Earthwatch 2017 Annual Field Report

Costa Rican Sea Turtles

Authors: Nathan J. Robinson[1,2], Frank V. Paladino[1,2], Pilar Santidrián Tomillo[1,3]

Affiliations:

[1]The Leatherback Trust, Goldring-Gund Marine Biology Station, Playa Grande, Guanacaste, Costa Rica

[2]Department of Biology, Indiana University-Purdue University Fort Wayne, Fort Wayne, Indiana, U.S.A

[3]Population Ecology Group, Institut Mediterrani d' Estudis Avançats, IMEDEA (CSIC-UIB), Miquel Marquès, 21, 07190, Esporles, Mallorca, Spain.

Period Covered by this report: October 2016 – February 2017

Dear Earthwatch volunteers,

We've just reached the end of another fantastic season of research and conservation at Las Baulas National Park and we couldn't have done it without you! You are now part of a great community who have dedicated their time, money, and effort to help save the sea turtles of the Eastern Pacific Ocean. Thank you!

Over the 28 consecutive years that we have been monitoring the leatherback turtles of Las Baulas National Park, we have seen this population decline by over 98 %. The situation for the Eastern Pacific leatherback turtle is currently very dire; however, there are some promising signs of hope. Since 2015/16, leatherback turtles have been observed on many beaches throughout Costa Rica where leatherback turtles have not been seen nesting for many years. Parque Nacional Marino Las Baulas remains the most important nesting beach for the East Pacific leatherback turtle, but the re-occurrence of leatherback turtles on these secondary nesting beaches is exactly what you would expect in a recovering population. As always, we are very excited to see how next year looks!

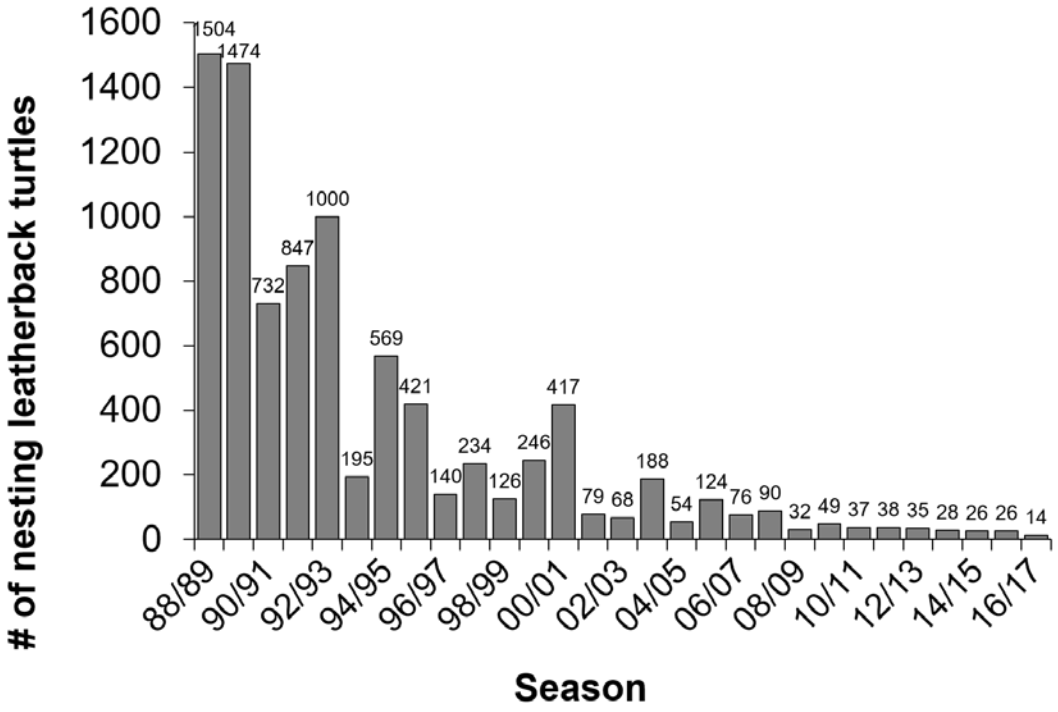
Sincerest regards,
Nathan J. Robinson, Frank V. Paladino, and Bibi Santidrián Tomillo

SUMMARY

This year we completed our 28th successful year monitoring and protecting that sea turtles that nest in Parque Nacional Marino Las Baulas, Costa Rica. This year we had a total of 12 leatherback, 55 olive ridley, and 5 black turtles. This means that we protected an estimated 84 leatherback, 110 olive ridley, and 20 black turtle nests.
The numbers of leatherback, olive ridley, and black turtles were all significantly lower than the previous year; however, over the past two years we have seen an unusually large number of turtles nesting on many nearby beaches. Interestingly, most of these beaches have not had any nesting activity for many years. We hope that this is a good sign of a potential recovery of the Eastern Pacific leatherback turtle soon!

