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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 MARIANA ISLANDS TRAINING AND TESTING (MITT) STUDY AREA

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Summer L. Martin, Ph.D.
Alexander R. Gaos, 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

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BACKGROUND:

The U.S. Navy developed monitoring questions for the Mariana Islands Training and Testing (MITT) study area (under the Mariana Islands Range Complex Monitoring Plan) as required under the Marine Mammal Protection Act (MMPA) of 1972 and the Endangered Species Act (ESA) of 1973. The MITT monitoring questions outline the scope of monitoring the Navy will undertake to understand marine mammal and sea turtle distribution and, ultimately, impacts from Navy training and testing. The monitoring described in this annual report will result in partial fulfillment of the ESA Biological Opinion (BO) received for the MITT in 2015. The overall objective of the plan is to collect field data that will enable the Navy and NOAA Fisheries to better understand the distribution and habitat use of sea turtles in the Mariana Islands. Data generated via implementation of this monitoring plan will be integrated into the Navy-wide Integrated Comprehensive Monitoring Program (ICMP). Of the 5 species of sea turtles associated with the MITT, this annual report provides data on the habitat and movements of green turtles (*Chelonia mydas*) and hawksbill turtles (*Eretmochelys imbricata*) that were tagged by PIFSC-MTBAP staff and satellite-tracked in the nearshore waters of Saipan, Tinian, and Guam. The other three species are not generally associated with neritic nearshore waters and were not observed during the monitoring years.

GUIDING QUESTIONS FROM THE FY13-15 MONITORING PLAN:

- Are there locations of greater cetacean and/or sea turtle concentration around Guam, Saipan, and Tinian?
- What is the occurrence and habitat use of sea turtles in the MITT study area?
- What is the exposure of cetaceans and sea turtles to explosives and/or sonar in the MITT study area?

SUMMARY OF TASKS:

1. Capture and tag sea turtles in the MITT study area, and deploy biotelemetry devices
2. Process and analyze biotelemetry data and other survey data
3. Prepare annual reports

PROGRESS ON FIELD RESEARCH:

The most recent field research was conducted on October 17-27, 2017. Drs. Summer Martin and Camryn Allen of the Marine Turtle Biology and Assessment Program (PIFSC, NOAA Fisheries), together with local partners, conducted marine turtle surveys and in-water captures of green turtles (*Chelonia mydas*) and hawksbill turtles (*Eretmochelys imbricata*). Captured turtles were weighed, measured, biopsied, and tagged (i.e., flipper, PIT, satellite tracking) in an effort to expand our knowledge of the population demographics, population structure, and fine-scale habitat use of the turtles. Blood samples were also collected for two studies: 1) hormone analysis to determine population sex ratios, and 2) metabolite analysis to determine nutritional/feeding state. The aforementioned activities were permitted under National Marine Fisheries Service ESA10a1A Take permit #17022 and NMFS IACUC SWPI2013-05R. Additionally, in Guam, the Division of Aquatic and Wildlife Resources (DAWR) biologists were provided with hands-on refresher training. In both Guam and the Commonwealth of the Northern Mariana Islands (CNMI), local partners continue to be engaged in this collaborative research effort. Many of these activities are part of the larger collaborative effort with NOAA Fisheries, Guam DAWR, CNMI Department of Lands and Natural Resources (DLNR), Naval Base Guam, and the U.S. Pacific Fleet Environmental Readiness Office.

The recent mission included 6 days of in-water surveys and turtle captures in Guam and Saipan. Activities in Guam were focused on the nearshore waters from the Hagatna boat basin (central west coast) north to Tumon Bay and beyond, including Tanguisson. In Saipan, activities were conducted from Sugar Dock (central west coast) north to Wing Beach, including the reef outside Mañagaha Island. Suboptimal weather conditions prohibited operations on two days, but the team successfully surveyed all new areas on the six remaining in-water days. Captured turtles were typically processed and satellite tagged on the boats, except when weather conditions (e.g., rain and swell) were unfavorable, in which case the team brought the turtles back to shore for processing and released them later. Turtles meeting satellite tagging criteria (straight carapace length > 45 cm and good body condition) were equipped with Wildlife Computers SPLASH 297A satellite tags with Fastloc GPS capability and temperature and depth sensors.

Days 1-3 of in-water surveys were conducted along the western coast of Guam, primarily along the outer reef of Tumon Bay. The team also surveyed waters north and south of Tumon Bay, but most captures occurred in Tumon Bay. This was a successful contribution to the long-term project as no surveys or captures had previously occurred at these sites. Days 4-6 of in-water surveys were conducted along the western coast of Saipan, mainly from Mañagaha Island north to Wing Beach. New areas surveyed included waters off of Wing Beach, Pau Pau Beach, Aqua Hotel Reef, and outside of Mañagaha Island. Despite some swell, the team was successful in capturing and satellite tagging turtles from all sites, which will fill in important geographic gaps in the project. Over the 6 in-water days, the team observed a total of 84 turtles, 24 of which were captured and 15 of which were outfitted with Wildlife Computers SPLASH satellite transmitters.

PROGRESS ON DATA ANALYSIS:

Data analysis and collection are ongoing from the 2013 season to present. The PIFSC project staff are currently processing satellite tracking data as they arrive from Collecte Localisation Satellites America (CLSA) which collects and stores the Argos satellite information. These data will be organized and analyzed to understand spatial distribution and depth and temperature profiles for tagged turtles.

The findings presented here provide essential biogeographical and historical context for understanding the spatial distribution and abundance of sea turtles and other large marine vertebrates in the MITT. Furthermore, these data and analyses have helped to inform the proposed Critical Habitat for the Endangered Central West Pacific distinct population segment of green turtle (NMFS and USFWS 2015). They have also informed incidental take statements and impact assessments for NOAA Fisheries ESA Section 7 and Biological Opinion needs.

In January of 2016, the first manuscript derived from this Navy / NOAA interagency agreement was published, “Five Decades of Marine Megafauna Surveys from Micronesia” Martin et al. 2016 Frontiers in Marine Science doi.org/10.3389/fmars.2015.00116 (see attached publication in Appendix I). The analysis suggested a substantial but isolated increase in sea turtles over the last five decades in Guam. Specifically, there was an observed island-wide trend in turtle counts from semimonthly aerial surveys (surveys conducted by Guam DAWR). The mean annual population growth rate of turtles (mostly green sea turtles) was 8.0% (s.d. = 5.7%) since 1963 and 9.3% (s.d. = 3.5%) since 1989.

PIFSC staff are working on the second major manuscript with a target publication date in 2018. The manuscript, “Reef-dwelling turtles of the Mariana Archipelago: fine-scale habitat use revealed by multiple in-water surveys and GPS telemetry,” will provide further analysis of the boat-based and snorkel surveys and satellite telemetry efforts in this study, including in-depth analyses of horizontal, vertical, temporal, and temperature-based habit use by perhaps the largest sample of juvenile foraging green and hawksbill turtles in the literature. A third manuscript, with a 2019 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 over 1,688 observations. The synthesis of results from three in-water survey methods with data from the first in-water satellite transmitter deployments in this archipelago will advance our understanding of the distribution, horizontal movements, and habitat use patterns of green and hawksbill turtles throughout the Mariana Archipelago.

PROGRESS ON DATA AVAILABILITY:

The supplementary materials list all data available to date. The listed files include (1) all boat survey tracks from the 2013-2017 field seasons throughout the MITT study area, (2) all metadata on turtle observations, captures, and satellite tag deployments in 2013-2017 (date, location, species, numbers of all tags applied, turtle length measurement, etc.), (3) all metadata on cetacean observations for 2016-2017 (date, location, species), (4) time-at-depth histogram data from satellite tags deployed in 2014-2017 (raw data are provided as the proportion of time spent at binned depths for designated periods of time), (5) time-at-temperature histogram data from satellite tags deployed in 2014-2017 (raw

data are provided as the proportion of time spent at binned temperatures for designated periods of time), (6) raw x,y Argos location data from Wildlife Computers SPLASH Satellite tags deployed in 2013-2016 (with table for interpretation of Argos derived locations), and (7) raw x,y GPS location data from Wildlife Computers SPLASH Satellite tags (with table for interpretation of GPS locations)

METHODS:

In-water surveys and capture

The small boat surveys were conducted in the nearshore and coastal waters of Guam, Saipan, and Tinian (Figure 1). Turtles encountered on surveys were hand captured while snorkeling or 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 placed in turtle holding bins. 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-17-001.

All turtles were tagged with metal (Inconel) self-piercing sea turtle 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 turtle mass were measured, and turtles of appropriate SCL (see Jones et al. 2013) were outfitted with a satellite tag (Wildlife Computers SPLASH/SPOT tags with GPS Fast-Loc technology, temperature, and depth).

All satellite tags are the SPLASH10-F series of Platform Transmitting Terminals by Wildlife Computers. They are data-archiving tags that transmit to the Argos system. In addition to Argos-derived location data, the tags also upload sensor data that include GPS derived location, depth, temperature, light level, and wet/dry (based on conductivity). For this study we used SPLASH10-F tags that range in frontal area from 48 – 59 cm^2; the sole difference in the tags used is the battery life, and the smaller frontal area allows us to use the tags on smaller juvenile turtles. Satellite tag attachment followed the drag recommendations of Jones et al. (2011, 2013) and the attachment methods as described in Jones and Van Houtan (2012). 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 it from damage by reef and rock ledges during the course of normal turtle behavior. This technique is widely used and works well with reef-dwelling hawksbill or green turtles. Captured turtles that were too small, had poor body condition, or physical abnormalities were not outfitted with a satellite tag.

Home range estimates and movements

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. Turtle movement tracks were created using all available x, y Argos locations; however, kernel interpolation with barriers (KIWB) and the associated 50% and 95% density volume contours were generated from GPS x, y locations only. The KIWB method was selected over traditional kernel density estimation (KDE) due to its ability to account for land barriers for nearshore marine species (Sprogis et al. 2016). All tracks and density estimates were performed in ARCGIS (ESRI 2012). The data analysis is 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.

Further details on the KIWB estimates in ARCGIS are given here. The KIWB tool is available within the 'Geostatistical Analyst' toolbox section of ARCGIS. Prior to performing a KIWB estimate on a set of GPS points, we grouped the data by species and tagging location and filtered out (i) all points that occurred within the first two weeks of tag deployment (to remove erratic behavior and displacement from capture), (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 area and home range, respectively. We calculated the area of each volume contour polygon (km^2) to quantify core area and home range and allow for comparisons across sites.

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 of a turtle before it began its long-distance movement out of an area and (ii) the first GPS location point associated with its arrival at the new location.

Temperature data and depth data were collected every 10 seconds and archived by the Wildlife Computers tags; these data were then binned and sent via satellite transmissions with the Argos and GPS location data when the turtle surfaced. The binned data gives the percentage of time the turtle was at a particular temperature or depth for every 6-hour period. Maximum dive depth and dive duration data were collected as the number of dives reaching specified bin values for every 6-hour period. The temperature, depth, maximum dive depth, and dive duration bins were as follows:

Temperature:	19, 21, 23, 24, 25, 26, 27, 28, 29, 30, 31, 33, 35, >35 (in degrees Celsius)
Depth:	0, 2, 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 100, >100 (in meters)
Max Dive Depth:	4, 6, 8, 10, 14, 18, 24, 30, 40, 60, 80, >80 (in meters)
Dive Duration:	1, 2, 3, 4, 5, 10, 15, 20, 25, 30, 40, 50, 60, >60 (in minutes)

The total time a turtle was in a particular 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. The data were separated by species.

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 NIST:

Genetic and Stable Isotope analysis NOAA, NMFS, SWFSC
3333 North Torrey Pines Court
La Jolla, CA 92037

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 following is a synopsis of surveys, captures, and analyses to date (2013-2017). The survey tracks and satellite tags deployed by location for the 2013-2017 field seasons can be seen in Figure 1. A total of 36 days of boat-based snorkel survey effort were conducted;17 days in Guam, 11 days in Saipan, and 8 days in Tinian (Table 1, Appendix 1). A total of 375 turtles were encountered (Table 1). Of those encounters, 252 turtles were observed but not captured (46 Saipan, 47 Tinian, 159 Guam), 50 turtles were captured but not outfitted with a Wildlife Computers SPLASH satellite tag (13 Saipan, 19 Tinian, 18 Guam), and 73 turtles were captured and outfitted with a satellite tag (23 Saipan, 23 Tinian, 27 Guam) (Table 1). Of the 252 observations, 69% were identified as green turtles, 4% as hawksbill turtles, and 27% as "unknown" species but either green or hawksbill turtles (Table 1). Of the 44 turtles captured but released without SPLASH tags, 82% were green turtles, and 18% were hawksbill turtles (Table 1). For the 73 satellite tags, 88% were deployed on green turtles and 12% on hawksbill turtles (Tables 1-4). Three of the tags on green turtles failed within two weeks of deployment.

Details on dates, locations, and species of all satellite tag deployments, turtle captures, and turtle observations are provided in Tables 2-4, Appendix 1, and as supplementary files. In 2016-2017, cetacean observations were also recorded during surveys and transit periods; sightings details are provided in Appendix 1. For all captured and tagged turtles, measurements and tag identification numbers are also provided in Tables 2-4 and Appendix 1. Captured green turtles ranged in straight carapace length from 37.2 cm to 84.1 cm (mean = 53.5, sd = 9.2 cm, n = 105) and in mass from 6.6 kg to 76.2 kg (mean = 22.1, sd = 12.9 kg, n = 105). Captured hawksbills ranged in straight carapace length from 34.4 cm to 72.3 cm (mean = 50.4, sd = 11.0 cm, n = 18) and in mass from 4.4 kg to 48.9 kg (mean = 18.2, sd = 12.5 kg, n=18). Two large captured green turtles were determined to be male based on tail length. All other captured turtles were sub-adults for which sex could not be determined using visual observation and morphometric techniques.

The size distributions of green and hawksbill turtles captured in this study are typical for turtles throughout the Mariana Archipelago. From an analysis of over 500 in-water captures from 2006 to 2014, Summers et al. (2017) suggest 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, remaining in the nearshore waters for an estimated 17 years (13 – 28 years: 95% confidence interval) between recruitment and maturity. Except for the two adult males, the turtles captured in this study are mostly juveniles and subadults residing in developmental foraging grounds.

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

The KIWB estimates and volume contours in Figures 2-7 elucidate the general habitat use, home range, and core area for turtles tagged in each location based on their horizontal movements. Of the 73 satellite devices deployed, three were not included in this analysis due to lack of sufficient data, either from immediate failure of the tag or less than two weeks of data collected from the deployment date. Details on the number, species, and carapace lengths of turtles tagged at each site are provided in Tables 2-4, along with the longevity (i.e., transmission days), Argos IDs, current status (e.g., active) of the tags, and core use and home range areas (km^2) from the KIWB analysis.

Tag longevity, calculated from 56 tags that were no longer transmitting a signal as of January 1, 2018, was similar across islands. For green turtles, tags transmitted data for an average of 187 days on Saipan (sd = 173, n = 16 tags), 162 days on Tinian (sd = 77, n = 17 tags), and 167 days on Guam (sd = 66, n = 16 tags). For hawksbill turtles, tag life was 669 days on Saipan (sd = 850, n = 2 tags) and 693 days on Tinian (sd = 349, n = 5 tags). For the three islands combined, tags lasted an average of 172 days (sd = 113, n = 49 tags) on green turtles and 686 days (sd = 449, n = 7) on hawksbill turtles. Maximum tag life was 721 days for green turtles (Argos ID 131995 tagged on the northern shore of Saipan at Spotlight; Table 2 and Figure 3D) and 1,270 days for hawksbill turtles (Argos ID 85496 tagged on the west coast of Saipan at Balisa; Table 2 and Figure 2D). Eleven tags were still active and transmitting data on January 1, 2018, and three were possibly still transmitting. All of these were deployed in 2017 (Table 2).

