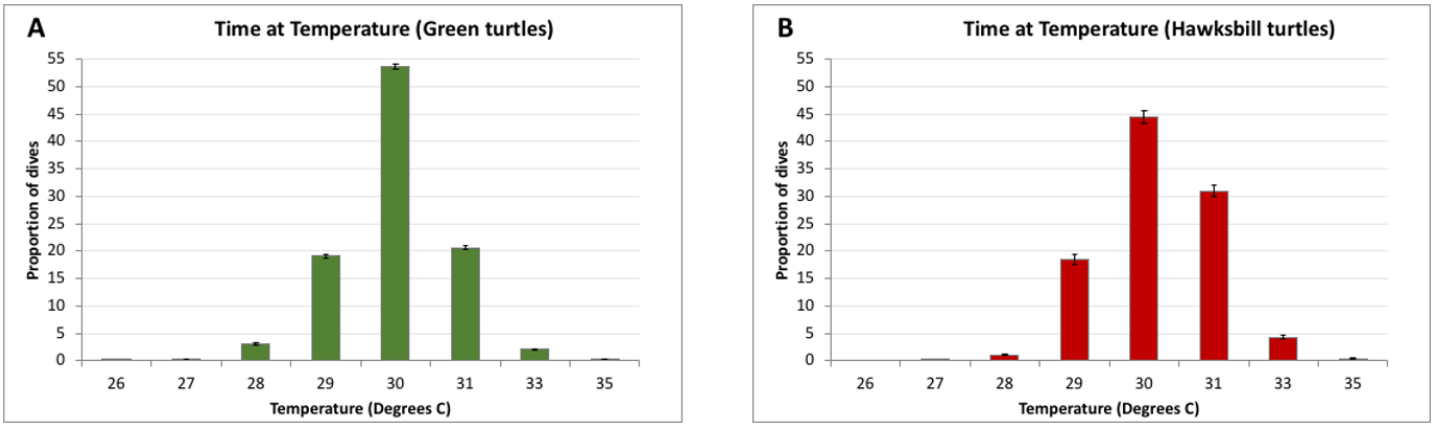

Figure 7. Proportion of time-at-temperature profiles for 41 green turtles (A) and 5 hawksbill turtles (B) in the study area in 2015–2019.

Hawksbills tended to have longer dive durations than green turtles, with average dive durations of 45.2 min compared to 30.4 min, respectively (Figure 8). Beginning in 2018 we adjusted our dive duration bins (see Methods) and since that time have been able to get increased resolution on the dive duration of 7 green turtles and 2 hawksbill turtles equipped with SPLASH tags. Results of the new bin settings further supported longer dive durations by hawksbills, with 7.5% of dives lasting more than one hour, compared to 4.9% for green turtles (Figure 9).

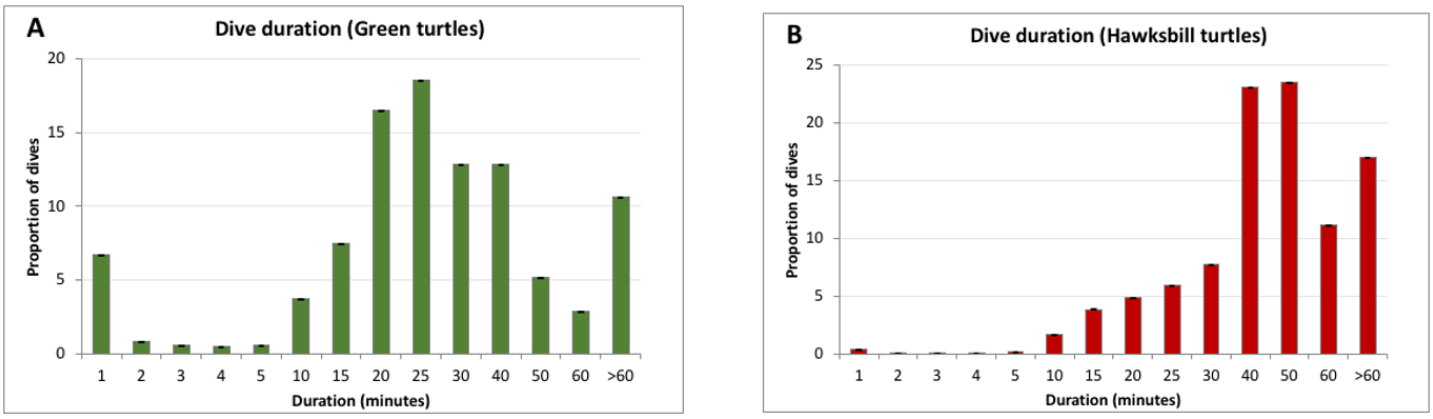

Figure 8. Dive duration profiles for 59 green turtles (A) and 7 hawksbill turtles (B) in the study area in 2015–2017.

