Sea Turtles in the East Pacific Ocean Region

IUCN-SSC Marine Turtle Specialist Group Annual Regional Report 2019

Editors

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Photo: Olive ridley (RMU LO-EPO) at Ostional, Costa Rica

Photo credit: Roderic Mast

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REGIONAL OVERVIEW

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Table 1. Overview of Eastern Pacific country chapters submitted.

Country	Country Abbreviation used in main table (Table 2)	Included in present report
Canada	CA	NO
U.S.A.	US	NO
Mexico	MX	YES
Guatemala	GT	NO
El Salvador	SV	YES
Nicaragua	NI	YES
Costa Rica	CR	YES
Panama	PA	NO
Colombia	CO	YES
Ecuador	EC	YES
Peru	PE	YES
Chile	CL	YES

1. RMU *Dermochelys coriacea* (DC-EPO)

1.1. Distribution, abundance, trends

1.1.1. Nesting sites

Leatherbacks nest along the coast of the Americas from Mexico to Ecuador, with mayor nesting beaches in Mexico and Costa Rica, with a smaller –but highly significant – nesting site in Nicaragua. It is estimated that there are now fewer than 1,000 adult female turtles in this population.

Here, we are presenting recent nesting data from Mexico, Costa Rica, Nicaragua, El Salvador, Colombia and Ecuador. There are 15 mayor nesting sites and 145 minor nesting sites in the region (table 1).

1.1.2. Marine areas

Satellite telemetry studies show that females primarily migrate southward to the southern hemisphere into the South Pacific Gyre in pelagic waters off Peru and Chile. There is not published information on the habitat use and diving behavior of juveniles and subadults of this population; however, Ecuador's chapter mentions several interactions between artisanal fisheries and juveniles of leatherback.

Pelagic and foraging grounds are reported for juveniles in Peru, Colombia, Chile and Ecuador, just Peru reported data for juveniles and adults at benthic foraging grounds.

1.2. Other biological data

We are reporting studies on size class, trophic ecology and habitat use in Peruvian waters. See table 1. For more information on biological data.

1.3. Threats

1.3.1. Nesting sites

Egg poaching still is a concern even in Costa Rica, where the species counts with exclusive protected areas. Coastal development also is a frequent threat in the region, finally, climate change is a regional concern.

1.3.2. Marine areas

Unintended capture of adult and sub-adult of leatherback turtles by fisheries operating within this species' foraging habitats are of particular concern, given the strong influence that these life stages have on population dynamics. Results from port-based surveys administered along the coast of South America indicate that between 1000 and 2000 EP leatherback turtles are caught in regional small-scale fisheries annually, and approximately 30% - 50% of the captured turtles die.

1.4. Conservation

Sea turtles are protected under national law in all the countries included in this report, also, these countries have signed several regional and international marine –and sea turtle– protection agreements.

In March 2012, an Expert Working Group was assembled to develop a Regional Action Plan to halt and reverse the decline of the EP leatherback turtle. The Regional Action Plan emphasizes the critical importance of protect all the nest along the region, and identifying areas of high bycatch risk, and specifically recommends the expansion of port-based marine turtle bycatch assessments. Moreover, The Regional Action Plan acknowledges that mortality due to fisheries bycatch presents a formidable challenge to EP leatherback turtle recovery efforts and asserts that a better understanding of post-interaction mortality rates is crucial for a sound assessment of the true impact of fisheries bycatch on this species.

One of the most important outcomes of the Regional Working Group was the conformation of Laúd OPO Conservation Network, which is a platform to recover critically endangered sea turtle population, at local and regional scales.

1.5. Research

Table 1. summarizes the scientific studies conducted on leatherbacks in the region.

2. RMU *Eretmochelys imbricata* (EI-EPO)

2.1. Distribution, abundance, trends

2.1.1. Nesting sites

There are 6 mayor nesting sites and 23 minor nesting sites located in Nicaragua, Mexico, Ecuador, and El Salvador (table 1).

2.1.2. Marine areas

Pelagic and foraging grounds are reported for juveniles in Mexico, Colombia, and Ecuador. On the other hand, at benthic foraging grounds were reported juveniles and adults in Peru, Chile, Colombia, Costa Rica, El Salvador, Nicaragua, Mexico and Ecuador.

Although the present report does not include information from Panama, recently, was determinate that Coiba Island is the most important foraging and development ground for hawksbill turtle in the East Pacific Ocean.

2.2. Other biological data

Table 1.

2.3. Threats

2.3.1. Nesting sites

Egg poaching, female consumption, coastal development also is a frequent threat in the region, finally, climate change is a regional concern.

2.3.2. Marine areas

Unintended capture of adult and sub-adult of hawksbill turtles by fisheries operating within this species' foraging habitats are of particular concern, given the strong influence that these life stages have on population dynamics.

2.4. Conservation

Sea turtles are protected under national law in all the countries included in this report, also, these countries have signed several regional and international marine –and sea turtle– protection agreements.

The Strategic Plan developed to address the critically endangered status of hawksbill turtle in the East Pacific highlight the importance of cooperation with international partners to identify regions of concern for fisheries interactions in waters off Central and South America. Furthermore, these plans prioritize capacity building and training in fishing communities to promote best practices for avoiding interactions when feasible and for safely handling and releasing captured turtles. Bycatch assessment programs are well-established in Peru, Ecuador, and Chile, and Mexico, Nicaragua, and Costa Rica. Colombia and Panama represent a critical gap in sea turtle bycatch monitoring efforts for Central and South America.

One of the most important outcomes of the Regional Strategic Plan, was the conformation of ICAPO Conservation Network, which is a platform to recover critically endangered sea turtle population, at local and regional scales.

2.5. Research

Table 1. summarizes the scientific studies conducted on leatherbacks in the region.

3. RMU *Chelonia mydas* (CM-EPO)

3.1. Distribution, abundance, trends

3.1.1. Nesting sites

Green turtles nest along the coast of the Americas from Mexico to Peru.

Here, we are presenting recent nesting data from 22 mayor nesting sites at Costa Rica, Nicaragua, Mexico and Ecuador, and 29 minor nesting sites at Colombia, Costa Rica, Nicaragua and Ecuador (table 1).

3.1.2. Marine areas
Juveniles of green turtles use neritic coastal lagoons along the coastal of the Americas as feeding and development grounds. There are important aggregation sites in Baja California Peninsula, Mexico; Gorgona Island, Colombia; and Galapagos Island, Ecuador.

3.2. Other biological data
Table 1.

3.3. Threats

3.3.1. Nesting site
Egg poaching, female consumption, coastal development also is a frequent threat in the region, finally, climate change is a regional concern.

3.3.2. Marine areas
Unintended capture of adult and sub-adult of green turtles by fisheries operating within this species' foraging habitats are of particular concern, given the strong influence that these life stages have on population dynamics.

3.4. Conservation
Sea turtles are protected under national law in all the countries included in this report, also, these countries have signed several regional and international marine –and sea turtle– protection agreements.

Michoacán, Mexico, is one the most important nesting sites for the population, there are data from a long-term monitoring and the multidecadal trend indicates that the number of nesting females has been raising from 2000.

3.5. Research
Table 1. summarizes the scientific studies conducted on leatherbacks in the region.

4. RMU *Lepidochelys olivacea* (LO-EPO)

4.1. Distribution, abundance, trends

4.1.1. Nesting sites
Olive ridley is the most abundant sea turtle for the East Pacific. This species shows multiple nesting strategies in the region. It is usually solitary nester but in some beaches from Mexico, Costa Rica, Nicaragua, and Panama where they nest in "arribada" (Table 1).

4.1.2. Marine areas
This species is mostly pelagic, however, in the region is reported in benthic foraging grounds in four countries (Peru, Chile, El Salvador and Mexico).

4.2. Other biological data
Table 1.

4.3. Threats

4.3.1. Nesting sites
Egg poaching, female consumption, coastal development also is a frequent threat in the region, finally, climate change is a regional concern.

4.3.2. Marine areas
Unintended capture of adult and sub-adult of olive ridleys by fisheries operating within this species' foraging habitats are of particular concern, given the strong influence that these life stages have on population dynamics.

4.4. Conservation
Sea turtles are protected under national law in all the countries included in this report, also, these countries have signed several regional and international marine –and sea turtle– protection agreements.

4.5. Research
Table 1. summarizes the scientific studies conducted on leatherbacks in the region.

5. RMU *Caretta caretta* (CC-EPO)

5.1. Distribution, abundance, trends

5.1.1. Nesting sites
N/A

5.1.2. Marine areas
The neritic waters of the Baja California Peninsula (BCP) are one the most important aggregation areas of juveniles of the North Pacific population. These turtles nest exclusively in Japan rockeries.

A similar situation happens in Southern latitudes, juveniles find an aggregation hotspot in the Chilean and Peruvian waters. These juveniles come from Australia and New Caledonia.

5.2. Other biological data
Table 1.

5.3. Threats

5.3.1. Nesting sites
N/A

5.3.2. Marine areas

Unintended capture of juveniles and sub-adult of loggerhead by fisheries operating within this species' foraging habitats are of particular concern, given the strong influence that these life stages have on population dynamics.

5.4. Conservation

Sea turtles are protected under national law in all the countries included in this report, also, these countries have signed several regional and international marine –and sea turtle– protection agreements.

5.5. Research

Table 1. summarizes the scientific studies conducted on leatherbacks in the region.

Table 2. key biological information for sea turtles RMUs () in the East Pacific Ocean.

Country chapters: MX-Mexico, SV-El Salvador, NI-Nicaragua, CR-Costa Rica, CO-Colombia, EC-Ecuador, PE-Peru, CL-Chile.

	Caretta caretta		Chelonia mydas		Dermochelys coriacea		Eretmochelys imbricata		Lepidochelys olivacea	
RMU	**CC - EPO**	**Country chapters**	**CM - EPO**	**Country chapters**	**DC - EPO**	**Country chapters**	**EI - EPO**	**Country chapters**	**LO - EPO**	**Country chapters**
Occurrence										
Nesting sites			Y	PE,CO,CR, SV, NI, MX, EC	Y	CO,CR, SV, NI, MX, EC	Y	SV, NI, MX, EC	Y	PE,CO,CR, SV, N, MXI, EC
Pelagic foraging grounds	Y	PE, CL, EC	Y, JA	PE, CL,CO, SV, MX, EC	Y	PE, CL,CO, EC	Y, J	CO, MX, EC	Y, JA, A	PE, CL,CO, SV, MX
Benthic foraging grounds			Y,JA	PE, CL,CO,CR, SV, MX, EC	Y	PE	Y,JA, J	PE, CL,CO,CR, SV, NI, MX, EC	Y, JA, A	PE, CL, SV, MX
Key biological data										
Nests/yr: recent average (range of years)	38.3 (2010 - 2014)	EC	3132.3 (2007 - 2018)	PE, CO, CR, NI, MX, EC	7.1 (2004 - 2018)	CR, NI, EC	17 (2008 -2018)	CR, NI, MX, EC	21399 (1998 - 2018)	PE,CO, CR, NI, MX; EC
Nests/yr: recent order of magnitude			1_2769	PE, EC			1_46	EC	1 - 1390985	PE, CR, EC
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	1	EC	22	CR,NI, MX, EC	15	CR,NI, MX	6	NI, MX, EC	59	CO, CR, NI, MX, EC
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)			29	CO, CR, NI, EC	145	CO, CR, NI, MX, EC	23	CR, NI, MX, EC	61	PE, CO, CR, NI, EC
Nests/yr at "major" sites: recent average (range of years)	38.3 (2010 - 2014)	EC	6249 (2008 - 2015)	NI,MX, EC	23.6 (2010 - 2016)	NI	35 (2007 - 2017)	NI, MX, EC	19707 (1991 - 2017)	CO, NI, MX, EC
Nests/yr at "minor" sites: recent average (range of years)			9.3 (2007 - 2017)	CO, CR, NI, EC	8.3 (2004 - 2018)	CO;CR, NI, EC	3 (2008 - 2018)	CR, NI, MX, EC	15 (2008 - 2018)	PE,CO; CR, NI, EC
Total length of nesting sites (km)			351.45	CR, SV, NI,MX,EC	429.3	CR, SV, NI, MX, EC	197.7	CR, SV, NI, MX, EC	819.83	PE, CR, SV, NI, MX, EC

Nesting females / yr			6130.7	CR, MX, EC	34.8	CR	47.4	SV, EC	586924	CR
Nests / female season (N)			4.3 (4769)	CR, EC	4.11(>110)	CR	2.2 (255)	SV, EC	3.85 (1929)	CR
Female remigration interval (yrs) (N)			3.4 (947)	CR, MX, EC	3.1	CR, MX	2.5 (73)	SV, MX, EC	1.5	MX
Sex ratio: Hatchlings (F / Tot) (N)					0.85	CR	0.69 - 0.85 (705 clutches)	SV		
Sex ratio: Immatures (F / Tot) (N)							0.86 (77)	SV	0.57	
Sex ratio: Adults (F / Tot) (N)							0.46 (57)	CR, SV, EC		
Min adult size, CCL or SCL (cm)			76.6	CR, NI, MX, EC	138	CR, NI, MX	58; 66.6;69.95; 93; 67	SV, NI, CR, MX, EC	62.5	PE,CO,CR, NI, MX
Age at maturity (yrs)	25 -30	MX	20 - 30	CR, MX	13-14	MX			10-18 años	MX
Clutch size (n eggs) (N) número de nidos			75 (3979)	SV, NI, MX, EC	63 (719)	CR, SV, NI, MX	196 (1118)	SV, NI, MX, EC	98 (213)	CO, SV, NI, MX
Emergence success (hatchlings/egg) (N) N:nidos			0.7 (2553)	CR, SV, N, MX	0.38 (1018)	CR, SV; NI; MX	0.65 (1862)	SV, NI, MX, EC	0.6 (20807)	CO, CR, NI
Nesting success (Nests/ Tot emergence tracks) (N)			0.6 (22023)	CR, EC	0.9	CR	0.62 (184)	EC		
Trends										
Recent trends (last 20 yrs) at nesting sites (range of years)					Declining (90%) (1988 - 2018)	CR,NI			STABLE	CO; CR; NI
Recent trends (last 20 yrs) at foraging grounds (range of years)	43226 (2015)	MX								
Oldest documented abundance: nests/yr (range of years)			76 (2012)	SV	32 (2014 - 2015)	CR, SV	164 (1996 - 2015)	SV, EC	11137.5 (1998 - 2010)	CO,CR, SV
Published studies										
Growth rates	Y	MX	Y	PE, CL,CO, MX,EC	Y	CR	Y	EC		
Genetics	Y	PE	Y	PE, CL,CO,CR, EC	Y	PE, CL, CR	Y	PE,CO, CR, SV, NI,EC	Y	PE,CO, MX
Stocks defined by genetic markers	Y	MX	Y	CL,CO, CR,EC	Y	CL, CR	Y	CO, CR, SV, NI,EC	Y	PE,CO
Remote tracking (satellite or other)	Y	PE	Y	CL,CO, CR,NI, MX, EC	Y	PE, CR, MX	Y	PE,CO, SV, NI, MX, EC	Y	MX
Survival rates			Y	MX	Y	CR, MX			Y	MX

Population dynamics	Y	CL	Y	PE, CL,CO, EC	Y	CL, CR	Y	NI, MX, EC	Y	CO, MX
Foraging ecology (diet or isotopes)	Y	PE, CL, MX	Y	PE, CL,CO, CR, SV, MX	Y	PE, CL, CR	Y	CR, SV, NI, EC	Y	PE, MX
Capture-Mark-Recapture			Y	PE, CL,CO, CR, SV, MX, EC	Y	CR	Y	CO, CR, SV, NI, EC	Y	CO, CR, MX
Threats										
Bycatch: presence of small scale / artisanal fisheries?	Y (PLL, DN, DLL)	PE, MX	Y(PLL, SN, DN,OTH, PT, FP, PN)	PE,CO, CR, NI, MX	Y(PLL,SN,DN, FP)	PE,CO, NI, MX, EC	Y (SN, PLL,OTH, PN, DLL, DN, ST, MT)	PE,CO, CR, SV, NI, EC	Y (PLL, SN, DN, PT,ST, DLL, MT)	CO, CR, SV, NI, MX, EC
Bycatch: presence of industrial fisheries?	Y (PLL, SN, BT)	EC	Y (PLL, SN, BT, ST, DLL, PN, DN, MT, PT)	CO, CR, SV, MX, EC	Y (PLL, PT, PN, SN, FP, BT)	PE,CO, MX, EC	Y (PLL, SN, BT, PT, MT, FP, ST)	CO, CR, MX	Y (PLL, ST, BT)	CO, CR, SV, EC
Bycatch: quantified?	Y (PLL)	PE, MX	Y	CO	Y(PLL,SN,DN)	PE,CO	Y	CO, SV, NI	Y (PLL, SN, DN, PT)	CO
Take. Intentional killing or exploitation of turtles	Y	MX	Y	PE,CO, MX	Y	PE,CO, MX	Y	PE,CO, SV, MX, EC	Y	PE,CO, NI, MX, EC
Take. Egg poaching			Y	CO, CR, SV, NI, MX	Y	CO,CR, SV, NI, MX	Y	CO, CR, SV, NI, EC	Y	PE,CO, CR, SV, NI, MX, EC
Coastal Development. Nesting habitat degradation			Y	CO, CR, SV, MX, EC	Y	CO, CR, SV, NI, EC	Y	CO, CR, SV, MX, EC	Y	PE,CO, CR, SV, NI, MX, EC
Coastal Development. Photopollution			Y	CO, CR, SV, MX, EC	Y	CO, CR, SV, EC	Y	CO, CR, SV, MX, EC	Y	PE,CO,CR, SV, MX, EC
Coastal Development. Boat strikes	Y	MX	Y	PE,CO, CR, SV, MX, EC	Y	CO, CR	Y	CO, CR, SV, MX, EC	Y	CO, CR, MX, EC
Egg predation			Y	CO, CR, MX, EC	Y	CO, CR	Y	CO, CR, SV,EC	Y	CO, CR, NI, MX, EC
Pollution (debris, chemical)	Y	PE, MX	Y	PE,CO, CR, MX,EC	Y	CO, CR, MX	Y	CO, CR, SV, MX, EC	Y	CO, CR, MX, EC
Pathogens	Y	MX	Y	PE, CR, EC			Y	CR	Y	CR
Climate change			Y	PE, CR, MX	Y	PE, CR	Y	CR, MX, EC	Y	CR, MX, EC
Foraging habitat degradation	Y		Y	PE,CO, CR, SV, MX, EC	Y	CO	Y	CO, CR, SV, MX, EC	Y	CO, CR
Other (Parasites/Simbionts)			Y	PE, SV, EC			Y	MX, EC	Y	SV, EC

Long-term projects										
Monitoring at nesting sites			Y	PE,CO, CR, SV, NI, MX, EC	Y	CR, SV, NI, MX, EC	Y	CO, CR, SV, NI, MX, EC	Y	PE,CO,CR, SV, NI, MX, EC
Number of index nesting sites			33	CR, SV, NI, MX, EC	24	CR, SV, NI, MX	14	SV, NI, EC	57	CO, CR, SV, NI. MX, EC
Monitoring at foraging sites	Y	MX	Y	CR, SV, MX, EC	Y	EC	Y	CR, SV, NI, EC		
Conservation										
Protection under national law	Y	PE, MX, EC	Y	PE,CO, CR, SV,NI, MX, EC	Y	PE,CO, CR, SV, NI, MX, EC	Y	PE,CO, CR, SV, NI, MX, EC	Y	PE,CO, CR, SV, NI, MX, EC
Number of protected nesting sites (habitat preservation)			24	CO, CR, SV, NI,EC	16	CO, CR, SV, NI	23	CO, CR, SV, NI, EC	24	CO, CR, SV, NI, EC
Number of Marine Areas with mitigation of threats			39	PE,CO, CR,EC	29	PE,CO,CR	35	PE,CO, CR, SV,NI, EC	40	PE,CO, CR, EC
Long-term conservation projects (number)	7	PE	36	PE,CO, CR,SV, NI,EC	16	PE, CR, SV, NI, EC	16	PE,CO, CR, SV, NI, EC	54	PE,CO, CR, SV, NI, EC
In-situ nest protection (eg cages)			Y	CO, CR, NI,EC	Y	CR, EC	Y	CR, SV, NI, MX, EC	Y	CO,CR, SV, NI, MX, EC
Hatcheries			Y	CO, CR, SV, NI, MX, EC	Y	CR, SV, NI, MX	Y	SV, NI, MX, EC	Y	CO, CR, SV, NI, MX, EC
Head-starting										
By-catch: fishing gear modifications (eg, TED, circle hooks)	Y	MX, EC	Y	PE,CO, CR, SV, NI, MX, EC	Y	PE,CO, NI, MX, EC	Y	PE,CO, CR, SV, NI, MX, EC	Y	PE,CO, SV, NI, MX, EC
By-catch: onboard best practices	Y	PE, MX, EC	Y	PE,CO, CR, MX	Y	PE,CO, EC	Y	PE,CO, CR, SV, NI, MX	Y	PE,CO, NI
By-catch: spatio-temporal closures/reduction	Y	MX	Y	CO, SV, NI, MX	Y	CO, NI, MX	Y	CO, SV, NI, MX	Y	CO, SV, NI, MX
Hibridization			Y	PE			Y	PE		
Health			Y	PE						

MEXICO

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Table 1. Main biology and conservation aspects of sea turtles in the Mexican Pacific.

RMU	Pacífico Oriental									
	Cm	**Ref #**	**Dc**	**Ref #**	**Lo**	**Ref #**	**Cc**	**Ref #**	**Ei**	**Ref #**
Ocurrencias										
Sitios de Anidación	Y	1	Y	1	Y	1,2	n/a		Y	36, 37
Sitios de Forrajeo Pelágicos	JA	1,2	n/a		A	1,51,55	JA	1	J	1
Sitios de Forrajeo Bénticos	JA	1,2	n/a		A	1,55	JA	1	J	1
Datos biológicos de importancia										
Nidos/por año: promedio actual (rango de años)							n/a		94 (2010-2014)	36, 37
Nidos/por año: orden de magnitud actual							n/a			
Número de sitios con abundancia de anidación (>20 nidos/por año Y >10 nidos/km por año)	3	1,12	13	1	3	1, 12, 23	n/a		3	36, 37
Número de sitios con menor anidación (<20 nidos/por año ó <10 nidos/km por año)			131	1			n/a			
Nidos/por año en sitios de abundancia: promedo actual (rango de años)							n/a			
Nidos/por año en sitios con menor anidación: promedio actual (rango de años)							n/a			
Largo total de sitios de anidación (km)			2226.2	1			n/a			
Hembras anidantes / por año	3500 (2011)#						n/a			
Nidos / temporada de anidación (N)							n/a			
Intervalo de remigración de hembras(años) (N)	3 años	1	2-3 años	1	1-2 años	23	2-3 años	1	3.5 años	1
Radio sexual: Neonatos (hembras / Total) (N)							n/a			
Radio sexual: Inmaduras (hembra / Total) (N)							n/a			
Radio sexual: Adulta (hembra / Total) (N)							n/a			
Min medidas adultos, LCC (cm)	85.7 LCC	1,	143 LCC	1,	60-73 LCC	1,	95-110 LCC	1	92.9- 94.4 LCC	1
Edad de madurez (yrs)	24 años	1,	13-14 años	1	13 años (10-18)^	1,	25-30 años	1		
Tamaño del nidos (n eggs) (N)	69.3	1,	64	1	110.6	23	110		150- 200	1
Éxito de eclosión (neonatos/huevos) (N)	70.6% Y 88.2% *		57%	1			n/a		75% - 85%	1
Nesting success (Nidos/ huellas totales) (N)							n/a			
Tendencias										
Tendencias actuales (últimos 20 años) en los sitios de anidación (rango de años)							n/a			

Tendencias actuales (últimos 20 años) en los sitios de forrajeo (rango de años)							43,226 (2015)"	24		
Mayor abundancia documentada: nido/año (rango de años)						58	n/a			
Estudios Publicados										
Tasas de crecmiento	Y	1,21			N		Y	16		
Genética					Y	1,27,34				
Stocks definidos por marcadores genéticos					N		Y	15, 41		
Rastreo remoto (satelital u otro)	Y	60	Y	59	Y	1,50,61			Y	37
Tasas de sobrevivencia	Y	28,33			Y	1,33,35	Y	13,33		
Dinámica de la población					Y	1		17		
Ecología de forrajeo (dieta/ isotopos)	Y	21,29,30 ,32			y	32	Y	14,16, 24		
Captura- Marca -Recaptura	Y	12, 19, 20,21,31			Y	1, 23				
Amenazas										
Bycatch: presencia a menor escala / pesca artesanal?	Y (PT, SN,FP, PLL, PN)	1, 12	Y (PLL, SN, FP)	1	Y ()	1,52,53,5 4,57	Y (PLL, PN, DLL)	1, 24,42, 43	Y (PLL, PN, DLL)	1,4 4
Bycatch: presencia de pesca industria?	Y (PLL, DLL, PN)	1, 12	Y (PLL, PT, PN, SN, FP)	1	Y ()	1,52,53,5 4,57	Y (PLL, PT, MT,FP, ST)	1,24,4 2	Y (PLL, PT, MT,FP, ST)	1,4 4
Bycatch: cuantificada?	N		N		N		y	24,42	N	
Take. Mortalidad intencionada/ Explotación de tortugas	Y	1	Y	1	Y	1,12,52,5 3,54,57	Y	1,43	N	
Take. Saqueo de huevos	Y	1,12	Y	1	Y	1	n/a		N	
Desarrollo costero. Degradación del hábitat de anidación	Y	22	N		Y	12	n/a		Y	1,4 5
Desarrollo costero. Contaminación lumínica	Y	12	N		Y	12	n/a		Y	1,4 8
Desarrollo costero. Golpes de botes	Y	12			Y	12	Y	1, 24,42	Y	1
Depredación de huevos	Y	1			Y	12	n/a		N	
Contaminación (debris, química)	Y	49	Y	49	Y	49	Y	1, 24,42, 49	Y	49
Patógenos	N				N		Y	24	N	
Cambio Climático	Y	12			Y	12	n/a		Y	1,4 5,4 7
Degradación del hábitat de forrajeo	Y	12,22			N		Y	1, 24,42	Y	1
Otros	N				N		n/a		Y	1

Proyectos a largo plazo										
Monitoreo en sitios de anidación	Y	1	Y	1	Y	1	n/a		Y	36, 37
Número de sitios de anidación prioritarios	3	1, 12, 22	3	1	3	1	n/a			
Monitoreo en sitios de forrajeo	Y	1, 22	N		N		Y	1,22, 24	N	
Conservación										
Protección bajo la ley nacional	Y	1,22	Y	1	Y	1	Y	1	Y	1,4 6
Número de sitios de anidacieon protejidos (preservación de hábitat)							n/a			
Número de áreas marinas con mitigación de amenazas										
Proyectos de conservación a largo plazo (número)										
Protección de nidos In- Situ (ej. jaulas)	N				Y		n/a		Y	1
Viveros	Y		Y	62	Y		n/a		Y	1
Head-starting	N		N		N		N		N	
By-catch: Modificación en los aparejos de pesca (ej, DET, canzuelos circulares)	Y! (TED)	1,22	Y (TED)	1	Y (TED)	1,56	Y (TED)	1, 24	Y	1
By-catch: buenas prácticas abordo	Y!	22					Y	24	Y	1
By-catch: vedas/reducción	Y	1, 12,22, 24	Y	1, 12	Y	1,12	Y	1, 24	Y	1
Otros	Y	22					n/a			

* 70.6% de éxito de eclosión en nidos protegidos en vivero y 88.2% de éxito de eclosión en nidos naturales de Cm o Ca.

^ madurez sexual en promedio 13 años con un rango entre 10-18 de Cc.

! Monitoreos en áreas de alimentación

3500 hembras anidadoras solo en la playa de Colola, Michoacán para Ca o Cm.

" 2015 se hizo la primera estimación de Cc en el Golfo de Ulloa (Sitio de alimnetación)

Table 2. Sea turtle nesting beaches in the Mexican Pacific.

Especie / RMU	Index site	Nidos/año: promedio actual (rango de años)	Límite Occidental		Límite Oriental		Punto Central		Largo (km)	% Monitoreado	# Referencia	Nivel de monitoreo (1-2)
Departamento			Long	Lat	Long	Lat	Long	Lat				
Playa de anidación												
Cm EPO												
JALISCO												
Chalacatepec	N	4178 (2012)	105° 17' 29"	19° 43' 8"	105° 12' 3"	19° 37' 21"	105°40'46.33"	19°40'46.33"	12		25,26	
Majahuas	N		105° 22' 6"	19° 50' 53"	105° 19' 0"	19° 47' 8"	105°22'17.77"	19°50'14.68"	10		25	
Playón de Mismaloya	N		105° 32' 58"	20° 5' 46"	105° 27' 5"	19° 56' 50"	105°29'37.43"	19°59'56.64"	19		25	
Teopa	N		105° 14' 9"	19° 25' 51"	105° 1' 51"	19° 23' 48"			7		25	
La Gloria	N		105° 27' 5"	19° 56' 50"	105° 22' 6"	19° 50' 53"	105°13'58.16"	20°37'50.68"	15		25	
COLIMA												
Isla Clarión	N						114° 43′ 19″	18° 21′ 32″				
Isla Socorro	N						110°59′0″	18°48′0″				
MICHOACÁN												
Colola	Y	119,150 (2008-2015)	103° 25' 52.55"	18° 18' 40.04"	103° 24' 34.53"	18° 17' 33.78"	103° 25' 50"	18° 18' 17"	4.80	100.0	1,5	2
Maruata	Y	1000 ±1500 (2015)	103° 21' 14.42"	18° 16' 05.15"	103° 19' 34.66	18° 15' 55.52"	103° 20' 35"	18° 16' 07"	2.40	100.0	1,6	2
Motín del Oro	Y		103° 28' 26.34"	18° 19' 39"	103° 27' 03.51"	18° 18' 44.39"	103° 27' 43.85"	18° 19' 03.13"	2.67	100.0	12	2
Paso de Noria	Y		103°18'42.63"	18°15'43.4"	103°17'55.22"	18°15'20.39"	103°18'15.89"	18°15'31.59"	1.57		8	
Playa azul	N		102°22'33.33"	17°59'11.16"	102°19'37.01"	17°58'24.66"	102°20'59.56"	17°58'49.34"	5.4		12	2
Caleta de campos	N		102°45'09.58"	18°04'21.90"	102°44'41.97"	18°04'23.69"	102°44' 54.95"	18°04'28.91"	1.16		12	2
La placita	N		103°36'25.55"	18°31'48.71"	103°35'58.56"	18°31'23.42"	103°36'06.95"	18°31'31.13"	1.10		12	2
Boca de Apiza	N		103°42'11.29"	18°39'19.64"	103°44'06.43"	18°40'59.99"	103°4'24.08"	18°41'19.13"	4.57		12	2
Playa la llorona	N		103°30'09.70"	18°20'25.63"	103°29'31.48	18°19'47.44"	103° 29'49.04"	18°20'16.63"	1.89		12	2
Playa la manzanillera	N		103°30'47.30"	18°21'32.91"	103°30'50.05"	18°21'11.81"	103°30'45.18"	18°21'22.31"	0.72		12	2

Faro de Bucerías	N		103°30'38.08"	18°20'48.36"	103°30'43.84"	18°21'06.08"	103°30'36.15"	18.20'58.41"	0.68		12	2
Barra de Pichi	N		102°20'35.29"	17°58'41.70"	102°19'17.54"	17°58'20.82"	102°19'58.32"'	17°58'18"	2.37		12	2
Barra de Tigre	N		102°21'40.32"	17°59'21.66"	102°21'40.32"	17° 58'59.59"	102°22'19.69"	17°59'07.75"	2.65		12	2
San Juan de Alima	N						103°40'28.28"	18.34'58.34"			12	2
Las calabazas	N		102°25'35.99"	18°00'0.533"	102°24'06.86"	17°59'37.26"	102°24'53.04"	18°00'01.81"	2.78		23	2
Playa Ximapa	N		103°27'59.78"	18°19'10.78"	103°26'48.76"	18°18'39.61"	103°27'16.81"	18°18'50.68"	2.27		12	2
Chuquiapan	N		102°36'42.88"	18°02'54.75"	102°36'25.37"	18°02'53.29"	102°36'35.65"	18°02'55.46"	0.54		12	2
OAXACA												
Morro Ayuta			95°52'54.52"	15°50'58.21"	95°51'39.87"	15°51'20.41"	95°52'20.08"	15°51'13.59"	2.47		25	
Dc EPO												
BAJA CALIFORNIA												
Agua Blanca	N		110° 35' 31"	23° 42' 01"	110° 16' 27"	23° 29' 34"	110° 23' 26"	23° 36' 55"	40.0	100.0	1,3	2
Cabo Pulmo	N		109°28'03".90	23°30'00"	109°23'00"	23°22'30"	109°25'53".61	23°22'30"	2.72		12,23	2
JALISCO												
Chalacatepec			105°15'45.64"	19°40'47.51"	105°13'28.20"	19°38'58.87"	105°14'35.07"	19°39'56.95"	5.16		25	
Playón de Mismaloya			105°29'45.34"	19°59'52.65"	105°29'39.95"	19°59'44.15"	105°29'42.88"	19°59'48.67"	0.28		25	
Cuitzmala			105°01'10.13"	19°22'50.79"	105°01'10.13"	19°22'50.97"	105° 00'24.08"	19°22'17.24"	3.40		25	
COLIMA												
Puerta del Mar			104°18'52.41"	19°05'23.97"	104°18'12.10"	19°03'43.56"	104°18'20.77"	19°04'38.00"	3.42		25	
Boca de Apiza			103°44'58.52"	18°42'06.09"	103°44'19.23"	18°41'05.48"	103°44'34.43"	18°41'36.23"	2.21		25	
Cuyutlán			104°04'34.14"	18°55'13.78"	104°03'28.59"	18°54'34.04"	104°04'02.70"	18°54'54.19"	2.28		25	
MICHOACÁN												
Mexiquillo	Y		102° 58' 25"	18°10' 25"	102° 48' 31"	18° 05' 34"	102° 55' 77"	18° 05' 34"	18.0		1,3,4	2
Colola			103° 25' 52.55"	18° 18' 40.04"	103° 24' 34.53"	18° 17' 33.78"	103° 25' 50"	18° 18' 17"	4.80		25	
Maruata			103° 21' 14.42"	18° 16' 05.15"	103° 19' 34.66	18° 15' 55.52"	103° 20' 35"	18° 16' 07"	2.40		25	
GUERRERO												
Tierra Colorada	Y		98° 43' 40"	16° 30' 03"	98° 34' 05"	16° 19' 36"			26.0		1,3	2

San Valentín	N		101° 20' 23"	17° 28' 42"	101° 14' 09"	17° 26' 17"	101°19'56.82"	17°19'56.82"	21.0		1,3	2
Piedra de Tlacoyunque	N		101° 03' 0"	17° 15' 59"	100° 39' 43"	17° 08' 15"			44.0		1,3	2
Playa Ventura	N		98° 58' 12"	16° 33' 32"	98° 55' 14"	16° 32' 25"	98°54'49.30"	16°32'22.30"	6.0		1,3	2
OAXACA												
Cahuaitán	Y		98° 32' 26"	16° 18' 42"	98° 26' 59"	16° 16' 47"	98°29'55.41"	16°17'53.71"	12.0		1,3	2
Barra de la Cruz	Y		95° 57' 59"	15° 49' 19"	95° 53' 28"	15° 50' 36"	95°57'55.59"	15°49'28.96"	8.0		1,3	2
La tuza	N		97° 54' 34"	16° 03' 57"	97° 47' 20"	15° 59' 12"	97°51'41.47"	16°01'51.22"	16.0		1,3	2
San Juan Chacahua	N		97° 46' 41"	15° 58' 45"	97° 40' 41"	15° 57' 50"			11.0		1,3	2
Cerro Hermoso	N		97° 40' 37"	15° 57' 52	97° 34' 05"	15° 57' 55"	97°32'08.54"	15°58'10.73"	12.0		1,3	2
Palmarito	N										25	
Morro Ayuta							74°0'21.38''	40°42'46.02			25	
L.o. EPO												
Arribadas												
MICHOACÁN												
Playa Ixtapilla	Y	204,737.5 (2008-2015)	n/a	n/a	n/a	n/a	103° 31' 54"	18° 25' 04"	600m	100%	1,12	2
OAXACA												
Santuario playa de Escobilla	Y	1,183,750 (2008-2015)					96°44'45.78"	15°43'36.49"	25.0		1,12	
Playa de Morro Ayuta							74°0'21.38''	40°42'46.02			1,12	
Solitaria												
SINALOA												
Isala Quevedo	N	162 (2015)					107°21'34.87"	24°12'25.23"	26.0		1	2
Isla Santa María	N	99 (2015)					109°15'57.24"	25°38'25.93"	25.0		1	2
Las arenitas	N	199 (2015)					107°33'39.79"	24°21'01.80"	59.0		1	2
Ceuta	N	679 (2015)					106°58'34.13"	23°55'10.50"	40.0		1	2
Celestino Gasca	N	255 (2015)					106°53'01.26"	23°49'08.62"	35.0		1	2
Barras de Piaxtla	N	1781 (2015)^					106°48'05.04"	23°39'48.31"	5.0		1	2
Pozole	N	1781 (2015)^					106°43'24.08"	23°35'30.27"	8.0		1	2

Toyhua	N	1781 (2015)^					106°42'22.47"	23°34'44.58"	12.0		1	2
El verde	N	2666 (2015)					106°30'48.11"	23°22'11.36"	28.0		1	2
Playas urbanas de Mazatlán	N	1678 (2015)							21.0		1	2
Isla de la Piedra	N	4553 (2015)					106°24'29.09"	23°11'36.02"	17.0		1	2
Caimero	N	4305 (2015)							41.0		1	2
Chametla	N	247 (2015)							9.0		1	2
Playa las Cabras	N	841 (2015)					105°51'59.66"	22°42'18.70"	12.0		1	2
Isla del Bosque	N	45 (2015)					105°52'31.57"	22.42'48.87"	6.0		1	2
La Guásima							106°07'22.20"	22°56'11.08"			25	
Teacapan	N	44 (2015)							13.0		1	2
NAYARIT												
Playa de Chila							105°13'14.75"	21°15'22.85"			18	2
Playa de Platanitos							105°14'26.19"	21°21'06.33"			18	2
San Francisco							105°24'51.74"	20°54'16.84"			18	2
El Naranjo							105°13'47.60"	21°05'03.47"			18	2
Nuevo Vallarta	N	5039 ±1705 (2005-2008)					105°17'51.90"	20°41'43.07"			18	2
Bahia de Badera	N	3742 ± 904									18	2
JALISCO												
Boca de Tomates	N	10.121 (2016) #					105°16'26.29"	20°40'13.29"			18	2
Puerto Vallarta	N	10.121 (2016) #									18	2
Mayto	N	10.121 (2016) #					105°34'57.68"	20°15'09.27"			18	2
Teopa			105° 14' 9"	19° 25' 51"	105° 1' 51"	19° 23' 48"			7		25	
Mismaloya							105°29'37.43"	19°59'56.64"			12	2
Chalacatepec							105°40'46.33"	19°40'46.33"			25	
Cuitzmala							105°17'30.66"	20°31'56.76"			25	
La Gloria							105°13'58.16"	20°37'50.68"			25	
Majahuas							105°22'17.77"	19°50'14.68"			25	

COLIMA												
Boca de Apiza							103°4'24.08"	18°41'19.13"			25	
MICHOACÁN												
Colola	N	1,046 (1991-2002)	103° 25' 52.55"	18° 18' 40.04"	103° 24' 34.53"	18° 17' 33.78"	103° 25' 50"	18° 18' 17"	4.8	100.0	1,5,12	2
Maruata			103° 21' 14.42"	18° 16' 05.15"	103° 19' 34.66	18° 15' 55.52"	103° 20' 35"	18° 16' 07"	2.4	100.0	1,6,12	2
Mexiquillo							102° 55' 77"	18° 05' 34"			25	
GUERRERO												
Piedra de Tlacoyunque											12	2
La Gloria							99°45'00.02"	16°44'19.07"			12	2
Playa Ventura							98°54'49.30"	16°32'22.30"			25	
Pico del Monte											25	
Tierra Colorada											25	
Playa Encantada							99°38'03.08"	16°41'23.45"			25	
Estero Colorado											25	
OAXACA												
San Juan Chacuaha											12	2
Barra de la Cruz							95°57'55.59"	15°49'28.96"			25	
CHIAPAS												
Playa puerto Arista	N						93°48'35.67"	15°55'57.76"			25	
E.i. EPO												
SINALOA												
Guasave			108°32'00.09"	25°17'52.25"	108°23'40.84"	25°11'31.49"	108°27'07.91"	25°15'30.60"	18.73		1	
NAYARIT												
Punta de Mita		41 (2010-2014)	105°31'26.38"	20°46'05.05"	105°28'55.95"	20°45'20.99"	105°28'55.95"	20°45'20.99"	6.1		36,37	
Bahia de Jaltemba			105°17'33.10"	21°01'30.97"	105°16'59.15"	21°01'40.58"	105°17'16.67"	21°01'32.74"	1.5		1	
San Blas		2 (2010-2014)					105°17'3.48"	21°32'28.5"	7		36,37	
Platanitos		15 (2010-2014)					105°14'26.19"	21°21'06.33"			36,37	
Chila							105°13'14.75"	21°15'22.85"			36,37	
JALISCO												

Costa Careyes		36 (2010-2014)					104°46'19.9194"	19°16'0.12"			36,37	
Playa Teopa			105° 14' 9"	19° 25' 51"	105° 1' 51"	19° 23' 48"			7		63	
Tehuamixtle							105°35'13.27"	20°11'54.74"			1	
Mayto							105°34'57.68"	20°15'09.27"			1	
Playa Cuitzmala			105°01'10.13"	19°22'50.79"	105°01'10.13"	19°22'50.97"	105° 00'24.08"	19°22'17.24"	3.40		63	
COLIMA												
Isla Revillagigedo							112°45'50"	18°49'17"			63	
Isla Socorro							110°59′0″	18°48′0″			63	

10.121 (2016) total de nidos de las tres playas (Boca de tomates, Puerto Vallarta y Mayto)
^1781 (2015) total de nidos en las tres playas (meseta de Cacaxtla)

Table 3. International conventions protecting sea turtles and signed by Mexico.

Convenciones Internacionales	Fir ma dos	Conveni o Vinculan te	Es pec ies	Acciones de conservación	Relevancia para las tortugas marinas
Apendice 1 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).	Y	Y	ALL	El comercio se encuentra sujeto a reglamentación estricta.	Se prohibe el comercio de cualquier especie de tortuga marina, y se regula mediante una serie de acciones aplicadas con los diferentes países que forman parte del convenio.
Acuerdo de cooperación ambiental de America del Norte y Comisión para la Cooperación Ambiental (CCA) 1994.	Y		ALL		
Convención de las Naciones Unidas sobre el Derecho del Mar (UNCLOS), Montego Bay, 1982.	Y		ALL		
Memorándum de entendimiento, programa de coperación MexUs Golfo y MexUs Pacífico, 1992.	Y		ALL		
Convenio sobre Diversidad Biológica, 1993.	Y		ALL		
Código de Conducta para la pesca responsable, FAO, 1995.	Y		ALL		
Convención Interamericana para la Protección y Conservación de las Tortugas Marinas (CIT), 1999.	Y	Y	ALL	Brindar protección a las tortugas en territorio nacional	rectricion de actividades humanas, prohibido captura o comercio, ptotección del habitat.
Simposium internal de tortuga marina, 1998. Mazatlan, México.			ALL		
Simposium internal de tortuga marina, 2008. Loreto, México.			ALL		
Simposium internal de tortuga marina, 2012. Huatulco, México.			ALL		

Table 4. Organizations and agencies related with sea turtle research and conservation in the Mexican Pacific.

