

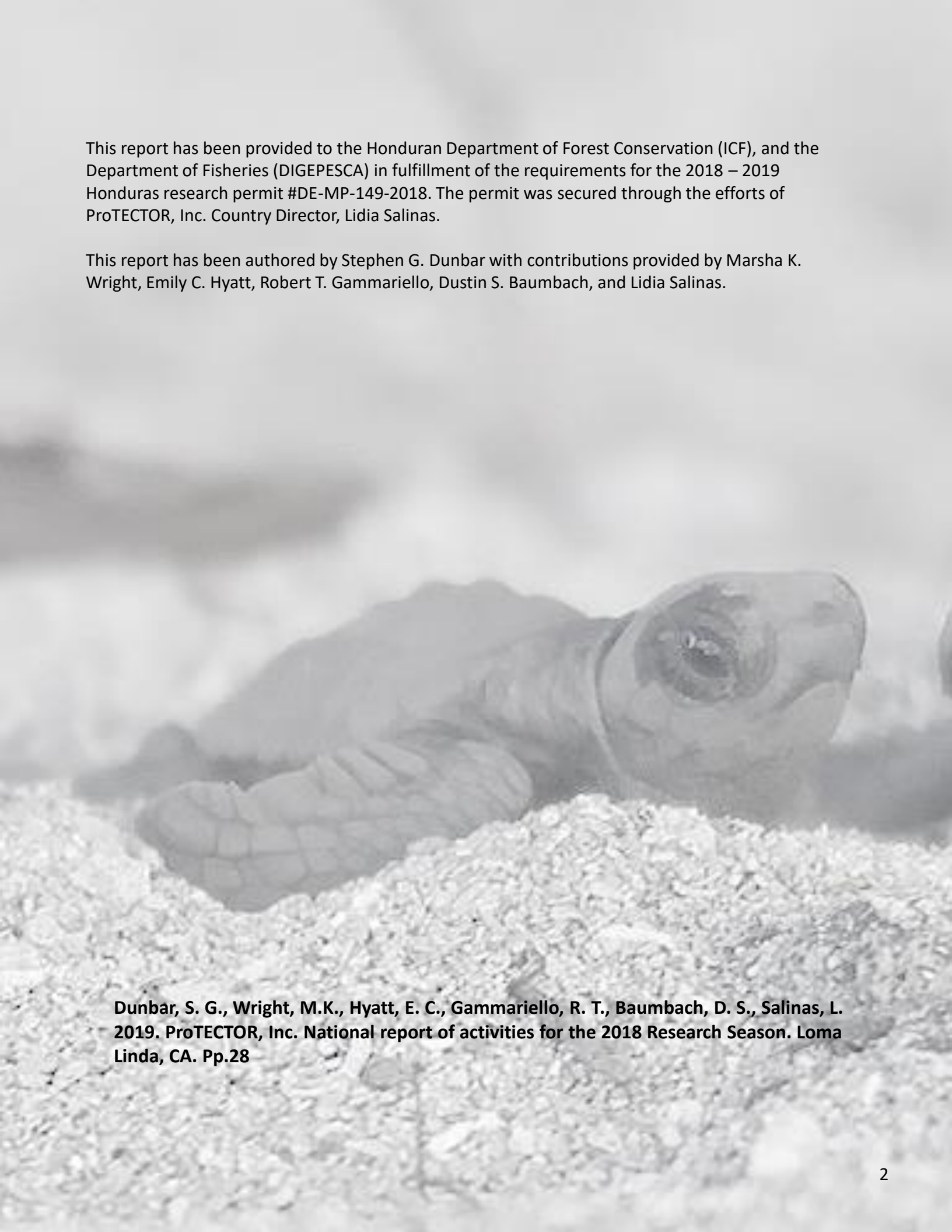
ProTECTOR, Inc. NATIONAL REPORT OF ACTIVITIES FOR THE 2018 RESEARCH SEASON

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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 2018 – 2019 Honduras research permit #DE-MP-149-2018. The permit was secured through the efforts of ProTECTOR, Inc. Country Director, Lidia Salinas.

This report has been authored by Stephen G. Dunbar with contributions provided by Marsha K. Wright, Emily C. Hyatt, Robert T. Gammariello, Dustin S. Baumbach, and Lidia Salinas.



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INTRODUCTION

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 2018 research season from June to October. Results of individual projects are presented in brief. All research efforts were carried out under national permits issued by the Honduras government through the departments of Fisheries (DIGEPESCA), the Secretariat of Agriculture and Ranching (SAG), and the Department of Forestry Conservation (ICF).

The research area was comprised of all three of the Bay Islands in Caribbean Honduras. These include Roatán, Utila, and Guanaja (Fig. 1). Utila, the first and westernmost of the three islands, lies approximately 29 Km north of mainland of Honduras and is the smallest of the three Bay Islands, while Guanaja lies approximately 69 Km north of mainland Honduras, and is the easternmost of the islands. Roatán is the largest of the three Bay Islands sitting approximately 48 Km north of mainland Honduras, being 77 Km long and 8 Km wide (Fig. 1). We carried out research efforts on each of the three islands, in some cases with direct assistance from local community members, national non-governmental organizations (NGOs), and local municipal governments.

