# ProTECTOR, Inc. NATIONAL REPORT OF ACTIVITIES FOR THE 2022 RESEARCH SEASON

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LOMA LINDA UNIVERSITY

PROTECTOR

TAPS
TURTLE AWARENESS AND PROTECTION STUDIES

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 2022 Honduras ICF research permit #DE-MP-067-2022. The permit was secured through the efforts of ProTECTOR, Inc. Country Director, Lidia Salinas, with assistance from the Secretary of State from the Office of the President of Honduras, Snr. Rodolfo Pastor de Maria y Campos.

This report has been authored by Stephen G. Dunbar and Lidia Salinas.

**Citation**

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

This report provides a brief overview of the activities of the Protective Turtle Ecology Center for Training, Outreach, and Research, Inc. (ProTECTOR, Inc.) over the 2022 research season from June 4 to July 5, 2022. We present brief results of individual projects. We undertook all research under national permits issued by the Honduras government through the departments of Fisheries (DIGEPESCA) and the Department of Forestry Conservation (ICF).

The research area for the brief 2022 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), and nesting beaches of Guanaja (Fig. 1C). 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, but 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, and the Secretary of State from the Office of the President, Snr. Rodolfo Pastor de Maria y Campos. On Guanaja, our work was assisted by the Green Island Challenge Initiative, and undertaken by Mr. Anuar Romero. Mr. Romero was assisted by the Guanaja Municipal Environmental Unit, the Berkshire High School, and the Guanaja Hotel.

Once again, there were major delays and setbacks during the permitting process in which our 2019 application for a research permit through the previous national government, was not issued as a result of a lack of coordinated oversight on the part of the prior governance of the Institute for Forestry Conservation (ICF), which both issues the permit, as well as oversees the management of the marine protected area of the Bay Islands. The lack of clear directives from both the national and regional offices of ICF resulted in much confusion and misunderstanding among ICF offices, delaying for more than 30 months the issuing of the permit with three areas of major restrictions on the research efforts. This led ProTECTOR, Inc. to reject the issued permit, and to submit rebuttals to the restrictions, and an immediate reconsideration of these restrictions, based on scientific evidence for the need to undertake methods which had been restricted by the regional offices of ICF in Roatan and La Ceiba in January, 2022.

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

The newly elected Castro Administration of the Central Government of Honduras, immediately undertook efforts to work through ICF to have the permit reissued with all restrictions on research methods removed from the permit. Through the efforts of the Secretary of State from the Office of the President, Snr. Rodolfo Pastor de Maria y Campos, the unrestricted ICF permit was issued on March 17, 2022. There remains a strong need for a streamlined and standardized mechanism for the application for national research permits to be issued in an effective and timely manner if environmental and conservation research is to be continued in the country.

As a result of the studies reported here, we have increased our bank of blood, skin, and scute samples for genetic haplotype, heavy metal, and blood parasite analyses to more than 540. Additionally, we have been able to track the growth rates of juvenile hawksbills within the SBWEMR over the past 6 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, and 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.