NGO, ANP Y RPC	Primary species	Primary beaches	Long-term (>5 consecutive years)
Ayotzintli A.C.	*Lo*		Y
Los Grupos Ecologistas de Nayarit A.C	*Lo*	EL Naranjo	Y
Red Tortuguera A.C.	*Lo*	Mayto	Y
Sea Turtle Protection Program at Acuario Mazatlan	*Lo*	Mazatlán	Y
Tortugueros Las Playitas A.C.	*Cm*	Todos Santos	Y
Colola Capital mundial de la tortuga negra A.C.	*Cm*	Playa de Colola	Y
Santuario Playa Teopa, Jal.		Playa Teopa	Y
Santuario Playa Cuixmala A.C., Jal.		Playa Cixmala	Y
Grupo tortuguero el Conchal, Sinaloa	*Lo*	Isla Quevedo	Y
Grupo tortuguero de las Californias			Y
PN CABO Pulmo, BCS, Los Cabos.	*Cc*	Los Cabos	Y
RPC Lucenilla, Sin.		Lucenilla	Y
Santuario Playa Ceuta, Sin.		Playa Ceuta	Y
Playa Verde Camacho, Sin		Playa Verde Camacho	Y
RPC Playa Platanitos, Nay.		Playa Platanitos	Y
RCP Nuevo Vallarta, Nay.		Bahía de Banderas	Y
Santuario Playa de Mismaloya, Jal.		Playa Mismaloya	Y
RCP Playa Chalcatepec, Jal.		Playa Chalcatepec	Y
Playas Boca de Apiza, El Chupadero y El Tecuanillo, Col.		Boca de Apiza	Y
Santuario Playa Mexiquillo, Mich.		Mexiquillo	Y
Santuario Playa Tierra Colorada, Gro.		Tierra Colorada	Y
RPC Playa Cahuitán, Oax.			Y
Santuario Playa de la Bahía de Chacahua, Oax.		Chacahua	Y
Santuario Playa de Escobilla, Oax.		Escobilla	Y
RPC Barra de la Cruz y Playa Grande, Oax.		Barra de la Cruz	Y
RPC Morro Ayuta, Oax.		Morro Ayuta	Y
Santuario Playa de Puerto Arista, Chiapas.		Puerto Arista	Y
Kutzari, Asociación para el Estudio y Conservacion de las Tortugas Marinas A.C.	Dc		Y
ASUPMATOMA A.C.	Dc		Y
Red de Humedales de la Costa de Oxaca	Dc		Y
Fondo Oaxaqueño para la Consevación de la Naturaleza A.C.	Lo		Y

Costa Salvaje A.C.	Lo		Y
Piedra de Tlacoyunque, Gro.	Lo		Y
Agua Blanca B.C.S.	Dc		Y
FEEDING GROUNDS			
RB Bahía de los Angeles y El Barril, BC.		Bahía de los Angeles	Y
RB El Vizcaíno, BC.		Vizcíno	Y
PN Bahía de Loreto		Loreto	Y
La Paz, BCS		La Paz	Y
RB Islas del Golfo, Sonora y Sinaloa			Y

Figure 1. Nesting areas located in every state of the Pacific of Mexico.

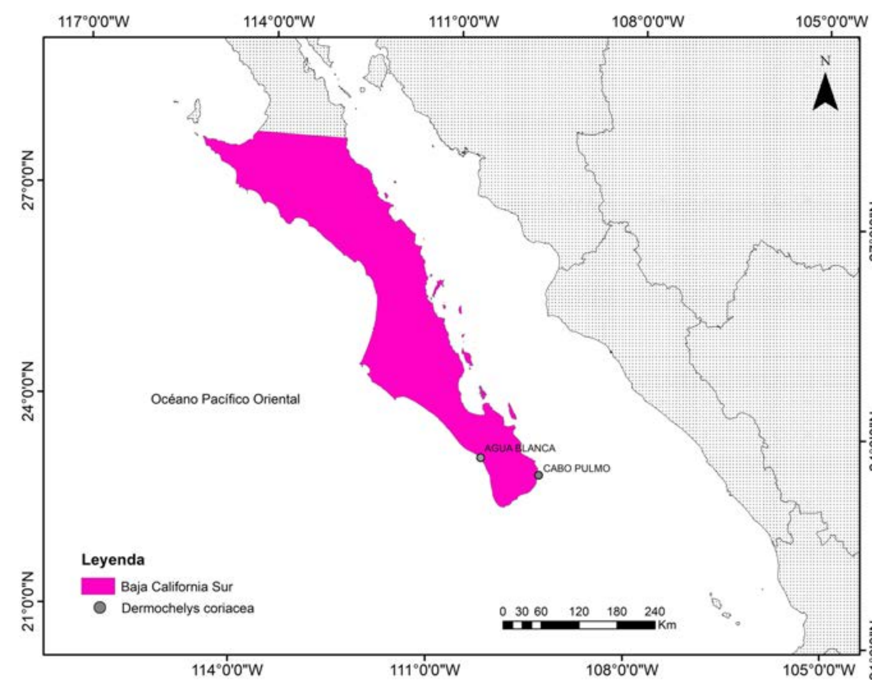

Figure 2. Nesting beaches for *D. coriace* at Baja California Sur state.

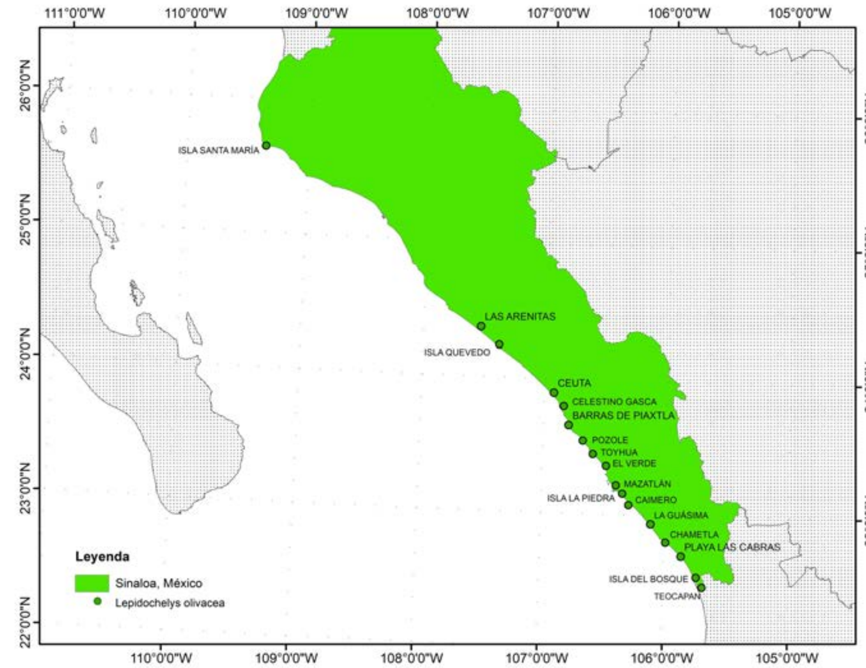

Figure 3. Nesting beaches for *L. olivacea* at Sinaloa state.

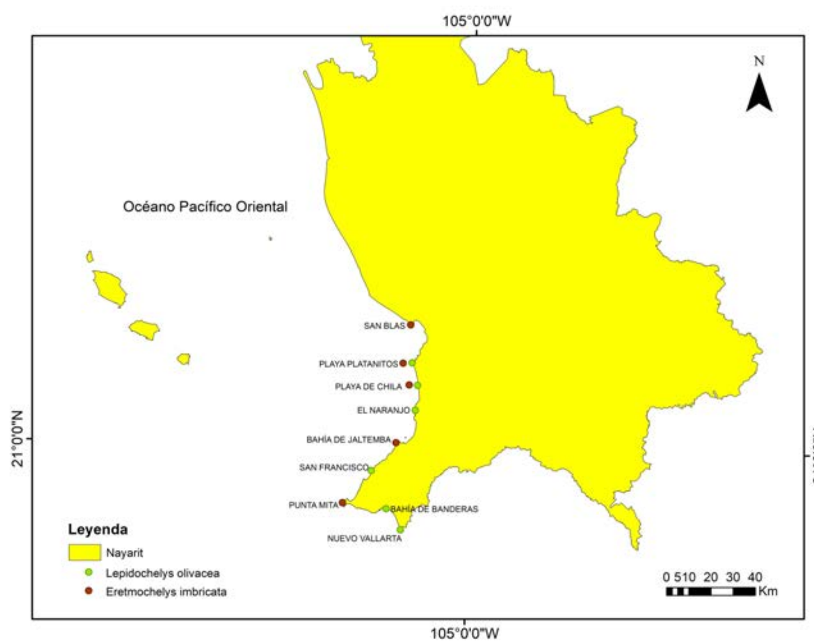

Figure 4. Nesting beaches for *L. olivacea* and *E. imbricata* at Nayarit state.

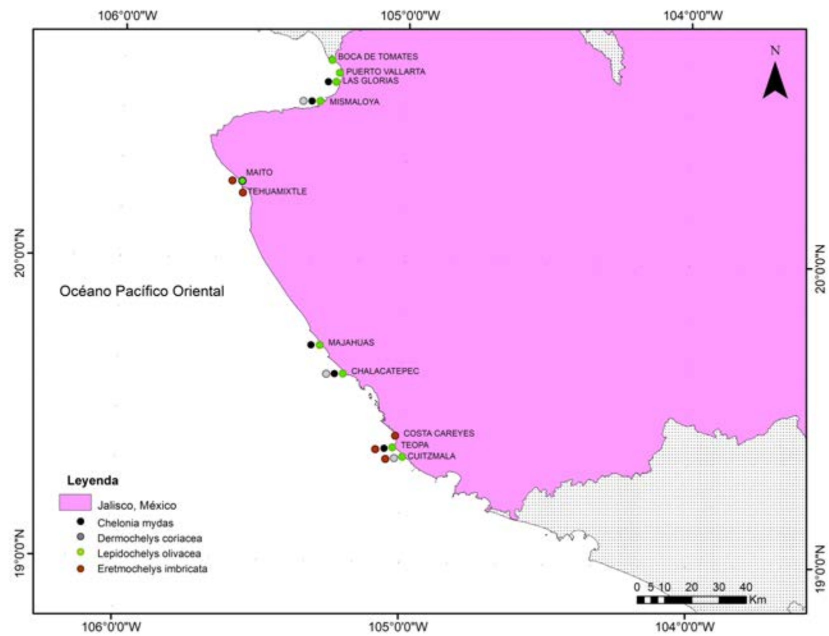

Figure 5. Nesting beaches for *C. mydas*, *D. coriacea*, *L. olivacea*, and *E. imbricata* at Jalisco state.

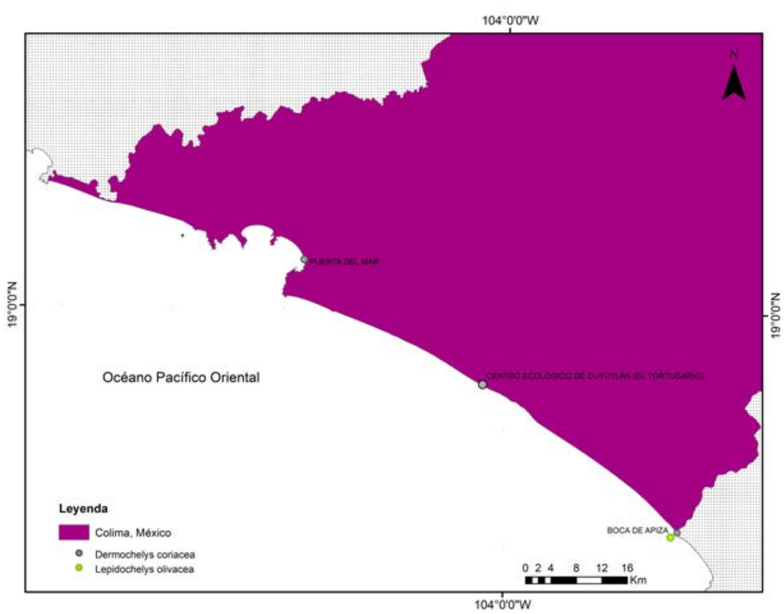

Figure 6. Nesting beaches for *D. coriacea* and *L. olivacea* at Colima state.

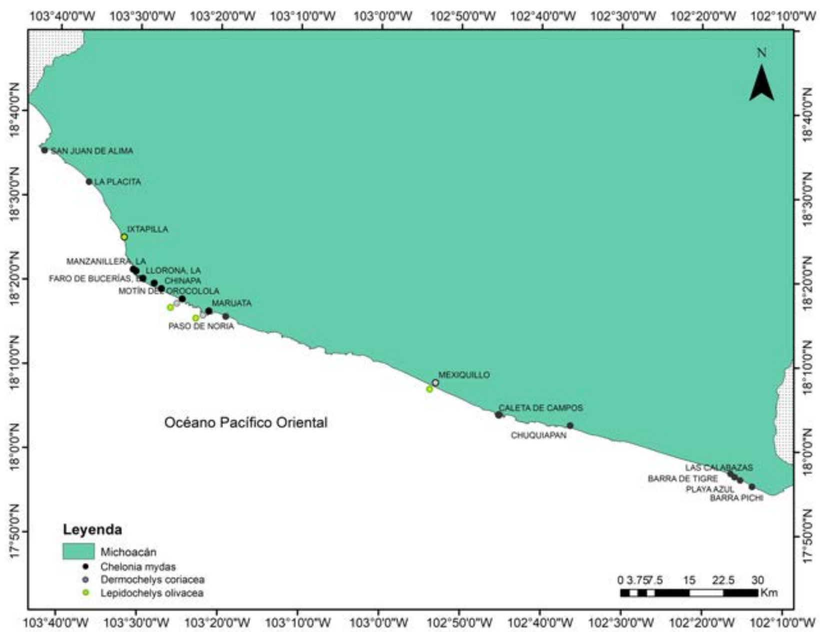

Figure 7. Nesting beaches for *C. mydas*, *D. coriacea*, and *L. olivacea* at Michoacán state.

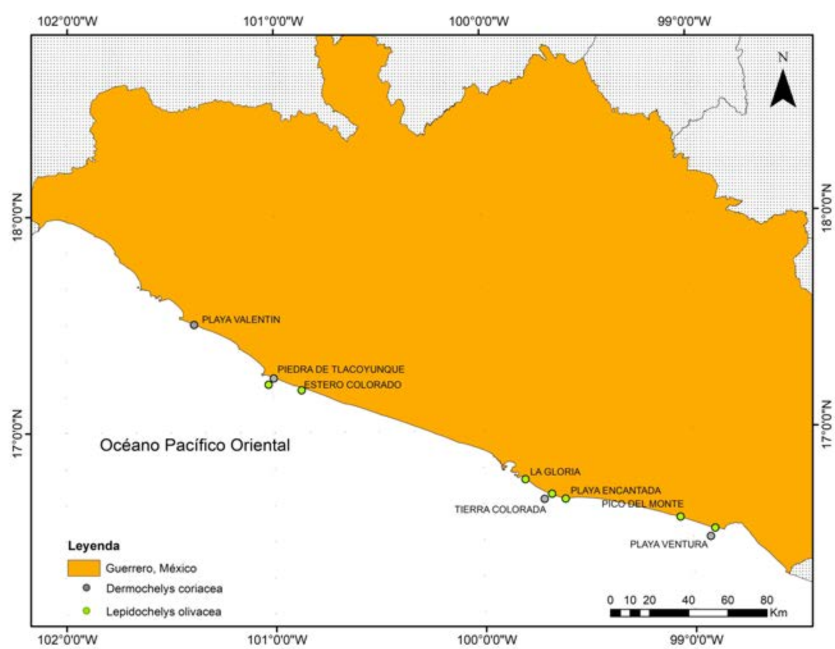

Figure 8. Nesting beaches for *D. coriacea* and *L. olivacea* at Guerrero state.

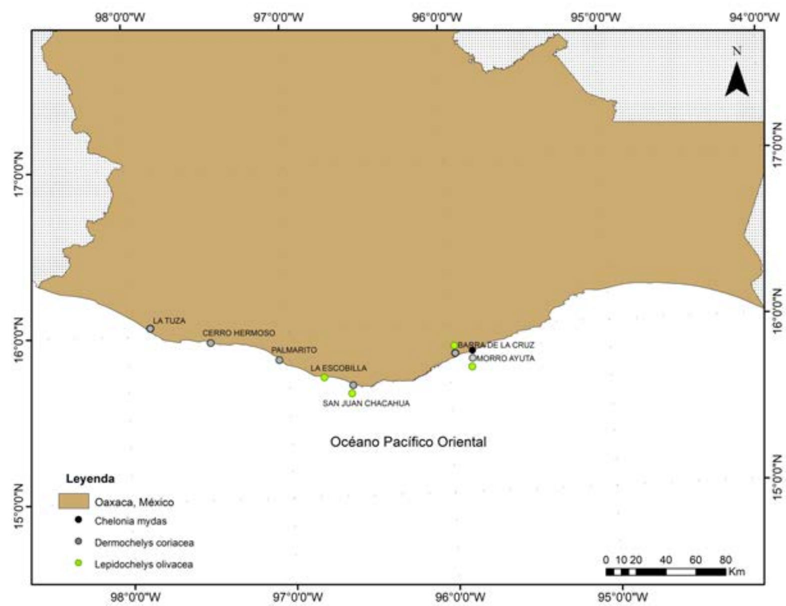

Figure 9. Nesting beaches for *C. mydas*, *D. coriacea*, and *L. olivacea* at Oaxaca state.

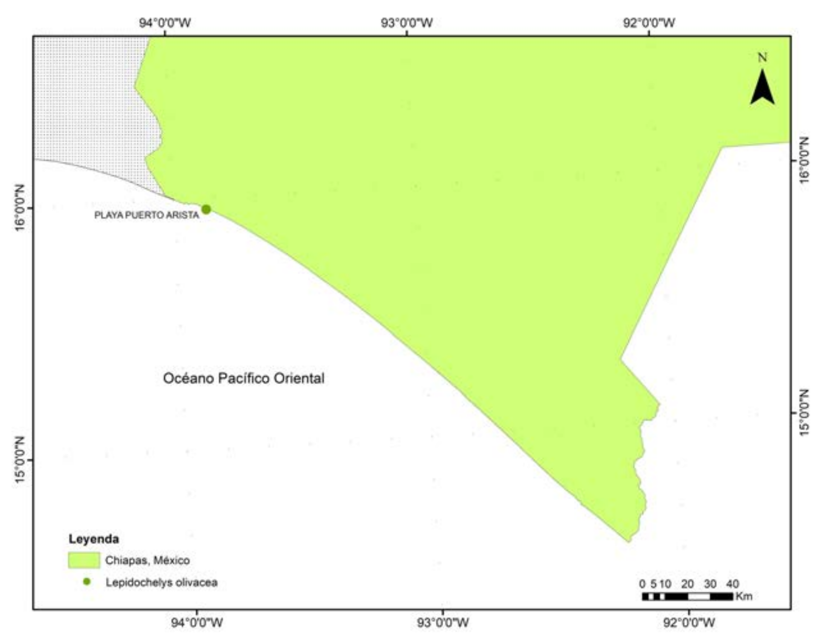

Figure 10. Nesting beach for *L. olivacea* at Chiapas state.

Figure 11. Distribution of marine protected areas for sea turtles in the Pacific of Mexico.

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Table 1. Main biology and conservation aspects of sea turtles in the El Salvador.

RMU	Pacífico Oriental							
	LO	**Ref #**	**CM**	**Ref #**	**DC**	**Ref #**	**EI**	**Ref #**
Ocurrencias								
Sitios de Anidación	Y	1,2	Y	1,2	Y	1,2	Y	3,4,5,6,7
Sitios de Forrajeo Pelágicos	JA	8	JA	9	n/a		n/a	
Sitios de Forrajeo Bénticos	JA	9,10	JA	9,10, 11	n/a		JA	5,9,12,13,14 ,15,22
Datos biológicos de importancia								
Anidación/por año: promedio actual (rango de años)	>14,554[*] (2009-2016)	16	>19.6[^] (2009-2016)	16	>9.0 (1995-2015)	17	251 (2008-2015)	3,4,5,6,7
Anidación/por año: orden de magnitud actual	n/a		n/a		n/a		n/a	
Número de sitios con abundancia de anidación (>20 nidos/por año Y >10 nidos/km por año)	$\geq$36	16	0	16	0	16,17	3	5,6,7
Número de sitios con menor anidación (<20 nidos/por año ó <10 nidos/km por año)	0	16	$\geq$19	16	$\geq$18	16,17	$\geq$7	16
Nidos/por año en sitios de abundancia: promedo actual (rango de años)	>14,554[*] (2009-2016)	16	n/a		n/a		245.7 (2008-2016)	5,6,7
Nidos/por año en sitios con menor anidación: promedio actual (rango de años)	n/a		>19.6[^] (2009-2016)	16	>9.0 (1995-2015)	16,17	8.5 (2009-2016)	16
Largo total de sitios de anidación (km)	177.5	PS	115.5	PS	110.7	PS	87.1	5,6,7, PS
Hembras anidantes / por año	n/a		n/a		n/a		90	6,7,18
Nidos / temporada de anidación (N)	n/a		n/a		n/a		2.1 (190)	7,18
Intervalo de remigración de hembras(años) (N)	n/a		n/a		n/a		2.1 (54)	7,18
Radio sexual: Neonatos (hembras / Total) (N)	n/a		n/a		n/a		0.69-0.85 (705 clutches)	PS
Radio sexual: Inmaduras (hembra / Total) (N)	n/a		n/a		n/a		0.86 (77)	PS
Radio sexual: Adulta (hembra / Total) (N)	n/a		n/a		n/a		0.53-0.61 (41 clutches from 34 females)	19
Min medidas adultos, LCC (cm)	n/a		n/a		n/a		Bahía de Jiquilisco = 71.0; Punta Amapala = 62.2	7
Edad de madurez (yrs)	n/a		n/a		n/a		n/a	

Tamaño del nidos (n eggs) (N)	96.5 (117)	1	73.0 (24)	PS	64.5 eggs with yolk (13)	17	ANP Los Cóbanos = 132.4 (77); Bahía de Jiquilisco = 167.8 (835); Punta Amapala = 138.7 (41)	7
Éxito de eclosión (neonatos/huevos) (N)	0.84 (11,235,540 eggs)	16	0.61 (21)	PS	0.35 (18)	17	ANP Los Cóbanos = 0.63 (237); Bahía de Jiquilisco = 0.53 (1348); Punta Amapala = 0.72 (93)	7
Nesting success (Nidos/ huellas totales) (N)	n/a		n/a		n/a		n/a	
Tendencias								
Tendencias actuales (últimos 20 años) en los sitios de anidación (rango de años)	n/a		n/a		n/a		n/a	
Tendencias actuales (últimos 20 años) en los sitios de forrajeo (rango de años)	n/a		n/a		n/a		n/a	
Mayor abundancia documentada: nido/año (rango de años)	22,184 (2010)	16	76 (2012)	16	32 (2014-2015)	17	322 (2015)	7,16
Estudios Publicados								
Tasas de crecmiento	N		N		N		N	
Genética	N		N		N		Y	19,20,21,22
Stocks definidos por marcadores genéticos	N		N		N		Y	20,21,22
Rastreo remoto (satelital u otro)	N		N		N		Y	12,13,23
Tasas de sobrevivencia	N		N		N		N	
Dinámica de la población	N		N		N		N	
Ecología de forrajeo (dieta/ isotopos)	N		Y	11	N		Y	15
Captura- Marca -Recaptura	N		Y	11	N		Y	6,7,15
Amenazas								

Bycatch: presencia a menor escala / pesca artesanal?	Y (PLL)	8	n/a		n/a		Y (SN, OTH)	5,14
Bycatch: presencia de pesca industria?	Y (ST)	10	Y (ST)	10	n/a		n/a	
Bycatch: cuantificada?	N		N		N		Y	14
Take. Mortalidad intencionada/ pesca con bomba	n/a		n/a		n/a		Y (pesca con bomba)	4,5
Take. Saqueo de huevos	Y	2	Y	2	Y	2,17	Y	2,3,4,5,18,25
Desarrollo costero. Degradación del hábitat de anidación	Y	24	Y	24	Y	24	Y	3,4,6,24
Desarrollo costero. Contaminación lumínica	Y	24	Y	24	Y	24	Y	24
Desarrollo costero. Golpes de botes	n/a		Y	PS	n/a		Y	PS
Depredación de huevos	n/a		n/a		n/a		Y	PS
Contaminación (debris, química)	n/a		n/a		n/a		Y	26
Patógenos	n/a		n/a		n/a		n/a	
Cambio Climático	n/a		n/a		n/a		n/a	
Degradación del hábitat de forrajeo	n/a		Y	27	n/a		Y	13
Otros	Y (see text)	28	Y (see text)	28	n/a		n/a	
Proyectos a largo plazo								
Monitoreo en sitios de anidación	Y	16	Y	16	Y	16,17	Y	3,4,5,6,7
Número de sitios de anidación identificados	≥36	16	≥19	16	≥18	17	10	3,4,5,6,7,16
Monitoreo en sitios de forrajeo	N		Y	11	N		Y	15
Conservación								
Protección bajo la ley nacional	Y	25	Y	25	Y	25	Y	25
Número de sitios de anidacieon protejidos (preservación de hábitat)	2	31,32,33	2	31,32,33	2	31,32,33	2	31,32
Número de áreas marinas con mitigación de amenazas	n/a		n/a		n/a		3	PS
Proyectos de conservación a largo plazo (número)	≥20	16	1		1		3	7
Protección de nidos In- Situ (ej. jaulas)	Y		N		N		Y	6
Viveros	Y	16	Y	16	Y	16	Y	5,6,7,16
Head-starting	N		N		N		N	

By-catch: Modificación en los aparejos de pesca (ej, DET, canzuelos circulares)	Y (ST, PLL)	8,10	Y (ST, PLL)	8,10	n/a		Y (SN)	14
By-catch: buenas prácticas abordo	N		N		N		Y	14
By-catch: vedas/reducción	Y (ST)	30	Y (ST)	30	n/a		Y (SN)	29
Otros	n/a		n/a		n/a		n/a	

*96.5 eggs/clutch (n = 117 clutches) was used to estimate number of *Lo* clutches[1]
^73.0 eggs/clutch (n = 24 clutches) was used to estimate number of *Cm* clutches (PS)
[$]64.5 eggs with yolk/clutch (n = 13 clutches) was used to estimate number of *Dc* clutches[17]
[%]132.4 eggs/clutch (n = 77 clutches) was used to estimate number of *Ei* clutches[7]
[#]138.7 eggs/clutch (n = 41 clutches) was used to estimate number of *Ei* clutches[7]

Table 2. Sea turtle nesting beaches in the El Salvador.

Especie / RMU	**Index site**	**Nidos/año: promedio actual (rango de años)**	**Punto Central**		**Largo (km)**	**% Monitoreado**	**# Referencia**	**Nivel de monitoreo (1-2)**	**Protocolo de monitoreo (A-F)**
Departamento			Long	Lat					
Playa de anidación									
LO-EPO*									
Ahuachapán									
Bola de Monte	N	370.5 (2009, 2012)	-90.110254°	13.735812°	4.0	100.0	16	2	B
Garita Palmera	N	230.5 (2009, 2012)	-90.070928°	13.719591°	6.7	100.0	16	2	B
ANP Barra de Santiago	N	418.5 (2009, 2012)	-90.012507°	13.693083°	5.6	100.0	16	2	B
Sonsonate									
Metalío	N	405.0 (2012)	-89.891733°	13.632187°	6.0	100.0	16	2	B
ANP Los Cóbanos	Y	1255.0 (2009, 2012)	-89.807170°	13.524219°	7.8	100.0	16	2	B
Barra Ciega	N	197.5 (2009, 2012)	-89.712139°	13.528635°	2.0	100.0	16	2	B
Playa Dorada	N	750.7 (2009, 2012, 2016)	-89.654950°	13.529289°	4.9	100.0	16	2	B
La Libertad									
El Zonte	N	26.0 (2009)	-89.442071°	13.495081°	1.9	100.0	16	2	B
El Majahual	N	227.0 (2009)	-89.365790°	13.490160°	1.5	100.0	16	2	B
San Blas	N	144.0 (2009, 2012, 2016)	-89.357605°	13.486021°	1.6	100.0	16	2	B

San Diego	Y	1381.3 (2009, 2012, 2016)	-89.278185°	13.477297°	9.0	100.0	16	2	B
El Amatal	N	339.0 (2009, 2012, 2016)	-89.242829°	13.461899°	1.0	100.0	16	2	B
Toluca	Y	823.5 (2009, 2012)	-89.225890°	13.453534°	3.9	100.0	16	2	B
Boca Poza	N	142.0 (2009)	-89.204077°	13.442142°	1.5	100.0	16	2	B
Los Pinos/Cangrejera	N	771.5 (2009, 2012)	-89.183532°	13.432252°	4.1	100.0	16	2	B
La Paz									
Las Bocanitas	N	416.5 (2009, 2012)	-89.162258°	13.421546°	1.6	100.0	16	2	B
Amatecampo	N	405.0 (2009, 2012)	-89.143259°	13.411992°	1.8	100.0	16	2	B
La Zunganera	N	382.0 (2009, 2012)	-89.124908°	13.402021°	2.8	100.0	16	2	B
El Pimental	N	520.5 (2009, 2012)	-89.079360°	13.376987°	4.5	100.0	16	2	B
San Marcelino/Las Hojas	N	360.0 (2016)	-89.042070°	13.357346°	4.9	100.0	16	2	B
Costa del Sol	N	673.7 (2009, 2011-2016)	-88.922981°	13.306390°	13.7	100.0	16	2	B
Isla Tasajera	Y	1036.0 (2009, 2012, 2016)	-88.853545°	13.270221°	6.9	100.0	16	2	B
San Vicente									
Isla Montecristo	N	777.7 (2009, 2012-2016)	-88.788574°	13.244457°	7.0	100.0	16	2	B
Usulután									
San Juan del Gozo	N	743.0 (2009, 2012)	-88.751490°	13.232316°	3.0	100.0	16	2	B
Isla de Méndez	N	723.5 (2009, 2012)	-88.715585°	13.224762°	5.6	100.0	16	2	B

Ceiba Doblada	N	282.5 (2012)	-88.644276°	13.213307°	8.5	100.0	16	2	B
Corral de Mulas	N	471.0 (2009-2011)	-88.542621°	13.192864°	4.7	100.0	16	2	B
El Icaco	N	484.5 (2009, 2011)	-88.525353°	13.186542°	2.5	100.0	16	2	B
Punta San Juan	N	227.0 (2011)	-88.489407°	13.176040°	7.4	100.0	16	2	B
Isla San Sebastián	N	684.0 (2009, 2012, 2016)	-88.408611°	13.162931°	12.6	100.0	16	2	B
El Espino	N	241.7 (2009, 2012, 2016)	-88.303310°	13.172478°	6.5	100.0	16	2	B
Salamar	N	92.5 (2009, 2012)	-88.235933°	13.163123°	2.8	100.0	16	2	B
La Unión									
El Icacal	N	137.0 (2009, 2012, 2016)	-88.015986°	13.165526°	9.4	100.0	16	2	B
Punta Amapala	N	170.5 (2012, 2016)	-87.936131°	13.159791°	6.5	100.0	16	2	B
El Tamarindo	N	61.4 (2009-2010, 2012-2016)	-87.916344°	13.183208°	1.9	100.0	16	2	B
El Majahual (Isla Meanguera)	N	49.0 (2009, 2016)	-87.709121°	13.170171°	1.4	100.0	16	2	B
CM-EPO^									
Sonsonate									
ANP Los Cóbanos	N	1.3 (2009, 2012, 2016)	-89.807170°	13.524219°	7.8	100.0	16	2	B
Barra Ciega	N	0.5 (2009, 2012)	-89.712139°	13.528635°	2.0	100.0	16	2	B
Playa Dorada	N	1.0 (2009, 2012, 2016)	-89.654950°	13.529289°	4.9	100.0	16	2	B

La Libertad	N								
San Diego	N	0.3 (2009, 2012, 2016)	-89.654950°	13.529289°	9.0	100.0	16	2	B
La Paz									
El Pimental	N	2.5 (2009, 2012)	-89.079360°	13.376987°	4.5	100.0	16	2	B
San Marcelino/Las Hojas	N	1.0 (2016)	-89.042070°	13.357346°	4.9	100.0	16	2	B
Costa del Sol	N	2.7 (2009, 2011-2016)	-88.922981°	13.306390°	13.7	100.0	16	2	B
Isla Tasajera	N	3.7 (2009, 2012, 2016)	-88.853545°	13.270221°	6.9	100.0	16	2	B
San Vicente									
Isla Montecristo	N	1.0 (2009, 2012-2016)	-88.788574°	13.244457°	7.0	100.0	16	2	B
Usulután									
Isla de Méndez	N	1.0 (2012)	-88.715585°	13.224762°	5.6	100.0	16	2	B
Corral de Mulas	N	1.0 (2009-2011)	-88.542621°	13.192864°	4.7	100.0	16	2	B
El Icaco	N	3.5 (2009, 2011)	-88.525353°	13.186542°	2.5	100.0	16	2	B
Punta San Juan	Y	6.0 (2011-2016)	-88.489407°	13.176040°	7.4	100.0	16,PS	2	B
Isla San Sebastián	N	0.9 (2009, 2011-2016)	-88.408611°	13.162931°	12.6	100.0	16	2	B
Salamar	Y	8.7 (2009, 2012, 2016)	-88.235933°	13.163123°	2.8	100.0	16	2	B
La Unión									
El Icacal	N	5.7 (2009, 2012, 2016)	-88.015986°	13.165526°	9.4	100.0	16	2	B

Punta Amapala	N	2.7 (2009, 2012, 2016)	-87.936131°	13.159791°	6.5	100.0	16	2	B
El Tamarindo	N	0.1 (2009-2010, 2012-2016)	-87.916344°	13.183208°	1.9	100.0	16	2	B
El Majahual (Isla Meanguera)	N	0.5 (2009, 2016)	-87.709121°	13.170171°	1.4	100.0	16	2	B
DC-EPO[$]									
Ahuachapán									
Garita Palmera	N	0.5 (2009, 2012)	-90.070928°	13.719591°	6.7	100.0	16	2	B
ANP Barra de Santiago	N	1.0 (2009, 2012, 2014)	-90.012507°	13.693083°	5.6	100.0	16,17	2	B
Sonsonate									
ANP Los Cóbanos	N	0.5 (2009, 2012, 2014, 2016)	-89.807170°	13.524219°	7.8	100.0	16,17	2	B
Barra Ciega	N	0.3 (2009, 2012, 2014)	-89.712139°	13.528635°	2.0	100.0	16,17	2	B
La Libertad									
San Diego	N	0.8 (2009, 2012, 2014, 2016)	-89.654950°	13.529289°	9.0	100.0	16,17	2	B
El Amatal	N	0.3 (2009, 2012, 2016)	-89.242829°	13.461899°	1.0	100.0	16,17	2	B
Los Pinos/Cangrejera	Y	2.0 (2009, 2012, 2014)	-89.183532°	13.432252°	4.1	100.0	16,17	2	B
La Paz									
La Zunganera	N	0.7 (2009, 2012, 2014)	-89.124908°	13.402021°	2.8	100.0	16,17	2	B
El Pimental	Y	1.7 (2009, 2012, 2014)	-89.079360°	13.376987°	4.5	100.0	16,17	2	B
Costa del Sol	N	1.1 (2009, 2011-2016)	-88.922981°	13.306390°	13.7	100.0	16,17	2	B

Usulután									
San Juan del Gozo	N	0.3 (2009, 2012, 2014)	-88.751490°	13.232316°	3.0	100.0	16,17	2	B
Isla de Méndez	Y	2.0 (2009, 2012)	-88.715585°	13.224762°	5.6	100.0	16,17	2	B
El Icaco	N	0.7 (2009, 2011, 2014)	-88.525353°	13.186542°	2.5	100.0	16	2	B
Punta San Juan	N	0.5 (2011-2012)	-88.489407°	13.176040°	7.4	100.0	16	2	B
Isla San Sebastián	Y	1.5 (2009, 2012, 2014, 2016)	-88.408611°	13.162931°	12.6	100.0	16,17	2	B
El Espino	N	0.5 (2009, 2012, 2014, 2016)	-88.303310°	13.172478°	6.5	100.0	16,17	2	B
La Unión									
El Icacal	Y	1.7 (2009, 2012, 2016)	-88.015986°	13.165526°	9.4	100.0	16	2	B
Punta Amapala	N	0.7 (2009, 2012, 2016)	-87.936131°	13.159791°	6.5	100.0	16	2	B
EI-EPO									
Ahuachapán									
Garita Palmera[%]	N	1.0 (2009)	-90.070928°	13.719591°	6.7	100.0	16	2	B
Sonsonate									
ANP Los Cóbanos	Y	51.1 (2008-2010, 2012, 2014-2016)	-89.807170°	13.524219°	7.8	100.0	5,6,7,16	1	B
Barra Ciega[%]	N	1.0 (2009, 2012)	-89.712139°	13.528635°	2.0	100.0	16	2	B
Usulután									
Bahía de Jiquilisco (inshore beaches)	Y	172.1 (2008-2016)			42.1	100.0	5,6,7,16	1	B
El Espino	N	0.3 (2009, 2012, 2016)	-88.303310°	13.172478°	6.5	100.0	16	2	B

Salamar	N	1.0 (2009, 2012)	-88.235933°	13.163123°	2.8	100.0	16	2	B
La Unión									
El Icacal#	N	2.3 (2009, 2012, 2016)	-88.015986°	13.165526°	9.4	100.0	16	2	B
Punta Amapala#	Y	22.5 (2008-2009, 2012, 2014-2016)	-87.936131°	13.159791°	6.5	100.0	5,6,7,16	1	B
El Tamarindo#	N	0.4 (2009, 2012-2016)	-87.916344°	13.183208°	1.9	100.0	16	2	B
El Majahual (Isla Meanguera)#	N	2.5 (2009, 2016)	-87.709121°	13.170171°	1.4	100.0	16	2	B

*96.5 eggs/clutch (n = 117 clutches) was used to estimate number of *Lo* clutches[1]

^73.0 eggs/clutch (n = 24 clutches) was used to estimate number of *Cm* clutches (PS)

$64.5 eggs with yolk/clutch (n = 13 clutches) was used to estimate number of *Dc* clutches[17]

%132.4 eggs/clutch (n = 77 clutches) was used to estimate number of *Ei* clutches[7]

#138.7 eggs/clutch (n = 41 clutches) was used to estimate number of *Ei* clutches[7]

Table 3. International conventions protecting sea turtles and signed by El Salvador.

Convenciones Internacionales	Firmados	Convenio Vinculante	Cumplimiento medido e informado	Especies	Acciones de conservación	Relevancia para las tortugas marinas
Convention on Biological Diversity	Y	Y	Y	ALL	Facilitates conservation planning and sustainable use of natural resources.	"…obliged to develop (or adapt existing) national strategies, plans, or programs for the conservation and sustainable use of biological diversity." This includes sea turtles.
Inter-American Convention (IAC) for the Protection and Conservation of Sea Turtles	N	n/a	n/a	n/a	n/a	n/a
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	Y	Y	Y	ALL	Deincentivizes harvest of sea turtle products.	Prohibits international trade of sea turtle products.
Ramsar Convention	Y	Y	Y	n/a	Facilitates wetland conservation.	"...provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources."

Table 4. Organizations related with sea turtle research and conservation in El Salvador.

NGO	Primary species	Primary beaches	Long-term (>5 consecutive years)
ADEL LA UNION	*Lo*	El Icacal	N
ADESCOIM	*Lo*	Isla de Méndez	Y
AMBAS	*Lo*	Barra de Santiago	Y
Arenas del Pacífico	*Lo*	Las Bocanitas	N
ASIBAHIA	*Lo*	Isla San Sebastián	N
Asociación Mangle	*Lo*	Isla Montecristo, Ceiba Doblada	Y
ATOPLOCPC	*Lo*	Los Pinos/Cangrejera	Y
Ayuda en Acción	*Lo*	El Tular, Corral de Mulas	Y
CODEPA	*Lo*	Isla San Sebastián	N
Fundación Domenech	*Lo*	Costa del Sol	Y
FUNDARRECIFE	*Lo*	Los Cóbanos Reef Protected Area	Y
FUNDATAMARINDO	*Lo*	El Tamarindo	Y
FUNSALPRODESE	*Lo*	Icacal, El Majahual (Meanguera)	N
FUNZEL	*Lo*	Playa Dorada, San Blas, San Diego, El Amatal, Isla Tasajera	Y
FUTECMA	*Lo*	Los Pinos/Cangrejera	N
ICAPO/ProCosta	*Ei*	Bahía de Jiquilisco, Los Cóbanos Reef Protected Area, Punta Amapala	Y
Madre Cría	*Lo*	San Marcelino/Las Hojas	N
MSM	*Lo*	San Juan del Gozo	Y
Oikos	*Lo*	El Espino, Salamar	N
PROMESA	*Lo*	El Espino	Y
SalvaNatura	*Lo*	Costa del Sol	Y
VIVAZUL	*Lo*	El Amatal, Toluca, Salamar, El Icacal	N

Table 5. Minimum annual fishing effort and hawksbill bycatch in lobster gillnet fisheries at Los Cóbanos Reef Protected Area (LC, 2008-2009) and Punta Amapala (PA, 2012-2014) in El Salvador. Min. effort: minimum gillnet fishing effort; Bycatch, number of hawksbills captured in lobster gillnet fisheries. Modified from Table 3 in 14.

Site	Year	Observed			Estimated total		
		Boats	Min. effort	Bycatch	Boats	Min. effort	Bycatch
LC	2008	1	177.5	2	14	2485.0	27
	2009	1	710.7	1	14	9950.0	12
	Total	1	888.2	3	14	12,435.0	41
PA	2012	4	676.8	3	53	8967.0	40
	2013	4	5988.7	10	53	79,350.6	106
	2014	4	3181.5	1	53	42,154.9	12
	Total		9847.0	14	53	130,472.8	158
Overall		5	10,735.2	17	67	142,907.8	199

Figure 1. Main sea turtle nesting beaches in El Salvador.

Figure 2. Marine areas in EL Salvador.

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NICARAGUA

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Table 1. Main biology and conservation aspects of sea turtles in the Nicaraguan Pacific.

RMU	Lo	Ref #	Dc	Ref #	Cm	Ref #	Ei	Ref #
Occurrence								
Nesting sites	Y	21	Y	21	Y	21	Y	21
Pelagic foraging grounds	n/a		n/a				n/a	
Benthic foraging grounds	n/a		n/a				JA	15,20
Key biological data								
Nests/yr: recent average (range of years)	194400 (2011-2016)	Table 2	45.8 (2008-2016)	Table 2	293.2 (2008-2017)	Table 2	278.67 (2012-2017)	Table 2
Nests/yr: recent order of magnitude	n/a				n/a		n/a	
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	9	Table 2	1	Table 2	4	Table 2	2	Table 2
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	~15	PS (See text)	> 3	Table 2 & See text	8	Table 2	8	Table 2
Nests/yr at "major" sites: recent average (range of years)	194400 (2011-2016)	Table 2	23.57 (2010-2012; 2016)	Table 2	234.8 (2008-2017)	Table 2	257 (2012-2017)	Table 2
Nests/yr at "minor" sites: recent average (range of years)	n/a		22.2 (2008-2016)	Table 2	58.4 (2008-2017)	Table 2	23.67 (2012-2017)	Table 2
Total length of nesting sites (km)	55.05	Table 2	37.3	Table 2	57.55	Table 2	43.05	Table 2
Nesting females / yr	n/a		n/a		n/a		n/a	
Nests / female season (N)	n/a		n/a		n/a		n/a	
Female remigration interval (yrs) (N)	n/a		n/a		n/a		n/a	
Sex ratio: Hatchlings (F / Tot) (N)	n/a		n/a		n/a		n/a	
Sex ratio: Immatures (F / Tot) (N)	n/a		n/a		n/a		n/a	
Sex ratio: Adults (F / Tot) (N)	n/a		n/a		n/a		n/a	
Min adult size, CCL (cm)	56.3-62.9	Table 2	127.1-132.8	Table 2	72.5-86	Table 2	69.95-70.1	Table 2
Age at maturity (yrs)	n/a		n/a		n/a		n/a	
Clutch size (n eggs) (N)	85.0 - 95	Table 2	51-64	Table 2	71-81	Table 2	150.9-151.4	Table 2
Emergence success (hatchlings/egg) (N)	0.063 - 0.847	Table 2	13-50.33	Table 2	0.615-0.75	Table 2	60.1-67.21	Table 2
Nesting success (Nests/ Tot emergence tracks) (N)	n/a		n/a		n/a		n/a	
Trends								

Recent trends (last 20 yrs) at nesting sites (range of years)	Up (2000-2016)	42, PS	Down (2002-2017)	25	n/a		n/a	
Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a		n/a		n/a		n/a	
Oldest documented abundance: nests/yr (range of years)	n/a		n/a		n/a		n/a	
Published studies								
Growth rates	N		N		N		N	
Genetics	N		N		N		Y	14,18
Stocks defined by genetic markers	N		N		N		Y	18, 48
Remote tracking (satellite or other)	N		N		Y	26	Y	15
Survival rates	N		N		N		N	
Population dynamics	N		N		N		Y	17
Foraging ecology (diet or isotopes)	N		N		N		Y	Unpublished
Capture-Mark-Recapture	N		N		N		Y	17
Threats								
Bycatch: presence of small scale / artisanal fisheries?	Y	22	Y	22, 25	Y	22	Y	20
Bycatch: presence of industrial fisheries?	N		N	22	N		N	
Bycatch: quantified?	N		N	22	N		Y	20
Take. Intentional killing or exploitation of turtles	Y	22	n/a		n/a		N	
Take. Egg poaching	Y	22	Y	22, 25	Y	22, 27	Y	Table 2
Coastal Development. Nesting habitat degradation	Y	22	Y	22, 25	n/a		n/a	
Coastal Development. Photopollution	n/a		n/a		n/a		n/a	
Coastal Development. Boat strikes	n/a		n/a		n/a		n/a	
Egg predation	Y	22	N		n/a		n/a	
Pollution (debris, chemical)	n/a		n/a		n/a		n/a	
Pathogens	n/a		n/a		n/a		n/a	

Climate change	n/a		n/a		n/a		n/a	
Foraging habitat degradation	n/a		n/a		n/a		n/a	
Other			n/a		n/a		n/a	
Long-term projects								
Monitoring at nesting sites	Y	22	Y	22, 25	Y	22,27	Y	8
Number of index nesting sites	2	PS	2	22, 25	2	27	2	8, 32
Monitoring at foraging sites	N		N		N		Y	unpublish ed
Conservation								
Protection under national law	Y	22	Y	22	Y	22	Y	22
Number of protected nesting sites (habitat preservation)	5	See text	2	22	4	22, 27, 41	1	27, 32
Number of Marine Areas with mitigation of threats	n/a		n/a		n/a		1	27, 32
Long-term conservation projects (number)	5	See text	1	25	1		2	27, 32
In-situ nest protection (eg cages)	Y		N		Y	27	Y	8, 27, 32
Hatcheries	Y		Y		Y	27, 41	Y	8, 27, 32
Head-starting	n/a		N		N		N	
By-catch: fishing gear modifications (eg, TED, circle hooks)	Y	22	Y	22	Y	22	Y	22
By-catch: onboard best practices	Y		N	n/a	N		Y	20
By-catch: spatio-temporal closures/reduction	Y	22	Y	22	Y	22	Y	22
Other	n/a		n/a		n/a		n/a	

Table 2. Sea turtle nesting beaches in the Nicaraguan Pacific.

