Ningaloo Turtle Program
Annual Report 2018 -19





GOVERNMENT OF WESTERN AUSTRALIA

Department of **Biodiversity, Conservation and Attractions**

PARKS AND WILDLIFE SERVICE

CAPE CONSERVATION GROUP

Woodside

CITATION

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DISCLAIMER

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GLOSSARY

Body pit	A depression dug in the sand by a turtle during a nesting attempt.
Egg chamber	A deep cylindrical hole which a turtle digs into the bottom of 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 includes the intensive peak period monitoring and the pre and post peak period monitoring data.
Escarpment	The edge of a ridge which indicates a filled-in primary body pit.
False crawl	An abandoned nesting attempt with no eggs being laid.
GPS unit	Global Positioning System unit: an electronic navigational device which obtains a position on the earth using satellite signals.
Pre and post peak	Monitoring on the weekends either side of the intensive peak monitoring period.
Intensive peak monitoring period	Four-week period centred around the 31st December, during which monitoring takes places every day. Note: peak period was identified by Andrea Whiting as the 7th January but due to having volunteers adequately trained before Christmas, the peak period has been brought forward one week every year.
Nest	A nesting attempt which we suspect 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 tracks counted.
New nest	A suspected nest laid during the night before or the morning of monitoring, which has therefore not been previously recorded.
Old nest	A suspected nest laid during the current season (but not laid during the previous night) which has been predated on.
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.

Rookery	A significant breeding area for a large number of turtles.
Secondary body pit	The last depression dug 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	Total number of times each subsection was 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	The imprint left in the sand by a turtle emerging from and returning to the water.
Turtle activity	Includes both turtle nests and false crawls.
Zoning	Hierarchical spatial classification system of divisions, sections & subsections**.**

LIST OF ABBREVIATIONS

CCG	Cape Conservation Group Inc.
DBCA	Department of Biodiversity, Conservation and Attractions
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	Parks and Wildlife Service, Department of Biodiversity, Conservation and Attractions

SUMMARY

The Ningaloo Turtle Program (NTP) was established in 2002 as a collaboration between the Cape Conservation Group Inc., World Wildlife Fund Australia, Murdoch University and the predecessors of the Parks and Wildlife Service at the Department of Biodiversity, Conservation and Attractions, Exmouth District. During the 2018-19 season, NTP sponsors Woodside Energy Ltd made a significant contribution to the program. The Australian Government's National Landcare Program (Threatened Species Recovery Fund) also supported the program. The primary aim of the NTP is to predict long-term trends in marine turtle populations along the Ningaloo coast.

The monitoring design was the same as previous recent seasons; 4 weeks of daily monitoring during the predicted peak period of nesting at both the North West Cape and Cape Range divisions (referred to hereby as the standardised season) and 3 weekends pre-peak and 3 weekends post-peak at the North West Cape sections only.

The NTP was spatially expanded in 2018-19 to include monitoring of remote rookeries at Janes Bay and Whaleback Beach on Ningaloo Station (previously last monitored in 2007) and Gnarraloo Bay (previously monitored by the Gnaraloo Turtle Conservation Program). Three surveys were done throughout the season.

Sixty five volunteers contributed a total of 4199 hours to the Ningaloo Turtle Program in 2018-19. Since commencement of the program, volunteers have contributed a total of 68,912 hours. These hours demonstrate the effort and value of the volunteers over the life of the program.

3289 suspected nests and 8933 false crawls were recorded in the Ningaloo Region over the full 2018-19 season. In the NW Cape division, 95.5% of activities were from green turtles. In the Cape Range division, loggerhead turtles were responsible for 81.7% of activities. In the Ningaloo division, 57.5% of activities were from green turtles and 37.8% were from loggerhead turtles. 96% of activity in the Gnarraloo division was from loggerhead turtles.

For all species combined, average activity per subsection per day during the standardised season was the 3rd highest since 2002/03. There were more nests and false crawls by green and loggerhead turtles and fewer by hawksbills in comparison to long-term averages. All three species had lower than average rates of nesting success.

In the standardised season, volunteers recorded on average 22.4 green turtle activities per subsection per day (nests and false crawls), which is higher than the long-term average of 16.6 activities per day. Greens turtles had a nesting success rate of 24.6%, slightly lower than the long-term average of 27.5%.

Loggerhead turtles had an average of 2.6 activities subsection per day which is also higher than the long-term average of 2.4 activities. Nesting success rate was 39.2% (long-term average of 41.7%).

Hawksbill nesting activity remained relatively small as expected, with 0.3 activities on average per subsection per day. The long-term average is 0.4 activities. Nesting success (39.0%) was lower than the long-term average of 48.7%.

Eight nests were considered to be disturbed, which was 0.2% of the total recorded nests. Seven were attributed to ghost crabs, tidal inundation, another turtle accidentally excavating other turtle's nest or human disturbance. One disturbance was attributed to introduced predators (dog) or dingo.

During 2018-19, volunteers rescued 20 stranded turtles, making a total of 276 rescued since 2002. Mortalities (15) and tagged turtles (4) were also reported.

1.0 INTRODUCTION

The Ningaloo Turtle Program (NTP) was established in 2002, as a collaborative initiative between the predecessors of the Parks and Wildlife Service at the Department of Biodiversity, Conservation and Attractions 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 information such as nesting abundance, distribution and disturbance. This information informs management and conservation by Parks and Wildlife including reducing disturbance to nesting turtles, management of introduced predators and managing coastal access and visitation to support effective conservation of sea turtles on the Ningaloo Coast.

Volunteers are essential to 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 training and practical experience with track monitoring, turtle rescues and other related activities.

Woodside Energy Ltd has been the main sponsor of the program, contributing to the program's operational costs since 2012. This has included funding toward volunteer costs, website maintenance, community activities, monitoring equipment and education. The Australian Government's National Landcare Program (Threatened Species Recovery Fund) contributed funding towards control of introduced predators.

In 2008 the monitoring design for NTP was consolidated after it was determined that long-term trends in turtle populations could be detected with an acceptable level of confidence when survey effort was reduced (Whiting, 2008).

NTP seasons in the NW Cape division now consist of daily monitoring over the 28 days of the peak nesting period and three weekends of monitoring during each of the pre and post peak nesting periods. Cape Range sections are monitored daily over the 28 days of the peak nesting period.

Monitoring at the remote rookeries of Janes Bay and Whaleback Beach (Bundera/Ningaloo division) and Gnarraloo Bay (Gnarraloo division) involved three surveys by NTP volunteers and Parks and Wildlife staff throughout the season, as recommended by Whiting, 2018.

Trend analyses are done every three years to understand longer-term changes in patterns of nesting at Ningaloo. The most recent trend analysis in 2016 is available online at http://www.ningalooturtles.org.au/media_reports.html.

The goals and objectives listed below have been developed through a community-based steering 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.

2.0 METHODS

Activities of turtles are recorded by observing fresh tracks from the previous night to determine species and identify suspected nests[1]. Volunteers use standard procedures to determine if the activity has resulted in a successful nest or a false crawl. Nest positions are recorded using GPS. Signs of predation at nests are also recorded, along with sightings of tagged turtles, the presence of introduced animals, mortalities of turtles and rescues.

For more detailed information on the 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.

In the 2018-19 season, the NTP changed from recording data on paper data sheets and using a hand-held GPS to record locations to collecting data using the ODK Collect app, installed on Lenovo tablets (https://getodk.org/). This was part of a state-wide Departmental initiative to standardise and coordinate the collection of data among turtle monitoring programs throughout WA. The app has the benefit of eliminating human error in transcribing GPS coordinates from the GPS to the data sheet because the app enables the location to be automatically saved when recording a turtle activity. All local and external volunteers were trained in the use of the app. The data from the app were automatically uploaded via WIFI to a centralised database in Perth.

2.1 Monitoring zones & dates

Important nesting beaches were identified through past aerial and ground surveys during the development of the program. For the purpose of the program, the Ningaloo Region is divided into four divisions. A fifth division was added in 2018-19 (Gnarraloo). Divisions are further divided into sections and subsections. Subsections are on average 2-3kms long so that they are practical to survey on foot (with the exception of Janes Bay). The starts and ends of subsections were determined by either natural barriers that separate beaches or positions of car parks to facilitate access by volunteers. Volunteers identify subsections with a GPS location and NTP totems 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 11 subsections (Appendix 1). In 2018-19, each subsection was monitored for 38 or 39 days depending on the availability of

[1] The term 'nest' is used in this report to indicate an activity that appeared to be a nest based on a consistent set of criteria. Nests however cannot be confirmed unless egg-laying is witnessed. Uncertainty can be expected as turtles can sometimes create the appearance of nests without depositing any eggs into them (Whiting pers. comm. 2012) or may deposit eggs without creating the appearance of a nest. Any uncertainty, however, was not considered to be a significant source of bias nor would likely affect the confidence in the interpretation of results.

volunteers for each of the subsections. The NW Cape division was monitored daily during the intensive peak period from the 17 December 2018 to 13 January 2019 and also before the peak period on the weekends of the 10 & 11, 24 & 25 November and 8 & 9 December 2018 and again after the peak period on the weekends of the 26 & 27 January and 9 & 10 and 23 & 24 February 2019.

Cape Range division

The Cape Range division includes the Bungelup section, which is divided into three subsections and South Mandu section (Appendix 2). South Mandu was not monitored in 2018-19. Each subsection of the Cape Range division was monitored for 27 days during the intensive peak period from the 17 December 2018 to 13 January 2019.

Bundera/Ningaloo division

The Bundera/Ningaloo division includes six sections each divided into subsections. The Janes Bay and Whaleback Beach sections (Appendix 4) were monitored in 2018-19 for the first time since the 2007-08 season. They were monitored for 5 days pre-peak nesting period (3 – 7 December 2018), 7 days centred on the peak nesting period (4 – 10 January 2019) and 5 days post-peak nesting period (11 – 15 February 2019), as recommended by Whiting 2018. Parks and Wildlife staff also opportunistically monitor these subsections during monthly baiting operations for management of introduced predators including foxes and cats.

Coral Bay division

The Coral Bay division includes two sections: Batemans Bay and The Lagoon. These sections are divided into one or more subsections. This division has not been consistently monitored by NTP since the 2008-09 season. Parks and Wildlife staff opportunistically monitor these subsections during monthly baiting operations for management of introduced predators including foxes and cats, but for the purpose of this report these data have not been included.

Gnarraloo division

The Ningaloo Turtle Program was expanded in 2018-19 to include the minor loggerhead rookery in Gnarraloo Bay (Gnarraloo Bay section)[2]. This was previously monitored extensively by the Gnaraloo Turtle Conservation Program from 2008-09 to 2017-18 (Hattingh *et al.* 2018). The NTP commenced monitoring in Gnarraloo Bay in 2018/19 using a sampling regime recommended by Whiting (2018) based on assessment of available data from previous surveys at Gnarraloo Bay. Turtle nesting was monitored in Gnarraloo Bay between GBN and beach point 9 (Appendix 5) for 5 days pre-peak period (27 November – 1 December 2018), 7 days over the peak period (31 December 2018 – 6 January 2019) and 5 days post-peak period (5 – 9 February 2019).

[2] Gnarraloo Bay follows the traditional Baiyungu spelling of Ngarralu (double 'r'). Gnaraloo Station and the Gnaraloo Turtle Conservation Program use one 'r'.

3.0 RESULTS

Sixty five volunteers contributed 4199 hours to the Ningaloo Turtle Program in 2018-19, in addition to a significant amount of time for coordination, management, supervision and training by Parks and Wildlife staff. Since commencement of the program in 2002, 68,912 hours (or almost 10,000 working days) of time from volunteers have been contributed to the program. This time was primarily monitoring, but also through data entry, training, education, school visits, turtle rescues, media and assisting with external research.

3.1 Nesting Activity

3.1.1 NW Cape division

2829 suspected nests and 8149 false crawls were recorded within the NW Cape division during the full 2018-19 season (Table 1). Green turtles were the most active species in the NW Cape division (both nests and false crawls) representing 95.5% of total turtle activity recorded, followed by loggerheads (3%), hawksbills (1.3%), flatbacks (0.1%) and unidentified species (0.2%) (Figure 1).

Table 1: Total activities (suspected nests and false crawls) recorded for each species within the North West Cape division, NTP 2018-19 full season.

North West Cape division	Turtle Species					
	Green	Hawksbill	Loggerhead	Flatback	Unidentified	Total
New nests	2632	54	133	2	8	2829
False crawls	7850	84	198	5	12	8149
Total activity	10482	138	331	7	20	10978

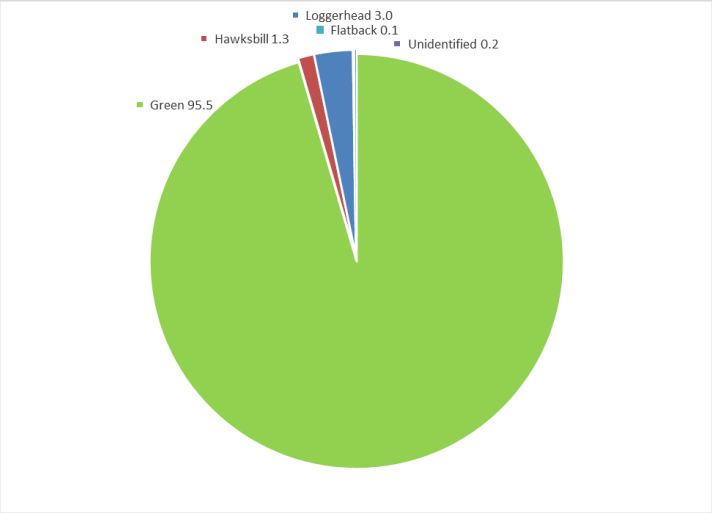

Figure 1: Percentage of activity by species within the North West Cape division, 2018-19 full season.

Figure 2 shows the variation in numbers of nests and false crawls among the four NW Cape sections. For section lengths and locations, see Appendix 2. The Graveyards section had the most activity and the Lighthouse Bay section had the least amount of nests. For individual nest locations see maps in Appendix 6 – 9. Loggerhead and hawksbill activity was higher in the northern subsections and the southern subsections were dominated by green activity.

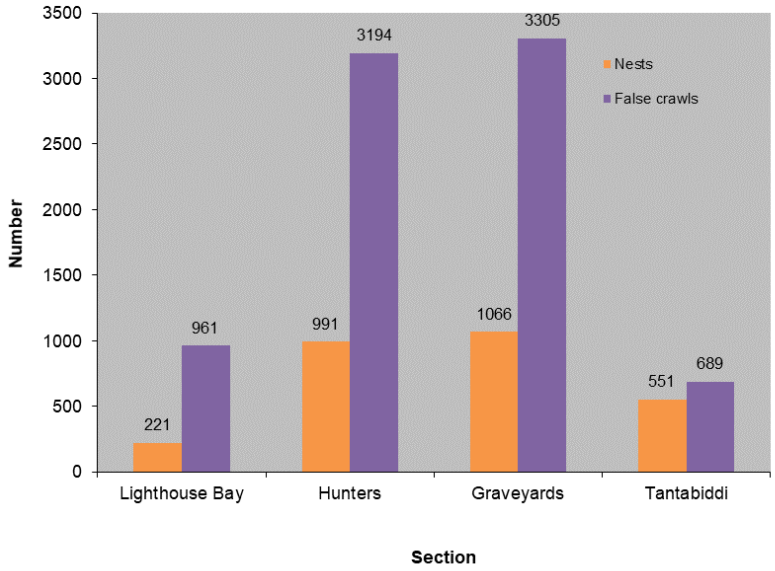

Figure 2: Nesting activity (nests and false crawls) for all species in each section of the North West Cape division, 2018-19 full season.

3.1.2 Cape Range division

335 suspected nests and 529 false crawls were recorded in the Bungelup section during the 2018-19 NTP season (Table 2). Loggerhead turtles were the most active (81.7%), followed by green (15.9%), hawksbill (2%), flatback (0.1%) and unidentified turtle species (0.3%) (Figure 3). Figure 4 shows the spread of activity between the 3 subsections at Bungelup and for individual nest locations see maps in Appendix 3. Consistent with previous years, the middle subsection of beach had the most activity.

