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A fisherman of Kutch with his accidental catch, a loggerhead sea turtle, not recorded for 84 years from Mandavi Beach, Kutch, Gujarat. See pages 20-22.

Articles

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Northernmost Known Sea Turtle Nesting Activity in NW Atlantic: Nantucket Island, Massachusetts, USA

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Green sea turtles (*Chelonia mydas*) occur in tropical and subtropical waters worldwide and nest in more than 90 countries (Spotila 2004; Turtle Taxonomy Working Group 2021). In the continental USA, nesting has been documented in Texas, Alabama, Florida, Georgia, South Carolina, North Carolina, Virginia, Maryland, and New York (Ernst & Lovich 2009; Shaver *et al.* 2020; Hulslander unpubl. data), although most nesting in the USA occurs in Florida (Turtle Taxonomy Working Group 2021). Off Massachusetts USA, juvenile *C. mydas* forage in coastal, temperate waters during the summer and fall, reflecting the pattern of early development in the oceanic zone and recruitment to the neritic zone (Bolten 2003), at approximately 30-40 cm curved carapace length (CCL) (Musick & Limpus 1997). Historically, *C. mydas* off Massachusetts have been known primarily from juvenile greens that became cold-stunned and stranded on beaches (Still *et al*. 2005) and were rescued or recovered by the Mass Audubon Wellfleet Bay Wildlife Sanctuary (WBWS) Sea Turtle Rescue and Research Program (Griffin *et al*. 2019). Nearshore waters in Massachusetts appear to be at least part of a developmental habitat for juveniles, but not for adults (Lazell 1980; Shamblin *et al*. 2018).

On 20 September 2022, two beach-walkers on the eastern shore of Nantucket Island, Massachusetts (41.2647 °N, -69.9612 °W) saw

Figure 1. *Chelonia mydas* nesting crawl tracks on Nantucket, showing species-specific characteristics. Photo by P. Meerbergen.

Figure 2. *Chelonia mydas* nesting crawl tracks on Nantucket, showing one body pit. Photo by P. Meerbergen.

what looked to them like sea turtle crawl tracks, having observed sea turtle nesting tracks in Florida. They reported the tracks to Marine Mammal Alliance Nantucket (MMAN) staff, who investigated and reported the occurrence to WBWS, who are the Sea Turtle Stranding and Salvage Network (STSSN) responders in SE Massachusetts. Communications ensued among personnel from MMAN, WBWS, the National Oceanic and Atmospheric Organization (NOAA), and the United States Fish and Wildlife Service (USFWS).

The USFWS is the federal agency that has jurisdiction over sea turtle nesting activity in the USA (USFWS & NOAA 2015). At the request of USFWS, MMAN staff returned to the site to document the tracks. Their photos, measurements and diagrams helped researchers confirm that this track was made by a *C. mydas* (Fig. 1). Species-distinguishing track characteristics included: symmetrical, simultaneous flipper movement, a center tail drag depression, and track width of 95-144 cm (Shigenaka *et al*. 2003; Witherington & Witherington 2015). MMAN staff measured the average crawl track width on Nantucket as 105 cm. The track also exhibited the typical pattern of a nesting sea turtle re-entering the water on a different route than along her emergent track (Carr 1967).

There were three depressions along the crawl track which fit the description of sea turtle body pits (Shigenaka *et al*. 2003). The first was near the surf and two others were high on the beach toward the dunes within sparse beach vegetation (Fig. 2). In accordance with USFWS Nest Protection Protocol for sea turtle nest sites north of Virginia (USFWS unpubl. internal document 2019), USFWS advised MMAN to mark the potential nest to protect it from human activity as management decisions were discussed with the Massachusetts Division of Fisheries and Wildlife (MW). Due to the location of Nantucket (40 km off Cape Cod, Massachusetts) and an approaching storm, MW, in close coordination with USFWS, authorized a Wildlife Research Ecologist from Nantucket Conservation Foundation (NCF) to carefully dig into the body pits to check for eggs. The NCF ecologist excavated two body pits by hand to a depth of approximately 1 m (Najwa-Sawawi *et al*. 2021), but eggs were not found. The sand was compact, appearing undisturbed beyond approximately 60 cm down, with normal stratification of sand layers present. The NCF ecologist and MMAN personnel filled the holes for public safety and then left the site.

No one reported seeing the *C. mydas* during its emergence on the Nantucket beach. This is not surprising, as *C. mydas* typically nest at night (Carr 1967; Shaver *et al*. 2020), and this beach on eastern Nantucket is remote. The turtle's age and exact size was unknown. Compared to all the juvenile, cold-stunned *C. mydas* rescued on Massachusetts beaches (Prescott & Dourdeville unpubl. data), the Nantucket turtle was larger. The largest chelonid species, *C. mydas* mature slowly, with females reaching sexual maturity at 30 to 40 years in Florida, Costa Rica, and Mexican waters (Goshe *et al*. 2010). From a study of nesting *C. mydas* in eastern Florida, 3,401 mature females exhibited a mean straight carapace length of 99.8 cm (SD 5.3), with a range of 81.4-117 cm (Phillips *et al*. 2021).

Prior to the Nantucket occurrence, other NW Atlantic sea turtle nesting activity has been documented north of Virginia, USA. Although not a comprehensive list, in recent years these include: a *C. mydas* nested and deposited eggs in 2011 in Delaware, USA (Shamblin *et al*. 2018; Shaver *et al*. 2019); two occurrences of non-nesting emergence by *C. mydas* were documented in New York, USA, in 1998 and 2011 (Shaver *et al*. 2019); a Kemp's ridley (*Lepidochelys kempii*) nested and deposited eggs on Long Island, New York, in 2018 (Rafferty *et al*. 2019); and a loggerhead (*Caretta caretta*) nested and deposited eggs in southern New Jersey, USA, in 2022 (USFWS pers comm. 2022).

The presence of an adult *C. mydas* off Massachusetts is highly unusual according to four data sets. WBWS staff have responded to sea turtle strandings since the 1980s, including: (1) hundreds of summer strandings, mostly leatherback (*Dermochelys coriacea)* and *C. caretta,* and (2) thousands of cold-stunned strandings (mostly juvenile *L. kempii* with a smaller percentage of subadult and juvenile *C. caretta* and juvenile *C. mydas*). Throughout these many years of stranding response by WBWS, an adult *C. mydas* has never been found on the Massachusetts coast. (3) WBWS has operated a sea turtle sighting hotline/website for marine vessel operators since 2002, seaturtlesightings.org. From the ensuing database of more than 2,500 vetted sea turtle sightings, there are no credible (documented photographically) adult *C. mydas* (Dourdeville & Prescott 2022). (4) In the NOAA Northeast Fisheries Observer Program, no *C. mydas* with CCL) > 90 cm have been documented in commercial fisheries in this region. From 1989 to August 2022, there have been 45 *C. mydas* identified in the observer program data, 26 of which had carapace measurements taken. Since 2000, there have been five *C. mydas* interactions recorded north of 40.0 °N latitude, all of which were under 35 cm CCL; the largest observed *C. mydas* was an estimated 76 cm CCL, at latitude 37.5 °N in 2018 (Harner unpubl. data).

The Nantucket *C. mydas* nesting activity may be considered an outlier occurrence, both temporally and spatially (Shaver *et al*. 2020). Climate change, however, can be expected to bring about shifts in all aspects of sea turtle life history, both at sea and on land, including temporal and latitudinal shifts in ranges of foraging and nesting (Witt *et al*. 2009; Hawkes *et al*. 2010; Patrício *et al*. 2021). For example, *C. caretta* in the western Mediterranean show definitive nesting range expansion northward (Hochscheid *et al*. 2022). Patrício *et al*. (2019) used nine criteria to model climate change resilience of the *C. mydas* nesting population on Poilão Island in the Bijagós Archipelago, Guinea-Bissau, West Africa. Blechschmidt *et al*. (2020) modeled the effect of manipulating nest depth and altering the level of nest shade in *C. mydas* at the northern Great Barrier Reef, Australia. Sönmez *et al.* (2021) projected habitat loss and subsequent nest destruction due to sea level rise for the important *C. mydas* nesting beaches in Samandag, Turkey.

Currently, North Atlantic *C. myda*s are listed as a threatened Distinct Population Segment under the US Endangered Species Act (NMFS & USFWS 2016). Shamblin *et al*. (2018) investigated *C. mydas* turtle nesting range expansion northward in the NW Atlantic from nests in South Carolina, North Carolina and Delaware from 2010 through 2014. From DNA analysis, the authors suggest that these northern nesting females "represent an incipient subpopulation, with need for distinct management unit status;" the authors also found that juvenile *C. mydas* foraging nearshore off North Carolina demonstrated a genetic link to the northward nesting females (Shamblin *et al.* 2018).

Future preparedness for sea turtle nesting range expansion in the NW Atlantic includes increased alertness by researchers and marine animal stranding responders about how to identify sea turtle nesting crawl tracks. It is important to learn characteristics which distinguish sea turtle tracks from seal haul-out tracks on some beaches, using photographs and descriptions. Cunningham *et al.* (2009) describe how to do so for harbor seal (*Phoca vitulina*) tracks. Raising awareness of sea turtle crawl tracks will help monitor possible nesting and non-nesting emergences (Shaver *et al*. 2020). Further research is also needed for juvenile *C. mydas* that forage off Massachusetts. DNA analysis could reveal how northern foraging juveniles relate at a population level to nesting females. This work could be facilitated by DNA analysis of samples from WBWS's annual necropsies of deceased, cold-stunned juvenile *C. mydas*.

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Green Turtle Tagged in Okinawa Found 19 Years Later Nesting on Guam

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Green sea turtles (*Chelonia mydas*) are widely distributed in Japan from the south of Muroran, Hokkaido, to the southernmost tip of the Nansei Islands (Suganuma 1994). This includes nesting sites on the Ogasawara Islands and part of the Nansei Islands south of Yakushima Island, plus foraging habitats on the coasts of the Japanese Archipelago (Uchida & Nishiwaki 1982; Kamezaki 1989; Suganuma 1994; Kameda *et al.* 2013; Nishizawa *et al.* 2013; Oki *et al.* 2019). Yaeyama Islands, the southernmost islands in the Ryukyu Archipelago (Okinawa Prefecture; Fig. 1) host abundant foraging habitat, yet little is known about the migration and long-term growth rates of green turtles residing in this region. To fill this gap in knowledge and collect the baseline data needed to study green turtle growth and migration, capture-mark-recapture (CMR) efforts were conducted during 2001 to 2004 on Ishigaki Island in the Yaeyama Islands.

CMR studies rely on the recognition of previously tagged sea turtles to answer biological and conservation questions (Reisser *et al.* 2008; Omeyer *et al.* 2019). Therefore, identification tags should ideally persist for a long period of time to allow multiple recaptures throughout the lifetime of the turtle. However, many factors contribute to the high rate of tag loss, which includes the length of time after application, experience of the tagger, the application site on the turtle, and tag material and design (Balazs 1982; Limpus 1992; Bjorndal *et al.* 1996; Bellini, Godfrey & Sanches 2001). Further, metal tag loss may ensue due to failure of the locking-mechanism, tissue necrosis, tearing, abrasion, and corrosion (Balazs 1982). Therefore, if a turtle loses all metal tags and/or if the tag is illegible, then the turtle cannot be re-identified (Gibbons & Andrews 2004; Omeyer *et al.* 2019). Overall, tag loss is a challenge for long-term CMR studies because it is confounded with turtle mortality (Casale *et al.* Salvemini 2016) and it decreases the return rate (Broderick *et al.* 2003), especially for juvenile turtles during the critical 'lost years' pelagic phase (Casale *et al.* 2017). On nesting beaches, Ehrhart *et al.* (2014) found a steep decline in the chances of encountering a flipper-tagged nesting loggerhead sea turtle (*Caretta caretta*) more than seven years after its first encounter. Further, the chances of recapturing a previously tagged turtle are also decreased due to sparse detection capacity by monitoring teams (Casale & Ceriani 2020). For example, remigration events for nesting hawksbill sea turtles (*Eretmochelys imbricata*) go undetected in the Main Hawaiian Islands due to limited funding as well as staff safety concerns (Gaos *et al.* 2021). Despite these limitations, metal tag recapture for long-term CMR studies can benefit sea turtle management by providing key information on behavior, demography, foraging patterns, growth, movements, population size, reproductive biology, residency, stranding, and survivorship (Bellini *et al.* 2001; Reisser *et al.* 2008; Foley *et al.* 2021). In this report, we are focusing on the turtles tagged in the Yaeyama Islands feeding area within the 2001-2004 timeframe. Here, we describe the first recapture on Guam obtained 19 years after initial tagging.

A juvenile green sea turtle was caught on 20 March 2003 by a licensed fisherman in the waters around the Yaeyama Islands (Fig. 1). Size and weight measurements were obtained. The turtle's straight carapace length (SCL) was 49.5 cm, straight carapace width (SCW)

Figure 1. Location of the tagging and release site of the juvenile green turtle on Ishigaki Island (red circle), Japan, and the turtle's recapture location while nesting on Cocos Island (red triangle), Guam 19 years later. The map was created by processing the digital map Ninomap.

