Ningaloo

STUDENT RESEARCH DAY

Tuesday 30 March 2010 • CSIRO Auditorium, Underwood Ave, Floreat

Supporting students undertaking research in the Ningaloo region

western australian marine science institution

Department of Environment and Conservation
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For further information on Ningaloo research or to download a copy of the Ningaloo Student Research Day proceedings, visit the Ningaloo research website:

www.ningaloo.org.au

introduction

The iconic Ningaloo Marine Park is the focus of substantial research activity, with scientists from many organisations investigating its biodiversity, ecological and physical processes and interaction with human use. A multi-million-dollar research effort – funded by the Commonwealth and Western Australian Governments, research institutions, universities and industry – began in 2005 and is jointly led by the Western Australian Department of Environment and Conservation, the CSIRO Wealth from Oceans Flagship's Ningaloo Collaboration Cluster, the Western Australian Marine Science Institution (WAMSI) and the Australian Institute of Marine Science.

The collaborative research effort seeks to fill critical information gaps needed to better understand and manage Ningaloo Marine Park in the wake of changes made to its management plan, including extending and re-zoning the marine park. The research program – developed in consultation with the research community and resource managers – aims to provide a better understanding of the natural values within the marine park and how best to manage them effectively. The partner organisations integrate their research findings and information from the various projects through the Ningaloo Research Coordinating Committee (NRCC).

Each year since July 2007, the NRCC brings together scientists working in Ningaloo to discuss their research and learn more about the big picture of work at Ningaloo and more broadly in the region. There is a clear focus at these symposia on addressing management issues for the Ningaloo Marine Park and on working together to make the biggest difference through collaboration and integration of our shared knowledge.

As the number of research projects grew, the committee decided to also hold a separate science day for postgraduate students, to recognise the contribution they make to the bigger picture of Ningaloo and to the advancement of marine science in Western Australia.

We hope you take the opportunity today to meet other scientists engaged in similar paths, to share your ideas and experiences and to open the way for further collaboration and integration between projects.

The Ningaloo research partners are committed to making a difference at Ningaloo Marine Park. We rely on the scientists to assist by providing information that will improve our understanding and long term management of the marine park.

We wish you all an enjoyable and productive symposium.

Neil Loneragan
(Murdoch University, Ningaloo Cluster)

Tom Hatton
Bill de la Mare
(CSIRO Wealth from Oceans Flagship)

Chris Simpson
Kelly Waples
(Department of Environment and Conservation, WAMSI, Node 3 research)

Steve Blake
(Western Australian Marine Science Institution (WAMSI))

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9am Tuesday 30th March 2010 • CSIRO, Underwood Avenue, Floreat

Time	Presentation	Speaker
9:00	**Welcome and Introduction**	Steve Blake, WAMSI
9:10	The trophic ecology of the grazing sea urchin *Echinometra mathaei* within NMP, WA: Comparing the effects of different closure regimes on urchin distribution and trophodynamics	Mark Langdon Murdoch
9:30	Cycles of vertical habitat use in whale sharks (*Rhincodon typus*) tagged at Ningaloo	Yuval Berger UNE, AIMS
9:50	Comparison of methods and intensity of sampling assemblages of species on intertidal platforms at Ningaloo Marine Park	Victoria Inman UWA
10:10	Production and transport of particulate matter in a regional current system adjacent to a fringing coral reef	Cecile Rousseaux UWA
10:30	Life history and ecology of *Octopus cyanea* at Ningaloo Reef, Western Australia	Jade Herwig, UWA
10:45	**Morning tea and Poster viewing on Mezzanine**	
11:15	Nearshore circulation in a fringing reef system: Ningaloo reef	Soheila Taebi, UWA
11:35	Economics of coastal vulnerability and resilience: A case study from Exmouth, WA	Rebecca Roberts Murdoch
11:55	Planning for sustainable tourism development in a sparsely populated remote landscape: Camping along the Ningaloo coastline	Anna Lewis Curtin
12:15	Understanding the place attachment of campers along the southern Ningaloo Coast	Joanna Tonge Murdoch
12:35	Mechanisms by which science is transmitted into community education programs for the purpose of capacity building	Nadine Smith Curtin
12:55	**Summary and Awards**	Chris Simpson, DEC
1:00	**Lunch**	

Additional Abstracts

Title	Author
Functional Groups and Coral Reef Health	Charlotte Johansson
The Demography and Ecology of Demersal Stingrays at Ningaloo Reef, Western Australia	Owen O'Shea
Gnaraloo Turtle Conservation Program	Karen Hattingh

