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Photo Credit: Aliki Panagopoulou

Costa Rican Sea Turtles

EARTHWATCH FIELD REPORT

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Period covered by this report: 2019–2020 field season

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Dear Earthwatch volunteers,

Looking back, we are very proud to see the breadth and quality of our work at Las Baulas National Marine Park! 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%. This year may have been disheartening due to the low number of turtles, but we maintain 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; a recent publication by Laud OPO, a group of experts we belong to, showed that this is crucial to the survival of the population. Parque Nacional Marino Las Baulas continues to be a significant nesting beach for the East Pacific leatherbacks as over 70% of the total activity in Costa Rica is recorded there. 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

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Summary

During the period covered in this report, we completed 31 years monitoring and protecting sea turtles in Parque Nacional Marino Las Baulas, Costa Rica. During the 2019—2020 season we identified a total of 4 leatherbacks, 41 olive ridleys, and 11 east Pacific green turtles, protected 23 leatherback, 97 ridley and 37 black turtle nests and guaranteed that more than 8,600 hatchlings made it to the ocean (2,900 of these from the hatchery). Our results show the total numbers of turtles nesting within Parque Nacional Marino Las Baulas continues to be low, however the hatchlings that were recruited to the population can 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 2019—2020 season we identified 4 leatherbacks, 41 olive ridleys, and 11 black turtles and protected 23 leatherback, 97 ridley and 37 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. A paper published by Laúd OPO Network* in 2020 showed that the trend of extinction can be reversed if we continue (and increase) to produce as many hatchlings as possible each year. This means that protecting and relocating endangered nests into our approved hatchery is essential for the future of the turtle populations at Las Baulas National Marine Park.

One of the leatherback turtles recorded in 2019—2020 was a neophyte, which means that it was observed for the first time. Despite the small number of leatherbacks nesting this season, the recruitment level appears to remain stable over time.

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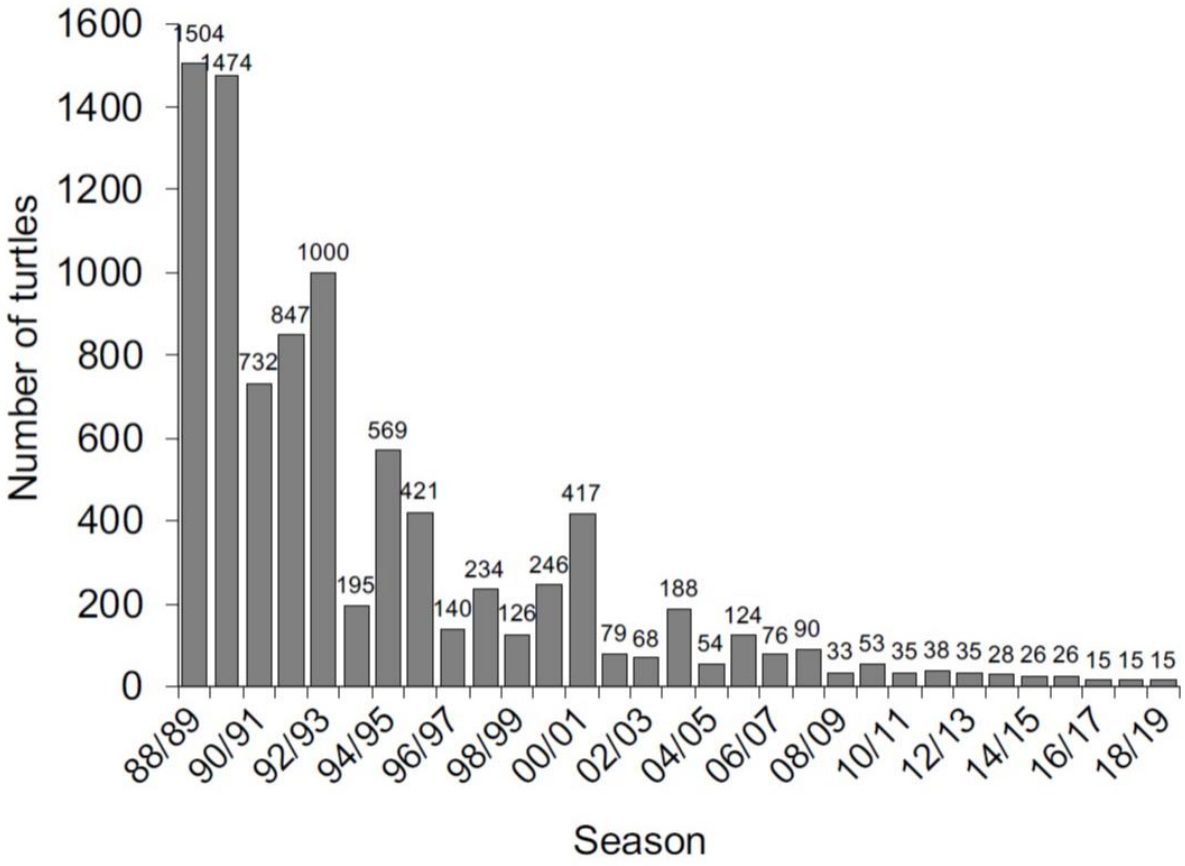

