

Ningaloo **TURTLE** PROGRAM



CITATION

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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. |
| Combined tracks | Tracks left from both false crawls and nests. |
| 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 not resulting in eggs being laid. |
| GPS unit | Global Positioning System unit: an electronic navigational device which obtains a position on the earth using satellite signals. |
| Hatchling | A newly hatched young turtle. |
| Pre and post peak period | Monitoring of the weekends either side of the intensive peak monitoring period. |
| Intensive peak monitoring period | Four-week period centred roughly around the 31 st of December, during which monitoring takes places every day. |
| Nest | A new suspected nesting attempt which we expect has resulted in eggs being deposited. |
| Nest damage | The nest has been dug up, eggs or fresh empty egg shells are around the nest or eggs are exposed. |
| Nesting success | The number of suspected nests laid as a percentage of total turtle activities. |
| Old nest | A suspected nest laid during the current season (but not laid during the previous night) 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. |

| | |
|----------------------------|--|
| Pre-ocular 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 with the aim of laying eggs into it. The egg chamber is located here in a successful nest but a primary body pit can also be left exposed from a false crawl. |
| 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 | A depression dug lastly during a successful nesting attempt to cover the primary body pit and egg chamber with sand. |
| Standardised season | Period which only includes the intensive peak monitoring period so as to make data comparisons possible between seasons which would otherwise have different monitoring timeframes. |
| Survey effort | Factors in the total number of times monitoring was conducted and the total number of subsections monitored over a specified period of time. |
| Suspected nest | 'Nests' suspected of containing eggs as a result of assessment using standard monitoring techniques. Eggs were not witnessed being deposited into an egg chamber within the structure, hence the 'nests' are referred to as "suspected nests". |
| Tracks | In the form of false crawls or the tracks left behind during nesting. |
| Track abundance | The number of recorded turtle tracks (includes false crawl tracks and nest tracks). This term is interchangeable with the level of turtle activity. |
| Turtle activity | Includes both turtle nests and false crawls. |
| Turtle tracker | A volunteer competent in identifying turtle species and observing activity during monitoring. |
| Zoning | Hierarchical spatial classification system of divisions, sections & subsections. |

LIST OF ABBREVIATIONS

| | |
|---------------------------|---|
| CCG | Cape Conservation Group Inc. |
| EPBC Act | Environmental Protection and Biodiversity Conservation Act 1999 |
| JTC | Jurabi Turtle Centre |
| NMP | Ningaloo Marine Park |
| NTP | Ningaloo Turtle Program |
| NW Cape | North West Cape |
| Parks and Wildlife | Department of Parks and Wildlife |
| WWF | World Wildlife Foundation |

1.0 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 Parks and Wildlife (Parks and Wildlife), Exmouth District. During the 2013-14 season, NTP sponsors Woodside Energy Ltd. made a significant contribution to the program and BHP Billiton contributed to the supply of a vehicle for the program's use during the peak monitoring period. The primary aim of the program is to predict long-term trends in marine turtle populations along the Ningaloo Coast.

Fifty volunteers contributed a total of 3186 hours to the Ningaloo Turtle Program in 2013-14. Since commencement of the program a total of 51861 volunteer hours have been contributed to the program. These figures demonstrate the effort of the volunteers over the life span of the program.

A total of 2795 suspected nests and 5623 false crawls were recorded in the Ningaloo Region over the entire 2013-14 season.

Volunteers recorded 2276 green turtle nests and 4960 green false crawls, which equates to a nesting success rate of 31.5% for this species.

Loggerhead turtles had a nesting success rate of 42% with 430 nests and 595 false crawls being recorded, equating to an above average level of activity when compared to other seasons for this species.

Hawksbill turtle records accounted for 69 nests and 51 false crawls which resulted in the highest nesting success rate of 57.5%. Activity data for this species in 2013-14 was lower than average in comparison to other seasons.

Nest disturbance was observed towards 41 nests. This was attributed to natural causes and predators, but the majority was caused by turtles accidentally excavating another turtle's nest. This amounted to 1.47% of the total nests recorded for the season.

Records of fox and dog predation on nests may be currently underestimated since predation and nest damage is only recorded for new nests and opportunistically for old nests. Any subsequent damage and predation on those nests may go unnoticed as the nests are not specifically checked every day throughout incubation. Further research will be undertaken using remote cameras during the 2014 - 15 season to gain a better understanding of this.

During 2013-14 nine stranded turtles were recorded. The total number of turtles rescued since 2002 has been 235 turtles. Nineteen turtle mortalities were recorded during the 2013-14 season.

2.0 INTRODUCTION

The Ningaloo Turtle Program (NTP) was established in 2002, as a collaborative initiative between Department of Parks and Wildlife (Parks and Wildlife) - Exmouth District, Cape Conservation Group Inc. (CCG), Murdoch University and the World Wildlife Fund - Australia (WWF). The mission statement 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 Parks and Wildlife in the reduction of disturbance levels to nesting turtles and therefore improves the conservation of the species breeding in the area.

Volunteers are essential to the maintenance of the program. Based in Exmouth, Western Australia, the NTP provides an opportunity for local community, interstate and international volunteers to take part in turtle conservation. Participating volunteers gain practical experience with turtle monitoring, turtle rescues and other related activities.

In 2008 it was determined that trends in marine turtle populations within the study area could be detected with a reasonable level of error when survey effort was reduced. Survey effort would need to include both the pre-peak, intensive and post-peak monitoring periods in order to establish these trends in abundance (Whiting, 2008).

A typical NTP monitoring season now includes a peak nesting period of intensive monitoring, which constitutes four weeks of daily effort. This period was identified by analysing previous seasons data. Additionally, weekend monitoring during the pre and post peak nesting periods captures early and late fluctuations in the nesting activity.

Trend analysis is undertaken every three years, most recently in 2013. A generalised additive model is applied to the data to predict nesting abundance throughout the seasons. Linear regression models are used to calculate annual nesting abundance and trends in track and nest counts.

Woodside Energy Ltd has provided a significant contribution to the programs operational costs since 2012 and is the main sponsor of the program. This has included the funding of volunteer food and accommodation, website maintenance, community activities, equipment and educational materials costs.

BHP Billiton has also generously contributed to the sponsorship of the program since 2010 and has funded the hire of a mini-bus, which is used to transport the volunteers to and from the monitoring beaches during the program.

The goals and objectives listed below have been formulated through a community-based community and are updated as required.

NTP Overarching Goals

- Collect data at key nesting beaches as representative sites for local turtle populations.
- Monitor turtle activity levels within Ningaloo region and assess nesting trends through time.
- Build a culture of awareness and stewardship for marine turtle conservation

NTP Primary Objectives

- Estimate the abundance and distribution of turtle nests on key sections of beach over specified time intervals for each species that nests within the area.
- Identify the relative significance of specific nesting beaches to each species.
- Identify any temporal changes relating to nesting season and spatial changes in nesting distribution amongst species.
- Quantify predation and disturbance levels through NTP methodology and external supporting research.
- Support external research initiatives relating to the goals of the program.
- Encourage community and wider involvement, through continuous education and the recruitment of volunteers, in order to build interest, skills and knowledge to assist with turtle conservation.

3.0 Methods

Data is collected by observing fresh tracks to determine turtle species and identify suspected nests. Volunteers use standard procedures to determine if the turtle activity has resulted in a successful nest or a false crawl. Nest positions are recorded using GPS's. Signs of predation at nests are also recorded, along with tagged turtle sightings, the presence of feral animals, turtle mortalities, and rescues.

For more detailed information on current NTP monitoring methodologies please see NTP Annual Report 2012-13 (Section 5.0) or the Turtle Monitoring Field Guide, both of which are available at www.ningalooturtles.org.au

Points worth noting in regards to the NTP methodology:

- Throughout the report the term nest is used, but during monitoring the eggs aren't actually witnessed being laid. Therefore error can be expected as turtles can sometimes create the appearance of nests without depositing any eggs into them (Whiting pers.com. 2012). Due to this, the term 'suspected nest' is used interchangeably with 'nest' throughout the report.

- The proportion of damage recorded is not viewed as an accurate figure, since only new nests are checked for signs of predation after the first evening of the incubation term. Old nests are recorded on an incidental basis, during the monitoring of the new nests. Therefore there is a high likelihood that predation and disturbance to old nests goes undetected, resulting in an underestimate of predation.

4.0. MONITORING ZONES

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 and subsections. Subsections were determined by natural barriers that separate beaches and car parks. Subsection length is an important consideration and restricted to an average length of 2-3kms so that they are practical to survey on foot. A subsection is defined with a GPS location and NTP totem markers are located at the start and finish point of each one.

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 subsections (see Appendix 11 for further division information).

Bundera/Ningaloo Division

The Bundera/Ningaloo Division includes six sections. These sections are classified into subsections. This division has not been monitored by NTP since the 2007-08 season. However, Parks and Wildlife staff have conducted opportunistic monitoring within this division during monthly fox baiting operations. Since then 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 The Lagoon. These sections are classified into one or more subsections. This division has not been monitored by NTP since the 2008-09 season. Parks and Wildlife staff have conducted opportunistic monitoring within this division during monthly fox baiting operations, but for the purpose of this report these data have not been included.

5. RESULTS

5.1 Survey Effort

In 2013-14 monitoring was conducted in the NW Cape Division (37-46 days) and Cape Range Division (27-44 days), depending on the weather conditions and availability of volunteers for each of the subsections.

Fifty volunteers contributed a total of 3186 hours to the Ningaloo Turtle Program in 2013-14. Since commencement of the program a total of 51861 volunteer hours have been contributed to the program. This time was primarily accrued during beach monitoring, but also included data entry, training, and general tasks toward the running of the program.

From the 16th December 2013 – 12th January 2014 intensive peak period monitoring was conducted seven days a week at both the NW Cape Division and Cape Range Division. Outside of the intensive peak period monitoring, pre and post peak weekend monitoring was undertaken on the 9th & 10th and 23rd & 24th November, and the 7th & 8th December in 2013. The post monitoring weekends occurred on the 1st & 2nd and 15th & 16th in February and the 1st & 2nd of March in 2014. These weekend monitoring sessions were conducted only within the NW Cape Division.

Parks and Wildlife field staff conducted opportunistic turtle monitoring during monthly fox baiting operations in the Bundera/Ningaloo and Coral Bay Divisions, but for the purpose of this report this data has been omitted from the results.

Survey effort figures incorporate both the number of days and the number of subsections monitored within that day. Some figures throughout this report are adjusted by survey effort in order to make fair comparisons between seasons (i.e. because the number of days for which monitoring occurred, and the number of subsections monitored each day may vary between seasons).

Table 1: Survey effort and turtle activity 2002-14 entire season (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 | 2012/13 | 2013/14 | 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 | 10/11/12-10/03/13 | 28/10/13 - 2/3/14 | |
| Division | Section | | | | | | | | | | | | | |
| North West Cape | Graveyards | 165 | 375 | 374 | 368 | 341 | 336 | 234 | 160 | 153 | 144 | 162 | 172 | 2984 |
| | Hunters | 248 | 263 | 271 | 271 | 256 | 252 | 173 | 117 | 114 | 109 | 111 | 117 | 2302 |
| | Lighthouse Bay | 127 | 137 | 215 | 260 | 222 | 251 | 147 | 83 | 93 | 97 | 106 | 113 | 1851 |
| | Navy Pier | N/A | 86 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 86 |
| | Tandabiddi | 115 | 3 | N/A | 85 | 86 | 84 | 58 | 38 | 37 | 36 | 41 | 38 | 621 |
| Cape Range | Bloodwood | N/A | 4 | N/A | N/A | 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 | 78 | 114 | 1142 |
| | Turquoise Bay | N/A | 16 | N/A | N/A | 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 | 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 | N/A | N/A | 211 |
| | Janes Bay | 13 | 24 | 12 | 29 | 22 | 4 | N/A | N/A | 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 | 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 | N/A | N/A | 15 |
| Coral Bay | Batemans Bay | 103 | 100 | 117 | 51 | 76 | 47 | 34 | N/A | N/A | N/A | N/A | N/A | 528 |
| | Lagoon | 103 | 100 | 116 | 51 | 76 | 47 | 34 | N/A | N/A | N/A | N/A | N/A | 527 |
| | Turtle Beach | 56 | 100 | 66 | 49 | N/A | | N/A | N/A | N/A | N/A | N/A | N/A | 271 |
| Total survey effort | | 940 | 1265 | 1738 | 1278 | 1199 | 1161 | 804 | 470 | 484 | 477 | 496 | 554 | 10866 |
| Number subsections monitored | | 22 | 29 | 28 | 20 | 19 | 19 | 18 | 14 | 14 | 14 | 14 | 14 | 225 |
| Green nests | | 1539 | 1552 | 788 | 4695 | 4349 | 5254 | 6297 | 571 | 2732 | 6594 | 585 | 2276 | 37232 |
| Green false crawls | | 5404 | 3086 | 2533 | 9948 | 14395 | 13156 | 12608 | 1451 | 6507 | 22865 | 1769 | 4960 | 98682 |
| Green activity | | 6943 | 4638 | 3321 | 14643 | 18744 | 18410 | 18905 | 2022 | 9239 | 29459 | 2354 | 7236 | 135914 |
| Green nesting success % | | 22.2% | 33.5% | 23.7% | 32.1% | 23.2% | 28.5% | 33.3% | 28.2% | 29.6% | 22.4% | 24.9% | 31.5% | 27.4% |

