

It's not easy being green

The life and times of
green turtles at Ningaloo

The name Ningaloo conjures images of whale sharks, or perhaps snorkelling in clear waters gazing at colourful corals and fishes. But for those who are not Exmouth locals or haven't endured the blazing heat of its summer, turtles are not the first thing that comes to mind. Yet, Ningaloo has some of the largest populations of sea turtles in the world.

by Mat Vanderkluft and Richard Pillans



Of the seven species of sea turtles that swim in the world's oceans, three call Ningaloo home—green, hawksbill and loggerhead turtles (three other species visit occasionally). Most of the individuals that inhabit the clear lagoons of Ningaloo are green turtles (*Chelonia mydas*). CSIRO scientists have been studying these fascinating creatures for the last ten years, complementing efforts by other organisations, including the Department of Biodiversity, Conservation and Attractions (DBCA), which runs an annual survey of nesting tracks on the beaches of North West Cape.

As part of this research, many turtles have had tags attached to them and biological samples collected from them. More than 80 turtles have had acoustic tags attached that transmit a 'ping' detected by an array of devices installed on the seafloor. The 'ping' of each tag has a unique code so that individual turtles can be distinguished. More than 40 turtles have been equipped with satellite tags that transmit signals to satellites orbiting Earth. The chemical signatures of samples from hundreds of turtles have also been analysed. The discoveries made from combining the tagging and sampling techniques, as well as other scientific techniques during this decade of research, have unveiled multiple features of the green turtles' life history.



life. At around seven years old, they start to appear in the lagoons of Ningaloo as juveniles. Thus begins their life at Ningaloo.

After they arrive, these small juveniles stay in shallow habitats close to the shoreline; so close that they need to move offshore whenever the tide drops. Their roaming is also restricted, and they tend to stay within home ranges that are typically not much more than a square kilometre. Some individuals appear particularly unadventurous—one has been captured four times in eight years, never more than a few hundred metres away from where it was first found.

During their time in the shallows, they eat a variety of the foods that are available, like the macroalgae (seaweed)

GROWING UP IN THE LAGOON

Green turtles, like other sea turtles, lay their eggs on sandy beaches, including the beaches of Ningaloo. After an incubation of eight weeks or so, the hatchlings run a gauntlet of predators on the beach to get to the sea, where more predators await. Those that survive swim directly to the open ocean far from shore, where they spend the first few years of their

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Main Female green turtle returning to the water after nesting.

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Above Green turtle resting on the shore after a big night of nesting.

Inset right Green turtle hatchling.

Photos – Craig Duncan

Inset left Satellite tagged green turtle after release.

Photo – Richard Pillans



which is abundant, and seagrass which grows more sparsely. As small juveniles, they are vulnerable to predators (like the tiger sharks that roam the lagoons of Ningaloo), so this strategy makes sense.

The turtles stay in this shallow habitat close to the shore for several years. Eventually, they grow to a size where their life begins to change. At around 60 centimetres, they have moved slightly further offshore where they establish a new home range and are eating less macroalgae. They are still eating lots of seagrass, and other foods, like jellyfish, have become a more important part of their diet.

These changes continue, and by the time they have grown to 80 centimetres long (double the size they were when they arrived, but not yet a mature adult), they have home ranges that encompass four or more square kilometres, located a kilometre from the shore in the deeper areas of the lagoon. There, they seem to no longer eat much macroalgae, but seagrass and jellyfish dominate their diet. Occasionally, one might be tempted to explore further afield, and forays to deeper water outside the lagoon are not uncommon, but mostly they tend to stay

in constrained home ranges within the lagoon.

ADULTHOOD

These overall patterns don't seem to change much as the turtles become sexually mature, which at Ningaloo happens from around 88 centimetres or so (it varies between individuals). However, come mating season, other patterns appear.

Mating season for green turtles at Ningaloo begins around October. During this time, adult males that had remained within their home range make rapid migrations to areas where mating aggregations occur. One 91-centimetre male (named 'Jeff' after a naming competition with the Exmouth community) had remained in a very consistent area since he had a satellite tag attached in May 2015. Jeff suddenly moved to a known mating aggregation further up the coast at the end of September. He stayed there, just off the beach, for three weeks before leaving, just as suddenly, returning to his home range where he remained until May 2016, when the tag stopped transmitting.

Females have a more arduous journey. Their migration can stretch for hundreds or even thousands of kilometres, and last for months. To be able to do this they need to be in prime condition, with fat reserves that not only nourish them for the journey, but also nourish the hundreds of eggs that they will lay, which means eating a lot of seagrass. Understandably, they don't do this every year, or even every other year. According to scientists' best estimates, female green turtles nest every five years or so.

While green turtles nest on the beaches of Ningaloo, most of those females are not actually from Ningaloo. Satellite tagging of female green turtles revealed they come from as far afield as the Kimberley in the north, and Shark

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Above left Green turtle covering her nest in the early hours of the morning.
Photo – Craig Duncan

Above right Green turtles aggregating in the shallows to mate.
Photo – David Bettini

20 years and tracking

By Craig Duncan,
Ningaloo Turtle Program intern

One of Australia's most comprehensive turtle monitoring programs, the *Ningaloo Turtle Program*, is now celebrating its 20th anniversary of researching the nesting habits of sea turtles. Volunteers have come from across the world and have walked more than 20,000 kilometres, explored 237,448 turtle tracks and identified 67,157 nests. The program plays an important role in understanding the world's marine turtle species, and their nesting habits by monitoring the Ningaloo coastline.