Table 2: Total activities (suspected nests and false crawls) recorded for each species within the Cape Range division, NTP 2018-19 full season.

Cape Range division	Turtle Species					
	Green	Hawksbill	Loggerhead	Flatback	Unidentified	Total
New nests	47	6	278	1	3	335
False crawls	90	11	428	0	0	529
Total activity	137	17	706	1	3	864

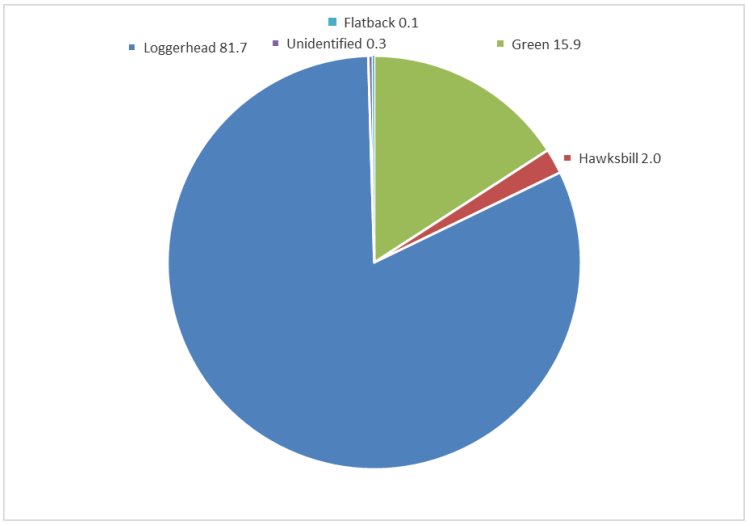

Figure 3: Percentage of turtle activity by species within the Cape Range division, 2018-19.

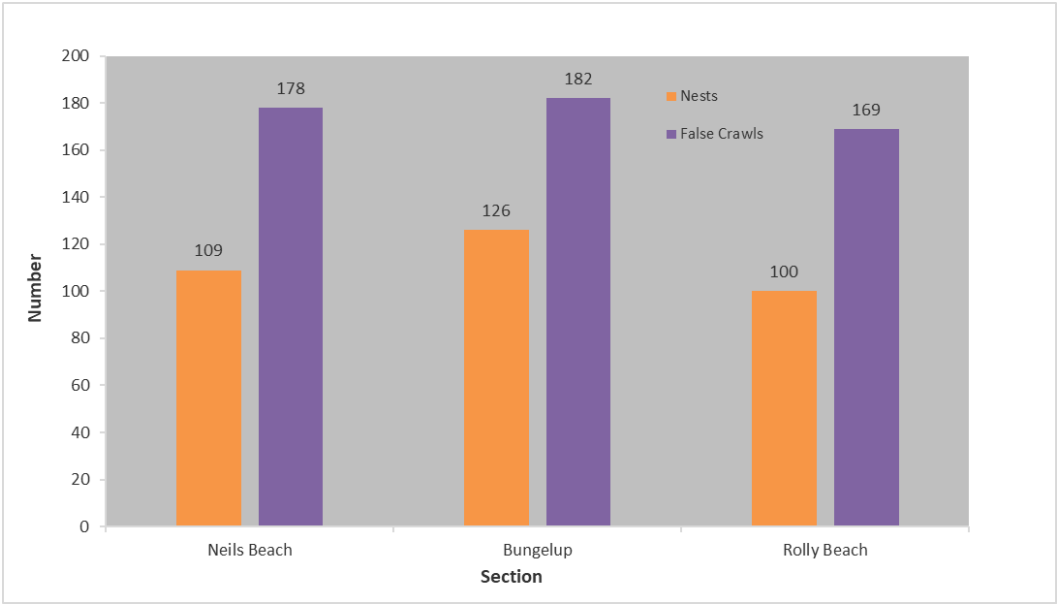

Figure 4: Numbers of suspected nests and false crawls within each Bungelup subsection (Cape Range division), 2018-19.

3.1.3 Ningaloo division

95 suspected nests and 246 false crawls were recorded in the Janes Bay and Whaleback Beach subsections in the 2018/19 monitoring (Table 3). Green turtles were the most active (57.5% of activities) followed by loggerheads (37.8%), hawksbills (3.2%) and unidentified species (1.5%) (Figure 5). There was a concentration of green turtle activity in the northern area of Janes Bay while most of the loggerhead activity was observed in the southern areas (Appendix 11).

Table 3: Total number of activities (suspected nests and false crawls) recorded for each species within the Bundera/Ningaloo division, 2018-19.

Bundera / Ningaloo division	Turtle Species				
	Green	Hawksbill	Loggerhead	Unidentified	Total
New nests	54	3	37	1	95
False crawls	142	8	92	4	246
Total activity	196	11	129	5	341

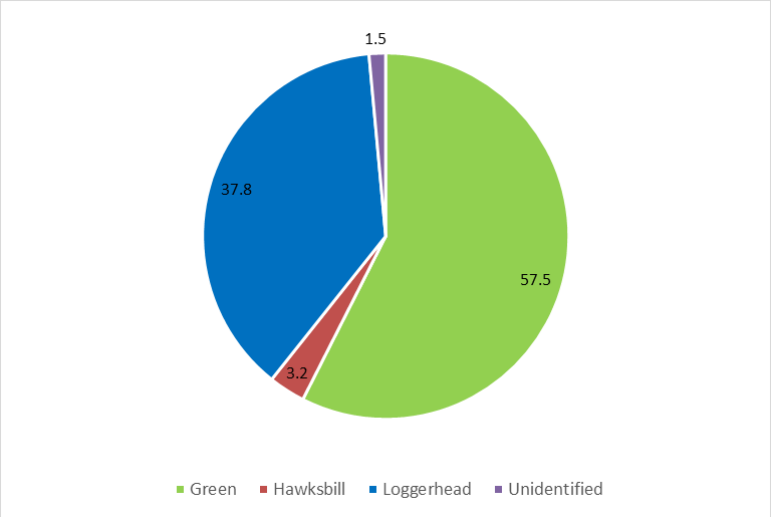

Figure 5: Percentage of activity by species within the Bundera/Ningaloo division in 2018-19.

3.1.4 Gnarraloo division

33 suspected nests and 14 false crawls were recorded in the Gnarraloo Bay subsection in 2018/19 (Table 4). 96% of the activity observed was from loggerhead turtles, with 1 false crawl left by a suspected hawksbill turtle and 1 from an undetermined species. 100% of nests were from loggerhead turtles.

Table 4: Total number of activities (suspected nests and false crawls) recorded for each species within the Gnarraloo division, 2018-19.

Gnarraloo division	Turtle Species			
	Loggerhead	Hawksbill	Unidentified	Total
New nests	33	0	0	33
False crawls	12	1	1	14
Total activity	45	1	1	47

Consistent with findings from previous monitoring (Hattingh et. al 2018), the majority of activity (66.7%) was between beach point 8 (BP8) and beach point 9 (BP9), in the northern area of Gnarraloo Bay (Appendix 12).

3.2 Long-term patterns of nesting – NW Cape and Cape Range divisions

NTP has recorded 57,229 suspected nests and 134,441 false crawls in total since commencement of the program in 2002 (full season data and all subsections included as per the survey effort in Appendix 1). Green turtles have been by far the most abundant species with 87% of activities, followed by loggerhead (10.7%), hawksbill (2%) and unidentified species (0.4%).

Estimates of activity for each season and subsection have been standardised using survey effort to compare activity among seasons. Survey effort is defined as the number of times each subsection was monitored. Not all subsections were monitored on the same days or for the same total number of days within or among seasons (Appendix 1).

From 2002/03 – 2018/19, within the standardised intensive peak monitoring period (NW Cape and Cape Range divisions only), NTP has recorded 33,337 nests and 83,204 false crawls (total activity 116,541). Average activity during the 2018-19 season was 3rd highest since 2002/03 (Figure 6) and 4th highest for numbers of nests (Figure 7). Activity and number of nests were above the long-term averages.

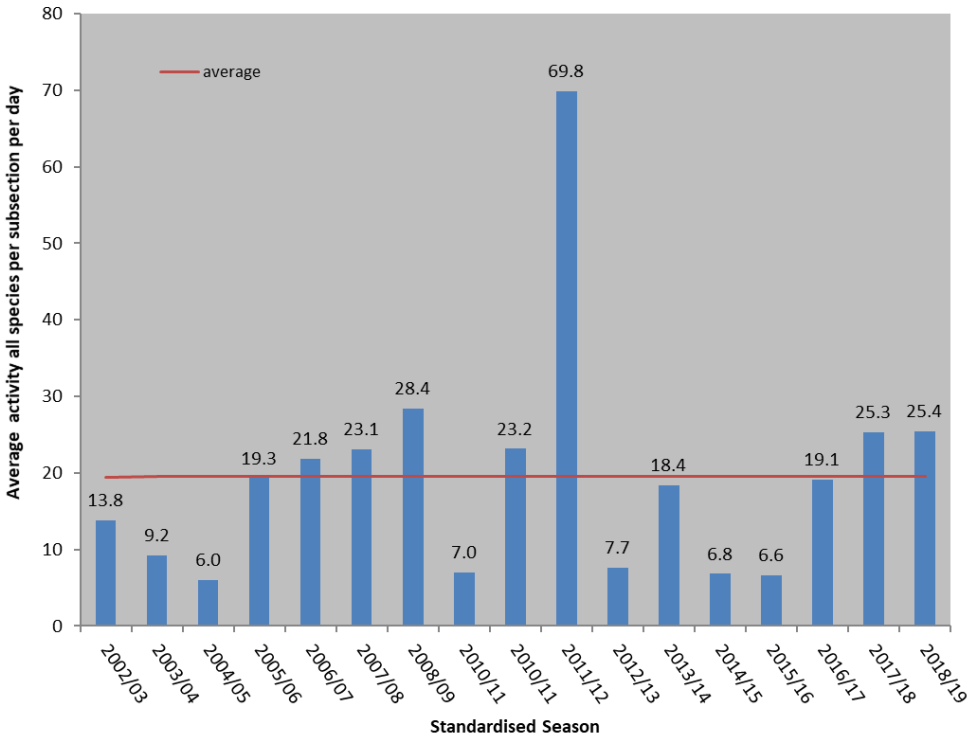

Figure 6: Turtle activity (nests and false crawls for all species) for each season standardised by survey effort during the intensive peak monitoring period (NW Cape and Cape Range divisions).

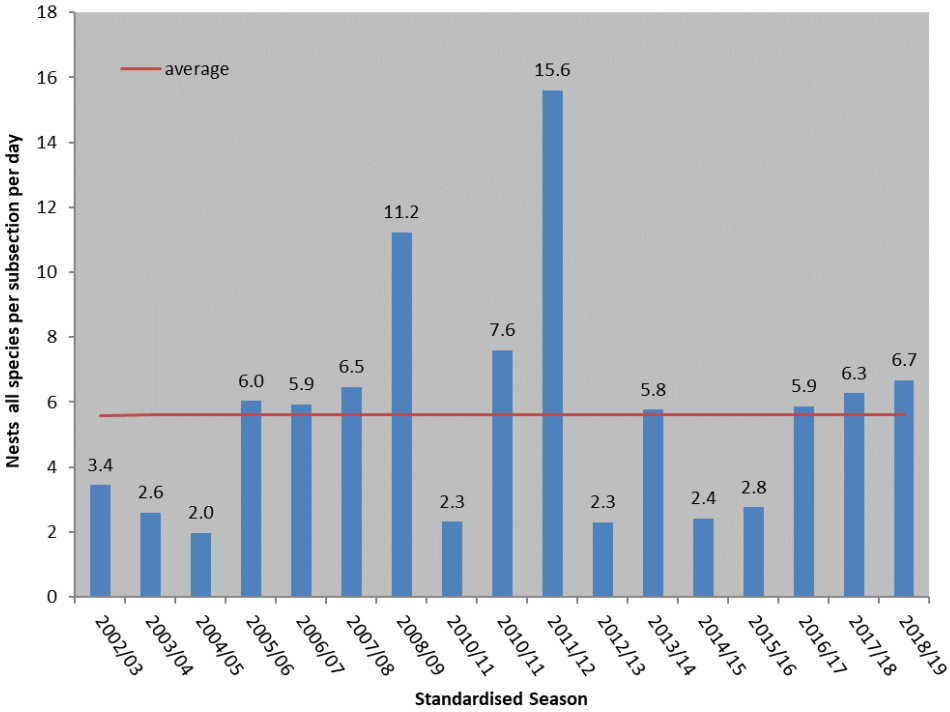

Figure 7: Nests (all species) for each season standardised by survey effort during the intensive peak monitoring period (NW Cape and Cape Range divisions).

Green turtles

Nesting activity by green turtles varies largely among years. When comparing standardised seasons, the levels of green turtle activity and nesting in 2018-19 were above average (Figure 8 & Figure 9).

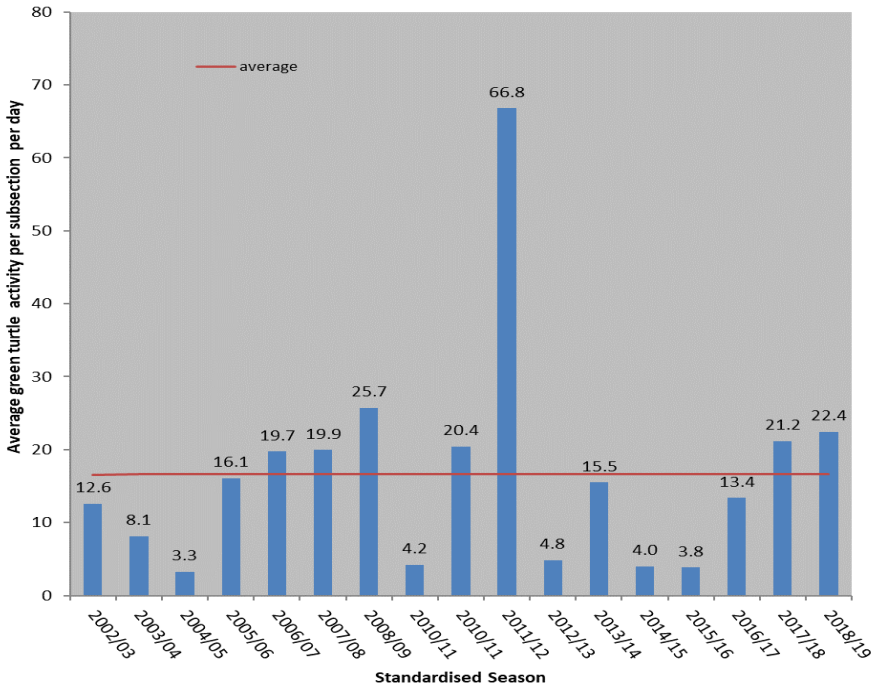

Figure 8: Green turtle activity (nests and false crawls) for each season standardised by survey effort during the intensive peak monitoring period.

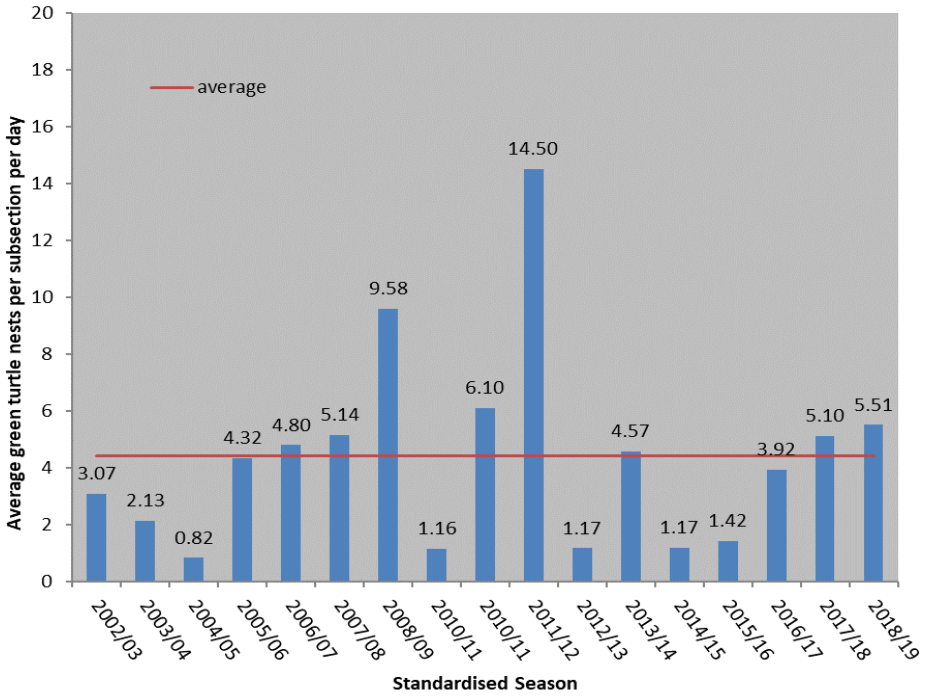

Figure 9: Green turtle nests for each season standardised by survey effort during the intensive peak monitoring period.

