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Stuffed hawksbill turtle *Eretmochelys imbricata* openly for sale in Pangandaran, West Java, Indonesia in June 2013 (see pages 10-13). Photo credit: Vincent Nijman.

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Editorial: Pathways for Marine Turtle Conservation Research

George H. Balazs[1] & Thierry M. Work[2]
[1]*NOAA Pacific Islands Fisheries Science Center, 1845 Wasp Blvd, Honolulu, Hawaii 96818 USA (E-mail: george.balazs@noaa.gov)*
[2]*USGS National Wildlife Health Center, PO Box 50187, Honolulu, Hawaii 96850 USA (E-mail: thierry_work@usgs.gov)*

Many avenues are possible for conducting research relating to the globally diverse fields of marine turtle conservation. Showing the major pathways can be useful to those contemplating options in marine turtle research such as graduate and undergraduate students searching for a meaningful and achievable project. We present here 11 sources of data that can be used to aid in project development: 1) Turtles Directly; 2) Archived Samples from Turtles; 3) Photography of Turtles; 4) Turtle Habitats; 5) Predators of Turtles; 6) Turtle Feces; 7) Interview Surveys; 8) Policy and Management; 9) By-Catch Reduction; 10) Literature Reviews; and 11) Data Archives. The route selected for study will be heavily dependent upon individual interests, abilities, and the availability of necessary materials. Not everyone that studies sea turtles has access to, nor necessarily wants or needs, access to turtles. We note that the examples provided under each of the 11 headings are not intended to be comprehensive, but rather to show a few of the study areas possible. Useful information, as a companion to these pathways, can be found in Hammann *et al.* (2010), and Wallace *et al.* (2011).

1) TURTLES DIRECTLY

Alive in the Wild. Turtles encountered or captured on a nesting beach (nesters, eggs, hatchlings), or captured from the ocean (direct researcher capture, fishery by-catch, shipboard observer program), or ocean sighting surveys and transects of turtles. The potential exists for a broad array of sampling and tagging, including use of satellite tags and other electronics that remotely send, or archive, information for the researcher.

Alive in Captivity. Turtles in aquaria, marine parks, or rehabilitation or religious facilities- Including captive and veterinary care-diagnosis and treatment and captive breeding. The potential exists for a broad array of sampling and tagging to obtain data.

Alive and Released from Captivity. Released turtles can be sampled or tagged, including use of satellite tags and other electronics that remotely send, or archive, information for the researcher. Again, the potential exists for a broad array of sampling and tagging for data acquisition.

Alive and Released from Fishery By-catch. Released turtles can be sampled or tagged, including use of satellite tags and other electronics that remotely send to, or archive information for, the researcher.

Dead as Carcasses or Parts Thereof. Dead turtles salvaged in stranding programs, from fishery by-catch, or from hunting harvest for community, religious, or commercial purposes. These offer a greater range of sampling possibilities because there is access to internal organs in addition to samples outlined above for live turtles.

Dead from Humane Euthanasia. Euthanized turtles from rehabilitation programs where recovery of health in an individual, or risk of disease introduction from release back into the wild, is deemed impossible in a rehabilitation program. These offer a greater range of sampling possibilities because there is access to internal organs in fresh condition.

2) ARCHIVED SAMPLES FROM TURTLES

Collection by Others and Available from Archives. Examples include tissues, scute scrapings, serum, blood, bone, feces, parasites, epibionts, DNA, and cell cultures.

3) PHOTOGRAPHY OF TURTLES

Video and Still Photography. Examples include images taken in the water and/or on land, documenting such topics as turtle behaviors, cleaner-fish symbiosis, remote censusing and viewing, and facial patterns for individual identity.

4) TURTLE HABITATS

Marine Habitats. Examples include studies of neritic and pelagic habitats, such as underwater refugia, turtle prey items, seagrass beds, coral reefs, cleaning stations and associated cleaner fish, foraging sites, evaluating carry capacity, habitat phenology, and remote satellite sensing.

Terrestrial Habitats. Examples include studies of terrestrial habitats: such as nesting beaches and basking shorelines; including substrate characteristics, vegetation, tidal impacts, coastal geology, and adverse impacts (e.g. fungal or other infections in nests), carrying capacity, and remote satellite sensing.

5) PREDATORS OF TURTLES

Predators and Predation. Examples include rates of predation, stomach contents from both marine habitats (such as fish and sharks), and on land predators of eggs, hatchlings, and nesters (such as by crabs, reptiles and mammals).

6) TURTLE FECES

Ocean Floating and Shoreline Wash-up. Examples include collection and study of feces, such as for digestion analyses, prey contents, parasites, contaminants, debris, and DNA analysis for population genetics.

7) INTERVIEW SURVEYS

Information Derived from Ocean Users. Examples include interviews or surveys of fishermen and others involving turtle by-catch, observations of behaviors, direct hunting harvest (including eggs and hunting techniques) for community, religious, or commercial purposes.

8) MANAGEMENT AND POLICY

Formulation and Retrospective Examination of Management and Policy. Examples include strategies for the recovery and maintenance of stability of turtle populations, including sustainable use where appropriate, establishing marine protected areas, and ecotourism.

9) BY-CATCH MITIGATION

Modify and Test Fishing Gear. Such as fishing techniques and fishing strategies aimed at the reduction of turtle by-catch in both commercial and recreational fisheries.

10) LITERATURE REVIEWS

Synthesis and Analysis of Past Work. Examples include use of published and unpublished materials both historical and contemporary, such as from the PDF Library of SeaTurtle.Org (http://www.seaturtle.org/library), archives of Marine Turtle Newsletter (http://www.seaturtle.org/mtn/) and the Cturtle Listserver (http://www.lists.ufl.edu/cgi-bin/wa?A0=CTURTLE).

11) DATA ARCHIVES

Data Available for Analyses. Many open-access and negotiable searchable datasets are available involving numerous aspects of turtles and their habitats, including but not limited to all of the above 1-10, as well as data for the study of methodologies used by turtle researchers and their outcomes.

The pathways for data we have set forth here for consideration are meant to be global in perspective, rather than national or regional. Cross-border equitable partnerships and mentoring, both within and between disciplines in today's digital and airline-linked shrunken world, can be productive and professionally rewarding. Cultural bridges can also be built. Like sea turtles themselves, it behooves us to navigate and migrate to achieve our conservation goals.

HAMANN, M, M.H. GODFREY, J.A SEMINOFF, K. ARTHUR, P.C.R. BARATA, K.A. BJORNDAL, A.B.BOLTEN, A.C. BRODERICK, L.M. CAMPBELL, C. CARRERAS, P. CASALE, M. CHALOUPKA, S.K.F. CHAN, M.S. COYNE, L.B. CROWDER, C.E. DIEZ, P.H.DUTTON, S.P. EPPERLY, N.N.FITZSIMMONS, A. FORMIA, M. GIRONDOT, G.C. HAYS, I.J. CHENG, Y. KASKA, R. LEWISON, J.A. MORTIMER, W.J. NICHOLS, R.D. REINA, K. SHANKER, J.R. SPOTILA, J. TOMAS, B.P. WALLACE, T.M. WORK, J. ZBINDEN & B.J. GODLEY. 2010. Global research priorities for sea turtles: informing management and conservation in the 21st Century. Endangered Species Research 11: 245-269.

WALLACE, B.P, A.D. DiMATTEO, B.J. HURLEY, E.M. FINKBEINER, A.B. BOLTEN, M.Y. CHALOUPKA, B.J. HUTCHINSON, F. ALBERTO ABREU-GROBOIS, D. AMOROCHO, K.A. BJORNDAL, J. BOURJEA, B.W.BOWEN, R.B. DUENAS, P. CASALE, B.C. CHOUDHURY, A. COSTA, P.H. DUTTON, A.F. FALLABRINO, A. GIRARD, M. GIRONDOT, M.H. GODFREY, M. HAMANN, M. LOPEZ-MENDILAHARSU, M.A. MARCOVALDI, J.A. MORTIMER, J.A. MUSICK, R. NEL, N.J. PILCHER, J.A. SEMINOFF, S. TROENG, B. WITHERINGTON & R.B. MAST. 2011. Global conservation priorities for marine turtles. PLoS ONE 6(9): e24510.

The Creation of a Map of Hawksbill Turtle (*Eretmochelys imbricata*) Nesting in Tobago, West Indies

Grant Walker[1,2], Ben Cawley[2], Heather Pepe[1], Amy Robb[2], Suzanne Livingstone[2] & Roger Downie[2]

[1]North East Sea Turtles, Man O'War Bay Cottages, Charlotteville, Tobago (E-mail: grantwalkergw@gmail.com; heather_pepe@yahoo.com); [2]School of Life Science, Graham Kerr Building, University of Glasgow, Glasgow, G12 8QQ, Scotland (E-mail: benjamincawley1@hotmail.com; amy-robb@hotmail.co.uk; suzanne.r.livingstone@gmail.com; roger.downie@Glasgow.ac.uk)

The number of hawksbill turtles (*Eretmochelys imbricata*) using known globally important nesting sites has declined by over 80% in recent decades, resulting in the species being listed as Critically Endangered on the IUCN Red List of Threatened Species (www.redlist.org). However, it remains the case that not all hawksbill populations are well documented, because nesting often occurs on small dispersed beaches on islands where monitoring is logistically difficult.

The wider Caribbean is thought to host an estimated 40% of the world's remaining nesting hawksbill turtles (Dow *et al.* 2007); consequently it may be regarded as one of the most important regions for the species. However, within the Caribbean there exists a sizeable proportion (33% of 817) of known hawksbill nesting beaches for which abundance estimates are not available (Dow *et al.* 2007). For example on the southern Caribbean island of Tobago, hawksbill turtles have been reported to nest (Carr *et al.* 1982), but basic information on the species' presence was unknown less than 15 years ago (Eckert 1998; Meylan & Donnelly 1999). Until Dow *et al.*'s (2007) Atlas of Sea Turtle Nesting, there were few published reports of hawksbill nesting activity in Tobago.

Formal sea turtle conservation and monitoring efforts have been on-going on Tobago since 2000. Monitoring of important nesting beaches in the south-west of the island has revealed that activity is dominated by the leatherback (*Dermochelys coriacea*, 200-300 nests/yr; Dow *et al*. 2007; Law *et al*. 2010) with low-level hawksbill and green turtle (*Chelonia mydas*) nesting activity (Dow *et al*. 2007). More recently, it has also been established that north-east Tobago hosts a population of hawksbill turtles that is of regional conservation relevance (Walker & Gibson in press). However, a full survey of all of Tobago's nesting beaches has not yet been published and knowledge gaps remain regarding hawksbill abundance and distribution on the island (Forestry Division *et al*. 2010).

Here we provide an updated map of hawksbill turtle nesting for Tobago that can be compared with the findings of Dow *et al*. (2007). We present a list of all Tobago's sandy beaches, indicating those surveyed for hawksbill turtle nesting activity, and compile published data and previously unpublished data for locations around the island indicating the level of annual activity at surveyed sites.

Tobago (11°10' N, -60°44' E) is located at the southernmost extent of the Caribbean and forms part of the twin-island Republic of Trinidad and Tobago. The island is 41 km long by 14 km wide, orientated SW-NE, and has many sandy beaches separated by rocky outcrops (Georges 1983). Beaches in Tobago's north-east, highland region are generally enclosed by steep, vegetation-covered slopes without human development and those in the south-west, lowland region are often flanked by human settlements. Beaches on the Atlantic side of the island are typically longer and more exposed, whereas the Caribbean beaches are small, numerous and more sheltered.

Beaches that previously had not been visited for hawksbill assessment were identified from local knowledge and satellite imagery available through the websites Google Maps (maps.google.co.uk/) and Flickr (www.flickr.com/map). The names of these beaches were identified using the maps and sources outlined above (Table 1, Fig. 1). Due to its colonial past and local conditions, name variations exist for many of Tobago's beaches. For 10 of the smaller beaches (<50m), no name was identified. These beaches were given the name of the nearest beach or village and then a relative position indicated using compass directions (north, east, south, west).

We compiled 18 published and unpublished reports of hawksbill turtle nesting that were produced in 1991 and during the formal monitoring period 2005-2012 (Table 2). Despite wide variation in survey effort, all nesting surveys in these reports encompassed the peak nesting months for the species in the region: June - August (Walker & Gibson in press).

Nesting events were counted either when females were encountered nesting on the beach at night (Beggs *et al*. 2007) or by verifying nesting events based on crawls found in the sand (Schroeder & Murphy 1999). Nesting events include: (a) confirmed lay (visually confirmed at time of oviposition), (b) estimated lay (retrospective track assessment), (c) non-nesting "false crawl" emergence, and (d) poaching. An outcome of poaching was recorded when a carcass or shell of an adult female was found near a crawl, or when the beach crawl ended mid-beach and there were signs that the turtle had been dragged away. All carcasses or shells were identified by species based on anatomical features (Pritchard & Mortimer 1999; Wyneken 2001). Only confirmed or estimated turtle nesting events were used in the abundance totals reported in this analysis. All observers were trained in techniques for monitoring sea turtle nesting by experienced sea turtle ecologists. The unique gait evident in hawksbill tracks as well as narrow width compared to tracks left by nesting leatherback and green turtles allowed for differentiation among other species that have been confirmed nesting on Tobago. Although olive ridley turtles, *Lepidochelys olivacea*, create a similar track to hawksbill, the species has never been recorded nesting on Tobago (Dow *et al.* 2007). Once recorded, turtle tracks were effaced to avoid double-counting.