There was a major delay in data collection during 2018 as a result of problems acquiring the appropriate research permit. This reduced the amount of time in which data could be collected and the time over which nesting beach protection could effectively be accomplished. There is need for national permits to be issued in an efficient and timely manner if sea turtle and marine research is to be effective for marine conservation in the country.

INTRODUCTION

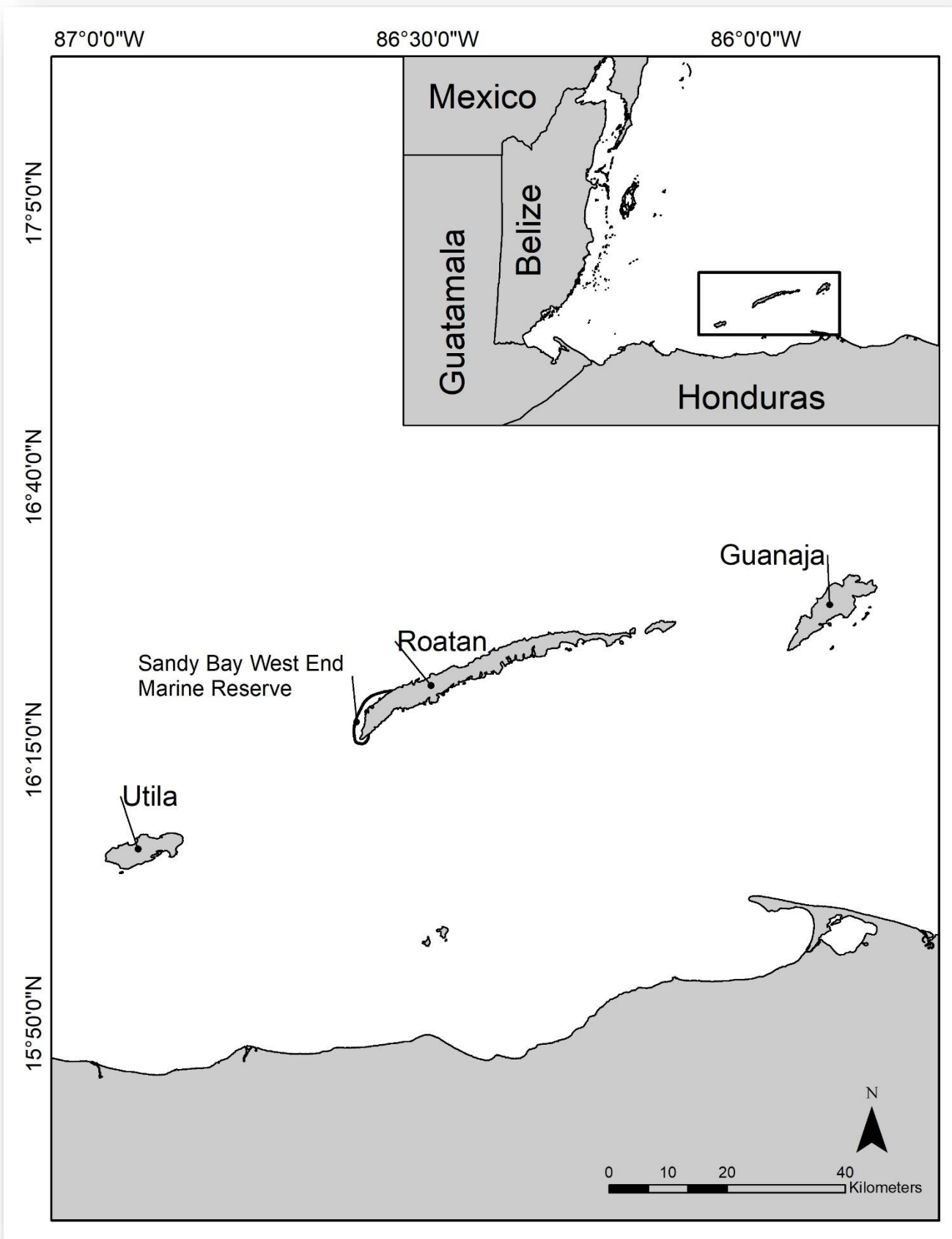


Fig. 1. A map of the research sites throughout the Bay Islands, including Útila, Roatán, and Guanaja. Inset, regional view of the north coast of Honduras.

INTERN TRAINING

During the 2018 research season, we facilitated 9 ProTECTOR, Inc. Interns (assisting for more than one month), 3 Volunteer families, and 1 individual Volunteer (assisting for less than one month). Volunteers and Interns were placed at different research sites throughout the Bay Islands, with two working on the nesting beach in Utila, two based in Guanaja on the newly launched Guanaja Nesting Recovery Project, and the remainder based in Roatán on various projects being carried out there. Despite the delay in obtaining the research permit from the Honduran government, Interns and Volunteers accomplished a great deal of research data collection.

Interns were initially established in their respective project areas and were then provided opportunities to conduct semi-independent research efforts that contributed to the overall goals of ProTECTOR, Inc. research, conservation, and environmental outreach (Figs. 2, 3, 4, 5, and Table 1). All Interns and Volunteers had, in their respective roles, opportunities to interact with local NGOs, government officials, community businesses, or local community members, giving them real-world experience in understanding that conservation efforts and research require engaging communities beyond the research or conservation team. These experiences are critical to developing future conservation biologists and international researchers that are able to work collaboratively with international partners and governments on problems of biodiversity declines in the context of global climate changes. Specific examples will be provided throughout this report under the various project categories.

