2014 ANNUAL REPORT

LANG TENGAH TURTLE WATCH

SUMMARY

- Lang Tengah Turtle Watch has grown considerably in our second year of operation, with staff and intern hired, as well as hosting 77 volunteers from Malaysian and international origins.

- From March to November 2014, we recorded 47 turtle landings resulting in 23 nests laid.

- For the first time, we recorded critically endangered hawksbill turtles landing and nesting on Pulau Lang Tengah, with a total of four nests and 475 eggs laid.

- Meanwhile, green turtles laid 19 nests throughout the season, where 18 of those nests contained 1,655 eggs in total.

- 1,213 hatchlings from 18 nests were released: 928 green turtles and 285 hawksbill turtles. The average hatching success rate of nests was 67.81%.

- We also contributed to photo-identification of sea turtles in collaboration with Ecoteer in Pulau Perhentian, as well as flipper tagging with the Department of Fisheries. Three new green turtle mothers were tagged.

CONTENTS

THE PROJECT

Background

Initiated by Hayati Mokhtar in 2013, the organisation has just completed its second season of data collection. Having grown considerably from the 2013 season, the project received 77 volunteers in 2014 – an increase of 320%.

Having mainly received volunteers from overseas in the previous season, the project wanted to attract more Malaysian participants and so forged alliances with a number of Malaysian institutions, such as Taylor's University, University Malaysia Kelantan, University Kebangsaan Malaysia, University Malaysia Terengganu and the Malaysian Nature Society. Overall, visitors from these institutions accounted for 42% of our volunteer intake. This is a proportion that we are happy to have achieved and hope to maintain, as it provides an optimal chance for cultural exchange between all of the project's participants.

To operate under this inflated amount of volunteers Lang Tengah Turtle Watch employed one staff member, Nur Liyana Fauzi, and adopted two intern students - Rifqah Ahmad Rostam from University Kebangsaan Malaysia and Molly Manwill from University of Sussex, UK.

The project was able to contribute to the development of facial recognition technology for sea turtles by sending portrait images of nesting mothers to Ecoteer on Pulau Perhentian who were accommodating a pair of marine researchers. The actualisation of such a technology would result in a non-invasive tagging method for sea turtles and would help instigate citizen science initiatives, encouraging tourists to take photographs of turtles and upload them to an online database. This would give the photographer the known information

about that particular individual and their photo would in turn add to that individual's dataset (migration patterns, etc.). Lang Tengah Turtle Watch was also included in the Department of Fisheries turtle tagging programme. We were only able to to tag three individuals as otherwise, when tagging was possible, the turtle was either already tagged, in which case the tagging entity was contacted to inform them of the individuals' appearance on Pulau Lang Tengah, or there was no trained staff member present to install the tag.

The Future

Due to the success of the project over the past two seasons with regard to growth in volunteer numbers and the interest and involvement of local institutions, we have planned to expand our operations to address other facets of conservation through a programme we have named LEAP Together (Learn, Evaluate, Act, Participate Together). This holds at its core the element of '*gotong-royong*', the Malay term for a collaborative community effort, which will be comprised of participants from local resorts and individuals from neighbouring islands and/or the mainland.

This endeavour will integrate three phases into the daily operating of Lang Tengah Turtle Watch this coming season. First and foremost is a cleanup programme that will address the issue of waste disposal on the island. Lots of rubbish is discarded by resorts and tourists, as well as that which is washed ashore by the tides. There are currently no protocols in place nor, indeed, is there any cohesion or consensus between neighbouring resorts on how to deal with the issue. Lang Tengah Turtle Watch will organise routine cleanup operations with combined help from the resorts, school groups and willing tourists.

The second component of LEAP Together will be to improve our organisation's turtle management practices. We feel that it is imperative to improve our protocols, equipment and protection on the project, as we have recorded the critically endangered hawksbill turtle (*Eretmochelys imbricata*) nesting multiple times on Turtle Bay. When considering the small size of the beach on Turtle Bay, it is highly remarkable that 33.33% of all nests deposited in said rookery over the season belonged to this species. Poaching is still a very real threat to the project and we are unsure of the effects that numerous, unregulated groups of tourists visiting the beach each day are having on the turtles and nests.

The third element to this programme will be to accommodate specialists on the project who will study the terrestrial and marine ecosystems present on the island and will discern how best to preserve them.

