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Photographic Identification of Green Turtles (*Chelonia mydas*) at Redang Island, Malaysia

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Details of life history traits of animals are often obtained through mark-recapture projects that identify individuals. For sea turtles, the most common approach is to attach metal tags to the trailing edge of the flippers. Through recaptures of marked individuals, valuable information such as the reproductive biology, movement patterns, habitat use and population size estimates may be obtained (Godley et al. 2008; Mansfield 2006; van de Merwe et al. 2009). However, this identification method is not foolproof. Apart from tag loss, which causes bias in sea turtle studies such as overestimation of the number of nesting females in a nesting season; underestimation of the number of clutches deposited by individual turtles and incorrect inter-nesting data (Bjorndal et al. 1996; Liew & Chan 2001), flipper tagging is an invasive method that may cause disturbance and discomfort to sea turtles (Shanker et al. 2003). Passive Integrated Transponder (PIT) tags that are injected into muscle have a higher retention rate than metal flipper tags (Fontaine et al. 1987; van Dam & Diez 1999), but require a scanner to record the unique ID.

An alternative method for recognizing individual turtles is photographic identification (photo-ID). Compared to conventional tagging, this method of visual identification has advantages such as animals are not physically captured or hurt and the chances of stressing the animal are reduced (Schofield et al. 2008). Moreover, with the advent of digital technology, studies of various taxa are turning to photo-identification as an alternative method of identification. This method has been used in green-eyed tree frogs (Kenyon et al. 2009), painted crayfish (Frisch & Hobbs 2007), dolphins (Currey & Rowe 2008; Weir et al. 2008), whalesharks (Brooks et al. 2010), cheetahs (Kelly 2001), small-scaled skinks (Gebauer 2009), elephants (Ardovini et al. 2008) and polar bears (Anderson et al. 2007). For sea turtles, this unique, natural feature is found on the head.

In 1986, McDonald & Dutton (1996) reported that the pineal “pink” spots of nesting leatherbacks were recognizable over time. The method was reinvestigated by Buonantony (2008) and De Zeeuw et al. (2010). Subsequently, photo-ID utilizing the facial scute patterns has been explored in other species of sea turtles: hawksbill, green and loggerhead turtles (Chassagneux et al. 2013; Feliz et al. 2013; Jean et al. 2010; Lloyd et al. 2012; Reisser et al. 2008; Schofield et al. 2008). There are two main assumptions underlying the application of photo-ID: i) the distinct characteristic of each individual is different and ii) the distinct characteristics are stable over time.

We used photo-ID to recognize individual green turtles at Chagar Hutang, Malaysia (Fig. 1). This nesting beach was declared a turtle sanctuary in 2005 and public access is now restricted. During the 2010 (May-June), 2013 (March-July), and 2014 (March-May) nesting seasons, we photographed the left and right facial profiles of nesting females after they had finished oviposition on the beach. Sand was first cleared from the head so that the scute patterns could be seen clearly. With a flashlight shining from above or sideways, both sides of the facial profile (left and right) were photographed using a digital camera (SONY DSC-T2 - 8.1 Megapixels or Olympus XZ-1 - 10 Megapixels). The profile pictures were taken at a distance of approximately 20 cm at a 90° angle to reduce distortions caused by inclination. Flash photography was not used as literature has shown that green turtles shorten the duration of nest covering and camouflaging stages when exposed to camera flashes (Campbell 1994). Instead a small flashlight shone from above was used as the light source. For each nesting female we photographed, we also measured curved carapace length (CCL) and width (CCW) using a flexible measuring tape; we also attached tags (Inconel 625 Style 681c) on both front flippers. If the turtle was already tagged (either from the previous season(s) or previous nesting event) the tag numbers were read and recorded. After that, the sea turtle facial profile was photographed. We are uncertain if the use of flashlights would deter landing females from nesting or if the duration used to cover and camouflage the nests would be affected. This warrants further investigation.

To determine the stability of facial scute patterns, we collected 12 newly emerged green turtle hatchlings in June 2013 and maintained them in a fiberglass reinforced plastic tank (diameter = 1.35 m; height = 1.0 m) for one year (June 2013-June 2014). The tank was cleaned and seawater changed every four days. Hatchlings were fed a combination of turtle pellets, fish and squid. The left and right

![Figure 1. Map showing the location of Chagar Hutang, Redang Island.](image)
facial profiles of the hatchlings were photographed every 7-14 days. From January 2014 onwards, photographs were taken once a month.

Good quality images were selected and subjected to analysis using two different methods. The first method was based on Reisser et al. (2008) where the facial scute patterns were drawn and extracted using Adobe Photoshop CS4. In order to determine if the left and right profiles are symmetrical, the left facial profiles of all images catalogued were flipped horizontally using Microsoft Power Point 2007 and subsequently compared to the corresponding right facial profile. Images of the facial scute patterns were then compared manually and results were validated by checking the tag numbers. Whenever an individual turtle was photographed, the images were placed in their own folder. The folder was then labeled based on the date it was taken, e.g., 20.05.2014. If two or more individuals were photographed the same night, the folder was labeled as: 20.05.2014(1); 20.05.2014(2) and so on. The tag numbers of each individual sea turtle were noted in their respective folders.

When images were compared, only the folder name was written on the image. Thus, when two or more images were similar, the folders concerned were checked and tag numbers validated. Only two individual authors compared the images independently as the process was very time consuming. In the second method by Jean et al. (2010), each individual was assigned a unique identification code number. We assigned 3-digit codes for up to three rows of scutes. All results were verified by checking the corresponding tag numbers.

The left and right facial scute patterns of 155 adult female green turtles were photographed throughout the study. However, the images of only 140 green turtles could be analyzed and catalogued due to picture quality. As the inter-nesting interval for nesting females is approximately 10 days, some individual nesters were encountered for the second, third and even fourth time. The total number of different individuals analyzed in this study was 133 green turtles, with six turtles recaptured in subsequent years.

The visual comparison of the left and right profiles showed that nearly all turtles could be distinguished from each other through the shape and arrangement of facial scute patterns. The exception was the discovery of similar left and right profiles for two turtles: one that nested in 2010 and one that nested in 2013 (Fig. 2). In 2013, a newly tagged nester was observed to have similar left and right facial scute profiles to a 2010 nester. Unfortunately, we were unable to confirm if they were the same nester who lost both her tags or indeed two different nesters exhibiting similar facial scute profiles. Although it is suspected that these two nesters are in fact the same individual, we do not have concrete evidence to prove such a claim.

The only way we could validate the photo-ID method would be to attach an additional tag to the sea turtle such as a passive integrated transponder (PIT) as done by McDonald & Dutton (1996).

