Rediscovery of the flatback turtle (*Natator depressus* [Garman]) and its conservation

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The flatback turtle is an excellent example of a large animal that was long denied scientific recognition even though it occurred in relatively large numbers in its preferred habitat. Although it could not be confused with other species of sea turtle it did not obtain full recognition until the late 1960s (Bustard & Limpus 1969). This remarkable situation forms the first part of this paper.

The rediscovery of the flatback is arguably the most remarkable event in the lifetime of current marine turtle biologists. It shows how scientific papers tend to be overlooked or inadequately evaluated and points out some of the difficulties associated with working on large animals like turtles.

In 1880 Samuel Garman described a new species of sea turtle in the *Bulletin of the Museum of Comparative Zoology* at Harvard. He named the turtle *Chelonia depressa* and listed one of his two specimens as coming from Penang (now part of Malaysia) and the other from northern Australia. This created the first problem as the two turtles he listed were different species! In 1889 G.A. Boulenger, the great reptile systematist at the British Museum, published his Catalogue of the Chelonians in the British Museum. In this he considered *Chelonia depressa* to be synonymous with the green turtle *Chelonia mydas.*

To appreciate what follows one must know something of the situation as it was at the end of the 19th century. Adult turtles were rare in museum collections because it is difficult to preserve and transport such cumbersome animals (this is still the situation today). Early taxonomists, who had to work on only a few specimens from any one region which did not encompass the various age classes (sizes), were not aware of the changes in shape undergone by the scutes during growth. As a result, specimens showing markedly different shapes and often different colour patterns were believed to represent different species.

Clearly the easiest stage of the life history to collect, preserve and transport are the hatchlings. Anyone who has examined series of hatchlings will have been impressed by the great variability shown by these, especially in the number of scutes. This led herpetologists to believe that the species were extremely variable, and as a consequence the number of recognised species

was reduced to four (green turtle, hawksbill, loggerhead and leathery turtle). In this way the two ridley species were included in the loggerhead and the flatback in the green turtle. In view of the above, it is not surprising that Boulenger referred *depressa* to the green turtle.

Furthermore, the fact that turtles are marine animals and the species like the green turtle, the hawksbill, the loggerhead and the leathery turtle have a worldwide distribution may also have influenced herpetologists. They believed that there were no barriers to prevent marine animals crossing the oceans of the world and they just could not understand that there could be species of sea turtle with only a very limited distribution.

In 1890 George Baur examined Garman's co-types (two types). Remarkably he failed to recognise that these belonged to different species. However, he did conclude that Garman's species was distinct from the green turtle and belonged to a different genus.

In 1908 McCulloch described a new genus and species of sea turtle which he named *Natator tessellatus* on the basis of a single juvenile individual from Darwin. Fry (1913) decided that the turtle named *Chelonia depressa* was distinct. However, he weakened his arguments by placing emphasis on skull characteristics that are subject to considerable variation. As pointed out (Bustard 1972) many Australian herpetologists interested in taxonomy, myself included, had not doubted the possibility of a distinct species of sea turtle inhabiting northern Australian waters which had been named *Chelonia depressa* by Garman in 1880. However, prior to 1968 I had never seen one.

Fry's paper did not result in any international recognition. Loveridge (1934) working at the Museum of Comparative Zoology, like Boulenger (1889), did not accept it, again placing it in the synonomy of the green turtle. Later Wermuth and Mertens (1961), in an important illustrated checklist of the chelonians and crocodilians of the world, described some 210 species of living chelonians. Most distinctive species were very fully illustrated in the 422 pages. However, amazing as it may seem, the only reference to *Chelonia depressa* appeared under the list of synonyms for the so-called Pacific race of the green turtle.

It is only fair to point out, however, that in taking this action Wermuth and Mertens were following that taken by previous reviewers. Garman's juvenile co-type from North Australia was considered to be an aberrant *mydas* green turtle by Loveridge (1934), Siebenrock (1908) and Smith (1931) thus these authors followed Boulenger (1889). On the spot investigations were never carried out, northern Australia being very sparsely populated and a very long way from the south where most of the population live. In 1956 Colin Limpus started visiting a colony of flatbacks which, remarkably, were nesting near Bundaberg in south Queensland at a latitude of 25° S but he never published anything about these observations (Limpus, pers. comm.).

