Preliminary Report on Activities Under
Interim Permits # DGPA/005/2006 and DGPA/245/2006

by the

Turtle Awareness and Protection Studies (TAPS) Group

under the

Protective Turtle Ecology Cooperative for Training, Outreach and Research (ProTECTOR)

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Conducted February – March, 2006 and June – July, 2006

at

The "Escuela de Buceo Reef House," Oak Ridge, Roatan, Honduras.

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Preliminary Report on the Turtle Awareness and Protection Studies Conducted February and June, 2006

Background

Throughout their respective ranges the green sea turtle (*Chelonia mydas*) is listed as Endangered and the hawksbill (*Eretmochelys imbricata*) has been designated as Critically Endangered in the **IUCN Red List of Threatened Animals** (Baillie and Goombridge, 1996 in Bjorndal, 1999). The hawksbill has endured the longest and most intense history of exploitation of all the marine turtle species, since they are especially sought for the intricately patterned scutes, called tortoiseshell. According to Meylan and Donnelly (1999), tortoiseshell has been considered on par with precious substances such as ivory, gems and gold. Throughout history these species have been captured, and are still being captured today, for purposes of food and profit.

The global population of hawksbills has declined as much as 80% in the last 105 years, with declines projected to continue over the next 100 years. It is surprising that so few studies have focused on this species over the past 50 years of scientific monitoring of marine turtles (Meylan and Donnelly, 1999). This is especially true in the Central American country of Honduras. Although Davidson (1979) states that both hawksbill and green sea turtles had been plentiful sources of both shells and food for at least three centuries, by 1979 Davidson reports (without evidence) that turtles “are caught now only occasionally” (Davidson, 1979). Although assessments of both hawksbill and green sea turtles have been done throughout the wider Caribbean, little work has been done to monitor nesting populations, track turtles in their local habitats, or investigate migratory patterns among these species in Honduran waters. As a result, turtles in this area continue to face extreme pressure from the long-term harvesting of eggs and adults during nesting periods, the taking of juvenile turtles from local feeding grounds, incidental capture in fishing gear and increased habitat loss due to coastal development and land-based pollution.

The Turtle Awareness and Protection Studies (TAPS) program request a temporary permit from the Direccion General de Pesca (DIGEPESCA) for research activities from June 14 – July 1, 2006 while full permit application is in process. Temporary permit (DGPA/245/2006) was provided June 30, 2006 covering work from June 14 – July 1, 2006 and allowed the continuation of studies started in March, 2006 (under temporary permit number DGPA/005/2006 to Dr. Stephen G. Dunbar) on the growth rates and general health of ‘reclaimed’ hawksbill (*Eretmochelys imbricata*) and green (*Chelonia mydas*) sea turtles. The temporary permit issued June, 2006 did not allow additional studies, flipper tagging or release of turtles.

This study is the first of its kind in Honduras with the aim to tag and track juvenile sea turtles, as well as assess the health of wild-caught and captive turtles throughout the area of the Bay Islands. Eventually, ProTECTOR aims to expand research efforts throughout Honduras.

A CITES permit application from DIGEPESCA has already been filed through the office of Merinela Ferrera (Attorney at Law, Tegucigalpa) and is currently in process.

Detailed Methods

We collected initial data in Phase T1 from February 28 - March 9, 2006 (Interim permit # DGPA/005/2006) on a group of 20 juvenile hawksbills and four green sea turtles that have been 'reclaimed' on the island of Roatan. The owner of "Escuela de Buceo Reef House" has reclaimed these sea turtles from being illegally slaughtered. One advantage of this study over some previous studies (Balazs *et al.*, 1996; Bresette and Gorham, 2001; Mortimer *et al.*, 2003) is that these turtles are currently protected in an adequetly-sized sea pen with sheltering areas (Figure 1), thus avoiding the necessity of capturing juveniles from the wild.

Figure 1. Owner of the "Escuela de Buceo Reef House" releases a green turtle back into the protective pool.