Originally developed in 2002, the program began as a collaboration between the local Cape Conservation Group, the Department of Biodiversity, Conservation and Attractions (DBCA), Murdoch University and the World Wide Fund for Nature.

Today, the program is run by DBCA's Exmouth District.

Each year local and external volunteers survey the beaches, identifying turtle tracks and nests. These surveys build on several decades of research and contribute to understanding nesting turtles and the threats they might face along the Ningaloo Coast.

Throughout Exmouth, the program has developed a culture of understanding within the community around the importance of the marine park and coastal reserves, its conservation and one of its most magnificent inhabitants, the turtles.

Beyond tracking turtles, the *Ningaloo Turtle Program* has rescued over 345 turtles in its time. Some turtles have tracked too far and become lost within dunes or trapped within the rocky coast.

TRIAL FOR TURTLES

Along the 25 kilometres of the Ningaloo Coast surveyed by the program, three turtle species appear most frequently—the green, hawksbill and loggerhead turtles.

Living the majority of their lives in the ocean, these turtles only return to land to lay their eggs. Estimates state only one in 1000 hatchlings will reach sexual maturity. For some species, this won't be until they are around 30 years old.

ON THE BEACHES

The work of a volunteer can best be described as detective work. Beginning a march along a section of pristine beach, piecing together the mysteries of the night with little more than tracks in the sand, arriving at a beach decorated with an intricate sprawl of turtle tracks, they begin by finding the track that leads to the ocean, identifying the unique pattern of ridges and lines that show the direction of travel.

Each species of turtle can be identified by its unique track. The symmetrical crawl of a green turtle creates a pattern similar to a tractor tyre, carved deep into the sand. Loggerheads move in alternating thrusts, leaving behind a



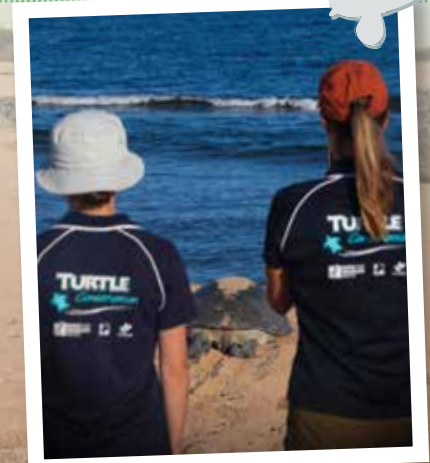
broad flat path in their wake. The most petite of the three, the hawksbill also climbs in an alternating motion, leaving much narrower tracks, with a distinct tail wiggle to be followed.

Finally, the volunteers climb the sand to identify the turtle's last known action, be it a nest, an empty pit, or a seemingly pointless walk around the beach.

The process is recorded digitally and collated into a database illustrating the past 20 years.

The very fact these turtles live such lengthy lives and take so long to reach maturity means we may not know the full impact of threats on turtle populations for another 10 years.

Nests that were recorded at the beginning of the program have birthed hatchlings that are still yet to nest on the Ningaloo Coast to repeat their cycle anew.



Inset above Volunteers assist in a green turtle rescue.

Below Turtle tracks from a green turtle.

Inset right Ningaloo Turtle Program volunteers.
Photos – Craig Duncan



Bay in the south. Most of these voyagers to the Ningaloo nesting beaches travel at least a hundred kilometres, leaving Ningaloo Marine Park entirely.

So, if the turtles that nest on the beaches of Ningaloo don't originate from Ningaloo, where do the turtles that call Ningaloo home go to nest? The scientists had found a few clues, such as the presence of flipper tags that had been attached on nesting beaches at Barrow Island on adult female turtles captured in the lagoon at Ningaloo. But, to investigate this further, the scientists needed to tag the turtles before they departed on their migrations. This in turn meant there needed to be a way of telling which turtles were going to migrate—no easy

task. To do this, the scientists turned to ultrasound.

PRENATAL SCANS FOR TURTLES

Ultrasound machines are often associated with pristine white rooms in medical practices, which isn't so practical on a beach. So, scientists turned to a small ultrasound that ran from a laptop, easily packed into a rugged case. Armed with this equipment, the scientists were able to identify female green turtles with vitellogenic oocytes—undeveloped eggs with yolk beginning to form. To date scientists have been able to tag and follow six females all the way through their nesting migration, from departure from the lagoon, to mating, and finally to

the nesting beaches. All females tagged so far have left the waters of Ningaloo and travelled to Barrow and Montebello islands, more than 200 kilometres away.

At these offshore islands, individual turtles laid between four and eight clutches of eggs, each separated by about 10 days. After the last clutch had been laid, almost all of them returned directly to their home range back in the lagoon at Ningaloo. One female did not return to Ningaloo, but instead went to the Dampier Archipelago, where she remained until the satellite tag stopped transmitting.

And the eggs? After an incubation of eight weeks or so, the hatchlings emerged, ran the gauntlet of predators to get to the sea, and it began all over again.

Top T-Bone Bay, Ningaloo.

Above right Green turtles mating, Ningaloo.
Photos – David Bettini

Above left Green turtle.
Photo – Jiri Lochman

Right Researchers release a green turtle.
Photo – Violeta Brosig



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