Photo Credit: Adam Yaney-Keller

Costa Rican Sea Turtles

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Period covered by this report: 2017-2018 and 2018-2019 field seasons

Dear Earthwatch volunteers,

Looking back, we are very proud to see how successful our last two seasons of research and conservation at Las Baulas National Marine Park have been! This would have never been possible without you, and the time, money, and effort you have invested towards the protection of East Pacific Ocean sea turtles. So thank you very much, and we are happy to have you in our team!

For 30 years now, we have been monitoring the leatherback turtles of Las Baulas National Park and we have seen this population decline by over 98%. As disheartening as this may be, we can see the glimmer of hope. Thanks to your efforts, each year we make sure that as many hatchlings as possible make it safely to the water, ensuring new recruitment into the population; leatherback turtles have been observed on many beaches along the Pacific coast of Costa Rica that have not seen nesting for many years. Parque National Marino Las Baulas continues to be a significant nesting beach for the East Pacific leatherbacks as 70% of the total activity is recorded there, but these secondary beaches are exactly what you would expect in a recovering population. More importantly, largely thanks to your help and support, we are still here working hard to save this population. We are already super-excited to see what the next season will bring. In the meantime, you can follow our progress on Facebook (@leatherbacktrust.org).

Sincerely,

Frank Paladino, Aliki Panagopoulou and Bibi Santidrián Tomillo

Photo credit: Nathan J Robinson

SUMMARY

During the period covered in this report, we completed 30 years monitoring and protecting sea turtles in Parque Nacional Marino Las Baulas, Costa Rica. During the 2017-2018 season we identified a total of 13 leatherbacks, 75 olive ridleys, and 8 black turtles, protected 65 leatherback, 147 ridley and 17 black turtle nests and helped more than 13,300 hatchlings to make it to the ocean. During the 2018-2019 season we identified 13 leatherbacks, 68 olive ridleys, and 8 black turtles, protected 82 leatherback, 158 ridley and 33 black turtle nests and helped an additional 13,000 hatchlings reach safely the ocean. Our results show the total numbers of turtles nesting within Parque Nacional Marino Las Baulas continues to be low, however we were able to ensure that more than 26,000 hatchlings were recruited in the population and will contribute to the recovery of these endangered sea turtle populations. In addition, the sporadic nesting on secondary beaches has continued, and we continue to hope that this is a good sign of a potential recovery of the Eastern Pacific leatherback turtle soon!

GOALS, OBJECTIVES, AND RESULTS

RESEARCH GOALS: POPULATION BIOLOGY AND NESTING ECOLOGY

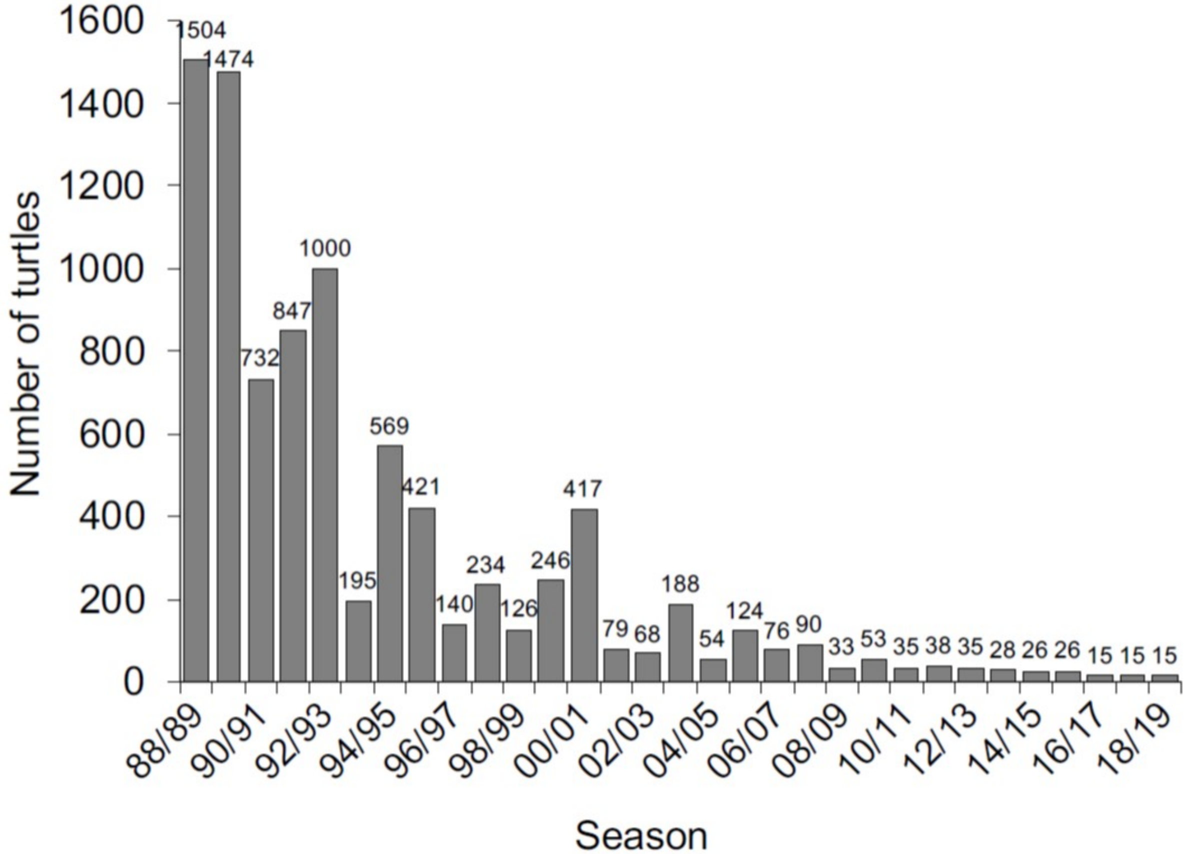
Objective 1: Identify all female turtles that nest in Las Baulas National Marine Park.

