



# Ningaloo Turtle Program

## Annual Report 2017–18



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## TABLE OF CONTENTS

LIST OF FIGURES .....	III
GLOSSARY.....	IV
LIST OF ABBREVIATIONS .....	VI
1.0 SUMMARY.....	7
2.0 INTRODUCTION.....	8
3.0 METHODS.....	10
4.0 MONITORING ZONES .....	11
5. RESULTS .....	12
5.1 SURVEY EFFORT.....	12
5.2 TURTLE ACTIVITY.....	13
5.3 NESTING SUCCESS.....	21
5.4 NEST DAMAGE.....	24
5.5 TURTLE RESCUES.....	25
5.6 TURTLE MORTALITIES.....	26
5.7 WEATHER EVENTS 2017-18 .....	26
5.8 TAGGED TURTLE RE-SIGHTINGS 2017-18 .....	27
5.9 ADDITIONAL MONITORING SITE (SOUTH MANDU).....	28
6.0 ACKNOWLEDGEMENTS.....	29
7.0 REFERENCES .....	30
8.0 APPENDIX .....	31
APPENDIX 1: SURVEY EFFORT AND TURTLE ACTIVITY RAW DATA.....	31
APPENDIX 2 ZONING AND SUBSECTION DETAILS NW CAPE DIVISION.....	35
APPENDIX 3: ZONING AND SUBSECTION DETAILS CAPE RANGE DIVISION.....	37
APPENDIX 4: NTP DATA SHEET.....	39
APPENDIX 5: TAGGED TURTLE RE-SIGHTINGS DATASHEET .....	40
APPENDIX 6: MARINE TURTLE STRANDING AND MORTALITY DATASHEET.....	41
APPENDIX 7: LIGHTHOUSE BAY SECTION - LOCATION OF NEW NESTS (NTP 2017-18) MAP 1 & 2.....	42
APPENDIX 8: HUNTERS SECTION - LOCATION OF NEW NESTS (NTP 2017-18) MAP 1 & 2.....	44
APPENDIX 9: GRAVEYARDS SECTION - LOCATION OF NEW NESTS (NTP 2017-18) MAP 1 & 2.....	46
APPENDIX 10: TANTABIDDI SECTION - LOCATION OF NEW NESTS (NTP 2017-18) MAP 1.....	48
APPENDIX 11: BUNGELUP SECTION - LOCATION OF NEW NESTS (NTP 2017-18) MAP 1 & 2.....	49

**LIST OF TABLES**

TABLE 1: THE TOTAL NUMBER OF ACTIVITIES (SUSPECTED NESTS AND FALSE CRAWLS) RECORDED FOR EACH SPECIES WITHIN THE NORTH WEST DIVISION, NTP 2017-18 ENTIRE SEASON ..... 13

TABLE 2: THE TOTAL NUMBER OF ACTIVITIES (SUSPECTED NESTS AND FALSE CRAWLS) RECORDED FOR EACH SPECIES WITHIN THE CAPE RANGE DIVISION, NTP 2017-18 ENTIRE SEASON ..... 14

TABLE 3: TAGGED TURTLE SIGHTING DETAILS, NTP 2017-18 SEASON ..... 27

**LIST OF FIGURES**

FIGURE 1: COMPARISON OF NESTING ACTIVITY (SUSPECTED NESTS AND FALSE CRAWLS) RECORDED IN EACH NW CAPE SECTION, NTP 2017-18 FOR ENTIRE SEASON..... 13

FIGURE 2: PERCENTAGE OF NESTS BY SPECIES WITHIN THE NORTH WEST CAPE DIVISION, 2017-18 ENTIRE SEASON ..... 14

FIGURE 3: NUMBERS OF SUSPECTED NESTS AND FALSE CRAWLS WITHIN EACH BUNGELUP SUBSECTION (CAPE RANGE DIVISION), NTP 2017-18 ..... 15

FIGURE 4: PERCENTAGE OF NESTS BY SPECIES WITHIN THE CAPE RANGE DIVISION, 2017-18..... 15

FIGURE 5: SEASONAL GREEN, LOGGERHEAD AND HAWKSBILL TURTLE ACTIVITY (NESTS AND FALSE CRAWLS) STANDARDISED BY SURVEY EFFORT DURING THE INTENSIVE PEAK MONITORING PERIOD..... 16

FIGURE 6: SEASONAL GREEN, LOGGERHEAD AND HAWKSBILL NESTS STANDARDISED BY SURVEY EFFORT DURING THE INTENSIVE PEAK MONITORING PERIOD. .... 17

FIGURE 7: SEASONAL GREEN TURTLE ACTIVITY (NESTS AND FALSE CRAWLS) STANDARDISED BY SURVEY EFFORT DURING THE INTENSIVE PEAK MONITORING PERIOD. .... 18

FIGURE 8: SEASONAL GREEN TURTLE NESTS STANDARDISED BY SURVEY EFFORT DURING THE INTENSIVE PEAK MONITORING PERIOD..... 18

FIGURE 9: SEASONAL HAWKSBILL ACTIVITY (FALSE CRAWLS AND NESTS) STANDARDISED BY SURVEY EFFORT DURING THE INTENSIVE PEAK MONITORING PERIOD. .... 19

FIGURE 10: SEASONAL HAWKSBILL NESTS STANDARDISED BY SURVEY EFFORT DURING THE INTENSIVE PEAK MONITORING PERIOD..... 19

FIGURE 11: SEASONAL LOGGERHEAD ACTIVITY (FALSE CRAWLS AND NESTS) STANDARDISED BY SURVEY EFFORT DURING THE INTENSIVE PEAK MONITORING PERIOD. .... 20

FIGURE 12: SEASONAL LOGGERHEAD NESTS STANDARDISED BY SURVEY EFFORT DURING THE INTENSIVE PEAK MONITORING PERIOD..... 20

FIGURE 13: GREEN TURTLE NESTING SUCCESS 2002-2018 (%) STANDARDISED BY SURVEY EFFORT DURING INTENSIVE PEAK MONITORING PERIOD. .... 22

**FIGURE 14: HAWKSBILL TURTLE NESTING SUCCESS (%) 2002-18 STANDARDISED BY SURVEY EFFORT DURING THE INTENSIVE PEAK MONITORING PERIOD. .... 22**

FIGURE 15: LOGGERHEAD TURTLE NESTING SUCCESS 2002-18 (%) STANDARDISED BY SURVEY EFFORT DURING INTENSIVE PEAK MONITORING PERIOD ..... 23

FIGURE 16: FOX AND DOG PREDATION AS A PERCENTAGE OF TOTAL NESTS RECORDED PER SEASON, NTP 2002-18. NOTE: DATA FROM 2009-10 SEASON ONWARDS INCLUDES NW CAPE AND CAPE RANGE DIVISIONS ONLY, OTHER SEASONS INCLUDE AN ADDITIONAL TWO DIVISIONS..... 24

FIGURE 17: THE NUMBER OF TURTLES RESCUED IN EACH NTP SEASON, 2002-18..... 25

FIGURE 18: THE NUMBER OF TURTLES MORTALITIES RECORDED PER SEASON FROM 2007 - 2018 ( 2002-06 DATA NOT AVAILABLE)..... 26

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## GLOSSARY

<b>Body pit</b>	A depression dug in the sand by a turtle during a nesting attempt.
<b>Carapace</b>	The shell covering the dorsal surface of the turtle.
<b>Costal scales</b>	Large scales lining both sides of the carapace, below the centre row of scales.
<b>Combined tracks</b>	Tracks from both false crawls and nests.
<b>Egg chamber</b>	A deep cylindrical hole which a turtle digs into a primary body pit with her back flippers only. The eggs are deposited here.
<b>Emerging track</b>	Track of a turtle emerging from the ocean onto land.
<b>Entire season</b>	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.
<b>Escarpment</b>	The edge of a ridge which indicates a filled-in primary body pit.
<b>False crawl</b>	An abandoned nesting attempt not resulting in eggs being laid.
<b>GPS unit</b>	Global Positioning System unit: an electronic navigational device which obtains a position on the earth using satellite signals.
<b>Hatchling</b>	A newly hatched young turtle.
<b>Pre and post peak period</b>	Monitoring of the weekends either side of the intensive peak monitoring period.
<b>Intensive peak monitoring period</b>	Four-week period centred around the 31 <sup>st</sup> December, during which monitoring takes places every day. Note: peak period was identified by Andrea Whiting as the 7 <sup>th</sup> January but due to trainers required before Christmas break the peak period has been brought forward one week every year.
<b>Nest</b>	A new suspected nesting attempt which we expect has resulted in eggs being deposited.
<b>Nest damage</b>	The nest has been dug up, eggs or fresh empty egg shells are around the nest or eggs are exposed.
<b>Nesting success</b>	The number of suspected nests laid as a percentage of total turtle activities.
<b>New nest</b>	A suspected nest laid during the night before or the morning of monitoring, which has therefore not been previously recorded.

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<b>Old nest</b>	A suspected nest laid during the current season (but not laid during the previous night) which has been predated on.
<b>Plastron</b>	The underside of a turtle.
<b>Prefrontal scales</b>	Situated on the head of a turtle, anterior to the frontal bone.
<b>Pre-ocular scales</b>	Situated on the head of a turtle, anterior from the eyes.
<b>Primary body pit</b>	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.
<b>Returning track</b>	Track of a turtle returning from the land to the ocean.
<b>Rookery</b>	A significant breeding area for a large number of animals.
<b>Secondary body pit</b>	A depression dug lastly during a successful nesting attempt to cover the primary body pit and egg chamber with sand.
<b>Standardised season</b>	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.
<b>Survey effort</b>	Total number of times each subsection was monitored over a specified period of time.
<b>Suspected nest</b>	‘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”.
<b>Tracks</b>	In the form of false crawls or the tracks left behind during nesting.
<b>Track abundance</b>	The number of recorded turtle tracks (includes false crawl tracks and nest tracks). This term is interchangeable with the level of turtle activity.
<b>Turtle activity</b>	Includes both turtle nests and false crawls.
<b>Turtle tracker</b>	A volunteer competent in identifying turtle species and observing activity during monitoring.
<b>Zoning</b>	Hierarchical spatial classification system of divisions, sections & subsections.

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## LIST OF ABBREVIATIONS

<b>CCG</b>	Cape Conservation Group Inc.
<b>EPBC Act</b>	Environmental Protection and Biodiversity Conservation Act 1999
<b>JTC</b>	Jurabi Turtle Centre
<b>NMP</b>	Ningaloo Marine Park
<b>NTP</b>	Ningaloo Turtle Program
<b>NW Cape</b>	North West Cape
<b>Parks and Wildlife Attractions</b>	Parks and Wildlife Service, Department of Biodiversity, Conservation and Attractions

## 1.0 SUMMARY

The Ningaloo Turtle Program was established in 2002 as a collaboration between the Cape Conservation Group Inc., World Wildlife Fund Australia and Parks and Wildlife, Exmouth District. During the 2017-18 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-seven volunteers contributed a total of 3 588 hours to the Ningaloo Turtle Program in 2017-18. Since commencement of the program, volunteers have contributed a total of 64 712 hours. These figures demonstrate the effort and value of the volunteers over the life span of the program.

A total of 2 986 suspected nests and 8 498 false crawls were recorded in the Ningaloo Region over the entire 2017-18 season. Overall, green and loggerheads had higher activity levels and hawksbills had a slightly lower than average activity in comparison to other seasons. However, all three species had lower than average nesting success rates. This was evident in both the full season and standardized season.

Volunteers recorded 2518 green turtle nests and 7307 green false crawls, which equates to a slightly lower nesting success rate of 25.6% for this species compared to other seasons. However, green turtle activity was slightly above average in comparison to that recorded in previous seasons.

Loggerhead turtles had a nesting success rate of 26.5% with 392 nests and 1086 false crawls recorded, equating to a below average nesting success rate but above average activity in comparison to previous seasons.

Hawksbill turtle records accounted for 70 nests and 99 false crawls which resulted in a below average nesting success rate of 41.4%. Similarly, activity for this species in 2017-18 was slightly lower than average.

Nest disturbance was recorded at 13 nests, which is 0.43% of total recorded nests. This was attributed to natural causes, being tidal inundation and turtles accidentally excavating other turtle's nests. No nest disturbance by invasive predators was recorded.

During 2017-18 six stranded turtles were rescued, adding to a total of 256 rescued since 2002. Five turtle mortalities and one tagged turtle were recorded during the 2017-18 season.



## 2.0 INTRODUCTION

The Ningaloo Turtle Program (NTP) was established in 2002, as a collaborative initiative between 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 information helps inform management by Parks and Wildlife in the reduction of disturbance to nesting turtles supporting effective 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.

Woodside Energy Ltd is the main sponsor of the program and has been providing significant contributions to the program's operational costs since 2012. This has included funding toward volunteer costs, website maintenance, community activities, equipment and educational materials.

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

In 2008 the NTP was consolidated after 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. Additionally, weekend monitoring during the pre and post peak nesting periods captures early and late fluctuations in the nesting activity. This period and configuration was identified to be suitable through an analysis of data from previous seasons.

Trend analysis is undertaken every three years, most recently in 2016. 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. The most recent trend analysis is available online at [http://www.ningalooturtles.org.au/media\\_reports.html](http://www.ningalooturtles.org.au/media_reports.html).

The goals and objectives listed below have been formulated through a community-based committee 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 the 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 are 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 technology. Signs of predation at nests are also recorded, along with sightings of tagged turtle, the presence of feral animals, turtle mortalities and rescues.

