Marine Turtle Newsletter

Issue Number 153 *April 2017*

Male hawksbill turtle emergence just above the surf zone, on Cousine Island, Seychelles. See pages 9-10.
Photo by Nina Voogt.

ISSN 0839-7708

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Successful Use of Buccal Swabs to Obtain Genetic Material from Loggerhead Sea Turtles (*Caretta caretta*)

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Traditionally, the use of genetic material from sea turtles has been acquired from adult individuals employing invasive techniques like taking blood or skin tissue to obtain DNA. These methods tend to be expensive and time consuming and may harm or stress the individuals sampled, particularly neonates and juveniles because blood is usually drawn from the dorsal cervical sinus in the neck or from the femoral venous plexus in the hind flipper (Wyneken 2001; Wallace & George 2007), while skin is sampled using a razor blade or biopsy punch to collect tissue from the top few layers of the turtle's epidermis (Dutton & Balazs 1995; Dutton 1996). Both methods, particularly blood sampling, require sample-handling protocols that may not be feasible under challenging field conditions or they may not be permitted by regulatory agencies. It is often necessary to hire a specialized technician as it takes expert skills to take the sample, as well as prophylactic processes required to decrease the risk of infection. Biological samples obtained from juvenile loggerhead turtles (*Caretta caretta*) have been used to isolate DNA employing traditional protocols, which has resulted in several common difficulties such as creating wounds and increasing stress levels. Here we propose the use of buccal swabs as an alternative method to avoid these complications on these relatively fragile life stages (Deelman *et al.* 2002; Freeman *et al.* 2003); this method is based on briefly scraping epidermal cells from the mouth, providing sufficient amounts of tissue to extract DNA for genetic studies. This technique has been used for reptiles such as tuataras, *Sphenodon punctatus* (Miller 2006), newts, *Triturus alpestris*, and frogs, *Hyla arborea* (Broquet *et al.* 2007). However, in collecting DNA for endangered species such as marine turtles it has had limited implementation (Lanci *et al.* 2012).

The buccal swab method is an easy way to obtain biological samples from sea turtles of any size and life stage that would prevent damage to individuals. This is a low-cost method that can be applied to multiple individuals in a relatively short time when gravid females or neonates aggregate along the beach or are individually captured in the sea. The information obtained from genetic analyses constitutes one of the most relevant lines of evidence to understand levels of organization and variability of populations (Marco *et al.* 2009). The identification of haplotypes is useful in conservation management, particularly since sea turtles have been exploited around the world during recent decades with resulting population declines. Low population recruitment results in an imbalance in population dynamics and decreased survival rates in the population increases the risk of extinction (Margalef 1977; Eckert 2002). The loggerhead turtle is currently considered Endangered (EN) internationally (www.redlist.org) and Critically Endangered ("Peligro critico") in Colombia (Castaño-Mora 2002). Therefore, it is important to study population structure in terms of variability, heterozygosity and allelic diversity as part of conservation efforts to protect loggerheads in different habitats and along migration routes.

The 20 loggerhead samples were obtained from head-started juveniles at the Sea Turtle and Marine Mammals Conservation Program (ProCTMM) of the Jorge Tadeo Lozano University research group "Dinámica y Manejo de Ecosistemas Marinos y Costeros (DIMARCO)," category A-COLCIENCIAS. Dermal epithelial cells were taken while the mouth was carefully kept open using cables and hoses for better handling and with a sterile cotton applicator scraping was performed on the tongue and on the palate for approximately 5 seconds. This was done with the endorsement of the Corporación Autónoma Regional del Magdalena-Corpamag, through cooperation agreement Nº 04 de 2011. The research permit was granted by DADMA resolution No. 081 of 5 April 2011; these organizations are local and regional environmental authorities, respectively.

DNA was isolated from 20 buccal swabs collected from juveniles (approximately 3 months in age, average carapace length = 15 cm). Different sterilized cotton swabs were used for each turtle to avoid contamination during the buccal swab sampling process. Each sample was immersed in 500 uL of lysis buffer (SDS 2%), followed by proteinase K (Bioline) digestion for 16 h at 65°C. Samples were cooled to -4 °C for 30 min, DNA precipitation was done with 500 µl of 5 M NaCl and centrifuged at 13,000 RPM for 30 min at 4 °C. 500 µl of supernatant was mixed with 500 µl of -4 °C isopropyl alcohol. Samples were kept at this temperature for 16 h. The samples were centrifuged at 13,000 RPM for 20 min to purify and isolate genetic material, and then the aqueous phase was discarded. 500 µl of 70% ethanol was added to wash out impurities and the sample was centrifuged at 13,000 RPM for 20 min at -4 °C. Ethanol was carefully discarded and the remaining alcohol was dried on paper towels with the sample tubes upside down for 3 h. Finally, 40 µl of TE buffer was added to preserve the DNA. An electrophoresis gel was carried out on a 1.3% agarose gel to confirm DNA isolation (Fig. 1).

To assess DNA quantity and quality, 1 µl of each DNA sample was added to a Nanodrop® ND-2000 Spectrophotometer (Thermo Scientific). Absorbance was measured at wavelengths of 260 nm and 280 nm, and relative absorbance ratios (260/280 nm and 260/230 nm) were calculated to evaluate the DNA purity obtained from the buccal samples.

PCR amplification (Saiki *et al.* 1988) was carried out for 20 buccal swab samples, using primers designed by Norman *et al.* (1994).

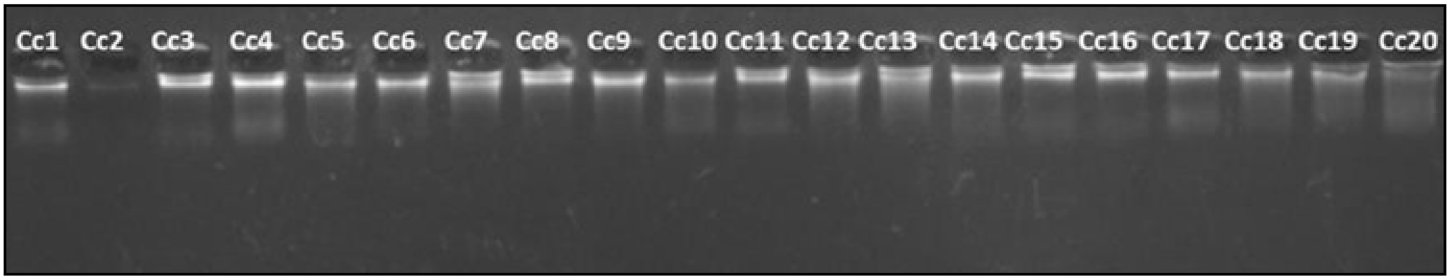

Figure 1. DNA agarose gel electrophoresis of 20 loggerhead DNA samples isolated from buccal swabs.

We amplified a 380-bp D-loop mitochondrial control region with the primers TCR5 TTGTAGATCTACTTATTTAGCAC and TCR6 GTAGGTAGAAGTAAAAGTAGGGTATGGC. PCR products were checked on a 2.3% agarose gel (Fig. 2) and sequenced using the Sanger method (Macrogen). Sequences were edited, aligned and compared with available sequences from BLAST databases using Geneious software (version 8.0.3, http://www.geneious.com; Kearse *et al.* 2012).

Genetic material isolated from buccal swabs of 20 *C. caretta* individuals had high DNA quality and quantity, low degradation and low quantities of RNA (Fig. 1). The samples had 260/280 ratios of <2.0 (mean = 1.87). The 260/230 ratios were higher with range of 0-3.84 with a mean ±SD of 1.24 ±2.43. As a point of reference, we compared our results with those done by Lanci *et al.* (2012); we found similar results and concentrations.

All sequences identified corresponded to known *C. caretta* haplotypes. After maximum likelihood analyses of the 15 sequences, three haplotypes (CC-A1, CC-A2 and CC-A17) were found from the nesting sea turtle population from Don Diego beach (Santa Marta, Colombia). With the BLAST search, we found these haplotypes from Green Cape in Cape Verde and in Brazil nesting sea turtles (CC-A.1 and CC-A.17 haplotypes); these locations have major aggregations of nesting *C. caretta*. DNA haplotypes from our specimens correspond to relatively well-known feeding areas (CC-A.1 and CC-A.2 haplotypes) (Garofalo *et al.* 2013), and migration routes (haplotype CC-A.2) (LaCasella *et al.* 2013). Haplotypes CC-A1 and CC-A2 are ancestral and likely originate in lineages from Atlantic and Mediterranean Sea populations. The presence of these haplotypes among the Western Atlantic Ocean, the Mediterranean Sea, and Indian Ocean basins may suggest a sequence of colonization as these haplotypes occur regularly in these regions (Franco 2010). Haplotype CC-A17.1, from Cape Verde (Africa), is a foraging area, and the second oldest known colony in the Atlantic (Shamblin *et al.* 2014). These haplotypes are shared throughout the North Atlantic and the Mediterranean; the North Atlantic gyre circulation pattern likely helps the colonization of new beaches and foraging areas.

The data we obtained here reveal the genetic potential in terms of variability for *C. caretta* in Colombia. It is urgent to carry on genetic studies including analyses for longer sequences (800 bp), with the aim of clarifying the structure and genetic relationship of Colombian loggerheads with global populations. We conclude that the buccal swab method of tissue collection is effective, easy, fast, and an economic alternative to obtain good quality and quantity DNA. This non-invasive technique is advantageous over invasive procedures, with possibly less damage to an individual. Also, this method can provide similar results in less time with fewer resources, thereby providing scientific contributions for future research. Nevertheless, the use of blood and skin samples allows for replication of the process and the storage of subsamples for further study. Using the swabs, this is more difficult, because extracting the DNA for a second time is not guaranteed because most of the cells are used in the initial extraction.

Our genetic results indicate that Colombia turtles share relationships with global aggregations, bringing awareness that Colombia is an important habitat for turtles; protection and conservation of sea turtles there must be a priority. This points out the urgent need for increased research efforts and protection of marine ecosystems such as nesting habitat, with the aim of controlling and reduce numerous anthropogenic threats and deterioration that may affect the permanence of these populations.

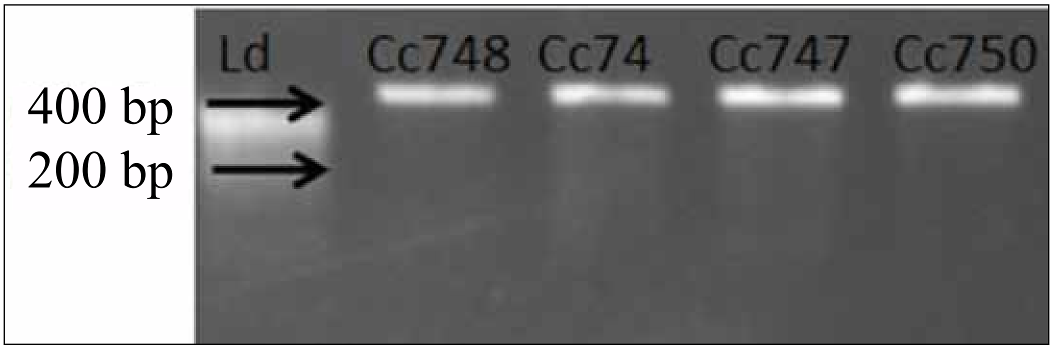

Figure 2. Electrophoresis of PCR products, amplicon of 388 bp corresponding to the control region of the mtDNA of loggerheads. Ld = ladder.

BOWEN, B., J.C. AVISE, J.I. RICHARDSON, A.B. MEYLAN, D. MARGARITOULIS & S.R. HOPKINS-MURPHY. 1993. Population structure of loggerhead turtles (*Caretta caretta*) in the northwestern Atlantic Ocean and Mediterranean Sea. Conservation Biology 7: 834-844.

BOWEN, B.W., N. KAMEZAKI, C.J. LIMPUS, G.R. HUGHES, A.B. MEYLAN & J.C. AVISE. 1994. Global phylogeography of the loggerhead turtle (*Caretta caretta*) as indicated by mitochondrial DNA haplotypes. Evolution 48: 1820-1828.

BOWEN, B.W., A.L. BASS, S-M. CHOW, M. BOSTROM, K.A. BJORNDAL, A.B. BOLTEN, T. OKUYAMA, B.M. BOLKER, S. EPPERLY, E. LACASELLA, D. SHAVER, M. DODD, S.R. HOPKINS-MURPHY, M. SWINGLE, K. RANKIN-BARANSKY, W. TEAS, W.N. WITZELL & P.H. DUTTON. 2004. Natal homing in juvenile loggerhead turtles (*Caretta caretta*). Molecular Ecology 13: 3797-3808.

BOWEN, B.W & S.A. KARL. 2007. Population genetics and phylogeography of sea turtles. Molecular Ecology 16: 4886-4907.

BROQUET, T., L. BERSET-BRAENDLI, G. EMARESI & L. FUMAGALLI. 2007. Buccal swabs allow efficient and reliable microsatellite genotyping in amphibians. Conservation Genetics 8: 509-511.

CASTAÑO-MORA, O.V. (Ed.). 2002. Libro rojo de reptiles de Colombia. Serie Libros Rojos de Especies Amenazadas de Colombia. Instituto de Ciencias Naturales - Universidad Nacional de Colombia y Ministerio del Medio Ambiente. Bogotá, Colombia.

DEELMAN, L.E., E.A. VAN DER WOUDEN, M. DUIN & R.H. HENNING. 2002. A method for the ultra-rapid isolation of PCR-ready DNA from urine and buccal swabs. Molecular Biology Today 3: 51-54.

DUTTON, P.H. 1996. Methods for collection and preservation of samples for sea turtle genetic studies. In: Bowen, B.W. & W.N. Witzell (Eds.). Proceedings of the International Symposium on Sea Turtle Conservation Genetics. NOAA Tech Memo NMFS-SEFSC-396, 17pp.

DUTTON, P.H. & G. BALAZS. 1995. Simple biopsy technique for sampling skin for DNA analysis of sea turtles. Marine Turtle Newsletter 69: 9-10.

ECKERT, S.A. 2002 Swim speed and movement patterns of gravid leatherback sea turtles (*Dermochelys coriacea*) at St. Croix, U.S. Virgin Islands. Journal of Experimental Biology 205: 3689-3697.

FRANCO, A. 2010. Haplotypes of the loggerhead turtle *Caretta caretta* (Testudines: Cheloniidae): first study in individuals from the beaches Don Diego (Magdalena) and Isla San Martin (Bolivar), Colombian Caribbean. Jorge Tadeo Lozano University. Faculty of Natural Sciences and Engineering. Marine Biology Program. Bogotá, Colombia. 78pp.

FREEMAN, B., N. SMITH, C. CURTIS, L. HUCKETT, J. MILL & I.W. CRAIG. 2003. DNA from buccal swabs recruited by mail: evaluation of storage effects on long-term stability and suitability for multiplex polymerase chain reaction genotyping. Behavior Genetics 33: 67-72.

GAROFALO, L., A. MASTROGIACOMO, P. CASALE, R. CARLINI, C. ELENI, D. FREGGI & A. NOVELLETTO. 2013. Genetic characterization of central Mediterranean stocks of the loggerhead turtle (*Caretta caretta*) using mitochondrial and nuclear markers, and conservation implications. Aquatic Conservation: Marine and Freshwater Ecosystems 23: 868-884.

