ProTECTOR, Inc. NATIONAL REPORT OF ACTIVITIES FOR THE 2023 RESEARCH SEASON

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This report has been provided to the Honduran Department of Forest Conservation (ICF), and the Department of Fisheries (DIGEPESCA) in fulfillment of the requirements for the 2023 Honduras ICF research permit # ICF-121-2023. The permit was secured through the efforts of ProTECTOR, Inc. Country Director, Lidia Salinas.

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Citation
Dunbar, S. G., Romero, A., and Salinas, L. 2024. ProTECTOR, Inc. National Report of the Protective Turtle Ecology Center for Training, Outreach, and Research, Inc. (ProTECTOR, Inc.) Activities for the 2023 Research Season. Loma Linda, CA. Pp.32

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INTRODUCTION

In this report, we provide a brief overview of the activities of the Protective Turtle Ecology Center for Training, Outreach, and Research, Inc. (ProTECTOR, Inc.) over the 2023 research season from June 4 to July 6, 2023. Here, brief results of individual projects are presented. We undertook all research under national permits issued by the Honduras Government through the Department of Fisheries (DIGEPESCA) and the Department of Forestry Conservation (ICF).

The research area for the 2023 research season was focused on Caribbean Honduras (Fig. 1A), with sites in the Sandy Bay West End Marine Reserve (SBWEMR) on the island of Roatan (Fig. 1B), the area of Calabash Bight (Fig. 1C), and nesting beaches of Guanaja (Fig. 1D). Roatán is the largest of the three Bay Islands sitting approximately 48 km north of mainland Honduras, and is 77 km long and 8 km wide, while Guanaja is the eastern-most island in the group and is also approximately 48 km from mainland Honduras. The island is a mere 16 km long and 6 km wide.

We carried out research efforts on Roatán with direct assistance from Splash Inn Dive Resort in the area of West End and West Bay. In the area of Calabash Bight, we worked with the Cooper family on rescued green turtles, and on Guanaja, our work was assisted by the Green Island Challenge Initiative, and undertaken by Mr. Anuar Romero. Mr. Romero was assisted by the Berkshire High School, and the Guanaja Hotel.

The projects undertaken in 2023 continued prior work in each of these areas of Roatan and Guanaja. In the SBWEMR, our prior studies have increased our understanding of the responses of juvenile sea turtles in proximity to SCUBA divers (Hayes, et al. 2017), and the impacts of boat activity on sea turtle feeding and movements in the marine reserve (Wright, et al. 2020). Our prior studies have also assessed the habitats of the marine reserve in relation to turtle distribution in the West Bay, West End, and Sandy Bay areas (Wright, et al. 2022). Through our previous work, we found that contributions by community scientists allowed us to track the movements of hawkbills within the SBWEMR (Baumbach, et al. 2019; Baumbach, 2020), as well as to estimate juvenile hawksbill home ranges (Baumbach, et al. 2019) based on both flipper-ID and photo-ID (PID) (Dunbar, et al, 2021).

I N T R O D U C T I O N

ProTECTOR, Inc. Interns and Volunteers have been vital to the success of the research work done by ProTECTOR, Inc. in Honduras. Again, in 2023, we had two Interns who worked throughout the research season and were stationed in the West End, but also assisted with collecting data in the marine reserve, at the Calabash study site, and at the CFB tagging site.

Interns also collected information and data during dive sightings and analyzed these data to investigate trends in turtle growth rates and turtle interactions with other marine vertebrates in relation to the type of turtle feeding activity.

As a result of the studies reported here, we have increased our bank of blood, skin, and scute samples for genetic haplotyping, heavy metal, and blood parasite analyses to more than 1,000. These samples are currently being analyzed for haplotype diversity and heavy metals in blood and scute. A current graduate student is assessing blood parasites in a comparison of adults and hatchlings from two sites in the Caribbean. Additionally, we have been able to track the growth rates of juvenile hawksbills within the SBWEMR over the past 7 years. These studies meet the research objectives of ProTECTOR, Inc. by providing ongoing monitoring data that can assist marine area habitat managers in understanding the population dynamics of sea turtles within and outside of marine protected areas. Beyond the scientific information garnered, we have provided countless hours of education outreach and community awareness regarding the status and plight of sea turtles in Honduras, presented research findings at international research symposia, published our research findings in international peer-reviewed scientific journals, and continue to provide specific recommendations for ongoing and additional studies to answer questions of the origins of turtles that recruit to, and nest in the Bay Islands. Answers to many of these questions will require further ongoing studies, as well as undertaking new studies.

Additional studies may include further satellite and GPS tracking of nesting and juvenile turtles within and outside the SBWEMR, the assessment and monitoring of nesting habitats, the impacts of global climate change (GCC) on habitats and sea turtles, and national assessments for all five species of turtles found within Honduran waters. Additionally, there is great need to evaluate the impacts of large-scale and artisanal fisheries on sea turtles in all marine areas of the country. However, this report will focus on studies undertaken in the 2023 research season.

