

Sea Turtle Conservation Research Diego Garcia, British Indian Ocean Territory 20 September – 13 October 2017

Expedition Report



N Esteban¹, G C Hays²

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¹Department of Bioscience, Swansea University

²Centre for Integrative Ecology, Deakin University

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Contents

1. Executive summary	4
2. Introduction and Methods	5
2.1 Satellite tracking of green turtles, <i>Chelonia mydas</i>	5
2.2 Assessment of sea turtle nesting incubation conditions	8
3. Results and discussion	9
3.1 Satellite tracking of green turtles, <i>Chelonia mydas</i>	9
3.2 Assessment of sea turtle nesting incubation conditions	10
3.3 Other sea turtle observations	12
4. References	14
Appendix 1: Nesting turtle patrol details.....	15
Appendix 2: Report of dead turtle, Marina beach	16

1. Executive summary

This scientific expedition to Diego Garcia, British Indian Ocean Territory (BIOT) from 20 September to 13 October 2017 builds on previous conservation research on the ecology of hawksbill and green turtles in the archipelago. The primary objective was to increase understanding of green turtle movements within and outside of BIOT.

1. A presentation on sea turtle conservation research in BIOT took place to a packed audience of 100 military and civilian residents of Diego Garcia.
2. Patrols of a 4 km beach section in South West Diego Garcia were carried out between sunset and sunrise for 19 consecutive nights. Scientists (Hays and Esteban) were assisted by 81 volunteers from all sectors of the community.
3. Fastloc-GPS-Argos satellite tags were attached to five nesting green turtles bringing the total sample size of tracked turtles by the team to 23 green turtles.
4. At the end of the expedition, initial satellite tracking locations showed that three of the turtles were migrating on a south-westerly trajectory towards Madagascar. Two of the turtles remained just offshore of the nesting beach.
5. Green turtle hatchlings were observed emerging from five nests likely laid in late July. Crab predation of hatchlings was recorded: three hatchlings were rescued from ghost crabs on two nights; 41 turtle eggs had been excavated and broken egg shells were found at the top of a large crab burrow.
6. Temperature loggers deployed in June 2015 and containing two years of sand temperature data from different beach zones (shaded and unshaded) and at various turtle nesting depths were recovered.
7. Monitoring of sea turtle nesting activities on the Diego Garcia index beach was validated to provide an updated estimation of hawksbill and green turtles nesting numbers.
8. Monitoring of sea turtle nesting activities on outer islands was organised with the Fisheries Officer.

2. Introduction and Methods

The conservation research objective of this expedition to Diego Garcia was to increase understanding of sea turtle movements within and outside of the British Indian Ocean Territory (BIOT) by attachment of satellite tags to nesting green turtles. Additional objectives were to continue monitoring of turtle nesting activities on the index beach and to recover temperature loggers recording sand temperature to monitor turtle nesting incubation conditions in different zones.

2.1 *Satellite tracking of green turtles, Chelonia mydas*

This expedition contributes to our programme to attach satellite tags to nesting green turtles so that we can continue to assess the extent of their post-nesting migration from Diego Garcia (Figure 1, Hays et al. 2014). At the same time, we will analyse location data at the breeding ground and foraging ground to learn more about space use of green turtles within and outside BIOT, building on previous studies of nesting locations at Diego Garcia (Esteban et al. 2017) and home range of foraging grounds in Great Chagos Bank and further afield (Christiansen et al. 2017).