KEARSE. M., R. MOIR, A. WILSON, S. STONES-HAVAS, M. CHEUNG, S. STURROCK, S. BUXTON, A. COOPER, S. MARKOWITZ, C. DURAN, T. THIERER, B. ASHTON, P. MENTJIES & A. DRUMMOND. 2012. Geneious Basic: an integrated and extendable desktop software platform for the organization and analysis of sequence data. Bioinformatics 28: 1647-1649.

LACASELLA, E.L., S.P. EPPERLY, M.P. JENSEN, L. STOKES & P.H. DUTTON. 2013. Genetic stock composition of loggerhead turtles *Caretta caretta* bycaught in the pelagic waters of the North Atlantic. Endangered Species Research 22: 73-84.

LANCI, A., S. RODEN, A. BOWMAN, E. LACASELLA, A. FREY & P.H. DUTTON. 2012. Evaluating buccal and cloacal swabs for ease of collection and use in genetic analyses of marine turtles. Chelonian Conservation & Biology 11: 144-148.

MARCO, A., C. CARRERAS & E. ABELLA. 2009. Tortuga boba-*Caretta caretta* (Linnaeus, 1758). Enciclopedia Virtual de los Vertebrados Españoles. Salvador, A. & A. Marco (Eds.). Museo Nacional de Ciencias Naturales. www.vertebradosibericos.org

MARGALEF, R. 1977. Ecología. Universidad de Barcelona. Omega, SA Barcelona, Spain.

MILLER, H.C. 2006. Cloacal and buccal swabs are a reliable source of DNA for microsatellite genotyping of reptiles. Conservation Genetics 7: 1001-1003.

NORMAN, J.A., C. MORITZ & C.J. LIMPUS. 1994. Mitochondrial DNA control region polymorphisms: genetic markers for ecological studies of marine turtles. Molecular Ecology 3: 363-373.

SAIKI, R.K., D.H. GELFAND, S. STOFFEL, S.J. SCHARF, R. HIGUCHI, G.T. HORN & H.A. ERLICH. 1988. Primer-directed enzymatic amplification of DNA with a thermostable DNA polymerase. Science 239: 487-491.

SHAMBLIN, B.M., A.B. BOLTEN, F.A. ABREU-GROBOIS, K.A. BJORNDAL, L. CARDONA, C. CARRERAS, M. CLUSA, C. MONZÓN-ARGÜELLO, C.J. NAIRN, J.T. NIELSEN, R. NEL, L.S. SOARES, K.R. STEWART, S.T. VILAÇA, O. TÜRKOZAN, C. YILMAZ & P.H. DUTTON. 2014. Geographic patterns of genetic variation in a broadly distributed marine vertebrate: new insights into loggerhead turtle stock structure from expanded mitochondrial DNA sequences. PloS ONE 9: e85956.

TAMURA, K & M. NEI. 1993. Estimation of the number of nucleotide substitutions in the control region of mitochondrial DNA in humans and chimpanzees. Molecular Biology and Evolution 10: 512-526.

TAMURA, K., G. STECHER, D. PETERSON, A. FILIPSKI & S. KUMAR. 2013. MEGA6: Molecular Evolutionary Genetics Analysis version 6.0. Molecular Biology and Evolution 30: 2725-2729.

WALLACE, B.P. & R.H. GEORGE. 2007. Alternative techniques for obtaining blood samples from leatherback turtles. Chelonian Conservation & Biology 6: 147-150.

WYNEKEN, J. 2001. The Anatomy of Sea Turtles. NOAA Tech Memo NMFS-SEFSC-470. 172pp.

YILMAZ, C., O. TURKOZAN & F. BARDAKCI. 2011. Genetic structure of loggerhead turtle (*Caretta caretta*) populations in Turkey. Biochemical Systematics and Ecology 39: 266-276.

A Leatherback Sea Turtle Entangled in Fishing Net in Mersin Bay, Mediterranean Sea, Turkey

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Three species of marine turtles, the loggerhead *Caretta caretta*, the green turtle *Chelonia mydas* and the leatherback *Dermochelys coriacea*, are found regularly in the Mediterranean (Godley *et al*. 1998; Margaritoulis 2003; Rees *et al*. 2004). Loggerhead and green turtles nest in the eastern Mediterranean, while leatherbacks are considered migrants from the wider Atlantic (Godley *et al*. 1998; Margaritoulis 2003; Casale *et al*. 2003).

Casale *et al*. (2003) reported a total of 411 records of leatherback turtles for the whole of the Mediterranean. Rees *et al*. (2004) reported a live leatherback turtle in the coast of Syria. From the coast of Israel, one leatherback was captured incidentally in a trawler net, and subsequently died from debris ingestion (Levy *et al*. 2005) and another stranded dead entangled with a static long-line (Levy 2010). Bearzi *et al*. (2015) reported a leatherback in the semi-enclosed Gulf of Corinth, Greece. Türkozan & Kaska (2010) summarized records for this species from the Aegean and Mediterranean coasts of Turkey, including a dead leatherback found stranded on the shore of the Anamur-Bozyazı Highway in southeastern Turkey (for details, see Taşkavak & Farkas 1998). Here we report on another leatherback entangled in fishing nets on the coast of Mersin.

On 11 May 2016, a leatherback was observed in Mersin Bay, about 3 m from the shoreline on Adnan Menderes Avenue, Mersin (36.7766 °N, 34.5837 °E). The leatherback's head, front right and left flippers were entangled in a piece of net that appeared to have been clipped from a larger net, presumably by a fisherman. The leatherback was observed passively floating at the surface of the water, entangled in the piece of net. One of the authors (AHU) swam to the turtle and cut the net with clippers, in order to free the head and right front flipper. Subsequently, the turtle was observed to breath and use its flippers. Soon after, the turtle dove beneath the surface of the water before the net attached to the left front flipper could be freed. The turtle appeared to swim away easily, and it was assumed that the remaining net would fall off eventually. The turtle was not measured and sex was not verified. The total length of the turtle was less than the height of the researcher who freed it (180 cm). The turtle was photographed but it is not possible to discern tail length (Fig. 1). We recommend that efforts should be made to include the tail in photographs of future incidents of stranded turtles, to allow sex to be assigned.

Figure 1. Floating leatherback, entangled in fishing net, off Adnan Menderes Avenue, in Mersin Bay, Turkey, on 11 May 2016.

	Location	Date	Type of encounter	Condition	Sex	Reference
Aegean coast of Turkey	Edremit Bay, near Ören, Balıkesir province	1997-10-05	Entangled in gill nets set in 10-13 m water	Dead	A large subadult, male	Baran *et al.* 1998; Taşkavak *et al.* 1998
	İzmir Bay, between Foça and Karaburun, İzmir province	Last week November 1997	Captured in trammel net, brought ashore, released back to sea	Alive	Unknown	Taşkavak & Farkas 1998
	Coast of İzmir Bay, İzmir province	2011-10-28	Stranded on the coast; two deep transversal cuts on carapace	Dead	Mature, female	Taşkavak *et al.* 2015
Southern coast of Turkey	Antalya province	1985	Captured by fishermen and brought to the harbor of Antalya	Unknown	Unknown	Baran & Kasparek 1989
	Strait of Hurma, Karataş, Adana province	1994	Photographed by officials of the Ministry of Agriculture and Rural Services, Karataş District Directorate, as it landed on the shore dead in the Strait of Hurma	Dead	Adult, unknown sex	Oruç *et al.* 1997; Oruç 2001; Türkozan & Kaska 2010
	Karataş, Adana province	1995	Found dead in nets by the fishermen of Karataş	Dead	Unknown	Oruç *et al.* 1997; Oruç 2001
	Coastline near the Anamur-Bozyazı Highway, Mersin province	1998	Stranded between rocks on the shore	Dead	Unknown	Taşkavak & Farkas 1998
	Beach in İskenderun Bay, İskenderun, Hatay province	2006-06-06	Stranded dead on the beach; originally tagged in 2005 while nesting at Matura beach, Trinidad	Dead	Adult female	Sönmez *et al.* 2008.
	In Mersin Bay, off Adnan Menderes Ave., Mersin, Mersin province	2016-05-11	Observed about 3 m offshore, entangled in fishing nets	Alive	Unknown	This study

Table 1. Reports of the leatherback turtle (*Dermochelys coriacea*), coasts of Turkey.

Local fishermen report that they occasionally encounter leatherbacks (Oruç 2001). To date, there are three records of leatherbacks from the Aegean coasts of Turkey (Taşkavak et. al. 1998; Taşkavak & Farkas 1998; Taşkavak et. al. 2015) and five records of leatherback from southern coasts of Turkey (Baran & Kasparek 1989; Oruç *et al*. 1997; Oruç 2001; Taşkavak & Farkas 1998; Sönmez *et al*. 2008) (Table 1). This new record of the leatherback turtle is reported from the coast of Mersin, Turkey, increasing the total number of records in southern coasts of Turkey to six and the total number of records in coasts of Turkey to nine.

Acknowledgements. We thank the Department of Municipal Police of Mersin Metropolitan Municipality for alerting us to this occurrence.

BARAN, İ. & M. KASPAREK. 1989. Marine turtles - Turkey. Status survey 1988 and recommendations for conservation and management. WWF, Hedielberg, Germany. 123pp.

BARAN, İ., S.H. DURMUŞ & O. TÜRKOZAN. 1998. Erster Nachweis der lederschildkröte, *Dermochelys coriacea* (Linnaeus, 1766) (Testudines: Dermochelyidae) aus türkischen gewässern. Herpetofauna 20: 34-37.

BEARZI, G., P. CASALE, D. MARGARITOULIS, S. BONIZZONI, & N.L. SANTOSTASI. 2015. Observation of a leatherback sea turtle, *Dermochelys coriacea*, in the Gulf of Corinth, Greece. Marine Turtle Newsletter 146: 6-9.

CASALE, P., P. NICOLOSI, D. FREGGI, M. TURCHETTO & R. ARGANO. 2003. Leatherback turtles (*Dermochelys coriacea*) in Italy and in the Mediterranean Basin. Herpetological Journal 13: 135-139.

GODLEY, B.J., A.C. GÜCÜ, A.C. BRODERICK, R.W. FURNESS & S.E. SOLOMON. 1998. Interaction between marine turtles and artisanal fisheries in the eastern Mediterranean: a probable cause for concern? Zoology in the Middle East 16: 49-64.

LEVY, Y., R. KING & I. AIZENBERG. 2005. Holding a live leatherback turtle in Israel: lessons learned. Marine Turtle Newsletter 107: 7-8.

LEVY, Y. 2010. Israel. In: Casale, P. & D. Margaritoulis (Eds.). Sea Turtles in the Mediterranean: Distribution, Threats and Conservation Priorities. IUCN/SSC Marine Turtle Specialist Group, Gland, Switzerland. pp. 113-133.

MARGARITOULIS, D. 2003. The status of marine turtles in the Mediterranean. In: Margaritoulis, D. & A. Demetropoulos (Eds.). Proceedings of the First Mediterranean Conference on Marine Turtles. Barcelona Convention-Bern Convention-Bonn Convention, Nicosia, Cyprus. pp. 51-61.

ORUÇ, A., F. DEMİRAYAK & G. ŞAT. (1997). Trawl fisheries in the eastern Mediterranean and its impact on sea turtles: the conclusive report. DHKD-WWF, İstanbul, Turkey. 30pp. (in Turkish).

ORUÇ, A. 2001. Trawl fisheries in the eastern Mediterranean and their impact on marine turtles. Zoology in the Middle East 24: 119-125.

REES, A.F., A. SAAD & M. JONY. 2004. First record of a leatherback turtle in Syria. Marine Turtle Newsletter 106: 13.

SÖNMEZ B., D. SAMMY, Ş. YALÇIN-ÖZDİLEK, Ö. A. GÖNENLER, U. AÇIKBAŞ, Y. ERGÜN & Y. KASKA. 2008. A stranded leatherback sea turtle in the Northeastern Mediterranean, Hatay, Turkey. Marine Turtle Newsletter 119: 12-13.

TAŞKAVAK, E. & B. FARKAS, 1998. On the occurrence of the leatherback turtle, *Dermochelys coriacea*, in Turkey (Testudines: Dermochelyidae). Zoology in the Middle East 16: 71-75.

TAŞKAVAK, E., R. H. BOULON & M. K. ATATÜR. 1998. An unusual stranding of a leatherback turtle in Turkey. Marine Turtle Newsletter 80: 13.

TAŞKAVAK, E., S.C. AKÇINAR & C. İNANLI, 2015. Rare occurrence of the leatherback sea turtle, *Dermochelys coriacea*, in İzmir Bay, Aegean Sea, Turkey. Ege Journal of Fisheries and Aquatic Sciences 32: 51-52.

TÜRKOZAN, O. & Y. KASKA. 2010. Turkey. In: Casale, P. & D. Margaritoulis (Eds.). Sea Turtles in the Mediterranean: Distribution, Threats and Conservation Priorities. IUCN/SSC Marine Turtle Specialist Group, Gland, Switzerland. pp. 257-293.

Long Distance Movement Between Nesting Sites for Two Green Turtles in the Eastern Mediterranean

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The green sea turtle (*Chelonia mydas* L. 1758) has a complex life history that is difficult to study directly. Much of what is known about life history of green turtles has come from studies focused at nesting beaches (Bowen *et al.* 1992). Hatchlings and juveniles move among several habitats during development, and adults migrate between foraging and nesting grounds (Carr 1980). During a single nesting season, an adult female typically lays two to seven clutches, each consisting around 100+ eggs. Hatchlings emerge after incubation and enter an oceanic habitat where they may remain for several years until the juvenile period (Carr 1987). Juveniles eventually recruit to neritic foraging habitats and switch to a primarily herbivorous adult diet (Pritchard 1976).

There are two important hypotheses about the philopatric behavior of female green turtles, who are observed to return to the same nesting sites year after year. The "natal homing" hypothesis states that females return to the same nesting region where they had hatched, to nest in successive seasons (Carr & Orgen 1960; Carr 1967). The hypothesis has been most extensively developed for green turtles. Another hypothesis, proposed by Hendrickson (1958) and Owens *et al.* (1982), is the "social facilitation" hypothesis and suggests that first-time nesting females follow older, experienced females to a nesting beach. Once the neophyte adult females successfully nest, they will return to that site for future egg deposition. Historically, these hypotheses were difficult to test directly, in part because of the logistical challenge of applying tags to hatchlings that would be observed on the nesting beach when they return as adults. Tagging data of nesting females can be informative of female nest site choice (Pritchard 1976), although neophyte nesting females cannot be tagged until they have already chosen a nesting beach, and incomplete monitoring effort for tagged females using nesting beaches at night remains a logistical challenge.

Natal homing should result in demographically distinct assemblages of nesting females, because successive generations of daughters should return to the same beach to nest. In contrast, social facilitation should result in high rates of female-mediated gene flow across nesting beaches (Bowen *et al*. 1992). Overall, analyses of mitochondrial DNA, which is maternally inherited, indicate that assemblages of nesting females are demographically isolated, which supports natal homing (Lohmann *et al.* 2013). Nevertheless, there remains some question as to how faithful individual sea turtles are to specific nesting beaches. Here we present records of two green sea turtle adults tagged in two different nesting beaches, that were observed nesting elsewhere in the same nesting season.

