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REPORT

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Queensland Government

AERIAL SURVEYS

Determining the spatial distribution and densities of marine turtle nesting and predator activity in the northern Great Barrier Reef, Queensland.

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Acknowledgements

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SUMMARY

Mainland and island beaches along most of the north-east Queensland coast are known to support nesting populations of flatback (*Natator depressus*) and green (*Chelonia mydas*) turtles. However, in contrast to other coastal areas of Queensland, there is a paucity of marine turtle nesting information in the Whitsunday-Burdekin-Townsville region (though some nesting datasets have been collected in that area since the late 1960s). In recent years there has been some collaborative effort between government agencies, Indigenous rangers, and local community groups to increase this information base for the Whitsunday-Burdekin-Townsville region. Nevertheless the level of nesting and predator activity is largely unknown for much of this coastline with current surveys only focusing on accessible areas and using anecdotal evidence.

This project represents a WWF-Australia and Queensland Government Department of Environment and Heritage Protection (EHP) initiative to determine the spatial distribution and densities of marine turtle nesting and predator activity in the Whitsunday-Burdekin-Townsville section of the northern Great Barrier Reef (nGBR), Queensland.

As part of this project, a pilot aerial survey of turtle nesting track data and predator activity was collected between Euri Creek (-19^0 56' 35"; 148^0 06' 50") and Magnetic Island (-19^0 06" 26"; 146^0 52' 31") in December 2014. Air surveys were used to cover this large geographical area of reasonably remote coastline to record the presence of turtle tracks and predator activity, predation on turtle nests and observations of other marine fauna such as saltwater crocodiles, dugong and dolphins. Incidental surveillance of netting operations was also recorded. These data were supported with ground-truthed nesting data collected by local community groups.

This project provides a baseline dataset and understanding which can inform future on-ground regional management, and in particular quantify the effectiveness of existing turtle monitoring and predator activity programs.

The key project findings include:

- The distribution of flatback and green turtle nesting stretches along the majority of the Whitsunday-Burdekin-Townsville coastline with higher density nesting occurring on the mainland coastal beaches at Rita Island (51 tracks), Paradise Bay (22 tracks), and Abbot Point (21 tracks) respectively. Wunjunga Beach was also found to support regionally high density nesting of flatback turtles but since it is monitored daily (with the removal of sighted tracks) the track count was lower than known nesting attempts (refer Table 1 below).
- A regional density of 185 flatback and green turtle nesting attempt tracks were recorded. Although difficult to distinguish due to cloud cover and sun angle, the majority of tracks were thought to be primarily flatback turtles. Of these 142 were old (5 days) tracks and 43 considered new (< 2 days) (refer Table 1 below).
- Predator tracks (primarily pig) were identified on the mainland coastal beaches at Abbot Bay, Abbot Point, eastern Cape Upstart, Rita Island, Bowling Green Bay / eastern coast of Cape Cleveland, AIMS beach and Paradise Bay.
- Overlapping turtle nesting and predator activity indicative of **'*hot spots*'** for further investigation included Rita Island, the eastern beaches of Cape Cleveland particularly Paradise Bay, Abbot Bay including Abbot Point (refer Attachment One).

Key recommendations for the long-term sustainability of Burdekin and Bowling Green Bay nesting turtle populations include:

- Support Whitsunday-Burdekin-Townsville stakeholders to cooperatively manage feral animal predation and provide funding to ensure a bi-annual (i.e. May and October) feral pig / wild dog management program that incorporates baiting, aerial shooting and the assistance of Indigenous ranger and community groups. This should take place before the wet season (before pigs reach their population peak) and before peak turtle nesting.
- Engage local Indigenous rangers and community groups to monitor turtle nesting and predator activity at each ***'hotspot'***.
- Provide on-going funding support to conduct more comprehensive aerial assessments for at least four years with the aim of determining the spatial distribution and densities of marine turtle nesting and predator activity including regional seasonality in Queensland, particularly the northern GBR.
- Investigate the relative impact of netting activities including inshore net fisheries on marine turtle species during the nesting period and if required, explore if seasonal netting closures in the vicinity of turtle nesting beaches is appropriate.

BACKGROUND

Coastal mainland beaches and islands in the northern Great Barrier Reef (nGBR) support some of the highest-density sea turtle nesting populations in the world. To date survey effort has typically focused on known high-density nesting sites, while lower-density, spatially dispersed nesting occurs on many other beaches. The extent and distribution of nesting effort in these areas is based predominately on anecdotal evidence and therefore likely to be grossly underestimated. This has been highlighted through the recent identification of Wunjunga beach in Upstart Bay, where local community and Indigenous groups have recorded over 90 nests each year during the last two nesting seasons. The aggregate total and benefit of this disparate nesting cohort may in-fact provide a greater population benefit than single high density nesting sites.

However, turtle nests are being threatened by unsustainable levels of predation. The incidence of predation of turtle nests is one of the major threats turtles face in Queensland and threatens their very survival. Reports of feral pig predation are resulting in near total decimation, particularly on the west coast of Queensland. While there is anecdotal information regarding predation of turtles on the east coast and islands of Queensland, for the majority of the GBR World Heritage Area, it is largely unknown.

