Marine Turtle Nesting Populations: Peak Island Flatback Turtles, 2015-2016 breeding season




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Cover photographs:

Scenes from the census of flatback turtles, *Natator depressus*, at Peak Island, November - December 2015 and late January 2016. Photo Credits: Lucy Pople

This report should be cited as:

Lucy POPLE, Linda REINHOLD and Colin J. LIMPUS (2016). Marine Turtle Nesting Population: Peak Island Flatback Turtles, 2015-2016 breeding season. Brisbane: Department of Environment and Heritage Protection, Queensland Government. Report produced for the Ecosystem Research and Monitoring Program Advisory Panel as part of Gladstone Ports Corporation's Ecosystem Research and Monitoring Program. 21 pp.

This report has been produced for the Ecosystem Research and Monitoring Program Advisory Panel as part of Gladstone Ports Corporation Ecosystem Research and Monitoring Program. The study was undertaken under a Consultancy Agreement (CA12000291 [130032]) between Gladstone Ports Corporation and the Department of Environment and Heritage Protection to monitor marine turtle nesting at Peak, Curtis and Avoid islands.

This publication has been compiled by the Queensland Department of Environment and Heritage Protection (EHP).

MARINE TURTLE NESTING POPULATIONS: PEAK ISLAND FLATBACK TURTLES, 2015-2016 BREEDING SEASON

Lucy POPLE, Linda REINHOLD and Colin J. LIMPUS

EXECUTIVE SUMMARY

- This report summarises the results of monitoring the eastern Australian flatback turtle nesting population during the 2015-2016 breeding season at Peak Island, an index beach supporting the largest nesting aggregation for flatback turtles within the eastern Australian stock:
  - A total of 207 individual nesting flatback turtles were recorded during the two week census period (24 November – 07 December 2015).
  - A total of 211 clutches of eggs were laid during the two-week census.

- Eastern Australian nesting flatback turtles continue to display a high fidelity to specific nesting beaches with most turtles returning to lay successive clutches of eggs at the same beach between nesting seasons, usually returning on a 2 year remigration interval (mean = 2.7).

- Recruitment of new nesting females into the breeding population during the census period (12.1% of the recorded turtles) appears to be low for flatback turtles.

- These turtles show normal demographic features for the eastern Australian flatback turtle stock:
  - Nesting females had a mean curved carapace length = 94.3 cm with new first-time nesting females being smaller than turtles returning from previous breeding seasons.
  - They laid an average of 51.4 large eggs per clutch with few yolkless or multiyolked eggs.

- No hatchlings were observed emerging during the nesting census in late November/early December.

- 56 nests were excavated to assess incubation success during an eight night hatchling census (27 January – 3 February 2016).

- Incubation and emergence success were lower than the previous two years (mean = 70.0% and 62.4%, respectively).

- A sand temperature data logger buried at a depth of 50 cm in the dune at post 10 was downloaded and re-buried.

MARINE TURTLE NESTING POPULATIONS: PEAK ISLAND FLATBACK TURTLES, 2015-2016 BREEDING SEASON

INTRODUCTION

This report provides a summary of results from monitoring marine turtle nesting at Peak Island during the 2015-2016 breeding season, the third year of study under this contract.

Peak Island, 23.333ºS, 150.933ºE, is a continental island in Keppel Bay and sits approximately 15 km off the mainland coast southwest of Yeppoon in eastern Australia (Figure 1). Tenure of the island is "National Park (Scientific)", which is the strongest level of land management protection under the *Nature Conservation Act* 1992. Peak Island is also surrounded by a one kilometre wide Preservation Zone within the Great Barrier Reef Coast Marine Park and the Great Barrier Reef Marine Park. The area has been managed by the Department of National Parks, Recreation, Sport and Racing (NPRSR) in accordance with the Keppel Bay Islands National Park (Scientific) and adjoining State Waters Management Plan. As a consequence, the turtle nesting habitat of Peak Island and immediately adjacent inter-nesting habitat are managed to provide the highest level of habitat protection available to any turtle nesting population. The island is closed to visitation by the general public and is uninhabited except by the turtle monitoring team during annual monitoring visits. There is no built structure on the island. Peak Island has one nesting beach on its north-western corner that faces westerly towards the mainland, of which only 300 m provide access to sand dunes suitable for turtle nesting. The other accessible sandy beach is on the south-western side of the island, but rocks under the sand at dune level would prevent successful egg chambering.

Peak Island beach was not structurally impacted by cyclonic activity during the 2015-2016 breeding season.

Peak Island supports one of the largest populations of nesting flatback turtles in the east Australian (EA) stock (Limpus *et al*. 2013) and is recognised as an index beach for long term monitoring of flatback turtles within the east Australian stock. Census of the Peak Island flatback turtle nesting population commenced in the 1980-1981 breeding season (Limpus *et al*. 1981).

METHODOLOGY

Standard EHP Threatened Species Unit Turtle Conservation Project methodologies (Limpus *et al*. 1983; Limpus, 1985) were followed for the project. These included:

- Each turtle had a titanium tag (manufactured by Stockbrands Australia) applied in the front left and right flipper tagging positions (Limpus, 1992), generally proximal to the flipper scute closest to the body. If scar tissue from previous tagging made this position unsuitable for tagging, tags were applied distally to this last scute.

