



EXPEDITION REPORT

Expedition dates: 6 – 13 May 2019

Report published: June 2020

Gentle giants:

Protecting leatherback and other sea turtles through direct conservation action on the Caribbean coast of Costa Rica



Picture courtesy of G. Berg



EXPEDITION REPORT

Gentle giants: Protecting leatherback and other sea turtles through direct conservation action on the Caribbean coast of Costa Rica

Expedition dates:
6– 13 May 2019

Report published:
June 2020

Authors:
Fabian Carrasco
Latin American Sea Turtles

Matthias Hammer (editor)
Biosphere Expeditions

Abstract

Latin American Sea Turtles (LAST) has run this sea turtle conservation project on Pacuare beach, Caribbean coastline, Costa Rica, for eight years from 2012 to 2019, with Biosphere Expeditions citizen scientists assisting since 2016.

Between 21 February and 31 October 2019, nesting activities of leatherback turtles (*Dermochelys coriacea*) (478 nesting attempts, 294 successful nests), green turtles (*Chelonia mydas*) (243 nesting attempts, 57 successful nests) and hawksbill turtles (*Eretmochelys imbricata*) (30 nesting activities, 11 successful nests) were recorded. 207 (60%) nests of the three different sea turtle species were relocated to the custom-built hatchery and therefore saved by the project's direct conservation action. Of these, 155 (72%) were leatherback turtle nests, 42 (20%) were green turtle nests and 10 (5%) were hawksbill turtle nests.

Eight green turtles were killed by poachers during the 2019 season. No leatherback or hawksbill turtles were killed.

Over 10,000 hatchlings were released across the three species. The emergence percentage of the exhumed nests of leatherback turtle was 75% (SD = 21%, n = 157), releasing approximately 8,530 hatchlings; 83% (SD = 14%, n = 14) for green turtle, releasing approximately 1,200 hatchlings; and 75% (SD = 8%, n = 3) for hawksbill turtle, releasing 286 hatchlings. Note that only a fraction of successful nests were exhumed.

Overall, these results are excellent, given the resources available. The number of turtles killed was the lowest to date, the number of nests saved the second highest on average across species and the number of hatchlings released slightly above average across the years and species.

The above conservation success is all from one stretch of beach where, without LAST, Biosphere Expeditions and their citizen scientists from all over the world, close to 100% of all eggs and nests would be taken by illegal poachers.

However, challenges remain. In 2020 the biggest challenge by far is the COVID-19 crisis, severely affecting, even threatening the entire project at the time of writing through lack of international citizen scientists and therefore funding. Other challenges are (1) chronic under-resourcing of authorities, such as the coastguard, who only patrol the beach sporadically and are unable to enforce the law protecting sea turtles, (2) ongoing activities of poachers with a low threshold towards further criminal activity and (3) the project's limited resources in terms of funding and manpower.

Despite this, and given enough future input from international volunteers and citizen scientists, many nests will continue to be saved and many hatchlings will be helped into the ocean, thereby preventing the local extinction of sea turtle populations.

If, however, the national authorities tasked with nature protection and law enforcement were to be properly resourced so that they could join efforts in turtle conservation effectively, then extinction prevention could be turned into population recovery. In the opinion of the authors, combined action would have a high chance of success and bring down poaching levels to below 10%.

Resumen

Latin American Sea Turtles (LAST) ha sido la organización encargada del proyecto de conservación de tortugas marinas en Playa Pacuare, Costa Caribe, Costa Rica, en los últimos ocho años, desde 2012 a 2019, con el apoyo de ciudadanos científicos de Biosphere Expeditions desde el 2016.

Desde el 21 de febrero al 31 de octubre se contabilizaron las actividades de anidación de tortuga baula (*Dermochelys coriacea*) (478 actividades de anidación, 294 nidos), tortuga verde (*Chelonia mydas*) (243 actividades de anidación, 57 nidos) y tortuga carey (*Eretmochelys imbricata*) (30 actividades de anidación, 11 nidos).. Del total denidos, 207 (60%) fueron relocalizados en el vivero destinado para los nidos de las tres especies de tortugas marinas salvados por acción directa del proyecto. 155 (72%) nidos fueron de tortuga baula, 42 (20%) fueron de tortuga verde y 10 (5%) fueron de tortuga carey.

Ocho tortugas verdes fueron asesinadas por cazadores furtivos. Ninguna tortuga baula ni tortuga carey fueron asesinadas durante la temporada 2019.

Alrededor de 10,000 neonatos de las tres especies fueron liberados. El éxito de emergencia de los nidos exhumados de tortuga baula fue de 75% (SD = 21%, n = 157), liberando aproximadamente 8,530 neonatos; 83% (SD = 14%, n = 14) para tortuga verde, liberando aproximadamente 1,200 neonatos; y 75% (SD = 8%, n = 3) para tortuga carey, liberando 286 neonatos.

A pesar de todo, estos resultados son excelentes, aún con los pocos recursos disponibles. El número de tortugas asesinadas es el más bajo de todos los tiempos, el número de nidos salvados es el segundo más alto en promedio con las tres especies y el número de neonatos liberados acorde con la cantidad de nidos salvados y el éxito de eclosión permanece en promedio.

Todo esto en una playa donde sin LAST, Biosphere Expeditions y todos los ciudadanos científicos de todas partes del mundo, cerca del 100% de los huevos y nidos serían robados por saqueadores de huevos.

Aunque aún hay desafíos que enfrentar. En el año 2020 el desafío más grande es la crisis global por el COVID-19, afectando severamente, incluso amenazando el proyecto entero debido a la falta de ciudadanos científicos internacionales y otras donaciones. Otros desafíos son (1) la falta de apoyo por parte de las autoridades como Guardacostas, quien patrullan la playa esporádicamente y son incapaces de ejercer la ley protegiendo a las tortugas marinas, (2) las actividades criminales sin límite por parte de los saqueadores de huevos y cazadores furtivos y (3) los limitados recursos del proyecto en términos de fondos y mano de obra.

A pesar de esto, en el futuro con el suficiente apoyo de parte de los voluntarios y ciudadanos científicos internacionales, muchos nidos serán salvados y muchos neonatos serán liberados en el océano y por consecuente se evitará la extinción de la población local de tortugas marinas.

Sin embargo, si las autoridades nacionales implementaran la protección de la naturaleza y ejercieran la ley debidamente uniéndolo esfuerzos en la conservación de las tortugas marinas, la prevención de extinción se convertiría en la recuperación de la población de tortugas marinas. En la opinión de los autores, acciones combinadas tendrían una alta probabilidad de éxito, llevando los niveles de saqueo y cacería de tortugas por debajo del 10%.

Contents

Abstract	2
----------	---

Resumen	3
---------	---

Contents	4
----------	---

1. Expedition review	5
----------------------	---

1.1. Background	5
-----------------	---

1.2. Dates & team	5
-------------------	---

1.3. Partners	6
---------------	---

1.4. Acknowledgements	6
-----------------------	---

1.5. Further information & enquiries	6
--------------------------------------	---

1.6. Expedition budget	7
------------------------	---

2. Annual report of the nesting activity of sea turtles in Pacuare beach, Costa Rica	8
--	---

2.1. Introduction, background and methods	8
---	---

2.2. Results	8
--------------	---

2.2.1. Leatherback turtle <i>Dermochelys coriacea</i>	8
---	---

2.2.2. Green turtle <i>Chelonia mydas</i>	12
---	----

2.2.3. Hawksbill turtle <i>Eretmochelys imbricata</i>	15
---	----

2.3. Discussion and conclusions	16
---------------------------------	----

2.4. Literature cited	20
-----------------------	----

Appendix I: Expedition diary & reports	21
--	----

1. Expedition review

M. Hammer
Biosphere Expeditions

1.1. Background

Background information, location conditions and the research area are as described in [Carrasco & Hammer \(2019\)](#).

1.2. Dates & team

The project ran over a period of eight months from 21 February to 31 October 2019 with the expedition assisting from 6 to 13 May 2019 with a team of national and international citizen scientists, a professional scientist and an expedition leader.

The expedition team was recruited by Biosphere Expeditions and consisted of a mixture of ages, nationalities and backgrounds. They were (in alphabetical order and with country of residence): Shaun Busuttil (Australia, press), Andreas Dank (Germany), Freya Forrest (UK), Barbara Gustafson (USA), Phillip Gustafson (USA), Adrián Palomo (Costa Rica, placement), Jillian Polson (UK), Beate Schawaller (Germany), Cynthia Singer (USA), Simona Wirth (Switzerland).