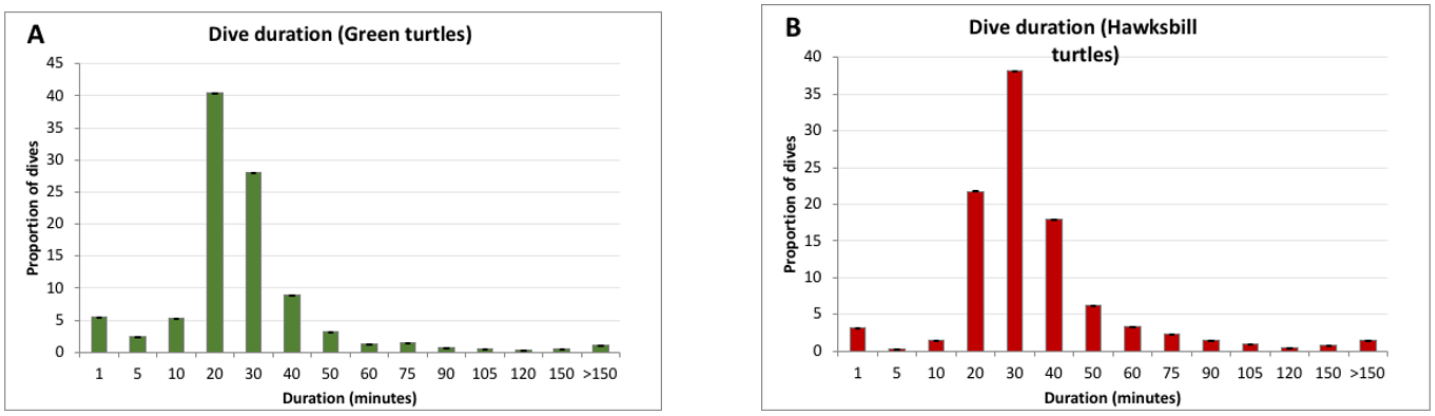

Figure 9. Dive duration profiles with increased time resolution beyond 60 min for 25 green turtles (A) and 2 hawksbill turtles (B) in the study area in 2018 and 2019.

PROGRESS TOWARDS SUMMARY OF TASKS

(1) Capture and tag sea turtles on Naval Base Guam

Sixty-eight captures of turtles in the Naval Base Guam study area and 53 satellite tags deployed.

(2) Analyze capture and tracking data

Kernel interpolation estimates include all tags to date (with sufficient data) and all areas of capture. Analysis revealed high site fidelity and limited movements of turtles. Several tags are still signaling and complete analysis is forthcoming. PIFSC staff will continue conducting in-depth analysis of satellite tagging data including spatial analysis and dive behavior of turtles, as well as the influence of temperature on habitat use. See Figures 2–4 for kernel interpolation estimates and details of short-range movements and Figures 5–9 for dive depth and temperature histograms.

(3) Prepare interim and final report

In progress.

PROGRESS TOWARDS GUIDING QUESTIONS FROM THE FY13–15 MONITORING PLAN

i. Are there locations of greater sea turtle concentration within Apra Harbor and other DoN submerged lands around Guam?

Efforts are on-going to answer this question. We have encountered and captured turtles in most locations we have surveyed in the Naval Base Guam study area. The following areas appear to have high turtle density based on our survey experiences: (1) nearshore waters inside Apra Harbor near San Luis Beach and Gab Gab Beach, (2) nearshore waters near Spanish Steps, and (3) nearshore waters near Dadi Beach and Tipalao Beach outside of the harbor to the south. These areas are primarily dominated by patch reef communities were the turtles both forage and rest. The habitat in the vicinity of Double Reef appear to have a particularly high ratio of hawksbill turtles (to green turtles), likely a result of the large coral reefs dominating the area that likely host preferred hawksbill diet items.

ii. What is the occurrence and/or habitat use of sea turtles in areas within Apra Harbor and other DoN submerged lands around Guam?

Thirty-one turtles have been outfitted with satellite tags inside Apra Harbor and around Orote Point, while 22 have been equipped with tags at Dadi Beach, Piti Bomb Holes, Haputo and Double Reef (Figure 1 and Table 2). The habitats used by tagged turtles were relatively small, with the more precise SPLASH tags indicating core home range (50% of GPS locations) of <0.5 km^2 and overall home ranges (95% of GPS locations) of 1–3 km^2 (Figures 2–4, Table 2). Green turtles and hawksbill turtles resided mostly between the surface and 20 m depth, and utilized similar depths, with averages of 10.1 m and 10.4 m, respectively (Figure 5 and Figure 6); Green turtles and hawksbill turtles also used waters of similar temperatures, with averages of 30.0 °C and 30.3 °C, respectively (Figure 7). Hawksbills tended to have longer dive durations than green turtles, with average dive durations of 45.2 min compared to 30.4 min, respectively (Figure 8). From in-water surveys, the spatial analysis of the GPS locations and movements from these satellite tags, we have seen some direct overlap of turtle positions with the Navy detonation sites (Figure 1, Figure 3 and Figure 4). Additionally, turtles are spending significant amounts of time in and moving through areas within 1–2 km of these sites, and the lack of overlapping GPS points from more tagged turtles could be due to the relatively low frequency of GPS locations obtained from these tags (often a maximum of one per day). Analysis and filtering of Argos location classes (see supplemental materials) may provide more data on daily locations.

TENTATIVE ACTIVITIES PLANNED FOR 2020

In-water surveys were originally planned for the Naval Base Guam study area in May or June of 2020 to deploy additional satellite tags. However, field work has been tentatively suspended due to COVID19 pandemic. If possible, we will conduct field work in Sept–Oct 2020. Alternatively, if the pandemic continues for an extended period of time, we will postpone field activities and conduct one or multiple research trips in May/June and Sept/October 2021.We will continue our analyses of the satellite data to understand home range, habitat preferences, preferred depths and temperature, as well as movements around Guam. These analyses will provide the basis of a manuscript intended for journal submission in mid to late 2022.

ACKNOWLEDGEMENTS

We thank our current and former collaborative partners at Guam DAWR (Celestino F. Aguon, Jay T. Gutierrez, Jamie D. Bass, Francisco D. Manibusan, Carlos S. Quintanilla, Cristian M. Cayanan, Johnedel H. Ducusin, Shawn B. Wusstig), Guam OLE, CNMI DLNR (Augustin "Gus" M. Kaipat, Lisa Szutukowski, Carey Demapan, Anthony Benavente, Richard Sean and Joe Ruak), NAVFAC (Jennifer Cruce Horeg), USFWS (Tammy Summers) and Jessy's Tag Services (Jessy Hapdei). From PIFSC, we thank Shawn Murakawa, Julie Whitaker, Karen Beck, Mary Zadlo, Jon Yun, and Sujuan Situ for logistics and contracting support.