Event counts for beaches were converted and scored using the following ranges of crawls per year: 0 = 0, 1-24, 25-100 and > 100 (Table 3). As hawksbill turtles nest at many of Tobago's beaches in low densities (Dow *et al*. 2007; Forestry Division *et al*. 2010), results from beaches that were surveyed only once in a season serve

No.	Name	Variations	S
1 (25)	Pigeon Point		Y
2	Shearbird's Point	No Mans Land	Y
3 (26)	Buccoo Bay		Y
4	Grange Bay		N
5	Mount Irvine		N
6 (27)	Mount Irvine Back Bay	Rocky Point	Y
7 (28)	Stonehaven Bay	Grafton Beach	Y
8 (29)	Great Courland Bay	Turtle Beach	Y
9 (30)	Plymouth Back Bay		Y
10	Plymouth Footsteps Bay		N
11	Plymouth Footsteps (N)		N
12 (31)	Arnos Vale		Y
13	Anse Fromager (S)		N
14	Anse Fromager		N
15 (32)	Culloden Bay		Y
16	Washerwomans Bay		N
17	Culloden Little Bay		N
18 (33)	King Peters Back Bay	Cotton or Moriah Big Bay	Y
19	King Peters Bay		N
20 (34)	Gordon Bay		Y
21 (35)	Celery Bay		Y
22	Celery Bay (N)		N
23	Bullman Bay	Little Rocky Bay	Y
24	Castara Big Bay		Y
25	Castara Little Bay	Nature or Heavenly Bay	N
26 (36)	Emerald Bay	Emerald Cove	Y
27	Emerald Bay (N)		N
28	Little Englishmen's Bay		N
29 (37)	Englishmen's Bay		Y
30 (38)	Parlatuvier Beach		Y
31 (39)	Erasmus Cove	Dead or Bloody Bay Back Bay	Y
32	Bloody Bay		Y
33	Bloody Bay (N)		N
34 (40)	L'Anse Fourmi Beach		Y
35 (42)	Hermitage Bay		Y
36	Waterfall Bay		N
37	Dead Man's Bay		N
38 (43)	Campbleton Bay	Cambleton Bay	Y
39	Lovers Bay		N
40 (41)	Man O'War Bay beach	Charlotteville Beach	Y
41	Pirate's Bay (S)		N
42 (44)	Pirate's Bay		Y
43	Iguana Bay		Y
44	Starwood Bay	Anse Gouleme	N
45 (45)	Belmont Bay	Anse Brisant	Y
46	Batteux Bay	Anse Batteux	N
47	Laos Bay		N
48 (46)	Speyside Beach	Tyrrels Bay	Y
49	Bishops Bay		N
50	Bishops Bay (S)		N
51	Lusyvale Bay		N
52	Lusyvale (S)		N
53	King's Bay		Y
54	Queen's Bay		N
55 (47)	Roxborough (N)	Back Bay Beach	N
56	Roxborough Beach		Y
57	Argyle	Carapuse Bay	N
58	Argyle (S)		N
59	Bellevue Bay		N
60	Clarkes Bay	Mangrove Bay	N
61 (48)	Richmond Bay		N
62	Goodwood Beach	Goldsborough Bay	Y
63 (49)	Fort Grandby Beach	Pinfold Bay	N
64	Barbados Bay		Y
65 (50)	Mt. St. George		N
66 (51)	Hope Bay Hillsborough	John Dial Beach	Y
67	Minister Bay	Big Bacolet	Y
68	Little Minister Bay	Little Bacolet	N
69 (52)	Rockley Bay		N
70	Little Rockley Bay	Lambeau Beach	Y
71	Cove Bay	Petit Trou (S)	N
72	Canoe Bay		N
73 (53)	Kilgwyn Bay		Y
74	Crown Point		N
75	Sandy Point		N
76	Store Bay		Y
77 (54)	Coco Reef		N
78	Swallows Bay	Cable Bay	Y

Table 1. Sandy beaches of Tobago including name variations and whether a survey (S) for hawksbill turtle nesting has been carried out (Y = yes, N = no) as of 2007. In Number (No.) column, numbers in brackets refer to beaches in Dow *et al.* (2007). Beach names obtained from alternate maps and local tour guides are also included.

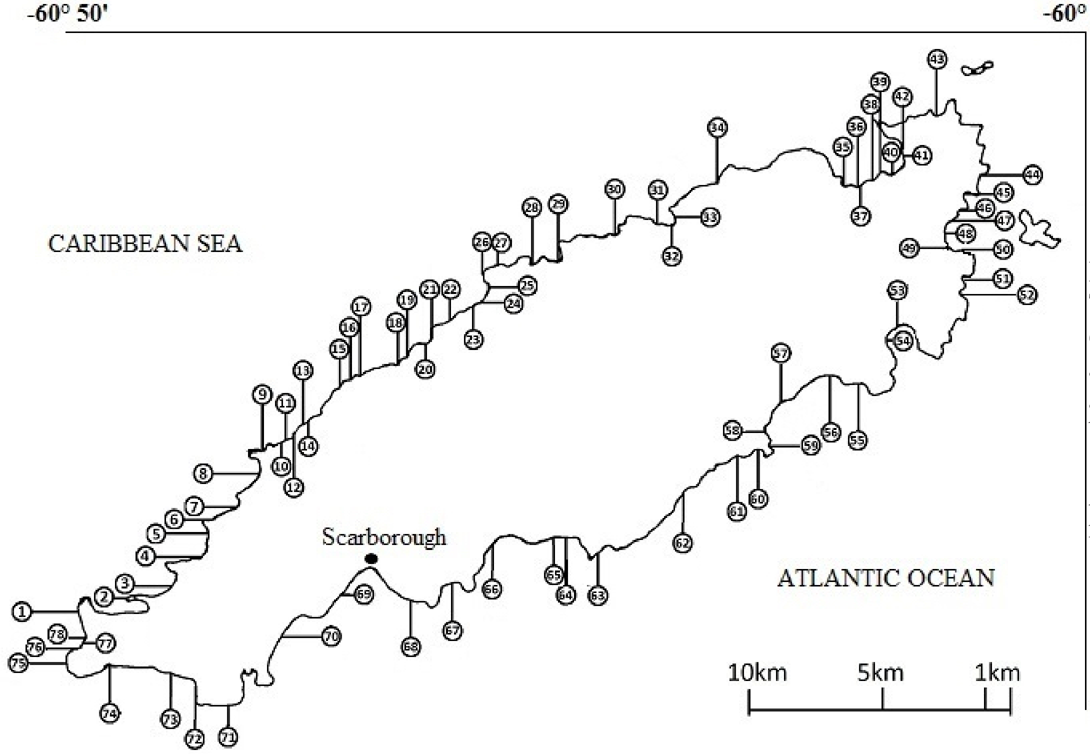

Figure 1. A map of all of Tobago's sandy beaches (n=78). This figure is an amplified version of Dow et al.'s (2007) nesting map. All beaches are named in Table 1 using Institute of Marine Affairs (2004) as a source reference.

as an indication of the species' presence and are marked as "Data Deficient" (Table 3). This categorization identifies the need for more surveys in order to make an assessment of abundance.

Data points from beaches surveyed more than once but irregularly (generally 2-3 visits between June-August) provide a low-confidence indication of the absence of nesting hawksbills if no nesting events were recorded. Confidence is limited because wave action may remove all signs of nesting emergences. Hence irregularly surveyed beaches are also considered "Data Deficient" as hawksbill abundance cannot be assessed.

At sites that were visited regularly (≥1 or more times per week), nest data were considered to provide an indication of the annual abundance. Increasing the frequency of surveys reduces the period within which turtle tracks can be lost by being washed away. Furthermore, as hawksbills show strong beach fidelity and a fine-scale tendency to nest close to the locations of previous clutches (Kamel & Mrosovsky 2005), there is a possibility nesting crawls may be obscured by subsequent crawls made by other turtles, particularly on beaches that are not surveyed regularly. Given that many of Tobago's nesting beaches are small (55 of 78 were ≤0.3km), more frequent surveys reduce the likelihood that nesting crawls are effaced by subsequent nesting females on beaches with higher nest density (Beggs *et al*. 2007).

The confidence in abundance estimates varies considerably with survey effort and level of turtle nesting at a given beach (Delcroix *et al*. 2013). Where a multi-year data set was available for the same beach, we assigned a score based on the maximum number of events recorded in a single survey year. As of 2013, 55 of Tobago's 78 (70.5%) sandy beaches were surveyed at least once for sea turtle nesting activity. A total of 1,323 hawksbill nesting events were recorded between 2005 and 2012 across all surveyed beaches (range: 0 - 144 events in a single season, Table 3).

On 19 July 1991, Godley *et al*. (2001) visited beaches #1, 2, 6-8 and #76 (n=6) reporting five hawksbill nests at #6 and two at #7. An additional report for beach #2 on 14 August 1991 documented a single hawksbill nest (Godley *et al*. 1992).

The 55 beaches scored as follows in the single survey year crawl abundance categories: 27 (49.9%) beaches scored 1-24 and eight (14.6%) scored 25-100. Only two beaches (3.6%), #35 and #38, scored >100. Eighteen (32.7%) beaches scored in the "0" category. We present no data for three beaches (#20, #26 and #78) listed by Dow *et al*. (2007). From 2007 to 2013 beaches #20 (Gordon's Bay) and #26 (Emerald Bay) had only rocky debris and were unsuitable for nesting sea turtles. Furthermore, we cannot verify the previous assessments (Dow *et al.* 2007) for beaches (#20, #36 and #78) (all 'unknown crawl abundances'), as the data upon which these scores were based have not been published. Cawley's (2005) result for beach 'Major Bay' has been omitted because the location cannot be verified. Thirty-five (63.6%) beaches have been visited only once or irregularly in a single season and were assigned the "Data Deficient" status.

This paper presents data for 14 beaches for which Dow *et al*. (2007) state the presence of nesting hawksbill but not crawl totals. Three beaches scored in the zero crawls category, seven scored 1-24 nests and four scored 25-100.

Nineteen beaches (34.5%) have been surveyed only in a single year during 2005-2012, twelve (21.8%) surveyed in two years, twelve (21.8%) in three years, five (9.1%) in four years, two (3.6%) in five years, 1 (1.8%) in six years, 1 (1.8%) in seven years, and three (5.5%) in all eight years.

There were 112 instances of poached hawksbill turtles recorded across all surveyed beaches of Tobago between 2005-2012 (range: 0-25 per beach per year).

This paper compiles and presents all available data for hawksbill nesting on Tobago and thus provides the most complete overview of the species nesting around the island. Survey data presented

Year	Beach	E	Source
1991	2	I	Godley *et al.* 1991
1991	1,6-8,76	S	Godley *et al.* 2001
2005	23, 31, 35, 40, 43, 53, 62, 64, 66	S	Cawley 2005
	18, 21, 24, 29, 30, 32, 34, 42	I	
	6-8	R	
2006	6-8	R	Alkins & Pepe 2007; Lalsingh 2008, 2009, 2010, 2011; Save Our Seaturtles 2006, 2012
2007	31, 34, 35, 38	R	
2007	21,55	S	
2008	6-8	R	
2009	6-8	R	
2010	6-8	R	
2011	3, 4, 6-8, 12, 29-32, 57, 63, 67, 69, 70, 73-75	R	
2012	4, 12, 62	S	
2012	1, 3, 4, 6-8, 29, 30, 57, 63, 67, 70, 73-75, 77	R	
2006	34	S	Walker 2006, 2007, 2008, 2010, 2011
2007	40	S	
2008	42	S	
2010	18, 21, 24, 31, 32, 34, 58	S	
2011	1, 2, 9, 11, 12, 15, 18, 19, 21, 25, 34, 40, 41, 43-49, 51, 53, 58, 62, 66, 72, 76	S	
	38	I	
	35	R	
2012	35, 38, 40	R	
	31, 32, 34, 36, 37, 39, 40, 42-45, 47, 53	I	
2008	31, 34, 35, 38, 40	R	Pepe 2008
2010	29, 30-32, 57, 63, 67, 69, 69, 73-75	R	Robb 2010
2007	6-8	R	Reid 2007

Table 2. Reports of hawksbill nesting Tobago, 1991-2012, published (Y = yes, N = no), E = survey effort summary methods (S = single day, I = irregular, R = regular).

for 55 beaches around Tobago represent a near twofold increase from the 30 previously documented (Dow *et al*. 2007) and include novel records of nesting on six beaches. Excluding beaches #20 and #26, 76 sandy beaches were identified as possible suitable nesting habitat and provide a basic framework for assessing the true extent of hawksbill turtle nesting on Tobago.

Improved monitoring, survey effort and increased number of beaches surveyed in the latter years of data collection (Tables 2 & 3) resulted in a large increase in the number of overall nesting events recorded in years 2011 and 2012, and may not necessarily represent an increase in nesting turtles.

When comparing results with the findings of Dow *et al*. (2007), we find that current scorings are consistent for nine of fifteen beaches for which known crawl abundances were given. Other beaches scored higher: #56 and #67 scored in the 1-24 category (previously absent); #6 scored in the 25-100 category (previously 1-24) and beaches #35 and #38 score >100 (previously 25-100). For beaches scoring in a higher category, we do not claim an increase in the size of the population as seen at some other Caribbean nations (e.g., Barbados, Beggs *et al*. 2007; Guadeloupe, Kamel & Delcroix 2009) although we cannot rule this out. Instead we suggest the underlying factor is likely improved monitoring. No beaches scored in lower categories than in Dow *et al.* (2007). Data presented in this paper provide further support for the conclusion that many of Tobago's beaches support a small number of nesting hawksbills (Dow *et al*. 2007; Forestry Division *et al*. 2010).

Records of hawksbills nesting on six new beaches can most likely be attributed to the increased geographic range over which surveys were conducted as opposed to an expanded local distribution of the species. However, as these beaches were previously un-surveyed we cannot rule out recent colonization.

There is a clear difference between the mean (±S.D.) number of hawksbill crawls on the beaches on the Caribbean side of the island (20.78±33.9, n=31) compared to those on the Atlantic side (4.56±8.01, n=18). This may be explained by differences in beach topography: the Atlantic beaches are flatter and perhaps more prone to tidal inundation as well as wave strength as the Atlantic coast is more energetic.

Over three quarters of Tobago's beaches were surveyed in three or less years during 2005-2012, while only three beaches (5.5%) have been surveyed in all eight years (Table 3). Furthermore, 35 of the 55 beaches (63.6%) have been visited only once or irregularly in a single season and are assigned the "Data Deficient" status, meaning they require more surveys in order to obtain accurate abundance estimates (Delcroix *et al*. 2013). Nineteen beaches were surveyed only for the first time in 2011. Crawl totals presented here are likely underestimates and the counts are complicated by the inclusion of both successful and unsuccessful nesting attempts. The lack of consistent, regular survey effort is a critical limitation to assessing the abundance of the hawksbill population in Tobago. Therefore, the data are not used to definitively estimate population size but rather to give an indication of hawksbill nesting levels on Tobago's beaches. We believe the coarseness of our scoring category increments is effective in capturing activity levels.

