

RPS

2011 SUPPLEMENT REPORT

Woodside Browse Turtle Studies





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SUMMARY

RPS Environment and Planning Pty Ltd (RPS) was commissioned by Woodside Energy Limited (Woodside) to undertake a third year of baseline marine turtle studies for the Browse Liquefied Natural Gas (LNG) Development. These baseline studies for 2011 included:

- track count and nearshore point surveys along the west coast of the Dampier Peninsula between December 2010 and June 2011
- satellite telemetry data received between 30 November 2010 and 31 May 2011 for three green turtles (Alba, Meg and Kai Laini) and five flatback turtles (Flossy, Courtney, Tiane, Charlotte and Jeanie)
- aerial surveys targeting turtles was conducted as part of the broader 2011 Marine Megafauna Surveys (MMFS).

The key findings from these studies are:

- Beaches between James Price Point Beach (Main) and Jajal Beach support very low nesting activity throughout the year, with no nesting activity recorded in the James Price Point area between December 2010 and June 2011.
- A small number of turtles were recorded during the point count survey in nearshore areas at Quondong South Beach and James Price Point Beach (Main).
- Foraging areas for green turtles that nest at the Lacepede Islands are more broadly distributed than flatback turtles. Most flatback turtles released from the Lacepede Islands spent their non-breeding years at the Holothurian Foraging Ground.
- Some flatback turtles travelled up to 350 km south-west of their main foraging area toward the Lacepede Islands but did not reach their natal beach and returned to the foraging grounds.
- Turtles are distributed throughout the aerial survey area with areas of higher densities north of Coulomb Point and offshore from James Price Point.
- The nearshore waters (<14 km from shore) between Coulomb Point and Cape Carnot are recognised as aggregation areas during the winter months.
- An increase of turtles in late September may be associated with increased activity in the southern migration pathway for turtles off the Dampier Peninsula as breeding turtles head to southern rookeries.

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1.0 INTRODUCTION

RPS has been conducting baseline marine turtle studies for the Browse LNG development since November 2009. The results from these studies are presented in RPS (2010; 2011). The following provides a brief account of the studies undertaken to-date:

- vessel-based transects to identify the relative abundance and species composition of mating and resident foraging turtles along the west coast of the Dampier Peninsula and at the Lacepede Island Group. These surveys were conducted in December 2009 and February 2010
- preliminary habitat assessments to identify potential turtle nesting beaches between Manari Beach and Jajal Beach on the west coast of the Dampier Peninsula and at the Lacepede Island Group. These surveys were conducted in November and December 2009
- track count surveys to determine the relative abundance and species of nesting turtles Manari Beach and Jajal Beach on the west coast of the Dampier Peninsula and at the Lacepede Island Group. These surveys were conducted between November 2009 and November 2010
- nearshore scanning and point surveys to determine the relative abundance, species, age class and activity of turtles in nearshore waters adjacent to nesting beaches along the west coast of the Dampier Peninsula and at the Lacepede Island Group. These surveys were conducted between December 2009 and November 2010
- sand temperature monitoring to determine nest incubation temperatures (and hence hatchling gender ratios) along the west coast of the Dampier Peninsula and at the Lacepede Island Group. These surveys were conducted between November 2009 and March 2010
- satellite telemetry studies to determine the inter-nesting, post-nesting migration and foraging movements of turtles that nest at the Lacepede Island Group. Satellite transmitters were deployed in December 2009 and February 2010 and data up to 30 November 2010 was presented in RPS (2011)
- aerial and vessel surveys (conducted as part of the 2009 and 2010 Woodside Browse Marine Megafauna Survey (MMFS) programs) to gather information about the in-water distribution of turtles in the Kimberley region. These surveys were conducted between June and October 2009 and 2010.

Ongoing baseline turtle studies, comprising monthly track count and nearshore point surveys along the west coast of the Dampier Peninsula, analysis of satellite telemetry data received beyond 30 November 2010 and aerial surveys are presented in this supplementary report.

2.0 METHODS

2.1 Beach Studies

2.1.1 Track Counts

Track count surveys were planned to be conducted one day per month from December 2010 – June 2011. However survey sites were inaccessible by road from January–April 2011 due to Manari Road being flooded. In March 2011, a vessel was used to access James Price Point Beach (Main) and Murdudun Beach, but the other survey sites could not be accessed. The final survey schedule is provided in Table 1.

Track count surveys were undertaken at Jajal Beach, Quondong South Beach, Quondong Beach, Murdudun Beach and James Price Point Beach (Main) (Figure 1). Methods were based on those described in Schroeder and Murphy (1999), Pendoley (2005) and Waayers (2010) and were consistent with surveys undertaken by RPS from March–November 2010 (RPS 2011).

The surveys were undertaken by a turtle biologist who walked the length of the beach above the high water mark and recorded any evidence of turtle activity on the beach (e.g. tracks, nests, body pits, hatchlings, eggs or turtle bones). Where possible, the species of turtle was identified (by observing the characteristics of the track such as track width, gait symmetry, plastron drag, tail drag and/or track depth) as well as whether or not the individual nested. Due to the low levels of turtle nesting activity recorded during the surveys, results are presented as individual records of turtle nesting activity.

Table 1: Beach Studies Survey Schedule

Survey Site	Length of Beach Surveyed (km)	Survey Dates						
		Dec-10	Jan-11*	Feb-11*	Mar-11*^	Apr-11*	May-11	Jun-11
Jajal Beach	0.64	6	–	–	–	–	5	9
Quondong South Beach	0.59	6	–	–	–	–	5	9
Quondong Beach	1.05	6	–	–	–	–	5	9
Murdudun Beach	0.9	6	–	–	16	–	5	9
James Price Point Beach (Main)	0.72	6	–	–	16	–	5	9
Total	8.65							