Initial data has been collected by catching turtles by hand within the protection pen, giving each individual a name and painting an identification number on the carapace with a non-reactive, non-toxic marine paint (Figure 2). This has provided a non-invasive means for immediate, short-term identification while the turtles remain under protection. All animals have also been checked for general health, ectoparisites (barnacles, mites) and for Fibropapilomas. Several non-invasive morphometrics, such as Straight Carapace Length (SCL) (Figure 3), Straight Carapace Width (SCW), Curved Carapace Length (CCL), Curved Carapace Width (CCW), weight to the nearest 0.1 kg and the notation of identifiable distinguishing marks were recorded. All animals were also checked for general health and for fibropapilomas. Curved carapace length was recorded with a vinyl tape measure in two ways. The first was to measure minimum value, from the nuchal notch at the anterior of the carapace to the notch made by the two, trailing marginal scutes. The second method was to measure the maximum value, from the nuchal notch to the tip of the marginal scute. Straight carapace length was measured with a 127 cm forestry caliper (Forestry Suppliers, Inc.) from the nuchal notch to both the notch made by the posteriormost marginal scutes and to the tip of the marginal scute. All turtles were weighed on an NC-1 Series Crane scale (American Weigh, suppliers) with accuracy to 0.0005 kg. Turtles were placed in the weighing bucket (Figure 3) and weighed. The bucket was then unhooked from the scale and lowered to the ground where all other measurements were taken. Upon completion of all data collection, each turtle was digitally photographed from different views (dorsal, ventral, lateral) to produce

Figure 2. Dunbar applies non-toxic paint to Green Turtle # TIN005-06 for immediate identification

Figure 3. Dr. Stephen G. Dunbar measures Straight Carapace Length (SCL) with forestry calipers

a digital catalogue of all study animals. These have been linked to the database for subsequent tagging and tracking projects (Figure 4).

Project personnel handling animals are required to wear protective gloves for animal captures or rubber (surgical) gloves for handling to reduce the risk of infection to either turtles or handlers (Figures 1 & 3).

In Phase T2 (June 17 – July 1, 2006), we again recorded morphoetrics for comparison to Phase 1A measurements. From these measurements we calculated short-term estimates of growth rates, although better estimates can be made when measurements are taken at least 11 months apart. These weights and measurements will be used to further compare growth rates in captivity to those in the wild in the event that turtles are recaptured at a later date. During the period between March and June, some turtles escaped from the protective enclosure. New turtles were also purchased. Therefore, it was not possible for us to collect a second (T2) measurement on some turtles and new turtles were measured for the first time during the July investigation.

