

Ningaloo **TURTLE** PROGRAM



ACKNOWLEDGEMENTS

Cape Conservation Group Inc, World Wildlife Fund-Australia and the Department of Environment and Conservation for their initial collaborative partnership.

Roland Mau, Susie Bedford and David Waayers, for the 2001-2002 NTP pilot program.

Gnulli Working Group – The program is conducted on the traditional lands of the Jinigudira, Thalanji and Baiyungu people. We recognise their traditional custodial role and continued support for turtle conservation.

Cape Conservation Group Inc, in particular Susie Bedford, Suzie Lalor and Jutta Wildforster, for their continued passion, support and partnership.

2010-2012 Sponsorship:

BHP Billiton and the Department of the Environment, Water, Heritage and the Arts for their support and sponsorship.

2011-2012 Sponsorship

Technip Oceania Pty Ltd for their sponsorship.

External Volunteers- Michelle Ivory, Julie Coyle, Abbey Duncan, Alysha Sozou, Bonita Prior, Chantelle Ridley, Hamish Strachan, Angie Sherwin, Sharyn Hickey, Rachel Macgregor and Marshall Waters.

Team Leaders-Coin Valentine, Tahia Isher and Claire Wallis

Exmouth Local Volunteers- Anne McCarrol, Beck Freeman, Bev Wilson, Claire Griffiths, Dani Rob, Inday Ford, Jack Hine, Jemma, Lindy & Jamie Cross, Jen Thompson, Jutta Wildforster, Lyn Irvine, Susie Bedford, Suzie Lalor, Yvonne Turbett, and Niki Mouzourides.

CITATION

This document may be cited as:

Coote, C (Nature Conservation Ranger), Markovina, K (Assistant Operations Officer), Prophet, M (Nature Conservation Coordinator) and Smallwood, C (Spatial Information Analysis) (2012), Department of Environment and Conservation, Exmouth. *'Ningaloo Turtle Program Annual Report 2011-2012'*. Ningaloo Turtle Program, Exmouth, Western Australia.

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GLOSSARY

Body pit	A depression dug in the sand by a turtle during a nesting attempt.
Carapace	The shell covering the dorsal surface of the turtle.
Costal scales	Large scales lining both sides of the carapace, below the centre row of scales.
Egg chamber	A deep cylindrical hole which a turtle digs into a primary body pit with her back flippers only. The eggs are deposited here.
Emerging track	Track of a turtle emerging from the ocean onto land.
Entire season	All NTP database season dates and subsections except 1080 baiting data. This included the intensive peak period monitoring and the pre and post peak period monitoring period data.
Escarpment	The edge of a ridge which indicates a filled in primary body pit.
False crawl	An abandoned nesting attempt.
GPS unit	Global Positioning System unit: an electronic navigational device which obtains a position on the earth using satellite signals.
Hatchling	A newly hatched turtle.
Pre and post peak period	Monitoring of weekends either side of the intensive peak monitoring period.
Intensive peak period monitoring	Occurs when intensive surveys are centred around the 31 st December allowing for 1 week of monitoring prior to Christmas.
Nest Damage	The nest has been dug up, eggs or empty egg shells are around the nest or eggs are exposed.
Nesting success	The number of expected nests laid as a percentage of total turtle activities.
Old Nest	A nesting attempt from the current season we expect has resulted in eggs being deposited and nest completely covered which has been predated on.
Plastron	The underside of a turtle.
Prefrontal scales	Situated on the head of a turtle, anterior to the frontal bone.
Preocular scales	Situated on the head of a turtle, anterior from the eyes.
Primary body pit	A depression dug in the sand by a turtle during a nesting attempt. The egg chamber is located here.
Returning track	Track of a turtle returning from the land to the ocean.
Rookery	A significant breeding area for a large number of animals.

Secondary body pit	Dug during a successful nesting attempt to cover the primary body pit and egg chamber with sand.
Standardised Season	Only includes the intensive peak period monitoring data.
Nest	A new nesting attempt which we expect has resulted in eggs being deposited and nest completely covered.
Survey Effort	The total number times each subsection was monitored over a specified period of time.
Turtle activity	Includes both nests and false crawls.
Turtle tracker	A competent volunteer in identifying turtle species and observing activity during monitoring.
Zoning	Identification of divisions, sections & subsections.

LIST OF ABBREVIATIONS

CCG	Cape Conservation Group Inc.
DEC	The Department of Environment and Conservation (formally the Department of Conservation and Land Management (CALM))
EPBC Act	Environmental Protection and Biodiversity Conservation Act 1999
JTC	Jurabi Turtle Centre
NTP	Ningaloo Turtle Program
NW Cape	North West Cape
NMP	Ningaloo Marine Park
WWF	World Wildlife Foundation

1. EXECUTIVE SUMMARY

The Ningaloo Turtle Program was established in 2002 as a collaborative effort between Cape Conservation Group Inc, World Wildlife Fund Australia and the Department of Environment and Conservation, Exmouth District. The primary aim of the program is to promote and ensure the long-term survival of turtle populations within the Ningaloo Region by collecting track data that is then used to determine trends in population fluctuations.

For the purpose of the program, the Ningaloo Region is divided spatially into a hierarchical classification. Within this classification there are four divisions within the Ningaloo Region: North West Cape Division, Cape Range Division, Bundera/Ningaloo Division and Coral Bay Division. Each of these divisions is then further divided into sections and subsections. Again in 2011-12 only the North West Cape and Cape Range divisions were monitored intensively due to consolidation of the program in 2009-10 and 2010-11 (Whiting, 2008). This consolidation is attributed to scientific recommendations and capacity constraints which dictated the long-term viability of the program. Opportunistic monitoring was carried out in the Bundera/Ningaloo and Coral Bay divisions. For the purpose of this report, data collected from these divisions has been omitted from the results.

Thirty nine volunteers contributed a total of 2,872 hours to the Ningaloo Turtle Program in 2011-12. Since commencement, of the program a total of 46,856 volunteer hours have been contributed to the program. These figures demonstrate the effort of the volunteers over the life span of the program.

The 2011-12 season is one of the biggest seasons on record thus far with 7,044 nests and 23,668 false crawls recorded in the Ningaloo Region. Volunteers recorded 6,591 nests and 22,865 false crawls as being created by Green Turtles, which equates to 24.4% nesting success for this species. The Hawksbill Turtle had the greatest nesting success rate of 43.6% with NTP recording 65 nests and 84 false crawls. The Loggerhead records show 382 nests and 715 false crawls which resulted in a nesting success rate of 34.8%. The relatively low levels of nesting success could be attributed to the high number of turtles nesting in concentrated areas, which can result in high rates of disturbance and failed nesting attempts. Proportionally this is lower than some previous seasons despite the high level of activity recorded.

Green turtles accounted for 93.5% of recorded nests, loggerheads turtles (5.4%) and hawksbill turtles (0.9%). A total of 66 of the recorded nests were damaged, which amounted to 0.9% of the total nests recorded for the season. The majority of nest damage was a result of other turtles accidentally disturbing nests whilst digging. This equates to a total of 1.9% of nests damaged between 2002 and 2012.

This season the level of fox predation has remained below the 5% sustainable threshold with predation by fox's and dogs recorded at 0.07% of the total new and old nests. Note, records of fox and dog predation and nest damage is not viewed as an accurate figure since predation and nest damage is only recorded the night after the nest has been laid or if a volunteer incidentally comes across an old nest that has been predated on or damaged. Visits by foxes or dogs to nests on following evenings are not specifically recorded.

During 2011-12 volunteers rescued 39 turtles of which 37 were females and 2 were unknown. This brings the total of turtles rescued since 2002 to 226 turtles. There were a total of 36 turtle mortalities recorded during the 2011-12 season.

Cyclonic activity brought heavy rain and wind in late January, which along with a lack of available volunteers, resulted in the cancellation of a total of 4 intermittent monitoring days.

1.1. Key Program Recommendations

Volunteer Participation

- Build capacity among the local Exmouth community and promote local program participation.
- Increase the volunteer participation fee to recoup a greater proportion of program costs.

Occupational Health and Safety

- Update job safety analyses (JSA's) and maintain occupational health and safety standards and vigilance.
- Consider a full manual license and senior first aid certificate as prerequisites for all external volunteers.

Field Data Collection

- Ensure accurate data collection and data entry is of a high standard.
- Ensure volunteer accuracy in track, nest and predation identification.
- Continue to improve monitoring techniques and data collection methods.
- Utilise Bungelup research station during training to expand knowledge base of loggerhead track identification.
- Encourage volunteers to take photos of tracks or turtles to improve certainty of records.
- Reorganise monitoring folders to make them more practical.

Organisation and Procedures

- Build and expand the current mailing list for the NTP.
- Build on professional relations established between Australian Universities and the program.
- Consider past experience of candidates for the Team Leader positions.
- Consider video interviews for team leader positions if practical.
- Maintain the NTP coordinator role as an internal role filled by existing DEC member/s.
- Continue to involve NTPSC members and DEC staff in day to day management during the intensive mid season monitoring period.
- Encourage feedback from all volunteers.
- Maintain and ensure monitoring rosters are implemented.
- Consider compulsory days off for team leaders.

Data Management

- Upgrade the Microsoft Access database to ensure currency and functionality.
- Conduct regular checks of data collection and ensure accurate recording of information.
- Implement a daily data entry roster for the external volunteers.
- Ensure daily data entry which is supervised by a team leader or DEC/CCG person.

- Provide the volunteer team leaders with access to the database password.
- Ensure accuracy and consistency of data entry and data security.
- Provide detailed data entry training.

Volunteer Education, Information and Communication

- Encourage local participation in the program.
- Continue with relevant turtle presentations to external and local volunteers, to stimulate interest.
- Continue with various DEC presentations which give insight to Departmental roles and functions.
- Encourage local volunteers to give presentations to external volunteers.
- Consider local Indigenous Coral Coast Park Council members to provide information on Indigenous history of the area.
- Deliver progress updates to all volunteers throughout the season.

Survey Effort and Nesting Abundance

- Continue to monitor turtle activity within the NW Cape and Cape Range divisions.
- Continue with opportunistic monitoring by DEC staff within the Bundera/Ningaloo and Coral Bay divisions.
- Maintain the intensive mid season monitoring period between mid-December to mid-January, and adjust if peak season shifts are detected
- Consider determining nesting success for a sample of turtles using night-time monitoring to gather data for trend refinement during analyses.
- Ensure intermittent weekend track counts outside of the intensive mid season monitoring period are only counting the tracks from the previous night's nesting.

Training

- Expand trainer and assessor capacity prior to the arrival of the external volunteers.
- Ensure DEC staff with adequate NTP experience are trained as trainers.
- Ensure a minimum of two seasons experience as prerequisite to becoming a trainer.
- Update the 6th edition of the "Turtle Monitoring Field Guide" to reflect changes in recent years (last updated in November 2007).
- Maintain development of field staff to ensure accurate recognition of tracks during training week and throughout the program.
- Continue to ensure smaller training and assessment groups where possible.

Predation Control

- DEC to continue and improve fox control programs within the four divisions - NW Cape, Cape Range, Bundera/Ningaloo and Coral Bay.
- Further investigate the impacts of ghost crab predation on nesting success within the Ningaloo Region.
- Continue to report opportunistic dingo and fox sightings to the DEC Feral Control Officer.
- Report evidence of human damage to nests to DEC Wildlife Officer.

Turtles Rescues

- Conduct turtle rescues when it is feasible.

- Provide volunteers with turtle rescue training.
- Notify the DEC Wildlife Officer of areas with considerable numbers of turtle strandings and mortalities.

General Recommendations

- Continue to investigate future funding opportunities for the program.
- Review the NTP overarching goals and objectives.
- Develop the NTP in conjunction with the DEC State Turtle Coordinator's recommendations, taking into consideration threats and adaptations required.
- Organise trend analyses which will include data from 2010-2011 and 2011-2012.

2. BACKGROUND

2.1. Ningaloo Marine Park

Ningaloo Reef is Australia's largest fringing reef, extending 300 km from the North-West Cape to Red Bluff in Western Australia (Department of Conservation and Land Management (CALM) 2005). Over 500 species of finfish, 600 species of mollusc and 90 species of echinoderms inhabit Ningaloo Reef, as well as many species of coral, crustacean and worms (CALM 2005). The area is also an important habitat for marine mega-fauna such as whale sharks, turtles, dugongs, whales, dolphins, sharks and manta rays. The diversity of marine life combined with the near-shore accessibility of the coral reef system promotes Ningaloo Reef as a prime tourism and conservation location.

In recognition of its unique values and cultural importance to West Australians, approximately 90% of Ningaloo reef was gazetted as a Marine Park in 1987 with the remaining area included within the Marine Park in 2004 (CALM 2005). In June 2011, the World Heritage Committee inscribed the Ningaloo Coast on the World Heritage List, acknowledging it as one of the most outstanding natural places in the World. The Ningaloo Coast World Heritage area incorporates Ningaloo Marine Park, Cape Range National Park, Learmonth Air Weapons Range & Muiron Islands Marine Management Area. The area is one of the most important turtle rookeries in the Indian Ocean, which is also a key reason for the World Heritage listing.

2.2. Marine Turtles of Ningaloo

Of the seven species of marine turtles recognised internationally, four of the species have breeding populations within Western Australia - the green turtle (*Chelonia mydas*), loggerhead turtle (*Caretta caretta*), hawksbill turtle (*Eretmochelys imbricata*) and flatback turtle (*Natator depressus*) (CALM 2005). Green, loggerhead and hawksbill turtles are the primary species that nest along the coast of the Ningaloo Marine Park with occasional records of nesting flatback turtles.

Green turtles are the most abundant species within the area while loggerhead and hawksbill turtles are found in much smaller populations. The Western Australian population of green turtles is thought to be the largest population in the Indian Ocean (Limpus 2007), which highlights the significance of green turtle rookeries found along the Ningaloo Coast.

Currently all species of marine turtles within Australia are protected under the *Commonwealth Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)*, the *Endangered*

Species Protection Act 1992 and the *Wildlife Conservation Act 1950*. The protection of marine turtles is vested with the Department of Environment and Conservation.

2.3. Marine Turtle Threats

Marine turtles face numerous threats around the world including harvesting for food; entanglement in commercial fishing nets; alterations to nesting beaches and foraging areas; human disturbance to nesting turtles and emerging hatchlings; egg collection by humans; and predation of eggs and hatchlings by feral predators (Lutcavage et al. 1997). Marine turtles undertake long migrations of up to 2,500 km from their feeding grounds to their breeding and nesting areas, magnifying their vulnerability to human-induced threats (Plotkin 2003; Spotilla 2004). For example, tagged green and loggerhead turtles that nest in Western Australia have been resighted in Arnhem Land and as far north as the Java Sea near Indonesia (Baldwin et al. 2003; Limpus 2007).

Increased anthropogenic threats, coupled with the low fecundity of marine turtles, have resulted in many turtle species being threatened with extinction throughout their distribution around the world (Gulko & Eckert 2003). The International Union for Conservation of Nature (IUCN) Red List classifies green and loggerhead turtles as endangered species and hawksbill turtles are listed as critically endangered. The flatback turtle is not classified as there is insufficient data on their population size (IUCN 2007). Historically, turtle populations in Australia are reported to have declined steadily and significantly (Environment Australia 2003).

Marine turtles and their eggs were commercially harvested in the Ningaloo Region from the early 1950's until 1973, with historical reports suggesting that tens of thousands of turtles were harvested (Limpus 2002; Limpus 2007). The size of turtle populations prior to commercial harvesting is not quantified due to a lack of data (Dean 2003), in part because monitoring entire populations of turtles is complex given their migratory nature (Girondot et al. 2006). This highlights the importance of collecting data on nesting abundance, to predict long term trends which will assist future conservation and management strategies for turtle populations within the Region.

Since commercial harvesting has ceased, the key threat to turtle population recovery along the Ningaloo Coast remains to be the predation of eggs and hatchlings by introduced species, in particular the European red fox (*Vulpes vulpes*) (Limpus 2002; Dean 2003; McKinna-Jones 2005). Foxes have been reported to have damaged between 40-70% of nests on some beaches in the past (Dean 2003). Uncontrolled predation of turtle nests by foxes can reduce the chance of population recovery within the Region.

Growing ecotourism in the area has increased public interest with regards to turtle viewing resulting in turtle interactions along the coast. Marine turtles are sensitive to disturbance during the nesting period when adults aggregate in shallow waters and come ashore to nest (Collins 2000). The presence of people on nesting beaches at night using artificial light can cause disturbance to nesting females and hatchlings (Waayers 2003; Johnson et al. 1996; Lorne & Salmon 2007). Nesting female turtles are sensitive to disturbance and will abandon nesting attempts if they feel threatened. This unnecessary expenditure of energy can also potentially reduce their nesting success rate. Hatchlings are also disturbed by artificial light, causing disorientation and may cause them to become lost on the beach. This can lead to dehydration and increased risk of predation (Lutcavage et al. 1997).

Another unnatural threat is the presence of four wheel drive vehicles on beaches which results in sand compaction and also the formation of wheel ruts, in which hatchlings can become trapped (Limpus 2002).

3. INTRODUCTION

3.1. The Ningaloo Turtle Program

The Ningaloo Turtle Program (NTP) was established in 2002 as a collaborative initiative between the Department of Environment and Conservation (DEC) - Exmouth District, Cape Conservation Group Inc. (CCG), and the World Wildlife Fund - Australia (WWF).. The primary aim of the program is to predict long-term trends in marine turtle populations along the Ningaloo Coast. This is accomplished through the collection of turtle nesting information such as nesting abundance and disturbance data. This data assists DEC in managing the reduction of disturbance levels to nesting turtles.

Volunteers are essential to the maintenance of the program. Based in Exmouth, Western Australia the NTP provides an opportunity for the local community and, interstate and international volunteers to partake in turtle conservation. Participating provides volunteers with an opportunity to gain practical field experience and learn scientific monitoring techniques and skills.

The program's overarching goals and objectives are listed below:

NTP Overarching Goals

- Identify key nesting beaches.
- Monitor population fluctuations between regions and assess trends.
- Identify the level of threat of feral predators on nests.
- Implement protection of key nesting beaches in cooperation with DEC.
- Generate and maintain community interaction and support for the program.
- Educate visitors and the community about marine turtles.

NTP Primary Objectives

- Determine the abundance of expected nests on specific sections of beach over specified time intervals for each species.
- Identify the relative significance of specific nesting beaches to each species.
- Establish the level of disturbance on nests; and
- Determine the impact of human interaction on the nesting success of each species.

Consolidation of the Ningaloo Turtle Program

Turtle activity has been monitored along this coastline for the past ten nesting seasons. The survey effort has varied from season to season. In 2008 the program undertook research into consolidating the program. Trend analysis showed that the trends in marine turtle populations within the study area could be detected, with a reasonable level of error when monitoring/survey effort was substantially reduced. Survey effort would need to include both the pre and post peak and intensive peak period of the monitoring in order to establish these trends (Whiting, 2008).

The peak period was determined by data analysis from previous seasons nesting patterns. Weekend monitoring within the pre and post peak monitoring periods captures early and late fluctuations in nesting activity.

3.2. NTP Zoning

Important nesting beaches were identified through past aerial and ground surveys. For the purpose of the program, the Ningaloo Region is divided into four divisions. These are further divided into sections which are divided into subsections. Subsections were determined by natural barriers that separate beaches and car parks. Subsection length is also an important consideration and distances of these are restricted to an average of 2-3kms so that surveying on foot remains a practical means of conducting the survey. Subsections are defined by GPS locations and are signalled by NTP totem markers which indicate the start and finish of each subsection.

North West Cape Division

The North West Cape (NW Cape) Division includes Lighthouse Bay, Hunters, Graveyards and Tantabiddi sections, which are further divided into subsections (see Appendix 1 for further division information).

Cape Range Division

The Cape Range Division encompasses one Bungelup section, which is divided into three separate subsections (see Appendix 2 for further division information).

Bundera/Ningaloo Division

The Bundera/Ningaloo Division includes six sections. These sections are classified into one or more subsections. This division has not been monitored by NTP since the 2007-08 season. However, DEC field staff conduct opportunistic monitoring within this division during monthly fox baiting operations. For the purpose of this report this data has been omitted from the results contained within this report.

Coral Bay Division

The Coral Bay Division is divided into two sections: Batemans Bay and Lagoon. These sections are each classified into one or more subsections. This division has not been monitored by NTP since the 2008-09 season. However DEC field staff conduct opportunistic monitoring within this Division during monthly fox baiting operations, but for the purpose of this report this data has been omitted from the results.

4. VOLUNTEER COORDINATION 2011-12

NTP Coordinator

In 2011-12 the NTP Coordinator role was the responsibility of the DEC Nature Conservation Ranger position. Additional DEC staff assistance was provided by Marine Rangers over the intensive monitoring period. This approach ensures consistency, knowledge retention and a high level of management throughout the program. The key duties of the NTP coordinator include organisation of the program data management, quality control, field work and reporting. The coordinator currently reports to the District Nature Conservation Coordinator.

4.1. PARTICIPATION, RECRUITMENT AND ACCOMMODATION

Participation

Volunteers have contributed a total of 45,856 hours since monitoring began in 2002 (Figure 1). Volunteer contribution has significantly reduced in the past three seasons (Figure 1 and Figure 2). This can be attributed to the reduction in NTP survey effort both spatially and temporally in 2009-10, 2010-11 and 2011-12 and the discontinuation of the Jurabi Turtle Centre (JTC) program as an element of NTP operations. It should be noted that these figures do not include the Department of Environment and Conservations staff time and costs.