REFERENCES

Eckert KL, Bjorndal KA, Abreu-Grobois FA, and Donnelly M (Editors). 1999. Research and Management Techniques for the Conservation of Sea Turtles. IUCN/SSC Marine Turtle Specialist Group Publication No. 4.

ESRI. 2012. ArcGIS. Environmental Systems Research Institute, Inc., Redlands, CA.

Gaos AR, Lewison RL, Wallace B, Yañez IL, Liles, Baquero A, Seminoff JA. 2012. Dive behaviour of adult hawksbills (*Eretmochelys imbricata*, Linnaeus 1766) in the eastern Pacific Ocean highlights shallow depth-use by the species. Journal of Experimental Marine Biology and Ecology. 432–433: 171–178.

Hart KM, Sartain AR, Fujisaki I. 2015. Bahamas connection: residence areas selected by breeding female loggerheads tagged in Dry Tortugas National Park, USA. Animal Biotelemetry. 3:3.

Hill MC, Oleson, Baumann-Pickering S, Van Cise AM, Ligon AD, Bendlin AR, U AC, Trickey JS, and Bradford AL. 2016. Cetacean Monitoring in the Mariana Islands Range Complex, 2015. Prepared for the U.S. Pacific Fleet Environmental Readiness Office. PIFSC Data Report DR-16-01. 36 pp.

Jones TT, Bostrom BL, Carey M, Imlach B, Mikkelsen J, Ostafichuk P, Eckert S, Opay P, Swimmer Y, Seminoff JA, Jones DR. 2011. Determining transmitter drag and best practice attachment procedures for sea turtle biotelemetry studies. NOAA Technical Memorandum NMFS-SWFSC-480.

Jones TT, Van Houtan KS, Bostrom BL, Ostafichuk P, Mikkelsen J, Tezcan E, Carey M, Imlach B, Seminoff J. 2013. Calculating the ecological impacts of animal-borne instruments on aquatic animals. Methods in Ecology and Evolution. 4(12):1178–1186.

Jones TT, Martin S, and Gaos A. 2018. Platform Transmitter Terminal (PTT) application and deployment protocol for hard-shelled marine turtles around the Pacific Islands Region. NOAA Internal Report. 11.

NMFS and USFWS. 2015. Green turtle *(Chelonia mydas*) Status Review under the U.S. Endangered Species Act. Report of the Green Turtle Status Review Team. May 2014. 567 pp.

Sprogis KR, Raudino HC, Rankin R, MacLeod C, Bejder L 2016. Home range size of adult Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) in a coastal and estuarine system is habitat and sex- specific. Marine Mammal Science. 32(1): 287–308.

Summers TM, Jones TT, Martin SL, Hapdei JR, Ruak JK, and Lepczyk CA. 2017. Demography of marine turtles in the near-shore environments of the Northern Mariana Islands. *Pacific Science*, 71(3): 269–286.

SUPPLEMENTARY MATERIALS

Figure S1. Argos satellite tag reference table. Provides information describing accuracy of location classes associated with Argos-derived and Fastloc-GPS-derived locations.

Class	Type	Estimated error*		Number of messages received per satellite pass	
		Least Squares	Kalman Filter	Least Squares	Kalman Filter
G	GPS	< 100m		1 message or more	
3	Argos	< 250m		4 messages or more	
2	Argos	250m ≤ ≤ 500m		4 messages or more	
1	Argos	500m ≤ ≤ 1500m		4 messages or more	
0*	Argos	> 1500m		4 messages or more	
A	Argos	No accuracy estimation	Unbounded accuracy estimation	3 messages	
B	Argos	No accuracy estimation	Unbounded accuracy estimation	messages	1 or 2 messages
Z	Argos	Invalid location (available only for Service Plus/Auxiliary Location Processing)			

Table S1. Summary of 2015–2016 turtle observations, captures, and satellite tag deployments from boat-based snorkel surveys in nearshore waters of Guam (in and around Apra Harbor). Data fields from left to right: Survey date, Site location, Longitude, Latitude, Type of Event (Obs. = observation only, SatTag = capture with satellite tag deployment, Capt. = capture but no satellite tag deployed), Species (CM = green turtle, EI = hawksbill turtle, UN = unknown species, but green or hawksbill turtle), Number of individuals, Attachments (instruments; "WC" = Wildlife Computers), Argos ID (satellite tags), Straight Carapace Length (cm), Mass (kg), Sex (U = unknown, M = male), Turtle ID (species, date, location, length), Flipper tag ID (left front flipper), Flipper tag ID (right front flipper), PIT tag microchip ID (left hind flipper), PIT tag microchip ID (right hind flipper).

Date	Site	Longitude	Latitude	Type	Sp.	No.	Attach.	Argos ID	SCL	Sex	L. Flipper	R Flipper	Left PIT	Right PIT
19-May-15	Gab Gab (Apra Harbor)	13.4439	144.6408	Capture	CM	1			45.5	U	PI1315	PI1316	982.0001678	982.0001678
19-May-15	Western Shoals (Apra Harbor)	13.454	144.6543	Capture-SatTagApplied	CM	1	Wildlife Computers SPLASH	149123	47.6	U	PI1311	PI1312	982.0001678	982.0001678
19-May-15	Gab Gab Beach (Apra Harbor)	13.4434	144.6437	Capture-SatTagApplied	EI	1	Wildlife Computers SPLASH	149125	68.2	U	PI1313	PI1314	982.0001678	982.0001678
19-May-15	Apra Harbor	13.446279	144.634903	Observation	CM	1								
19-May-15	Apra Harbor	13.446279	144.634903	Observation	CM	1								
19-May-15	Apra Harbor	13.446279	144.634903	Observation	CM	1								
20-May-15	Dadi Beach	13.41118	144.65234	Capture	CM	1			45.5	U	PI1319	PI1320	982.0001678	982.0001678
20-May-15	Kilo wharf (Apra Harbor)	13.44476	144.63422	Capture	EI	1			46.9	U	PI1077	PI1076	982.0001907	982.0001902
20-May-15	Kilo wharf (Apra Harbor)	13.44473	144.63472	Capture-SatTagApplied	CM	1	Wildlife Computers SPLASH	149116	56	U	PI1317	PI1318	982.0001678	982.0001678
20-May-15	Dadi Beach	13.412355	144.649354	Capture-SatTagApplied	CM	1	Wildlife Computers SPLASH	149121	50.8	U	PI1323	PI1324	982.0001678	982.0001678
20-May-15	Dadi Beach	13.41232	144.64984	Capture-SatTagApplied	CM	1	Wildlife Computers SPLASH	149131	55.2	U	PI1321	PI1322	982.0001678	982.0001678

