

Marine Turtle Monitoring and Conservation Programme

Playa Norte, Tortuguero



2007 Green Turtle Report

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1 Introduction

Tortuguero and the surrounding area have a long history with marine turtles. Archie Carr began his studies of green turtles (*Chelonia mydas*) in Tortuguero in 1955 and since 1958 the Caribbean Conservation Corporation (CCC) has continued work on this species and the others that nest on that beach (Haro & Troëng, 2006). Although Tortuguero and the Tortuguero National Park (TNP) are best known for their populations of green turtles, they also host populations of leatherback turtles (*Dermochelys coriacea*), hawksbill turtles (*Eretmochelys imbricata*) and the occasional loggerhead turtle (*Caretta caretta*).

Located about 7 km north of Tortuguero, inside the Barra del Colorado Wildlife Refuge, is the *Estación Biológica Caño Palma* (EBCP). EBCP is owned by the Canadian Organization for Tropical Education and Rainforest Conservation (COTERC) and is the base of the Marine Turtle Monitoring and Conservation Programme of Playa Norte (North Beach).

Two years after its creation in 1990, COTERC was approached by the CCC with the idea of monitoring the marine turtle population on Playa Norte (Greg Mayne written comm 2007), the beach to the north of Laguna Tortuguero. It was not until 2004 and 2005 that COTERC undertook a feasibility assessment in order to establish the significance of the population of marine turtles nesting on Playa Norte and to determine whether this number warranted a programme and significant protection (Greg Mayne written comm 2007). The findings of the assessment were considered sufficient to warrant the implementation of a long-term marine turtle monitoring programme and the programme was initiated with the assistance of Global Vision International (GVI) in 2006.

The number of tourists visiting TNP has increased from about 49,000 in 2000 to over 103,000 in 2006 (Allan Valverde, written comm 2007). This increase in visitors to the TNP has had a trickle down effect on the reserve, Playa Norte and the surrounding communities. The increase in tourism has opened up opportunity for employment and with that has come further development. Playa Norte currently has two hotels, several private homes and a new larger hotel is being planned. The nearest community to Playa Norte, San Francisco, is increasing in size almost constantly and as a result is having a very obvious impact on the local environment. This increased demand on local

resources is demonstrating the need for management of both TNP and the Barra del Colorado Wildlife Refuge as well as the importance of the monitoring programme on Playa Norte.

It is expected that with a greater understanding of the turtle population and Playa Norte this programme will help contribute to an informed approach to the management of the study site, the refuge and the surrounding area.

Table of Contents

1	Introduction.....	i
	Table of Contents	iii
	List of Figures.....	1
	List of Tables.....	2
2	Aim.....	4
3	Acknowledgements	4
4	Executive summary	5
4.1	Research Conducted	5
4.2	Conclusions	8
4.3	Recommendations	9
5	Methodology.....	13
5.1.1	Study site	13
5.1.2	Beach preparations	14
5.1.3	Staff and volunteer training.....	14
5.1.4	Daily morning census and nest surveys.....	14
5.1.5	Night patrols	15
5.1.6	Nest fate, nest survivorship and hatching success	16
5.1.7	Disguising nests	17
5.1.8	Collection of human impact data.....	18
5.1.9	Dead and lifted turtles.....	18
6	Results	18
6.1	Morning track census	18
6.1.1	Green turtle temporal distribution.....	18
6.1.2	Hawksbill temporal distribution	20
6.1.3	Loggerhead turtle temporal distribution.....	22
6.1.4	Green turtle spatial distribution	22
6.1.5	Hawksbill spatial distribution.....	23
6.1.6	Green turtle nest status based on morning census	23
6.1.7	Hawksbill nest status based on morning census.....	28
6.2	Night Patrol	29
6.2.1	Encountered green turtles	29
6.2.2	Encountered hawksbills	32

6.2.3	Green turtle tagging.....	33
6.2.4	Hawksbill tagging	34
6.2.5	Green turtle biometric data	34
6.2.6	Hawksbill biometric data	37
6.3	Nest fate, nest survivorship and hatchling success	38
6.3.1	Green nest fate of triangulated nests	38
6.3.2	Hawksbill nest fate for triangulated nests.....	40
6.3.3	Green turtle summary of all hatched nest excavations.....	41
6.3.4	Hawksbill summary of all hatched nest excavations	42
6.4	Human impact data	43
6.5	Dead and lifted turtles	47
7	Discussion.....	48
7.1	Daily morning census.....	48
7.1.1	Green turtle activity.....	48
7.1.2	Hawksbill turtle activity	48
7.1.3	Green turtle spatial distribution	48
7.1.4	Hawksbill turtle spatial distribution	48
7.1.5	Green turtle nest status based on morning census.....	48
7.1.6	Hawksbill turtle nest status based on morning census.....	49
7.2	Night patrol.....	50
7.2.1	Encountered green turtles	50
7.2.2	Encountered hawksbills	50
7.2.3	Green turtle tagging.....	50
7.2.4	Hawksbill turtle tagging.....	50
7.2.5	Green turtle biometric data	51
7.2.6	Hawksbill turtle biometric data	51
7.3	Nest fate and hatching success.....	51
7.3.1	Green turtle nest fate for triangulated nests.....	51
7.3.2	Hawksbill turtle nest fate for triangulated nests.....	51
7.3.3	Green turtle summary of all hatched nest excavations.....	51
7.3.4	Hawksbill turtle summary of all hatched nest excavations.....	52
7.4	Human impact.....	52
7.5	Dead and Lifted Turtles	52
8	References.....	53

9	Personal communications.....	53
10	Written communications	53
11	Appendix	54
11.1	Appendix A: Summary of all green turtle tags applied or encountered.....	54
11.2	Appendix B: Summary of all hawksbill turtle tags applied or encountered	58
•	HLF- Turtle did not lay	58
•	NST-Turtle nested, no tags recorded.....	58
•	REC-Newly tagged turtle	58
•	REM-Previously tagged turtle	58
•	Shaded cells are tags applied on that specific occasion	58

List of Figures

Figure 6-1 Monthly green turtle activity. Playa Norte, Costa Rica.	19
Figure 6-2 Weekly green turtle activity. Playa Norte, Costa Rica.	20
Figure 6-3 Number of green nests per night from June to November. Playa Norte, Costa Rica.	20
Figure 6-4 Monthly hawksbill turtle activity. Playa Norte, Costa Rica.	21
Figure 6-5 Weekly hawksbill turtle activity. Playa Norte, Costa Rica.	21
Figure 6-6 Spatial distribution of green turtle nests and half moons from mile 0 to mile 3 1/8. Playa Norte, Costa Rica.	22
Figure 6-7 Spatial distribution of hawksbill turtle nests and half moons from mile-markers 0 to 3 1/8. Playa Norte, Costa Rica.	23
Figure 6-8 Green nest status based on morning census. Playa Norte, Costa Rica.	24
Figure 6-9 Green nest status percents based on morning census per week. Playa Norte, Costa Rica.	25
Figure 6-10 Green nest status based on morning census per week. Playa Norte, Costa Rica.	26
Figure 6-11 Green nest status percents based on morning census from mile 0 to 3 1/8. Playa Norte, Costa Rica.	26
Figure 6-12 Green nest status based on morning census from mile 0 to 3 1/8. Playa Norte, Costa Rica.	27
Figure 6-13 Percent of all green turtle nests poached per day of the week. Playa Norte, Costa Rica.	28
Figure 6-14 Hawksbill turtle nest status based on morning census. Playa Norte, Costa Rica.	29

Figure 6-15 Percent of nesting green turtles encountered per eighth of a mile. Playa Norte, Costa Rica.	30
Figure 6-16 Number of encountered nesting green turtles per hour. Playa Norte, Costa Rica.	31
Figure 6-17 Direction facing during oviposition for green turtles. Playa Norte, Costa Rica.	32
Figure 6-18 Average green turtle clutch size compared to curved carapace length. Playa Norte, Costa Rica.	36
Figure 6-19 Excavation nest status for triangulated green nests. Playa Norte, Costa Rica.	38
Figure 6-20 Human impact data by month for PM one team. Playa Norte, Costa Rica.	44
Figure 6-21 Human impact data by month for PM two team. Playa Norte, Costa Rica.	45
Figure 6-22 Evidence of local presence per day of week based on PM one data. Playa Norte, Costa Rica.	46
Figure 6-23 Stationary lights recorded per month. Playa Norte, Costa Rica.	47

List of Tables

Table 6-1 Nesting hawksbill turtle encounter time. Playa Norte, Costa Rica.	32
Table 6-2 Direction facing during oviposition for hawksbill turtles. Playa Norte, Costa Rica.	33
Table 6-3 Tag numbers applied to green turtles in 2007. Playa Norte, Costa Rica.	33
Table 6-4 Tag numbers applied to hawksbill turtles in 2007. Playa Norte, Costa Rica.	34
Table 6-5 Green turtle mean CCLmin. Playa Norte, Costa Rica.	35
Table 6-6 Green turtle mean CCWmax. Playa Norte, Costa Rica.	35

Table 6-7 CCL Precision for re-emergent green turtles. Playa Norte, Costa Rica.	36
Table 6-8 Mean number of fertile and infertile eggs for green turtles. Playa Norte, Costa Rica.	36
Table 6-9 Mean CCLmin for hawksbill turtles. Playa Norte, Costa Rica.	37
Table 6-10 Mean CCWmax for hawksbill turtles. Playa Norte, Costa Rica.	37
Table 6-11 Mean egg count difference between oviposition and excavation for hawksbill turtles. Playa Norte, Costa Rica.	37
Table 6-12 Hatching and emerging success for all green turtle triangulated nests. Playa Norte, Costa Rica.	39
Table 6-13 Summary of green turtle excavations for all triangulated nests. Playa Norte, Costa Rica.	40
Table 6-14 Hatching and emerging success for all hawksbill triangulated nests. Playa Norte, Costa Rica.	40
Table 6-15 Summary of excavations for all hawksbill triangulated nests. Playa Norte, Costa Rica.	41
Table 6-16 Summary of the hatched nest green excavations. Playa Norte, Costa Rica.	41
Table 6-17 Mean egg and nest depth for green excavations; hatched and un-hatched. Playa Norte, Costa Rica.	41
Table 6-18 Percent of all eggs predated from green turtle excavations. Playa Norte, Costa Rica.	42
Table 6-19 Summary of the hatched nest hawksbill excavations. Playa Norte, Costa Rica.	43
Table 6-20 Mean egg and nest depth hawksbill excavations. Playa Norte, Costa Rica.	43

Table 6-21 Percent of all eggs predated from hawksbill turtle excavations. Playa Norte, Costa Rica..... 43

Table 6-22 Human impact data for nights with two teams on North Beach from 01 May to 26 October. Playa Norte, Costa Rica..... 44

Table 6-23 Dead and lifted turtles found during 2007 season. Playa Norte, Costa Rica.47

2 Aim

The overall aim of this programme is to be a leader in the long-term conservation of marine turtles in the area of Playa Norte and to ethically gather valuable scientific data on the nesting marine turtles.

The programme's specific conservation aims are to 1) reduce poaching rates and 2) educate the community and tourists about marine turtle conservation, including appropriate behaviour on the beach.

The programme's specific scientific aims are to 1) gather selected biometric data on nesting marine turtles, 2) record the spatial and seasonal distribution of nesting females, 3) monitor the number of nests and half moons, 4) determine the level of illegal poaching on turtles and their nests, 5) record hatchling emergence and hatching success rates, 6) monitor for the apparent physical health of nesting females, 7) track re-emergences to the nesting beach and migration between beaches, and 8) register tourist and human development around the nesting site.

3 Acknowledgements

This programme is as a result of the hard work of GVI and COTERC employees and volunteers. Their time and dedication is invaluable and the programme would not be possible without them.

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4 Executive summary

4.1 Research Conducted

1. Morning census was conducted from 26 March to 17 November and night walks from 26 March to 26 October. Turtle tracks of all species were recorded but only those of green, hawksbill, and loggerhead are included in this report.
2. The first green turtle half moon was recorded on 23 April and the first nest was recorded on 13 May.
3. The first hawksbill half moon was recorded on 26 March and the first nest was recorded on 15 May.
4. A total of 1834 green tracks were recorded this season; 803 nests and 1031 half moons.
5. A total of 32 hawksbill tracks were recorded this season; 16 nests and 16 half moons.
6. The peak nesting month for green turtles was September with 334 nests and 426 half moons whilst the peak nesting week was that of 2 September to 8

- September with 110 nests and 196 half moons. The peak nesting night for green turtles was 6 September with 31 nests and 43 half moons.
7. The peak nesting month for hawksbill turtles was June with six nests and two half moons. The peak nesting week was 10 June to 16 June with three nests and one half moon.
 8. The sections of beach with the highest green turtle nest activity were the eighth of a mile before mile-markers 7/8 and 1. This area of the beach represents only 8% of the beach but contains almost 16% of all of the green nests.
 9. The eighth of a mile before mile-marker 2 6/8 had the highest number of hawksbill nests (n=3). There was a large gap between mile-markers 1 4/8 and 2 5/8 in which only one hawksbill nest was found.
 10. A total of 31.38% of all green nests were in the open area (n=252), 56.91% in the border (n=457), and 11.71% were found in the vegetation (n=94).
 11. A total of 18.75% of all hawksbill nests were in the open area (n=3), 50.00% in the border (n=8), and 31.25% were found in the vegetation (n=5).
 12. Based on morning censuses 68.74% (n=552) of green turtle nests were recorded as natural, 21.79% (n=175) as poached, 6.85% (n=55) as unknown and 2.62% (n=21) as eroded.
 13. Of the 16 hawksbill nests 81.25% were natural (n=13) this season and 18.75% poached (n=3). No nests were classified as unknown or eroded.
 14. Over 45% of all green turtle nests that were determined poached or unknown fell within four weeks; the weeks of 12 August, 26 August, 2 September, and 9 September.
 15. High areas of poaching or possible poaching (status 'unknown') for green nests containing over 58% of the poached or possibly poached nests were the eighth of a mile before mile-markers 3/8, 4/8, 5/8, 6/8, 7/8, 1, and 1 6/8. These sections of beach make up only 28% of the study site.
 16. More than 35% of all green nests laid on Friday or Saturday nights were poached whilst less than 20% of all nests laid on Thursday nights were poached (Figure 6-13).
 17. A total of 390 green turtles were encountered at night during survey, 261 of them nested and 129 of them did half moons. One additional nesting turtles was seen during morning census.

18. Of the 803 green nest occurrences this season the nesting turtle was observed 32.63% (n=262) of the time and the track was observed at night 43.09% (n=346) of the time.
19. The peak encounter time for nesting green turtles was between 22:00 and 23:59 when 44.66% of nesting encountered turtles was seen.
20. Of the 16 hawksbill nest occurrences this year the nesting turtle was observed 37.50% of the time (n=6) and the track was observed at night 87.50% of the time (n=14).
21. During this season, 106 of the nesting green turtles observed were newly tagged whilst 92 were previously tagged and 64 turtles were seen whilst nesting but were not tagged at all.
22. A total of 27 individual green turtles re-nested on North Beach, one nesting four times, seven nesting three times and 19 nesting twice.
23. Four nesting hawksbill turtles were newly tagged. One hawksbill re-nested.
24. The mean CCLmin for previously tagged green turtles was 105.38 cm (excluding re-emergent turtles), the mean CCLmin for newly tagged turtles with evidence of previous tagging was 104.48 cm, and the mean CCLmin for newly tagged turtles without evidence of previous tagging was 103.82 cm.
25. The mean CCWmax for previously green tagged turtles was 95.31 cm (excluding re-nesting turtles), for newly tagged turtles with evidence of previous tags was 95.57 cm, and for newly tagged turtles with no evidence of previous tagging was 94.11 cm.
26. The mean CCLmin for newly tagged hawksbill turtles with no evidence of previous tagging was 86.01 cm. There were no previously tagged turtles (excluding the re-nesters) and no newly tagged turtles with evidence of previous tagging.
27. The mean CCWmax for newly tagged hawksbill turtles with no evidence of previous tagging was 82.09 cm.
28. Of 123 green turtle nests triangulated, 29 could not be located. Of the remaining 94 nests a total of 56.38% of the nests were found to be natural compared to 32.08% in 2006.
29. The overall green turtle hatching rate for all 94 triangulated nests was 41.93% and the emerging rate was 40.43%.

30. Of the five hawksbill nests triangulated all were located. Four were found to be natural and one was poached.
31. A total of 137 green nests were determined natural, hatched and were able to be located during excavation. Some were located due to triangulation and some due to the sightings of hatchling tracks. The hatching rate for all 137 nests was 86.54% and the emerging rate was 84.54%
32. Of all fertile eggs in the 137 excavated natural green turtle nests a total of 9.27% showed evidence of predation. Of all fertile eggs in the six green turtle natural, un-hatched excavated nests a total of 49.42% showed evidence of predation.
33. The egg depth for all hatched green turtle nests was 47.78 cm whilst the nest depth was 62.31 cm.
34. A total of 142 sets of green turtle hatchling tracks were seen this year as opposed to 13 sets of hatchling tracks seen in 2006.
35. The mean incubation time for 88 green turtle nests was 54.07 days with a minimum of 44 days and a maximum of 64 days.
36. Seven hawksbill nests in total were found to have hatched. These nests were located either by triangulation or because tracks hatchling tracks were seen. The hatching rate for all seven nests was 82.18% and the emerging rate was 82.09%.
37. The mean egg depth found during hawksbill excavations was 29.43 cm and the mean nest depth was 48.69.
38. Four sets of hawksbill hatchling tracks were seen with a mean incubation time of 67.25 days. The minimum incubation time was 57 days and a maximum was 77 days.
39. July had the highest mean number of tourists per night.
40. Saturday had the highest mean number of locals and mobile white lights per night whilst Tuesday had the lowest.