Abstracts:

Presented at the Ningaloo Research Student Day 2010

The trophic ecology of the grazing sea urchin Echinometra mathaei within Ningaloo Marine Park, Western Australia: Comparing the effects of different closure regimes on urchin distribution and trophodynamics

Mark Langdon

PhD Student; Murdoch University; M.Langdon@murdoch.edu.au

Sea urchins can have a significant influence upon the ecological structure of coral reefs through bioerosion of substrata and also by affecting competition for space. However, the relative importance of the role of sea urchins in influencing the composition and structure of coral reef habitats has rarely been explored.

Ningaloo Marine Park provides an opportunity to study a near-pristine tropical coral reef environment that has not been affected by the severe over-exploitation of natural resources or suffered from major bleaching events that have occurred in many other tropical reef systems of the World. Furthermore, this allows for comparisons in reef community structure between Ningaloo and other degraded systems.

The overall objective of this research project is to add to the general understanding of coral reef ecology and more specifically, advance the existing knowledge of the role of sea urchins in coral reef ecology at Ningaloo Marine Park. The project is linked to the CSIRO Wealth from Oceans Ningaloo Collaboration Cluster, Component 1: Habitat Mapping and Biodiversity.

This study has so far examined coral reef habitats (substrate % cover) and macro invertebrate (particularly urchins) distribution and abundance within Ningaloo Marine Park. Field sampling has been undertaken at over 100 sites within the Park, focussing on near shore, lagoonal and back reef areas within Sanctuary zones and adjacent Recreation zones. Data analysis is underway and will investigate several factors that may affect urchin distribution, including habitat type, habitat location, and management zoning.

Further field experiments investigating urchin bioerosion and behaviour are expected to be completed over the next 12 months.

Supervisors:
Dr. Mike van Keulen (Murdoch University)
Associate Professor Eric Paling (Murdoch University)

Cycles of vertical habitat use in whale sharks (Rhincodon typus) tagged at Ningaloo

Yuval Berger[1,2,3]

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We analysed time-depth records of four whale sharks tagged off Ningaloo, Western Australia. Fast Fourier Transform (FFT) revealed a diel and an 8 day cycle of vertical habitat use. Occurrence and nature of cycles varied amongst individual sharks. Throughout the tracks, sharks mostly swam near the surface. During the day sharks spent more time at the surface than at night, but descended to greater depths than at night. The 8 day cycle had a phase in which day/night differences in habitat use were highly evident and another in which such differences were attenuated. Our results suggest that previously reported differences between patterns of vertical movement in coastal waters and the open ocean may be due to bathymetry limiting the sharks' vertical movement as opposed to an intrinsic change in behaviour.

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Comparison of methods and intensity of sampling assemblages of species on intertidal platforms at Ningaloo Marine Park

Victoria Inman

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For four sites inside and four sites outside Jurabi Sanctuary Zone, we compared three different methods of sampling: timed searches for number of species in eight 15 minute intervals; random placement of 25 1 m^2 quadrats and five shore-to-sea transects of five 1 m^2 quadrats for number of individuals and species. We conducted univariate and multivariate analyses to determine if there were differences inside and outside the sanctuary zone, and among methhods.

In the same time that it took to collect data from 25 1 m^2 quadrats, the timed searches found more species than in the 25 random quadrats or in the five transects; there were more species inside the sanctuary zone than outside. However, the species accumulation curves for all methods did not plateau, indicating that more intensive sampling by each each method would reveal additional species. Multivariate analyses based on presence and absence of species revealed important differences among sites, among methods, and between inside and outside the sanctuary zone.

We conducted analyses using subsets of the entire data. The differences in assemblages between inside and outside the sanctuary zones detected in whole data set remained statistically significant if the number of random quadrats per site was reduced to 15 and the transects per site to 3 (each of 5 quadrats). Importantly, reducing the number of sites removed the statistical differences between inside and outside the sanctuary zone.