- Passive Integrated Transponder (PIT) tags have been used as a second tagging method (Parmenter, 1993) for identification of nesting females at Peak Island since the 2008-2009 breeding season The PIT tags were injected into the upper left (or occasionally right) shoulder (just below the carapace) of nesting females.
- Curved carapace length (CCL ± 0.1 cm) was measured from the skin/carapace junction at the anterior edge of the nuchal scale, along the midline, to the posterior junction of the end post-vertebral scutes at the rear of the carapace using a flexible fibreglass tape measure. Any barnacles living along the midline of the carapace were removed prior to measuring.
- Any damage to the turtle or unusual features were recorded and photographed if possible.
- A nest tag (flagging tape ~20 cm long) with the date of laying and a tag number of the turtle (Limpus, 1985) was placed in the nest during oviposition for most clutches. The nest tag assists in identifying the female that laid the clutch when hatchlings emerge some two months later.
- Some clutches of eggs were counted and ten eggs were selected to represent a cross-section of eggs from top to bottom of the nest. Each of these selected eggs was weighed (± 0.1 g) on a digital balance and measured for maximum and minimum diameter (± 0.01 cm) with vernier callipers. To minimise movement induced mortality of eggs (Limpus *et al*. 1979), all handled eggs were returned to their respective nests within two hours of being laid and with the minimum of rotation.
- The nesting beach was subdivided into 25 m sectors identified by numbered posts.
- Nest locations were recorded using a hand held GPS (global positioning system) unit (± 4 m). Habitat type of the nest location was recorded.
- The level of light disorientation of adult turtles was assessed by measuring from the body pit exit point 15 m along the down track and recording a compass measurement along this line. This bearing was then compared to the bearing perpendicular to the high tide mark, which represents the shortest possible route back to the water.
- The level of light disorientation of hatchling turtles was assessed by measuring from the centre of the nest 5.3 m along the left and right side of the hatchling fan and recording a compass measurement along both of these lines. The average bearing was then compared to the bearing perpendicular to the high tide mark, which represents the shortest possible route back to the water.
- Initially, nests were fanned and dug after a good number of tracks had emerged from them. If only one or two tracks came out, it was assumed that the rest of the clutch would come out later. After we noticed that some of these nests did not have subsequent emergences, we started to mark nests with low numbers of tracks for excavation regardless of a full emergence. These nests did not have fans measured for orientation.
- A sample of 10 hatchlings (+ any live in nest) from emergences found running down the beach were weighed, measured and scale counted.
- A clutch was assessed for incubation and hatchling emergence success by excavating the nest, usually later the same night, or for nests with very few tracks, a day or two after the hatchlings had left the nest. A count was

made of hatched eggs, unhatched eggs with embryos, unhatched eggs with no signs of embryonic development (= undeveloped egg), eggs showing signs of predation by crabs or other animals (= predated egg), live hatchlings trapped in the nest, and dead hatchling within the nest.

  - Estimated clutch count = hatched eggs + unhatched eggs + undeveloped eggs + predated eggs'
  - Incubation success = (hatched eggs ÷ estimated clutch count)*100 %;
  - Emergence success = (hatched eggs – [live + dead hatchlings] ÷ estimated clutch count)*100 %.
  - Counting error, the accuracy of counting broken egg shells = estimated clutch count following hatchling emergence - clutch count made when the eggs were laid.
  - After it was noticed that most nests had hatchlings which had left the eggshell, but had become stuck in the neck of the nest and been either rescued or died of heat, the numbers of these live and dead which had left the eggshell but not successfully emerged from the surface were counted for 20 nests.

- A Minilog II temperature data logger had been buried at a depth of 50cm a couple of metres in front of the Sector 10 post on 26 November 2014, and has been recording continuously at 30 minute intervals since. This data logger was downloaded and re-buried on 31 January 2016.

The planned census of hatchling production in late January 2016 was disrupted. The organised volunteer team withdrew at short notice, resulting in the census period having to be delayed to start after 26th January. With the onset of storms and heavy rain, hatchling tracks required for location of nest sites were obliterated from the beach surface, resulting in nests only being found during the first 7 days/nights of census. Because of the severe weather warnings, Marine Parks management evacuated our monitoring team from the island back to the mainland after only 8 nights on shore.

RESULTS

Tagging census results

A total of 207 nesting flatback turtles were recorded during the two week census period, 24 November – 07 December 2015 (Table 1). No other species of turtle was recorded nesting during this period.

A further three nesting turtles were encountered in late January. Two of these were previously untagged, and one was carrying recent-season tags.

No flatback turtle was recorded with tags that had been recorded nesting at any beach other than Peak Island.

The approximate recruitment rate of first time breeding females into the adult nesting population, as measured by the proportion of first time tagged nesting females, was 12.1% for turtles within the census period and 13.0% if the additional observations of nesting turtles during the hatchling monitoring in January are included.

The mean nightly number of turtles coming ashore for nesting (track count) was 25.71 (sd = 16.615, n = 14, range = 1-66. Table 2). The mean number of different turtles ashore per night was 19.93 (sd = 11.586, n = 14, range = 1-44). The mean number of clutches laid per night was 15.07 (sd = 9.988, n = 14, range = 1-40).

There were 360 recorded flatback turtle nesting crawls during the census period. The frequency distribution of nesting crawls by beach sectors is summarised in Figure 2. Sectors 0-5 are fronted by inter-tidal rocks while above the tidal level, it is a sandy beach. Sectors 14-17 is fronted by extensive inter-tidal rocks which extend to exposed rocks above the high tide level and into the dunes. The majority of the nesting turtles came ashore within sectors 8-15 which were not fronted by inter-tidal rocks. First-time nesters and remigrants nested similarly in these areas. Nesting success, the proportion of nesting crawls that resulted in eggs being laid by the turtle, was 59.3% Nesting success was very low in sectors 14-15 (Figure 2) where the beach and dunes consisted of rocky rubble and relatively low in sectors 0-4.

The mean return interval for a turtle returning to attempt to lay eggs following its return to the sea after an unsuccessful nesting crawl was 0.84 days (sd = 0.843, n = 85, range = 0-4 days). Most females returned to re-attempt nesting on the same night or the following night after an unsuccessful nesting attempt. Turtle were recorded taking up to 4 attempts before successfully laying eggs (n = 60 turtles, mean = 2.5 ± 0.69).

Internesting intervals could be determined for 15 turtles that nested twice during the entire period of monitoring (24 Nov - 7 Dec). Internesting intervals ranged from 10 to 13 days, with the most common interval being 13 days (n = 10; mean = 12.5 ± 0.81).

