

FINAL REPORT OF SEA TURTLES NESTING IN PACUARE BEACH

2018



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I. ABSTRACT

Since February 24th until October 31st the nesting activities of leatherback turtles (*Dermochelys coriacea*), green turtles (*Chelonia mydas*) and hawksbill turtles (*Eretmochelys imbricata*) in Pacuare beach, Costa Rica were recorded. A total of 191 sea turtles' nests were protected out of which 156 nests corresponded to leatherback turtles, 29 to green turtles and six to hawksbill turtles. A total of 173 nests were relocated in the hatchery and 18 nests were buried in a safe place at the beach. The emergence percentage of the exhumed nests of leatherback turtle was 67.2% (SD = 21.52, n = 155) including the nets relocated at the beach and the nests placed in the hatchery, 73.70% (SD = 20.23, n = 24) for green turtle and 87.57% (SD = 20.78, n = 6) for hawksbill turtle.

A total of 10,960 neonates were released from all the protected nests, 8,112 from leatherback turtle, 2,038 from green turtle and 810 from hawksbill turtle. The number of released neonates could have been higher but due obstacles as illegal extraction of the eggs by poachers, the extension of the beach and the lack of resource to bring raise the participation of volunteers and personnel, the project could not protect all sea turtles' nests.

LAST Association recommends keeping operation the project in Pacuare beach to generate more scientific information in order to create management and conservation strategies that help recovering the population of sea turtles in the Caribbean coast of Costa Rica. A good indicator of the success of the project is the percentage of protected nests which was 64.53% of the total, number that has been increasing every year.

II. INTRODUCTION

Sea Turtles are ancestral reptiles that have suffered a constant pressure in the last decades which have let them to a state of near extinction. Human beings play an important role in reducing sea turtle populations due to the use of products and by-products derived from these reptiles. Mainly as a food resource but also for the confection of handcrafts' (Chacón, 2002). With the demographic increase in Costa Rica, the threats to the sea turtles' populations have also augmented due to the development of an entire black market all around the country targeting sea turtle meat and eggs; being the Caribbean side one of the most important supply zones for the country.

Sea turtle nesting studies in Costa Rica started in the 70's mainly in Tortuguero National Park (Troëning & Rankin, 2005). All around the world projects had been implemented to manage and conserve sea turtles by reducing threats, raising the population of these reptiles and increasing the knowledge of all the species. The Sea Turtle Conservation Project in Pacuare beach was started in 2012 by Latin American Sea Turtles (LAST) in association with WIDECAST, La Tortuga Feliz Foundation and the Asociación para el Ambiente de Nuevo Pacuare.

The project involves the community in conservation activities as research assistants or hatchery managers. The community in Pacuare is considered a highly vulnerable zone of the country because of the lack of jobs, the low levels of education and the insecurity due to the use and traffic of drugs. During sea turtles' nesting season people from nearby areas, outside of the local community, arrive to the beach to poach eggs and hunt sea turtles which increases the pressure on these animals.

The conservation activities are extremely important for the protection and survival of the four species present in Pacuare beach: hawksbill turtle (*Eretmochelys imbricate*), green turtle (*Chelonia mydas*), leatherback turtle (*Dermochelys coriacea*) and loggerhead turtle (*Caretta caretta*) (Fonseca & Chacón, 2012; Marion & Chacón, 2013). *E. imbricata* is catalogued as critically endangered; *C. mydas* is classified as vulnerable and *C. caretta* as endangered due the population decline around the world. Leatherback turtles of the Northwest Atlantic were catalogued as vulnerable in 2014's assessment by the Convention of the Sea Turtles Specialist Group of UICN due the recovery of the population mostly in Guyana, Trinidad & Tobago, Panama and Surinam but, in the last assessment, the Northwest Atlantic Leatherback turtles were catalogued as Endangered by the Northwest Atlantic Leatherback Working Group due to the declines in nesting abundance caused by anthropogenic sources, habitat loss and change in the life history parameters (Northwest Atlantic Leatherback Working Group, 2018).

The main objective of this project is to improve the conservation status of the sea turtles in Pacuare beach through the support of government institutions as well as the local community. Backed by institutional agreements that allow the standardization of conservation activities, which provides adequate techniques to increase the reproductive success of sea turtles and protection of the females while nesting. The following report shows all the conservation activities done in Pacuare beach, since February 24th to October 31st of 2018. This includes the number of nests protected, emergence and hatching success and the number of neonates released.

III. METHODOLOGY

III.1 STUDY AREA

Pacuare beach ($10^{\circ}18'48.66''\text{N}$, $83^{\circ}21'17.25''\text{O}$ – $10^{\circ}13'25.37''\text{N}$, $83^{\circ}16'47.12''\text{O}$) is situated in Bataán's district within the Canton of Matina, in Limon province, Costa Rica. The beach has an extension of 7.1 km from the Parismina's river mouth to Pacuare's river mouth. The amount of people living in Pacuare is approximately 20 to 35 but during sea turtles nesting season 20 more people may incorporate themselves into the community to collect eggs illegally and hunt turtles.



Figure 1. Location of Pacuare beach and Cahuita National Park, sites were LAST work or collaborate with sea turtles' conservation projects.

III.2 BEACH PREPARATION

The beach was divided every 50 meters using wooden markers following a line parallel to the coast to distinguish the location of the nests more easily. Each wooden marker was given reflective tape and was numerated with black paint over a yellow background. The numeration was done from north to south, starting in Parismina's river mouth and ending in Pacuare's river mouth. The wooden markers from the previous seasons were evaluated and re-painted or replaced.

The beach was divided into two sectors in order to organize night patrols. Sector A began in wooden marker 0 to 79 (Laguna Perla – Laguna 1) and sector B started in wooden marker 80 to 144 (Laguna 1 – Pacuare River Mouth).

III.3 NIGHTLY PATROLS

The night patrols began on February 21st and ended on October 31st in both sectors of the beach. Every night patrol started at 20:00 until 00:00 and the last patrol started at 00:00 until 04:00, approximately. The number of volunteers on each patrol was about five and during high season eight. Patrols were guided by national or international research assistants which were previously trained in the management and collection of the data.

Pacuare Sea Turtle project is supported by the Asociación para el Ambiente de Nuevo Pacuare, a local group in charge of organizing work with the local research assistants. This organization gets paid for the work, as well as each one of the local assistants.

The national and international research assistants were registered by Área de Conservación La Amistad Caribe which approved and administered research passports under resolution **R-SINAC-PNI-ACLAC-010-2018** signed by Jorge Arturo Gonzáles Villalobos, functionary of ACLAC-SINAC and research director of this state agency.

To maintain order during patrols and avoid any incidents or the interruption of any nesting processes, the research assistant walked in front of the volunteers in a line parallel to the ocean. Red light was only used during the data collection, measurements, the application of the tags and the handling of the clutches.

III.4 MORNING CENSUS

Morning walks began every day at 05:00 from the wooden market 144 to 0 to examine the activities that happened during the previous night. Recording the number of saved and poached nests, as well as the hunted turtles.

III.5 TAGGING

Monel tags size #49 and #681 were used on sea turtle females that were not previously tagged, that had damaged tags or that were about to lose them. Bigger size (#49) tags were applied on leatherback turtles as external tags and Pit's (Passive Internal Transponders) were applied as internal tags. Smaller tags (#681) were used on green and hawksbill turtles. Every tagging process was performed following the protocol established in the **R-055-2007 SINAC**.

Any evidence of previous tags was recorded in the data sheets.