For more detailed information on current NTP monitoring methodologies please see Section 5.0 of the NTP Annual Report 2012-13 (Coote et al 2013), or the NTP Turtle Monitoring Field Guide Edition 7 (McKinna et al 2015), both of which are available at [www.ningalooturtles.org.au](http://www.ningalooturtles.org.au)

Points to note in regard to the NTP methodology:

- Throughout the report the term nest is used. Nests, however, cannot be confirmed unless egg laying is witnessed. Therefore, uncertainty can be expected as turtles can sometimes create the appearance of nests without depositing any eggs into them (Whiting pers. com. 2012) or may deposit eggs without creating the appearance of a nest.
- There is uncertainty in estimating the proportion of damaged nests because nests are only checked for signs of predation on the morning after they were laid. Any damage on subsequent days is recorded only on an incidental basis during track monitoring. Therefore, there is a possibility that predation and disturbance to old nests goes undetected, resulting in an underestimate of predation.
- In the 2014-15 season the methodology for distinguishing hawksbill from loggerhead tracks was refined due to the difficulty that relatively inexperienced volunteers were having in distinguishing between the two similar track types. In the past, the width of the track and the presence or absence of tail drag marks were used as indicative features to guide the volunteer, however there were no definitive rules for the final identification. The new rule introduced in 2014 defined a hawksbill track as one with alternate flipper marks and a continuous or broken tail drag mark. Any other alternate tracks would be classified as loggerhead tracks (unless they are flatback tracks which can be alternate but have other defining characteristics). These definitions have remained the same since the 2014-15 season. A trend analysis conducted in 2016 suggested that this refinement in track identification caused no significant effect on annual estimates of hawksbill and loggerhead activity, most likely due to the similarity in the two techniques.

## **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 either natural barriers that separate beaches or positions of car parks. Subsection length are restricted to an average of 2-3kms so that they are practical to survey on foot. Subsection are identified with a GPS location and NTP totem markers located at the start and finish points.

### **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 includes the Bungelup Section, which is divided into three subsections and South Mandu Section (see Appendix 11 for further division information). Data from South Mandu has not been used in this report.

### **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 conduct opportunistic monitoring there 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 includes 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 conduct opportunistic monitoring there 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 2017-18, subsections along the NW Cape Division were monitored for between 32-43 days and Cape Range Division for 26-27 days, depending on the weather conditions and availability of volunteers for each of the subsections.

Fifty-seven volunteers contributed a total of 3588 hours to the Ningaloo Turtle Program in 2017-18, in addition to a significant amount of time contributed by Parks and Wildlife staff. Since commencement of the program a total of 64 712 volunteer hours have contributed to the program. This time was primarily accrued during beach monitoring, but also through data entry, training, education, school visits, turtle rescues, media, assisting with external research programs and general tasks toward the running of the program.

The NW Cape Division and Cape Range Division were monitored daily during the intensive peak period from the 18<sup>th</sup> December 2017 to 14<sup>th</sup> January 2018. . Beaches were monitored before the peak period on the weekends of the 11<sup>th</sup> & 12<sup>th</sup>, 25<sup>th</sup> & 26<sup>th</sup> November, and 9<sup>th</sup> & 10<sup>th</sup> December. Beaches were monitored after the peak period on the weekends of the 27<sup>th</sup> & 28<sup>th</sup> January and 10<sup>th</sup> & 11<sup>th</sup> and 24<sup>th</sup> & 25<sup>th</sup> February. Monitoring on these weekends was done only within the NW Cape Division.

Parks and Wildlife field staff also conducted opportunistic turtle monitoring during monthly fox baiting operations in the Bundera/Ningaloo and Coral Bay Divisions, but for the purpose of this report these data have not been included in the results.

Survey effort includes both the number of days and the number of subsections monitored within that day. Some figures in this report are adjusted by survey effort in order to allow comparisons between seasons (i.e. because the number of days monitoring occurred, and the number of subsections monitored each day sometimes varied among seasons).

## 5.2 Turtle Activity

### 5.2.1 2017 – 2018 Season

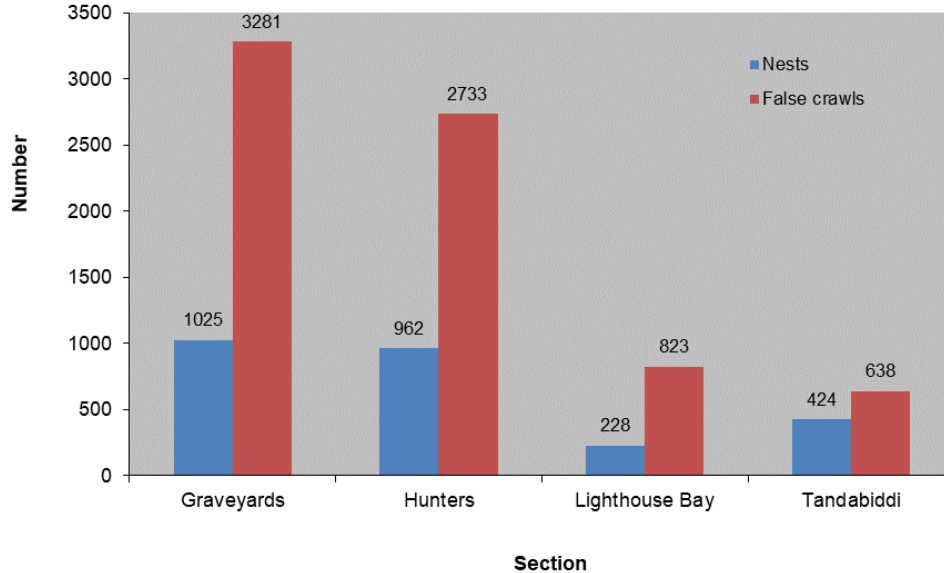
#### North West Cape Division

2639 suspected nests and 7475 false crawls were recorded within the NW Cape Division during 2017-18 (**Table 1**). Green turtles were the most active species in the NW Cape Division (both nests and false crawls) with 96.1 % of total activity recorded, followed by loggerhead turtles (2.6%), then hawksbills (1.2%) and unidentified species (0.1%) (Figure 2).

**Table 1: The total number of activities (suspected nests and false crawls) recorded for each species within the North West Division, NTP 2017-18 entire season**

North West Cape Division	Turtle Species					Total
	Green	Hawksbill	Loggerhead	Flatback	Unidentified	
New nests	2497	46	93	0	3	2639
False crawls	7221	75	174	0	5	7475
<b>Total activity</b>	<b>9718</b>	<b>121</b>	<b>267</b>	<b>0</b>	<b>8</b>	<b>10114</b>

Figure 1 shows variation in numbers of nests and false crawls among 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 2017-18 for entire season.**

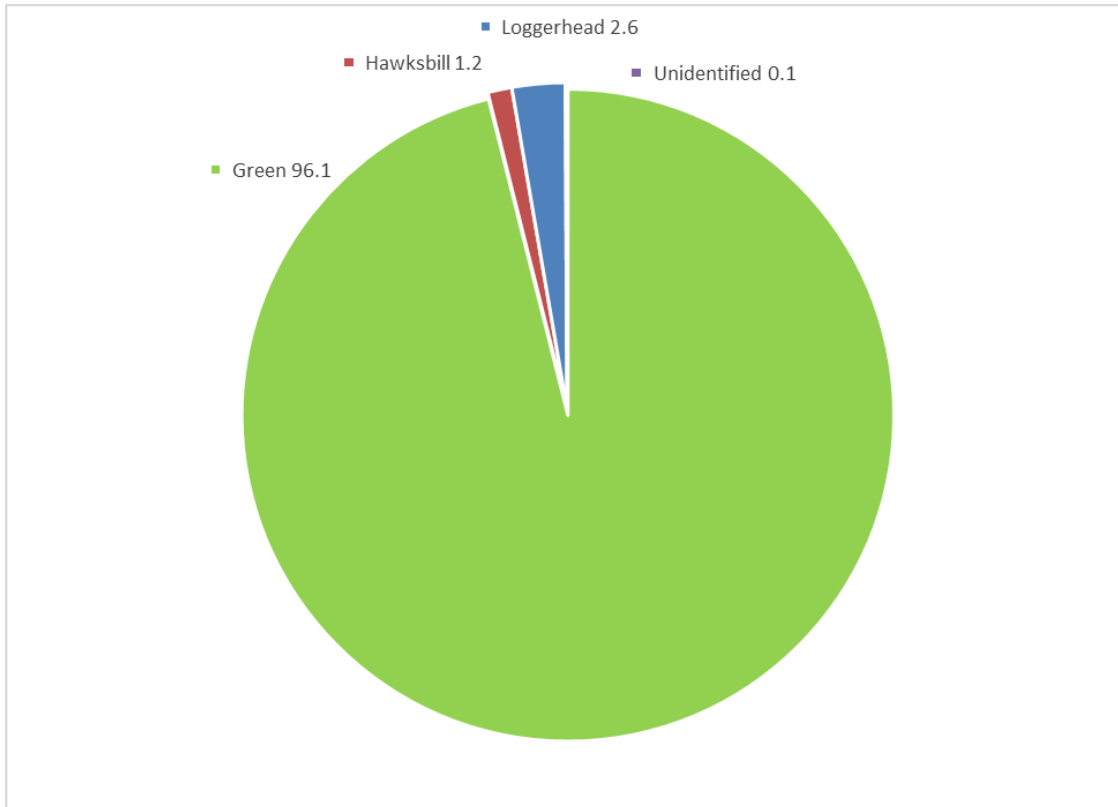


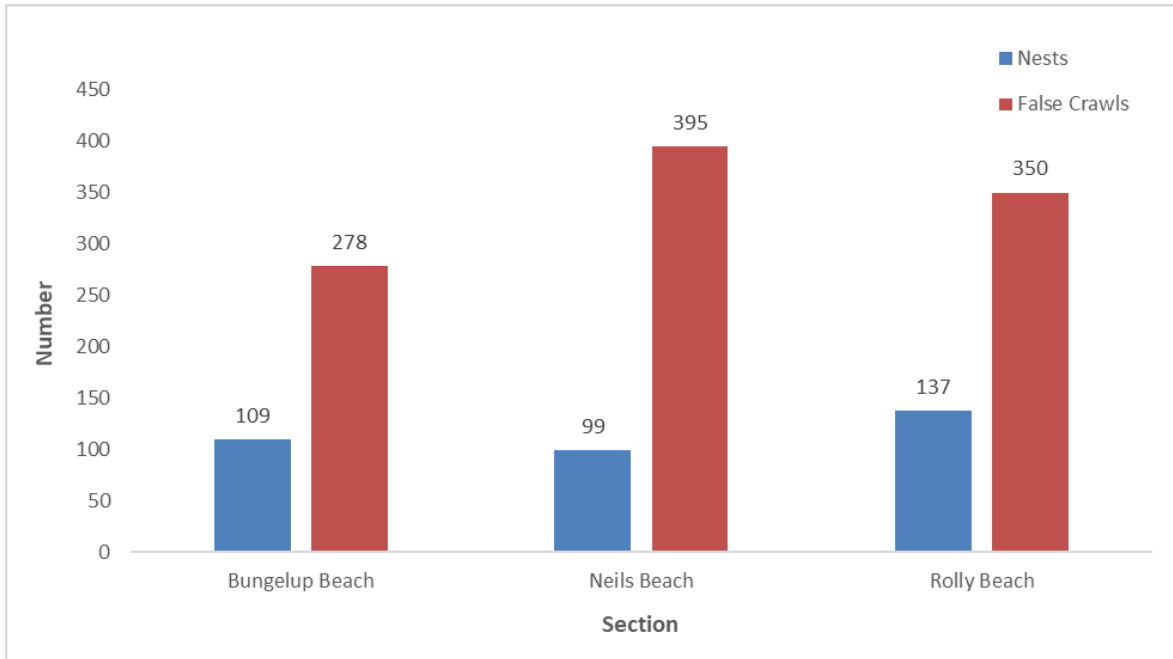
Figure 2: Percentage of nests by species within the North West Cape Division, 2017-18 entire season

### Cape Range Division

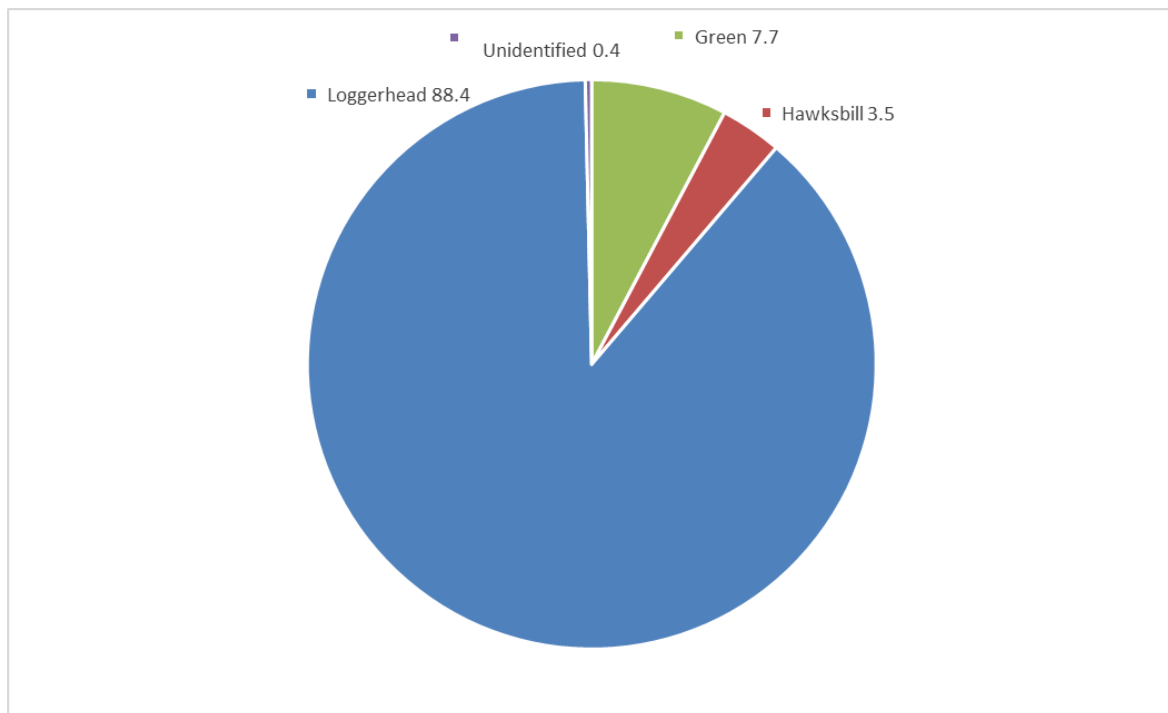
A total of 347 suspected nests and 1023 false crawls were recorded in the Bungelup Section (Cape Range Division) during the 2017-18 NTP season (Table 2). Loggerhead Turtles showed the greatest nesting activity in the Bungelup Section (both suspected nests and false crawls) with 88.4%, followed by green (7.7%), hawksbill (3.5%) and unidentified turtle species (0.4%). No flatback turtle activity was recorded (Figure 4). For individual nest locations see maps in Appendix 11.