RMU / Nesting beach name	Index site	Nests/ yr: recent average (range of years)	Crawls/ yr: recent average (range of years)	Central point		Length (km)	% Monitored	Reference #	Monitoring Level (1-2)	Monitoring Protocol (A-F)	Average protection (%)	Average minimun CCL/ season (cm)	Average clutch size / season	Average % hatch success /season	Average Monitoring season (Start date - En date)	renesting (clotches/female) Range-seanon	remigration (Yrs)
Lo				Long	Lat												
Ostional*	N	73.5 (2014-2015)	n/a	-85.76010179	11.10619335	1.5	n/a	27	2							n/a	n/a
Guacalito	N	0.5 (2014-2015)	n/a	-85.78023317	11.11680168	0.3	100	27	1	B					Ene-Dic	n/a	n/a
Holman	N	2 (2012-2013)	n/a	-85.79125555	11.12199507	0.8	100	26	1	B					Jun-Jan	n/a	n/a
La Flor	Y	136014 (2011-2016)	n/a	-85.79411084	11.14119138	1	100	21, 24	1	B	n/a	n/a	95	6.3	(1-July/ 31-Jan)	n/a	n/a
Brasilon	N	21.3 (2013-2015)	n/a	-85.79988094	11.14889052	0.35	100	27	1	B	87				Ene-Dic	n/a	n/a
El Coco*	N	173.5 (2014-2015)	n/a	-85.80223115	11.15655136	0.8	n/a	27	2							n/a	n/a
Escondida	N	28.7 (2013-2015)	n/a	-86.12224065	11.46853317	0.5	100	27	1	B				76.3	Ene-Dic	n/a	n/a
Redonda	N	16 (2015)	23 (2015)	-86.03087102	11.38316457	0.3	100	27	1	B					Ene-Dic	n/a	n/a
Chacocente	Y	57408 (2011-2016)	n/a	-86.18570537	11.52476736	1.5	100	21, 24	1	B	n/a	n/a	95	16	(1-July/ 31-Jan)	n/a	n/a
Veracruz de Acayo	N	267 (2010-2016)	326 (2010-2016)	-86.25083333	11.57722222	5.5	100	4, 25, 35-39	2	D	23.3	57.9	86	68.57	(28-Oct / 23-March)	n/a	n/a

Salamina	N	376 (2010-2016)	387 (2010-2012; 2016)	-86.65361111	11.9775	9	100	10-13,19, 33,34	2		25.7	56.3	87.1	73.14	(24-Oct/1-Apr)	n/a	n/a
Juan Venado	N	530 (2008)	n/a	-86.94422071	12.30900206	22	100	42	2							n/a	n/a
Estero Padre Ramos	Y	19.5 (2012-2017)	20.14 (2012-2017)	-87.48443559	12.77513888	12	100	1, 5-8, 41	2		84.62	62.9	85	84.65	(2-May/30-Sep)	n/a	n/a
Dc																	
El Coco*	N	1.5 (2014-2015)	n/a	-85.80207474	11.15681255	0.8	n/a	27	2				64	13			
Veracruz de Acayo	Y	9.7 (2010-2016)	10.5 (2010-2016)	-85.80223115	11.15655136	5.5	100	4, 25, 35-39	1	B	76	127.1	51	50.33	(28-Oct / 23-March)	7 to 11	2 to 5
Salamina	Y	23.57 (2010-2016)	23.95 (2010-2016)	-86.65361111	11.9775	9	100	10-13,19, 33,34	1	B	94	132.8	58.5	31	(24-Oct/1-Apr)	8 to 12	2
Juan Venado	N	11 (2008)	n/a	-86.94422071	12.30900206	22	100	42	1	B					(25-Jul/31-jan)		
Cm																	
Ostional*	N	5 (2014-2015)	n/a	-85.76010179	11.10619335	1.5	n/a	27	2								
Guacalito	Y	16.5 (2014-2015)	n/a	-85.78023317	11.11680168	0.3	100	27	1	B	93.9				Ene-Dic		
Holman	N	1 (2012-2013)	n/a	-85.79125555	11.12199507	0.8	100	26	1	B							
Brasilon	Y	108 (2013-2015)	n/a	-85.79988094	11.14889052	0.35	100	27	1	B	87				Ene-Dic		
El Coco*	N	29.5 (2014-2015)	n/a	-85.80223115	11.15655136	0.8	n/a	27	2								
Escondida	Y	74.3 (2013-2015)	n/a	-86.12224065	11.46853317	0.5	100	27	1	B				75	Ene-Dic		
Redonda	N	23 (2015)	26 (2015)	-86.03087102	11.38316457	0.3	100	27	1	B					Ene-Dic		

Veracruz de Acayo	N	13.4 (2010-2016)	20.9 (2010-2016)	-86.25083333	11.57722222	5.5	100	4, 25, 35-39	1	B	90.4	86	71	63.52	(28-Oct / 23-March)	NA	NA
Salamina	N	3.5 (2010-2016)	3.5 (2010-2016)	-86.65361111	11.9775	9	100	10-13,19, 33,34	1	B	100	72.5	75.7	61.49	(24-Oct/1-Apr)	NA	NA
Juan Venado	N	4 (2008)	n/a	-86.94422071	12.30900206	22	100	42	1	D							
Aserradores	N	8 (2014-2017)	15.7 (2014-2017)	-87.34361111	12.61583333	4.5	100	29-32	2		96.9	84.25	75	63.17	(16-May/16-Sep)	NA	NA
Estero Padre Ramos	N	7 (2012-2017)	9.9 (2012-2017)	-87.48443559	12.77513888	12	100	1, 5-8, 41	2		79.5	79.5	81	71.06	(2-May/30-Sep)	NA	NA
Ei																	
Ostional*	N	5 (2014-2015)	n/a	-85.76010179	11.10619335	1.5		1	2								
Guacalito	N	1.5 (2014-2015)	n/a	-85.78023317	11.11680168	0.3	100	1	1	B	75				Ene-Dic		
Holman	N	1 (2012-2013)	n/a	-85.79125555	11.12199507	0.8	100	26	1	D							
Brasilon	N	0.67 (2013-2015)	n/a	-85.79984093	11.14867741	0.35	100	1	1	B	87				Ene-Dic		
El Coco*	N	3.5 (2014-2015)	n/a	-85.80207474	11.15681255	0.8	100	1	2				149.4	36.3			
Escondida	N	2 (2013-2015)	n/a	-86.12224065	11.46853317	0.5	100	1	1	B				75.00	Ene-Dic		
Redonda	N	8 (2015)	9 (2015)	-86.03087102	11.38316457	0.3	100	1	1	B					Ene-Dic		
Juan Venado	N	1 (2008)	n/a	-86.94422071	12.30900206	22	100	42	1	D							
Aserradores	Y	70 (2014-2017)	127.3 (2014-2017)	-87.34361111	12.61583333	4.5	100	29-32	1	B	86.2	69.95	150.9	67.21	(16-May/16-Sep)		1.8
Estero Padre Ramos	Y	187 (2012-2017)	222.6 (2012-2017)	-87.48443559	12.77513888	12	100	1, 5-8, 41	1	B	96.3	70.1	151.4	60.1	(2-May/30-Sep)		2.3

Table 3. International conventions protecting sea turtles and signed by Nicaragua.

Binding	Compliance measured and reported	Species	Conservation actions	Relevance to sea turtles
-	Yes (43)	all	Sea Turtle Conservation Plan in La Flor and Chacocente Wildlife Refuges and the Natural Reserve Isla Juan Venado	Umbrella for sea turtle and habitat protection
Y	Yes	all	It restricts the international trade of sea turtle sub products.	
Y	n/a	all	This convention binds the country to the sustainable management and protection of critical habitat for sea turtles such as nesting beaches, mangroves and coral reef	
	n/a	all	Nicaragua has not signed this convention	

Table 4. Organizations and agencies related with sea turtle research and conservation in Nicaragua.

Organization coordinating field work	Organization type	Primary species	Primary beaches	Long-term (>5 consecutive years)
MARENA	Gobernment	Lo	La Flor	Y
MARENA	Gobernment	Lo	Chacocente	Y
Paso Pacifico	NGO	Cm, Lo	Ostional	
Paso Pacifico	NGO	Lo	Guacalito	Y
Paso Pacifico	NGO	Lo	Holman	Y
Paso Pacifico	NGO	Cm	Brasilon	Y
Paso Pacifico/ Parque Maritimo El Coco	NGO / Private*	Lo, Cm	El Coco	Y
Paso Pacifico	NGO	Cm	Escondida	
Paso Pacifico	NGO	Cm	Redonda	
Fauna & Flora International	NGO	Dc	Veracruz de Acayo	Y
Fauna & Flora International	NGO	Dc	Salamina	Y
Fauna & Flora International / Comite Carey	NGO / Community	Ei	Reserva Natural Estero Padre Ramos	Y
Fauna & Flora International / Marina Puesta del Sol	NGO / Private	Ei	Aserradores	N
Los Cardones Ecolodge	Private	Lo	Los Cardones	Y
Proyecto Casa Madera	Private	Lo	Maderas	
Resort Mujul	Private	Lo	Guacalito de la Isla; Mansanillo	
Proyecto Cooperativa	Community/Private	Lo	Santana	
Hotel Punta Teonoste	Private	Lo	Punta Teonoste	Y
Gran Pacifica	Private	Lo	San Juan	Y
Rigo's House	Private	Lo	Salinas Grandes	
UNAN Leon	University	Lo, Dc	Salinas Grandes	Y
Proyecto Palo de Oro/ UNAN Leon / FFI	Private / Academic /NGO	Lo, Dc	Juan Venado	Y
Estreya del Pacifico		Lo	Poneloya	Y
Surfing Turtle Lodge	Private	Lo	Los Brasiles	
Coco loco -proyecto comunidad	Private / community	Lo	Maria del Mar, Manzano 1	Y

Sea Joy- Aquaculture	Private	Lo	Jiquilillo	Y
El Proyecto de Arturo	NGO / Community	Lo	Los Zorros	
El Proyecto de Rob	Private	Lo	Los Zorros	
Monty's Surf Ranch	Private	Lo	Venecia, RN Padre Ramos	
Redwood resort	Private	Lo	Mechapa	

Figure 1. Sea turtle nesting beaches in the Nicaraguan Pacific.

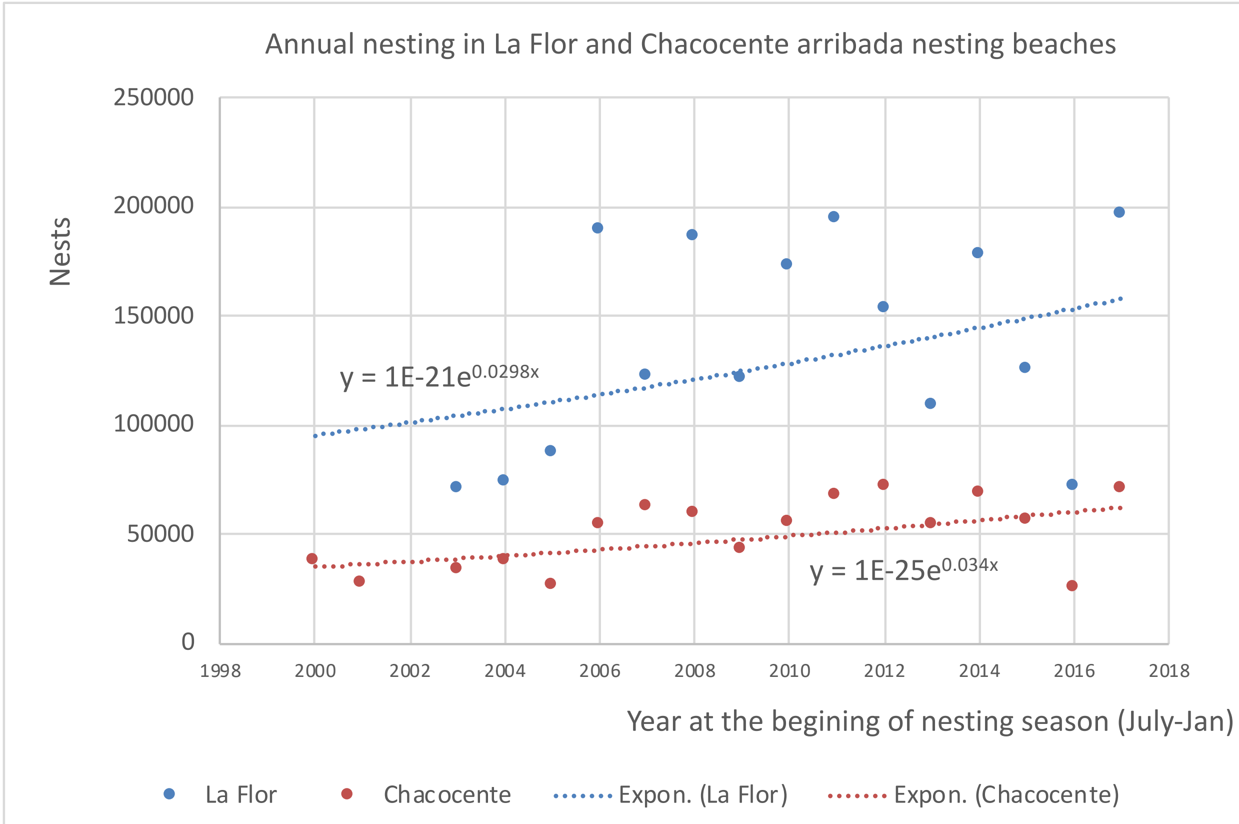

Figure 2. Annual nesting in La Flor and Chacocente arribada beaches.

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COSTA RICA

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General remarks

Costa Rica has been making an important effort in terms of improving its ecological representativeness, and precisely one of the conservation objects due to its hazards are the marine turtles. Four species are frequently observed in national waters and lay their eggs on our beaches, the leatherback turtle (*Dermochelys coriacea*), the olive ridley (*Lepidochelys olivacea*), the green (Caribbean) or black (Pacific) (*Chelonia mydas*) and the hawksbill turtle (*Eretmochelys imbricata*). Nesting loggerhead turtles (*Caretta caretta*) have been reported on Caribbean beaches, but it is not a frequent activity.

Although there is still a lot of work to be done on marine conservation, the country already has different management categories that help complement the efforts being made in the field of sea turtle conservation and protection. Up today, there are 22 marine areas with mitigation of threats in the Pacific side of Costa Rica: five National Wildlife Refuges with a marine portion; five National Parks with marine extensions;

two Marine Management Areas and ten marine responsible fishing areas (Fig. 1a and 1b).

In 2018, Costa Rica formalized its National Strategy for the Conservation and Protection of Sea Turtles, with the objective of improving the management over the following 10 years. Its vision is focused on developing management within and outside protected wilderness areas under alternative governance models for the generation of well-being, based on management, research, education and ecotourism programs, with the participation of the State, civil society, non-governmental organizations, government, the academy and the private sector (MINAE 2018).

In Costa Rica, non-governmental and academic organizations, as well as government institutions, make major contributions each year investing time and resources to investigate and protect sea turtles that arrive to the country to nest on their beaches or use foraging areas. Thus, many monitoring and research programs have been consolidated over the years, whereas others are currently being developed along the coast of Costa Rica (see Table 4). Research and conservation of sea turtles has not only increased our knowledge about the biology of turtles over time, but has also provided scientists with important information to evaluate the population status of these species at a regional level and, thereby, consider and implement the most effective conservation measures.

Today, there is an enormous effort to monitor and / or tag sea turtles on almost all the nesting beaches of the country, both within and outside the protected areas, providing information about population trends of the four species of sea turtles that are present in the Pacific side of Costa Rica. Most of these projects also evaluate the success of egg incubation and the possible factors that affect it. This has allowed the Costa Rican State, through the National System of Conservation Areas (SINAC) of the Ministry of Environment and Energy (MINAE), to register for the Pacific side of Costa Rica, at least 68 nesting sites for sea turtles (Fig. 2) and several foraging sites (Fig. 5 and Fig. 9). Of those 68 sites, 41.2% (n = 28) are within Protected Wildlife Areas (ASP, acronym in Spanish) and 58.8% (n = 40) outside Protected Wildlife Areas (FASP, acronym in Spanish).

The information that has been used to prepare this report corresponds only to data available for 33 nesting beaches where consolidated monitoring programs have been implemented. This group included index beaches by species and according to what has been reported to the Inter-American Convention for the Protection and Conservation of Sea Turtles (IAC) (MINAE-SINAC, 2018).

1. RMU *Dermochelys coriacea*, Eastern Pacific Ocean (DC-EPO)

1.1. Distribution, abundance, trends

1.1.1. Nesting sites

Along the Pacific coast of Costa Rica, nowadays 15 sites have been reported in which leatherback turtle nesting occurs (Fig. 3), 9 of them are in protected wildlife areas and 6 sites are outside protected wildlife areas. For the purposes of this report, the information was compiled for 9 of these sites, which have been permanently monitored over a determined period of years (see Table 2).

The greatest conservation efforts for the species in the country have been concentrated mainly on the beaches of Parque Nacional Marino Las Baulas (PNMB), a complex of three sandy beaches (Playa Grande, Ventanas and Langosta), considered as an index site for the species and that has a nesting history since the end of the 1980s (Fig. 4) (Santidrian-Tomillo et. al., 2007; Santidrian-Tomillo et. al., 2017a; Piedra et. al., 2007).

In the other 12 sites, leatherback nestings have also been reported, however, and according to Santidrian-Tomillo et. al. (2017a), four sites (Naranjo, Cabuyal, Nombre de Jesús and Ostional) can be classified as important secondary beaches due to the regular occurrence of nesting events. Playa Junquillal also seems to be an important secondary beach for leatherback turtles, according to the information compiled in this report.

Table 2 shows the information of the beaches Grande, Ventanas and Langosta, as one and refered to as PNMB, this is because there are frequent exchanges between the Park beaches and the analysis of the nesting at the three beaches independently may result in errors and underestimation of population size. The same applies to the beach complex Nombre de Jesús-Zapotillal.

According to Santidrian-Tomillo et. al. (2017a), although nesting abundance is relatively low at secondary beaches, they host at least ~ 25% of total leatherback nesting abundance in Costa Rica.

Leatherback turtles in the Eastern Pacific have declined drastically during the last two decades, as indicated by the trends in number of nesting females and nests in the beaches of PNMB (Fig. 4). Steyermark et. al. (1996), Chaves et. al. (1996), Reina et. al. (2002) and Piedra et. al. (2007), in their works described important population parameters such as number of females, number of nests, mortality rates, remigration intervals, clutch size, reproductive frequency. On the other hand, Spotila et. al., (2000) and Santidrian-Tomillo et. al. (2007) described a highly threatened and declining population. According to the information collected for the 9 nesting sites included in this report, for the period comprised between 2014-2018, an amount of 206 annual leatherback nests was averaged in the Costa Rican Pacific (see Table 1). Currently, the trends do not show any recovery signs.

The current numbers continue positioning the leatherback turtles in an alarming status, so it is very important and critical to maintain a permanent presence on the index beaches. Due to the critical state of the population, it is also necessary to maintain the effort in all those beaches that have been classified as secondary. Secondary beaches are considered as nesting sites where turtles nest regularly, are used by the same subpopulation and are of secondary importance due to the lower intensity of nesting activities (Santidrian-Tomillo et. al., 2017a). The information collected will continue to be relevant to generate important estimates of population trends.

1.1.2. Marine areas

During the nesting season, females make use of marine coastal habitats near the beaches where they nest. Shillinger et. al. (2010), determined that during the internesting period, leatherback turtles remain in an area of approximately 33 542 Km^2 (Fig 5).

Once they finish their nesting period on the Pacific coast of Costa Rica, they seem to migrate exclusively to the South Pacific, where their main foraging areas are found (Fig 6) (Morreale et. al., 1996; Shillinger et. al., 2008, 2011 and Bailey et. al., 2012). The persistent migrations of the Costa Rican Pacific leatherbacks to the South Pacific Gyre and their subsequent sustained residence within this region suggest that this population shows fidelity to foraging sites (Shillinger et. al., 2011).

1.2. Other biological data

Table 1. shows a summary of important biological data for the specie in the Pacific side of Costa Rica.

1.3. Threats

Table 1 lists the threats that affect the species in the country. Historical poaching of eggs and bycatch are possibly the two main threats that have led leatherback turtles to their current critical condition. Here are some details regarding these and other threats:

1.3.1. Nesting sites

Egg poaching is a common threat to sea turtles in Costa Rica and was one of the main drivers of the population collapse at PNMB. Approximately, 90% of leatherback clutches were poached for ~20 years before the Park was established (Santidrian-Tomillo et. al., 2008). The levels of egg poaching have been reduced in Protected Wildlife Areas and in places where there are long-term monitoring projects. However, the pressure is still high, and effective conservation depends on human presence on the nesting beaches. If there is no presence related to conservation, the threat of egg poaching is still high.

Coastal development without control continues to be a threat, especially when the design of developmental projects that are adjacent to critical habitats for marine turtles does not include conservation and protection measures. According to Roe et.

al. (2013), leatherback turtles in Playa Grande (PNMB) nest more frequently in beach sections with steeper slopes, higher elevation dunes and deeper marine areas. So, presence of vegetation is important, as well as lack of infrastructure in the areas adjoining the nesting habitats.

Marine protected areas of Costa Rica must have management plans, which defines a buffer zone adjacent to its official limits. The managers of marine protected areas have great interference over the real estate projects to be developed in the buffer zone. They can influence the management of light, noise, tourism and beach activities among others. In addition, the Secretaría Técnica Nacional Ambiental (National Environmental Technical Secretariat, a.k.a. Setena), institution of the Ministry of Environment and Energy, has as one of its functions the analysis and approval or rejection of the environmental viability instrument that must be drawn up by those responsible for real estate projects. This should consider parameters that reduce the impact of some construction activities and its subsequent operation of the project on the sea turtle and its habitat.

Undoubtedly, the foregoing is a fundamental technical-legal tool that, when well implemented, helps to reduce the impacts of coastal development. However, there is still a need for a greater incidence of control and compliance with environmental commitments to effectively reduce the impact of development on nesting habitats, but there are important advances such as the implementation of administrative resolutions that establish guidelines for infrastructure development. Outside of protected areas, control remains more complicated and requires the commitment of many key actors.

Climate change can greatly affect leatherback populations mainly through the detrimental effect of hot and dry conditions on egg incubation. As a result, hatching and emergence success is expected to decline due to climate change by the end of the 21st century (Santidrián-Tomillo et. al., 2012). In a follow-up study Saba et. al. (2012), projected that the population of leatherback turtles that nest at PNMB will decrease at a rate of 7% per decade during the 21st century due to the projected increase of air temperatures and decrease precipitation levels. The population will remain stable until 2030, but will suffer a reduction of 75% by the year 2100 due to climate change alone. The sensitivity of leatherback turtles to climatic variability is remarkable in comparison to other species (Santidrián-Tomillo et. al., 2017b) and makes it essential to consider the impacts of climate change in their recovery plans.

Costa Rica, in the framework of the Inter-American Convention for the Protection and Conservation of Sea Turtles (IAC), has recognized that the effects of climate change impact sea turtle nesting and feeding habitats. So that, in some of its beaches will be implemented the project called "Pilot Project for IAC Party Countries for the collection of environmental parameters of their nesting index beaches", for a continuous period of 5 years, and that is based on the Resolution of Adaptation of sea turtle habitats to climate change CIT-COP4-2009-R5 (http://www.iacseaturtle.org/docs/resolucionesCOP4CIT/CIT-COP4-2009-R5ESP_Final.pdf).

1.3.2. Marine areas

Sea turtles are long-lived organisms with delayed sexual maturity and high fecundity and that require high survival rates to keep their populations viable. Unfortunately, the population that nests in the Pacific side of Costa Rica has an estimated relatively low annual survival rate for a long-lived species, which suggests that there is an important interaction of leatherbacks with fishing (Santidrian-Tomillo et. al., 2017b).

In general, bycatch data are provided by observers on board or from reports in log books. For small-scale or artisanal fisheries, this type of information is not available in Costa Rica, so we have very little or no information available on fishing interactions with leatherbacks in jurisdictional waters of Costa Rican Pacific. However, post-nesting leatherback turtles migrate to distance foraging grounds crossing areas where pelagic fisheries operate, Shillinger et. al. (2008) and Alfaro-Shigueto et. al. (2018) mention the occurrence of interactions with fisheries in the oceanic and coastal areas near Ecuador, Peru and Chile.

Roe et. al. (2014), determined that there is an area of potential risk from fishing along the leatherback migration corridor between Costa Rica and the Galapagos Islands (Fig. 6). Although they predicted that in this area females would have a moderate risk of incidental capture, being a persistent migration route for leatherback turtles, it represents a potential permanent threat during a critical phase in the life cycle of adult reproductive turtles. Reducing fishery bycatch in the ocean is essential for beach protection to be effective.

Climate Change may result in changes in prey distribution or abundance. El Niño Southern Oscillation (ENSO) has been shown to influence reproductive frequency of EP leatherbacks, most likely as a result of its impact on prey abundance in the southeast Pacific (Saba et. al., 2007). During the La Niña periods, the ocean surface temperature is lower, so there is a higher primary production and the turtles take less years to return to the beaches to lay their eggs. Otherwise it happens during El Niño events, in which the surface temperature of the water is high, there is less primary production and therefore the turtles take more years to return to the beach to lay their eggs (Saba et. al., 2007; Reina et. al., 2009)

1.4. Conservation

As mentioned in section 1.1.1, on the Pacific coast of Costa Rica there have been 15 beaches where leatherback turtle nesting has been reported (Fig. 3), 9 of these sites are under some category of State protection as National Wildlife Refuges or National Parks. In 6 of these sites there are long-term monitoring programs, with information available and that was facilitated to prepare this report (see Table 2). Twelve areas were been created for marine conservation and are under the administration of SINAC, and ten are marine areas of responsible fishing under the administration of the National Fisheries Institute. The leatherbacks of the Eastern Pacific could eventually move through these spaces (Fig. 1a and 1b).

The country has ratified 9 international treaties (see Table 3) and at least 30 national legal instruments (MINAE-SINAC 2018), which are directly related to the conservation and protection of sea turtles.

Sea turtle monitoring programs carry out protection and conservation activities for females, nests and, to the extent of their competencies and possibilities, for the current habitats (see Table 4). The nesting beaches that are found in protected areas have the strength to be under the protection of a specific law, a Management Plan and a Regulation for Public Use. However, nesting beaches and marine spaces that are outside protected areas are at high risk to anthropogenic threats, so it is urgent to define and implement governance models that ensure the conservation of the habitat, the species and human well-being.

It is essential to maintain the monitoring and research programs on the index and secondary nesting beaches. This way it is ensured to continue with the generation of information, but at the same time, with human presence on the nesting beaches as permanent as possible. This has a significant impact on reducing egg poaching and preventing other possible threats. Table 4 lists the NGOs and State institutions that have been related to the management, conservation and research of sea turtles in the country.

Conservation priorities

Costa Rica has already been working on the identification of its conservation priorities, which have already been expressed in its recent National Strategy for the Conservation and Protection of Sea Turtles, and from which the following stand out:

1. Creation and implementation of a National Program for the Conservation of Sea Turtles as a mechanism to follow up and manage the provisions of national legislation, international agreements and the National Strategy for the Conservation and Protection of Sea Turtles.

2. Conformation of an Interinstitutional Advisory Group on marine turtles, to provide technical criteria and recommendations to the State authorities and the National Program for the Conservation of Sea Turtles.

3. Definition, officialization and implementation of governance models that help the sustainable management of sea turtle critical habitats.

4. Evaluation of the interaction of sea turtles with fisheries.

5. Ensure the continuity of the monitoring programs that occur inside and outside Protected Wildlife Areas.

6. Implement the Pilot Project for IAC Countries Parties for the collection of environmental parameters of their nesting index beaches, for a continuous period of 5 years.

7. Create a database at the country level, in which the results of the studies carried out and the registered information of standardized monitoring indicators are systematized.

8. Monitoring of traffic and illegal trade of sea turtle products and byproducts.

9. The country has identified several marine spaces that stand out for their importance for marine conservation. In recent years, some of these spaces have already been attended. Now, the work is being done to address, together with key actors, the spaces between the Las Baulas National Park and the Santa Rosa National Park (Figure 1), known as: Sector Punta Pargos - Punta Gorda and Sector Papagayo.

10. Another priority that has been discussed in the framework of the IAC is the identification and implementation of spatio-temporal management measures in areas adjacent to nesting beaches and inter-nesting habitats. This could include temporary fishing closures and explore options for the fishing sector affected by the measure.

11. Increase observer coverage in the longline fishery.

12. Standardization of a format to report bycatch.

13. Organization of a National workshop on incidental capture of turtles and mitigation measures, to determine the level of interaction and the relative mortality resulting from it in different fishing gears.

1.5. Research

Evaluate the impact of different types of fisheries on foraging habitat, inter-nesting and spaces where sea turtle movement occurs, identifying those areas of greatest interaction.

Promote research techniques to reduce incidental capture of sea turtles.

Marine debris impacts on sea turtles (including ingestion of plastics, ghost gear, microplastics) Impacts of climate change on sea turtle nesting and on its critical habitats.

2. RMU *Chelonia mydas*, Eastern Pacific Ocean (CM-EPO)

2.1. Distribution, abundance, trends

2.1.1. Nesting sites

Along the Pacific coast of Costa Rica, nowadays 41 sites have been reported in which black turtle nesting occurs (Fig. 7), 18 of them are in protected wildlife areas and 23 sites are outside of protected wildlife areas. For the purposes of this report, the information was compiled for 19 of these sites (25,2 Km beach lenght), which have been permanently monitored in the last years (see Table 1 and Table 2).

Table 2 shows the information of the beaches Nombre de Jesús and Zapotillal compiled into one. This because the analysis of nesting that occurs in these beaches independently can mislead and underestimate the dynamics of the population. The same happens with the Los Pargos beach complex. Reference is made to this detail because in table 2, in the sections "Number of" major "sites" and "Number of" minor "sites" the number of sites mentioned corresponds to 16 beaches.

The green turtle is one of the most studied sea turtles in the world, however, scientific information published on the species in the Pacific of Costa Rica has been scarce. Richard and Hughes (1972) and Cornelius (1976), were the first to report the nesting of the black turtle. It is from recent years that the importance of Costa Rican beaches for the nesting of the species is more consistently known and this is demonstrated by the published papers of Drake et. al. (2003), Blanco et. al. (2011 and 2012a), Santidrian-Tomillo et. al. (2014), Ureña López (2014), Dutton et. al. (2014) and Fonseca et. al. (2018). Monitoring and research programs have been consolidated over the years. This has allowed the registration and systematization of the information and, to some extent, its socialization. Although many of the projects still need to publish their results beyond the annual reports they must submit to the state authorities.

Recent data on number of nests and number of nesting females that have been reported for three of the index beaches (Isla San José, Cabuyal and Nombre de Jesús) (Fig 8), position the North Pacific of Costa Rica as the most relevant nesting area for this species in the Central American isthmus (Chacon-Chaverri et. al., 2014a; CIT 2018). Even though the number of years of monitoring does not allow to determine a robust population trend of black turtle in Costa Rica, the attention and concern must be called when analyzing how the number of nests and females have been reducing in the last four years.

The population of black turtles in Costa Rica is recently monitored, however, it is very interesting and important for its conservation knowing that according to Dutton et. al. (2014), the population is genetically closely related to the population of Galápagos. He also argued that the presence of ancient endemic haplotypes suggests that the area was not recently colonized and shows signs of a population that remained stable for a long period of time. Thus, the recent nesting data observed in Figure 8 may be evidence of a change that should be considered for immediate attention and particularly when the numbers of nesting in Galapagos are declining (CIT 2018).

2.1.2. Marine areas

By now, the available information on feeding areas and migratory routes of green turtles in Costa Rica is very limited. This is especially due to the fact that the greatest research and conservation efforts have been concentrated mainly on nesting ecology, identification of females and protection of their nests. In recent years, at least six important foraging areas have been identified for the black turtle in the Costa Rican Pacific, and in which the released information has been very relevant to consider into the conservation efforts that will be developed. These marine areas are: Golfo Dulce (Chacón-Chaverri et. al., 2014a) (Fig. 9a); Gulf of Papagayo (Blanco et. al., 2012b) (Fig. 9b): Santa Elena Bay (Blanco et. al., 2012b) (Fig. 9b); adyacent Matapalito Bay and rather sporadic or stop-over sites such as Coyote and Cabo Blanco (Heidemeyer et. al., 2014; Heidemeyer et. a., 2018) (Fig. 9c).

In the Golfo Dulce, classified as a responsible marine fishing area (Fig. 1b), the availability of food is high throughout the year, so it is not surprising that this has been determined as an important habitat for adult green turtles (Chacón-Chaverri et. al., 2014a). Other relevant information is that turtles that were captured and tagged in the Gulf have not been reported yet on Costa Rican nesting beaches, not even found dead or incidentally captured; so, the origin of the individuals are not known (Chacón-Chaverri et. al., 2014a). However, recently in Golfo Dulce there have been registered females that were tagged at Nombre de Jesús beach in Costa Rica and two turtles with tags from Quinta Playa, Isla Isabela Galapagos Islands, which reinforces the importance of the Gulf as a feeding habitat for green turtles regionally. Matapalito and Santa Elena Bay on the other hand, host green turtle populations of distinct natal origins (Heidemeyer et al., 2014), including from the largest regional nesting rookery found in Colola, Mexico (Heidemeyer et al., 2018).

On the other hand, satellite information has shown that green turtles from Mexico and Galapagos migrate to foraging areas in Central America (Hart et. al., 2015) and, according to Dutton et. al. (2014), the Costa Rican population is product of multiple colonization paths from antient Central Pacific populations (Hawaii) and more recent immigrations from both the Galapagos and Mexian rookeries. In fact, green turtles tagged in Galapagos have been recorded nesting in beaches of the Costa Rican Pacific (Blanco et. al., 2012b), as well as foraging in Golfo Dulce (Chacón-Chaverrí et al. 2014a).

Further north, at playa Nombre de Jesús, an important finding of the green turtle population was discovered. During inter-nesting periods, females stay most of the time near the nesting beach (Blanco et. al., 2012a) and once their egg-laying phase is over, some remain resident in the Gulf of Papagayo and Gulf of Santa Elena, remaining in the region during the non-reproductive phases (Blanco et. al., 2012b; Hart et. al., 2015).

Other interesting information to be considered is that in the other foraging sites for the green turtle, Punta Coyote and Cabo Blanco, juvenile individuals of green turtle predominated with sizes close to adult sizes, which could represent a habitat dominated by subadults close to maturity (Heidemeyer et. al., 2014).

The migratory movements of the green turtles showed at least three different migratory strategies. The first one corresponds to turtles that migrated to waters off the coast of Nicaragua, El Salvador and Guatemala. The second strategy refers to turtles that moved to Panama and a third, very important for the country, which corresponds to a population that remains resident near its nesting beach (Blanco et. al., 2012b).

All of the above represents a great responsibility and demonstrates that green turtles use marine corridors near the coast to move between nesting sites and feeding sites found in the country and in the Central American isthmus region (Blanco et. al., 2012b), where an interaction occurs between the individuals who congregate, even if they come from different places located at great distances.

2.2. Other biological data

Table 1 shows a summary of important biological data for the specie in the Costa Rican Pacific.

2.3. Threats

2.3.1. Nesting sites

Table 1 shows the threats that are still affecting the green turtles in the Pacific of Costa Rica. As is the case for all sea turtle species, egg poaching is one of the highest impacts and occurs mainly on nesting beaches outside protected wildlife areas. It has been estimated that, in the complex of Nombre de Jesús, one of the most important in the Pacific of Costa Rica (781 nests / year), egg extraction was more than 90% before 2006, year in which the monitoring program and research led by the organization Kuemar, entered the site more consistently. To this day, this percentage of extraction is estimated at 10% (unpublished data), since the presence of personnel is maintained most of the year and relocation of nests is made on the same beach. Despite this, the activity of egg poaching has not been eradicated.

In other important places such as Cabuyal, Los Pargos and Matapalo, egg poaching is still present and decreases during periods of time when there are staff working on the beaches.

High visitation of tourists without control is another threat that begins to be relevant on nesting beaches outside protected areas. In wildlife protected areas, the entry of visitors for the observation of sea turtles is controlled through a legal instrument known as 'regulation of public use'. Nonetheless, outside of protected areas, these prevention tools do not exist, and some tourist activities are carried out without applying good practices. For example, a large number of tourists around a turtle for the observation can cause a negative impact on them. Some just return to the sea, others even stop their egg-laying process.

The coastal development that does not include in its operation, risk analysis and impact mitigation measurements towards critical habitats for sea turtles, remains present as a threat that worries those responsible for the coordination of monitoring and research programs and to the SINAC. However, this concern requires to work on a governance models for these sites, which requires the participation of all key actors. This is the line of action that is being worked on.

The reproductive success of sea turtles depends largely on the stability of the nesting beaches, and that a good hatching and hatchlings emergence successes occur. In the ocean, good conditions of productivity must exist, which favor the food and energy necessary for them to migrate and lay their eggs on the nesting beaches. The sensitivity of marine turtles to climatic variability is remarkable and makes it essential to consider the impacts of climate change in their national and regional recovery plans. Costa Rica, in the framework of the Inter-American Convention for the Protection and Conservation of Sea Turtles (IAC), has recognized that the effects of climate change impact the nesting and feeding habits of sea turtles, so in some of its index beaches the project called "Pilot Project for IAC Countries Parties for the collection of environmental parameters of their nesting index beaches" will be implemented for a continuous period of 5 years, based on the Resolution on the impacts of the Climate in the Sea Turtle habitats CIT-COP4-2009-R5 (http://www.iacseaturtle.org/docs/resoluciones COP4CIT/CIT-COP4-2009-R5ESP_Final.pdf).

2.3.2. Marine areas

The fact that green turtles are concentrated in areas near nesting beaches, that they use marine corridors near the coast to move towards feeding sites and that some of these sites are located in jurisdictional waters, makes them vulnerable to the impact of anthropogenic activities such as incidental capture by fishing.

2.4. Conservation

From the 41 sites where green turtles are reported, 18 of them are protected by some category of state management, National Wildlife Refuge or National Park. In 19 beaches there is a monitoring and research program of sea turtles, in which the protection of females and nests are carried out. Twelve are the areas that have been created for marine conservation and that are under the administration of SINAC and ten are the marine areas of responsible fishing, under the administration of the National Fisheries Institute. The green turtles could eventually move through these spaces (Fig.1a and 1b).

Other conservation details and priorities that all sea turtle species share can be seen in section 1.4. Table 4 shows a list of monitoring and research programs led by NGOs and state institutions.

2.5. Research

Evaluate the impact of different types of fisheries on foraging habitat, inter-nesting and spaces where sea turtle movement occurs, identifying those areas of greatest interaction.

Promote research techniques to reduce incidental capture of sea turtles.

Marine debris impacts on sea turtles (including ingestion of plastics, ghost gear, microplastics). Impacts of climate change on sea turtle nesting and on its critical habitats.

3. RMU: *Lepidochelys olivacea*, Eastern Pacific Ocean (LO-EPO)

3.1. Distribution, abundance, trends

3.1.1. Nesting sites

In the Pacific of Costa Rica, the nesting of *Lepidochelys olivacea* is reported in 65 beaches (Fig. 10), 27 of them are in protected wildlife areas and the remaining 38 are outside protected wildlife areas. It is the most abundant species in the Costa Rican Pacific and the one with the widest range of nesting. For the purposes of this report, information was compiled from 19 important sites (55.3 km of beach length), seven of them considered as index (see Table 1 and Table 2).

Although the seven species of marine turtles share a generalized nesting behavior, they differ in their temporal space patterns. For example, the most unusual of all species is the Olive ridley turtle, which presents two types of reproductive strategy. The solitary nesting, each independent of the other, and the nesting that occurs under an “arribada” (“arrival” in English), in which thousands of females emerge from the sea in a synchronized manner, in mass and for short periods of days (2-7 days) to lay their eggs on the beach (Bernardo and Plotkin 2007). Precisely in two of the Costa Rican beaches this behavior occurs, Ostional and Nancite.

The females that nest in a solitary way do so mostly in defined seasons that coincide with the months of July to November, although there are nestings in months before and after the season. In addition, the arribada happens approximately once a month.

Playa Nancite is a protected beach under the category of National Park. The arribada in this site are smaller and less frequent compared to those occurring in Ostional. According to Valverde et. al. (1998), the population had shown a marked decline between 1987 and 1996. Possibly related to a low success rate in recruitment. A high concentration of nesting females in a small space, resulted in a low production of neonates due to a high mortality of density-dependent eggs, to which were added high concentrations of fungi and bacteria, as well as an important predation (Bernardo and Plotkin, 2007; Honarvar et. al., 2008; Fonseca et. al., 2009). However, Fonseca et. al. (2009) and information compiled for this report (see Table 1), indicate that although the arrival population in Nancite suffered a significant decrease in the last 36 years, it is currently experiencing low but stable numbers.

In Costa Rica, environmental laws prohibit the use of sea turtle eggs, however, in the case of Ostional, a protected beach under the category of Mixed National Wildlife Refuge, it is the only place in the country where the community has a Project for the

Management and Conservation of Olive Ridley sea turtles, whose egg collection is authorized by the State and is the only exception in Costa Rica within the framework of the CIT, according to Resolution CIT-COP7-2015-R1.

The sea turtle management and conservation project has created an adaptive action management model that contributes to the conservation of sea turtles, as well as the sustainable use of a sensitive natural resource such as Olive Ridley eggs. The Ostional Wildlife Refuge has a management plan that operationalizes the project's actions for a period of five years. The Plan contains a regulatory framework with objectives, principles and rules on the governability and implementation of the plan, as well as actions aimed to the management and conservation of the habitat, sea turtles and their eggs. These rules were developed jointly by representatives of the community of Ostional through the Association of Integral Development (ADIO), the Costa Rican Fisheries Institute (INCOPESCA), the National System of Conservation Areas (SINAC) and the University of Costa Rica (UCR) (Orrego and Rodríguez, 2017). In addition, the wildlife refuge administration has the support of an Inter-Institutional Advisory Council and a permanent program of biological monitoring of Olive ridley population.

Even so the arribada in Ostional were discovered in the 70s and since the end of the 80s the legal extraction of eggs by the community is allowed, little scientific information is published. According to Valverde et. al. (2012), the arribada show large intra and interannual fluctuations, so that a particular population trend could not be discerned. However, for Cornelius et. al. (2007) and Plotkin et. al. (2012), the population that nests in Ostional seems stable and may be growing. Given this situation, it is essential to continue monitoring until we have gathered enough information to determine the population trend.

The attention of this species has been focused on arribada beaches. Nevertheless, solitary nesting sites are important and in many of them a monitoring and conservation program has been consolidated, such is the case of the beaches shown in Table 2. According to Dornfeld et. al. (2015), the turtles that nest in a solitary way make an important contribution to the Olive ridley population in the Tropical Eastern Pacific. For example, they found that solitary nesting beaches could be key sites for the birth of males since those laid nests between June to September (rainy season), in their study, were incubated under cooler temperatures than those recorded at arribada beaches, hatching successes were greater and, according to recent data presented in this report, emergency success was greater than that shown at the arribada beaches (see Table 1).

The Olive ridley sea turtle shows low fidelity to solitary nesting sites. This is proven with the low numbers of recaptured individuals at monitoring sites. Even then, the number of nests that are reported at nesting sites is very relevant to the conservation status of the species. So, those identified and reported beaches in this report should, as far as possible, be maintained under a monitoring and protection program for the nests.

3.1.2. Marine areas

Plotkin (2010), who determined that olive ridleys are highly migratory, is one of the most complete studies carried out on the post nesting movements of the olive ridley turtles. The females that nested in Nancite did not follow a migratory corridor and were widely distributed between the jurisdictional waters of Mexico and Peru, where most of the females migrated to deep pelagic waters and others moved near the coast, but also in deep waters (Fig. 11). She also did not observe specific feeding zones for those years of study, but she assumes that the brief stops made by the turtles along the migratory route was a positive indication of the availability of resources. Olive ridley adult turtles spend their lives in ocean waters.

3.2. Other biological data

Table 1 shows a summary of important biological data for the specie in the Costa Rican Pacific.