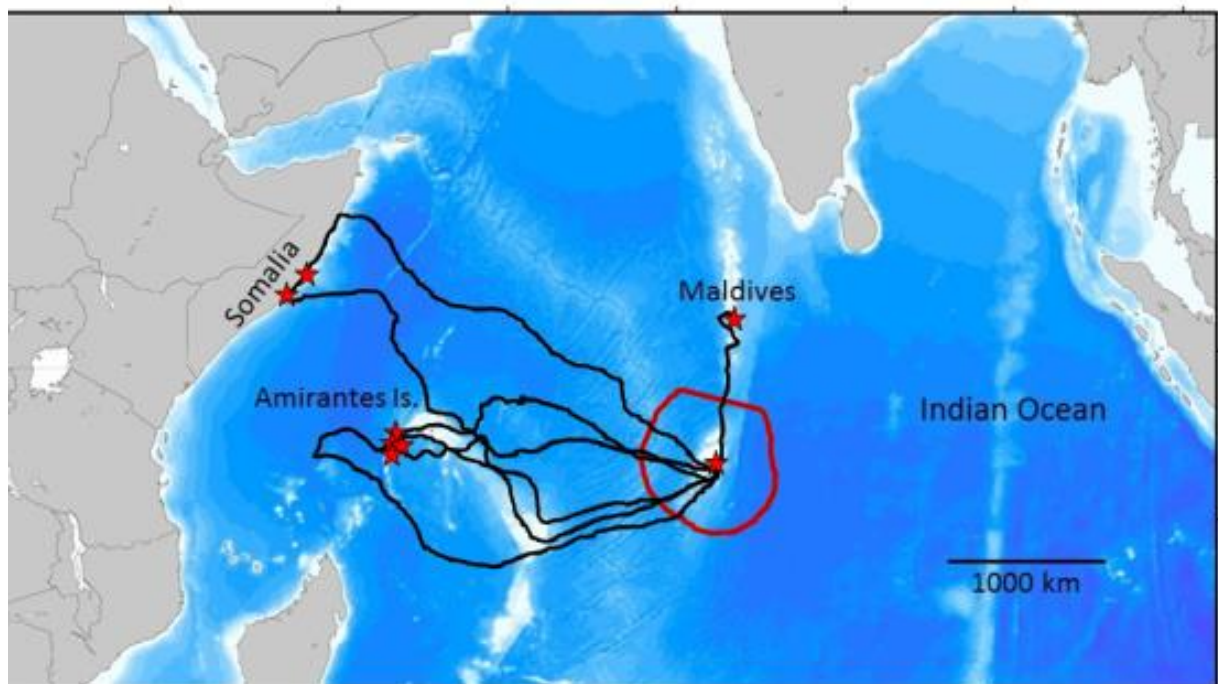


Figure 1. Migration of eight green turtles after nesting on Diego Garcia, 2012

We commenced the expedition with a presentation about sea turtle research in BIOT. The talk was widely publicised via radio, monthly activity schedule and all-personnel emails and we presented to a packed audience of 100 military and civilian residents of Diego Garcia. Enthusiastic attendees even came dressed as turtles (Fig. 2a). A schedule for up to eight people per night was drawn up with people volunteering to assist on the planned nightly beach patrols during the three week expedition.



Figure 2. a) Enthusiastic Royal Marines dressed as turtles for research presentation. b) Volunteers assisting with observing green turtle after satellite tag has been attached using a 2-part epoxy and coated with anti-fouling paint.

We used methodologies previously tested and successful in Diego Garcia (the same satellite tag brand/product, identical attachment methodology), and attached Wildlife Computer Splash-10 Fastloc-GPS satellite tags to green turtles nesting on the beach. Similar to past expeditions (8-26 October 2012, 29 June-21 July 2015), we patrolled beaches in South West Diego Garcia (Figure 3) at night to locate nesting females. A wooden box was placed around each turtle (after nesting) to prevent return to the sea (Fig. 2b). The transmitter was then attached with quick-setting epoxy. Attachment of the tag takes approximately two hours to allow time for epoxy to set after which time the turtle is released. After release of the turtle, all location data are acquired via

Fastloc-GPS location transmissions to the Argos satellite. Locations can be transmitted for 1-2 years.

