ANNUAL REPORT 2015

LANG TENGAH TURTLE WATCH

Summary

127

Volunteers Hosted

3

Research Interns

13

Individual Nesting Mothers

39

Nests Laid

3,189

Eggs Saved

85.02

Hatching Success (%)

Contents

LANG TENGAH TURTLE WATCH

Acknowledgements

All members of The Lang Tengah Turtle Watch would like to extend their gratitude to the members of WWF, University Malaysia Terengganu and the Department of Fisheries for all their help and guidance in realising the project and for supporting the work being done by the project on Pulau Lang Tengah.

We would also like to thank all the volunteers who helped in the gathering and collation of data. In addition, much gratitude must be given to CIMB Foundation, whose funding has enabled Lang Tengah Turtle Watch to diversify greatly and aid with further projects on Pulau Lang Tengah.

The Project

BACKGROUND & CURRENT WORK

Initiated by Hayati Mokhtar in 2013, the organisation has just completed its third season of data collection. The project's volunteer programme has again witnessed considerable growth, with 127 volunteers from the months of March to October. This is an increase of 65% when compared to 2014, which saw 77 volunteers at Lang Tengah Turtle Watch.

The organisation again received a combination of both overseas and local Malaysian volunteers. During the volunteer period from 1 March to 4 October 2015, the ratio of overseas to local volunteers was almost 1:1. In all aspects of conservation, educational outreach is particularly important, and the fact we have been able to include people from many different backgrounds and educate them about sea turtle conservation in Malaysia is something we are extremely proud of.

With an increased number of volunteers and the organisation beginning to branch out into other lines of environmental work on the island, Lang Tengah Turtle Watch invited three interns to work for the project, on the same basis of the very successful intern programme from the previous year. The intern programme was split into thirds, with different interns working the beginning, middle and end of the nesting season. Lang Tengah Turtle Watch has again been able to contribute greatly to the Department of Fisheries Turtle Tagging Programme.

Exclusive to the 2015 season, we have been conducting research with regard to the temperature and humidity inside the nest chambers. Using funding from the CIMB Foundation, Lang Tengah Turtle Watch purchased six iButton devices. By placing iButtons into a nest chamber, we have been able to estimate the number of males and females produced on Turtle Bay through analysis of temperatures. Humidity readings have allowed us to further analyse the effect this has on fungal infections. In addition to this environmental data, research concerning predation on nests has also been more thorough, with staff members hoping to publish an academic paper on the ‘Predation from Termites’ with the help of academic partners.

It is pleasing to say that the LEAP Together programme initiated last year has been a great success. The issue of waste of waste disposal is being met, with staff and volunteers conducting weekly island-wide beach clean-ups. The resulting rubbish is taken to a recycling plant on the mainland.

Sea turtle conservation through nightly patrolling and daily nest monitoring remains our primary goal. Results and achievements in this field are visible later in this paper.

Future Initiatives

Following such a successful season, with increased volunteer numbers, total nests and turtle landings, it is important to keep much of the same framework that has guaranteed such results. Protocols for patrolling and nest monitoring will be improved as much as is possible within the current scope of the project. We will be able to provide individual head torches for each volunteer during their stay, and hope to have a higher number of interns and trained staff members, so as to not miss an opportunity where it is crucial to tag and measure the turtle upon landing. In a hope to gain a more accurate data set with regard to temperature and humidity of the nest, iButtons will be used throughout the 2016 season, enabling any change through the year to be seen.

Lang Tengah Turtle Watch also aims to fully begin a waste management project, which has been somewhat initiated in the 2015 season. In 2016, we will work with the four resorts of the island, ensuring proper waste disposal and recycling. Improving the overall aesthetics of the island is important due to the high numbers of tourists who expect a pleasant environment. Proper waste management will benefit the ecology of Lang Tengah, as plastics found on beaches and in the coastal forest can be detrimental to the lives of many of the islands inhabitants.

In the 2016 season, we again aim to diversify and conduct research on more areas of the biology and ecology of Lang Tengah Island. Staff members, interns and volunteers will be joining Summer Bay Resort's coral reef restoration programme, taking data and aiding their staff by suggesting possible improvements. Staff members and interns will also begin a census of marine life, beginning with Turtle Bay and Batu Kuching.