Fabian Carrasco was the head scientist for this expedition and is the on-site biologist at the Pacuare research site of LAST. He has dedicated much of his career to sea turtle research and conservation, and was previously a research assistant at Pacuare. Fabian has a Bachelor of Science degree in Biology from the Universidad Autónoma of Morelos, México. Fabian worked with three species of sea turtle in México before joining LAST in 2016. Fabian is a fully qualified first aider and speaks both English and Spanish.

The expedition leader was Lucy Marcus. She was born in California and gained a love for marine environments when she started diving in Belize at the age of ten, and later became a scientific research diver whilst a student of Environmental Studies at the University of California, Santa Cruz. Lucy then completed a Masters in Marine Biology at James Cook University in Australia, where she became fascinated with underwater videography. She has worked as a guide in Costa Rica, Cuba and U.S. National Parks, as a PADI dive instructor in Hawaii, volunteered in the US Virgin Islands, and sailed from New Zealand to the Solomon Islands on a marine conservation expedition. When not working as an expedition leader, Lucy enjoys the winters in the snowy mountains of California and spends her summers guiding hiking and kayaking tours from a small cruise ship in Alaska. In her free time Lucy loves to snowboard, surf and travel in remote locations. She has her captain's license and Wilderness First Responder certification.

1.3. Partners

Our partner on this project is Latin American Sea Turtles (LAST) who represent WIDECAST (the Wider Caribbean Sea Turtle Network in Costa Rica). LAST has over 28 years of experience in sea turtle management and research, and has attracted various strategic partners thanks to their contribution to this field (Whitley Award for Nature, The Nature Conservancy and WWF). LAST has initiated projects to monitor reefs, trained national park rangers in monitoring turtle nesting, and educated hundreds of local students on the importance of marine and coastal conservation. They also act as environmental advisors to the government on marine environments, participate in several local, national and international networks, and publish articles to improve public knowledge about the ocean and its life. In order to reduce threats to sea turtles and to restore population levels, LAST has implemented a series of sea turtle management programmes on many of the Caribbean beaches in Costa Rica – including Pacuare beach. When the Pacuare project started in 2004, it was just for egg protection and no data were collected. WIDECAST took over the research in 2007 and LAST have become the sole researchers since 2012.

1.4. Acknowledgements

This study was conducted by Biosphere Expeditions, which runs wildlife conservation expeditions all over the globe. Without our expedition team members (listed above) who provided an expedition contribution and gave up their spare time to work as research assistants, none of this research would have been possible. The same is true for all LAST volunteers, helpers and research assistants, whom we thank too. Thank you also to the support team and staff, who were central to making it all work on the ground. Biosphere Expeditions would also like to thank the Friends of Biosphere Expeditions for their sponsorship and/or in-kind support, Thomas Douglas of Hotel Santo Tomas in San José for his support and advice in Costa Rica, Nicki Wheeler of LAST for being ever helpful and reliable in setting things up and keeping them running, and Robert Adeva of La Tortuga Feliz for help and advice in Pacuare. Finally, thank you to the anonymous reviewers for helpful comments on the various draft versions of this report.

1.5. Further information & enquiries

More background information on Biosphere Expeditions in general and on this expedition in particular including pictures, diary excerpts and a copy of this report can be found on the Biosphere Expeditions website www.biosphere-expeditions.org. Copies of this and other expedition reports can be accessed via www.biosphere-expeditions.org/reports. Enquires should be addressed to Biosphere Expeditions via www.biosphere-expeditions.org/offices.

1.6. Expedition budget

Each team member paid a contribution of €1,730 per seven-day slot towards expedition costs. The contribution covered accommodation and meals, supervision and induction, all maps and special non-personal equipment, and all transport from and to the team assembly point. It did not cover excess luggage charges, travel insurance, personal expenses such as telephone bills, souvenirs, etc., or visa and other travel expenses to and from the assembly point (e.g. international flights). Details on how these contributions were spent are given below.

Income	€
Expedition contributions	18,592
 Expenditure	
Staff includes local & international salaries, travel and expenses	2,762
Research includes equipment and other research expenses	817
Transport includes car hire, fuel, taxis and other local transport	842
Base includes board and lodging at the research station	2,664
Administration includes local sundries, fees and miscellaneous expenses	555
Team recruitment Costa Rica as estimated % of PR costs for Biosphere Expeditions	4,981
 Income – Expenditure	 5,972
 Total percentage spent directly on project	 68%

Please note: This report details the results of an entire nesting season from February to October 2019. The bulk of the work during this period was conducted by LAST, with Biosphere Expeditions assisting during the leatherback nesting season in May.

2. Annual report of the nesting activity of sea turtles in Pacuare beach, Costa Rica

2.1. Introduction, background and methods

These are as described in [Carrasco & Hammer \(2019\)](#). In brief, the aim was to increase reproductive capacity of leatherback (*Dermochelys coriacea*), green (*Chelonia mydas*) and hawksbill turtles (*Eretmochelys imbricata*), and reduce adult mortality, through regular beach patrols along the Pacuare beach, Costa Rica.

2.2. Results

2.2.1 Leatherback turtle (*Dermochelys coriacea*)

Number of leatherback turtle nests

A total of 478 nesting attempts were registered during the 2019 season at Pacuare beach, of which 294 were successful and ended up as viable nests. Compared with the previous seasons (Figure 2.2.1a), the 2019 season data is in line with average numbers of successful nests (278, SD = 36) with the number of nesting activities in the season in line with the inter-annual fluctuations described by Troëng et al. (2004) and Chacón-Chaverri & Eckert (2007).

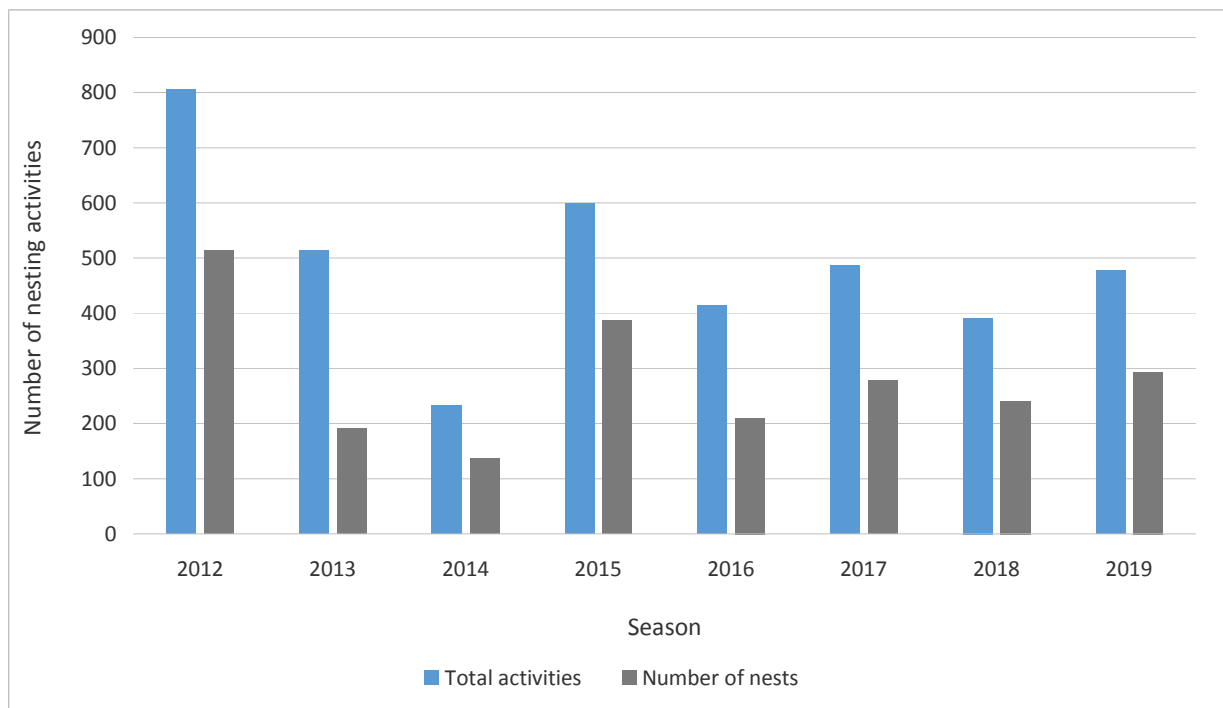


Figure 2.2.1a. Leatherback turtle (*Dermochelys coriacea*) nesting activities at Pacuare beach since 2012.