3.3. Threats

3.3.1. Nesting sites

Table 1 shows the threats that are still affecting olive ridleys in the Pacific of Costa Rica. As is the case for all sea turtle species, egg poaching is one of the highest impacts and occurs mainly on nesting beaches outside protected wildlife areas. On a nesting beach where there is no human presence to develop activities to protect nests and females, egg poaching will be associated with a high percentage of extraction.

The low percentage of emergency success at arribada beaches (see Table 1) has an impact on the recruitment rates of individuals in olive ridley populations. According to Fonseca et. al. (2009) and Honarvar et. al. (2008), the decrease in the population at Playa Nancite could have been due to low hatching success as a result of a high density of nests on the beach. So, the recruitment for the population was insufficient to balance mortality. In Ostional, the combined effect of high temperatures in the nest and a partial pressure of oxygen (pO2) at the beginning of the incubation, resulting from the microbial decomposition of organic matter, influence in the low hatching success (Bezy et. al., 2015).

The reproductive success of sea turtles depends largely on the stability of the nesting beaches, and that a good hatching and hatchlings emergence successes occur. In the ocean, good conditions of productivity must exist, which favor the food and energy necessary for them to migrate and lay their eggs on the nesting beaches. The sensitivity of marine turtles to climatic variability is remarkable and makes it essential to consider the impacts of climate change in their national and regional recovery plans. Costa Rica, in the framework of the Inter-American Convention for the Protection and Conservation of Sea Turtles (IAC), has recognized that the effects of climate change impact the nesting and feeding habits of sea turtles, so in some of its index beaches the project called "Pilot Project for IAC Countries Parties for the collection of environmental parameters of their nesting index beaches" will be implemented for a continuous period of 5 years, based on the Resolution on the impacts of the Climate in the Sea Turtle habitats CIT-COP4-2009-R5-(http://www.iacseaturtle.org/docs/resolucionesCOP4CIT/CIT-COP4-2009-R5ESP_Final.pdf).

3.3.2. Marine areas

Bycatch remains one of the major threats to the conservation of olive ridleys in the Tropical Eastern Pacific; dead turtles are frequently observed on nesting beaches, however, published and recent information regarding the impact of fisheries on the populations of sea turtles is scarce. Relevant information was shared by Whoriskey et. al. (2011), who were able to quantify the impact of olive ridley sea turtle bycatch effect on the capture of Coryphaena hippurus (Mahi-mahi). They determined that between 1999-2008, 1348 individuals were captured, for an average of 9.05 olive ridleys per 1000 hooks. The mortality reported was low and this was due to the fact that almost all the turtles observed were released. Fishing efforts were concentrated between 19.5 km and 596.2 km from the coast.

On the other hand, Drapp et. al. (2013) estimated that between 1999 and 2010, an amount of 92,300 adult olive ridleys were captured by longline fishing fleet. The impact of these catches on the population is not easy to measure, since according to Swimmer et. al. (2006), released turtles apparently survive and behave normally. An important information to consider in the measures to mitigate threats is that much of the effort of this fishery occurs both near and far from the nesting beaches.

3.4. Conservation

Table 1 shows some of the conservation activities that have been implemented in the country for the conservation of olive ridley sea turtles. Of the 65 reported sites where nesting occurs, 27 of them are within a protected wildlife area. Twelve are the areas that have been created for marine conservation and that are under the administration of SINAC, and ten are the marine areas of responsible fishing under the administration of the National Fisheries Institute. The olive ridleys could eventually move within these spaces (Fig. 1a and 1b).

Other conservation details and priorities that are shared for all species of marine turtles can be seen in section 1.4. Table 4 shows a list of monitoring and research programs led by NGOs and government institutions.

3.5. Research

1. Evaluate the impact of different types of fisheries on foraging habitat, inter-nesting and spaces where sea turtle movement occurs, identifying those areas of greatest interaction.

2. Promote research on techniques to reduce the incidental capture of sea turtles.

3. Marine debris impacts on sea turtles (including ingestion of plastics, ghost gear,
microplastics)

4. Impacts of climate change on sea turtle nesting and on its critical habitats.

4. RMU: *Eretmochelys imbricata*, Eastern Pacific Ocean (EI-EPO)

4.1. Distribution, abundance, trends

4.1.1. Nesting sites

The information published on hawksbill turtles in the Pacific of Costa Rica is very scarce (see Table 1). The nesting of this species is reported and in a sporadically way in 15 sites of the Pacific coast (Fig. 12), 8 of them are in protected wildlife areas and 7 outside protected areas. For the purposes of this report, the information was collected from 3 sites, two of which are specifically foraging areas, and one a nesting beach. Historical data cites that between January 1982 to May 2009, only 48 individuals were observed nesting in Costa Rica (Gaos et. al., 2010). For the period comprised between 2016-2018 in Playa Rajada, North Pacific, only 3 nests per year were reported (see Table 2). According to Chacón-Chaverri et. al. (2014b), in the South Pacific there are less than 25 nests per year. The foregoing highlights the vulnerability of the species in the Costa Rican Pacific.

4.1.2. Marine areas

Information on feeding sites or aggregation of hawksbill turtles is also scarce in the country, although it is higher than what is published on nesting beaches. In recent years, at least five important foraging areas have been identified for juvenile, subadult and adult individuals of the hawksbill turtle in the Costa Rican Pacific. This information is very relevant to be considered in conservation efforts that has been developed. These marine areas are: Golfo Dulce (Chacón-Chaverri et. al., 2014b); Cabo Blanco (Heidemeyer et. al., 2014); Punta Coyote (Carrión-Cortés et. al., 2013); Punta Pargos (Chacón-Chaverri et. al., 2014b; Heidemeyer et. al., 2014) and Bahía Matapalito (Heidemeyer et. al., 2014) (Fig. 9).

Unlike the low numbers in the amount of nesting females registered on nesting beaches, Chacón-Chaverri et. al. (2014b) reported a catch of 62 individuals in the Golfo Dulce for the period 2010-2013. An important fact is that the greatest number of captures occurred when the greatest sampling effort was presented. In this aggregation site, the individuals captured were mostly adults and are likely to be feeding on macro and micro invertebrates associated with seagrasses present in the Gulf.

A different situation was presented at Punta Coyote, where most of the individuals captured were juveniles and many of small sizes, which suggests that it is a recruitment site (Carrión-Cortés et al., 2013). On the other hand, between 2010 and

2013, Heidemeyer et. al. (2014) captured a total of 28 individuals in the sampling sites of their study, in this case all were juveniles (Fig. 9c). According to the available information, the hawksbill turtles confirm fidelity to the Punta Coyote and Golfo Dulce sites, while Matapalito Bay seems to be an important site for its development.

4.2. Other biological data

Table 1 shows a summary of important biological data for the specie in the Costa Rican Pacific.

4.3. Threats

1.3.1. Nesting sites

Table 1 shows the threats that are still affecting hawksbill turtles in the Pacific of Costa Rica. As it happens for all species of sea turtles, egg poaching, climate change, pollution, coastal development without control, are present threats in the Costa Rican Pacific coast.

A threat that persists in the region is the furtive capture for the use of the shell, making crafts for commercial purposes. Although in the Pacific of Costa Rica it is not common to capture the species for these purposes, the craft trade does occur.

1.3.2. Marine areas

Bycatch remains one of the major threats to the conservation of hawksbill in the Tropical Eastern Pacific, however, published and recent information regarding the impact of fisheries on the populations of sea turtles is scarce.

4.4. Conservation

From the 15 sites in which hawksbill turtle has been reported, 8 of them are protected under some category of government management, National Wildlife Refuge or National Park. In 7 sites there is a monitoring and research program for sea turtles at least during the peak of the season. Twelve are the areas that have been created for marine conservation and that are under the administration of SINAC and ten are the marine areas of responsible fishing, under the administration of the National Fisheries Institute. Through these spaces the hawksbill turtles could eventually move (Fig.1a, 1b).

Other conservation details and priorities that are shared for all species of marine turtles can be seen in section 1.4. Table 4 shows a list of monitoring and research programs led by NGOs and government institutions.

4.5. Research

1. Evaluate the impact of different types of fisheries on foraging habitat, inter-nesting and spaces where sea turtle movement occurs, identifying those areas of greatest interaction.

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3. Marine debris impacts on sea turtles (including ingestion of plastics, ghost gear,
microplastics)

4. Impacts of climate change on sea turtle nesting and on its critical habitats.

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Table 1. Main biology and conservation aspects of sea turtles in the Costa Rican Pacific.

RMU:	(CM) Eastern Pacific	Ref #	(LO) arribadas-Eastern Pacific	Ref #	(LO) solitarias-Eastern Pacific	Ref #	(DC) Eastern Pacific	Ref #	(Ei) Eastern Pacific
Occurrence									
Nesting sites	Y	2,26,29,30,34	Y	PS,2,40	Y	PS,2,58	Y	PS,2,3,4,57	N
Pelagic foraging grounds	N	PS	N	PS	N	PS	N	PS	N
Benthic foraging grounds	JA	33,34,54,55	N	PS	N	PS	N	PS	JA
Key biological data									
Nests/yr: recent average (range of years)	1978(2014-2018)	PS,2,30	955434 (2014-2018)	PS,2	2603 (2014-2018)	PS,2	206 (2014-2018)	PS,2	3 (2016-2018)
Nests/yr: recent order of magnitude	5-1698	PS	49383- 1390985	PS	53-4283	PS	1-171	PS	unknown
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	11	PS	2	PS	15	PS	1	PS	0
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	5	PS	0	PS	2	PS	5	PS	1
Nests/yr at "major" sites: recent average (range of years)									
Nests/yr at "minor" sites: recent average (range of years)									
Total length of nesting sites (km)	25.2	PS	8.4	PS	46.9	PS	25.4	PS	unknown
Nesting females / yr	597	PS	584418	PS	2506	PS	34.8	PS	unknown
Nests / female season (N)	3.16	PS	2.2	PS	1,65 (1929)	PS	4,11 (>110)	PS	unknown
Female remigration interval (yrs) (N)	2,6(63)	PS	unknown		unknown		3.65	17	unknown
Sex ratio: Hatchlings (F / Tot) (N)	unknown		unknown		unknown		0.85	27	unknown
Sex ratio: Immatures (F / Tot) (N)	unknown		unknown		unknown		unknown		unknown
Sex ratio: Adults (F / Tot) (N)	unknown		unknown		unknown		unknown		0.66 (57)
Min adult size, CCL or SCL (cm)	79.20	PS	60,75 (3083)	PS	66,5 (3037)	PS	144	PS	58.00
Age at maturity (yrs)	20-30	PS							
Clutch size (n eggs) (N)	73,6(3955)	PS	92,7 (8484)	PS	88,9 (3688)	PS	66,3 (706)	PS	unknown
Emergence success (hatchlings/egg) (N)	0,85 (2532)	PS	0,26 (8484)	PS	0,79 (6295)	PS	0.28 (>1000)	PS	unknown
Nesting success (Nests/ Tot emergence tracks) (N)	0,60 (5154)	PS	unknown		unknown		0.90	PS	unknown

Trends									
Recent trends (last 20 yrs) at nesting sites (range of years)	unknown		Stable	PS, 40	unknown	PS	Declining (90%)(1988-2018)	3,57,64	Declining
Recent trends (last 20 yrs) at foraging grounds (range of years)	unknown		n/a		unknown	PS	n/a		n/a
Oldest documented abundance: nests/yr (range of years)	n/a		Y	38, 42	unknown	PS	Y	8,9,,6	n/a
Published studies									
Growth rates	N	PS	N	PS	N	PS	Y	62	N
Genetics	Y	29.54	N	PS	N	PS	Y	60	Y
Stocks defined by genetic markers	Y	29,34,54	N	PS	N	PS	Y		Y
Remote tracking (satellite or other)	Y	26	N	PS	N	PS	Y	10,11,12	N
Survival rates	N		N	PS	N	PS	Y		N
Population dynamics	N		N	PS	N	PS	Y	3,4,27,57	N
Foraging ecology (diet or isotopes)	Y	PS	N	PS	N	PS	Y	59	Y
Capture-Mark-Recapture	Y	PS,31	Y	PS	Y	PS	Y	PS,4,5,6,7,8	Y
Threats									
Bycatch: presence of small scale / artisanal fisheries?	Y (SN, OTH)	PS	Y(PLL, ST,)	PS	Y(PLL, ST,)	PS	N		Y (SN, OTH)
Bycatch: presence of industrial fisheries?	Y (PLL, SN, BT)		Y(PLL, ST,)	PS	Y(PLL, ST,)	PS	N		Y (PLL, SN, BT)
Bycatch: quantified?	N		10 (PLL)/9,4 per 1000 hooks (Mahi mahi fisheries)	PS,48, 49	10 (PLL)/9,4 per 1000 hooks (Mahi mahi fisheries)	PS, 48,49	N		N
Take. Intentional killing or exploitation of turtles	N		N	PS	N	PS	N		Y (2-5 per year)
Take. Egg poaching	Y	2	Y	PS	Y	PS	Y	57	Y
Coastal Development. Nesting habitat degradation	Y	2	Y	PS	Y	PS	Y	14	Y
Coastal Development. Photopollution	Y	2	Y	PS	Y	PS	Y		Y
Coastal Development. Boat strikes	Y (2-5 per year)	2	Y (7-10 Per year)	PS	Y (7-10 Per year)	PS	Y		Y (2-5 per year)
Egg predation	Y	PS	Y	PS	Y	PS	Y		Y
Pollution (debris, chemical)	Y	2	Y	PS	Y	38	Y	65	Y
Pathogens	Y	2	Y	PS	Y	PS	n/a		Y

Climate change	Y	2	Y	PS	Y	PS	Y	15,16,20,21,66,67,68	Y
Foraging habitat degradation	Y (Contaminants)	2	Y	PS	Y	PS	N		Y (Contaminants)
Other	Y (Ghost fishing gear)	PS	Artisanal fisheries	PS	Artisanal fisheries	PS	N		Y (Ghost fishing gear)
Long-term projects									
Monitoring at nesting sites	Y		Y	PS	Y	PS	Y		Y
Number of index nesting sites	5	2	2	PS	1	PS	1		0
Monitoring at foraging sites	Y	31,34,54,55,56	n/a		n/a		n/a		Y
Conservation									
Protection under national law	Y	2	Y	2	Y	2	Y	2	Y
Number of protected nesting sites (habitat preservation)	4	PS	2	PS	3	PS	9	PS	8
Number of Marine Areas with mitigation of threats	22	PS	22	PS	22	PS	22	PS	22
Long-term conservation projects (number)	19	PS	2	PS	17	PS	6	PS	3
In-situ nest protection (eg cages)	Y	PS	Y	PS	Y	PS	Y	PS	Y
Hatcheries	Y	PS	Y	PS	Y	PS	Y	PS	N
Head-starting	N	PS	N	PS	N	PS	N	PS	N
By-catch: fishing gear modifications (eg, TED, circle hooks)	Y (TED)	PS	N	PS	N	PS	N	PS	Y (TED)
By-catch: onboard best practices	Y	PS	N	PS	N	PS	N	PS	Y
By-catch: spatio-temporal closures/reduction	N	PS	N	PS	N	PS	N	PS	N
Other	N	PS	N	PS	N	PS	N	PS	N

Table 2. Sea turtle nesting beaches in the Costa Rican Pacific.

RMU / Nesting beach name	Index site	Nests/yr: recent average (range of years)	Central point		Length (km)	% Monitored	Reference #	Monitoring Level (1-2)	Monitoring Protocol (A-F)
CM-NW IND			Long	Lat					
Nombre de Jesús-Zapotillal	Y	655 (2014-2018)	-85.834599	10.39442	1.7	100	PS	1	D
Cabuyal	Y	237 (2014-2018)	-85.653405	10.675365	1.4	100	PS	1	D
Isla San José	Y	597 (2014-2017)	-85.912374	10.856928	0.125	100	PS	1	D
Nancite	N	15 (2014-2018)	-85.711894	10.809324	1.05	100	PS	1	D
Naranjo	N	35 (2014-2018)	-85.699344	10.805686	4	50	PS	2	D
Coyotera	N	5 (2016-2018)	-85.721481	11.041878	0.900	100	PS	1	D
Coquito	N	9,5 (2017-2018)	-85.732365	11.045944	0.350	100	PS	1	D
El Jobo	N	68 (2016-2018)	-85.734743	11.033851	0.750	100	PS	1	D
Rajadita	N	25 (2016-2018)	-85.75139	11.025429	0.300	100	PS	1	D
Rajada	N	30 (2016-2018)	-85.746064	11.028376	0.800	100	PS	1	D
Piro	N	49 (2014-2018)	-83.338702	8.3954722	2	100	PS	1	D
Pejeperro	N	168(2014-2018)	-83.371519	8.4073861	4.5	100	PS	1	D
Junquillal	N	15(2015-2018)	-85.809437	10.161793	5.3	100	PS	1	D

Pargos (Avellanas, Lagartillo, Negra, Callejones, Blanca)	N	108 (2012-2018)	-85.836332	10.201512	7.7	100	PS	1	D
DC-NW IND									
Parque Nacional Marino Baulas (Grande, Ventanas y Langosta)	Y	125 (2013/14-2017/18)	-85.843432	10.327754	6	100	PS	1	D
Ostional	N	23 (2004-2015)	-85.700403	9.993913	7	100	9	1	D
Nombre de Jesús y Zapotillal	N	10 (2010-2018)	-85.834599	10.39442	1.7	100	PS	1	D
Cabuyal	N	16 (2013/14-2017/18)	-85.653405	10.675365	1.4	100	PS	1	D
Naranjo	N	18 (2014-2018)	-85.699344	10.805686	4	95	PS	2	D
Junquillal	N	17(2014-2018)	-85.809437	10.161793	5.3	100	PS	1	D
LO-NW IND									
Nancite	Y	81455 (2014-2018)	-85.711894	10.809324	1.05	100	PS	1	F
Naranjo	N	764 (2014-2018)	-85.699344	10.805686	4	50	PS	2	
Ostional	Y	873979 (2014-2018)	-85.700403	9.993913	7	100	PS	1	F
Camaronal	Y	2076(2014-2018)	-85.444924	9.86236	3	100	PS	1	D
Rajada	N	67 (2016-2018)	-85.746064	11.028376	0.900	100	PS	1	D
Rajadita	N	16 (2016-2018)	-85.75139	11.025429	0.300	100	PS	1	D

El Jobo	N	18 (2016-2018)	-85.734743	11.033851	0.750	100	PS	1	D
Coquito	N	45,5 (2017-2018)	-85.732365	11.045944	0.350	100	PS	1	D
Coyotera	N	78,3 (2017-2018)	-85.721481	11.041878	0.900	100	PS	1	D
San Miguel	Y	6000 (1998-2018)	-85.311402	9.81221	2.5	100	PS	1	D
Costa de Oro	Y	2400 (2012-2018)	-85.284919	9.796089	4.6	100	PS	1	D
Bejuco	Y	2000 (2016-2018)	-85.332842	9.822719	3.5	100	PS	1	D
Corozalito	Y	18000 (2008-2018)	-85.37777	9.847904	0.800	100	PS	1	D
Piro	N	515(2014-2018)	-83.338702	8.3954722	2	100	PS	1	D
Pejeperro	N	707(2014-2018)	-83.371519	8.4073861	4.5	100	PS	1	D
Playa Montezuma	N	1403 (2011-2018)	-85.063628	9.6580138	0.8	100	PS	1	D
Playa Buena Vista	N	461 (2017-2018)	-85.941333	10.468641	1.8	100	PS	1	D
Junquillal	N	229(2015-2018)	-85.809437	10.161793	5.3	100	PS	1	D
Hermosa	N	1424 (2002-2011)	-84.5869478	9.5727856	8	50	22	2	D
Ei-NW IND									
Rajada	N	3 (2016-2018)	-85.746064	11.028376	0.8	100	PS	1	D

Table 3. International conventions protecting sea turtles and signed in Costa Rica.

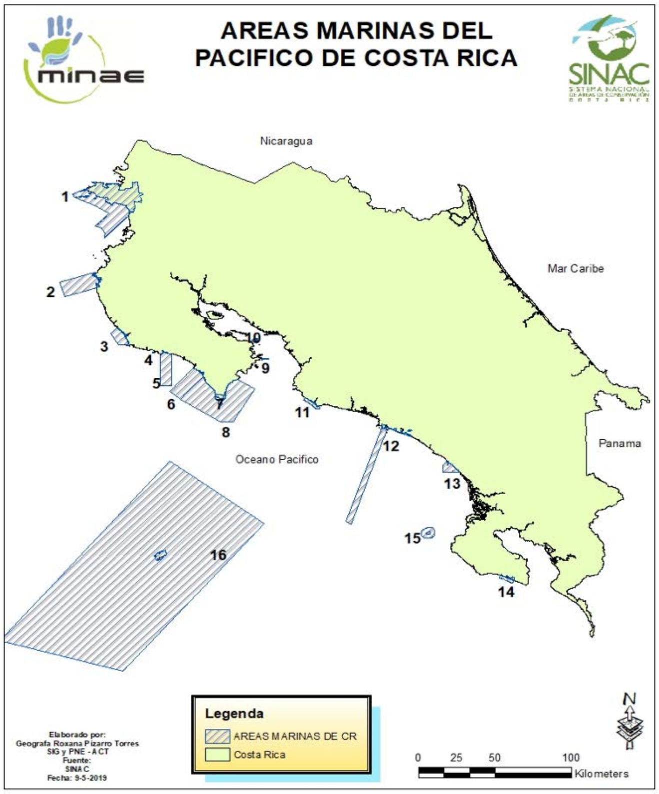
International Conventions	Signed	Binding	Compliance measured and reported	Species	Conservation actions	Relevance to sea turtles
Inter-American Convention (IAC) for the Protection and Conservation of Sea Turtles	Y	Y	Y	ALL		
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	Y	Y	Y	ALL	Deincentivizes harvest of sea turtle products.	Prohibits international trade of sea turtle products.
The RAMSAR Convention	Y	Y	Y	ALL	It is intended to join efforts to build capacities in the Contracting Parties of both Conventions to achieve the rational use of Ramsar Sites, which contain essential habitats for sea turtles.	The Inter-American Convention for the Protection and Conservation of Sea Turtles (IAC) and the Convention on Wetlands (Ramsar, Iran 1971) signed in July 2012, a Memorandum of Understanding (MoU) between the Secretariat of the Ramsar Convention and the Secretariat pro tempore of the CIT. The signature of this MOU responds to the recognition of the threatened status of sea turtle species in the Americas and the knowledge that the critical habitats (feeding, reproduction, migration and nesting) of these species are part of marine-coastal wetlands. Some of which are on the List of Wetlands of International Importance or are potential areas for designation. This agreement is under review for renewal.
Convention for the Conservation of Biodiversity and Protection of Wild Protected Areas in Central America	Y	Y	Y	ALL	Its actions are aimed to conserve biological diversity and the biological resources of the Central American region by means of sustainable use.	Develop Monitoring programs, ecosystem protection, sustainable use, creation of protected areas

Convention on Biological Diversity	Y	Y	Y	ALL	Its actions are aimed at the conservation of biological diversity, the sustainable use of its components and the fair and equitable participation in the benefits derived from the use of genetic resources, through, among other things, adequate access to these resources. and an appropriate transfer of relevant technologies, taking into account all rights to these resources and technologies, as well as through appropriate financing.	Establish a system of protected areas or areas where special measures must be taken to conserve biological diversity. It will promote the protection of ecosystems and natural habitats and the maintenance of viable populations of species in natural environments
Convention on Fishing and Conservation of Living Resources of the High Seas	Y	Y	Y	ALL	All States have the duty to adopt, or to cooperate with other States in adopting, such measures for their respective nationals as may be necessary for the conservation of the living resources of the high seas.	The problems related to the conservation of the living resources of the high seas are such that there is a clear need to resolve them, whenever possible, on the basis of international cooperation through the concerted action of all States.
United Nations Convention on the Law of the Sea	Y	Y	Y	ALL	Agreement that is aimed at resolving, in a spirit of mutual understanding and cooperation, all issues related to the law of the sea and aware of the historical importance of this Convention as an important contribution to the maintenance of peace, justice and progress for all the peoples of the world.	
Code of Conduct for Responsible Fisheries of the FAO Committee on Fisheries	Y	Y	Y	ALL	Serve as an instrument of reference to help States to establish or to improve the legal and institutional framework required for the exercise of responsible fisheries and in the formulation and implementation of appropriate measures; Promote protection of living aquatic resources and their environments and coastal areas; provide standards of conduct for all persons involved in the fisheries sector.	It should help to reduce the impact of fisheries on sea turtles

United Nations Framework Convention on Climate Change	Y	Y	Y	ALL	Its actions are aimed at achieving the stabilization of greenhouse gas concentrations in the atmosphere at a level that prevents dangerous anthropogenic interference with the climate system.	Climate change has become one of the main threats to sea turtles and biological processes. High temperatures negatively affect several aspects of the life cycle of these species, both on the beach and in the sea, so that the increase in temperature due to climate change can be highly detrimental to the future of their populations.

Table 4. Organizations and agencies related with sea turtle research and conservation in the Costa Rican Pacific.

Organization	Contact person	e-mail
Reserva Playa Tortuga	Oscar Brenes	oscarbreari@gmail.com
Fundación Corcovado	Aida García Solá	aida@corcovadofoundation.org
Comité para la Conservación de las Tortugas Marinas de Corcovado (COTORCO)	Pilar Bernal	cotorco@adicorcovado.org
Latin American Sea Turtle (LAST)	Luis Fonseca	luisfonsecalopez@gmail.com
WIDECAST	Didiher Chacón	dchacon@widecast.org
Conservación OSA	Mónica Espinoza Miralles	monicaespinoza@osaconservation.org
Asociación Vecinos Punta Banco		puntabancoambiental@gmail.com
The Leatherback Trust	María del Pilar Santidrian-Tomillo	bibi@leatherback.org
Asociación Kuemar	Elizabeth Vélez	evelez@kuemar.org
SINAC/ACT	Rotney Piedra	rotney.piedra@sinac.go.cr
Sea Turtle Forever	Nancy Tankersley	akwildguide@yahoo.com
ASVO	Greivin Fallas	jipifallas@yahoo.com
Asociación Vida Verdiazul	Valerie Guthrie	valerie@verdiazulcr.org
CREMA / Turle Trax	Isabel Naranjo	inaranjo@cremacr.org
Cirenas	Keylin Torres	info@cirenas.org
Refugio Nacional Mixto de Vida Silvestre Romelia	Oscar Cubero Vasquez	samanea88@gmail.com
Equipo Tora Carey /Universidad de Costa Rica	Maike Heidemeyer	maike.heidemeyer@gmail.com
Refugio Nacional Mixto de Vida Silvestre Barú	Alberto Villarreal Bogarín	info@haciendabaru.org
Tambor Bay Turtles	Javier Carazo	carazo.javier@gmail.com



No.	NOMBRE	CATEGORIA DE MANEJO
1	Santa Rosa	Parque Nacional
2	Marino las Baulas de Guanacaste	Parque Nacional
3	Ostional	Refugio Nacional de Vida Silvestre
4	Isla Chora	Refugio Nacional de Vida Silvestre
5	Camaronal	Refugio Nacional de Vida Silvestre
6	Caletas Ario	Refugio Nacional de Vida Silvestre
7	Cabo Blanco	Reserva Natural Absoluta
8	Cabo Blanco	Area Marina de Manejo
9	Islas Negritos	Reserva Biologica
10	Isla San lucas	Refugio Nacional de Vida Silvestre
11	Playa Hermosa-Punta Mala	Refugio Nacional de Vida Silvestre
12	Manuel Antonio	Parque Nacional
13	Marino Ballena	Parque Nacional
14	Pejeperro	Refugio Nacional de Vida Silvestre
15	Isla del Cano	Reserva Biologica
16	Isla del Coco	Parque Nacional

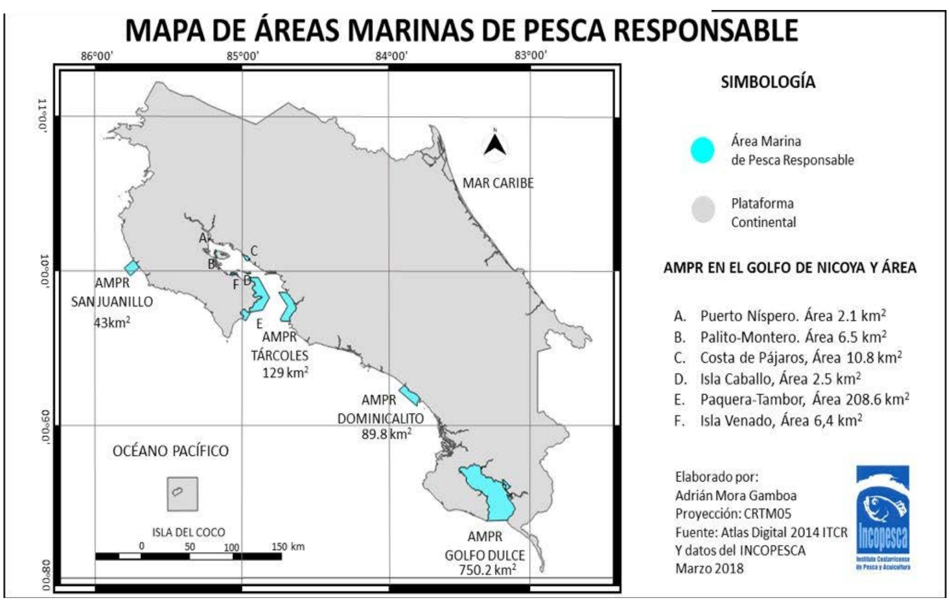
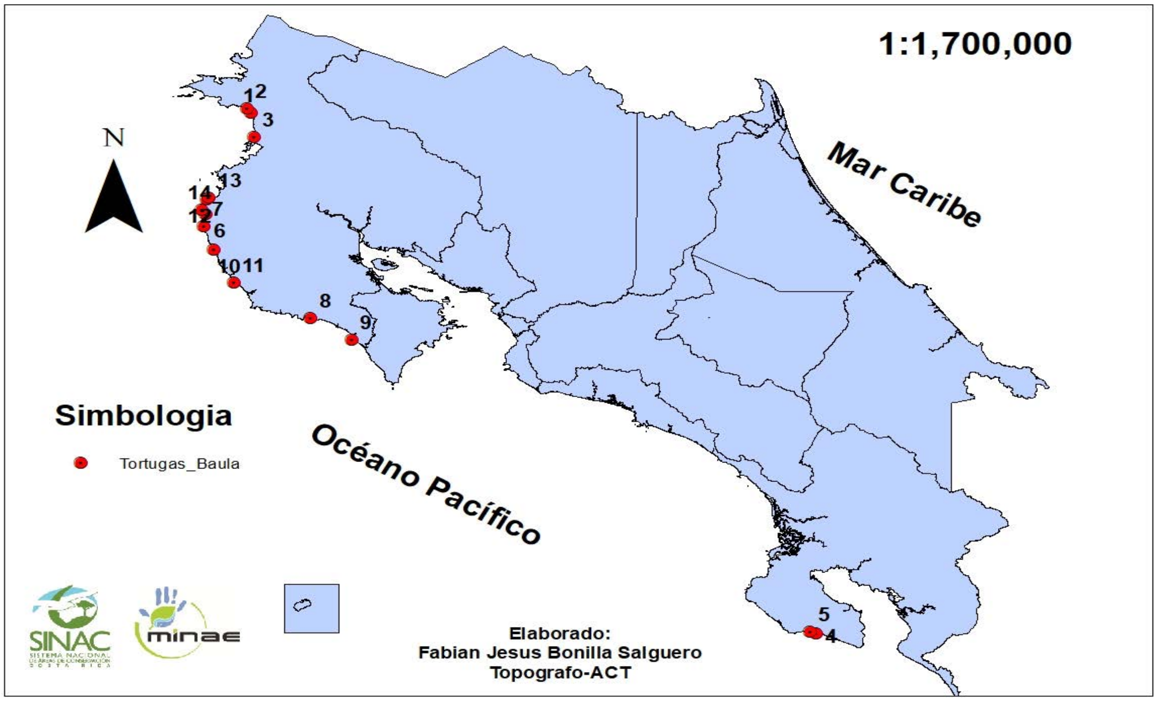


Figure 1. a). Map of Marine Protected Areas and Marine Management Areas, Pacific of Costa Rica (Source: SINAC); b). Marine Areas of Responsible Fishing, Pacific of Costa Rica (Source: INCOPESCA).

Figure 2. Nesting beaches of sea turtles in the Pacific and Caribbean coast of Costa Rica.



Simbologia

- <all other values>

Numero, Nombre de Playa, Area Conservacion

- 1, Nancite, ACG
- 10, Junquillal, ACT
- 11, Ostional, ACT
- 12, Nombre de Jesús, ACT
- 13, Playa Minas, ACT
- 14, Playa Ventanas, ACT
- 2, Playa Naranjo, ACG
- 3, Cabuyal, ACG
- 4, Carate, ACOSA
- 5, Playa La Leona, ACOSA
- 6, Playa Grande, ACT
- 7, Langosta, ACT
- 8, Camaronal, ACT
- 9, Playas Ario Caletas, ACT

Figura 3. Nesting beaches where leatherbacks are reported.

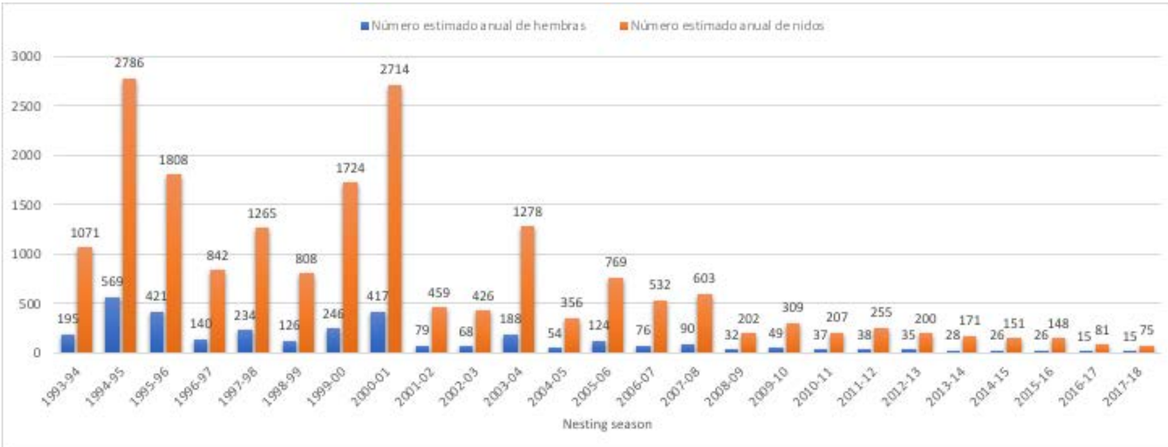


Figure 4. Estimated anual number of females and estimated anual number of nest. Source from TLT, KUEMAR, SINAC.

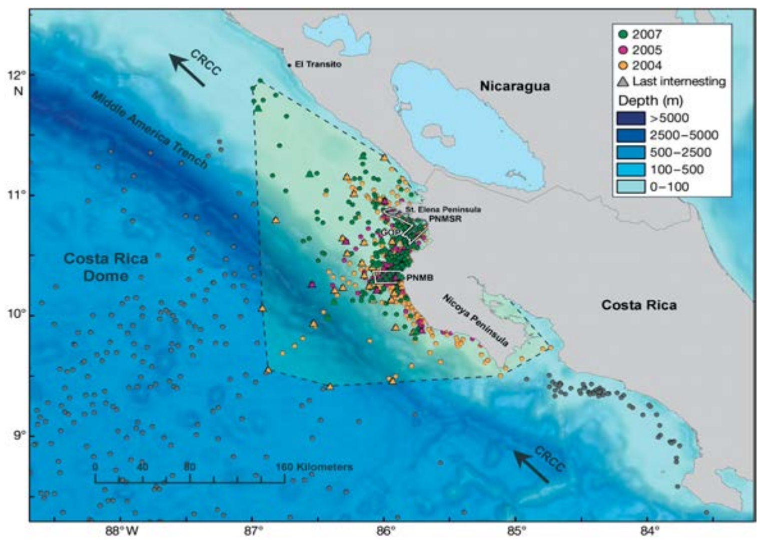


Figure 5. The polygon shows the area where the leatherbacks move during their internesting period. (**Map taken from Shillinger et. al., 2010**).

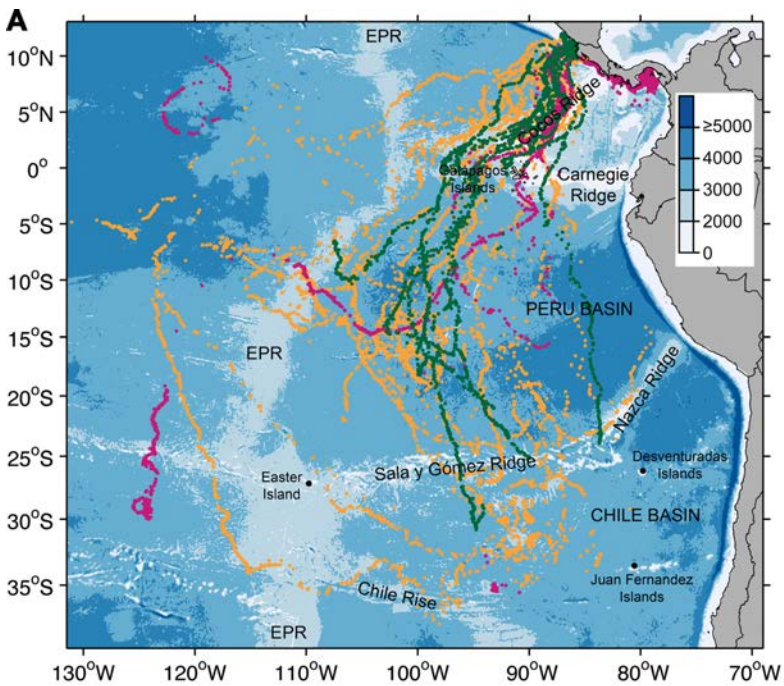
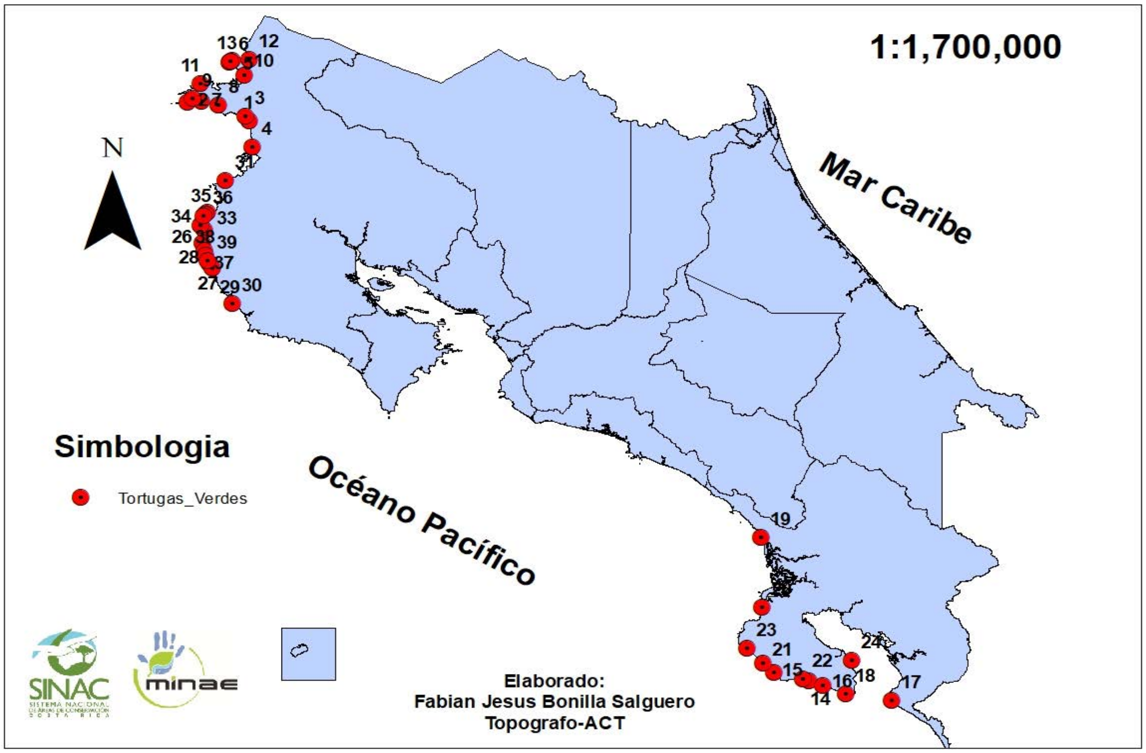


Figure 6. Migration route. Satellite transmission positions for *Dermochelys coriacea* from 2004, 2005 and 2007 (**Map taken from Shillinger et. al., 2008**).



Simbologia

- <all other values>

Numero, Nombre de Playa, Area de Conservacion

- 1, Nancite, ACG
- 10, Playa Junquillal, ACG
- 11, Playa Blanca, ACG
- 12, Coyotera, ACG
- 13, Rajadita, ACG
- 14, Carate, ACOSA
- 15, Sirena, ACOSA
- 16, Pejeperro, ACOSA
- 17, Punta Banco, ACOSA
- 18, Playa Piro, ACOSA
- 19, Playa Garza, ACOSA
- 2, Isla San José, ACG
- 20, Playa Ganado, ACOSA
- 21, Playa Corcovado, ACOSA
- 22, Playa La Leona, ACOSA
- 23, Playa Llorona, ACOSA
- 24, Playa Preciosa-Platanares, ACOSA
- 25, Playa Grande, ACT
- 26, Langosta, ACT
- 27, Playa Blanca, ACT
- 28, Playa Callejones, ACT
- 29, Junquillal, ACT
- 3, Playa Naranjo, ACG
- 30, Ostional, ACT
- 31, Matapalo, ACT
- 32, Nombre de Jesús, ACT
- 33, Playa Minas, ACT
- 34, Playa Ventanas, ACT
- 35, Playa Real, ACT
- 36, Playa Onda, ACT
- 37, Playa Avellanas, ACT
- 38, Playa Lagartillo, ACT
- 39, Playa Negra, ACT
- 4, Cabuyal, ACG
- 5, El Jobo, ACG
- 6, Playa Rajada, ACG
- 7, Playa Colorada, ACG
- 8, Playa Potrero Grande, ACG
- 9, Isla Pelada, ACG

Figure 7. Nesting beaches where green turtles are reported.

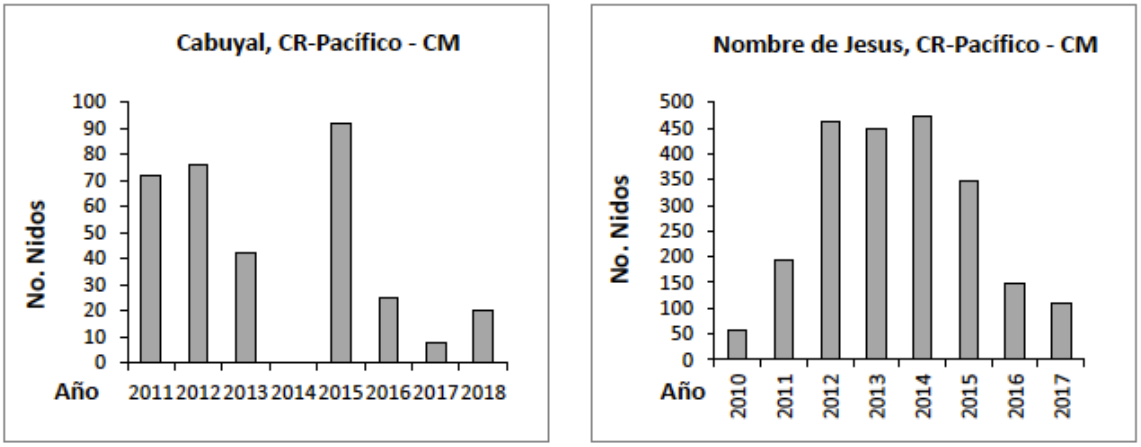


Figure 8. Number estimated of green turtle nest in index beaches (Cabuyal, Nombre de Jesús) (CIT 2018).

