CONSERVATION OF SEA TURTLES WITH SPECIAL REFERENCE TO INDIA

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Like my talk, this article falls into two parts – firstly how my involvement with sea turtles began and the Australian conservation successes which led from it, and secondly my involvement in olive ridleys in India and the huge upsurge in interest and work on sea turtles in India that has resulted.

My involvement with sea turtles started in December 1963. I had returned to Australia as a Research Scholar in that great world-class institution the Australian National University and the Senior Lecturer in Zoology asked me to join the Honours students field course on the Great Barrier Reef as a demonstrator. On the first evening we saw huge green and loggerhead turtles hauling out and nesting. They captivated me at once and I knew that I had to start work on them although I was only in the first year of my PhD. On my return to Canberra I saw the Reader, in my Professor's absence in the UK, and he approved my starting a postdoctoral project with immediate effect. The rest is history as they say.

Before going on to discuss the work and its outcome in two great Commonwealth countries, it is important to understand the basics about conservation. Conservation is about land – "they are not making it any more". Conservation requires land and is about how that land is utilised. Nothing in this world is more political. I always told my students that in their conservation projects science was only 10% (it had to be good science of course) but 90% was politics. This requires a certain kind of person. This was first pointed out to me in India by a Dutch FAO staffer. As he said, "you have to be able to build bridges to your counterparts to meet them two-thirds of the way". If you are unable to do this your project is doomed. This means you have to be an extrovert. You also have to be able to blend in with the nationals of the country you are working in and have access to the levers of power.

I started off in Queensland with a severe handicap – I was from Canberra (the seat of power and its prestigious University). One of my mentors pointed out to me that Queensland thought it had had a bad deal from federation (in 1901) and was very suspicious of the government in Canberra. When I wanted to start my research project on sea turtles in

Queensland the necessary licences from the Queensland government were not forthcoming. Throughout the early days I was met with suspicion and even obstructed along the way. This took time and a lot of effort to overcome. Scots, I believe, are very chameleon-like and like that famous lizard are able to quickly blend in with their surroundings. I was delighted that on gaining my PhD I was referred to in the press as a "promising young Australian". That meant I had succeeded!

I have been extremely fortunate at a number of times in my life, and one very important occasion was when my PhD led to the award of a very prestigious Queen Elizabeth II Fellowship. These were handled through the Prime Minister's department in Australia so I was quickly in touch with the levers of power. Britain still does not have a PM's department but these have long been a part of government in India as well as Australia and other Commonwealth countries. Naturally many of the best and brightest civil servants gravitate to them. So as a young post-doctoral I was in a position to learn how things got done in the world of politics. This has stood me and my students in good stead for the past half century.

So after eventually obtaining the necessary licences with the help of my professor, who spoke directly several times with the authorities in Queensland having been primed by me, I was able to initiate what was to become a ten-year study which achieved several major outcomes. The most immediately important one was the Queensland sea turtle legislation in 1968 extending green turtle protection to the whole of the state and at the same time fully protecting the four other species of sea turtles in the State of Queensland – the loggerhead (*Caretta caretta*), the hawksbill (*Eretmochelys imbricata*), the leathery turtle (*Dermochelys coriacea*), which is now commonly called the leatherback, and the soon-to-be-rediscovered flatback turtle (*Natator depressa*). The IUCN declared this achievement as "by far the most significant legislation in turtle conservation that has yet been enacted anywhere in the world".

Back to the politics – the achievements set out in the above paragraph would not have been possible without becoming in effect 'an honorary Queenslander'. There was an organisation in Queensland known as the Great Barrier Reef Committee with a secretary whose negative opinions on 'outsiders', i.e. those from Canberra, carried a lot of weight. The Committee ran a research station on Heron Island which had to be our HQ. I knew I had arrived when, after some years, I was invited to join the Committee.

There was, of course, a lot of spadework in bringing this about and a lot of conservation-based research and many publications and interaction with the Government of Queensland along the way (References in Bustard, 1972). I was fortunate that my first University (St Andrews) had stressed

the importance of scientists talking and writing about their work for the general public. From the outset, each evening during the 13 weeks we spent each year at our base at the Great Barrier Reef Committee Research Station on Heron Island (then an island privately owned by the Poulson family) our Honours Zoology students took it in turns to guide a group of tourists to watch nesting turtles undisturbed and talk to the tourists about turtles and their conservation. In this way, over the years, we built up a very substantial body of people who became ardently pro-turtle.

That legendary figure Tom Harrison of Sarawak – Curator of the Sarawak Museum and Chairman of the Turtle Board – invited me to become a foundation member of the IUCN Marine Turtle Group and we held our first meeting in Morges (Switzerland) in 1969, Morges then being IUCN's headquarters.