For all individual images catalogued, no symmetry between the left and right profiles was detected. No changes in the shape and arrangement of facial patterns were detected in remigrants that were re-sighted. Out of the 43 nesters catalogued in 2010, six returned to nest in 2013 and one in 2014. The images obtained were successfully matched with the first year images in 2010 of the respective individuals indicating the scute patterns had not changed and were stable over a period of at least four years.

By implementing the method adapted from Jean et al. (2010), each image was assigned an individual photo-identification code, akin to a human’s identification number. In this study, 3-digit codes were assigned up to the third row of scutes. For some turtles, codes could only be assigned until the second row as the nester did not fully extend her neck (Fig. 3). In addition, some individual turtles displayed similar codes up to the second row of scutes. Positive results were obtained, as each individual could be distinguished from the others using the coding system, with the exception of the

![Figure 2. The left and right profile of a nester from 2010 (A1 and A2; tag number: 2311.2312) and a nester from 2013 (B1 and B2; tag number: 5466.5469). Both turtles display similar facial scute shapes and arrangement.](image-url)
two nesters exhibiting similar left and right facial patterns. The maximum number of scutes observed in a row was six and the maximum number of sides to a scute recorded was 10.

The 12 hatchlings raised in captivity for one year showed a mean weight gain of 292.8 ± 63.3SD g while the mean increase in straight carapace length and straight carapace width was 8.8 ± 1.1SD cm and 7.9 ± 1.1SD cm respectively. Although the sample size was small, the experiment produced promising results in terms of utilizing photo-ID for tagging sea turtle hatchlings. Each individual hatchling was identified by comparing the images photographed on the first day with the most recently photographed images. It was apparent that the scutes increased in size during their growth but no changes were observed in the shape and arrangement of the scutes (Fig. 4).

Results from this study demonstrate that the nesting turtles at Chagar Hutang displayed sufficient variability in facial scute patterns to identify individuals, a finding similar to other studies (Reisser et al. 2008; Schofield et al. 2008). Manual comparisons of the images were relatively easy as most individuals exhibited distinct pattern differences. An interesting finding was that some individuals displayed incomplete sides to a scute (Fig. 5). In many cases where natural markings are used for recognition purposes, the chances of patterns repeating are there, albeit very low. Such is the case for human fingerprinting identification where the chances of a person’s fingerprint matching another individual in the population is one in a million (Cherry & Imwinkelried 2006). The incomplete side found in the scutes of sea turtles might therefore serve as nature’s

Figure 3. Right profile code of two different green turtles showing similar 3-digit series: 4-115-125-135-145-214-226-236-246. The coding system is described in Jean et al. (2010). The first single digit of the code represents the number of post-ocular scutes. The first number of the 3-digit code corresponds to the row number; the second corresponds to the scute position in the row while the third corresponds to the number of sides on the scute. The code for the third row of Turtle 6210.6211 was not assigned as her neck was not fully extended. They were identified as different individuals after comparison with the codes of the left profile.

Figure 4. Left facial image of a green turtle hatchling captured on 10 June 2013 (A) and 26 June 2014 (B). Although the scute patterns remained stable for a year, there is the possibility that the pattern might change in the future. Thus photo-ID may be suitable for identifying hatchlings in the short term. More work has to be done for verification.
explore the feasibility of implementing photo-identification as a potential method for “tagging” green turtle hatchlings. The results obtained revealed that the facial scute shape and arrangement patterns of green turtle hatchlings are stable from hatch date to a time span of at least a year. Despite the small sample size and short study period, the findings signify the potential of using photo-ID as a method in tracking sea turtle hatchlings. Studies have shown that “living tags” created through autografting are retained from the hatching phase until maturity (Bell & Parsons 2002; Rodríguez 2013). While photo-ID presents similar potential to autografting, this method should be subjected to continuous work and monitoring efforts before verification can be done.

Despite the many advantages photo-ID offers, there are limitations to this method. The main concern lies with the image quality of photographs taken. Poor quality images would decrease the matching success (Frish & Hobbs 2007; Speed et al. 2007). With large numbers of hatchling photos produced, the post-processing of images will be time consuming. Moreover, photo-ID is unsuitable at nesting sites with light ordinances and in areas where water visibility is limited.

Our results signify the importance of photographing two sides of a sea turtle profile to increase the success of identifying an individual. Moreover, as long as both sides of the facial profile have been documented, we would still be able to identify an individual even if only one side of the profile was photographed. Unlike sea turtles underwater, nesting turtles on occasion do not fully extend their necks and are sensitive to movement, causing them to contract their neck when disturbed. Thus, as the coding system is reliant on the degree of neck extension exhibited by the turtle, the ability to assign a complete set of codes to a certain individual will sometimes be hampered.

At present, we do not have an automated matching program developed for comparing and matching the images of the nesting sea turtle population at Redang Island. Although the images were compared manually in this study, it would be time consuming and laborious to process larger amounts of photographs. Having said this, in spite of the fact that the method adapted from Jean et al. (2010) resulted in certain nesters displaying similar codes, the process of counting the number of sides to scutes was no doubt more convenient. Given that the probability of two individuals having similar codes will decrease when the length of the code increases, it would therefore be interesting to determine this probability value. We did find, however, that photographic identification proved to be a feasible potential tagging method for nesting green turtles and green turtle hatchlings at Chagar Hutang, Redang Island.

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Figure 5. A green turtle exhibiting an incomplete side to a scute. This incomplete side refers to the line projecting midway through a scute from a point of intersection. In contrast to the other sides of a scute; this line has only one intersection point.

way to diversify the facial scute patterns that may be found on sea turtles. This variation in scute pattern would lower the probability of different sea turtle individuals having similar facial scute patterns.

Our study also showed that the facial scute patterns in green turtles are stable for at least four years. The stability of characteristics used as identifiers is fundamental for long-term monitoring purposes (Rocha & Rebelo 2014; Vincent et al. 2001; Waye et al. 2013). Evolution in the markings (patterns or pigmentation) has serious implications in population studies as misidentification of individuals may either underestimate or overestimate population size. In two separate studies, Kenyon et al. (2009) discovered that the dorsal spot patterns found on green-eyed tree frogs had a risk of changing significantly over the course of just two months while in Waye et al. (2013), spot patterns on tiger salamanders changed dramatically in less than a year. As far as sea turtles are concerned, however, photo-ID has thus far been successful for individual recognition of juvenile and adult turtles (Chassagneux et al. 2013; Feliz et al. 2013; Jean et al. 2010; Lloyd et al. 2012; Rees et al. 2013; Reisser et al. 2008; Schofield et al. 2008). In these studies, the longest time span between re-sightings of sea turtles using photo-ID was six years, recorded by Feliz et al. (2013) in their work on hawksbill turtles. Whether the facial scute patterns of sea turtles will remain as a unique identifier in the long run remains unknown. Continuous effort should be done to verify the feasibility of using photo-ID as an alternative method for tagging sea turtles.

