Health and hatching success of Western Australian loggerhead turtle (*Caretta caretta*) nesting populations

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Abstract

*Most of the existing sea turtle populations worldwide are in decline. In particular, loggerhead turtles (*Caretta caretta*) are listed as endangered and loggerhead nesting populations in Eastern Australia declined by 86% since the 1970s.*

This study aims to collect critical baseline data regarding health and hatching success of the loggerhead turtle nesting population in Cape Range National Park. Adult nesting turtles were examined and a blood sample taken to establish reference ranges of several blood health parameters and screen for toxin levels. The marked nests were excavated after observed hatchling emergence to establish hatching and emergence success, and collect samples of dead hatchlings and embryos for further histological examination, as well as unhatched eggs for toxin screening. Additionally, all nests were monitored for signs of predation.

*The research was conducted for two nesting seasons (2006/07 and 2007/08) and initial results show that in Cape Range National Park nest predation is a crucial limiting factor affecting hatching success. Predation by ghost crabs (Ocypode spp), monitor lizards (*Varanus giganteus*) and feral European red foxes (*Vulpes vulpes*), considerably reduce survivorship from egg to hatchling. In fact, in the first and second years of this study 78.2% and 83.3% of the monitored nests respectively, showed signs of partial or complete nest predation. It is unlikely that this mainland nesting population can sustain such severe level of predation pressure, especially in conjunction with other anthropogenic causes of decline at foraging sites and during migration to the nesting site (i.e. poaching, fisheries by-catch and pollution), and more studies are recommended to identify successful management strategies to reduce nest predation on this beach.*

This study takes an important first step towards obtaining crucial information on loggerhead turtle nest ecology and nesting turtle health in this region.

Project description

The main objective of this study is to investigate loggerhead turtle (*Caretta caretta*) hatching success and health; two very important aspects for sea turtle conservation and management at a loggerhead nesting beach in Cape Range National Park (Bungelup beach). This project is part of a larger study focusing on health and hatching success of loggerhead turtles, which includes monitoring another important Western Australian nesting site located on Dirk Hartog Island in Shark Bay.

The research was conducted for two nesting seasons (December-March): 2006/07 and 2007/08. During the first stage, nests are marked and blood samples are collected from successfully nesting turtles. Additionally, all turtles are examined for external traumatic injuries, fibropapillomas or any other lesions.

In the second stage, nest excavations after hatchling emergence allow the assessment of hatching and emergence success, as well as the collection of unhatched eggs for toxin screening. Furthermore, all dead hatchlings and embryos are examined to identify and classify deformities, and a sub-set collected for further histological and radiological examinations. Some of the biotic and abiotic factors monitored and correlated to hatching and emergence success include: nest temperature and humidity; nest location across and along the beach; several beach characteristics; signs of nest predation; blood health parameters in nesting females and pollutant levels in undeveloped eggs and blood of nesting turtles.

An understanding of reproduction and nest biology is crucial for the recovery and management of sea turtle populations, providing fundamental data to understand the suitability of a nesting beach and the general health of the nesting population (Miller 1999). Besides, studies addressing the health of marine animals are being recognised as increasingly important due to the growing pressure on the marine ecosystem from factors, such as coastal development, pollutants and global warming (Deem 2004, Wilcox and Aguirre 2004). Loggerhead turtles are classified as endangered (IUCN 2006), and whilst the Eastern Australian genetic stock has been extensively studied since 1968, little has been published on the Western Australian genetic stock. The number of adult females breeding annually in Eastern Australia has declined by approximately 86% since the 1970s (Limpus & Limpus 2003), it is therefore considered critical to obtain baseline population data and assess the impacts of threatening processes on the Western Australian loggerhead breeding population.

In this study, special attention was given to the assessment of nest predation, as in particular nest predation by feral European red foxes (*Vulpes vulpes*) has been identified as a key threatening process in Cape Range National Park (Onton

et al. 2006). Loggerhead nesting populations on the mainland of the North West Cape are significantly smaller than island nesting populations (Dirk Hartog Island in Shark Bay; Muiron Island in the Ningaloo region), and it has been speculated that ongoing nest predation by feral foxes may have contributed to the decline (Baldwin et al. 2003).

In conclusion, this study on loggerhead turtle health and hatching success will enhance general knowledge with regards to health and reproduction of loggerhead sea turtles in Western Australia; and will provide fundamental information for management policies and conservation initiatives aimed at conserving these sea turtle populations.

Current findings and their implications for management

To date, data and biological samples have been collected during two nesting seasons (2006/07 and 2007/08) and partial analyses of data has been completed.