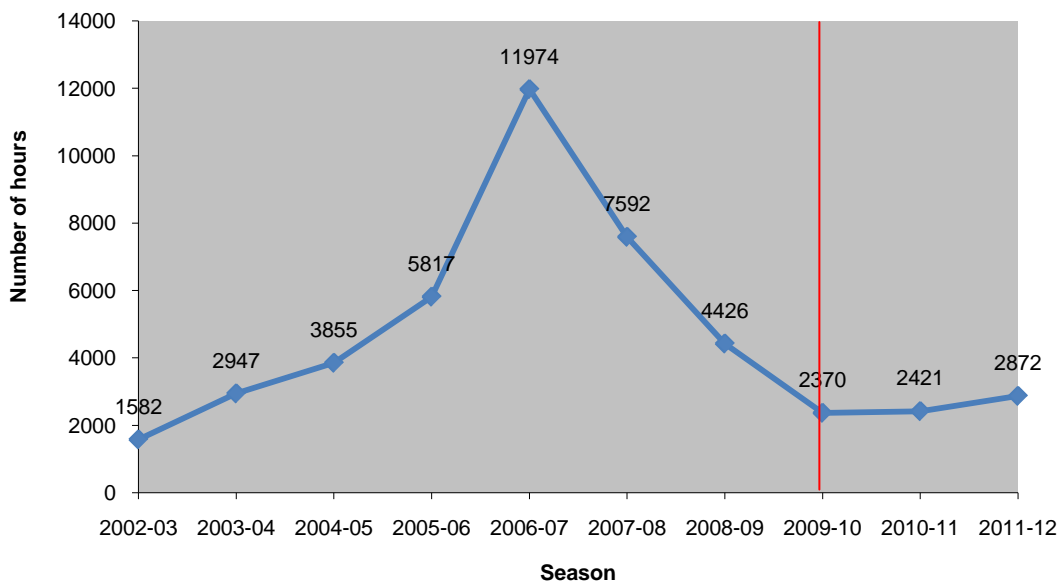


Figure 1: NTP volunteer hours contributed per year 2002-12. The red lines show the year the program was consolidated.

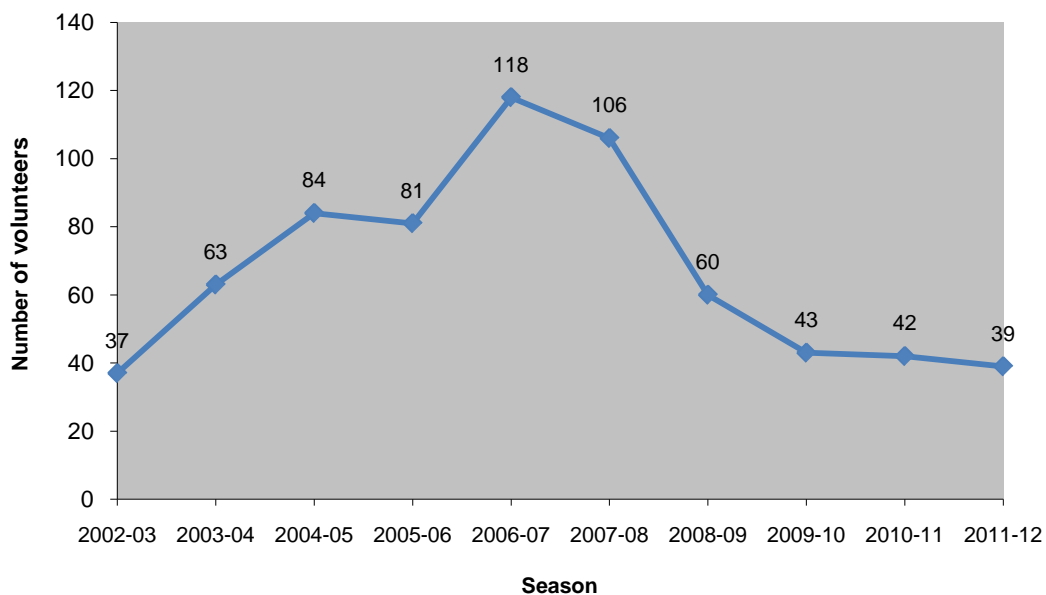


Figure 2: The number of NTP volunteers per year 2002-12.

This season a total of 39 local and external volunteers assisted with NTP operations - monitoring, training, data entry and administration. This contribution equates to a value of \$57,440 based on a pay rate of \$20/hour (Table 1).

Table 1: Summary of volunteer contribution and associated monetary value, NTP 2011-12.

Volunteer type	Number of Volunteers	Hours	Volunteer hours at \$20 p/hr
Local	25	423.5	\$8 470
Team Leaders	3	893	\$17 860
Externals	11	1555.5	\$31 110
Total	39	2872	\$57 440

In 2009-10 NTP introduced a scheme to minimise its costs by way of cost recovery. Since the 2009-10 season external volunteers have been charged a participation fee. In 2011-12 the participation fee was \$1,300 which subsidised volunteer accommodation..

Of the 39 volunteers that participated in 2011-12, 64% were residents of Exmouth, 13% were external volunteers from other areas in Western Australia and 23% came from interstate. The age of volunteers ranged from 18 to 63.

Recruitment

NTP Local Volunteers

The local community plays an integral role in the longevity of the current NTP. Twenty five local volunteers participated in the pre and post peak weekend monitoring. Five of these volunteers are trainers and they assisted in training locals, team leaders and external volunteers.

NTP Volunteer Team Leader Internship

Volunteer Team Leaders were appointed to help prepare for and assist in supervising the external volunteers over the intensive peak period of monitoring. Successful applicants were required to participate for a period of eight weeks, during which they were provided a subsidy for accommodation, food and air travel to and from Perth to Exmouth. The positions were advertised as an 8 week internship from 25th November 2011 to the 20th January 2012. Three team leaders were appointed, one with previous Ningaloo Turtle Program experience and two with other turtle related experience.

The Team Leader internships were advertised through the following mediums: the NTP website, NTP workshops and information days in Exmouth, the CCG Newsletter, EELIS (Exmouth emails for local information service), Exmouth community notice boards and a number of Australian Universities. Previous local and external volunteers were invited to participate in this season's program, by way of email prior to the commencement of the new season. Individuals enquiring about the program throughout the year were also contacted by email prior to the commencement of the new season.

NTP External Volunteers

External volunteers coming from various Australian and International locations are a vital part of the NTP. They are required to provide an intensive volunteer role and commit to the program for a period of 5 weeks. This includes 1 week of training and 4 weeks of daily monitoring. During 2011-12, 12 external volunteers were recruited with one leaving the program due to health reasons..

The NTP volunteer positions were advertised through the same mediums as the NTP Team Leader internships.

DEC staff

Five DEC staff assisted in monitoring and training over the intensive monitoring period on 2011-12. This provided the volunteers and team leaders with added assistance and support on a regular basis.

NTP Indigenous Internship

The NTP encourages participation of local indigenous people within the program. A subsidy is available for local indigenous participants to assist payment of accommodation, food and travel, similar to that available to the volunteer team leaders

Accommodation

- Team Leaders were provided with accommodation at the Exmouth Villas in the Exmouth Township for the entire eight weeks.
- NTP external volunteers were provided accommodation for a five week period in Exmouth at the Exmouth Villas, Exmouth, Western Australia. All 2011-2012 external volunteers were required to pay a participation fee of \$1,300 of which a majority of this went towards the cost of their accommodation.
- Team Leaders and External volunteers also had the opportunity to participate in remote camping at the Bungelup Camp, located 6km north of Yardie Creek in Cape Range National Park. Volunteers rotated between the camp on a four day, three night roster.
- Local Volunteers were not provided with accommodation.

4.2. MONITORING OPERATIONS

From the 19th December 2011 – 15th January 2012 intensive peak monitoring was conducted seven days a week by team leaders and external volunteers, with a DEC staff member assisting every second to third day. Local volunteers were also encouraged to participate in the program during the peak period. Volunteers were rotated between NW Cape and Cape Range Divisions (see Appendix 8.1 and Appendix 8. 2 for respective maps). Outside of intensive peak period monitoring, pre and post peak weekend monitoring was undertaken on 12th - 13th and 26th - 27th November 2011, 10th - 11th December 2011, 19th February and 11th March 2012. The weekend of the 28th - 29th January 2012 was cancelled due to cyclonic activity. The 18th Feb and 10th March were cancelled due to lack of local volunteer availability. Pre and post peak monitoring was conducted solely by local volunteers along the NW Cape Division only. DEC staff were rostered to fill gaps where possible to provide added monitoring capacity during this period.

North West Cape Division

- A minimum of 10 volunteers are required to adequately survey each of the 11 subsections within the NW Cape Division.
- A 12-seater minibus was required for the duration of the intensive peak monitoring period to transport external volunteers to and from the NW Cape monitoring sites (hired from Budget).
- Several DEC vehicles were required to transport local volunteers to and from monitoring throughout the entire the season including pre and post peak weekend monitoring and intensive peak period monitoring.
- On numerous occasions volunteers chose to use their own vehicle without receiving any reimbursement for fuel costs or additional expenses relating to their vehicle.
- Monitoring hours were between 5:30am – 10:30am depending on the amount of nesting activity and number of turtle strandings discovered on that day.

Cape Range Division

- One team leader accompanied by a maximum of two volunteers was required to monitor each of the three Bungelup subsections within the Cape Range Division.
- A DEC vehicle was used at the Bungelup camp throughout the four week intensive peak monitoring period.
- Monitoring hours occurred approximately between 5:30am – 10:30am depending on the amount of nesting activity and number of turtle strandings.

Bundera/Ningaloo Division and Coral Bay Division

- During 2011-12 the intensive peak monitoring period did not occur within the Bundera/Ningaloo and Coral Bay Divisions due to continued reductions in survey effort. Please refer to section six for further details.
- DEC field staff conducted opportunistic turtle monitoring during monthly fox baiting operations in these divisions, but for the purpose of this report this data has been omitted from the results.

4.3. VOLUNTEER TRAINING AND ASSESMENT

It is a prerequisite that NTP participants have a good understanding and a sound knowledge of monitoring techniques and turtle nesting activity to accurately record findings. Volunteers undertake an induction which includes the following:

- A background briefing on NTP and its operations, Exmouth Township and surrounding area including the Ningaloo Marine Park and Cape Range National Park.
- Occupational health and safety policies and procedures.
- NTP monitoring procedures.
- Participation in a Jurabi Turtle Centre (JTC) tour and a briefing on the DEC Code of Conduct for beach-based marine turtle observations.
- A temporary copy of the NTP Turtle Monitoring Field Guide (CCG 2007).
- Practical training by DEC staff in radio and Global Positioning System (GPS) use.

NTP volunteers were trained prior to the four week intensive peak monitoring period. Each participant was required to undertake a minimum of three practical training sessions followed by a practical competency-based assessment. Once qualified, they were deemed competent as “Turtle Trackers” and were provided with a certificate of competency and a NTP t-shirt. Additional training sessions were available if required to ensure volunteers were confident to accurately survey a subsection unaccompanied. Daily supervision was provided by team leaders and DEC staff.

This season training and assessment was facilitated by five DEC staff and five local volunteer trainers. Together they awarded competency to four local volunteers and 13 external volunteers (one team leader already had their competency).

5. MONITORING METHODS AND DATA COLLECTION

5.1. Identification of Nests and False Crawls

- To determine turtle nesting activity, volunteers survey beaches at sunrise. Turtle tracks and nest markings in the sand from the previous evening are recorded. Track and nest markings allow volunteers to identify the presence of green, loggerhead, hawksbill or flatback female turtles.
- A nest is determined by the presence of a nest mound and additional key features such as an escarpment and a shallow secondary body pit (CCG 2007). The term nest is used but the eggs aren't actually witnessed to be laid. Therefore error can be expected as turtles can sometimes create nests without depositing any eggs into them (Whiting pers.com. 2012)
- The position of the nest is recorded using a GPS and its location on the beach is noted: (I) Intertidal, (H) High tide area, (E) edge of vegetation, or (D) dunes and beyond.
- If a nest is not located with the associated turtle track and the turtle has abandoned any nesting attempt and returned to the water, this activity is recorded as a false crawl.
- Once the turtle activity is identified and recorded as either a nest or a false crawl, volunteers mark off the activity by drawing a line in the sand (across the neck of the nest away from the egg chamber, or through the track in the case of a false crawl) to avoid double counting of turtle activities on subsequent beach surveys.
- All turtle activity is recorded on the NTP monitoring data sheet, which is then entered into the NTP database at a later stage (Appendix 4).
- Other observations and general comments such as: a turtle still nesting on the beach, presences of hatchlings, comments relating to a photograph taken, illegal activities sighted on the beach are also recorded on the data sheet.

5.2. Identification of Predation and Predator Prints

- Evidence of damage to new nests and old nests along with the potential cause of damage are recorded on the NTP monitoring data sheet. This includes the presence of eggshells, partially consumed eggs, and significant holes dug within the immediate locality of the egg chamber (CCG 2007). The level of damage recorded is not viewed as an accurate figure because during monitoring new nests are checked for signs of predation and old nests are only recorded on an incidental basis if they are encountered during the monitoring of the new nests. Therefore there is a high likelihood that some of the disturbance to old nests goes undetected, resulting in underestimates of true predation levels.
- Any prints within a 5m radius of the nest, including dog (D), fox (F) or human (H) prints are recorded.
- Fox and/or dog presence in any subsection is also recorded. A single dog or fox can walk along a stretch of beach for many kilometres, subsequently leaving prints on a number of subsections within a single evening. Therefore, the presence or absence of fox and dog prints is recorded and does not indicate the number of individual animals present on a beach in one evening.
- This season volunteers were required to complete a DEC "Dangerous Fauna Record Sheet" for every dingo sighting. The locality, date, time and observer are recorded, along with the identifying characteristic of the animal and observed behaviour, if relevant.

5.3. Data Entry

- All data recorded on each NTP data sheet is entered into a Microsoft Access database which is managed by the DEC Exmouth District. The database allows for information to be retrieved via queries and the generation of summary reports.
- Data is entered according to the date, division, section and subsection on the data sheet. Along with all turtle activity details including species type, nest location coordinates, details of predation, general comments, the presence of fox and dog tracks and the number of false crawls (Appendix 4).

5.4. Rescues and Mortalities

- Volunteers will occasionally encounter stranded turtles, which they assist back to the ocean. Nesting turtles are likely to become stranded in either the rocky shoreline or behind the sand dunes. Purpose-made turtle stretchers are kept in the two NTP vehicles throughout the season and are used to carry turtles when they are rescued from these situations. Volunteers are required to complete a DEC form “Marine Turtle Stranding or Mortality Datasheet” for every stranded or deceased turtle that is encountered.
- Volunteers are also required to complete a DEC “Marine Wildlife Stranding and Mortality Datasheet” for all other deceased wildlife – i.e. dolphins, whales, dugongs, sea birds, sharks and sea snakes that they may encounter.

5.5. Tagged Turtles

- During the 1986-87 turtle nesting season the Western Australian Marine Turtle Project (WAMTP) was introduced by DEC (formally known as CALM) in order to gather information on the distribution and abundance of Western Australian marine turtle populations and the movements of individual turtles. Turtles were tagged at several locations in WA such as the Lacepede, Muiron, Barrow, Varanus, and Rosemary Islands, the North West Cape, Exmouth Gulf and Cape Thouin. Tagging was conducted over several intermittent turtle nesting seasons with varying intensity at the tagging locations.
- Turtles encountered on the beaches during NTP monitoring activities are checked for tags wherever possible, without disturbing the turtle (preferably when the turtle is returning to the water’s edge). Tagged turtles are recorded on the Tagged Turtle Resighting datasheet for DEC’s West Australian Turtle Research Program (Appendix 5). The locality, date and observer are recorded, along with the left and right tag numbers, turtle species, time of observation, turtle activity and nest location if relevant.

6. MONITORING RESULTS

6.1. Survey Effort

Survey Effort 2011-12

In 2011-12 monitoring was conducted in the North West Division (32-37 days) and Cape Range Division (29-30 days) (Table 1).

Table 2: Number of days monitored of each NW Cape and Cape Range Division per subsection, 2011-12.

Division	Section	Subsection	Number of Days Monitored
North West Cape	Lighthouse	Mildura Wreck – North West Car park	32
		North West Car park - Surf Beach	32
		Surf Beach – Hunters	33
	Hunters	Hunters – Mauritius	37
		Mauritius – Jacobsz South	36
		Jacobsz South – Wobiri	36
		Graveyards	Five Mile - Five Mile North
	Tantabiddi	Five Mile – Trisel	37
		Brooke – Graveyards	36
		Graveyards – Burrows	36
		Burrows - Jurabi Point	36
Cape Range		Bungelup	Bungelup North - Neils North
	Bungelup South - Bungelup North		31
	Rollys- Bungelup South		29
TOTAL			477

North West Cape Division

Within the NW Cape Division monitoring occurred between the 12th November 2011 and the 10th March 2012. This included both intermittent weekend monitoring and an intensive four week mid-season period of monitoring. Refer to Appendix 8.1 for a map of the North West Cape Division.

The four week intensive peak period of monitoring occurred between the 19th December 2011 and the 15th January 2012. No monitoring was conducted on New Year's Day (1st January 2012); counts of tracks on 2nd January 2012 included tracks from 1st January and 2nd January. In this instance the track counts were averaged over the two days.

Outside of this four week block period, intermittent weekend monitoring was conducted on the following dates: 12th -13th November, 26th - 27th November, 10th -11th December, the 19th Feb and 11th March. The weekend of the 28th -29th January 2012 was cancelled due to cyclonic activity. The 18th February and 10th of March were cancelled due to lack of local volunteer availability. The pre and post peak weekend monitoring is designed to pick up any early or late fluctuations in breeding activity that would indicate a shift in the peak period.

All subsections were monitored between 32-37 days, depending on the availability of volunteers and weather conditions (Table 2). In the case of insufficient volunteers to cover all sections, the most northern three subsections (between Mildura Wreck and Hunters) were omitted from monitoring. This is due to those subsections having lower turtle nesting density.

Cape Range Division

Within the Cape Range Division, monitoring occurred only over the four week intensive peak period between the 19th December 2011 and the 15th January 2012. All three Bungelup subsections were monitored between 29-30 days (Table 2). No monitoring was conducted on New Year's Day (1st January 2012); counts of tracks on 2nd January 2012 included tracks from both 1st January and 2nd January, therefore track counts were averaged over the two days. Refer to Appendix 8.2 for a map of Cape Range Division and Bungelup sections.

Bundera/Ningaloo Division and Coral Bay Division

Due to continued reductions in survey effort during the 2011-12 season, monitoring did not occur within the Bundera/Ningaloo and Coral Bay Divisions.. DEC field staff conducted opportunistic turtle monitoring during monthly fox baiting operations in these two Divisions. For the purpose of this report, this data has been omitted from the results. Refer to Appendix 8.3 for a map of the Bundera/Ningaloo and Coral Bay Divisions.

Survey Effort 2002-12

The survey effort for all dates and subsections during 2002-2012 is 9,814 subsections surveyed Table 3. However, since the commencement of the NTP in 2002, there has been a reduction in the program survey area and effort. This is due to capacity constraints and limited funding availability. In 2008, research was undertaken to determine the minimum amount of survey effort and area required to adequately predict long term trends in the marine turtle population within the Ningaloo Region. The results indicated that subsections and survey effort could be reduced compared to that of previous seasons (Whiting, 2008).

Therefore the survey period in 2009-10 and successive seasons since then have been reduced to a four week block of intensive peak period monitoring and pre and post peak monitoring weekends outside of this. Monitoring was also reduced to only high density nesting beaches, which excluded Bundera and Coral Bay Divisions.

Due to the change in effort and to make previous session's data comparable to recent data, survey effort per subsection is the unit of measure. Refer to Table 4 for standardised season dates, survey effort, and subsections monitored.

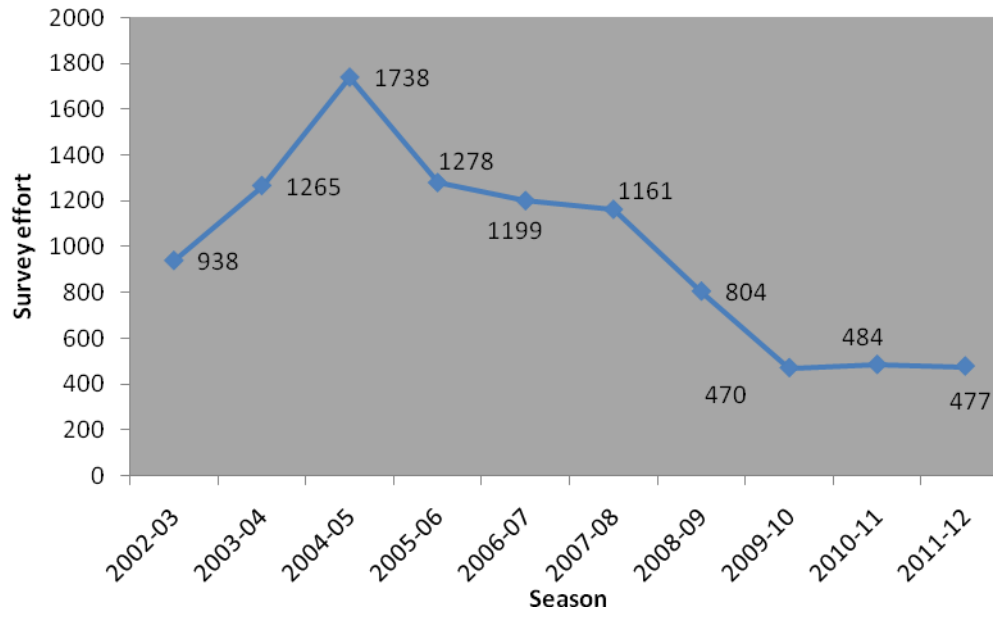


Figure 3: Seasonal survey effort for all dates and subsections 2002-12.

Table 3: Survey effort and turtle activity per entire season for 2002-12 (all data and subsections).

