

RTA WEIPA PTY LTD

AMRUN PROJECT MARINE TURTLE NESTING SURVEYS

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Acronyms and Abbreviations

AEC	Animal Ethics Committee
DAF	Queensland Department of Agriculture and Fisheries
DEHP	Department of Environment and Heritage Protection
EPBC	Environmental Protection and Biodiversity Conservation Act
FCA	False-crawl attempt
FCU	False-crawl U-turn
HSEQ	Health, Safety, Environment and Quality
JSA	Job Safety Analysis
LSMP	Land and Sea Management Program
PALM	Permits and Licensing Management (Queensland)
PENV	Pendoley Environmental Pty Ltd
QTRP	Queensland Turtle Research Project
RTAW	RTA Weipa Pty Ltd
SOP	Standard Operating Procedure
TO	Traditional Owner

1 SURVEY BACKGROUND, OBJECTIVES AND METHODS

1.1 Survey Background and Objectives

This survey has been designed to address marine turtle nest monitoring commitments within the RTA Weipa Pty Ltd (RTAW) Marine Turtle Offset Plan (referred to herein as the 'Plan') and a Feral Pig Management Offset Strategy (referred to herein as the 'Strategy'). The commitments within the Plan and Strategy are in accordance with Condition (J42) (b) of the RTAW Environmental Authority (EA) No EPML00725113, and Condition 45 of the RTAW Environmental Protection and Biodiversity Conservation Act (EPBC Act) Approval (EPBC 2010/5642), respectively. The execution of the survey was in alignment with EA Condition (J43) and EPBC Act Approval Condition 44, which requires that the Plan, and the Strategy, are implemented.

The Plan and Strategy were designed to reduce feral pig predation on marine turtle nests, thereby increasing hatchling survivorship. Both the Plan and the Strategy therefore commit to annual monitoring of marine turtle nests to detect variation in nest predation rates by feral pigs.

The primary objective of this marine turtle nesting survey was therefore to obtain sufficient data to detect long-term trends in nest predation rates by feral pigs.

1.2 Survey Design and Methods: Marine Turtle Nesting

To ensure the objective was met and for consistency with baseline surveys, survey design was per Guinea (2014). Survey approach was based on the relevant Pendoley Environmental (PENV) Standard Operating Procedures (SOP; Pendoley Environmental 2016, 2016a, 2016b, 2016c, 2017). Variation from methods detailed in the SOPs and those detailed herein were allowed to facilitate collection of additional data to meet specific scope requirements. Further modifications were incorporated to ensure data collection methods and data recording aligned with those of the Department of Environment and Heritage (DEHP) Queensland Turtle Research Project (QTRP). Modifications since 2016 have been limited to only those that would substantially enhance either data quality or collection efficiency, or both.

1.2.1 Survey Area

In each survey season, all known marine turtle nesting habitat in proximity to the Amrun project was assessed (Guinea 2014). The survey area was divided into seven discrete survey beach sections and included all accessible nesting beaches between Winda Winda Creek in the north and Ina Creek to the south. The survey area is shown in **Figure 1** with detail on each surveyed beach section provided in **Table 1**. For a detailed description of the natural features and conditions at each survey beach section, see Guinea (2014).

The sections surveyed were consistent in all survey seasons. The frequency of surveys on each section varied among seasons and in 2018, bushfire prevented access to the southern section on two available survey days. **Section 1.6** lists all factors that influenced access to beach section.)

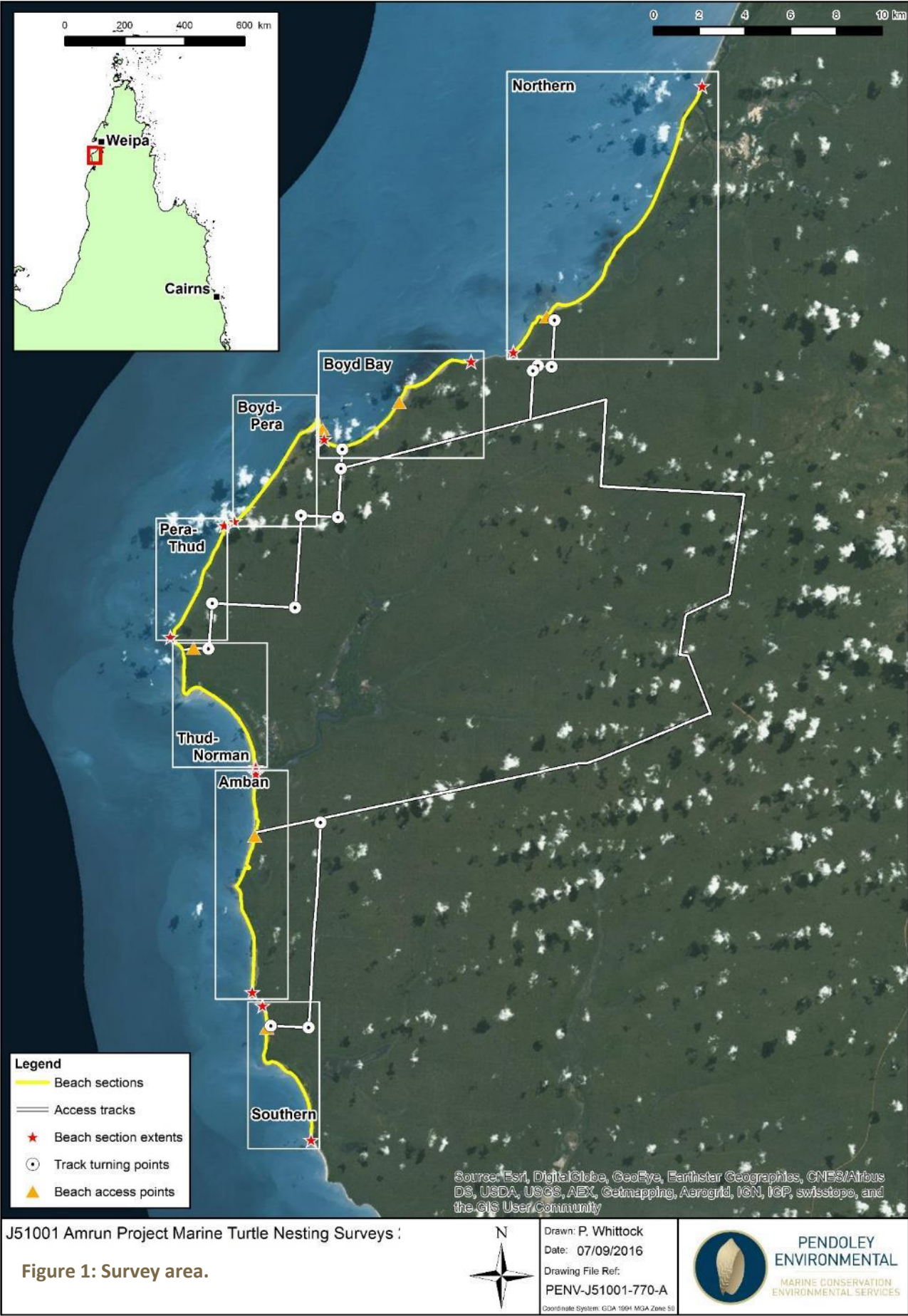


Table 1: Surveyed beach sections, August/September 2018.

Beach Section		Section Access	
Name	Length (km)	Tidal Phase	Permission
Northern	14.5	Low-tide *	None required
Boyd Bay	9.2	Not restricted	TO required
Boyd – Pera	6.5	Not restricted	TO required
Pera – Thud	6.0	Not restricted	TO required
Thud – Norman	7.3	Not restricted	None required
Amban	9.5	Low-tide	None required
Southern	5.1	Low-tide	None required

Table 1 Notes: TO required: permission to access to this area only if a Traditional Owner (TO) is present; * high tide restricts access to the northern end of this section.

1.2.1 Species Identification

Species identification was primarily via assessment of track and nest morphology. Track width (mm) and plastron width (mm) were measured using a straight ruler (Lufkin 1000 mm). Each event was assigned to species using a combination of information supplied in the Queensland Government Environmental Protection Agency/Queensland Parks and Wildlife Service 'Turtle Species Identification' and 'Adult Marine Turtle Track Identification' guides. In addition to this, field staff experience in assessing track width and gait, position of the activity on the beach and where possible, assessment of nest morphology, was utilised.

1.2.2 Nesting Activity

During daytime track surveys, all observed nesting activity was recorded and where possible, assigned to species.

The position of each activity relative to the beach profile was recorded as per the QTRP, as either:

- dune;
- slope;
- below slope (beach flat); or
- below mean high water mark.

Nesting activity was categorised as either:

- 'nest' including both nests and potential nests; or
- 'attempt', including:
 - 'false-crawl u-turn' (FCU) track only, no nesting attempt made; and
 - 'false-crawl attempt' (FCA) tracks associated with attempted nesting i.e. digging, but no nest mound or other signs of covering.

The proportion of all recorded nesting events (i.e. nests and attempts) that resulted in a successful nesting event (nest) is termed the 'nesting success rate'.