During the 2017-2018 season we identified 13 leatherbacks, 75 olive ridleys, and 8 black turtles and protected 65 leatherback, 147 ridley and 17 black turtle nests. During the 2018-2019 season we identified 13 leatherbacks, 68 olive ridleys, and 8 black turtles and protected 82 leatherback, 158 ridley and 33 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 30 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.

However, 46% of the leatherback turtles recorded in 2018-2019 and 38% of those recorded in 2018-2019 were neophytes, which means that they were observed for the first time. This supports our hypothesis that the recruitment level remains stable over time.

![EARTHWATCH INSTITUTE]



Important note: 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.

The average remigration interval (= the number of years between reproductive seasons) remains stable with an average of 3.6 years. Data collected on nesting females are currently being analyzed in order to assess if the remigration intervals continue to be impacted by ENSO (El Niño) (Saba et al., 2007). Further, we continue to assess the impact of bycatch on leatherback populations (Santidrián Tomillo et al., 2017) with the collaboration of specialists working in other countries along the East Pacific coast that include the United States, Mexico, Ecuador, Nicaragua, Costa Rica, Panama, Colombia, Peru and Chile. Currently, we have a paper under review on leatherback bycatch across nesting and internesting areas from the Eastern Pacific Ocean.

Saba V.S., Santidrian-Tomillo P., Reina R.D., Spotila J.R., Mu-sick J.A., Evans D.A., Paladino F.V. (2007) The effect of theEl Nino Southern Oscillation on the reproductive frequency of eastern Pacific leatherback turtles. Journal of Applied Ecology 44, 395–404

Santidrián Tomillo P, Robinson NJ, Sanz-Aguilar A, Spotila JR, Paladino FV, Tavecchia G (2017) Unexpected high and variable mortality of leatherback turtles reveal a possible role of fisheries. Ecology https://doi.org/10.1002/ecy.1909

Objective 2: Estimation of total reproductive output

During 2017-2018, we identified a total of 65 leatherback, 147 ridley and 17 black turtle nests. Average clutch size was 57 eggs for leatherback clutches, 97 for ridleys and 60 for blacks. Hatching success (= the percentage of hatchlings that emerged from the nest) ranged from 55% for leatherbacks to 91% for blacks.

During the 2018-2019 season, we recorded a total of 82 leatherback, 158 ridley and 33 black turtle nests. Average clutch size was 57 eggs for leatherback clutches, 97 for ridleys and 60 for blacks. Hatching success ranged from 38% for leatherback turtle clutches to 74% for blacks.

The above data have been added to our long-term data set and are being assessed in order to determine if remigrant turtles have a higher reproductive output than neophytes, if there are differences in reproductive output among individuals and if total reproductive output remains the same over time.

