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Shoreline Ecological Assessment
Aerial and Ground Surveys
7-19 November 2009

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Title

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(Images from left to right: Mangroves and saltmarsh in King Sound, Western Australia: Survey helicopter flying in to land on the research vessel; Rocky shore, Western Australia).

As part of the Scientific Monitoring Study of the Montara Monitoring Plan

A report commissioned by PTTEP Australasia (Ashmore Cartier) PL for the Department of the Environment, Water, Heritage and the Arts (DEWHA).

Declaration

This report/proposal has been prepared in accordance with UniQuest's Quality Management System, which is compliant with AS/NZS ISO 9000:2000.

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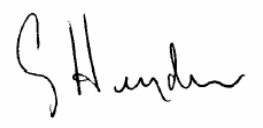

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Gary Heyden – General Manager
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EXECUTIVE SUMMARY

- On the 29 October 2009, Dr Norm Duke of the University of Queensland was commissioned by PTTEPAA in consultation with DEWHA to lead shoreline ecological aerial and ground surveys in the Montara oil spill region of coastal NW Australia.
- The survey, conducted from the vessel *Flamingo Bay,* began in Darwin NT on the 9th November, 2009 and ended on the 18th November in Broome WA.
- This report provides a detailed compilation of coastal shoreline habitats, excluding islands, present within the Montara oil release region.
- No identifiable oil slicks or oil contamination were observed during the survey. However, there were notable flotsam and bloom-like debris in many places. These were observed and sampled during the survey. Preliminary findings suggest these were biotic in makeup, or the result of agitated tidal flows.
- Aerial surveys employed high definition digital video and still cameras from a helicopter at 500 feet altitude to capture detailed imagery of 5102 km of shoreline in the region. Video footage, covering the entire coastline, was used to categorize the shoreline with 16 subregions into representative classes of type and condition. An archive of 6000 high definition still imagery provides a further resource and baseline record.
- Tidal wetlands are common across the survey region, with mangroves occurring along 3214 km of shoreline. OzCoasts database includes 9441 km^2 of tidal wetland (mangrove plus saltmarsh) as occurring along the surveyed coastline, with an average of 1.85 km^2 of tidal wetland for every kilometer of shoreline within the Montara well release region (Darwin to Broome). This measure quantifies coastal shorelines at greatest risk, varying between 0.04 and 10.88 km^2 of tidal wetland/km of shoreline. Three coastal areas are at greatest risk in having disproportionately vast tidal wetland areas, including: Joseph Bonaparte Gulf (subregion #5), Cambridge Gulf (subregion #6) and King Sound (subregion #14).
- Vulnerability is associated also with the biodiversity of mangrove species progressively limited to the west. Species endpoint occurrences are recognized as limits of existence where such species are at high risk from further disturbance, like an oil spill. Respective coastal areas at greatest risk in having species limits west, include: the area west of Darwin (subregions #1 & #2), and the area around King Sound (subregions #14 & #15).
- Significant diversity and numbers of marine megafauna were observed. The type of megafauna recorded included: dolphins, dugong, whales, turtles, crocodiles, sharks and rays. All sightings were marked with location coordinates. Greatest concentrations of megafauna (~60% observed) were recorded from Cape Londonderry to Admiralty Gulf (subregions #8 & #9). The majority (67%) of sightings were of turtles. Additional

observations of beaches with recent turtle tracks were also recorded – as a potentially valuable contribution to our knowledge of turtle nesting activity along this coastline. In the latter case, shoreline imagery taken can be assessed for enhanced quantification. There were signs of greater nesting activity shown with turtle tracks in York Sound (subregion #11).

- A number of estuary mouths and inlets were observed, recorded on film and compared with those previously given in regional and national databases. Imagery showing each estuary was available for use in estuarine databases (like OzCoasts.org.au). Our findings show a number of estuaries were poorly known or described for this country.
- Sea and land based sampling of water and marine sediments were taken at 24 sampling stations, with samples being provided to Eleanor Stoney of PTTEPAA for further analysis. Many of these were made in the intertidal zone. Analysis of these samples is not part of this assessment.
- Land based surveys identified the presence of mangrove species in two locations to compare with species available for the region.
- Video and photographic data captured during the survey provides a permanent baseline record of shoreline habitats and their condition in the Montara oil release region from which impacts associated with future large-scale disturbances can be gauged.

Report submitted to PTTEPAA includes:

Written report with associated:

- Shoreline maps
- Appendices

Shoreline electronic database (66GB) consisting of:

- Excel spreadsheet “Darwin – Broome Shoreline Ecological Surveys”
- Digital image library of photographs and frames from video footage

Figure 1. Mangroves and saltmarsh, King Sound Western Australia.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. BACKGROUND

On Friday 21st August 2009, an oil release was observed from the West Atlas drilling rig at Montara oil field in the Timor Sea, off the northern coast of Western Australia. Oil continued leaking until November 3, 2009 when mud was pumped into the well and stopped the flow. The West Atlas rig is owned and operated by Seadrill. The Montara oilfield is operated by PTTEP Australasia, a subsidiary of PTT Exploration and Production (PTTEP) a subsidiary of PTT, the Thai state-owned oil and gas company. The leaking rig was located off the Kimberley coast, 250 km (160 mi) north of Truscott airbase, and 690 km (430 mi) west of Darwin. The oil loss rate was variously estimated to be between 400 and 2000 barrels/day by the Australian Department of Resources, Energy and Tourism, and PTTEP Australasia. Oil from the Montara Well is a light crude oil with an 11% wax content.

As shoreline impact, and subsequent harm, was anticipated, it was considered useful to obtain baseline information relating to the fitness of coastal species and habitats prior to impact. This information would assist in determining whether any damage observed after impact might be due to the oil, cleanup or it was pre-existing. This was important also for habitats such as mangroves where seasonal dieback is known to occur, or for species where carcases on shorelines are not uncommon.

The Project

On the 29 October 2009, Dr Norm Duke of the University of Queensland was commissioned by PTTEP Australasia (Ashmore Cartier) PL (PTTEPAA) in consultation with the Australian Government Department of Environment, Water, Heritage and the Arts (DEWHA) to lead shoreline ecological aerial and ground surveys in the Montara oil spill region of coastal north western Australia. This included a rapid survey of marine megafauna (defined as cetaceans and marine reptiles) plus water and sediment sampling. Dr Duke working with postgraduate student colleagues (Jock Mackenzie, Alex Haller, Apanie Wood plus four others), also from University of Queensland assisted with these surveys.

The survey, conducted from the vessel *Flamingo Bay,* began in Darwin Northern Territory NT on the 9th November, 2009 and ended on the 18th November in Broome Western Australia WA.

Figure 2. 'RV Flamingo Bay', the support vessel used in aerial surveys.

The project specifically addressed two of the West Atlas Monitoring Programme tasks:

- Shoreline Ecological Assessment Aerial Surveys (Study S2). In this, the project targeted the aerial survey of mainland shoreline in the first instance.
- Shoreline Ecological Ground Surveys (Study S6). As with Study S2, this was designed to quantify any effects on coastal fauna or flora.

This was considered primarily a baseline survey to ascertain prior condition of habitats threatened by the oil leak offshore. The major component of the shoreline aerial survey was undertaken using a helicopter. This allowed flexibility, so if in the eventuality there were signs of associated impacts, these locations could be identified immediately, and preliminary ground surveys undertaken as needed. This was considered crucial to provision of unequivocal confirmation of the source of any potential impact. The shoreline aerial surveys were conducted at the earliest possible date. The shoreline survey is designed to capture the current and prior condition of the shoreline from Darwin in the Northern Territory to Broome in Western Australia. Primary information was recorded as digital imagery. Recorded data included both high definition (HD) video and still images along with coordinate location information and date of acquisition. Using these digital data, interpretation observations were scored and combined with observations recorded from logbooks kept during aerial surveys. Our interpretations identify types of shoreline habitats, their condition, and to some extent, their vulnerability to oil damage.

This report presents the findings of these aerial and ground surveys in fulfilment of our part in the Scientific Monitoring Study S2 “Shoreline Ecological Assessment Aerial Surveys” and Study S6 “Shoreline Ecological Ground Surveys” as set out in the Montara Monitoring Plan. This work included the option to take samples of sediment, waters and biota on behalf of Operational Monitoring Study O2 “Monitoring of Oil Character Fates and Effects”. In all these, the scope of work accounts for baseline studies only and does not include Ashmore of Cartier reefs.

Specific objectives of surveys

The objectives of our survey were based listed in the Montara Monitoring Plan, specifically described as:

- To quantify the presence of megafauna (like dugongs) in the subject area pre-impact in order to determine the level of potential exposure to oil
- To quantify the presence and extent of communities or habitats (mangroves, other tidal wetlands, and other shoreline types) in the subject area before impact by oil in order to determine the level of potential exposure to oil
- To record pre-existing (i.e. pre-impact) condition of communities or habitats (e.g. dieback, bare areas) in the subject area
- To determine any exposure of waters, sediments, fauna or flora to oil and if detected, to quantify the level of exposure
- To quantify actual area or extent of any observed effects of oil impact on habitats or communities in the subject area in order to determine the level of potential exposure.

Later (non baseline) surveys included the following objectives:

- To determine any residual exposure of waters, sediments, fauna or flora to oil and if detected, to quantify the level of exposure
- To quantify area or extent of recovery from any harmful effect of oil impact on habitat or communities in the subject area.

2. METHODOLOGY

Survey Logistics and Operations

Aerial surveys were conducted from a mobile base, 'RV Flamingo Bay' – owned and operated by Flamingo Bay Research, registered in Queensland with USL 2B survey and fitted for receiving and deploying a helicopter that meets AMSA and CASA standards. The vessel and crew have extensive Australian and overseas project experience and marine survey work.

The aircraft used was a Robinson R44 helicopter (Fig. 2), owned and operated by Cape York Helicopters. The helicopter, equipped with pop out flotation devices for overwater activity, was flown from the mobile base. Both pilot and aircraft have conducted regular marine and seagrass surveys for Queensland Fisheries Service over many years and have covered the coastline from Darwin around the Gulf of Carpentaria to Thursday Island in Torres Strait, as well as the area between Cairns and Townsville.

Figure 3. Robinson R44 helicopter with crew conducting aerial ecological surveys.

This combination of operational logistics proved essential for the expeditious, effective and efficient conduct of aerial surveys for this project. The vessel provided not only a platform for the helicopter, but also a base for its fuel, as well as providing all accommodation, transport and office work space for our survey crew. Each of these elements contributed to the ultimate successful conduct and completion of the aerial survey - on schedule, as planned.

Survey Shoreline Ecological Assessment Team

Project Director, Dr Norm Duke (MSc, PhD), with the University of Queensland, is a mangrove and tidal wetlands ecologist of more than 30 years standing, specialising in mangrove floristics, biogeography, genetics, climate change ecology, vegetation mapping, plant-animal relationships, pollution and habitat health assessments. Norm gained his earlier experience at James Cook University, Australian Institute of Marine Science, and Smithsonian Tropical Research Institute in Panama. He currently leads an active research and teaching group on marine tidal wetlands at the University of Queensland School of Biological Sciences. With his detailed knowledge and understanding of tidal wetland processes he regularly advises on effective management and mitigation of disturbed, damaged and polluted ecosystems. He has published more than 170 peer-reviewed articles and technical reports, including 'Australia's mangroves'. Fifty of his publications include assessments of the impacts of large oil spills on mangrove forests around Australia, Panama and Micronesia.

Mr Jock Mackenzie has worked with Dr Duke for the past 8 years developing mangrove survey methods to assess estuary and mangrove ecosystem health. He is currently undertaking a PhD assessing mangroves as indicators of estuarine health. This includes surveys of tidal wetlands in the Burnett-Mary region as part of the State of the Estuary reporting, assessment of Kien Giang coastline condition, Vietnam and development of Mangrove Watch methodology for community group assessment of mangrove condition.

Mr Alex Haller began working under the supervision of Dr Duke at the University of Queensland's Centre for Marine Study in May of 2008. Since then he has been involved in several coastal/estuarine survey projects including: the development of horizontal mangrove profiles in the Burnett-Mary region and mangrove health assessment maps throughout the Moreton Bay area. Alex has experience working with and interpreting satellite imagery, using mapping software such as ArcGIS, as well as recent aerial and ground surveys using helicopters and small vessels.

Survey Shoreline Ecological Assessment Methods

The major component of the shoreline ecological assessment was the aerial surveys. As noted, surveys were conducted using helicopter aircraft. Assessments were based on observer records in combination with two high definition video cameras and three Digital still cameras all synchronised by time and with GPS units recording both track and waypoints.

On-going assessments and data compilation were undertaken on the vessel to carefully download each flight record, with labelling, archival, and recording of operational observations.

This was undertaken using on-board computers and appropriate monitors and data storage capacity.

2.1 Shoreline Video Surveys

The Shoreline Video Assessment Method (SVAM) relies on qualitative assessments of shoreline habitat, physical condition and human influence determined from continuous video recordings of the shoreline and intertidal zone of a coastline. The video is analysed for a number of features that relate to the 'condition' of the coast. For the current project, this method was used to quantify coastal and shoreline habitats present within the Montara well release region. Video surveys were completed between Darwin (Northern Territory) and Broome (Western Australia) between the 9-18th November 2009. Simultaneous GPS data acquisition enabled features to be mapped to give accurate spatial representation of shoreline habitats.

2.1.1. Video Recording

A video of the shoreline was taken using High Definition Sony Handycam cameras (HDR-XR200E) from a helicopter flying parallel to the coastline mostly at 500 ft altitude. Two Garmin GPS devices (Garmin GPS60) were used to record latitude and longitude every 2 seconds. Four digital cameras (one Nikon DSLR D90, two Olympus Tough cameras M770 SW, one Sony Cybershot), were used to photograph the shoreline to supplement video footage with higher resolution imagery. Digital still cameras, GPS units and Handycam video cameras were set to the same time for aerial and ground surveys.

Figure 4. Two HD video cameras were used during aerial surveys – one hand held, and the other mounted.

2.1.2. Video Assessment

The video was assessed as a continuous point intercept transect of the coast.

Video of the coastline was reduced to 1 second frame .jpg files.

The time of the video and GPS was used to match each frame to a specific GPS location. Each frame that matched a GPS position was used as a point on the transect. Observer based assessments of frames (.jpg images) were used to classify the SVAM into the following parameters.

Physical characteristics – Rocky, Beach, Flat, Dune, Other Wetland.

Vegetated habitat type – Mangrove, Saltmarsh, Fringing Coral Reefs, Seagrass Verge, Coastal Woodland

State of erosion and deposition– Eroded, Stable, Depositional.

Tidal wetlands – Mangrove, Saltmarsh, Mud Flats, Salt Flats, Sand Flats.

Other – Human Modified, Water Reach.

The classification *Water Reach* was defined as any water body the survey crossed, including channels and large estuary mouths.

For examples of the remaining above categories see Appendix 7.2

2.1.3. Mapping methods

I. For each video clip taken on each survey day, coordinates were matched to every frame number in Excel, based on synchronised time of GPS and video camera (i.e. start and end time of each clip). Coordinates were then identified for each section of analysed video data contained in data file using LOOKUP equation in Excel – i.e. coordinates were identified for each location where the coastline was assessed to change according to one or more assigned categories. Occasional coordinates where the GPS track had skipped a section, e.g. due to poor reception, were approximated in ArcMap using nearest track points. For each survey day, all analysed video clip data matched with coordinates (2-10 clips per day) was collated in one Excel worksheet and prepared for import into ArcGIS. Each data point was assigned a number ID in the order in which the data was collected.

II. The surveyed coastline was digitised from Google Earth images.

III. All data points were shifted perpendicularly from their original position along the helicopter track to a position along the coastline, to reflect their approximate location when viewed from helicopter. This was initially undertaken using a VBA macro (“Snap

and split program" developed by Dussault and Brochu (2009), available from ESRI ArcScripts website), and then checked manually and points further shifted as necessary. Manual shifting was necessary where the automatic shift was not perpendicular to helicopter track (since the macro shifted points to nearest position along coastline). Data points analysed as "Water" were used as approximate checkpoints against creeks/rivers identifiable in the underlying satellite images (from Google Earth). These points were used to estimate positional accuracy. As a conservative estimate, positional accuracy is ± 500 m.

IV. The coastline was split at all data point locations using VBA macro ("Split lines at points" developed by Lundeen (2008), available from ESRi ArcScripts website, and then checked to ensure splits had occurred at all points. A number ID was assigned to each line segment, and checked to ensure all line segments were numbered in the order in which data was collected and corresponded to the ID number of the shifted data point.

V. Line segments were joined to attributes using "Join" tool based on line segment ID and corresponding data point ID, and then exported as a new shapefile/dataset.

VI. The nine shapefiles containing mapped video analysis data for each survey day were checked for consistency, and then appended into one shapefile/data table (File name: "ALL_coast_data").

VII. Lengths of each segment/assessed category were calculated in ArcMap, after splitting the data based on UTM grid zone (zones 51 and 52) and projecting the data for each zone separately. A table from each file was exported to Excel, appended, and used for calculating distances surveyed and lengths of each assessed category. Note these distances have been calculated from a simplified representation of the coastline, therefore are approximate, and may be more appropriately regarded as percentages of distance surveyed.

VIII. The surveyed coastline was split into 16 coast sections. Maps were created of each region at scales ranging from 1:200 000 to 1:500 000, showing physical characteristics, vegetated habitat type, tidal wetlands, state of erosion and deposition, and observations of estuary mouths and marine megafauna.

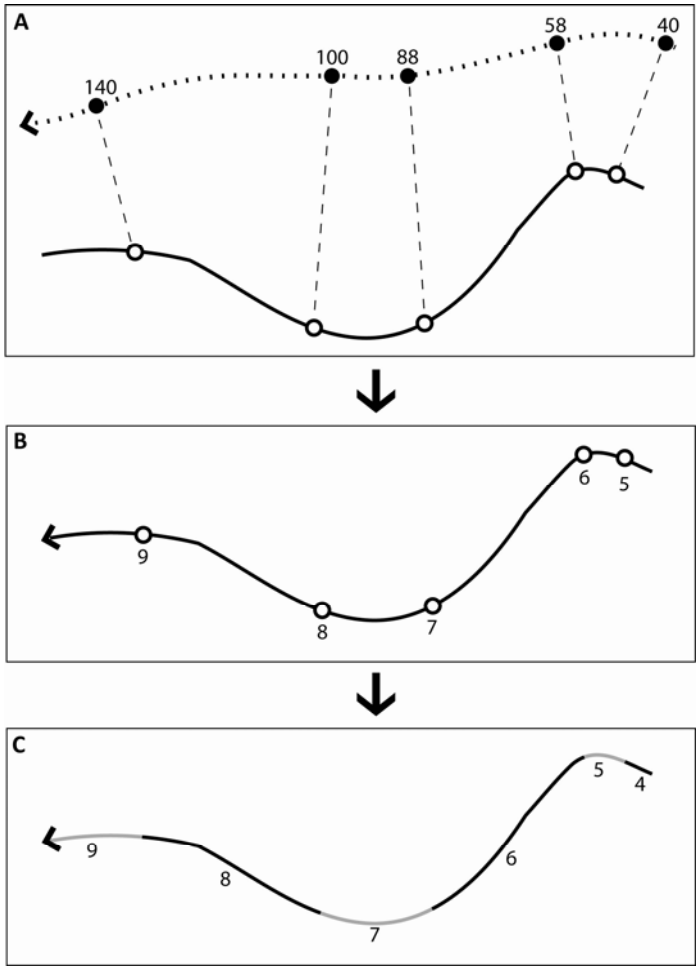


Figure 5: Methods used in mapping analysed coastline video data. (A) shows the helicopter track recorded by GPS (dotted line) with video clip frame number (solid black dots) where the coastline changed according to one or more assessment criteria (i.e. a different category was assigned to the frame). The coordinates for these points were shifted perpendicularly to the coastline to reflect the approximate location when viewed from the helicopter (hollow dots). Positional error was conservatively estimated at ± 500 m. (B) shows the ID number for each shifted data point (which is linked to analysed video data). (C) shows the line split by points, and each segment given the same ID number as its corresponding data point, which was then used to join attributes to line segments.

2.2 Rapid Water Quality & Benthic Sediment Assessment

Samples of sediments, water and biota were collected during this survey. These were shipped to PTTEPAA for further analysis. It was proposed that these are handled and analysed as per Monitoring Study S7, Study O2 or other methods as determined by PTTEPAA.

Duration of sampling: November 10-19, 2009

Locations of sampling: Darwin to Broome at various sites selected based on conservation and cultural significance as outlined by NT/WA government, logistical feasibility, and areas identified as possibly suspect for release byproducts (e.g. suspicious foam or particles in water).

At the sample sites water samples were obtained either from the vessel (boat) or during touch downs of the helicopter survey (beach). When possible, sediment samples were taken, all "beach" samples included sediment, however due to varying substrates (e.g. bedrock) and depths on "boat" samplings, sediment was often unobtainable. Tissue samples were collected at locations where bivalve specimens were able to be collected without impairing the progress of the rest of the survey.

At each sample site a unique identification number (S1-S24) the time and date, lat and long, and general conditions were recoded. When logistics allowed, the ambient water conditions (pH, DO, Salinity or conductivity, temperature) were also noted. Generally, samples taken from the vessel (location title included "boat" in parentheses) included these ambient water conditions, samples from "beaches" did not. This information is provided in a table in Appendix 7.4.

Water sampling for the following were taken:

- Seawater: Just below the surface, depth of 1m, and, when sampling from the vessel, at approximately 10m. PVC Niskin bottle was used to obtain sampled from the vessel, from the beach sampled were collected directly into bottles
- When obtainable, a sediment grab sample of 0.5L
- When obtainable, bivalves for tissue analysis wrapped in solvent cleaned aluminum foil.

Handling and storage

- Water samples were stored at approximately 0 ºC (not frozen due to salinity content) in solvent-rinsed, amber 1L bottles for water storage were obtained from QHSS

- Sediment and tissue samples frozen and stored in glass jars acid washed, rinsed in demonized water, mentholated spirits, and acetone.

2.3 Marine Megafauna Surveys

During aerial surveys, all marine megafauna observed were recorded and identified to the lowest taxonomic level possible. Helicopter height remained between 500 ft, allowing a large area of ocean to be monitored. Observations were made by all helicopter crew (4 observers per survey), and waypoints taken using a GPS (Garmin GPS 60). Sea turtle tracks and nests were also recorded. The help of Carole Palmer, a marine megafauna specialist from the Northern Territory Department of Natural Resources, Environment and The Arts, was solicited during the first 5 days of survey. Carole's presence allowed training of the crew, who then completed the final 5 survey days. Visibility was affected by both sun position and weather, in particular sea swell and wind level. As water turbidity and general visibility varied, detailed abundance estimates should not be made from these observations. Our sightings are usefully considered an indication of available marine megafauna present. Locations of megafauna observations are mapped for each of the 16 coastline sections.

2.4 Mangrove species

A list of mangrove species with ranges within the survey region was compiled from the literature and presented for each of the sixteen coastal regions. This data was supplemented with actual recorded sightings in each estuary, as listed in various publications and compiled in a database by Dr Duke. Listings of mangrove species present and respective source information is provided for each of the 16 subregions for this survey. Source references for mangroves list are designated in the tables for each subregion and are as follows;
NCD = Duke (1985)
GW81 = Wells (1981)
GW82 = Wells (1982)
GW85 = Wells (1985)
GW86 = Wells (1986)
SKW = Semeniuk *et al* (1978)

Figure 6. Selected landings enabled sampling and verification of ground conditions.

3. RESULTS

Around 5102 km of shoreline was surveyed, analysed and mapped to provide spatial and quantitative characterisation of vulnerable coastal ecological features between Darwin (NT) and Broome (WA). Mangroves, the most vulnerable coastal habitat present, grow along 63% of the surveyed shoreline, covering over 3200 km (Table 1). Saltmarsh occurs on more than 1200 km of coastline or 23.8% survey region and the coastline is rocky for 2763 km of shoreline (Table 1).

For the total shoreline surveyed, 9441 km^2 of tidal wetland were observed (Table 4; OzCoasts 2009). This is calculated as 1.85 km^2 of tidal wetland for every kilometer of shoreline within the Montara well release region (Darwin to Broome).

Assessment of oil spill impacts

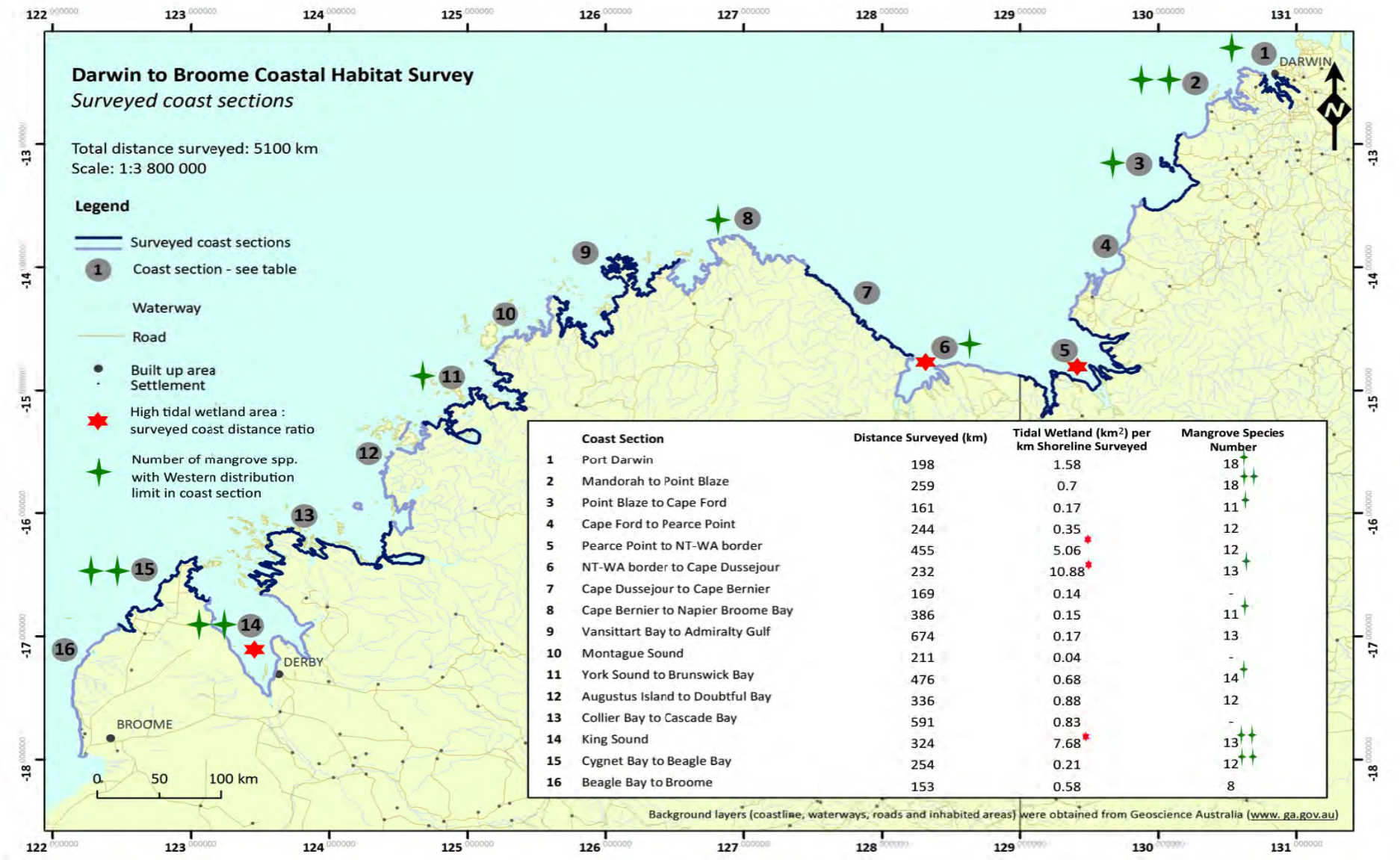
No visual evidence of oil or wax residue was identified during this shoreline survey of the Montara well release region.

Observations of marine megafauna

Marine megafauna sightings were common in all survey regions except Port Darwin, with a wide range of taxonomic groups being represented including marine reptiles, cetaceans, sharks, rays and dugongs as outlined in Table 2.

Ground ecological assessment sampling

Twenty-four water and sediment samples were collected during the survey at destinations highlighted in Figure 8. Sediment samples were collected during the survey in November 2009.



	Coast Section	Distance Surveyed (km)	Tidal Wetland (km²) per km Shoreline Surveyed	Mangrove Species Number
1	Port Darwin	198	1.58	18
2	Mandorah to Point Blaze	259	0.7	18
3	Point Blaze to Cape Ford	161	0.17	11
4	Cape Ford to Pearce Point	244	0.35	12
5	Pearce Point to NT-WA border	455	5.06	12
6	NT-WA border to Cape Dussejour	232	10.88	13
7	Cape Dussejour to Cape Bernier	169	0.14	-
8	Cape Bernier to Napier Broome Bay	386	0.15	11
9	Vansittart Bay to Admiralty Gulf	674	0.17	13
10	Montague Sound	211	0.04	-
11	York Sound to Brunswick Bay	476	0.68	14
12	Augustus Island to Doubtful Bay	336	0.88	12
13	Collier Bay to Cascade Bay	591	0.83	-
14	King Sound	324	7.68	13
15	Cygnet Bay to Beagle Bay	254	0.21	12
16	Beagle Bay to Broome	153	0.58	8

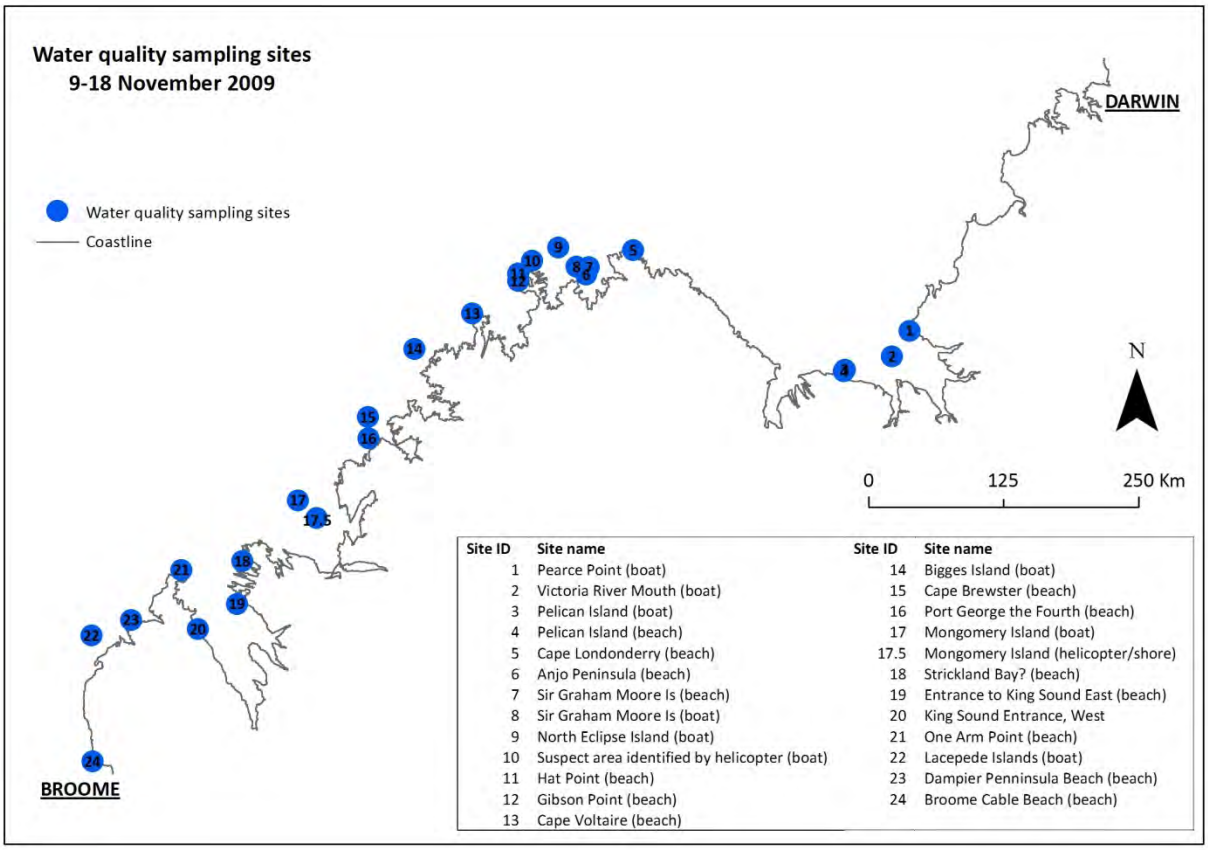
Figure 7: Surveyed coast sections, Darwin – Broome.

Table 1: Summary of coastal characteristics from Darwin (NT) to Broome (WA). Category percentages do not add to 100 as categories overlap in some locations.

		km	*% of shoreline*
Physical characteristics	**Rocky**	2762.8	*54.2*
	Beach	1663.7	*32.6*
	Flat	2185.5	*42.8*
	Dune	1536.9	*30.1*
	Other wetland	15.9	*0.3*
Vegetated habitat type	**Mangrove**	3214.1	*63.0*
	Saltmarsh	1215.4	*23.8*
	Fringing coral	350.9	*6.9*
	Seagrass verge	11.5	*0.2*
	Coastal Woodland	3886.6	*76.2*
State of erosion and deposition	**Deposition**	548.8	*10.8*
	Erosion	544.7	*10.7*
	Stable	3576.7	*70.1*
Tidal wetlands	**Mangrove**	3214.1	*63.0*
	Saltmarsh	1215.4	*23.8*
	Sand and mud flats	1379.2	*27.0*
	Salt flat	1396.8	*27.4*
Other	**Human modified**	169.5	*3.3*
	Water reach	514.2	*10.1*

Table 2: Summary of marine megafauna observed during aerial ecological assessment surveys by subregions, and in total.

Marine Megafauna - NT-WA shoreline survey Ordered West to East – Broome (WA) to Darwin (NT)																
	WA	WA	WA	WA	WA	WA	WA	WA	WA	WA	WA	NT	NT	NT	NT	
Species / Subregion #	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	**Total**
Dolphins – Family Delphinidae	2	3	0	12	5	8	2	25	17	20	7	0	0	0	1	102
Dugongs – *Dugong dugong*	0	0	0	0	3	2	0	12	18	10	2	0	0	2	1	50
Whales – *Cetacea*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Turtles – *Chelonia* or *Caretta* spp	20	36	6	71	32	8	10	135	283	29	4	0	1	2	3	640
Sea turtle tracks – *Chelonia* or *Caretta* spp	0	0	0	0	1	18	6	7	4	1	0	0	0	0	0	37
Saltwater crocodiles - *Crocodylus porosus*	0	0	0	7	0	2	0	3	1	1	0	0	0	0	0	14
Rays – Superorder Batoidea	0	10	1	5	1	3	1	52	5	11	0	0	0	0	4	93
Sharks – Superorder: Selachimorph	0	2	0	1	4	0	1	7	6	2	0	0	0	0	0	23
TOTAL observed	**22**	**52**	**7**	**96**	**46**	**41**	**20**	**241**	**334**	**74**	**13**	**0**	**1**	**4**	**9**	**960**



Site ID	Site name	Site ID	Site name
1	Pearce Point (boat)	14	Bigges Island (boat)
2	Victoria River Mouth (boat)	15	Cape Brewster (beach)
3	Pelican Island (boat)	16	Port George the Fourth (beach)
4	Pelican Island (beach)	17	Mongomery Island (boat)
5	Cape Londonderry (beach)	17.5	Mongomery Island (helicopter/shore)
6	Anjo Peninsula (beach)	18	Strickland Bay? (beach)
7	Sir Graham Moore Is (beach)	19	Entrance to King Sound East (beach)
8	Sir Graham Moore Is (boat)	20	King Sound Entrance, West
9	North Eclipse Island (boat)	21	One Arm Point (beach)
10	Suspect area identified by helicopter (boat)	22	Lacepede Islands (boat)
11	Hat Point (beach)	23	Dampier Penninsula Beach (beach)
12	Gibson Point (beach)	24	Broome Cable Beach (beach)
13	Cape Voltaire (beach)		

Figure 8: Location of water and sediment sampling sites for the 24 samples collected and dispatched to PTTEPAA for analysis.

Survey region and sub region background data

Table 3: Coastline data for the complete survey region. Source OzCoasts 2009

Total NT-WA Survey – Darwin (NT) to Broome (WA)		
Features	**Total**	**Relevance to Australia**
Annual Rainfall –range & mean (mm)	600-1688 (1190)	Dry & hot
Number of estuaries listed	114	~7 estuar./subregion
Total Catchment Area (km2)	599,885	
Average Catchment Area (km2)	5262	Large catchments
Total Estuary Length (km)	2041	
Average Estuary Length (km)	17.9	Large estuaries
Tidal Range (in m)	6.10	High
Condition Status	Near Pristine to Modified	Very low disturbance by humans
Area of Mangrove (km2)	2827.47	~1/3 of national total
Area of Salt Marsh (km2)	6613.15	
WCI% from Region Total	30.0	
Total Tidal Wetland (km2)	9440.63	
BOM 1998 Climatic Area	Dry hot steppe - Summer drought to Tropical Savannah - Wet Autumn	
Mangrove species number	22	43 in Australia
Mangrove species limit west	11	

Table 4: Coastline data for the Northern Territory region of surveyed coast (Darwin (NT) to the NT/WA border. Source OzCoasts 2009.

NT-WA Survey – Northern Territory (NT) section.		
Features	**NT**	**Relevance to survey region**
Annual Rainfall –range & mean (mm)	1134-1688 (1515)	Moderate overall
Number of estuaries listed	23	~5 estuar./subregion
Total Catchment Area (km2)	167232	27.9%
Average Catchment Area (km2)	7271	Smaller in WA
Total Estuary Length (km)	619	30.3%
Average Estuary Length (km)	26.9	Shorter in WA
Tidal Range (in m)	5.42	High
Condition Status	Near Pristine to Modified	Low disturbance by humans
Area of Mangrove (km2)	920.65	67.4%
Area of Salt Marsh (km2)	2046.59	69.1%
WCI% from Region Total	31.0	Large saltpan areas
Total Tidal Wetland (km2)	2967.23	31.4%
BOM 1998 Climatic Area	Mostly tropical savannah - wet autumn - uniform temp	
Mangrove species number	20	32 in NT
Mangrove species limit west	4	

Table 5: Coastline data for the Western Australia region of surveyed coast (NT/WA border to Broome WA). Source OzCoasts 2009.

NT-WA Survey – Western Australia (WA) section.		
Features	**WA**	**Relevance to survey region**
Annual Rainfall –range & mean (mm)	600-1400 (1042)	Semi-arid overall
Number of estuaries listed	91	~8 estuary/subregion
Total Catchment Area (km2)	432,653	72.1%
Average Catchment Area (km2)	4754	Larger in NT
Total Estuary Length (km)	1422	69.7%
Average Estuary Length (km)	15.6	Longer in NT
Tidal Range (in m)	6.42	Highest
Condition Status	Near Pristine to Largely Unmodified	Very low disturbance by humans
Area of Mangrove (km2)	1906.83	67.4%
Area of Salt Marsh (km2)	4566.57	69.1%
WCI% from Region Total	29.5	Large saltpan areas
Total Tidal Wetland (km2)	6473.39	68.4%
BOM 1998 Climatic Area	Mostly dry hot steppe - summer drought	
Mangrove species number	17	18 in WA
Mangrove species limit west	6	

Table 6: Mangrove species present in the Northern Territory and Western Australia. Green highlights species with ranges within each shoreline region (source: Duke 1985). Crosses identify recorded species occurrence in the shoreline region.

Mangrove Species - NT-WA shoreline survey Ordered West to East – Broome (WA) to Darwin (NT)																
	WA	WA	WA	WA	WA	WA	WA	WA	WA	WA	WA	NT	NT	NT	NT	NT
Species / Subregion #	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Acanthus ebracteatus											X			X	X	
Acanthus ilicifolius														X	X	X
Acrostichum speciosum																X
Aegialitis annulata	X	X	X		X	X		X	X		X	X	X	X	X	X
Aegiceras corniculatum	X	X	X		X	X		X	X		X	X	X	X	X	X
Avicennia integra																
Avicennia marina	X	X	X		X	X		X	X		X	X	X	X	X	X
Bruguiera exaristata	X	X	X		X	X		X	X		X	X		X	X	X
Bruguiera gymnorhiza																X
Bruguiera parviflora			X		X	X		X					X		X	X
Bruguiera sexangula																
Camptostemon schultzii		X	X		X	X		X			X	X	X	X	X	X
Ceriops australis	X	X	X		X	X		X	X		X	X	X		X	X
Ceriops decandra															X	X
Ceriops tagal																
Cynometra iripa																
Diospyros littorea																
Excoecaria agallocha	X	X	X		X	X		X			X	X	X	X	X	X
Lumnitzera littorea															X	
Lumnitzera racemosa		X	X			X		X	X		X	X	X	X	X	X
Nypa fruticans																
Osbornia octodonta	X	X	X		X	X		X	X		X	X	X		X	X
Pemphis acidula		X							X							
Rhizophora apiculata																
Rhizophora X *lamarckii*																
Rhizophora stylosa	X	X	X		X	X		X	X		X	X	X	X	X	X
Scyphiphora hydrophylacea									X						X	X
Sonneratia alba		X	X		X	X		X	X		X	X	X		X	X

Mangrove Species - NT-WA shoreline survey (continued) Ordered West to East – Broome (WA) to Darwin (NT)																
	WA	WA	WA	WA	WA	WA	WA	WA	WA	WA	WA	NT	NT	NT	NT	NT
Species / Subregion #	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Sonneratia lanceolata																
Sonneratia X *urama*																
Xylocarpus granatum						X										
Xylocarpus moluccensis			X		X	X		X	X		X	X	X	X	X	X
TOTAL recorded species	8	12	13	0	12	14	0	13	11	0	13	12	12	11	18	18
TOTAL species with range in the vicinity	11	13	15	15	15	16	16	16	17	17	18	18	18	19	21	22

3.1 Port Darwin (NT)

Coast section start: Lat: -12.47445,
Long: 130.84674
Coast section end: Lat: -12.44232
Long: 130.77077

Region includes Stokes Hill Wharf to Mandorah

- 198 km coast surveyed, making 4% of the total 5102 km.
- 90.8% of the shoreline region is mangrove.
- 312.70 km^2 of mangrove habitat occurs within the region (OzCoasts 2009), calculated as 1.58 km^2 mangrove habitat per kilometer of coastline surveyed in the region.
- 32.2 km of coast has been modified by human activity (16.4% of the region).
- Estuaries in this region include Darwin Harbour, Woods Inlet, West Arm, Middle Arm, East Arm and Reichardt Creek.
- No marine megafauna were sighted in the Port Darwin region.

Table 7: Summary of coastal characteristics in Port Darwin region.

		km	*% of region*
Physical characteristics	**Rocky**	23.7	*12.0*
	Beach	10.5	*5.3*
	Flat	170.4	*86.2*
	Dune	14.7	*7.4*
	Other wetland	0.3	*0.1*
Vegetated habitat type	**Mangrove**	179.5	*90.8*
	Saltmarsh	61.8	*31.2*
	Fringing coral	0.0	*0.0*
	Seagrass verge	0.0	*0.0*
	Coastal Woodland	156.3	*79.0*
State of erosion and deposition	**Deposition**	0.3	*0.2*
	Erosion	15.6	*7.9*
	Stable	174.3	*88.2*
Tidal wetlands	**Mangrove**	179.5	*90.8*
	Saltmarsh	61.8	*31.2*
	Sand and mud flats	149.0	*75.4*
	Salt flat	88.5	*44.8*
Other	**Human modified**	32.4	*16.4*
	Water reach	16.5	*8.3*

Port Darwin (NT):

Figure 9: Representative coastline imagery from the Port Darwin region. Image numbers are unique within the electronic database

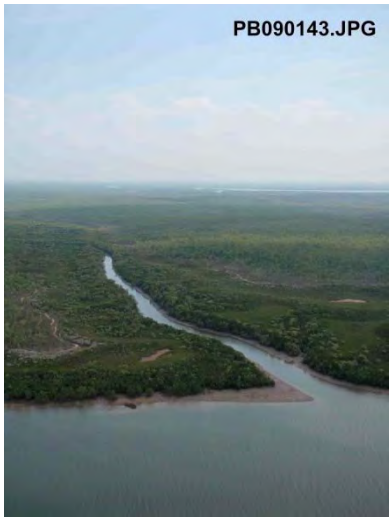


Table 8: Coastline data for the Port Darwin region. Source OzCoasts 2009.

NT-WA Survey – 1. Port Darwin, NT		
Features	**#1**	**Relevance to survey region**
Annual Rainfall –range & mean (mm)	1609-1684 (1646)	Above average
Number of estuaries listed	6	Below average
Total Catchment Area (km2)	3821	Below average size
Total Estuary Length (km)	93.4	Below average size
Tidal Range (in m)	5.45	
Condition Status	Near Pristine to Modified	Low disturbance by humans
Area of Mangrove (km2)	312.70	
Area of Salt Marsh (km2)	59.74	
WCI% from Region Total	84.0	
Total Tidal Wetland (km2)	372.44	
BOM 1998 Climatic Area	Tropical Savannah - Wet Autumn - Uniform temp	
Mangrove species number	18	22 in vicinity
Mangrove species limit west	1	

Table 9: Estuary data for notable estuaries within the Port Darwin (NT) shoreline region. Source NLWRA; 1998.

NT-WA Survey **1. Port Darwin, NT**				
Feature / Location	**Darwin Harbour**	**Woods Inlet**	**East Arm**	**Reichardt Creek**
NLWRA Estuary Reference#	**98**	**99**	**102**	**103**
Latitude S	12.421	12.480	12.495	12.467
Longitude E	130.802	130.760	130.888	130.890
Annual Rainfall – mean (mm)	1684	1673	1618	1609
Catchment Area (km2)	1990	80	498	47
Estuary Length (km)	20.15	7.72	21.21	3.52
Tidal Range (in m)	5.5	5.4	5.5	5.5
Condition Status	LU	P	MOD	MOD
Area of Mangrove (km2)	171.85	10.92	32.25	8.28
Area of Salt Marsh (km2)	34.97	0.63	11.63	0.96
Wetland Cover Index (WCI %)	83.1	94.5	73.5	89.6
Total Tidal Wetland (km2)	206.82	11.55	43.88	9.24
BOM 1998 Climatic Area	Tropical Savannah - Wet Autumn - Uniform temp	Tropical Savannah - Wet Autumn - Uniform temp	Tropical Savannah - Wet Autumn - Uniform temp	Tropical Savannah - Wet Autumn - Uniform temp
Mangrove species number	16 (22)			7 (22)
Source of mangrove data:	GW85, NCD			NCD

Table 10: Mangrove species present in the Northern Territory and Western Australia. Green highlights species with ranges within the Port Darwin region (source: Duke 2006). Crosses identify recorded species occurrence in the listed estuary. Yellow denotes western limit of species range.

1. Port Darwin		
Species/ Locations	**Darwin Harbour #98**	**Rapid Creek #103**
Acanthus ebracteatus subsp. *ebarbatus*		
Acanthus ilicifolius		X
Acrostichum speciosum		X
Aegialitis annulata	X	
Aegiceras corniculatum	X	
Avicennia integra		
Avicennia marina	X	X
Bruguiera exaristata	X	X
Bruguiera gymnorhiza	X->	
Bruguiera parviflora	X	
Bruguiera sexangula		
Camptostemon schultzii	X	
Ceriops australis	X	
Ceriops decandra	X	
Ceriops tagal		
Cynometra iripa		
Diospyros littorea		
Excoecaria agallocha	X	X
Lumnitzera littorea		
Lumnitzera racemosa	X	X
Nypa fruticans		
Osbornia octodonta	X	
Pemphis acidula		
Rhizophora apiculata		
Rhizophora X *lamarckii*		
Rhizophora stylosa	X	X
Scyphiphora hydrophylacea	X	
Sonneratia alba	X	
Sonneratia lanceolata		
Sonneratia X *urama*		
Xylocarpus granatum		
Xylocarpus moluccensis	X	
TOTAL recorded	**16**	**7**
TOTAL in vicinity	**22**	**22**
Sources:	GW85, NCD	NCD

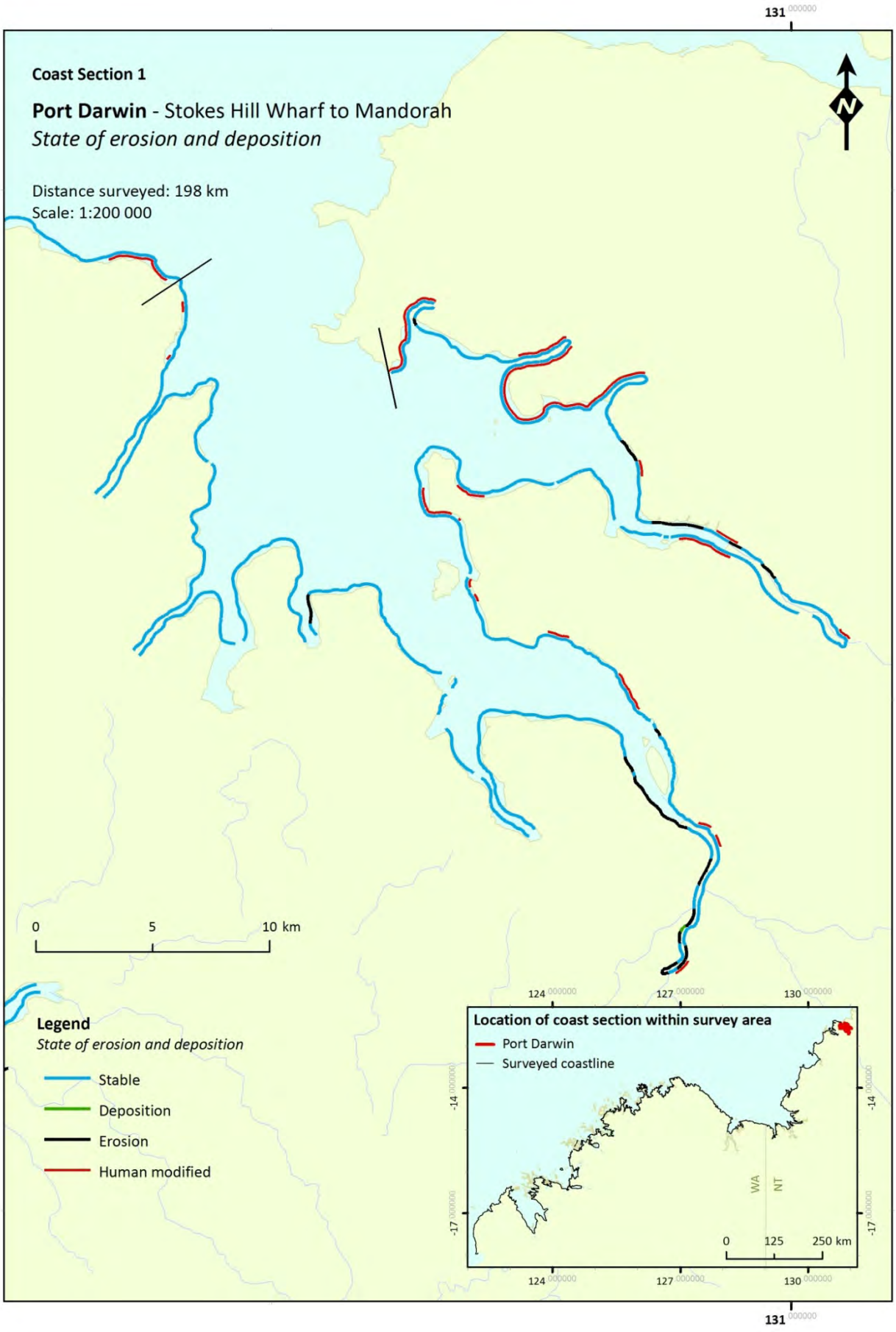


Figure 10: Shoreline stability in the Port Darwin survey region

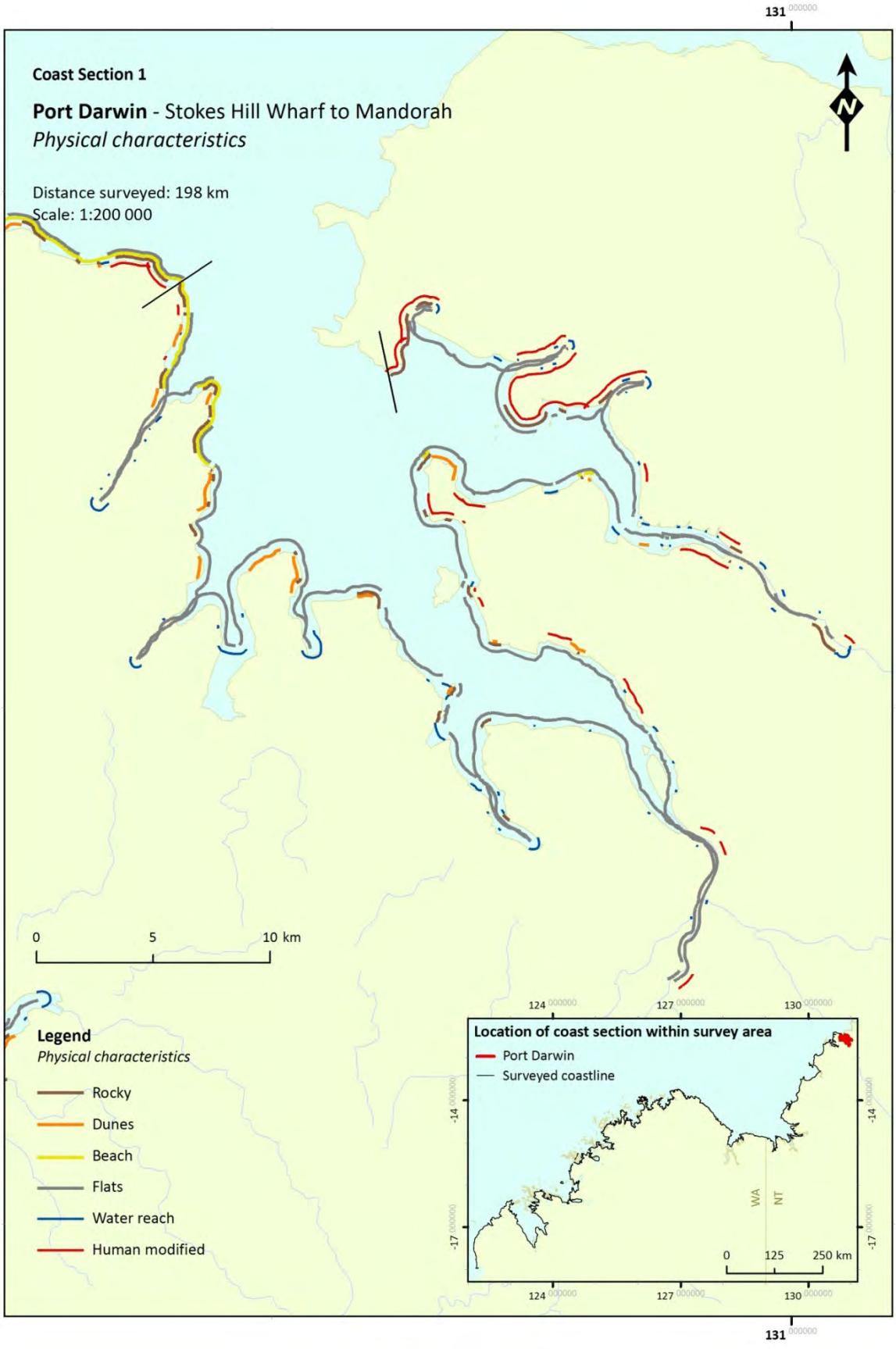


Figure 11: Physical characteristics of the Port Darwin survey region

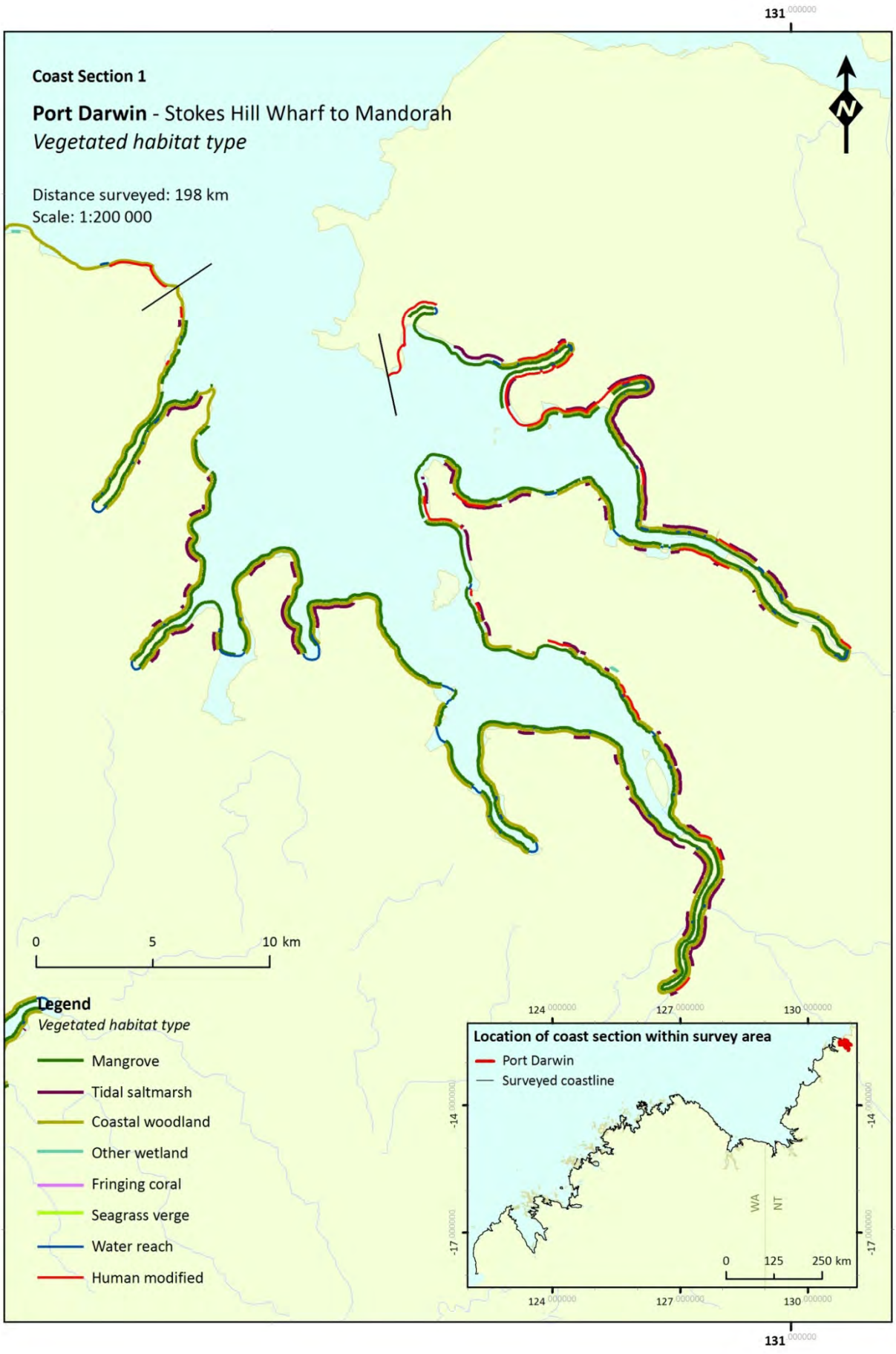


Figure 12: Vegetated habitat types within the Port Darwin survey region

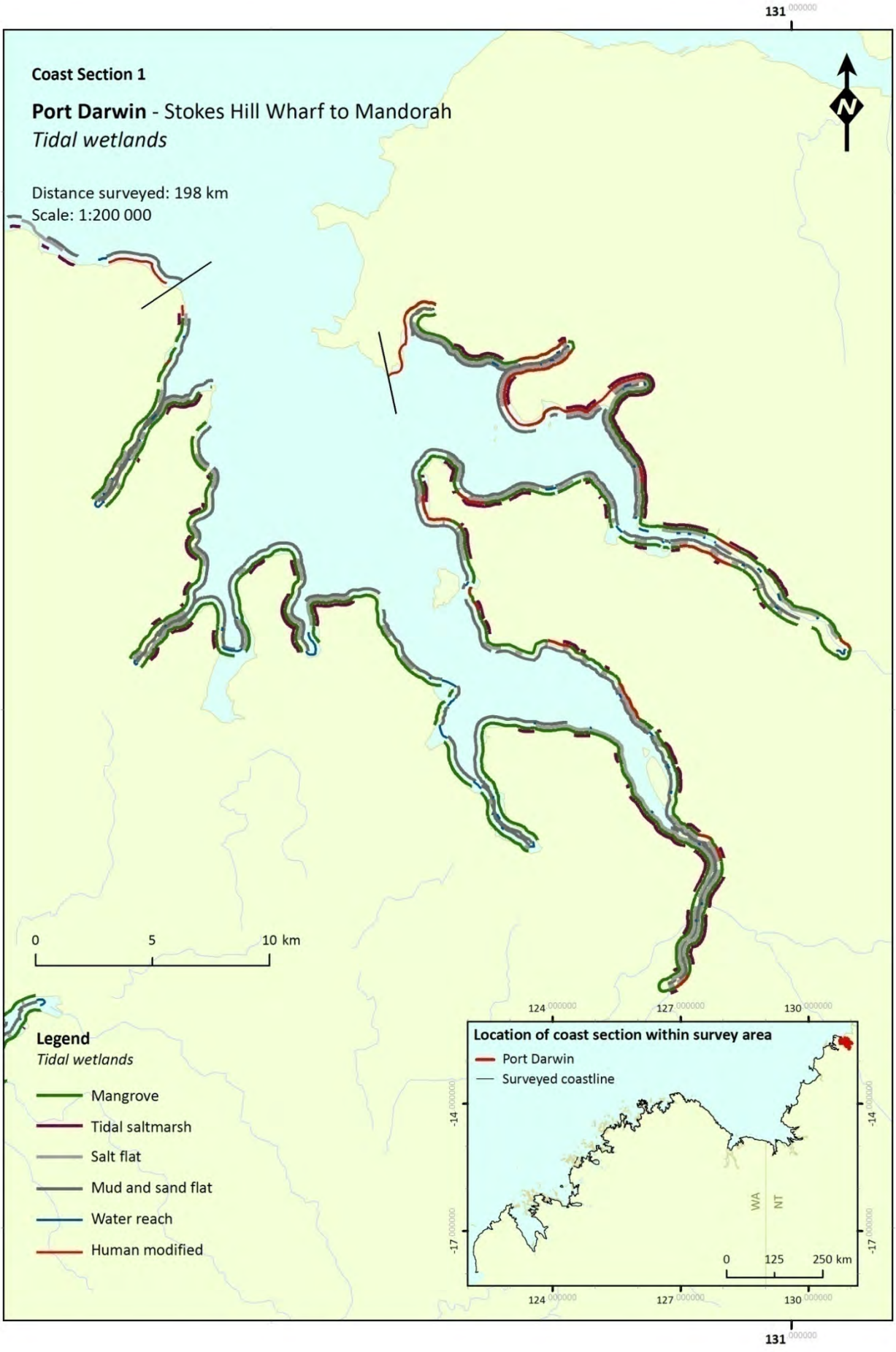


Figure 13: Tidal wetlands in the Port Darwin region

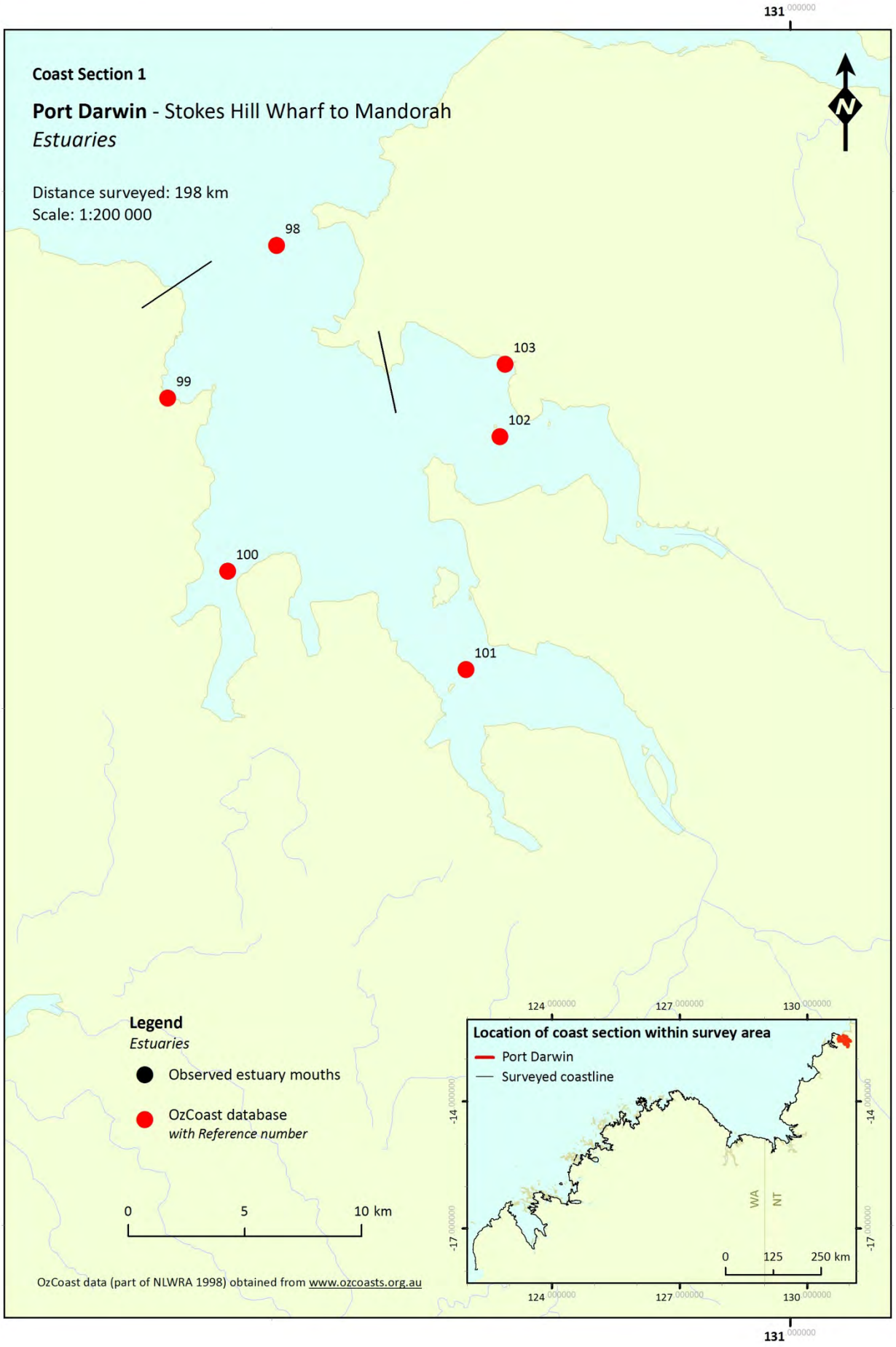


Figure 14: Estuaries in the Port Darwin region

3.2 Mandorah to Point Blaze (NT):

Coast section start: Lat: -12.43312
Long: 130.76673
Coast section end: Lat: -12.90963
Long: 130.17198

Region includes Bynoe Harbour and Fog Bay

- 259 km coast surveyed, making 5% of the total 5102 km.
- 73% of the region is mangrove. Flats (sand, mud and salt) are found on 72.8% of the region. Total area of tidal wetland in the region is 180.55 km^2 (OzCoasts 2009), calculated as 0.7 km^2 tidal wetland per kilometer of coastline surveyed in the region.
- Human modification of the coast is lower than in the Darwin Port region, with 11% of the coast having been impacted by human activity (28.6 km).
- Coastal woodland is found on 211.7 km (76.5%) of coast above the intertidal region.
- Estuaries in this region include Finnis River, Bynoe Harbour & Corrawara Creek.
- Dugong, rays, one snubfin dolphin and three sea turtles were sighted during aerial surveys in the region.

Table 12: Summary of coastal characteristics in the Mandorah to Point Blaze region.

		km	*% of region*
Physical characteristics	**Rocky**	77.7	*30.0*
	Beach	74.0	*28.6*
	Flat	188.5	*72.8*
	Dune	82.3	*31.8*
	Other wetland	2.9	*1.1*
Vegetated habitat type	**Mangrove**	189.1	*73.0*
	Saltmarsh	69.0	*26.7*
	Fringing coral	1.9	*0.7*
	Seagrass verge	1.2	*0.4*
	Coastal Woodland	211.7	*81.7*
State of erosion and deposition	**Deposition**	11.5	*4.4*
	Erosion	25.8	*9.9*
	Stable	198.0	*76.5*
Tidal wetlands	**Mangrove**	189.1	*73.0*
	Saltmarsh	69.0	*26.7*
	Sand and mud flats	172.6	*66.6*
	Salt flat	75.3	*29.1*
Other	**Human modified**	28.6	*11.0*
	Water reach	22.3	*8.6*

Mandorah to Point Blaze (NT):

Figure 15: Representative coastline imagery from the Mandorah to Pt Blaze region. Image numbers are unique within the electronic database

Table 13: Summary of marine megafauna observed during aerial surveys of Mandorah to Point Blaze (NT).

Common name	Genus/Species	Total observed
Australian snubfin dolphin	*Orcaella heinsohni*	1
Indo-Pacific bottlenose	*Tursiops aduncas*	0
Unidentified dolphin species	Family Delphinidae	0
Sea turtle	*Chelonia* or *Caretta* spp	3
Sea turtle track	*Chelonia* or *Caretta* spp	0
Dugong	*Dugong dugong*	1
Whale	*Order Cetacea*	0
Manta ray	*Manta birostris*	0
Ray species	Superorder Batoidea	4
Saltwater crocodile	*Crocodylus porosus*	0
Unidentified shark species	Superorder: Selachimorph	0

Table 14: Coastline data for the Mandorah to Point Blaze region (NT). Source OzCoasts 2009.

NT-WA Survey – 2. Mandorah to Point Blaze, NT		
Features	**#2**	**Relevance to survey region**
Annual Rainfall –range & mean (mm)	1600-1688 (1649)	Above average
Number of estuaries listed	4	Below average
Total Catchment Area (km2)	4303	Below average size
Total Estuary Length (km)	78.1	Below average size
Tidal Range (in m)	5.20	
Condition Status	Near Pristine to Largely Unmodified	Low disturbance by humans
Area of Mangrove (km2)	165.96	
Area of Salt Marsh (km2)	14.59	
WCI% from Region Total	91.9	
Total Tidal Wetland (km2)	180.55	
BOM 1998 Climatic Area	Tropical Savannah - Wet Autumn	
Mangrove species number	18	21 in vicinity
Mangrove species limit west	2	

Table 15: Estuary data for notable estuaries within the Mandorah to Point Blaze region (NT) . Source NLWRA; 1998.

NT-WA Survey **2. Mandorah to Point Blaze, NT**				
Feature / Location	**Finnis River**	**Port Paterson, NT014**	**Bynoe Harbour**	**Corrawarra Creek**
NLWRA Estuary Reference#	**94**	**95**	**96**	**97**
Latitude S	12.890	12.671	12.560	12.449
Longitude E	130.335	130.386	130.543	130.618
Annual Rainfall – mean (mm)	1600	1642	1666	1688
Catchment Area (km2)	2823	275	1014	191
Estuary Length (km)	16.48	13.64	40.64	7.38
Tidal Range (in m)	5.2	5.2	5.2	5.2
Condition Status	LU	P	P	P
Area of Mangrove (km2)	6.79	13.50	139.94	5.73
Area of Salt Marsh (km2)	7.33	2.86	4.00	0.40
Wetland Cover Index (WCI %)	48.1	82.5	97.2	93.5
Total Tidal Wetland (km2)	14.12	16.36	143.94	6.13
BOM 1998 Climatic Area	Tropical Savannah - Wet Autumn	Tropical Savannah - Wet Autumn	Tropical Savannah - Wet Autumn	Tropical Savannah - Wet Autumn
Mangrove species number		14 (20)	17 (21)	
Source of mangrove data:		GW85	GW85	

Table 16: Mangrove species present in the Northern Territory and Western Australia. Green highlights species with ranges within the Mandorah to Point Blaze region (NT) (source: Duke 2006). Crosses identify recorded species occurrence in the listed estuary. Yellow denotes western limit of species range.