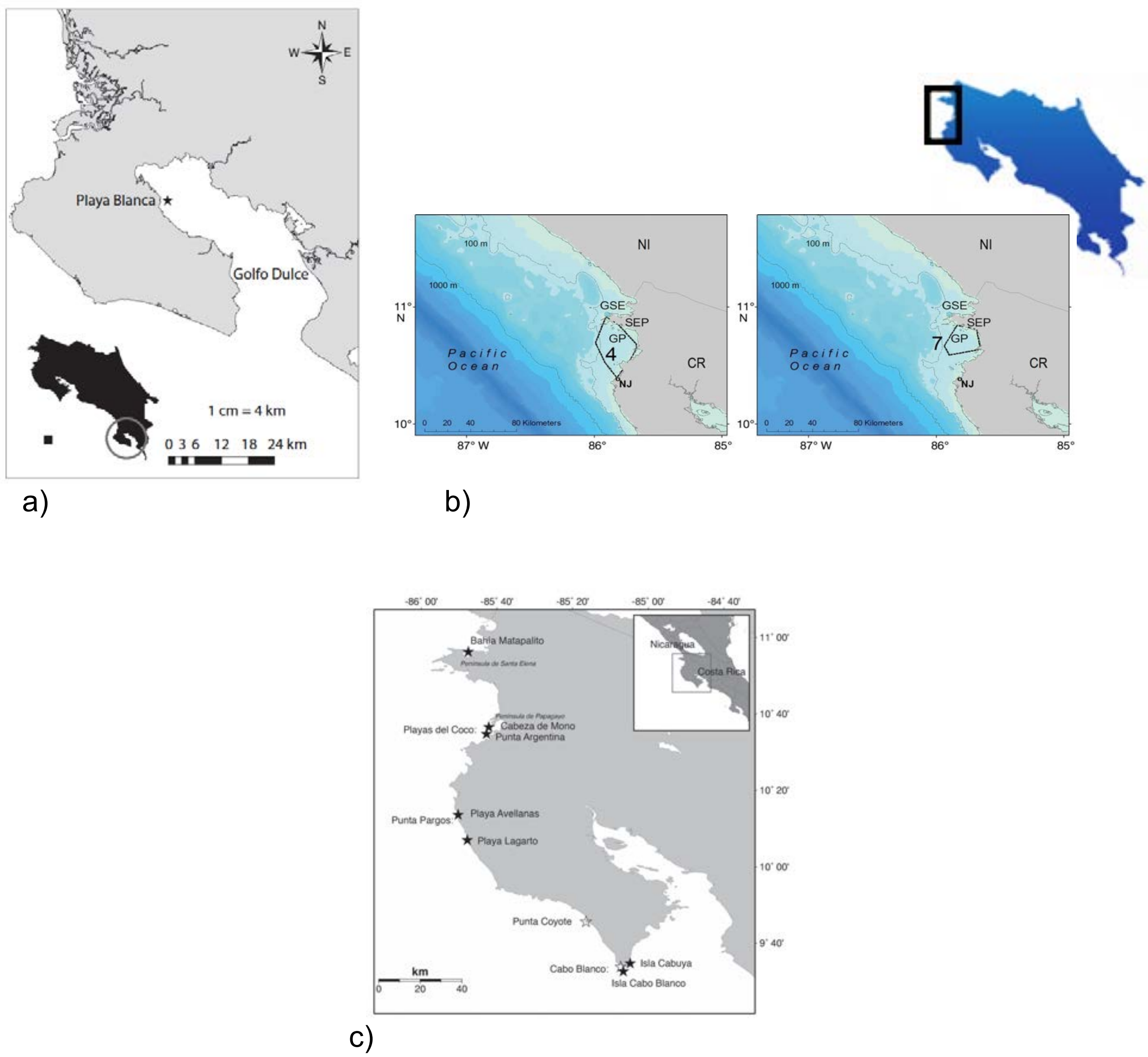
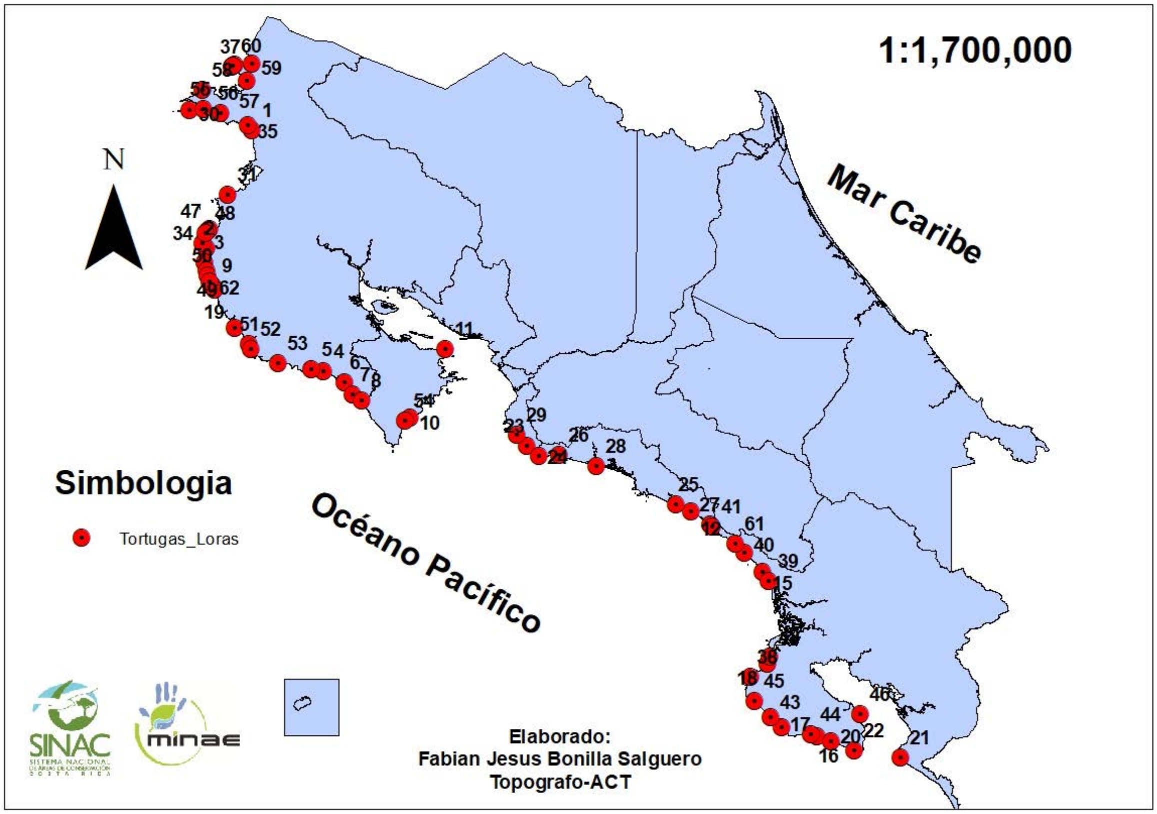


Figure 9. Foraging areas for balck turtle (a, b, c) and Hawksbill turtle (a, c) in the Pacific of Costa Rica. a). Golfo dulce (**Map taken from Chaverri-Chacón et. al., 2014a**); b). Gulf of Papagayo (GP) and Gulf of Santa Elena (GSE) two foraging areas of green turtles from Nombre de Jesús (NJ), Costa Rica (CR) (**Map taken from Blanco et. al., 2012b**); c) Foraging grounds for green sea turtles and hawksbill sea turtles: Bahía Matapalito, Punta Pargos, Punta Coyote and Cabo Blanco (**Map taken from Heidemeyer et. al., 2014**).



Simbologia

- <all other values>

Numero, Nombre de Playa, Area Conservacion

- 1, Nancite, ACG
- 10, RNVS Romelia, ACT
- 11, Playa Cocos RNVSSL, ACOPAC
- 12, Matapalo, ACOPAC
- 13, Playa Callejones, ACT
- 14, Junquillal, ACT
- 15, Playa Tortuga, ACOSA
- 16, Carate, ACOSA
- 17, Sirena, ACOSA
- 18, Drake, ACOSA
- 19, Ostional, ACT
- 2, Playa Grande, ACT
- 20, Pejeperro, ACOSA
- 21, Punta Banco, ACOSA
- 22, Playa Piro, ACOSA
- 23, Playa Hermosa, ACOPAC
- 24, Punta Mala, ACOPAC
- 25, Playa Rey, ACOPAC
- 26, Esterillos, ACOPAC
- 27, Barú, ACOPAC
- 28, Palo Seco, ACOPAC
- 29, Jacó, ACOPAC
- 3, Langosta, ACT
- 30, Isla San José, ACG
- 31, Matapalo, ACT
- 32, Nombre de Jesús, ACT
- 33, Playa Minas, ACT
- 34, Playa Ventanas, ACT
- 35, Playa Naranjo, ACG
- 36, El Jobo, ACG
- 37, Playa Rajada, ACG
- 38, Playa San Josecito, ACOSA
- 39, Playa Garza, ACOSA
- 4, Corozalito, ACT
- 40, Playa Colonia, ACOSA
- 41, Playa Dominical, ACOSA
- 42, Playa Ganado, ACOSA
- 43, Playa Corcovado, ACOSA
- 44, Playa La Leona, ACOSA
- 45, Playa Llorona, ACOSA
- 46, Playa Preciosa-Platanares, ACOSA
- 47, Playa Real, ACT
- 48, Playa Onda, ACT
- 49, Playa Avellanas, ACT
- 5, Camaronal, ACT
- 50, Playa Lagartillo, ACT
- 51, Playa Pelada, ACT
- 52, Playa Guiones, ACT
- 53, Playa Buena Vista, ACT
- 54, Playa Montezuma, ACT
- 55, Playa Colorada, ACG
- 56, Playa Potrero Grande, ACG
- 57, Playa Junquillal, ACG
- 58, Playa Blanca, ACG
- 59, Coyotera, ACG
- 6, Playa San Miguel, ACT
- 60, Rajadita, ACG
- 61, Playa Hermosa, ACOSA
- 62, Playa Negra, ACT
- 7, Playas Ario Caletas, ACT
- 8, Pencal, ACT
- 9, Playa Blanca, ACT

Figure 10. Nesting beaches where Olive ridley turtles are reported.

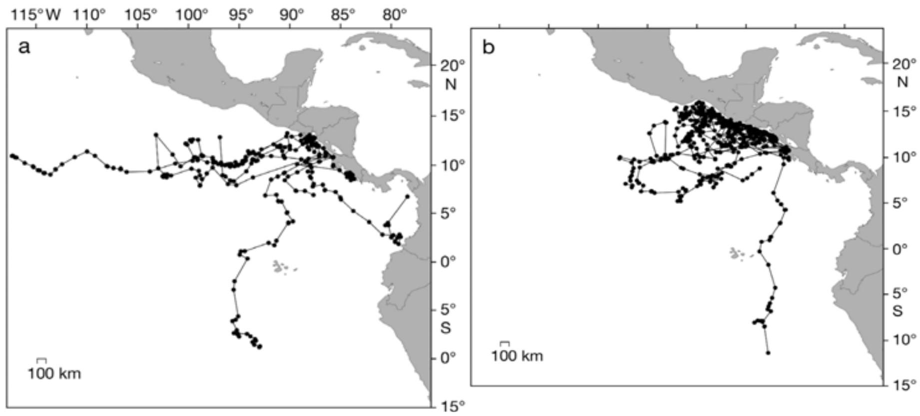
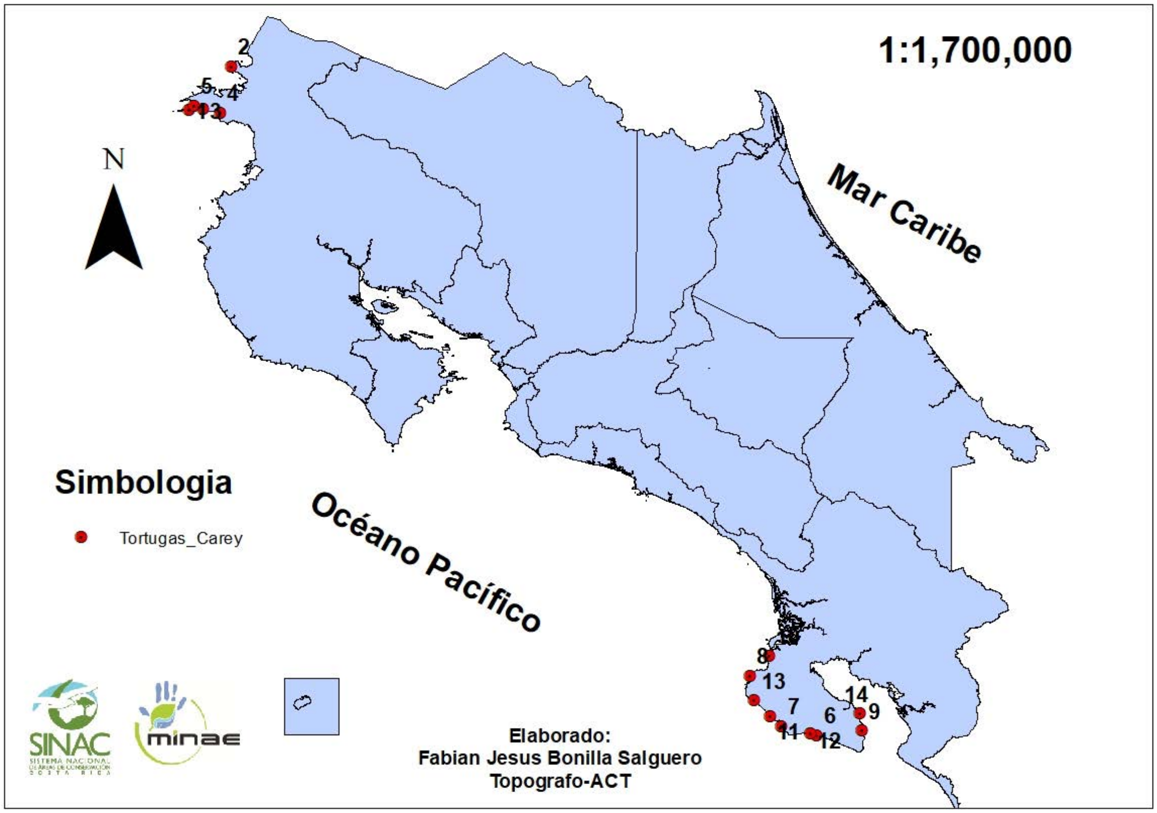


Figure 11. *Lepidochelys olivacea.* Post-nesting migrations of 20 female olive ridleys during (a) 1990–1991 and (b) 1991–1992. **Map taken from Plotkin 2010**.



Simbologia

- <all other values>

Numero, Nombre de Playa, Area Conservacion

- 1, Isla San José, ACG
- 10, Playa Ganado, ACOSA
- 11, Playa Corcovado, ACOSA
- 12, Playa La Leona, ACOSA
- 13, Playa Llorona, ACOSA
- 14, Playa Preciosa-Platanares, ACOSA
- 2, Playa Rajada, ACG
- 3, Playa Colorada, ACG
- 4, Playa Potrero Grande, ACG
- 5, Isla Pelada, ACG
- 6, Carate, ACOSA
- 7, Sirena, ACOSA
- 8, Playa San Josecito, ACOSA
- 9, Playa Tamales, ACOSA

Figure 12. Nesting beaches where hawksbill turtles are reported.

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COLOMBIA

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1. RMU *Lepidochelys olivacea*, Eastern Pacific Ocean (LO-EPO)

1.1. Distribution, abundance, trends

1.1.1. Nesting sites

Here, we present the most updated available olive ridley nesting data for the Colombian Pacific. This information comes from three departments (Chocó, Cauca and Nariño). Olive ridley's nesting season in the area takes place from July to December, with nesting peaks in August and September [15, 31].

El Valle, is located nearby National Natural Park (NNP) Utría, and represent the most important nesting rockery for the species at the South American Pacific [9]. The conservation activities started in 1991 by Fundación Natura that included the relocation of nests to in-situ hatcheries. This initiative was determinant for the protection of more than 100,000 hatchlings between 1991 and 2001 [22, 38]. Since then, several governmental agencies, NGOs, and universities, such as, INVEMAR, CODECHOCO, CIMAD, and WWF, Universidad de Antioquia and Universidad del Valle, have been participating in interdisciplinary approaches for conserving and researching olive ridleys in the area.

Work by local community members to monitor of reproductive activities has been of special importance. Since 2008, a group of local enthusiastic —Asociación Caguama— has led monitoring and education activities. These efforts have been coordinated with Fundación Natura, the National Natural Parks, WWF, Patrimonio Natural and CIMAD [Table 2].

Other two important nesting sites and monitoring programs are located at NNP Gorgona and NNP Sanquianga. The Territorial Directorate of National Parks in the Pacific is in charge of monitoring two beaches, Palmeras (NNP Gorgona), and Mulatos (PNN Sanquianga). In Palmeras, from 2005 the NNP park rangers along with volunteers, researchers from several NGOs and Universities, have conducted a systematic monitoring and taken relevant information on demographic aspects of females and hatchlings. The average of nests in this beach is 45.3 nests per year [6, 13, 16, 17, 18, 19, 25, 26]. In Mulatos, an average of 83.6 nests annually have been recorded from nine years of monitoring [35, 36].

Although we are not showing data from the following beaches, there are reports of them as secondary nesting beaches: San Pichí, Jobí, Nuquí, and Tribugá (Chocó Department); Puerto España, Ladrilleros, Punta Bonita, and Isla Ají (El Valle Department); Naranjo, Guayabal, Amarales, Papayal, Boca Grande, Terán, Milagros, and Boca Nueva (Nariño Department) [38].

1.1.2. Marine areas

There is anecdotal information, mainly by fishermen, about the use of neritic and oceanic habitats by *L. olivacea* along the continental and insular waters of the Colombian Pacific. There is no monitoring program to estimate the number of turtles or the size class composition of individuals of this species in the area.

Sea turtles' behaviors at offshore aggregation areas are an unexplored subject in Colombia.
Through observations from opportunity platforms—on the route between Buenaventura and Malpelo—Fundación Malpelo y Otros Ecosistemas confirmed the presence of sea turtles. Sightings were taken of four species (*Lepidochelis olivacea, Chelonia mydas*, *Eretmochelys imbricata*, and *Dermochelys coriacea*) [24].

1.2. Research

All published research studies on olive ridleys have been conducted in El Valle, Palmeras, and Mulatos beaches. Some demographic and reproductive aspects have been characterized, the importance of the area for the conservation of the species has been estimated [6, 9, 13, 14, 15, 16, 17, 18, 19, 25, 26, 35, 36, PS], the genetic characterization of the nesting colony in Palmeras was conducted in 2008 [10], and a genotoxic biomarkers in erythrocytes was assessed at El Valle in 2017 [23].

2. RMU *Chelonia mydas*, Eastern Pacific Ocean (CM-EPO)

2.1. Distribution, abundance, trends

2.1.1. Nesting sites

The nesting density of green turtles is low in the Colombian Pacific. Their nesting season occurs between July and November [33]. The present report only contains quantitative information on a scarce nest in El Valle and Palmeras beaches (Table 2).

2.1.2. Marine areas

The Colombian Pacific is considered an area of importance as a feeding ground and for the development of green turtles. However, all the research on feeding ecology, and population structure has taken in PNN Gorgona. The study and protection of other areas is critical since *C. mydas* can remain in its feeding grounds for more than 20 years before migrating to breeding areas [39].

Sea turtles' behaviors at offshore aggregation areas are an unexplored subject in Colombia.
hrough observations from opportunity platforms—on the route between Buenaventura and Malpelo—Fundación Malpelo y Otros Ecosistemas confirmed the presence of sea turtles. Sightings were taken of four species (*Lepidochelis olivacea, Chelonia mydas*, *Eretmochelys imbricata*, and *Dermochelys coriacea*) [24].

2.2. Research

The Territorial Directorate of National Parks in the has developed a long-term monitoring at La Azufrada, and Playa Blanca in NNP Gorgona. This platform has facilitated the development of the highest quality scientific studies in the country. Among the research on the area, we find the assessment of trophic ecology through traditional tools and stable isotope analysis [2, 28], experiments on food digestibility items [3], genetic composition of the foraging population [4], and the intraspecific variation of two morphotypes [27].

3. RMU *Eretmochelys imbricata*, Eastern Pacific Ocean (EI-EPO)

3.1. Distribution, abundance, trends

3.1.1. Nesting sites

Anecdotal information indicates that hawksbill nests irregularly in the Colombian Pacific. The present report does not provide quantitative data on nesting activities of the species.

3.1.2. Marine areas

NNP Gorgona, NNP Utría, and NNP Sanquianga are recognized as important feeding and development grounds for juveniles of hawksbill. In 2014, an expedition was conducted in NNP Utría, eleven juveniles were captured by-hand, and two satellite tags were deployed. Important data on size class of juveniles have been obtaining from a long-term in-water monitoring in NNP Gorgona [21].

Sea turtles' behaviors at offshore aggregation areas are an unexplored subject in Colombia. Through observations from opportunity platforms—on the route between Buenaventura and Malpelo—Fundación Malpelo y Otros Ecosistemas confirmed the presence of sea turtles. Sightings were taken of four species (*Lepidochelis olivacea, Chelonia mydas*, *Eretmochelys imbricata*, and *Dermochelys coriacea*) [24].

3.2. Research

The Territorial Directorate of National Parks in the has developed a long-term monitoring at La Azufrada, and Playa Blanca in NNP Gorgona. This platform has facilitated the development of the highest quality scientific studies in the country. Trujillo-Arias and collaborators conducted a phylogeographic study comparing individuals from feeding grounds of NNP Gorgona with turtles from three sites in the Colombian Caribbean [31]. More recently, were evaluated some ecological and biological features of the species, among the variables tested the authors assessed some biochemical features on blood samples [29].

4. RMU *Dermochelys coriacea*, Eastern Pacific Ocean (DC-EPO)

4.1. Distribution, abundance, trends

4.1.1. Nesting sites

Anecdotal information indicates that leatherback nests irregularly in the Colombian Pacific. The present report just provides one quantitative data on nesting activities of the species (table 2).

4.1.2. Marine areas

There is anecdotal information, mainly by fishermen, about the use of neritic and oceanic habitats by *D. coriace* along the continental and insular waters of the Colombian Pacific. There is no monitoring program to estimate the number of turtles or the size class composition of individuals of this species in the area.

Sea turtles' behaviors at offshore aggregation areas are an unexplored subject in Colombia. Through observations from opportunity platforms—on the route between Buenaventura and Malpelo—Fundación Malpelo y Otros Ecosistemas confirmed the presence of sea turtles. Sightings were taken of four species (*Lepidochelis olivacea, Chelonia mydas*, *Eretmochelys imbricata*, and *Dermochelys coriacea*) [24].

4.2. Research

In 2016, JUSTSEA Foundation started a scalable project in order to generate the information for evaluating the nature and frequency of fishing interactions and their potential effects on sea turtle' conservation, and to establish collaborative relationships with fishers to promote data sharing and implementation of fishing practices to minimize the impacts of interactions on survivability of released leatherbacks turtles. Finally, the information generated in this study has been shared with broader, region-wide initiatives (Laúd OPO conservation network, Scientific Committee of IAC, and Bycatch Working Group of IATTC) to characterize bycatch of leatherback turtles in the fisheries of South

America and inform management decisions regarding conservation targets under threat reduction scenarios. This research is the first of its kind in Colombia and will lay the groundwork for additional studies and outreach activities.

5. Threats of sea turtles in the Colombian Pacific

5.1. Nesting sites

long-term and unsustainable harvesting of eggs and adult females, alterations of nesting beaches, and a lack of systematic governance for the sea turtle protection. Other threats include the are erosion of nesting beaches and sand extraction.

5.2. Marine Areas

It has been determined through interviews with fishermen, that juvenile and adult turtles are consumed when caught incidentally. In general terms, we do not have quantitative information on the effect of sea turtle bycatches in the Colombian Pacific. It is known through interviews with fishermen that juvenile and adult turtles are caught by artisanal and industrial vessels, by multiple fishing gear.

6. Conservation of sea turtles in the Colombian Pacific

In the last five decades in Colombia, various efforts have been made to protect, conserve, and research sea turtles. However, there are no rigorous population assessments for any of the species in Colombia. It is thus necessary to implement information management systems on demographic aspects to determine key information for the implementation of effective management measures in nesting beaches, and in development and foraging areas [37].

Colombia has signed several treaties that ensure the management and protection of sea turtles. Among these are the Convention of International Trade in Endangered Species of Wild Fauna and Flora (Appendix I), the Bonn Convention (Appendices I and II), the Specially Protected Areas and Wildlife (Appendix II), and the Convention on Biological Diversity. Therefore, it is necessary to generate mechanisms to strengthen compliance with the guidelines set forth in instruments and initiatives directed at the recovery and conservation of species, such as the National Program for the Conservation of Marine and Continental Turtles [22] and the National Migratory Species Plan [20], which have objectives such as “collecting and producing information related to the populations of migratory species present in Colombia”, “Designing, adopting, implementing and administering a specialized system of public information on species migratory,” and “Establishing mechanisms and rules that allow the exchange of information between entities and organizations dedicated to the study and conservation of migratory species at the national level.”

Table 1. Main biology and conservation aspects of sea turtles in the Colombian Pacific.

RMU								
	Lo	Ref#	Cm	Ref#	Ei	Ref#	Dc	Ref#
Occurrence								
Nesting sites	Y	1,6,7,9,13,14,15,16,17,18,19,25, 26,35,36	Y	1,8,19,PS	N	n/a	Y	1
Pelagic foraging grounds	Y	24	Y	24	Y	24	Y	24
Benthic foraging grounds	N	n/a	Y	2	y	19,29	N	n/a
Key biological data								
Nests/yr: recent average (range of years)	Y	Table 2	Y	Table 2	N	n/a	N	n/a
Nests/yr: recent order of magnitude								
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	3	9,26,35,36PS	N	n/a	N	n/a	N	n/a
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	3	1	2	1,8,25,PS	N	n/a	1	1
Nests/yr at "major" sites: recent average (range of years)	Table2	Table2	n/a	n/a	n/a	n/a	n/a	n/a
Nests/yr at "minor" sites: recent average (range of years)	Table2	Table2	Table2	Table2	n/a	n/a	Tabl e2	Table2
Total length of nesting sites (km)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nesting females / yr	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nests / female season (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Female remigration interval (yrs) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Hatchlings (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Immatures (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Adults (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Min adult size, CCL or SCL (cm)	64LCC	26	n/a	n/a	n/a	n/a	n/a	n/a
Age at maturity (yrs)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Clutch size (n eggs) (N)	92(96)	6,19,35,36PS	n/a	n/a	n/a	n/a	n/a	n/a
Emergence success (hatchlings/egg) (N)	0.8(6028)	25,35,36PS	n/a	n/a	n/a	n/a	n/a	n/a
Nesting success (Nests/ Tot emergence tracks) (N)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Trends								
Recent trends (last 20 yrs) at nesting sites (range of years)	(2001-2017)	8,14,14,19,35,36PS	n/a	n/a	n/a	n/a	n/a	n/a

Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a	n/a	(2003-2017)	25,27	(2003-2017)	25	n/a	n/a
Oldest documented abundance: nests/yr (range of years)	91 (1998)	14	n/a	n/a	n/a	n/a	n/a	n/a
Published studies								
Growth rates	n/a	n/a	Y	27	N	n/a	N	n/a
Genetics	Y	10	Y	4	Y	30	N	n/a
Stocks defined by genetic markers	Y	10	Y	4	Y	30	N	n/a
Remote tracking (satellite or other)	N	n/a	Y	See text	Y	See text	n/a	n/a
Survival rates	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Population dynamics	Y	19	Y	27	n/a	n/a	n/a	n/a
Foraging ecology (diet or isotopes)	n/a	n/a	Y	2,3,28	n/a	n/a	n/a	n/a
Capture-Mark-Recapture	Y	19	Y	27	Y	29	n/a	n/a
Threats								
Bycatch: presence of small scale / artisanal fisheries?	Y	PLL,SN,MT	Y	PLL,SN,MT	Y	SN,MT,FP	Y	PLL,SN
Bycatch: presence of industrial fisheries?	Y	Purse seine	Y	Purse seine	Y	Purse seine	Y	Purse seine
Bycatch: quantified?	Y	See text	Y	See text	Y	See text	Y	See text
Take. Intentional killing or exploitation of turtles	Y	7	Y	7	Y	7	Y	7
Take. Egg poaching	Y	7	Y	7	Y	7	Y	7
Coastal Development. Nesting habitat degradation	Y	7	Y	7	Y	7	Y	7
Coastal Development. Photopollution	Y	7	Y	7	Y	7	Y	7
Coastal Development. Boat strikes	Y	7	Y	7	Y	7	Y	7
Egg predation	Y	7	Y	7	Y	7	Y	7
Pollution (debris, chemical)	Y	7	Y	7	Y	7	Y	7
Pathogens	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Climate change	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Foraging habitat degradation	Y	7	Y	7	Y	7	Y	7
Other								
Long-term projects								
Monitoring at nesting sites	Y	19,PS	Y	19	Y	19	n/a	n/a
Number of index nesting sites	2	6,19,PS	N	n/a	N	n/a	N	n/a
Monitoring at foraging sites								

Conservation								
Protection under national law	Y	20,22	Y	20,22	Y	20,22	Y	20,22
Number of protected nesting sites (habitat preservation)	3	See text	3	See text	3	See text	3	See text
Number of Marine Areas with mitigation of threats	4	See text	4	See text	4	See text	4	See text
Long-term conservation projects (number)	3	19,PS, see taxt	3	19,PS, see taxt	3	19,PS, see taxt	n/a	n/a
In-situ nest protection (eg cages)	Y	19	Y	19	n/a	n/a	n/a	n/a
Hatcheries	Y	35,36	Y	PS	n/a	n/a	n/a	n/a
Head-starting	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
By-catch: fishing gear modifications (eg, TED, circle hooks)	Y	See text	Y	See text	Y	See text	Y	See text
By-catch: onboard best practices	Y	See text	Y	See text	Y	See text	Y	See text
By-catch: spatio-temporal closures/reduction	Y	See text	Y	See text	Y	See text	Y	See text

Table 2. Sea turtle nesting beaches in the Colombian Pacific.

RMU / Nesting beach name	Index site	Nests/yr: recent average (range of years)	Crawls/ yr: recent average (range of years)	Western limit		Eastern limit		Central point		Length (km)	% Monitored	Reference #
LO-EPO												
Chaguera	N	8 (2015)						-77.56603	6.78378	1.5	100	1
Tortuguera	N	8 (2015)						-77.56887	6.79421	1.3	25	1
Palmeras - PNN Gorgona	Y	45.3 (2005-2016)						-78.1153	2.5638	1.2	89	6,13,16,17,18,19,25,26
El Valle	Y	142.7 (2008, 2017-2018)	202 (2008)					-77.240462	6.042100	8.2	100	9,PS
Los Mulatos - PNN Sanquianga	Y	83.6 (2008-2017)						-78.285831	2.649719	3	100	35,36
Termales	N	20 (2015)						-77.262906	5.362326			1
CM-EPO												
El Valle	N	3.5 (2007-2008)									100	1,8,PS
Palmeras - PNN Gorgona	N	1 (2007,2011, 2016)						-78.1153	2.5638		89	13,19,25
DC-EPO												
Termales	N	2 (2015)						-77.262906	5.362326			1

Table 3. International conventions protecting sea turtles and signed by Colombia.

International Conventions	Signed	Binding	Compliance measured and reported	Species	Conservation actions	Relevance to sea turtles
CBD: Convention on Biological Diversity	Y		Y	ALL	To conserve the biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources, taking into account all rights over those resources and to technologies, and by appropriate funding.	Marine turtle conservation is relevant to the agreement given the species' importance to overall biological diversity. For example, text in Article 8 states that each contracting party shall: "promote the protection of ecosystems, natural habitats and the maintenance of viable populations of species in natural surroundings" (CBD, 1992).
CITES: Convention on International Trade in Endangered Species of Wild Fauna and Flora.	Y	Y	Y	ALL	An international agreement between governments, the aim of which is to ensure that international trade in specimens of wild animals and plants does not threaten their survival.	All seven species listed in Appendix I of CITES.
Ramsar Convention	Y		Y		It is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.	Based on a MOU between IAC and Ramsar, of the Parties to both Conventions in order to identify and strngthen conservation and wise use of Ramsar Sites (https://www.ramsar.org/sites/default/files/documents/library/mou_seaturtlesconvention_eng_8-7-12.pdf).

Table 4. Organizations and agencies related with sea turtle research and conservation in the Colombian Pacific.

Government Agencies
Ministerio de Ambiente y Desarrollo Sostenible
Instituto de Investigaciones Marinas y Costeras , INVEMAR
Parques Nacionales Naturales de Colombia
Corporación Autónoma Regional del Cauca
Corporación Autónoma Regional del Valle del Cauca
CODECHOCO
Autoridad Nacional de Acuicultura y Pesca
Instituto Alexander von Humboldt
Comminity groups
Asociación Caguama
Consejo Comunitario El Cedro
Grupo Interinstitucional y Comunitario de Pesca Artesanal del Pacífico Chocoano, GIC PA
Comunidad Vereda Mulatos
NGOs
JUSTSEA Foundation
World Wildlife Fund Colombia
Conservación Internacional Colombia
Fundación Conservación Ambiente Colombia
Fundación Tortugas del Mar
Fundación Natura
Centro de Investigación para el Manejo Ambiental y el Desarrollo, CIMAD
Fundación Coriacea
Fundación Malpelo y Otros Ecosistemas
Patrimonio Natural
Fundación Zoológico de Cali

Universities
Universidad Jorge Tadeo Lozano
Universidad de Antioquia
Universidad de los Andes
Pontificia Universidad Javeriana
Universidad del Valle
Fundación Universitaria de Popayán

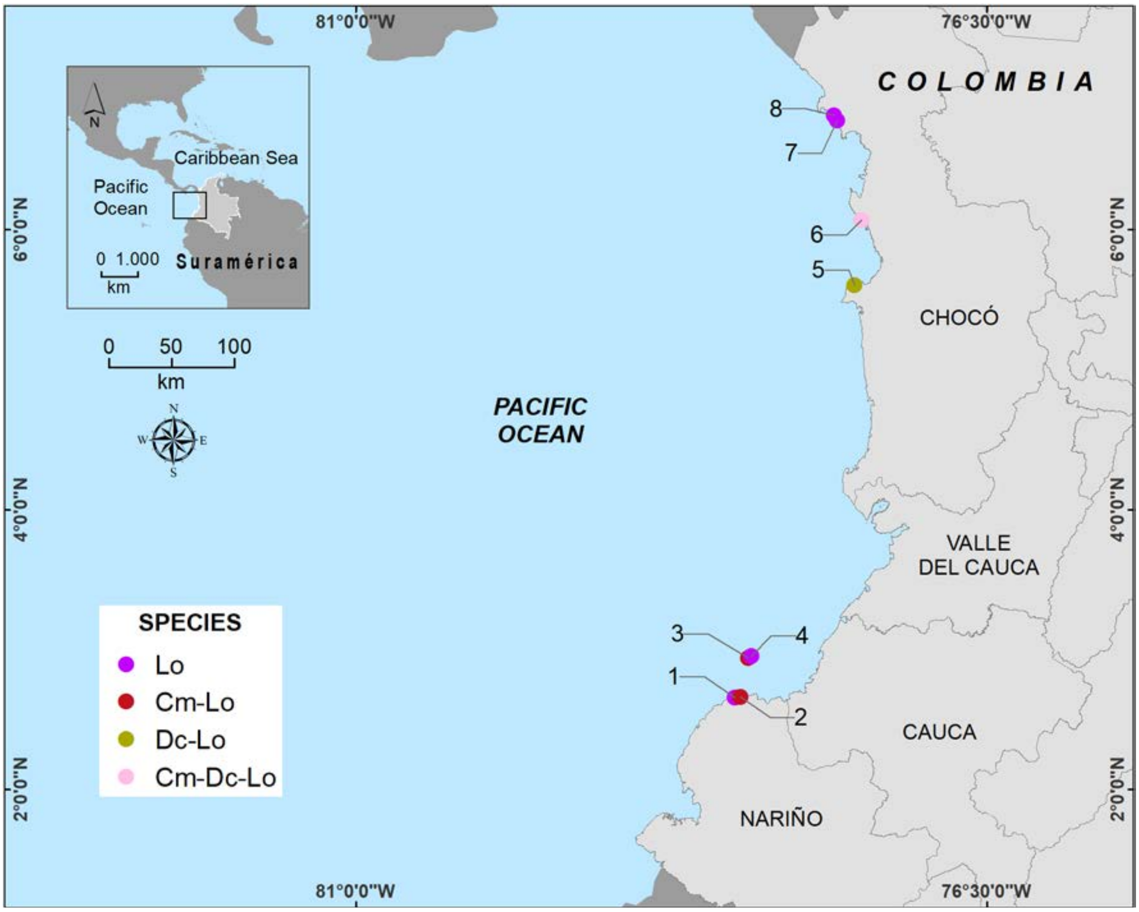

Figure 1. Biogeography and nesting beaches of sea turtles in the Colombian Pacific. 1 and 2. Los Mulatos, PNN Sanquianga, 3. PNN Gorgona, Palmeras, 4. PNN Gorgona, Playa Blanca, 5. Termales, 6. El Valle, 7. Chaguer, 8. Tortuguera.

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General Remarks

The state of Ecuadorian sea turtles, except for the Galapagos Islands, was completely unknown, except for some very few and superficial reports on nesting and stranding events. During the last 10 years this has changed as long-term research and conservation projects have settled along the continental coast, and Galapagos, making incredible advances in sea turtle research, such a re-discovering species that were thought to have disappeared, and in conservation such as protecting the most important beaches for sea turtles along the coast.

Added to this, the Ministry of Environment created a National Sea Turtle Plan (Plan Nacional de Tortugas Marinas) with the purpose of creating a monitoring program along the coast to protect as much nests and learn from the information gathered to contribute to their conservation (62). As a result, all the coastal and marine reserves in Ecuador have a sea turtle monitoring program, collaborate with international agreements such as the IAC, IATTC, Lima Convention, CMS, CITES, etc., and are constantly looking for new was to contribute to sea turtle conservation such as creating biological corridors through the Ministry's Subsecretaría de Gestión Marino with collaboration of local NGOs and universities (61).

There is still a long road ahead for sea turtle research and conservation in Ecuador.

1. RMU *Caretta caretta*, Eastern Pacific Ocean (CC-EPO)

1.1. Distribution, abundance, trends

1.1.1. Nesting sites

No nesting has been registered for this specie in Ecuador.

1.1.2. Marine areas

Loggerhead sea turtles (*Caretta caretta*) have only been registered in Ecuadorian waters through an analysis of the Inter American Tropical Tuna Commission (IATTC) observers' data, collected between 1993-2002, where 383 sightings of loggerheads interacting with the fishery were reported. The locations of these records are at pelagic waters, close to the Galapagos Islands and very few close to continental Ecuador (34). The presence of this specie is occasional.

1.2. Threats

1.3.1. Nesting sites

No nesting has been registered for this species in Ecuador.

1.3.2. Marine areas

Even thought there is not much information about this specie in Ecuador, the only records are from industrial fishery interactions and by-catch from the IATTC on board observer's data. Therefore, the main threat for this specie is by-catch by fishing fleets in pelagic waters with long-lines, or purse seine. Alava, J. J. also reports mortality of loggerhead sea turtles associated to "floating objects" and fishing gear (34).

Only one report of a stranded loggerhead, in 2017, has been registered in Ecuador since the marine-protected areas and the Ministry of Environment rangers and volunteers started monitoring nesting beaches (61).

1.3. Conservation

There are no research or conservation programs taking place in Ecuador for this species in particular. However, Ecuador's legislation protects all species of sea turtles, it is a member of the IAC, IATTC, and Lima Conventions. The use of circled hooks has been promoted but not enforced. By-catch in industrial fisheries is of concern, but an even greater concern is artisanal fisheries by-catch as it is not quantified or monitored.

1.4. Research

There is an enormous gap in knowledge regarding this species. Its presence is confirmed in Ecuadorian waters, however there is no data regarding its abundance, distribution or conservation. The only existent data is 15 years old; a more recent analysis of the IATTC observers' data is necessary.

2. RMU *Chelonia mydas*, Eastern Pacific Ocean (CM-EPO)

2.1. Distribution, abundance, trends

2.1.1. Nesting sites

Green sea turtles are found nesting in continental Ecuador as well as in the Galápagos Islands. Abundance should be differenced between Galapagos Islands and continental Ecuador due to the high differences present.

In continental Ecuador they nest mostly in 15 beaches in the southern part of the coast, however only one index nesting site has been identified in Bahía Drake, La Plata Island, Machalilla National Park, with an average of 48 nests per year (13). At this site, between 2008-2013, a total of 81 nesting females were identified (50). Another index beach is hypothesized in Playa Dorada, a 300m long beach in a private reserve in Machalilla National Park's influence area, where an average of 12.7 nests per year have been reported between 2014-2016 (43), however further research is required to confirm the data of this site. In the remaining beaches, the average nests per year are between 1- 8.3 (1-15). Fig 1.

The Galápagos Islands are amongst the largest aggregation sites and nesting grounds for green sea turtle in the entire eastern Pacific with the highest abundance (45, 46, 48). There is nesting activity reported in almost the entire archipelago (47) but of sporadic nature; it is estimated that there are more than 100 nesting beaches (58), but the most important identified so far are Quinta Playa and Barahona Bay in Isabela Island, Las Bachas in Santa Cruz and Las Salinas in Bartolomé. Between 1999-2001 a total of 3790 nests were recorded in these 4 beaches (45). Since then, much of the research on nesting sea turtles is focused on Quinta Playa, Barahona Bay and Las Bachas due to the high nesting abundance these three beaches show with an average of 2769, 1726 and 613 nests respectively between 2009 and 2013, plus the nesting season of 2015 (10,11, 58). Other beaches of less abundance are also monitored (with less effort) such as the iconic Tortuga Bay in Santa Cruz Island where in 2015 46 nests were reported (11). There are some gaps in the latest nesting data; the data available for the nesting seasons 2013-2014 and 2015-2016 is incomplete (19, 26). Fig 2.

2.1.2. Marine areas

Green sea turtles, both black and yellow morphs, are found in rookeries, reefs and aggregation sites of continental Ecuador and the Galapagos Islands.

In continental Ecuador, the most important aggregation site for this species is La Plata Island in Machalilla National Park where, between 2008-2013, a total of 403 individuals were identified through capture-recapture (50). This specie is also associated to human activities; there is an aggregation of this species at Puerto López' port, where fish scraps attract green sea turtles and are observed feeding.

The Galápagos Islands represents one of the most abundant sites for green sea turtles in the eastern Pacific (47, 48, 75). The most important foraging grounds are Punta Espinoza, Bahia Elizabeth, Caleta Derek and Punta Nuñez, where between 2000-2008 a total of 1065 turtles were captured and tagged (69). More recently, in 2015, 623 green sea turtle individuals were identified in San Cristobal Island on just 3 sites and 35 boat surveys (52).

In terms of migration, four types of migratory patterns have been established for nesting green sea turtles from Galapagos: 1. Residents. 2. Migrating to Central America. 3. Migrating to the continent (South America). 4. Southwest oceanic migrations (48). Furthermore, a migratory connection between the Galápagos Islands and continental Ecuador has been identified by genetic analysis of green sea turtles in Machalilla National Park and the Galapagos, showing no genetic differences between the two sites (40) and also through capture-recapture programs where one individual tagged at Isla de La Plata (continent) was observed nesting at Quinta Playa-Isabela, Galapagos (50).

The Galapagos Islands seems to be amongst the most important rookeries in the EP as it provides of turtles for foraging areas of the entire eastern Pacific and the main contributing rookery for green sea turtles in the South American eastern Pacific (57, 76-81).

2.3. Threats

2.3.1. Nesting sites

The main index nesting sites for green sea turtles are located inside protected areas and National Parks where there are little human threats such as habitat destruction or artificial lights. Bahía Drake is the most important nesting site in continental Ecuador; it is a protected beach in Isla de la Plata-Machalilla National Park. However, nests there are threatened with sea level rise, as it is a very narrow beach. Nests have to be moved to a hatchery every season.

In other beaches, where even though the nesting activity for this specie is less abundant, threats are habitat destruction due to coastal development and sand removal, artificial illumination, depredation by feral and domestic dogs, and to a minimal extent egg and turtle poaching, which is illegal.

In the Galápagos Islands threats to nests by human activities are minimal, most of the beaches are away from human settlements and are of very difficult access. Tortuga Bay in Santa Cruz Island has the highest threats to its nests as it is a highly touristic beach where not only do thousands of visitors go every year, but public events from the Santa Cruz municipality have also taken place at this beach. A reported threat to nests in Galapagos comes from native and introduced species such as flies, beetles, ghost crabs and feral pigs; inundation is also a cause of nest failure (68, 71).

2.3.2. Marine areas

Green sea turtles in Ecuador interact with fisheries; they are constantly attracted to boats, nets and longlines. A big amount of sea turtles at Isla de La Plata are observed with hooks and other injuries produced by fishing gear. The Marine Animal Rehabilitation Center of the Machalilla National Park (Centro de Rehabilitación de Fauna Marina del Parque Nacional Machalilla) constantly treats sea turtles with injuries from boat strikes and/or fishing gear (that are brought from all around the continental coast). Up to March 2017, the center had rehabilitated and released 103 sea turtles, however the species are no specified (51).

On both continental Ecuador and Galápagos green sea turtles are threatened by boat strikes (52). In 2014, the Charles Darwin Foundation reported that out of 1458 nesting females evaluated in Quinta Playa, 12% had injuries due to boat strikes (53).

In La Plata Island (continent) they are fed by tourism boats, possibly creating an association with boats and food, which could increase boat strikes and by-catch.

2.4. Conservation

Ecuadorian law protects this specie. Between 1994-1995 a total of 76 green sea turtle strandings due to trawling (83) and more recently a total 255 have been found straded (between 2014-2017) by the Ministry of Environment beach monitoring program (61). There are reports of by-catch with gillnets, long-line and trawling. The government as well as the IACCT have prometed the use of Turtle Exclusion Devices (TEDs) and circled hooks, however it is only a suggestion, not an obligation.