Several aerial surveys have been conducted along various sections of the Queensland coast in the past, but this is the first attempt at conducting a more comprehensive assessment of turtle nesting, and predator track activity or interactions on beaches in the Whitsunday-Burdekin-Townsville region of the nGBR. It is proposed that similar surveys for the entire GBR World Heritage Area should occur.

The project was conducted along the Whitsunday-Burdekin-Townsville region of the nGBR coastline to determine if unknown nesting sites existed, and to elucidate information on nesting species, distribution and density, and correlate these data with predator activity. The survey provides a contemporary understanding of turtle nesting and predator impacts in this area informing future baiting projects to reduce pig numbers, reduce predation of turtle nests, and quantify management effectiveness.

METHOD

A survey of the distribution and density of flatback and green turtle nesting and predator activity was conducted along mainland beaches and islands between Euri Creek (-19^0 56’ 35”; 148^0 06’ 50”) to Cape Cleveland and Magnetic Island (-19^0 06” 26”; 146^0 52’ 31”) on 9 December 2014. Incidental sightings of other species or activity such as inshore netting was also observed and recorded.

On-ground turtle track surveys were carried out by the Queens Beach Action Group on 8 and 9 December 2014 to coincide with the aerial surveys. Combining these techniques is important for validation of the overall survey.

Species identification from tracks: when turtles were not sighted, tracks from nesting turtles were identified to species level using the following key:

1a. breast-stroking gait (rear flipper marks on either side of the central skid mark of the plastron are adjacent) ……**go to 2**

1b. alternating gait (hind flipper marks on either side of the central skid mark of the plastron are not adjacent) ……..……..…….. **go to 4**

2a. narrow (<100cm wide) or no front flipper marks outside of the hind flipper marks ……***Natator depressus***

2b. wide (>100cm wide) and obvious front flipper marks outside of the hind flipper marks ……**go to 3**

3a. medium width track (<130cm wide) from outer edges of front flipper marks ……***Chelonia mydas***

3b. very wide track (>150cm wide) from outer edges of front flipper marks ……***Dermochelys coriacea***

4a. in eastern Australia, south of 16^{o}S latitude …….***Caretta caretta***

Aerial survey

A Robinson 44 rotating wing aircraft (helicopter) was selected for the survey so as to maximise vision of the beaches from the aircraft. A flight date was chosen to meet the following conditions:

- to occur within the common period of highest nesting density for the species of greatest interest within the survey area;
- after regional pig eradication and baiting programs by the Whitsunday Shire Council (as at 23 October, 5 November, and 3-4 December 2014); and,
- to coincide with an approximately midnight high tide on the night before the flight so as to provide the maximum beach width when the flight commenced early in the morning. It also provided approximately 6 hours of flying time before that day's high tide washed away the tracks from the night before.

In addition, by flying early in the morning, the tracks were more visible than later in the day after the sun had dried the surface sand and the increasing onshore winds had blurred the tracks.

Turtle tracks from the night preceding the flight were counted for each species on each beach. A "track" up and a "track" down the beach were counted as a single track (= one turtle nest attempt) for this census study. Counts of older tracks which terminated at the previous day's high tide mark and counts of old body pits provided additional qualitative information on the level of nesting activity for the beach. During aerial surveys, no attempt was made to determine the nesting success for individual beachings because much of the turtle nesting habitat was within the vegetated zones of beach dunes and high velocity winds experienced in the days prior to the survey removed evidence of front flipper filling following oviposition.

For the purposes of the survey and subsequent mapping, the coastline was subdivided into discrete lengths of sandy beach delineated by prominent features such as rivers, creeks, headlands, and rocky outcrops. Each beach was identified by the latitude and longitude at the commencement of the beach when travelling in a south to north direction. Latitudes and longitudes were read from hand-held geographical positioning system (GPS) units.

Nesting beach aerial surveys were undertaken using a single pass flight along coastal beaches to identify species and count the tracks left in the sand by turtles attempting to nest the previous evening, and of any predators including nest diggings.

The transect was conducted at a mean height of 50 m and a speed of 60 kms over suitable nesting beaches. Two experienced observers recorded nesting turtle and predator track occurrence with GPS waypoints and hand-written records. The flight path was also filmed using a GoPro camera for cross-referencing and to eliminate human observation bias. Turtle nesting monitoring on the day before the survey and day of the survey was also conducted by the local community group, Queens Beach Action Group.

These data were later uploaded onto Google Maps and analysed to correlate relative density and distribution of turtle nesting and predator activity, and to identify ***'hotspots'*** where these activities overlapped.

RESULTS

The regional density of flatback and green turtle nesting in the Whitsunday-Burdekin-Townsville region was 185 (+/-6). Between the experienced surveyors, there was more than 90% track count accuracy, and 100% accuracy validated by on-ground surveys. The degree of error on average underestimated nesting abundance and therefore the greater number of track counts was included in the overall nesting density figures.

Wunjunga beach was also found to support regionally high density nesting of flatback turtles but since it is monitored daily (including the removal of sighted tracks) the track count was recorded lower than known nesting attempts. Therefore the regional density is believed to be an underestimate. During the past two nesting seasons (2013/2014 and 2014/2015), 288 nesting attempts have been recorded (refer Table 1 below).