2. Mandorah to Point Blaze		
Species/ Locations	**Port Paterson NT014 #95**	**Bynoe Harbour #96**
Acanthus ebracteatus subsp. *ebarbatus*		X
Acanthus ilicifolius		X
Acrostichum speciosum		
Aegialitis annulata	X	X
Aegiceras corniculatum	X	X
Avicennia integra		
Avicennia marina	X	X
Bruguiera exaristata	X	X
Bruguiera gymnorhiza		
Bruguiera parviflora	X	X
Bruguiera sexangula		
Camptostemon schultzii	X	X
Ceriops australis	X	X
Ceriops decandra		X->
Ceriops tagal		
Cynometra iripa		
Diospyros littorea		
Excoecaria agallocha	X	X
Lumnitzera littorea	X->	
Lumnitzera racemosa	X	X
Nypa fruticans		
Osbornia octodonta	X	X
Pemphis acidula		
Rhizophora apiculata		
Rhizophora X *lamarckii*		
Rhizophora stylosa	X	X
Scyphiphora hydrophylacea		X
Sonneratia alba	X	X
Sonneratia lanceolata		
Sonneratia X *urama*		
Xylocarpus granatum		
Xylocarpus moluccensis	X	X
TOTAL recorded	**14**	**17**
TOTAL in vicinity	**20**	**21**
Sources:	GW85	GW85

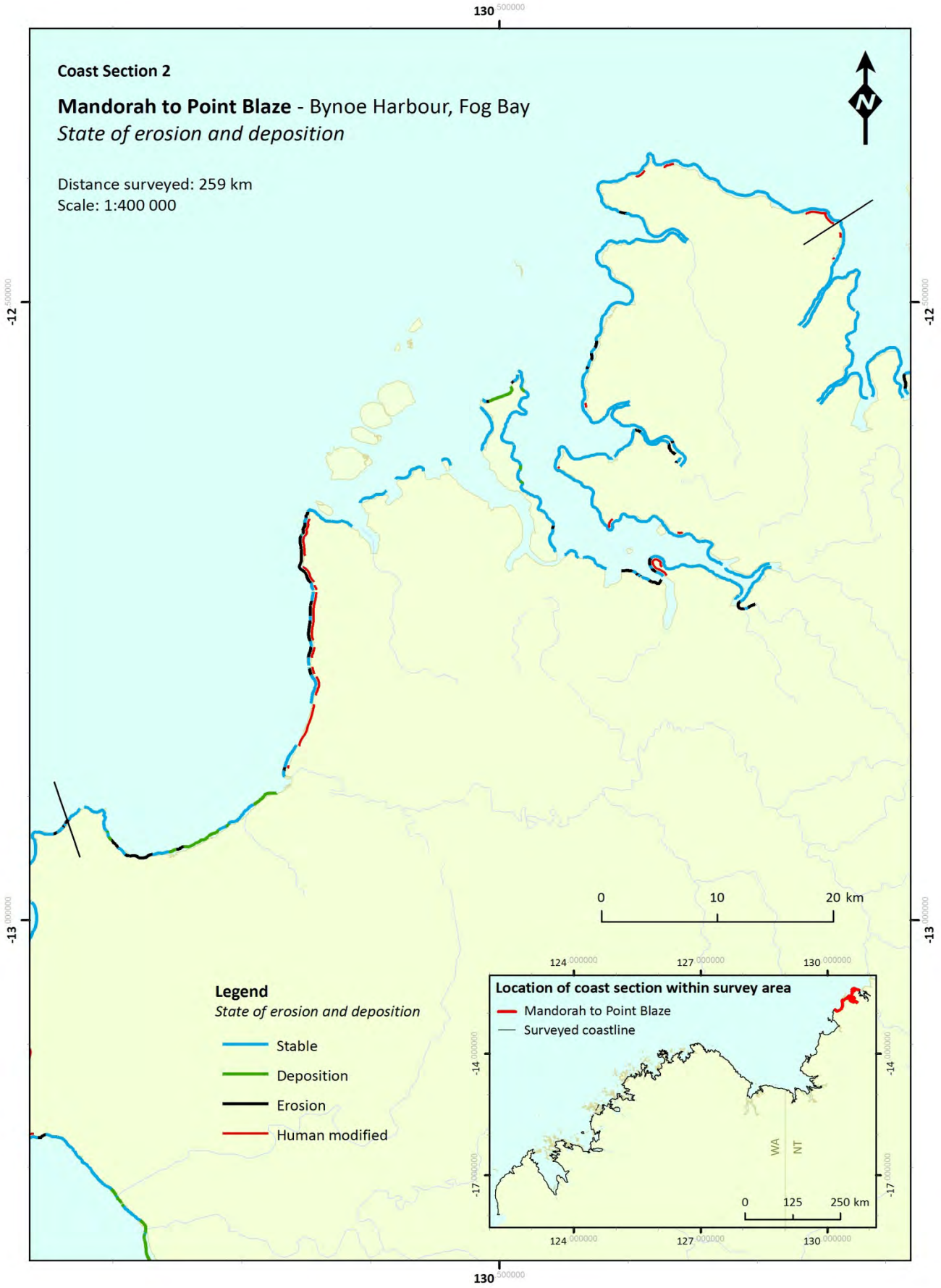


Figure 16: Bank stability within the Mandorah to Pt Blaze region

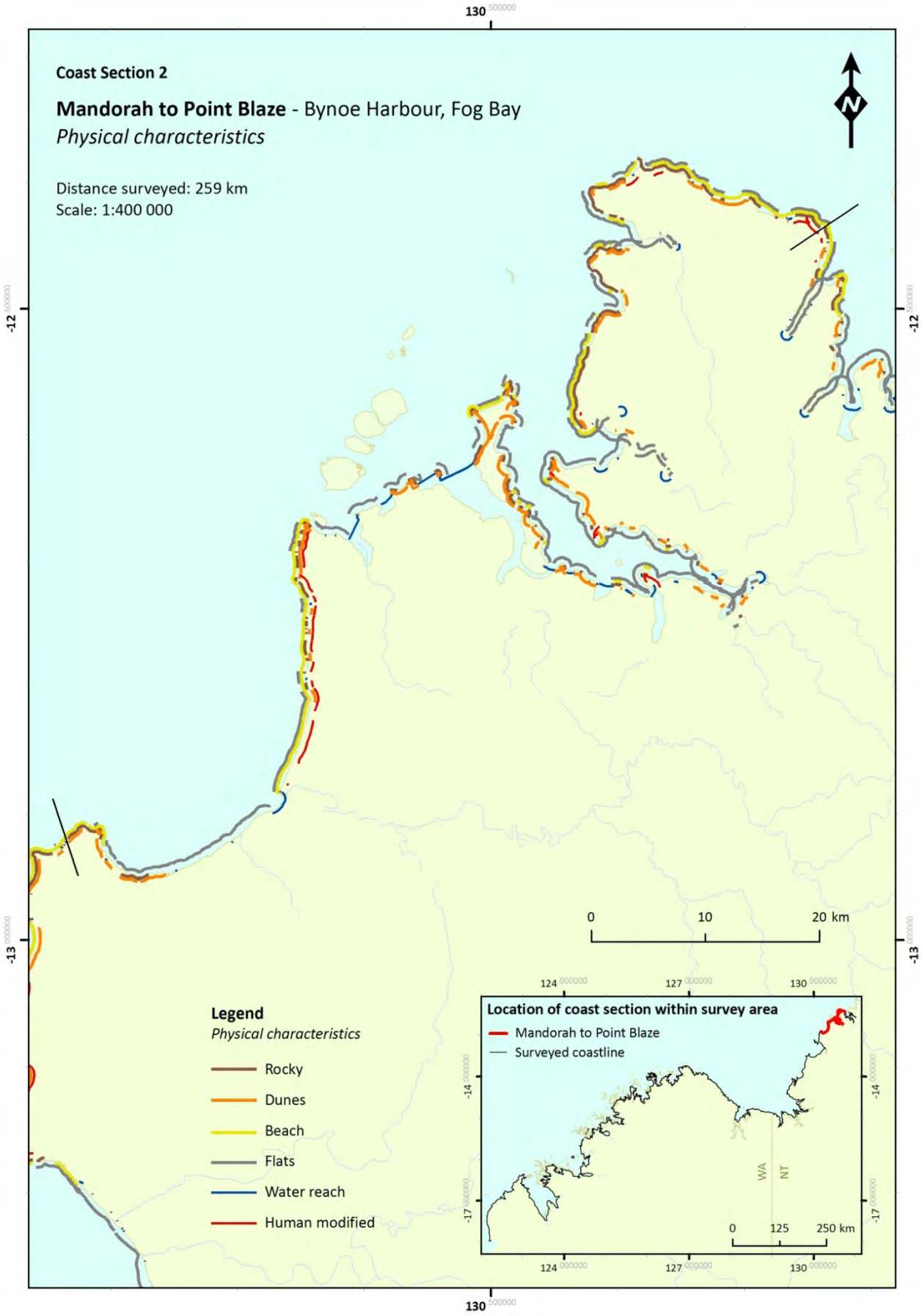


Figure 17: Shoreline physical characteristics in the Mandorah to Pt Blaze region

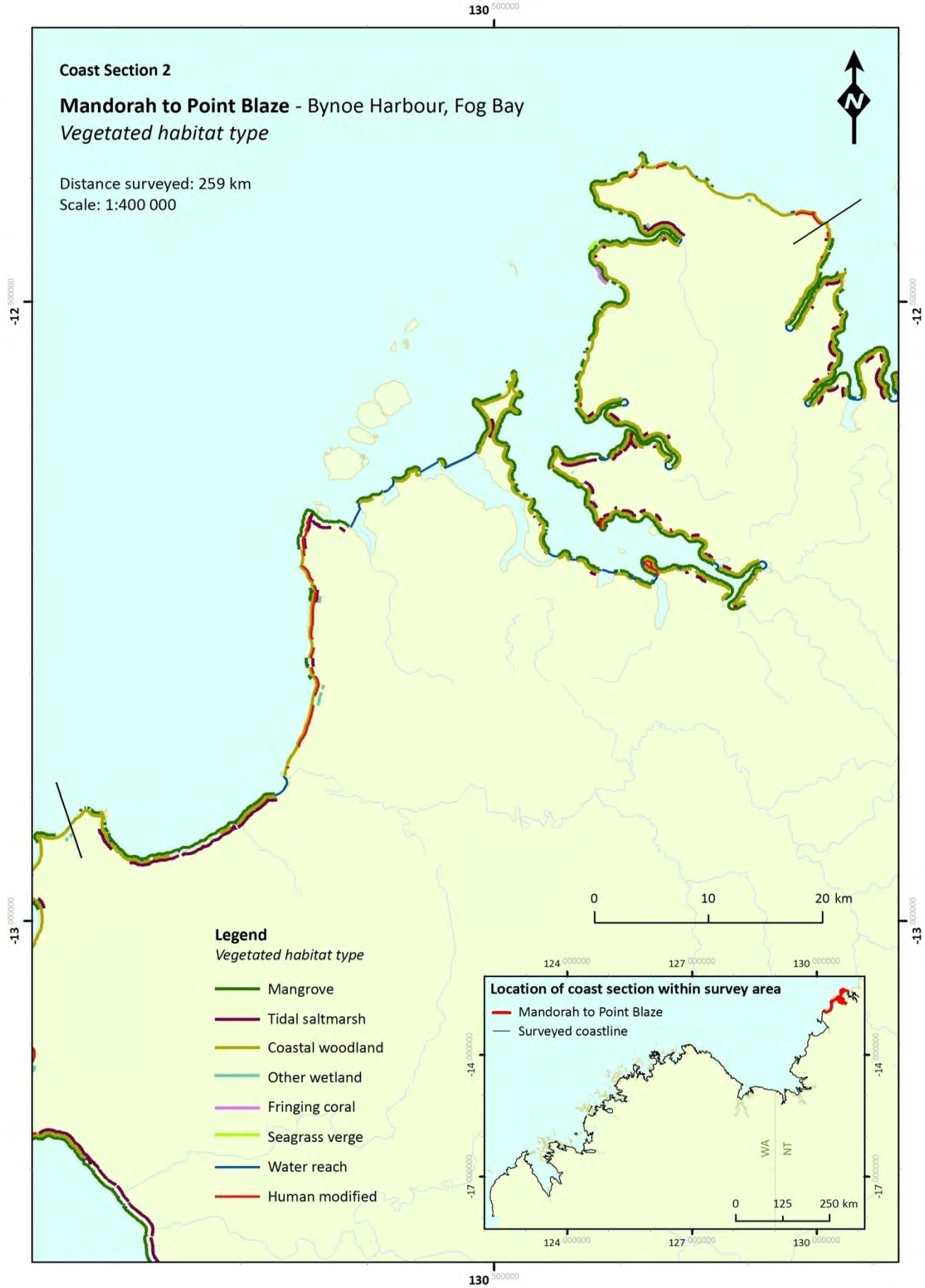


Figure 18: Vegetated habitat types within the Mandorah to Pt Blaze region

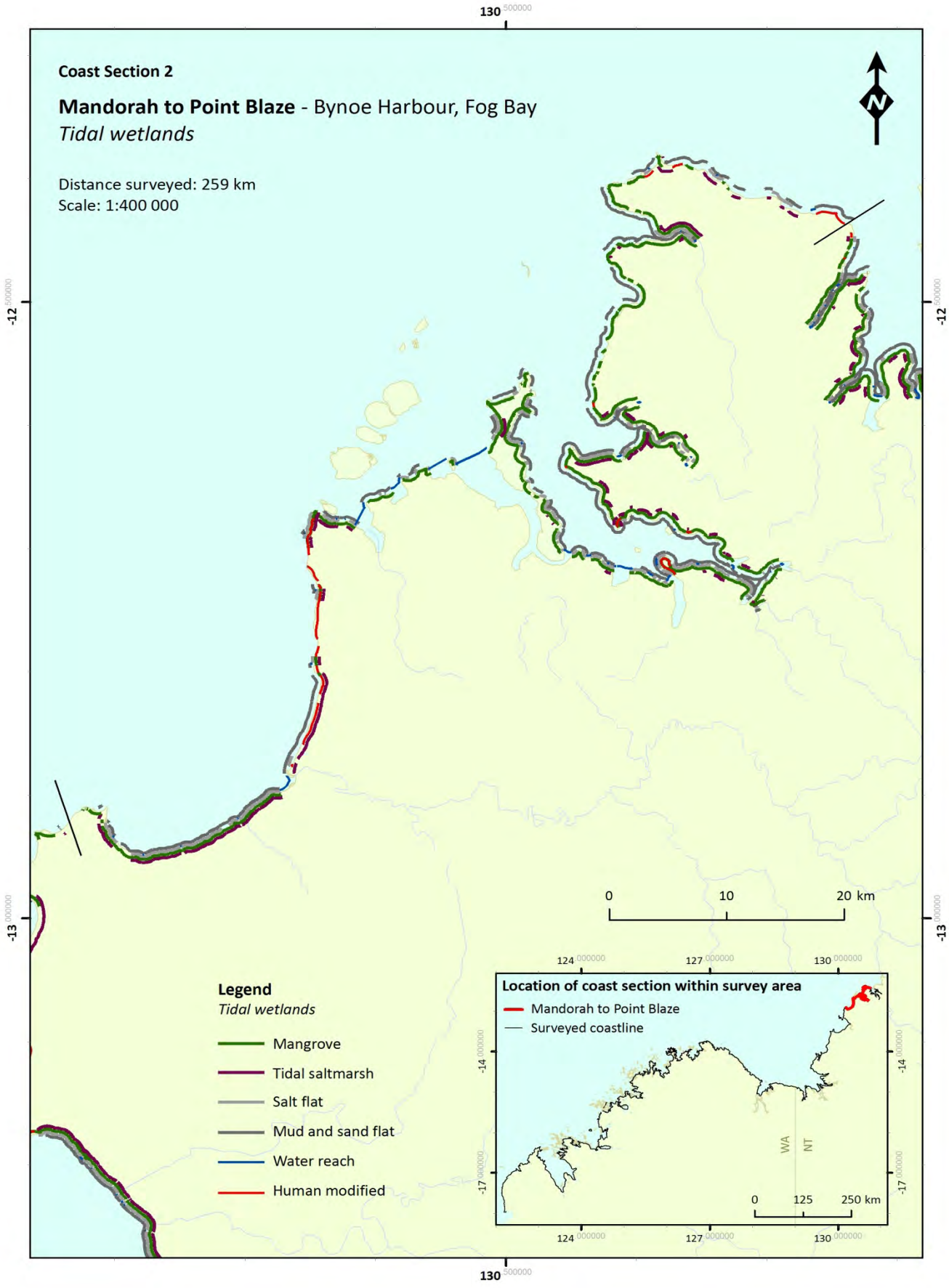


Figure 19: Tidal wetlands within the Mandorah to Pt Blaze region

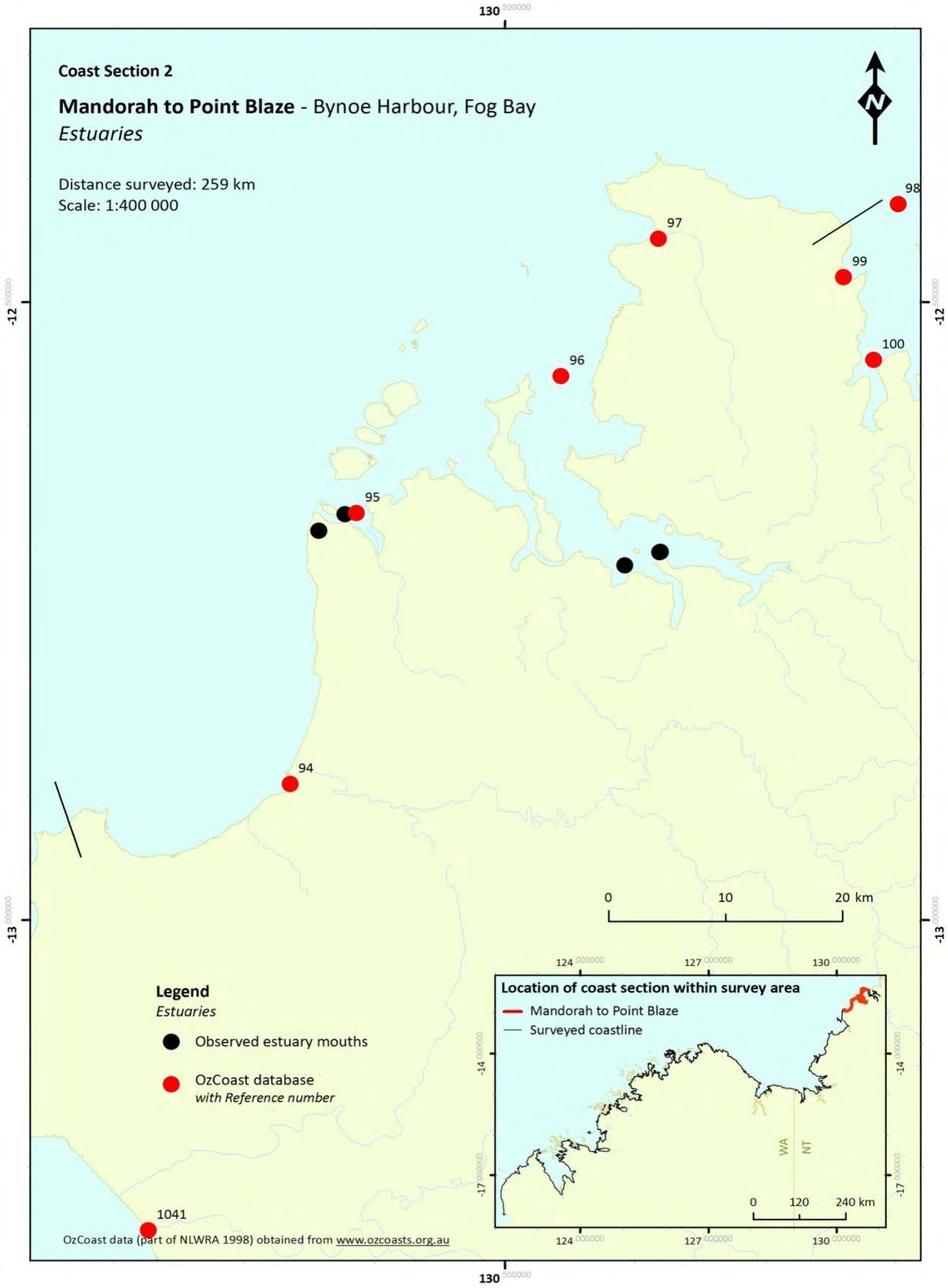


Figure 20: Estuaries within the Mandorah to Pt Blaze region

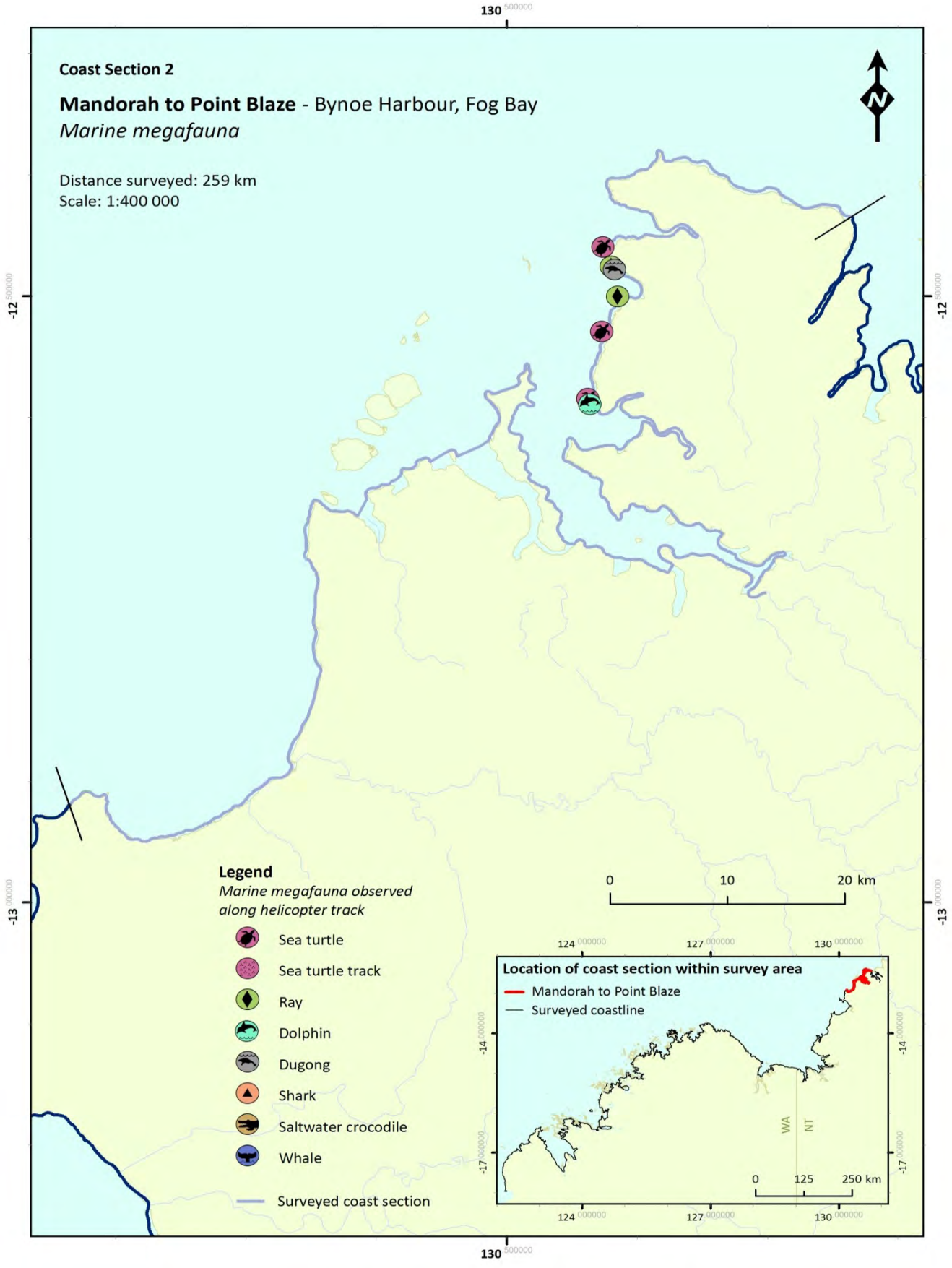


Figure 21: Marine megafauna observed in the Mandorah to Pt Blaze region

3.3 Point Blaze to Cape Ford (NT)

Coast section start: Lat: -12.91714
Long: 130.16413
Coast section end: Lat: -13.43934
Long: 129.90061

Region includes Daly River, North and South Peron Islands and Anson Bay

- 161 km coast surveyed, making 3% of the total 5102 km.
- Mangroves grow along 91.4 km of coast in this region, 56.9%. Total area of tidal wetland in the region is 26.68 km^2 (OzCoasts 2009), calculated as 0.17 km^2 tidal wetland per kilometer of coastline surveyed in the region.
- Beaches dominate in this region, spanning 119.2 km of coastline (74.3%).
- Human modification of the coast is low in this region (14.6 km, 9.1%).
- Estuaries in this region include the mouths of the Daly River and Reynolds River.
- Marine megafauna in this region included sea turtles and Dugong.

Table 17: Summary of coastal characteristics in Point Blaze to Cape Ford region.

		km	*% of region*
Physical characteristics	**Rocky**	43.6	*27.2*
	Beach	119.2	*74.3*
	Flat	114.5	*71.3*
	Dune	77.8	*48.4*
	Other wetland	1.4	*0.8*
Vegetated habitat type	**Mangrove**	91.4	*56.9*
	Saltmarsh	60.7	*37.8*
	Fringing coral	0.0	*0.0*
	Seagrass verge	0.0	*0.0*
	Coastal Woodland	117.4	*73.1*
State of erosion and deposition	**Deposition**	11.9	*7.4*
	Erosion	19.6	*12.2*
	Stable	125.2	*78.0*
Tidal wetlands	**Mangrove**	91.4	*56.9*
	Saltmarsh	60.7	*37.8*
	Sand and mud flats	111.3	*69.3*
	Salt flat	44.5	*27.7*
Other	**Human modified**	14.6	*9.1*
	Water reach	6.5	*4.1*

Point Blaze to Cape Ford (NT)

Figure 22: Representative coastline imagery from the Pt Blaze to Cape Ford region. Image numbers are unique within the electronic database

Table 18: Summary of marine megafauna observed during aerial surveys of Point Blaze to Cape Ford **(**NT).

Common name	Genus/Species	Total observed
Australian snubfin dolphin	*Orcaella heinsohni*	0
Indo-Pacific bottlenose	*Tursiops aduncas*	0
Unidentified dolphin species	Family Delphinidae	0
Sea turtle	*Chelonia* or *Caretta* spp	2
Sea turtle track	*Chelonia* or *Caretta* spp	0
Dugong	*Dugong dugong*	2
Whale	*Order Cetacea*	0
Manta ray	*Manta birostris*	0
Ray species	Superorder Batoidea	0
Saltwater crocodile	*Crocodylus porosus*	0

Table 19: Coastline data for the Point Blaze to Cape Ford, NT region. Source OzCoasts 2009.

NT-WA Survey – 3. Point Blaze to Cape Ford, NT		
Features	**#3**	**Relevance to survey region**
Annual Rainfall –range & mean (mm)	1500-1520 (1510)	Above average
Number of estuaries listed	2	Far below average
Total Catchment Area (km2)	53776	Above average size
Total Estuary Length (km)	65.8	Below average
Tidal Range (in m)	5.60	
Condition Status	Near Pristine	Virtually no disturbance by humans
Area of Mangrove (km2)	3.22	
Area of Salt Marsh (km2)	23.46	
WCI% from Region Total	12.1	
Total Tidal Wetland (km2)	26.68	
BOM 1998 Climatic Area	Tropical Savannah - Wet Autumn	
Mangrove species number	11	19 in vicinity
Mangrove species limit west	1	

Table 20: Estuary data for notable estuaries within the Point Blaze to Cape Ford (NT) shoreline region. Source NLWRA; 1998.

NT-WA Survey **3. Point Blaze to Cape Ford, NT**		
Feature / Location	**Daly River**	**Reynolds River**
NLWRA Estuary Reference#	**93**	**1041**
Latitude S	13.312	13.251
Longitude E	130.232	130.226
Annual Rainfall – mean (mm)	1500	1520
Catchment Area (km2)	53776	
Estuary Length (km)	65.76	
Tidal Range (in m)	5.6	
Condition Status	P	
Area of Mangrove (km2)	3.22	
Area of Salt Marsh (km2)	23.46	
Wetland Cover Index (WCI %)	12.1	
Total Tidal Wetland (km2)	26.68	
BOM 1998 Climatic Area	Tropical Savannah - Wet Autumn	
Mangrove species number	11 (19)	
Source of mangrove data:	GW85	

Table 21: Mangrove species present in the Point Blaze to Cape Ford, NT region. Green highlights species with ranges within the Port Darwin region (source: Duke 2006). Crosses identify recorded species occurrence in the listed estuary. Yellow denotes western limit of species range.

3. Point Blaze to Cape Ford	
Species/ Locations	**Daly River #93**
Acanthus ebracteatus subsp. *ebarbatus*	X
Acanthus ilicifolius	X->
Acrostichum speciosum	
Aegialitis annulata	X
Aegiceras corniculatum	X
Avicennia integra	
Avicennia marina	X
Bruguiera exaristata	X
Bruguiera gymnorhiza	
Bruguiera parviflora	
Bruguiera sexangula	
Camptostemon schultzii	X
Ceriops australis	
Ceriops decandra	
Ceriops tagal	
Cynometra iripa	
Diospyros littorea	
Excoecaria agallocha	X
Lumnitzera littorea	
Lumnitzera racemosa	X
Nypa fruticans	
Osbornia octodonta	
Pemphis acidula	
Rhizophora apiculata	
Rhizophora X *lamarckii*	
Rhizophora stylosa	X
Scyphiphora hydrophylacea	
Sonneratia alba	
Sonneratia lanceolata	
Sonneratia X *urama*	
Xylocarpus granatum	
Xylocarpus moluccensis	X
TOTAL recorded	**11**
TOTAL in vicinity	**19**
Sources:	GW85

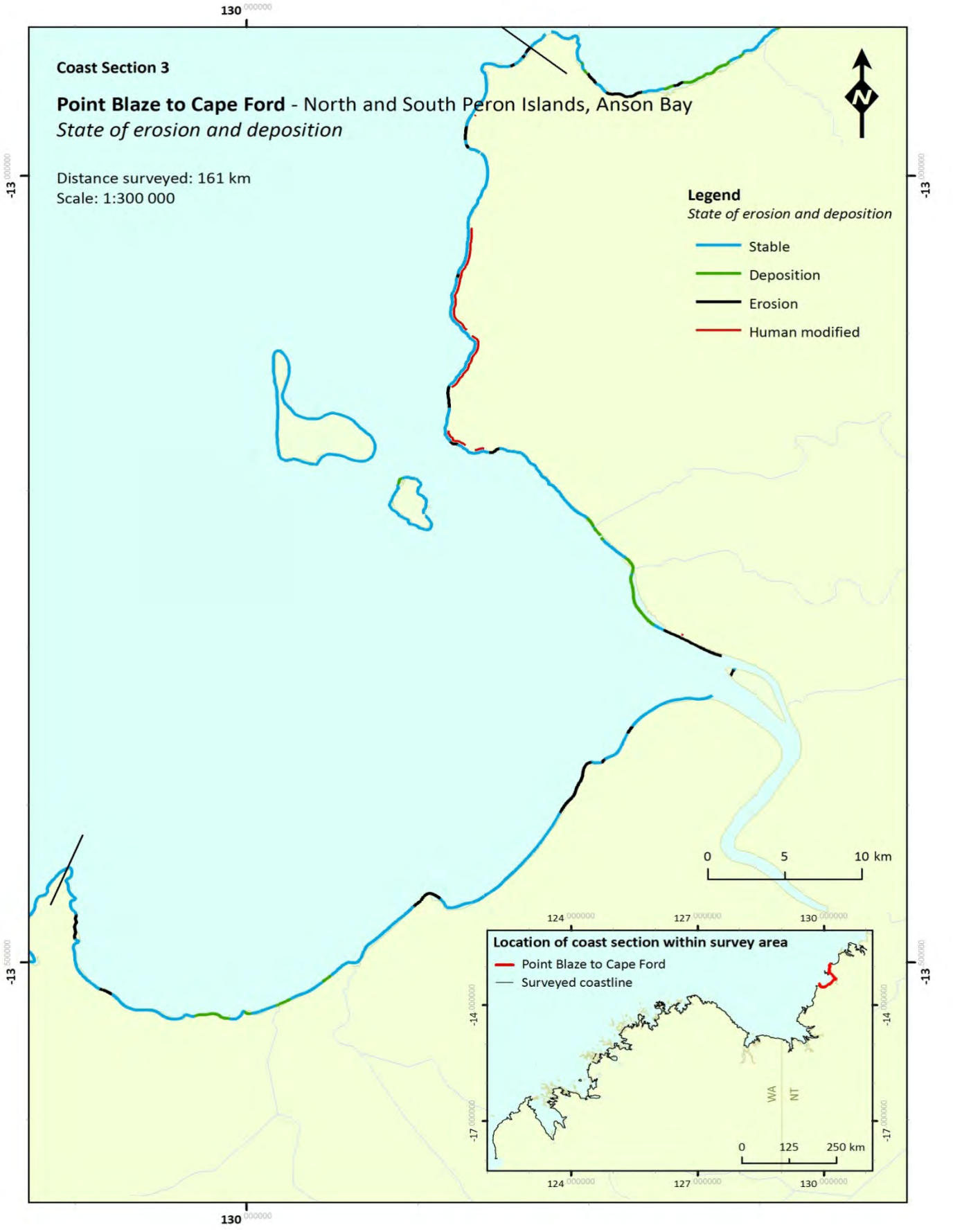


Figure 23: Bank stability within the Pt Blaze to Cape Ford region

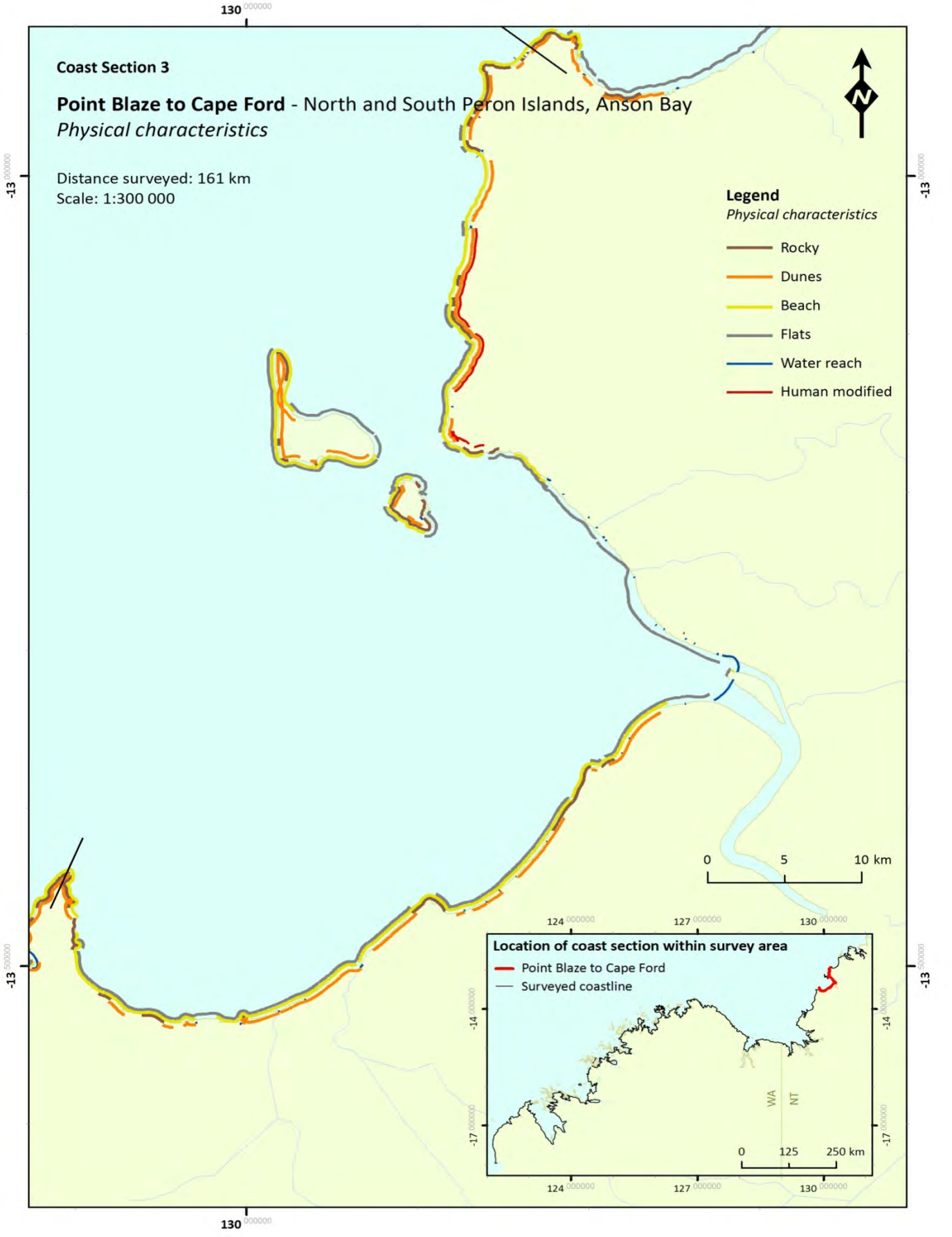


Figure 24: Shoreline physical characteristics in the Pt Blaze to Cape Ford region

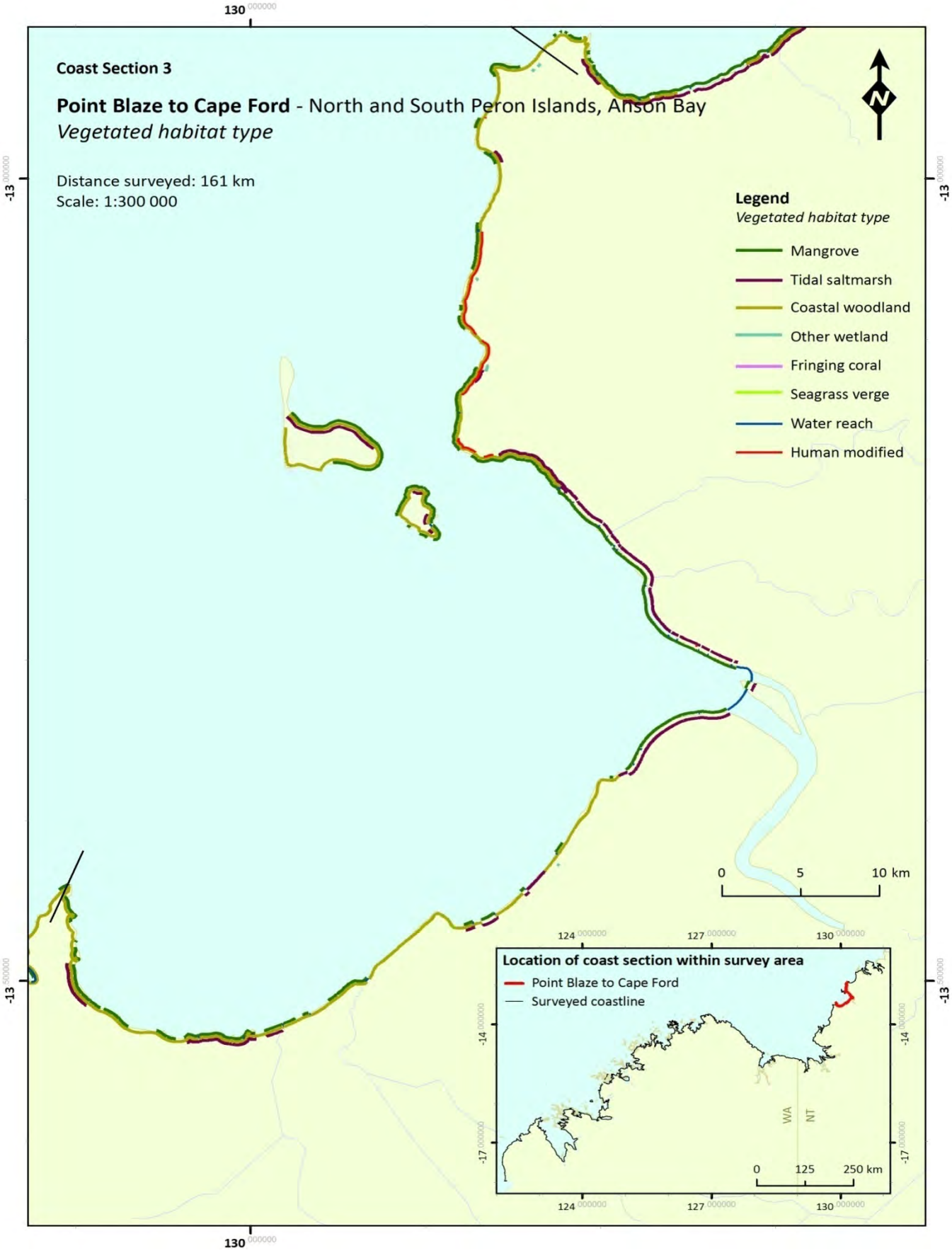


Figure 25: Vegetated habitat types in the Pt Blaze to Cape Ford region

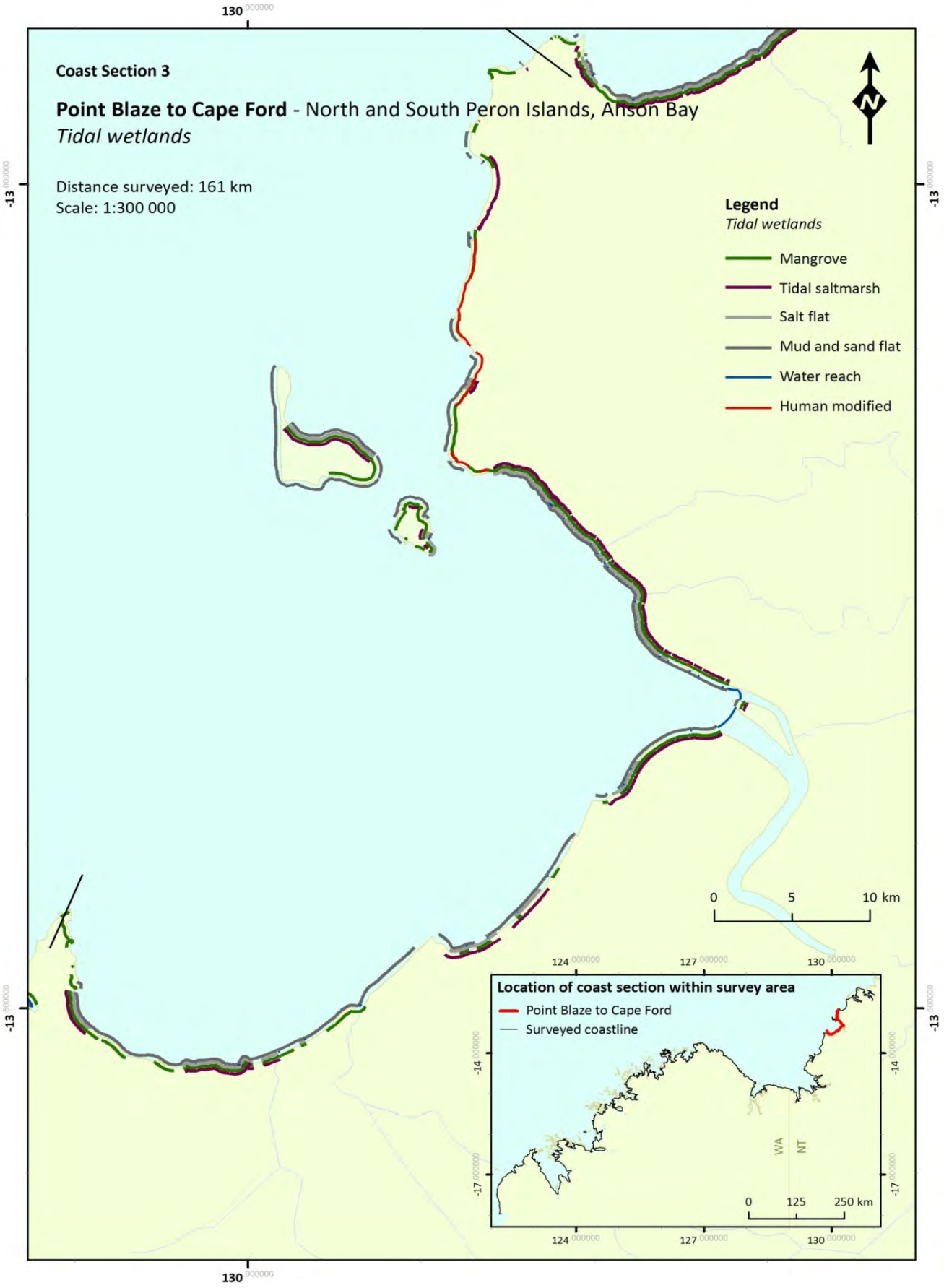


Figure 26: Tidal wetlands in the Pt Blaze to Cape Ford region

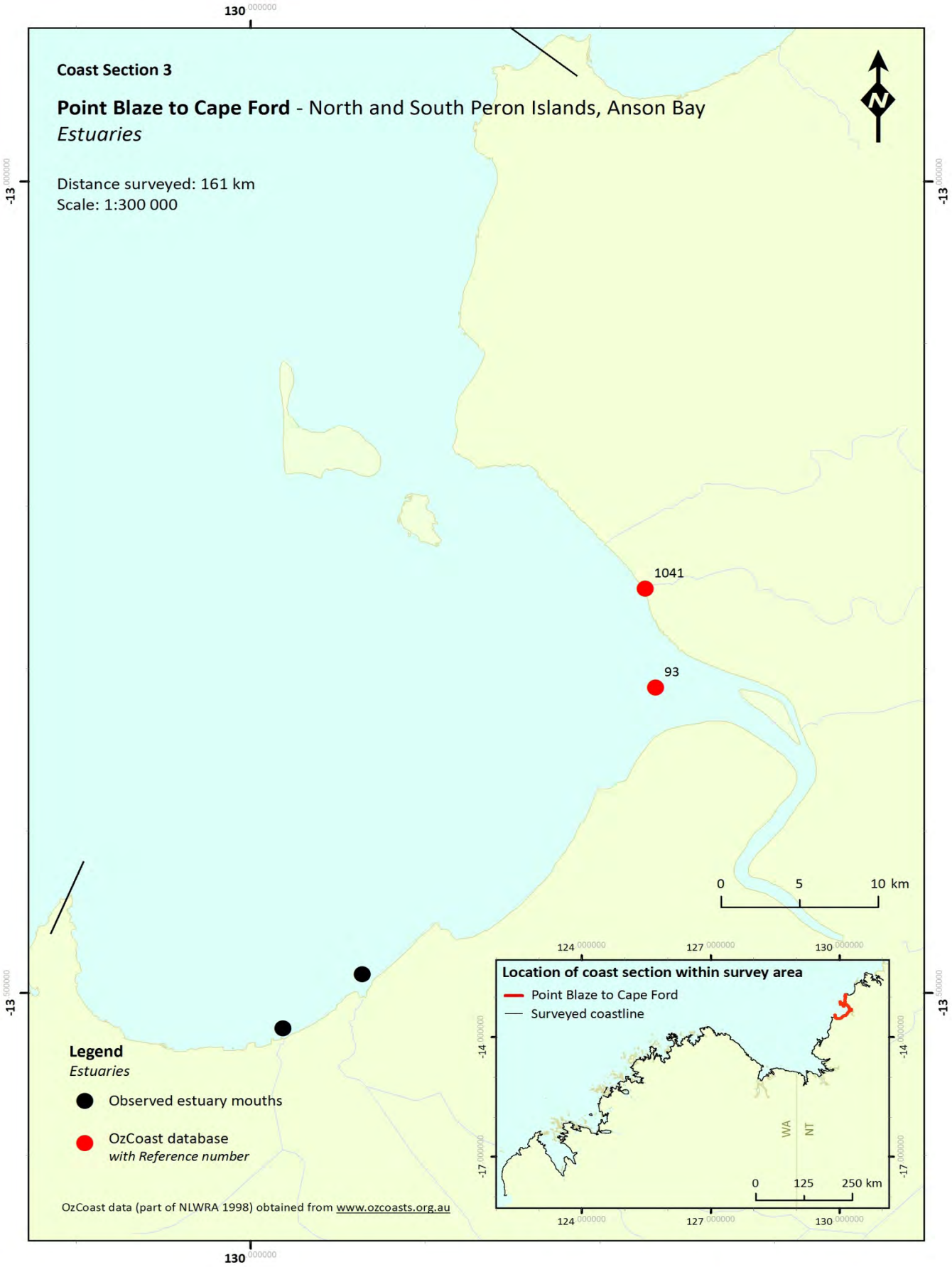


Figure 27: Estuaries within the Pt Blaze to Cape Ford region

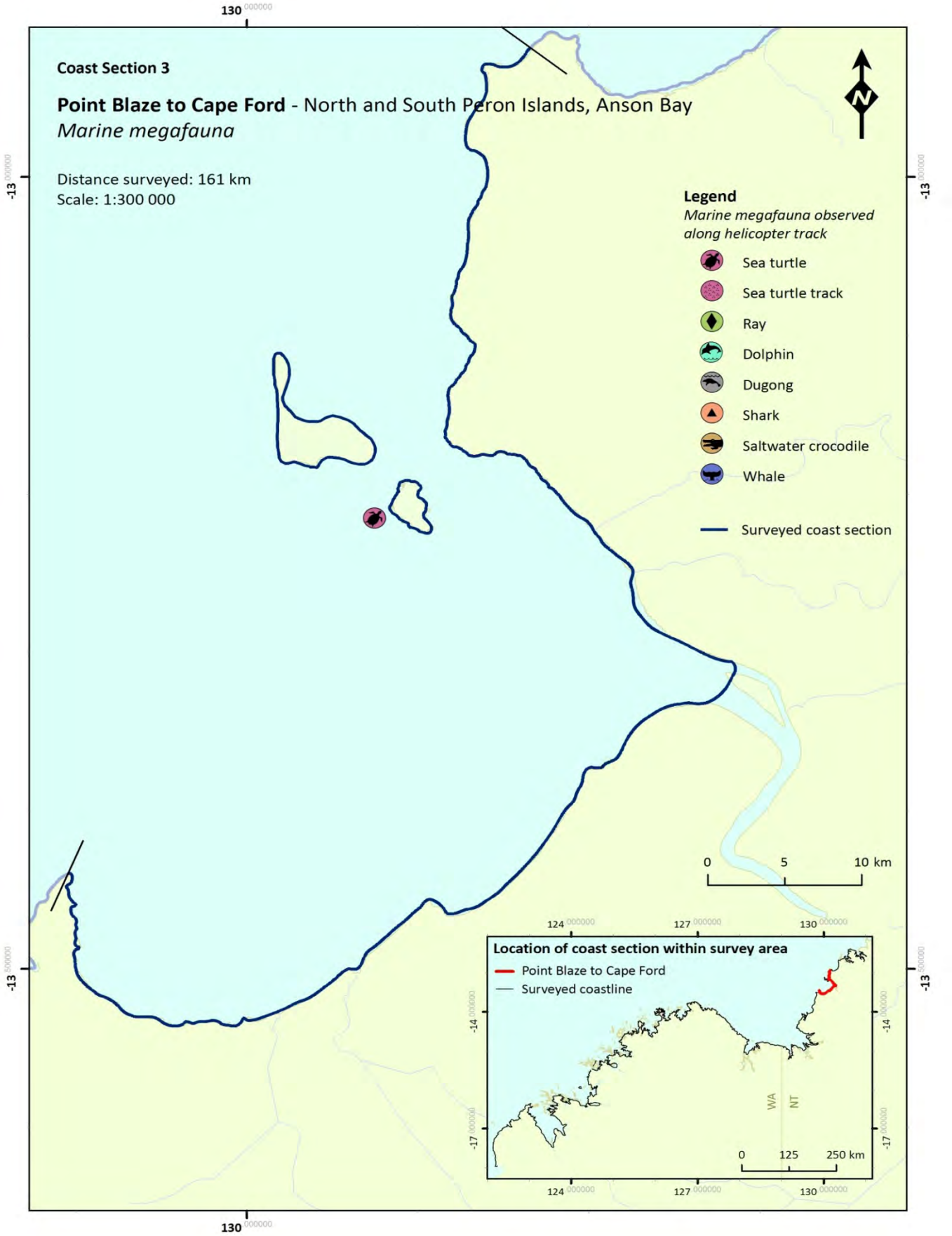


Figure 28: Marine megafauna observed in the Pt Blaze to Cape Ford region

3.4 Cape Ford to Pearce Point (NT)

Coast region start: Lat: -13.43925
Long: 129.89579
Coast region end: Lat: -14.42518
Long: 129.35248

Region includes Moyle River and Port Keats

- 244 km coast surveyed, making 4% of the total 5102 km.
- Mangroves are found on 51.5% of the region, 115.2 km. Total area of tidal wetland in the region is 86.33 km^2 (OzCoasts 2009), calculated as 0.35 km^2 tidal wetland per kilometer of coastline surveyed in the region.
- Beaches dominate in this region, spanning 160.7 km of coastline (71.8% of the region).
- Human activities impact 5 km of coastline, 2.2% of the region.
- Estuaries include Port Keats, Moyle River and Little Moyle Inlet.
- Marine megafauna in this region was limited to one sea turtle sighting (*Caretta* or *Chelonia* spp.).

Table 22: Summary of coastal characteristics in Cape Ford to Pearce Point region.

		km	*% of region*
Physical characteristics	**Rocky**	75.4	*33.7*
	Beach	160.7	*71.8*
	Flat	132.5	*59.3*
	Dune	125.3	*56.0*
	Other wetland	3.7	*1.7*
Vegetated habitat type	**Mangrove**	115.2	*51.5*
	Saltmarsh	78.0	*34.9*
	Fringing coral	0.0	*0.0*
	Seagrass verge	0.0	*0.0*
	Coastal Woodland	180.1	*80.5*
State of erosion and deposition	**Deposition**	7.0	*3.1*
	Erosion	39.9	*17.8*
	Stable	174.5	*78.0*
Tidal wetlands	**Mangrove**	115.2	*51.5*
	Saltmarsh	78.0	*34.9*
	Sand and mud flats	86.1	*38.5*
	Salt flat	70.4	*31.5*
Other	**Human modified**	5.0	*2.2*
	Water reach	17.4	*7.8*

Cape Ford to Pearce Point (NT)

Figure 29: Representative coastline imagery from the Cape Ford to Pearce Point region. Image numbers are unique within the electronic database

Table 23: Coastline data for the Cape Ford to Pearce Point region (NT). Source OzCoasts 2009.

NT-WA Survey – 4. Cape Ford to Pearce Point, NT		
Features	**#4**	**Relevance to survey region**
Annual Rainfall –range & mean (mm)	1522-1563 (1542)	Above average
Number of estuaries listed	4	Below average
Total Catchment Area (km2)	5832	Below average size
Total Estuary Length (km)	52.9	Below average size
Tidal Range (in m)	5.43	
Condition Status	Near Pristine	Virtually no disturbance by humans
Area of Mangrove (km2)	44.14	
Area of Salt Marsh (km2)	42.19	
WCI% from Region Total	51.1	
Total Tidal Wetland (km2)	86.33	
BOM 1998 Climatic Area	Tropical Savannah - Wet Autumn	
Mangrove species number	12	18 in vicinity
Mangrove species limit west	0	

Table 24: Estuary data for notable estuaries within the Cape Ford to Pearce Point region (NT). Source NLWRA; 1998.

NT-WA Survey **4. Cape Ford to Pearce Point, NT**				
Feature / Location	**Port Keats**	**NT009**	**Moyle River**	**Little Moyle Inlet**
NLWRA Estuary Reference#	**89**	**90**	**91**	**92**
Latitude S	14.085	14.085	13.975	13.782
Longitude E	129.551	129.586	129.745	129.784
Annual Rainfall – mean (mm)	1563	1559	1522	1522
Catchment Area (km2)	322	373	3835	1302
Estuary Length (km)	18.32	13.45	9.69	11.4
Tidal Range (in m)	5.5	5.5	5.4	5.3
Condition Status	P	P	P	P
Area of Mangrove (km2)	21.78	6.11	2.80	13.45
Area of Salt Marsh (km2)	19.50	15.30	3.95	3.44
Wetland Cover Index (WCI %)	52.8	28.5	41.5	79.6
Total Tidal Wetland (km2)	41.28	21.41	6.75	16.89
BOM 1998 Climatic Area	Tropical Savannah - Wet Autumn	Tropical Savannah - Wet Autumn	Tropical Savannah - Wet Autumn	Tropical Savannah - Wet Autumn
Mangrove species number	11 (18)		6 (18)	
Source of mangrove data:	GW85		GW85	

Table 25: Mangrove species present in the Northern Territory and Western Australia. Green highlights species with ranges within the Cape Ford to Pearce Point region (NT) (source: Duke 2006). Crosses identify recorded species occurrence in the listed estuary. Yellow denotes western limit of species range.

4. Cape Ford to Pearce Point		
Species/ Locations	**Port Keats #89**	**Moyle River #91**
Acanthus ebracteatus subsp. *ebarbatus*		
Acanthus ilicifolius		
Acrostichum speciosum		
Aegialitis annulata	X	X
Aegiceras corniculatum	X	
Avicennia integra		
Avicennia marina	X	X
Bruguiera exaristata		
Bruguiera gymnorhiza		
Bruguiera parviflora	X	
Bruguiera sexangula		
Camptostemon schultzii	X	X
Ceriops australis	X	X
Ceriops decandra		
Ceriops tagal		
Cynometra iripa		
Diospyros littorea		
Excoecaria agallocha		X
Lumnitzera littorea		
Lumnitzera racemosa	X	
Nypa fruticans		
Osbornia octodonta	X	
Pemphis acidula		
Rhizophora apiculata		
Rhizophora X *lamarckii*		
Rhizophora stylosa	X	X
Scyphiphora hydrophylacea		
Sonneratia alba	X	
Sonneratia lanceolata		
Sonneratia X *urama*		
Xylocarpus granatum		
Xylocarpus moluccensis	X	
TOTAL recorded	**11**	**6**
TOTAL in vicinity	**18**	**18**
Sources:	GW85	GW85

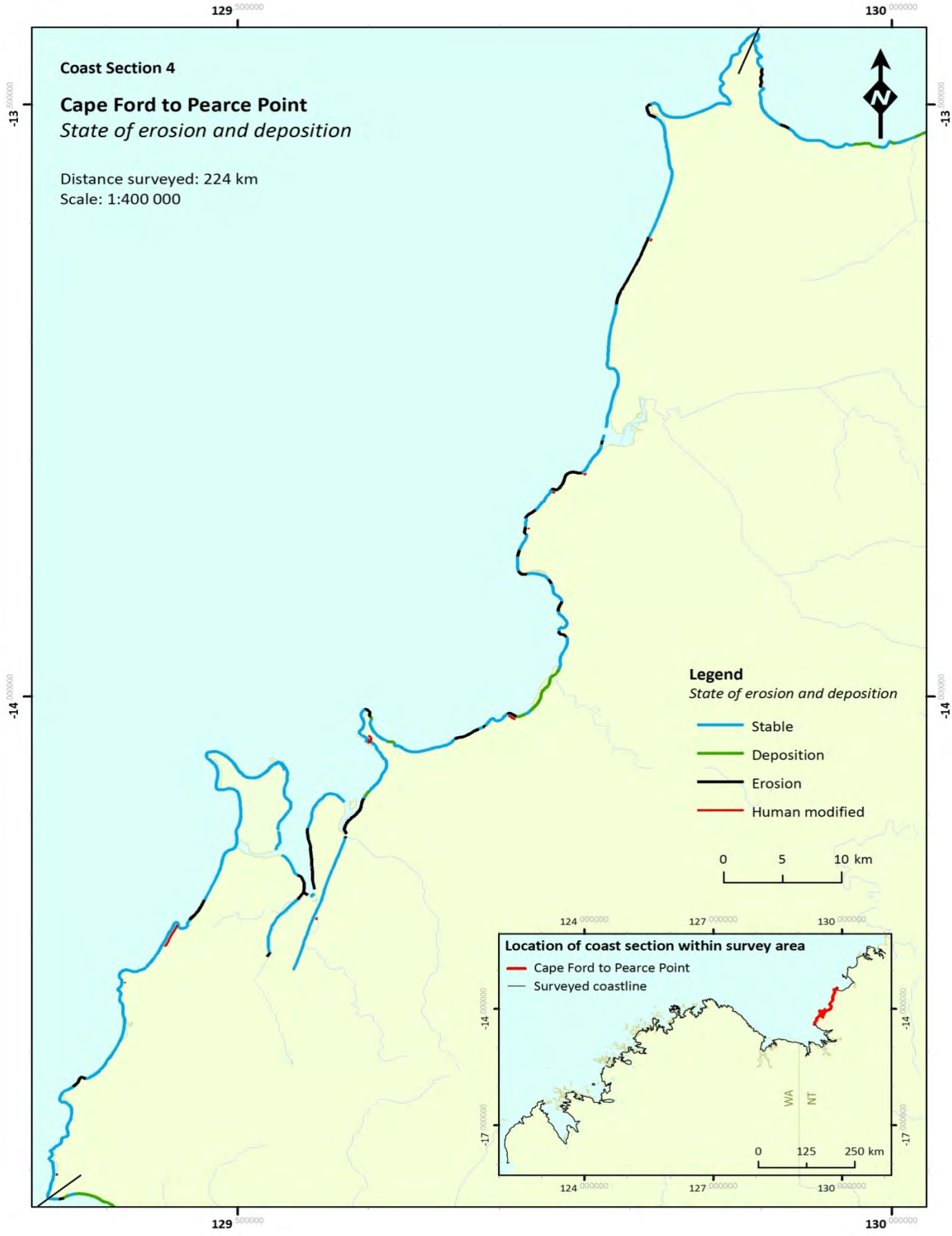


Figure 30: Bank stability in the Cape Ford to Pearce Pt region

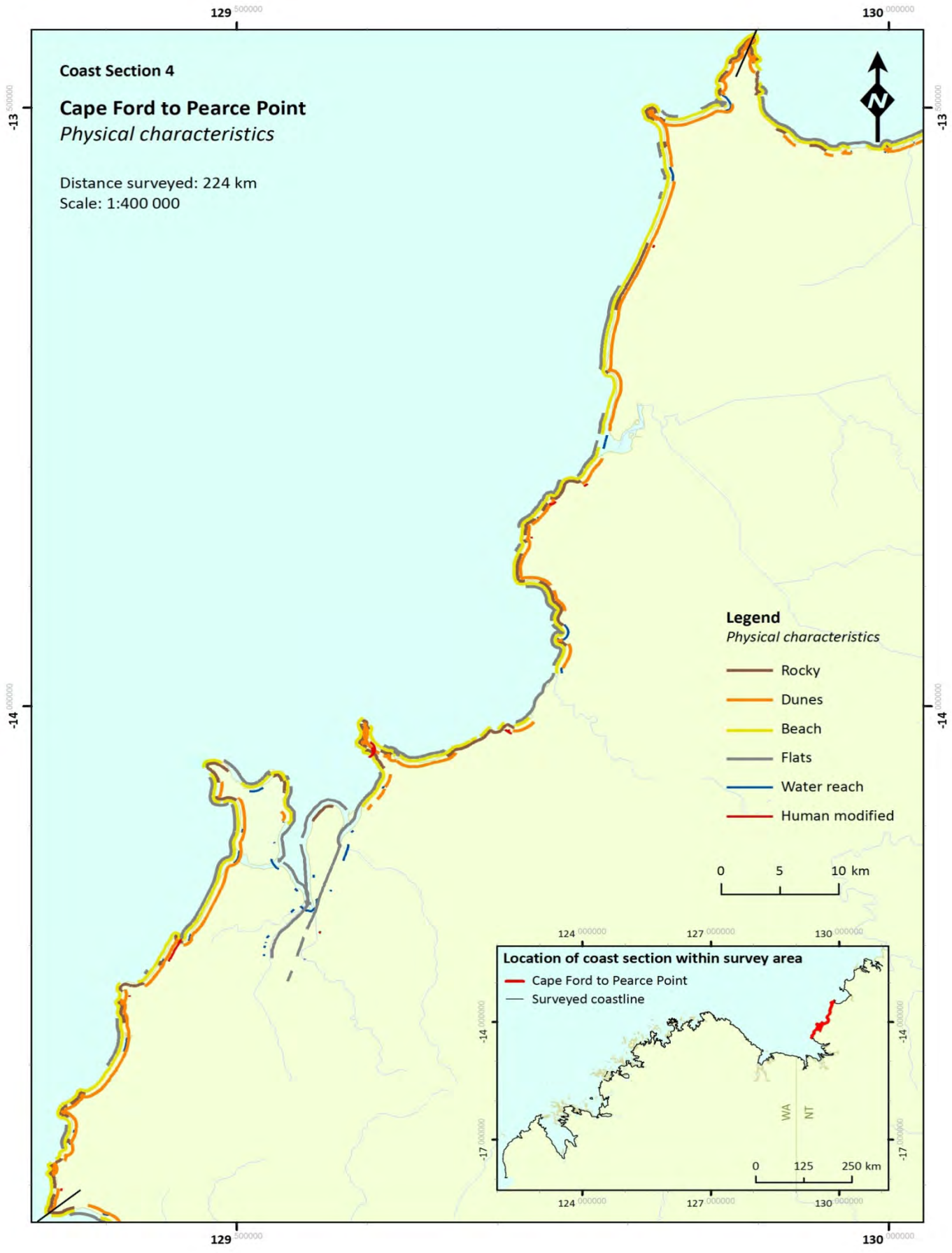


Figure 31: Physical characteristics in the Cape Ford to Pearce Pt region

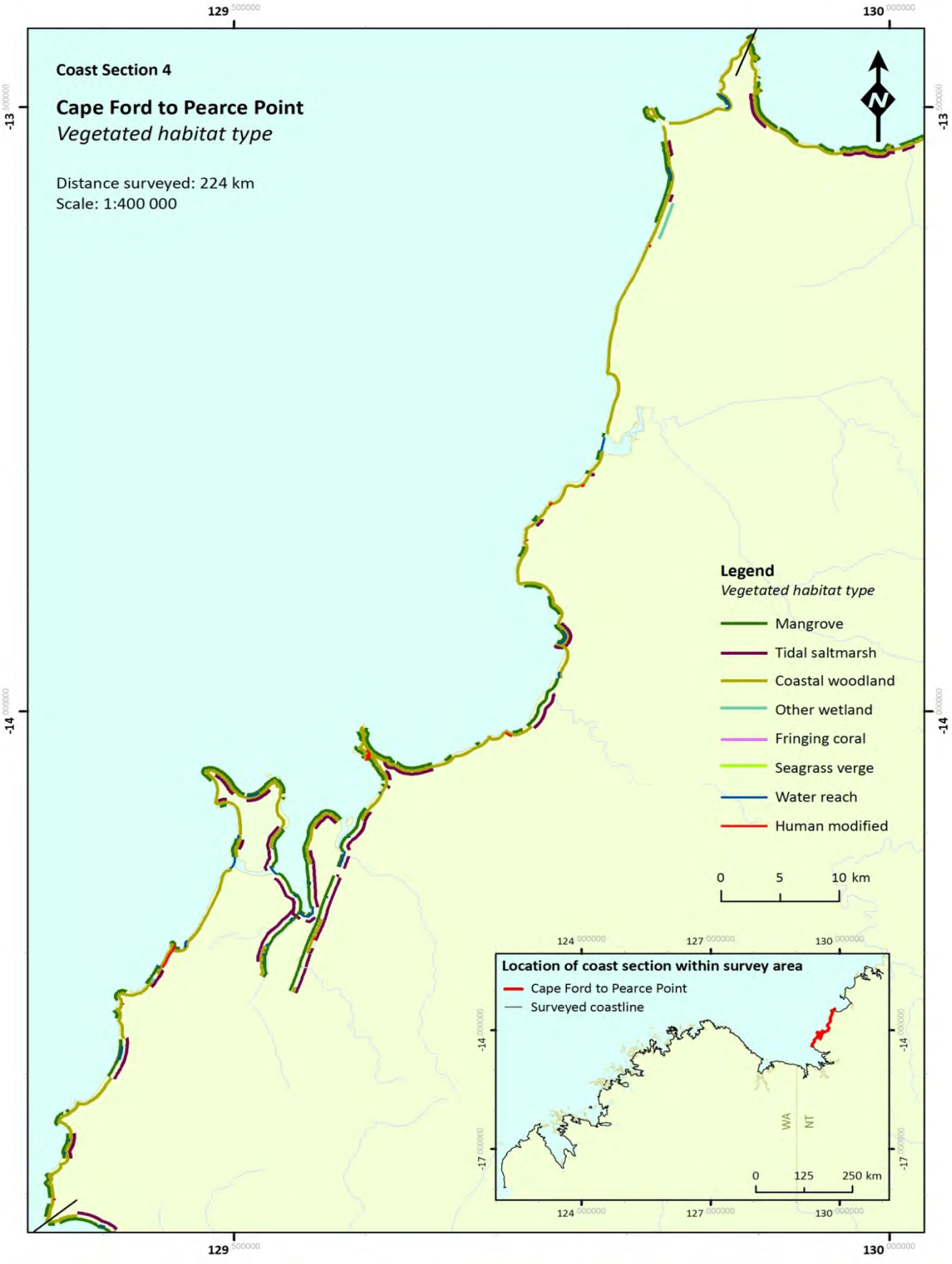


Figure 32: Vegetated habitat types in the Cape Ford to Pearce Pt region

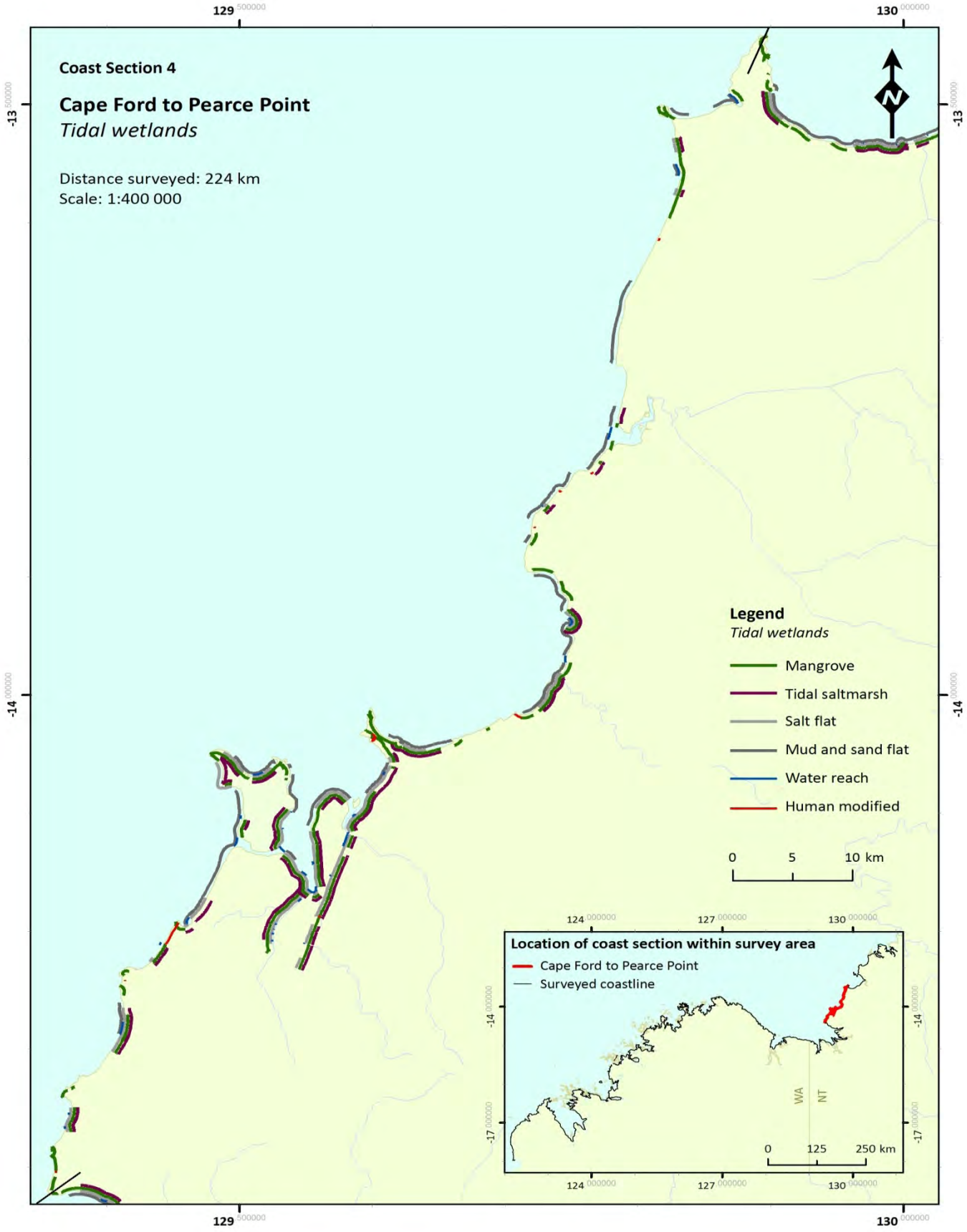


Figure 33: Tidal wetlands in the Cape Ford to Pearce Pt region

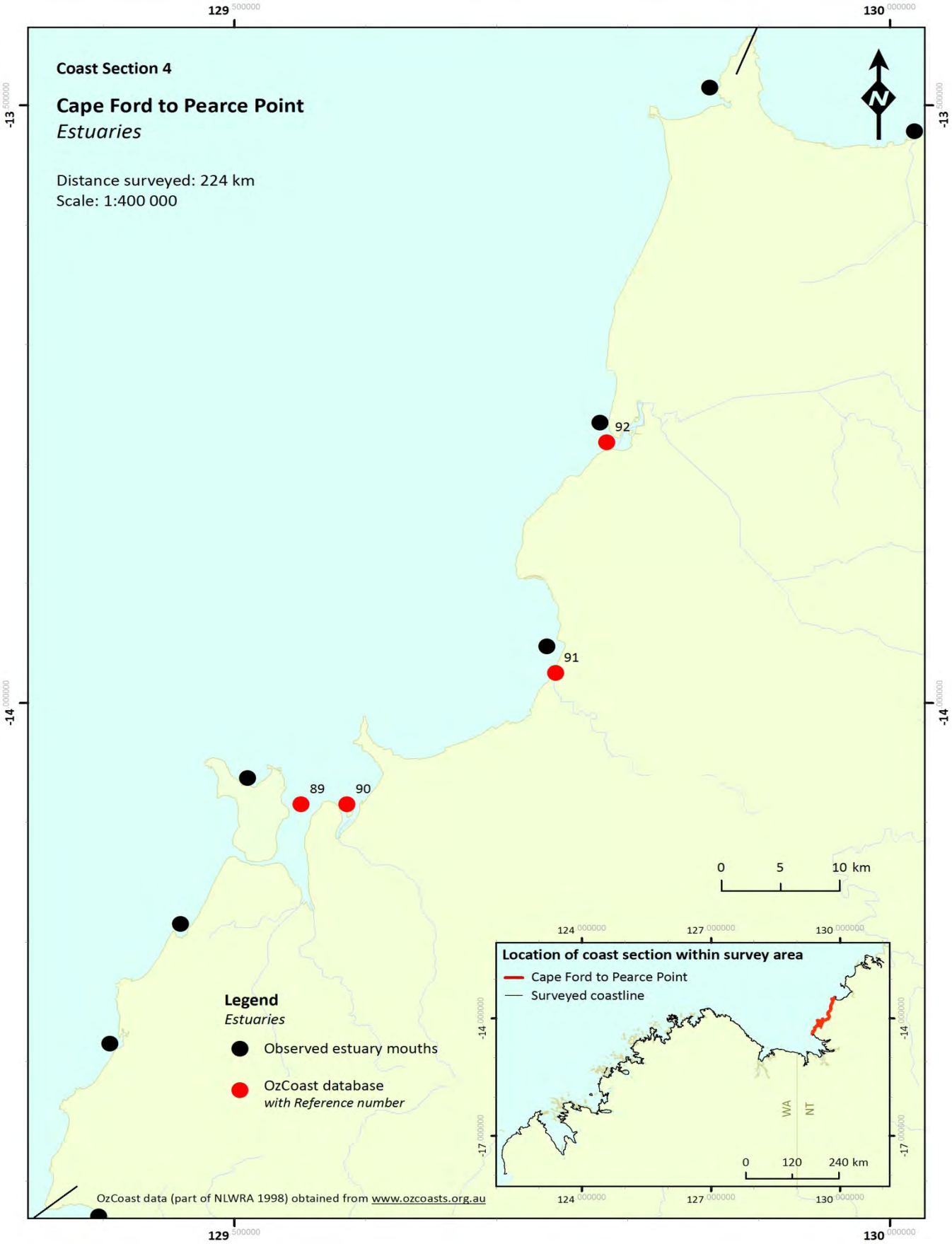


Figure 34: Estuaries in the Cape Ford to Pearce Pt region

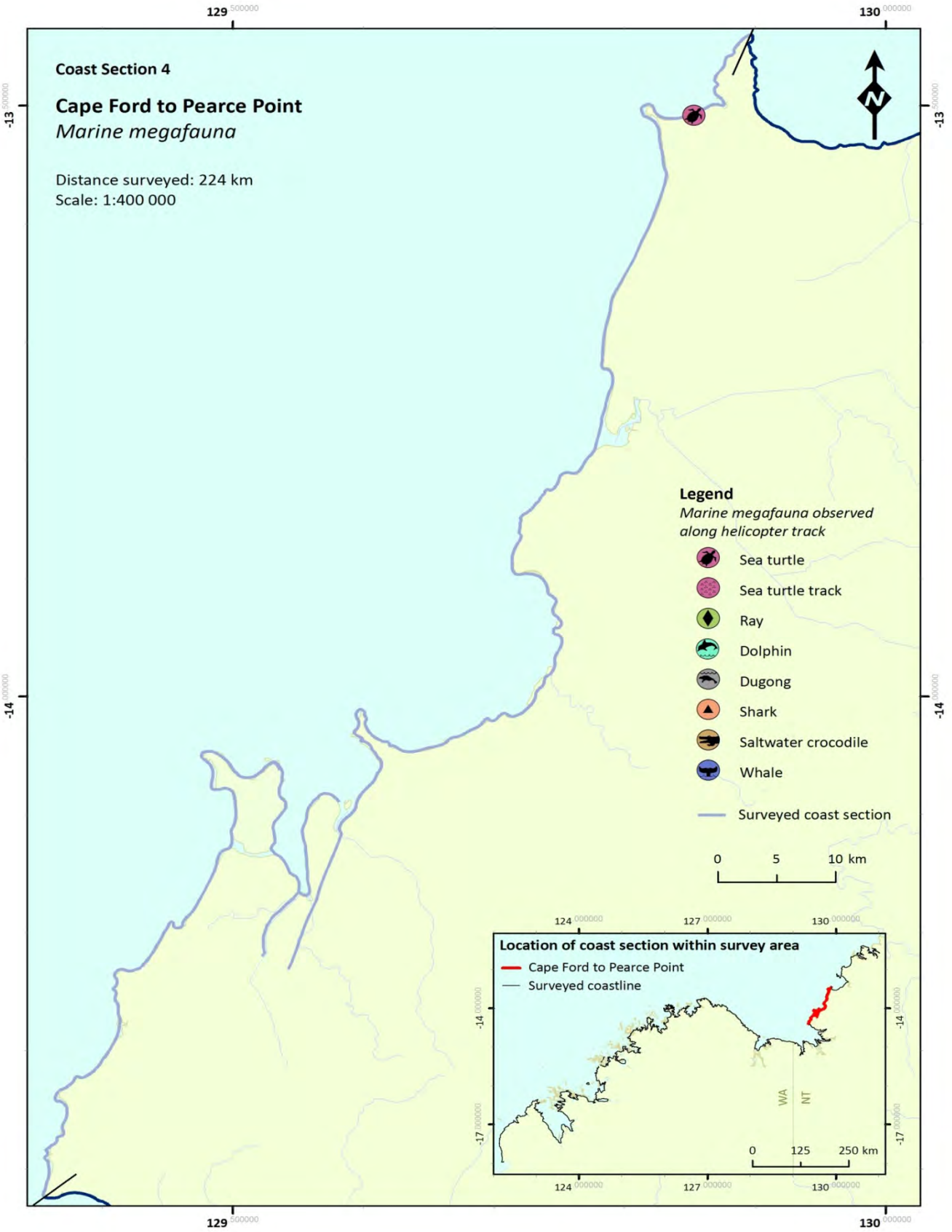


Figure 35: Marine megafauna observed in the Cape Ford to Pearce Pt region

3.5 Pearce Point to NT-WA border

Coast region start: Lat: -14.42668
Long: 129.35406
Coast region end: Lat: -14.72703
Long: 128.22284

Region includes Joseph Bonaparte Gulf, Fitzmaurice River, Victoria River and Keep River.

- 455 km coast surveyed, making 9% of the total 5102 km.
- Mangroves are found along 94.2% of the shoreline in this region, 428.6 km. Total area of tidal wetland in the region is 2301.23 km^2 (OzCoasts 2009), calculated as 5.06 km^2 tidal wetland per kilometer of coastline surveyed in the region.
- Sand flats, mud flats and salt flats dominate in this region, being found 419.1 km, 92.1% of the coastline.
- Estuaries include the mouths of the Keep River, Forsyth Creek, Victoria River, Fitzmaurice River and New Moon Inlet.
- No marine megafauna was observed in this region.