Unknown to him, Williams, Grandison and Carr decided to reinvestigate *C. depressa*. Referring to the genus Chelonia, they wrote: 'One local population, however, is morphologically so distinct that it may be tentatively regarded as a species... This sharply distinguished taxon is *Chelonia depressa'.* They went on to write: 'There is an important nesting colony of *mydas*-like turtles on Capricorn Reef... especially on Heron Island...' This was, of course, the population of green turtles (*C. mydas*) which had already been the subject of a detailed four-year population study (Bustard 1966, 1968a & b) and they greatly weakened their case by their '*mydas*-like' remark. Col Limpus and I were able to finally put the existence of *depressa* beyond doubt by reporting in detail observations based on living animals in the field.

The story of how I came to see my first flatback began one night in mid-January 1968 when I was returning from a busy night's work on Heron Island. I took the shortcut back to the research station as I had one green turtle near there still to tag. This individual had not finished laying when last checked. As I climbed wearily up the 12-foot bank I wondered, as I had done on countless previous nights, how the turtles ever make their way up the steep slopes.

I had just tagged the green turtle, receiving a faceful of sand in the process. It was actively throwing sand backwards and was almost ready to return to the water. I was writing up the particulars of the individual and as I brushed the sand off the side of its face to check the number of post-ocular scales a voice in the darkness asked why I was doing that. The voice belonged to Mr Colin Limpus of Bundaberg who later informed me that there were flatbacks near his home in south Queensland. I was incredulous, as the scant published information always referred to the tropical north of Australia. The Capricorn-Bunker group of islands which include Heron Island lie at the southern breeding limits of the green turtle and even the comparatively hardy loggerhead does not nest much further south. I certainly never expected to hear of flatbacks nesting in South Queensland (Fig. 1). As a result, I accompanied Mr Limpus to Mon Repos beach in the afternoon of 20 January 1968 so that I could examine the site. We returned in the evening; shortly after midnight it was cool (about 23°C) and a number of loggerheads were nesting. At 12.45 a.m. as we were walking along the beach we saw my first live flatback (Fig. 2) and later nesting (Fig. 3). This individual, which was returning to the water, is shown on plate 16 of my book (Bustard 1972). It had nested just over the top of the bank. The first attempt to dig an egg chamber had been abandoned and it had laid in the second. The nest was carefully excavated and contained 44 eggs, which were collected for incubation in my laboratory in Canberra as set out by Bustard and Greenham (1968). Most of the laboratory-hatched young were returned to Mon Repos immediately after hatching and liberated on the beach (Fig. 4). Specimens