4.2 Conclusions

1. The quality of data has increased this season mainly due to the facts that data is being stored in a Microsoft Office Access database and is being checked daily. The new database proved to be a much more efficient and easier way to store, extract and analyse data.

2. In the last two years, this programme has improved greatly. Its standards for data collection, training, data management, and ethics are continually being revised and improved.
3. The new criteria being used to assess nest status is considerably less subjective and therefore hopefully more accurate.
4. The poaching rate on hawksbill nests has gone down considerably over the past three seasons from about 91% in 2005 to less than 20% in 2007. This may be due to the increased presence on the beach. There has also been a great effort in 2007 to reach all nests before poachers in order to disguise them.
5. A consistent management team throughout the season has been key to the successful improvements made to the programme.

4.3 Recommendations

1. It is critical to the programme that a Field Coordinator(s) is designated to manage the training, ensure high quality data collection, entry and analysis, and to guarantee that all aspects of the programme continue (beach cleans, excavations, hatchling watches, etc). The Field Coordinator(s) should not be required to partake in multiple areas of station or expedition work but be able to focus on the management of the turtle programme. This may mean the Field Coordinator(s) will be unable to undertake patrols due to other priorities such as data control and report writing.
2. Extensive training in the classroom and in the field for patrol leaders and volunteers increased competence levels on the beach and the quality of data collection. The comprehensive training and high standards should continue next season.
3. It is advised that the programme has more patrol leaders as the schedule for GVI is rigorous. More patrol leaders would allow time for presentations in the community and at hotels, more patrols on the beach, more beach cleans, and higher quality data collection as the patrol leaders would have more time to recuperate prior to their next patrol.
4. A recruiting effort should be made to maintain the number of volunteers next year in order to undertake the large amount of work that is needed to run the programme. GVI has consistently provided enough volunteers during their occupancy of the station, however, in the time between these periods the number

- of volunteers drops dramatically. It is suggested that more volunteers and patrol leaders are recruited during these periods in order to continue at the same standard of work throughout the season.
5. It is recommended that all patrol leaders and volunteers get trained in managing tourists and those from the local community. Since patrol teams are not policing the beach, they must not act like it and should use these encounters as an opportunity to create awe and to educate.
 6. Environmental education in the local community of San Francisco and for the landowners along Playa Norte is critical. Presentations about the work done at the station and about the need for conserving marine turtles should be done at least twice during the turtle season.
 7. Environmental education for the children is very important to the future of the programme and the area. It is recommended that this be continued. It is also recommended that the children, in small groups, be invited to the beach to watch a marine turtle nest whilst learning about the importance of protecting them. Parents should be invited as well.
 8. The mile-markers on the beach help teams to know their location and it is an easy way to divide up the beach for analysis. Before next season, all markers should be re-measured to ensure that they are 200 meters apart and the accurate GPS coordinates should be taken at each one (with an accuracy of five meters or less). Each mile-marker should be painted white with large black numbers written on them.
 9. More white lights on the beach over the season were replaced with red ones, but the programme should contact hotels and landowners prior to the beginning of the season to ensure more lights are red before the season starts. As done during this year, the programme could purchase red lights for the landowners as long as there is a commitment to use them.
 10. Morning censuses and night walks should be continued as during the 2007 season. It is advised that more night walks should take place, having at least two to three patrols every night. This would require more patrol leaders.
 11. The criteria used during morning census to determine the nest status should continue in order to allow for comparing poaching rates from year to year.
 12. During the 2007 season, night survey data was entered after each patrol, either after the shift or the following morning. Morning census and excavation data was

- always entered immediately after the survey. The data was then checked thoroughly by the programme manager. Because of the nature of this programme and the changing patrol leaders and volunteers, it is absolutely essential to the consistency and quality of the data that it continues to be entered by field teams and that the programme manager is able to check it on a daily basis for the entire season.
13. The Microsoft Office Access database should continue to be used to ensure data consistency. Some improvements should be implemented.
 14. It is recommended that the data continue to be managed on site in order for high poaching areas to receive immediate attention.
 15. A good relationship with the local hotels is important to the programme. It is recommended that a presentation be developed for hotel staff (in Spanish or English as needed) in order to educate them about what is being studied on Playa Norte and about good practices on the beach. Another presentation should be developed for tourists educating them about what is done on the beach and about the importance of protecting marine turtles.
 16. Local lodges should be encouraged to use the programme's staff to deliver presentations to tourists on a regular basis. This would require staff, interns and volunteers to be able to schedule time to do such visits.
 17. A brochure was designed during this season. The proper funding should be allocated to print and distributed it to the hotels so that their tourists are aware of what the programme does and guidelines for walking the beach at night.
 18. At various times throughout the season flagging tape was found either on gates to people's houses or ripped off the trees and thrown onto the beach. The programme was also informed that the poachers read the dates on the flagging tape in order to determine if a nest can be dug up or not. Moreover, partway through the season the dates were no longer written on the tape. It is recommended that green flagging tape be purchased in order to camouflage it, that no tape be left flying in the wind, and that dates are not to be written onto the tape.
 19. Since regular police and MINAE visits could deter poachers from coming onto the beach, there should be a stronger presence from both parties. The police should continue to be encouraged to visit the local community of San Francisco when possible. More police presence may deter the selling of turtle eggs and turtle

meat in town. From personal communication with villagers the programme has learned that it is fairly easy to obtain both.

20. Development along Playa Norte is continuing and increasing with speed. It is advised that all developed areas are documented by both informal observations as well as mapping using ArcView at the beginning and the end of each season.
21. There should be an extra effort to walk in areas with high amounts of poaching. The areas should be based on 2007 data unless different areas arise during 2008.
22. Although nest numbers are low for green turtles in June and July it is a high nesting time for hawksbills on Playa Norte. Because each hawkbill nest so important the level of commitment to night walks should not lessen during this time.
23. Because of the relative low number of nests and the high importance of the individuals, all hawkbill nests should be monitored for more than two days. It would be of interest to monitor each nest daily in order to know if they have become flooded, eroded, poached or predated. This would require more patrol leaders as it may cause a need for two morning census teams.
24. It is recommended that all mapping GPS units have all nests coordinates. This will prevent covering a nest with logs during beach cleans.
25. More effort needs to be put into finding triangulated nests. At least two separate attempts should be conducted if the egg chamber is not found. Those excavating need to dig much deeper because sand can be deposited on top of the nest throughout the season. It is worth considering marking the nests in some way in addition to triangulation. A bit of flagging tape or aluminium tag could be placed into the nest after the turtle begins to cover the egg chamber. This would make it simpler to find the egg chamber during excavation.
26. It is not known how many marine turtles nest north of mile 3 1/8. If the resources allow, the programme should perform a preliminary study on this beach to determine the level of activity in that area, something in which MINAE is highly interested.
27. For the purpose of relocation training, at least one patrol leader without previous experience should be trained in nesting beaches with greater nesting numbers in order to reduce the time to acquire the necessary experience and confidence.

28. Based on the 2007 season data, it is recommended that all hawksbill nests in front of Laguna Cuatro are relocated without hesitation. There was a very high natural rate for hawksbill nests this season possibly due to the large amount of effort put into disguising the nests. If this method of protecting the nest continues to be successful then relocation should not occur in areas of high poaching as disguising may be just as effective.
29. The large amount of effort that was put into finding hatchling tracks this season should continue next year including walks specific for this purpose in late November and December.

5 Methodology

The methodology used for the marine turtle monitoring programme follows the GVI and COTERC protocols and it was used for the duration of the season. For further details, please refer to the 2007 Marine Turtle Monitoring and Conservation Programme Night and Day Protocols.

5.1.1 Study site

The study area is located within Playa Norte and encompasses the 3 1/8 mile (~5 km) long sandy beach that extends from the Tortuguero River mouth (10°36'36.9"N - 83°31'52.1"W) on the southern end to Laguna Cuatro (10°38'06.9"N – 83°32'31.7"W) at the northern end. This beach is located within the Barra del Colorado Wildlife Refuge, which like TNP, is managed by ACTo (Area de Conservación Tortuguero), part of the Costa Rica Ministry of Environment and Energy (MINAE).

The study area is marked as mile 0 at the Tortuguero River mouth and mile 3 1/8 just north of Laguna Cuatro. The length of the beach is divided and marked with mile-markers at every 1/8 of a mile (approximately 200 meters). The mile-markers run in ascending order from the south to the north to allow for the documentation of spatial distribution and density of nests along the beach.

The nearest village to the study site is San Francisco, a constantly growing community of about 274 residents (van Oudenhoven, 2007), situated south of mile 0. Two hotels, Cabinas Vista al Mar and Turtle Beach Lodge, and several houses are located along the study site. There is a road that runs parallel to the beach the entire length of the study

site which is used by those on foot, bike, horseback, and car. On the southern side of the Tortuguero River mouth is Tortuguero beach, which the CCC monitors from mile 0 to Jalova lagoon at mile 18.

The dominant plants on the nesting beach are morning glory (*Ipomoea pes-caprae*), rearspurline (*Sesuvium portulacastrum*) and rush grass (*Sporobolus virginicus*). The berm is bordered by a hedgerow of cocoplum (*Chrysobalanus icaco*) and sea grapes (*Coccoloba uvifera*) with a mixture of coconut palms (*Cocos nucifera*) and various tropical hardwoods behind. The beach is littered with a variety of debris including logs, coconut husks and a large amount of plastics, bottles, and garbage in general.

5.1.2 *Beach preparations*

Before the season began in February 2007, each mile-marker was repaired or replaced if necessary, and reflective tape was nailed to the markers. Many beach cleans were completed with the purpose of creating a better nesting site for female turtles. In addition, before a nest was meant to hatch the area in front was cleaned in order to increase the survival rates of hatchlings.

5.1.3 *Staff and volunteer training*

Each volunteer and patrol leader was trained extensively both in the classroom and in the field in order to ensure competent data collection and ethical behaviour on the beach. Field training consisted of triangulating on the beach once during the day and twice at night. Both patrol leaders and volunteers were tested on the night and day protocols in the classroom and had a triangulation test on the beach. For the classroom tests all patrol leaders and volunteers needed to receive a 95% in order to participate in patrols. Patrol leaders were trained throughout the season, whilst training dates for GVI volunteers staying five or ten weeks were 14 February—19 February, 12 April—16 April, and 17 May—21 May, 12 July—17 July, 16 August—21 August, 11 October—16 October, and 15 November—20 November.

5.1.4 *Daily morning census and nest surveys*

Morning census was conducted each day beginning in February specifically for leatherback season but continued uninterrupted until the end of green season. The date recorded

was that of the night before since data is collected on each and every nest and half moon from the previous night and dates needed to be kept consistent. The daily morning census started at approximately 5:00 to 6:00 and lasted for up to three hours depending on the volume of data to collect. The survey involved walking the beach between mile 0 and 3 1/8, recording and monitoring tracks and nests from the two nights before.

The morning team identified tracks as full tracks (turtle nested), half moons (non-nesting emergences), or a lifted turtle (no tracks going back into the sea). The vertical position of the nest on the beach was identified either as Open (O – area of beach which receives 100% sunlight), Border (B - area where nest is partially shaded by vegetation) or Vegetation (V - area where nest is constantly shaded by vegetation). Nests were then identified as natural (if it remained in its original state until hatchling emergence or excavation), poached (when egg shells or a cavity were found), eroded or predated by an animal. It was marked as unknown if the nest had signs of poaching such as flies, stick holes, and human and/or dog prints, and it was believed that the nest was poached but no egg shells or cavity were seen.

5.1.5 Night patrols

Night patrols began 8 March specific for leatherback season but continued uninterrupted through green season until 26 October. Each night a minimum of one survey team walked the beach between mile 0 and 3 1/8 for a minimum of four hours per patrol. Nights when only one team was on the beach, they patrolled around 21:30 to 01:30 since these are the hours of greater emergence. When two teams were scheduled, the first team surveyed the beach from approximately 20:00 to 00:00 whilst the second team patrolled from 23:00 to 03:00.

When a turtle track was found, the patrol leader determined whether or not the turtle was still on the beach. If the turtle was not on the beach, the patrol leader determined if the track was a half moon, nest, or lifted turtle. If it was deemed a half moon, the species, coordinate using a handheld Geographical Positioning System (GPS), closest northern mile-marker, and the time track was seen were recorded. If the encountered track led to a nest the species, GPS coordinate, closest northern mile-marker, time the track was seen, vertical position, and nest status were recorded. If a lifted turtle was encountered, the species, GPS coordinate, closest northern mile-marker, time the track was seen and

vertical position (if it had nested), were recorded along with any additional information available that may help to determine the event circumstances.

All efforts were made not to disturb the turtle before oviposition. Patrol members who were to come in contact with the turtle put on gloves. Once the egg-laying process had started, the eggs were counted (yolkless and fertile counted separately) and triangulation of the nest was completed. When the turtle completed oviposition and began to cover her egg chamber, she was then checked for tags, old tag notches (OTNs), old tag holes (OTHs), and tagged if necessary. Green, hawksbill, and loggerhead turtles were tagged in the thin membrane between the front flippers and the body just before the primary scale using Iconel #681 tags (National Band & Tag Co., Newport, USA).

Once tagging was complete, the CCLmin and CCWmax were measured to the nearest millimetre, three times each. If the measurements were not within 3mm of each other, it was taken again until the data was consistent. For green, hawksbill, and loggerhead turtles, CCLmin was measured from the nuchal scute where the skin touches the carapace, along the centre of the carapace until the notch at the posterior end. The CCWmax was measured along the widest part of the carapace.

Once tagging and measuring were completed, the turtle was checked for external physical signs of health. Abnormalities such as missing parts, scars, fibropapillomas tumors and other irregularities were recorded.

The GPS coordinate, closest northern mile-marker, phase the turtle was found in (1-emerging from the sea, 2-selecting nest site, 3-digging body pit, 4-digging egg chamber, 5-oviposition, 6-covering egg chamber, 7-camouflaging, 8-returning to the sea), encounter time, direction whilst nesting, and vertical position were also recorded.

5.1.6 Nest fate, nest survivorship and hatching success

Nests were triangulated during oviposition whenever possible. During this season, triangulation was attempted for hawksbill turtles even when the egg chamber was not seen in order to gather as much information about the poaching rate and hatchling success as possible. Triangulation was done in order to locate and excavate the nests 70 days after the nest was laid (75 for hawksbills). Triangulation was conducted using

three pieces of flagging tape which featured the date, relative direction from nest (north, centre, south), and the station name. These were attached to large trees, palms or suitable structures behind the nest. The distance from the centre of the egg chamber to each of these tags was measured to the nearest centimetre whilst the turtle was laying eggs. The distance to the most recent high tide line was also recorded. Three tags are used to compensate for the loss of any points of reference: if one tag is lost it is still possible to locate the nest using the other two flagging tapes.

Reverse triangulation was also used during some beach cleans in order to locate the nest so a pathway could be cleared for the hatchlings.

In addition to triangulated nests, all nests found because hatchlings or hatchling tracks were seen on the beach during morning or night surveys were excavated two days after the first hatchling tracks were encountered.

For all excavations, the number of live and dead hatchlings, hatched shells (egg shells accounting for more than 50% of an egg), un-hatched eggs with embryo (stages 1, 2, 3 or 4), un-hatched eggs without embryos and pipped eggs were recorded. Any egg or hatchling that was predated by larvae, bacteria or fungi, ants, crabs or other animals were counted and recorded.

For all nests accurately marked and measured, the nest's fate was determined. Nests which were not marked or unable to be excavated were excluded from the analysis. The following nest fate categories were applied: natural, poached, partially poached, predated, eroded and unknown. Empty egg chambers were classified as poached nests. If there was any doubt about the fate of a nest it was categorized as unknown.

During all excavations, the distance from the top of the sand to the top of the eggs (egg depth) as well as the top of the sand to the bottom of the egg chamber (nest depth) was measured.

5.1.7 Disguising nests

For all hawksbill nests, a considerable effort was put into disguising the nests from poachers. Different strategies were applied in order to make it as difficult as possible to find the egg chamber. Oftentimes the team attempted to make then nest disappear

because the tracks were so small and not very deep. On occasion, green turtle tracks were disguised.

5.1.8 Collection of human impact data

During each night survey, the number of red and white mobile lights, fires, locals and tourists on the beach were recorded. It was noted when there were tour groups of more than ten people on the beach. Each month during the new moon, the number of stationary white and red lights was recorded.

5.1.9 Dead and lifted turtles

For any dead or lifted turtles as much information as possible was recorded and pictures were taken.