The specific location of each activity was recorded by documentation of GPS position. GPS of each activity was recorded at either:

- Nest: taken at the nest site;
- FCA: taken at the position of the first nesting attempt; or
- FCU: taken at the highest point of the track on the beach i.e. greatest distance from the mean high-water mark in the direction of the dunes.

The presence of a clutch of eggs within a nest can only be confirmed by sighting the eggs. In these surveys, eggs were sighted and nesting confirmed when either:

- the turtle was observed laying; or
- egg shells were seen scattered at the sand surface.

Where the turtle was not observed laying and no egg shells were seen at the surface of the sand (due to predation), the disturbed area was carefully assessed to infer behaviour. Where it was concluded that the turtle had most likely laid, a 'potential nest' was recorded. For the purpose of analysis, once categorised, a potential nest was treated in the same group as a nest, but for accuracy, could not be recorded as a confirmed nest.

1.3 Survey Design and Methods: Predator Activity and Predation

Predator species were identified by careful study of tracks and traces left in the sand, at and around the nest area. Where field cameras were installed at the nest site and stored images of a predation event, species was identified from review of images. Where activity could not be assigned to species, the event was assigned to the category 'unidentified'.

1.3.1 Daytime Beach Surveys

During daytime beach surveys, observations of predator behaviour were derived from observed indicators of predator activity. Indicators included tracks and traces of predator species that overlapped with signs of turtle activity and observations of egg shells scattered on the surface of the sand. Each indicator was then assigned to one of three of predator behaviour categories:

- Indicator: tracks; behaviour: predator activity ('tracks');
- Indicator: digging; behaviour: predation or attempted predation ('digging'); and
- Indicator: shells/remains; behaviour: confirmed predation, egg shells are scattered at the surface of the sand ('shells', 'remains').

The location of each indicator ('tracks' and/or 'digging') was recorded relative to the position of the turtle nesting activity and was categorised as either:

- Nest: on or over the turtle nest;
- Tracks: along the turtle tracks; or
- Nearby: in the area but not associated with the turtle nesting activity.

1.3.1.1 Hatched nests

Hatched nests were identified by either a small cone-shaped depression in the sand or observation of hatchling tracks which were followed to locate the emergence point, or clutch location.

1.3.1.2 Incubation success

Where the clutch of a hatched nest could be located, the area was excavated and the clutch contents assessed to identify the nesting species, gather hatchling morphometric data (Straight Carapace Length (SCL): +/- 1.0 mm; mass: +/- 0.1 g) and determine hatch and emergence success (%) rates (Pendoley Environmental 2016c).

1.3.1.1 Hatchling orientation

Where hatchling tracks were visible, hatchling orientation was recorded to measure hatchling dispersal patterns immediately following emergence from the clutch as hatchlings orient toward the ocean (Pendoley Environmental 2016a). Hatchling tracks are not persistent in sand over time and detection was limited to hatching events that occurred during the night preceding the survey.

1.3.2 24-hour Monitoring: Field Cameras

To monitor for predation and predator activity, motion sensitive field cameras (Reconyx PC900) were deployed at either a. freshly laid 'potential' nests where no previous predation or predator activity was observed or b. confirmed nests where laying was observed and eggs were sighted.

Field cameras were positioned approximately one meter behind the known or estimated location of the clutch. A 'clutch' being the term for the group of eggs, which are located within the nest mound, which is substantially larger and is comprised of sand. Where nesting was not observed, the estimated clutch location was determined by examination of track/nest morphology and inferred nesting behaviour.

Field cameras were mounted on plastic poles approximately one meter above the sand surface using cable ties. Detection range was tested using the camera's 'Walk Test' function to ensure capture of activity within a 40° field of view and up to 30 m from the camera's location. Predator activity was captured when the motion sensor was triggered using either daylight or infra-red technology (at night).

The motion sensor function was set at high sensitivity, and camera function set to 'HyperFire' which recorded ten images each time the motion sensor was triggered, at a minimum rate of one image per second, with 'no delay' between triggers. Field cameras recorded the date, time, temperature, moon phase and the number of the image/motion in the sequence (e.g. M1 – M10) each time the sensor was triggered.

At each deployment location, the Field Team recorded the date, time, beach, GPS position (of the field camera and the clutch), beach position, distance of camera from clutch, position of camera in relation to the clutch and nesting turtle species (Pendoley Environmental 2017).

Upon retrieval, where possible, the following information was extracted from images:

Predator activity:

- predator species identification;
- predator abundance (*n*);

- clutch location method (e.g. olfactory – sniffed out, other predator seen at nest site, turtle seen nesting, nest seen hatching);
- time of approach; and
- activity (predation attempt: scratch, sniff; predation success: dig, extract).

Predation:

- time first dig start/end;
- duration of predation event; and
- confirmed predation (i.e. number of eggs extracted and/or consumed).

1.3.3 Night-time Tagging Surveys

1.3.3.1 Night-time beach survey

Nesting turtles were approached only when they had finished laying. One or titanium flipper tags were attached to each of the front flippers (axial scale, closest to the body) as per Limpus (1971), Limpus et al. (1983), Pendoley Environmental (2016b) and with reference to the DEHP guidelines for Tagging and Measuring Turtles. Curved carapace length (CCL) and curved carapace width (CCW) were measured (+/- 1.0 mm) with a flexible fiberglass tape. All data were recorded as per Pendoley Environmental (2016b) and in compliance with the DEHP Queensland Turtle Research Project (QTRP) requirements (Limpus 2013). A sample of 10 eggs from each clutch were weighed (mass: +/- 0.1 g) and measured (diameter: +/- 0.1 mm).

1.3.4 Traditional Owner Engagement

Traditional Owners (TOs) from the Land and Sea Management Program (LSMP) accompanied the Field Team, fulfilling support roles and receiving training pre-departure for the field and on-the-job training during daily surveys with PENV field staff.

1.4 Data Handling and Presentation

For meaningful comparison of findings among seasons, all data were collected and analysed in alignment with the approach detailed in the previous (baseline) survey report (Guinea 2014). All summary statistics presented within are given as mean \pm standard deviation (SD), (range, *n*). For a limited number of monitored parameters, a single tailed t-test was used to determine statistically significant variation among surveys.

1.4.1 Nesting Activity and Density

Total nesting activity includes both categories described in **Section 1.2.2**. i.e. 'nests' and 'attempts'.

On the initial survey days, assessment of all visible nesting activity provides a 'snapshot' of activity on the beach up to approximately two weeks prior to the survey. For accuracy and consistency with baseline surveys, the 'snapshot' data were excluded from analysis of nesting density. Nesting density, excluding the initial 'snapshot' days is referred to as overnight nesting density.

Consistent with baseline surveys, overnight nesting density was calculated by conversion of the number of overnight nests per km of surveyed beach over the duration of the survey. Survey duration

is defined as the number of nights between the first and last survey to assess overnight nesting activity on each beach section (inclusive) and is presented within as 'nests/km/night'. A single tailed t-test was used to determine significant variation in nesting density on all surveyed beach sections between baseline (2013), previous (2016, 2017) and current (2018) surveys.

1.4.2 Species-specific Morphological Measurements

Individual turtle and track morphological measurements are given as mean \pm SD (range, *n*) for each parameter given.

1.4.3 Predation and Predator Activity

Rate of predation was analysed to determine the influence of three primary covariates: beach section, nesting turtle species and predator species. The rate of predation is given as the proportion of all recorded nesting events (nests and potential nests) where predation was observed and included observations of previous (snapshot) and overnight nesting events. Observations that could not be assigned to species (listed separately in **Table 10**) were included in estimates of predation rates.

1.5 Ethics Approval and Permit to Conduct Works

All works were conducted under, and in accordance with, the appropriate licenses issued by the DEHP, Permits and Licensing Management (PALM) Department License No. WA0001415 and with the approval of the relevant Animals Ethics Committee (AEC) (Department of Agriculture and Fisheries; DAF), Registered User No. 505, Approval Reference No. CA2016/08/996.

1.6 Survey Schedule

Survey scheduling was successfully planned around a number of variables influencing survey timing, frequency and duration (including the impact of lunar phase and predicted tidal cycles on nesting activity and beach access), resource availability and other logistical factors such as training and inductions. These variables were accounted for and did not impact survey success.

All factors with the potential to influence survey execution were broadly grouped into three categories:

Timing and duration:

- lunar phase;
- sunset and sunrise times;
- beach length;
- travel time to each beach section; and
- level of activity at each beach section.

Accessibility:

- natural hazards (e.g. bushfire)
- access points and access tracks; and
- availability of traditional owners.

Available resources and safety considerations:

- logistical, resource and personnel requirements;
- safety at night; and
- fatigue management requirements.

1.7 Limitations

On occasion, the following limitations to data collection were noted:

- marine turtle and predator abundance and species identification were constrained by high winds and/or rain erasing tracks; and/ or
- marine turtle abundance and species identification was constrained by predator activity or predation, which obliterated the required detail.

