

Informing research priorities for immature sea turtles through expert elicitation

Natalie E. Wildermann¹, Christian Gredzens¹, Larisa Avens², Héctor A. Barrios-Garrido^{1,3}, Ian Bell⁴, Janice Blumenthal⁵, Alan B. Bolten⁶, Joanne Braun McNeill², Paolo Casale⁷, Maikon Di Domenico⁸, Camila Domit⁸, Sheryan P. Epperly⁹, Matthew H. Godfrey^{10,11,12}, Brendan J. Godley¹³, Victoria González-Carman^{14,15}, Mark Hamann¹⁶, Kristen M. Hart¹⁷, Takashi Ishihara^{18,19}, Kate L. Mansfield²⁰, Tasha L. Metz²¹, Jeffrey D. Miller²², Nicolas J. Pilcher²³, Mark A. Read²⁴, Christopher Sasso⁹, Jeffrey A. Seminoff²⁵, Erin E. Seney²⁰, Amanda Southwood Williard²⁶, Jesús Tomás²⁷, Gabriela M. Vélez-Rubio^{28,29}, Matthew Ware¹, Jessica L. Williams³⁰, Jeanette Wyneken³¹, Mariana M. P. B. Fuentes^{1,*}

*Corresponding author: mfuentes@fsu.edu

Endangered Species Research 37: 55–76 (2018)

¹Marine Turtle Research, Ecology and Conservation Group, Department of Earth, Ocean and Atmospheric Science, Florida State University, Tallahassee, FL 32306, USA

²NOAA, National Marine Fisheries Service, Southeast Fisheries Science Center, Beaufort, NC 28516, USA

³Laboratorio de Ecología General, Centro de Modelado Científico (CMC), La Universidad del Zulia (LUZ), Av. Universidad, Sector Grano de Oro. Ciudad Universitaria, Bloque A-2. Planta Baja. Maracaibo, 4005, Venezuela

⁴Aquatic Species Program, Conservation and Biodiversity Operations Branch, Queensland Department of Environment and Science, Brisbane, 4102, Australia

⁵Cayman Islands Department of Environment, KY1-1002, Grand Cayman

⁶Archie Carr Center for Sea Turtle Research and Department of Biology, University of Florida, Gainesville, FL 32611, USA

⁷Ethology Unit, Dept. of Biology, University of Pisa, Pisa 56126, Italy

⁸Center for Marine Studies, Federal University of Paraná, Pontal do Paraná, Paraná, 83255-000, Brazil

⁹NOAA, National Marine Fisheries Service, Southeast Fisheries Science Center, Miami, FL 33149, USA

¹⁰North Carolina Wildlife Resources Commission, Beaufort, NC 28516, USA

¹¹Duke University Marine Lab, Nicholas School of the Environment, Duke University, Beaufort, NC 28516, USA

¹²Department of Clinical Sciences, College of Veterinarian Medicine, North Carolina State University, Raleigh, NC 27607, USA

¹³Marine Turtle Research Group, Centre for Ecology and Conservation, School of Biosciences, University of Exeter, Cornwall Campus, Penryn, TR10 9EZ, UK

¹⁴Instituto de Investigaciones Marinas y Costeras (CONICET – UNMdP), Mar del Plata, Buenos Aires province, 7600, Argentina

¹⁵Instituto de Investigación y Desarrollo Pesquero (INIDEP), Mar del Plata, Buenos Aires province, 7600, Argentina