Hawksbill turtles

The standardised levels of hawksbill turtle activity and nesting during the 2018-19 season were below average in comparison to other seasons (Figure 10 & Figure 11).

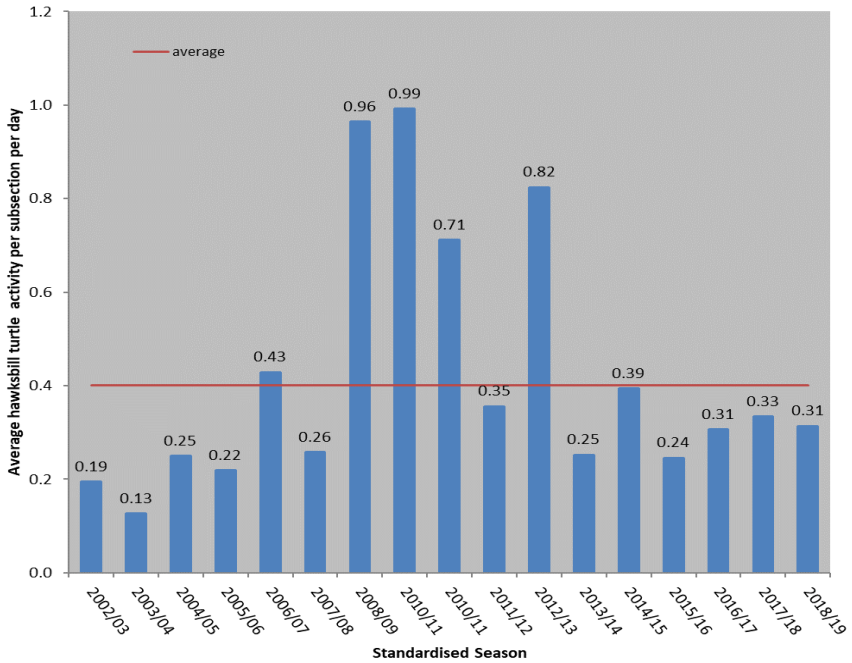

Figure 10: Hawksbill activity (false crawls and nests) for each season standardised by survey effort during the intensive peak monitoring period.

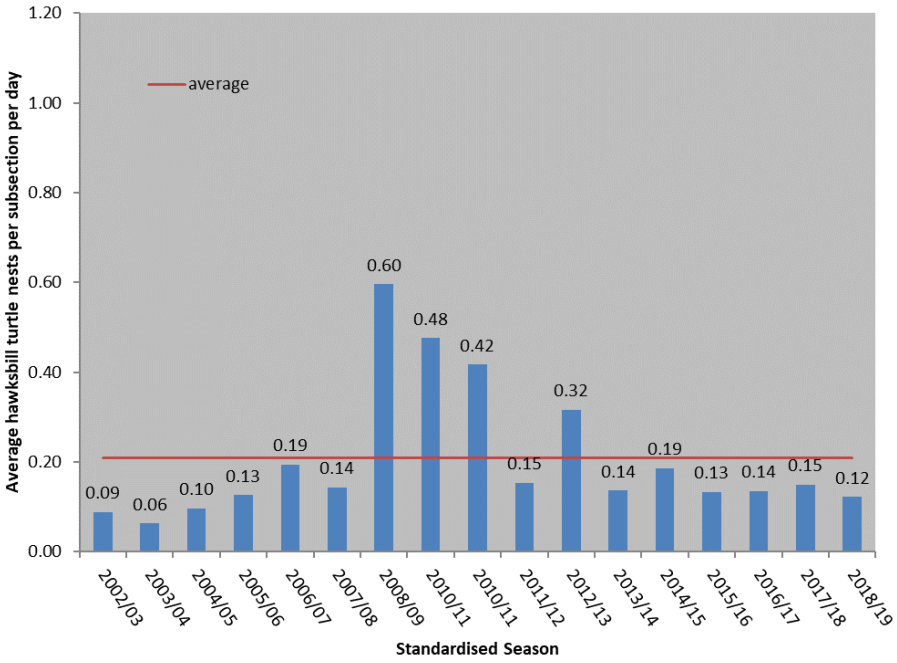

Figure 11: Hawksbill nests for each season standardised by survey effort during the intensive peak monitoring period.

Loggerhead turtles

The standardised levels of loggerhead turtle activity during the 2018-19 season were slightly above average (Figure 12). Standardised loggerhead nesting was close to the average since 2002/03 (Figure 13).

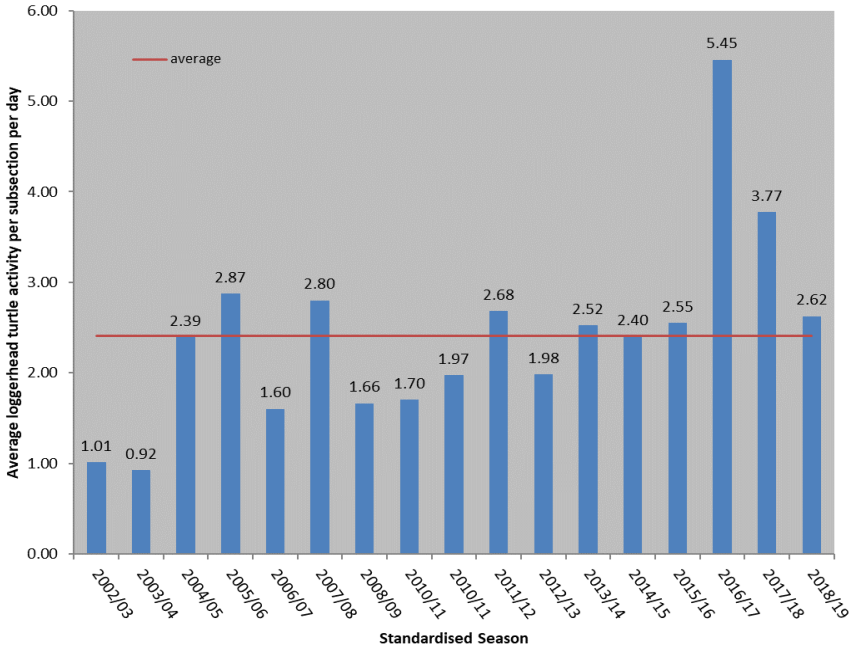

Figure 12: Loggerhead activity (false crawls and nests) for each season standardised by survey effort during the intensive peak monitoring period.

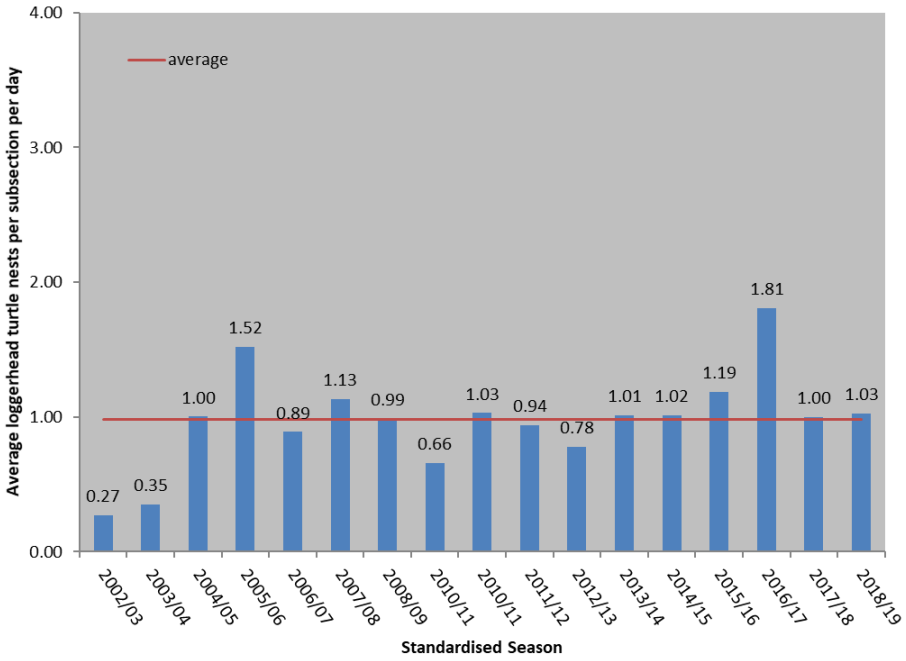

Figure 13: Loggerhead nests for each season standardised by survey effort during the intensive peak monitoring period.

3.3 Nesting success

Nesting success is defined as the number of suspected nests laid as a percentage of total turtle activities.

3.3.1 NW Cape and Cape Range

Nesting success for green turtles was 25.3% for the 2018-19 full season with 2733 nests and 8082 false crawls. Hawksbill (37.7%) and loggerhead turtles (39.7%) had higher nesting success than greens, with 63 nests and 104 false crawls for hawksbills and 481 nests and 730 false crawls for loggerheads (Appendix 1).

Patterns of nesting success of the three species fluctuate in synchrony among seasons (Whiting 2016), as shown in long-term patterns below.

Green turtles

Nesting success for green turtles is generally lower than those of loggerhead and hawksbill turtles. Nesting success for green turtles has ranged from a maximum of 37.3% in 2008-09 to a minimum of 21.7% in 2011-12 (Figure 14). Nesting success of 24.6% in the 2018-19 standardised season was just below the long term average of 27.5%.

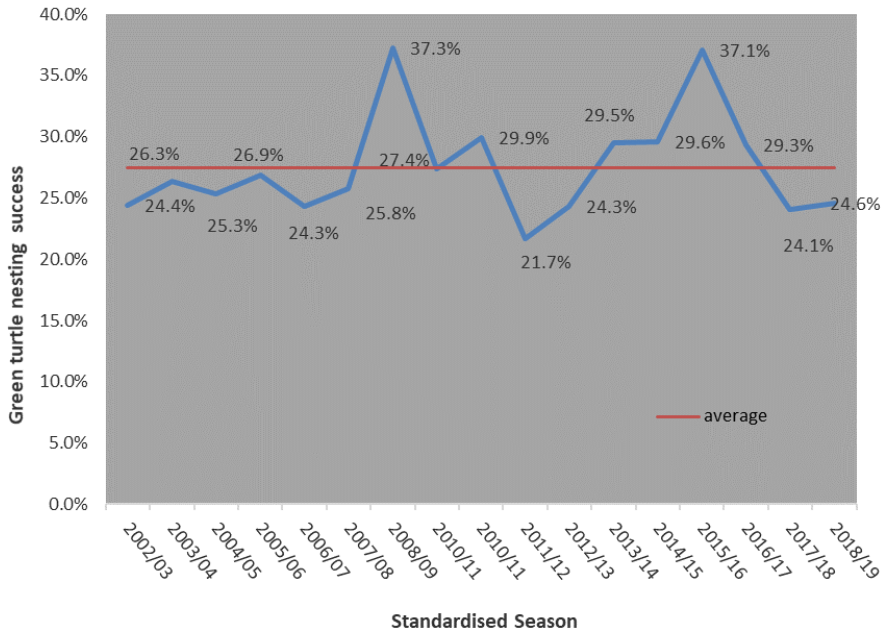

Figure 14: Nesting success (%) for green turtles during the intensive peak monitoring periods each season.

Hawksbill turtles

Nesting success for hawksbill turtles has ranged from a maximum of 61.9% in 2008-09 to a minimum of 38.4% in 2012-13 (Figure 15). Nesting success of 39% in the 2018-19 standardised season was well below the long-term average of 48.7% and nearly the lowest on record.

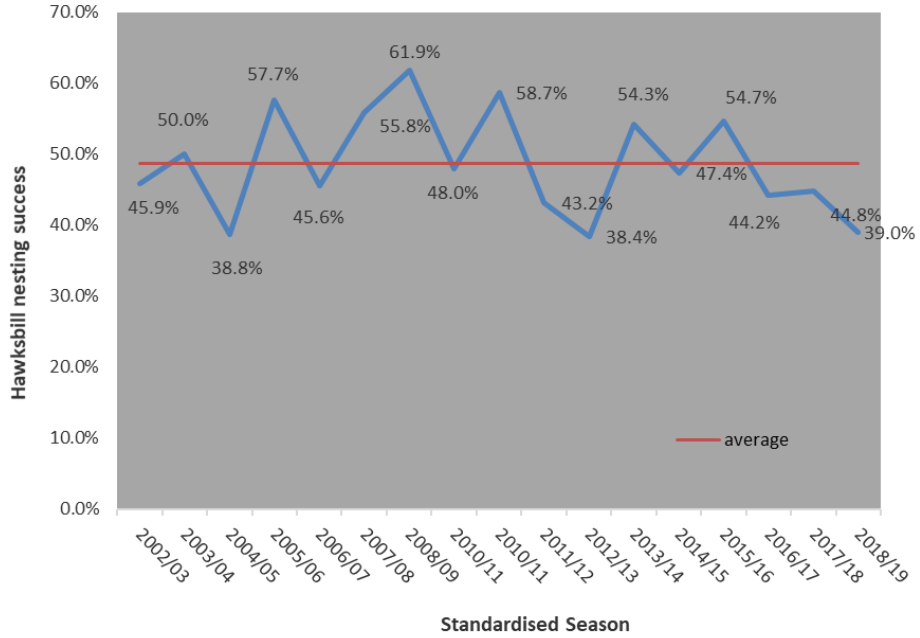

Figure 15: Nesting success (%) for hawksbill turtles during the intensive peak monitoring periods each season.

Loggerhead turtles

Nesting success for loggerhead turtles has ranged from a maximum of 59.5% in 2008-09 to a minimum of 26.5% in 2017-18 (Figure 16). Nesting success of 39.2% in the 2018-19 standardised season was higher than the previous record low year and just below average (41.7%).

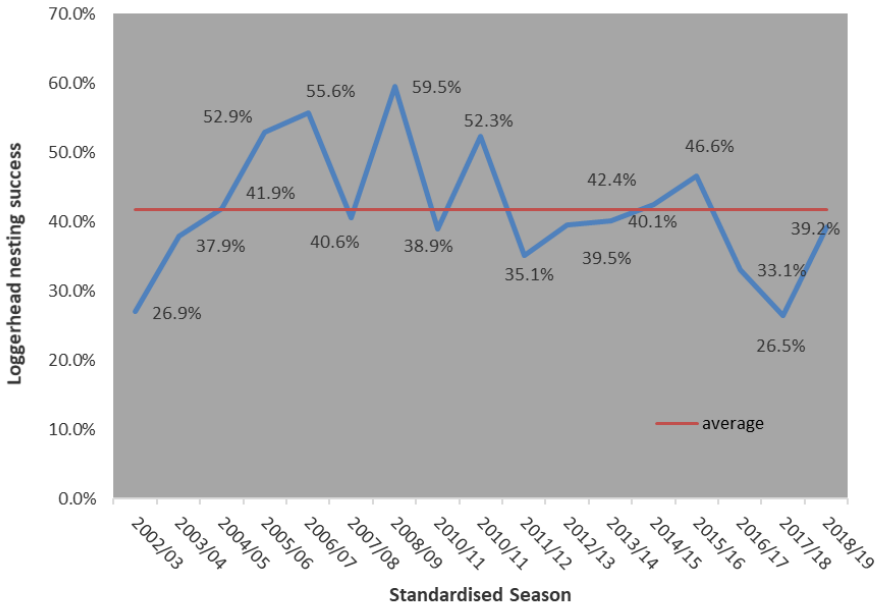

Figure 16: Nesting success (%) for loggerhead turtles during the intensive peak monitoring period each season.