Various techniques have been employed to tag hatchlings such as carapace notching, internal placement of radio-active wires, plastral tattoos (Balazs 1978; Eckert & Eckert 1990), europium tagging (Shoop 1978) and autografting (Hendrickson & Hendrickson 1981; Wood & Wood 1993). However, as opposed to individual identification, tagging hatchlings using methods such as coded wire tags, notching and autografting is limited to identifying cohorts (Dutton & Stewart 2013). An emerging tool, still in its early stages, is genetic fingerprinting; this may allow hatchlings to be identified individually. To the authors’ knowledge, ours is the first study to explore the feasibility of implementing photo-identification as a


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Published records of the leatherback sea turtle, *Dermochelys coriacea* (Vandelli 1761) in the Mediterranean are few, particularly in comparison to those of the loggerhead sea turtle *Caretta caretta* (Casale & Margaritoulis 2010). However, these records indicate that leatherbacks occur throughout the basin, from the Gibraltar Strait to the easternmost part, and enter the basin at a relatively large size (large juveniles/adults), with no evidence of breeding in the Mediterranean (Casale et al. 2003). The species is classified globally as Vulnerable by the International Union for Conservation of Nature and (2013). Mediterranean leatherbacks are considered part of the north-Atlantic regional management unit of this species, categorized as Low risk–Low threat (Wallace et al. 2013). The Gulf of Corinth (surface area of approximately 2,400 km²) is a deep semi-enclosed basin separating the Peloponnese from mainland Greece (Fig. 1). The 1.9-km-wide Rion-Antirion strait, crossed by a four-pan bridge, separates the Gulf from open Mediterranean waters. The waters of the Gulf of Corinth are oligotrophic and transparent, with no significant river runoff. While the western part of the Gulf is relatively shallow (the maximum depth under the Rion-Antirion bridge is about 70 m), its central portion has waters 500 – 900 m deep, offering a suitable albeit restricted habitat to marine fauna that is normally pelagic (e.g., striped dolphins *Stenella coeruleoalba*; Bearzi et al. 2011).

On 7 August 2012, while conducting a boat survey in the Gulf of Corinth in the context of a study of dolphin abundance that was initiated in 2009 (Bearzi et al. 2011), we spotted a leatherback breathing at the surface on a completely flat sea (38°11’174N, 22°44’851E; sea floor about 700-800 m deep). Starting 7 min after the beginning of the observation, we timed a total of 29 consecutive surfacings, until the animal was lost from view due to deteriorating weather conditions. While the animal was close to the boat, we took 1 min of underwater footage with a Canon Powershot S100 digital camera (12 Megapixel) in a waterproof casing, deployed manually while we stayed on board our 5.80-m inflatable boat. In addition, a number of photos were taken with a Canon 7D digital camera (12 Megapixel) in a waterproof casing, deployed manually while we stayed on board our 5.80-m inflatable boat.

Observation of a leatherback sea turtle, *Dermochelys coriacea*, in the Gulf of Corinth, Greece

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camera (18 Megapixel) equipped with a Canon EF 70–200 mm f 2.8 IS USM zoom. Estimated body size was approximately 1.5-2 m (total length), based on the relative size of boat and leatherback when the animal swam close by. Dive durations recorded continuously during a 36 min sampling interval ranged between 8 and 601 s (mean = 75 s, SD = 145.5, n = 29). The diving pattern of the leatherback is shown in Fig. 2. Observed dive durations were much shorter than those observed at nesting grounds (Reina et al. 2005; Shillinger et al. 2010, 2011; Wallace et al. 2005) and also shorter than those recorded during migration or at foraging grounds (Fossette et al. 2010; Heaslip et al. 2012; Shillinger et al. 2011).

About 21 min after the beginning of the observation, the animal surfaced close to our boat (the low-noise four-stroke engine of 100 HP was operated either on idle or at minimum speed). There was no clear avoidance behavior. The underwater video shows that the turtle suddenly changed direction when the distance from the boat was about 5 m (surfacing no. 21 in Figure 2). The animal did not

**Figure 1.** Map of the Gulf of Corinth showing bathymetry as well as the position of the leatherback sea turtle observed on 7 August 2012 (triangle), together with the approximate location of animals found stranded in the past (dots).

**Figure 2.** Dive durations recorded between 16:37 and 17:13. Interval no. 21 is when the animal came close to the boat and passed under the keel.
attempt to avoid the boat but swam directly toward it, passing under the keel and to the opposite side, at about 1 m depth. Subsequent surfacing intervals were likely affected by this close approach, although the animal soon resumed its original dive pattern (Fig. 2). The underwater video shows a total of 12 pilot fish Naucrates ductor swimming in close proximity to the leatherback (Fig. 3). Additionally, a bloom of Mediterranean jelly Cotylorhiza tuberculata was ongoing at the time of the observation, and several of these invertebrates (diameter ~ 20 cm) may be seen in the video near the swimming leatherback; the turtle ignored these. While no feeding behavior was observed, the animal defecated (a large yellowish cloud) while swimming about 10 m from the boat and parallel to it. The “pink spot” on the top of the head - a characteristic of adult leatherbacks - was photographed during surfacings (Fig. 4) and its contour may be used for individual identification in case this individual is re-sighted.

The only other published record of a leatherback sea turtle in the Gulf of Corinth refers to an animal caught in fishing gear and then killed by a fisherman near Psatha in November 1982 (Margaritoulis 1986; Fig. 1). More recent unpublished data from the ARCHELON Sea Turtle Rescue Network include two incidents in the Gulf of Corinth, both concerning dead-stranded leatherbacks with severe injuries on the neck and front flippers, attributed to incidental capture in fishing nets: one near Vrachati (28 September 1997; in advanced decay) and one near Derveni (26 June 2004; in decay). Both stranding locations are on the Gulf’s southern shores (Fig. 1). Our observation contributes to documenting the occurrence of charismatic and vulnerable fauna in the Gulf of Corinth, where efforts to preserve marine biodiversity have been modest.

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Natural Death of a Hawksbill Turtle Due to Feeding Behavior

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The Abrolhos Archipelago (17.93°S, 38.94°W), located within the Abrolhos National Marine Park, is an important feeding area for immature hawksbill turtles Eretmochelys imbricata (Proietti et al. 2012). This species is generally carnivorous and has been reported to feed on a wide range of prey, with preference for ingesting sessile benthic organisms such as sponges and zoanthids (León & Bjorndal 2002; Proietti et al. 2012; Stampar et al. 2007). At the archipelago, hawksbill turtles are commonly seen at shallow reef areas, where they feed in a distinctive manner on the green sea mat Zoanthus sociatus (Fig. 1).