Date	Site	Longitude	Latitude	Type	Sp.	No.	Attach.	Argos ID	SCL	Sex	L. Flipper	R Flipper	Left PIT	Right PIT
20-May-15	Dadi Beach	13.411383	144.650204	Observation	CM	1								
20-May-15	Dadi Beach	13.412334	144.645895	Observation	CM	1								
20-May-15	Dadi Beach	13.412633	144.645549	Observation	CM	2								
20-May-15	Western Shoals	13.430774	144.636281	Observation	CM	1								
21-May-15	Gab Gab (Apra Harbor)	13.4439	144.64085	Capture	CM	1			46.5	U	PI2726	PI2727	982.0001678	982.0001678
21-May-15	Dadi Beach	13.4115	144.6508	Capture-SatTagApplied	CM	1	Wildlife Computers SPLASH	149117	47.8	U	PI2728	PI2729	982.0001678	982.0001678
21-May-15	Dadi Beach	13.41071	144.65042	Capture-SatTagApplied	CM	1	Wildlife Computers SPLASH	149119	72	U	PI2731	PI2730	982.0001678	982.0001678
21-May-15	Western Shoals	13.453642	144.653842	Observation	CM	1								
21-May-15	Apra Harbor	13.4444	144.639576	Observation	CM	1								
21-May-15	Apra Harbor	13.444344	144.638566	Observation	CM	1								
21-May-15	Apra Harbor	13.444251	144.642081	Observation	UN	1								
21-May-15	Dadi Beach	13.407673	144.65696	Observation	CM	1								
21-May-15	Apra Harbor	13.445405	144.636567	Observation	UN	1								
21-May-15	Apra Harbor	13.444993	144.636826	Observation	UN	1								
21-May-15	Apra Harbor	13.444572	144.635017	Observation	UN	1								
21-May-15	Apra Harbor	13.44435	144.639829	Observation	UN	1								

Date	Site	Longitude	Latitude	Type	Sp.	No.	Attach.	Argos ID	SCL	Sex	L. Flipper	R Flipper	Left PIT	Right PIT
21-May-15	Western Shoals	13.453642	144.653842	Observation	CM	1								
21-May-15	Dadi Beach	13.411777	144.64839	Observation	CM	1								
21-May-15	Dadi Beach	13.411837	144.649835	Observation	CM	1								
21-May-15	Dadi Beach	13.411495	144.650392	Observation	CM	1								
21-May-15	Dadi Beach	13.411498	144.650377	Observation	CM	1								
21-May-15	Dadi Beach	13.411466	144.65049	Observation	CM	1								
21-May-15	Dadi Beach	13.408465	144.656841	Observation	CM	1								
21-May-15	Apra Harbor	13.44435	144.638339	Observation	UN	1								
21-May-15	Dadi Beach	13.410946	144.65287	Observation	CM	1								
22-May-15	Gab Gab Beach (Apra Harbor)	13.44482	144.63646	Capture	CM	1			43.9	U	PI2732	PI2733	982.0001678	982.0001678
22-May-15	Gab Gab (Apra Harbor)	13.44481	144.63426	Capture-SatTagApplied	CM	1	Wildlife Computers SPLASH	149132	60.3	U	PI2735	PI2734	982.0001678	982.0001678
22-May-15	Dadi Beach	13.41076	144.6501	Capture-SatTagApplied	CM	1	Wildlife Computers SPLASH	149134	65.5	U	PI2737	PI2736	982.0001678	982.0001678
22-May-15	Apra Harbor	13.444332	144.640391	Observation	CM	1								
22-May-15	Dadi Beach	13.410299	144.649875	Observation	CM	1								
22-May-15	Dadi Beach	13.410761	144.6501	Observation	CM	1								

Date	Site	Longitude	Latitude	Type	Sp.	No.	Attach.	Argos ID	SCL	Sex	L. Flipper	R Flipper	Left PIT	Right PIT
22-May-15	Dadi Beach	13.409807	144.650425	Observation	CM	1								
22-May-15	Dadi Beach	13.409587	144.651287	Observation	CM	1								
22-May-15	Apra Harbor	13.444949	144.637236	Observation	CM	2								
22-May-15	Apra Harbor	13.444522	144.638293	Observation	CM	1								
22-May-15	Apra Harbor	13.444827	144.635562	Observation	CM	1								

Supplemental Table S1 (Continued). Summary of 2015–2016 turtle observations, captures, and satellite tag deployments from boat-based snorkel surveys in nearshore waters of Guam (in and around Apra Harbor).