KIWB estimates revealed high site fidelity and limited movements for both green and hawksbill turtles while residents of Guam, Tinian, and Saipan (Figures 2-7 and Table 2). Across all islands and sites, the core area (50% KIWB

volume contour) was geographically concentrated for both green turtles (mean = 0.51 km^2, sd =0.66 km^2, range = 0.03 – 2.58 km^2) and hawksbill turtles (mean = 0.26 km^2, sd = 0.13 km^2, 0.10 – 0.46 km^2). Home ranges (95% KIWB volume contour) were also similar for the two species, with green turtles using an average area of 3.20 km^2 (sd = 4.47 km^2, range = 0.07 – 18.17 km^2) and hawksbill turtles 3.29 km^2 (sd = 4.67 km^2, range = 0.20 – 12.57 km^2). For green turtles, there were some subtle inter-island differences in core area, with turtles in Guam (mean = 0.59 km^2, sd = 0.98 km^2, range = 0.08 – 2.58 km^2) and Tinian (mean = 0.57 km^2; sd = 0.19 km^2; range = 0.46 – 0.79 km^2) using slightly larger areas than in Saipan (mean = 0.39 km^2, sd = 0.48 km^2, range = 0.03 – 1.33 km^2). Home range of green turtles was also larger on Guam (mean = 4.20 km^2, sd = 6.88 km^2, range = 0.43 – 18.17 km^2) and Tinian (mean = 3.09 km^2, sd = 0.78 km^2, range = 2.24 – 3.76 km^2) than on Saipan (mean = 2.26 km^2, sd = 2.45 km^2, range = 0.07 – 6.59 km^2). The two hawksbill turtles tagged in Saipan had a similar core area (mean = 0.21 km^2, sd = 0.04, range = 0.18 – 0.24) to the two tagged on Tinian (mean = 0.37 km2, sd = 0.13 km^2, range = 0.28 – 0.46 km^2) and the two residing in Guam (mean = 0.22 km^2, sd = 0.17 km^2, range = 0.10 – 0.34 km^2). The home range for the Saipan hawksbills (mean = 1.09 km^2, sd = 1.25 km^2, range = 0.20 – 1.97 km^2) was smaller than for those tagged on Tinian (mean = 2.20 km^2, sd = 1.36 km^2, range = 1.24 – 3.16 km^2) and those residing in Guam (mean = 6.58 km^2, sd = 8.48 km^2, range = 0.59 – 12.57 km^2). Summary statistics specific to each tagging location are broken down in Table 2.

While the majority of tagged turtles remained within a 1-3 km^2 area for the entire life of the tag, there were a few long-range movements. One 61.7 cm hawksbill turtle tagged in 2013 on Tinian traveled 233 km south to the southern coast of Guam, where it remained for over 2 years (Argos ID 85493; Figure 8A). This movement was somewhat unexpected, as hawksbill turtles of this size are not thought to be mature and thus are likely not making breeding migrations yet. Therefore, this turtle possibly moved to a different foraging site, reached maturity at a smaller size than expected and moved to breed, or moved for a different unknown reason. Another 72.3 cm hawksbill tagged in 2014 on Tinian migrated east 2,118 km in 74 days to Ant Atoll adjacent to Pohnpei, Federated States of Micronesia, where it remained in nearshore waters for 10 months (Argos ID 138963; Figure 8B). This individual was likely a mature adult making a long-distance breeding migration to a known breeding site; however, it is also possible that it was concluding a breeding season near Tinian and returning to Ant Atoll to forage. One adult male green turtle tagged off Orote Point in Guam in May 2016 moved 39 km north to Pati Point before making a 70 km roundtrip jaunt offshore and then traveling south again to Apra Harbor and Orote Point (Argos ID 142752; Figure 6D). Given there are known nesting sites near both Pati Point (e.g., along Andersen Airforce Base beaches) and Orote Point (e.g., Spanish Steps in Apra Harbor), this adult male could have been visiting multiple breeding grounds or possibly moving between a combination of foraging and breeding sites. These movements indicate some diversity in nearshore habitat use and movements around the Mariana Islands and beyond. This suggests that movement patterns, residency times, and thus exposure to nearshore threats, likely vary throughout an individual's life, with smaller juvenile turtles potentially spending most of their time in a localized reef area and larger mature turtles having intermittent periods of residency as they move between foraging and breeding grounds.

Dive patterns suggest that both green and hawksbill turtles spend most of their time in waters shallower than 25 m and temperatures of 28-31 °C (Figures 9 and 10), but that habitat differentiation may exist between the two species in this region. Binned depth data from the tags suggest both species made dives down to 100 m; however, hawksbill turtles spent more time in deeper waters than green turtles, with an average depth of 15.5 m compared to 11.2 m (Figure 9) and an average dive depth maximum of 21.8 m compared to 13.1 m (Figure 11). Similarly, hawksbill turtles spent more time in slightly cooler waters, experiencing an average water temperature of 30.0 °C compared to 30.1 °C by green turtles (Figure 10) and longer dive durations of 51 minutes compared to 31 minutes (Figure 12). Time-at-depth, time-at-temperature, maximum dive depth, and dive duration histograms in Figures 9-12 provide a detailed breakdown of these habitat and behavioral variables for each species and suggest that hawksbill turtles spend more time at depth and in cooler water.

PROGRESS TOWARDS SUMMARY OF TASKS:

(1) Capture and tag sea turtles in the MITT study area, and deploy biotelemetry devices

123 captures of turtles in the MITT study area and 73 satellite tags deployed.

(2) Process and analyze biotelemetry data and other survey 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, although some long-distance movements were recorded. Tagging results suggest that movement patterns, residency times, and thus exposure to nearshore threats, likely vary throughout an individual's life. Smaller juvenile turtles potentially spend most of their time in a localized reef area, and larger mature turtles have intermittent periods of residency as they move between foraging and breeding grounds. These habitat use patterns are consistent with previous telemetry studies on reef-dwelling green and hawksbill turtles in other locations, yet possibly reveal habitat niches that are specific to the region.

Fourteen tags are possibly still signaling, and complete analysis is forthcoming. Dr. Summer Martin and MTBAP staff will continue conducting in-depth analysis of satellite tagging data including spatial analysis, dive depth and duration of turtles, and influence of temperature on habitat use. See Figures 2-7 and Table 2 for kernel interpolation estimates, Figure 8 for turtle migratory movements, and Figures 9-12 for dive depth and temperature histograms, as well as maximum dive depth and dive duration profiles.

(3) Prepare annual reports

Complete.

PROGRESS TOWARDS GUIDING QUESTIONS FROM THE FY13-15 MONITORING PLAN:

(i) Are there locations of greater cetacean and/or sea turtle concentration around Guam, Saipan, and Tinian?

Efforts are on-going to answer this question. We have expanded our survey efforts to new areas of the Marianas Archipelago with each field season and have encountered turtles in most locations we have surveyed around Guam, Saipan, and Tinian. The following areas appear to have high turtle density based on our survey experiences: (1) in Guam, the waters inside Apra Harbor near San Luis, Gab Gab, out to Spanish Steps including Dadi and Tipalao beaches outside of the harbor, as well as Cocos Lagoon and Achang Bay (Martin et al. 2016); Tumon Bay also has high density, as recently confirmed by 2017 in-water surveys in this study, (2) in Saipan, the area stretching from the Balisa Channel to Managaha Island, as well as Lao Lao Bay, and (3) the west coast of Tinian. These areas are primarily dominated by patch reef communities where the turtles both forage and rest.

(ii) What is the occurrence and/or habitat use of sea turtles in areas that the Navy conducts underwater detonations?

Seventeen turtles have been outfitted with satellite tags inside and out of Apra Harbor (including capture sites at Orote Point, Dadi Beach, and Piti Bomb Holes), and all but one of the tags have completed their data transmission period. From the spatial analysis of the GPS locations and movements from these satellite tags shown in Figures 6 and 7, we have not seen direct overlap of the turtles or their core use or home range areas with the Agat Bay Mine Neutralization Site, Piti Point Mine Neutralization Site, and Outer Apra Harbor Underwater Detonation Site. However, 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 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.

Activities Planned for 2018:

We have in-water surveys planned for Guam, Saipan, and Tinian in May and July-November (weather dependent) of 2018 to survey new areas and deploy additional satellite tags. We will continue our analyses of the satellite data to understand home range, habitat preferences, preferred depths and temperature, as well as movement within the archipelago. These analyses will provide the basis of a manuscript intended for journal submission in 2018. The research

to date has largely focused on in-water surveys and expansion to regions/areas throughout the archipelago. Moving into FY19 and beyond, our efforts will build from presence/absence to population status and trends and eventually abundance estimates. To get to trends and abundance, the MTBAP will use data derived from the IAA as well as DAWR, PRIFSC CREP, and PIFSC CRP turtle sighting data to gain a more robust understanding of the population distribution and abundance. The MTBAP is also incorporating genetic and hormone assays to get at regional management units and to understand environmental impacts such as climate change. In the coming 2 years our research portfolio will include manuscripts (publications and submissions) describing the in-water and nesting populations, modeling for habitat use, and population abundance.

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Supplementary Material:

1) Text file: PACFLEET1_PIFSC_Turtles_Surveys_GPS_BoatTracks_2013-2017.txt

   Includes all boat survey tracks from the 2013-2017 field seasons throughout the MITT study area.

2) Text file: PACFLEET2_PIFSC_Turtles_Obs_Capts_SatTags_2013-2017.txt

   Includes all metadata on turtle observations, captures, and satellite tag deployments in 2013-2017 (date, location, species, numbers of all tags applied, turtle length measurement, etc.).

3) Text file: PACFLEET3_PIFSC_Cetaceans_Obs_2016-2017.txt

   Includes all metadata on cetacean observations for 2016-2017 (date, location, species).

4) Text file: PACFLEET4_PIFSC_Turtles_SatTags_Locations_GPS_2013-2017.txt

   Includes raw x,y GPS location data from Wildlife Computers SPLASH Satellite tags. See table below for interpretation of GPS locations.

5) Text file: PACFLEET5_PIFSC_Turtles_SatTags_Locations_ARGOS_2013-2017.txt

   Includes raw x,y Argos location data from Wildlife Computers SPLASH Satellite tags deployed in 2013-2017. See table below for interpretation of Argos derived locations.

6) Text file: PACFLEET6_PIFSC_Turtles_SatTags_TimeAtDepth_2014-2017.txt

   Includes time-at-depth histogram data from satellite tags deployed in 2014-2017. Raw data are provided as the proportion of time spent at binned depths for designated periods of time.

7) Text file: PACFLEET7_PIFSC_Turtles_SatTags_TimeAtTemp_2014-2017.txt

   Includes time-at-temperature histogram data from satellite tags deployed in 2014-2017. Raw data are provided as the proportion of time spent at binned temperatures for designated periods of time.

8) Text file: PACFLEET8_PIFSC_Turtles_SatTags_DiveDepth_2014-2017.txt

   Includes dive depth histogram data from satellite tags deployed in 2014-2017. Raw data are provided as the number of dives reaching the maximum depth within specified bins for designated periods of time.

9) Text file: PACFLEET9_PIFSC_Turtles_SatTags_DiveDuration_2014-2017.txt

   Includes dive duration histogram data from satellite tags deployed in 2014-2017. Raw data are provided as the number of dives reaching the durations within specified bins for designated periods of time.

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)			

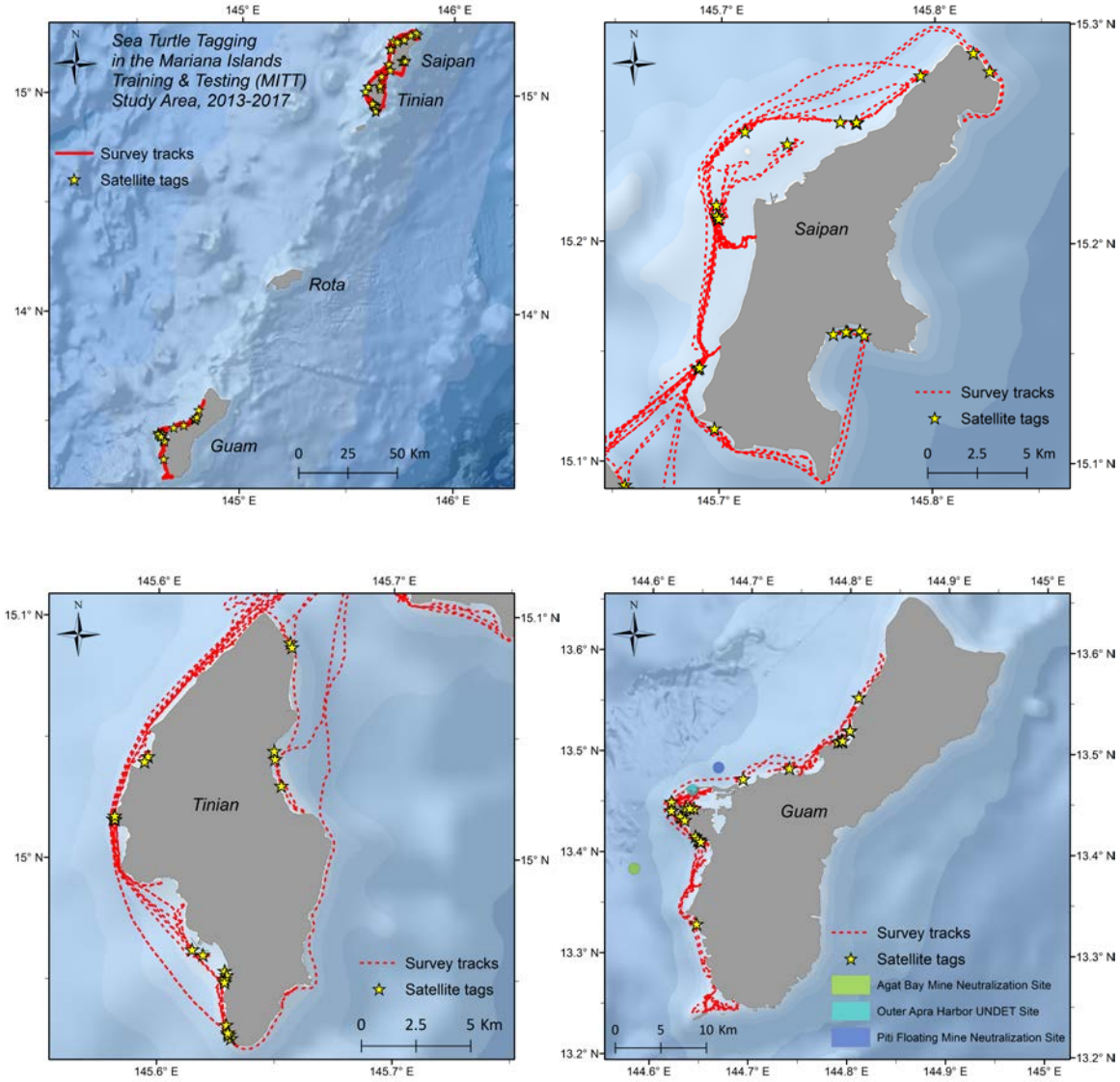

Figure 1. Marine turtle surveys and satellite tag deployment locations in the Mariana Islands Training and Testing (MITT) study area. Red lines on each map are small-boat GPS tracks from sea turtle surveys conducted in the nearshore waters of Saipan, Tinian, and Guam in 2013-2017. Yellow stars indicate locations of satellite tag deployments on green and hawksbill turtles captured during surveys. Navy sites on Guam are depicted with colored circles.