Table 2: The total number of activities (suspected nests and false crawls) recorded for each species within the Cape Range Division, NTP 2017-18 entire season

Cape Range Division	Turtle Species					Total
	Green	Hawksbill	Loggerhead	Flatback	Unidentified	
<b>New nests</b>	21	24	299	0	3	347
<b>False crawls</b>	85	24	912	0	2	1023
<b>Total activity</b>	<b>107</b>	<b>48</b>	<b>1217</b>	<b>0</b>	<b>5</b>	<b>1377</b>



**Figure 3: Numbers of suspected nests and false crawls within each Bungalow subsection (Cape Range Division), NTP 2017-18.**



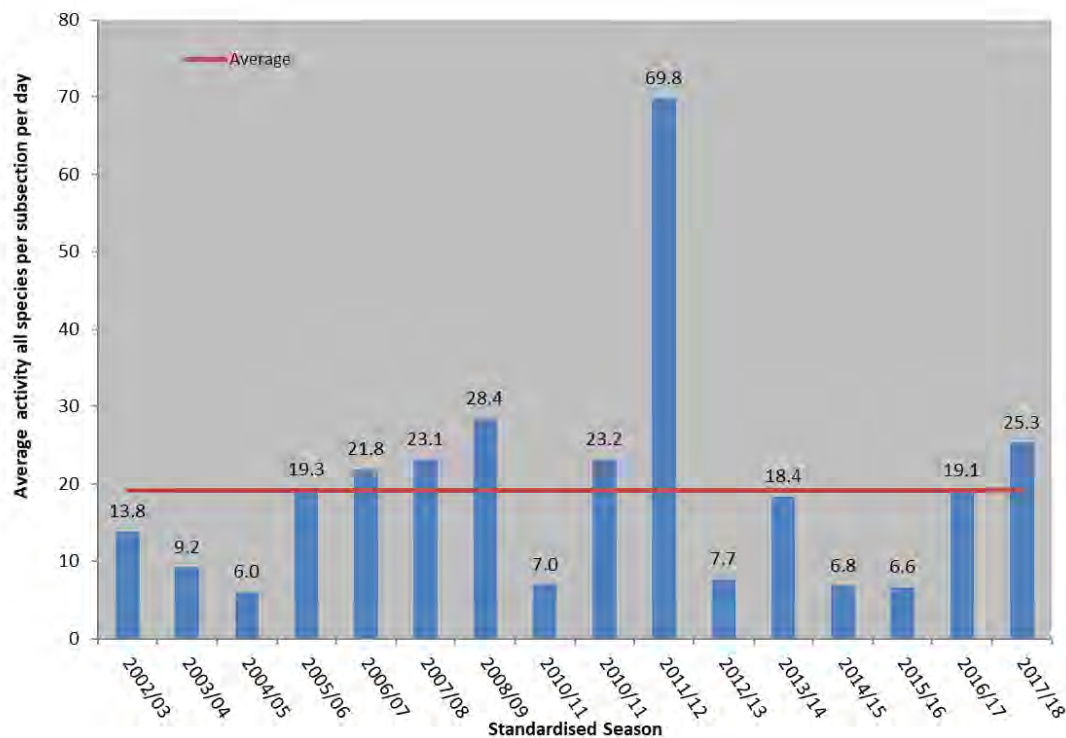
**Figure 4: Percentage of nests by species within the Cape Range Division, 2017-18.**



## 5.2.2 History of Turtle Activity (2002-2018)

NTP has recorded 53 940 suspected nests and 128 267 false crawls (total activity: 182 216) in total (full season data and all subsections included) since commencement of the program in 2002 (Table 1). Green turtles are by far the most abundant species with a total of 156 046 nests and false crawls recorded, followed by loggerhead turtles (19 236 activities) and hawksbill turtles (3785 activities). A total of 809 activities have been recorded as being from unidentified species (Appendix 1).

During 2002 – 2018, within the standardised intensive peak monitoring period, the NTP has recorded a total of 30 814 nests and 76 128 false crawls (total activity: 106 942). In comparisons between seasonal total activity levels, the 2017-18 season (standardized figure) activity level was ranked 3<sup>rd</sup> highest out of 16 (figure 5), and the total standardized nesting level was ranked 5<sup>th</sup> out of 16 (Figure 6). Within the intensive monitoring period green turtle activities are recorded the most often, with 90 979 activities (nests and false crawls), this is followed by loggerhead turtles with 13 381 activities, and then hawksbills with 2 253 activities. A total of 326 turtle activities have been recorded as unidentified species (Appendix 1).



**Figure 5:** Seasonal green, loggerhead and hawksbill turtle activity (nests and false crawls) standardised by survey effort during the intensive peak monitoring period.

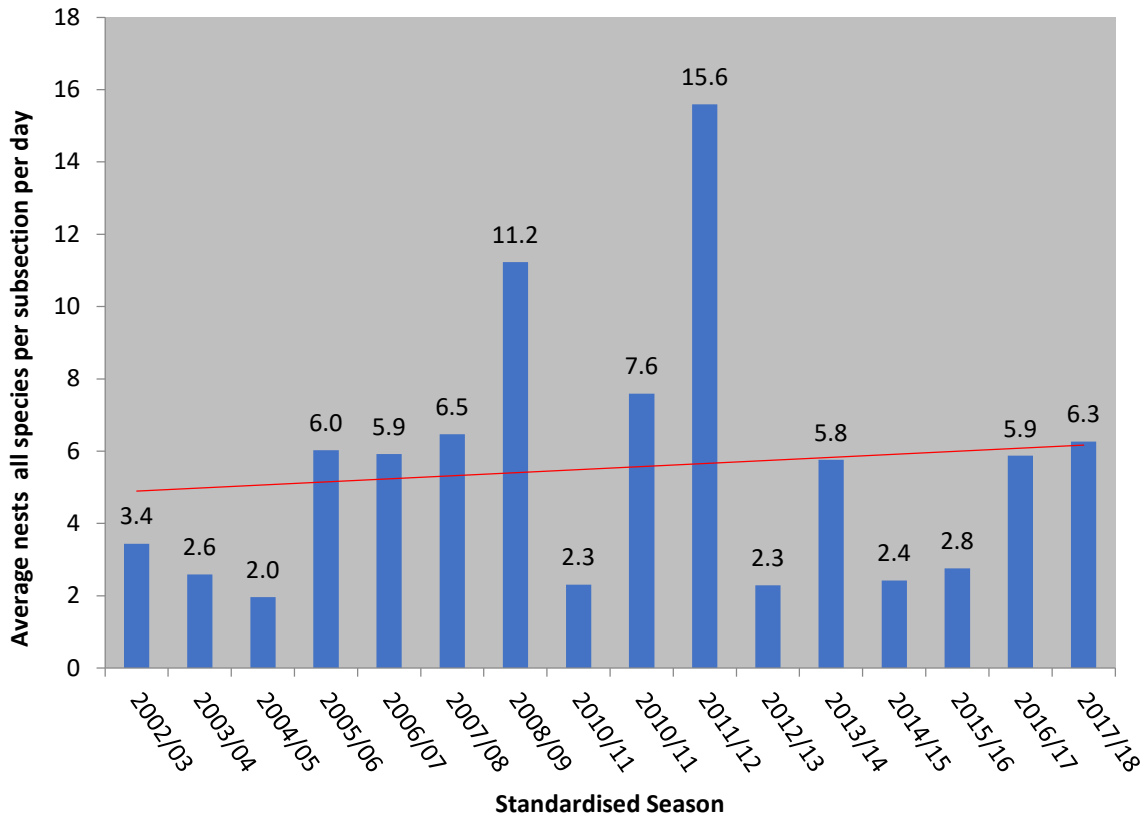


Figure 6: Seasonal green, loggerhead and hawksbill nests standardised by survey effort during the intensive peak monitoring period.

### Green Turtles

Nesting activity by green turtles varies largely among years. When comparing standardised seasons, the level of green turtle activity and nesting in 2017-18 were above average (Figure 7 & figure 8)

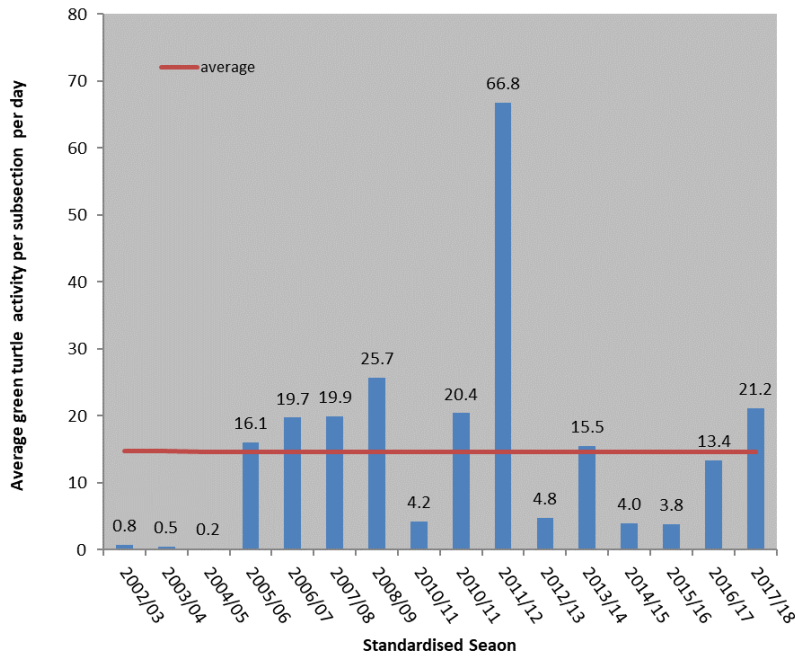


Figure 7: Seasonal green turtle activity (nests and false crawls) standardised by survey effort during the intensive peak monitoring period.

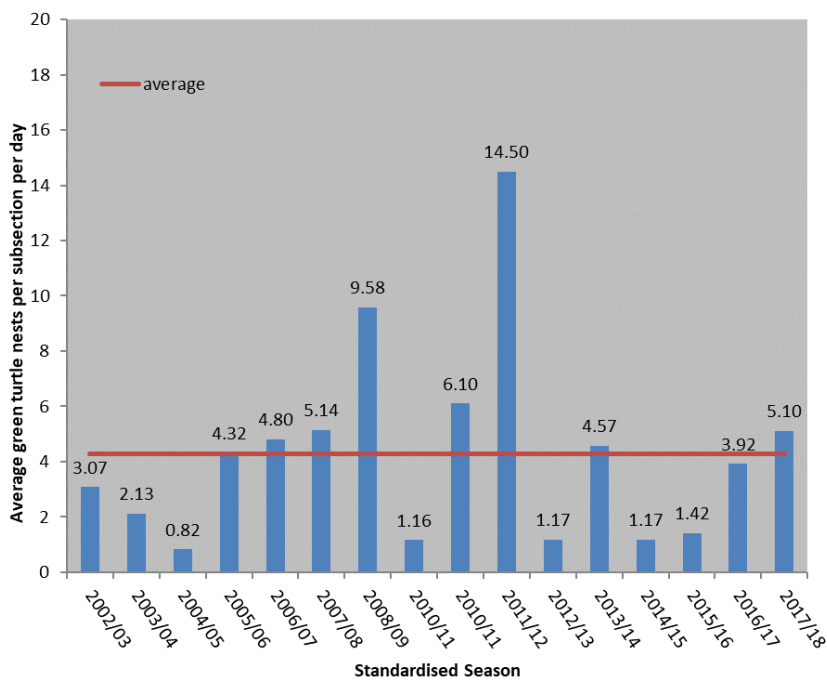


Figure 8: Seasonal green turtle nests standardised by survey effort during the intensive peak monitoring period.

### Hawksbill Turtles

The standardised levels of hawksbill turtle activity and nesting during the 2017-18 season were slightly below average in comparison to other seasons (Figure 9 and Figure 10 respectively).