In 2019, the months with the highest number of nests (78%) were April and May with 135 and 95 nests respectively (Figure 2.2.1b). Two nests were recorded during the month of February, 36 nests were registered in March, 26 in June and zero in July. Following the five previous seasons, the nesting pattern at Pacuare beach is similar to the one observed at Gandoca beach, located in the South Caribbean of Costa Rica, 80k m away from Pacuare and part of the complex of nesting beaches used by the Northwest Atlantic Leatherback turtles , where the majority of nests (71%) were also recorded in April and May (Chacón-Chaverri & Eckert 2007, Fonseca et al. 2012, Marion & Chacón 2013, Fonseca & Chacón 2014, Marion & Chacón 2016, Carrasco & Chacón 2017, Carrasco & Chacón 2018).

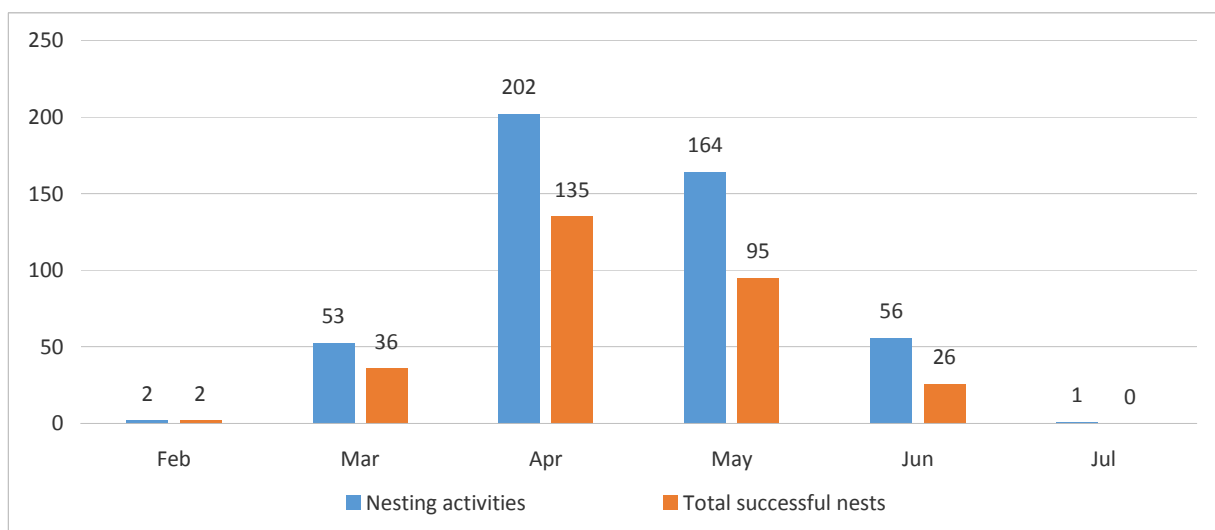


Figure 2.2.1b. Seasonal distribution of leatherback turtle nesting activity at Pacuare beach in 2019.

During the 2019 season, nesting activities were recorded along all 144 wooden markers that divide the beach into monitoring plots in three sections (A – B) from south to north. Most activity was recorded between markers 51-60, 71-80 and 81-90 (Figure 2.2.1c).

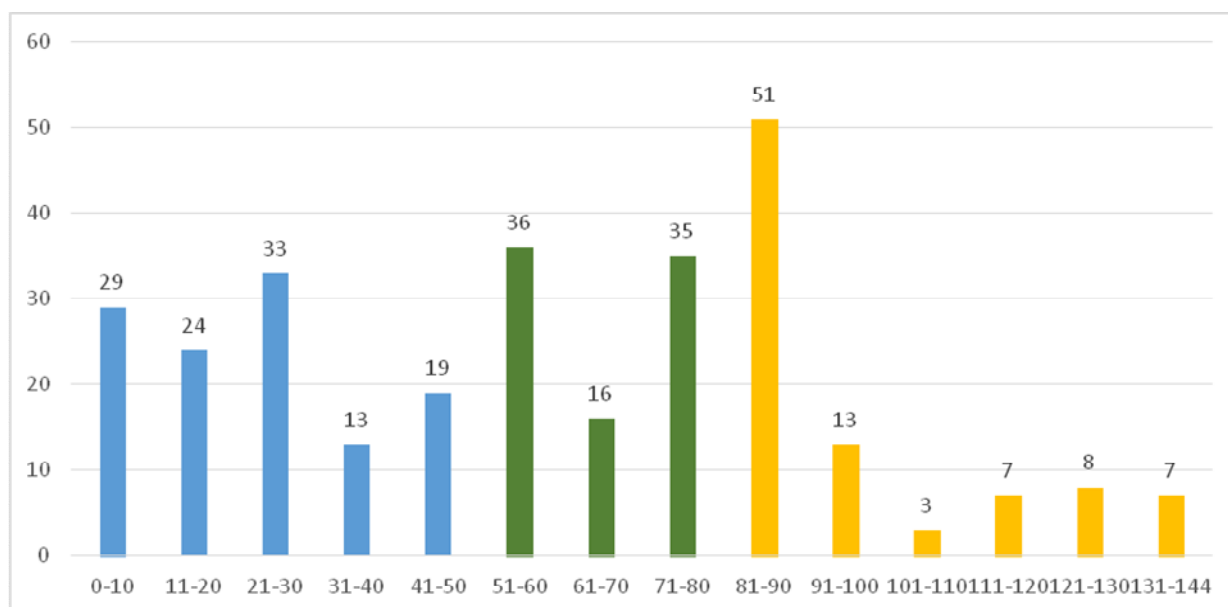


Figure 2.2.1c. Spatial distribution of leatherback turtle nesting activity at Pacuare beach in 2019. Blue bars = sector A, green bars = sector B, yellow bars = sector C (see Carrasco & Hammer 2019).

Number of leatherback nesting females

161 females came to Pacuare to nest. Twenty-four of them did not have any tag or evidence of being tagged before, 104 laid only once, 43 twice, seven 3 times, five 4 times, zero 5 times and two 6 times (Figure 2.2.1d).