The first record comes from a green sea turtle observed laying eggs during the 2006 nesting season on both Akyatan and Yumurtalık beaches. A metal tag (ID: TR-504) was placed on the left front flipper during nesting at Akyatan beach (36.6228 °N, 35.1900 °E) in late June. She measured 95 cm curved carapace length (CCL), 85 cm curved carapace width (CCW), 88.5 cm straight carapace length (SCL), 69 cm straight carapace width (SCW) and weighed 95 kg. This same turtle was seen at Yumurtalık beach (36.6952 °N, 35.6928 °E) while laying eggs in mid-July, by the local field team. These two nesting sites are more than 70 km distance from each other coastally.

The second record comes from a green sea turtle that nested both in Syria and Turkey during the summer of 2011. On 21 June 2011, a green turtle with a plastic tag on its left front flipper (ID: 09/34562) was observed nesting south of Latakia, Syria, on Snoubar beach (35.4370 °N, 35.8984 °E). On 15 July 2011, this same female was observed nesting on Samandağ beach (36.1174 °N, 35.9235 °E). The turtle's measurements were CCL=92 cm, CCW=80 cm, SCL=87 cm, and SCW=68 cm. These two beaches are approximately 100 km apart from each other coastally.

Many sea turtle workers interpret natal homing to mean that females faithfully return to the beaches where they were produced. However, both examples from the individuals given above moved between beaches. Miller (1997) stated that a breeding female turtle will likely place her nests in relatively close proximity (0 to 5 km), although a small percentage utilize more distant nesting sites in the general area. Green turtles are reported to show a high degree of nest site fidelity, such as on Tromelin Island in the Indian Ocean, where most renesting attempts were within 200 m of the previous attempt, with a range of about 600 m (Bosc & Le Gall 1986). Similarly, Hendrickson (1958) found on islands in Malaya and Sarawak that tagged green turtles returned repeatedly to the same beach to nest, although 3-7% failed to return to the same island previously used, and these islands were about 500 m apart. The approximate curved line distances between Snoubar-Samandağ and Akyatan-Yumurtalık beaches are 100 km and 70 km, respectively (Fig. 1). Bjorndal *et al.* (1983) reported the distance between renesting attempts of loggerheads turtles ranged up to 290 km, but the proportion of individuals that moved hundreds of km is low. Margaritoulis (1998) reported that nine individual loggerhead turtles failed to return to the same beach previously used and one of them changed twice. The shortest distances between nests laid in different sites by individual turtles ranged from 85 to 365 km (Margaritoulis, 1998). More recently, Ehrart *et al.* (2014) reported two loggerhead turtles were observed nesting on beaches in the SE USA that were nearly 700 km straight line distance apart. Thus, while many sea turtles may show strong nest fidelity, some may show reduced nest fidelity. Margaritoulis (1998) provided two possible reasons for this observed behavior in some loggerhead turtles. The first is that "disturbances at the nesting site can make an individual turtle change its general nesting area" and the second is that the "individuals that changed

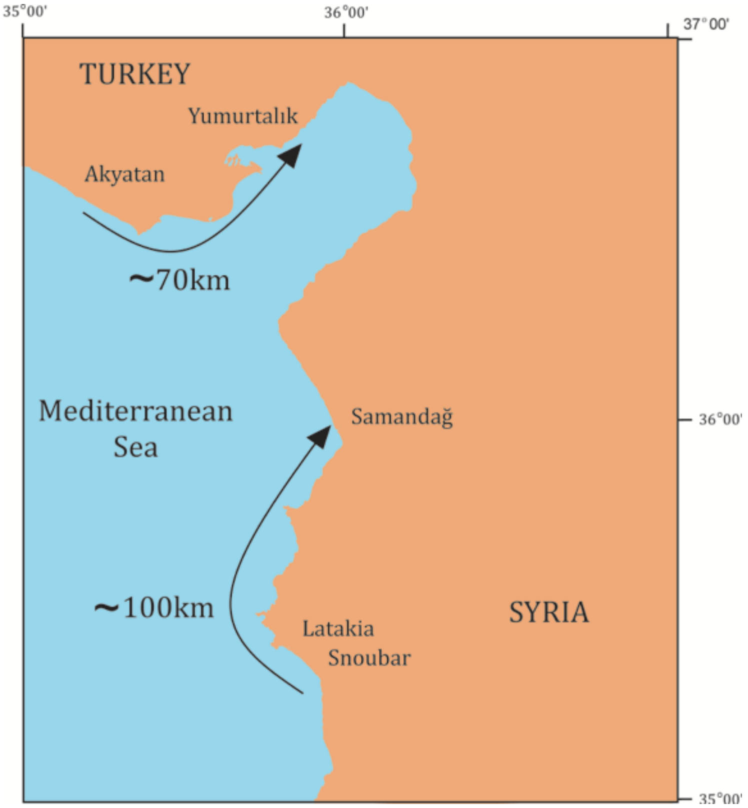

Figure 1. Locations of two different green turtle females that nested on different beaches in the eastern Mediterranean in a single nesting season.

their nesting area, were somehow lost or confused." We add another possible reason: these turtles are opportunistic and will nest in an appropriate nesting area that is available or accessible to them.

Overall, these two records further illustrate that some breeding female green turtles do nest on different beaches, even in the same nesting season, and it is likely "the nesting population" should include adjacent beaches or regions, to account for the longer distances between nests of some individual females in the population.

Acknowledgements. The authors thank the Hatay Provincial Directorate of Nature Conservation and National Parks, the District Governor of Samandağ, the Samandağ Environmental Protection and Tourism Foundation, the volunteer students for their support, and many special thanks to ALan Rees for comments and suggestions.

BJORNDAL, K. A., A.B. MEYLAN & B.J TURNER. 1983. Sea turtle nesting at Melbourne Beach, Florida. I. Size, growth, and reproductive biology. Biological Conservation 26: 65-77.

BOSC, P. & LE GALL, J.Y., 1986. Attachement spatial des tortues vertes *Chelonia mydas* aux plages de l'île de Tromelin (Océan Indien). Oceanologica ACTA 9: 489-495.

BOWEN, B.W., A.B. MEYLAN, J.P. ROSS, C.J. LIMPUS, G.H. BALAZS & J.C. AVISE. 1992. Global population structure and natural history of the green turtle (*Chelonia mydas*) in term of matriarchal phylogeny. Evolution 46: 865-881.

CARR, A. 1967. So Excellent a Fishe: A Natural History of Sea Turtles. Scribner. New York. 266pp.

CARR, A. 1980. Some problems of sea turtle ecology. American Zoologist 20: 489-498.

CARR, A. 1987. New perspectives on the pelagic stage of sea turtle development. Conservation Biology 1: 103-212.

CARR, A. & L. OGREN. 1960. The ecology and migrations of sea turtles IV: The green turtle in the Caribbean Sea. Bulletin of the American Museum of Natural History 121: 1-48.

EHRHART L., W. REDFOOT, D. BAGLEY & K. MANSFIELD. 2014. Long-term trends in loggerhead (*Caretta caretta*) nesting and reproductive success at an important western Atlantic rookery. Chelonian Conservation & Biology 13: 173-181.

HENDRICKSON, J.R. 1958. The green sea turtle, *Chelonia mydas* (Linn.), in Malaya and Sarawak. Proceedings of the Zoological Society 130: 455-535.

LOHMANN, K.J., C.M.F. LOHMANN, J.R. BROTHERS & N.J. PUTMAN. 2013. Natal homing and imprinting in sea turtles. In: Wyneken, J., K.J. Lohmann & J.A. Musick (Eds.). The Biology of Sea Turtles Vol 3. CRC Press, Boca Raton, FL. pp. 59-78.

MARGARITOULIS, D. 1998. Interchange of nesting loggerheads among Greek Beaches. In: S.P. Epperly & J. Braun (Comps). Proceedings of the 17th Annual Sea Turtle Symposium. NOAA Tech Memo NMFS-SEFSC-415. pp. 239-241.

MILLER, J.D. 1997. Reproduction in sea turtles. In: P.L. Lutz & J.A. Musick (Eds.). The Biology of Sea Turtles. CRC Press, Boca Raton, FL. pp. 51-81.

OWENS, D.W., M.A. GRASSMAN & J.R. HENDRICKSON. 1982. The imprinting hypothesis and sea turtle reproduction. Herpetologica 38: 124-135.

PRITCHARD, P.C.H. 1976. Post-nesting movements of marine turtles (Cheloniidae and Dermochelyidae) tagged in the Guianas. Copeia 1976: 749-754.

Terrestrial Emergence Recorded for a Male Hawksbill (*Eretmochelys imbricata*) on Cousine Island, Seychelles

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Basking behavior (sea or land based) is one of the less understood behaviors in marine turtles. Land-basking is a widely documented behavior for green turtles (*Chelonia mydas*) in Hawaii and the Galápagos (Whittow & Balazs 1982; Murakawa & Balazs 2005; Van Houtan *et al.* 2015). Possible reasons for land-basking include predator avoidance (Balazs 1980), energy conservation (Balazs 1980; Garnett *et al.* 1985), thermoregulation (Hughes 1974; Van Houtan *et al.* 2015), and females escaping unwanted attention from males (Booth & Peters 1972; Hughes 1974; Mortimer 1981). It has been suggested that the occasional beached male in the Galápagos occurs incidentally due to following females ashore (Green 1997). At-sea basking has been recorded in olive ridleys (*Lepidochelys olivacea*) (Hughes & Richard 1974) and loggerheads (*Caretta caretta*) (Green 1997). Murakawa & Balazs (2005) compiled a bibliography of all known terrestrial basking and non-nesting emergence publications for marine turtles, but there is no reference to basking behavior by hawksbills (*Eretmochelys imbricata*).

Cousine Island (-4.350577 °S, 55.647527 °E) is a privately owned island, which features a resort and a nature reserve in the inner-granitic Seychelles. Its one kilometer stretch of beach is a nesting beach for both the diurnally nesting hawksbills (September - March) and the nocturnally nesting greens (rare, with one or two females observed nesting each year). The Cousine Island Marine Turtle Research and Monitoring Program began in the early 1990s, and during the hawksbill nesting season, hourly beach patrols are performed, tagging and reading tags of turtles that come ashore, and recording and monitoring nests and hatchlings. During the nesting season there are a few males observed lingering on the surrounding reef.

On 21 September 2016, a hawksbill was observed on the beach at 17:00 h, exiting the wave wash. Initially, from a distance, the turtle was perceived to be a female emerging from the surf and coming ashore to nest. When the turtle did not continue crawling up the beach, as a female would do during exploration or nesting, we became concerned and moved to another vantage point to take a better look at the turtle. We viewed the turtle from the side, noticed an unusually long tail, and then realized it was a male. He had crawled just past the surf (Fig. 1) and showed very little movement,

Figure 1. Returning to the sea after being tagged. Note the characteristic elongated tail of the male hawksbill turtle.

only twice lifting his head to make a gulping motion. Occasionally he would crawl forward if the waves washed over him. Once the sun began setting, he returned to the sea at 18:00 h. He was then caught in the shallows and brought back onshore whereupon we read his flipper tags and checked for injuries or signs of sickness. The external examination revealed no evidence of trauma, lesions, growths or ectoparasites, with the exception of a few small barnacles on the soft tissue of the hind flippers. He was very strong and healthy. The left flipper tag read SEY 6229 (on the second scale) while the right tag was missing. There was evidence of a flipper tag scar on the right second scale, therefore, the tag was presumed to have been pulled out. A replacement tag (SCA 7677), was placed in the skin adjacent to the first scale on the right flipper.

From Cousine Island internal records, this turtle was originally tagged SEY 6229/6228 (second scales) and identified as a male on Cousine Island by P.M. Hitchins in October 2003. The record showed that the turtle was observed during a similar time of the year, with the same duration out of the water, and on the same area of beach as sighted in 2016. This rare case was published as a photo of "basking" and the "only record of a male emerging onto the beach in the Seychelles" in a book describing Cousine Island's restoration and conservation programs (Samway *et al.* 2010).

These two terrestrial emergences by this one individual male are fascinating, and if these two incidents on Cousine Island were truly land-basking, they were incredibly rare occurrences. This is the first known recorded hawksbill male to demonstrate this behavior in the Seychelles.

Acknowledgments. We thank Mr. Keeley for the opportunity to work on Cousine Island and his unwavering support for turtle conservation. Thanks are also extended to Prof. Martin H. Villet (Rhodes University, South Africa) for comments on the original manuscript, and to the reviewers for the advice and comments.

BALAZS, G.H. 1980. Synopsis of biological data on the green turtle in the Hawaiian Islands. Tech Memo NMFS-TM-NMFS-SWFC-7. 141pp.

BOOTH, J. & J.A. PETERS. 1972. Behavioural studies on the green turtle (*Chelonia mydas*) in the sea. Animal Behaviour 20: 808-812.

GARNETT, S.T., G.M. CROWLEY & N. GOUDBERG. 1985. Observations of non-nesting emergence by green turtles in the Gulf of Carpentaria. Copeia 1985: 262-264.

GREEN, D. 1997. Basking in Galapagos green turtles. In: Epperly, S.P. & J. Braun (Comps.). Proceedings of the 17th Annual Sea Turtle Symposium. NOAA Tech Memo NMFS-SEFSC-415. pp. 63-65.

HUGHES, G.R. 1974. The sea turtles of South-East Africa. 2. The biology of the Tongaland loggerhead turtle *Caretta caretta* L. with comments on the leatherback turtle *Dermochelys coriacea* L. and the green turtle *Chelonia mydas* L. in the study region. South African Association for Marine Biological Research Oceanographic Research Institute. Investigational Report 36. 96pp.

HUGHES, D.A. & J.D. RICHARD. 1974. The nesting of the Pacific ridley turtle *Lepidochelys olivacea* on Playa Nancite, Costa Rica. Marine Biology 24: 97-107.

MORTIMER, J.A. 1981. Reproductive ecology of the green turtle, *Chelonia mydas*, at Ascension Island. Ph.D. Thesis. Department of Zoology, University of Florida, Gainesville, FL, USA. 163pp.

MURAKAWA, S.K.K. & G.H. BALAZS. 2005. Bibliography of terrestrial basking and non-nesting emergence in marine turtles. Marine Turtle Research Program, NOAA-NMFS-PISFC. 7pp. http://bit.ly/2mNpJvY

SAMWAYS, M., P. HITCHINS, O. BOURQUIN & J. HENWOOD. 2010. Tropical Island Recovery: Cousine Island, Seychelles. Wiley-Blackwell, Chichester, UK. 260pp.

WHITTOW, G.C. & G.H. BALAZS. 1982. Basking behavior of the Hawaiian green turtle (*Chelonia mydas*). Pacific Science 36: 129-139.