# INTRODUCTION

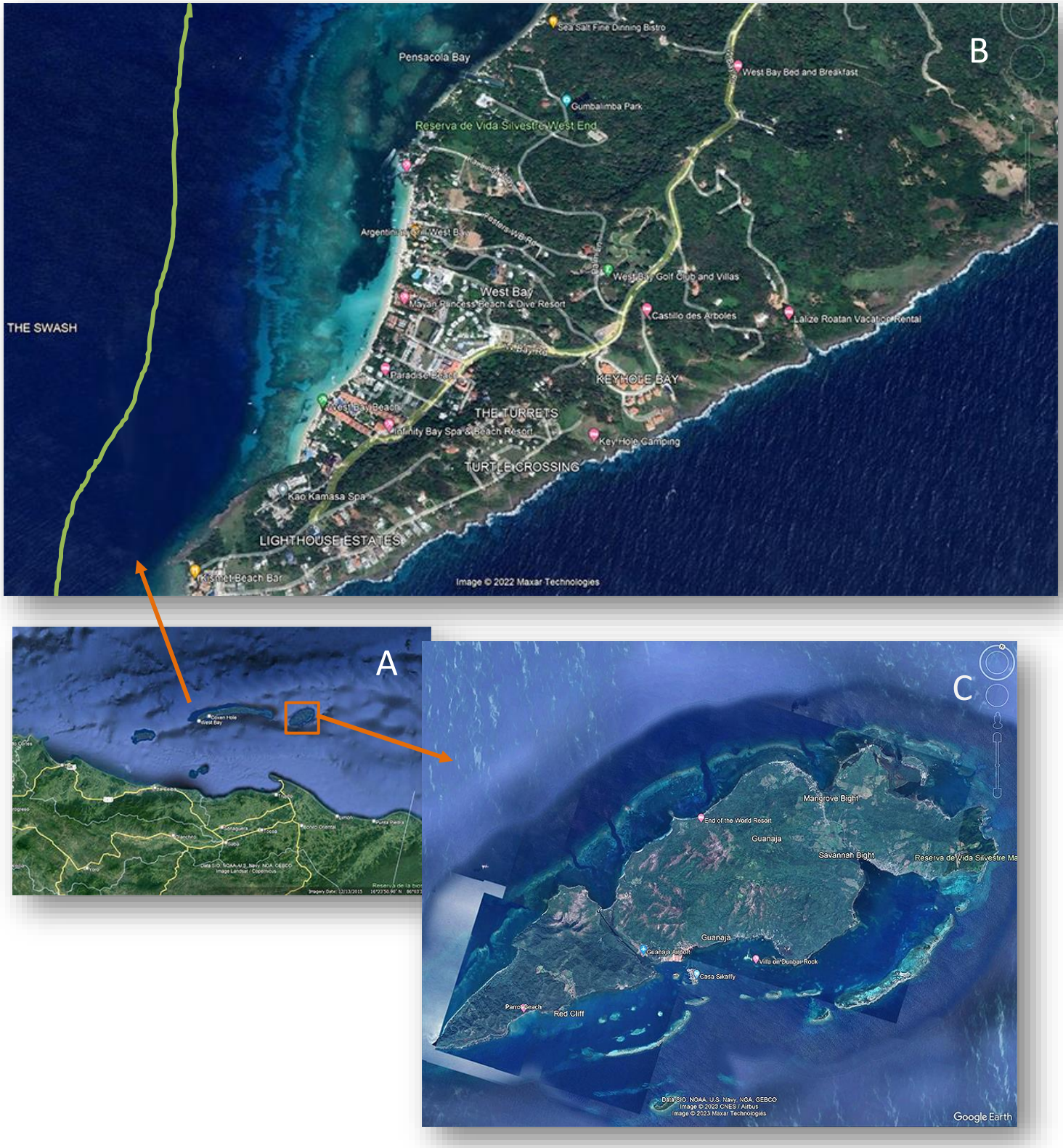


**Fig. 1.** A map of the regional view of the north coast of Honduras (A) with the main research sites on Roatán (B) and Guanaja (C), Bay Islands, Honduras. The target area of investigation for Roatan was the Sandy Bay West End Marine Reserve (SBWEMR) (B), while the areas of research in Guanaja (C) were several nesting beaches around the island.

# INTERN TRAINING

During the 2022 research season, we were again able to facilitate several ProTECTOR, Inc. Interns (assisting for more than one month), and Volunteers (assisting for less than one month). All ProTECTOR, Inc. Volunteers and Interns were placed at the main 2022 research site in the SBWEMR in Roatán on various projects undertaken there. In all, we hosted four ProTECTOR, Inc. Interns, and three ProTECTOR, Inc. Volunteers through the one-month period of our research efforts in Roatan. The number of Interns and Volunteers recruited to the program was again slightly compromised by the uncertainty of the issuance of the permit prior to the Castro Administration taking office in late January. Once the permit was finally issued in mid-March, we then set about to recruit Interns and Volunteers for the ProTECTOR, Inc. research projects in Honduras. However, by this time, many potential Interns and Volunteers from North America and Europe had already received Internship placements and were unavailable to join the ProTECTOR, Inc. Internship and Volunteer program. Additionally, international travel restrictions for some countries due to the Covid-19 pandemic, continued to restrict some potential Interns and Volunteers from participating again this year. Despite these setbacks, we were nevertheless able to continue important data collection on the juvenile population of hawksbill and green sea turtles in the SBWEMR through the 2022 research season.

Our ProTECTOR, Inc. Interns and Volunteers for the 2022 season once again, came mainly from Canada and the United States, but this year also included a Volunteer from Chile. Our ProTECTOR, Inc. Volunteers included: Dominic and Voicu Tulai (repeat Volunteers from 2019), and Carolina Germakova (who witnessed our ProTECTOR, Inc. research at Splash Inn in 2019, and requested to return to work with us for two weeks as a ProTECTOR, Inc. Volunteer in 2022). Interns included: Dawson Pan, Ben Streit, Treson Thompson, and Jayden Wilson (see Fig. 2).

Interns undertook data collection on symbiosis of sea turtles with other marine invertebrates by observing and recording in-water interactions of sea turtles with marine organisms, especially in relation to turtle feeding events. Other Volunteers and Interns assisted with the collection and preservation of invertebrate epibionts from juvenile hawksbill turtles as part of an ongoing assessment of epibiotic symbionts associated with resident turtles within the SBWEMR. This study has implications for understanding the long-term association of different suites of epibionts that may be unique to a specific habitat in which turtles reside. Additionally, Volunteers and Interns assisted

# INTERN TRAINING






**Fig. 2.** As in previous years, ProTECTOR, Inc. Volunteers and Interns are an essential part of the functioning of the organization, and assist with data collection, education outreach, and project development. ProTECTOR, Inc. Interns and Volunteers also help provide funding support of the organization. From top left to bottom right, 2022 ProTECTOR, Inc. Interns and Volunteers were: (Interns) Treson Thompson, Ben Streit, Dawson Pan, Jayden Wilson, (Volunteers) Dominic Tulai, Voicu Tulai, and Carolina Germakova.

in the collection and recording of morphometric data for both recaptured and newly captured individual green and hawksbill turtles from within the SBWEMR. As part of the Internship, Interns were required to analyze the data collected and to present a write-up of the data as a brief report. The opportunity to develop these reports provides each Intern with an opportunity not only to experience the fieldwork related to endangered species conservation research, but also to bring together the background knowledge and current research information regarding the topic of their project. These written reports, at times, also lead to individual ProTECTOR, Inc. Interns submitting abstracts to present their findings at the International Sea Turtle Symposium (ISTS). As a result of this year's efforts by Interns, three abstracts were submitted and have been accepted for presentations at the 41st ISTS in Colombia in March, 2023 (for a list of submitted abstracts to the 41st ISTS, see the abstract list, pg. 23). These results highlight the success and importance of the goals of the ProTECTOR, Inc. Interns and Volunteer Program in demonstrating that ProTECTOR, Inc. Interns and Volunteers are obtaining unique experiences in hands-on endangered species conservation research, and applying their field experiences to the larger context of wildlife conservation. This context includes interactions with other students, researchers, local NGOs, government officials, and local community members, as stakeholders in the conservation of national biodiversity resources.

ProTECTOR, Inc. continues to seek to develop opportunities for Honduran students, government officials, and members of local NGOs to partner with ProTECTOR, Inc. to also gain valuable experience in undertaking research that can guide conservation decision-making within the country. Such experiences will continue to develop local capacity for the management of natural resources within the country of Honduras. With assistance from the new Castro Administration, and specifically from the Office of the Secretary of State from the Office of the President, Snr. Rodolfo Pastor de Maria y Campos, we have identified potential funding streams through the Central Government of Honduras, that will not only assist in capacity building for Honduran students and government agents, but also for expanding the conservation research of ProTECTOR, Inc. throughout the country.

These funds will facilitate national citizens of Honduras to receive real-world training in conservation fieldwork and laboratory investigations that will expand the potential for Hondurans to assume leadership roles in national conservation efforts for both marine and terrestrial habitats. Basic field and laboratory training will be applicable to other projects dealing with habitats or species of conservation concern within the country.