Date	Site	Longitude	Latitude	Type	Sp.	No.	Attach.	Argos ID	SCL	Sex	L. Flipper	R Flipper	Left PIT	Right PIT
22-May-15	Apra Harbor	13.445165	144.636328	Observation	CM	1								
23-May-15	Dadi Beach	13.41011	144.6523	Capture	CM	1			42.2	U	PI2747	PI2746	982.0001906	982.0001678
23-May-15	Kilo Wharf	13.44481	144.633518	Capture-SatTagApplied	CM	1	Wildlife Computers SPLASH	149120	58.4	U	PI2748	PI2749	982.0001678	982.0001678
23-May-15	Gab Gab Beach (Apra Harbor)	13.44385	144.64185	Capture-SatTagApplied	CM	1	Wildlife Computers SPLASH	149122	54	U	PI2750	PI1325	982.0001678	982.0001678
23-May-15	Dadi Beach	13.41222	144.6485	Capture-SatTagApplied	CM	1	Wildlife Computers SPLASH	149124	75	U	PI2743	PI2742	982.0001678	982.0001678
23-May-15	Dadi Beach	13.41074	144.65041	Capture-SatTagApplied	CM	1	Wildlife Computers SPLASH	149126	71	U	PI2744	PI2745	982.0010001	982.0010001
23-May-15	Gab Gab II (Apra Harbor)	13.44403	144.63812	Capture-SatTagApplied	EI	1	Wildlife Computers SPLASH	149127	53.5	U	PI2740	PI2741	982.0001906	982.0001678
23-May-15	Apra Harbor	13.445389	144.636837	Observation	EI	2								
23-May-15	Apra Harbor	13.445389	144.636837	Observation	CM	1								
23-May-15	Apra Harbor	13.444684	144.633353	Observation	CM	1								
23-May-15	Apra Harbor	13.445134	144.633189	Observation	CM	1								
23-May-15	Apra Harbor	13.445087	144.636666	Observation	UN	1								
23-May-15	Dadi Beach	13.409745	144.651085	Observation	UN	1								
23-May-15	Apra Harbor	13.444195	144.64134	Observation	UN	1								

Date	Site	Longitude	Latitude	Type	Sp.	No.	Attach.	Argos ID	SCL	Sex	L. Flipper	R Flipper	Left PIT	Right PIT
23-May-15	Apra Harbor	13.444225	144.640337	Observation	UN	1								
23-May-15	Apra Harbor	13.444901	144.638492	Observation	UN	3								
23-May-15	Apra Harbor	13.445389	144.636837	Observation	UN	2								
23-May-15	Apra Harbor	13.444613	144.633221	Observation	CM	1								
24-May-15	Gab Gab Beach (Apra Harbor)	13.4448	144.63634	Capture	CM	1			50.2	U	PI2738	PI2739	982.0001907	982.0001678
24-May-15	Kilo Wharf (Apra Harbor)	13.44494	144.63269	Capture-SatTagApplied	CM	1	Wildlife Computers SPLASH	149133	55.3	U	PI2724	PI2725	982.0001678	982.0001907
24-May-15	Kilo Wharf (Apra Harbor)	13.44498	144.63243	Capture-SatTagApplied	CM	1	Wildlife Computers SPLASH	149135	61.2	U	PI2722	PI2723	982.0001902	982.0001678
24-May-15	Apra Harbor	13.444534	144.63981	Observation	CM	1								
24-May-15	Apra Harbor	13.444523	144.639692	Observation	CM	1								
24-May-15	Apra Harbor	13.444326	144.642196	Observation	CM	1								
24-May-15	Apra Harbor	13.444432	144.640163	Observation	CM	1								
24-May-15	Apra Harbor	13.444984	144.632431	Observation	CM	12								
11-May-16	Gab Gab	13.4439	144.6389	Capture	EI	1	Wildlife Computers SPLASH	149125	68.2	U	PI1313	PI1314		982.0001678
11-May-16	Gab Gab	13.444	144.6393	Capture-SatTagApplied	CM	1	Wildlife Computers SPLASH	149118	60.3	U	PI1551	PI1562	982.0001905	982.0001906
11-May-16	Gab Gab	13.444997	144.632725	Capture-SatTagApplied	CM	1	Wildlife Computers SPLASH	149128	50.8	U	RI11865	PI1566	982.0001907	982.0001907

Date	Site	Longitude	Latitude	Type	Sp.	No.	Attach.	Argos ID	SCL	Sex	L. Flipper	R Flipper	Left PIT	Right PIT
11-May-16	Inner Glass Break	13.4632	144.6443	Capture-SatTagApplied	EI	1	Wildlife Computers SPLASH	149129	58.6	U	PI1576	PI1577	982.0001902	982.0001678
11-May-16	Gab Gab	13.444908	144.632305	Capture-SatTagApplied	CM	1	Wildlife Computers SPLASH	149130	54.3	U	PI2715	PI2716	982.0001678	982.0001902
11-May-16	Gab Gab	13.444929	144.632228	Observation	UN	1								
11-May-16	Gab Gab	13.444	144.6393	Observation	CM	1								
11-May-16	Gab Gab	13.44422	144.63872	Observation	CM	1								
11-May-16	Gab Gab	13.444354	144.638103	Observation	UN	1								
11-May-16	Gab Gab	13.444731	144.637166	Observation	UN	1								
11-May-16	Gab Gab	13.444881	144.632191	Observation	UN	1								
11-May-16	Gab Gab	13.44522	144.633312	Observation	UN	1								
11-May-16	Gab Gab	13.445136	144.634275	Observation	UN	1								
11-May-16	Gab Gab	13.445112	144.634209	Observation	UN	1								
11-May-16	Gab Gab	13.446097	144.634844	Observation	CM	3								
11-May-16	Gab Gab	13.44418	144.63897	Observation	CM	2								
11-May-16	Gab Gab	13.444191	144.639596	Observation	UN	1								
11-May-16	Gab Gab	13.44499	144.636322	Observation	UN	1								
11-May-16	Jade Shoals	13.463187	144.660199	Observation	CM	1								

Date	Site	Longitude	Latitude	Type	Sp.	No.	Attach.	Argos ID	SCL	Sex	L. Flipper	R Flipper	Left PIT	Right PIT
11-May-16	San Luis	13.4451	144.64715	Observation	UN	1								
11-May-16	Inner Glass Break	13.4634	144.66038	Observation	CM	1								
11-May-16	Inner Glass Break	13.4632	144.6443	Observation	CM	1								