3.3.2 Ningaloo division

Green turtles had a nesting success of 27.6%, which was very similar to the figures for both the NW Cape and Cape Range divisions for this season (25.3%) and the long-term average for these divisions (27.5%). However, hawksbill (27.3%) and loggerhead (28.7%) turtles had a substantially lower nesting success than recorded in the NW Cape and Cape Range divisions for this season (hawksbill 39% and loggerhead 39.2%). Their nesting success was also noticeably lower than the long-term averages at NW Cape and Cape Range (48.7% for hawksbills and 41.7% for loggerheads).

3.3.3 Gnarraloo division

Nesting success in Gnarraloo Bay was a lot higher for loggerheads than in all other NTP subsections at 73.3%. In comparison, the long-term average nesting success for loggerhead turtles in the NW Cape and Cape Range divisions is 41.7%.

3.4 Nest damage and predation

Seven new nests were recorded with damage in the 2018-19 full season in the NW Cape and Cape Range divisions (equating to 0.21% of total recorded nests)[3]. One of these nests was in the Cape Range division and 6 were located within the North West Cape division. Six were attributed to either ghost crabs, tidal inundation, a turtle accidentally excavating another turtle's nest or human disturbance. One disturbance was attributed to introduced predators (possibly a dog) or dingo[4].

In the Ningaloo division, no nests were recorded as being damaged or having any signs of predation. In the Gnarraloo division, one nest was recorded as being damaged by ghost crabs.

3.4.1 Presence of introduced species

Dogs and foxes are known to dig up turtle nests and eat the eggs. While feral cats can prey upon turtle hatchlings, they have not been observed nor are suspected to dig up nests (Lucy Clausen, 2019, *pers. comm*). NTP methodology includes volunteers recording the presence of prints and tracks from introduced species, to help inform targeted management efforts.

In 2018/19, volunteers recorded the tracks of dogs (10 of 11 subsections in NW Cape division, 3 of 3 subsections in the Cape Range division, 1 of 4 subsections in the Ningaloo division, and 2 of 3 subsections in the Gnarraloo division); cat (5 of the 11 subsections in NW Cape division, 3 of 4 subsections in the Ningaloo division) and fox (1 of the 11 subsections in NW Cape division, 2 of 4 subsections in the Ningaloo division).

Parks and Wildlife have recorded a reduction in predation of nests by introduced predators in recent years through a rigorous introduced predator control program including aerial and ground baiting and trapping (Figure 17).

[3] Only new nests (i.e. on first day of incubation period) are methodically checked for signs of disturbance. Damage to old nests (i.e. after the first day of the incubation period until hatching) is only recorded opportunistically if it is encountered whilst monitoring new nests. Therefore, it is likely that incidences of damaged nests go undetected.

[4] The term 'dog' used throughout this report refers to wild dog, domestic dog or dingo as species cannot be differentiated from prints. A wild or domestic dog is considered an introduced species whereas a dingo is not.

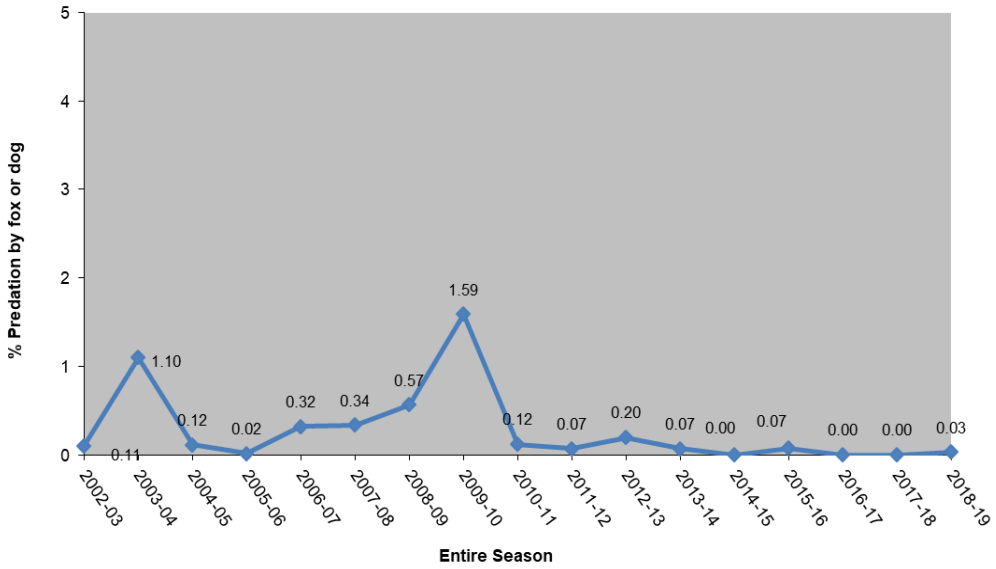

Figure 17: Percentage of new nests damaged by fox or dog per season, NW Cape and Cape Range divisions.

3.5 Other observations and data

3.5.1 Turtle mortalities

Turtle mortalities have been recorded as part of NTP since 2007-08 (Figure 18). Four turtle mortalities were recorded by NTP volunteers during the 2018-19 season in the NW Cape and Cape Range divisions. A further 11 dead turtles were recorded in the Ningaloo division (Janes Bay subsections).

Turtle mortalities have fluctuated greatly over the seasons, with the highest number recorded in 2011-12, which coincides with the highest level of turtle activity recorded since the commencement of the program. Mortalities recorded by Parks and Wildlife staff outside of the NTP season, or on beaches not monitored as part of NTP are not reported here.

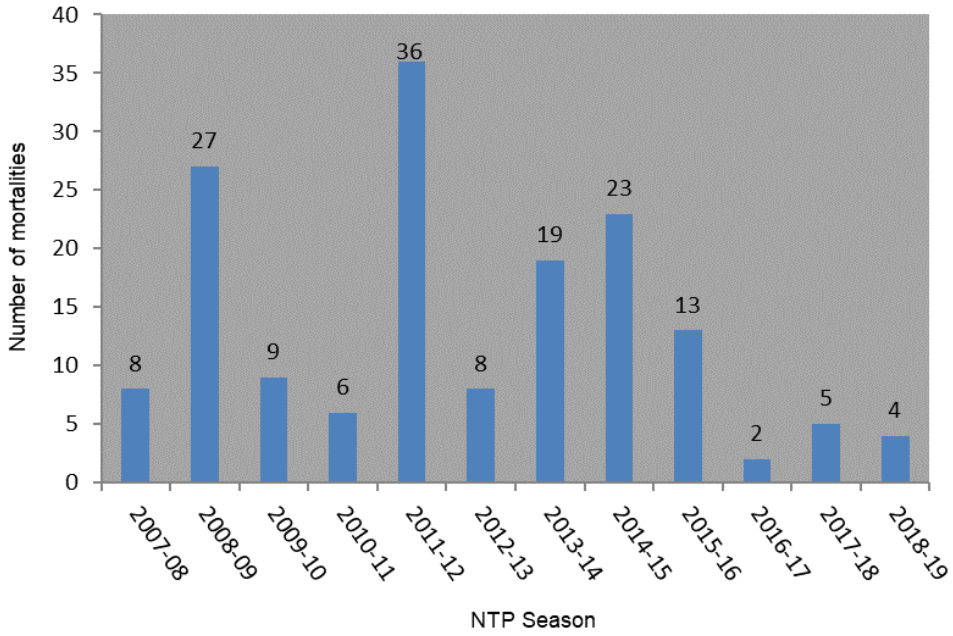

Figure 18: Turtle mortalities recorded during the NTP per season, from NW Cape and Cape Range divisions.

3.5.2 Rescues of stranded turtles

Twenty turtles were rescued during the 2018-19 monitoring by NTP volunteers and staff, seventeen in the NW Cape and Cape Range divisions and three in the Ningaloo division (Janes Bay subsections). 276 stranded marine turtles have been rescued since the program began in 2002-03. The number of turtles rescued varies among seasons and rescues done outside of the NTP monitoring are not reported here, e.g. Parks and Wildlife staff routinely "flip" stranded turtles that have been turned over by the waves on the shoreline while patrolling remote beaches.

3.5.3 Re-sightings of tagged turtles

Four tagged turtles were re-sighted during the 2018-19 season by NTP volunteers (Table 5).

Table 5: Tagged turtle re-sighting details during NTP 2018-19 season.

Tag	Species	Gender	Date tagged	Location tagged	Location resighted	Date resighted
WA28874	Green	Female	1996	Five mile	Five mile north	29/11/2018
WA18530	Green	Female	1992	Wobiri	Jacobsz	10/12/2018
WB19969	Green	Female	8/12/2018	Mauritius	Mauritius	29/12/2018
WB16440	Green	Female	6/1/2019	Trisel	Five mile to Trisel	26/1/2019

3.5.4 Weather events

Beaches surveyed in the Ningaloo Turtle Program are susceptible to seasonal weather events such as cyclones, storm surges and flooding. These can significantly affect turtle nests and available nesting habitat and the program's ability to monitor. During the 2018-19 season there were no significant weather events and no disturbance to monitoring.

4.0 ACKNOWLEDGEMENTS

The NTP is conducted on the traditional lands of the Baiyungu, Thalanyji and Yinikurtura People. We recognise their traditional custodial role and continued support for turtle conservation. *Bujurrba nhuna majunjarri nyinggulubarndi* – looking after turtles in Nyinggulu.

Thank you to the local NTP volunteers from the Exmouth community, the external volunteers recruited nationally and internationally and the team leaders and media intern. The program would not be able to function without the significant contribution of time, effort, passion and enthusiasm that these volunteers contribute.

Thanks to the Cape Conservation Group Inc. for their continued passion and support for the program, and Roland Mau, Susie Bedford and David Waayers, for the development and implementation of the original 2001-2002 NTP pilot program.

Thank you to Woodside Energy Ltd for the ongoing funding contribution to the operational costs of the Ningaloo Turtle Program.

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6.0 APPENDICES

Appendix 1: Survey effort and turtle activity raw data

Survey effort* 2002/03 – 2018/19 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	2018/19	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	10/11/18-24/02/2019	
Division	Section																		
North West Cape	Graveyards	165	375	374	368	341	336	234	160	153	144	162	172	185	193	174	171	154	**3861**
	Hunters	248	263	271	271	256	252	173	117	114	109	111	117	120	123	111	121	116	**2893**
	Lighthouse Bay	127	137	215	260	222	251	147	83	93	97	106	113	113	119	106	100	115	**2404**
	Navy Pier	-	86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**86**
	Tantabiddi	115	3	-	85	86	84	58	38	37	36	41	38	43	41	39	41	39	**824**
Cape Range	Bloodwood	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**4**
	Bungelup	1	49	152	114	120	140	124	72	87	91	78	114	91	85	82	81	81	**1562**
	Turquoise Bay	-	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**16**
	Boat Harbour	-	-	203	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**203**
Bundera/ Ningaloo	Carbaddaman	7	-	204	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**211**
	Janes Bay	13	24	12	29	22	4	-	-	-	-	-	-	-	-	-	-	17	**121**
	Norwegian Bay	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**3**
	Whaleback Beach	-	7	8	-	-	-	-	-	-	-	-	-	-	-	-	-	17	**32**
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**
Gnaraloo	Gnarraloo Bay	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17	**17**
Total survey effort		**940**	**1265**	**1738**	**1278**	**1199**	**1161**	**804**	**470**	**484**	**477**	**498**	**554**	**552**	**561**	**512**	**514**	**556**	**13563**
Number subsections monitored		22	29	28	20	19	19	18	14	14	14	14	14	14	14	14	14	17	**298**

* Survey effort is defined as the number of times each subsection was monitored. These are totalled for each section.

Turtle activity 2002/03 – 2018/19 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	2018/19	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	10/11/18-24/02/2019	
Green nests	1539	1552	788	4695	4349	5254	6297	571	2732	6594	585	2276	628	759	1856	2518	2733	**45726**
Green false crawls	5404	3086	2533	9948	14395	13156	12608	1451	6507	22865	1769	4960	1465	1357	4243	7306	8082	**121135**
Green activity	6943	4638	3321	14643	18744	18410	18905	2022	9239	29459	2354	7236	2093	2116	6099	9824	10815	**166861**
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**	**4.73**	**13.06**	**3.79**	**3.77**	**11.91**	**19.11**	**19.45**	**14.14**
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%	25.3%	**28.2%**
Hawksbill nests	48	81	100	108	157	156	336	202	189	65	125	69	91	75	67	70	63	**2002**
Hawksbill false crawls	49	60	139	71	153	145	207	202	132	84	192	51	108	65	89	99	104	**1950**
Hawksbill activity	97	141	239	179	310	301	543	404	321	149	317	120	199	140	156	169	167	**3952**
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**	**0.30**	**0.35**
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%	37.7%	**49.7%**
Loggerhead nests	288	387	777	1068	540	795	580	288	405	382	304	430	436	519	696	392	481	**8768**
Loggerhead false crawls	429	359	1040	925	477	954	486	471	388	715	466	595	580	583	1395	1086	730	**11679**
Loggerhead activity	717	746	1817	1993	1017	1749	1066	759	793	1097	770	1025	1016	1102	2091	1478	1211	**20447**
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**	**2.18**	**1.74**
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%	33.3%	26.5%	39.7%	**43.3%**
Unidentified nests	29	123	59	42	33	61	38	8	18	7	7	20	19	4	7	6	12	**493**
Unidentified false crawls	44	20	82	45	19	29	12	8	9	4	12	17	14	3	3	7	17	**345**
Unidentifed activity	73	143	141	87	52	90	50	16	27	11	19	37	33	7	10	13	29	**838**
Unidentifed 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%	41.4%	**55.5%**
Total all species nests	1904	2180	1724	5913	5279	6266	7252	1069	3343	7049	1023	2795	1174	1357	2626	2986	3289	**57229**
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**	**2.05**	**5.05**	**2.13**	**2.42**	**5.13**	**5.81**	**5.92**	**4.74**
Total all species false crawls	**5925**	**3536**	**3794**	**10989**	**15044**	**14284**	**13314**	**1451**	**7038**	**23668**	**2439**	**5623**	**2167**	**2008**	**5730**	**8498**	**8933**	**134441**
Total activity	**7829**	**5716**	**5518**	**16902**	**20323**	**20550**	**20566**	**2520**	**10381**	**30717**	**3462**	**8418**	**3341**	**3365**	**8356**	**11484**	**12222**	**191670**
Total turtle activity adjusted by survey effort per day	**8.3**	**4.5**	**3.2**	**13.2**	**16.9**	**17.7**	**25.6**	**5.4**	**21.4**	**64.4**	**7.0**	**15.2**	**6.1**	**6.0**	**16.3**	**22.3**	**22.0**	

