The Kimberley Marine Turtle Project under the Western Australian Marine Sciences Institution (WAMSI)

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Western Australia's marine turtle projects encompass nesting habitats, foraging grounds, or migratory routes for six sea turtle species, with flatback turtles, green turtles, loggerhead turtles, and hawksbill turtles the predominant nesting species. WA's history includes monitoring at more than 30 rookeries (with selected datasets spanning 1987-2014), four foraging grounds, and six turtle care and rehabilitation facilities. The research and monitoring stakeholders include State wildlife and fisheries agencies, Indigenous rangers, environmental consultants to industry, academic institutions, and community conservation groups. The collaborations generate information and data essential to successful marine turtle co-management.

A current focus of the Western Australian Marine Science Institution (WAMSI) is the Kimberley Marine Research Program Node. The WAMSI collaboration between 15 agencies provides an understanding of key ecosystem processes in the region and their response to a range of potential human impacts, including climate change. Projects are conducted across the Kimberley with emphasis on the existing (Camden Sound and Eighty Mile Beach) and proposed (Roebuck Bay and North Kimberley) marine parks (Figure 1). The breadth of all 25 WAMSI research projects extends beyond the narrow scope of this talk, but is detailed online http://www.wamsi.org.au/programs.

We outline the WAMSI Marine Turtle Project and explain its structure and partners that seek to acquire new data or information essential to management of marine turtles in the remote Kimberley coasts of Australia. The Kimberley coastline of 2,633 islands and 1,375 mainland beaches has 91% of its available rookery habitats accessible only by foot, boat, or helicopter. Consequently, all field surveys present a significant challenge whether in logistic, temporal, or financial terms. Partners in WAMSI 1.2.2 Kimberley Turtle Project include the Western Australia Department of Parks and Wildlife (Parks and Wildlife), The University of Western Australia (UWA), CSIRO, Griffith University, and Pendoley Environmental.

The WAMSI Marine Turtle Project adopts a rookery-based approach with its main focus to determine the spatial and temporal distribution of nesting by species. The project will also define appropriate longer-term monitoring strategies to continue beyond the life of this project. With many Saltwater Country Plans, Healthy Country Plans and Indigenous Protected Areas completed or in progress, the opportunity also exists to develop and strengthen co-management arrangements between indigenous rangers groups and Parks and Wildlife for new marine parks of the Kimberley coast.

With major knowledge gaps for this part of Australia the major drivers for this project were to:

- determine the significance of turtles to the proposed marine parks
- determine condition, pressure response indicators for marine turtles which can be used for development time-series data for monitoring
- determine the spatial and temporal nesting abundance which is needed for development assessments both in State and Commonwealth waters
- determine the management units (based on genetics) to enable strategic management
- determine basic biological parameters required to monitor trends
- What species visit Kimberley beaches?
- When/where are they nesting?