Based on initial assessment of data, it is clear that predation by natural and introduced predators greatly reduces clutch survivorship. First results during the 2006/07 nesting season showed that nest and hatchling predation by ghost crabs (*Ocypode spp*) (Fig 1), perentie (*Varanus giganteus*) (Fig. 2) and feral European red foxes (*Vulpes vulpes*), significantly reduced survivorship from egg to hatchling. In 2006-2007, 78.2% of the monitored nests showed signs of nest predation and nests with signs of confirmed and suspected predation had a statistically significant smaller clutch size at excavation, than nests without any signs of predation (P=0.003) (Graph 1).

During the first year of monitoring, 52 nests were excavated, but clutch count at deposition was available only for 11 nests. When comparing the egg count at deposition with the count at excavation, 8 of these nests had a much smaller clutch count at excavation, due to partial predation of the nests.

Figure 1.

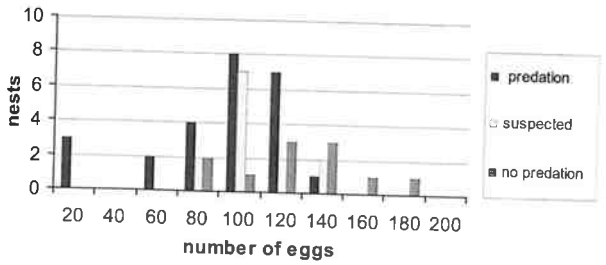
Ghost crab with loggerhead hatchling (photo by D.Mancini).

Therefore, it was concluded that, due to the high levels of predation, hatching and emergence success could not be reliably calculated from the remaining shells in the nest.

During the nesting season 2007/08, 30 study nests were marked and clutch count at deposition was available for all study nests. Additionally, all study nests were monitored every morning for signs of predation and hatchling emergence during the whole incubation period. First analyses confirm the results of the first year of monitoring, with a total of 83.3% of nests showing signs of partial or total predation. Over 60% of the monitored nests showed signs of predation by ghost crabs, while fox and perentie were responsible for 20% and 16.7%, respectively, of predations on the monitored nests (Table 1). Over half of predated nests (52%) showed signs of predation by multiple predators. The only introduced predator is the fox; however numbers of ghost crabs could have

Figure 1.

Perentie excavating a loggerhead turtle nest (photo by S.Trocini).



Graph 1.

Clutch size of nests with signs of confirmed and suspected predation, and no predation.

	% Ghost crab	Fox	Perentie	Unknown
2006/07	49.1	14.6	18.2	21.8
2007/08	66.7	20	16.7	23.3

Table 1.

Percentage of study nests with signs of predation by ghost crab, fox, perentie and unknown predator.

increased above normal levels due to tourism activities in Cape Range National Park (e.g. littering, burying of fishing offal) or possibly changes associated to climate change.

The level of predation at this mainland nesting beach can not be considered sustainable, as studies in Eastern Australian turtle populations showed that small long term increases in annual mortality from introduced sources above natural mortality levels will cause population declines. Increases in turtle mortality of more than a few percent are considered unsustainable (Limpus, 2002).

The general clinical condition of the 52 nesting turtles examined in this study was rated as good, and the screening of the blood samples collected during both nesting seasons in Cape Range National Park, in conjunction with the samples obtained on Dirk Hartog Island, will provide reference ranges for several blood health parameters (e.g. haematology, plasma biochemistry, plasma protein electrophoresis, blood vitamin levels).

Results of this study provide critical information on the nest ecology and health of loggerhead nesting turtle populations in the region and give insight on nest predation levels, as well as on predator dynamics. Important management issues are raised due to the reported high levels of predation and more studies are warranted to identify possible management strategies.

Knowledge transfer

Data collected in this study is critical to developing further understanding about nesting loggerhead sea turtle populations in the Exmouth region and to making informed decisions with regards to prioritising management actions. Therefore information gained from this study will be useful for both the scientific community and the Western Australian Department of Environment and Conservation. Preliminary results have been presented at national and international conferences (International Sea Turtle Symposium, Wildlife Disease Association conference; Wildlife Disease Symposium at Perth zoo) and other results obtained from further data analyses and laboratory work will be presented at several other conferences on wildlife health and management. Additionally, all results will be submitted for publication in relevant peer-reviewed journals. By the end of the study all results will be presented to the Department of Environment and Conservation in Exmouth, so that information gained during this project can be utilized to develop recommended guidelines and define management priorities to facilitate high levels of hatching success.

Next stage

Further statistical and laboratory analyses on the 2007/08 nesting seasons are underway. It is expected that necropsies and histopathological examinations of tissue samples of dead embryos and hatchlings collected during both nesting seasons will be completed by May 2009.

Several management strategies to reduce nest predation will be recommended and the success of such strategies could be assessed by experimental studies. Additionally, further investigations might be warranted in the future to assess the success of the ongoing fox baiting program and to investigate if ghost crab numbers are artificially increased due to anthropogenic factors (e.g. fishing offal buried near to fishing sites may increase crab numbers due to a constant and reliable food source).

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