*Survey site was inaccessible due to Manari Road being flooded

^Survey was attempted via vessel

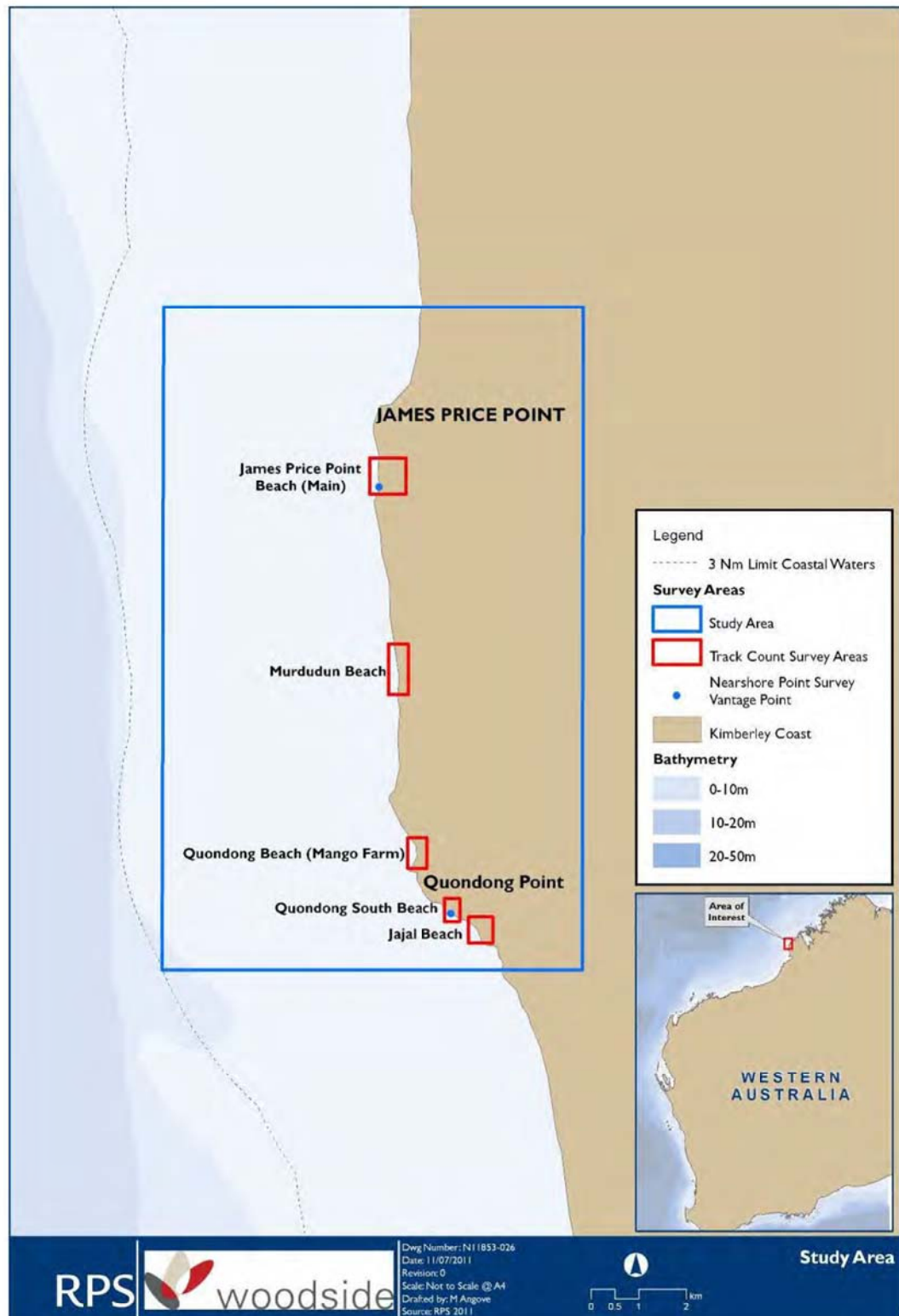


Figure 1: Track Count and Nearshore Point Survey Sites

2.1.2 Nearshore Point Surveys

Nearshore point surveys were undertaken at Quondong South Beach (17°34'55.658"S, 122°9'27.279"E) and James Price Point Beach (Main) (17°30'2.789"S, 122°8'36.573"E) (Figure 2) in conjunction with the track count surveys (see Table 1).

The nearshore point surveys involved surveying a quadrant that extended approximately 50 m out to sea and was approximately 100 m wide (Figure 2). Quadrants were surveyed for 10–20 minutes¹ from a fixed vantage point on the beach. Where possible, the following parameters were recorded for each turtle observation:

- species
- age class (adult or juvenile) based on carapace size and/or head size
- environmental conditions (e.g. Beaufort Sea State (BSS), swell, glare and turbidity).

Total numbers of turtles recorded at each site during each survey were determined and, to standardise for variation in survey duration, average numbers of turtles recorded per minute were calculated for each survey day and site.

¹ Surveys were originally being undertaken for 10 minutes but were extended to 20 minutes as a result of requests from Woodside.



Figure 2: Nearshore Point Survey Areas

2.2 Satellite Telemetry

Argos location data received between 1 December 2010 and 31 May 2011 was filtered for Location Class (3, 2 and 1 only²), travel speed (< 5 km/h) and bearing (< 25° turning angle) using the Satellite Tracking and Analysis Tool (STAT) and as described by Coyne and Godley (2005). This data was then combined with the dataset from RPS (2011) and analysed to determine the following parameters for each turtle:

- number of days the transmitter operated
- maximum straight line distance travelled from the Lacepede Islands
- number of transmission received since 30 November 2010
- maximum straight line distance travelled since 30 November 2011
- location of last transmission
- activity at last transmission (as defined in RPS 2011).

The above parameters were presented in tables and maps showing the movements of the turtles were prepared in ArcMap.

2.3 Aerial Surveys

The aerial data collected for marine turtles was part of broader survey that also targeted dugongs and dolphins (for detailed methods, see Intensive Marine Megafauna Aerial Survey Report: Browse Marine Megafauna Study 2011).

2.3.1 Survey Schedule

Seven survey trips were scheduled between late June and late September 2011, to occur at a frequency of once every two weeks (Table 2). However, Trip MS6 was cancelled due to unsuitable observation conditions. All 15 transects were flown on the same day.

Table 2: 2011 Intensive Marine Megafauna Survey Schedule

Trip Number	Date
MS1	29 June 2011
MS2	13 July 2011
MS3	26 July 2011
MS4	11 August 2011
MS5	26 August 2011
MS6	–
MS7	23 September 2011

² Argos locations are classed according to their accuracy. Location Class 3, 2 and 1 are the most accurate with <250 m, 250<500 m and <1500 m error, respectively.

2.3.2 Survey Design

The 2011 Megafauna Survey was conducted using 15 transects from the 2009 Dugong Survey (SKM 2009; RPS 2010). These transects were approximately 20 km in length and extended westwards from the shoreline of the western Dampier Peninsula (Figure 3). All survey flights were conducted from a CASA 212-400 aircraft flown at 900 ft (274 m) and at 110 knots (204 km/h). Surveys were intended to be conducted in good weather conditions of Beaufort Sea State (BSS) 4 or less.