Note: reproductive output = total number of clutches and total number of eggs per female

Objective 3: Assessing total recruitment of hatchlings to the sea turtle population.

Total recruitment of hatchling is calculated based on clutch size and hatching success. During the 2017-2018 nesting season, nests recorded yielded approximately 2,000 leatherback, 10,400 ridley and 900 black turtle hatchlings reaching an estimated 13,300 hatchlings recruited to the populations. During 2018-2019, hatching success was a little lower which means that with 2,200 leatherback, 9,500 ridley and 1,400 black turtle hatchlings approximately 13,000 hatchlings reached the ocean. These data have been included in our long-term dataset and are currently analyzed to assess if there are significant differences in hatching success among nests, among females between beaches and between seasons. Our analyses have shown some interesting results such as the impact of temperature and depth of drying front on hatchling emergence (Swiggs et al., 2018), the effect of lights on the in-water orientation of ridley hatchlings (Cruz et al., 2018) and the thermal sensitivity of different species of sea turtles to changes in nest temperature (Santidrián Tomillo et al. 2017). These will play a key role in assessing total recruitment of hatchling to the sea turtle population as they factor in conditions that may increase hatchling mortalities.

Lauren M. Cruz, George L. Shillinger, Nathan J. Robinson, Pilar Santidrián Tomillo, Frank V. Paladino, 2018. Effect of light intensity and wavelength on the in-water orientation of olive ridley turtle hatchlings. Journal of Experimental Marine Biology and Ecology 505, 52-56. https://doi.org/10.1016/j.jembe.2018.05.002.

Santidrián Tomillo P, Fonseca L, Paladino FV, Spotila JR, Oro D (2017) Are thermal barriers "higher" in deep sea turtle nests? PLoS ONE 12(5): e0177256. https://doi.org/10.1371/journal.pone.0177256

Swiggs, J., Paladino, F.V., Spotila, J.R. et al. Mar Biol (2018) 165: 91. https://doi.org/10.1007/s00227-018-3350-y

Objective 4: Assessing temperature profiles of nests.

Changes in temperature within the egg chamber have been shown to impact egg development and total hatchling output. In addition, sex ratios (= percentage of male vs female hatchlings produced) within the nest are affected by temperatures, with higher temperatures producing more females. For this reason, we continue to monitor temperature within sea turtle clutches. There have been several papers produced on the impact of temperature of nests, such as:

Binckley CA, Spotila JR, Wilson KS, Paladino FV (1998) Sex determination and sex ratios of Pacific leatherback turtles, Dermochelys coriacea. Copeia 1998:291–300.

Santidrián Tomillo P, Suss SJ, Wallace BP, Magrini KD, Blanco G, Paladino FV and Spotila JR (2009) Influence of emergence success on the annual reproductive output of leatherback turtles. Marine Biology 156:2021-2031.

Santidrián Tomillo, P., Oro, D. Paladino, F.V., Piedra, R., Sieg, A.E. and Spotila, J.R. 2014. High beach temperatures increased female-biased primary sex ratios but reduced output of female hatchlings in the leatherback turtle. Biological Conservation 176:71-79.

In the period covered by this report, we continued to collect temperature data from nests by placing thermocouples inside the nest chamber. These data were added onto our existing datasets and are currently being assessed in view of Objective #5 below.

Objective 5: Monitoring and studying the effect of climatic conditions within the nest environment.

Research has shown that climate change has an impact on sea turtle populations (Saba et al., 2012; Santidrián Tomillo et al, 2012; 2015a; 2015b). Some years ago, we began experiments to mitigate the impact of climate change on protected sea turtle nests (Hill et al. 2015). In the period covered by this report, we continued to conduct such experiments at the hatchery that yielded some interesting results. For example, we found that using different types of shade cover mitigates temperatures and may be an effective way to reach target temperatures in nests. Further, we found that using boxes when temperatures get too high will allow individual treatment of nests to reduce temperature once they have passed a certain threshold to avoid changing sex ratios. However we still need to explore the effectiveness of the shade treatments directly at increasing hatching success. These results complement those found by Hill et al. in 2015, and we are planning to use the results to update our nest protection protocols accordingly.

Hill JE, Paladino FV, Spotila JR, Santidrián Tomillo P. 2015. Shading and watering as a tool to mitigate the impacts of climate change in sea turtle nests. PLoS ONE 10(6):e0129528.