6 Results

The data set for this report is restricted to data recorded on green, hawksbill, and loggerhead tracks. The first record of any of these three species was recorded on 26 March when a hawksbill half moon was recorded. Any leatherback activity that occurred during this time was recorded but is summarized in the 2007 Leatherback Season Report.

6.1 Morning track census

Morning track censuses were conducted daily from 26 March to 17 November with the exception of 7-13 November because of a flood at EBCP.

6.1.1 Green turtle temporal distribution

Based on morning census a total of 1834 green turtle tracks were encountered on Playa Norte; 803 nests and 1031 half moons. The first green turtle half moon was recorded on 23 April and the first nest was recorded on 13 May. Green turtle activity reached its peak in September with 334 nests and 426 half moons (Figure 6-1).

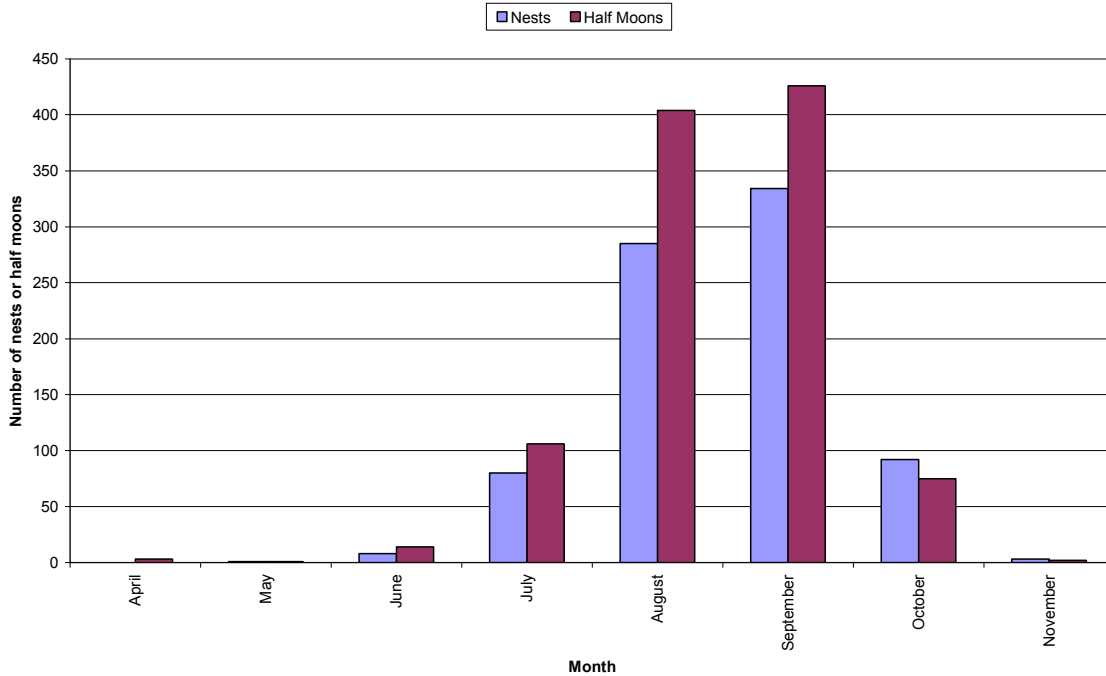


Figure 6-1 Monthly green turtle activity. Playa Norte, Costa Rica.

The peak week for green turtles was that of 2 September to 8 September with 110 nests and 196 half moons. More than 40% of all green nests (n=341) occurred within four weeks between the dates of 12 August and 8 September (Figure 6-2).

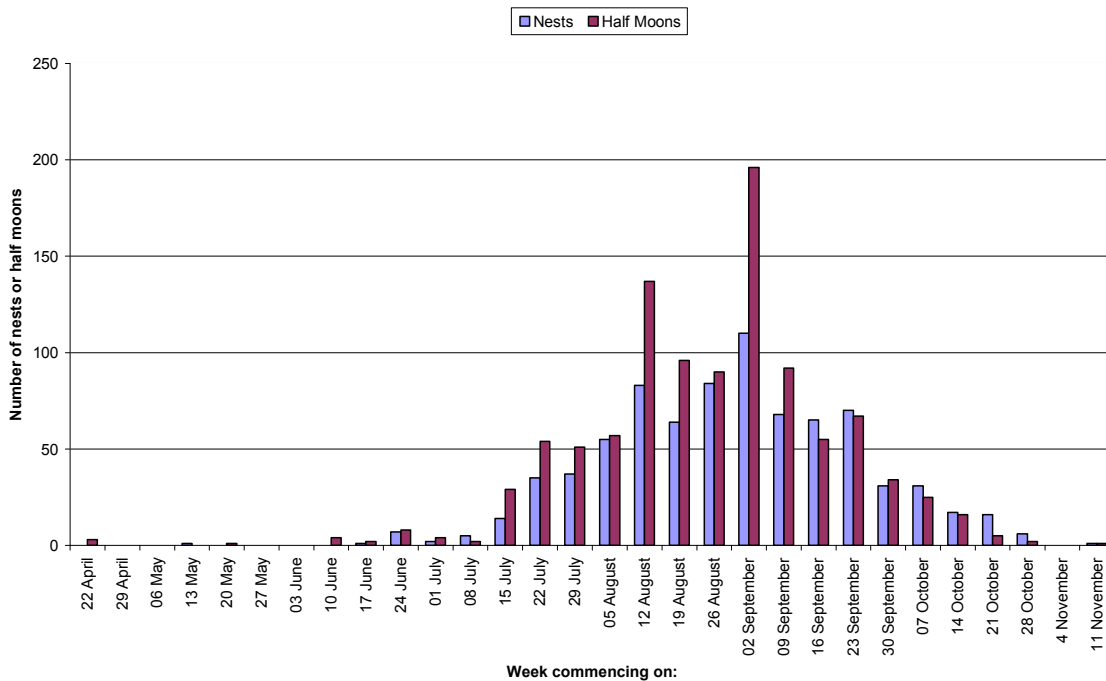


Figure 6-2 Weekly green turtle activity. Playa Norte, Costa Rica.

The top five nights nesting nights were the nights of 6 September with 31 nests, 12 August with 27 nests, 21 August with 24 nests, 4 September with 23 nests, and 30 August with 21 nests. The nests per night is illustrated in Figure 6-3. One nest from 13 May is not shown on the graph. It should be noted that often before a peak night there was one or two days of very low activity.

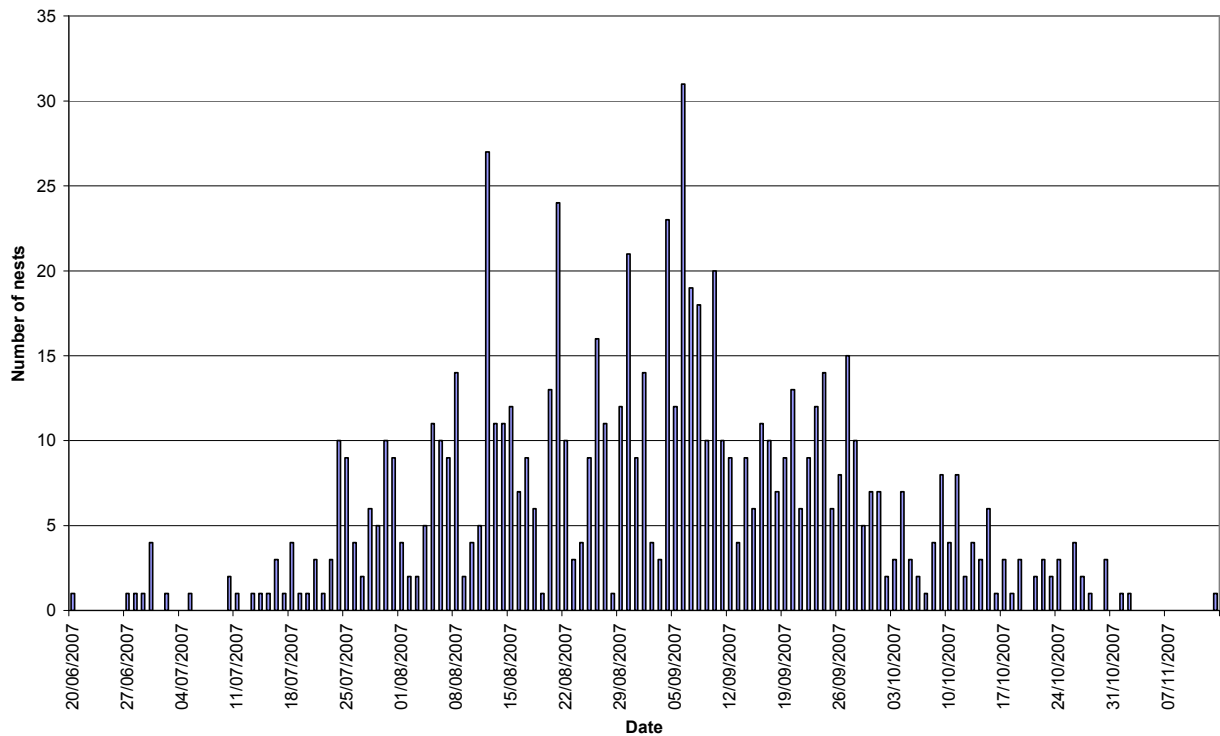


Figure 6-3 Number of green nests per night from June to November. Playa Norte, Costa Rica.

6.1.2 Hawksbill temporal distribution

A total of 32 hawksbill tracks were recorded on Playa Norte; 16 half moons and 16 nests. The first hawksbill half moon was recorded on 26 March and the first nest was recorded on 15 May. The peak month for hawksbill activity was June when six nests and two half-moons were recorded (Figure 6-4). Although hawksbill half moons extended from March to October all nests fell within the four months of May, June, July and August.

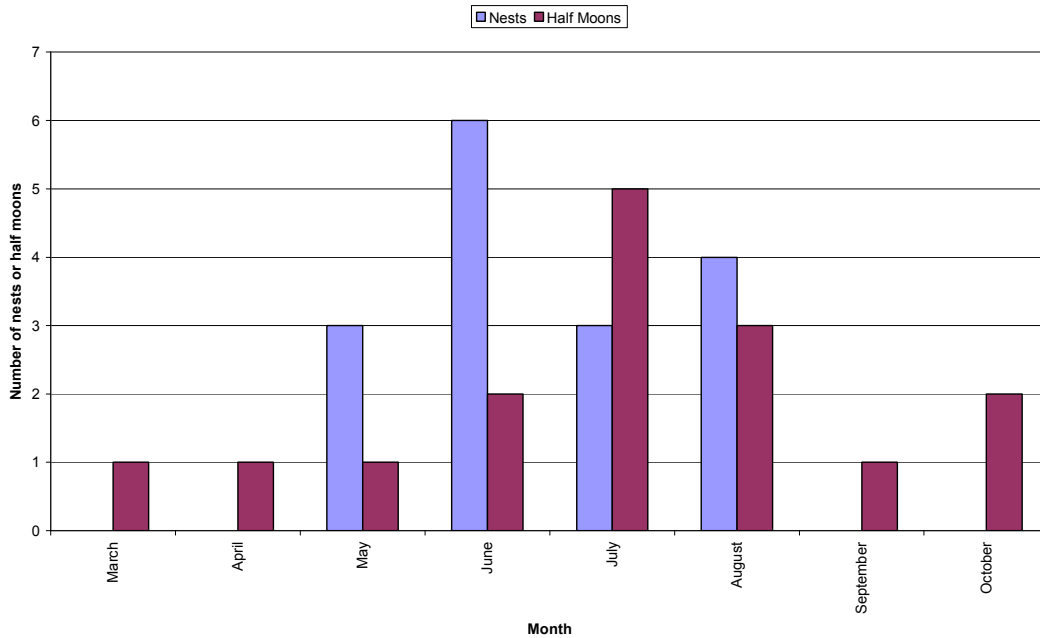


Figure 6-4 Monthly hawksbill turtle activity. Playa Norte, Costa Rica.

The peak nesting week for hawksbills was that of 10 June to 16 June when three nests and one half moon were recorded (Figure 6-5).

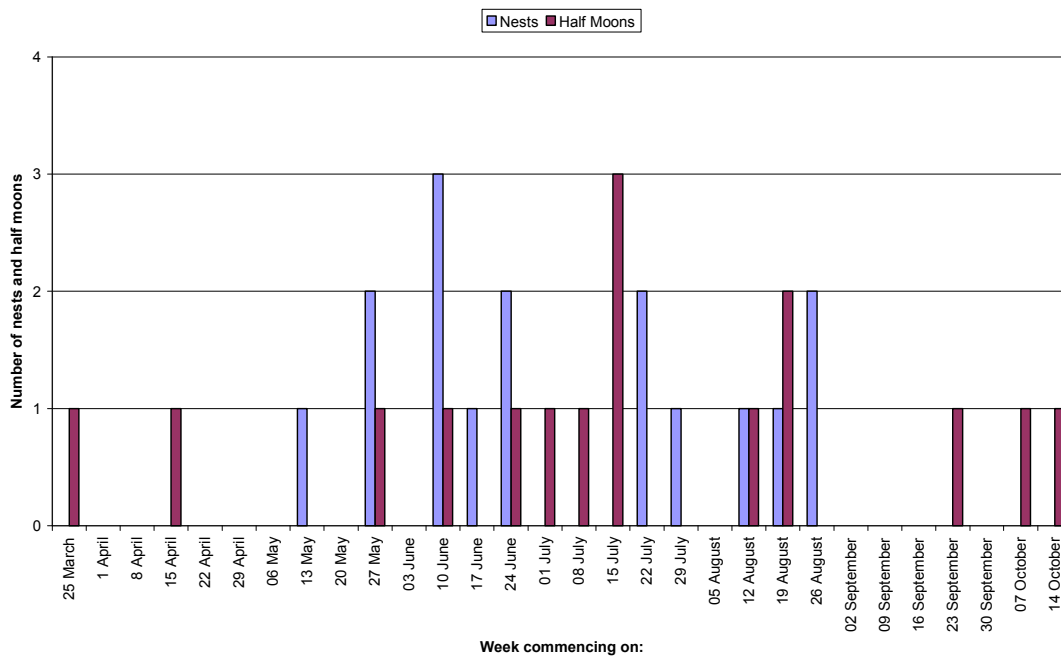


Figure 6-5 Weekly hawksbill turtle activity. Playa Norte, Costa Rica.

6.1.3 Loggerhead turtle temporal distribution

Five loggerhead half moons and no loggerhead nests were recorded on Playa Norte this season. One half moon was recorded on each of the nights of 16 May, 17 August, and 27 August. Two half moons were recorded on the night of 23 October.

6.1.4 Green turtle spatial distribution

The spatial distribution of green turtle nests and half moons is shown in Figure 6-6. The average number of nests per eighth of a mile was 32.12. Eight percent of the beach contained almost 16% of all of the green nests. These locations are the eighth of a mile before mile-markers 7/8 and 1.

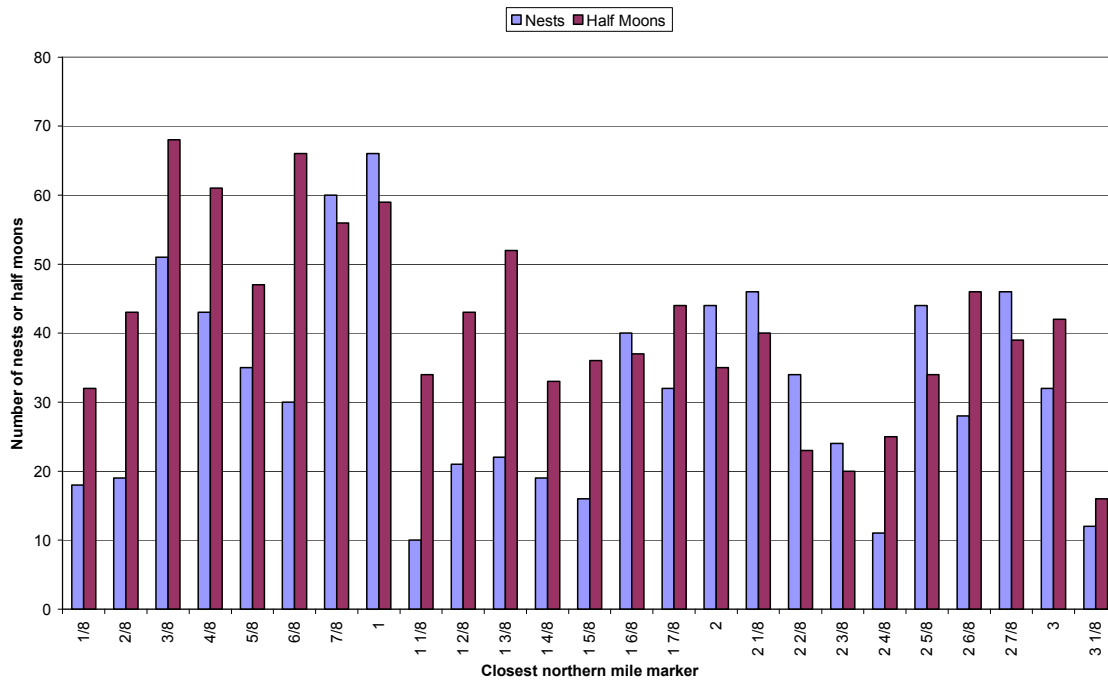


Figure 6-6 Spatial distribution of green turtle nests and half moons from mile 0 to mile 3 1/8. Playa Norte, Costa Rica.