Figure 2. At initial capture and tagging, the turtle's SCL=49.5 cm. A metal tag was placed on each of the turtle's two front flippers and two hind limbs (left panel). The juvenile green turtle was released on Ishigaki Island, Japan on 23 March 2003..

was 42.1 cm, curved carapace length (CCL) was 53.5 cm, and curved carapace width (CCW) was 49.3 cm. The turtle weighed 14.4 kg. Following standard practice in sea turtle studies, metal flipper tags were applied to the turtle (Fig. 2; Godley *et al.* 1999; Omeyer *et al.* 2019) on the front left: KK1 0128 (Fig. 3a) and right: KK1 0129 (Fig. 3b) flippers and hind limbs (left: KK3 0096; right: KK3 0095). The titanium tags were made by Stockbrands Co., Pty. Ltd (Osborne Park, Western Australia). The identifying alphanumeric codes and contact information (email address, phone number) were stamped onto the metal tags. After all data were collected, the turtle was released on 23 March 2003 (Fig. 2) from the northeastern coast of Ishigaki Island (24.507535 °N, 124.283162 °E; Fig. 1).

On 19 May 2022 (19 years after release), this turtle was observed nesting on Cocos Island (or *Islan Dåno'* in Chamorro), which is a small island (1.93 km in length and 0.15 km in width) located 1.6 km off the southwestern coast of Guam (13.444304 °N, 144.793732 °E; Fig. 1). After the turtle completed oviposition, the Guam researchers collected data and biological information, which included examining the turtle for existing identification tags, applying short- and long-term identification tags, obtaining size measurements, and collecting skin tissue samples for genetic and stable isotope studies.

All four flippers were examined for any existing metal tags. Two metal tags were found on the front flippers of the turtle. The alphanumeric identification on the upward facing portion of the tag read KK1 0128 for the left tag (Fig. 4) and KK1 0129 for the right tag. On the bottom of both tags was an email address with the internet domain name for Japan, which is ".jp." All this information matched the description of the titanium tags applied by the Japan researchers in 2003. The metal tags on the left and right hind limbs were no longer present during the recapture.

As demonstrated by the tag loss before recapture, technologies other than external metal tags are clearly needed to maximize success of long-term CMR studies. Passive Integrated Transponder (PIT) tags, an internal identifier, are more commonly used for sea turtles (Balazs 1999) because they greatly increase recapture rates (Wyneken *et al.* 2010) due to relative permanency and durability

Figure 3. Metal tags were attached to the juvenile green turtle's front left flipper with tag number KK1 0128 (left panel) and front right flipper with tag number KK1 0129 (right panel).

Figure 4. The metal tags KK1 0129 on the front left flipper (tag number: KK1 0128) of a green turtle nesting on Cocos Island, Guam19 years after its tagging and release on Ishigaki Island, Japan. Photo courtesy of Clark Kent Hoshino.

Figure 5. The green turtle with metal flipper tags originating from Ishigaki Island, Japan was observed nesting on Cocos Island, Guam 19 years later. The turtle's straight carapace length was 91.7 cm at the time of recapture.

over metal tags (Gibbons & Andrew 2004; Ondich & Andrews 2013; Omeyer *et al.* 2019). PIT tag limitations include cases wherein the tag may migrate within the turtle's tissue (Wyneken *et al.* 2010) or be expelled from the turtle before the application site heals (Godley *et al.* 1999). Also, various types of PIT tags require specific hand-held readers to be identified; therefore, a PIT-tagged turtle cannot be recognized without the appropriate PIT tag reader (James *et al.* 2007; Epperly *et al.* 2015). Nonetheless, these limitations are outweighed by the higher retention rate of PIT tags over metal flipper tags. For this reason, the Guam researchers use PIT tags as a second identifier. A Biomark, Inc. hand-held reader (Model No. GPR+; Boise, Idaho, USA) is used by the Guam turtle team to detect PIT tags. PIT tags were not found in any potential PIT tag sites on the recaptured turtle (left and right shoulder muscle, left and right front flippers, left and right hind flippers, neck; Eckert & Beggs 2006). Considering the loss of two of the four metal tags, the turtle was double tagged with PIT tags in each of the hind flippers to ensure that this individual can be identified in the future (Gaos *et al.* 2021). Eckert & Beggs (2006) recommend this location specifically for nesting females because: (1) it is located away from the turtle's head and thus reduces the chances of disturbance, (2) it is associated with less bleeding compared to application in the front flipper, (3) discomfort is minimized during the tag application, and (4) the chances of injury to researchers are reduced. Additionally, the rear hind flippers were selected because PIT tags in the shoulder and front flippers may be more difficult to detect for future scanning opportunities (Foley *et al.* 2021).

The Guam researchers utilize a third identifier, a temporary shell marking, to differentiate between individual nesting females during the nesting season. This short-term marking is etched onto the carapace and painted with white, non-toxic paint to identify each turtle from afar. The alphanumeric identifier assigned to this turtle was GU12 located on the fourth lateral scute on the right side of the turtle's carapace (Fig. 5). The first two letters indicate the nesting location; "GU" is the shorthand for Guam. The last two numbers differentiate between encountered individuals since the start of the ongoing nesting sea turtle research. Therefore, this individual was the twelfth recorded nester on Guam since the beginning of near-saturation tagging in 2021.

At the time of recapture in Guam, part of the turtle's supracaudal scute was missing, but that did not affect carapace length measurements. The turtle's most recent SCL was 91.7 cm, SCW was 71.7 cm, CCL was 98.5 cm, and CCW was 90.9 cm. The annual growth rate, from this turtle's release (2003) to recapture (2022) across 19 years, was 2.2 cm in SCL, 1.5 cm in SCW, 2.4 cm in CCL, and 2.2 cm in CCW. This is consistent with the findings of Kameda *et al.* (2017) which reported that juvenile green turtles around the Yaeyama Islands had an annual growth rate of 2.7 cm year^{-1} for turtles captured between 1995-2003. They also found that these green turtles had a mean SCL of 51.5 cm, which is similar to the SCL measurement of 49.5 cm during the initial tagging on Ishigaki Island. Here, we confirmed that a juvenile green turtle with a <50 cm SCL was observed breeding after approximately 19 years. Within this timeframe, the recaptured turtle reached sexual maturity and successfully migrated to the nesting site in Guam.

In this study, the turtle migrated approximately 2,500 km from its foraging areas at the Yaeyama Islands to the nesting beach on Guam. According to the natal homing hypothesis, which states that females return to their natal beach to nest (Bowen & Karl 2007; Lohmann *et al.* 2013; Brothers & Lohmann 2015), it is assumed that Cocos Island is this turtle's natal beach. Further, satellite telemetry confirms that post-nesting green turtles from the Mariana Islands (including Guam) migrate to Japan (Seminoff *et al.* 2015). This report further corroborates the connectivity between the Mariana Islands and Okinawa, Japan for green turtle migration patterns. In addition to Guam as a source of turtles, over 20% of the Yaeyama

Islands' foraging population originates in the Federated States of Micronesia (FSM) and close to 25% is sourced from Papua New Guinea (Nishizawa *et al.* 2013). Due to their migrations to respective nesting grounds in multiple countries, international approaches will be needed to protect Western Pacific green sea turtles.

Given that monitoring of nesting beaches in Guam has been sporadic until recently, it is our hope that this report marks the beginning of multiple recaptures of turtles tagged in the Yaeyama Islands and recovered in Guam. The information obtained through these tag recoveries, such as growth rates, migration, and movements will be important for long-term conservation benefits and protections in both Guam and Okinawa. The recovery of the two metal tags reiterates the importance of CMR studies, especially for data deficient populations such as the Central West Pacific (CWP) green sea turtles, which includes Guam's nesting green sea turtles. The CWP population is listed as Endangered under the U.S. Endangered Species Act (ESA). The most recent population status review by Seminoff *et al.* (2015) highlighted the need to fill knowledge gaps. Therefore, any baseline information that can be obtained via CMR studies such as this will help inform future population status reviews, critical habitat assessments, and management frameworks that will benefit the long-term conservation of this distinct population segment. In Okinawa Prefecture, sea turtles are part of the fishing industry with restrictions on the annual number and size of turtles caught. Therefore, information on the migration and growth of sea turtles from recaptures, such as the one described here, is useful in considering the conservation of sea turtles inhabiting Okinawan waters. Lastly, our observations are an additional example of the importance of a strong and collaborative network for the conservation of green sea turtles in the Western Pacific.

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A Male East-Pacific Green Turtle that Associates with Small Fishing Boats and Eats Fish

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Green sea turtles are known for their ontogenetic shift to an herbivorous diet of seagrass and algae as they mature (Arthur *et al.* 2008; Morais *et al.* 2014; Price *et al.* 2017). This shift occurs as the turtles transition from the juvenile pelagic foraging phase to the coastal foraging phase (Reich *et al.* 2007; Price *et al.* 2017; Burgett *et al.* 2018). However, a major exception is seen in green turtles that nest and forage in the eastern Pacific Ocean. Here, coastal juveniles and adults consume an omnivorous diet of both plant and animal matter (Seminoff *et al.* 2002; Amorocho & Reina 2007; Esteban *et al.* 2020). Commonly, East Pacific green turtles opportunistically consume seagrasses, algae, and mobile and sessile invertebrates (Seminoff *et al.* 2002; Robinson *et al.* 2015; Sampson *et al.* 2018; Duncan *et al.* 2019; Seminoff *et al.* 2021). To add to this, our report documents a male East-Pacific green turtle opportunistically foraging on fish parts cast overboard by fishermen during processing, which has implications for future sea turtle diet studies and human-turtle interactions.

Weekly surveys were conducted as part of an ongoing foraging population dynamics study in Costa Rica. We launched from a fishing dock along Punta Descartes, the northmost peninsula in Pacific Costa Rica (Heidemeyer *et al.* 2014). Local fishermen use this dock to process their night's catch before bringing the fish to shore. We observed sea turtles occasionally swimming along the shoreline when boats were returning, and these turtles sometimes appeared to consume fish-heads that were thrown overboard. We were able to film a male (determined by tail length) East Pacific green turtle engaging in this behavior (Fig. 1), then caught this filmed turtle (identification number CM-31), and collected samples for stable isotope analysis (September 2017, Table 1). We collected a whole blood sample (< 1 ml/kg) from the cervical sinus using a non-heparinized 21 g needle, and an epidermal (1 cm^2) sample from the trailing edge of one of the hind flippers using a sterilized scalpel and forceps (Owens & Ruiz 1980). The whole blood was stored without additives and the epidermal tissue was stored in a high concentration saline solution (Arrington & Winemiller 2002). We held both samples at the Research Center for Cellular and Molecular Biology (CIBCM) of the University of Costa Rica for 4 months at -18°C before transporting them to Purdue University. In addition, we measured curved carapace length (CCL) from the nuchal notch to the posterior tip of the caudal peduncle, curved carapace width (CCW) at the widest point of the shell, tail length from the plastron to the tip of the tail, and plastron-anus distance (P-A) to the nearest 0.5 cm using a flexible measuring tape. We identified this turtle using a passive integrated transponder (PIT) tag (AVID2028 FriendChip, Norco, California, USA) injected into the right shoulder beneath the skin, and two metal flipper tags (Style 681IC, National Band and Tag Company, Newport, KY, USA) attached to the hind flippers (Heidemeyer *et al.* 2018). Samples were processed at the Purdue University Wildlife Physiology Lab and analyzed at the University of Wyoming Stable Isotope Facility (UWSIF) for $\delta^{13}C$ and $\delta^{15}N$ ratios (for methods see Clyde-Brockway *et al.* 2022). Stable isotope ratios were reported in delta (δ) notation in parts per thousand (‰; Ben-David & Flaherty 2012).

Turtle CM-31 had skin $\delta^{15}N$ and $\delta^{13}C$ ratios ($\delta^{15}N$ = 17.66‰, $\delta^{13}C$ = -14.34‰) that were higher compared to whole blood $\delta^{15}N$ and $\delta^{13}C$ ratios ($\delta^{15}N$ = 16.49 ‰, $\delta^{13}C$ = -15.07 ‰, Table 1). In rapidly growing juvenile turtles, blood and skin can reflect the stable isotope signatures of diet in as little as 3-4 months (Reich *et al.* 2008). However, in slower growing adult turtles, blood is expected to equilibrate in about 6 months while skin could require more than twice that time (Seminoff *et al.* 2007, 2009; Rosenblatt & Heithaus 2013). While comparing stable isotope ratios between tissues is complicated because of variable time to equilibrate with diet, it can indicate shifts in diet over time (Phillips & Eldridge 2006; Arthur *et al.* 2008). Turtle CM-31 was 93 cm curved carapace length, therefore we assumed he was not growing rapidly and was instead approaching, or already in, the adult reproductive years. As such, we posit that skin stable isotope ratio reflects the cumulative diet across the previous years that he was foraging, while the whole blood stable isotope ratio reflects food consumed in the ~6 months prior to September 2017.