Saba VS, Stock CA, Paladino FV, Spotila JR, Santidrián Tomillo P (2012) Projected response of an endangered marine turtle population to climate change. Nature Climate Change 2:814-820.

Santidrián Tomillo P, Saba VS, Blanco GS, Stock CA, Paladino FV, Spotila JR (2012) Climate drive egg and hatchling mortality threatens survival of Eastern Pacific leatherback turtles. PLoS ONE 7:e37602.

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.

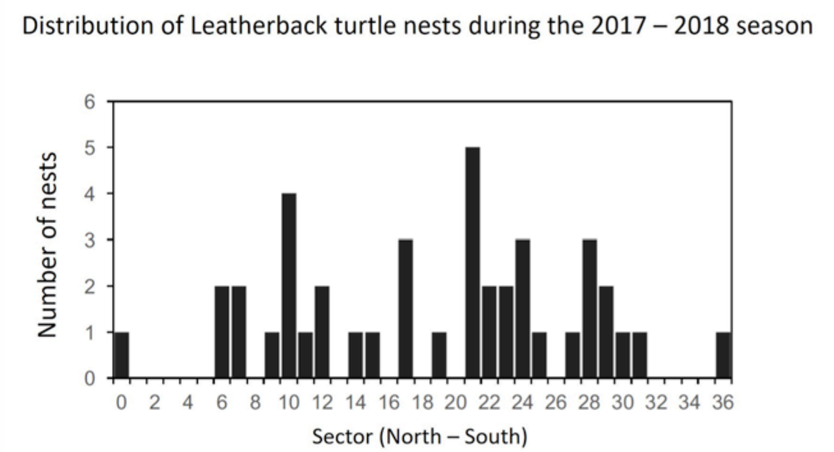
Santidrián Tomillo P, Genovart M, Paladino FV, Spotila JR, Oro D (2015) Climate change overruns resilience conferred by temperature-dependent sex determination in sea turtles and threatens their survival. Global Change Biology 21:2980-2988.

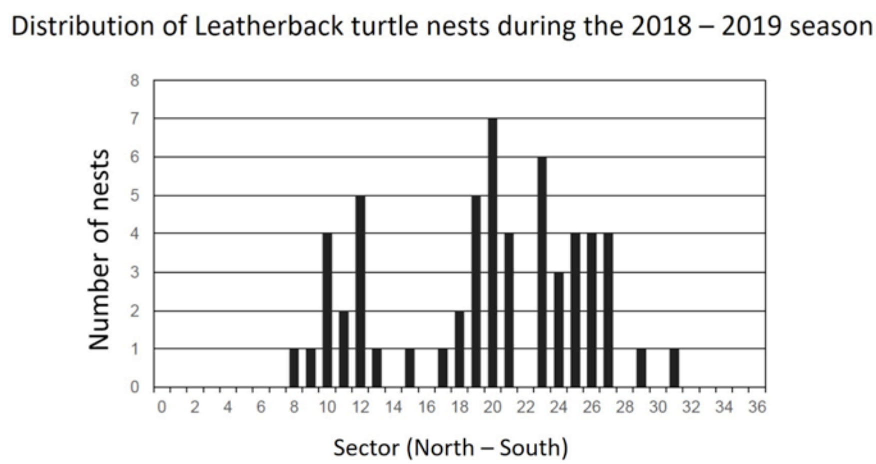
RESEARCH GOALS: PHYSIOLOGY AND BEHAVIOR

Objective 1: Recording coordinates for all clutches deposited within the Park, as well as distances to the ocean and the vegetation line.

For each clutch recorded during the 2017-2018 and 2018-2019 seasons, we triangulated it to the nearest two beach markers to identify its location within the Park, then took distances to the ocean and the vegetation line. These data help us identify preferences in the selection of the nesting site by sea turtles, and assess potential differences among individuals or between nesting events. They also help assess changes in nest distribution over time that could be related to human activities on the nesting beaches.