Of the 803 green nests 31.38% were in the open area (n=252), 56.91% in the border (n=457) and 11.71% were found in the vegetation (n=94).

6.1.5 Hawksbill spatial distribution

The area of the beach with the highest hawksbill nest concentration was the eighth of a mile before mile-marker 2 6/8 where three nests were recorded. There was a large gap between mile-markers 1 4/8 and 2 5/8 in which only one hawksbill nest was found (figure 6-7).

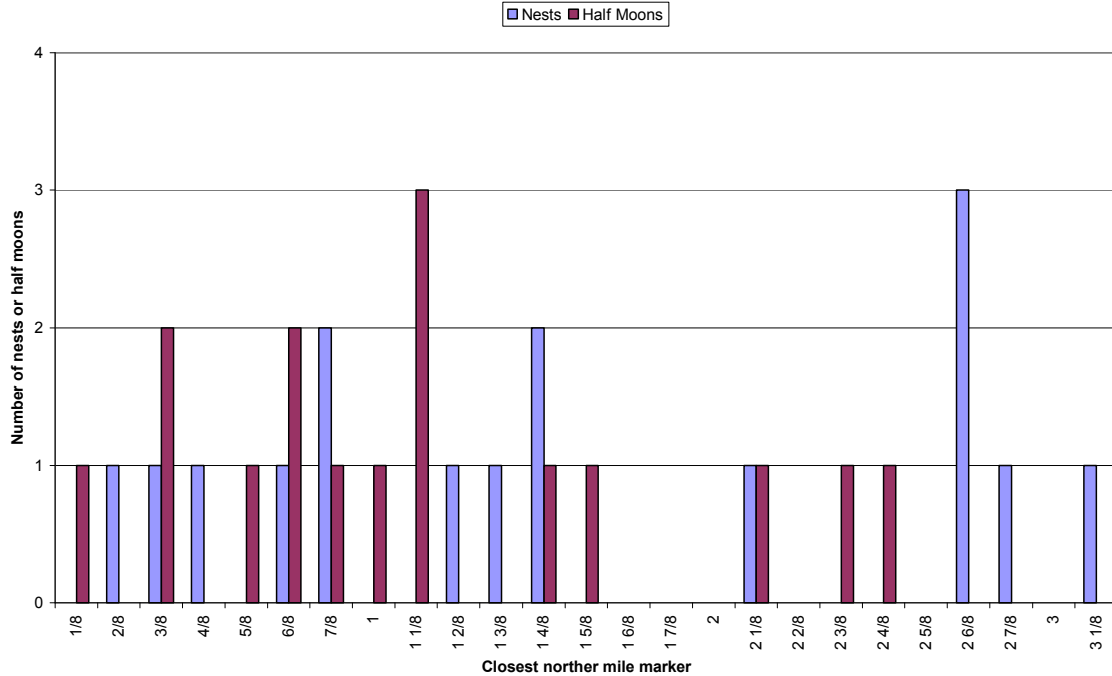


Figure 6-7 Spatial distribution of hawksbill turtle nests and half moons from mile-markers 0 to 3 1/8. Playa Norte, Costa Rica.

Of the 16 hawksbill nests this season 18.75% (n=3) were found in the open, 50.00% (n=8) were found in the border, and 31.25% (n=5) were found in the vegetation.

6.1.6 Green turtle nest status based on morning census

Figure 6-8 shows the green turtle nest status based on morning census. Of the 803 nests recorded during the survey period, 68.74% (n=552) were recorded as natural, 21.79% (n=175) poached, 6.85% (n=55) unknown and 2.62% (n=21) eroded. A total of 16 natural nests were changed to eroded after a flood on 18 November created rivers along the beach washing away many nests. It is possible that up to 29 additional nests were eroded before having the opportunity to hatch.

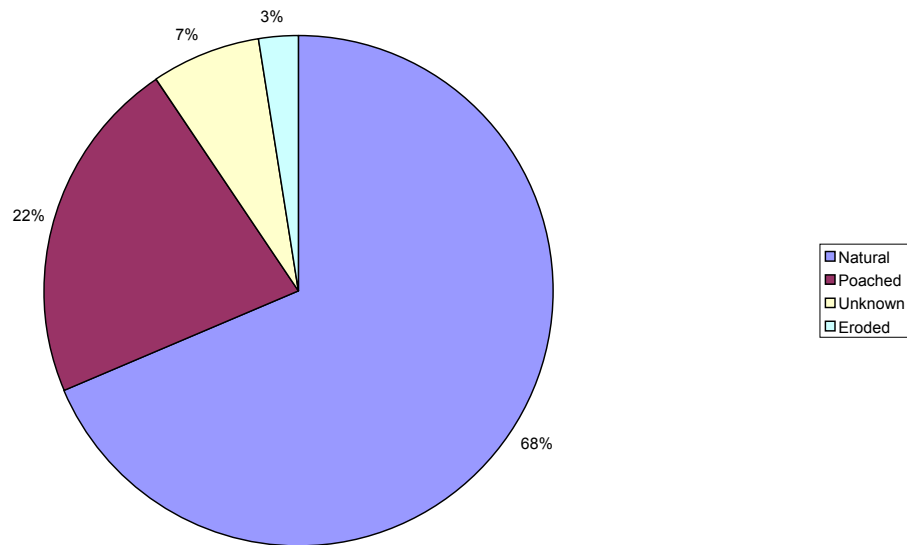


Figure 6-8 Green nest status based on morning census. Playa Norte, Costa Rica.

Figure 6-9 shows the nest status per week. The data is divided into the categories of natural, poached or unknown, and eroded. Nests classified as poached and unknown are added together because nests that are classified as unknown are suspected to have been poached. During the weeks of 24 June, 30 September, 21 October, and 28 October (Figure 6-9) less than 60% of nests laid remained natural.

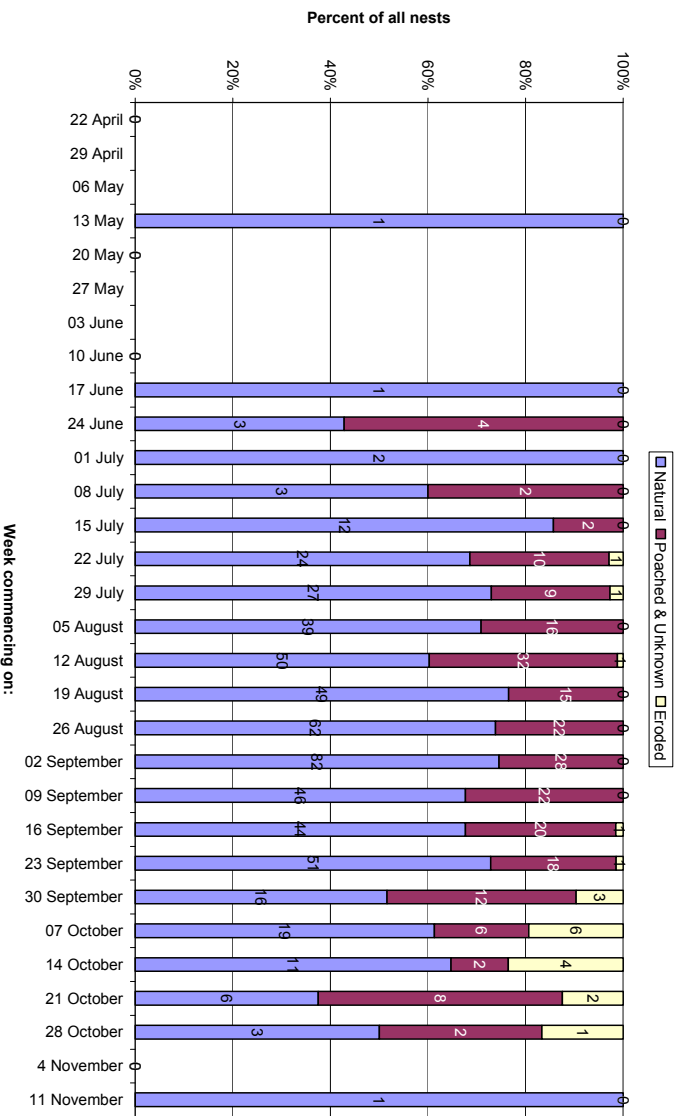


Figure 6-9 Green nest status percents based on morning census per week. Playa Norte, Costa Rica.

Over 45% of all nests that were determined poached or unknown fell within four weeks; the weeks of 12 August, 26 August, 2 September, and 9 September (Figure 6-10).

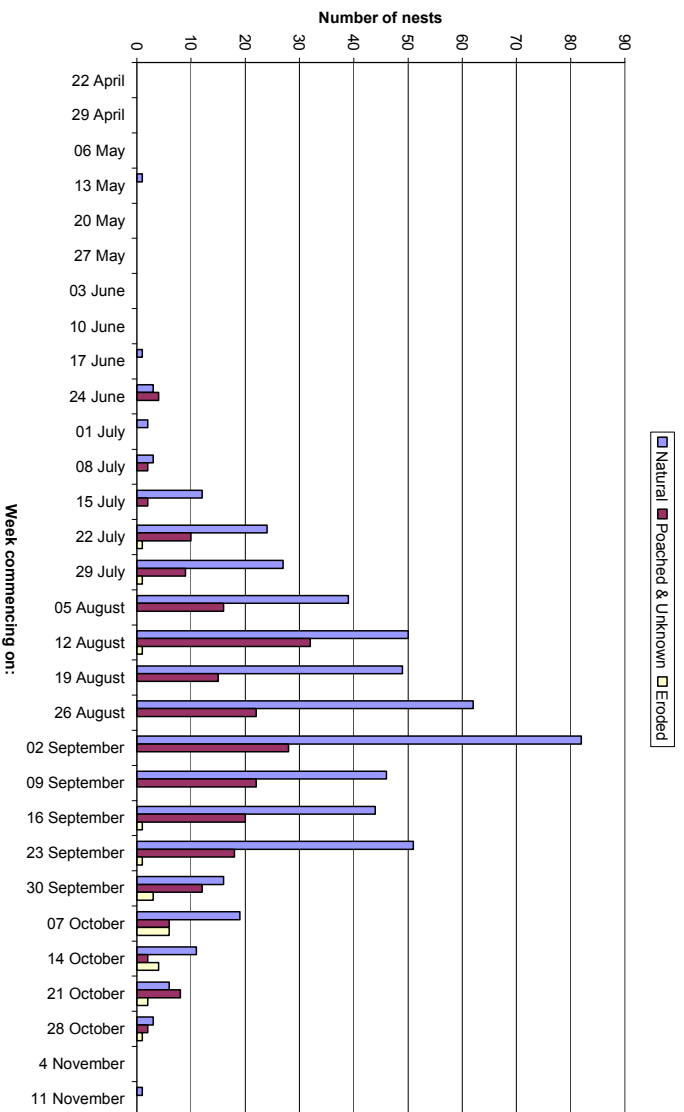


Figure 6-10 Green nest status based on morning census per week. Playa Norte, Costa Rica.

Of the nests laid within the eighth of a mile before mile-markers 2/8, 4/8, 5/8, 6/8, 7/8, 1, and 3 1/8 less than 60% remained natural (Figure 6-11). In addition to these areas, nests were eroded along the beach in various places. More than one eroded nest was recorded within the eighth of a mile before mile-markers 1, 1 7/8, 2 7/8, and 3.

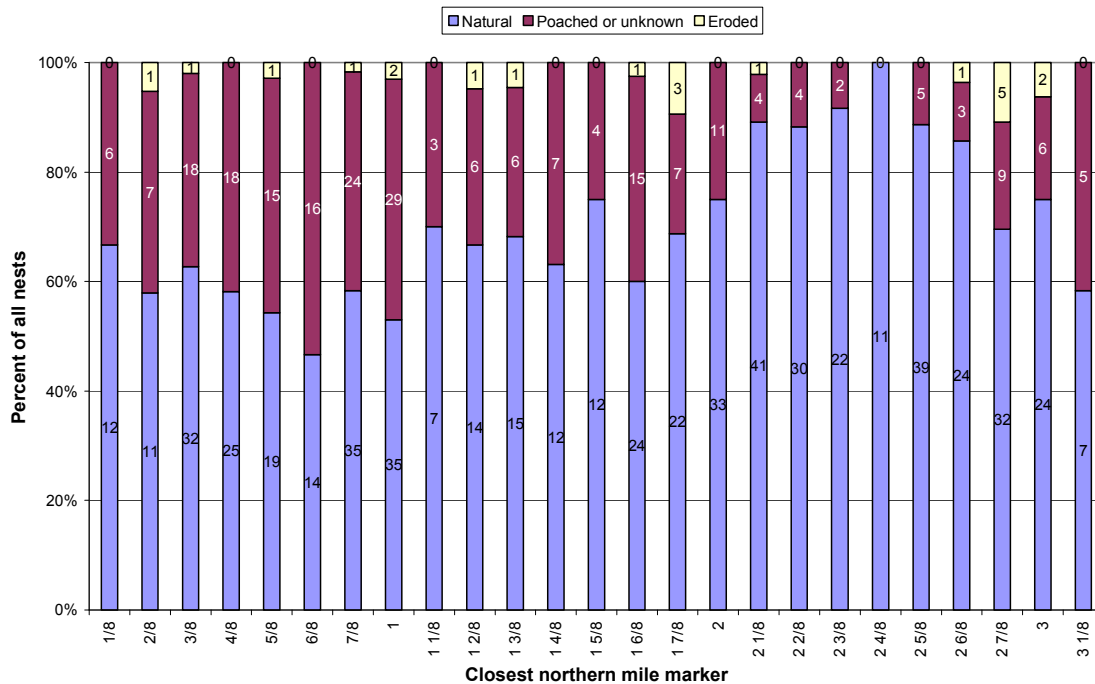


Figure 6-11 Green nest status percents based on morning census from mile 0 to 3 1/8. Playa Norte, Costa Rica.

About 28% of the beach contained over 58% of all of the poached and unknown nests. These high areas of poaching were the eighths of a mile before mile-markers 3/8, 4/8, 5/8, 6/8, 7/8, 1 and 1 6/8 (Figure 6-12). All of these locations are very close to houses but not directly in front of a hotel.

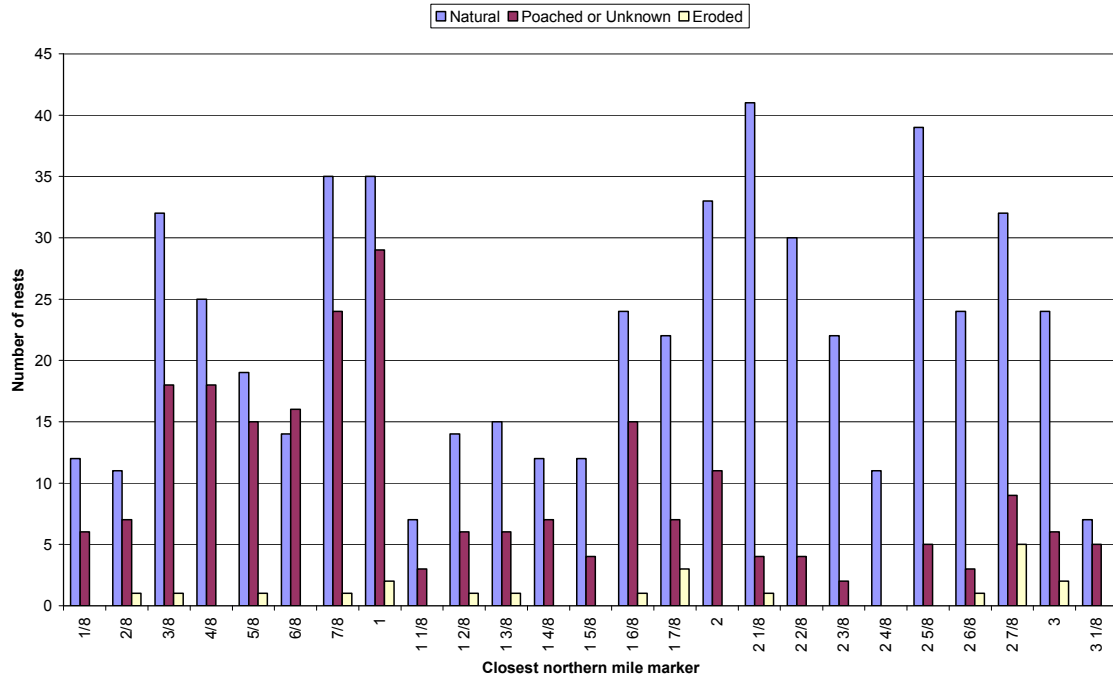


Figure 6-12 Green nest status based on morning census from mile 0 to 3 1/8. Playa Norte, Costa Rica.

More than 35% of all nests laid on Friday or Saturday nights were poached whilst less than 20% of all nests laid on Thursday nights were poached (Figure 6-13).