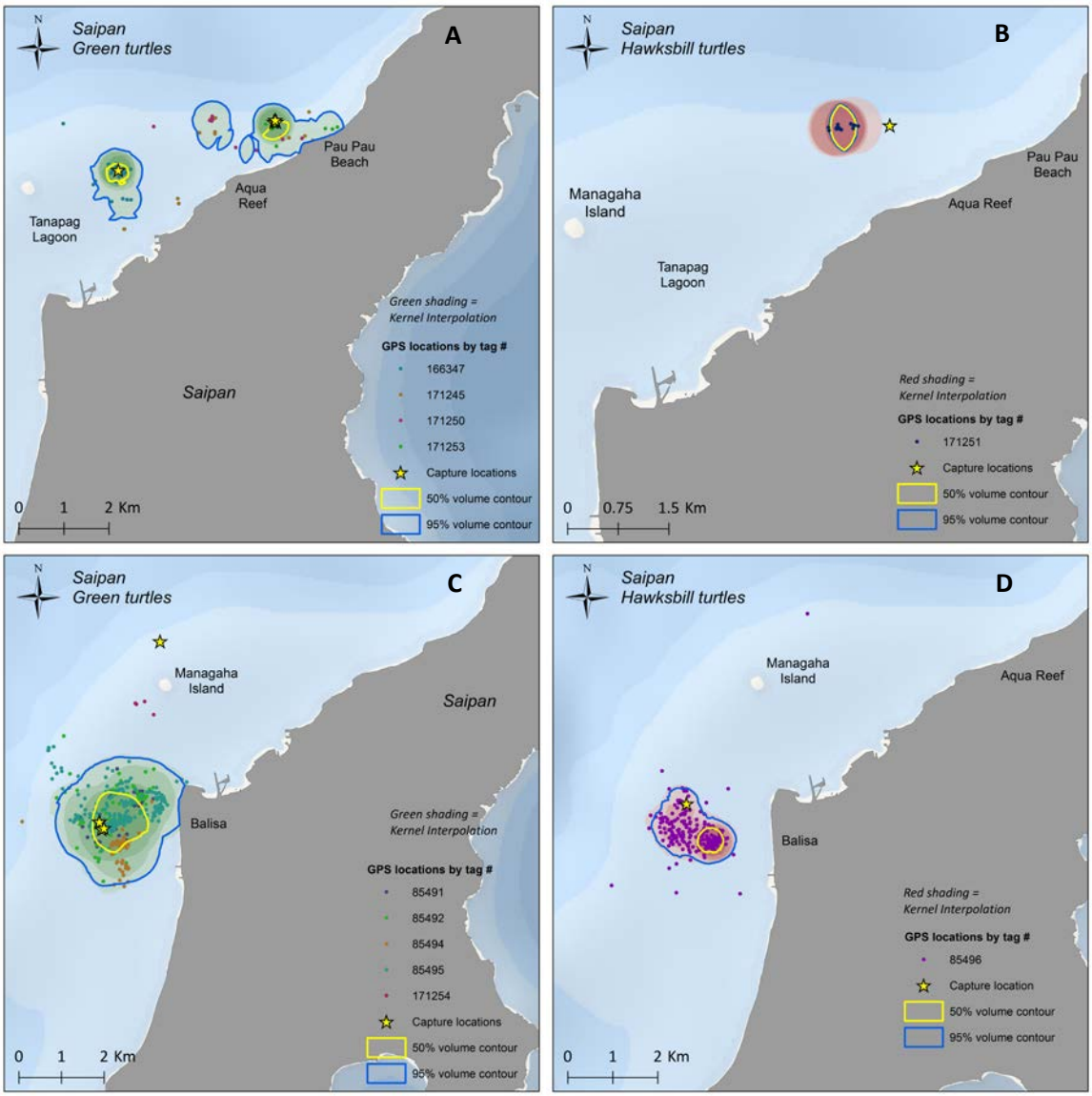

Figure 2. Habitat use maps for green and hawksbill turtles tagged in western Saipan (sites: Pau Pau Beach, Aqua Reef, Tanapag Lagoon, Outer Mañagaha Island, and Balisa). GPS location data were analyzed using a Kernel Interpolation with Barriers method. Darker shades of green (green turtles) or red (hawksbill turtles) indicate higher density of GPS location points, with the 50% (core area) and 95% (home range) volume contours outlined in yellow and blue, respectively. For each map, Table 2 provides a summary of the core area and home range sizes, the status of each tag as of January 1, 2018 (active/inactive), the transmission time for each tag ("tag life"), the last signal date, and the date, location, and size of turtle for each tag.

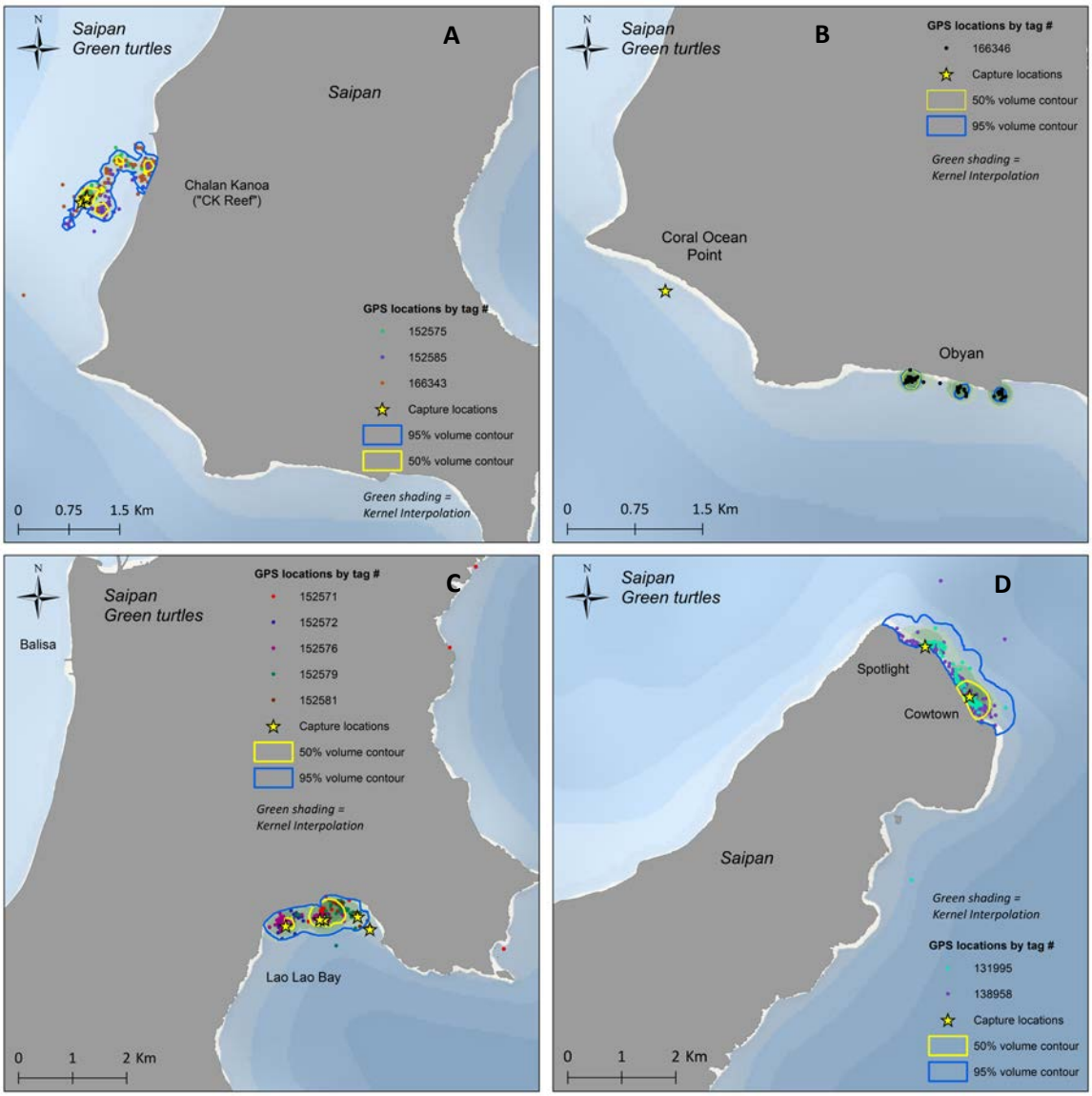

Figure 3. Habitat use maps for green and hawksbill turtles tagged in southern, eastern, and northern Saipan (sites: Chalan Kanoa Reef, Coral Ocean Point, Lao Lao Bay, Cowtown, and Spotlight). GPS location data were analyzed using a Kernel Interpolation with Barriers method. Darker shades of green (green turtles) or red (hawksbill turtles) indicate higher density of GPS location points, with the 50% (core area) and 95% (home range) volume contours outlined in yellow and blue, respectively. For each map, Table 2 provides a summary of the core area and home range sizes, the status of each tag as of January 1, 2018 (active/inactive), the transmission time for each tag ("tag life"), the last signal date, and the date, location, and size of turtle for each tag

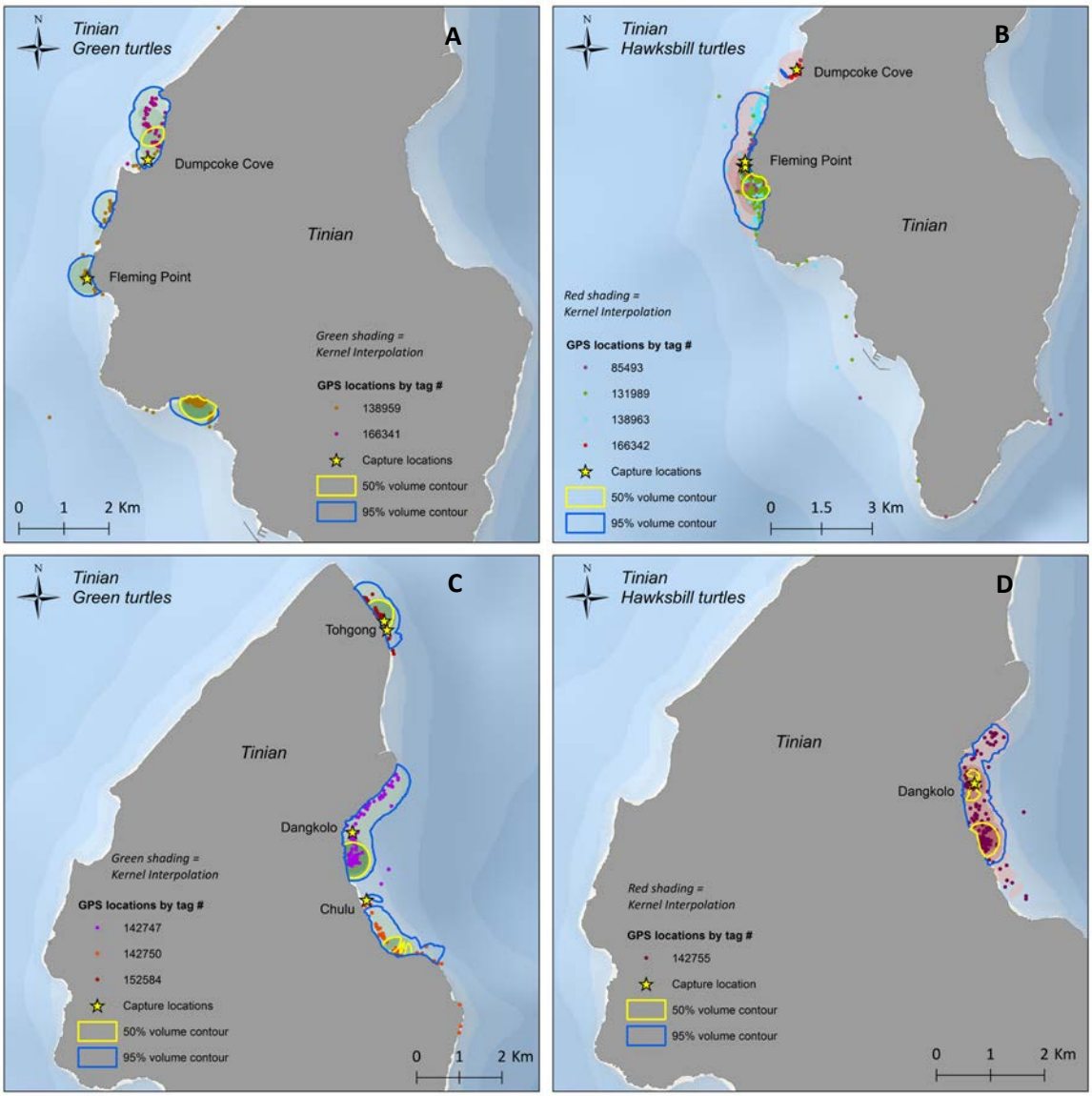

Figure 4. Habitat use maps for green and hawksbill turtles tagged in northwest and northeast Tinian (sites: Dumpcoke Cove, Fleming Point, Chulu, Dangkolo, and Tohgong). GPS location data were analyzed using a Kernel Interpolation with Barriers method. Darker shades of green (green turtles) or red (hawksbill turtles) indicate higher density of GPS location points, with the 50% (core area) and 95% (home range) volume contours outlined in yellow and blue, respectively. For each map, Table 3 provides a summary of the core area and home range sizes, the status of each tag as of January 1, 2018 (active/inactive), the transmission time for each tag ("tag life"), the last signal date, and the date, location, and size of turtle for each tag.

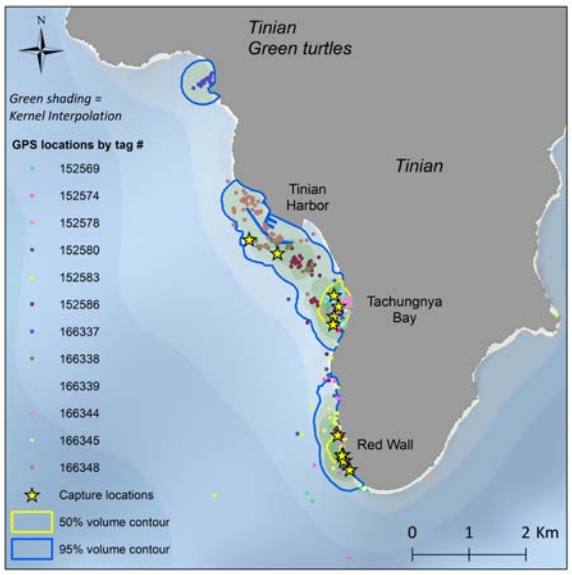

Figure 5. Habitat use map for green turtles tagged in southern Tinian (sites: Red Wall, Tachungnya Bay, Tinian Harbor). GPS location data were analyzed using a Kernel Interpolation with Barriers method. Darker shades of green (green turtles) or red (hawksbill turtles) indicate higher density of GPS location points, with the 50% (core area) and 95% (home range) volume contours outlined in yellow and blue, respectively. For each map, Table 3 provides a summary of the core area and home range sizes, the status of each tag as of January 1, 2018 (active/inactive), the transmission time for each tag ("tag life"), the last signal date, and the date, location, and size of turtle for each tag.

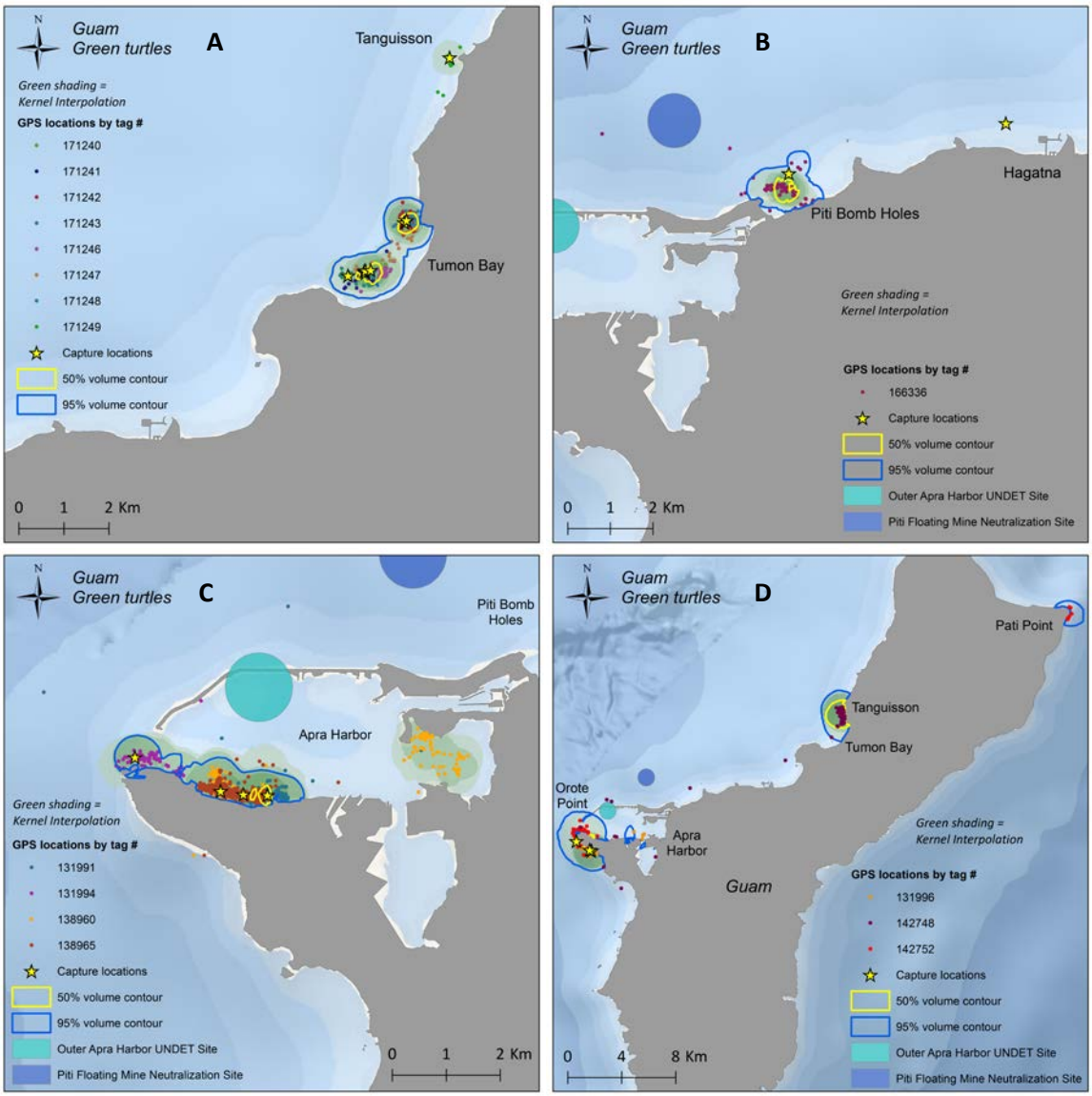

Figure 6. Habitat use map for green turtles tagged in western Guam (sites: Tanguisson, Tumon Bay, Piti Bomb Holes, Apra Harbor, and Orote Point). GPS location data were analyzed using a Kernel Interpolation with Barriers method. Darker shades of green (green turtles) or red (hawksbill turtles) indicate higher density of GPS location points, with the 50% (core area) and 95% (home range) volume contours outlined in yellow and blue, respectively. For each map, Table 4 provides a summary of the core area and home range sizes, the status of each tag as of January 1, 2018 (active/inactive), the transmission time for each tag ("tag life"), the last signal date, and the date, location, and size of turtle for each tag. The points at Pati Point in (D) are from an 82.3 cm (straight carapace length) adult male green turtle that was tagged in May 2016 at Orote Point. It moved away on 13 September 2016 and arrived 5 days later at Pati Point, northeastern Guam, traveling over 39 km. It moved offshore to the northeast of Pati Point between 20-28 September, with a roundtrip distance of at least 70 km. On 23 October, it returned south to Apra Harbor near Spanish Steps, arriving 4 days later on 27 October after another 39 km (minimum distance) trip. It then moved out of the harbor back to its tagging location at Orote Point between 29-31 October (> 2.6 km distance).