Throughout all of the above phases we will invite local school groups to participate and engage with the various aspects of the project, reinforced by creative and informative workshops. All of this we hope to be made possible with the approval of a grant from the CIMB Bank Foundation and help from other collaborators.

METHODOLOGY

Study Area

Our study area consists of three beaches: Turtle Bay, Lang Sari and Summer Bay. They cover a distance of coastline measuring 50 m, 450 m and 500 m respectively on Pulau Lang Tengah, Terengganu, Malaysia. All three beaches are located on the southern side of the island. Both Turtle Bay and Lang Sari are south-facing, but Summer Bay 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, Summer Bay is subjected to high levels of disturbance from light and noise pollution which act as major deterrents to nesting individuals and therefore we consider Turtle Bay and Lang Sari to be the principal nesting beaches on Lang Tengah.

Patrolling

Patrols were conducted hourly by different volunteer groups along each of the beaches, every night from 8 p.m. to 6 a.m. These hourly patrols are used because the general nesting time of green turtles (*Chelonia mydas*) is over an hour long, we can therefore be sure to intercept should any poachers be present and yet space out the patrols enough as to not create too much disturbance on the beach. Any nests found on Lang Sari or Summer Bay were carefully relocated to Turtle Bay, with the depth of the egg chamber and bush/shrub coverage mimicked as closely as possible to the original nest. This was done in order to minimise anthropogenic interference with incubation. Once back on Turtle Bay the nests were marked and were then monitored. Any disturbance to the nests from visible signs of predation such as dug out holes by poachers, water monitor lizards (*Varanus salvator*), crabs or ants/termites were noted. If any predators had penetrated through to the egg chamber the nest was relocated.

Nest monitoring

After 45 days the nest would be inspected every three days to minimise contamination from fungus and infestation from crabs and ants. Again, if there were any signs of infestation, the nest was relocated. 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. Notes were also taken on other developmental aspects, such as unfertilised eggs or underdeveloped embryos.

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 (see Figure 2). If it is not possible to secure the tag between the second and third scale, then it will be secured between the third and fourth. However, the further away from the body of the turtle that the tag is placed, the more likely it is that the tag will detach itself over time (Eckert & Beggs, 2006).

After the turtle has been tagged (if required), then the curved carapace length (CCL) and curved carapace width (CCW) are measured according to the guidelines of Wyneken (2001).

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 individual 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.

Figure 2. A correctly cinched identity tag, placed between the second and third scales. Note that the tag shown has been secured 'upside-down' (Eckert & Beggs, 2006).

RESULTS

Data collection occurred between 1 March and 1 November 2014. We only have complete datasets for 18 nests: 14 green and four hawksbill (Table 1).

47
total turtle landings

The most eggs laid by an individual green turtle was 154 and the fewest was 46. The most eggs laid by a hawksbill turtle was 157 and the fewest was 51. Overall, the average clutch size was 97 eggs (green = 92; hawksbill = 119), producing on average, from the 18 known nests, 67 successful hatchlings (green = 65; hawksbill = 71) – a success rate of 67.81% (green = 69.15%; hawksbill = 63.12%) (see Table 1).

23
total nests

Unusual/anomalous data from Table 1 is notable in the dataset of nest no. 9. This hawksbill nest was laid at low, incoming tide during the full moon. The nest was immediately swamped by the incoming tide and although the nest was relocated once the tide receded, the eggs had been too badly damaged to develop.

In Figure 2. the dataset for nest no. 9 was omitted, as this nest was swamped by sea water immediately after laying and is therefore not representative of the effects that relocation has on hatching success. It can be noted that the success rate of relocated eggs (Lang Sari = 73.36%) was marginally greater than that of undisturbed eggs (Turtle Bay = 70.05%).

