

Introduction

The leatherback turtle, *Dermochelys coriacea*, is the only surviving species of the Family Dermochelyidae. This ancient turtle family probably had its origins more than 60 millions years ago in the early Cretaceous (Gaffney 1991). This is the largest living turtle (up to 916kg. Morgan 1989) and it has the greatest geographical distribution for any reptile. Its habitat range extends from tropical nesting beaches to marine foraging areas spread from the tropics to cool temperate waters, with some individuals even foraging in sub-polar waters (Goff and Lien 1988). It is the deepest diving turtle, having been recorded down to depths of 315m (possibly to depths exceeding 1000m) during dives up to 37minutes in duration (Eckert et al. 1989).

While leatherback turtles share many features of their biology with the hard-shelled turtles, Family Cheloniidae, leatherback turtles also are characterised by a number of unique features. The leatherback turtle can be regarded as a warm-blooded reptile. They can maintain a core body temperature well above that of the surrounding waters (Frair et al. 1972, Standora et al. 1984). To maintain these elevated temperatures they must be able to generate endogenous heat via utilisation of thermogenic brown fat tissue (Eckert 1992). Additional heat would be derived from normal metabolism during muscular activity. Reduction in heat loss is facilitated by this turtle's thick insulating sub-epithelial fat deposits (blubber), its large body size and hence its low surface area to volume ratio and the counter-current heat exchange system utilising a bundle of veins and arteries at the base of each flipper to reduce heat loss via blood flow to the flippers (Greer et al. 1973). With these adaptations, the leatherback turtle is able to remain functional in the very cold waters that it encounters during deep dives and during migrations to high latitudes. This species also has a number of skeletal features within its limb bones that are unique among living reptiles but which it shares with other marine diving animals including cetaceans and sirenians and the extinct ichthyosaurs and plesiosaurs (Rhodin et al. 1981, 1996). The diet of leatherback turtles consists primarily of large planktonic invertebrates such as jellyfish and tunicates.

The Indian Ocean – South-east Asian region can be regarded in many ways as a birth place for modern turtle biology and conservation management, particularly for the leatherback turtle. In the northern Indian Ocean during the early 1900s, Sri Lanka, then a British Colony known as Ceylon, was recognised as a significant area for leatherback turtles (Smith 1931). It was from Ceylon that Deraniyagala published numerous scientific papers commencing with his description of the nesting biology of leatherback turtles and his first paper on leatherback turtle embryology (Deraniyagala 1930, 1932). His detailed descriptions of marine turtle taxonomy, behaviour, embryology and morphology (Deraniyagala 1939) remain essential reading for any serious student of leatherback turtle biology. In his later career, Deraniyagala (1953) enhanced these studies with publication of his well illustrated "Atlas" of the reptiles of Ceylon. Although Smith (1931) reported declining occurrences for these turtles, no significant conservation actions for the Sri Lankan leatherback turtles appear to have been initiated as a consequence of the scientific studies of the 1930s. While various proposals have been made for improving leatherback turtle conservation in Sri Lanka (de Silva 1996), it was not until the late 1990s that concerted efforts to improve the conservation outlook for leatherback turtles under threat from egg harvest and coastal development in southern Sri Lanka were revitalised by the proactive involvement of community groups (Kapurusinghe 2000).

Concerns regarding the long term survival of marine turtle populations subject to intense egg harvest in Sarawak (Harrison 1947) led to the invention of the stainless steel (monel metal) flipper tag (Harrison 1956a,b, 1958). This tag facilitated detailed studies of marine turtle reproductive biology and the formulation of hatchery-based management projects in Sarawak, now a State within Malaysia, for the green turtle (*Chelonia mydas*) (Harrison 1951, 1952, 1954, 1955, 1956a,b,c, 1958, 1959, 1961, 1962a,b; Hendrickson 1958).