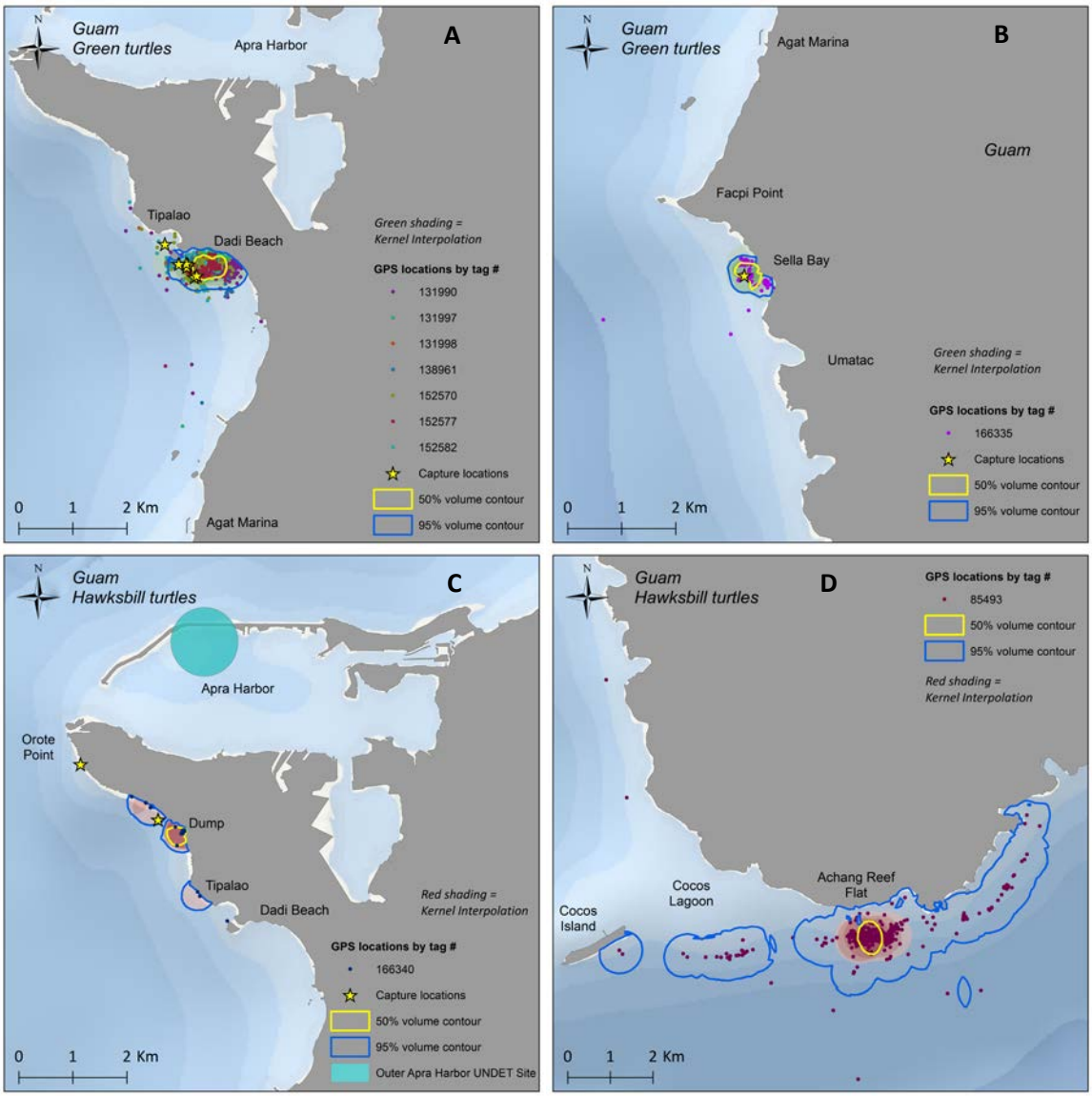

Figure 7. Habitat use map for green and hawksbill turtles tagged in western Guam and northwestern Tinian (sites: Dadi Beach, Sella Bay, Orote Point in Guam and Fleming Point in Tinian). Tags were deployed in Guam in A-C, but the hawksbill turtle in D was tagged at Fleming Point in Tinian and migrated to Guam. GPS location data were analyzed using a Kernel Interpolation with Barriers method. Darker shades of green (green turtles) or red (hawksbill turtles) indicate higher density of GPS location points, with the 50% (core area) and 95% (home range) volume contours outlined in yellow and blue, respectively. For each map, Table 4 provides a summary of the core area and home range sizes, the status of each tag as of January 1, 2018 (active/inactive), the transmission time for each tag ("tag life"), the last signal date, and the date, location, and size of turtle for each tag.

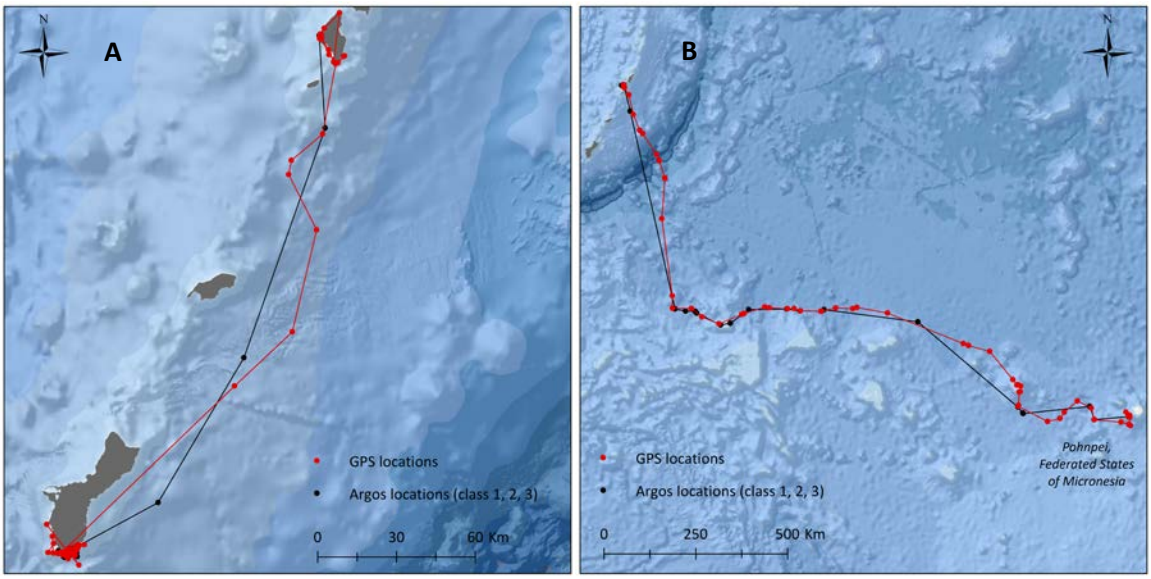

Figure 8. Migration of hawksbill turtles from Tinian to Guam and Pohnpei. (A) A 61.7 cm hawksbill turtle (Argos ID: 85493) was tagged 20 August 2013 at Fleming Point, Tinian. It departed Tinian on 11 October 2013 and arrived 5 days later in Cocos Lagoon, southern Guam on 16 October 2013 after traveling a distance of 233 km. This turtle remained in nearshore waters along the south and southwest coasts of Guam for over 2 years until 27 February 2016, when the last signal was transmitted. Total tag transmission time was 922 days or 2.5 years. (B) A 72.3 cm hawksbill turtle (Argos ID: 138963) was tagged 21 July 2014 at Fleming Point, Tinian. It departed Tinian on 18 April 2015 and arrived 74 days later to Ant Atoll adjacent to Pohnpei, Federated States of Micronesia on 1 July 2015 after traveling a distance of 2,118 km. It remained in the nearshore waters of Ant Atoll for 10 months until its last signal transmission on 27 April 2016. Total tag transmission time was 646 days or 1.8 years.

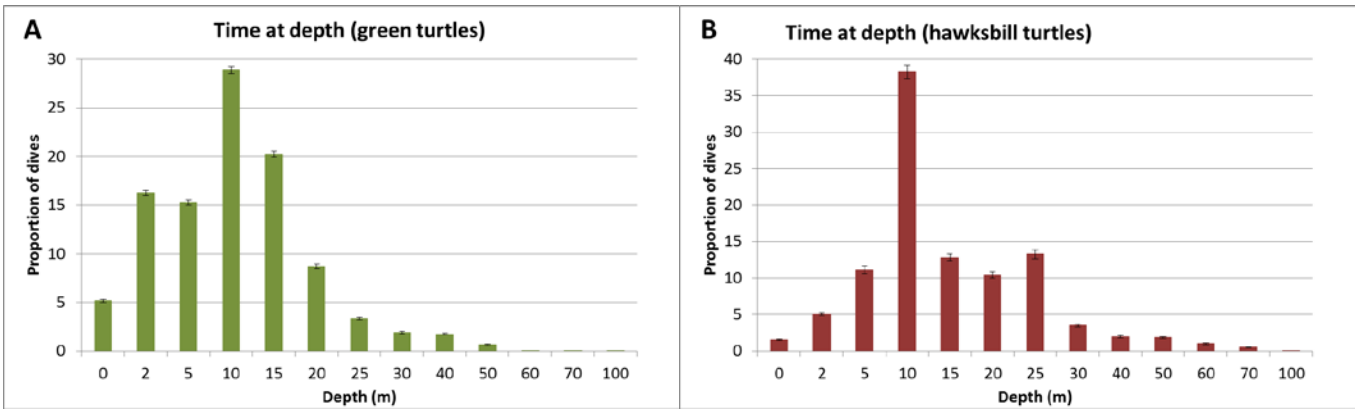

Figure 9. Proportion of time-at-depth profiles for 57 green turtles (A) and 7 hawksbill turtles (B) in the MITT study area in 2014-2017. Green turtles resided between the surface and 25 m depth 98% of the time, with an average depth of 11.2 m. Hawksbill turtles spent more time at deeper depths, with 93% of the time spent between the surface and 25 m and an average depth of 15.5 m. Histogram bars are time-at-depth averages; error bars represent standard error of the mean.

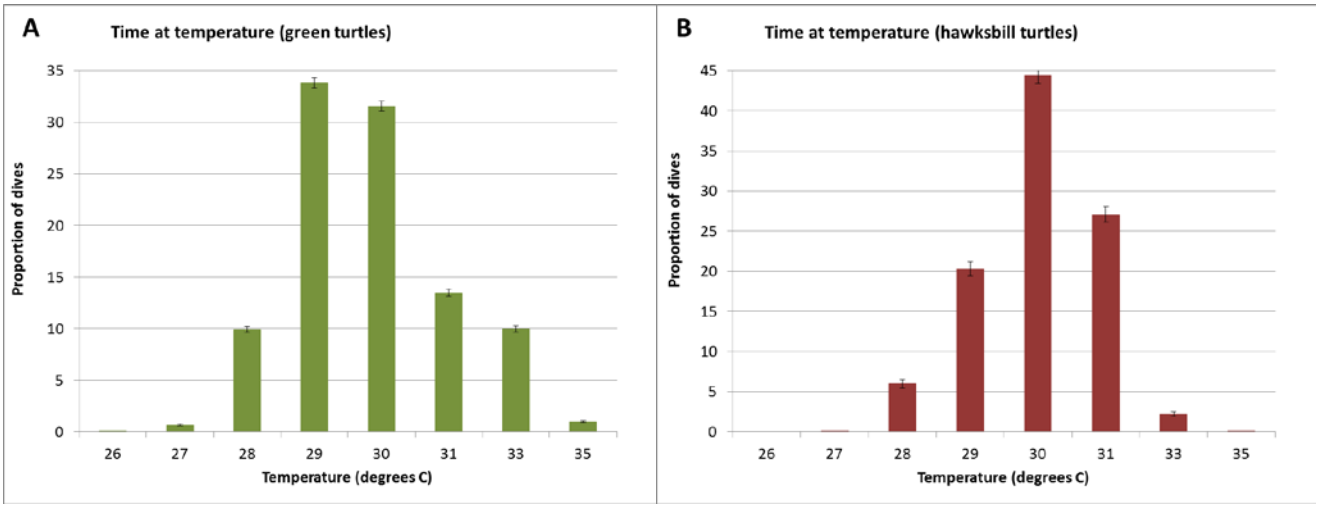

Figure 10. Proportion of time-at-temperature profiles for 57 green turtles (A) and 7 hawksbill turtles (B) in the MITT study area in 2014-2017. Green turtles spent 90% of their time in waters with temperatures 31 °C and below, with an average temperature of 30.1 °C. Hawksbill turtles spent more time in cooler waters, with 98% of the time at temperatures 31 °C and below and an average temperature of 30.0 °C. Histogram bars are time-at-temperature averages; error bars represent standard error of the mean

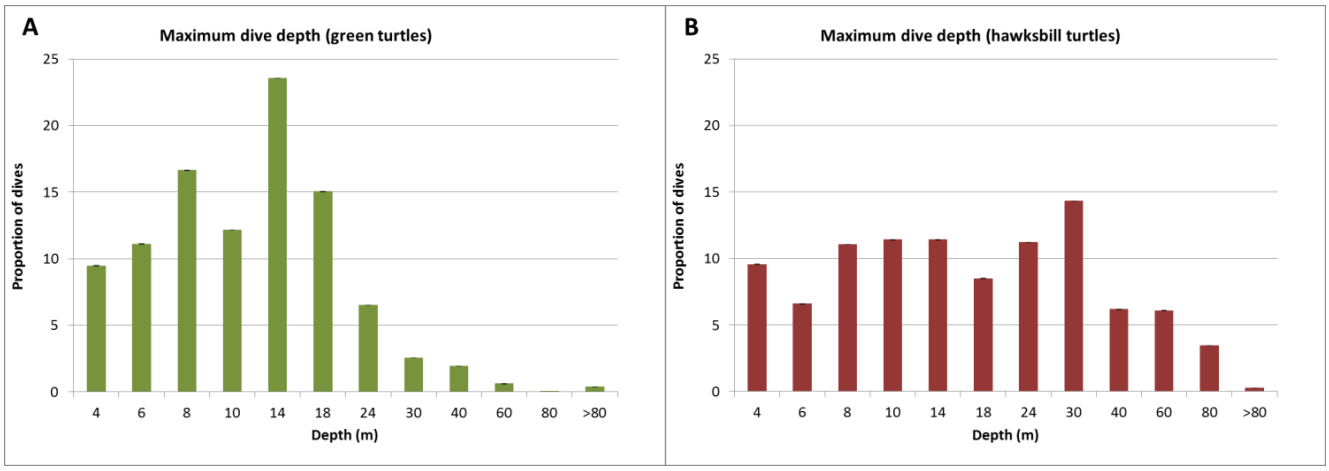

Figure 11. Maximum dive depth profiles for 57 green turtles (A) and 7 hawksbill turtles (B) in the MITT study area in 2014-2017. Green turtles dove to maximum depths of 24 m or less on 95% of their dives, with an average maximum depth of 13.1 m. Hawksbill turtles performed deeper dives more frequently, with only 70% of their dives occurring in the 0 to 24 m depth range, and an average of 21.8 m maximum dive depth. Histogram bars are time-at-depth averages; error bars represent standard error of the mean.