Study Area

Pulau Lang Tengah lies approximately 20 km off the coast of Terengganu State in Peninsular Malaysia. Like many of the neighboring islands and much of the mainland of Terengganu, Lang Tengah is in important sea turtle nesting site, home to the endangered green turtle *(Chelonia mydas)* and the critically endangered hawksbill turtle *(Eretmochelys imbricata*; International Union for Conservation of Nature [IUCN], 2015).

Pulau Lang Tengah consists of three beaches: Turtle Bay (TB), Lang Sari (LS) and Summer Bay (SB). They cover a distance of coastline measuring 50 m, 450 m and 500 m, respectively.

All three beaches are located on the southern side of the island. Both LS and TB are south-facing, while SB is west-facing. The northern coast of Lang Tengah is composed of granite rocks which provide unsuitable nesting habitat for sea turtles. All three beaches provide ecologically suitable nesting habitat for sea turtles, with reports of landings occurring on all of them. However, SB is subjected to high levels of disturbance from light and noise pollution due its heavy commercial development. Light and noise pollution are major deterrents to nesting individuals and therefore we consider TB and LS to be the principal nesting beaches on Lang Tengah.

Methodology

PATROLLING

Patrols were conducted hourly along each of the beaches, every night from 8 p.m. to 6 a.m. Groups were made up of volunteers, interns and staff members. The average nesting time for a green turtle is between 1–2 hours. Patrolling once an hour ensures that no nesting female is missed and that disturbance to the beach is minimal. Any nests found on LS or SB were carefully relocated to TB, with the depth of the egg chamber and bush/shrub coverage mimicked as closely as possible to the original nest. This is done in order to minimise anthropogenic influence within the incubation process. Once back on TB the nests were marked and were then monitored. Nesting females on TB are rarely interfered with. Unless the case arises that an individual begins to dig a body pit on top of, or in close proximity to an existing nest. In this case the individual is carefully guided to an area where it is safe to nest. This again emphasizes the importance of hourly patrols, particularly late in the season when TB has a high amount of active nests.

NEST MONITORING

Each nest is first checked 45 days after being laid, and subsequently checked every three days until emerging from the sand and entering the sea. This time period allows for constant and thorough monitoring of the eggs, with as little human interference and chance of contamination as possible. Aside from scheduled checks after an initial 45-day incubation period, all nests are inspected daily for any visible signs of predation. Once the eggs had hatched and emerged from the nest, a post-hatch inspection (PHI) was carried out in order to determine how many individuals had successfully hatched.

TAGGING

Once a female has finished laying her eggs and is covering the egg chamber with sand it is possible to tag her flipper. The metal tags are secured between the second and third scale away from the body of the turtle, on the trailing edge of the flipper (Eckert & Beggs, 2006). A method known as ‘double-tagging’ was employed, whereby a tag is placed on both front flippers. This is to ensure the greatest chance of the turtle retaining at least one of its identity tags over the course of its migration period. If one of the tags is missing upon an individuals return to the nesting beach, then another tag is inserted and the identity form for that individual is updated. Only participants trained in tagging sea turtles were allowed to undertake this procedure, in the event of their absence and the arrival of a new mother, the tracks in the sand were measured at their widest point. When a subsequent new mother came ashore her tracks were also measured to see if they matched those of the previous, untagged mother.

NEST TEMPERATURE

Temperature and humidity data was collected with the use of 11 iButtons. The buttons were secured in a mesh parcel and attached onto the nest marking stick. The buttons were placed as close to the centre of the clutch as possible. A reading from the centre of the nest will therefore provide a more accurate reading for the overall nest temperature to be averaged. Temperature data used came from the middle third of the incubation period. An average green turtle incubation period is 60 days; if this is the case, data was collected from day 20–40. It is during this time in the egg incubation that the Temperature-Dependent Sex Determination (TSD) is most heavily influenced (Spotila, 2004).



Results

NESTING

Over the course of the nesting season a total of 88 landings were recorded, almost twice as many as the 47 landings seen the previous season. Of these 88 landings, 39 resulted in nesting, with 24 natural nests laid on TB, and the remaining 15 laid on LS. Green turtles make up 38 out of the 39 nests, with only one hawksbill nest, laid on 28 September on TB. Thirteen individual turtles laid the 39 nests: 11 green turtles and one hawksbill turtle. Three of the 39 nests were only found after the eggs were laid, and once the mothers had already returned to sea, resulting in three nests from unidentified mothers. Of the 13 mothers, Sue (15G002) produced the most eggs and nests, laying 1,049 eggs in seven different nests throughout the season. Each turtle on average laid three nests, however it can be said that this is largely the result of eight individuals laying only one nest (Table 1).