INTRODUCTION

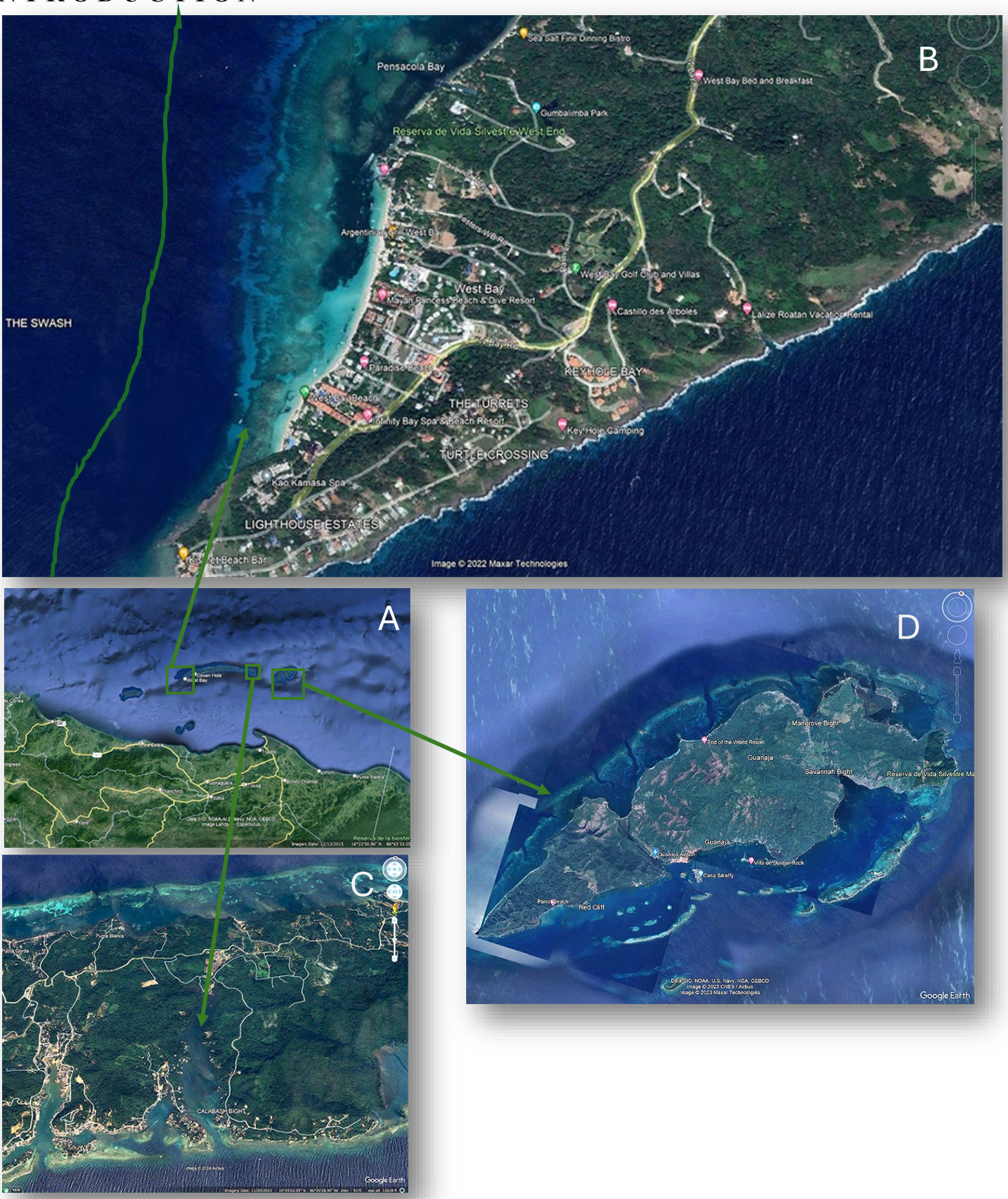

Fig. 1. A map of the regional view of the north coast of Honduras (A) with the main research sites on Roatán at the Sandy Bay West End Marine Reserve (SBWEMR)(B) and Calabash Bight (C), and the island of Guanaja (G).

M E T H O D S

ProTECTOR, Inc. Interns and Volunteers

During the 2023 research season, we were able to facilitate two ProTECTOR, Inc. Interns (assisting for more than one month). Both ProTECTOR, Inc. Interns were placed at the main research site in the SBWEMR in Roatán on specific projects. One Intern was tasked with collecting in-water photographs and video of turtle feeding events to evaluate interactions between hawksbill turtles and other marine invertebrates. The other Intern collated data on turtle recaptures to evaluate growth rates. These Intern projects provided additional data to be combined with previous studies for larger assessments and analyses. Interns also assisted with turtle tagging and sampling during turtle work-ups, and were carefully trained in how to correctly and safely handle sea turtles to avoid injury to the turtles and themselves.

Feeding Study

Data on feeding events were collected during two morning dives and one afternoon dive, all using SCUBA. We used the ProTECTOR boat to journey to a pre-selected dive site where we entered the water and swam out to the edge of the reef. We then formed a line of approximately 20 m with the first diver over the reef slope and the other divers over the reef flat. All three divers swam a straight-line transect away from the dive site mooring, going out against the current (if present) for approximately 30 min (or until one diver reached half-tank). If a turtle was sighted, we followed the turtle at a distance of 1 – 3 m. If the turtle paused to forage, we photographed and videoed the event. If the feeding event was of sufficient duration, we captured the turtle by hand and slowly directed it to the surface.

Turtle Work-Ups

Once captured turtles were brought to the surface, the ProTECTOR boat approached the divers with the turtle. The boat pulled up alongside the divers and a large bucket was placed on the surface of the water. Turtles were gently placed in the bucket, and the bucket lifted onto the deck of the boat. Once divers were onboard, turtles were taken back to the makeshift laboratory area where the turtles were placed on the wooden flooring, and the work-up began by checking the turtle for flipper tags or marks.

Turtles were first measured for maximum and minimum curved carapace length (CCLmax and min), and curved carapace width (CCW) to the nearest 0.1 cm. Turtles were then weighed (to the nearest

0.01 kg). Once weighed, we probed the overlaying scutes of the carapace (on hawksbills) for epibionts, collecting and preserving them in vials labelled with the turtle tag number, species, and date of capture (Fig. 2). We then drew a blood sample of from 1 – 4 mL based on a rough estimation from the following equation:

$$SBV = \text{Turtle Weight (g)} \times 0.08 \times 0.01 \quad (1)$$

where SBV is the sample blood volume to be collected, 0.08 is the fraction of total blood volume of the animal in relation to its weight, and 0.1 represents the fraction of total blood volume that may be sampled. These blood samples were then sub-divided into 1.5 mL microcentrifuge tubes for genetic, heavy metal, parasite, and health studies.

Calabash Bight Rescued Juveniles

We received a call from the Roatan Marine Park (RMP) regarding a family that had been holding several turtles of unidentified origin and species in a small water pen in the upper area of Calabash Bight. After investigating this report further with the RMP, we contacted the family who had been reported holding the turtles, and discussed with them the possibility of ProTECTOR, Inc. coming out to their location to assess the turtles, view their holding pen, and prepare the turtles for release.

Once at the site, we captured each of the small turtles with a dip net from the approximately 10L×10W×1D m holding pen and undertook a brief external health assessment to ensure that turtles did not have external bite marks or injuries. We then measured and weighed each turtle, took a small blood sample corresponding to the size of each individual, and attempted to take scute cuttings from those we could. Blood samples were collected from the cervical sinus, and placed in 1.5 ml microcentrifuge vials, and placed in a cooler on ice. Each turtle also received an Inconel (681 style) flipper tag with unique identification number, placed on the right front flipper on the proximal scute. In addition, we photographed the dorsal head and both sides of the face to place in our PID database for later PID, should any of these individuals survive release and make their way to establish a long-term home range under the protection of the SBWEMR.

Fig. 2. As part of the systematic work-up on captured turtles, we cleaned (A), measured, weighed, and flipper tagged (if new captures) turtles. Additionally, we collected epibionts from interstitial spaces between imbricated scutes, as well as blood and scute cuttings for additional genetic, heavy metal, parasite, and health analyses. Interns learned the process of handling and collecting samples from turtles (B)

M E T H O D S

CFB Juvenile Turtle Tagging

ProTECTOR, Inc. received a request by CFB to return to the island to check the health status of several juvenile sea turtles that had been hatched on the private island in 2022, and had been held until 2023. We agreed to provide an assessment of all held juvenile turtles, as well as to flipper tag and sample each individual before the wildlife managers of CFB planned to release the turtles to the wild.