Exceptional Leatherback Turtle Stranding Event in the Moroccan Atlantic During 2015

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Leatherback turtles (*Dermochelys coriacea*) have been recorded throughout the Mediterranean Sea but are concentrated in certain areas, including the Tyrrhenian and Aegean Seas, and the area around the Sicily strait (Margaritoulis 1986; Casale *et al.* 2003). The absence of nesting sites (Groombridge 1990; Laurent *et al.* 1999) and the absence of small juveniles, which are restricted to tropical waters (Eckert 2002), suggest that leatherback turtles observed in the Mediterranean are of Atlantic origin. They reach the Mediterranean Sea through the strait of Gibraltar in small groups (De Los Rios Y Los Huertos & Ocaña 2009; Casale & Margaritoulis 2010). Leatherbacks are known to occur along the Mediterranean Moroccan coast (northwest African continent), from Strait of Gibraltar east to the border with Algeria (Casale *et al.* 2003; Rojo–Nieto *et al.* 2011).

Leatherback turtles are seldom observed along the Moroccan Atlantic coast; only stranded sub-adult and adult individuals have been observed and no nesting has been confirmed there (Tiwari *et al.* 2001; Casale & Margaritoulis 2010). Along the coastline of Casablanca, rare cases have been recorded in the past by the National Institute of Fisheries Research (INRH). During 2015, we documented 10 stranded leatherback turtles, and we conducted a survey along the shoreline of Casablanca to make sure that all stranding events were recorded. We synthesise here the information of these stranding cases, as well as available historical data on leatherback turtle stranding events along the entire Atlantic and Mediterranean Moroccan coasts, with complementary data from southern peninsular Spain and the Canary Islands.

The INRH is the Moroccan government authority that manages data on stranded sea turtles and provides scientific advice in managing stranding events. For all reported stranding events, we recorded standardized stranding information, including species identification, location, and biometric and biological parameters, and we collect tissue samples, primarily skin and muscle. We obtained data for 2015 from field operations for the Casablanca region, complemented with data from the Royal Gendarmerie of Morocco, who respond to stranding events throughout the Moroccan coast. Historical data for Morocco were extracted from a reconstructed stranding database (Masski & De Stéphanis 2015). Data for Spain (1980 to 2012) were gathered from an online biodiversity database (http://siare.herpetologica.es/). For all databases, images were used when available to collect supplementary information and measurements using ImageJ (Schneider *et al.* 2012).

We conducted a beach survey on foot along 105 km of shoreline around Casablanca, to search for stranded sea turtles, and to interview local coastal inhabitants. The people we spoke to were asked if they could identify leatherback turtles on photographs and they were questioned on how frequently they observed this species during their lives. The 22 respondents, ranging in age from 19 to 56 years old, had all participated in fishing activities for fish, shellfish or urchins.

Between 14 November and 12 December 2015, we observed five stranded dead leatherback sea turtles along 25 km of the coastline in the area of Casablanca (Fig. 1). The stranded individuals were all female and had a mean curved carapace length (CCL) of 130 cm ± 18 SD (range: 118 - 162 cm). Two individuals were in early stages of decomposition and the three others were freshly stranded. None of them was thin or showed injuries or signs of interaction with fishing gear and one of them seemed to have arrived alive on the sandy beach. Two of them were necropsied and no anomalies were observed in the lung, liver, heart or kidney. The intestines were full of digesta, but the single stomach that was analysed was empty. Furthermore, no obstructing material (*e.g.,* plastic bags) was observed in the trachea after dissection. On 23 January 2016, a decomposing individual with 120 cm CCL was observed stranded in the same area. Its death may have occurred in December 2015.

Earlier during the 2015, five other stranded leatherback turtles were recorded in a 120 km area around Casablanca in February, May, July, September and November. The first turtle was decomposed and had lost its internal organs (98 cm CCL), while the others were between 103-144 cm CCL and were in the first stages of decomposition. One of them was female, and the others were not examined due to being buried before the INRH was alerted.

The survey conducted around Casablanca did not lead to the discovery of any other stranded leatherback sea turtles. During the interviews, only two fishermen recognised the leatherback sea turtle. One of these fishermen described a stranding a few months earlier and the other

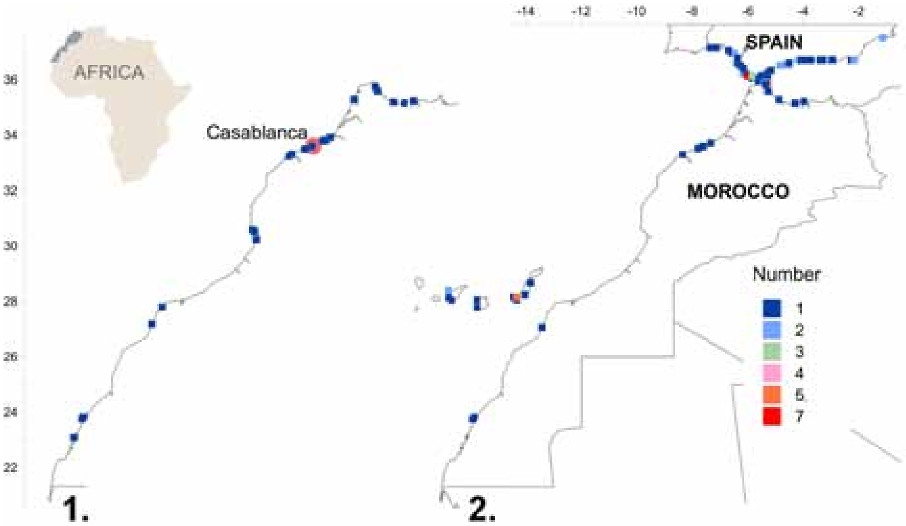

Figure 1. Leatherback sea turtle strandings 1. In the Moroccan coast for 2015, 2. historical records in Morocco (1990-2014) and Spain (1980-2012 from: http://siare.herpetologica.es/).

fisherman recounted that a large turtle had been caught 15 years ago by a fishing boat. The lack of recognition of the leatherback turtle by the local population supports the apparent scarcity of stranded leatherbacks in this area.

The review of historical leatherback stranding records prior to 2015 showed that four out of 21 records occurred in the Casablanca area and dated back to December 1990, July and December 2004, and December 2005. Most stranding events were recorded in the last two decades, which may reflect increased survey effort of the least surveyed areas (Casale *et al.* 2003). Four cases were recorded in the Saharan area, a coastline of more than 1000 km long where the detection probability of stranded turtles is low. The fourteen other cases occurred in the Mediterranean, of which 10 were recorded in three weeks in October and November 1995 on 8 km of coast on the Mediterranean coast close to the strait of Gibraltar.

Although rare, the leatherback turtle appears to be present all months of the year in Moroccan waters, as indicated by stranding events. This is concordant with what is observed in the Alboran sea (Rojo-Nieto *et al.* 2011), Portuguese waters (Nicolau *et al.* 2016) and in the Bay of Biscay (Morinière & Dell'amico 2011). Few leatherback stranding events were documented along the entire Moroccan coast, which may be due in part to underreporting. The shoreline of Casablanca is a highly populated region and stranding events are nearly always reported by local and law enforcement authorities. The multiple reports of stranded leatherbacks during 2015 in this area were unusual. Two mass stranding events occurred in winter in the western Mediterranean coast of Morocco in 2004 and during the 1980s (De Los Rios Y Los Huertos & Ocaña 2009), close to the strait of Gibraltar. These events probably occurred during the migration of leatherbacks into the Mediterranean of groups of sub-adults and adults, but females seem to be more common. Wind and current patterns influence where dead or debilitated sea turtles end up on land (Hart *et al*. 2006), and stranding probability decreases with increased distance from the shore (near zero for >100 km). The Casablanca coastline receives yearly stranded cetaceans (Masski & De Stéphanis 2015) and 2015 was not different in this regard from other years, suggesting that there were no exceptional environmental circumstances that led to the leatherback stranding event. We suspect that the death of these observed stranded leatherback turtles in 2015 may have occurred in an area close to Casablanca. The stranded leatherback turtles did not have signs of interaction with fishing gear and none of the other data collected pointed to a specific cause of the stranding events. Indeed, the cause(s) of stranded leatherback sea turtles remain to a large extent unknown (Nicolau *et al.* 2016). More consistent and standardized reporting of stranded sea turtles in Morocco may help better characterize the occurrence of leatherbacks in Morrocan waters, and the threats they face.

Acknowledgements. The Royal Gendarmerie of the Kingdom of Morocco graciously offered us the opportunity to use their stranding database. We are grateful to Dewez A. from GEFMA (Groupe d'étude de la faune marine Atlantique) gave us advice for the analysis of stranding causes. We also thank anonymous reviewers for their comments and suggestions.

CASALE, P., P. NICOLOSI, D. FREGGI, M. TURCHETTO & R. ARGANO. 2003. Leatherback turtles (*Dermochelys coriacea*) in Italy and in the Mediterranean basin. Herpetological Journal 13: 135-140.

CASALE, P. & D. MARGARITOULIS. 2010. Sea Turtles in the Mediterranean: Distribution, Threats and Conservation Priorities. IUCN: Gland, Switzerland. 294pp.

DE LOS RIOS Y LOS HUERTOS, A.G. & O. OCAÑA. 2009. A massive stranding of six leatherback turtles (*Dermochelys coriacea*) at the western African Alboran Sea: confirmation of the most important wintering area for this species in the Mediterranean Sea. In: Demetropoulos A. & O. Turkozan (Eds.). Proceedings of the Second Mediterranean Conference on Marine Turtles. Barcelona Convention - Bern Convention - Bonn Convention (CMS). p.79.

ECKERT, S.A. 2002. Distribution of juvenile leatherback sea turtle *Dermochelys coriacea* sightings. Marine Ecology Progress Series 230: 289-293.

GROOMBRIDGE, B. 1990. Marine turtles in the Mediterranean: distribution, population status, conservation. Report to the Council of Europe, Environment Conservation and Management Division, Nature and Environment Series No. 48. Strasbourg, France. 98pp.

HART, K.M., P. MOORESIDE & L.B. CROWDER. 2006. Interpreting the spatio-temporal patterns of sea turtle strandings: going with the flow. Biological Conservation 129: 283-290.

LAURENT, L., M.N. BRADAI, D.H. HADOUD, H.M. EL GOMATI & A.A. HAMZA. 1999. Marine turtle nesting activity assessment on Libyan coasts, Phase 3: Survey of the coast to the West of Misratah. RAC/SPA and UNEP, Tunis. 35pp.

MARGARITOULIS, D.N. 1986. Captures and strandings of the leatherback sea turtle, *Dermochelys coriacea*, in Greece (1982-1984). Journal of Herpetology 20: 471-474.

MASSKI, H. & R. DE STÉPHANIS. 2015. Cetaceans of the Moroccan coast: information from a reconstructed strandings database. Journal of the Marine Biological Association UK: 1-9. DOI:10.1017/S0025315415001563

MORINIÈRE, P. & F. DELL'AMICO. 2011. Synthèse des observations de tortues marines sur la façade Manche-Atlantique de 1988 à 2008. Bulletin de la Société Herpétologique de France 139: 131-141.

NICOLAU, L., M. FERREIRA, J. SANTOS, H. ARAÚJO, M. SEQUEIRA, J. VINGADA & A. MARÇALO. 2016. Sea turtle strandings along the Portuguese mainland coast: spatio-temporal occurrence and main threats. Marine Biology 163: 1-13.

ROJO–NIETO, E., P.D. ÁLVAREZ–DÍAZ, E. MOROTE, M. BURGOS-MARTÍN, T. MONTOTO-MARTÍNEZ, J. SÁEZ-JIMÉNEZ & F. TOLEDANO. 2011. Strandings of cetaceans and sea turtles in the Alboran Sea and Strait of Gibraltar: a long–time glimpse of the north coast (Spain) and the south coast (Morocco). Animal Biodiversity and Conservation 34: 151-163.

SCHNEIDER, C.A., W.S. RASBAND & K.W. ELICEIRI. 2012. NIH Image to ImageJ: 25 years of image analysis. Nature Methods 9: 671-675.

TIWARI, M., A. MOUMNI, H. CHFIRI & H. EL HABOUZ. 2001. A report on sea turtle nesting activity in the Kingdom of Morocco and Western Sahara. Testudo 5: 71-77.

ANNOUNCEMENT

A *Sea Turtle Nesting Beach Indicator Tool* to Help Identify Areas with Potential for Sea Turtle Nesting

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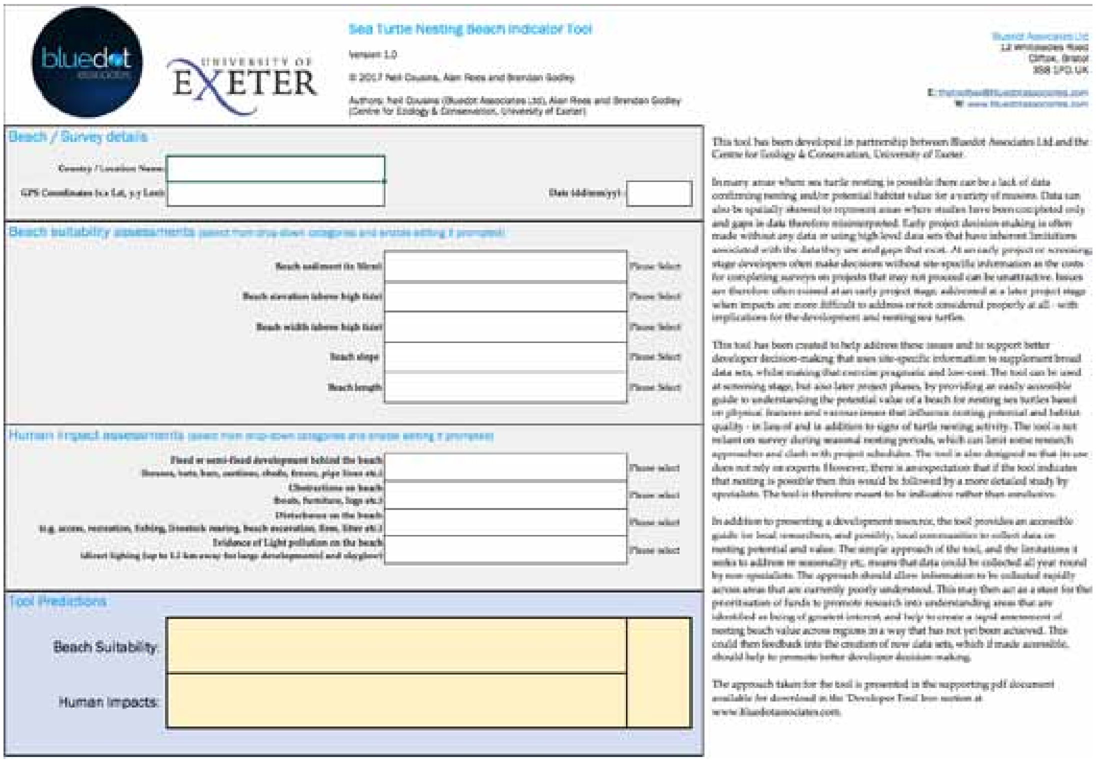
In many countries where sea turtle nesting occurs or is expected, there is a paucity of data for understanding the spatial extent of nesting and relative habitat value of different beaches. As sea turtle nesting areas are a commonly encountered issue for development in some regions, and given the conservation importance of the species affected, we seek to promote enhanced detection of marine turtle nesting beaches in the absence of prior biological data. A better understanding of the likelihood of sea turtle nesting will allow the management of impacts and risks associated with projects.