Our results were comparable to average skin stable $\delta^{15}N$ ratios from sub-adult and adult green turtles foraging in the United States (Long Beach: 16.7 ±1.2‰ and San Diego Bay: 17.5 ±1.9‰) and Mexico (Infiernillo Channel: 16.1 ±1.1‰ and Navachiste Bay: 16.4 ±1.2‰, respectively). However, they were higher compared to turtles in other foraging habitats in Costa Rica and most locations sampled in the Eastern Pacific (Seminoff *et al.* 2021; Clyde-Brockway *et al.* 2022), including locations in the South Pacific where turtles consumed fish (Piovano *et al.* 2020). The $\delta^{15}N$ ratios were similar to the red blood cell signatures in Costa Rican leatherback sea turtles (*Dermochelys coriacea*, $\delta^{15}N$ = 15.4 ±1.8‰), a species that consumes gelatinous prey (Wallace *et al.* 2006). The most notable comparison, however, is that CM-31 had $\delta^{15}N$ ratios that were higher than the 46 East Pacific green turtles sampled as part of our forging and diet study conducted in two bays on either side of Punta Descartes (Matapalito and Salinas Bays; Clyde-Brockway *et al.* 2022). Clyde-Brockway *et al.* (2022) found turtles sampled in

Figure 1. A male East-Pacific green turtle (CM-31) swimming along the docks with fish in his mouth. This photo was taken by M. Giry, Punta Descartes, Costa Rica, 2017.

these bays had $\delta^{15}N$ ratios that ranged from 11.03‰ to 16.23‰ (skin and whole blood combined) and were measured in turtles ranging from 58.5 cm to 95.0 cm curved carapace length and included a combination of presumed males, females and juveniles, and size classes including adult, sub-adult, and juvenile. It is probable that CM-31 is a member of the population sampled in Clyde-Brockway *et al.* (2022) but is displaying an individualist foraging strategy.

In general, we expect $\delta^{15}N$ ratios to increase 3.4 ±1.0‰ and $\delta^{13}C$ ratios to increase 0.4 ±1.0‰ with every increase in trophic level (Post 2002). In areas where green turtles consume mostly seagrasses and algae, $\delta^{15}N$ values were lower in comparison to CM-31 ($\delta^{15}N$ range 2.4-12.6‰; Vander Zanden *et al.* 2013; Burgett *et al.* 2018). These data support observations that CM-31 was consuming a diet that included foods in trophic levels above the diet of these other turtles. Further, fish in the eastern Pacific region (*L. campechanus, F. Catostomidae, K. pelamis, Arius spp., C. parallelus, Oreochromi sp.*) had lower $\delta^{15}N$ ratios compared to CM-31 ($\delta^{15}N$: 12.52 ±2.99‰; Elliot *et al.* 2015), providing further support for their inclusion as a component of turtle diets (Clyde-Brockway *et al.* 2022). The consumption of fish is documented in several species of hard-shelled sea turtle, including green sea turtles (Plotkin *et al.* 1993, Piovano *et al.* 2020; Ramirez *et al*. 2020). In addition to seagrass, algae, invertebrates and fish, green turtles eat leaves, mangrove fruit, gelatinous plankton, and terrestrial plant matter, some, or all of which may be important to consider when building stable isotope models (Seminoff *et al.* 2002; Phillips *et al.* 2005; Seminoff *et al.* 2006; Amorocho & Reina 2007; Lemons *et al.* 2011; Carman *et al.* 2013; Phillips *et al.* 2014).

The $\delta^{13}C$ ratio of animal tissue can help us infer whether an animal is foraging close to shore or out in the open ocean and at what latitude (Cherel & Hobson 2007). Therefore, as sea turtles leave juvenile oceanic foraging habitats and establish residency in coastal habitats, we should see increasing tissue $\delta^{13}C$ values. The $\delta^{13}C$ ratio of CM-31 was within the range established by turtles sampled along the coastal Eastern Pacific foraging habitats (-25.5‰ to -10.7‰), in agreement with size (CCL) that this turtle had established coastal residency (Tomaszewicz *et al.* 2018; Piovano *et al.* 2020; Seminoff *et al.* 2021; Clyde-Brockway *et al.* 2022).

Stable isotopic analysis, specifically diet modeling, has become a powerful tool to infer diet and trophic position of sea turtles. However, stable isotope mixing models require inclusion of all isotopically distinct potential diet items (Post 2002; Parnell *et al.*

Tissue	CCL cm	CCW cm	Tail (P-A) cm	Mass kg	$\delta^{13}C$	$\delta^{15}N$	CN	%C	%N
Whole Blood	93	86.5	53.5 (41.5)	80	-15.07	16.49	3.32	44.9	13.5
Skin					14.34	17.66	3.2	46.4	14.3

Table 1. Morphological measurements and stable isotope data from an East-Pacific green turtle foraging along Punta Descartes, Costa Rica (2017). Curved carapace length (CCL), curved carapace width (CCW), tail length, and plastron-anus (P-A) were measured in centimeters. Mass was measuring in kilograms. δ13C and δ15N ratios were measured in parts per thousand (‰). CN ratio is percent total carbon to percent total nitrogen ratio.

2012). We present a report of an adult male East Pacific green turtle observed resting and foraging along a fishing dock in the Gulf of Santa Elena, Costa Rice. This specific turtle opportunistically foraged on fish parts cast overboard during processing, and stable isotope signatures of tissue samples collected from this turtle suggests that the turtle was consuming and assimilating the fish, as opposed to regurgitating it. This highlights the need for consideration of human-wildlife interactions, ingestion of unexpected foods, and individual variability in sea turtle foraging that need to be accounted for in isotopic modeling (Thomson *et al.* 2018). We want to draw attention to three aspects of this report: first, CM-31 is engaging in interesting interactions with fishing vessels, second, CM-31 is eating dead fish, and third, CM-31 is a male turtle. Our knowledge of movement ecology and stable isotope analysis is heavily skewed toward samples from female or juvenile turtles. It is feasible that higher trophic level foods and variable foraging strategies are common in male turtles, however sex-based variability in behavior and ecology of sea turtles needs significantly more research. Turtle CM-31's behavior also points to potential risks associated with sea turtle acclimation to fishing activities and attraction to fishing vessels that may increase risk of injury or mortality, another area necessitating further investigation. Finally, this highlights that traditional ecological knowledge within local communities is usually more extensive than that of visiting scientists and that it is invaluable for science and conservation.

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A Photographic Record of Loggerhead Sea Turtle (*Caretta caretta*) from Coastal Waters of the Gulf of Kutch, Gujarat, India

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The state of Gujarat is situated in the western corner of India and has the longest coastline in the country. Covering more than 1,600 km, it accounts for approximately 22% of the country's total 7,100 km coastline (Mahapatra *et al.* 2015). Stretching from Lakhpat, northwest of the Kutch district, to Umargam, south of the Valsad district, this coastline is divided into three major geographical parts; the Saurashtra open seacoast and two gulfs, the Gulf of Khambhat and the Gulf of Kutch.

A literature survey shows the state is rich in reptilian diversity (Patel & Vyas 2019). There are four species of sea turtles documented in Gujarat; the olive ridley (*Lepidochelys olivacea*), green (*Chelonia mydas*), leatherback (*Dermochelys coriacea*), and hawksbill (*Eretmochelys imbricata;* Das 1995; Patel & Vyas 2019). Only olive ridley and green turtles have been documented nesting on the Gujarat coast (Bhaskar 1978, 1982; Kar & Bhaskar 1982; Venkatesan *et al*. 2004), while the other two species are occasionally sighted entangled in fishing gear and nets by local fishermen (Sunderraj *et al*. 2006).

Most local fisher communities use mechanical fishing gear, but a few fishermen still follow traditional methods. Traditional fishermen use long bag-shaped nets, locally known as "Gunja." The Gunja has a square mouth and gradually tapers, as a cone, to an opening at the end. Gunjas are operated as both passive and active gear. When Gunjas are used as passive gear, they are fixed in a series against the outgoing tidal flow to catch the fish, prawns, and shrimp. These traditional methods are used by local fishing communities along the entire coast of Gujarat and widely in other Indian states.

On 9 September 2022 on Mandvi Beach, in Kutch, a fisherman brought a sea turtle ashore that had been captured in a Gunja (see cover photo). The fisherman took a few photographs of the turtle before it was released. These photographs were used to identify the turtle as a loggerhead sea turtle (*Caretta caretta;* Das 1995; Sea Turtles of India 2011). The turtle had five pairs of costal scutes on the carapace, the first costal scute was in contact with the nuchal, there were two pairs of prefrontal scales on the head, and each flipper had two claws. The head, neck, and flippers were yellow, and the carapace was reddish brown. Several barnacles (five on the left side and four on the right) were attached to the carapace (Figs. 2 & 3).

The loggerhead sea turtle is globally distributed, especially in warmer waters, including the Indian coastal region (Uetz *et al*. 2022). A literature survey shows that this species is rare in the Indian ocean (Das 1995; Daniel 2002), with very few records reported from

Figure 1 (above). The loggerhead sea turtle (*Caretta caretta*), carapace showing a few barnacles.

Figure 2 (right). The loggerhead sea turtle (*Caretta caretta*), carapace showing a few barnacles.

coastal waters of the southern coast of Tamil Nadu, Bay of Bengal, and the Arabian Sea (Sea Turtles of India 2011).

Records also show this species occurs in the waters of Pakistan (Minton 1966). Minton (1966) states that "*Caretta caretta gigas*, the race of this turtle in the Indian Ocean undoubtedly occurs in West Pakistan waters, but I obtained no specimens." According to Minton (1966), records are difficult to evaluate since this species has repeatedly been confused with the olive ridley sea turtle. There are several publications on sea turtle surveys from the Gulf of Kutch and its adjoining regions, but only McCann (1938) noted the occurrence of loggerhead sea turtles in the Kutch (Bhaskar 1979; Vyas 1998; Sunderraj *et al*. 2001, 2006; Meena *et al*. 2007, 2009; Vyas & Patel 2009; Goswamy *et al*. 2013). In his account of the reptiles of Kutch, McCann (1938: 425) stated that "according to Captain V.C. Steer-Webster *Caretta caretta* comes ashore at Mandvi to breed." In a recent survey, Patel & Vyas (2019) did not include the loggerhead on the state list of wildlife species due to a lack of evidence.

The coastline of the southwestern Kutch, especially the beaches between Jakhau to Mandvi, have some of the most pristine sandy beaches in the region. Around 60 km of this coastline is known as a breeding ground for a small number of olive ridleys, particularly the Pingleshwar Mahadev beach (Rahmani 1996; Sunderraj *et al*. 2006). It is possible that a handful of female loggerhead sea turtles sporadically visit the coast of Kutch, but there needs to be more monitoring and studies conducted in the area.

Masirah Island, Sultanate of Oman, is known for large breeding rookeries of three sea turtle species in the Arabian Sea, including loggerhead sea turtles (Tucker *et al*. 2018; Willson *et al*. 2020). The loggerhead widely occurs in Baluchistan, Sindh, and Karachi, Pakistan (Moazzam & Nawaz 2019). The rare occurrence of a loggerhead in Mandvi is of great interest because Masirah Island is only 100 km from Mandvi-Kutch coastline. These photographs from Mandvi provide evidence for the rediscovery, or reappearance, of the loggerhead sea turtle in the Gulf of Kutch after an 84-year absence.

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Green Sea Turtle (*Chelonia mydas*) Predation by Mediterranean Monk Seal (*Monachus monachus*) Along Turkish Coast

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In the Mediterranean basin, loggerhead sea turtle *Caretta caretta*, green sea turtle *Chelonia mydas*, and Mediterranean monk seal *Monachus monachus*, have their main breeding distribution confined in the eastern Mediterranean including along Turkish coasts. The global population status of the loggerhead turtles is Vulnerable (VU) (Casale & Tucker 2017) while the Mediterranean subpopulation of loggerhead turtle was designated as Least Concern (LC) (Casale 2015). The global population of green turtles is Endangered (EN) (Seminoff 2004) while the regional Mediterranean subpopulation assessment is in progress. In the Mediterranean, the three species are threatened due to anthropogenic factors including fisheries related bycatch, habitat loss or fragmentation, disturbances in breeding habitats and deliberate killing, although the Mediterranean populations of these marine vertebrates have been legally protected (Kıraç *et al.* 2013; Casale *et al*. 2018). The Mediterranean monk seal is an opportunistic predator foraging on a variety of marine fauna. Interactions between sea turtles and monk seals in terms of predatory and aggressive behaviors have relatively recently been observed and are among the least studied subjects. The current study provides two new records of sea turtle predation by monk seals. One from the remains of a green sea turtle found in the digestive system of a stranded subadult monk seal in Mersin in 2018 and another one from an attack by a juvenile monk seal on a juvenile green turtle videotaped in Antalya in 2021.

The Mediterranean Sea is globally one of the most important ecoregions in terms of biodiversity (Myers *et al*. 2000; Mittermeier *et al*. 2004). This precious biodiversity hotspot includes several charismatic and conservation priority species such as sea turtles and Mediterranean monk seal. The nesting, foraging, and wintering grounds of sea turtles in the Mediterranean are well documented and the general populations are increasing based on long standing conservation activities (Casale *et al*. 2018). The average annual nest counts range from 3,694-4,667 and 684-1005 for loggerhead and green turtles respectively in the Mediterranean (Casale *et al*. 2018). The Mediterranean monk seal is considered Endangered (EN) on a global scale (Karamanlidis & Dendrinos 2015) and is a Critically Endangered (CR) marine mammal at the European level according to the IUCN (2015) with the global population estimated at around 700 individuals (Karamanlidis *et al*. 2015). The species is estimated to have approximately 120 individuals along Turkish coasts currently (Cem Kıraç & Meltem Ok, pers. comm. 2022).