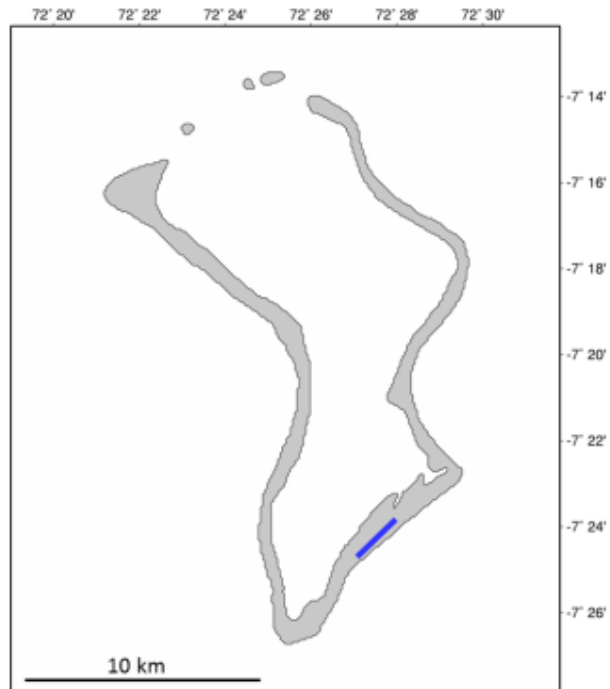


Figure 3. Location of Diego Garcia index beach (2.75 km) selected for satellite tag attachment due to relative high density of recorded turtle nesting track activities.

The timing of satellite attachment to green turtles is critical and the expedition was scheduled during the peak green turtle nesting period on Diego Garcia (September-October) based on nesting data collected in 2012 and 2015 (Figure 4).

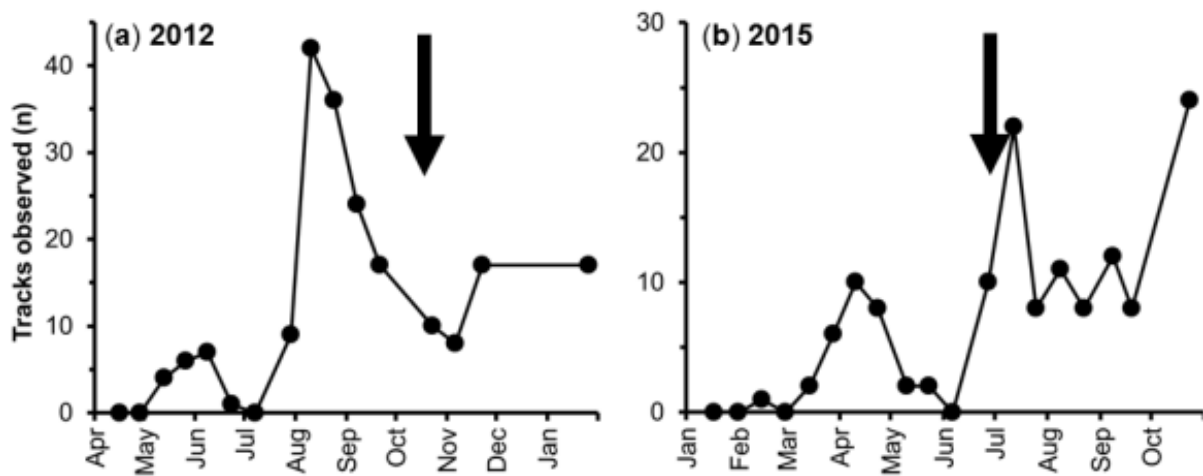


Figure 4. Green turtle nesting tracks observed at Diego Garcia index beach (see Fig. 3) in 2012 and 2015. Timings of previous satellite tag attachment expeditions are indicated with an arrow.

2.2 *Assessment of sea turtle nesting incubation conditions*

Assessment of the temperature of turtle nests in BIOT continues after publication of initial findings in 2016 (see Esteban et al. 2016). Sea turtles exhibit temperature dependent sex determination, so continued measurements of sand temperature will allow us to make informed predictions of the hatchling sex ratio and guide conservation activities for long-term protection of turtles in BIOT in future. We use fully waterproof temperature loggers to measure sand temperature and store data for up to 2 years. We recovered temperature loggers deployed in 2015.