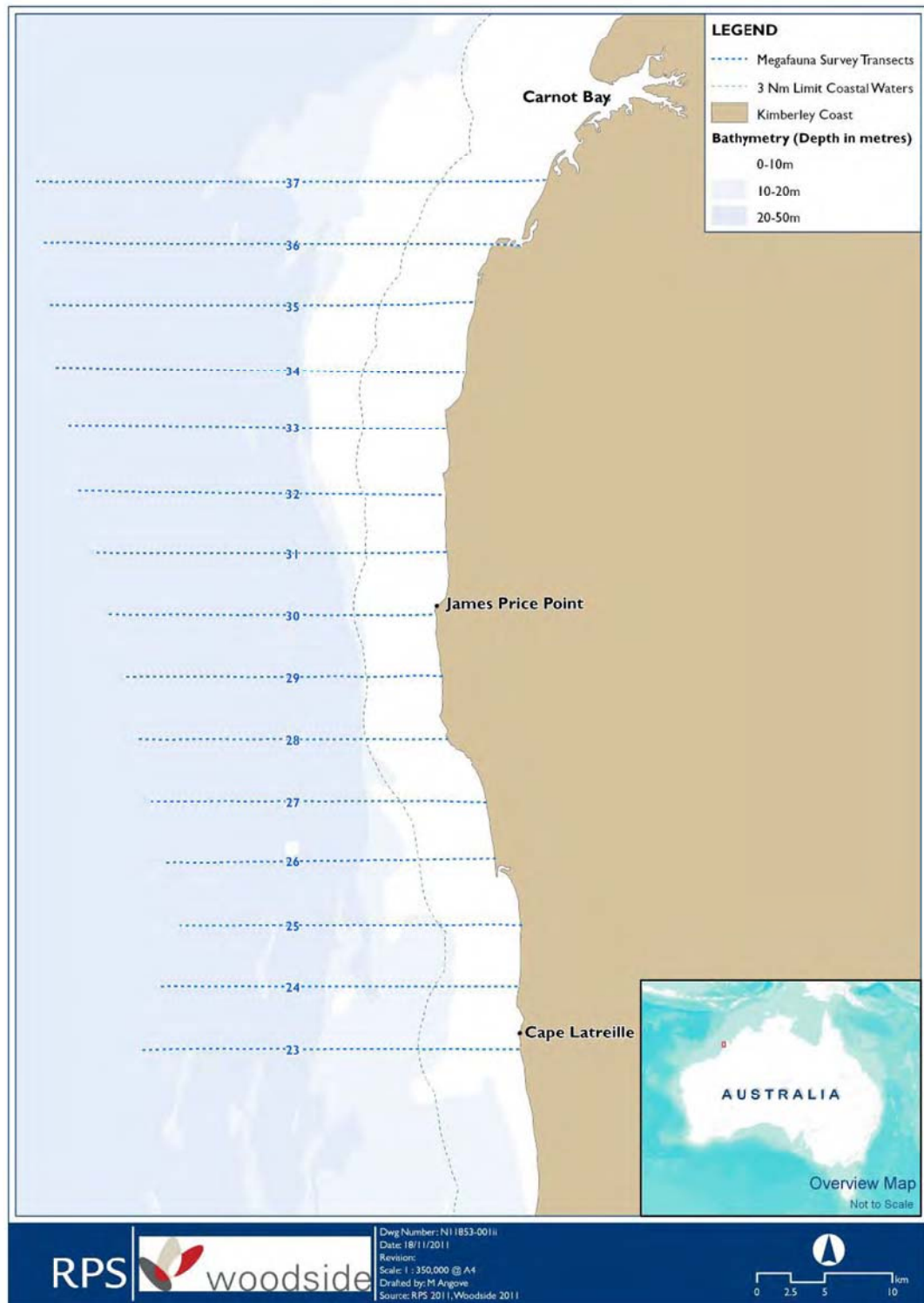


Figure 3: Marine Megafauna Aerial Survey Transects off James Price Point

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3.0 RESULTS AND DISCUSSION

3.1 Track Counts

No nesting activity was recorded in the James Price Point area between December 2010 and June 2011 (Table 3). Old turtle egg shells were recorded at James Price Point Beach (Main) in December 2010 at the site where a nest was identified in January 2010 (Table 3), however there is no evidence to link these records. Turtle bones were recorded at Murdudun Beach in May and June 2011 and Jajal Beach in June 2011 (Table 3), but it is not known if these bones were from turtles attempting to nest or from carcasses that washed up on shore. No evidence of turtle presence was recorded at Quondong South Beach or Quondong Beach (Table 3). Nesting attempts between January and April 2011 could not be confirmed due to heavy rainfall, preventing access to survey beaches and depleting any evidence of turtle nesting activity.

Although the entire survey area was not accessible from January–April 2011, based on nesting activity at Eco Beach (McFarlane 2010), it is likely that the main nesting period for flatback turtles (September–December) was covered. As with previous surveys (RPS 2010; 2011), it appears that the beaches between James Price Point and Jajal Beach support very low nesting activity.

Table 3: Results of Track Count Surveys in the James Price Point Area December 2010–June 2011

Survey Site	Survey Dates and Observations				Total No. of New Observations
	6/12/2010	1/03/2011	1/05/2011	1/06/2011	
Jajal Beach	No evidence of turtle activity recorded.	NS	A potential nest was identified immediately above the high water mark. The potential nest was marked and revisited in June 2010 at which stage it was decided that it was not a nest (or a nesting attempt).	Plastron bone observed below high water mark. Researcher footprints around potential nest identified in March 2011 were still visible.	Turtle bones: 1
Quondong South Beach	No evidence of turtle activity recorded.	NS	No evidence of turtle activity recorded.	No evidence of turtle activity recorded.	None
Quondong Beach	No evidence of turtle activity recorded.	NS	No evidence of turtle activity recorded.	No evidence of turtle activity recorded but there were lots of four-wheel-drive tracks over the beach.	None
Murdudun Beach	No evidence of turtle activity recorded.	No evidence of turtle activity recorded.	Turtle carapace bone identified above the high water mark.	Turtle scapula bones found above the high water mark. The bones are possibly part of the same carcass as the carapace bone identified in May 2011.	Turtle bones: 2
James Price Point Beach (Main)	Old turtle eggs shells were seen near the site of the nest that was identified in January 2010. There was also an indent in the sand that resembled an erupted nest.	The turtle carcass identified in November 2010 was still visible at northern end of beach but there were only a few bones left.	No evidence of turtle activity recorded.	The turtle carcass identified in November 2010 was still visible at northern end of beach but there were only a few bones left.	Egg shells: 1
Total					Turtle bones: 3 Egg shells: 1

NS = Not surveyed

3.2 Nearshore Point Surveys

Few turtles were seen during the nearshore point surveys (Table 4). Turtles were seen on two of four days at James Price Point Beach (Main) and one of three days at Quondong South Beach. BSS varied from 2–4 with the greatest number of turtles (nine) seen at James Price Point during BSS 4 conditions.

Numbers of turtles seen in nearshore point surveys (range = 0–9; Table 4) were within the ranges observed in surveys between December 2009 and November 2010 (range = 0–10; RPS 2011) although a greater proportion of the 2010–2011 surveys resulted in zero turtle observations (four of seven compared with two of 21) (Table 4; RPS 2011). As with surveys completed between December 2010 and June 2011, more turtles were seen in the nearshore areas at James Price Point Beach (Main) than Quondong South Beach.

The results from the nearshore point surveys to-date suggest that the nearshore areas adjacent to James Price Point Beach (Main) and Quondong South Beach support resident foraging turtles. Given most turtles spotted during the nearshore surveys and also the vessel surveys conducted in 2009 (RPS 2010) were reported as juveniles or small adults, suggests they have not yet reached a breeding age and therefore remain in the foraging area for many years before become sexually mature. However, due to small sample sizes and varying sea state and tide heights, it is not possible to quantify the size and composition of this resident population. Nor is it possible to determine the home ranges and site fidelity of these turtles.

Table 4: Numbers of Turtles seen during Nearshore Point Surveys

Survey Site and Date	Survey Time	Tide Height (m)	Survey Duration (Minutes)	Observations	Mean No. of Turtles Per Minute	BSS
James Price Point Beach (Main)						
6/12/2010	11:20	8.4	10	0	0	4
16/03/2011	13:20	4.8	10	0	0	2
5/05/2011	13:20	7.8	15	2 juvenile green turtles	0.13	3
9/06/2011	11:45	4.9	20	9 turtles (unidentified species or age class)	0.45	4
Quondong South Beach						
6/12/2010	8:40	6.5	10	1 adult turtle (unidentified species) 3 juvenile green turtles	0.40	3
16/03/2011	–	–	–	–	–	–
5/05/2011	8:25	5.2	10	0	0	3
9/06/2011	9:09	3.2	20	0	0	4

3.3 Satellite Telemetry

The maximum number of days that individual turtles were tracked were 537 days for green turtles (by Kai Laini) and 542 days for flatback turtles (by Jeanie) (Table 5; Table 6). The maximum straight line distance travelled from the Lacepede Islands was 2,337 km for green turtles (by Shirley) and 1,022 km for flatback turtles (by Flossy) (Table 5; Table 6).

Transmissions were received between 30 November 2010 and 31 May 2011 for three green turtles (Alba, Meg and Kai Laini) and five flatback turtles (Flossy, Courtney, Tiane, Charlotte and Jeanie) (Table 5; Table 6). Maps showing the movements of these turtles before and after 30 November 2010 are provided as Figure 3–Figure 11.

For two of the three green turtles (Alba and Meg), very few locations (≤ 5) were received between 30 November 2010 and 31 May 2011. The maximum distance travelled by these turtles during this period were 37 km and 650 m respectively (Table 5). A total of 70 locations were received for the third green turtle (Kai Laini) however the maximum distance travelled by this turtle during this period was 1.17 km (Table 5) and all transmissions were within 0.66 km of land (Figure 6). Given that there was an eight month gap between transmissions for this turtle (from 14 March 2010–4 November 2010), it is possible that this transmitter became detached from the turtle in March 2010 and washed up on shore in November 2010. However, unless the beach is surveyed and the transmitter recovered it is not possible to confidently determine the fate of this transmitter.