The distribution of flatback and green turtle nesting stretches the majority of the coastline surveyed with higher density nesting (>20 nests) occurring on the mainland coastal beaches at Rita Island (51 tracks), Paradise Bay (22 tracks), and Abbot Point (21 tracks) respectively (refer Table 2 below). Lower density nesting sites included Alva beach and AIMS beach.

Although difficult to distinguish due to cloud cover and sun angle, the majority of tracks were thought to be primarily flatback turtles. Of these 142 were old tracks and 43 considered new. Due to rain, tidal cycles and wind, it is estimated that the old tracks identified during the aerial survey were of no more than five days old.

The identification of predator tracks (primarily identified as pig) occurred on the mainland coastal beaches at Abbot Bay, Abbot Point, eastern Cape Upstart, Rita Island, Bowling Green Bay / eastern coast of Cape Cleveland and Paradise Bay. Limited wild dog activity was noted at AIMS beach.

Overlapping turtle nesting and predator activity indicative of **'*hot spots*'** for further investigation was noted at Rita Island, on the eastern beaches of Cape Cleveland particularly Paradise Bay, Abbot Bay including Abbot Point (refer Attachment One).

Table 1: Wunjunga beach track counts 2013/2014 and 2014/2015 nesting seasons

Nesting season	Nesting attempt	No Lay	Total
2013/2014	105	4	**109**
2014/2015	151	28	**179**
Total counts	**256**	**32**	**288**

Table 2: Aerial survey turtle track and predator activity counts

Location / Map #	Turtle track counts	New turtle tracks	Old turtle tracks	Evidence of predator tracks (Y/N)	Other species present
Abbot Point Map 1	21	2	19	Y	Unique rock wall formation
Abbot Bay Map 2	4	0	4	N	
Abbot Bay Map 3	14	0	14	Y	Stranded turtle carcass
Abbot Bay and eastern coast of Cape Upstart Map 4	16	0	16	Y	
Wunjunga beach Map 5	16	1	15	N	Six Manta rays; Two swimming turtles
Rita Island Map 6	3	1	2	N	
Rita Island Map 7	52	18	34	Y	
Alva Beach Map 8	10	6	4	N	
eastern coast of Cape Bowling Green Map 9	16	11	5	N	
Bowling Green Bay and eastern coast of Cape Cleveland Map 10	6	3	3	Y	Dugong
AIMS and Paradise Bay Map 11	27	1	26	Y	
Magnetic Island Map 12	0	0	0	N	Shark control nets; Commercial fishery
Total counts	**185**	**43**	**142**		

DISCUSSION

Historically, aerial surveys have been used in many sea turtle studies as a technique for covering large areas of coastline, reaching remote areas, and reducing costs of conducting season-long daily or nightly surveys. Overall the results show that aerial surveys validated by on-ground turtle nesting monitoring, proved to be an effective method for determining the spatial distribution and density of turtle nesting and predator activity on beaches routinely monitored in the Whitsunday-Burdekin-Townsville region.

While these surveys did not generally provide data suitable for rigorous estimation of population size or trends, they did identify unknown nesting sites which in a number of cases was correlated to predator activity. These data were used to identify ***'hotspots'*** however it must be noted that these aerials surveys require replication during each nesting season to compensate for seasonality of turtle nesting and the unknown seasonality of pig or wild dog foraging behaviour.

Knowledge of new high density nesting beaches and predator activity should be used to target future management and focus investment to maximise turtle productivity and reduce predator threats.

It is recommended that ongoing surveys in the Whitsunday-Burdekin-Townsville region during the peak of turtle nesting and hatchling season would be beneficial to determine turtle densities and predator activity including ***'hotspots'*** over a period of at least four years. These data will provide an important baseline or measure for quantifying the effectiveness of community turtle nesting monitoring and predator eradication projects to combat the apparent continuing loss of turtle nests to predation.

A more comprehensive survey along the entire coastline of Queensland would be more relevant and combined with existing on-ground nesting monitoring, provide a comprehensive survey of turtle nesting and pig activity for targeting future community driven on-ground action.

Netting activity was also noted around Magnetic Island by both shark control and commercial fishing operators. Although foraging grounds for flatback turtles are still unknown, a recent collaborative project between WWF, EHP and James Cook University has identified this location as a possible *stop-over* for flatback turtles en-route to northern feeding grounds. Green turtles are also known to feed inshore around Magnetic Island and Cleveland Bay.

It is recommended, that an investigation of the relative impact of netting activities including inshore net fisheries and shark control programs on marine turtle species during the nesting period is conducted.