Table 26: Summary of coastal characteristics from Pearce Point to NT-WA border.

		km	*% of region*
Physical characteristics	**Rocky**	25.5	*5.6*
	Beach	55.8	*12.3*
	Flat	419.1	*92.1*
	Dune	109.5	*24.1*
	Other wetland	2.4	*0.5*
Vegetated habitat type	**Mangrove**	428.6	*94.2*
	Saltmarsh	386.0	*84.8*
	Fringing coral	1.8	*0.4*
	Seagrass verge	0.0	*0.0*
	Coastal Woodland	62.3	*13.7*
State of erosion and deposition	**Deposition**	184.5	*40.6*
	Erosion	156.1	*34.3*
	Stable	89.2	*19.6*
Tidal wetlands	**Mangrove**	428.6	*94.2*
	Saltmarsh	386.0	*84.8*
	Sand and mud flats	209.9	*46.1*
	Salt flat	355.3	*78.1*
Other	**Human modified**	1.2	*0.3*
	Water reach	70.0	*15.4*

Pearce Point to NT-WA border

Figure 36: Representative coastline imagery from the Pearce Point to the NT-WA border region. Image numbers are unique within the electronic database

Table 27: Coastline data for Pearce Point to NT-WA border, NT. Source OzCoasts 2009.

NT-WA Survey – 5. Pearce Point to NT-WA border, NT		
Features	**#5**	**Relevance to survey region**
Annual Rainfall –range & mean (mm)	1134-1416 (1229)	Above average
Number of estuaries listed	7	Average
Total Catchment Area (km2)	99500	Above average size
Total Estuary Length (km)	329.0	Above average size
Tidal Range (in m)	5.40	
Condition Status	Near Pristine	Virtually no disturbance by humans
Area of Mangrove (km2)	394.62	
Area of Salt Marsh (km2)	1906.61	
WCI% from Region Total	17.1	
Total Tidal Wetland (km2)	2301.23	
BOM 1998 Climatic Area	Tropical Savannah - Wet Autumn	
Mangrove species number	12	18 in vicinity
Mangrove species limit west	0	

Table 28: Estuary data for notable estuaries within Pearce Point to NT-WA border, NT . Source NLWRA; 1998

NT-WA Survey **5. Pearce Point to NT-WA border, NT**				
Feature / Location	**Keep River**	**Victoria River**	**Fitzmaurice River**	**New Moon Inlet**
NLWRA Estuary Reference#	**83**	**85**	**86**	**87**
Latitude S	14.917	14.883	14.794	14.589
Longitude E	129.181	129.500	129.656	129.558
Annual Rainfall – mean (mm)	1134	1193	1212	1327
Catchment Area (km2)	7495	81216	8522	1242
Estuary Length (km)	44.12	129.35	77.72	30.5
Tidal Range (in m)	5.2	5.3	5.4	5.6
Condition Status	P	P	P	P
Area of Mangrove (km2)	55.55	198.90	26.90	47.42
Area of Salt Marsh (km2)	504.00	522.03	255.96	382.60
Wetland Cover Index (WCI %)	9.9	27.6	9.5	11.0
Total Tidal Wetland (km2)	559.55	720.93	282.86	430.02
BOM 1998 Climatic Area	Tropical Savannah - Wet Autumn	Tropical Savannah - Wet Autumn	Tropical Savannah - Wet Autumn	Tropical Savannah - Wet Autumn
Mangrove species number		10 (18)	12 (18)	
Source of mangrove data:		GW85	GW85	

Table 29: Mangrove species present in the Northern Territory and Western Australia. Green highlights species with ranges within the Pearce Point to NT-WA border region (NT) (source: Duke 2006). Crosses identify recorded species occurrence in the listed estuary. Yellow denotes western limit of species range.

5. Pearce Point to NT-WA border		
Species/ Locations	**Victoria River #85**	**Fitzmaurice River #86**
Acanthus ebracteatus subsp. *ebarbatus*		
Acanthus ilicifolius		
Acrostichum speciosum		
Aegialitis annulata	X	X
Aegiceras corniculatum	X	X
Avicennia integra		
Avicennia marina	X	X
Bruguiera exaristata		X
Bruguiera gymnorhiza		
Bruguiera parviflora		
Bruguiera sexangula		
Camptostemon schultzii	X	X
Ceriops australis	X	X
Ceriops decandra		
Ceriops tagal		
Cynometra iripa		
Diospyros littorea		
Excoecaria agallocha	X	X
Lumnitzera littorea		
Lumnitzera racemosa	X	X
Nypa fruticans		
Osbornia octodonta	X	X
Pemphis acidula		
Rhizophora apiculata		
Rhizophora X *lamarckii*		
Rhizophora stylosa	X	X
Scyphiphora hydrophylacea		
Sonneratia alba		X
Sonneratia lanceolata		
Sonneratia X *urama*		
Xylocarpus granatum		
Xylocarpus moluccensis	X	X
TOTAL recorded	**10**	**12**
TOTAL in vicinity	**18**	**18**
Sources:	GW85	GW85

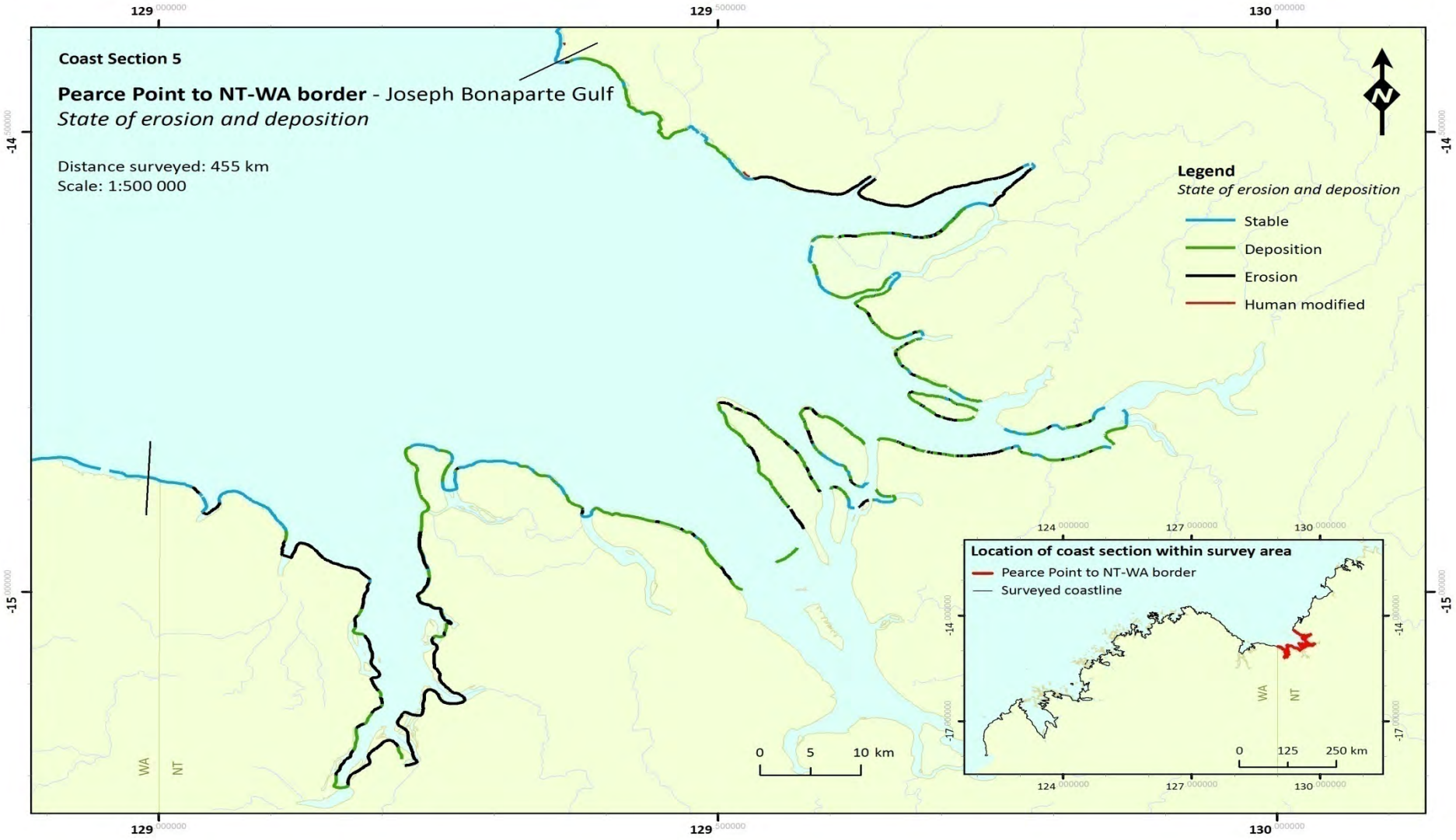


Figure 37: Shoreline stability in the Pearce Pt to the Northern Territory – Western Australian border region

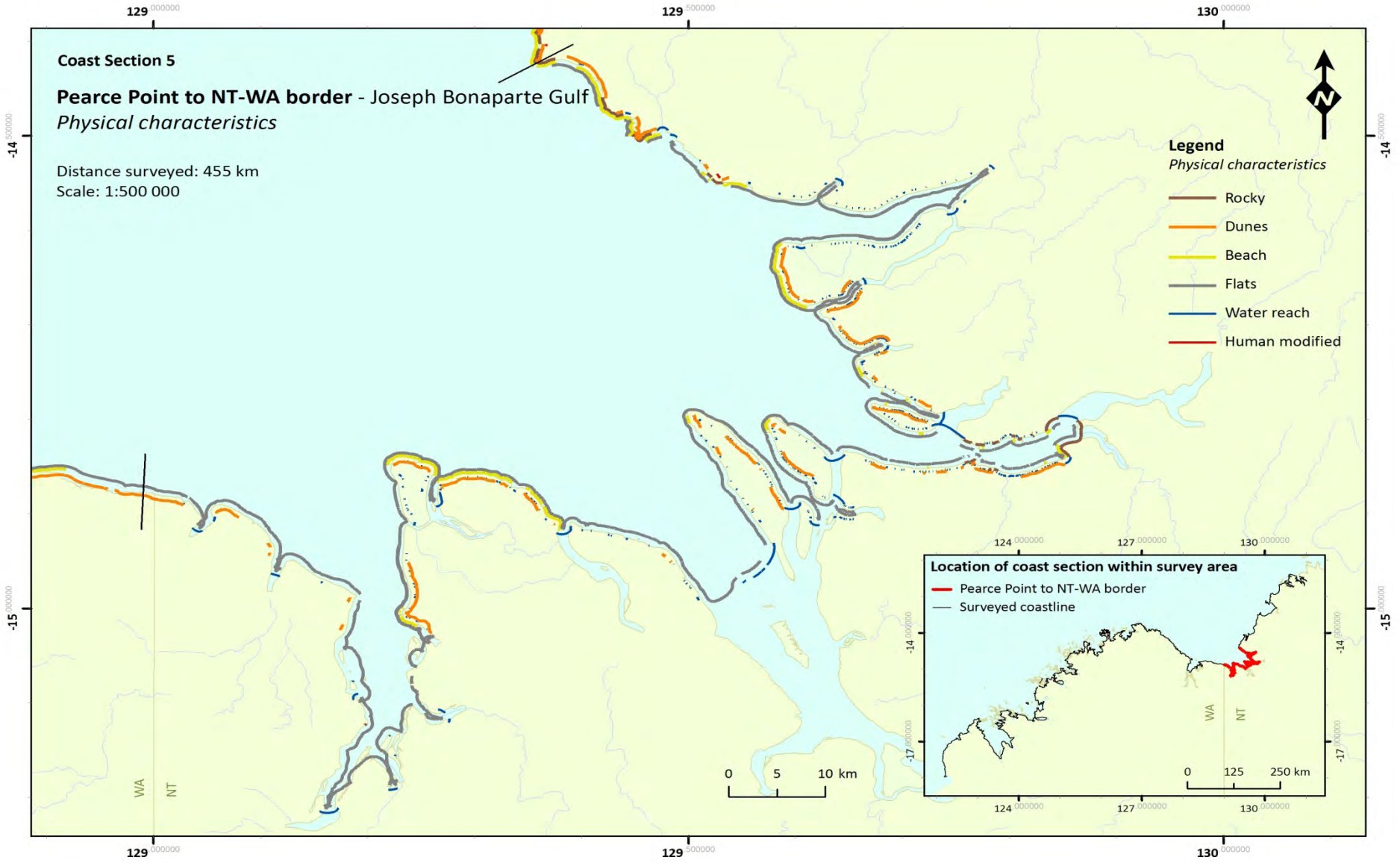


Figure 38: Shoreline stability in the Pearce Pt to the Northern Territory – Western Australian border region

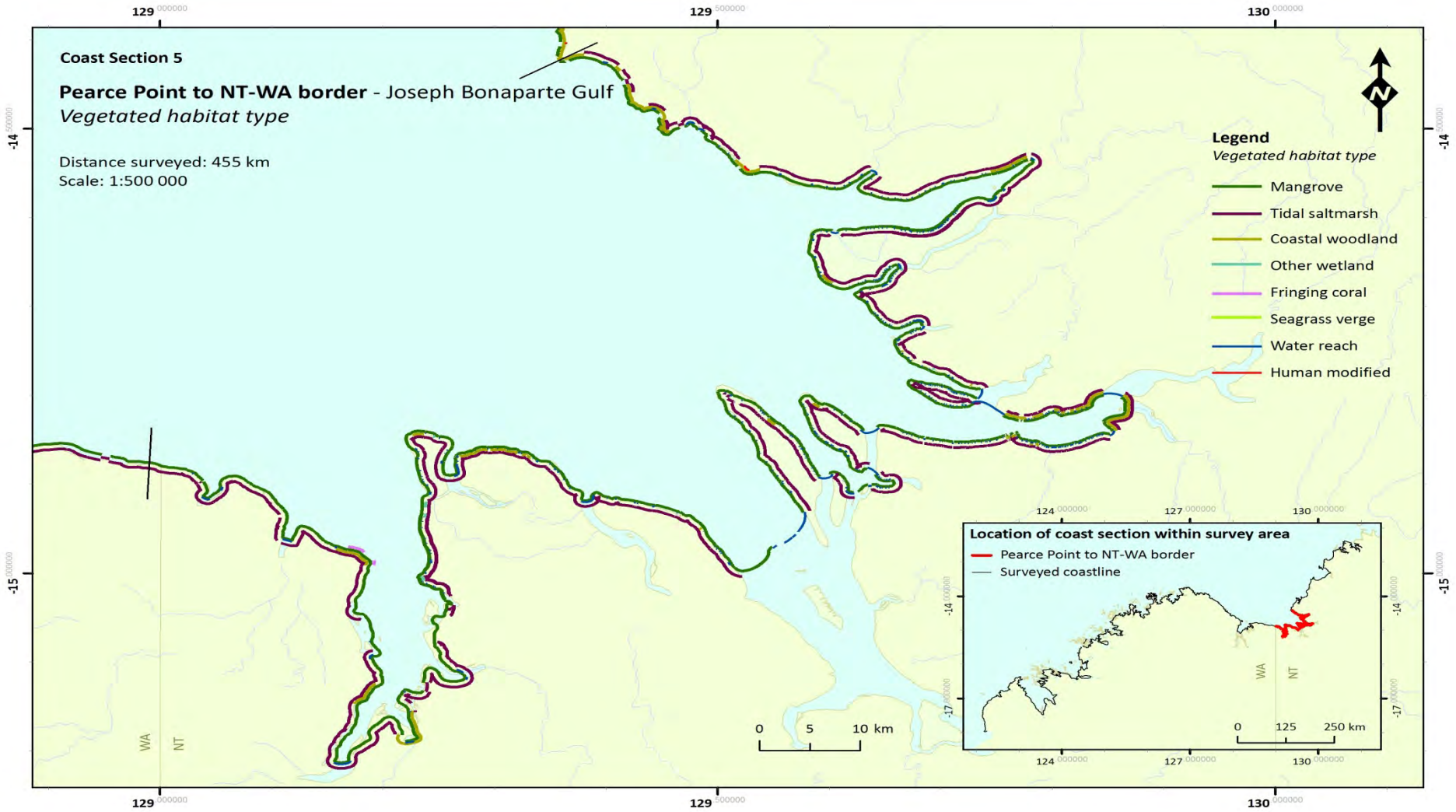


Figure 39: Vegetated Habitat Types in the Pearce Pt to the Northern Territory – Western Australian border region

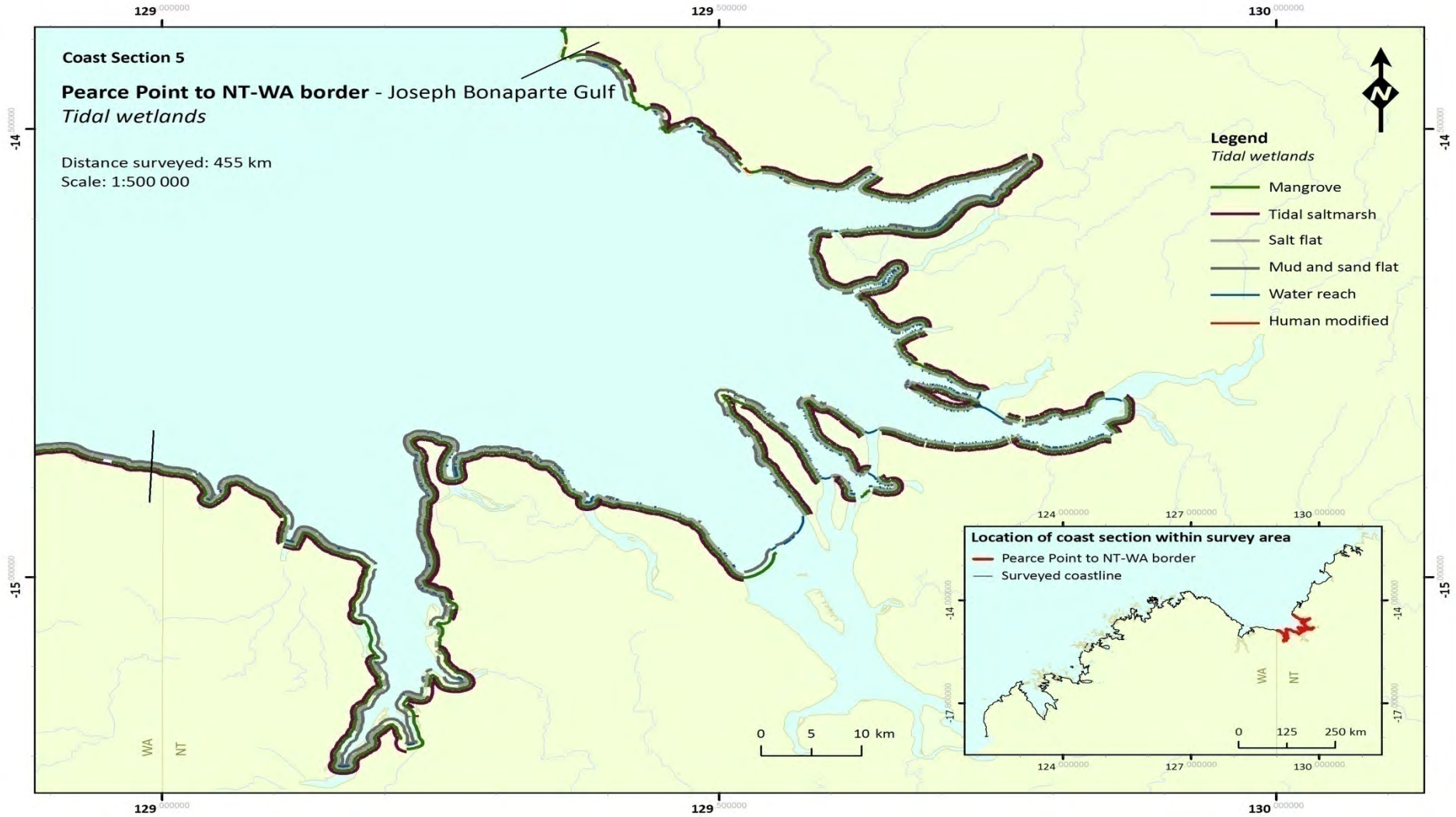


Figure 40: Tidal wetlands in the Pearce Pt to the Northern Territory – Western Australian border region

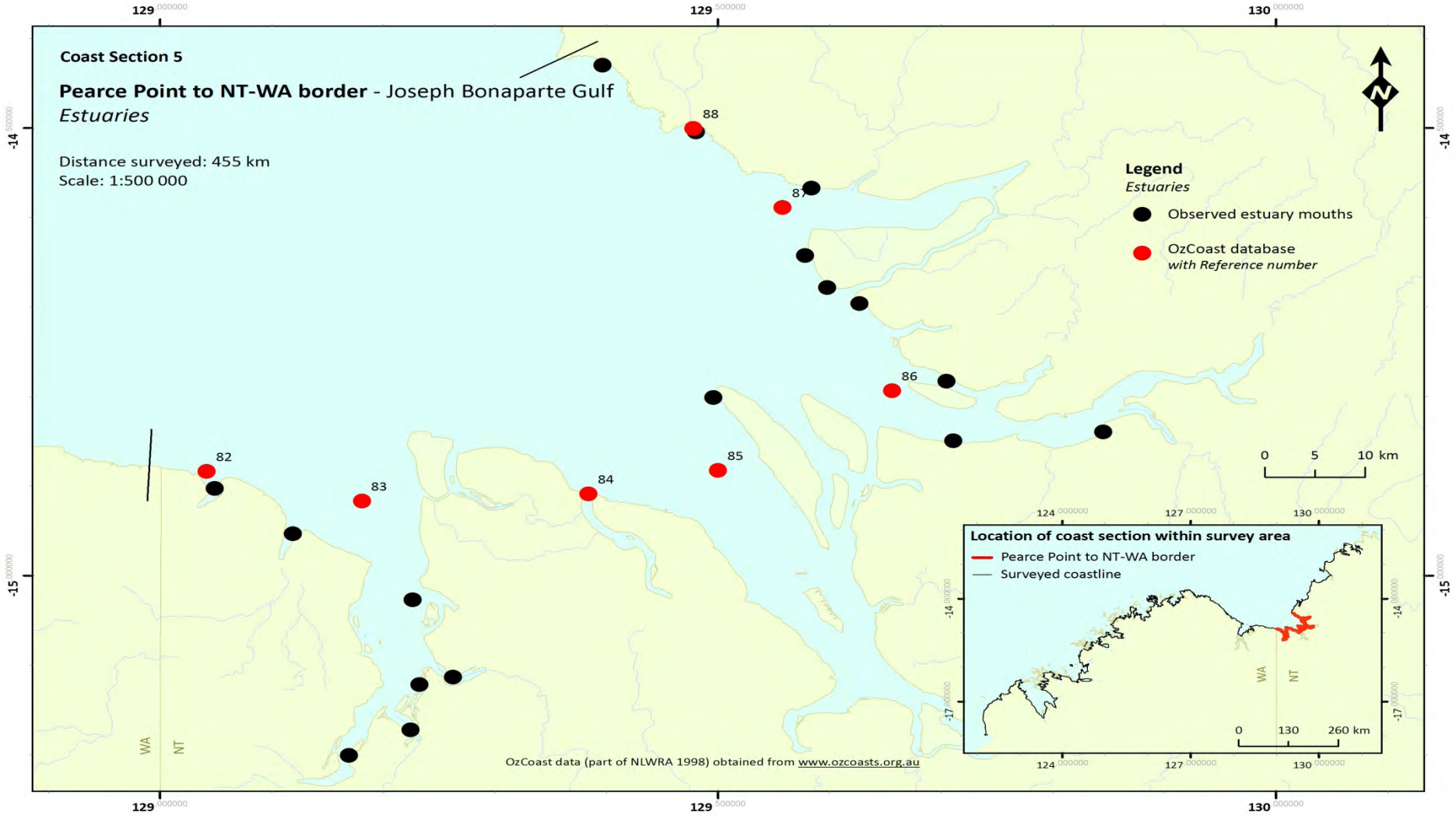


Figure 41: Estuaries in the Pearce Pt to the Northern Territory – Western Australian border region

3.6 NT-WA border to Cape Dussejour

Coast region start: Lat: -14.87234
Long: 128.99128
Coast region end: Lat: -13.99172
Long: 127.46695

Region includes Joseph Bonaparte Gulf and Cambridge Gulf

- 232 km coast surveyed, making 5% of the total 5102 km.
- Region dominated by mangroves and sand/mud/salt flats. Mangroves grow along 189.9 km of coast, 81.9 % of the region. Flats are found over 179 km, 77.3% of the regions coastline. Total area of tidal wetland in the region is 2524.84 km^2 (OzCoasts 2009), calculated as 10.88 km^2 tidal wetland per kilometer of coastline surveyed in the region.
- This 232 km of coastline was totally free from human modification.
- Estuaries include the mouths of the Helby River, Lyne River, Thompson River, Ord River as well as three Ningbing Range Creeks and the false mouth of the Ord.
- Marine megafauna in the region included several dolphins and sea turtles.

Table 30: Summary of coastal characteristics from NT-WA border to Cape Dussejour.

		km	*% of region*
Physical characteristics	**Rocky**	54.3	*23.4*
	Beach	48.2	*20.8*
	Flat	179.0	*77.3*
	Dune	60.6	*26.2*
	Other wetland	0.0	*0.0*
Vegetated habitat type	**Mangrove**	189.9	*81.9*
	Saltmarsh	79.9	*34.5*
	Fringing coral	0.0	*0.0*
	Seagrass verge	0.0	*0.0*
	Coastal Woodland	71.3	*30.8*
State of erosion and deposition	**Deposition**	17.8	*7.7*
	Erosion	120.5	*52.0*
	Stable	85.7	*37.0*
Tidal wetlands	**Mangrove**	189.9	*81.9*
	Saltmarsh	79.9	*34.5*
	Sand and mud flats	64.0	*27.6*
	Salt flat	175.0	*75.5*
Other	**Human modified**	0.0	*0.0*
	Water reach	31.1	*13.4*

NT-WA border to Cape Dussejour

Figure 42: Representative coastline imagery from the Cape Ford to Pearce Point region. Image numbers are unique within the electronic database.

Table 31: Summary of marine megafauna observed during aerial surveys of NT-WA border to Cape Dussejour (WA).

Common name	Genus/Species	Total observed
Australian snubfin dolphin	*Orcaella heinsohni*	5
Indo-Pacific bottlenose	*Tursiops aduncas*	0
Unidentified dolphin species	Family Delphinidae	2
Sea turtle	*Chelonia* or *Caretta* spp	4
Sea turtle track	*Chelonia* or *Caretta* spp	0
Dugong	*Dugong dugong*	2
Whale	*Order Cetacea*	0
Manta ray	*Manta birostris*	0
Ray species	Superorder Batoidea	0
Saltwater crocodile	*Crocodylus porosus*	0
Unidentified shark species	Superorder: Selachimorph	0

Table 32: Coastline data for the NT-WA border to Cape Dussejour region (WA). Source OzCoasts 2009.

NT-WA Survey – 6. NT-WA border to Cape Dussejour, WA		
Features	**#6**	**Relevance to survey region**
Annual Rainfall –range & mean (mm)	916-1151 (994)	Below average
Number of estuaries listed	8	Average
Total Catchment Area (km2)	88730	Above average size
Total Estuary Length (km)	231.3	Above average size
Tidal Range (in m)	5.35	
Condition Status	Near Pristine to Largely Unmodified	Very low disturbance by humans
Area of Mangrove (km2)	575.69	
Area of Salt Marsh (km2)	1949.15	
WCI% from Region Total	22.8	
Total Tidal Wetland (km2)	2524.84	
BOM 1998 Climatic Area	Dry hot steppe - Winter drought to Tropical Savannah - Wet Autumn	
Mangrove species number	13	18 in vicinity
Mangrove species limit west	1	

Table 33: Estuary data for notable estuaries within the NT-WA border to Cape Dussejour region (WA). Source NLWRA; 1998.

NT-WA Survey **6. NT-WA border to Cape Dussejour, WA**				
Feature / Location	**Ord River, Cambridge Gulf**	**False Mouth of Ord**	**Ningbing Range Creeks**	**Ningbing Range Creeks, East**
NLWRA Estuary Reference#	**776**	**777**	**779**	**780**
Latitude S	14.764	14.851	14.795	14.833
Longitude E	128.307	128.370	128.609	128.745
Annual Rainfall – mean (mm)	1151	933	1000	1100
Catchment Area (km2)	85213	2298	176	355
Estuary Length (km)	119.37	38.89	8.09	11.2
Tidal Range (in m)	6	5.2	5.3	5.3
Condition Status	LU	P	P	P
Area of Mangrove (km2)	418.79	102.52	3.34	0.29
Area of Salt Marsh (km2)	1385.89	362.32	42.52	61.99
Wetland Cover Index (WCI %)	23.2	22.1	7.3	0.5
Total Tidal Wetland (km2)	1804.69	464.84	45.86	62.28
BOM 1998 Climatic Area	Dry hot steppe - Winter drought	Dry hot steppe - Winter drought	Tropical Savannah - Wet Autumn	Tropical Savannah - Wet Autumn
Mangrove species number	13 (18)			1 (18)
Source of mangrove data:	GW 86, SKW			NCD

Table 34: Mangrove species present in the Northern Territory and Western Australia. Green highlights species with ranges within the NT-WA border to Cape Dussejour region (WA) (source: Duke 2006). Crosses identify recorded species occurrence in the listed estuary. Yellow denotes western limit of species range.

6. NT-WA border to Cape Dussejour			
Species/ Locations	**King River, Cambridge Gulf ~#776**	**Ord River, Cambridge Gulf #776**	**E Ningbing Range Creeks #780**
Acanthus ebracteatus subsp. *ebarbatus*	X->	X	
Acanthus ilicifolius			
Acrostichum speciosum			
Aegialitis annulata	X	X	
Aegiceras corniculatum	X	X	
Avicennia integra			
Avicennia marina	X	X	
Bruguiera exaristata	X	X	
Bruguiera gymnorhiza			
Bruguiera parviflora			
Bruguiera sexangula			
Camptostemon schultzii	X	X	
Ceriops australis	X	X	
Ceriops decandra			
Ceriops tagal			
Cynometra iripa			
Diospyros littorea			
Excoecaria agallocha	X	X	
Lumnitzera littorea			
Lumnitzera racemosa	X	X	
Nypa fruticans			
Osbornia octodonta	X	X	
Pemphis acidula			
Rhizophora apiculata			
Rhizophora X *lamarckii*			
Rhizophora stylosa	X	X	X
Scyphiphora hydrophylacea			
Sonneratia alba	X	X	
Sonneratia lanceolata			
Sonneratia X *urama*			
Xylocarpus granatum			
Xylocarpus moluccensis	X	X	
TOTAL recorded	**13**	**13**	**1**
TOTAL in vicinity	**18**	**18**	**18**
Sources:	SKW	GW 86	NCD

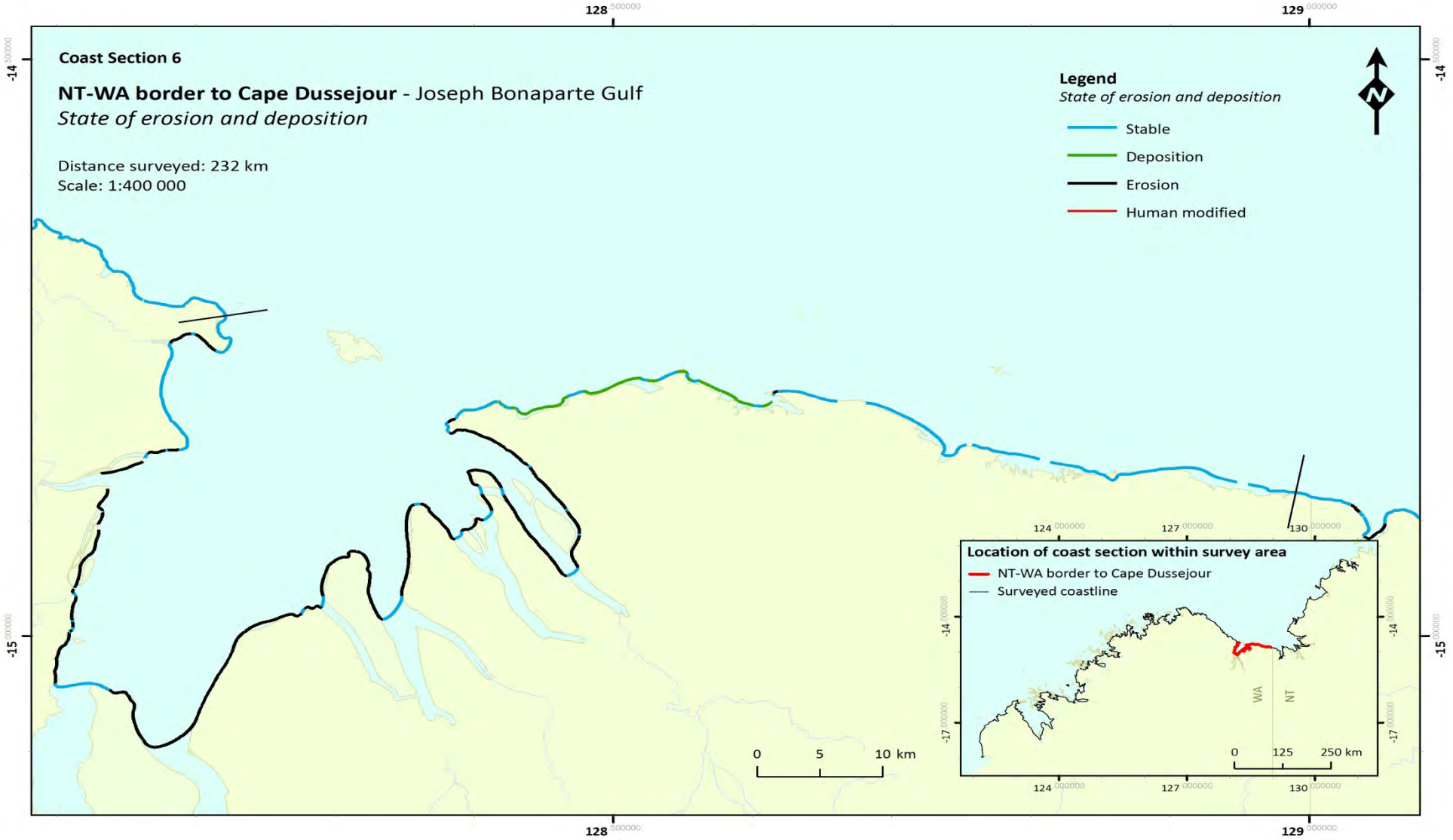


Figure 43: Shoreline stability in the Northern Territory – Western Australian border to Cape Dussejour region

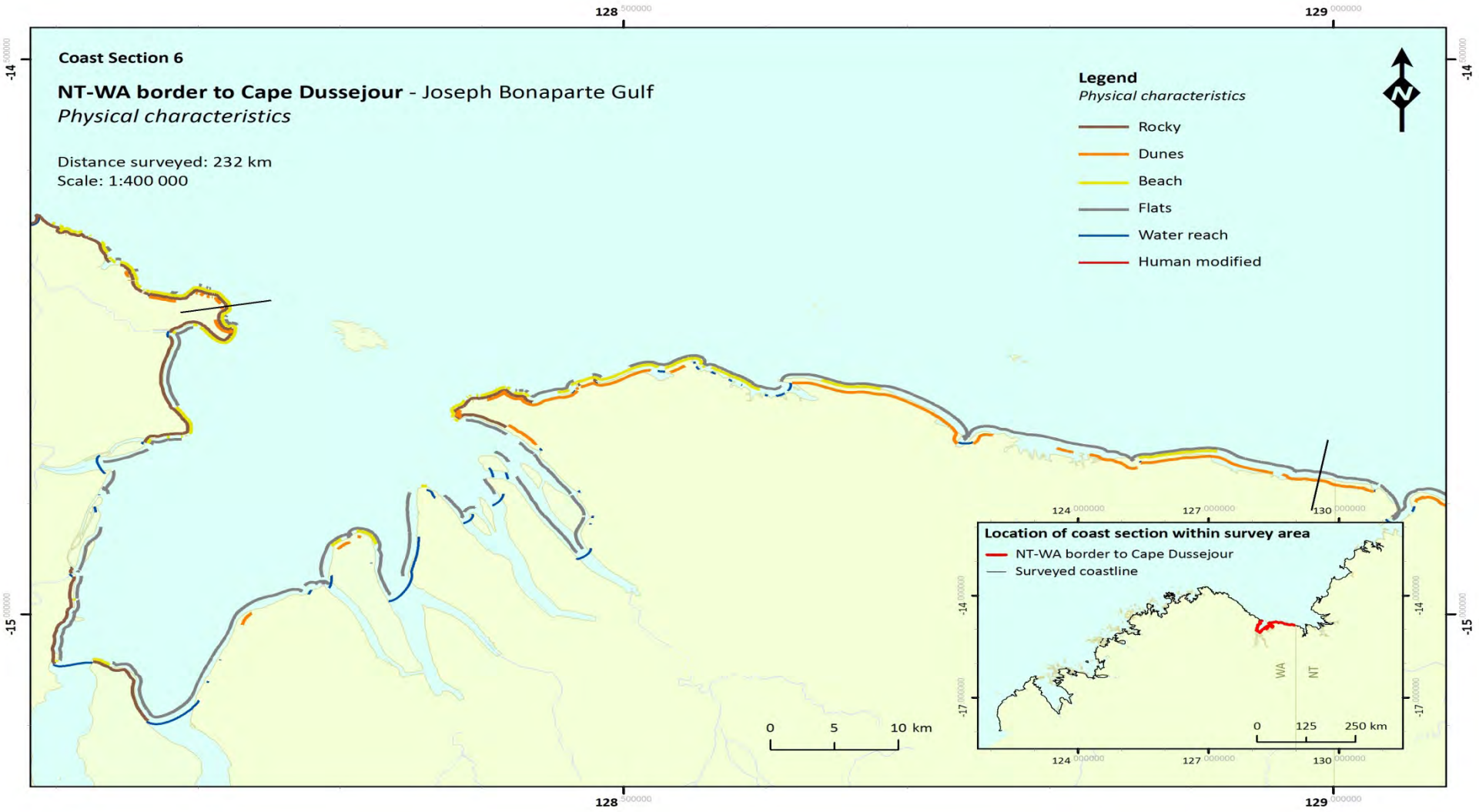


Figure 44: Shoreline physical characteristics in the Northern Territory – Western Australian border to Cape Dussejour region

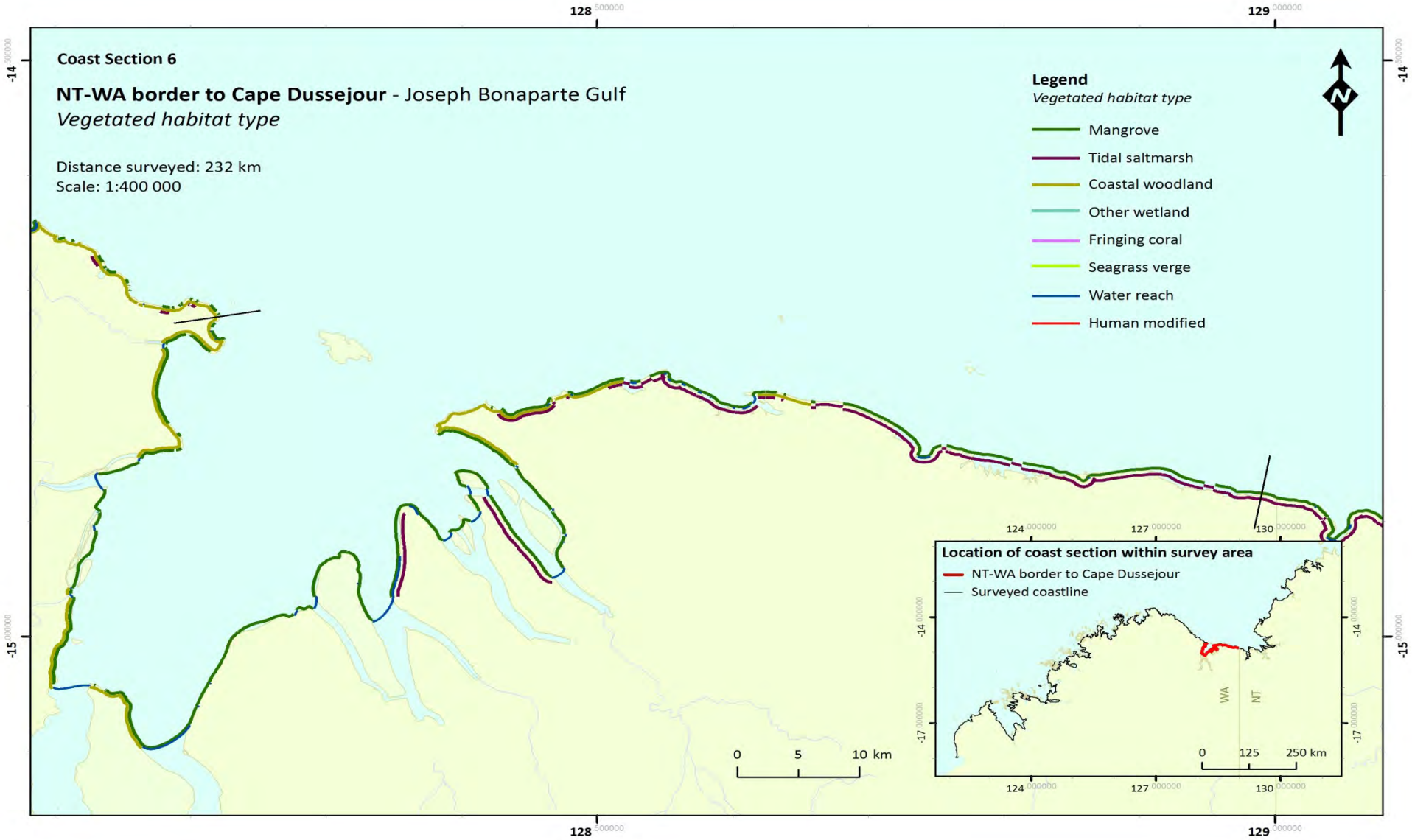


Figure 45: Vegetated habitat types in the Northern Territory – Western Australian border to Cape Dussejour region

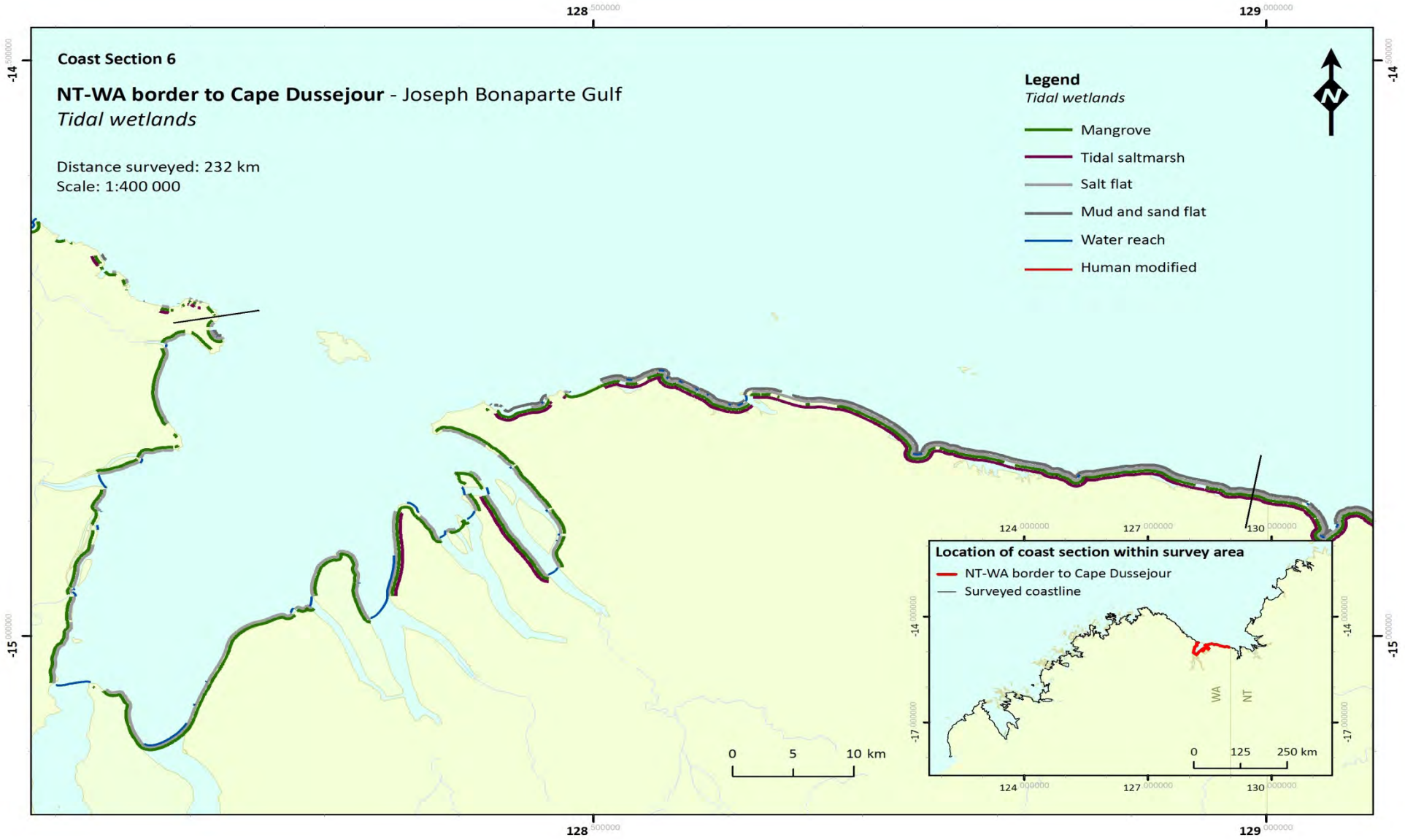


Figure 46: Tidal wetlands in the Northern Territory – Western Australian border to Cape Dussejour region

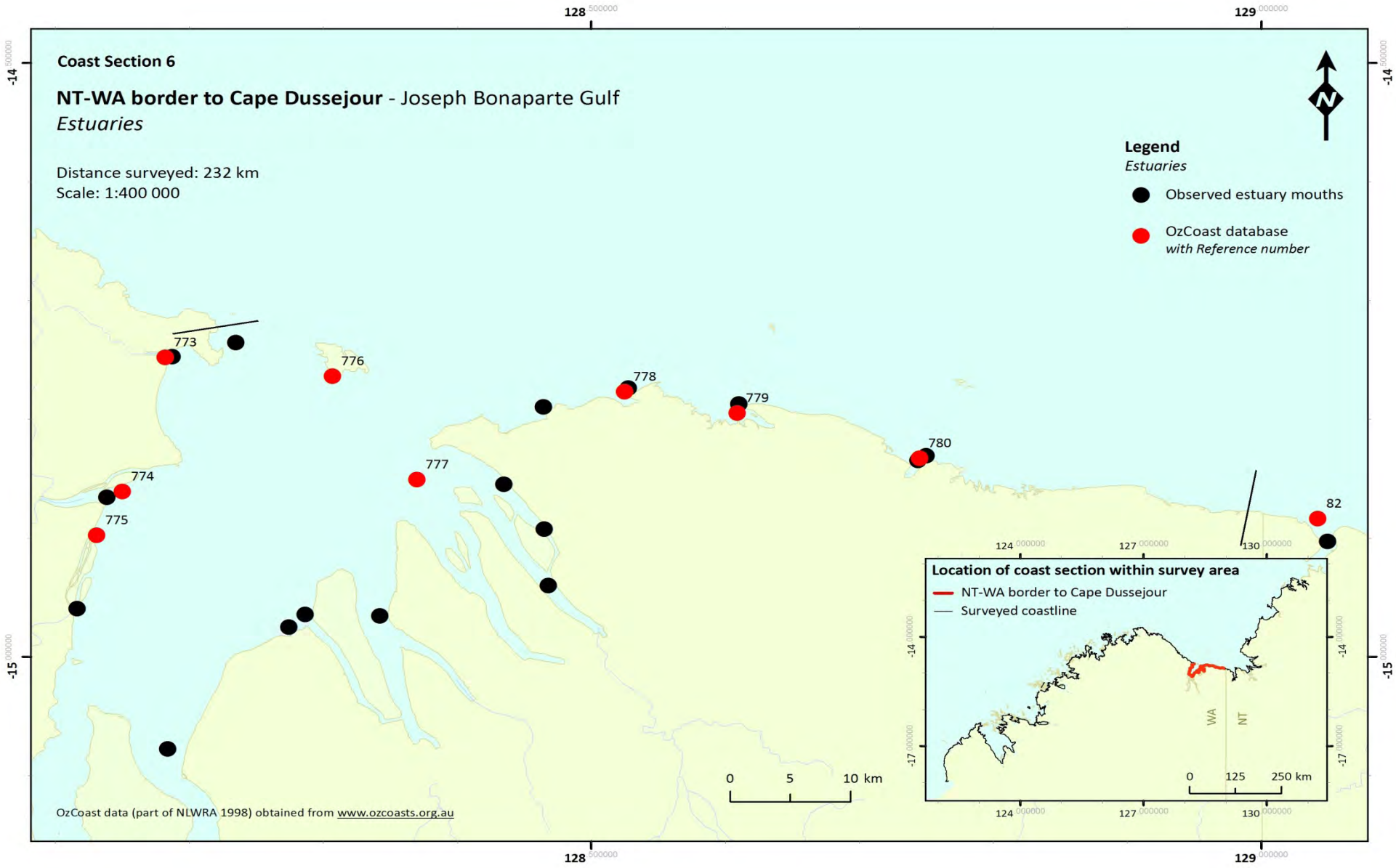


Figure 47: Estuaries in the Northern Territory – Western Australian border to Cape Dussejour region

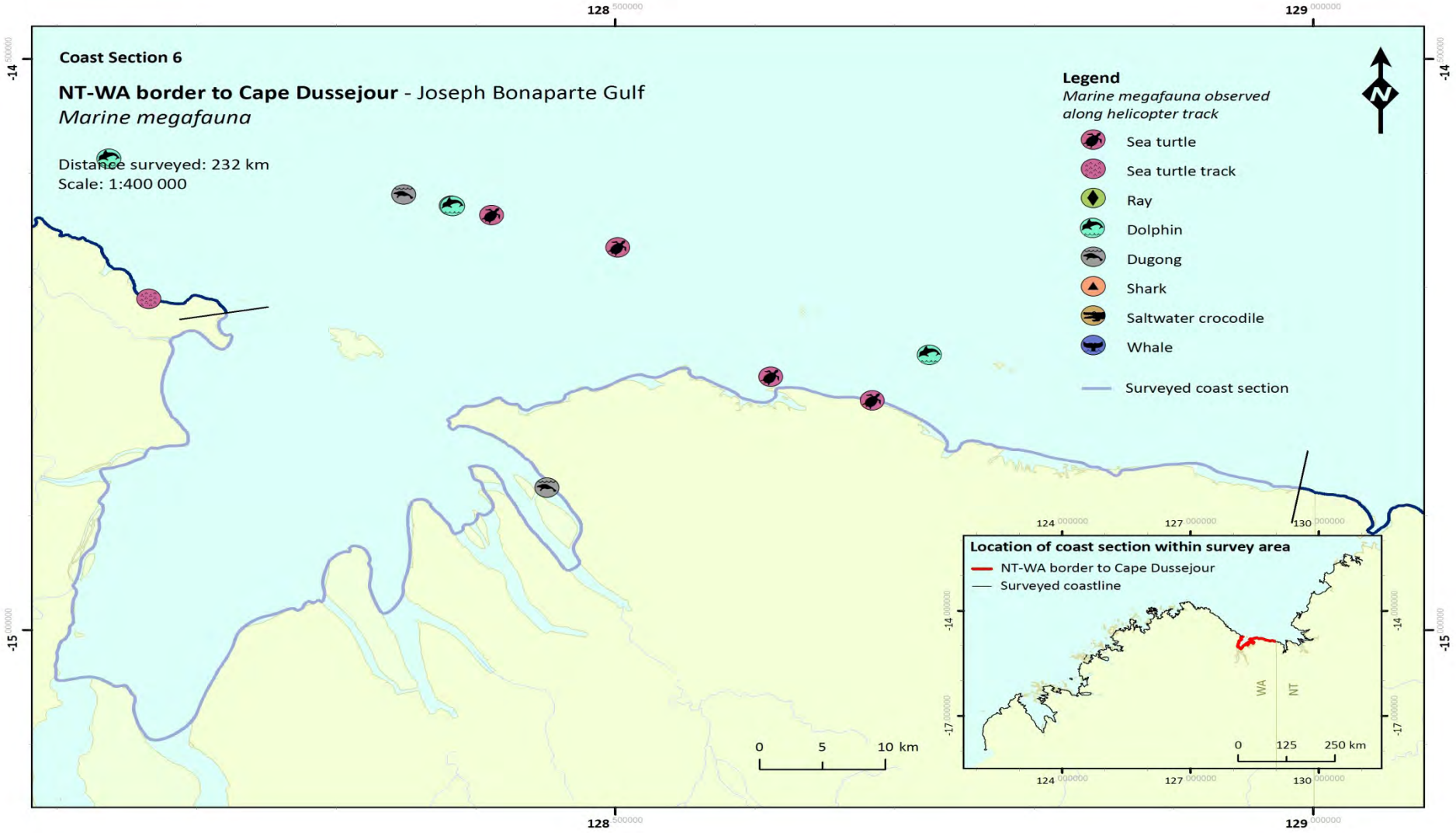


Figure 48: Marine megafauna observed in the Northern Territory – Western Australian border to Cape Dussejour region

3.7 Cape Dussejour to Cape Bernier (WA)

Coast region start: Lat: -14.72250
Long: 128.22309
Coast region end: Lat: -13.99172
Long: 127.46695

Region includes Thurburn Creek, Bucklehead Creek, Berkeley River, Cape Whiskey Creek to Cape Bernier.

- 169 km coast surveyed, making 3% of the total 5102 km.
- Mangroves were present along 64.6 km of coast, 38.4% of the region. Total area of tidal wetland in the region is 23.97 km^2 (OzCoasts 2009), calculated as 0.14 km^2 tidal wetland per kilometer of coastline surveyed in the region.
- Fringing coral was found along 79 km of coast, 46.9% of the region.
- No human modification was present.
- Estuaries in this region include the mouths of Cape Whiskey Creek, Berkely River, Buckle Head Creek and Thurburn Creek.
- Dolphins, dugongs, rays and sea turtles were all commonly observed during marine megafauna surveys in the region.

Table 35: Summary of coastal characteristics from Cape Dussejour to Cape Bernier.

		km	*% of region*
Physical characteristics	**Rocky**	143.9	*85.4*
	Beach	70.9	*42.1*
	Flat	41.1	*24.4*
	Dune	29.8	*17.7*
	Other wetland	0.0	*0.0*
Vegetated habitat type	**Mangrove**	64.6	*38.4*
	Saltmarsh	14.7	*8.7*
	Fringing coral	79.0	*46.9*
	Seagrass verge	0.0	*0.0*
	Coastal Woodland	143.4	*85.1*
State of erosion and deposition	**Deposition**	0.0	*0.0*
	Erosion	0.6	*0.4*
	Stable	151.0	*89.6*
Tidal wetlands	**Mangrove**	64.6	*38.4*
	Saltmarsh	14.7	*8.7*
	Sand and mud flats	31.4	*18.6*
	Salt flat	20.4	*12.1*
Other	**Human modified**	0.0	*0.0*
	Water reach	13.5	*8.0*

Cape Dussejour to Cape Bernier (WA)

Figure 49: Representative coastline imagery from the Cape Dussejour to Cape Bernier region. Image numbers are unique within the electronic database

Table 36: Summary of marine megafauna observed during aerial surveys of Cape Dussejour to Cape Bernier (WA).

Common name	Genus/Species	Total observed
Australian snubfin dolphin	*Orcaella heinsohni*	0
Indo-Pacific bottlenose	*Tursiops aduncas*	4
Unidentified dolphin species	Family Delphinidae	16
Sea turtle	*Chelonia* or *Caretta* spp	29
Sea turtle track	*Chelonia* or *Caretta* spp	1
Dugong	*Dugong dugong*	10
Whale	*Order Cetacea*	0
Manta ray	*Manta birostris*	0
Ray species	Superorder Batoidea	11
Saltwater crocodile	*Crocodylus porosus*	1
Unidentified shark species	Superorder: Selachimorph	2

Table 37: Coastline data for the Cape Dussejour to Cape Bernier region (WA). Source OzCoasts 2009.

NT-WA Survey – 7. Cape Dussejour to Cape Bernier, WA		
Features	**#7**	**Relevance to survey region**
Annual Rainfall –range & mean (mm)	967-1000 (987)	Below average
Number of estuaries listed	4	Below average
Total Catchment Area (km2)	5968	Below average size
Total Estuary Length (km)	40.1	Below average size
Tidal Range (in m)	4.18	
Condition Status	Near Pristine to Largely Unmodified	Very low disturbance by humans
Area of Mangrove (km2)	8.95	
Area of Salt Marsh (km2)	15.03	
WCI% from Region Total	37.3	
Total Tidal Wetland (km2)	23.97	
BOM 1998 Climatic Area	Dry hot steppe - Winter drought to Tropical Savannah - Wet Autumn	
Mangrove species number		17 in vicinity
Mangrove species limit west	0	

Table 38: Estuary data for notable estuaries within the Cape Dussejour to Cape Bernier region (WA). Source NLWRA; 1998.

NT-WA Survey **7. Cape Dussejour to Cape Bernier, WA**				
Feature / Location	**Cape Whiskey Creek**	**Berkeley River**	**Buckle Head Creek**	**Thurburn Creek**
NLWRA Estuary Reference#	**769**	**770**	**771**	**772**
Latitude S	14.064	14.349	14.451	14.581
Longitude E	127.457	127.781	127.832	127.956
Annual Rainfall – mean (mm)	1000	1000	981	967
Catchment Area (km2)	157	5149	115	547
Estuary Length (km)	2.3	24.82	6.23	6.76
Tidal Range (in m)	3.4	4	4.4	4.9
Condition Status	P	P	LU	LU
Area of Mangrove (km2)	0.80	1.52	2.86	3.77
Area of Salt Marsh (km2)	0.37	3.05	5.15	6.45
Wetland Cover Index (WCI %)	68.4	33.3	35.7	36.9
Total Tidal Wetland (km2)	1.17	4.57	8.01	10.22
BOM 1998 Climatic Area	Tropical Savannah - Wet Autumn	Dry hot steppe - Winter drought	Dry hot steppe - Winter drought	Dry hot steppe - Winter drought
Mangrove species number				
Source of mangrove data:				

Table 39: Mangrove species present in the Northern Territory and Western Australia. Green highlights species with ranges within the Cape Dussejour to Cape Bernier region (WA). (source: Duke 2006). Crosses identify recorded species occurrence in the listed estuary. Yellow denotes western limit of species range.

7. Cape Dussejour to Cape Bernier	
Species/ Locations	None recorded
Acanthus ebracteatus subsp. *ebarbatus*	
Acanthus ilicifolius	
Acrostichum speciosum	
Aegialitis annulata	
Aegiceras corniculatum	
Avicennia integra	
Avicennia marina	
Bruguiera exaristata	
Bruguiera gymnorhiza	
Bruguiera parviflora	
Bruguiera sexangula	
Camptostemon schultzii	
Ceriops australis	
Ceriops decandra	
Ceriops tagal	
Cynometra iripa	
Diospyros littorea	
Excoecaria agallocha	
Lumnitzera littorea	
Lumnitzera racemosa	
Nypa fruticans	
Osbornia octodonta	
Pemphis acidula	
Rhizophora apiculata	
Rhizophora X *lamarckii*	
Rhizophora stylosa	
Scyphiphora hydrophylacea	
Sonneratia alba	
Sonneratia lanceolata	
Sonneratia X *urama*	
Xylocarpus granatum	
Xylocarpus moluccensis	
TOTAL recorded	**0**
TOTAL in vicinity	**17**
Sources:	

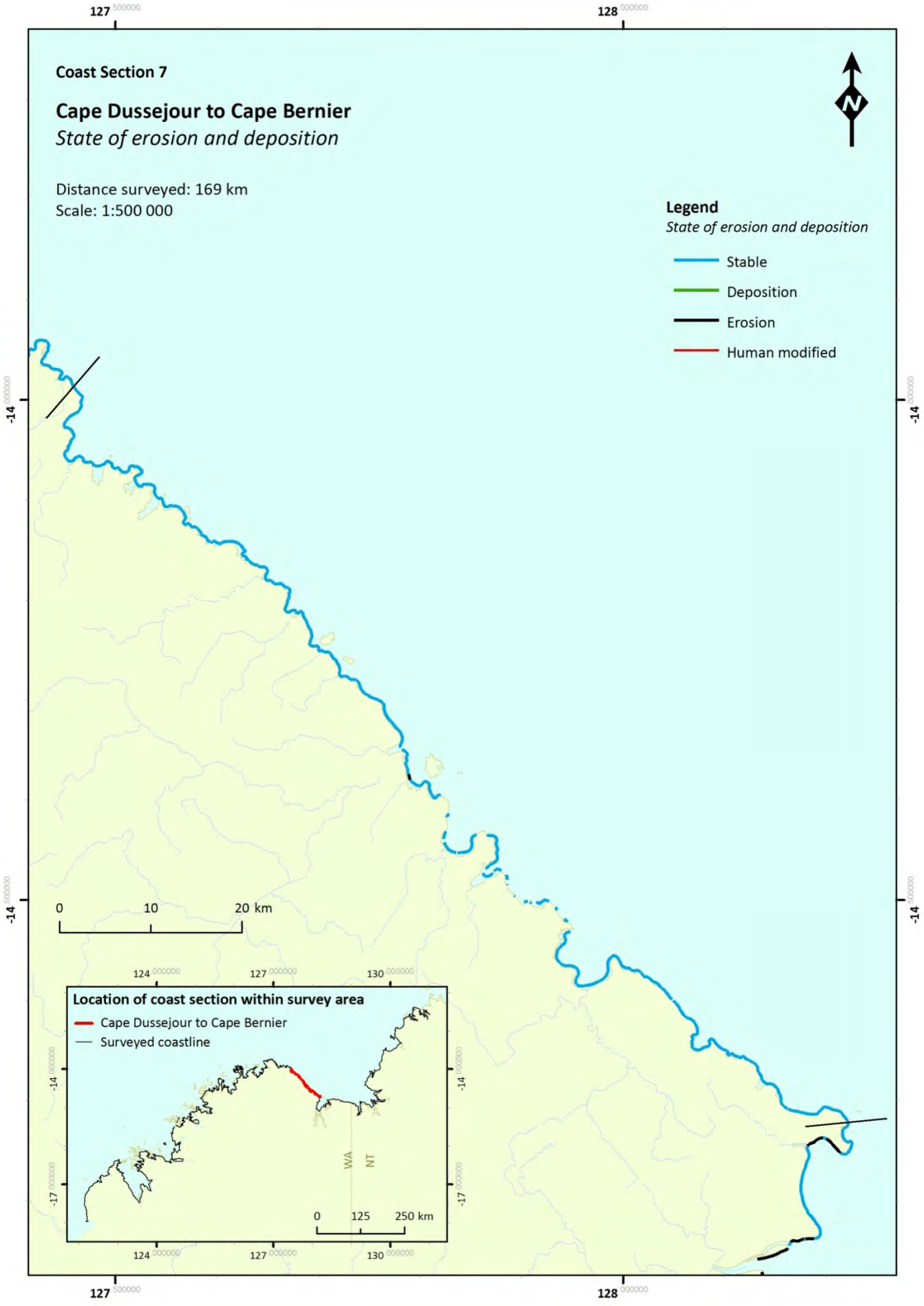


Figure 50: Shoreline stability in the Cape Dussejour to Cape Bernier region

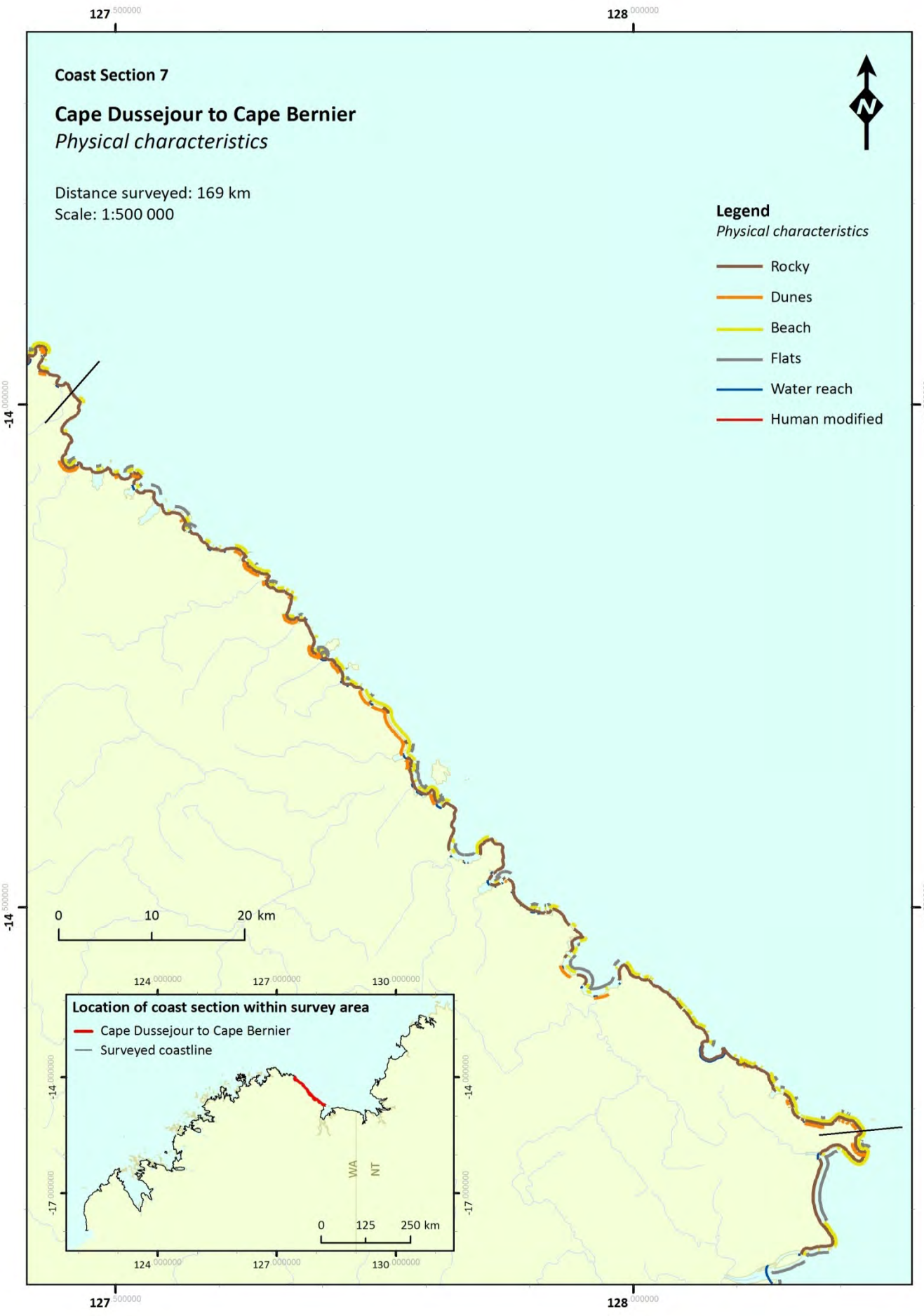


Figure 51: Physical characteristics in the Cape Dussejour to Cape Bernier region

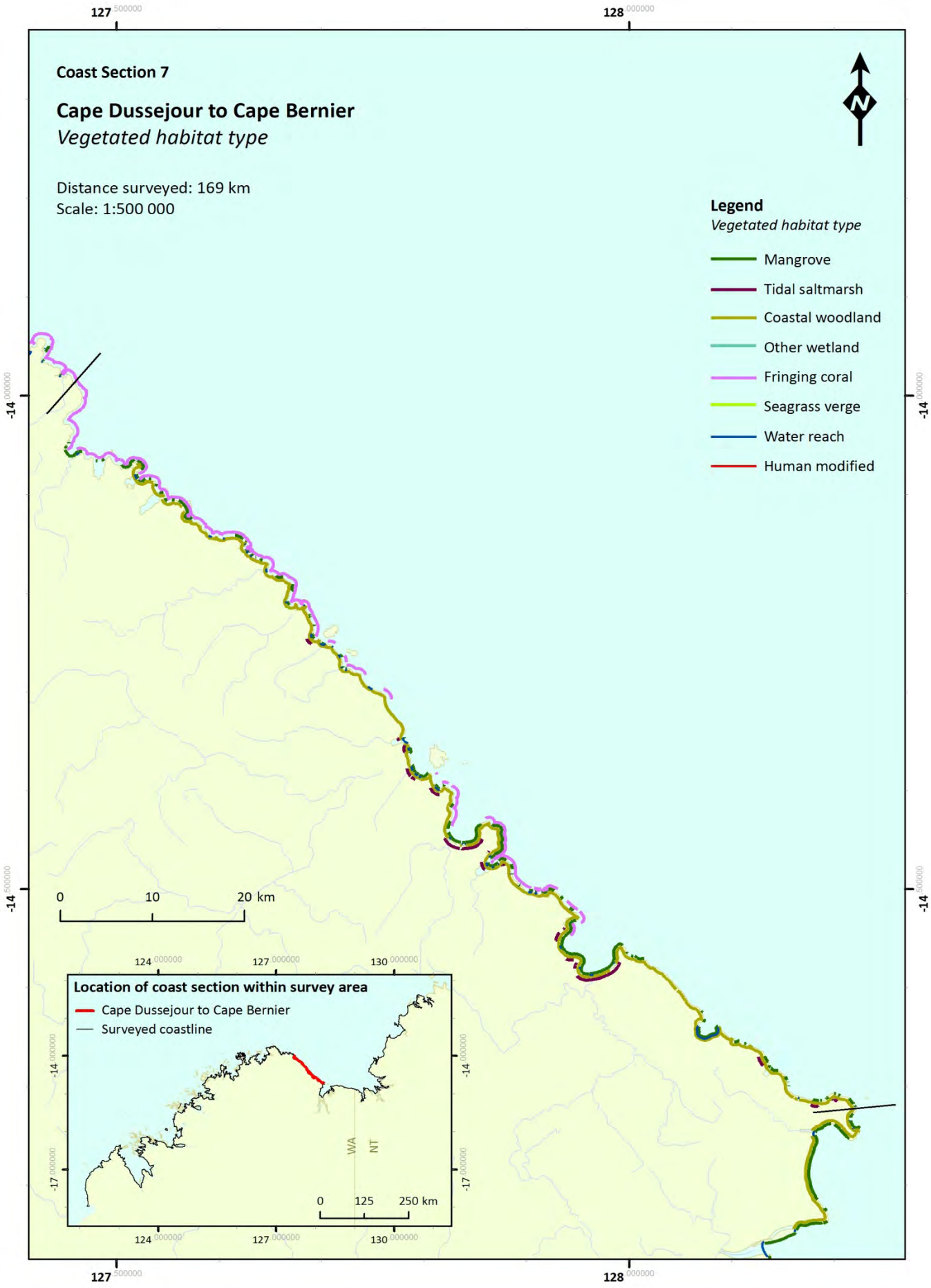


Figure 52: Vegetated habitat types in the Cape Dussejour to Cape Bernier region

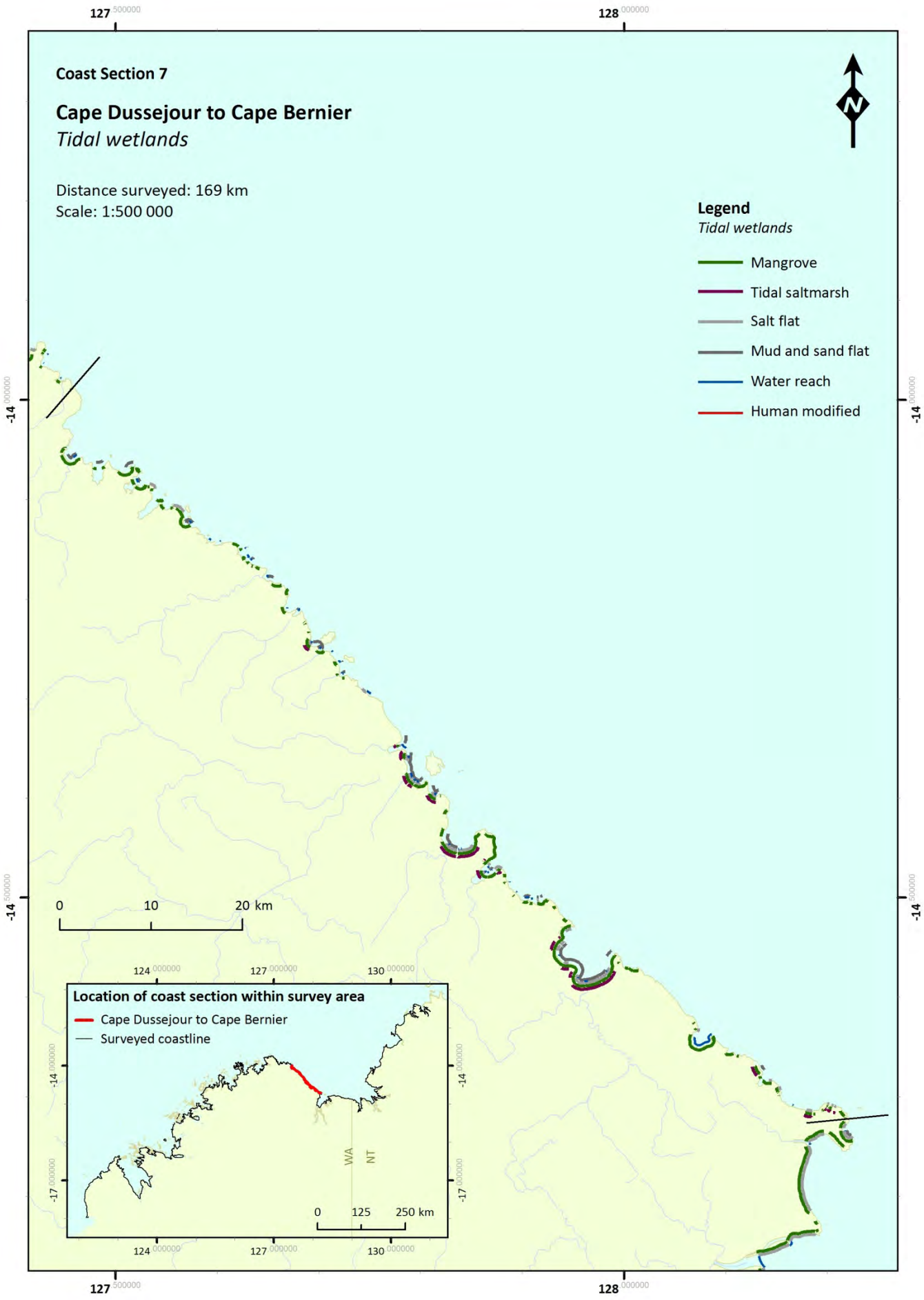


Figure 53: Tidal wetlands types in the Cape Dussejour to Cape Bernier region

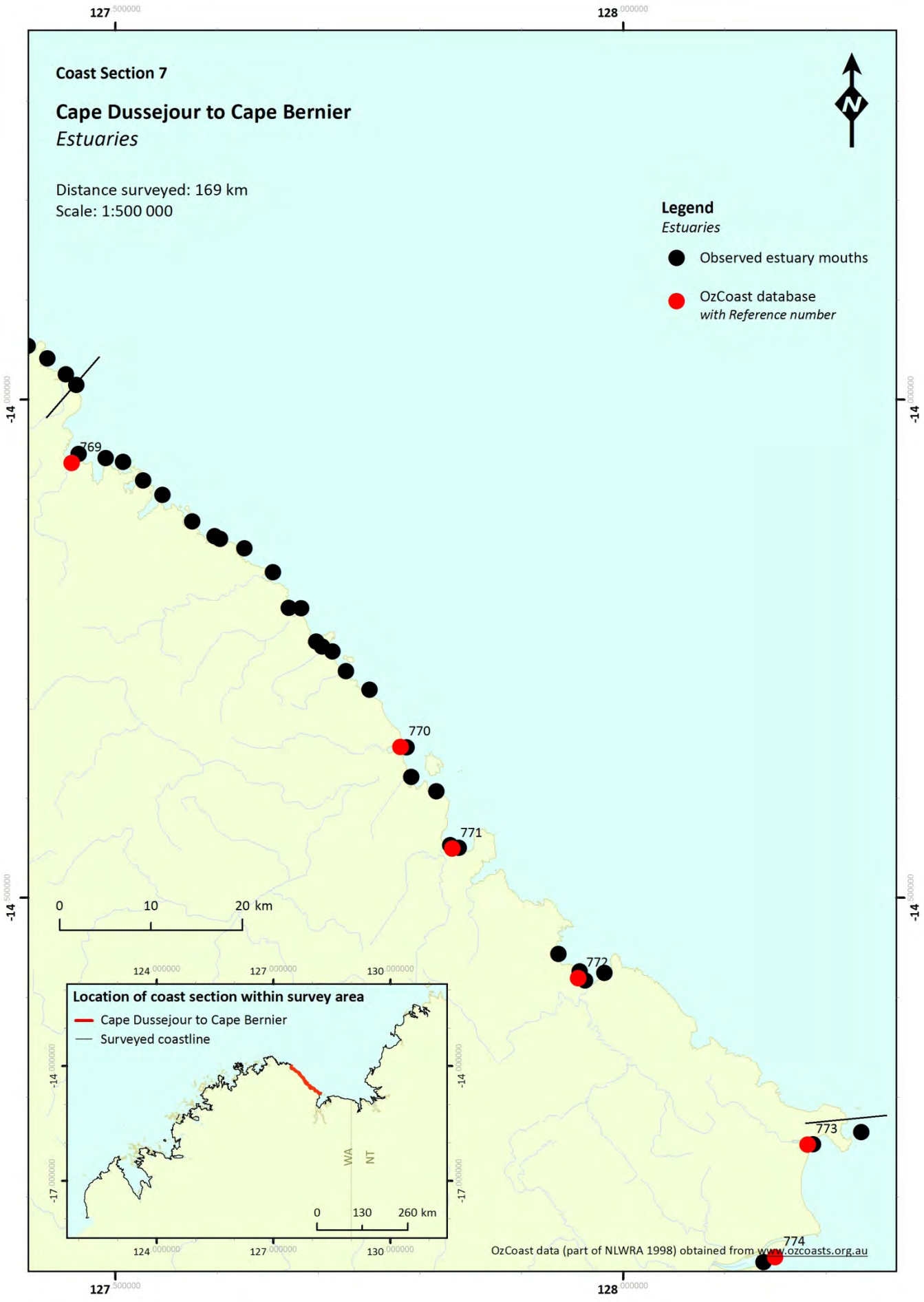


Figure 54: Estuary types in the Cape Dussejour to Cape Bernier region

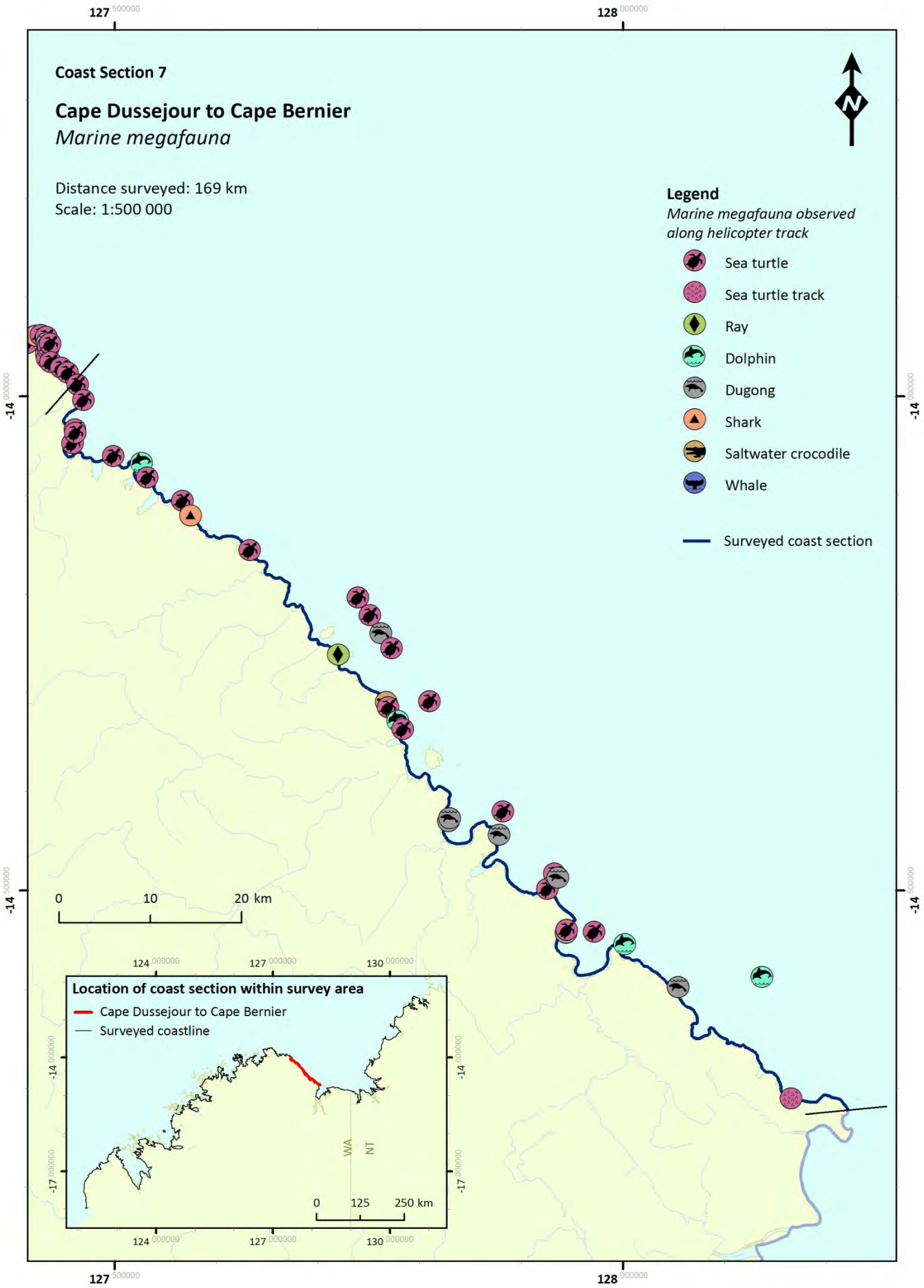


Figure 55: Marine megafauna in the Cape Dussejour to Cape Bernier region

3.8 Cape Bernier to Napier Broome Bay (WA)

Coast region start: Lat: -13.98607
Long: 127.46216
Coast region end: Lat: -13.93868
Long: 126.54137

Region includes King George River, Cape Londonderry, Cape Talbot and Napier Broome Bay.