Size of nesting females

The mean curved carapace length (CCL) of the nesting female flatback turtles (n = 201) was 94.3 cm (±2.8, range 86.1-102.6) (Table 3, Figure 3). Females that were tagged for their first recorded nesting season, presumed first time breeding turtles, were significantly smaller than remigrant turtles with a past breeding history ($F_{1,199}$ = 8.38, 0.05 < p < 0.01).

Remigration

The mean remigration interval, the number of years between recorded breeding seasons, for adult female flatback turtles (n = 180) at Peak Island during the 24 November – 7 December 2015 census period was 2.73 years (±1.16, range 2-7) (Table 3, Figure 4).

Eggs and nests

A total of 211 clutches were laid during the two week census. The number of eggs per clutch, including yolkless and multi-yolked eggs, egg diameters, egg weights and nest depths are summarised in Table 4 and Figure 5. The sampled flatback turtle clutches (n = 40) had on average: 51.4 eggs, 0.135 yolkless eggs and no multi-yolked eggs per clutch; with eggs (n = 27 clutches) averaging 5.2 cm in diameter and weighing 76.5 g. The nests were on average 30.6 cm deep to the top of the eggs and 48.0 cm to the bottom.

Nineteen turtles were observed digging into existing clutches during the observed laying of 211 clutches. This amounts to 8.84% of beachings resulting in clutch destruction. On average, 13.5 eggs were disturbed and killed when a nesting turtle dug into an existing clutch, equivalent to an average loss of 26.25% of a clutch. If extrapolated for the entire season, this should be equivalent to a loss of 1.16 eggs per clutch of eggs laid or 2.32% of the seasonal egg production.

Incubation success and hatchlings

As was observed during the standard 2 week census period in 2014, no clutches were observed producing hatchlings during the nesting census from 24 November – 7 December 2015. In 2013, 18 clutches were observed emerging during the nesting census period, indicating an earlier start to nesting in 2013 compared to the last two nesting seasons.

The trip to assess incubation and emergence success was delayed such that nearly all the clutches laid during the census period had already emerged and data were instead collected from nests laid shortly after the census period. Only two nests had been previously marked and had identification tags in them. Data on incubation success of eggs and emergence success of hatchlings are summarised in Table 5 and Figure 6. The mean incubation success of eggs was 70.0% (± 20.5) and the mean hatchling emergence to the beach surface was 62.4% (± 23.1) of the eggs laid (56 clutches) during 27 January 2015 – 3 February 2016. Of the 56 nests excavated, 34 nests (61%) had dead hatchlings in them and 42 of nests (75%) had either live or dead hatchlings in them. Combined counts of live and dead hatchlings in the nests represented 7.5% of all eggs laid. However, it should be noted that 41 of the nests were excavated on the same night as hatchlings emerged because of concern over hatchlings dying of heat stress. This may have given a somewhat lower estimate of emergence success in comparison to previous years, where nest were not excavated for an additional 24 hours after emergence.

There appears to be some variation in incubation success across sectors (Figure 7), though statistical test results vary based on which sectors are grouped together to provide enough data points for comparisons. For example if Sectors 2-7 and 13-14 are grouped, the result is nearly significant ($F = 2.26$, $df = 55$, $P = 0.053$), but if instead Sector 7 is grouped with Sector 8 the result is significant ($F = 2.64$, $df = 55$, $p = 0.027$). Hatch success was generally higher in sectors 2-6 and widely scattered between sectors 8-10 and higher in sectors 11-12.

This season there were 15.2% of nests laid on the beach or slope and 84.8% in dune habitat. Incubation success varied by habitat type ($F = 4.38$, $df = 55$, $p = 0.004$) and was generally higher in bare sand on the front of the dune slope or on the beach, or under trees in the dune and varied widely on the dunes in bare sand or in the low dune vegetation (Figure 8). There was no. relationship between hatch success and depth to the bottom of the nest ($r^2 = 0.003$, $p = 0.71$).

Delays in commencing the census resulted in the incubation period to emergence of the hatchlings to the beach surface not being quantified this season.

For the seven effective nights of the census, the time of hatchling emergence was recorded. Most emergences occurred after midnight, but on overcast days some hatchlings emerged during the day or earlier in the evening. Six clutches were sampled for weighing, measuring and scale counting of hatchlings found running down the beach. Two of these clutches also had live hatchlings in nest that were sampled.

Hatchling depredation and island fauna

The only evidence of depredation from within the nests was by vegetation growing into the eggs. A few hatchlings on the beach surface had been attacked by crabs and ants. A small spotted python was seen in the dunes on the first night. Although this snake species is a known predator of flatback turtle hatchlings, none were observed taking hatchlings this summer. Potential bird predators of hatchlings recorded during the field studies included beach stone-curlews and white-bellied sea eagles but no bird depredation of hatchlings was recorded. Reef sharks were seen in the shallows in the mornings.

A large cane toad was observed in the dunes on both of the rainy nights.

Sand temperatures

The temperature data logger readings downloaded on 31 January 2016 showed a sharp rise from below to above the pivotal temperature coinciding with the peak of the nesting season (Figure 9). Sand temperatures at 50 cm depth were above the optimal range for incubation for various durations in the month preceding the hatchling census. The entire incubation environment from the peak of the nesting season onwards was above the pivotal temperature of 29.3°C (Limpus 2007). Temperatures ranged from 19.3°C (July) to 33.5° (January). These temperatures are more extreme than at the same time during the preceding season. These sand temperatures at nest depth are indicative of a female biased sex ratio and a lowered incubation success for the 2015-2016 breeding season

Light pollution and orientation of turtles

During the 2014-2015 season night lighting was documented photographically during the census under different lighting conditions (bright moon, no moon etc) and at different times of night (8pm and midnight). The most predominant lighting visible from the nesting beach was from Gladstone, Rockhampton and the Keppell Bay coast (Twaddle et al. 2015). As determined from last season, Sectors 1-9 in the southern part of the nesting beach are shielded from the Gladstone glow by the lower peak of the island. Additionally, nests here are also more likely to be laid on the slope or beach, so have a more direct path to the sea than those laid further back in the dunes. Sectors 10-11 are exposed to both the Gladstone and the Rockhampton glows and Sectors 12-15 are exposed to the lights of the Keppel Coast.