3. Results and discussion

3.1 *Satellite tracking of green turtles, Chelonia mydas*

We were assisted by 81 volunteers from all different sectors of the Diego Garcia community: UK military personnel, US Navy, US Air Force and contractors. Night time surveys of the index nesting beach in Diego Garcia (Fig 3; between the Plantation and Antenna field) were conducted on 19 consecutive nights (see Appendix 1 for dates, times, volunteer names) covering a survey distance of 350 km. Five nesting green turtles were tagged along this stretch of coastline (Table 1).

Table 1. Overview of nesting green turtles tagged with satellite transmitters during September-October 2017.

Release date / time	ID	Name	Biopsy	CCL	CCW	Longitude	Latitude
27/09/2017							
2350 hr	41090	Tulula	BIOT014	111.5	126.0	-7.4157	72.4525
28/09/2017							
0500 hr	41089	Binibining Pagong	BIOT016	97.5	96.0	-7.4185	72.4505
01/10/2017							
0350 hr	41096	April	BIOT017	111.0	116.0	-7.403	72.4649
01/10/2017							
0700 hr	41098	Feisty	BIOT018	115.0	119.0	-7.4156	72.4526
02/10/2017							
0245 hr	41091	Serenity Ham-bone	BIOT019	109.0	117.0	-7.4025	72.4656

By the end of the expedition, three turtles had commenced migration in a south-westerly direction (Fig. 5). Turtles departed early morning from Diego Garcia after nesting the previous evening, exhibiting similar behaviour as documented in 2012-13 (Dujon et al. 2017). Two turtles have remained in shallow waters just offshore of the nesting beach (less than 50 m depth contour) and are continuing to nest approximately every 12 days (As of 1 November 2017. We continue to monitor the movements of all the equipped turtles).