MONITORING RESULTS

| | | | | | | | | | | | | | |
|---------------------------------------|-------------|-------------|-------------|--------------|--------------|--------------|--------------|-------------|--------------|--------------|-------------|-------------|---------------|
| Hawksbill nests | 48 | 81 | 100 | 108 | 157 | 156 | 336 | 202 | 189 | 65 | 125 | 69 | 1636 |
| Hawksbill false crawls | 49 | 60 | 139 | 71 | 153 | 145 | 207 | 202 | 132 | 84 | 192 | 51 | 1485 |
| Hawksbill activity | 97 | 141 | 239 | 179 | 310 | 301 | 543 | 404 | 321 | 149 | 317 | 120 | 3121 |
| Hawksbill nest success % | 49.5% | 57.4% | 41.8% | 60.3% | 50.6% | 51.8% | 61.9% | 50.0% | 58.9% | 43.6% | 39.4% | 57.5% | 52.4% |
| Loggerhead nests | 288 | 387 | 777 | 1068 | 540 | 795 | 580 | 288 | 405 | 382 | 304 | 430 | 6244 |
| Loggerhead false crawls | 429 | 359 | 1040 | 925 | 477 | 954 | 486 | 471 | 388 | 715 | 466 | 595 | 7305 |
| Loggerhead activity | 717 | 746 | 1817 | 1993 | 1017 | 1749 | 1066 | 759 | 793 | 1097 | 770 | 1025 | 13549 |
| Loggerhead nesting success | 40.2% | 51.9% | 42.8% | 53.6% | 53.1% | 45.5% | 54.4% | 37.9% | 51.1% | 34.8% | 39.5% | 42.0% | 46.1% |
| Unidentified nests | 29 | 123 | 59 | 42 | 33 | 61 | 38 | 8 | 18 | 7 | 7 | 20 | 445 |
| Unidentified false crawls | 44 | 20 | 82 | 45 | 19 | 29 | 12 | 8 | 9 | 4 | 12 | 17 | 301 |
| Unidentified activity | 73 | 143 | 141 | 87 | 52 | 90 | 50 | 16 | 27 | 11 | 19 | 37 | 746 |
| Unidentified nesting success | 39.7% | 86.0% | 41.8% | 48.3% | 63.5% | 67.8% | 76.0% | 50.0% | 66.7% | 63.6% | 36.8% | 54.1% | 59.7% |
| Total all species nests | 1904 | 2180 | 1724 | 5913 | 5279 | 6266 | 7252 | 1069 | 3343 | 7049 | 1023 | 2795 | 45797 |
| Total all species false crawls | 5925 | 3536 | 3794 | 10989 | 15044 | 14284 | 13314 | 1451 | 7038 | 23668 | 2439 | 5623 | 107105 |
| Total activity | 7829 | 5716 | 5518 | 16902 | 20323 | 20550 | 20566 | 2520 | 10381 | 30717 | 3462 | 8418 | 152902 |

5.2 Turtle Activity

5.2.1 2013 – 2014 Season

North West Cape Division

A total of 2454 suspected nests and 5150 false crawls were recorded within the NW Cape Division during 2013-14 (Table). Green turtles showed by far the greatest nesting activity in the NW Cape Division (both nests and false crawls) being responsible for 94.7 % of total activity recorded, followed by loggerhead turtles (4.0%), then hawksbills (1.1%) and unidentified species (0.2%). No flatback turtle activity was recorded.

Table 2: The total number of activities (suspected nests and false crawls) recorded for each species within the North West Division, NTP 2013-14 entire season

| North West Cape Division | Turtle Species | | | | | Total |
|--------------------------|----------------|-----------|------------|----------|--------------|-------------|
| | Green | Hawksbill | Loggerhead | Flatback | Unidentified | |
| New nests | 2265 | 47 | 130 | 0 | 12 | 2454 |
| False crawls | 4935 | 38 | 171 | 0 | 6 | 5150 |
| Total activity | 7200 | 85 | 301 | 0 | 18 | 7604 |

Figure 1 shows the distribution of nests and false crawls amongst the four NW Cape sections. For individual nest locations see maps in Appendix 7, 8, 9 and 10.



Figure 1: Comparison of nesting activity (suspected nests and false crawls) recorded in each NW Cape Section, NTP 2013-14 for entire season.

Figure 2 shows that green turtles were responsible for the highest proportion of nesting activity recorded within the North West Cape Division. No nesting activity was recorded for flatback turtles.

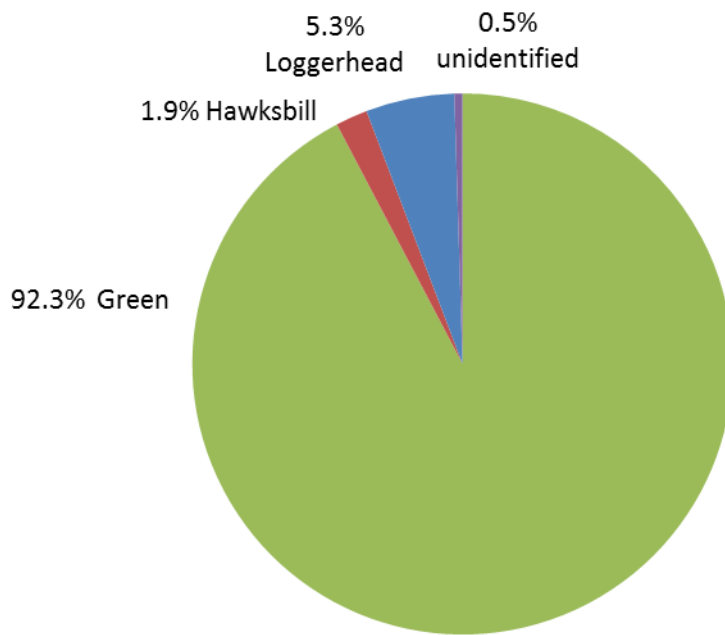


Figure 2: Percentage comparison of nests by species recorded within the North West Cape Division, 2013-14 entire season

Cape Range Division

A total of 341 suspected nests and 473 false crawls were recorded in the Bungelup Section (Cape Range Division) during the 2013-14 NTP (Table 3). Loggerhead Turtles showed the greatest nesting activity in the Bungelup Section (both suspected nests and false crawls) with (89.6%), followed by green (5.3%), hawksbill (2.7%) and unidentified turtle species (2.3%). No flatback turtle activity was recorded.

Table 3: The total number of activities (suspected nests and false crawls) recorded for each species within the Cape Range Division, NTP 2013-14 entire season

| Cape Range Division | Turtle Species | | | | Total |
|-----------------------|----------------|-----------|------------|--------------|------------|
| | Green | Hawksbill | Loggerhead | Unidentified | |
| New nests | 11 | 22 | 300 | 8 | 341 |
| False crawls | 25 | 13 | 424 | 11 | 473 |
| Total activity | 36 | 35 | 724 | 19 | 814 |

Figure 3 shows the distribution of nests and false crawls amongst the Cape Range subsections. For individual nest locations see Appendix 11.

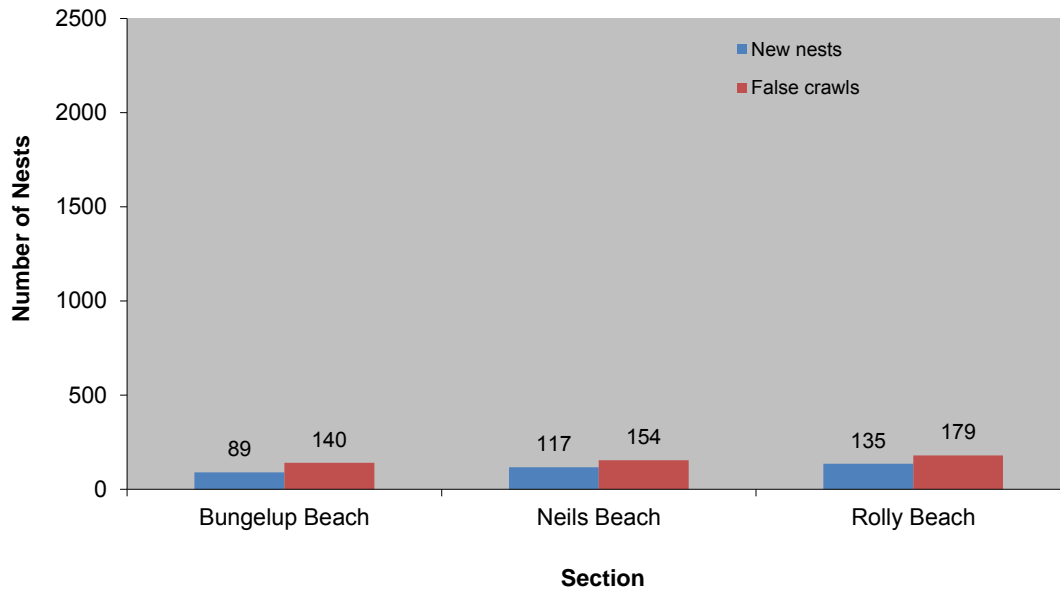


Figure 3: Comparison of nesting activity (suspected nests and false crawls) recorded within each Bungelup subsection (Cape Range Division), NTP 2013-14.

Figure 4 shows loggerhead turtles accounted for the highest proportion of nests recorded within the Cape Range Division, followed by hawksbill and then green turtles. A small proportion of nests could not be identified to a species.

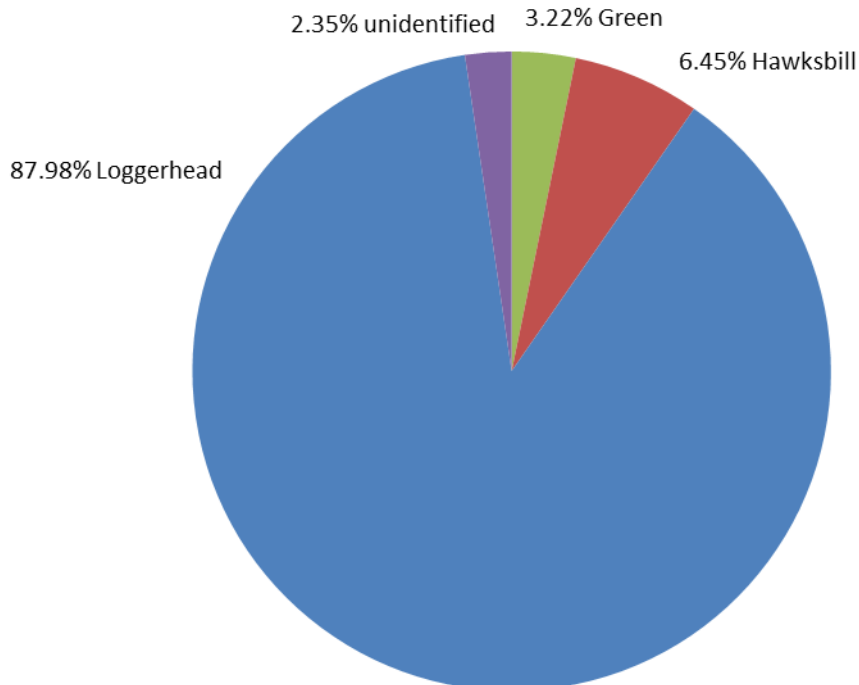


Figure 4: Percentage comparison of nests by species within the Cape Range Division, 2013-14.

5.2.3 History of Turtle Activity (2002-2014)

NTP has recorded 45 797 suspected nests and 107 105 false crawls (total activity: 152 902) over-all season dates and subsections since commencement of the program in 2002 (Table 1). Green turtles are by far the most abundant species with a total of 135 914 nests and false crawls recorded, followed by loggerhead turtles (13 549 activities) and hawksbill turtles (3121 activities). A total of 746 activities have been recorded as being from unidentified species (Table 1).

Between 2002 – 2014, within the standardised intensive peak monitoring period, the NTP has recorded a total of 24 265 nests and 60 813 false crawls (total activity: 85 078). When comparing the activity recorded over the past twelve years, the 2013-14 season figure for total turtle activity was only just below the average level recorded since 2002 (Figure), and total nesting levels were right on average (Figure). Green turtles are by far the most abundant species with a total of 75 021 activities (nests and false crawls) recorded within the intensive monitoring periods (2002 – 2014), followed by loggerhead turtles (8015 activities) and hawksbill turtles (1766 activities). A total of 273 turtle activities have been recorded as unidentified species.