- 386 km coast surveyed, making 8% of the total 5102 km.
- Mangroves were present along 195.6 km of the coast, 50.7% of the region. Total area of tidal wetland in the region is 59.60 km^2 (OzCoasts 2009), calculated as 0.15 km^2 tidal wetland per kilometer of coastline surveyed in the region.
- Rocky shore again dominates, covering 269.7 km, 69.8% of the region.
- Fringing coral was found along 99.2 km of coast, 25.7% of the region.
- A small area of coastline was modified by human activity: 6.4 km, 1.7%.
- Estuaries in this region include Woppinbie Creek, King Edward River, Mission Cove, Drysdale River, four Cape Londonderry Creeks and the King George River.
- Over 250 sea turtles were identified in the region. Dugong and sharks were also common.

Table 40: Summary of coastal characteristics from Cape Bernier to Napier Broome Bay.

		km	*% of region*
Physical characteristics	**Rocky**	269.7	*69.8*
	Beach	170.0	*44.0*
	Flat	146.1	*37.9*
	Dune	180.8	*46.8*
	Other wetland	0.4	*0.1*
Vegetated habitat type	**Mangrove**	195.6	*50.7*
	Saltmarsh	53.2	*13.8*
	Fringing coral	99.2	*25.7*
	Seagrass verge	0.4	*0.1*
	Coastal Woodland	329.5	*85.3*
State of erosion and deposition	**Deposition**	2.6	*0.7*
	Erosion	12.1	*3.1*
	Stable	357.9	*92.7*
Tidal wetlands	**Mangrove**	195.6	*50.7*
	Saltmarsh	53.2	*13.8*
	Sand and mud flats	120.2	*31.1*
	Salt flat	57.8	*15.0*
Other	**Human modified**	6.4	*1.7*
	Water reach	25.6	*6.6*

Cape Bernier to Napier Broome Bay (WA)

Figure 56: Representative coastline imagery from the Cape Bernier to Napier Broome Bay region. Image numbers are unique within the electronic database

Table 41: Summary of marine megafauna observed during aerial surveys of Cape Bernier to Napier Broome Bay (WA).

Common name	Genus/Species	Total observed
Australian snubfin dolphin	*Orcaella heinsohni*	0
Indo-Pacific bottlenose	*Tursiops aduncas*	3
Unidentified dolphin species	Family Delphinidae	14
Sea turtle	*Chelonia* or *Caretta* spp	283
Sea turtle track	*Chelonia* or *Caretta* spp	4
Dugong	*Dugong dugong*	18
Whale	*Order Cetacea*	0
Manta ray	*Manta birostris*	2
Ray species	Superorder Batoidea	3
Saltwater crocodile	*Crocodylus porosus*	1
Unidentified shark species	Superorder: Selachimorph	6

Table 42: Coastline data for the Cape Bernier to Napier Broome Bay, WA region. Source OzCoasts 2009.

NT-WA Survey – 8. Cape Bernier to Napier Broome Bay, WA		
Features	**#8**	**Relevance to survey region**
Annual Rainfall –range & mean (mm)	1016-1200 (1100)	Average
Number of estuaries listed	9	Average
Total Catchment Area (km2)	28435	Average size
Total Estuary Length (km)	103.9	Average size
Tidal Range (in m)	2.87	
Condition Status	Near Pristine to Modified	Low disturbance by humans
Area of Mangrove (km2)	44.44	
Area of Salt Marsh (km2)	15.16	
WCI% from Region Total	74.6	
Total Tidal Wetland (km2)	59.60	
BOM 1998 Climatic Area	Tropical Savannah - Wet Autumn	
Mangrove species number	11	17 in vicinity
Mangrove species limit west	1	

Table 43: Estuary data for notable estuaries within the Cape Bernier to Napier Broome Bay, WA region. Source NLWRA; 1998.

NT-WA Survey **8. Cape Bernier to Napier Broome Bay, WA**				
Feature / Location	**King Edward River, Napier Broome Bay**	**Drysdale River**	**Cape Londonderry Creeks**	**King George River**
NLWRA Estuary Reference#	**761**	**763**	**767**	**768**
Latitude S	14.179	13.947	13.945	13.958
Longitude E	126.587	126.800	127.205	127.330
Annual Rainfall – mean (mm)	1175	1125	1034	1016
Catchment Area (km2)	9002	15106	134	2776
Estuary Length (km)	28.96	25.77	9.21	18.24
Tidal Range (in m)	2.8	2.8	3	2.9
Condition Status	LU	MOD	P	P
Area of Mangrove (km2)	9.21	27.30	1.16	2.76
Area of Salt Marsh (km2)	2.69	6.95	1.28	0.72
Wetland Cover Index (WCI %)	77.4	79.7	47.5	79.3
Total Tidal Wetland (km2)	11.89	34.25	2.44	3.48
BOM 1998 Climatic Area	Tropical Savannah - Wet Autumn	Tropical Savannah - Wet Autumn	Tropical Savannah - Wet Autumn	Tropical Savannah - Wet Autumn
Mangrove species number	7 (16)		9 (17)	
Source of mangrove data:	SKW, NCD		NCD, SKW	

Table 44: Mangrove species present in the Northern Territory and Western Australia. Green highlights species with ranges within the Cape Bernier to Napier Broome Bay, WA region (source: Duke 2006). Crosses identify recorded species occurrence in the listed estuary. Yellow denotes western limit of species range.

8. Cape Bernier to Napier Broome Bay			
Species/ Locations	**Anjo Point**	**Napier Broome Bay ~#761**	**Cape Londonderry #764-767**
Acanthus ebracteatus subsp. *ebarbatus*			
Acanthus ilicifolius			
Acrostichum speciosum			
Aegialitis annulata			X
Aegiceras corniculatum		X	X
Avicennia integra			
Avicennia marina		X	X
Bruguiera exaristata		X	X
Bruguiera gymnorhiza			
Bruguiera parviflora			
Bruguiera sexangula			
Camptostemon schultzii			
Ceriops australis			X
Ceriops decandra			
Ceriops tagal			
Cynometra iripa			
Diospyros littorea			
Excoecaria agallocha			
Lumnitzera littorea			
Lumnitzera racemosa			X
Nypa fruticans			
Osbornia octodonta			
Pemphis acidula	X	X	
Rhizophora apiculata			
Rhizophora X *lamarckii*			
Rhizophora stylosa	X	X	X
Scyphiphora hydrophylacea			X->
Sonneratia alba		X	
Sonneratia lanceolata			
Sonneratia X *urama*			
Xylocarpus granatum			
Xylocarpus moluccensis		X	X
TOTAL recorded	**2**	**7**	**9**
TOTAL in vicinity	**16**	**16**	**17**
Sources:	NCD	SKW, NCD	NCD, SKW

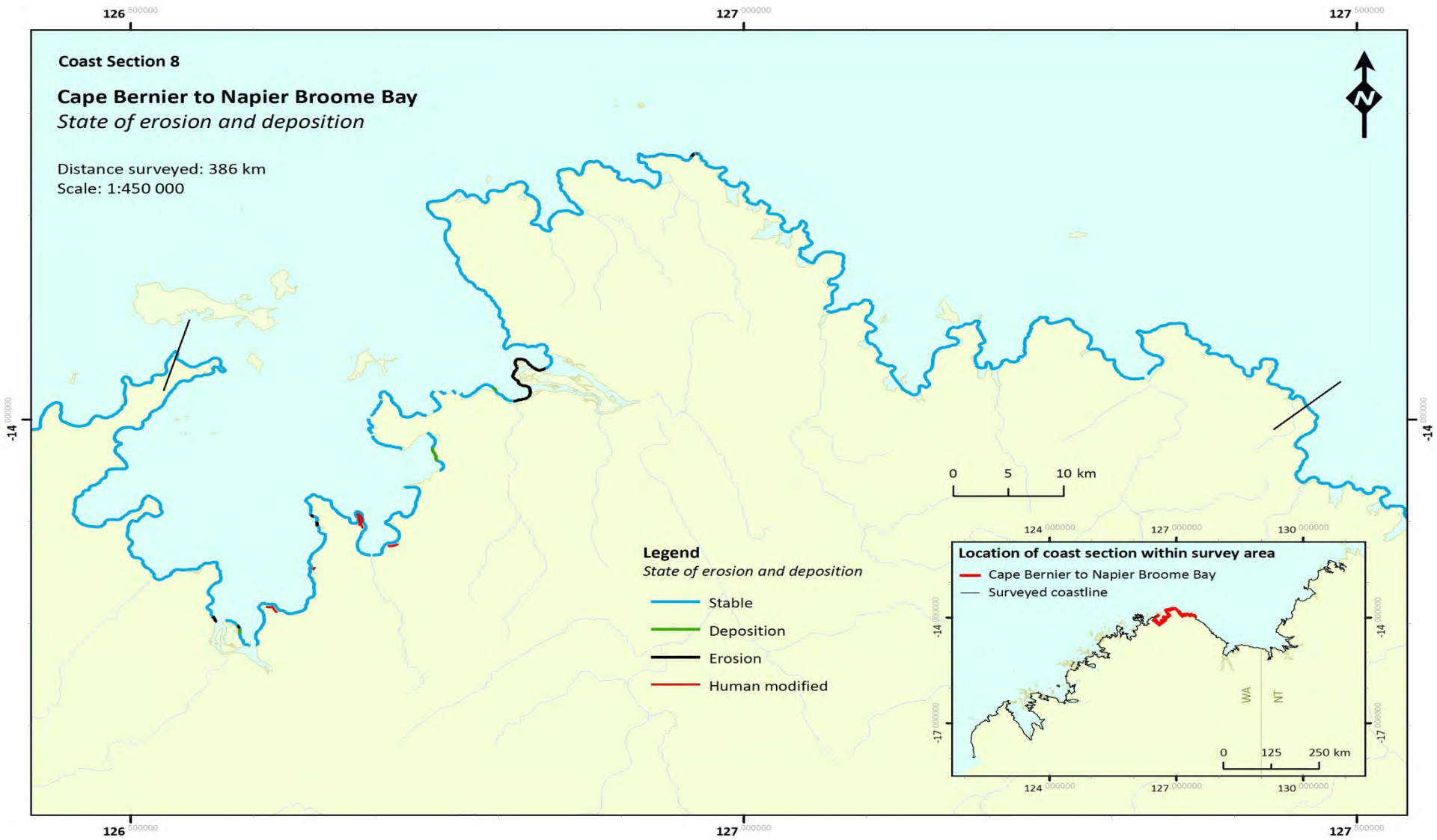


Figure 57: Shoreline stability in the Cape Bernier to Napier Broome Bay region

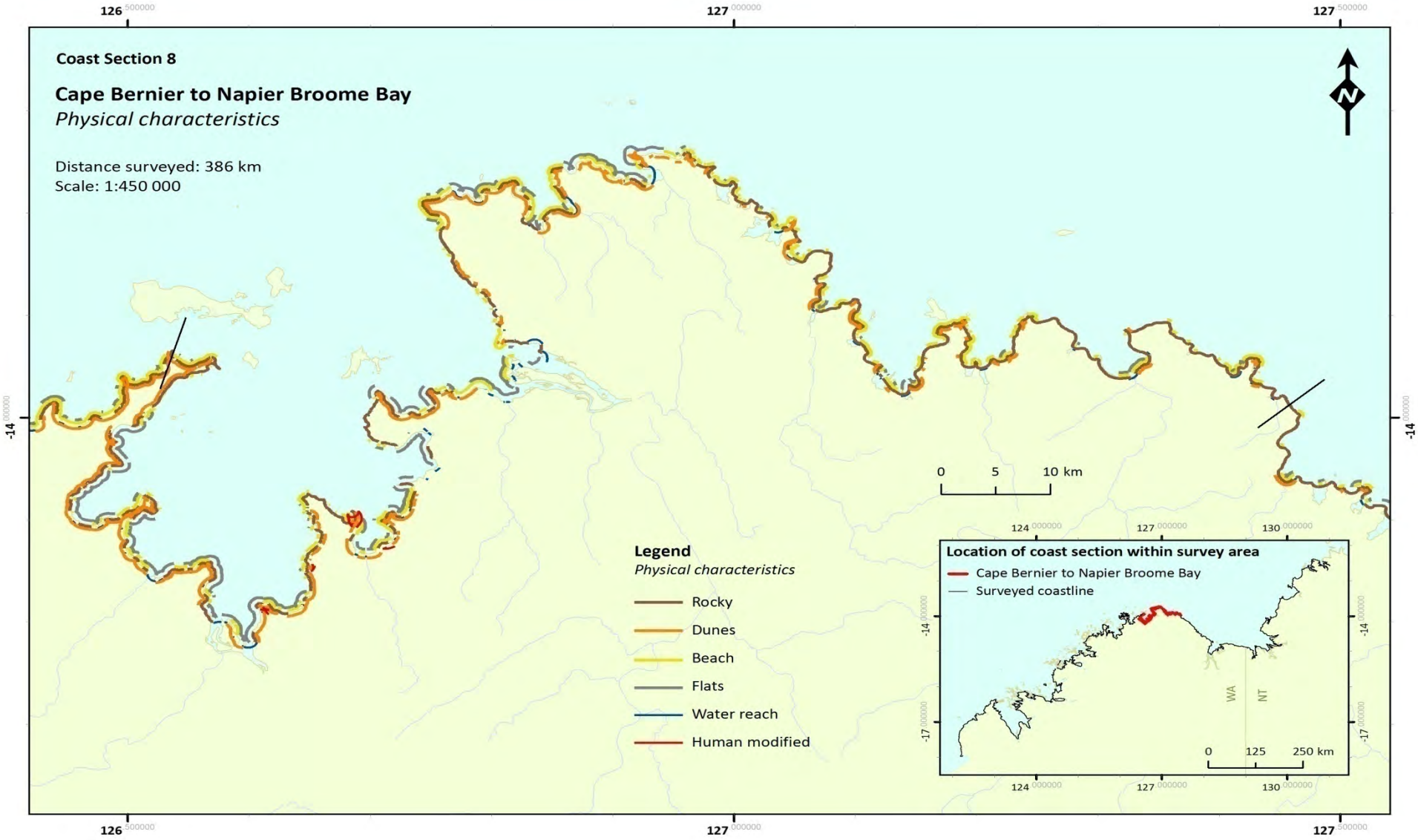


Figure 58: Shoreline physical characteristics in the Cape Bernier to Napier Broome Bay region

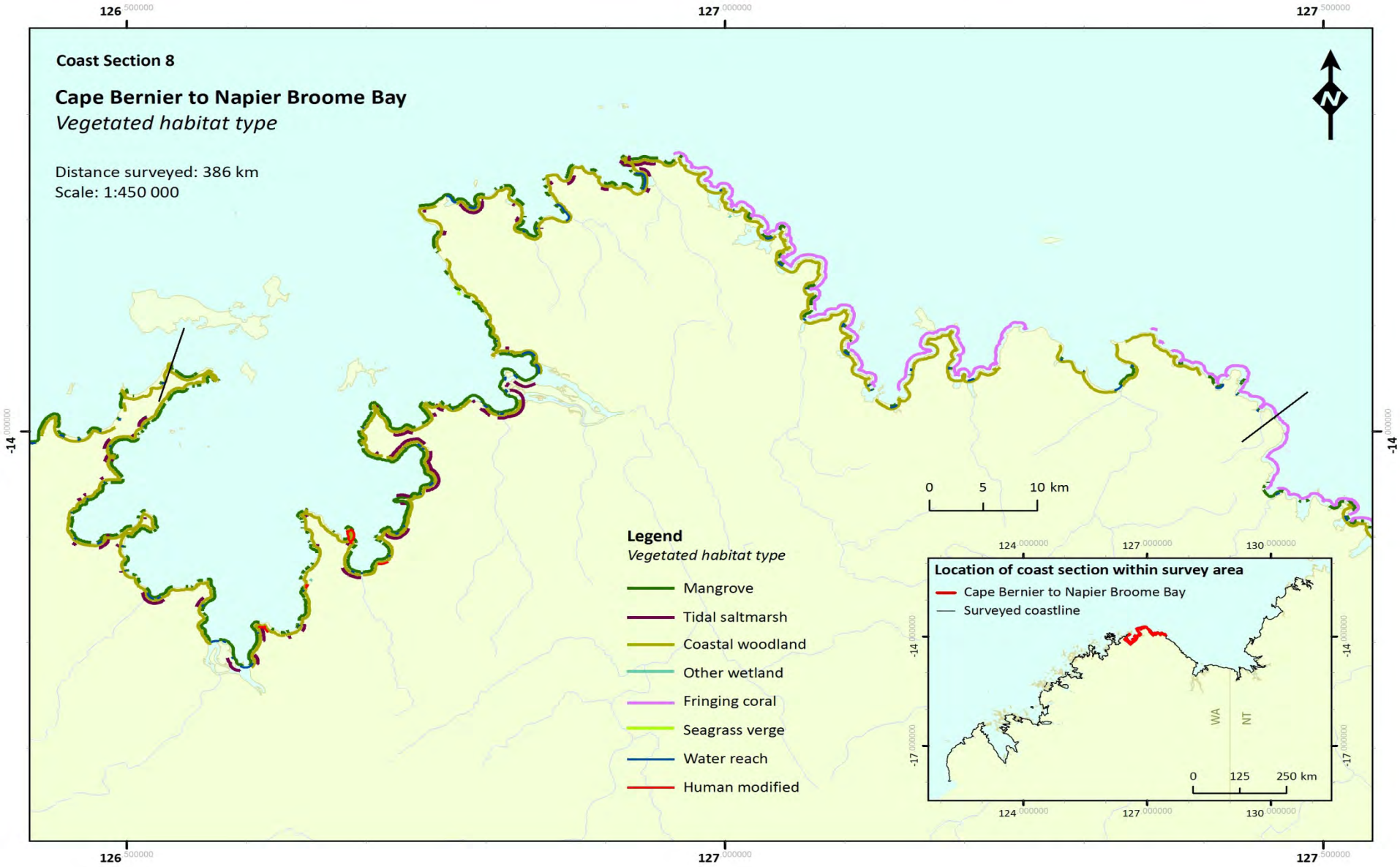


Figure 59: Vegetated habitat types in the Cape Bernier to Napier Broome Bay region

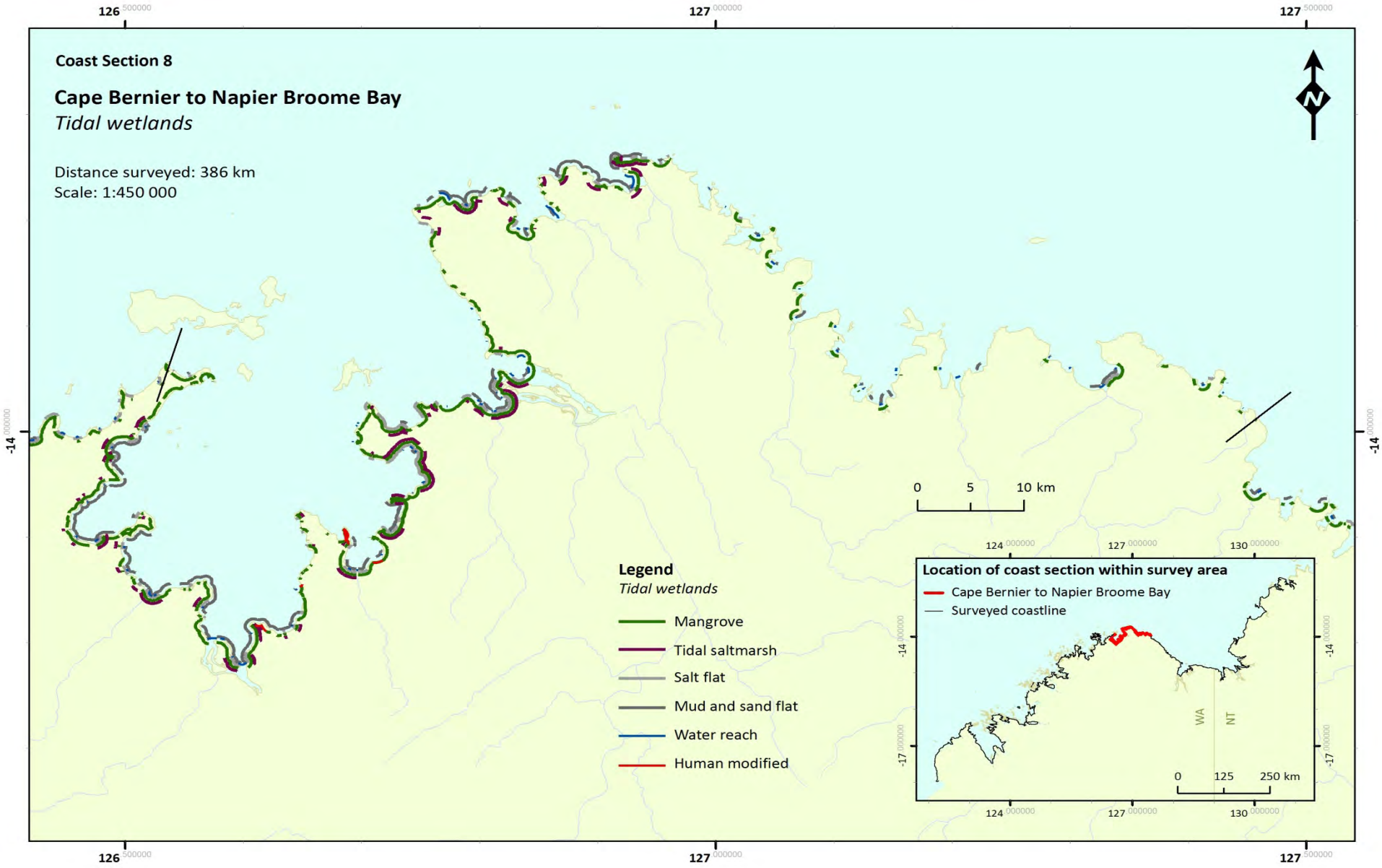


Figure 60: Tidal wetlands in the Cape Bernier to Napier Broome Bay region

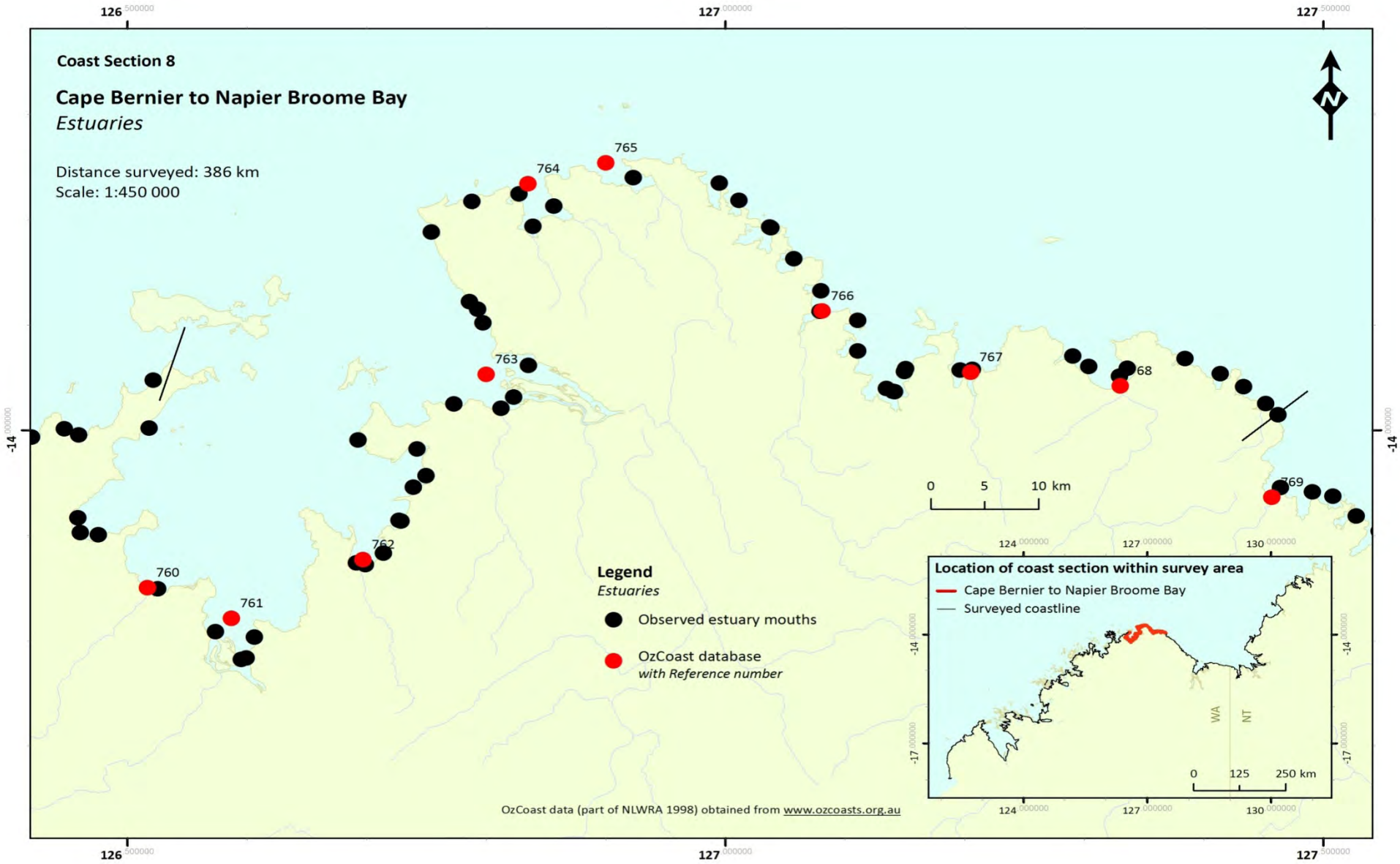


Figure 61: Estuaries in the Cape Bernier to Napier Broome Bay region

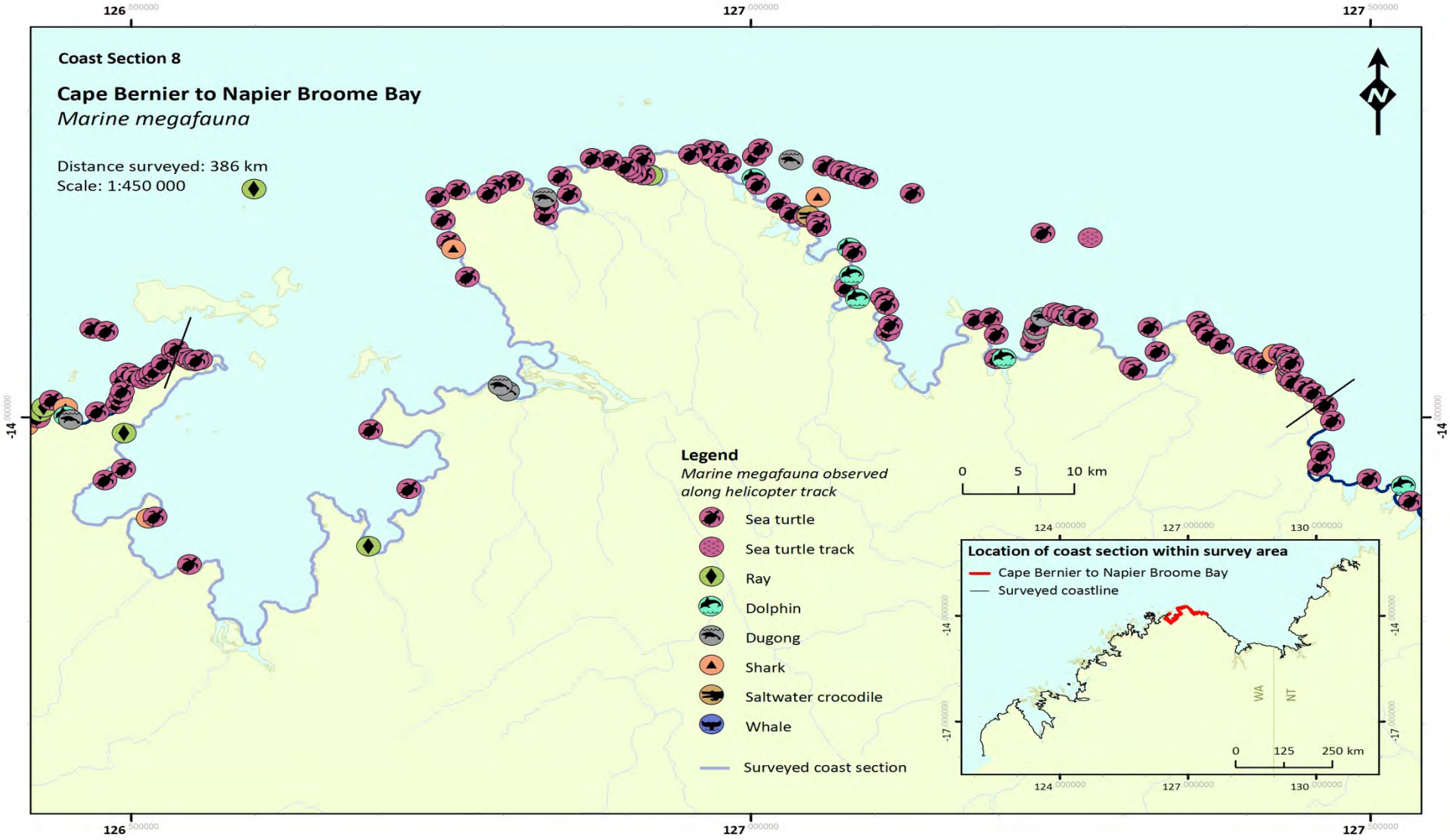


Figure 62: Marine megafauna observed in the Cape Bernier to Napier Broome Bay region

3.9 Vansittart Bay to Admiralty Gulf (WA)

Coast region start: Lat: -13.937
Long: 126.54091
Coast region end: Lat: -14.23192
Long: 125.62873

Region includes Cape Bouganville, Anjo Peninsula, Cape Voltaire and Admiralty Gulf.

- 674 km coast surveyed, making 13% of the total 5102 km.
- Mangroves were present along 438.6 km of the coast, 65.1% of the region. Total area of tidal wetland in the region is 116.76 km^2 (OzCoasts 2009), calculated as 0.17 km^2 tidal wetland per kilometer of coastline surveyed in the region.
- Rocky shore dominates, spanning 522 km, 77.5% of the region.
- Less than 0.5 km of coast in this region was modified by human activity.
- Estuaries in this region include three Montague Sound Creeks, the mouths of both the Mitchell River and the Lawley River, as well as Mt Conner Creek, Wade Creek, Rocky Cove and Pauline Bay.
- Marine megafauna observations were very common in this region and included dolphins, sea turtles and many rays.

Table 45: Summary of coastal characteristics from Vansittart Bay to Admiralty Gulf.

		km	*% of region*
Physical characteristics	**Rocky**	522.0	*77.5*
	Beach	211.0	*31.3*
	Flat	146.8	*21.8*
	Dune	140.3	*20.8*
	Other wetland	0.0	*0.0*
Vegetated habitat type	**Mangrove**	438.6	*65.1*
	Saltmarsh	41.1	*6.1*
	Fringing coral	143.0	*21.2*
	Seagrass verge	5.2	*0.8*
	Coastal Woodland	648.4	*96.2*
State of erosion and deposition	**Deposition**	0.0	*0.0*
	Erosion	0.0	*0.0*
	Stable	595.6	*88.4*
Tidal wetlands	**Mangrove**	438.6	*65.1*
	Saltmarsh	41.1	*6.1*
	Sand and mud flats	46.8	*6.9*
	Salt flat	125.0	*18.5*
Other	**Human modified**	0.1	*0.0*
	Water reach	31.4	*4.7*

Vansittart Bay to Admiralty Gulf (WA)

Figure 63: Representative coastline imagery from the Cape Dussejour to Cape Bernier region. Image numbers are unique within the electronic database

Table 46: Summary of marine megafauna observed during aerial surveys of Vansittart Bay to Admiralty Gulf (WA).

Common name	Genus/Species	Total observed
Australian snubfin dolphin	*Orcaella heinsohni*	0
Indo-Pacific bottlenose	*Tursiops aduncas*	5
Unidentified dolphin species	Family Delphinidae	20
Sea turtle	*Chelonia* or *Caretta* spp	135
Sea turtle track	*Chelonia* or *Caretta* spp	7
Dugong	*Dugong dugong*	12
Whale	*Order Cetacea*	0
Manta ray	*Manta birostris*	0
Ray species	Superorder Batoidea	52
Saltwater crocodile	*Crocodylus porosus*	3
Unidentified shark species	Superorder: Selachimorph	7

Table 47: Coastline data for the Vansittart Bay to Admiralty Gulf, WA region. Source OzCoasts 2009.

NT-WA Survey – 9. Vansittart Bay to Admiralty Gulf, WA		
Features	**#9**	**Relevance to survey region**
Annual Rainfall –range & mean (mm)	1200-1275 (1237)	Above average
Number of estuaries listed	9	Average
Total Catchment Area (km2)	5963	Below average size
Total Estuary Length (km)	79.6	Below average size
Tidal Range (in m)	4.83	
Condition Status	Near Pristine to Largely Unmodified	Very low disturbance by humans
Area of Mangrove (km2)	80.78	
Area of Salt Marsh (km2)	35.99	
WCI% from Region Total	69.2	
Total Tidal Wetland (km2)	116.76	
BOM 1998 Climatic Area	Tropical Savannah - Wet Autumn	
Mangrove species number	13	16 in vicinity
Mangrove species limit west	0	

Table 48: Estuary data for notable estuaries within the Vansittart Bay to Admiralty Gulf, WA region. Source NLWRA; 1998.

NT-WA Survey **9. Vansittart Bay to Admiralty Gulf, WA**				
Feature / Location	**Mitchell River**	**Lawley River**	**Mt Connor Creek**	**Rocky Cove**
NLWRA Estuary Reference#	**754**	**755**	**756**	**757**
Latitude S	14.427	14.632	14.535	14.220
Longitude E	125.697	125.917	126.043	126.245
Annual Rainfall – mean (mm)	1251	1275	1233	1200
Catchment Area (km2)	3704	1201	100	155
Estuary Length (km)	37.22	10.18	5.41	10.08
Tidal Range (in m)	5.7	6	5.8	3
Condition Status	LU	P	P	P
Area of Mangrove (km2)	33.59	25.07	8.40	3.44
Area of Salt Marsh (km2)	15.35	7.27	9.37	1.95
Wetland Cover Index (WCI %)	68.6	77.5	47.3	63.8
Total Tidal Wetland (km2)	48.93	32.34	17.77	5.39
BOM 1998 Climatic Area	Tropical Savannah - Wet Autumn	Tropical Savannah - Wet Autumn	Tropical Savannah - Wet Autumn	Tropical Savannah - Wet Autumn
Mangrove species number	13 (16)	13 (16)		
Source of mangrove data:	GW85	GW81, SKW, NCD		

Table 49: Mangrove species present in the Northern Territory and Western Australia. Green highlights species with ranges within the Vansittart Bay to Admiralty Gulf, WA region (source: Duke 2006). Crosses identify recorded species occurrence in the listed estuary. Yellow denotes western limit of species range.

9. Vansittart Bay to Admiralty Gulf				
Species/ Locations	**Mitchell River #754**	**Lawley River #755**	**Osborne Bonaparte Archipelago ~#755**	**Gibson Point ~#755**
Acanthus ebracteatus subsp. *ebarbatus*				
Acanthus ilicifolius				
Acrostichum speciosum				
Aegialitis annulata	X	X		
Aegiceras corniculatum	X	X	X	X
Avicennia integra				
Avicennia marina	X	X	X	X
Bruguiera exaristata	X	X	X	
Bruguiera gymnorhiza				
Bruguiera parviflora	X	X		
Bruguiera sexangula				
Camptostemon schultzii	X	X		X
Ceriops australis	X	X	X	X
Ceriops decandra				
Ceriops tagal				
Cynometra iripa				
Diospyros littorea				
Excoecaria agallocha	X	X		
Lumnitzera littorea				
Lumnitzera racemosa	X	X	X	X
Nypa fruticans				
Osbornia octodonta	X	X	X	
Pemphis acidula				
Rhizophora apiculata				
Rhizophora X *lamarckii*				
Rhizophora stylosa	X	X		X
Scyphiphora hydrophylacea				
Sonneratia alba	X	X		
Sonneratia lanceolata				
Sonneratia X *urama*				
Xylocarpus granatum				
Xylocarpus moluccensis	X	X	X	X
TOTAL recorded	**13**	**13**	**7**	**7**
TOTAL in vicinity	**16**	**16**	**16**	**16**
Sources:	GW85	GW81, SKW	SKW	NCD

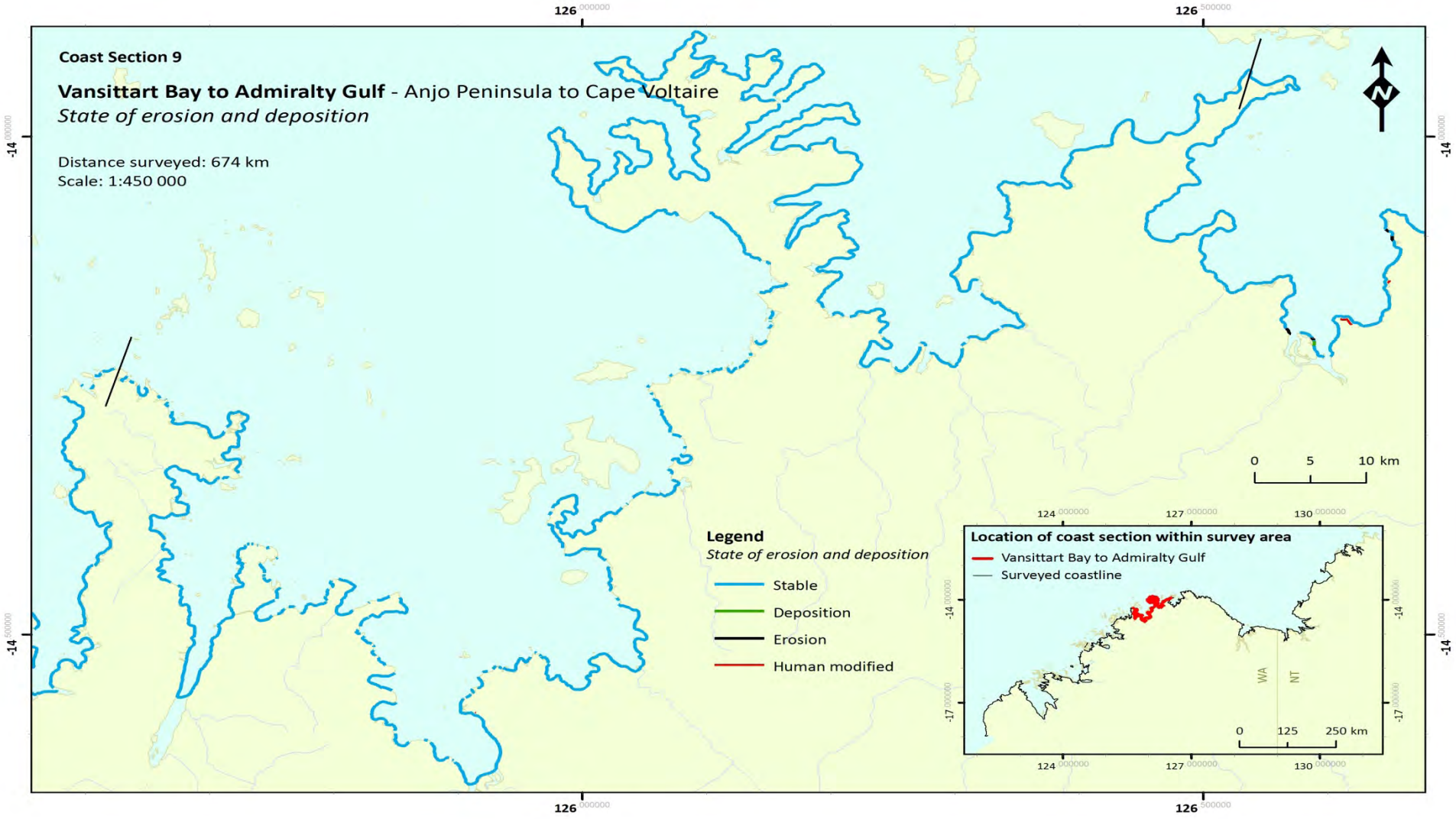


Figure 64: Shoreline stability in the Varsittart Bay to Admiralty Gulf region

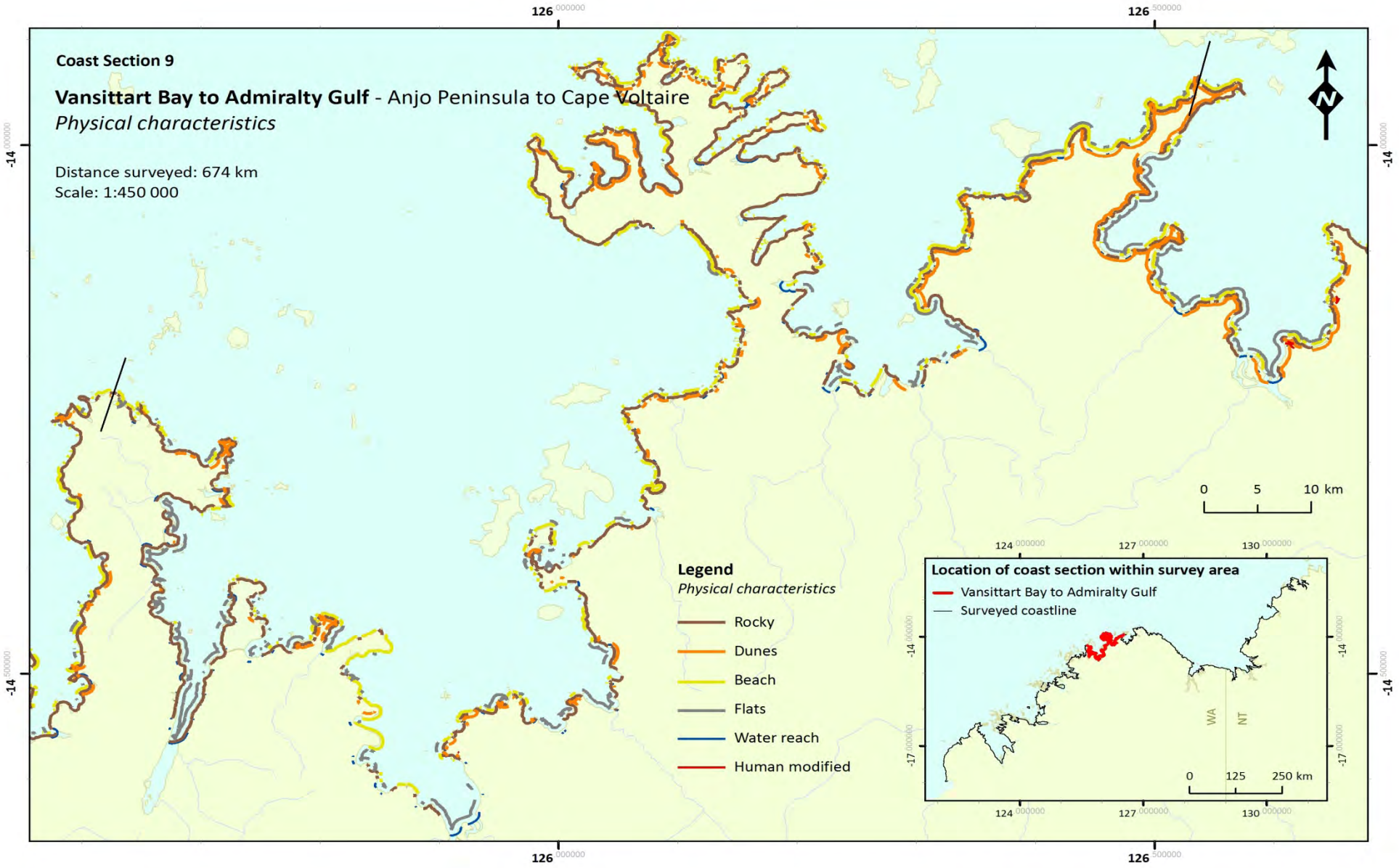


Figure 65: Shoreline physical characteristics in the Varsittart Bay to Admiralty Gulf region

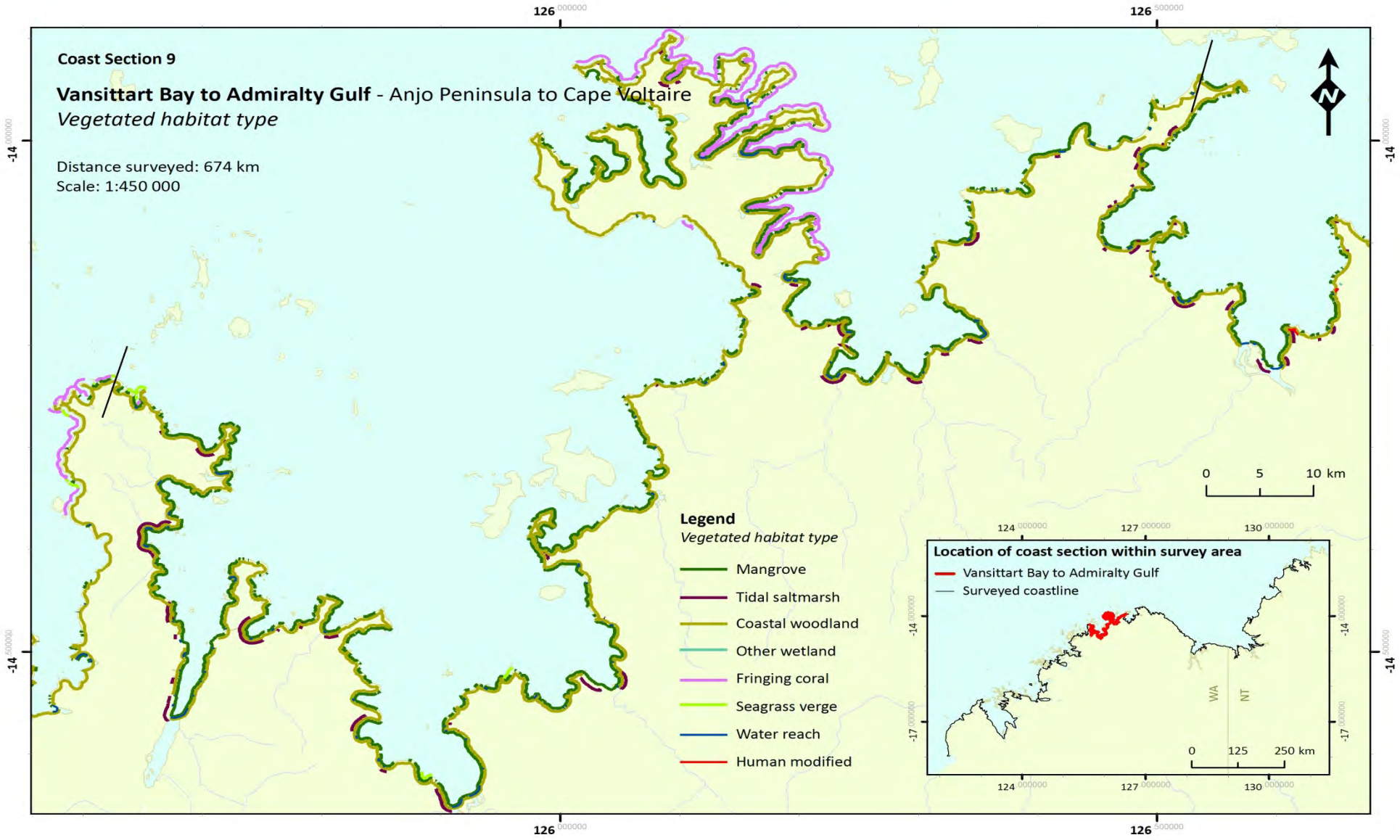


Figure 66: Vegetated habitat types in the Varsittart Bay to Admiralty Gulf region

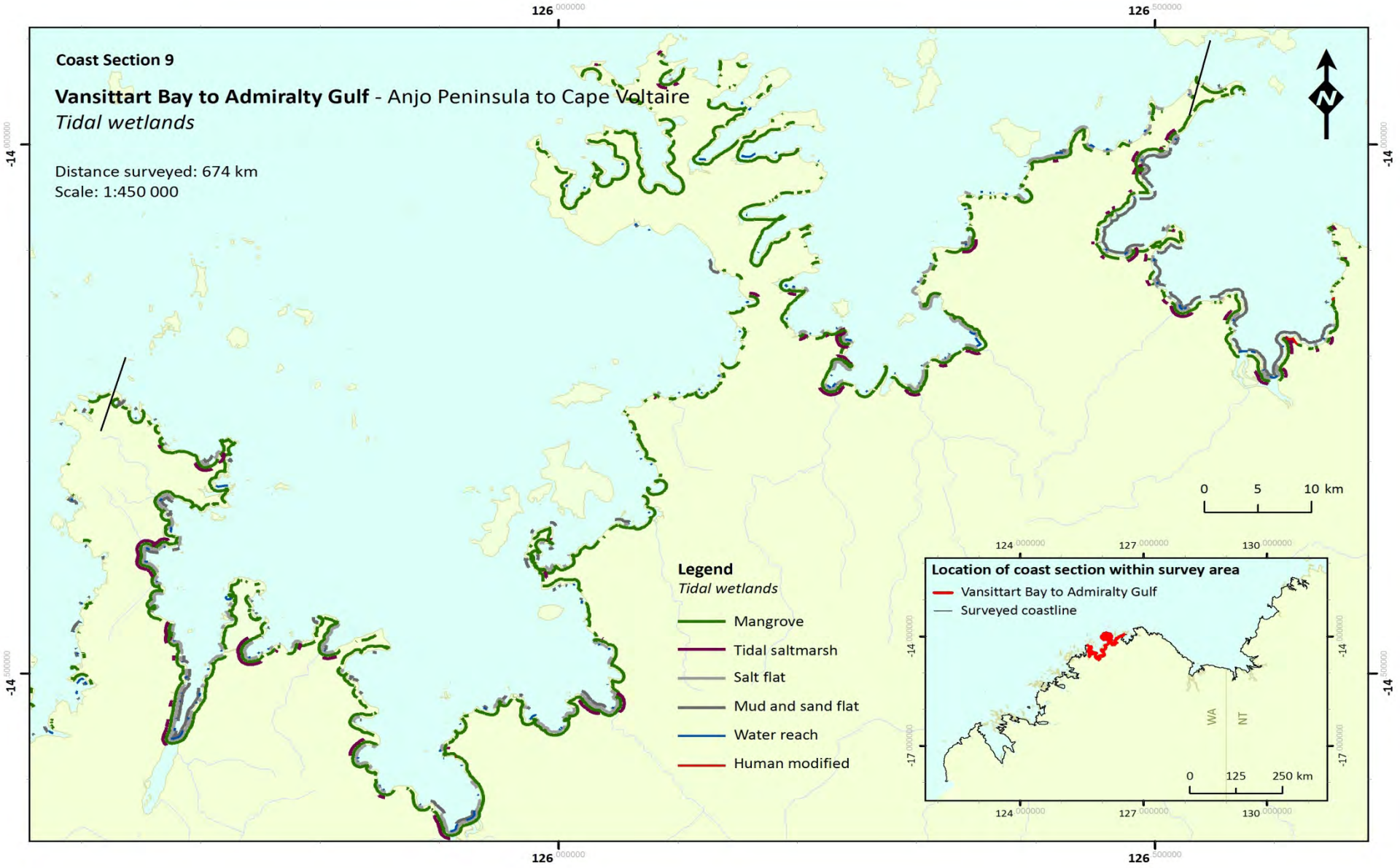


Figure 67: Tidal wetlands in the Varsittart Bay to Admiralty Gulf region

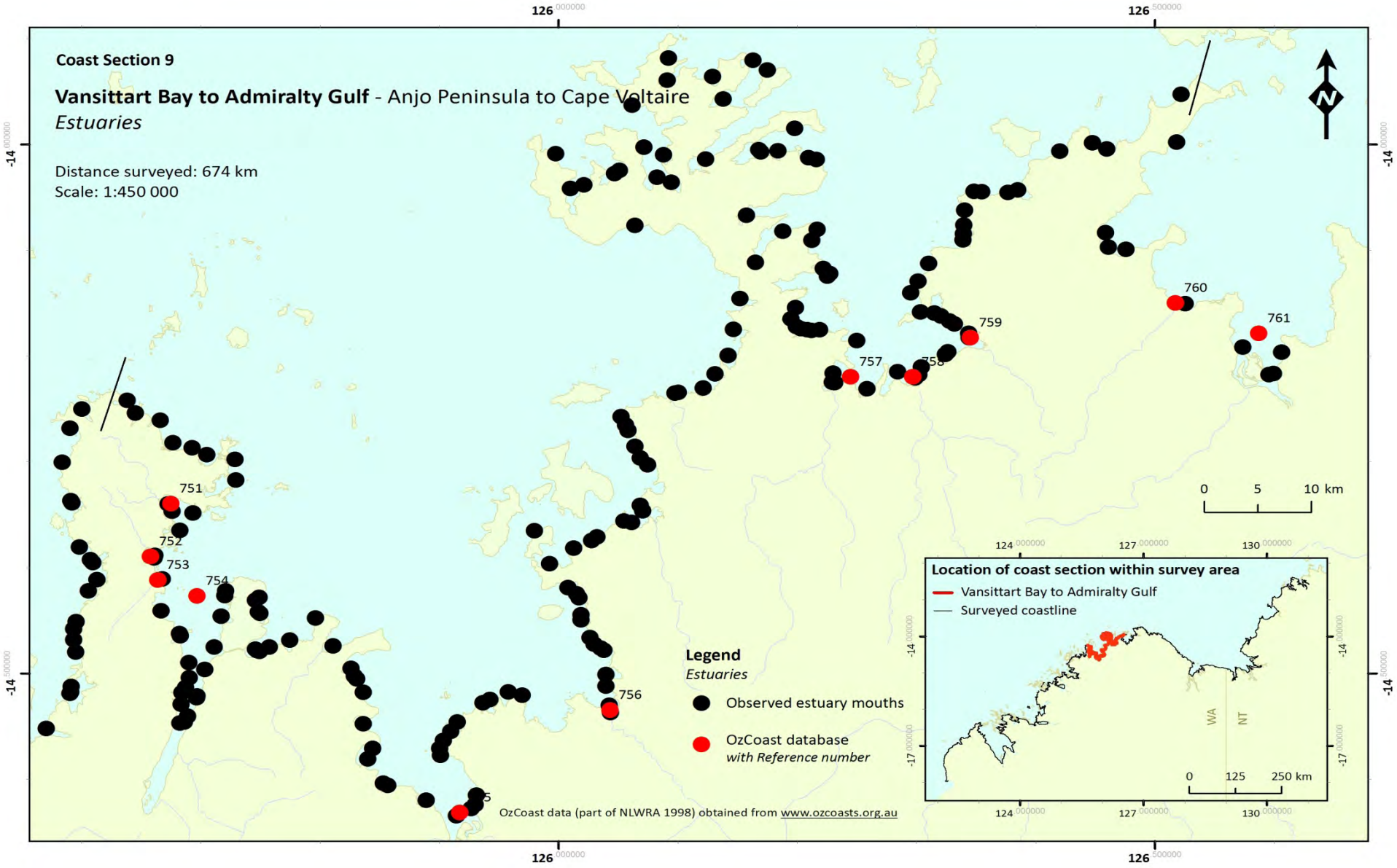


Figure 68: Estuaries in the Varsittart Bay to Admiralty Gulf region

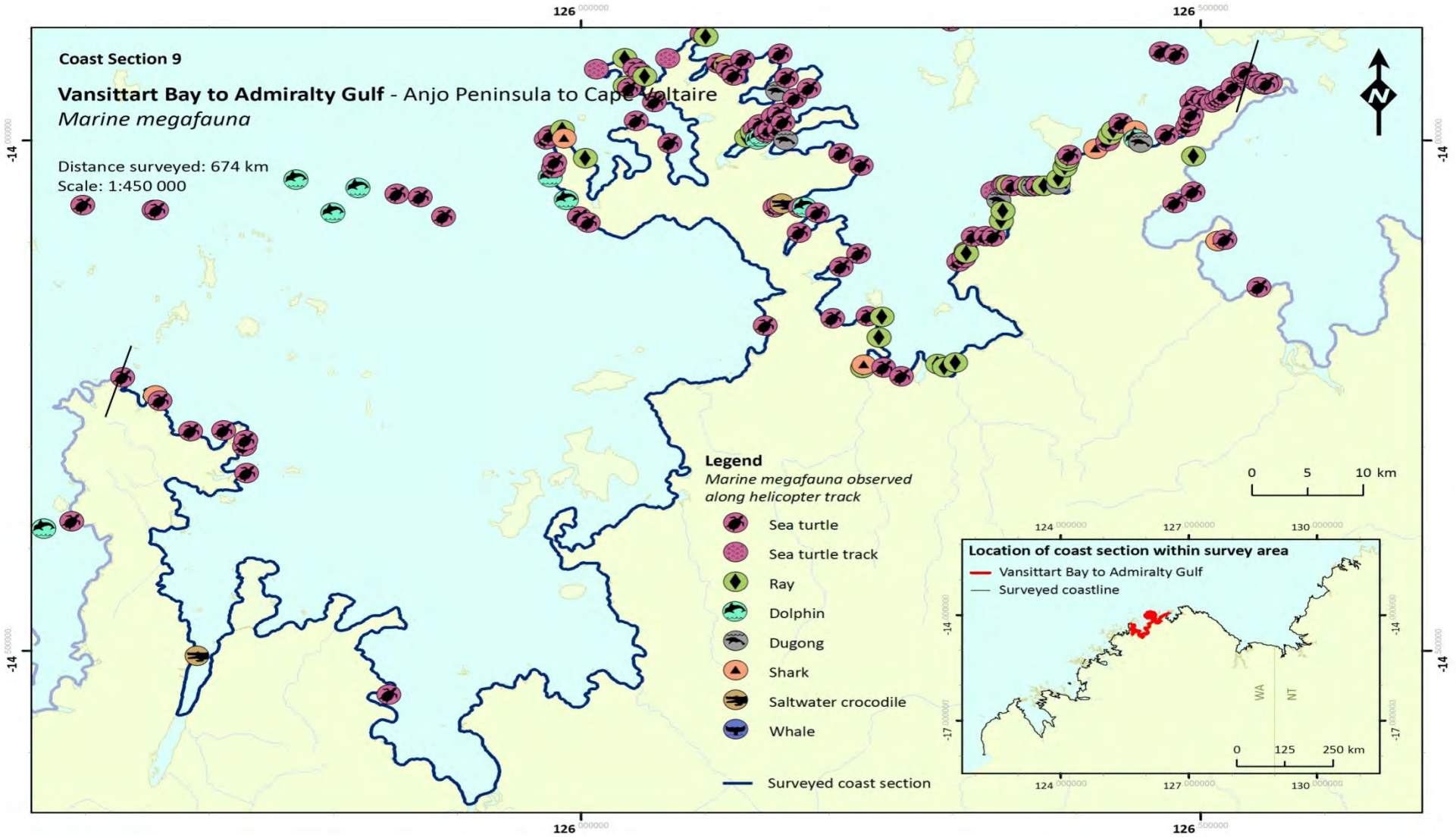


Figure 69: Marine megafauna observed in the Varsittart Bay to Admiralty Gulf region

3.10 Montague Sound (WA)

Coast region start: Lat: -14.23183
Long: 125.62801
Coast region end: Lat: -14.75394
Long: 125.12416

Region encompasses Cape Voltaire to Augereau Island.

- 211 km coast surveyed, being 4% of the total 5102 km.
- The region is highly dominated by rocky shore, which spans 198 km of the coast, comprising 93.8% of the region.
- Mangroves were scarce, growing on 19.8 km or 9.4% of the region. Total area of tidal wetland in the region is 8.78 km^2 (OzCoasts 2009), calculated as 0.04 km^2 tidal wetland per kilometer of coastline surveyed in the region.
- The shoreline in the Montague Sound region remains completely free of human modification.
- Estuaries in this region include the Scott Straight Creeks, Mudge Bay and Pauline Bay.
- Six sea turtle tracks were identified on beaches in this region.

Table 50: Summary of coastal characteristics the Montague Sound region.

		km	*% of region*
Physical characteristics	**Rocky**	198.0	*93.8*
	Beach	56.4	*26.7*
	Flat	10.7	*5.1*
	Dune	16.0	*7.6*
	Other wetland	0.0	*0.0*
Vegetated habitat type	**Mangrove**	19.8	*9.4*
	Saltmarsh	0.0	*0.0*
	Fringing coral	20.8	*9.8*
	Seagrass verge	3.6	*1.7*
	Coastal Woodland	199.4	*94.4*
State of erosion and deposition	**Deposition**	0.0	*0.0*
	Erosion	0.0	*0.0*
	Stable	190.5	*90.2*
Tidal wetlands	**Mangrove**	19.8	*9.4*
	Saltmarsh	0.0	*0.0*
	Sand and mud flats	10.7	*5.1*
	Salt flat	2.3	*1.1*
Other	**Human modified**	0.0	*0.0*
	Water reach	36.1	*17.1*

Montague Sound (WA)

Figure 70: Representative coastline imagery from the Cape Bernier to Napier Broome Bay region. Image numbers are unique within the electronic database

Table 51: Summary of marine megafauna observed during aerial surveys of Montague Sound (WA).

Common name	Genus/Species	Total observed
Australian snubfin dolphin	*Orcaella heinsohni*	0
Indo-Pacific bottlenose	*Tursiops aduncas*	0
Unidentified dolphin species	Family Delphinidae	2
Sea turtle	*Chelonia* or *Caretta* spp	10
Sea turtle track	*Chelonia* or *Caretta* spp	6
Dugong	*Dugong dugong*	0
Whale	*Order Cetacea*	0
Manta ray	*Manta birostris*	0
Ray species	Superorder Batoidea	1
Saltwater crocodile	*Crocodylus porosus*	0
Unidentified shark species	Superorder: Selachimorph	1

Table 52: Coastline data for the Montague Sound, WA region. Source OzCoasts 2009.

NT-WA Survey – 10. Montague Sound, WA		
Features	**#10**	**Relevance to survey region**
Annual Rainfall –range & mean (mm)	1266-1271 (1269)	Above average
Number of estuaries listed	3	Far below average
Total Catchment Area (km2)	655	Below average size
Total Estuary Length (km)	38.2	Below average size
Tidal Range (in m)	5.67	
Condition Status	Near Pristine	Virtually no disturbance by humans
Area of Mangrove (km2)	8.78	
Area of Salt Marsh (km2)	0.00	
WCI% from Region Total	100.0	
Total Tidal Wetland (km2)	8.78	
BOM 1998 Climatic Area	Tropical Savannah - Wet Autumn	
Mangrove species number		16 in vicinity
Mangrove species limit west	0	

Table 53: Estuary data for notable estuaries within the Montague Sound, WA shoreline region. Source NLWRA; 1998.

NT-WA Survey **10. Montague Sound, WA**			
Feature / Location	**Scott Straight Creeks**	**Mudge Bay**	**Montague Sound Creeks**
NLWRA Estuary Reference#	**748**	**749**	**750**
Latitude S	14.664	14.569	14.537
Longitude E	125.211	125.374	125.453
Annual Rainfall – mean (mm)	1271	1271	1266
Catchment Area (km2)	411	60	184
Estuary Length (km)	16.96	6.75	14.51
Tidal Range (in m)	5.8	5.6	5.6
Condition Status	P	P	P
Area of Mangrove (km2)	6.85	0.17	1.76
Area of Salt Marsh (km2)	0	0	0
Wetland Cover Index (WCI %)	100.0	100.0	100.0
Total Tidal Wetland (km2)	6.85	0.17	1.76
BOM 1998 Climatic Area	Tropical Savannah - Wet Autumn	Tropical Savannah - Wet Autumn	Tropical Savannah - Wet Autumn
Mangrove species number			
Source of mangrove data:			

Table 54: Mangrove species present in the Northern Territory and Western Australia. Green highlights species with ranges within the Montague Sound, WA region (source: Duke 2006). Crosses identify recorded species occurrence in the listed estuary. Yellow denotes western limit of species range.