The "discovery" by the scientific community of the leatherback turtle nesting population at Terengganu in Peninsula Malaysia in the 1950s (Tweedie 1953), was closely followed by scientific investigations that paralleled those under way in Sarawak. These studies raised concerns for the sustainability of the existing intense egg harvest from this leatherback turtle population (Hendrickson and Albert 1957, 1961; Hendrickson 1961). A hatchery based conservation project was initiated (Wyatt-Smith 1960, Hendrickson 1962, Anon 1963, Balasingam 1965, 1969, Wycherley 1969, Tho 1974, Kiew 1975, Siow 1978, Leong and Siow 1980a,b, Siow and Moll 1982, Siow 1987) and investigation of leatherback

reproductive biology and ecology commenced (Hendrickson and Winterflood 1961, Hendrickson and Balasingham 1966, Balasingham 1967). Subsequent tagging studies provided the first detailed descriptions of the reproductive biology and breeding migrations for this species (Balasingham and Tho 1972, Chua 1988, Chua and Furtado 1988). The egg harvest was progressively reduced and an increasing proportion of eggs retained for hatchery incubation as the nesting population continued to decline during the 1980s and 1990s (Chan 1986a, Salleh et al. 1987, Chan 1988a, Aikanathan 1989, Chan and Liew 1989a, Aikanathan and Mortimer 1990, Limpus 1993). In response to the declining nesting population and corresponding decreasing incubation success of the eggs in the hatcheries, additional research addressing embryology, incubation success and hatchling biology was initiated (Chan 1985, 1986b, Chan et al. 1985, Chan 1988b, 1989, Chan and Solomon 1989, Chan 1993). At the same time, increased emphasis was given to understanding leatherback turtle interesting biology (Eckert et al. 1991, Chan et al. 1988, Chan et al. 1991, Chan and Liew 1995) and to introducing conservation measures within the interesting habitat (Chan and Liew 1989b, 1995).

Although Loveridge and Williams (1957), in their taxonomic review of African turtles, record leatherback turtles from Cape Province of South Africa, they make no reference to the Natal–Mozambique breeding population. In response to local concerns for the depleted leatherback and loggerhead turtle nesting populations of north-eastern Natal, the Natal Parks Board commenced long term research and monitoring of these nesting populations in the early 1960s (Bass and McAllister 1964). The ongoing studies of this leatherback breeding population (Hughes et al. 1967, Hughes and Mentis 1967, Hughes 1969, 1971a,b, Hughes and Brent 1972, Hughes 1974a,b, 1989, Hughes and Bartholomew 1998) have provided leadership in increasing our understanding of leatherback turtle biology and conservation.

In Indonesia, leatherback turtle distribution had been poorly documented (de Rooij 1915) but by the 1970s marine turtle specialists were aware of leatherback turtle nesting along the northern New Guinea coast (Pritchard 1979). As the conservation movement in Indonesia became more informed regarding marine turtles within their country, it became apparent that a very large leatherback turtle population was nesting in north-eastern New Guinea (Anon 1981). In addition, a nation wide survey by IUCN-WWF staff identified that leatherback turtle nesting was wide spread throughout Indonesia (Salm 1984): southern Sumatra, southern Java, many of the other islands bordering the Indian Ocean as well as the Vogelkop area of north-western Irian Jaya (now known as Papua).

WWF Indonesia has had two decades of participation in developing and implementing conservation actions in the Vogelkop area, beginning with Bhaskar's intensive population surveys in 1984 – 1985. This work has been complemented by additional studies by other Indonesian teams (Yamasaki 1991, Nababan and Jacob 1996) and visiting international teams (Starbird and Suarez 1994). Loss of eggs through pig predation, erosion and egg harvest were identified as significant issues for this population and conservation efforts have focused on nesting census and increasing hatchling production. Few additional studies (Maturbongs et al. 1993, Maturbongs 1995, 1996) of leatherback turtles within its more broadly dispersed nesting range within Indonesia have occurred since the country-wide survey in the early 1980s (Salm 1984). The localized traditional leatherback turtle harvest in the Kei Islands of eastern Indonesia has been highlighted (Starbird and Suarez 1994, Suarez and Starbird 1996, Suarez 2000) and offers some insights into the poorly understood oceanic life of the species.

The significant leatherback nesting population of the Andaman Sea and eastern Bay of Bengal started to gain recognition during the latter part of the 1900s (Polunin 1975, Phasuk 1983). However, it was not until the surveys commenced by Baskar in the early 1990s that the significance of the Andaman and Nicobar Islands leatherback nesting population was appreciated (Bhaskar 1993, Tiwari 1994, Andrews 2000). This leatherback population is now identified as under threat (Andrews 2000) and plans were developed to address some of the conservation problems for the area (Choudhury et al. 2000). The 1990s also saw a breakdown of language barriers in the region. Actions by Thailand, Myanmar and Bangladesh agencies and NGO groups in conservation of the depleted and small nesting population along the Andaman coast of mainland Asia are now recognised (Chantraspornsy 1996, 2000, Islam 2000). Egg harvest and egg depredation has been a significant threat to leatherback turtles along this coastal region.