On 18 March 2015, at 3:50 PM local time, while snorkeling at a protected bay (Mato Verde) of Santa Barbara Island, we observed an...

Figure 1. Live immature hawksbill turtles feeding on Zoanthus sociatus at the Abrolhos Archipelago.
immature hawksbill turtle with its head wedged in a small crevice on the seabed, at approximately 2.5 m depth (Fig. 2a). After noting that the animal was unresponsive, we removed it from the seabed and determined that it was deceased. The turtle had initially been captured and tagged (left front flipper tag BR96926, right front flipper tag BR96927) on 3 March 2015, and was subsequently recaptured on 15 March at the same location. It measured 35.5 and 27.7 cm curved carapace length and curved carapace width, respectively, and weighed 6 kg. It had no apparent debilitation and its body showed no signs of degradation, which indicated that it had died just previously to us finding it.

A visual inspection of the crevice revealed that the interior was lined with green sea mat (Fig. 2b). This is a common feature of this bay, and likely the reason why it is frequently visited by hawksbills during high tide. We believe that while eating this food item, the hawksbill got its head irremovably lodged in the crevice, and subsequently drowned. While anthropogenic threats are commonly reported for the Critically Endangered hawksbill turtle (Mortimer & Donnelly 2008), this is, to our knowledge, the first description of such an odd and natural cause of death.

Figure 2. Hawksbill turtle found deceased with head lodged in crevice (left); example of Zoanthus sociatus at Mato Verde Bay, Abrolhos Archipelago (right).

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Mitochondrial Repeat Haplotypes Suggest Local Origins for CM-A13 Green Turtles Foraging in Florida

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Maternally inherited mitochondrial DNA haplotypes are useful in quantifying connectivity in two important ways. The first is assessing the degree of demographic connectivity among rookeries with respect to female recruitment. The second is assessing migratory connectivity through mixed stock analyses that estimate rookery contributions to admixed foraging aggregations. Robust inferences from these mixed stock analyses depend on a few critical assumptions, one of which is that representative baseline data are available from all potentially contributing rookeries (Lahanas et al. 1998). The accuracy and precision of mixed stock analyses are also affected by the degree of structure among potential source rookeries. Most often, regional rookeries are distinguished by frequency differentiation rather than the presence of diagnostic haplotypes, which can lead to considerable uncertainty in rookery contribution estimates for foraging aggregations (Bolker et al. 2007).

The green turtle (Chelonia mydas) haplotype CM-A13 has been recorded in the Greater Caribbean region as well as in the Mediterranean Sea (Bagley 2003; Encalada et al. 1996). Phylogeographic analyses placed CM-A13 within the northern Caribbean haplogroup and prompted the hypothesis that the Mediterranean nesting aggregation was founded through colonization from the Caribbean (Bowen et al. 1992; Encalada et al. 1996). CM-A13 accounted for nearly all females sampled in the nesting populations of Turkey and Cyprus (Bagda et al. 2012; Encalada et al. 1996) but was not known from rookeries outside the eastern Mediterranean. Therefore the presence of CM-A13 among juveniles foraging at northern Greater Caribbean sites (Florida, the Bahamas and Texas) invoked the possibility of dispersal from the Mediterranean into the western Atlantic (Anderson et al. 2013; Bagley 2003; Bjorndal & Bolten 2008). However the recent detection of CM-A13 at low frequency in the Florida nesting aggregation suggested that local origins for foraging juveniles was a more parsimonious alternative (Shamblin et al. 2015). All CM-A13 turtles analyzed using expanded (~800 base pair) control region sequences on both sides of the Atlantic were identical (CM-A13.1) (Bagda et al. 2012; Shamblin et al. 2015), so determining the origins of the Greater Caribbean juveniles required application of additional markers.

The dinucleotide microsatellite repeat array (mtSTR) that occurs at the 3’ end of the mitochondrial control region has proven useful in uncovering additional mitochondrial variation (Tikochinski et al. 2012). In Atlantic green turtles, this array was partitioned into four separate loci by point mutations and non-repetitive sequences that interrupt strings of ‘AT’ repeats (Fig. 1). Therefore assessing the number of ‘AT’ repeat units present in each of the four loci permits subdivision of point mutation-defined haplotypes into multiple variants. Despite nearly complete fixation of haplotype CM-A13 in the Mediterranean (Bagda et al. 2012), analysis of individuals representing the Israeli rookery and strandings along the Israeli coast detected 33 mtSTR haplotypes (Tikochinski et al. 2012). Several variants recorded among the strandings were absent in the Israeli nesting population, suggesting that some degree of structure likely occurs among rookeries comprising the Mediterranean nesting aggregation.

We sequenced the mtSTR array in 15 CM-A13 turtles from Florida: 12 nesting females and three foraging juveniles (Fig. 2). Nesting samples were those previously analyzed in Shamblin et al. (2015) as well as new females sampled at Melbourne Beach in 2011 (n = 2) and 2012 (n = 1). Foraging juveniles were those previously identified as CM-A13 in an analysis of foraging aggregations in developmental habitats in east central Florida (Bagley 2003). We generated 817-base pair control region haplotypes using primers LCM15382 and H950 as previously described (Shamblin et al. 2012). We conducted polymerase chain reactions and sequencing of the mitochondrial repeat as described by Tikochinski et al. (2012), except that primer CMD1 was used for sequencing the forward strand.

All 15 individuals nesting and foraging in Florida carried the same mitochondrial repeat haplotype: 5-7-7-4. This was not one of the 33 repeat haplotypes detected in the Israeli rookery or among individuals stranded along the Israeli coast (Tikochinski et al. 2012). These results suggest that the CM-A13 juveniles foraging in Florida

![Figure 1. Sequence chromatogram illustrating the four ‘AT’ repeat unit loci in the Atlantic green turtle mitochondrial genome.](image-url)
First, incomplete baseline data from rookeries may yield misleading results with respect to mixed stock analysis. In addition to ensuring that all potentially contributing rookeries have been represented, rookery sampling should be designed to capture any geographical structure that might be present and be sufficiently deep to detect rare haplotypes. Second, traditionally used control region sequences may provide limited resolution for assessing stock structure and migratory connectivity at regional and even ocean basin scales. Use of nuclear and additional mitochondrial markers have improved stock resolution in some cases (Dutton et al. 2013; Shamblin et al. 2012; Tikochinski et al. 2012). Finally, the strongest inferences of connectivity often arise from combining multiple methodologies (Godley et al. 2010; Stewart et al. 2013). In our case, the genetic results were congruent with previous biophysical modeling, suggesting that the connection between CM-A13 green turtles in the Greater Caribbean and Mediterranean Sea reflects an historical colonization signature rather than contemporary migratory connectivity.