Season		2002/03	2003-/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	TOTAL
Survey Dates for entire season		18/11/02-16/04/03	11/11/03-30/03/04	3/11/04-18/03/05	21/11/05-28/02/06	1/12/06-28/02/07	1/12/07-28/02/08	7/12/08-1/03/09	7/11/09-27/03/10	6/11/10-27/03/11	12/11/11-11/03/12	
Division	Section											
North West Cape	Graveyards	165	375	374	368	341	336	234	160	153	144	2650
	Hunters	248	263	271	271	256	252	173	117	114	109	2074
	Lighthouse Bay	127	137	215	260	222	251	147	83	93	97	1632
	Navy Pier	N/A	86	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	86
	Tantabiddi	115	3	N/A	85	86	84	58	38	37	36	542
Cape Range	Bloodwood	N/A	4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4
	Bungelup	1	49	152	114	120	140	124	72	87	91	950
	Turquoise Bay	N/A	16	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	16
	Boat Harbour	N/A	N/A	203	N/A	N/A	N/A	N/A	N/A	N/A	N/A	203
Bundera/ Ningaloo	Carbaddaman	7	N/A	204	N/A	N/A	N/A	N/A	N/A	N/A	N/A	211
	Janes Bay	13	24	12	29	22	4	N/A	N/A	N/A	N/A	104
	Norwegian Bay	2	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3
	Whaleback Beach	N/A	7	8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	15
Coral Bay	Batemans Bay	103	100	117	51	76	47	34	N/A	N/A	N/A	528
	Lagoon	103	100	116	51	76	47	34	N/A	N/A	N/A	527
	Turtle Beach	56	100	66	49	N/A		N/A	N/A	N/A	N/A	271
Total survey effort*		940	1265	1738	1278	1199	1161	804	470	484	477	9816
Number subsections monitored		22	29	28	20	19	19	18	14	14	14	197
Green nests		1539	1552	788	4695	4349	5254	6297	571	2732	6591	34368
Green false crawls		5404	3086	2533	9948	14395	13156	12608	1451	6507	22865	91953
Green activity		6943	4638	3321	14643	18744	18410	18905	2022	9239	29456	126321
Green nesting success %		22.2%	33.5%	23.7%	32.1%	23.2%	28.5%	33.3%	28.2%	29.6%	22.4%	27.2%
Hawksbill nests		48	81	100	108	157	156	336	202	189	64	1442
Hawksbill false crawls		49	60	139	71	153	145	207	202	132	84	1242
Hawksbill activity		97	141	239	179	310	301	543	404	321	148	2684

Hawksbill nest success %	49.5%	57.4%	41.8%	60.3%	50.6%	51.8%	61.9%	50.0%	58.9%	43.2%	53.7%
Loggerhead nests	288	387	777	1068	540	795	580	288	405	382	5510
Loggerhead false crawls	429	359	1040	925	477	954	486	471	388	715	6244
Loggerhead activity	717	746	1817	1993	1017	1749	1066	759	793	1097	11754
Loggerhead nesting success	40.2%	51.9%	42.8%	53.6%	53.1%	45.5%	54.4%	37.9%	51.1%	34.8%	46.9%
Unidentified nests	29	123	59	42	33	61	38	8	18	7	418
Unidentified false crawls	44	20	82	45	19	29	12	8	9	4	272
Unidentified activity	73	143	141	87	52	90	50	16	27	11	690
Unidentified nesting success	39.7%	86.0%	41.8%	48.3%	63.5%	67.8%	76.0%	50.0%	66.7%	63.6%	60.6%
Total all species nests	1904	2180	1724	5913	5279	6266	7252	1069	3343	7044	41979
Total all species false crawls	5925	3536	3794	10989	15044	14284	13314	1451	7038	23668	99043
Total activity	7829	5716	5518	16902	20323	20550	20566	2520	10381	30712	141017

Table 4: Survey effort and turtle activity 2002-12 standardised season (only includes the intensive peak period monitoring data and specific subsections).

NTP Season		2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2010/11	2010/11	2011/12	TOTAL
Survey Dates intensive peak period monitoring dates		16/12/02-12/01/03	15/12/03-11/01/04	20/12/04 - 16/01/05	19/12/05 - 15/01/06	18/12/06 - 14/01/07	17/12/07-13/01/08	15/12/08 - 11/01/09	14/12/09 - 10/01/10	20/12/10 - 16/01/11	19/12/11 - 15/01/12	
Division	Section											
North West Cape	Graveyards	57	100	112	107	100	100	96	70	108	112	1066
	Hunters	72	78	84	81	75	75	72	50	81	84	830
	Lighthouse Bay	53	34	56	77	75	75	72	39	77	84	720
	Tantabiddi	9	N/A	N/A	27	25	25	24	17	27	28	208
Cape Range	Bungelup	0	11	71	66	69	60	60	30	79	84	605
Total survey effort*		191	223	323	358	344	335	324	206	372	392	3068
Number subsections monitored		11	12	12	14	14	14	14	14	14	14	147
Flatback nest		0	0	0	0	0	0	0	0	0	0	2
Flatback false crawl		0	0	0	0	0	0	1	0	0	0	1
Flatback activity		0	0	0	0	0	0	1	0	0	0	3

Flatback activity adjusted by survey effort	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Flatback nesting success	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Green new nests	587	475	266	1548	1650	1721	3103	239	2270	5683	17964
Green new nests adjusted by survey effort per day	3.1	2.1	0.8	4.3	4.8	5.1	9.6	1.2	6.1	14.5	5.9
Green false crawls	1821	1328	785	4217	5138	4959	5226	634	5322	20501	51245
Green activity	2408	1803	1051	5765	6788	6680	8329	873	7592	26184	69209
Green activity adjusted by survey effort per day	12.6	8.1	3.3	16.1	19.7	19.9	25.7	4.2	20.4	66.8	22.6
Green nesting success %	24.4%	26.3%	25.3%	26.9%	24.3%	25.8%	37.3%	27.4%	29.9%	21.7%	26.0%
Hawksbill new nests	17	14	31	45	67	48	193	98	155	60	842
Hawksbill new nests adjusted by survey effort	0.1	0.1	0.1	0.1	0.2	0.1	0.6	0.5	0.4	0.2	0.3
Hawksbill false crawls	20	14	49	33	80	38	119	106	109	79	830
Hawksbill activity	37	28	80	78	147	86	312	204	264	139	1672
Hawksbill activity adjusted by survey effort per day	0.2	0.1	0.2	0.2	0.4	0.3	1.0	1.0	0.7	0.4	0.5
Hawksbill nesting success	45.9%	50.0%	38.8%	57.7%	45.6%	55.8%	61.9%	48.0%	58.7%	43.2%	50.4%
Loggerhead new nests	52	78	324	544	306	380	320	136	383	368	3173
Loggerhead new nests adjusted by survey effort	0.3	0.3	1.0	1.5	0.9	1.1	1.0	0.7	1.0	0.9	1.0
Loggerhead false crawls	141	128	449	484	244	557	218	214	349	681	3897
Loggerhead activity	193	206	773	1028	550	937	538	350	732	1049	7070
Loggerhead activity adjusted by survey effort per day	1.01	0.92	2.39	2.87	1.60	2.80	1.66	1.70	1.97	2.68	2.30
Loggerhead nesting success	26.9%	37.9%	41.9%	52.9%	55.6%	40.6%	59.5%	38.9%	52.3%	35.1%	44.9%
Unidentified new nests	1	10	14	21	13	17	21	3	15	3	124
Unidentified new nests by survey effort per day	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0
Unidentified false crawls	2	7	36	18	9	12	7	3	9	4	116

Unidentified activity	3	17	50	39	22	29	28	6	24	7	240
Unidentified activity adjusted by survey effort per day	0.0	0.1	0.2	0.1	0.1	0.1	0.1	0.0	0.1	0.0	0.1
Unidentified nesting success	33.3%	58.8%	28.0%	53.8%	59.1%	58.6%	75.0%	50.0%	62.5%	42.9%	51.7%
Total new nests (all species)	657	577	635	2158	2036	2166	3637	476	2823	6114	22105
Total new nests (all species) adjusted by survey effort per day	3.4	2.6	2.0	6.0	5.9	6.5	11.2	2.3	7.6	15.6	7.2
Total false crawls (all species)	1984	1477	1319	4752	5471	5566	5571	957	5789	21265	56089
Total activity (all species)	2641	2054	1954	6910	7507	7732	9208	1433	8612	27379	78194
Total turtle activity adjusted by survey effort per day	13.83	9.21	6.05	19.30	21.82	23.08	28.42	6.96	23.15	69.84	25.49

6.2. Turtle Activity

Turtle activity 2011-12

North West Cape Division

A total of 6,606 nests and 22,830 false crawls were recorded within the NW Cape Division during 2011-12 (Table 5). Green turtles showed by far the greatest nesting activity in the NW Cape Division (both nests and false crawls) with 97.9%, followed by the loggerhead turtle (1.4%) and hawksbill turtle (0.6%). 0.2% of nests were unidentified.

Table 5: The total number of activities (nests and false crawls) recorded for each species within the North West Division, NTP 2011-12.

North West Cape Division	Turtle Species				
	Green	Hawksbill	Loggerhead	Unidentified	Total
New nests	6484	31	84	7	6606
False crawls	22625	39	163	3	22830
Total activity	29109	70	247	10	29436

The greatest number of nests was within the Hunters Section (2,583), followed by Graveyards Section (2,319), Tantabiddi Section (1,015) and Lighthouse Bay Section (689). The greatest number of false crawls was within the Graveyards Section (8,681) followed by Hunters Section (8,612), Lighthouse Bay Section (3,944) and Tantabiddi Section (1,593) (Figure 4). For individual nest locations see maps in Appendix 7, Appendix 8, Appendix 9 and Appendix 10.

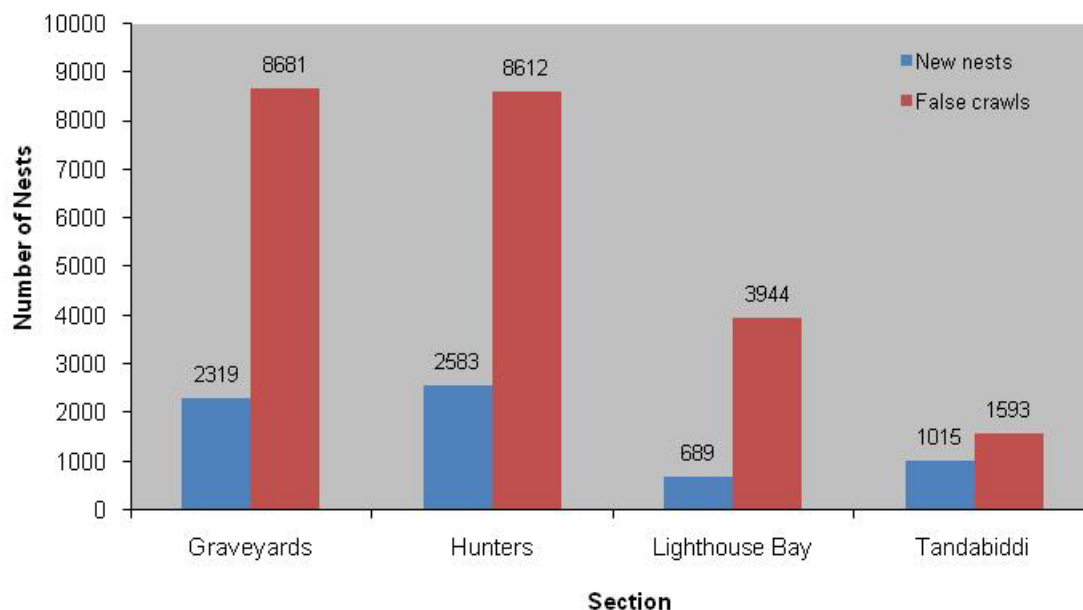


Figure 4: Comparison of nesting activity (nests and false crawls) recorded in each NW Cape Section, NTP 2011-12.

Green turtles accounted for 98.18% of recorded nests along the North West Cape Division, followed by loggerhead (1.27 %) and hawksbill turtles (0.47 %). A small percentage of nesting activity was recorded as unknown (0.11%) (Figure 5).

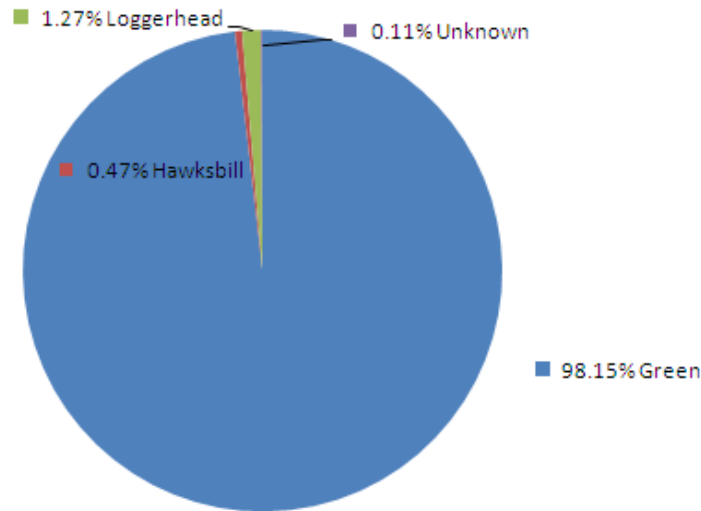


Figure 5: Percent comparison of species for North West Cape Division, 2011-12

Cape Range Division

A total of 438 nests and 837 false crawls were recorded in the Bungelup Section (Cape Range Division) during the 2011-12 NTP season (Table 8 and Table 9). The loggerhead turtle had the greatest number of nests recorded in the Bungelup Section (68%), followed by green (24.5%) and hawksbill turtles (7.5%).

Table 6: The total number of nests recorded for each species within the Ningaloo Region (NW Cape and Cape Range Divisions), NTP 2011-2012.

Division	Turtle Species				Total
	Green	Hawksbill	Loggerhead	Unidentified	
Cape Range	107	33	298	0	438

Table 7: The total number of false crawls recorded for each species within the Ningaloo Region (NW Cape and Cape Range Divisions), NTP 2011-2012.

Division	Turtle Species				Total
	Green	Hawksbill	Loggerhead	Unidentified	
Cape Range	239	45	552	1	837

The highest number of nests was recorded in the Bungelup Beach Subsection (163) followed by Rolly Beach Subsection (151) and Neils Beach Subsection (124). The greatest number of false crawls was in the Rolly Beach Subsection (301) followed by Bungelup Beach Subsection (300) and Neils Beach Subsection (236) (Figure 6). For individual nests locations see Appendix 11.

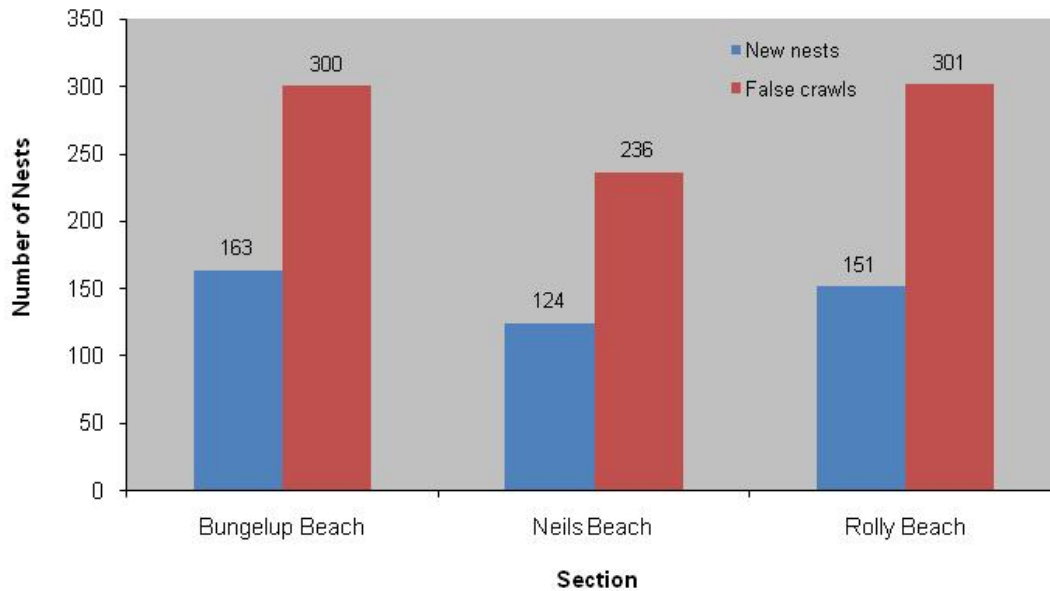


Figure 6: Comparison of nesting activity (nests and false crawls) recorded within each Cape Range Division (Bungelup Section), NTP 2011-12.

Loggerhead turtles accounted for 68.04% of recorded nests along the Cape Range Division, followed by green (24.43%) and hawksbill turtles (7.53%) (Figure 7).

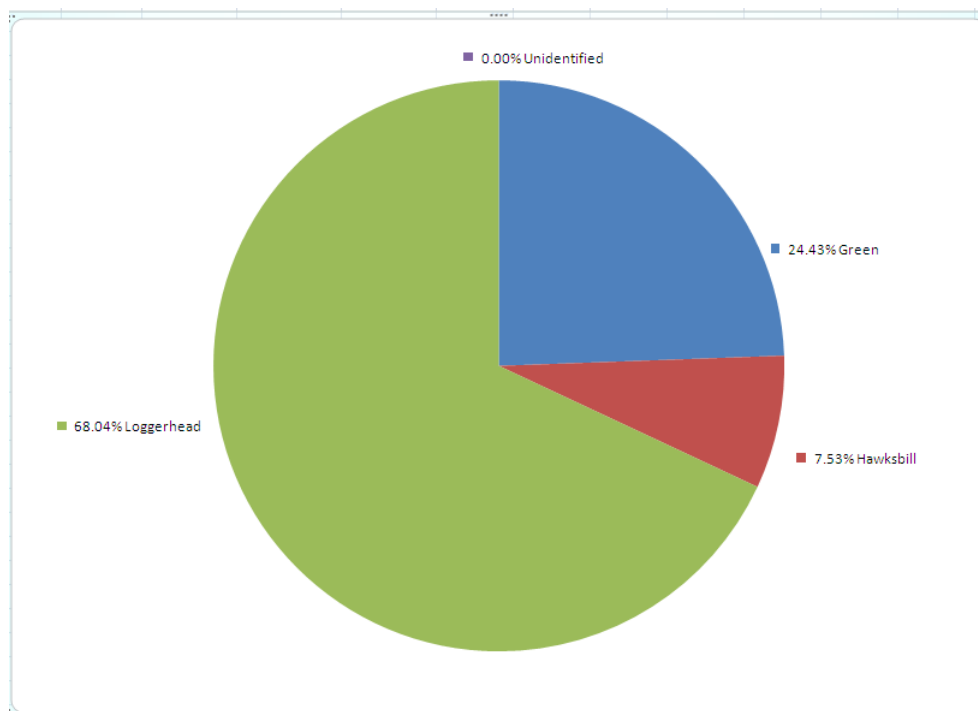


Figure 7: Percent comparison of species for Cape Range Division, 2011-12.

Ningaloo Region (North West Cape and Cape Range Divisions)

Green turtles accounted for 93.6% of recorded nests in the Ningaloo Region, followed by loggerhead (5.4%) and hawksbill turtles (0.9 %). A small percentage of nesting activity was recorded as unknown (0.1%) and no flatback nests were identified during the 2011-2012 season (Figure 8).

Similarly green turtles had the highest records of false crawls (22853) followed by loggerhead (715), hawksbill (84) and unidentified tracks (4) (Figure 9).

Table 8: The total number of nests recorded for each species within the Ningaloo Region (NW Cape and Cape Range Divisions), NTP 2011-12.

Division	Turtle Species				Total
	Green	Hawksbill	Loggerhead	Unidentified	
Cape Range	107	33	298	0	438
North West Cape	6484	31	84	7	6606
Grand Total	6591	64	382	7	7044

Table 9: The total number of false crawls recorded for each species within the Ningaloo Region (NW Cape and Cape Range Divisions), NTP 2011-12.

Division	Turtle Species				Total
	Green	Hawksbill	Loggerhead	Unidentified	
Cape Range	239	45	552	1	837
North West Cape	22614	39	163	3	22830
Total	22853	84	715	4	23667

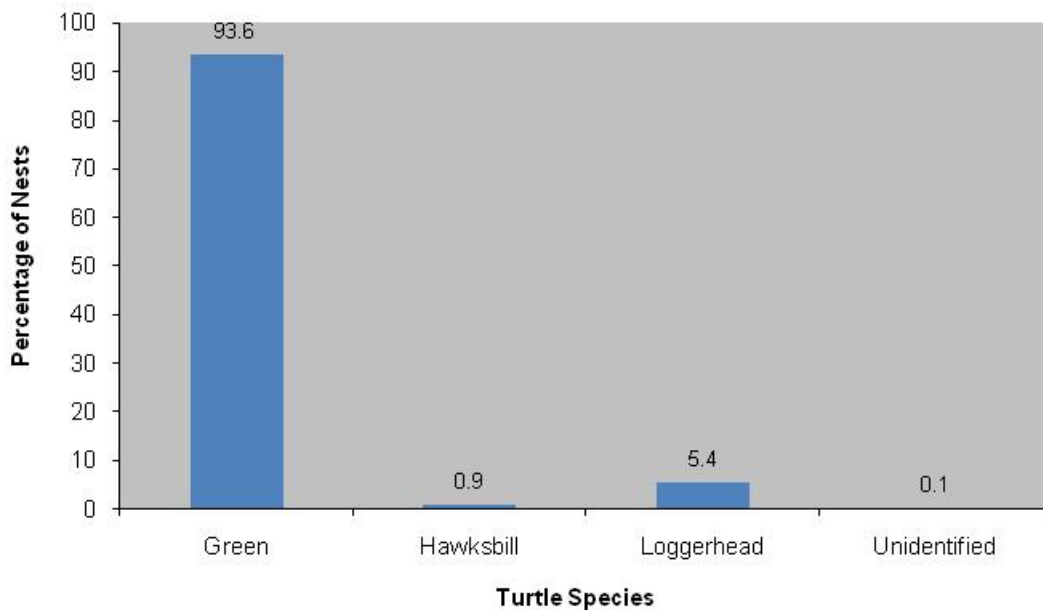


Figure 8: Percentage comparison of nests recorded for each species within the Ningaloo Region (NW Cape and Cape Range Divisions), NTP 2011-12.

Turtle Activity 2002-12

The NTP has recorded 41,979 nests and 99,043 false crawls over all season dates and subsections since commencement of the program in 2002 (Table 3). The 2011-12 season has had the greatest activity since the commencement of NTP despite having one of the lowest survey efforts. Green turtles are by far the most abundant species with a total of 126,321 nests and false crawls recorded, followed by loggerhead activities 11,754 and hawksbill activities 2684 (Table 3).

When comparing data standardised by subsection and survey effort occurring over the intensive peak monitoring period 2002-12, NTP has recorded 22, 525 nests and 55, 023 false crawls (Table 4). These results also show that the 2011-12 season has had the highest level of turtle activity and nests recorded since the commencement of the program (Figure 9 and Table 4).