2 RESULTS

2.1 Survey Timing, Schedule and Effort

Survey timing (25th August – 5th September 2018) fell within the peak nesting period for this region (August/September; Guinea 2014).

2.1.1 Daytime Beach Surveys

Daytime survey effort ranged from one to three teams of either two or three field staff per beach section per day, depending on available resources and survey requirements. Total survey duration was 12 days and included one snapshot survey day and a maximum of 11 census survey days per beach section. Overnight nesting was assessed on each visit to each beach section on each census day.

It was not possible to survey all beach sections on each survey day (see **Section 1.6**). In this 2018 survey, Southern beach section was only accessible on survey days 5 and 12 due to an uncontrolled natural bushfire. Survey duration varied among beach sections from seven (Southern) to 11 (Boyd-Pera) days (**Table 2**). Average survey duration (all sections) was 9.6 days. Average survey duration (excluding Southern, which had limited access) was 10.0 days.

2.1.2 Night-time Tagging Surveys

The night-time tagging survey focused on nesting habitat from Boyd Point to Pera Head (Boyd – Pera) consistent with all previous (baseline (2013), 2016 and 2017) surveys (**Figure 1**). Survey effort included one team of two PENV field staff as a minimum and either one or two LSMP teams of between two to three people per team. The total number of tagging nights in 2018 was eight (**Table 2**).

Table 2: Survey schedule for daytime track and night-time tagging surveys, August/September 2018.

Survey Day	1	2	3	4	5	6	7	8	9	10	11	12	Visits	Days
Northern		Trk	Trk			Trk		Trk	Trk		Trk		6	10
Boyd – Bay		Trk	Trk			Trk		Trk			Trk		5	10
Boyd – Pera	Trk	Trk	Trk	Tag	Tag	Tag	Tag	Tag	Tag	Tag	Tag	Trk	12	11
Pera – Thud		Trk				Trk			Trk			Trk	4	10
Thud – Norm.		Trk		Trk			Trk		Trk		Trk		5	10
Amban			Trk				Trk					Trk	3	9
Southern					Trk							Trk	2	7

Table 2 Notes: Trk: daytime beach survey; Tag: night-time tagging survey; Visits: total number of occasions on which the beach was visited; Days: Survey duration i.e. the total number of days from the first to the last visit inclusive, on each beach section.

2.2 Marine Turtle Nesting Activity

‘Snapshot’ survey days on each beach section were: Boyd-Pera: day one; Northern, Boyd – Bay, Pera – Thud, Thud – Norman: day two; Amban: day three; Southern: survey day five. Generally, nesting activity recorded on ‘snapshot’ survey days showed potentially higher numbers of nests (**Table 3**) and false-crawls (**Table 4**) in previous weeks than was recorded during the remainder of the survey period. The exceptions were Thud – Norman (nesting) (**Table 3**) and Northern (nesting attempts: FCA / FCU)

(Table 4). There was little variation in the number of overnight nests laid on each beach section throughout the survey period.

The rate of overnight nesting success for all turtle species on all beach sections ($n = 7$) was 56%. The rate of overnight nesting success on each beach ranged from 43% on Amban to 78% on Southern. The rate of overnight nesting success for each turtle species on all beach sections combined, ranged from 31% olive ridley to 73% flatback turtle.

Table 3: Total nests (confirmed and potential) recorded on each beach section on each survey day August/September 2018.

Beach Section	Survey Day												Total Activity	
	1	2	3	4	5	6	7	8	9	10	11	12	o/n	All
Northern	-	9	0	-	-	-	-	3	0	-	1	-	4	13
Boyd Bay	-	7	1	-	-	0	-	0	-	-	0	-	1	8
Boyd – Pera	24	2	0	1	1	1	1	0	2	1	1	0	10	34
Pera – Thud	-	21	-	-	-	2	-	-	1	-	-	4	7	28
Thud – Norman	-	3	-	1	-	-	0	-	1	-	2	-	4	7
Amban	-	-	7	-	-	-	2	-	-	-	-	0	2	9
Southern	-	-	-	-	34	-	-	-	-	-	-	9	9	43
Total	24	42	8	2	35	3	3	3	4	1	4	13	37	142

Table 3 Notes: 'Nests' includes nests and potential nests, combined; Total Activity o/n: Total overnight activity which therefore excludes data captured on the initial 'snapshot' survey day; Total Activity All: Total of all activity recorded on each surveyed section, including snapshot day.

Table 4: Total nesting attempts (FCA and FCU) recorded on each beach section on each survey day, August/September 2018.

Beach Section	Survey Day												Total Activity	
	1	2	3	4	5	6	7	8	9	10	11	12	o/n	All
Northern	-	8	1	-	-	4	-	3	0	-	0	-	8	16
Boyd Bay	-	2	1	-	-	0	-	1	-	-	0	-	2	4
Boyd – Pera	27	5	1	5	0	1	2	1	1	1	0	0	17	44
Pera – Thud	-	17	-	-	-	1	-	-	5	-	-	0	6	23
Thud – Norman	-	3	-	0	-	-	0	-	0	-	0	-	0	3
Amban	-	-	9	-	-	-	1	-	-	-	-	2	3	12
Southern	-	-	-	-	12	-	-	-	-	-	-	0	0	12
Total	27	35	12	5	12	6	3	5	6	1	0	2	36	114

Table 4 Notes: 'Nesting Attempts' includes both FCU and FCA combined; Total Activity o/n: Total overnight activity which therefore excludes data captured on the initial 'snapshot' survey day; Total Activity All: Total of all activity recorded on each surveyed section, including snapshot day.

2.3 Marine Turtle Nesting Density

Overnight nesting density (nests/km/night) in 2018 was highest at Southern and lowest at Boyd Bay (Table 5) which is the same as in 2017 (Table 6).

Table 5: Total overnight nests and nesting density on each surveyed beach section in August/September 2018.

Beach Section	Overnight Nests	Survey Nights	Beach Length (km)	Nesting Density (Nests/km)	Overnight Nesting Density (Nests/km/night)
Northern	4	10	14.5	0.28	0.03
Boyd Bay	1	10	9.2	0.11	0.01
Boyd – Pera	10	11	6.5	1.54	0.14
Pera – Thud	7	10	6.0	1.17	0.12
Thud – Norm.	4	10	7.3	0.55	0.05
Amban	2	9	9.5	0.21	0.02
Southern	9	7	5.1	1.76	0.25
(Total) Average	(37)	9.6	(58.1)	0.64	0.09

Compared to the 2017 survey, overnight nesting density in 2018 was lower on Boyd-Pera, Pera-Thud and Thud-Norman beach sections. Compared to baseline, overnight nesting density in 2018 was lower at all monitored beach sections (**Table 6**).

On all beaches combined, mean \pm SD (range, *n*) overnight nesting density (nests/km/night) in 2018 was 0.09 ± 0.09 ($0.09 - 0.25$, $n = 7$) which was lower than in all previous survey seasons (2017: 0.10 ± 0.10 , $0.00 - 0.24$; 2016: 0.09 ± 0.07 , $0.02 - 0.22$; 2013 (baseline): 0.38 ± 0.38 , $0.02 - 1.17$, $n = 7$). The difference in mean overnight nesting density (nests/km/night) between 2018 and 2017 was not significant, however mean overnight nesting density (nests/km/night) in 2018 was significantly lower compared to 2013 ($p < 0.05$, $U = 6$) (**Table 6**).

Table 6: Variation in overnight nesting density in 2018 compared to 2017, 2016 and 2013 (baseline).

Beach Section	Nests/km/night				Annual variation	
	2018	2017	2016	2013	2018 v 2017	2018 v 2013
Northern	0.03	0.01	0.05	0.23	0.01	-0.20
Boyd Bay	0.01	0.00	0.10	0.02	0.01	-0.01
Boyd – Pera	0.14	0.18	0.13	0.29	- 0.04	-0.15
Pera – Thud	0.12	0.20	0.02	0.19	- 0.08	-0.07
Thud – Norman	0.05	0.10	0.03	0.50	- 0.04	-0.45
Amban	0.02	0.00	0.07	0.26	0.02	-0.24
Southern	0.25	0.24	0.22	1.17	0.02	-0.92
Annual Mean (v)	0.09	0.10	0.09	0.38	(- 0.02)	(-0.29)

Table 6 Notes: Annual Mean: average nesting density in 2018; Annual Mean; (v): numbers in brackets denote average variation between surveys.

2.4 Species-Specific Nesting Activity

In total, 265 events were recorded. Of these, 247 were assigned to one of four species of nesting marine turtles; flatback (*Natator depressus*), olive ridley (*Lepidochelys olivacea*), hawksbill (*Eretmochelys imbricata*) and green (*Chelonia mydas*). A further 18 events were not assigned to species (**Table 7**). Of nests that were identified to species, 73% were flatback, 23% were olive ridley 3% were hawksbill and 1% were green turtle nests.

Overall, nesting activity in 2018 was highest on Southern and lowest on Amban (**Table 7**). Among species, the rate of nesting success was greatest in flatback turtles (74%). Olive ridley turtle nesting success was 31% (**Table 7**).