The foraging behavior and dietary preferences of monk seals are among the least studied subjects (Cebrian *et al.* 1990; Karamanlidis *et al.* 2011; Pierce *et al.* 2011). Monk seals prey on at least 75 taxa including Chondrichthyes, Osteichthyes, Cephalopods, Mollusca and Crustaceans and they are regarded as generalists, perhaps opportunistic predators, that exploit the most readily available prey (Pierce *et al*. 2011). There are only three studies into the diet of monk

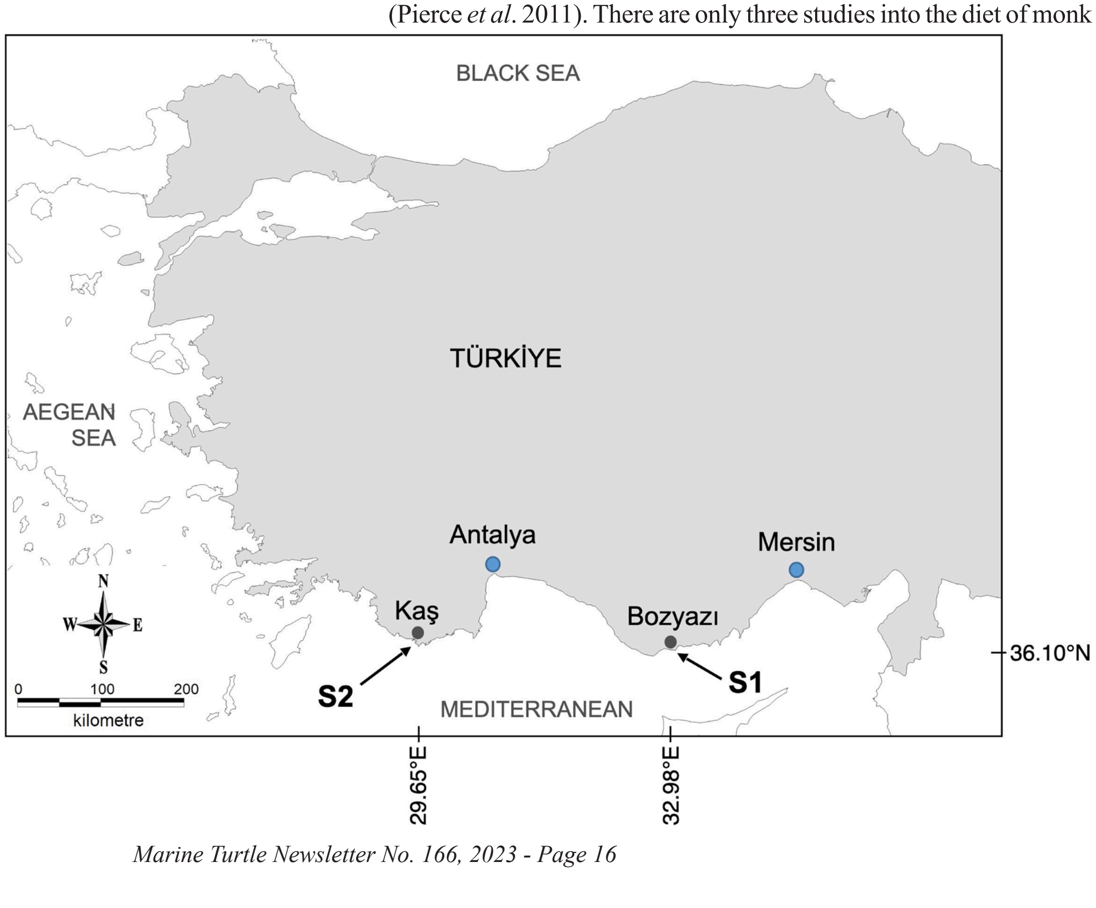

Figure 1. Locations of the monk seal predation encounters; the subadult female seal found stranded in Kızılliman, Bozyazı, Mersin on 3.2.2018 (S1) and the young monk seal predating on a sea turtle in sea in Limanağzı, Kaş, Antalya on 5.7.2021 (S2)

Figure 2. Stranded subadult female monk seal found dead by local fishermen in Kızılliman region in Bozyazı, Mersin on 3.2.2018 (S1).

Figure 3. (A) the eastern coasts of Kızılliman Peninsula, Bozyazı, Mersin, South Türkiye where the dead monk seal (S1) was located on 3.2.2018; (B) the stranded subadult female monk seal (S1) found dead; (C) and (D) the total curved length (from tip of nose to tip of hind flipper, measured over the curved body) of (S1); (E) left fore flipper of a green sea turtle Chelonia mydas found stuck inside the mouth of the dead monk seal; (F) a smaller piece of bone considered another part of the same green sea turtle C. mydas found stuck in the throat of the dead monk seal (S1).

seals in Turkish waters. Salman *et al*. (2001) examined the diet of juvenile and subadult female monk seals from the Aegean coast. A second study examined the stomach content of an adult female found dead in Antalya in southern Türkiye (Tonay *et al*. 2016). Finally, the stomach content of a five-month old, molted pup found dead in Foça town of İzmir in the western Türkiye was studied and documented (Kıraç & Ok 2019).

On the other hand, interactions between sea turtles and monk seals have been previously reported as rare cases of predatory and aggressive behavior (Margaritoulis *et al*. 1996; Margaritoulis & Touliatou 2011). Recently, Tonay *et al*. (2016) reported prey item remains from several body parts (heads, forelimbs) belonging to three green turtles in the stomach of a stranded Mediterranean monk seal near the coast of Antalya, Türkiye. In the current study, we report two new cases: one green turtle limb from the digestive system of a stranded subadult monk seal and another, a videotaped juvenile monk seal attack on a juvenile green turtle.

SAD-AFAG, an NGO dedicated to monk seal conservation, has been monitoring monk seals and their suitable habitats along the Turkish coasts since 1987 (Kıraç *et al*. 2004). These monitoring activities include both direct observations during field research and reaching first-hand and reliable sightings from locals, especially artisanal fishermen, around the Turkish coasts. During these monitoring activities, two separate observations of monk seal predation on sea turtles were obtained.

On the first occasion, a dead subadult female monk seal was found stranded on the cliff shore in Kızılliman protected area, Bozyazı town, Mersin (36.093562° N, 33.093857° E) on 3.2.2018 (S1) by local fishermen. The fishermen found the dead seal, filmed, and photographed it in its original location, measured the total length and carefully checked its external appearance.

The seal (S1) was found dead by the fishermen (Fig. 2) at the eastern cliffs of Kızılliman Peninsula in Bozyazı of Mersin (Fig. 1) on 3.12.2018. It was a subadult female monk seal determined from the general pelage pattern as per Samaranch & Gonzales (2000) as well as from other physical characteristics such as four teats on the belly and overall curved length of 237 cm (curved body length from tip of nose to end of hind flipper). The reason for the seal's death was unknown, however, there were no open wound(s) or hole(s) on the body, as it was checked by the local fishermen on the scene and also reviewed by the authors from the numerous high quality photos. The interesting finding was that the fishermen also found a limb (left fore flipper) of a green sea turtle stuck inside the mouth, which could apparently not be swallowed by the monk seal. In addition, another smaller prey item piece, a fleshy bone, was found farther down the throat. This smaller prey item is also considered to belong to the same green turtle. The limb and the bone were removed manually by the fishermen and the seal and the prey items were photographed in situ (Fig. 3).

On the second occasion, a professional scuba diver recorded a video of a young monk seal, predating a juvenile green sea turtle in the shallow waters near Kaş town, Antalya (36.177341 °N, 29.642428 °E) in 2021 (S2). The observer shot two short videos from the deck of a boat showing the predation in action and shared them with SAD-AFAG through the AFBİKA network. The original videos were then closely examined and recorded into the FokData database, which was specifically designed for the determination of spatial and temporal distribution of monk seals along Turkish coasts. The observer was later contacted by SAD-AFAG and detailed information obtained on the behavior of the juvenile monk seal exposed during the whole scene.

The second case (S2) was from Limanağzı cove in Kaş town of Antalya (Fig. 1) recorded on 5.7.2021, where a young monk seal tried to prey upon a juvenile green turtle. This was videotaped and is probably the first visual clue of aggressive/predatory behavior of a monk seal toward a sea turtle (see Video 1 and Video 2). According to the observer who recorded the two movie clips, the juvenile monk seal caught, and attempted to kill the turtle, tossing it around at the sea surface for approximately an hour. Although the prey struggled to escape, the monk seal finally killed it. However, the monk seal was disturbed by the boats in close proximity during the foraging action and consequently left the dead prey. The dead sea turtle then sank to the bottom (*c.* 3m deep) and could clearly still be seen by the observer. Based on our previous observations and experience along Turkish coasts, the tossing behavior of the monk seal is a typical foraging action meant to kill prey, and break it up into smaller pieces. This feeding behavior always happens on the sea surface, when prey is not small enough to be swallowed whole.

Marine mammal and sea turtle interactions are rarely reported in the literature. In a review of these interactions, cetaceans were reported to be mainly investigating sea turtles but only a few cases of predation were reported for killer whales *Orcinus orca* (Fertl & Fulling 2007). In the diet of the Hawaiian monk seal (*Neomonachus schauinslandi*), the closest relative of Mediterranean monk seal, no sea turtle species is recorded as a prey item (Longenecker 2010), while Hawaiian monk seal and Australian sea lion (*Neophoca cinerea*) have been suspected predators (Fertl & Fulling 2007).

Monk seal attacks on loggerhead sea turtles were first reported from Laganas Bay, Greece, where the sea turtles were found injured or dead with clear bite marks and the reasons behind these attacks were thought to be related to the depletion of local fish stocks (Margaritoulis *et al*. 1996). Similar infrequent and unusual cases were noted in the following years. However, during the 2010 nesting season in Zakynthos, a remarkable record of 21 loggerhead turtles were found stranded or floating in the area of Laganas Bay, bearing injuries attributed to predation by monk seals (Margaritoulis & Touliatou 2011). Based on stomach content data, two cases of confirmed predation records of the Mediterranean monk seals recorded; one on loggerhead sea turtles (Fertl & Fulling 2007) and one on green sea turtles (Tonay *et al*. 2016), both of which were in the eastern Mediterranean.

The two recent predation interactions given in this study have probably resulted from a shortage of prey items, or else only a few monk seal individuals are engaging in this type of predatory behavior (Fertl & Fulling 2007; Margaritoulis & Touliatou 2011).

In conclusion, in all the three proven predation cases happened along Turkish coasts; the one given by Tonay *et al*. (2016) and the two given in this study, demonstrate that all the predated sea turtles by monk seals happened to be green sea turtles (*Chelonia mydas*). Further study is needed to better understand the interaction between Mediterranean monk seals and sea turtles with special emphasis on the reasons whether depleted fish stocks is one of the main driving force for such an interaction.

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Juvenile Green Turtle (*Chelonia mydas*) Migration from Kalba, UAE, to Masirah, Oman

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Characterizing coastal habitat interaction by endangered migratory marine species is essential for implementing site-specific and international conservation actions. Determining spatial and ecological linkages for a species can be particularly challenging when wide-ranging habitat utilization is related to life-stage development. Juvenile green sea turtles, *Chelonia mydas*, tend to forage within shallow coastal zones (Chambault *et al.* 2018; Tomaszewicz *et al.* 2018), occupying discrete developmental habitats as they mature to adulthood (Bjorndal *et al.* 2005; Naro-Maciel *et al.* 2012; Patricio *et al.* 2017). Upon maturity, these turtles routinely migrate great distances between foraging locations and breeding and nesting sites (Hays & Scott 2013; Pilcher *et al.* 2021b).

Green turtles are rarely recorded nesting on beaches on the United Arab Emirates' (UAE) eastern coast (Hebbelmann *et al.* 2016). Neighboring Oman, however, holds amongst the largest nesting aggregations of this endangered species (Seminoff *et al.* 2015) in the region, particularly on Masirah Island and Ras Al Hadd Nature Reserve, where there are about 12,000 to 20,000 nests per year (Rees *et al.* 2018; Ross & Barwani 1982; Mendonca & Abi-Aoun 2009; Pilcher *et al.* 2021a).