This season, data were collected on orientation of 34 females and 46 hatchlings. Because of the need to analyse data relative to different phases of the moon and under different amounts of cloud cover, statistical analyses using circular statistics will be done in a later report. In brief, the average deviation of the down track relative to the nearest route from the water was 14.8 degrees (±17.1; range -28° to +55°) in west, southwest direction (Figure 10). Hatchling fans had an average spread of 37.5 degrees (± 26.1; range 3° to 118°). Deviation from the shortest direction to the beach averaged 13.2 degrees (± 22.7; range -40° to +85°) in west, southwest direction (Figure 11).

DISCUSSION

Hatch success of 70.0% was lower than in 2013-2014 (76.8%) and 2014-2015 (81.2%), and somewhat lower than the historic mean value of 74.6% reported for 1980-1986 (Limpus 2007). Additionally, incubation and emergence success may have been lower than was recorded, because in the absence of accurately mapped nest sites, only clutches that produce hatchlings to the beach surface are assessed. There is no current measure of the proportion of clutches laid on Peak Island that have a zero hatching success. Because many clutches were dug on the same day that hatchlings were first observed to emerge, the emergence success may be under estimated as some of the hatchling found alive in the nest may have successfully emerged the following evening. The live hatchlings (n = 111) found in the nests represented 6.3% of all hatchlings that had successfully hatched.

It does not appear that the lower incubation success in the 2015-2016 season occurred at specific sectors in specific habitats as most sectors (except sector 14, which only had two nests) and habitats with low incubation success also had high incubation success in several clutches. One factor that needs more attention is the possibility that elevated sand temperatures may have contributed to embryonic death of hatchlings about to emerge. Observations of dead hatchlings near the surface of some nests were what prompted the digging of nests on the same evening of emergence.

Light orientation studies conducted this season indicate a wide range in deviation from the most direct path to the water for both adults and hatchlings. In general, the average deviation suggests a west to southwest direction. Additional data are needed across years prior to conducting analyses using circular statistics to understand the effect that the phase of the moon, extent of cloud cover and location of the nest is having on orientation. These data are needed to quantify the extent to which the ocean finding behaviour of the nesting turtles and their hatchlings are being disrupted by the light polluted horizons visible from Peak Island.

Trends

Limpus *et al*. (2013) have identified a downward trend in population size at Peak Island over recent decades. The number of tagged turtles observed this season is above that observed in 2014 and within the range of the upward trend in numbers observed during 2010-2013 (Figure 12).

The recruitment rate (12.1%) of estimated 1st time nesters (turtles not previously tagged) during the census is the lowest it has been in the past eight years of data collection (Figure 13). This value is towards the bottom of the range reported for flatback turtles nesting at Wild Duck Island and the Woongarra Coast (10-20%) reported in Limpus (2007), and it should continued to be carefully monitored for any further declines, which would be of concern.

ACKNOWLEDGEMENTS

The Peak Island flatback turtle project was conducted as a cooperative project between the Threatened Species Unit, Department of Environment and Heritage Protection and Marine Parks, Department of National Parks, Recreation, Sport and Racing. David Orgill, Oliver Lanyon, Rod McKenzie and Rosslyn Bay QPWS Marine Parks staff provided logistic support before and during the study. This study could not have been completed without the assistance of the Queensland Turtle Conservation volunteers: John van Osta, Elisha Petrie, Nick Goody and Bronah Fahey. This assistance is gratefully acknowledged.

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TABLES and FIGURES

1a. Peak Island and surrounding areas

1b. Peak Island

Figure 1. Maps of Peak Island

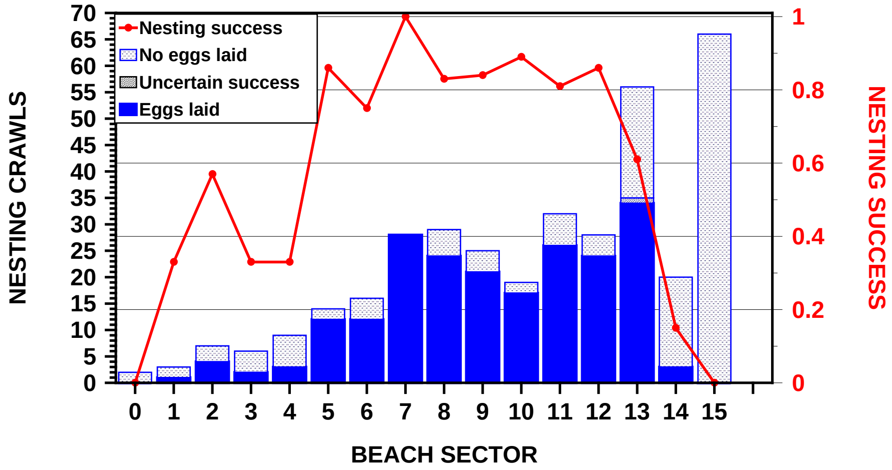

Figure 2. Frequency distribution of flatback turtles, *Natator depressus,* nesting crawls (tracks) and nesting success by beach sectors, Peak Island during 24 November – 7 December 2015.