10. Montague Sound	
Species/ Locations	None recorded
Acanthus ebracteatus subsp. *ebarbatus*	
Acanthus ilicifolius	
Acrostichum speciosum	
Aegialitis annulata	
Aegiceras corniculatum	
Avicennia integra	
Avicennia marina	
Bruguiera exaristata	
Bruguiera gymnorhiza	
Bruguiera parviflora	
Bruguiera sexangula	
Camptostemon schultzii	
Ceriops australis	
Ceriops decandra	
Ceriops tagal	
Cynometra iripa	
Diospyros littorea	
Excoecaria agallocha	
Lumnitzera littorea	
Lumnitzera racemosa	
Nypa fruticans	
Osbornia octodonta	
Pemphis acidula	
Rhizophora apiculata	
Rhizophora X *lamarckii*	
Rhizophora stylosa	
Scyphiphora hydrophylacea	
Sonneratia alba	
Sonneratia lanceolata	
Sonneratia X *urama*	
Xylocarpus granatum	
Xylocarpus moluccensis	
TOTAL recorded	**0**
TOTAL in vicinity	**16**
Sources:	

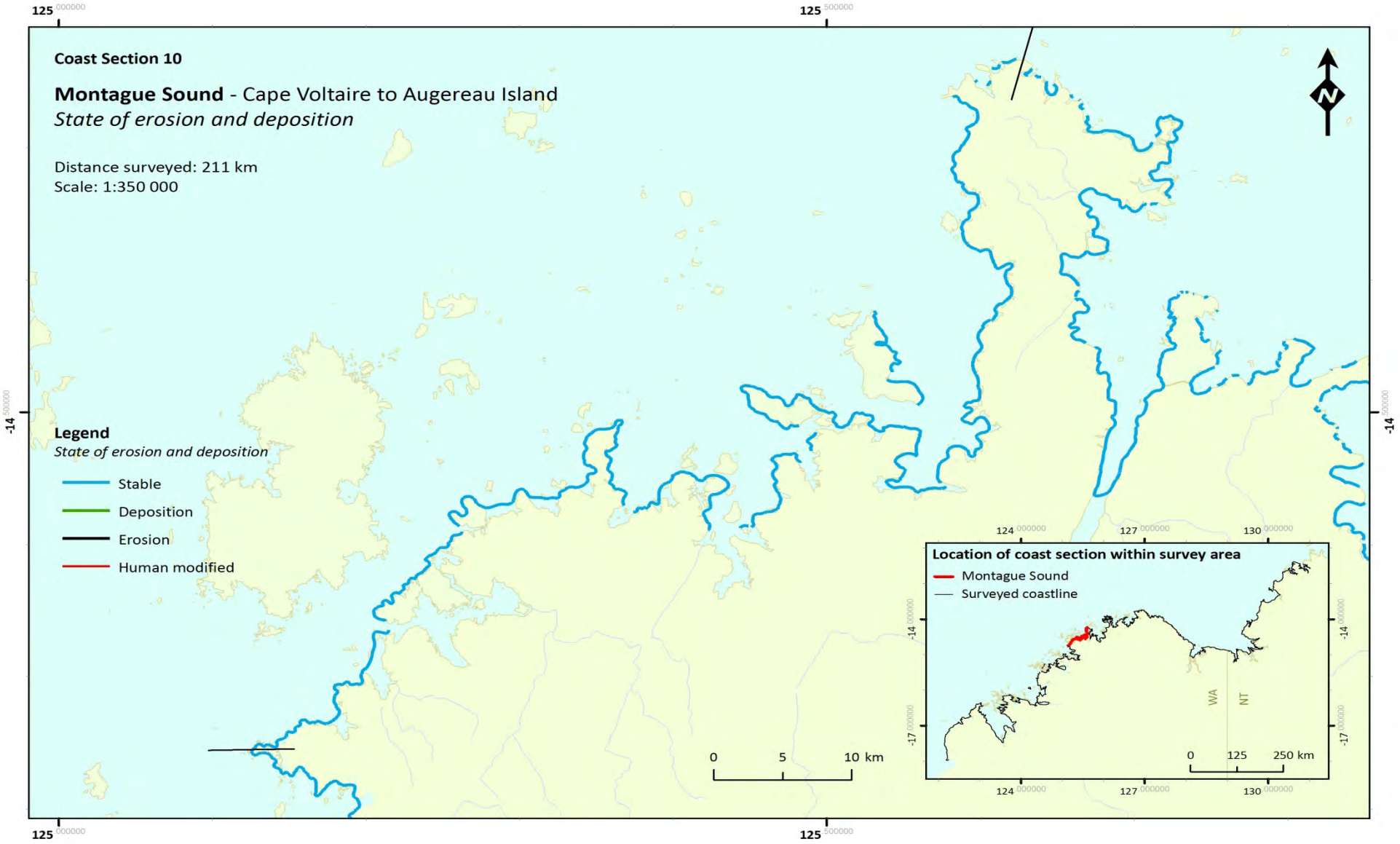


Figure 71: Shoreline stability in the Montague Sound region

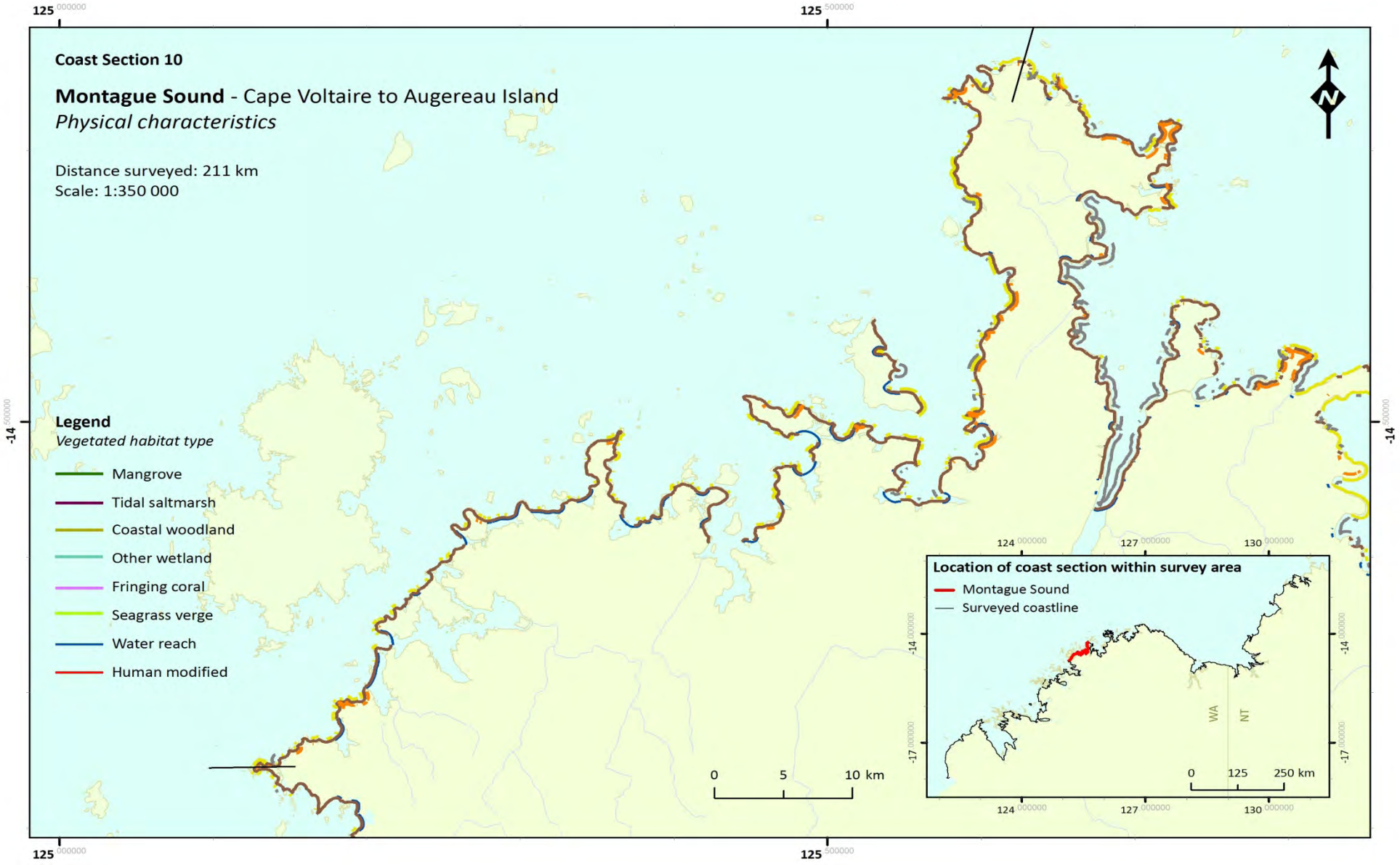


Figure 72: Shoreline physical characteristics in the Montague Sound region

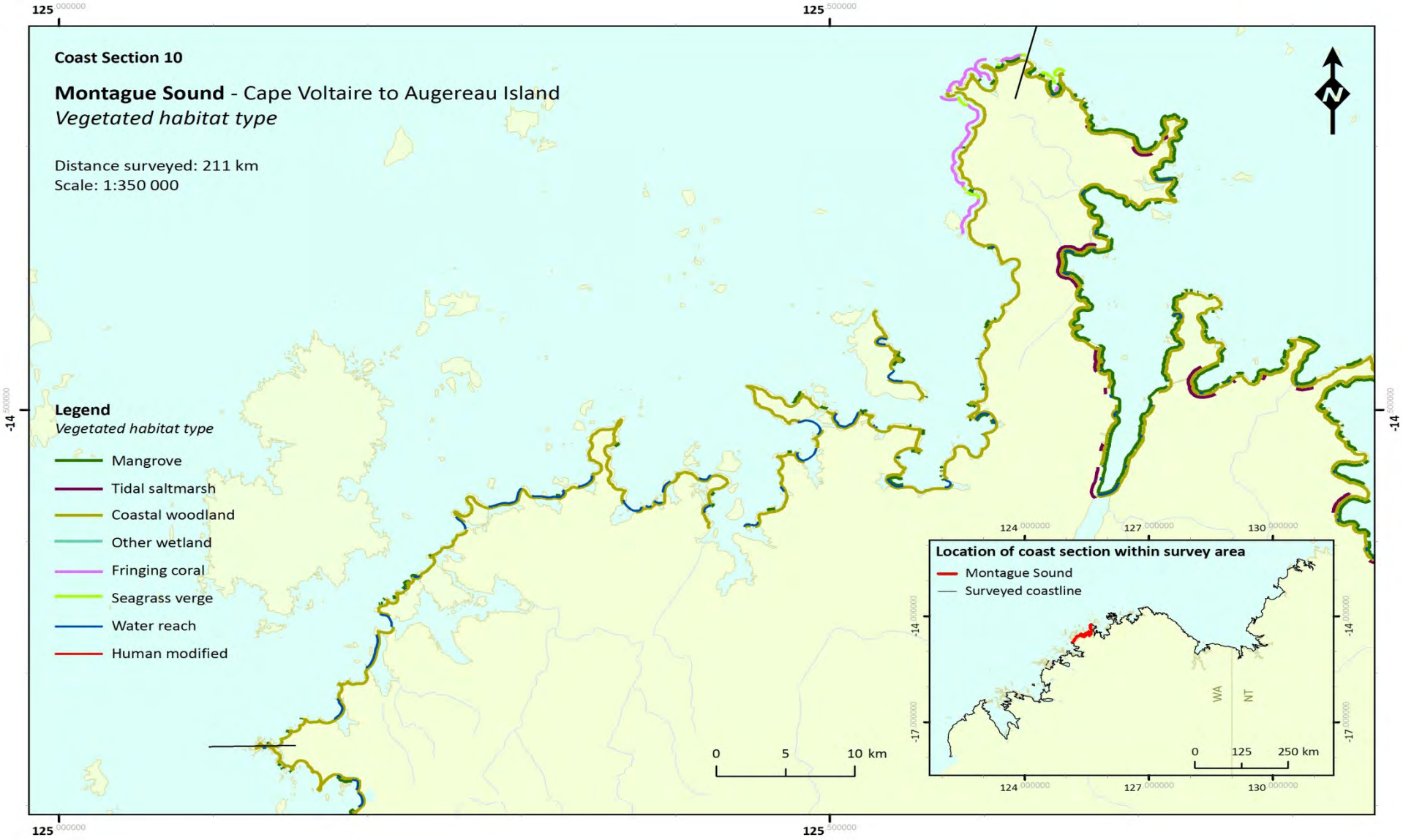


Figure 73: Vegetated habitat types in the Montague Sound region

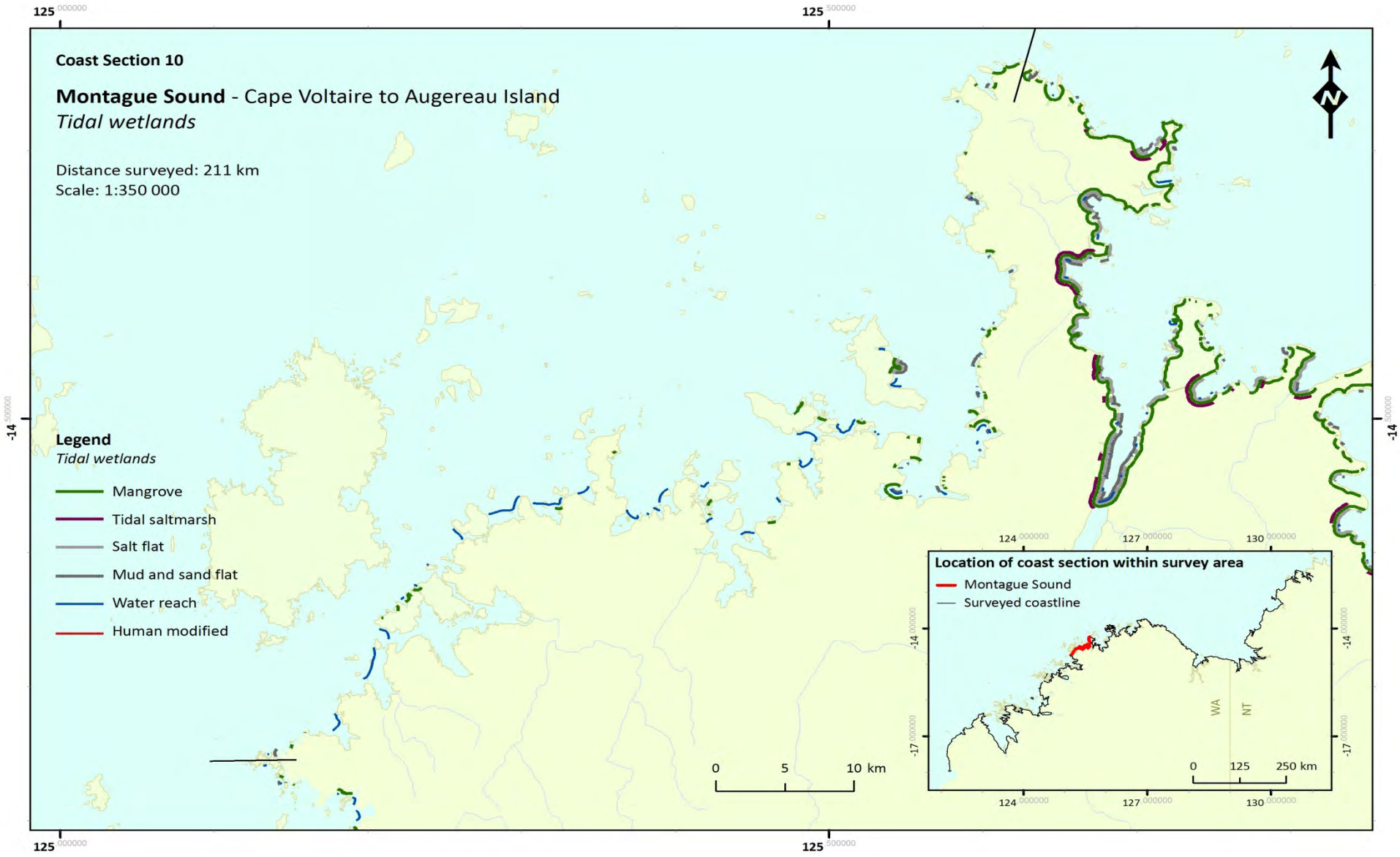


Figure 74: Tidal wetlands in the Montague Sound region

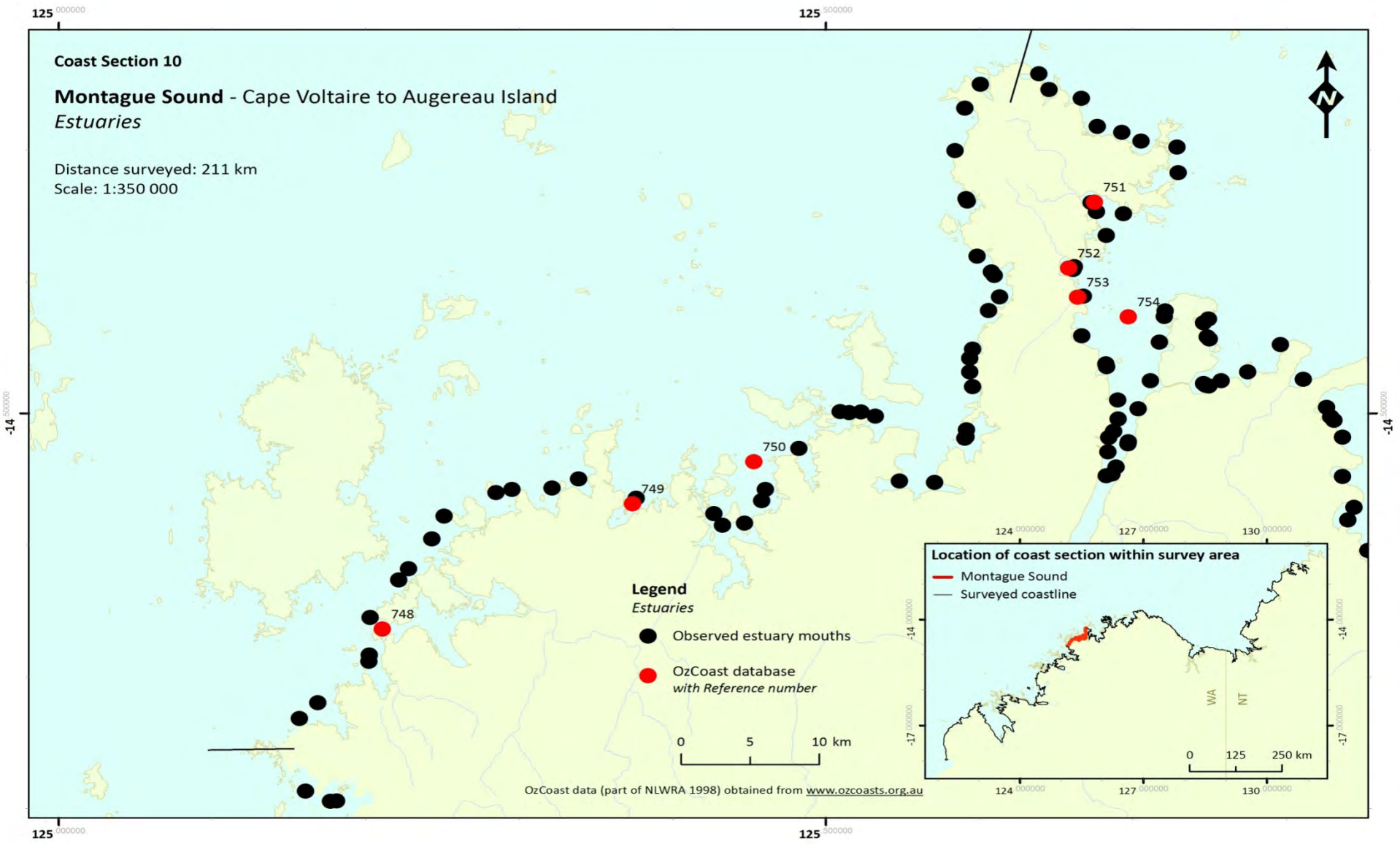


Figure 75: Estuaries in the Montague Sound region

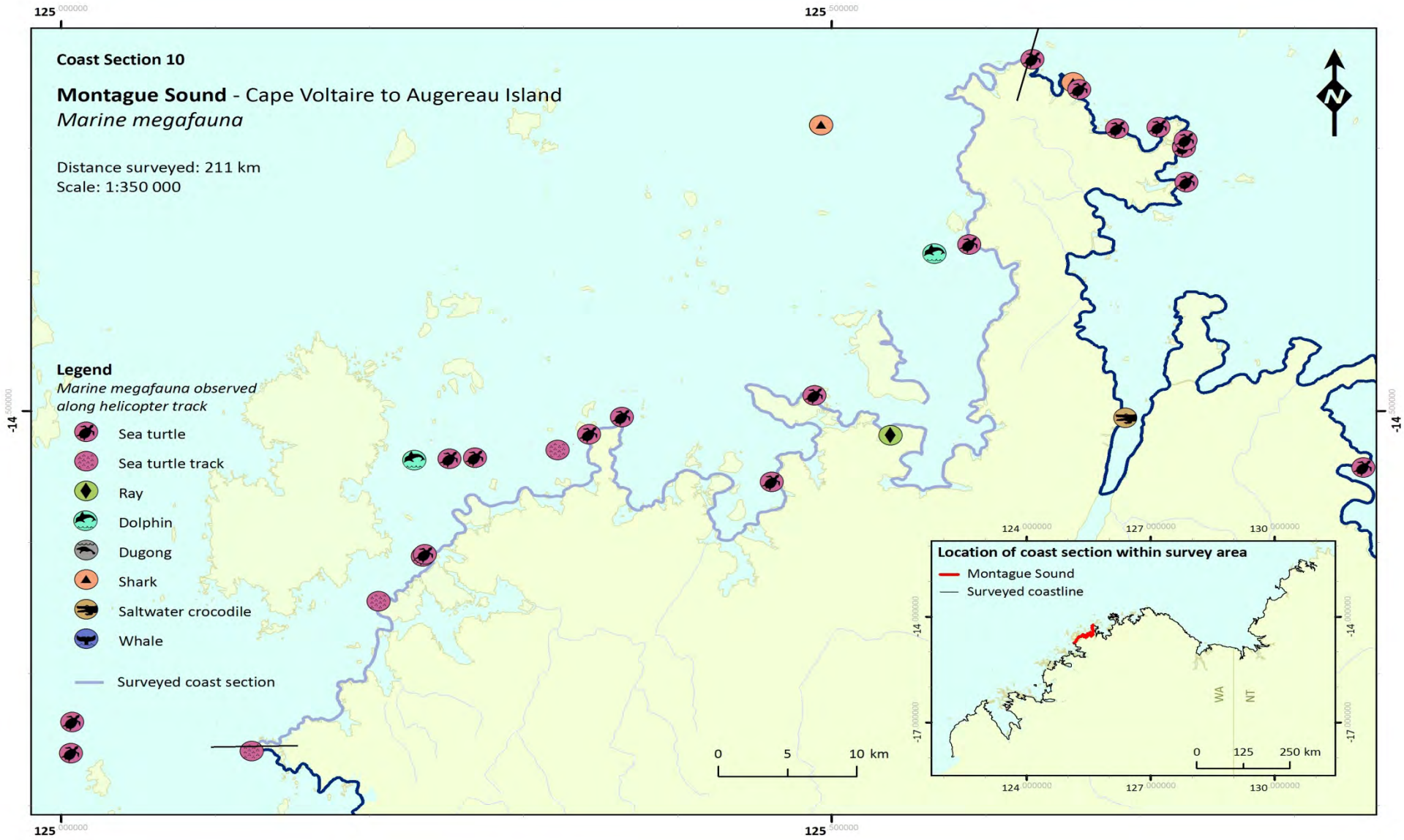


Figure 76: Marine megafauna observed in the Montague Sound region

3.11 York Sound to Brunswick Bay (WA)

Coast region start: Lat: -14.75455
Long: 125.12376
Coast region end: Lat: -15.25315
Long: 124.68173

Region encompasses Augereau Island to High Bluff and includes Moran River, St George Basin and Hanover Bay.

- 476 km coast surveyed, being 9% of the total 5102 km.
- Mangroves become more common than in the Montague Sound region, growing on 51.3% of the coast, 244.3 km in the region. Total area of tidal wetland in the region is 324.05 km^2 (OzCoasts 2009), calculated as 0.68 km^2 tidal wetland per kilometer of coastline surveyed in the region.
- This area is the coast is completely unmodified by humans. It remains completely pristine.
- Estuaries in this region include four Scott Straight Creeks, the Cape Torrens Embayment and the mouths of the Prince Regent River and the Hunted River.
- Many sea turtle tracks were identified on beaches in this region. Other megafauna sightings included dolphins, crocodiles and rays.

Table 55: Summary of coastal characteristics the York Sound to Brunswick Bay region.

		km	*% of region*
Physical characteristics	**Rocky**	426.2	*89.5*
	Beach	75.1	*15.8*
	Flat	50.2	*10.5*
	Dune	9.5	*2.0*
	Other wetland	0.0	*0.0*
Vegetated habitat type	**Mangrove**	244.3	*51.3*
	Saltmarsh	22.3	*4.7*
	Fringing coral	0.0	*0.0*
	Seagrass verge	0.0	*0.0*
	Coastal Woodland	440.3	*92.4*
State of erosion and deposition	**Deposition**	17.3	*3.6*
	Erosion	0.0	*0.0*
	Stable	404.8	*85.0*
Tidal wetlands	**Mangrove**	244.3	*51.3*
	Saltmarsh	22.3	*4.7*
	Sand and mud flats	44.8	*9.4*
	Salt flat	26.8	*5.6*
Other	**Human modified**	0.0	*0.0*
	Water reach	94.2	*19.8*

York Sound to Brunswick Bay (WA)

Figure 77: Representative coastline imagery from the York Sound to Brunswick Bay region

Image numbers are unique within the electronic database

Table 56: Summary of marine megafauna observed during aerial surveys of York Sound to Brunswick Bay (WA).

Common name	Genus/Species	Total observed
Australian snubfin dolphin	*Orcaella heinsohni*	2
Indo-Pacific bottlenose	*Tursiops aduncas*	0
Unidentified dolphin species	Family Delphinidae	6
Sea turtle	*Chelonia* or *Caretta* spp	8
Sea turtle track	*Chelonia* or *Caretta* spp	18
Dugong	*Dugong dugong*	2
Whale	*Order Cetacea*	0
Manta ray	*Manta birostris*	0
Ray species	Superorder Batoidea	3
Saltwater crocodile	*Crocodylus porosus*	2
Unidentified shark species	Superorder: Selachimorph	0

Table 57: Coastline data for the York Sound to Brunswick Bay, WA region. Source OzCoasts 2009.

NT-WA Survey – 11. York Sound to Brunswick Bay, WA		
Features	**#11**	**Relevance to survey region**
Annual Rainfall –range & mean (mm)	1200-1350 (1273)	Above average
Number of estuaries listed	13	Far above average
Total Catchment Area (km2)	9989	Below average size
Total Estuary Length (km)	203.4	Above average size
Tidal Range (in m)	6.48	
Condition Status	Near Pristine	Virtually no disturbance by humans
Area of Mangrove (km2)	286.01	
Area of Salt Marsh (km2)	38.04	
WCI% from Region Total	88.3	
Total Tidal Wetland (km2)	324.05	
BOM 1998 Climatic Area	Tropical Savannah - Wet Autumn	
Mangrove species number	14	16 in vicinity
Mangrove species limit west	1	

Table 58: Estuary data for notable estuaries within the York Sound to Brunswick Bay, WA region. Source NLWRA; 1998.

NT-WA Survey **11. York Sound to Brunswick Bay, WA**				
Feature / Location	**Hanover Bay, Augustus Is.** vicinity	**Prince Regent River**	**Roe River**	**Hunter River**
NLWRA Estuary Reference#	**735**	**736**	**741**	**743**
Latitude S	15.304	15.246	15.133	15.042
Longitude E	124.775	124.860	125.373	125.379
Annual Rainfall – mean (mm)	1200	1303	1283	1292
Catchment Area (km2)	47	4964	3625	408
Estuary Length (km)	6.92	81.44	28.33	17.58
Tidal Range (in m)	7.6	7.4	6.2	6
Condition Status	P	P	P	P
Area of Mangrove (km2)	1.43	180.04	23.06	14.39
Area of Salt Marsh (km2)	0	7.12	16.49	0.57
Wetland Cover Index (WCI %)	100.0	96.2	58.3	96.2
Total Tidal Wetland (km2)	1.43	187.16	39.55	14.96
BOM 1998 Climatic Area	Tropical Savannah - Wet Autumn	Tropical Savannah - Wet Autumn	Tropical Savannah - Wet Autumn	Tropical Savannah - Wet Autumn
Mangrove species number	7 (15)	14 (16)	13 (16)	13 (16)
Source of mangrove data:	SKW	GW81, 85	SKW	NCD

Table 59: Mangrove species present in the Northern Territory and Western Australia. Green highlights species with ranges within the York Sound to Brunswick Bay, WA region(source: Duke 2006). Crosses identify recorded species occurrence in the listed estuary. Yellow denotes western limit of species range.

11. York Sound to Brunswick Bay				
Species/ Locations	**Augustus vicinity ~#735**	**Prince Regent River #736**	**Roe River ~#741**	**Hunter River ~#743**
Acanthus ebracteatus subsp. *ebarbatus*				
Acanthus ilicifolius				
Acrostichum speciosum				
Aegialitis annulata	X	X	X	X
Aegiceras corniculatum	X	X	X	X
Avicennia integra				
Avicennia marina		X	X	X
Bruguiera exaristata	X	X	X	X
Bruguiera gymnorhiza				
Bruguiera parviflora		X	X	X
Bruguiera sexangula				
Camptostemon schultzii		X	X	X
Ceriops australis	X	X	X	X
Ceriops decandra				
Ceriops tagal				
Cynometra iripa				
Diospyros littorea				
Excoecaria agallocha		X	X	X
Lumnitzera littorea				
Lumnitzera racemosa		X	X	X
Nypa fruticans				
Osbornia octodonta	X	X	X	X
Pemphis acidula				
Rhizophora apiculata				
Rhizophora X *lamarckii*				
Rhizophora stylosa	X	X	X	X
Scyphiphora hydrophylacea				
Sonneratia alba	X	X	X	X
Sonneratia lanceolata				
Sonneratia X *urama*				
Xylocarpus granatum		X->		
Xylocarpus moluccensis		X	X	X
TOTAL recorded	**7**	**14**	**13**	**13**
TOTAL in vicinity	**15**	**16**	**16**	**16**
Sources:	SKW	GW81, 85	SKW	NCD

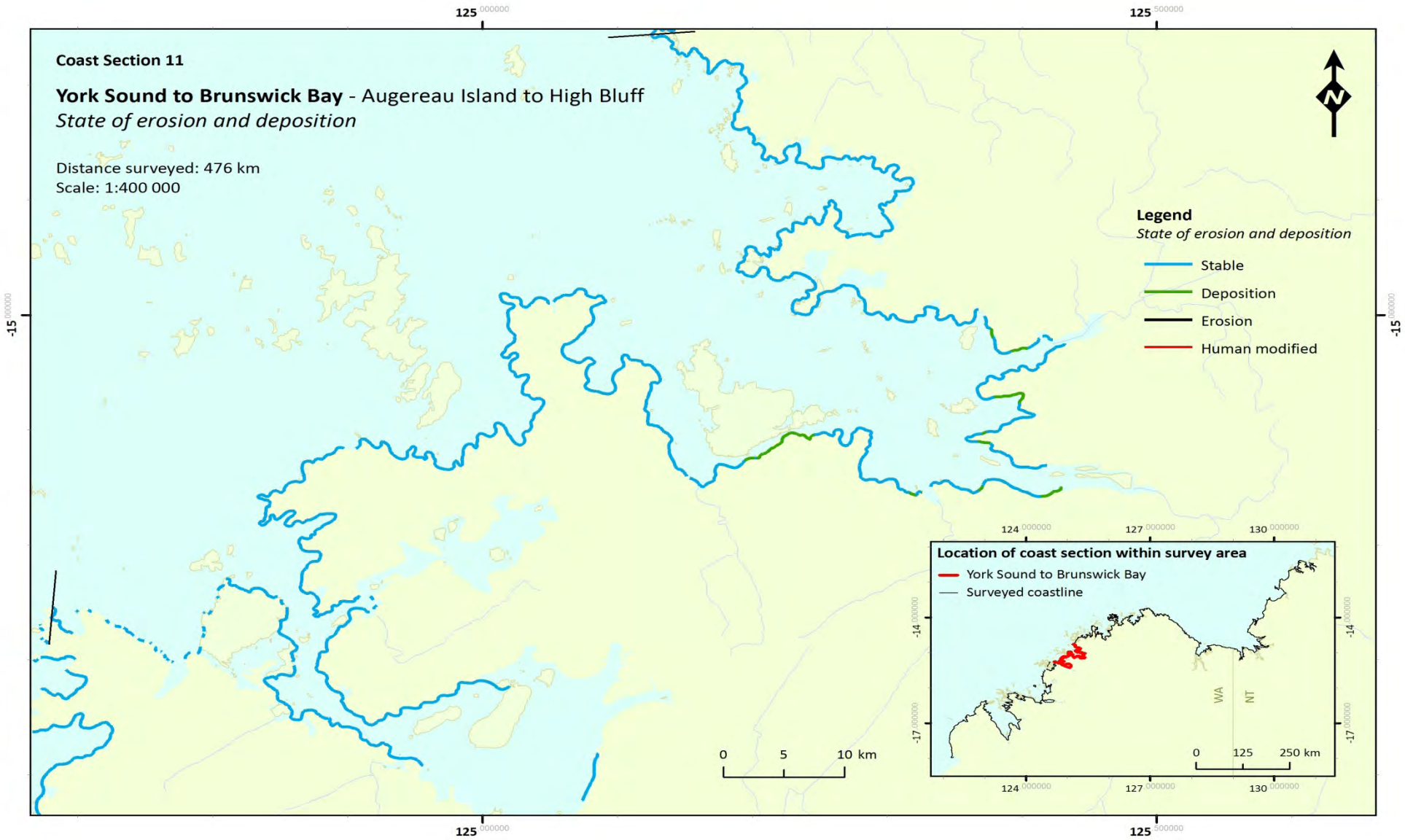


Figure 78: Shoreline stability in the York Sound to Brunswick Bay region

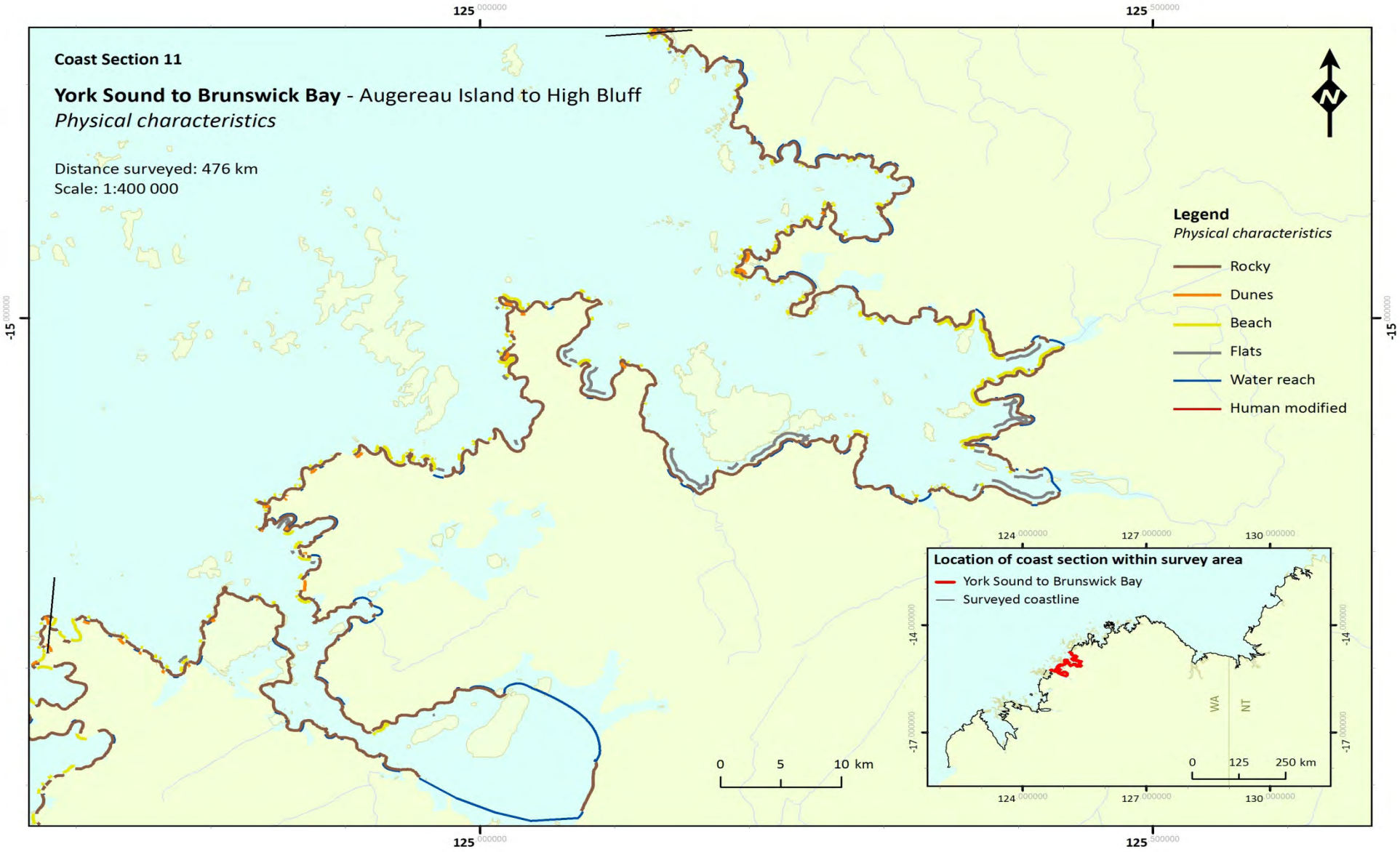


Figure 79: Shoreline physical characteristics in the York Sound to Brunswick Bay region

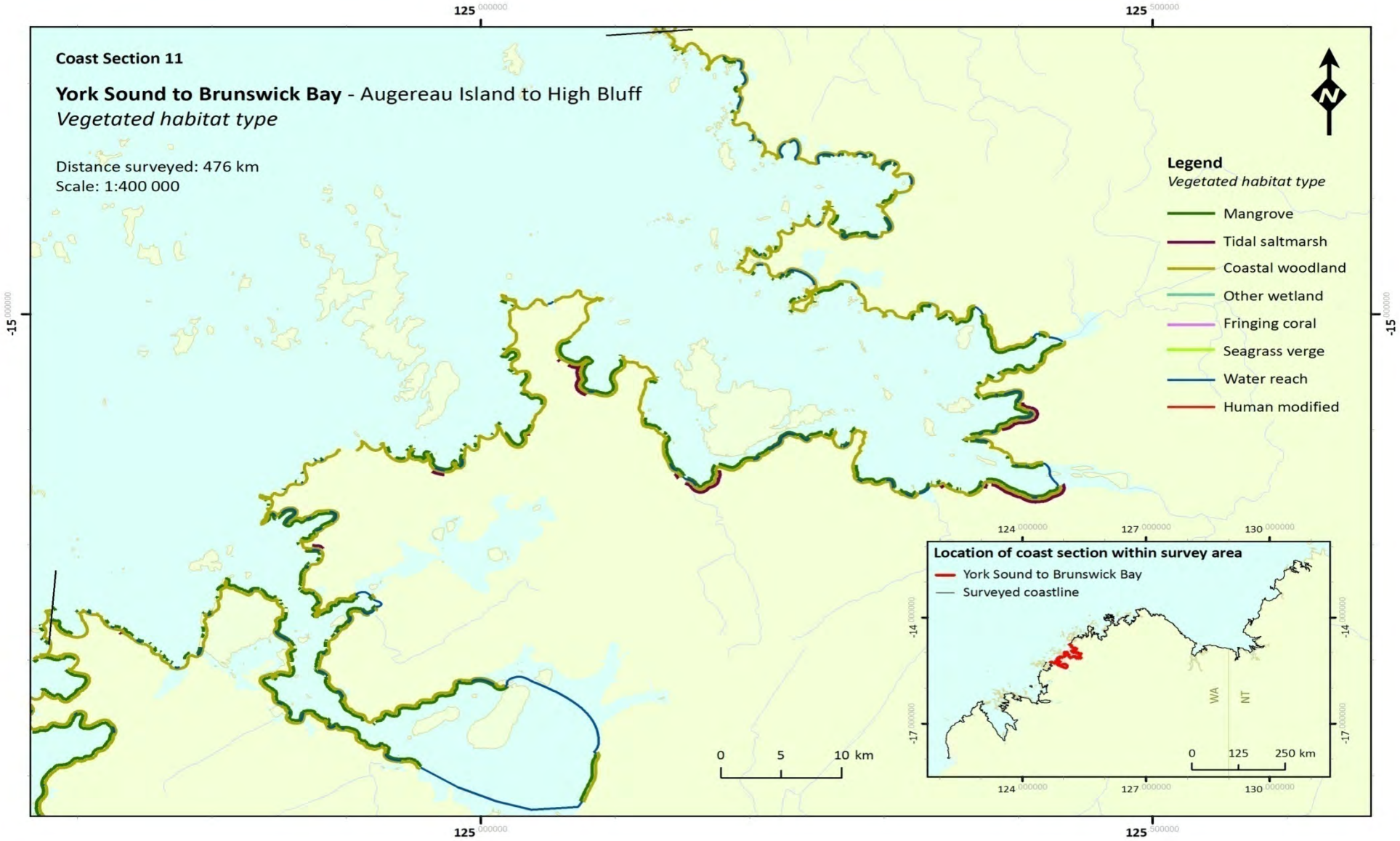


Figure 80: Vegetated habitat types in the York Sound to Brunswick Bay region

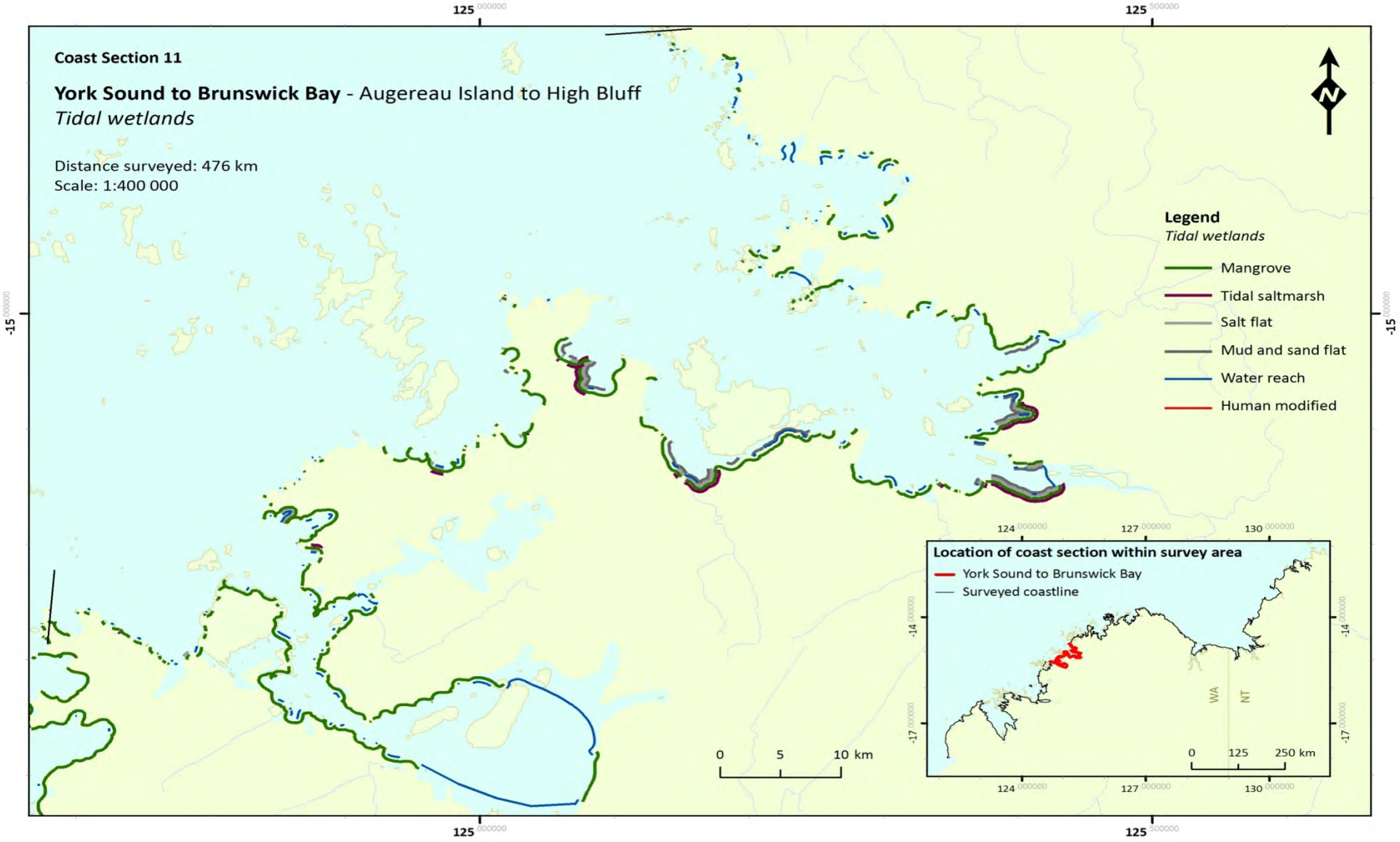


Figure 81: Tidal wetlands in the York Sound to Brunswick Bay region

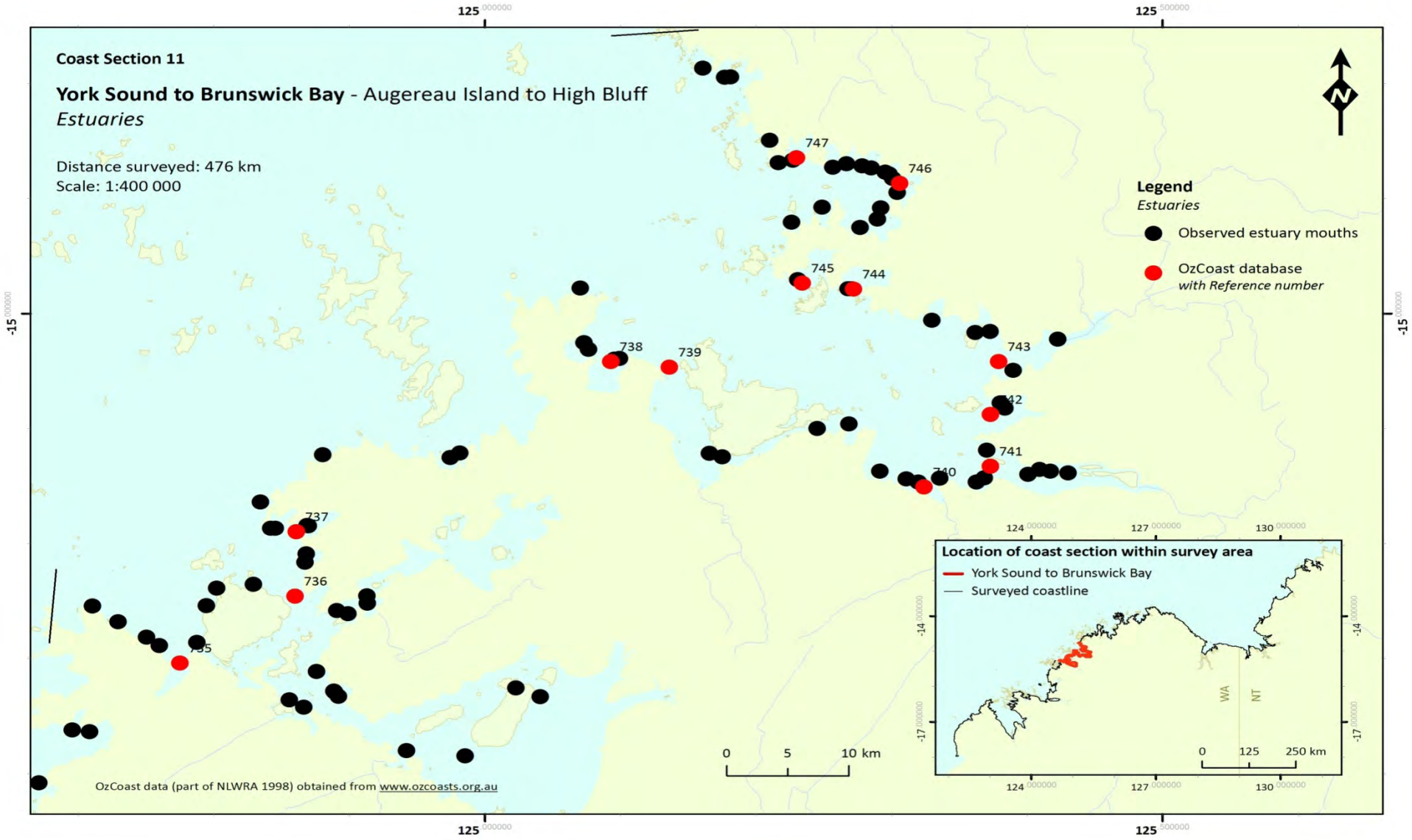


Figure 82: Estuaries in the York Sound to Brunswick Bay region

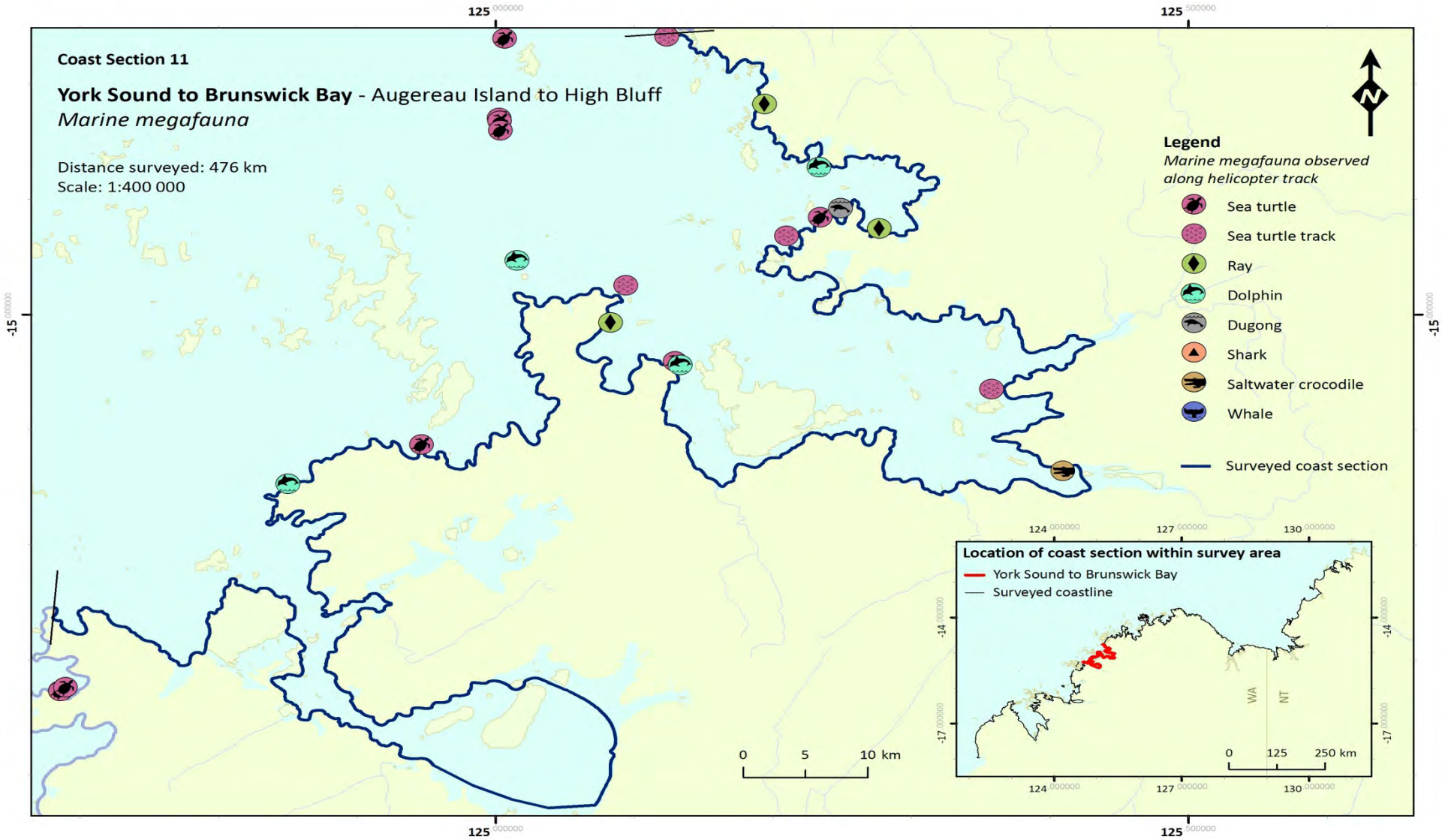


Figure 83: Marine megafauna observed in the York Sound to Brunswick Bay region

3.12 Augustus Island to Doubtful Bay (WA)

Coast region start: Lat: -15.25307
Long: 124.68100
Coast region end: Lat: -15.95424
Long: 124.23398

Region encompasses High Bluff to Raft Point and includes Deception Bay and Yawajaba Island.

- 336 km coast surveyed, being 7% of the total 5102 km.
- Mangroves are common in the region, growing on 65.6% of the coast, 220.5 km. Total area of tidal wetland in the region is 296.82 km^2 (OzCoasts 2009), calculated as 0.88 km^2 tidal wetland per kilometer of coastline surveyed in the region.
- A very small amount of coast has been modified by humans.
- Estuaries in this region include Doubtful Bay South and East, Deception Bay, Sampson Inlet and the mouth of the Sale River.
- Marine megafauna in this region crocodiles, dugong, sea turtles and dolphins.

Table 60: Summary of coastal characteristics in the Augustus Island to Doubtful Bay region.

		km	*% of region*
Physical characteristics	**Rocky**	253.7	*75.5*
	Beach	92.3	*27.5*
	Flat	77.3	*23.0*
	Dune	47.4	*14.1*
	Other wetland	0.0	*0.0*
Vegetated habitat type	**Mangrove**	220.5	*65.6*
	Saltmarsh	27.8	*8.3*
	Fringing coral	0.0	*0.0*
	Seagrass verge	1.2	*0.4*
	Coastal Woodland	296.7	*88.3*
State of erosion and deposition	**Deposition**	26.7	*7.9*
	Erosion	6.4	*1.9*
	Stable	270.9	*80.6*
Tidal wetlands	**Mangrove**	220.5	*65.6*
	Saltmarsh	27.8	*8.3*
	Sand and mud flats	76.3	*22.7*
	Salt flat	15.5	*4.6*
Other	**Human modified**	0.5	*0.2*
	Water reach	35.2	*10.5*

Augustus Island to Doubtful Bay (WA)

Figure 84: Representative coastline imagery from the Augustus Island to Doubtful Bay region. Image numbers are unique within the electronic database

Table 61: Summary of marine megafauna observed during aerial surveys of Augustus Island to Doubtful Bay (WA).

Common name	Genus/Species	Total observed
Australian snubfin dolphin	*Orcaella heinsohni*	0
Indo-Pacific bottlenose	*Tursiops aduncas*	0
Unidentified dolphin species	Family Delphinidae	5
Sea turtle	*Chelonia* or *Caretta* spp	32
Sea turtle track	*Chelonia* or *Caretta* spp	1
Dugong	*Dugong dugong*	3
Whale	*Order Cetacea*	0
Manta ray	*Manta birostris*	0
Ray species	Superorder Batoidea	1
Saltwater crocodile	*Crocodylus porosus*	2
Unidentified shark species	Superorder: Selachimorph	4

Table 62: Coastline data for the Augustus Island to Doubtful Bay, WA region. Source OzCoasts 2009.

NT-WA Survey – 12. Augustus Island to Doubtful Bay, WA		
Features	**#12**	**Relevance to survey region**
Annual Rainfall –range & mean (mm)	1100-1400 (1180)	Average
Number of estuaries listed	8	Average
Total Catchment Area (km2)	5771	Below average size
Total Estuary Length (km)	159.1	Average size
Tidal Range (in m)	8.83	
Condition Status	Near Pristine	Virtually no disturbance by humans
Area of Mangrove (km2)	197.11	
Area of Salt Marsh (km2)	99.70	
WCI% from Region Total	66.4	
Total Tidal Wetland (km2)	296.81	
BOM 1998 Climatic Area	Tropical Savannah - Wet Autumn	
Mangrove species number	12	15 in vicinity
Mangrove species limit west	0	

Table 63: Estuary data for notable estuaries within the Augustus Island to Doubtful Bay, WA region. Source NLWRA; 1998.

NT-WA Survey **12. Augustus Island to Doubtful Bay**				
Feature / Location	**Doubtful Bay South**	**Doubtful Bay East**	**George Water**	**Wedge Hill Creeks**
NLWRA Estuary Reference#	**727**	**728**	**730**	**731**
Latitude S	16.157	16.118	15.956	15.885
Longitude E	124.521	124.584	124.589	124.447
Annual Rainfall – mean (mm)	1100	1199	1127	1145
Catchment Area (km2)	635	163	2824	234
Estuary Length (km)	14.54	11.33	62.52	22.12
Tidal Range (in m)	9.5	9.1	8.6	8.7
Condition Status	P	P	P	P
Area of Mangrove (km2)	23.69	30.08	119.64	14.19
Area of Salt Marsh (km2)	1.17	1.47	94.07	2.42
Wetland Cover Index (WCI %)	95.3	95.3	56.0	85.4
Total Tidal Wetland (km2)	24.86	31.55	213.71	16.61
BOM 1998 Climatic Area	Tropical Savannah - Wet Autumn	Tropical Savannah - Wet Autumn	Tropical Savannah - Wet Autumn	Tropical Savannah - Wet Autumn
Mangrove species number			12 (15)	
Source of mangrove data:			GW85	

Table 64: Mangrove species present in the Northern Territory and Western Australia. Green highlights species with ranges within the Augustus Island to Doubtful Bay, WA region(source: Duke 2006). Crosses identify recorded species occurrence in the listed estuary. Yellow denotes western limit of species range.

12. Augustus Island to Doubtful Bay	
Species/ Locations	**George Water #730**
Acanthus ebracteatus subsp. *ebarbatus*	
Acanthus ilicifolius	
Acrostichum speciosum	
Aegialitis annulata	X
Aegiceras corniculatum	X
Avicennia integra	
Avicennia marina	X
Bruguiera exaristata	X
Bruguiera gymnorhiza	
Bruguiera parviflora	X
Bruguiera sexangula	
Camptostemon schultzii	X
Ceriops australis	X
Ceriops decandra	
Ceriops tagal	
Cynometra iripa	
Diospyros littorea	
Excoecaria agallocha	X
Lumnitzera littorea	
Lumnitzera racemosa	
Nypa fruticans	
Osbornia octodonta	X
Pemphis acidula	
Rhizophora apiculata	
Rhizophora X *lamarckii*	
Rhizophora stylosa	X
Scyphiphora hydrophylacea	
Sonneratia alba	X
Sonneratia lanceolata	
Sonneratia X *urama*	
Xylocarpus granatum	
Xylocarpus moluccensis	X
TOTAL recorded	**12**
TOTAL in vicinity	**15**
Sources:	GW85

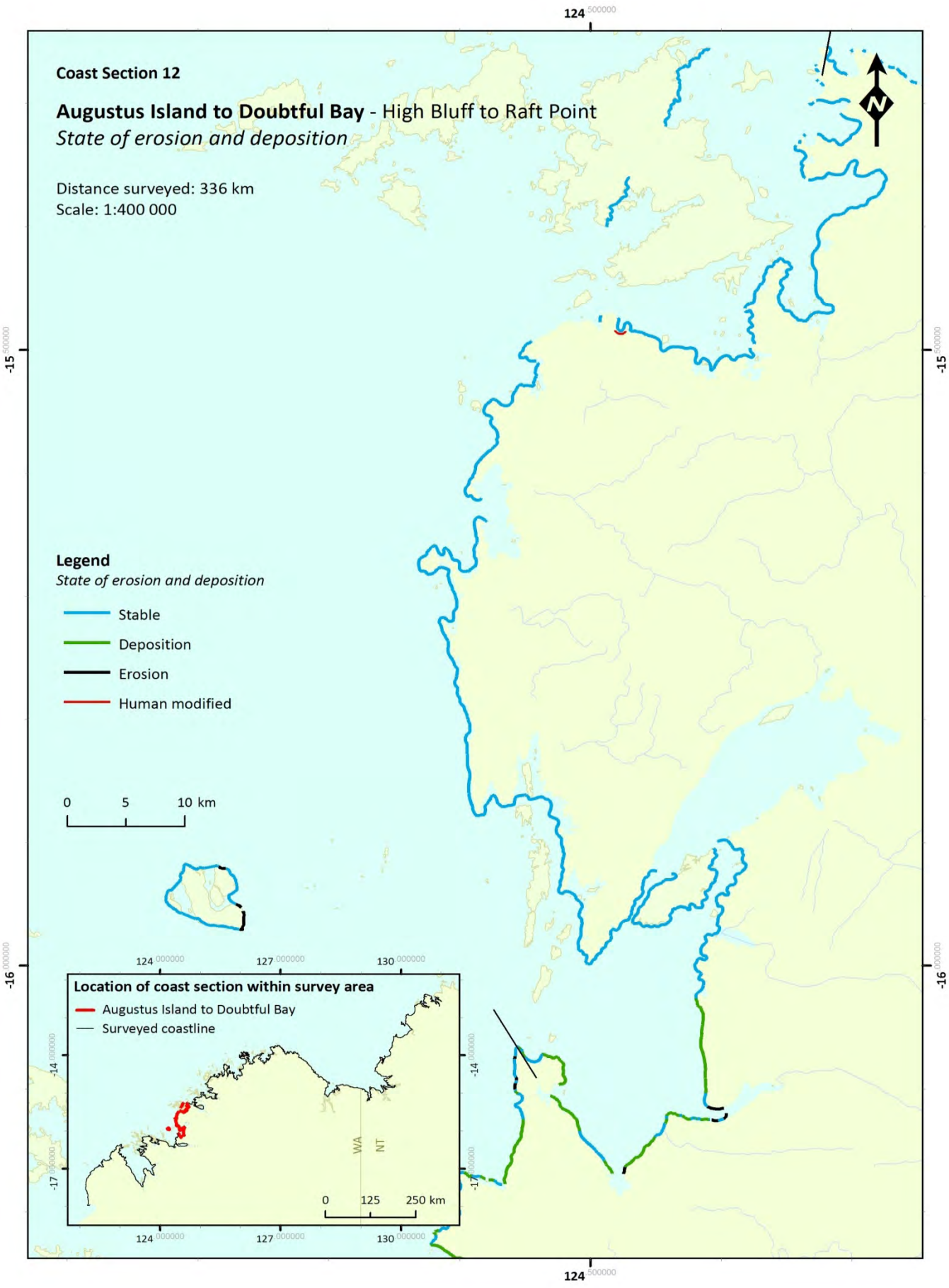


Figure 85: Shoreline stability in the Augustus Island to Doubtful Bay region

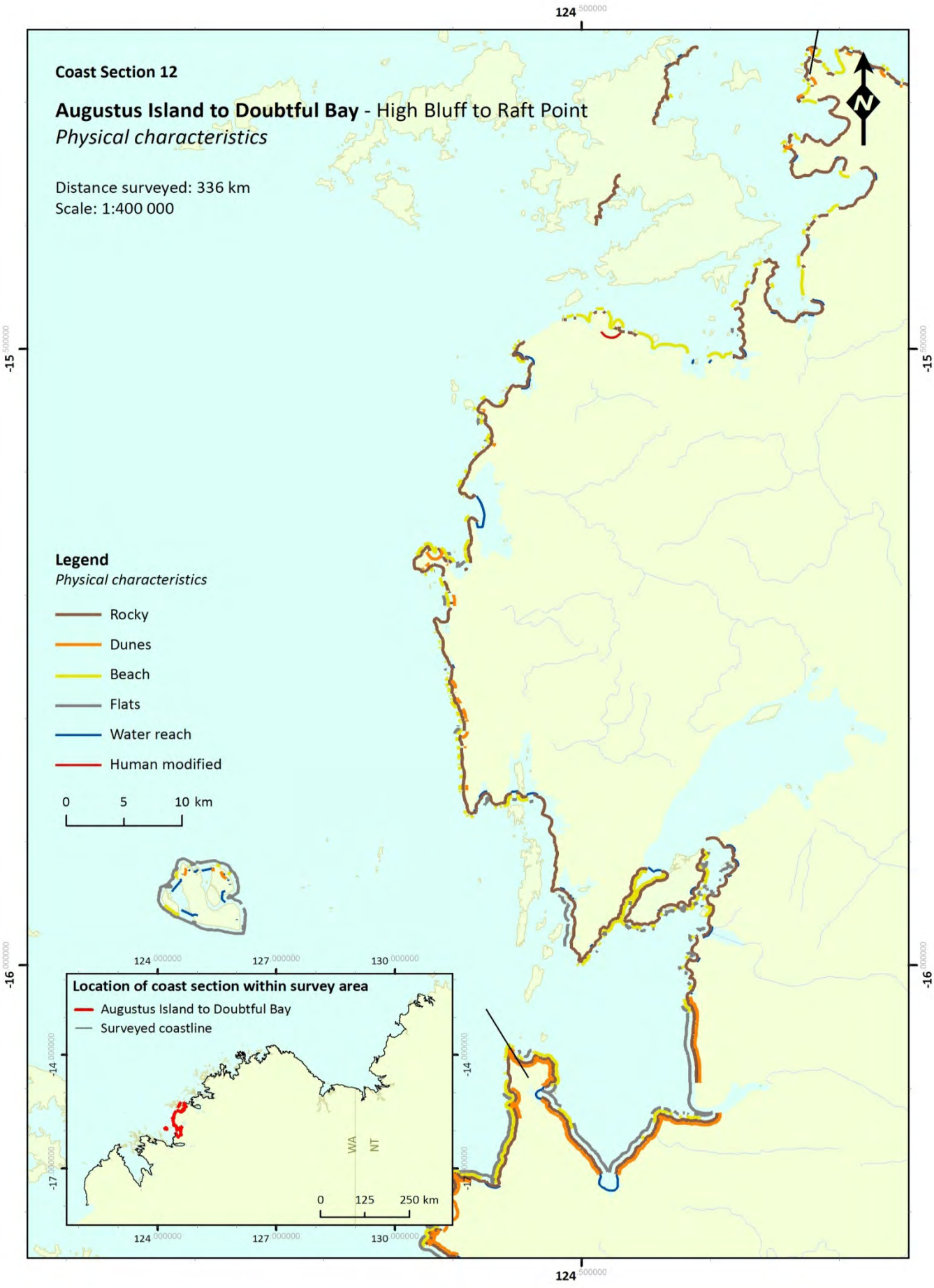


Figure 86: Physical characteristics in the Augustus Island to Doubtful Bay region

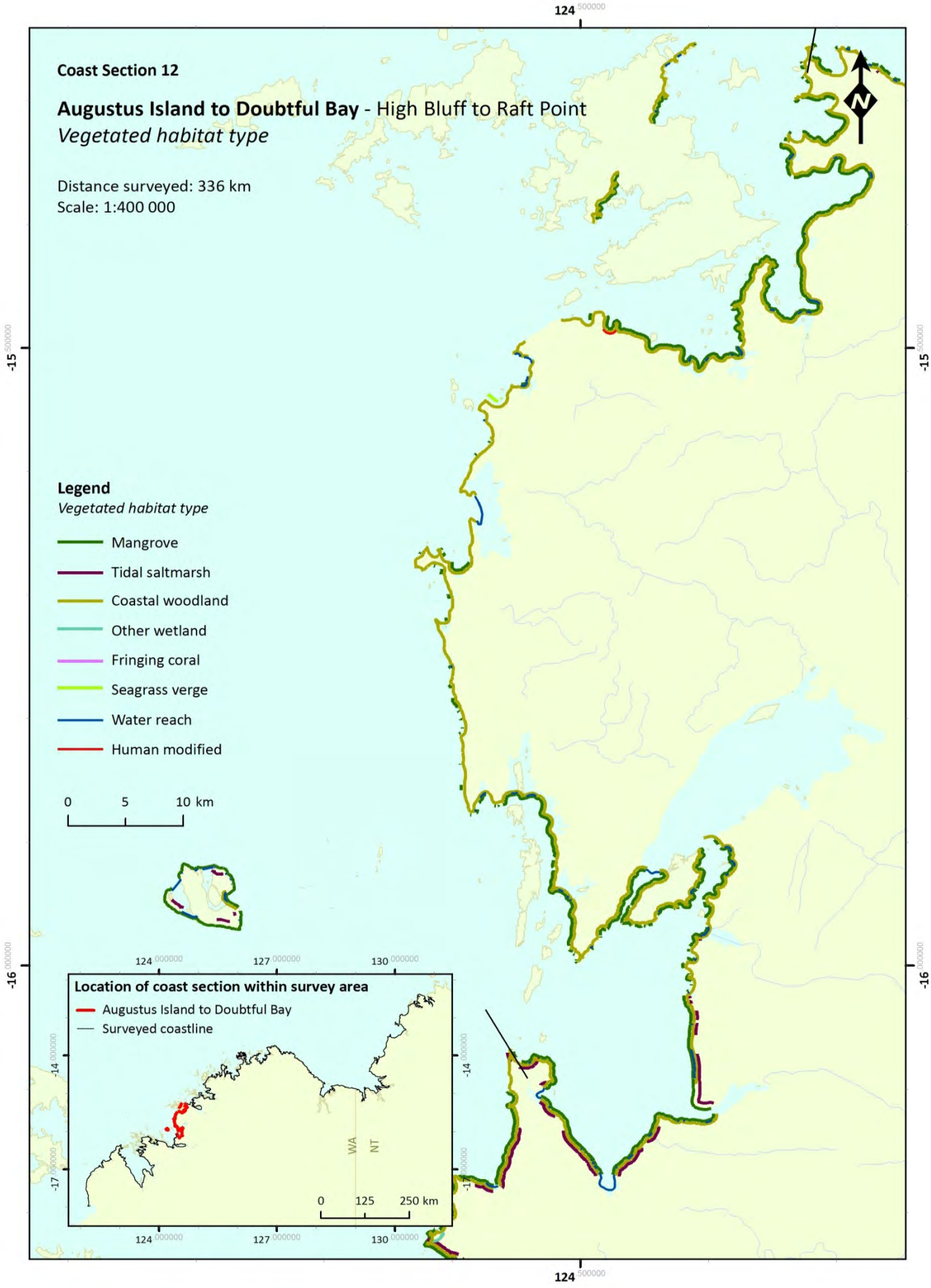


Figure 87: Vegetated habitat types in the Augustus Island to Doubtful Bay region

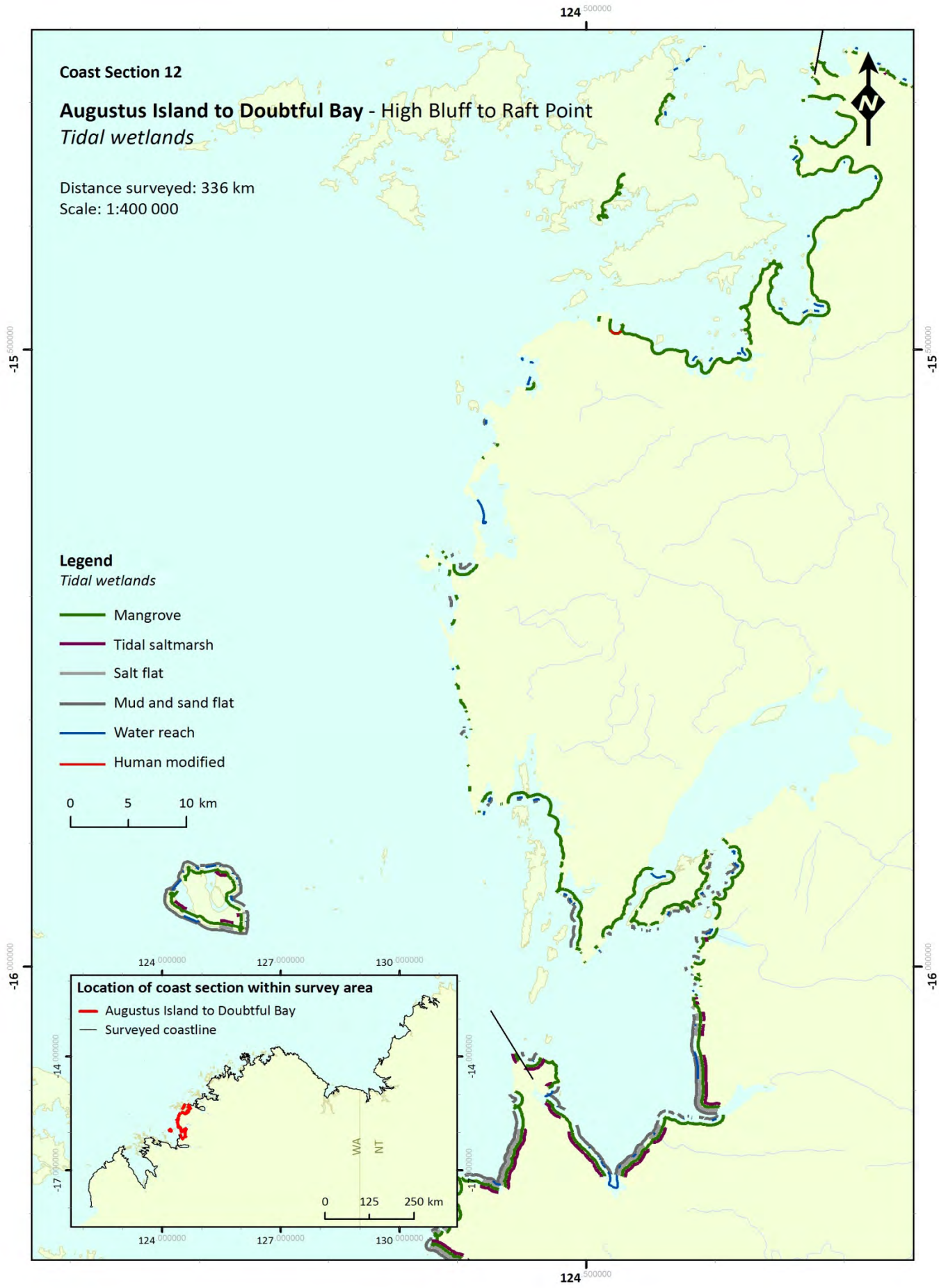


Figure 88: Tidal wetlands in the Augustus Island to Doubtful Bay region

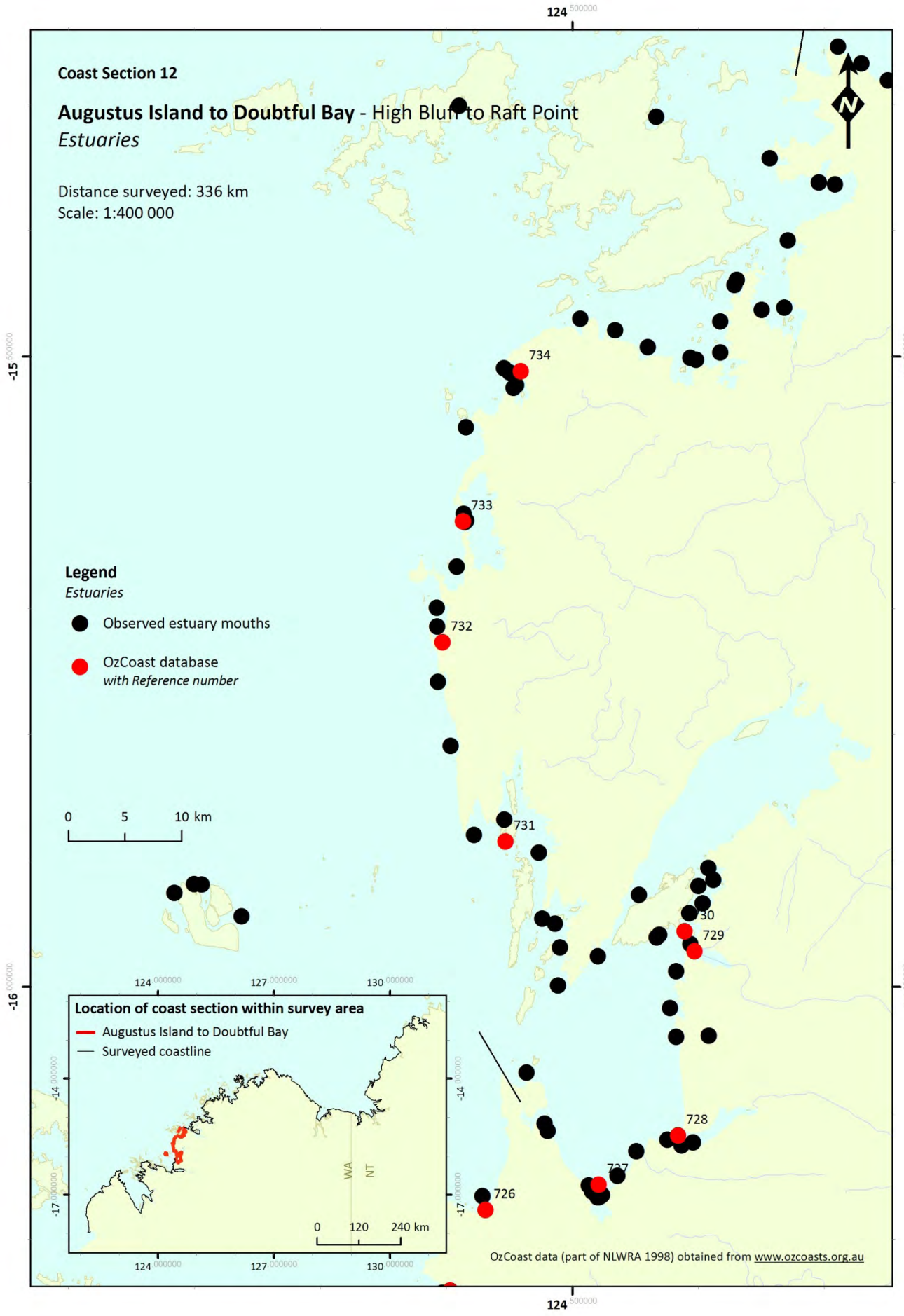


Figure 89: Estuaries in the Augustus Island to Doubtful Bay region

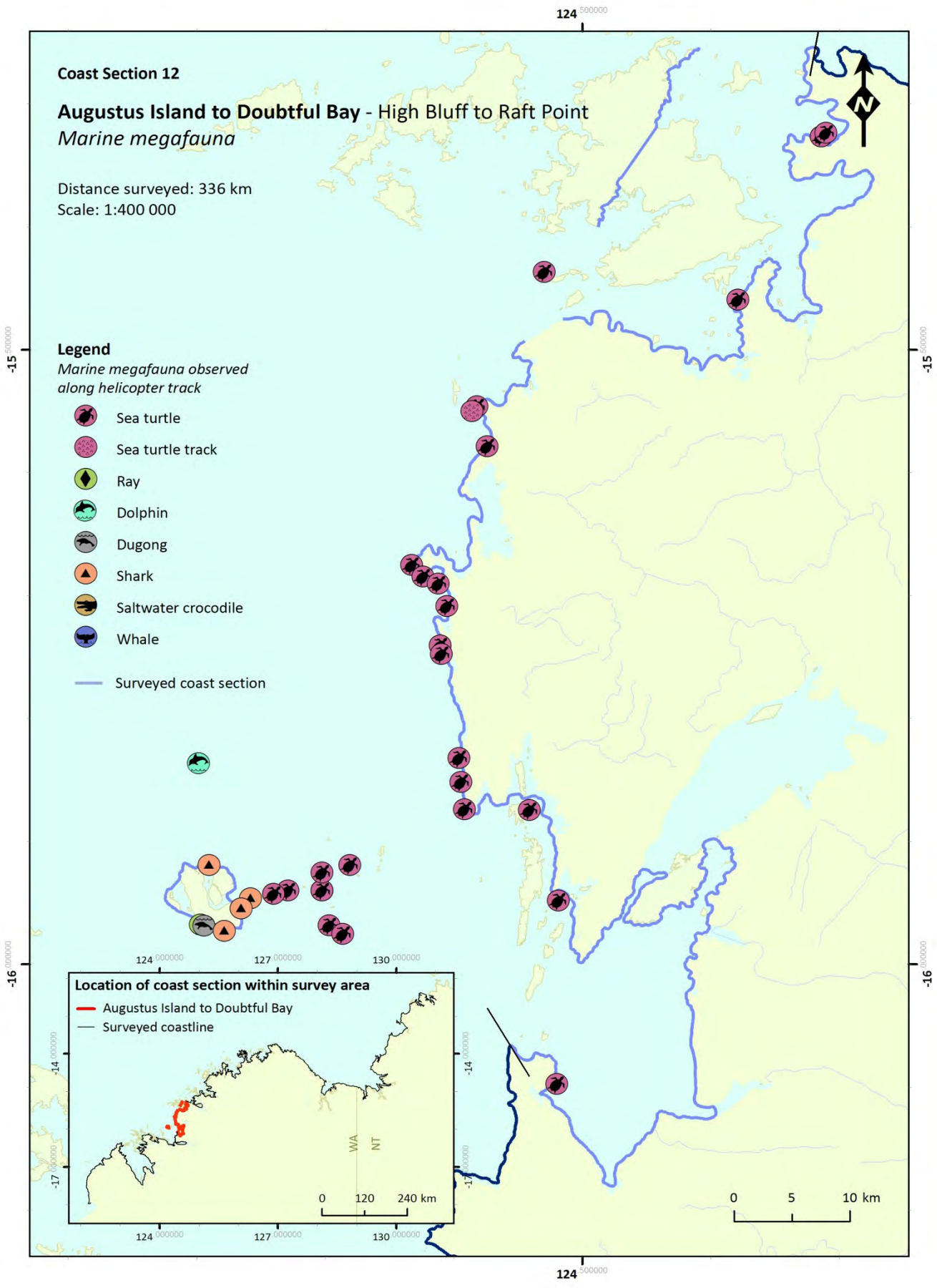


Figure 90: Marine megafauna in the Augustus Island to Doubtful Bay region

3.13 Collier Bay to Cascade Bay (WA)

Coast region start: Lat: -16.06259
Long: 124.44121
Coast region end: Lat: -16.66348
Long: 123.50681

Region encompasses Raft Point to Usborne Point and includes Walcott Inlet, Koolan Island, and Myridi Bay.

- 591 km coast surveyed, being 12% of the total 5102 km.
- The region is dominated by rocky shore, spanning 514.9 km of the coast, 87.1% of the region.
- Mangroves grow along on 73.9% of the coast in the region, 437 km. Total area of tidal wetland in the region is 489.88 km^2 (OzCoasts 2009), calculated as 0.83 km^2 tidal wetland per kilometer of coastline surveyed in the region.
- A very small amount of coast has been modified by humans. 3.7 km or 0.6% of the region.
- Estuaries in this region include Cascade Bay, Secure Bay, Talbot Bay and Eagle Point.
- Marine megafauna in this region included many sea turtles, dolphins and dugong.

Table 65: Summary of coastal characteristics in Collier Bay to Cascade Bay region.

		km	*% of region*
Physical characteristics	**Rocky**	514.9	*87.1*
	Beach	175.7	*29.7*
	Flat	210.9	*35.7*
	Dune	289.4	*49.0*
	Other wetland	4.8	*0.8*
Vegetated habitat type	**Mangrove**	437.0	*73.9*
	Saltmarsh	56.6	*9.6*
	Fringing coral	5.2	*0.9*
	Seagrass verge	0.0	*0.0*
	Coastal Woodland	549.1	*92.9*
State of erosion and deposition	**Deposition**	183.5	*31.1*
	Erosion	5.1	*0.9*
	Stable	311.1	*52.6*
Tidal wetlands	**Mangrove**	437.0	*73.9*
	Saltmarsh	56.6	*9.6*
	Sand and mud flats	201.8	*34.1*
	Salt flat	59.7	*10.1*
Other	**Human modified**	3.7	*0.6*
	Water reach	59.9	*10.1*

Collier Bay to Cascade Bay (WA)

Figure 91: Representative coastline imagery from the Collier Bay to Cascade Bay region.