Additional Authors:

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Production and transport of particulate matter in a regional current system adjacent to a fringing coral reef

Cecile Rousseaux

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While recycling of nutrients play a key role in coral reef food webs, it is increasingly evident that reefs must rely on the production, supply and incorporation of particulate matter from the ocean to sustain their high productivity. Due to its proximity to Ningaloo Reef, the Leeuwin Current off Western Australia may represent a significant source of particulate matter for the reef. We combine satellite-derived ocean colour data and numerical model output with field observations to understand the processes affecting the delivery of particulate matter to the reef at different temporal and spatial scales. In spring/summer, when the conditions can be upwelling favourable along much of the West Australian coast, the high production usually generated by these events is not always evident in the Ningaloo region. However, a phytoplankton blooms develops around April each year (during the downwelling favourable season). The phytoplankton concentration reached in June/July is approximately four times than that observed in summer. This increase in particulate matter is associated with an annual deepening of the mixed layer depth. Field observations bring additional information about the diversity, productivity and cross-shelf transport of this particulate matter. These results show that the bloom observed during autumn 2008 was mainly represented by diatoms and that these were taking up nitrate rather than ammonium, suggesting an allochthonous supply. The dominance of downwelling favourable conditions and the analysis of nitrate profiles allow us to identify the deepening of the mixed layer depth as the key mechanism replenishing the surface layer with nutrients that in turn allows the phytoplankton bloom to develop.

Life history and ecology of Octopus cyanea at Ningaloo Reef, Western Australia

Jade Herwig

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Understanding the life history and trophic biology of a species is an essential prerequisite to defining their ecological role within an ecosystem. Age estimation in particular is an important life history feature as accurate estimates of this can be used to understand other life history characteristics such as rates of population growth, levels of mortality, age at first maturity and peak breeding times. *Octopus cyanea* is a tropical cephalopod that is found to inhabit the intertidal reef areas of Ningaloo, Western Australia and is currently taken off the reef as an unregulated but recreationally fished species. Traditional age estimations done on *O. cyanea* have typically used size: age relationships or estimates of age from the size of laboratory examined animals. However, the plasticity in growth and high levels of individual variability that is typical of cephalopods tends to render these methods inaccurate. Stylet Increment Analysis is a new technique that can age octopus by counting the daily rings found on the microstructure of the octopus's stylet. The purpose of this study is to expand on previous research done on the ecology and life history of *O. cyanea* by using new ageing techniques to provide more accurate estimates. The new age estimates will be combined with other key life history data that will be collected including examining the reproductive status and the density and distribution of individuals within these populations as well as looking at possible trophic interactions. This data can then be used for more effective management as it will provide a baseline from which to estimate the significance of this octopus as an ecosystem component, as well as looking at the vulnerability of this species from unregulated fishing.

Nearshore circulation in a fringing reef system: Ningaloo reef

Soheila Taebi 1

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The role of waves, tide and wind on the circulation of fringing reef systems was investigated using data collected over 6 week field experiment in Sandy Bay, Ningaloo Reef, off Western Australia. The data set included surface waves, current velocities, tidal level, wind speed and high resolution bathymetry. High correlation between current velocity and wave height revealed the importance of waves in driving the overall reef-lagoon circulation, whilst the modulation of current speeds at tidal frequencies in the spectrum suggests the currents respond to tidal variations in the water level over the reef. The influence of each of the forcing mechanisms on the current field was investigated for both high and low frequencies bands. Wave breaking was found to be the driving mechanism in the low frequency (subtidal) currents, where the dominant flow pattern consists of cross-reef flow over the reef, alongshore in the lagoon, with water exiting the channel. The tides control the high frequency current variability via two mechanisms: one associated with the ebb/flood cycle of the tides and the second associated with tidal modulations of the wave-driven currents. The flushing time scale varied from 3 hours to over a day for the wide range of incident wave heights and in the longer term it may be influenced by the changes in the mean sea level as the maximum flux occurred at medium tidal level. Wind forcing and buoyancy effects were found to be negligible in driving circulation and flushing during the observation program.

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Economics of coastal vulnerability and resilience: A case study of Exmouth

Rebecca Roberts

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Coastal planners in Australia have to factor into their land-use decisions, rising sea-levels and predictions of more intense and frequent extreme events. This is especially so, in the construction of coastal developments that alter the geomorphology and ecosystems along the Australian coastline. Decision-makers in high-growth, regional coastal towns have to be especially cognisant of the increased risks from the combined threat of sea-level rise and storm-surge inundation and the associated socio-economic implications.

Using the case of Exmouth, one component of this study evaluated coastal vulnerability to cyclonic storm-surge risk in the context of land-use plans laid out by the Town Council. Exmouth is located along the Pilbara coast, which is one of the most cyclone-prone regions of the country. Using the SRTM Digital Elevation Model, a storm-surge scenario analysis was carried out in a Geographic Information System. Potential erosion and medium to high probability estimates of coastal inundation were also considered.