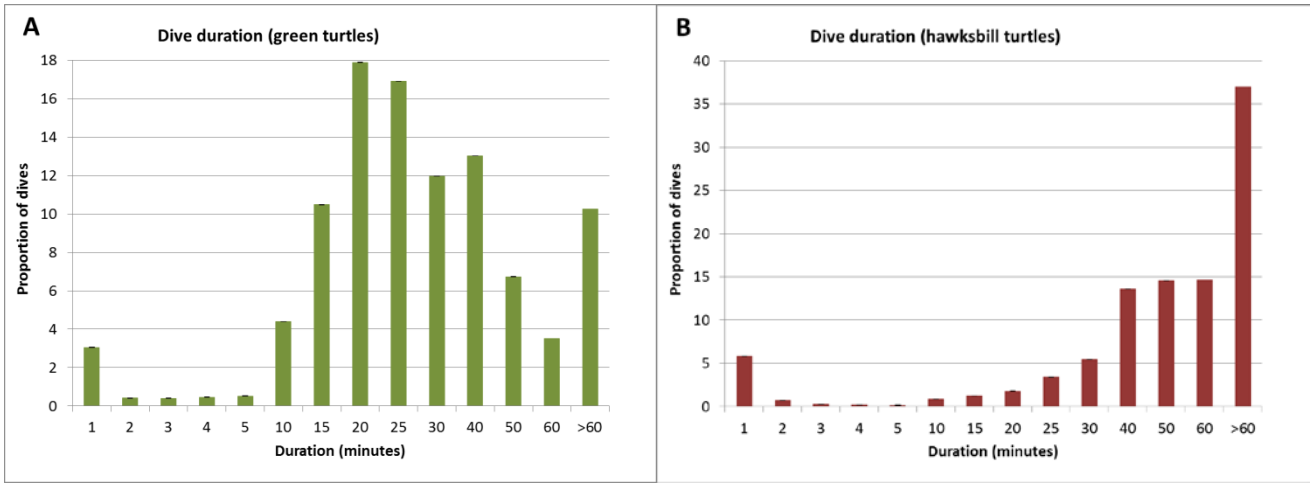

Figure 12. Dive duration profiles for 57 green turtles (A) and 7 hawksbill turtles (B) in the MITT study area in 2014-2017. Green turtles dove for 60 minutes or less on 90% of their dives, with an average dive duration of 31 minutes. Hawksbill turtles performed longer dives more frequently, with only 63% of their dives lasting 60 minutes or less, and an average dive duration of 51 minutes. Histogram bars are time-at-depth averages; error bars represent standard error of the mean.

Table 1. Summary of boat-based snorkel surveys and turtle captures from August 2013 through October 2017. Data include survey dates, site locations, turtle observations (number of individuals), captures, and satellite tag deployments, and cetacean observations (number of individuals). CM = green turtle (*Chelonia mydas*); EI = hawksbill turtle (*Eretmochyls imbricata*); UN = unknown turtle species (either green or hawksbill turtle). Cetacean observations were of spinner dolphins (*Stenella longirostris*) or unknown species.

		Observations only				Captures (no sat tags)			Captures (sat tags)			Cetaceans
Survey Date	**Location**	**CM**	**EI**	**UN**	**Total**	**CM**	**EI**	**Total**	**CM**	**EI**	**Total**	**CET**
8/15/2013	Guam (Cocos Lagoon)	1	-	5	**6**	-	-	-	-	-	**-**	-
8/16/2013	Guam (Cocos Lagoon)	-	-	3	**3**	-	-	-	-	-	**-**	-
8/18/2013	Saipan (Balisa)	-	-	-	**-**	-	-	-	1	1	**2**	-
8/19/2013	Saipan (Balisa)	-	-	-	**-**	-	-	-	2	-	**2**	-
8/20/2013	Tinian (Fleming Point)	-	-	-	**-**	-	-	-	-	1	**1**	-
8/21/2013	Saipan (Balisa)	-	-	-	**-**	-	-	-	1	-	**1**	-
	2013 Subtotals	**1**	**-**	**8**	**9**	**-**	**-**	**-**	**4**	**2**	**6**	**-**
7/15/2014	Guam (Cocos Lagoon + Apra Harbor)	8	-	-	**8**	-	-	-	-	-	**-**	-
7/16/2014	Guam (Apra Harbor + Dadi Beach)	5	-	-	**5**	2	-	**2**	4	-	**4**	-
7/17/2014	Guam (Apra Harbor + Dadi Beach)	8	-	-	**8**	1	1	**2**	3	-	**3**	-
7/18/2014	Guam (Apra Harbor)	-	-	-	**-**	2	-	**2**	1	-	**1**	-
7/21/2014	Tinian (Fleming Point + Dumpcoke)	-	-	-	**-**	4	-	**4**	1	2	**3**	-
7/22/2014	Saipan (Spotlight + Cowtown)	-	-	-	**-**	-	-	**-**	2	-	**2**	-
	2014 Subtotals	**21**	**-**	**-**	**21**	**9**	**1**	**10**	**11**	**2**	**13**	**-**
11/12/2015	Tinian (Red Wall)	4	-	2	**6**	2	-	**2**	6	-	**6**	-
11/13/2015	Saipan (Lao Lao Bay)	1	-	8	**9**	1	-	**1**	5	-	**5**	-
11/14/2015	Saipan (Chalan Kanoa Reef)	-	-	4	**4**	1	-	**1**	2	-	**2**	-
11/17/2015	Guam (Agat Bay + Dadi Beach)	1	-	4	**5**	-	1	**1**	1	-	**1**	-
11/18/2015	Guam (Agat Bay + Dadi Beach)	1	-	9	**10**	-	-	**-**	2	-	**2**	-
	2015 Subtotals	**7**	**-**	**27**	**34**	**4**	**1**	**5**	**16**	**-**	**16**	**-**
5/12/2016	Guam (Apra Harbor + Orote Point)	11	-	4	**15**	6	-	**6**	1	1	**2**	-
5/13/2016	Guam (Orote Point)	12	1	11	**24**	-	-	**-**	2	-	**2**	-
5/15/2016	Tinian (Dangkolo + Chulu)	1	-	8	**9**	1	-	**1**	2	1	**3**	-
5/16/2016	Tinian (Babui Beach + LamLam + Tohgong)	5	1	4	**10**	5	3	**8**	2	-	**2**	-
5/17/2016	Tinian (Chulu + Babui Beach)	4	-	-	**4**	1	1	**2**	-	-	**-**	-
10/26/2016	Tinian (circumnavigate + Tachungnya Bay)	8	1	1	**10**	1	1	**2**	4	-	**4**	12
10/27/2016	Saipan (Chalan Kanoa + Coral Ocean Point)	4	2	-	**6**	2	1	**3**	2	-	**2**	-
10/28/2016	Tinian (Tinian Harbor + Dumpcoke Cove)	7	-	1	**8**		-	**-**	3	1	**4**	-
10/29/2016	Saipan (Tanapag Lagoon + Balisa)	5	-	2	**7**	2	-	**2**	1	-	**1**	27
11/1/2016	Guam (Bile Bay + Sella Bay)	27	2	1	**30**	2	-	**2**	1	-	**1**	30
11/2/2016	Guam (Piti Bomb Holes)	4	-	-	**4**	-	-	**-**	-	-	**-**	-
	2016 Subtotals	**88**	**7**	**32**	**127**	**20**	**6**	**26**	**18**	**3**	**21**	**69**
5/22/2017	Guam (Piti Bomb Holes)	**1**	**-**	**-**	**1**	**-**	**-**	**-**	**1**	**-**	**1**	**-**
5/23/2017	Guam (Orote Point)	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**-**
10/17/2017	Guam (Tanguisson/Tumon)	**17**	**2**	**-**	**19**	**-**	**-**	**-**	**4**	**-**	**4**	**-**
10/18/2017	Guam (Tumon Bay)	**15**	**-**	**-**	**15**	**3**	**-**	**3**	**4**	**-**	**4**	**-**
10/19/2017	Guam (Hagatna)	**6**	**-**	**-**	**6**	**-**	**-**	**-**	**1**	**-**	**1**	**-**
10/25/2017	Saipan (Pau Pau Beach)	**7**	**-**	**1**	**8**	**1**	**-**	**1**	**1**	**1**	**2**	**2**
10/26/2017	Saipan (Wing Beach)	**4**	**-**	**-**	**4**	**3**	**-**	**3**	**3**	**-**	**3**	**-**
10/27/2017	Saipan (Managaha/Tanapag)	**8**	**-**	**-**	**8**	**1**	**1**	**2**	**1**	**-**	**1**	**-**
	2017 Subtotals	**58**	**2**	**1**	**61**	**8**	**1**	**9**	**15**	**2**	**17**	**2**
	2013-2017 Totals	**175**	**9**	**68**	**252**	**41**	**9**	**50**	**64**	**9**	**73**	**71**

Summary for Turtles	
Survey days:	*36*
Encounters:	*375*
Captures:	*123*
Satellite tags.	*73*

Table 2. Saipan summary of 2013-2017 satellite tags by deployment location, Kernel Interpolation with Barriers analysis (KIWB) for core use and home range calculations, and tag life as transmission days.

Fig.	Island	Deploy Location	Deploy Date	Sp.	Argos ID	SCL (cm)	Last Signal GPS	Tag Life (GPS days)	Last Signal Argos	Tag Life (Argos days)	Tag Status 1/1/18	Core use area (sq. km) 50% KIWB contour	Home range (sq. km) 95% KIWB contour	Mean Tag Life (Argos days)
2a	SAIPAN	Wing Arch	10/26/17	CM	171252	54.3	NA	NA	NA	NA	tag failed	0.30	3.62	>112 (ongoing)
		Pau Pau Beach	10/26/17	CM	171245	59.5	12/10/17	46	1/1/18	67	active			
		Pau Pau Beach	10/26/17	CM	171253	49.2	12/29/17	64	12/30/17	66	active			
		Aqua Reef	10/25/17	CM	171250	55.7	12/19/17	55	1/1/18	68	active			
		Tanapag Lagoon	10/29/16	CM	166347	47	6/24/17	239	6/30/17	244	inactive			
2b	SAIPAN	Aqua Reef	10/25/17	EI	171251	50.3	12/20/17	57	1/1/18	68	inactive	0.18	0.20	68
2c	SAIPAN	Outer Managaha	10/27/17	CM	171254	46.3	12/6/17	41	1/1/18	66	active	1.33	6.59	>186 (ongoing)
		Balisa	8/18/13	CM	85491	60.9	10/12/13	56	10/15/13	59	inactive			
		Balisa	8/19/13	CM	85495	66.1	1/18/14	152	1/19/14	154	inactive			
		Balisa	8/19/13	CM	85494	60.4	4/18/14	242	5/3/14	257	inactive			
		Balisa	8/21/13	CM	85492	62.5	9/16/14	392	9/17/14	392	inactive			
2d	SAIPAN	Balisa	8/18/13	EI	85496	66.6	2/5/17	1268	2/8/17	1270	inactive	0.24	1.97	1270
3a	SAIPAN	Chalan Kanoa	11/14/15	CM	152585	50.2	4/12/16	150	4/18/16	157	inactive	0.11	0.59	169
		Chalan Kanoa	11/14/15	CM	152575	67.1	1/31/16	78	2/1/16	79	inactive			
		Chalan Kanoa	10/27/16	CM	166343	64.3	7/21/17	267	7/25/17	271	inactive			
3b	SAIPAN	Coral Ocean Point	10/27/16	CM	166346	44	2/28/17	124	3/7/17	132	inactive	0.03	0.07	132
3c	SAIPAN	Lao Lao Bay	11/13/15	CM	152576	55.6	3/24/16	132	3/28/16	137	inactive	0.28	0.99	70
		Lao Lao Bay	11/13/15	CM	152572	63.5	12/25/15	42	12/29/15	46	inactive			
		Lao Lao Bay	11/13/15	CM	152571	56.7	1/11/16	59	1/13/16	62	inactive			
		Lao Lao Bay	11/13/15	CM	152579	65	1/13/16	62	1/18/16	67	inactive			
		Lao Lao Bay	11/13/15	CM	152581	53.6	12/18/15	36	12/21/15	38	inactive			
3d	SAIPAN	Spotlight	7/22/14	CM	131995	61.7	6/28/16	707	7/11/16	721	inactive	0.26	1.70	451
		Cow Town	7/22/14	CM	138958	63.9	1/16/15	179	1/19/15	181	inactive			

Table 3. Tinian summary of 2013-2017 satellite tags by deployment location, Kernel Interpolation with Barriers analysis (KIWB) for core use and home range calculations, and tag life as transmission days.

Fig.	Island	Deploy Location	Deploy Date	Sp.	Argos ID	SCL (cm)	Last Signal GPS	Tag Life (GPS days)	Last Signal Argos	Tag Life (Argos days)	Tag Status 1/1/18	Core use area (sq. km) 50% KIWB contour	Home range (sq. km) 95% KIWB contour	Mean Tag Life (Argos days)
4a	TINIAN	Dumpcoke Cove	10/28/16	CM	166341	84.1	2/4/17	100	2/8/17	104	inactive	0.46	2.24	116
		Fleming Point	7/21/14	CM	138959	54.3	11/26/14	128	11/26/14	128	inactive			
4b	TINIAN	Dumpcoke Cove	10/28/16	EI	166342	56.2	2/5/17	101	2/9/17	104	inactive	0.46	3.16	636
		Fleming Point	8/20/13	EI	85493	61.7	2/25/16	920	2/28/16	922	inactive			
		Fleming Point	7/21/14	EI	138963	72.3	4/25/16	645	4/27/16	647	inactive			
		Fleming Point	7/21/14	EI	131989	58.1	1/14/15	177	12/8/16	872	inactive			
4c	TINIAN	Tohgong	5/16/16	CM	152584	54.9	12/10/16	208	12/16/16	214	inactive	0.79	3.27	147
		Tohgong	5/16/16	CM	142753	56.5	NA	NA	5/31/16	15	tag failed			
		Dangkolo	5/15/16	CM	142747	52.6	11/17/16	187	11/19/16	188	inactive			
		Chulu	5/15/16	CM	142750	51.6	10/27/16	166	10/31/16	169	inactive			
4d	TINIAN	Dangkolo	5/15/16	EI	142755	62.8	12/21/17	586	12/28/17	592	active	0.28	1.24	592
5	TINIAN	Tinian Harbor	10/28/16	CM	166348	47.6	5/10/17	194	5/12/17	196	inactive	0.47	3.76	163
		Tinian Harbor	10/28/16	CM	166338	44.4	2/9/17	104	2/15/17	111	inactive			
		Tachungnya Bay	10/26/16	CM	166339	44.4	2/27/17	124	3/1/17	126	inactive			
		Tachungnya Bay	10/26/16	CM	166344	52.8	2/14/17	111	2/17/17	114	inactive			
		Tachungnya Bay	10/26/16	CM	166337	48.2	2/4/17	102	2/8/17	105	inactive			
		Tachungnya Bay	10/26/16	CM	166345	44	12/31/16	66	1/4/17	70	inactive			
		Red Wall	11/12/15	CM	152580	56	9/24/16	318	9/30/16	323	inactive			
		Red Wall	11/12/15	CM	152586	61.1	4/16/16	157	4/17/16	157	inactive			
		Red Wall	11/12/15	CM	152583	54.2	9/9/16	302	9/17/16	310	inactive			
		Red Wall	11/12/15	CM	152578	59.5	1/6/16	56	1/9/16	58	inactive			
		Red Wall	11/12/15	CM	152569	53	7/12/16	244	7/18/16	249	inactive			
		Red Wall	11/12/15	CM	152574	55.4	3/22/16	131	3/27/16	136	inactive			

Table 4. Guam summary of 2013-2017 satellite tags by deployment location, Kernel Interpolation with Barriers analysis (KIWB) for core use and home range calculations, and tag life as transmission days.