III.6 NEST DESTINATION

a) *In situ* or natural: Nests left in the place where the turtle laid, those were not touched in any way. After nesting, the track was erased to avoid poachers.

b) Relocated at the beach: Nests collected and moved to a safe place on the beach due the risk of erosion or high pressure by predators. To relocate the nests properly, the nest depth and width were measured to make a similar nest than the one made by the mother turtle and the eggs would be incubated in similar conditions. If the patrol leader could not measure the nest depth and width, the average measurement was used to bury the clutches. Leatherback turtle: 75 cm nest depth and 40 cm nest width, green turtles: 65 cm depth and hawksbills: 55 cm depth for. Once the turtles finished digging the incubation chamber and put a rear flipper inside it, a sterilized plastic bag was

placed inside to catch the eggs. The egg bag was closed and removed when the turtle started to cover the nest. The bag remained closed so that it would not lose heat, latex gloves were always used during the collection and relocation of eggs making sure not to hold the eggs for a long time to prevent damaging them.

c) Relocated at the hatchery: Nests moved from the beach to the hatchery, which is a zone destined for the protection and survival of the nests. The hatchery was built within sector B (Figure 2) in the same exact place used the previous season due the low risk of inundation or erosion. A 1.5-meter fence was placed all around the hatchery to avoid natural predators, humans or any turtle.



Figure 2. Panoramic view of the hatchery built in sector B to relocate all the sea turtles' clutches, Pacuare beach, Costa Rica.

To build the hatchery, the sand was removed up to a meter depth in the whole area in order to replace the sand that had been impregnated with amniotic liquid from the nests of the previous seasons and with sand from the intertidal zone (naturally sterilized by the ocean). The sand was filtered to avoid any roots, trash or pollutants that would damage the clutches. Subsequently, the entire area of the hatchery was divided into 80 cm squares, allowing a total of 300 nests to be relocated to the hatchery.

III.7 HATCHERY MONITORING

The hatchery was monitored 24/7. During the night, the hatchery shifts were about six hours: from 18:00 h to 00:00 h and from 00:00 h to 06:00 h. During the day the shifts were only two hours. The nests were checked every 15 minutes to notice the emergence of the neonates and to avoid natural predators such as ants, flies, crabs, among others, that could damage them.

The release of neonates was carried out at a minimum distance of 10 meters away from the ocean in the high tide line so they could fulfill their imprint mechanism. Every release was at a different point of the beach to avoid creating feeding areas for predators.



Figure 3. Extraction of the sand in the area destined for the creation of the hatchery in Pacuare beach.

Hatchlings were released without any kind of light during the nighttime in order not to disturb them on their way to the ocean and during the day, hatchlings were released after 17:00 h, when the sand temperature becomes low enough and will not damage the neonates. The hatchlings were released in the middle of the day only if it was cloudy or the temperature was low.

The nests' exhumations were done one or two days after the massive emergence of neonates in order to see the eggs' contents and know the hatching and emerge success. In cases where the nest never hatched, the exhumation was done after 80 days of incubation.

Broken shells with more than 50% of the original size, neonates trapped inside the nest, either dead or alive, unhatched eggs and depredated eggs were counted. Unhatched eggs were opened to observe and classify the stage of development of the embryo (Figure 4):

- I) Embryo occupies 0 to 25 % of the space into the egg
- II) Embryo occupies 26 to 50 % of the space into the egg
- III) Embryo occupies 51 to 75 % of the space into the egg
- IV) Embryo occupies 76 to 100 % of the space into the egg

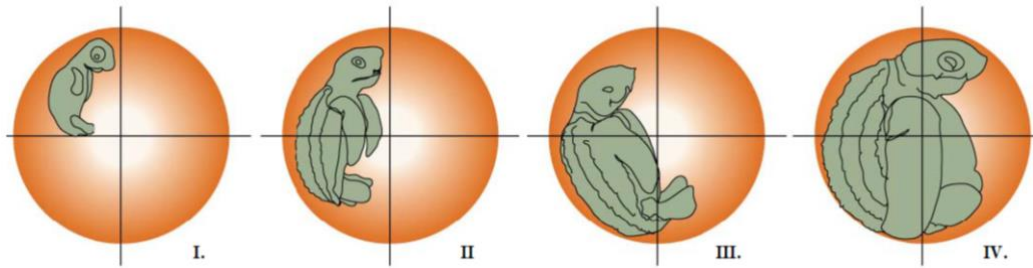


Figure 4. Development stages of the embryos in non-hatched eggs (Chacón *et al.* 2007).

The hatching and emergence percentages were calculated with the following formulae:

$$PE = \frac{C}{N} \times 100$$

$$PEM = \frac{C - TM}{N} \times 100$$

Where: PE = hatching percentage, PEM = emergence percentage, C = shells, N = total number of eggs and TM = number of dead neonates present in the nest or surrounding.

III.8 PROJECT DEVELOPMENT PERMITS

On March 2nd of 2018, LAST Association submitted the application for the research permits required by Área de Conservación La Amistad Caribe (ACLAC) in order to monitor the three species of sea turtles present in Pacuare. The permission was delivered on March 4th under resolution **R-SINAC-PNI-ACLAC-010-2018** signed by Jorge Gonzáles Villalobos.

III.9 TRAINING

The training of the research assistants was completed during the second week of March. The research assistants participated in lectures about ecology, biology, threats to sea turtles, sea turtle

conservation strategies and monitoring protocols on nesting beaches. All lectures took place at the biological station of LAST Association.

The research assistants also received practical training on tagging techniques, data collection, clutch handling and nest relocation.



Figure 5. Practical training – Data and nest collection during patrols.

During the season, volunteers were trained by the resident biologist and the international research assistants. Every activity was supervised by a trained professional.

III.10 ENVIRONMENTAL EDUCATION

Activities related to sea turtle biology and conservation were carried out throughout the season with the national and international volunteers as well as informative talks about the work done by LAST and the accomplishments achieved in Pacuare. Conservation activities such as beach clean-ups were also carried out throughout the season.

III.11 BEACH CLEAN-UPS

Every week, beach clean-ups at Pacuare were done together with the volunteers. Solid waste was collected and sorted so it could be sent to a recycling station in Bataán. Along the beach and in the river mouth, there were high levels of solid waste pollution which would be considerably reduced if

the municipality took responsibility for trash collection in the communities near to Pacuare given that currently, there are no collection or recycling systems in place.



Figure 6. Volunteers collecting solid waste at Pacuare's River mouth.

IV. RESULTS

IV.1 Leatherback turtle (*Dermochelys coriacea*)

IV.1.1 NUMBER OF NESTS

A total of 392 nesting activities were recorded during the 2018 season in Pacuare beach, of which 241 were successful and ended up as a viable nests. Compared with the previous seasons, the 2018 season's data is slightly below average. The number of nesting activities in the season correspond to the inter-annual fluctuations described previously by several authors (Troëng *et al.*, 2004; Chacón-Chaverri & Eckert, 2007) (Figure 7).