13 individual mothers

3,189 total eggs

39 total nests

Table 1. Nesting mothers by ID number that laid nests on Lang Tengah in 2015, with the number of eggs and nests laid by each.

ID	Eggs	Nests
15G001	603	5
15G002	1,049	7
15G003	101	1
15G004	107	1
15G005	556	6
15G006	100	1
15G011	96	1
15G013	-	1
15G007	324/3	6
15G008	113	1
15G009	429	4
15G012	35	1
15G010	-	1

The total number of eggs laid on Pulau Lang Tengah from the first nest on 28 February to the last nest on 28 September was 3,891. The highest number of eggs laid by a female in one nest was 172 (15G002), with the lowest being 35 (15G012), laid by a new mother, extremely sensitive to light. Overall the average clutch size was 111 (Table 2).

Turtle landings on TB were far more common during the beginning weeks of the season. There were no recorded landings at LS until 18 April, whilst this period saw 27 landings on TB, yielding six nests. Following the first landing at LS on the 18 April, landing and nesting was split fairly evenly between the two sites (33 on LS, 28 on TB, see Table 2). The months of March and July saw the most turtle landings, 20 in each month. However, August yielded the highest number of nests, 10 out of 17 landings. May and June was the least productive period of the season, with only four landings and three nests in each month. Figure 1 shows the number of nests laid in each month. The most productive month in terms of number of eggs laid was again August with 938 eggs (Figure 2).

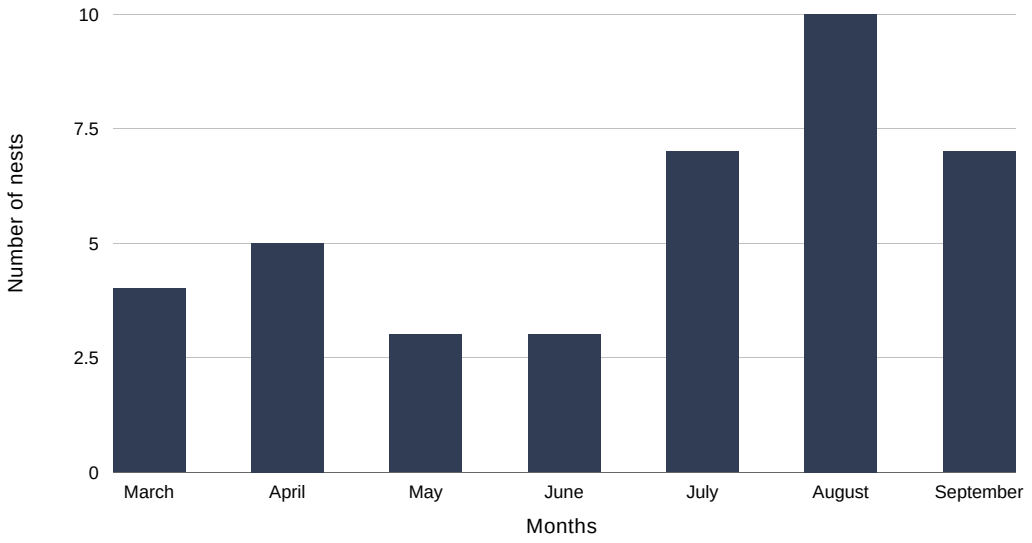


Figure 1. Number of nests laid in each month of the 2015 season on Pulau Lang Tengah.