Green turtles have been the focus of numerous studies aiming to reveal population connectivity and linkages in long-range migratory and dispersal movements. Analysis of mitochondrial DNA (mDNA) verified the origin and dispersal networks of green turtles congregating at feeding grounds along the coastlines of Brazil (Naro-Maciel *et al.* 2007), the United States (USA), Mexico (Bass *et al.* 2006), the southern Caribbean (Zee *et al.* 2019) and Guinea-Bissau (Patricio *et al.* 2017). In the southwestern Indian Ocean (SWIO), this approach demonstrated green turtle hatchling dispersal and links to developmental habitats (Jensen *et al.* 2020). In 2019, the recapture of Inconel-tagged green turtles in Kenya and Seychelles' Aldabra atoll highlighted a migratory route of over 950 km between the two nations (Sanchez *et al.* 2020). Alternatively, satellite transmitters were fitted to juvenile green turtles in the USA to determine ranging in the coastal waters of the northwestern Gulf of Mexico (Metz *et al.* 2020), while in Uruguay, satellite tracking was combined with isotope analysis of juvenile green turtles to determine recruitment to neritic habitats in the southwestern Atlantic Ocean (Vélez-Rubio *et al.* 2018). In the northwestern Indian Ocean (NWIO), post-nesting green turtles in Oman were fitted with satellite transmitters to record

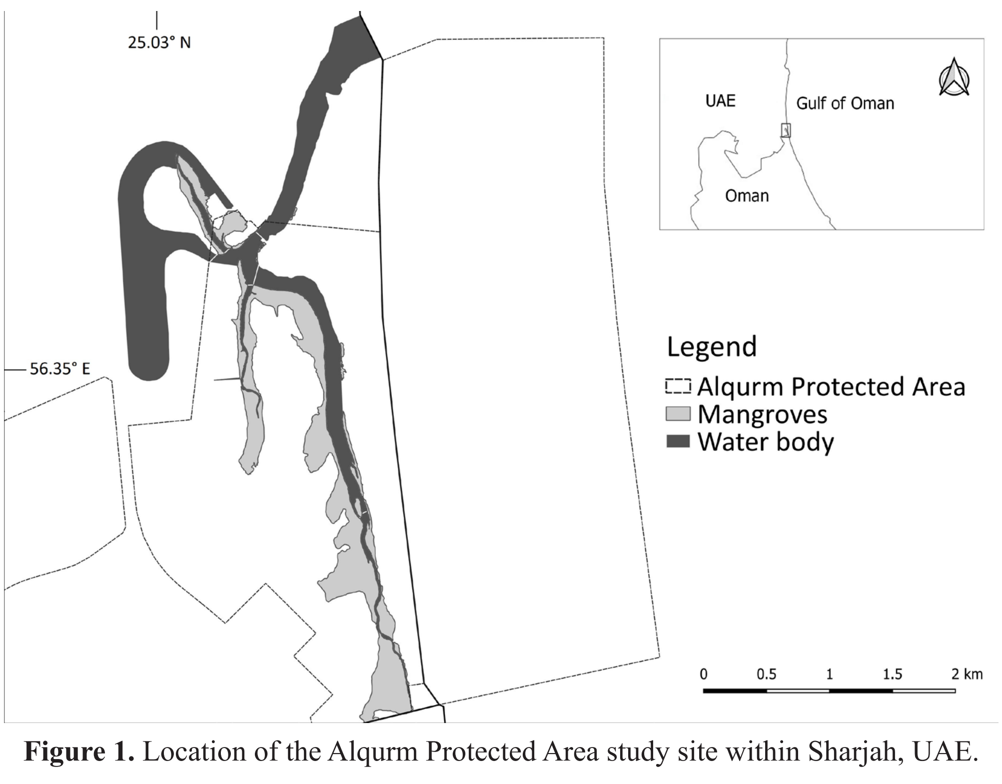

Figure 1. Location of the Alqurm Protected Area study site within Sharjah, UAE.

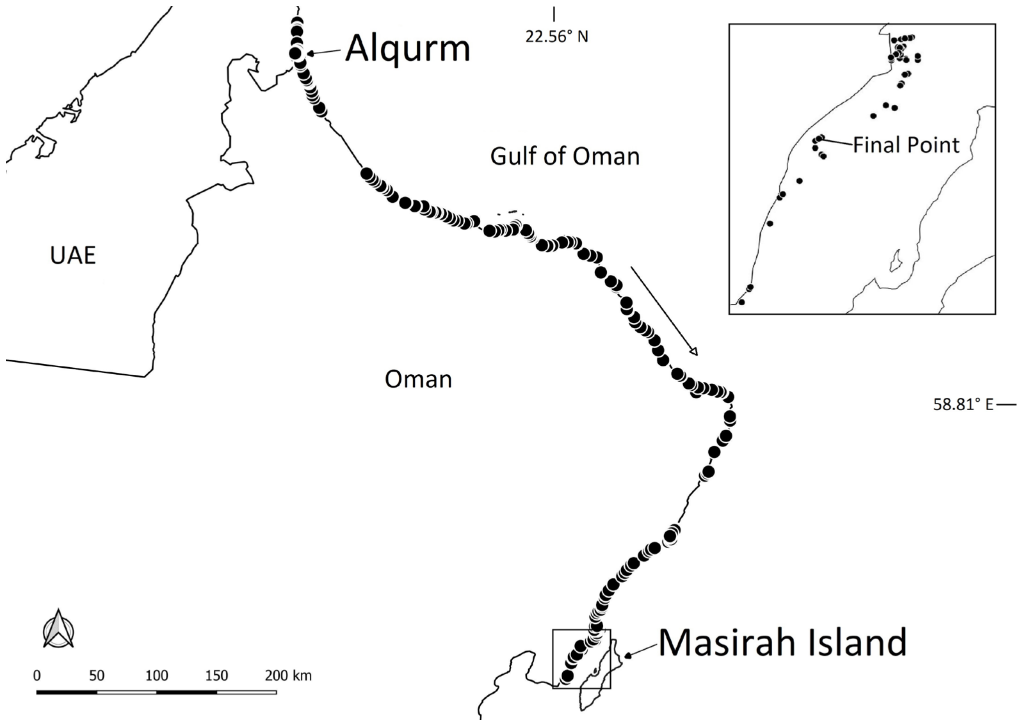

Figure 2. The 42-day, 805-km migration of juvenile green turtle 67871 from Alqurm Protected Area, UAE, to the seagrass-rich feeding grounds west of Masirah Island, Oman in 2020.

movement patterns in the Arabian region (Pilcher *et al.* 2020; Pilcher *et al.* 2021a, b).

Despite these global efforts, little is known about the spatial movements or foraging aggregations of juvenile green turtles in the NWIO. Alqurm Wa Lehhfaiiah Protected Area (hereafter "Alqurm") in Sharjah Emirate safeguards the only remaining mangrove ecosystem on the UAE's eastern coast. Juvenile green turtles forage in Alqurm's channels throughout the year and high tide-focused unmanned aerial vehicle (UAV) surveys by Sharjah's Environment and Protected Areas Authority (EPAA) recorded between 100 to 200 juvenile green turtles in different months (Pereira pers. comm. 2019).

Advances in Global Positioning System (GPS) technology, optimized for locational data acquisition on diving marine wildlife, presented an opportunity to monitor habitat occupancy by turtles in narrow mangrove channels previously unavailable with lower-accuracy ARGOS technology (www.argos-system.org/). In 2018, EPAA and Emirates Nature-WWF collaborated to determine spatial and temporal utilization of the Alqurm channels (Figure 1) and Kalba nearshore environment by juvenile green turtles, particularly aiming to assess the overlap of turtle-favored habitat with the boundaries of the Protected Area. The study also aimed to expand knowledge of population connectivity links to nesting areas (main nesting rookeries in Oman), feeding zones, and metapopulation dynamics of green turtles in the UAE. Here we report an unanticipated finding: the first record of a juvenile green turtle leaving the population in Alqurm and migrating to Masirah, Oman (Fig. 2).

Alqurm (25.028223 °N, 56.368909 °E) includes a series of tidal, predominantly sandy-bottom channels with intermittent seagrass beds and small portions of rocky reef with sparse coral, sponges, and oyster aggregations. Before 2009, three narrow mangrove channels, varying in width from 140 m to 1 m at their narrow ends and totaling approximately 5.8 km, extended from a central tidal channel linking the 2 km distance to the ocean. By 2010 an additional 6.6 km² of shallow inlet was excavated for a corniche on the inland side of the mangroves and connected to the tidal system.

Green turtles in Alqurm can forage further up the narrow passages as the incoming tides raise the water level. After observations of tide height thresholds for movements into and out of the target channel, turtles were captured in a channel-width, modified fishing net as they retreated with the receding tide. Turtles were restrained in shaded, open wooden boxes. Following standard morphological data collection, blood and tissue sampling by EPAA veterinarians, and fitment of Inconel 681 tags (National Band and Tag Company, Newport, KY, USA), Sirtrack F6G 276A transmitters were attached using standard protocols before the turtles were released into the water. Five transmitters were deployed in November 2019 and four in December 2019. Data acquisition was set for whenever a turtle breached the water surface sufficiently for a location reading to be registered by the transmitter. For spatial analysis, GPS data were processed using QGIS (QGIS Development Team, 2020). Data acquired by the Sirtrack platform were restricted by default settings of the HDOP (Horizontal Dilution of Precision) of five, the minimum satellites required being four, and eRes (Residual Error) of 50. Improbable point data over land were deleted (Witt *et al.* 2010).

The mean curved carapace length (CCL) for the nine immature turtles was 49.2 cm (SD = 5.1 cm), with the ranging individual that is the subject of this note (ID 67871) recorded with a CCL of 46.2 cm. The nine transmitters functioned for a mean of 150 days (SD = 56), with two turtles demonstrating notable site fidelity, remaining exclusively within the mangrove channels and corniche zone for the

Figure 2. Nest counts for three species of sea turtles at Maunabo, Puerto Rico, 2001-2021.

monitoring period. Except for turtle 67871, all turtles foraged within 4.4 km of the main channel's mouth to the ocean for the duration their transmitters reported. Turtle 67871's transmitter provided location data for 158 days (12 December 2019 to 18 May 2020), with 42 of those representing the 805 km journey from Alqurm to Masirah, where 20 days were registered before data transmission stopped. In this migration period, 230 data points were logged; 92% within 1.5 km of the coastline. No point was further than 5.3 km from the shoreline. The final recorded location of 67871 was in the coastal channel between Bar al Hikman and Masirah Island, south of the Omani town of Shannah.

Our findings demonstrate a potentially significant development linkage between the green turtle aggregations at Alqurm in the UAE and Bar Al Hikman - Masirah Island in Oman. Despite this being a single record from nine turtles within the study, the accuracy and frequency of the location data, following a sustained period in Alqurm, suggests this was an intentional migration to a foraging location known for its shallow seagrass habitat (Ross 1985; Salm *et al.* 1993; Pilcher *et al.* 2021b), dominated by *Halodule uninervis* and *Halophila ovalis* (Jupp *et al.* 1996).

Connectivity between green turtle populations in Oman, the islands of the Arabian Gulf (Pilcher *et al.* 2020; Pilcher *et al.* 2021a,b) and other states of the NWIO (Salm 2001; Ferreira *et al.* 2006; Attum *et al.* 2014; Pilcher *et al.* 2021a) has been documented previously in adult post-nesting turtles; however, this is the first evidence of juvenile turtles following portions of these recognized routes. Of relevance to 67871's migration is the post-nesting adult green turtle 169438 (Pilcher *et al.* 2020) that followed a similar coastal route, although in the opposite direction from Ras Al Hadd towards the Straits of Hormuz. These two results of independent studies, years apart and focusing on differing age classes, suggest a migratory path that may be important to regional green turtle populations. Identifying favored resources like seagrass beds or mangrove channels within these known adult migration routes may assist in recognizing key juvenile green turtle developmental areas.

Growing evidence indicates natal homing by sea turtles is guided using the earth's magnetic fields as directional cues during long-distance migrations (Lohmann *et al.* 2004; Lohmann *et al.* 2008; Lohmann & Lohmann 2019). The combination of this navigational methodology and the preference of juvenile green turtles to forage within shallow coastal zones (Rees *et al.* 2012; Chambault *et al.* 2018; Rees *et al.* 2018; Tomaszewicz *et al.* 2018) may have influenced the approach of 67871 to track the coastline (within 1.5 km) for almost its entire migration. There is no indication prevailing currents directly influenced the coastal proximity of the journey. The south-eastwards migration from Alqurm towards Ras Al Hadd followed the direction of the prevailing East Oman Current (Purnama *et al.* 2011; Piontkovski *et al.* 2019); however, after passing the headland and heading towards Masirah Island, the swim was counter to the Oman Coastal Current (Purnama *et al.* 2011; Piontkovski *et al.* 2019).

There are several risks associated with green turtles staying close to shore where there is a higher density of marine traffic. An investigation of stranded sea turtles from the eastern coast of Sharjah reports that 8% of stranded green turtles were dead and showed evidence of boat-related injuries (Yaghmour 2020). Occupation of nearshore waters also risks exposure to land-based pollutants. Insecticides, herbicides, and fungicides enter and contaminate the marine environment through agricultural runoff. An investigation of sea turtle strandings from the eastern coast of the UAE found that 25% of green turtles carried detectable levels of harmful and illegal organochlorine pesticides at their death (Yaghmour *et al.* 2020). The refined scale of this migratory pathway is sufficiently accurate to characterize some high-risk zones like industrial and fishing ports (Ferreira *et al.* 2006; Seminoff *et al.* 2015) while also revealing locations for targeted conservation opportunities, particularly at likely foraging grounds suggested by multi-day, clustered point locations. Considering the international scope of spatial and temporal results of compatible studies on adult turtles in the UAE and Oman (Pilcher *et al.* 2021a,b), isolated conservation actions implemented in locations such as Alqurm, Bar Al Hikman, and Masirah Island, and as recommended in Pilcher *et al.* (2021b) have the potential to result in cross-generational outcomes with important regional implications for green turtles.