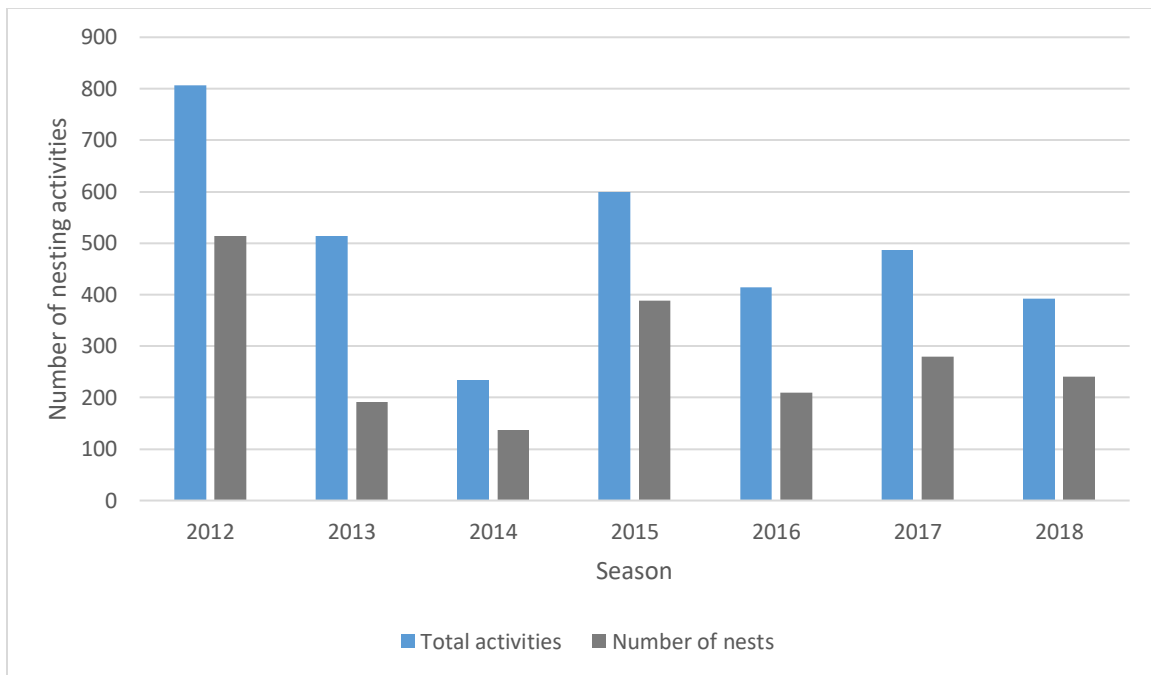


Figure 7. Leatherback turtle (*Dermochelys coriacea*) nesting activities registered in Pacuare beach since 2012.

The months with highest number of nests were April and May with 103 and 60 nests respectively (Figure 8). No nests were recorded during the month of February, 49 nests were registered in March, June presented 24 nests, in July four nests were recorded and only one nest was collected in August. As well as the four previous seasons, the nesting pattern in Pacuare beach is similar to the one observed in Gandoca beach, where 71.3% of the nests were recorded in April and May (Chacón-Chaverri & Eckert, 2007; Fonseca & Chacón, 2012; Marion & Chacón, 2013; Fonseca, 2014; Marion & Chacón, 2016; Carrasco & Chacón, 2017).

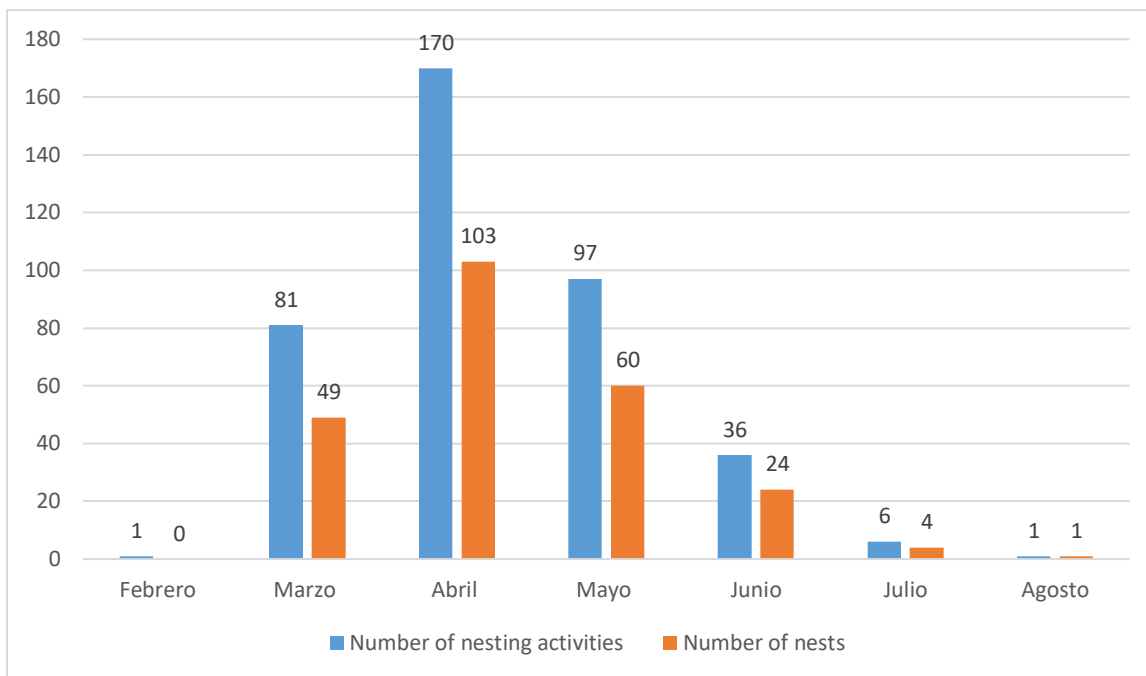


Figure 8. Seasonal distribution of the nesting activity for Leatherback turtles in Pacuare beach during the year 2018.

During the 2018 season, nesting activities were recorded along all 144 wooden markers. The marked parts of the beach with the most activity were 0-10, 51-60 and 81-90 (Figure 9). The spatial distribution of the nesting activity continues to represent a challenge for the project because more staff and volunteers would be needed in order to successfully cover the 7.1 km of beach throughout the whole night. More income could be generated with a higher number of volunteers which would be used to employ more research assistants from the community during the busiest season. It is important to mention that the organization that works with LAST donates a percentage of the income generated by the international volunteers to Asociación para el Ambiente de Nuevo Pacuare; through the actions that La Tortuga Feliz Foundation leads, this donative is designated to employ the local research assistants during the season.

In 2018 season, the average of poachers present at the beach was about 10 every night, reaching the 20 on weekends. LAST team organized an average of six patrols during the night which was clearly not enough to protect all the nests along the 7.1 km kilometers of the beach extension.

Unfortunately, the indiscriminate eggs poaching in the Caribbean region is one of the main anthropogenic activities that cause the decline of the Northwest Atlantic Leatherback turtles' subpopulation. This decline in the population would classify them as Endangered according to the IUCN criteria (IUCN, 2014) due to a decline of approximately 60% between the past and present estimators of abundance of leatherback turtle nests (Northwest Atlantic Leatherback Working Group, 2018).