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An Unusual Physical Interaction between Two Adult Hawksbill Turtles (Eretmochelys imbricata) in the Seychelles

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The hawksbill turtle (Eretmochelys imbricata) (Linnaeus 1766), is listed as Critically Endangered by the IUCN (Meylan & Donnelly 1999; Mortimer & Donnelly 2008). Despite a substantial amount of research conducted on the biology of sea turtles, very little published information exists regarding their social and mating behaviors. This paucity of information is particularly relevant to the hawksbill turtle. Both sea turtles (Booth & Peters 1972; Frick et al. 2000; Rostal et al. 1998; Schofield et al. 2006) and terrestrial tortoises (Frazier & Peters 1981) are well known for aggressive mating and courtship behavior, as they are observed mating regularly. However, when observing the behavior of terrestrial tortoises, gravity dictates that a male will always mount the carapace of the female from the top, plastron to carapace (Frazier & Peters 1981). Inversely, due to their aquatic environment, sea turtles have more flexibility and may exhibit a wide range of mating behaviors and different physical interactions as they can move in a three-dimensional plane (Schofield et al. 2006). Nevertheless, most reports describe the standard mating position where a male will mount a female from behind and hook his fore flipper claws over the anterior rim of the female’s carapace (Booth & Peters 1972; Rostal et al. 1998; Schofield et al. 2006). Due to the paucity of published information regarding sea turtle courtship and mating in general, this note describes an unusual physical interaction between two adult hawksbill turtles, observed offshore of Cousine Island in the Seychelles.

Cousine Island is a small (26 ha) granitic island rising to just over 70 m above sea level and is situated at 4° 20’ 41” S and 55° 38’ 44” E (Samways et al. 2010). On 24 November 2013, I observed an unusual hawksbill turtle interaction during a reef-monitoring dive and recorded it with a high definition underwater video camera. Behavioral observations were made in shallow water (7-10 m depth), approximately 100 m off the island and visibility and water temperature on that day was 15 m and 29°C respectively.

Courtship and pre-copulatory behavior was observed from the initiation chase by the male entering the visual range of the female and biting at her carapace (Fig. 1a). The mounting behaviors during this interaction differed from the norm described in the literature in that the male initiated an attempt at courtship and copulation by mounting the female plastron-to-plastron (Fig. 1b). Thus orientated,
the male gripped the female’s carapace on the dorsal surface of her carapace with the fore-claws in his front flippers and began biting around and behind the female’s head and neck (Fig. 1b). After further interaction, when orientating themselves vertically in the water (Fig. 1c), the male folded his tail onto the carapace of the apparently receptive female, and attempted to copulate, and appeared to be successful for a short period of time (Fig. 1d).

The entire interaction took place over a period of 20 minutes from approximately 12:30 through to 12:50. During this time both the male and female remained completely submerged. After this period of intense interaction both individuals surfaced for air, after which the male again attempted to copulate in the same position, but was unable to successfully mount the female. At no time during the interaction were there any other male turtles present. Although the photographic evidence suggests that mating occurred, it is unlikely as marine turtles, unlike other marine species, may take up to a minimum of 40 minutes to mate successfully (Schofield et al. 2006), as fertilization is internal and females store viable sperm in their oviducts for long periods of time (Gist & Jones 1989).

During a genetic study conducted on Cousine Island by Phillips et al. (2011), it was shown that most male hawksbill turtles mated with only a single female. This behavior could lead to increased aggression in males, and thus precipitate a higher occurrence of males attacking any turtle perceived to be a threat (Mortimer pers. comm. 2014). When taking the above into consideration, the behavior that I observed might best be described as aggressive and pre-copulatory and not the standard for successful copulation between adult hawksbill turtles.

However, detailed, focal observational studies need to be undertaken on the behavior of hawksbill turtles in the Seychelles in order to investigate their behavioral activity more comprehensively. It is becoming increasingly important to understand sea turtle biology in light of global climate change and behavioral studies would benefit from data on the males behavior during the reproduction process and their reproductive success. This type of information would aid in understanding the progression of mating systems in the hawksbill turtle.

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**Figure 1.** Hawksbill turtle pair observed offshore of Cousine island beach, 2013-11-24. (a) Male initiating interaction and chase of the female turtle; (b) Male and female interacting, male here biting the neck of the female turtle; (c) Male and female orientated vertically in the water; (d) Male attempting to copulate with the female.
Sea Turtles: A Guide About the Biology, Conservation and Environmental Education for Educators

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Worldwide, there are seven species of sea turtles, of which five are found in Brazil: Caretta caretta, Chelonia mydas, Eretmochelys imbricata, Lepidochelys olivacea and Dermochelys coriacea (Pritchard 1996). All sea turtle species in Brazil are classified by the IUCN (International Union for Conservation of Nature) as Vulnerable, Endangered or Critically Endangered (IUCN 2015). The main threats to sea turtles are incidental capture in several types of fishing gear and marine pollution, and other factors such as urbanization and lighting on beaches (Eckert 1996; Fuentes et al. 2009; Lohmann et al. 1996) as well as global warming (Fuentes & Porter 2013; Pike 2014).

Environmental education is an important tool for the conservation of species, since it enables the expansion of knowledge about animal ecology and also promotes favorable attitudes that protect the environment and the conservation of natural resources (Reigada & Tozoni-Reis 2004). These actions seek to promote behavior change, which is of great importance for the success in long-term conservation programs (Jacobson 1987). The application of environmental education for children has proven to be effective in the process of awareness about environmental issues, since this is the key period for learning about the environment and for educating the next generation of decision makers (Basile 2000). Studies have shown the ability of children to influence their parents’ behavior around environmental issues (Damerell et al. 2013; Evans & Gill 1996; Vaughan et al. 2003).

The impacts of environmental education programs related to behavioral changes as regards to the global environment, however, is not immediate, since there is a time interval between the period when children and students learn and the time that they may be in the roles of planners and decision makers (Evans & Gill 1996). Previous contact with environmental education will provide these children and young people with values, attitudes and skills to convert knowledge into action once they become adults (Goldman et al. 2006). Educators have an important role in the transmission of knowledge, including environmental education, and may influence the way students think, seek solutions and take actions. Researchers still debate the importance that should be given to how this knowledge is transmitted to children and for a more effective delivery, there should be a stronger focus on teacher training (Basile 2000).

In the United States and Israel, studies conducted on the content of environmental education lessons being applied to teachers have made it clear that there is a big gap in the training of these professionals in relation to knowledge about the subject (Goldman et al. 2006; Mckeown-Ice 2000) and also in how it is transmitted (Mckeown-Ice 2000). One of the proposals from researchers to fill this gap in the preparation of educators was the development of environmental education guidelines (Mckeown-Ice 2000).