Except for localised egg harvests, the leatherback turtle has not had any prominent role in trade in marine turtle (Mack et al. 1979). In response to the recognised threat to the populations arising from

the over harvest of eggs for local consumption, South Africa and Malaysia developed two independent management regimes for leatherback turtles commencing in the 1960s:

- **Natal, South Africa:** The management responses included a long term moratorium on harvest of eggs by the indigenous community, protection of over 200km of nesting habitat as National Park and habitat protection in the immediately adjacent waters, maintenance of a darkness zone along these hundreds of kilometres of coast, and control of public access to the nesting habitat by night.
- **Terengganu, Malaysia:** The management response in the initial phases included the protection of a few percent of eggs in hatcheries while maintaining the “traditional” harvest of the majority of the eggs. No management was put in place to protect the nesting habitat from the encroachment of coastal development and associated change of light horizons. In the late 1970s, the majority of the Rantau Abang nesting beach was declared a turtle sanctuary but its role was primarily to minimise public disturbance of the turtles nesting in the area designated for egg harvest. Through the 1980s and into early 1990s, the percentage of eggs laid taken into protected incubation in hatcheries was progressively increased to 100% of leatherback turtle eggs laid throughout the State.

Both these models were initially designed at a time when the global understanding of marine turtle biology and population dynamics was limited and both were designed on the basis of what was at the time to be considered good turtle conservation management practice. The results of these two long term management experiments are summarised in the population census graphs within the respective national reports (see Malaysia and South African sections of this report).

The South African model with regional protection of the turtles, their eggs and breeding habitat over decades has worked. It halted the decline of the species in Natal, increased the size of the nesting population and ensured a controlled but financially viable tourist industry around these turtles.

The Malaysian model with its initial emphasis on maintaining a large egg harvest has clearly failed in maintaining a viable leatherback turtle population as well as having failed to ensure a long term sustainable egg harvest. At the same time, the leatherback turtle tourist industry which had been a significant international dollar earner for the State also collapsed.

As the 20th Century drew to a close, the new genetic research tools were applied to the region's leatherback turtle breeding populations. The region was found to support several discrete breeding populations or stocks. The leatherbacks that breed in South Africa, peninsula Malaysia and northern New Guinea are genetically different to each other and to the leatherback turtle nesting populations from other ocean basins (Figure 1) (Dutton et al. 1999). Unfortunately, samples from the leatherbacks that breed in Sri Lanka, Andaman and Nicobar Islands and from the widely dispersed low density nesting that occurs along southern Indonesia (Sumatra, Java, Bali) and across to northern Australia were not available for inclusion in these genetic analyses.

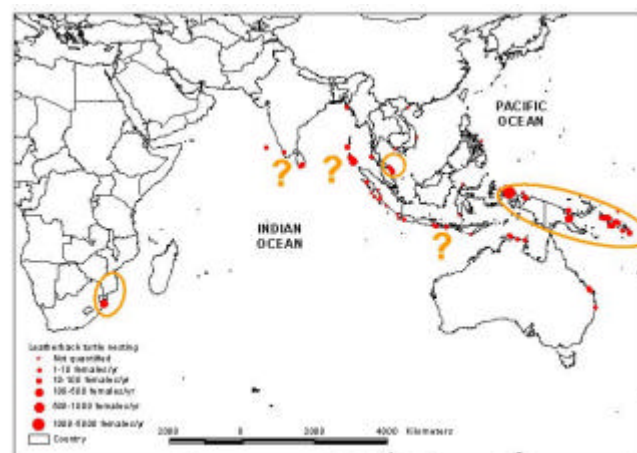


Figure 1 Nesting distribution of leatherback turtles in the Indian Ocean – Australasian region showing identified independent genetic stocks for the species (After Dutton et al. 1999). ? denotes that the nesting population has not been genetically identified.