Image numbers are unique within the electronic database

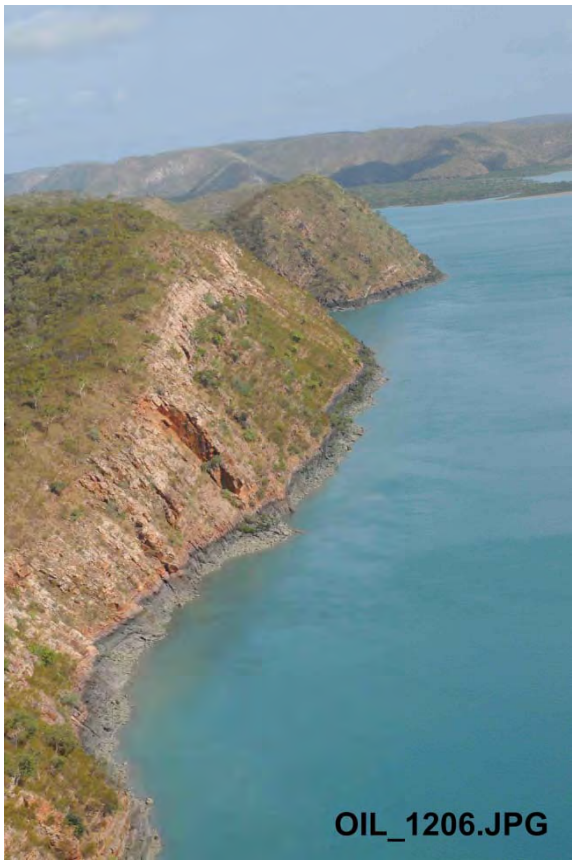


Table 66: Summary of marine megafauna observed during aerial surveys of Collier Bay to Cascade Bay (WA).

Common name	Genus/Species	Total observed
Australian snubfin dolphin	*Orcaella heinsohni*	2
Indo-Pacific bottlenose	*Tursiops aduncas*	0
Unidentified dolphin species	Family Delphinidae	10
Sea turtle	*Chelonia* or *Caretta* spp	71
Sea turtle track	*Chelonia* or *Caretta* spp	0
Dugong	*Dugong dugong*	12
Whale	*Order Cetacea*	0
Manta ray	*Manta birostris*	0
Ray species	Superorder Batoidea	5
Saltwater crocodile	*Crocodylus porosus*	7
Unidentified shark species	Superorder: Selachimorph	1

Table 67: Coastline data for the Collier Bay to Cascade Bay, WA region. Source OzCoasts 2009.

NT-WA Survey – 13. Collier Bay to Cascade Bay, WA		
Features	**#13**	**Relevance to survey region**
Annual Rainfall –range & mean (mm)	897-1074 (987)	Below average
Number of estuaries listed	13	Far above average
Total Catchment Area (km2)	17128	Below average size
Total Estuary Length (km)	233.8	Above average size
Tidal Range (in m)	9.08	
Condition Status	Near Pristine	Virtually no disturbance by humans
Area of Mangrove (km2)	278.73	
Area of Salt Marsh (km2)	211.15	
WCI% from Region Total	56.9	
Total Tidal Wetland (km2)	489.88	
BOM 1998 Climatic Area	Dry hot steppe - Summer drought to Tropical Savannah - Wet Autumn	
Mangrove species number		15 in vicinity
Mangrove species limit west	0	

Table 68: Estuary data for notable estuaries within the Collier Bay to Cascade Bay, WA region. Source NLWRA; 1998.

NT-WA Survey **13. Collier Bay to Cascade Bay, WA**				
Feature / Location	**Cascade Bay**	**Talbot Bay**	**Secure Bay**	**Walcott Inlet**
NLWRA Estuary Reference#	**714**	**721**	**723**	**724**
Latitude S	16.598	16.211	16.416	16.343
Longitude E	123.516	123.866	124.331	124.394
Annual Rainfall – mean (mm)	897	1007	1025	1041
Catchment Area (km2)	370	1024	1778	12732
Estuary Length (km)	21.09	28.38	27.85	65.86
Tidal Range (in m)	7.8	8.7	10.5	10.5
Condition Status	P	P	P	P
Area of Mangrove (km2)	33.44	39.68	81.32	57.85
Area of Salt Marsh (km2)	3.75	2.24	37.20	148.85
Wetland Cover Index (WCI %)	89.9	94.7	68.6	28.0
Total Tidal Wetland (km2)	37.19	41.92	118.52	206.70
BOM 1998 Climatic Area	Dry hot steppe - Summer drought	Dry hot steppe - Summer drought	Dry hot steppe - Summer drought	Dry hot steppe - Summer drought
Mangrove species number				
Source of mangrove data:				

Table 69: Mangrove species present in the Northern Territory and Western Australia. Green highlights species with ranges within the Collier Bay to Cascade Bay, WA region (source: Duke 2006). Crosses identify recorded species occurrence in the listed estuary. Yellow denotes western limit of species range.

13. Collier Bay to Cascade Bay	
Species/ Locations	None recorded
Acanthus ebracteatus subsp. *ebarbatus*	
Acanthus ilicifolius	
Acrostichum speciosum	
Aegialitis annulata	
Aegiceras corniculatum	
Avicennia integra	
Avicennia marina	
Bruguiera exaristata	
Bruguiera gymnorhiza	
Bruguiera parviflora	
Bruguiera sexangula	
Camptostemon schultzii	
Ceriops australis	
Ceriops decandra	
Ceriops tagal	
Cynometra iripa	
Diospyros littorea	
Excoecaria agallocha	
Lumnitzera littorea	
Lumnitzera racemosa	
Nypa fruticans	
Osbornia octodonta	
Pemphis acidula	
Rhizophora apiculata	
Rhizophora X *lamarckii*	
Rhizophora stylosa	
Scyphiphora hydrophylacea	
Sonneratia alba	
Sonneratia lanceolata	
Sonneratia X *urama*	
Xylocarpus granatum	
Xylocarpus moluccensis	
TOTAL recorded	**0**
TOTAL in vicinity	**15**
Sources:	

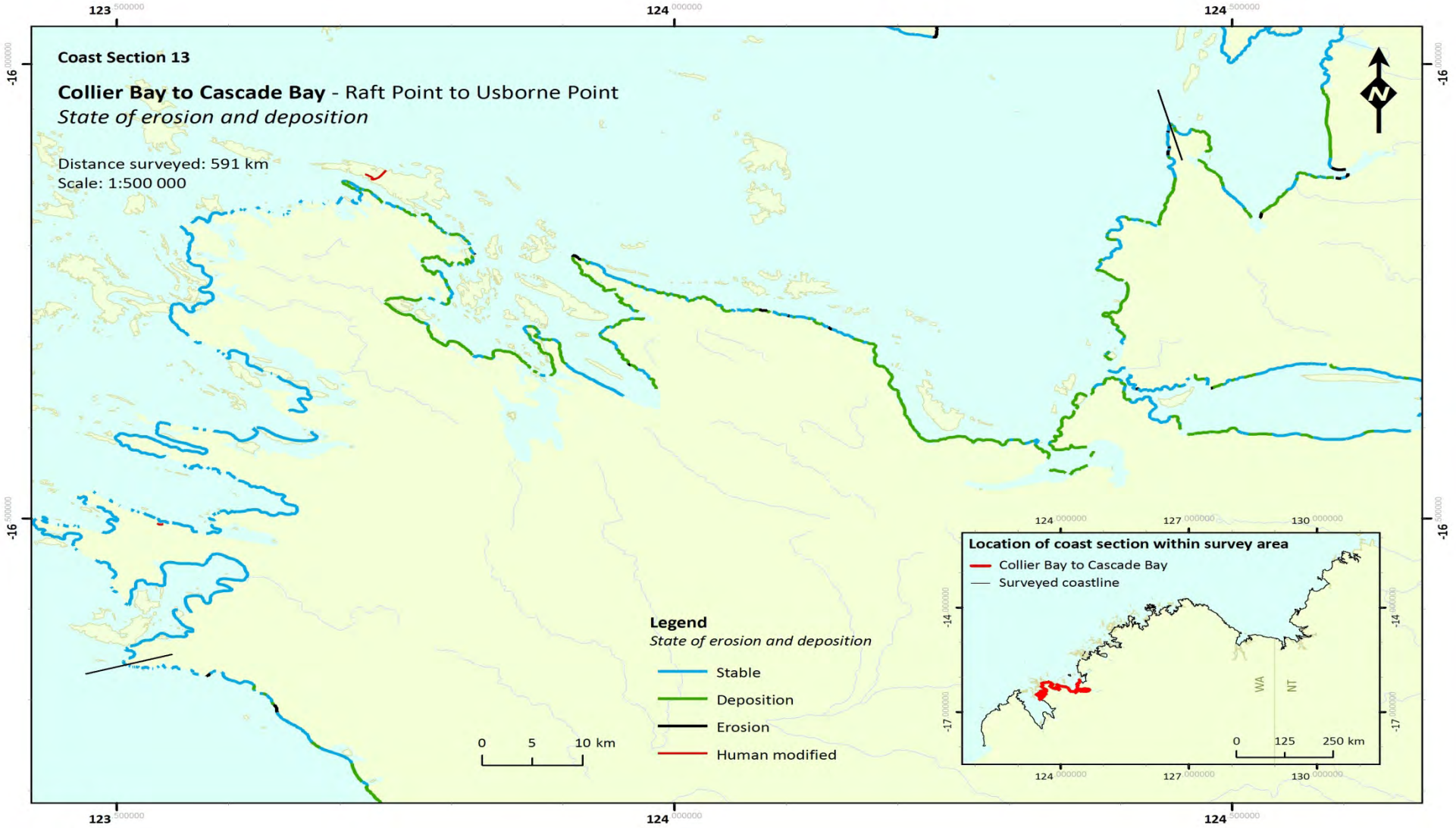


Figure 92: Shoreline stability in the Collier Bay to Cascade Bay region

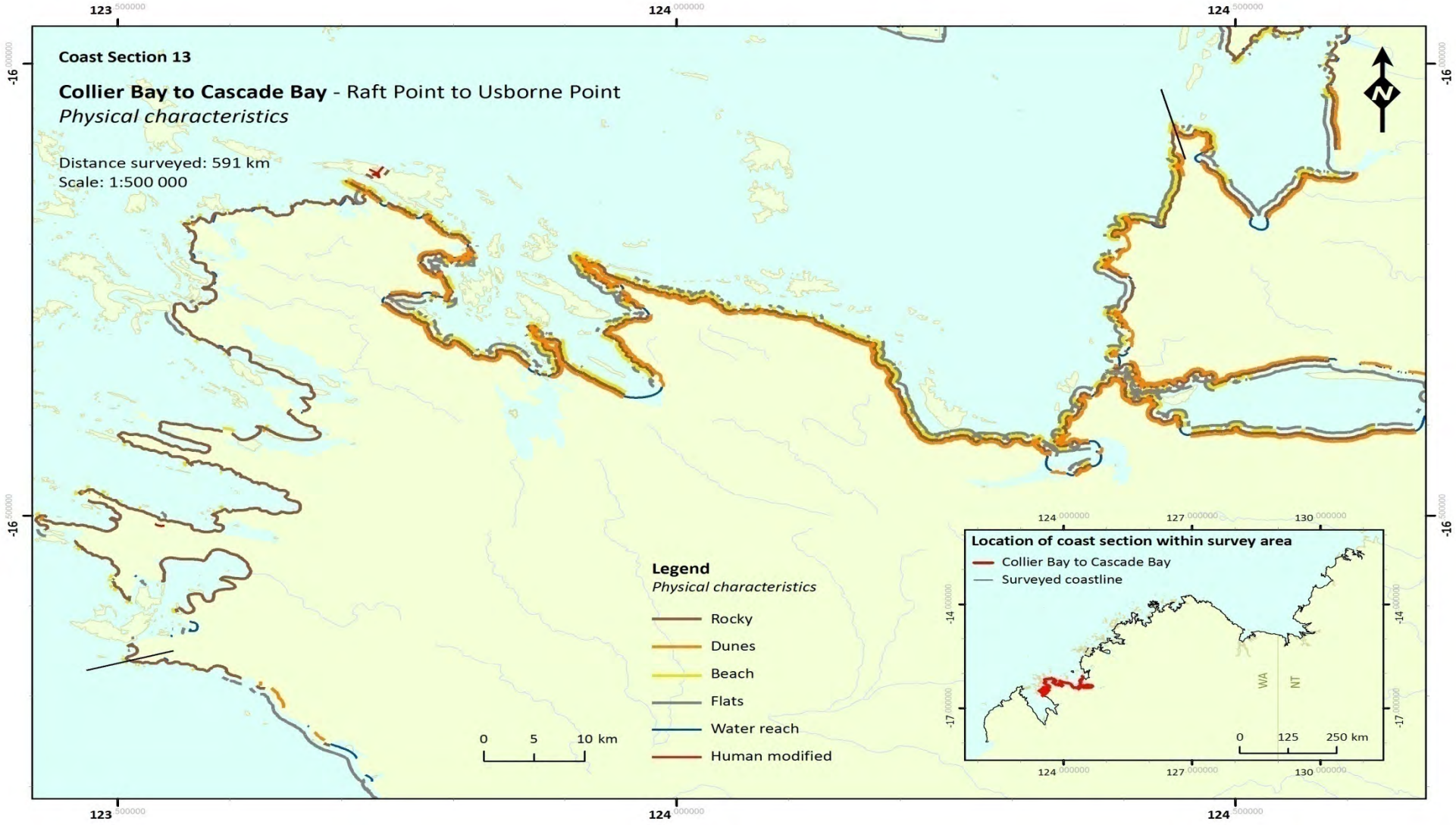


Figure 93: Shoreline physical characteristics in the Collier Bay to Cascade Bay region

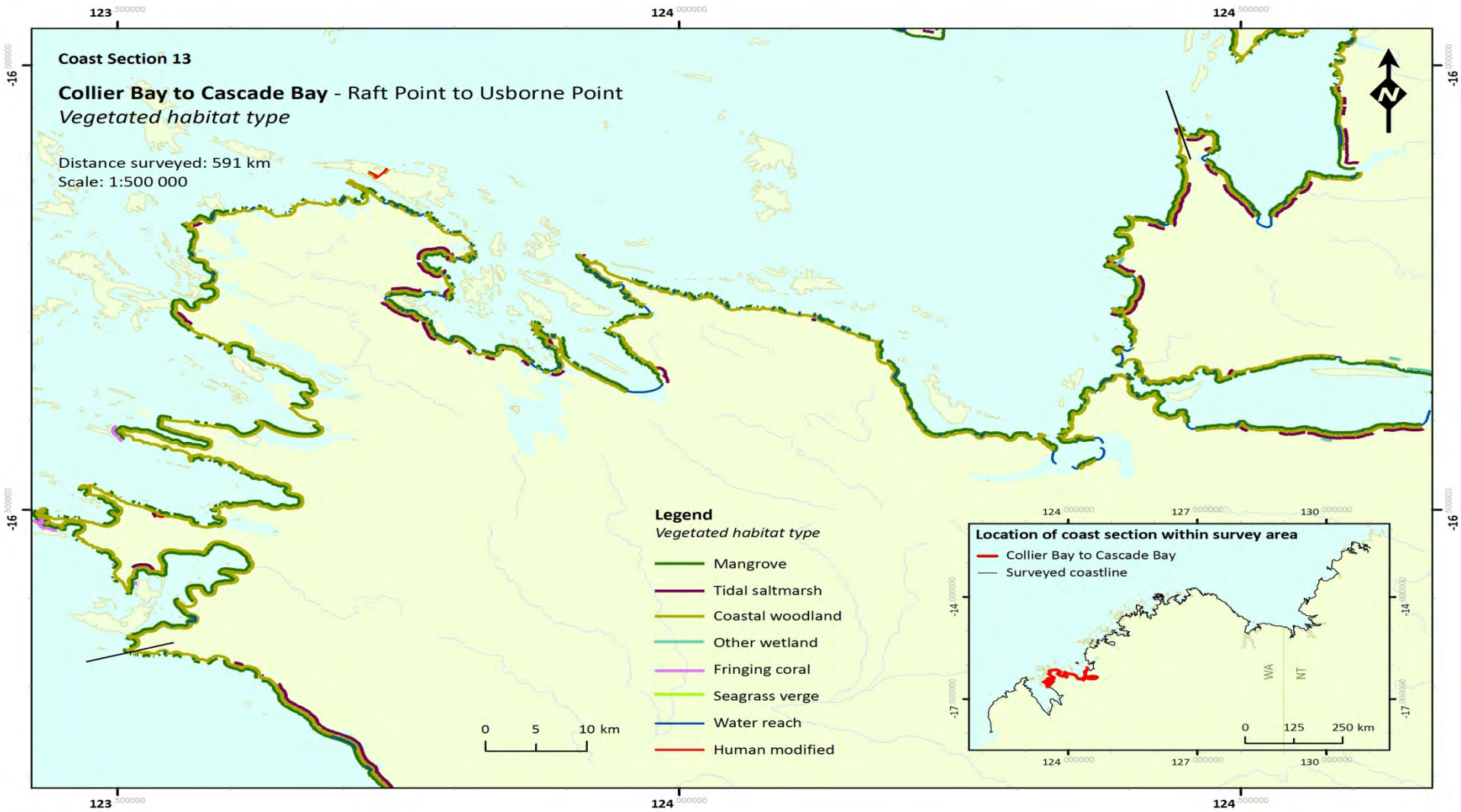


Figure 94: Vegetated habitat types in the Collier Bay to Cascade Bay region

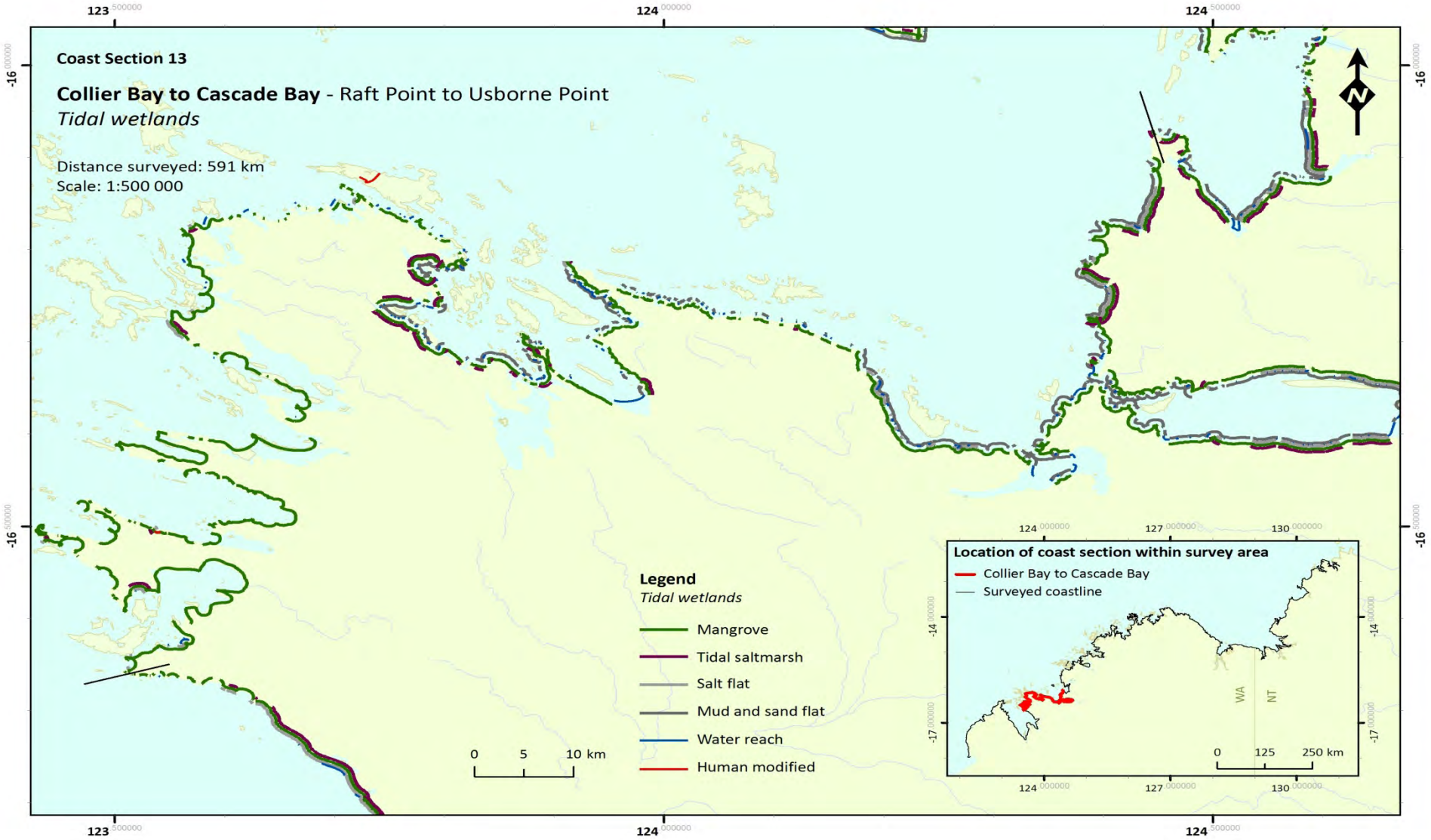


Figure 95: Tidal wetlands in the Collier Bay to Cascade Bay region

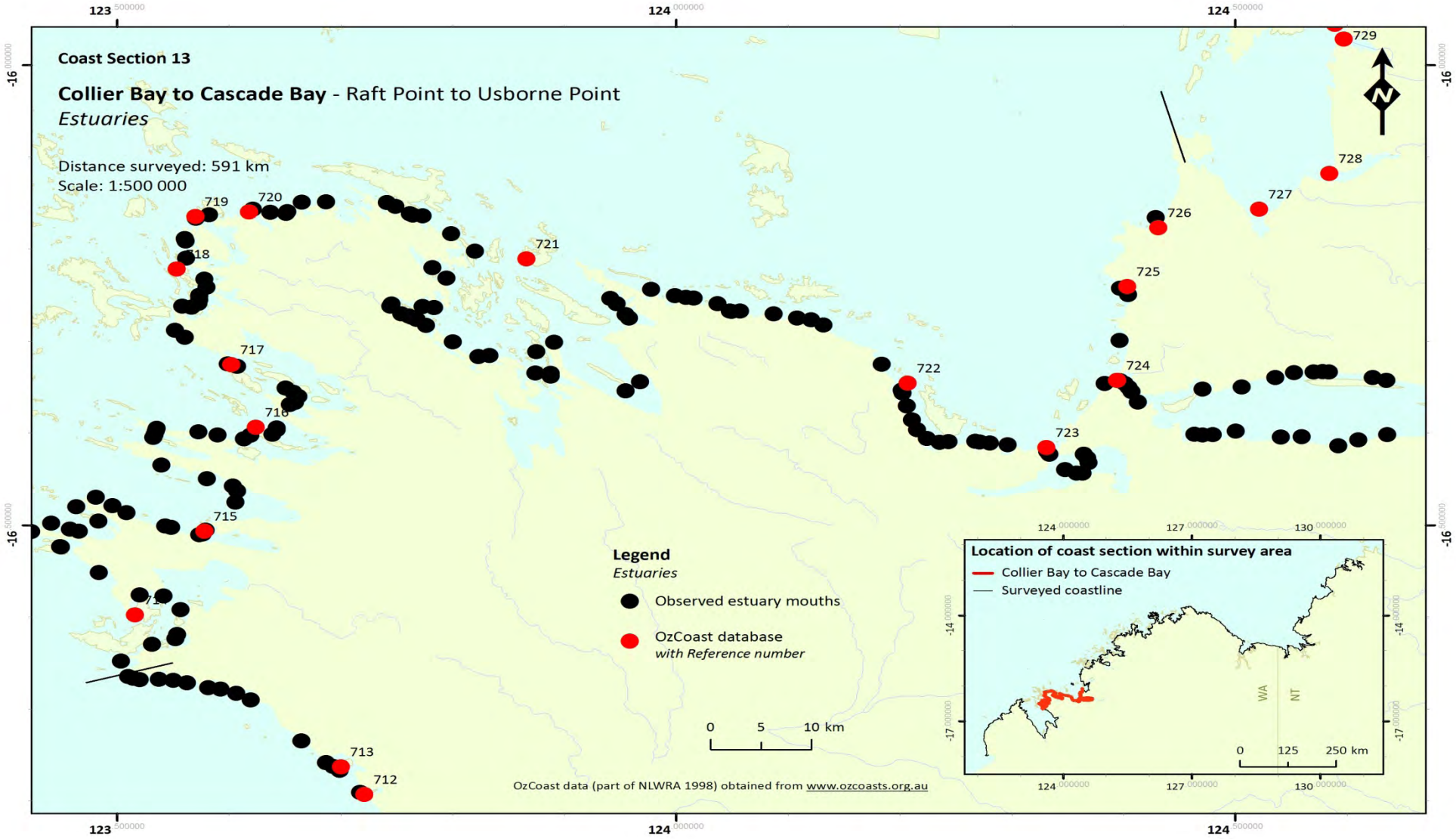


Figure 96: Estuaries in the Collier Bay to Cascade Bay region

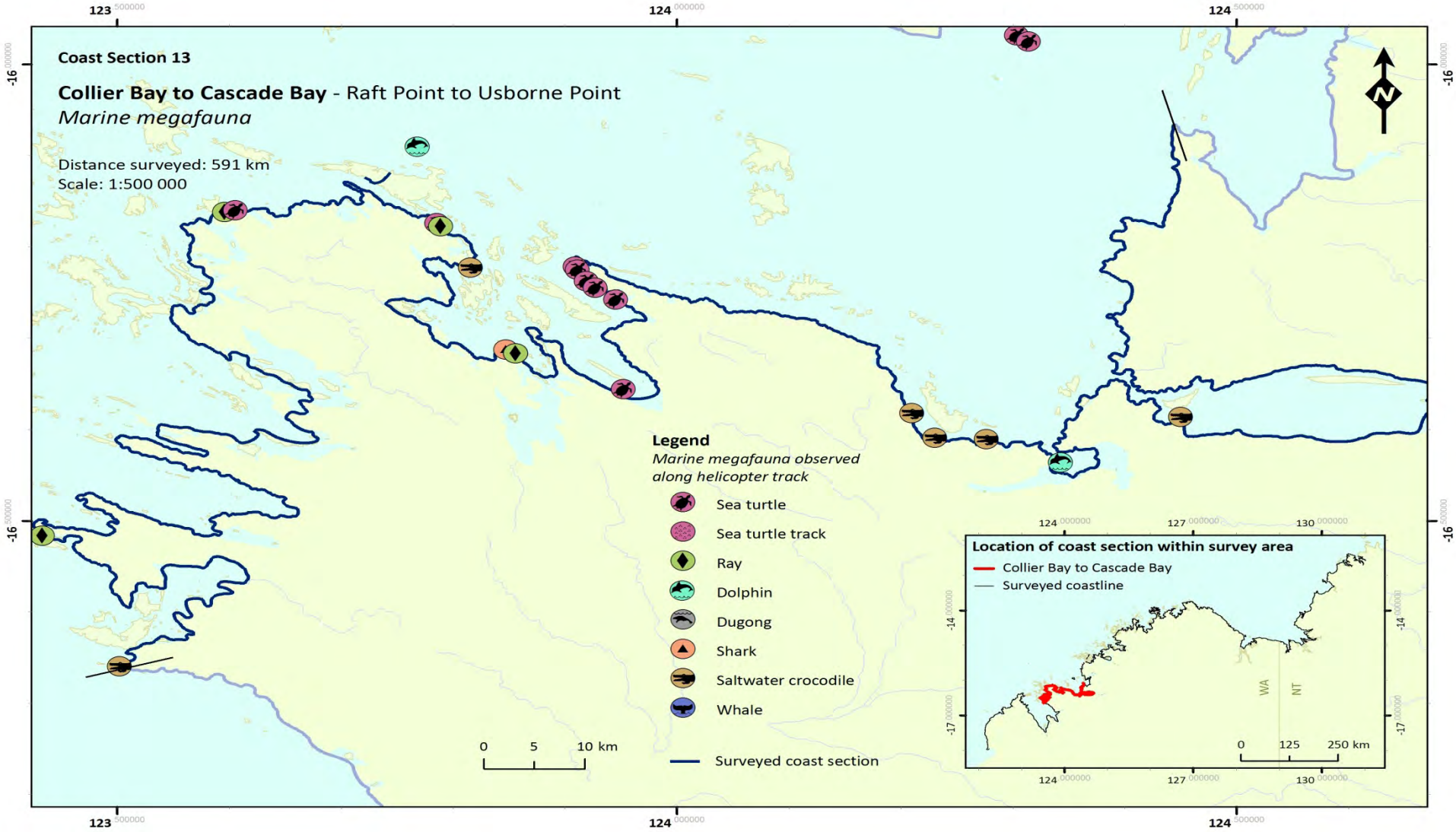


Figure 97: Marine megafauna observed in the Collier Bay to Cascade Bay region

3.14 King Sound (WA)

Coast region start: Lat: -16.6638
Long: 123.50743
Coast region end: Lat: --16.52749
Long: 123.00945

Region encompasses Usborne Point to Cunningham Point.

- 324 km coast surveyed, being 6% of the total 5102 km.
- Mangroves are very common, growing along on 84.6% of the coast in the region, 273.8 km. Total area of tidal wetland in the region is 2487.19 km^2 (OzCoasts 2009), calculated as 7.68 km^2 tidal wetland per kilometer of coastline surveyed in the region.
- A very small amount of coast has been modified by humans. 1.8 km or 0.6% of the region.
- Estuaries in this region include Disaster Bay, Goodenough Bay and the mouths of the Fraser River and the Fitzroy River.
- Marine megafauna in this region was limited to two Snubfin dolphin and 6 sea turtles (*Caretta* or *Chelonia* spp.).

Table 69: Summary of coastal characteristics of the King Sound region.

		km	*% of region*
Physical characteristics	**Rocky**	24.7	*7.6*
	Beach	49.0	*15.1*
	Flat	250.9	*77.5*
	Dune	49.2	*15.2*
	Other wetland	0.0	*0.0*
Vegetated habitat type	**Mangrove**	273.8	*84.6*
	Saltmarsh	225.4	*69.7*
	Fringing coral	0.0	*0.0*
	Seagrass verge	0.0	*0.0*
	Coastal Woodland	147.2	*45.5*
State of erosion and deposition	**Deposition**	79.5	*24.6*
	Erosion	101.0	*31.2*
	Stable	117.5	*36.3*
Tidal wetlands	**Mangrove**	273.8	*84.6*
	Saltmarsh	225.4	*69.7*
	Sand and mud flats	50.2	*15.5*
	Salt flat	232.9	*72.0*
Other	**Human modified**	1.8	*0.6*
	Water reach	31.8	*9.8*

King Sound (WA)

Figure 98: Representative coastline imagery from the King Sound region. Image numbers are unique within the electronic database

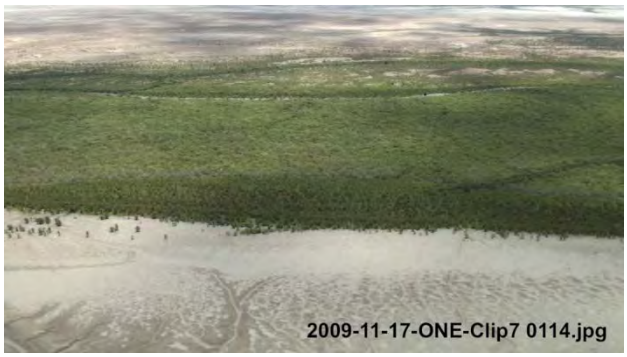


Table 70: Summary of marine megafauna observed during aerial surveys of King Sound (WA).

Common name	Genus/Species	Total observed
Australian snubfin dolphin	*Orcaella heinsohni*	2
Indo-Pacific bottlenose	*Tursiops aduncas*	0
Unidentified dolphin species	Family Delphinidae	0
Sea turtle	*Chelonia* or *Caretta* spp	6
Sea turtle track	*Chelonia* or *Caretta* spp	0
Dugong	*Dugong dugong*	0
Whale	*Order Cetacea*	0
Manta ray	*Manta birostris*	0
Ray species	Superorder Batoidea	0
Saltwater crocodile	*Crocodylus porosus*	0
Unidentified shark species	Superorder: Selachimorph	0

Table 71: Coastline data for the King Sound, WA region. Source OzCoasts 2009.

NT-WA Survey – 14. King Sound, WA		
Features	**#14**	**Relevance to survey region**
Annual Rainfall –range & mean (mm)	800-900 (841)	Below average
Number of estuaries listed	15	Far above average
Total Catchment Area (km2)	265861	Above average size
Total Estuary Length (km)	301.1	Above average size
Tidal Range (in m)	8.63	
Condition Status	Near Pristine to Largely Unmodified	Very low disturbance by humans
Area of Mangrove (km2)	373.31	
Area of Salt Marsh (km2)	2113.88	
WCI% from Region Total	15.0	
Total Tidal Wetland (km2)	2487.19	
BOM 1998 Climatic Area	Dry hot steppe - Summer drought	
Mangrove species number	13	15 in vicinity
Mangrove species limit west	2	

Table 72: Estuary data for notable estuaries within the King Sound, WA region. Source NLWRA; 1998.

NT-WA Survey **14. King Sound, WA**				
Feature / Location	**King Sound – Goodenough to Cascade**	**Fitzroy River**	**Point Torment Creek**	**Point Torment Creek, near Koolan Is.**
NLWRA Estuary Reference#	**699**	**704**	**706**	**707**
Latitude S	16.703	17.390	17.003	17.037
Longitude E	123.310	123.542	123.610	123.693
Annual Rainfall – mean (mm)	900	800	850	800
Catchment Area (km2)	136668	103900	49	222
Estuary Length (km)	81.02	31.16	6.66	20.14
Tidal Range (in m)	8.7	9.3	8.8	9
Condition Status	P	LU	P	P
Area of Mangrove (km2)	165.63	30.30	9.37	20.99
Area of Salt Marsh (km2)	590.43	580.65	16.06	98.07
Wetland Cover Index (WCI %)	21.9	5.0	36.8	17.6
Total Tidal Wetland (km2)	756.06	610.95	25.43	119.06
BOM 1998 Climatic Area	Dry hot steppe - Summer drought	Dry hot steppe - Summer drought	Dry hot steppe - Summer drought	Dry hot steppe - Summer drought
Mangrove species number		12 (15)	10 (15)	7 (15)
Source of mangrove data:		NCD	SKW	NCD

Table 73: Mangrove species present in the Northern Territory and Western Australia. Green highlights species with ranges within the King Sound, WA region(source: Duke 2006). Crosses identify recorded species occurrence in the listed estuary. Yellow denotes western limit of species range.

14. King Sound			
Species/ Locations	**King Sound vicinity #704**	**Point Torment #706**	**Koolan Island ~#707**
Acanthus ebracteatus subsp. *ebarbatus*			
Acanthus ilicifolius			
Acrostichum speciosum			
Aegialitis annulata	X	X	X
Aegiceras corniculatum	X	X	
Avicennia integra			
Avicennia marina	X	X	X
Bruguiera exaristata	X	X	
Bruguiera gymnorhiza			
Bruguiera parviflora	X->		
Bruguiera sexangula			
Camptostemon schultzii	X	X	X
Ceriops australis	X	X	X
Ceriops decandra			
Ceriops tagal			
Cynometra iripa			
Diospyros littorea			
Excoecaria agallocha	X	X	X
Lumnitzera littorea			
Lumnitzera racemosa	X		
Nypa fruticans			
Osbornia octodonta	X	X	
Pemphis acidula			
Rhizophora apiculata			
Rhizophora X *lamarckii*			
Rhizophora stylosa	X	X	X
Scyphiphora hydrophylacea			
Sonneratia alba			X
Sonneratia lanceolata			
Sonneratia X *urama*			
Xylocarpus granatum			
Xylocarpus moluccensis	X->	X	
TOTAL recorded	**12**	**10**	**7**
TOTAL in vicinity	**15**	**15**	**15**
Sources:	NCD	SKW	NCD

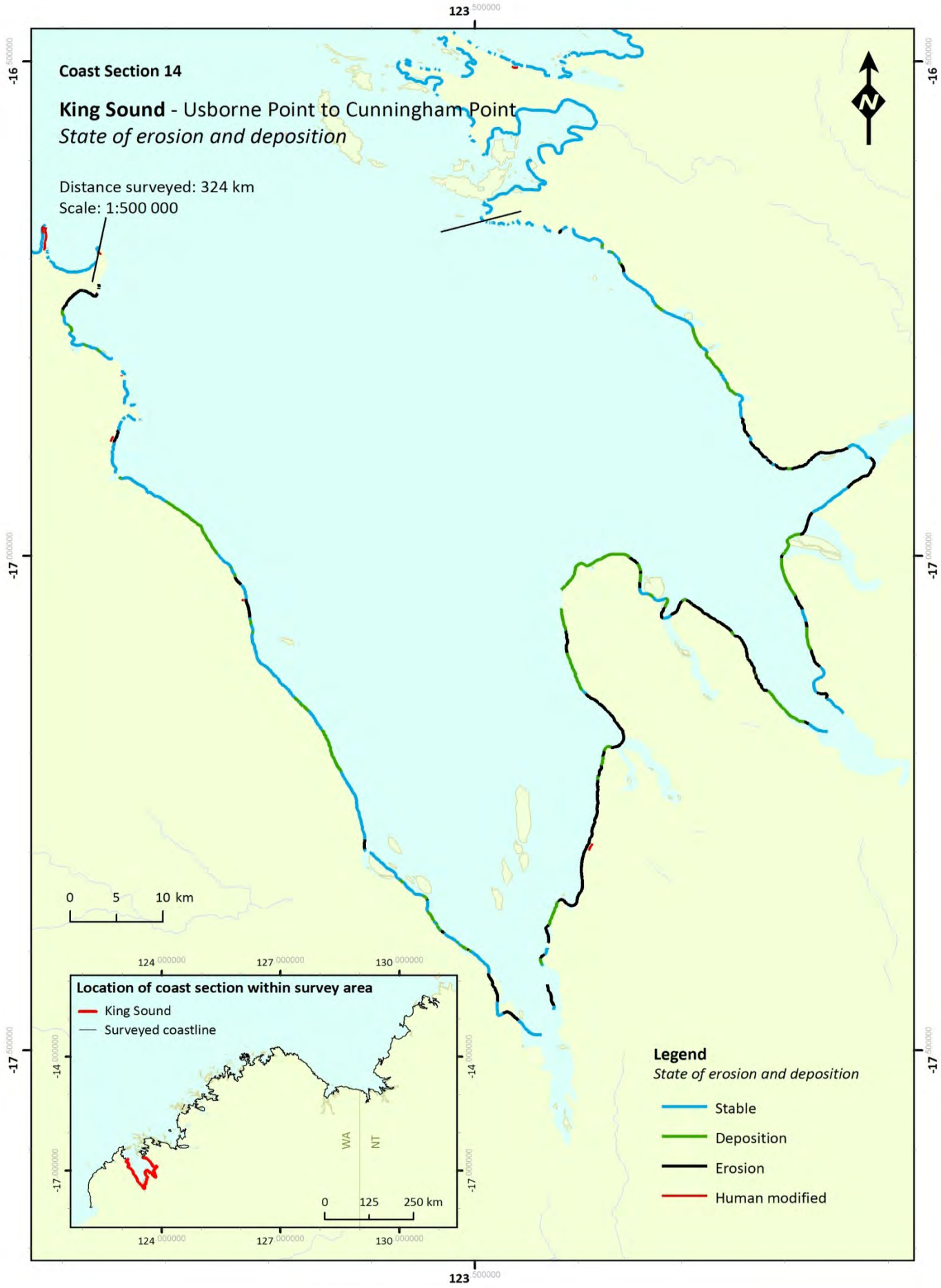


Figure 99: Shoreline stability in the King Sound region

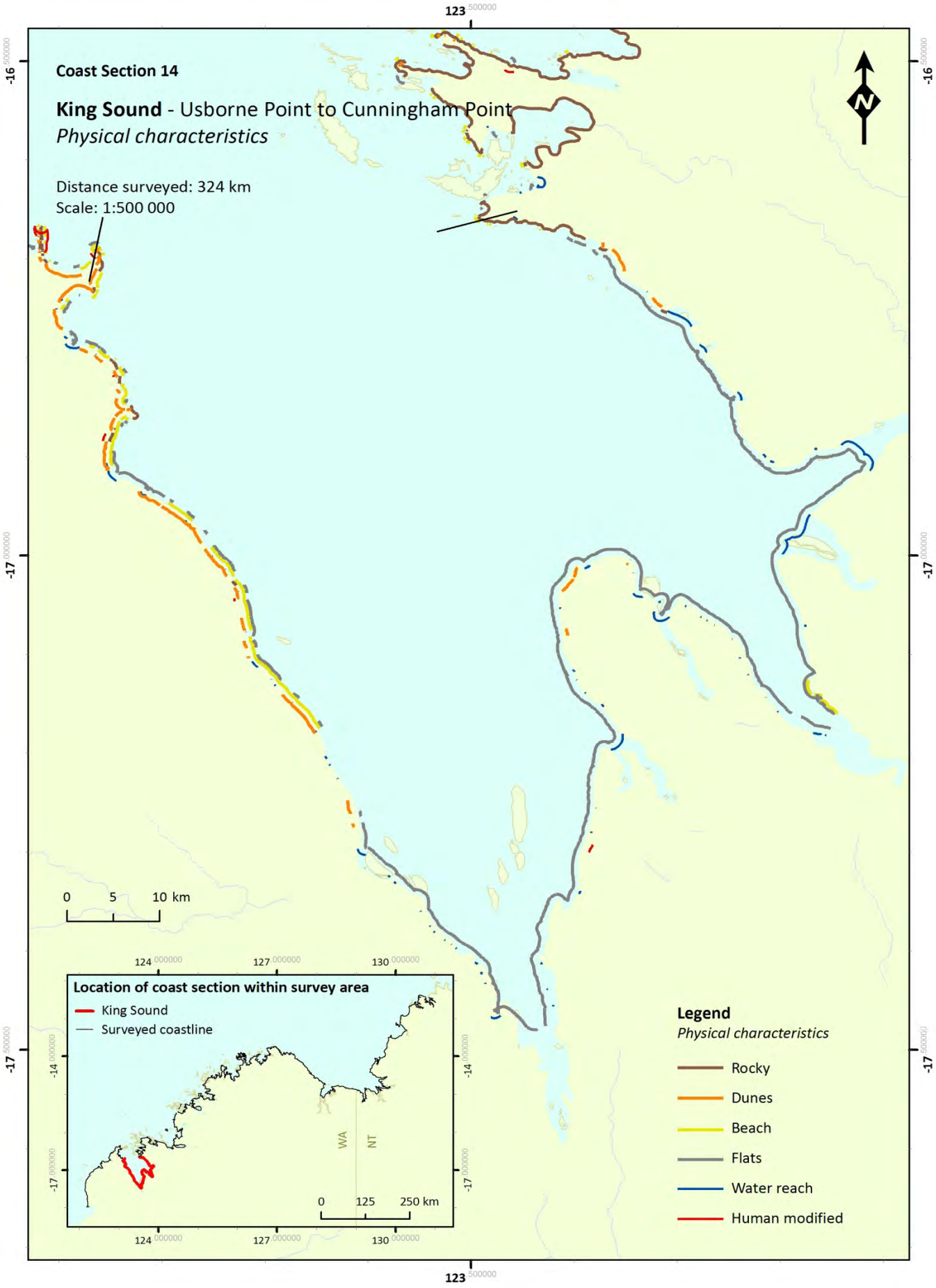


Figure 100: Physical characteristics in the King Sound region

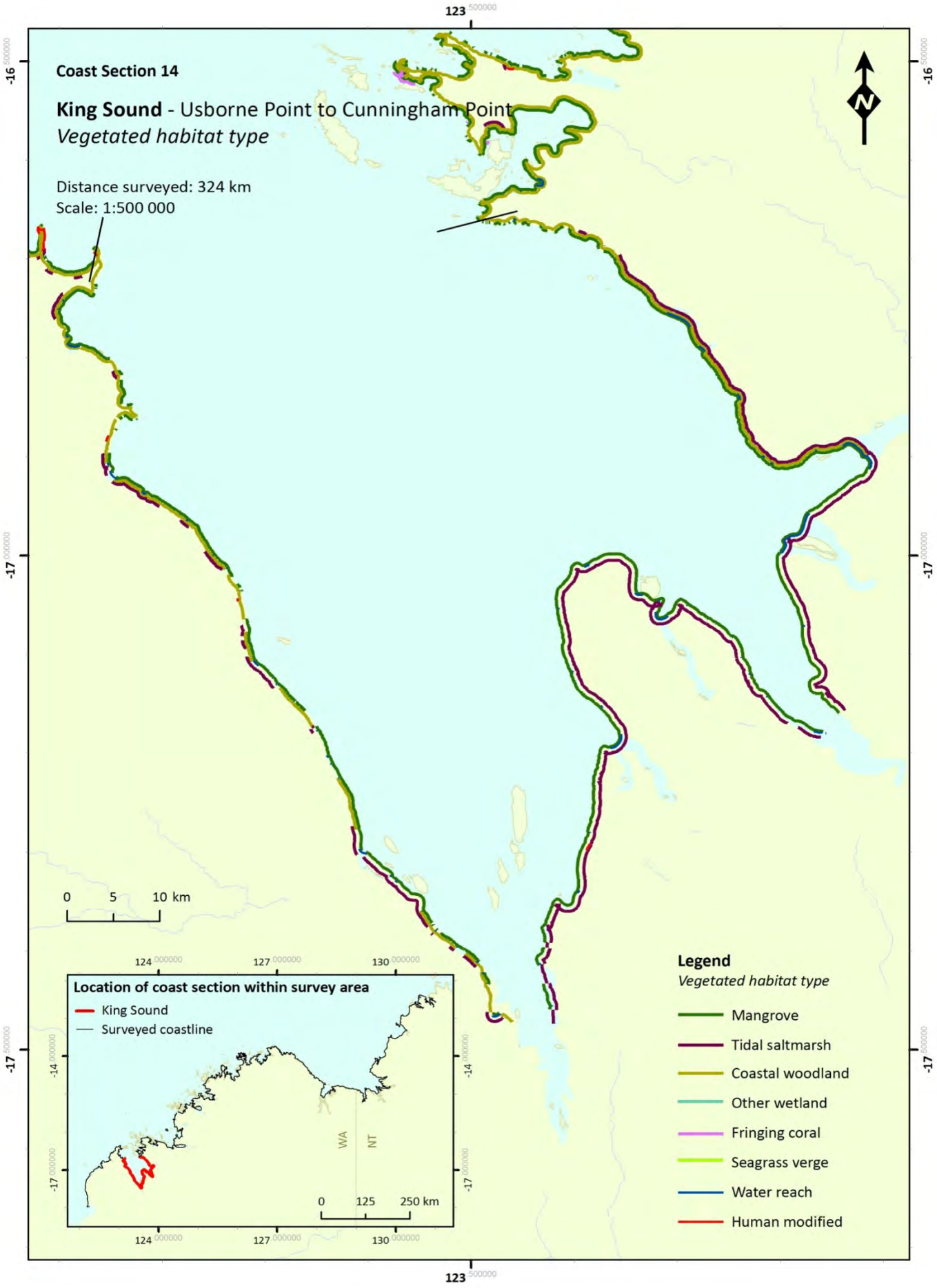


Figure 101: Vegetated habitat types in the King Sound region

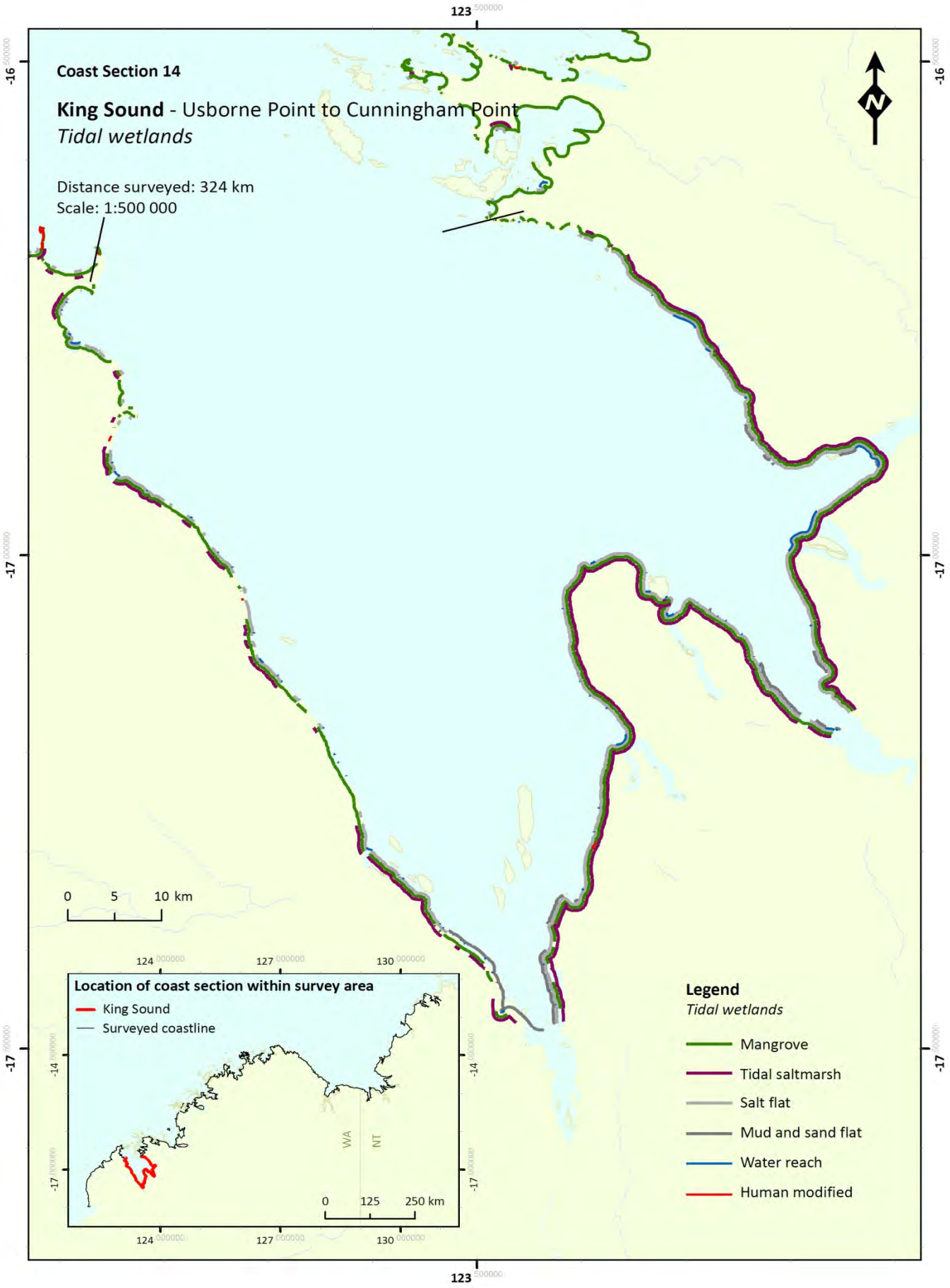


Figure 102: Tidal wetlands in the King Sound region

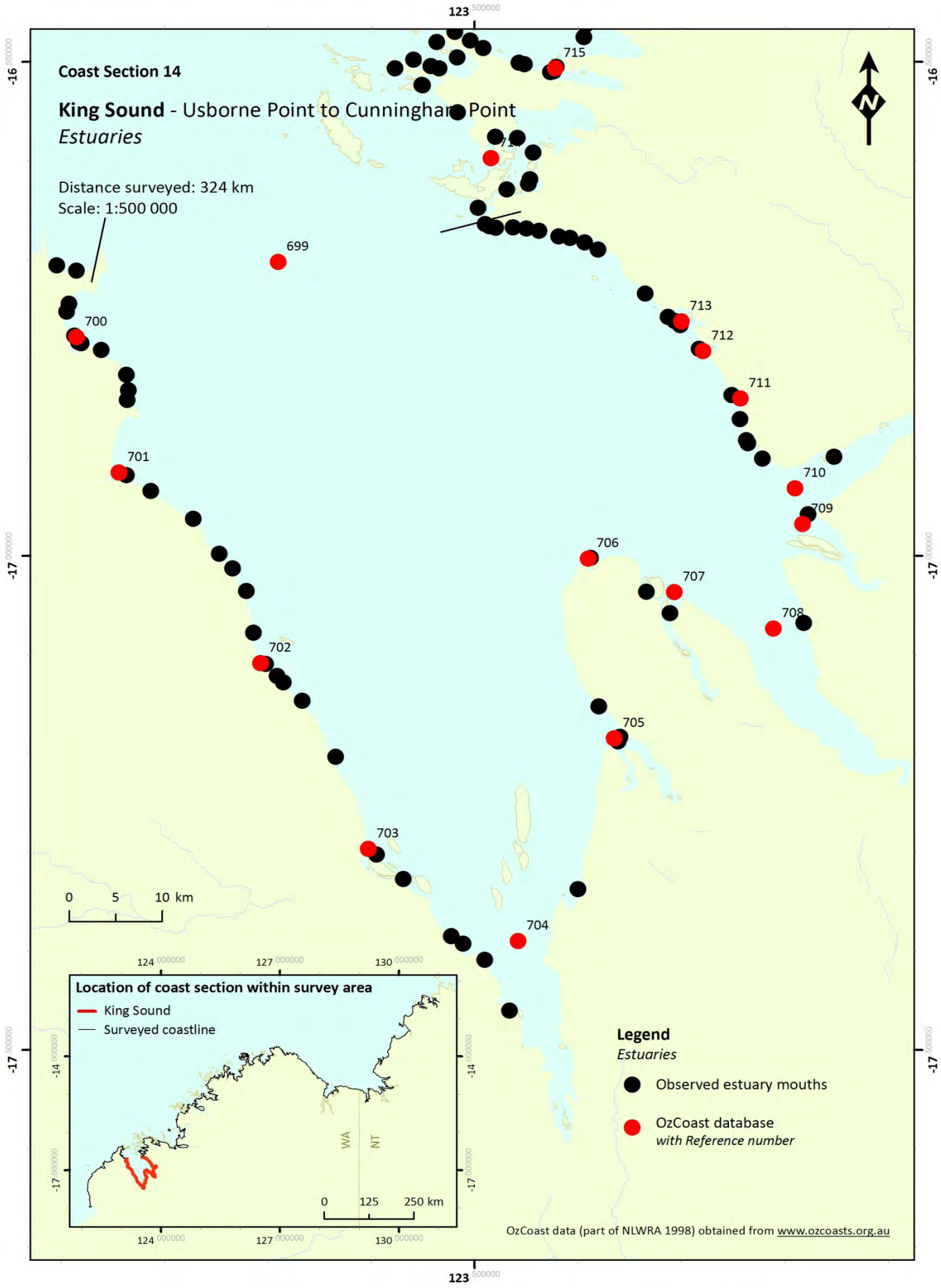


Figure 103: Estuaries in the King Sound region

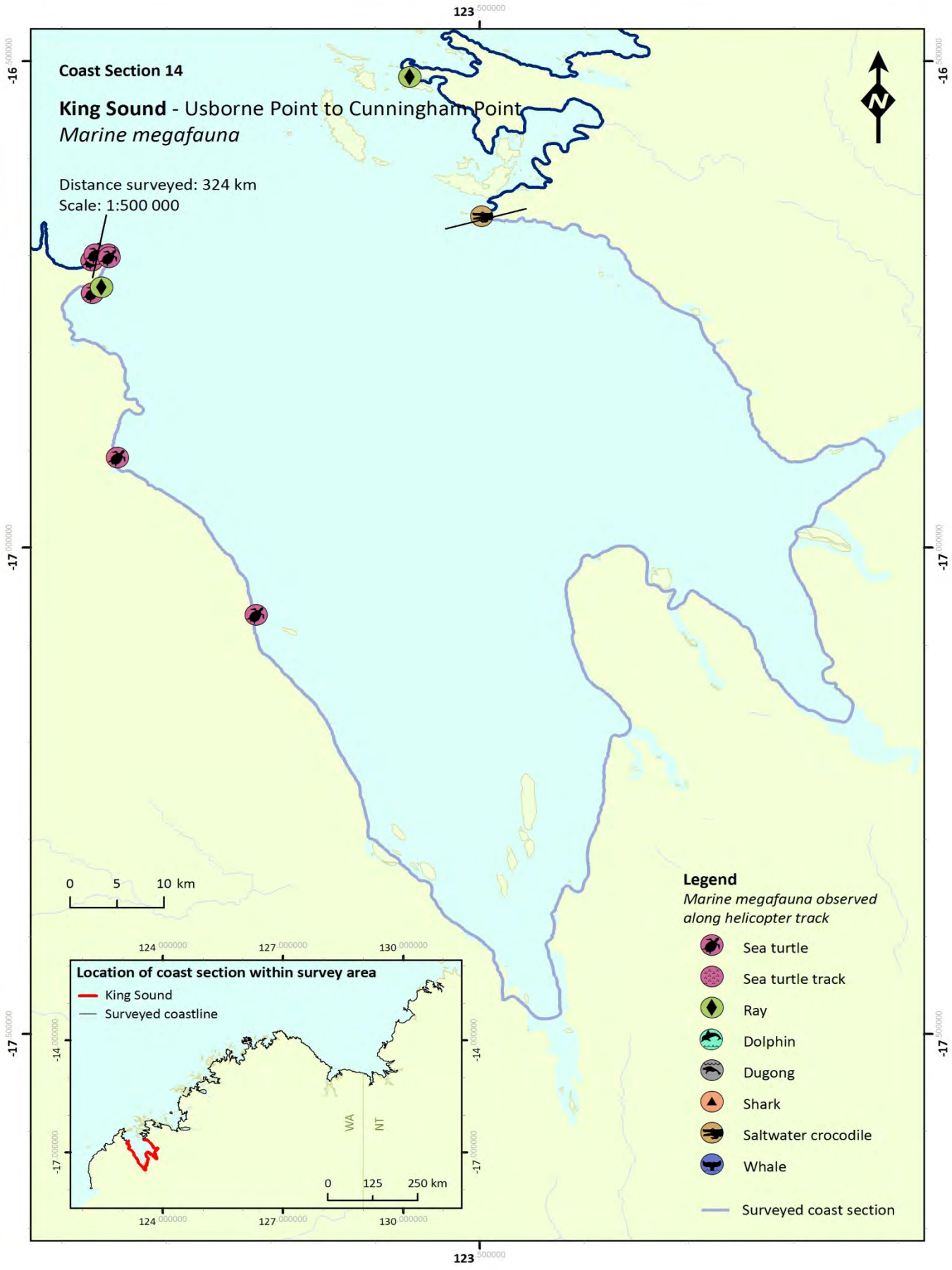


Figure 104: Marine megafauna in the King Sound region

3.15 Cygnet Bay to Beagle Bay (WA)

Coast region start: Lat: -16.52682
Long: 123.00935
Coast region end: Lat: --16.9047
Long: 122.49159

Region encompasses Cunningham Point to Sandy Point and includes Cape Leveque and Pender Bay.

- 254 km coast surveyed, being 5% of the total 5102 km.
- Mangroves are found on more than 40% of the coastline in the region (108.3 km), and saltmarsh on 11.5%, 29.1 km. Total are of tidal wetland in the region is 52.42 km^2 (OzCoasts 2009), calculated as 0.21 km^2 tidal wetland per kilometer of coastline surveyed in the region.
- Estuaries in this region include Beagle Bay, Tappers Inlet and the mouths of the Kelk, Lombadina and Chile Creeks.
- One whale was sighted during megafauna surveys.

Table 74: Summary of coastal characteristics in the region from Cygnet Bay to Beagle Bay.

		km	*% of region*
Physical characteristics	**Rocky**	72.7	*28.6*
	Beach	151.8	*59.8*
	Flat	37.5	*14.8*
	Dune	172.4	*67.9*
	Other wetland	0.0	*0.0*
Vegetated habitat type	**Mangrove**	108.3	*42.6*
	Saltmarsh	29.1	*11.5*
	Fringing coral	0.0	*0.0*
	Seagrass verge	0.0	*0.0*
	Coastal Woodland	220.7	*86.9*
State of erosion and deposition	**Deposition**	3.4	*1.3*
	Erosion	19.5	*7.7*
	Stable	206.2	*81.2*
Tidal wetlands	**Mangrove**	108.3	*42.6*
	Saltmarsh	29.1	*11.5*
	Sand and mud flats	3.6	*1.4*
	Salt flat	37.5	*14.8*
Other	**Human modified**	27.4	*10.8*
	Water reach	10.8	*4.2*

Cygnet Bay to Beagle Bay (WA)

Figure 105: Representative coastline imagery from the Cygnet Bay to Beagle Bay region. Image numbers are unique within the electronic database

Table 75: Summary of marine megafauna observed during aerial surveys of Cygnet Bay to Beagle Bay (WA).

Common name	Genus/Species	Total observed
Australian snubfin dolphin	*Orcaella heinsohni*	0
Indo-Pacific bottlenose	*Tursiops aduncas*	0
Unidentified dolphin species	Family Delphinidae	3
Sea turtle	*Chelonia* or *Caretta* spp	36
Sea turtle track	*Chelonia* or *Caretta* spp	0
Dugong	*Dugong dugong*	0
Whale	*Order Cetacea*	1
Manta ray	*Manta birostris*	1
Ray species	Superorder Batoidea	9
Saltwater crocodile	*Crocodylus porosus*	0
Unidentified shark species	Superorder: Selachimorph	2

Table 76: Coastline data for the Cygnet Bay to Beagle Bay, WA region. Source OzCoasts 2009.

NT-WA Survey – 15. Cygnet Bay to Beagle Bay, WA		
Features	**#15**	**Relevance to survey region**
Annual Rainfall –range & mean (mm)	850-900 (885)	Below average
Number of estuaries listed	5	Below average
Total Catchment Area (km2)	2401	Below average size
Total Estuary Length (km)	28.5	Below average size
Tidal Range (in m)	7.06	
Condition Status	Near Pristine	Virtually no disturbance by humans
Area of Mangrove (km2)	16.28	
Area of Salt Marsh (km2)	36.14	
WCI% from Region Total	31.1	
Total Tidal Wetland (km2)	52.42	
BOM 1998 Climatic Area	Dry hot steppe - Summer drought	
Mangrove species number	12	13 in vicinity
Mangrove species limit west	2	

Table 77: Estuary data for notable estuaries within the Cygnet Bay to Beagle Bay, WA region. Source NLWRA; 1998.

NT-WA Survey **15. Cygnet Bay to Beagle Bay, WA**				
Feature / Location	**Beagle Bay**	**Tappers Inlet, Cape Leveque**	**Kelk Creek**	**Lombadina Creek**
NLWRA Estuary Reference#	**694**	**695**	**696**	**697**
Latitude S	16.942	16.816	16.738	16.541
Longitude E	122.563	122.554	122.765	122.819
Annual Rainfall – mean (mm)	900	900	900	850
Catchment Area (km2)	1659	84	563	56
Estuary Length (km)	6.93	2.83	9.89	3.97
Tidal Range (in m)	6.9	7	7.2	7.1
Condition Status	P	P	P	P
Area of Mangrove (km2)	1.50	2.34	9.27	1.69
Area of Salt Marsh (km2)	7.97	1.58	24.78	0.64
Wetland Cover Index (WCI %)	15.8	59.7	27.2	72.5
Total Tidal Wetland (km2)	9.47	3.92	34.05	2.33
BOM 1998 Climatic Area	Dry hot steppe - Summer drought	Dry hot steppe - Summer drought	Dry hot steppe - Summer drought	Dry hot steppe - Summer drought
Mangrove species number	2 (12)	11 (12)		10 (13)
Source of mangrove data:	SKW	NCD		SKW

Table 78: Mangrove species present in the Northern Territory and Western Australia. Green highlights species with ranges within the Cygnet Bay to Beagle Bay, WA region (source: Duke 2006). Crosses identify recorded species occurrence in the listed estuary. Yellow denotes western limit of species range.

15. Cygnet Bay to Beagle Bay			
Species/ Locations	**Beagle Bay #694**	**Cape Leveque ~#695**	**Lombadina Creek #697**
Acanthus ebracteatus subsp. *ebarbatus*			
Acanthus ilicifolius			
Acrostichum speciosum			
Aegialitis annulata		X	X
Aegiceras corniculatum		X	X
Avicennia integra			
Avicennia marina		X	
Bruguiera exaristata		X	X
Bruguiera gymnorhiza			
Bruguiera parviflora			
Bruguiera sexangula			
Camptostemon schultzii		X	X
Ceriops australis	X	X	X
Ceriops decandra			
Ceriops tagal			
Cynometra iripa			
Diospyros littorea			
Excoecaria agallocha		X	
Lumnitzera littorea			
Lumnitzera racemosa	X->	X	X
Nypa fruticans			
Osbornia octodonta		X	X
Pemphis acidula			X->
Rhizophora apiculata			
Rhizophora X *lamarckii*			
Rhizophora stylosa		X	X
Scyphiphora hydrophylacea			
Sonneratia alba		X	X
Sonneratia lanceolata			
Sonneratia X *urama*			
Xylocarpus granatum			
Xylocarpus moluccensis			
TOTAL recorded	**2**	**11**	**10**
TOTAL in vicinity	**12**	**12**	**13**
Sources:	SKW	NCD	SKW

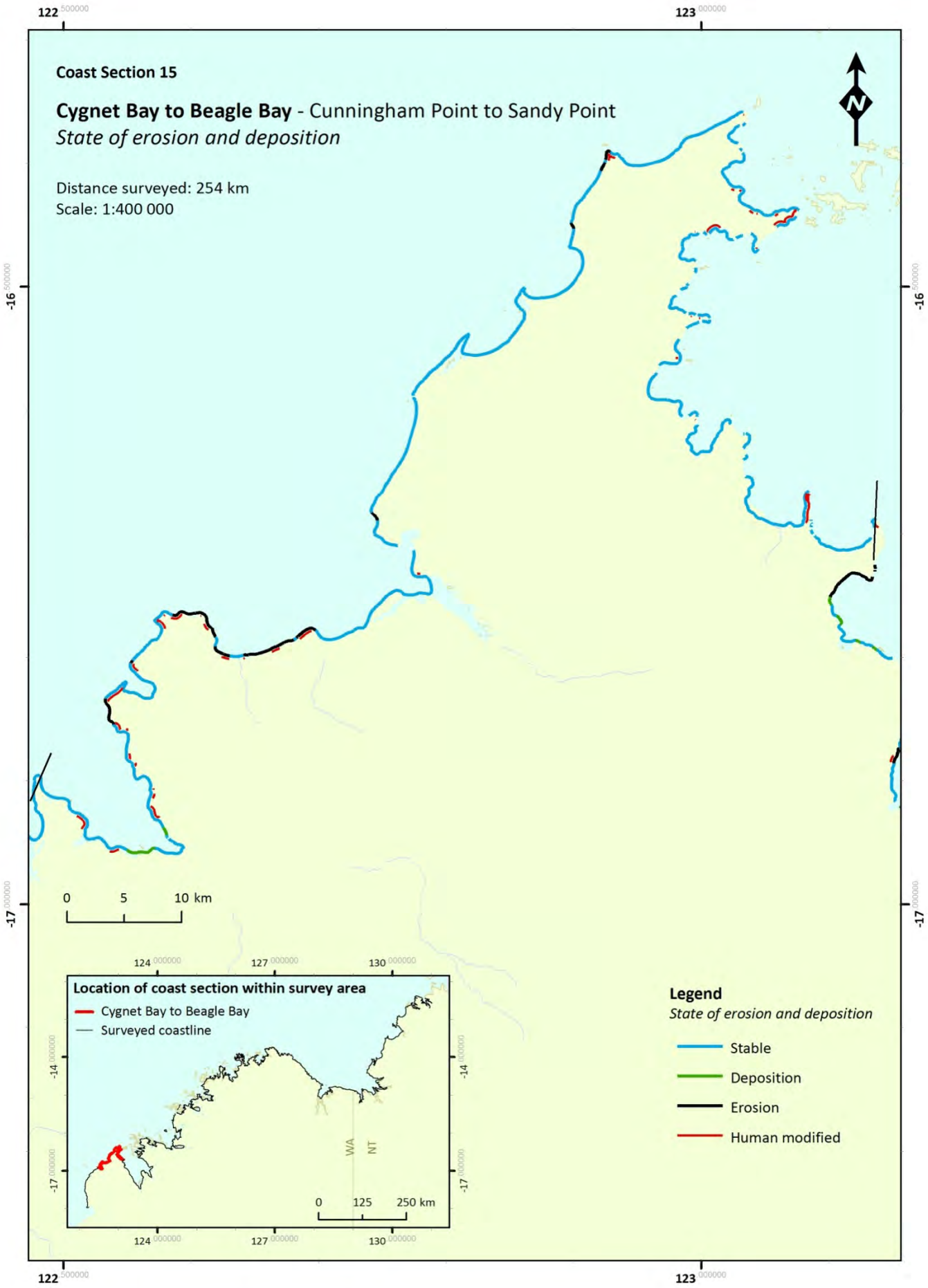


Figure 106: Shoreline stability in the Cygnet Bay to Beagle Bay region

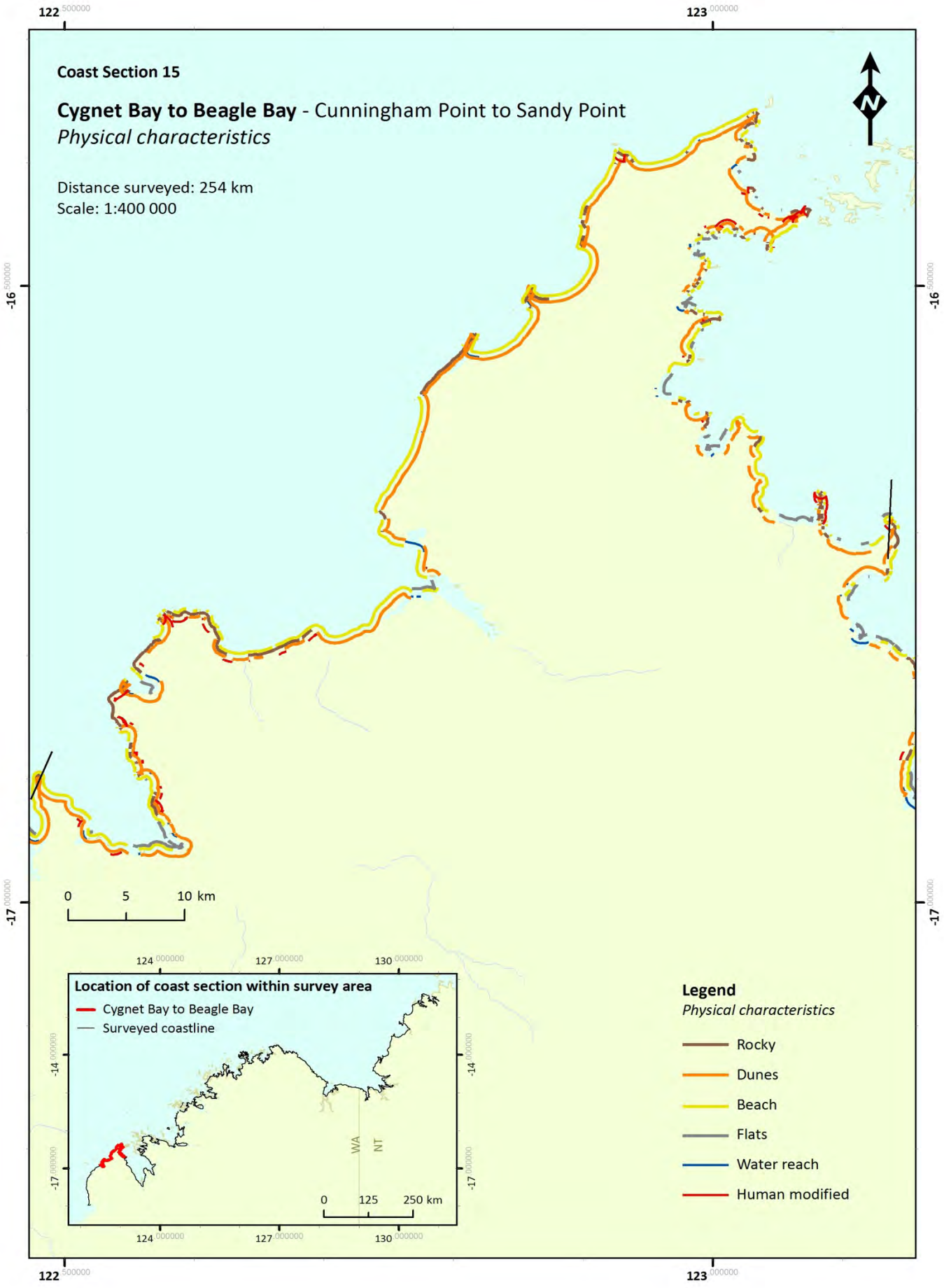


Figure 107: Physical characteristics in the Cygnet Bay to Beagle Bay region

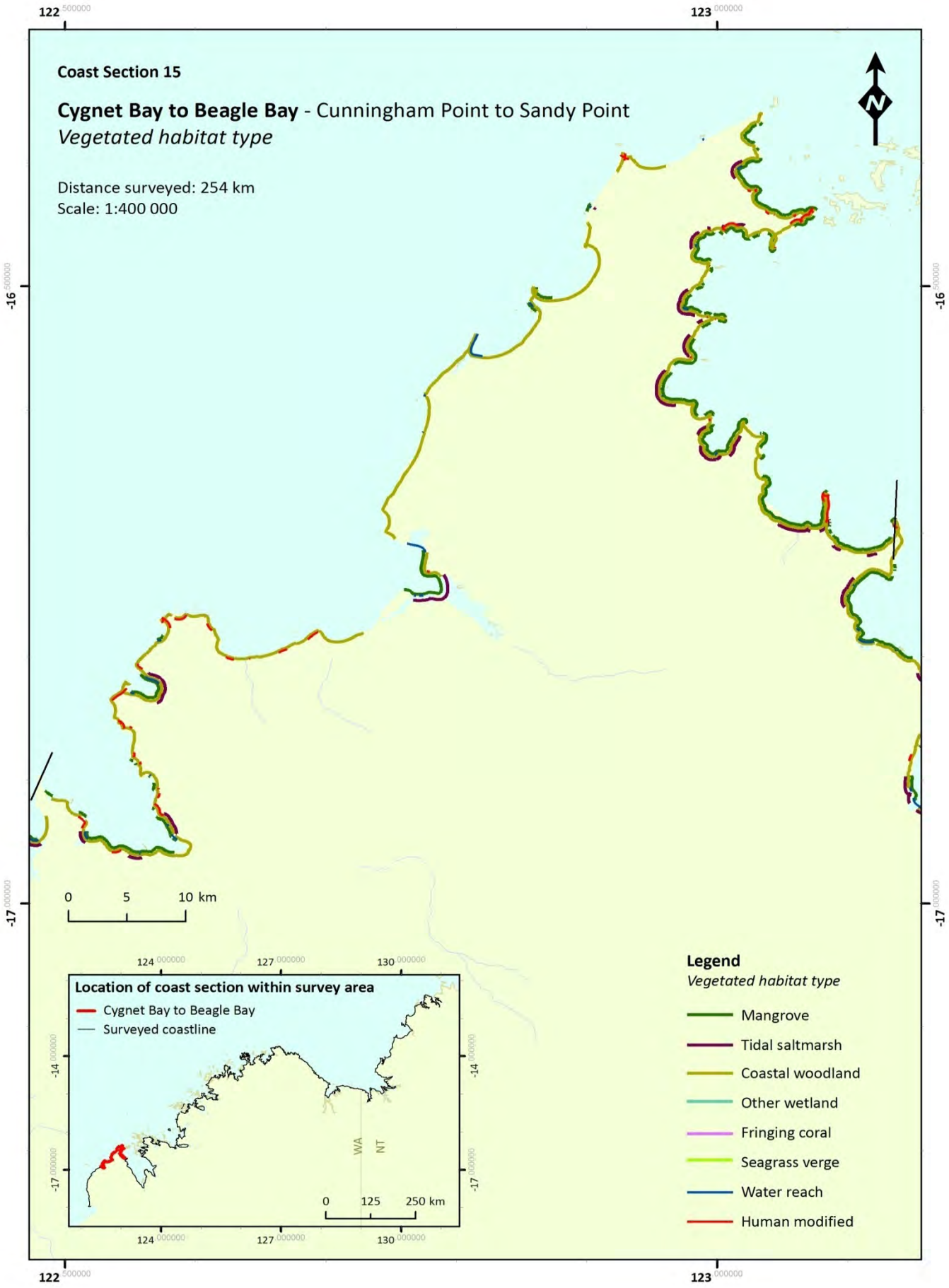


Figure 108: Vegetated habitat types in the Cygnet Bay to Beagle Bay region

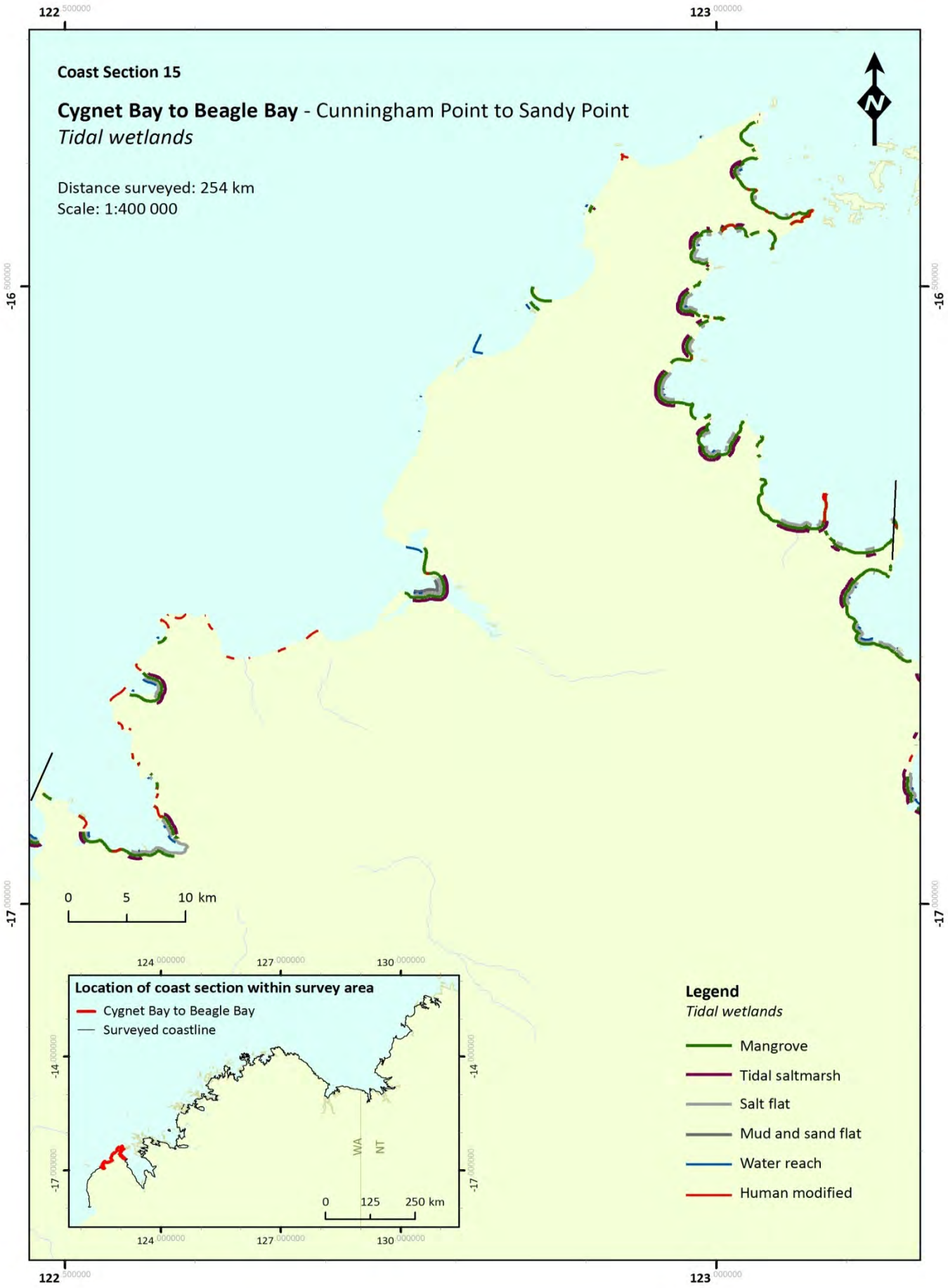


Figure 109: Tidal wetlands in the Cygnet Bay to Beagle Bay region

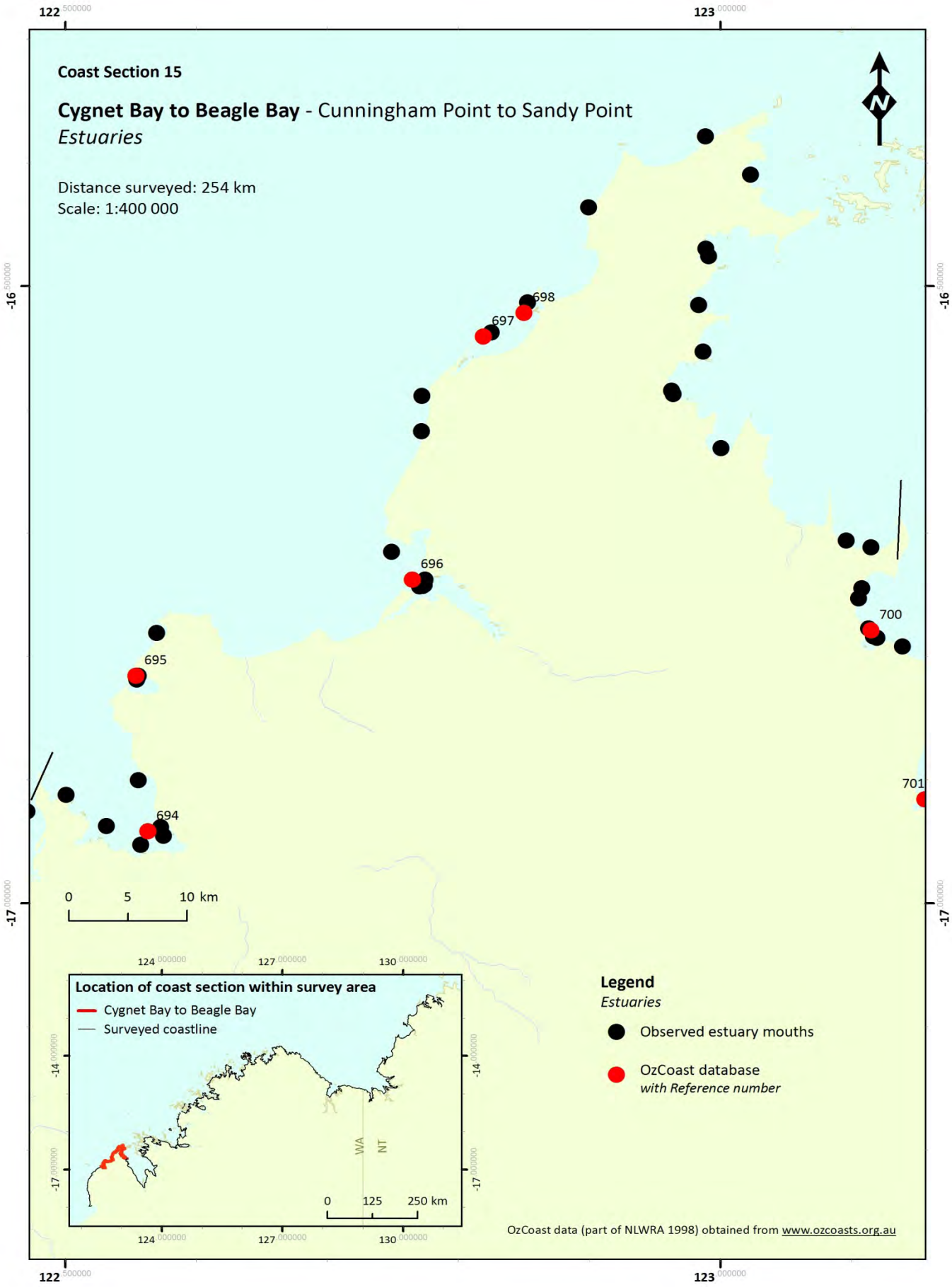


Figure 110: Estuaries in the Cygnet Bay to Beagle Bay region

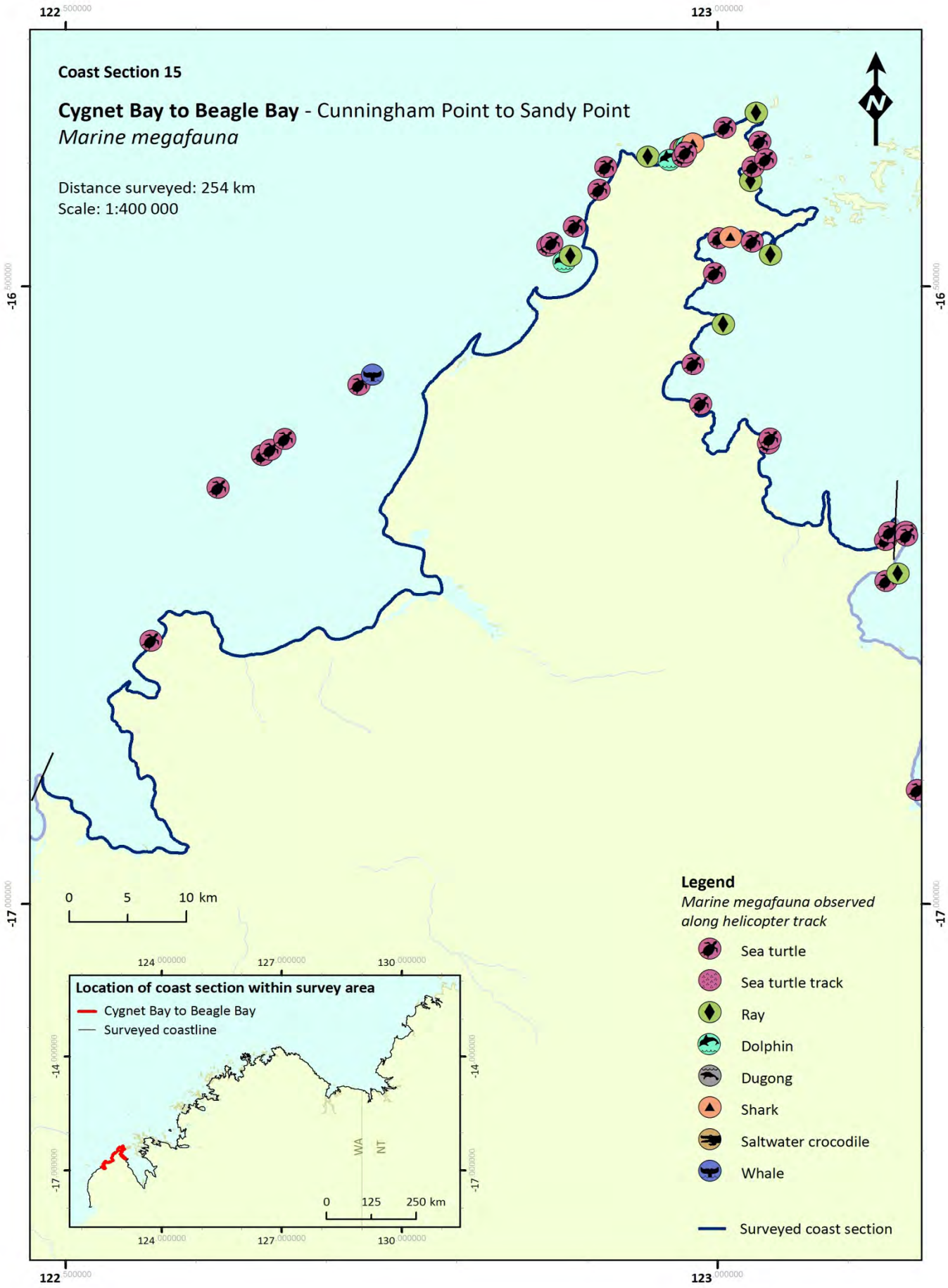


Figure 111: Marine megafauna in the Cygnet Bay to Beagle Bay region

3.16 Beagle Bay to Broome (WA)

Coast region start: Lat: -16.90418
Long: 122.49109
Coast region end: Lat: -17.94815
Long: 122.22987

Region encompasses Sandy Point to Gantheaume Point

- 153 km coast surveyed, being 3% of the total 5102 km.
- Coastal wetlands constitute 17.9% of the coast in this region (mangrove + saltmarsh). Total tidal wetland in the region is 89.09 km^2 (OzCoasts 2009), calculated as 0.58 km^2 tidal wetland per kilometer of coastline surveyed in the region.
- Human influence rises due to the proximity to the Broome township, with 31.2% of the regions coastline has been modified by human activity.
- Estuaries in this region include Carnot Bay and the mouths of Willies Creek, Dampier Creek and Baldwin Creek.
- Observed marine megafauna in this region included 20 sea turtles (*Caretta* or *Chelonia* spp.).