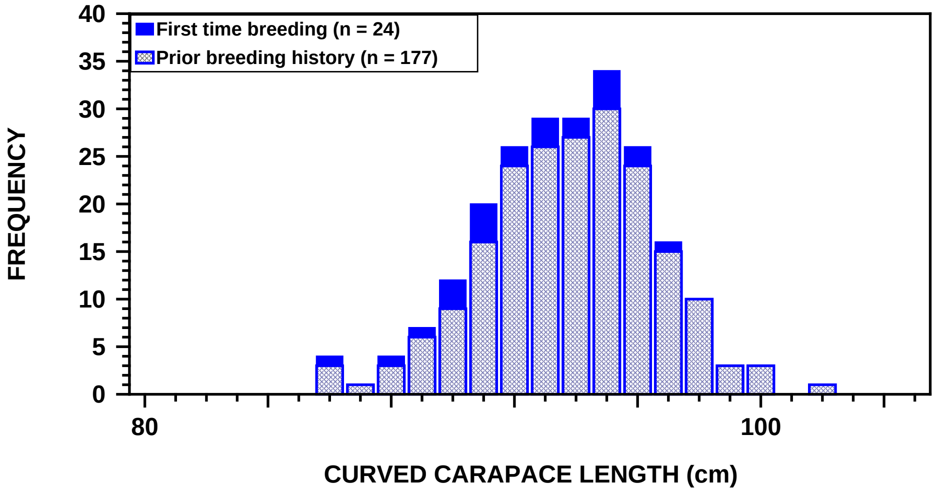

Figure 3. Frequency distribution of curved carapace length by breeding experience of flatback turtles, *Natator depressus*, recorded nesting at Peak Island during the 24 November – 7 December 2015.

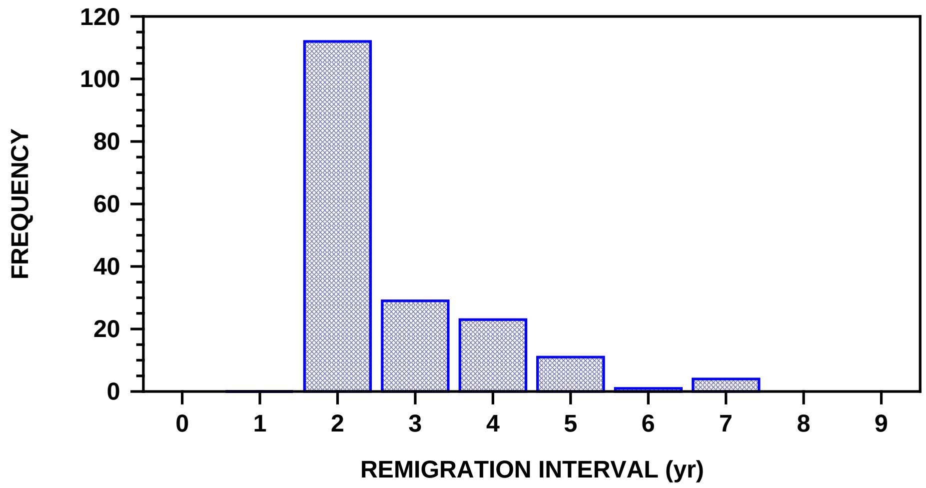

Figure 4. Frequency distribution of the number of years between breeding seasons (remigration interval) of flatback turtles, *Natator depressus*, recorded nesting at Peak Island during the 24 November – 7 December 2015.

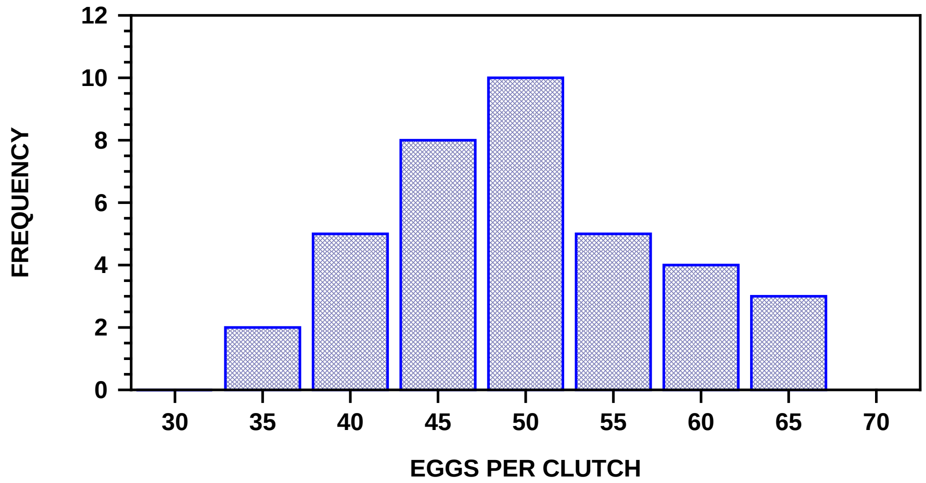

Figure 5. Frequency distribution of the number of eggs per clutch of flatback turtles, *Natator depressus*, recorded nesting at Peak Island during the 24 November – 7 December 2015.

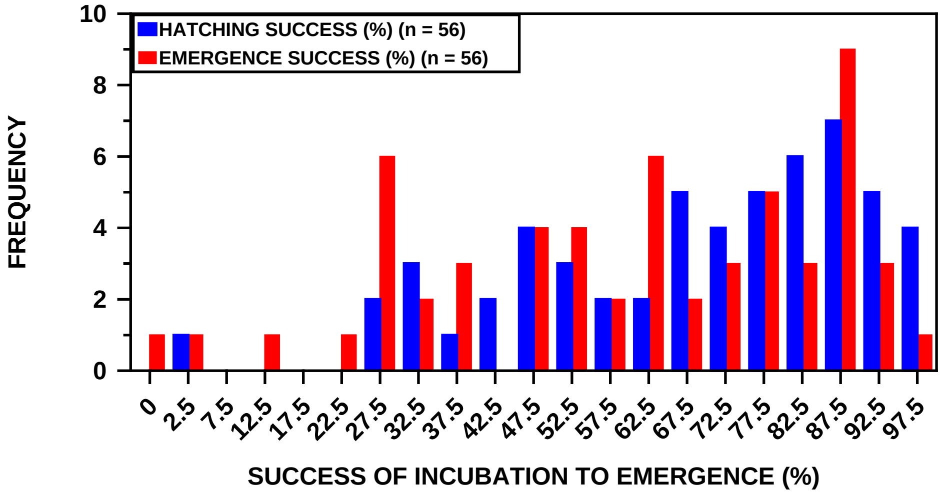

Figure 6. Distribution of the percentage of incubation and emergence success across flatback turtle clutches at Peak Island during the 2015-2016 season.