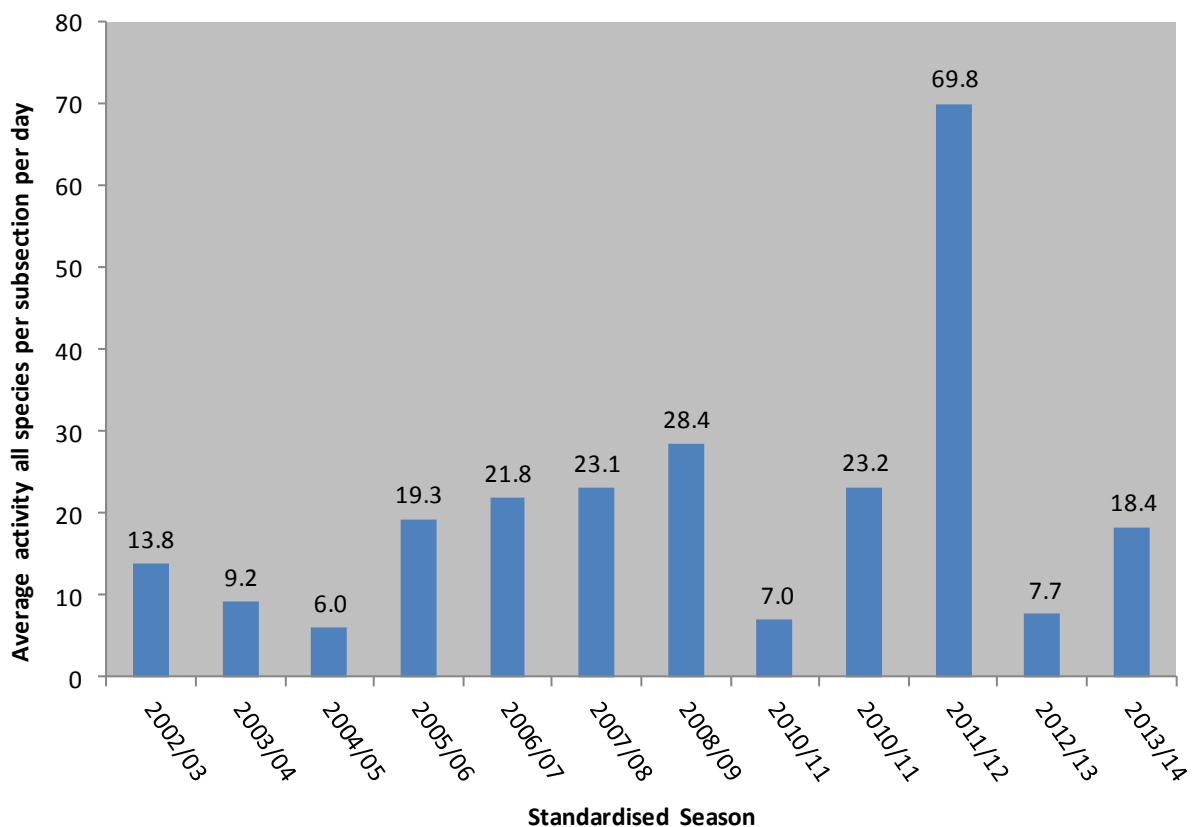


Figure 1: Seasonal green, loggerhead and hawksbill turtle activity (nests and false crawls) standardised by survey effort during the intensive peak monitoring period.

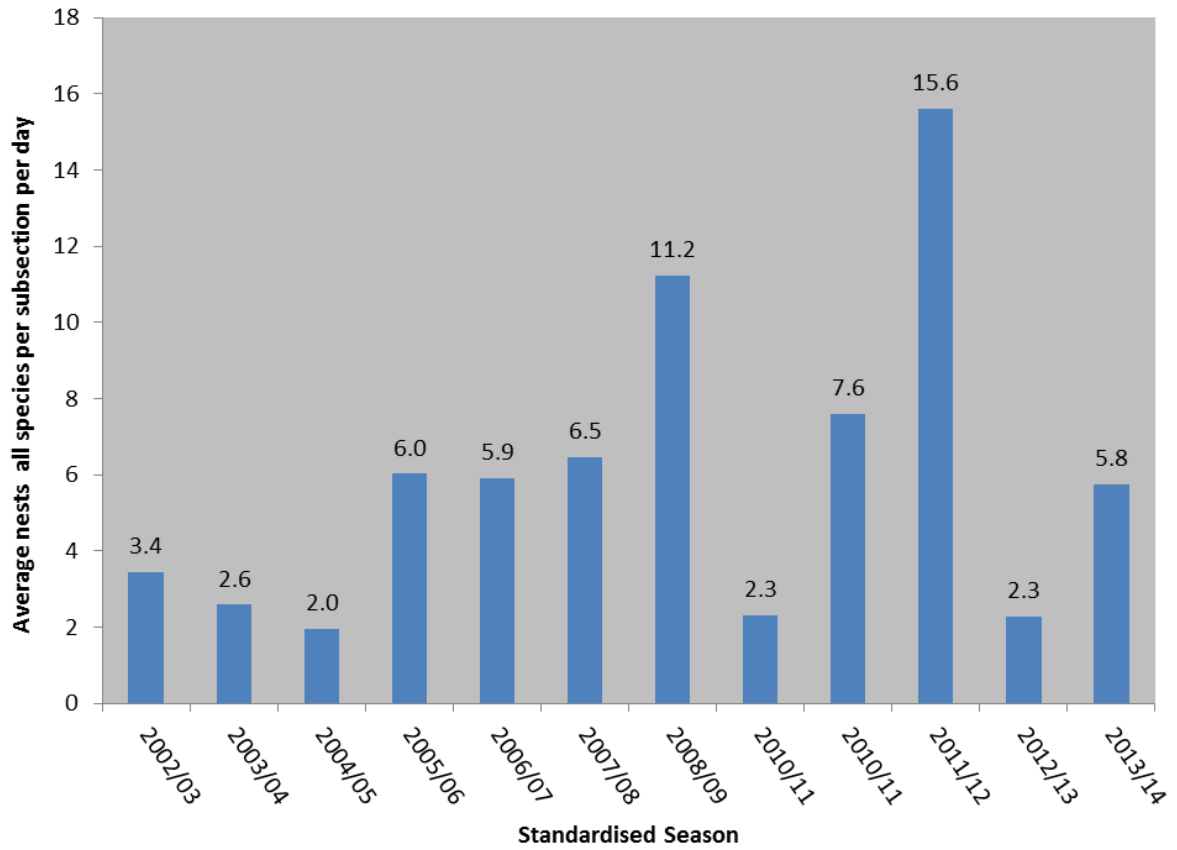


Figure 6: Seasonal green, loggerhead and hawksbill nests standardised by survey effort during the intensive peak monitoring period

Green Turtles

When comparing standardised seasons, the level of green turtle activity recorded during 2013-14 was slightly below average but nesting levels were on average (Figure).

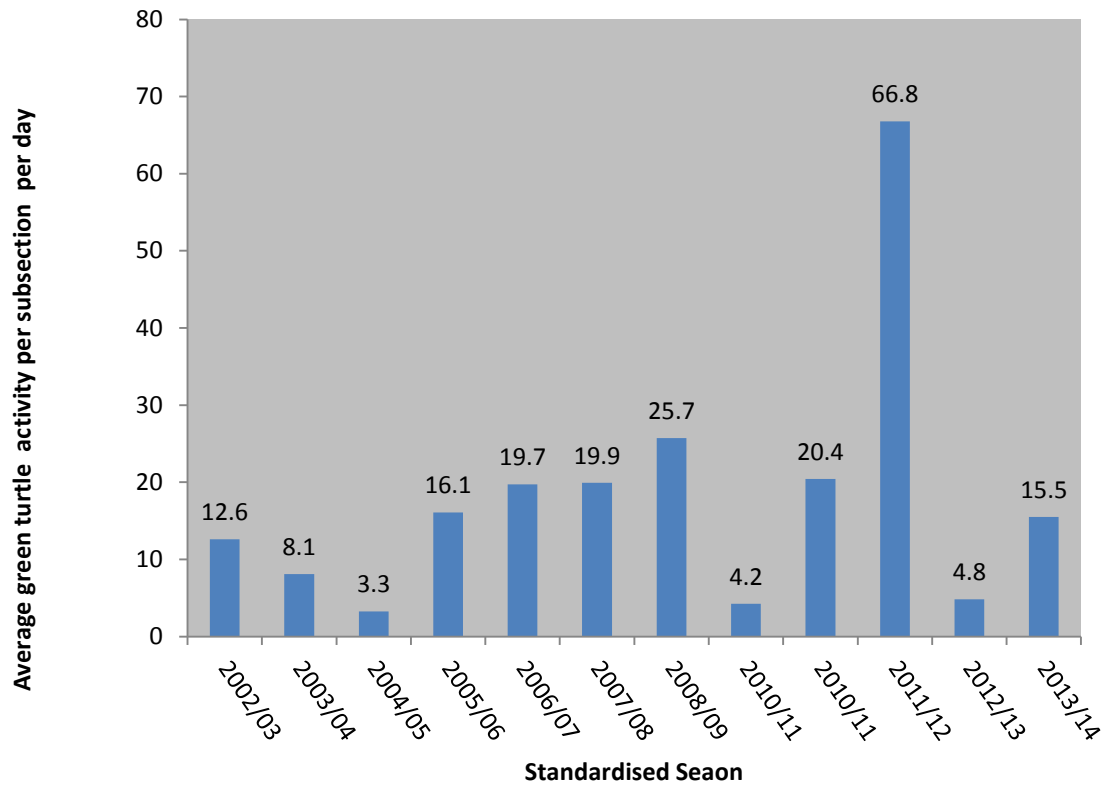


Figure 7: Seasonal green turtle activity (nests and false crawls) standardised by survey effort during the intensive peak monitoring period.

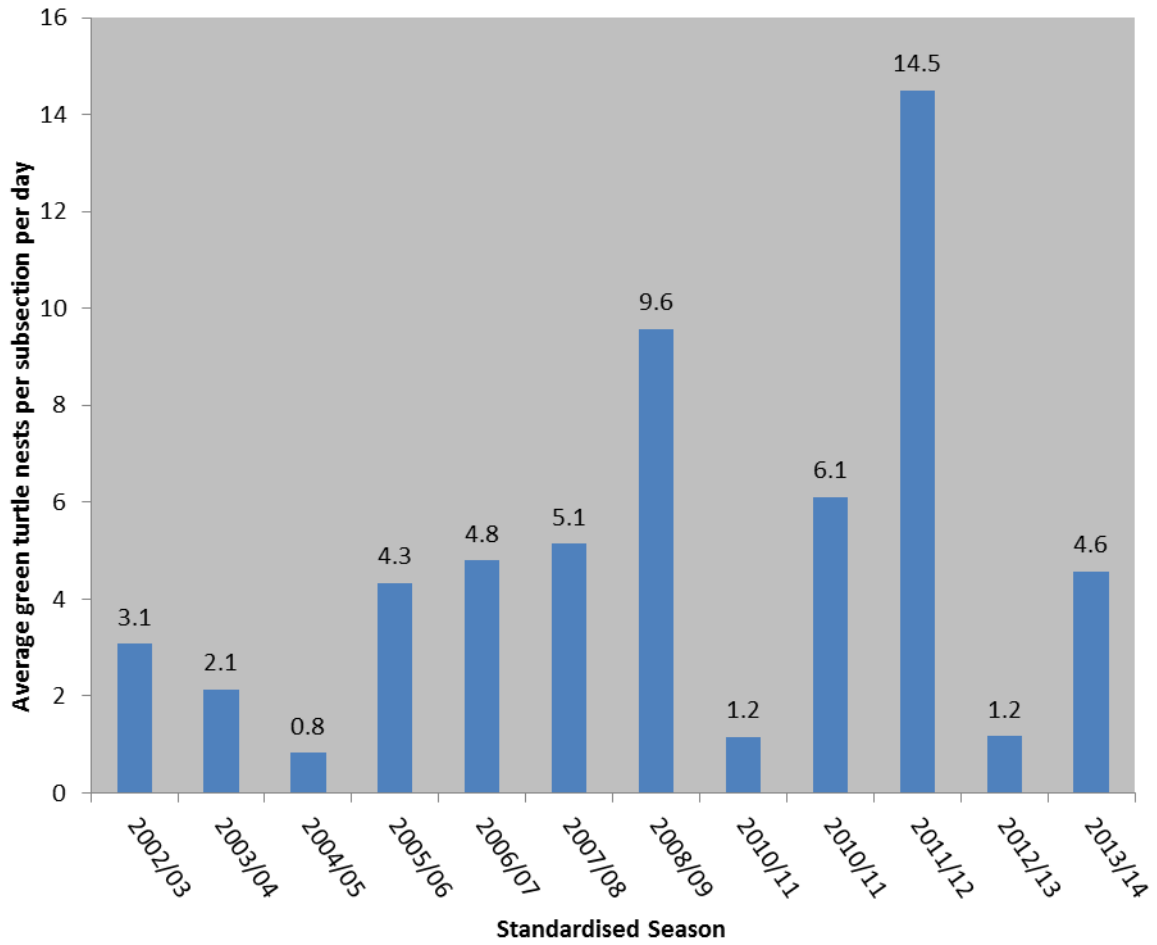


Figure 8: Seasonal green turtle nests standardised by survey effort during the intensive peak monitoring period.

Hawksbill Turtles

Since the commencement of NTP, the level of hawksbill turtle total activity and nesting has varied between seasons but was lower than the average in 2013-14 (Figure and Figure).