In continental Ecuador the Equilibrio Azul Foundation has research programs with this specie both in nesting beaches and in-water, as well as environmental education with children and fisherman. The ministry of environment with the Plan Nacional de Tortugas Marinas has a monitoring program in nesting beaches along the coast and protecting nests while working with local communities that live in or close to the nesting beaches (62). In Galápagos, the National Park has a monitoring program for two beaches: Las Bachas (Santa Cruz Island) and Quinta Playa (Isabela Island). The Galapagos Science Center (GSC) from San Francisco de Quito University San Francisco works with the "Tortuga Negra" project that focuses on green sea turtle in-water research working with the black and yellow morphs, mainly in San Cristobal island.

2.5. Research

Equilibrio Azul, the Galapagos Science Center-Proyecto Tortuga Negra from San Francisco de Quito University, and the Charles Darwin Foundation are the main entities researching this specie.

Much of the information that has been researched by the National Parks and/or by different NGOs since 2008 has not been published yet, both for Galápagos and for the rest of continental Ecuador. This research is focused on population dynamics and sizes, migratory patters, interaction with fisheries, boat strikes, the effects of ocean pollution on sea turtles, amongst other.

There is very important information from the observer programs from the government and/or the IACCT that is not readily available for the general public or scientific community, which should be easily available for researchers.

3. RMU *Eretmochelys imbricata*, Eastern Pacific Ocean (EI-EPO)

3.1. Distribution, abundance, trends

3.1.1. Nesting sites

Up until 2008, this species was thought to be extinct in Ecuador as well as in the entire eastern Pacific Ocean; there were very few reports of crawls on beaches that were thought to belong to this species, and few reports of by-catch (54). In 2008, La Playita in Machalilla National Park was found not only to host hawksbill nesting females, but to have important numbers of nests for such a diminished population (55). Since then 14 nesting beaches have been identified, 2 of them being index beaches, with more than 10 nests per km/year. These 2 beaches are La Playita in Machalilla National Park, south-central Ecuador with a mean of nearly 30 nests per year (1-3,35) and Playa Rosada (including the small adjacent beach of Chipi-Chipi; these two are only separated by a small patch of intertidal zone and the monitoring efforts are the same, so for the purpose of this report they are considered the same beach) in El Pelado Marine Reserve, south of Ecuador, with a mean of 41 nests per year (9, 17, 35, 44). Fig 3.

There is one more beach that requires further research, but is hypothesized to be of great importance for hawksbill sea turtles: Playa Dorada, a private reserve within the influence area of Machalilla National Park, that has reported only nearly 3 nests per year, but has not been monitored thoroughly and probably has a greater number of nests for these specie (43). Fig 3.

A total of 54 nesting females have been identified in Ecuador, 44 from Machalilla National Park, and 10 from El Pelado, with around 5 nesting each year in Machalilla Naitonal Park. Tagging efforts of females in Machalilla National Park are close to their saturation point (35).

3.1.2. Marine areas

A long-term research study taking place by Equilibrio Azul has identified Machalilla National Park's rocky and coral reefs as the most important foraging grounds for juveniles and adults of this species. Within this study, from 2008 to 2016 a total of 143 hawksbill captures were done in a small area of fragmented reefs of Machalilla National Park, identifying around 60 hawksbill individuals. Of those captures, 71% were juveniles, 15% adult females and 13% adult males (38). Other foraging grounds are hypothesized based on by-catch, in-water census, and personal communications with local people and fisherman in rocky and coral reefs in El Pelado Marine Reserve, Reserva de Producción de Fauna Marina Costera Puntilla de Santa Elena, Isla Puná, Archipiélago de Jambeli, and the mangrove estuary of San Lorenzo in Esmeraldas Province. By-catch reports suggest that the Galera-San Francisco Marine Reserve could also be an aggregation site and foraging ground.

Through satellite telemetry on nesting females, a migratory route has been identified after breeding seasons from Machalilla National Park: nesting females migrate south of Ecuador after nesting and stay in mangrove estuaries and islands for the rest of the year/s (37-39,73, 74, 82, PS), on average they remigrate to their nesting ground in Machalilla National Park after 1.9 years (35). The only female tagged so far at Playa Rosada showed the same behavior (44). Some of the females tagged also visited and stayed at other reefs and rookeries such as Anconcito, south of Machalilla National Park, in Santa Elena province.

Neonate hatchlings have also been acoustically tracked, showing to migrate to pelagic waters, and 2 one-year old juveniles have been satellite tracked showing to migrate north to pelagic waters. This is an ongoing project (82).

This species has predominantly coastal behavior in continental Ecuador (36). Telemetry has also taken place in San Cristobal Island, Galapagos, showing no specific migratory patterns and staying within the Islands' reefs, close to shore (39).

Through capture-recapture, connectivity between the Galápagos Islands and continental Ecuador has also been confirmed; Equilibrio Azul captured a male hawkwbill in 2016 in Machalilla National Park that had originally been tagged as a juvenile in the Galapagos Islands by Patricia Zárate (PS).

Strandings and by-catch for this species are not common, which could be related to little abundance of this specie; the Ministry of Environment has reported a total of 11 stranded hawksbills between 2016-2017 (61).

3.2. Other biological data

An adult male hawksbill that was rehabilitated at Machalilla National Park's Rescue center, after being kept as a pet was found to have mangrove roots and seeds in his stomach (84).

3.3. Threats

3.3.1. Nesting sites

Nesting sites for hawksbill sea turtles are threatened mainly due to habitat destruction for development and artificial illumination. Despite the index beaches being inside protected areas, Playa Rosada in El Pelado Marine Reserve has been altered with the construction of tourism facilities, and there are plans for the construction of a big development right behind the beach. Development has increased artificial illumination and nest destruction, as well as access of invasive and destructive species such as feral and domestic dogs. Vegetation on beaches is often destroyed (burned or cut down); most hawksbills seek vegetation when nesting at La Playita (there is no vegetation left al Playa Rosada) (PS).

La Playita in Machalilla National Park is a protected beach with restricted access to the public; the conservation of hawksbill sea turtles was the purpose restricting access to this beach since 2008; however in 2016 a new tourist trail was opened to increase tourism in the area with an agreement with a local community (Salango). The creation of this trail has increased the number of people entering the beach during the day or illegally camping on it (with threats such as bonfires, dogs, and trash coming with it) even though access is now only allowed with a guide from the Salango community. The National Park has no resources to have Park rangers at this trail controlling the entrance and monitoring the beach. As a result in the 2016-2017 nesting season two hawksbill nests were stolen from the beach (PS).

Nesting beaches outside protected areas, or with communities living next to them, are threatened with destruction by development projects, sand extraction, vehicle entrance, artificial illumination, depredation by feral and domestic dogs and pigs, and illegal egg harvesting. In the past ten years a construction boom has taken place in the coast of Ecuador accelerating the destruction of habitat to build homes, hotels and government facilities and infrastructure (boardwalks), without rational management plans or zoning of beaches and nesting habitats.

Specifically, in the beach of Puerto López, a 2 km beach boardwalk was built on 2016 taking up to 16 meters of the width of the beach in some areas, making it less suitable for hawksbills sea turtles to nest. The boardwalk was illuminated with no regards towards nesting sea turtles. As a result, cars get in the beach to park during weekends and holidays on the southern part of the beach (the most suitable hawksbill habitat). Hawksbills have already been observed trying to nest next to the concrete walls of the boardwalk, people carrying the turtles when they've seen them on the beach and hatchlings going towards the illumination and dying. Sand extraction is also a big problem on this beach.

3.3.2. Marine areas

- Habitat destruction from infrastructure: As part of the construction boom in Ecuador in the last several years there has been several big scale artisanal fishing ports built, some of them in known rookeries for this specie and even inside Marine Protected Areas known to be the most important foraging ground for juveniles of this specie, such as in Machalilla National Park. Despite the protection that the Law gives to coral and rocky reefs, the special protection through IAT for hawksbill foraging habitat, and the special protection given to National Parks in Ecuadorian law, in 2017 a big artisanal fishing port was constructed in the southern limit of Puerto Lopez in a foraging ground for hawksbills.
- Habitat destruction from anchors (artisanal fishing boats and tourism boats)
- Overexploitation of reefs (even inside the protected areas) by artisanal fisherman.
- Shrimp trawling.
- Driftnets within foraging and aggregation areas, and especially inside protected areas.
- Pollution with fuel and oil spills (from industrial and artisanal fishing boats)
- Plastic, ghost nets, and fishing gear trash.
- By-catch and direct catch: there is a limited black market of hawksbill shell for artisanal jewelry and in (probably) a bigger scale for cock fighting spurs Further research is required to quantify the real impact of these markets.

3.4. Conservation

Hawksbill sea turtles are of particular interest considering their Critically Endangered status. Ecuador is also a signatory of the IAC that has a special issue on protecting hawksbill sea turtles and their habitats. Furthermore, Ecuador's legislation has coral reefs and mangroves under protection, thus protecting important hawksbill habitat.

-Protected under CITES, IAC and the Plan Nacional de Tortugas Marinas.
- Their most important nesting grounds are in protected areas: Machalilla National Park (the most important protected area in the coast) and El Pelado Marine Reserve.
-New marine reserves that connect both nesting grounds with their foraging areas are being established, such as the Machalilla-Cantagallo Marine Reserve: a reserve that will connect Machalilla National Park with El Pelado and will control and manage fisheries by banning large scale and industrial fisheries and specially trawlers.

There are 3 long-term projects taking place with this species: Ecuador Mundo Ecológico Foundation works in nesting beaches in El Pelado Marine Reserve.

Equilibrio Azul works at nesting beaches, foraging grounds and aggregation sites in continental Ecuador, with special emphasis on Machalilla National Park. The Galapagos Science Center – Proyecto Tortuga Negra from San Francisco de Quito University works with hawksbills in foraging areas in the Galapagos Islands. All three organizations are part of the Eastern Pacific Hawksbill Initiative, ICAPO, that seeks to reaserch.

Recommendations: it is important for the Ministry of Environment to work with NGOS and universities that are doing research by providing the information and using the information collected by researchers. Hawksbill shells are still observed in various towns and especially in cock-fighting pits. The construction of boardwalks on beaches should be reconsidered, banning any type of construction on beaches, including their vegetation zone, which is of most importance for hawksbills.

3.5. Research

There are several research projects in continental Ecuador and Galapagos working with hawksbill sea turtles. Also, the Eastern Pacific Hawksbill Initiative, through its local partners – Equilibrio Azul, Ecuador Mundo Ecológico and Galapagos Sciencie Center-Proyecto Tortuga Negra are doing long-term research.

There are still great knowledge gaps regarding this specie, especially in-water. There is data from 2008 on foraging grounds, migration and nesting that should be urgently published.

4. RMU *Dermochelys coriacea*, Eastern Pacific Ocean (DC-EPO)

4.1. Distribution, abundance, trends

4.1.1. Nesting sites

For a long time it was believed that this specie only used Ecuadorian waters, far away from the continent. This specie is scarce in Ecuador; very few nests have been registered in the last several years (one per year). There are 5 beaches where nesting has been reported, two of the nests were monitored, but none was successful. Fig 4

There is no more information regarding nesting or abundance of females for this specie.

4.1.2. Marine areas

Through satellite tracking of nesting females from Central America it is known that this species uses Ecuadorian waters when migrating to southern eastern Pacific waters such as Chilean (85).

However, there is also data from by-catch and interaction with fisheries for this specie in Ecuadorian waters, both close to the Galapagos Islands and close to continental Ecuador (59, PS). In a tri-national survey project conducted by the IUCN SSC Marine Turtle Specialist Group and NFWF, two fishing ports in Ecuador (Manta and Santa Rosa) were found to be of great significance in leatherback bycatch using gillnets and longlines, placing Ecuador as a “high-bycatch zone”; other ports in the country were also identified to contribute to bycatch of this species such as Esmeraldas, Anconcito and Puerto Bolivar (86-87).

Anectotal data from artisanal fishermen seems to suggest that this species uses Ecuadorian waters constantly, and that there even seems to be presence of juveniles. Some fishermen have reported to have caught up to 4 juveniles leatherback turtles in one single set of gillnets (PS), however further research is required.

Stranding data from the Ministry of Environment have reported 5 stranded individuals since 2015 (61), plus one report by Equilibrio Azul (31) (Fig. 5).

4.3. Threats

4.3.1. Nesting sites

Although there is not much nesting activity for this specie in Ecuador, habitat destruction is still a threat for the very few nests reported. The invasion of the beach with constructions, walls and boardwalks, as well as with artificial illumination and sand extraction is a problem in the entire coast.

Some anecdotic nesting records for this specie reported leatherback turtles nesting against concrete walls with the tide crushing on to them in Same beach, Esmeraldas province (PS).

The few nests reported in the last 4 years have all been unsuccessful. There is no information available on the excavation of these nests, but anecdotical information suggests that all the eggs in one nest in San Lorenzo beach did not develop (8, 12, 27).

4.3.2. Marine areas

By-catch is the greatest threat for this specie in Ecuador (continental and Galapagos) The stranding information for this specie shows interaction with fisheries such as wounds on the anterior flippers.

4.4. Conservation

As with all other sea turtle specie, this specie is protected under Ecuadorian laws. There is an agreement with the IACCT to promote TEDs and circle hooks with the tuna fleet, however there is no program or control to reduce by-catch with the artisanal fishery.

The NFWF had a 10-year plan developed in 2013 for the conservation of the eastern Pacific leatherback population that included Ecuador, considering that it is a “high-by-catch zone”, with the objective to reduce by-catch of this species in the area (87).

Ecuadorian organizations, such as Equilibrio Azul are part of the LAUD OPO (Red Laud del Océano Pacífico Oriental) network that seeks to “protect, monitor and recover the east Pacific leatherback" based on the "A 10-year plan to stabilize the East Pacific Leatherback Regional Management Unit and reverse the current population trend to a recovery trajectory" (87).

Equilibrio Azul has a project with artisanal fisherman to report any interaction with this specie (and any specie of sea turtles); in this project fisherman are the citizen scientists who take photos of the turtles, GPS points of the location of the turtles, if they can measure them, take DNA samples, and release them alive.

4.5. Research

There is a huge gap in knowledge about this specie in Ecuador, both in nesting activity as in water.

The only existent data comes from stranding events, few nests that were monitored by the Ministry of Environment of Ecuador, and fishery interaction from the IACCT and port-based surveys; all this information should be urgently published or made available to researchers working with this specie.

5. RMU *Lepidochelys olivacea*, Eastern Pacific Ocean (LO-EPO)

5.1. Distribution, abundance, trends

5.1.1. Nesting sites

This is the most abundant specie nesting in continental Ecuador with several index beaches as well as erratic nesting events found in the entire coast (PS).

Forty nesting beaches have been identified with constant nesting every year and which have monitoring efforts. Of these, 10 are index beaches, but further research is needed; there are many beaches from Ecuador that are not monitored or have never been monitored and that are potential nesting grounds for this specie. The most important nesting beaches are located in Manabí province, south-central Ecuador, in the Refugio de Vida Silvestre Pacoche (Pacoche Wildlife Reserve) and its surrounding areas with an average of 127 nests per year on its main beach, San Lorenzo, followed by 95 nests in La Botada beach, also within the reserve. In Esmeraldas province, north of Ecuador, Portete beach and Las Palmas are next in abundance with 77 and 88 nests per year, respectively. Fig. 6.

Research and beach monitoring is recent for most of continental Ecuador, especially for this species; probably as the monitoring efforts improve the number of nesting beaches and abundance will increase for this specie. Despite being the most abundant nesting specie, there is no data regarding number of females, remigration intervals, number of nests per female, etc. Most monitoring takes place through diurnal patrols.

5.1.2. Marine areas

No research has taken place in marine areas for this specie; there is no information regarding their foraging grounds, mating areas and migratory corridors; however, this species has constant interaction with fisheries and the stranding information available suggests high in-water abundance.

Olive-ridleys are the most common specie found stranded on beaches on the entire coast. In 1999 more than 1500 individuals of this species were found stranded along the continental coast (83). The Ministry of Environment, through the beach monitoring program conducted by the Subsecretaría de Gestión Marino-Costera, has reported a total of 418 olive-ridley stranding events along the coast between 2014-2017 (61). It is also the most common specie at Machalilla National Park's Marina Fauna Rescue Center (84).

From a by-catch study conducted by Equilibrio Azul between 2009-2010, this specie was the one with the most interaction with long-line artisanal fisheries from the four species observed (green, hawksbill, leatherback and olive-ridley). A total of 92 olive-ridley sea turtles 'fell' in the long-line, representing 71% of all sea turtle bycatch during the study; the study had an effort of approximately one vessel per day. It is important to note that the study was conducted in pelagic waters, between 12 and 90 miles from the central coast of continental Ecuador. (59).

5.3. Threats

5.3.1. Nesting sites

The main threats for this species nesting sites are the following:

- Coastal development and artificial illumination
- Egg harvesting
- Climate change and rising seas
- Introduced animals such as feral and domestic dogs and pigs
- Removal of beach sand

The last two may be the biggest direct threats for this species. For example, in Portete, Esmeraldas province, dogs destroyed 100% of the nests prior to sea turtle conservation projects being established by Equilibrio Azul in 2011 (30) and later by the Ministry of Environment of Ecuador. Other beaches such as Las Tunas, Manabi have around 40% of the nests destroyed by dogs (more research is required at this beach to have better estimates of nests per year and percentages of destruction (43). Most of the dogs that destroy nests in Ecuador are not feral but free roaming domestic pets. Furthermore coastal development is rapidly diminishing the available nesting habitats for this specie.

Sand removal is also a great problem, as it occurs in every beach with a community or town close to it. Some beaches such as San Lorenzo in the Pacoche Wildlife Reserve have reduced the impact of this threat by establishing zones where the community can extract sand and no-extraction zones to protect nests.

The use and sale of sea turtles eggs is banned in Ecuador however when given the opportunity people harvest the eggs for self-consumption. The same goes for sea turtle meat and blood; if people happen to encounter sea turtles or their nests, they will make use of them, especially in beaches in the north of the country such as in Esmeraldas province (30, 31). This situation is very rare south of the country, but it has been reported in Las Tunas and in Playa Dorada, Manabi province (43).

5.3.2. Marine areas

The main threat in marine-areas for this species, based on stranding information and in the fact that the aggregation site is unknown, is by-catch and fishery interactions. A great percentage of the stranded olive ridleys are found with severe injuries on their skulls and carapace, possibly caused to avoid entanglement or to disentangle them from fishing gear (30, 31, 61, 84). On a series of surveys conducted to artisanal fisherman in Esmeraldas province during 2012, 83% admitted to hit turtles on the head with sticks to numb them in order to release them from the nets (30).

From a by-catch study conducted between 2009-2010, this specie was the one with the most interaction with long-line artisanal fisheries from the four species observed (green, hawksbill, leatherback and olive-ridley). A total of 92 olive-ridley sea turtles 'fell' in the long-line, representing 71% of all sea turtle bycatch during the study. It is important to note that the study was done in pelagic waters, between 12 and 90 miles from the central coast of continental Ecuador. (59).

5.4. Conservation

All sea turtles are protected in Ecuador. The main index beaches for this species are protected. San Lorenzo and La Botada were already part of the Pacoche Wildlife Reserve prior to sea turtle monitoring, but since they have a local community great effort have been put into environmental education and conservation. Portete beach was recently included as part of the Refugio de Vida Silvestre Manglares Estuario del Rio Muisne (Muisne River Estuary Wildlife Reserve) after evidencing the nesting abundance it has, however there are very limited resources for its real protection and nest destruction by dogs continues to be a problem.

Las Palmas beach is the main beach of the city of Esmeraldas, the biggest in northern Ecuador, and adjacent to the largest oil refinery of the country. The problems here are habitat destruction, artificial illumination, nest destruction and obstruction by human activities and sand removal. Research and nest protection on this beach are very recent and is conducted by the Ministry of Environment of Ecuador; their efforts have managed to protect a great percentage of the nests that this important beach holds, and environmental education with the local tourism is taking place.

5.5. Research

Despite this specie being the most abundant nesting in Ecuador, the information gathered is limited to number of nests. Most of the monitoring is diurnal so there is little information on females, capture-recapture, clutch frequency, etc., but the work done in the last couple of years is very promising.

Table 1. Main biology and conservation aspects of sea turtles in Ecuador.

RMU	Eastern Pacific CC	Ref #
Occurrence		
Nesting sites	N	
Pelagic foraging grounds	Y	34
Benthic foraging grounds	N	
Key biological data		
Nests/yr: recent average (range of years)	n/a	
Nests/yr: recent order of magnitude	n/a	
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	n/a	
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	n/a	
Nests/yr at "major" sites: recent average (range of years)	n/a	
Nests/yr at "minor" sites: recent average (range of years)	n/a	
Total length of nesting sites (km)	n/a	
Nesting females / yr	n/a	
Nests / female season (N)	n/a	
Female remigration interval (yrs) (N)	n/a	
Sex ratio: Hatchlings (F / Tot) (N)	n/a	
Sex ratio: Immatures (F / Tot) (N)	n/a	
Sex ratio: Adults (F / Tot) (N)	n/a	
Min adult size, CCL or SCL (cm)	n/a	
Age at maturity (yrs)	n/a	
Clutch size (n eggs) (N)	n/a	
Emergence success (hatchlings/egg) (N)	n/a	
Nesting success (Nests/ Tot emergence tracks) (N)	n/a	

Trends		
Recent trends (last 20 yrs) at nesting sites (range of years)	n/a	
Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a	
Oldest documented abundance: nests/yr (range of years)	n/a	
Published studies		
Growth rates	N	
Genetics	N	
Stocks defined by genetic markers	N	
Remote tracking (satellite or other)	N	
Survival rates	N	
Population dynamics	N	
Foraging ecology (diet or isotopes)	Y	
Capture-Mark-Recapture	N	
Threats		
Bycatch: presence of small scale / artisanal fisheries?	N	34
Bycatch: presence of industrial fisheries?	Y (PLL, SN, BT)	34
Bycatch: quantified?	N	34
Take. Intentional killing or exploitation of turtles	N	
Take. Egg poaching	n/a	
Coastal Development. Nesting habitat degradation	n/a	
Coastal Development. Photopollution	n/a	
Coastal Development. Boat strikes	N	
Egg predation	n/a	
Pollution (debris, chemical)	n/a	

Pathogens	n/a	
Climate change	n/a	
Foraging habitat degradation	n/a	
Other	N	
Long-term projects		
Monitoring at nesting sites	N	
Number of index nesting sites	n/a	
Monitoring at foraging sites	N	
Conservation		
Protection under national law	Y	
Number of protected nesting sites (habitat preservation)	n/a	
Number of Marine Areas with mitigation of threats	n/a	
Long-term conservation projects (number)	n/a	
In-situ nest protection (eg cages)	n/a	
Hatcheries	n/a	
Head-starting	n/a	
By-catch: fishing gear modifications (eg, TED, circle hooks)	BT,PLL	
By-catch: onboard best practices	Y	
By-catch: spatio-temporal closures/reduction	N	
Other	N	
RMU	**Eastern Pacific CM**	Ref #
Occurrence		
Nesting sites	Y	1-15, 58
Pelagic foraging grounds	A	48, 56

Benthic foraging grounds	JA	48, 56, 64-67
Key biological data		
Nests/yrCONTINENT: recent average (range of years)	7.7 (2012-2017)	
Nests/yrGALAPAGOS: recent average (range of years)	1536.7 (2013-2016)	
Nests/yrCONTINENT: recent order of magnitude	1_48	
Nests/yrGALAPGAOS: recent order of magnitude	46-2769	
Number of "major" sites GALAPAGOS (>20 nests/yr AND >10 nests/km yr)	4	10, 11, 45, 58,
Number of "major" sites CONTINENT (>20 nests/yr AND >10 nests/km yr)	1	50
Number of "minor" sites GALAPAGOS (<20 nests/yr OR <10 nests/km yr)	100	45, 58
Number of "minor" sites CONTINENT (<20 nests/yr OR <10 nests/km yr)	14	1-15, 50
Nests/yr at "major" sitesCONTINENT: recent average (range of years)	30.3 (2011-2016)	50
Nests/yr at "major" sitesGALAPAGOS: recent average (range of years)	1536.7 (2013-2016)	58
Nests/yr at "minor" sitesCONTINENT: recent average (range of years)	0.0	1_15
Nests/yr at "minor" sitesGALAPAGOS: recent average (range of years)	n/a	
Total length of nesting sites (km) GALAPAGOS	#VALUE!	
Total length of nesting sites (km) CONTINENT	30.954	
Nesting females / yr CONTINENT	28.7	50
Nesting females / yr GALAPAGOS	2005	45, 58
Nests / female season (N)	2.3 (4769)	58
Female remigration interval (yrs) (N) GALAPAGOS	4.7 (884)	58
Female remigration interval (yrs) (N) CONTINENT	n/a	
Sex ratio: Hatchlings (F / Tot) (N)	n/a	
Sex ratio: Immatures (F / Tot) (N)	n/a	
Sex ratio: Adults (F / Tot) (N)	n/a	
Min adult size, CCL or SCL (cm)	69 cm	45
Age at maturity (yrs)	n/a	

Clutch size (n eggs) (N) GALAPAGOS	82.9 (3790)	45
Clutch size (n eggs) (N) CONTINENT	n/a	
Emergence success (hatchlings/egg) (N) GALAPAGOS	45.6 (1039)	71
Emergence success (hatchlings/egg) (N) CONTINENT	n/a	
Nesting success (Nests/ Tot emergence tracks) (N) GALAPAGOS	0.66 (16869)	58
Nesting success (Nests/ Tot emergence tracks) (N) CONTINENT	n/a	
Trends		
Recent trends (last 20 yrs) at nesting sites (range of years) GALAPAGOS	n/a	
Recent trends (last 20 yrs) at nesting sites (range of years) CONTINENT	n/a	
Recent trends (last 20 yrs) at foraging grounds (range of years) GALAPAGOS	n/a	
Recent trends (last 20 yrs) at foraging grounds (range of years) CONTINENT	n/a	
Oldest documented abundance: nests/yr (range of years)		
Published studies		
Growth rates	Y	69
Genetics	Y	40, 63, 70
Stocks defined by genetic markers	Y	70
Remote tracking (satellite or other)	Y	64,41, PS
Survival rates	N	
Population dynamics	Y	40, PS
Foraging ecology (diet or isotopes) GALAPAGOS	Y	64-67
Foraging ecology (diet or isotopes) CONTINENT	N	
Capture-Mark-Recapture	Y	58, 45, 69, PS
Threats		

Bycatch: presence of small scale / artisanal fisheries?	Y	59, 83
Bycatch: presence of industrial fisheries?	Y (PLL,DLL,SN,DN,ST,MT,PT)	
Bycatch: quantified?	N	
Take. Intentional killing or exploitation of turtles	N	
Take. Egg poaching	N	
Coastal Development. Nesting habitat degradation	Y	PS
Coastal Development. Photopollution	Y	PS
Coastal Development. Boat strikes	Y	52, 53
Egg predation	Y	68, 71
Pollution (debris, chemical)	Y	52
Pathogens	Y	42
Climate change	n/a	
Foraging habitat degradation	Y	PS
Other	Y	68
Long-term projects		
Monitoring at nesting sites	Y	PS
Number of index nesting sites	4	
Monitoring at foraging sites	Y	PS
Conservation		
Protection under national law	Y	62
Number of protected nesting sites (habitat preservation)	11	62
Number of Marine Areas with mitigation of threats	10	62
Long-term conservation projects (number)	6	
In-situ nest protection (eg cages)	Y	
Hatcheries	Y	

Head-starting	n/a	
By-catch: fishing gear modifications (eg, TED, circle hooks)	BT,PLL	
By-catch: onboard best practices	Y	
By-catch: spatio-temporal closures/reduction	N	
Other	N	
RMU	**Eastern Pacific EI**	Ref #
Occurrence		
Nesting sites	Y	1-5,9,14,16-20,44,35
Pelagic foraging grounds	J	82
Benthic foraging grounds	JA	1,2,4,36,37
Key biological data		
Nests/yr: recent average (range of years)	93.2 (n/a)	1-5,9,14,16-20,44,35
Nests/yr: recent order of magnitude	1-46	1-5,9,14,16-20,44,35
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	2	1-5, 9, 44
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	12	1-5,9,14,16-20,44,35
Nests/yr at "major" sites: recent average (range of years)	70.7 (2015-2017)	1-5, 9, 44
Nests/yr at "minor" sites: recent average (range of years)	22.5 (n/a)	1-5,9,14,16-20,44,35
Total length of nesting sites (km)	19.62	1-4,16-20,35,43,44
Nesting females / yr	4.89	35
Nests / female season (N)	2.3(65)	35
Female remigration interval (yrs) (N)	1.9 (19)	35
Sex ratio: Hatchlings (F / Tot) (N)	n/a	
Sex ratio: Immatures (F / Tot) (N)	n/a	
Sex ratio: Adults (F / Tot) (N)	0.15	38
Min adult size, CCL or SCL (cm)	67cm	PS

Age at maturity (yrs)	n/a	
Clutch size (n eggs) (N)	159.1 (165)	35
Emergence success (hatchlings/egg) (N)	.597 (184)	35
Nesting success (Nests/ Tot emergence tracks) (N)	0.62(184)	35
Trends		
Recent trends (last 20 yrs) at nesting sites (range of years)	n/a	
Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a	
Oldest documented abundance: nests/yr (range of years)	5(1996-1997)	60
Published studies		
Growth rates	Y	69
Genetics	Y	36, 72
Stocks defined by genetic markers	Y	72
Remote tracking (satellite or other)	Y	37, 38, 39,73, 74,82, PS
Survival rates	N	
Population dynamics	Y	35, PS
Foraging ecology (diet or isotopes)	Y	PS
Capture-Mark-Recapture	Y	PS
Threats		
Bycatch: presence of small scale / artisanal fisheries?	Y (SN,DN,ST,MT)	Equilibrio Azul PS
Bycatch: presence of industrial fisheries?	n/a	
Bycatch: quantified?	N	
Take. Intentional killing or exploitation of turtles	Y	PS
Take. Egg poaching	Y	PS
Coastal Development. Nesting habitat degradation	Y	PS

Coastal Development. Photopollution	Y	PS
Coastal Development. Boat strikes	Y	52
Egg predation	Y	31
Pollution (debris, chemical)	Y	PS
Pathogens	N	
Climate change	Y	
Foraging habitat degradation	Y	PS
Other	Y (see text)	PS
Long-term projects		
Monitoring at nesting sites	Y	PS, 61, 1-5, 44
Number of index nesting sites	2	1-5, 9, 44
Monitoring at foraging sites	Y	38
Conservation		
Protection under national law	Y	62
Number of protected nesting sites (habitat preservation)	9	62
Number of Marine Areas with mitigation of threats	2	62
Long-term conservation projects (number)	2	
In-situ nest protection (eg cages)	2	
Hatcheries	1	
Head-starting	N	
By-catch: fishing gear modifications (eg, TED, circle hooks)	BT,PLL	
By-catch: onboard best practices	N	
By-catch: spatio-temporal closures/reduction	N	
Other	Y (see text)	

RMU	Eastern Pacific DC	Ref #
Occurrence		
Nesting sites	Y	8, 12, 27
Pelagic foraging grounds	JA	PS
Benthic foraging grounds	N	
Key biological data		
Nests/yr: recent average (range of years)		
Nests/yr: recent order of magnitude		
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	0	
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	5	8, 12, 27
Nests/yr at "major" sites: recent average (range of years)		
Nests/yr at "minor" sites: recent average (range of years)		
Total length of nesting sites (km)		
Nesting females / yr	n/a	
Nests / female season (N)	n/a	
Female remigration interval (yrs) (N)	n/a	
Sex ratio: Hatchlings (F / Tot) (N)	n/a	
Sex ratio: Immatures (F / Tot) (N)	n/a	
Sex ratio: Adults (F / Tot) (N)	n/a	
Min adult size, CCL or SCL (cm)	n/a	
Age at maturity (yrs)	n/a	
Clutch size (n eggs) (N)	n/a	
Emergence success (hatchlings/egg) (N)	n/a	
Nesting success (Nests/ Tot emergence tracks) (N)	n/a	
Trends		

Recent trends (last 20 yrs) at nesting sites (range of years)	n/a	
Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a	
Oldest documented abundance: nests/yr (range of years)	n/a	
Published studies		
Growth rates	N	
Genetics	N	
Stocks defined by genetic markers	N	
Remote tracking (satellite or other)	N	
Survival rates	N	
Population dynamics	N	
Foraging ecology (diet or isotopes)	N	
Capture-Mark-Recapture	N	
Threats		
Bycatch: presence of small scale / artisanal fisheries?	Y (PLL, SN,DN)	
Bycatch: presence of industrial fisheries?	Y (PLL, SN, BT)	
Bycatch: quantified?	N	
Take. Intentional killing or exploitation of turtles	N	
Take. Egg poaching	N	
Coastal Development. Nesting habitat degradation	Y	
Coastal Development. Photopollution	Y	
Coastal Development. Boat strikes	N	
Egg predation	N	
Pollution (debris, chemical)	n/a	
Pathogens	n/a	
Climate change	N	

Foraging habitat degradation	N	
Other	N	
Long-term projects		
Monitoring at nesting sites	Y	
Number of index nesting sites	0	
Monitoring at foraging sites	Y	
Conservation		
Protection under national law	Y	
Number of protected nesting sites (habitat preservation)	0	
Number of Marine Areas with mitigation of threats	0	
Long-term conservation projects (number)	1	
In-situ nest protection (eg cages)	Y	
Hatcheries	N	
Head-starting	N	
By-catch: fishing gear modifications (eg, TED, circle hooks)	BT,PLL	
By-catch: onboard best practices	Y	PS
By-catch: spatio-temporal closures/reduction	N	
Other	N	
RMU	**Eastern Pacific LO**	Ref #
Occurrence		
Nesting sites	Y	
Pelagic foraging grounds	n/a	
Benthic foraging grounds	n/a	

Key biological data		
Nests/yr: recent average (range of years)	578 (2013-2017)	1-12,14,15,17,20,23-33,43
Nests/yr: recent order of magnitude	1_127	1-12,14,15,17,20,23-33,43
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	10	1-12,14,15,17,20,23-33,43
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	30	1-12,14,15,17,20,23-33,43
Nests/yr at "major" sites: recent average (range of years)	50.2 (2013-2017)	1-12,14,15,17,20,23-33,43
Nests/yr at "minor" sites: recent average (range of years)	2.5 (2013-2017)	1-12,14,15,17,20,23-33,43
Total length of nesting sites (km)	#VALUE!	1-12,14,15,17,20,23-33,43
Nesting females / yr	n/a	
Nests / female season (N)	n/a	
Female remigration interval (yrs) (N)	n/a	
Sex ratio: Hatchlings (F / Tot) (N)	n/a	
Sex ratio: Immatures (F / Tot) (N)	n/a	
Sex ratio: Adults (F / Tot) (N)	n/a	
Min adult size, CCL or SCL (cm)	n/a	
Age at maturity (yrs)	n/a	
Clutch size (n eggs) (N)	n/a	
Emergence success (hatchlings/egg) (N)	n/a	
Nesting success (Nests/ Tot emergence tracks) (N)	n/a	
Trends		
Recent trends (last 20 yrs) at nesting sites (range of years)	n/a	
Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a	
Oldest documented abundance: nests/yr (range of years)	n/a	

Published studies		
Growth rates	N	
Genetics	N	
Stocks defined by genetic markers	N	
Remote tracking (satellite or other)	N	
Survival rates	N	
Population dynamics	N	
Foraging ecology (diet or isotopes)	N	
Capture-Mark-Recapture	N	
Threats		
Bycatch: presence of small scale / artisanal fisheries?	Y (PLL, DLL, SN, DN, ST, MT, PT)	59
Bycatch: presence of industrial fisheries?	Y (PLL, SN, BT)	
Bycatch: quantified?	N	
Take. Intentional killing or exploitation of turtles	Y	
Take. Egg poaching	Y	
Coastal Development. Nesting habitat degradation	Y	
Coastal Development. Photopollution	Y	
Coastal Development. Boat strikes	Y	
Egg predation	Y	
Pollution (debris, chemical)	Y	
Pathogens	N	
Climate change	Y	
Foraging habitat degradation	N	
Other	Y (see text)	
Long-term projects		

Monitoring at nesting sites	Y	
Number of index nesting sites	10	
Monitoring at foraging sites	N	
Conservation		
Protection under national law	Y	
Number of protected nesting sites (habitat preservation)	11	
Number of Marine Areas with mitigation of threats	11	
Long-term conservation projects (number)	3	
In-situ nest protection (eg cages)	Y	
Hatcheries	Y	
Head-starting	N	
By-catch: fishing gear modifications (eg, TED, circle hooks)	BT,PLL	
By-catch: onboard best practices	N	
By-catch: spatio-temporal closures/reduction	N	
Other	Y (see text)	

Table 2. Sea turtle nesting beaches in Ecuador.

RMU / Nesting beach name	Index site	Nests/yr: recent average (range of years)	Crawls/yr: recent average (range of years)	Southern Western limit		Northern Eastern limit		Central point		Length (km)	% Monitored	Reference #	Monitoring Level (1-2)	Monitoring Protocol (A-F)
				Lat	Long	Lat	Long	Lat	Long					
CM-EP IND														
La Playita	N	8.3 (2015-2017)	16.6 (2008-2016)	-1.567051	-80.83884	-1.562954	-80.835042			0.8	100	1,2,3	1	B
Salango	N	7 (2013; 2016)	6.5 (2008-2016)	-1.598321	-80.8510	-1.570236	-80.840971			3.6	100	1,2,3,4	1	B
Salaite	N	4 (2014)	4.7 (2008-2016)	-1.40632	-80.754453	-1.391433	-80.759474			1.77	100	5	1	B
Los Frailes	N	1 (2014)	9.5 (2008-2011, 2014)	-1.498012	-80.797867	-1.488703	-80.793389			1.5	100	5	1	B
San Lorenzo	N	5 (2013-2014; 2016-2017)	n/a					-1.068554	-80.907768	2.64	100	6,7,8	1	B
La Botada	N	3.25 (2013-2014; 2016-2017)	n/a					-1.050000	-80.904193	1.5	100	6,7,8	1	B
Santa Marianita	N	4 (2014)	n/a					-0.962986	-80.832935	3.3	n/a	8	n/a	n/a
Playa Rosada & Playa Chipi-chipi	N	6 (2016)	n/a	-2.009946	-80.749705	-2.003524	-80.750037			0.860	100	9	1	B
Playa Dorada	Y	12.67 (2014-2016)	14.3 (2014-2016)	-1.622874	-80.843368	-1.619742	-80.84355			0.320	60	43	n/a	n/a
Las Tunas	N	6.67 (2014-2016)	10 (2014-2016)	-1.683954	-80.811126	-1.630429	-80.837369			6.000	40	43	n/a	n/a
Quinta Playa, Galapagos	Y	2769 (2009-2013; 2015)	2336.75 (2009-2013)					-1.00616	-91.081	2	100	10, 11, 58	1	B

Bahía Barahoa, Galapagos	Y	1726.5 (2009-2011)	2877 (2009-2011)					-1.001694	-91.058849	1.2	100	58	1	B
Las Bachas, Galapagos	Y	613.7 (2010, 2013, 2015)	884 (2010, 2013)					-0.494063	-90.339391	n/a	100	10, 58	1	B
Tortuga Bay, Galapagos	Y	46 (2015)	n/a					-0.761473	-90.335652	1.1	n/a	11	n/a	n/a
Punta Carola, Galapagos	N	7 (2016)	n/a					-0.88991	-89.61233	0.214	n/a	49	n/a	n/a
San Jacinto	N	1 (2016)	n/a					-0.782666	-80.518363	6.7	0	12	n/a	n/a
Bahía Drake, Isla de La Plata	Y	48 (2011)	168 (2009-2011)	-1.270346	-81.063053	-1.267836	-81.066363			0.47	100	13	1	B
Mar Bravo	N	1 (2015)	n/a					-2.24544	-80.95087	13.2	n/a	14	1	B
Tres Cruces	N	6 (2015)	n/a					-2.19158	-81.00374	1.1	100	14	1	B
Punta Brava	N	3 (2014)	n/a					-2.1993	-80.99751	0.870	100	15	1	B
EI-EP IND														
La Playita	Y	29.7 (2015-2017)	-	-1.567051	-80.83884	-1.562954	-80.835042			0.800	100	1,2,3,35	1	B
Puerto López	N	3 (2017)	-	-1.562801	-80.818647	-1.530318	-80.812545			4	100	1	1	B
Salango	N	1 (2015-2017)	-	-1.598321	-80.8510	-1.570236	-80.840971			3.6	100	1,2,3	1	B
Los Frailes	N	1 (2017)	-	-1.498012	-80.797867	-1.488703	-80.793389			1.5	100	1	1	B
Playa Negra	N	7 (2015)	-	-1.482821	-80.792577	-1.481871	-80.792369			0.113	100	2	1	B

Tortuguita	N	2 (2008)	-	-1.486723	-80.793107	-1.484134	-80.792567			0.347	100	16	1	B
Salaite	N	1 (2013)	-	-1.40632	-80.754453	-1.391433	-80.759474			1.77	100	4	1	B
Playa Dorada	N	2.33 (2014-2016)	6 (2014-2016)	-1.622874	-80.843368	-1.619742	-80.84355			0.320	50	43	n/a	n/a
Las Tunas	N	0.67 (2014-2016)	2.33 (2014-2016)	-1.683954	-80.811126	-1.630429	-80.837369			6.000	40	43	n/a	n/a
Playa Rosada & Playa Chipi-chipi	Y	41 (2016-2017)	-	-2.009946	-80.749705	-2.003524	-80.750037			0.860	100	9, 17, 35, 44	1	B
Playa de Portete Chico	N	1.5 (2016-2017)	-					n/a	n/a	0.280	n/a	9, 17	n/a	n/a
Punta Carola, Galapagos	N	1 (2016-2017)	-					-0.89995	-89.60949	0.030	0	18, 19	n/a	n/a
Punta Brava	N	1 (2015)	-					-2.1993	-80.99751	0.870	100	14	1	B
Portete	N	1 (2015)	-	0.47039	-80.053468	0.487126	-80.046194			2.15	100	20	1	B
DC-EP IND														
Puerto López	N	1 (2014)	-	-1.562801	-80.818647	-1.530318	-80.812545			4	100	20		
San Lorenzo	N	1 (2013)	-					-1.068554	-80.907768	2.64	100	8		
Santa Marianita	N	1 (2014)	-					-0.962986	-80.832935	3.3	n/a	8	n/a	n/a
Puerto Cabuyal	N	1 (2015-2016)	-					-0.191272	-80.334106	4.6	n/a	12	n/a	n/a
Same	N	1 (2008)	-	0.826124	-79.952499	0.852943	-79.920023			4.7	n/a	21	n/a	n/a

LO-EP IND														
La Playita	N	1.5 (2015-2017)	-	-1.567051	-80.83884	-1.562954	-80.835042			0.8	100	1,2,3	1	B
Puerto López	N	5 (2017)	-	-1.562801	-80.818647	-1.530318	-80.812545			4	100	1	1	B
Playa Dorada	N	4 (2014-2016)	10.67 (2014-2016)	-1.622874	-80.843368	-1.619742	-80.84355			0.320	50	43	n/a	n/a
Las Tunas	Y	15.25 (2008, 2014-2016)	35 (2014-2016)	-1.683954	-80.811126	-1.630429	-80.837369			6.000	40	22, 43	n/a	n/a
San Lorenzo	Y	127.2 (2013-2014; 2016-2017)	-					-1.068554	-80.907768	2.64		6,7,8, 61	1	B
La Botada	Y	95.2 (2013-2014; 2016-2017)	-					-1.050000	-80.904193	1.5		6,7,8, 61	1	B
Santa Marianita	Y	15 (2014; 2016-2017)	-					-0.962986	-80.832935	3.3		6,7,8, 61	n/a	n/a
Ligüiqui	N	5 (2014; 2016-2017)	-					-1.027514	-80.88311	0.500		6,7,8, 61	1	B
Murciélago	N	2 (2015-2017)	-					-0.940283	-80.733805	2		7,8, 61	n/a	n/a
San José	N	7 (2017)	-					-1.23501	-80.82531	4.88	n/a	6	n/a	n/a
Rio Caña	N	1 (2016)	-					-1.085000	-80.900531	2	n/a	7	n/a	n/a
Crucita	Y	15 (2016-2017)	-					-0.87185	-80.54105	4.15	n/a	23, 24	n/a	n/a
Canoa	N	1 (2015)	-					-0.46764	-80.45612	7.09	n/a	25	n/a	n/a
Playa Rosada & Playa Chipi-chipi	N	1 (2017)	-	-2.009946	-80.749705	-2.003524	-80.750037			0.860	100	17	1	B

Playa Bruja	N	4.7 (2015-2017)	-					-2.18658	-80.84078	1	n/a	9,17,26	n/a	n/a
Playa de Valdivia	N	3.3 (2015-2017)	-					-1.94485	-80.72732	2	n/a	9,17,26	n/a	n/a
Playa de Palmar	N	1 (2017)	-					-2.02871	-80.73551	2.1	n/a	17	n/a	n/a
Montañita	N	2 (2017)	-					-1.82303	-80.75539	1	n/a	17	n/a	n/a
Olón	N	1 (2017)	-					-1.79652	-80.76036	7.15	n/a	17	n/a	n/a
Mar Bravo	Y	26.3 (2013-2014; 2017)	-					-2.24544	-80.95087	13.2	n/a	15,27	1	B
Punta Brava	N	7.6 (2013-2014; 2017)	-					-2.1993	-80.99751	0.870	100	15,27	1	B
Tres Cruces	N	8.3 (2013-2014; 2017)	-					-2.19158	-81.00374	1.1	100	15,27	1	B
Punta Carnero	N	2 (2013)	-					-2.27717	-80.92005	10	n/a	15	n/a	n/a
La Diablica	N	1 (2013)	-					-2.31763	-80.89557	3	n/a	15	n/a	n/a
Galera	N	2.5 (2016-2017)	-					0.81858	-80.04574	1.66	n/a	28,61	n/a	n/a
Galerita	Y	28.7 (2015-2017)	-					0.82032	-80.05385	0.635	n/a	26,28,61	n/a	n/a
Tongorachi	N	1 (2017)	-					n/a	n/a	n/a	n/a	28	n/a	n/a
Quingue	Y	13.5 (2015;2017)	-					0.71966	-80.0947	4	n/a	26,28	n/a	n/a
Tongora	N	2 (2017)	-					n/a	n/a	n/a	n/a	28	n/a	n/a
Piquero	N	2 (2015; 2017)	-					n/a	n/a	n/a	n/a	26,28	n/a	n/a

El Morro	N	1.5 (2015; 2017)	-					n/a	n/a	n/a	n/a	26,28	n/a	n/a
La Manga	N	1 (2015)	-					n/a	n/a	n/a	n/a	26	n/a	n/a
Estero de Platano	N	1 (2015)	-					0.77724	-80.0893	0.676	n/a	26	n/a	n/a
Caimito	N	2 (2015)	-					0.66523	-80.09393	0.29	n/a	26	n/a	n/a
Playa Escondida	N	1 (2015)	-					0.81779	-80.00601	0.25	n/a	26	n/a	n/a
Las Palmas	Y	88.5 (2016-2017)	-					0.99082	-79.66096	2.6	n/a	29,61	n/a	n/a
Portete	Y	77 (2012-2015)		0.47039	-80.053468	0.487126	-80.046194			2.15	100	20, 30, 31	1	B
Mompiche	N	2 (2009)	-					0.5063	-80.02424	1.24	0	32	n/a	n/a
Same	N	1 (2010)	-	0.826124	-79.952499	0.852943	-79.920023			4.7	n/a	33	n/a	n/a
Bahía Drake (Isla de La Plata)	N	1 (2008)	-	-1.270346	-81.063053	-1.267836	-81.066363			0.47	100	13	1	B

Table 3. International conventions protecting sea turtles and signed in Ecuador.