- ¹⁶College of Science and Engineering, James Cook University, Townsville, Queensland, 4811, Australia
- ¹⁷US Geological Survey, Wetland and Aquatic Research Center, 3321 College Avenue, Davie, FL 33314, USA
- ¹⁸Suma Aqualife Park, Kobe, Hyogo, 654-0049, Japan
- ¹⁹Sea Turtle Association of Japan, Hirakata, Osaka, 573-0163, Japan
- ²⁰Marine Turtle Research Group, Department of Biology, University of Central Florida, Orlando, FL 32816, USA
- ²¹Tasha L. Metz, Ph.D. Consulting, 5607 Borden Avenue, Galveston, TX 77551, USA
- ²²Biological Research and Education Consultants, Missoula, MT 59801, USA
- ²³Marine Research Foundation, Kota Kinabalu, Sabah, 88450, Malaysia
- ²⁴Great Barrier Reef Marine Park Authority, Townsville, Queensland, 4810, Australia
- ²⁵NOAA, National Marine Fisheries Service, Southwest Fisheries Science Center, La Jolla, CA 92037, USA
- ²⁶Department of Biology and Marine Biology, University of North Carolina Wilmington, Wilmington, NC 28403, USA
- ²⁷Marine Zoology Unit, Cavanilles Institute of Biodiversity and Evolutionary Biology, University of Valencia, Valencia, 46071, Spain
- ²⁸Karumbé NGO, Montevideo, 11600, Uruguay
- ²⁹Centro Universitario Regional del Este (CURE), Universidad de la República, Rocha, 27000, Uruguay
- ³⁰Tartarugas para o Amanhã, Praia do Tofo, Inhambane Province, Mozambique
- ³¹Biological Sciences, Florida Atlantic University, Boca Raton, FL 33431, USA
-

SUPPLEMENTARY TABLES

Table S1. Categorical variables correlated (R^2) with MCA Dimension 1 (X-axis) and Dimension 2 (Y-axis), indicating levels of relatedness (positive and negative) for each dimension. Bold p-values: significant; *ns*: non-significant.

Categorical variables	Dimension 1 (15.1%)		Dimension 2 (13.3%)	
	R^2	p-value	R^2	p-value
Priority region (PRg)	0.72	< 0.0001	0.76	< 0.0001
Priority barrier (PB)	0.68	< 0.0001	0.52	< 0.0001
Priority research (PR)	0.61	< 0.0001	0.27	< 0.0001
Experience region (ERg)	0.38	< 0.0001	0.29	< 0.0001
Priority species (PS)	0.31	< 0.0001	0.76	< 0.0001
Experience role (ER)	0.14	<i>ns</i>	0.07	<i>ns</i>
Experience species (ES)	0.17	<i>ns</i>	0.08	<i>ns</i>
Experience years (EY)	0	<i>ns</i>	0.03	<i>ns</i>
Levels positively related	Long-term data (PB)		<i>Lepidochelys olivacea</i> (PS)	
	Age (PR)		Australia (PRg)	
	North Atlantic (PRg)		no response (PB)	
	Pacific (ERg)		Pacific (ERg)	
Levels negatively related	South Atlantic (PRg)			
	Atlantic (ERg)		<i>Dermochelys coriacea</i> (PS)	
	<i>Natator depressus</i> (PS)		Atlantic (ERg)	
	no response (PR)			

Table S2. Literature review results of peer-reviewed publications on immature sea turtles, between 1913 and 2015, organized by (a) species, (b) research topic, and (c) species and research topic. Darker shades indicate higher percentage.

(a) Species	% of studies
Cc	35
Cm	35
Ei	13
Lk	10
Dc	5
Lo	2
Nd	0.3

(b) Research topic	% of studies
Health	25
Movement	25
Population	16
Growth	14
Distribution	11
Morphology	10
Diet	10
Threats	5
Habitat	4
Age	4

	% of studies						
	Cc	Cm	Dc	Ei	Lk	Lo	Nd
Age	3	2	5	1	3	6	0
Diet	3	10	0	8	7	0	0
Distribution	8	12	16	12	15	6	0
Growth	7	12	8	14	5	6	0
Habitat	3	3	5	6	4	6	0
Health	15	24	8	10	21	22	0
Morphology	8	4	13	7	8	11	0
Movement	34	17	29	20	22	17	100
Population	12	10	5	19	11	11	0
Threats	6	5	11	3	4	17	0

Table S3. Cross-tabulation of the species that respondents have worked with and those species they consider having the highest priority for future research. Percentages indicate the proportion of times respondents working with each species (species of work) identified each of the species as priority for research; darker shades indicate higher priority. Values in brackets indicate the number of respondents that have worked with each species. Cc: *Caretta caretta*, Cm: *Chelonia mydas*, Lk: *Lepidochelys kempii*, Dc: *Dermochelys coriacea*, Ei: *Eretmochelys imbricata*, Lo: *Lepidochelys olivacea*, Nd: *Natator depressus*.