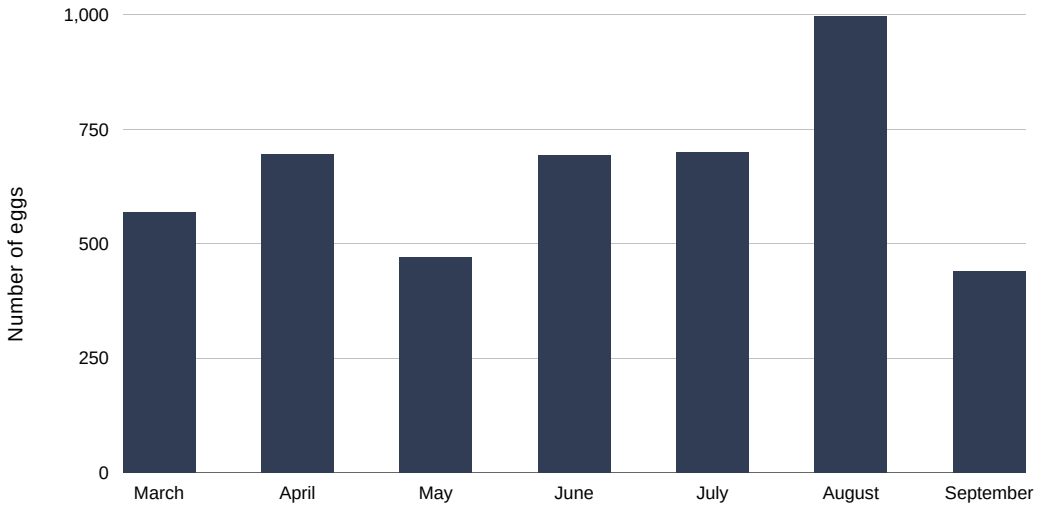


Figure 2. Number of eggs laid in each month of the 2015 season on Pulau Lang Tengah.

Table 2. Nest number, total eggs in each nest, the incubation period of each nest, the month in which the eggs were laid and the location.

Nest No.	Total Eggs	Incubation Period (days)	Month	Location
1	113	55	March	TB
2	157	58	March	TB
3	126	59	March	TB
4	172	54	March	TB
5	121	58	April	TB
6	145	55	April	TB
7	143	60	April	TB
8	133	56	April	LS
9	153	58	April	TB
10	116	54	May	TB
11	154	53	May	TB
12	125	56	May	TB
13	69	55	June	LS
14	101	62	June	LS
15	101	55	June	TB
16	107	62	July	TB
17	111	58	July	LS
18	83	59	July	TB
19	84	63	July	LS
20	100	53	July	TB
21	96	63	July	TB
22	118	60	July	TB
23	113	59	August	TB
24	92	57	August	LS
25	105	58	August	TB
26	105	57	August	TB
27	85	60	August	LS
28	101	56	August	TB
29	125	58	August	TB
30	117	58	August	LS
31	95	N/A	August	LS
32	N/A	N/A	August	TB
33	109	N/A	September	LS
34	N/A	N/A	September	TB
35	89	N/A	September	LS
36	98	N/A	September	LS
37	N/A	N/A	September	TB
38	35	N/A	September	LS
39	N/A	N/A	September	TB
Average	**111**	**58.7**		

The average incubation period of a green turtle egg is 60 days (Spotila, 2004). On Pulau Lang Tengah the average incubation period was 58 days. Hawksbills have a shorter incubation period, however during the writing of this, the hawksbill nest on TB has yet to emerge, as have eight other green turtle nests laid late in the season, meaning incubation period and egg number are unknown at this point. The longest period of incubation was 63 days (nest 20) and the shortest was 53 days (nest 19). Incubation periods of all the nests are visible in Table 2.

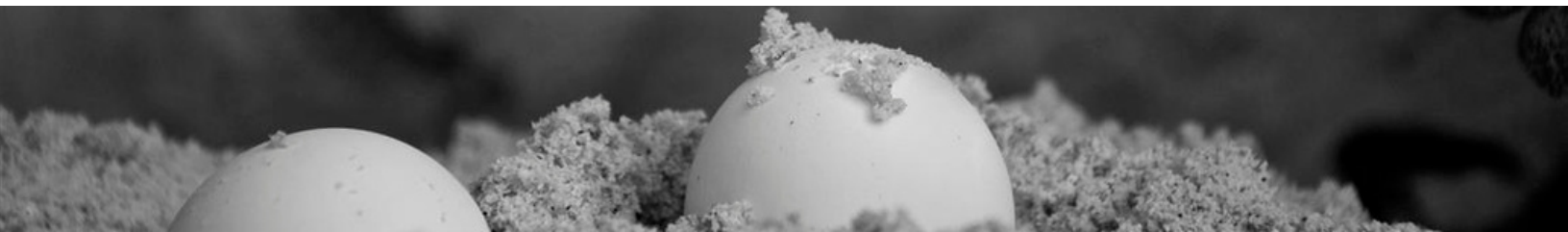
HATCHING SUCCESS & PREDATION

In the 2015 season, Lang Tengah Turtle Watch witnessed an average success rate of 85.02%, for hatchlings surviving in the nest and emerging to sea. This is an increase of almost 10% when compared to the 72% success rate seen in the 2014 season. The highest success rate in any single nest was 99.15% (nest 30, relocated from LS to TB). In this nest at total of 116 hatchlings made it to sea, out of 117 eggs. In contrast the lowest was 18.07%, a natural nest laid on TB (nest 18), where only 15 hatchlings survived to sea out of the 83 eggs laid. Hatching success is calculated by dividing the number of successfully hatched eggs by the total number of eggs in the nest, then by multiplying this figure by 100.