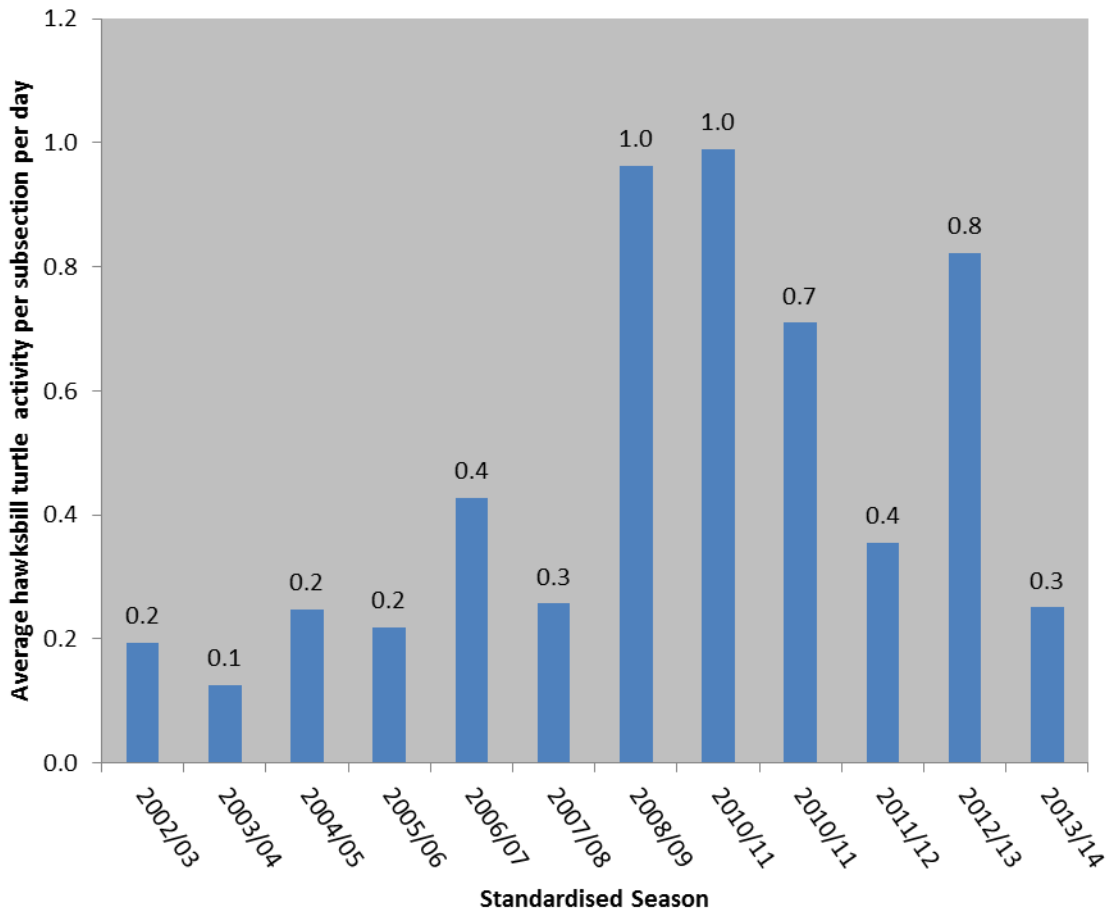


Figure 9: Seasonal hawksbill activity (false crawls and nests) standardised by survey effort during the intensive peak monitoring period.

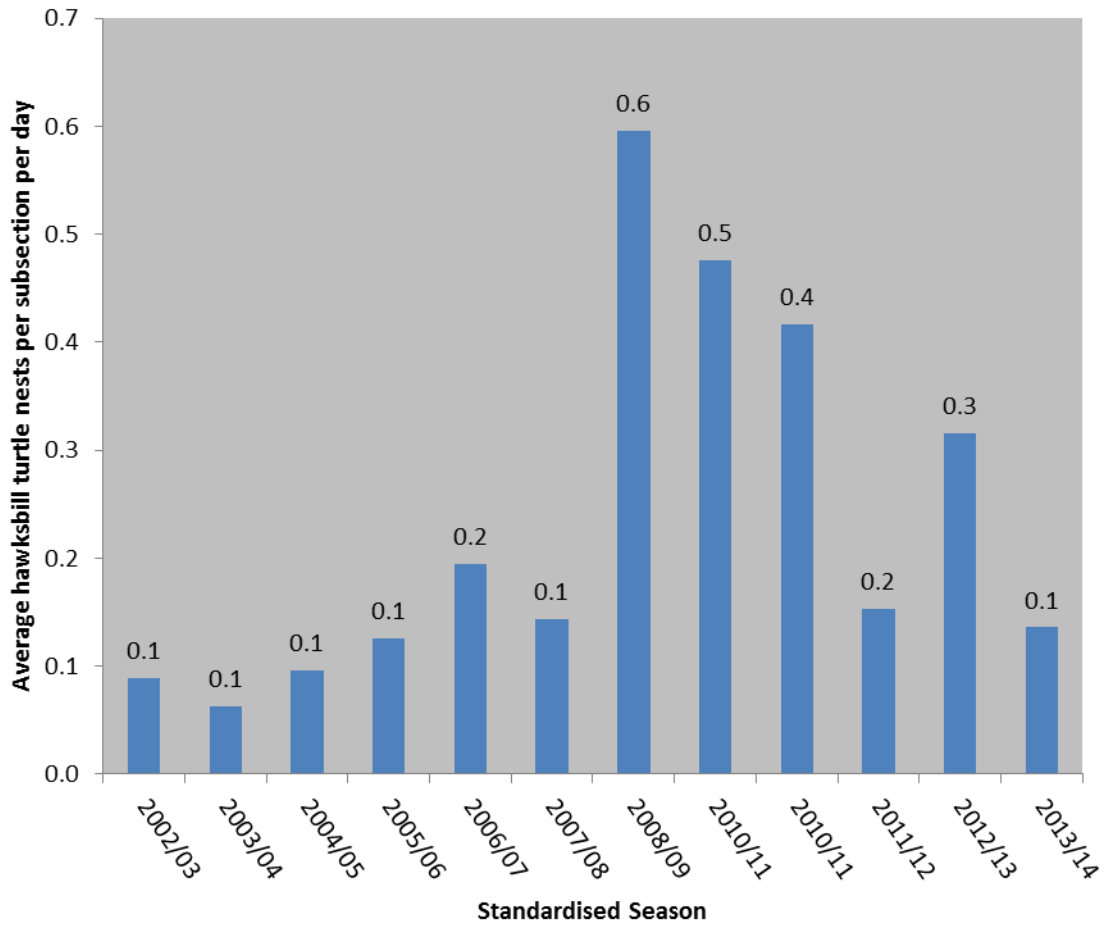


Figure 2: Seasonal hawksbill nests standardised by survey effort during the intensive peak monitoring period.

Loggerhead Turtles

Since the commencement of NTP, the level of activity and nesting recorded for loggerhead turtles has varied. Total activity and nesting levels recorded for the 2013-14 season were above average (Figure and Figure 12).

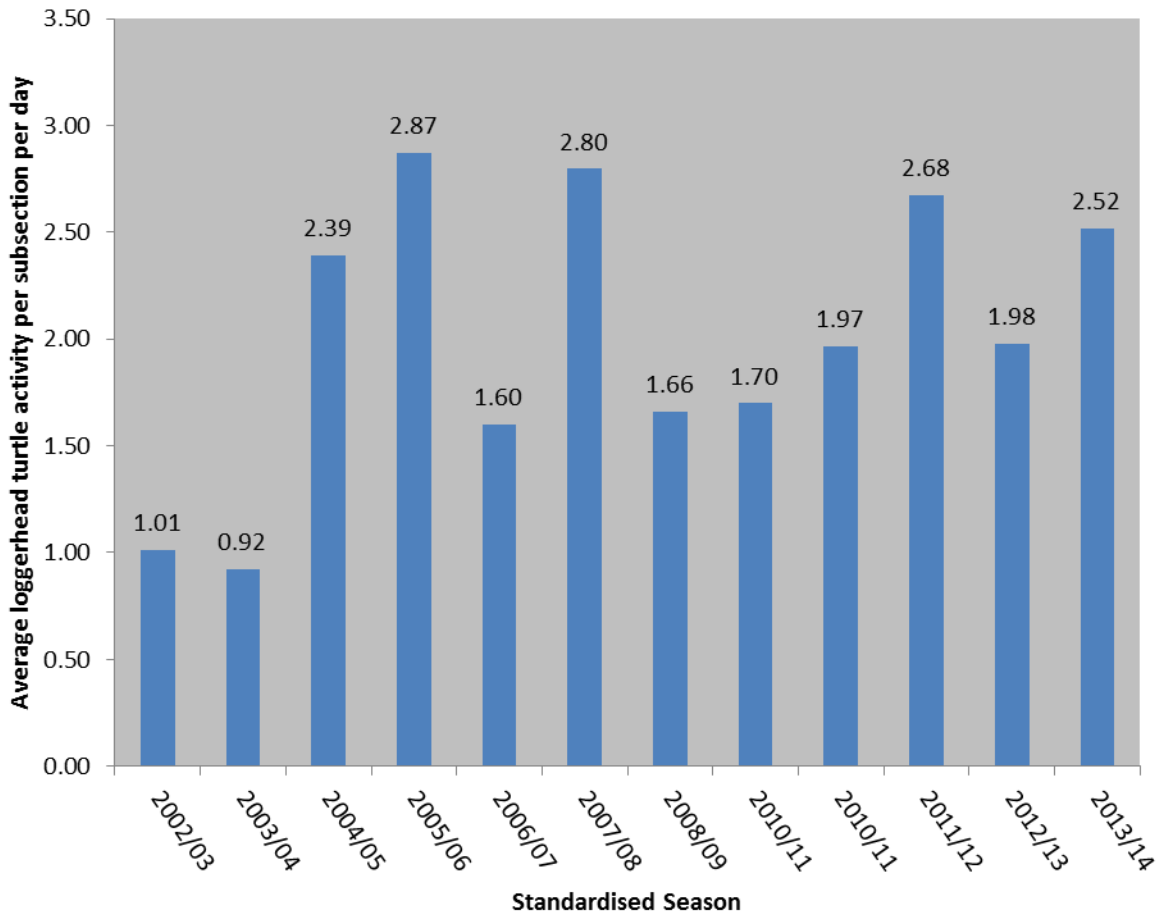


Figure 3: Seasonal loggerhead activity (false crawls and nests) standardised by survey effort during the intensive peak monitoring period.

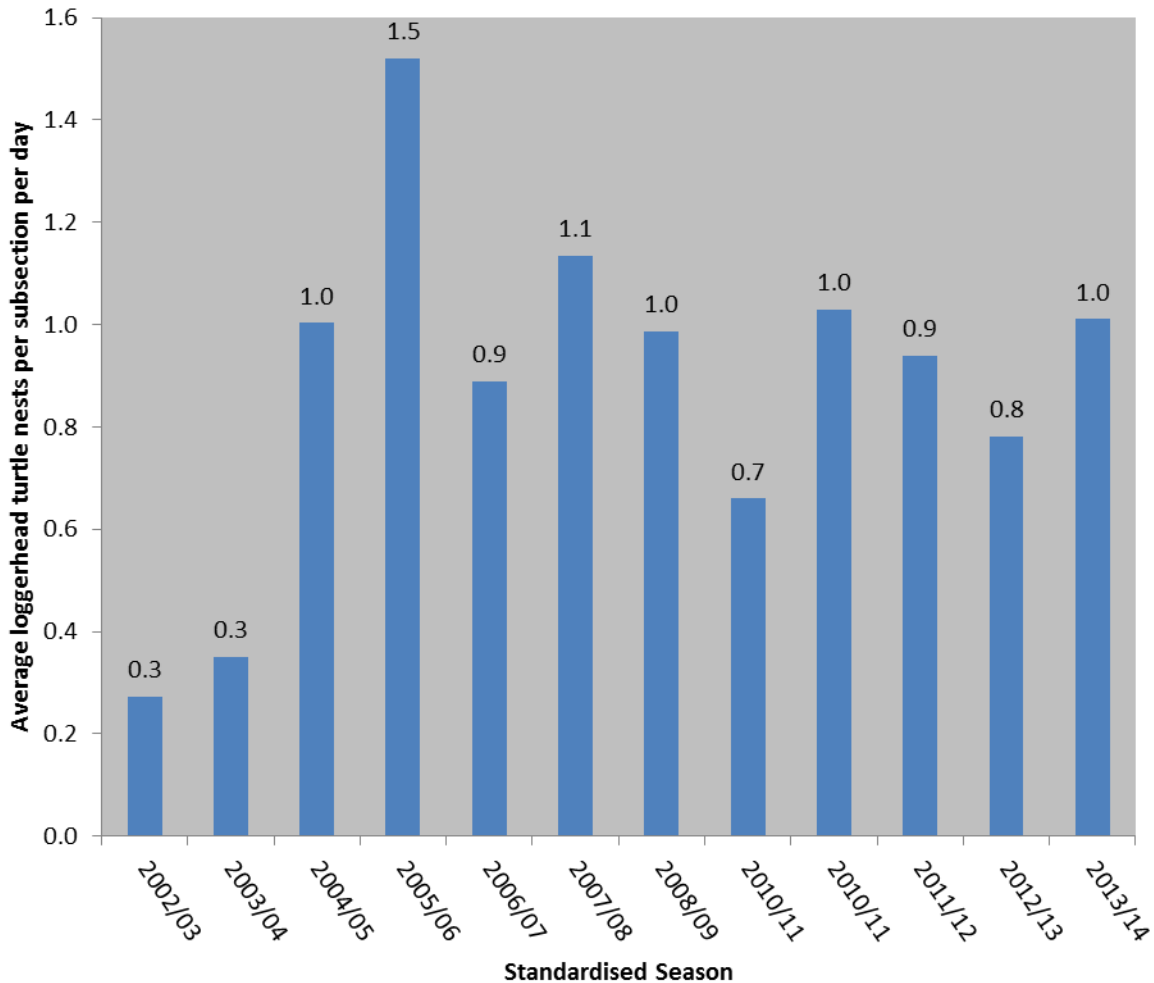


Figure 4: Seasonal loggerhead nests standardised by survey effort during the intensive peak monitoring period.