GOALS, OBJECTIVES, AND RESULTS

This year we completed our 28th successful year monitoring and protecting that sea turtles that nest in Parque Nacional Marino Las Baulas, Costa Rica. This year we had a total of 12 leatherback, 55 olive ridley, and 5 black turtles. This means that we protected an estimated 84 leatherback, 110 olive ridley, and 20 black turtle nests.
The graph below shows the number of nesting leatherback turtles in Parque Nacional Marino Las Baulas since monitoring began in 1988/89 (and excluding this year's data). The data show that over the past 28 years, the numbers of nesting leatherback turtles have declined by about 98 %, or 20 % per year. Our primary mission, as it has always been, is to aid the recovery of this species.



To create this graph, we share data with Kuemar who patrol Playa Langosta. Consequently, the numbers shown here are larger than those for Playa Grande alone.

Objective 2 - *Quantify hatchling production per year and how hatchling production differs between months/years.*

We marked and excavated 60 % of the nests laid this year by leatherback, olive ridley, and black turtles on Parque Nacional Marino Las Baulas. The hatching success from all in situ leatherback turtle nests was 50 % this year, while it is normally closer to 40 %. The reason that hatching success was higher than normal was because we had a very rainy wet season, which leads to optimal conditions for the nests.

Objective 3 - *Estimate mortality rates for adult turtles. This is achieved by analysing the PIT tagging data to determine how many marked individuals are re-encountered on subsequent years.*

Our most recent estimates indicate that the leatherback turtles nesting in Parque Nacional Marino Las Baulas have a survival rate of approximately 80 % per year. With our 28-year dataset, we now have enough data to determine if the survival rate has changed over the study period. We are currently using this information to help inform us about temporal patterns in the effectiveness of at-sea conservation methods for leatherback turtles. More on this research project can be found in our latest publication: Santidrián Tomillo P, Robinson NJ, Sanz-Aguilar A, Spotila JR, Paladino FV, Tavecchia G (In Press) Unexpected high and variable mortality of leatherback turtles reveal a possible role of fisheries. Ecology.

Objective 4 - *Estimate mortality rates for hatchlings. This is achieved by comparing values of hatchling output to the rate of adult recruitment into the population.*

To estimate the mortality rate of hatchlings, we need to have approximately 30 years of data. As a result, we hope to begin addressing this research question in the next few years.

Objective 5 - *Examine patterns of population structuring both within Parque Nacional Marino Las Baulas and along the entire Pacific coastline of Central America. This is achieved by using genetic tools to assess the relationship between turtles that nest in different locations.*

We did not collect any samples for genetic analysis in 2016/17. Nevertheless, we hope to start collecting tissue samples from leatherback and olive ridley turtles in 2017/18. We will use these tissue samples to investigate the reproductive strategies of leatherback and olive ridley turtles along the coastline of Guanacaste.

RESEARCH GOALS – PHYSIOLOGY

Objective 1 - *Determine the effects of abiotic factors, such as sand temperature, moisture, and oxygen levels, and biotic factors, such as maternal identity, on the hatchling success and gender of sea turtle eggs.*

We were able to record, mark, and excavate 60 % of the nests laid this year from all three species. We now have 11 years of excavation data on hatchling production. These data have already been incorporated into a range of studies that have examined the effects of environmental conditions on

hatchling success. We are also using these data to determine how hatchling production is likely to be affected by climate change. Below are the citations from the most recent publications that we have produced on this subject.

Santidrián Tomillo P, Saba VS, Lombard CD, Valiulis JM, Robinson NJ, Paladino FV, Spotila JR, Fernández C, Rivas ML, Tucek J, Nel R, Oro D (2015) Global analysis of the effect of local climate on the hatchling output of leatherback turtles. Scientific Reports 5:16789.

Santidrián Tomillo P, Genovart M, Paladino FV, Spotila JR, Oro D (2015) Climate change overruns resilience conferred by temperature-dependent sex determination in sea turtles and threatens their survival. Global Change Biology 21:2980-2988.

Objective 2 - *Understand how sea turtles are able to regulate salt levels while inhabiting the marine environment.*

This year we did not conduct any experiments focusing on salt-regulation in sea turtles.

RESEARCH GOALS - BEHAVIOUR

Objective 1 - *Uncover the inter-nesting and foraging habitats of sea turtles as well as the migratory corridors connecting these habitats.*

For the last 5 years, we have been deploying satellite transmitters onto the black turtles that nest on Playa Cabuyal. We finished deploying all the satellite transmitters last year and are currently analyzing the data they generated.