Table 79: Summary of coastal characteristics the Beagle Bay to Broome region.

		km	*% of region*
Physical characteristics	**Rocky**	36.9	*24.0*
	Beach	143.1	*93.3*
	Flat	9.9	*6.5*
	Dune	131.8	*85.9*
	Other wetland	0.0	*0.0*
Vegetated habitat type	**Mangrove**	17.9	*11.6*
	Saltmarsh	9.7	*6.3*
	Fringing coral	0.0	*0.0*
	Seagrass verge	0.0	*0.0*
	Coastal Woodland	112.9	*73.6*
State of erosion and deposition	**Deposition**	3.1	*2.0*
	Erosion	22.5	*14.6*
	Stable	124.1	*80.9*
Tidal wetlands	**Mangrove**	17.9	*11.6*
	Saltmarsh	9.7	*6.3*
	Sand and mud flats	0.5	*0.4*
	Salt flat	9.9	*6.5*
Other	**Human modified**	47.9	*31.2*
	Water reach	11.8	*7.7*

Beagle Bay to Broome (WA)

Figure 112: Representative coastline imagery from the Beagle Bay to Broome region. Image numbers are unique within the electronic database

Table 80: Summary of marine megafauna observed during aerial surveys of Beagle Bay to Broome (WA).

Common name	Genus/Species	Total observed
Australian snubfin dolphin	*Orcaella heinsohni*	0
Indo-Pacific bottlenose	*Tursiops aduncas*	0
Unidentified dolphin species	Family Delphinidae	2
Sea turtle	*Chelonia* or *Caretta* spp	20
Sea turtle track	*Chelonia* or *Caretta* spp	0
Dugong	*Dugong dugong*	0
Whale	*Order Cetacea*	0
Manta ray	*Manta birostris*	0
Ray species	Superorder Batoidea	0
Saltwater crocodile	*Crocodylus porosus*	0
Unidentified shark species	Superorder: Selachimorph	0

Table 81: Coastline data for the Beagle Bay to Broome, WA region. Source OzCoasts 2009.

NT-WA Survey – 16. Beagle Bay to Broome, WA		
Features	**#16**	**Relevance to survey region**
Annual Rainfall –range & mean (mm)	600-825 (706)	Below average
Number of estuaries listed	4	Below average
Total Catchment Area (km2)	1752	Below average size
Total Estuary Length (km)	2.7	Below average size
Tidal Range (in m)	7.63	
Condition Status	Near Pristine to Largely Unmodified	Very low disturbance by humans
Area of Mangrove (km2)	36.76	
Area of Salt Marsh (km2)	52.33	
WCI% from Region Total	41.3	
Total Tidal Wetland (km2)	89.09	
BOM 1998 Climatic Area	Dry hot steppe - Summer drought	
Mangrove species number	8	11 in vicinity
Mangrove species limit west	0	

Table 82: Estuary data for notable estuaries within the Beagle Bay to Broome, WA region. Source NLWRA; 1998.

NT-WA Survey **16. Beagle Bay to Broome, WA**				
Feature / Location	**Dampier Creek, Broome**	**Willies Creek**	**Carnot Bay, Cape Bertholet**	**Baldwin Creek**
NLWRA Estuary Reference#	**690**	**691**	**692**	**693**
Latitude S	17.961	17.767	17.151	17.017
Longitude E	122.250	122.200	122.263	122.367
Annual Rainfall – mean (mm)	600	650	750	825
Catchment Area (km2)	111	84	1483	74
Estuary Length (km)	2.73			
Tidal Range (in m)	8.3	9.1	6.6	6.5
Condition Status	LU	P	P	P
Area of Mangrove (km2)	5.00	16.50	9.17	6.09
Area of Salt Marsh (km2)	5.10	8.03	35.35	3.85
Wetland Cover Index (WCI %)	49.5	67.3	20.6	61.3
Total Tidal Wetland (km2)	10.10	24.53	44.52	9.94
BOM 1998 Climatic Area	Dry hot steppe - Summer drought	Dry hot steppe - Summer drought	Dry hot steppe - Summer drought	Dry hot steppe - Summer drought
Mangrove species number	4 (11)	6 (11)	6 (11)	
Source of mangrove data	SKW	SKW	SKW	

Table 83: Mangrove species present in the Northern Territory and Western Australia. Green highlights species with ranges within the Beagle Bay to Broome, WA region (source: Duke 2006). Crosses identify recorded species occurrence in the listed estuary. Yellow denotes western limit of species range.

16. Beagle Bay to Broome			
Species/ Locations	**Dampier Creek, Broome #690**	**Willies Creek #691**	**Cape Bertholet ~#692**
Acanthus ebracteatus subsp. *ebarbatus*			
Acanthus ilicifolius			
Acrostichum speciosum			
Aegialitis annulata	X		X
Aegiceras corniculatum			X
Avicennia integra			
Avicennia marina	X	X	
Bruguiera exaristata		X	X
Bruguiera gymnorhiza			
Bruguiera parviflora			
Bruguiera sexangula			
Camptostemon schultzii			
Ceriops australis	X	X	X
Ceriops decandra			
Ceriops tagal			
Cynometra iripa			
Diospyros littorea			
Excoecaria agallocha		X	X
Lumnitzera littorea			
Lumnitzera racemosa			
Nypa fruticans			
Osbornia octodonta		X	
Pemphis acidula			
Rhizophora apiculata			
Rhizophora X *lamarckii*			
Rhizophora stylosa	X	X	X
Scyphiphora hydrophylacea			
Sonneratia alba			
Sonneratia lanceolata			
Sonneratia X *urama*			
Xylocarpus granatum			
Xylocarpus moluccensis			
TOTAL recorded	**4**	**6**	**6**
TOTAL in vicinity	**11**	**11**	**11**
Sources:	SKW	SKW	SKW

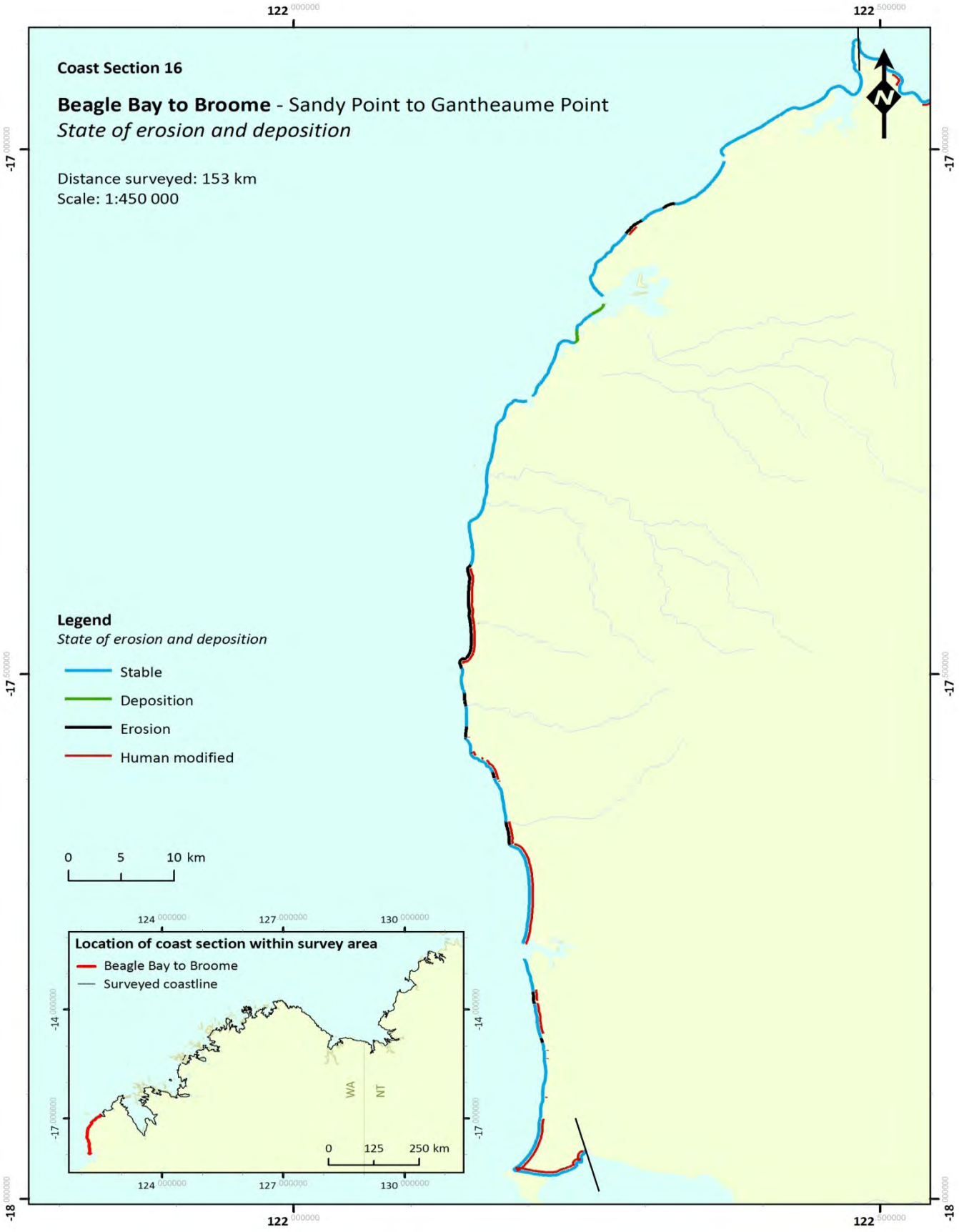


Figure 113: Shoreline stability in the Beagle Bay to Broome region

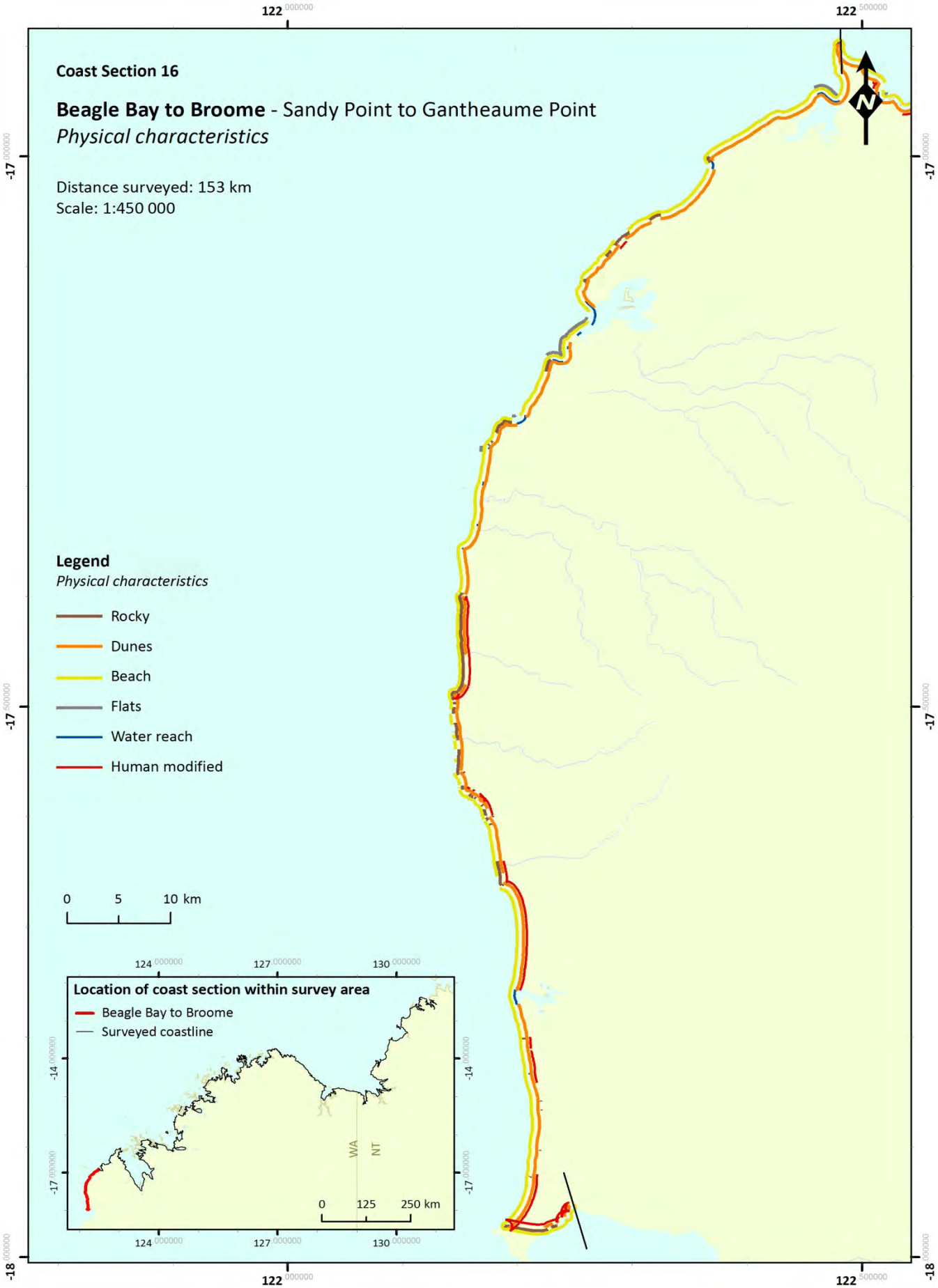


Figure 114: Physical characteristics in the Beagle Bay to Broome region

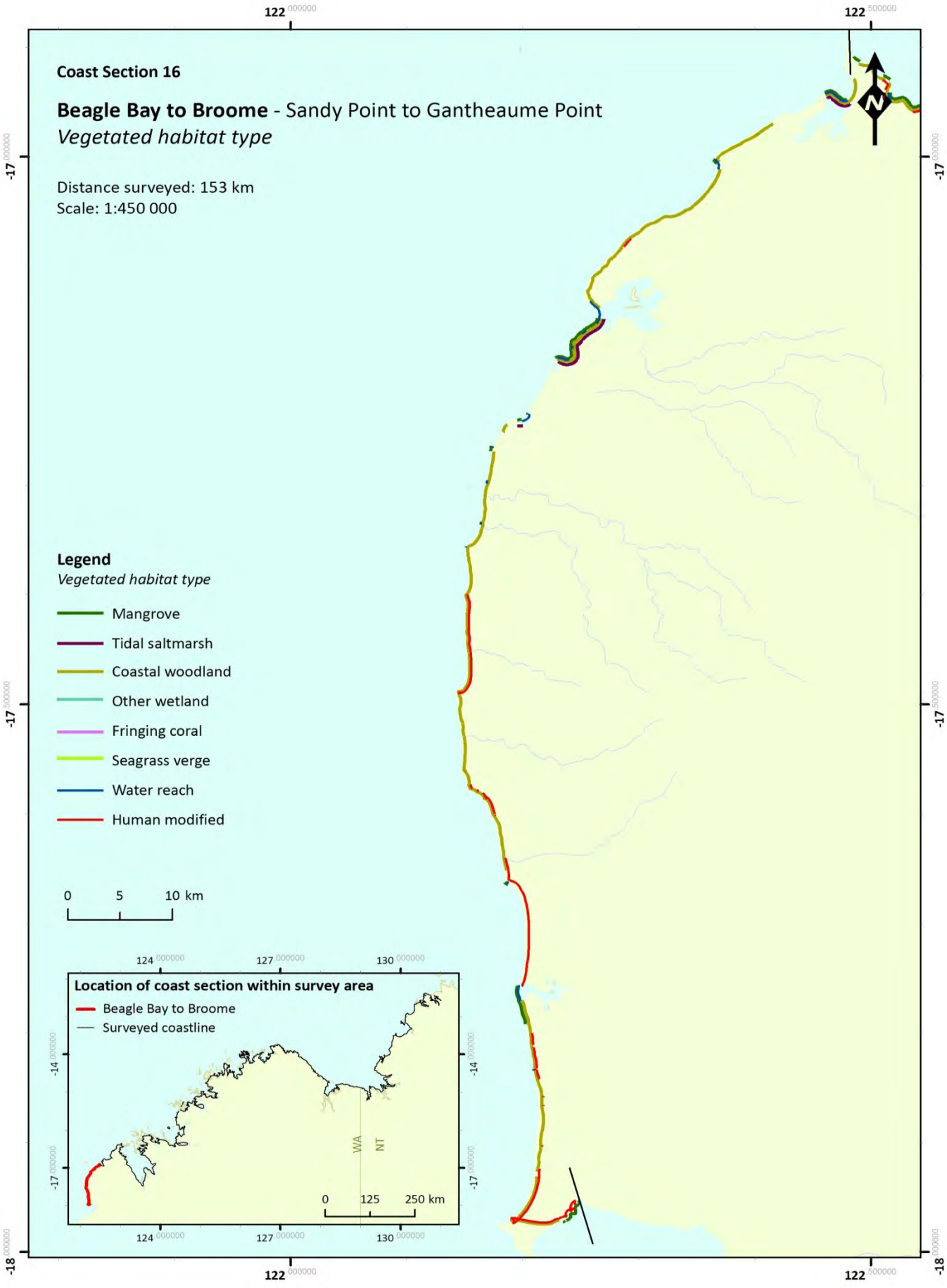


Figure 115: Vegetated habitat types in the Beagle Bay to Broome region

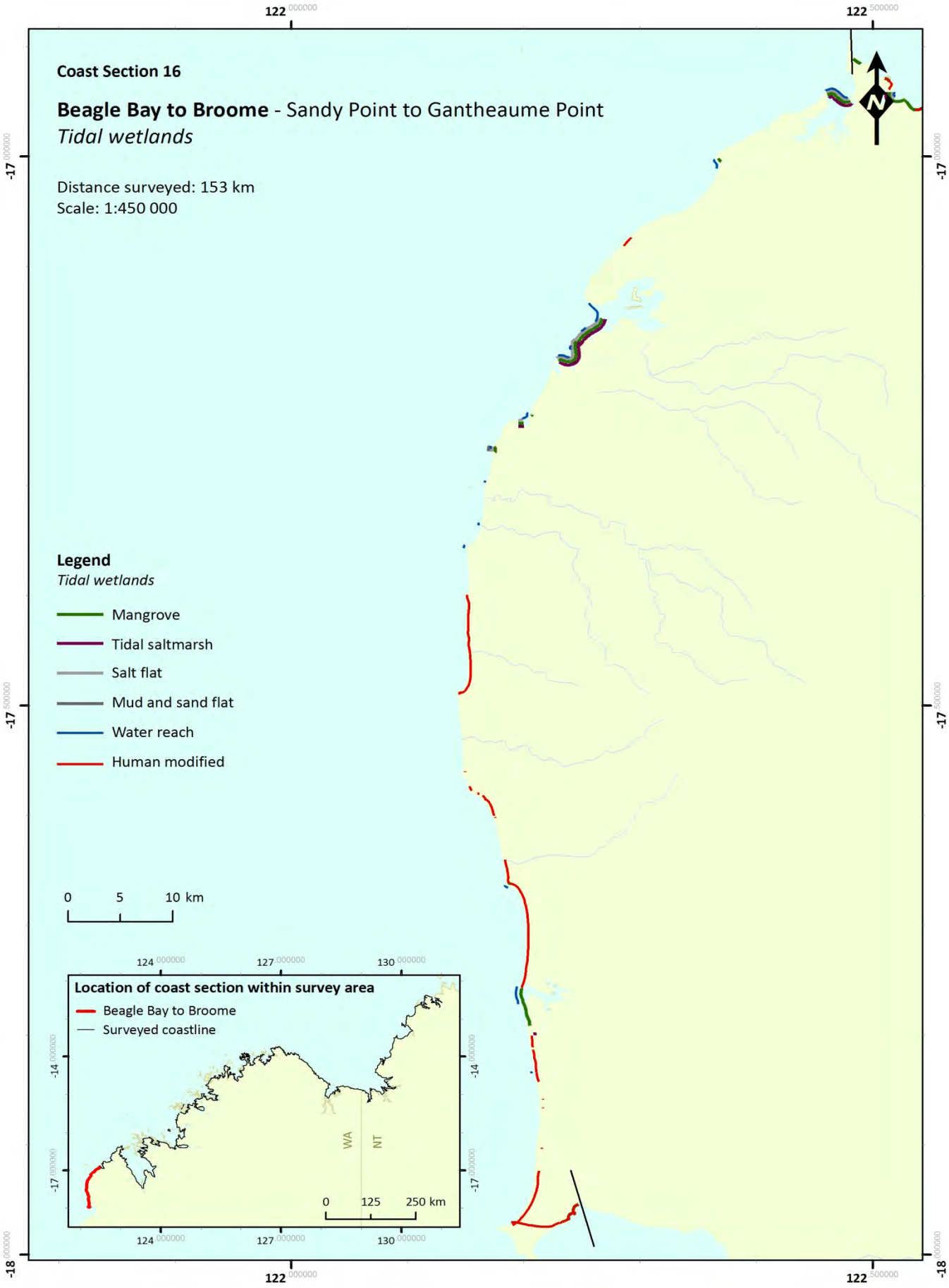


Figure 116: Tidal wetlands in the Beagle Bay to Broome region

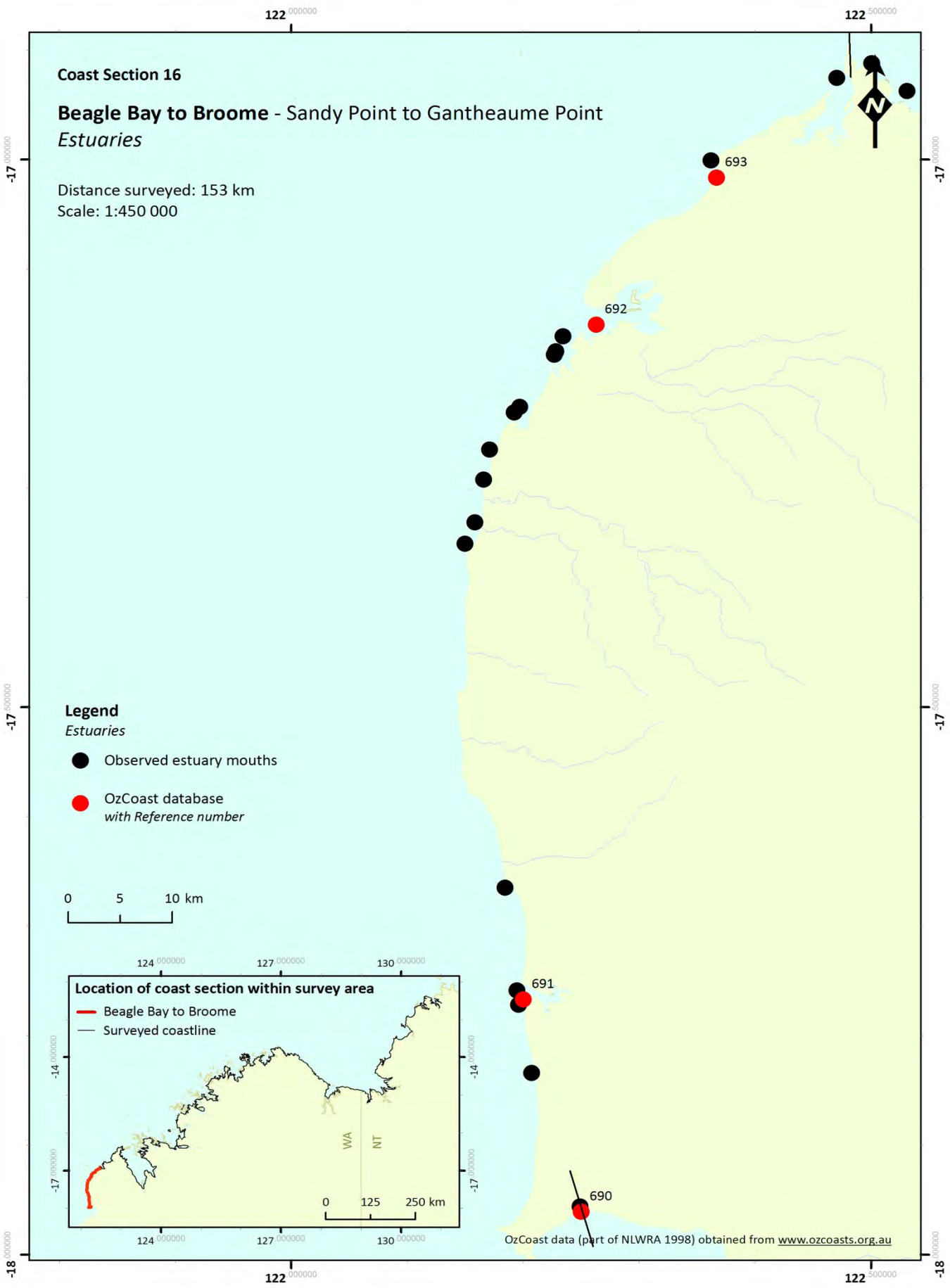


Figure 117: Estuaries in the Beagle Bay to Broome region

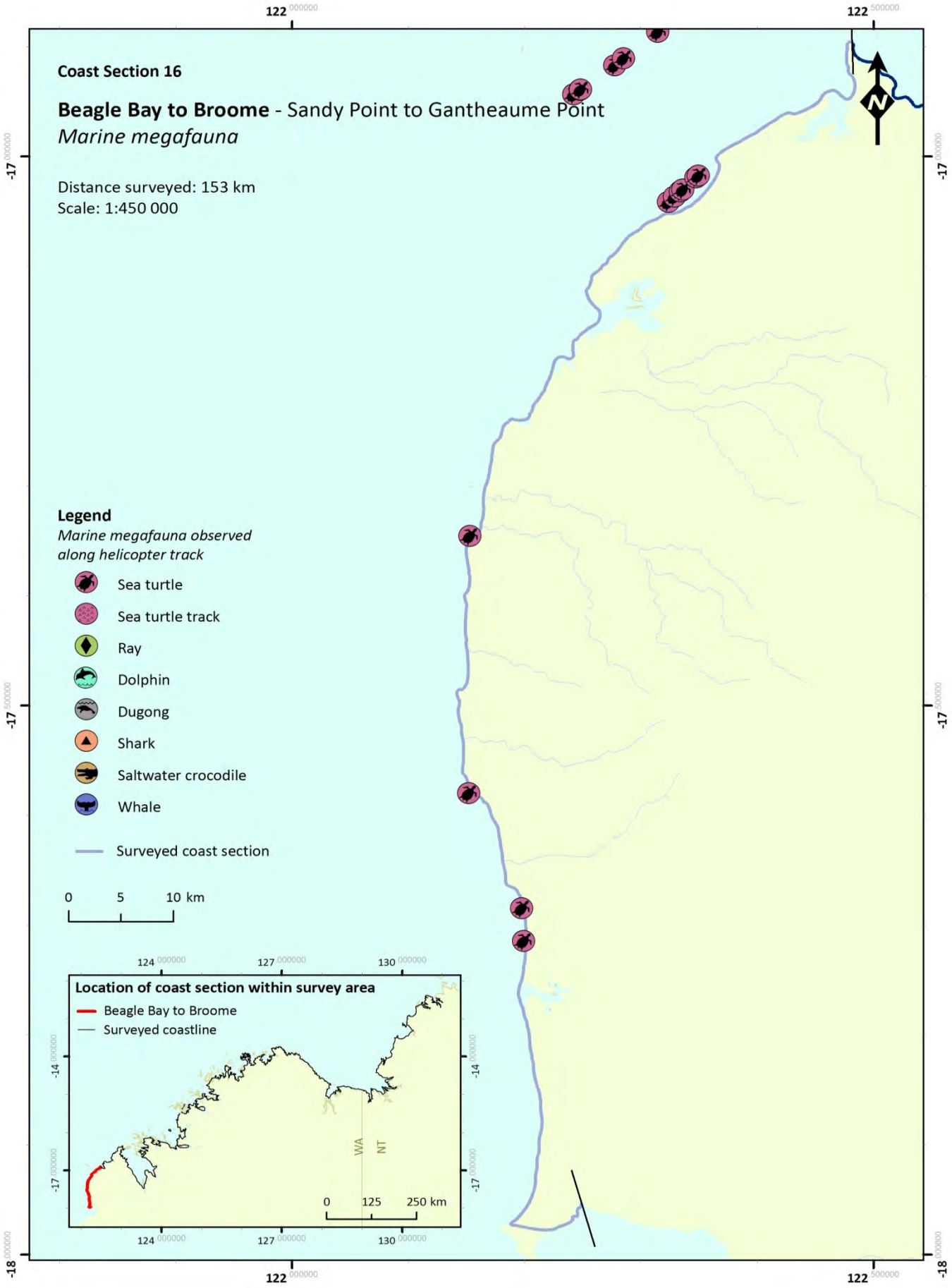


Figure 118: Marine megafauna in the Beagle Bay to Broome region

4. DISCUSSION

Conclusions based on objectives

Only the first four objectives were acted upon as no oil was detected along the surveyed shoreline from Darwin to Broome.

Marine megafauna

Objective: *To quantify the presence of megafauna in the subject area pre-impact in order to determine the level of potential exposure to oil.*

Marine megafauna sightings were common along almost the entire shoreline. All identified species are highly vulnerable to oil spill damage should oil come in direct contact with the animal. In addition, a number of these species rely on seagrass and coral reef communities as foraging ground (e.g. dugong, sea turtles), enhancing the risk of impact from oil spill to these species. Others depend on coastal fisheries as food sources (dolphins, sharks). Oil damage to mangrove communities will therefore have further consequences for these species due to the utilization of mangrove systems by juvenile fish as nursery grounds (Nagelkerken *et al* 2000). Reduced numbers of high quality fish prey has been noted following past oil spills (Irons *et al* 2000). It is highly likely oil spill damage to mangrove communities along this coastline would result in a reduction of forage fish abundance long term.

The greatest concentrations of megafauna (~60% observed) were recorded in the area from Cape Londonderry to Admiralty Gulf (subregions #8 & #9). The majority (67%) of megafauna sightings were of turtles. Additional observations of beaches with recent turtle tracks were also recorded. This data provides a potentially valuable contribution to our knowledge of turtle nesting activity along this coastline. There were signs of greater nesting activity shown with turtle tracks in York Sound (subregion #11). For enhanced quantification of sea turtle nesting activity, shoreline imagery provided in the digital database can be further assessed.

Frequency and types of observed fauna varied considerably from one section of coastline to the next. While some of this variation may be attributed to biotic preferences, a significant amount may be due to weather conditions influencing turbidity, time of day affecting light, tidal condition affecting exposure, as well as currents and rain squalls. The latter notably affected our survey track and timing on several occasions. Tidal flux at the mouths of large river systems commonly resulted in high turbidity, and hence decreased visibility. These conditions can only have resulted in underrepresentation of fauna counts during surveys, not detracting from the extreme

sensitivity to marine fauna identified in the region to impact from oil residue reaching the coastal waters and shore.

Habitats present in shoreline ecological assessment

Objective: *To quantify the presence and extent of communities or habitats (mangroves, other tidal wetlands, and other shoreline types) in the subject area before impact by oil in order to determine the level of potential exposure to oil.*

Tropical and subtropical mangrove habitats are considered as particularly vulnerable to damage from petrochemicals (Duke 1991, 1992; Duke & Pinzon 91a, 91b; Garrity and Levings 1993, Duke et al. 1993; Proffitt et al. 1995; Duke et al. 1997, 1998a, 1998b, 1999a, 1999b; Duke & Shulkin 1999; Duke et al. 2000; Duke & Burns 2003). Intertidal habitats present along the shoreline between Darwin and Broome included vast mangrove habitats, growing on 3214 km coast; constituting 63% of the surveyed region. The OzCoast database (2009) identifies 9440.63 km^2 of tidal wetland habitat within the Montara well release region, calculated as 1.85 km^2 of tidal wetland for every kilometer of coast surveyed during the present project. Saltmarsh and salt flats were also common along the intertidal region, spanning more than 1215 and 1317 km respectively. The extent of intertidal wetland varied between the 16 surveyed regions. Measures for each region of tidal wetland quantifies coastal shorelines at greatest risk, varying between 0.04 and 10.88 km^2 of tidal wetland/km of shoreline. Three coastal areas are at greatest risk in having disproportionately vast tidal wetland areas, including: Joseph Bonaparte Gulf (subregion #5), Cambridge Gulf (subregion #6) and King Sound (subregion #14).

Vulnerability of tidal wetland habitats to damage from oil spills is also associated with the biodiversity of mangrove species. In the survey region, the range of mangrove species are progressively limited to the west. Species endpoint occurrences are recognized as limits of existence where such species are at high risk from further disturbance (Duke et al. 2007), like an oil spill (Duke et al. 2000). Respective coastal areas at greatest risk in having western species limits, include: the area west of Darwin (subregions #1 & #2), and the area around King Sound (subregions #14 & #15).

The extent of intertidal habitats vulnerable to oil spill damage within the Montara well release region is extreme. These intertidal communities are essential to the maintenance healthy fisheries (Nagelkerken *et al* 2000; Duke et al. 2007). The quantification of shoreline habitats provided in this report highlights the vulnerability of the coastline to oil pollution.

Habitat condition in shoreline ecological assessment

Objective. *To record pre-existing (i.e. pre-impact) condition of communities or habitats in the subject area.*

Digital imagery collected during the November 2009 survey provides a record of almost the complete shoreline habitat between Darwin and Broome. This dataset is a permanent record of current ecosystem health and habitat condition of the shoreline between Darwin (NT) and Broome (WA). Quantification of habitat condition was not completed during the present study. However the permanent digital imagery record of current habitat condition will allow future comparisons of ecosystem health and condition should the need arise. If impacted, shoreline biota and habitats can continue to be monitored to assess the extent and duration of any damage.

Exposure to oil in shoreline ecological assessment

Objective: *To determine any exposure of waters, sediments, fauna or flora to oil and if detected, to quantify the level of exposure.*

No identifiable oil slicks or contamination were observed during the November 2009 shoreline surveys of Darwin to Broome. Survey methodology proved excellent for oil detection, as the utilization of a helicopter for aerial surveys allowed close inspection of any notable flotsam or debris suspected of being hydrocarbon in origin. It was possible to collect samples of any bloom-like debris directly from the helicopter. Overall, the operational logistics utilized in this study proved essential for the expeditious, effective and efficient conduct of aerial surveys aimed to both detect oil residues as well as comprehensively survey shoreline habitats.

5. CONCLUSIONS & RECOMMENDATIONS

The area between Darwin and Broome remains one of the most isolated areas of Australia, and data for this region is therefore scarce. The present study quantifies habitat types in this region in an accessible manner as a series of detailed maps for 16 subregions of the surveyed shoreline. A comprehensive digital library of georeferenced photographic imagery complements the report. Together, report and digital library present the most comprehensive database of habitat type and condition for this area to date. This data will provide valuable information to gauge future changes to the environment in this remote area of Australia.

Data collected in the present project has identified the shoreline between Darwin and Broome to be at high risk of damage should oil reach the coast. Intertidal wetlands are common throughout the region, with 1.88 km^2 of intertidal wetland present for every kilometre of shoreline surveyed during the present project. Intertidal wetlands are sensitive ecosystems and any damage from oil in these systems will take years to repair. Native marine megafauna observed in the region are also at risk of oil damage both directly and indirectly through the impact of oil on foraging habitats and on environments essential to the reproductive success of prey species.

6. ACKNOWLEDGEMENTS

We are grateful to PTTEPAA, John Wardrop, and DEWHA for the opportunity to conduct baseline aerial and ground surveys. The baseline information gathered has immense and lasting value for the better management of this remote region of Australia.

We would like to thank David Tomlinson and the crew of the *Flamingo Bay*. It was a pleasure to work with you all.

We also thank Karen Edyvane and Carol Palmer (NT Government) for their assistance with this survey, and in particular for megafauna surveys.

The Nikon camera was loaned from Prof Justin Marshall's group at UQ for use with this project.

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APPENDIX

Mapping Metadata

Darwin (NT) to Broome (WA) coastline habitat survey 2009

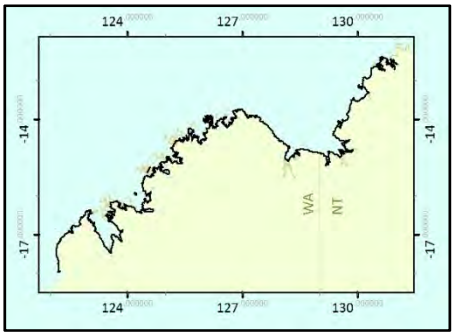
File name: "CoastHabitat_DarwinBroome"

Description

*Abstract***:**

Darwin (NT) to Broome (WA) coastline habitat survey 2009 was created from analysed video clip images, collected from a helicopter during a nine-day period from 9th to 18th November 2009. It shows coastal habitat types and physical attributes of the coastline between Darwin in the Northern Territory and Broome in Western Australia.

Spatial domain:



Geographic extent:

Coastline between Darwin, Northern Territory (130.8453°E 12.4693°S) and Broome, Western Australia (122.2462°E 17.9502°S).

Data currency

*Beginning date***:** 9th November 2009

*Ending date***:** 18th November 2009

Dataset status

*Progress***:** Complete

Maintenance and update frequency: Not updated

Access

Stored data format: DIGITAL - ArcView shape file, GCS WGS84

Data quality

Lineage:

Data were created from aerial video clips, analysed every 2nd frame (every 2 seconds of video footage). Coordinates were identified for frames where one or more assessed categories changed by aligning GPS track data. These data points were shifted perpendicularly to coastline to reflect approximate view of coast from helicopter. Coastline (digitised from satellite imagery) was split at each data point and assigned the corresponding attributes.

Positional accuracy:

Estimated at ± 500m based on location of water reach data points as a check category against creeks/channels visible in underlying satellite imagery. Also, positional accuracy is dependent on the GPS accuracy at the location/time of data collection.

Attribute accuracy:

To be assessed.

Completeness:

Complete for region surveyed.

Contact information

Contact organisation: Centre for Marine Studies, University of Queensland

Mail address: Level 8, Gehrmann Building, University of Queensland, St Lucia, QLD 4072

Metadata information

*Metadata date***:** 2010-04-13

Additional Metadata

Attributes:

Attribute abbreviation	Attribute name	Description	Broad classification
CL	Cliff	1 (present), 0 (absent)	Physical – rocky
R	Rocky	1 (present), 0 (absent)	
HRS	High energy rocky shore	1 (present), 0 (absent)	
LRS	Low energy rocky shore	1 (present), 0 (absent)	
RW	Rock wall	1 (present), 0 (absent)	
WCP	Wave Cut Platform	1 (present), 0 (absent)	
StB	Stony beach	1 (present), 0 (absent)	Physical – beach
SB	Sandy beach	1 (present), 0 (absent)	
Sand	Sand flat	1 (present), 0 (absent)	Physical – flats
MF	Mudflat	1 (present), 0 (absent)	
SF	Salt flat	1 (present), 0 (absent)	
ChR	Chenier Ridge	1 (present), 0 (absent)	Physical – dunes
ED	Exposed Dune	1 (present), 0 (absent)	
VD	Vegetated dune	1 (present), 0 (absent)	
M	Mangrove	1 (present), 0 (absent)	Vegetated habitat – mangrove
SM	Saltmarsh	1 (present), 0 (absent)	Vegetated habitat – saltmarsh
CR	Fringing coral	1 (present), 0 (absent)	Vegetated habitat – fringing coral
sG	Seagrass verge	1 (present), 0 (absent)	Vegetated habitat – seagrass verge
S	Swamp	1 (present), 0 (absent)	Vegetated habitat – other wetland
W	Wetland	1 (present), 0 (absent)	
CW	Coastal Woodland	1 (present), 0 (absent)	Vegetated habitat – coastal woodland
G	Grassland	1 (present), 0 (absent)	Vegetated habitat – grassland
A	Human modified	1 (present), 0 (absent)	Human modified
H2O	Water reach	1 (present), 0 (absent)	Water reach
Dep	Deposition	1 (present), 0 (absent)	Deposition
Erod	Erosion	1 (present), 0 (absent)	Erosion
Stab	Stable	1 (present), 0 (absent)	Stable
Scum	Scum	1 (present), 0 (absent)	Scum
Oil	Oil	1 (present), 0 (absent)	Oil

Region_	Coast section name	Name of coast section
Coast_ID	Coast section number	ID number of coast section
Map	UTM grid	UTM grid used for projecting data
Date_	Survey date	Date aerial survey of coast was undertaken
Clip	Video clip analysed	Video clip analysed
Clip_image	Frame number	Frame number for first analysed image in section of unchanged coast
Lat	Original latitude	Original coordinate of data point along helicopter route
Long	Original longitude	Original coordinate of data point along helicopter route
ET_Lat	Shifted latitude	Coordinate of data point after shifted to coastline, perpendicularly to helicopter track
ET_Long	Shifted longitude	Coordinate of data point after shifted to coastline, perpendicularly to helicopter track

Observations of marine megafauna and estuary mouths during coastline survey from Darwin to Broome

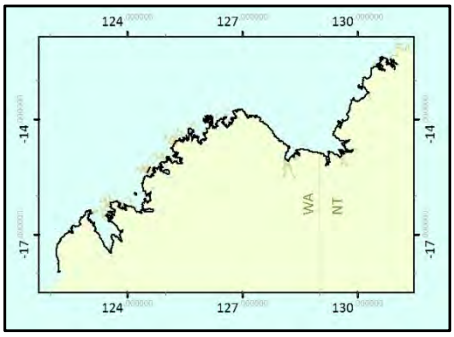
File name: "MarineFauna_Estuaries"

Description

*Abstract***:**

Point locations describing observations made of marine megafauna from helicopter surveys undertaken from Darwin to Broome during the period 9th – 18th November 2009. Also contains point locations describing observations of estuary mouths made during the same surveys.

Spatial domain:



Geographic extent:

Coastline between Darwin, Northern Territory (130.8453°E 12.4693°S) and Broome, Western Australia (122.2462°E 17.9502°S).

Data currency

*Beginning date***:** 9th November 2009

*Ending date***:** 18th November 2009

Dataset status

*Progress***:** Mostly complete – missing observational data collected on the afternoon survey of 16th November 2009.

Maintenance and update frequency: Not updated

Access

Stored data format: DIGITAL - ArcView shape file, GCS WGS84

Data quality

Lineage:

Data were created

Positional accuracy:

For marine megafauna observations, positional accuracy is variable, dependent on the accuracy of the GPS at the time of collection. For estuary mouths, locations shown are the position of the helicopter when the estuary mouth was viewed perpendicularly out the left-hand side. Positional accuracy is dependent on GPS accuracy at the time/location of data collection.

Attribute accuracy:

Broad categorisation of marine megafauna is good, while some error may be present in identification of observations to species/genus level.

Completeness:

Mostly complete – missing observational data collected on the afternoon survey of 16th November 2009.

Contact information

Contact organisation: Centre for Marine Studies, University of Queensland

Mail address: Level 8, Gehrmann Building, University of Queensland, St Lucia, QLD 4072

Metadata information

*Metadata date***:** 2010-04-13

Additional Metadata

Attribute abbreviation	**Attribute name and description (where required)**
Date_	Date observation made
Time	Time observation made
Lat	Coordinates of observation location
Long	Coordinates of observation location
Notes_abbr	Abbreviated notes made during helicopter survey describing observation (e.g. sea turtle or estuary mouth).
Genus_Spec	Genus/Species level identification of fauna observed – where possible to identify
Number_see	Number of animals/estuary mouths observed at specified location (number format)
Obs_notes	Qualitative statements regarding number of animals observed (e.g. “more than” indicates at least the specified number were observed).

Marine megafauna observations

Date	Lat	Long	Common name	Genus/Species	Number
9/11/2009	S12.58942268	E130.56356502	Australian snubfin dolphin	*Orcaella heinsohni*	1
9/11/2009	S12.47827998	E130.58251709	Dugong	*Dugong dugong*	1
9/11/2009	S12.47573549	E130.58014819	Ray	Superorder Batoidea	2
9/11/2009	S12.50059529	E130.58490794	Ray	Superorder Batoidea	2
9/11/2009	S12.45978909	E130.57370804	Sea turtle	*Chelonia* or *Caretta* spp	1
9/11/2009	S12.52943088	E130.57288486	Sea turtle	*Chelonia* or *Caretta* spp	1
9/11/2009	S12.58462219	E130.56227873	Sea turtle	*Chelonia* or *Caretta* spp	1
10/11/2009	S13.21531716	E130.07470141	Dugong	*Dugong dugong*	2
10/11/2009	S13.50825286	E129.8531393	Sea turtle	*Chelonia* or *Caretta* spp	1
10/11/2009	S13.21531716	E130.07470141	Sea turtle	Chelonia or Caretta spp	2
12/11/2009	S14 45.553	E128 43.497	Australian snubfin dolphin	*Orcaella heinsohni*	5
12/11/2009	S14 52.516	E128 27.054	Dugong	*Dugong dugong*	1
12/11/2009	S14 37.127	E128 20.897	Dugong	*Dugong dugong*	1
12/11/2009	S14 35.860	E128 03.258	Dugong	*Dugong dugong*	3
12/11/2009	S14 35.859	E128 03.257	Indo-Pacific bottlenose dolphin	*Tursiops aduncas*	~ 4
12/11/2009	S14 46.698	E128 36.672	Sea turtle	*Chelonia* or *Caretta* spp	1
12/11/2009	S14 32.509	E127 58.305	Sea turtle	*Chelonia* or *Caretta* spp	1
12/11/2009	S14 38.203	E128 24.682	Sea turtle	*Chelonia* or *Caretta* spp	1
12/11/2009	S14 39.903	E128 30.097	Sea turtle	*Chelonia* or *Caretta* spp	1
12/11/2009	S14 42.611	E128 09.938	Sea turtle track	*Chelonia* or *Caretta* spp	1
12/11/2009	S14 35.248	E128 08.222	Unidentified dolphin species	Family Delphinidae	1
12/11/2009	S14 37.710	E128 22.938	Unidentified dolphin species	Family Delphinidae	1
12/11/2009	S14 37.729	E128 23.002	Unidentified dolphin species	Family Delphinidae	1
14/11/2009	S13 44.907	E127 01.934	Dugong	*Dugong dugong*	1
14/11/2009	S13 47.097	E127 03.246	Dugong	*Dugong dugong*	1
14/11/2009	S13 54.903	E127 13.783	Dugong	*Dugong dugong*	2
14/11/2009	S13 54.133	E127 14.144	Dugong	*Dugong dugong*	2
14/11/2009	S13 54.073	E127 15.445	Dugong	*Dugong dugong*	1
14/11/2009	S13 56.153	E127 19.668	Dugong	*Dugong dugong*	1
14/11/2009	S13 55.700	E127 22.794	Dugong	*Dugong dugong*	1
14/11/2009	S13 57.388	E127 25.968	Dugong	*Dugong dugong*	1
14/11/2009	S13 56.753	E127 26.019	Dugong	*Dugong dugong*	1
14/11/2009	S13 57.115	E127 26.061	Dugong	*Dugong dugong*	1
14/11/2009	S14 14.392	E127 45.718	Dugong	*Dugong dugong*	1

14/11/2009	S14 25.789	E127 49.696	Dugong	*Dugong dugong*	2
14/11/2009	S14 25.609	E127 49.778	Dugong	*Dugong dugong*	1
14/11/2009	S14 26.610	E127 52.685	Dugong	*Dugong dugong*	1
14/11/2009	S14 29.210	E127 56.165	Dugong	*Dugong dugong*	1
14/11/2009	S14 32.577	E127 56.651	Dugong	*Dugong dugong*	1
14/11/2009	S13 56.569	E127 12.256	Indo-Pacific bottlenose dolphin	*Tursiops aduncas*	3
14/11/2009	S14 15.671	E127 43.202	Ray	Superorder Batoidea	11
14/11/2009	S13 48.175	E127 02.794	Saltwater crocodile	*Crocodylus porosus*	1
14/11/2009	S14 18.547	E127 46.030	Saltwater crocodile	*Crocodylus porosus*	1
14/11/2009	S13 44.376	E126 57.988	Sea turtle	*Chelonia* or *Caretta* spp	>15
14/11/2009	S13 44.732	E126 58.102	Sea turtle	*Chelonia* or *Caretta* spp	>15
14/11/2009	S13 44.392	E126 58.321	Sea turtle	*Chelonia* or *Caretta* spp	1
14/11/2009	S13 45.060	E126 58.531	Sea turtle	*Chelonia* or *Caretta* spp	2
14/11/2009	S13 45.111	E126 58.958	Sea turtle	*Chelonia* or *Caretta* spp	2
14/11/2009	S13 44.695	E127 00.165	Sea turtle	*Chelonia* or *Caretta* spp	1
14/11/2009	S13 46.348	E127 00.324	Sea turtle	*Chelonia* or *Caretta* spp	1
14/11/2009	S13 47.434	E127 01.332	Sea turtle	*Chelonia* or *Caretta* spp	>15
14/11/2009	S13 48.043	E127 01.961	Sea turtle	*Chelonia* or *Caretta* spp	>15
14/11/2009	S13 48.258	E127 02.648	Sea turtle	*Chelonia* or *Caretta* spp	>15
14/11/2009	S13 48.479	E127 03.249	Sea turtle	*Chelonia* or *Caretta* spp	>15
14/11/2009	S13 48.824	E127 03.289	Sea turtle	*Chelonia* or *Caretta* spp	3
14/11/2009	S13 45.263	E127 03.571	Sea turtle	*Chelonia* or *Caretta* spp	1
14/11/2009	S13 45.531	E127 04.255	Sea turtle	*Chelonia* or *Caretta* spp	1
14/11/2009	S13 45.600	E127 04.443	Sea turtle	*Chelonia* or *Caretta* spp	2
14/11/2009	S13 52.384	E127 04.598	Sea turtle	*Chelonia* or *Caretta* spp	1
14/11/2009	S13 45.772	E127 04.900	Sea turtle	*Chelonia* or *Caretta* spp	1
14/11/2009	S13 50.308	E127 04.998	Sea turtle	*Chelonia* or *Caretta* spp	8
14/11/2009	S13 45.924	E127 05.325	Sea turtle	*Chelonia* or *Caretta* spp	1
14/11/2009	S13 46.022	E127 05.580	Sea turtle	*Chelonia* or *Caretta* spp	1
14/11/2009	S13 52.995	E127 06.366	Sea turtle	*Chelonia* or *Caretta* spp	2
14/11/2009	S13 53.401	E127 06.571	Sea turtle	*Chelonia* or *Caretta* spp	1
14/11/2009	S13 54.967	E127 06.643	Sea turtle	*Chelonia* or *Caretta* spp	2
14/11/2009	S13 54.586	E127 06.762	Sea turtle	*Chelonia* or *Caretta* spp	1
14/11/2009	S13 46.856	E127 07.815	Sea turtle	*Chelonia* or *Caretta* spp	1
14/11/2009	S13 54.273	E127 10.856	Sea turtle	*Chelonia* or *Caretta* spp	1
14/11/2009	S13 54.185	E127 11.616	Sea turtle	*Chelonia* or *Caretta* spp	1

14/11/2009	S13 55.135	E127 11.872	Sea turtle	*Chelonia* or *Caretta* spp	1
14/11/2009	S13 56.587	E127 11.901	Sea turtle	*Chelonia* or *Caretta* spp	2
14/11/2009	S13 55.608	E127 13.630	Sea turtle	*Chelonia* or *Caretta* spp	3
14/11/2009	S13 54.622	E127 13.825	Sea turtle	*Chelonia* or *Caretta* spp	>15
14/11/2009	S13 49.177	E127 14.141	Sea turtle	*Chelonia* or *Caretta* spp	1
14/11/2009	S13 54.132	E127 14.143	Sea turtle	*Chelonia* or *Caretta* spp	>15
14/11/2009	S13 53.871	E127 14.676	Sea turtle	*Chelonia* or *Caretta* spp	2
14/11/2009	S13 53.941	E127 14.926	Sea turtle	*Chelonia* or *Caretta* spp	2
14/11/2009	S13 54.044	E127 15.127	Sea turtle	*Chelonia* or *Caretta* spp	2
14/11/2009	S13 54.072	E127 15.444	Sea turtle	*Chelonia* or *Caretta* spp	1
14/11/2009	S13 54.030	E127 15.685	Sea turtle	*Chelonia* or *Caretta* spp	3
14/11/2009	S13 54.256	E127 16.219	Sea turtle	*Chelonia* or *Caretta* spp	1
14/11/2009	S13 57.049	E127 18.418	Sea turtle	*Chelonia* or *Caretta* spp	1
14/11/2009	S13 57.248	E127 18.599	Sea turtle	*Chelonia* or *Caretta* spp	1
14/11/2009	S13 54.729	E127 19.322	Sea turtle	*Chelonia* or *Caretta* spp	1
14/11/2009	S13 56.154	E127 19.669	Sea turtle	*Chelonia* or *Caretta* spp	1
14/11/2009	S13 54.366	E127 21.674	Sea turtle	*Chelonia* or *Caretta* spp	>15
14/11/2009	S13 54.742	E127 21.820	Sea turtle	*Chelonia* or *Caretta* spp	1
14/11/2009	S13 55.206	E127 22.129	Sea turtle	*Chelonia* or *Caretta* spp	1
14/11/2009	S13 55.701	E127 22.795	Sea turtle	*Chelonia* or *Caretta* spp	1
14/11/2009	S13 56.443	E127 24.002	Sea turtle	*Chelonia* or *Caretta* spp	2
14/11/2009	S13 56.607	E127 24.175	Sea turtle	*Chelonia* or *Caretta* spp	2
14/11/2009	S13 56.826	E127 24.634	Sea turtle	*Chelonia* or *Caretta* spp	1
14/11/2009	S13 56.786	E127 24.825	Sea turtle	*Chelonia* or *Caretta* spp	2
14/11/2009	S13 56.324	E127 25.337	Sea turtle	*Chelonia* or *Caretta* spp	3
14/11/2009	S13 56.282	E127 25.645	Sea turtle	*Chelonia* or *Caretta* spp	10
14/11/2009	S13 56.402	E127 25.964	Sea turtle	*Chelonia* or *Caretta* spp	8
14/11/2009	S13 57.694	E127 26.007	Sea turtle	*Chelonia* or *Caretta* spp	3
14/11/2009	S13 56.753	E127 26.019	Sea turtle	*Chelonia* or *Caretta* spp	2
14/11/2009	S13 56.961	E127 26.071	Sea turtle	*Chelonia* or *Caretta* spp	2
14/11/2009	S13 56.816	E127 26.187	Sea turtle	*Chelonia* or *Caretta* spp	2
14/11/2009	S13 57.916	E127 26.211	Sea turtle	*Chelonia* or *Caretta* spp	1
14/11/2009	S13 58.255	E127 26.829	Sea turtle	*Chelonia* or *Caretta* spp	6
14/11/2009	S13 58.567	E127 27.231	Sea turtle	*Chelonia* or *Caretta* spp	2
14/11/2009	S14 02.865	E127 27.514	Sea turtle	*Chelonia* or *Caretta* spp	1
14/11/2009	S14 02.007	E127 27.647	Sea turtle	*Chelonia* or *Caretta* spp	1

14/11/2009	S14 02.216	E127 27.685	Sea turtle	*Chelonia* or *Caretta* spp	2
14/11/2009	S13 59.298	E127 27.822	Sea turtle	*Chelonia* or *Caretta* spp	1
14/11/2009	S14 00.223	E127 28.159	Sea turtle	*Chelonia* or *Caretta* spp	2
14/11/2009	S14 03.637	E127 29.925	Sea turtle	*Chelonia* or *Caretta* spp	1
14/11/2009	S14 04.927	E127 31.931	Sea turtle	*Chelonia* or *Caretta* spp	1
14/11/2009	S14 06.339	E127 34.009	Sea turtle	*Chelonia* or *Caretta* spp	1
14/11/2009	S14 09.328	E127 37.970	Sea turtle	*Chelonia* or *Caretta* spp	1
14/11/2009	S14 12.220	E127 44.374	Sea turtle	*Chelonia* or *Caretta* spp	2
14/11/2009	S14 13.296	E127 45.082	Sea turtle	*Chelonia* or *Caretta* spp	1
14/11/2009	S14 18.874	E127 46.133	Sea turtle	*Chelonia* or *Caretta* spp	2
14/11/2009	S14 15.303	E127 46.360	Sea turtle	*Chelonia* or *Caretta* spp	1
14/11/2009	S14 20.210	E127 47.007	Sea turtle	*Chelonia* or *Caretta* spp	1
14/11/2009	S14 18.508	E127 48.596	Sea turtle	*Chelonia* or *Caretta* spp	1
14/11/2009	S14 25.608	E127 49.777	Sea turtle	*Chelonia* or *Caretta* spp	~5
14/11/2009	S14 25.200	E127 52.929	Sea turtle	*Chelonia* or *Caretta* spp	1
14/11/2009	S14 29.898	E127 55.558	Sea turtle	*Chelonia* or *Caretta* spp	1
14/11/2009	S14 28.958	E127 55.961	Sea turtle	*Chelonia* or *Caretta* spp	1
14/11/2009	S14 32.393	E127 56.685	Sea turtle	*Chelonia* or *Caretta* spp	1
14/11/2009	S13 55.149	E127 13.723	Sea turtle track	*Chelonia* or *Caretta* spp	1
14/11/2009	S13 49.474	E127 16.423	Sea turtle track	*Chelonia or Caretta spp*	3
14/11/2009	S13 46.001	E127 00.147	Unidentified dolphin species	Family Delphinidae	~7
14/11/2009	S13 50.060	E127 04.764	Unidentified dolphin species	Family Delphinidae	1
14/11/2009	S13 51.695	E127 04.877	Unidentified dolphin species	Family Delphinidae	1
14/11/2009	S13 53.059	E127 05.166	Unidentified dolphin species	Family Delphinidae	1
14/11/2009	S13 57.387	E127 25.967	Unidentified dolphin species	Family Delphinidae	2
14/11/2009	S13 56.752	E127 26.018	Unidentified dolphin species	Family Delphinidae	2
14/11/2009	S14 04.033	E127 31.591	Unidentified dolphin species	Family Delphinidae	4
14/11/2009	S14 19.691	E127 46.724	Unidentified dolphin species	Family Delphinidae	4
14/11/2009	S14 33.250	E128 00.111	Unidentified dolphin species	Family Delphinidae	~7
14/11/2009	S13 47.098	E127 03.247	Unidentified shark species	Superorder: Selachimorph	1
14/11/2009	S13 56.325	E127 25.338	Unidentified shark species	Superorder: Selachimorph	1
14/11/2009	S13 57.389	E127 25.969	Unidentified shark species	Superorder: Selachimorph	2
14/11/2009	S14 07.243	E127 34.481	Unidentified shark species	Superorder: Selachimorph	2
15/11/2009	S13 56.799	E126 02.132	Dugong	*Dugong dugong*	1
15/11/2009	S13 56.927	E126 02.346	Dugong	*Dugong dugong*	1
15/11/2009	S13 57.111	E126 09.513	Dugong	*Dugong dugong*	2

15/11/2009	S13 59.992	E126 09.909	Dugong	*Dugong dugong*	2
15/11/2009	S14 03.532	E126 20.207	Dugong	*Dugong dugong*	2
15/11/2009	S14 02.699	E126 21.872	Dugong	*Dugong dugong*	1
15/11/2009	S14 02.597	E126 23.084	Dugong	*Dugong dugong*	1
15/11/2009	S13 59.936	E126 26.847	Dugong	*Dugong dugong*	1
15/11/2009	S14 00.133	E126 27.070	Dugong	*Dugong dugong*	1
15/11/2009	S13 56.713	E126 33.090	Dugong	*Dugong dugong*	1
15/11/2009	S14 04.270	E125 47.985	Indo-Pacific bottlenose dolphin	*Tursiops aduncas*	2
15/11/2009	S13 59.946	E126 08.520	Indo-Pacific bottlenose dolphin	*Tursiops aduncas*	2
15/11/2009	S14 03.932	E126 10.800	Indo-Pacific bottlenose dolphin	*Tursiops aduncas*	1
15/11/2009	S13 59.391	E125 59.097	Ray	Superorder Batoidea	1
15/11/2009	S14 01.051	E126 00.206	Ray	Superorder Batoidea	1
15/11/2009	S13 55.171	E126 02.120	Ray	Superorder Batoidea	1
15/11/2009	S13 56.799	E126 02.132	Ray	Superorder Batoidea	1
15/11/2009	S13 56.927	E126 02.346	Ray	Superorder Batoidea	1
15/11/2009	S13 56.257	E126 03.078	Ray	Superorder Batoidea	1
15/11/2009	S13 53.910	E126 06.042	Ray	Superorder Batoidea	1
15/11/2009	S13 53.911	E126 06.043	Ray	Superorder Batoidea	2
15/11/2009	S13 59.848	E126 08.016	Ray	Superorder Batoidea	1
15/11/2009	S13 59.500	E126 08.277	Ray	Superorder Batoidea	1
15/11/2009	S14 13.379	E126 13.631	Ray	Superorder Batoidea	1
15/11/2009	S14 11.601	E126 14.423	Ray	Superorder Batoidea	1
15/11/2009	S14 10.380	E126 14.574	Ray	Superorder Batoidea	1
15/11/2009	S14 13.157	E126 17.257	Ray	Superorder Batoidea	1
15/11/2009	S14 13.341	E126 17.577	Ray	Superorder Batoidea	1
15/11/2009	S14 13.068	E126 18.123	Ray	Superorder Batoidea	3
15/11/2009	S14 06.643	E126 18.656	Ray	Superorder Batoidea	1
15/11/2009	S14 04.739	E126 20.343	Ray	Superorder Batoidea	1
15/11/2009	S14 04.167	E126 20.430	Ray	Superorder Batoidea	3
15/11/2009	S14 02.637	E126 20.677	Ray	Superorder Batoidea	1
15/11/2009	S14 02.710	E126 21.721	Ray	Superorder Batoidea	1
15/11/2009	S14 02.678	E126 22.417	Ray	Superorder Batoidea	3
15/11/2009	S14 02.273	E126 23.118	Ray	Superorder Batoidea	10
15/11/2009	S14 01.594	E126 23.426	Ray	Superorder Batoidea	6
15/11/2009	S14 01.250	E126 23.516	Ray	Superorder Batoidea	4
15/11/2009	S14 01.068	E126 23.524	Ray	Superorder Batoidea	1

15/11/2009	S13 59.695	E126 25.601	Ray	Superorder Batoidea	1
15/11/2009	S13 59.410	E126 25.771	Ray	Superorder Batoidea	1
15/11/2009	S14 30.312	E125 41.414	Saltwater crocodile	*Crocodylus porosus*	1
15/11/2009	S13 55.580	E126 06.992	Saltwater crocodile	*Crocodylus porosus*	1
15/11/2009	S14 03.737	E126 09.713	Saltwater crocodile	*Crocodylus porosus*	1
15/11/2009	S14 03.806	E125 35.872	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S14 04.088	E125 39.337	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S14 04.089	E125 39.451	Sea turtle	*Chelonia* or *Caretta* spp	2
15/11/2009	S14 04.498	E125 53.348	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S14 10.892	E126 08.920	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S14 32.589	E125 50.685	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S14 19.570	E125 43.804	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S14 17.982	E125 43.698	Sea turtle	*Chelonia* or *Caretta* spp	3
15/11/2009	S14 17.639	E125 43.764	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S14 17.052	E125 42.706	Sea turtle	*Chelonia* or *Caretta* spp	2
15/11/2009	S14 17.113	E125 41.093	Sea turtle	*Chelonia* or *Caretta* spp	2
15/11/2009	S14 15.324	E125 39.622	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S14 13.949	E125 37.810	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S14 22.404	E125 35.350	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S14 03.158	E125 51.075	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S14 03.329	E125 52.221	Sea turtle	*Chelonia* or *Caretta* spp	12
15/11/2009	S13 59.956	E125 58.307	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S13 59.716	E125 58.510	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S14 01.626	E125 58.665	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S14 01.274	E125 58.730	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S14 04.493	E125 59.921	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S14 04.832	E126 00.354	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S13 56.927	E126 02.346	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S13 55.757	E126 02.602	Sea turtle	*Chelonia* or *Caretta* spp	2
15/11/2009	S13 58.863	E126 02.671	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S13 56.020	E126 02.850	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S13 57.745	E126 03.548	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S14 00.178	E126 04.292	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S13 53.737	E126 05.848	Sea turtle	*Chelonia* or *Caretta* spp	3
15/11/2009	S13 55.461	E126 06.637	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S13 55.813	E126 07.110	Sea turtle	*Chelonia* or *Caretta* spp	2

15/11/2009	S13 56.179	E126 07.404	Sea turtle	*Chelonia* or *Caretta* spp	2
15/11/2009	S13 55.273	E126 07.823	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S13 59.323	E126 08.421	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S13 59.055	E126 08.655	Sea turtle	*Chelonia* or *Caretta* spp	2
15/11/2009	S13 59.546	E126 08.946	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S13 59.395	E126 09.130	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S13 58.621	E126 09.309	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S14 03.930	E126 09.398	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S14 03.788	E126 09.571	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S13 59.353	E126 09.581	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S13 58.400	E126 09.594	Sea turtle	*Chelonia* or *Caretta* spp	4
15/11/2009	S13 54.912	E126 09.633	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S13 58.937	E126 09.779	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S13 56.325	E126 09.947	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S13 57.549	E126 10.332	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S14 05.432	E126 10.561	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S14 03.949	E126 10.607	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S13 56.947	E126 11.027	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S14 04.269	E126 11.447	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S14 10.474	E126 12.186	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S14 00.775	E126 12.580	Sea turtle	*Chelonia* or *Caretta* spp	2
15/11/2009	S14 07.446	E126 12.593	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S14 06.662	E126 13.438	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S14 01.491	E126 13.562	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S14 10.351	E126 13.881	Sea turtle	*Chelonia* or *Caretta* spp	2
15/11/2009	S14 11.600	E126 14.422	Sea turtle	*Chelonia* or *Caretta* spp	2
15/11/2009	S14 13.370	E126 14.646	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S13 52.003	E126 14.799	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S14 13.872	E126 15.502	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S13 53.007	E126 17.895	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S14 07.143	E126 18.279	Sea turtle	*Chelonia* or *Caretta* spp	4
15/11/2009	S14 06.908	E126 18.523	Sea turtle	*Chelonia* or *Caretta* spp	2
15/11/2009	S14 06.534	E126 18.643	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S14 06.642	E126 18.655	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S14 05.659	E126 18.983	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S14 05.631	E126 19.570	Sea turtle	*Chelonia* or *Caretta* spp	1