The loss of 112 nesting females in eight years to poaching highlights a significant pressure that is likely underestimated, given the low level of monitoring at many of Tobago's beaches. For a long-lived species like the hawksbill, with a late age of reproductive

Beach	2005	2006	2007	2008	2009	2010	2011	2012	Score	Data Deficient
1							24	26	25-100	Y
2							0		1-24[1]	Y
3							29	19(3)	25-100	N
4							0	1	1-24	Y
6	13(1)	0	2(1)			13	32	28(2)	25-100	N
7	2	1	0	10	21	11	23	11	1-24	N
8	9	4	1			16	5	16	1-24	N
9							0		0	Y
11							4		1-24	Y
12							5	1	1-24	Y
15							0		0	Y
18	0					11(1)	21(1)		1-24	Y
19							9		1-24	Y
21	5		1(1)			10(1)	35(6)		25-100	Y
23	0								0	Y
24	0					0			0	Y
25							0		0	Y
29	1					14	11(1)	4(1)	1-24	N
30	0					0	6	1	1-24	N
31	0		6	3		9	19(9)	28(2)	25-100	N
32	0		0			1	6(1)	2(1)	1-24	N
34	13(1)	3(1)	13(1)	2(2)		1	46(25)	22(5)	25-100	N
35	1		16	9			58(21)	132(2)	>100	N
36								23	1-24	Y
37			5					28	25-100	Y
38			26(1)	10(2)			34(8)	144	>100	N
39								8	1-24	Y
40			1	1			0	1	1-24	N
41							0		0	Y
42	1			0				2	1-24	N
43	5						5(1)	5	1-24	Y
44							16(6)	26(1)	25-100	Y
45							1(1)	2	1-24	Y
46							0		0	Y
47							0	0	0	Y
48							0		0	Y
49							0		0	Y
51							0		0	Y
53	0						0	5	1-24	Y
56			0						0	Y
57						0	0	1	1-24	N
58						0	0		0	Y
62	0						2	0	1-24	Y
63						1	13	2	1-24	N

Beach	2005	2006	2007	2008	2009	2010	2011	2012	Score	Data Deficient
64	0								0	Y
66	0						0		0	Y
67						10	12	4(1)	1-24	N
69						0	0		0	Y
70						1	19	21	1-24	N
72							0		0	Y
73						0	3	1	1-24	N
74						3	2	5	1-24	N
75						3	17	7(1)	1-24	N
76							0		0	Y
77								1	1-24	Y
TOTAL	50 (2)	8 (1)	71 (4)	35 (4)	21	104 (2)	457 (80)	577 (19)		
	n= 19	n= 4	n= 10	n= 9	n = 3	n= 20	n=46	n=33		

Table 3. Table begins on page 7. Data for beaches that have been surveyed for hawksbill nesting around Tobago, 1991 and 2005-2012. Numbers = crawls (poachings), Data Deficient (Y = yes, N = no), n = no. beaches surveyed. Data sources are listed in Table 2. [1]Based on Godley *et al*. (1991) result for beach #2: presented in text results only.

maturity (Musick 2001), this pressure is likely unsustainable and could lead to a population decline.

This paper shows that the distribution of hawksbill turtles is wider than was previously known for Tobago and that the island supports consistent hawksbill nesting in non-negligible numbers. Few sites in the Caribbean are known to support >1,000 hawksbill crawls per year (Dow *et al*. 2007); hence the nearly 600 crawls found on beaches #1-43 in 2012 along Tobago's 41 km of Caribbean coastline signify a site of regional conservation relevance.

Clearly there is a need for greater resources to be directed towards conservation activities. However, given the issues of numerous, small, dispersed nesting beaches and logistics (access, manpower, equipment) it is perhaps unrealistic to expect to regularly monitor all nesting beaches in the immediate future. It is recommended that effort is focused on the main identified nesting beaches, in order to reduce the impact of illegal poaching and to maximize the efficacy of data collection efforts by prioritizing beaches and employing suitable sampling regimes (SWOT Scientific Advisory Board 2011).

As a program of regular surveys demands significant resource investment, we suggest exploring different population modeling techniques such as those utilized in other Caribbean nations with similar geographical and logistical challenges (Delcroix *et al*. 2013). Modeling may provide useful numerical outputs for beaches that currently cannot be monitored frequently. This could be beneficial for site managers whose decisions are currently limited by a deficiency of empirical data.

This paper addresses the need for an updated map of hawksbill turtle nesting around Tobago as identified in Trinidad and Tobago's Sea Turtle Recovery Action Plan (Forestry Division *et al*. 2010). By compiling all available hawksbill nesting data for Tobago (from 1991 to 2012) and identifying every beach that is deemed suitable for nesting, this paper will allow for the development of a more effective strategy for monitoring hawksbills, and green turtles in Tobago. It is hoped this paper will provide cohesion and act as a baseline from which other researchers can build, improve and populate.

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ALKINS, G. & H. PEPE. 2007. Summary of Marine Turtle Nesting Activity 2007 - Cambleton Bay, Hermitage Bay, L'Anse Fourmi Bay and Dead Bay. Save Our Sea Turtles, Tobago. 1pp.

BEGGS, J.A, J.A. HORROCKS & B.H. KRUEGER. 2007. Increase in hawksbill sea turtle *Eretmochelys imbricata* nesting in Barbados, West Indies. Endangered Species Research 3: 159-168.

CARR, A.F., A.B. MEYLAN, J.A. MORTIMER, K.A. BJORNDAL & T. CARR. 1982. Preliminary survey of marine turtle populations and habitats in the western Atlantic. NOAA Tech Memo NMFS-SEFC-91, 91pp.

CAWLEY, B. 2005. The Nesting and Conservation Status of Sea Turtles in Tobago. BSc Thesis. University of Glasgow, Glasgow, Scotland, 64pp.

DELCROIX, E, S. BÉDEL, G. SANTELLI & M. GIRONDOT. 2013. Monitoring design for quantification of marine turtle nesting with limited effort: a test case in the Guadeloupe archipelago. Oryx 48: 95-105.

DOW, W, K.L. ECKERT, M. PALMER & P. KRAMER. 2007. An Atlas of Sea Turtle Nesting Habitat for the Wider Caribbean

Region. WIDECAST Tech Rep No. 6. Beaufort, NC. 267 pp.

ECKERT, K.L. 1998. Endangered sea turtles of Tobago. Environment Tobago Newsletter Issue 2.2.

FORESTRY DIVISION (GOVERNMENT OF THE REPUBLIC OF TRINIDAD AND TOBAGO), SAVE OUR SEATURTLES-TOBAGO & NATURE SEEKERS. 2010. WIDECAST Sea Turtle Recovery Action Plan for Trinidad & Tobago (K. L. Eckert, Editor). CEP Technical Report No. 49. UNEP Caribbean Environment Programme. Kingston, Jamaica. 132pp.

GEORGES, C. 1983. A Coastal Classification for Trinidad. Institute of Marine Affairs, Chaguaramas, Trinidad & Tobago. 10pp.

GODLEY, B., A. BRODERICK, S. BLACKWOOD, L. COLLINS, K. GLOVER, C. MCALDOWIE, D. MCCULLOCH, J. MCLEOD. 1992. Studies on Marine Turtles Nesting in Trinidad and Tobago, University of Glasgow Conservation Expedition, Glasgow, Scotland. 19pp.

GODLEY, B., A. BRODERICK, S. BLACKWOOD, L. COLLINS, K. GLOVER, C. MCALDOWIE, D. MCCULLOCH & J. MCLEOD. 2001. Survey of marine turtles nesting in Trinidad and Tobago. Marine Turtle Newsletter 61: 15-18.

INSTITUTE OF MARINE AFFAIRS. 2004. A Guide to the Beaches and Bays of Trinidad and Tobago. Institute of Marine Affairs, Chaguaramas, Trinidad & Tobago. 113pp.

KAMEL, S.J. & N. MROSOVSKY. 2005. Repeatability of nesting preferences in the hawksbill sea turtle, *Eretmochelys imbricata,* and their fitness consequences. Animal Behaviour 70: 819–828.

KAMEL, S.J. & E. DELCROIX. 2009. Nesting ecology of the hawksbill turtle, *Eretmochelys imbricata*, in Guadeloupe, French West Indies from 2000-07. Journal of Herpetology 43: 367-376.

LAW, A., T. CLOVIS, G.R. LALSINGH & J. R. DOWNIE. 2010. The Influence of lunar, tidal and nocturnal phases on the nesting activity of leatherbacks (*Dermochelys coriacea*) in Tobago, West Indies. Marine Turtle Newsletter 127: 12-17.

LALSINGH, G. 2008. Summary of Marine Turtle Nesting Activity, Save Our Sea Turtles. 21 pp. www.sos-tobago.org

LALSINGH, G. 2009. Summary of Marine Turtle Nesting Activity 2009 - Turtle Beach, Grafton and Mt. Irvine Back Bay. G. www.sos-tobago.org.

LALSINGH, G. 2010. Summary of Sea Turtle Nesting Activity 2010. www.sos-tobago.org.

LALSINGH, G. 2011. Summary of Sea Turtle Nesting Activity 2011. www.sos-tobago.org.

MEYLAN, A.B. & M. DONNELLY. 1999. Status justification for listing the hawksbill turtle (*Eretmochelys imbricata*) as Critically Endangered on the 1996 IUCN Red List of Threatened Animals. Chelonian Conservation & Biology 3: 200-224.

MUSICK, J. A. 2001. Management planning for long-lived species. In: K.L. Eckert & F.A. Abreu-Grobois. (Eds.). Proceedings of the Regional Meeting: "Marine Turtle Conservation in the Wider Caribbean Region - A Dialogue for Effective Regional Management", Santo Domingo, 16-18 November 1999. WIDECAST, IUCN-MTSG, WWF and UNEP-CEP, pp. 59–68.

PEPE, H. 2008. Nesting Turtles. North East Sea Turtles, Charlotteville, Tobago. 1pp.

PRITCHARD, P. C. H. & MORTIMER, J. A. 1999. Taxonomy, external morphology, and species identification. In: Eckert, K.L., K.A. Bjorndal, F.A. Abreu-Grobois & M.A. Donnelly (Eds.). Research and Management Techniques for the Conservation of Sea Turtles. IUCN/SSC Marine Turtle Specialist Group Publication No. 4, pp. 21-38.

REID, K. 2007. Sea turtles in Tobago: report from a University of Glasgow undergraduate expedition. Testudo 6: 25-39.

ROBB, A. 2010. A study of Tobago's nesting beaches: leatherback and hawksbill turtles. BSc Thesis. University of Glasgow, Glasgow, Scotland. 70pp.

SCHROEDER, B. & S. MURPHY. 1999. Population surveys (ground and aerial) on nesting beaches. In: Eckert, K.L., K.A. Bjorndal, F.A. Abreu-Grobois & M.A. Donnelly (Eds.). Research and Management Techniques for the Conservation of Sea Turtles. IUCN/SSC Marine Turtle Specialist Group Publication No. 4, pp. 45-55.

SAVE OUR SEA TURTLES. 2006. Summary of Marine Turtle Nesting Activity 2006 - Turtle Beach, Grafton and Mt. Irvine Back Bay. www.sos-tobago.org

SAVE OUR SEA TURTLES. 2012. Summary of Sea Turtle Nesting Activity 2012. G. Lalsingh, T. Clovis-Howie (Editor). www.sos-tobago.org

SWOT Scientific Advisory Board. 2011. The State of the World's Sea Turtles (SWOT) Minimum Data Standards For Nesting Beach Monitoring. www.seaturtlestatus.org

WALKER, G. 2006. Turtle Nesting Activity in North East Tobago. North East Sea Turtles, Charlotteville, Tobago. 1pp.

WALKER, G. 2007. Turtle Nesting Activity in North East Tobago. North East Sea Turtles, Charlotteville, Tobago. 1pp.

WALKER, G. 2008. Turtle Nesting Activity in North East Tobago. North East Sea Turtles, Charlotteville, Tobago. 1pp.

WALKER, G. 2010. Turtle Nesting Activity in North East Tobago. North East Sea Turtles, Charlotteville, Tobago. 1pp.

WALKER, G. 2011. Nesting Events Summary 2011. North East Sea Turtles, Charlotteville, Tobago. 4pp.

WALKER, G. & GIBSON, K. W. In press. The first documented evidence of a rookery of the Critically Endangered hawksbill sea turtle (*Eretmochelys imbricata*) in north east Tobago. Chelonian Conservation & Biology 14.

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

Decades-long Open Trade in Protected Marine Turtles Along Java's South Coast

Vincent Nijman
Oxford Wildlife Trade Research Group, Oxford Brookes University, OX0 1BP, Oxford UK (E-mail: vnijman@brookes.ac.uk)

The island of Java, Indonesia, has long been recognized as globally important for marine turtle conservation. Five species (green *Chelonia mydas*, hawksbill *Eretmochelys imbricata*, olive ridley *Lepidochelys olivacea*, loggerhead *Caretta caretta*, and leatherback turtles *Dermochelys coriacea*) are found in the Indian Ocean to the south of the island (Derawan 2004; Whitten *et al*. 1996). While it has been argued that traditionally for the majority of Javan people, the sea and the coast, and especially its southern shores, are something to be feared (Polunin 1985), throughout the centuries communities have exploited coastal resources, and this includes the use of marine turtles (Whitten *et al.* 1996).

Over-exploitation of eggs and adults, especially of green and hawksbill turtles on Java have led to their decline with considerable decreases in population sizes (Whitten *et al*. 1995). While studies have been published on the harvesting of eggs along the south coast beaches (Sloan *et al*. 1994) and the struggles of several hatchling projects (Arinal 1997; Derawan 2004; Whitten *et al*. 1995), comparatively little has been reported on the extent to which adult turtles are exploited on Java (but see Salm & Usher 1984). Marine turtles have received legal protection from exploitation through various legal decrees and laws. Leatherbacks were the first to be protected in 1978 through a decree from the Ministry of Agriculture (SK Mentan No 327/Kpts/Um/5/1978), followed by loggerheads and olive ridley turtles in 1980 (SK Mentan No 716/ Kpts/Um/10/1980). Green and hawksbill turtles, as well as flatback turtles *Natator depressus*, received formal protection in 1999 when they, as well as the aforementioned species, were included in a government regulation (Peraturan Pemerintah No 7 / 1999). This regulation protected all marine turtles occurring in Indonesian waters (Noerjito & Marjanto 2001). All capture or trade of protected wildlife is prohibited, and offenders are liable for fines of up to IDR 100,000,000 (USD $8,200 at 2014 exchange rates), as well as imprisonment of up to 5 years.