ProTECTOR, Inc. seeks to further 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. However, there is currently no mechanism in place for funding support for transportation, accommodations, and resource requirements for most students from within the country to receive direct field training experience, aside from those who are residents of areas where projects are carried out.

INTERN TRAINING



Fig. 2. Intern, Dustin Gienger, assisting with day beach patrols for hatching nests in Utila.



Fig. 3. As a ProTECTOR, Inc. Intern, Ashley Morrow and Ashlyn Lewis (not pictured) collected important data on interactions of *E. imbricata* and several commensal fish species.



Fig. 4. ProTECTOR, Inc. Intern, Lindsay Marston (L) worked with graduate student, Marsha Wright (R) recording responses of turtles to boat traffic.



Fig. 5. Interns Robert Gammariello (R), and Emily Hyatt (2nd from R) prepare to take the short flight to Guanaja to assist with the Guanaja Nesting Recovery Project.

Table 1. The number of ProTECTOR, Inc. Interns and Volunteers participating in research, conservation, and environmental outreach at different research sites throughout the Bay Islands. Projects (i.e. P1, P2) are listed in which Interns and Volunteers were involved.

Number of Interns or Volunteers	Research Site	Overview of Projects (P)
2 Interns	Utila nesting beach	P1 - Collection of hatchlings to test impacts of sand temps on running speed. P2 – Collection of egg remains for assessment of target heavy metal.
2 Interns	Guanaja	P1 – Rapid assessment for hawksbill nesting recovery. P2 – testing lighting preferences in hatchling hawksbills.
5 Interns	Roatan	P1 – Rapid survey assessment for tourism interests in sea turtle conservation. P2 – Assistance with boat traffic surveys. P3 – Assistance with in-water surveys, captures, and data collection. P4 – In-water data collection on interactions of hawksbills with marine fishes.
3 Volunteer Families	Roatan	P1 – Assist with in-water surveys and data collection on captured turtles.
1 Volunteer	Guanaja	P1 – Assisted with data collection on nesting hawksbills.

PROJECTS

Utila Nesting

The Utila nesting project is a continuation of a project ProTECTOR, Inc. has been carrying out since 2011 with assistance from the Bay Islands Conservation Association – Utila (BICA-Utila). Nesting hawksbills have been flipper tagged under the ProTECTOR, Inc. sea turtle research permit each year during nesting events. During 2018, the delay in permits from the Honduras government also delayed our ability to tag nesting hawksbills, although this appeared to be a very active nesting season. The delay in permitting resulted in very little tagging activity and the loss of important data collection for the beach. Nevertheless, Interns were involved in the collection of nesting data for three nesting turtles during both day and night patrol hours (Fig. 6).

Hatchlings from nests laid early in the season were collected from Pumpkin Hill Beach to investigate running speed of hatchlings on different temperatures of sand. However, we were unable to maintain sand temperatures sufficiently different from each other for the experimentation to be completed successfully. Insufficient sample sizes were collected, and inadequate data were collected to statistically analyze the experimental results. Therefore, we plan to undertake this investigation again in the 2019 season if experimental methods can be worked out for the conditions on the island.



Fig. 6. ProTECTOR, Inc. Intern, Dustin Gienger searches for a hatched nest during daytime research on the nesting beach (A). Dustin and Stephen Dunbar keeping watch for nesting activity during a night patrol (B).

Guanaja Nesting Recovery Project

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. There has been essentially no intervention against turtle poaching or the illegal take of nesting turtles and their eggs by either the national or local municipal governments in the island until the 2018 nesting season.

As part of the commitment to the conservation of sea turtles throughout Honduras, ProTECTOR, Inc., in partnership with Guanaja community and municipal government members held a town-hall meeting to present the research work of ProTECTOR, Inc. throughout the Bay Islands over the past 11 years (Fig. 7, 8), and to solicit the assistance of community members to establish a nesting recovery project for sea turtles on the island. The town-hall meeting was held on Friday, June 29, 2018, and was attended by approximately 40 members of the community and municipality. There was unanimous agreement from attendees that the illegal take of both turtles and their nests must be stopped if there was to be hope for nesting turtle populations to recover on the island. A good discussion followed about how best to initiate a recovery project, and it was agreed that Dr. Stephen Dunbar should hold a data collection, flipper tagging, and beach patrol training session in the following days. This was arranged to take place on Monday, July 2 at a private cay near Bonacca.

Training at the cay included a discussion about the importance of consistent measurements and data collection (Fig. 9), careful recording, flipper tagging (Fig. 10), photo-identification, and best practice nesting beach monitoring procedures. This capacity-building gave community members the skills to be able to work against poaching activities, and to establish a community run conservation effort with support from the Guanaja municipality.

Guanaja Nesting Recovery Project



Fig. 7. Stephen G. Dunbar providing an overview of the research and conservation work done by ProTECTOR, Inc. over the past 11 years in Honduras, to a group of community and municipal leaders in the public library on Bonacca Cay on June 29.