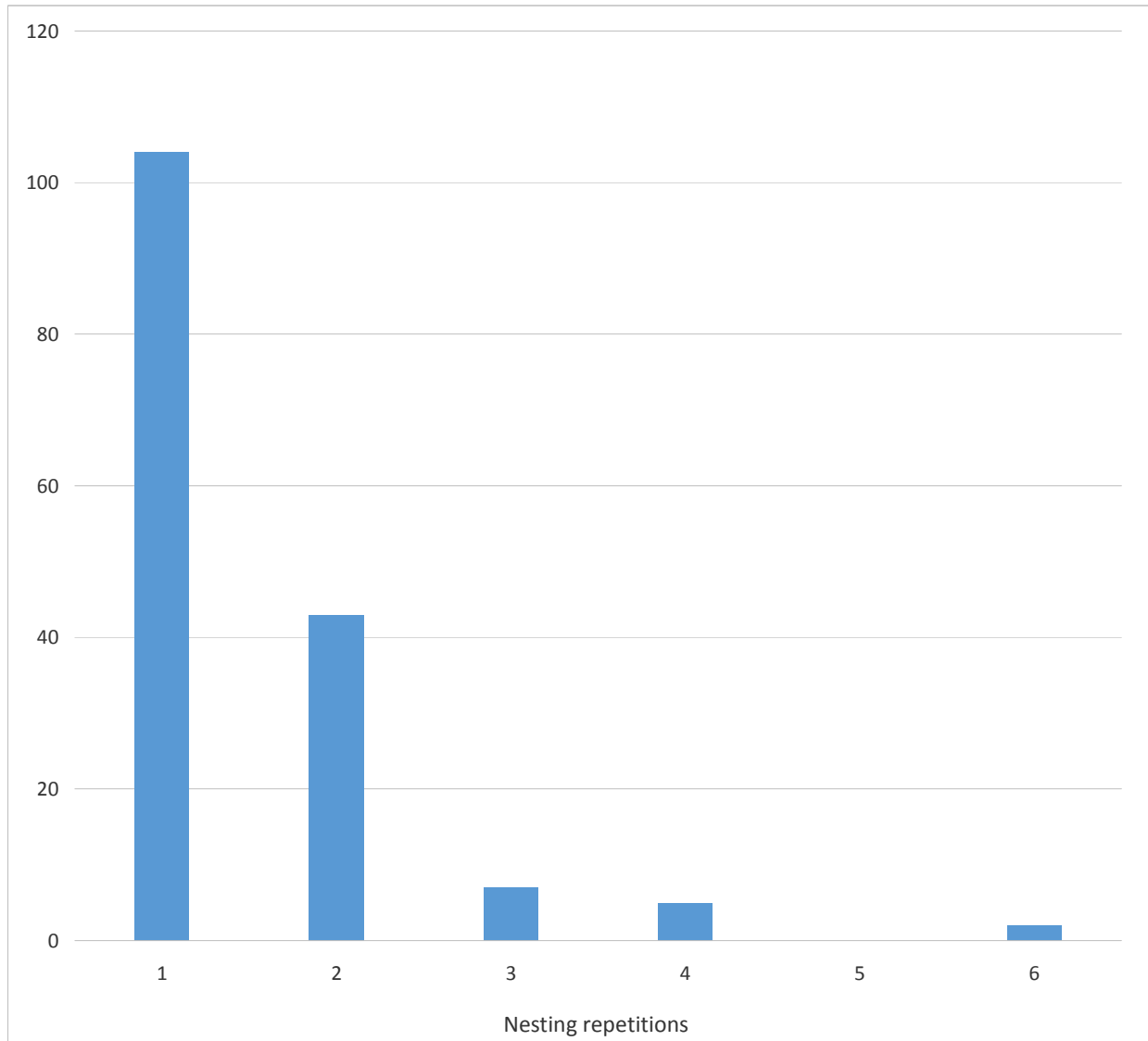


Figure 2.2.1d. Number of returning leatherback turtle females and their nesting repetitions at Pacuare beach in 2019

Number of leatherback turtles killed

Leatherback turtles are not hunted or killed at Pacuare beach, because at weights of up to 300 kg for adult egg-laying females, they are too heavy for poachers to drag into the vegetation behind the beach for butchering. Also, culturally the consumption of leatherback meat is not favoured in Costa Rica. As such, zero leatherback turtles were killed.

Saved leatherback turtle nests

The percentage of protected nests in 2019 was 59% (155): above the 52% average for all seasons and the second-best result after 2018 (65%) (Figure 2.2.1e). Of the saved nests 94% were relocated to the hatchery for round-the-clock protection and 6% were relocated to a safe place on the beach.

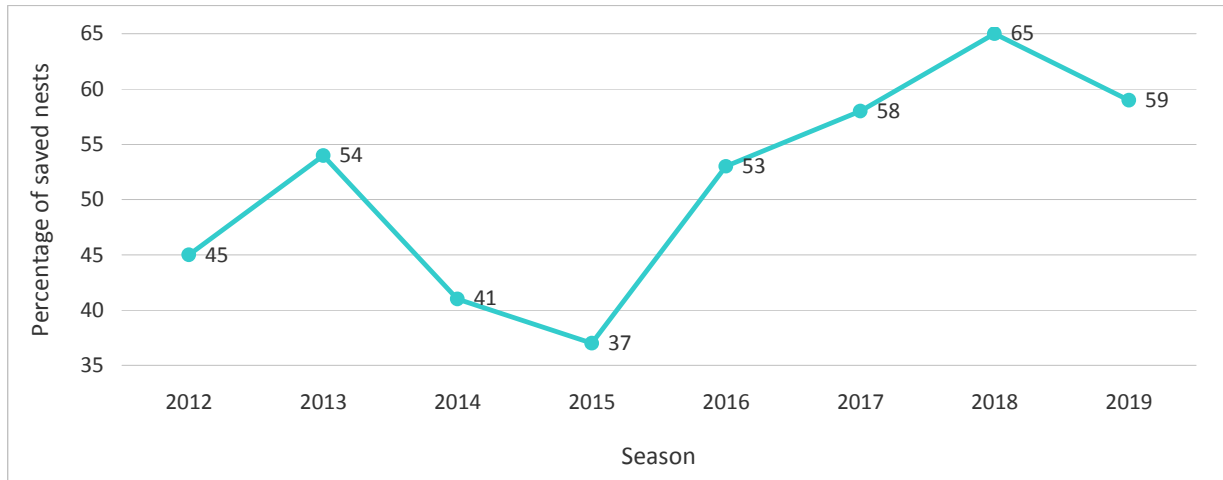


Figure 2.2.1e. Percentage of leatherback turtle nests saved at Pacuare beach over the seasons 2012 – 2019.

Leatherback hatching and emergence success

The emergence success of leatherback nests (hatchery and beach) was 75% (SD = 21%, n = 157), releasing 8,530 neonates (approximately). The emergence success of the nests incubated in the hatchery was 77%, the highest percentage since 2012 (Figure 2.2.1f) and higher than the percentage recorded in Gandoca (Chacón-Chaverri & Eckert 2007) and Tortuguero (Troëng et al. 2007) where the emergence success was 11-39% and 42±35% respectively. However, it is noteworthy that the large variance at both Gandoca and Tortuguero is due to the fact that they were pioneering projects where hatchery re-nesting techniques were being developed with low emergence success rates at the beginning.

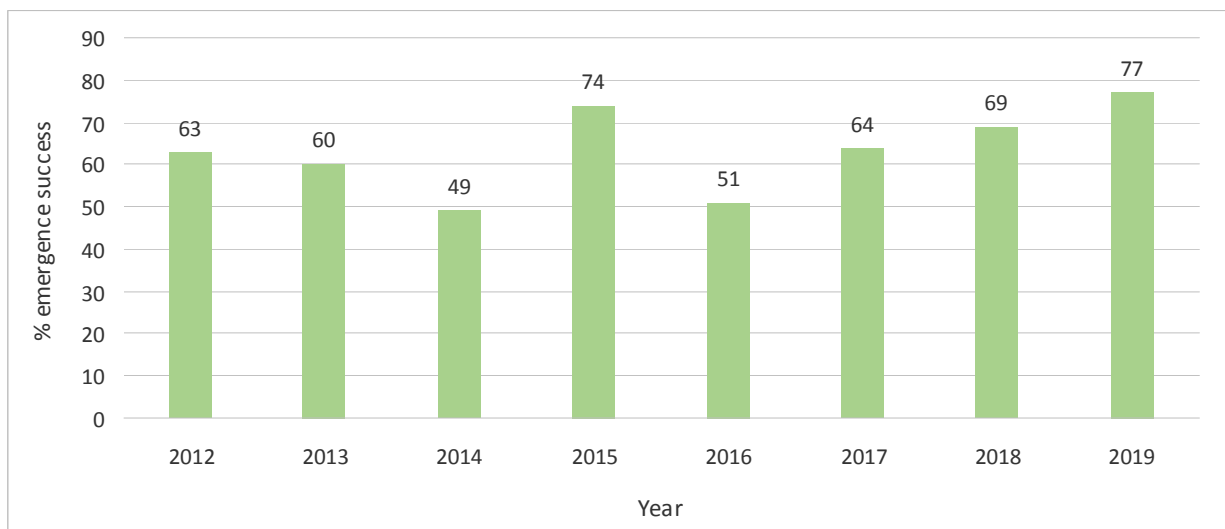


Figure 2.2.1f. Percentage emergence success of leatherback turtle nests saved to the hatchery at Pacuare beach over the seasons 2012 – 2019.

2.2.2 Green turtle (*Chelonia mydas*)

Number of green turtle nests

243 nesting activities of green turtles (*Chelonia mydas*) were logged in 2019, of which only 57 ended up as a successful nest (Figure 2.2.2a). This is well below the 2012-2019 average of 71 successful nests and largely due to the activities of poachers.