Much less known, but equally important, was that the Government of Western Australia – another huge state with, like Queensland, a coastline of several thousand miles – following my advice, stopped the commercial fishery for green turtles and likewise provided full protection. It only required the Northern Territory (then run from Canberra) to come into line **for all five species of sea turtles to be fully protected at all times throughout the Australia subcontinent.**

What I see as one of our major contributions to the study of sea turtles was the reinstatement of the flatback (*Chelonia depressa*) as a species completely distinct from the green turtle. We provided a wealth of physical and biological data which made this specific status unquestionable (Bustard & Limpus 1969). The flatback, although described and placed in a separate genus by Garman in 1880, had been included in the synonomy (i.e. as the same) of the green turtle and it was subsequently restored to its originally described genus *Natador.* Col Limpus, who had wanted to study for his MSc under my guidance, has gone on to become a major force in sea turtle research and conservation, particularly in his native Queensland.

At the next IUCN Marine Turtle Group meeting members wanted to place the flatback in the Red Data Book as an endangered species "because it only occurs in one island" – Australia – some island! I pointed out it has an east-west distribution of several thousand miles and enjoys, like all sea turtles in Australia, total protection throughout the subcontinent.

I was again fortunate that Billy (later Sir William) Collins, chairman of Collins Publishing Company based in St James's, London, but with offices around the world, wanted to see sea turtles on his biennial visit to Collins Australia and I arranged for him to visit us at Heron Island. Billy invited me to write a book for Collins on sea turtles. This resulted in 1972 in *Sea Turtles: their Natural History and Conservation*. This was a particularly happy event since at the first meeting of the IUCN Marine Turtle Group

in 1969 those present lamented that there was no text on sea turtles and that this was a great handicap and I had said I would write one. When I returned with my book at a later meeting following its publication in London, Sydney (as Australian Sea Turtles) and in New York, the members were most enthusiastic.

However, I said it was insufficient as it would only attract people who were already interested in sea turtles, not encourage others to become interested in these incredible animals. So I then wrote a popular book around a girl from the Torres Strait Islands, *Kay's Turtles*, also published by Collins. Remarkably this book, illustrated in colour, was on the Canberra best-sellers list for many weeks following its publication. More remarkably it won me a prestigious Australian book prize. Hopefully this book has contributed to increasing the number of people interested in sea turtles.

An account on sea turtle conservation elsewhere is outside the scope of this paper. However, it is interesting to note just how long ago the green turtle was being drastically reduced in numbers in the Americas. The world's first conservation legislation for sea turtles was passed by the Bermuda Assembly in 1620! This was as a result of massive over-exploitation even then by sailors upturning nesting females on the beaches for supplies of fresh meat.

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Turning now to India, I came there at the request of the Prime Minister, Mrs Indira Gandhi, through the auspices of FAO/UNDP. Mrs Gandhi had enjoyed an international upbringing and had been very close to her father, Jawaharlal Nehru, India's first Prime Minister following independence. Like him she had a deep interest in the natural world but this followed a more practical bent than that of her father. As a result of concern about the status of the gharial (*Gavialis gangeticus*), a specialised, long-snouted, fish-eating crocodilian, the PM requested that I be deputed to carry out an investigation into its status and report what needed to be done to ensure a secure future for this crocodilian. I should explain here that I had been instrumental in the creation of the IUCN Crocodile Specialist Group with the help of Sir Peter Scott, Chairman of WWF, who had long been one of my mentors, and I became Group Secretary. I had also been responsible for crucial conservation legislation for crocodiles in Papua-New Guinea and in Australia.

A practical example of Mrs Gandhi's interest in wildlife was the first wildlife conservation legislation to be enacted since independence – the Indian Wildlife (Protection) Act, 1972. However, this key Act did not include sea turtles because nothing was known about them at this time. This was to change rapidly . . .

My initial report (FAO 1974) highlighted the presence of an enormous olive ridley (*Lepidochelys olivacea*) sea turtle rookery on the coast of the eastern Indian State then known as Orissa with a 480-km coastline fronting onto the Bay of Bengal. My report included preliminary advice on its protection. This rookery was immediately adjacent to estuarine mangrove habitat ideal for the estuarine crocodile (*Crocodylys porosus*) which I had proposed for Odisha's first wildlife sanctuary, now the State's only National Park, and the ridley rookery is managed in conjunction with that.