Two of the five flatback turtles (Flossy and Courtney) remained within the same foraging area since 30 November 2010, travelling maximum straight line distances of 29 km and 139 km (Table 6; Figure 7; Figure 8). The remaining three flatback turtles (Tiane, Charlotte and Jeanie) left their foraging area near Gale Bank, travelling in a south-westerly direction (Figure 9–Figure 11). The movements of these three turtles were as follows:

- Tiane left the foraging area on 23 June 2010, travelling in a south-westerly direction to an area approximately 50 km south of Browse Island. Tiane spent about a month in this area, from 26 November–29 December 2010, before returning to the foraging area near Gale Bank (Figure 9).
- Charlotte left the foraging area near Gale Bank on 18 October 2010, also travelling in a south-westerly direction to approximately 50 km south of Browse Island. Charlotte spent about a month in this area, from 10–23 November 2010 before also returning to the foraging area near Gale Bank (Figure 10).
- Jeanie left foraging area on 14 April 2011. Jeanie travelled a further 140 km to south-west to Barcoo Shoal (30 km south-west of Adele Island). Jeanie remained in this area for about a week from 6–14 May 2011 before travelling about 75 km to the north-north-west over the next two weeks (Figure 11).

It is presently not known why these three turtles left the foraging area near Gale Bank. It is unlikely that they were undertaking pre-mating migrations as none of the turtles were recorded near rookeries. The turtles' movements could be associated with seeking alternate or more abundant foraging areas, yet little is known about their behaviour during these periods and habitats within these areas.

Table 5: Summary of Green Turtle Post-nesting Movements

Name	Release Date (Time)	Date (Time) of Last Location	Total No. of Days Tracked	Maximum Straight Line Distance Travelled (km) from Lacepede Island Group	No. of Transmissions Received since 30 November 2010	Maximum Straight Line Distance (km) Travelled since 30 November 2010	Location of Last Transmission	Activity at Last Transmission
Kai Laini*	02/12/2009 (21:25)	24/05/2011 (4:03)	537	1217	70	1.17	Cape Don, NT	Milling
Alba*	04/12/2009 (20:58)	14/04/2011 (8:26)	495	1569	5	37	38 km west-north-west of the Sir Edward Pellew Group, NT	Milling
Meg	09/02/2010 (20:57)	22/12/2010 (7:12)	315	667	1	0.65	Elsie and Eric Islands, WA	Milling
Shirley	09/02/2010 (20:41)	8/07/2010 (16:34)	149	2337	0	–	Cape Horn, QLD	Milling
Chrissy	10/02/2010 (20:02)	5/07/2010 (7:47)	144	481	0	–	North Turtle Island, WA	Travelling
Petrina	10/02/2010 (23:23)	5/07/2010 (5:19)	144	203	0	–	16 km NE of One Arm Point, WA	Travelling
Laia	03/12/2009 (20:30)	14/05/2010 (21:33)	162	148	0	–	King Sound, WA	Milling
Danni	10/02/2010 (21:35)	11/05/2010 (10:04)	90	189	0	–	12 km north-north-west of Cockatoo Island, WA	Travelling
Patty	03/12/2009 (20:30)	8/04/2010 (21:50)	126	323	0	–	55 km north-east of Wallal Downs (Eighty Mile Beach), WA	Milling
Anya	04/12/2009 (21:22)	3/03/2010 (8:25)	88	357	0	–	Rowley Shoals, WA	Travelling
Sam	02/12/2009 (21:10)	24/02/2010 (12:25)	84	1144	0	–	Melville Island, NT	Travelling

*Tag transmitted beyond 31 May 2011

Table 6: Summary of Flatback Turtle Post-nesting Movements

Name	Release Date (Time)	Date (Time) of Last Location	Total No. of Days Tracked	Maximum Straight Line Distance Travelled (km) from Lacepede Island Group	No. of Transmissions Received since 30 November 2010	Maximum Straight Line Distance Travelled since 30 November 2010	Location of Last Transmission	Activity at Last Transmission
Jeanie*	02/12/2009 (23:27)	29/05/2011 (7:13)	542	724	172	515	95 km north-north-west of Adele Island, WA	Travelling
Tiane*	04/12/2009 (0:18)	28/05/2011 (12:04)	540	561	45	272	28 km west-north-west of Cassini Island, WA	Travelling
Courtney*	04/12/2009 (23:16)	20/05/2011 (2:50)	531	702	6	139	24 km north-north-west of Gale Bank, WA	Unknown
Flossy	09/02/2010 (22:38)	3/05/2011 (6:15)	447	1022	31	29	160 km north-west of Bathurst Island, NT	Milling
Charlotte	03/12/2009 (22:48)	13/01/2011 (6:12)	405	910	16	467	132 km north-north-west of Gale Bank, WA	Travelling
Toni	10/02/2010 (21:47)	11/06/2010 (7:00)	120	32	0	–	17 km west of the Lacepede Islands, WA	Milling
Becky	10/02/2010 (23:53)	9/04/2010 (21:55)	58	230	0	–	30 km north-east of Adele Island, WA	Travelling
Arnica	02/12/2009 (20:30)	5/04/2010 (2:01)	123	31	0	–	14 km south-south-west of the Lacepede Island Group, WA	Milling
Amanda	10/02/2010 (22:12)	15/03/2010 (3:29)	32	714	0	–	Gale Bank, WA	Travelling
Hannah	09/02/2010 (21:52)	25/02/2010 (18:45)	16	432	0	–	36 km north of the Maret Islands, WA	Travelling
Adie	04/12/2009 (22:13)	25/12/2009 (22:18)	21	–	0	–	West Lacepede Island, WA	Unknown