Table 7: Number of nests and nesting attempts recorded by each species on each beach section, August/September 2018.

Beach Section	Flatback		Hawksbill		Olive ridley		Unidentified		Green		Total		
	Nests	FCA/U	Nests	FCA/U	Nests	FCA/U	Nests	FCA/U	Nests	FCA/U	Nests	FCA/U	All
Northern	4	4	0	0	7	11	1	0	1	1	13	16	29
Boyd Bay	5	1	1	0	2	2	0	1	0	0	8	4	12
Boyd – Pera	22	16	0	2	7	24	5	2	0	0	34	44	78
Pera – Thud	19	10	2	1	6	10	1	1	0	1	28	23	51
Thud – Norman	5	2	0	0	2	1	0	0	0	0	7	3	10
Amban	8	2	0	0	1	10	0	0	0	0	9	12	21
Southern	33	0	1	0	6	12	3	0	0	0	43	12	55
Total	96	35	4	3	31	70	10	4	1	2	142	114	256
	131		7		101		14		3				
% all activity	67.6		2.8		21.8		0.8		7.0				

Table 7 Notes: Not included are those events where ‘activity’ was not clear and records denote ‘na’ ($n = 9$) in this category.

2.4.1 Species-specific Morphological Measurements

Mean \pm SD (range, n) flatback track and plastron widths were 719 ± 78 mm (450 – 960, $n = 96$) and 214 ± 31 mm (130 – 310, $n = 96$), respectively. Mean olive ridley track and plastron widths were 553 ± 66 mm (360 – 680, $n = 66$) and 179 ± 34 mm (110 – 250, $n = 66$), respectively. Mean hawksbill track and plastron widths were 672 ± 54 mm (600 – 750, $n = 7$) and 208 ± 22 mm (180 – 247, $n = 7$) respectively and mean green turtle track and plastron widths were 743 ± 64 mm (600 – 740, $n = 3$) and 187 ± 29 mm (170 – 220, $n = 3$), respectively.

2.5 Tagged Turtles

Nesting turtles were observed on Boyd-Pera beach section on six of the eight tagging nights in 2018. There were seven sightings of six adult female flatback turtles (5 new and 1 remigrant). Turtle QA74213 was sighted twice: it was first sighted and tagged on 30th August and resighted on 4th September. Turtle QA74224 was a remigrant turtle as she was previously sighted and tagged in 2016. In 2018, she was observed attempting to nest on the same beach where she was sighted in 2016. In total there were four nests laid during the 2018 tagging survey.

2.5.1 Turtle QA74213

At 00:26 on 30th August, tag numbers QA74212 (left) and QA74213 (right) were applied to the front flippers of a previously untagged adult flatback turtle as she returned to the water following an unsuccessful nesting attempt. At 20:20 on 4th September she was resighted and CCL of 890 mm was recorded. This time she nested successfully before returning to the water. Total clutch size was 43 eggs. Mean egg mass was 70.3 ± 1.1 g (range = 68.6 – 72.5, $n = 10$) and diameter was 50.9 ± 0.7 mm (range = 49.4 – 52.0, $n = 10$).

2.5.2 Turtle QA74215

At 21:27 on 31st August, tag numbers QA74214 (left) and QA74215 (right) were applied to the front flippers of a previously untagged adult flatback turtle measuring 916 mm (CCL) following successful nesting.

2.5.3 Turtle QA74224

At 00:21 on 1st September, a turtle with tag numbers QA74223 (left) and QA74224 (right) was sighted but did not nest. The turtle was previously tagged after successfully nesting, on 20th September 2016 at 19:38.

2.5.4 Turtle QA74217

At 18:44 on 3rd September, tag numbers QA74216 (left) and QA74217 (right) were applied to the front flippers of a previously untagged adult flatback turtle measuring 890 mm (CCL). Total clutch size was 29 eggs. Mean egg mass was 70.5 ± 1.8 g (range = 67.2 – 73.1, $n = 10$) and diameter was 50.9 ± 0.7 mm (range = 49.4 – 52.0, $n = 10$).

2.5.5 Turtle QA74220

At 22:23 on 2nd September, tag numbers QA74219 (left) and QA74220 (right) were applied to the front flippers of a previously untagged adult flatback turtle after she had nested successfully.

2.5.6 Turtle QA74226

At 22:54 on 3rd September, tag numbers QA74225 (left) and QA74226 (right) were applied to the front flippers of a previously untagged adult flatback turtle. The turtle did not nest and was tagged as she returned the water.

2.6 Hatchling Orientation

Hatchling sea finding orientation was recorded opportunistically at five hatched clutches (flatback, $n = 4$; olive ridley, $n = 1$) on Boyd – Pera ($n = 1$) Pera-Thud ($n = 1$) Thud – Norman ($n = 2$) and Amban ($n = 1$) beach sections (**Table 8**). On Boyd-Pera, large spread and offset angles indicate hatchlings deviated from the most direct path toward the ocean. There are many vessels moored offshore from this beach at night. The fishing vessels in particular have extremely bright lights (Author, *pers obs.*) and it is probable that these point sources of light influenced hatchling sea-finding on this beach. There was no evidence of influence from land-based light sources on hatchling orientation and all hatchling tracks indicated that they successfully located the ocean.

The location of all nests assessed for orientation is shown in **Appendix A**.

Table 8: Hatchling sea-finding orientation, August/September 2018

Day	Species	Beach Section	Spread°	Offset°	Tracks	Predation
2	FB	Thud-Norman	34	4	11	Pig
2	FB	Thud-Norman	38	2	46	Pig
6	FB	Pera-Thud	60	10	25	No
7	FB	Boyd-Pera ¹	82	44	48	No
12	OR	Amban	37	7.5	44	Seagulls

Table 8 Notes: 'Day: Survey Day; Spread°: the angle of maximum dispersion of each group of hatchlings as they leave the nest in search of the ocean; Offset°: the degree of deflection from the most direct path toward the ocean; Tracks: the number of hatchlings tracks leaving the nest; Boyd-Pera¹: This nest was excavated and contents examined (**Section 2.7, Table 9**)

2.7 Hatched Nests

Four hatched nests (flatback $n = 3$; olive ridley $n = 1$) were identified on Northern ($n = 1$), Boyd – Pera ($n = 1$); Pera-Thud ($n = 1$) and Thud – Norman ($n = 1$) beach sections. Each clutch was excavated and the contents examined to confirm species and determine incubation success (**Figure 2**). The sea-finding bearing of hatchlings emerging from the clutch on Boyd – Pera beach section was also recorded (**Section 2.6, Table 8**). Mean flatback clutch size was 59 eggs ($n = 3$). Mean hatch and emergence success were 43.3% and 41.5%, respectively. Olive ridley clutch size ($n = 1$) was 110 eggs, hatch success was 54.5% and emergence success was 17.3% (**Table 9**). Only the nest on Thud-Norman beach section showed evidence of pig predation and no damage was noted to eggs or hatchlings. After being allowed to crawl across the sand and/or intertidal platform, all live hatchlings were released to the ocean.

The location of all excavated nests is shown in **Appendix A**.

Table 9: Incubation success of excavated clutches, August/September 2018

Spps	Beach Section	Hatched Eggs					Unhatched Eggs			Overall		
		Empty Shells	Hatchlings		Pipped Eggs		Development			Total Clutch Size	Success (%)	
			Live	Dead	Live	Dead	0	Part.	100%		Hatch	Emerge
OR	Northern	60	22	19	10	37	1	2	0	110	54.5	17.3
FB	Boyd – Pera ¹	56	3	0	0	1	3	0	0	60	93.3	88.3
FB	Thud – Norm ²	52	1	0	0	0	0	0	0	52	100.0	98.1
FB	Pera – Thud	14	0	0	0	1	40	1	0	64	21.9	21.9

Table 9 Notes: Spps: Species- O Olive ridley, F flatback.



Figure 2: Olive ridley turtle hatchlings Left: Recently emerged Olive ridley turtle hatchlings on Northern beach section on 26th August 2018; Middle: a hatchling awaits safe transfer to the ocean on Amban beach section on 5th September 2018; Right: Hatchlings on Amban beach section 5th September 2018, make their way to the ocean.

2.8 Predation and Predator Activity

The overall rate of predation of marine turtle nests was 70%, equal to 100 nests that were predated of the total of 142 nests recorded. The rate of predation varied among beach sections (**Table 10**) and turtle species (**Table 11**) and ranged from 36% - 100% and 0% - 72%, respectively.

The overall feral pig (*Sus scrofa*) nest predation rate was 65%, which is equal to ($n = 92$).

Of nests that were predated ($n = 100$), the feral pig predation rate was 92%, goanna (gen. *Varanus*) predation rate was 2 % ($n = 2$) and the rate of predation by unidentified predator species was 3% ($n = 3$).

Evidence of feral pig activity was documented at every recorded event where predation and predator activity could be assigned to species with the exception of two nests that were predated by goannas.