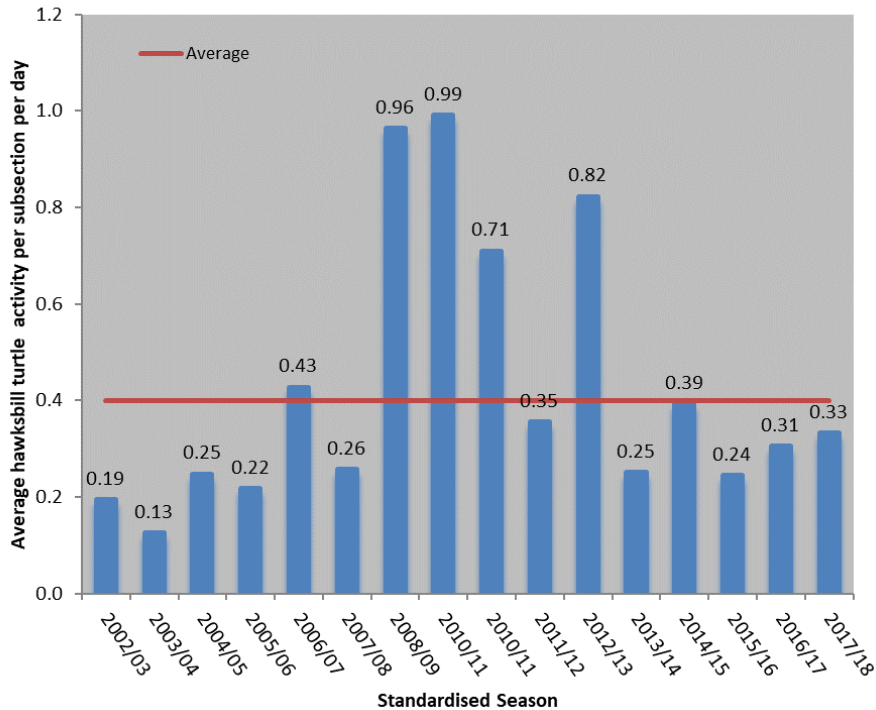


Figure 9: Seasonal hawksbill activity (false crawls and nests) standardised by survey effort during the intensive peak monitoring period.

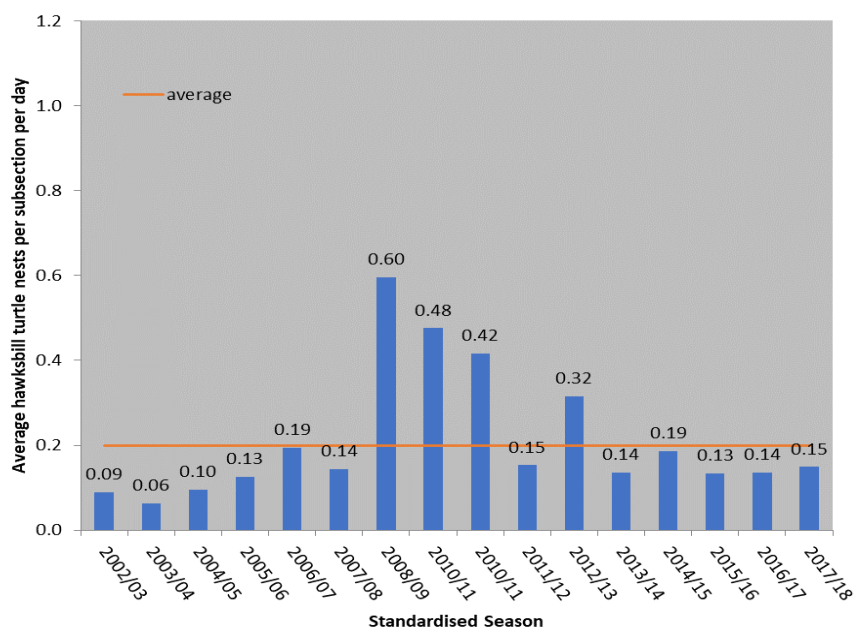


Figure 10: Seasonal hawksbill nests standardised by survey effort during the intensive peak monitoring period.

### Loggerhead Turtles

The standardised levels of loggerhead turtle activity recorded during the 2017-18 season were the second highest recorded since 2002/03 (Figure 11). Standardised loggerhead nesting were close to the average since 2002/03 (Figure 12).

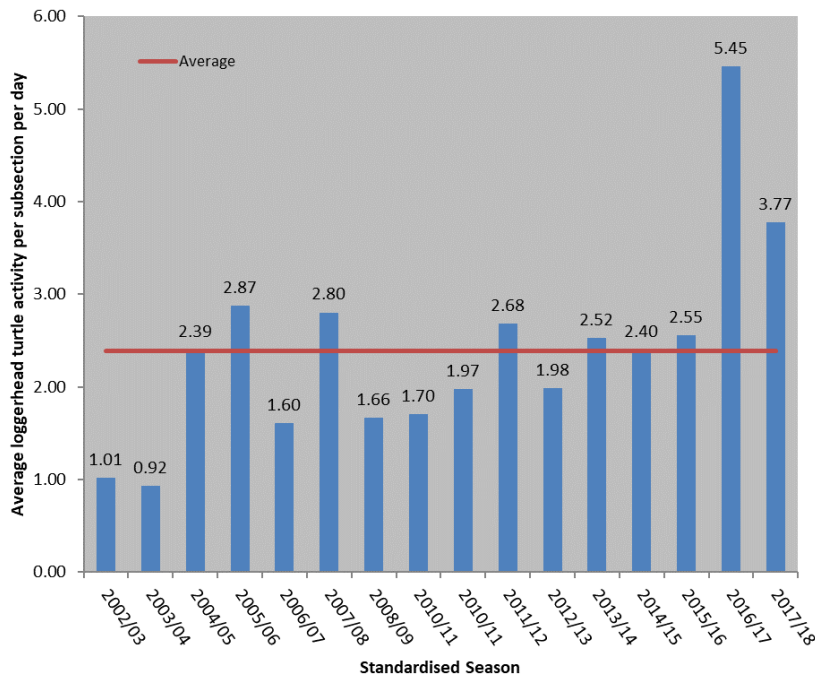


Figure 11: Seasonal loggerhead activity (false crawls and nests) standardised by survey effort during the intensive peak monitoring period.

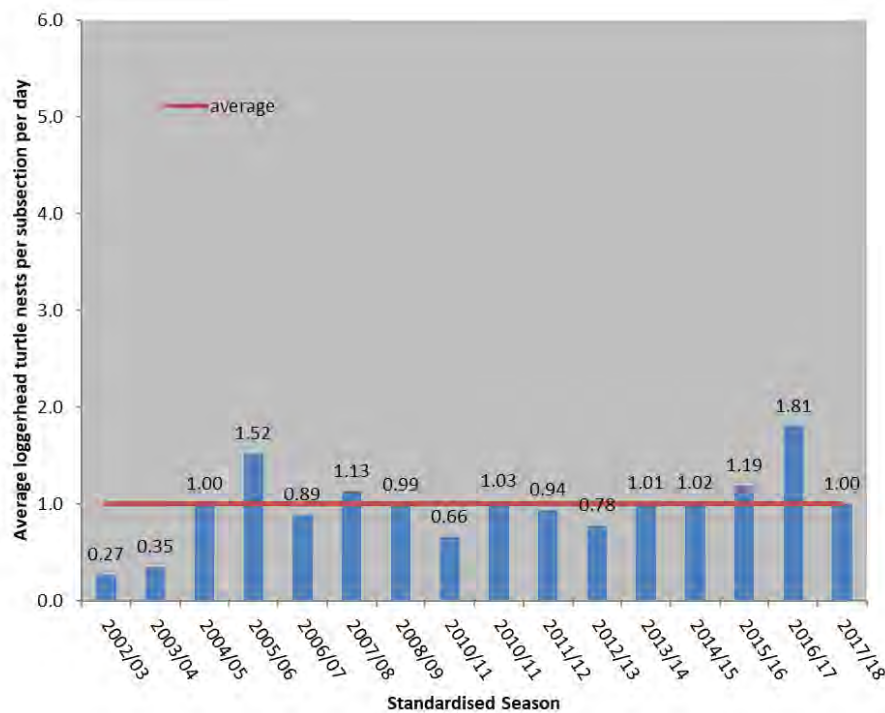


Figure 12: Seasonal loggerhead nests standardised by survey effort during the intensive peak monitoring period.

## **5.3 Nesting Success**

### **5.3.1 2017-18**

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, the actual egg-laying is rarely observed, there will remain some uncertainty in confirming a nest

2518 green turtle nests and 7306 false crawls were recorded in the 2017-18 entire season, which equates to a 25.6% nesting success. Hawksbill and loggerhead turtles had higher rates of nesting success (41.4% and 26.5% respectively), with 70 nests and 99 false crawls for hawksbills and 392 nests and 1086 false crawls for loggerheads (Appendix 1).

### **5.3.2 Nesting Success History (2002-18)**

In the latest trend analysis (including data up to 2015-16 season) it was identified that no long term increases or decreases for all three species of turtles can be seen, however a correlation was identified indicating that the nesting success of the three species fluctuates in synchrony (Whiting 2016).

### Green Turtles

Green turtle nesting success rates recorded since the start of the NTP have generally remained lower than those of loggerhead and hawksbill turtles. A maximum green turtle nesting success rate of 37.34% occurred in 2008-09 and 37.1% in 2016-17, but in other seasons figures have remained in a range starting at 21.7%. (Figure 13) Nesting success in 2017-18 was just below average at 24.1%.

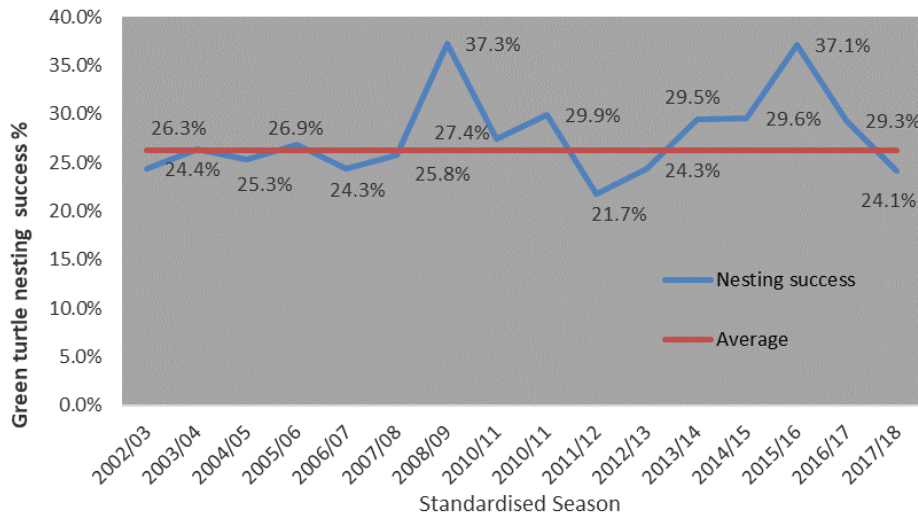


Figure 13: Green turtle nesting success 2002-2018 (%) standardised by survey effort during intensive peak monitoring period.

### Hawksbill Turtles

Nesting success rates of hawksbill turtles has varied between 38.4 - 61.9% throughout the past sixteen nesting seasons (Figure 14). The 2017-18 season success rate (44.8%) was below the average.

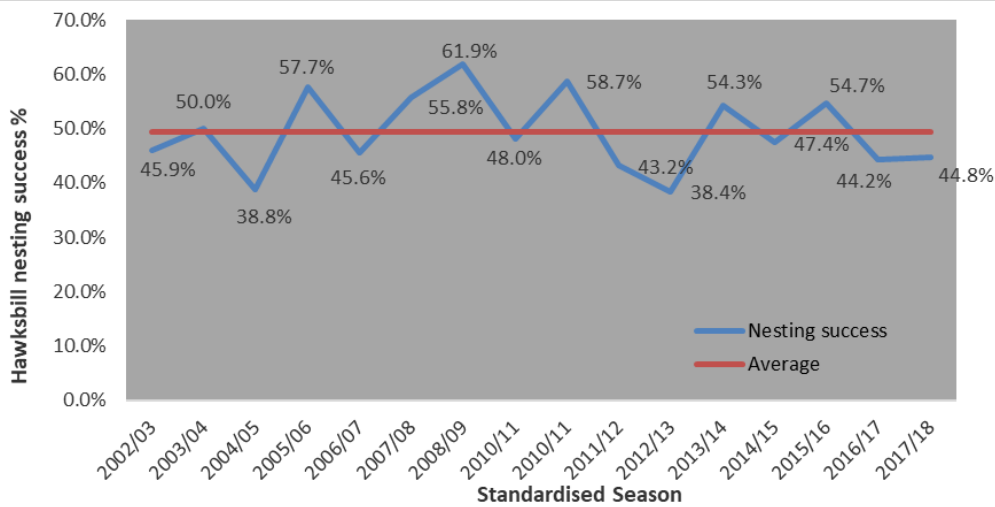


Figure 14: Hawksbill turtle nesting success (%) 2002-18 standardised by survey effort during the intensive peak monitoring period.

## Loggerhead Turtles

The loggerhead turtle nesting success rate has varied from 26.5 – 59.5% since 2002 (Figure 15). The success rate observed in the 2017-18 season was the lowest recorded since the program commenced (26.5%).

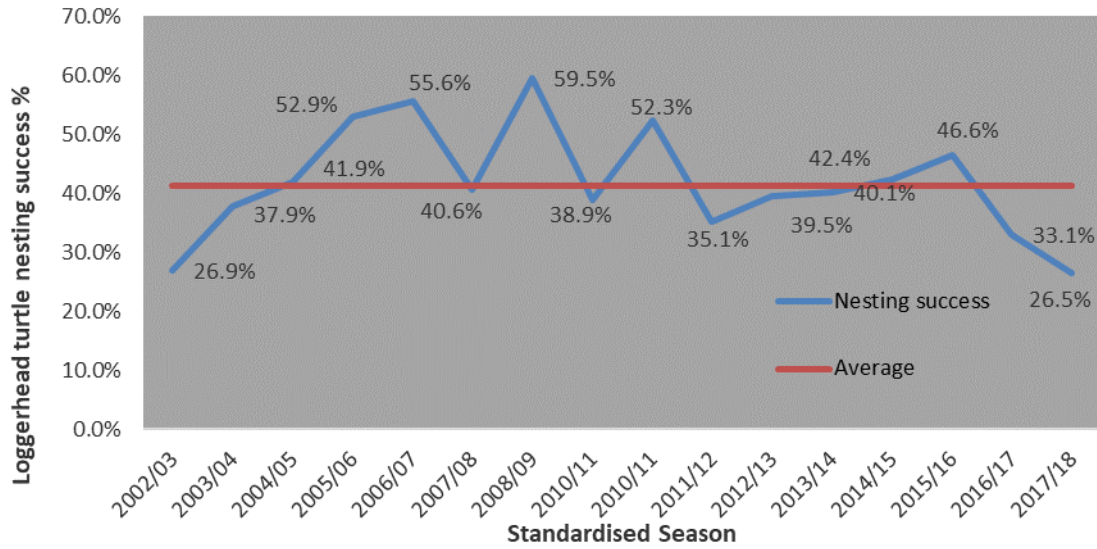


Figure 15: Loggerhead turtle nesting success 2002-18 (%) standardised by survey effort during intensive peak monitoring period



## 5.4 Nest Damage

### 5.4.1 2017-18

Thirteen new nests were recorded to have been damaged in the 2017-18 full season, equating to 0.43% of total recorded nests. Four nests were recorded in the Cape Range Division and the remainder of damaged nests were located within the North West Cape Division. Four of the occurrences were attributed to tidal inundation, and the other nine as accidental damage by other nesting turtles.