## Guanaja Nesting Recovery Project (GNRP)

The Guanaja Nesting Recovery Project was established on June 28, 2018 at the request of community land owners who have watched the devastation of nests and nesting turtles over the past decade on the island of Guanaja. Through the 2019 season, monitoring of the nesting beaches around Guanaja continued with the oversight of the Green Island Challenge (GIC) initiative, a highly competent conservation research partner with ProTECTOR, Inc. However, during the onset of the Corona Virus pandemic in March, 2020, and through 2020 and 2021, much of the work of the GNRP was forced to come to a standstill due to restrictions of movement of community members.

The potential for light pollution on nesting beaches in Guanaja due to increasing housing and hotel development (as is currently taking place on Utila), continues to be of great concern to ProTECTOR, Inc. and the GIC. Previous studies (Witherington, 1991; Witherington and Martin, 2000; Salmon, 2003) have demonstrated disorientation in hatchlings during sea-finding due to beach lighting. For nesting recovery efforts to be successful, an evaluation of both beach house lighting, and of turtle orientation to light of different colors and wavelengths, is critically important. Prior lack of clarity in the research permit issued by ICF to ProTECTOR, Inc. in 2019 resulted in BICA-Guanaja resisting our ability to undertake research efforts and the collection of critically important nesting activities data. These interferences resulted in a complete shut-down of this important study taking place on the island of Guanaja in 2019.

During the ensuing 2020 and 2021 nesting seasons, Covid-19 lockdowns on Guanaja also reduced the ability to have consistent beach monitoring. However, in 2022, the project was running once again, including the flipper tagging of new nesting females, and the collection of data from the main nesting sites around the island. Active and intense nest monitoring was resumed and overseen by Anuar Romero of the GIC. The work by GIC has continued to provide critical information on the number of nests laid around Guanaja by hawksbills (*Eretmochelys imbricata*), green (*Chelonia mydas*), and loggerhead (*Caretta caretta*) sea turtles. From data collected by Romero and his team, it appears that there were 20 hawksbill nests, 20 green, and up to 5 loggerhead nests laid in the 2022 season.

## Guanaja Nesting Recovery Project

Nesting female numbers appear to be on a slightly increasing trend (Fig. 3), and may continue to increase as Guanaja potentially attracts nesting turtles who may no longer utilize the increasingly developed Pumpkin Hill nesting beach on Utila. Continuing flipper tagging of all nesting turtles from both Utila and Guanaja is needed in order to track the nesting trends of individuals in both locations. We plan to continue training of GIC personnel for flipper tagging and data collection, and to join with GIC in education outreach and opportunities to students on Guanaja.

Although we were unable to collect blood samples from nesting and hatching turtles in the 2022 season, we plan to again develop a project in which regular blood collections will be taken from both nesting and hatching turtles for the purposes of health and parasite analyses, and the genetic haplotyping of nesting and hatching turtles. These project will provide much-needed insights into both individual nesting trends, and nesting population trends, allowing us to predict if populations are on the rise, or are in decline.

Because of the importance of this study in providing best-practice guidance to land and business owners who are undertaking the private or commercial development of nesting beach areas on all Bay Islands, as well as to local ecosystem managers for the management of nesting habitats around the islands, we plan to resurrect this study in Guanaja again in the 2023 or 2024 research seasons to help us understand the complexities of turtle hatchling success in the Bay Islands, and how best to manage the resources critical to the recovery of nesting and hatchling success in this region.

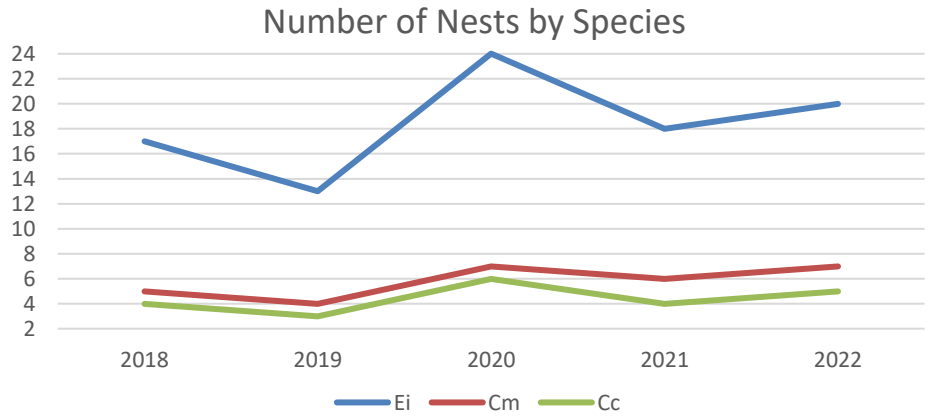


**Fig. 3.** Number of nests by species per year since the start of the Guanaja Nesting Recovery Project in 2018. Potential sampling bias due to annual fluctuations in monitoring efforts and reporting.

## Roatán Turtle Sampling in the SBWEMR

In 2022, we continued to sample juvenile sea turtles in the SBWEMR from June 4 – July 5. Unfortunately, we were hindered over some days due to boat and motor problems, which reduced our ability to dive and capture/recapture turtles in the reserve for approximately five days within our short research period. These five days resulted in the loss of some data collection. However, despite the loss of these five working days, we were nevertheless able to conduct in-water surveys, undertaking observations of turtle feeding, and captures of both untagged and tagged hawksbills and greens.

In all, we captured 17 juvenile turtles (16 hawksbills and 1 green) over the research period. Of these, three hawksbills and the single green were untagged. From the tagged turtles re-captured, we were able to remeasure and reweigh all turtles except two, which were captured while we had technical difficulties with our weighing scale. This issue was quickly remedied, and weighing of all subsequent turtles took place unhindered.

Data collected in 2022 and compared with prior data, demonstrated large increases in size (CCL and CCW), as well as in weight, in turtles recaptured over the past six years of the current research efforts in the SBWEMR. These data, along with reports by Baumbach, et al (2022), and Wright, et al (2022) on food choices and prey abundances in the SBWEMR, support the suggestion that the marine habitat is currently sufficient to support the rapid growth of the relatively small population of juvenile hawksbill and green turtles that reside in the reserve.