International Conventions	Signed	Binding	Compliance measured and reported	Species	Conservation actions	Relevance to sea turtles
IAC	Y	Y	Y	ALL		
CMS	Y	N	Y	ALL		
CITES	N	N	n/a	ALL		
IATTC	Y	N	n/a	ALL		
Lima Convention	Y	N	n/a	ALL		
The Eastern Tropical Pacific Marine Corridor	Y	N	n/a	ALL		
RAMSAR	Y	N	n/a	EI	Protection of important habitat such as mangrove estuaries	Isla Santay in Ecuador is an important estuary for sea turltes, hawksbill sea turtles have been observed migrating towards the mangroves in this area.
United Nations-Convention on Biological Diversity CBD	Y	Y	n/a	ALL		Protects fragiles ecosystems such as mangroves and marine ecosystems. Especial interst in Galapagos
Decisión 391 de la Comunidad Andina de Naciones sobre el Acceso a Recursos Genéticos	Y	Y	n/a			Protects access to genetic resources

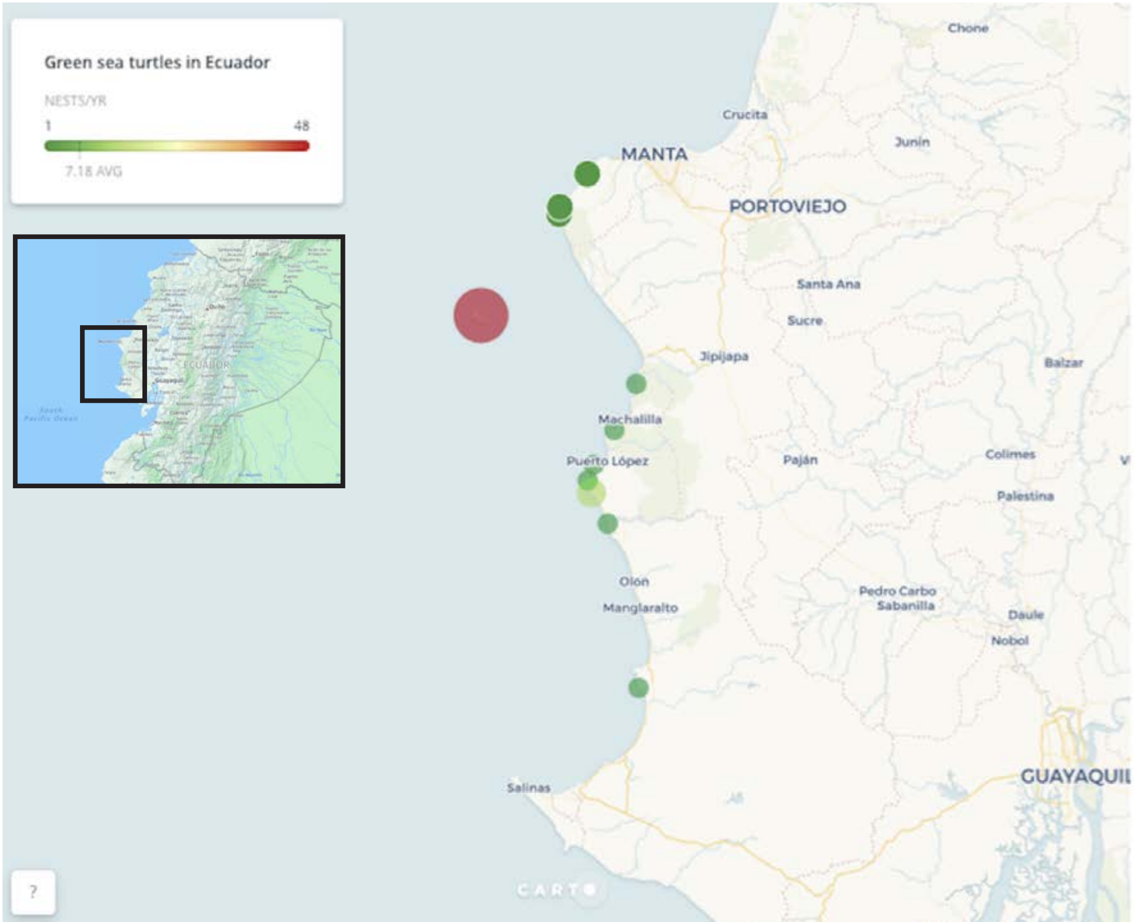

Figure 1. Green sea turtle nesting distribution and abundance in continental Ecuador. Bahía Drake (in red) is the most abundant nesting site.

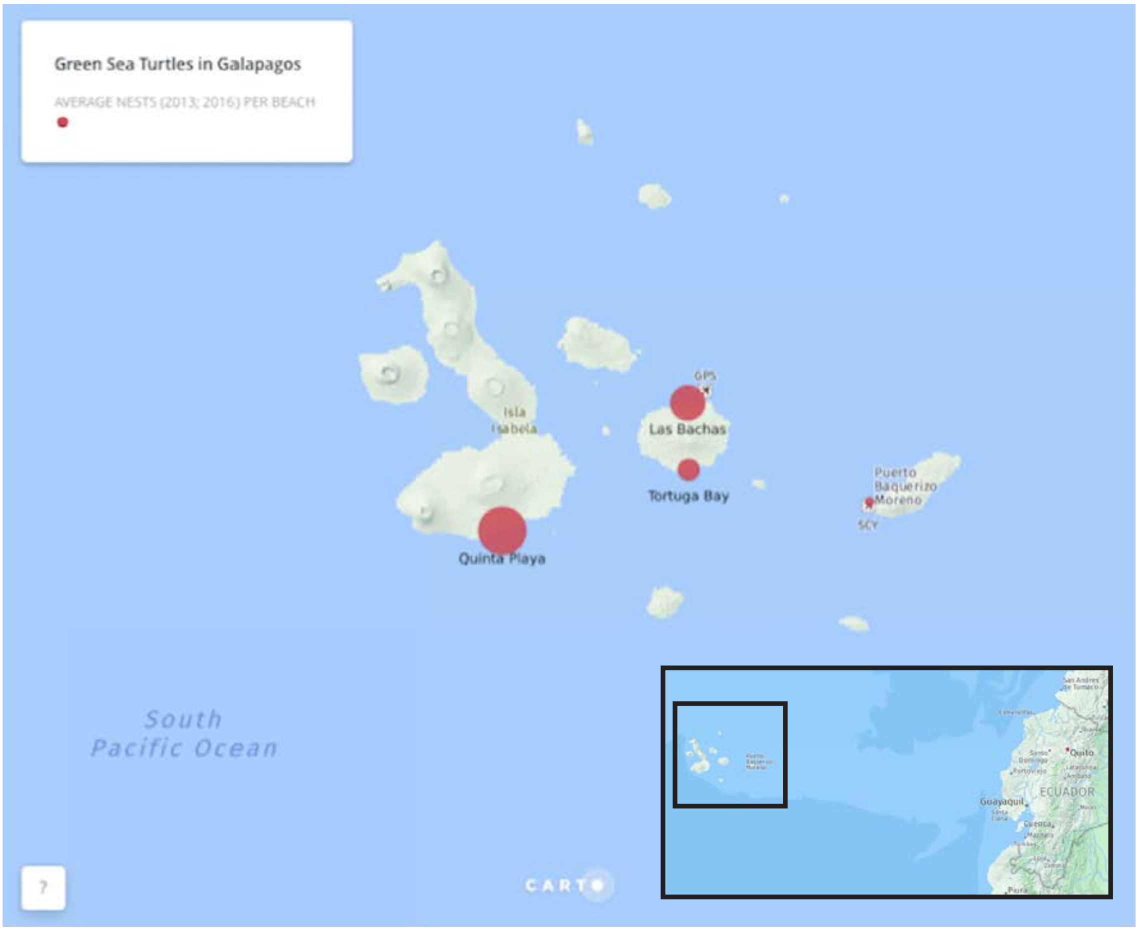

Figure 2. Green sea turtle nesting distribution in the Galapagos Islands. Abundance is shown, being Quinta Playa the beach with most nesting abundance. Barahona Bay, next to Quinta Playa is not shown on the map.

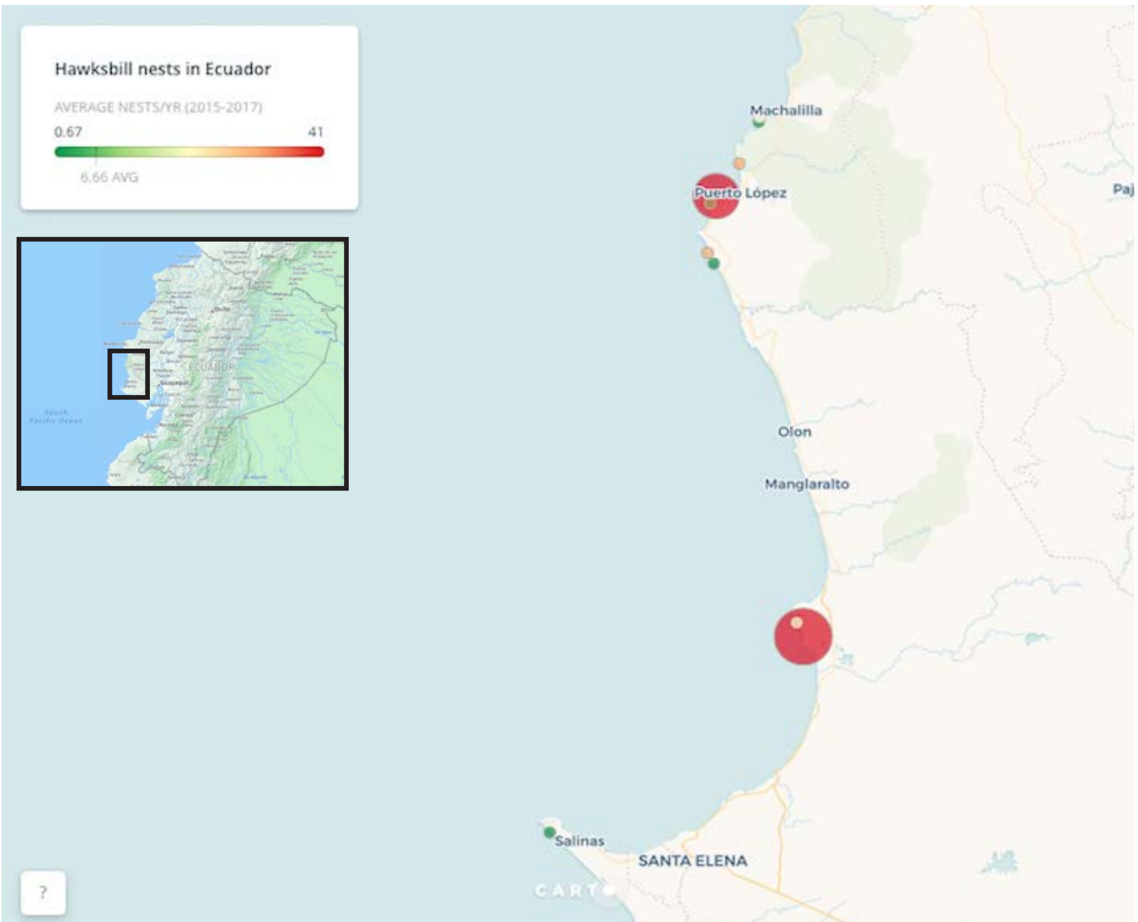

Figure 3. Nesting beaches for *Eretmochelys imbricata* in south-central Ecuador. The beaches with greater abundance (Playa Dorada and La Playita) are in red. Portete in Esmeraldas province and San Cristobal-Galapagos are not included in the figure as only 1 nest has been registered in each site.

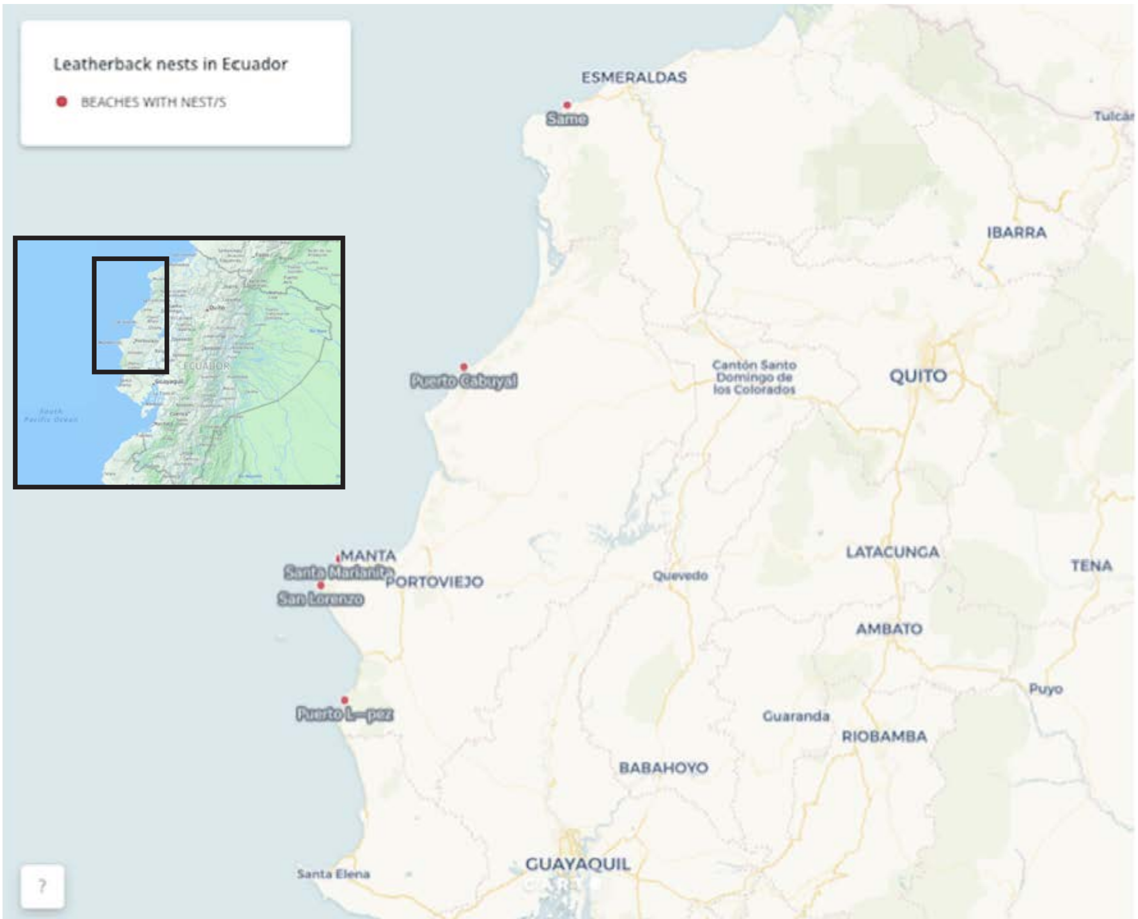

Figure 4. Beaches (5) in Ecuador where *Dermochelys coriacea* nests have been reported.

Figure 5. Leatherback turtle stranded in Mompiche, Esmeraldas province, with injuries on the anterior flippers, possibly from gillnets.

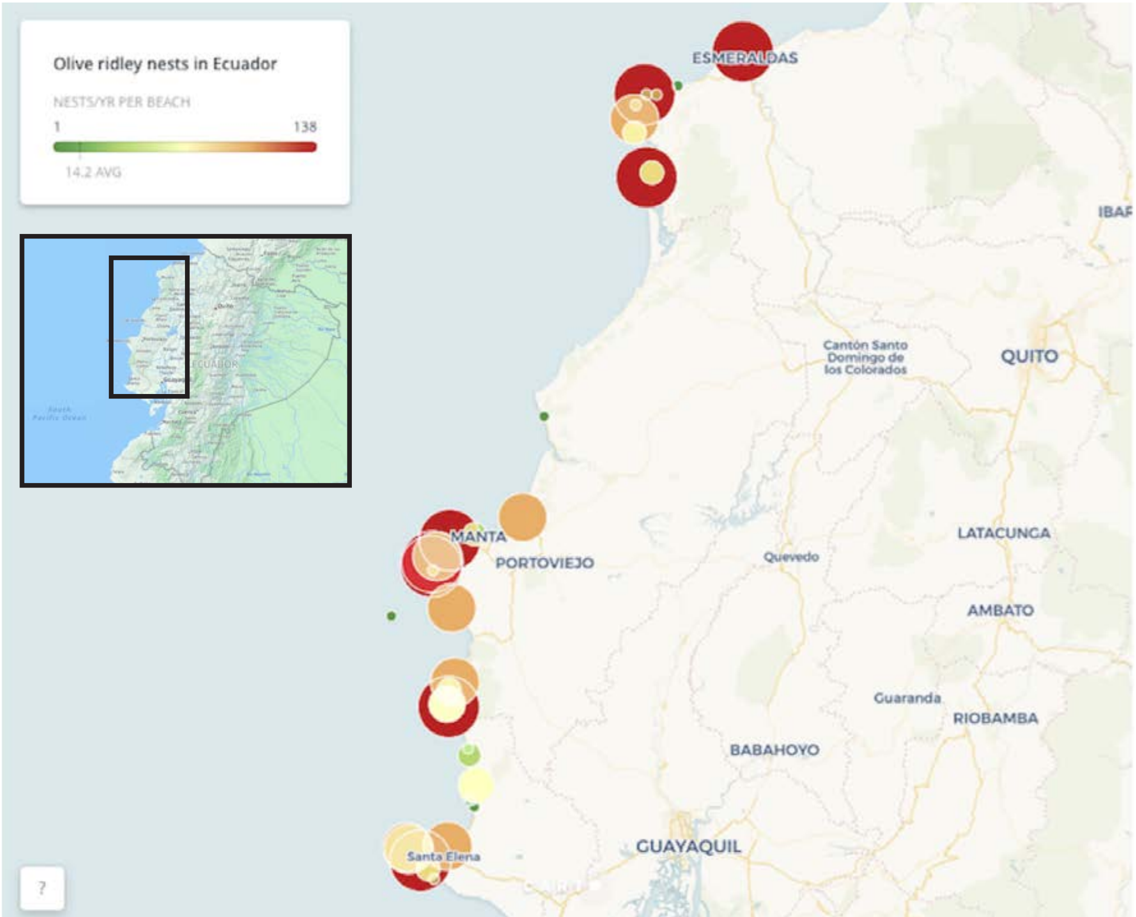

Figure 6. Nesting beaches for *Lepidochelys olivacea* in continental Ecuador. The beaches with greater abundance (San Lorenzo, La Botada, Las Palmas and Portete) are in red.

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PERU

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1. RMU: *Eretmochelys imbricata* – East Pacific Ocean (EI-EPO)

1.1 Distribution, abundance, trends

1.1.1. Nesting sites

Does not apply

1.1.2. Marine areas

The hawksbill turtle is distributed from the central coast (Ica) of Peru to Tumbes in the north, having higher concentrations in northern areas (Piura and Tumbes). Most information on the use of marine areas comes from bycatch, making it difficult to determine foraging areas or migratory corridors (see Table 1- Main Table).

The main hawksbill aggregation is found in the ecosystem of the tropical sea of Peru, in 3 areas: 1) From Quebrada Verde to Máncora, 2) Canoas de Punta Sal and 3) Zorritos (Ref #76). In addition, in the mixing zone between the tropical sea and the current in Humboldt, Sechura Bay hosts an important area of aggregation. There more than 10 stranding events reported inside the Virrila Estuary (05°51’S;80°59’W) (Ref 73) In the south they are rare but become more abundant during El Niño years, where more than 13 individuals were registered in EN 1987 and EN 1998 (Ref 38).

1.2. Other biological data

The size structure for hawksbill turtles in Peru had an average CCLn-t of 40.9 cm (range 23-75.5cm, n = 69), showing an aggregation of mostly juveniles. No recaptures had been reported so estimates on growth rate or survival rates are not available.

1.3. Threats

1.3.1. Nesting sites

Do not apply.

1.3.2. Marine areas

One of the main threats for this species is the interaction with fisheries resulting in bycatch, especially in the north of Peru in set nets but there are records of bycatch in longline sets too (Fig. 2). Also, their shells are highly prized in Peru and its commercialization can still be seen in tourist places of northern Peru like Mancora (Piura) so if and individual gets captured or is found stranded its shell is likely to be kept and commercialized. In general, we know very little about this turtle in Peru so this lack of information can be considered the second main threat to its survival.

1.4. Conservation

Hawksbills are protected under national legislation and under international conventions (see Table 1 and Table 3). There are 3 National Reserves that include marine areas. In Paracas National Reserve the presence of hawksbill had been observed but in general these reserves and in Humboldt current ecosystem (cold) so they do not encompass the main habitat of this species which is the Tropical marine ecosystem. The most important conservation projects with this species involves bycatch mitigation and the promotion of best practices for handling and release of turtles incidentally capture in fishing gear.

1.5 Research

Current research with hawksbills in Peru includes monitoring of bycatch in the north of Peru, monitoring of strandings in the north of Peru, and evaluation of illegal trade (see Table 4).

2. RMU *Lepidochelys olivacea*, East Pacific Ocean (LO-EPO)

2.1 Distribution, abundance, trends

2.1.1. Nesting sites

There are 18 nesting sites, that had been reported to have had at least one olive ridley nest, hosting a small population (see Table 1- Main Table, Fig. 2). None are index beaches, none are major sites and only 1 have regular monitoring. The averages given in the table are for all beaches combined. Not enough information for providing trends.

2.1.2. Marine areas

Information on the use of marine areas by olive ridley comes mainly from bycatch reports. Therefore, it is hard to determine if the areas are foraging grounds or migratory corridors. In general, they are distributed along the entire peruvian coast with a higher concentration in northern areas, from the latitude 10 to the north (see Table 1- Main Table). See fig 2 and 3 for distribution of bycatch in pelagic longline.

In neritic areas, there are records of olive ridley bycatch in Lambayeque, Sechura Bay (Piura) and Tumbes (see Table 1- Main Table for references).

2.2. Other biological data

The average number of nests per year from all nesting beaches combined is 23.7 nest (period 2012-2018), the most recent total number of nests is 34 (Kelez, S., 2019 personal communication). Only one nesting female had been measured in Peru, the curved carapace length (notch to tip) was 68.2 cm. Some individual had been flipper tagged when captured in pelagic longline fisheries, but no recaptures had been reported so estimates on growth rate or survival rates are not available (see Table 1- Main Table).

2.3. Threats

2.3.1. Nesting sites

Main threats to nesting beaches are urban development and light pollution which reduces nesting habitat and affects it quality, the main threats to nests are predation by foxes and dogs, beach erosion and high tides, egg poaching (see Table 1- Main Table, R # 60).

2.3.2. Marine areas

Main threat to olive ridley is bycatch in fishing gear, especially in pelagic longlines, set nets, drift nets and pelagic trawls. There is also some degree of illegal capture and commercialization of its meat and products. Strandings of this species are more common in the north of Peru and are mainly a consequence of interactions with fisheries (see Table 1- Main Table).

2.4. Conservation

Olive ridleys are protected under national legislation and under international conventions (see Table 1 and Table 3). However, there are no nesting beaches protected in the country. There are 3 National Reserves that include marine areas, but they do not protect olive ridley that much as these areas are small, mainly in the south of the country and to close to the coastline. The most important conservation projects with this species involves their nesting activities and monitoring of strandings (see Table 4). In the past, research was conducted on longline gear modification (circle hooks) but that is no longer in progress.

2.5 Research

Current research with olive ridleys in Peru includes monitoring of nesting in the north of Peru, monitoring of strandings in the north of Peru, bycatch and illegal trade (which is conducted mainly for green turtles but some olive ridleys are also captured) (see Table 1- Main Table).

3. RMU: *Chelonia mydas*, East Pacific Ocean (CM-EPO)

3.1 Distribution, abundance, trends

3.1.1 Nesting sites

There are 12 nesting sites, that had been reported to have had at least one East Pacific Green Turtle nest, hosting a very small population (see Table 1- Main Table, Fig. 1). None are index beaches, none are major sites and only 2 have regular monitoring, like El Bravo beach (04°02'S; 81°00'W) and Vichayito beach (04°08'S; 81°06'W) (Ref 58,59,68). The averages given in the table are for all beaches combined. Not enough information for providing trends.

3.1.2 Marine areas

East Pacific Green Turtles are distributed in the entire Peruvian coastline, with highest concentration in neritic waters whiting the continental shelf waters. There are several identified feeding areas: from north to south in Tumbes, where large coastal areas are used by the species (03°23'S – 03°58'S), (Ref 31); In the northern areas of Piura, like Los Órganos (04°10'S; 81°08'W) and El Ñuro (04°13'S; 81°10'W), (Ref 40), where turtles are concentrated in the surrounding areas of the fishing piers; In Sechura Bay, where most turtles are concentrated in the southern area with greatest concentrations in the surrounding areas of La Bocana (05°46'S; 80°52'W) and Bayovar (05°49'S; 81°02'W) (Ref 13,20); In the Virrilá estuary, turtles enters up to 20 km inshore; however, the greatest concentrations are at 8 km inshore around a shallow island (05°49'S; 80°51'W), (Ref 34,73,90). In Lobos de Tierra, a guano island, there is an important hot spot in the beaches located in the south east, like El Ñopo (06°27´S; 80°50'W), (Ref 37), Further south in Paracas bay there is one of the most important feeding areas in the South East Pacific, located in La Aguada inlet (13°51'S; 76°15'W), (Ref 35,38,65,80,84).

3.2 Other biological data

East pacific green turtles size structure in Perú is constituted mainly by juveniles within the influence of the cold Humboldt current, for instance in Paracas, they have a mean CCL of 58.3 ± 7.9 (40.9-84.5 cm, n=405), (Ref 38), similarly in Lobos de Tierra mean CCL is 57.5 ± 7.0 (26.0-74.4.5 cm, n=199), (Ref 39). Conversely, in the transition ecotone area, the size structure gradually increases from south to north, having greater percentages of sub adults and some adults, for example in Virrila Estuary the mean CCL is 64 ± 11.5 (30.9-105.1 cm, n=1113), (Ref 36) while in El Ñuro mean CCL is 72.4 ± 10.9 (47.5-107 cm, n=228), (Ref 42). Regarding prey preferences in Paracas they mainly prey on animal matter like sea anemones, scyphozoan jellyfishes, silverside eggs and some green and red algae (Ref 35,38,104) in the other hand in the northern areas like Virrilá Estuary and Sechura Bay they prefer to feed in green and red algae and in less percentage in animal matter like squid eggs and some fish (Ref 13,57,105).

3.3 Threats

Based on the stranding information, anthropogenic activities, such as: by-catch, illegal direct captures and boat strike are identified as the main threat affecting the East Pacific Green Turtle population in Peruvian foraging areas. Illegal capture has been identified as the main threat affecting this species in Paracas and Virrilá Estuary and could be defined as the illicit harvesting of legally protected turtle species in order to use and benefit from the products and by-products. (Ref 34). This bad practice has been reported in Peru, since 1970's. In Peru, East Pacific Green Turtles have been consumed by men since the pre-Hispanic era, In addition, a traditional sea turtle fishery, with a well-developed trade along the southern coast existed until 1995 when this fishery was banned (Ref 35). However, carapaces are found sporadically on dump sites, suggesting that some captures still occur nowadays. Regarding boat strikes, the increase of tourism increases the risk of boat collision; this situation was reported in Paracas due to the increase of nautical sports and tourism (Ref 38). In the Virrilá Estuary boat strikes are due to the increase of the artisanal fishery in the Parachique area (Ref 34).

3.4 Conservation

East Pacific green turtles are Endangered according to the IUCN and Peruvian legislation (DS N° 004-2014-MINAGRI). Recently (2018) a Sea turtle conservation Action Plan (AP) was developed in Peru. This AP is a management tool that leads concrete actions in order to achieve the conservation and protection of sea turtles in Peru. The authority leading the elaboration of the action plan is the Ministry of Environment through the National Forest and Wildlife Service (SERFOR). The main goal of the AP is to ensure the conservation and sustainable management of the five species of sea turtles and their habitats. Specific objectives include: (1) articulating in an appropriate way the efforts made by the state and civil society for the conservation of sea turtles in the country; (2) reducing the illegal capture of the five species of sea turtles present in Peruvian waters; (3) improving the control and monitoring systems to ensure an adequate monitoring of capture and trade of products and by-products and (4) reducing the impacts that are generated by coastal activities.

3.5 Research

The East Pacific Green Turtle is the most studied species in Peru. Most of the research efforts have focused in Sea turtle occurrence, population dynamics, trophic ecology, interactions between this species and local fisheries, their relationship with environmental variability and several research efforts in conservation, developed by NGO's and public institutions. However, it seems that all these efforts are not enough to translate them into concrete and effective conservation actions that help the preservation of this emblematic species.

4. RMU *Dermochelys coriacea*, East Pacific Ocean (DC-EPO)

4.1. Distribution, abundance and threats

4.1.1. Nesting sites

Do not apply.

4.1.2. Marine areas

In the eastern Pacific Ocean, studies show that females primarily migrate southward to the southern hemisphere into the South Pacific Gyre in pelagic waters off Peru and Chile.

Leatherbacks in Peru come from the nesting populations in the eastern (i.e. Costa Rica and Mexico) and western Pacific (i.e. Papua New Guinea, Indonesia and Solomon Islands). (R # 94,99) The national distribution of this species includes coastal and oceanic areas. The highest density of leatherbacks appears to occur in front of the northern region of La Libertad (08°14'S, 78°59'W). (see Table 1- Main Table for references, R # 22). In addition, other hot-spot areas of neritic distribution are in shallow waters off Tumbes (03°23'S; 80°18'W – 03°51'S; 80°50'W) and in the central Southern area between Cerro Azul (13°01'S; 76°29'W) and Paracas (13°50'S; 76°15'W), with the highest concentrations in the surrounding areas of Tambo de Mora (13°27'S; 76°11'W) (Ref 42,81). Other important area is in waters off Lambayeque, mainly between Lobos de Tierra Island (06°26'W; 80°51'W) and Punta Chérrepe (07°10'S; 79°41'W) (Ref 56,79,106).

4.2. Other biological data

Leatherbacks captured in Peruvian waters have a mean CCL of 115.3 ± 17.7 (80-136 cm, n=13). Three stomach were sampled, and almost 100% of the diet was the scyphozoan jellyfish *Chrysaora plocamia.* Food availability (represented by the abundances of the jellyfish *C.plocamia* in the area) together with environmental variability driven by warm water intrusions resulting from Kelvin waves, seem to strongly influence the coastal distribution of juvenile and sub-adult leatherbacks in Peruvian waters. (see Table 1- Main Table for references).

4.3. Threats

4.3.1. Nesting sites

Do not apply.

4.3.2. Marine areas

Leatherback turtles do not have any terrestrial nor nesting habitat in Peru. However, they are under threat of the negative impacts of the incidental capture in fishing gear (e.g. gillnets and longlines) Published data estimated the incidental capture of 133 turtles between 2000 and 2003. (Ref # 22) Another subsequent study recorded the capture of 70 leatherbacks in gillnets, bottom nets and longline fisheries in the period from 2000 to 2007. (Ref # 5).

4.4. Conservation

Leatherback sea turtles of the Eastern Pacific population are Critically Endangered, according to the IUCN. However, in Peru they are categorized as Endangered (DS N° 004-2014-MINAGRI). The Peruvian government banned the direct capture of all marine turtle species in Peruvian waters under the Ministerial Resolution No. 103-95-PE. Subsequently, Supreme Decree No. 026-2001-PE maintains this prohibition and the Supreme Decree No. 034-2004-AG approves the categorization of endangered wild fauna and flora species, and prohibits their hunting, capture, possession, transport or export for commercial purposes. Under the protection of the Criminal Code (Title XIII) illegal trafficking of this species is punishable by imprisonment. As well, its extraction, transport or storage is considered a serious infraction (Supreme Decree N ° 016-2007-PRODUCE).

The National Plan for the Conservation of Sea Turtles is in process of approval by the Agriculture Ministry (MINAGRI). Local efforts are focused in bycatch prevention and reduction of mortality in entangled sea turtles. Also, national efforts for the improvement of solid waste management and reduction of plastic use are currently in development.

4.5. Research

Most of the research efforts have focused in the interactions between leatherbacks and local fisheries in Peru. However, information on basic ecology of the species is still lacking, as well as information on habitat use and the length of stay of juveniles in the area.

Finally, despite the efforts of national and independent institutions to conduct research and monitoring programs alongside the Peruvian coastline, most of the existing information remains unpublished.

5. RMU *Caretta caretta*, South Pacific

5.1. Distribution, abundance, trends

5.1.1 Nesting sites

Do not apply.

5.1.2 Marine areas

The predominant presence of mainly juvenile loggerhead sea turtles in Peru (Ref #1) and the absence of individuals smaller than 70 cm long in Australia (Ref #100), suggest that Peruvian waters are development grounds, as well as foraging habitat for this species (Ref #4).

The presence of Loggerhead sea turtles in Peru have been recorded between 5°-22°S and 71°-81°W, and 46.5 to 637.1 km from the coast (Ref #1; Ref #66) These records support the findings of stable isotopes analyses, which reveal an oceanic feeding behavior. Moreover, these findings have been verified through satellite tracking. (Ref #3). See fig 1 and 2 for distribution of bycatch in pelagic longline.

5.2. Other biological data

Genetic studies indicate that the population of *Caretta caretta* in Peru comes from nesting populations of eastern Australia and New Caledonia (Ref #70; Ref #99). Loggerheads in Peru have been reported with a mean CCL of ± SD = 57.2 ± 9.18 cm (35.9 - 86.3 cm, n= 307) (Ref #1). However, as this study depended on bycaught sea turtles it only represents the size of turtles vulnerable to longline and gillnet bycatch.

Based on the stable isotope analysis performed, this species has an oceanic feeding behavior and an intermediate trophic level in Peruvian waters.

5.3. Threats

5.3.1 Nesting sites

Do not apply

5.3.2 Marine areas

The main threat for this species in Peru is bycatch in artisanal longline fisheries of mahi mahi and shark. (Ref #1; Ref #66; Ref #48; Ref #21). In that sense, a study highlighted an overlap between the distribution zone of sea turtles and the fishing areas used by the mahi-mahi artisanal fishing fleet. (Ref #3).

5.4 Conservation

Under Ministerial Resolution No. 103-95-PE, the direct capture of all species of marine turtles in Peruvian waters, including *C. caretta*, is prohibited. Subsequently, Supreme Decree No. 026-2001-PE maintains this prohibition and Supreme Decree No. 034-2004-AG approves the categorization of endangered wild fauna and flora species, and prohibits their hunting, capture, possession, transport or export for commercial purposes. Under the protection of the Criminal Code (Title XIII) illegal trafficking of this species is punishable by imprisonment. As well, its extraction, transport or storage is considered a serious infraction (Supreme Decree N ° 016-2007-PRODUCE).

The species is listed as endangered (D.S. N° 004-2014-MINAGRI) (Ref #101), this being approved at the national level with the updating of the classification and categorization list of legally protected wildlife species. It should be noted that Peru is part of the Convention on Biological Diversity (CBD) and the Inter-American Convention for the Protection and Conservation of Sea Turtles (IAC).

As part of the projects developed for its conservation, a circular hook interchange program was carried out to reduce its bycatch in the artisanal longline fishery. (Ref #102). However, currently this program is no longer in development. In recent years, tools and good practices for the recovery, handling and release of bycatch turtles in fishing nets have been used, which are available in manuals and have been applied in the field (Ref #6).

5.5 Research

There are information gaps that must be filled as a priority, such as bycatch rates, assess injuries produced because of fishing interactions, trophic ecology and habitat use in the overlap area with fisheries (tagging, satellite transmitters). Also, it must be identified if there are other fisheries that affect the populations of this species in Peruvian waters, evaluate the survival after bycatch, report new areas used by this species, among others.

Table 1. Main biology and conservation aspects of sea turtles in Perú.

RMU	Ref #	Ei	Ref #	Lo	Ref #	DC	Ref #	CC	Ref #	Cm	Ref #
Occurrence											
Nesting sites	28, 29, 30, 33, 43, 49, 51, 60, 61, 70	N		Y	28, 29, 33, 43, 49, 51, 60, 61, 70	N		N		Y	28, 33, 49, 60, 61, 63, 70, 80, 90
Pelagic foraging grounds	1, 4, 45, 48, 50, 53, 68	N		Y	5, 48, 50, 53, 68, 71	Y	5,6,12,22,44,50,57 ,68,71,98	Y	1, 2 ,3,4,5,6,12, 68,74	Y	6, 48, 50, 53, 55, 68, 69, 71, 94
Benthic foraging grounds	4,13, 30, 31, 34, 35, 37, 39, 40, 46, 59	Y	76,77	Y	20, 27, 31	Y	44, 103	N			34, 37, 39, 82, 90, 92
Key biological data											
Nests/yr: recent average (range of years)	Kelez, S., 2017 personal communication	N		23.7 average (2012-2018)	Kelez, S., 2019 personal communication	N		N		3.4 average (2012-2018)	Kelez, S., 2019 personal communication
Nests/yr: recent order of magnitude	Kelez, S., 2017 personal communication	N		34 (2018)	Kelez, S., 2019 personal communication	N		N		7 (2018)	Kelez, S., 2019 personal communication
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	Kelez, S., 2017 personal communication, 63	N		N		N		N		N	
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	Kelez, S., 2017 personal communication, 63	N		18	Kelez, S., 2019	N		N		12	Kelez, S., 2019 personal communication

					personal communication						
Nests/yr at "major" sites: recent average (range of years)		N		N		N		N		N	
Nests/yr at "minor" sites: recent average (range of years)		N		23.7 average (2012-2018)	Kelez, S., 2019 personal communication	N		N		N	
Total length of nesting sites (km)	Kelez, S., 2017 personal communication	N		N		N		N		N	
Nesting females / yr		N		N		N		N		N	
Nests / female season (N)		N		N		N		N		N	
Female remigration interval (yrs) (N)		N		N		N		N		N	
Sex ratio: Hatchlings (F / Tot) (N)		N		N		N		N		N	
Sex ratio: Immatures (F / Tot) (N)		N		N		N		N		N	
Sex ratio: Adults (F / Tot) (N)		N		N		N		N		N	
Min adult size, CCL or SCL (cm)		N		68.2 cm CCLnt	Kelez, S., 2019 personal communication	N		N		N	
Age at maturity (yrs)		N		N		N		N			
Clutch size (n eggs) (N)		N		N		N		N		N	
Emergence success (hatchlings/egg) (N)		N		N		N		N		N	
Nesting success (Nests/ Tot emergence tracks) (N)		N		N		N		N		N	

Trends											
Recent trends (last 20 yrs) at nesting sites (range of years)		N		N		N		N		N	
Recent trends (last 20 yrs) at foraging grounds (range of years)		N		N		N		N		N	
Oldest documented abundance: nests/yr (range of years)		N		N		N		N		N	
Published studies											
Growth rates	40, 41, 30	N		N		N		N		Y	40, 86
Genetics	30, 54, 55, 72, 73	Y	78	Y	54, 55	Y	93,102	Y	48, 70,102	Y	54, 73
Stocks defined by genetic markers	2, 30, 54, 55	N		Y	54, 55	N		N		N	
Remote tracking (satellite or other)	3, 30	Y	79	N		Y	91,95	Y	3	N	
Survival rates		N		N		N		N		N	
Population dynamics	2, 17,18, 22, 30, 35, 36, 45	N		N		N		N		Y	40, 86
Foraging ecology (diet or isotopes)	4, 13, 30, 34, 35, 37, 39, 46, 59, 67, 74	N		Y	67, 74	Y	81,93	Y	4,72	Y	47, 59, 74, 91
Capture-Mark-Recapture	30, 40	N		N		N		N		Y	40, 86
Threats											
Bycatch: presence of small scale / artisanal fisheries?	1, 6, 11, 20, 21, 22, 27, 30, 41, 42, 48, 50, 53, 65, 67, 68	Y	17,21,69,27 ,9,20,31,26, 76,77	Y (PLL, SN, DN, PT)	5, 20, 27, 31, 50, 68, 69, 71	Y(PLL ,SN, DN)	5, 6,12, 22,28,38, 42,48,54,55,65,69, 81, 93,95	Y (PLL, DN)	1,2,3,5,6,1 2.43,48,66, 69,72	Y(PLL, SN, DN)	6, 21, 38, 48, 50, 53, 55, 65, 68, 69, 74, 94
Bycatch: presence of industrial fisheries?	30	N		N		Y	42	N			
Bycatch: quantified?	5, 6, 11, 30, 42, 50, 65	N		140 (PLL ref 5), 47(SN ref 5),	5, 20	70 (PLL, SN,DN, ref 5)133 (PLL, DN,ref	5,22,42	323 (PLL, ref 1) 3200 (PLL,ref 5)172	1, 5, 66		

				16.5 (SN ref 20), 60(DN ref 5), N(PT)		22)209 (PLL, DN,SN, Purses seines, ref 44)		(PLL ,ref 68)			
Take. Intentional killing or exploitation of turtles	11, 22, 26, 30, 38, 41, 42, 62, 67	Y	36,38,76,77	Y	38, 67	Y	38, 65, 93	N		Y	38, 67, 84, 85, 87
Take. Egg poaching	51	N		Y	60	N		N		N	
Coastal Development. Nesting habitat degradation	30	N		Y	60	N		N		N	
Coastal Development. Photopollution		N		Y	60	N		N		N	
Coastal Development. Boat strikes	31	N		N		N		N		Y	34, 38, 75
Egg predation	60	N		Y	60	N		N		N	
Pollution (debris, chemical)	13, 30, 34, 35, 39	N		N		N		Y	Zambrano, M., 2019 personal communication	Y	95
Pathogens		N		N		N		N		Y	23, Bachmann, V. 2018 personal communication
Climate change		N		N		Y	79	N		Y	35
Foraging habitat degradation		N		N		N		N		Y	47, 59, 74, 91
Parasites / Simbiots	19, 25, 30, 39	N		N		N		N		Y	25, 88
Strandings	30, 31, 32, 41, 42, 46, 56, 64	Y	64,27,46,75,76,77	Y	27, 31, 32, 41, 42, 46, 56, 71	Y	28,38,42,54,93	Y	103		
Long-term projects											

Monitoring at nesting sites	60,61	N		Y	60, 61, 70	N		N		Y	60, 61, 70
Number of index nesting sites		N		N		N		N		N	
Monitoring at foraging sites	13, 34, 37, 39, 59	N		N		N		N		N	
Conservation										Y	27, 30, 34, 57, 92
Protection under national law	8, 10, 62, 66	Y	8,10,66	Y	8, 10, 66	Y	8,10, 64	Y	8,10,64		
Number of protected nesting sites (habitat preservation)		N		0		N		N		N	
Number of Marine Areas with mitigation of threats	14,15, 16	3	14, 15, 16	3	14, 15, 16	N		N			
Long-term conservation projects (number)	WWF-Perú/ ACOREMA / ProDelphinus / ecOceanica/ Planeta Océano / IMARPE / SERFOR /MINAM / SERNANP	3	ProDelphinus / ecOceanica /IMARPE	6	WWF-Perú/ ProDelphinus / ecOceanica/ IMARPE / SERFOR / SERNANP	Y	WWF-Perú/ ProDelphinus / ecOceanica/ IMARPE / SERFOR / SERNANP/ACOREMA	Y	WWF-Perú/ ProDelphinus / ecOceanica/ IMARPE / SERFOR / SERNANP/ ACOREMA	Y	WWF-Perú/ ProDelphinus / ecOceanica/ IMARPE / SERFOR / SERNANP
In-situ nest protection (egg cages)		N		N		N		N		N	
Hatcheries	52	N		N		N		N		N	
Head-starting		N		N		N		N		N	
By-catch: fishing gear modifications (eg, TED, circle hooks)	6, 9, 58	Y	6,9	Y	6	Y	6, 9	N	6	Y	9
By-catch: onboard best practices	7, 12, 44, 57, 58	Y	7,57	Y	7	Y	6,7	Y	6,7		
By-catch: spatio-temporal closures/reduction		N		N		N		N			
Hibridization	24	Y	24	N		N		N		Y	24
Health	23	N		N		N		N			
Gaps	66	N		N		N		N			

Research		Y	Current research: strandings, bycatch	Y	Curent research: nesting, strandings, bycatch, ilegal trade	Y	Current research: strandings, bycatch	Y	Current research: strandings, bycatch		Current research: population dynamics, strandings, trophic ecology, genetics and stable isotops (IMARPE)

Table 2. International conventions protecting sea turtles and signed by Perú.