Turtles were captured by hand or dip net by staff of CFB and brought to the tagging area, where turtles were cleaned, weighed, measured, and flipper tagged on the right rear flippers on the proximal-most scute. Scute cuttings and blood samples were collected from each individual. Blood samples of 2 mL or less were then subdivided into marked 1.5 mL microcentrifuge vials for different analyses. Once tagged and sampled, turtles were also photographed for PID, and then released back into the larger holding pen until released by CFB staff.

Guanaja Nesting Recovery Project

This year, the Guanaja Nesting Recovery Project (GNRP) continued under the field direction of Mr. Anuar Romero and the Green Island Challenge initiative. This ProTECTOR, Inc. partner team continued their nightly monitoring of the beaches around Guanaja for nesting hawksbills, greens, and loggerhead turtles during the entire nesting season of 2023, from May to September.

When turtles were sighted emerging from the water to nest, the team carefully followed the turtle at a distance to observe the turtle digging the nest, laying the eggs, burying the clutch, and returning to the ocean. The nest location was then marked and triangulated with a handheld GPS so that the nest could be relocated at the time of approximate hatching. The latitude and longitude of the nest was recorded, as was the species of turtle nesting. Monitors searched the turtle for any identifying markings and the presence of flipper tags. If the turtle was carrying a flipper tag, the tag number was recorded in the database. Monitors also noted if no flipper tags were present.

Within two days prior to the expected time of hatching, the monitoring team checked the nest for signs of hatching during the day and at night to ensure they could secure a count of the number of hatchlings

that emerged from the nest. Once the clutch had hatched, the team continued to monitor the nest for the following 24 hrs, after which nests were excavated, and any remaining live hatchlings were released to the water's edge. Dead hatchlings and unhatched eggs were counted and recorded, and then reburied into the nest and fully covered over again with sand from the excavated nest area.

R E S U L T S

Interns

The two ProTECTOR, Inc. Interns involved with projects in 2023 (Mallori Lloyd and Emma Carlson) received training in both SCUBA diving, and sea turtle handling and research (Fig. 3). These interns were exposed to the daily realities of wildlife conservation research, as well as conservation education outreach, and the need to continually seek ways to develop partnerships with local community members and local non-governmental organizations (NGOs). As part of their field research experiences, the interns had opportunities to read, discuss, and critique published sea turtle research articles, as well as to write up the results of their own small research projects under the direction of PI Dunbar. Some of their project work will be incorporated into larger projects and be included in manuscripts for publication and public presentations.

SBWEMR Captures

During the 2023 season, we continued to sight hawksbill and green turtles that had already been flipper tagged, as well as several untagged turtles. Some of the untagged turtles we sighted were relatively large (mean = 47.5 ± 1.2 cm CCLmin; range = 42 – 52.5 cm CCLmin) and appeared to behave as individuals that were still cautious at the presence of divers. Still, we were able to capture images and video of these turtles (Fig. 4) to contribute to the photo-ID (PID) database to track juvenile turtle residency within the SBWEMR over time. We were also able to collect additional images and video on the feeding interactions of sea turtles (Fig. 4) with other organisms in different feeding events.

In the SBWEMR, we captured a total of 13 juvenile turtles. Of the 13 turtles captured, 12 were hawksbills and one was a green turtle. Eight (66.7%) of the 12 captured hawksbills were recaptures. All remaining turtles captured during 2023 were new captures, although not necessarily new to the marine reserve.