In addition to weighing and measuring captured turtles, we also collected blood and scute samples for continuing genetic haplotype and heavy metal investigations (neither of which can be predicted), as well as epibionts from beneath overlapping scutes. Epibionts were preserved in 70% EtOH, and analysis of genera and species will be done. An additional study included the in-water observation of hawksbills while foraging, to determine the species of fishes with which turtles interact, and to assess the nature of those interactions. This study has been taking place since 2016, and has finally resulted in sufficient data to analyze and report.

## Roatán Turtle Sampling in the SBWEMR

Results of growth rate studies on juvenile *E. imbricata* and *C. mydas* have demonstrated that juvenile turtles within the SBWEMR are growing at relatively rapid rates. Data collected and compared with previous data by ProTECTOR, Inc. Intern, Dawson Pan, have shown that over the past 3 – 6 years, juvenile hawksbills have increased in minimum Curved Carapace Length (CCLmin) at rates from 0.05 cm/yr - 4.8 cm/yr. (Table 1). These results demonstrate the importance of flipper tagging individual turtles within the Bay Islands, and support the results of studies by Baumbach et al (2022) and Wright, et al (2022) that suggest that the habitat of the SBWEMR (especially the southern areas of West End and west Bay) contain sufficient prey items to facilitate rapid rates of growth for juvenile *E. imbricata.*

It will be important to continue monitoring of this population, not only to establish continuing growth rates and their relationship with habitat changes due to habitat contamination and global climate change, but to also assess whether the population is increasing, or is in decline.

Table 1. Examples of calculated growth rates of individual flipper-tagged *E. imbricata*. CCLmin = Curved carapace length minimum; T1 = date of first measurements at Time 1; Tc = date of current measurement.

| Turtle Tag Number | CCLmin (cm) T1(date) – Tc(date) | Calculated Growth Rate/yr (cm) | Weight (Kg) T1 - Tc | Calculated Growth Rate/yr (kg) |
|---|---|---|---|---|
| MMT777* | 62.3 (9/7/2018) – 62.5 (6/10/2022) | 0.05 | 26.0 - ?? | ?? |
| BBQ344 | 31.5 (8/2/2016) – 58.4 (6/14/2022) | 4.5 | 6.8 – 21.0 | 2.4 |
| BBQ235 | 27.0 (8/24/2016) – 56.0 (6/19/2022) | 4.8 | 5.91 – 21.0 | 2.52 |
| BBQ310* | 57.6 (8/24/2017) – 61.5 (6/20/2022) | 0.8 | 21.2 – 28.6 | 1.48 |
| MMT568 | 39.0 (9/5/2018) – 54.9 (6/24/2022) | 3.98 | 6.9 – 17.4 | 2.65 |
| BBQ157 | 48.2 (8/20/2017) – 63.8 (6/26/2022) | 3.12 | 12.2 - 28.8 | 3.32 |
| BBQ303 | 39.2 (8/31/2017) – 59.3 (7/4/2022) | 4.02 | 6.4 – 20.8 | 2.88 |

* Suspected sub-adults at time of first measurements (T1).

## Photo Identification (PID) in the SBWEMR

Photo ID (PID) studies began in 2014 (Dunbar and Ito, 2014; Dunbar, et al, 2016; Dunbar, et al, 2021) in the SBWEMR, and continued in 2022 with the ongoing collection of digital photographs of individual sea turtles (both tagged and untagged) taken during SCUBA diving or during sea turtle work-ups (Fig. 4). These photos were submitted to a computer database for a computerized matching process that provides six potential matches. These matches can then be manually compared by viewing the test photo to the resulting match photos, and verified by eye.

Although we were unable to be in the field throughout the 2020 and 2021 seasons, due to Covid-19 travel restrictions, we were, nevertheless able to continue to submit new images to the growing PID database, due to the dedicated work of Mr. Ted Anger (Scuba Ted) (Dunbar, et al, 2021), who continued submitting new face and head photos of *E. imbricata* to our hawksbill PID database.

During the 2022 season, we continued to collect both in-water, and out-of-water images of all captured, and uncaptured turtles we observed in close enough proximity to photograph. These images have now been submitted to the ProTECTOR, Inc. PID database, and bring the total number of images to more than 3,144 photos of hawksbill individuals. We continue to analyze the dynamics of the foraging populations of juvenile hawksbill and green turtles in the SBWEMR to seek understanding of the general dynamics of these populations (Baumbach, et al, 2019; Baumbach, et al, 2019; Baumbach, et al, 2022; Wright, et al, 2022).

## Photo Identification in the SBWEMR

From tests carried out after the 2019 season, we were able to correctly match new images to individuals in the database, up to 96.3% of the time. These studies, as well as recommendations for increasing the number of images captured and submitted to our database by citizen-scientists, are reported in the Journal of Experimental Marine Biology and Ecology (Dunbar, et al, 2021).