Survey effort* 2002/03 – 2018/19 standardised season

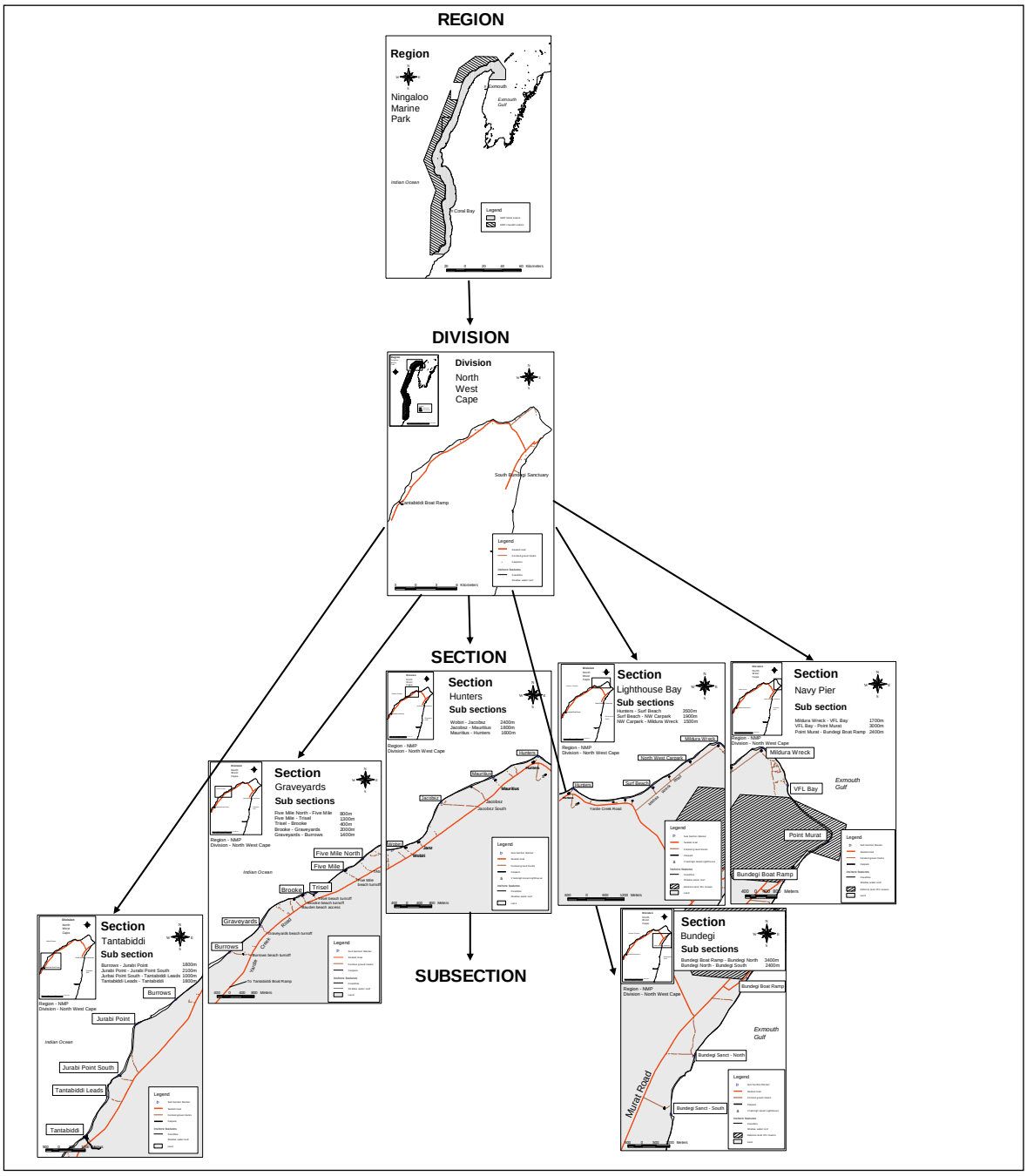
Standardised season		2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	TOTAL
Survey Dates intensive peak period monitoring dates		16/12/02-12/01/03	15/12/03-11/01/04	20/12/04 - 16/01/05	19/12/05 - 15/01/06	18/12/06 - 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	17/12/18-13/01/19	
Division	Section																		
North West Cape	Graveyards	57	100	112	107	100	100	96	70	108	112	104	108	112	112	107	108	108	1721
	Hunters	72	78	84	81	75	75	72	50	81	84	78	81	84	84	78	81	81	1319
	Lighthouse Bay	53	34	56	77	75	75	72	39	77	84	78	81	84	83	78	80	81	1207
	Tantabiddi	9	-	-	27	25	25	24	17	27	28	26	27	28	28	28	27	27	373
Cape Range	Bungelup	0	11	71	66	69	60	60	30	79	84	75	78	84	82	79	80	81	1089
Total survey effort		**191**	**223**	**323**	**358**	**344**	**335**	**324**	**206**	**372**	**392**	**361**	**375**	**392**	**389**	**370**	**376**	**378**	**5709**
Number subsections monitored		11	12	12	14	14	14	14	14	14	14	14	14	14	14	14	14	14	

* Survey effort is defined as the number of times each subsection was monitored. These are totalled for each section.

Turtle activity 2002/03 – 2018/19 standardised season

Standardised 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	2018/19	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	17/12/18-13/01/19	
Green new nests	587	475	266	1548	1650	1721	3103	239	2270	5683	422	1714	459	554	1449	1919	2082	26141
Green new nests adjusted by survey effort per day	**3.07**	**2.13**	**0.82**	**4.32**	**4.80**	**5.14**	**9.58**	**1.16**	**6.10**	**14.50**	**1.17**	**4.57**	**1.17**	**1.42**	**3.92**	**5.10**	**5.51**	**4.38**
Green false crawls	1821	1328	785	4217	5138	4959	5226	634	5322	20501	1314	4098	1092	939	3495	6051	6397	73317
Green activity	2408	1803	1051	5765	6788	6680	8329	873	7592	26184	1736	5812	1551	1493	4944	7970	8479	99458
Green activity adjusted by survey effort per day	**12.61**	**8.09**	**3.25**	**16.10**	**19.73**	**19.94**	**25.71**	**4.24**	**20.41**	**66.80**	**4.81**	**15.50**	**3.96**	**3.84**	**13.36**	**21.20**	**22.43**	**16.59**
Green nesting success %	24.4%	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%	24.6%	27.5%
Hawksbill new nests	17	14	31	45	67	48	193	98	155	60	114	51	73	52	50	56	46	1170
Hawksbill new nests adjusted by survey effort	**0.09**	**0.06**	**0.10**	**0.13**	**0.19**	**0.14**	**0.60**	**0.48**	**0.42**	**0.15**	**0.32**	**0.14**	**0.19**	**0.13**	**0.14**	**0.15**	**0.12**	**0.21**
Hawksbill false crawls	20	14	49	33	80	38	119	106	109	79	183	43	81	43	63	69	72	1201
Hawksbill activity	37	28	80	78	147	86	312	204	264	139	297	94	154	95	113	125	118	2371
Hawsbill activity adjusted by survey effort per day	**0.19**	**0.13**	**0.25**	**0.22**	**0.43**	**0.26**	**0.96**	**0.99**	**0.71**	**0.35**	**0.82**	**0.25**	**0.39**	**0.24**	**0.31**	**0.33**	**0.31**	**0.42**
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%	39.0%	48.7%
Loggerhead new nests	52	78	324	544	306	380	320	136	383	368	282	379	398	462	668	375	388	5843
Loggerhead new nests adjusted by survey effort per	**0.27**	**0.35**	**1.00**	**1.52**	**0.89**	**1.13**	**0.99**	**0.66**	**1.03**	**0.94**	**0.78**	**1.01**	**1.02**	**1.19**	**1.81**	**1.00**	**1.03**	**0.98**
Loggerhead false crawls	141	128	449	484	244	557	218	214	349	681	432	566	541	530	1350	1042	603	8529
Loggerhead activity	193	206	773	1028	550	937	538	350	732	1049	714	945	939	992	2018	1417	991	14372
Loggerhead activity adjusted by survey effort per	**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**	**2.62**	**2.41**
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%	39.2%	41.7%
Unidentified new nests	1	10	14	21	13	17	21	3	15	3	6	16	19	4	6	5	7	181
Unidentified new nests adjusted by survey effort	0.01	0.04	0.04	0.06	0.04	0.05	0.06	0.01	0.04	0.01	0.02	0.04	0.05	0.01	0.02	0.01	0.02	0.03
Unidentified false crawls	2	7	36	18	9	12	7	3	9	4	9	17	11	1	3	4	4	156
Unidentified activity	3	17	50	39	22	29	28	6	24	7	15	33	30	5	9	9	11	337
Unidentified activity adjusted by survey effort per day	0.02	0.08	0.15	0.11	0.06	0.09	0.09	0.03	0.06	0.02	0.04	0.09	0.08	0.01	0.02	0.02	0.03	0.06
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%	63.6%	55.3%
Flatback new nests	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	4
Flatback false crawls	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	4	5
Flatback activity	0	0	0	0	0	0	1	0	0	0	2	0	0	0	0	0	6	9
Flatback activity adjusted by survey effort	0	0	0	0	0	0	0.00	0	0	0	0.01	0	0	0	0	0	0.02	
Flatback nesting success	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	100.0%	n/a	n/a	n/a	n/a	n/a	33.3%	
Total new nests (all species)	657	577	635	2158	2036	2166	3637	476	2823	6114	826	2160	949	1072	2173	2355	2523	33337
Total new nests (all species) adjusted by survey effort per day	3.44	2.59	1.97	6.03	5.92	6.47	11.23	2.31	7.59	15.60	2.29	5.76	2.42	2.76	5.87	6.26	6.67	5.60
Total false crawls (all species)	1984	1477	1319	4752	5471	5566	5571	957	5789	21265	1938	4724	1725	1513	4911	7166	7076	83204
Total activity	2641	2054	1954	6910	7507	7732	9208	1433	8612	27379	2764	6884	2674	2585	7084	9521	9599	116541
Total turtle activity adjusted by survey effort per day	**13.8**	**9.2**	**6.0**	**19.3**	**21.8**	**23.1**	**28.4**	**7.0**	**23.2**	**69.8**	**7.7**	**18.4**	**6.8**	**6.6**	**19.1**	**25.3**	**25.4**	

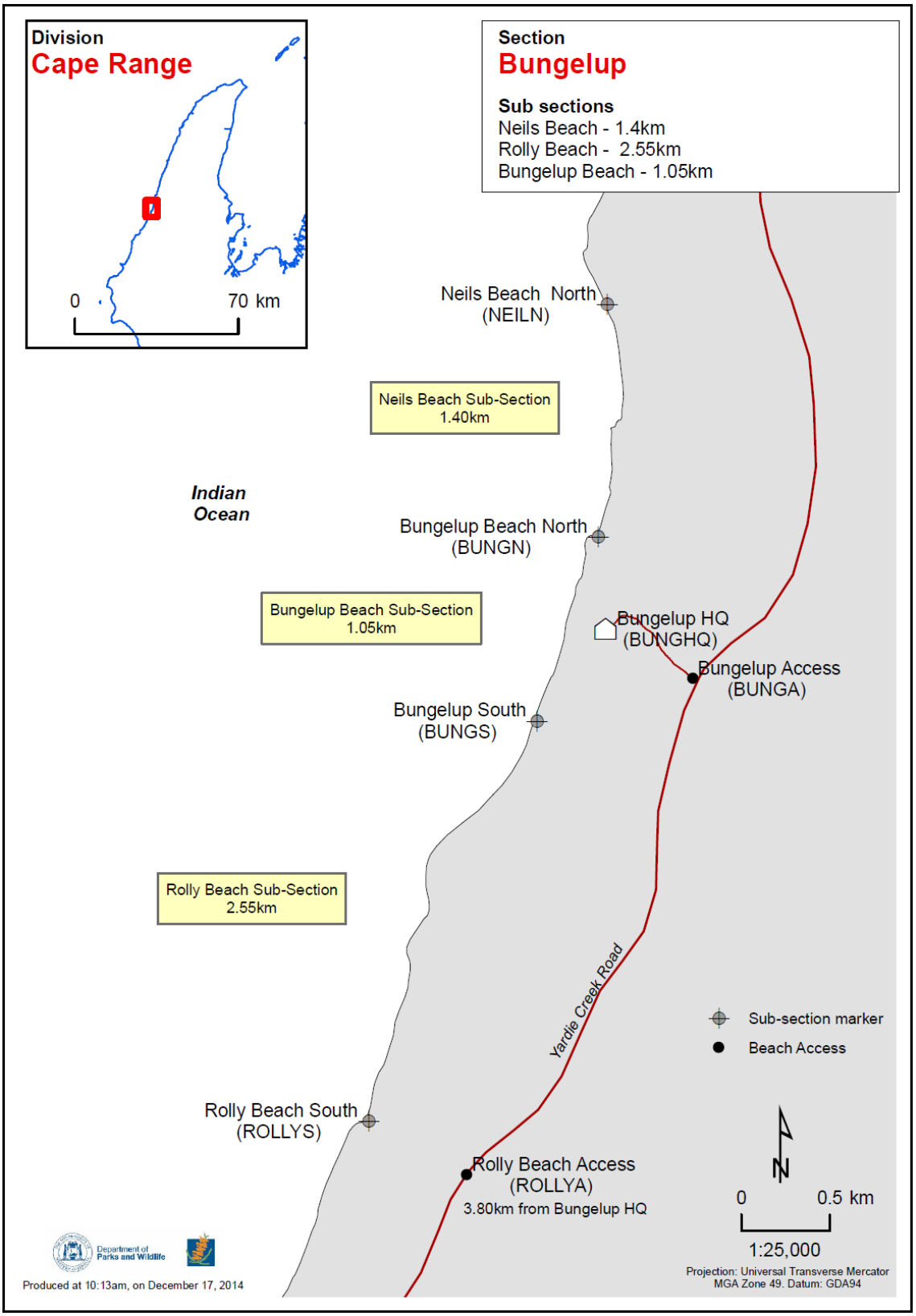
Appendix 2: Zoning and subsection details NW Cape division.



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

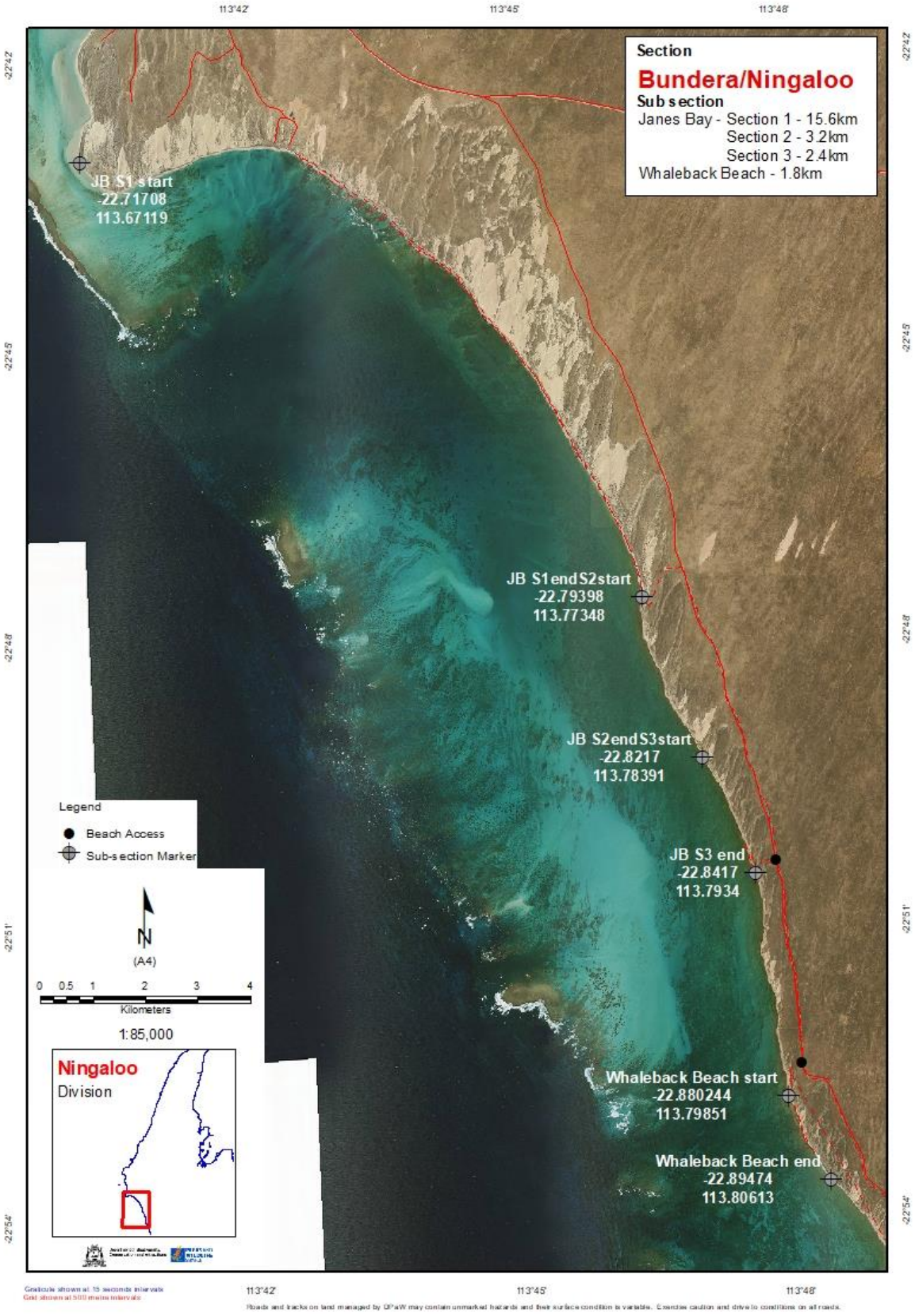
Appendix 3: Zoning and subsection details Cape Range division.