Because of the illegal nature of the trade in marine turtles it may be difficult to obtain reliable data on the number of turtles taken, apart from those areas where they are openly traded. One such area is the tourist resort of Pangandaran (7°41' S, 108°39' E), which is situated on a small peninsula along Java's south coast, protruding into the Indian Ocean. There are four reports of the marine turtle trade in Pangandaran. Work by Hilterman & Goverse (2005) was qualitative, with only generalities of the trade being presented. This work was based on a single, four-day visit in 2004. Work by the Indonesian NGOs ProFauna (Anonymous 2005) and the Wildlife Conservation Society Indonesia (Anonymous 2010) were based on single, what appeared to be one-day, visits and while they were quantitative, they lacked detail on what was observed where. Finally Nijman (2013) reported data from a 3-day visit in 2012, during which all specimens were counted, measured and data were collected on the monetary value of the turtle trade.

Additionally, we do know that turtle trade was altered after Pangandaran was hit in July 2006 by a tsunami, which killed approximately 600 people and destroyed many single story structures. The pre–tsunami Pangandaran tourist business was characterized by small hotels and hostels catering to individual tourists and smaller parties. Pratiwi (1994) indicated that approximately 700,000 visitors, 98% of them Indonesian, visited Pangandaran annually in 1991 and 1992. Pre–tsunami turtles, turtle eggs and turtle derivatives were openly traded primarily in a central market area close to the southern part of the village. It took a few years for Pangandaran to rebuild itself after the tsunami, with the town investing in large-scale tourism. This resulted in high-rise three and four star hotels being erected side by side on the western beach front. It also resulted in a significant increase in visitor numbers: according to staff at the entry gate in 2013, some 2.5 million holidaymakers, still predominantly Indonesian, frequented the peninsula. Immediately following the tsunami, Wiradnyana (2007) noted a decline in the trade in marine turtles and their derivatives but hitherto no overview has been available on trade in marine turtles in recent years.

Over the last twenty years I have made eight visits to Pangandaran (1995, 1997 twice, 1999, 2004, 2012 twice, 2013), which has allowed me to observe the trade in stuffed marine turtles, their eggs and derivatives. Because tourism in the area is open to outsiders, I had no problem collecting key data on the exploitation of marine turtles. Each visit lasted between two and four days, totaling 22 days in all. During the visits in the 1990s the mornings were spent primarily collecting data on eagles and primates in the adjacent nature reserve, and the shops and stalls were visited during the afternoon. These shops were mostly concentrated in the southernmost part of the village close to the nature reserve and the entire area could be surveyed in the course of an afternoon. Unfortunately I did not count each and every turtle in trade and I did not make attempts to visit each and every shop selling marine turtles; as such my data from this period are best considered qualitative. From 2004 onwards surveys were more extensive and more systematic, and were as much as possible conducted during weekends or public holidays when more shops were open. I attempted to visit all shops that potentially could sell turtles, turtle eggs or turtle oil. Given that by this time the total number of shops had increased, and the shops selling marine turtles were spread out over a larger area, it would typically take me a full day or sometimes a day and a half, to check all shops. Subsequent days were spent revisiting shops, checking ones that may have been closed on the first day and collecting additional data on the wildlife trade. Early mornings were spent at the fish market. The survey in 2004 stood out as it coincided with the end of Ramadan (the ninth month of the Islamic calendar during which Muslims observe a month of fasting) and few shops were open. Throughout my visits in Pangandaran, interviews with traders, fishermen and government officials were conducted in Bahasa Indonesia. As such I built up an overview that allow me to give a narrative of the turtle trade in this village. At no point did I purchase marine turtles or their derivatives.

Post-tsunami trade in marine turtles took place in three distinct areas: the tourist market on the northern end of the peninsula (Pasar

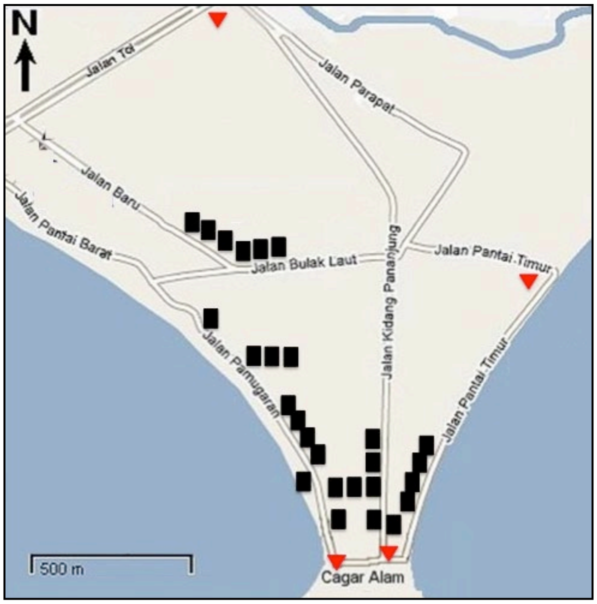

Figure 1. Map of Pangandaran, South Java, Indonesia, showing the approximate locations where marine turtles were traded in 2012-2013 (black squares) as well as the offices of authorities responsible for enacting wildlife protection laws (police, national park authorities; red triangles).

Wisata at the junction between Jl Bulak Laut and Jl Baru), along the entire West Beach Road (Jl Pantai Barat and Jl Pamugaran) and at the southern end of the East Beach Road (Jl Pantai Timur, Fig. 1).

The total number of shops selling stuffed marine turtles fluctuated between 15 and 30; this differed little between years but more shops were open on weekends and during public holidays. Pre-tsunami, in the 1990s, at least a dozen shops were selling marine turtles, mostly in the southern part of the village. In 2005 ProFauna found 64 shops selling marine turtle products (Anonymous 2005). It is unclear how many shops were active when Hilterman & Goverse (2005) surveyed Pangandaran but it appears to have been dozens of souvenir stalls and shops. In the post-tsunami era, most shops sell just two or three individual stuffed turtles with the most I have seen in one single shop visit being 18 (greens, hawksbills and olive ridleys). In the 1990s (pre-tsunami), several shops displayed tens of stuffed marine turtles, and in 2004 Hilterman & Goverse (2005) recorded over 30 individuals in a single shop (see Fig. 2). Having received all the photographs they took during their visit, 16 of which depict one or more stuffed turtles, it seems that a minimum of around 75 stuffed turtles were on display. Overall, there seems to have been a clear decline in the number of turtles for sale when comparing pre- and post-tsunami surveys (Table 1).

Area	Period	Shops	Hawksbill	Olive ridley	Green	Total
Tourist market	Apr. 2005	35	46	6	6	58
	Apr. 2012	8	4	8	12	24
West Beach	Apr. 2005	35	25	16	0	41
	Apr. 2012	8	5	4	8	17
East Beach	Apr. 2005	19	29	15	0	44
	Apr. 2012	1	1	0	1	2

Table 1. Number of stuffed turtles openly for sale in the month of April in Pangandaran, Java, Indonesia, before and following the July 2006 tsunami (2005 data from Anonymous 2005 and 2012 data from this study).

Vendors I have interviewed indicated that the turtles are caught locally by Pangandaran fishermen. Based on some of the larger pelagic fish that are typically landed by these fishermen (e.g., skipjack tuna *Katsuwonus pelamis*, Indo-Pacific king mackerel *Scomberomorus guttatus*, tongkol *Euthynnus* spp., and also occasionally manta rays *Manta* spp.), I suspect that at least some of the marine turtles are caught in pelagic waters. Again based on information provided to me by traders, after being brought ashore in Pangandaran the turtles are stuffed and sold locally. Unlike some other protected wildlife for sale in Pangandaran, such as nautilus *Nautilus pompilius* that are brought in from other parts of Java, I received no information that the turtles were derived from outside the immediate area. This is in contrast to reports from ProFauna that stated that 99% of the stuffed turtles originated from traders in Cilacap (a town 50 km east of Pangandaran), who in turn obtained their turtles from the north coast of East Java province (Anonymous 2005).

Green turtles are the most common species observed in Pangandaran, with typically over two dozen stuffed individuals observed at a time. In addition to stuffed turtles, green turtle oil (locally known as *minyak bulus*) is also sold (according to the traders I spoke to *minyak bulus* is derived from green turtles and not any other species). Hilterman & Goverse (2005) reported the presence of large volumes of turtle oil in 2004, with individual shops displaying over 150 bottles, including one liter bottles, in large glass display cases (Fig. 2). In contrast, Anonymous (2005) explicitly stated that at Pangandaran no turtle oil was observed for sale, and Anonymous (2010) does not mention turtle oil at all. I have observed turtle oil for sale during all post-tsunami surveys, mostly in small 100 ml bottles, and at most twenty bottles per shop.

Hawksbill turtles are the second most common species in Pangandaran. Typically, 15 to 20 stuffed hawksbill turtles are on display. I have not seen any genuine tortoise shell (*bekko*) products made out of hawksbill scutes for sale in Pangandaran but in 2005 a total of 338 tortoise shell bracelets were reported for sale in the three market areas (Anonymous 2005). Olive ridley turtles were recorded during each post-tsunami survey. Numbers observed per surveyed ranged from eight to twelve.

I did not observe any loggerhead turtles for sale but Hilterman & Goverse (2005) recorded them in Cilacap and indicated that loggerheads were equally present in Pangandaran. Finally, leatherback turtles have not been recorded for sale in Pangandaran. The limited data available on the distribution of marine turtles along Java's south coast, as summarized by Whitten *et al*. (1996), indicate that leatherbacks have been recorded nesting only on the far western and far eastern tips of the island, some 400-700 km from Pangandaran.

In summary, for at least 20 years, three or possibly four species of marine turtle have been traded openly in Pangandaran. While the volume of adult stuffed turtles and their by-products has gone down considerably over this period, importantly, stuffed turtles remain an omnipresent feature of the tourist shopping experience in

Figure 2. Trade in marine turtles in Pangandaran, 2004 (left) and 2013 (right), showing stuffed green, olive ridley and hawksbill turtles for sale inside and in front of shops, along with bottles of turtle oil (photo credit: 2004 = Edo Goverse and Maartje Hilterman, 2013 = Vincent Nijman).

Pangandaran. It is unclear whether this decrease is due to a decrease in demand, a decrease in the supply, or a combination of both. While all species of marine turtle have been legally protected in Indonesia since 1999 (and loggerheads and olive ridleys since 1980) my experience in Pangandaran does not suggest that an increase in law enforcement is one of underlying factors of a decrease in trade.

Wiradnyana (2007) reported that in 2005, following enforcement actions in Cilacap, there had been a shift of “turtle stock” from Cilacap to Pangandaran. As reported by Nijman (2013) and noted by others (Anonymous 2012; Hilterman & Goverse 2005) the trade of protected wildlife in Pangandaran occurs openly, including in shops in front of the offices of the nature reserve. Wildlife protection laws are not being enforced as intended and this does not appear to be from limited capacity. The offices of the nature reserve are manned continuously, as is the town’s police station, and marine turtle products are traded within walking distance of the law enforcement offices (Fig. 1). Rather it appears that the laissez-faire attitude toward protected species laws is due to a lack of pressure on the authorities to treat these illegal sales as a priority issue (cf. Lee *et al*. 2005; Nijman & Nekaris 2014; Shepherd 2008). All participants involved in the illegal trade of marine turtles in Pangandaran (collectors, middlemen, traders and consumers) must be held accountable for their actions and prosecuted. To this extent, law enforcement must be incentivized to firmly uphold turtle protection legislation. In the absence of this, populations along Java’s south coast may decline even further than they have already.

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ANONYMOUS. 2005. Laporan Investigasi Perdagangan Penyu di Pesisir Selatan Jawa. Malang: ProFauna. 17pp. http://ow.ly/Jmpvh

ANONYMOUS. 2010. Sea turtles trading at Pangandaran beach, need urgent action immediately! Wildlife Conservation Society-Indonesia.

ANONYMOUS. 2012. Penjualan penyu yang diawetkan masih marak. Radar Tasikmalaya 1 Sept 2012: 18.

ARINAL, I. 1997. Marine turtle management in Meru Betiri National Park. In: Noor, Y.R., I.R. Lubis, R. Ounsted, S. Troëng, & A. Abdullah (Eds.). Proceedings of the Workshop on Marine Turtle Research and Management in Indonesia. Wetlands International, Bogor, Indonesia. pp. 151-157.

DERAWAN, A. 2004. Indonesia. Conservation and enhancement of sea turtles in the Southeast Asian Region. Talib, Z., A. Ali, K.K.K. Yaacob, & M.M. Isa (Eds.). Southeast Asian Fisheries Development Center, Kuala Terengganu. pp. 53-60.

HILTERMAN, M. & GOVERSE, E. 2005. A note on the illegal trade in stuffed turtles in South Java, Indonesia. Marine Turtle Newsletter 109: 9.

LEE, R.J., A.J. GOROG, A. DWIYAHRENI, S. SIWU, J. RILEY, H. ALEXANDER, G.D. PAOLI & W. RAMONO.2005. Wildlife trade and implications for law enforcement in Indonesia: a case study from North Sulawesi. Biological Conservation 123: 477-488.

NIJMAN, V. 2012. Marine turtles trade at Pangandaran, South Java. TRAFFIC Bulletin 24: 49-50.

NIJMAN, V. & K.A.I. NEKARIS. 2014. Trade in wildlife in Bali, Indonesia, for medicinal and decorative purposes. TRAFFIC Bulletin 26: 31-36.

NOERJITO, M & I. MARJANTO. 2001. Jenis-jenis Hayati yang Dilindungi Perundang-undangan Indonesia. LIPI, Cibinong. 217pp.

POLUNIN, N.V.C. 1985. Traditional marine practices in Indonesia and their bearing on conservation. In: McNeely, J.A. & D.C. Pitt (Eds.). Culture and Conservation: The Human Dimension in Environmental Planning. Croom Helm, London. pp. 155-179.

PRATIWI, W. 1994. Development, tourism, and gender analysis: Pangandaran, West Java, Indonesia as the case study. M.Sc. Thesis, York University, North York, Ontario, Canada. 116pp.

SALM, R. & G.H. USHER. 1984. Sea Turtle Trade in Indonesia WWF Indonesia, Bogor, Indonesia. 59pp.

SHEPHERD, C.R. 2008. Civets in trade in Medan, North Sumatra, Indonesia (1997–2001) with notes on legal protection. Small Carnivore Conservation 38: 34-36.