Note: Only new nests (i.e. first day of incubation period) are methodically checked for signs of damage. 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 incidences of damaged nests go undetected and are underestimated. More comprehensive assessments of damage to nests at Ningaloo over the entire incubation period have been investigated elsewhere Markovina and Valentine (2015) recorded damage due to predation at one of 29 nests (attributed to predation by ghost crabs) and an additional four cases of nest disturbance (dune encroachment, tide and another turtle digging up a nest) were noted. For more detailed results on the project please see 'Green Turtle Nest Predation Report: North West Cape Division; Ningaloo Turtle Program 2014-15' available at [www.ningalooturtles.org.au](http://www.ningalooturtles.org.au).

### 5.4.3 Predation of nests by foxes and dogs

No fox or dog predation was recorded during the 2017-18 season.

Parks and Wildlife have recorded a reduction in fox numbers in recent years through remote camera monitoring, invasive predator track monitoring, and trapping. This can be attributed to the effectiveness of Parks and Wildlife's rigorous invasive predator control program.

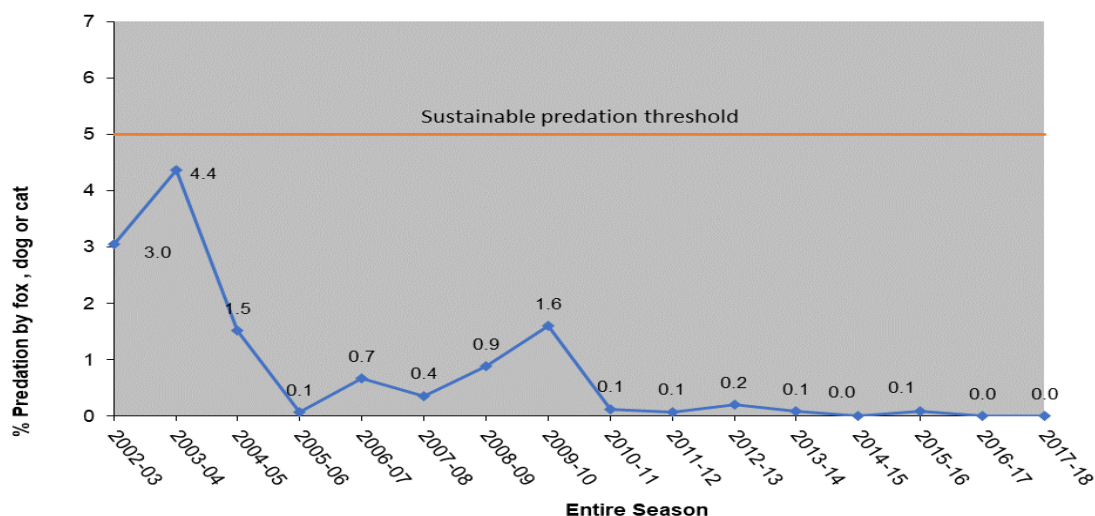


Figure 16: Fox and dog predation as a percentage of total nests recorded per season, NTP 2002-18. Note: data from 2009-10 season onwards includes NW Cape and Cape Range Divisions only, other seasons include an additional two divisions.

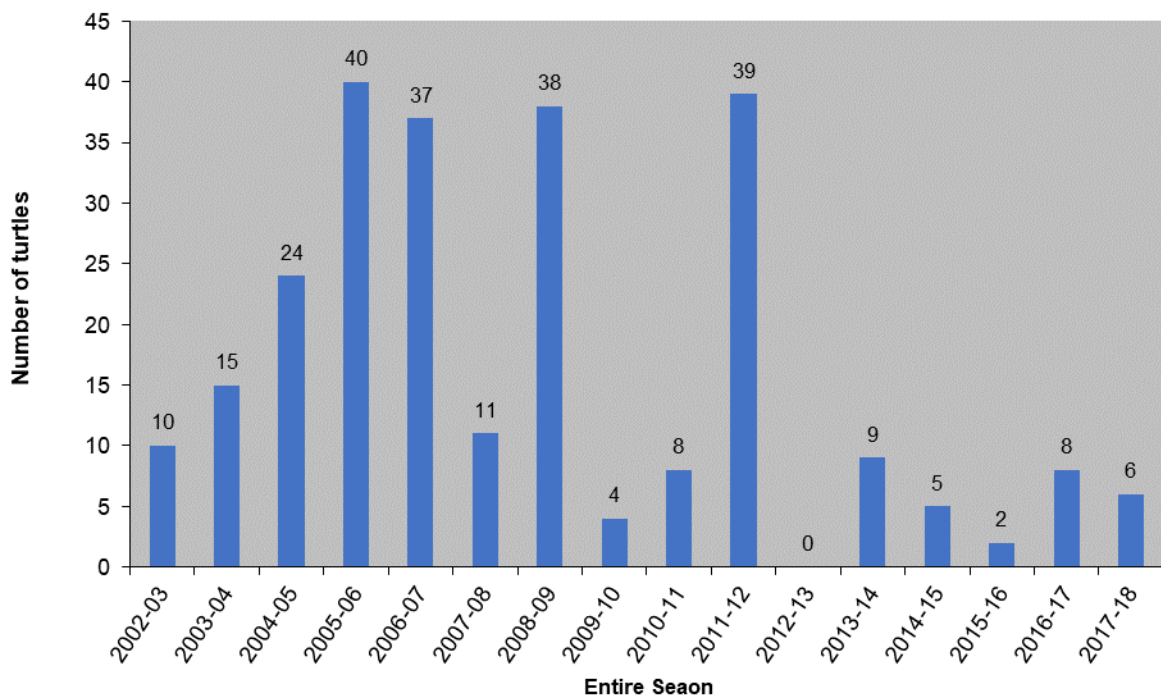
#### 5.4.4 Predation of hatchlings by feral cats

No cat predation was recorded during the 2017-18 season.

The Ningaloo Turtle Program volunteers have recorded on the presence of cat prints since the 2013-14 season. Cat presence has been consistently higher in the North West Cape division than the Cape Range division.

### 5.5 Turtle Rescues

Six turtles were rescued during the 2017-18 NTP season. NTP volunteers have rescued a total of 256 stranded marine turtles from 2002-2018. The number of turtles rescued has fluctuated over the seasons (Figure 17).



**Figure 17: The number of turtles rescued in each NTP season, 2002-18.**

Note: from 2009-10 season onwards data include NW Cape and Cape Range Divisions only, previous to this Bundera, Ningaloo and Coral Bay Divisions were included in the yearly totals.

## 5.6 Turtle Mortalities

Five turtle mortalities were recorded by NTP volunteers during the 2017-18 season.

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 dead turtles recorded in 2011-12, which coincides with the highest level of turtle activity recorded since the commencement of the program.

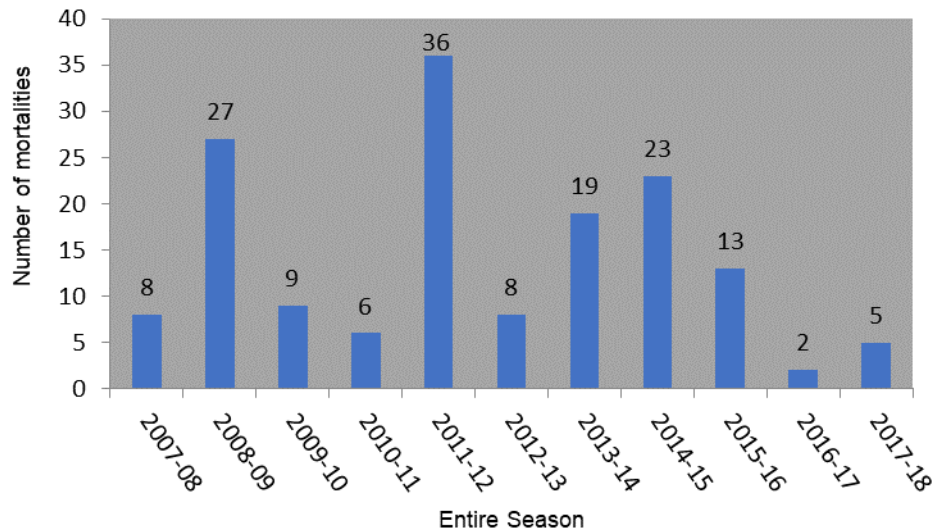


Figure 18: The number of turtles mortalities recorded per season from 2007 - 2018 ( 2002-06 data not available).

## 5.7 Weather Events 2017-18

Beaches included in Ningaloo Turtle Program are susceptible to seasonal weather events, such as cyclones, storm surge and flooding. These can have significant effects on turtle nests and available nesting habitat. During the 2017-18 season there were no significant weather events.

## 5.8 Tagged Turtle Re-sightings 2017-18

One tagged turtle was sighted during the 2017-18 season by NTP volunteers. Details are provided in Table 3 below.

**Table 3:** Tagged turtle sighting details, NTP 2017-18 season

<b>Species</b>	<b>Gender</b>	<b>Year tagged</b>	<b>Location tagged</b>	<b>Number of sightings since tagged</b>	<b>Comments</b>
Green	Female	1988	Five mile	2 (2003&2017)	Flipper tag identification: WA9236

## 5.9 Additional Monitoring Site (South Mandu)

During the 2017-18 season the staff at Sal Salis Eco Retreat continued to monitor at South Mandu, within Cape Range National Park, as per current NTP methodology. (Figure 19). The subsection was monitored opportunistically on x days between 21/12/2017 and 2/3/2018, during which five green turtle and one hawksbill turtle nests were recorded. Additionally, 17 green, eight loggerhead, and three hawksbill false crawls were recorded. South Mandu data have not been detailed in this report.

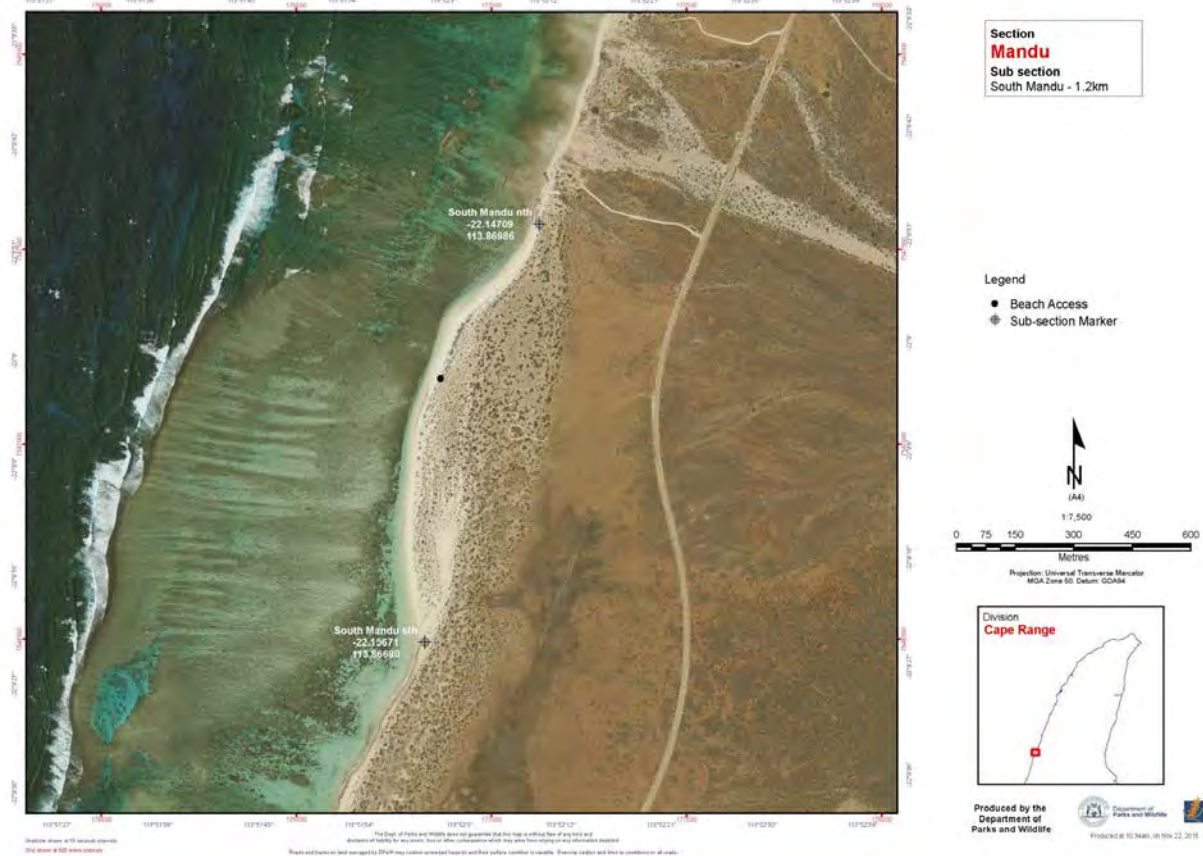


Figure 19: Map of beach monitored at South Mandu

## **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.

Thank you also to the local NTP volunteers from the Exmouth community, the external volunteers recruited from national and international areas, and the team leader and media intern volunteers. 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: Survey effort and turtle activity raw data