Fig. 8. The community and municipal government group of participants and attendees at the start of the Guanaja Nesting Recovery Project discussion in the public library on Bonacca Cay.

Guanaja Nesting Recovery Project



Fig. 9. Stephen Dunbar providing training to local community members on how to take consistent curved carapace length and width measurements.



Fig. 10. Local community capacity building for the Guanaja Nesting Recovery Project in the form of flipper tagging training. The involvement of local community and government agents is key to the success of the project.

Guanaja Nesting Recovery Project

From June 31 to September 8, we undertook a rapid assessment of potential and actual nesting beaches. Community members and prior poachers provided anecdotal reports of recent nesting activities that had resulted in turtles being killed and sold, or of the harvesting of all eggs from recently laid nests. We sought to utilize this network of community members to establish nesting beach monitoring teams for several beaches reported to have recent (although unsuccessful) nesting activity. Initial efforts were focused on the identification of key nesting beaches based on anecdotal reports from residents and environmental characteristics, such as the length and slope of the beach face, and the amount and type of abutting vegetation. We assessed anecdotal evidence as qualitative, rather than quantitative, data and corroborated reports of nesting beaches with direct observations. One of these beaches was West End Beach, which the ProTECTOR, Inc. team took responsibility for monitoring each night. While ProTECTOR, Inc. Interns monitored West End Beach, community members and volunteers monitored 8 additional beaches during the same period of time.

Additionally, surveys were provided to local community members requesting information about the harvesting of turtle eggs, and the consumption of turtle meat within the island community. Questionnaires were distributed within the areas of Bonacca Cay, Savannah Bight, and West End, from which data were retrieved through a combination of direct personal interviews and the anonymous submission of the survey to local volunteers. These were distributed in English and in Spanish and assessed age, occupational demographics, and a series of questions regarding direct observations of turtles and nests, including personal consumption and collection of turtle eggs and meat. Date and location of collections and observations were requested if known.

Nightly patrols were conducted on West End beach between July and September 2018 to locate nesting turtles as they came to nest. Beach monitoring and protection resulted in a surprisingly high number of nesting events relative to the short time period during which organized monitoring took place. A total of 26 nests were laid around the island, with only 2 eventually poached.

Guanaja Nesting Recovery Project

We consider this a very successful initial effort, considering the past decade of unsuccessful nesting taking place around the island. The enthusiastic participation of community members, and the assistance of the municipality in day monitoring by local navy (Fig. 11) have demonstrated there is willingness on the part of local entities to ensure that sea turtle nesting can recover on the island of Guanaja.

Results of community surveys are presented in Fig. 12 and 13. We found that 27 % of respondents had purchased turtle meat or eggs, 27% had collected hatchlings (usually done to raise them either as pets or for eventual consumption), and 43% had collected turtle eggs from natural nests at nesting beaches around the island, or had collected turtle meat for consumptive purposes. More than half of survey respondents affirmed personal collection and/or purchase of turtle meat or eggs on the island and indicated positive identification of hatchling individuals of each of the three species mentioned. However, the current nesting season yielded identification of only hawksbill and green nesting females.



Fig. 11. Navy personnel departing one of the nesting beaches after patrolling during the day.

Guanaja Nesting Recovery Project

Survey

- 27% admitted to purchasing turtle meat or eggs.
- 27% confirmed they had collected hatchlings.
- 43% respondents collected turtle meat or eggs.

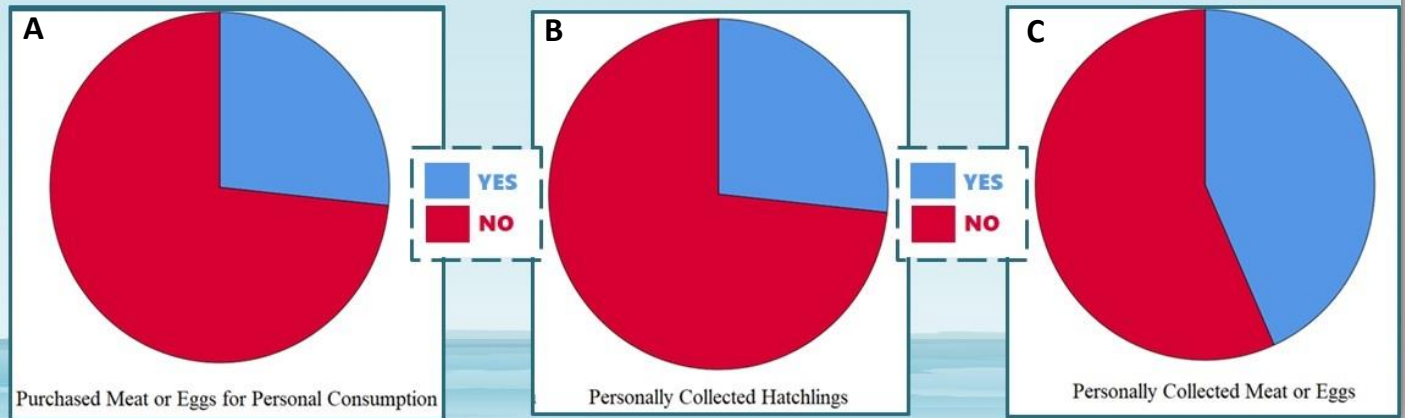


Fig. 12. Pie charts showing the percentages of respondents who (A) purchased turtle meat or eggs for personal consumption; (B) personally collected hatchlings from a natural nest; (C) previously collected turtle meat or eggs. Percentages are provided above the graphs (from Hyatt, et al, 2019).