The Prime Minister accepted my report on the gharial (which work had been extended to cover India's other two species of crocodiles) and said the Government of India would implement the work if I would return to India to head up the project. This resulted in my spending eight years in India during which period my brief expanded considerably. Here, however, we are only concerned with sea turtles.

At that time almost nothing was known about sea turtles in India. One of the great successes of the Odisha ridley conservation project has been the incredible spin-off effect it had in galvanising extensive research on all India's sea turtles starting with the ridley rookery which (with future discoveries) became three rookeries along the Odian (Odisha) coast of which two are huge (see Table 1). A Research Scholar, working under my guidance, was appointed to determine basic paramaters of the population. A mark recapture programme using the standard monel metal tags applied to the trailing edge of the right front flipper showed that they nested annually (Bustard & Kar, 1981).The aim of this section is to very briefly outline what has happened over the 40 years since my first report on the Gahirmatha rookery (FAO 1974). Further, more detailed information is given in Odisha Forest Department (2011) and Bustard (in press).

Although the Government of Odisha stopped the selling of olive ridley eggs and protected the rookery area, there was no protection for the adult turtles which were still being taken on the beaches in small numbers (Fig. 1) and at sea in very considerable numbers – 50,000/annum has been suggested but without any back-up data – mainly for sale in Kolkatta where turtle meat is greatly sought after. Turtles collected on beaches in Odisha, or at sea offshore, were forwarded to Kolkatta by sea, rail and truck. This legal loophole was closed when the Government of India gave full protection to all Indian sea turtles under an amendment to the Indian Wildlife (Protection) Act in 1978. As is natural, it then took some time for this to be followed through and for people to become aware that it was now a crime to take sea turtles in India. So harvesting, especially at sea, continued, but in reduced numbers until the early 1980s and thereafter ceased.

Fig. 1. Women carrying olive ridleys up the beach at Gahirmatha in 1975, in what is now Bhitarkanika National Park, Odisha, en route to the rail head at Puri and thence to Kolcatta. Photo by Robert Bustard.

At the start of the conservation work fishing was being carried out by native craft which did not impact on sea turtles to any great extent. Following the build-up of fleets of mechanised trawlers in the 1990s 'bycatch' became a very serious problem in that turtles were being accidentally caught and drowned in gill and trawl nets. It took time to reduce bycatch but this has been done to a very great extent (Table 2).

Gahirmatha Marine Sanctuary (Fig. 2), which is 35km long and extends seawards for 10km from the beach with a total area of c1,500 sq km, was declared in 1997. This is patrolled in season by the Odisha Forest Department and when required also by the Indian Coast Guard service. Sometimes the Indian Navy is also involved. So the protection of the adult turtles is taken very seriously.

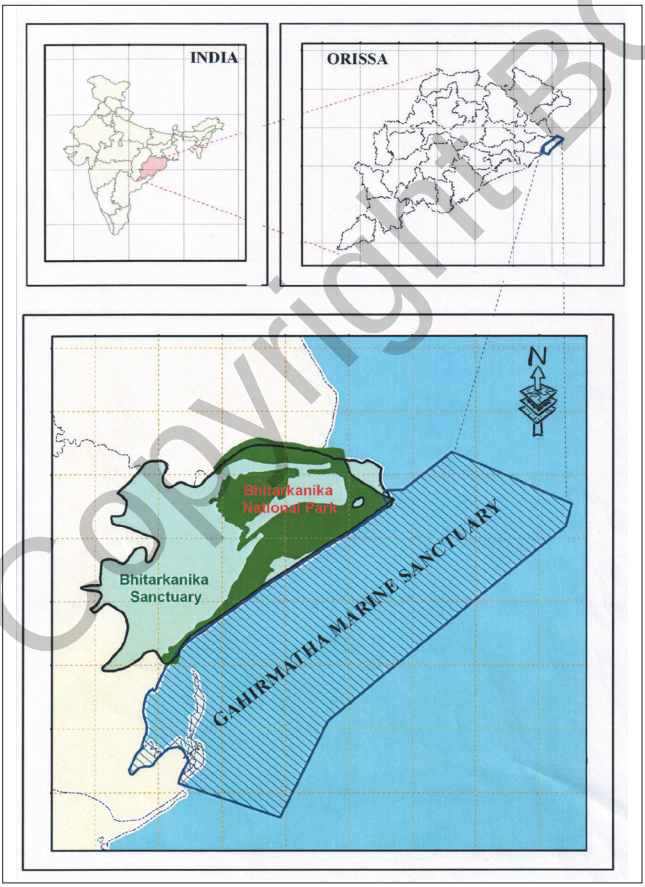

Fig. 2. Map showing the location of Gahirmatha Marine Sanctuary.