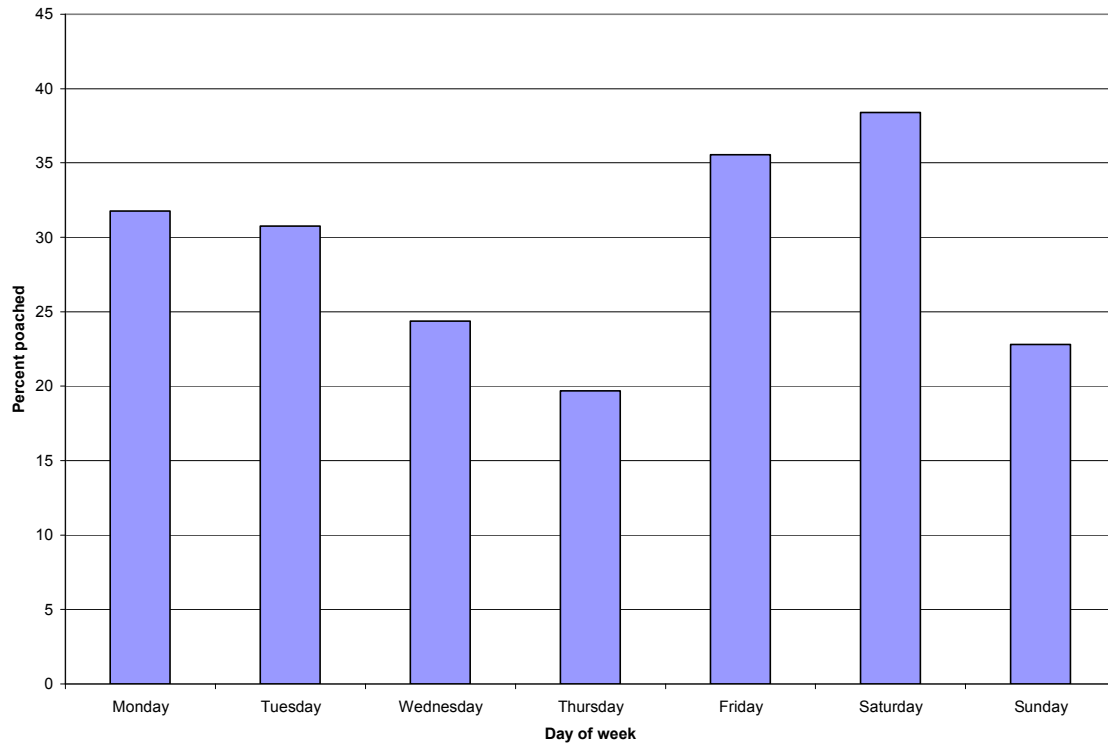


Figure 6-13 Percent of all green turtle nests poached per day of the week. Playa Norte, Costa Rica.

6.1.7 Hawksbill nest status based on morning census

A total of 81.25% of the hawksbill nests were natural (n=13) this season and 18.75% poached (n=3). No nests were classified as unknown or eroded (Figure 6-14).

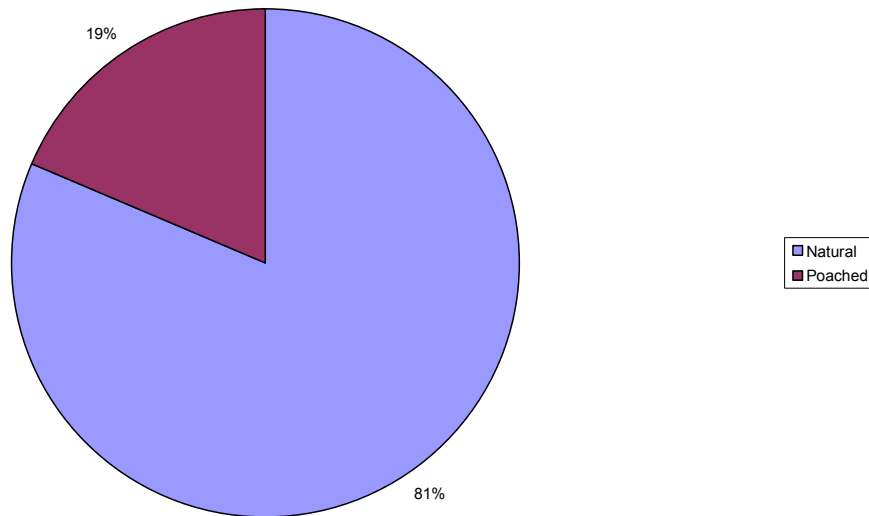


Figure 6-14 Hawksbill turtle nest status based on morning census. Playa Norte, Costa Rica.

6.2 Night Patrol

6.2.1 Encountered green turtles

During the season green turtles were encountered at night 390 times; 261 nested and 129 half mooned. One additional nesting turtle was seen during morning census. Of the 803 nest occurrences this season the nesting turtle was observed 32.63% (n=262) of the time and the track was observed at night 43.09% (n=346) of the time.

The majority of nesting green turtles were encountered before mile 1 (Figure 6-15). This was largely due to the fact patrol teams begin at mile 2/8 and because of the high level of turtle activity did not get the chance to walk farther north.

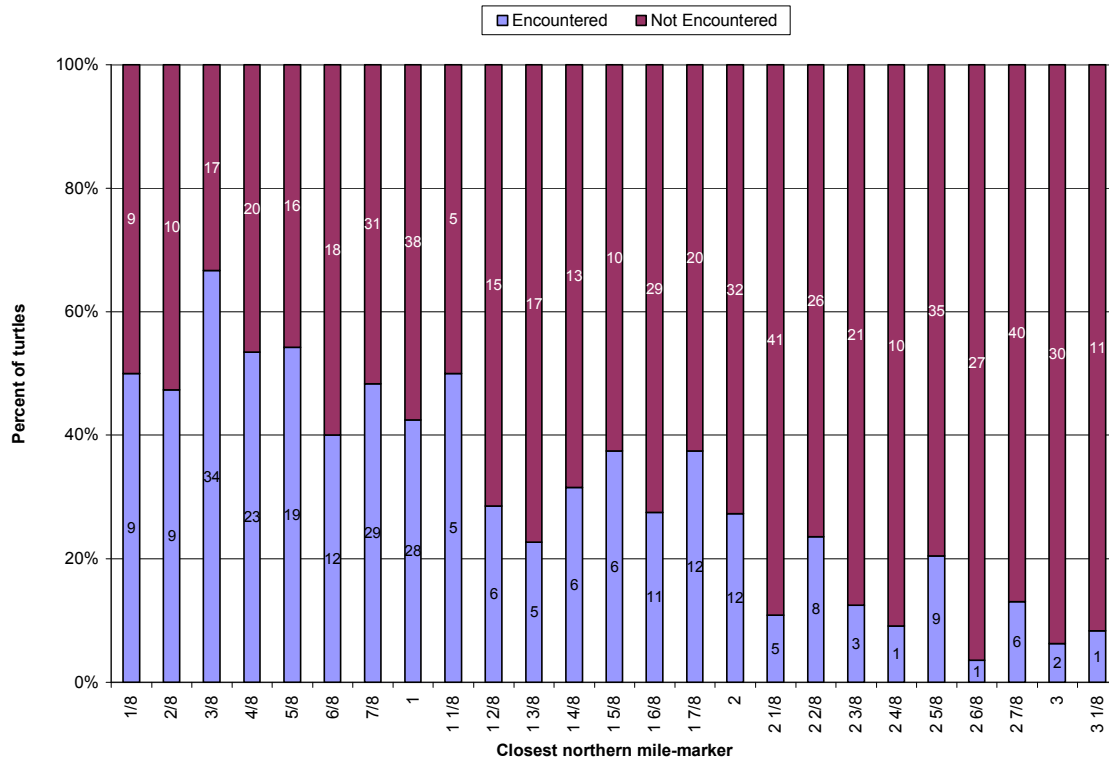


Figure 6-15 Percent of nesting green turtles encountered per eighth of a mile. Playa Norte, Costa Rica.

The peak encounter time for nesting green turtles was between 22:00 and 23:59 when 44.66% of nesting encountered turtles were seen as is shown in Figure 6-16. It should be kept in mind that on nights when two teams were on the beach the time between 23:00 and midnight is the time when there was the most coverage of the study site.

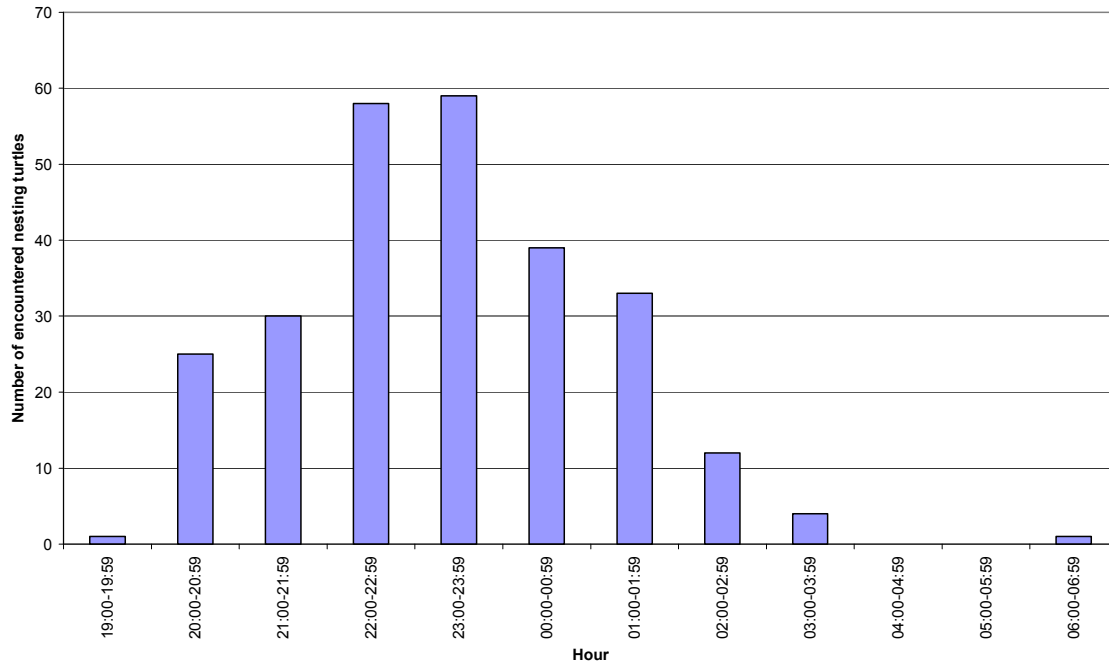


Figure 6-16 Number of encountered nesting green turtles per hour. Playa Norte, Costa Rica.

For the majority of the beach the sea is to the northeast whilst the vegetation is to the southwest. Figure 6-17 illustrates the direction the turtles were facing whilst nesting. The majority of green turtles were found facing West.

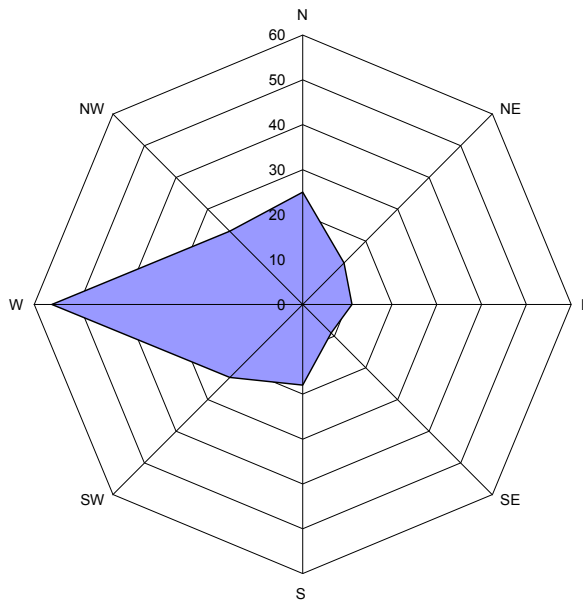


Figure 6-17 Direction facing during oviposition for green turtles. Playa Norte, Costa Rica.

6.2.2 Encountered hawksbills

Hawksbill turtles were encountered at night seven times; six of which nested and one preformed a half moon. Of the 16 hawksbill nest occurrences this year the nesting turtle was observed 37.50% of the time (n=6) and the track was observed at night 87.50% of the time (n=14). All observed nesting hawksbill turtles were seen between the hours of 21:00 and 00:59 (Table 6-1).

Encountered between	Number of nesting turtles
19:00-19:59	0
20:00-20:59	0
21:00-21:59	2
22:00-22:59	1
23:00-23:59	2
00:00-00:59	1
01:00-01:59	0
02:00-02:59	0
03:00-03:59	0
04:00-04:59	0
05:00-05:59	0
06:00-06:59	0

Table 6-1 Nesting hawksbill turtle encounter time. Playa Norte, Costa Rica.

Five hawksbill turtles were encountered either before or during the egg laying process. The directions they were facing during nesting are shown in Table 6-2.

Direction	Number of turtles
N	0
NE	1
E	0
SE	0
S	1
SW	1
W	0
NW	2

Table 6-2 Direction facing during oviposition for hawksbill turtles. Playa Norte, Costa Rica.

No loggerhead turtles were encountered this season.

6.2.3 Green turtle tagging

A total of 106 nesting green turtles were newly tagged this season whilst 92 had been previously tagged. 64 additional nesting green turtles were observed that had no tags and were not tagged. 129 turtles were encountered performing half moons; 24 of which the tags were read and 105 of which either had no tags or the tags were not read. Refer to Table 6-3 for all Caño Palma tags applied to green turtles for the 2007 season and appendix A for a summary of all tagged encountered turtles.

Iconel tags applied in 2007 to green turtles			
CP0256-CP0257	CP0342-CP0346	CP0438	CP0517
CP0259-CP0266	CP0353-CP0373	CP0440	CP0526-CP0527
CP0268	CP0375-CP0378	CP0442	CP0529-CP0531
CP0271	CP0380-CP0392	CP0444	CP0536
CP0275	CP0395-CP0401	CP0446-CP0455	CP0541-CP0542
CP0280	CP0403-CP0405	CP0457-CP0466	CP0544
CP0282-CP0285	CP0408	CP0468-CP0473	CP0553-CP0558
CP0288-CP0299	CP0410	CP0481-CP0484	CP0560-CP0561
CP0301-CP0303	CP0412-CP0418	CP0488	CP0563-CP0570
CP0305-CP0311	CP0420-CP0421	CP0490	CP0572-CP0574
CP0313	CP0423-CP0425	CP0492-CP0493	CP0578-CP0580
CP0315-CP0335	CP0427-CP0430	CP0495-CP0499	CP0582-CP0583
CP0337	CP0432-CP0433	CP0502-CP0504	CP0589-CP0597
CP0339-CP0340	CP0435	CP0506-CP0513	CP0599
			CP0607

Table 6-3 Tag numbers applied to green turtles in 2007. Playa Norte, Costa Rica.

According to the tags recorded none of the green turtles were tagged on Playa Norte in previous seasons.

A total of 27 green turtles re-nested on North Beach, one nesting four times, seven nesting three times and 19 nesting twice.

6.2.4 Hawksbill tagging

Four hawksbill turtles were newly tagged this season. One individual re-nested. Table 6-4 lists all Iconel tags applied to hawksbill turtles in 2007.

Iconel tags applied in 2007 to hawksbill turtles
CP0222
CP0228
CP0230
CP0253-CP0254
CP0272-CP0273
CP0276

Table 6-4 Tag numbers applied to hawksbill turtles in 2007. Playa Norte, Costa Rica.

No hawksbills were previously tagged by another project. Appendix B gives a summary of all encounters of hawksbills in which tags were read or applied.

6.2.5 Green turtle biometric data

A total of 154 green turtles were measured for CCLmin. The mean CCLmin for previously tagged turtles was 105.38 cm (excluding re-emergent turtles), the mean CCLmin for newly tagged turtles with evidence of previous tagging was 104.48 cm, and the mean CCLmin for newly tagged turtles without evidence of previous tagging was 103.82 cm as shown in

Status	N	Mean CCLmin $\bar{x} \pm SD$
Previously tagged turtle	50	105.38 \pm 5.09
Newly tagged turtle with OTN/OTH	16	104.48 \pm 4.41
Newly tagged turtle with no OTN/OTH	88	103.82 \pm 5.07

Table 6-5. The minimum CCLmin was 92.3 cm and the maximum CCLmin was 116.5 cm.

Status	N	Mean CCLmin $x \pm SD$
Previously tagged turtle	50	105.38 \pm 5.09
Newly tagged turtle with OTN/OTH	16	104.48 \pm 4.41
Newly tagged turtle with no OTN/OTH	88	103.82 \pm 5.07

Table 6-5 Green turtle mean CCLmin. Playa Norte, Costa Rica.

The mean CCWmax for previously tagged turtles was 95.31 cm (excluding re-nesting turtles), for newly tagged turtles with evidence of previous tags was 95.57 cm, and for newly tagged turtles with no evidence of previous tagging was 94.11 cm (

Status	N	Mean CCWmax $x \pm SD$
Previously tagged turtle	47	95.31 \pm 5.78
Newly tagged turtle with OTN/OTH	16	95.57 \pm 4.54
Newly tagged turtle with no OTN/OTH	82	94.11 \pm 4.83

Table 6-6).