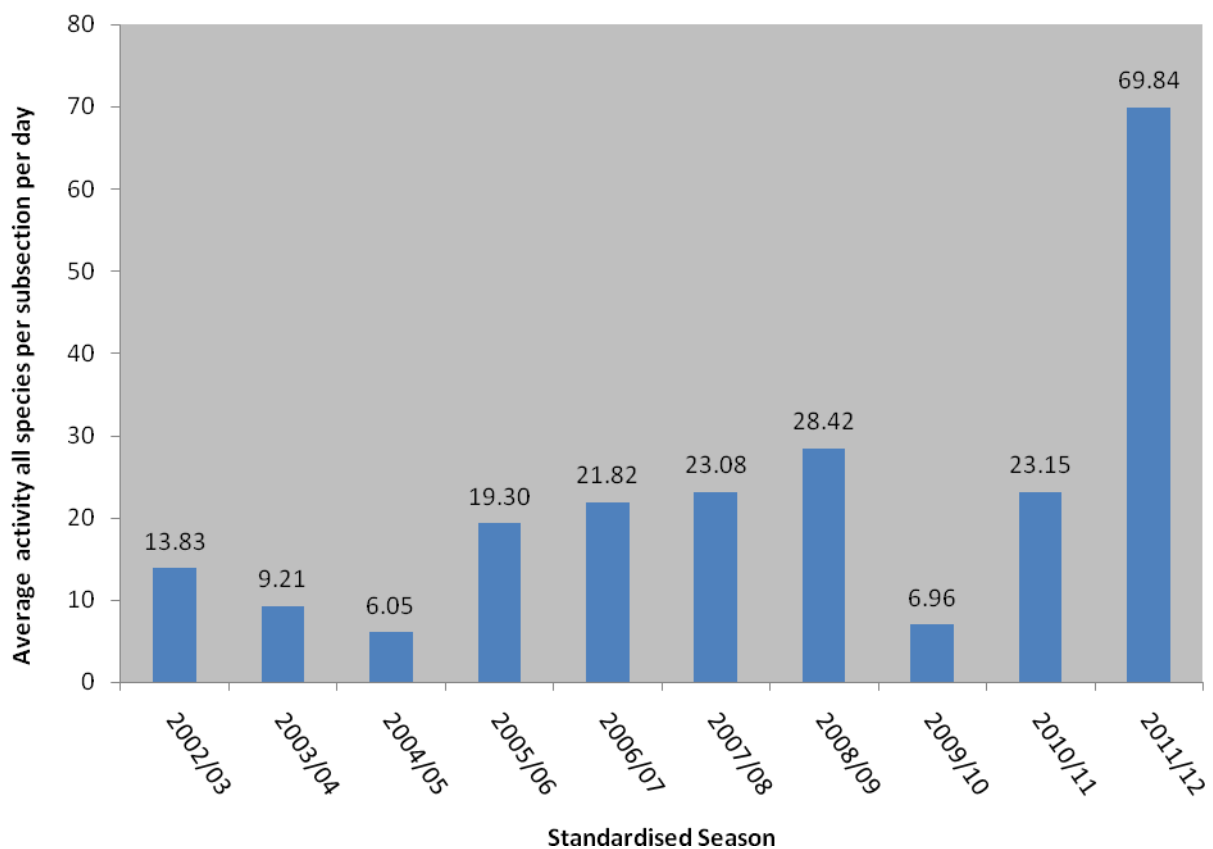


Figure 9: Seasonal green, loggerhead and hawksbill turtle activity (nest and false crawls) standardised by subsection and survey effort during the intensive peak monitoring period.

Green Turtle

When comparing species the green turtle had the highest level of activity and nesting recorded during 2011-12 (Figure 10 and Figure 11).

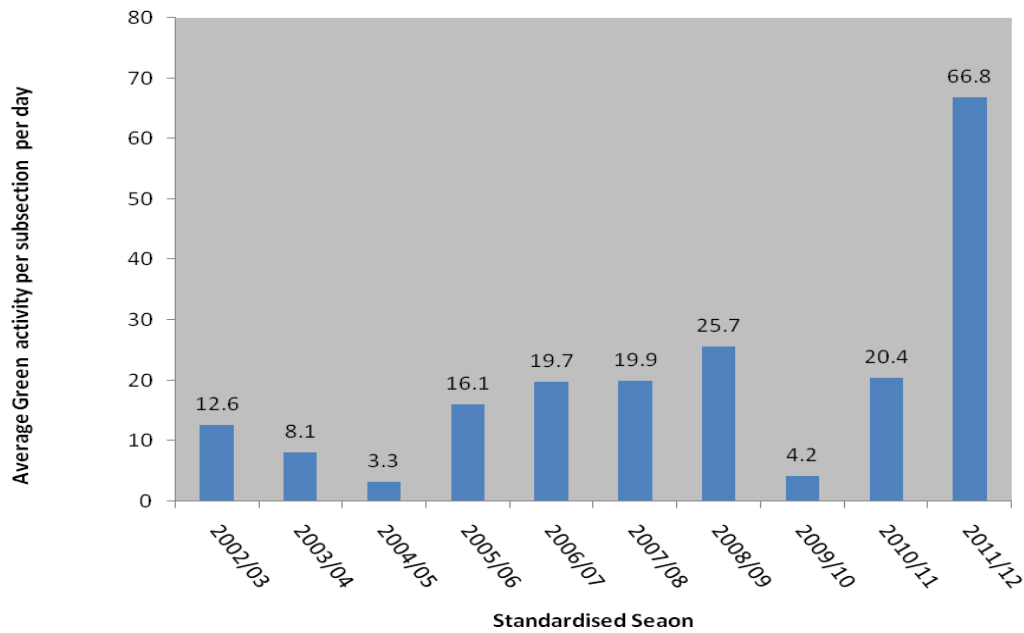


Figure 10: Seasonal green activity (nests and false crawls) standardised by subsection and survey effort during the intensive peak monitoring period

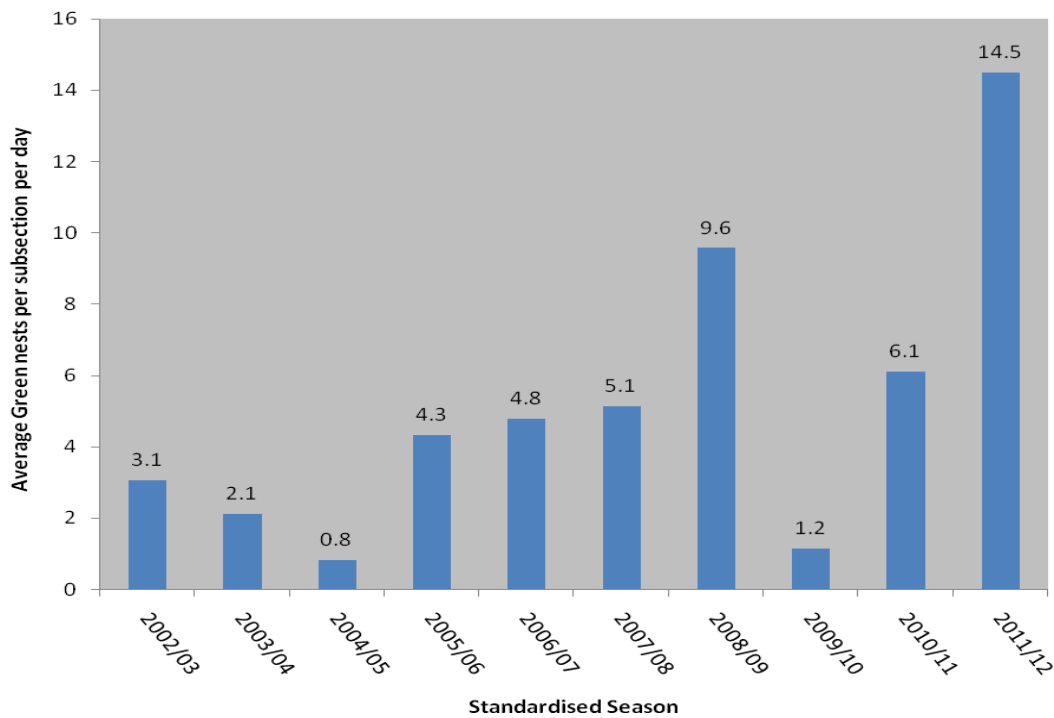


Figure 11: Seasonal green turtle nests standardised by subsection and survey effort during the intensive peak monitoring period.

Hawksbill Turtle

Since the commencement of NTP the level of hawksbill turtle total activity and nesting has varied but both have seen a decrease over the past two years (Figure 12 and Figure 13).

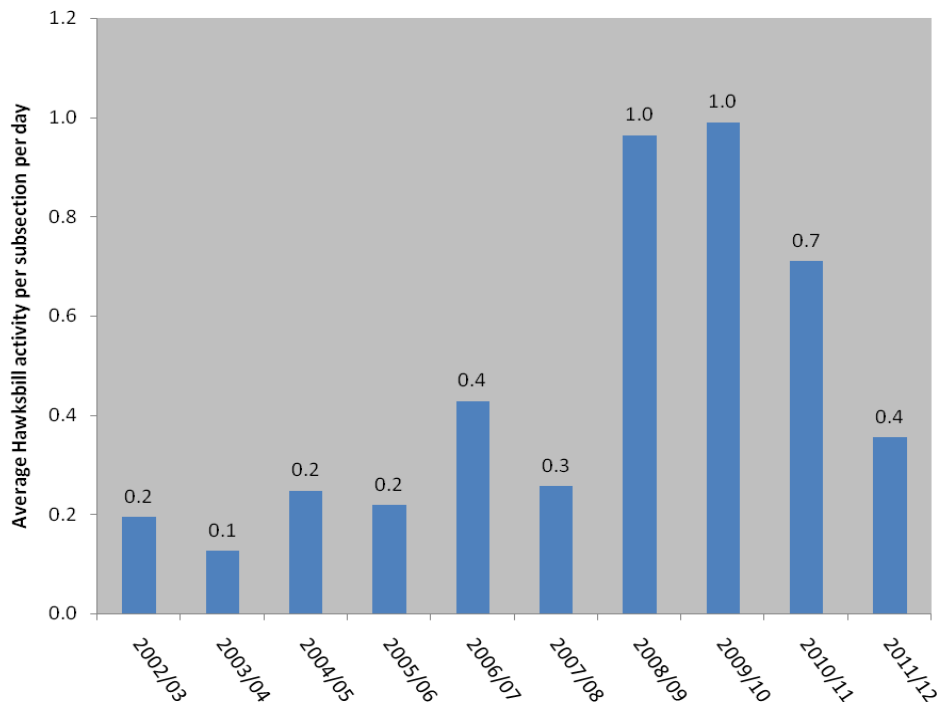


Figure 12: Seasonal hawksbill activity (false crawls and nests) standardised by subsection and survey effort during the intensive peak monitoring period.

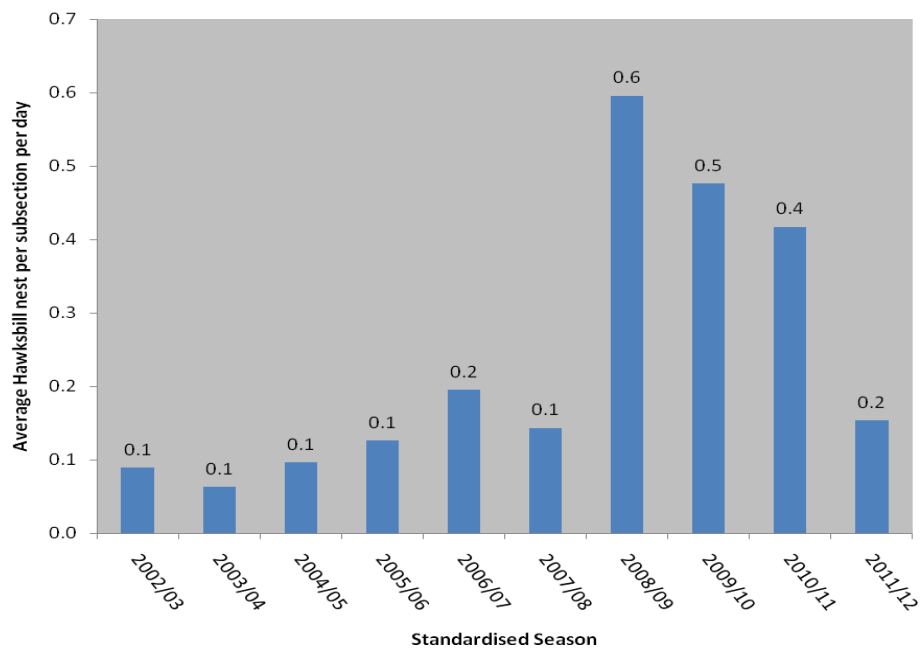


Figure 13: Seasonal hawksbill nests standardised by subsection and survey effort during the intensive peak monitoring period.

Loggerhead Turtle

Since the commencement of NTP the level of activity and nesting conducted by loggerhead turtles has also varied. Activity has increased over the past three years and nesting has increased in the last two years (Figure 14 and Figure: 15)

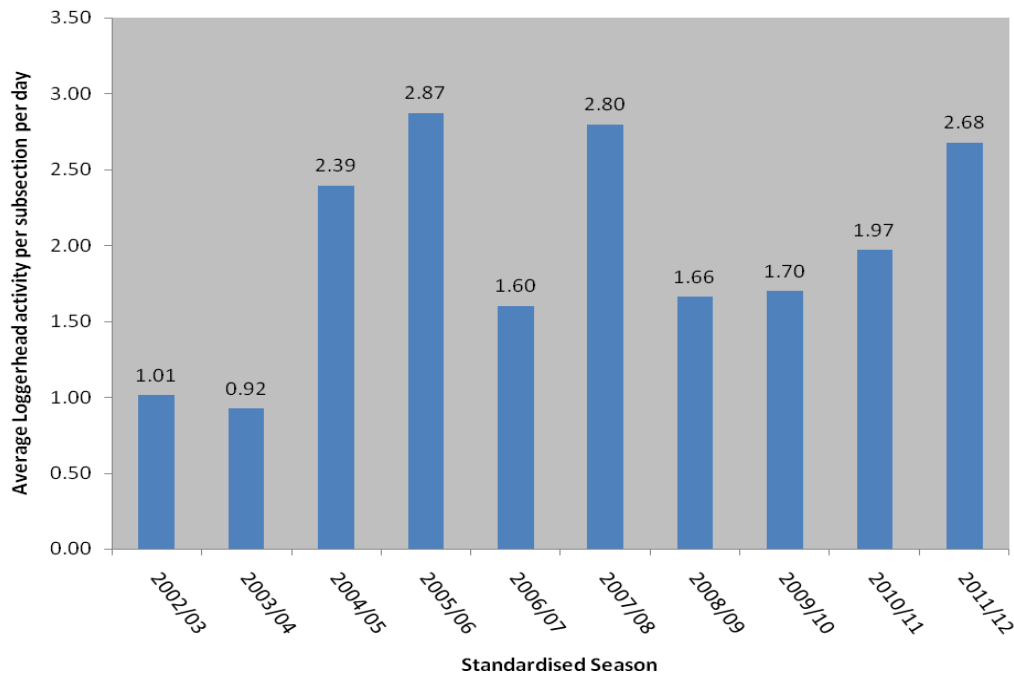


Figure 14: Seasonal loggerhead activity (false crawls and nests) standardised by subsection and survey effort during the intensive peak monitoring period.

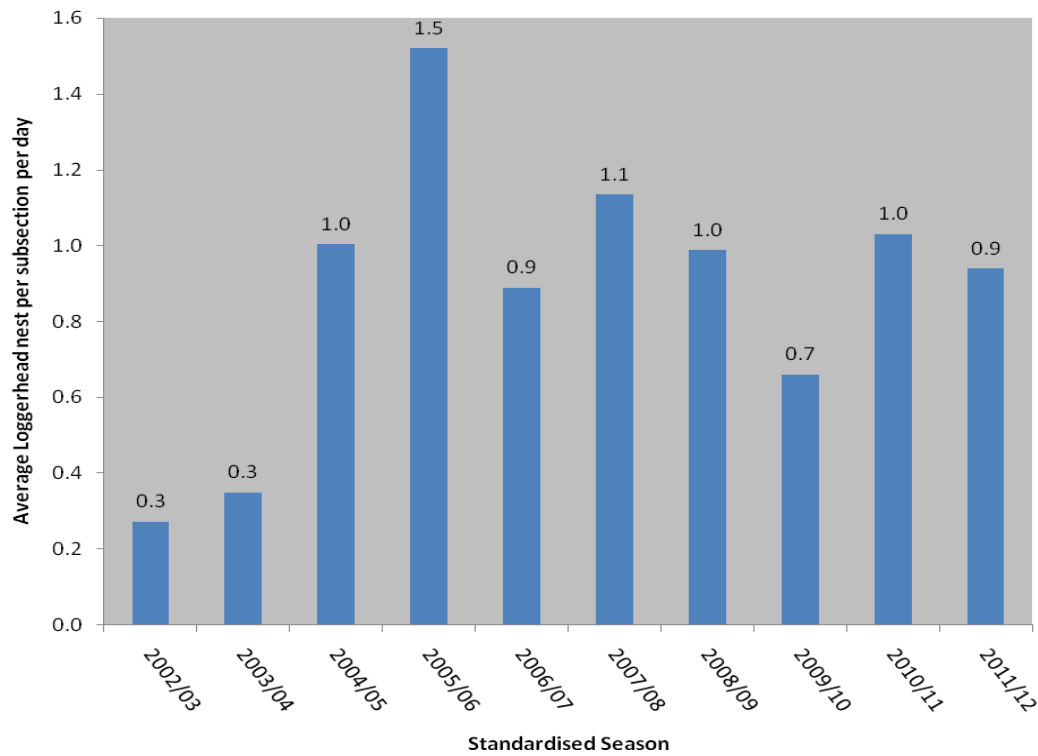


Figure: 15: Seasonal loggerhead nests standardised by subsection and survey effort during the intensive peak monitoring period.

6.3. Nesting Success

Nesting Success 2011-12

It should be noted that nesting success has been calculated using visual assessment of the nest after the turtle has left the beach. The nests are identified and recorded as nests if they meet the visual characteristics which define nests. Night time records of a sample of 50 nesting turtles needs to be undertaken to check whether eggs are deposited or not. This would give an indication of how much error exists in terms of identifying a viable nest (Whiting, 2010).

When the data is compared per species NTP recorded a total of 6594 green turtle nests and 22865 green turtle false crawls during 2011-12 season which equates to 22.38% nesting success (Table 3). The hawksbill turtle had the greatest nesting success rate of 43.62% with NTP recording 56 new nests and 84 false crawls (Table 3). The loggerhead turtle had 382 nests and 715 false crawls which resulted in a nesting success rate of 34.9%.

The proportionally low success rate for this season may possibly be influenced by the high number of turtles nesting in concentrated areas, which could result in a higher rate of turtles disturbing each other and hence producing more false crawls.

Nesting Success 2002-12

Green Turtle

Green turtle nesting success has varied over the years with a spike in 2008-09 with a 37.3% success rate. In previous seasons this has ranged between 24.4 –39.9% (Figure 17) .

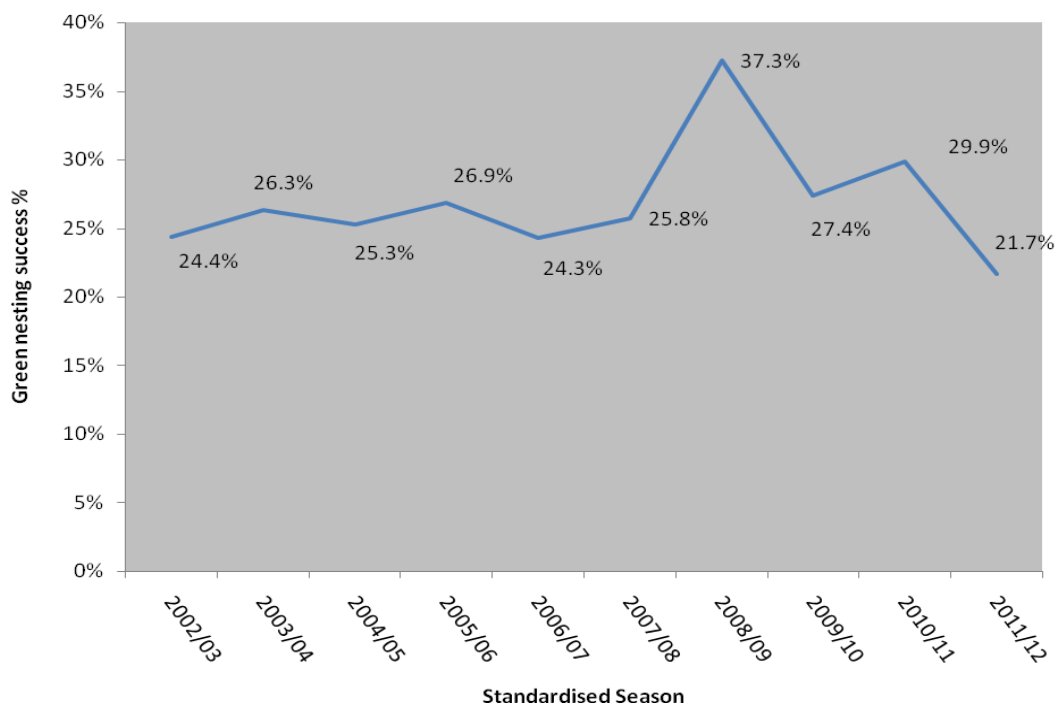


Figure 16: Green turtles nesting success between 2002 and 2012 (%), Standardised by subsection and survey effort during intensive peak monitoring period.

Hawksbill Turtle

Nesting success of hawksbill turtles has varied from between 38.8-61.9% (Figure 17).