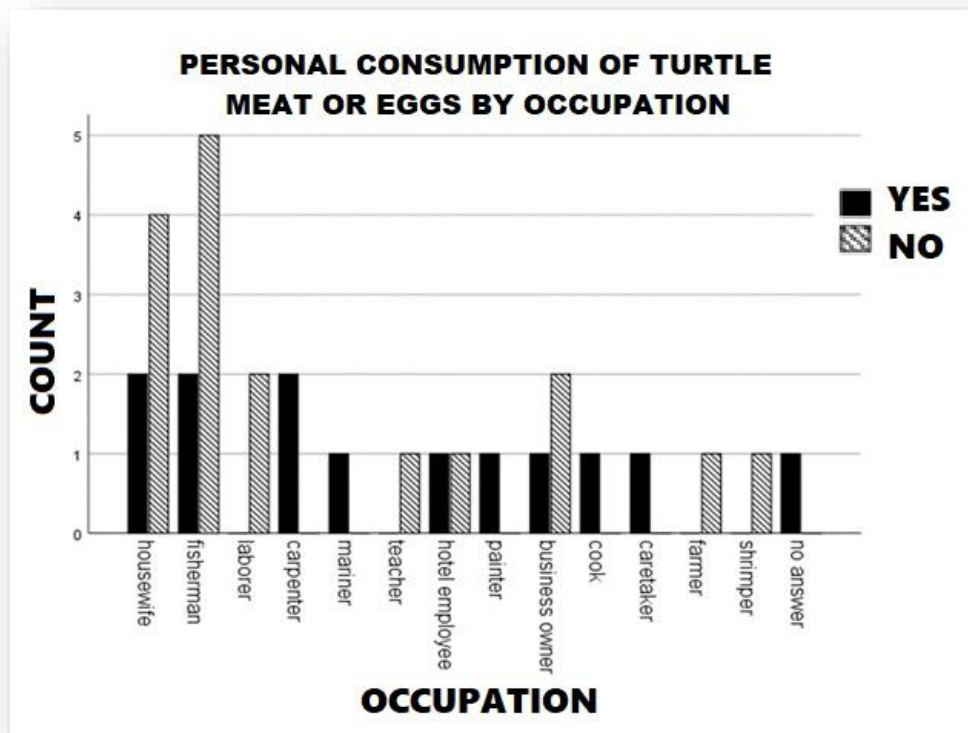


Fig. 13. Occupations of survey respondents who consumed turtle meat or eggs. The greatest number of respondents who consumed meat or eggs were fishermen, followed by housewives, followed by carpenters (from Hyatt, et al, 2019).

Guanaja Nesting Recovery Project

The potential for light pollution on nesting beaches in Guanaja due to increasing housing and hotel development (as is currently taking place on Utila), is of concern. 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 home lighting, and of turtle orientation to light of different colors and wavelengths, is critically important.

Additional research was carried out on turtle vision in which turtles were tested to detect their attraction preferences among red, blue, and white light. Results demonstrated there was a significantly greater attraction to white light than to blue light, and a significantly greater attraction to blue light than to red light (Table 2).

Further studies are needed in the 2019 research season to more fully understand if the use of red light filters both on beach front housing and by nesting beach monitoring personnel can help reduce the disorientation of hatchlings in their sea-finding activity after hatching.

Table 2. Results for factorial experimentation of hatchling hawksbills and their responses to red, blue, and white light. Mean time to complete the Y-maze track is reported as time (seconds) (from Gammariello, et al, 2019).

	Red	Blue	White1	White2	Time (seconds)	Comparisons
Experiment 1	0		10		27 ± 2	between E1 and C p-value = 0.01
Experiment 2	0	7			23 ± 2	between E1 and E2 p-value = 0.31
Control			8	2	37 ± 3	between E2 and C p-value < 0.01

Roatán Boat Traffic Project in the SBWEMR

Injuries to marine turtles in areas of high tourist and fisheries boat traffic have been documented in some areas of the Caribbean (Lutcavage, et al, 1997; Hazel, et al, 2007; Barrios-Garrido, & Montiel-Villalobos, 2016). The development of marine protected areas (MPAs) may not fully protect turtles from the threat of boat strikes if boat traffic is unassessed, unregulated, and remains unconnected to sea turtle behaviors. In the Sandy Bay West End Marine Reserve (SBWEMR), boat activities consist of dive boating, pleasure boating, speed boating, and water taxis, all of which have been unstudied for their impacts on sea turtle behaviors and activities within the SBWEMR. Additionally, the number of turtle boat strikes has not been analyzed in relation to boat traffic in this area.

Over the past 3 years, we have been assessing boat traffic and the behaviors of turtles in response to boat traffic within the SBWEMR. We divided the SBWEMR into 3 zones and 14 sectors (Wright, et al, 2017) (Fig. 14), and counted the intensity of boat traffic of 4 types of boats (Fig. 15).