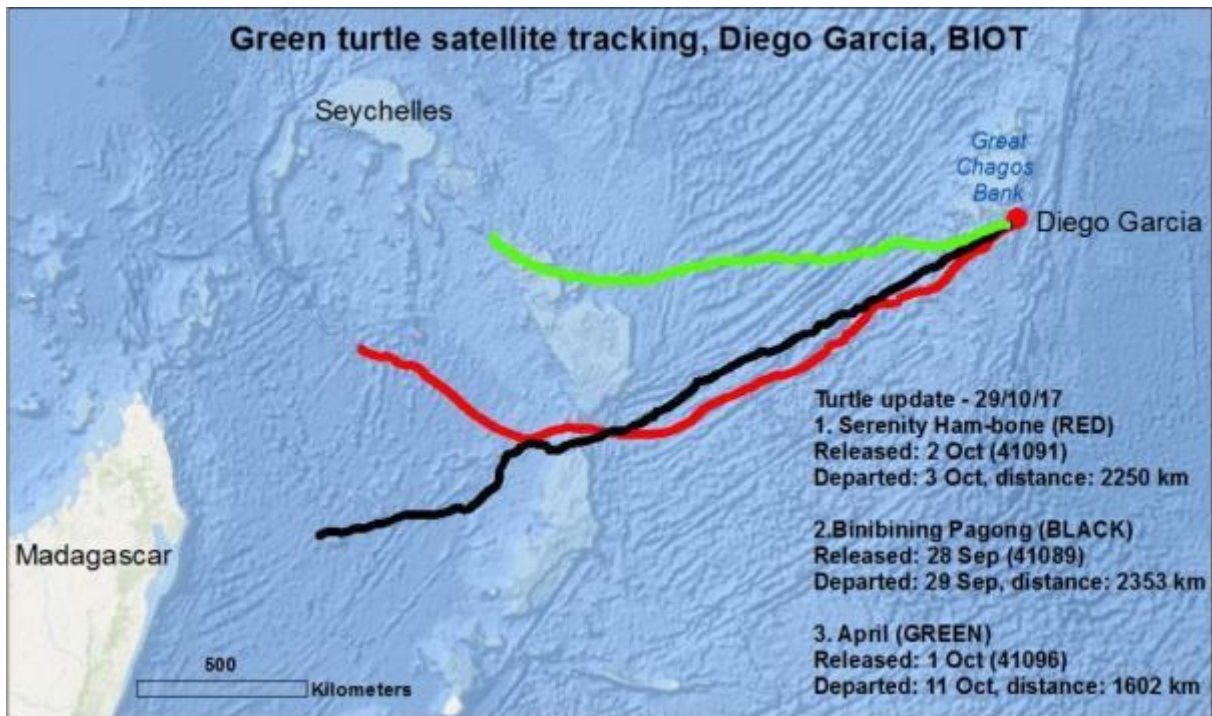


Figure 5. Initial green turtle migration tracks after nesting on Diego Garcia. We continue to monitor the movements of the equipped turtles as they move to their foraging sites. Tracking data will be supplied for up to 2-years after we attached the tags.

Our 2017 results, when viewed alongside tracks from previous years, indicate a very broad range of destinations for the turtle migrations. So we need to track more individuals so the full extent of space use across the Indian Ocean can be gauged and hence the appropriate conservation measures instigated across this ocean basin. So we are aiming to build to a data-base of >30 tracked adult green turtles.

3.2 Assessment of sea turtle nesting incubation conditions

Six temperature loggers (Gemini Tinytag TGP-4017) were excavated from a range of turtle nesting depths in two zones (shaded and unshaded positions) on the beach located at the 18 mile marker seaward side of Diego Garcia. Thanks to the Royal Marines for assistance with digging and locating loggers (Fig. 6). Data will be used for the long-term monitoring study of nesting incubation temperatures.

The recovered loggers provide a wealth of information on sand temperature since their deployment in 2015 (see Figure 7). Initial examination of these data shows relatively cool incubation temperatures that straddled the thermal range where both male and female hatchlings are produced. These cool incubation temperatures are

also likely to maximise hatchling survival in nests (Hays et al. 2017). So these incubation conditions are good news for sea turtles in terms of successful production of high numbers of male and female hatchlings.



Figure 6. Excavation of temperature loggers from partially shaded zone.