SLOAN, A., A. WICAKSONO, T. TOMASCIK & UKTOLSEYA, H. 1994. Pangumbahan sea turtle rookery, Java, Indonesia: Toward protection in a complex regulatory regime. Coastal Management 22: 251-264.

WHITTEN, A.J., R.E. SOERIAATMADJA & S.A. AFIFF. 1996. The ecology of Java and Bali. Singapore: Periplus Editions. 969pp.

WIRADNYANA, I.W. 2007. ProFauna's annual reflection on turtle trade in Indonesia. Indian Ocean Turtle Newsletter 5: 30-31.

Absence of Ingested Plastics in 20 Necropsied Sea Turtles in Western Australia

Linda Reinhold

Department of Parks and Wildlife, 20 Nimitz Street, Exmouth WA 6707 and 61 Knight Terrace, Denham WA 6537, Australia (E-mail: linda_reinhold@hotmail.com)

Reports of sea turtles having ingested plastic debris were becoming common by 1985 (Balazs 1985). Schuyler *et al.* (2014) compiled data from subsequent studies worldwide. They found that for green turtles, the 30% likelihood of consuming anthropogenic debris in 1985 had increased to nearly 50% in 2012. Of 37 studies summarized, 29 reported seeing anthropogenic debris in turtles. Debris was most commonly plastics, but included rope, Styrofoam, fishing line, balloons and other items. Ingested marine debris was found in turtles from the Southwest Pacific, Central North Pacific, Northeast Pacific, Southeast Pacific, Southwest Atlantic, Gulf of Mexico / Northwest Atlantic, Northeast Atlantic and Mediterranean regions. The only region where no ingested marine debris was recorded was the Persian Gulf, although studies from this region did not examine the entire gastrointestinal tract. There were no studies from the Southeast Indian Ocean region. Hoarau *et al.* (2014) have since documented the ingestion of plastics by loggerhead turtles in the Southwest Indian Ocean.

My study adds the first data on debris ingestion in sea turtles from Western Australia. I aimed to quantify the incidence of plastic ingestion in opportunistic necropsies of stranded animals. The digestive tracts of 20 sea turtles that stranded at Ningaloo and Shark Bay on the Western Australian mainland coast were examined for presence of plastics. It was beyond the scope of this study to definitively determine the cause of death.

During the 2002/03 summer nesting season on the Ningaloo coast, one loggerhead (*Caretta caretta*) and nine green (*Chelonia mydas*) turtles that washed ashore dead were necropsied.

From 2009 to 2013, ten green turtles were necropsied in Shark Bay. There was variation in strandings by year, with two dead turtles reported in 2010, none in 2011, eight in 2012, then none in 2013. By 2012, Thomson *et al.* (In press) observed a decline in the condition of green turtles in eastern Shark Bay, which they attributed to the degradation of the seagrass meadows from a marine heat wave lasting the first quarter of 2011 and possibly floods in January 2011. Of the ten Shark Bay animals, eight died in winter or early spring, and two died in late spring, suggesting that the cooler winter water may have put extra stress on these turtles. It is also possible that the increase in strandings in winter is due to decreased shark activity in the cooler months, which allows for dead and moribund animals to wash ashore instead of being consumed at sea. Three of the animals had stranded alive, but subsequently died during rehabilitation at the Ocean Park aquarium facility.

In the field at the time of stranding, death was confirmed by testing the muscle response of the neck. An external examination of each carcass was made, noting decomposition, presence of any external injuries or abnormalities, and body condition. All animals had curved carapace length (CCL) recorded. The plastron was then removed to enable internal examination and to determine sex. On all of the animals the entire gastrointestinal tract was dissected and examined for presence of plastics from the mouth, through the oesophagus, stomach, large and small intestines, to the cloaca. Presence of parasites in the intestinal tract was recorded on all but four Ningaloo necropsies. Full details of necropsy results are stored in the Western Australian Department of Parks and Wildlife's marine stranding database.

On the Ningaloo coast, two of the necropsied turtles were juvenile greens (CCL = 42.0-45.8 cm), four were sub-adult greens (CCL = 75.4-89.4 cm) and three were adult-sized greens (CCL = 92.2 -99.4 cm) (The 92.2 cm male and a 94.7 cm female were adults, but the 99.4 cm female was pubescent. The one adult female had bred before, but was not breeding in the current season) (size classification follows Read & Limpus 2002). The loggerhead was adult-sized. All ten turtles autopsied in Shark Bay were juvenile greens (CCL = 39.0-50.6 cm). Of the 20 turtles examined, eight of the animals were determined by necropsy to be female and 12 were male.

Necropsy results from the 20 animals revealed that none had plastic or other anthropogenic debris in the gastrointestinal tract. Gut contents consisted mostly of seaweed and seagrass, with the occasional incidence of sponge. One juvenile green from Coral Bay (Ningaloo) had been in good condition, but died from a slit throat (presumably a fishing incident), and another from Monkey Mia (Shark Bay) had ingested a piece of hard stick which had lodged crossways in the gut, rupturing the gut wall and causing a blockage. Neither of these animals had obvious internal parasites. The other animals were generally in poor condition with sunken plastrons, black fat, non-functional digestive tracts and parasites.

In the search for parasites in the six Ningaloo green turtles, one had no parasites, five had coccidia and one of these animals also had large numbers of spirochids. Eight of the ten Shark Bay green turtles had obvious infestations of parasites, five of these spirochids (two of which were noted as severe) and three had coccidia.

Green turtles in Shark Bay have been observed to feed on temperate and tropical seagrasses, benthic macroalgae, sponges and scyphozoan jellyfish/ctenophores (Burkholder *et al.* 2011; Heithaus *et al.* 2002; Jordan Thomson unpubl. data).

The absence of plastics in the intestinal tracts of Ningaloo and Shark Bay stranded turtles is in contrast to findings from the east coast of Australia. Schuyler *et al.* (2012) autopsied 115 stranded green (n = 88), hawksbill (n = 24), loggerhead (n = 2) and flatback (n = 1) turtles in Queensland from 2006 to 2011. Of these, 64 had washed up dead to North Stradbroke Island, and 51 had not survived rehabilitation after live stranding on the Sunshine Coast. Ingested plastics were found in the intestinal tracts of 54.5% of pelagic-sized (CCL < 40 cm for green and CCL ≤ 35 cm for hawksbill) turtles (n = 22), and 29% of benthic-feeding (CCL ≥ 40 cm for green and CCL > 35 cm for hawksbill) turtles (n = 93). In southeast Queensland, offshore turtles ingested more debris than inshore turtles (Schuyler *et al.* 2014).

The Shark Bay animals were resident juveniles, with none of the pelagic-stage turtles that Schuyler *et al.* (2012) found to have the highest debris ingestion rates. Schuyler *et al.* (2012) also suggest that the smaller a turtle is, the more likely a given piece of debris is to become lodged in its intestinal tract.

Studies finding no anthropogenic debris in the intestinal tracts of sea turtles are becoming the exception, and Schuyler *et al.* (2014) did not identify any regions of the world with an absence of ingested debris where intestinal tracts had been dissected during necropsy. The Southeast Indian Ocean is now the only region of the world to have had entire intestinal tracts of sea turtles dissected, yet no ingested anthropogenic debris found. Only 20 turtles from the central west coast of Western Australia were examined in this study, and ingested debris may be found if necropsies are done in other areas of the Western Australian coast.

Hardesty *et al.* (2014) found the Australian coastline between Brisbane and Melbourne on the east coast, and to the south of Perth on the west coast, to be highest in the input of debris to the marine environment. Southwest Shark Bay had a coastal debris density comparable with more populated areas, but it may not have been the type of debris that is ingested by turtles. Ningaloo had a negligible density of coastal debris. Availability of the types of debris commonly ingested by sea turtles would be expected to be a factor in ingestion rates. With Shark Bay being so remote to dense human population, it may be that the sorts of anthropogenic debris that sea turtles consume are not encountered in the water column as readily as are their gelatinous prey.

In a study where video cameras were attached to 12 green turtles (CCL = 76-103 cm) in Shark Bay, Heithaus *et al.* (2002) recorded turtles consuming 67 of the 275 potential jellyfish and ctenophore prey items encountered. They inferred that if green turtles consumed such prey at the rates observed, each turtle would consume about 40 jellyfish and ctenophores each day. Although the green turtles lived in sea grass habitats, only two of the 12 turtles briefly consumed sea grass. A subsequent study also of 12 green turtles (CCL ≥ 60 cm) mounted with video cameras in Shark Bay found an even greater rate of foraging on gelatinous macroplankton, and confirmed low rates of foraging on sea grass (Burkholder *et al.* 2011). The Burkholder *et al.* (2011) study, however, suggested that green turtles of CCL 40-60 cm (which is a similar size range in which all ten of the green turtles I necropsied fell) consumed mostly macroalgae, and relatively little gelatinous macroplankton. Perhaps juvenile turtles have different nutritional requirements until they reach the next growth stage, or perhaps they find safety grazing on the sea floor, whereas larger turtles which have outgrown the size most vulnerable to sharks may spend more time foraging in the water column.

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BALAZS, G.H. 1985. Impact of ocean debris on marine turtles: entanglement and ingestion. In: Shomura, R.S. & H.O. Yoshida (Eds.). Proceedings of the Workshop on the Fate and Impact of Marine Debris. NOAA Tech Memo NMFS-SWFC-54. pp. 387-429.

BURKHOLDER, D.A., M.R. HEITHAUS, J.A. THOMSON & J.W. FOURQUREAN. 2011. Diversity in trophic interactions of green sea turtles *Chelonia mydas* on a relatively pristine coastal foraging ground. Marine Ecology Progress Series 439: 277-293.

HARDESTY, B.D., WILCOX, C., LAWSON, T.J., LANSDELL, M. & T. VAN DER VELDE. 2014. Understanding the effects of marine debris on wildlife. A Final report to Earthwatch Australia. CSIRO.

HEITHAUS, M.R., J.J. MCLASH, A. FRID, L.M. DILL & G.J. MARSHALL. 2002. Novel insights into green sea turtle behaviour using animal-borne video cameras. Journal of the Marine Biological Association of the United Kingdom 82: 1049-1050.

HOARAU, L., L. AINLEY, C. JEAN & S. CICCIONE. 2014. Ingestion and defecation of marine debris by loggerhead sea turtles, *Caretta caretta*, from by-catches in the South-West Indian Ocean Marine Pollution Bulletin 84: 80-96.

READ, M.A. & C.J. LIMPUS. 2002. The green turtle, *Chelonia mydas,* in Queensland: feeding ecology of immature turtles in Moreton Bay, southeastern Queensland. Memoirs of The Queensland Museum 48: 207-214.

SCHUYLER, Q., B.D. HARDESTY, C. WILCOX & K. TOWNSEND. 2012. To eat or not to eat? Debris selectivity by marine turtles. PLoS ONE 7(7): e40884.

SCHUYLER, Q., B.D. HARDESTY, C. WILCOX & K. TOWNSEND. 2014. Global analysis of anthropogenic debris ingestion by sea turtles. Conservation Biology 28: 129-139.

THOMSON, J.A., D.A. BURKHOLDER, M.R. HEITHAUS, J.W. FOURQUREAN, M.W. FRASER, J. STATTON & G.A. KENDRICK. In press. Extreme temperatures, foundation species, and abrupt ecosystem change: an example from an iconic seagrass ecosystem. Global Change Biology. doi: 10.1111/gcb.12694

Literature and Conservation: “The Turtle”, A Short Story by the Brazilian Writer Rubem Braga

Paulo C. R. Barata

Fundação Oswaldo Cruz, Rua Leopoldo Bulhões 1480-8A, 21041-210 Rio de Janeiro - RJ, Brazil

(E-mail: paulo.barata@ensp.fiocruz.br)

"The Turtle" (original title in Portuguese: "A Tartaruga"; Braga 1960) is a short story written in 1959 by the Brazilian journalist and writer Rubem Braga. In the text, "Copacabana" is one of Rio de Janeiro's seaside districts, where the world-famous Copacabana Beach is located, and "Cachoeiro" is short for Cachoeiro de Itapemirim, the author's native city in the state of Espírito Santo.

The Turtle

Copacabana dwellers, buy your fish at Bolivar Fish Market, 70 Bolivar Street, owned by Mr. Francisco Mandarino. Because it happens that he is a good man.

The fact is that he was sent a turtle of about 150 kilos, two meters long and (it is said) 200 years old, and he displayed it in his fish market for three days and he did not want to sell it; and he took it up to the beach, and released it into the sea.

There was a poet sleeping within the merchant, and he revered life and freedom in the image of a turtle.

Never kill a turtle.

Once, at my father's house, we killed a turtle. It was a big old sea turtle that a fisherman friend sent to us in Cachoeiro.

Men get together to kill a turtle, and it resists for hours. They cut its head off, it continues to flap its flippers. They rip its heart off, the heart continues to beat. Life is deep-rooted in its tissues with an obstinacy that inspires respect and fear. A cut piece of flesh, thrown on the floor, trembles on its own, all of a sudden. Its agony is as terrible and insistent as a nightmare.

Suddenly the men stop and look at each other with the vague feeling that they are committing a crime.

Copacabana dwellers, buy your fish at Francisco Mandarino's Bolivar Fish Market, because within him, in a beautiful moment of his common life, the poet defeated the merchant. Because he did not kill the turtle.

Rio, July, 1959.

Rubem Braga (1913-1990), widely acknowledged in Brazilian literary circles as a master in the art of writing, produced mainly short stories of a literary genre called in Brazil "crônica", defined by the Encyclopaedia Britannica as "a short prose sketch integrating elements of essay and fiction" (Encyclopaedia Britannica 2008), where the underlying theme, generally taken from real everyday affairs, and the author's reflections about it are in many instances intertwined, making up a unit. However, many of his texts were of a journalistic character, and he would write reports often with a stronger tone, whenever some political or social matter that was a concern of his came into question (Ribeiro 2013). Braga's short stories and reports, numbering in the thousands, were originally published in daily newspapers and weekly magazines, each time on a different subject – he compared a writer as himself to "the gypsy who every night sets up his tent and takes it down in the morning, and goes" (Braga 1955). Only afterwards some of his texts were compiled and published in book format; 18 books were published in his lifetime, the first one in 1936. Dubiela (2010) and Ribeiro (2013) presented analyses of Rubem Braga's literary and journalistic work. A detailed biography was provided by Carvalho (2007).