Status	N	Mean CCWmax $x \pm SD$
Previously tagged turtle	47	95.31 \pm 5.78
Newly tagged turtle with OTN/OTH	16	95.57 \pm 4.54
Newly tagged turtle with no OTN/OTH	82	94.11 \pm 4.83

Table 6-6 Green turtle mean CCWmax. Playa Norte, Costa Rica.

A total of 15 turtles of the re-nesting turtles were measured twice whilst five were measured three times. As shown below in

Number of Encounters	n	CCLmin (cm)	
		$x \pm SD$	Range
2	15	0.99 \pm 0.67	0.00-2.07
3	5	1.55 \pm 0.86	1.00-2.67

Table 6-7 the precision was better for turtles that were encountered only twice than for those that were encountered three times.

Number of Encounters	n	CCLmin (cm)	
		$x \pm SD$	Range
2	15	0.99 \pm 0.67	0.00-2.07
3	5	1.55 \pm 0.86	1.00-2.67

Table 6-7 CCL Precision for re-emergent green turtles. Playa Norte, Costa Rica.

The average number of eggs for previously tagged turtles, newly tagged turtles with evidence of old tagging, and newly tagged turtles with no evidence of tagging were all fairly similar at 104.60, 105.79, and 104.56 respectively (Table 6-8).

Status	N	Mean Fertile Eggs $\bar{x} \pm SD$	Mean Infertile Eggs $\bar{x} \pm SD$
Previously tagged turtle	50	104.60 \pm 28.60	0.38 \pm 1.16
Newly tagged turtle with OTN/OTH	14	105.79 \pm 19.45	1.21 \pm 2.22
Newly tagged turtle with no OTN/OTH	72	104.56 \pm 26.76	0.58 \pm 1.73

Table 6-8 Mean number of fertile and infertile eggs for green turtles. Playa Norte, Costa Rica.

Figure 6-18 shows a positive correlation between clutch size and carapace length of green turtles.

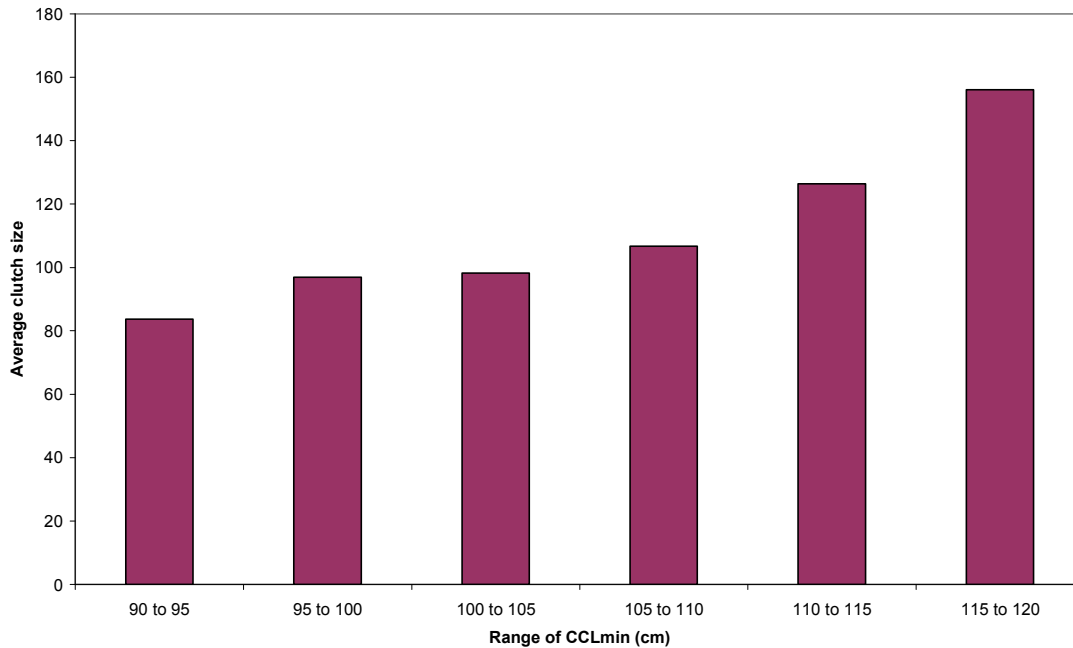


Figure 6-18 Average green turtle clutch size compared to curved carapace length. Playa Norte, Costa Rica.

6.2.6 Hawksbill biometric data

The mean CCLmin for newly tagged hawksbill turtles with no evidence of previous tagging was 86.01 cm. There were no previously tagged turtles (excluding the re-nesters) and no newly tagged turtles with evidence of previous tagging (Table 6-9).

Status	n	Mean CCLmin $\bar{x} \pm SD$
Previously tagged turtle	0	N/A
Newly tagged turtle with OTN/OTH	0	N/A
Newly tagged turtle with no OTN/OTH	4	86.01 \pm 3.94

Table 6-9 Mean CCLmin for hawksbill turtles. Playa Norte, Costa Rica.

The mean CCWmax for newly tagged hawksbill turtles with no evidence of previous tagging was 82.09 cm (Table 6-10).

Status	N	Mean CCWmax $\bar{x} \pm SD$
Previously tagged turtle	0	N/A
Newly tagged turtle with OTN/OTH	0	N/A
Newly tagged turtle with no OTN/OTH	4	82.09 \pm 4.48

Table 6-10 Mean CCWmax for hawksbill turtles. Playa Norte, Costa Rica.

The eggs of four hawksbill turtles were counted. The average number of fertile eggs was 177.50 \pm 24.85 and the average number of infertile eggs was 0.75 \pm 1.50.

For three excavations the eggs were counted during the excavation as well as whilst the turtle was laying. There was an average count difference of 5.33 eggs with a range of 2 to 10 (Table 6-11).

	n	Count difference $\bar{x} \pm SD$	Range
Clutch counted during oviposition and during excavation	3	5.33 \pm 4.16	2.00-10.00

Table 6-11 Mean egg count difference between oviposition and excavation for hawksbill turtles. Playa Norte, Costa Rica.

6.3 Nest fate, nest survivorship and hatchling success

6.3.1 Green nest fate of triangulated nests

A total of 123 green nests were triangulated this season. 29 nests could not be located due to missing triangulation tape or poor triangulation. Of the remaining 94, 50.00% were natural and hatched (n=47), 6.38% were natural and un-hatched (n=6), 34.04% were poached (n=32), 6.38% were partially poached (n=6), 2.13% were predated (n=2), and 1.06% was eroded (n=1) (Figure 6-19). The natural rate increased from 32.08% in 2006 to 56.38% in 2007.

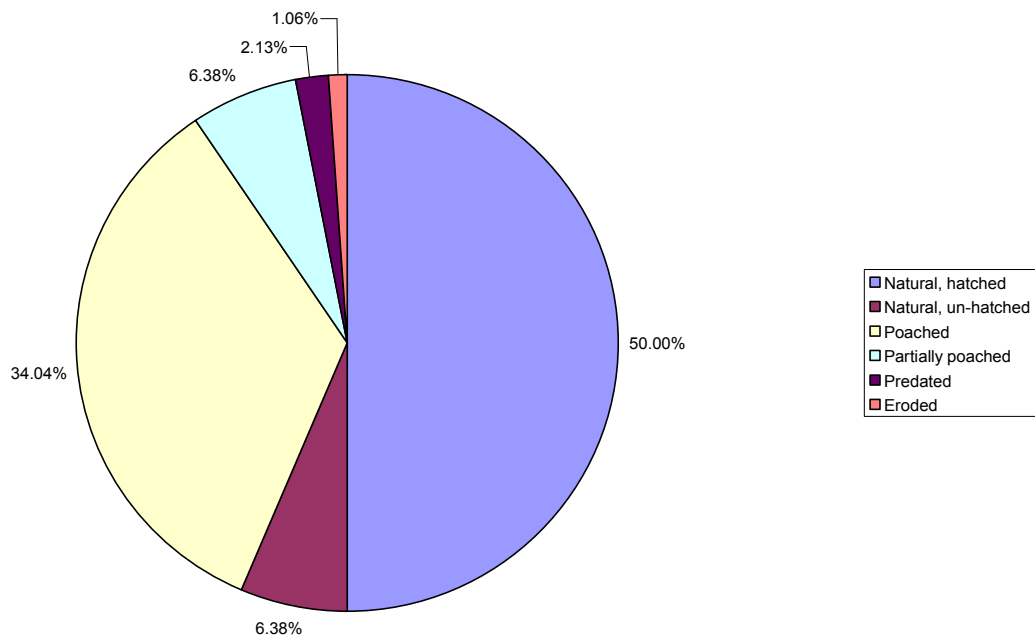


Figure 6-19 Excavation nest status for triangulated green nests. Playa Norte, Costa Rica.

Of the 47 natural nests 46 were able to be located during excavation. One additional nest was known to have hatched because hatchling tracks were seen but the nest was not found during excavation.

The hatching success for the triangulated natural, hatched nests was 83.23% whilst the emerging success was slightly smaller at 80.12% (table 6-12).

Nest fate	n	% of total	% Hatching success	% Emerging success
Natural, hatched	46	48.94	83.23	80.12
Natural, hatched, not found	1	1.06	?	?
Natural, un-hatched	6	6.38	0.00	0.00
Poached	32	34.04	0.00	0.00
Partially poached ¹	6	6.38	0.00	0.00
Predated	2	2.13	0.00	0.00
Eroded	1	1.06	0.00	0.00
Totals	94	100.00	41.98	40.43

Table 6-12 Hatching and emerging success for all green turtle triangulated nests. Playa Norte, Costa Rica.

The overall hatching rate for all 94 nests was 41.93% and the emerging rate was 40.43% (

Nest fate	n	% of total	% Hatching success	% Emerging success
Natural, hatched	46	48.94	83.23	80.12
Natural, hatched, not found	1	1.06	?	?
Natural, un-hatched	6	6.38	0.00	0.00
Poached	32	34.04	0.00	0.00
Partially poached	6	6.38	0.00	0.00
Predated	2	2.13	0.00	0.00
Eroded	1	1.06	0.00	0.00
Totals	94	100.00	41.98	40.43

Table 6-12). These figures were calculated using the estimated 9619.02 total eggs (102.33 x 94). The average number of eggs per nest was estimated using the average number of eggs for all 52 located natural nests which was 102.33. The details of all 94 excavations are shown below in Table 6-13.

¹ Those nests marked partially poached had some of their eggs removed. It is believe that in some of those nests eggs actually hatched. However, when determining hatching and emerging success for partially poached nests it was deemed to be 0% as it is unknown what the total number of eggs is.

Nest fate	n	Live	Dead	Hatched	Unhatched, no Embryo	Stage 1	Stage 2	Stage 3	Stage 4	Pipped	Total Number of Eggs	Mean clutch size
Natural, hatched	46	107	42	3999	456	73	124	77	74	2	4805	104.46
Natural, hatched, not found	1	?	?	?	?	?	?	?	?	?	?	N/A
Natural, un-hatched	6	0	0	0	108	1	93	191	108	10	516	86.00
Poached	32	0	0	0	0	0	0	0	0	0	?	N/A
Partially poached	6	0	0	39	46	2	2	4	22	0	?	N/A
Predated	2	?	?	?	?	?	?	?	?	?	?	N/A
Eroded	1	?	?	?	?	?	?	?	?	?	?	N/A
Totals	94	107	42	4038	610	76	219	272	204	12	5321	N/A

Table 6-13 Summary of green turtle excavations for all triangulated nests. Playa Norte, Costa Rica.

6.3.2 Hawksbill nest fate for triangulated nests

Five hawksbill nests were triangulated this season and all five were located. Four were found to be natural and hatched and one was deemed poached (Table 6-14). The hatching success for the triangulated natural, hatched nests was 86.49% whilst the emerging success was slightly smaller at 86.18%.

Nest fate	n	% of total	% hatching success	% emerging success
Natural and hatched	4	80.00	86.49	86.18
Poached	1	20.00	0.00	0.00
Totals	5	100	69.19	68.94

Table 6-14 Hatching and emerging success for all hawksbill triangulated nests. Playa Norte, Costa Rica.

The overall hatching rate for all five nests was 69.19% and the emerging rate was 68.94% (Table 6-14). These figures were calculated using the estimated 805 total eggs (161.00 x 5). The average number of poached eggs per nest was estimated using the average number of eggs for all four nests located which was 161.00. The details of all five excavations are shown below in Table 6-15.

Nest fate	n	Live	Dead	Hatched	Un-hatched, no Embryo	Stage 1	Stage 2	Stage 3	Stage 4	Pipped	Total Number of Eggs	Mean clutch size
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Natural, hatched	4	1	1	557	40	3	3	2	39	0	644	161.00
Poached	1	0	0	0	0	0	0	0	0	0	?	?
Total	5	1	1	557	40	3	3	2	39	0	644	N/A

Table 6-15 Summary of excavations for all hawksbill triangulated nests. Playa Norte, Costa Rica.

6.3.3 Green turtle summary of all hatched nest excavations

A total of 137 green nests were determined natural, hatched and were able to be located during excavation. Some were located due to triangulation and some were found because hatchling tracks were seen. The hatching rate for all 137 nests was 86.54% and the emerging rate was 84.54%.

From all 137 hatched nest excavations 12,951 eggs were found to have hatched out of 14,966 total fertile eggs. The mean number of eggs per nest was 109.24 (Table 6-16).

	n	Alive Hatchlings	Dead Hatchlings	Number of eggs hatched	Unhatched, no embryo	Stage 1	Stage 2	Stage 3	Stage 4	Pipped	Total fertile eggs	Total yolkless eggs
Total	137	145	154	12951	1315	150	252	172	127	25	14966	37
Mean	N/A	1.06	1.12	94.53	9.60	1.09	1.84	1.26	0.93	0.18	109.24	0.27

Table 6-16 Summary of the hatched nest green excavations. Playa Norte, Costa Rica.

The average egg depth for hatched nests was 47.78 cm and for un-hatched nests was 56.17 cm. The average nest depth for hatched nests was 62.31 cm and for un-hatched was 69.75 cm (Table 6-17).

	Egg Depth (cm)		Nest Depth (cm)	
	n	x ± SD	n	x ± SD
Hatched	135	47.78 ± 13.71	135	62.31 ± 12.97
Un-hatched	6	56.17 ± 10.44	6	69.75 ± 5.49

Table 6-17 Mean egg and nest depth for green excavations; hatched and un-hatched. Playa Norte, Costa Rica.

A total of 9.27% of all fertile eggs showed evidence of predation for hatched nests whilst 49.42% showed evidence of predation for un-hatched nests (

	n	Ants	Larvae	Bacteria/ Fungi	Crabs	Unknown	Total predation	No signs of predation	Total
Hatched	137	0.78	1.03	6.15	0.12	1.19	9.27	90.73	100.00
Un-hatched	6	7.56	12.40	22.29	7.17	0.00	49.42	50.58	100.00

Table 6-18).

	n	Ants	Larvae	Bacteria/ Fungi	Crabs	Unknown	Total predation	No signs of predation	Total
Hatched	137	0.78	1.03	6.15	0.12	1.19	9.27	90.73	100.00
Un-hatched	6	7.56	12.40	22.29	7.17	0.00	49.42	50.58	100.00

Table 6-18 Percent of all eggs predated from green turtle excavations. Playa Norte, Costa Rica.

A total of 142 sets of hatchling tracks were seen this year as opposed to 13 sets of hatchling tracks seen in 2006. The mean incubation time for 88 sets of hatchling tracks was 54.07 days with a minimum incubation time of 44 days and a maximum of 64 days.

6.3.4 Hawksbill summary of all hatched nest excavations

Seven hawksbill excavations proved to be natural and hatched. Some nests were located due to triangulation and some were found because hatchling tracks were seen. The hatching rate for all seven excavations was 82.18% whilst the emerging rate was 82.00%.

A total of 936 eggs hatched out of 1139 fertile eggs. A summary of the seven excavations is found below in Table 6-19.

Nest	Alive hatchlings	Dead hatchlings	Number of eggs hatched	Unhatched egg, No embryo	Stage 1	Stage 2	Stage 3	Stage 4	Pipped	Total fertile eggs	Total yolkless eggs
1	1	0	185	6	1	2	0	2	0	196	0
2	0	0	181	3	0	0	0	0	0	184	0
3	0	1	169	3	0	0	1	2	0	175	0
4	0	0	131	8	0	1	0	0	0	140	0
5	0	0	128	6	3	1	0	3	0	141	0
6	0	0	72	23	2	0	1	35	0	133	0

7	0	0	70	74	19	2	2	3	0	170	0
Total	1	1	936	123	25	6	4	45	0	1139	0
Mean	0.14	0.14	133.71	17.57	3.57	0.86	0.57	6.43	0.00	162.71	0.00

Table 6-19 Summary of the hatched nest hawksbill excavations. Playa Norte, Costa Rica.