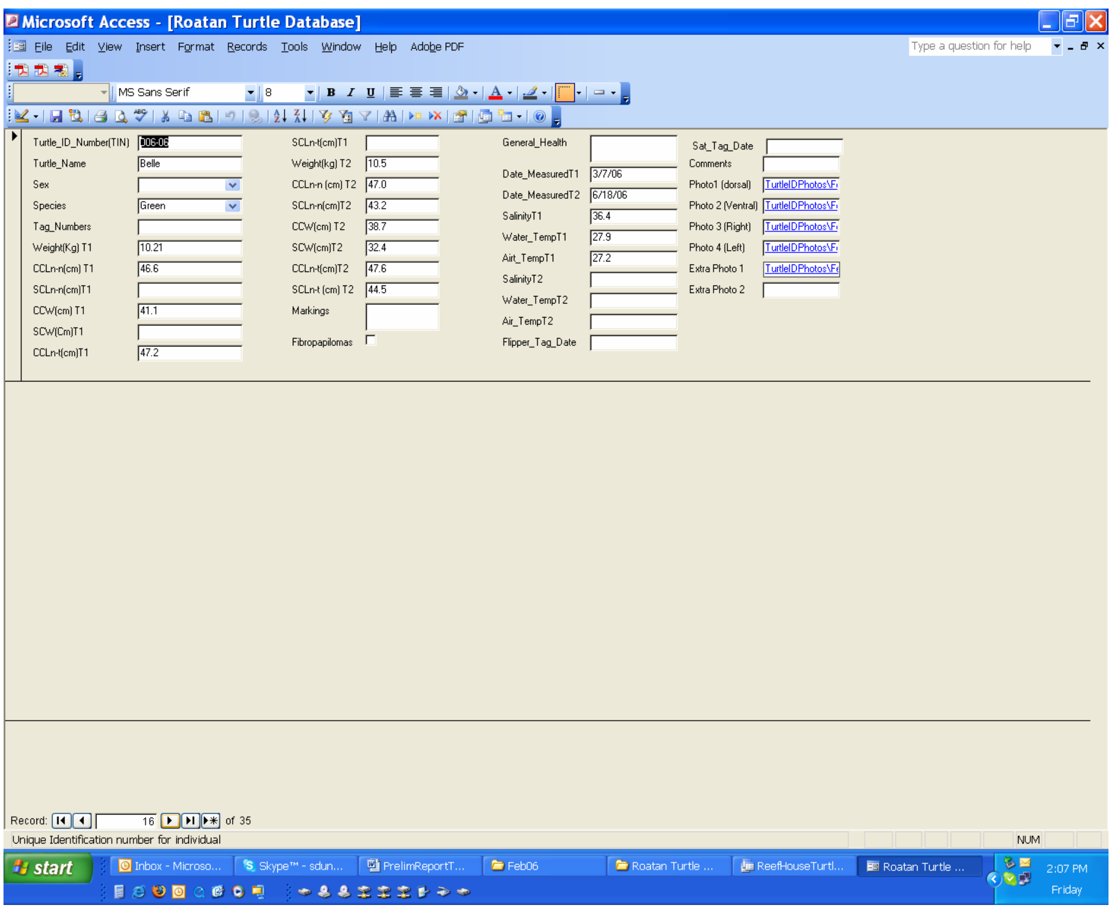

Figure 4. A sample of a TAPS database page. Note the fields for data input and the linked digital photographs in the right hand column. These provide a photographic means by which each animal can be identified.

Results to Date[1]

To date, we have collected data on 35 sea turtles from the south coast of Roatan. The data are housed in the project database and on completion of all data verification and cleaning, they are moved to a geographical information system (GIS) for storage and future data analyses.

The majority of turtles we measured appeared to be in good health, although some appeared to be slightly malnurished. No animals we examined appeared to have fibropapilomas, although some did have varying degrees of associated epibionts in the form of barnacles. These mainly appeared on the fleshy portions of the animals, such as the neck, the distal, trailing areas of the flippers and around the tail. These barnacles have not yet been identified. On occasion small crabs are associated with the soft tissue, usually in the tail region. We have not yet identified these decapods.

Data from Phase T1 reveal that the weight range of both hawksbills and greens combined, in March, 2006 was 1.86 – 22.6 kg. This can further be divided into the weight range for hawksbills (1.86 – 16.9 kg) and for greens (7.5 – 22.6 kg). Mean weight for hawksbills was 5.18 kg, while that for green turtles during T1 was 12.11 kg. Carapace lengths were recorded CCL_{max} for each individual and resulted in an overall range of 27.2 – 65.5 cm. When comparing species, we found that hawksbills ranged from 27.2 – 55.7 cm, while green sea turtles ranged in length from 42.7 – 65.5 cm. During this time, we found the mean length of hawksbills to be 35.7 cm, compared with 50.0 cm for green turtles.

In July (T2), weight ranged from 1.8 – 23.0 kg over all turtles. The change in ranges was due, in part, to the loss of some individual turtles from escapes and the addition of new turtles through purchase. Of the turtles present, the weight range for hawksbills was 1.6 – 17.4 kg, while the weight range of greens was 7.3 – 23.0 kg. The mean weight of hawksbills present during T2 was 6.1 kg, compared with 13.6 kg for greens present during the same period. When mean CCL_{max} was compared between species, it can be seen that hawksbills were smaller, measuring only 39.1 cm, compared with 52.6 for greens (Table 1).

Table 1. Measurements of hawksbill (*E. imbricata*) and green (*C. mydas*) sea turtles at Oak Ridge, Roatan during T1 (February – March, 2006) and T2 (June – July, 2006). CCL = curved carapace length. H = hawksbills; G = greens.

Time	Species	Weight Range (kg)	CCL_{Max} Range	Mean Weight (kg)	Mean Length (cm)
T1	All	1.86 – 22.6	27.2 – 65.5	5.8	37.3
T1	H	1.86 – 16.9	27.2 – 55.7	5.2	35.7
T1	G	7.5 – 22.6	42.7 – 65.5	12.1	50.0
T2	All	1.8 – 23.0	29.7 – 65.7	7.5	40.4
T2	H	1.8 – 17.4	29.7 – 57.4	6.1	39.1
T2	G	7.3 – 23.0	44.6 – 65.7	13.6	52.6

[1] The data presented here have not yet been statistically analyzed. We are currently transferring data into the Statistical Package for the Social Sciences (SPSS) and into a geographical information system (GIS) for this purpose.

In Table 2 it can be seen that turtles both gained and lost weight. The highest amount gained was by hawksbill # 024-06 (1.4 kg), followed by hawksbill # 008-06 (1.2 kg). The most weight lost (1.3 kg) was by hawksbill # 009-06. Overall, five of 16 individuals declined in weight. This is equivalent to 31.25% of the sample population, while 68.75% gained weight.