Fig.	Island	Deploy Location	Deploy Date	Sp.	Argos ID	SCL (cm)	Last Signal GPS	Tag Life (GPS days)	Last Signal Argos	Tag Life (Argos days)	Tag Status 1/1/18	Core use area (sq. km) 50% KIWB contour	Home range (sq. km) 95% KIWB contour	Mean Tag Life (Argos days)
6a	GUAM	Tanguisson	10/17/17	CM	171249	48.2	12/27/17	72	1/1/18	76	active	0.30	2.35	> 71 (ongoing)
		Tumon Bay	10/17/17	CM	171248	48.8	12/28/17	72	1/1/18	76	active			
		Tumon Bay	10/17/17	CM	171247	62.7	12/28/17	73	1/1/18	76	active			
		Tumon Bay	10/17/17	CM	171246	53.6	12/29/17	74	1/1/18	76	active			
		Tumon Bay	10/18/17	CM	171240	66.6	11/29/17	42	12/8/17	51	active?			
		Tumon Bay	10/18/17	CM	171241	73.2	12/24/17	68	1/1/18	75	active			
		Tumon Bay	10/18/17	CM	171242	58.2	12/28/17	72	1/1/18	75	active			
		Tumon Bay	10/18/17	CM	171243	56.4	12/12/17	55	12/16/17	59	active?			
6b	GUAM	Sewer Island	10/19/17	CM	171244	47.1	NA	NA	NA	NA	tag failed	0.22	1.54	154
		Piti Bomb Holes	5/22/17	CM	166336	56	10/17/17	149	10/23/17	154	inactive			
6c	GUAM	Apra Harbor	7/16/14	CM	131994	49.2	12/23/14	161	12/26/14	163	inactive	0.08	1.84	197
		Apra Harbor	7/16/14	CM	131991	58.3	3/1/15	229	3/4/15	231	inactive			
		Apra Harbor	7/17/14	CM	138960	58.6	1/1/15	169	1/4/15	172	inactive			
		Apra Harbor	7/18/14	CM	138965	59.3	2/22/15	220	2/23/15	220	inactive			
6d	GUAM	Orote Point	5/12/16	CM	131996	60.8	8/22/16	102	8/24/16	104	inactive	2.58	18.17	204
		Orote Point	5/13/16	CM	142752	82.3	11/1/16	172	11/12/16	183	inactive			
		Orote Point	5/13/16	CM	142748	63.8	1/14/17	247	4/2/17	325	inactive			
7a	GUAM	Dadi Beach	7/16/14	CM	131998	64.3	12/15/14	153	12/18/14	155	inactive	0.23	0.86	128
		Dadi Beach	7/16/14	CM	131990	54.3	1/6/15	174	1/7/15	175	inactive			
		Dadi Beach	7/17/14	CM	138961	66	9/10/14	56	9/13/14	58	inactive			
		Dadi Beach	7/17/14	CM	131997	55.2	12/21/14	157	12/26/14	162	inactive			
		Dadi Beach	11/17/15	CM	152577	65.6	4/28/16	164	4/30/16	165	inactive			
		Dadi Beach	11/18/15	CM	152582	73.4	1/12/16	55	1/16/16	59	inactive			
		Dadi Beach	11/18/15	CM	152570	76	3/14/16	117	3/17/16	121	inactive			
7b	GUAM	Sella Bay	11/1/16	CM	166335	49.3	6/11/17	223	6/15/17	226	inactive	0.14	0.43	226
7c	GUAM	Orote Point	5/12/16	EI	142756	52.9	NA	NA	NA	NA	tag failed	0.10	0.59	> 209 (ongoing)
		Orote Point	5/23/17	EI	166340	55.7	12/13/17	204	12/17/17	209	active?			
7d	GUAM	Fleming Point, Tinian to Achang Reef, Guam	8/20/13	EI	85493	61.7	2/25/16	920	2/28/16	922	inactive	0.34	12.57	922

APPENDIX

Table A1. Summary of 2013-2014 turtle observations, captures, and satellite tag deployments from boat-based snorkel surveys in nearshore waters of Guam, Saipan, and Tinian. Data fields from left to right: Survey date, Island, 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), 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	Isl.	Site	Longitude	Latitude	Type	Sp.	No.	Attach.	Argos ID	SCL	Mass	Sex	Turtle ID	L. Flipper	R. Flipper	Left PIT	Right PIT
8/15/13	GU	Cocos Lagoon	144.668	13.249	Observation	CM	1										
8/15/13	GU	Cocos Lagoon	144.659	13.258	Observation	UN	1										
8/15/13	GU	Cocos Lagoon	144.660	13.258	Observation	UN	1										
8/15/13	GU	Cocos Lagoon	144.662	13.256	Observation	UN	1										
8/15/13	GU	Cocos Lagoon	144.665	13.254	Observation	UN	1										
8/15/13	GU	Cocos Lagoon	144.668	13.252	Observation	UN	1										
8/16/13	GU	Cocos Lagoon	144.668	13.250	Observation	UN	1										
8/16/13	GU	Cocos Lagoon	144.657	13.253	Observation	UN	1										
8/16/13	GU	Cocos Lagoon	144.655	13.252	Observation	UN	1										
8/18/13	SA	Balisa	145.699	15.210	Capture-SatTag	CM	1	SPLASH	85491	60.9	32.5	U	CM08182013CN60.9	RI08566	RI08565	982.000149990073	NA
8/18/13	SA	Balisa	145.698	15.217	Capture-SatTag	EI	1	SPLASH	85496	66.6	34.0	U	EI08182013CN66.6	RI08560	RI08561	982.000150012839	NA
8/19/13	SA	Balisa	145.698	15.212	Capture-SatTag	CM	1	SPLASH	85495	66.1	39.1	U	CM08192013CN66.1	RI08563	RI08552	982.000153675029	NA
8/19/13	SA	Balisa	145.698	15.212	Capture-SatTag	CM	1	SPLASH	85494	60.4	30.2	U	CM08192013CN60.4	RI01207	RI01208	982.000153662662	4B107C1747
8/20/13	TI	Fleming Point	145.581	15.016	Capture-SatTag	EI	1	SPLASH	85493	61.7	27.5	U	EI08202013CN61.7	RI08553	RI08558	982.000149986359	NA
8/21/13	SA	Balisa	145.699	15.211	Capture-SatTag	CM	1	SPLASH	85492	62.5	34.6	U	CM08212013CN62.5	RI01351	RI01352	982.000153662001	NA
7/15/14	GU	Apra Harbor	144.650	13.445	Observation	CM	1										
7/15/14	GU	Apra Harbor	144.649	13.444	Observation	CM	1										
7/15/14	GU	Cocos Lagoon	144.671	13.248	Observation	CM	1										
7/15/14	GU	Cocos Lagoon	144.671	13.247	Observation	CM	1										
7/15/14	GU	Cocos Lagoon	144.671	13.252	Observation	CM	1										
7/15/14	GU	Cocos Lagoon	144.658	13.258	Observation	CM	1										
7/15/14	GU	Cocos Lagoon	144.659	13.258	Observation	CM	1										
7/15/14	GU	Cocos Lagoon	144.659	13.255	Observation	CM	1										
7/16/14	GU	San Luis/Gab Gab	144.638	13.444	Capture	CM	1			47.3	13.8	U	CM07162014GM47.3	PI1030	PI1031	982.000167772196	982.000167771931
7/16/14	GU	San Luis/Gab Gab	144.632	13.445	Capture	CM	1			53.5	19.5	U	CM07162014GM53.5	PI1037		982.000167827186	NA
7/16/14	GU	Wharf/Spanish	144.621	13.450	Capture-SatTag	CM	1	SPLASH	131994	49.2	16.1	U	CM07162014GM49.2	PI1035	PI1036	982.000167772276	982.000167799783
7/16/14	GU	Dadi to Tipalao	144.649	13.413	Capture-SatTag	CM	1	SPLASH	131998	64.3	32.0	U	CM07162014GM64.3	PI1034	PI1033	982.000167777159	982.000167771216
7/16/14	GU	Dadi to Tipalao	144.649	13.412	Capture-SatTag	CM	1	SPLASH	131990	54.3	20.3	U	CM07162014GM54.3	PI1051	PI1032	982.000167792000	982.000167850045
7/16/14	GU	San Luis/Gab Gab	144.643	13.444	Capture-SatTag	CM	1	SPLASH	131991	58.3	26.6	U	CM07162014GM58.3	PI1028	PI1029	982.000167824346	982.000167776941
7/16/14	GU	Apra Harbor	144.632	13.445	Observation	CM	1										
7/16/14	GU	Apra Harbor	144.629	13.447	Observation	CM	1										
7/16/14	GU	Apra Harbor	144.619	13.449	Observation	CM	1										
7/16/14	GU	Dadi Beach	144.656	13.409	Observation	CM	1										
7/16/14	GU	Dadi Beach	144.645	13.415	Observation	CM	1										
7/17/14	GU	Dadi to Tipalao	144.653	13.411	Capture	CM	1			50.1	16.9	U	CM07172014GM50.1	PI1078	PI1079	982.000190724529	982.000190219933
7/17/14	GU	Dadi to Tiaplao	144.654	13.410	Capture	EI	1			42.3	7.6	U	EI07172014GM42.3	PI1077	PI1076	982.000190720929	982.000190220237
7/17/14	GU	Dadi to Tipalao	144.645	13.416	Capture-SatTag	CM	1	SPLASH	138961	66.0	40.6	U	CM07172014GM66	PI1086	PI1082	982.000167777401	982.000167769582
7/17/14	GU	Dadi to Tipalao	144.649	13.413	Capture-SatTag	CM	1	SPLASH	131997	55.2	24.5	U	CM07172014GM55.2	PI1085	PI1084	982.000190685832	982.000190657337
7/17/14	GU	Gab Gab	144.635	13.444	Capture-SatTag	CM	1	SPLASH	138960	58.6	26.7	U	CM07172014GM58.6	PI1088	PI1089	982.000167832019	982.000190686081
7/17/14	GU	Dadi Beach	144.651	13.409	Observation	CM	1										
7/17/14	GU	Dadi Beach	144.659	13.408	Observation	CM	1										
7/17/14	GU	Dadi Beach	144.652	13.411	Observation	CM	1										
7/17/14	GU	Dadi Beach	144.648	13.413	Observation	CM	1										
7/17/14	GU	Apra Harbor	144.632	13.459	Observation	CM	1										
7/17/14	GU	Apra Harbor	144.625	13.455	Observation	CM	1										
7/17/14	GU	Apra Harbor	144.642	13.444	Observation	CM	1										
7/17/14	GU	Apra Harbor	144.635	13.445	Observation	CM	1										
7/18/14	GU	Gab Gab/Wharf	144.641	13.445	Capture	CM	1			49.7	14.6	U	CM07182014GM49.7	PI1099	PI1100	982.000167845961	982.000167846072
7/18/14	GU	Gab Gab/Wharf	144.640	13.444	Capture	CM	1			48.8	15.9	U	CM07182014GM48.8	PI1098	PI1097	982.000167777299	982.000167777349
7/18/14	GU	Gab Gab/Wharf	144.639	13.444	Capture-SatTag	CM	1	SPLASH	138965	59.3	24.5	U	CM07182014GM59.3	PI1095	PI1096	982.000190220432	982.000190550517
7/21/14	TI	Dumpcoke	145.596	15.052	Capture	CM	1			49.1	17.3	U	CM07212014CN49.1	RI11221	RI11220	982.000190546954	
7/21/14	TI	Fleming Point	145.582	15.016	Capture	CM	1			46.6	13.0	U	CM07212014CN46.6	RI11219	RI11216	982.000167843811	
7/21/14	TI	Fleming Point	145.582	15.017	Capture	CM	1			47.8	14.6	U	CM07212014CN47.8	RI11211	RI11210	989.001000126187	
7/21/14	TI	Dumpcoke Cove	145.592	15.039	Capture	CM	1			37.2	6.6	U	CM07212014CN37.2	RI11209	RI11208	989.001000126213	
7/21/14	TI	Fleming Point	145.582	15.016	Capture-SatTag	CM	1	SPLASH	138959	54.3	20.5	U	CM07212014CN54.3	RI11215	RI11214	NA	982.000167831575
7/21/14	TI	Fleming Point	145.582	15.016	Capture-SatTag	EI	1	SPLASH	138963	72.3	48.9	U	EI07212014CN72.3	RI11218	RI11217	NA	982.000167825272
7/21/14	TI	Fleming Point	145.582	15.017	Capture-SatTag	EI	1	SPLASH	131989	58.1	21.3	U	EI07212014CN58.1	RI11213	RI11212	982.000167836199	NA
7/22/14	SA	Cow Town	145.826	15.278	Capture-SatTag	CM	1	SPLASH	138958	63.9	36.0	U	CM07222014CN63.9	RI11207	RI11206	989.001000126236	
7/22/14	SA	Spotlight	145.818	15.287	Capture-SatTag	CM	1	SPLASH	131995	61.7	30.4	U	CM07222014CN61.7	RI11205	RI11204	989.001000126251	

Table A2. Summary of 2015 turtle observations, captures, and satellite tag deployments from boat-based snorkel surveys in Guam, Saipan, and Tinian. Data fields as in Table A1.

Date	Isl.	Site	Longitude	Latitude	Type	Sp.	No.	Attach.	Argos ID	SCL	Mass	Sex	Turtle ID	L. Flipper	R. Flipper	Left PIT	Right PIT
11/12/15	TI	Red Wall	145.631	14.927	Capture	CM	1			44.0	10.6	U	CM11122015CN44	none	RI12041	982.000167837266	
11/12/15	TI	Red Wall	145.630	14.931	Capture	CM	1			46.4	14.5	U	CM11122015CN46.4	RI12026	RI12036	982.000167827644	
11/12/15	TI	Red Wall	145.631	14.928	Capture-SatTag	CM	1	SPLASH	152583	54.2	19.4	U	CM11122015CN54.2	RI12045	RI12046	982.000167837893	
11/12/15	TI	Red Wall	145.631	14.927	Capture-SatTag	CM	1	SPLASH	152578	59.5	28.0	U	CM11122015CN59.5	RI12044	RI12043	982.000167841620	
11/12/15	TI	Red Wall	145.632	14.926	Capture-SatTag	CM	1	SPLASH	152580	56.0	25.2	U	CM11122015CN56	RI12034	RI12031	982.000167818272	
11/12/15	TI	Red Wall	145.631	14.927	Capture-SatTag	CM	1	SPLASH	152569	53.0	19.5	U	CM11122015CN53	RI12035	RI12033	982.000167847472	
11/12/15	TI	Red Wall	145.630	14.928	Capture-SatTag	CM	1	SPLASH	152574	55.4	20.6	U	CM11122015CN55.4	RI12040	RI12039	982.000190685201	
11/12/15	TI	Red Wall	145.630	14.931	Capture-SatTag	CM	1	SPLASH	152586	61.1	29.8	U	CM11122015CN61.1	RI12038	RI12037	982.000167831390	
11/12/15	TI	Red Wall	145.631	14.927	Observation	CM	1										
11/12/15	TI	Red Wall	145.631	14.927	Observation	CM	1										
11/12/15	TI	Red Wall	145.631	14.927	Observation	CM	1										
11/12/15	TI	Red Wall	145.631	14.927	Observation	CM	1										
11/12/15	TI	Red Wall	145.631	14.928	Observation	UN	1										
11/12/15	TI	Red Wall	145.631	14.927	Observation	UN	1										
11/13/15	SA	Lao Lao Bay	145.766	15.160	Capture	CM	1			46.7	13.1	U	CM11132015CN46.7	RI12029	RI12027	982.000190215353	
11/13/15	SA	Lao Lao Bay	145.768	15.158	Capture-SatTag	CM	1	SPLASH	152581	53.6	20.9	U	CM11132015CN53.6	RI12032	RI12028	982.000190550407	
11/13/15	SA	Lao Lao Bay	145.766	15.160	Capture-SatTag	CM	1	SPLASH	152579	65.0	39.7	U	CM11132015CN65	RI12030	RI11876	982.000190221835	
11/13/15	SA	Lao Lao Bay	145.760	15.159	Capture-SatTag	CM	1	SPLASH	152576	55.6	22.1	U	CM11132015CN55.6	RI11878	RI11879	982.000167825279	
11/13/15	SA	Lao Lao Bay	145.759	15.159	Capture-SatTag	CM	1	SPLASH	152571	56.7	26.3	U	CM11132015CN56.7	RI11880	RI11881	982.000167841944	
11/13/15	SA	Lao Lao Bay	145.753	15.158	Capture-SatTag	CM	1	SPLASH	152572	63.5	38.2	U	CM11132015CN63.5	RI11877	RI11882	982.000167830770	
11/13/15	SA	Lao Lao Bay	145.766	15.160	Observation	CM	1										
11/13/15	SA	Lao Lao Bay	145.765	15.160	Observation	UN	1										
11/13/15	SA	Lao Lao Bay	145.764	15.160	Observation	UN	1										
11/13/15	SA	Lao Lao Bay	145.764	15.160	Observation	UN	1										
11/13/15	SA	Lao Lao Bay	145.764	15.160	Observation	UN	1										
11/13/15	SA	Lao Lao Bay	145.764	15.160	Observation	UN	1										
11/13/15	SA	Lao Lao Bay	145.763	15.160	Observation	UN	1										
11/13/15	SA	Lao Lao Bay	145.760	15.159	Observation	UN	1										
11/13/15	SA	Lao Lao Bay	145.760	15.159	Observation	UN	1										
11/14/15	SA	Chalan Kanoa	145.690	15.142	Capture	CM	1			44.4	11.2	U	CM11142015CN44.4	RI11895	RI11891	363810876	
11/14/15	SA	Chalan Kanoa	145.691	15.143	Capture-SatTag	CM	1	SPLASH	152575	67.1	47.5	U	CM11142015CN67.1	RI11885	RI11892	none	363834195
11/14/15	SA	Chalan Kanoa	145.690	15.142	Capture-SatTag	CM	1	SPLASH	152585	50.2	16.6	U	CM11142015CN50.2	RI11887	RI11884	363805919	
11/14/15	SA	Chalan Kanoa	145.690	15.158	Observation	UN	1										
11/14/15	SA	Chalan Kanoa	145.690	15.158	Observation	UN	1										
11/14/15	SA	Chalan Kanoa	145.688	15.157	Observation	UN	1										
11/14/15	SA	Chalan Kanoa	145.691	15.144	Observation	UN	1										
11/17/15	GU	Agat Bay	144.643	13.378	Capture	EI	1			44.5	9.4	U	EI011172015GM44.5	PI1574	PI1575	363805702	
11/17/15	GU	Dadi Beach	144.648	13.413	Capture-SatTag	CM	1	SPLASH	152577	65.6	37.8	U	CM011172015GM65.6	PI1573	PI1572	363794111	
11/17/15	GU	Agat Bay	144.650	13.387	Observation	CM	1										
11/17/15	GU	Agat Bay	144.654	13.392	Observation	UN	1										
11/17/15	GU	Agat Bay	144.651	13.389	Observation	UN	1										
11/17/15	GU	Agat Bay	144.651	13.389	Observation	UN	1										
11/17/15	GU	Agat Bay	144.642	13.376	Observation	UN	1										
11/18/15	GU	Dadi Beach	144.651	13.411	Capture-SatTag	CM	1	SPLASH	152570	76.0	59.2	U	CM011182015GM76	PI1571	PI1570	363834759	
11/18/15	GU	Dadi Beach	144.650	13.410	Capture-SatTag	CM	1	SPLASH	152582	73.4	52.9	U	CM11182015GM73.4	PI1569	PI1568	363794120	
11/18/15	GU	Agat Bay	144.642	13.371	Observation	CM	1										
11/18/15	GU	Dadi Beach	144.650	13.411	Observation	UN	1										
11/18/15	GU	Dadi Beach	144.650	13.411	Observation	UN	1										
11/18/15	GU	Dadi Beach	144.650	13.411	Observation	UN	1										
11/18/15	GU	Dadi Beach	144.648	13.411	Observation	UN	1										
11/18/15	GU	Dadi Beach	144.646	13.413	Observation	UN	1										
11/18/15	GU	Dadi Beach	144.655	13.409	Observation	UN	1										
11/18/15	GU	Dadi Beach	144.651	13.409	Observation	UN	1										
11/18/15	GU	Dadi Beach	144.651	13.409	Observation	UN	1										
11/18/15	GU	Dadi Beach	144.646	13.411	Observation	UN	1										