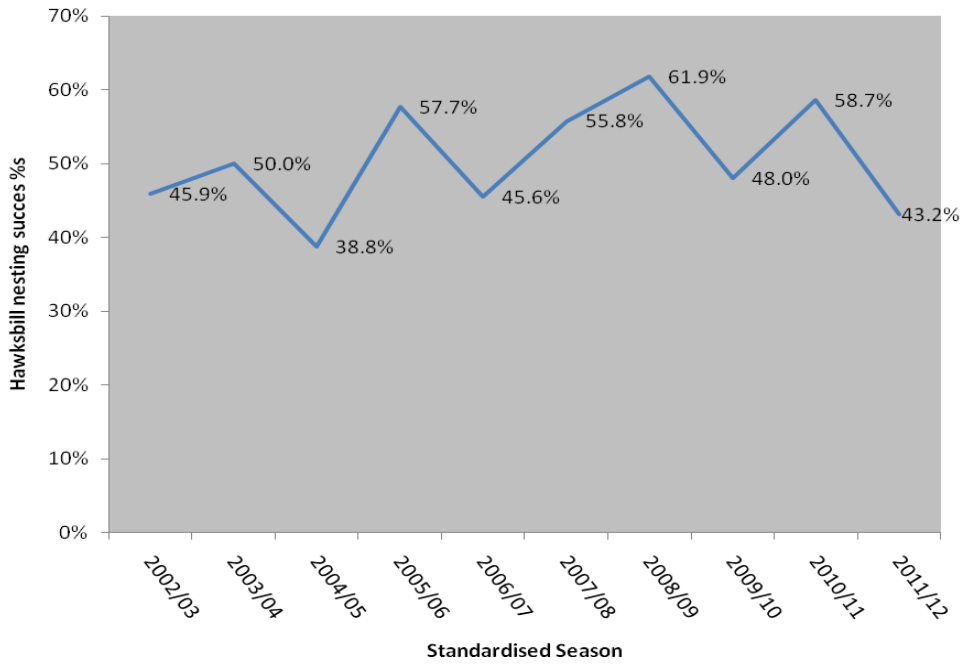


Figure 17: Hawksbill turtle nesting success between 2002-12 (%).standardised by subsection and survey effort during intensive peak monitoring period.

Loggerhead Turtle

The loggerhead nesting success rate has varied from 26.9 – 59.5%.

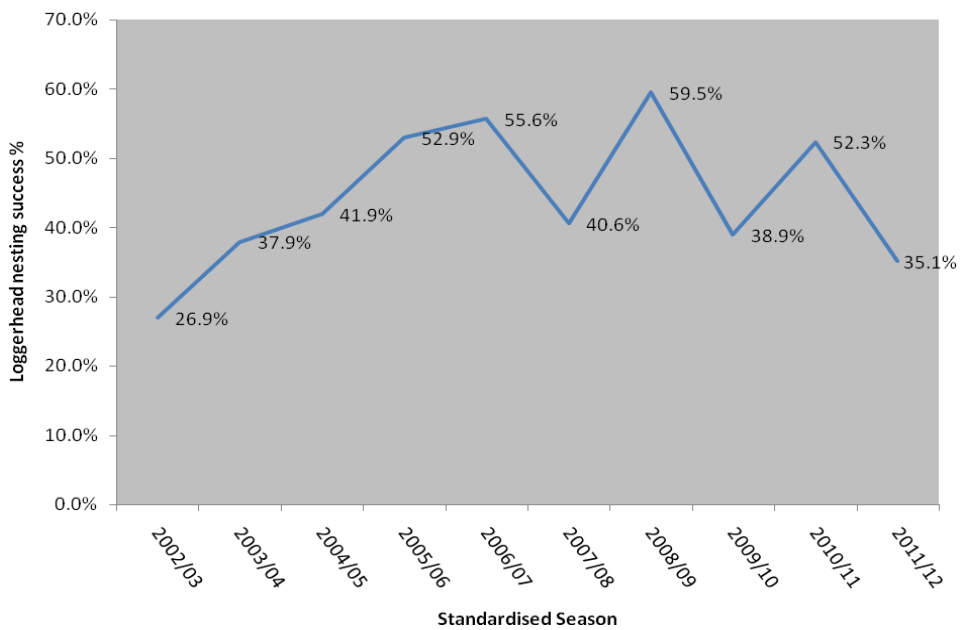


Figure 18: Loggerhead nesting success between 2002 and 12 (%) standardised by subsection and survey effort during intensive peak monitoring period.

6.4. Nest Damage

Nest Damage 2011-12

A total of 66 nests (new and old) were recorded as damaged in the Ningaloo Region, 64 of which were located in the NW Cape Division - Graveyards Section (29), Hunters Section (22), Tantabiddi Section (6), and Lighthouse Bay Section (7). Only 2 nests were damaged in the Cape Range Division (Bungelup Section) (Table 10). Damaged nests account for 0.9% of the total nests recorded in the 2011-12 season. Refer to Appendix 1 and Appendix 2 for maps of sections. Note: nest damage is however not viewed as an accurate figure since during monitoring only new nests are purposely checked for signs of damage and a large proportion of old nests are not checked for damage (old nests are only recorded on an incidental basis if they are encountered during the monitoring of the new nests), therefore there is a high likelihood of not seeing old damaged nests and hence underestimating true nest damage levels.

Cause of New and Old Nest Damage							
Division	Section	Another Turtle	Dog	Fox	Tide	Unknown	Total
Cape Range	Bungelup	1	1	0	0	0	2
North West Cape	Graveyards	17	1	2	3	6	29
	Hunters	16	0	0	2	4	22
	Lighthouse Bay	5	0	0	1	1	7
	Tantabiddi	3	0	1	1	1	6
Total		42	2	3	7	12	66

Table 10: The total number of damaged nests and causes, NTP 2011-12.

The majority of nest damage this season was contributed to other turtles accidentally digging up nests (63%), followed by unidentified damage (18%), tide inundation (11%), fox disturbance (5%) and dog disturbance (3%) (Figure 19).

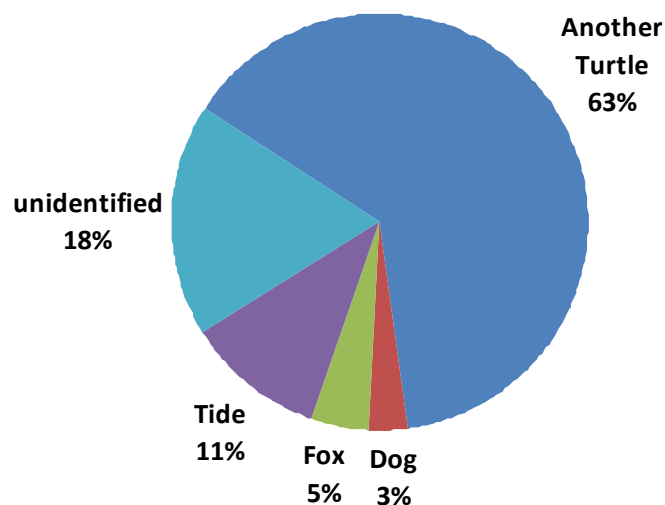


Figure 19: Percentage comparison of nest (new and old) damage cause, Ningaloo Region 2011-12.

Nest Damage 2002-12

Since monitoring began in 2002 a total of 798 nests (new and old) have been recorded as damaged within the Ningaloo Region (Table 11). This equates to 1.9% of total nests recorded within the Ningaloo Region 2002-2012 (please note that survey effort within the region varies for each NTP season, see Table 3 and Table 4 for detailed survey effort data).

Table 11: Total number of damaged nests (new and old) and cause per season NTP 2002-2012 entire season. NA indicates data no longer collected on this category.

Season	Cause of Nest (new and old) Damage										Total
	Unknown	Dog	Fox	Ghost Crab	Goanna	Human	Seagull	Tide	Another Turtle	Vehicle	
2002-2003	14	0	58	14	3	9	2	2	3	0	105
2003-2004	53	0	95	4	2	11	2	4	2	0	173
2004-2005	10	0	26	2	1	1	0	2	1	2	45
2005-2006	0	0	4	12	0	0	2	2	4	1	25
2006-2007	5	5	30	22	1	0	0	1	13	0	77
2007-2008	9	9	13	96	4	2	3	9	13	0	158
2008-2009	31	7	57	1	0	0	0	0	1	0	97
2009-2010	15	2	15	2	4	1	0	0	0	0	39
2010-2011	0	1	2	3	0	1	0	6	0	0	13
2011-2012	12	2	3	NA	NA	NA	NA	7	42	NA	66
Total	149	26	303	156	15	25	9	33	79	3	798

6.5. Nest Predation

Nest Predation 2011-12

Predation of nests by foxes and dogs

Damage by foxes and dogs accounted for 7.6% of damaged nests in 2011-12 and 0.07% of the total nests in the 2011-12 NTP (Table 10 and Figure 20). Note recorded fox and dog predation is however not viewed as an accurate figure since only predation is recorded the night after the nest has been laid or if a volunteer happens to come across an old nest that has been predated on. Visits by foxes or dogs to nests on subsequent evenings are not specifically recorded.

Nest Predation 2002-12

Predation of nests by foxes and dogs

Since 2002, damage by foxes and dogs has accounted for 41.2 % of the total damaged nests recorded. Nest predation by foxes and dogs has remained below the accepted level of 5% for all recorded nests. Loss of up to 5% of nests to foxes and dogs is considered a non threatening level of nest predation (Limpus pers. coms).

The highest record of fox and dog predation since monitoring began is 4.6% of total nests in 2003-04 and was primarily within the Five Mile subsection. As this subsection is a significant green turtle rookery, fox control measures were introduced by DEC in the following season (2004-2005) (Halkyard, 2008) and as a result fox and dog predation has declined significantly in subsequent seasons and has maintained a very low level (less than 1.59%) due to continued fox baiting at key rookeries.

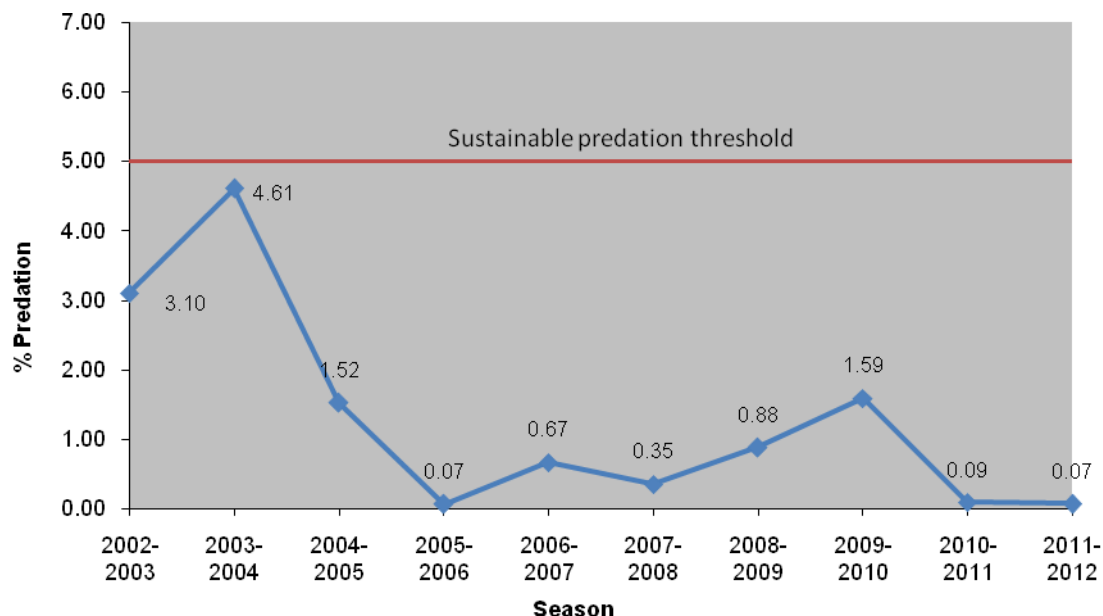


Figure 20: Fox and dog predation as a percentage of total nests per season, NTP 2002-12. Note: data from 2009-10 season onwards includes NW Cape and Cape Range Divisions only, other seasons include an additional two divisions.

Division	Subsection	Species	Maturity	Sex	Number
North West Cape	Graveyards- Burrows	Green	Adult	Female	1
Cape Range	Bungelup Beach	Green	Adult	Unknown	1
Cape Range	Neils Beach	Green	Adult	Female	1
Total					39

Table 12: The number of turtles and location rescued, in 2011-2012.

Turtle Rescues 2002-12

NTP volunteers have rescued a total of 226 stranded marine turtles from 2002-2012. The number of turtles rescued has fluctuated greatly over the seasons, with the highest number of turtles rescued in the 2005-2006 season (40), one less than in 2012 (Figure 21). This could be attributed to the increased number of nesting seen in 2011-12.

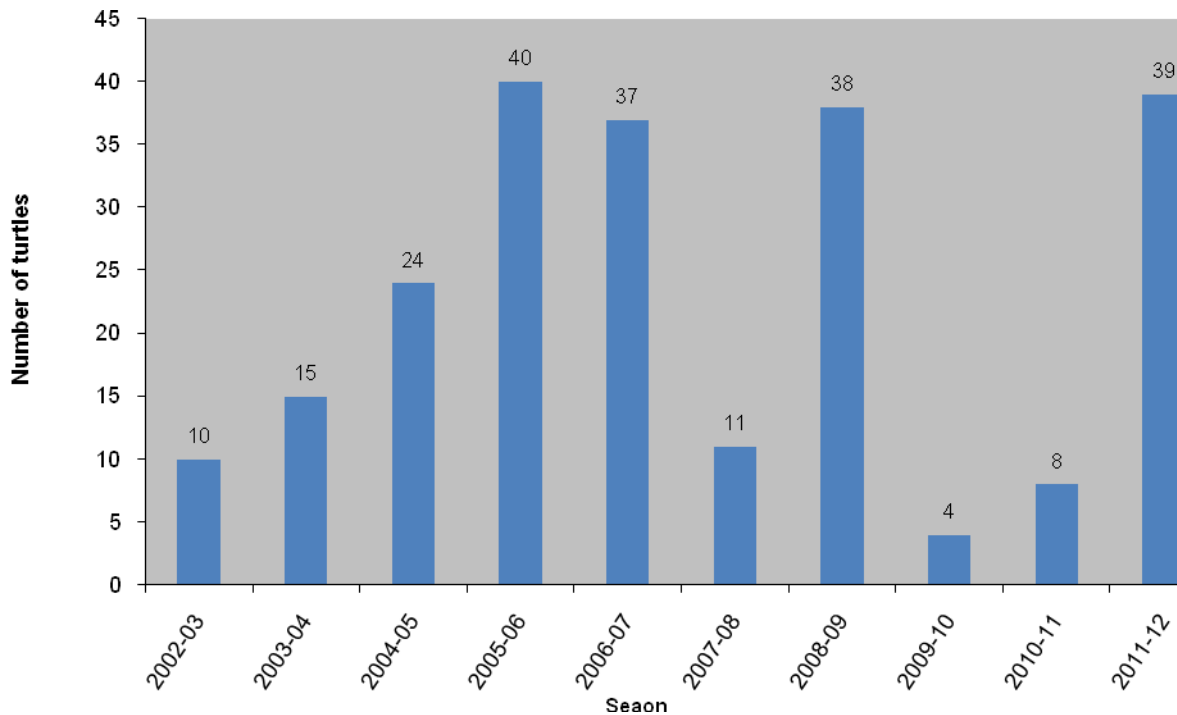


Figure 21: The number of turtles rescued in each NTP season, 2002-12. Note: from 2009-10 season data includes NW Cape and Cape Range Divisions only, other seasons include an additional two divisions.

6.7. Turtle Mortalities

Turtle Mortalities 2011-12

A total of 36 turtle mortalities were recorded during the 2011-12 season, compared to 6 in 2010-2011 (Table 13). Detailed mortality reports can be obtained from the DEC Exmouth District.

Division	Subsection	Species	Maturity	Sex	Number
North West Cape	Mildura- North West Car park.	Green	Adult	Female	1
North West Cape	Five Mile – Trisel	Green	Adult	Female	1
North West Cape	Five Mile - Trisel	Green	Juvenile	Unknown	1
North West Cape	Five Mile - Trisel	Green	Adult	Female	1
North West Cape	Five Mile - Trisel	Green	Adult	Female	1
North West Cape	Five Mile - Trisel	Green	Adult	Female	1
North West Cape	Five Mile - Trisel	Green	Adult	Female	1
North West Cape	Five Mile - Trisel	Green	Adult	Female	1
North West Cape	Five Mile - Trisel	Green	Adult	Female	1
North West Cape	Five Mile - Trisel	Green	Adult	Female	1
North West Cape	Five Mile - Trisel	Green	Juvenile	Unknown	1
North West Cape	Five Mile - Trisel	Green	Adult	Female	1
North West Cape	Brookes - Graveyards	Green	Adult	Female	1
North West Cape	Mauritius - Jacobsz sth	Green	Adult	Female	1
North West Cape	Mauritius- Jacobsz sth	Green	Adult	Female	1
North West Cape	Mauritius - Jacobsz sth	Green	Adult	Unknown	1
North West Cape	Jacobsz sth – Wobiri	Green	Adult	Male	1
North West Cape	Jacobsz sth – Wobiri	Green	Juvenile	Unknown	1
North West Cape	Jacobsz sth – Wobiri	Green	Adult	Male	1
North West Cape	Jacobsz sth – Wobiri	Green	Adult	Female	1
North West Cape	Jacobsz sth – Wobiri	Green	Unknown	Unknown	1
North West Cape	Jacobsz sth – Wobiri	Green	Adult	Unknown	1
North West Cape	Jacobsz sth – Wobiri	Green	Adult	Female	1
North West Cape	Jacobsz sth – Wobiri	Green	Adult	Female	1
North West Cape	Jacobsz sth – Wobiri	Green	Adult	Unknown	1
North West Cape	Jacobsz sth – Wobiri	Green	Adult	Male	1
North West Cape	Jacobsz sth – Wobiri	Green	Adult	Unknown	1
North West Cape	Brookes - Graveyards	Green	Adult	Female	1
North West Cape	Brookes - Graveyards	Green	Adult	Unknown	1
North West Cape	Brookes - Graveyards	Green	Juvenile	Unknown	1
North West Cape	Burrows- Jurabi Point	Green	Adult	Unknown	1
North West Cape	Burrows- Jurabi Point	Green	Adult	Female	1
North West Cape	Burrows- Jurabi Point	Green	Juvenile	Female	1
Cape Range	Bungelup Beach	Green	Adult	Male	1
Cape Range	Bungelup Beach	Hawksbill	Adult	Female	1
Cape Range	Neils Beach	Green	Juvenile	Unknown	1

Division	Subsection	Species	Maturity	Sex	Number
Total					36

Table 13: The location, species and number of deceased turtles recorded in the Ningaloo Region 2011-12.

Turtle Mortalities 2002-12

Turtle mortalities have only been recorded as part of NTP since 2007-08. This number has fluctuated greatly over the seasons, with the highest number of deceased turtles in 2011-12.

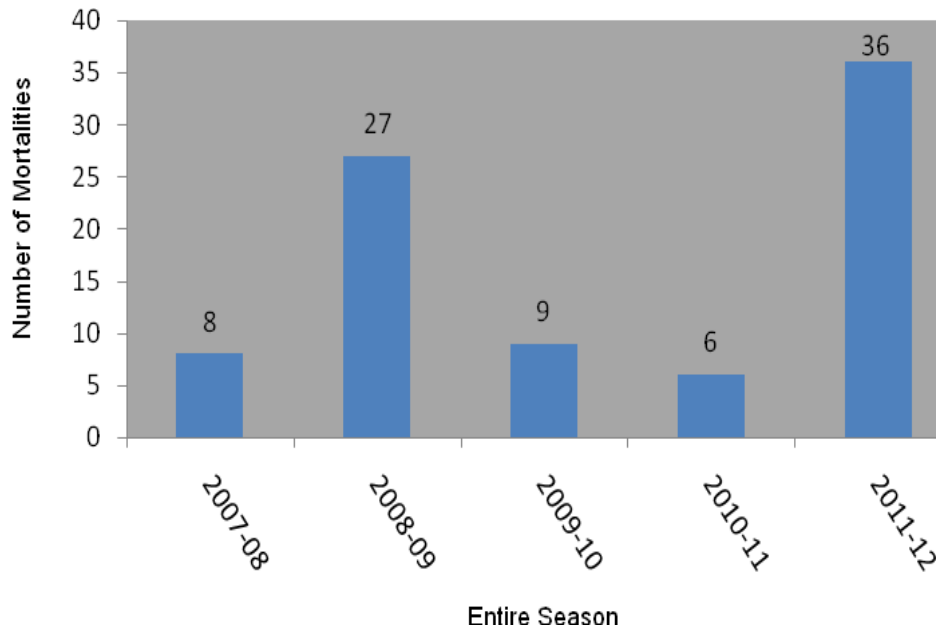


Figure 22: The number of turtle mortalities 2007-12 (2002-06 data not available).

6.8. Weather Events 2011-12

NTP experienced subdued cyclonic activity compared to the previous years. One major cyclonic event affected the program, Cyclone Iggy, a Category 2 which led to the cancellation of post peak monitoring on the 28th & 29th January, as a result this weekend monitoring wasn't rescheduled.

This cyclone activity produced large storm surges well past the high tide mark up along the base of the dunes in some sections within both the NW Cape and Cape Range Divisions. Large amounts of sand were eroded and underlying rocks were exposed. This changed the structure of the beaches and left few areas suitable for nesting. As a result, the northern sections of the NW Cape Division were devoid of any nesting activity in the days following the cyclones. On subsequent monitoring weekends a large number of nests were observed to be destroyed, having been inundated by the tide and leaving eggs exposed or washed away.

6.9. Tagged Turtle Resightings 2011-12

Four tagged turtles were sighted during the 2011-12 season. Three were female green turtles and one a loggerhead of unknown gender. One record for a green turtle was incomplete. If we assume that the tag number has the last digit omitted, and the species identity reported is correct, it could be either of two green turtles that were first tagged and released from the South Muiron Island in mid-January 2001. If the species identity is incorrect, it could be one of four female loggerhead turtles tagged in the same place and time (Table 14 Table 12).

Table 14: Details of tagged turtle re-sightings 2011-12.

