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CHANGE OF PERSPECTIVE: USING AERIAL SURVEYS TO IDENTIFY HUMAN-TURTLE INTERACTIONS IN THE NINGALOO MARINE PARK

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ABSTRACT

Shore-based turtle tourism is emerging as a popular activity for independent travellers during the summer months in the Ningaloo Marine Park, yet little is known about the spatial extent of human-turtle interactions and their impact on nesting marine turtle species in the area. Aerial survey techniques in conjunction with Geographic Information Systems (GIS) can provide useful tools for identifying potential ‘interaction hotspots’ where management of human-turtle interactions is required. This paper explores the application of aerial surveys that quantify both tourist activity and turtle nesting activity along the Ningaloo Marine Park coast in Western Australia.

Keywords: Aerial surveys, GIS monitoring, sustainable wildlife tourism management, marine turtles, wildlife interactions.
INTRODUCTION

In Australia, tourism based on viewing and interacting with coastal and marine wildlife is considered one of the fastest growing tourism sectors (Birtles, Valentine & Curnock, 2001; Orams, 2001; Reynolds & Braithwaite, 2001; Page & Dowling, 2002; Higginbottom, 2004; Newsome, Dowling, & Moore, 2005). The value of shore-based turtle tourism has been demonstrated by the large numbers of visitors to Mon Repos Conservation Park and Heron Island National Park. These two relatively small beaches in the southern Great Barrier Reef attract as many as 35,000 visitors each year during the summer (Tisdell and Wilson, 2001).

Shore-based turtle tourism is also becoming popular in the Ningaloo Marine Park in Western Australia. Of the six species of marine turtles found in Western Australia, loggerhead (Caretta caretta), hawksbill (Eretmochelys imbricata) and green (Chelonia mydas) turtles are known to nest on the beaches of the Ningaloo Mark Park and represent a significant breeding population worldwide (Preen, Marsh, Lawler, Prince & Shepherd, 1997; Prince, 2000; Limpus & Chatto, 2004). Although independent travellers have been watching nesting turtles incidentally for decades, there has been little management or guidance to prevent impacts from tourism. The main impacts from tourist activities include the use of artificial lighting on nesting beaches, which disrupts critical behaviours, including nest-site choice and nocturnal nesting behaviour (Lutcavage, Plotkin, Witherington & Lutz, 1997) and off-road beach traffic, which can destroy nests, crush hatchlings as they transverse the beach and create deep wheel ruts that present a barrier to hatchlings attempting to reach the ocean (Hosier, Kochhar & Thayer, 1981; Cox, Percival & Colwell, 1994). As tourist activity in the Ningaloo region increases (CALM, 2005), there is concern among the Department of Environment and Conservation (DEC) managers, scientists and wildlife conservation NGOs that human-turtle interactions will impact on the ecological integrity of nesting marine turtle species.
Fundamental to achieving sustainable wildlife tourism is ensuring that the wildlife is not adversely impacted by tourism. Monitoring is essential for managers who are increasingly required to report on the outcomes of their activities, which includes collecting data on the target species and visitors seeking wildlife (Pitts & Smith 1993; Newsome, Moore & Dowling, 2002). In the case of turtle tourism in the Ningaloo region, there remains inadequate baseline data on marine turtles and visitor distribution for controlling access and tourist behaviour at important turtle nesting sites.

In wildlife management applications, a central role of Geographical Information System (GIS) techniques has been to associate landscape features with ecological-spatial attributes to identify suitable habitat that may be threatened by human activities (Congalton & Green, 1995; Griffiths, Lee & Eversham, 2002). GIS applications in wildlife management include recording the distribution of animals, such as whales, dugongs and turtles using aerial surveys (Preen, Marsh, Lawler, Prince & Shepherd, 1997). The data collected in aerial surveys can then be used as a geographical layer over other resource areas, such as tourism facilities and activity. GIS applications for tourism are often related to tourism marketing and information technology linked with mass tourism (McAdam, 1999; Van der Knaap, 1999) and destination-based tourism information management systems (e.g. maps and websites) (Porter & Tarrant, 2001). However, there is a paucity of studies that quantify tourist and wildlife distributions for the purpose of identifying potential impact sites or ‘interaction hotspots’.

This paper is part of a broader study that explores the development of sustainable turtle tourism in the Ningaloo region and includes investigating impacts of human-turtle interactions. This paper explores the use of aerial surveys, as a first step, to identify ‘interaction hotspots’ where levels of tourist activity spatially coincide with important turtle nesting sites along the Ningaloo Marine Park coast. More detailed on-site studies were undertaken at these ‘interaction hotspots’ to determine the level of impact associated with each interaction (see Waayers, Newsome & Lee, 2006).
METHODS

Six aerial surveys were conducted along the coastline of the Ningaloo Marine Park in 2001-02 and 2002-03 nesting seasons. The survey area covered 300km of the Ningaloo Marine Park coastline between Bundegi and Amherst Point including the Muiron and Sunday Islands. The survey area was divided into 15 sections representing different areas of management, tenure and geographical boundaries.