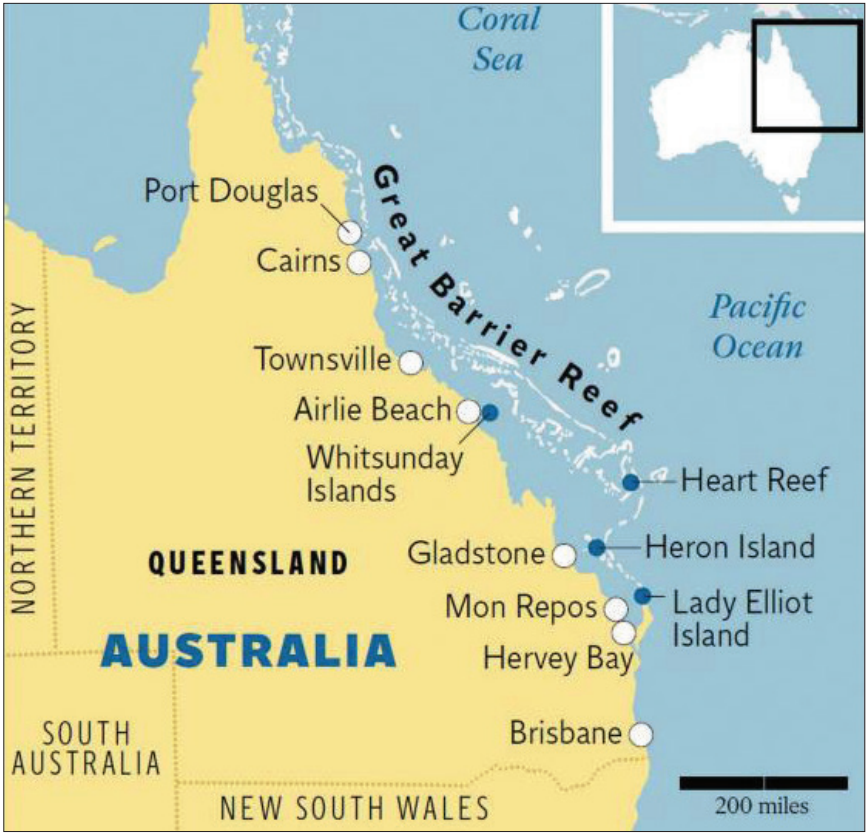

Fig. 1. Map of Queensland showing position of Great Barrier Reef, Heron Island and Mon Repos.

were also deposited in the Natural History Museum, London (BM 1968.889-890) and the Rijksmuseum van Natuurlijke Historie, Leiden (No. 14879).

As both its English and scientific name *depressa* suggest, the carapace is greatly depressed compared to the green turtle and the scutes are very thin and oily. This latter feature alone provides ready separation from the green turtle whose flippers have an outer covering of hard, horny scutes. Furthermore, in a flatback the scales in the area of the flippers between the phalanges are small and very numerous with the exception of several very large ones (Fig. 5). This compares to the green turtles where the scales covering the upper surfaces of the front flippers are comparatively few in number and all large. The flippers of the green turtle are tough to the touch and extremely powerful; those of the flatback are soft and considerably less powerful. This shows up in the tracks where the front

Fig. 2. The author meeting his first flatback turtle.

flipper mark is from the inner portion of the flipper, hence it spreads only a little wider than that of the back flippers. The tracks more closely resemble loggerhead tracks than those of the green turtle (Bustard *et al*. 1971). However, the flatback moves ashore by simultaneous forward pushes of all four limbs like the green turtle (Bustard & Greenham 1969)

Fig. 3. Flatback nesting on the lower bank.

Fig. 4. View along Mon Repos beach.

Fig. 5. One-year-old and three-year-old captive reared flatbacks. Note the enlarged scutes at the top of the trailing edge of the flipper – a diagnostic feature.

and unlike the quadrupedal locomotion used by the loggerhead. If the flatback is turned on its back it is relatively easy for the terminal region of the front flippers to be damaged or actually broken – I have never seen this happen in the green turtle. The carapace is curved upwards particularly towards the rear. Another notable feature is the much larger head compared to that of the green turtle.

Colouration also provides ready identification. In the adult green turtle of the Great Barrier Reef, the flippers vary from grey-green to light tan and the carapace is typically olive-green or olive-brown with pronounced chestnut-brown and/or black streaks and blotches. In contrast, the head and flippers of the flatback are olive grey, the anterior of the head is yellowish and the carapace is a darker olive grey than the flippers with indistinct darker markings.

Virtually nothing had been written about the biology of the flatback. Accordingly, we had several important tasks: the first was to protect the Mon Repos rookery; over a longer time span it was important to carry out detailed scientific studies of its biology and distribution.

For this work, I had the advantage of being able to carry out the first extensive aerial surveys thanks to the loan of a light aircraft, enabling us to land on the sandy beaches of remote islands at low tide. I surveyed the whole

of Queensland at set states of the tide so that data were directly comparable on each occasion; flying at 150m altitude every single turtle track could be recorded and most distinguished at species level. Furthermore, the project had been able to purchase Australia's last remaining pearling lugger. Crewed by Torres Strait Islanders we could travel anywhere. These were priceless assets enabling us to greatly extend our knowledge of all species of Australian sea turtles. This led to the discovery of the Crab Island flatback population.