Western Australian Turtle Research- Nesting Turtles Tagged Turtles Re-sightings 2011-12								
Species	Date	Time	Sex	Tag left	Tag right	Turtle Activity	Tagging Details	Previous sighting
Loggerhead	11/12/2011	6:44	F	Nil	WA15876	Stuck in rocks	December 1991 Baudin Access	twice in 1991, three times in 1992 but not again for 20 years
Green	6/01/2012	8:50	F	Nil	WA28487	Returning to water	January 1996 Five Mile	Twice in 1996 but not again for 16 years
Green	8/01/2012	6:15	F	WA 9884	Nil	unknown	November 1988 Jacobsz	1988 not recorded again for 23 years
Green	5/01/2012	7:15	U	WA4348 (incomplete number)	Nil	Returning to water	unknown	unknown

SUMMARY OF 2011-12 SEASON AGAINST NTP OBJECTIVES

The Ningaloo Turtle Program has four primary objectives as outlined below:

Objective 1: Determine the abundance of nests on specific sections of beach over specified times for each species

Nesting Abundance

Nesting abundance for the 2011-12 season was the highest on record since monitoring began in 2002. This season's results are not however indicative of an increase in population, as marine turtle populations fluctuate considerably between years (Broderick et al. 2001).

Nesting Trends

Nesting trends were not analysed this season, as were conducted in the 2008-09 and 2009-10 seasons (see Section 7 "*Turtle Nesting Within the Ningaloo Region, 2009-10: Statistical Analyses and Graphical Presentation of Data*" in the 2009-10 NTP Annual Report).

The 2008-09 modelling indicated a positive nesting trend for green and hawksbill turtles, but it was uncertain as to whether this increase was an artefact of survey error or an actual increasing population of nesting turtles (Whiting, 2009). If the apparent increase was due to a real increasing population of nesting turtles, then this would be apparent in the following years of monitoring (Whiting, 2009). To determine this, the statistical analysis was conducted again at the conclusion of the 2009-10 season, which showed a discontinuation of the positive nesting trend for green turtles, but a continuation of the positive nesting trend in hawksbills; although the magnitude of the trend was lower (Whiting, 2010).

Further analysis of nesting trends should be completed every few years to continue the long term analysis of nesting trends.

Nesting Success

A total of 7044 nests and 23667 false crawls from green, hawksbill and logger turtles were recorded by volunteers during the 2011-12 season. When the data is compared per species NTP recorded a total of 6594 green turtle nests and 22865 green turtle false crawls during 2011-12 season which equates to a nesting success rate of 22.38% (Table 3). The hawksbill turtle had the greatest nesting success rate of 43.62%, with NTP recording 56 new nests and 84 false crawls (Table 3). The loggerhead turtle had 382 nests and 715 false crawls, which resulted in a nesting success rate of 34.9%.

The proportionally low nesting success rate for this season, may possibly be influenced by the high number of turtles nesting in concentrated areas, which could result in a higher rate of turtles disturbing each other and hence producing more false crawls.

Nesting success in the 2011-12 season, as per the 2009-10 and 2010-11 seasons, was calculated using visual assessment of the nest after the turtle had left the beach. It is known that a margin of error exists when using this method (Whiting, 2010). For nesting success to be *quantifiable* night time studies of egg laying turtles should be conducted in conjunction with the current track

counts and post nesting observations, in order to gain more accurate estimates of hatchling success and the annual number of nesting turtles (Whiting, 2010).

Objective 2: Identify the significance of nesting beaches per species

Nesting Locations

At the commencement of the program, significant nesting locations along the Ningaloo coastline were identified. NTP data from 2002-12 indicates that the turtle nesting locations originally identified remain important within the Region:

- The NW Cape Division is an important rookery for the green and hawksbill turtles.
- The Cape Range Division which contains the Bungelup Section is an important rookery for loggerhead turtles.
- Gnaraloo Bay also contains a significant loggerhead rookery (The Gnaraloo Turtle Conservation Program (GTCP) has adapted the NTP monitoring procedures to collect nesting abundance and nest disturbance data. 2011-12 data is to be provided to the NTP for comparison).

No planned research was carried out during 2011-12 NTP to identify additional significant turtle nesting locations within the Ningaloo Region. However, Colin Valentine (2011-12 Team Leader with several years of turtle experience at Bungelup) believes it's worth investigating to see if the Loggerhead rookery has moved further north.

During 2011-12 volunteers from Gnaraloo Bay identified a loggerhead turtle rookery adjacent to Gnaraloo station in the Cape Farquhar Sanctuary Zone, which they will continue to monitor.

Objective 3: Establish the level of disturbance on nests

Nest Disturbance

Since monitoring began in 2002, 798 nests (1.9%) have been disturbed by various natural and unnatural factors. In the 2011-12 season 0.94% of nests recorded were disturbed within the Cape Range and NW Cape Divisions.

The level of predation on turtle nests by the European red fox

Foxes have been present along the beaches of the Ningaloo Coastline since the 1960s and are known to predate turtle nests and hatchlings (Limpus 2002; Dean 2003; McKinna Jones 2005). Consequently, the implementation of fox control is a key management strategy under the Ningaloo Marine Park Management Plan 2005-2015 for the conservation of marine turtles. This includes the controlled distribution of 1080 poison (sodium fluoro acetate) in the form of dried meat baits placed at key rookeries where the risks to the general public are deemed to be low. The aim is to reduce the number of foxes within the area thereby reducing the number of nests predated on by foxes and increasing nesting success. Nest disturbance data collected by the NTP assists DEC to target fox control in areas of high nest predation.

Loss of up to 5% of nests to foxes and dogs is considered a non threatening level of nest predation. (Limpus pers. coms). During the 2011-12 season foxes and dogs accounted for 7.6% of damaged nests within the NW Cape Division. Of this study area this equates to 0.07% of total nests recorded within the entire Ningaloo Region. This percentage can not only be used as an indicator of fox and dog presence but also an indicator of the effectiveness of fox control.

Since monitoring began in 2002, fox and dog predation of total recorded nests has remained well below the 5% threshold.

However, it may be possible that the actual level of nest predation is higher than that observed given that:

- Predation on a nest is only recorded from the night before.
- Volunteers are not highly trained on identifying predation of nests and may not be accurately recording nest predation. (Identifying predation requires experience). The period of time NTP monitoring is conducted may not be the optimal time to be accurately gaining predation information. During the 2003-04 NTP season fox predation along the Five Mile beach subsection (NW Cape Division) was at its highest during March (McKinna-Jones 2005). This is consistent with findings by researcher Sabrina Trocini indicating that much of this nest predation occurs towards the end of the incubation period (Trocini, S et al 2009), which is largely outside of the NTP monitoring season. McKinna Jones (2005) also found that during the emergent phase nests were predominantly predated by foxes.
- Trocini et al (2009) found that levels of nest predation at Bungelup were much higher than those observed through the NTP. During the 2007-08 nesting season, 83.3% of nests showed signs of partial or total predation. Over 60% of the monitored nests showed signs of predation by ghost crabs while fox and perenties were responsible for 20% and goannas were responsible for 16.7% (Trocini, S et al 2009). During monitoring new nests are checked for signs of predation but 'old' nests are only checked on an incidental basis if they are encountered whilst monitoring the new nests. Therefore there is a high likelihood of old predated nests going unnoticed, resulting in an underestimation of true predation levels.
- It is known that foxes are still present at the turtle rookeries from track observations recorded during NTP monitoring and bait uptake monitoring, and from remote camera footage (Department of Environment and Conservation, 2011). It may be likely that foxes are predated a higher level of turtle nests than suggested in this report and/or consuming hatchlings.

Ghost crabs: natural predators of marine turtle eggs

The level of predation by ghost crabs and the impact on clutch success are not known and is not a component of this monitoring. Determining ghost crab predation by visual assessment of a nest alone is prone to uncertainty, as the presence of a ghost crab hole into the egg chamber does not necessarily indicate that ghost crabs predated the nest, nor does it give an indication if predation *has* occurred how many eggs within a clutch were depredated. For this season crab damage to a nest was not recorded as a cause of nest damage. Ghost crabs are natural predators within the area and research is required to determine the dynamics of ghost crab predation on nesting turtle populations at Ningaloo over space and time. For further studies on ghost crab predation on the Ningaloo coast please contact the Gnaraloo Turtle Conservation Program.

Objective 4: Determine the impact of human interaction on nesting success of each species

Human Interaction with Nesting Turtles

Since the commencement of the NTP (2002), human disturbance to nests has been recorded as minimal (0.06% of total recorded nests). This is done by recording human prints within a 5 metre radius of the nest. The data however does not necessarily indicate the level of disturbance to nesting female turtles by human interactions, because it does not include visual observation of visitors interacting with nesting turtles. The presence of people on nesting beaches are likely to cause disturbance to nesting females and hatchlings if they do not follow appropriate interaction protocols (Waayers 2003; Johnson et al. 1996; Lorne & Salmon 2007). Disturbance by humans can lead to the female abandoning her nesting attempt prior to the laying of eggs and returning to the ocean, resulting in a failed nesting attempt. Further research into visual assessments of turtle-visitor interactions is required to determine the level of impact on new nests within the Ningaloo Region and subsequent impact on local turtle populations.

The development of the DEC Jurabi Turtle Centre (JTC) program in 2008-09 was supported by Woodside Energy Ltd and Mitsui Ltd (2009-11) through the Community Partnerships Program. The program operates along the NW Cape and provides a supervised interaction experience with nesting turtles using TAFE accredited turtle tour guides, giving visitors an opportunity to observe turtles nesting in their natural environment and contribute to turtle conservation within the Region. DEC encourages visitors to participate in a guided experience with JTC staff but those wishing to observe nesting turtles independently are required to abide by DEC's Turtle Watcher's Code of Conduct (available online at the DEC website).

6.10. Achievements NTP 2002-12

- Integration of the NTP Coordinator role into the DEC Nature Conservation Ranger position.
- Training of 3 DEC staff members in order to provide assistance in future years.
- Ongoing distribution of the NTP monitoring field guide and monitoring training videos to community turtle projects worldwide.
- Continual support for marine turtle monitoring programs throughout Western Australia.
- Continual collection of nesting data to assist with the implementation of visitor management strategies such as beach accesses and 4WD vehicle restrictions.
- Continual collection of nest distribution data to assist government agencies in future tourism development planning.
- Continual collection of nesting habitat locations to improve Oil Spill Contingency Atlas (OSRA) information and support potential oil spill response planning.
- Continual collection of nesting habitat encroachment data to assist in the removal of existing car parks within the Jurabi Coastal Park.
- The rescue of 226 stranded turtles within the Ningaloo Region between 2002 and 2012.

In the coming years the program will continue to collect data on nesting female turtles within the Ningaloo Region which will assist in the long term prediction trends in turtle populations. This will assist management in identifying turtle population recovery targets within the Region.

6.11. Key Program Recommendations

Volunteer Participation

- Continue to build capacity among the local community and promote local program participation. Encourage greater local participation in the program prior to the commencement of the 2012-2013 NTP season. Local volunteer involvement outside of the peak monitoring period, including NTP social activities, remains limited despite all efforts to date.
- Improve the level of interaction between external volunteers and local volunteers and the NTPSC throughout the program.
- Increase volunteer participation fees to cover a greater proportion of program costs.

Occupational Health and Safety

- Continue to update Job Safety Analyses and improve occupational health and safety standards for activities volunteers conduct as part of the program and provide these documents to all volunteers.
- Consider a full manual license and senior first aid certificate as prerequisites for all the external volunteers. These qualifications are currently only required by the NTP Team Leaders and Coordinator.

Field Data Collection

- Emphasise to volunteers the importance of accurate data collection and data entry. Ensure volunteers fill in data sheets accurately, cross-check data sheets on a daily basis and maintain daily communication with the Volunteer Coordinator regarding any data collection or entry issues
- Continue to ensure volunteer accuracy in track, nest and predation identification by carrying out concurrent cross-checks of beach surveys and data collection.
- Continue to improve monitoring techniques and data collection methods with all trainers and volunteers prior to the start of the monitoring. This will provide consistent methodology and accurate data collection.
- Continue to provide additional volunteer training on species-specific track identification – especially how to distinguish between loggerhead and hawksbill turtle tracks. Utilise Bungelup research station and adjacent loggerhead rookery during training to expand the knowledge base of loggerhead track identification.
- Continue to encourage volunteers to use their own digital cameras (rather than the supplied disposable cameras) to take photos of turtle tracks, deceased and stranded turtles for quicker identification and more cost effective reporting.
- Consolidate monitoring folder content into a more practical field folder.

Organisation and Procedures

- Continue to build and expand on the current email mailing list for the NTP.
- Continue to build upon the professional relations established this season between Australian Universities and NTP to encourage student research projects.
- Consider past experience with the program a highly desired criteria for selection for Team Leader positions to minimise the effort of re-training every season, assist in

streamlining NTP procedures and maintaining consistency with seasonal NTP operations.

- If an external applicant, consider extending the current NTP Volunteer Coordinator 4 month contract to a 6 month contract to allow completion of all post-peak season intermittent monitoring operations and inclusion of this data into the annual report.
- Continue to involve the NTPSC and DEC staff in field operations as much as possible throughout the intensive peak period of monitoring to support the external volunteers and build capacity.
- Continue to encourage feedback from all volunteers throughout the entirety of the program.
- Consider compulsory rostered days off for Team Leaders.

Data Management

- Continue to carry out intermittent checks of GPS settings and waypoints during the season as they can be accidentally changed by volunteers.
- Reinforce the importance of accurate data entry to those volunteers entering the data: ensure data is entered on a *daily* basis (consider a daily data entry roster).
- Continue ensuring data entry by volunteers is supervised by a Team Leader or Coordinator, or ensure a Team Leader or Coordinator is readily accessible if assistance is required, to ensure accuracy and consistency in data entry.
- Provide the Team Leaders with access to the database password (previously only the Volunteer Coordinator had access), and additional database training, so any data entry issues or mistakes can be rectified quickly and at the time of entry.
- Continue with ensuring backup copies of the 'live' database are saved in town at least once a week to ensure data security.
- Continue to ensure data entry training consists of clear procedures and provides a process for correcting mistakes.
- Ensure regular checking of the database by the Volunteer Coordinator.

Volunteer Education, Information and Communication

- Continue to encourage local participation in social activities prearranged for external volunteers for more social interaction and opportunities for knowledge exchange between the two groups of volunteers.
- Continue with general turtle biology and conservation presentations to external and local volunteers.
- Continue with DEC Wildlife Officer and Education Officer presentations on wildlife management within the area
- Encourage local volunteers to give presentations to external volunteers relating to the Ningaloo region and their NTP experiences.
- Consider inviting local Indigenous council members (Coral Coast Park Council) to provide information of Indigenous history in the area.
- Continue with program progress updates to all volunteers throughout the season.

Survey Effort and Nesting Abundance

- Continue to monitor turtle activity along the NW Cape and Cape Range Divisions. Opportunistic monitoring should continue within the Bundera/Ningaloo and Coral Bay Divisions where possible to provide ongoing data collection.
- Conduct further track surveys to assess if turtle rookeries have moved and subsequently if monitoring is being conducted in the most effective area. In particular, the southern end of Cape Range National Park.
- Continue with the current length of the NTP survey period - an intense 5 week peak period including one week of training (5 days) and 4 weeks of monitoring with intermittent weekend monitoring outside of this period.
- Continue with the centre of the peak monitoring period to cover mid-December to mid-January to capture the peak period of nesting.
- Consider determining nesting success for a sample of turtles using night time surveys observing turtles. Nesting success has previously been calculated using visual assessment of the nest after the turtle has left the beach, which is not a very accurate method of determining nesting success. Quantifying true nesting success will give an indication of the accuracy in assessing nesting success from morning track counts and will reduce error in converting between track counts and clutch counts.
- Ensure track counts outside of the intensive period are only counting the tracks from the previous night's nesting. I.e. ensure the entire subsection is walked and tracks are crossed off prior to the census day.

Training

- Continue to expand local trainer and assessor capacity prior to the arrival of the external volunteers. This will greatly reduce the workload of the other key trainers. Provide more encouragement to new local volunteers to work towards this.
- Encourage all DEC staff with NTP experience to be trained as NTP trainers, this will also help to reduce the workload of the other key trainers and reduce the reliance on external sources.
- Ensure a trainer refresher meeting is held prior to commencement of monitoring training. This will improve consistency in training information and techniques.
- Consider updating the 6th edition of the "Turtle Monitoring Field Guide" to reflect changes in recent years (last updated November 2007).
- Continue to provide volunteers with the 6th edition of the "Turtle Monitoring Field Guide" (on loan) in volunteer induction packs and encourage frequent use of the Field Guide, especially during the training week. Encourage all volunteers to become familiar with the glossary of terms (in Appendix 1). E.g. costal scales, prefrontal scales and false crawl definitions.
- Continue to utilize the training week to gain as much practical experience in track monitoring, including identifying loggerhead and hawksbill tracks, as well as a night time JTC tour, to give volunteers the full picture of turtle nesting for a greater understanding of the overall process.
- Continue to ensure a minimum of two seasons experience as a prerequisite to train volunteers in monitoring techniques in order to ensure accurate and consistent methods.
- Continue to ensure smaller training and assessment groups where possible. Ideally a maximum of four volunteers per trainer/assessor.

- Continue to provide training on turtle rescues.
- Train the Gnaraloo Turtle Conservation Program (GTCP) Manager in NTP methodologies to enable the GTCP to train their own volunteers in-house.

Predation Control

- Continue with the current DEC fox control program within the four divisions - NW Cape, Cape Range, Bunda/Ningaloo and Coral Bay. This will assist in maintaining the current low level of fox predation on nests within the Ningaloo Region.
- Ensure fox control within Cape Range Division (Bungelup Section) is adequate to maintain predation levels at less than five percent of recorded nests.
- Further investigate the impacts of ghost crab predation on nesting success within the Ningaloo Region.
- Continue to report opportunistic dingo and fox sightings to the DEC Wildlife Officer.
- Report evidence of human damage to nests to the DEC Wildlife Officer to enable immediate action to be taken and to prevent further occurrences.

Turtles Rescues

- Continue to conduct opportunistic turtle rescues.
- Continue to provide volunteers with turtle rescue training.
- Notify the DEC Wildlife Officer of areas with considerable numbers of turtle strandings and deaths recorded within previous seasons for follow up outside of the peak monitoring period.

General Recommendations

- Continue to investigate future funding opportunities to ensure the longevity and sustainability of the program.
- Review and update the NTP overarching goals and objectives to reflect the progression of the program and changes which have occurred since the commencement of the program in 2002.
- Continue to develop the NTP to match current environmental conditions and resource demands through the Ningaloo Turtle Program Steering Committee.
- In future years of monitoring, further analysis of nesting trends should be completed annually to continue the long term analysis of these trends and fulfil the first primary objective of the NTP.

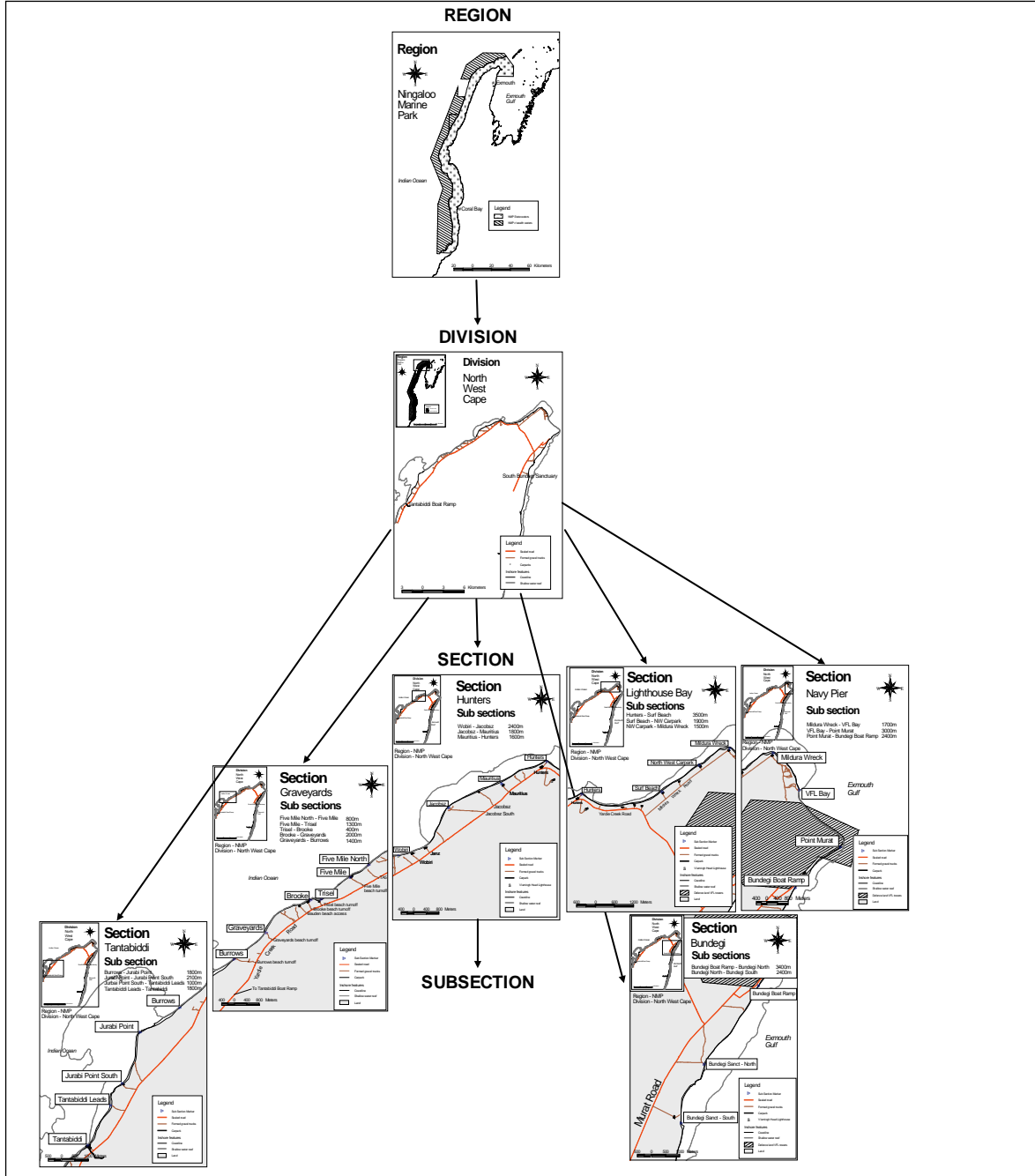
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8. APPENDIX