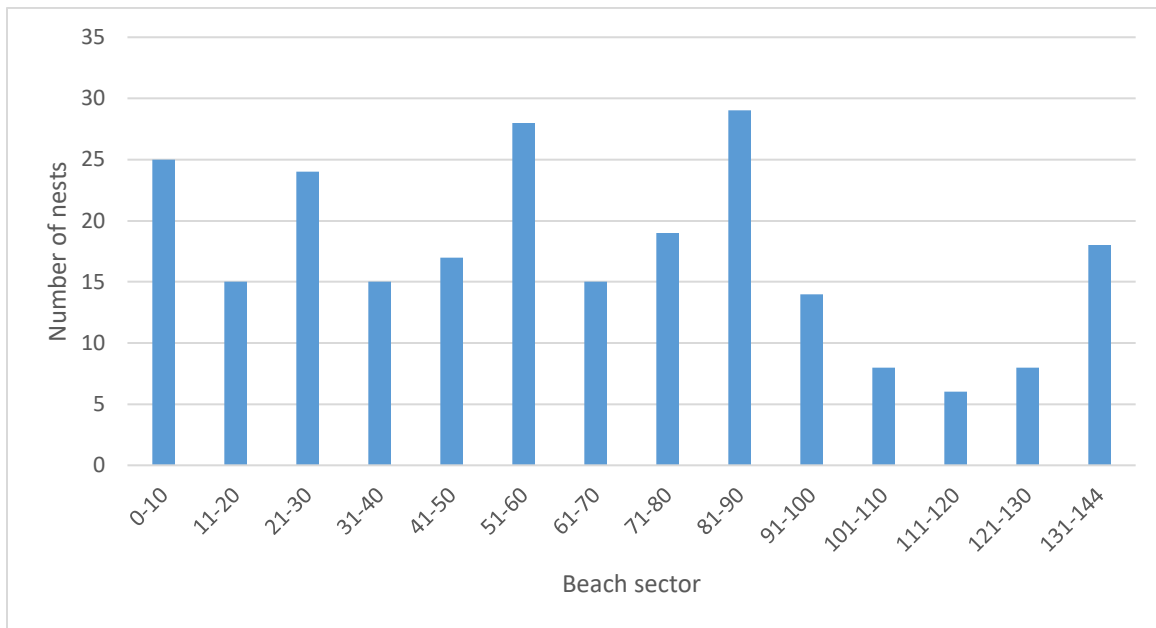


Figure 9. Spatial distribution of the nesting activity for Leatherback turtle in Pacuare beach during the 2018 season

IV.1.2 NUMBER OF NESTING FEMALES

A total of 134 nesting females were registered during the season, of which 29 turtles did not show any tag or evidence of previous tags. This could represent the addition of new females that reach the sexual maturity and replace dead or poached individuals, which is a good indicator of the current state of the Caribbean population in Costa Rica and Panamá. Unfortunately, there are not any relevant studies that estimate sea turtle mortality in this area.

Of the 134 nesting females recorded throughout the season, 97 laid only once, 23 nested in two occasions, 12 three times, one turtle laid five times and another turtle nested six times (Figure 10).

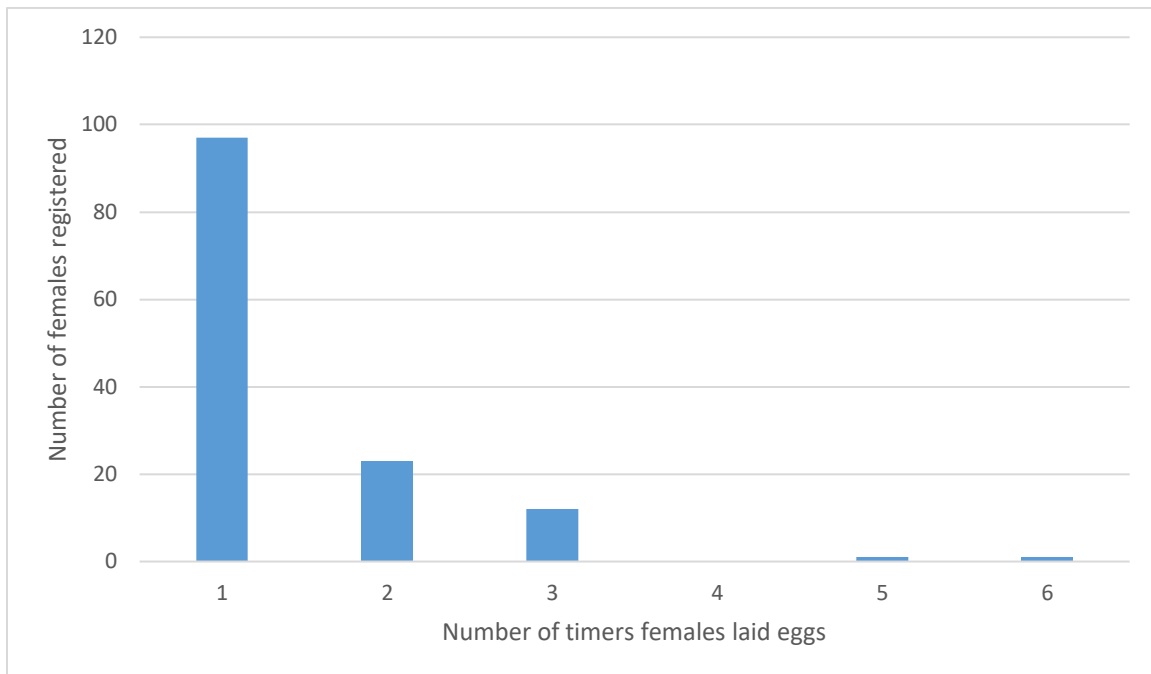


Figure 10. Number of returning Leatherback females registered during the season 2018 in Pacuare beach, Costa Rica.

IV.1.3 NEST DESTINATION

The percentage of protected nests was 64.7% of the total amount of nests in the season, 57.7% of this percentage of nests were relocated to the hatchery and the 7% were relocated to a safe place on the beach. Most nests were guarded at the hatchery because the protection and control provided in the hatchery is better. At nighttime, poachers stay in the vegetation to avoid being detected by LAST staff members during nest relocation and they could steal the clutch once patrols continue walking or even steal them the next day.

The illegal poaching of the eggs recorded throughout 2018 season was of 35.3%. This has been the lowest percentage recorded for leatherback turtle (*Dermochelys coriacea*) in Pacuare since 2012, year when LAST started with the project (Figure 11).

The correlation between the illegal poaching and the general nesting activities is still present. With more nesting activities, there is more illegal poaching. While the patrols are busy collecting the nests and relocating them in the hatchery poachers take advantage of the unwatched parts of the beach.

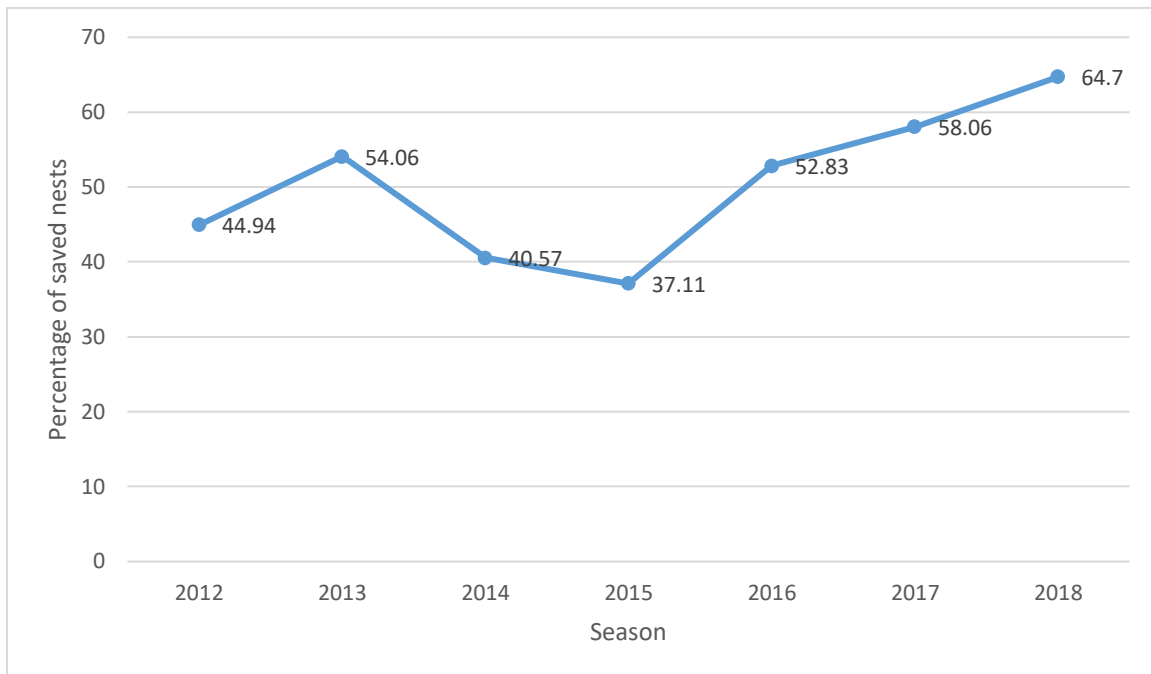


Figure 11. Percentage of saved nests for Leatherback turtles (*Dermochelys coriacea*) in Pacuare beach since 2012

IV.1.4 HATCHING AND EMERGENCE SUCCESS

The emergence success of the total leatherback nests was 67.2% (SD = 21.52, n = 155) including the nests relocated in a safe place at the beach and the nests incubated in the hatchery. An approximate of 8,112 neonates were released. The emergence success of the nests incubated in the hatchery was 69.28%. This percentage was higher than the percentage recorded in Gandoca (Chacón & Eckert, 2007) and Tortuguero (Troëng *et al.*, 2007) where the emergence success was $11,6 \pm 39,4\%$ and $42,6 \pm 35,14\%$ respectively.

