Cockermouth Island Turtle Monitoring

Building a foundation to support turtle nesting habitats

Marine turtles are a keystone species within the Great Barrier Reef World Heritage Area. Being a keystone species means that they are integral to the tropical marine ecosystem because they consume prey like jellyfish and sea sponges, allowing coral and lower trophic fish to grow in abundance.

Through the **Management of the Great Barrier Reef World Heritage Area (Islands) within the Mackay Whitsunday** project, Reef Catchments has been working with partners, tourism operators and volunteers to improve the knowledge of threats facing nesting marine turtles at known high-priority nesting islands. This information will provide a better understanding of suitable nesting habitats and what management interventions need to be implemented to protect these sites. The project visited several islands across the Mackay and Whitsunday regions, identified as turtle nesting islands by Dr Col Limpus, Steve Fisher and Ken Griffin through an aerial survey conducted in 2000-2001. These trips refined the turtle monitoring methodology and identified the highest-priority turtle nesting islands, one of which was Cockermouth Island.

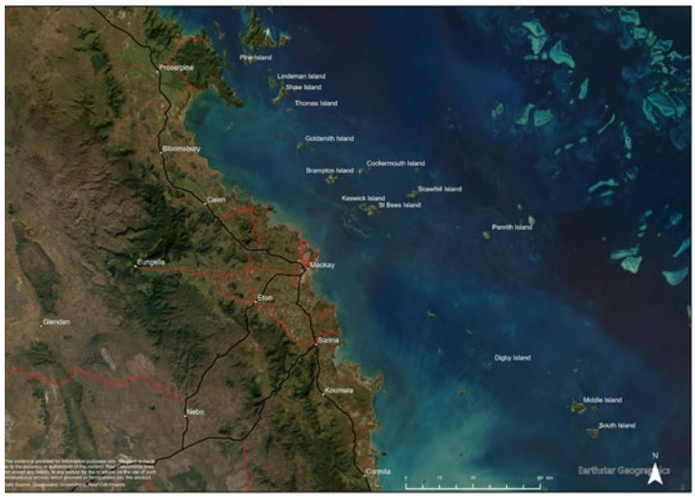

Figure 1. Islands monitored for turtles across the Mackay and Whitsunday regions

Cockermouth Island

Cockermouth Island is a hilly Island that lies within the South Cumberland Islands National Park ~25nm off the coast of Mackay. The island is not inhabited and is home to an important turtle rookery which is not impacted by light pollution. On the Western side of the island there is a 900mtr long white sandy beach that supports nesting sea turtles. A large tidal lagoon also occurs on the island's western side where low tides expose an ancient Pleistocene reef.

This beach was severely impacted in 2017 by Cyclone Debbie resulting in erosion of the foreshore beach and reduction in suitable marine turtle nesting habitat.

The flora species on the Island is mainly open grassland. The frontal dune system pioneer zone is dominated by saltbush (*Atriplex nummularia)*, woodland zone contains mature and emerging beach sheoak (*Casuarina equisetifolia)* and octopus bush (*Argusia argentea)* and in the scrub zone screwpine (*Pandanus tectorius)*, crinum lily (*Crinum pedunculatum)*, and silver bean (*Sophora tomentosa)*.

Other native plant species include:

- Beach almond (*Terminalia porphyrocarpa*)
- Lolly bush (*Clerodendrum floribundum*)
- Beach vitex (*Vitex rotundifolia*)
- Hibiscus (*Hibiscus sp.*)
- Tuckeroo (*Cupaniopsis anacardioides*)
- Bloodhorn (*Ochrosia elliptica*)
- Coastal Jack bean (*Canavalia rosea*)
- Sea lettuce (*Scaevola taccada*)
- Wild prune (*Pouteria sericea*)
- Goat's foot convolvulus (*Ipomoea pes-caprae subsp. brasiliensis*)
- Beach spinifex (*Spinifex sericeus*)

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Methodology - Looking for signs of turtles

Every year between 2018 and 2023, two turtle nesting survey expeditions were conducted during the turtle nesting season (October to April). Surveys were carried out according to the Standard Queensland Turtle Conservation Project methodologies which involved recording signs of turtle activity such as the number of turtle tracks and body pits, as well as any observed individual adult turtles or hatchlings on the beach.

The number of attempted and successful nests were recorded along with the species of turtle for all categories. The surveys also involved excavating already hatched nests to determine the success rate, as turtle tracks can indicate nesting attempts, not nesting success. Any observed adult female turtles without tags were tagged after completing nesting and any nests considered at-risk were relocated. The information collected during the surveys will contribute to long-term management outcomes of marine turtles by helping address some knowledge gaps.

Figure 2. Marine turtle tracks on Cockermouth Island.

Results

Survey results from two trips for the past five years (2018–23) show that the number of tracks and body pits are much higher than confirmed successful lays, which is a common occurence with nesting turtles. Repeated night monitoring found several of the tracks were created by the same turtles returning in close succession in an attempt to lay. Most turtles dug two to three chambers before re-entering the water without laying. Unsuccessful nesting was due to dry sand collapsing into the chambers as the turtle digs.On average five successful lays occurred each year, over the five years.

Figure 3. Turtle laying eggs

Figure 4. Cockermouth Island turtle tracks on the beach

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Cockermouth Island's reputation for being an important nesting site for Flatback and Green turtles was confirmed with several sightings of each species during each trip. However, surveying also found that Loggerhead turtles nest on the Island. In 2019-20, one Loggerhead turtle was observed on the beach and successfully nested. In 2022–23 a post-hatched Loggerhead turtle nest was identified and excavated with a 93.3% success rate, as shown in Table 1. These results demonstrate that Cockermouth Island provides nesting habitat for all three marine turtles known to nest in the Mackay, Whitsunday and Isaac region, making it highly important for turtle conservation.