The low level of baseline understanding can be due to lack of funding to deliver research, lack of easy accessibility to nesting beaches, focus on more easily accessible areas that skews spatial data, the lack of in-country expertise to undertake detailed research or the vast extent of beaches that need to be surveyed in areas where turtle nesting may occur during relatively short seasonal periods. There can also be a tendency for long term research to focus effort in areas that are known to support nesting, have historically been thought to be of greater importance and/or form part of protected areas.

We have developed an electronic tool to assess the nesting potential of beaches at minimal cost. The simple approach of the tool is seasonally independent. The approach should facilitate information to be collected rapidly across areas that are currently poorly understood, perhaps using local networks that do not require specialist knowledge – thus helping to quickly improve the understanding of nesting potential across wider areas. This may then act as a steer for the prioritisation of funds to promote research into understanding areas that are identified as being of greatest interest; and help to create a rapid assessment of nesting beach value across regions in a way that has not yet been achieved. This could then feedback into the creation of new data sets, which if made accessible, should help to promote better developer decision-making. It should be noted that the tool deals with physical habitat features only and that it provides *indicative* rather than conclusive results on nesting potential, i.e. indications of poor suitability for certain beaches should not be used as evidence there is no nesting. The tool is useful *in lieu* of, and supplementary to, seasonal surveys that record the signs of nesting activity. In most cases the indications should be followed-up by specialist surveys.

The tool's inputs and outputs are divided into two sections (Fig. 1): the first section assesses the potential for supporting a viable nesting population, based on nearshore and beach geomorphology; and the second assesses if human disturbance is already likely to be impacting nesting activity. The tool (and accompanying explanatory documentation) is freely available, with no cost to download from www.bluedotassociates.com. It has been reviewed by several sea turtle researchers with experience from around the globe, but we are keen to hear how it can be improved and hence welcome feedback sent to thetoolbox@bluedotassociates.com.


Sea Turtle Nesting Beach Indicator Tool
Version 1.0
© 2017 Neil Cousins, Alan Rees and Brendan Godley
Authors: Neil Cousins (Bluedot Associates Ltd), Alan Rees and Brendan Godley (Centre for Ecology & Conservation, University of Exeter)

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Beach / Survey details
Country / Location Name:
GPS Coordinates (x.x Lat, y.y Lon):
Date (dd/mm/yy):

Beach suitability assessments
Beach sediment: Please Select
Beach elevation (above high tide): Please Select
Beach width (above high tide): Please Select
Beach slope: Please Select
Beach length: Please Select

Human impact assessments
Fixed or semi-fixed development behind the beach: Please select
Obstructions on beach: Please select
Disturbance on the beach: Please select
Evidence of Light pollution on the beach: Please select

Tool Predictions
Beach Suitability:
Human Impacts:

This tool has been developed in partnership between Bluedot Associates Ltd and the Centre for Ecology & Conservation, University of Exeter.

Figure 1. The Sea Turtle Nesting Beach Indicator Tool user interface.

BOOK REVIEW

Title: Between the Tides: In Search of Sea Turtles
Year: 2012
Author: George Hughes
Publisher: Jacana Media (Pty) Ltd
ISBN: 978-1431405626
Pages: 252 (softcover)
Price: US $23.95

As a budding environmental professional and aspiring sea turtle conservationist, I certainly consider myself passionate about sea turtles. *Of course,* I dream of saving sea turtles from the many threats they face worldwide, and I plan to work hard towards that goal in my forthcoming career. Yet how hard do scientists *really* fight in the name of understanding and conserving their species? Upon reading George Hughes' remarkable book, *Between the Tides: In Search of Sea Turtles*, I found my answer. This 250-page publication presents a collection of riveting stories about the lengths this well-known conservationist has gone to protect sea turtles in southern Africa. His commitment to the cause has taken him to far corners of the earth on thrilling, sometimes risky, journeys, sometimes requiring him to overcome immense challenges.

Nowadays, as noted by Godfrey (2005), scientific writing has become devoid of personal opinions, anecdotes, and colorful language. Hughes' book provides a refreshing exception to that pattern; he strikes a balance between both factual information and exciting stories of his many adventures in sea turtle research.

Hughes' writing captivates your attention from the very start, when he tells a particularly special tale of an elderly, decrepit female loggerhead nesting for possibly the last time in her life on the beaches of Maputaland, South Africa. He states, "Her every feature demanded respect and we somehow felt that this unique moment was to be savoured to the full" (p. 13). This moving story showcases the great admiration the author has for sea turtles, thus setting the stage for an inspiring account of his endeavors to describe their life history.

Through other lighthearted, suspenseful, and shocking stories, the author makes it clear that turtles are worth appreciating, and it quickly becomes easy for even someone who is not eco-minded to sympathize with their threats and consider the conservation implications of their actions. Never have I felt more humbled than when reading Chapter 4, *From the Beginning*, when the author describes the primitive living conditions he endured while monitoring sea turtle nests for many years on the beaches of Maputaland. Their "modest cottage", as he calls it, lacked electricity and running water, and the author recalls regularly journeying over 15 kilometers through rugged and dangerous terrain to retrieve water that would sustain the turtle researchers while living on the beach. At one point I found myself wondering, "Why didn't they just give up?" The answer, of course, was because the turtles needed protecting, and it was clear that nothing was going to stand in the way of that. Furthermore, there seems to be a strong emotional connection between Hughes and the turtles he studies, made evident by several of his life choices, such as selecting an aragonite blue car. His justification was: "Simply because aragonite…is the primary mineral making up the shell of a sea-turtle egg and a sea-turtle egg is a very unique and valuable thing" and "rather like turtle hatchlings, I am attracted to blue things" (pp. 118).

Possibly the most commendable aspect of the book is that it frequently pays homage to the tireless efforts of dozens of sea turtle researchers and conservationists throughout the years. He also kindly acknowledges by name the many people who assisted him in his research endeavors, even those who provided him a bed on which to spend the night or a boat ride across the occasional river. Rather than seeming boastful, Hughes paints a collaborative picture of the collective determination of hundreds of scientists and volunteers to understand all aspects of sea turtle biology, ecology, and conservation.

Despite its many overwhelmingly positive characteristics, there are three shortcomings that are worth mentioning. First, *Between the Tides* appears to lack a well-organized structure, and would have benefitted from being arranged chronologically or by topic. The photographic section that bisects the book also appeared unorganized and random at times. Secondly, I would have enjoyed more information on the author's perceptions of the current and future state of sea turtle conservation within the region and beyond. For example, what are the highest-priority research considerations for the future? Finally, an index would have been helpful for the reader to return to specific sections. However, these drawbacks are minor and do not in any way undermine the importance of this work. Overall, this publication will likely be of interest to a wide range of audiences, from individuals merely looking to learn more about sea turtles, to well-established sea turtle biologists in need of a reminder why they chose their line of work.

GODFREY, M.H. 2005. Sea Turtles: A Complete Guide to Their Biology, Behavior, and Conservation. Marine Turtle Newsletter 108:28-29.

Reviewed by: **Melissa L. Whaling**, Nicholas School of the Environment, Duke University, Durham, NC USA (Email: melissa.whaling@duke.edu)

RECENT PUBLICATIONS

This section is compiled by the Archie Carr Center for Sea Turtle Research (ACCSTR), University of Florida. The ACCSTR maintains the Sea Turtle On-line Bibliography: (http://st.cits.fcla.edu/st.jsp). It is requested that a copy of all publications (including technical reports and non-refereed journal articles) be sent to both:

The ACCSTR for inclusion in both the on-line bibliography and the MTN. Address: Archie Carr Center for Sea Turtle Research, University of Florida, PO Box 118525, Gainesville, FL 32611, USA.

The Editors of the Marine Turtle Newsletter to facilitate the transmission of information to colleagues submitting articles who may not have access to on-line literature reviewing services.

RECENT PAPERS

AK, O., H. POLAT, E. KUCUK & H. SELEN. 2016. First confirmed record of the green sea turtle, *Chelonia mydas* (Linnaeus, 1758) (Cheloniidae), from the eastern Black Sea waters of Turkey. Turkish Journal of Zoology 40: 1-4. DOI: 10.3906/zoo-1503-7. (O. Ak, Central Fisheries Research Institute, Trabzon, Turkey).

ALMPANIDOU, V., G. SCHOFIELD, A.S. KALLIMANIS, O. TURKOZAN, G.C. HAYS & A.D. MAZARIS. 2016. Using climatic suitability thresholds to identify past, present and future population viability. Ecological Indicators 71: 551-556. V. Almpanidou, Aristotle Univ Thessaloniki, Dept Ecology, Sch Biol, Thessaloniki 54124, Greece. (E-mail: valmpani@bio.auth.gr).

ANDRADE, M.F., C. DOMIT, M.K. BROADHURST, D.J. TOLHURST & A.T. SILVA-SOUZA. 2016. Appropriate morphometrics for the first assessment of juvenile green turtle (*Chelonia mydas*) age and growth in the south-western Atlantic. Marine Biology 163: Article UNSP 254. C. Domit, Univ Estadual Londrina, Programa Posgrad Ciencias Biol, Av Celso Garcia Cid, Pr 445 Km 380, BR-86057970 Londrina, Parana, Brazil. (E-mail: cadomit@gmail.com).

ANONYMOUS. 2016. Inside a sea turtle hospital: Loggerhead MarineLife Center heals turtles, promotes education. Eco (July): 32-37.

ANONYMOUS. 2016. Sea turtle monitoring and research from the experts. Eco (July): 39-43.

ASCANI, F., K.S. VAN HOUTAN, E. DI LORENZO, J.J. POLOVINA & T.T. JONES. 2016. Juvenile recruitment in loggerhead sea turtles linked to decadal changes in ocean circulation. Global Change Biology 22: 3529-3538. F. Ascani. (E-mail: francois.ascani@gmail.com).

BARCENAS-IBARRA, A., I. ROJAS-LLEONART, R.I. LOZANO-GUZMAN & A. GARCIA-GASCA. 2017. Schistosomus Reflexus Syndrome in olive ridley sea turtles (*Lepidochelys olivacea*). Vet Pathology 54: 171-177. A. Garcia-Gasca, Ctr Invest Alimentac & Desarrollo, Ave Sabalo Cerritos S-N, Mazatlan 82100, Sinaloa, Mexico. (E-mail: alegar@ciad.mx).

BERGAMO, T.F., S. BOTTA & M. COPERTINO. 2016. Lipid extraction in stable isotope analyses of juvenile sea turtle skin and muscle. Aquatic Biology 25: 1-6. S. Botta, Programa de Pós-Graduaeco em Oceanografia Biológica, Instituto de Oceanografia, Universidade Federal do Rio Grande - FURG, CP 474, Rio Grande, RS 96203-900, Brazil. (E-mail: silbotta@gmail.com).

BICKNELL, A.W.J., B.J. GODLEY, E.V. SHEEHAN, S.C. VOTIER & M.J. WITT. 2016. Camera technology for monitoring marine biodiversity and human impact. Frontiers in Ecology and Environment 14: 424-432.

BLASI, M.F., F. ROSCIONI & D. MATTEI. 2016. Interaction of loggerhead turtles (*Caretta caretta*) with traditional Fish Aggregating Devices (FADs) in the Mediterranean Sea. Herpetological Conservation & Biology 11: 386-401. M.F. Blasi, Filicudi Wildlife Conservat, I-98055 Messina, Italy. (E-mail:blasimf@yahoo.com).

BUTT, N., S. WHITING & K. DETHMERS. 2016. Identifying future sea turtle conservation areas under climate change. Biological Conservation 204: 189-196. N. Butt, Univ Queensland, Global Change Inst, St Lucia, QLD 4072, Australia. (E-mail: n.butt@uq.edu.au).

CAILLOUET, C.W.JR., N.F. PUTMAN, D.J. SHAVER, R.A. VALVERDE, E.E. SENEY, K.J. LOHMANN, K.L. MANSFIELD, B.J. GALLAWAY, J.P. FLANAGAN & M.H. GODFREY. 2016. A call for evaluation of the contribution made by rescue, resuscitation, rehabilitation, and release translocations to Kemp's ridley sea turtle (*Lepidochelys kempii*) population recovery. Herpetological Conservation & Biology 11: 486-496. C.W. Caillouet, Marine Fisheries Scientist-Conservation Volunteer, Montgomery, Texas 77356, USA. (E-mail: Waxmanjr@aol.com).

CARACAPPA, S., A. PISCIOTTA, M.F. PERSICHETTI, G. CARACAPPA, R. ALDUINA & M. ARCULEO. 2016. Nonmodal scutes patterns in the loggerhead sea turtle (*Caretta caretta*): a possible epigenetic effect? Canadian Journal of Zoology 94: 379-383.

CARLSON, J.K., S.J.B. GULAK, M.P. ENZENAUER, L.W. STOKES & P.M. RICHARDS. 2016. Characterizing loggerhead sea turtle, *Caretta caretta*, bycatch in the US shark bottom longline fishery. Bulletin of Marine Science 92: 513-525. J.K. Carlson, NOAA, Natl Marine Fisheries Service, Southeast Fisheries Sci Ctr, 3500 Delwood Beach Rd, Panama City, FL 32408 USA. (E-mail: john.carlson@noaa.gov).

CARPENA-CATOIRA, C., C.D. ORTEGA-ORTIZ & F.R. ELORRIAGA-VERPLANCKEN. 2016. Isotopic effects of different preservation methods on scales of olive ridley sea turtles (*Lepidochelys olivacea*) from the Mexican Central Pacific. Rapid Communications in Mass Spectrometry 30: 2480-2486. C.D. Ortega-Ortiz, Univ Colima, Fac Ciencias Marinas, Km 20 Carr Manzanillo Barra de Navidad, Manzanillo 28860, Colima, Mexico. (E-mail: christian_ortega@ucol.mx).

CASALE, P., D. FREGGI & P. SALVEMINI. 2017. Tag loss is a minor limiting factor in sea turtle tagging programs relying on distant tag returns: the case of Mediterranean loggerhead sea turtles. European Journal of Wildlife Research 63: 12. DOI:10.1007/s10344-016-1059-0. P. Casale, Dept of Biology, University of Pisa, 56126 Pisa, Italy. (E-mail: paolo.casale1@gmail.com).

CHAMBAULT, P., L. GIRAUDOU, B. DE THOISY, M. BONOLA, L. KELLE, V. DOS REIS, F. BLANCHARD, Y. LEMAHO & D. CHEVALLIER. 2017. Habitat use and diving behaviour of gravid olive ridley sea turtles under riverine conditions in French Guiana. Journal of Marine Systems 165: 115-123. P. Chambault, Univ Strasbourg, Institut Pluridisciplinaire Hubert Curien, 23 Rue Becquerel, F-67087 Strasbourg 2, France. (E-mail: philippine.chambault@gmail.com).

CHELLIAH, K. 2016. Book review: From Soup to Superstar: The Story of Sea Turtle Conservation Along the Indian Coast. Current Science 111: 1412-1413. Centre for Ecological Sciences, Indian Institute of Science, Bengaluru 560 012, India. (E-mail: karpakazi@gmail.com).

CHRISTIANSEN, F., N. ESTEBAN, J.A. MORTIMER, A.M. DUJON & G.C. HAYS. 2017. Diel and seasonal patterns in activity and home range size of green turtles on their foraging grounds revealed by extended Fastloc-GPS tracking. Marine Biology 164: 10 DOI: 10.1007/s00227-016-3048-y. F. Christiansen, Centre for Integrative Ecology, School of Life and Environmental Sciences, Deakin University, Warrnambool, VIC 3280, Australia. (E-mail: f.christiansen@murdoch.edu.au).