5.3 Nesting Success

5.4.1 2013-14

For the purposes of this report, nesting success is defined as the number of suspected nests laid as a percentage of total turtle activities. 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, however eggs have not been observed deposited into the nest. Therefore night time observations of at least 30 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 entire season's data is compared per species, NTP recorded a total of 2276 green turtle nests and 4960 false crawls during 2013-14 season, which equates to 31.45% nesting success. Hawksbill and loggerhead turtles had the greatest nesting success rates of 57.5% and

41.95% respectively, with NTP recording 69 nests and 51 false crawls for hawksbills and 430 nests and 595 false crawls for loggerheads (Table 1).

5.4.2 Nesting Success History (2002-14)

Green Turtles

Green turtle nesting success has varied over the years with a spike in 2008-09 with a success rate of 37.34%. In other seasons this has ranged between 21.7% – 29.9% (Figure).

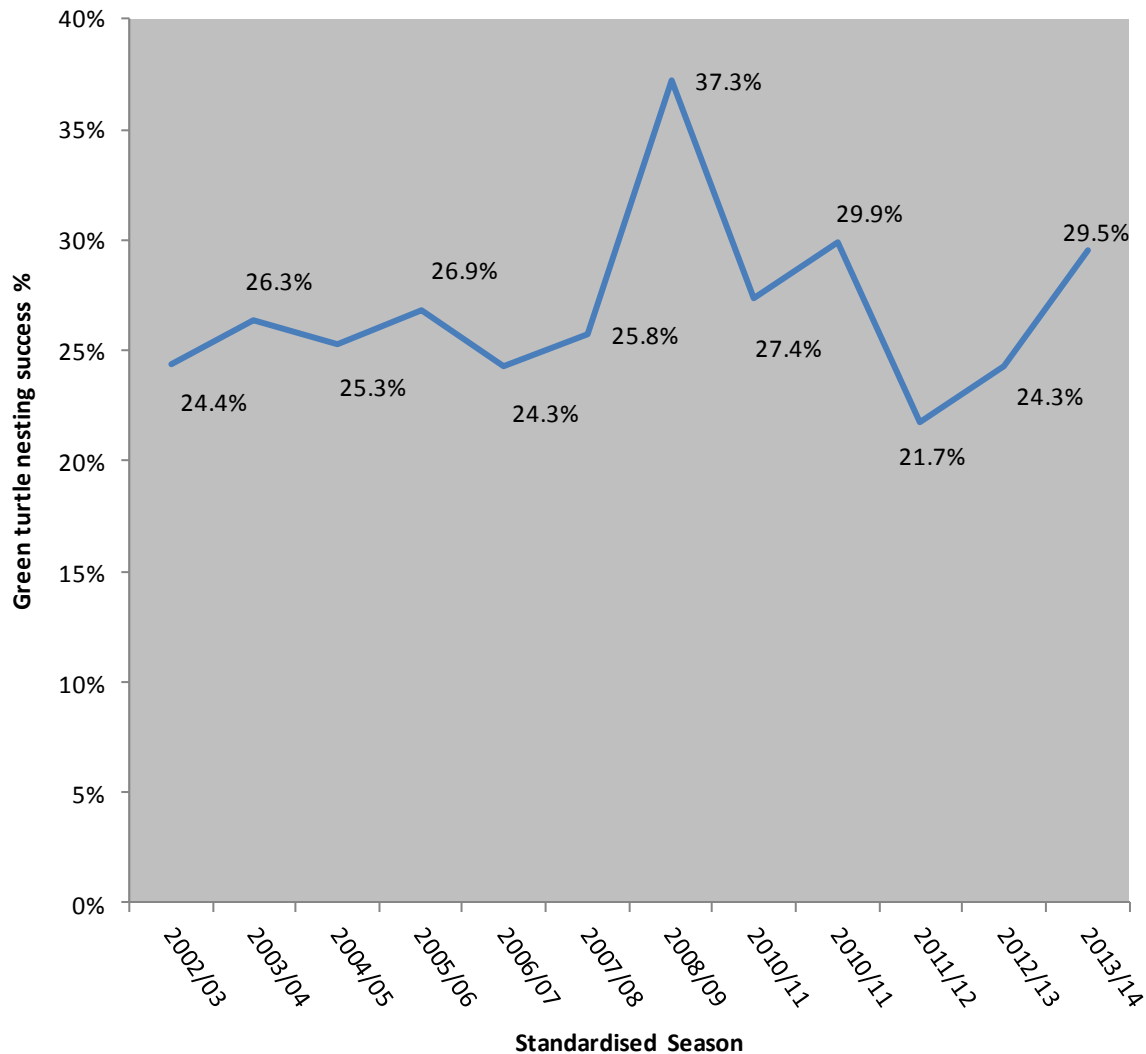


Figure 13: Green turtle nesting success 2002-2014 (%) standardised by survey effort during intensive peak monitoring period.

Hawksbill Turtles

Nesting success of hawksbill turtles has varied from between 38.4-61.9% (Figure 14).

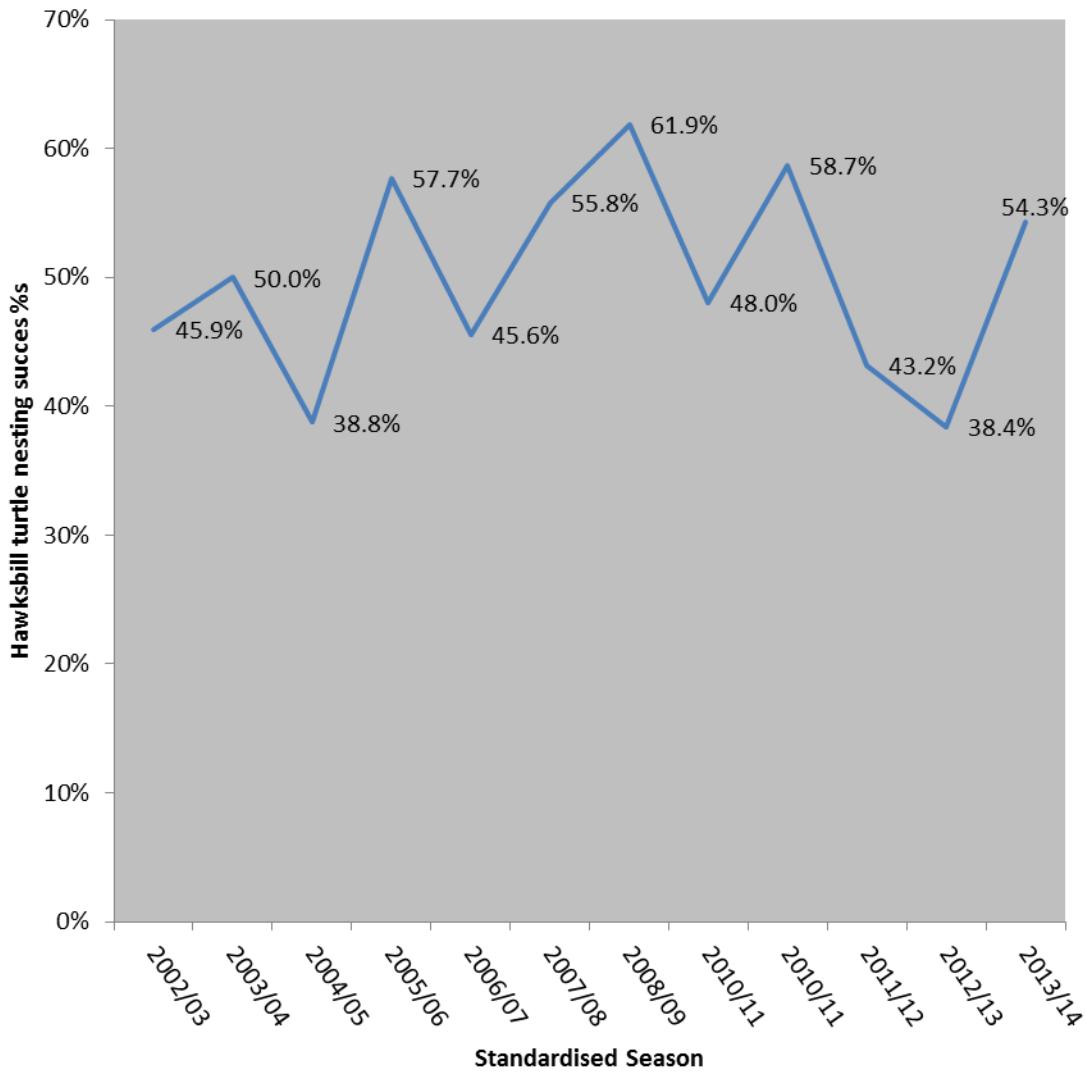


Figure 14: Hawksbill turtle nesting success (%) 2002-14 standardised by survey effort during the intensive peak monitoring period.

Loggerhead Turtles

The loggerhead turtles nesting success rate has varied from 26.9 – 59.5% (Figure 15).

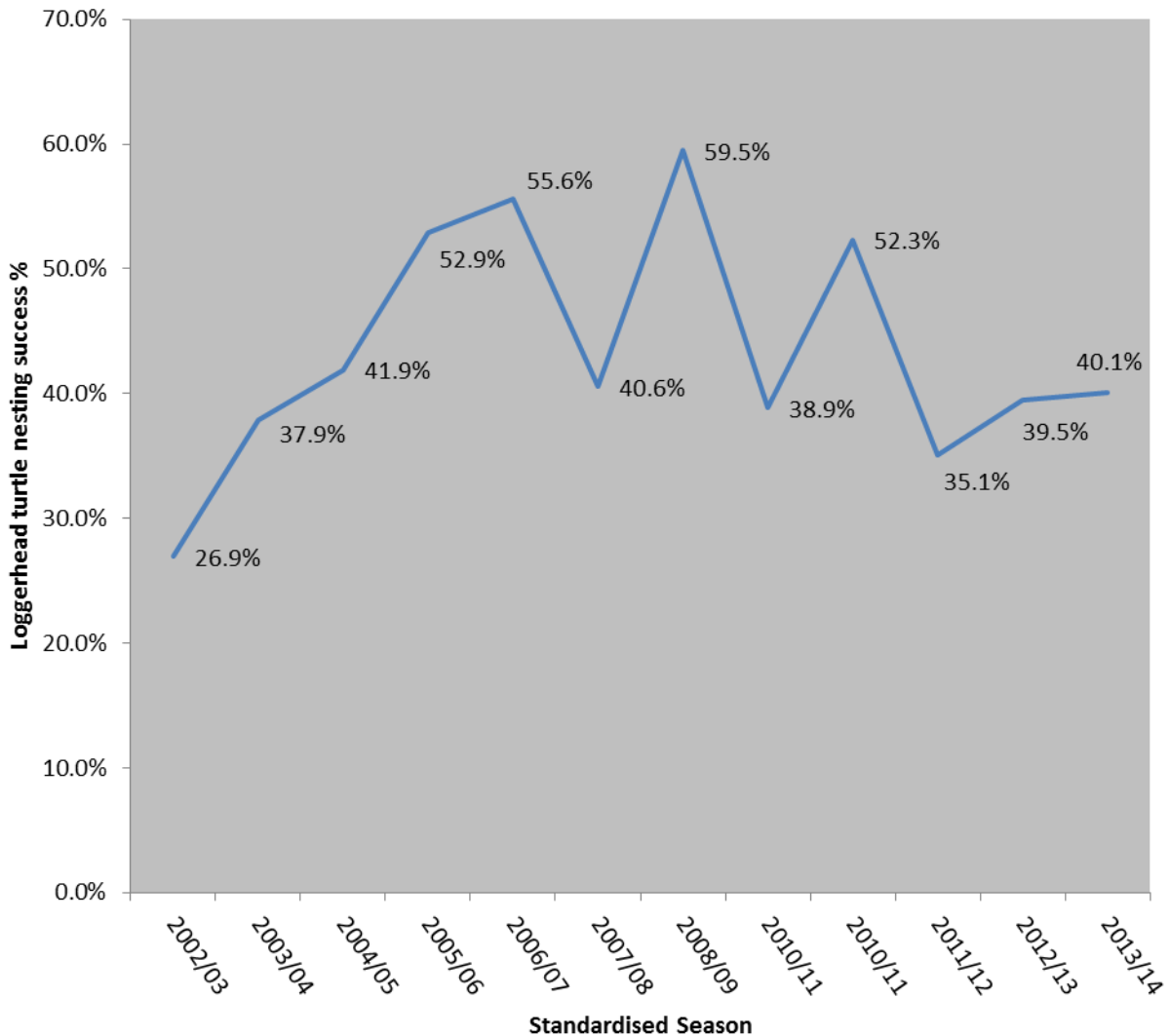


Figure 15: Loggerhead turtle nesting success 2002-14 (%) standardised by survey effort during intensive peak monitoring period

5.4 Nest Damage

5.4.1 2013-14

Six new nests and 35 old nests were recorded as damaged in the 2013-14 full season. Two of these were recorded in the Cape Range Division and the remainder in the North West Cape Division. Nest damage was attributed to the following causes: 26 were damaged by another turtle, one by a fox, one by a dog, three by goannas, three by humans and seven by unknown causes. Refer to Appendix 1 and Appendix 2 for maps of sections.