Crab Island: Australia's largest rookery for the endemic flatback

Crab Island is a small coral cay with an area of 2.8sq km at the top right of the Gulf of Carpentaria situated just 1.4km off the north-western Cape York Peninsula at 10.9° S, 142.1° E (Fig. 6). Following counting of mass tracks during aerial surveys we took our pearling lugger there in order to carry out extensive research tagging over a month in 1970. We realised then Crab Island was a huge rookery for flatbacks. However, we had discovered what was – and still is today – the largest known rookery for the flatback. The most interesting observation was that virtually all flatbacks nested during daylight hours with a peak at around 3pm – the heat of the tropical day. A random sample of 10 nesting females were weighed and measured. The weights varied only between 69-72kg and the measurements of the curved carapace length from 80-97cm (mean 89cm). For details of our work there see Bustard (1972).

Crab Island is free from the mainland predators which destroy a large percentage of turtle eggs laid on mainland beaches. This is a crucial advantage and probably the reason why such a large population of nesting flatbacks has built up. Limpus (2007) wrote that there were 'very high levels of egg loss from pig predation on all (mainland) nesting beaches of north-western Cape York Peninsula. More generally the stock there is subject to Varanid (monitor lizard) and dog predation of eggs and vehicle damage to nests.'

Hence the importance of Crab Island – located in this region – being predator free cannot be overestimated. It is of great scientific importance not only to the Arafura cohort of the species but to the species in Queensland as a whole.

Crab Island became an aboriginal reserve, now referred to as indigenous owned land, in 1963. 'This land cannot be sold or acquired by anyone else – hence the land cannot be acquired for creating a national park or other protected estate' (Limpus, pers. comm.). However, Raine Island, the world's largest rookery for the green turtle, also indigenous-owned land, was created a National Park (Scientific) as a result of the four groups of indigenous landowners entering into a special Indigenous Land Use Agreement with the state government. This designation provides the state's highest possible level of legal protection, strictly limiting all access to scientific research and

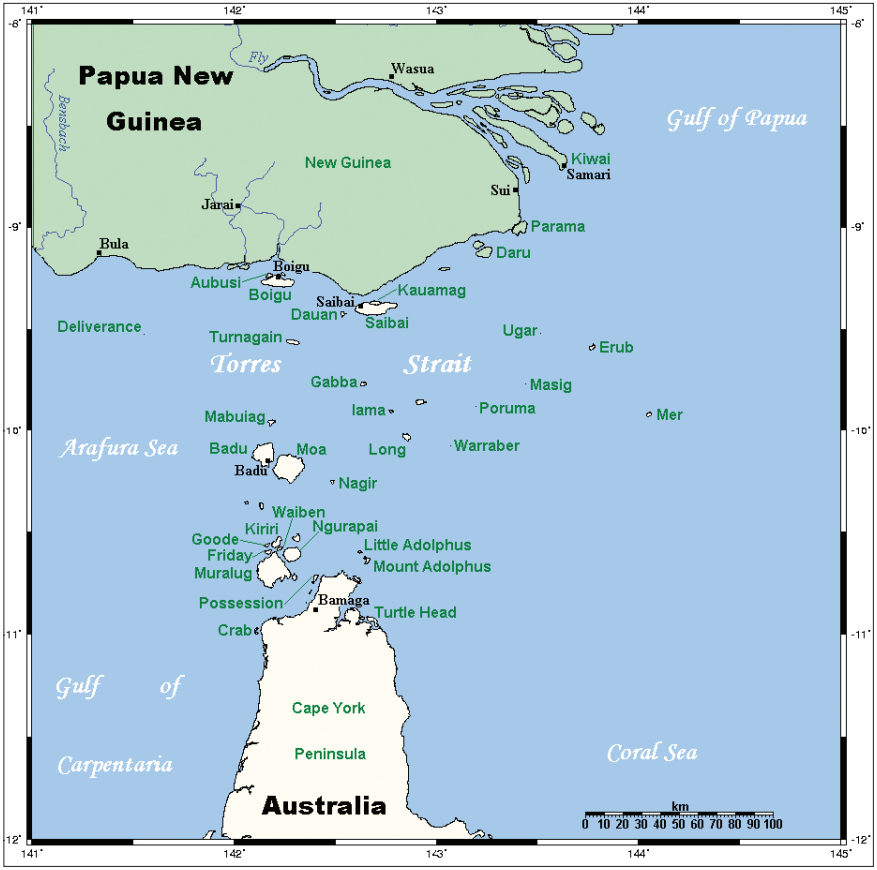

Fig. 6. Map of Torres Strait showing the position of Crab Island – the world's largest flatback turtle rookery.

essential management only. What is good for Raine Island will be even more important for Crab Island. Raine Island is a remote location on the outer Barrier Reef whereas Crab Island is all too accessible. Crab Island needs this level of protection as a matter of urgency and I will continue to press for this.