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	1050
Bungelup Beach South – Rolly Beach South	22.28613 S; 113.8292 E	22.30650 S; 113.82062 E	2550

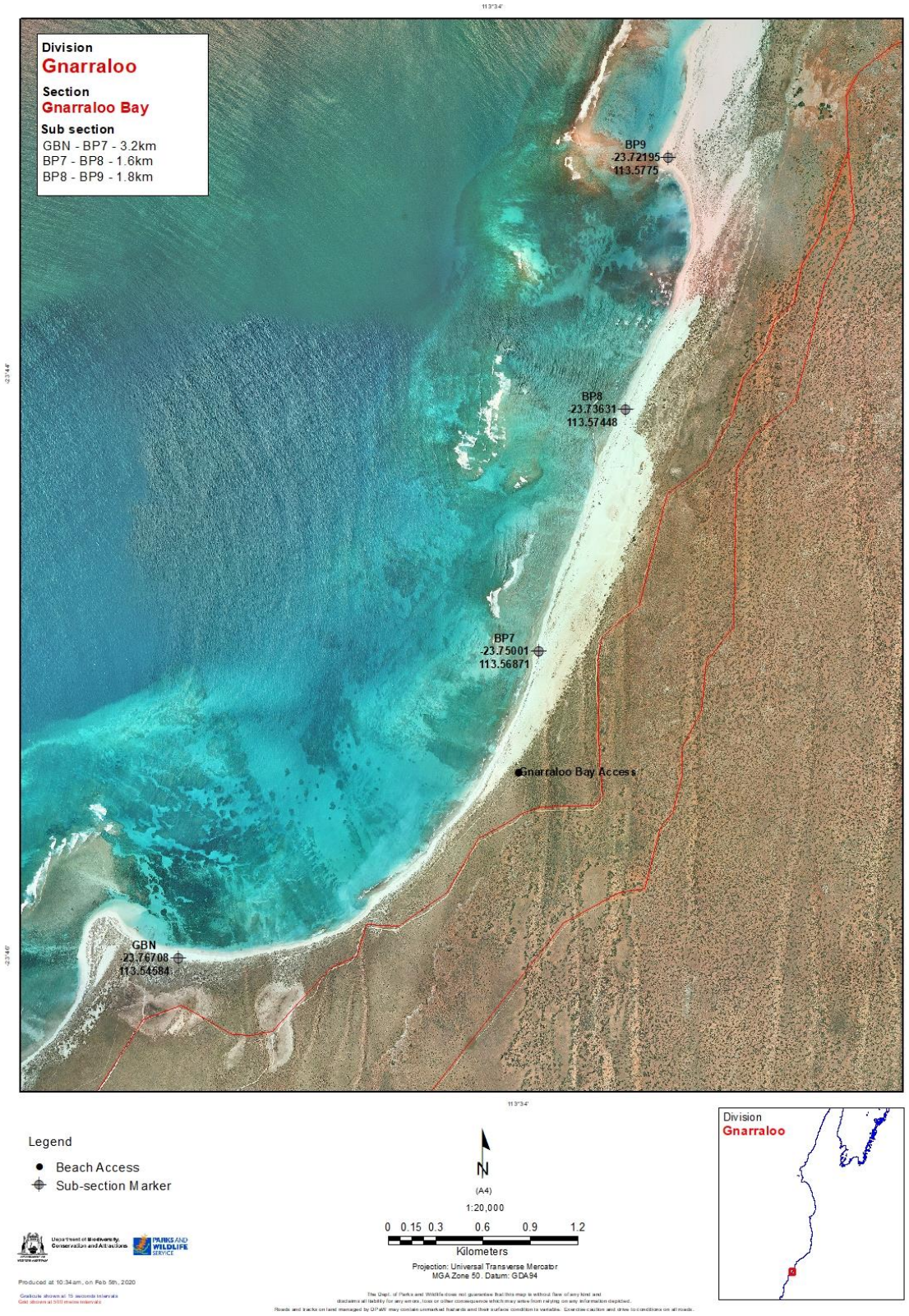
Appendix 4: Zoning and subsection details Bundera/Ningaloo division (Janes Bay and Whaleback sections)



Location and distance of each subsection within Janes Bay section.

Subsection	Location of northern totem	Location of southern totem	Distance (km)
Janes Bay subsection 1	22.71708 S; 113.67119 E	22.79398 S; 113.77348 E	15.6
Janes Bay subsection 2	22.79398 S; 113.77348 E	22.8217 S; 113.78391 E	3.2
Janes Bay subsection 3	22.8217 S; 113.78391 E	22.8417 S; 113.7934 E	2.4
Whaleback Beach	22.88024 S; 113.79851	22.89474 S; 113.80613 E	1.8

Appendix 5: Zoning and subsection details Gnarraloo division



Location and distance of each subsection within Gnarraloo division.

Subsection	Location of northern totem	Location of southern totem	Distance (km)
BP9 – BP8	23.72195 S; 113.5775 E	23.73631 S; 113.57448 E	3.2
BP8 – BP7	23.73631 S; 113.57448 E	23.75001 S; 113.56871 E	1.6
BP7 - GBN	23.75001 S; 113.56871 E	23.76708 S; 113.54584 E	1.8

Appendix 6: Lighthouse Bay section - New nests (NTP 2018-19) Map 1 & 2

Note: Locations of some nests in the figure may vary from actual locations due to occasional inaccuracies in the GPS. Inaccuracies are considered unlikely to affect illustrations of overall patterns of nesting across the section.


114°6'36"E
114°7'12"E
114°7'48"E
114°8'24"E
21°48'0"S
21°48'36"S
Hunters
Surf Beach
Ningaloo Turtle Program
2018-2019 (new nests)
LIGHTHOUSE SECTION
Map 2 of 2
Legend
Subsection locations
Turtle Nests 2019
Green
Hawksbill
Loggerhead
Unidentified
Flatback
N
(A4)
1:17,500
0 100 200 300 400 m
Projection: MGA Zone 49
Datum: GDA94
NORTH WEST CAPE
EXMOUTH
Department of Biodiversity,
Conservation and Attractions
Job Ref: NTP
Produced at 11:36 AM on March 25, 2020
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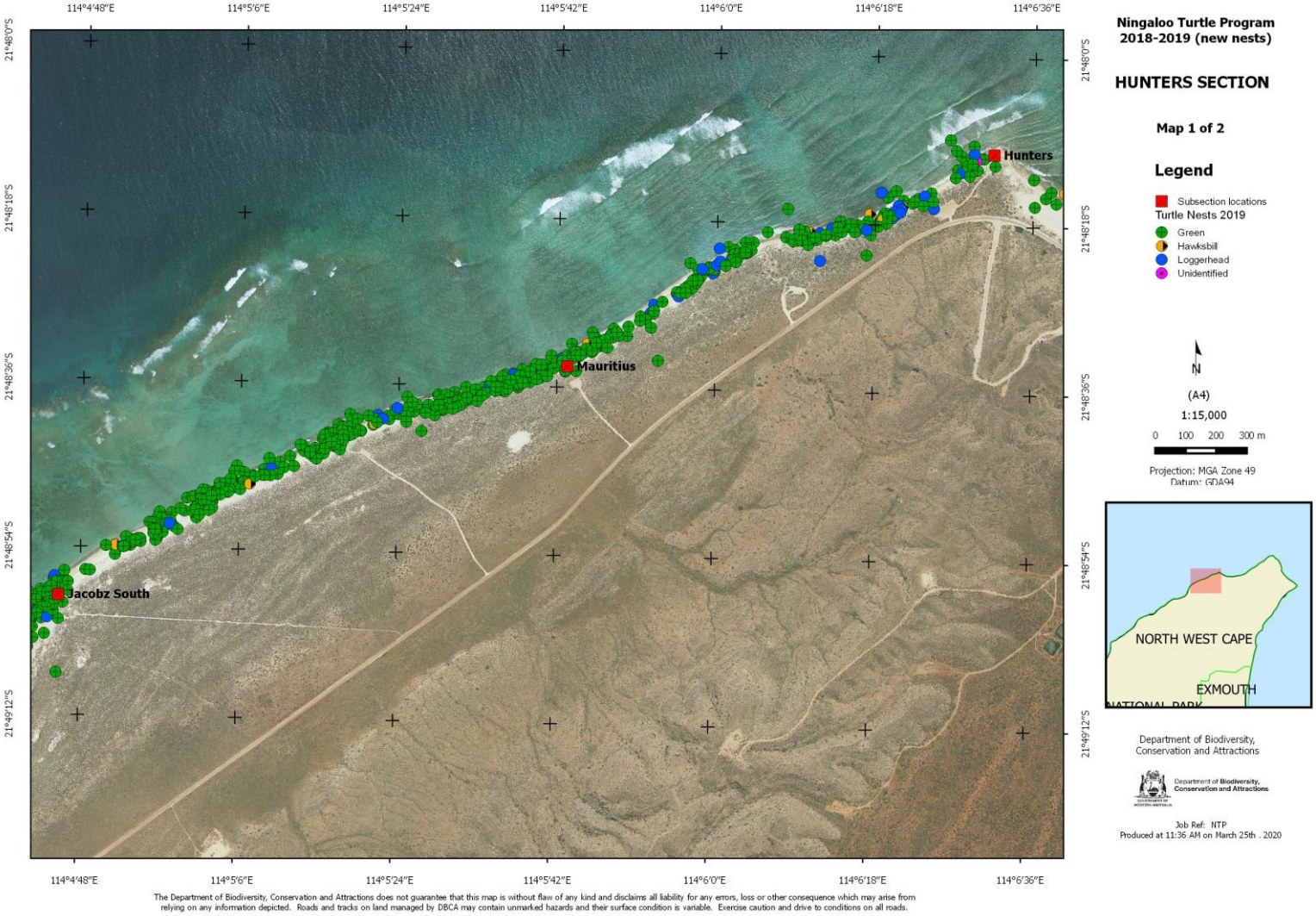
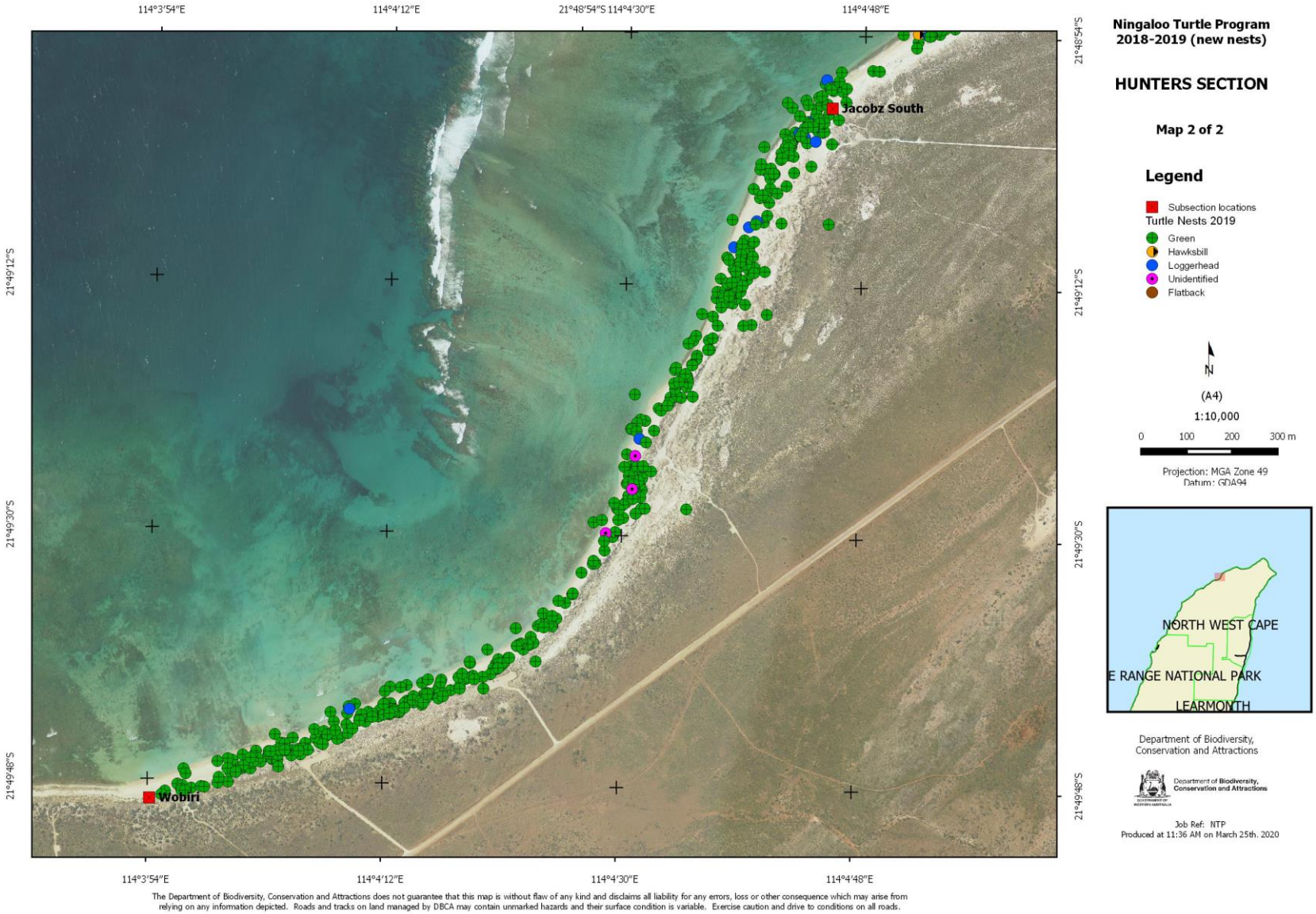
Appendix 7: Hunters section - New nests (NTP 2018-19) Map 1 & 2

Note: Locations of some nests in the figure may vary from actual locations due to occasional inaccuracies in the GPS. Inaccuracies are considered unlikely to affect illustrations of overall patterns of nesting across the section.