Figure 3 shows the number and proportion of predated nests on each beach section. **Table 12** provides summary of nest predation on each section by each predator species. **Appendix A** shows the location of predation events on each beach section.

2.8.1 Predation

The rate of predation in 2018 was highest on Boyd Bay beach section. All nests ($n = 8$) found during the snapshot ($n = 7$) and overnight census ($n = 1$) surveys on Boyd Bay, were predated. The next highest rate of nest predation was on Southern beach section where there was evidence of predation at 97% of nests found during the snapshot survey ($n = 34$) and 78% of overnight nests ($n = 7$). Overall predation rate on this section was 93% (**Figure 3; Table 10**).

Compared to 2017, the rate of predation in 2018 was greater on Northern and Boyd-Pera beach sections only. Overall, the annual rate of predation in 2018 was lower compared to the 2017 survey (76%) but greater than the 2016 (69%) survey.

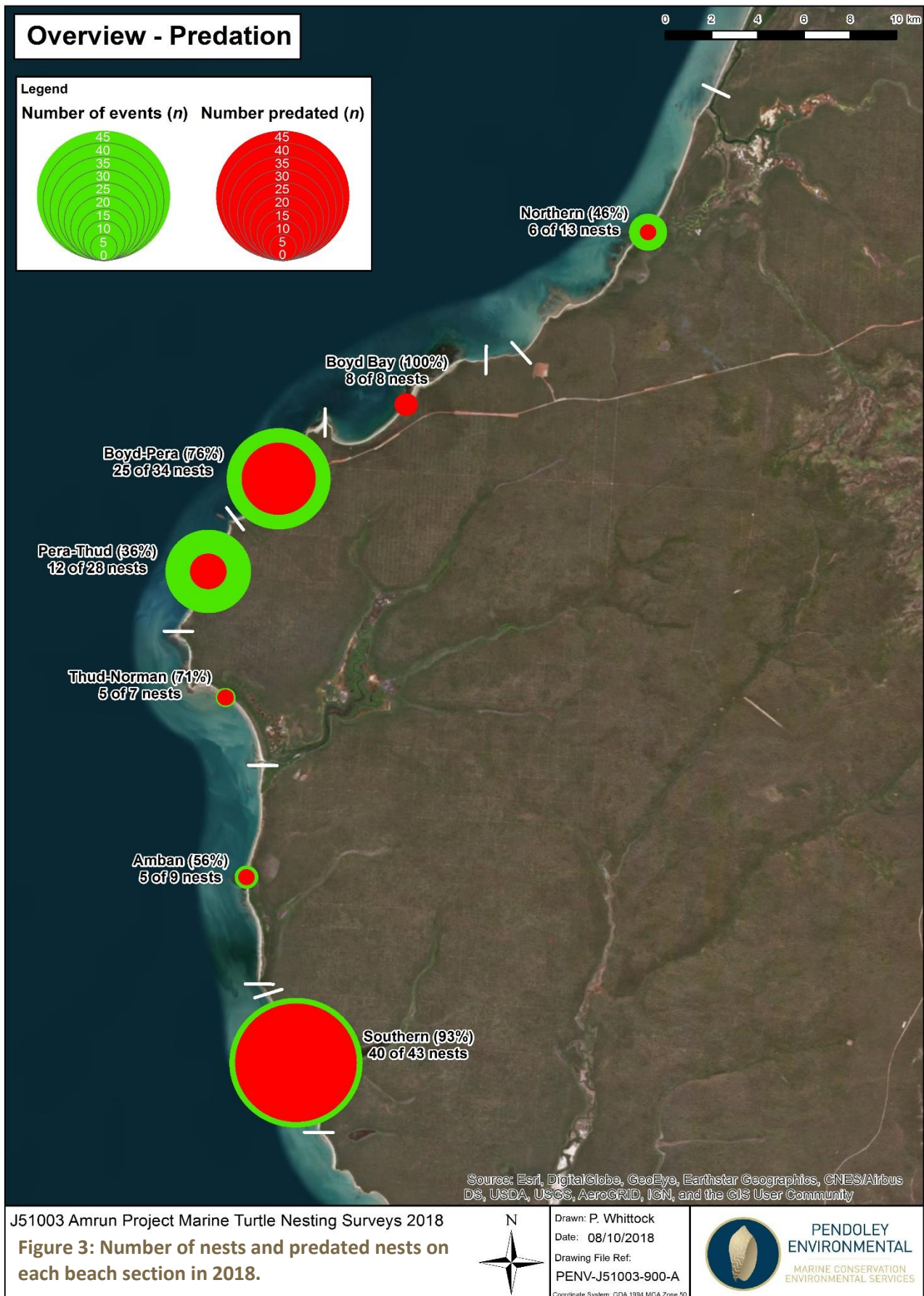
Among nesting events that were assigned to species, the rate of predation in 2018 was highest in flatback turtle nests. The rate of predation of olive ridley nests has been similar in each of the 2018, 2017 and 2016 surveys (**Table 11**).

Table 10: Nests/potential nests, predated nests/potential nests by beach section in snapshot and overnight surveys, August/September 2018.

Beach Section	Overnight Nests			Snapshot Nests			All Nests		Predation Rate (%)		
	Nests (n)	Pred. (n)	Pred. Rate (%)	Nests (n)	Pred. (n)	Pred. Rate (%)	Nests (n)	Pred. (n)	2018	2017	2016
Northern	4	0	0	9	6	67	13	6	46	25	0
Boyd Bay	1	1	100	7	7	100	8	8	100	100	71
Boyd – Pera	10	4	40	23	21	91	33	25	76	36	88
Pera – Thud	7	2	29	21	8	38	28	10	36	79	96
Thud – Norm.	4	2	50	3	3	100	7	5	71	84	100
Amban	2	0	0	7	5	71	9	5	56	67	21
Southern	9	7	78	35	34	97	44	41	93	98	100
Total	37	16	43	105	84	80	142	100	70	76	69

Table 11: Nests/potential nests, predated nests/potential nests by nesting turtle species, August/September 2018.

Species	Nests (n)	Predated Nests (n)	Predation Rate (%)		
			2018	2017	2016
Flatback	98	71	72	69	67
Hawksbill	4	2	50	-	52
Olive ridley	31	21	68	71	72
Green	1	0	0	100	-
Unidentified	8	6	75	92	86
Total	142	100	70	76	69



2.8.2 Predator Species

In 2018, four predator species were observed: feral pigs, wild dogs or dingos (*Canis lupus dingos*), goannas and crocodiles (*Crocodylus porosus*). Feral pigs were the predominant predator of marine turtle nests along this coastline. Evidence of feral pig activity was documented at every predation event where the predator could confidently be assigned to species with two exceptions: Amban ($n = 1$) and Northern ($n = 1$) beach sections where only goanna tracks and digging were observed.

Feral pigs were recorded as the sole predator at 93 predation events and one of two predators at two predation events where there was also evidence of dingo and crocodile activity (**Table 12**).

Predator species could not be identified at 3% of all confirmed predation events (see **Sections 1.4.3** and **Section 1.7**). These observations, listed separately in **Table 12**, were included in the predation rate estimate.

2.8.3 Predator Activity

During daytime surveys, predator species were identified from tracks and evidence of digging for eggs, at and around each nesting event. Feral pig activity was identified by rooting holes and tracks, wild dogs by tracks and goannas and crocodiles by tracks/tail drags in the sand. Feral pig and wild dog activity were also identified from field camera footage (**Section 2.8.4**).

Review of field camera images showed, for example, that at each event where there were signs of predation by more than one species i.e. pigs and either a dingo or a crocodile, pigs were the primary predator and the other a secondary visitor that did not consume any eggs.

Each observed indicator of either predation or predator activity was assigned to a category, as defined in **Section 1.4.3**. The frequency of each indicator and its location relative to the turtle nest (and eggs) is given in **Table 13**.

The location of all predation events is shown in **Appendix A**.

Table 12: Predator species and predation rate of marine turtle nests recorded on each beach section, August/September 2018.

Beach Section	Nests		Predator Species (n)								Predation Rate (%)	
	Nests*	Predated Nests	Feral Pig (beach survey)	Feral Pig (field cam)	Feral Pig & Goanna	Feral Pig & Dingo	Goanna	Crocodile & Feral Pig	Unid	Total Feral Pig	Feral Pig (%)	Total (%)
Northern	13	6	4	0	0	0	1	0	1	4	67	46
Boyd Bay	8	8	3	3	0	1	0	1	0	8	100	100
Boyd - Pera	33	25	19	4	0	0	0	0	2	20	92	76
Pera - Thud	28	10	10	0	0	0	0	0	0	10	100	36
Thud - Norman	7	5	1	4	0	0	0	0	0	5	100	71
Amban	9	5	3	1	0	0	1	0	0	4	80	56
Southern	44	41	36	5	0	0	0	0	0	41	100	93
Total	142	100	76	17	0	1	2	1	3	92	95	70

Table 12 Notes: Nests* includes 'potential nests' Unid: Unidentified

Table 13: Location and frequency of all predator activity and predation on each beach section, relative to the position of the turtle nest, August/September 2018.