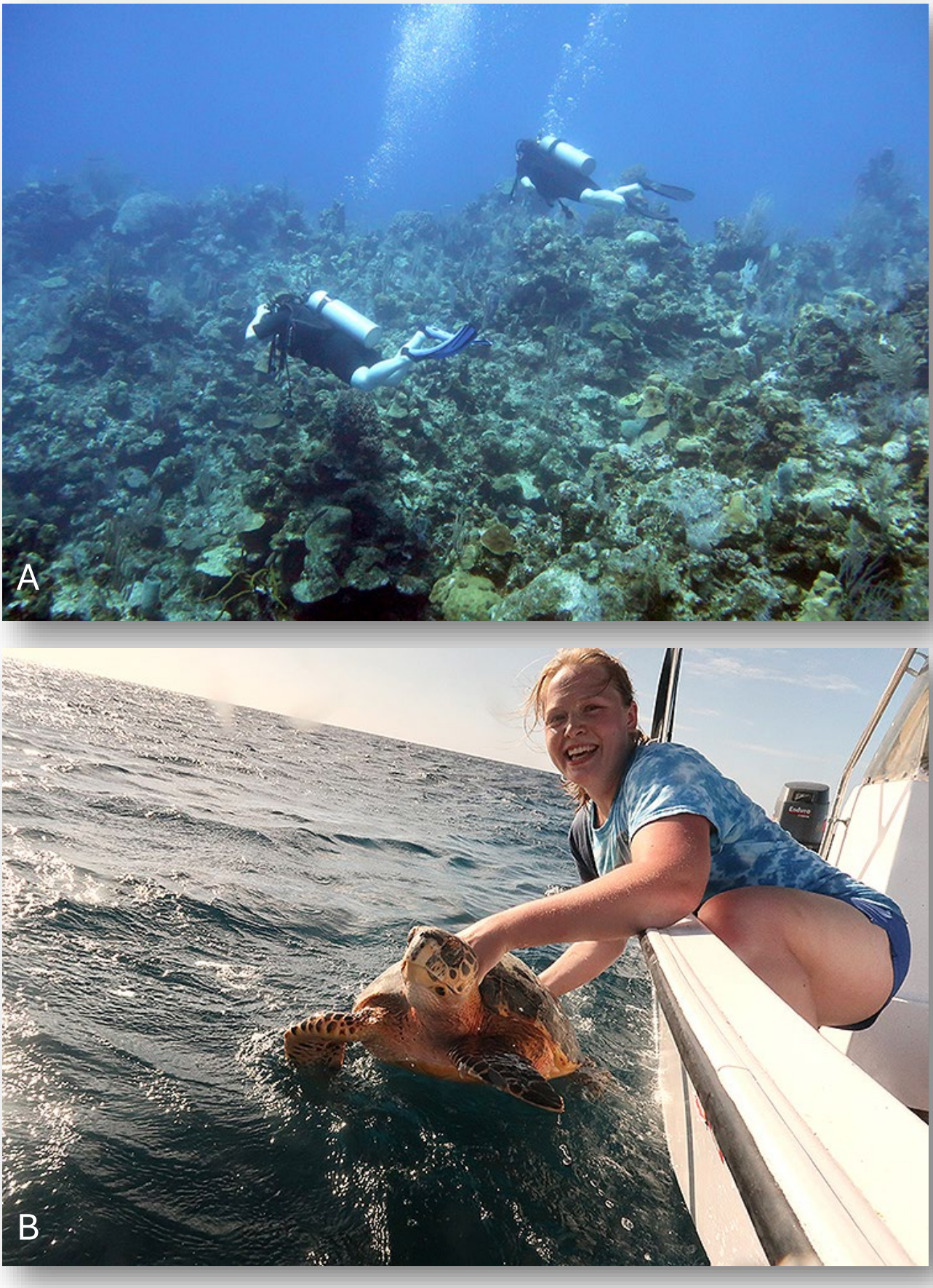

Fig. 3. As in previous years, ProTECTOR, Inc. Interns are vitally important for the functioning of the organization. Interns assist with data collection, education outreach, and project development. ProTECTOR, Inc. Interns also help provide funding support of the organization. In 2023, we had two ProTECTOR, Inc. Interns; Mallori Lloyd and Emma Carlson (A). Emma Carson releases a hawksbill back to the water (B).

Fig. 4. In-water images of hawksbill (A) and green (B) sea turtles used for photo-identification of turtles residing in the SBWEMR. These images can also be used to identify individuals and their prey item usage (C) and interactions with other marine vertebrates (D).

Table 1. Capture and recapture measurements for juvenile hawksbills in the SBWEMR over the past 7 years. Differences in length (CCLmin), width (CCW), and weight (kg) are provided for each turtle. The single green turtle captured is not presented in this table.

Turtle Tag ID	CCL min (cm) T1 to T? (date)	Difference (+/-)/# of years	CCW (cm) T1 to T? (date)	Difference (+/-)/# of years	Weight (kg) T1 to T? (date)	Difference (+/-)/ # of years
YYJ363	T1 (8/19/2019):52.3 cm T2 (6/19/2023): 67.5 cm	+15.2 cm over 4 years	T1 (8/19/2019): 27 cm T2 (6/19/2023):60.1	+33.1 cm over 4 years	T1 (8/19/2019):16.2 kg T2 (6/19/2023):32.2 kg	+16 kg over 4 years
BBQ310	T1 (8/24/2017): 57.5 cm T3 (6/22/2023): 65 cm	+7.5 cm over 6 years	T1 (8/24/2023):53.7 cm T3 (6/22/2023):59.2 cm	+5.5 cm over 6 years	T1 (8/24/2017):21.2 T3 (6/22/2023):30.4 kg	+9.2 kg over 6 years
MMT767(First capture)	T1 (6/23/2023): 52.5 cm	N/A	T1 (6/23/2023): 46.3 cm	N/A	T1 (6/23/2023):14.8 kg	N/A
BBQ365	T1 (8/24/2016): 35.9 cm T2 (6/23/2023): 65 cm	+29.1 cm over 7 years	T1 (8/24/2016):31.5 cm T2 (6/23/2023):54 cm	+22.5 cm over 7 years	T1 (8/24/2016):8.89 kg T2 (6/23/2023):29.2 kg	+20.31 kg over 7 years
BBQ155	T1 (6/17/2022): 67 cm T2 (6/27/2023): 67.6 cm	+.6 cm over 1 year	T1 (6/17/2022):58 cm T2 (6/27/2023):58.9 cm	+.9 cm over 1 year	T1 (6/17/2022):33.2 kg T2 (6/27/2023):34.4 kg	+1.2 kg over 1 year
MMT529(First capture)	T1 (6/27/2023): 50.8 cm	N/A	T1 (6/27/2023):42.1 cm	N/A	T1 (6/27/2023):___ kg	N/A
MMT567(First capture)	T1 (6/28/2023): 44.7 cm	N/A	T1 (6/28/2023):40.6 cm	N/A	T1 (6/28/2023):11 kg	N/A
YYJ335	T1 (8/18/2019): 54.5 cm T2 (6/29/2023): 62.7 cm	+8.2 cm over 4 years	T1 (8/18/2019):48 cm T2 (6/29/2023):54.3 cm	+6.3 cm over 4 years	T1 (8/18/2019):19.6 kg T2 (6/29/2023):29 kg	+9.4 kg over 4 years
YYJ273	T1 (7/24/2019): 36.9 cm T2 (6/29/2023): 54.2 cm	+17.3 cm over 4 years	T1 (7/24/2019):33.6 cm T2 (6/29/2023):49.3 cm	+15.7 cm over 4 years	T1 (7/24/2019):5.6 kg T2 (6/29/2023):18.6 kg	+13 kg over 4 years
BBQ114	T1 (8/2/2016): 38.2 cm T3 (7/3/2023): 62.1 cm	+23.9 cm over 7 years	T1 (8/2/2016): 33.4 cm T3 (7/3/2023): 52.9 cm	+19.5 cm over 7 years	T1 (8/2/2016): 9.8 kg T3 (7/3/2023): 24 kg	+14.2 kg over 7 years
MMT508(First capture)	T1 (7/3/2023): 42 cm	N/A	T1 (7/3/2023): 36.7 cm	N/A	T1 (7/3/2023): 8 kg	N/A
BBQ348	T1 (9/21/2017): 44 cm T2 (7/4/2023): 61.5 cm	+17.5 cm over 6 years	T1 (9/21/2017):36.3 T2 (7/4/2023): 50.1 cm	+13.8 cm over 6 years	T1 (9/21/2023):9.4 kg T2 (7/4/2023): 24 kg	+14.6 kg over 6 years

Table 2. Summary recapture growth data for juvenile *E. imbricata* captured in the Sandy Bay West End Marine Reserve showing individual increases in length (CCLmin), width (CCW), and weight (Kg) per year.

Turtle ID #	CCL-min (cm) growth per year	CCL-W (cm) growth per year	Weight (kg) growth per year
YYJ363	3.8 cm	8.275 cm	4 kg
BBQ310	1.25 cm	.917 cm	1.53 kg
BBQ365	4.157 cm	3.214 cm	2.9 kg
BBQ155	.6 cm	.9 cm	1.2 kg
YYJ335	2.05 cm	1.575 cm	2.35 kg
YYJ273	4.325 cm	3.925 cm	3.25 kg
BBQ114	3.414 cm	2.785	2.029
BBQ348	2.917 cm	2.3 cm	2.43 kg

Table 3. Average growth in length (CCLmin), width (CCW), and weight (Kg) for all hawksbill turtles recaptured in 2023.