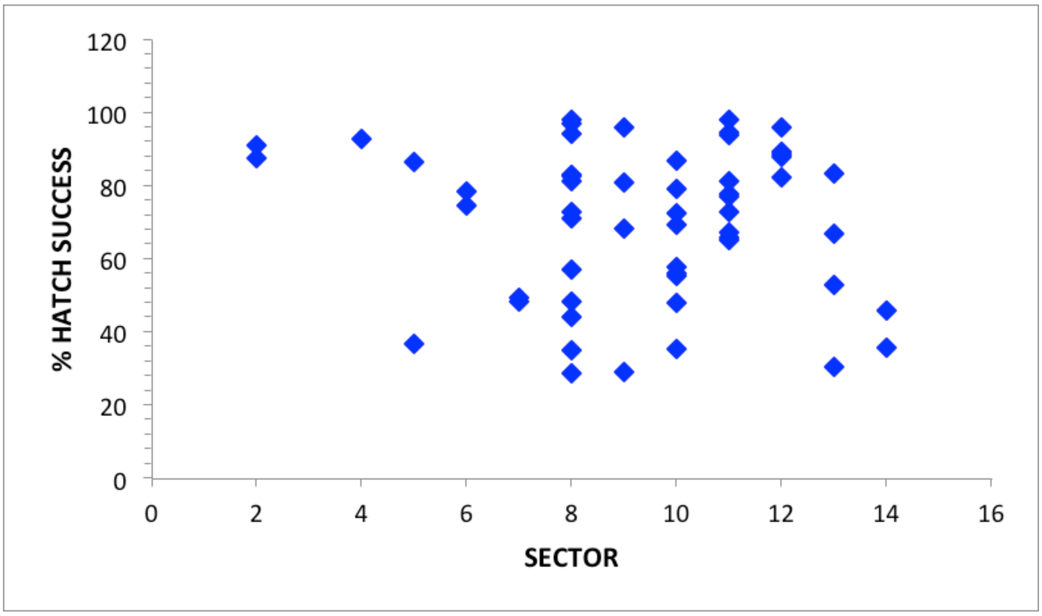

Figure 7. Incubation success by sector at Peak Island flatback turtle, *Natator depressus*, rookery at sectors 2 through 14 during the 2015-2016 season.

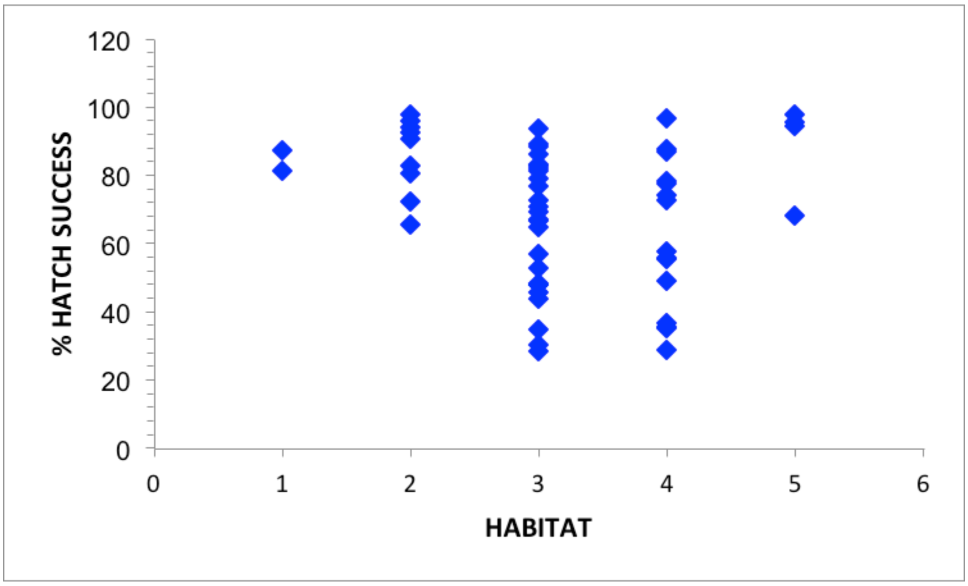

Figure 8. Hatch success by habitat at Peak Island flatback turtle, *Natator depressus*, rookery during the 2015-2016 season. Habitat types are 1 = beach sand; 2 = slope sand; 3 = dune sand; 4 = dune in grass; 5 = dune under tree