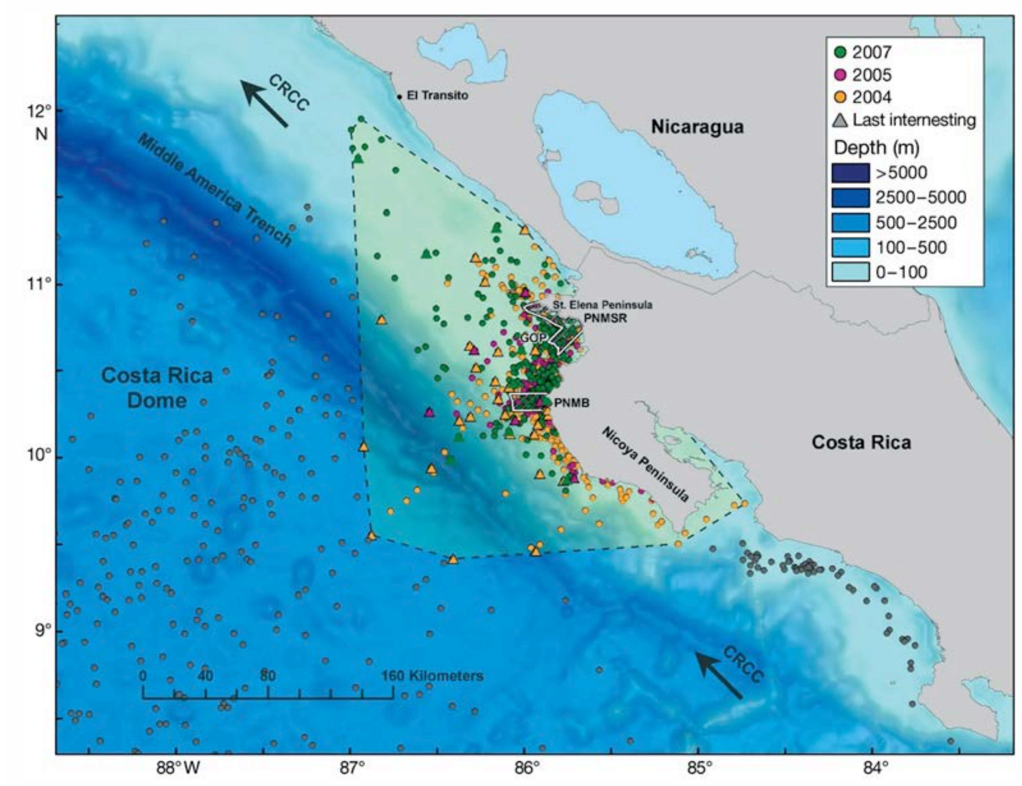
As can be seen in the graphs below, there are some differences in distribution of leatherback nests between the two seasons covered by this report. However, long-term data are needed in order to draw any meaningful conclusions and to assess if these differences are related to specific factors (e.g. sand temperatures, proximity to light sources, human disturbances, etc).





Objective 2. Studying the internesting habitats of turtles nesting in Playa Grande

During the 2017-2018 and 2018-2019 seasons, we did not deploy any satellite transmitters or data loggers on nesting females to assess their internesting habitat. The internesting habitat of leatherback turtles has been identified in previous studies (e.g. Shillinger et al., 2010) and can be seen in the graph below:



As seen in the graph, the marine section of Parque Nacional Marino Las Baulas is also critical for nesting leatherback turtles, although the total internesting habitat far exceeds its boundaries. We hope to be able to deploy more satellite transmitters in the future so as to be able to further assess the turtles internesting behavior.

Shillinger G, Swithenbank A, Bograd S, Bailey H, Castelton M, et al. (2010) Identification of high-use internesting habitats for eastern Pacific leatherback turtles: role of the environment and implications for conservation. Endangered Species Research 10: 215–232. (This paper is also source for the graph utilized in this section of the report)

Objective 3. Studying environmental and oceanic data in order to determine oceanic features that drive habitat utilization patterns

We continue to study the effect of environmental and oceanic data such as El Niño on the nesting behavior of turtles. Currently, we have a paper in preparation regarding the effect of extreme events on the reproductive ecology of sea turtles including leatherbacks and ridleys nesting in Playa Grande.

RESEARCH GOALS: CONSERVATION

Objective 1: Maintain a hatchery to relocate nests laid in detrimental locations.

As in previous seasons, we maintained a 15 X 15 m (approx. 50 X 50 feet) beach hatchery close to the station. Here we relocated nests laid in doomed locations due to proximity to the ocean, trampling or predation risks. During the 2017-2018 season, we relocated a total of 75 nests (14 leatherback, 54 ridley and 4 black) to the hatchery, which resulted in a total of nearly 8,000 hatchlings reaching the ocean. During the 2018-2019 season, we relocated 55 nests (6 leatherback, 48 ridley and 1 black) which resulted in about 3,800 hatchlings reaching the ocean. All nests from the hatchery were excavated to assess hatching success. Further, our results show that because of the increased protection for nests relocated to the hatchery has led to increased hatchling production per nest as it significantly reduces mortalities as a result of predation.