A survey of the literature conducted by the authors has shown the rarity of Portuguese reference materials about the various aspects of sea turtles. Thus, both educators and the general public, who are not involved with the study of sea turtles, have little access to information about these animals and their conservation in a practical way. This may be improved with the addition of a specific guide or booklet. The development of tools and the training of educators are important because they allow the dissemination of information about sea turtles in Brazilian territory, the importance of these animals in their environment, the impact that humans can have on their survival, a presentation of conservation strategies and the development of environmental education activities that reach different age groups. In addition, sea turtles are considered flagship
species, i.e., charismatic species that captivate audiences and have the ability to attract attention to other environmental concerns (Campbell & Smith 2006).

The aim of this study was to develop a guide for educators containing information on the biology and conservation and of sea turtles, and to contribute ideas about how to present this material. As well, we assessed the acceptance and effectiveness of the guide with teachers at a public school in São Paulo.

In Brazil, public schools suffer from a lack of extracurricular activities, and therefore have little or no contact with the conservation theme; a fact that highlights the relevance of this work specifically for this audience. Furthermore, the nearest beach to the city of São Paulo is 70 km away, making it difficult to access information on marine animals or the conservation of this ecosystem. Most children from the city go to the beach only during vacation or holidays as tourists and therefore contact with environmental information about the ocean is quite limited.

Apart from information about sea turtles, the guide contains interdisciplinary activities on environmental education that is applicable for children from 7 to 14 years old. These activities are meant to ensure that teachers are transmitting to the students the information they learned from the guide. The steps involved in making the guide included a literature survey on information for the guide, the creation of images by an artist, layout and printing of the materials. This was followed by the presentation to 25 teachers in São Paulo.

During the literature survey we found that specific activities like word searches and tangram were frequently found, which indicated their widespread use and acceptance. Other activities were developed by a team of monitors of the OSCIP Passatempo Educativo, which has experience in the development and application of educational content for children of different age groups. For four days in October 2011, twenty-five teachers of the EMEF Roge Ferreira School, located in Jaragua, a district of São Paulo, Brazil, received a copy of the guide, the evaluation questionnaire that contained 11 multiple choice questions and a space for suggestions. Furthermore, they were given some photographs of species of turtles found in Brazil and the main threats they face. They were instructed how to use the guide and how to apply the activities from the guide for their students. Finally, after collecting the questionnaires, the answers provided by the teachers were analyzed to verify the effectiveness of the guide.

Of the twenty-five teachers who received the guide and orientation, 48% (12) returned the questionnaire evaluating the material and activities. This percentage was probably due to the short time limits that teachers had to perform a careful and thorough evaluation of the guide. The time for returning the questionnaires was related to the short time teachers had to evaluate the material (approximately 15 days), apply the activities and return the completed questionnaire. The time for returning the questionnaires was related to the short time limits that teachers had to perform a careful and thorough evaluation of the guide. The time for returning the questionnaires was related to the short time limits that teachers had to perform a careful and thorough evaluation of the guide.

The results presented in this study contradict those presented in other studies in which teachers reported having difficulties in class to address issues that were not part of the school curriculum, such as those related to environmental education (Reis 2001; Disinger 2001; Parlo & Butler 2007). The contextualization of the subject by teachers using other tools, such as those presented above is important for making adjustments in both content and approach of the guide. The use of other materials, among other factors, contributed to 100% of the teachers believing that they had reached the goals proposed by the activities. Likewise, all teachers expressed that they consider the guide and its activities an appropriate tool for environmental education for children, indicating that the content of the guide meet the expectations of the teachers. Only one teacher suggested making games with recyclable materials. The absence of more suggestions, however, may be related to the short time limits that teachers had to perform a careful and detailed analysis of the guide.

Based on the results obtained in this study, the necessary reformulations will be performed and the guide will be published and distributed among researchers and in schools where training will be conducted; it will also be available for free access on the internet. The answers provided through the questionnaires allowed for a clear assessment of the acceptance of this type of tool. In addition, it led
to a reflection on the relevance of the development of materials that introduce important concepts about environmental education in the classroom. Therefore, we conclude that materials like the one developed in this work, may be added to school curricula, since its multidisciplinary approach allows discussions on the subject during classes in different disciplines.

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The 35th Annual Symposium on Sea Turtle Biology and Conservation was held in Dalaman, Mugla, Turkey on 18-24 April, 2015. The theme of the symposium was “Hospitality.” It was chosen as meeting participants will be attending from around the world and hospitality reflects Turkey’s friendly and inviting culture. Furthermore, Turkey brought everyone together, “bridging the civilizations,” bridging Europe, Asia and Africa. This was a great opportunity for the people from these continents to participate in the Symposium, as it was easier for them to travel from their home countries. Besides the regular sessions normally held at past symposia, specific to the meeting in Turkey, we celebrated “World Children Day” on 23 April with special sessions for children’s activities. Without a doubt, today’s children are the future sea turtle researchers and conservationists, and so we wanted to ensure that we pass our mission on to the younger generation.

A total of 610 people from 80 countries registered for the Symposium. An additional 250 local students and educators attended particular sessions. The venue for the symposium was the Hilton Hotel-Dalaman, Turkey. The program included 4 regional meetings (Africa, IOSEA, Retomala and East Asia), 9 workshops, 2 special sessions (Mediterranean Turtle Conference and Freshwater turtle Session), and a Video Night that showed 12 videos. In addition to those sessions, we hosted the 5th Mediterranean Conference on Marine Turtles. A total of 135 oral papers and 230 posters were presented.

Workshops: A total of 9 workshops were offered the weekend before the symposium started. These were the Fourth Workshop on Stable Isotope Techniques in Sea Turtle Research: Lessons Learned and Future Steps, Temperature-dependent Sex Determination, Sea Turtle Rehabilitation and Health, GIS, Tourism and Turtles, Biologging For Sea Turtles, Fisheries Observer Programs: Key to Successful Fisheries Management, Children Activities and New Techniques. The first parts of two of the workshops were held on Thursday, 23rd April 2015. Unfortunately, the Novel Techniques for Environmental Campaigning Workshop that was scheduled had to be cancelled. The attachment of four satellite devices and releasing of sea turtles within the Biologging For Sea Turtles Workshop II and Children Workshop activities were carried out at the DEKAMER Sea Turtle rescue center. This event attracted many local people and authorities as well as children. A 3D printed section of mandible was attached to an injured turtle on 23 April, attracting many local and international media. These activities overlapped with ISTS’s mission to bring people together to promote the exchange of information that advance the global knowledge of sea turtle biology and conservation.