This study found that current town plans, especially the configuration of sites for future urban and residential development in the south of the townsite will increase risk in the area. Coastal dune systems however, can buffer storm-surge waves, and natural flood detention areas proximal to the coastline can contain flood-water, thereby reducing impacts on coastal infrastructure. Damage due to a storm-surge event such as that generated by Tropical Cyclone Vance in 1999 can be compounded by storm-erosion, resulting in waves progressing further inland, and flooding key evacuation routes. These findings have implications with regards to the State Coastal Setback Policy, and other key town-planning policies, especially for disaster-prone areas. Risk-mapping results obtained from this study are used in the other components of this research to examine the altered economic dynamics of the case study site, particularly changes in property values, associated property insurance premiums and economic instruments for socio-ecological adaptation.

Planning for sustainable tourism development in a sparsely populated, remote landscape: Camping along the Ningaloo coastline

Anna Lewis

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The Ningaloo Marine Park in Western Australia is an increasingly popular coastal camping destination. Multiple management regimes which differ in road access quality, amenities, price, and most controversially regulation, still exist along the remote coastline. This has prompted the Government to seriously consider relinquishing the Ningaloo coastal strip in a bid to regulate management, prevent further environmental degradation, and establish tourism 'nodes'. In response, this study asks:

'Given the remote landscape, likely visitor increases and visitor preferences, what is the most appropriate development for coastal camping areas at Ningaloo?'

One component of the study aims to determine whether visitors who camp under different management regimes, have different waste, water and energy usage. Campers completed 734 questionnaires concerning waste composition and disposal, power and water sources, and transport. It was found that responses from campers staying in higher regulated areas differ to those from lower regulated areas. The resource use of coastal campgrounds, caravan parks, eco-lodges, and resorts will later be compared through 'ecological footprinting' to aid planning and management in this fragile environment.

A second aim of the questionnaire was to determine whether visitors camping under different management regimes have different campsite selection preferences. It was found that campers seek distinctly different experiences, reflected through clear management regime preferences when selecting a campsite. These findings highlight the importance of maintaining a breadth of camping options at Ningaloo, in order to provide desirable experiences for visitors.

The final component of the study compares the type and extent of environmental impact created by visitors at campsites along the Ningaloo coast. Preliminary results indicate that impacts do vary, and that higher regulation does not necessarily equate to lesser impacts. It is important go note that campsites are difficult to compare due to variations in environmental and visitor numbers along the Ningaloo coastline.

Understanding the place attachment of campers along the southern Ningaloo Coast

Joanna Tonge

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Place attachment has been the subject of a rich, growing body of research in natural resource management with a particular emphasis on visitors to terrestrial national parks and forests, and little attention paid to marine settings. The question as to whether the same predominant elements of place attachment – physical environment, recreational activities, social ties and emotional connection – apply to marine parks remains to be answered. Ningaloo Marine Park provides the focus of this study given a recently completed human usage survey which indicated strong site fidelity by visitors. This paper addresses the first of the objectives for the study, as listed above. In July 2009, 30 visitors at three study sites on the southern Ningaloo coast participated by taking photographs of the elements that attracted them to the site and then engaging in subsequent interviews about their photographs (method known as photo elicitation). A total of 34% of the photos were of the physical environment, 28% focused on recreational activities and 38% showed a social situation. Overall 55% of photos had a marine influence. Although this study had the same elements evident from other place studies, there were some subtle differences. The ability to escape the cold weather further south and maintaining friendships made at Ningaloo were contributing aspects not well documented in other studies. Another differing key aspect related to the emotional connection that developed because "everybody's happy" with a holiday to Ningaloo. This was especially the case for participants visiting as part of a family group, where all members could undertake their own activities in the one setting, making it an enjoyable experience for all. The second phase of this research will use a questionnaire, distributed during June and July 2010, to further develop these identified elements of place attachment.

Mechanisms by which science is transmitted into community education programs for the purpose of capacity building.

Nadine Smith

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Defining indicators to monitor and measure the impact of community engagement programs is difficult for many reasons, including the fact that raised awareness and knowledge is not automatically translated into action. The impact of such programs may also be limited by potential barriers in knowledge transfer and appropriation, between researchers and communicators involved in development and delivery of such programs.

Grounded Theory will be used to code and analyse data collected from documents and semi-structured interviews in order to, understand the mechanisms by which community education programs are developed within a marine science perspective. The intent of this research is that understanding these mechanisms may positively contribute to the impact of community capacity building strategies.