It has been and still is extremely difficult for interested parties to obtain a balanced and informed account of the effects of the massive conservation effort that has been extended over these 40 years. There are several reasons for this.

- ❏ A problem is that many reports are by people who are not population ecologists and so, while well-meaning, do not begin to understand the dynamics of the ridley population. One consequence is that they publish conclusions based on far too short periods of a few years. Such results will not provide useful data for long-term conservation planning.
- ❏ In order to obtain good funding support NGOs (non-government organisations) may have to present a negative story, often a doomsday scenario (global warming scientists in the UK and elsewhere provide a prime example). Of course, this does not include all NGOs and Belinda Wright´s and her associates´ work for example, referred to below, has been first class. An important corollary of this, and something we are well used to in the UK, is that the media like to present 'bad news'. Good news it seems, is not 'newsworthy' and India, like us, has a very vibrant free press.
- ❏ Some scientists, particularly in the west – very unwisely in my opinion – strongly recommend this gigantic Pacific ridley population as a resource to be utilised without perhaps fully understanding the problems on the ground of effectively preventing such utilisation resulting in a large, and probably unsustainable, exploitation, completely negating many years of successful conservation. Nicholas Mrosovsky is a prime example (Mrosovsky 2001, 2008) .

The Government of India does not believe that such a scheme would be workable under Indian conditions, and nor do I. I believe in sustained use of natural resources where **the resource can be managed in such a way that the *actual* exploitation remains within the scientifically approved limits.** As Adviser in the early 1970s I gave the opinion that this would not work for crocodiles and that crocodile farming should not be permitted in India, which advice has been consistently followed. The same was – and still is – my opinion on exploitation of these huge rookeries. **It is simply not feasible to implement a scheme which would guarantee the necessary safeguards for the olive ridley population.**

We have been extremely lucky that this project has now been funded for 40 years and that this funding will continue. Because of this we have data on which we can make predictions about the success or otherwise of the

massive conservation effort by the Odian Forest Department. The data for the last 12 years are given in Table 1 for the two key rookeries. This shows that the ridley population is doing extremely well. For Gahirmatha the three largest arribadas for the 12 year period – all very large – occurred in the last four years. For Rushikulya the results are similar, with the largest arribadas occurring in four of the last five years.

Shanker, Pandav & Choudhury (2003) have collated and reworked published arribada data for the Gahirmatha rookery from the first arribada census by myself in1975-6 (Bustard 1976) when we recorded 158,171 nesting females, through to 2001-02. The mean number of nesting ridleys at Gahirmatha over these initial 25 years was approximately 20,000 less compared with the twelve years reported in Table 1 at 192,000 and 210,000 respectively.

That is, the population had on average increased by 9.3% over the last 12 years compared with the previous 25 years. Their conclusion that "the Orissa population is clearly of imminent conservation concern" is shown to be no longer valid by the facts presented here.

If we had recorded the Gahirmatha rookery only, when we know that there is considerable interchange of nesting females between this rookery and that of Rushikulya, the results would be virtually meaningless. Table 1 highlights the problems which would arise from such an approach. For instance in 2002-03 the Gahirmatha arribada was very low (73,000) but that at Ruskikula was 201,000. Two years later the figures are almost reversed. Clearly the two rookeries have to be studied in tandem, which the Odisha Forest Department has done.

The populations of olive ridleys whose arribadas nest on the two key sites in Odisha have been shown to be genetically different from those elsewhere including those from Sri Lanka (Shanker *et al.* 2004), which is why I do not apply the name Pacific ridley to them. The same authors suggest that these populations are the ancestral source for contemporary global populations of olive ridley sea turtles. This further underlines the importance of this stringent conservation programme in protecting something which appears to be unique. Those from the Odisha rookeries remain in the Bay of Bengal with some venturing as far south as Sri Lanka (see also Forest Department, Orissa, 2011, fig. 17). It is important to realise that this does not imply interbreeding with the Sri Lankan population which are genetically distinct (see above) since those members of the Odisha rookeries are using feeding grounds off the South Indian state of Tamil Nadu and Sri Lanka and will return to Odisha to breed. A parallel exists with the green turtle (*C. mydas*): two distinct populations feed off the Brazilian coast but return to their respective rookeries – far apart – in Surinam and Ascension Island to nest (Bustard 1979).

To sum up: We have been extremely fortunate to have been able to continuously study both rookeries over such a long timespan. This long-term study is continuing. In my opinion, and at a time when many turtle rookeries around the world are being decimated or destroyed, the Odian olive ridleys are **thriving** (Figs 3-7).