*Tag transmitted beyond 31 May 2011

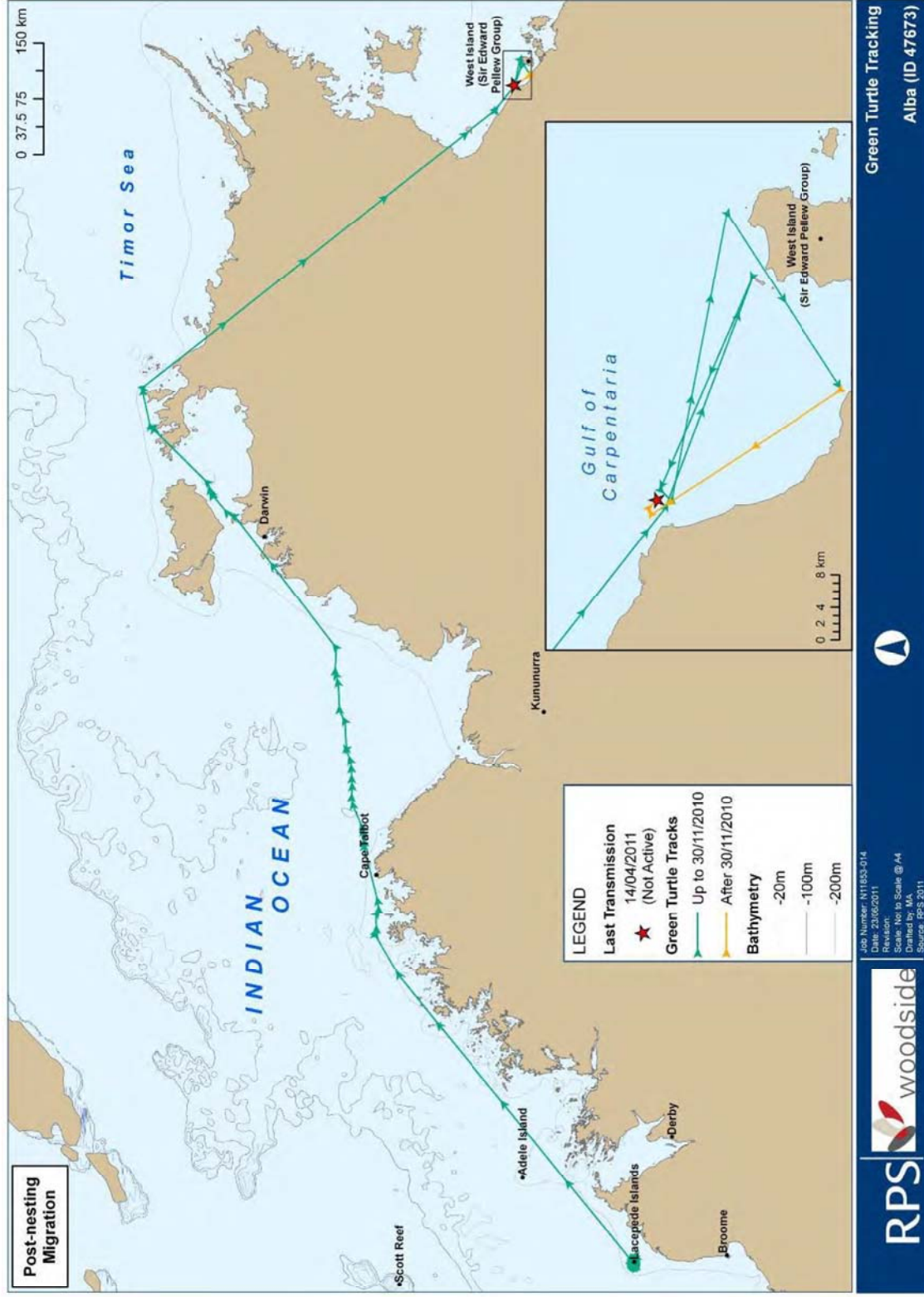


Figure 4: Post-nesting Movements by Alba

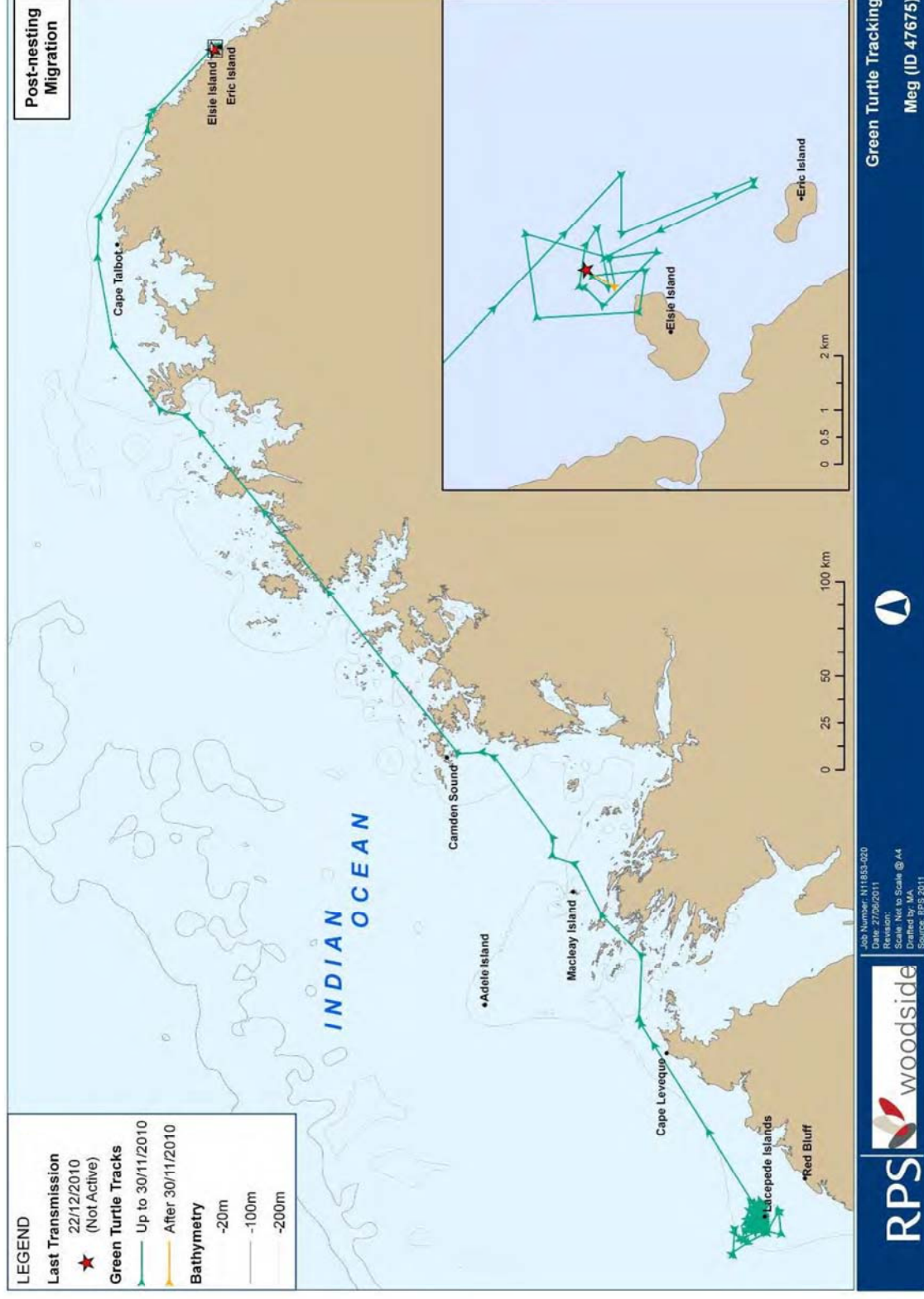


Figure 5: Post-nesting Movements by Meg

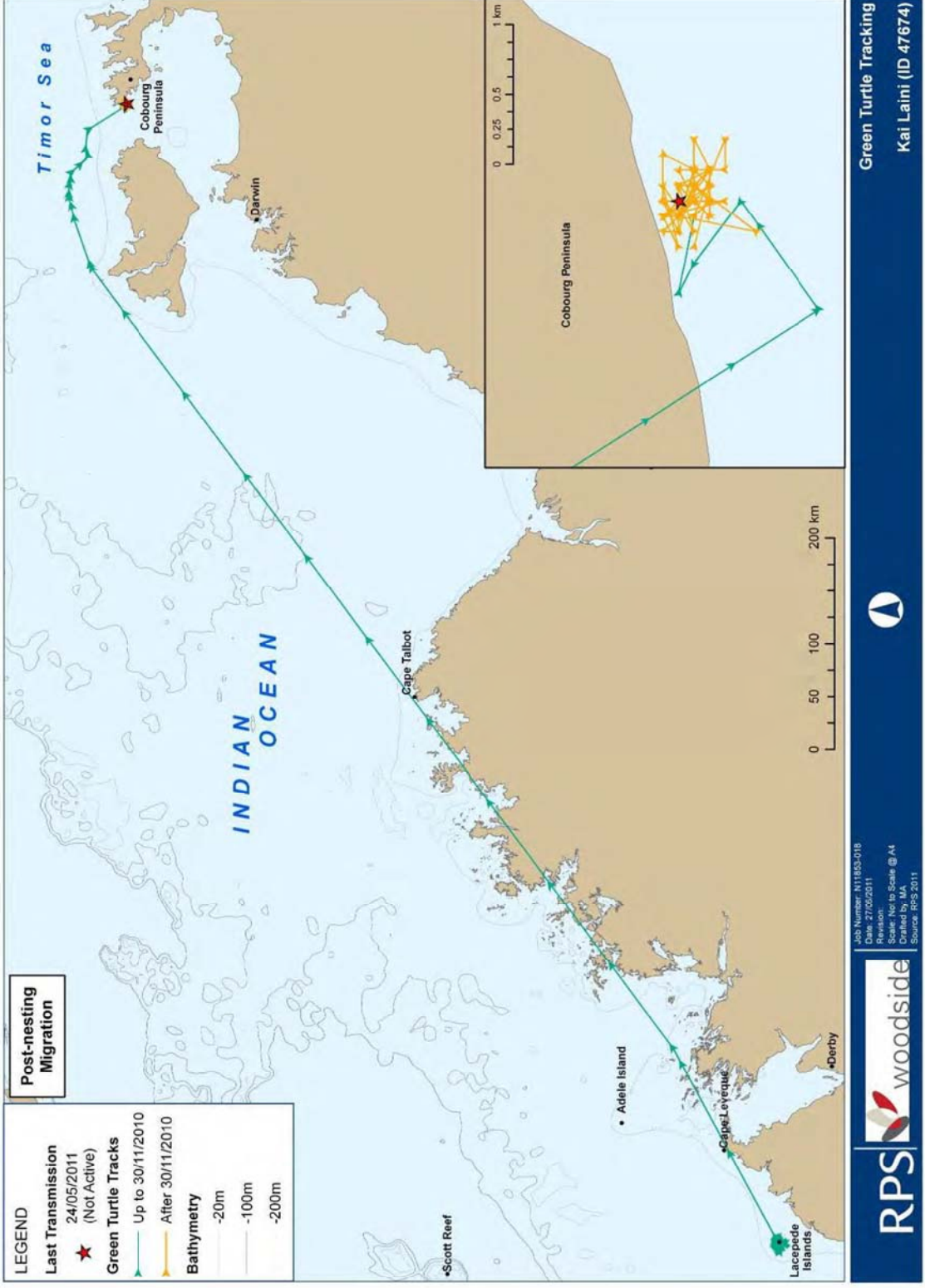


Figure 6: Post-nesting Movements by Kai Laini

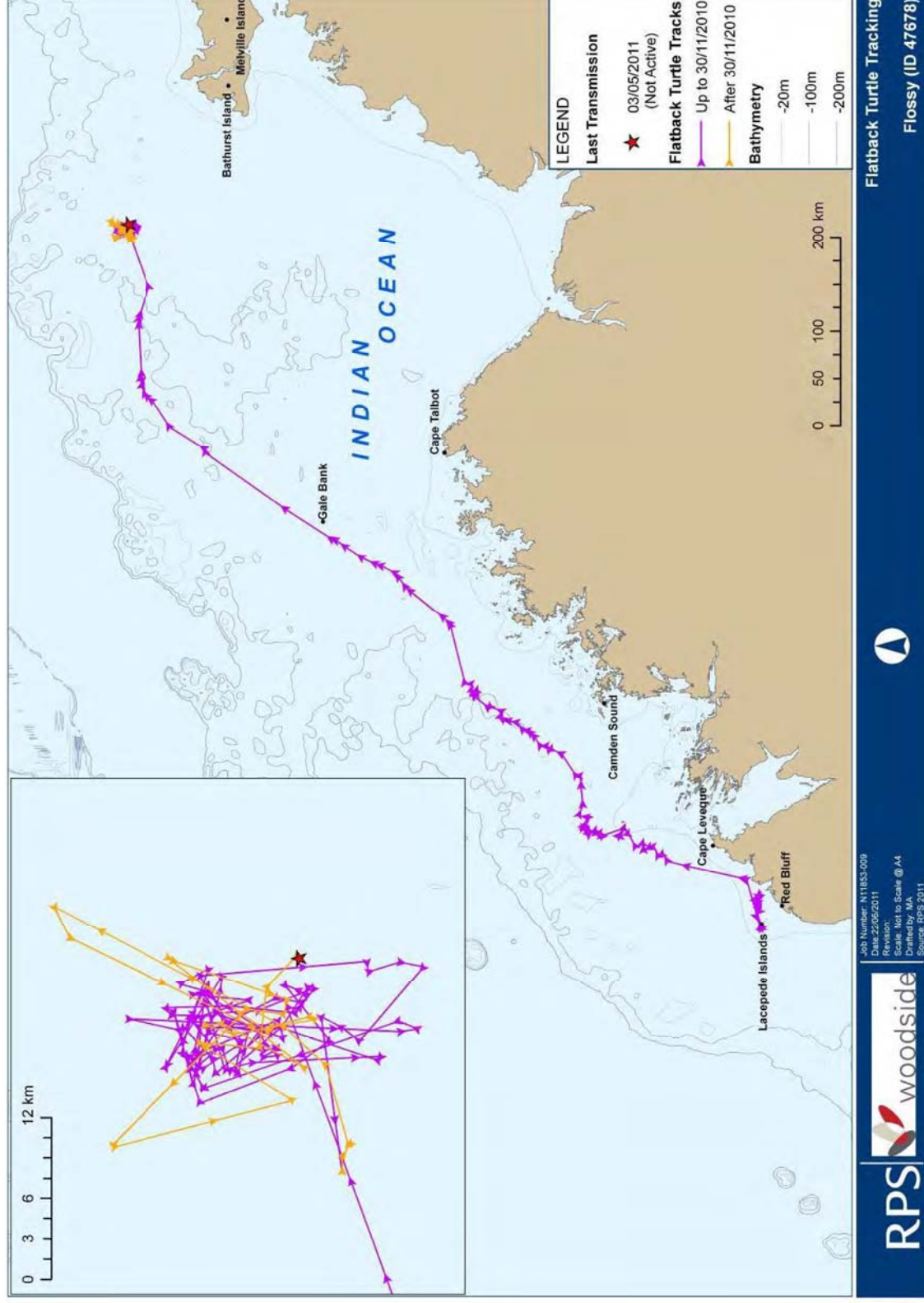


Figure 7: Post-nesting Movements by Flossy



Figure 8: Post-nesting Movements by Courtney



Figure 9: Post-nesting Movements by Tiane

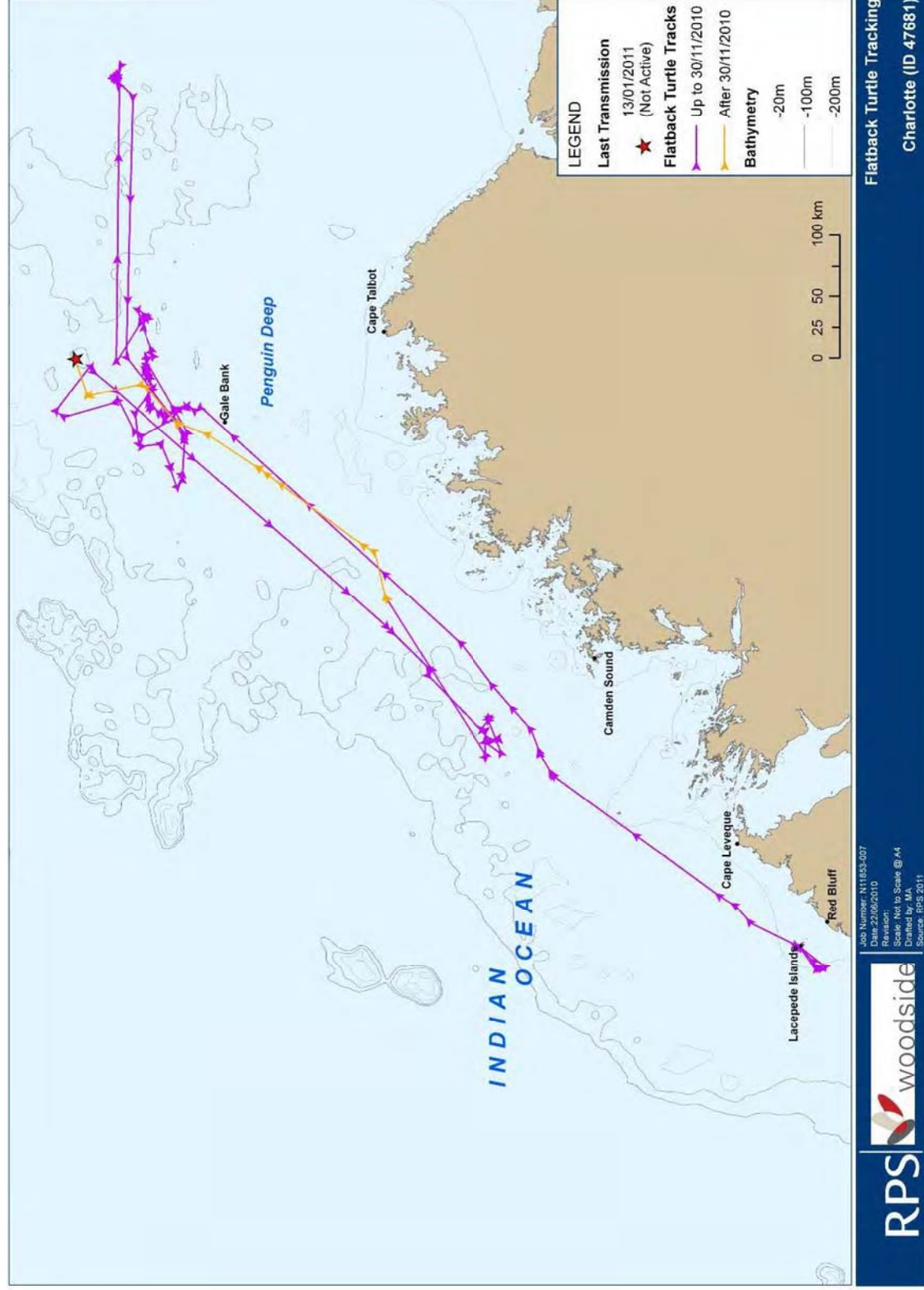


Figure 10: Post-nesting Movements by Charlotte

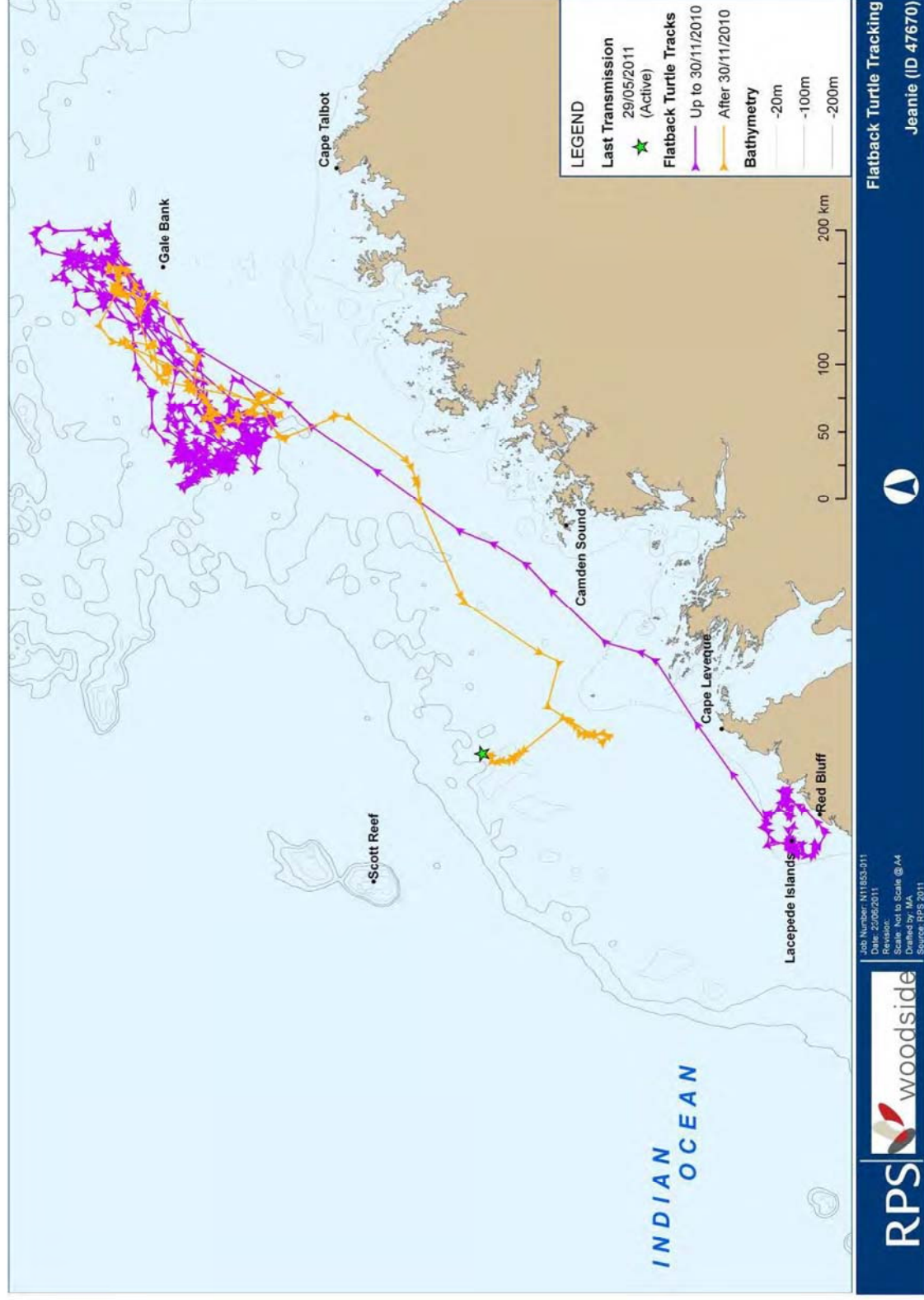


Figure 11: Post-nesting Movements by Jeanie

3.4 Aerial Surveys