Important note: *To create this graph, we share data with Kuemar who patrol Playa Langosta. Consequently, the numbers shown here are larger than those for Playa Grande alone.*

The average remigration interval (= the number of years between reproductive seasons) has been similar to other years with an average of 3.3 years. Data collected on nesting females are currently being analyzed to assess the effect of El Niño Southern Oscillation (ENSO) on adult turtles and (Saba et al., 2007) hatchlings (Santidrián Tomillo et al. 2020). Likewise, we continue to assess the impact of bycatch on leatherback populations (Santidrián Tomillo et al., 2017a) 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. We have recently collaborated in one new publication on leatherback bycatch across nesting and internesting areas from the Eastern Pacific Ocean (Ortiz-Alvarez et al., 2020).

- Ortiz-Alvarez, C.A., Pajuelo, M., Grados, D., Abrego, M.E., Barragán-Rocha, A.R., Barrantes, M., Cotto, A., Fonseca, L., Gadea Espinal, V., Mangel, J.C., Rguez-Baron, J.M., Santidrián Tomillo, P.*, Sarti, L., Santana-Hernández, H., Shillinger, G.L., Prado, M., Wallace, B.P., Williard, A.S., Zavala-Norzagaray, A.A. and Alfaro Shigueto, J. 2020. Rapid assessments of leatherback small-scale fishery bycatch in interesting areas in the eastern Pacific Ocean. Frontiers in Marine Science 6: article 813.
- 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 the El 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 (2017a) Unexpected high and variable mortality of leatherback turtles reveal a possible role of fisheries. Ecology https://doi.org/10.1002/ecy.1909

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- Santidrián Tomillo P, Fonseca L, Ward M, Tankersley N, Robinson NJ, Orrego CM, Paladino FV Saba VS (2020). The impacts of extreme El Niño events on sea turtle nesting populations. Climatic Change 159, 163-176.
- The Laúd OPO Network*, 2020: Enhanced, coordinated conservation efforts required to avoid extinction of critically endangered East Pacific leatherback turtles. Nature Scientific Reports, 10.1 (2020): 4772.

** Laúd OPO Network: A regional team of researchers, managers, field biologists, students, and many others from Chile to the United States who work together to recover critically endangered leatherback turtles from extinction (www.savepacificleatherbacks.org). Experts working on this project are members of this Network. We are co-authors to this paper and developed the model that was used in this analysis.*

OBJECTIVE 2: Estimation of total reproductive output

During the 2019—2020 season, we recorded a total of 23 leatherback, 97 ridley and 37 black turtle nests. Average clutch size was 66 (Standard deviation: 7.5) eggs for leatherback clutches, 93 (Standard deviation: 22.3) for ridleys and 63 (Standard deviation: 13.4) for east Pacific green turtles. Hatching success ranged from 47% for leatherback turtle clutches to 88% for greens. We note that these rates are higher than those of the last two seasons and may be explained by the higher levels of rain and lower temperatures recorded this year.

The above data have been added to our long-term data set and are being assessed to determine if there are changes in reproductive output with age and experience, 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

Standard deviation = Statistical term indicating the amount of variation or dispersion of a set of values. A low standard deviation value suggests that the values tend to be close to the mean of the set, while a high standard deviation value indicates that the values spread out over a wider range.

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Relocation of a nest at Las Baulas National Marine Park

OBJECTIVE 3: Assessing total recruitment of hatchlings to the sea turtle populations.

Total recruitment of hatchlings is calculated based on clutch size and hatching success. During the 2019-2020 nesting season, nests recorded yielded approximately 713 leatherback, 5860 ridley and 900 black turtle hatchlings reaching an estimated 8,600 hatchlings recruited to the populations. The lower number of new hatchlings recruited to the ocean can be explained by the unusually low number of nesting females recorded this year.

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 strong effect of local climatic conditions and ENSO on hatching success (Santidrián Tomillo et al. 2012, Santidrián Tomillo et al. 2020) 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. 2017b). These will play a key role in increasing total recruitment of hatchling to the sea turtle population as conservation actions focus on counteracting the conditions that increase hatchling mortalities. This is especially important as our most recent publication highlighted the importance of hatchling recruitment to the recovery of leatherback turtles (Laud OPO Network, 2020)

- Cruz LM, 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
- The Laúd OPO Network*, 2020: Enhanced, coordinated conservation efforts required to avoid extinction of critically endangered East Pacific leatherback turtles. Nature Scientific Reports, 10.1 (2020): 4772.