Objective 2 - *Determine which oceanographic features, such as temperature, ocean currents, or productivity, determine the patterns of habitat usage as exhibited by sea turtles.*
See response to objective 1.

Objective 3 - *Determine the dietary preferences of adult sea turtles*
This year we did not conduct any dietary experiments.

CONSERVATION GOALS

Objective 1 - *Maintain a beach hatchery. All nests that are laid in detrimental locations, such as below the high-tide line or in front of beach entrances, are relocated to the hatchery. In the hatchery, these nests are continually monitored until they hatch.*

We had a total of 17 leatherback nests, 21 olive ridley nests, and 1 black turtle nest in the hatchery. These nests produced a total of 986 leatherback hatchlings, 1890 olive ridley hatchlings, and 0 black turtle hatchlings.

Objective 2 - *Maintain a continual vigilant presence on the nesting beaches to serve as a deterrent to egg poachers.*

We did not miss a single night of patrolling from October 1st until March 29th.

Objective 3 - *Excavate all nests to maximise the numbers of hatchlings that are able to successfully make it to the water.*

This year we excavated approximately 60 % of all the nests laid in Parque Nacional Marino Las Baulas.

Project Impacts

Increasing Scientific Knowledge

a) Total citizen science research hours:

This is the timeline for a typical Earthwatch volunteer:

- Training = 2 hours
- Patrolling (6 hours per night over 8 nights) = 48 hours
- Daytime activities, e.g. excavations and taking nest temperatures (2 hours per day over 2 days) = 4 hours

This makes a total of 54 hours per volunteer and we had 63 volunteers this year. Thus, we estimate a total of **3,402 citizen science research hours.**

b) Peer-reviewed publications

1. Farlow JO, Robinson NJ, Kumagai CJ, Paladino FV, Falkingham PL, Elsey RM, Martin AJ (In Press) Trackways of the American crocodile (*Crocodylus acutus*), Northwestern Costa Rica: implications for crocodylian ichnology. Ichnos.

2. Robinson NJ, Dornfeld TC, Butler BO, Domico LJ, Hertz CR, McKenna LN, Neilson CB, Williamson SA (2016) Plastic fork found inside the nostril of an olive ridley sea turtle. Marine Turtle Newsletter 150:1-3.

3. Robinson NJ, Lazo-Wasem EA, Paladino FV, Zardus JD, Pinou T (2016) Assortative epibiosis of leatherback, olive ridley, and green sea turtles in the Eastern Tropical Pacific. Journal of the Marine Biological Association of the United Kingdom. doi:10.1017/S0025315416000734Pub

4. Robinson NJ, Majewska R, Lazo-Wasem EA, Nel R, Paladino FV, Rojas L, Zardus JD, Pinou T (2016) Epibiotic diatoms are universally present on all sea turtle species. PLoS ONE 11:e0157011. doi:10.1371/journal.pone.0157011

5. Robinson NJ, Paladino FV, Santidrián Tomillo P (2017) Evidence of a green turtle commencing a post-nesting migration without laying all its vitellogenic follicles. Marine Turtle Newsletter 152:8-10.

6. Robinson NJ, Stewart KR, Dutton PH, Nel R, Paladino FV, Santidrián Tomillo P (In Press) Standardizing curved carapace length measurements for leatherback turtles, *Dermochelys coriacea*, to investigate global patterns in body size. The Herpetological Journal.
7. Santidrián Tomillo P, Robinson NJ, Fonseca L, Quirós W, Arauz R, Beange M, Piedra R, Vélez E, Paladino FV, Spotila JR, Wallace BP (In Press) Secondary nesting beaches of leatherback turtles in Pacific Costa Rica. Latin American Journal of Aquatic Research.

8. Santidrián Tomillo P, Robinson NJ, Sanz-Aguilar A, Spotila JR, Paladino FV, Tavecchia G (In Press) Unexpected high and variable mortality of leatherback turtles reveal a possible role of fisheries. Ecology.

c) Non-peer reviewed publications:

Technical reports, white papers, articles, sponsored or personal blogs

1. Robinson NJ, Santidrián Tomillo P, Paladino FV (2017) The benefits and costs of satellite telemetry. The State of the World's Sea Turtles. Report XII:6-7. (seaturtlestatus.org/sites/swot/files/report/0420517_SWOT12_p06-07_Satellite%20Tagging.pdf)

Books and book chapters

1. Kingsbury B, Robinson NJ (2016) Movement patterns and telemetry. In: Reptile Ecology and Conservation. Kenneth Dodd C (eds). Oxford University Press, Oxford, U.K., pp 110 – 121.