Additional abstracts:

Functional Groups and Coral Reef Health

Charlotte Johansson[1,2]

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Coral reefs around the globe experience various levels of degradation. Although some are considered to be healthy and well managed, other coral reefs show strong signs in the reduction of functions and processes. Human induced impacts on critical functional groups, weakens and reduces the links and processes within the system. Overfishing of herbivores can consequently increase macroalgae populations beyond a beneficial threshold to a state where increased biomass is negative to the system. The composition of functional groups shows great diversity between reefs and between habitats within one single reef. The question is if the composition of functional groups changes in a system less exposed to human disturbance. Ningaloo reef on the west Australian coast is a unique reef ecosystem due to its west-continental location and relative low human impact. Ningaloo has no documented history of fishing, minimal fresh water run-off and low human development hence is dominated by natural disturbances like high wave energy and cyclones. It was therefore of interest to map the distribution of herbivorous functional groups within this coral reef ecosystem.

Additional Authors:

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The Demography and Ecology of Demersal Stingrays at Ningaloo Reef, Western Australia

Owen R. O'Shea[1,2]

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As is typical of elasmobranchs, most rays have life history traits that include slow growth, late maturation to adulthood and low fecundity. Due to this, rays are under increasing threat from anthropogenic pressures, such as overfishing and habitat destruction. Despite this, little is known of the demography and role of stingrays in coral reef communities. This project aims to address this need by directly examining the ecology, demography and role of rays within a coral ecosystem at Ningaloo Reef. Detailed habitat mapping has been conducted by manta tow (> 2 km^2), at two locations to identify sites used by rays within the reef and to describe their characteristics. Passive observations have also been made to determine factors influencing movement to and from key areas identified during mapping. Further to this, an age validation study has commenced whereby individuals from six species have been caught and injected with a biomarker (calcein), to stain calcified bands within the vertebrae which will act as a time marker so that the number of bands deposited in the vertebrae after marking, can be compared to time at liberty. Lethal sampling has begun to collect baseline data of age and growth rates, reproductive capacity and gut content analysis. It is predicted that the large rays inhabiting the lagoon at Ningaloo Reef will display similar life history characteristics and that growth and reproduction will be correlated with adult size and longevity.

An exclusion experiment has been set up to preclude stingrays from foraging in a sandy, inter-tidal habitat (10 x 4 m^2 replicates) to quantify the effect of their removal on benthic and infaunal communities over a 12 month period. It is predicted that moderate levels of feeding by rays will increase the diversity and richness of these benthic communities through re-suspension of nutrients and possible increased settlement of sessile organisms and plants. Ray feeding excavations are also being modelled to determine the importance of sediment removal on infaunal communities and to quantify how much sediment is being moved. The distribution and longevity of these feeding pits is also being investigated to determine their importance in the ecology of soft sediment habitats.

Finally, habitat utilization will be described through the use of continual acoustic tracking of individuals over multiple 24 hour periods throughout the year. It is hypothesised that these rays will display migratory behaviour, both at small and large spatial scales.

The information generated by this research will not only be useful for designing appropriate management strategies for rays at Ningaloo Reef, but will also be applicable in a wider tropical context. The rays occurring at Ningaloo are widespread throughout the Indo-Pacific, where they are important targets or by-catch in both artisanal and commercial fisheries. These results will provide a framework where the effects of removal of these taxa from reef environments and their surrounds can be assessed.

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Gnaraloo Turtle Conservation Program

Karen Hattingh

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Five of the world's seven sea turtles are internationally recognized as species of conservation concern listed as either endangered or vulnerable. Loggerhead (Caretta caretta), Hawksbill (Eretmochelys imbricata) and Green (Chelonia mydas) turtles found along the Ningaloo coast in Western Australia are three of these species. Studies have revealed that only about 1 out of 1,000 turtle hatchlings make it to maturity, making the survival of every hatchling critical to the future of the species globally.

Based on, The Gnaraloo Turtle Conservation Program (GTCP) was initiated 2 years ago, based on the Ningaloo Turtle Program in Exmouth. Under arrangements with Gnaraloo, DEC provides scientific advice and support to the GTCP while Gnaraloo executes the onsite beach monitoring program, including attracting and managing the required scientific and community volunteers, data collection and entry into required databases, as well as data analyses and production of end-of-season reporting, which is released in full to DEC and other interested parties such as the CSIRO.