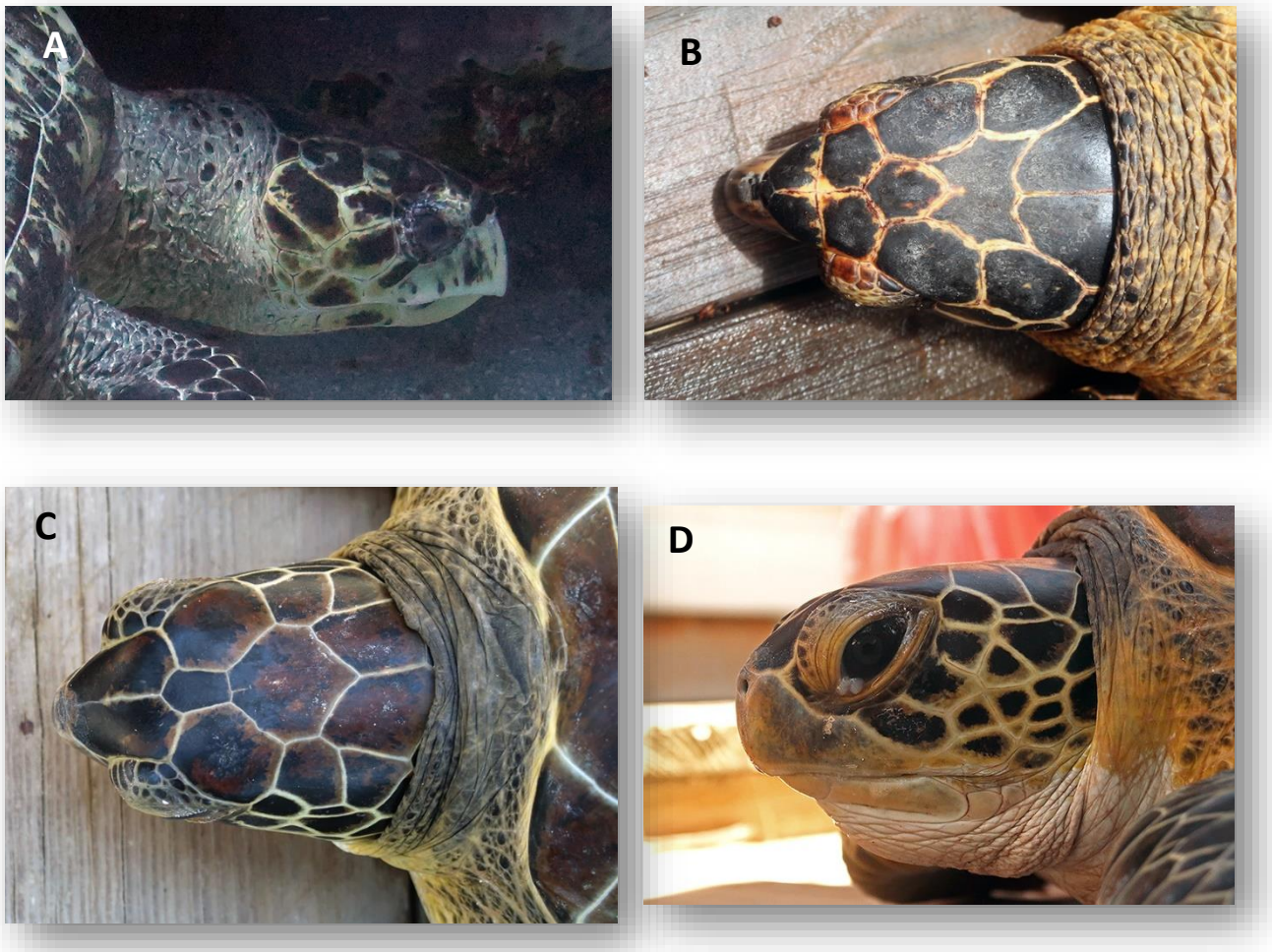


**Fig. 4.** Face and head photos of hawksbill (*E. imbricata*) (A, B), and green (*C. mydas*) (C, D) turtles taken during diving observations and during turtle work-ups for use in the computerized photo ID (PID) matching system. The computerized system allows the identification of individuals residing in the SBWEMR over time, and will eventually assist in modelling resident population changes within the marine reserve. Both in-water, and out-of-water images can be used in the automated database system.

## Tissue Sampling of Turtles in the SBWEMR

Throughout the 2022 research season, we were able to hand capture and flipper tag *E. imbricata* and *C. mydas* individuals. From each of these turtles, we collected tissue samples (Fig. 5) for additional studies undertaken at Loma Linda University, including continuing work on genetic haplotype diversity, heavy metal contamination, and stable isotope analyses. Due to the support and efforts of both the Secretary of State from the Office of the President, Snr. Rodolfo Pastor de Maria y Campos, and the ProTECTOR, Inc. Country Director, Ms. Lidia Salinas, we have been issued the CITES Export permit from Honduras. The United States Fish and Wildlife Service (USFWS) CITES Import permit has been issued, allowing us to retrieve the sample in early 2023 for import back to the United States, where the samples will undergo analyses at Loma Linda University. These studies are linked in providing a variety of information for the same population of juvenile hawksbills in the SBWEMR, allowing us to evaluate genetic links between these individuals, their natal beaches, and their maternal foraging grounds.