The mean egg depth for all seven hatched hawksbill excavations was 29.43 cm and the mean nest depth was 48.69 cm (Table 6-20).

	Egg Depth (cm)		Nest Depth (cm)	
	n	$\bar{x} \pm S.D.$	n	$\bar{x} \pm S.D.$
Hatched	7	29.43 \pm 8.48	7	48.69 \pm 6.68
Un-hatched	0	N/A	0	N/A

Table 6-20 Mean egg and nest depth hawksbill excavations. Playa Norte, Costa Rica.

At total of 12.29% of all fertile eggs showed evidence of predation for hatched nests (Table 6-21).

	n	Ants	Larvae	Bacteria/ Fungi	Crabs	Unknown	Total predation	No signs of predation	Total
Hatched	7	0.09	5.44	4.21	0.00	2.55	12.29	87.71	100.00
Un-hatched	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 6-21 Percent of all eggs predated from hawksbill turtle excavations. Playa Norte, Costa Rica.

Four sets of hawksbill hatchling tracks were seen this season whilst no sets of hawksbill hatchling tracks were seen in 2006. The mean incubation time for all four nests was 67.25 days with a minimum incubation time of 57 days and a maximum of 77 days.

6.4 Human impact data

Table 6-22 shows the mean number of mobile red lights, mobile white lights, locals, tourists, and fires on the beach per walk for nights when there were two walks. Although times did vary usually the PM one team walked from about 20:00 to 00:00 and the PM two team walked from about 23:00 to 3:00.

	Mobile red lights $\bar{x} \pm SD$	Mobile white lights $\bar{x} \pm SD$	Locals $\bar{x} \pm SD$	Tourists $\bar{x} \pm SD$	Fires $\bar{x} \pm SD$
PM one team	1.87 ± 2.24	2.74 ± 2.26	2.87 ± 3.17	9.15 ± 13.17	0.11 ± 0.35
PM two team	0.71 ± 1.10	1.85 ± 1.87	1.84 ± 2.31	2.19 ± 5.08	0.04 ± 0.19

Table 6-22 Human impact data for nights with two teams on North Beach from 01 May to 26 October. Playa Norte, Costa Rica.

Figure 6-20 and Figure 6-21 show the mean number of mobile red lights, mobile white lights, locals, tourists, and fires per month. The months from May to October are shown as those are the months that include green and/or hawksbill nests. Based on the PM one data, the peak month for tourist activity was July and the peak month for local activity was August (Figure 6-20).

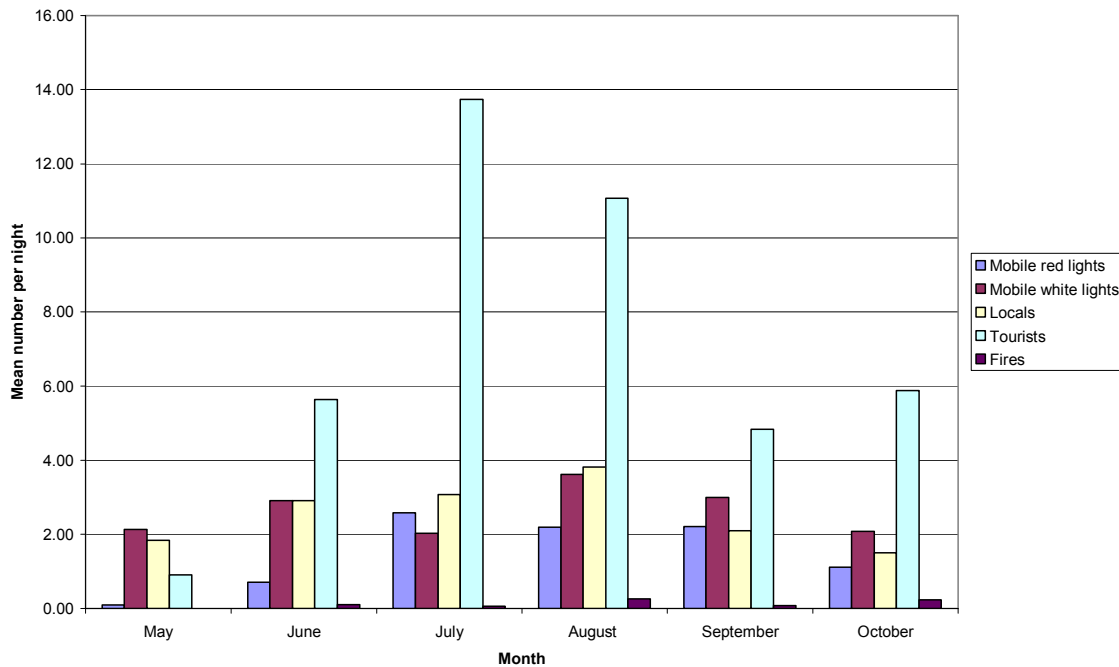


Figure 6-20 Human impact data by month for PM one team. Playa Norte, Costa Rica.

The graph for PM two does not include data from October as only one PM two walk was conducted during that month. Like the PM one graph the PM two graph shows a peak for tourist activity in July. Unlike the PM one graph the PM two graph shows a peak for local activity in September as opposed to August (Figure 6-21).

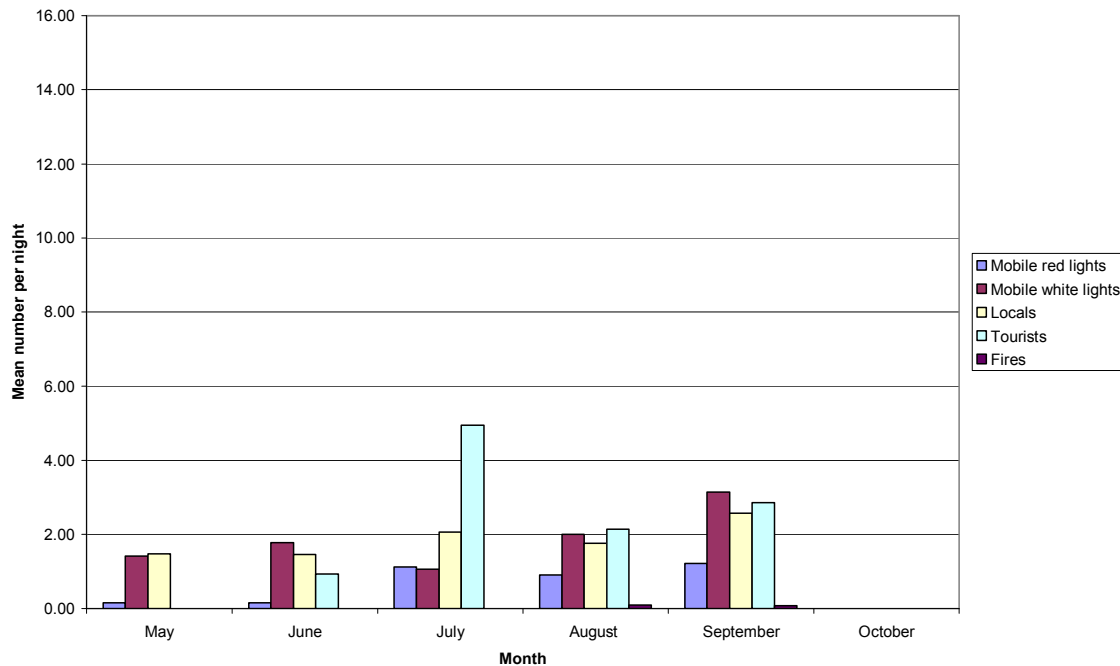


Figure 6-21 Human impact data by month for PM two team. Playa Norte, Costa Rica.

Figure 6-22 shows evidence of local presence on the beach by day of the week based on PM one data from March to October. Saturday had the highest mean number of locals and mobile white lights per night whilst Tuesday had the lowest.

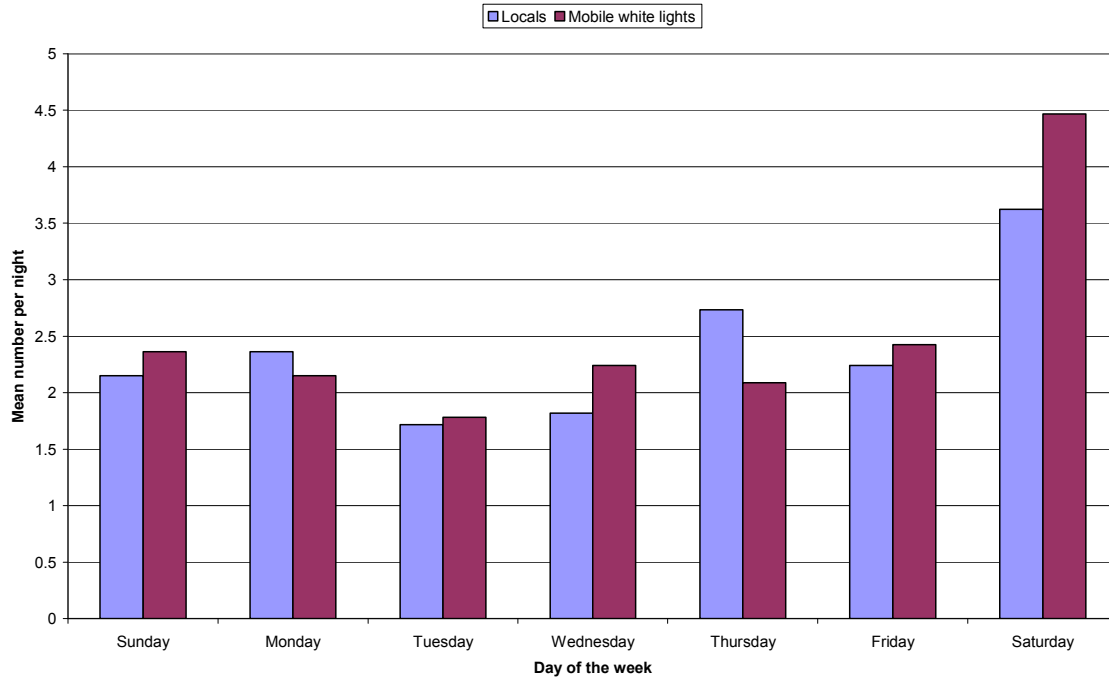


Figure 6-22 Evidence of local presence per day of week based on PM one data. Playa Norte, Costa Rica.

Stationary red and white lights were recorded each new moon when possible or within a few days of it. Over the season many white lights were changed to red at the local hotels and at a couple of the houses at the request of the station. The number of lights is shown below in Figure 6-23.

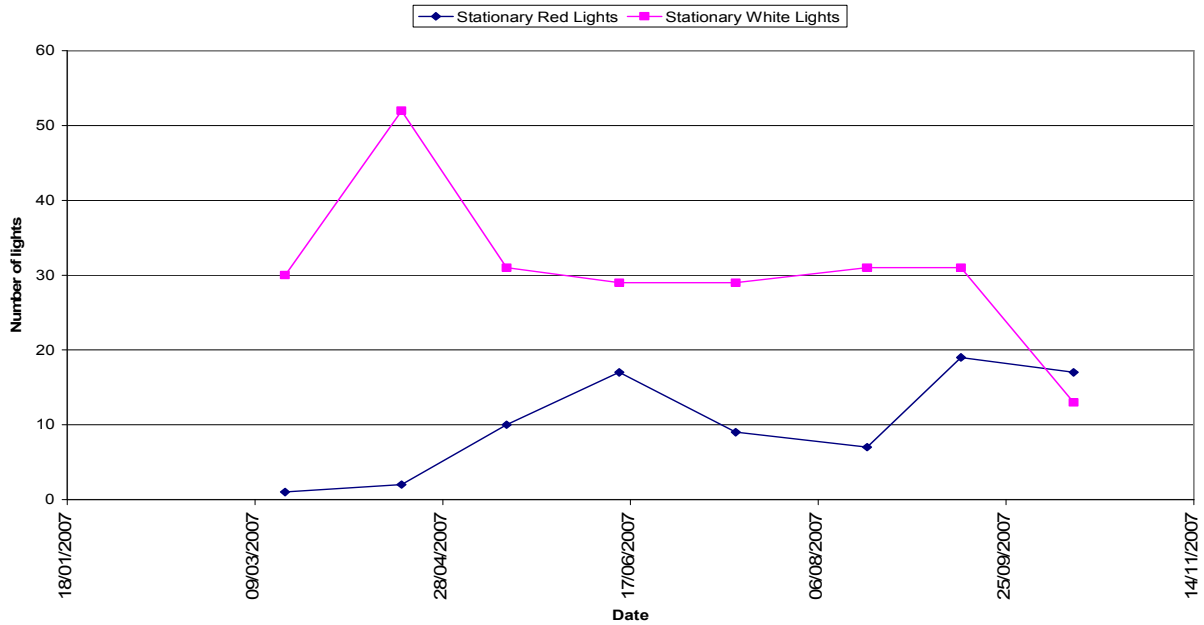


Figure 6-23 Stationary lights recorded per month. Playa Norte, Costa Rica.

6.5 Dead and lifted turtles

Three dead turtles and three lifted turtles were recorded this season (Table 6-23). One additional turtle that was tagged by Caño Palma on 20 June was killed on the Tortuguero beach on 2 July by poachers (reported by the CCC).

Date	Dead or Lifted	Species	Sex	Mile	Cause of death	Comments
1-Jul-07	Dead	Cm	M	2 6/8	Unknown	Turtle appeared to have washed up
1-Aug-07	Lifted	Cm	F	1 7/8	Presumably taken and killed by poachers	Clear up track found with no down track
27-Aug-07	Dead	Cm	F	6/8	Killed by poachers	Turtle was in surf found still alive with sliced throat
7-Sep-07	Lifted	Cm	F	1 1/8	Possibly taken and killed by poachers	Up track found with no down track. Track looked strange, possibly fake.
11-Sep-07	Dead	Cm	?	1 1/8	Killed by poachers	Fresh turtle head found on beach
24-Sep-07	Lifted	Cm	F	2 6/8	Presumably taken and killed by poachers	Clear up track found with no down track

Table 6-23 Dead and lifted turtles found during 2007 season. Playa Norte, Costa Rica.

7 Discussion

7.1 Daily morning census

7.1.1 Green turtle activity

The number of nests this season (n=803) was more than twice the number last season (n=347). Many more years of data collection will be necessary in order to determine an increase or decrease in the number of green turtles using the beach.

7.1.2 Hawksbill turtle activity

Hawksbill activity was encouraging this season with an average of over five nests per mile. The level of hawksbill activity on Playa Norte is proving to be very interesting and further study of the population is important.

7.1.3 Green turtle spatial distribution

The areas of the beach with the lowest number of nests were the eighth of a mile before mile-markers 1 1/8, 2 4/8, and 3 1/8. The number could be low at 1 1/8 because that stretch of beach is very narrow compared to the rest of Playa Norte. Mile 2 4/8 is directly in front of Turtle Beach Lodge, which consistently has a high amount of human activity and stationary lights (both red and white). Mile 3 1/8 is in front of Laguna Cuatro and thus could deter many turtles from nesting.

The areas of highest nesting activity were the eighth of a mile before mile-markers 7/8 and 1. There are houses in these areas that keep the beach relatively clean. The beach in these areas is typically rather wide.

7.1.4 Hawksbill turtle spatial distribution

Hawksbill nesting activity was recorded from mile-markers 2/8 to 3 1/8 with large gap between 1 5/8 and 2 5/8 in which only one nest was recorded.

7.1.5 Green turtle nest status based on morning census

This season each nest was monitored for two days. In many instances nests were recorded as natural on the first day but then recorded as poached on the second. This method of monitoring nests for two days gives a better indication of the true poaching

rate on Playa Norte compared to previous seasons when the nests were monitored for only one day.

This season new criteria were used for determining nest status. Now a minimum and maximum poaching rate is able to be calculated. The status 'poached' will be used to calculate the minimum poaching rate and the statuses 'poached' and 'unknown' will be added together to calculate the maximum poaching rate. Also, with the new criteria there is less room for subjectivity when it comes to determining nest status. It should be noted that it is possible that nests classified as unknown this season could have been classified as poached last season. This should be kept in mind when comparing data from past seasons.

This season the natural rate was 68.74% compared to last season 47.71%. This season's poaching rate was between 21.79% and 28.64%. Last season the poaching rate was determined to be 51.96%. A higher natural rate is promising especially since the night work has only been conducted for two years. It should be kept in mind, however, that this season showed over twice the number of nests than last season and the actual number of nests poached this season was more than last season. More coverage on the beach by patrol teams and a higher presence on the beach by police on strategic nights could contribute to lowering the poaching rate for next season. It is also a concern that the number of houses along the beach is increasing which could cause an increase in the poaching if the beach is not managed.

7.1.6 Hawksbill turtle nest status based on morning census

Hawksbill natural rate this season was 81.25% compared to 9.09% in 2005. This may be due to the fact that there was an increase in the presence on the beach this season and a large effort put in to disguising the nests. The programme does have a licence to relocate hawksbill nests, however, this should be used cautiously. If the natural rate continues to be high then more emphasis should be put into disguising nests rather than relocating them from high poaching areas.