Average CCL-min growth per year	Average CCL-W growth per year	Average Weight growth per year
2.81 cm	2.99 cm	2.46 kg

RESULTS

As part of a ProTECTOR, Inc. Intern project, we calculated growth rates of recaptured hawksbill juveniles (Table 1) and found all had relatively high rates of growth. However, turtles of small size when first captured had higher rates of growth than turtles captured when large for the first time and recaptured at a later date. We noted that both CCL, CCW, and weight all increased more rapidly between first and second captures when turtles were first captured at a smaller size than if they were first captured at a larger size (Table 1).

Tissue Sampling of Turtles in the SBWEMR

During the 2023 research season, we were able to hand-capture and flipper tag *E. imbricata* and *C. mydas* individuals. We collected tissue samples from each turtle (Fig. 5) for additional studies undertaken at Loma Linda University, including continuing work on genetic haplotype diversity, heavy metal contamination, and blood parasite genetic barcoding. New developments allowed us to partner with a local veterinarian, Dr. Jorge Bolivar, to begin evaluating health parameters of turtles in-country. These studies are linked together to provide a variety of information for the same population of juvenile hawksbills in the SBWEMR over consecutive years of monitoring. Results of some studies are allowing us to evaluate genetic links between these individuals, their natal beaches, and their maternal foraging grounds.

Fig. 5. ProTECTOR, Inc. Volunteers assisted with collecting in-water images of tagged (A) and untagged hawksbill (B) and green turtles. Once turtles were brought to the makeshift laboratory area, Interns also assisted with measuring and sampling captured turtles (C). Hands-on experiences with sea turtles through the ProTECTOR, Inc. Intern Program facilitated connections with marine habitats and organisms that will stimulate the support of marine protected areas in Honduras and around the world.

R E S U L T S

Calabash Juvenile Turtles

In partnership with the Cooper family at Calabash Bight, we collected morphometric data on 14 juvenile green turtles (mean CCLmax = 39.5 cm; range = 29 – 55.4 cm; mean weight = 7.6 Kg; range = 2.6 – 25.8 Kg), and a single hawksbill turtle (CCLmax = 25.2 cm; weight = 1.6 Kg). These turtles all had algal growth on the shell and soft tissue, which were easily cleaned using a soft scrubbing dish pad. Once turtles were cleaned, measured, photographed, and sampled for blood and scute (Fig. 6), they were placed back in the small holding pool to await release within the next few weeks.

CFB Juvenile Turtle Tagging

We weighed, measured, photographed, sampled, and flipper tagged (on right rear flipper) nine head-started juvenile hawksbill turtles (Fig. 7). These turtles hatched on beaches of the island, and were kept in a large ocean pool with an area of approximately 40m (L) × 40m (W) × 2m (D). For the turtles we flipper tagged, mean turtle CCLmax was 35.8 cm (range = 26.9 – 40.8 cm), while mean weight was 4.6 kg (range = 1.8 – 6.2 kg). Turtles were all in good external physical condition, with no turtles appearing to have injuries or abnormal growths. At the conclusion of each work-up, each turtle was returned to the large holding pool. When we left the island, these turtles were scheduled to be released within the following 1 – 2 months.

Guanaja Nesting Recovery Project

Although hawksbill nesting on Guanaja had been reported previously (Hyatt, et al. 2019), no records of loggerhead and green nesting had been quantified until recently (Romero, et al, 2023). During the 2023 research season, monitoring for sea turtle nesting on Guanaja resulted in locating nests of three sea turtle species; *E. imbricata, C. caretta,* and *C. mydas* (Fig. 7). Numbers of nests for each of the three species encountered in 2023 are reported in Table 4.

Fig. 6. Rescued green (A and D) and hawksbill turtles were held in a small sea pen in Calabash Bight. ProTECTOR, Inc. contacted the family who had rescued the turtles, and partnered with the family to collect data from the turtles, including weights, measures, and photographs of all turtles held. We also placed a flipper tag on each turtle (front, right flipper) (B) and collected a small blood sample (C) prior to release of the turtles back to the wild.