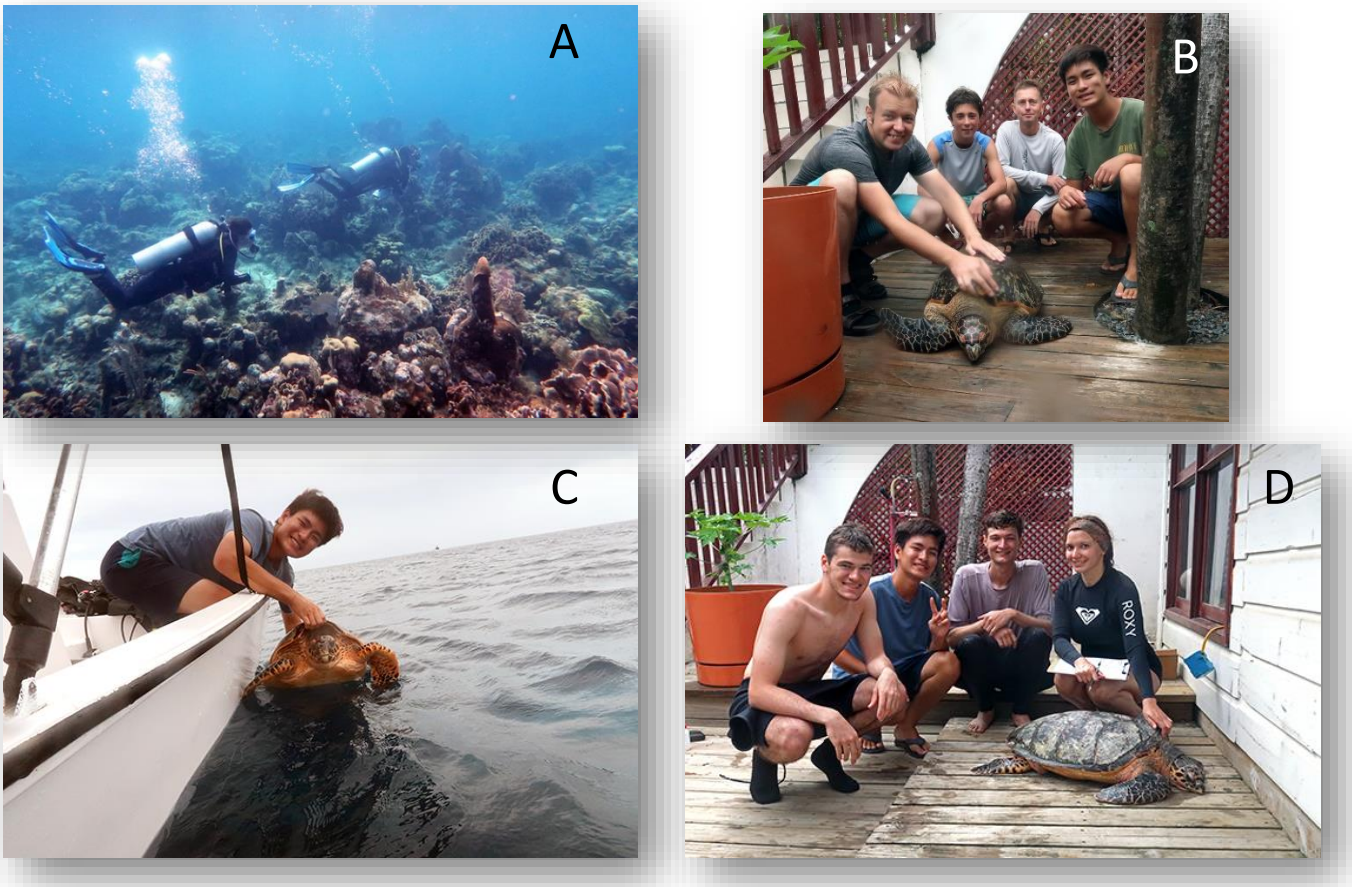


**Fig. 5.** ProTECTOR, Inc. Volunteers and Interns assist with the measuring and sampling of a captured hawksbill turtle. Hands-on experiences with sea turtles through the ProTECTOR, Inc. Intern and Volunteer Program facilitate connections with marine habitats and organisms that will stimulate the support of marine protected areas in Honduras and around the world. A) Dominic and Voicu Tulai on dive monitoring. B) From L to R, Ben Streit, Dominic Tulai, Voicu Tulai, and Dawson Pan. C) Dawson Pan releases a hawksbill back to sea. D) L to R, Jayden Wilson, Dawson Pan, Treson Thompson, and Carolina Germakova assist with collecting data on each turtle.

## Governmental Support

This year, the visit by the Secretary of State from the Office of the President, Snr. Rodolfo Pastor de Maria y Campos, during June 22 and 23, significantly altered the ability of ProTECTOR, Inc. to continue and expand our work in Honduras, without the delays in permitting, and lack of government interest and support that have especially plagued our efforts since 2014. Snr. Pastor arrived on Roatan on Wed. June 22 and met with Dr. Stephen Dunbar, Lidia Salinas, and representatives from the Roatan Marine Park, to discuss the situation of turtle research continuing and advancing in Roatan, and Honduras, in general. There was discussion of some of the issues that ProTECTOR, Inc. has faced while working in Roatan from local offices of ICF in Roatan and La Ceiba, as well as prior lack of interest in collaborations by local environmental NGOs. However, the emphasis was on the opportunities that lay ahead to make real changes in the way research is supported from the Central Government down to local NGOs.

On June 23, Snr. Pastor spent the afternoon diving with the ProTECTOR, Inc. team (Fig. 6A) to observe the process of a turtle capture and work up at our makeshift laboratory space at our partner/supporter, Splash Inn Dive Resort. After the capture of a turtle, we brought the turtle back to the facility at Splash Inn, and measured, weighed, and cleaned the turtle, then took blood and scute samples, as well as collected epibionts, and photographs (Fig. 6B and C) before taking the turtle out of the causeway to release the turtle back into the water. Snr. Pastor accompanied the ProTECTOR, Inc. team, and personally participated in the release of the turtle.

As a result of this experience, Snr. Pastor assured the ProTECTOR, Inc. team that both he and President Castro were fully supportive of the work of ProTECTOR, Inc. on sea turtle and marine habitat research, and that they wanted to encourage the organization to, once again, expand our research across the country.

We are currently working with the Castro Administration and the Ministries of the Central Government to stabilize the work of ProTECTOR, Inc. through funding support identified by the government Ministries. 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.

## Education Outreach


**Fig. 6.** Secretary of State from the Office of the President of Honduras, Snr. Rodolfo Pastor de Maria y Campos, spent two days with the ProTECTOR, Inc project in the Sandy Bay West End Marine Reserve. A) Snr. Pastor (right) diving with ProTECTOR, Inc. Intern, Jayden Wilson (center), and ProTECTOR, Inc. Volunteer, Carolina Germakova (left) on a turtle monitoring dive. B) Pastor assists with the turtle 'work-up,' including weighing, measuring, and sampling the turtle. C) Part of the ProTECTOR, Inc. research team with Snr. Pastor, just before release of the turtle back into the SBWEMR.

# C O N C L U S I O N S

Although we applied for continuing research permits during the 2019 research season, we were unable to secure permits through the prior administration due to an number of factors (for more on these, Dunbar & Salinas, 2021). It was not until the Castro Administration took power at the end of January, 2022, that the Secretary of State from the Office of the President, Snr. Rodolfo Pastor de Maria y Campos, became involved with ensuring the permits would be issued and that ProTECTOR Inc. (one of the very few long-term research entities in the country) would be able to continue the work of investigating the status and plight of all five species of sea turtles within the waters of Honduras. Permits were finally issued, under direct intervention by Snr. Pastor, in mid-March of 2022. With the permit finally in place, ProTECTOR, Inc. was able to begin the process of planning our research efforts and recruitment of Interns and Volunteers in early April. Although this recruitment effort was late in beginning, we nevertheless attracted several Interns and Volunteers to work with ProTECTOR, Inc. to undertake various projects in the SBWEMR. Our 2022 ProTECTOR, Inc. Interns and Volunteers were highly successful in assisting in collecting in-water, as well as nesting beach information that continue to clarify the plight and status of sea turtles in the country of Honduras. ProTECTOR, Inc. is seeking to expand our Intern and Volunteer programs through increasing web and social media presence, and has extended invitations to national students, academic faculty, and government agents in Honduras to become involved in sea turtle conservation research through our efforts.