The emergence success of the 2018 season is the second highest percentage registered in Pacuare beach since 2012, only below of 2015 season which presented 73.69% (Figure 12).

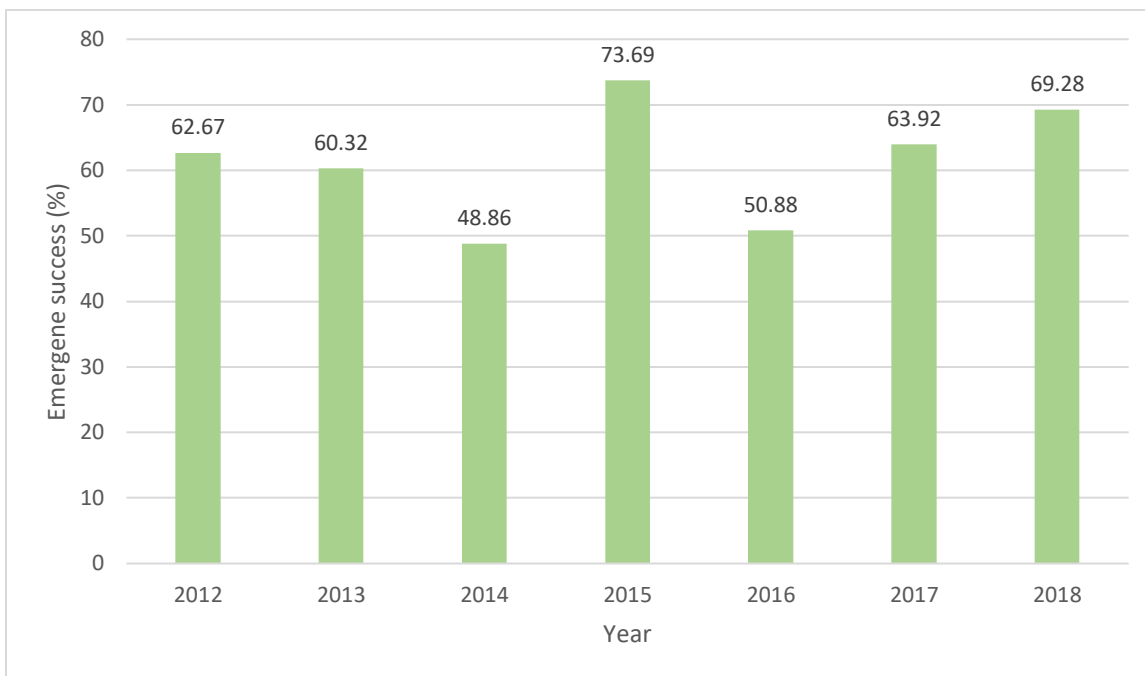


Figure 12. Percentage of emergence success estimated for the nests relocated in the hatchery of leatherback turtles (*Dermochelys coriacea*) since 2012 in Pacuare beach, Costa Rica.

IV.2 Green turtle (*Chelonia mydas*)

IV.2.1 NUMBER OF NESTS

During 2018 season a total of 126 nesting activities of green turtles (*Chelonia mydas*) were logged which only 42 ended up as successful nests. The disturbance of the nesting females by poachers in Pacuare continues which is observed in the low number of activities occurred because the turtles are scared or killed before or while nesting.

This season is the second lowest season recorded in Pacuare beach since LAST began in 2012, only under 2015 season (Figure 13). These numbers could be the consequences of the 171,556 turtles killed between 1991 and 2011 in the Caribbean of Nicaragua (Langueux, 2014). Most of the turtles that nest in Tortuguero and Pacuare use Nicaraguan water as feeding grounds (Troëng, 2005). This is the importance of monitoring these organisms year by year to determine long-term trends and establish proper conservation measures to rise the population of sea turtles.

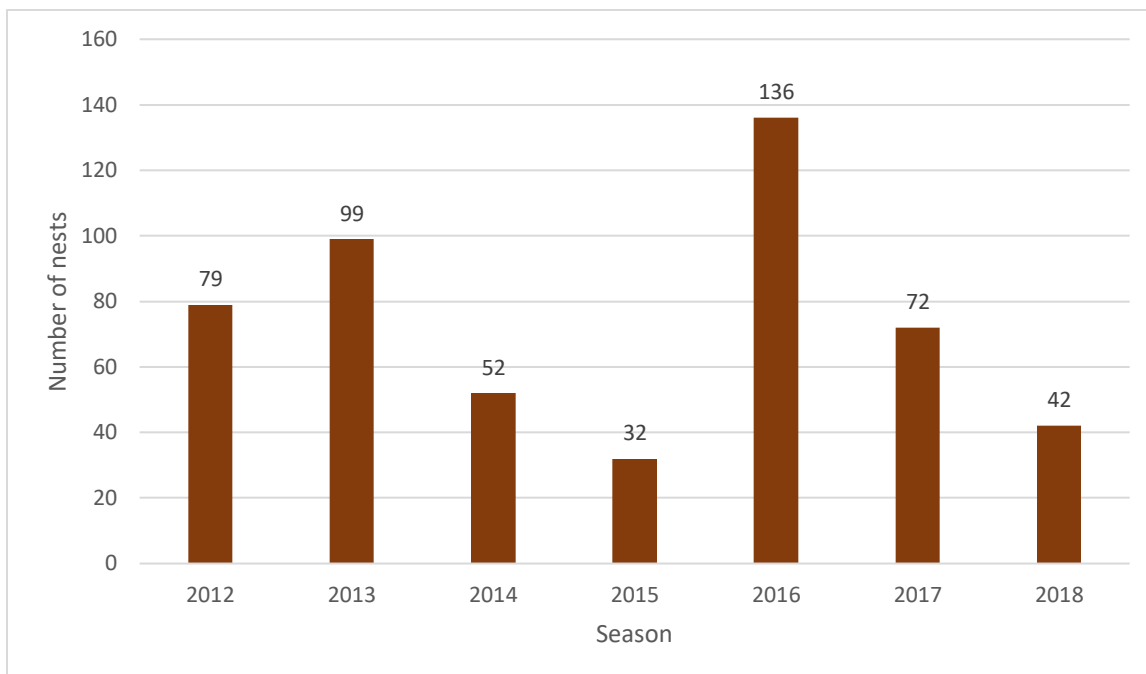


Figure 13. Number of nests of Green turtle (*Chelonia mydas*) since 2012 in Pacuare beach, Costa Rica.