COVELO, P., L. NICOLAU & A. LOPEZ. 2016. Four new records of stranded Kemp's ridley turtle *Lepidochelys kempii* in the NW Iberian Peninsula. Marine Biodiversity Records 9: 80 DOI: 10.1186/s41200-016-0079-5. P. Covelo, Coordinadora para o Estudo dos Mamiferos Mariños, P.O. Box 15. 36380, Pontevedra, Gondomar, Spain. (E-mail: cemmaorganizacion@gmail.com).

CRUZ-ESCALONA, V.H., A.F. NAVIA, P.A. MEJIA-FALLA, M.V. MORALES-ZARATE & C.A. SALINAS-ZAVALA. 2016. Topological and biomass balance approaches to analyzing food webs of Bahia Magdalena, Baja California Sur, Mexico. Community Ecology 17: 125-136. V.H. Cruz-Escalona, Inst Politecn Nacl, Ctr Interdisciplinario Ciencias Marinas, Dept Pesquerias & Biol Marina, Av IPN S-N Col Playa Palo de Santa Rita, La Paz 23096, Baja California, Mexico. (E-mail: vescalon@ipn.mx).

DI BENEDITTO, A.P.M., S. SICILIANO & L.R. MONTEIRO. 2017. Herbivory level and niche breadth of juvenile green turtles (*Chelonia mydas*) in a tropical coastal area: insights from stable isotopes. Marine Biology 164: 13. DOI:10.1007/s00227-016-3044-2. A.P.M. Di Beneditto, Univ Estadual Norte Fluminense, CBB, Lab Ciencias Ambientais, Ave Alberto Lamego 2000, BR-28013620 Campos Dos Goytacazes, RJ, Brazil. (E-mail: anadibeneditto@gmail.com).

DOMENECH, F., J. TOMAS, J.L. CRESPO-PICAZO, D. GARCIA-PARRAGA, J.A. RAGA & F.J. AZNAR. 2017. To swim or not to swim: Potential transmission of *Balaenophilus manatorum* (Copepoda: Harpacticoida) in marine turtles. PLoS One 12: e0170789. F. Domenech, Marine Zoology Unit, Cavanilles Institute of Biodiversity and Evolutionary Biology, University of Valencia, Valencia, Spain. (E-mail: francesc.domenech@uv.es).

ENSTIPP, M.R., K. BALLORAIN, S. CICCIONE, T. NARAZAKI, K. SATO & J.-Y. GEORGES. 2016. Energy expenditure of adult green turtles (*Chelonia mydas*) at their foraging grounds and during simulated oceanic migration. Functional Ecology 30: 1810-1825. M.R. Enstipp, Univ Strasbourg, IPHC, 23 Rue Becquerel, F-67087 Strasbourg, France. (E-mail: manfred.enstipp@iphc.cnrs.fr).

ESCOBAR-LASSO, S., M. GIL-FERNANDEZ, J. SAENZ, E. CARRILLO-JIMENEZ, G. WONG & L.G. FONSECA. 2016. Inter-trophic food provisioning between sea and land: the jaguar (*Panthera onca*) as provider of sea turtle carcasses to terrestrial scavengers. International Journal of Conservation Science 7: 1081-1094. S. Escobar-Lasso, Univ Nacl Costa Rica, Inst Int Conservac & Manejo Vida Silvestre ICOMVI, Heredia 13503000, Costa Rica. (E-mail: biosergiobike@gmail.com).

ESTEBAN, N., J.A. MORTIMER & G.C. HAYS. 2017. How numbers of nesting sea turtles can be overestimated by nearly a factor of two. Proceedings of the Royal Society B 284: 20162581. G.C. Hays, School of Life and Environmental Sciences, Centre for Integrative Ecology, Deakin University, Warrnambool, VIC 3280, Australia. (E-mail: g.hays@deakin.edu.au).

FLINT, M., P.C. MILLS, F. LOBAN, T. SIMPSON, S. LUI, R. FUJII, D. WHAP, J.B. FLINT & H. OWEN. 2017. Development of a humane slaughter device for green turtles for use by traditional owners in the Torres Strait Islands, Australia. PLoS One 12(1): e0167849. M. Flint, Veterinary-Marine Animal Research, Teaching and Investigation Unit, School of Veterinary Science, The University of Queensland, Gatton Campus, Queensland, Australia. (E-mail: flintm@ufl.edu).

FRANKOVICH, T.A., M.P. ASHWORTH, M.J. SULLIVAN, J. VESELA & N.I. STACY. 2016. *Medlinella amphoroidea gen. et sp. nov.* (Bacillariophyta) from the neck skin of loggerhead sea turtles (*Caretta caretta*). Phytotaxa 272: 101-114. T.A. Frankovich, Florida Int Univ, Florida Bay Interagency Sci Ctr, 98630 Overseas Highway, Key Largo, FL 33037 USA. (E-mail: frankovich@virginia.edu).

GIRARD, A., M. GODGENGER, A. GIBUDI, J. FRETEY, A. BILLES, D. ROUMET, G. BAL, N. BREHERET, A.L.H. BITSINDOU, B. VERHAGE, S. RICOIS, J. BAYE, J. CARVALHO, H. LIMA, E. NETO, H. ANGONI, I. AYISSI, C. BEBEYA, I. FOLACK, J. NGUEGIM & M. GIRONDOT. 2016. Marine turtles nesting activity assessment and trend along the Central African Atlantic coast for the period of 1999-2008. International Journal of Marine Science and Ocean Technology 3:21-32. M. Girondot, Laboratoire Ecologie, Systématique et Evolution, UMR 8079, Université Paris-Sud, Orsay, 91405, France. (E-mail: marc.girondot@u-psud.fr).

GODOY, D.A., A.N.H. SMITH, C. LIMPUS & K.A. STOCKIN. 2016. The spatio-temporal distribution and population structure of green turtles (*Chelonia mydas*) in New Zealand. New Zealand Journal of Marine and Freshwater Research 50: 549-565. D.A. Godoy, Coastal-Marine Research Group, Massey Univ, Albany, Auckland, New Zealand. (E-mail: d.a.godoy@massey.ac.nz).

GRIFFIN, L.P., J.W. BROWNSCOMBE, T.O. GAGNE, A.D.M. WILSON, S.J. COOKE & A.J. DANYLCHUK. 2017. Individual-level behavioral responses of immature green turtles to snorkeler disturbance. Oecologia 183: 909-917. L.P. Griffin, Dept of Environmental Conservation and Intercampus Marine Science Graduate Program, University of Massachusetts Amherst, 160 Holdsworth Way, Amherst, MA 01003, USA. (E-mail: lpgriffin@eco.umass.edu).

HART, K.M., A.R. IVERSON, A.M. BENSCOTER, I. FUJISAKI, M.S. CHERKISS, C. POLLOCK, I. LUNDGREN & Z. HILLIS-STARR. 2017. Resident areas and migrations of female green turtles nesting at Buck Island Reef National Monument, St. Croix, US Virgin Islands. Endangered Species Research 32: 89-101. K. M. Hart, US Geological Survey, Wetland and Aquatic Research Center, Davie, FL 33314, USA. (E-mail: kristen_hart@usgs.gov).

HARYATI, J.R., J.F. PUTRI, N. CHAIRIYAH, A. HARRIS, H.A. PUTRI & R.N. PAMUNGKAS. 2016. Action plan in developing sea turtle conservation as ecotourism attraction in Sukamade, Meru Betiri National Park. Journal of Indonesian Tourism and Development Studies 4: 67-74. J.R. Haryati, Graduate School of Environmental Sciences, University of Brawijaya, Malang, Indonesia. (E-mail: jehanramdani@ub.ac.id).

HAYES, C.T., D.S. BAUMBACH, D. JUMA & S.G. DUNBAR. 2017. Impacts of recreational diving on hawksbill sea turtle (*Eretmochelys imbricata*) behaviour in a marine protected area. Journal of Sustainable Tourism 25: 79-95. C.T. Hayes, Dept. Earth & Biological Sciences, Marine Research Group, Loma Linda University, Loma Linda, CA, USA. (E-mail: cthayes@llu.edu).

HAYS, G.C., A.D. MAZARIS, G. SCHOFIELD & J.-O. LALOE. 2017. Population viability at extreme sex-ratio skews produced by temperaturedependent sex determination. Proceedings of the Royal Society B 284: 20162576. G.C. Hays, Deakin University, Geelong, Australia, School of Life and Environmental Sciences, Centre for Integrative Ecology, Warrnambool, VIC 3280, Australia. (E-mail: g.hays@deakin.edu.au).

HEATON, A.J., E.E. PULIS, J.L. PITCHFORD, W.L. HATCHETT, A.M. CARRON & M. SOLANGI. 2016. Prevalence and transience of ingested fishing hooks in Kemp's ridley sea turtles. Chelonian Conservation & Biology 15: 257-64. E.E. Pulis, Institute for Marine Mammal Studies, 10801 Dolphin Lane, Gulfport, Mississippi 39503 USA. (E-mail: epulis@imms.org).

HERRERA, H., S. ESCOBAR-LASSO & E. CARRILLO-JIMENEZ. 2016. Predation on the hawksbill turtle *Eretmochelys imbricata* by the jaguar *Panthera onca* in the Pacific coast of Costa Rica. Mammalogy Notes 3: 13-6. H. Herrera, Instituto Internacional en Conservación y Manejo de Vida Silvestre, Universidad Nacional de Costa Rica, Heredia, Costa Rica. (E-mail: bluecloudcr@gmail.com).

HILL, J. 2016. *Eretmochelys imbricata* (Hawksbill sea turtle). Fishing gear mortality. Herpetological Review 47: 284. J. Hill, Carnivore Ecology Laboratory, Forest and Wildlife Research Center, Mississippi State University, Mississippi State, MS 39762, USA. (E-mail: jearl.hill98@gmail.com).

HILL, J.E., N.J. ROBINSON, C.M. KING & F.V. PALADINO. 2017. Diving behavior and thermal habitats of gravid hawksbill turtles at St. Croix, USA. Marine Biology 164: 17. DOI: 10.1007/s00227-016-3050-4. J.E. Hill, Indiana Univ Purdue Univ Ft Wayne, Dept Biology, Science Bldg,2101 E Coliseum Blvd, Ft Wayne, IN 46835 USA.(E-mail: jearl.hill98@gmail.com).

HONARVAR, S., M.C. BRODSKY, E.P. VAN DEN BERGHE, M.P. O'CONNOR & J.R. SPOTILA. 2016. Ecology of olive ridley sea turtles at arribadas at Playa La Flor, Nicaragua. Herpetologica 72: 303-308. S. Honarvar, Indiana Univ Purdue Univ, Dept Biology, Ft Wayne, IN 46805 USA. (E-mail: shaya.honarvar@ipfw.edu).

HOWELL, L.N., K.J. REICH, D.J. SHAVER, A.M. LANDRY JR. & C.C. GORGA. 2016. Ontogenetic shifts in diet and habitat of juvenile green sea turtles in the northwestern Gulf of Mexico. Marine Ecology Progress Series 559: 217-229. L.N. Howell, NOAA-NMFS, Southeast Fisheries Science Ctr, Galveston, TX 77551 USA. (E-mail: lyndsey.howell@noaa.gov).

KHUBCHANDANI, M. & M. PARTI. 2016. Cultural rights v. species protection: A case study of Pacific leatherback sea turtles. Seattle Journal of Environmental Law 6: 161-188. M. Khubchandani. (E-mail: mohit.khubchandani@hotmail.com).

KOBAYASHI, S., M. WADA, R. FUJIMOTO, Y. KUMAZAWA, K. ARAI, G. WATANABE & T. SAITO. 2017. The effects of nest incubation temperature on embryos and hatchlings of the loggerhead sea turtle: Implications of sex difference for survival rates during early life stages. Journal of Experimental Marine Biology and Ecology 486: 274-281. T. Saito, Usa Marine Biological Institute, Kochi University, Tosa, Kochi, 781-1164, Japan. (E-mail: t-saito@kochi-u.ac.jp).

KUO, F-W., T.Y. FAN, C.K.-Y. NG, Y. CAI, G.H. BALAZS & T.-H. LI. 2017. Tale of the unlucky tags: the story of a rescued, rehabilitated, and released green sea turtle (*Chelonia mydas*) in southern Taiwan. Bulletin of Marine Science 93: 527-528. T.-H. Li, National Museum of Marine Biology and Aquarium, Pingtung 944, Taiwan, ROC. (E-mail: lith@nmmba.gov.tw).

LABRADA-MARTAGON, V., F.A.M. TENERIA, R. HERRERA-PAVON & A. NEGRETE-PHILIPPE. 2017. Somatic growth rates of immature green turtles *Chelonia mydas* inhabiting the foraging ground Akumal Bay in the Mexican Caribbean Sea. Journal of Experimental Marine Biology and Ecology 487:68-78. F.A.M. Teneria, Univ Autonoma San Luis Potosi, Fac Agron & Vet, Carretera San Luis Potosi Matehuala Km 14-5, Soledad De Graciano Sanc 78321, SLP, Mexico. (E-mail: fernando.munoz@uaslp.mx).

LAURITSEN, A.M., P.M. DIXON, D. CACELA, B. BROST, R. HARDY, S.L. MACPHERSON, A. MEYLAN, B.P. WALLACE & B. WITHERINGTON. 2017. Impact of the Deepwater Horizon oil spill on loggerhead turtle *Caretta caretta* nest densities in northwest Florida. Endangered Species Research 33: 83-93. A.M. Lauritsen, US Fish and Wildlife Service, Jacksonville, Florida 32256, USA. (E-mail: AnnMarie_Lauritsen@fws.gov).

LE GOUVELLO, D.Z.M., R. NEL, L.R. HARRIS & K. BEZUIDENHOUT. 2017. The response of sandy beach meiofauna to nutrients from sea turtle eggs. Journal of Experimental Marine Biology and Ecology 487: 94-105. D. Z. M Le Gouvello, Nelson Mandela Metropolitan Univ, Dept Zoology, Coastal & Marine Res Inst, POBox 77000, ZA-6031 Port Elizabeth, South Africa. (E-mail: diane.legouvello@gmail.com).

LINDBORG, R., E. NEIDHARDT, B. WITHERINGTON, J.R. SMITH & A. SAVAGE. 2016. Factors influencing loggerhead (*Caretta caretta*) and green turtle (*Chelonia mydas*) reproductive success on a mixed use beach in Florida. Chelonian Conservation

& Biology 15: 238-248. R. Lindborg, Disney's Animal Kingdom, PO Box 10000, Lake Buena Vista, Florida 32830 USA. (E-mail: Rebekah.J.Lindborg@disney.com).

LOPES, K., L. PASSOS, J.G. RODRIGUES, F. KOENEN, V. STIEBENS, T. SZEKELY & A. DUTRA, A. 2016. Sea turtle, shark, and dolphin bycatch rates by artisanal and semi-Industrial fishers in Maio Island, Cape Verde. Chelonian Conservation & Biology 15: 279-288. K. Lopes, Capeverdean Ecotourism Association (ECOCV), Cidade da Praia, Santiago, Republic of Cabo Verde. (E-mail: katia.f.lopes22@gmail.com).