Braga's subjects ranged from seemingly modest everyday situations to grand scale 20th century world politics. But, among his manifold interests, the natural environment was always to him a most cherished one (Dubiela 2010). He produced short stories about a variety of themes related to nature, and his journalistic reports dealt often extensively with pressing environmental matters of his days, like deforestation, the risk of extinction of some animal species and the drying up of rivers, at a time when legal environmental protection in Brazil and public awareness of environmental problems were well behind the present levels. Many of the themes in his writings on environmental issues came through a working partnership and friendship, over a period of about 27 years, with the Brazilian naturalist Augusto Ruschi (1915-1986), also from Espírito Santo, Braga's native state (Dubiela 2010). A specialist in hummingbirds and orchids but with ample interests in ecology and in the conservation of nature (Marden & Blair 1963), Ruschi was one of the true pioneers in nature conservation in Brazil (see *e.g.*, Ruschi (1949)), combining his work as a biological researcher with intense political action in conservation (Medeiros 1995). Braga, a most respected writer, with scores of readers all over the country, with a strong concern about the natural world himself, provided, in his own words, "a kind of journalistic support" to Ruschi's campaigns for nature conservation (Braga 1984).

Rubem Braga was ahead of his time in relation to sea turtle conservation in Brazil when he wrote "The Turtle" in 1959. In those days there were no laws protecting these animals, which in Rio de Janeiro, the setting of the story and the then capital of Brazil, were served in restaurants (*e.g.*, Anonymous 1958). Sea turtles were in fact considered a fishing resource, as were all animals living in the sea, so much so that until well into the 1980s the catch of these turtles was included in the official data of the federal government agencies in charge of fisheries statistics in the country (*e.g.*, IBGE 1985). Little was known about sea turtles in Brazil when the short story "The Turtle" was written, but already in 1949 Augusto Ruschi, based on his own field experience, "as a first step" (in his own words) to call the attention of the institutions committed to nature conservation in Brazil at that time, made by his own a list of fauna and flora threatened with extinction in the country, on which he included hawksbill (*Eretmochelys imbricata*) and leatherback (*Dermochelys coriacea*) sea turtles (Ruschi 1949).

The situation concerning both the protection of sea turtles in Brazil and the information about their ecology started to change only around 1980. In that year, Projeto TAMAR, the Brazilian government's sea turtle conservation program, was established (Marcovaldi 1987), marking the beginning of regular sea turtle conservation and research activities in the country. Full legal protection of all species of sea turtles in Brazil, including their eggs, came into force in 1986, after a series of other regulations issued between 1976 and 1984 partially protecting sea turtles by restricting their capture to certain species, size ranges and periods of the year. Currently, sea turtles and their habitats, especially nesting beaches, are protected in Brazil by a range of federal laws and other kinds of legal regulations. Projeto TAMAR developed into a large network of conservation and research stations spread along the Brazilian coast (Marcovaldi & Marcovaldi 1999), and additionally there are all over the country many universities and non-governmental organizations doing research and working for the conservation of sea turtles. As a result of its internal actions, Brazil is now integrated into the worldwide movement for sea turtle conservation, an inherently international endeavor, as these animals recognize no country boundaries. Most significantly, sea turtle populations that nest in Brazil, many of them once heavily exploited and under immediate threat of extinction, are generally thriving (*e.g.*, Silva *et al.* 2007). The National Action Plan for Sea Turtle Conservation, issued in 2011 by the Brazilian government, presents an overview of the current situation regarding the conservation of these turtles in the country (Marcovaldi *et al.* 2011).

Notwithstanding the accomplishments, sea turtle conservation, as everyone who works in this realm in Brazil possibly well knows, is an endless task. Much ingenuity and resources are constantly required, under ever-changing social and political conditions, to maintain and expand what has already been achieved and to meet new and pressing conservation challenges that continually arise. Educational activities and media communications must be continuously addressed, not least because each year a new cohort of schoolchildren needs to be exposed to sea turtle conservation concepts and to marine conservation in general. In Brazil, a country with a large society comprised of people with a variety of cultural backgrounds and marked educational inequalities, in the long run the most valuable asset of sea turtle conservation, as a basis for society's continued commitment to their preservation, should possibly be the attainment of a high level of public awareness of the value of protecting these beautiful animals and their habitats. The short story "The Turtle" was Rubem Braga's early and touching contribution to the formation of that collective consciousness.

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ANONYMOUS. 1958. Prato do dia na Barra da Tijuca: sôpa (fresca) de tartaruga de 300 anos. Jornal do Brasil, 27 May 1958, 1o. caderno: 13.

BRAGA, R. 1955. Manifesto. In: Braga, R. A Borboleta Amarela. Livraria José Olympio Editora, Rio de Janeiro, Brazil. pp. 171-175.

BRAGA, R. 1960. A Tartaruga. In: Braga, R. Ai de Ti, Copacabana! Editora do Autor, Rio de Janeiro, Brazil. pp. 175-176.

BRAGA, R. 1984. Crônicas do Espírito Santo. Fundação Ceciliano Abel de Almeida / UFES, Secretaria de Educação e Cultura do Estado do Espírito Santo, Vitória, Brazil. 160pp.

CARVALHO, M.A. 2007. Rubem Braga: Um Cigano Fazendeiro do Ar. Editora Globo, São Paulo, Brazil. 610pp.

DUBIELA, A.K. 2010. Um Coração Postiço: A Formação da Crônica de Rubem Braga. Banco do Nordeste do Brasil, Fortaleza, Brazil. 208pp.

ENCYCLOPAEDIA BRITANNICA. 2008. Rubem Braga. In: Encyclopaedia Britannica Ultimate Reference Suite, DVD software edition. Chicago, USA.

IBGE (INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA). 1985. Estatística da Pesca. Volume 4, No. 2 (2o. Semestre - 1983). IBGE, Rio de Janeiro, Brazil. 97pp.

MARCOVALDI, M.A.G. DEI. 1987. Marine turtle protection in Brazil. Marine Turtle Newsletter 40: 4-5.

MARCOVALDI, M.A. & G.G. DEI MARCOVALDI. 1999. Marine turtles of Brazil: the history and structure of Projeto TAMAR-IBAMA. Biological Conservation 91: 35-41.

MARCOVALDI, M.A.A.G. DEI, A.S. DOS SANTOS & G. SALES (Orgs.). 2011. Plano de Ação Nacional para Conservação das Tartarugas Marinhas. Instituto Chico Mendes de Conservação da Biodiversidade, Brasília, Brazil. 120pp.

MARDEN, L. & J. BLAIR. 1963. The man who talks to hummingbirds. National Geographic Magazine 123: 80-99.

MEDEIROS, R. 1995. Ruschi: O Agitador Ecológico. Editora Record, Rio de Janeiro, Brazil. 223pp.

RIBEIRO, C. 2013. Rubem Braga: Um Escritor Combativo. Editora Booklink, Rio de Janeiro, Brazil. 224pp.

RUSCHI, A. 1949. Proteção à natureza. Boletim do Museu de Biologia Prof. Mello Leitão, Série Proteção à Natureza 2A: 1-54.

SILVA, A.C.C.D. DA, J.C. DE CASTILHOS, G.G. LOPEZ & P.C.R. BARATA. 2007. Nesting biology and conservation of the olive ridley sea turtle (*Lepidochelys olivacea*) in Brazil, 1991/1992 to 2002/2003. Journal of the Marine Biological Association of the United Kingdom 87: 1047-1056.

BOOK REVIEW

Title: Turtles: The Animal Answer Guide

Year: 2009

Authors: Whit Gibbons & Judy Greene

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https://jhupbooks.press.jhu.edu/content/turtles

Turtles are fascinating creatures. With over 300 species worldwide, they are found in a wide variety of habitats, and they range in size from just a few inches long to well over six feet. If you have questions about these wonderful creatures, chances are good that you'll find helpful and informative answers in the book, *Turtles: The Animal Answer Guide*. Authors Whit Gibbons and Judy Greene have put together an amazing resource detailing hundreds of facts about the world's turtles.

Arranged into twelve chapters, the authors answer 108 questions about turtles. To support these answers, the book is nicely illustrated with 36 color and 64 black and white photos. There are also two appendices including common and scientific names of turtle species, and turtle conservation groups, as well as an extensive bibliography and useful index. The binder material used for the front and back covers has a nice soft feel and the overall size of the book is comfortable in the hands. The individual pages are a bit on the thin side, but understandable considering how much material is packed into the 184 pages of the book. Chapter titles such as "Turtle Behavior" and "Reproduction and Development" take us through questions about the many points of turtle natural history, while answers to questions from the more whimsical "Turtles in Stories and Literature" and "Human Problems (from a turtle's viewpoint)" remind us how important turtles are in our lives and culture.

Gibbons and Greene are both accomplished researchers in the field of herpetology, and have both been studying and learning about turtles for over 30 years. From the very first page of the book, they make it clear that turtles are worth knowing about, by including a quote from Alfred Sherwood Romer:

> "Because they are still living, turtles are common place objects to us; were they entirely extinct, their shells - the most remarkable defensive armor ever assumed by a tetrapod - would be a cause for wonder."

Continuing in this thread throughout the book, the authors answer questions in a manner that cannot help but steer the reader to an appreciation for turtles, and to consider conservation implications of their actions. Why should people care about turtles? "We should care about turtles because they are a unique and admirable component of native wildlife." What can an ordinary citizen do to help turtles? "The problem would be solved if everyone had the attitude that all turtles were special and that humans have a responsibility to protect them at all costs… People with a strong interest in preserving and protecting turtles must continue to shift public attitudes toward one of responsible stewardship so that improper actions against turtles and other wildlife are viewed with public scorn, regardless of whether a law enforcement official is present."

In addition to the many facts and interesting anecdotes about various turtle species, humor can also be found in the details of many answers. How many kinds of turtles are there? "Taxonomists will continue to enjoy the dynamic process of working out the details while the turtles already know who they are and really do not care one way or the other what we call them." Do turtles have teeth? "Most turtles have relatively sharp-edged upper and lower jaws suitable for slicing plant material, animal prey, or occasionally the finger of a careless biologist."

Turtles: The Animal Answer Guide has something in it for everyone, whether new to the world of turtles, or very familiar with their biology (or, as the authors write, "turtleology").

Reviewed by: **Jeff Hall**, NC Wildlife Resources Commission, 405 Lancelot Dr., Greenville, NC 27858 USA (E-mail: jeff.hall@ncwildlife.org)

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

ATTUM, O., A. KRAMER, T. MAHMOUD & M. FOUDA. 2014. Post-nesting migrations patterns of green turtles (*Chelonia mydas*) from the Egyptian Red Sea. Zoology in the Middle East 60: 299-305. O. Attum, Indiana Univ SE, Dept Biology, New Albany, IN 47150 USA. (E-mail: oattum@ius.edu)

BARREIROS, J. P. & V. S. RAYKOV. 2014. Lethal lesions and amputation caused by plastic debris and fishing gear on the loggerhead turtle *Caretta caretta* (Linnaeus, 1758). Three case reports from Terceira Island, Azores (NE Atlantic). Marine Pollution Bulletin 86: 518-522. J. P. Barreiros, Azorean Biodiversity Group (CITA-A) and Platform for Enhancing Ecological Research & Sustainability (PEERS), Universidade dos Azores, 9700-042 Angra do Heroismo, Portugal. (E-mail: joaopedro@uac.pt)

BARRIENTOS-MUNOZ, K.G., C. RAMIREZ-GALLEGO & V. PAEZ. 2014. Nesting ecology of the olive ridley sea turtle (*Lepidochelys olivacea*) (Cheloniidae) at El Valle Beach, Northern Pacific, Colombia. Acta Biologica Colombiana 19: 437-445. K.G. Barrientos-Munoz, Dept. de Biologia, Universidad de Puerto Rico, Rio Piedras, San Juan, Puerto Rico, USA. (E-mail: biokeroz@gmail.com)

BOURJEA, J., S. CLERMONT, A. DELGADO, H. MURUA, J. RUIZ, S. CICCIONE & P. CHAVANCE. 2014. Marine turtle interaction with purse-seine fishery in the Atlantic and Indian Oceans: Lessons for management. Biological Conservation 178: 74-87. J. Bourjea, IFREMER, Rue Jean Bertho,BP 60, Le Port 97822, Reunion. (E-mail: jerome.bourjea@ifremer.fr)

BURGER, J. & M. GOCHFELD. 2014. Avian predation on olive ridley (*Lepidochelys olivacea*) sea turtle eggs and hatchlings: avian opportunities, turtle avoidance, and human protection. Copeia 2014: 109-122. J. Burger, Div. of Life Sciences, Rutgers Univ., Piscataway, NJ 08854-8082, USA. (E-mail: burger@biology.rutgers.edu)

CAMEDDA, A., S. MARRA, M. MATIDDI, G. MASSARO, S. COPPA, A. PERILLI, A. RUIU, P. BRIGUGLIO & G. A. DE LUCIA. 2014. Interaction between loggerhead sea turtles (*Caretta caretta*) and marine litter in Sardinia (Western Mediterranean Sea). Marine Environmental Research 100: 25-32. A. Camedda, Natl Res Council IAMC CNR, Inst Coastal Marine Environm, I-09170 Oristano, Italy. (E-mail: a.camedda@iamc.cnr.it)

CAUDILL, D., G. CAUDILL, B. CARPENTER, D. WOLF & Z. T. BOWLING. 2014. *Caretta caretta* (Loggerhead Sea Turtle). Predation. Herpetological Review 45: 481-482. D. Caudill, Florida Fish and Wildlife Conservation Commission, 1105 SW Williston Rd, Gainesville, FL 32601 USA. (E-mail: charles.caudill@myfwc.com)

CERIANI, S.A., J.D. ROTH, L.M. EHRHART, P.F. QUINTANA-ASCENCIO & J.F. WEISHAMPEL. 2014. Developing a common currency for stable isotope analyses of nesting marine turtles. Marine Biology 161: 2257-2268. S.A. Ceriani, Fish and Wildlife Research Institute, Florida FWCC, 100 8th Ave. SE, St. Petersburg, FL 33701, USA. (E-mail: simona.ceriani@gmail.com)