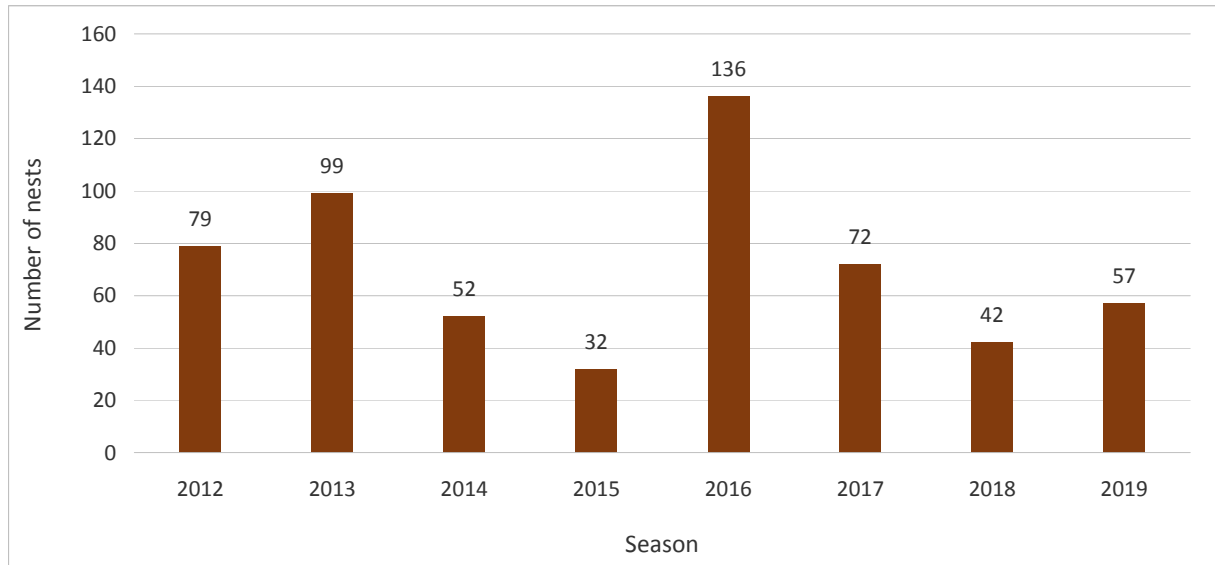


Figure 2.2.2a. Number of successful green turtle nests at Pacuare beach over the seasons 2012 – 2019.

The highest amount of green turtle nests occurred in July and August, with 12 and 33 nests respectively (Figure 2.2.2b). The nesting pattern in Pacuare is similar to the pattern for the rest of the Caribbean (Bruno 2017), but different from Tortuguero where the nesting peak occurred in September and October (González and Harrison 2012).

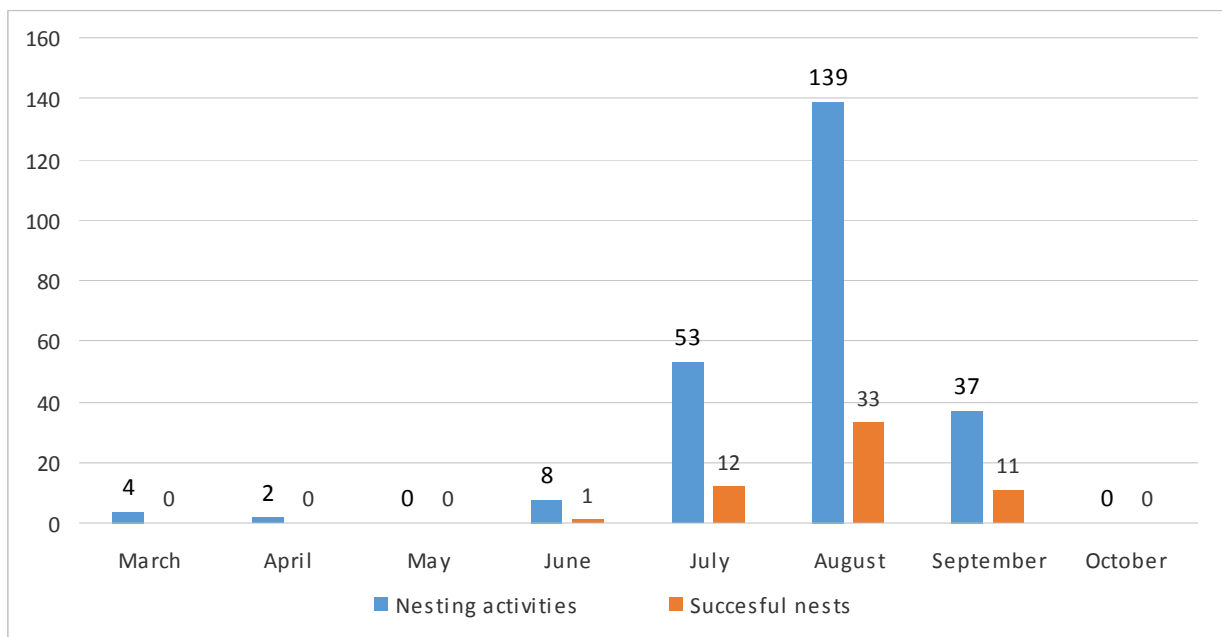


Figure 2.2.2b. Seasonal distribution of green turtle nesting activity at Pacuare beach 2019.

Nesting activity was concentrated in between markers 1-10, 11-20, 21-30, 51-60 (Figure 2.2.2c). 60% of nests were laid in the north part of the beach (after the second lagoon). No nesting activity was recorded in the sectors near to the Pacuare river mouth (121-144).

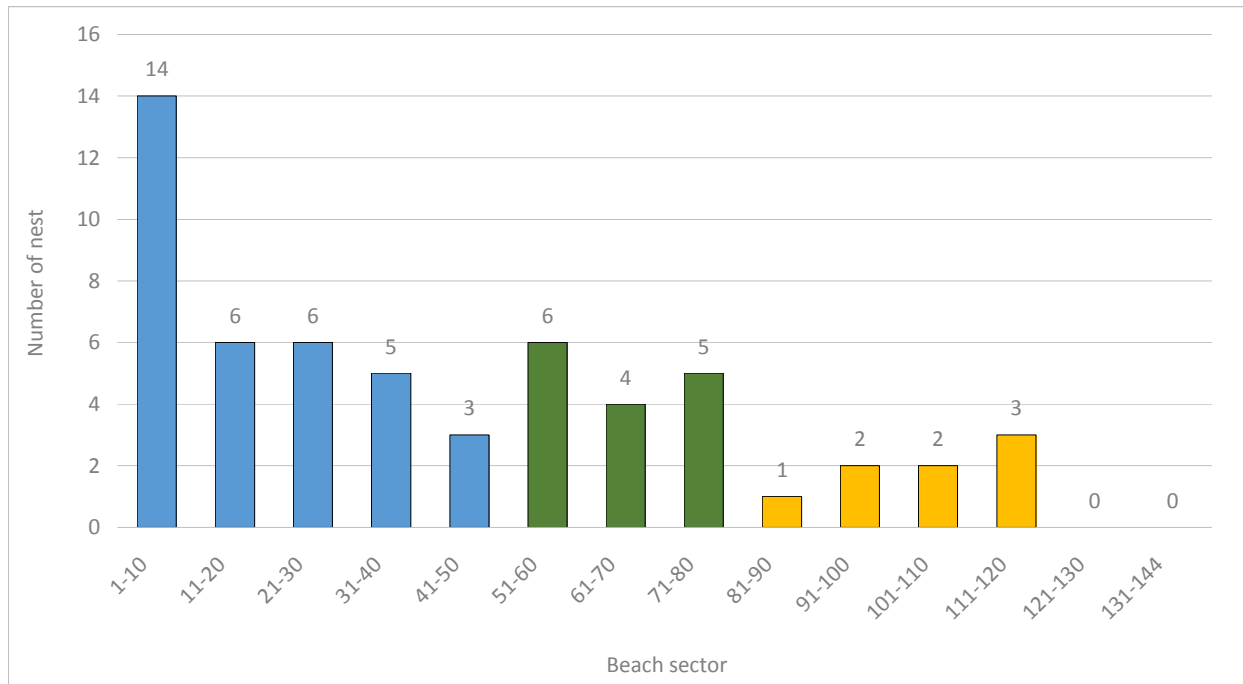


Figure 2.2.2c. Spatial distribution of green turtle nesting activity at Pacuare beach 2019. Blue bars = sector A, green bars = sector B, yellow bars = sector C (see Carrasco & Hammer 2019).

Number of nesting green turtle females

Thirty-six female turtles were recorded, of which 23 nesting turtles did not present any tag or evidence of previous tagging.