		SPECIES OF WORK						
		CC (N = 26)	CM (29)	LK (10)	DC (15)	EI (20)	LO (8)	ND (8)
PRIORITY	CC	9%	9%	7%	7%	8%	8%	4%
	CM	12%	11%	7%	13%	12%	17%	17%
	LK	12%	11%	13%	4%	10%	4%	13%
	DC	28%	26%	30%	33%	28%	29%	25%
	EI	21%	22%	30%	22%	22%	25%	17%
	LO	8%	8%	0%	9%	10%	4%	17%
	ND	12%	11%	13%	11%	10%	13%	8%

Table S4. Cross-tabulation of the regions that respondents have worked with and those regions they consider having the highest priority for future research of immature sea turtles. Percentages indicate the proportion of times respondents working in each location (region of work) identified each of the regions as highest priority for research; darker shades indicate higher priority. Values in brackets indicate the number of respondents that have worked in each region. Region of work is based on the RMUs selected by each respondent, and no RMU is delimited by Central America; thus, this category is inexistent in “Region of work”. IND: Indian Ocean, S PAC: South Pacific, S ATL: South Atlantic, CAR: Caribbean, GOM: Gulf of Mexico, N PAC: North Pacific, N ATL: North Atlantic, MED: Mediterranean, AUS: Australia.

		REGION OF WORK								
		N ATL (N = 15)	S ATL (10)	N PAC (7)	S PAC (7)	GOM (10)	CAR (11)	MED (5)	AUS (9)	IND (7)
HIGHEST PRIORITY	N ATL	6%	0%	6%	5%	3%	3%	0%	12%	5%
	S ATL	12%	20%	11%	0%	13%	11%	15%	0%	5%
	N PAC	6%	6%	17%	14%	7%	5%	15%	8%	10%
	S PAC	12%	17%	17%	14%	13%	14%	10%	15%	14%
	GOM	16%	3%	6%	10%	17%	11%	5%	8%	10%
	CAR	14%	9%	6%	10%	13%	16%	10%	8%	10%
	C AMER	10%	11%	0%	5%	13%	14%	10%	8%	10%
	MED	6%	6%	0%	5%	3%	5%	10%	4%	0%
	AUS	2%	3%	11%	14%	0%	3%	5%	15%	10%
	IND	16%	26%	28%	24%	17%	19%	20%	23%	29%

Table S5. Cross-tabulation of the regions that respondents have worked with and those regions they consider having the lowest priority for future research of immature sea turtles. Percentages indicate the proportion of times respondents working in each location (region of work) identified each of the regions as lowest priority for research; darker shades indicate lower priority. Values in brackets indicate the number of respondents that have worked in each region. Region of work is based on the RMUs selected by each respondent, and no RMU is delimited by Central America; thus, this category is inexistent in “Region of work”. IND: Indian Ocean, S PAC: South Pacific, S ATL: South Atlantic, CAR: Caribbean, GOM: Gulf of Mexico, N PAC: North Pacific, N ATL: North Atlantic, MED: Mediterranean, AUS: Australia.

		REGION OF WORK								
		N ATL (N = 15)	S ATL (10)	N PAC (7)	S PAC (7)	GOM (10)	CAR (11)	MED (5)	AUS (9)	IND (7)
LOWER PRIORITY	N ATL	33%	43%	42%	25%	38%	38%	45%	20%	25%
	S ATL	0%	0%	8%	17%	0%	0%	0%	13%	17%
	N PAC	0%	4%	0%	8%	0%	0%	0%	13%	8%
	S PAC	0%	0%	0%	0%	0%	0%	0%	0%	0%
	GOM	10%	13%	8%	0%	10%	13%	9%	7%	8%
	CAR	13%	4%	17%	25%	14%	13%	9%	20%	8%
	C AMER	3%	4%	0%	0%	5%	4%	9%	0%	0%
	MED	17%	17%	17%	8%	10%	13%	9%	13%	25%
	AUS	23%	13%	8%	17%	24%	21%	18%	13%	8%
	IND	0%	0%	0%	0%	0%	0%	0%	0%	0%