The highest amount of green turtle nests occurred on August and September, both with 17 nests (Figure 14). None were recorded in May, during June four nests were registered, whereas July and October only two nests were recorded. The nesting pattern in Pacuare is like the one observed in Tortuguero where the nesting peak happens in September and October (González & Harrison, 2012).

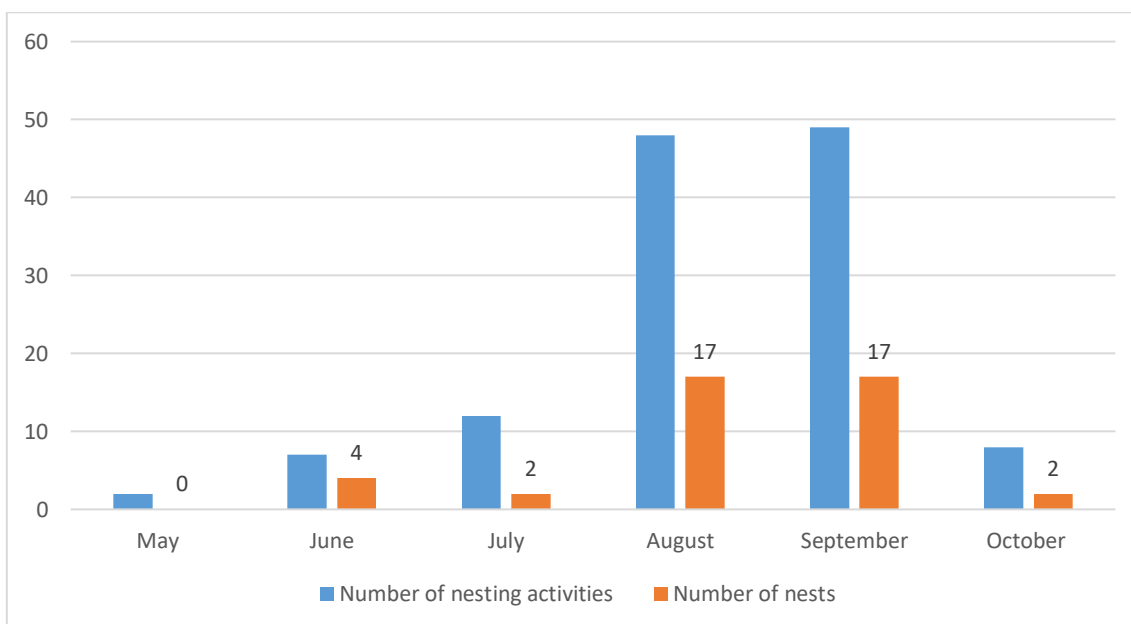


Figure 14. Seasonal distribution of the nesting activity of Green turtle (*Chelonia mydas*) in Pacuare beach, Costa Rica.

In this season, the nesting activity was concentrated in the sectors 11-20 and 21-30 (Figure 15). The 54.7% of the nests were laid in the north part of the beach (after the second lagoon). No nesting activity was recorded in the sectors near to Pacuare's River mouth (121-130 and 131-144). The reason of this could be the high number of logs and woods in those sectors which made impossible for turtles to lay eggs. The protection of the nesting females and their clutches is still a challenge for the project due the distribution of the nests. A higher number of personnel is needed along the beach during all night which is not possible if there is not enough volunteers.

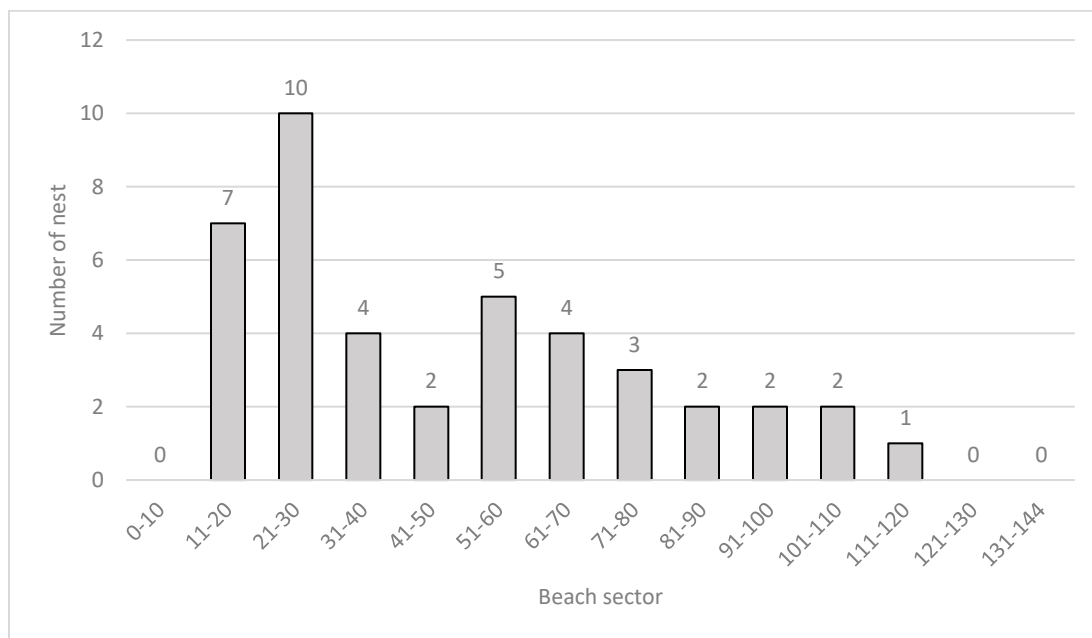


Figure 15. Spatial distribution of the nests of Green turtle (*Chelonia mydas*) in Pacuare beach, Costa Rica.

IV.2.2 NUMBER OF FEMALES REGISTERED

During 2018 season 27 female turtles were recorded of which 22 nesting turtles did not present any tag nor evidence of previous tagging.

IV.2.3 NUMBER OF KILLED TURTLES

In this season, a total of 10 nesting females were killed by poachers, same amount recorded in the seasons 2013 and 2017 (Figure 16). In consideration of the total number of nesting females, the percentage of killed turtles is average compared to the previous years (Figure 17). The conservation efforts in Pacuare require more years to completely eradicate these illegal activities. One of the biggest obstacles of sea turtles' protection in Pacuare is that poachers are not permanent residents of the zone, whereby the environmental education and the opening of new economic alternatives are not a solution to stop the slaughtering of green turtles.