OBJECTIVE 4: Assessing temperature profiles of nests.

Changes in temperature within the egg chamber have been shown to impact egg development and hatchling emergence. In addition, sex ratios (= percentage of male vs female hatchlings produced) within the nest are determined 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.
- Santidrián Tomillo, P.*, Fonseca, L.G., Ward, M., Tankersley, N., Robinson, N.J.*, Orrego, C.M.*, Paladino, F.V. and Saba, V.S. 2020. The impacts of extreme El Niño events on sea turtle nesting populations. Climatic Change 159, 163-176.

In the period covered by this report, we continued to collect temperature data from nests by placing thermocouples or hobo dataloggers inside the nest chamber. These data were added onto our existing datasets and are currently being assessed.

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, 2020). 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 to increase hatching success while maintaining natural sex ratios. 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 (2015a) 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 (2015b) Climate change overruns resilience conferred by temperature-dependent sex determination in sea turtles and threatens their survival. Global Change Biology 21:2980-2988.
- Santidrián Tomillo, P.*, Fonseca, L.G., Ward, M., Tankersley, N., Robinson, N.J.*, Orrego, C.M.*, Paladino, F.V. and Saba, V.S. 2020. The impacts of extreme El Niño events on sea turtle nesting populations. Climatic Change 159, 163—176.

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 2019—2020, 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.

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

During the 2019—2020 season, 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:

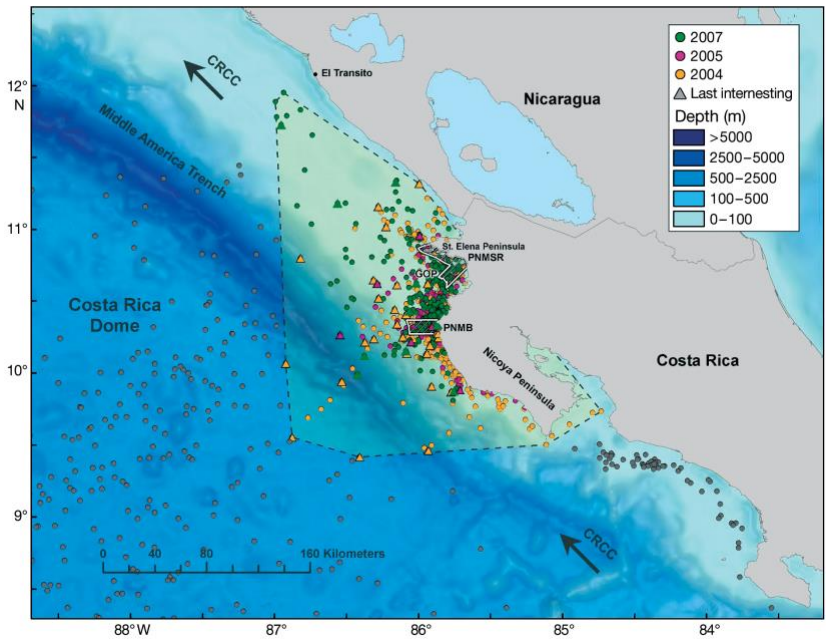

Fig. 1. Internesting positions for leatherback turtles during 2004 (yellow dots), 2005 (violet dots) and 2007 (green dots). From Shillinger et al., 2010

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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 and encompasses the Santa Rosa National Park. We hope to be able to continue the study of the behavior of the turtles during their internesting periods.

- 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 oceanographic conditions on the remigration intervals of green turtles.

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 research station. Here we relocated clutches laid in doomed locations due to proximity to the ocean, poaching or predation risks. During the 2019—2020 season, we relocated a total of 53 clutches (1 leatherback, 48 ridley and 4 green) to the hatchery, which resulted in a total of nearly 3,000 hatchlings reaching the ocean.

All nests from the hatchery were excavated to assess hatching success. Further, our results show that the increased protection for nests relocated to the hatchery has led to increased hatchling production per nest.

During the 2019–2020 season, we noted an increasing number of raccoons trying to predate nests in 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 protective method was found to be effective, and we are working to improve it. The photos below show nests at the time they are relocated in the hatchery.

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Photo credit: *Adam Yanney-Keller*

Photo credit: *Courtney King*

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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 preventing opportunistic poachers from removing eggs from the nests.

OBJECTIVE 3 & 4: All nests are excavated after hatching, and live hatchlings found are guarded while they move 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 released to the ocean, thus increasing the total number of hatchlings that reach the water.