Number of green turtles killed

Eight nesting females were killed by poachers, which is the lowest number since the project began (Figure 2.2.2d). In percentage terms, the number of turtles killed in 2019 (3%) was also well below the 8% average of the project (Figure 2.2.2e).

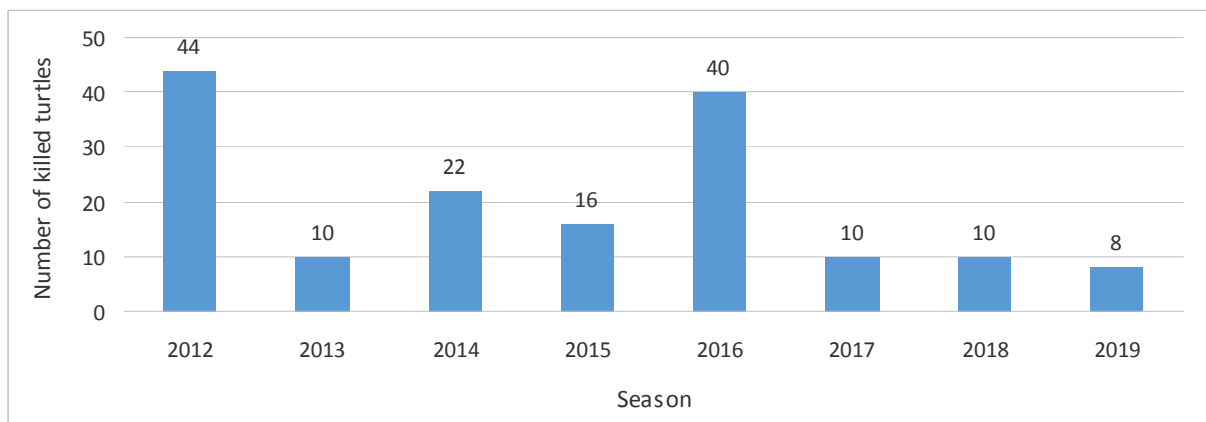


Figure 2.2.2d. Number green turtles killed at Pacuare beach 2012 - 2019.

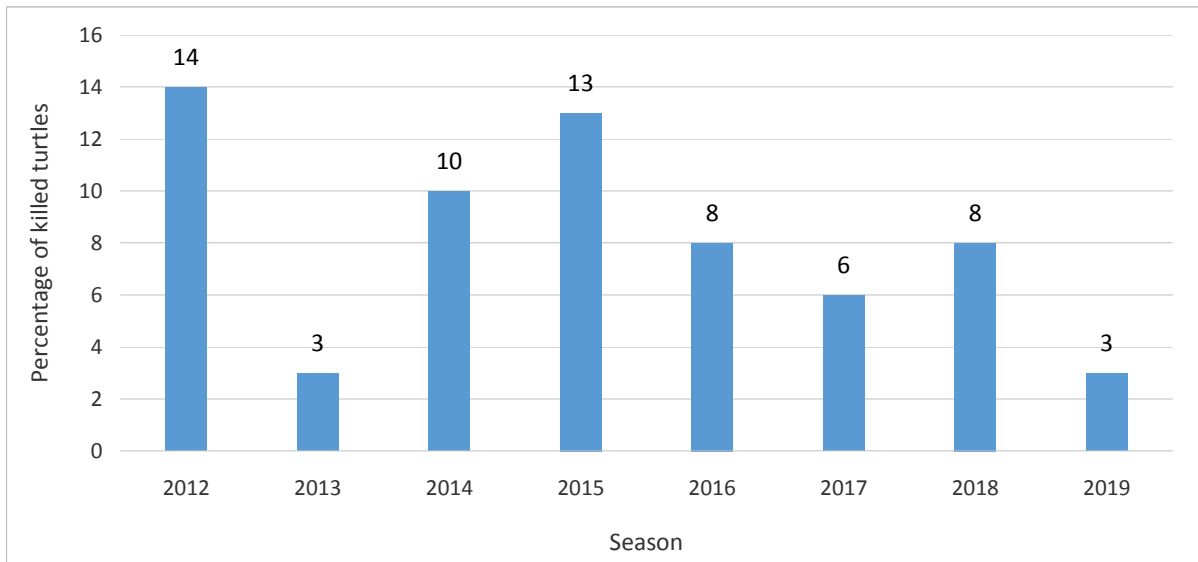


Figure 2.2.2e. Percentage of green turtles killed at Pacuare beach 2012 - 2019.

Saved green turtle nests

74% of the green turtle nests were saved in 2019. 42 nests were moved to the hatchery; 41 by volunteers and one by the coastguard, who ran only sporadic patrols. There were no nests left *in situ*.

Green turtle hatching and emergence success

The percentage of emergence was 83% (SD = 14%, n = 14), releasing 1,200 neonates (approximately). Compared to previous seasons (average 76%), this percentage is the highest to date (Figure 2.2.2h). One nest, collected in August, had a 100% hatching success rate. The lowest success was from a nest collected in July (61%). The coastguard saved one nest, which had a hatching success of 72%, which shows that they were following correct procedure.

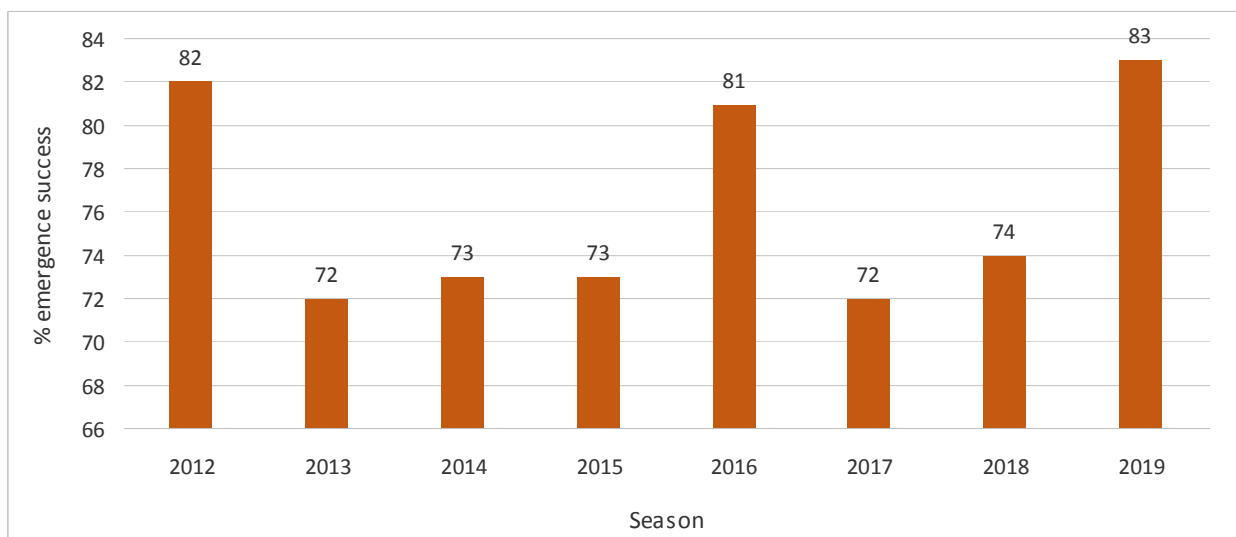


Figure 2.2.2h. Percentage emergence success of green turtle nests saved to the hatchery at Pacuare beach over the seasons 2012 – 2019.

2.2.3 Hawksbill turtle (*Eretmochelys imbricata*)

Number of hawksbill turtle nests

There were 30 nesting activities, which is the highest number since the beginning of the project. Eleven nesting activities were successful. Ten nests were saved into the hatchery, one nest was poached and no nesting females were killed. This is also the first time in the history of the project that all the nesting females were protected (Figure 2.2.3a).