Note: The percentage of nest damage mentioned above is not viewed as an accurate figure since only new nests (i.e. first day of incubation period) are specifically checked for signs of damage whereas damage to old nests (i.e. day two of the incubation period until hatching) is only

recorded on an incidental basis if it is encountered whilst monitoring new nests. Therefore it is likely that a proportion of damaged nests go undetected.

5.4.2 Nest Damage History (2002-14)

Since monitoring began in 2002, a total of 857 nests (new and old) have been recorded as damaged within the Ningaloo Region (Table). This equates to 1.9% of total nests recorded within the Ningaloo Region 2002-2014 (please note that survey effort within the Region varies for each NTP season; see Table 1 for detailed survey effort data).

Table 4: Total number of damaged nests (new and old) and cause per season NTP 2002-2014. 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 | 14 | 2 | 2 | 3 | 0 | 1 | 0 | 6 | 0 | 0 | 28 |
| 2011-2012 | 12 | 2 | 3 | NA | NA | NA | NA | 7 | 42 | NA | 66 |
| 2012-2013 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 3 |
| 2013-2014 | 7 | 1 | 1 | 0 | 3 | 3 | 0 | 0 | 26 | 0 | 41 |
| Total | 170 | 29 | 305 | 156 | 18 | 28 | 9 | 33 | 106 | 3 | 857 |

5.4.3 Predation of nests by foxes and dogs

Since 2002, damage by foxes and dogs has accounted for 39% of the total damaged nests recorded. Nest predation by foxes and dogs has remained below 5% for all recorded nests. When the NTP was commenced, discussions were held on the possible sustainable level of fox/dog predation to turtle nests, with the consideration of advice provided by C. Limpus (pers. com.). It was concluded that a desirable maximum threshold of 5% would be adequate to monitor a measure of the success of fox baiting regimes. However, this threshold is not indicative of the acceptable total level of predation, as the cumulative effects of mortality of hatchlings, juvenile and adult turtles would need to be considered in order to assess a truly sustainable level of predation for the whole turtle population.

The highest record of fox and dog predation since monitoring began is 4.4% 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 the Department of Environment and Conservation in 2004-05 (Halkyard, 2008). As a result of this initiative, fox and dog predation has declined significantly in subsequent seasons and has maintained a very low level (less than 2%) due to continued fox baiting at key rookeries.

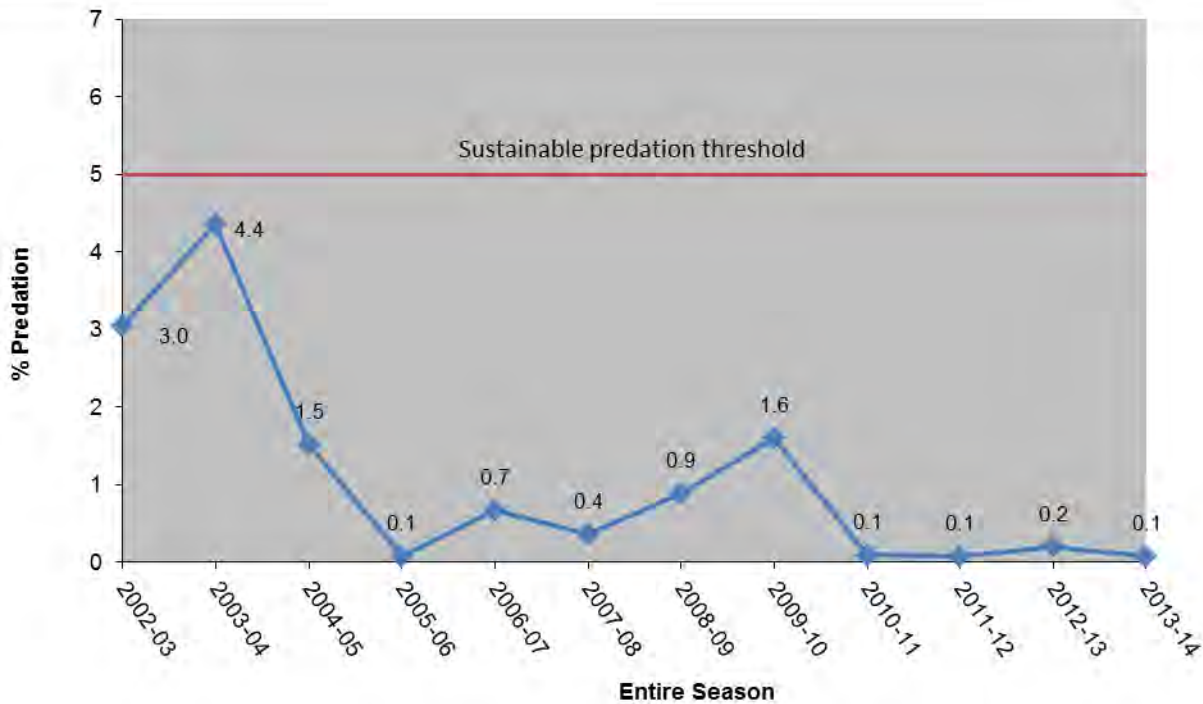


Figure 165: Fox and dog predation as a percentage of total nests per season, NTP 2002-14. Note: data from 2009-10 season onwards includes NW Cape and Cape Range Divisions only, other seasons include an additional two divisions.

5.5 Turtle Rescues

There were nine records of turtle rescues carried out during the 2013-14 NTP season. NTP volunteers have rescued a total of 235 stranded marine turtles from 2002-2014. The number of turtles rescued has fluctuated over the seasons (Figure 17), which is often influenced by the level of turtle activity for the season (i.e. higher activity levels mean more turtles present on the beaches, which can also result in more turtle rescues being required).

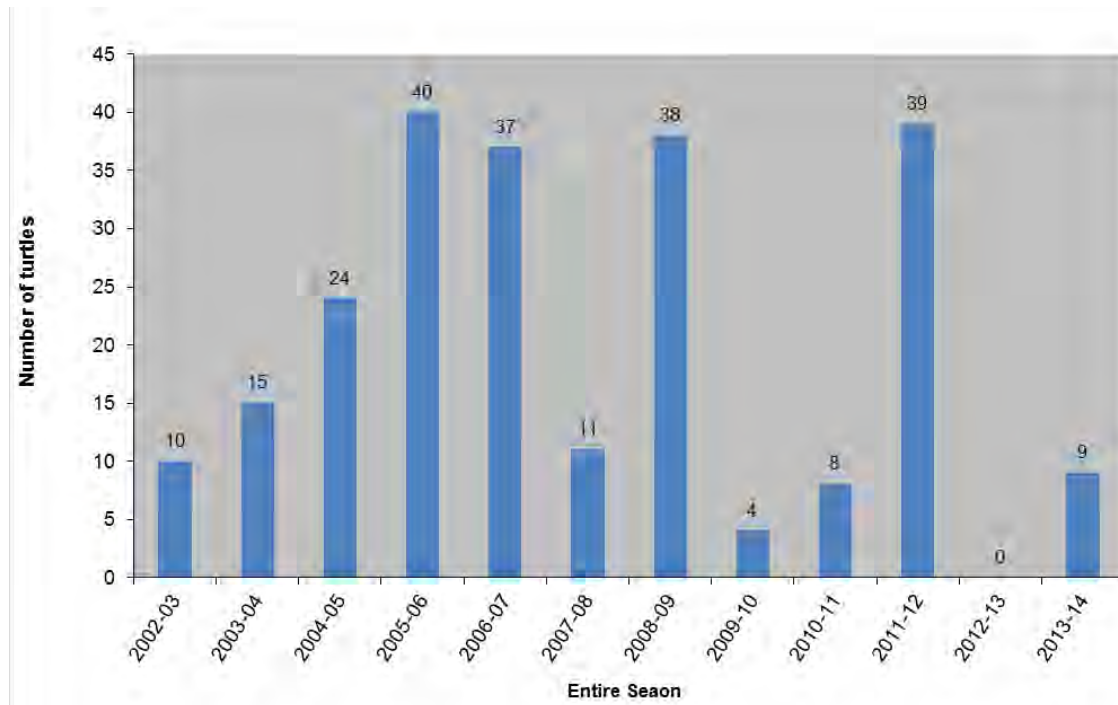


Figure 6: The number of turtles rescued in each NTP season, 2002-14. Note: from 2009-10 season data includes NW Cape and Cape Range Divisions only, other seasons include an additional two divisions.

5.6 Turtle Mortalities

Nineteen turtle mortalities were recorded during the 2013-14 season. Detailed mortality reports can be obtained from the Parks and Wildlife Exmouth District.

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.

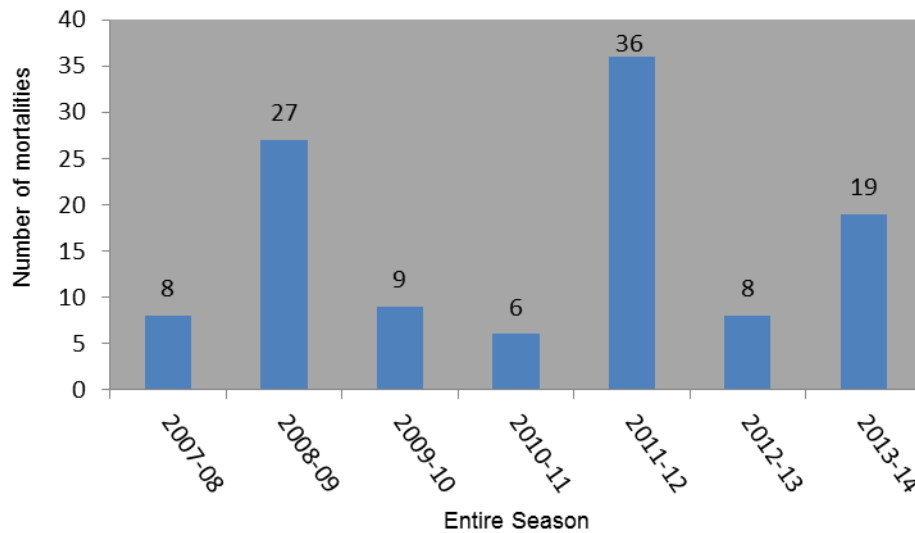


Figure 18: The number of turtles mortalities 2007-14 (2002-06 data not available).

5.7 Weather Events 2013-14

The Ningaloo Turtle Program monitoring beaches are susceptible to seasonal weather events, such as cyclones. These can have significant effects on turtle nests and available nesting habitat. However no cyclonic events or other significant weather events affected the program during the 2013-14 monitoring season.

A significant flooding event occurred on the 24th of April, however any possible effects on the nesting beaches were not recorded.

5.8 Tagged Turtle Re-sightings 2013-14

Two tagged Turtles were recorded as being sighted in 2013-14 season.

6.0 ACKNOWLEDGEMENTS

Thank you to Woodside Energy Ltd. for the significant funding contribution to the operational costs of the Ningaloo Turtle Program and to BHP Billiton for funding the minibus which is used to transport the volunteers.

Thanks also to the local NTP volunteers from the Exmouth community, the external volunteers recruited from national and international areas, and the team leader interns. The program would not be able to function without the significant contribution of time and effort that these volunteers contribute.

Cape Conservation Group Inc. and the Department of Parks and Wildlife for their initial collaborative partnership and their continued passion and support for the program.

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.

