The choosy turtle

Nesting green turtles.

A turtle crawling out of the surf onto gleaming white sand seems to epitomise a tropical beach. Turtles must come up onto the sand to lay their eggs, which cannot develop in sea water, but how does mother turtle know which beach to choose? Nobody knows for sure and, as with so much of turtle biology, it's not easy to find out.

The green turtle, *Chelonia mydas*, is widely distributed in warm waters. It is found in the Gulf of Mexico, around the coast of Brazil, in western and eastern African waters, and in South-East Asia. It also occurs around northern Australia and nests regularly as far south as Bundaberg, on the Queensland coast, and North-West Cape in Western Australia.

In most places the species has, sadly, been chronically overharvested, and so Australia is the last remaining area where the turtles exist in anything like their natural abundance. Indeed, until the mid 1970s commercial fishing of them also occurred in Western Australia, and they are still taken by indigenous people in northern Australia for their own use.

In the wild, green turtles may take from 35 to 50 years to reach sexual maturity, by which time they would have a carapace length of at least 1 m and a weight of 138 kg, on average. When kept in captivity, and fed a diet of fish, they may often grow faster and reach sexual maturity more quickly. Nobody knows their natural life-span for certain, but Dr Colin Limpus, a noted turtle biologist with the Queensland Parks and Wildlife Service, suspects that we are dealing with a species that outlives us considerably.

We do know that turtles may travel a vast distance to a nesting beach from their feeding grounds; for example, many of the green turtles captured in Indonesia breed in Australia.

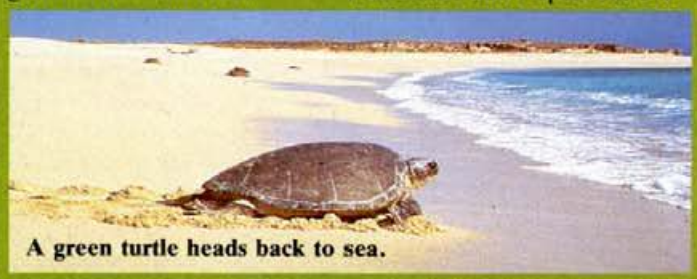
But what makes a good breeding beach? That question has been the subject of some research by Dr Bob Johannes and Mr D. W. Rimmer, of the CSIRO Division of Fisheries Research at the Perth Marine Laboratories.

In their study area around North-West Cape in Western Australia, they identified three characteristics that seemed to make a good turtle creche. These are the salinity of the moisture in the sand at the depth (up to 1 m) where the eggs are laid (nests must have a salinity far lower than sea water); the salinity of the surface sand; and shelter from the prevailing winds, which is important to ensure the stability of the nest and the sand above it.

The next question is, how do the turtles detect these features? It seems an especially difficult task, as they choose their beaches while still in the water, and often at night when the prevailing winds have died down. Tantalisingly, the answers remain unknown.

An even more puzzling feature of Dr Johannes' work is that some beaches, which seem to have the right nesting qualities, are simply not used by the turtles.

Dr Limpus speculates that temperature is an important factor. The sand temperature where the eggs are laid must be at least 25°C continuously for about 13 weeks in order for the eggs to hatch. This, of course, is primarily responsible for determining the latitudes within which the green turtles can breed.



A green turtle heads back to sea.

But more importantly, Dr Limpus has shown the intriguing fact that the temperature at which an egg develops determines the sex of the baby turtle that eventually emerges.

The so-called pivotal temperature, required to give a 50:50 sex ratio, occurs at about 27·5°C for eastern Australian green turtles. Higher temperatures for egg development will increase the percentage of female hatchlings, and above 30°C all the baby turtles will be female. Conversely, below 27·5°C, the percentage of male hatchlings progressively increases to reach about 100% at 25°C.

Dr Limpus suspects that the pivotal temperatures of a species may vary over large areas.

Mother turtles may choose a beach where the temperature of the sand at nest depth does not give an equal sex ratio among the offspring. But, intriguingly, the mother turtles somehow seem to have the good sense to balance one another's inequalities, so in hatchlings from a large number of nests the sex ratio will be equal.

Once the hatchlings emerge, they scuttle down the beach to the sea, where they are dispersed by the ocean currents, and the location of the beach with regard to these currents seems to be another factor influencing choice of nesting site.

We are fortunate that these remarkable marine giants choose our shores on which to raise their families, and we must be careful that our activities don't upset the sex ratio of the young by altering the incubation environment of the eggs.

Identifying the factors that make a good nesting beach, and then protecting those areas, obviously will help to ensure that the green turtles continue to be with us, a source of delight for the beach stroller, and of wonder for the biologist.

Roger Beckmann

Some distinguishing characteristics of nesting beaches of the green turtle, *Chelonia mydas*, on North West Cape Peninsula, Western Australia. R.E. Johannes and D.W. Rimmer. *Marine Biology*, 1984, **83**, 149–54.

Islands and turtles: the influence of choice of nesting beach on sex ratio. C. Limpus, P.C. Reed, and J.D. Miller. *Proceedings, the Inaugural Great Barrier Reef Conference, Townsville, August 28–September 2 1983*, 390–402.