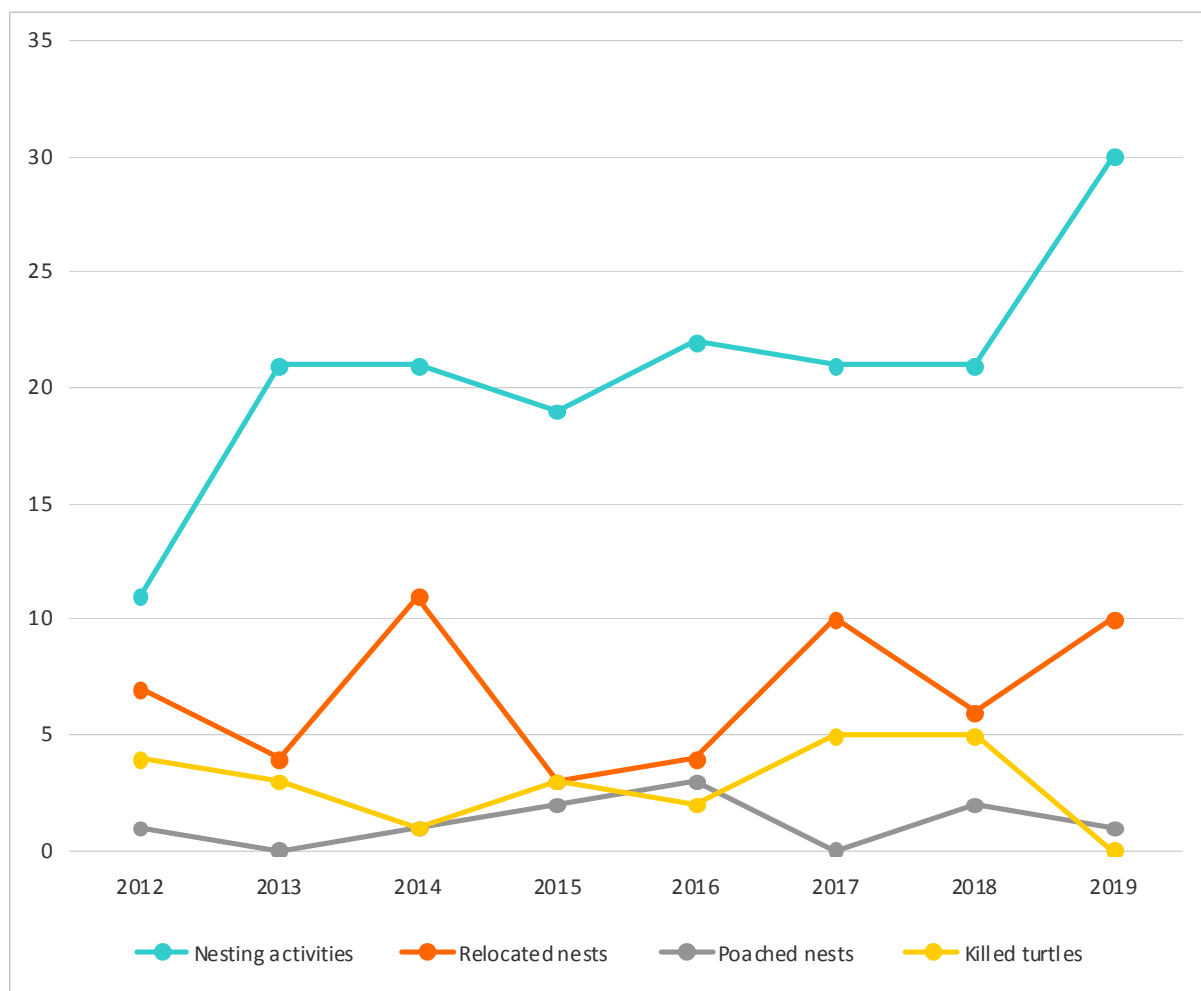


Figure 2.2.3a. Nesting activity, number of relocated nests, number of poached nests and number of killed turtles of Hawksbill turtle (*Eretmochelys imbricata*) since 2012 in Pacuare, Costa Rica.

Saved hawksbill turtle nests

Ten hawksbill turtle nests (91%) were saved in 2019, which is the highest percentage that the project has achieved thus far.

Hawksbill turtle hatching and emergence success

The percentage of emergence of the exhumed nests was 75% (SD = 8%, n = 3) releasing 286 hatchlings. The nest with highest emergence percentage (79%) was laid in May, as was the nest with the lowest emergence percentage (64%).

2.3. Discussion and conclusions

Leatherback turtle

155 nests (59%) were protected through the project's direct conservation actions, the second best result since the project started in 2012. No leatherback turtles were killed. The emergence percentage of the exhumed nests was 75% (SD = 21%, n = 157), releasing approximately 8,530 hatchlings.

The data recorded by the project since 2012 indicates that the leatherback turtle population at Pacuare beach remains stable. However, work by the [Northwest Atlantic Leatherback Working Group](#) (NWALWG) analysing leatherback nesting data from 17 countries and territories since 1990 revealed significant declines across most nesting sites, among all genetic stocks. At the region-wide scale, the population has declined more than 4% per year since 1990. The negative trends were apparent at large and small rookeries over the long term (1990–2017) and in recent years (2008–2017). Although specific causes and their effects are not completely clear, one possibility is that bycatch - particularly near key nesting beaches and in important foraging habitats in national and international waters - has finally taken a toll that is now visible on nesting beaches. But because the declines are widespread across rookeries throughout the region, there are likely multiple factors at work such as habitat loss due to natural beach erosion, longer remigration, as well as fewer and/or less predictable resources.

The lack of returning (i.e. remigrant) leatherbacks is another concern. However, one reason that could explain why Pacuare does feature many remigrant leatherbacks is that Pacuare is part of a complex of nesting beaches that stretches from Nicaragua via Costa Rica to Panamá. The genetic pool of the Western Caribbean (Dutton et al. 2013) runs from the south of Nicaragua to the north of Colombia, so females can return to nest in areas where the project does not operate.

On the other hand, the addition of new nesting females that reach sexual maturity and replace dead or poached individuals is positive news. However, there are no relevant studies that estimate sea turtle mortality in the area.

Overall, the population decline described above would require reclassification of the Northwest Atlantic (Caribbean) leatherback population into the Endangered category (from Vulnerable), according to the IUCN criteria (IUCN 2014). The global population is Critically Endangered already (IUCN 2014). Therefore, LAST and Biosphere Expeditions will keep monitoring nesting activity to determine the long-term trends and promote fact-based conservation measures that prevent the extinction of the species.

Green turtle

42 green turtle nests (74%) were protected through the project's direct conservation actions, the second best result since the project started in 2012. Eight nesting females were killed by poachers, which is the lowest number since the project began. The emergence percentage of the exhumed nests was 83% (SD = 14%, n = 14), releasing approximately 1,200 hatchlings. The coastguard rescued one nest of a killed turtle and this nest had a good emergence percentage of 72%. This is encouraging on two levels: first it shows increased engagement by law enforcement agencies and secondly it shows that they are following procedure whilst saving a nest as evidenced by the good emergence percentage rate.

Hawksbill turtle

Ten nests (91%) were protected through the project's direct conservation actions, the best result since the project started in 2012. No nesting females were killed. The emergence percentage of the exhumed nests was 75% (SD = 8%, n = 3), releasing 286 hatchlings.

This is an excellent result for this species and showcases the importance of this project.

Loggerhead turtle

In 2019 no loggerhead turtle activity was recorded in Pacuare beach, which means the nest recorded in 2017 was a sporadic event.

Overall efforts

207 nests (60%) of three different sea turtle species were relocated to the custom-built hatchery and therefore saved by the project's direct conservation action.

Whilst the numbers above are good, encouraging and moving in the right direction, they also show that protection of the whole beach remains a challenge with the resources available. Law enforcement agencies such as the coastguard and police have the capacity to provide these resources, but apart from one encouraging event of a nest saved by the coastguard, they remained largely absent from the beach with the coastguard running sporadic patrols only.

Project overview

The project has been active for eight years now and in this time was able very significantly to reduce the poaching of sea turtle nests and nesting females in a place where those activities were very common; almost 100% of turtles arriving at the beach and their eggs were poached prior to 2012.

Since the start of the project in 2012, data strongly indicates that Pacuare beach is one of the most important nesting sites, for the leatherback turtle in particular, but also for other sea turtles in Costa Rica (Marion & Hammer 2017). In this context poaching must be reduced even further, despite the poaching challenges that are mainly due to the high value of turtle eggs and meat on the black market. Law enforcement agencies such as the coastguard, the Ministry of Environment and Energy (MINAE) and the Fuerza Pública should support the efforts of NGOs such as LAST and Biosphere Expeditions and make sure the law, which protects sea turtles and their eggs, is implemented.

It is self-evident that the eradication of the poaching problem is not easy, since poaching provides a very significant income for otherwise very poor and disadvantaged residents and transient communities along Pacuare beach. In addition, most of the individuals involved in poaching are already outlaws or delinquents with criminal records (as ascertained through personal communication and observation), with a concomitant low threshold towards further illegal activities.