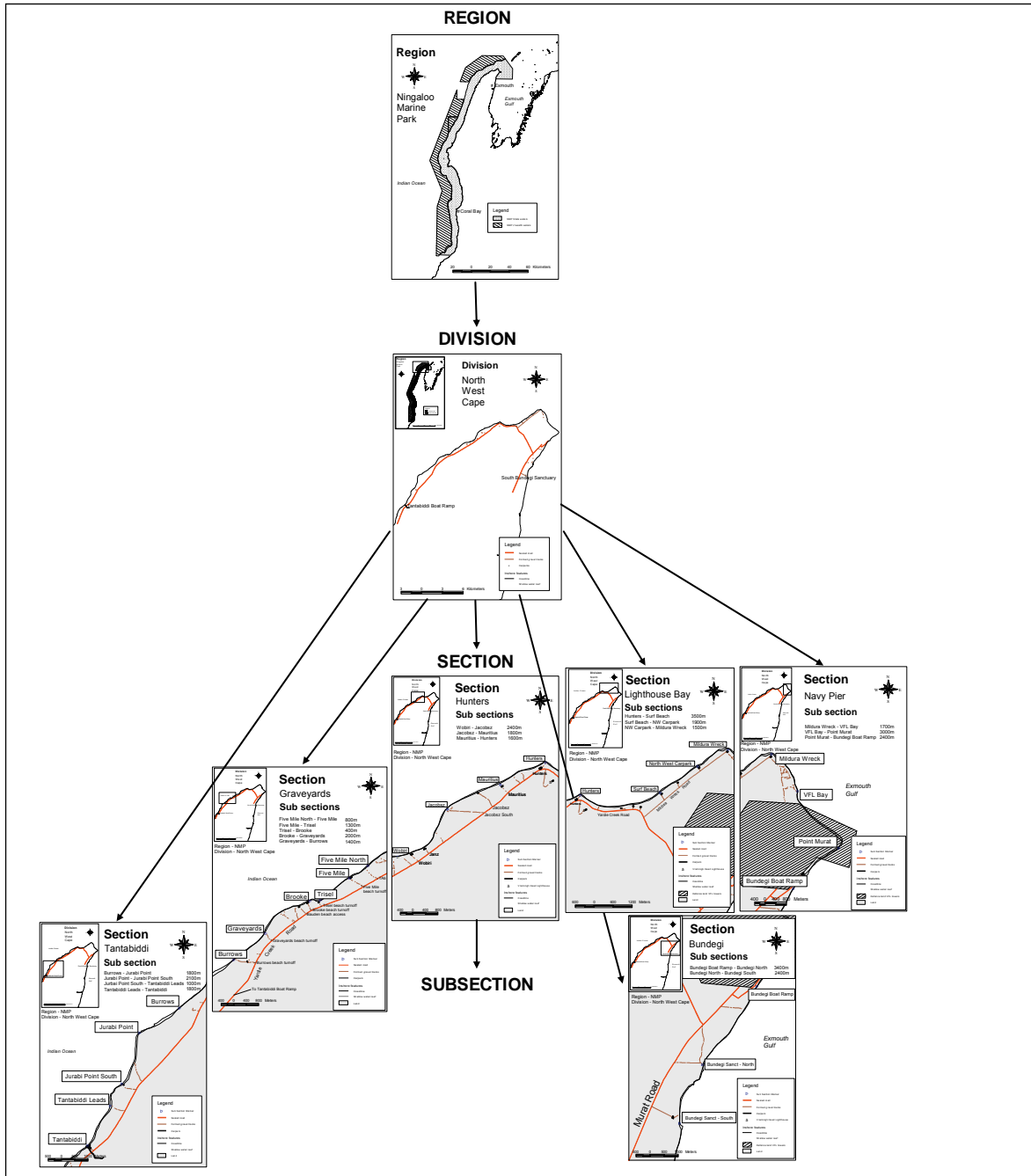
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8.0 Appendix

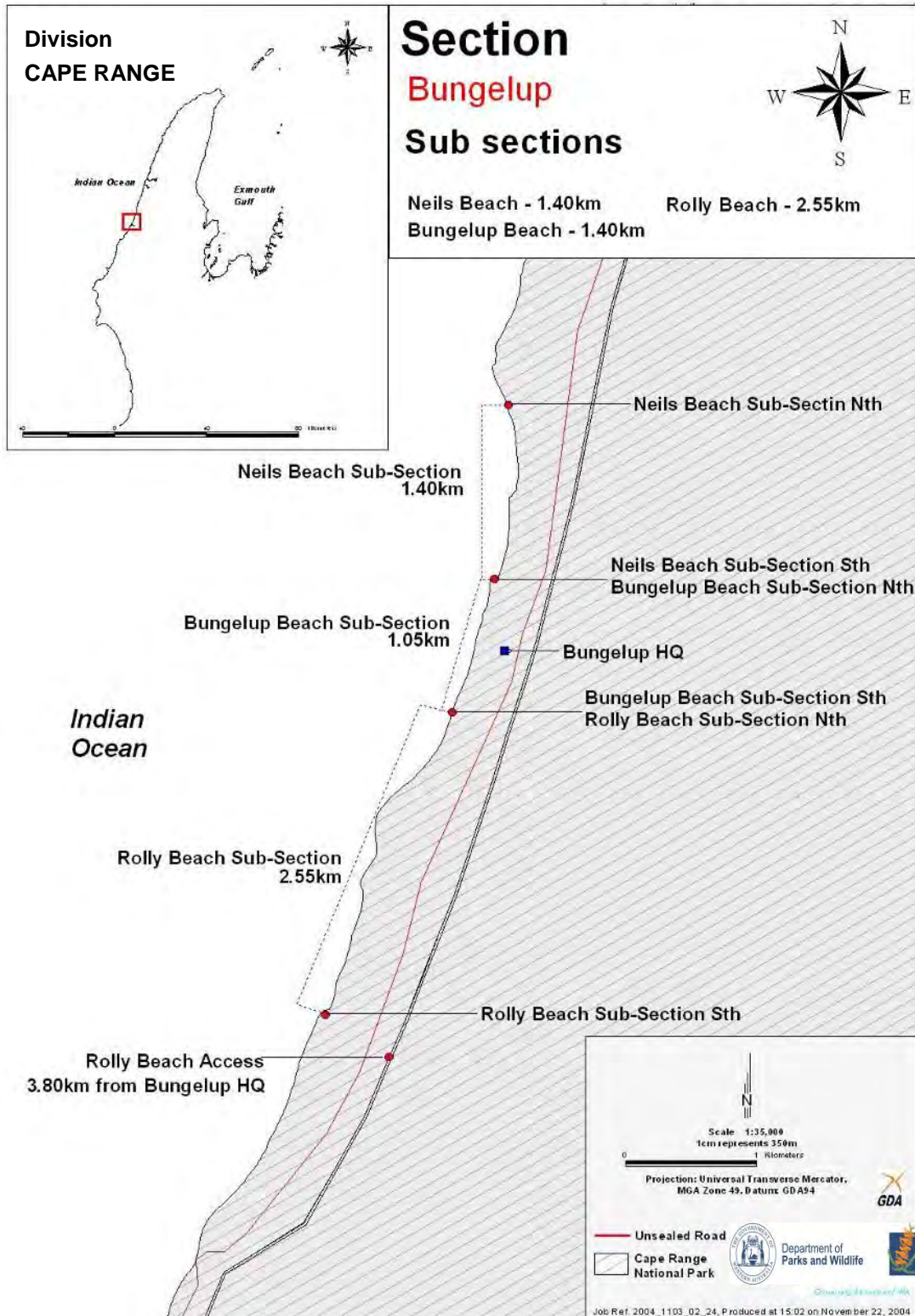
Appendix 1: Zoning of the NW Cape Division.



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

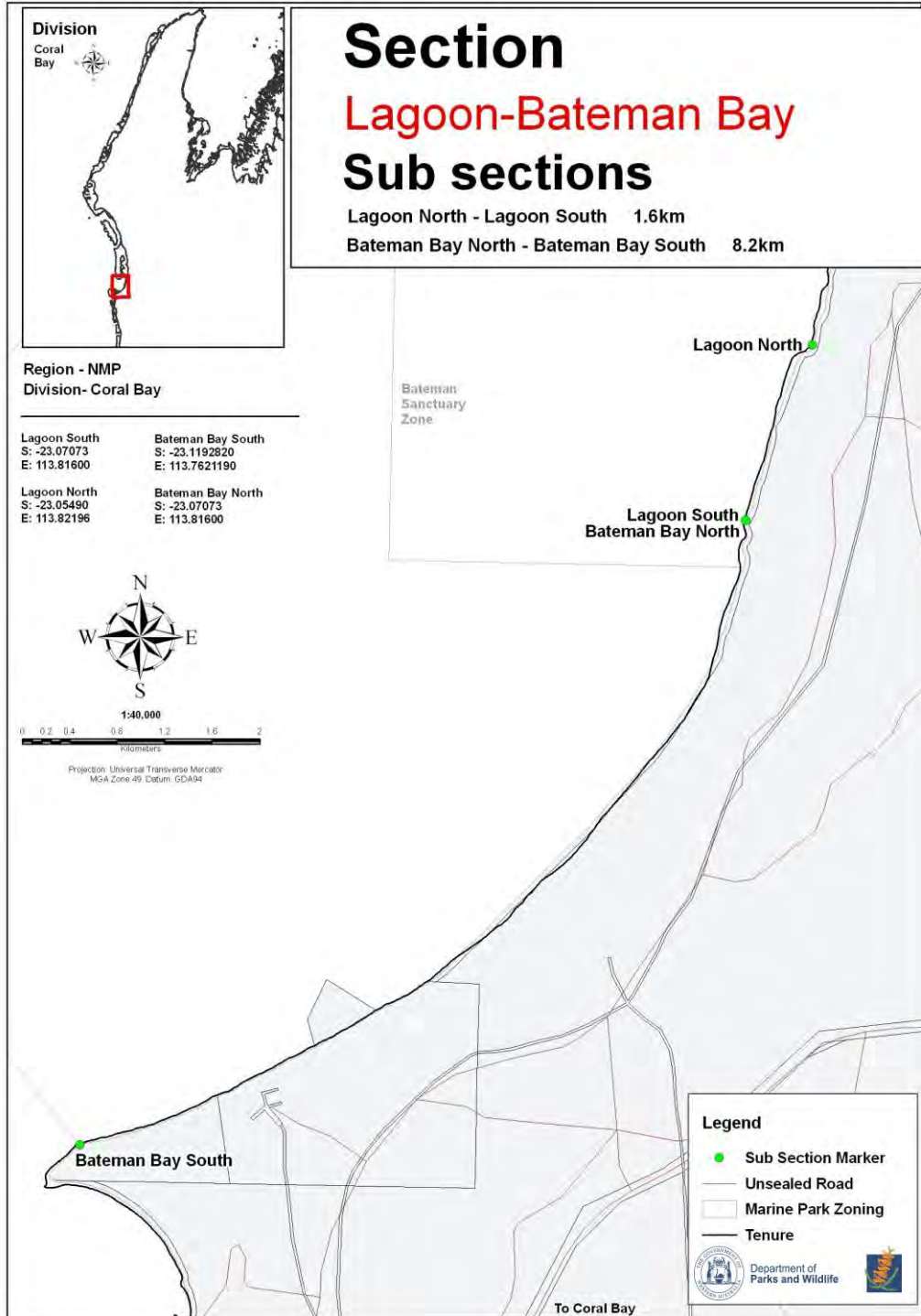


Location and distance of each subsection within Cape Range Division.

| 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 South | 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 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 Parks and Wildlife 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:

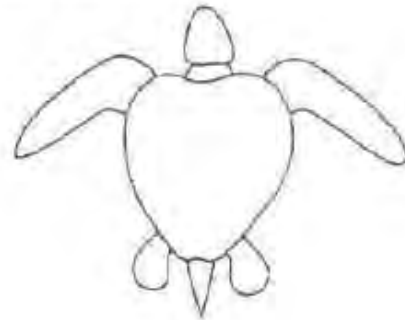
- | | |
|--|--|
| <input type="checkbox"/> Live but subsequently died | <input type="checkbox"/> Carcass poor (advanced decomposition) |
| <input type="checkbox"/> Carcass in good condition (fresh/edible) | <input type="checkbox"/> Mummified carcass (skin holding bones) |
| <input type="checkbox"/> Carcass 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 2013-14) Map 1 & 2



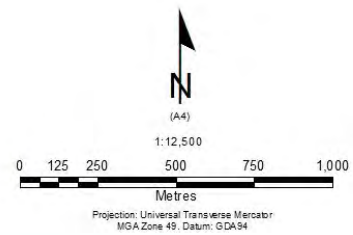
Ningaloo Turtle Program
2013-2014 (New Nests)

LIGHTHOUSE BAY
SECTION

Map 1 of 2

Legend

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



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Parks and Wildlife



Produced at 3:25pm, on Oct 29, 2014



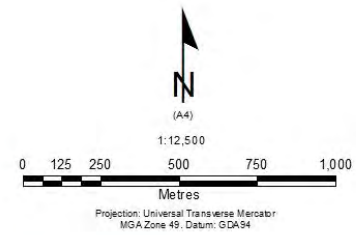
**Ningaloo Turtle Program
2013-2014 (New Nests)**

**LIGHTHOUSE BAY
SECTION**

Map 2 of 2

Legend

- Sub-section marker
- Green
- Hawksbill
- Loggerhead



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Produced at 3:25pm, on Oct 29, 2014

Details shown at 1:12,500 scale only
See the actual 1:12,500 scale plan

The Dept. of Parks and Wildlife does not guarantee that this map is without fault of any kind and
disclaims all liability for any errors, loss or other consequences which may arise from relying on any information displayed.
Roads and tracks on land managed by DPWW may contain unmarked hazards and their surface condition is variable. Situations can and do change and are to conditions on all roads.

Appendix 8: Hunters Section - Location of New Nests (NTP 2013-14) Map 1 & 2.



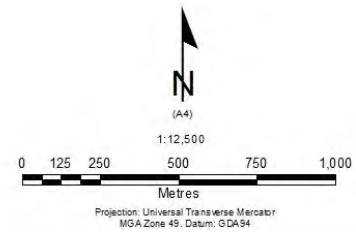
Ningaloo Turtle Program
2013-2014 (New Nests)

HUNTERS
SECTION

Map 1 of 2

Legend

- Sub-section marker
- Green
- Hawksbill
- Loggerhead



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Produced at 3:23pm, on Oct 29, 2014

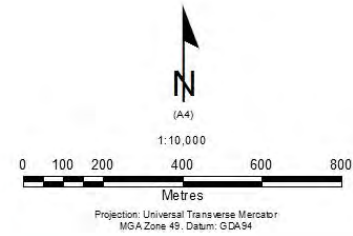


**Ningaloo Turtle Program
2013-2014 (New Nests)**

**HUNTERS
SECTION**

Map 2 of 2

- Legend
- Sub-section marker
 - Green
 - Hawkbill
 - Loggerhead



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Produced at 3:23pm, on Oct 29, 2014

Appendix 9: Graveyards Section - Location of New Nests (NTP 2013-14) Map 1 & 2.