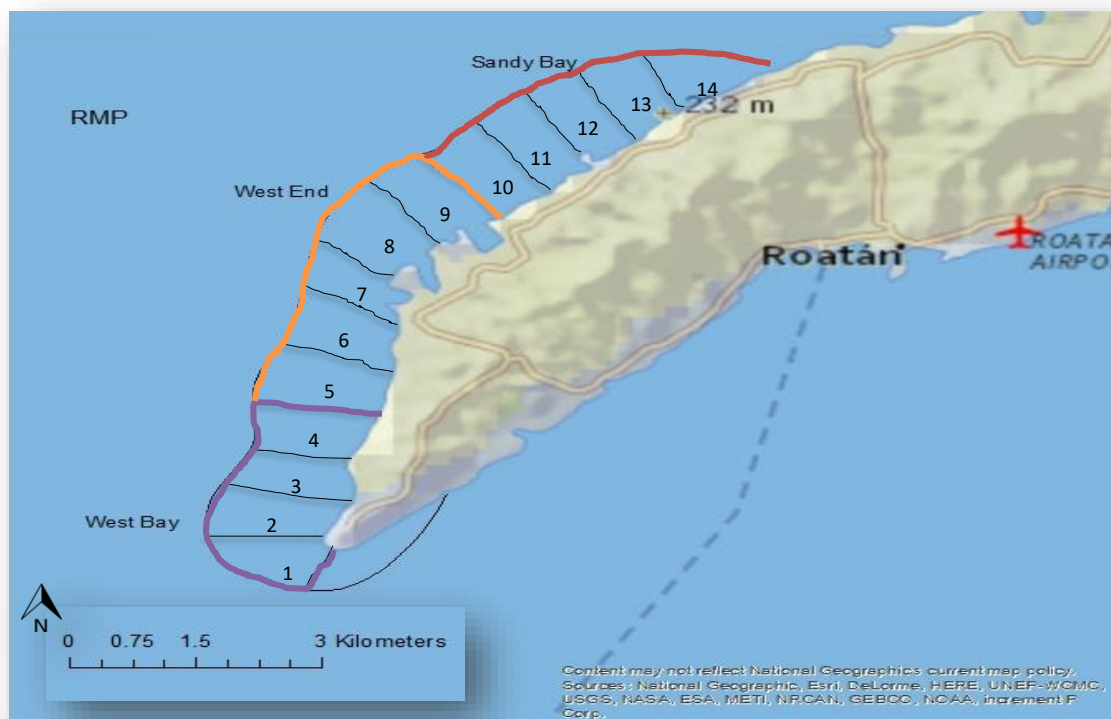


Fig. 14. The SBWEMR divided into 3 zones and 14 sectors for surveying boat traffic intensity within the marine reserve (from Wright, et al, 2017)

Roatán Boat Traffic Project in the SBWEMR



Fig. 15. The 4 types of boats assessed for traffic intensity in the SBWEMR. Water taxis (A); dive boats (B); Pleasure boats (C); non-motorized boats (D) (from Wright, et al, 2017).

We also undertook turtle sightings counts during the same times in which boat traffic surveys were done and connected boat intensity with turtle sightings . We found that in areas where there was high boat traffic, there were also high numbers of turtle sightings (Fig. 16). From direct observations of turtles both when no boats were present, and when boats were present, we observed no significant differences in behaviors during feeding, swimming, and resting activities. Additionally, we have seen almost no evidence of boat strikes on turtles in the SBWEMR, and have received only two reports of turtles sighted with evidence of propeller strikes in the 3 years since the initiation of the study.

Although further analyses are required, these results may initially indicate that turtles within the SBWEMR have altered their behavior to both ignore boat sounds while feeding, swimming and resting below the surface, and to avoid boat strikes at the surface.