114°3'54"E
114°4'12"E
21°48'54"S 114°4'30"E
114°4'48"E
21°48'54"S
21°49'12"S
21°49'30"S
21°49'48"S
Jacobz South
Wobiri
114°3'54"E
114°4'12"E
114°4'30"E
114°4'48"E
Ningaloo Turtle Program
2018-2019 (new nests)
HUNTERS SECTION
Map 2 of 2
Legend
Subsection locations
Turtle Nests 2019
Green
Hawksbill
Loggerhead
Unidentified
Flatback
N
(A4)
1:10,000
0 100 200 300 m
Projection: MGA Zone 49
Datum: GDA94
NORTH WEST CAPE
E RANGE NATIONAL PARK
LEARMONTH
Department of Biodiversity,
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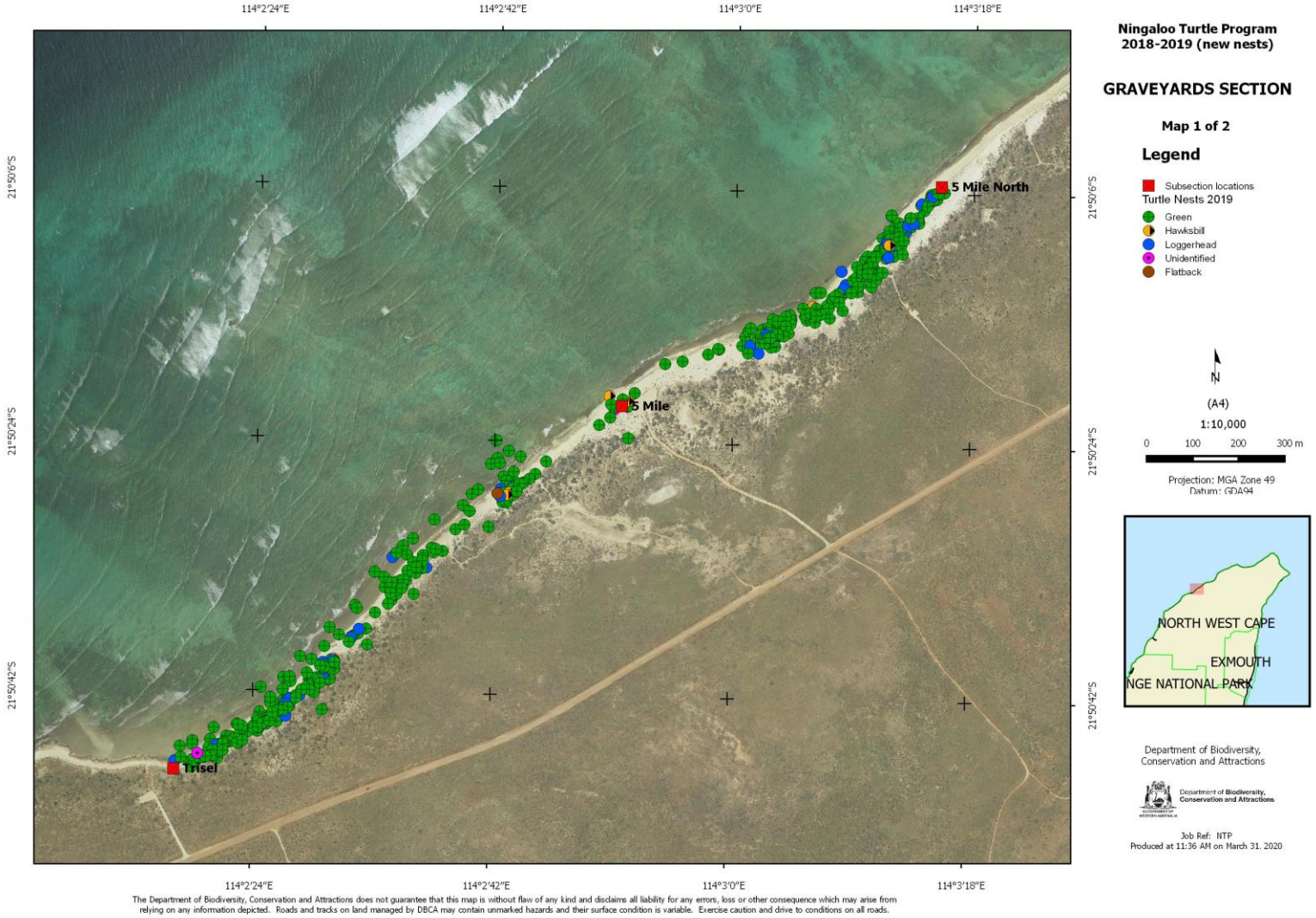
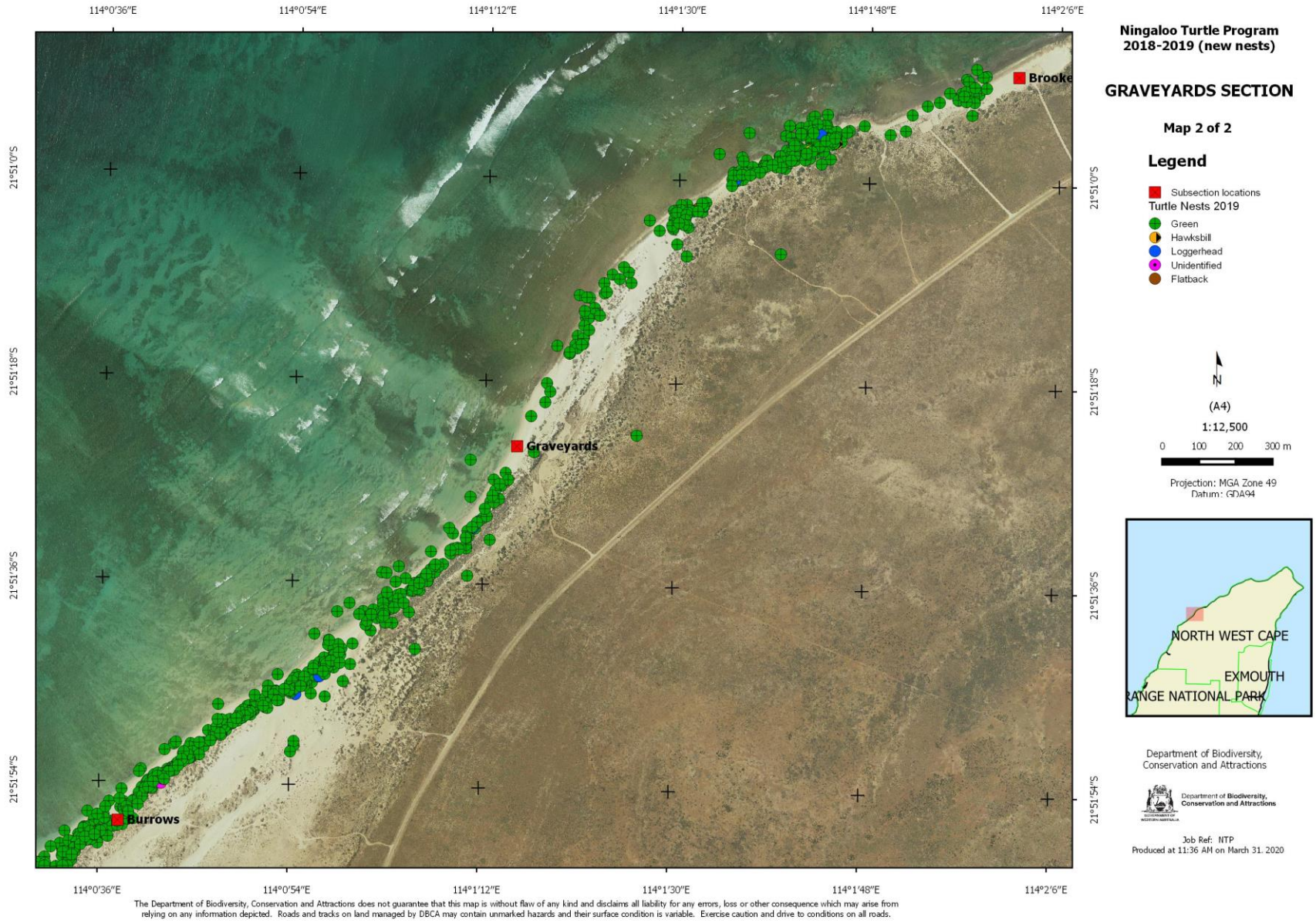
Appendix 8: Graveyards section - New nests (NTP 2018-19) Map 1 & 2

Note: Locations of some nests in the figure may vary from actual locations due to occasional inaccuracies in the GPS. Inaccuracies are considered unlikely to affect illustrations of overall patterns of nesting across the section.




114°0'36"E
114°0'54"E
114°1'12"E
114°1'30"E
114°1'48"E
114°2'6"E
21°51'0"S
21°51'18"S
21°51'36"S
21°51'54"S
Brooke
Graveyards
Burrows
Ningaloo Turtle Program
2018-2019 (new nests)
GRAVEYARDS SECTION
Map 2 of 2
Legend
Subsection locations
Turtle Nests 2019
Green
Hawksbill
Loggerhead
Unidentified
Flatback
N
(A4)
1:12,500
0 100 200 300 m
Projection: MGA Zone 49
Datum: GDA94
NORTH WEST CAPE
EXMOUTH
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Conservation and Attractions
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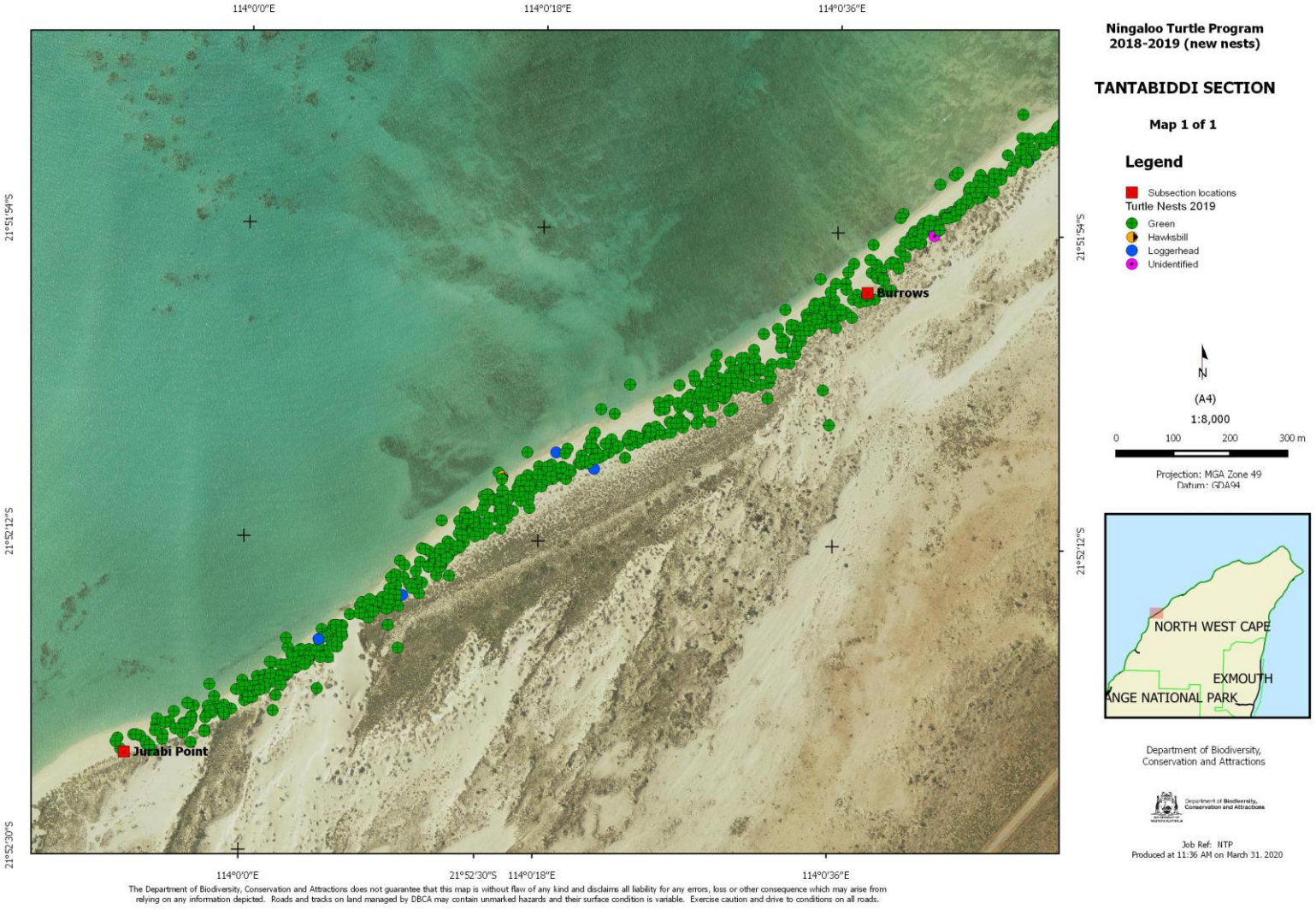
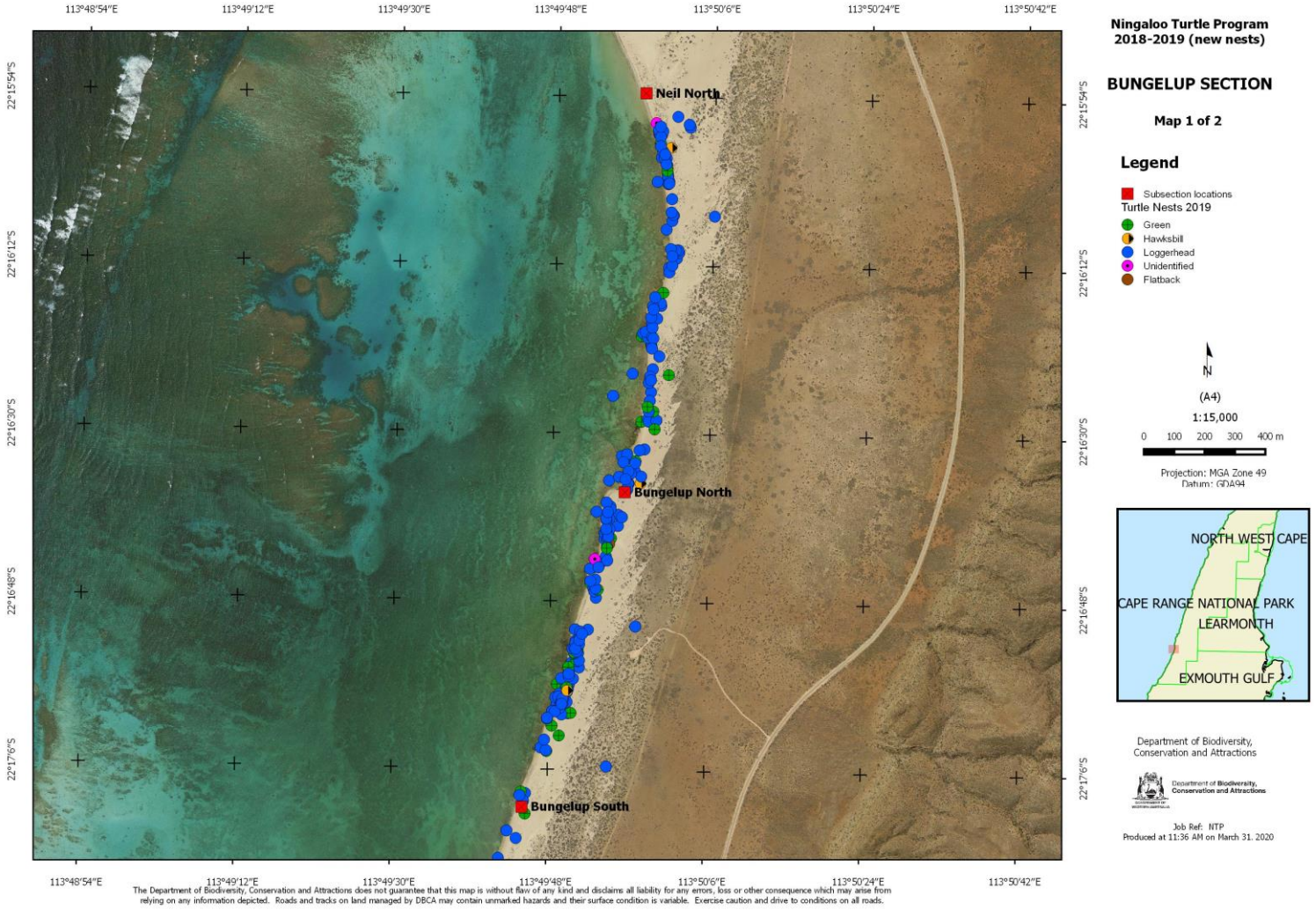
Appendix 9: Tantabiddi section - New nests (NTP 2018-19) Map 1