This record also emphasizes the need to deploy additional sampling and data acquisition methodologies to reveal a more comprehensive regional context for the Alqurm green turtle population. Although this tracking outcome indicated a linkage between Alqurm and Masirah Island, the recapture of juvenile green turtle 011L-012R in Alqurm in November 2021 (Rodríguez-Zarate pers. comm. 2021), 22 months after its initial capture in the same mangrove channel, implies that our understanding of the spatial and temporal dynamics of this age group of turtles in Alqurm is rudimentary. Ongoing and future DNA analysis may also clarify the significance of the linkage between these two sites or decisively reveal connectivity to alternate breeding and foraging locations for juvenile green turtles within the regional network.

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Loggerhead Turtle (*Caretta caretta*) Tagged in Cuba is Observed in Belize

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A nesting loggerhead (*Caretta caretta*) tagged in September 2012 in Cayo Largo (Canarreos Archipelago) Cuba, was observed resting near a lobster trap in Belize near the Caye Caulker Marine Reserve (Fig. 1) ten years later, on 8 September 2022. The loggerhead was tagged (CB790) by Marina Marlin (Cayo Largo) staff with tags provided by the Fisheries Research Center (CIP-Cuba).

Cayo Largo is located at the eastern end of the Canarreos Archipelago. It is the most important nesting site for green and loggerhead turtles in the Cuban Archipelago, and is a main site for green turtles in the Caribbean Sea (Medina *et al.* 2009; Nodarse *et al.* 2010). In comparison, the area around Caye Caulker is characterized by having vast seagrass beds and coral reefs, which offer an array of food items and shelter for marine turtles. The commercial fishers that found CB790 use pimento lobster traps that can be baited with coconut husk, cow hide, and occasionally crustaceans. When the sleeping loggerhead was found near their lobster shade, the fishers became concerned the turtle would eat the lobster under the shade. Due to their concern, the fishers reported they relocated the turtle to an area outside of their fishing grounds, less than one km east of where it was encountered. The fishers reported seeing another loggerhead turtle nearly 100 m away from where CB790 was observed. The turtle was observed in an area where loggerheads have historically been attacked by sharks. In 2015, one loggerhead turtle that survived a shark attack was recovered, rehabilitated, and later released by ECOMAR. These observations of loggerheads in the area suggest that it might be an important foraging area for loggerhead turtles in Belize.

The observation of this loggerhead constitutes the first record in Belize of a nesting loggerhead tagged in Cuba since the three loggerheads previously reported, one from Playa ¨El Guanal¨ (southern Isla de la Juventud) and two from Cayo Largo, were reported foraging in Cayo Miskitos in Nicaragua (Moncada *et al*. 2010, 2016). Therefore, this report contributes to the expanding knowledge about the movements and migratory routes of this species in the Caribbean Sea.

Acknowledgements. We thank the Staff of Marina Marlin (Cayo Largo) who have been tagging Cayo Largo sea turtles for several years. We also thank the fishermen (Carlos Chan, Luis Alcoser and Hortencio Pott) for reporting the loggerhead observed to the Caye Caulker Marine Reserve, a member of the Belize Sea Turtle Conservation Network.

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Figure 1. Geographic location of Cayo Largo (Cuba) and Caye Caulker (Belize).

Recreational Beach Seining and Sea Turtle Incidental Capture: The Need for a Proper Assessment Along the State of Rio de Janeiro, Brazil

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Recreational beach seining is popular along the Rio de Janeiro state coast in southeastern Brazil. The popularity of this fishing technique is related to its easy operability, in which the net is pulled to the beach by hand and the catch is sorted on site. Fish in the surf zone are usually the main targets, such as bluefish (*Pomatomus saltatrix*) and mullets (*Mugil* spp.). On 11 December 2022, a recreational beach-seine was launched in the surf zone of Praia do Dentinho (Fig. 1), located in the district of Praia Seca, in the municipality of Araruama. This is part of the 50 km long Restinga de Massambaba, which is a sandy beach along eastern Rio de Janeiro coast. This net caught both a medium-size leatherback sea turtle (*Dermochelys coriacea*) (Fig. 2) and a juvenile green turtle (*Chelonia mydas*) (Fig. 3). Due to its greater size and weight, the leatherback turtle was first noticed and released from the fishing net. The green turtle was seriously injured, with cuts and wounds due to the fishing net, and was left on the beach for a few minutes to rest, and then released back to sea. The survival of these animals after the event is unknown.

Among the five species of sea turtles present on the Brazilian coast, the leatherback turtle is the largest, commonly transiting in deep water (Thomé *et al.* 2007; Pádua Almeida *et al.* 2011). Additionally, Reis *et al.* (2009) and Rêgo *et al.* (2021) highlighted the relevance of the Rio de Janeiro eastern coast as a feeding ground for sea turtles, due to upwelling brought about by prevailing north-easterly winds in the summer. These waters are enriched due to high levels of primary production that propagates up the food chain, which may result in an important foraging ground for sea turtles. Therefore, the occurrence of leatherback sea turtles interacting with anthropic activities in this area, such as beach-seining, should be further examined. The green sea turtle is regularly observed along the Rio de Janeiro coast, feeding on macroalgae and phanerogams found in benthic environments.

Although scarce in the literature, entanglement of marine megafauna in recreational beach seines has previously been reported along the coast of Rio de Janeiro. Siciliano *et al.* (2017) described a Guiana dolphin (*Sotalia guianensis*) that had been captured and released in a beach seine off Farol de São Thomé in March 2016. Additional captures of manta rays (*Manta birostris*) and large sharks, especially tiger sharks (*Galeocerdo cuvier*) and sand tiger sharks (*Carcharias taurus*), in beach seines have been observed along the coast of Rio de Janeiro (GEMM-Lagos, unpublished data). These events are noteworthy as these species are all classified as endangered or critically endangered, and

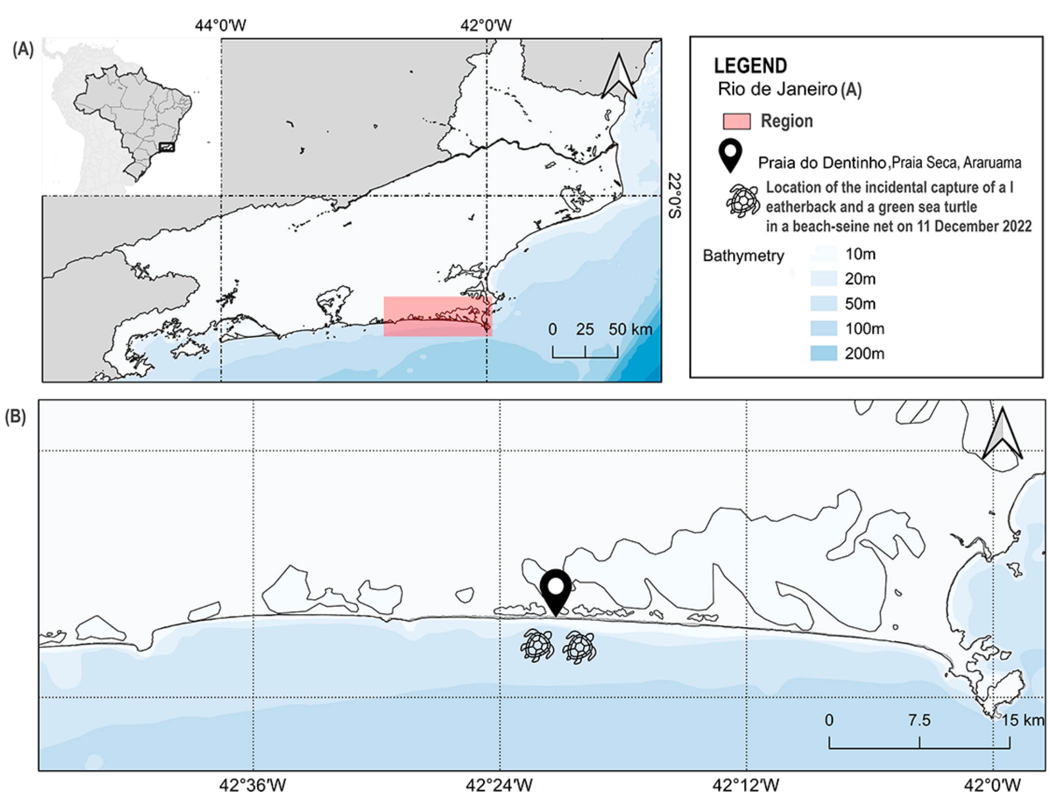

Figure 1. Location of Praia do Dentinho (Praia Seca district, municipality of Araruama, Rio de Janeiro), beach where the recreational beach seine was set and where sea turtles were caught (Greicy F. Ruenes, 2023).

Figure 2. Medium-sized leatherback sea turtle captured by the seine net at Praia do Dentinho (district of Praia Seca, municipality of Araruama, Rio de Janeiro).

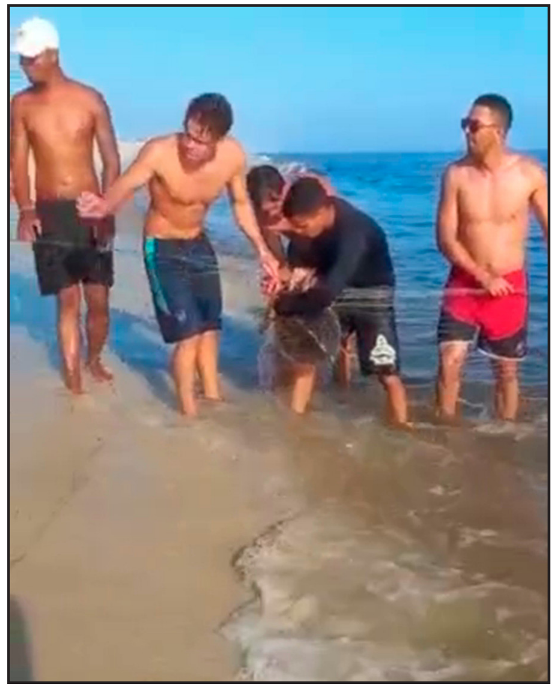

Figure 3. Juvenile green sea turtle captured by in the seine net at Praia do Dentinho (district of Praia Seca, municipality of Araruama, Rio de Janeiro).

their numbers have been declining abruptly in the last decades. (Marcovaldi *et al.* 2006; Thomé *et al.* 2007).

As sea turtles concentrate and use Rio de Janeiro coastal waters during their life cycle, potential threats to their conservation need to be identified. High numbers of sea turtles have been reported stranded along the Rio de Janeiro coastline recently and most show signs of interactions with fishing gear (Werneck *et al.* 2018). Our record occurs within a presumed hotspot for anthropogenic threats to sea turtles, which affects their mortality rates in south-eastern Brazil (Tagliolatto *et al.* 2019). As such, the case of recreational beach seining and their role in the incidental catches of sea turtles needs to be assessed to determine the severity of impact on sea turtle populations.

Acknowledgements. We thank Ana Paula Barbosa Soares and Marcia Caldeira da Costa for providing the videos that allowed the identification of the sea turtle species. We also thank researcher Greicy F. Ruenes for producing the map (Fig. 1).

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President's Report For 41st Annual Symposium On Sea Turtle Biology And Conservation, Cartagena, Bolivar, Colombia, 18-24 March 2023

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The 41st Annual Symposium on Sea Turtle Biology and Conservation was held in Cartagena, Colombia from 18-24 March 2023. The city of Cartagena is located on the shores of the Caribbean Sea, in the northwestern part of the South American continent. The city has several archipelagos and islands around that are paradises for true rest. Among these are Tierra Bomba Island, Múcura Island, Barú Island and many others Cartagena de Indias brings together the charm of colonial architecture, the excitement of a vivid nightlife, fascinating cultural festivals, and lush landscapes. This fabulous destination holds the secrets of history within its walled city, on its balconies, and in the narrow stone walkways that inspired author Gabriel García Márquez, who received the Nobel Prize in Literature in 1982. Framed by its stunning bay, Cartagena de Indias is one of the most beautiful, well-preserved cities in the Americas; a treasure that is currently one of the most heavily frequented tourist destinations in Colombia. Thus, Cartagena provided a great venue for the International Sea Turtle Symposium and aligned with this year's symposium theme which was "Vision 20/20: Bridging communities and technology for marine turtle conservation". The theme focuses on a new scope of what should be community-based conservation worldwide, as well as applying technologies and field techniques for new researchers to deal with future challenges in the conservation biology of sea turtles. A total of 583 people attended the symposium, all of which came together to learn more about turtles, community engagement, and conservation of our ocean resources. A total of 157 oral papers and 263 posters were presented at the symposium. The program also included several workshops, regional meetings and the annual Marine Turtle Specialist Group meeting. Several fun and productive social events were scheduled as well.

Overall, the meeting was exciting and a success from every perspective. After three years of non in-person symposia due to the covid-19 pandemic, the 41st International Sea Turtle Symposium was undoubtedly an **Unforgettable Gathering.** This event will be remembered for decades as one of the best symposia in the history of the International Sea Turtle Symposium. Details are offered below.