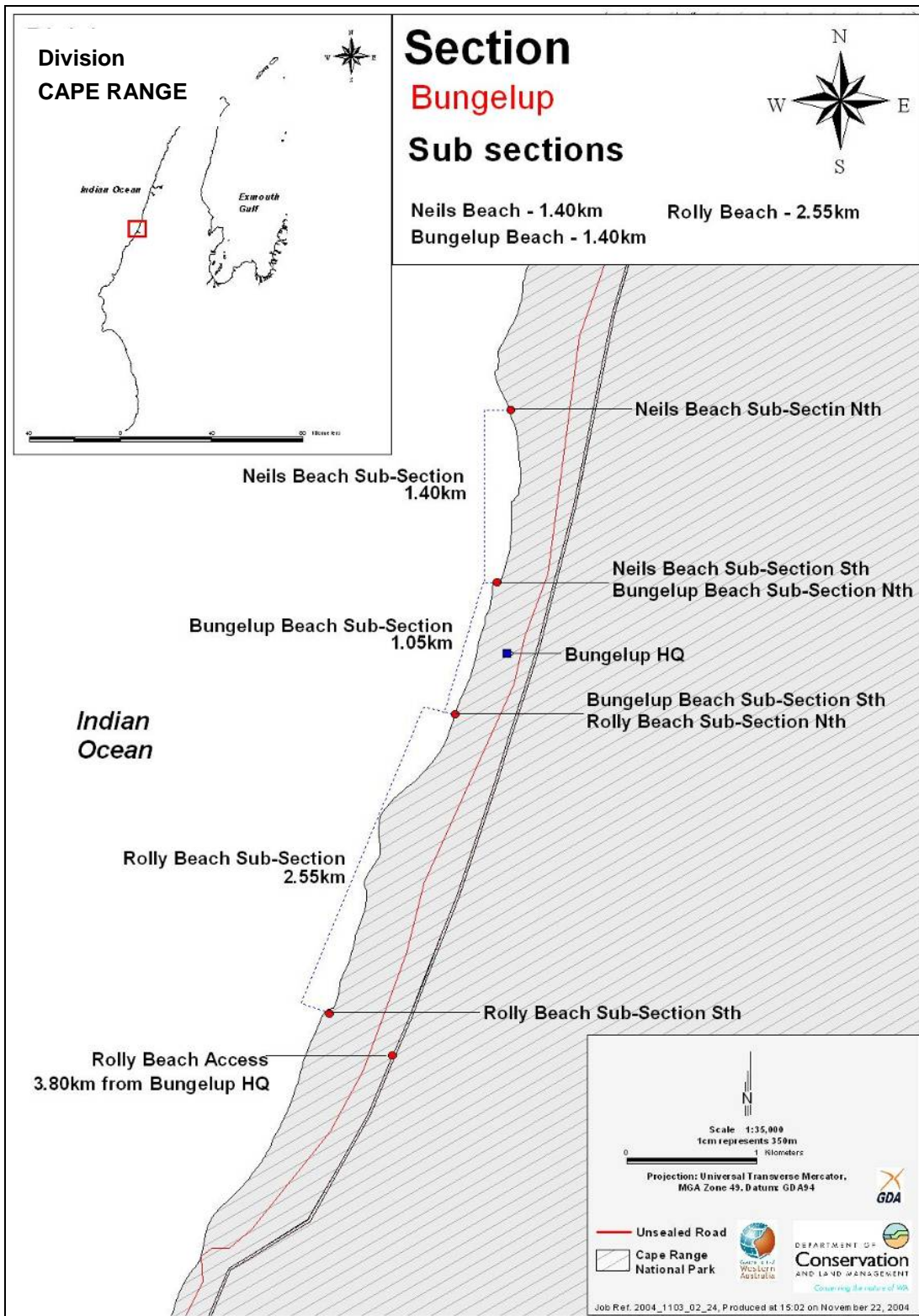
Appendix 1: Zoning representation of the NW Cape Division.



Location and distance of each subsection within the NW Cape Division.

Subsection	Location of northern totem	Location of southern totem	Distance (m)
Mildura Wreck - North West car park	21.78568 S; 114.16518 E	21.79174 S; 114.15402 E	1500
North West car park - Surf Beach	21.79174 S; 114.15402 E	21.81590 S; 114.13930 E	1900
Surf Beach - Hunters	21.81590 S; 114.13930 E	21.80287 S; 114.10873 E	3500
Hunters - Mauritius	21.80287 S; 114.10873 E	21.80938 S; 114.09532 E	1600
Mauritius - Jacobsz South	21.80938 S; 114.09532 E	21.81638 S; 114.07927 E	1800
Jacobsz South - Wobiri	21.81638 S; 114.07927 E	21.83038 S; 114.06505 E	2400
Five Mile North - Five Mile	21.83485 S; 114.05431 E	21.83928 S; 114.04766 E	800
Five Mile - Trisel	21.83928 S; 114.04766 E	21.84658 S; 114.03836 E	1300
Brooke - Graveyards	21.84733 S; 114.03389 E	21.85660 S; 114.02085 E	2000
Graveyards - Burrows	21.85660 S; 114.02085 E	21.86595 S; 114.01052 E	1400
Burrows - Jurabi Point	21.86595 S; 114.01052 E	21.87348 S; 113.99803 E	1800

Appendix 2: Zoning representation of the Cape Range Division.

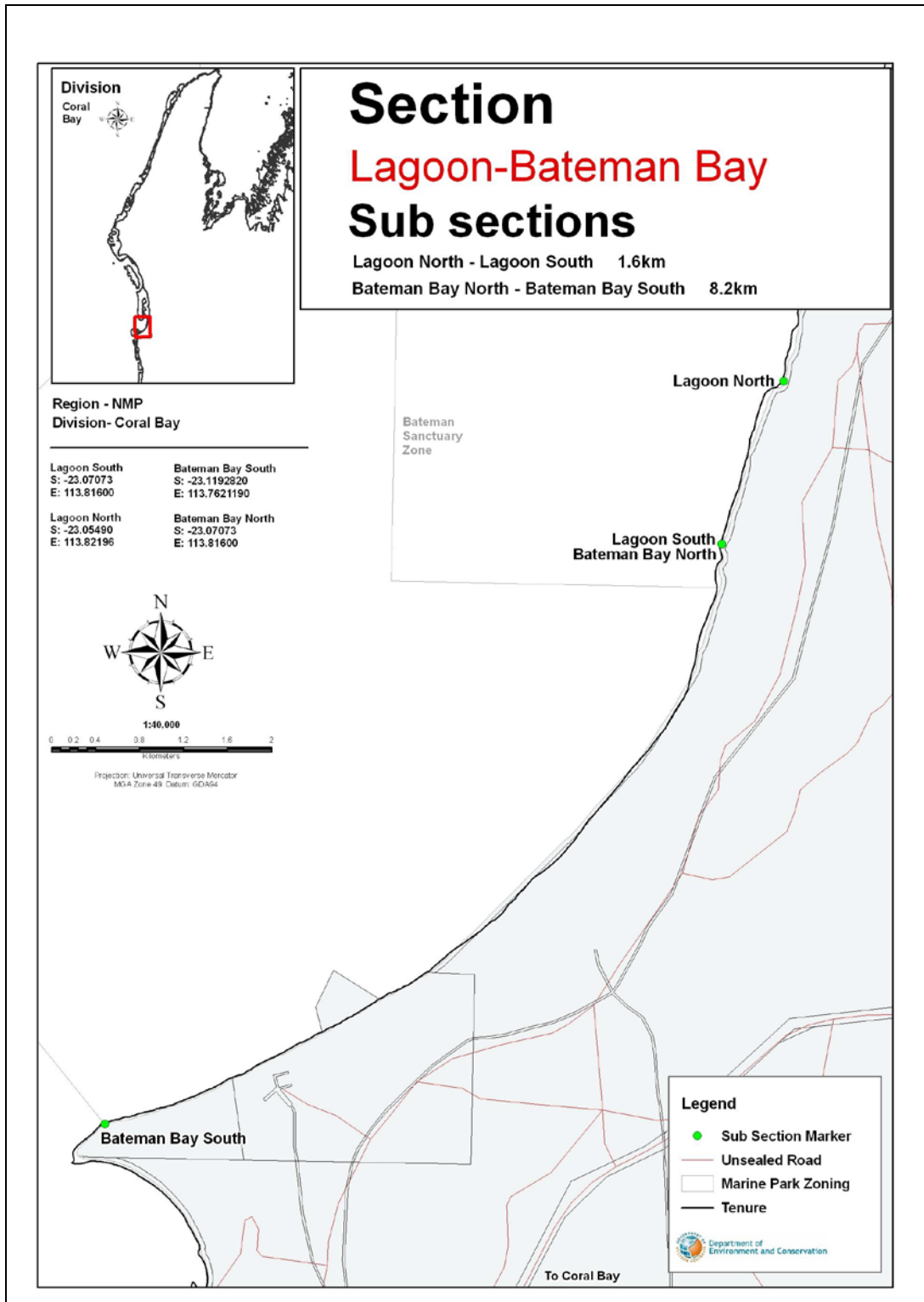


Location and distance of each subsection within Cape Range Division.

Subsection	Location of northern totem	Location of southern totem	Distance (m)
Neils Beach North - Bungelup Beach North	22.26489 S; 113.83277 E	22.27674 S; 113.83231 E	1400
Bungelup North – Bungelup Beach South	22.27674 S; 113.83231 E	22.28613 S; 113.8292 E	1400
Bungelup Beach South – Rolly Beach	22.28613 S; 113.8292 E	22.30650 S; 113.82062 E	2550

Appendix 3: Coral Bay Division

Location of subsection within the Lagoon-Bateman Bay Section (Coral Bay Division), (Lagoon South - Lagoon North; Batemans South – Batemans North).



Location and distance of each subsection within the Coral Bay Division.

Subsection	Location of northern totem	Location of southern totem	Distance (m)
Batemans South - Batemans North	23.07073 S; 113.81600 E	23.11928 S; 113.76211 E	8200
Batemans North – Lagoon North	23.05490 S; 113.82196 E	23.07073 S; 113.81600 E	1500

Appendix 4: NTP Data Sheet 2011- 12



Ningaloo Community TURTLE MONITORING PROGRAM DATASHEET

Daily Report

Page.....of.....

Date		Recorder	
Start subsection		Finish subsection	
Start time		Finish time	
Equipment Details		Radio No	
GPS No		Camera No	

TABLE A: FALSE CRAWLS TALLY			
Green	Loggerhead	Hawksbill	Unknown
Total			

Prints in subsection?	
Fox	Y/N
Dog	Y/N

TABLE B: NESTS

New (N) / Old* (O) Nest?	Species Type G/L/H/U	GPS Position (in decimal degrees) (Datum WGS84)		Nest Position I/H/E/D	Is Nest Damaged? Y/ N	Damage Cause? A/D/F/G/H/Ti	Photo Frame No.	Any Other Observations? (e.g. Diggings, Egg shells, Hatchlings, Turtle)
		latitude (S)	longitude (E)					
Comments:								


Cause of Damage Key: A= Another turtle, D= Dog, F= Fox, G= Goanna, H= Human, Ti= Tide

* Only record old nest data if it has been disturbed.

~Please complete and return even if no nests are recorded!

311011

Appendix 5: Tagged Turtle Re-sightings Datasheet

<p style="margin: 0;">West Australian Turtle Research – Nesting Turtles</p> <p style="margin: 0;">TAGGED TURTLE RESIGHTINGS</p> <p style="margin: 0;">Locality: _____ Date: _____ Observer: _____</p>	 <p style="font-size: small; margin: 0;">DEPARTMENT OF Conservation AND LAND MANAGEMENT <i>Caring for the nature of WA</i></p>
--	--

Tag Left	Tag Right	Time	Turtle Activity	Nest Location	Egg Count	Turtle Species

Tag Position:

- Please record tag information for both left and right flippers. If single tagged put 'NIL' in the column as needed.

Turtle Activity Key:	
A = resting at waters edge	F = excavating egg chamber
B = leaving water	G = laying eggs
C = climbing beach slope	H = covering eggs (filling in)
D = moving over bare sand	I = returning to water
E = digging body pit	

Nest Location Key:
A = above high water mark
B = at high water mark
C = below high water mark
D = edge of Spinifex
E = in Spinifex

Appendix 6: Marine Turtle Stranding and Mortality Datasheet

MARINE TURTLE STRANDING AND MORTALITY DATASHEET – Pilbara Region

Please record the following information for all sick, injured or dead marine turtles and send it to the nearest Department of Environment and Conservation office (see overleaf for addresses).

DATE: _____ (DD/MM/YYYY) TIME: _____ (24 hour)

LOCATION: _____

Latitude: _____° _____ S

Longitude: _____° _____ E

STATUS: Alive Condition/Behaviour: _____

Dead The following coding can be used to code beach washed carcasses:

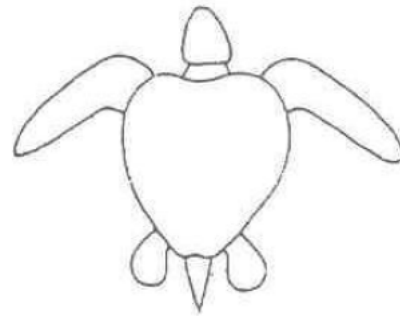
- | | |
|--|--|
| <input type="checkbox"/> Live but subsequently died | <input type="checkbox"/> Carcass poor (advanced decomposition) |
| <input type="checkbox"/> Carcass in good condition (fresh/edible) | <input type="checkbox"/> Mummified carcass (skin holding bones) |
| <input type="checkbox"/> Carcass fair (decomposed but organs intact) | <input type="checkbox"/> Disarticulated bones (no soft tissue remaining) |

SPECIES (see key overleaf):

- Green
 Loggerhead
 Flatback
 Hawksbill
 Olive Ridley
 Leatherback
 Unknown

DISTINGUISHING FEATURES: (please also indicate on diagram)

- Obvious damage/injuries
 Missing limbs
 Barnacles
 Algal growth on carapace
 Tagging scars



TAG NUMBERS: Left flipper _____

Right flipper _____

MEASUREMENTS:

Curved Carapace Length:	_____ mm	<input type="checkbox"/> Measured	<input type="checkbox"/> Estimated
Curved Carapace Width:	_____ mm	<input type="checkbox"/> Measured	<input type="checkbox"/> Estimated
Tail Length (from Carapace):	_____ mm	<input type="checkbox"/> Measured	<input type="checkbox"/> Estimated
Maximum Head Width:	_____ mm	<input type="checkbox"/> Measured	<input type="checkbox"/> Estimated

SEX: Male Female Unknown

MATURITY: Juvenile Adult Unknown

PHOTOGRAPHS* (see overleaf): _____

SECURITY/DISPOSAL/RELEASE of turtle: _____

NOTES: _____

CONTACT DETAILS:

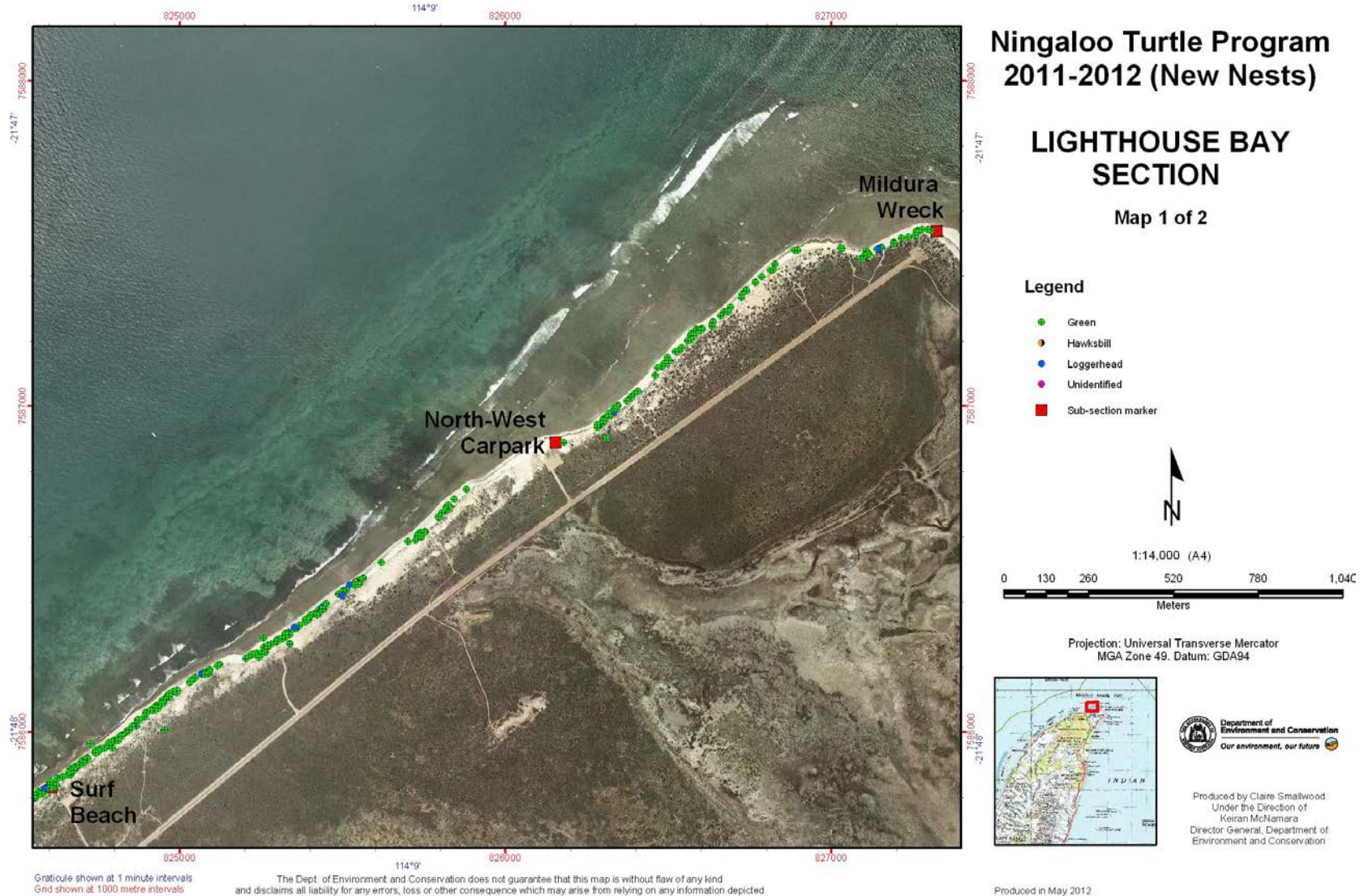
Name: _____

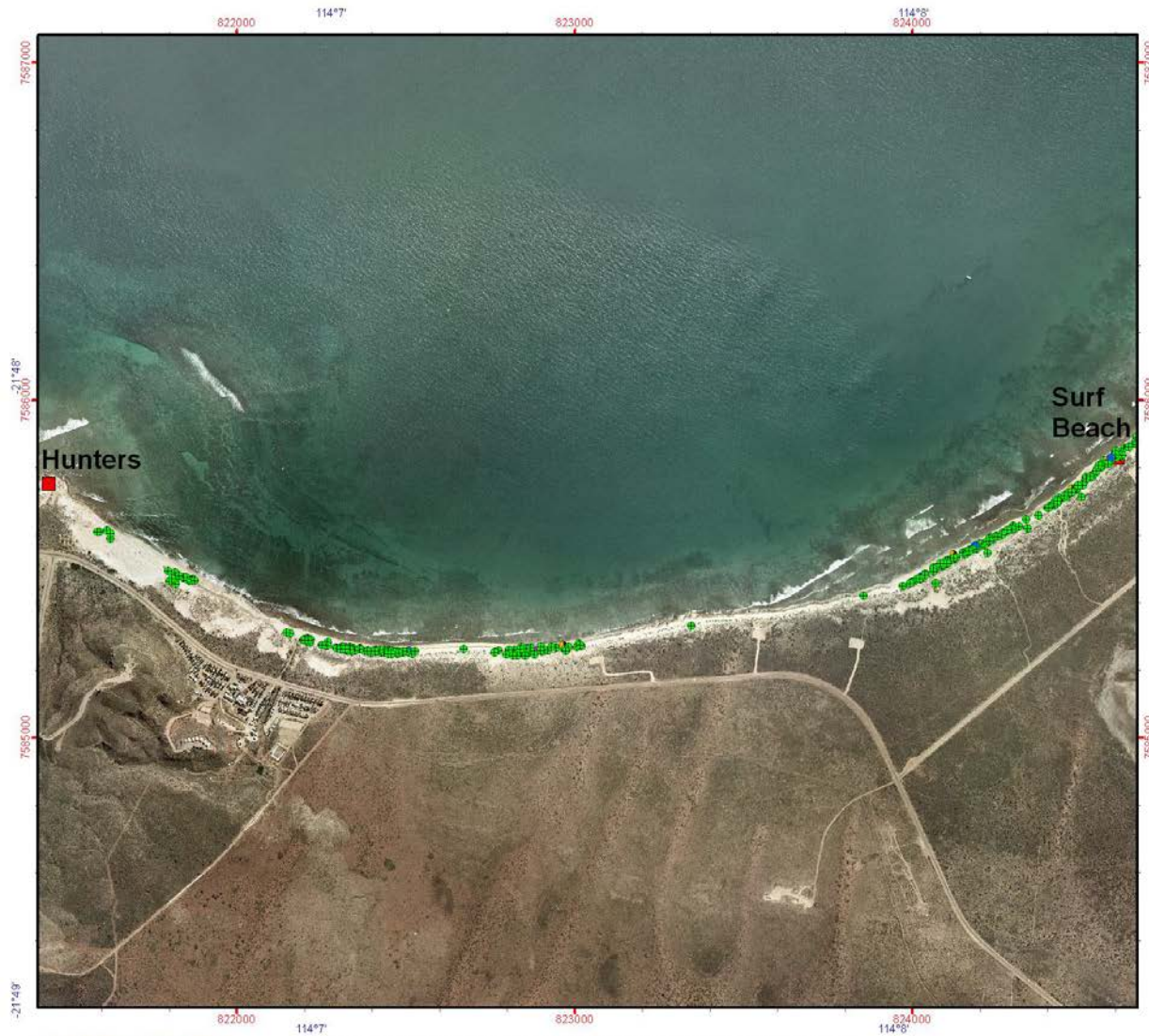
Phone number: _____

Address: _____

Email: _____

Appendix 7: Lighthouse Bay Section - Location of New Nests (NTP 2011-12) Map 1 & 2