On average, natural nests had a higher success rate than those relocated from LS although the difference between the two is minimal. Nests laid naturally on TB had an average success rate of 85.16%, whereas the average for relocated nests was 84.82%. That being said, there were a greater number of natural nests, 17 compared to 13 relocated, which have emerged at this time of writing. This further reinforces the success of natural nesting on TB. Table 3 illustrates the success rates of each nest, and whether the nest was natural on relocated. In-situ nests are naturally laid on TB, nests that are denoted as relocated were laid on LS and then moved to the safety of TB.

Nest No.	Status	No. of Eggs	Eggs Hatched	Success %
1	In-situ	113	83	73.45
2	In-situ	157	145	92.36
3	Relocated	126	114	90.48
4	In-situ	172	162	94.19
5	In-situ	121	120	99.17
6	Relocated	145	111	76.55
7	In-situ	143	100	69.93
8	In-situ	133	126	94.74
9	In-situ	153	136	88.89
10	In-situ	116	105	95.45
11	In-situ	154	140	90.91
12	Relocated	125	82	65.60
13	Relocated	69	51	73.91
14	Relocated	101	91	90.10
15	In-situ	101	92	91.09
16	In-situ	107	100	93.46
17	Relocated	111	80	72.07
18	In-situ	83	15	18.07
19	Relocated	84	78	92.86
20	Relocated	100	82	82.00
21	In-situ	96	67	69.79
22	Relocated	118	105	88.98
23	In-situ	113	98	86.73
24	Relocated	92	77	83.70
25	In-situ	105	102	97.14
26	Relocated	105	104	99.05
27	Relocated	85	75	88.24
28	In-situ	101	99	98.02
29	In-situ	125	118	94.40
30	Relocated	117	116	99.15
Total		**3,471**	**2,974**	**85.02**

Table 3. Nest number, whether the nest has been relocated of left in-situ, the total number of eggs and the total number of hatched eggs, followed by percentage of successful hatching of each nest.



It is also visible in Table 3 that generally nest with a greater number of eggs have a higher success rate. Twenty four nests yielded over 100 eggs; the success rate of these nests was 88.5%. Of the six nests to yield less than 100 eggs, the success rate was considerably lower at 71.09%. This pattern is also visible in the extremities of the data. Nest 4, with the highest number of eggs at 172, had a success rate of 94.19%. On the other end of the spectrum nest 13, which yielded the lowest number of eggs, a total of 69, had a success rate of only 73.91%.

Success rate is determined by a number of factors, including position of the nest on the beach and predation. It is important to consider the effect different predators have on each nest, and how this influences the number of hatchlings that survive.

There are four known animal species that actively predate on turtle eggs on Pulau Lang Tengah. These include crabs, termites, monitor lizards and maggots. Fungal infections also result in embryo mortality, and are classified in the predator category, although fungus does not fall within the Animal Kingdom. The most prevalent predators in the 2015 season were termites. Termites were responsible for the mortality of 175 green turtle eggs, one higher than the number killed by crabs, 174. Fungal infections were responsible for the death of 111 eggs, while maggots and monitor lizards were responsible for 58 and 26 deaths respectively. A combination of these various predators can also result in unhatched eggs; this season saw five eggs killed as a combination. A breakdown of predation numbers is visible in Figure 3.

As well as direct predation from animals and fungal infections, a large proportion of eggs did not hatch due to other reasons. Whole ‘unhatched’ eggs make up 222 of the total number of eggs not to hatch and make it to sea. Eggs can remain unhatched either due to unfertilisation or embryo mortality as a result of inundation of seawater, ultimately leading to suffocation.