Table 2. Weight differences (kg) of all 16 turtles weighed during both T1 and T2. H = hawksbills; G = greens.

Species	ID Number	Weight T1	Weight T2	Weight Difference
H	008-06	16.2	17.4	1.2
H	009-06	3.9	2.6	-1.3
H	010-06	5.4	6.4	1.0
H	012-06	4.0	4.4	0.4
H	013-06	3.7	3.8	0.1
H	014-06	5.6	5.8	0.2
H	015-06	6.1	6.8	0.7
H	018-06	4.7	4.6	-0.1
H	019-06	3.5	3.9	0.4
H	020-06	6.9	7.6	0.7
H	021-06	2.0	1.8	-0.2
H	023-06	5.9	5.8	-0.1
H	024-06	7.3	8.7	1.4
G	005-06	22.6	23.0	0.4
G	006-06	10.2	10.5	0.3
G	017-06	7.5	7.3	-0.2

In Table 3, comparisons of curved carapace lengths are shown. These data show that CCL increased for all individuals except one. Therefore, 93.75% of the sample population increased in length over the period between March and July, 2006. Hawksbill # 023-06 declined in length by 0.2 cm. The greatest increase in CCL was seen in hawksbill # 010-06 (2.1 cm), followed by hawksbill # 024-06 with a growth of 2.0 cm. The smallest amount of growth was seen in hawksbill #013-06 and hawksbill # 021-06, both of whom showed only 0.1 cm difference in CCL. Two individuals, hawksbill # 018-06 and green # 017-06 showed no difference in CCL.

Changes in mean weight and length were calculated for both species using only those turtles that were measured during both T1 and T2. This provided a total of 16 turtles; 13 hawksbills and three greens. Hawksbills had a mean change in weight of 0.3 kg compared with 0.2 kg for green turtles (Table 4). When measures for CCL were compared between hawksbills and greens, we saw a mean increase in hawksbills of 0.8 cm, while that in greens was only 0.3 cm.

Table 3. Curved carapace length (CCL) differences of all turtles measured during both T1 and T2. H = hawksbills; G = greens.

Species	ID Number	CCL T1	CCL T2	CCL Difference
H	008-06	55.7	57.4	1.7
H	009-06	35.0	35.5	0.5
H	010-06	37.1	39.2	2.1
H	012-06	36.1	37.0	0.9
H	013-06	34.7	34.8	0.1
H	014-06	38.9	39.5	0.6
H	015-06	40.0	40.9	0.9
H	018-06	35.8	35.8	0.0
H	019-06	32.5	33.3	0.8
H	020-06	40.2	41.4	1.2
H	021-06	29.6	29.7	0.1
H	023-06	40.2	40.0	-0.2
H	024-06	42.3	44.3	2.0
G	005-06	65.5	65.7	0.2
G	006-06	47.2	47.6	0.4
G	017-06	44.6	44.6	0.0

Table 4. Mean changes in weight (kg) and length (cm) of species between T1 (February – March, 2006) and T2 (June – July, 2006). H = hawksbills; G = greens.

Species	Mean Weight Change	Mean Length Change
H	0.3	0.8
G	0.2	0.3

From Table 4, mean growth rates can be calculated by using the equation:

$$CCL_m \cdot (T2 - T1)^{-1} \qquad (1)$$

where CCLm is the mean change in curved carapace length and (T2 – T1) is the difference in time (months) between the first measurement and the second. Using this equation, we calculated the mean growth rate for hawksbills to be 0.27 cm/month, while that for greens is 0.1 cm/month. Since the CCL of mature, nesting females in Honduran waters are not reported in the literature, there is currently no way to estimate the years to maturity. Additionally, our current comparison data were collected as CCL, which are not directly comparable to straight carapace length (SCL) measurements. However, some general associations can be made with growth rates recorded for immature green turtles in Hawaii (Balazs, 1982a; Balazs *et al.*, 1996) which were found to have growth rates from 0.02 – 0.52 cm/month. Our data fall within the median of turtle growth rates from Hawaii. However, it must be emphasized that, at present, our data cannot be directly compared with the data from Balazs, 1982 or Balazs *et al*, 1996.

In Figure 5, the number of turtles in each weight class is shown for all turtles measured during T1 and T2. It can be seen that at time T1, the highest number of turtles (nine) were in the 6 kg weight class, while the next largest weight class was 4 kg, with five turtles. Of 23 turtles examined, 78.3% were within the weight range from 4 – 8 kg. At time T2, there was a more bimodal distribution of weights with both 4 kg and 8 kg classes containing six turtles each. The next largest class at that time was the 2 kg class with five individuals. Of 26 turtles measured at T2, 80.8% of individuals fell within the weight range of 2 – 8 kg. During both T1 and T2, only 2 individuals were measured that were in weight classes between 18 – 24 kg, representing only 8.7% of the sample population at T1 and 7.7% during T2.