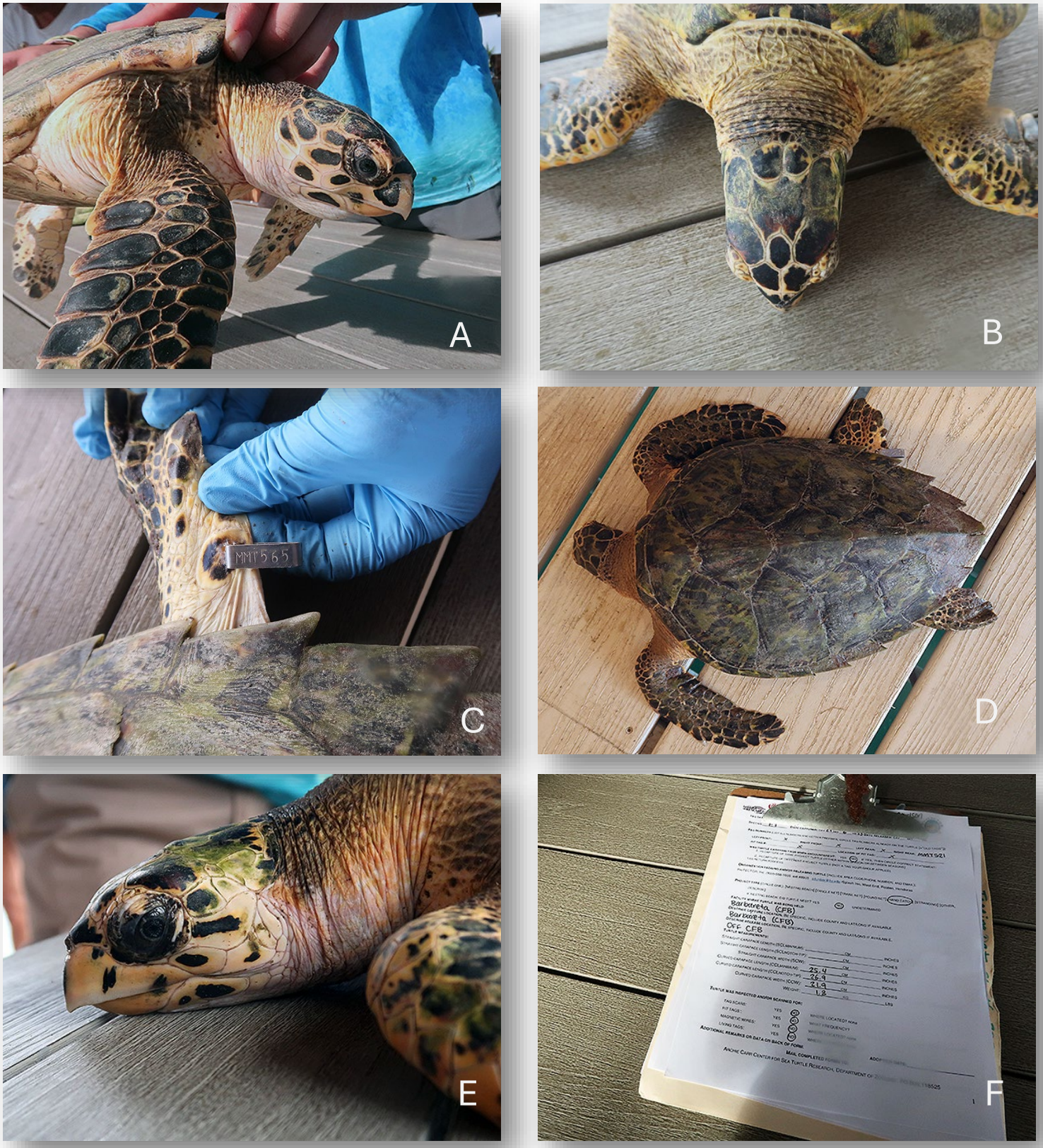

Fig. 7. ProTECTOR, Inc. was requested by the CFB Environmental Manager to come to the island to flipper tag and collect information on hawksbill turtles hatched at CFB in late 2022. Turtles were weighed (A), photographed (B, D, and E), and flipper tagged on the right, rear flipper (C). All data were recorded on data sheets designed for the project (E). ProTECTOR, Inc. and CFB will continue to work together to gather further information on sea turtles nesting at CFB.

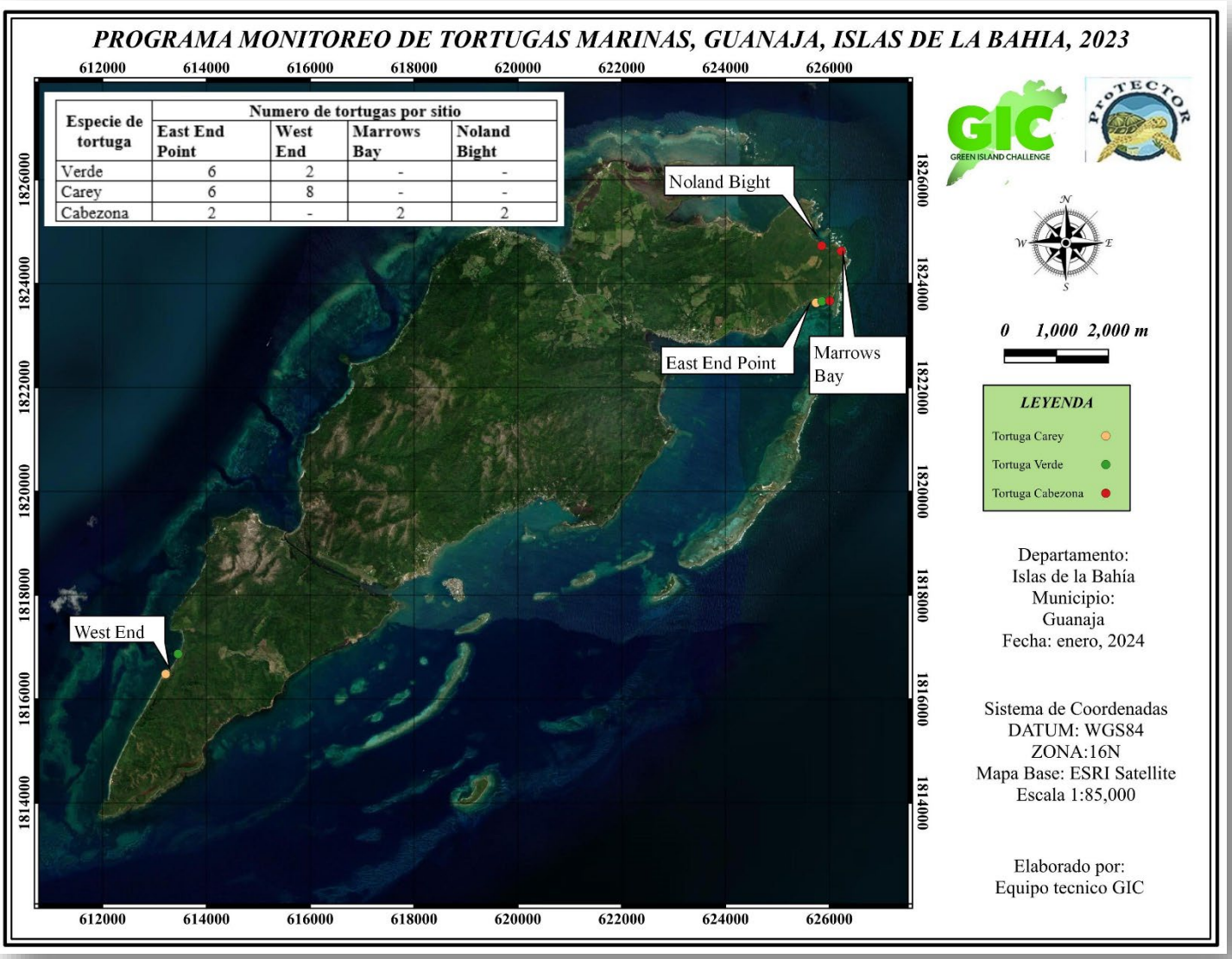

Fig. 8. Map of nesting locations on Guanaja. Nests of *E. imbricata*, *C. mydas*, and *C. caretta* were encountered and verified by monitors in 2023. Map produced by Anuar Romero, GIC.

Table 4. Nesting and hatching data from Guanaja beaches for the 2023 monitoring season. Number of eggs laid, hatchlings released, and hatching success for the three species are included.

Species	Number of Nests	Number Eggs Laid	Number Hatchlings Released	% Hatching Success
C. mydas	8	1,280	1,020	79.7
C. caretta	6	870	810	93.1
E. imbricata	14	1,820	1,710	93.9

G O V E R N M E N T A L S U P P O R T

Our efforts in 2023 were again supported by the central Government of Honduras through the interactions of Snr. Rodolfo Pastor de Maria y Campos; the Secretary of State from the Office of the President of Honduras, with ProTECTOR, Inc. Country Director, Lidia Salinas.

We continue to work with the Castro Administration and the applicable Ministries of the Central Government to stabilize the work of ProTECTOR, Inc. through funding support identified by these government Ministries, and opportunities for government agents, and national university faculty and students to become much more involved with current and developing projects over the long-term in order to build capacity for conservation research in Honduras. These funds will provide foundational support to the ongoing development of scientific protocols for assessing the status of endangered sea turtles and their habitats throughout the waters of Honduras. Equally importantly, these funds will facilitate support for training national Hondurans in scientific research development, field research methodologies, sample collection and storage, sample and data analyses, dissemination of results on national and international scales, and mentorship of new scientists for the long-term development of a national culture of research and scientific development.