Both national students and academic faculty at UNAH have demonstrated intense interest in partnering with ProTECTOR, Inc. in carrying out research efforts for sea turtles and other marine organisms. We continue to seek ways to facilitate these students and faculty, recognizing the importance of capacity building for national students and research faculty. In addition to facilitating these experiences for Honduran citizens, we are also seeking ways to assist UNAH faculty in securing national and international funding support for such vital training activities.

In addition, because up until late January we were unsure if we would continue our efforts in Honduras, we made plans to initiate work in another area of the Caribbean, and committed to being on site in that country by mid-August. This meant that our time for research efforts was limited to just one month this season, limiting the amount of research that could be accomplished in that brief time period.

# C O N C L U S I O N S

We continue to emphasize to all agencies of the government of Honduras the critical importance of the research and conservation efforts being carried out by ProTECTOR, Inc. It continues to be evident that there is need for a national program of well-developed sea turtle research if turtle and marine habitat conservation efforts are to succeed at a national scale. Despite many efforts by national government agencies and non-governmental organizations (NGOs) to undertake conservation measures (beach hatcheries, nesting beach monitoring, efforts to reduce illegal trade of turtle products), these efforts are likely to continue unsuccessfully without rigorous scientific evaluation of their impacts. These evaluations must be done through targeted and ongoing research efforts.

The ongoing nesting beach studies on Guanaja were again able to continue after two prior years of Covid-19 lockdowns impacting the monitoring that could take place. These efforts have been coordinated by our ProTECTOR, Inc. partners at the Green Island Challenge (GIC), under the field direction of Mr. Anuar Romero, with assistance from Ms. Crystal Vance. Without their efforts in rallying the local communities of Guanaja, and the support of community members, the project would have come to a standstill, making it much more difficult to resurrect after the relaxation of Covid lockdowns. This project continues to facilitate opportunities to assess potential nesting beaches and the threats associated with turtle nesting, as well as to provide direct capacity building and environmental education outreach to multi-generational community members of island residents.

Studies on Roatan in the SBWEMR continued with observations of feeding turtle and fish interactions, and regular captures of both tagged and untagged individual juvenile hawksbill and green turtles. Although having a reduced time for the research in this 2022 season, and being plagued by boat and motor problems, we nevertheless were able to conduct significant research, and were able to again demonstrate growth rates of individuals that have been recaptured over the past 4 – 5 years, and yet remain in the marine reserve during their juvenile growing years. Continuing and more intensive studies will provide information on the time to maturity of individuals residing in the marine reserve, as well as clues to links between the SBWEMR, and the adult foraging grounds maturing individuals migrate to from the SBWEMR. Genetic studies may also provide life cycle links to the nesting beaches on Utila and Guanaja in the near future.

# CONCLUSIONS

In 2019, we continued to undertake projects in the Sandy Bay West End Marine Reserve (SBWEMR). These included the collection of habitat data throughout the marine reserve and investigating the relationship of boat traffic to sea turtle behavior at and below the surface, as well as the connection of boat traffic to incidents of boat strikes. Thus far, we have found little evidence for a relationship between boat traffic and boat strike injuries to turtles. We also have seen little response by turtles below the surface to boat activity.

We were also able to continue to identify individual turtles through our computerized photo-ID system. This system will allow us to continue to track the growth and movements of juveniles within the SBWEMR over time.

ProTECTOR, Inc. Research was disseminated through research publications in peer-reviewed scientific journals, as well as in the development of seven abstracts for presentations at the 41st International Sea Turtle Symposium to be held in Cartagena, Colombia, 18 – 25 March, 2023.

## Peer-reviewed publications resulting from our research efforts in Honduras are:


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

Baumbach, D. S., Renwu Zhang, Christian T. Hayes, Marsha K. Wright, Stephen G. Dunbar. 2022. Strategic foraging: Understanding hawksbill (*Eretmochelys imbricata*) prey item energy values and distribution within a marine protected area. *Marine Ecology* 43(1): e12703. https://doi.org/10.1111/maec.12703

Dunbar, S. G., Anger, E. C., Parham, J. R., Kingen, C., Wright, M. K., Hayes, C.T., Safi, S., Holmberg, J., Salinas, L., Baumbach, D. S. 2021. HotSpotter computer-driven photo-ID for in-water and out-of-water identification of sea turtles. *Journal of Experimental Marine Biology and Ecology*. 535: 151490. https://doi.org/10.1016/j.jembe.2020.151490

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

Dunbar, S. G., Baumbach, D. S. 2020. Sea Turtles of Pacific Honduras. *Marine Turtle Newsletter.* 160: Cover, 1 - 4.

Baumbach, D. S., Anger, E. C., Collado, N. A., Dunbar, S. G. 2019 Identifying sea turtle home ranges utilizing data from novel web-based and smartphone GIS applications. *Chelonian Conservation and Biology*. 18(2): 133 – 144.