Conservation

We were extremely fortunate that within months of the rediscovery of the flatback the Queensland Government, following my advice, gazetted legislation protecting all species of sea turtles at all times throughout the State of Queensland on 18th July 1968. IUCN declared this 'by far the most significant legislation in sea turtle conservation that has yet been enacted anywhere in the world.' (Bustard 1969).

Very briefly this is how this came about: in December 1964 I commenced a long-term study of green and loggerhead sea turtles in Queensland with field headquarters at Heron Island. This research was carried out under licence from the Queensland government. At the outset, the government was informed that it was envisaged the work would extend over a period of 10 to 20 years (Bustard 1966, 1968a).

Heron Island and nearby North-West Island had been the sites of turtle soup canneries in the 1920s and early 30s (Musgrave & Whitley 1926). Their publicisation was important in creating an atmosphere receptive to conservation. Then important work on sea turtle biology was carried out, again at Heron Island, during a three and a half month period in summer 1929-30 by a Queensland government biologist (Moorhouse 1933). Moorhouse was alone at that time in carrying out detailed fieldwork which was vital in backing up his recommendations that some degree of protection be given to the green turtle. Furthermore, he set these recommendations out in detail – that it should be illegal to take green turtles south of latitude 17° S between the dates of 30th September and 30th November of each year. These important proposals were accepted by the Queensland government. Hence the green turtle had a three-month close season in the southern part of the state, the idea being that females would be able to lay several clutches of eggs before being killed for the canneries. Following deliberations by the Great Barrier Reef committee in 1950 protection for the green turtle was extended throughout the year. This legislation again only referred to South Queensland.

This remained the situation 34 years after Moorhouse's field work when I started my research at Heron Island. Since I was working under licence on a protected species and my work included huge egg collection for a hatchery capable of holding up to 50,000 eggs, the Fisheries Department, the responsible government licensing agency, took a close interest. Several years later in the summer of 1967-68 the Chief Inspector of Fisheries in Queensland was visiting Heron Island seeing our programme. Being deeply interested in conservation he asked me whether I had yet come to any conclusions on the conservation requirements of the species. It was clear that any depositions that I might make would receive the most careful consideration. My immediate response was that our work confirmed that it was not practical to operate a fishery based on taking breeding female green turtles from the nesting beaches. Turtle populations could not sustain the resulting considerable loss. Therefore, a total protection of green turtles was favoured in order to conserve the substantial Queensland populations of this species. I further pointed out that since most Queenslanders did not know the difference between the then six, about to become seven, species of sea turtles in Queensland waters, protection, if it was to be

effective, should be extended to all species and throughout the whole of the state of Queensland. These far-reaching proposals were duly accepted by government and led to the legislation set out above. This meant that all sea turtles were totally protected along the coastline of 5,230km (3,250 miles) as well as along 2,000km (1,250 miles) of the Great Barrier Reef (with provision for a regulated off-take by Australian aborigines and Torres Strait Islanders). This immense area embraced by the Order in Council guaranteed the future of very substantial turtle populations and applied total protection to the flatback for the first time. A fuller account is given in Bustard (1972).

Mon Repos presented a whole series of problems (Bustard 1968a, 1969). Quite apart from the presence of flatbacks, the large population of loggerhead turtles nesting on the mainland there was unique in the area and had very great tourist potential. Many people were visiting the beach and some were actively destroying nests. Many of the turtles were chased off the beach before they could nest by people shining powerful torches.

I had come to Mon Repos just in time. The local council had recently approved plans for subdivision of land adjacent to the beach for housing purposes. Illumination from these homes, together with car headlights on a projected road along the top of the dunes, was likely to lead to the rapid extinction of the Mon Repos rookery. Working together, and using his local knowledge, Colin Limpus and I attended a meeting of the Shire Council where these issues were now highlighted and the Queensland government intervened, appreciating the need to protect habitats. The Conservation Minister declared Mon Repos a National Park in the face of concerted opposition from speculators supported by the local council. The government announced its intention to buy or reclaim the land used by the turtles and to re-route the road away from the nesting area.