Presentations:

1. Robinson NJ, Blanco G, Clyde-Brockway C, Hill J, Patel SH, Panagapoulou A, Santidrián Tomillo P, Shillinger GS, Williams C, Spotila JR, Paladino FV (2017) Comparing the effect of temperature on the duration of the interesting interval across multiple sea turtle species. 37th Annual Symposium on Sea Turtle Biology and Conservation. Las Vegas, U.S.A. Oral presentation.

2. Mentoring

a) Graduate students

Student Name	Graduate Degree	Project Title	Anticipated Year of Completion
Jenell Black	MSc	Spatial ecology of the American crocodile (*Crocodilus acutus*) in the Tamrindo Estuary, Costa Rica	2017

3. Partnerships

Partner	Support Type(s)[1]	Years of Association (e.g. 2006-present)
MINAE (Ministerio de Ambiente y Energía – Ministy of the Environment and Energy)	Logistics, technical support, academic support.	1988 - Present
Matapalo Tour Guides Association	Collaboration, cultural support.	1995 – Present

4. Contributions to management plans or policies

Plan/Policy Name	Type[2]	Level of Impact[3]	New or Existing?	Primary goal of plan/policy[4]	Stage of plan/policy[5]	Description of Contribution
Inter-American Convention For the Protection of Sea Turtles	Convention	International	New	To develop management plans for sea turtles and their habitats throughout Central America.	In Progress	Data

5. Conserving natural and sociocultural capital

a) Conservation of taxa

i. In the past year, has your project helped conserve or restore populations of species of conservation significance? If so, please describe below.

Species	IUCN Red List category	Local/regional conservation status	Local/regional conservation status source	Description of contribution	Resulting effect[6]
Leatherback turtle	Vulnerable	Critically Endangered		Protecting nests from poaching, coastal development inundation, and predation	population increase
East Pacific green turtle	Endangered	Critically Endangered		Protecting nests from poaching, coastal development inundation, and predation	population increase
Olive ridley turtle	Vulnerable	Vulnerable		Protecting nests from poaching, coastal development inundation, and predation	population increase

b) Conservation of ecosystems

In the past year, has your project helped conserve or restore habitats? If so, please describe below.

Habitat type	Habitat significance[7]	Description of contribution	Resulting effect[8]
Beach	Nesting site	We are protecting Parque Nacional Marino Las Baulas by patrolling the nesting beaches nightly. In this manner, we are able to successfully safe-guard the nesting turtles from poachers and invasive predators, such as dogs. Our daytime work also helps to reforest the dunes at the back of the nesting beach and reduces the effects of artificial lighting from houses situated behind the beach.	Condition achieved.

c) Ecosystem services

Indicate which ecosystem service categories you are directly studying in your Earthwatch research and provide further details in the box below.

☐Food and water ☒Flood and disease control ☒Spiritual, recreational, and cultural benefits ☒Nutrient cycling

Details:

Carbon sequestration and erosion regulation due to reforestation. Maintaining sea turtle populations also helps maintain a thriving sea turtle ecotourism business in the local area. Sea turtle eggs, when left to incubate in the sand as well as when egg shells remain in the sand after the hatchlings have emerged, serve to provide essential and otherwise unavailable nutrients to the beach ecosystem.

d) Conservation of cultural heritage

Provide details on intangible or tangible cultural heritage components that your project has conserved or restored in the past year.

Cultural heritage component[9]	Description of contribution	Resulting effect
Traditional ecological knowledge	The local populace surrounding Parque Nacional Marino Las Baulas have always lived alongside the leatherback turtle. Without the leatherback turtle, these local people would lose an important piece of their cultural heritage. We also help fund a 'leatherback festival' at the end of each year, where many of the local schools, local citizens, and small local businesses congregate to share stories of life alongside sea turtles as well as artistic interpretations of personal importance of these animals. Moreover, many schools showcase unique traditional dances and as such, the festival serves as a platform to maintain a unique cultural identity.	

RESEARCH PLAN UPDATES

Report any changes in your research since your last proposal/annual report. For any 'yes' answers, provide details on the change in the 'Details' box.

1) Have you added a new research site or has your research site location changed? ☐**Yes** ☒**No**
2) Has the protected area status of your research site changed? ☐**Yes** ☒**No**
3) Has the conservation status of a species you study changed? ☐**Yes** ☒**No**
4) Have there been any changes in project scientists or field crew? ☒**Yes** ☐**No**

We will be recruiting a new field crew in the summer of 2017.