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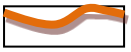
ATTACHMENT ONE

Aerial survey turtle and predator track transect maps and legend:

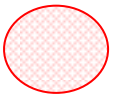
Aerial survey transect



Predator tracks

Turtle track (GPS location)

Other species or activity identified

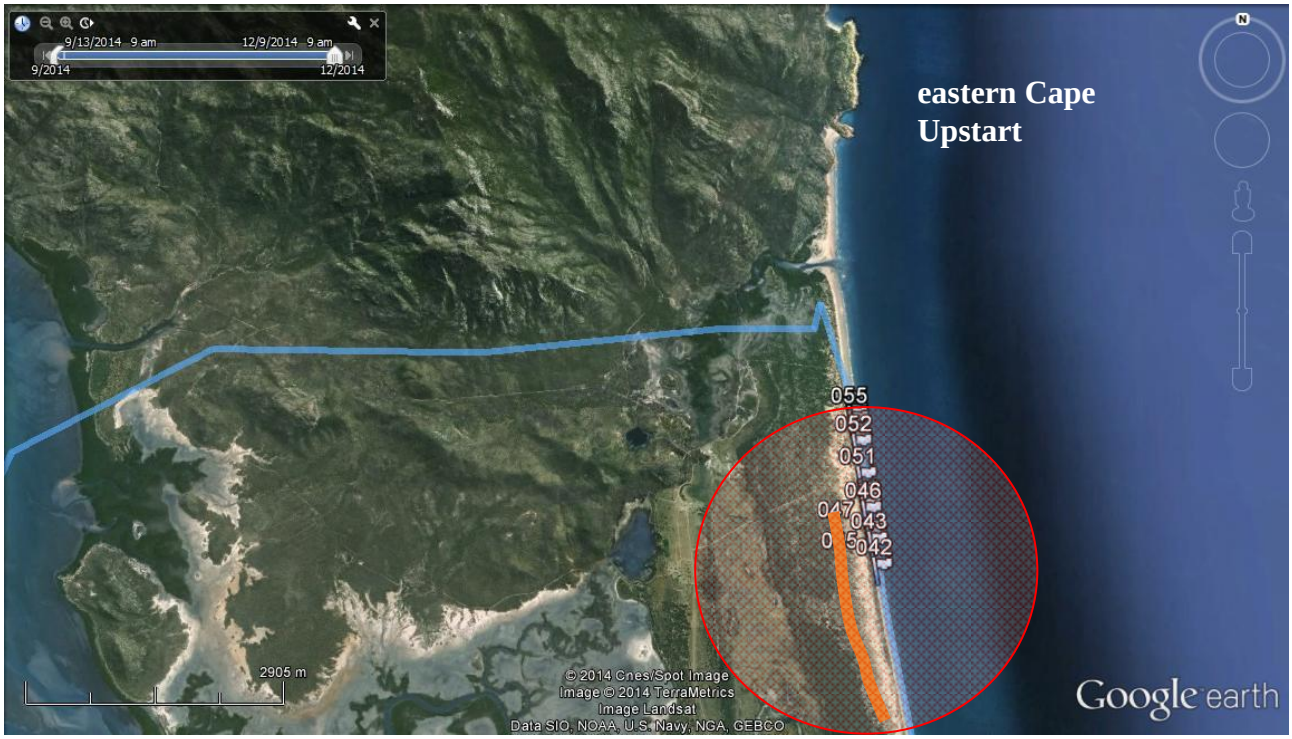


'Hotspots' correlated turtle and predator activity