Table S 2. Summary of 2017–2019 turtle observations, captures, and satellite tag deployments from boat-based snorkel surveys in nearshore waters of Guam (in and around Apra Harbor, Haputo and Double Reef). Data fields from left to right: Survey date, Site location, Longitude, Latitude, Type of Event (Obs. = observation only, SatTag = capture with satellite tag deployment, Capt. = capture but no satellite tag deployed), Species (CM = green turtle, EI = hawksbill turtle, UN = unknown species, but green or hawksbill turtle), Number of individuals, Attachments (instruments; "WC" = Wildlife Computers), Argos ID (satellite tags), Straight Carapace Length (cm), Mass (kg), Sex (U = unknown, M = male), Turtle ID (species, date, location, length), Flipper tag ID (left front flipper), Flipper tag ID (right front flipper), PIT tag microchip ID (left hind flipper), PIT tag microchip ID (right hind flipper).

Date	Site	Longitude	Latitude	Type	Sp.	No.	Attach.	Argos ID	SCL	Sex	L. Flipper	R Flipper	Left PIT	Right PIT
16-May-17	Dump to Orote Point	13.43287	144.63419	Capture-SatTagApplied	CM		Wildlife Computers SPLASH	166331	45.4	U	PI4503	PI4501	982.000402	982.000402
16-May-17	Dump to Orote Point	13.4349	144.63069	Capture-SatTagApplied	CM		Wildlife Computers SPLASH	166332	52.1	U	PI4502	PI4506	982.000402	982.000402
16-May-17	Orote Point	13.43953	144.62204	Capture-SatTagApplied	CM		Wildlife Computers SPLASH	166333	52.5	U	PI4507	PI4508	982.000402	982.000402
16-May-17	Orote Point	13.43962	144.62161	Capture-SatTagApplied	CM		Wildlife Computers SPLASH	166334	59.4	U	PI4505	PI4504	982.000402	982.000402
16-May-17				Observation	CM	1								
16-May-17		13.43375	144.63158	Observation	CM	1								
16-May-17		13.43107	144.63542	Observation	CM	1								
16-May-17		13.43138	144.63499	Observation	CM	1								
16-May-17		13.43137	144.63498	Observation	CM	1								
16-May-17		13.4318	144.63457	Observation	CM	1								
16-May-17		13.43962	144.62161	Observation	CM	1								
16-May-17		13.43378	144.63158	Observation	CM	1								
16-May-17				Observation	CM	1								
17-May-17	Gab Gab	13.44398	144.63898	Capture-SatTagApplied	EI		Wildlife Computers SPLASH	149125	71.1	M	PI1313	PI1314	982.000168	982.000168

Date	Site	Longitude	Latitude	Type	Sp.	No.	Attach.	Argos ID	SCL	Sex	L. Flipper	R Flipper	Left PIT	Right PIT
17-May-17	Kilo Wharf	13.44448	144.63396	Capture-SatTagApplied	CM		Wildlife Computers SPOT	166350	40.3	U	PI4515	PI4514	982.000402	982.000402
17-May-17	Gab Gab	13.44382	144.64256	Capture-SatTagApplied	CM		Wildlife Computers SPLASH	171221	54.4	U	PI4512	PI4513	982.000402	982.000402
17-May-17	San Luis	13.44472	144.64494	Capture-SatTagApplied	CM		Wildlife Computers SPLASH	171222	44.5	U	PI4509	PI4510	982.000402	982.000402
17-May-17		13.44411	144.64922	Observation	CM	1								
17-May-17				Observation	CM	2								
17-May-17		13.44407	144.64279	Observation	CM	1								
17-May-17				Observation	TU	1								
17-May-17		13.44482	144.63361	Observation	CM	1								
17-May-17		13.44406	144.64886	Observation	CM	1								
17-May-17		13.45418	144.65439	Observation	CM	1								
17-May-17		13.45283	144.65614	Observation	CM	1								
18-May-17	Dadi	13.40943	144.65289	Capture	CM				45.5	U	PI4528	PI4529	982.000402	982.000402
18-May-17	Dadi	13.41149	144.65096	Capture	CM				45.6	U	PI4530	PI4531	982.000402	982.000402
18-May-17	Dadi	13.40896	144.6564	Capture	CM				46	U	PI4520	PI4518	982.000402	982.000402
18-May-17	Dadi	13.41269	144.64876	Capture	CM				53	U	PI4533	PI4532	982.000402	982.000402
18-May-17	Dadi	13.4114	144.65036	Capture	CM				44.9	U	PI4522	PI4523	982.000402	982.000402
18-May-17	Dadi	13.4498	144.65027	Capture-SatTagApplied	CM		Wildlife Computers SPOT	166349	40	U	PI4526	PI4527	982.000402	982.000402
18-May-17	Dadi	13.41169	144.64948	Capture-SatTagApplied	CM		Wildlife Computers SPLASH	171220	67.2	U	PI4524	PI4525	982.000402	982.000402
18-May-17	Dadi	13.4107	144.65221	Capture-SatTagApplied	CM		Wildlife Computers SPLASH	171223	61.2	U	PI1051	PI1032	982.000168	982.000168