Table A3. Summary of 2016 turtle observations, captures, and satellite tag deployments from boat-based snorkel surveys in Guam, Saipan, and Tinian. Data fields as in Table A1.

Date	Isl.	Site	Longitude	Latitude	Type	Sp.	No.	Attach.	Argos ID	SCL	Mass	Sex	Turtle ID	L. Flipper	R. Flipper	Left PIT	Right PIT
5/12/16	GU	Dump/Orote	144.635	13.433	Capture	CM	1			46.2	13.2	U	CM05122016GM46.2	PI1580	PI1581	982.000190725951	982.000190547778
5/12/16	GU	Dump/Orote	144.628	13.436	Capture	CM	1			48.0	14.0	U	CM05122016GM48	PI1585	PI1584	982.000190550798	982.000190550362
5/12/16	GU	Gab Gab	144.642	13.444	Capture	CM	1			47.8	13.2	U	CM05122016GM47.8	PI1587	PI1586	982.000167837687	982.000190551030
5/12/16	GU	Gab Gab	144.633	13.445	Capture	CM	1			42.7	8.6	U	CM05122016GM42.7	PI1591	PI1590	982.000190550197	982.000190546384
5/12/16	GU	Gab Gab	144.633	13.445	Capture	CM	1			56.9	27.2	U	CM05122016GM56.9	PI1588	PI1589	982.000190553692	982.000190686463
5/12/16	GU	Gab Gab	144.632	13.445	Capture	CM	1			38.4	7.2	U	CM05122016GM38.4	PI1592	PI1563	982.000190686178	982.000190642806
5/12/16	GU	Dump/Orote	144.631	13.435	Capture-SatTag	CM	1	SPLASH	131996	60.8	28.8	U	CM05122016GM60.8	PI1582	PI1583	982.000167837911	982.000190214992
5/12/16	GU	Orote Point	144.621	13.441	Capture-SatTag	EI	1	SPLASH	142756	52.9	14.6	U	EI05122016GM52.9	none	PI1579	982.000167835281	982.000167815470
5/12/16	GU	Orote Point	144.621	13.441	Observation	CM	2										
5/12/16	GU	Orote Point	144.619	13.444	Observation	CM	7										
5/12/16	GU	Dump/Orote	144.631	13.435	Observation	CM	1										
5/12/16	GU	Dump/Orote	144.628	13.435	Observation	CM	1										
5/12/16	GU	Dump/Orote	144.636	13.431	Observation	UN	1										
5/12/16	GU	Dump/Orote	144.630	13.435	Observation	UN	1										
5/12/16	GU	Gab Gab	144.643	13.444	Observation	UN	1										
5/12/16	GU	Gab Gab	144.635	13.445	Observation	UN	1										
5/13/16	GU	Dump/Orote	144.630	13.435	Capture-SatTag	CM	1	SPLASH	142752	82.3	75.0	M	CM05132016GM82.3	PI1593	PI1594	982.000167847438	982.000190550507
5/13/16	GU	Dump/Orote	144.620	13.441	Capture-SatTag	CM	1	SPLASH	142748	63.8	29.0	U	CM05132016GM63.8	PI1596	PI1595	982.000406138283	982.000406135443
5/13/16	GU	Dump/Orote	144.636	13.430	Observation	CM	1										
5/13/16	GU	Dump/Orote	144.630	13.435	Observation	CM	1										
5/13/16	GU	Dump/Orote	144.630	13.435	Observation	CM	2										
5/13/16	GU	Orote Point	144.618	13.445	Observation	CM	3										
5/13/16	GU	Dump/Orote	144.639	13.454	Observation	CM	1										
5/13/16	GU	Dump/Orote	144.636	13.431	Observation	CM	1										
5/13/16	GU	Dump/Orote	144.636	13.431	Observation	CM	1										
5/13/16	GU	Dump/Orote	144.621	13.440	Observation	CM	2										
5/13/16	GU	Orote Point	144.618	13.445	Observation	EI	1										
5/13/16	GU	Orote Point	144.621	13.440	Observation	UN	1										
5/13/16	GU	Orote Point	144.620	13.441	Observation	UN	1										
5/13/16	GU	Dump/Orote	144.624	13.437	Observation	UN	1										
5/13/16	GU	Dump/Orote	144.621	13.440	Observation	UN	1										
5/13/16	GU	Dump/Orote	144.621	13.440	Observation	UN	3										
5/13/16	GU	Dump/Orote	144.621	13.440	Observation	UN	1										
5/13/16	GU	Dump/Orote	144.621	13.441	Observation	UN	1										
5/13/16	GU	Dump/Orote	144.621	13.440	Observation	UN	1										
5/13/16	GU	Dump/Orote	144.620	13.441	Observation	UN	1										
5/15/16	TI	Chulu	145.650	15.038	Capture	CM	1			48.6	14.2	U	CM05152016CN48.6	RI15006	RI15005	982.000406092730	
5/15/16	TI	Chulu	145.652	15.030	Capture-SatTag	CM	1	SPLASH	142750	51.6	22.0	U	CM05152016CN51.6	RI15019	RI15020	982.000406092295	
5/15/16	TI	Dangkolo	145.649	15.044	Capture-SatTag	CM	1	SPLASH	142747	52.6	18.6	U	CM05152016CN52.6	none	RI15017	982.000406092569	
5/15/16	TI	Dangkolo	145.650	15.041	Capture-SatTag	EI	1	SPLASH	142755	62.8	31.1	U	EI05152016CN62.8	RI15008	RI15007	982.000406092592	
5/15/16	TI	Dangkolo	145.649	15.042	Observation	CM	1										
5/15/16	TI	Chulu	145.651	15.035	Observation	UN	2										
5/15/16	TI	Chulu	145.653	15.029	Observation	UN	1										
5/15/16	TI	Chulu	145.650	15.039	Observation	UN	2										
5/15/16	TI	Chulu	145.650	15.040	Observation	UN	1										
5/15/16	TI	Chulu	145.650	15.043	Observation	UN	1										
5/15/16	TI	Dangkolo	145.649	15.042	Observation	UN	1										
5/16/16	TI	Tohgong	145.653	15.093	Capture	CM	1			50.3	18.5	U	CM05162016CN50.3	RI15009	RI15010	982.000406092685	
5/16/16	TI	Babui	145.622	15.081	Capture	CM	1			48.1	14.5	U	CM05162016CN48.1	RI15016	RI15015	982.000406092417	
5/16/16	TI	Babui/LamLam	145.623	15.082	Capture	CM	1			51.0	16.4	U	CM05162016CN51	PI1565	PI1559	982.000406137787	
5/16/16	TI	Babui/LamLam	145.629	15.087	Capture	CM	1			45.9	13.4	U	CM05162016CN45.9	PI1552	PI1554	982.000406092394	
5/16/16	TI	Babui/LamLam	145.632	15.089	Capture	CM	1			44.0	10.9	U	CM05162016CN44	PI1553	PI1564	982.000406092191	
5/16/16	TI	Babui/LamLam	145.623	15.082	Capture	EI	1			46.7	12.9	U	EI05162016CN46.7	PI1501	PI1502	982.000406137779	
5/16/16	TI	Babui/LamLam	145.624	15.083	Capture	EI	1			34.4	4.4	U	EI05162016CN34.4	PI1558	PI1561	982.000406092624	
5/16/16	TI	Babui/LamLam	145.629	15.087	Capture	EI	1			42.3	8.7	U	EI05162016CN42.3	PI1555	PI1560	982.000406138075	
5/16/16	TI	Tohgong	145.656	15.089	Capture-SatTag	CM	1	SPLASH	152584	54.9	24.3	U	CM05162016CN54.9	RI15011	RI15012	982.000406092812	
5/16/16	TI	Tohgong	145.657	15.087	Capture-SatTag	CM	1	SPLASH	142753	56.5	26.5	U	CM05162016CN56.5	RI15014	RI15013	982.000406137831	
5/16/16	TI	Tohgong	145.688	15.139	Observation	CM	3										
5/16/16	TI	Babui/LamLam	145.628	15.087	Observation	CM	1										
5/16/16	TI	Babui/LamLam	145.629	15.087	Observation	CM	1										
5/16/16	TI	Tohgong	145.682	15.129	Observation	EI	1										
5/16/16	TI	Tohgong	145.656	15.089	Observation	UN	1										
5/16/16	TI	Tohgong	145.657	15.087	Observation	UN	1										
5/16/16	TI	Babui/LamLam	145.623	15.082	Observation	UN	1										
5/16/16	TI	Babui	145.627	15.085	Observation	UN	1										
5/17/16	TI	Chulu/Babui	145.625	15.084	Capture	CM	1			40.1	7.9	U	CM05172016CN40.1	PI1504	PI1505	982.000406133981	
5/17/16	TI	Chulu/Babui	145.619	15.079	Capture	EI	1			37.2	5.2	U	EI05172016CN37.2	PI1503	PI1567	982.000406133987	
5/17/16	TI	Chulu/Babui	145.624	15.083	Observation	CM	1										
5/17/16	TI	Chulu/Babui	145.623	15.081	Observation	CM	1										
5/17/16	TI	Chulu/Babui	145.625	15.084	Observation	CM	2										
10/26/16	TI	Tachungnya Bay	145.629	14.948	Capture	CM	1			40.1	8.6	U	CM10262016CN40.1	RI15266	RI15267	982.000363798452	
10/26/16	TI	Tachungnya Bay	145.629	14.954	Capture-SatTag	CM	1	SPLASH	166339	44.4	11.5	U	CM10262016CN44.4	RI15278	RI15279	982.000363805390	

Table A3 (continued). Summary of 2016 turtle observations, captures, and satellite tag deployments from boat-based snorkel surveys in Guam, Saipan, and Tinian. Data fields as in Table A1.