Pre-symposium Meetings: The 5th Mediterranean Conference on Marine Turtles and the Terrapin, Tortoise & Freshwater Meetings were the two main pre-symposium meetings. The regional meetings for Africa, Latin America, East Asia, and Indian Ocean-South East Asia were also held. The Marine Turtle Specialist Group meeting was set on Wednesday 22 April, 2015.

Key Note Speakers: Three keynote speakers each delivered a 30-minute address to symposium participants. Richard Reina’s presentation gave the audience a comprehensive overview of the topic Climate Change and Sea Turtles: What It Is, What it isn’t and What We Need to Do About It, which came after the opening ceremony of the symposium and was presented to all of the symposium participants. Mohd Uzair Rusli gave his keynote talk on Synchronous Activity Lowers The Energetic Cost of Nest Escape by Green Turtle Hatchlings in the Nesting Biology-I session on Tuesday 21 April, 2015. On Wednesday, 22 April 2015, Kate Mansfield gave her talk at the In-Water Biology-II session on Out With the Old, in with the New Hypothesis: Swimming Behavior and Ontogenetic Habitat Shifts Among Wild-Caught Oceanic Stage Turtles. All three keynote talks were excellent and well received by the audience.

Symposium Sessions: This symposium included traditional sessions held at previous symposia, such as Anatomy, Physiology and Health; In-Water Biology Session (Ecology, Telemetry, Foraging, Behavior); Nesting Biology (Ecology, Behavior, and Reproductive Success), Population Biology and Monitoring (Status, Modeling, Demography, Genetics, Nesting Trends, In-Water Trends), Fisheries and Threats Session; Conservation, Management and Policy; Education, Outreach And Advocacy; and Social, Economic and Cultural Studies. In addition to those sessions, we also scheduled poster discussion hours for each session and these were productive times for participants to meet with all presenters in one room, facilitated by session chairs.

Business Meeting: Important issues were addressed during the plenary business meeting conducted on the last day of the symposium. The travel committee report, the Treasurer’s report and other issues related to our society were discussed.

ISTS Elections: The report of the ISTS Nominations Committee presented the following names of the winners of the 2015 Elections: President Elect: Frank Paladino, Board of Directors: Andrea Phillott and Laura Prosdocimi, and Nominations Committee: Michael Jensen, Thushan Kapurusinghe and Andy Estrades.

Board meeting: The Board meeting was held on Tuesday 21 April, 2015. The meeting was fruitful and lasted until midnight. The Board received and discussed reports from the Nominations Committee, Student Committee, Travel Committee, Students Awards Committee, Awards Committee, as well as reports from the Treasurer.

Student Committee: Since its inception at the 31st Symposium,
the ISTS Student Committee has played an increasingly important role in the meeting. For the meeting in Turkey, the Committee was chaired by Itzel Sifuentes and Adriana Cortez. Student participation in the Symposia is critical to the future of our Society’s mission, and we commend and encourage continued productive activity by the Student Committee. They organized around 50 volunteer evaluators to provide valuable presentation feedback for about 100 students that requested it. They were actively involved in New Techniques Workshop and organized Student Committee Mixer on Tuesday afternoon.

**Travel grants:** A total of 162 registrants received a travel grant at ISTS35. This level of travel grant awards represents about 25% of the total registered participants. Travel grants took the form of room and board grants, which was highly advantageous for the awardees and for the Society. Only 16 people who received Travel Grant had to cover their food shares. The Travel Grant Committee was chaired by Alexander Gaos, with Angela Formia, Kelly Stewart, Karen Eckert, Alan Rees, Alejandro Fallabrino, Aliki Panagopoulou, Maggie Muurmans, Andrea Phillott and Emma Harrison as members. Participant distribution for Travel Grant was 28% from Europe, 18% from America, 14% from US/Canada and %14 Central and South America, 11% from Africa, 7% from Asia-Pacific and 4% from South Asia and 4% from Middle East.

**Social Events:** Welcome Social, Live and Silent Auctions, Farewell party, Student Awards were some of the social events held during the symposium. A welcome cocktail and Turkish Folk Dance were performed on Sunday evening. Children performed folk dances on Sunday and Monday evenings. The popular “Speed Chatting with the Sea Turtle Experts” session made an appearance on Wednesday afternoon and was enjoyed by the experts as well as the participants that plied them with questions on topics ranging from techniques to career advice. On Tuesday evening, Video Night provided informative entertainment to Symposium participants as they enjoyed 12 video presentations from around the world. On the final day of the Symposium, together with the Gala dinner, the Archie Carr Student Awards and the ISTS Awards were followed. The formal portion of the evening closed with words of appreciation from the President and the ceremonial passing of the ISTS Presidential Trowel to incoming President Joanna Alfaro Shigueto. On Friday, we organized three tours and participants visited Pamukkale, Ephesus and Dalyan lagoons.

**Auctions:** The proceeds from the annual Live and Silent auctions contribute to Travel Grant funding for students and international participants. We had the usual fantastic response from the sea turtle community in the way of unique donated items for both auctions. With ISTS promoting a more socially responsible outlook, the Auction Team found themselves pushed to the limits to find creative and fun ways to raise funds. The results of their efforts were brilliant and provided new paying and entertaining activities, including “Jail and Bail” and “A Sea Turtle Beauty Pageant”. The live auctioneer Rod Mast did again an excellent job. The dedication of Auction Chairs, Jennifer Homcy and Marina Zucchini, for the success of these important events is appreciated by all.

**Awards:** During the gala dinner, a series of awards were made to prominent members of our society. Lily Venizelos and Henri Reichart were awarded the *Lifetime Achievement Award* for their extensive and significant contributions to the promotion of sea turtle biology and conservation. Awards were also given to Kutlay Keco for *Ed Drane Award for Volunteerism*, Flegra Bentivegna for *Champions Award*. *President’s Awards* were given to Ibrahim Baran and June Haimoff. Congratulations to all the awardees.

**Archie Carr Student Awards:** There were 41 oral presentations and 67 poster presentations entered by students in the Archie Carr Student Awards. The Program Chairs worked with the Student Award Chairs to minimize conflicting student presentation times, thereby ensuring all student presentations were seen by the judges, but we encourage future Program Chairs to liaise with the Student Award Chairs early in the planning process to minimize the requirement for last minute work by all parties. Judges of the student presentations in Turkey were: Ana Barragan, Cynthia Lagueux, Dave Owens, Emma Harrison, Kate Mansfield, Marc Girondot, Mariana Fuentes, Paolo Casale, Ray Carthy, Roldan Valverde, Sara Maxwell and Zoe Meletis. The winner for Best Biology Poster was Abilene Colin Aguilar (CICESE, Mexico). Best Conservation Poster went to Mireia Aguilera Rodá (Univ. Las Palmas de Gran Canaria) and runner up was Aurora Oliver de la Esperanza (Univ. Zaragoza, Spain). The Best Biology Oral was won by Natalie Wildermann (James Cook University, Australia) and Joseph Pfaller (University of Florida, USA) was Runner Up. The Conservation Oral winner was Sarah Nelms (University of Exeter, England), and Aliki Panagopoulou (Drexel University, USA) was Runners-Up.

