Satellite Tracking of Loggerhead Turtles (*Caretta caretta*) at Ningaloo Marine Park

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Abstract

*The beaches of the Ningaloo coast form part of critical nesting habitat for the West coast population of the nationally endangered loggerhead turtle (*Caretta caretta*). Most research conducted on marine turtles has been carried out on nesting beaches while well over 90% of a turtle's life is spent in the water – feeding, resting, mating, migrating etc. This leaves us with very limited knowledge about conservation needs of marine turtles while at sea. A greater understanding and knowledge of marine turtle habitat use and migratory paths and patterns is becoming increasingly more critical with growth in tourism, aquaculture, and oil and gas exploration and coastal and regional marine conservation reserve planning processes along the North-West shelf. This project aims to gain an understanding of habitat use and migratory paths of breeding* Caretta caretta *marine turtle species from Ningaloo Marine Park. The objectives of the project were: to establish migratory and behavioural patterns for breeding* Caretta caretta *marine turtles; to establish migratory routes and foraging habitats; and to establish use patterns of these different habitats. Nine loggerhead turtles were fitted with KiwiSat Platform Terminal Transmitters (PTTs) following a nesting emergence in the months of December 2007 and January 2008. All PTTs were successfully deployed and four were still transmitting by August 2008. All turtles appeared to have settled into feeding areas at the time of last transmission. The tracked turtles migrated to areas near Shark Bay, 80 Mile Beach, One Arm Point, Timor Sea, Torres Straits and one remained at Ningaloo reef.*

Project description

The loggerhead turtle has been listed as a threatened species under the *WA Wildlife Conservation Act 1950* and identified as endangered under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999*. Western Australia supports one genetic stock of loggerhead turtles with nesting encompassing the Shark Bay to North-Western region including the Ningaloo coast (Baldwin *et al.*, 2003).

Even though WA supports one of the largest nesting populations of loggerhead turtles in the world, this stock is exposed to substantial unquantified losses from a broad range of anthropogenic activities (Limpus, 2002).

The 2003 "Recovery Plan for Australia" (Commonwealth) identified steps necessary to reduce threats on marine turtles to allow for the national recovery of all marine turtles. Specific objectives of the plan include "*to identify and protect habitats that are critical for the survival of marine turtles*" (p.10; item C). Habitats were categorised as: natal beach, mating, inter-nesting, feeding and pelagic.

Little is known about feeding habitats of loggerhead turtles at Ningaloo Marine Park (Carter, unpublished). In a review of loggerhead populations in the Indian Ocean, Baldwin *et al*. (2003) identified, amongst others the following management related research needs:

- benchmark aquatic habitats and feeding grounds; and
- more detailed information on dispersal from nesting beaches and on migration routes.

A greater understanding and knowledge of marine turtle habitat use and migratory paths and patterns is becoming increasingly more critical with growth in tourism within the reserves and oil exploration just outside its boundaries. The current development of a Visitor Services Plan for Ningaloo Marine Park will require considerable knowledge of all marine habitats used by marine turtles in the reserve to ensure that incompatible activities are not focused into significant marine turtle habitats and conflicting uses can be separated.

Research into the behaviour and life cycle of marine turtles has taught us that these creatures do not generally nest and feed in the same area. We now know that marine turtles are highly migratory, often travelling hundreds of even thousands of kilometres between the beaches where they lay their eggs and the foraging (feeding) grounds where they spend much of their time at sea (http://www.cccturtle.org/satellitetracking.php?page=satintro).

Most research conducted on marine turtles has been carried out on nesting beaches while well over 90% of a turtle's life is spent in the water – feeding, resting, mating, migrating etc. This leaves us with very limited knowledge about conservation needs of marine turtles while at sea. For instance, Zbinden *et al.* (2007) used satellite telemetry data to assess the efficacy of two zones of marine reserves (i.e. boat exclusion areas) in relation to internesting area use of four loggerhead turtles nesting in the Bay of Laganas (Zakynthos, Greece). Hawkes *et al.* (2006) used satellite tracking to investigate the migratory movements of adult female loggerhead marine

turtles from one of the world's largest nesting aggregations at Cape Verde, West Africa, and found that adults displayed two distinct foraging strategies that appear to be linked to body size. The conservation findings of this were profound, with the population compartmentalized into habitats that may be differently impacted by fishery threats.

The technology of satellite telemetry has become useful and important in protecting marine turtles and their habitats. Satellite telemetry provides the means to monitor the movement and behavioural patterns of multiple turtles for a year or more at great distances (Eckert 1999). Satellite telemetry (following an object on the earth with the use of orbiting satellites) has advanced to the stage of allowing researchers to track turtles in the open ocean after attaching a Platform Terminal Transmitter (PTT) to the back of a marine turtle.

This project aims to gain an understanding of habitat use and migratory paths of breeding Caretta caretta marine turtle species from Ningaloo Marine Park and beyond. The objectives of the project were:

1. to establish migratory and behavioural patterns for breeding *Caretta caretta* marine turtles;
2. to establish migratory routes and foraging habitats;
3. to establish use patterns of these different habitats;

Current findings and their implications for management

The PTTs for this project were programmed for a 24 hours/day transmission with a 40 second repetition rate. The KiwiSat PTT should thus operate for 245 days continuously, however, the salt water switch will turn the PTT off when underwater and save power so the actual life will be in excess of a year.