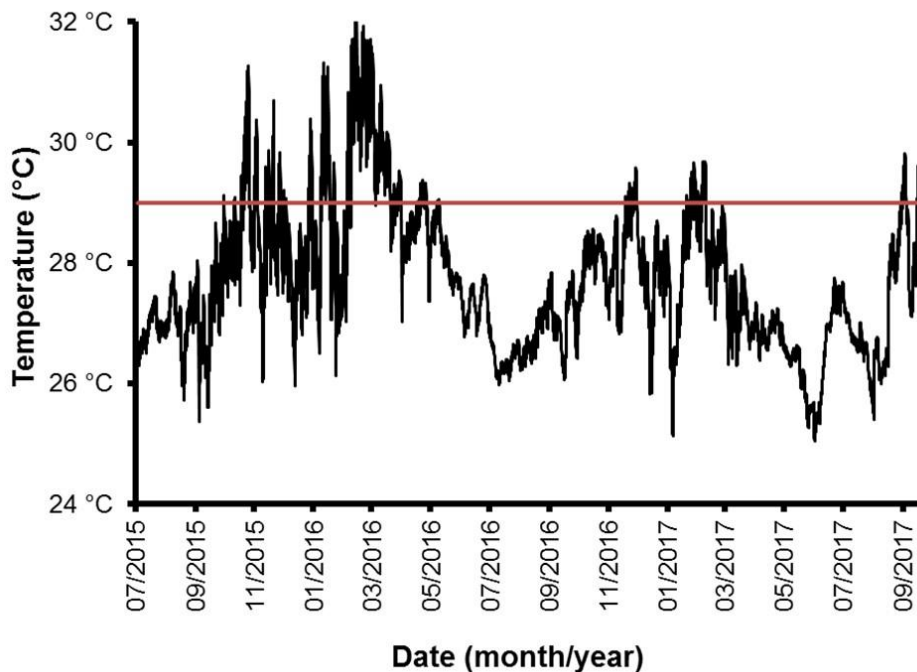


Figure 7. A 2-year record of sand temperature at nests depths on Diego Garcia. The red horizontal line at 29°C is the incubation temperature at which equal numbers of male and female hatchlings are produced. In contrast to many nesting beaches around the world, these relatively cool incubation temperatures at Diego Garcia will ensure both high survival of eggs during incubation as well as the production of both male and female hatchlings.

3.3 *Other sea turtle observations*

1. **Hatchlings:** we observed hatchlings emerging from four nests during the 19 day survey, these hatchling observations were between 1900 – 2400 hr. Additionally, we observed 28 hatchlings emerging from a nest that was disturbed by a green turtle (while digging sand to disguise her nest).
2. **Predation:** we observed predation of eggs and hatchlings on a number of nights. Crab burrows extended to a recently laid nest, recently excavated (fresh) egg shells were found at the surface of two burrows over one nest. Remains of 41 eggs were counted. A number of ghost crabs were observed predated on hatchlings, carrying them back to burrows. We rescued three hatchlings from crabs.
3. **Coastal clean-up:** at the start of our survey (21 September), we observed a crew cleaning up debris (all plastics, other waste) from the beach and around trees and bushes growing between the beach and road. Two weeks later (9 October) after the spring tides, the beach looked like it had not been cleaned and was covered with debris including fishing nets, rope, barrels, tarpaulins, large pieces of Styrofoam, buoys, fenders, plastic bottles, flip flops, and more (Fig. 8). These observations highlight the challenges of keeping the beaches clean as rubbish arrival from distant sites across the Indian Ocean and beyond is likely to be never ending.
4. **Dead turtle report:** we were requested to examine a dead turtle found close to the Marina by the Logistics Officer (see Appendix 2).



Figure 8. Debris accumulation less than three weeks after coastal clean-up.

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Appendix 1: Nesting turtle patrol details

Table A1. Patrols to locate and satellite tag nesting Green Turtles on Diego Garcia were conducted on 19 consecutive nights. 85 volunteers assisted on most nights

Date	Patrol hours	Volunteer #
22-Sep-17	1800-2300; 0100-0330	8
23-Sep-17	1800-1100; 0100-0300	7
24-Sep-17	1800-1100; 0100-0500	8
25-Sep-17	1800-2330; 0130-0630	6
26-Sep-17	1800-2345; 0200-0500	4
27-Sep-17	1800-0630	3
28-Sep-17	1830-0230	4
29-Sep-17	1830-0245	8
30-Sep-17	1830-0700	3
01-Oct-17	1830-0245	3
02-Oct-17	1930-0500	4
03-Oct-17	2200-0500	9
04-Oct-17	2230-0140; 0330-0530	5
05-Oct-17	2300-0200; 0500-0700	3
06-Oct-17	1800-2130; 2300-0230	9
07-Oct-17	1800-2130; 2330-0400	8
08-Oct-17	1800-2100; 2400-0400	3
09-Oct-17	1800-2200; 0600-0830	-
10-Oct-17	1800-2200	1

Appendix 2: Report of dead turtle, Marina beach

A dead turtle was reported to us on 24 September located on the north side of Marina beach at high water level. We were asked to investigate and report the following:

Species: Green turtle (*Chelonia mydas*)

Size: 66 cm Curved Carapace Length (CCL) (estimated) carapace was missing

State: Recently killed, washed up during high water

Cause: Most likely attacked by a shark, causing extensive bite wounds to the rear carapace and body (see Figs A1)



Figure A1. Photos of dead green turtle at Marina Beach, 24 September 2017.