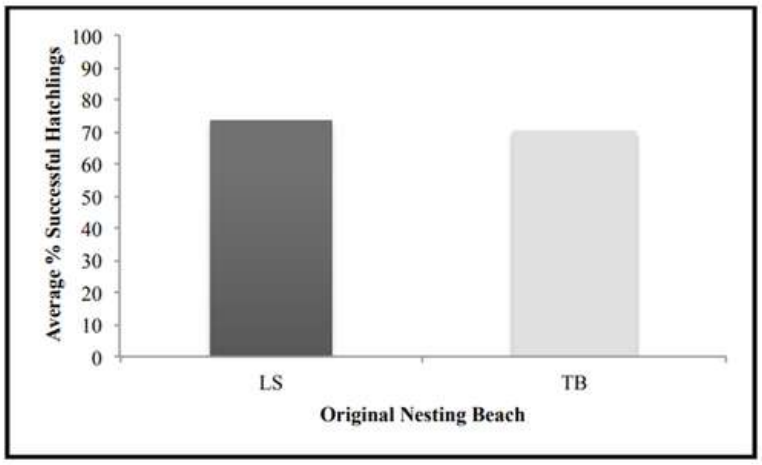

Figure 2. Average success rate of relocated from Lang Sari (LS) and undisturbed eggs in Turtle Bay (TB).

The most prolific month for both landings and nestings was August (N = 15 and N = 6, respectively), with the least occurring in March (N = 2 and N = 1, respectively). We can assume that the nesting season finished by the end of September as there were no landings in October (see Table 1). All hawksbill nests were laid at beginning of the season, between March and June (see Table 1).

Table 1. Nest data for green and hawksbill turtles for Lang Tengah (N/A = data deficient, G = green turtle, H = hawksbill turtle).

Nest No.	Species	Location	Month Laid	No. of Eggs	No. of Released Hatchlings	Success (%)
1	H	Turtle Bay	March	117	112	95.73
2	G	Lang Sari	April	67	53	79.10
3	H	Turtle Bay	April	150	141	94.00
4	G	Turtle Bay	April	79	78	98.73
5	H	Turtle Bay	April	51	32	62.75
6	G	Lang Sari	April	87	76	83.91
7	G	Turtle Bay	May	59	50	84.75
8	G	Turtle Bay	May	46	12	26.09
9	H	Turtle Bay	June	157	0	0.00
10	G	Lang Sari	June	154	101	65.58
11	G	Turtle Bay	June	69	65	94.20
12	G	Lang Sari	July	133	122	91.73
13	G	Lang Sari	July	141	104	65.96
14	G	Lang Sari	July	122	101	82.79
15	G	Lang Sari	August	73	71	97.26
16	G	Turtle Bay	August	96	4	4.17
17	G	Lang Sari	August	68	32	47.06
18	G	Lang Sari	August	126	59	46.83
19	G	Turtle Bay	August	91	N/A	N/A
20	G	Turtle Bay	August	N/A	N/A	N/A
21	G	Lang Sari	September	70	N/A	N/A
22	G	Turtle Bay	September	83	N/A	N/A
23	G	Lang Sari	September	91	N/A	N/A
Average				**97**	**67**	**67.81**
Total				**2,130**	**1,213**	**-**

Over the course of the season we saw 1,213 turtle hatchlings go into the sea (green turtle = 928; hawksbill turtle = 285) from 18 nests. We are missing data from nests 19–23, denoted by 'N/A' in Table 1. This is because we were unable to stay on the island long enough to gather post-hatch data from those nests. If we extrapolate from the success rates of undisturbed and relocated nests over the past season (see Figure 2), using the average amount of eggs per nest for nest no. 20, we can expect a further 308 successful hatchlings to emerge in our absence, bringing the total number of hatchlings for the season to 1,521 individuals.

When analysing the PHI data (see Table 2), it is apparent that the majority of unhatched eggs were not eaten by predators, but were found whole. These whole, undeveloped eggs accounted for 68.9% of our total egg loss this season. The cause of this being a combination of unfertilised eggs (N = 243) and damaged eggs due to the flooding of nest no. 9 by sea water (N = 157) (see Table 2).

Following this, the level of impact from a particular predator in descending order is as follows: crab (N = 76), termite (N = 48), monitor lizard (N = 21), fungus (N = 16), maggot (N = 13) and ant (N = 7). Overall, natural predators account for only 31.1% of total egg losses. Out of the total number of eggs from the 18 known nests, we only lost 10.1% to natural predators.

This season we lost nest no. 15 to poachers, but managed to reclaim it at a later date. We don't know if all the eggs from the original nest were retrieved but the ones that were exhibited a success rate of 97.26% after being relocated to TB (see Table 2). The relocation occurred three days after the initial laying of the eggs. This is the only nest that we are aware of being poached on the island between March and October 2014.