Beach Section	Predator Observations							
	Predator Activity			Predation/Attempted Predation				
	Nest	Tracks	Nearby	Nest	Tracks	Nearby	Shells	Remains
Northern	6	9	2	6	0	0	6	0
Boyd Bay	6	8	1	5	0	0	4	0
Boyd – Pera	26	10	17	19	1	6	23	4
Pera – Thud	11	6	5	12	0	2	12	0
Thud – Norman	1	0	1	1	0	0	1	0
Amban	5	3	5	4	1	2	4	0
Southern	39	8	2	38	1	0	39	0
Total	94	44	33	85	3	10	89	4

Table 13 Notes: Due to the categorisation method used in these observations, the total number of nests where either predator activity or predation given in this table does not equal that given in Table 12 above.

2.8.4 Field Camera Observations

Thirty field cameras were deployed at 30 nests on Northern ($n = 2$), Boyd Bay ($n = 3$) Boyd – Pera ($n = 11$), Pera – Thud ($n = 4$), Thud - Norman ($n = 4$) Amban ($n = 4$) and Southern ($n = 2$) beach sections for a maximum duration of ten days (**Table 14**) and a total of 140 camera nights. Two of the nesting events where field cameras were deployed on Boyd-Pera beach section were confirmed prior to deployment via observation of nesting and sighting of eggs as part of the night-time tagging program; the remaining 28 events were considered ‘potential nests’.

Fifteen cameras captured predation events on Boyd Bay ($n = 3$), Boyd – Pera ($n = 6$), Thud - Norman ($n = 4$) and Southern ($n = 2$) beach sections. **Figure 3** shows where cameras were positioned on each beach section. **Figure 4** provides sample camera trap images captured by trap deployed at Boyd-Bay on the first survey day. The nests at fourteen of the predation events were previously identified as ‘potential nests’ and were recategorised as ‘nests’ following footage review. The remaining event was one of two confirmed nests where eggs were sighted during laying.

Feral pigs were the only species recorded by field cameras actively digging, searching for and consuming eggs. Two cameras recorded dingoes passing by the nest but there was no evidence that they were either looking for the nest or eggs. Both nests were unpredated at the end of the survey when the cameras were retrieved.

Table 14: Field camera deployment schedule.

Beach Section	Survey Day												Duration (o/n)
	1	2	3	4	5	6	7	8	9	10	11	12	
Boyd – Pera*	°		P										2
Boyd - Pera	°					P							5
Boyd - Pera	°										E		10
Boyd Bay		°				P							4
Boyd Bay		°				P							4
Boyd - Pera		°									E		9
Pera - Thud		°							E				7
Pera - Thud		°										E	10
Thud - Norman		°									P		9
Thud - Norman		°									P		9
Boyd Bay			°			P							3
Amban			°									E	9
Amban			°									E	9
Boyd - Pera				°							E		7
Thud - Norman				°			P						3
Boyd - Pera					°	P							1
Southern					°							P	7
Southern					°							P	7
Boyd - Pera						°					E		5
Boyd - Pera							°			P			3
Amban							°					E	5
Amban							°					E	5
Northern								°			E		3
Northern								°			E		3
Boyd - Pera									°		E		2
Boyd - Pera									°		P		2
Thud - Norman									°		P		2
Pera - Thud												°	-
Pera - Thud											°	E	1
Boyd - Pera												°P*	2

Table 14 Notes: °: Field camera deployed; Shaded cells: deployment period; Camera retrieval: E: End of survey (not predated); P: Predation event; P*: predation event 09:10 on 7th September 2018; *Camera trap content reviewed in detail in **Section 2.8.4.1**.

2.8.4.1 Boyd – Bay

Event 3: The camera was deployed on Boyd-Bay beach section on 28th September at 12:20. A total of 1429 images were collected over 36 minutes of predation activity. At 20:20, a pig arrived in the area and began sniffing. Digging began at 20:22. Although the camera angle did not allow a time to be recorded for when the eggs were located, it appears they were found and some were consumed. The pig left after 26 minutes, at 20:48.

A second pig arrived at 01:23 on 29th September. The camera captured 760 images of the pig digging and eating. The pig departed seven minutes later at 01:30.

At 01:31 on 30th September a third pig arrived, departing one minute later at 01:32, the eggs having been consumed by this time. Later, on 30th September, a pig arrived at 20:47 and left at 20:49. A fifth and final pig arrived at 03:07, and left one minute later.



Figure 4: Feral pigs at Boyd Bay beach section on 29th September 2018. Top left and right: images captured 28th September at 20:31 and 20:42 show pig (1) searching and then digging for the eggs; middle left: image captured 29th September at 01:23 shows pig (2) arriving at the nest; middle right: image captured 29th September at 01:32 shows pig (3) at the nest; bottom left: image captured 29th September at 20:47 shows pig (4) searching for eggs; bottom right: image captured 30th September at 03:07 shows pig (5) searching for eggs.

2.9 Traditional Owner Engagement

Traditional owners were engaged for the duration of the surveys in 2018, with several of the same team members as in the previous survey in 2017. One LSMP team member has participated in all three surveys, since 2016. Two individuals who were field team members in 2017, were promoted to the role of 'Acting LSMP Program Coordinator' in 2018. They successfully ran the field component of the surveys on behalf of the LSMP Program Coordinator who was managing the program remotely.

At least eight LSMP Advisors participated in training delivered by PENV in the form of a formal presentation prior to conducting fieldwork and ongoing training in the field throughout the survey duration.

Initial training was given in a presentation prior to departure to the field. Sample slides are shown in **Appendix B**. The training included:

- i. Relevant aspects of Pendoley Environmental's HSEQ policies and procedures, review of the field survey JSA and evaluation of identified risks potentially associated with carrying out the field survey component of the surveys; and
- ii. Data collection techniques and protocols including review of datasheets and PENV data handling and management protocols.

In the field, the PENV Field Team took every opportunity to train LSMP crew members and give them the skills and experience to successfully manage and execute these field surveys as follows:

- i. When an event was observed, LSMP advisors were shown the approach used by PENV staff with regards to all field survey tasks and given the direction and support required for them to complete each task.
- ii. Skills obtained included e.g. data collection, understanding observation made in the field, data recording, and animal handling and management, turtle and track morphological measurements, egg handling and management, turtle tagging, nest excavation and hatchling orientation.

Following the field survey, the LSMP crew successfully retrieved one of two remaining cameras and relayed the information for inclusion in this report.

3 REFERENCES

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Appendix A: Location of predated nests

Northern: 6 of 13 nests predated

Legend

- ▲ Predated Turtle Nest
 - ▲ Non-predated Turtle Nest
 - ◆ Hatched clutch
 - Beach section extents
 -  Camera Deployed
- Survey nights = 10
Beach length = 14.5 km

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

J51003 Amrun Project Marine Turtle Nesting Surveys 2018

Location of identified nests and predation events at Northern beach section



Drawn: P. Whittock
Date: 08/10/2018
Drawing File Ref:
PENV-J51003-901-A
Coordinate System: GDA 1994 MGA Zone 50



PENDOLEY ENVIRONMENTAL
MARINE CONSERVATION
ENVIRONMENTAL SERVICES

Boyd Bay: 8 of 8 nests predated

0 1 2 3 km

Legend

- ▲ Predated Turtle Nest
- ▲ Non-predated Turtle Nest
- ◆ Hatched clutch
- Beach section extents
-  Camera Deployed
- Survey nights = 10
- Beach length = 9.2 km



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

J51003 Amrun Project Marine Turtle Nesting Surveys 2018

Location of identified nests and predation events at Boyd Bay beach section



Drawn: P. Whittock

Date: 08/10/2018

Drawing File Ref:

PENV-J51003-905-A

Coordinate System: GDA 1994 MGA Zone 50



PENDOLEY ENVIRONMENTAL
MARINE CONSERVATION
ENVIRONMENTAL SERVICES

Boyd - Pera: 25 of 34 nests predated**Legend**

- ▲ Predated Turtle Nest
 - ▲ Non-predated Turtle Nest
 - ◆ Hatched clutch
 - Beach section extents
 -  Camera Deployed
- Survey nights = 11
Beach length = 6.5 km



J51003 Amrun Project Marine Turtle Nesting Surveys 2018

**Location of identified nests and predation events
at Boyd – Pera beach section**



Drawn: P. Whittock

Date: 08/10/2018

Drawing File Ref:

PENV-J51003-903-A

Coordinate System: GDA 1994 MGA Zone 50



**PENDOLEY
ENVIRONMENTAL**
MARINE CONSERVATION
ENVIRONMENTAL SERVICES

Pera - Thud: 12 of 28 nests predated

Legend

- ▲ Predated Turtle Nest
 - ▲ Non-predated Turtle Nest
 - ◆ Hatched clutch
 - Beach section extents
 -  Camera Deployed
- Survey nights = 10
Beach length = 6 km