7.2 Night patrol

7.2.1 *Encountered green turtles*

This season 261 nesting green turtles were encountered out of 803. The majority of those turtles were encountered south of mile 1. It would be beneficial to increase the number of teams so patrols could get further up the beach. During peak times patrol teams could be dropped off at Laguna Cuatro or Turtle Beach Lodge in order to patrol the northern section of the beach.

More turtles nest facing toward the vegetation than towards the ocean. This arguable preference may be a sign of turtles avoiding the most lighted area of the horizon and preferring the darker vegetation line (Chacón-Chaverri, 2007 pers comm).

7.2.2 *Encountered hawksbills*

It is important to note that 87.50% of all hawksbill tracks were seen at night as opposed to in the morning. The sooner hawksbill tracks can be located the sooner they can be disguised from poachers. This is likely one of the reasons for the low poaching rate for hawksbill nests in 2007.

7.2.3 *Green turtle tagging*

This season 106 green turtles were newly tagged season. This number could have been increased with an increase in the number of teams during peak times. Many turtles had been tagged by other projects such as Pacuare and Tortuguero both in Costa Rica. This illustrates the need for widespread turtle conservation as turtles nest on multiple beaches within a season and from year to year.

7.2.4 *Hawksbill turtle tagging*

Four hawksbill turtles were newly tagged this season. On at least two of the occasions the turtle reacted to the tagging leaving her nest without fully disguising. This illustrates the need to be very cautious around hawksbills as they can react to human presence and especially to tagging.

7.2.5 *Green turtle biometric data*

The precision between encounters for measurements of CCLmin were fairly good this season, which illustrates the need to continue to train patrol leaders and volunteers thoroughly. All measurements must continue to be taken in a standard way.

7.2.6 *Hawksbill turtle biometric data*

It will be beneficial to continue to collect biometric data because so few hawksbills nest on Playa Norte and therefore little data has been collected so far.

7.3 Nest fate and hatching success

7.3.1 *Green turtle nest fate for triangulated nests*

The status for excavated nests was divided into many categories this season in order to give a better picture of what is happening to the nests. It is a great concern that 40.42% of the nests were found to be poached or partially poached even with increased presence on the beach. This causes the overall hatching and emerging rates to be low.

There were also many nests that could not be located due to poor triangulation or missing triangulation tape. It is a concern that much of the vegetation on the beach is being cleared and one result is the loss of information on many marked nests. It is also a concern that many nests were not found due to poor triangulation. It is hoped that with more intense training next year, fewer nests will be poorly marked.

7.3.2 *Hawksbill turtle nest fate for triangulated nests*

The results of the triangulated hawksbill excavations showed a natural rate of 80% similar to the morning census nest status natural rate of 81.25%. It is encouraging that for a critically endangered species the natural rate is so high. It is hoped that next season, with a higher beach presence more hawksbills will be encountered during nesting and more nests can be triangulated.

7.3.3 *Green turtle summary of all hatched nest excavations*

It is encouraging that 123 nests could be determined natural and hatched based on triangulated nests and nests found due to hatchling tracks being seen.

It is also encouraging that 142 sets of green hatchling tracks were seen in 2007 compared to only 13 in 2006. There was a greater effort put into locating hatchling tracks this season, a higher number of green nests overall, and higher natural rate all contributing to the higher number of tracks seen.

7.3.4 *Hawksbill turtle summary of all hatched nest excavations*

It was surprising that the mean incubation time for hawksbills were so high at 67.25 days and that the maximum incubation time was 77 days. Because of this it is suggested that all hawksbill excavations occur 80 days after the nesting date.

It is encouraging that four sets of hatchling tracks were seen this season compared to none in 2006.

7.4 Human impact

The amount of human activity has increased over the years and with constant data collection throughout the seasons, this should be easily illustrated in the future. The amount of houses along the beach is on the rise as well as the amount of clearing of the beach vegetation. This could be a problem because the number of lights is increasing along with development on the beach which could interfere with hatchling orientation.

The human impact data collection can have management implications for next season. Since Saturday nights have the highest poaching rate and the highest amount of local activity it would be beneficial to increase presence on those nights.

7.5 Dead and Lifted Turtles

There is evidence that up to six turtles were killed this season by poachers on Playa Norte. It is presumed that additional turtles were taken from the beach before they reached dry sand and therefore leaving no track. There were many occasions when poachers were observed scanning the high tide line presumable looking for emerging turtles.

It is, however, encouraging that no hawksbill turtles were killed this season compared to two in 2006. This could be partially due to the fact that six out of the 16 nesting hawksbills were observed and watched until they returned to sea.

8 References

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11 Appendix

11.1 Appendix A: Summary of all green turtle tags applied or encountered

- HLF- Turtle did not lay
- NST-Turtle nested, no tags recorded
- REC-Newly tagged turtle
- REM-Previously tagged turtle
- Shaded cells are tags applied on that specific occasion

Date	Record Type	Right Front Tag	Left Front Tag	Tagging Comments
20-Jun-07	REC	CP0284	CP0285	
27-Jun-07	REC	CP0256	CP0257	
30-Jun-07	REC	CP0259	CP0260	
13-Jul-07	REC	CP0261	CP0262	
14-Jul-07	REM	95246	95247	
15-Jul-07	REC	CP0263	CP0264	
16-Jul-07	REM	9565	CP0265	
17-Jul-07	REC	CP0266	CP0268	
18-Jul-07	REC	CP0280		
18-Jul-07	REM	101945		
18-Jul-07	REM	87578	87579	
21-Jul-07	REC	CP0282	CP0283	
23-Jul-07	REC	CP0288		
23-Jul-07	REM	101677	101678	
24-Jul-07	REM	100300	100301	
24-Jul-07	REM	102862	107273	
24-Jul-07	REM	107190	107191	
25-Jul-07	HLF		98283	
25-Jul-07	REC	CP0353	CP0354	
25-Jul-07	REM	107375	107377	
25-Jul-07	REM	99251	99252	
25-Jul-07	REM	V3732		
26-Jul-07	HLF	107222	107223	
26-Jul-07	REC	CP0275	CP0271	
26-Jul-07	REM	103647	103648	
28-Jul-07	REC	CP0289	CP0290	
28-Jul-07	REC	CP0355	CP0356	
29-Jul-07	REC	CP0291	CP0292	
30-Jul-07	REC	CP0293	CP0294	
30-Jul-07	REC	CP0357	CP0358	
30-Jul-07	REM	103672	103673	
31-Jul-07	REC	CP0295	CP0296	
31-Jul-07	REC	CP0297	CP0298	
31-Jul-07	REC	CP0359	CP0360	
31-Jul-07	REM	95295	95296	
02-Aug-07	HLF		88055	
02-Aug-07	REC	CP0299	CP0301	
03-Aug-07	REC	CP0302	CP0303	
04-Aug-07	HLF	107239	107242	

04-Aug-07	REM	107239	107242	
04-Aug-07	REM	96586	96587	
05-Aug-07	REC	CP0305	CP0306	
05-Aug-07	REC	CP0361	CP0362	
06-Aug-07	REM	103076	103077	
07-Aug-07	HLF		98283	
07-Aug-07	REC	CP0307	CP0308	
07-Aug-07	REC	CP0363	CP0364	
07-Aug-07	REM	101267		
08-Aug-07	REC	CP0309	CP0310	
08-Aug-07	REC	CP0365	CP0366	
08-Aug-07	REC	CP0367	CP0368	
08-Aug-07	REM	CP0311	98283	
10-Aug-07	REM	84798	84799	
10-Aug-07	REM	CP0357	CP0358	
11-Aug-07	HLF	PN0264	PN0263	
11-Aug-07	REC	CP0369	CP0370	
11-Aug-07	REM	CP0371	CP0372	Removed and recovered-PN0264 Removed and lost-PN0263
12-Aug-07	REC	CP0373	CP0375	
13-Aug-07	HLF	107884	107885	
13-Aug-07	HLF	86519		
13-Aug-07	REC	CP0328	CP0329	
13-Aug-07	REC	CP0330	CP0331	
13-Aug-07	REM		101678	
13-Aug-07	REM		89983	Right front tag unreadable - embedded - last three digits 193, tagged between first and second scale.
13-Aug-07	REM	CP0288	CP0332	
14-Aug-07	REM	107389		
15-Aug-07	REC	CP0313		
15-Aug-07	REC	CP0337	CP0339	
15-Aug-07	REM	82455	CP0315	
15-Aug-07	REM	CP0305	CP0306	
15-Aug-07	REM	CP0333	CP0334	Removed and recovered-100334
15-Aug-07	REM	CP0335	99019	
16-Aug-07	REC	CP0316	CP0317	
16-Aug-07	REC	CP0318	CP0319	
17-Aug-07	REC	CP0320	CP0321	
17-Aug-07	REC	CP0376	CP0377	
17-Aug-07	REM	84004	94869	
18-Aug-07	REM	108264	108265	
18-Aug-07	REM	CP0355	CP0356	
20-Aug-07	REC	CP0378	CP0380	
20-Aug-07	REC	CP0381	CP0382	
20-Aug-07	REM	101377	CP0322	Removed and recovered left front-88056
20-Aug-07	REM	CP0293	CP0294	
21-Aug-07	HLF	91056	91057	
21-Aug-07	REC	CP0323	CP0346	
21-Aug-07	REC	CP0324	CP0325	
21-Aug-07	REC	CP0326	CP0327	
22-Aug-07	REC	CP0383	CP0384	
23-Aug-07	REM	CP0340	101678	
25-Aug-07	REC	CP0342	CP0343	
25-Aug-07	REC	CP0344	CP0345	
25-Aug-07	REM	107634	107635	

25-Aug-07	REM	108451	95540	
25-Aug-07	REM	93965	93966	
26-Aug-07	REC	CP0385	CP0386	
26-Aug-07	REC	CP0387	CP0388	
26-Aug-07	REC	CP0391	CP0392	
26-Aug-07	REM	CP0389	CP0390	Removed and recovered-97560
27-Aug-07	REM	59552	CP0395	Removed and recovered-59551
27-Aug-07	REM	96586	CP0396	Removed and recovered left front-96587
27-Aug-07	REM	CP0282	CP0283	
28-Aug-07	REM	CP0397	CP0398	Removed and recovered right front-82811 Removed and recovered left front-102693
29-Aug-07	REC	CP0408	CP0410	
29-Aug-07	REM	107982	107983	
29-Aug-07	REM	CP0361	CP0362	
29-Aug-07	REM	CP0399	107215	
30-Aug-07	HLF	107516	107517	
30-Aug-07	REC	CP0401	CP0403	
30-Aug-07	REC	CP0404	CP0405	
30-Aug-07	REM	87622	87623	
30-Aug-07	REM	CP0357	CP0412	Removed and recovered left front-CP0358
30-Aug-07	REM	CP0400		Removed and recovered right front-85399
31-Aug-07	REC	CP0427	CP0428	
31-Aug-07	REM	CP0288	CP0332	
01-Sep-07	REC	CP0429	CP0430	
02-Sep-07	REC	CP0413	CP0414	
04-Sep-07	HLF	84004	94869	
04-Sep-07	HLF	CP0297	CP0298	
04-Sep-07	HLF	CP0313		
04-Sep-07	REC	CP0415	CP0416	
04-Sep-07	REC	CP0417	CP0418	
04-Sep-07	REM	108151	108152	
05-Sep-07	HLF	CP0318	CP0319	
05-Sep-07	HLF	CP0385	CP0386	
05-Sep-07	REC	CP0432	CP0433	
05-Sep-07	REC	CP0435	CP0438	
05-Sep-07	REM	90193		
05-Sep-07	REM	CP0337	CP0420	
05-Sep-07	REM	CP0389	CP0390	
06-Sep-07	REC	CP0440	CP0442	
06-Sep-07	REC	CP0481	CP0482	
06-Sep-07	REM	59552	CP0424	Removed and recovered left front-CP0395
06-Sep-07	REM	CP0385	CP0386	
06-Sep-07	REM	CP0421	CP0423	Removed and recovered right-VA5208
07-Sep-07	HLF	108968		
07-Sep-07	HLF	86630	86631	
07-Sep-07	REC		CP0425	
07-Sep-07	REC	CP0483	CP0484	
07-Sep-07	REC	CP0488	CP0490	
07-Sep-07	REM	CP0444	CP0446	Removed and recovered front right-81280 Removed and recovered left front-81281 LF.
08-Sep-07	REC	CP0447	CP0448	
08-Sep-07	REC	CP0449	CP0450	
08-Sep-07	REC	CP0492	CP0493	
08-Sep-07	REM	CP0404	CP0405	
09-Sep-07	REC	CP0451	CP0452	

09-Sep-07	REC	CP0495	CP0496	
09-Sep-07	REM	87622	87623	
10-Sep-07	REC	CP0453	CP0454	
10-Sep-07	REC	CP0497	CP0498	
10-Sep-07	REC	CP0499	CP0502	
10-Sep-07	REC	CP0503	CP0504	
10-Sep-07	REM	100455	100456	
11-Sep-07	REM	CP0326	CP0327	
12-Sep-07	REC		CP0507	
12-Sep-07	REC	CP0508	CP0509	
13-Sep-07	REC	CP0455	CP0457	
13-Sep-07	REC	CP0458	CP0459	
13-Sep-07	REC	CP0510	CP0511	
14-Sep-07	REC	CP0512	CP0513	
14-Sep-07	REM	93965	93966	
14-Sep-07	REM	CP0316	CP0317	
15-Sep-07	HLF	103076	103077	
16-Sep-07	REC	CP0460	CP0461	
16-Sep-07	REM	CP0462	CP0463	Removed and recovered right front-CP0435 Removed and recovered left front-CP0438
17-Sep-07	REC	CP0464	CP0465	
19-Sep-07	REM	100941	100942	
19-Sep-07	REM	CP0361	CP0362	
20-Sep-07	REM		102971	
20-Sep-07	REM	CP0383	CP0384	
21-Sep-07	REC	CP0466	CP0468	
22-Sep-07	REM	CP0508	CP0509	
23-Sep-07	REC	CP0469	CP0470	
23-Sep-07	REC	CP0471	CP0472	
24-Sep-07	REC	CP0473	CP0506	
24-Sep-07	REC	CP0517		
25-Sep-07	HLF	100138	100139	
26-Sep-07	HLF	PN0383	PN0382	
26-Sep-07	REC	CP0526	CP0527	
26-Sep-07	REC	CP0529	CP0530	
27-Sep-07	REC	CP0531		
27-Sep-07	REC	CP0536		
27-Sep-07	REC	CP0541	CP0542	
27-Sep-07	REC	CP0544		
28-Sep-07	HLF	109430		
28-Sep-07	REC	CP0553	CP0554	
28-Sep-07	REM	86519	86520	
28-Sep-07	REM	CP0432	CP0433	
28-Sep-07	REM	CP0462	CP0463	
28-Sep-07	REM	CP0464	CP0465	
29-Sep-07	HLF	109430	109431	
29-Sep-07	REC	CP0563	CP0564	
29-Sep-07	REM	CP0555	CP0556	Removed and recovered-82387 Removed and recovered-82388
30-Sep-07	REC	CP0565	CP0566	
30-Sep-07	REM	CP0291	CP0292	
01-Oct-07	REC	CP0557	CP0558	
01-Oct-07	REC	CP0560	CP0561	
02-Oct-07	REM	CP0508	CP0509	
03-Oct-07	REC	CP0567	CP0568	

06-Oct-07	REC	CP0569	CP0570	
06-Oct-07	REM	83599	CP0572	Removed and recovered left front-83600
08-Oct-07	REC	CP0573	CP0574	
08-Oct-07	REM	CP0316	CO0317	
09-Oct-07	REC	CP0578	CP0579	
09-Oct-07	REC	CP0580	CP0582	
10-Oct-07	REM	CP0288	CP0332	
11-Oct-07	REM	100826	CP0583	
14-Oct-07	HLF	87769	8777?	
14-Oct-07	REM	CP0589	CP0590	Removed and recovered right front-90705 Removed and recovered left front-90704
15-Oct-07	REC	CP0591	CP0592	
16-Oct-07	HLF	109916		
16-Oct-07	REM	PN0383	PN0382	
18-Oct-07	REM	CP0578	CP0579	
19-Oct-07	REM	CP0389	CP0390	
19-Oct-07	REM	CP0607	CP0566	
21-Oct-07	REC	CP0593	CP0594	
22-Oct-07	REM	100598	100599	
22-Oct-07	REM	87917	87918	
23-Oct-07	REM	CP0432	CP0433	
24-Oct-07	REC	CP0595	CP0596	
26-Oct-07	REC	CP0597	CP0599	
26-Oct-07	REM	CP0567	CP0568	

11.2 Appendix B: Summary of all hawksbill turtle tags applied or encountered

- HLF- Turtle did not lay
- NST-Turtle nested, no tags recorded
- REC-Newly tagged turtle
- REM-Previously tagged turtle
- Shaded cells are tags applied on that specific occasion

Date	Record Type	Right Front Tag	Left Front Tag	Tagging Comments
31-May-07	REC	CP0222		
10-Jun-07	REC	CP0228	CP0230	
14-Jun-07	REM	CP0222	CP0276	
26-Jun-07	REC	CP0253	CP0254	
26-Jul-07	REC	CP0272	CP0273	