While the worst of the COVID-19 pandemic has certainly passed, as a Society (International Sea Turtle Society, ISTS) we did our part to keep everyone safe and healthy and be socially responsible. Recommendations were shared and precautions were implemented throughout the symposium (Fig. 1).

Logo: The logo was designed by Sarah Shaver, an amateur artist from the University of Central Florida's Marine Turtle Research Group. The logo incorporated the focus of hawksbill sea turtle conservation with the iconic fruit sellers, "*Palenqueras*", a symbol of the woman of Cartagena. Dressed in colorful costumes and wearing a great smile, the "*Palenqueras*" embellish the Historical Center of Cartagena de Indias, becoming part of the landscape. Their name comes from their origins, because these women, who sell delicious tropical fruits and sweets, are native to the first slave-

Figure 1. Symposium participants wearing masks during a "Meet the Authors" session for posters presentations..

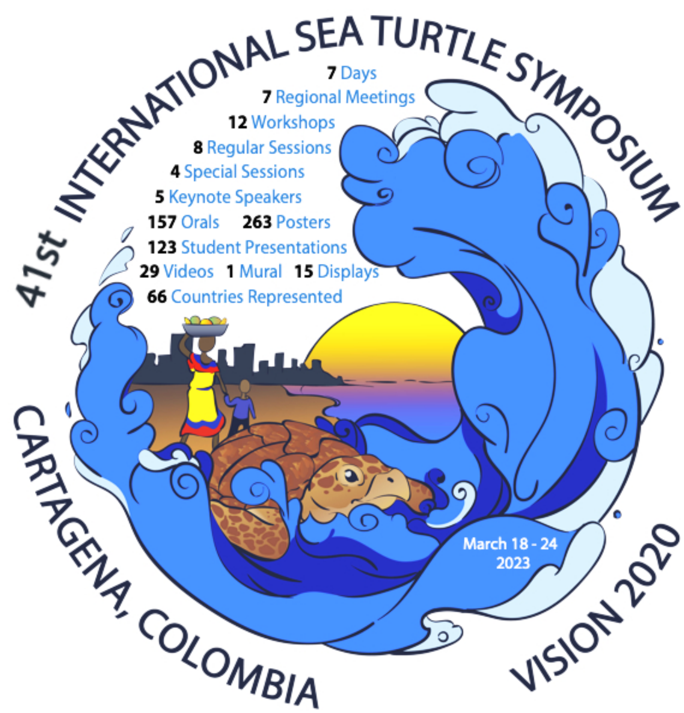

Figure 2. Summary numbers of the 41st International Sea Turtle Symposium included in the symposium logo design.

free town in America, called San Basilio de Palenque, a district of Mahates, Bolivar. The logo perfectly combines conservation with culture: the *Palenquera* showing a child the turtle symbolizes the importance of passing the passion for sea turtle conservation on to the next generation (Fig.2).

Pre-Symposium Workshops & Regional Meetings: The structure of the symposium was similar to past symposia, with several pre-symposium workshops and regional meetings scheduled during the three days prior to the symposium's main four days. They provided the opportunity to exchange ideas regarding environmental and sea turtle conservation issues, as well as cutting-edge research and techniques.

A total of 12 workshops were held, including: A Strategy framework on the Development of Solutions to Address the Key Threat of Sea Turtle Trafficking and Direct Take in the Caribbean, Central and South America; 4th Drones and Turtles; 12th Medicine and Rehabilitation of Sea Turtles; Reducing Bycatch by Building Capacity for Collaborative Research among Fishers and Conservationists; Designing Behavior Change Campaigns for Sea Turtle Conservation; The Climate-threats Matrix: Understanding and Quantifying the Interactions of Cumulative Stressors with Climate Change and the resulting Impacts on Sea Turtles; Applications of Sea Turtle Reference Genomes for Research and Conservation Management; Student Committee Workshop: Career Paths and Key Approaches to Prepare and Succeed in the Sea Turtle World; Male Sea Turtles: Current Global Conservation and Research Efforts; 4th Plastic Pollution and Sea Turtles; Future Technologies for Large-scale Monitoring of Marine Turtle Nesting Populations; Strengthening Community-based Environmental Education through efficient use of Technological Communication Tools.

The 41st symposium brought together participants from over 66 countries around the world, allowing them to discuss specific problems that impact their regions. A total of five successful Regional Meetings were held and these had the extra benefit of helping attract attendees early to the symposium venue. These regional meetings included: Africa, Indian Ocean and South East Asia (IOSEA); Latin America (RETOMALA); Mediterranean; and Oceania and Pacific Islands. Two special meetings were also developed during the symposium week: the Annual General Meeting of the Wider Caribbean Sea Turtle Conservation Network (WIDECAST) and the 5th Eastern Pacific Leatherback Network Meeting (LaudOPO).

Also, two side meetings were held: the Colombian Ministry of Environment Sea Turtle Planning meeting, and the International Union for Conservation of Nature's Marine Turtle Specialist Group (IUCN-MTSG).

Opening and Keynote Speakers: ISTS President Diego Amorocho provided the symposium's opening remarks, reflecting on the uncertainty and despair that settled in the hearts of many during the pandemic era, which also led to the loss of many loved ones, jobs and conservation efforts. Due to the pandemic, the Cartagena Symposium in 2020 was cancelled one week before the opening day. Nonetheless, as stated by Diego, "But hope got us through that and brought us back together, as an example of resilience we are gathered here, and this is a reason to celebrate life, celebrate this very unusual and unique Society, to which we all belong". He continued highlighting the importance of the interdependence between technology and communities to achieve sea turtle conservation. Technology is significantly increasing our understanding of sea turtles and making our vision much sharper, broader, and precise; while the empowered communities are increasingly aware of the importance of protecting sea turtles and their habitats. The key is to address the importance of community involvement from project conception to implementation in the field without which nothing could be accomplished, and use technology to close knowledge gaps, and to help confront new challenges.

Diego included an *In Memoriam* tribute to sea turtle friends and colleagues that have passed away during the past three years. He thanked the sponsors and his outstanding organizing team. The symposium was subsequently officially opened by Ximena Rojas Giraldo, Director of the Direction of Marine, Coastal and Aquatic Resources Affairs (DAMCRA) from the Ministry of Environment and Sustainable Development of Colombia. Two keynote speakers addressed attendees with speeches focused on the symposium theme: Hector Barrios from TropWATER and Grupo de Trabajo en Tortugas Marinas del Golfo de Venezuela, talked about the evolution of sea turtle community-based conservation in Latin America and the Caribbean; and Brad Nahill, from SEE Turtles provided valuable personal experience to the audience about fundraising for sea turtle conservation by presenting innovative ideas, advice, and opportunities.

Symposium Sessions: The oral and poster presentations consisted of traditional session categories, including Anatomy, Physiology and Health; In-Water Biology; Nesting Biology; Population Biology and Monitoring; Fisheries and Threats; Conservation, Management and Policy; Education, Outreach and Advocacy; and Social, Economic and Cultural Studies. A total of 157 oral papers and 263 posters were presented within these categories. Poster presenters also had the opportunity to answer questions and give more details on their presentations during "Meet the Authors" sessions scheduled during the afternoons of all four primary days of the symposium.

There were four one-hour special oral sessions that included discussion panels on Wildlife Crime: Illegal Trade in Marine Turtles (moderated by Christine Hof, WWF Australia); How Can Technology Improve Community Conservation Efforts? (moderated by Jeffrey Seminoff, National Oceanic and Atmospheic Administration Fisheries, USA); The Ultimate Goal of Hatcheries: Finding a Balance between Business and Conservation (moderated by Nicholas Pilcher, National Center for Wildlife, Saudi Arabia, and Marine Research Foundation, Malaysia); The Ultimate Community-Based Conservation of Marine Turtles: The Next Generation (moderated by Adriana Cortés, SEE Turtles, USA).

Social Events: The social component of the symposium was underscored by several events, including Cultural Night, Welcome Social at the Hilton gardens, Student Committee activities, Video Night, Turtle Trading Post, Silent and Live Auctions, Awards Ceremony, the Farewell Banquet, and the painting of an outstanding Mural, which included an associated Hand printing event and Unveiling Ceremony.

The *Cultural Night* welcomed all symposium attendees with a colorful and vibrant performance by the school children from Colegio Ambientalista de Cartagena. They donned vibrant clothing made out of recycled materials that showcased marine resources on a light blue mantle. They started dancing the popular cumbia

Figure 3. Girl from Colegio Ambientalista de Cartagena showed details of her dress while dancing "La Tortuga Bajo el Agua" during the Cultural Night at the 41st International Sea Turtle Symposium.

"*La Tortuga Bajo el Agua*" (The Turtle Under the Sea) and the contagious Caribbean and African rhythms invited everyone to the dance floor (Figure 3).

The *Student Committee* conducted its 11th year of activities dedicated to welcoming and encouraging student attendees. The committee led three core activities. First, they hosted the Student Presentation Feedback, during which 71 evaluators volunteered to give feedback on 122 student presentations (52 oral papers and 70 posters), including identification of strengths and areas for improvement. Second, they organized a half-day workshop titled "Career paths and key approaches to prepare and succeed in the sea turtle world", during which eight guest speakers provided 52 student participants with career advice related to obtaining jobs and working in government, consultancy, academia, and non-profits. Last, the Committee hosted their "Speed Chatting with Experts" event for the 10th time, where for a small donation, symposium attendees had the opportunity to have one-on-one chats with top research and conservation experts. Eleven experts shared their knowledge and experience in 10-minute slots. Experts included: Alan Zavala, Alejandro Fallabrino, Alexander Gaos, Bryan Wallace, Camryn Allen, Daniel Gonzalez, Felix Moncada, Frank Paladino, Kate Mansfield, Manjula Tiwari, and Miguel Reyes.

The *Video Night* ran for three hours with 29 videos from 19 countries which highlighted their sea turtle research, conservation, and educational programs

The *Turtle Trading Post*, in its 2nd year, was a total success in providing a platform for sharing gently used or never used equipment, field gear and laboratory items. Our global sea turtle family donated 90 items valued >US$6,800. Through a raffle the items found a second life to support new science and more conservation.

Figure 4. Beautiful quilt auctioned during the Live Auction at the 41st International Sea Turtle Symposium.

As is typical, the *Silent and Live Auctions* were among the most popular events. Between both events, >400 items were auctioned and approximately US$24,000 was raised (Fig 4). All raised funds go towards the Travel Grants Program to help students and participants from underrepresented countries to attend future symposia.

Art Mural: As part of the legacy that the symposium wanted to leave in the city of Cartagena, a large mural was painted during the symposium by Colombian artist Akilles. The mural displayed a beautiful hawksbill sea turtle in the ocean, with local people looking after it. The artwork helped highlight the importance of sea turtles for ecosystems and the vital role communities play in their conservation. This beautiful mural is located on the Mezzanine on the 2nd floor of the hotel, across from the symposium's primary registration and event halls. Funding for the mural was donated by The Turtleman Foundation, Artesanías Tortugas Sin Fronteras, and Hilton Cartagena. Akilles painted the mural during the symposium, thus attendees and the public were able to observe his painting process from start to finish. The artist reserved a space on the mural for participants who had purchased a ticket to print their hands on the mural. The collection of handprints depicted a coral reef, representing the primary habitat on which hawksbill turtles rely (Figure 5). All funds raised in the handprint activity went to the Travel Grant Program as well.

A**wards:** Two rounds of ISTS Awards took place during the 41st symposium.

The 2020 ISTS Awards: Barbara Schroeder, Karen Eckert and Larry Crowder received the ISTS Lifetime Achievement Award

Figure 5. Mural painted during the week of the 41st International Sea Turtle Symposium in Cartagena, where symposium participants had the opportunity to leave their handprints as part of the colorful coral reef (left).

for their enormous contributions to the study and conservation of marine turtles. Karumbé: Tortugas Marinas del Uruguay, Marine Turtle Newsletter, Kimberly Stewart, and Pedro Vernet all received the ISTS Champions Award.

The 2023 ISTS Awards: Jacques Fretey, Kenneth J. Lohmann, and Fernando Manzano "Papá Tortuga" (R.I.P.) received the ISTS Lifetime Achievement Award for their devotion to sea turtle research and conservation. The ISTS Champions Award was awarded to Verdiazul, a sea turtle conservation group from Costa Rica. The ISTS Ed Drane Award for Volunteerism was received by Carl W. Stearns for his very long history of volunteerism with many projects throughout the United States. Three President's Awards were presented to: Asociación Caguama, a sea turtle community-based conservation organization based in El Valle, Chocó in the Colombian Pacific coast; Hector Barrios for his contribution to sea turtle research and conservation in Venezuela; and Richard Reina for his outstanding contributions to the Society and devotion to educate new generations of sea turtle scientists worldwide.

Grassroots Conservation Award: Sixteen presentations met the award criteria and were reviewed by the four judges of the committee. The Wayuu Indigenous Communities of Venezuela won the award for their important role in sea turtle conservation, which they demonstrated in their presentation "The Wayuu Voices: A changing connection with the marine turtles".