MADRAK, S.V., R.L. LEWISON, J.A. SEMINOFF & T. EGUCHI. 2016. Characterizing response of East Pacific green turtles to changing temperatures: using acoustic telemetry in a highly urbanized environment. Animal Biotelemetry 4:22 DOI: 10.1186/s40317-016-0114-7. S.V. Madrak, San Diego State University, 5500 Campanile Drive, San Diego, CA 92181, USA. (E-mail: svmadrak@gmail.com).

MARCO, A., E. ABELLA-PEREZ & M. TIWARI. 2017. Vulnerability of loggerhead turtle eggs to the presence of clay and silt on nesting beaches. Journal of Experimental Marine Biology and Ecology 486: 195-203. A. Marco, Estacion Biologica de Donana, 41092 Sevilla, Spain. (E-mail: amarco@ebd.csic.es).

MCDONALD, T.L., B.A. SCHROEDER, B.A. STACY, B.P. WALLACE, L.A. STARCEVICH, J. GORHAM, M.C. TUMLIN, D. CACELA, M. RISSING, D.B. MCLAMB, E. RUDER & B.E. WITHERINGTON. 2017. Density and exposure of surface-pelagic juvenile sea turtles to Deepwater Horizon oil. Endangered Species Research 33: 69-82. T.L. McDonald, Western EcoSystems Technology, Inc., Laramie, WY 82070, USA. (E-mail: tmcdonald@west-inc.com).

MITCHELMORE, C.L., C.A. BISHOP & T.K. COLLIER. 2017. Toxicological estimation of mortality of oceanic sea turtles oiled during the Deepwater Horizon oil spill. Endangered Species Research 33: 39-50. C.L. Mitchelmore, Chesapeake Biological Laboratory, University of Maryland Center for Environmental Science, 146 Williams Street, Solomons, MD 20688, USA. (E-mail: mitchelmore@umces.edu).

MONTEIRO, D.S., S.C. ESTIMA, T.B.R. GANDRA, A.P. SILVA, L. BUGONI, Y. SWIMMER, J.A. SEMINOFF & E.R. SECCHI. 2016. Long-term spatial and temporal patterns of sea turtle strandings in southern Brazil. Marine Biology 163: 247. DOI: 10.1007/s00227-016-3018-4. D.S. Monteiro, Univ Fed Rio Grande FURG, Lab Ecol & Conservacao Megafauna Marinha EcoMega, Rio Grande, RS, Brazil. (E-mail: danismonteiro@yahoo.com.br).

MYRE, B.L., J. GUERTIN, K. SELCER & R.A. VALVERDE. 2016. Ovarian dynamics in free-ranging loggerhead sea turtles (*Caretta caretta*). Copeia 2016: 921-929. R.A. Valverde, Southeastern Louisiana Univ, Dept Biol Sci, 808 North Pine St SLU 10736, Hammond, LA 70402 USA. (E-mail: roldan.valverde@selu.edu).

NG, C.K.Y., P.O. ANG, D.J. RUSSELL, G.H. BALAZS & B.M. MURPHY. 2016. Marine macrophytes and plastics consumed by green turtles (*Chelonia mydas*) in Hong Kong, South China Sea region. Chelonian Conservation & Biology 15: 289-292. C.K.Y. Ng, Dept of Biology and Chemistry and State Key Laboratory in Marine Pollution, City University of Hong Kong, Hong Kong Special Administrative Region, PRC. (E-mail: kayan.ng.connie@gmail.com).

NOGUEIRA, M.M. & R.R.N. ALVES. 2016. Assessing sea turtle bycatch in Northeast Brazil through an ethnozoological approach. Ocean & Coastal Management 133: 37-42. R.R.N. Alves, Univ Estadual Paraiba, Dept Biol, Ave Baraunas,351 Campus Univ, BR-58109753 Campina Grande, Paraiba, Brazil. (E-mail: romulo_nobrega@yahoo.com.br).

NOVELLETTO, A., L. TESTA, F. IACOVELLI, P. BLASI, L. GAROFALO, T. MINGOZZI & M. FALCONI. 2016. Polymorphism in mitochondrial coding regions of Mediterranean loggerhead turtles: Evolutionary relevance and structural effects. Physiological and Biochemoical Zoology 89: 473-486. A. Novelletto, Univ Roma Tor Vergata, Dept Biol, Rome, Italy. (E-mail: velletto@bio.uniroma2.it).

PASANISI, E., A.A. CORTES-GOMEZ, M. PEREZ-LOPEZ, F. SOLER, D. HERNANDEZ-MORENO, C. GUERRANTI, T. MARTELLINI, G. FUENTES-MASCORRO, D. ROMERO & A. CINCINELLI. 2016. Levels of perfluorinated acids (PFCAs) in different tissues of *Lepidochelys olivacea* sea turtles from the Escobilla beach (Oaxaca, Mexico). Science of the Total Environment 572: 1059-1065. D. Romero, Univ Murcia, Fac Vet Med, Toxicol Unit, E-30100 Murcia, Spain. (E-mail: diegorom@um.es).

PATEL, S.H., K.L. DODGE, H.L. HAAS & R.J. SMOLOWITZ. 2016. Videography reveals in-water behavior of loggerhead turtles (*Caretta caretta*) at a foraging ground. Frontiers in Marine Science 3: 254. DOI: 10.3389/fmars.2016.00254 S.H. Patel, Coonamessett Farm Foundation, East Falmouth, MA, USA. (E-mail: spatel@cfarm.org).

PAWAR, P. R., S.S. SHIRGAONKAR & R.B. PATIL. 2016. Plastic marine debris: Sources, distribution and impacts on coastal and ocean biodiversity. PENCIL Publication of Biological Sciences 3: 40-54. P.R. Pawar, Veer Wajekar Arts, Science and Commerce College, Mahalan Vibhag, Phunde, Tal. Uran, Dist. Raigad, Navi Mumbai, 400 702, Maharashtra, India. (E-mail: prpawar1962@gmail.com).

PERRAULT, J.R., K.D. BAUMAN, T.M. GREENAN, P.C. BLUM, M.S. HENRY & C.J. WALSH. 2016. Maternal transfer and sublethal immune system effects of brevetoxin exposure in nesting loggerhead sea turtles (*Caretta caretta*) from western Florida. Aquatic Toxicology 180: 131-140. J.R. Perrault, Mote Marine Laboratory, 1600 Ken Thompson Parkway, Sarasota, FL 34236, USA. (E-mail: jperrault@mote.org).

PIACENZA, S.E., G.H. BALAZS, S.K. HARGROVE, P.M. RICHARDS & S.S. HEPPELL. 2016. Trends and variability in demographic indicators of a recovering population of green sea turtles *Chelonia mydas*. Endangered Species Research 31: 103-117. S.E. Piacenza, Dept of Biology, Occidental College, Los Angeles, CA 90041, USA. (E-mail: susiepiacenza@gmail.com).

PURDY, R. 2016. Kauai's first documented green sea turtle nest of 2016 hatches: Sixty-three hatchlings emerge from Pacific Missile Range Facility. Currents (Fall): 24-25. http://greenfleet.dodlive.mil/currents

PUTMAN, N.F., R. LUMPKIN, A.E. SACCO & K.L. MANSFIELD. 2016. Passive drift or active swimming in marine organisms?

Proceedings of the Royal Society B 283(1844): 20161689. N.F. Putman, Cooperative Institute for Marine and Atmospheric Studies, Rosenstiel School of Marine and Atmospheric Science, University of Miami, Miami, FL 33149, USA. (E-mail: nathan.putman@gmail.com).

QI, X.K., D.X. YE, Y.Z. SUN, C.Z. LI & L.X. RAN. 2017. Simulations to true animals' long-distance geomagnetic navigation. IEEE Transactions on Magnetics 53(1): Article 5200108. DOI: 10.1109/TMAG.2016.2600540. L.X. Ran, Zhejiang Univ, Lab Appl Res Electromagnet, Hangzhou 310027, Zhejiang, People's Republic of China. (E-mail: ranlx@zju.edu.cn).

RECKENDORF, A., K. TUXBURY, J. CAVIN, G. SILVER, J. BRISSON, C. MCMANUS, B. STACY, C. MERIGO & C. INNIS. 2016. Laryngeal paralysis in a loggerhead sea turtle (*Caretta caretta*). J. Herpetol. Med. Surgery 26:20-5.

REES, A.F., J. ALFARO-SHIGUETO, P.C.R. BARATA, K.A. BJORNDAL, A.B. BOLTEN, J. BOURJEA, A.C. BRODERICK, L.M. CAMPBELL, L. CARDONA, C. CARRERAS, P. CASALE, S.A. CERIANI, P.H. DUTTON, T. EGUCHI, A. FORMIA, M.M.P.B. FUENTES, W.J. FULLER, M. GIRONDOT, M.H. GODFREY, M. HAMANN, K.M. HART, G.C. HAYS, S. HOCHSCHEID, Y. KASKA, M.P. JENSEN, J.C. MANGEL, J.A. MORTIMER, E. NARO-MACIEL, C.K.Y. NG, W.J. NICHOLS, A.D. PHILLOTT, R.D. REINA, O. REVUELTA, G. SCHOFIELD, J.A. SEMINOFF, K. SHANKER, J. TOMAS, J.P. VAN DE MERWE, K.S. VAN HOUTAN, H.B. VANDER ZANDEN, B.P. WALLACE, K.R. WEDEMEYER-STROMBEL, T.M. WORK & B.J. GODLEY. 2016. Are we working towards global research priorities for management and conservation of sea turtles? Endangered Species Research 31: 337-382. B.J. Godley, Centre for Ecology and Conservation, School of Biosciences, University of Exeter, Penryn Campus, Treliever Road, Penryn, Cornwall TR10 9FE, UK. (E-mail: b.j.godley@exeter.ac.uk).

REES, A.F., C. CARRERAS, A.C. BRODERICK, D. MARGARITOULIS, T.B. STRINGELL & B.J. GODLEY. 2017. Linking loggerhead locations: using multiple methods to determine the origin of sea turtles in feeding grounds. Marine Biology 164: 30. DOI: 10.1007/s00227-016-3055-z. A.F. Rees, Marine Turtle Research Group, Centre for Ecology and Conservation, Univ. of Exeter, Cornwall Campus, TR10 9EZ, UK. (E-mail: a.f.rees@exeter.ac.uk).

RENEKER, J.L. & S.J. KAMEL. 2016. Climate change increases the production of female hatchlings at a northern sea turtle rookery. Ecology 97: 3257-3264. J.L. Reneker, UNC Wilmington, Ctr Marine Science, Dept Biology & Marine Biology, Wilmington, NC 28409 USA. (E-mail: jreneker@gmail.com).

RESENDIZ, E., R. RIOSMENA-RODRIGUEZ & R.M. MEDINA. 2016. *Chelonia mydas* (Eastern Pacific Green Sea Turtle). Diet. Herpetological Review 47: 282-283. E. Resendiz, (E-mail: jresendiz@uabcs.mx).

RHODIN, A.G.J. 2016. In honor of Peter C.H. Pritchard. Chelonian Conservation & Biology 15: 293.

RINKUS, M.A., D. KRAMER & T. DOBSON. 2016. Informing community engagement in sea turtle conservation by examining non-conservation-related participation in Northeast Brazil. Human Dimensions of Wildlife 21: 47-64. M.A. Rinkus, Dept of Fisheries and Wildlife, Michigan State University, 480 Wilson Road, Room 13 Natural Resources Bldg., East Lansing, MI 48824, USA. (E-mail: rinkusma@msu.edu).

ROBINSON, N.J., E.A. LAZO-WASEM, F.V. PALADINO, J.D. ZARDUS & T. PINOU. 2016. Assortative epibiosis of leatherback, olive ridley and green sea turtles in the Eastern Tropical Pacific. Journal of the Marine Biological Association UK 2016: 1-8. DOI: 10.1017/S0025315416000734. N. J. Robinson, Dept. of Biology, Indiana University-Purdue University Fort Wayne, Fort Wayne, Indiana, USA. (E-mail: nathan@leatherback.org).

ROBINSON, N.J., S.J. MORREALE, R. NEL & F.V. PALADINO. 2016. Coastal leatherback turtles reveal conservation hotspot. Scientific Reports 6: 37851. DOI: 10.1038/srep37851. (Address same as above)

ROSADO-RODRIGUEZ, G. & S.L. MALDONADO-RAMIREZ. 2016. Mycelial fungal diversity associated with the leatherback sea turtle (*Dermochelys coriacea*) nests from western Puerto Rico. Chelonian Conservation & Biology 15: 265-272. G. Rosado-Rodriguez, Dept of Marine Sciences, University of Puerto Rico, Mayaguez Campus,Call Box 9000, Mayaguez 00681-9000 Puerto Rico USA. (E-mail: gualberto.rosado@upr.edu).

ROSSI, S., N.G.T. DE QUEIROZ HAZARBASSANOV, A.M. SANCHEZ-SARMIENTO, F.E.S. PRIOSTE & E.R. MATUSHIMA. 2016. Immune response of green sea turtles with and without fibropapillomatosis: evaluating oxidative burst and phagocytosis via flow cytometry. Chelonian Conservation & Biology 15: 273-278. S. Rossi, Research Group on Fibropapillomatosis in Sea Turtles, Universidade de Sao Paulo, Sao Paulo/SP, Brazil. (E-mail: smara.rossi@gmail.com).

ROSSI, S., A.M. SANCHEZ-SARMIENTO, R.E.T. VANSTREELS, R.G. DOS SANTOS, F.E.S. PRIOSTE, M.A. GATTAMORTA, J.H.H. GRISI & E.R. MATUSHIMA. 2016. Challenges in evaluating the severity of fibropapillomatosis: a proposal for objective index and score system for green sea turtles (*Chelonia mydas*) in Brazil. PLoS One 11(12): Article e0167632. (Address same as above)

SCHROEDER, R., B.R. BOTTENE, R. SANT'ANA, R. WAHRLICH & D. QUEIROLO. 2016. Using the turtle excluder device (TED) in the pink shrimp trawling fishery off southern Brazil. Latin American Journal of Aquatic Research 44: 1123-1129. R. Schroeder, Univ Vale Itajai, Ctr Cincias Tecnol Terra & Mar, Grp Estudos Pesqueiros, Itajai, Brazil. (E-mail: schroederichthys@gmail.com).

SENKO, J., L.D. JENKINS & S.H. PECKHAM. 2017. At loggerheads over international bycatch: Initial effects of a unilaterally imposed bycatch reduction policy. Marine Policy 76: 200-209. J. Senko, School for the Future of Innovation in Society, Arizona State University, Tempe, AZ, USA. (E-mail: jesse.senko@asu.edu).

SHAMBLIN, B.M., P.H. DUTTON, D.J. SHAVER, D.A. BAGLEY, N.F. PUTMAN, K.L. MANSFIELD, L.M. EHRHART, L.J. PENA & C.J. NAIRN. 2017. Mexican origins for the Texas green turtle foraging aggregation: A cautionary tale of incomplete baselines and poor marker resolution. Journal of Experimental Marine Biology and Ecology 488: 111-120. B.M. Shamblin, Daniel B. Warnell School of Forestry and Natural Resources, University of Georgia, Athens, GA 30602, USA. (E-mail: brian.shamblin@gmail.com).