#### Survey effort 2002-18 entire season (all data and subsections).

Full 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	2014/15	2015/16	2016/17	2017/18	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	3/11/14 - 1/3/15	31/10/15 - 7/03/16	27/10/16 - 26/02/2017	11/11/17-2/03/18	
Division	Section																	
North West Cape	Graveyards	165	375	374	368	341	336	234	160	153	144	162	172	185	193	174	171	3707
	Hunters	248	263	271	271	256	252	173	117	114	109	111	117	120	123	111	121	2777
	Lighthouse Bay	127	137	215	260	222	251	147	83	93	97	106	113	113	119	106	100	2289
	Navy Pier	-	86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	86
	Tantabiddi	115	3	-	85	86	84	58	38	37	36	41	38	43	41	39	41	785
Cape Range	Bloodwood	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
	Bungelup	1	49	152	114	120	140	124	72	87	91	78	114	91	85	82	81	1481
	Turquoise Bay	-	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16
	Boat Harbour	-	-	203	-	-	-	-	-	-	-	-	-	-	-	-	-	203
Bundera/ Ningaloo	Carbaddaman	7	-	204	-	-	-	-	-	-	-	-	-	-	-	-	-	211
	Janes Bay	13	24	12	29	22	4	-	-	-	-	-	-	-	-	-	-	104
	Norwegian Bay	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
	Whaleback Beach	-	7	8	-	-	-	-	-	-	-	-	-	-	-	-	-	15
Coral Bay	Batemans Bay	103	100	117	51	76	47	34	-	-	-	-	-	-	-	-	-	528
	Lagoon	103	100	116	51	76	47	34	-	-	-	-	-	-	-	-	-	527
	Turtle Beach	56	100	66	49	-	-	-	-	-	-	-	-	-	-	-	-	271
<b>Total survey effort</b>		<b>940</b>	<b>1265</b>	<b>1738</b>	<b>1278</b>	<b>1199</b>	<b>1161</b>	<b>804</b>	<b>470</b>	<b>484</b>	<b>477</b>	<b>496</b>	<b>554</b>	<b>552</b>	<b>561</b>	<b>512</b>	<b>514</b>	<b>12491</b>
<b>Number subsections monitored</b>		22	29	28	20	19	19	18	14	14	14	14	14	14	14	14	14	281



**Turtle activity 2002-18 entire season (all data and subsections): NA – not monitored**

Full 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	2014/15	2015/16	2016/17	2017/18	TOTAL or AVERAGE
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	3/11/14 - 1/3/15	31/10/15 - 7/03/16	27/10/16 - 26/02/2017	11/11/17-2/03/18	
Green nests	1539	1552	788	4695	4349	5254	6297	571	2732	6594	585	2276	628	759	1856	2518	42993
Green false crawls	5404	3086	2533	9948	14395	13156	12608	1451	6507	22865	1769	4960	1465	1357	4243	7306	113053
Green activity	6943	4638	3321	14643	18744	18410	18905	2022	9239	29459	2354	7236	2093	2116	6099	9824	156046
Green activity adjusted by survey effort per day	7.39	3.67	1.91	11.46	15.63	15.86	23.51	4.30	19.09	61.76	4.75	13.06	3.79	3.77	11.91	19.11	-
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%	30.0%	35.9%	30.4%	25.6%	27.6%
Hawksbill nests	48	81	100	108	157	156	336	202	189	65	125	69	91	75	67	70	1939
Hawksbill false crawls	49	60	139	71	153	145	207	202	132	84	192	51	108	65	89	99	1846
Hawksbill activity	97	141	239	179	310	301	543	404	321	149	317	120	199	140	156	169	3785
Hawksbill activity adjusted by survey effort per day	0.10	0.11	0.14	0.14	0.26	0.26	0.68	0.86	0.66	0.31	0.64	0.22	0.36	0.25	0.30	0.33	-
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%	45.7%	53.6%	42.9%	41.4%	51.2%
Loggerhead nests	288	387	777	1068	540	795	580	288	405	382	304	430	436	519	696	392	8287
Loggerhead false crawls	429	359	1040	925	477	954	486	471	388	715	466	595	580	583	1395	1086	10949
Loggerhead activity	717	746	1817	1993	1017	1749	1066	759	793	1097	770	1025	1016	1102	2091	1478	19236
Loggerhead activity adjusted by survey effort per day	0.76	0.59	1.05	1.56	0.85	1.51	1.33	1.61	1.64	2.30	1.55	1.85	1.84	1.96	4.08	2.88	-
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%	42.9%	47.1%	26.5%	26.5%	43.1%
Unidentified nests	29	123	59	42	33	61	38	8	18	7	7	20	19	4	7	6	481
Unidentified false crawls	44	20	82	45	19	29	12	8	9	4	12	17	14	3	3	7	328
Unidentified activity	73	143	141	87	52	90	50	16	27	11	19	37	33	7	10	13	809
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%	57.6%	57.1%	46.2%	46.2%	59.5%
Total all species nests	1904	2180	1724	5913	5279	6266	7252	1069	3343	7049	1023	2795	1174	1357	2626	2986	53940
Total new nests (all three species) adjusted by survey effort per day	2.03	1.72	0.99	4.63	4.40	5.40	9.02	2.27	6.91	14.78	2.06	5.05	2.13	2.42	5.13	5.81	4.67
Total all species false crawls	5925	3536	3794	10989	15044	14284	13314	1451	7038	23668	2439	5623	2167	2008	8498	8498	128276
Total activity	7831	5718	5519	16907	20327	20555	20575	2522	10388	30732	3464	8423	3343	3367	11129	11490	182291
Total turtle activity adjusted by survey effort per day	8.3	4.5	3.2	13.2	17.0	17.7	25.6	5.4	21.5	64.4	7.0	15.2	6.1	6.0	21.7	22.4	16.2

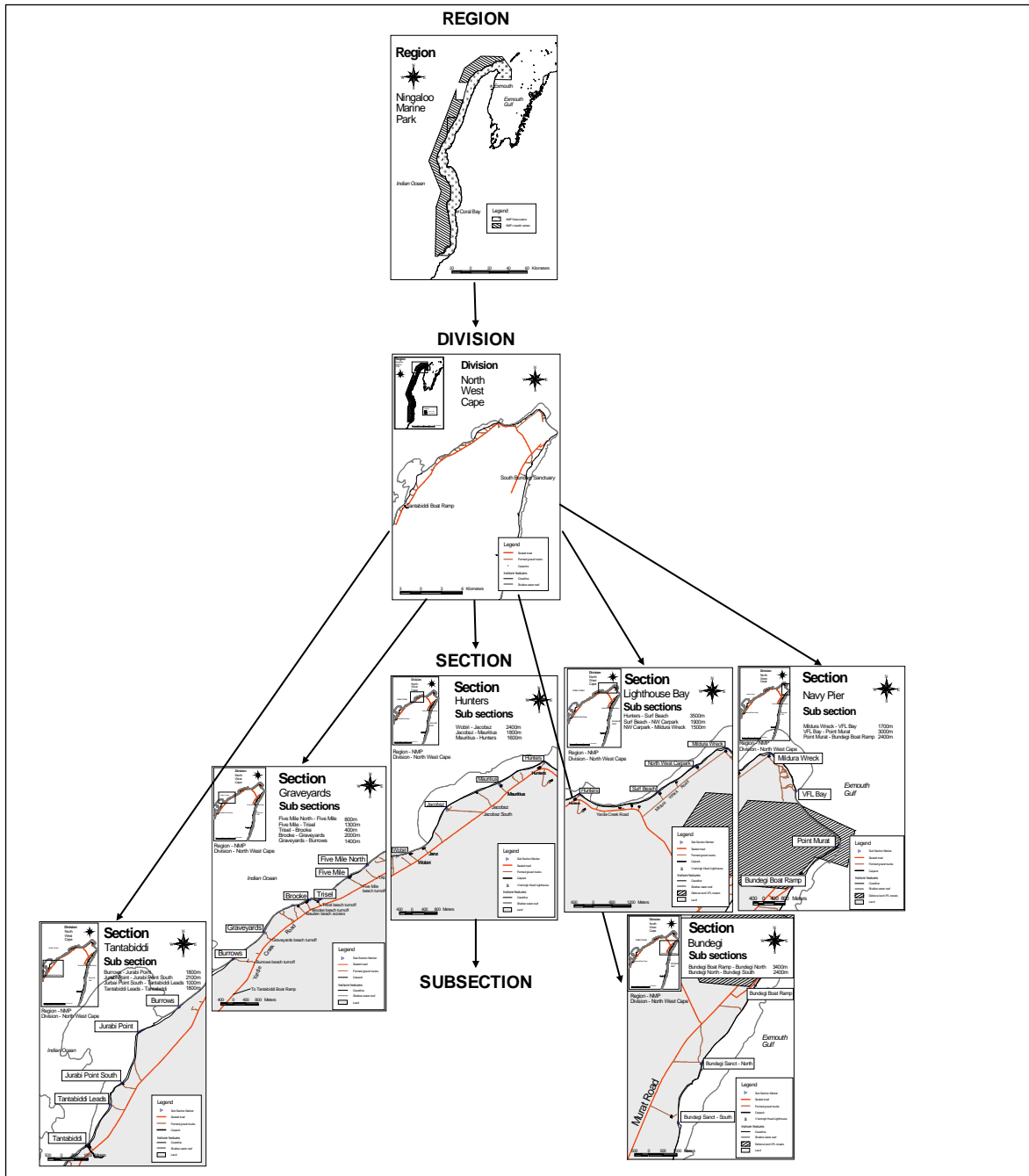
**Survey effort 2002-18 standardised season**

Standardised season		2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2010/11	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	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	17/12/12-11/01/13	16/12/13-12/01/14	15/12/14-11/1/15	14/12/15-10/1/16	12/12/16-8/1/17	18/12/17-14/01/18	
Division	Section																	
North West Cape	Graveyards	57	100	112	107	100	100	96	70	108	112	104	108	112	112	107	108	1613
	Hunters	72	78	84	81	75	75	72	50	81	84	78	81	84	84	78	81	1238
	Lighthouse Bay	53	34	56	77	75	75	72	39	77	84	78	81	84	83	78	80	1126
	Tantabiddi	9	NM	NM	27	25	25	24	17	27	28	26	27	28	28	28	27	346
Cape Range	Bungelup	0	11	71	66	69	60	60	30	79	84	75	78	84	82	79	80	1008
Total survey effort*		191	223	323	358	344	335	324	206	372	392	361	375	392	389	370	376	5331
Number subsections monitored		11	12	12	14	14	14	14	14	14	14	14	14	14	14	14	14	217

## Turtle activity 2002-18 standardised season

Standardised season	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2010/11	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	TOTAL or AVERAGE
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	17/12/12-11/01/13	16/12/13-12/01/14	15/12/14-11/1/15	14/12/15-10/1/16	12/12/16-8/1/17	18/12/17-14/01/18	
Green new nests	587	475	266	1548	1650	1721	3103	239	2270	5683	422	1714	459	554	1449	1919	24059
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	1.2	4.6	1.2	1.4	3.9	5.1	4.3
Green false crawls	1821	1328	785	4217	5138	4959	5226	634	5322	20501	1314	4098	1092	939	3495	6051	66920
Green activity	2408	1803	1051	5765	6788	6680	8329	873	7592	26184	1736	5812	1551	1493	4944	7970	90979
Green activity adjusted by survey effort per day	0.8	0.5	0.2	16.1	19.7	19.9	25.7	4.2	20.4	66.8	4.8	15.5	4.0	3.8	13.4	21.2	14.8
Green nesting success %	1.5%	26.3%	25.3%	26.9%	24.3%	25.8%	37.3%	27.4%	29.9%	21.7%	24.3%	29.5%	29.6%	37.1%	29.3%	24.1%	26.3%
Hawksbill new nests	17	14	31	45	67	48	193	98	155	60	114	51	73	52	50	56	1124
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	0.1	0.2	0.1	0.1	0.1	0.2
Hawksbill false crawls	20	14	49	33	80	38	119	106	109	79	183	43	81	43	63	69	1129
Hawksbill activity	37	28	80	78	147	86	312	204	264	139	297	94	154	95	113	125	2253
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	0.8	0.3	0.4	0.2	0.3	0.3	0.4
Hawksbill nesting success	45.9%	50.0%	38.8%	57.7%	45.6%	55.8%	61.9%	48.0%	58.7%	43.2%	38.4%	54.3%	47.4%	54.7%	44.2%	44.8%	49.3%
Loggerhead new nests	52	78	324	544	306	380	320	136	383	368	282	379	398	462	668	375	5455
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	0.8	1.0	1.0	1.2	1.8	1.0	1.0
Loggerhead false crawls	141	128	449	484	244	557	218	214	349	681	432	566	541	530	1350	1042	7926
Loggerhead activity	193	206	773	1028	550	937	538	350	732	1049	714	945	939	992	2018	1417	13381
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	1.98	2.52	2.40	2.55	5.45	3.77	2.39
Loggerhead nesting success	26.9%	37.9%	41.9%	52.9%	55.6%	40.6%	59.5%	38.9%	52.3%	35.1%	39.5%	40.1%	42.4%	46.6%	33.1%	26.5%	41.9%
Unidentified new nests	1	10	14	21	13	17	21	3	15	3	6	16	19	4	6	5	174
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	0.0	0.0	0.0	0.0	0.0	0.5
Unidentified false crawls	2	7	36	18	9	12	7	3	9	4	9	17	11	1	3	4	152
Unidentified activity	3	17	50	39	22	29	28	6	24	7	15	33	30	5	9	9	326
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	0.0	0.1	0.1	0.0	0.0	0.0	1.0
Unidentified nesting success	33.3%	58.8%	28.0%	53.8%	59.1%	58.6%	75.0%	50.0%	62.5%	42.9%	40.0%	48.5%	63.3%	80.0%	66.7%	55.6%	87.1%
Total new nests (all three species)	656	567	621	2137	2023	2149	3616	473	2808	6111	818	2144	930	1068	2167	2355	30643
Total new nests (all species) adjusted by survey effort per day	3.4	2.5	1.9	6.0	5.9	6.4	11.2	2.3	7.5	15.6	2.3	5.7	2.4	2.7	5.9	6.3	88.0
Total false crawls (all species)	1982	1470	1283	4734	5462	5554	5563	954	5780	21261	1929	4707	1714	1512	4908	7166	75979
Total activity	2638	2037	1904	6871	7485	7703	9179	1427	8588	27372	2747	6851	2644	2580	7075	9521	106622
Total turtle activity adjusted by survey effort per day	13.8	9.1	5.9	19.2	21.8	23.0	28.3	6.9	23.1	69.8	7.6	18.3	6.7	6.6	19.1	25.3	19.0