The duration of each flight were approximately four hours commencing at approximately 5:30am, to take advantage of the angle of the sun and mild wind conditions. At low angles, the sun cast shadows across the tracks and made them more visible from the air. Light winds during the surveys meant there was minimal erosion of the tracks before each survey. A two-seated Cessna 175 aircraft was used to follow the shape of the coastline from north to south to use the prevailing south-west headwinds to maintain low aircraft speeds. The aircraft was positioned 45 degrees from the high tide mark on the ocean side at an altitude ranging between 85 – 130m. The most effective aircraft speed varied between 80 - 100 knots, depending on the density of turtle tracks, wind speed and direction of wind.

A digital video camera was used to record turtle tracks, beach traffic and human footprints from indentations in the sand. A Global Positioning System (GPS) (Garman 12) was used to record the position of the track(s) on the beach.

Turtle tracks

The methods used to record turtle tracks were modified from aerial surveys undertaken in Australia (Chatto, 1997; Pendoley, 2005) and America (Schroeder & Murphy, 1999). A ‘turtle track’ represents a nesting attempt or emergence of a female turtle and does not necessary constitute a successful nest or a clutch of eggs. The survey dates corresponded with optimal tidal conditions, which are tides that are
high as night falls. The high tide at sunset cleared all turtle tracks from the previous night. Fresh tracks created after the tide receded were visible between the previous high tide mark and the water line at the time of the survey.

**Tourist activity**

The length of beach with vehicle tracks and footprints on the beach were estimated by recording the GPS positions at either end of the imprints. The proportion of the length of the beach with vehicle tracks and footprints was calculated and the locations of off-road vehicle access to the beach were recorded.

The length of beach and density of tracks were used to measure the extent of beach used by off-road vehicles. Off-road vehicles include four-wheel-drives (4WD’s), motorbikes and quad-bikes (which are often used in Coral Bay as a common form of transportation). The densities of vehicle tracks were recorded by observing the closeness and overlap of tracks. The following categories were developed to represent the varying density of vehicle tracks:

- High density: tracks overlapping and covering the beach (>10 tracks)
- Medium density: tracks that do not overlap but cover some of the beach (3–10 tracks)
- Low density: evidence of one or two vehicle tracks along the beach

The spatial distribution human footprints were recorded as a surrogate measure of human presence on beaches. Areas of high densities of footprints were identified and the proportion of footprints recorded over the entire survey area was calculated. Although the length and density of footprints does not depict turtle watchers, it does isolate specific areas where turtle tourism activity may be occurring. Areas containing high densities of footprints were ground-truthed to confirm the presence of turtle watchers. The densities of footprints were estimated using the following categories:
• High density: areas were characterised by overlapping footprints covering the area between the high tide mark and the fringing vegetation

• Medium density: areas were not overlapping but covered the beach area

• Low density: areas were characterised by sparsely spaced footprints in the sand (i.e. no more than three people walked along the beach).

RESULTS

Seventeen percent of beaches along the Ningaloo Marine Park had evidence of off-road vehicle activity. The greatest length of beach used by off-road vehicles was recorded at Graveyards, Bateman’s Bay, Cloates and Bundera. The highest density of tracks was recorded at Bateman’s Bay, with Bundegi, Jane’s Bay and Coral Bay comprising medium densities. The vehicle tracks were mostly located in the critical nesting area on the beach, which is generally along the higher portion of the beach near the vegetation.

A total of 10% of beaches had evidence of human footprints. The greatest lengths of beach with footprints were recorded Bungelup, Jurabi, and Lighthouse. The density of footprints was greatest at Jurabi, Bundegi and Coral Bay. The footprints recorded at Bundegi and Coral Bay were from daytime users rather than turtle watchers, while footprints recorded at Jurabi were likely to be from turtle watchers.

CONCLUSIONS AND IMPLICATIONS

The aerial surveys proved to be an affective technique for identifying ‘interaction hotspots’ along the Ningaloo Marine Park coast. The results confirmed that off-road vehicle access to Bateman’s Bay, which is 5km north of Coral Bay, needed to be restricted during the nesting season and monitored to prevent further destruction of nests and hatchlings. The majority of off-road vehicle tracks were on the higher section of the beach, which was identified as being prime nesting habitat for turtles in the Ningaloo region (Waayers, in prep). The surveys also confirmed that most
visitors walking the beaches were in the Jurabi Coastal Park (15km west of Exmouth). To ascertain whether these sites were used by turtle watchers, on-site studies were conducted as part of the broader PhD project. The on-site studies indicated that up to 37% of interactions resulted in disturbance, which caused the turtle to return to the ocean without laying eggs (Waayers, Newsome & Lee, 2006). Most of the footprints in Bungelup were recorded at Turquoise Bay, which is a popular day-use destination for visitors.

Data collected from the aerial surveys was used by the DEC to allocate resources to these areas. To prevent off-road traffic at nesting beaches along the Ningaloo Marine Park, fencing and educational signs were installed at access points in conjunction with an educational programme that targeted the local community and tour operators based in Exmouth and Coral Bay. An interpretation facility (i.e. the Jurabi Turtle Centre) was also constructed in the Jurabi Coastal Park to direct the majority of visitors to a designated tourism node that provides education and guiding (Waayers, in prep). The methods used in this study are also applicable to similar wildlife interactions, such as coastal and offshore wildlife tourism operations (e.g. seal and whale watching) and terrestrial operations (e.g. safari and jungle tours).

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