Table 1. Excavated turtle nests success rate from 2022/2023 trips

Species	Tagged	Laid	Excavated	Eggs	Hatched	Success
Flatback turtle *(Natator depressus)*	Yes	24/11/2022	05/02/2023	52	48	92%
Flatback turtle *(Natator depressus)*	Yes	24/11/2022	05/02/2023	54	48	89%
Flatback turtle *(Natator depressus)*	No	24/11/2022	05/02/2023	41	25	61%
Green turtle *(Chelonia mydas)*	No	27/11/2022	05/02/2023	132	117	88%
Loggerhead turtle *(Caretta caretta)*	No	unknown	05/02/2023	120	112	93.3%

Figure 5: Loggerhead turtle (*Caretta caretta*)

Figure 6: Green turtle (*Chelonia mydas*)

Sand temperature pilot study

A pilot study to measure the estimated sand temperature of marine turtle nests was conducted between November 2021 and February 2022. Two sand temperature loggers were buried 40cm deep to replicate the depth of a turtle nest during incubation. Mock nest #1 temperature logger was buried in bare sand and mock nest #2 under an Octopus bush (*Argusia argentea*). The loggers recorded the temperature at 10-minute intervals with a variance of 1 degree.

Results found both mock nests were hottest in the middle of the night due to the time taken for the heat from the Sun to reach the depth of the nests, and consequently the coolest in the middle of the day as the heat radiates away. Mock nest #1 temperature ranged from 28.50°C to 35.05°C with an average of 32.43°C. The average temperature for mock nest #2 was 33.36°C.

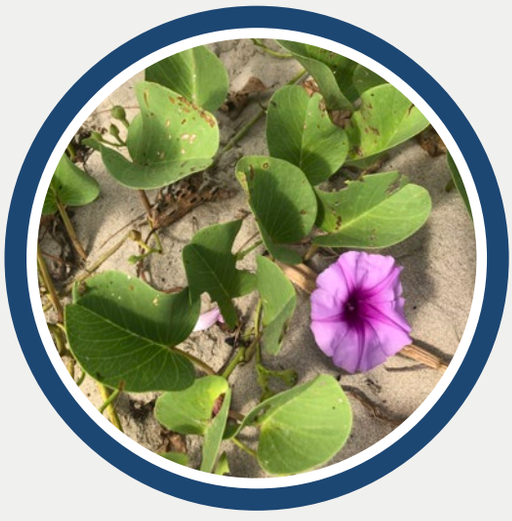
Many studies have demonstrated incubation temperatures correlate to the following sex determination for marine turtles. Eggs in sand temperature 33°C to 34°C won't hatch, 26°C to 27°C will be all males and 31°C to 32°C will be all females. The pivotal temperature for a 50/50 sex ratio is approximately 29°C. Therefore it is likely the sex ratio from the two mock nests would be female biased or would not hatch.

This was a pilot study and not a scientifically robust trial, and any trends cannot be reliably inferred from the data. This trial does not factor all influencing factors such as metabolic heating (~2°C).

Figure 7. Turtle hatching

Native Vegetation

Here are some examples of native vegetation found on Cockermouth Island. Native vegetation can provide shade to nesting areas and reduce sand temperatures. Turtles on Cockermouth have shown a preference to nesting under Sea lettuce and Beach sheoaks in particular.



Goat's foot convolvulus
(*Ipomoea pes-caprae subsp. brasiliensis*)

Octopus bush
(*Argusia argentea*)

Sea lettuce
(Scaevola taccada)

Beach sheoak
(Casuarina equisetifolia)

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Identified risks and recommended management activities

Identified risk	Risk to turtles	Proposed management action
Dry sand	Does not support body pit and egg chamber profile resulting in multiple body pit attempts.	Investigation into the concept to artificially water nesting sand prior to season commencement was deemed not feasible due to the amount of fresh water required to be viable.
Hot sand	Sand temperature is above normal due to a lack of moisture and limited vegetation cover. This could result in hatchling gender percentages trending towards female turtles or hatchling mortality increasing due to heat stress.	Natural foreshore vegetation recruitment is slowly occurring and will, with time, provide shade to nesting areas and reduce sand temps. Trained professinals to relocate at-risk nests to shaded areas. Assisted revegetation along the foreshore area. Monitoring sand temperatures using temperature loggers.
Beach erosion	Loss of sand has resulted in exposure of rocks and roots of she-oaks, which has caused a reduction in suitable nesting habitat especially near the mangroves/lagoon.	Natural migration of nesting turtles where sand is being accreted. Monitor.
Weeds	Observed in the camping area. • Caltrop *(Tribulus terrestris)* • Stinky Passionfruit *(Passiflora foetida)* • Cobbler pegs *(Bidens pilosa)* Invasive weeds can spread, smothering native vegetation and reducing suitable nesting habitat.	Biosecurity recommendations for people visiting the island. Weed management.
Marine debris	Debris poses a significant threat to marine turtles, as obstacles to nesting females and hatchlings.	Removal of marine debris whenever possible.
Predation	Natural predation of hatchling pre and post hatching.	Natural occurrence from native predators so no action required




Figure 8: Identified threats to nesting turtles across the Mackay-Whitsunday Islands (L-R: predation, marine debris, dry sand, beach erosion).