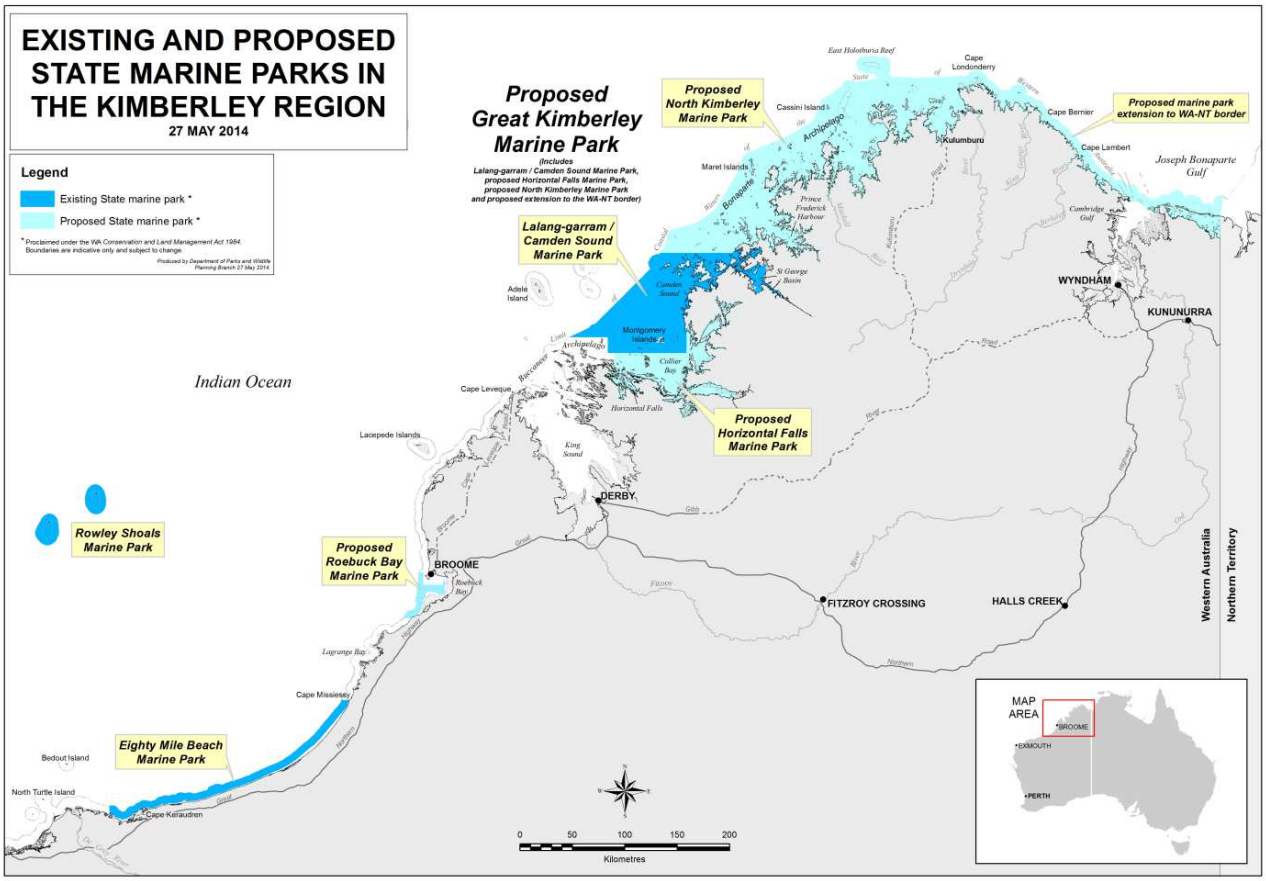

Figure 1. The spatial extent of existing and proposed marine parks across the Kimberley Region.

- How are these turtles related to other groups?
- What are impacts of climate change?
- How do traditional and scientific knowledge complement each other?

Species inventory, distribution and abundance

Currently there is no comprehensive understanding of the spatial and temporal distribution of marine turtles nesting by species across the Kimberley. An inventory of nesting will be conducted using a combination of aerial surveys, on ground surveys and remote cameras on nesting beaches. The coastline will be categorised using satellite or aerial imagery and stratified for aerial survey.

Existing information on flatback turtles indicates that winter nesting occurs in the east Kimberley and summer nesting occurs in the west Kimberley.

Aerial surveys using a plane with GPS wing mounted camera with be conducted in mid-summer and mid-winter and will photograph beaches with overlapping geo-tagged images with enough detail to identify turtle tracks to species. The images will be analysed later and archived. A combination of aerial and ground surveys will fill in gaps in nesting seasonality and confirm nesting species.

Genetic identification of management units/population stocks

Few genetic samples from green, flatback and hawksbill turtles in the Kimberley mean that they have not been assigned genetic stocks. The flatback samples collected during this project will augment a range-wide stock structure analysis already conducted with new samples from the central Kimberley to help define the summer and winter nesting populations. The North West Shelf green turtle stock will be revisited to determine if there is substructure within the stock between the North West Cape rookeries and those in the Kimberley. The outcomes will better define the management units found in the Kimberley and their relationship to stocks across the Northern Australia coast that feature in State or Commonwealth recovery plans.