0 500 1,000 1,500 m

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

J51003 Amrun Project Marine Turtle Nesting Surveys 2018

**Location of identified nests and predation events
at Pera-Thud beach section**



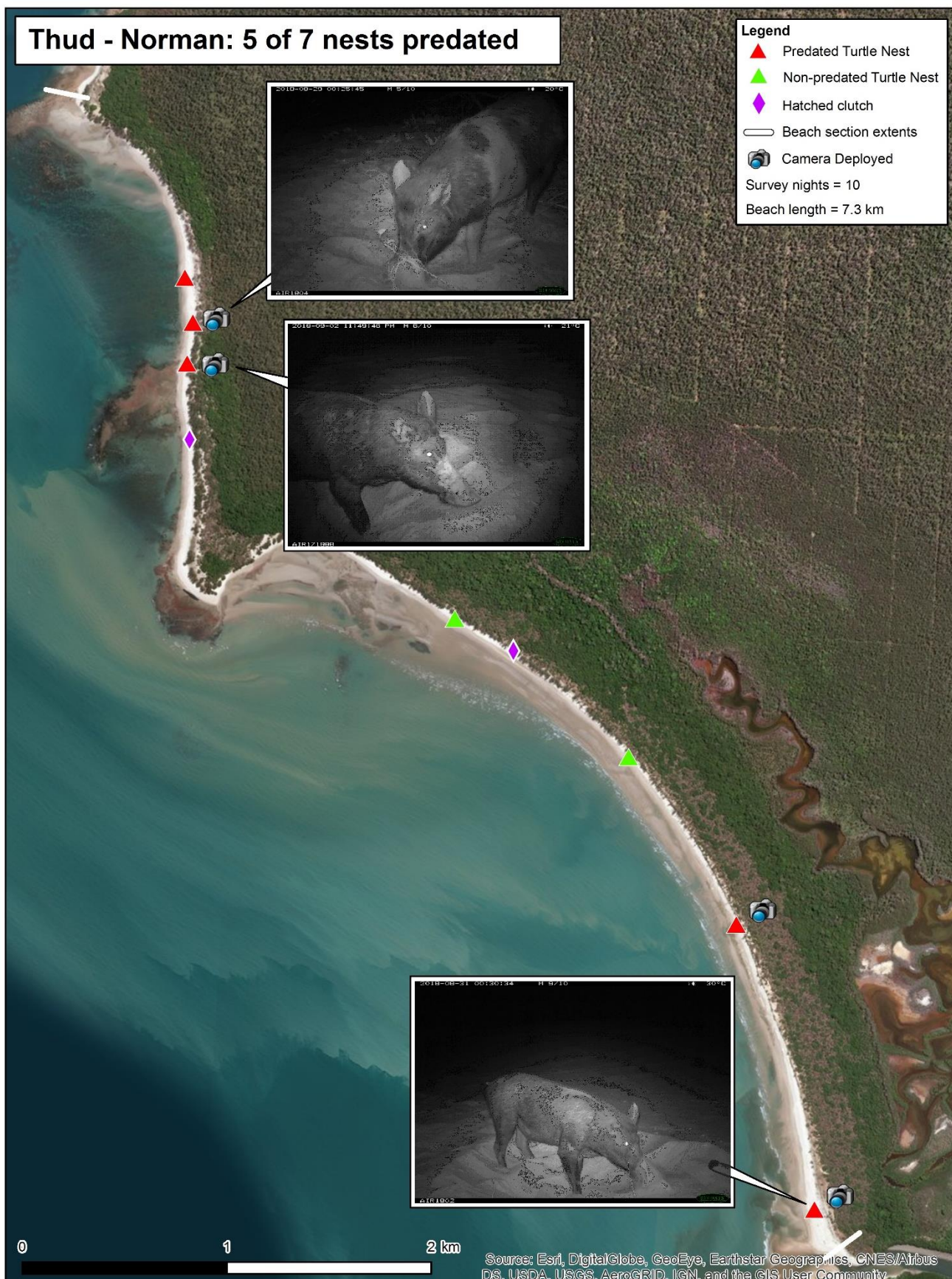
Drawn: P. Whittock
Date: 08/10/2018
Drawing File Ref:
PENJ-J51003-902-A
Coordinate System: GDA 1994 MGA Zone 50



**PENDOLEY
ENVIRONMENTAL**
MARINE CONSERVATION
ENVIRONMENTAL SERVICES

Thud - Norman: 5 of 7 nests predated**Legend**

- ▲ Predated Turtle Nest
- ▲ Non-predated Turtle Nest
- ◆ Hatched clutch
- Beach section extents
-  Camera Deployed
- Survey nights = 10
- Beach length = 7.3 km



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

J51003 Amrun Project Marine Turtle Nesting Surveys 2018

**Location of identified nests and predation events
at Thud – Norman beach section**



Drawn: P. Whittock

Date: 08/10/2018

Drawing File Ref:

PENV-J51003-904-A

Coordinate System: GDA 1994 MGA Zone 50



**PENDOLEY
ENVIRONMENTAL**
MARINE CONSERVATION
ENVIRONMENTAL SERVICES

Amban: 5 of 9 nests predated**Legend**

- ▲ Predated Turtle Nest
- ▲ Non-predated Turtle Nest
- ◆ Hatched clutch
- Beach section extents
-  Camera Deployed
- Survey nights = 9
- Beach length = 9.5 km

0 1 2 3 km

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

J51003 Amrun Project Marine Turtle Nesting Surveys 2018

**Location of identified nests and predation events
at Amban beach section**



Drawn: P. Whittock

Date: 08/10/2018

Drawing File Ref:

PENV-J51003-906-A

Coordinate System: GDA 1994 MGA Zone 50

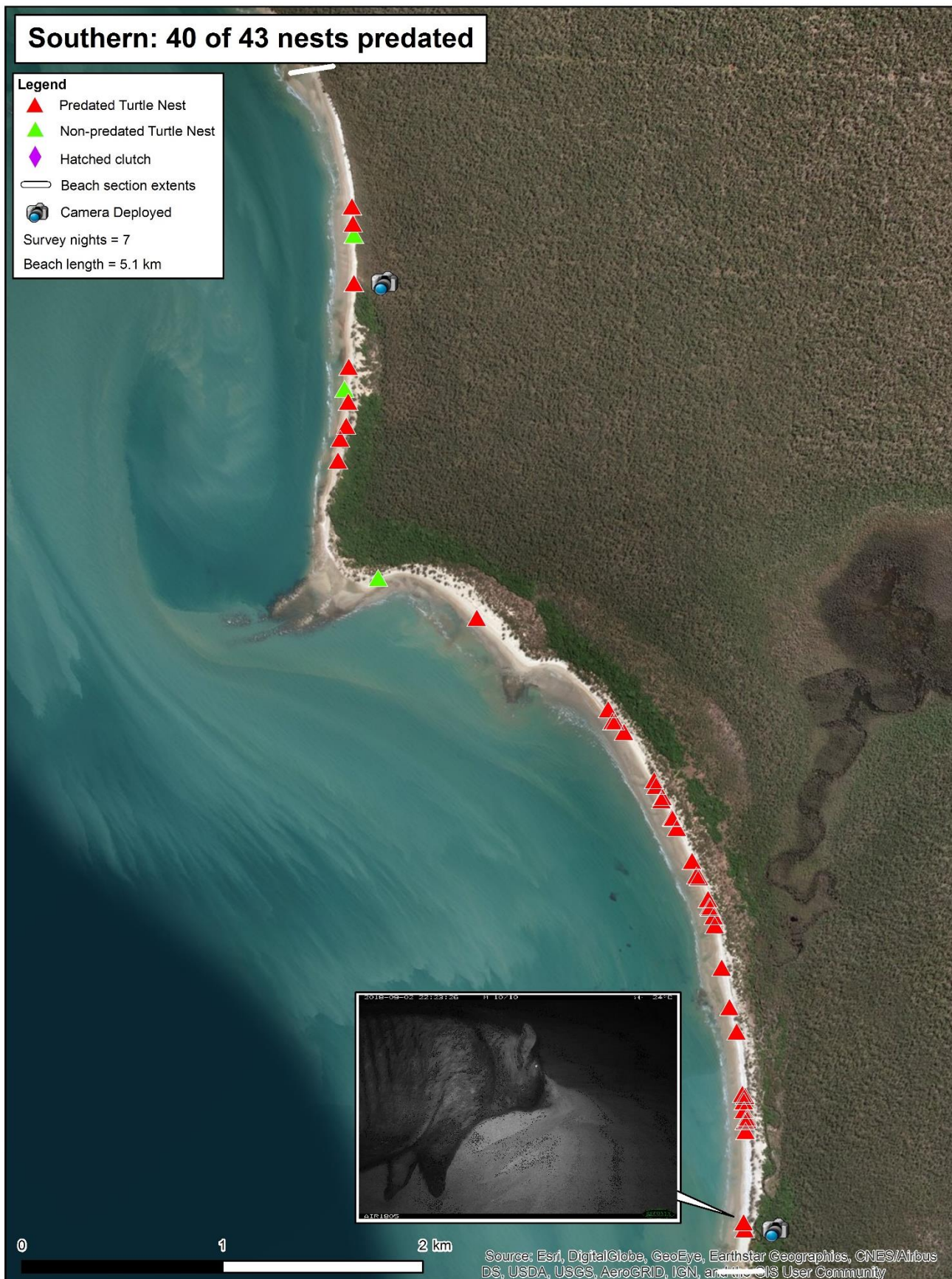


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Southern: 40 of 43 nests predated