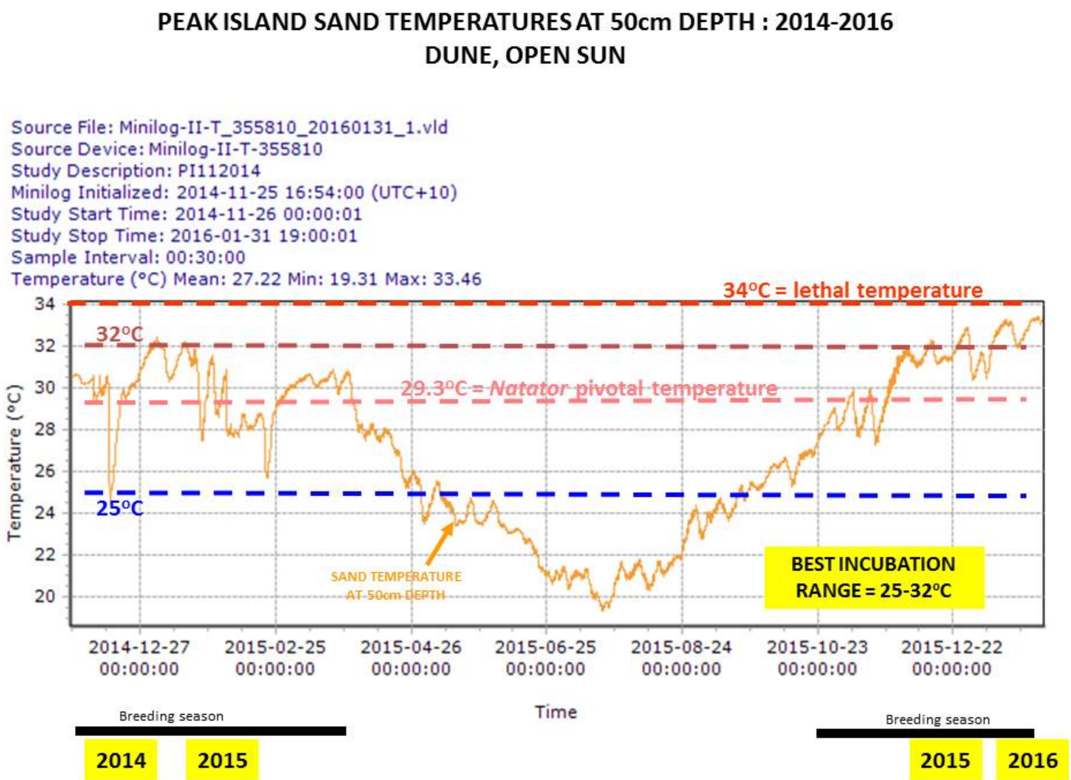

Figure 9. Sand temperature at 50 cm depth from 25 November 2014 – 31 January 2016. The pink line represents the pivotal temperature and the blue and mauve lines represent the suitable temperature range for incubation as reported by Limpus (2007).

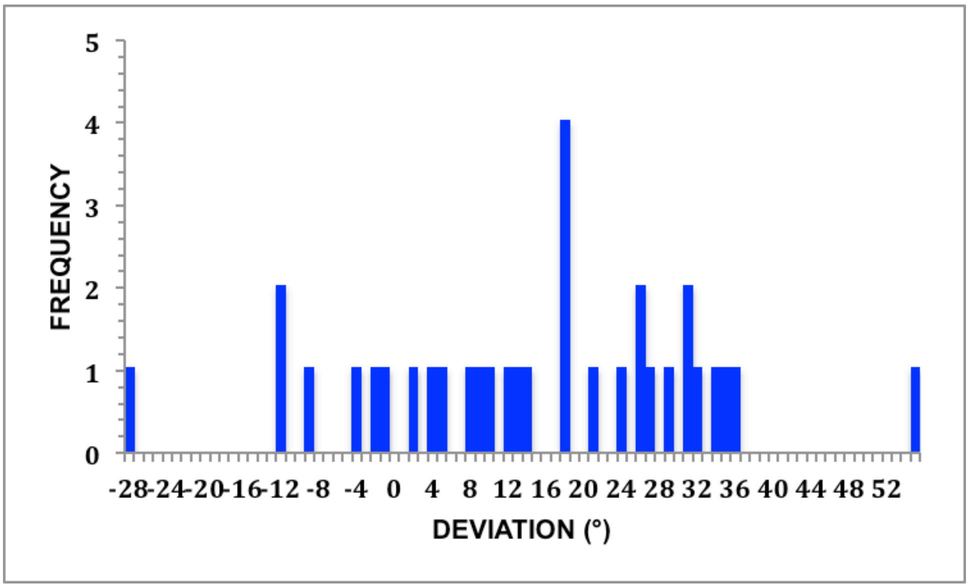

Figure 10. Frequency distribution of the deviation in degrees from the shortest direction to the water by nesting turtles as they return after nesting.

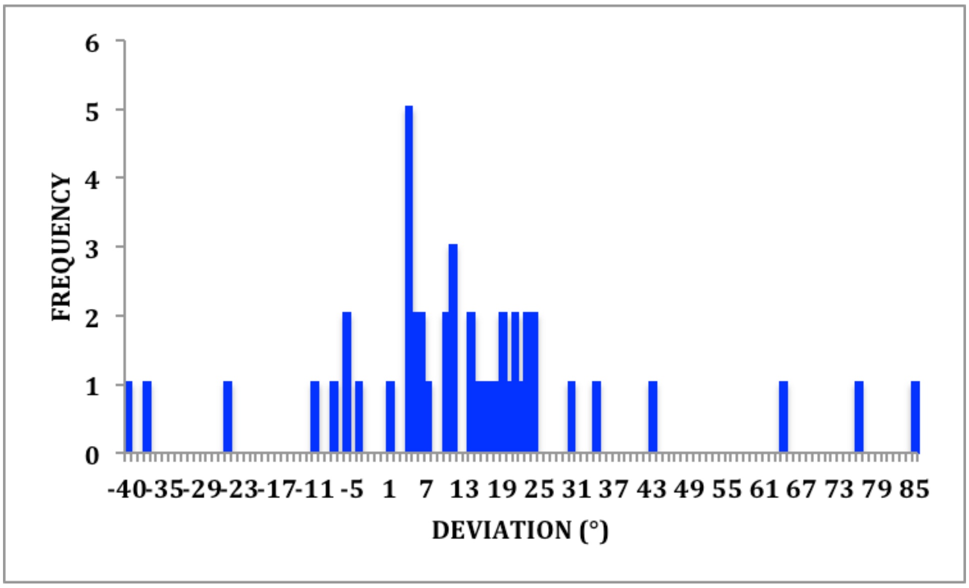

Figure 11. Frequency distribution of the deviation in degrees from the shortest direction to the water by hatchling turtles travelling to the water after emergence.