Date	Site	Longitude	Latitude	Type	Sp.	No.	Attach.	Argos ID	SCL	Sex	L. Flipper	R Flipper	Left PIT	Right PIT
18-May-17	Dadi	13.4114	144.65036	Capture-SatTagApplied	CM		Wildlife Computers SPLASH	171224	58.1	U	PI4519	PI4521	982.000402	982.000402
18-May-17	Dadi	13.40832	144.6571	Capture-SatTagApplied	CM		Wildlife Computers SPLASH	171225	50.5	U	PI4517	PI4516	982.000402	982.000402
18-May-17		13.46342	144.66031	Observation	CM	1								
19-May-17	Piti Bomb Holes	13.47154	144.69186	Capture-SatTagApplied	CM		Wildlife Computers SPLASH	171226	54.6	U	PI4535	PI4534	982.000402	982.000402
19-May-17		13.47377	144.69342	Observation	CM	1								
19-May-17		13.45309	144.62321	Observation	CM	1								
19-May-17		13.46779	144.65547	Observation	CM	2								
19-May-17		13.46341	144.66032	Observation	CM	1								
22-May-17	Piti Bomb Holes	13.47187	144.69168	Capture-SatTagApplied	CM		Wildlife Computers SPLASH	171227	63.9	U	PI4536	PI4537	982.000402	982.000402
22-May-17	Piti Bomb Holes	13.47235	144.69246	Capture-SatTagApplied	CM		Wildlife Computers SPLASH	171228	63.2	U	PI1551	PI1562	982.000191	982.000191
22-May-17	Piti Bomb Holes	13.47478	144.69569	Capture-SatTagApplied	CM		Wildlife Computers SPLASH	171229	67.1	U	PI4538	PI4539	982.000402	982.000402
22-May-17	Piti Bomb Holes	13.47413	144.69435	Capture-SatTagApplied	CM		Wildlife Computers SPLASH	171230	61.6	U	PI4542	PI4540	982.000402	982.000402
22-May-17	Piti Bomb Holes	13.47792	144.6983	Capture-SatTagApplied	CM		Wildlife Computers SPLASH	171231	54.2	U	PI4543	PI4541	982.000402	982.000402
22-May-17	Piti Bomb Holes	13.47387	144.69366	Capture-SatTagApplied	CM		Wildlife Computers SPLASH	171232	60.3	U	PI4545	PI4544	982.000402	982.000402
23-May-17	Orote Point	13.43894	144.62228	Capture-SatTagApplied	EI		Wildlife Computers SPOT	166352	40.3	U	PI4451	PI4452	982.000168	982.000168
23-May-17	Inner Glass Break	13.46302	144.64355	Capture-SatTagApplied	EI		Wildlife Computers SPOT	166356	45.9	U	PI4475	PI4474	982.000402	982.000402
22-May-19		13.47291	144.69313	Observation	CM	1								

Date	Site	Longitude	Latitude	Type	Sp.	No.	Attach.	Argos ID	SCL	Sex	L. Flipper	R Flipper	Left PIT	Right PIT
22-May-19		13.47268	144.69194	Observation	CM	1								
22-May-19		13.47272	144.69209	Observation	CM	1								
22-May-19		13.47413	144.69435	Observation	CM	3								
22-May-19		13.47213	144.69206	Observation	CM	4								
22-May-19		13.47342	144.69325	Observation	CM	1								
22-May-19		13.47503	144.69608	Observation	CM	1								
23-May-19		13.43772	144.623	Observation	CM	1								
23-May-19		13.46302	144.64355	Observation	EI	1								
23-May-19		13.46302	144.64355	Observation	EI	1								
23-May-19		13.45806	144.63228	Observation	TU	2								
23-May-19		13.43079	144.63568	Observation	CM	1								
23-May-19		13.43099	144.63516	Observation	TU	1								
23-May-19		13.43282	144.63318	Observation	CM	1								
23-May-19		13.43323	144.63075	Observation	TU	1								
23-May-19		13.43923	144.62219	Observation	CM	1								
23-May-19		13.43323	144.632	Observation	CM	1								

Table S2 (Continued). Summary of 2017–2019 turtle observations, captures, and satellite tag deployments from boat-based snorkel surveys in nearshore waters of Guam (in and near Apra Harbor, Haputo, and Double Reef).

Date	Site	Longitude	Latitude	Type	Sp.	No.	Attach.	Argos ID	SCL	Sex	L. Flipper	R Flipper	Left PIT	Right PIT
04-Jun-19		13.44453	144.61896	Capture-SatTagApplied	EI	1	Wildlife Computers SPOT	171265	35.7	U	PI4373	PI4372	982.000406	982.000406
04-Jun-19		13.43983	144.62138	Capture-SatTagApplied	EI	1	Wildlife Computers SPLASH	176769	46	U	PI4374	PI4375	982.000191	982.000364
04-Jun-19		13.43112	144.63608	Capture-SatTagApplied	CM	1	Wildlife Computers SPLASH	176770	45.4	U	PI4369	PI4370	982.000362	982.000406
04-Jun-19	Spanish Steps	13.44902	144.61877	Capture-SatTagApplied	CM	1	Wildlife Computers SPLASH	176771	56.8	U	PI4368	PI4367	982.000364	982.000364
04-Jun-19	Spanish Steps	13.44949	144.62561	Capture-SatTagApplied	CM	1	Wildlife Computers SPLASH	176772	51.4	U	PI1689	PI1699	982.000402	982.000402
04-Jun-19	Kilo Wharf/Spanish Steps	13.44898	144.625575	Capture-SatTagApplied	CM	1	Wildlife Computers SPLASH	176773	54.9	U	PI1693	PI1694	982.000402	982.000402
04-Jun-19		13.43088	144.63588	Observation	CM	1								
04-Jun-19		13.43349	144.83284	Observation	EI	1								
04-Jun-19	Kilo Wharf/Spanish Steps	13.44802	144.62726	Observation	EI	1								
04-Jun-19	Kilo Wharf/Spanish Steps	13.44931	144.62587	Observation	CM	1								
04-Jun-19	Spanish Steps	13.44956	144.62505	Observation	CM	1								
04-Jun-19	Spanish Steps	13.44964	144.62486	Observation	CM	1								
04-Jun-19	Spanish Steps	13.44902	144.61871	Observation	CM	1								
04-Jun-19		13.43356	144.63274	Observation	CM	1								
04-Jun-19		13.43303	144.63353	Observation	CM	1								
04-Jun-19		13.43281	144.63373	Observation	CM	1								
04-Jun-19		13.43198	144.63483	Observation	CM	1								
04-Jun-19		13.43005	144.63611	Observation	CM	1								
04-Jun-19		13.43488	144.63062	Observation	CM	1								
04-Jun-19		13.43493	144.62958	Observation	CM	1								
04-Jun-19		13.43503	144.6286	Observation	CM	1								