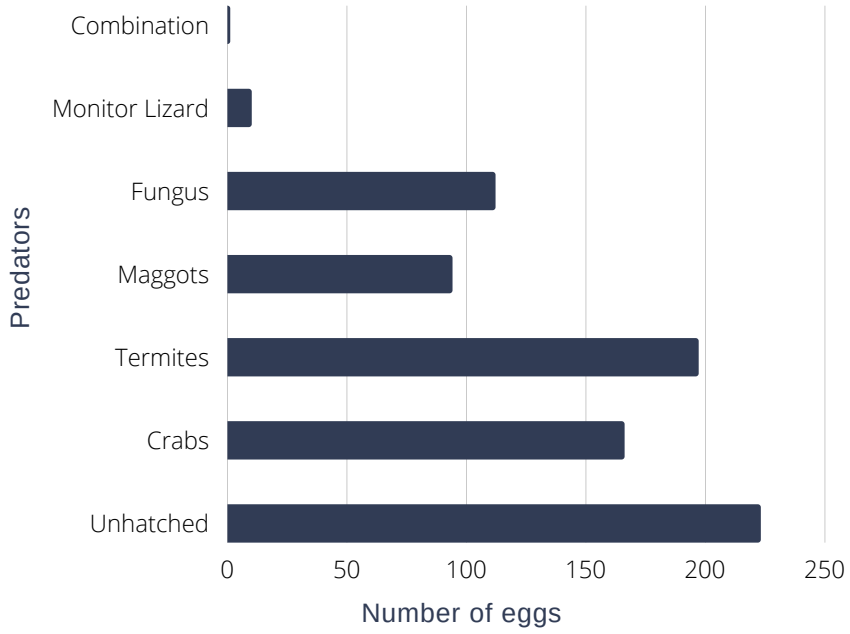


Figure 3. Number of eggs predated upon and by which predator during the 2015 nesting season on Pulau Lang Tengah. Also visible is the number of unhatched eggs.

Looking at predation figures in a temporal sense also yields interesting results. Eggs that were laid in the month of July saw the highest amount of predation at 172. Eggs laid in May saw the least amount of predation with only 62 eggs predated upon. However it is crucial to consider the number of eggs that were on in nests at a specific time, as May only saw three nests laid. Thus the percentage success from each month is a more reliable figure to consult. Table 4 shows the month in which the eggs were laid, the number that were predated upon and the percentage success, in other words the amount of predation relative to the amount of eggs on the beach. It is evident from this data that July again saw the most predation relative to the number of eggs. Figure 4 illustrates the data in the form of a column graph.

Table 4. A breakdown of data regarding egg predation and the month in which nests were laid.

Month	Eggs predated upon	Success %
March	64	87.62
April	102	85.86
May	62	83.99
June	19	85.03
July	172	73.89
August	64	93.30

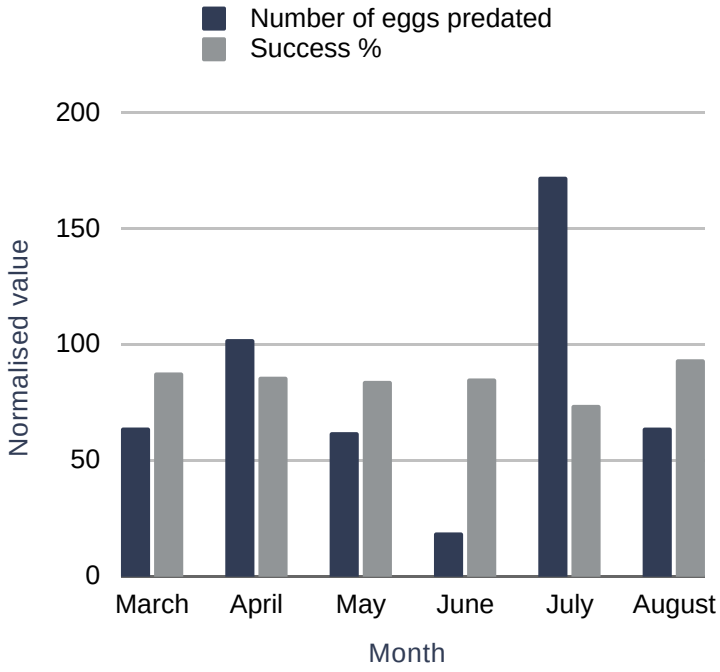


Figure 4. Relationship between egg predation and hatching success, and the month in which the eggs were laid.

NEST TEMPERATURE

The 2015 season is the first season in which Lang Tengah Turtle Watch has implemented the use of ‘iButton’ technology. By inserting an iButton into a nest it is possible to accurately record readings regarding the temperature and humidity from inside said nest. Over the course of the nesting season, six nests were monitored with iButtons; nests 3, 5, 6, 7, 8 and 9.