During the 2017-2018 and 2018-2019 seasons, we noted an increasing number of raccoons trying to predate nests relocated to the hatchery. For this reason, we introduced a new protection method for nests within the hatchery that involves placing a metal grid above the egg chamber. The grid does not allow the raccoons to dig their way to the egg chamber, thus protecting the nest from predation. This method was found to be effective, and we noted that towards the end of the 2018-2019 season there were fewer raccoons present in the area surrounding or within the hatchery. The photo below shows a nest at the time it is relocated in the hatchery by our field biologist Abigail Parker.

Photo credit: Courtney King

Objective 2: Conducting day and night patrols daily on the beach

We conducted day and night patrols daily on the beach as per our protocol. Night patrols typically started 3 hours before and ended 3 hours after high tide. Morning shifts started at 5am in the morning and had a duration of 2-3 hours depending on the findings. Besides the valuable scientific data collected, we were able to keep a vigilant presence on the beach that helped ensure that nests deposited incubated safely. For example, we are able to see and react to activities that may impact the habitat, record illegal activities and further our constant presence on the beach day and night prevents opportunistic poachers from removing eggs from the nests.

Objectives 3 and 4: All nests are excavated after hatching, and live hatchlings found are helped to the water

During the period covered by this report, more than 60% of nests recorded were excavated. During excavations several live hatchlings trapped inside the nest were found and helped to the ocean, thus increasing the total number of hatchlings that reach the water.

PROJECT IMPACTS

Report contributions in the categories below for the past fielding year.

1. 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 it a total of 56 hours per Earthwatch volunteer. During the 2017 – 2018 season, we had 35 volunteers and in 2018 – 2019 we had 29. Therefore the estimated total of research hours invested in the project comes up to 3,456 hours (1,890 and 1,566 respectively for each season)

For the following items, provide full references for publications and material resulting from or supported by your Earthwatch project, indicate the status of the publication (in press, published, etc.) and whether Earthwatch was acknowledged. Include papers/material from all staff, whether or not the PI is a co-author.

b) Peer-reviewed publications

The LaúdOPO network (In review) Reversing the long-term, persistent decline of eastern Pacific leatherbacks: where do we go from here? Scientific Reports.

Ortiz-Alvarez et al. (In review) Rapid assessments of leatherback bycatch across nesting and interesting areas from the eastern Pacific Ocean. Frontiers in Marine Science.

Santidrián Tomillo P, Fonseca, LG, Ward M, Tankersley N, Robinson NJ, Orrego CM, Paladino FV and Saba VS (In review) On the effect of extreme El Niño events on long-lived sea turtles. Climatic Change.

Williamson, S.A., Evans, R.G., Robinson, N.J. and Reina, R.D. 2019. Synchronised nesting aggregations are associated with enhanced capacity for extended embryonic arrest in olive ridley sea turtles. Scientific Reports 9:9783.

McKenna, L.N., Paladino, F.V., Santidrián Tomillo, P. and Robinson, N.J. 2019. Do sea turtles vocalize to synchronize hatching or nest emergence? Copeia 107:120-123.

Robinson, N.J., Lazo-Wasem, E.M., Butler, B.O., Lazo-Wasem, E.A., Zardus, J.D. and Pinou, T. 2019. Spatial distribution of epibionts on olive ridley sea turtles at Playa Ostional, Costa Rica. PLoS ONE 14:e0218838.

Swiggs, J., Paladino, F.V., Spotila, J.R. and Santidrián Tomillo P. 2018. Depth of the drying front and temperature affect emergence of leatherback turtles. Marine Biology 165:1-10.

Cruz, L.M., Shillinger, G.L., Robinson, N.J., Santidrián Tomillo, P. and Paladino, F.V. 2018. Effect of light intensity and wavelength on the in-water orientation of olive ridley turtle hatchlings. Journal of Experimental Marine Biology and Ecology 505:52-56.