Legend

- ▲ Predated Turtle Nest
- ▲ Non-predated Turtle Nest
- ◆ Hatched clutch
- Beach section extents
-  Camera Deployed
- Survey nights = 7
- Beach length = 5.1 km



J51003 Amrun Project Marine Turtle Nesting Surveys 2018

**Location of identified nests and predation events
at Southern beach section**



Drawn: P. Whittock

Date: 08/10/2018

Drawing File Ref:

PENV-J51003-907-A

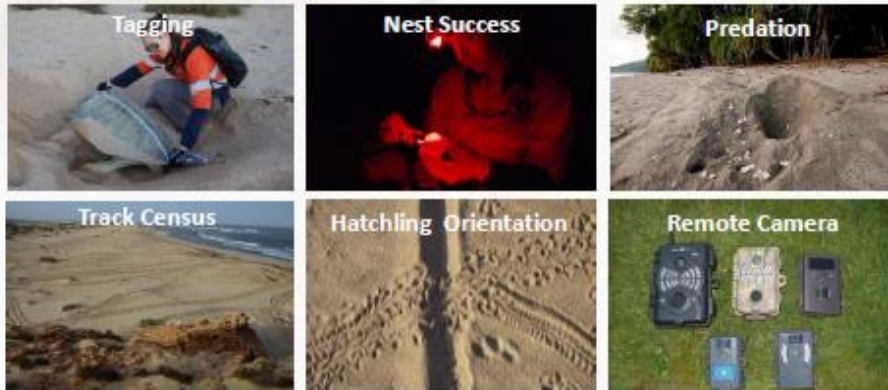
Coordinate System: GDA 1994 MGA Zone 50



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ENVIRONMENTAL SERVICES

Appendix B: Sample Slides LSMP Training 2018

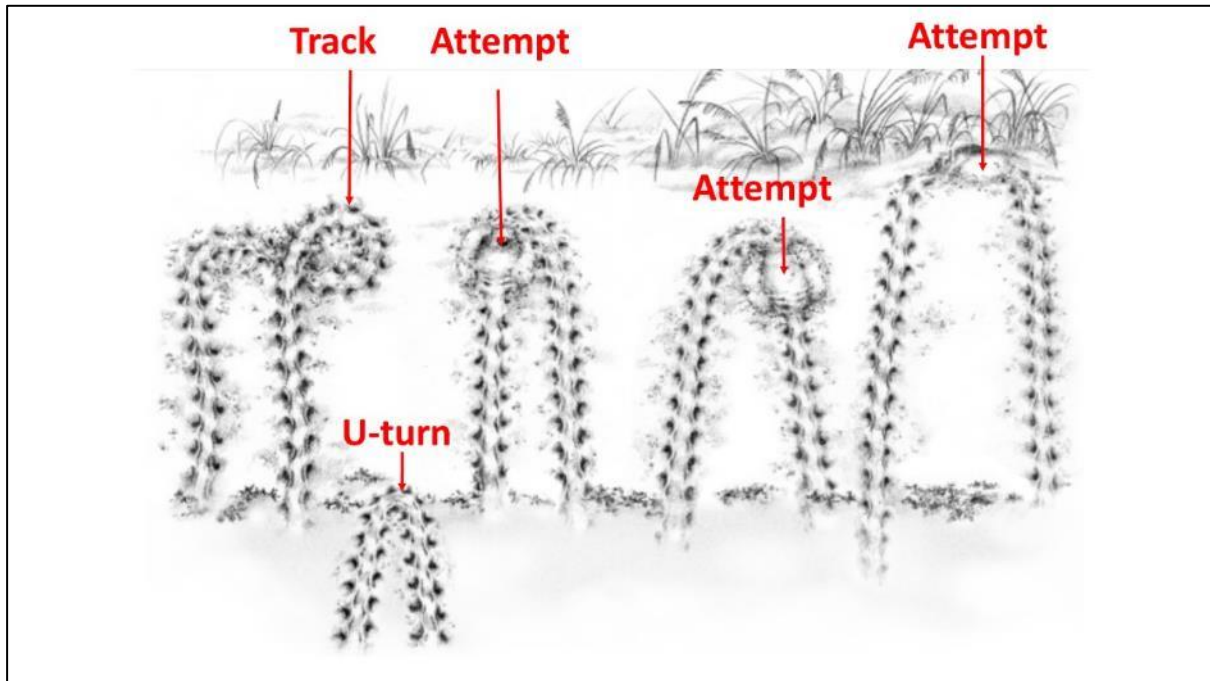
Pendoley Environmental Pty Ltd



Hatchling Orientation

[illegible]

- All information should be completed where possible
- Only 'confirmed' if you see a hatchling
- Get one person to count tracks and the other to record the measurements
- Mark the widest hatchling track at either side of the fan in sand near the high tide line

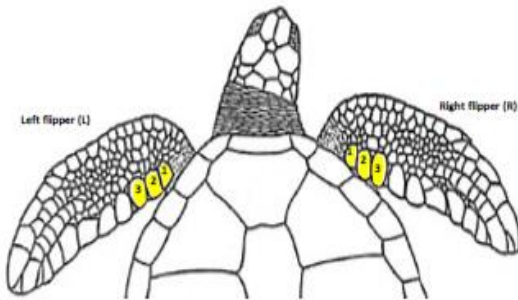


Nest Predation Beach Monitoring

PENDOLEY ENVIRONMENTAL MARINE TURTLE NEST PREDATION BEACH MONITORING DATASHEET					
PROJECT	DATE		TIME		
FIELD TEAM	BEACH		WEATHER		
GPS LAT: S	GPS LONG: S				
<small>Mark GPS lat. Track: highest point on beach. Attempt: location of last attempt. Nest: location of nest.</small>					
SPECIES	OLIVE RIDLEY	HAWKSBILL	FLATBACK	GREEN	UNIDENTIFIED
ACTIVITY	FALSE CRAWL U-TURN	FALSE CRAWL ATTEMPT	POTENTIAL NEST	NEST	
POSITION ON BEACH	DUNE	SLOPE	FLAT	BELOW HT	
TRACK WIDTH (m)	1.	2.	3.		
PLASTRON WIDTH (m)	1.	2.	3.		
PREDATOR ACTIVITY AND PREDATION					
PREDATOR ACTIVITY	YES / NO	PREDATOR SPECIES			
PREDATOR TRACKS	NEST	TURTLE TRACKS	NEARBY		
PREDATOR DIGGING	NEST	TURTLE TRACKS	NEARBY		
PREDATOR SEEN	YES / NO	IF YES, HOW MANY?			
PREDATION	YES / NO	EGGS AT SURFACE	REMAINS AT SURFACE		
PHOTO TAKEN	YES / NO	IF YES	CAMERA #	PHOTO #	
DEPLOY FIELD CAMERA					
CAMERA DEPLOYED	YES / NO	IF YES	CAMERA #	SD CARD #	
<small>Record remainder of field camera deployment data on FIMS DAT34- PENV Predation Monitoring Camera Datasheet</small>					
COMMENTS					

- All information should be completed where possible
- Mark GPS coordinates where activity occurred or at the top of the track
- Record evidence of predation if encountered
- Take photos of predators and predation if possible
- Add comments if extra information needed

Marine Turtle Tagging



Field Camera Deployment

After you arrive at the beach you will follow the sequence of events listed below:

1. Select the monitoring location by identifying a suitable nest (**Section 4.2.3**).
2. Identify the exact position for the camera (**Section 4.2.3**).
3. Document the position of the nest (**Section 4.2.4**).
4. Install the remote camera (**Section 4.2.5**).
5. Document the position of the remote camera (**Section 4.2.4**).
6. Check remote camera functionality (**Section 4.2.6**).
7. Arm the camera (**Section 4.2.6**).
8. Complete the datasheet (**Section 4.2.7**).

Data Collection and Handling

COMPLETING DATASHEETS

- All information completed where possible
- All data should be repeated back as it is written down
- Datasheets must be legible, written in pencil
- Single line through mistakes
- Unusual or extra-ordinary data noted using an exclamation mark
- Datasheet double-checked by both team members
- Datasheet tucked safely away, before moving onto next event

**Remember, completing the datasheet accurately
is the most important part of your job**

Health, Safety, Environment and Quality

HSEQ GOALS

Incident and Injury Free (IIF) Workplace

Applies to:

- Health and Safety
- Environment and
- Quality

PENV ARE VERY SERIOUS ABOUT HSEQ

- Policies - Your policies are our policies (JHA)
- Procedures – PENV Standard Operating Procedures (This presentation)

Persons not conforming will be removed



Hatchling Orientation