When T1 CCL_{max} classes were analyzed, we found the largest number of turtles occurred in the 35 cm class with eight individuals (Figure 6). The next largest class during that time was the 40 cm class with six turtles. Overall, individuals in the CCL range of 30 – 40 cm represented 82.6 % of all turtles in T1. During T2, the greatest number of turtles was within the 40 cm class with nine individuals. The next largest class was the 45 cm class with six turtles. Overall, turtles in the 30 – 45 cm range represented 88.5% of all turtles measured during T2. Only one individual (4.3%) was in a class of 60 cm or greater during T1. During T2, two individuals (7.7%) were found to be in length classes of 60 cm or greater (Figure 6).

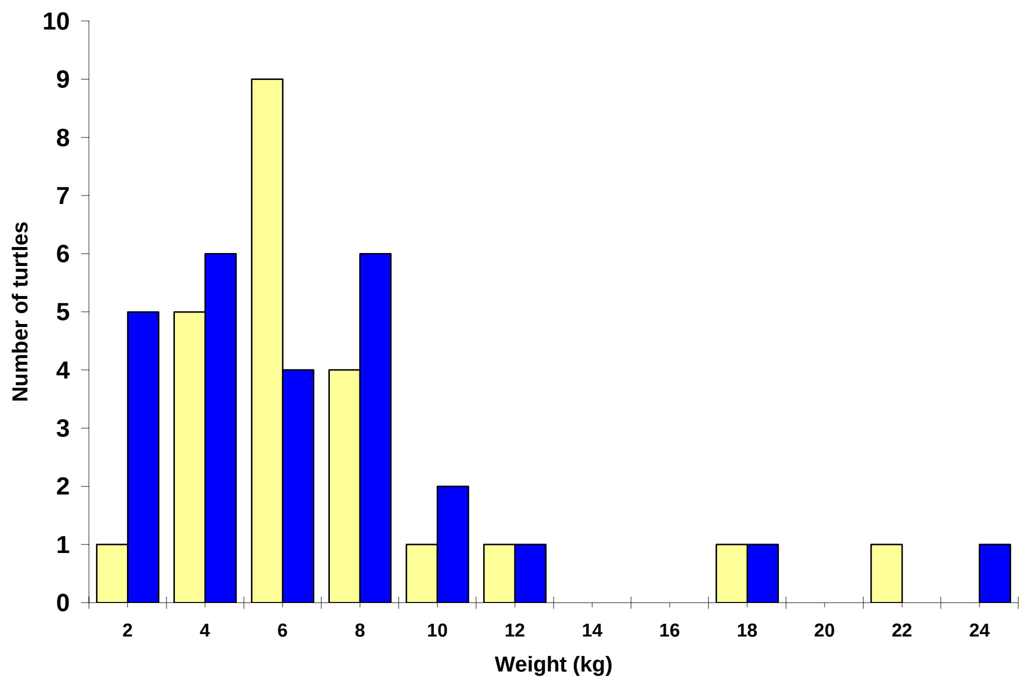

Figure 5. Number of turtles in 2 kg weight classes for all turtles measured at T1 (yellow) and T2 (blue). Numbers along the x-axis represent the highest weight in a given class.