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## ProTECTOR, Inc. research abstracts resulting from 2019 and 2022 research seasons are:


Dunbar, S. G., Daochai, C., Smithiwong, S., Haetrakul, T., Srisiri, S., Na Ayudhya, S. K., Keschumras, N., Satapoomin, U., Chansue, N. First results of the Rapid Nesting and Threats Assessment for the recovery of hawksbill nesting in the Gulf of Thailand. 41st International Sea Turtle Symposium, 18 – 24 March, 2023

Salinas, L and Dunbar, S. G. Scientific research and government processes: paradigm shifts in the conservation of sea turtles in Honduras. 41st International Sea Turtle Symposium, 18 – 24 March, 2023

Romero, A., Vance, C., Salinas, L. and Dunbar, S. G. Recent trends in the Guanaja Nesting Recovery Project, Guanaja, Honduras. 41st International Sea Turtle Symposium, 18 – 24 March, 2023

Hyatt, E., Hayes, W., and Dunbar, S. G. Gross and quantitative comparative analyses of epibiotic *Chelonibia SPP.* Barnacles suggest separation of morphotypes independent of host. 41st International Sea Turtle Symposium, 18 – 24 March, 2023

Gammariello, R., Ebanks, C., Anderson, E.,8 Green, C. and Dunbar, S. G. Detection thresholds for green and orange light in *Eretmochelys imbricata* hatchlings. 41st International Sea Turtle Symposium, 18 – 24 March, 2023

Pan, D. and Dunbar, S. G. Growth dynamics of juvenile hawksbills in a marine protected area in Roatan, Honduras. 41st International Sea Turtle Symposium, 18 – 24 March, 2023

Streit, M. B. Aguila, Z., Lewis, A., Morrow, A., Salinas, L., and Dunbar, S. G. Feeding interactions between hawksbill turtles and reef fishes in the Sandy Bay West End Marine Reserve, Roatan, Honduras. 41st International Sea Turtle Symposium, 18 – 24 March, 2023

Baumbach, D.S., Zhang, R., Hayes, C.T., Wright, M.K., Safi, S., Dunbar, S.G. 2020. Energy composition of hawksbill food items in the sandy bay west end marine reserve, Roatán, Honduras. 40th International Sea Turtle Symposium. 14 – 20 March 2020. Cartagena, Colombia.

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Wright, M., Baumbach, D., Pompe, L., Mishra, D., Salinas, L., Dunbar, S.G. 2020. Hawksbill utilization and habitat suitability of a marine reserve in Roatán, Honduras. 40th International Sea Turtle Symposium. 14 – 16 March 2020. Cartagena, Colombia.

Wright, M., Baumbach, D., Salinas, L., Dunbar, S.G. 2020. Reanalysis of natal contributions to a juvenile hawksbill foraging aggregation in a marine protected area in Roatán, Honduras. 40th International Sea Turtle Symposium. 14 – 16 March 2020. Cartagena, Colombia.

Wright, M., Baumbach, D., Salinas, L., Dunbar, S.G. 2019. Natal origins and genetic variations of juvenile hawksbill turtles foraging in a marine protected area in Roatan, Honduras. 39th International Sea Turtle Symposium. 2-8 February 2019. Charleston, SC.

## ProTECTOR, Inc. research abstracts Continued

Morrow, A., Lewis, A.L., Salinas, L., Dunbar, S.G. 2019. Hawksbill sea turtle-fish interactions: more than foraging friends? 39th International Sea Turtle Symposium. 2-8 February 2019. Charleston, SC. USA

Hyatt, E., Gammariello, R., Gerke, C., Salinas, L., Dunbar, S.G. 2019. Community-based evidence accrual for characterization of Guanaja, Honduras as an active nesting site for Caribbean sea turtle populations. 39th International Sea Turtle Symposium. 2-8 February 2019. Charleston, SC. USA

Gammariello, R., Gerke, C., Salinas, L., Dunbar, S.G. 2019. Color preferences of *Eretmochelys imbricata* hatchlings. 39th International Sea Turtle Symposium. 2-8 February 2019. Charleston, SC. USA

Baumbach, D.S., Wright, M.K., Seminoff, J.A., Lemons, G.E., Rützler, K., Wysor, B., Saunders, G.W., Estevez, D., Salinas, L., Dunbar, S.G. 2019. Foraging ecology of hawksbills in Roatán, Honduras: insights from in-water observations and stable isotope analysis. 39th International Sea Turtle Symposium. 2-8 February 2019. Charleston, SC. USA

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# RECOMMENDATIONS

The following are recommendations to the Honduras government and managing directors for the Bay Islands marine protected areas (MPAs):

1. To avoid the loss of important research and data collection throughout the year, research permits should be provided to legitimate research organizations (national or international) with proven track records in research and conservation, within the stated legal period of 2 months after the receipt of the research permit application.

2. Government agencies responsible for research permitting should have open and clear lines of consistent communications among national and local offices, and among 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 guides management processes will not be accomplished on an ongoing basis.

3. MPA managers should fully cooperate and collaborate with research organizations in conducting research and implementing conservation strategies based on annual results of research efforts, and to comply with the national strategy for the conservation of sea turtles developed by Honduras. There is need to collect additional data on the number and locations of turtle boat strikes. Results of the recent study by ProTECTOR, Inc. regarding turtle-powerboat interactions, should be implemented, including posted boat speed signs throughout the SBWEMR, and enforcement of speed regulations within the reserve.

4. Local community entities, such as the 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 discuss the projects with researchers directly. These discussions should, however, not interfere with scheduled and approved research activities.

# RECOMMENDATIONS

The following are recommendations to the Honduras government and managing directors for the Bay Islands marine protected areas (MPAs):

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 provide additional data to be collected on nesting beaches throughout Honduras, since turtle nesting often begins prior to our arrival in Honduras, and continues after our fieldwork has concluded.

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Baumbach, D. S., Anger, E. C., Collado, N. A., Dunbar, S. G. 2019 Identifying sea turtle home ranges utilizing data from novel web-based and smartphone GIS applications. *Chelonian Conservation and Biology*. 18(2): 133 – 144.

Baumbach, D. S., Renwu Zhang, Christian T. Hayes, Marsha K. Wright, Stephen G. Dunbar. 2022. Strategic foraging: Understanding hawksbill (*Eretmochelys imbricata*) prey item energy values and distribution within a marine protected area. *Marine Ecology* 43(1): e12703. https://doi.org/10.1111/maec.12703

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N O T E S

# APPENDIX 1 – PUBLISHED PAPERS

The following are published papers resulting from ongoing ProTECTOR, Inc. studies in Honduras.