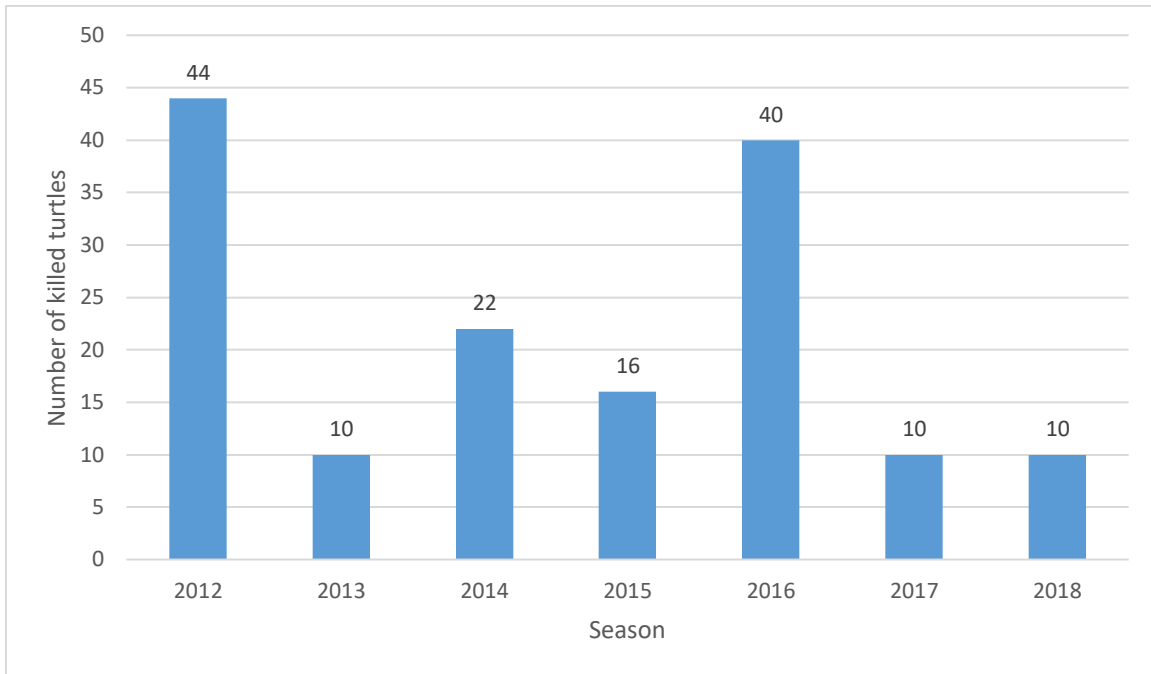


Figure 16. Number of Green turtles (*Chelonia mydas*) killed in Pacuare, Costa Rica since 2012.

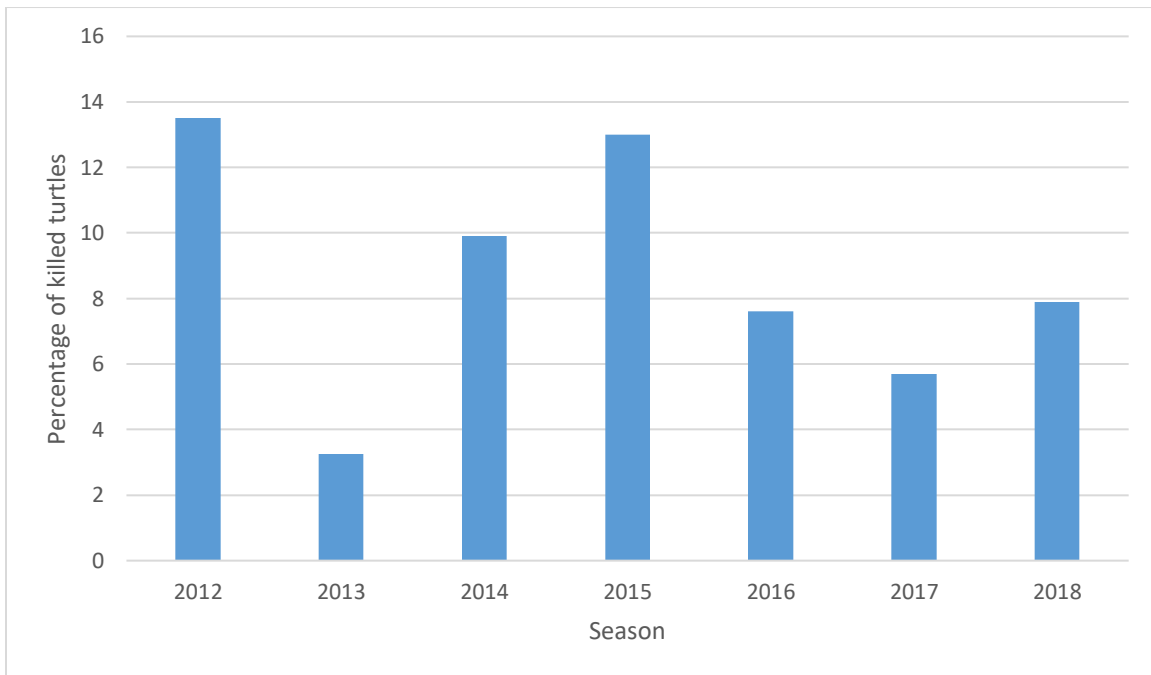


Figure 17. Percentage of Green turtles (*Chelonia mydas*) killed in Pacuare, Costa Rica, since 2012.

The Coastguards rescued a green turtle female and two green turtle nests, unfortunately, both nests came from turtles that were killed by the poachers hours before. Only in one of the situations Coastguards arrested two persons.

During August, two dead turtles appear at the beach; one of them was already decomposed (Figure 18a) which made impossible to know the causes of death and the second one presented the carapace cracked from the nuchal scute to the last vertebral scute (Figure 18b) possibly caused by a powerful impact against to a solid object.



Figure 18. a) Green turtle (*Chelonia mydas*) decomposed (left). B) Green turtle with the carapace broken (right).

IV.2.4 NEST DESTINATION

A total of 69.04% of the nests were protected in 2018. 29 nests were moved to the hatchery; 27 were collected during the night patrols and two were rescued and brought by coastguards. In this season there were not any nests left in situ. The percentage of rescued nests is an important achievement to LAST and the sea turtles that come to nest in Pacuare, but to get better results it is necessary to completely stop the poaching of green turtles.

IV.2.5 HATCHING AND EMERGENCE SUCCESS

The percentage of emergence from the nests exhumed was 73.70% (SD = 20.23, n = 24), releasing approximately 2,038 neonates. Compared with the previous seasons, this percentage is average (Figure 19). The nest with the highest emergence percentage was of 96.55%, this nest was collected during September while the lowest percentage was from a nest collected in August, with 13.04%. The two nests saved by Coastguard had a percentage of emergence of 18.02% because the second nest did not have any development due the long time outside the sand (more than 14 hours).

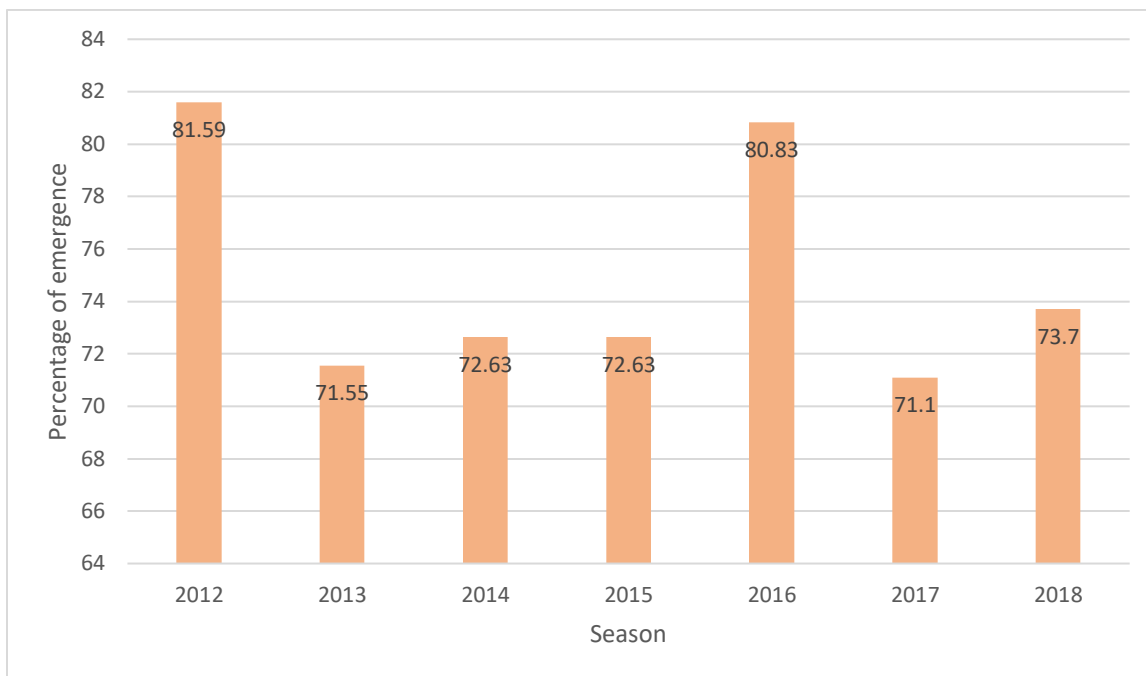


Figure 19. Percentage of emergence of Green turtle (*Chelonia mydas*) in Pacuare, Costa Rica since 2012.