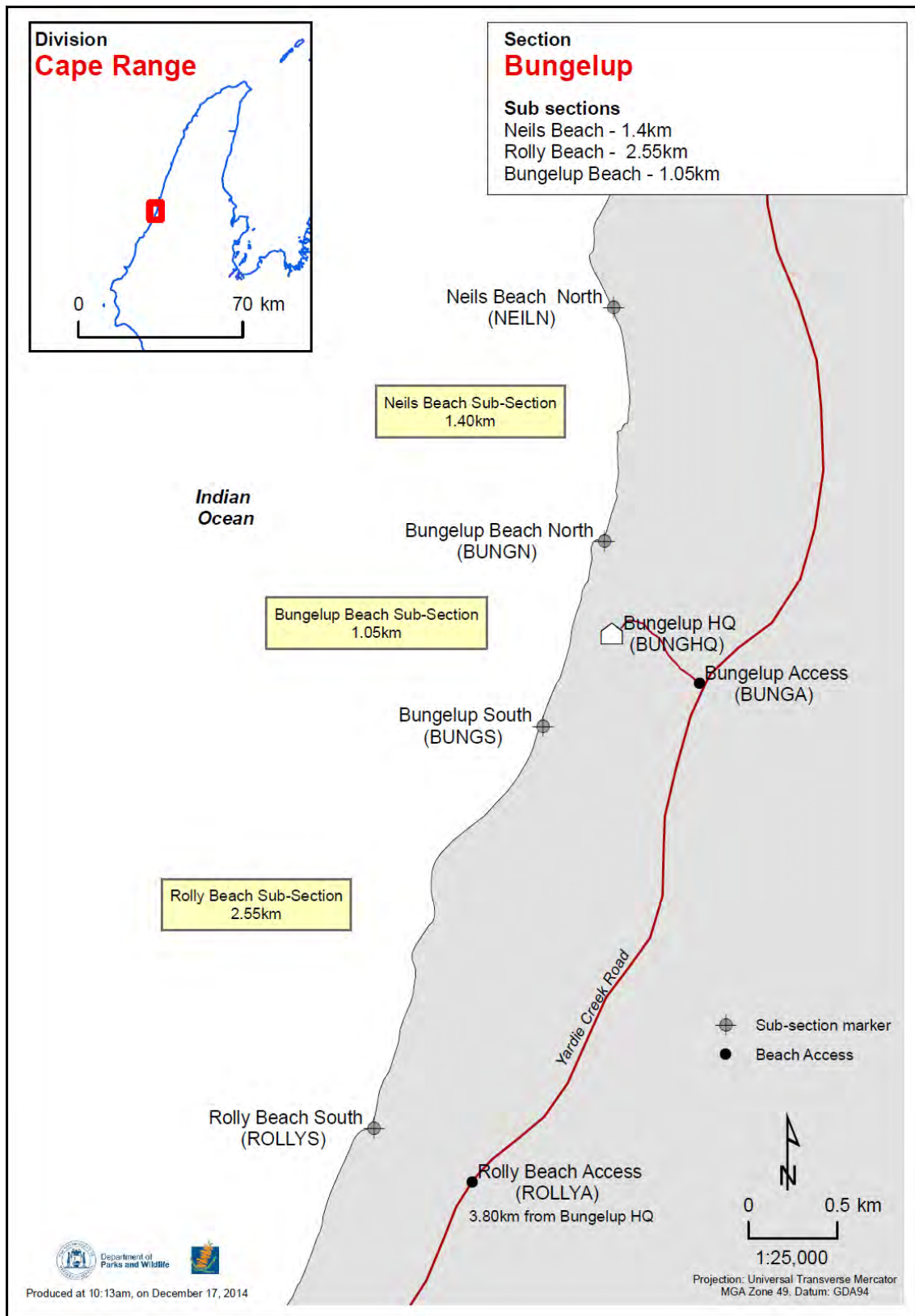
Appendix 2 Zoning and subsection details NW Cape Division.



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

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

Appendix 3: Zoning and subsection details Cape Range Division.





Location and distance of each subsection within Cape Range Division.

<b>Subsection</b>	<b>Location of northern totem</b>	<b>Location of southern totem</b>	<b>Distance (m)</b>
<b>Neils Beach North - Bungelup Beach North</b>	22.26489 S; 113.83277 E	22.27674 S; 113.83231 E	1400
<b>Bungelup North - Bungelup Beach South</b>	22.27674 S; 113.83231 E	22.28613 S; 113.8292 E	1050
<b>Bungelup Beach South - Rolly Beach South</b>	22.28613 S; 113.8292 E	22.30650 S; 113.82062 E	2550





**Appendix 5: Tagged Turtle Re-sightings Datasheet**

West Australian Turtle Research - Nesting Turtles <b>TAGGED TURTLE RESIGHTINGS</b>	 Department of Parks and Wildlife	
Locality: _____ Date: _____ Observer: _____		

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

Tag position: Please record tag number for both left and right flippers and include all letters and numbers on the tag. If single tagged, put 'nil' in the column as needed.

<b>Turtle Activity Key:</b>	
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

<b>Nest Location Key:</b>
A: Above high tide mark
B: At high tide mark
C: Below high tide mark
D: Edge of vegetation

## 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:

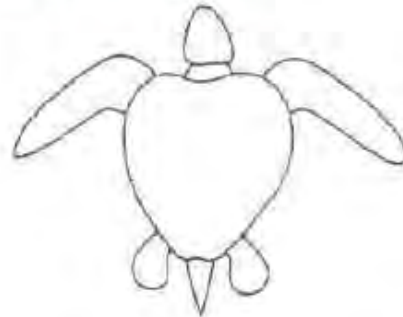
- |  |  |
|--|--|
| <input type="checkbox"/> Live but subsequently died                  | <input type="checkbox"/> Carcass poor (advanced decomposition)           |
| <input type="checkbox"/> Carcass in good condition (fresh/edible)    | <input type="checkbox"/> Mummified carcass (skin holding bones)          |
| <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 2017-18) Map 1 & 2



Ningaloo Turtle Program  
2017-2018 (new nests)

LIGHTHOUSE BAY SECTION  
Map 1 of 2

Legend

- Subsection locations
- Turtle Nests 2018
- Green
- Hawksbill
- Loggerhead
- Unidentified

North  
(A4)  
1:15,000  
0 100 200 300 400 m  
Projection: MGA Zone 49  
Datum: GDA94



Department of Biodiversity,  
Conservation and Attractions  
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Job Ref: NTP  
Produced at 11:36 AM on May 29, 2018

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**Ningaloo Turtle Program  
2017-2018 (new nests)**

**LIGHTHOUSE SECTION**

**Map 2 of 2**

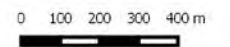
**Legend**

- Subsection locations
- Turtle Nests 2018**
- Green
- Hawksbill
- Loggerhead



(A4)

1:17,500



Projection: MGA Zone 49  
Datum: GDA94



Department of Biodiversity,  
Conservation and Attractions



Job Ref: NTP  
Produced at 11:35 AM on May 29, 2018



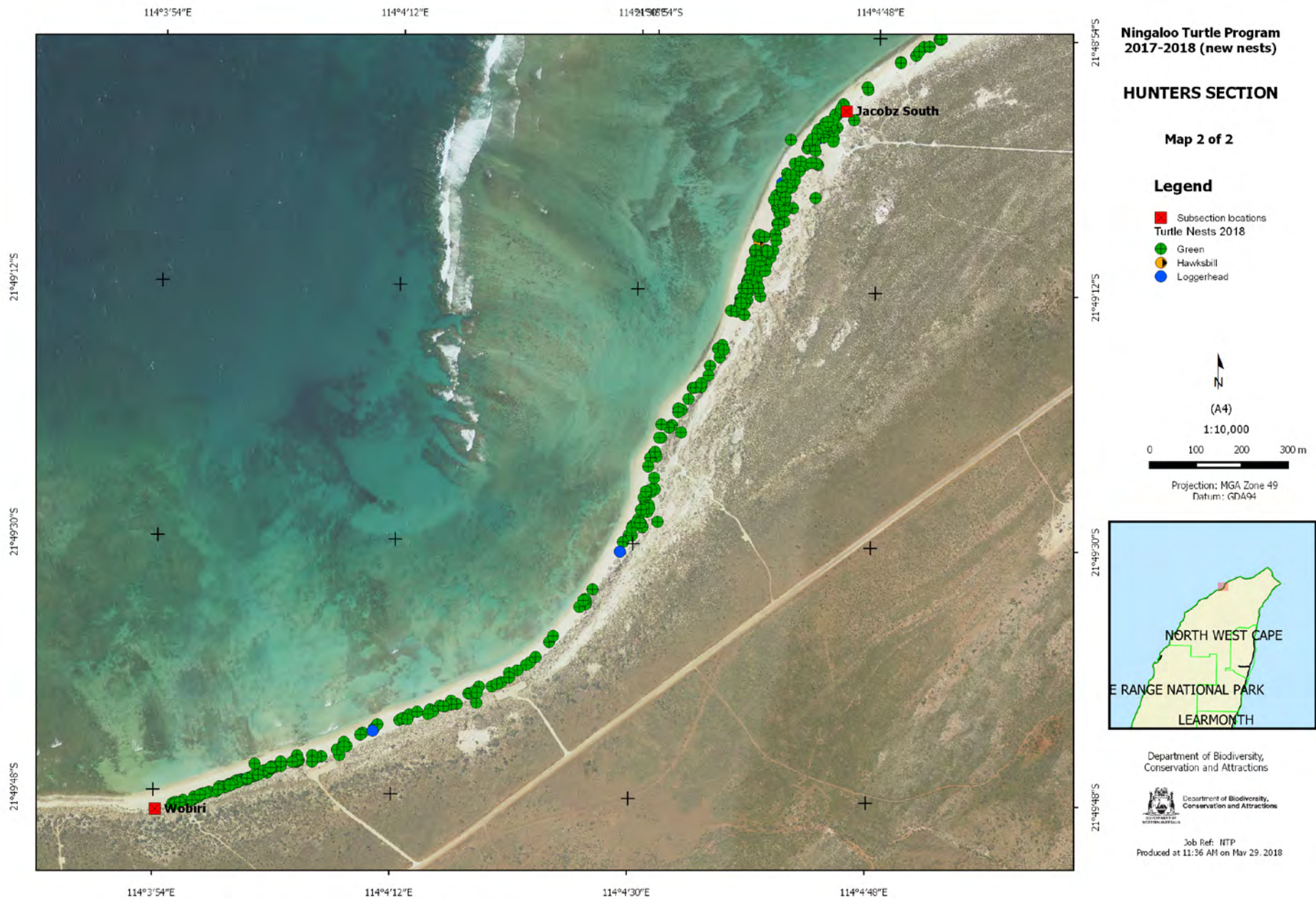
114°6'36"E      114°7'12"E      114°7'48"E      114°8'24"E

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Appendix 8: Hunters Section - Location of New Nests (NTP 2017-18) Map 1 & 2