Throughout the season, three new nesting mothers were tagged by Lang Tengah Turtle Watch. Turtle 14G001 was the individual that deposited the most clutches of eggs on Pulau Lang Tengah (see Table 3). She accounted for over a quarter, 25.82%, of all eggs recorded by the project in 2014 (see Table 1 & Table 3). With all her nests achieving high success rates (average 77.82%), she alone accounted for 35.28% of all released hatchlings on the project this season (see Table 1). All tagged nesting females exhibited complete site fidelity, consistently nesting on their chosen beach.

Table 2. Post-hatch inspection data, highlighting the various forms of predation.

Nest No.	No. of Eggs	Total Unhatched Eggs	Complete Eggs	Crab	Ants	Termites	Maggots	Fungus	Monitor Lizard
1	117	5	1	3	-	-	-	1	-
2	67	14	-	1	-	-	-	13	-
3	150	9	2	6	1	-	-	-	-
4	79	1	1	-	-	-	-	-	-
5	51	19	1	17	1	-	-	-	-
6	87	11	4	7	-	-	-	-	-
7	59	9	1	1	2	-	3	2	-
8	46	34	1	10	2	-	-	-	21
9	157	157	157	-	-	-	-	-	-
10	154	53	4	3	-	44	2	-	-
11	69	4	1	3	-	-	-	-	-
12	133	11	5	3	-	3	-	-	-
13	141	37	31	4	-	-	2	-	-
14	122	21	12	6	1	-	2	-	-
15	73	2	-	1	-	1	-	-	-
16	96	92	78	11	-	-	3	-	-
17	68	36	36	-	-	-	-	-	-
18	126	67	66	-	-	-	1	-	-
Total	**1,795**	**582**	**401**	**76**	**7**	**48**	**13**	**16**	**21**

Table 3. Turtle identification data for individuals tagged by Lang Tengah Turtle Watch in 2014.

ID No.	Left Tag	Right Tag	Nests	CCL (cm)	CCW (cm)	Total Eggs
14G001	MY2078	MY2079	10, 12, 13, 14	104.7	98.0	550
14G002	MY2088	MY2089	15, 21	95.5	84.0	143
14G003	MY2085	MY2086	22	90.0	86.0	83

DISCUSSION & RECOMMENDATIONS

Nesting & Predation

The 2014 season saw the first ever documentation of the critically endangered hawksbill turtle nesting on Turtle Bay, Pulau Lang Tengah. In total, hawksbill nests accounted for a third (33.33%) of all turtle nests on Turtle Bay in 2014 (see Table 1) and collectively, individuals deposited a total of 475 eggs. One nest was unfortunately flooded by sea water immediately after laying, which resulted in the destruction of the entire nest. It was thought that this was because the turtle nested during the low, incoming tide of the full moon. By the time the turtle had started to cover the nest the tide had already swamped her and the eggs. Nevertheless, it must be noted that these four nests found on the small, 50-m beach of Turtle Bay represent a large proportion of the total number of hawksbill nests found in Terengganu – in 2013 there were only 27 hawksbill nests throughout Terengganu (WWF Malaysia). To ensure that the nesting habitat of this critically endangered species is preserved it is advisable to award Turtle Bay, Pulau Lang Tengah the status of a Turtle Sanctuary.

The 23 sea turtle nests on Pulau Lang Tengah in 2014 is not a dissimilar number to that recorded in 2013 by the project (25 nests). This is interesting as the general trend of the nesting population throughout the region has been far lower in 2014 than in 2013. On Chagar Hutang in Pulau Redang, the University Malaysia Terengganu site which is managed by the Sea Turtle Research Unit (SEATRU) reported about a 40% reduction in nesting in 2014 compared with 2013 (R. J. Zevenbergen, personal communication, 2014). This fluctuation in breeding population is a natural phenomenon exhibited by sea turtles. This similarity in nesting numbers recorded between 2013 and 2014 either means that the breeding population on Pulau Lang Tengah has remained stable despite the 2014 regional drop in breeding individuals, or it means that not all nests were recorded by the project during the previous year. The latter is more probable, as the recording of data in 2013 did not



not start until mid April. However, this alone would not account for the distinct lack of a discrepancy between the 2014 and 2013 data.