IV.3 Hawksbill Turtle (*Eretmochelys imbricata*)

IV.3.1 NUMBER OF NESTS

During 2018 season a total of 21 nesting activities were registered out of which 13 were successful. Six nests were placed in the hatchery, two nests were poached, and five nesting females were killed by poachers. Most of the nesting activity was recorded during May and June with five and six nests respectively. This season was similar to the seasons of 2014 and 2017 (Figure 20). 2018 season was the second year in a row where five nesting females were killed (highest number of hawksbill turtles killed in a season) since LAST started the project in 2012.

It is possible that the shells of the females killed increase the illegal handicraft market that takes place in the city of Limón.

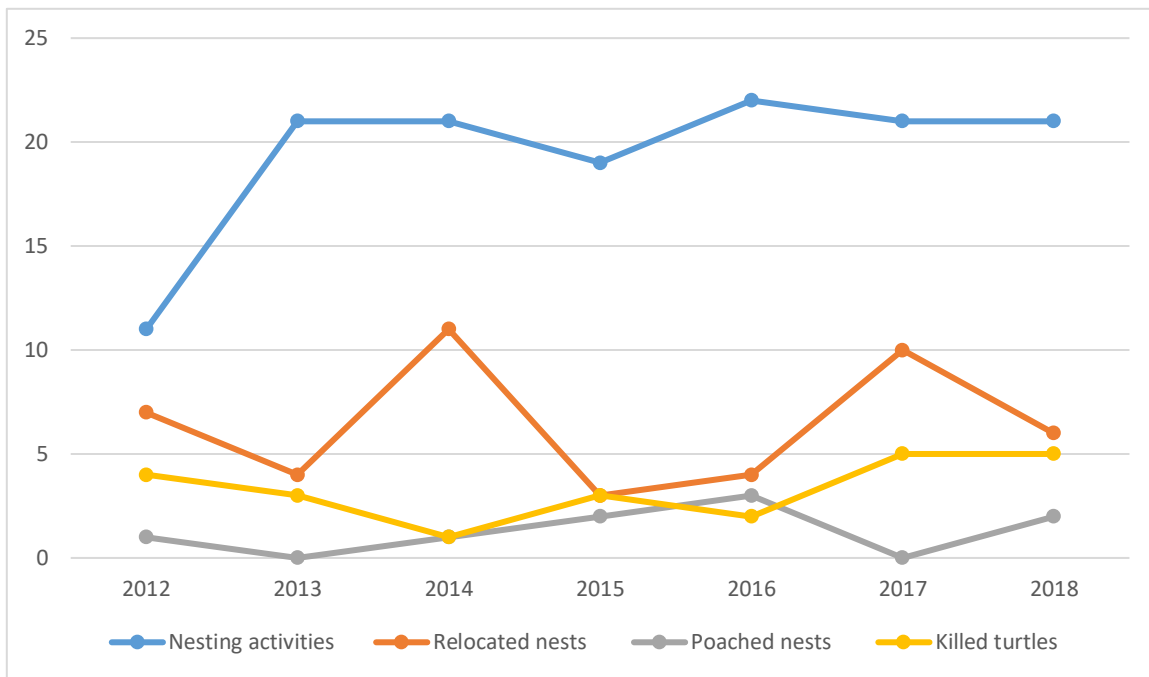


Figure 20. Nesting activity, number of relocated nests, number of poached nests and number of killed turtles of Hawksbill turtle (*Eretmochelys imbricata*) since 2012 in Pacuare, Costa Rica.

IV.3.2 HATCHING AND EMERGENCE SUCCESS

The percentage of emergence of the exhumed nests was 87.57% (SD = 20.78, n = 6) releasing an estimate of 810 hatchlings. The nest with the highest emergence percentage was laid in May (92.61%), during this same month the nest with lowest emergence percentage of the season was collected with 74.66%. This nest was buried in a zone in the hatchery where shade was always present which could explain the low emergence success.

V. CONCLUSIONS AND RECOMMENDATIONS

In the 2018 season a total of 191 sea turtles' nests were protected, 156 were from leatherback turtles (*Dermochelys coriacea*), 29 were from green turtles (*Chelonia mydas*) and six were from hawksbill turtles (*Eretmochelys imbricata*). Those nests produced 10,960 hatchlings out of which 8,112 were from leatherback turtle, 2,038 were from green turtle and 810 were from hawksbill turtle. The number of protected nests and hatchlings released are a big achievement for LAST Association because the project has been working for seven years and the project has been reducing the poaching of nests and slaughter of nesting females in a place where those activities were very common.

Thanks to the data collected since 2012 we know this beach is one of the most important nesting sites for Leatherback turtles in Costa Rica. Although a high number of poached nests and killed turtles are still perceived and the actions taken by the Ministerio de Ambiente y Energía (MINAE) and the Fuerza Pública are none or not enough. It is not easy to eradicate those activities due the high amount of money paid for turtle eggs and meat in the black market. Besides, most of the people involved in those illegal activities are outlaws or drug addicts. It also remains clear to us as a non-state organization that the role of protection is an exclusive power of the authorities of the Costa Rican State.

The program of environmental education has to be reintroduced in the zone because in previous seasons around 1000 kids from the main schools of Bataán and Siquerres were awarded. Its absence due to lack of financial resources and disinterest of partners such as banana plantations and commerce is affecting the younger classes Limón's society.

Human help is essential for the project, for that reason, the search of allies as donation agencies and volunteer agencies are crucial to employ more personnel and maximize the project achievements increasing the economy of the community and protecting the sea turtles.

In the season of 2018, the percentage of illegal poaching was 35.47% of the total. The constant of this percentage is explained due to:

- The lack of participation of authorities in charge of the protection of the natural resources in the zone, including the National Service of Coastguards (SNG), Costa Rican Institute of Fisheries and Aquaculture (INCOPECA) and the Ministry of Environment and Energy (MINAE).
- The lack of enforcement to the law of wildlife protection (Law 7317) and the law of protection, conservation and sea turtles' recovery (Ley 8325).
- The low participation of national and international volunteers which generate more resources to employ more local research assistants from Asociación para el Ambiente de Nuevo Pacuare which make the protection of the 7.1 km beach more efficient.
- The reduced number of job opportunities in Siquerres which forces a significant part of the population to commit crimes such as narcotrafficking and the illegal extraction of natural resources. If the Public Police and the institutions in charge of the protection of the natural resources in Costa Rica do not compromise protecting sea turtles, the NGOs and the communities will face delinquent groups trying to sustain their alcohol and drugs addictions attempting against the population of sea turtles in the Caribbean coast of Costa Rica. Also,

it is important to raise awareness in the population of Limón province to avoid the consumption of turtle eggs and meat because without consumers the black market would stop as well as the illegal collection of the eggs and the slaughter of the nesting females.

It is important that the municipalities get involve in topics related to construction of properties within the public zone and the management of the solid waste and grey waters. Because year by year people that not belong to the community and only arrive to the beach to collect sea turtles' eggs and kill nesting females, build illegal slums or ranchos without any sanitary measurement. If the municipality take those delinquents out of the zone, the protection of sea turtles and the security would be better

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