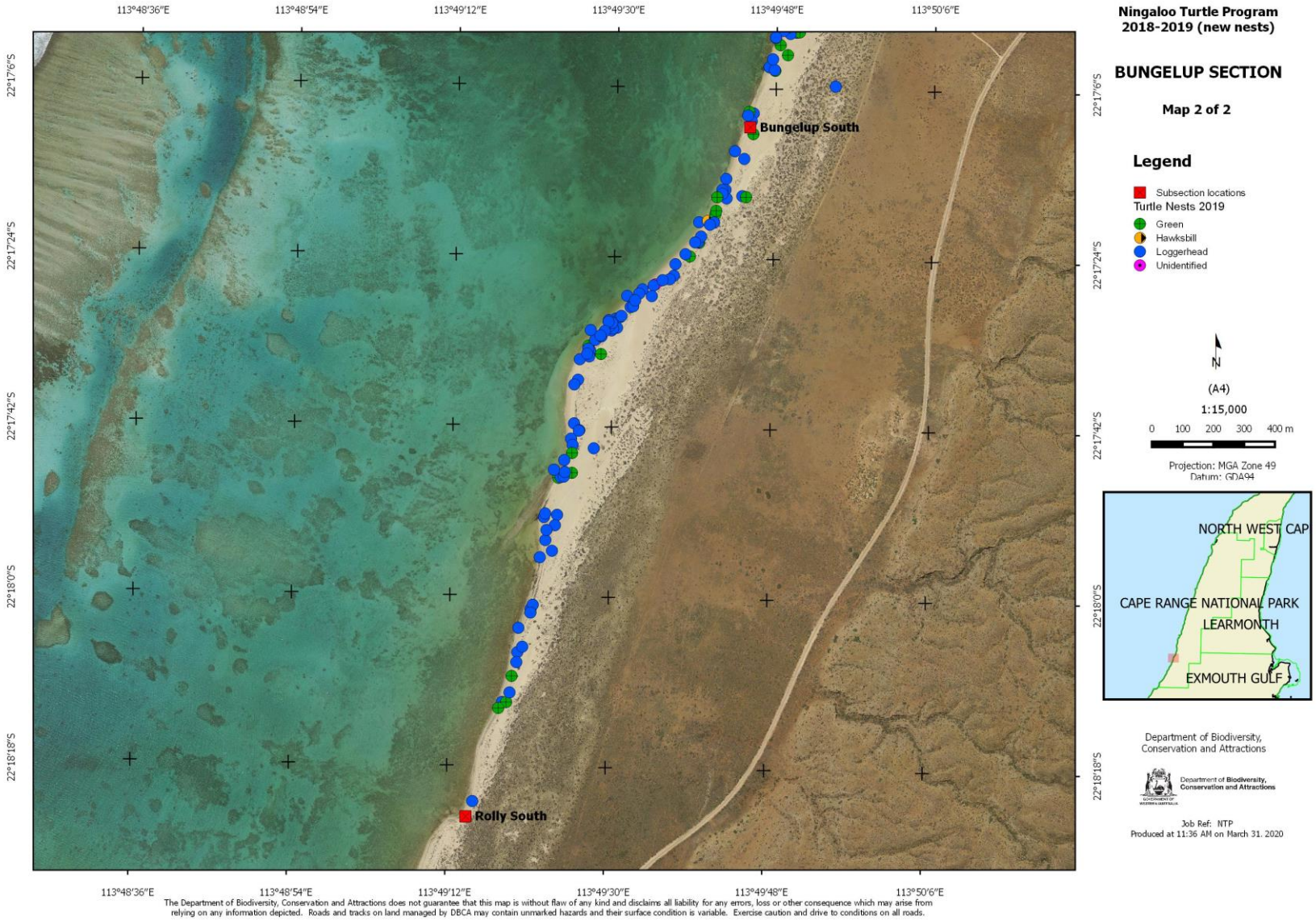
Note: Locations of some nests in the figure may vary from actual locations due to occasional inaccuracies in the GPS. Inaccuracies are considered unlikely to affect illustrations of overall patterns of nesting across the section.



Appendix 10: Bungelup section - New nests (NTP 2018-19) Map 1 & 2

Note: Locations of some nests in the figure may vary from actual locations due to occasional inaccuracies in the GPS. Inaccuracies are considered unlikely to affect illustrations of overall patterns of nesting across the section.




113°48'36"E
113°48'54"E
113°49'12"E
113°49'30"E
113°49'48"E
113°50'6"E
22°17'6"S
22°17'24"S
22°17'42"S
22°18'0"S
22°18'18"S
Bungelup South
Rolly South
Ningaloo Turtle Program
2018-2019 (new nests)
BUNGELUP SECTION
Map 2 of 2
Legend
Subsection locations
Turtle Nests 2019
Green
Hawksbill
Loggerhead
Unidentified
N
(A4)
1:15,000
0 100 200 300 400 m
Projection: MGA Zone 49
Datum: GDA94
NORTH WEST CAP
CAPE RANGE NATIONAL PARK
LEARMONTH
EXMOUTH GULF
Department of Biodiversity,
Conservation and Attractions
Department of Biodiversity, Conservation and Attractions
Job Ref: NTP
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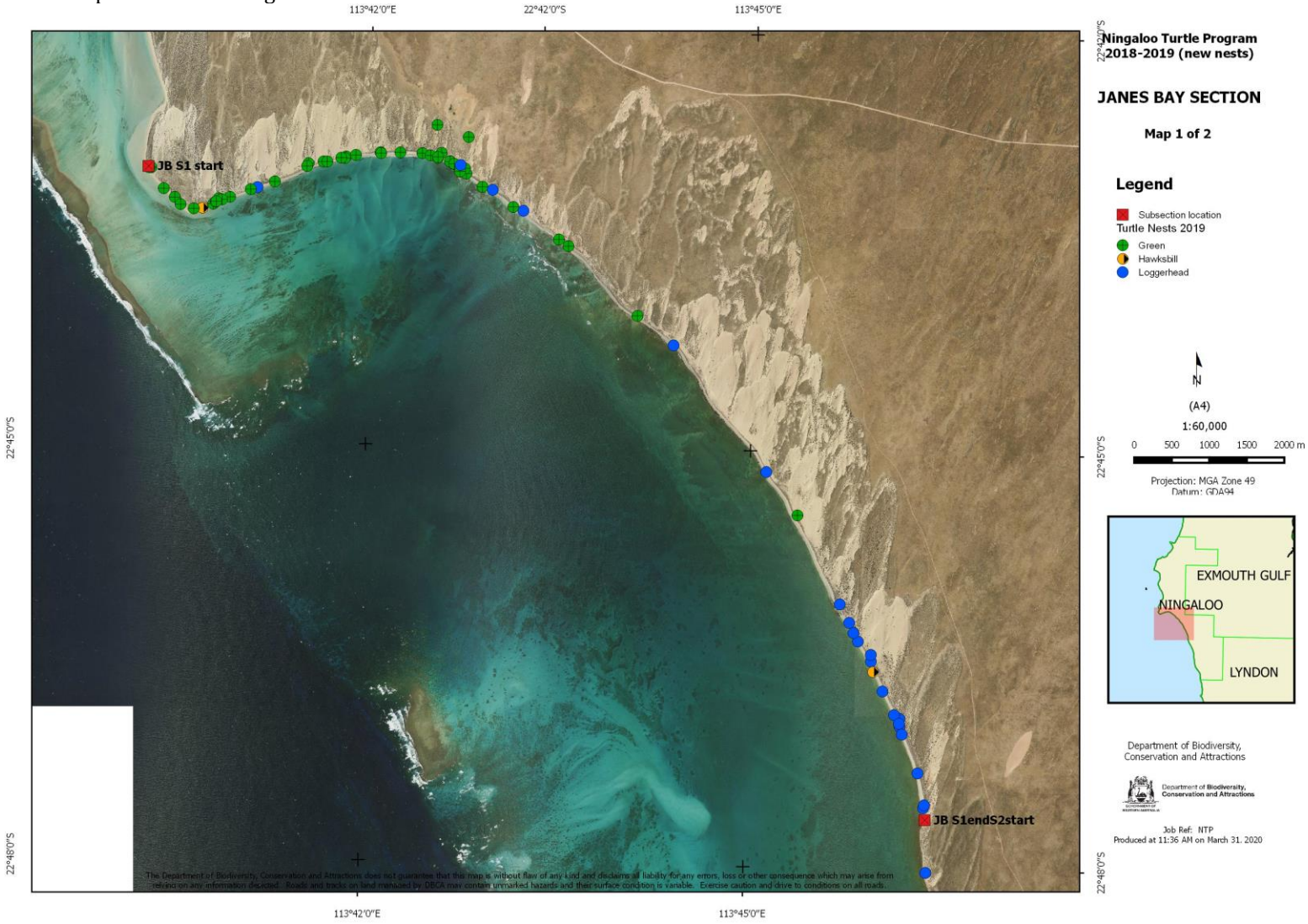
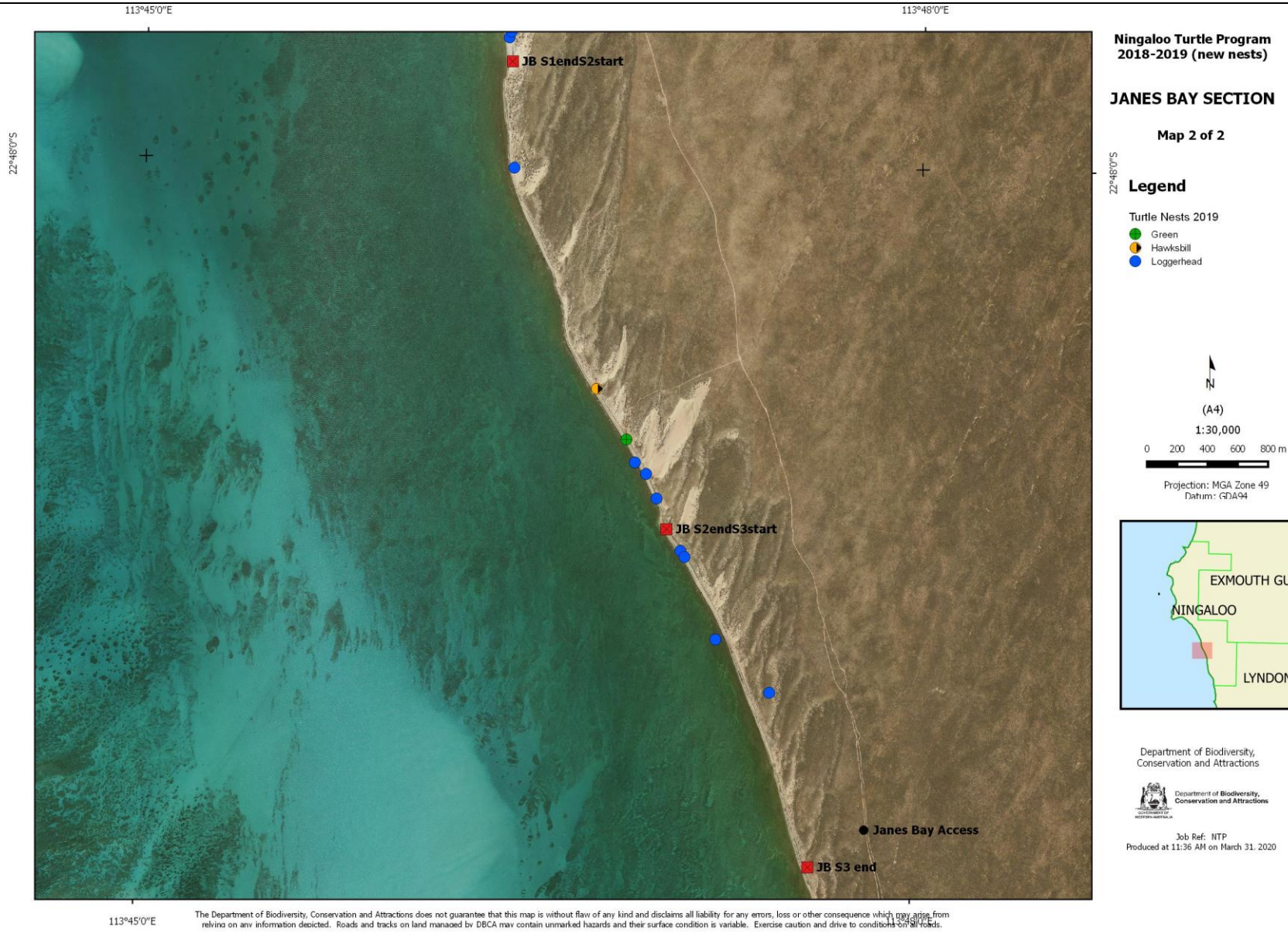
Appendix 11: Janes Bay section – New nests (NTP 2018-19) Map 1 & 2 and Whaleback section Map 1

Note: Locations of some nests in the figure may vary from actual locations due to occasional inaccuracies in the GPS. Inaccuracies are considered unlikely to affect illustrations of overall patterns of nesting across the section.




113°45'0"E
113°48'0"E
22°48'0"S
JB S1endS2start
JB S2endS3start
JB S3 end
Janes Bay Access
Ningaloo Turtle Program
2018-2019 (new nests)
JANES BAY SECTION
Map 2 of 2
Legend
Turtle Nests 2019
Green
Hawksbill
Loggerhead
N
(A4)
1:30,000
0 200 400 600 800 m
Projection: MGA Zone 49
Datum: GDA94
EXMOUTH GULF
NINGALOO
LYNDON
Department of Biodiversity, Conservation and Attractions
Job Ref: NTP
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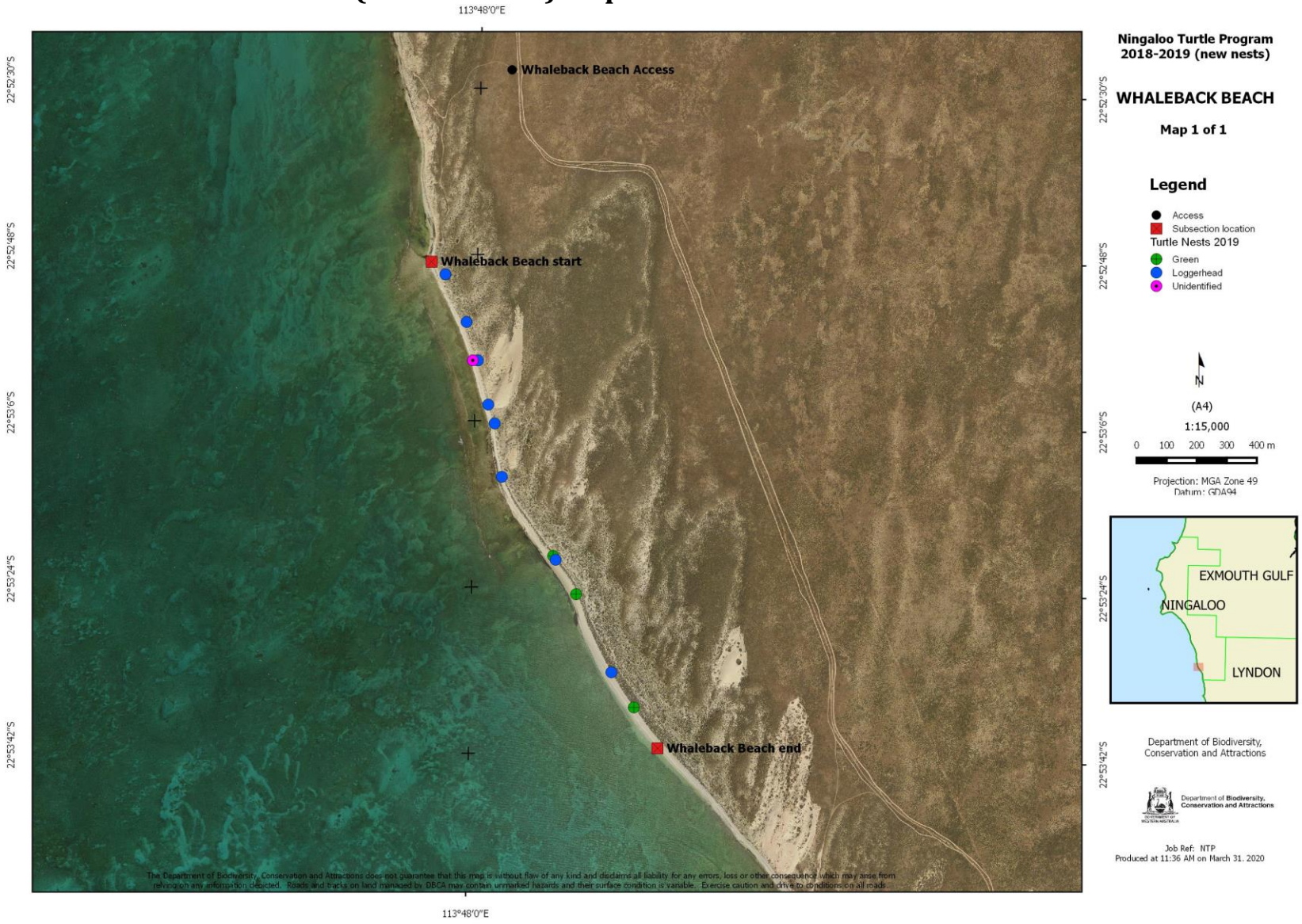
Whaleback section – New nests (NTP 2018-19) Map 1



Appendix 12: Gnarraloo Bay section – New nests (NTP 2018-19) – Map 1

Note: Locations of some nests in the figure may vary from actual locations due to occasional inaccuracies in the GPS. Inaccuracies are considered unlikely to affect illustrations of overall patterns of nesting across the section.