Impacts of climate change

In marine turtles, hatchling sex is determined by the temperature experienced during incubation (temperature dependent sex determination or TSD). Females are produced at higher nest temperatures and males are produced at lower nest temperatures. Climate change will increase sand temperatures at turtle rookeries and could potentially increase the proportion of female biased nests and so alter primary sex ratios.

A primary aim of this project is to precisely determine the thermo-sensitive period (the TSP – the period of development when gonads differentiate into either testes or ovaries) for the Western Australian genetic stocks of flatback and green turtles. The quantification of this key aspect of the turtle's physiology will help refine models of how hatchling sex ratios of this vulnerable species vary temporally and spatially, and under the influence of a warmer climate.

Sharing traditional and scientific knowledge

Sea turtles are an important part of culture for Indigenous Australians in the Kimberley and this project recognises that Indigenous Knowledge and local knowledge forms an integral part of documenting knowledge of sea turtles. Traditional owners and rangers will be vital to establish long-term monitoring and management of future Marine Parks across the Kimberley. This will be done in conjunction with Parks and Wildlife both in Broome and Kununurra and with liaison with the Kimberley Land Council (KLC)

Indigenous knowledge and engagement includes training in standard track count methods for long term monitoring, hatching success, and predator documentation. More innovative techniques such as cyber-tracker and remote camera monitoring are also covered in workshops and field training.

Acknowledgments

Traditional owners and rangers from the KLC, Nyangumarta, KaraJarri, Yawuru, Nyul Nyul, Bardi Jawi, Dambimangarri, Wunambal Gaambera, Balanggarra, and Miriuwung Gajerrong groups. Parks and Wildlife staff and marine parks officers from the Broome and Kununurra offices.

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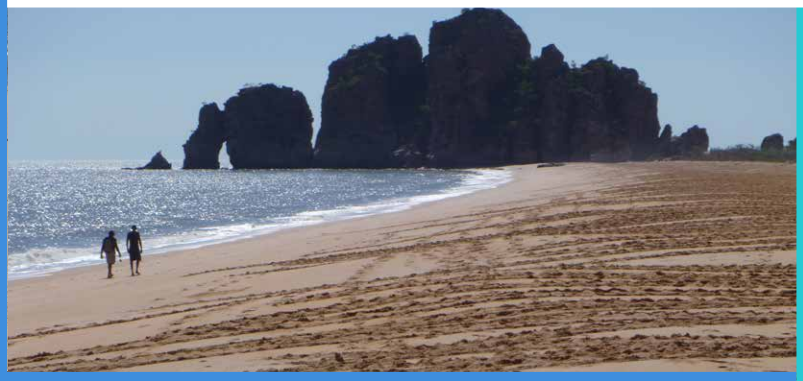
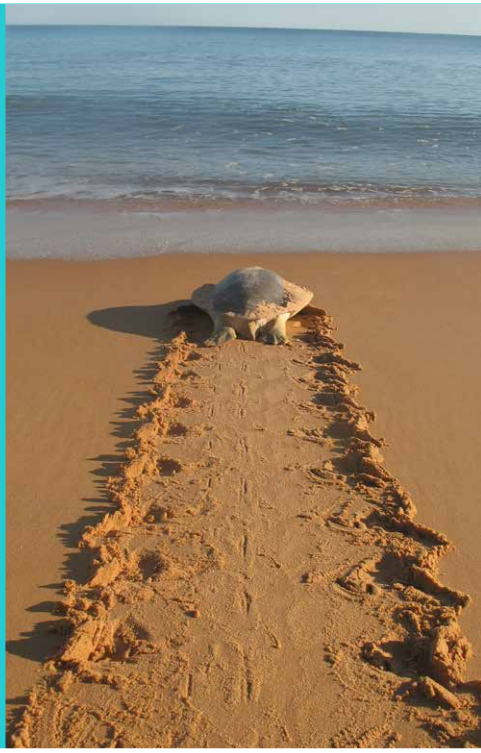


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