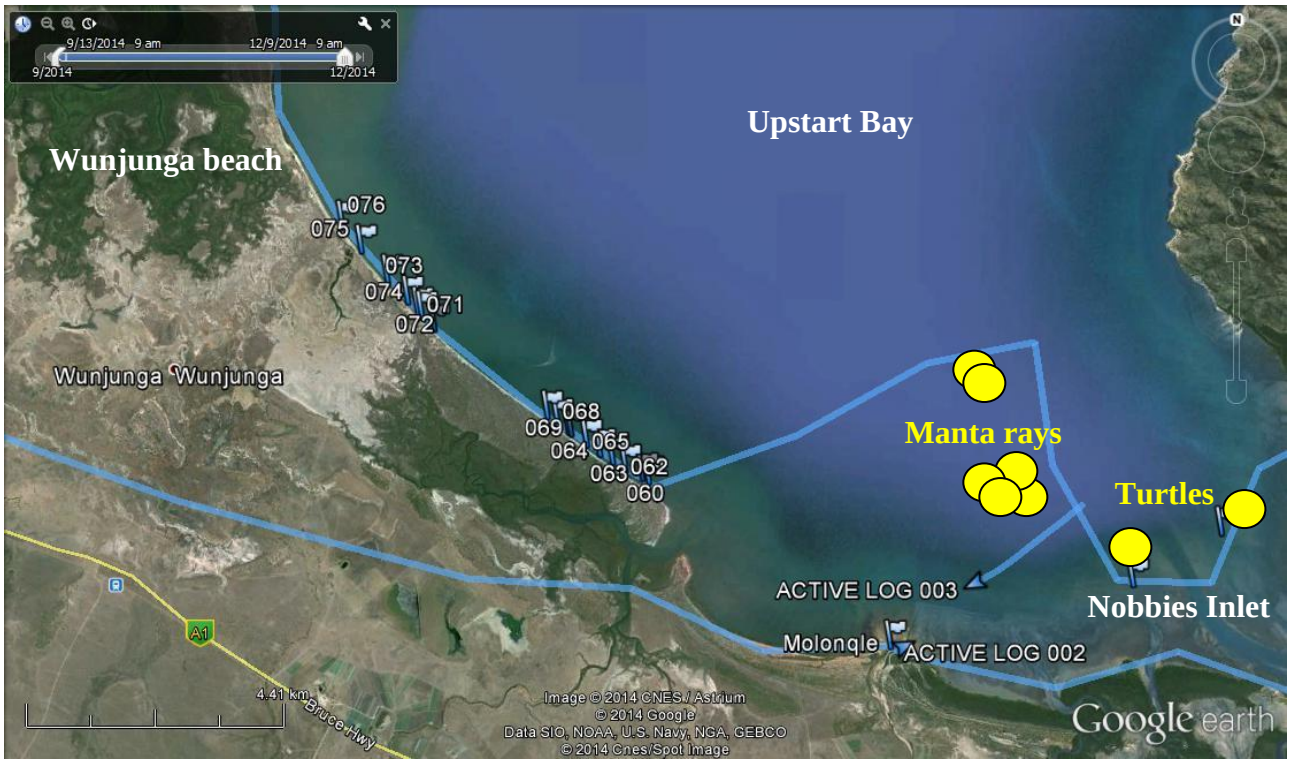
Map 1: Abbot Point

Map 2: Abbot Bay

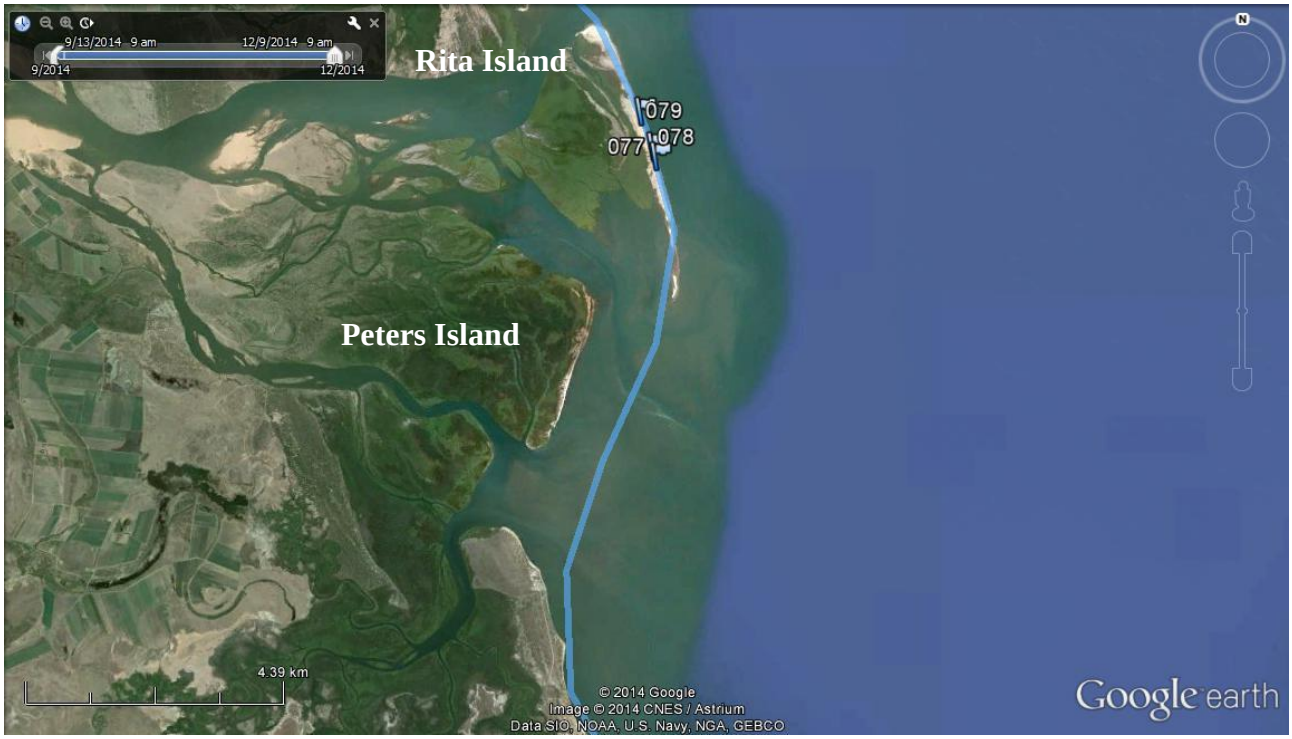
Map 3: Abbot Bay



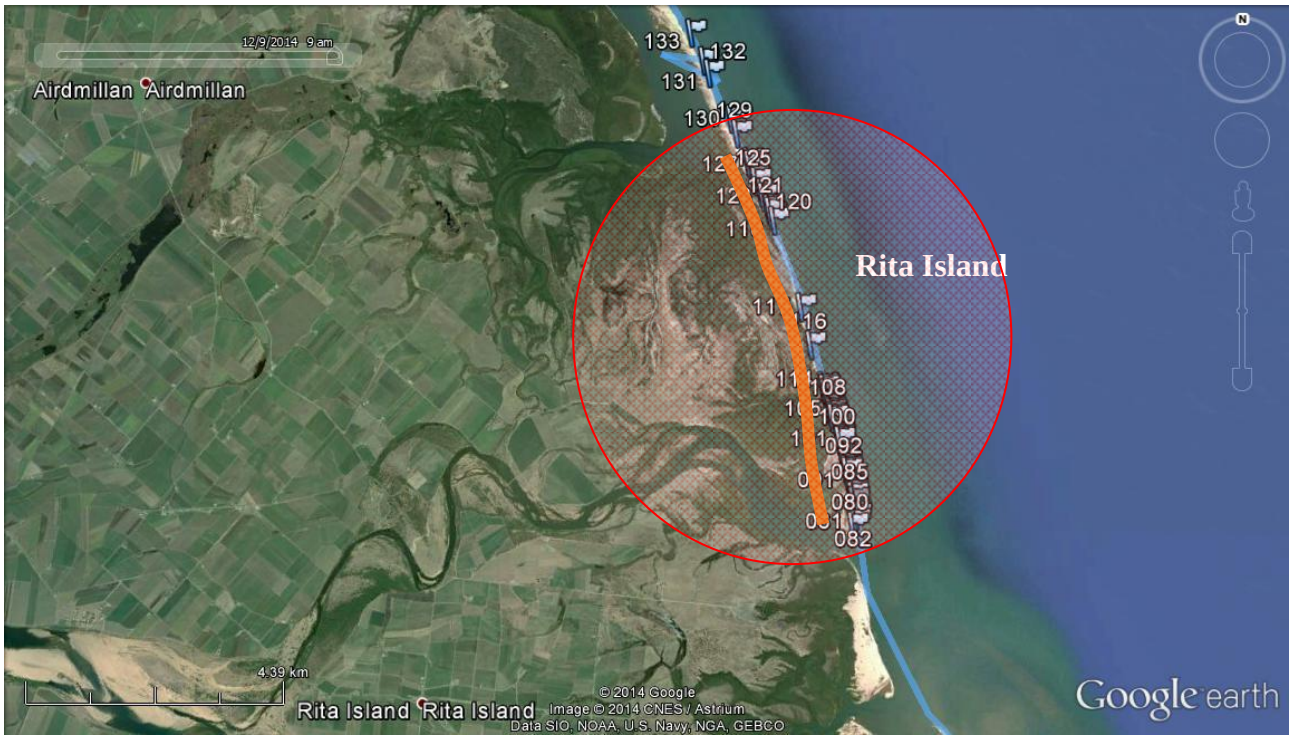
Map 4: Abbot Bay and eastern coast of Cape Upstart