A total of 981 sightings and 1034 turtles were recorded during the study period (Table 7). The aerial survey were generally conducted in suitable conditions for spotting turtles on the surface and within 1 m of the surface, with the exception of Trip 5 where BSS 4–5 was encountered in the northern transects (Figure 12). The influx of turtles in the survey area in late September may be associated with increased activity within the migration pathway as breeding turtles move past the James Price Point area from northern foraging grounds to southern rookeries, such as Ningaloo, Barrow Island and Port Hedland. The increase in numbers may also be a result of turtles moving into the James Price Point area to mate before nesting on the Lacepede Islands, which is the largest green turtle rookery in Western Australia (Waayers et al. 2011).

Table 7: Total Number of Sightings and Turtles for each Aerial Survey Trip

Trip No.	Survey Date	No. of Sightings	No. of Turtles
Trip 1	29 June 2011	110	112
Trip 2	13 July 2011	120	121
Trip 3	26 July 2011	141	153
Trip 4	11 August 2011	152	156
Trip 5	26 August 2011	90	98
Trip 6	23 September 2011	368	394
Total		981	1034

Although the distribution of turtles is widespread through the survey area, the contour density plot shows relatively higher densities of turtles <14 km from the shore between Coulomb Point and Carnot Bay and localised areas between 10–20 km offshore from James Price Point (Figure 13). High densities of turtles off Coulomb Point and Carnot Bay have also been reported in previous Megafauna Surveys and this has been recognised as a hot spot for turtle aggregations during the winter months.