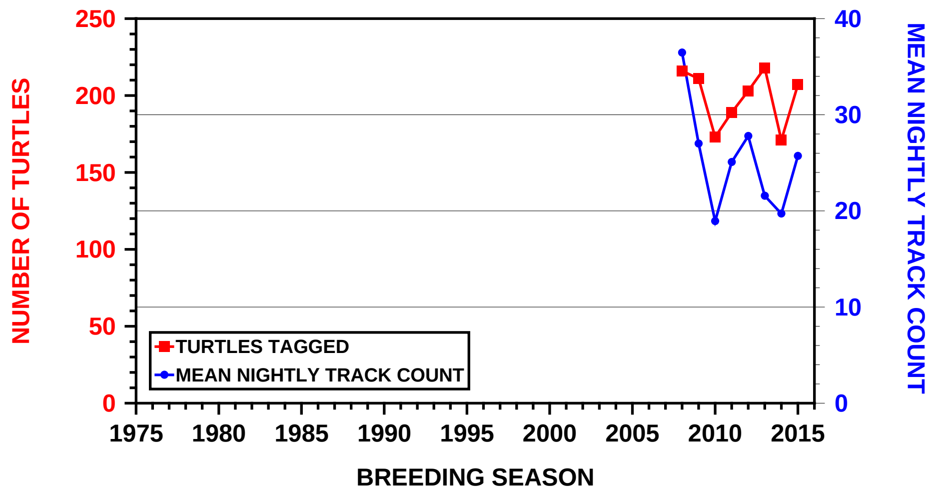

Figure 12. Trends in the number of nesting female flatback turtles, *Natator depressus*, tagged during the annual two-week mid-season census (last week of November – first week of December) and the associated mean number of nesting crawls per night during the same period at Peak Island.

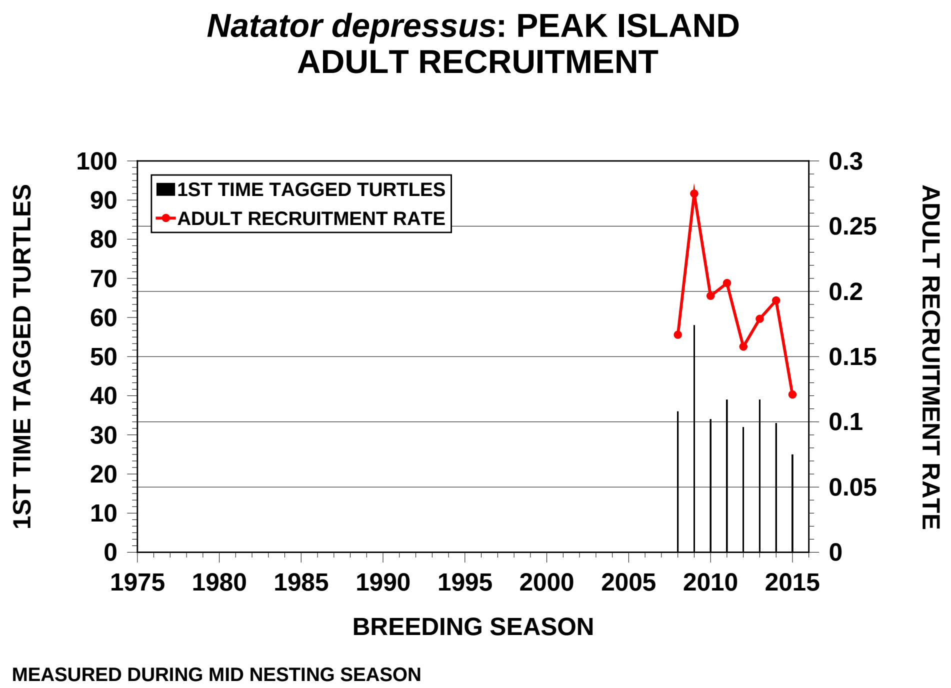

Figure 13. Trend in the annual recruitment of new females joining the flatback turtle, *Natator depressus*, nesting population at Peak Island.

Table 1. Tagging history of flatback turtles, *Natator depressus*, recorded nesting at Peak Island during the standard census period, 24 November – 07 December 2015.

Tagging history of turtles	No. turtles
First time tagged females (Primary tagged turtles)	25
Recaptures from past nesting seasons at Peak Island	
• Recaptured with tags previously recorded at Peak Island	181
• Recaptured with tag scars only, previously applied tags lost	1
TOTAL	**207**

Table 2. Nightly census of nesting flatback turtles, *Natator depressus*, at Peak Island during 24 November – 07 December 2015: track count, clutches laid and clutches of hatchlings emerging.

Date	No. tracks	No. clutches laid	No. clutches of hatchlings emerged
24 Nov	38	20	0
25 Nov	39	17	0
26 Nov	66	40	0
27 Nov	20	16	0
28 Nov	23	17	0
29 Nov	24	12	0
30 Nov	16	11	0
1 Dec	1	0	0
2 Dec	4	2	0
3 Dec	38	25	0
4 Dec	29	17	0
5 Dec	39	19	0
6 Dec	11	7	0
7 Dec	21	9	0

Table 3. Summary of curved carapace measurements and remigration intervals of nesting flatback turtles, *Natator depressus*, at Peak Island during the 25 November – 07 December 2015 census period.

	Mean	Std. Dev.	Minimum	Maximum	Sample size
	CURVED CARAPACE LENGTH (cm)				
1st breeding season (primary taggings)	92.8	2.74	86.2	97.2	24
All remigrant turtles	94.5	2.77	86.1	102.6	176
ALL TURTLES	**94.3**	**2.81**	**86.1**	**102.6**	**201**
	REMIGRATION INTERVAL (yr)				
All remigrant turtles	2.73	1.16	2	7	180

Table 4. Flatback turtle, *Natator depressus*, clutches, and nest descriptions at Peak Island, 2014-2015 breeding season.

	Mean	Std. Dev.	Range	N
Eggs per clutch	51.4	8.2	35-67	38
Yolkless eggs per clutch	0.14	0.48	0-2	37
Multiyolked eggs per clutch	0.0	-	-	37
Nest depth, top (cm)	30.6	7.2	12-47	38
Nest depth, bottom (cm)	48.0	6.5	31-73	37
Egg diameter (mean) (cm)	5.2	0.11	4.89-5.46	259 (26 clutches)
Egg weight (g)	76.5	4.7	63.6-87.3	269 (27 clutches)

Table 5. Incubation and hatchling emergence success and incubation period for Flatback turtle, *Natator depressus* clutches at Peak Island.

	Mean	Std. Dev.	Range	N
Incubation period (oviposition to emergence) (days)	-	-	59	1
Hatching success of eggs (%)	70.0	20.5	28.6 -98.0	56 clutches
Hatchling emergence success (%)	62.4	23.1	13.0-98.0	56 clutches