**Grassroots Award:** The Grassroots Conservation Award is given for the poster or oral presentation that best demonstrates a positive contribution towards the conservation of marine turtles and/or their habitats. This year the Award went to the Fundação Maio Biodiversidade for “Community-based conservation is a key to successful sea turtle protection in Maio Island, Cape Verde” with the authors of Adilson Passos, Amanda Dutra, Franziska Koenen, Alexandra Morais, and Mafalda Navas. The judges were Alejandro Fallabrino, Angela Formia, Jack Frazier, Manjula Tiwari and Ingrid Yanez.

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**Vendors:** This year’s Vendor tables were Wildlife Computers Inc, Collecte localisation satellite, Wipsea, Kaptan June Sea Turtle Conservation Foundation, Qarapara Sea Turtles Chile NGO, Karumbé, Endangered Wildlife Trust, IUCN Marine Turtle Specialist Group, WWF International, MEDASSET, ARCHELON, Loggerhead Marinelife Center.

**Carbon Offsets:** A meeting the size of the ISTS Symposium represents a considerable use of resources, primarily for travel, but also for onsite lodging and activities. This year, a coordination and
follow-through by Erin Seney and Ray Carthy, the ISTS introduced an initiative to offset the carbon footprint of the meeting. The organization made a donation to Carbonfund.org to offset the full on-site footprint of the meeting. We also gave one flask as a gift for participants to use in the future as a way of reducing plastic use.

Memorial Tribute: During the opening and closing ceremonies of the symposium, we observed one minute of silence in tribute to the lives that were lost since the last symposium, especially the recent loss of Prof. Nicholas Mrosovsky.

Acknowledgments. Organizing the symposium took a significant number of hours and effort. The successful organization strongly benefit from the selfless work of a large number of volunteers. My personal thanks goes to all organizing committee members. My deepest thanks go out to every single one of them for their hard work, friendship, and their dedication to the International Sea Turtle Society. Without the vision and generosity of our Sponsors this Symposium would not have been possible, and I thank them all for embracing our interests and cause as their own. I also thank the ISTS Board of Directors and its Executive Committee for their guidance and support, and thank every single one of the various Committees’ chairs. My Program Officer Ingrid Yanez did a great job of fund raising under trying conditions. Thanks to the Program Staff: Oğuz Türkozan, Brian Shamblin and Wayne Fuller, program coordinator: Eyüp Başkale, Event Coordinator: Dogan Sözbilen, and all of the outstanding Session Chairs.

I am grateful to the Logistics Staff: Registrar Serdar Düşen and Olcay Düşen; Volunteer Co-Chairs Natalie E. Wildermann and Can Yılmaz; Onur Candan, Alejandro Fallabrino and Karla G. Barrientos-Muñoz; Exhibitor/Vendor Chairs Çisem Sezgin and Nilüfer Araç; Speed Chatting Coordinators Emma Harrison and Zoe Meletis; Internet Gurus Doğukan Mutlu, Logo Designers Yıldız Duman Ercan and Mümin İnan; Nominations Committee Chair Nancy Fitzsimmons and members Shaleyla Kelez, Edward Aruna, Milagros Lopez-Mendilaharsu and Alberto Abreu Grobois; ISTS Awards Committee Chair Sally Murphy and members Dean Bagley, Jim Spotila, Brad Nahill and Blair Witherington; Student Committee members Itzel Sifuentes and Adriana Cortez; Student Awards Committee Co-Chairs Andrea Phillott and Matthew Godfrey; Video Night Co-Chairs Anna Stamatiou and Kerem Yekta Atatunç; Poster Chairs Yusuf Katılımış and Serap Ergene; Book of Abstract Compilers Bektas Sönmez, Onur Türkecan and Çisem Sezgin; Terrapin, Tortoise, and Freshwater Turtle Meeting Planners Chuck Shaffer and Dincer Ayaz; Carbon Offset organizers Erin Seney and Ray Carthy; English Proofreader Robin Snape; Workshop organizers Daniela Freggi, Andrew DiMatteo, Sandra Hochscheid, Kate L. Mansfield, Yonat Swimmer, Marc Girondot, Şükran Yalçın Özdiilek, Simona Ceriani, Kim Reich, Jeffrey Seminoff, Emine Dinç, Jane Akalay, Fikri Türeş, Ayşe Oruç and Konstantina Kostoula. I also thank Luis Cardona and his organizing committee for organizing 5th Mediterranean Conference on Marine Turtles within the ISTS35. Additional gratitude goes to the schoolchildren and teachers of Muğla Province for their participation in our outreach program. ALL OF THE VOLUNTEERS FROM ISTS AND THE PAMUKKALE UNIVERSITY! I am also grateful to those of you un-named here, who gave freely of your time, energy, and enthusiasm when I called upon you.
Mi Casa es su Casa: Bienvenidos al Peru! The Annual Symposium on Sea Turtle Biology and Conservation hosted every year by the International Sea Turtle Society (ISTS) is moving to South America for the first time. This event gathers multidisciplinary participants from around the world with a shared interest: conserving sea turtles and their environment. The 36th Annual Symposium will be held from February 29–March 04, 2016 at the Maria Angola Convention Center and Universidad Cientifica del Sur, both located in the capital of Peru, Lima, a city full of rich flavors, unique experiences, and the mystic union of the past and the present. Besides providing common advantages of a big city, Lima gives you the opportunity to learn about the Peruvian culture and as a coastal city, it reflects how we have related to the sea for many years. It may also serve as a starting point towards other Peruvian natural destinations such as the Amazon rainforest, Andes Mountains and northern subtropical beaches.

We expect over 700 participants from around the world. This year the Symposium’s theme will be Crossroads, highlighting the need for multi-disciplinary, multi-taxa, multi-national, and multi-gender efforts in advancing marine conservation worldwide. This meeting seeks to break down barriers and boundaries between people and countries in order to achieve marine conservation through its most global flagship, the sea turtle.

Our website will contain all the vital information about the 36th symposium (www.internationalseaturtlesociety.org), and will be updated throughout the year. Here you will find important information about Lima and Peru, as well as registration, costs, and general information regarding the symposium. We hope you find it useful.

Mark your calendars, start practicing your Spanish, and begin planning your trip to the 36th Symposium on Sea Turtle Biology and Conservation!
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THESES AND DISSERTATIONS


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