The high percentage of illegal harvesting is explained by several factors, which are:

- The absence or near absence of authorities tasked to protect natural areas and resources, including the National Service of Coastguards (SNG), Instituto Costarricense de Pesca y Acuicultura (INCOPECA) and the Ministry of Environment and Energy (MINAE).
- The lack of enforcement in the law of wildlife protection (Law 7317) and the law of protection, conservation and sea turtle recovery (Law 8325).
- The project's limited resources, both in terms of finance and manpower, meaning that not all 7.1 km of beach can be patrolled all the time, leaving opportunities for poachers. More resources would also generate opportunities to employ more local research assistants from the Asociación para el Ambiente de Nuevo Pacuare, which would make beach patrols more effective.
- The low number of job opportunities in Siquirres, which as a result force a significant part of the population to commit crimes such as drug trafficking and the illegal extraction of natural resources.

All of the above factors result in an ongoing, albeit successful, struggle of NGOs against transient and criminal poachers, many of whom sustain their alcohol and drug addiction through the depletion of the population of sea turtles on the Caribbean Coast. As long as NGOs are by and large left to continue this struggle by themselves, poaching will remain a problem and nests will continue to be poached. Despite this, and given enough future input from international volunteers and citizen scientists, many nests will continue to be saved and many hatchlings will be helped into the ocean, thereby preventing the local extinction of sea turtle populations.

If, however, the national authorities tasked with nature protection and law enforcement were to join efforts in turtle conservation, then this could be turned from extinction prevention into population recovery. In the opinion of the authors, combined action will have a high chance of success in bringing poaching down to levels below 10%.

In 2019, the project attempted to work closely with the coastguard to reduce the number of turtles poached. Every time a turtle poaching event was noticed, LAST staff called the coastguard to try to save the turtles and arrest the poachers. As a result, the coastguards arrested one poacher, but he was released again after a few days with a warning only. In addition, limited coastguard manpower made it impossible for them to attend all our calls for help. Despite this, project staff perceived that poachers are expending less time on the beach.

Even a slight increase in authority involvement is to be welcomed. Ultimately, however, authorities should be proactive in the removal of transient, criminal poachers from the community. This can only be achieved with the cooperation of the community, which could lead, in an ideal world, to the establishment of safe, nature-based tourism in the area with significant economic benefits for the community. This social and economic development of the community of Pacuare is a crucial parameter to allow LAST to meet its objectives and to protect the population of sea turtles.

According to LAST recommendations from previous seasons English classes for locals were performed throughout the season. These were created for local guides, but also open for the general public around Pacuare.

Other activities that have been recommended in previous reports, but have not been implemented by local authorities and partners so far are:

- The creation of a local police station.
- Recruitment of more national and international volunteers.
- Reviving the successful LAST environmental education programme.
- Removal of illegal slums, ranchos and beach squatters by the municipality of Siquirres.
- The central government setting up an effective rubbish collection system in the area and in the municipalities surrounding the area.
- The use of Styrofoam boxes as a replacement artificial hatchery at times when erosion patterns prevent the building of a beach hatchery and when the numbers of volunteers are not enough to conduct patrols as well as hatchery guarding activities at the same time.

Recommendations for the 2021 season (no citizen science due to Covid-19 in 2020)

LAST and Biosphere Expeditions recommend several measures to ensure population protection and recovery of turtle species present in Pacuare:

- The use of long-range radios to coordinate the relocation of clutches and to ensure a more efficient coverage of the beach would be welcome. However, these are very expensive.
- Continued nurturing of the existing relationship with the coastguards is critical, so that the joint efforts of law reinforcement authorities and NGOs can continue to combat and eventually eradicate illegal turtle poaching and killing activities in Pacuare. However, lack of personnel and other resources prevent the coastguard from helping more. We will therefore continue to lobby government to provide more personnel and resources to the coastguard station.
- The continued development of alternative livelihood opportunities for the local community is vital as a measure to reduce poaching activities and support the community in developing eco-tourism and voluntourism opportunities. The current handicraft activities (community members selling their products to beach visitors during a market that takes place once a week at the Pacuare research station), as well as English classes for local children aged 5 to 15 should be continued with a view to affecting long-term change in attitudes and behaviours.

2.4. Literature cited

Bruno R. (2017) Sea Turtle Monitoring and Research Report. Pacuare Reserve, Costa Rica. 2017. 61 pages.

Carrasco, F. & D. Chacón (2017) Informe final de la anidación de tortugas marinas en Playa Pacuare. Costa Rica, 2017. Asociación LAST. 26 pages.

Carrasco, F. & D. Chacón (2018) Informe final de la anidación de tortugas marinas en Playa Pacuare. Costa Rica, 2018. Asociación LAST. 29 pages.

Carrasco, F. & M. Hammer (2019) Gentle giants: Protecting leatherback sea turtles through direct conservation action on the Caribbean coast of Costa Rica. Expedition report for expedition dates 7 – 14 May 2018. Available via www.biosphere-expeditions.org/reports.

Chacón-Chaverri, D. & K. L. Eckert (2007) Leatherback Sea Turtle Nesting to Gandoca Beach in Caribbean Costa Rica: Management Recommendations from Fifteen Years of Conservation. *Chelonian Conservation Biology* 6: 101-110.

Dutton, P.H., Roden, S.E., Stewart, K.R., LaCasella, E., Tiwari, M., Formia, A., Thomé, J.C., Livingstone, S.R., Eckert, S., Chacón-Chaverri, D. & Rivalan, P. (2013) Population stock structure of leatherback turtles (*Dermochelys coriacea*) in the Atlantic revealed using mtDNA and microsatellite markers. *Conservation Genetics* 14.3: 625-636.

Fonseca, L. G., H. Alguera, B. Vanegas & D. Chacón (2012) Reporte final de la anidación de tortugas marinas, Parque Nacional Cahuita, Costa Rica (Temporada 2012). Informe Técnico. WIDECAST. 21 pages.

Fonseca L. & D. Chacón (2014) Informe final de la anidación de tortugas marinas, playa Pacuare, Costa Rica. Asociación LAST, 27 pages.

González, C. and E. Harrison (2012) Reporte del Programa de Tortuga Verde 2011, en Tortuguero, Costa Rica. Informe Técnico. STC. 56 pages.

IUCN Standards and Petitions Subcommittee (2014) Guidelines for Using the IUCN Red List Categories and Criteria. Version 11. Prepared by the Standards and Petitions Subcommittee. Downloadable from <http://www.iucnredlist.org/documents/RedListGuidelines.pdf>

Marion, M. and D. Chacón (2013) Reporte final de la anidación de tortugas marinas en Playa Pacuare, Costa Rica 2013. Asociación WIDECAST. Tibás, Costa Rica. 25 pages.

Marion, M. and D. Chacón (2016) Reporte final de la anidación de tortugas marinas en Playa Pacuare, Costa Rica 2016. Asociación LAST. Tibás, Costa Rica. 28 pages.

Marion, M. and Hammer, M. (2017) Gentle giants: Protecting leatherback sea turtles through direct conservation action on the Caribbean coast of Costa Rica. Expedition report for expedition dates 2 – 19 May 2016. Available via www.biosphere-expeditions.org/reports.

Northwest Atlantic Leatherback Working Group (2018) Northwest Atlantic Leatherback Turtle (*Dermochelys coriacea*) Status Assessment (Bryan Wallace and Karen Eckert, Compilers and Editors). Conservation Science Partners and the Wider Caribbean Sea Turtle Conservation Network (WIDECAST). WIDECAST Technical Report No. 16. Godfrey, Illinois. 36 pages.

Troëng, S., D. Chacón and B. Dick (2004) Possible decline in leatherback turtle *Dermochelys coriacea* nesting along the coast of Caribbean Central America. *Oryx* 38: 395-403.

Troëng, S., E. Harrison, D. Evans, A. de Haro and E. Vargas (2007) Leatherback turtle nesting trends and threats at Tortuguero, Costa Rica. *Chelonian Conservation and Biology* 6:117-122.

Appendix I: Expedition diary & reports



A multimedia expedition diary is available on <https://biosphereexpeditions.wordpress.com/category/expedition-blogs/costa-rica-2019/>



All expedition reports, including this and previous expedition reports, are available on www.biosphere-expeditions.org/reports.