CERIANI, S.A., J.D. ROTH, C.R. SASSO, C.M. MCCLELLAN, M.C. JAMES, H.L. HAAS, R.J. SMOLOWITZ, D.R. EVANS, D.S. ADDISON, D.A. BAGLEY, L.M. EHRHART & J.F. WEISHAMPEL. 2014. Modeling and mapping isotopic patterns in the Northwest Atlantic derived from loggerhead sea turtles. Ecosphere (http://dx.doi.org/10.1890/ES14-00230.1) 5(9): Article 122. (Address same as above)

CORREA, G.V.V., J. INGELS, Y.V. VALDES, V.G. FONSECA-GENEVOIS, C.M.R. FARRAPEIRA & G.A.P. SANTOS. 2014. Diversity and composition of macro- and meiofaunal carapace epibionts of the hawksbill sea turtle (*Eretmochelys imbricata* Linnaeus, 1822) in Atlantic waters. Marine Biodiversity 44: 391-401. G.A.P. Santos, Univ Fed Pernambuco, Dept Zool, Lab Meiofauna, CCB, Av Prof Moraes Rego 1235, BR-50670901 Recife, PE, Brazil. (E-mail: giopaiva@hotmail.com)

D'CRUZE, N., R. ALCOCK & M. DONNELLY. 2014. The Cayman Turtle Farm: Why we can't have our green turtle and eat it too. Journal of Agricultural and Environmental Ethics (doi: 10.1007/s10806-014-9519-6): 15pp. N. D'Cruze, World Animal Protection, 56th Floor, 222 Gray's Inn Road, London, WC1X 8HB, UK. (E-mail: NeilDCruze@worldanimalprotection.org)

DICKEY, M., C. CRAY, T. NORTON, M. MURRAY, C. BARYSAUSKAS, K.L. ARHEART, S. NELSON & M. RODRIGUEZ. 2014. Assessment of hemoglobin binding protein in loggerhead sea turtles (*Caretta caretta*) undergoing rehabilitation. Journal of Zoo and Wildlife Medicine 45: 700-703. C. Cray, Univ Miami, Miller Sch Med, Div Comparat Pathol, POB 016960,R-46, Miami, FL 33101 USA. (E-mail: c.cray@miami.edu)

DUJON, A.M., R.T. LINDSTROM & G.C. HAYS. 2014. The accuracy of Fastloc-GPS locations and implications for animal tracking. Methods in Ecology and Evolution (doi: 10.1111/2041-210X.12286) 5: 1162-1169. A. M. Dujon, Dept. of Biosciences, Swansea University, Singleton Park, Swansea SA2 8PP, UK.

(E-mail: ghays@deakin.edu.au)

DURAN, N., S.G. DUNBAR, R.A.I. ESCOBAR & T.G. STANDISH. 2015. High frequency of multiple paternity in a solitary population of olive ridley sea turtles in Honduras. Journal of Experimental Marine Biology and Ecology 463: 63-71. N. Duran, 10495 Savannah Ln., Mentone, CA 92359, USA. (E-mail: noemi.duran13@gmail.com)

EARLY CAPISTRAN, M.M. 2014. Amazons, pirates, and turtles on the Island of California. The Appendix 2(4): 16pp. Dept. of Ocean Sciences and Limnology, National Autonomous University of Mexico (UNAM), Mexico City, Mexico.

FERRARA, C.R., J.A. MORTIMER & R.C. VOGT. 2014. First evidence that hatchlings of *Chelonia mydas* emit sounds. Copeia 2014: 245-247. R.C. Vogt, Inst Nacl de Pesquisas da Amazonia, BR-69083000 Manaus, Amazonas, Brazil. (E-mail: vogt@inpa.gov.br)

GALGANI, F., F. CLARO, M. DEPLEDGE & C. FOSSI. 2014. Monitoring the impact of litter in large vertebrates in the Mediterranean Sea within the European Marine Strategy Framework Directive (MSFD): Constraints, specificities and recommendations. Marine Environmental Research 100: 3-9. F. Galgani, IFREMER, ZI Furiani, Immeuble Agostini, F-20600 Bastia, Corsica, France. (E-mail: francois.galgani@ifremer.fr)

GARCIA-PARRAGA, D., J.L. CRESPO-PICAZO, Y. BERNALDO DE QUIROS, V. CERVERA, L. MARTI-BONMATI, J. DIAZ-DELGADO, M. ARBELO, M.J. MOORE, P.D. JEPSON & A. FERNANDEZ. 2014. Decompression sickness ('the bends') in sea turtles. Diseases of Aquatic Organisms 111: 191-205. D. Garcia-Parraga, Oceanografic, Veterinary Services, Parques Reunidos Valencia, Ciudad de las Artes y las Ciencias, C/ Eduardo Primo Yufera 1B, 46013 Valencia, Spain. (E-mail: dgarcia@oceanografic.org)

GASKILL, M. 2014. Dr. Donna Shaver. Sea turtle champion celebrates their return to Texas beaches. Texas Shores 42: 28-31.

GIRONDOT, M. & Y. KASKA. 2015. Nest temperatures in a loggerhead nesting beach in Turkey is more determined by sea surface than air temperature. Journal of Thermal Biology 47: 13-18. M. Girondot, Laboratoire Ecologie, Systematique et Evolution (UMR8079), Faculte des Sciences d'Orsay, Universite Paris-Sud, 91405 Orsay, France. (E-mail: marc.girondot@u-psud.fr)

GOMEZ GALLARDO UNZUETA, E.A. 2013. Estudio sobre las causas de muerte de la tortuga amarilla (*Caretta caretta*) en la Costa Occidental de Baja California Sur (Golfo de Ulloa). Informe Final de Investigacion. Universidad Autónoma de Baja California Sur con la participación del Centro interdisciplinario de Ciencias Marinas del Instituto Politécnico Nacional (CICIMAR) y del Centro de Investigaciones Biológicas del Noroeste (CIBNOR): 128pp. Universidad Autónoma de Baja California Sur, Mexico.

GOMUTTAPONG, S., W. KLOM-IN, J. KITANA, P. PARIYANONTH, K. THIRAKHUPT & N. KITANA. 2013. Green turtle, *Chelonia mydas*, nesting and temperature profile of the nesting beach at Huyong Island, the Similan Islands in Andaman Sea. Natural Resources 4: 357-361. N. Kitana, Dept of Biology, Faculty of Science, Chulalongkorn University, Bangkok, Thailand. (E-mail: noppadon.k@chula.ac.th)

GUERRANTI, C., M. BAINI, S. CASINI, S.E. FOCARDI, M. GIANNETTI, C. MANCUSI, L. MARSILI, G. PERRA & M.C. FOSSI. 2014. Pilot study on levels of chemical contaminants and porphyrins in *Caretta caretta* from the Mediterranean Sea. Marine Environmental Research 100: 33-37. C. Guerranti, Univ Siena, Dept Phys Earth & Environm Sci, Via Mattioli 4, I-53100 Siena, Italy. (E-mail: guerranticri@unisi.it)

HARDY, R.F., A.D. TUCKER, A.M. FOLEY, B.A. SCHROEDER, R.J. GIOVE & A.B. MEYLAN. 2014. Spatiotemporal occurrence of loggerhead turtles (*Caretta caretta*) on the West Florida Shelf and apparent overlap with a commercial fishery. Canadian Journal of Fisheries and Aquatic Sciences 71: 1924-1933. R.F. Hardy, Marine Science Program, Western Australia Department of Parks and Wildlife, 17 Dick Perry Avenue, Kensington, Western Australia 6156. (E-mail: Robert.Hardy@MyFWC.com)

HAYS, G.C., J.A. MORTIMER, D. IERODIACONOU & N. ESTEBAN. 2014. Use of long-distance migration patterns of an endangered species to inform conservation planning for the world's largest Marine Protected Area. Conservation Biology 28: 1636-1644. G.C. Hays, Department of Biosciences, Swansea University, Singleton Park, Swansea, SA2, 8PP, UK.

HOWARD, R., I. BELL & D.A. PIKE. 2014. Thermal tolerances of sea turtle embryos: current understanding and future directions. Endangered Species Research 26: 75-86. D. A. Pike, School of Marine and Tropical Biology, James Cook University, Townsville, Queensland 4811, Australia. (E-mail: david.pike22@gmail.com)

INNIS, C.J., C. MERIGO, J.M. CAVIN, K. HUNT, K.L. DODGE & M. LUTCAVAGE. 2014. Serial assessment of the physiological status of leatherback turtles (*Dermochelys coriacea*) during direct capture events in the northwestern Atlantic Ocean: comparison of post-capture and pre-release data. Conservation Physiology 2: 1-9. C. J. Innis, Animal Health Department, New England Aquarium, Boston, MA 02110, USA. (E-mail: cinnis@neaq.org)

KNIGHT, K. 2014. Turtles digest dinner and stay warm. Journal of Experimental Biology 217: 2223-2224.

KOBAYASHI, D.R., R. FARMAN, J.J. POLOVINA, D.M. PARKER & M. RICE. 2014. "Going with the Flow" or not: evidence of positive rheotaxis in oceanic juvenile loggerhead turtles (*Caretta caretta*) in the South Pacific Ocean using satellite tags and ocean circulation data. PLoS One 9(10): e111358.

LAMONT, M. M., I. FUJISAKI & R. R. CARTHY. 2014. Estimates of vital rates for a declining loggerhead turtle (Caretta caretta) subpopulation: implications for management. Marine Biology 161(11): 2659-2668. M. M. Lamont, USGS, Southeast Ecological Science Center, Gainesville, FL 32653 USA. (E-mail: mlamont@usgs.gov)

LEBLANC, A. M., D. C. ROSTAL, K. K. DRAKE, K. L. WILLIAMS, M. G. FRICK, J. ROBINETTE & D. E. BARNARD-KEINATH. 2014. The influence of maternal size on the eggs and hatchlings of loggerhead sea turtles. Southeastern Naturalist 13(3): 587-599. A. M. LeBlanc, Georgia Southern Univ, Dept Biology, POB 8042, Statesboro, GA 30460 USA. (E-mail: annemarielbeich@gmail.com)

LETESSIER, T. B., P. J. BOUCHET, J. REISSER & J. J. MEEUWIG. 2014. Baited videography reveals remote foraging and migration behaviour of sea turtles. Marine Biodiversity (doi: 10.1007/s12526-014-0287-3): 2pp. T. B. Letessier , Centre for Marine Futures (Oceans Institute), Perth, Western Australia. (E-mail: tomletessier@gmail.com)

LOPEZ-CASTRO, M. C., K. A. BJORNDAL, G. D. KAMENOV & A. B. BOLTEN. 2014. Identifying oceanic foraging grounds of sea turtles in the Atlantic using lead isotopes. Marine Biology 161(10): 2269-2278. M. C. Lopez-Castro, Archie Carr Center for Sea Turtle Research and Dept. of Biology, P.O. Box 118525, University of Florida, Gainesville, FL 32611, USA. (E-mail: mlopezcast@ufl.edu)

MCLAREN, J. D., J. SHAMOUN-BARANES, A. M. DOKTER, R. H. G. KLAASSEN & W. BOUTEN. 2014. Optimal orientation in flows: providing a benchmark for animal movement strategies. Journal of the Royal Society Interface 11(99): 20140588. J. D. McLaren, Univ Amsterdam, Inst Biodivers & Ecosyst Dynam, Amsterdam, the Netherlands. (E-mail: j.d.mclaren@uva.nl)

MUTHULINGAM, P., S. RAMACHANDRAN & H. LAKSHMANAN. 2013. Observations of Olive Ridley turtles (Lepidochelys olivacea) along the northern shores of Puducherry, India. Journal of Marine Animals and Their Ecology 6(2): 4-5. P. Muthulingam, Dept of Ecology & Environmental Sciences, Pondicherry University, Puducherry, India. (E-mail: pradheep.ecol@gmail.com)

NARO-MACIEL, E., B. N. REID, A. E. ALTER, G. AMATO, K. A. BJORNDAL, A. B. BOLTEN, M. MARTIN, C. J. NAIRN, B. SHAMBLIN & O. PINEDA-CATALAN. 2014. From refugia to rookeries: phylogeography of Atlantic green turtles. Journal of Experimental Marine Biology and Ecology 461: 306-316. E. Naro-Maciel, Dept. Biology, College of Staten Island, CUNY, 2800 Victory Blvd, Staten Island, NY 10314, USA. (E-mail: eugenia.naromaciel@csi.cuny.edu)

OKUYAMA, J., R. TABATA, K. NAKAJIMA, N. ARAI, M. KOBAYASHI & S. KAGAWA. 2014. Surfacers change their dive tactics depending on the aim of the dive: evidence from simultaneous measurements of breaths and energy expenditure. Proceedings of the Royal Society B - Biological Sciences 281(1795): 20140040. J. Okuyama, Kyoto Univ, Grad Sch Informat, Sakyo Ku, Kyoto 6068501, Japan. (E-mail: okuyamajunichi@gmail.com)

PAGE-KARJIAN, A., T.M. NORTON, P. KRIMER, M. GRONER, S.E. NELSON JR. & N.L. GOTTDENKER. 2014. Factors influencing survivorship of rehabilitating green sea turtles (*Chelonia mydas*) with fibropapillomatosis. Journal of Zoo and Wildlife Medicine 45: 507-519. A. Page-Karjian, Univ Georgia, Coll Vet Med, Dept Pathology, 501 DW Brooks Dr, Athens, GA 30602 USA. (E-mail: anniep@uga.edu)

PAYNE, N.L., M.D. TAYLOR, Y.Y. WATANABE & J.M. SEMMENS. 2014. From physiology to physics: are we recognizing the flexibility of biologging tools? Journal of Experimental Biology 217: 317-322. N. Payne, School of Biological, Earth and Environmental Sciences, University of New South Wales, Sydney, NSW 2052, Australia. (E-mail: n.payne@unsw.edu.au)

PEREIRA DUTRA, G.H., F. FUTEMA, F.A. MARQUES DOS SANTOS & C. LASSALVIA NASCIMENTO. 2014. Intravascular access in *Chelonia mydas* and *Dermochelys coriacea* using the Seldinger Technique ultrasound-guided. Journal of Life Sciences 8: 385-393. G.H. Pereira Dutra, Aquario Municipal de Santos, Av. Bartolomeu de Gusmao s/n. Ponta da Praia. Santos-SP 11030-500, Brazil. (E-mail: dutravet@ig.com.br)