International Conventions	Signed	Binding	Compliance measured and reported	Species	Conservation actions	Relevance to sea turtles
Inter - American Convention for the Protection and Conservation of Sea Turtles (CIT)	Y	Y	Y	ALL	Resolutions for: 1) the conservation of the hawksbill turtle, 2) the east pacific leatherback turtle, 3) the loggerhead turtle, 4) the promotion of sustainable fishing in international waters, especially for the protection of sea turtles, 5) the adaptation of sea turtle habitats to climate change, 6) reduction of the adverse impacts of fisheries on sea turtles	It is specific for sea turtles

Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	Y	Y	Y	ALL	Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival.	Bans trade of sea turtles and their parts/products
Convention on the Conservation of Migratory Species of Wild Animals (CMS)	Y	Y	Y	ALL	CMS provides a global platform for the conservation and sustainable use of migratory animals and their habitats. Brings together the States through which migratory animals pass, the Range States, and lays the legal foundation for internationally coordinated conservation measures throughout a migratory range.	Provides funding for conservation research, developed the Memorandum of Understanding on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and South- East Asia (IOSEA), it has a specific resolution on bycatch detailing various actions needed to reduce bycatch of migratory species that will include marine turtles (UNEP/CMS/Resolution 9.18 on Bycatch).
South Pacific Permanent Comission (CPPS)	Y		Y	ALL		Marine environmental policies

Agreement for the protection of the marine environment and the coastal zone of the Southeast Pacific	Y			ALL		Marine protected areas
Protocol for the Conservation and Management of Marine and Coastal Protected Areas of the Southeast Pacific	Y			ALL		Marine protected areas
Convention on Biological Diversity	Y	Y	Y	ALL		Environmental protection

Table 3. Organizations, agencies and databases related with sea turtle research and conservation in Perú.

Institutions and organizations involved in conservation, management and research		
Public	**SERFOR**	The National Forest and Wildlife Service (SERFOR) from the Agriculture Ministry is the governmental body in charge of formulate environmental policies, currently developing the National Conservation Plan of Marine Turtles in Peru.
	SERNANP	The National Service of Protected Natural Areas (SERNANP) ascribed to the Environment Ministry manages natural protected areas and maintenance of biological diversity.
	IMARPE	The Peruvian Marine Research Institute (IMARPE) provides information to the Production Ministry and the scientific community about the marine ecosystem.
Private	**WWF-Peru**	The Marine Program of WWF-Peru is currently forging aliances to reduce bycatch, encouraging onboard best practices on correct handling and liberation of marine turtles focusing on the principal fisheries of the country and environmental education.
	ProDelphinus	ProDelphinus works assessing threats, testing bycatch solutions, and educating local communities about the importance of sea turtles in Perú.
	ACOREMA	Coastal Areas and Marine Resources (ACOREMA) works in coordination and collaboration with artisanal fishermen on sea turtle monitoring and bycatch reduction.
	ecOceánica	Evaluates nesting seasons, hatching and emergence success of green turtle and olive ridley in peruvian northern beaches, and the population structure and status of green turtle agregation in El Ñuro and Los Organos.
	Planeta Océano	Works in conservation and restore of coastal and marine environments.

Figure 1. Olive ridley nesting sites. (Kelez, S., 2019 personal communication, map elaborated by Carmen Rosa Gonzalez, 2019).

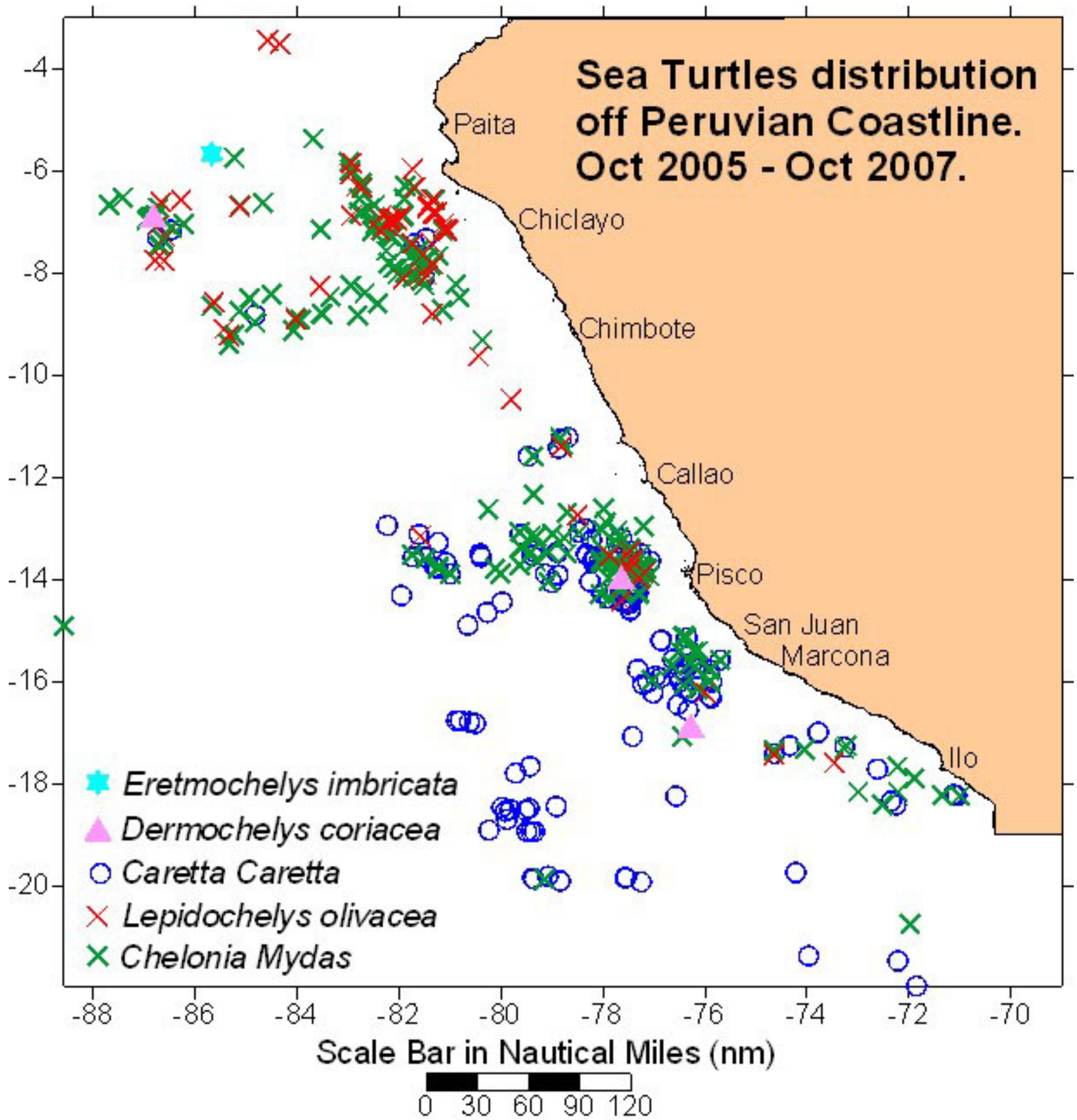

Figure 2. Sea turtle bycatch in pelagic longline off Peru. January 2005 - August 2007 (de Paz, et al. 2010, Ref 68).

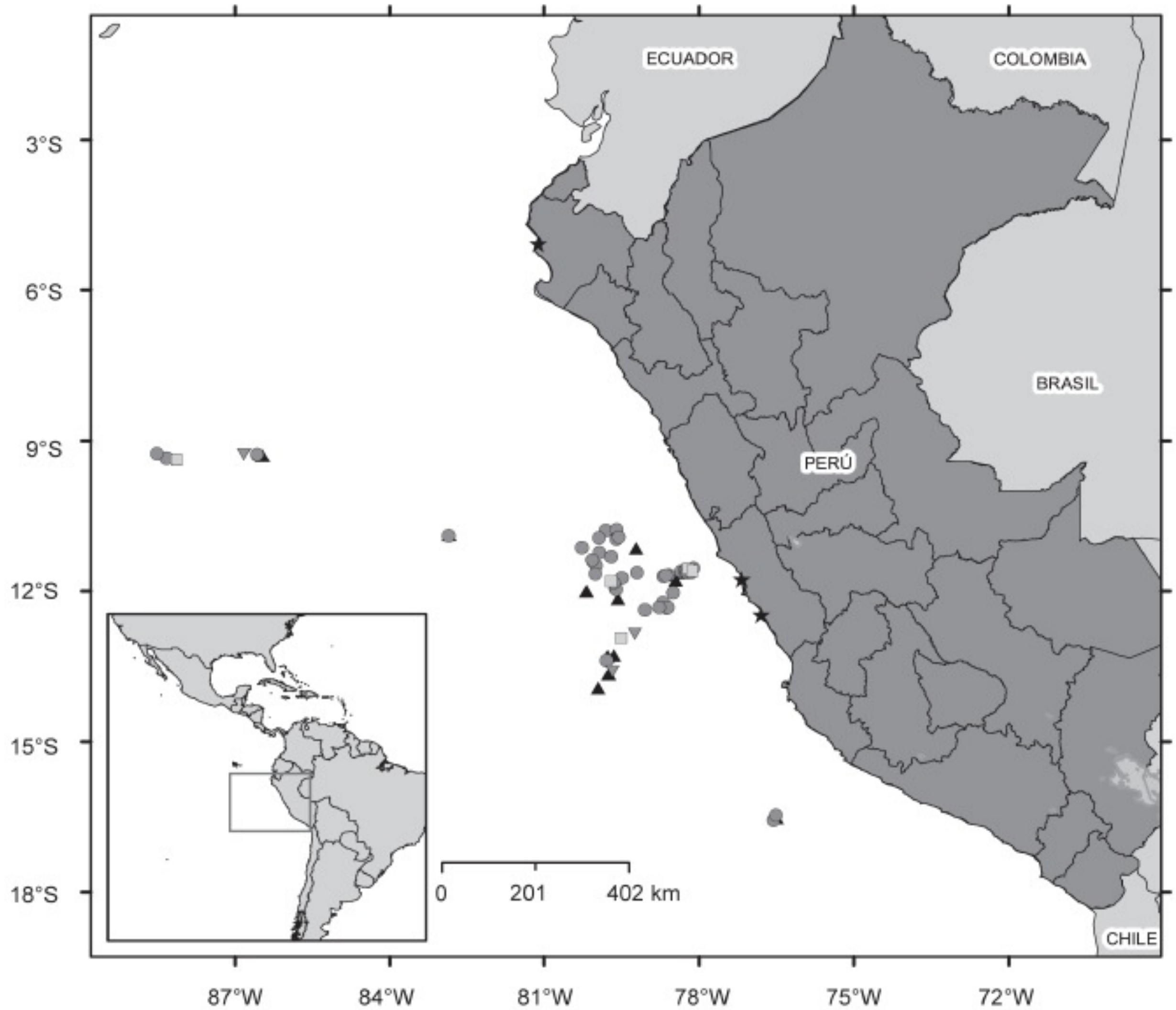

Figure 3. Sea turtle bycatch in pelagic longline off Peru. Caretta caretta (black triangles), *Chelonia mydas* (circles), Lepidochelys olivacea (squares), Dermochelys coriacea (inverted triangles). Sept 2009 - August 2010 (Ayala & Sanchez-Scaglioni 2010, Ref 71).

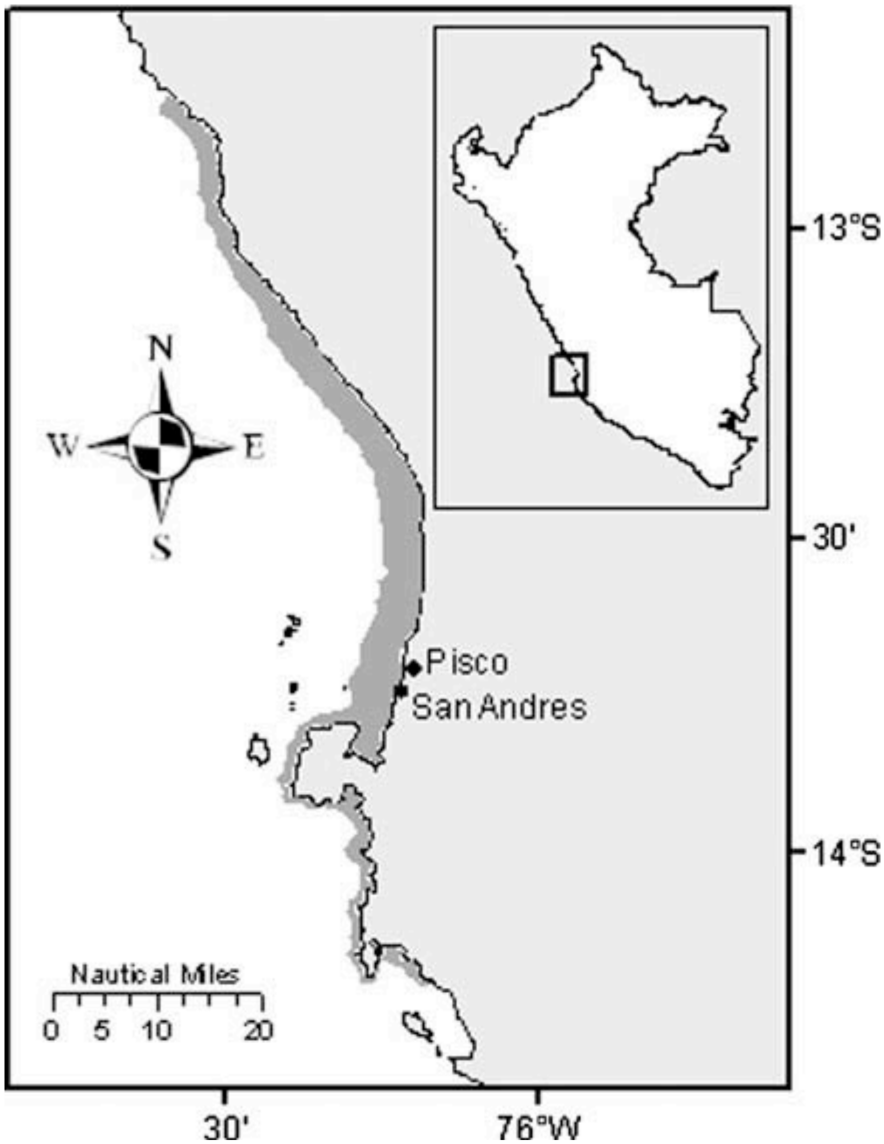

Figure 4. Principal foraging areas for *Chelonia mydas agassizii* identified in southern Perú.

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Table 1. Main biology and conservation aspects of sea turtles in Chile.

RMU	Eastern Pacific	Ref #
Occurrence		
Pelagic foraging grounds	Y	8, 9, 10, 11, 12, 28, 29, 34, 45, 46, 47, 48, 49, 57, 67, 68, 76, 77, 78
Benthic foraging grounds	Both	1, 2, 4, 5, 6, 13, 17, 19, 26, 30, 36, 37, 38, 42, 44, 49, 50, 51, 55, 56, 57, 59, 60, 62, 63, 69, 74
Published studies		
Growth rates	Y	60
Genetics	Y	4, 25, 26, 28, 29, 30, 31, 45, 57, 74, 77
Stocks defined by genetic markers	Y	4, 25, 28, 30, 57, 74
Remote tracking (satellite or other)	Y	37, 45, 55
Survival rates	N	
Population dynamics	Y	77
Foraging ecology (diet or isotopes)	Y	22, 33, 35, 44, 57, 63, 71, 77
Capture-Mark-Recapture	Y	4, 10, 40, 45, 60, 76, 77
Threats		
Bycatch: presence of small scale / artisanal fisheries?	Y (PLL, SN,DN,OTH: "Espinel" in Spanish (PLL < 700 hooks)and SN(Purse seine))	9, 10, 11, 12, 15, 34, 45, 49, 54, 76, 77, 78
Bycatch: presence of industrial fisheries?	Y (PLL, SN (Purse seine))	8, 9, 10, 11, 12, 27, 28, 29, 45, 46, 47, 48, 49, 76, 77, 78
Bycatch: quantified?	Y	8, 9, 10, 11, 12, 28, 29, 45, 46, 47, 48, 49, 76, 77, 78
Take. Intentional killing or exploitation of turtles	Y	15, 16, 19, 20, 34, 57
Coastal Development. Boat strikes	Y	2, 15, 16

Pollution (debris, chemical)	Y	4, 15, 16, 19, 39, 57, 64
Pathogens	N	
Climate change	N	
Foraging habitat degradation	Y	3, 4, 7, 23, 73
Depredation	Y	16, 38, 42, 45, 57, 60, 61, 64
Epibionts	Y	15, 18, 19, 32, 50, 52, 61, 62
Debilitated Turtle Syndrome (DTS)/Buoyancy disorder	Y	32, 43, 53, 61, 64, 72
Strandings	Y	3, 38, 49, 53, 54, 57, 58
Long-term projects		
Monitoring at foraging sites	Y	1, 4, 5, 36, 42, 49, 55, 56, 60, 74
Conservation		
Protection under national law	Y	9, 14, 15, 19, 24, 57, 59, 65, 66, 67, 68, 69, 70, 75
Long-term conservation projects (number)	3	4, 44, 55, 56, 60, 61, 76, 77
Head-starting	N	
By-catch: fishing gear modifications (eg, TED, circle hooks)	Y (PLL)	27, 29, 77
By-catch: onboard best practices	Y	8, 10, 11, 77, 78
By-catch: spatio-temporal closures/reduction	N	

Research	Chilean waters constitute foraging areas for five sea turtle species, all of them recently classified as threatened and protected by national law. Despite that several research and conservation efforts related to these species and their habitats have been implemented in Chilean territory, most data have not been published in scientific journals. In fact, most available information for the country is part of technical reports and studies presented in scientific meetings. Likewise, although several issues with national relevance have been addressed in such studies, data on growth rates, population dynamics, survival rates, pathogens, diseases, pollution, and potential negative impact of climate change on sea turtles in Chile is scarce or non-existent. In Chile there is no turtle meat consumption culture, and in general the major threats towards sea turtle populations are related to bycatch, pollution and foraging habitat degradation. In green turtle foraging areas of mainland Chile, depredation of turtles by sea lions (*Otaria flavescens*) has been identified as an important threat. In Easter island, increased and uncontrolled tourism also constitutes a threat towards turtles mainly due to the increase of marine pollution, overfishing and boat traffic in key habitats. Some efforts have been conducted on all these issues; however, it is necessary to increase monitoring and quantify such threats. For the particular case of *Chelonia mydas*, most data has been generated by NGOs and universities, focusing mainly on generating ecological information through systematic monitoring in foraging grounds. For the other species, most data have been collected by the Instituto de Fomento Pesquero (IFOP) and NGOs from interaction with Chilean fisheries. Such institutions have estimated turtle bycatch in industrial and artisanal fisheries and also have preliminarily implemented some mitigations measures. It is expected that both fisheries coverage and specific mitigation actions will be implemented over the next years.	

Table 2. International conventions protecting sea turtles and signed by Chile.

International Conventions	Signed	Binding	Compliance measured and reported	Species	Conservation actions	Relevance to sea turtles
Inter-American Convention for the Protection and Conservation of Sea Turtles (IAC)	Y	Y	Y	CC, CM, DC, EI, LO	Prohibition of deliberate take of sea turtles or their eggs; compliance with the Convention on International Trade in Endangered Species (CITES); implemention of appropriate fishing practices and gear technology to reduce incidental take (bycatch) of turtles in all relevant fisheries; use of Turtle Excluder Devices (TEDs) on shrimp trawl vessels; designation of protected areas for critical turtle habitat; restriction of human activities that could harm turtles and promotion of sea turtle research and education	Binding commitment by Contracting Parties to implement domestic measures to reduce threats to sea turtles
Convention of International Trade of Endangered Species (CITES)	Y	Y	Y	CC, CM, DC, EI, LO	Sanction commerce and/or possession of such specimens; foresee seizure or return of such specimens to the exporting country	Regulation of International Trade
Convention on Biological Diversity (CBD)	Y	Y	Y	CC, CM, DC, EI, LO	Elaboration and execution of the National Strategy and Action Plan for biodiversity protection; Integration of sustainable use of biodiversity and conservation in plans, programs and sectorial or intersectorial policies.	Biodiversity and Environmental Protection
Convention on the Conservation of Migratory Species of Wild Animals (CMS)	Y	Y	Y	CC, CM, DC, EI, LO	Participant countries must: Promote, cooperate and collaborate in financing research on migratory species, allocate immediate protection to certain migratory species and establish agreements related to conservation and management of migratory species	Conservation of Migratory Species and their Habitats
South Pacific Permanent Comission (CPPS)	Y	Y	Y	CC, CM, DC, EI, LO	Coordinate regional maritime policies in order to adopt concerted positions of its Member States in international negotiations, development of the Law of the Sea, International Environmental Law and other multilateral initiatives. CPPS is engaged in a capacity-building process at the national and regional levels in the areas of science, socio-economic policy and the environment.	Marine Environmental Policies
Agreement for the Protection of the Marine Environment and the Coastal Zone of the Southeast Pacific	Y	Y		CC, CM, DC, EI, LO	Research and monitoring of marine contamination; environmental management (management of integrated coastal zones); assessment of the marine environment; administration of protected coastal and marine areas; conservation of marine mammals of the Southeast Pacific; research on marine and coastal biodiversity; studies and reports on climate change and dissemination of information and public awareness	Marine Protection
Protocol for the Conservation and Management of Marine and Coastal Protected Areas of the Southeast Pacific	Y	Y		CC, CM, DC, EI, LO	Establishement of protected marine areas for contracting parties	Marine Protected Areas
United Nations Convention on the Law of the Sea (UNCLOS)	Y	Y		CC, CM, DC, EI, LO	Promote the use of oceans and seas with peaceful purposes, and its resources fairly and efficiently. International Action Plan to prevent, stop and eliminate illegal, non declared and non regulated fishing in Chile.	Ilegal Fisheries; Protection of Marine Resources
Protocol for the Protection of the South-East Pacific against Radioactive Pollution	Y	Y		CC, CM, DC, EI, LO	Forbid all dumping of radioactive waste within the Chilean 200 nautical miles	Marine Protection
Agreement on Regional Cooperation in Combating Pollution of the South-East Pacific by Hydrocarbons or other Harmful Substances in cases of Emergency	Y	Y		CC, CM, DC, EI, LO	Regional Contingency Plan for Fossil Fuel Spills and Hazardous Substances; and Regional Contingency Plan for Oilspill and Emergency Response in the Southeast Pacific	Marine Protection
United Nations Framework Convention on Climate Change (UNFCCC)	Y	Y		CC, CM, DC, EI, LO	Overall framework for intergovernmental efforts to tackle the challenge posed by climate change.	Environmental Protection
Kyoto Protocol (UNFCCC)	Y	Y		CC, CM, DC, EI, LO	Internationally binding emission reduction targets	Environmental Protection
***Based on Ref #21**						

Table 3. Organizations and agencies related with sea turtle research and conservation in Chile.

Institutions and organizations involved in sea turtle conservation, management and research			
Type	**Intitution/organization**	**Area**	**Extension**
Public	Ministerio de Medio Ambiente (MMA)	Species classification at national level through the Species Classification Regulation (Reglamento de Clasificación de Especies Silvestres, RCE, in Spanish)	National
	Grupo Nacional de Trabajo de Tortugas Marinas (GTTM)	Elaboration of the National Action Plan for the Protection and Conservation of Sea Turtles in Chile	National
	Subsecretaría de Pesca y Acuicultura (SUBPESCA)/Ministerio de Economía, Fomento y Turismo.	Regulation and management of fishing and aquaculture activities, through policies, rules and administrational measures, under a precautionary and systemic approach that promotes the conservation and sustainability of hydro-biological resources for the productive development of the area.	National
	Unidad de Rescate, Rehabilitación y Conservación de Especies Protegidas (URCEP)/Servicio Nacional de Pesca y Acuicultura (SERNAPESCA)	Sea turtle rescue and rehabilitation, strandings	National
	TORTUMAR/Universidad Arturo Prat	Ecological research, sea turtle monitoring and environmental education	Regional-Arica (northern Chile)
	Centro Regional de Estudios y Educación Ambiental (CREA)/Universidad de Antofagasta)	Ecological research, sea turtle monitoring, rescue and rehabilitation	Regional-Antofagasta (northern Chile)
Private	Instituto de Fomento Pesquero (IFOP)	Ecological and fisheries research, sea turtle monitoring and bycatch reduction	National
	Tortuga Verde NGO	Outreach, marine education	Regional-Arica (northern Chile)
	Qarapara Tortugas Marinas Chile NGO	Ecological research, monitoring, outreach, environmental education, rehabilitation and consulting	Regional-Atacama (northern Chile)
	Pacífico Laud NGO	Fisheries research, sea turtle monitoring and bycatch reduction	Regional-Southern Chile

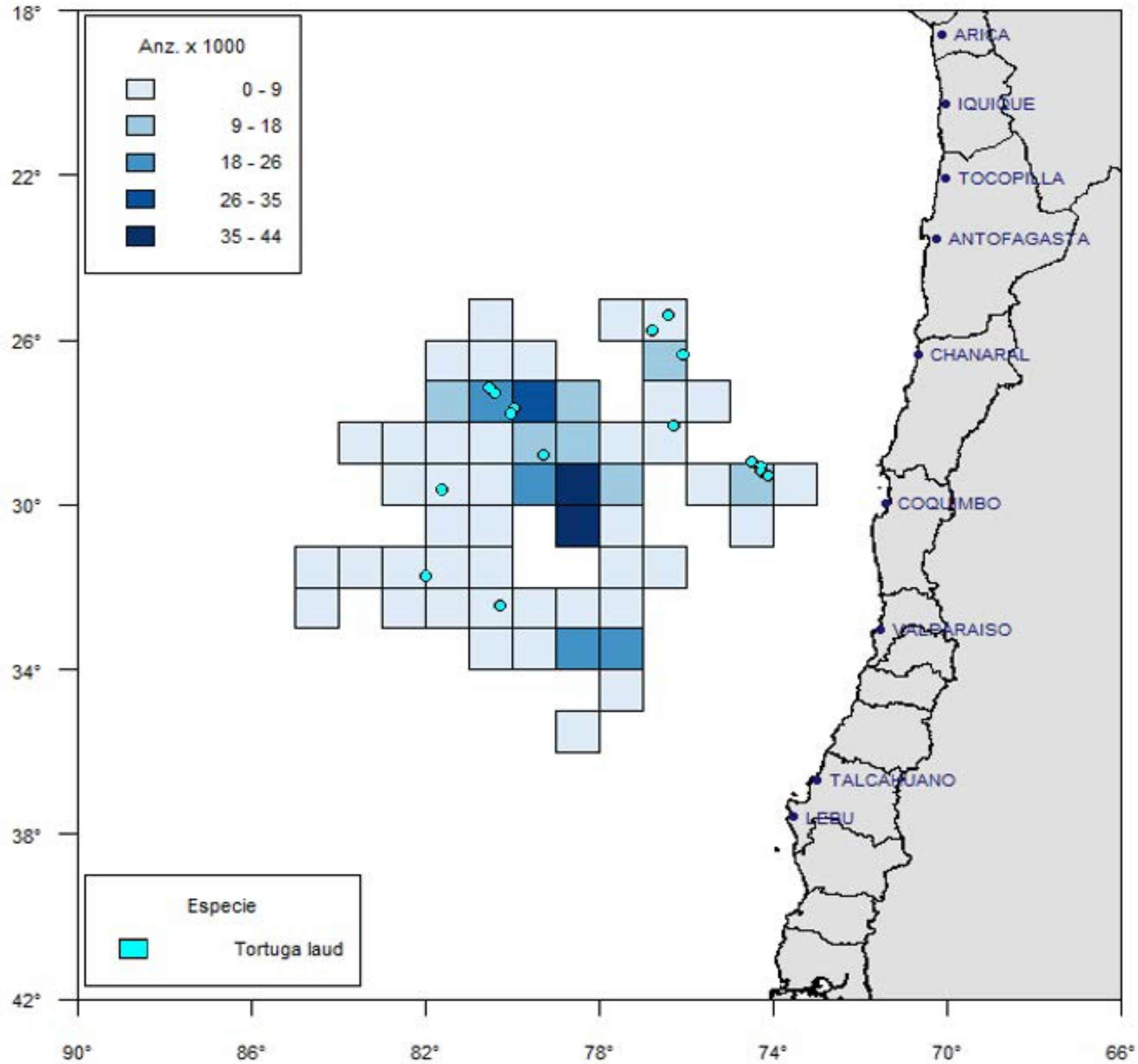

Figure 1. Spatial distribution of interaction between sea turtles and the surface longline fleet effort (artisanal and industrial; hooks set), which operated on swordfish during 2016 (Zárate et al. 2017c).

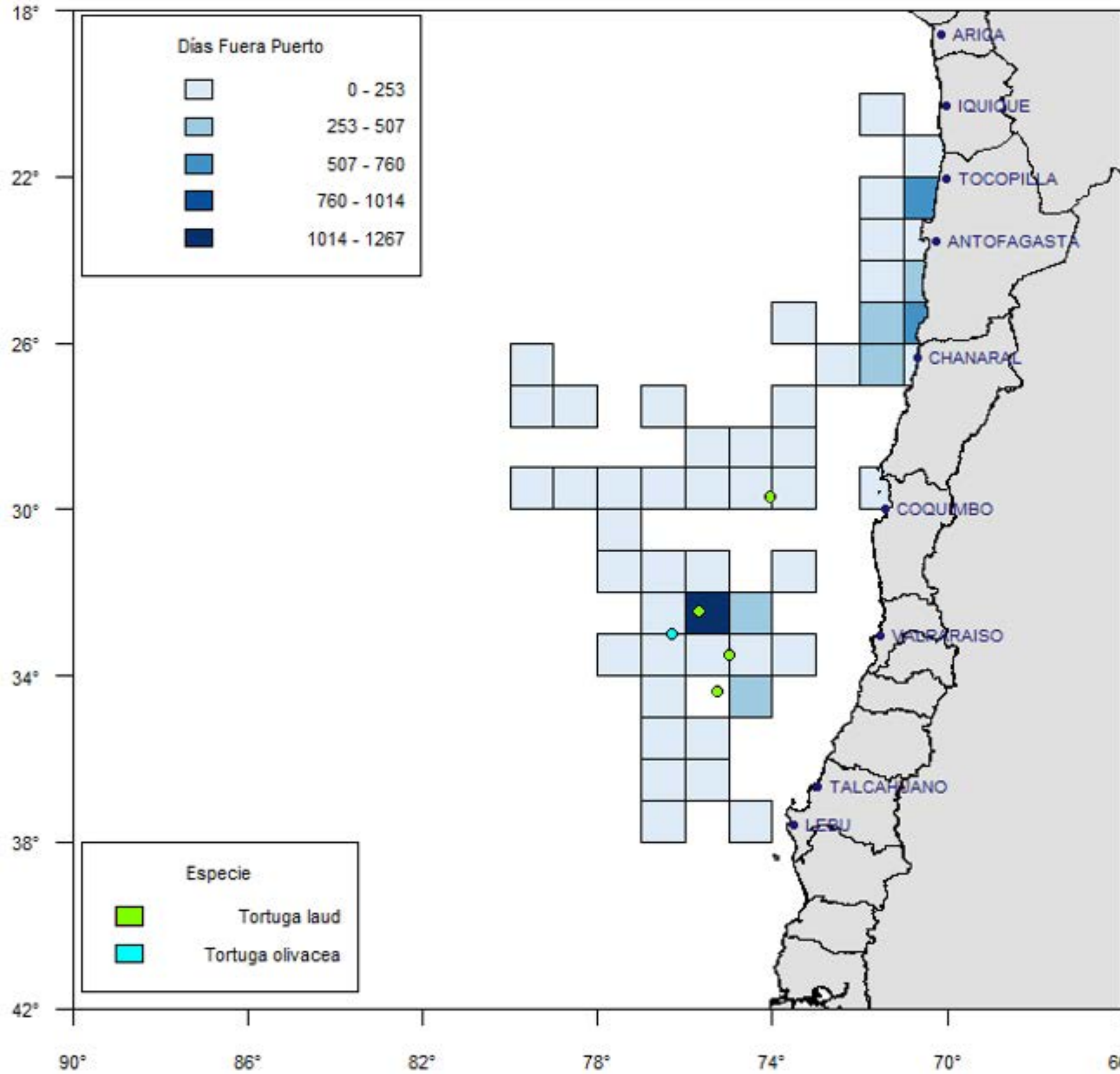

Figure 2. Spatial distribution of interaction between sea turtles and the artisanal gillnets fleet effort (days out of port), which operated during 2016 (Zárate et al. 2017c).

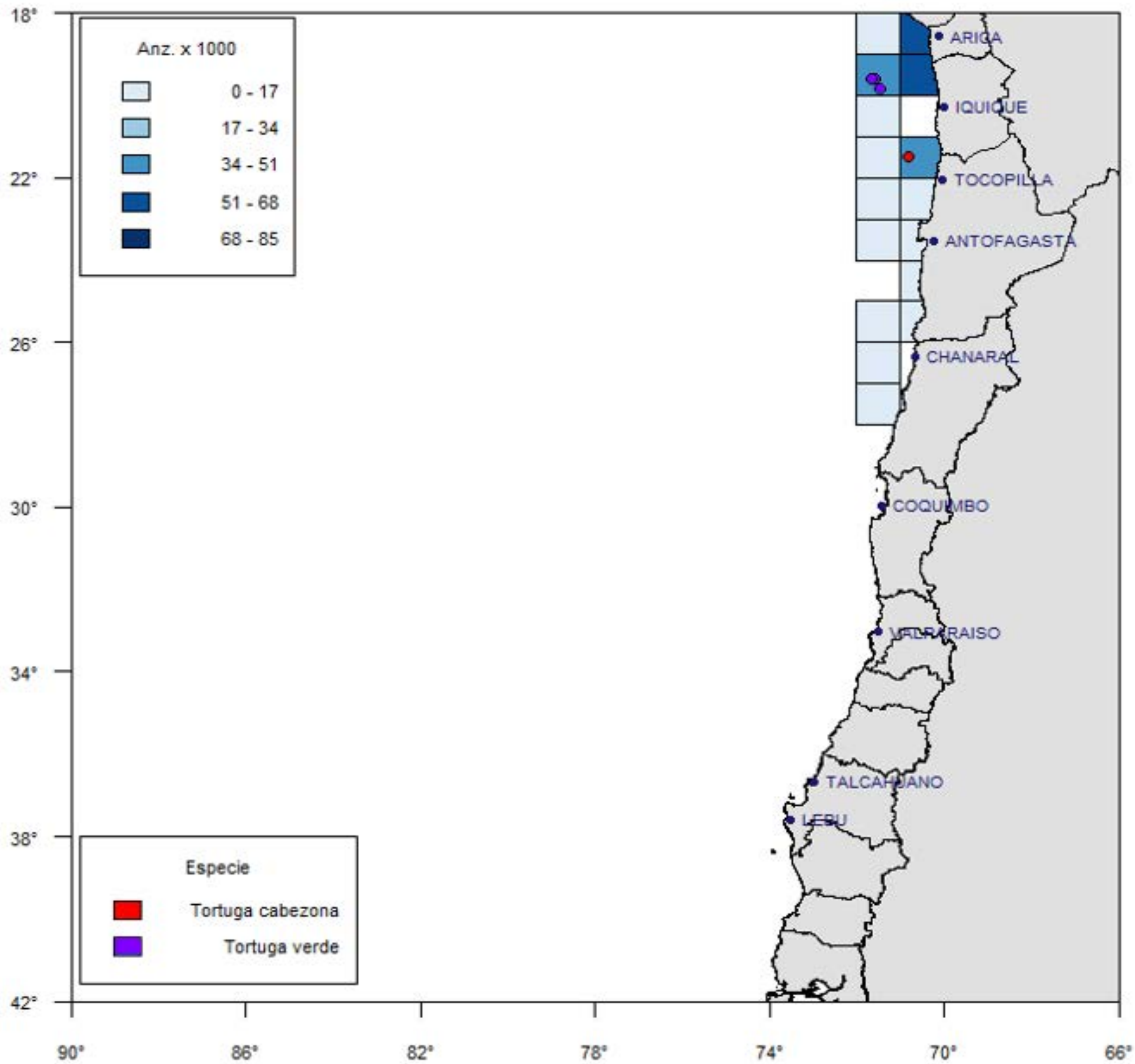

Figure 3. Spatial distribution of interaction between sea turtles and the artisanal longline (Espinel in Spanish) fleet effort (hooks set), which operated on sharks during 2016 (Zárate et al. 2017c).

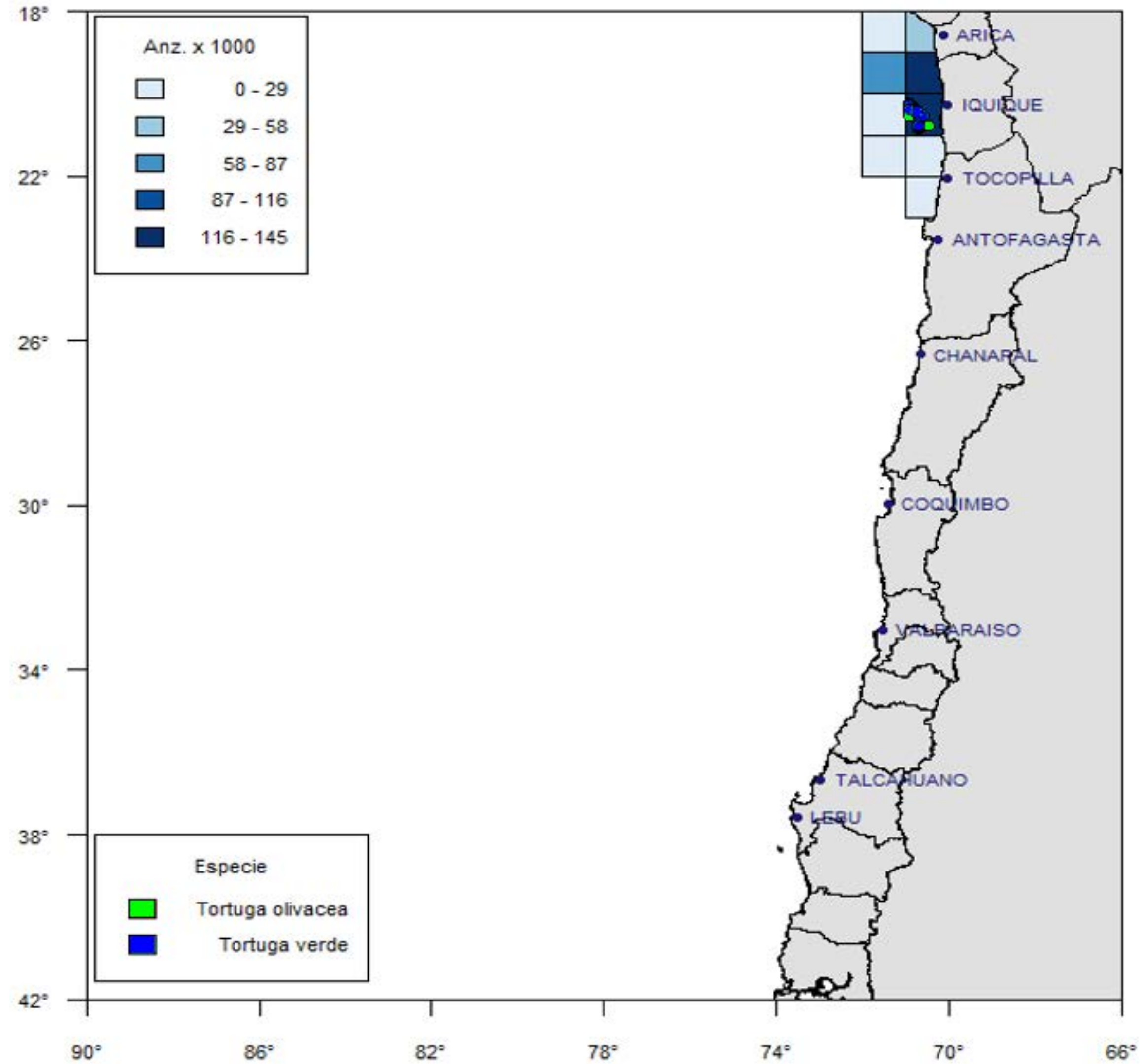

Figure 4. Spatial distribution of interaction between sea turtles and the artisanal longline (Espinel in Spanish) fleet effort (hooks set), which operated on common dolphinfish during 2016 (Zárate et al. 2017c).

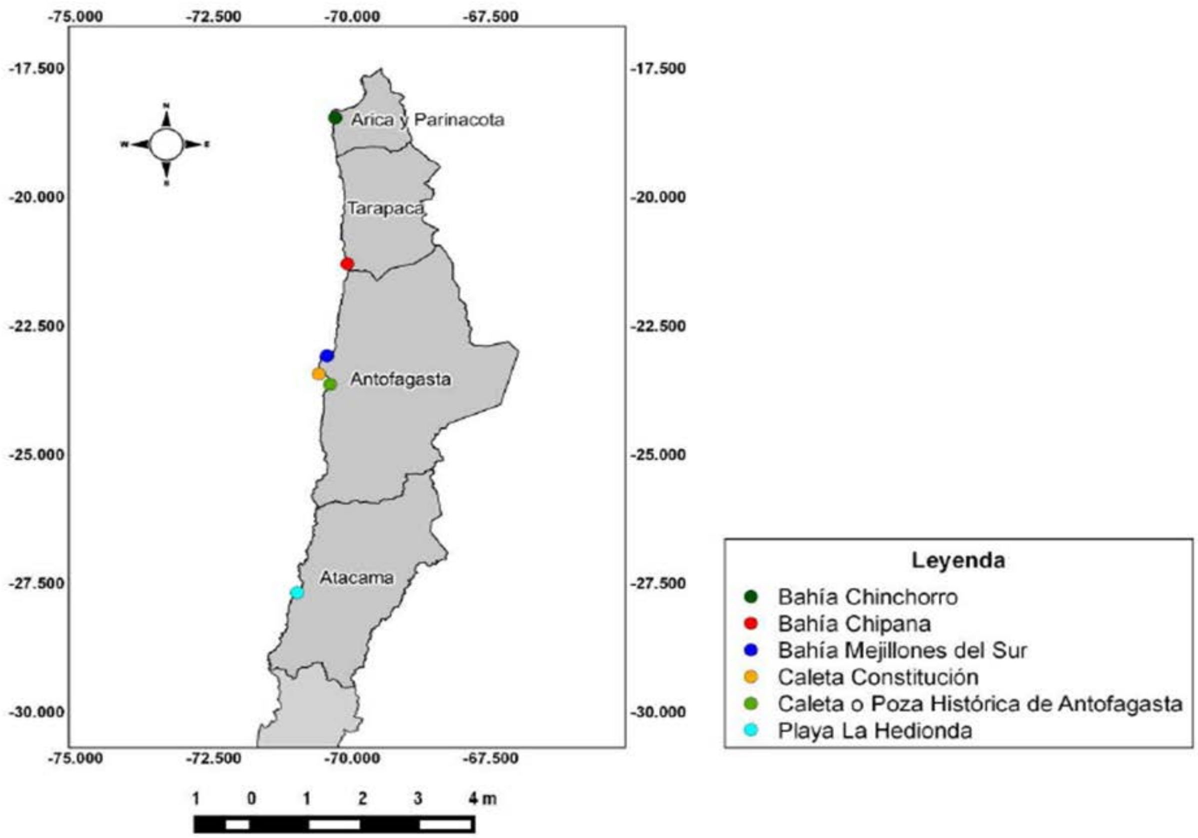

Figure 5. Foraging areas for Chelonia mydas identified in Chile (Sielfeld et al. 2015).

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