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
- Morning walk (3 hours per day over 2 days) = 6 hours
- Daytime activities, e.g., excavations & taking nest temperatures (2 hours per day over 2 days) = 4 hours

This makes it a total of 60 hours per Earthwatch volunteer. During the 2019–2020 season, we had 41 volunteers. Therefore, the estimated total of research hours invested in the project comes up to 2,640 hours.

b) Peer-reviewed publications

- The Laúd OPO Network, 2020: Enhanced, coordinated conservation efforts required to avoid extinction of critically endangered East Pacific leatherback turtles. Scientific Reports, 10.1 (2020): 4772.
- Santidrián Tomillo, P.*, Fonseca, L.G., Ward, M., Tankersley, N., Robinson, N.J.*, Orrego, C.M.*, Paladino, F.V. and Saba, V.S. 2020. The impacts of extreme El Niño events on sea turtle nesting populations. Climatic Change 159, 163-176.
- Ortiz-Alvarez, C.A., Pajuelo, M., Grados, D., Abrego, M.E., Barragán-Rocha, A.R., Barrantes, M., Cotto, A., Fonseca, L., Gadea Espinal, V., Mangel, J.C., Rguez-Baron, J.M., Santidrián Tomillo, P.*, Sarti, L., Santana-Hernández, H., Shillinger, G.L., Prado, M., Wallace, B.P., Williard, A.S., Zavala-Norzagaray, A.A. and Alfaro Shigueto, J. 2020. Rapid assessments of leatherback small-scale fishery bycatch in interesting areas in the eastern Pacific Ocean. Frontiers in Marine Science 6: article 813.
- 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.
- Williamson, S.A., Evans, R.G., Robinson, N.J. and Reina, R.D. 2019. Synchronized 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.
- 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 characterizing 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:

- Spotila, J.R., Paladino F.V. Santidrián Tomillo, P., Panagopoulou, A. and Yaney-Keller A. Monitoreo, conservación e investigación de las poblaciones de tortugas marinas en el Parque Nacional Marino Las Baulas, 2019—2020. Technical report submitted to MINAE (Costa Rican Ministry for the Environment)
- 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.

Note: *We were scheduled to present 3 papers on our work in Playa Grande at the International Symposium on Sea Turtle Biology and Conservation in Colombia, 14–20 March 2020, which was canceled due to the Covid-19 pandemic*

Mentoring

a) Graduate students

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

Name of school, organization, or group	Education level	Participants local or non-local	Details on contributions/ activities
Matapalo School	Elementary	210	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	Organizing beach cleaning events to increase awareness about the impacts of single use plastic
Las Baulas Festival	All classes + local community	250	Annual event celebrating leatherback turtles

Partnerships

Partner	Support Type(s)[1]	Years of Association (e.g., 2006–present)
MINAE (Ministerio de Ambiente y Energía—Ministry of the Environment and Energy)	Logistics, technical support, academic support.	1988–Present
Matapalo Tour Guides Association	Collaboration, cultural support	1995–Present
Kuemar (local environmental NGO)	Collaboration, data sharing	2005–Present

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

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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	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)
National Strategy for the conservation and protection of Sea Turtles in Costa Rica.	Network	National	Existing	To develop and implement a management strategy for the protection of sea turtles and their habitats in Costa Rica.	In Progress	Technical support Participation in collaborative meetings Data sharing

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)

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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]
Dermochelys coriacea	Vulnerable (VU), Decreasing	Critically Endangered		Research; Active nest management; habitat protection	Population still in decline; results of recruitment from previous years expected to show in following seasons. Habitat protected.
Chelonia mydas agasizii	Endangered (EN), Decreasing	Endangered (EN)		Research; Active nest management; habitat protection	Habitat protected. Nesting activity status still assessed.
Lepidochelys olivacea	Vulnerable (VU), Decreasing	N/A		Research; Active nest management; habitat protection	Habitat protected. Nesting activity status still assessed.

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

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 can 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

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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 Services	Regulating & Support Services
❑ Fisheries (Fresh & Marine)	❑ Carbon sequestration/storage
❑ Energy (fuelwood/hydropower)	✓ Coastal protection
❑ Livestock grazing	❑ Erosion control
❑ Material extraction (e.g., resin, grass)	✓ Flood regulation/protection
❑ Timber	❑ Pest and disease control
❑ Water supply	❑ Pollination
❑ Other food (crops, wild foods, spices)	❑ Seed dispersal
Cultural Services	**Other Services**
✓ Cultural/historical values	❑ Pharmaceuticals
❑ Health (mental & physical)	❑ Water purification/quality
✓ Research & knowledge	❑ Preserving/maintaining Biodiversity
❑ Recreational	✓ Nutrient cycling
✓ Spiritual/aesthetic values	✓ Biodiversity
	❑ Employment/Livelihoods

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 eggshells 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

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
Support	Supporting family-owned, sustainably produced fair-trade coffeemakers Coope Terrazú who provide Las Baulas Coffee and donate a portion of their proceeds to The Leatherback Trust	25 (Estimated)

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