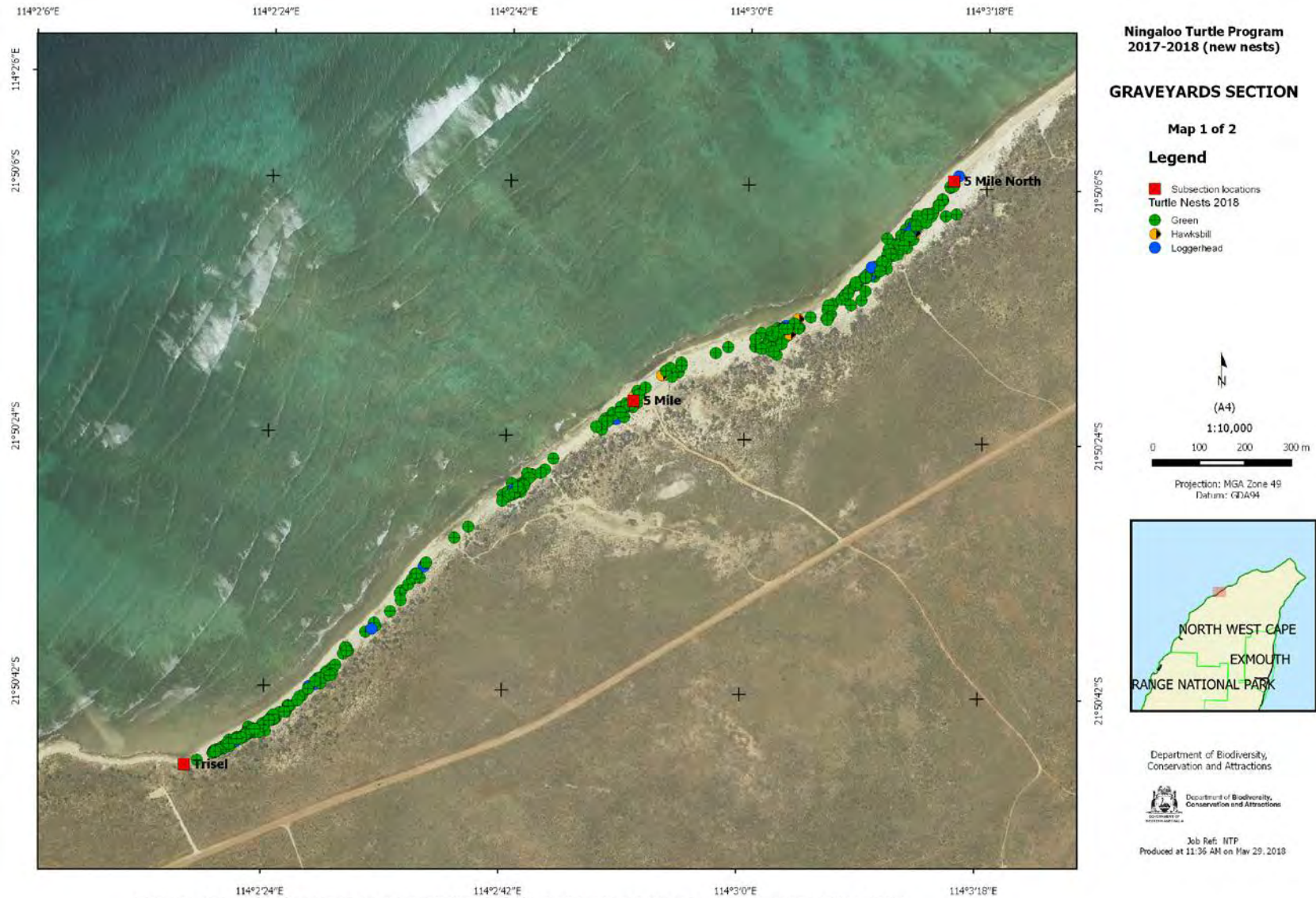


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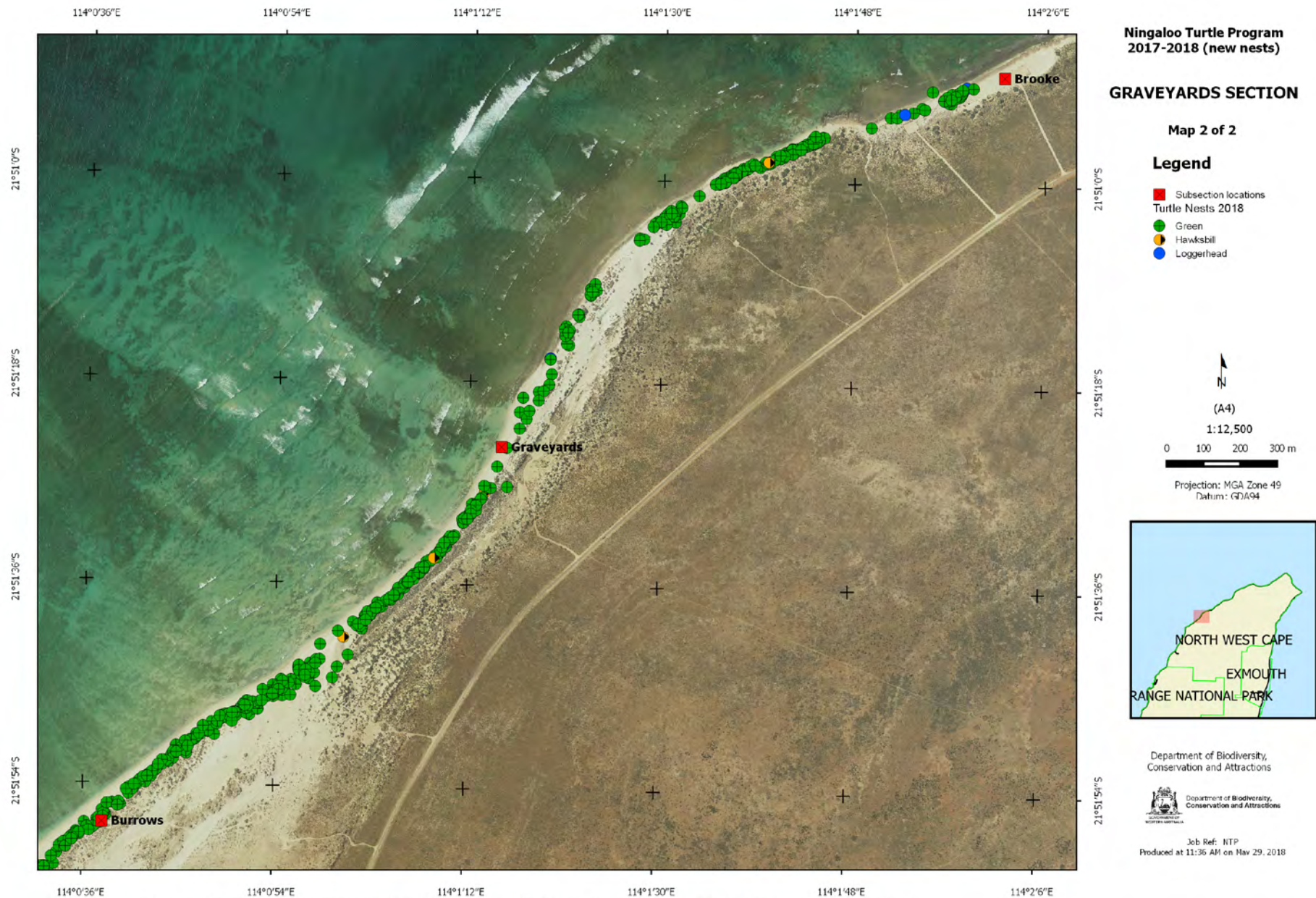


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Appendix 9: Graveyards Section - Location of New Nests (NTP 2017-18) Map 1 & 2



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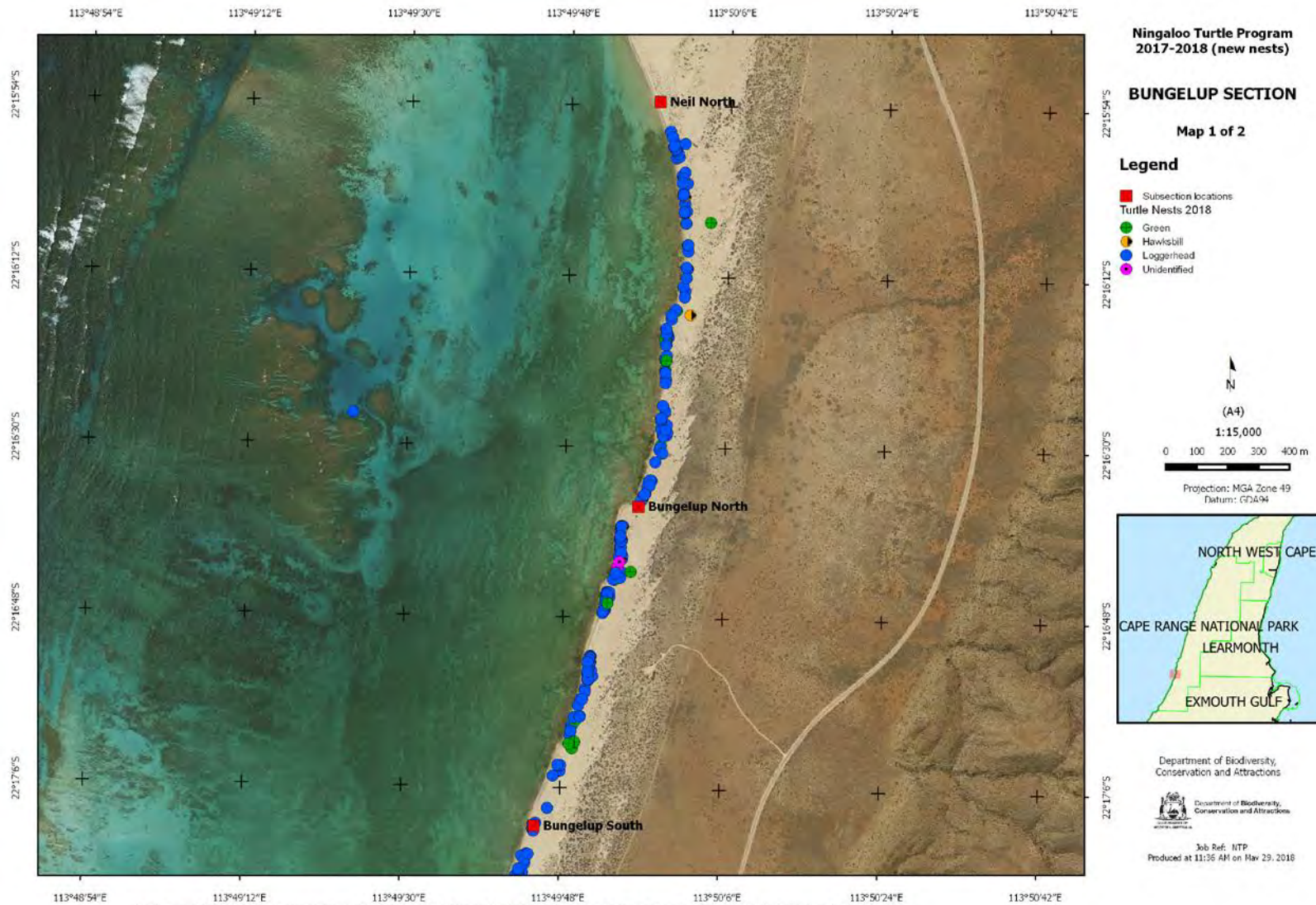


Appendix 10: Tantabiddi Section - Location of New Nests (NTP 2017-18) Map 1

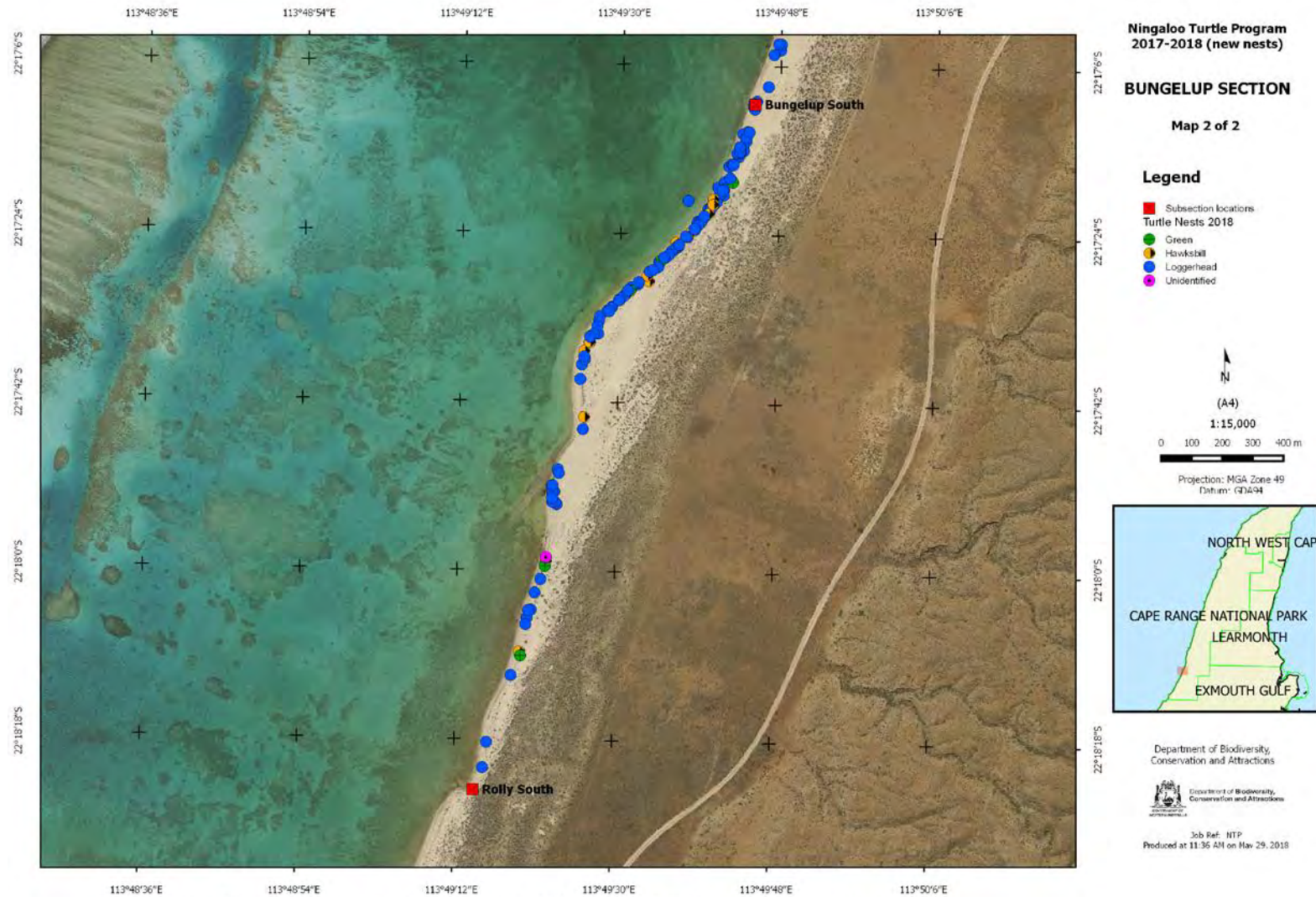


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Appendix 11: Bungelup Section - Location of New Nests (NTP 2017-18) Map 1 & 2



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