Roatán Boat Traffic Project in the SBWEMR

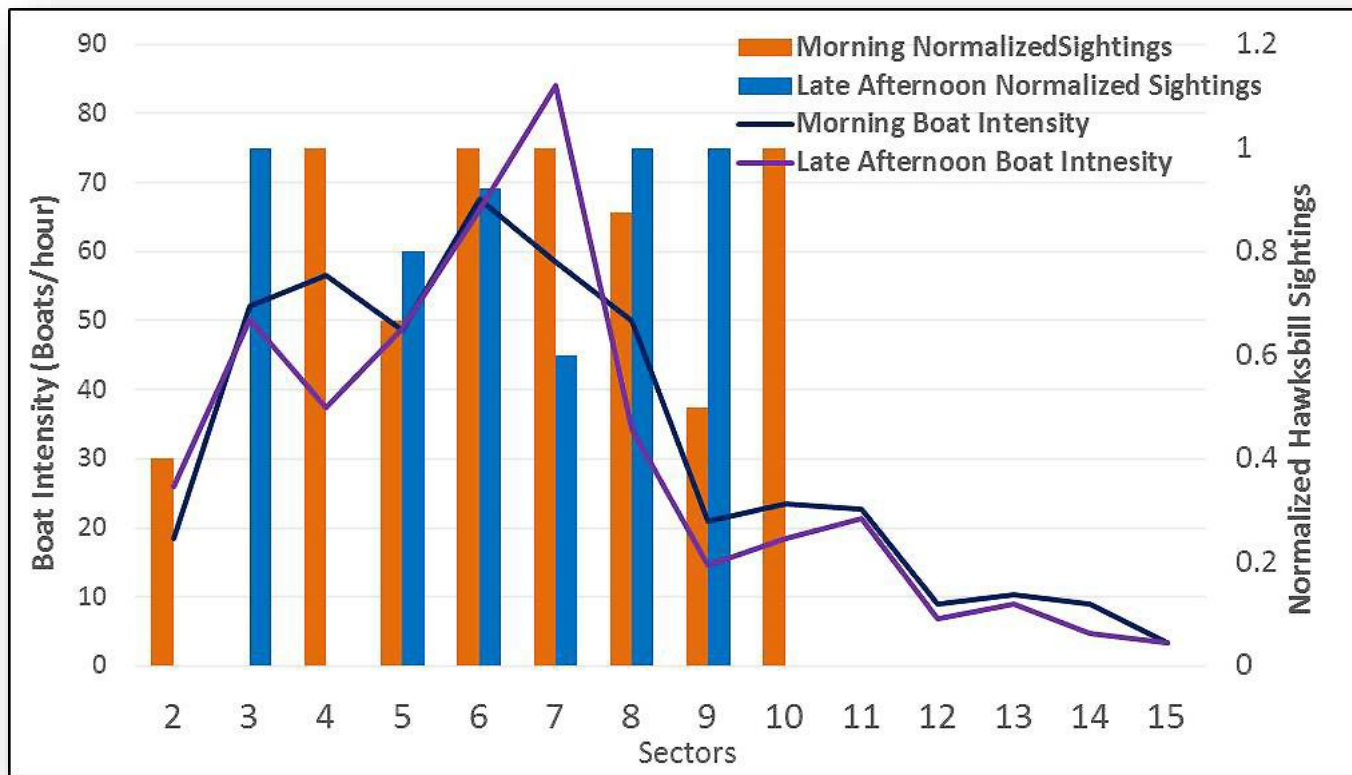


Fig. 16. Results of surveys for boat intensity and normalized sightings during morning and late morning monitoring. Results demonstrate that in the sectors in the Sandy Bay area (10 – 14) where there is little boat intensity, there is also a corresponding reduction in turtle sighting when compared with boat intensity and turtle sightings in sectors in West Bay (2 – 4) and West End (5 – 9) (from Wright, et al, 2017).

Photo Identification (PID) in the SBWEMR

Studies begun in 2014 (Dunbar, et al, 2017) in the SBWEMR continued in 2018. Digital photographs of individual sea turtles (both tagged and untagged) were taken during encounters with turtles while SCUBA diving (Fig. 17). These photos are 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.

Throughout the 2018 season we were able to submit an additional 188 face and head photos of *E. imbricata* and 62 of *C. mydas* to our PID database. These additional photos now gives us a current database of 2,136 photos of *E. imbricata*, and 241 of *C. mydas* by which to further

Photo Identification in the SBWEMR

compare new photographs in the upcoming 2019 season. This PID system is also providing a means through which we are able to begin to assess the population and population dynamics of juvenile turtles residing in the SBWEMR. Thus far, we have identified 150 *E. imbricata* and 60 *C. mydas* individual residents within the marine reserve boundaries.