Date	Isl.	Site	Longitude	Latitude	Type	Sp.	No.	Attach.	Argos ID	SCL	Mass	Sex	Turtle ID	L. Flipper	R. Flipper	Left PIT	Right PIT
10/26/16	TI	Tachungnya Bay	145.630	14.952	Capture-SatTag	CM	1	SPLASH	166344	52.8	19.1	U	CM10262016CN52.8	RI15275	RI15274	982.000363834373	
10/26/16	TI	Tachungnya Bay	145.629	14.950	Capture-SatTag	CM	1	SPLASH	166337	48.2	14.6	U	CM10262016CN48.2	RI15270	RI15271	982.000363805655	
10/26/16	TI	Tachungnya Bay	145.629	14.949	Capture-SatTag	CM	1	SPLASH	166345	44.0	10.6	U	CM10262016CN44	RI15268	RI15269	982.000363835417	
10/26/16	TI	Tachungnya Bay	145.629	14.948	Capture	EI	1			40.0	6.6	U	EI10262016CN40	RI15272	RI15273	982.000363834980	
10/26/16	TI	circumnavigate	145.690	15.141	Observation	CM	2										
10/26/16	TI	circumnavigate	145.685	15.134	Observation	CM	2										
10/26/16	TI	circumnavigate	145.669	14.982	Observation	CM	1										
10/26/16	TI	Tachogna Bay	145.629	14.954	Observation	CM	1										
10/26/16	TI	Tachogna Bay	145.629	14.953	Observation	CM	1										
10/26/16	TI	Tachogna Bay	145.629	14.950	Observation	CM	1										
10/26/16	TI	Tachogna Bay	145.629	14.952	Observation	EI	1										
10/26/16	TI	Banzai	145.655	14.944	Observation	UN	1										
10/27/16	SA	Chalan Kanoa	145.691	15.144	Capture	CM	1			59.9	27.4	U	CM10272016CN59.9	RI15251	RI15252	982.000363797151	
10/27/16	SA	Chalan Kanoa	145.690	15.142	Capture	CM	1			57.0	23.4	U	CM10272016CN57	RI15253	RI15254	982.000363810157	
10/27/16	SA	Chalan Kanoa	145.691	15.143	Capture-SatTag	CM	1	SPLASH	166343	64.3	31.6	U	CM10272016CN64.3	RI15265	RI15264	982.000363810884	
10/27/16	SA	Coral Ocean Point	145.698	15.115	Capture-SatTag	CM	1	SPLASH	166346	44.0	11.2	U	CM10272016CN44	RI15261	RI15260	982.000363797040	
10/27/16	SA	Coral Ocean Point	145.701	15.113	Capture	EI	1			40.0	7.0	U	EI10272016CN40	RI15263	RI15262	982.000363835085	
10/27/16	SA	CK reef	145.690	15.145	Observation	CM	1										
10/27/16	SA	CK reef	145.691	15.144	Observation	CM	1										
10/27/16	SA	transit	145.687	15.122	Observation	CM	1										
10/27/16	SA	transit	145.708	15.105	Observation	CM	1										
10/27/16	SA	Obyan Beach	145.733	15.102	Observation	EI	1										
10/27/16	SA	Obyan Beach	145.722	15.105	Observation	EI	1										
10/28/16	TI	TI Harbor	145.620	14.960	Capture-SatTag	CM	1	SPLASH	166348	47.6	12.0	U	CM10282016CN47.6	RI15255	RI15256	982.000363835278	
10/28/16	TI	TI Harbor	145.615	14.962	Capture-SatTag	CM	1	SPLASH	166338	44.4	11.8	U	CM10282016CN44.4	RI15257	RI15258	982.000363835472	
10/28/16	TI	Dumpcoke Cove	145.594	15.040	Capture-SatTag	CM	1	SPLASH	166341	84.1	76.2	M	CM10282016CN84.1	RI15225	RI15259	982.000363798612	
10/28/16	TI	Dumpcoke Cove	145.596	15.042	Capture-SatTag	EI	1	SPLASH	166342	56.2	21.3	U	EI10282016CN56.2	RI15224	RI15223	982.000363835630	
10/28/16	SA	transit to TI	145.694	15.148	Observation	CM	1										
10/28/16	TI	TI Harbor	145.615	14.962	Observation	CM	3										
10/28/16	TI	TI Harbor	145.612	14.967	Observation	CM	2										
10/28/16	TI	TI Harbor	145.611	14.969	Observation	CM	1										
10/28/16	TI	Dumpcoke Cove	145.595	15.040	Observation	UN	1										
10/29/16	SA	Balisa	145.702	15.211	Capture	CM	1			53.7	21.6	U	CM10292016CN53.7	RI15220	RI15219	982.000363794612	
10/29/16	SA	Balisa	145.701	15.212	Capture	CM	1			55.6	25.1	U	CM10292016CN55.6	RI15217	RI15218	982.000363812343	
10/29/16	SA	Tanapag Lagoon	145.731	15.245	Capture-SatTag	CM	1	SPLASH	166347	47.0	12.2	U	CM10292016CN47	RI15222	RI15221	982.000363835363	
10/29/16	SA	transit/Managaha	145.720	15.231	Observation	CM	1										
10/29/16	SA	Tanapag Lagoon	145.732	15.245	Observation	CM	1										
10/29/16	SA	Tanapag Lagoon	145.731	15.245	Observation	CM	1										
10/29/16	SA	Tanapag Lagoon	145.713	15.229	Observation	CM	1										
10/29/16	SA	Balisa	145.696	15.191	Observation	CM	1										
10/29/16	SA	transit/Managaha	145.728	15.239	Observation	UN	1										
10/29/16	SA	Balisa	145.703	15.212	Observation	UN	1										
11/1/16	GU	Sella Bay	144.647	13.329	Capture-SatTag	CM	1	SPLASH	166335	49.3	14.4	U	CM11012016GM49.3	PI1506	PI1525	982.000363835197	
11/1/16	GU	Sella Bay	144.647	13.329	Capture	CM	1			43.7	11.8	U	CM11012016GM43.7	PI1508	PI1507	982.000363812713	
11/1/16	GU	Sella Bay	144.645	13.335	Capture	CM	1			40.8	8.2	U	CM11012016GM40.8	PI1510	PI1509	982.000363834810	
11/1/16	GU	Bile Bay	144.660	13.278	Observation	CM	1										
11/1/16	GU	Bile Bay	144.661	13.283	Observation	CM	1										
11/1/16	GU	Bile Bay	144.658	13.285	Observation	CM	1										
11/1/16	GU	Bile Bay	144.657	13.287	Observation	CM	1										
11/1/16	GU	Bile Bay	144.655	13.290	Observation	CM	2										
11/1/16	GU	Bile Bay	144.655	13.290	Observation	CM	1										
11/1/16	GU	Bile Bay	144.655	13.291	Observation	CM	1										
11/1/16	GU	Bile Bay	144.656	13.291	Observation	CM	3										
11/1/16	GU	Bile Bay	144.656	13.292	Observation	CM	1										
11/1/16	GU	Bile Bay	144.655	13.293	Observation	CM	1										
11/1/16	GU	transit/Sella Bay	144.647	13.330	Observation	CM	1										
11/1/16	GU	transit/Sella Bay	144.647	13.330	Observation	CM	1										
11/1/16	GU	transit/Sella Bay	144.647	13.330	Observation	CM	1										
11/1/16	GU	Sella Bay	144.647	13.332	Observation	CM	1										
11/1/16	GU	Sella Bay	144.646	13.333	Observation	CM	1										
11/1/16	GU	Sella Bay	144.646	13.333	Observation	CM	2										
11/1/16	GU	Sella Bay	144.645	13.334	Observation	CM	1										
11/1/16	GU	Sella Bay	144.645	13.334	Observation	CM	1										
11/1/16	GU	Sella Bay	144.645	13.335	Observation	CM	3										
11/1/16	GU	Sella Bay	144.644	13.335	Observation	CM	1										
11/1/16	GU	Sella Bay	144.644	13.336	Observation	CM	1										
11/1/16	GU	Bile Bay	144.660	13.278	Observation	EI	1										
11/1/16	GU	Bile Bay	144.657	13.287	Observation	EI	1										
11/1/16	GU	Bile Bay	144.661	13.283	Observation	UN	1										
11/2/16	GU	Piti Bomb Holes	144.690	13.471	Observation	CM	1										
11/2/16	GU	Piti Bomb Holes	144.690	13.472	Observation	CM	1										
11/2/16	GU	Piti Bomb Holes	144.691	13.471	Observation	CM	1										
11/2/16	GU	Piti Bomb Holes	144.743	13.485	Observation	CM	1										

Table A4. Summary of 2017 turtle observations, captures, and satellite tag deployments from boat-based snorkel surveys in Guam, Saipan, and Tinian. Data fields as in Table A1.

Date	Isl.	Site	Longitude	Latitude	Type	Sp.	No.	Attach.	Argos ID	SCL	Mass	Sex	Turtle ID	L. Flipper	R. Flipper	Left PIT	Right PIT
5/22/17	GU	Piti Bomb Holes	144.693	13.473	Capture-SatTag	CM	1	SPLASH	166336	56.0	22.6	U	0402169998	PI4546	PI4547	982.000402169998	982.000402169358
5/22/17	GU	Piti Bomb Holes	144.693	13.473	Observation	CM	1										
5/23/17	GU	Dump	144.634	13.432	Capture-SatTag	EI	1	SPLASH	166340	55.7	19.2	U	0167835281	PI4453	PI1579	982.000167835281	982.000167815470
10/17/17	GU	Tanguisson	144.809	13.555	Capture-SatTag	CM	1	SPLASH	171249	48.2	14.8	U	0402166755	PI4801	PI4802	982.000402166755	982.000402166794
10/17/17	GU	Tumon Hilton	144.789	13.511	Capture-SatTag	CM	1	SPLASH	171248	48.8	13.4	U	0402167077	PI4804	PI4803	982.000402167077	982.000402163319
10/17/17	GU	Tumon Hilton	144.792	13.511	Capture-SatTag	CM	1	SPLASH	171247	62.7	32.7	U	0364287768	PI4807	PI4808	982.000364287768	982.000364287508
10/17/17	GU	Tumon Hilton	144.792	13.512	Capture-SatTag	CM	1	SPLASH	171246	53.6	18.1	U	0402166489	PI4806	PI4805	982.000402166489	982.000402163424
10/17/17	GU	Tanguisson Beach	144.809	13.554	Observation	CM	1										
10/17/17	GU	Tanguisson Beach	144.809	13.556	Observation	CM	1										
10/17/17	GU	Tanguisson Beach	144.810	13.558	Observation	CM	1										
10/17/17	GU	Haputo Beach	144.828	13.577	Observation	CM	1										
10/17/17	GU	Tanguisson Beach	144.809	13.556	Observation	CM	1										
10/17/17	GU	Tumon Bay	144.785	13.509	Observation	CM	4										
10/17/17	GU	Tumon Bay	144.786	13.510	Observation	CM	1										
10/17/17	GU	Tumon Bay	144.787	13.510	Observation	CM	1										
10/17/17	GU	Tumon Bay	144.787	13.510	Observation	CM	1										
10/17/17	GU	Tumon Bay	144.790	13.511	Observation	CM	1										
10/17/17	GU	Tumon Bay	144.791	13.511	Observation	CM	1										
10/17/17	GU	Tumon Bay	144.792	13.511	Observation	CM	2										
10/17/17	GU	Tumon Bay	144.786	13.510	Observation	CM	1										
10/17/17	GU	Haputo Beach	144.829	13.580	Observation	EI	1										
10/17/17	GU	Tumon Bay	144.785	13.509	Observation	EI	1										
10/17/17	GU	Tanguisson Beach	144.810	13.557	Observation	UN	1										
10/17/17	GU	Tumon Bay	144.786	13.510	Observation	UN	1										
10/17/17	GU	Tumon Bay	144.786	13.510	Observation	UN	1										
10/18/17	GU	Tumon (north)	144.795	13.512	Capture	CM	1			49.3	16.4	U	0364283766	PI4818	PI4813	982.000364283766	982.000364287102
10/18/17	GU	Tumon (north)	144.796	13.513	Capture	CM	1			54.0	19.5	U	0364287113	PI4815	PI4816	982.000364287113	982.000364291543
10/18/17	GU	Tumon (north)	144.800	13.520	Capture	CM	1			45.8	11.5	U	0364290092	PI4817	PI4818	982.000364290092	982.000364287444
10/18/17	GU	Tumon (central)	144.792	13.512	Capture-SatTag	CM	1	SPLASH	171240	66.6	38.4	U	0364286882	PI4809	PI4810	982.000364286882	982.000364285156
10/18/17	GU	Tumon (north)	144.793	13.512	Capture-SatTag	CM	1	SPLASH	171241	73.2	48.9	U	0364287735	PI4811	PI4812	982.000364287735	982.000364345328
10/18/17	GU	Tumon (north)	144.800	13.522	Capture-SatTag	CM	1	SPLASH	171242	58.2	26.4	U	0364285556	PI4819	PI4820	982.000364285556	982.000364284980
10/18/17	GU	Tumon (north)	144.801	13.522	Capture-SatTag	CM	1	SPLASH	171243	56.4	24.3	U	0364287500	PI4821	PI4822	982.000364287500	982.000364282890
10/18/17	GU	Tumon Bay	144.791	13.513	Observation	CM	1										
10/18/17	GU	Tumon Bay	144.791	13.512	Observation	CM	1										
10/18/17	GU	Tumon Bay	144.792	13.512	Observation	CM	2										
10/18/17	GU	Tumon Bay	144.794	13.512	Observation	CM	1										
10/18/17	GU	Tumon Bay	144.795	13.513	Observation	CM	1										
10/18/17	GU	Tumon Bay	144.799	13.520	Observation	CM	1										
10/18/17	GU	Tumon Bay	144.800	13.520	Observation	CM	1										
10/18/17	GU	Tumon Bay	144.800	13.520	Observation	CM	2										
10/18/17	GU	Tumon Bay	144.800	13.521	Observation	CM	1										
10/18/17	GU	Tumon Bay	144.800	13.522	Observation	CM	1										
10/18/17	GU	Tumon Bay	144.801	13.524	Observation	CM	3										
10/19/17	GU	Sewer Island	144.740	13.484	Capture-SatTag	CM	1	SPLASH	171244	47.1	13.7	U	0364288919	PI4823	PI4824	982.000364288919	982.000364283283
10/19/17	GU	Alupang	144.768	13.494	Observation	CM	1										
10/19/17	GU	Tumon Bay	144.791	13.511	Observation	CM	1										
10/19/17	GU	Tumon Bay	144.792	13.512	Observation	CM	1										
10/19/17	GU	Adelupe	144.731	13.483	Observation	CM	1										
10/19/17	GU	Adelupe	144.732	13.483	Observation	CM	1										
10/19/17	GU	Sewer Island	144.739	13.484	Observation	CM	1										
10/25/17	SA	Aqua Reef	145.763	15.255	Capture-SatTag	CM	1	SPLASH	171250	55.7	22.6	U	0167838510	PI4825	PI4826	982.000167838510	982.000190642571
10/25/17	SA	Aqua Reef	145.763	15.254	Capture	CM	1			43.3	9.6	U	0364285390	PI4827	PI4828	982.000364285390	982.000364285415
10/25/17	SA	transit / Sugar Dock	145.697	15.207	Observation	CM	1										
10/25/17	SA	Garapan	145.696	15.212	Observation	CM	2										
10/25/17	SA	Pau Pau Beach	145.769	15.258	Observation	CM	1										
10/25/17	SA	San Roque/Pau Pau	145.764	15.256	Observation	CM	1										
10/25/17	SA	San Roque/Pau Pau	145.763	15.254	Observation	CM	1										
10/25/17	SA	San Roque/Pau Pau	145.761	15.254	Observation	CM	1										
10/25/17	SA	Aqua Reef	145.756	15.255	Capture-SatTag	EI	1	SPLASH	171251	50.3	14.8	U	0167817478	PI4829	PI4830	982.000167817478	982.000190690873
10/25/17	SA	San Roque	145.771	15.258	Observation	UN	1										
10/26/17	SA	Pau Pau Beach	145.771	15.258	Capture	CM	1			43.9	12.2	U	0364290671	PI4833	PI4834	982.000364290671	982.000364287318
10/26/17	SA	Pau Pau Beach	145.769	15.258	Capture	CM	1			39.6	8.4	U	0167837900	PI4835	PI4836	982.000167837900	982.000364285720
10/26/17	SA	Pau Pau Beach	145.779	15.264	Capture	CM	1			37.6	7.6	U	0364289669	PI4831	PI4832	982.000364289669	982.000364287481
10/26/17	SA	Pau Pau Beach	145.764	15.255	Capture-SatTag	CM	1	SPLASH	171245	59.5	28.4	U	0167817808	PI4837	PI4838	982.000167817808	982.000190656985
10/26/17	SA	Pau Pau Beach	145.764	15.255	Capture-SatTag	CM	1	SPLASH	171253	49.2	17.6	U	0190685388	PI4839	PI4840	982.000190685388	982.000190685776
10/26/17	SA	Wing Arch	145.794	15.276	Capture-SatTag	CM	1	SPLASH	171252	54.3	19.6	U	0364290508	PI4842	PI4841	982.000364290508	982.000190720976
10/26/17	SA	Wing Beach	145.786	15.270	Observation	CM	1										
10/26/17	SA	Pau Pau Beach	145.771	15.258	Observation	CM	1										
10/26/17	SA	Aqua Resort	145.764	15.255	Observation	CM	1										
10/26/17	SA	Wing Beach	145.794	15.277	Observation	CM	1										
10/26/17	SA	Wing Beach	145.794	15.277	Observation	EI	1										
10/27/17	SA	Outer Managaha	145.711	15.250	Capture-SatTag	CM	1	SPLASH	171254	46.3	13.8	U	0364284942	PI4843	PI4844	982.000364284942	982.000167816236

Table A4 (continued). Summary of 2017 turtle observations, captures, and satellite tag deployments from boat-based snorkel surveys in Guam, Saipan, and Tinian. Data fields as in Table A1.

Date	Isl.	Site	Longitude	Latitude	Type	Sp.	No.	Attach.	Argos ID	SCL	Mass	Sex	Turtle ID	L. Flipper	R. Flipper	Left PIT	Right PIT
10/27/17	SA	Outer Managaha	145.741	15.256	Capture	CM	1			42.1	10.0	U	0190220549	PI4847	PI4848	982.000190220549	982.000190557063
10/27/17	SA	transit / Sugar Dock	145.697	15.213	Observation	CM	1										
10/27/17	SA	Managaha	145.694	15.225	Observation	CM	1										
10/27/17	SA	Managaha	145.692	15.231	Observation	CM	1										
10/27/17	SA	South Managaha	145.696	15.238	Observation	CM	1										
10/27/17	SA	South Managaha	145.695	15.235	Observation	CM	1										
10/27/17	SA	Tanapag outer	145.750	15.255	Observation	CM	1										
10/27/17	SA	inside Managaha	145.705	15.234	Observation	CM	1										
10/27/17	SA	Tanapag Lagoon	145.697	15.206	Observation	CM	1										
10/27/17	SA	Tanapag	145.751	15.256	Capture	EI	1			42.4	33.0	U	0167828469	PI4845	PI4846	982.000167828469	982.000167831977

Table A5. Summary of 2016-2017 cetacean observations boat-based snorkel surveys in Guam, Saipan, and Tinian. Spinner dolphins (Stenella longirostris) and possibly bottlenose dolphins (Tursiops truncatus) were the only species observed. Cetacean observations were the only species observed. Cetacean observations were not recorded in 2013-2015.

Date	Island	Site	Type	Species	Animals	Longitude	Latitude	Notes
10/26/2016	TINIAN	circumnavigate	Observation	CET	2	145.672	14.994	spinner dolphins
10/26/2016	TINIAN	circumnavigate	Observation	CET	10	145.666	14.960	spinner dolphins
10/29/2016	SAIPAN	transit to Managaha	Observation	CET	20	145.704	15.223	spinner dolphins
10/29/2016	SAIPAN	Tanapag Lagoon	Observation	CET	7	145.713	15.229	spinner dolphins
11/1/2016	GUAM	transit to Bile Bay	Observation	CET	30	144.660	13.277	spinner dolphins
10/25/2017	SAIPAN	transit Sugar Dock to Pau Pau	Observation	CET	10	145.714	15.253	bottlenose dolphins?
10/25/2017	SAIPAN	transit Pau Pau to Sugar Dock	Observation	CET	>1	145.691	15.235	bottlenose dolphins?