SHIMADA, T., R. JONES, C. LIMPUS, R. GROOM & M. HAMANN. 2016. Long-term and seasonal patterns of sea turtle home ranges in warm coastal foraging habitats: implications for conservation. Marine Ecology Progress Series 562: 163-179. T. Shimada, James Cook Univ, Coll Sci & Engn, Townsville, QLD 4811, Australia. (E-mail: takahiro.shimada@my.jcu.edu.au).

SILVA, M.A., H.L. JERDY, R.B. RIBEIRO, R.M. MEDINA, M.B.R.G. PETRONILHA, E. SHIMODA, M.R. WERNECK, J.G. ANDRADE & E.C.Q. CARVALHO. 2016. Histopathological findings in lungs of hawksbill turtles collected on the coasts of the states of Espirito Santo and Rio de Janeiro, Brazil. Arquivo Brasileiro De Medicina Veterinaria e Zootecnia 68: 1267-1274. M.A. Silva, Univ Fed Espirito Santo, Alegre, ES, Brazil. (E-mail: mvmariaaparecida@gmail.com).

SOARES, L.S., A.B. BOLTEN, M.L. WAYNE, S.T. VILACA, F.R. SANTOS, M.A.G. DEI MARCOVALDI & K.A. BJORNDAL. 2017. Comparison of reproductive output of hybrid sea turtles and parental species. Marine Biology 164: 9. DOI: 10.1007/s00227-016-3035-3. L.S. Soares, Archie Carr Center for Sea Turtle Research, Dept. of Biology, University of Florida, Gainesville, FL, USA. (E-mail: lsoares@ufl.edu).

SPADOLA, F., M. MORICI, M. OLIVERI & Z. KNOTEK. 2016. Description of cloacoscopy in the loggerhead sea turtle (*Caretta caretta*). Acta Veterinaria Brno 85: 367-370. Z. Knotek, Avian and Exotic Animal Clinic, Faculty of Veterinary Medicine, University of Veterinary and Pharmaceutical Sciences Brno, Palackeho tr. 1946/1, 612 42 Brno, Czech Republic. (E-mail: knotekz@vfu.cz).

SPIER, D. & H. GERUM. 2016. First record of predation on the zoanthid *Palythoa caribaeorum* (Anthozoa, Cnidaria) and the fish *Scomberomorus brasiliensis* (Scombridae) by the green turtle (*Chelonia mydas*) in South Brazil. Marine Biodiversity Records DOI: 10.1007/s12526-016-0503-4. D. Spier, Benthos Laboratory, Center for Marine Studies, Federal University of Paranį, Pontal do Paranį, PR 83255-976, Brazil. (E-mail: daphnespier@gmail.com).

STACY, N.I., C.L. FIELD, L. STAGGS, R.A. MACLEAN, B.A. STACY, J. KEENE, D. CACELA, C. PELTON, C. CRAY, M. KELLEY, S. HOLMES & C.J. INNIS. 2017. Clinicopathological findings in sea turtles assessed during the Deepwater Horizon oil spill response. Endangered Species Research 33: 25-37. N.I. Stacy, Dept of Large Animal Clinical Sciences, College of Veterinary Medicine, University of Florida, 2015 SW 16th Ave, Gainesville, FL 32610, USA. (E-mail: stacyn@ufl.edu).

STEWART, K.M., T.M. NORTON, D.S. TACKES & M.A. MITCHELL. 2016. Leatherback ecotourism development, implementation, and outcome assessment in St. Kitts, West Indies. Chelonian Conservation & Biology 15: 197-205. K.M. Stewart, St. Kitts Sea Turtle Monitoring Network, PO Box 2298, St. Kitts, West Indies. (E-mail: kstewart@rossvet.edu.kn).

TAPILATU, R.F., H. WONA & P.P. BATUBARA. 2017. Status of sea turtle populations and its conservation at Bird's Head Seascape, Western Papua, Indonesia. Biodiversitas 18: 129-136. R.F. Tapilatu, Marine Science Laboratory, Faculty of Fisheries and Marine Science, University of Papua. Marine and Fisheries Hall Room Ikn-4,Jl. Gunung Salju, Amban, Manokwari 98314, Papua Barat, Indonesia. (E-mail: rf.tapilatu@unipa.ac.id).

THOMSON, J.A., N. HAJNOCZKY & K. HATTINGH. 2016. The sea turtle rookery at Gnaraloo Bay, Western Australia: using nocturnal observations to validate diurnal track interpretations. Chelonian Conservation & Biology 15: 187-196. J.A. Thomson, Gnaraloo Turtle Conservation Program, Gnaraloo Station Trust and Gnaraloo Wilderness Foundation, PO Box 632 Australind, Western Australia 6233, Australia. (E-mail: jordy.thomson@deakin.edu.au).

THONGPRAJUKAEW, K., H. KANGHAE & K. KITTIWATTANAWONG. 2016. Faecal characteristics as markers of *Chelonia mydas* feeding. ScienceAsia 42: 237-246. K. Thongprajukaew, Prince Songkla Univ, Fac Sci, Dept Appl Sci, Hat Yai 90112, Thailand. (E-mail: karun.t@psu.ac.th).

TRIPATHY, B. 2016. Reproductive biology and conservation of olive ridley at the Rushikulya rookery of Odisha, India. International Journal of Conservation Science 7: 1105-1126. Zool. Survey India, M Block, Kolkata 700053, W Bengal, India. (E-mail: tripathyb@gmail.com).

VILLA, C.A., M. FLINT, I. BELL, C. HOF, C.J. LIMPUS & C. GAUS. 2017. Trace element reference intervals in the blood of healthy green sea turtles to evaluate exposure of coastal populations. Environmental Pollution Part B 220: 1465-1476. C.A. Villa, Univ Queensland, Natl Res Ctr Environm Toxicol Entox, 39 Kessels Rd, Coopers Plains, QLD 4108, Australia. (E-mail: c.villa@uq.edu.au).

WALLACE, B.P., T. BROSNAN, D. MCLAMB, T. ROWLES, E. RUDER, B. SCHROEDER, L. SCHWACKE, B.A. STACY, L. SULLIVAN, R. TAKESHITA & D. WEHNER. 2017. Effects of the Deepwater Horizon oil spill on protected marine species. Endangered Species Research 33: 1-7. B.P. Wallace, Abt Associates, Inc., Boulder, CO 80302, USA. (E-mail: bryan_wallace@abtassoc.com).

WALLACE, B.P., B.A. STACY, M. RISSING, D. CACELA, L.P. GARRISON, G.D. GRAETTINGER, J.V. HOLMES, T. MCDONALD, D. MCLAMB & B. SCHROEDER. 2017. Estimating sea turtle exposures to Deepwater Horizon oil. Endangered Species Research 33: 51-67. (Address same as above)

WERNECK, M.R., L.M. CONTI & B. BERGER. 2016. Report of *Enodiotrema megachondrus* (Looss, 1899) Looss, 1901 (Digenea: Plagiorchiidae) in a green turtle *Chelonia mydas* Linnaeus, 1758 (Testudines, Cheloniidae) from Brazil. Helminthologia 53: 385-390. M.R. Werneck, BW Vet Consulting, Rua Ponciano Eugenio Duarte 203, BR-11680000 Ubatuba, SP, Brazil. (E-mail: max@bwvet.com.br).

WERNECK, M.R. & L.S. MEDEIROS. 2016. Report of the fourth specimen of *Amphiorchis solus* (Simha & Chattopadhyaya, 1970) Platt, 2002 46 years after the original description. Helminthologia 53: 391-395. (Address same as above)

WESTERLAKEN, R. 2016. The use of green turtles in Bali, when conservation meets culture. Jurnal Studi Kultural 1: 94-98.

WHITTOCK, P.A., K.L. PENDOLEY & M. HAMANN. 2016. Using habitat suitability models in an industrial setting: the case for internesting flatback turtles. Ecosphere 7(11): e01551. P.A. Whittock, Pendoley Environm Pty Ltd, 12a Pitt Way, Booragoon, WA 6154, Australia. (E-mail: paul.whittock@penv.com.au).

WHITTOCK, P.A., K.L. PENDOLEY, R. LARSEN & M. HAMANN. 2017. Effects of a dredging operation on the movement and dive behaviour of marine turtles during breeding. Biological Conservation 206:190-200. (Address same as above)

WIBOWO, E. & T.S. SURYONO. 2016. Effect of giving dry shrimp with different concentration on the growth of green turtle baby [*Chelonia mydas* (Linnaeus, 1758)] in Sukamade coastal areas Meru Betiri National Park, Banyuwangi Regency, East Java, Indonesia. Aquatic Procedia 7: 54-8. T.S. Suryono, Fisheries and Marine Sciences Faculty, Diponegoro University, Jl. Prof. Soedarto, SH, Tembalang, Semarang, 50275, Indonesia. (E-mail: ediwibowo1960@gmail.com).

WILLIAMS, J.L., S.J. PIERCE, C.A. ROHNER, M.M.P.B. FUENTES & M. HAMANN, M. 2017. Spatial distribution and residency of green and loggerhead sea turtles using coastal reef habitats in southern Mozambique. Frontiers in Marine Science 3: 288. DOI: 10.3389/fmars.2016.00288. J.L. Williams, James Cook University, School of Earth and Environ Sciences, Townsville, QLD 4811, Australia. (E-mail: jess@mozturtles.com).

WILLIARD, A.S., A.G. HALL, I. FUJISAKI & J.B. MCNEILL. 2017. Oceanic overwintering in juvenile green turtles *Chelonia mydas* from a temperate latitude foraging ground. Marine Ecology Progress Series 564: 235-240. A.S. Williard, Dept of Biology and Marine Biology, University of North Carolina Wilmington, Wilmington, NC 28403, USA. (E-mail: williarda@uncw.edu).

YLITALO, G.M., T.K. COLLIER, B.F. ANULACION, K. JUAIRE, R.H. BOYER, D.A.M. DA SILVA, J.L. KEENE & B.A. STACY, B.A. 2017. Determining oil and dispersant exposure in sea turtles from the northern Gulf of Mexico resulting from the Deepwater Horizon oil spill. Endangered Species Research 33: 9-24. G.M. Ylitalo, Environmental and Fisheries Sciences Division, Northwest Fisheries Science Center, NMFS, NOAA, 2725 Montlake Boulevard East, Seattle, WA 98112, USA. (E-mail: gina.ylitalo@noaa.gov).

REPORTS

BARNARD, M.A. & J.M. PEISSIG. 2016. Effects of Light Pollution on Loggerhead Sea Turtle (*Caretta caretta*) Nesting Behavior in Georgia and South Carolina. Unpublished Report.

FERNANDES, R.S., J. WILLIAMS & J. TRINDADE. 2016. Monitoring, tagging and conservation of marine turtles in Mozambique: annual report 2015/16. Technical Report - Centro Terra Viva - June 2016. 28pp. R. Fernandes, Centro Terra Viva, Estudos e Advocacia Ambiental, Maputo, Mozambique. (E-mail: rakelsf.mz@gmail.com).

HAGIHARA, R., C. CLEGUER, S. PRESTON, S. SOBTZICK, M. HAMANN, T. SHIMADA & H. MARSH. 2016. Improving the estimates of abundance of dugongs and large immature and adult-sized green turtles in Western and Central Torres Strait. Report to the National Environmental Science Programme Reef and Rainforest Research Centre Limited, Cairns. 53pp.

MURAKAWA, S.K.K. 2016. 2015 Hawaiian sea turtle stranding data. PIFSC Tech Report DR-16-009. 13pp.

NOAA. 2016. Priority actions: 2016-2020 Pacific leatherback turtle *Dermochelys coriacea*. NOAA Fisheries. 23pp. https://repository.library.noaa.gov/view/noaa/11874

SATO, C.L. 2016. Periodic status review for the Leatherback Sea Turtle in Washington. Washington Department of Fish and Wildlife, Olympia, Washington 17pp.

SOWA, S.M. 2016. Sea turtle patrols of Playa Preciosa, Costa Rica and marine mammal and sea turtle boat-based surveys of Gulfo Dulce, Costa Rica September to November 2016. Technical report prepared for the Osa Conservation, Washington, D.C. 24pp. (E-mail: stephaniesowa@gmail.com) http://bit.ly/2ovgIYM

STEINER, T. & P. FUGAZZOTTO. 2016. California driftnet fishery: the true costs of a 20th century fishery in the 21st century. Report for Turtle Island Restoration Network. 10pp. T. Steiner, Sea Turtle Restoration Project, Earth Island Institute, P.O. Box 400, Forest Knolls, CA 94933, USA.

THESES & DISSERTATIONS

ALEXANDER, F., L. BARDALES, M. GABRIELA & Q. BENAVIDES. 2016. Determinacion de concentraciones de metales pesados en sangre de hembras anidantes de tortugas carey (*Eretmochelys imbricata*) en la Bahia de Jiquilisco. Thesis Por Licenciado(a) En Medicina Veterinaria y Zootecnia. Facultad de Ciencias Adronomicas, Departamento de Medicina Veterinaria, Universidad De El Salvador, El Salvador. 90pp.

GIORNO, T. & M. HERRMANN. 2016. Nesting trends of the green (*Chelonia mydas*) and hawksbill (*Eretmochelys imbricata*) turtles on Misali Island, Pemba. Independent Study Project (ISP) for the SIT Graduate Institute - Study Abroad Program. 57pp. http://digitalcollections.sit.edu/isp_collection/2343/

GOLDEN, E. 2016. Sea turtle response to climate change: analyzing current and predicting future impacts on populations, habitat, and prey populations. Honors Theses and Capstones. Paper 291. University of New Hampshire, Durham, NH, U.S.A. 2016.

HOLTZ, B. 2016. Now hear this! Orientation and behavioral responses of hatchling loggerhead sea turtles, *Caretta caretta*, to environmental acoustic cues. Celebration: paper 21. Gettysburg College, Gettysburg, Pennsylvania, U.S.A. 26pp. http://cupola.gettysburg.edu/celebration/2016/Friday/21/

MASLIM. 2016. Genetic Diversity and Origin of Leatherback Turtle (*Dermochelys coriacea*) from Sumatra. M.S. Thesis. Bogor Agricultural University, Indonesia. 23pp. (E-mail: maslim.singkil@gmail.com).

RECKSEIT, S.M. 2016. Volunteer programs in the conservation of sea turtles in Costa Rica. M.S. Thesis. Texas A&M University, College Station, TX, U.S.A. 27pp. http://hdl.handle.net/1969.1/158297

RIVAS, M. L. 2016. Ecologia de la nidificacion, conservacion y amenazas de la tortuga laud, *Dermochelys coriacea*, en Pacuare Nature Reserve, Costa Rica. PhD Thesis. Universidad De Granada, Spain. 131pp. https://dialnet.unirioja.es/servlet/tesis?codigo=67828

RODGERS, M.L. 2016. Humoral immune responses in loggerhead (*Caretta caretta*) and Kemp's ridley (*Lepidochelys kempii*) sea turtles. PhD Thesis. Clemson University, Clemson, South Carolina, USA. 92pp. http://tigerprints.clemson.edu/all_dissertations/1619/

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The MTN was founded in 1976 by Nicholas Mrosvosky
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