Following analysis of constant data relayed from the iButton (one reading every hour), it is possible to calculate an average temperature for an individual nest. Only readings from the middle period of incubation are used, as this is the time when temperature most affects the embryos and contributes most greatly to TSD. Table 5 illustrates the average temperatures for all nests fitted with an iButton.

Table 5. All nests that were equipped with iButton device, and their resulting average temperatures.

Nest	Average Temperature °C
3	29.05
5	29.99
6	28.48
7	29.66
8	29.35
9	29.99

It is visible from Table 5 that the average temperature of nests on TB hovers around 29°C, much similar to the average of many other nests around the world. The lowest average temperature was seen in nest number 6, at 28.48°C. The highest is seen in nest 9, with a high average temperature of 29.99°C.

Discussion & Recommendations

NESTING

An analysis of results shows that the 2015 season for Lang Tengah Turtle Watch was very successful indeed. 88 landings were documented; almost twice as many when compared to the 2014 season, yielding 39 nests, again a great increase from the 23 nests seen in the previous season. Perhaps the most important and promising figure to come out of the 2015 season is the percentage success. It is often difficult when monitoring twice as many nests and dealing with twice as many adult landings, and the success rate can suffer as a result. However with an average hatching success rate of 85.02% it can be said that methods deployed over the course of the nesting season, particularly with regards to relocation and nest monitoring have been significantly improved. As well as improved monitoring methods, it can be said that a large reason as to why such as increase of landings and nests has been documented is associated with volunteers. 2015 saw a great increase of volunteers, resulting in a more stringent and manageable approach to patrolling. Ongoing research must continue to assess whether this is a population trend, or simply a result of improved methods. If the breeding population on Pulau Lang Tengah does not fluctuate along with the regional trends, then this may provide scope for novel research to be conducted on the patterns in breeding habits of the island's turtle population.

One of the main differences to the 2014 season regarding nesting was the fact that 2015 saw only one nesting hawksbill Turtle. In 2014, Lang Tengah Turtle Watch saw hawksbills account for one third of total nests, a stark difference to one out of 39 in the 2015 season. Hawksbills like other sea turtle species lay 3–5 clutches of eggs in one season, then return to the same beaches 2–3 years later to repeat the process (Spotila, 2004). It is strange therefore to only receive one nest, as it would be usual practice for the same female to lay 3–5 times. A possible explanation for this is the physical wellbeing of the ahwksbill that nested on TB. She had only one rear flipper, thought to be a result of a shark attack. The same individual visited the beach months earlier and could not dig a sufficient egg chamber to release a clutch. Perhaps if this had been a healthy individual, then 3–5 clutches could have been laid on TB.

An average number of 111 eggs per clutch is extremely close to the global average of 110 for green turtles (Spotila, 2004). The lowest number in one nest seen on Lang Tengah was 35, in nest number 38. This is considerably below the average for a green turtle. It is thought that this nest was laid by a first time mother. The particular individual was extremely sensitive to red light and any movement from the staff attempting to take the eggs for relocation. As a result the individual didn't lay an entire clutch and returned to sea. The same individual returned on two separate occasions, however chose rocky areas and deemed them insufficient places to release a clutch.

HATCHING SUCCESS &PREDATION

Such a high success rate recorded this season implies that predation has been less prevalent. The success rate of relocated nests has again improved from the 2014 season, showing that improved methods of relocation developed in the previous season have continued to show dividends. This season however, the success rate of *in-situ* nests surpassed that of relocated nests, contrary to the 2014 season. It is difficult to assess reasoning behind this, however it can be said that improved nest monitoring and within beach relocation has certainly improved the health of all nests. This entails noting the original nest depth and bush coverage, both of which are then replicated as closely as possible in the new nest.

When studying figures with regard to predators, results are very interesting indeed. In the 2014 season it was noted that a new predator became active on TB; termites. Termites in the 2015 season were the most destructive predator, responsible for more deaths than crabs, monitor lizards, maggots and fungal infections. There is a very limited amount of work that has been done on termites predating upon turtle eggs, and it is believed that Pulau Lang Tengah may be exclusive in this activity. There is currently no literature existing that relates to the predation of sea turtle eggs by termites. In order to combat the amount of mortality due to termites, it was a realized that a certain area of the beach saw more termite attacks than any where else. This area was noted and no nests were relocated to this zone following this discovery. Research in this particular field is ongoing in order to assess whether this is a constant activity, how or if it is possible to mediate against, and whether this predation occurs anywhere else in the world.