Gnaraloo Station includes approximately 65 kilometres of coastline, 14 kilometres of which was daily monitored by GTCP researchers (day and night monitoring programs, running a total of 6 months over the nesting and hatching season). The day monitoring ran from 1 November 2009 to 28 February 2010, whilst the night monitoring ran from 1 January 2010 to 30 April 2010, having a 2 month overlap period from 1 January 2010 to 28 February 2010. The 2009/10 season was funded solely by Paul Richardson, the Gnaraloo leaseholder.

The long-term aim of the GTCP is to develop an effective management structure for the conservation and protection of local turtle populations along the Gnaraloo coastline. It also aims to create community awareness and support for the conservation of sea turtles and their environments.

The objectives to help achieve these aims are as follows:

Day

- Identify number of nests, distribution trends and number of breeding females at monitored nesting sites along Gnaraloo coastline.
- Identify incubation periods at monitored nesting sites along Gnaraloo coastline.
- Identify the level of predation observed on nests by feral and native species.
- Determine significance of key monitored nesting sites along Gnaraloo coastline.

- Through aerial survey, identify and confirm any additional potential significant rookeries along Gnaraloo coastline.
- Monitor conservation status of turtle populations at key monitored nesting sites along Gnaraloo coastline.

Night

- Determine nest emergence success rates, including location impacts on nests, at monitored night survey area.
- Determine predation percentage rates of egg chambers and of neonates by feral and native species at monitored night survey area.
- Confirm species identification at monitored night survey area [Comparison Day findings (tracks only) vs Night results (hatchlings)].
- Identify overall breeding success rates at monitored night survey area

RESULTS

During the 2009/10 day monitoring season, a total of 522 nests and 291 false crawls were recorded within the day study area, 1 November 2009 to 28 February 2010.

Loggerhead (Caretta caretta) turtle nests were predominantly recorded in the day study area. In total,

- Loggerheads accounted for 77% of nesting turtle species within day study area (402 out of the 522 nests)
- Hawksbills (Eretmochlys imbricata) for 15% (78 nests)
- Greens (Chelonia mydas) for 6% (30 nests)
- 2% (12 nests) were unable to be identified due to track erosion.

Species percentage composition varied considerably between the 2008/09 and 2009/10 monitoring seasons. While Loggerhead turtles comprised 90% of nesting turtles within the day study area in the 2008/09 season, they made up 77% of the nesting turtles within the day study area in the 2009/10 season. Green turtles increased in frequency within the day study area from 2008/09 to 2009/10, from 2% to 6%. Hawksbill turtles also increased this season, from 5% to 15% of overall species composition.

The 2008/09 breeding season experienced a peak in nesting activity in mid-January while the 2009/10 breeding season experienced two peaks in nesting activity, both in late December 2009 and mid-January 2010.

Data collected during the 2008/09 study season indicated that the highest frequency of incubation requiring 59 – 61 days before the first run of hatchlings. The 2009/10 monitoring season witnessed a higher incubation period, with the highest frequency of incubation requiring 61 – 80 days before the first run of hatchlings was seen.

The distribution of turtle nests was non-uniform over the study area and higher densities were apparent in specific sub-sections.

The predation of turtle nests (egg chambers only) by Golden ghost crabs (Ocypode convexa) was high within the day study area. A total of 47% of total nests (244 nests) were disturbed by ghost crabs during the 2009/10 study season, with 243 of those occurrences happening after 1 December 2009. The nests predated per week by Golden ghost crabs in the day study area rose in frequency as the day monitoring season continued, peaking during the week ending 13 February 2010. It is hypothesized that as the seasons changed, the higher summer tides left more environmental debris on shore, thus being able to sustain a higher population of crabs. As the hypothesis is based on high wave energy, this also may explain why dynamic sub-section BP7-BP9 had the highest frequency of nests predated by Golden ghost crabs.

Based on number of nests, the 2009/10 research concluded that the monitored Gnaraloo breeding area is considered to be a significant Loggerhead turtle rookery. Numbers of both Hawksbill and Green turtles have also increased since the 2008/09 monitoring season.

The IUCN Red List status of sea turtle populations nesting along the Gnaraloo coastline have been revised following the 2008/09 monitoring season. The classification of Loggerhead turtles were Endangered while Hawksbill and Green turtles were listed as vulnerable species during the 2008/09 season. As of the 2009/10 monitoring season, Loggerhead turtle populations remain Endangered, while Hawksbill turtle populations have been newly listed as Critically Endangered and Green turtle populations listed as Endangered.