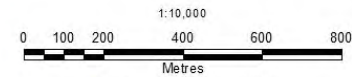
Ningaloo Turtle Program
2013-2014 (New Nests)

GRAVEYARDS
SECTION

Map 1 of 2

Legend

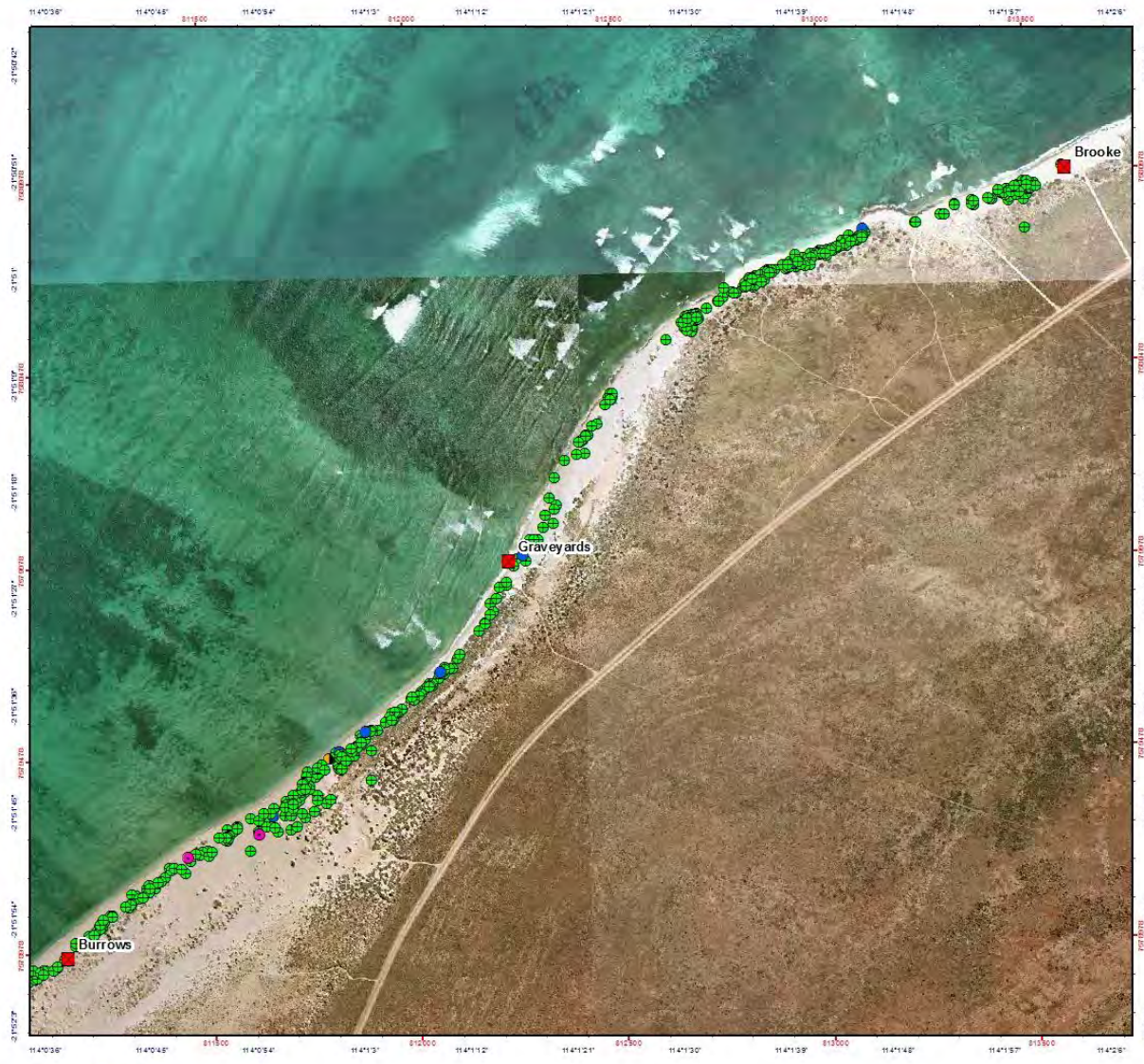
- Sub-section marker
- Green
- Hawksbill
- Loggerhead
- Unidentified



Produced by the
Department of
Parks and Wildlife



Produced at 3:23pm, on Oct 29, 2014



**Ningaloo Turtle Program
2013-2014 (New Nests)**

**GRAVEYARDS
SECTION**

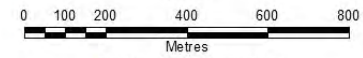
Map 2 of 2

Legend

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



1:10,000



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

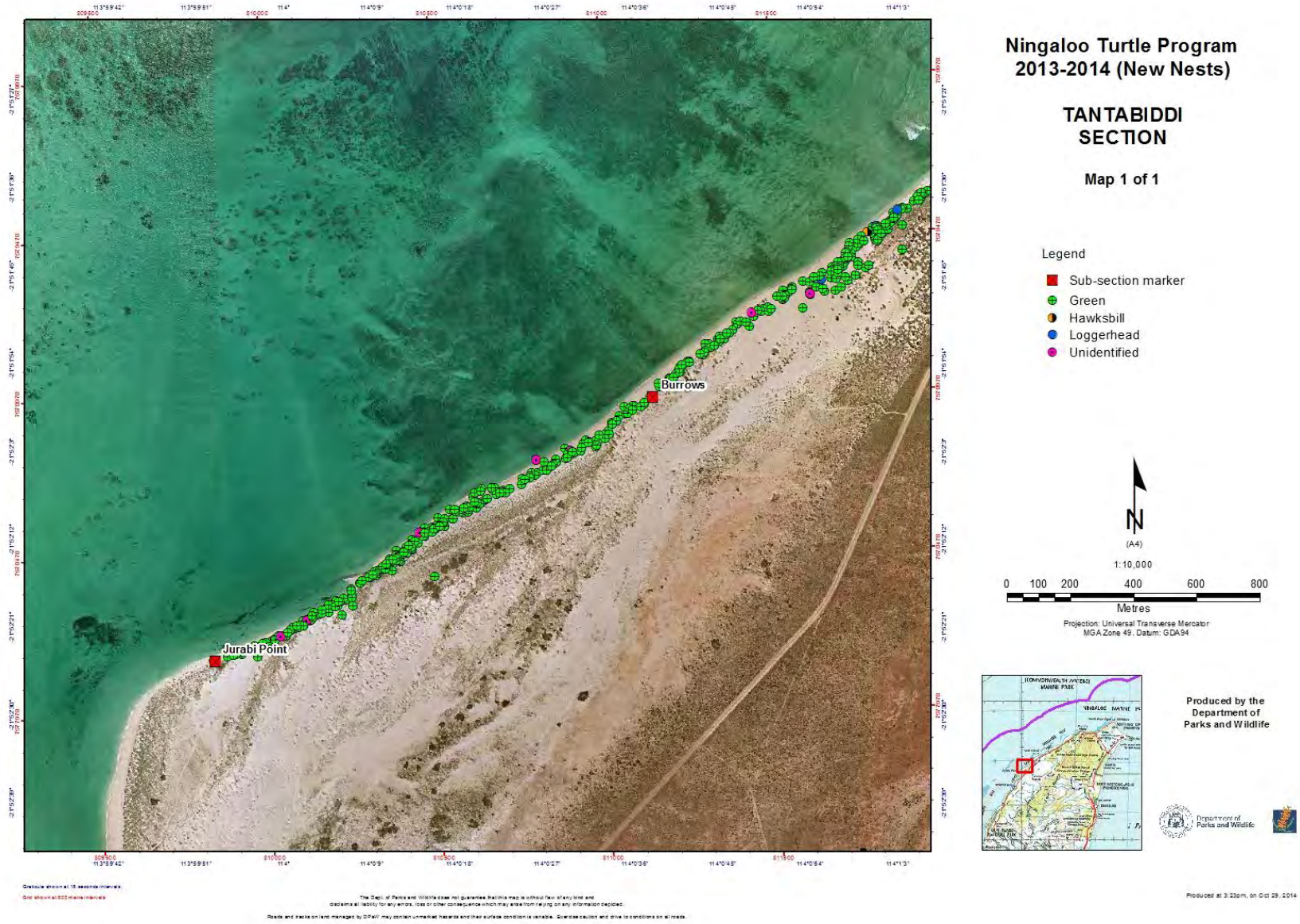


Produced by the
Department of
Parks and Wildlife

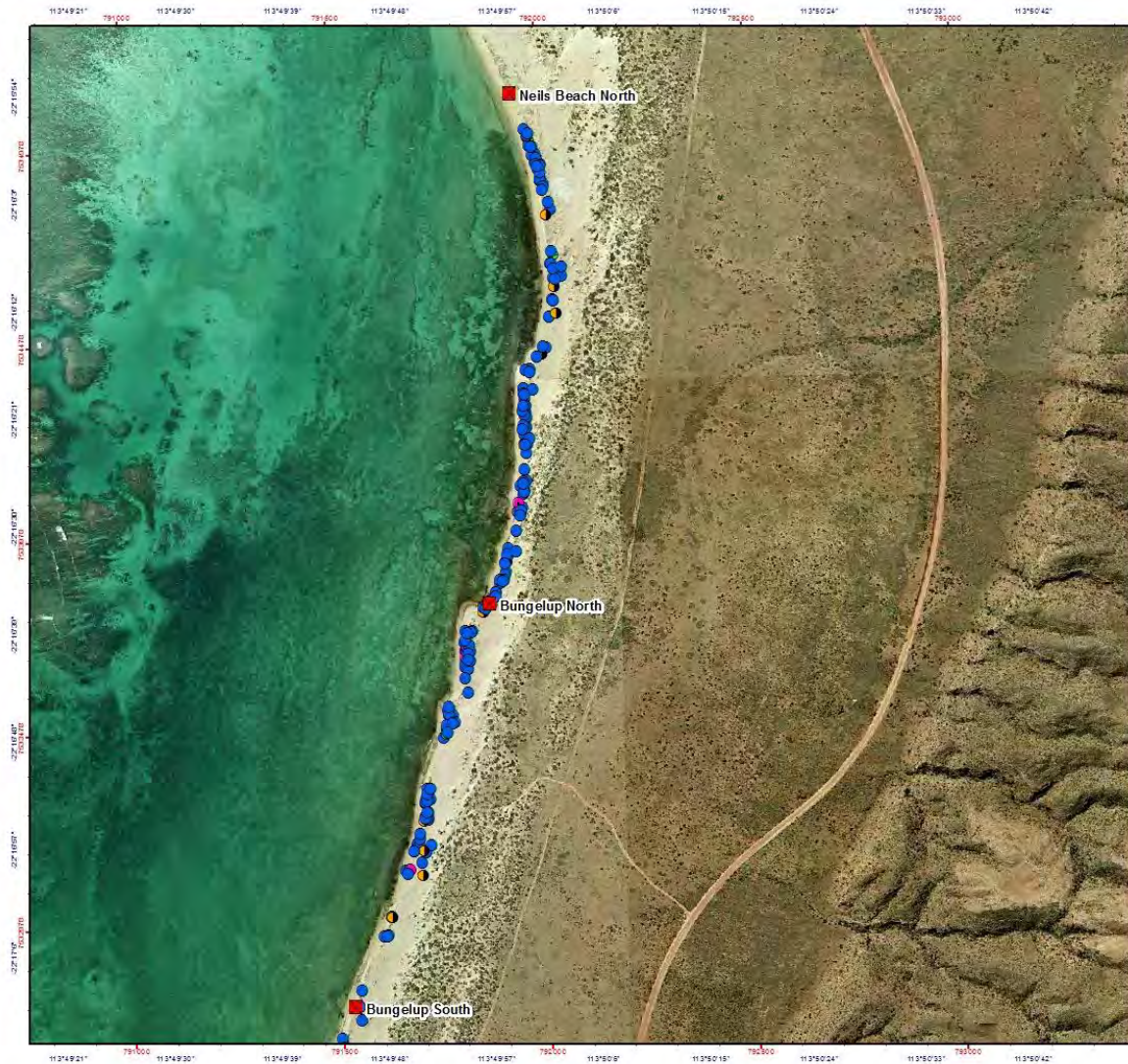


Produced at 3:23pm, on 0 Oct 2014

Appendix 10: Tantabiddi Section - Location of New Nests (NTP 2013-14) Map 1.



Appendix 11: Bungelup Section - Location of New Nests (NTP 2013-14) Map 1 & 2.



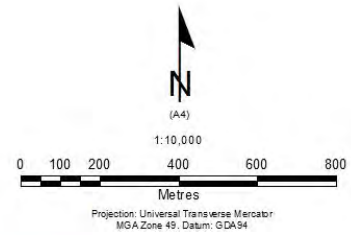
Ningaloo Turtle Program
2013-2014 (New Nests)

**BUNGELUP
SECTION**

Map 1 of 2

Legend

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



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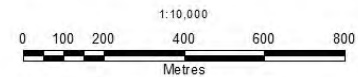
**Ningaloo Turtle Program
2013-2014 (New Nests)**

**BUNGELUP
SECTION**

Map 2 of 2

Legend

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



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