However, as pointed out by Colin Limpus '(it was) 1982 when first declaration of land protection on the nesting beaches (took place) and (this was) followed by 10 years of court cases to finalise land acquisition'. Furthermore, 'Mon Repos supports the primary total monitoring programme in Queensland which has now run continuously for 49 years.' (Limpus, pers. comm.)

So much has developed from a casual meeting on Heron Island and my subsequent involvement in the early stages of obtaining National Park status for this flatback and loggerhead turtle rookery. Every credit is due to Colin Limpus for pursuing this steadfastly over the years. Furthermore, in 1994 the Mon Repos Conservation Park visitor centre was constructed (Fig. 7), another great achievement as conservation depends heavily on getting the message across to as many people as possible. To achieve this all potential avenues should be investigated; such as including the species in tourist material and – very importantly – on postage stamps. Picturing the species on low-value stamps, which have the widest circulation, can be very effective (Fig. 8).

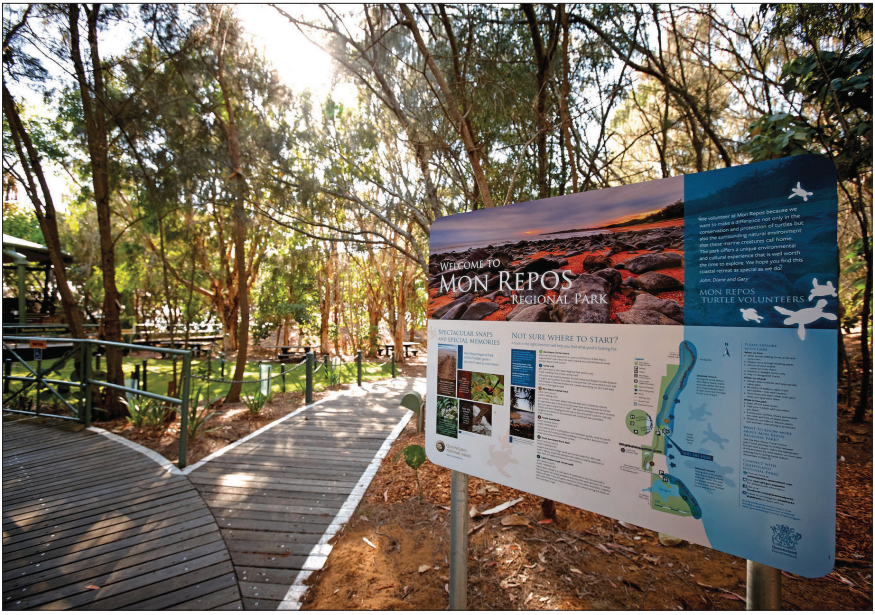

Fig. 7. Entrance information board at Mon Repos national park.

Fig. 8. Low value stamp showing a hatchling flatback turtle – an important conservation tool.

The conservation status of the flatback is excellent. It must be in the top echelon of species survival prognosis. All recorded nesting beaches are in Australia and the species is more or less restricted to the Australian continental shelf. There are no data to suggest oceanic dispersal of hatchlings like those of other sea turtle species. It enjoys total protection throughout Australia. In Queensland more than 70% of the nesting beaches are protected habitats (Limpus 2007).

The North West Shelf Flatback Turtle Conservation Programme in Western Australia is a 30 year $A32.5 million (£18.5 million) programme that aims to conserve flatbacks in Western Australian waters and nesting beaches and throughout the range. The research includes surveying, monitoring, locating key breeding and feeding sites and establishing information and education programmes. There can be few species anywhere in the world with this degree of conservation support.

Bustard (2016) reported a rough estimate for the nesting population of 20,000 adult female flatbacks. The population is probably biased around 60:40 in favour of females (Bustard, in prepn.) suggesting a total adult population of the order of 32,000. This is supported by all the growing age classes covering the two decades or more prior to achieving adulthood. This is a very large number of turtles, all in one huge politically stable country and receiving total protection.

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