Ningaloo Turtle Program 2011-2012 (New Nests)

LIGHTHOUSE BAY SECTION

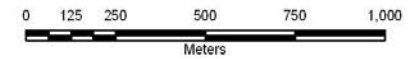
Map 2 of 2

Legend

- Green
- Hawksbill
- Loggerhead
- Unidentified
- Sub-section marker



1:16,000 (A4)



Projection: Universal Transverse Mercator
MGA Zone 49. Datum: GDA94



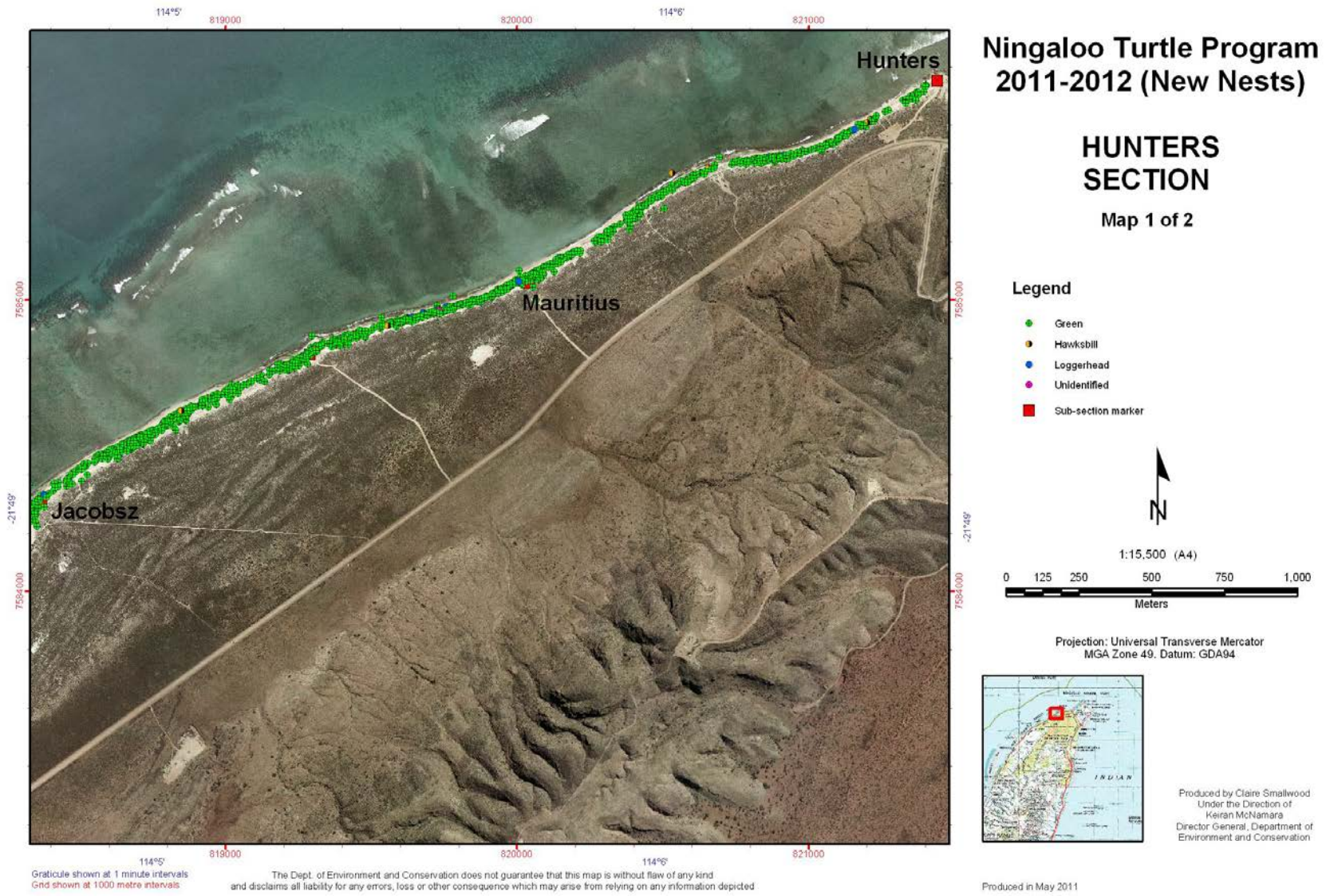
Produced by Claire Smallwood
Under the Direction of
Keiran McNamara
Director General, Department of
Environment and Conservation

Grid lines shown at 1 minute intervals
Grid shown at 1000 metre intervals

The Dept. of Environment and Conservation does not guarantee that this map is without flaw of any kind and disclaims all liability for any errors, loss or other consequence which may arise from relying on any information depicted

Produced in May 2011

Appendix 8: Hunters Section - Location of New Nests (NTP 2011-12) Map 1 & 2





Ningaloo Turtle Program 2011-2012 (New Nests)

HUNTERS SECTION

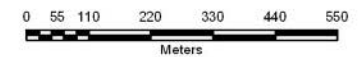
Map 2 of 2

Legend

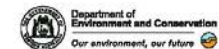
- Green
- Hawksbill
- Loggerhead
- Unidentified
- Sub-section marker



1:10,000 (A4)



Projection: Universal Transverse Mercator
MGA Zone 49. Datum: GDA94



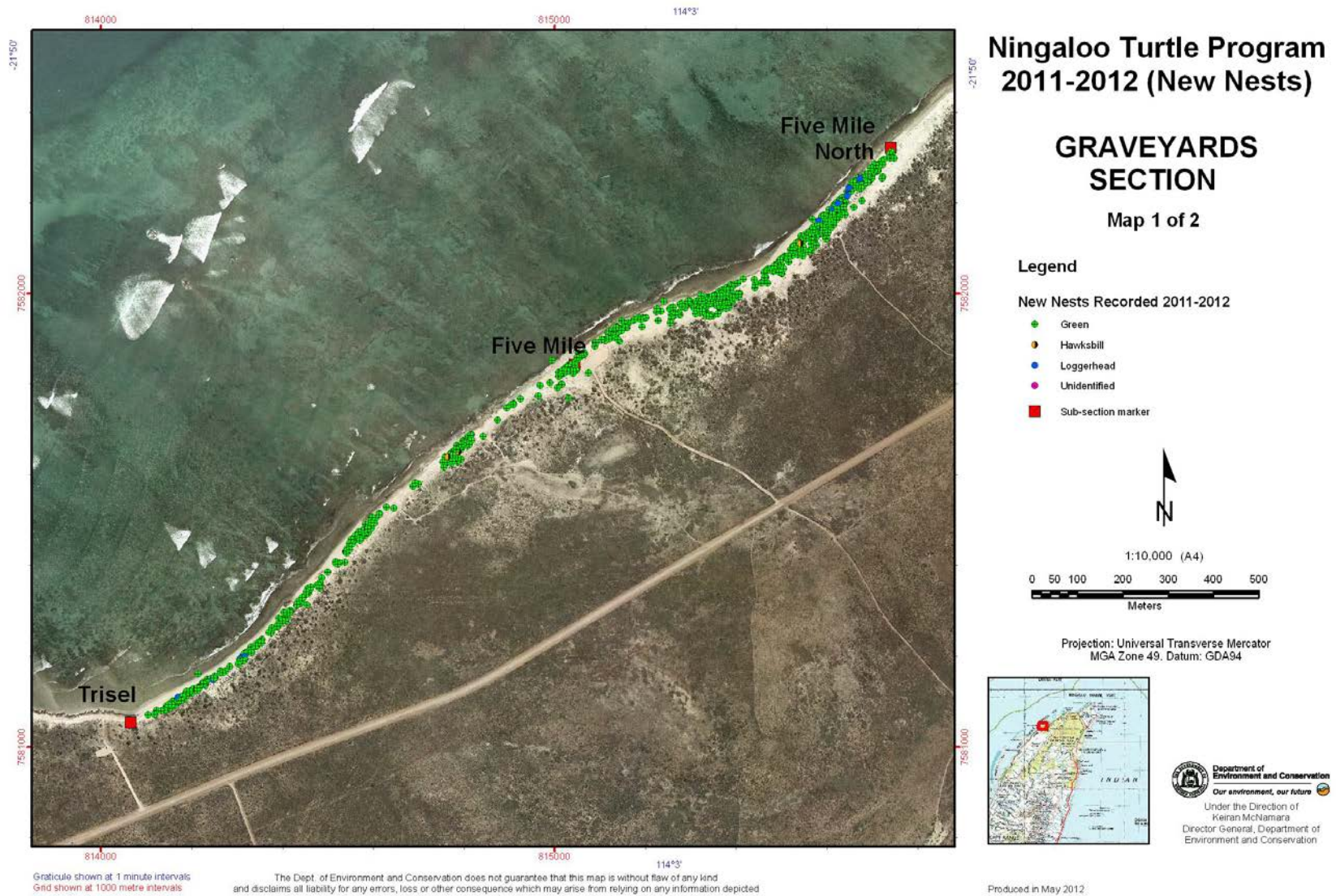
Produced by Claire Smallwood
Under the Direction of
Keiran McNamara
Director General, Department of
Environment and Conservation

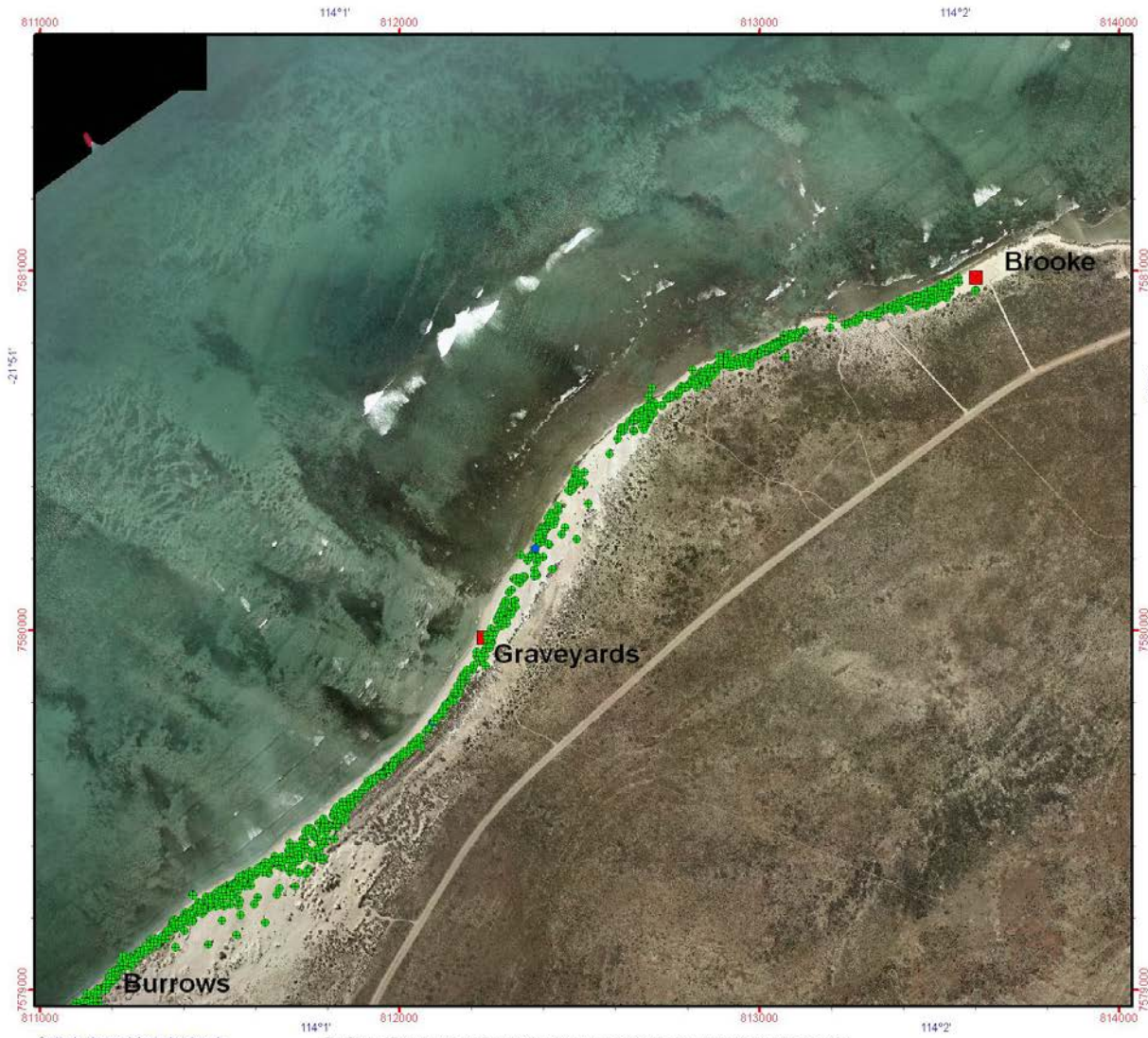
Graticule shown at 1 minute intervals
Grid shown at 1000 metre intervals

The Dept. of Environment and Conservation does not guarantee that this map is without flaw of any kind
and disclaims all liability for any errors, loss or other consequence which may arise from relying on any information depicted

Produced in May 2012

Appendix 9: Graveyards Section - Location of New Nests (NTP 2011-12) Map 1 & 2





Ningaloo Turtle Program 2011-2012 (New Nests)

GRAVEYARDS SECTION

Map 2 of 2

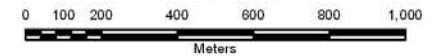
Legend

New Nests Recorded 2011-2012

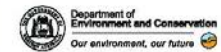
- Green
- Hawksbill
- Loggerhead
- Unidentified
- Sub-section marker



1:15,000 (A4)



Projection: Universal Transverse Mercator
MGA Zone 49. Datum: GDA94



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Graticule shown at 1 minute intervals
Grid shown at 1000 metre intervals

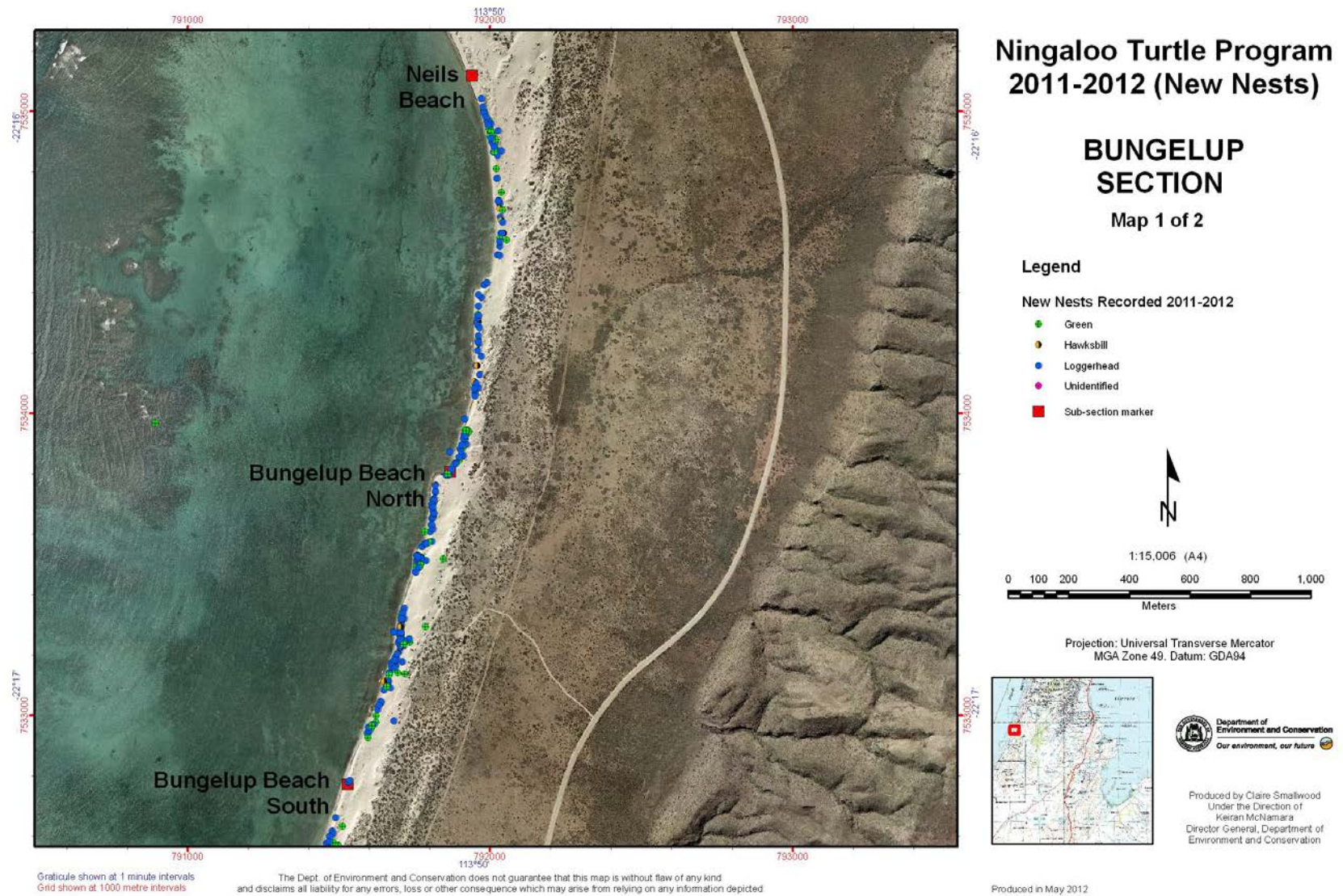
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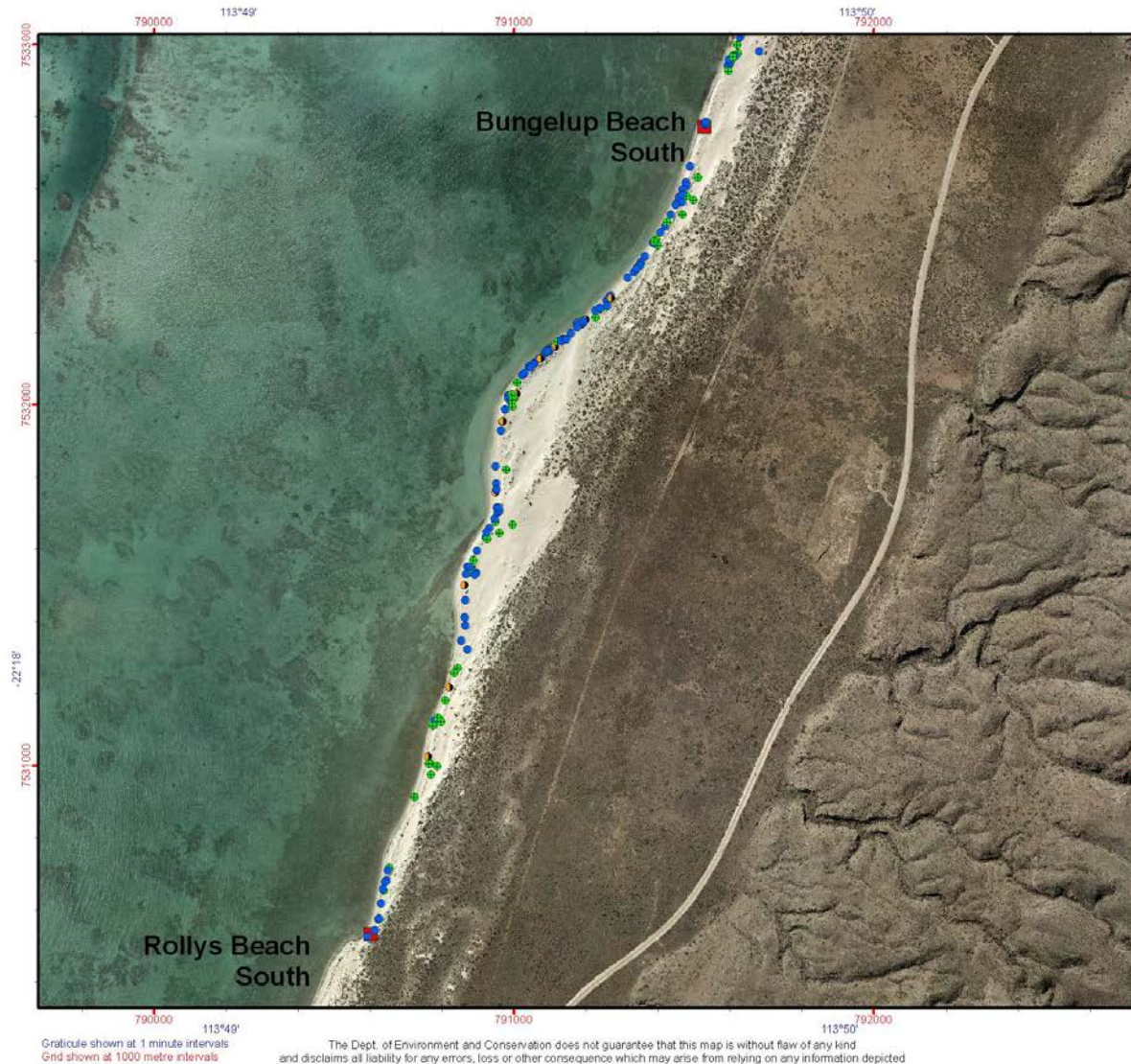
Produced in May 2012

Appendix 10: Tantabiddi Section - Location of New Nests (NTP 2011-12) Map 1



Appendix 11: Bungelup Section - Location of New Nests (NTP 2011-12) Map 1 & 2





Ningaloo Turtle Program 2011-2012 (New Nests)

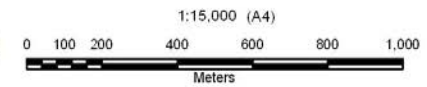
BUNGELUP SECTION

Map 2 of 2

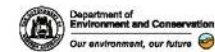
Legend

New Nests Recorded 2011-2012

- Green
- Hawksbill
- Loggerhead
- Unidentified
- Sub-section marker



Projection: Universal Transverse Mercator
MGA Zone 49. Datum: GDA94.



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Grid shown at 1000 metre intervals

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