Nine KiwiSat 101 PTT were applied to the carapace of female *Caretta caretta* following their nesting emergence on a beach in Cape Range National Park between 17 December 2008 and 24 January 2008. Details of their morphology are provided in Table 1 below. All turtles were flipper tagged under DEC's Western Australian Marine Turtle Program. A general health and condition assessment was made of individual turtles prior to the attachment of the PTT using an industrial epoxy glue, Powerfast®. Three loggerhead turtles were deemed unsuitable due to either heavy barnacle loading at the preferred attachment site or due to injury.

Knowledge transfer

The knowledge gained from this project will be provided to government agencies and marine resource managers primarily in form of a technical report and GIS data layer with metadata.

The project itself is hosted on seaturtle.org and any fellow marine turtle researcher can access the project outline and basic track maps. Further knowledge may be developed by researchers seeking to investigate the foraging grounds identified.

This project involved local community members in the application of the satellite tags to foster greater stewardship for the needs of marine turtles found along the Ningaloo coast.

Publicity has already been generated through two separate press releases, one at the local level and a second through Perth. The media releases led to on feature on WIN News, two radio interviews (ABC Regional and ABC Perth), an article in the West Australian, the regional paper, and two local papers.

The information gained has been relayed to relevant researchers and managers at a Workshop for remote area scientists and managers attended by the Principal Investigator. The follow up lead to contacts with Geoscience Australia and CSIRO in regards to Commonwealth Regional Planning for the North-West shelf.

Satellite tracking information is made publicly available to all interested stakeholders on www.seaturtle.org and the Ningaloo Turtle Program website www.ningalooturtles.org. A link to the website has also been provided to the DEC Marine Policy and Planning Branch to be considered as part of the development of new marine protected areas off the Pilbara coast.

Next stage

As the PTT are still transmitting, the analysis of the data will commence once the last transmission has ceased and no

Table 1.

Details of PTT KiwiSat101 PTTs deployment at Cape Range, Ningaloo Marine Park

No.	PTT ID no.	Turtle name	CCL (cm)	CC Width (cm)	Date of deployment	Transmission (days)	Distance travelled (km)	Straight line distance	Reference to nearest known location(s)
1	76031	Kate	96.5	81.5	11/01/2007	111	99	51	Jurabi Point, North-West Cape
2	76032	Susie	89.8	76.7	12/01/2008	57	1282	1097	Lacepede Island
3	76033	Lindsay	92.0	83.6	12/01/2008	221	4076	1616	150km east of Ashmore Reef
4	76034	Nicki	96.7	88.1	24/01/2008	203	3509	3203	100km north-east Cape York
5	76035	Claire	97.5	84.1	12/01/2008	213	447	431	South-eastern end of Dirk Hartog Is
6	76036	Jacqueline	94.5	85.5	19/01/2008	133	934	833	Northern end of 80 Mile beach
7	76037	Brooke	104.0	90.5	17/12/2007	242	1295	373	Cape Peron, Shark Bay
8	76038	Jen	97.5	85.0	19/01/2008	154	2903	2085	Timor Sea, 200km off Bathurst Is
9	76039	Naysa	97.8	87.5	21/12/2007	176	1135	682	Cape Keraudren, 80 Mile beach

Figure 1.

Map depicting the migratory routes and current locations of the nine tracked Caretta caretta *(as of 19/08/08)*

further signals are recorded for a period of two months. Due to fouling of the salt water switch by algae and subsequent removal during foraging behaviour, several PTTs had ceased transmitting only to become active again after several weeks. A project report will be prepared and distributed to funding providers. It is anticipated that a manuscript will be prepared for presentation at the International Turtle Symposium in Brisbane (February 2009) and scientific publication.

Little is known about the offshore habitats off the North-west shelf that appear to make up foraging grounds of the female loggerheads. Spatial information about the foraging grounds will provide researchers with areas to target for future habitat assessments.

When comparing this dataset with other tagging projects, some marine turtle foraging area hotspots may be identified. For instance, there are now three different species of marine turtles (*Natator depressor*, *Chelonia mydas* and *Caretta caretta*) that appear to favour an area off Roebuck Bay and to the north-east of 80 Mile beach.

The Commonwealth Department of Environment, Heritage, Water and the Arts is currently in Regional Marine Planning process and are seeking data indicating critical habitats that may require some form of management control.

There are numerous offshore gas and oil projects under investigation on the North-West shelf, Timor Sea and Gulf of Bonaparte. An understanding of habitat and migratory routes of *Caretta caretta* will allow decision-makers to consider their needs in relation to an expanding resource industry.

Acknowledgements

- Ningaloo Turtle Program volunteers
- Dr Michael Coyne and Dr B Godley from www.seaturtle.org
- Dr Scott Whiting, Department of Natural Resources, Environment and the Arts
- Dr Kellie Pendoley, Pendoley Environmental Pty Ltd
- Commonwealth Department of Environment, Heritage, Water and the Arts
- Kevin Lay, Sirtrack Ltd

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