Another reason could be the periodic lack of volunteers over the 2013 season, it must also be remembered that during this time poaching was widely practised on the island and there were potentially more nests lost to poachers than the four that were recorded by the project. Ongoing, consistent research on Pulau Lang Tengah will be able to determine what the cause of this finding is. 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. This also presents a strong case for ensuring that the project is able to continue unhindered through the forthcoming years. This can be greatly aided by denoting Turtle Bay a Turtle Sanctuary.

The poaching activity on Pulau Lang Tengah is important to note and to try and comprehend. Although in 2013 Lang Tengah Turtle Watch was a new organisation on the island (and there had been no prior conservation initiatives present), the attitude towards poaching was relaxed. This could explain why in 2013 we encountered more nests being poached than in 2014. It was found that when nest no. 15 was taken this season, it was when a group of volunteers missed their patrol. This means that the threat of poaching is still very real and they are keeping watch to see if there is ever a break in the patrolling routine of the project and have shown that if there is, they will not hesitate to take the eggs. This shows that the presence of the Lang Tengah Turtle Watch has not stopped the poaching activity on the island, it has merely made the poachers more cautious. More rigorous patrol management must be implemented, perhaps aided by the acquisition of additional members of trained and dedicated staff.

It is intriguing to note that to the contrary of the previous year, the success rates of relocated nests were higher than that of ones left undisturbed. This could be due to many factors. Firstly, we have now identified the ideal nesting sites on Turtle Bay and try to use them for the relocated nests if they are not already occupied by natural, undisturbed nests. A new protocol in the egg relocation procedure may have also lent itself to the increased success rates. This entails noting the original nest depth and bush coverage, both of which are then replicated as closely as possible back on Turtle Bay.

It must also be noted that the success rates of undisturbed nests were greatly reduced by a number of factors – a great number of eggs laid on Turtle Bay were unfertilised, notably nest no. 16 which had 92 eggs unfertilised (95.83% of the nest) (see Table 2.). This instance accounts for over half (53.18%) of all egg losses on Turtle Bay over the 2014 season. The remaining egg loss was due to nests that had succumbed to minor predation, notably nests no. 5 & 8 (see Table 2.). Unfertilised eggs result in an uncontrollable loss of hatchlings, which is not correctable by changing project protocols. Overall, the 243 unfertilised eggs account for 42.11% of all the egg losses in 2014. It is thought that maternal reproductive health can be affected by exposure to chemicals and organochlorines (Bell et al., 2004; Davenport et al., 1990). Indeed, it was noted by Bell et al. (2004) that Rantau Abang, Malaysia, had the lowest fertility rates of female leatherback turtles (*Dermochelys coriacea*) between 1987–1991 compared to other nesting populations around the world.

A new predator became apparent during the 2014 season – termites (see Table 2 & Figure 3). There is currently no literature existing that relates to the predation of sea turtle eggs by termites. This presents the opportunity for an area of interesting, novel research that could be conducted on Pulau Lang Tengah in the 2015 season. 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.

Figure 3. An egg from a nest that had been infected by termites on Turtle Bay.

Tagged Individuals

Although only three individuals were tagged over the course of the 2014 season, they collectively accounted for 30.44% of all nests laid. The most prolific of all was turtle 14G001, who laid a grand total of 550 eggs – contributing to over a quarter (25.82%) of all eggs laid over the season. There were potentially up to 14 individuals which were not able to be tagged, due to a lack of trained personnel. This can be addressed by ensuring that all staff and intern students are properly trained in tagging for the 2015 season.

CONCLUSION

The 2014 season has been an overall success for the project. With increased coverage of nesting turtles, a reduction in the amount of known nests lost to poachers and plans to conduct community outreach programmes. It is a project that has grown remarkably and has developed a meaningful purpose. Issues regarding the continued monitoring of the island's nesting turtle population, potentially novel research topics such as previously unrecorded predators of sea turtle eggs and preserving the nesting habitat of the hawksbill turtle can all be aided by ensuring that Lang Tengah Turtle Watch and Turtle Bay become a new Turtle Sanctuary. This will provide jurisdiction over when, and how many people are allowed onto the beach, to ensure that all visitors are supervised. Placing a sanctuary on the island may also aid in boosting the tourism industry, being noted by more and more travellers who are seeking an 'eco-tourism' holiday. Furthermore, it will mean that Lang Tengah Turtle Watch will be exempt from the annual tender system which is currently needed for the organisation to gain the rights to egg collection on the island. Without this guarantee, there is no assurance that this project, situated on such ecologically rich land, will be able to continue.

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