PFALLER, J.B., J. ALFARO-SHIGUETO, G.H. BALAZS, T. ISHIHARA, K. KOPITSKY, J.C. MANGEL, S.H. PECKHAM, A.B. BOLTEN & K.A. BJORNDAL. 2014. Hitchhikers reveal cryptic host behavior: new insights from the association between *Planes major* and sea turtles in the Pacific Ocean. Marine Biology 161: 2167-2178. J. B. Pfaller, Univ Florida, Archie Carr Center for Sea Turtle Research, Dept Biology, Gainesville, FL 32611 USA. (E-mail: jpfaller@ufl.edu)

PHILLOTT, A.D. & C.J. PARMENTER. 2014. Fungal colonization of green sea turtle (*Chelonia mydas*) nests is unlikely to affect hatchling condition. Herpetological Conservation and Biology 9: 297-301. A. D. Phillott, Asian Univ Women, Chittagong 4000, Bangladesh. (E-mail: andrea.phillott@auw.edu.bd)

PILCHER, N.J., M. ANTONOPOULOU, L. PERRY, M.A. ABDEL-MOATI, T.Z. AL ABDESSALAAM, M. ALBELDAWI, M. AL ANSI, S.F. AL-MOHANNADI, N. AL ZAHLAWI, R. BALDWIN, A. CHIKHI, H.S. DAS, S. HAMZA, O.J. KERR, A. AL KIYUMI, A. MOBARAKI, H.S. AL SUWAIDI, A.S. AL SUWEIDI, M. SAWAF, C. TOURENQ, J. WILLIAMS & A. WILLSON. 2014. Identification of Important Sea Turtle Areas (ITAs) for hawksbill turtles in the Arabian Region. Journal of Experimental Marine Biology and Ecology 460: 89-99. N. J. Pilcher, Marine Res Fdn, 136 Lorong Pokok Seraya 2, Kota Kinabalu 88450, Sabah, Malaysia. (E-mail: npilcher@mrf-asia.org)

RODENBUSCH, C.R., C. BAPTISTOTTE, M.R. WERNECK, T.T. PIRES, M.T.D. MELO, M.W. DE ATAIDE, P. TESTA, M.M. ALIEVE & C.W. CANAL. 2014. Fibropapillomatosis in green turtles *Chelonia mydas* in Brazil: characteristics of tumors and virus. Diseases of Aquatic Organisms 111: 207-217. C.R. Rodenbusch, Laboratory of Virology, Veterinary Medicine College, Federal University of Rio Grande do Sul, Av. Bento Goncalves 9090, Porto Alegre, 915640-000 RS, Brazil.

RUIZ-IZAGUIRRE, E., A. VAN WOERSEM, K.C.H.A.M. EILERS, S.E. VAN WIEREN, G. BOSCH, A.J. VAN DER ZIJPP & I.J.M. DE BOER. 2014. Roaming characteristics and feeding practices of village dogs scavenging sea-turtle nests. Animal Conservation (doi:10.1111/acv.12143) : 11pp. E. Ruiz-Izaguirre, Animal Production Systems, Dept of Animal Sciences, Wageningen University, de Elst 1, 6700 AH Wageningen, the Netherlands. (E-mail: eliza.ruizizaguirre@gmail.com)

SAMPSON, L., L. FERNANDO PAYAN, D. FERNANDO AMOROCHO, J.A. SEMINOFF & A. GIRALDO. 2014. Intraspecific variation of the green turtle, *Chelonia mydas* (Cheloniidae), in the foraging area of Gorgona Natural National Park (Colombian Pacific). Acta Biologica Colombiana 19: 461-470. L. Sampson, Univ Valle, Calle 13 100-00, Cali, Colombia. (E-mail: lausamps@gmail.com)

SANTILLANA SEGOVIA, P.R. 2013. Valores hematologicos y bioquimicos sanguineos de tortugas anidantes de Golfina (*Lepidochelys olivacea*) en El Salvador. Bioma 1(6): 11-16. (E-mail: amaru_santillana@yahoo.es) http://virtual.ues.edu.sv/bioma/index.php/home

SATO, K. 2014. Body temperature stability achieved by the large body mass of sea turtles. Journal of Experimental Biology 217: 3607-3614. K. Sato, Univ Tokyo, Atmosphere & Ocean Res Inst, 5-1-5 Kashiwanoha, Kashiwa, Chiba 2778564, Japan. (E-mail: katsu@aori.u-tokyo.ac.jp)

SCHUMACHER, V.L., B. MANGOLD, J. LENZYCKI, L. HINCKLEY, D.A. SUTTON & S.J. FRASCA. 2014. Occurrence of fruiting structures allows determination of *Purpureocillium lilacinum* as an inciting agent of pleuritis and pneumonia in a loggerhead sea turtle (*Caretta caretta*) by histopathologic correlation to culture. Medical Mycology Case Reports 6: 42-45. V.L. Schumacher, Connecticut Veterinary Medical Diagnostic Laboratory, Dept of Pathobiology and Veterinary Science, University of Connecticut, Storrs, CT 06269-3089, USA.

SCOTT, R., A. BIASTOCH, C. RODER, V. A. STIEBENS & C. EIZAGUIRRE. 2014. Nano-tags for neonates and ocean mediated swimming behaviours linked to rapid dispersal of hatchling sea turtles. Proceedings of the Royal Society B 281(1796): 20141209. R. Scott, GEOMAR, Helmholtz Centre for Ocean Research, Duosternbrookerweg 20, Kiel 24105, Germany. (E-mail: beckyscott130@hotmail.com)

SIGLER, M. 2014. The effects of plastic pollution on aquatic wildlife: current situations and future solutions. Water Air and Soil Pollution 225: 2184. M. Sigler, Miami Univ, 501 East High St, Oxford, OH 45056 USA. (E-mail: sigler_michelle@yahoo.com)

SIM, E.L., D.T. BOOTH & C.J. LIMPUS. 2014. Non-modal scute patterns, morphology, and locomotor performance of loggerhead (*Caretta caretta*) and flatback (*Natator depressus*) turtle hatchlings. Copeia 2014: 63-69. E. L. Sim, School of Biological Sciences, Univ. of Queensland, Brisbane, QLD 4072, Australia. (E-mail: elizabeth.sim@uqconnect.edu.au)

SIM, E.L., D.T. BOOTH, C.J. LIMPUS & M.L. GUINEA. 2014. A comparison of hatchling locomotor performance and scute pattern variation between two rookeries of the flatback turtle (*Natator depressus*). Copeia 2014: 339-344. E.L. Sim, Univ Queensland, Sch Biol Sci, Brisbane, Qld 4072, Australia. Address as above.

STACHOWITSCH, M. 2014. Book review: The Biology of Sea Turtles, Volume III J. Wyneken, K.J. Lohmann, J.A. Musick (Eds.). Marine Ecology 35: 146-147. University of Vienna, Vienna, Austria

TEDESCHI, J.N., W.J. KENNINGTON, O. BERRY, S. WHITING, M. MEEKAN & N. J. MITCHELL. 2015. Increased expression of Hsp70 and Hsp90 mRNA as biomarkers of thermal stress in loggerhead turtle embryos (*Caretta Caretta*). Journal of Thermal Biology 47: 42-50. J. N. Tedeschi, School of Animal Biology (M092), The University of Western Australia, 35 Stirling Highway, Crawley, WA 6009, Australia. (E-mail: jamie.tedeschi@research.uwa.edu.au)

TIBURCIO PINTOS, G., M.M. CARINO OLVERA & R. BRISENO DUENAS. 2014. Relaciones históricas entre las tortugas marinas y las sociedades del finis terra baja californiano. Belo Horizonte 3: 89-115. G. Tiburcio Pintos, Universidad Autonoma de Baja California Sur, Calle Andalucia Mz. 13. Lt. 2., Col. Colinas de San Jose, CP. 234444, San Jose del Cabo, BCS. Mexico. (E-mail: gtiburcio@prodigy.net.mx)

TOBON-LOPEZ, A. & D.F. AMOROCHO LLANOS. 2014. Estudio poblacional de la tortuga carey *Eretmochelys imbricata* (Cheloniidae) en el Pacifico sur de Colombia. Acta Biologica Colombiana 19: 447-459. A. Tobon-Lopez, Invest Fdn CIMAD, Cali, Colombia. (E-mail: alexander.tobon.l@gmail.com)

VANDER ZANDEN, H.B., A.D. TUCKER, A.B. BOLTEN, K.J. REICH & K.A. BJORNDAL. 2014. Stable isotopic comparison between loggerhead sea turtle tissues. Rapid Communications in Mass Spectrometry 28: 2059-2064. H.B. Vander Zanden, Dept. of Geology and Geophysics, Univ. of Utah, 115 S 1460 E, Salt Lake City, UT 84112, USA. (E-mail: h.vanderzanden@utah.edu)

VANDER ZANDEN, H.B., A.D. TUCKER, K.M. HART, M.M. LAMONT, I. FJUISAKI, D.S. ADDISON, K.L. MANSFIELD, K.F. PHILLIPS, M.B. WUNDER, G.J. BOWEN, M. PAJUELO, A.B. BOLTEN & K.A. BJORNDAL. 2014. Determining origin in a migratory marine vertebrate: a novel method to integrate stable isotopes and satellite tracking. Ecological Applications (http://dx.doi.org/10.1890/14-0581.1) (Address same as above)

VELEZ-RUBIO, G.M., J. TOMAS, R. MÍGUEZ-LOZANO, J.C. XAVIER, G. MARTINEZ-SOUZA & A. CARRANZA. 2014. New insights in southwestern Atlantic Ocean Oegopsid squid distribution based on juvenile green turtle (*Chelonia mydas*) diet analysis. Marine Biodiversity (DOI 10.1007/s12526-014-0272-x): 9pp. G. M. Velez-Rubio, Cavanilles Institute of Biodiversity and Evolutionary Biology, University of Valencia, Aptdo. 22085, 46071 Valencia, Spain. (E-mail: gabriela.velez@uv.es)

VELEZ-ZUAZO, X., J. QUINONES, A.S. PACHECO, L. KLINGE, E. PAREDES, S. QUISPE & S. KELEZ. 2014. Fast growing, healthy and resident green turtles (*Chelonia mydas*) at two neritic sites in the central and northern coast of Peru: implications for conservation. PLoS One 9: e113068. S. Kelez, ecOceanica, Lima, Peru. (E-mail: shaleyla.kelez@ecoceanica.org)

VIEIRA, S., S. MARTINS, L.A. HAWKES, A. MARCO & M.A. TEODOSIO. 2014. Biochemical indices and life traits of loggerhead turtles (*Caretta caretta*) from Cape Verde Islands. PLoS One 9: e112181. M.A. Teodosio, Centro de Ciencias do Mar, Universidade do Algarve, Campus de Gambelas, Faro, Portugal. (E-mail: mchichar@ualg.pt)

WALCOTT, J. & J. A. HORROCKS. 2014. Design of a protected area for inter-nesting hawksbills in Barbados: an evidence-based approach. Bulletin of Marine Science 90: 969-987. J. Walcott, Univ W Indies, Dept Biol & Chem Sci, Cave Hill Campus, POB 64, BB-11000 Bridgetown, Barbados. (E-mail: walcott.julian@gmail.com)

WEBER, S.B., N. WEBER, J. ELLICK, A. AVERY, R. FRAUENSTEIN, B.J. GODLEY, J. SIM, N. WILLIAMS & A.C. BRODERICK. 2014. Recovery of the South Atlantic's largest green turtle nesting population. Biodiversity and Conservation 23: 3005-3018. S.B. Weber, Ascension Island Govt, Conservation Dept, Georgetown, Ascension Island, United Kingdom (E-mail: sam.weber@ascension.gov.ac)

WHITING, A.U., M. CHALOUPKA, N. PILCHER, P. BASINTAL & C.J. LIMPUS. 2014. Comparison and review of models describing sea turtle nesting abundance. Marine Ecology Progress Series 508: 233-246. A.U. Whiting, Charles Darwin Univ, Sch Environment & Life Sci, Darwin, NT 0909, Australia. (E-mail: au.whiting@gmail.com)

ZAVALA-NORZAGARAY, A.A., C.P. LEY-QUINONEZ, T.L. ESPINOSA-CARREON, A. CANIZALEZ-ROMAN, C.E. HART & A.A. AGUIRRE. 2014. Trace elements in blood of sea turtles *Lepidochelys olivacea* in the Gulf of California, Mexico. Bulletin of Environmental Contamination and Toxicology 93: 536-541. A.A. Zavala-Norzagaray, Inst Politecn Nacl, CIIDIR SINALOA, Guasave, Sinaloa, Mexico. (E-mail: anorzaga@ipn.mx)

THESES AND DISSERTATIONS

AWABDI, D.R. 2013. Habito alimentar e ingestao de residuos solidos por tartarugas-verdes juvenis, *Chelonia mydas* (L. 1758), na costa leste do estado do Rio de Janeiro, Brasil. Master's Thesis. Universidade Estadual do Norte Fluminense Darcy Ribeiro, Lagoa - RJ, Brazil. 48pp.

BERTOLODO FILHO, V.J. 2013. Interacao entre tartarugas marinhas e a pesca artesanl no sul do municipio de Laguna, Santa Catarina, Brasil. Master's Thesis. Universidade do Extremo Sul Catarinense, Criciúma - SC, Brazil. 51pp.

GRACIANO OBESO, I.Q. 2013. Caracterizacion ambiental de la zona de alimentacion de tortugas marinas en el litoral del municipio de Guasave, Sinaloa. Master's Thesis. Instituto Politecnico Nacional, Ciudad de Mexico, D.F., Mexico. 78pp.

HALL, L. 2014. Spatial analysis for sea turtle conservation on the Georgia coast. Master's Thesis. Pennsylvania State University, State College, PA, USA. 69pp.

SARMIENTO-RAMIREZ, M. 2013. Biology, taxonomy and ecology of *Fusarium* species (Ascomycota) involved in sea turtle egg failure. Doctoral Thesis, Universidad Internacional Menendez-Pelayo - Consejo Superior de Investigaciones Científi, Santander, Spain.

VALENCIA MARTINEZ, S. 2013. Caracterizacion del įrea de alimentacion de tortugas marinas en la zona marino-costera del complejo insular San Ignacio-Navachiste-Macapule, Sinaloa, Golfo de California. Master's Thesis. Instituto Politecnico Nacional, Ciudad de Mexico, D.F., Mexico. 88pp.

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Michael Coyne (Managing Editor)
Marine Turtle Newsletter
1 Southampton Place
Durham, NC 27705, USA

Email: mcoyne@seaturtle.org