CONCLUSIONS

PI Dunbar has recently written the Marine Turtle Specialist Group (MTSG) Reports for both Caribbean and Pacific Honduras (*in review*), in which we recognize the lack of information available on the sea turtles of Honduras. The majority of our understanding of sea turtles in Honduran waters has come from the work of ProTECTOR, Inc. over the past 17 years. Still, the bulk of that work has focused on nesting olive ridley (*L. olivacea*) in the Gulf of Fonseca, juvenile hawksbill (*E. imbricata*) and green (*C. mydas*) turtles in the SBWEMR, and nesting hawksbills in Utila and Guanaja. These studies have, in the past, been limited by lack of government and community support, inefficiency of permit issuing processes, lack of funding support, and an unfortunate lack of skilled national personnel who can carefully and correctly manage the ongoing collection of information in the field.

Still, our efforts have focused on basic monitoring of small, protected populations, and there has been little work to investigate many aspects of life history stages of these populations of juvenile hawksbill and green turtles within the small area of the Bay Islands. Beyond the current studies, there is need to broaden our research efforts to other coastal areas of the mainland, and remote island territories of Caribbean Honduras. There is need to investigate populations of nesting and foraging leatherback (*Dermochelys coriacea*) and loggerhead (*Caretta caretta*) turtles along the north coast and Mosquito region of Honduras and in the non-protected areas of the Bay Islands. There is need to understand the presence, population dynamics, and nesting of species other than *L. olivacea* throughout the Honduras coast of the Gulf of Fonseca. There remains a great need to understand the migratory routes of sea turtles, and the impacts of large-scale and artisanal fisheries on all species of sea turtles in Honduran waters. In addition to these, there is an overarching need to study the impacts of habitat loss, coastal over-development, and global climate change on both sea turtles, and the habitats they require at different ontogenetic stages.

Without such studies, we will be limited in our understanding of how to manage and recover not only sea turtle populations, but also the habitats that sea turtles need, and human communities rely on for cultural, social, and economic growth and stability.

Although, our efforts are relatively small, in 2023 ProTECTOR, Inc. continued to undertake projects in the SBWEMR and on Guanaja. These included the collection of recapture and growth data throughout the SBWEMR, investigating the interactions of hawksbill turtles with other marine

vertebrates during feeding events, increasing our knowledge of epibiont communities that inhabit hawksbills in the SBWEMR, and expanding our photo identification (PID) dataset for juvenile green and hawksbill turtles in the confines of the marine reserve.

Additionally, with assistance and field work from Green Island Challenge, we continue to build our understanding of the potential to recover hawksbill, green, and loggerhead turtle nesting on Guanaja, Especially if nesting in Utila declines due to private development of the main nesting beach there. Over the past 3 – 4 years there is some evidence that consistent nesting is increasing around the island, and nesting populations (as opposed to sporadic individual nesting) are being established.

ProTECTOR, Inc. research was disseminated this past year through the Marine Turtle Specialist Group (MTSG) reports for Caribbean (Dunbar & Salinas) and Pacific (Dunbar, Collier, and Salinas) Honduras. Because of the small number of Interns in 2023, and because PI Dunbar has had the duties of presiding over the International Sea Turtle Society (ISTS) as President, he has had less time to prepare abstracts and manuscripts from the Honduras research for the ISTS Symposium and international journals, respectively. However, we expect our research efforts to yield several publications and abstracts throughout 2024 and 2025.

The research efforts of ProTECTOR, Inc. are of value to Honduras only if the information garnered, analyzed, and reported are used to develop recommendations and plans of action that increase the conservation and management potential of the relative organizations and departments to undertake data-driven, rather than emotion-driven, decision-making. While there are many organizations within the country claiming to undertake conservation projects, there is a need to guide these efforts by simple, yet effective methods of investigation to understand if such efforts are useful and impactful. Without such insights, efforts toward ‘conservation’ may utilize financial and human resources, yet be unsuccessful in achieving goals, since methods to reach set goals are not objectively evaluated.

Therefore, as a result of our efforts, we provide a brief list of recommendations we suggest are vital for ongoing monitoring of sea turtle status, population dynamics, and the development of programs that not only increase research efforts, but also build a strategy for long-term national research capacity.

RECOMMENDATIONS

We provide the following recommendations to the Honduras Government and managing directors for the Bay Islands marine protected areas (MPAs):

1. In order to avoid losses in time for collecting critical annual data for the conservation of sea turtles and their required marine and coastal habitats, we continue to urge the Department for Forestry Conservation (ICF) to undertake the assessment and issuing of our ProTECTOR, Inc. research permit applications in a timely manner, within a maximum of 2 months (60 days) from submission of the application. This is a high priority in ensuring the needed research efforts are able to continue without interruptions

2. Government agencies responsible for research permitting should clearly communicate these permissions to national and local offices, and to all local NGOs to ensure critical research on natural resources is maintained without interruption from local environmental organizations. This should be done in consultation with the research organization at regular intervals. Without such changes to the permitting process, conservation research which is essential for guiding protected area management processes will not be accomplished on an ongoing and uninterrupted basis.

3. The relevant departments of the Honduras Government should be tasked with assisting in locating funding opportunities for relevant studies, as well as participate with research organizations in applying for available funds to support national studies. Funding is a critical hinderance to accomplishing long-term, well-designed wildlife conservation monitoring and research studies. Relevant departments of the Honduras Government should take a partnership role in finding and applying for significant conservation funding, from both national and international funding sources.

4. Once again, we recommend that local community entities, such as Patrinatos organizations, should be informed of the research activities by the regional ICF Government offices at least 2 months prior to the initiation of research work. Meetings with such groups should be arranged by regional ICF offices just prior to the initiation of the research efforts, allowing local community members opportunities to directly discuss the projects with researchers. These discussions should, however, not interfere with scheduled and approved research activities.

RECOMMENDATIONS

5. In collaboration with the National Autonomous University of Honduras (UNAH), the Central Government of Honduras should establish a funding mechanism for student internships with ProTECTOR, Inc. that provide undergraduate students in Honduras opportunities to participate in research efforts on sea turtles throughout the country in conjunction with ProTECTOR, Inc. The training and capacity building of Honduran students will greatly improve natural resources leadership and decision-making at the national level, both now and in the immediate future. These opportunities will also facilitate additional data collection on nesting beaches throughout Honduras, since turtle nesting often begins prior to our arrival in Honduras, and continues after our fieldwork has concluded.