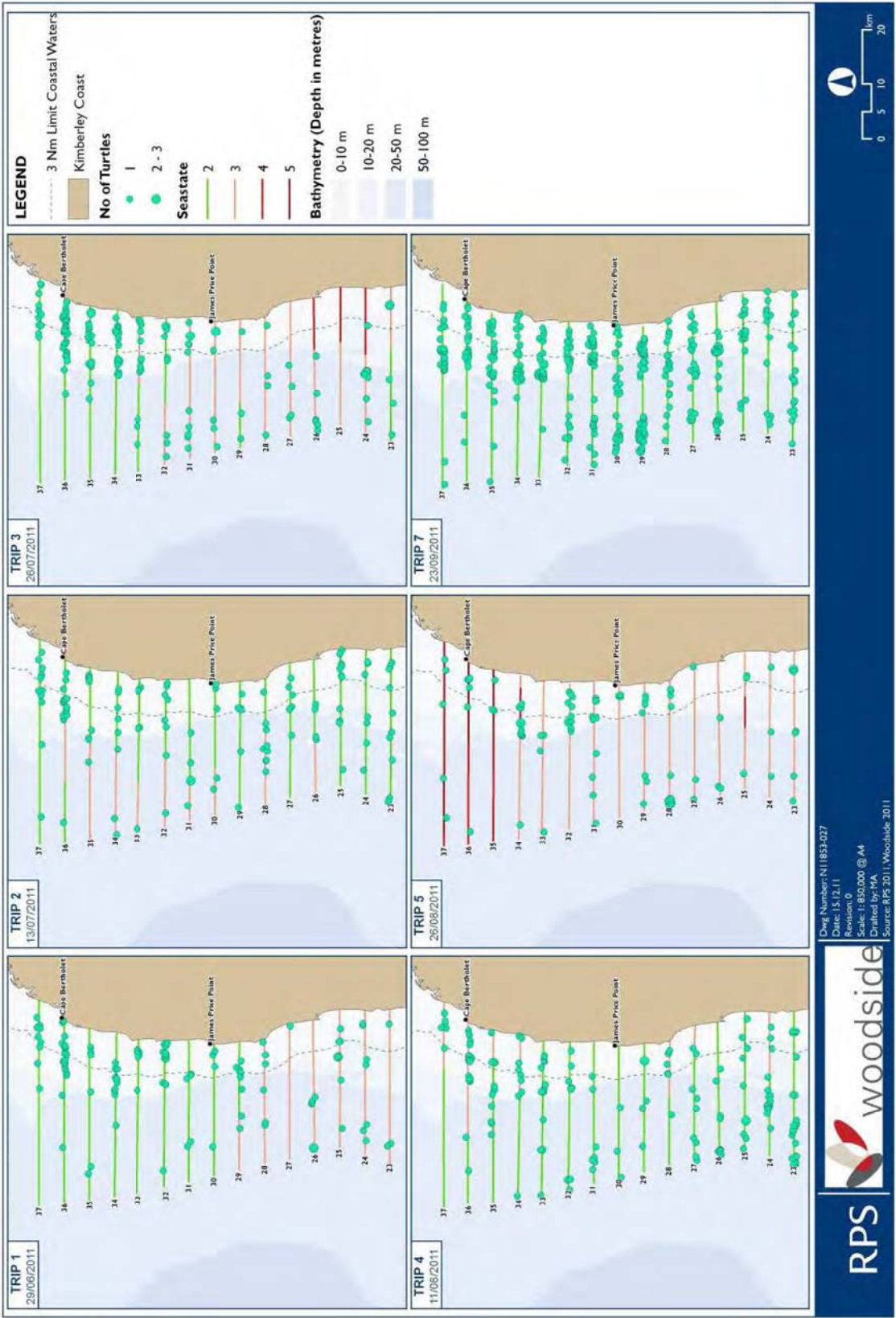
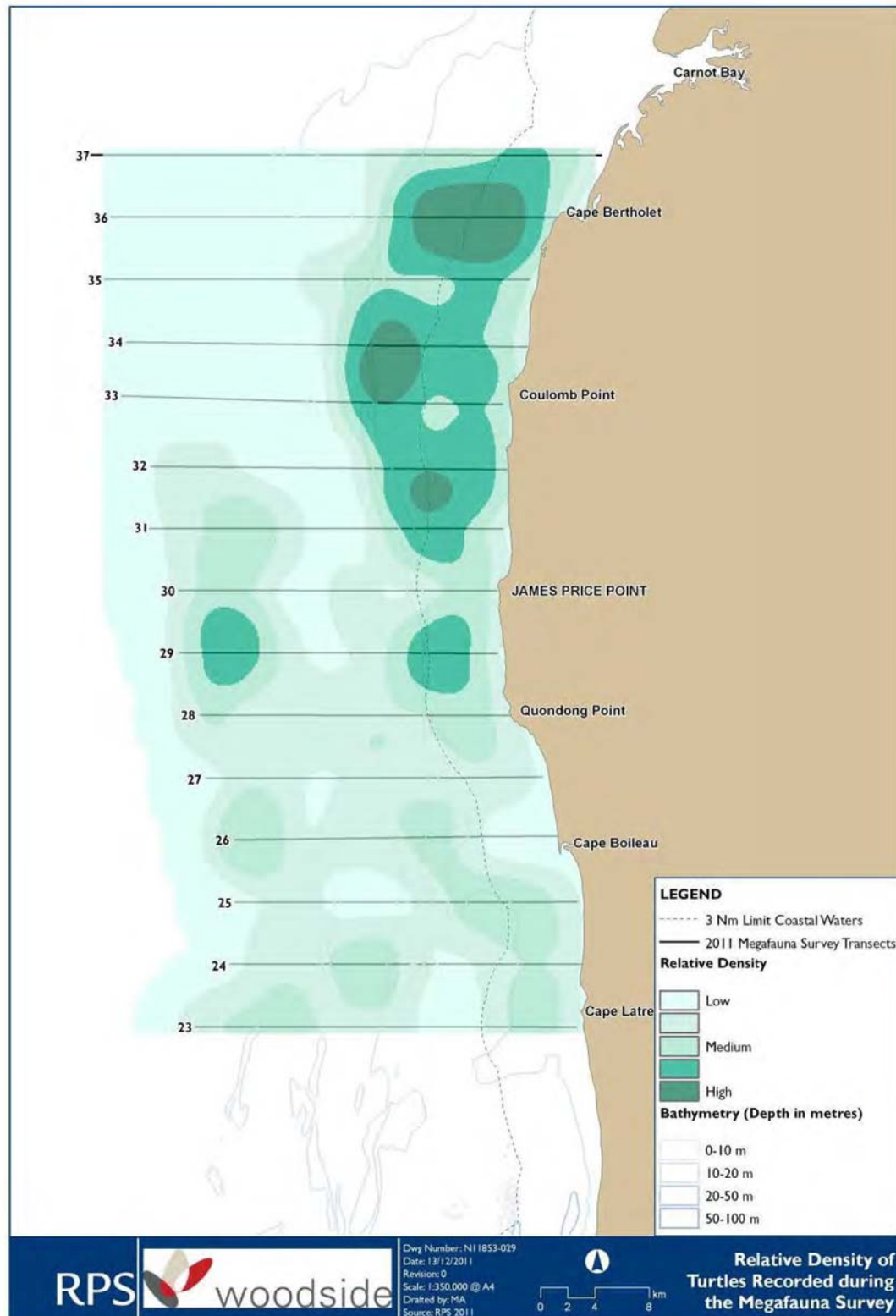


Figure 12: Distribution of Turtle Sightings during each Survey



Note: The density analysis has not removed the effect of sea state on the ability of the observers to detect turtles.

Figure 13: Relative Density of Turtles Recorded during the Megafauna Survey

4.0 CONCLUSIONS

Data from the third year of baseline turtle studies undertaken by RPS confirm that:

- Beaches between James Price Point Beach (Main) and Jajal Beach support very low nesting activity throughout the year, with no nesting activity recorded in the James Price Point area between December 2010 and June 2011.
- Fewer turtles are present in nearshore areas at Quondong South Beach than James Price Point Beach (Main).
- Foraging areas for green turtles that nest at the Lacepede Islands are more broadly distributed compared with flatback turtles. Most flatback turtles released from the Lacepede Islands spent their non-breeding years at the Holothurian Foraging Ground.
- Some flatback turtles travelled up to 350 km south-west of their main foraging area toward the Lacepede Islands but did not reach their natal beach and returned to the foraging grounds.
- Turtles are distributed throughout the survey area with localised higher densities north of Coulomb Point and offshore from James Price Point.
- The nearshore waters (<14 km from shore) between Coulomb Point and Cape Carnot are recognised as aggregation areas during the winter months.
- An increase of turtles in late September may be associated with increased activity in the southern migration pathway for turtles off the Dampier Peninsula as breeding turtles head to southern rookeries.

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