15/11/2009	S14 05.655	E126 19.972	Sea turtle	*Chelonia* or *Caretta* spp	7
15/11/2009	S14 02.634	E126 20.436	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S14 02.622	E126 20.535	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S14 02.671	E126 20.896	Sea turtle	*Chelonia* or *Caretta* spp	2
15/11/2009	S14 02.696	E126 21.491	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S14 02.709	E126 21.720	Sea turtle	*Chelonia* or *Caretta* spp	2
15/11/2009	S14 02.683	E126 22.098	Sea turtle	*Chelonia* or *Caretta* spp	2
15/11/2009	S14 02.597	E126 23.084	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S14 00.875	E126 23.652	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S14 00.050	E126 25.507	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S13 59.005	E126 26.140	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S13 54.786	E126 28.085	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S13 59.677	E126 28.357	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S13 54.963	E126 28.797	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S13 59.212	E126 29.356	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S13 58.843	E126 29.485	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S13 57.741	E126 29.558	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S13 58.486	E126 29.568	Sea turtle	*Chelonia* or *Caretta* spp	2
15/11/2009	S13 57.415	E126 29.839	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S13 57.633	E126 30.174	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S13 57.622	E126 30.787	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S13 57.489	E126 30.942	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S13 57.331	E126 31.132	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S13 56.874	E126 31.554	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S13 56.112	E126 32.047	Sea turtle	*Chelonia* or *Caretta* spp	2
15/11/2009	S13 56.010	E126 32.177	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S13 56.513	E126 32.648	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S13 56.671	E126 32.873	Sea turtle	*Chelonia* or *Caretta* spp	2
15/11/2009	S13 56.628	E126 33.359	Sea turtle	*Chelonia* or *Caretta* spp	1
15/11/2009	S13 55.812	E126 00.737	Sea turtle track	*Chelonia* or *Caretta* spp	1
15/11/2009	S13 55.181	E126 04.194	Sea turtle track	*Chelonia* or *Caretta* spp	2
15/11/2009	S14 02.991	E126 19.934	Sea turtle track	*Chelonia* or *Caretta* spp	2
15/11/2009	S13 57.763	E126 30.541	Sea turtle track	*Chelonia* or *Caretta* spp	2
15/11/2009	S14 22.826	E125 33.986	Unidentified dolphin species	Family Delphinidae	1
15/11/2009	S14 02.301	E125 46.189	Unidentified dolphin species	Family Delphinidae	~7
15/11/2009	S14 02.802	E125 49.194	Unidentified dolphin species	Family Delphinidae	~7

15/11/2009	S14 02.166	E125 58.506	Unidentified dolphin species	Family Delphinidae	3
15/11/2009	S14 03.509	E125 59.286	Unidentified dolphin species	Family Delphinidae	1
15/11/2009	S13 59.775	E126 08.707	Unidentified dolphin species	Family Delphinidae	1
15/11/2009	S13 59.937	E126 26.848	Unidentified dolphin species	Family Delphinidae	1
15/11/2009	S14 15.008	E125 39.387	Unidentified shark species	Superorder: Selachimorph	1
15/11/2009	S13 59.895	E125 59.169	Unidentified shark species	Superorder: Selachimorph	1
15/11/2009	S14 13.206	E126 13.691	Unidentified shark species	Superorder: Selachimorph	1
15/11/2009	S14 02.682	E126 22.097	Unidentified shark species	Superorder: Selachimorph	1
15/11/2009	S14 00.511	E126 24.906	Unidentified shark species	Superorder: Selachimorph	1
15/11/2009	S13 59.439	E126 26.817	Unidentified shark species	Superorder: Selachimorph	2
16/11/2009	S15 02.640	E125 07.977	Australian snubfin dolphin	*Orcaella heinsohni*	2
16/11/2009	S15 19.609	E124 41.154	Dugong	*Dugong dugong*	2
16/11/2009	S14 54.475	E125 14.922	Dugong	*Dugong dugong*	2
16/11/2009	S15 00.425	E125 04.980	Ray	Superorder Batoidea	1
16/11/2009	S14 49.050	E125 11.645	Ray	Superorder Batoidea	1
16/11/2009	S14 55.521	E125 16.600	Ray	Superorder Batoidea	1
16/11/2009	S14 31.116	E125 32.279	Ray	Superorder Batoidea	1
16/11/2009	S15 08.144	E125 24.557	Saltwater crocodile	Crocodylus porosus	2
16/11/2009	S15 06.785	E124 56.784	Sea turtle	*Chelonia* or *Caretta* spp	1
16/11/2009	S15 19.414	E124 41.368	Sea turtle	*Chelonia* or *Caretta* spp	1
16/11/2009	S15 27.557	E124 37.261	Sea turtle	*Chelonia* or *Caretta* spp	1
16/11/2009	S15 19.610	E124 41.155	Sea turtle	*Chelonia* or *Caretta* spp	1
16/11/2009	S14 49.782	E125 00.153	Sea turtle	*Chelonia* or *Caretta* spp	1
16/11/2009	S14 49.915	E125 00.163	Sea turtle	*Chelonia* or *Caretta* spp	1
16/11/2009	S14 50.419	E125 00.197	Sea turtle	*Chelonia* or *Caretta* spp	1
16/11/2009	S14 45.625	E125 00.380	Sea turtle	*Chelonia* or *Caretta* spp	1
16/11/2009	S14 44.206	E125 00.430	Sea turtle	*Chelonia* or *Caretta* spp	1
16/11/2009	S15 02.459	E125 07.762	Sea turtle	*Chelonia* or *Caretta* spp	1
16/11/2009	S14 54.951	E125 14.054	Sea turtle	*Chelonia* or *Caretta* spp	1
16/11/2009	S14 36.647	E125 14.076	Sea turtle	*Chelonia* or *Caretta* spp	2
16/11/2009	S14 36.544	E125 14.162	Sea turtle	*Chelonia* or *Caretta* spp	1
16/11/2009	S14 32.180	E125 15.119	Sea turtle	*Chelonia* or *Caretta* spp	1
16/11/2009	S14 32.134	E125 16.111	Sea turtle	*Chelonia* or *Caretta* spp	1
16/11/2009	S14 31.064	E125 20.549	Sea turtle	*Chelonia* or *Caretta* spp	1
16/11/2009	S14 30.292	E125 21.822	Sea turtle	*Chelonia* or *Caretta* spp	1
16/11/2009	S14 33.244	E125 27.655	Sea turtle	*Chelonia* or *Caretta* spp	1

16/11/2009	S14 29.299	E125 29.321	Sea turtle	*Chelonia* or *Caretta* spp	1
16/11/2009	S14 58.485	E125 05.622	Sea turtle track	*Chelonia* or *Caretta* spp	1
16/11/2009	S14 45.525	E125 07.409	Sea turtle track	*Chelonia* or *Caretta* spp	10
16/11/2009	S14 38.693	E125 12.353	Sea turtle track	*Chelonia* or *Caretta* spp	1
16/11/2009	S14 55.915	E125 12.583	Sea turtle track	*Chelonia* or *Caretta* spp	6
16/11/2009	S14 31.792	E125 19.315	Sea turtle track	*Chelonia* or *Caretta* spp	1
16/11/2009	S15 03.903	E125 21.470	Sea turtle track	*Chelonia* or *Caretta* spp	1
16/11/2009	S14 16.952	E125 29.585	Sea turtle track	*Chelonia* or *Caretta* spp	4
16/11/2009	S15 08.824	E124 50.993	Unidentified dolphin species	Family Delphinidae	4
16/11/2009	S14 57.194	E125 00.914	Unidentified dolphin species	Family Delphinidae	1
16/11/2009	S14 32.247	E125 13.734	Unidentified dolphin species	Family Delphinidae	1
16/11/2009	S14 52.337	E125 13.999	Unidentified dolphin species	Family Delphinidae	1
16/11/2009	S14 16.952	E125 29.585	Unidentified shark species	Superorder: Selachimorph	1
17/11/2009	S16 19.006	E123 51.341	Australian snubfin dolphin	*Orcaella heinsohni*	2
17/11/2009	S16 19.005	E123 51.340	Ray	Superorder Batoidea	1
17/11/2009	S16 10.644	E123 47.310	Ray	Superorder Batoidea	1
17/11/2009	S16 09.722	E123 35.746	Ray	Superorder Batoidea	1
17/11/2009	S16 19.007	E123 51.342	Ray	Superorder Batoidea	1
17/11/2009	S16 30.994	E123 25.977	Ray	Superorder Batoidea	1
17/11/2009	S16 43.959	E123 08.290	Ray	Superorder Batoidea	1
17/11/2009	S16 31.848	E123 00.265	Ray	Superorder Batoidea	1
17/11/2009	S16 28.458	E123 02.442	Ray	Superorder Batoidea	1
17/11/2009	S16 24.882	E123 01.521	Ray	Superorder Batoidea	2
17/11/2009	S16 23.238	E122 58.494	Ray	Superorder Batoidea	2
17/11/2009	S16 23.707	E122 56.798	Ray	Superorder Batoidea	1
17/11/2009	S16 21.568	E123 01.775	Ray	Superorder Batoidea	1
17/11/2009	S16 23.186	E124 26.981	Saltwater crocodile	*Crocodylus porosus*	1
17/11/2009	S16 24.641	E124 16.570	Saltwater crocodile	*Crocodylus porosus*	2
17/11/2009	S16 24.543	E124 13.811	Saltwater crocodile	*Crocodylus porosus*	1
17/11/2009	S16 22.942	E124 12.576	Saltwater crocodile	*Crocodylus porosus*	1
17/11/2009	S16 13.360	E123 48.917	Saltwater crocodile	*Crocodylus porosus*	1
17/11/2009	S16 39.570	E123 30.104	Saltwater crocodile	*Crocodylus porosus*	1
17/11/2009	S15 58.106	E124 18.175	Sea turtle	*Chelonia* or *Caretta* spp	1
17/11/2009	S15 58.513	E124 18.816	Sea turtle	*Chelonia* or *Caretta* spp	1
17/11/2009	S16 13.289	E123 54.530	Sea turtle	*Chelonia* or *Caretta* spp	2
17/11/2009	S16 13.509	E123 54.649	Sea turtle	*Chelonia* or *Caretta* spp	2

17/11/2009	S16 14.250	E123 55.125	Sea turtle	*Chelonia* or *Caretta* spp	>40
17/11/2009	S16 14.687	E123 55.614	Sea turtle	*Chelonia* or *Caretta* spp	>10
17/11/2009	S16 15.463	E123 56.699	Sea turtle	*Chelonia* or *Caretta* spp	>10
17/11/2009	S16 21.353	E123 57.126	Sea turtle	*Chelonia* or *Caretta* spp	>5
17/11/2009	S16 10.442	E123 47.116	Sea turtle	*Chelonia* or *Caretta* spp	1
17/11/2009	S16 09.597	E123 36.309	Sea turtle	*Chelonia* or *Caretta* spp	1
17/11/2009	S17 04.158	E123 17.168	Sea turtle	*Chelonia* or *Caretta* spp	1
17/11/2009	S16 54.470	E123 09.199	Sea turtle	*Chelonia* or *Caretta* spp	1
17/11/2009	S16 44.321	E123 07.756	Sea turtle	*Chelonia* or *Caretta* spp	1
17/11/2009	S16 42.114	E123 08.709	Sea turtle	*Chelonia* or *Caretta* spp	1
17/11/2009	S16 41.923	E123 08.662	Sea turtle	*Chelonia* or *Caretta* spp	2
17/11/2009	S16 41.938	E123 07.915	Sea turtle	*Chelonia* or *Caretta* spp	2
17/11/2009	S16 42.326	E123 07.731	Sea turtle	*Chelonia* or *Caretta* spp	1
17/11/2009	S16 37.637	E123 02.350	Sea turtle	*Chelonia* or *Caretta* spp	1
17/11/2009	S16 37.402	E123 02.414	Sea turtle	*Chelonia* or *Caretta* spp	2
17/11/2009	S16 35.711	E122 59.220	Sea turtle	*Chelonia* or *Caretta* spp	1
17/11/2009	S16 33.775	E122 58.879	Sea turtle	*Chelonia* or *Caretta* spp	1
17/11/2009	S16 29.364	E122 59.870	Sea turtle	*Chelonia* or *Caretta* spp	1
17/11/2009	S16 27.667	E123 00.058	Sea turtle	*Chelonia* or *Caretta* spp	1
17/11/2009	S16 27.825	E123 01.597	Sea turtle	*Chelonia* or *Caretta* spp	1
17/11/2009	S16 24.194	E123 01.636	Sea turtle	*Chelonia* or *Caretta* spp	1
17/11/2009	S16 23.827	E123 02.212	Sea turtle	*Chelonia* or *Caretta* spp	1
17/11/2009	S16 22.963	E123 01.947	Sea turtle	*Chelonia* or *Caretta* spp	1
17/11/2009	S16 21.566	E123 01.773	Sea turtle	*Chelonia* or *Caretta* spp	1
17/11/2009	S16 21.567	E123 01.774	Sea turtle	*Chelonia* or *Caretta* spp	1
17/11/2009	S16 23.307	E122 58.314	Sea turtle	*Chelonia* or *Caretta* spp	1
17/11/2009	S16 24.208	E122 54.861	Sea turtle	*Chelonia* or *Caretta* spp	1
17/11/2009	S16 26.179	E124 20.541	Unidentified dolphin species	Family Delphinidae	2
17/11/2009	S16 05.412	E123 46.065	Unidentified dolphin species	Family Delphinidae	~ 8
17/11/2009	S16 23.189	E122 58.608	Unidentified dolphin species	Family Delphinidae	1
17/11/2009	S16 18.764	E123 50.813	Unidentified shark species	Superorder: Selachimorph	1
17/11/2009	S16 27.604	E123 00.597	Unidentified shark species	Superorder: Selachimorph	1
17/11/2009	S16 23.064	E122 58.855	Unidentified shark species	Superorder: Selachimorph	1
18/11/2009	S16 38.201	E122 39.063	Manta ray	Manta birostris	1
18/11/2009	S16 28.513	E122 53.240	Ray	Superorder Batoidea	1
18/11/2009	S16 56.624	E122 14.528	Sea turtle	*Chelonia* or *Caretta* spp	1

18/11/2009	S16 56.362	E122 14.861	Sea turtle	*Chelonia* or *Caretta* spp	1
18/11/2009	S16 56.345	E122 14.883	Sea turtle	*Chelonia* or *Caretta* spp	1
18/11/2009	S16 55.025	E122 16.645	Sea turtle	*Chelonia* or *Caretta* spp	2
18/11/2009	S16 54.640	E122 17.113	Sea turtle	*Chelonia* or *Caretta* spp	1
18/11/2009	S16 53.201	E122 18.874	Sea turtle	*Chelonia* or *Caretta* spp	3
18/11/2009	S16 49.214	E122 24.109	Sea turtle	*Chelonia* or *Caretta* spp	1
18/11/2009	S16 47.331	E122 26.811	Sea turtle	*Chelonia* or *Caretta* spp	1
18/11/2009	S16 46.825	E122 27.464	Sea turtle	*Chelonia* or *Caretta* spp	2
18/11/2009	S16 39.782	E122 37.016	Sea turtle	*Chelonia* or *Caretta* spp	1
18/11/2009	S16 37.939	E122 39.421	Sea turtle	*Chelonia* or *Caretta* spp	1
18/11/2009	S16 37.404	E122 40.084	Sea turtle	*Chelonia* or *Caretta* spp	2
18/11/2009	S16 34.774	E122 43.497	Sea turtle	*Chelonia* or *Caretta* spp	1
18/11/2009	S16 28.028	E122 52.199	Sea turtle	*Chelonia* or *Caretta* spp	1
18/11/2009	S16 27.896	E122 52.375	Sea turtle	*Chelonia* or *Caretta* spp	2
18/11/2009	S16 27.103	E122 53.414	Sea turtle	*Chelonia* or *Caretta* spp	1
18/11/2009	S16 23.706	E122 58.419	Sea turtle	*Chelonia* or *Caretta* spp	1
18/11/2009	S16 22.288	E123 00.340	Sea turtle	*Chelonia* or *Caretta* spp	1
18/11/2009	S16 23.503	E122 58.524	Sea turtle	*Chelonia* or *Caretta* spp	1
18/11/2009	S16 25.312	E122 54.552	Sea turtle	*Chelonia* or *Caretta* spp	1
18/11/2009	S16 38.202	E122 39.064	Sea turtle	*Chelonia* or *Caretta* spp	1
18/11/2009	S16 47.223	E122 33.937	Sea turtle	*Chelonia* or *Caretta* spp	1
18/11/2009	S17 01.043	E122 20.961	Sea turtle	*Chelonia* or *Caretta* spp	1
18/11/2009	S17 01.159	E122 20.846	Sea turtle	*Chelonia* or *Caretta* spp	1
18/11/2009	S17 01.818	E122 20.160	Sea turtle	*Chelonia* or *Caretta* spp	1
18/11/2009	S17 01.916	E122 20.048	Sea turtle	*Chelonia* or *Caretta* spp	1
18/11/2009	S17 02.199	E122 19.730	Sea turtle	*Chelonia* or *Caretta* spp	1
18/11/2009	S17 02.498	E122 19.423	Sea turtle	*Chelonia* or *Caretta* spp	1
18/11/2009	S17 20.732	E122 09.177	Sea turtle	*Chelonia* or *Caretta* spp	1
18/11/2009	S17 34.783	E122 09.112	Sea turtle	*Chelonia* or *Caretta* spp	1
18/11/2009	S17 41.077	E122 11.842	Sea turtle	*Chelonia* or *Caretta* spp	1
18/11/2009	S17 42.852	E122 11.942	Sea turtle	*Chelonia* or *Caretta* spp	1
18/11/2009	S16 51.554	E122 20.916	Unidentified dolphin species	Family Delphinidae	1
18/11/2009	S16 48.692	E122 24.865	Unidentified dolphin species	Family Delphinidae	1
18/11/2009	S16 23.860	E122 57.772	Unidentified dolphin species	Family Delphinidae	1
18/11/2009	S16 28.803	E122 52.939	Unidentified dolphin species	Family Delphinidae	1
18/11/2009	S16 34.297	E122 44.122	Whale species	*Order Cetacea*	1

Sampling station log for various samplings: from vessel, from helicopter landing sites, and others. For time used, see Table 2, recognizing that clocks were standardized to change over on the night of the 12th Nov. – from NT to WA time.

Site ID	Site name (platform)	Lat	Long	Date	Time (local time):
S1	Pearce Point, NT (boat)	S 14º 25'42.9	E 129º 20'19.0	11-Nov-09	13:15

Depths	DO (ppm/%)	pH (units)	Temp (ºC)	Sal (ppt)
0m	7.09 / 92.4	7.91	29.9	37.9
5m	na	8.28	29.4	38.7

1L water samples taken at above depths
Sediment/ fauna: None, taken, sampler lost
Secchi depth: 1m
Conditions: Sunny, med wind, strong current, total depth 12 m

Site ID	Site name (platform)	Lat	Long	Date	Time (local time):
S2	Victoria River Mouth, NT (boat)	S 14º 38'47.5"	E 129º 11'16.6	11-Nov-09	18:30

Depths	DO (ppm/%)	pH (units)	Temp (ºC)	Sal (ppt)
0m	7.27 / 95.5	8.37	29.7	38
6m	na	8.38	29.1	38.8
10m	na	8.39	29.2	38.6

1L water samples taken at above depths
Sediment/fauna: None taken,
Secchi Depth: 0.5 m
Conditions: Windy, stormy, stirred up strong current

Site ID	Site name (platform)	Lat	Long	Date	Time (local time):
S3	Pelican Island, WA (boat)	S 14º 45'17.1"	E 128º 46'58.5"	12-Nov-09	11:50

Depths	DO (ppm/%)	pH (units)	Temp (ºC)	Sal (ppt)
0m	7.25/97.1	8.39	31.3	38.3
5m	na	8.4	30.2	38.5
10m	na	8.39	30.1	38.3

1L water samples taken at above depths
Sediment/fauna: sediment attempted, hard substrate, few bits of material retained
Secchi Depth: 1.5 m
Conditions: light wind, sunny

Site ID	Site name (platform)	Lat	Long	Date	Time (local time):
S4	Pelican Island, WA (beach)	S 14º 46'18.5"	E 128º 46'31.2	12-Nov-09	13:30

Parameters not taken

1L water samples taken at surface
Sediment/fauna: collected by hand from beach sand
Secchi Depth: 0.5 m
Conditions: light wind, sunny

S5	Cape Londonderry, WA (beach)	S 13.74018	E 126.9689	14-Nov-09	10:25

Parameters not taken

1L water sample taken at surface (0m) from beach
Sediment collected from beach coarse sand /shell
Conditions: Sunny, no wind, beach with coral flat

S6	Anjo Peninsula, WA (beach)	S 13.94326	E 126.56251	14-Nov-09	15:25

Parameters not taken

1L water sample taken at surface from beach
Sediment collected from beach sand, oysters taken
Conditions: overcast light wind, passing storms in area

S7	Sir Graham Moore Is, WA (Beach)	S 13.88242	E 126.58974	14-Nov-09	16:30

Parameters not taken

1L water sample taken at surface (0m) from beach
Sediment collected from beach, coral/shell
Conditions: Overcast, light wind, passing storms in area

S8	Sir Graham Moore Is, WA (Boat)	S 13º 52.61	E 126º 29.07	14-Nov-09	18:30

Depths	DO (ppm/%)	pH (units)	Temp (ºC)	Sal (ppt)
0m	7.45/98.3	8.33	30.1	38.8
10m	na	8.34	30	38.7

1L water samples taken at above depths
Sediment/fauna: Sediment obtained, gray mud
Secchi Depth: 4 m
Conditions: Overcast, light wind

S9	North Eclipse Island, WA (boat)	S 13º 42'37.6"	E 126º 19'38.8"	15-Nov-09	6:30

Parameters not taken

1L water sample taken at surface (0m) and 10m
Sediment: None taken
Secchi depth: 9m
Conditions: calm, sunny

S10	Suspect area identified by helicopter (Boat)	S 13º 49'21.8"	E 126º 06'13.4"	15-Nov-09	9:45

Parameters not taken

1L water sample taken at surface (0m)
Sediment: none taken
Small bottle sample with white waxy clumps found in floating algal mat (Sargassum sp)
algae mat (Sargassum sp.) sampled, wrapped in foil
Secchi depth: 9m
Conditions: calm sunny

S10.5	Suspect area identified from boat, WA (boat)	S 14º 03'49.8"	E 126º 53'34.5"	15-Nov-09	11:30

Parameters not taken, only 200 ml bottle with particles in it.
looked under microscope, most likely algae trycodesmium diatom algae

S11	Hat Point, WA (beach)	S 13.92700	E 125.98434	15-Nov-09	10:06

Parameters not taken

1L water sample taken at surface (0m)
Sediment sample taken, sandy beach, bivalve tissue sample
Conditions: sunny calm

S12	Gibson Point, WA (beach)	S 13.9913	E 125.98434	15-Nov-09	12:14

Parameters not taken

1L water sample taken at surface (0m)
Sediment sample taken, sandy beach, bivalve tissue sample taken
Conditions: sunny calm

S13	Cape Voltaire, WA (beach)	S 14.25930	E 125.58485	15-Nov-09	16:00

Parameters not taken

1L water sample taken at surface (0m)
Sediment sample taken, sandy beach with turtle nests
Conditions:sunny calm

S14	Bigges Island, WA (boat)	S 14º 32'49.2"	E 125º 05'11.2"	16-Nov-09	6:30

Depths	DO (ppm/%)	pH (units)	Temp (ºC)	Sal (ppt)
0m	7.33/96.1	8.31	30.7	37

1L water samples taken at 0m, 8m
Sediment sample not taken, substrate rock, depth 28m
Secch depth: 4m
Conditions calm sunny, strong tidal current

S15	Cape Brewster, WA (beach)	S 15.11526	E 124.67610	16-Nov-09	9:30

Parameters not taken

1L water sample taken at surface (0m)
Sediment taken, sandy beach
Conditions: high tide calm sunny

S16	Port George the Fourth, WA (beach)	S 15.29353	E 124.67610	16-Nov-09	10:40

Parameters not taken

1L water sample taken at surface (0m)
Sediment taken, sandy beach
Conditions: high tide calm sunny

S17	Montgomery Island, WA (from boat)	S 15º 48'02.3"	E 124º 03'13.0"	16-Nov-09	20:00

Depths	DO (ppm/%)	pH (units)	Temp (ºC)	Sal (ppt)
0m	7.74/100.3	8.15	29	38.3
10m	na	8.15	29	38.7

1L water sample taken at surface (0m) and 10m
Depth too deep to take sediment sample (ca 30m+)
Conditions: light chop, moderate current

S17.5	Montgomery Island, WA (from helicopter/shore)	S 15.95465	E 124.21360	16-Nov-09	16:05

Parameters not taken

2x 200ml water sample taken at surface (0m)
No sediment
Conditions low tide, muddy, windy, mangrove island

S18	Strickland Bay?, WA (beach)	S 16.29788	E 123.56147	17-Nov-09	10:03

Parameters not taken

1L water sample taken at surface (0m)
Sediment taken, Sandy beach
Conditions: rushing tide, calm on beach, partly cloudy some wind

S19	Entrance to King Sound East, WA (from beach)	S 16.65677	E 123.50729	17-Nov-09	11:00

Parameters not taken

1L water sample taken at surface (0m)
Sediment taken, Sandy beach
Conditions: rushing tide, calm on beach, partly cloudy some wind

S 20	King Sound Entrance, West	S 16.85969	E 123.16286	17-Nov-09	13:50

Parameters not taken

1L water sample taken at surface (0m)
Sediment taken, Sandy beach
Conditions: rushing tide, calm on beach, partly cloudy some wind

S 21	One Arm Point, WA (beach)	S 16.35893	E123.03236	17-Nov-09	15:00

Parameters not taken

1L water sample taken at surface (0m)
Sediment taken, Sandy beach
Conditions: rushing tide, windy, sunny

S 22	Lacepede Islands, WA (boat)	S 16º53'02.6"	E 122º 14'26.2	18-Nov-09	7:30

Depths	DO (ppm/%)	pH (units)	Temp (ºC)	Sal (ppt)
0m	7.65/98.6	8.3	29.2	37.9
10m	na	8.29	29	38.5

1L water sample taken at surface (0m) and 10m
Sediment: not taken, attempted but too rocky/ coraly
Conditions: calm, sunny, moderate current

S 23	Dampier Peninsula Beach, WA (Beach)	S 16.76449	E 122.58679	18-Nov-09	11:00

Parameters not taken

1L water sample taken at surface (0m)
Sediment taken, Sandy beach
Conditions: windy, sunny

S 24	Broome Cable Beach, WA (beach)	S 17.938046	E 122.209392	18-Nov-09	14:45

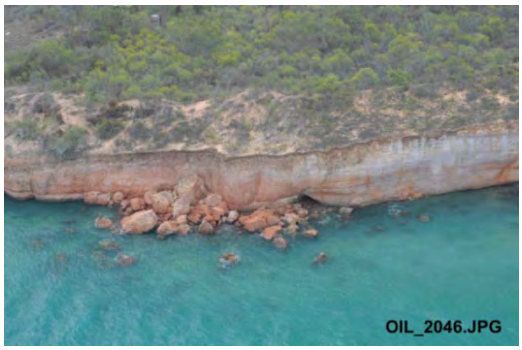
Parameters not taken

1L water sample taken at surface (0m)
Sediment taken, Sandy beach
Conditions: windy, sunny

Shoreline Classifications

Shoreline Stability

Depositional: Low slope gradient. Noticeable mangrove height gradient with recent seedling colonization in front.



Eroding: Steep bank gradient. Exposed face. Mangrove roots exposed. Sharp decline in vegetation (tall trees to no trees).

Vegetated Habitat Types

Mangroves

Saltmarsh

Coastal Woodland

Fringing Coral

Seagrass Verge

Shoreline Physical Characteristics

Beaches: Including sandy (OIL_2466.JPG, OIL_2078.JPG, OIL_2204.JPG) and rocky (2009-11-16-ONE-Clip 7 0350.JPG) beaches.

Dunes: Vegetated dunes (PB170088.JPG, OIL_2197.JPG), exposed dunes (OIL_2406.JPG) and Chenier ridges (PB090115.JPG).

Rocky Shore: Cliff (OIL_8848.JPG), low energy rocky shore (PB090091.JPG), high energy rocky shore (OIL_2375.JPG), rock wall (PB090066.JPG)

Flats: Mud flats (PB170131.JPG, PB090073.JPG), Sand flats (OIL_8779.JPG), Salt Flats (OIL 1681.JPG)

Tidal Wetlands

Mangroves

Saltmarsh

Salt Flat

Sand and Mud Flats

Marine Megafauna Observations

Date	Lat	Long	Common Name	Genus/Species	Number observed
9/11/2009	-12.58942	130.56357	Australian snubfin dolphin	*Orcaella heinsohni*	1
9/11/2009	-12.47828	130.58252	Dugong	*Dugong dugong*	1
9/11/2009	-12.47574	130.58015	Ray	Superorder Batoidea	2
9/11/2009	-12.50060	130.58491	Ray	Superorder Batoidea	2
9/11/2009	-12.45979	130.57371	Sea turtle	*Chelonia or Caretta spp*	1
9/11/2009	-12.52943	130.57288	Sea turtle	*Chelonia or Caretta spp*	1
9/11/2009	-12.58462	130.56228	Sea turtle	*Chelonia or Caretta spp*	1
10/11/2009	-13.21532	130.07470	Dugong	*Dugong dugong*	2
10/11/2009	-13.21532	130.07470	Sea turtle	*Chelonia or Caretta spp*	2
10/11/2009	-13.50825	129.85314	Sea turtle	*Chelonia or Caretta spp*	1
12/11/2009	-14.75922	128.72495	Australian snubfin dolphin	*Orcaella heinsohni*	5
12/11/2009	-14.87527	128.45090	Dugong	*Dugong dugong*	1
12/11/2009	-14.61878	128.34828	Dugong	*Dugong dugong*	1
12/11/2009	-14.77830	128.61120	Sea turtle	*Chelonia or Caretta spp*	1
12/11/2009	-14.63672	128.41137	Sea turtle	*Chelonia or Caretta spp*	1
12/11/2009	-14.66505	128.50162	Sea turtle	*Chelonia or Caretta spp*	1
12/11/2009	-14.79885	128.68409	Sea Turtle	*Chelonia or Caretta spp*	1
12/11/2009	-14.62850	128.38230	Unidentified dolphin species	Family Delphinidae	1
12/11/2009	-14.62882	128.38337	Unidentified dolphin species	Family Delphinidae	1
12/11/2009	-14.59767	128.05430	Dugong	*Dugong dugong*	3
12/11/2009	-14.59765	128.05428	Indo-Pacific bottlenose dolphin	*Tursiops aduncas*	4
12/11/2009	-14.54182	127.97175	Sea turtle	*Chelonia or Caretta spp*	1
12/11/2009	-14.71018	128.16563	Sea turtle track	*Chelonia or Caretta spp*	1
12/11/2009	-14.58747	128.13703	Unidentified dolphin species	Family Delphinidae	1
14/11/2009	-14.23987	127.76197	Dugong	*Dugong dugong*	1
14/11/2009	-14.42982	127.82827	Dugong	*Dugong dugong*	2
14/11/2009	-14.42682	127.82963	Dugong	*Dugong dugong*	1
14/11/2009	-14.44350	127.87808	Dugong	*Dugong dugong*	1

14/11/2009	-14.48683	127.93608	Dugong	*Dugong dugong*	1
14/11/2009	-14.54295	127.94418	Dugong	*Dugong dugong*	1
14/11/2009	-14.26118	127.72003	Ray	Superorder Batoidea	11
14/11/2009	-14.30912	127.76717	Saltwater crocodile	*Crocodylus porosus*	1
14/11/2009	-14.04775	127.45857	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-14.03345	127.46078	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-14.03693	127.46142	Sea turtle	*Chelonia or Caretta spp*	2
14/11/2009	-13.98830	127.46370	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-14.00372	127.46932	Sea turtle	*Chelonia or Caretta spp*	2
14/11/2009	-14.06062	127.49875	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-14.08212	127.53218	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-14.10565	127.56682	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-14.15547	127.63283	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-14.20367	127.73957	Sea turtle	*Chelonia or Caretta spp*	2
14/11/2009	-14.22160	127.75137	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-14.31457	127.76888	Sea turtle	*Chelonia or Caretta spp*	2
14/11/2009	-14.25505	127.77267	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-14.33683	127.78345	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-14.30847	127.80993	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-14.42680	127.82962	Sea turtle	*Chelonia or Caretta spp*	5
14/11/2009	-14.42000	127.88215	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-14.49830	127.92597	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-14.48263	127.93268	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-14.53988	127.94475	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-14.06722	127.52652	Unidentified dolphin species	Family Delphinidae	4
14/11/2009	-14.32818	127.77873	Unidentified dolphin species	Family Delphinidae	4
14/11/2009	-14.55417	128.00185	Unidentified dolphin species	Family Delphinidae	7
14/11/2009	-14.12072	127.57468	Unidentified shark species	Superorder: Selachimorph	2
14/11/2009	-13.78560	126.83355	Dugong	*Dugong dugong*	1
14/11/2009	-13.97460	126.80357	Dugong	*Dugong dugong*	3
14/11/2009	-13.96895	126.79778	Dugong	*Dugong dugong*	1

14/11/2009	-13.74845	127.03223	Dugong	*Dugong dugong*	1
14/11/2009	-13.78495	127.05410	Dugong	*Dugong dugong*	1
14/11/2009	-13.91505	127.22972	Dugong	*Dugong dugong*	2
14/11/2009	-13.90222	127.23573	Dugong	*Dugong dugong*	2
14/11/2009	-13.90122	127.25742	Dugong	*Dugong dugong*	1
14/11/2009	-13.93588	127.32780	Dugong	*Dugong dugong*	1
14/11/2009	-13.92833	127.37990	Dugong	*Dugong dugong*	1
14/11/2009	-13.95647	127.43280	Dugong	*Dugong dugong*	1
14/11/2009	-13.94588	127.43365	Dugong	*Dugong dugong*	1
14/11/2009	-13.95192	127.43435	Dugong	*Dugong dugong*	1
14/11/2009	-13.76375	126.91923	Eagle ray	Superorder Batoidea	1
14/11/2009	-13.94282	127.20427	Indo-Pacific bottlenose dolphin	*Tursiops aduncas*	3
14/11/2009	-13.77692	126.59900	Manta ray	*Manta birostris*	2
14/11/2009	-14.12608	126.69148	Ray	Superorder Batoidea	1
14/11/2009	-14.01572	126.49422	Ray	Superorder Batoidea	1
14/11/2009	-13.80292	127.04657	Saltwater crocodile	*Crocodylus porosus*	1
14/11/2009	-13.73960	126.96647	Sea turtle	*Chelonia or Caretta spp*	15
14/11/2009	-13.74553	126.96837	Sea turtle	*Chelonia or Caretta spp*	15
14/11/2009	-13.73987	126.97202	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.75100	126.97552	Sea turtle	*Chelonia or Caretta spp*	2
14/11/2009	-13.75185	126.98263	Sea turtle	*Chelonia or Caretta spp*	2
14/11/2009	-13.74492	127.00275	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.77247	127.00540	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.79057	127.02220	Sea turtle	*Chelonia or Caretta spp*	15
14/11/2009	-13.80072	127.03268	Sea turtle	*Chelonia or Caretta spp*	15
14/11/2009	-13.80430	127.04413	Sea turtle	*Chelonia or Caretta spp*	15
14/11/2009	-13.80798	127.05415	Sea turtle	*Chelonia or Caretta spp*	15
14/11/2009	-13.81373	127.05482	Sea turtle	*Chelonia or Caretta spp*	3
14/11/2009	-13.75438	127.05952	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.75885	127.07092	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.76000	127.07405	Sea turtle	*Chelonia or Caretta spp*	2

14/11/2009	-13.87307	127.07663	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.76287	127.08167	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.83847	127.08330	Sea turtle	*Chelonia or Caretta spp*	8
14/11/2009	-13.76540	127.08875	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.76703	127.09300	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.88325	127.10610	Sea turtle	*Chelonia or Caretta spp*	2
14/11/2009	-13.89002	127.10952	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.91612	127.11072	Sea turtle	*Chelonia or Caretta spp*	2
14/11/2009	-13.90977	127.11270	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.78093	127.13025	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.90455	127.18093	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.90308	127.19360	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.91892	127.19787	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.94312	127.19835	Sea turtle	*Chelonia or Caretta spp*	2
14/11/2009	-13.92680	127.22717	Sea turtle	*Chelonia or Caretta spp*	3
14/11/2009	-13.91037	127.23042	Sea turtle	*Chelonia or Caretta spp*	15
14/11/2009	-13.81962	127.23568	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.90220	127.23572	Sea turtle	*Chelonia or Caretta spp*	15
14/11/2009	-13.89785	127.24460	Sea turtle	*Chelonia or Caretta spp*	2
14/11/2009	-13.89902	127.24877	Sea turtle	*Chelonia or Caretta spp*	2
14/11/2009	-13.90073	127.25212	Sea turtle	*Chelonia or Caretta spp*	2
14/11/2009	-13.90120	127.25740	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.90050	127.26142	Sea turtle	*Chelonia or Caretta spp*	3
14/11/2009	-13.90427	127.27032	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.95082	127.30697	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.95413	127.30998	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.91215	127.32203	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.93590	127.32782	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.90610	127.36123	Sea turtle	*Chelonia or Caretta spp*	15
14/11/2009	-13.91237	127.36367	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.92010	127.36882	Sea turtle	*Chelonia or Caretta spp*	1

14/11/2009	-13.92835	127.37992	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.94072	127.40003	Sea turtle	*Chelonia or Caretta spp*	2
14/11/2009	-13.94345	127.40292	Sea turtle	*Chelonia or Caretta spp*	2
14/11/2009	-13.94710	127.41057	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.94643	127.41375	Sea turtle	*Chelonia or Caretta spp*	2
14/11/2009	-13.93873	127.42228	Sea turtle	*Chelonia or Caretta spp*	3
14/11/2009	-13.93803	127.42742	Sea turtle	*Chelonia or Caretta spp*	10
14/11/2009	-13.94003	127.43273	Sea turtle	*Chelonia or Caretta spp*	8
14/11/2009	-13.96157	127.43345	Sea turtle	*Chelonia or Caretta spp*	3
14/11/2009	-13.94588	127.43365	Sea turtle	*Chelonia or Caretta spp*	2
14/11/2009	-13.94935	127.43452	Sea turtle	*Chelonia or Caretta spp*	2
14/11/2009	-13.94693	127.43645	Sea turtle	*Chelonia or Caretta spp*	2
14/11/2009	-13.96527	127.43685	Sea turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.97092	127.44715	Sea turtle	*Chelonia or Caretta spp*	6
14/11/2009	-13.97612	127.45385	Sea turtle	*Chelonia or Caretta spp*	2
14/11/2009	-13.91915	127.22872	Sea turtle track	*Chelonia or Caretta spp*	1
14/11/2009	-13.82457	127.27372	Sea turtle track	*Chelonia or Caretta spp*	3
14/11/2009	-13.83540	126.75993	Unidentified shark species	Superorder: Selachimorph	1
14/11/2009	-14.09872	126.51382	Unidentified shark species	Superorder: Selachimorph	1
14/11/2009	-13.73758	127.00758	Sea Turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.73840	126.96187	Sea Turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.74320	126.95133	Sea Turtle	*Chelonia or Caretta spp*	2
14/11/2009	-13.74365	126.91120	Sea Turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.74748	126.91315	Sea Turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.76342	126.91350	Sea Turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.76112	126.90632	Sea Turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.75775	126.90230	Sea Turtle	*Chelonia or Caretta spp*	3
14/11/2009	-13.75538	126.89937	Sea Turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.74900	126.88653	Sea Turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.74675	126.87195	Sea Turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.76467	126.84595	Sea Turtle	*Chelonia or Caretta spp*	3

14/11/2009	-13.78195	126.85348	Sea Turtle	*Chelonia or Caretta spp*	2
14/11/2009	-13.80268	126.83473	Sea Turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.79188	126.83508	Sea Turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.76923	126.80710	Sea Turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.77358	126.79575	Sea Turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.78122	126.78877	Sea Turtle	*Chelonia or Caretta spp*	2
14/11/2009	-13.77753	126.76325	Sea Turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.78490	126.74740	Sea Turtle	*Chelonia or Caretta spp*	2
14/11/2009	-13.80702	126.75165	Sea Turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.82825	126.75618	Sea Turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.86292	126.77127	Sea Turtle	*Chelonia or Caretta spp*	1
14/11/2009	-14.01225	126.69335	Sea Turtle	*Chelonia or Caretta spp*	1
14/11/2009	-14.06995	126.72388	Sea Turtle	*Chelonia or Caretta spp*	1
14/11/2009	-14.14392	126.54688	Sea Turtle	*Chelonia or Caretta spp*	1
14/11/2009	-14.09752	126.51935	Sea Turtle	*Chelonia or Caretta spp*	1
14/11/2009	-14.06158	126.47892	Sea Turtle	*Chelonia or Caretta spp*	1
14/11/2009	-14.05062	126.49392	Sea Turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.94455	126.55298	Sea Turtle	*Chelonia or Caretta spp*	1
14/11/2009	-13.76668	127.00245	Unidentified dolphin species	Family Delphinidae	7
14/11/2009	-13.83433	127.07940	Unidentified dolphin species	Family Delphinidae	1
14/11/2009	-13.86158	127.08128	Unidentified dolphin species	Family Delphinidae	1
14/11/2009	-13.88432	127.08610	Unidentified dolphin species	Family Delphinidae	1
14/11/2009	-13.95645	127.43278	Unidentified dolphin species	Family Delphinidae	2
14/11/2009	-13.94587	127.43363	Unidentified dolphin species	Family Delphinidae	2
14/11/2009	-13.78497	127.05412	Unidentified shark species	Superorder: Selachimorph	1
14/11/2009	-13.93875	127.42230	Unidentified shark species	Superorder: Selachimorph	1
14/11/2009	-13.95648	127.43282	Unidentified shark species	Superorder: Selachimorph	2
15/11/2009	-14.37340	125.58917	Sea turtle	*Chelonia or Caretta sp*p	1
15/11/2009	-14.38043	125.56643	Unidentified dolphin species	Family Delphinidae	1
15/11/2009	-13.94522	126.55150	Dugong	*Dugong dugong*	1
15/11/2009	-13.94188	126.54413	Sea turtle	*Chelonia or Caretta spp*	1

15/11/2009	-13.94452	126.54788	Sea turtle	*Chelonia or Caretta spp*	2
15/11/2009	-13.94380	126.55598	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-13.94665	126.03553	Dugong	*Dugong dugong*	1
15/11/2009	-13.94878	126.03910	Dugong	*Dugong dugong*	1
15/11/2009	-13.95185	126.15855	Dugong	*Dugong dugong*	2
15/11/2009	-13.99987	126.16515	Dugong	*Dugong dugong*	2
15/11/2009	-14.05887	126.33678	Dugong	*Dugong dugong*	2
15/11/2009	-14.04498	126.36453	Dugong	*Dugong dugong*	1
15/11/2009	-14.04328	126.38473	Dugong	*Dugong dugong*	1
15/11/2009	-13.99893	126.44745	Dugong	*Dugong dugong*	1
15/11/2009	-14.00222	126.45117	Dugong	*Dugong dugong*	1
15/11/2009	-14.07117	125.79975	Indo-Pacific bottlenose dolphin	*Tursiops aduncas*	2
15/11/2009	-13.99910	126.14200	Indo-Pacific bottlenose dolphin	*Tursiops aduncas*	2
15/11/2009	-14.06553	126.18000	Indo-Pacific bottlenose dolphin	*Tursiops aduncas*	1
15/11/2009	-13.98985	125.98495	Ray	Superorder Batoidea	1
15/11/2009	-14.01752	126.00343	Ray	Superorder Batoidea	1
15/11/2009	-13.91952	126.03533	Ray	Superorder Batoidea	1
15/11/2009	-13.94665	126.03553	Ray	Superorder Batoidea	1
15/11/2009	-13.94878	126.03910	Ray	Superorder Batoidea	1
15/11/2009	-13.93762	126.05130	Ray	Superorder Batoidea	1
15/11/2009	-13.89850	126.10070	Ray	Superorder Batoidea	1
15/11/2009	-13.89852	126.10072	Ray	Superorder Batoidea	2
15/11/2009	-13.99747	126.13360	Ray	Superorder Batoidea	1
15/11/2009	-13.99167	126.13795	Ray	Superorder Batoidea	1
15/11/2009	-14.22298	126.22718	Ray	Superorder Batoidea	1
15/11/2009	-14.19335	126.24038	Ray	Superorder Batoidea	1
15/11/2009	-14.17300	126.24290	Ray	Superorder Batoidea	1
15/11/2009	-14.21928	126.28762	Ray	Superorder Batoidea	1
15/11/2009	-14.22235	126.29295	Ray	Superorder Batoidea	1
15/11/2009	-14.21780	126.30205	Ray	Superorder Batoidea	3
15/11/2009	-14.11072	126.31093	Ray	Superorder Batoidea	1

15/11/2009	-14.07898	126.33905	Ray	Superorder Batoidea	1
15/11/2009	-14.06945	126.34050	Ray	Superorder Batoidea	3
15/11/2009	-14.04395	126.34462	Ray	Superorder Batoidea	1
15/11/2009	-14.04517	126.36202	Ray	Superorder Batoidea	1
15/11/2009	-14.04463	126.37362	Ray	Superorder Batoidea	3
15/11/2009	-14.03788	126.38530	Ray	Superorder Batoidea	10
15/11/2009	-14.02657	126.39043	Ray	Superorder Batoidea	6
15/11/2009	-14.02083	126.39193	Ray	Superorder Batoidea	4
15/11/2009	-14.01780	126.39207	Ray	Superorder Batoidea	1
15/11/2009	-13.99492	126.42668	Ray	Superorder Batoidea	1
15/11/2009	-13.99017	126.42952	Ray	Superorder Batoidea	1
15/11/2009	-14.50520	125.69023	Saltwater crocodile	*Crocodylus porosus*	1
15/11/2009	-13.92633	126.11653	Saltwater crocodile	*Crocodylus porosus*	1
15/11/2009	-14.06228	126.16188	Saltwater crocodile	*Crocodylus porosus*	1
15/11/2009	-14.06343	125.59787	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-14.06813	125.65562	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-14.06815	125.65752	Sea turtle	*Chelonia or Caretta spp*	2
15/11/2009	-14.07497	125.88913	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-14.18153	126.14867	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-14.54315	125.84475	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-14.32617	125.73007	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-14.29970	125.72830	Sea turtle	*Chelonia or Caretta spp*	3
15/11/2009	-14.29398	125.72940	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-14.28420	125.71177	Sea turtle	*Chelonia or Caretta spp*	2
15/11/2009	-14.28522	125.68488	Sea turtle	*Chelonia or Caretta spp*	2
15/11/2009	-14.25540	125.66037	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-14.23248	125.63017	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-14.05263	125.85125	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-14.05548	125.87035	Sea turtle	*Chelonia or Caretta spp*	12
15/11/2009	-13.99927	125.97178	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-13.99527	125.97517	Sea turtle	*Chelonia or Caretta spp*	1

15/11/2009	-14.02710	125.97775	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-14.02123	125.97883	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-14.07488	125.99868	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-14.08053	126.00590	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-13.94878	126.03910	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-13.92928	126.04337	Sea turtle	*Chelonia or Caretta spp*	2
15/11/2009	-13.98105	126.04452	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-13.93367	126.04750	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-13.96242	126.05913	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-14.00297	126.07153	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-13.89562	126.09747	Sea turtle	*Chelonia or Caretta spp*	3
15/11/2009	-13.92435	126.11062	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-13.93022	126.11850	Sea turtle	*Chelonia or Caretta spp*	2
15/11/2009	-13.93632	126.12340	Sea turtle	*Chelonia or Caretta spp*	2
15/11/2009	-13.92122	126.13038	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-13.98872	126.14035	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-13.98425	126.14425	Sea turtle	*Chelonia or Caretta spp*	2
15/11/2009	-13.99243	126.14910	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-13.98992	126.15217	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-13.97702	126.15515	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-14.06550	126.15663	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-14.06313	126.15952	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-13.98922	126.15968	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-13.97333	126.15990	Sea turtle	*Chelonia or Caretta spp*	4
15/11/2009	-13.91520	126.16055	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-13.98228	126.16298	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-13.93875	126.16578	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-13.95915	126.17220	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-14.09053	126.17602	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-14.06582	126.17678	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-13.94912	126.18378	Sea turtle	*Chelonia or Caretta spp*	1

15/11/2009	-14.07115	126.19078	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-14.17457	126.20310	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-14.01292	126.20967	Sea turtle	*Chelonia or Caretta spp*	2
15/11/2009	-14.12410	126.20988	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-14.11103	126.22397	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-14.02485	126.22603	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-14.17252	126.23135	Sea turtle	*Chelonia or Caretta spp*	2
15/11/2009	-14.19333	126.24037	Sea turtle	*Chelonia or Caretta spp*	2
15/11/2009	-14.22283	126.24410	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-13.86672	126.24665	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-14.23120	126.25837	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-13.88345	126.29825	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-14.11905	126.30465	Sea turtle	*Chelonia or Caretta spp*	4
15/11/2009	-14.11513	126.30872	Sea turtle	*Chelonia or Caretta spp*	2
15/11/2009	-14.10890	126.31072	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-14.11070	126.31092	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-14.09432	126.31638	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-14.09385	126.32617	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-14.09425	126.33287	Sea turtle	*Chelonia or Caretta spp*	7
15/11/2009	-14.04390	126.34060	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-14.04370	126.34225	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-14.04452	126.34827	Sea turtle	*Chelonia or Caretta spp*	2
15/11/2009	-14.04493	126.35818	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-14.04515	126.36200	Sea turtle	*Chelonia or Caretta spp*	2
15/11/2009	-14.04472	126.36830	Sea turtle	*Chelonia or Caretta spp*	2
15/11/2009	-14.04328	126.38473	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-14.01458	126.39420	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-14.00083	126.42512	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-13.98342	126.43567	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-13.91310	126.46808	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-13.99462	126.47262	Sea turtle	*Chelonia or Caretta spp*	1

15/11/2009	-13.91605	126.47995	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-13.98687	126.48927	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-13.98072	126.49142	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-13.96235	126.49263	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-13.97477	126.49280	Sea turtle	*Chelonia or Caretta spp*	2
15/11/2009	-13.95692	126.49732	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-13.96055	126.50290	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-13.96037	126.51312	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-13.95815	126.51570	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-13.95552	126.51887	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-13.94790	126.52590	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-13.93520	126.53412	Sea turtle	*Chelonia or Caretta spp*	2
15/11/2009	-13.93350	126.53628	Sea turtle	*Chelonia or Caretta spp*	1
15/11/2009	-13.93020	126.01228	Sea turtle track	*Chelonia or Caretta spp*	1
15/11/2009	-13.91968	126.06990	Sea turtle track	*Chelonia or Caretta spp*	2
15/11/2009	-14.04985	126.33223	Sea turtle track	*Chelonia or Caretta spp*	2
15/11/2009	-13.96272	126.50902	Sea turtle track	*Chelonia or Caretta spp*	2
15/11/2009	-14.03835	125.76982	Unidentified dolphin species	Family Delphinidae	7
15/11/2009	-14.04670	125.81990	Unidentified dolphin species	Family Delphinidae	7
15/11/2009	-14.03610	125.97510	Unidentified dolphin species	Family Delphinidae	3
15/11/2009	-14.05848	125.98810	Unidentified dolphin species	Family Delphinidae	1
15/11/2009	-13.99625	126.14512	Unidentified dolphin species	Family Delphinidae	1
15/11/2009	-13.99895	126.44747	Unidentified dolphin species	Family Delphinidae	1
15/11/2009	-14.25013	125.65645	Unidentified shark species	Superorder: Selachimorph	1
15/11/2009	-13.99825	125.98615	Unidentified shark species	Superorder: Selachimorph	1
15/11/2009	-14.22010	126.22818	Unidentified shark species	Superorder: Selachimorph	1
15/11/2009	-14.04470	126.36828	Unidentified shark species	Superorder: Selachimorph	1
15/11/2009	-14.00852	126.41510	Unidentified shark species	Superorder: Selachimorph	1
15/11/2009	-13.99065	126.44695	Unidentified shark species	Superorder: Selachimorph	2
16/11/2009	-14.51860	125.53798	Ray	Superorder Batoidea	1
16/11/2009	-14.61078	125.23460	Sea turtle	*Chelonia or Caretta spp*	2

16/11/2009	-14.60907	125.23603	Sea turtle	*Chelonia or Caretta spp*	1
16/11/2009	-14.53633	125.25198	Sea turtle	*Chelonia or Caretta spp*	1
16/11/2009	-14.53557	125.26852	Sea turtle	*Chelonia or Caretta spp*	1
16/11/2009	-14.51773	125.34248	Sea turtle	*Chelonia or Caretta spp*	1
16/11/2009	-14.50487	125.36370	Sea turtle	*Chelonia or Caretta spp*	1
16/11/2009	-14.55407	125.46092	Sea turtle	*Chelonia or Caretta spp*	1
16/11/2009	-14.48832	125.48868	Sea turtle	*Chelonia or Caretta spp*	1
16/11/2009	-14.64488	125.20588	Sea turtle track	*Chelonia or Caretta spp*	1
16/11/2009	-14.52987	125.32192	Sea turtle track	*Chelonia or Caretta spp*	1
16/11/2009	-14.28253	125.49308	Sea turtle track	*Chelonia or Caretta spp*	4
16/11/2009	-14.53745	125.22890	Unidentified dolphin species	Family Delphinidae	1
16/11/2009	-14.28253	125.49308	Unidentified shark species	Superorder: Selachimorph	1
16/11/2009	-15.04400	125.13295	Australian snubfin dolphin	Orcaella heinsohni	2
16/11/2009	-14.90792	125.24870	Dugong	Dugong dugong	2
16/11/2009	-15.00708	125.08300	Ray	Superorder Batoidea	1
16/11/2009	-14.81750	125.19408	Ray	Superorder Batoidea	1
16/11/2009	-14.92535	125.27667	Ray	Superorder Batoidea	1
16/11/2009	-15.13573	125.40928	Saltwater crocodile	*Crocodylus porosus*	2
16/11/2009	-15.11308	124.94640	Sea turtle	*Chelonia or Caretta spp*	1
16/11/2009	-14.82970	125.00255	Sea turtle	*Chelonia or Caretta spp*	1
16/11/2009	-14.83192	125.00272	Sea turtle	*Chelonia or Caretta spp*	1
16/11/2009	-14.84032	125.00328	Sea turtle	*Chelonia or Caretta spp*	1
16/11/2009	-14.76042	125.00633	Sea turtle	*Chelonia or Caretta spp*	1
16/11/2009	-14.73677	125.00717	Sea turtle	*Chelonia or Caretta spp*	1
16/11/2009	-15.04098	125.12937	Sea turtle	*Chelonia or Caretta spp*	1
16/11/2009	-14.91585	125.23423	Sea turtle	*Chelonia or Caretta spp*	1
16/11/2009	-14.97475	125.09370	Sea turtle track	*Chelonia or Caretta spp*	1
16/11/2009	-14.75875	125.12348	Sea turtle track	*Chelonia or Caretta spp*	10
16/11/2009	-14.93192	125.20972	Sea turtle track	*Chelonia or Caretta spp*	6
16/11/2009	-15.06505	125.35783	Sea turtle track	*Chelonia or Caretta spp*	1
16/11/2009	-15.14707	124.84988	Unidentified dolphin species	Family Delphinidae	4

16/11/2009	-14.95323	125.01523	Unidentified dolphin species	Family Delphinidae	1
16/11/2009	-14.87228	125.23332	Unidentified dolphin species	Family Delphinidae	1
16/11/2009	-15.32682	124.68590	Dugong	*Dugong dugong*	2
16/11/2009	-15.96865	124.20543	Dugong	*Dugong dugong*	1
16/11/2009	-15.96768	124.20282	Ray	Superorder Batoidea	1
16/11/2009	-15.32357	124.68947	Sea turtle	*Chelonia or Caretta spp*	1
16/11/2009	-15.45928	124.62102	Sea turtle	*Chelonia or Caretta spp*	1
16/11/2009	-15.32683	124.68592	Sea turtle	*Chelonia or Caretta spp*	1
16/11/2009	-15.18105	124.37865	Sea turtle	*Chelonia or Caretta spp*	1
16/11/2009	-15.43683	124.47047	Sea turtle	*Chelonia or Caretta spp*	1
16/11/2009	-15.54627	124.41788	Sea turtle	*Chelonia or Caretta spp*	1
16/11/2009	-15.57875	124.42583	Sea turtle	*Chelonia or Caretta spp*	1
16/11/2009	-15.67507	124.36710	Sea turtle	*Chelonia or Caretta spp*	1
16/11/2009	-15.68452	124.37595	Sea turtle	*Chelonia or Caretta spp*	1
16/11/2009	-15.69042	124.38782	Sea turtle	*Chelonia or Caretta spp*	1
16/11/2009	-15.70862	124.39445	Sea turtle	*Chelonia or Caretta spp*	1
16/11/2009	-15.74053	124.38935	Sea turtle	*Chelonia or Caretta spp*	1
16/11/2009	-15.74750	124.39047	Sea turtle	*Chelonia or Caretta spp*	2
16/11/2009	-15.83222	124.40403	Sea turtle	*Chelonia or Caretta spp*	1
16/11/2009	-15.85182	124.40545	Sea turtle	*Chelonia or Caretta spp*	2
16/11/2009	-15.87385	124.40815	Sea turtle	*Chelonia or Caretta spp*	1
16/11/2009	-15.87450	124.45873	Sea turtle	*Chelonia or Caretta spp*	1
16/11/2009	-15.94827	124.48137	Sea turtle	*Chelonia or Caretta spp*	1
16/11/2009	-16.09732	124.48015	Sea turtle	*Chelonia or Caretta spp*	1
16/11/2009	-15.94000	124.29743	Sea turtle	*Chelonia or Caretta spp*	1
16/11/2009	-15.94000	124.29743	Sea turtle	*Chelonia or Caretta spp*	1
16/11/2009	-15.94000	124.29743	Sea turtle	*Chelonia or Caretta spp*	1
16/11/2009	-15.94000	124.29743	Sea turtle	*Chelonia or Caretta spp*	1
16/11/2009	-15.91918	124.31913	Sea turtle	*Chelonia or Caretta spp*	1
16/11/2009	-15.92547	124.29735	Sea turtle	*Chelonia or Caretta spp*	2
16/11/2009	-15.93985	124.27105	Sea turtle	*Chelonia or Caretta spp*	1

16/11/2009	-15.94260	124.25975	Sea turtle	*Chelonia or Caretta spp*	1
16/11/2009	-15.55002	124.41413	Sea turtle track	*Chelonia or Caretta spp*	1
16/11/2009	-15.83647	124.20127	Unidentified dolphin species	Family Delphinidae	5
16/11/2009	-15.94632	124.24195	Unidentified shark species	Superorder: Selachimorph	1
16/11/2009	-15.97292	124.22143	Unidentified shark species	Superorder: Selachimorph	1
16/11/2009	-15.95465	124.23460	Unidentified shark species	Superorder: Selachimorph	1
16/11/2009	-15.91915	124.20965	Unidentified shark species	Superorder: Selachimorph	1
17/11/2009	-15.96843	124.30292	Sea turtle	*Chelonia or Caretta spp*	1
17/11/2009	-15.97522	124.31360	Sea turtle	*Chelonia or Caretta spp*	1
17/11/2009	-16.31677	123.85568	Australian snubfin dolphin	*Orcaella heinsohni*	2
17/11/2009	-16.31678	123.85570	Ray	Superorder Batoidea	1
17/11/2009	-16.51657	123.43295	Ray	Superorder Batoidea	1
17/11/2009	-16.31675	123.85567	Ray	Superorder Batoidea	1
17/11/2009	-16.17740	123.78850	Ray	Superorder Batoidea	1
17/11/2009	-16.16203	123.59577	Ray	Superorder Batoidea	1
17/11/2009	-16.65950	123.50173	Saltwater crocodile	*Crocodylus porosus*	1
17/11/2009	-16.38643	124.44968	Saltwater crocodile	*Crocodylus porosus*	1
17/11/2009	-16.41068	124.27617	Saltwater crocodile	*Crocodylus porosus*	2
17/11/2009	-16.40905	124.23018	Saltwater crocodile	*Crocodylus porosus*	1
17/11/2009	-16.38237	124.20960	Saltwater crocodile	*Crocodylus porosus*	1
17/11/2009	-16.22267	123.81528	Saltwater crocodile	*Crocodylus porosus*	1
17/11/2009	-16.22148	123.90883	Sea turtle	*Chelonia or Caretta spp*	2
17/11/2009	-16.22515	123.91082	Sea turtle	*Chelonia or Caretta spp*	2
17/11/2009	-16.23750	123.91875	Sea turtle	*Chelonia or Caretta spp*	40
17/11/2009	-16.24478	123.92690	Sea turtle	*Chelonia or Caretta spp*	10
17/11/2009	-16.25772	123.94498	Sea turtle	*Chelonia or Caretta spp*	10
17/11/2009	-16.35588	123.95210	Sea turtle	*Chelonia or Caretta spp*	5
17/11/2009	-16.17403	123.78527	Sea turtle	*Chelonia or Caretta spp*	1
17/11/2009	-16.15995	123.60515	Sea turtle	*Chelonia or Caretta spp*	1
17/11/2009	-16.43632	124.34235	Unidentified dolphin species	Family Delphinidae	2
17/11/2009	-16.09020	123.76775	Unidentified dolphin species	Family Delphinidae	8

17/11/2009	-16.31273	123.84688	Unidentified shark species	Superorder: Selachimorph	1
17/11/2009	-16.73265	123.13817	Ray	Superorder Batoidea	1
17/11/2009	-17.06930	123.28613	Sea turtle	*Chelonia or Caretta spp*	1
17/11/2009	-16.90783	123.15332	Sea turtle	*Chelonia or Caretta spp*	1
17/11/2009	-16.73868	123.12927	Sea turtle	*Chelonia or Caretta spp*	1
17/11/2009	-16.70190	123.14515	Sea turtle	*Chelonia or Caretta spp*	1
17/11/2009	-16.69872	123.14437	Sea turtle	*Chelonia or Caretta spp*	2
17/11/2009	-16.53080	123.00442	Ray	Superorder Batoidea	1
17/11/2009	-16.47430	123.04070	Ray	Superorder Batoidea	1
17/11/2009	-16.41470	123.02535	Ray	Superorder Batoidea	2
17/11/2009	-16.38730	122.97490	Ray	Superorder Batoidea	2
17/11/2009	-16.39512	122.94663	Ray	Superorder Batoidea	1
17/11/2009	-16.35947	123.02958	Ray	Superorder Batoidea	1
17/11/2009	-16.69897	123.13192	Sea turtle	*Chelonia or Caretta spp*	2
17/11/2009	-16.70543	123.12885	Sea turtle	*Chelonia or Caretta spp*	1
17/11/2009	-16.62728	123.03917	Sea turtle	*Chelonia or Caretta spp*	1
17/11/2009	-16.62337	123.04023	Sea turtle	*Chelonia or Caretta spp*	2
17/11/2009	-16.59518	122.98700	Sea turtle	*Chelonia or Caretta spp*	1
17/11/2009	-16.56292	122.98132	Sea turtle	*Chelonia or Caretta spp*	1
17/11/2009	-16.48940	122.99783	Sea turtle	*Chelonia or Caretta spp*	1
17/11/2009	-16.46112	123.00097	Sea turtle	*Chelonia or Caretta spp*	1
17/11/2009	-16.46375	123.02662	Sea turtle	*Chelonia or Caretta spp*	1
17/11/2009	-16.40323	123.02727	Sea turtle	*Chelonia or Caretta spp*	1
17/11/2009	-16.39712	123.03687	Sea turtle	*Chelonia or Caretta spp*	1
17/11/2009	-16.38272	123.03245	Sea turtle	*Chelonia or Caretta spp*	1
17/11/2009	-16.35943	123.02955	Sea turtle	*Chelonia or Caretta spp*	1
17/11/2009	-16.35945	123.02957	Sea turtle	*Chelonia or Caretta spp*	1
17/11/2009	-16.38845	122.97190	Sea turtle	*Chelonia or Caretta spp*	1
17/11/2009	-16.40347	122.91435	Sea turtle	*Chelonia or Caretta spp*	1
17/11/2009	-16.38648	122.97680	Unidentified dolphin species	Family Delphinidae	1
17/11/2009	-16.46007	123.00995	Unidentified shark species	Superorder: Selachimorph	1

17/11/2009	-16.38440	122.98092	Unidentified shark species	Superorder: Selachimorph	1
18/11/2009	-16.63668	122.65105	Manta ray	*Manta birostris*	1
18/11/2009	-16.47522	122.88733	Ray	*Superorder Batoidea*	1
18/11/2009	-16.66303	122.61693	Sea turtle	*Chelonia or Caretta spp*	1
18/11/2009	-16.63232	122.65702	Sea turtle	*Chelonia or Caretta spp*	1
18/11/2009	-16.62340	122.66807	Sea turtle	*Chelonia or Caretta spp*	2
18/11/2009	-16.57957	122.72495	Sea turtle	*Chelonia or Caretta spp*	1
18/11/2009	-16.46713	122.86998	Sea turtle	*Chelonia or Caretta spp*	1
18/11/2009	-16.46493	122.87292	Sea turtle	*Chelonia or Caretta spp*	2
18/11/2009	-16.45172	122.89023	Sea turtle	*Chelonia or Caretta spp*	1
18/11/2009	-16.39510	122.97365	Sea turtle	*Chelonia or Caretta spp*	1
18/11/2009	-16.37147	123.00567	Sea turtle	*Chelonia or Caretta spp*	1
18/11/2009	-16.39172	122.97540	Sea turtle	*Chelonia or Caretta spp*	1
18/11/2009	-16.42187	122.90920	Sea turtle	*Chelonia or Caretta spp*	1
18/11/2009	-16.63670	122.65107	Sea turtle	*Chelonia or Caretta spp*	1
18/11/2009	-16.78705	122.56562	Sea turtle	*Chelonia or Caretta spp*	1
18/11/2009	-16.78885	122.44685	Sea turtle	*Chelonia or Caretta spp*	1
18/11/2009	-16.78042	122.45773	Sea turtle	*Chelonia or Caretta spp*	2
18/11/2009	-16.39767	122.96287	Unidentified dolphin species	Family Delphinidae	1
18/11/2009	-16.48005	122.88232	Unidentified dolphin species	Family Delphinidae	1
18/11/2009	-16.57162	122.73537	Whale species	Order Cetacea	1
18/11/2009	-17.01738	122.34935	Sea turtle	*Chelonia or Caretta spp*	1
18/11/2009	-17.01932	122.34743	Sea turtle	*Chelonia or Caretta spp*	1
18/11/2009	-17.03030	122.33600	Sea turtle	*Chelonia or Caretta spp*	1
18/11/2009	-17.03193	122.33413	Sea turtle	*Chelonia or Caretta spp*	1
18/11/2009	-17.03665	122.32883	Sea turtle	*Chelonia or Caretta spp*	1
18/11/2009	-17.04163	122.32372	Sea turtle	*Chelonia or Caretta spp*	1
18/11/2009	-17.34553	122.15295	Sea turtle	*Chelonia or Caretta spp*	1
18/11/2009	-17.57972	122.15187	Sea turtle	*Chelonia or Caretta spp*	1
18/11/2009	-17.68462	122.19737	Sea turtle	*Chelonia or Caretta spp*	1
18/11/2009	-17.71420	122.19903	Sea turtle	*Chelonia or Caretta spp*	1

18/11/2009	-16.94373	122.24213	Sea turtle	*Chelonia or Caretta spp*	1
18/11/2009	-16.93937	122.24768	Sea turtle	*Chelonia or Caretta spp*	1
18/11/2009	-16.93908	122.24805	Sea turtle	*Chelonia or Caretta spp*	1
18/11/2009	-16.91708	122.27742	Sea turtle	*Chelonia or Caretta spp*	2
18/11/2009	-16.91067	122.28522	Sea turtle	*Chelonia or Caretta spp*	1
18/11/2009	-16.88668	122.31457	Sea turtle	*Chelonia or Caretta spp*	3
18/11/2009	-16.82023	122.40182	Sea turtle	*Chelonia or Caretta spp*	1
18/11/2009	-16.85923	122.34860	Unidentified dolphin species	Family Delphinidae	1
18/11/2009	-16.81153	122.41442	Unidentified dolphin species	Family Delphinidae	1

Sampling Survey Sites

Sampling station log for various samplings: from vessel, from helicopter landing sites, and others. For time used, see Table 2, recognizing that clocks were standardized to change over on the night of the 12th Nov. – from NT to WA time.

Site ID	Site name (platform)	Lat	Long	Date	Time (local time):
S1	Pearce Point, NT (boat)	S 14º 25'42.9	E 129º 20'19.0	11-Nov-09	13:15

Depths	DO (ppm/%)	pH (units)	Temp (ºC)	Sal (ppt)
0m	7.09 / 92.4	7.91	29.9	37.9
5m	na	8.28	29.4	38.7

1L water samples taken at above depths
Sediment/ fauna: none, taken, sampler lost
Secchi depth: 1m
Conditions: sunny, med wind, strong current, total depth 12 m

Site ID	Site name (platform)	Lat	Long	Date	Time (local time):
S2	Victoria River Mouth, NT (boat)	S 14º 38'47.5"	E 129º 11'16.6	11-Nov-09	18:30

Depths	DO (ppm/%)	pH (units)	Temp (ºC)	Sal (ppt)
0m	7.27 / 95.5	8.37	29.7	38
6m	na	8.38	29.1	38.8
10m	na	8.39	29.2	38.6

1L water samples taken at above depths
Sediment/fauna: None taken,
Secchi Depth: 0.5 m
Conditions: Windy, stormy, stirred up strong current

Site ID	Site name (platform)	Lat	Long	Date	Time (local time):
S3	Pelican Island, WA (boat)	S 14º 45'17.1"	E 128º 46'58.5"	12-Nov-09	11:50

Depths	DO (ppm/%)	pH (units)	Temp (ºC)	Sal (ppt)
0m	7.25/97.1	8.39	31.3	38.3
5m	na	8.4	30.2	38.5
10m	na	8.39	30.1	38.3

1L water samples taken at above depths
Sediment/fauna: sediment attempted, hard substrate, few bits of material retained
Secchi Depth: 1.5 m
Conditions: light wind, sunny

Site ID	Site name (platform)	Lat	Long	Date	Time (local time):
S4	Pelican Island, WA (beach)	S 14º 46'18.5"	E 128º 46'31.2	12-Nov-09	13:30

Parameters not taken

1L water samples taken at surface
Sediment/fauna: collected by hand from beach sand
Secchi Depth: 0.5 m
Conditions: light wind, sunny

S5	Cape Londonderry, WA (beach)	S 13.74018	E 126.9689	14-Nov-09	10:25

Parameters not taken

1L water sample taken at surface (0m) from beach
Sediment collected from beach coarse sand /shell
Conditions: Sunny, no wind, beach with coral flat

S6	Anjo Peninsula, WA (beach)	S 13.94326	E 126.56251	14-Nov-09	15:25

Parameters not taken

1L water sample taken at surface from beach
Sediment collected from beach sand, oysters taken
Conditions: overcast light wind, passing storms in area

S7	Sir Graham Moore Is, WA (Beach)	S 13.88242	E 126.58974	14-Nov-09	16:30

Parameters not taken

1L water sample taken at surface (0m) from beach
Sediment collected from beach, coral/shell
Conditions: Overcast, light wind, passing storms in area

S8	Sir Graham Moore Is, WA (Boat)	S 13º 52.61	E 126º 29.07	14-Nov-09	18:30

Depths	DO (ppm/%)	pH (units)	Temp (ºC)	Sal (ppt)
0m	7.45/98.3	8.33	30.1	38.8
10m	na	8.34	30	38.7

1L water samples taken at above depths
Sediment/fauna: Sediment obtained, gray mud
Secchi depth: 4 m
Conditions: Overcast, light wind

S9	North Eclipse Island, WA (boat)	S 13º 42'37.6"	E 126º 19'38.8"	15-Nov-09	6:30

Parameters not taken

1L water sample taken at surface (0m) and 10m
Sediment: None taken
Secchi depth: 9m
Conditions: calm, sunny

S10	Suspect area identified by helicopter (Boat)	S 13º 49'21.8"	E 126º 06'13.4"	15-Nov-09	9:45

Parameters not taken

1L water sample taken at surface (0m)
Sediment: none taken
Small bottle sample with white waxy clumps found in floating algal mat (Sargassum sp) algae mat (Sargassum sp.) sampled, wrapped in foil
Secchi depth: 9m
Conditions: calm sunny

S10.5	Suspect area identified from boat, WA (boat)	S 14º 03'49.8"	E 126º 53'34.5"	15-Nov-09	11:30

Parameters not taken, only 200 ml bottle with particles in it.
Looked under microscope, most likely algae trycodesmium diatom algae

S11	Hat Point, WA (beach)	S 13.92700	E 125.98434	15-Nov-09	10:06

Parameters not taken

1L water sample taken at surface (0m)
Sediment sample taken, sandy beach, bivalve tissue sample
Conditions: sunny calm

S12	Gibson Point, WA (beach)	S 13.9913	E 125.98434	15-Nov-09	12:14

Parameters not taken

1L water sample taken at surface (0m)
Sediment sample taken, sandy beach, bivalve tissue sample taken
Conditions: sunny calm

S13	Cape Voltaire, WA (beach)	S 14.25930	E 125.58485	15-Nov-09	16:00

Parameters not taken

1L water sample taken at surface (0m)
Sediment sample taken, sandy beach with turtle nests
Conditions:sunny calm

S14	Bigges Island, WA (boat)	S 14º 32'49.2"	E 125º 05'11.2"	16-Nov-09	6:30

Depths	DO (ppm/%)	pH (units)	Temp (ºC)	Sal (ppt)
0m	7.33/96.1	8.31	30.7	37

1L water samples taken at 0m, 8m
Sediment sample not taken, substrate rock, depth 28m
Secch depth: 4m
Conditions calm sunny, strong tidal current

S15	Cape Brewster, WA (beach)	S 15.11526	E 124.67610	16-Nov-09	9:30

Parameters not taken

1L water sample taken at surface (0m)
Sediment taken, sandy beach
Conditions: high tide calm sunny

S16	Port George the Fourth, WA (beach)	S 15.29353	E 124.67610	16-Nov-09	10:40

Parameters not taken

1L water sample taken at surface (0m)
Sediment taken, sandy beach
Conditions: high tide calm sunny

S17	Montgomery Island, WA (from boat)	S 15º 48'02.3"	E 124º 03'13.0"	16-Nov-09	20:00

Depths	DO (ppm/%)	pH (units)	Temp (ºC)	Sal (ppt)
0m	7.74/100.3	8.15	29	38.3
10m	na	8.15	29	38.7

1L water sample taken at surface (0m) and 10m
Depth too deep to take sediment sample (ca 30m+)
Conditions: light chop, moderate current

S17.5	Montgomery Island, WA (from helicopter/shore)	S 15.95465	E 124.21360	16-Nov-09	16:05

Parameters not taken

2x 200ml water sample taken at surface (0m)
No sediment
Conditions low tide, muddy, windy, mangrove island

S18	Strickland Bay?, WA (beach)	S 16.29788	E 123.56147	17-Nov-09	10:03

Parameters not taken

1L water sample taken at surface (0m)
Sediment taken, Sandy beach
Conditions: rushing tide, calm on beach, partly cloudy some wind

S19	Entrance to King Sound East, WA (from beach)	S 16.65677	E 123.50729	17-Nov-09	11:00

Parameters not taken

1L water sample taken at surface (0m)
Sediment taken, Sandy beach
Conditions: rushing tide, calm on beach, partly cloudy some wind

S 20	King Sound Entrance, West	S 16.85969	E 123.16286	17-Nov-09	13:50

Parameters not taken

1L water sample taken at surface (0m)
Sediment taken, Sandy beach
Conditions: rushing tide, calm on beach, partly cloudy some wind

S 21	One Arm Point, WA (beach)	S 16.35893	E123.03236	17-Nov-09	15:00

Parameters not taken

1L water sample taken at surface (0m)
Sediment taken, Sandy beach
Conditions: rushing tide, windy, sunny

S 22	Lacepede Islands, WA (boat)	S 16º53'02.6"	E 122º 14'26.2	18-Nov-09	7:30

Depths	DO (ppm/%)	pH (units)	Temp (ºC)	Sal (ppt)
0m	7.65/98.6	8.3	29.2	37.9
10m	na	8.29	29	38.5

1L water sample taken at surface (0m) and 10m
Sediment: not taken, attempted but too rocky/ coraly
Conditions: calm, sunny, moderate current

S 23	Dampier Peninsula Beach, WA (Beach)	S 16.76449	E 122.58679	18-Nov-09	11:00

Parameters not taken

1L water sample taken at surface (0m)
Sediment taken, Sandy beach
Conditions: windy, sunny

S 24	Broome Cable Beach, WA (beach)	S 17.938046	E 122.209392	18-Nov-09	14:45

Parameters not taken

1L water sample taken at surface (0m)
Sediment taken, Sandy beach
Conditions: windy, sunny

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