6. We recommend that sea turtle conservation and research efforts throughout the country be guided by a single entity that is able to coordinate all efforts. This is needed to avoid duplication of effort and the confounding of methodologies among conservation organizations. For example, tagging of all sea turtles throughout the country should be overseen by a single entity so that duplicate orders of tags are not placed, and that tag records are not kept by individual organizations from which records can be lost or errors in record keeping be carried on without oversight.

7. There is a great need to develop a digital and publicly accessible library of reports and publications that have been submitted to all government agencies regarding sea turtles in the country. This library should be housed on a government server and a link be provided for public access on the ICF or DIGEPESCA website in both English and Spanish.

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Wright, M. K., Baumbach, D. S., Collado, N., Safi, S. B., & Dunbar, S. G. (2020). Influence of boat traffic on distribution and behavior of juvenile hawksbills foraging in a marine protected area in Roatán, Honduras. *Ocean & Coastal Management*, *198*, 105379. https://doi.org/https://doi.org/10.1016/j.ocecoaman.2020.105379

Wright, M. K., Pompe, L. R., Mishra, D. R., Baumbach, D. S., Salinas, L., & Dunbar, S. G. (2022). Hawksbill presence and habitat suitability of a marine reserve in Honduras. *Ocean & Coastal Management*, *225*, 106204. https://doi.org/https://doi.org/10.1016/j.ocecoaman.2022.106204

A C K N O W L E D G M E N T S

We are grateful to all those who have been involved with the research throughout the 2023 research season. Thanks to ProTECTOR, Inc. Country Director, Lidia Salinas, who continues to work tirelessly, to secure the Honduras research permits from the Department of Forestry Conservation (ICF), and who assists with project logistics throughout the Bay Islands. We continue to express our gratitude to the Secretary of State from the Office of the President of Honduras, Snr. Rodolfo Pastor de Maria y Campos and to the Castro Administration for their continuing commitment to the conservation and recovery of biodiversity and the environment of Honduras, and for their support of ProTECTOR, Inc. and encouragement to expand our work throughout the country in the coming years. Without the continuing moral support of Rafael Brioso, Paulo Shikanai, and Kathy Berner (owners) and dive support of the staff of the Splash Inn Dive Resort on Roatán, we would be unable to continue this critical sea turtle conservation research on Roatán.

Additional thanks to Mr. Jimmy Miller of the West End, for logistical support on Roatán.
Former graduate student Dustin Baumbach, continues to provide data analyses and mapping for the writing of these annual reports. We thank the ProTECTOR, Inc. Interns, Mallori Lloyd and Emma Carlson, who assisted with all aspects of these projects during the 2023 research season.

Funding and in-kind assistance for projects was provided by the California Turtle and Tortoise Club, the California Turtle and Tortoise Club (Inland Empire Chapter), Splash Inn Dive Resort Roatán, and Loma Linda University Department of Earth and Biological Sciences. We are grateful to Anuar Romero of the Green Island Challenge initiative for their leadership and direction over the Guanaja Nesting Recovery Project.

Research permitting was secured from the Department of Forestry Conservation (ICF) and the Division of Wildlife (Vida Silvestri). These studies were accomplished under Honduras permit # ICF-121-2023.

NOTES

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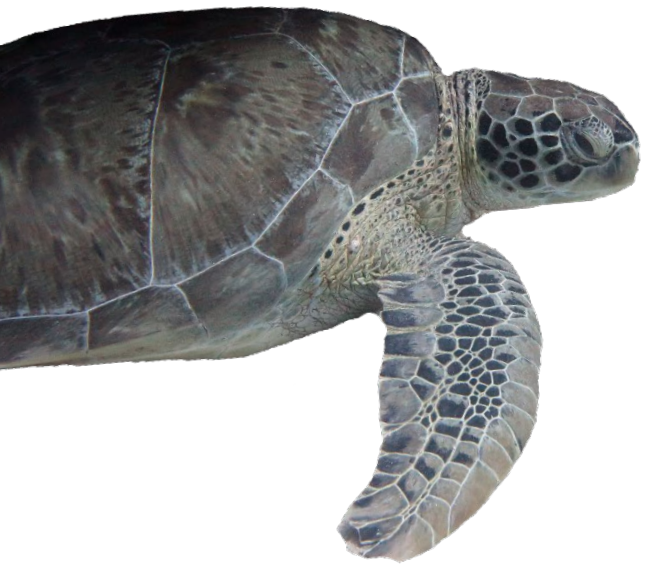

APPENDIX 1 – PUBLISHED PAPERS AND SYMPOSIUM ABSTRACTS

Peer-Reviewed Published Papers

Baumbach, D. S., Zhang, R., Hayes, C. T., Wright, M. K., & Dunbar, S. G. (2022). Strategic foraging: Understanding hawksbill (Eretmochelys imbricata) prey item energy values and distribution within a marine protected area. *Marine Ecology*, *43*(2), e12703. https://doi.org/https://doi.org/10.1111/maec.12703

Hyatt, E. C., Hayes, W. K., and Dunbar, S. G**.** 2023. Ecophenotypic variation or genetic differentiation? Ambiguity of morphological and molecular relationships presents uncertainty in host-specific plasticity of Chelonibia barnacles. *Estuarine, Coastal and Shelf Science*, 292 (2023) 108470. https://doi.org/10.1016/j.ecss.2023.108470

Wright, M. K., Pompe, L. R., Mishra, D. R., Baumbach, D. S., Salinas, L., & Dunbar, S. G. (2022). Hawksbill presence and habitat suitability of a marine reserve in Honduras. *Ocean & Coastal Management*, *225*, 106204. https://doi.org/https://doi.org/10.1016/j.ocecoaman.2022.106204

Symposium Abstracts

Pan, D., Dunbar, S.G. 2023. Growth dynamics of juvenile hawksbills in a marine protected area in Roatán, Honduras. 41st International Sea Turtle Symposium. 20 – 24 March, 2023. Cartagena, Colombia.

Romero, A., Vance, C., Salina, L., Dunbar, S.G. 2023. Recent trends in the Guanaja Nesting Recovery Project, Guanaja, Honduras. 41st International Sea Turtle Symposium. 20 – 24 March, 2023. Cartagena, Colombia.

Salinas, L., Pastor de Maria y Campos, R., Bermudez, J., Soliz, L., Pereira, S., Flores, D., Dunbar, S.G. 2023. Scientific research and government process: paradigm shifts in the conservation of sea turtles in Honduras. 41st International Sea Turtle Symposium. 20 – 24 March, 2023. Cartagena, Colombia.

Streit, M.B., Aguila, Z., Lewis, A.L., Morrow, A., Salinas, L., Dunbar, S.G. 2023. Feeding interactions between hawksbill turtles and reef fish in Sandy Bay West End Marine Reserve, Roatán, Honduras. 41st International Sea Turtle Symposium. 20 – 24 March, 2023. Cartagena, Colombia.