Archie Carr Student Awards: A panel of 16 judges evaluated 54 student oral presentations and 68 student poster presentations nominated for the Archie Carr Student Awards. In the Biology category, the students awarded were: Katrina Phillips, Makayla Kelso, Samantha Kuschke, and Taylor Brunson. In the Conservation category, the students awarded were: Kayla Burgher, Keilor Cordero, Ademir da Silva, and Katie Ayres.

Travel Grants: The 41st symposium was able to support a total of 74 symposium participants with lodging during the symposium. The distribution of grants per region was as follows: two grants to Africa representatives, five to Asia, six to Europe, 26 to Mexico and Central America, two to Middle East, three to Oceania, 17 to South America, and 13 to USA and Canada. This level of travel grant awards represented 12.7% of the total registered participants.

ISTS Board of Directors Meeting: The Society's Board of Directors got together and discussed reports from the ISTS President, Nominations Committee, Awards Committee, Student Committee, Travel Grants Committee, Archie Carr Student Awards Committee, Grassroots Conservation Award Committee, as well as reports from the Webmaster, Fundraising Officer, and Treasurer.

Closing Remarks: Keynote speakers included Rod Mast from Oceanic Society, USA, who addressed the progress in documenting the global geography of sea turtles in the last 20 years, and Luis Naranjo from WWF Colombia who spoke about the importance of public and private alliances for sea turtle conservation. ISTS President Diego Amorocho's closing remarks provided a summary on the numbers (attendance, funds raised, etc.) achieved during the symposium, and emphasized that sea turtle conservation is only possible with community participation. Diego used the opportunity to once again pay tribute to sea turtle friends and colleagues that have passed away during the past three years and thanked his outstanding organizing team.

Plenary Business Meeting: On the last day of the symposium, a board member presented the results of a survey of Society members, which allowed them to indicate their preferred format for symposium and associated events (workshops, regional meetings). Next steps on this matter will examine preferences of different demographics, financial projections with any change of format, among others. Other board members presented on the concept behind the Small Grant Program and how it has supported six sea turtle projects.

The Travel Grants Committee Chair and the Treasurer presented their reports to Society members. The attendees approved both reports. The Nominations Committee Chair presented the 2023 elections results: Andrews Agyekumhene from Ghana is the elected President for 2025. Also, the elections added two new members to the Board of Directors, Joseph Pfaller and Itzel Sifuentes, who will start their terms in 2023.

The 2024 ISTS President Stephen Dunbar from Protective Turtle Ecology Center for Training Outreach and Research (ProTECTOR, Honduras) and Loma Linda University (USA) provided details regarding the upcoming symposium to be held in Pattaya, Thailand. He reported that dates have been set as March 24–29, 2024, during which time Society members will once again convene, in this case celebrating the theme "All In - All Together: Inspiring the Next Generations of Sea Turtle Conservationists" (Fig. 6).

Exhibitors and Vendors: There were a variety of exhibitors and vendors that participated in the symposium, including: ASUPMATOMA A.C., Ayotzintii A.C., Asociación Centro de

Figure 6. The 2023 ISTS President Diego Amorocho (right) passed the baton to the 2024 ISTS President Stephen Dunbar (left).

Rescate de Especies Marinas Amenazadas (CREMA), Asociación Latin American Sea Turtles (LAST), Associação de Proteção e Conservação Ambiental Cabo de São Roque, CLS America, Fabien Cousteau Ocean Learning Center, Fundación Coriácea, La Tortuga Laúd, Lotek, Nest Domes, SEE Turtles, The State of the World's Sea Turtles (SWOT), The Turtleman Foundation, Universidad del Sinú, Wildlife Computers, and WWF Australia.

Fundraising: Generous funding by many entities made the success of the 41st symposium possible. The Society deeply thanks the following donors for their generous and valuable financial support: At the Gold level ($10,000-$24,999): WWF Australia & ShellBank, and National Save The Sea Turtle Foundation. At the Silver level ($5,000-$9,999): Sea Turtle Conservancy. At the Bronze level ($1,000-$4,999): Disney Conservation, Wildlife Computers, International Seafood Sustainability Foundation, Coastal Wildlife Club, Inc., and Lotek. At the Aluminum level ($500-$999): AZA Sea Turtle SAFE Program, Upwell Turtles, Centro de Investigación para el Manejo Ambiental y el Desarrollo (CIMAD), and The Leatherback Trust. At the Inconel level ($25-$499): Yonat Swimmer, Ecological Associates, Inc., Sea Turtle Week, and Pendoley Environmental.

Communications: The large communication effort was undertaken to promote the symposium and that effort was recognized, thanked, and congratulated by the Society's membership. The communications committee was led by Ingrid Yañez and Paul Whittock. Communication efforts focused on four areas: continuously updating the Society and Symposium webpages; sending e-mail messages to the Society's membership regarding important information, dates, events, etc.; dissemination of information on social media; and photographic and video documentation during the symposium. For the latter, an appointed photographer (Marcos Cossio) captured moments during all of the symposium's activities. Short interviews were conducted and included in recap videos that were created for each day and subsequently shared the following morning. A final video containing footage from the entire week was shared during the Closing Remarks. All communications were in English and Spanish since the symposium was held in Colombia and a large proportion of the audience was from Latin America.

Acknowledgments: Organizing the 41st International Sea Turtle Symposium took a large number of individuals in various committees: registrars, fundraising, website, travel grants, program, posters, special sessions, workshops & regional meetings, videos, vendors & exhibitors, students, auctions, turtle trading post, awards, and proceedings committees. All of them gave a significant number of hours, effort and dedication –many months in advance- towards their entrusted tasks to make the 41st symposium an **Unforgettable Gathering**.

By alphabetical order of their first name, the Society thanks Adolfo Marco, Adriana Cortés, ALan Rees, Alberto Abreu, Alejandra Sandoval, Alejandro Fallabrino, Alexander Gaos, Aliki Panagopoulou, Amalia Maria Cano, Amanda Southwood, Aminta Jauregui, Ana Barragán, Ana Liria, Ana Moncada, Andrea Phillott, Andres Estrades, Andrews Agyekumhene, Angela Formia, Ani Henriquez, Anjelika Solé Abdo Abou Issa, Ann Marie Lauritsen, Anna Ortega, Antonio Trujilo, Ashleigh Bandimere, Bia Dias, Blair Bentley, Brad Nahill, Brendan Godley, Brian Hutchinson, Bryan Wallace, Camila Mazzoni, Carmen Mejías, Catherine Hart, Christine Hof, Chris Long, Cindy Vargas, Daniel González, Daniela Freggi, Daniela Rojas, Daphne Wrobel, Dawn Witherington, Diana del Pilar Ramírez, Diego Amorocho, Emily Duncan, Erin Seney, Fanny Suarez, Frank Paladino, Gabriela Arango, Gabriela Vélez, Georgina Zamora, Hector Barrios, Imed Jribi, Ingrid Yañez, Irene Kelly, Jack Frazier, Jacques Fretey, Janie Reavis, Jeanette Wyneken, Jeffrey Mangel, Jeffrey Seminoff, Jesse Senko, Jesús Tomás, Jimena Gutiérrez, Joseph Pfaller, José Matarezi, José Urteaga, Juan Manuel Rodriguez, Juan Sebastian Ayala, Kara Dodge, Karen Eckert, Karla Barrientos, Kate Mansfield, Katharine Hart, Kellie Pendoley, Kelly Stewart, Kirsty Scott, Lalith Ekanayake, Laura Prosdocimi, Liliana Poggio, Lisa Komoroske, Luis German Naranjo, Lyndsey Tanabe, Manjula Tiwari, Marco García, Marcos Cossio, Mariana Fuentes, Mariela Pajuelo, Marina Zucchini, Mariluz Parga, Mark Hamann, Matt Ware, Matthew Godfrey, Matthew Lettrich, Matthew Ramirez, Michael Salmon, Michel Nalovic, Mustapha Aksissou, Natalia Teryda, Natalie Wildermann, Nathan Robinson, Neca Marcovaldi, Nicholas Blume, Nicholas Pilcher, Paul Whittock, Pilar Santidrián, Rachel Smith, Raul Garcia, Ray Carthy, Rebecca Mott, Renato Bruno, Richard Reina, Rita Patricio, Rocío Alvarez, Rod Mast, Roldán Valverde, Ryan Welsh, Shaleyla Kelez, Sam Weber, Sandra Hochscheid, Seh Ling Long, Shaya Honarvar, Stephen Dunbar, Summer Martin, Terry Meyer, Trevor Proctor, Ximena Rojas, Ximena Vélez, Yakup Kaska, Yonat Swimmer, Zahirul Islam, and Zoe Meletis.

The Society also thanks the 122 volunteers that were assigned on-site in different tasks: Aarston Dickson, Abigail Flowers, Alex Fireman, Alma Váquez, Aloysse Abreu, Amelly Ramos, Anahí Guadalupe, Andrea Hernández, Anna Ortega, Anuar Romero, Arona Bender, Astrid Luna, Bárbara Selles, Brenda Espinoza, Brittany Chang, Brittany Clemans, Camila Miguel, Camille Clarke, Camille Kynoch, Carlos Calagua, Carlos Pacheco, Chiara Agabiti, Claudia Rodríguez, Costanza Manes, Daiane Santana, Daniela Cabellero, Diana del Pilar Ramirez, Eamy Ayala, Elizabeth Gutiérrez, Emily Christiansen, Eneida Fajardo, Felipe Baker, Felix Moncada, Gabrielle Gagliotti, Gilberto Borges, Giovanna Martins, Gisela Marin, Gloria Guerrero, Guilia Baldi, Gustavo Ortíz, Ho Kooi Chee, Irama Perozo, Jack Wiggins, Jaime Restrepo, Jeffry Madrigal, Julia Azanza, Juliana Masis, Julie Barrios, Keilor Cordero, Keithlyin Rankin, Kendra Cope, Lara Heguaburu, Liberty Boyd, Luis Angel Tello, Luna Vieira, Mariana Inglés, Maria Dabrowski, Mariantú Robles, Marvin Pineda, Melissa Martinez, Melissa Valle, Netftaly Sánchez, Paris Organist, Perla Fernández, Priscilla Santos, Quintin Bergman, Raidel Borroto, Randy Calderón, Rebecca Diggins, Samantha Trail, Sarah Sexton, Sarah Shaver, Seh-Ling Long, Sofia Chavarria, Sofia Jones, Sophia Coveney, Teal Guetschow, Veronica Valverde, and the students from Universidad del Sinú.

Last but not least, the Society thanks Carlos Salas and Carlos Delgado for providing beautiful photos for the banners that embellished the conference rooms; and Alejandra Marines for providing an image for the COVID-19 precautions signage.

42nd Annual Symposium on Sea Turtle Biology and Conservation, 24-29 March, 2024 in Pattaya, Thailand

Stephen G. Dunbar
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In 2024, the 42nd Annual Symposium on Sea Turtle Biology and Conservation, hosted each year by the International Sea Turtle Society, will be held in the beautiful country of Thailand for the first time, and in Southeast Asia for only the second time in the symposium's history. The theme of the symposium is: "All In – All Together; Inspiring the next generations of sea turtle conservationists," as a call for us to unite as a global community to achieve our overarching goals of ensuring that sea turtles continue to thrive around the globe, and that new generations of sea turtle researchers and conservationists are inspired to continue this ongoing work.

The symposium will be held from 24-29 March, 2024 at the Dusit Thani Pattaya Hotel in the vibrant city of Pattaya, along the eastern coast of the Gulf of Thailand. Dusit Thani reflects an elegant Thai style in accommodations, cuisine, and hospitality, while Pattaya city boasts a rich and inviting cultural heritage, including a multitude of restaurants hosting international cuisine, opportunities to explore important nearby sites of cultural importance, local parks, extensive shopping, and ways to visit the Sattahip Sea Turtle Center that serves as the main focus of sea turtle conservation in Thailand. Both the capital city of Bangkok and the symposium host city of Pattaya offer easy jumping off points for those who wish to explore Thailand as the gateway to Southeast Asia before or after the conference.

We expect more than 600 participants from around the world to attend the Symposium, with special participation from the Indian Ocean, Asia, and Southeast Asia regions, highlighting the exciting research and conservation efforts taking place throughout the Asia-Pacific region as a whole. The first two pre-conference days will focus on regional meetings and a variety of practical workshops for which attendees will want to be present. The student mixer and opening social will feature international food stalls and local entertainment, while the closing banquet will be an elegant formal affair you will not want to miss. Special sessions on technology, fisheries biology, and community conservation (among others), will provide opportunities for students, researchers, government officials, and community members to present their conservation efforts and research findings among an engaging community of peers.

The symposium registration website (https://www.ists42thailand.org) will go live later this fall, with all the needed information regarding registering, deadlines, and helpful links for planning your trip and time at the Symposium and in Thailand. Be sure to plan to register early.

I and my entire organizing team encourage you to begin planning now to attend the 42nd International Sea Turtle Symposium, 24-29 March, 2024. We extend a warm and inviting *WELCOME* to you to join us in Pattaya, Thailand and look forward to seeing you there!

RECENT PUBLICATIONS

This section consists of publications, books, reports, and academic theses that feature subject material relevant to marine turtles. Most references come from major search engines, and the editors encourage authors to submit their publications directly by email to the Recent Publications editor: mtnrecentpubs@gmail.com.

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