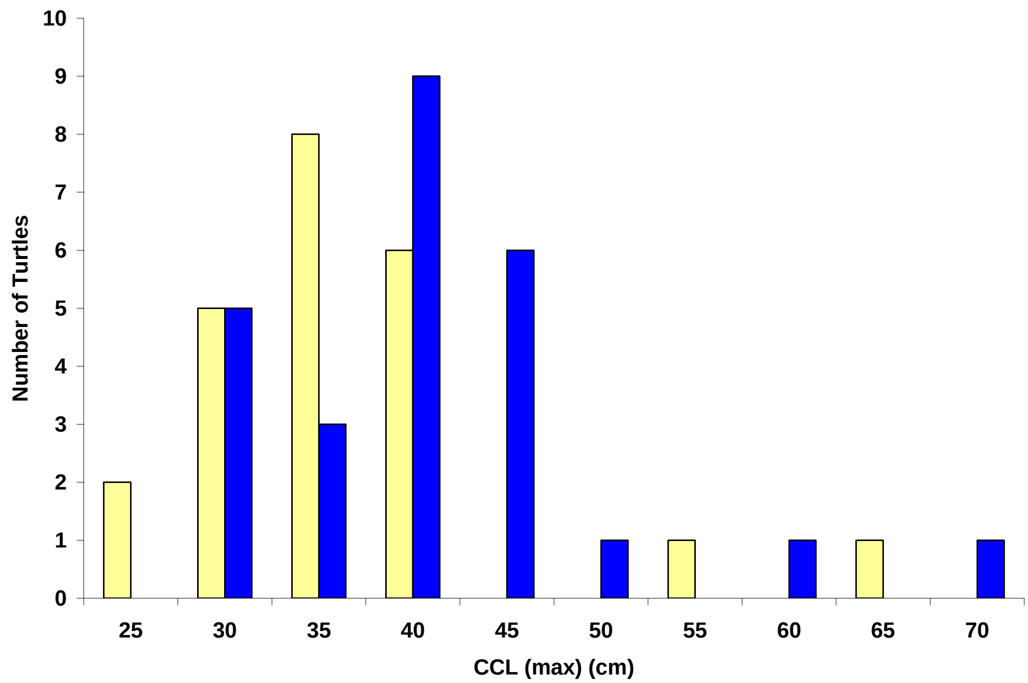

Figure 6. Number of turtles in 5 cm curved carapace length classes for all turtles measured at T1 ( ) and T2 ( ). Numbers along the x-axis represent the highest weight in a given class.

Discussion

In our results, to date, we have collected data on 35 sea turtles. Of these, 31 are hawksbills and 4 are greens. We found that the juvenile hawksbill and green sea turtles we examined have, in most cases, been in good physical condition (according to appearances), have not sustained visible injuries from fish hooks or fishing nets, or from larger predators, such as sharks. We have also found no evidence of fibropapiloma in any of the individuals we examined. On occasion, we detected the presence of epibionts in the form of barnacles and decapod crustaceans. To date, we have neither collected and preserved, nor identified the species of either crustacean. However, we plan to make a collection of these symbionts for identification during our next expedition (scheduled for September, 2006).

When turtles were compared over time and between species, we found differences in their weight distributions and size distributions. We found that in both time cases, hawksbills weighed less and were, on average, smaller than green turtles. In contrast, the range of sizes was greater in hawksbills (T1: 28.5 cm; T2: 27.7 cm) than in greens (T1: 22.8 cm; T2: 21.1 cm). This is likely to be a result of the fact that over 88% of all animals measured were hawksbills. Larger numbers of green turtles may result in greater variance in size measurements, leading to a more normal distribution of lengths.

We found that the mean weight change in hawksbills was greater than that for green turtles. This could be a result of the high protein diet that the hawksbills are consuming, when compared with the greens. We also noted that mean length change was higher in hawksbills than in greens. Taken together with the lower mean weight of hawksbills, the data may suggest that hawksbills may be assimilating intake energy into rapid length growth and less into muscle and tissue mass, whereas greens may be assimilating their energy intake into muscle and tissue mass more rapidly than into length changes. Although these results may be somewhat artificial due to the temporarily-captive nature of the subjects, these mechanisms of growth may be related to the ecologies and life histories of the animals, as well as their dietary preferences.

We recognize that conclusions drawn from the preliminary analyses presented in this report are difficult to support from such limited results. However, this report does provide a starting point from which the needs of turtle research in Honduras can be assessed and urgently-needed data be provided to decision-makers regarding the management of these endangered species.

These data further underscore the need for a concerted, national program of turtle research to be launched into all aspects of sea turtle ecology, biology, life-history, physiology, conservation and management in Honduras.

Acknowledgements

ProTECTOR and TAPS recognize that without the financial and logistical assistance of the “Escuela de Buceo Reef House,” this project would not have been initiated. We thank the owners and staff of that facility for their interest in sea turtle conservation and their invaluable efforts on behalf of the sea turtles of Honduras. We also extend our appreciation to ESRI for their funding support in terms of GIS software and training. We thank Karla Ventura, Edwin Cruz, the staff of PMAIB and Romeo Silvestri for their constant assistance in sharing data and logistical arrangements for the TAPS program. Numerous volunteers have also assisted in the collection of data, including Lyndsey Kelly, David Kirkwood and Leonardo Rodriguez. I thank Joe Breman for his input in planning, data collection, the development of the project database and GIS analyses.

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