Map 5: Wunjunga beach

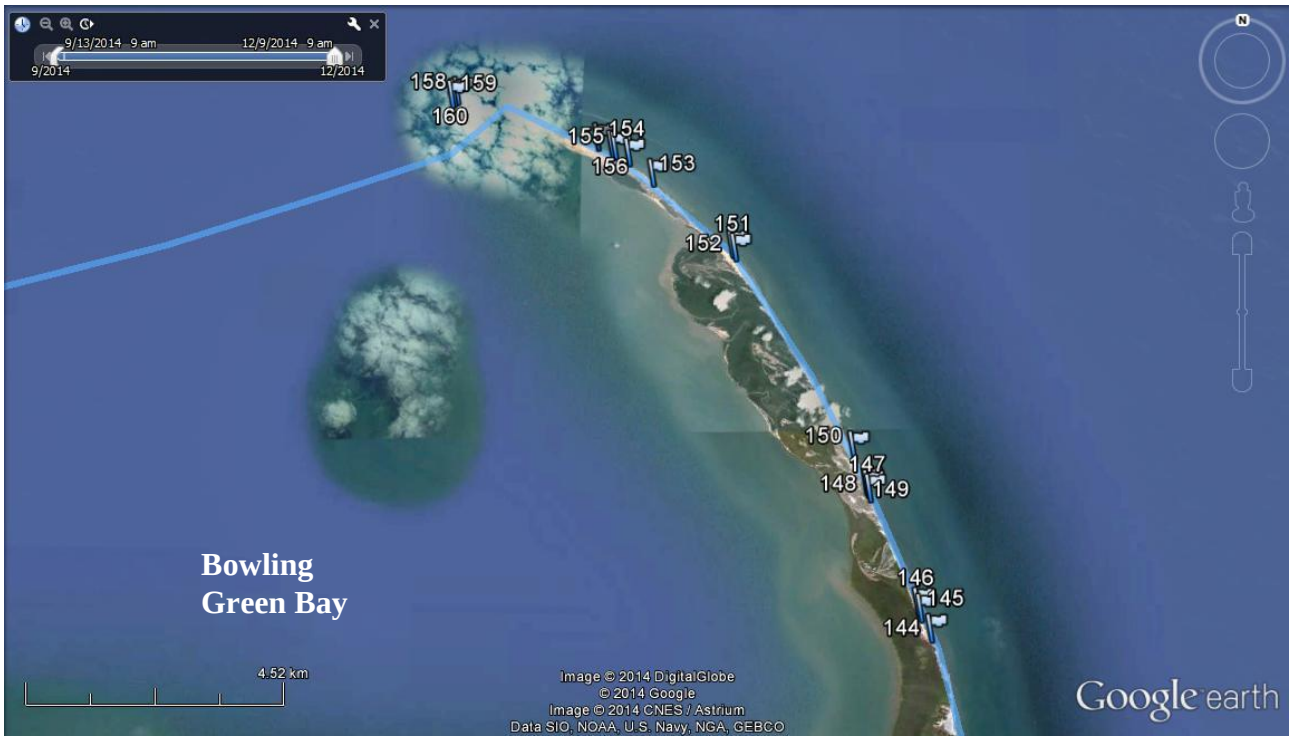


Map 6: Rita Island

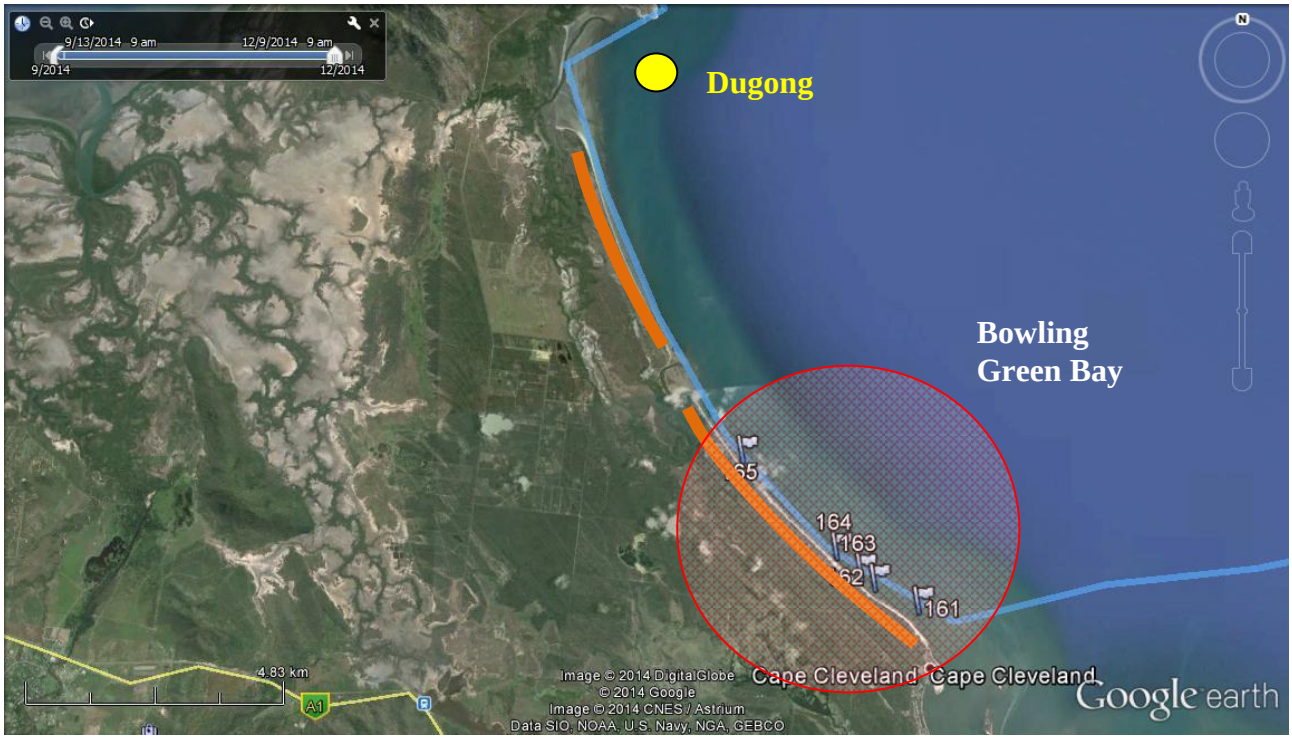


Map 7: Rita Island

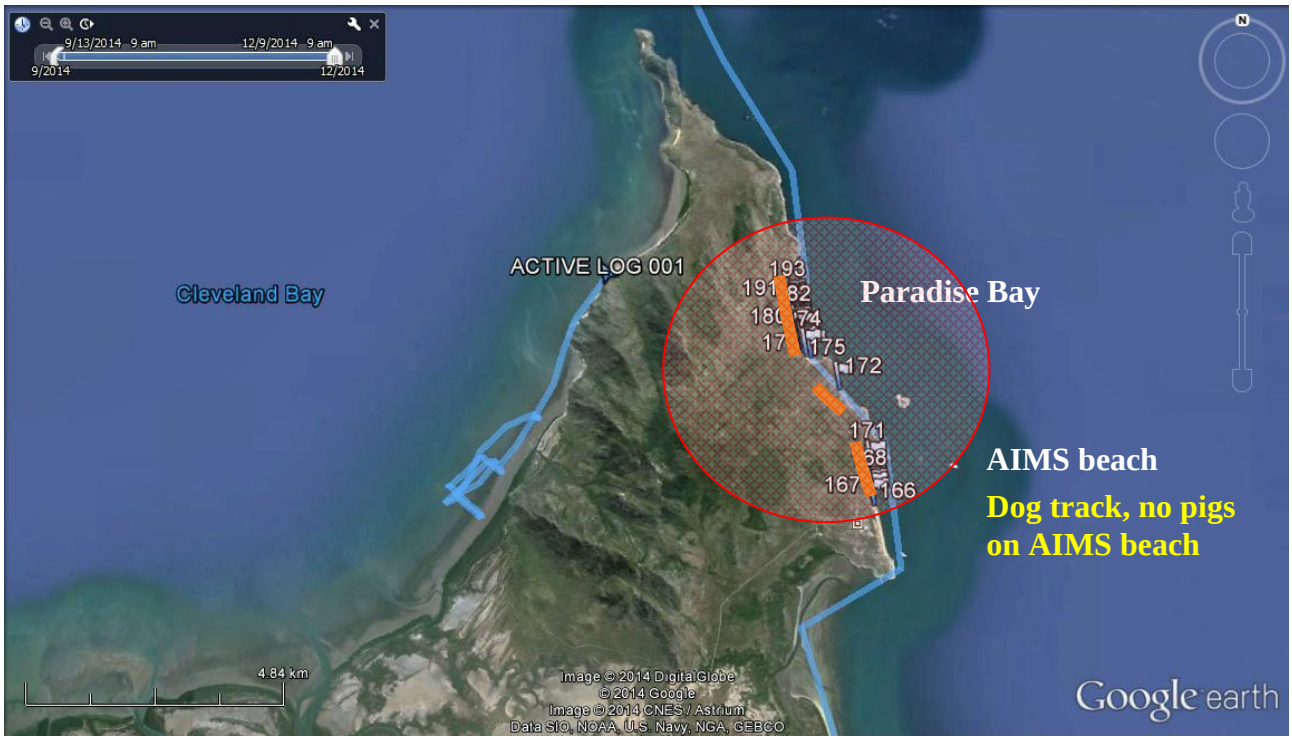
Map 8: Alva beach



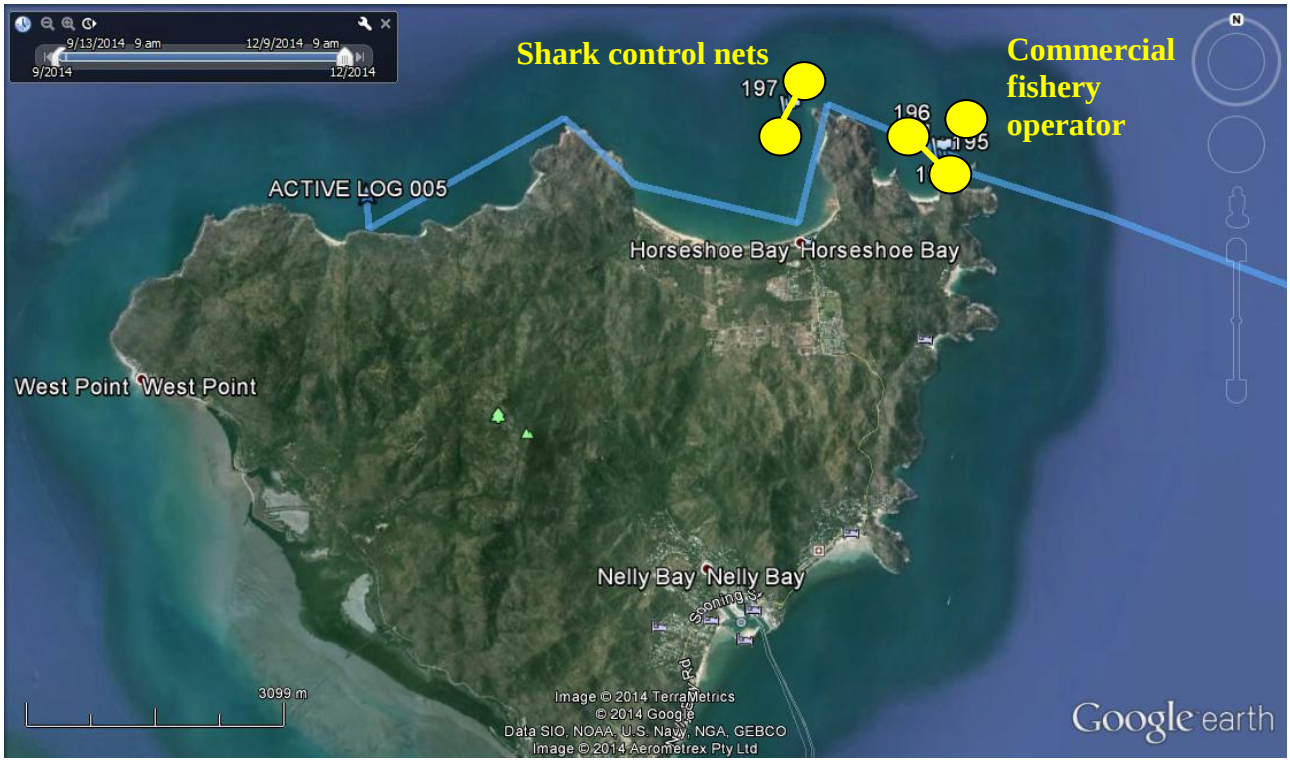
Map 9: eastern coast of Cape Bowling Green



Map 10: Bowling Green Bay and eastern coast of Cape Cleveland



Map 11: AIMS and Paradise Bay



Map 12: Magnetic Island

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