Loss of eggs to other predators, mainly crabs and monitor lizards could be stunted by improving the protection of the nests by increasing the amount of daytime patrols along Turtle Bay, and by possibly constructing physical barriers to keep such predators away.

Nest 18, a relative anomaly with regards to success rate, with only 18% of hatchlings surviving, suffered from crab attacks and large-scale fungal infection. Besides relocation of the nest following crab attacks, there is not much which can be done to amend fungal infection.

infection. Nest 7 also witnessed a low success rate of 69%; it was inundated by seawater during the high tide of a full moon. In hindsight this nest could perhaps have been relocated further up the beach, however we support methods involving the least human interruption.

The poaching activity on Pulau Lang Tengah is important to note and to try and comprehend. Also a predator of sea turtle eggs, human poachers on Pulau Lang Tengah were still active in the 2015 season, however an increased number of volunteers led to more organised patrols, in turn resulting in less poaching activity. It is assumed that poachers took only one nest in 2015, from LS beach as a result of volunteers missing a patrol. Later, tracks were discovered, but no eggs.

NEST TEMPERATURE

For the first time, Lang Tengah Turtle Watch was able to analyse nest temperatures, and estimate the sex of hatchlings. Low temperatures during the incubation of eggs produce males, and high temperatures produce females. The temperature that produces 50:50 ratio of male to female hatchlings is called the pivotal temperature (Spotila, 2004). The pivotal temperature for green turtles, of which all the iButton nests were, is 29.5°C. When analysing the iButton data from the sex nests on Pulau Lang Tengah, it is therefore visible that three nests were female, and three nests were male. This is however, not a completely accurate way to estimate the sex, as nests with a temperature of around the pivotal mark may contain females and males; males on the outside of the clutch where it is cooler, and females on the inside. It is not until the temperature reaches above 30°C or below 28°C that we can be 100% certain if the hatchlings are female or male respectively.

Turtle Beach has a large amount of shade, as the coastal forest is still very intact. Therefore it is not surprising that all of the average temperatures hover around the pivotal mark. This is by no means a bad thing, and more often than not results in a mixed nest.

The results however do prove the worth of the technology. 2015 was somewhat considered a trial run with regards to the iButton, and with the technique well practiced, and a reliable group of results, it can be fully implemented for the 2016 season, with many more nests being monitored with this technology, in hope to assess the sex ratio of the hatchlings emerging from TB.

Another interesting factor to note when looking nest temperature is incubation time. It is thought that the greater the temperature of the nest, the shorter the incubation time will be. However out of the six nests monitored for temperature, the two with the highest temperature did not have the shortest incubation period. This is another area which requires ongoing research in order to assess other factors that affect the incubation period of eggs.

TAGGING & FACIAL RECOGNITION

With such an inflated number of nesting mothers, it was crucial that the tagging and facial recognition procedures worked well. All nesting mothers in the 2015 season were tagged safely, and the ID numbers uploaded to a database. If the mother returned with a tag missing, a new tag was promptly attached. It can be said this improvement is partly due to an increased number of trained staff members able to tag individuals, and existing staff members from the previous season being more adept at the procedure and better suited to instruct new team members.

The number of photographs taken for facial recognition has also increased, in part due to a greater number of females to take photographs of, but also due to better equipment. With funding from the CIMB Foundation, Lang Tengah Turtle Watch was able to purchase a DSLR camera, resulting in excellent clarity and more reliable photographs.

Conclusion

The 2015 season has been an overall success for the project. With a large increase in volunteers and the addition of a new member of staff, the human resources of the project have certainly improved, which can only help conservation matters. With a large increase in nesting and landings, this inflated volunteer number has proven its worth, the same can be said with much improved tagging practices. Perhaps the most promising statistic however is such a great increase in overall success rate. Despite some mortality due to Lang Tengah's natural predators, an increase in success rate again reinforces the improvements made by the team, particularly when considering nest monitoring and relocation.

It can be hoped that a similar trend will be seen for the 2016 season, and we will again witness improvements on all fronts. With procedures now having been in place for three years, it also allows scope for diversity, and further work related to termite predation and nest temperature. A reduction in poaching activity is also important to note, as it can be said that without the efforts of the Lang Tengah Turtle Watch team and volunteers, poaching activity would certainly be higher, and turtle eggs would be in markets, and not in nests safely on our beach.

It is extremely promising to see, that although worldwide statistics talk of general population decline of all sea turtle species, the population around Pulau Lang Tengah, could in fact be on the rise.

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