Fig. 3. A pair of mating ridleys at Gahirmatha, Bhitarkanika National Park. A well developed claw on the first digit is hooked below the front of the female's carapace on each side to hold the male in position. Photo: Odisha Forest Department.

Fig. 4. A massive number of olive ridley hatchlings entering the sea at Gahirmatha. Photo: Odisha Forest Department.

Fig. 5. This shows the arribada at Rushikulya in relation to a sandspit used for nesting, which is narrow and completely unvegetated. Such sites are entirely free from egg predators which would destroy a high percentage of nests laid on the mainland, hence are very safe. These sandspits are also very unstable from year to year as a result of cyclones and changing oceanic currents. Photo by Kartik Shanker.

Fig. 6. Kartik Shanker walking amongst a very dense nesting arribada at Rushikulya. It would be possible here to move along the beach on turtles without touching sand! Photo by Maya Khosla.

Fig. 7. Turtles leaving the beach and more still arriving. Photo by Kartik Shanker.

Conservation faces continuous challenges in this vastly overpopulated world and how we proceed with our conservation strategies in the face of large-scale port developments along the Odisha coast will be the next challenge to surmount. Happily, the turtles now have many important friends.

Costs: So what has been the cost of this massive protection undertaking carried out both onshore and offshore? Currently it is running at about 20 million Rupees/annum. At the exchange rate while writing this article of Rs85=£1, the annual cost is approximately £250,000. It should be remembered that this conservation exercise has now been going on for 40 years. Currently the exchange rate Rs to the £ is very favourable. In the eight years I lived in India the rate varied only between Rs14 and Rs18 to the £, so the costs when converted into pounds would then have been much greater. As a rough conservative figure let us say that £10 million has been spent on the conservation of these olive ridleys so far. These costs, shared between the Government of India and the Odisha state government with the latter being responsible for recurrent costs (wages) will continue in future years. It should be noted that these costs do not take into account protection work carried out by the Indian Navy or the Coast Guard service.

Overall this must be by far the largest financial support anywhere to conserve specific sea turtle rookeries **which are not subject to utilisation** – this, too, by a developing country with massive calls on its funds. The Government of India and the Odisha State Government are to be congratulated on undertaking and maintaining this level of support over 40 years. Certainly the international community has not appreciated the high level of this support, nor given the governments credit for this.

Lessons to take from this study are:

1. That large-scale conservation projects cost very substantial sums of money, particularly when – as here – they have to be continued indefinitely. It is never possible to match the scale of such funds privately but private grants judiciously applied to niche projects can be highly successful. One such example is that of Wright & Mohanty (2006) where their practical assistance with fieldwork was excellent.
2. That by far the most rewarding and informative population studies are those which are continued over a very long timespan.

To close optimistically, I cannot do better than quote from Justin Gerlach's superb book (Gerlach 2012) which everyone interested in Chelonia should own: "The 220 million years of turtle history shows one thing clearly, the Chelonia will continue in some form: turtles are the great survivors." But they need all the help that we can give them.

The behavioural adaptations shown by sea turtles, which have contributed enormously to their success, and may even be responsible for their continued survival through the ages, are another fascinating story . . . .

Acknowledgements
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Table 1. Estimated number of olive ridley sea turtles nesting at the two main rookeries on the Odisha coast during the October-May arribada nesting seasons from 2001-02 to 2012-13. Odisha Forest Department (2011), updated with unpublished data for subsequent years courtesy of the Odisha Forest Department.

Year	Gahirmatha rookery (Dhamara river mouth)	Rushikulya rookery (Rushikulya river mouth)	Total
2001-02	no arribada	35,000	35,000
2002-03	73,000	208,000	281,000
2003-04	243,000	201,000	440,000
2004-05	234,000	89,000	323,000
2005-06	267,000	198,000	465,000
2006-07	146,000	no arribada	146,000
2007-08	no arribada	180,000	180,000
2008-09	167,000	261,000	428,000
2009-10	357,000	156,000	513,000
2010-11	472,000	252,000	724,000
2011-12	168.000	406,000	574,000
2012-13	401,000	288,000	689,000

Table 2. Annual number of deaths of olive ridley sea turtles due to fishing activities along the Odisha coast from 2001-02 to 2012-13. Odisha Forest Department (2011), updated with unpublished data for subsequent years courtesy of the Odisha Forest Department.

Year	Number of deaths
2001-02	12,977
2002-03	10,086
2003-04	4,981
2004-05	3,227
2005-06	3,242
2006-07	4,046
2007-08	5,760
2008-09	5,680
2009-10	5,003
2010-11	3,373
2011-12	2,382
2012-13	2,712

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