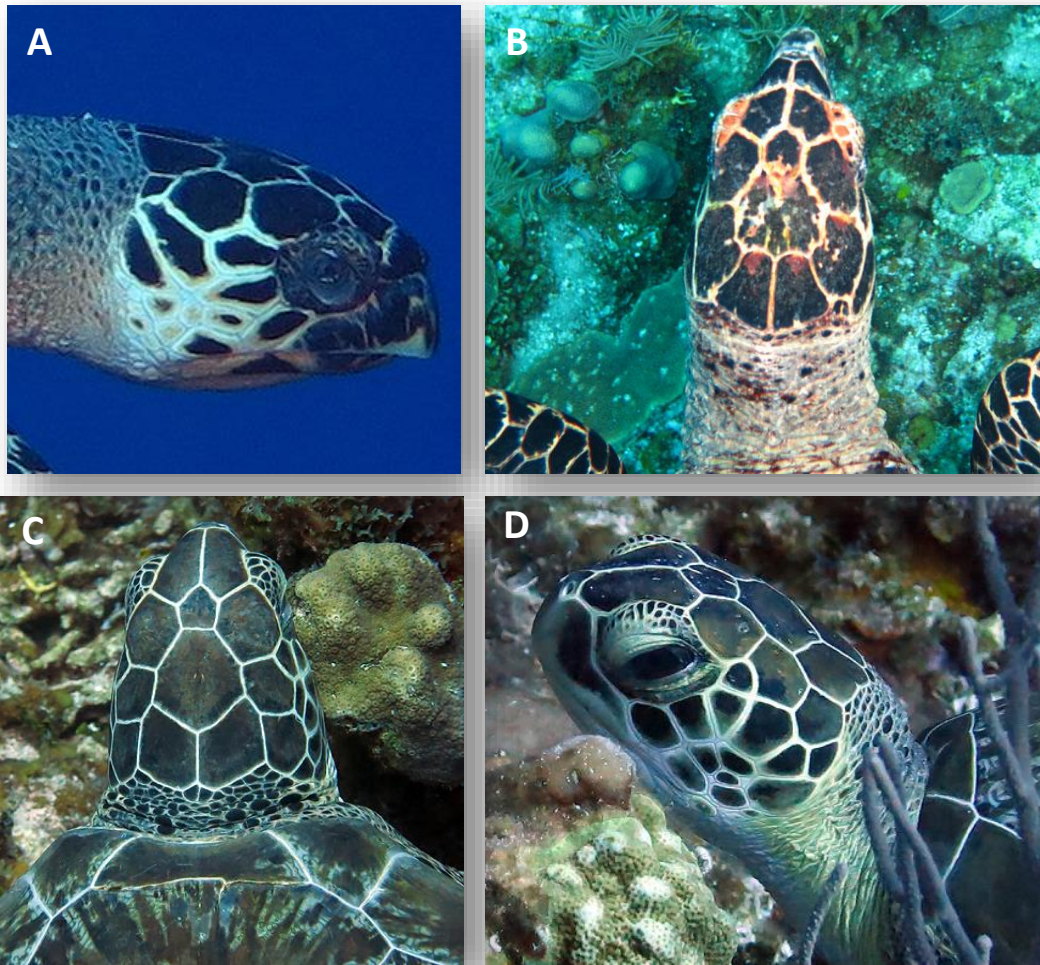


Fig. 17. Face and head photos of hawksbill (*E. imbricata*) (A, B), and green (*C. mydas*) (C, D) turtles taken during diving observations for use in the computerized photo ID (PID) matching system. The computerized system allows the identification of individuals residing in the SBWEMR over time, and will eventually assist in modelling resident population changes within the marine reserve.

Tissue Sampling of Turtles in the SBWEMR

During the shortened 2018 research season, we were able to hand capture and flipper tag 11 *E. imbricata* and 2 *C. mydas* individuals. From each of these turtles, we collected tissue samples (Fig. 18 and 19) for additional studies undertaken at Loma Linda University, including haplotype analyses, heavy metal contamination analyses, and stable isotope analyses. Additional studies on tissue samples will be continued in 2019.



Fig. 18. Marsha Wright (L) and Lindsey Marsten (R) collecting scute scrapings for laboratory heavy metal analysis.



Fig. 19. Dunbar and Wright collecting a blood sample for later analyses.

CONCLUSIONS

The delay in receiving permits for the 2018 research season greatly inhibited our ability to conduct the maximum amount of research possible. 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. Time and again, ProTECTOR, Inc. has demonstrated that well-developed sea turtle research is needed for any conservation efforts for sea turtles and the marine ecosystem to be successful. Despite valiant efforts by several 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 be unsuccessful without evaluating their impacts through continual research.

An important element of research carried out by ProTECTOR, Inc. is the involvement of our ProTECTOR, Inc. Volunteers and Interns. These individuals from around the world actively participate in the research conducted throughout Honduras and constitute a critical component of our annual research, conservation, and educational outreach. These volunteers and interns also have opportunities to work alongside local community and government members in establishing and carrying out projects that provide positive returns for the conservation of sea turtles throughout the country.

Despite significant delays in securing the 2018 Honduras government research permit, our researchers were able to continue our long series of studies on hawksbill nesting and hatchlings on Utila. We continue to have grave concerns for the nesting beach at Pumpkin Hill due to the development of a commercial campground (with its associated floodlights that remain on through the duration of the night), and the recent sale of private beach lots that make up the majority of the nesting beach.

The establishment of the Guanaja Nesting Recovery Program provided opportunities to conduct surveys of local community members to gauge the interest in reducing turtle meat and egg consumption, and improving the prospects of recovering a regular and successful nesting population on the beaches of Guanaja. We found high interest in recovery efforts among both community members and the municipal government, and excellent participation in undertaking both daily and nightly monitoring patrols.

CONCLUSIONS

This project also provided opportunities to assess potential nesting beaches and the threats associated with turtle nesting, as well as to study the responses of hatchlings to different colors of light. Further studies in this area will provide strong evidence for establishing and enforcing lighting protocols for homes and beaches during the nesting season.

In 2018, we continued to undertake projects in the Sandy Bay West End Marine Reserve (SBWEMR). These included a final collection of boat traffic 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 investigate interactions of sea turtles with other marine organisms during the 2018 research season. These studies provide evidence for the importance of turtles in healthy marine ecosystems, and their connectivity to many marine organisms within the habitat. We will continue to collect observational data for this project in the 2019 season.

Investigations into haplotype diversity, heavy metal contamination, home range analyses, stable isotope analyses, contributions of citizen-science, photo identification, and radio tracking continue throughout the Bay Islands.

RECOMMENDATIONS

The following are recommendations to the Honduras government and managing directors for 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 natural resource protection and management, should invest in capacity building of agents on a regular basis in collaboration with organizations conducting research in the country. This should be done in consultation with the research organization at regular intervals.
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.
4. To increase capacity of MPA co-managers, local NGOs should facilitate training events and workshops that utilize the data and information that result from ongoing sea turtle research within the country and the region.
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.

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NOTES