Date	Site	Longitude	Latitude	Type	Sp.	No.	Attach.	Argos ID	SCL	Sex	L. Flipper	R Flipper	Left PIT	Right PIT
04-Jun-19		13.44014	144.62057	Observation	CM	1								
04-Jun-19		13.43449	144.63181	Observation	CM	1								
05-Jun-19	Dump to Orote Point	13.43274	144.6346	Capture	EI	1			60.1	U	PI4453	PI1579	982.000168	982.000168
05-Jun-19	Barracuda Rock	13.43344	144.63348	Capture	CM	1			46	U	PI5815	PI5814	982.000364	982.000364
05-Jun-19	Dump to Orote Point	13.43898	144.62238	Capture-SatTagApplied	CM	1	Wildlife Computers SPOT	171262	41.4	U	PI5819	PI5818	982.000406	982.000191
05-Jun-19	Barracuda Rock	13.43501	144.62943	Capture-SatTagApplied	CM	1	Wildlife Computers SPLASH	178558	47.1	U	PI5816	PI5817	982.000364	982.000364
05-Jun-19	Barracuda Rock	13.43302	144.63396	Capture-SatTagApplied	CM	1	Wildlife Computers SPLASH	178559	48.7	U	PI5812	PI5813	982.000402	982.000364
05-Jun-19	Western Shoals	13.45229	144.65399	Observation	Cm	1								
05-Jun-19	Western Shoals	13.45113	144.6541	Observation	CM	1								
05-Jun-19	Dump to Orote Point	13.43532	144.62823	Observation	CM	1								
05-Jun-19	Barracuda Rock	13.43409	144.63153	Observation	CM	1								
05-Jun-19	Barracuda Rock	13.43327	144.6326	Observation	CM	1								
05-Jun-19	Barracuda Rock	13.43396	144.63174	Observation	CM	1								
05-Jun-19	Western Shoals	13.45186	144.65388	Observation	CM	1								
05-Jun-19	Kilo Wharf/Spanish Steps	13.44902	144.62648	Observation	CM	1								
05-Jun-19	Kilo Wharf/Spanish Steps	13.44988	144.62096	Observation	CM	1								
05-Jun-19	Kilo Wharf/Spanish Steps	13.44968	144.6201	Observation	CM	1								
05-Jun-19	Kilo Wharf/Spanish Steps	13.44703	144.61752	Observation	CM	1								
05-Jun-19	Barracuda Rock	13.43327	144.6326	Observation	EI	2								

Date	Site	Longitude	Latitude	Type	Sp.	No.	Attach.	Argos ID	SCL	Sex	L. Flipper	R Flipper	Left PIT	Right PIT
07-Jun-19	Outer edge	13.59553	144.83263	Capture-SatTagApplied	EI	1	Wildlife Computers SPLASH	176774	43.5	U	PI5824	PI5825	982.000364	982.000364
07-Jun-19	North Double Reef, outer edge	13.59972	144.83177	Capture-SatTagApplied	EI	1	Wildlife Computers SPLASH	178560	42.3	U	PI5822	PI5823	982.000364	982.000364
07-Jun-19	Outer edge	13.59483	144.83406	Observation	EI	1								
07-Jun-19	North Double Reef, outer edge	13.59878	144.83098	Observation	CM	1								
07-Jun-19		13.59001	144.83374	Observation	CM	1								
07-Jun-19	Tumon Bay			Observation	UN	1								
07-Jun-19	Outer edge	13.59504	144.83273	Observation	EI	1								
07-Jun-19	Outer edge	13.59519	144.83293	Observation	CM	1								
07-Jun-19	Outer edge	13.59552	144.83241	Observation	CM	1								
07-Jun-19		13.48961	144.7551	Observation	CM	1								
07-Jun-19		13.59711	144.833583	Observation	UN	1								
08-Jun-19		13.57747	144.82809	Capture-SatTagApplied	CM	1	Wildlife Computers SPLASH	178561	43.2	U	PI3010	PI3011	982.000168	982.000364
08-Jun-19		13.59514	144.83319	Observation	CM	1								
08-Jun-19		13.60155	144.83392	Observation	EI	1								
08-Jun-19		13.60227	144.83543	Observation	CM	1								
08-Jun-19		13.60256	144.83534	Observation	EI	1								
08-Jun-19		13.60551	144.83553	Observation	CM	1								
08-Jun-19		13.60569	144.83492	Observation	CM	1								
08-Jun-19		13.57771	144.82797	Observation	CM	1								
09-Jun-19		13.59904	144.83546	Observation	CM	1								
09-Jun-19		13.60064	144.83519	Observation	CM	1								
09-Jun-19		13.5955	144.83449	Observation	EI	1								
09-Jun-19		13.59638	144.83092	Observation	CM	2								
09-Jun-19		13.58919	144.83443	Observation	EI	1								
09-Jun-19		13.5949	144.83394	Observation	CM	1								
09-Jun-19		13.59492	144.83391	Observation	Cm	1								

Date	Site	Longitude	Latitude	Type	Sp.	No.	Attach.	Argos ID	SCL	Sex	L. Flipper	R Flipper	Left PIT	Right PIT
09-Jun-19		13.59491	144.83385	Observation	EI	1								
09-Jun-19		13.60086	144.83525	Observation	CM	1								