Robinson, N.J. and Peters, W.S. 2018. Complexity of the prey spectrum of *Agaronia propatula* (Gastropoda: Olividae), a dominant predator in sandy beach ecosystems of Pacific Central America. Peer J 6:e-4714

Williamson, S.A., Evans, R.G., Robinson, N.J. and Reina, R.D., 2017. Hypoxia as a novel method for preventing movement-induced mortality during translocation of turtle eggs. Biological Conservation 2016:86-92

Santidrián Tomillo, P., Robinson, N.J., Sanz-Aguilar, A., Spotila, J.R., Paladino, F.V. and Tavecchia, G., 2017. High and variable mortality of leatherback turtles reveal possible anthropogenic impacts. Ecology 98:2170-2179

Santidrián Tomillo, P., Fonseca, L., Paladino, F.V., Spotila, J.R. and Oro, D., 2017. Are thermal barriers "higher" in deep sea turtle nests? PloS ONE 12(5):e0177256

Santidrián Tomillo, P., Robinson, N.J., Fonseca, L.G., Quirós-Pereira, W., Arauz, R., Beange, M., Piedra, R., Vélez, E., Paladino, F.V., Spotila, J.R., and Wallace, B.P., 2017. Secondary nesting beaches for leatherback turtles on the Pacific coast of Costa Rica. Latin American Journal of Aquatic Research 45:563-571

Robinson, N.J., Stewart, K.R., Dutton, P.H., Nel, R., Paladino, F.V., Santidrián Tomillo, P., 2017. Standardizing curved carapace length measurements for leatherback turtles, *Dermochelys coriacea,* to investigate global patterns in body size. The Herpetological Journal 27:231-234

Robinson, N.J., Figgener, C., Gatto, C., Lazo-Wasem, E.A., Paladino, F.V., Santidrián Tomillo, P., Zardus, J.D. and Pinou, T. 2017. Assessing potential limitations when characterising the epibiota of marine megafauna: effect of gender, sampling location, and inter-annual variation on the epibiont communities of olive ridley sea turtles. Journal of Experimental Marine Biology and Ecology 497:71-77.

c) Non-peer reviewed publications:

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

Santidrián Tomillo, P. 2019. How many eggs does it take to make an adult turtle? The State of the World's Sea Turtles (SWOT) Report14:37

Robinson, N.J., Santidrián Tomillo, P. and Paladino, F.V. 2017. The benefits and, often ignored, costs of satellite tracking. The State of the World's Sea Turtles (SWOT) Report12:6-7.

d) Books and book chapters

e) Presentations:

Santidrián Tomillo P, Fonseca L, Ward M, Tankersley N, Robinson NJ, Orrego CM, Paladino FV and Saba VS (2019) Effects of the 2015-2016 extreme El Niño event on sea turtles. International Congress for Conservation Biology. Kuala Lumpur, Malaysia. Oral presentation.

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2. Mentoring

a) Graduate students

List graduate students doing thesis work on the project and include student CVs and their research proposal on file with the university as an attachment when you submit your annual report

Student Name	Graduate Degree	Project Title	Anticipated Year of Completion
Jennell Black	MSc	Spatial ecology of the American crocodile (*Crocodilus acutus*) in the Tamrindo Estuary, Costa Rica	2019 (completed)
Jose Vindas Picado	"Licenciatura"	Mitigating the impact of high sand temperature on sea turtle clutches maintaining their natural sex ratio	2019
Ashleigh Bandimere	MSc	Effect of local climate on leatherback (*Dermochelys coriacea*) hatchling morphology and implications for adult population sex ratios	2019 (completed)

b) Community outreach

Provide details on how you have supported the development of environmental leaders in the community in which you work.

Name of school, organization, or group	Education level	Participants local or non-local	Details on contributions/ activities
Matapalo School	Elementary	420 (210 in 2018 and 210 in 2019)	Collaboration between Bullis Charter School and Matapalo school for environmental Program related to turtles at Las Baulas National Marine Park
Beach cleaning activities	All classes + local community members	1225 (363 in 2018 and 862 in 2019)	Organizing beach cleaning events to increase awareness about the impacts of single use plastic
Las Baulas Festival	All classes + local community	500 (250 in 2018 and 250 in 2019)	Annual event celebrating leatherback turtles
Informed Tourists via Matapalo Tour Guides Association	Visitors to the area	2713 (1067 in 2018 and 1646 in 2019)	Providing information to tourists before going on the beach to observe nesting leatherback turtles

3. Partnerships

List your current active professional partnerships that contribute to your project and indicate the type of support these partners provide

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

[1] Support type options: funding, data, logistics, permits, technical support, collaboration, academic support, cultural support, other (define)

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4. Contributions to management plans or policies

List the management plans/policies to which your project contributed this year

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	Existing	To develop management plans for sea turtles and their habitats throughout Central America.	In progress	Data Expert opinion upon request
Laúd OPO	Network	Transnational/ Regional	Existing	To develop and maintain a network of organizations and stakeholders for the conservation and research of leatherback turtles along the East Pacific coast	In Progress	Data Participation in collaborative projects (e.g. reducing bycatch)

2. Type options: agenda, convention, development plan, management plan, policy, or other (define)

3. Level of impact options: local, regional, national, international

4. Primary goal options: cultural conservation, land conservation, species conservation, natural resource conservation, other (define)

5. Stage of plan/policy options: proposed, in progress, adopted, other (define)

5. Conserving natural and sociocultural capital

a) Conservation of taxa

i. *List any focal study species that you did not list in your most recent proposal*

Species	Common name	IUCN Red List category	Local/regional conservation status	Local/regional conservation status source
Dermochelys coriacea	Leatherback turtle	Vulnerable (VU), Decreasing	Critically Endangered	
Chelonia mydas agasizii	East Pacific green turtle	Endangered (EN), Decreasing	Endangered (EN)	
Lepidochelys olivacea	Olive ridley	Vulnerable (VU), Decreasing	N/A	

ii. *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]

6. Resulting effect options: decreased competition, improved habitat for species, range increased, population increase, improved population structure, increased breeding success, maintained/enhanced genetic diversity, other

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 safeguard the nesting turtles from poachers and unnatural 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

7. Habitat significance options: nursery, breeding ground, feeding site, corridor, migration path, refuge, winter range, summer range, spring range, fall range or other (define)

8. Resulting effect options: extent maintained, condition achieved, restored, expanded, improved connectivity or resilience

c) Ecosystem services

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

Provisioning

Fisheries (Fresh & Marine)
Fuelwood
Livestock grazing
Material extraction (e.g. resin, grass)
Timber
Water supply

Regulating

Carbon sequestration/storage/"blue"
☒Coastal protection
Erosion control
☒Flood regulation/protection
Pest and disease control
Pollination
Water purification/quality
☒Nutrient cycling

Cultural

☒Cultural/historical values
Health (mental & physical)
☒Research & knowledge
Recreational
☒Spiritual values

Other Services

☒Biodiversity
Employment

Details:

A protected coastline prevents coastal erosion by replenishing sand deposits removed as a result of wave activity. 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.	

9. Cultural heritage component options: traditional agriculture, artifacts, building(s), hunting ground or kill site, traditional ecological knowledge and practices, monument(s), oral traditions and history, spiritual site, traditional subsistence living

e) Impacting local livelihoods

Provide details on how livelihoods were impacted by your project. This includes persons hired to assist Earthwatch teams (field assistants, guides, cooks, drivers, etc.) and any economically applicable training provided to local community stakeholders.

Local livelihood impact(s)	Description of contribution	Number of people impacted
Employment	Support services to the Goldring-Gund Marine Biology Station (Outreach, Maintenance, Housekeeping)	3
Support	Income generated for the local family-owned restaurant (Kike's) that provides most of the meals to the team.	4-6
Income	The Matapalo Tour Guide Association Guides derive income from taking tourist out to the beach to observe nesting leatherback turtles. This is of particular significance as these people used to derive income from poaching eggs, which has now been substituted by an eco-tourist activity	10 currently active

f) Please provide any other measurable actions that you conducted within the local community(s) where your research takes place.

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. This section will not be published online.

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**

Details – provide more information for any 'yes' answers

Not applicable

5) Provide details on any changes to your objectives, volunteer tasks, or methods, include reason for the change.

ACKNOWLEDGEMENTS

We would like to thank all Earthwatch volunteers for contributing so much to our work. Special thanks are due to the personnel of the Goldring-Gund Marine Biology Station for providing all the support necessary for the smooth running of the project. Thank you to Kike's , Kike and all his family for making the team and volunteers feel so welcome. We would also like to acknowledge the administration of Las Baulas National Marine Park for a great collaboration spanning so many years that helps produce such great results

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