As the scientific community was coming to the understanding that widely separated breeding assemblages of leatherback turtles around the world were independent stocks/management units, other studies were aggregating the long term census data from many of these stocks and identifying that leatherback turtles were under threat (Spotila et al. 1996). Pritchard (1996) advised some caution in too broad a generalization of the global conservation problem, particularly within the Indian Ocean. However, Pritchard (1996) clearly recognized the major population decline of the Malaysian leatherback turtle population and stressed that excessive egg harvest would be a significant threat for any population. These two studies collectively highlight the general paucity of data on the biology of leatherback turtles with respect to a number of key issues that are critical to developing sound conservation management for the species – particularly in the IOSEA Turtle MoU region:

- Imprecise understanding of key population dynamics parameters including population age structure, age at first breeding, breeding life expectancy, annual survivorship values for any at-sea age class.
- Incomplete mapping of the nesting distribution throughout the Andaman Sea and across southern Indonesia, Timor Leste to northern Australia; across northern New Guinea and Southern Philippines and in Mozambique.
- Paucity of precise census data by which the population trends within the respective stocks can be assessed.
- Paucity of precise mortality data especially from the fisheries that catch leatherback turtles, especially the wide spread long-line, trawl and inshore gill-net fisheries.

It is against this background that we have moved into the 21st century and the IOSEA Marine Turtle MoU (www.ioseaturtles.org) Signatory States take up the challenge to care for leatherback turtles for future generations within the region. This report aims to provide a current assessment of the distribution, abundance and threats to leatherback turtles in the IOSEA region; while a separate, related document reports on the impacts that the December 2004 tsunami had on regional marine turtles, their habitats, and conservation programs.

To undertake the assessment, marine turtle experts in each of the countries in the IOSEA region (including non-Signatory States) were contacted and asked to complete a short survey regarding leatherback turtles in their country. The survey covered legislative aspects, nesting populations, foraging populations and the tsunami impacts. Completed surveys were then edited for content, by the compilers, and in some cases additional information was added. The final edited surveys on leatherback turtles are presented in the document as country reports, and the tsunami results are presented in a companion document.

References

- Aikanathan S (1989) 'Rantau Abang model Turtle Sanctuary: A management case-study of a leatherback rookery.' WWF Malaysia Unpublished Report.
- Aikanathan S, Mortimer JA (1990) 'Recommendations for the establishment and management of turtle sanctuaries and hatcheries in the state of Terengganu.' WWF Malaysia Unpublished Report.
- Andrews HV (2000) Current marine turtle situation in the Andaman and Nicobar islands - An urgent need for conservation action. *Kachhapa* **3**, 19-23.
- Anon (1963) Conservations programme of the giant leathery turtles. *Malayan Nature Journal* **18**, 64.
- Anon (1981) Trengganu meets competition: does Irian Jaya harbour southeast Asia's densest leatherback nesting beaches. *Conservation Indonesia* **5**, 18-19.
- Balasingam E (1965) The giant leathery turtle conservation program - 1964. *Malayan Nature Journal* **19**, 145-146.
- Balasingam E (1967) The ecology and conservation of the leathery turtle *Dermochelys coriacea* (Linn.) in Malaya. *Micronesica* **3**, 37-43.
- Balasingam E (1969) 'Marine turtles in West Malaysia.' IUCN Publication New Series Supplementary Series 20.
- Balasingam E, Pong TY (1972) Preliminary observation on nesting returns of the leathery turtle (*Dermochelys coriacea* Linn.) in central Trengganu, Malaysia. *Malayan Nature Journal* **25**, 6-9.
- Bass AJ, McAllister HJ (1964) Turtle breeding on the Natal Coast. *South African Journal of Science* **60**, 287-288.
- Bhaskar S (1993) 'The status and ecology of sea turtles in the Andaman and Nicobar Islands. ST 1/93.' Centre for herpetology, MCBT. India.
- Chan EH (1985) Twin embryos in an unhatched egg of *Dermochelys coriacea*. *Marine Turtle Newsletter* **32**, 2-3.
- Chan EH (1986a) The giant leatherback turtles of Rantau Abang, Terengganu. *Pelita* **1**, 24-29.
- Chan EH (1986b) Development of the white spot on leatherback eggs. *Marine Turtle Newsletter* **39**.
- Chan EH (1987) 'Status of the leatherback turtle, *Dermochelys coriacea*.' Report of Workshop on Sea Turtle Conservation and Management in Malaysia Tanjung Jara, Terengganu, 14-17 December 1987.
- Chan EH (1988a) An update on the leatherback turtles of Rantau Abang, Terengganu, Malaysia. *Marine Turtle Newsletter* **42**.

- Chan EH (1988b) A note on the feeding of leatherback (*Dermochelys coriacea*) hatchlings. *Pertanika* **11**, 147-9.
- Chan EH (1989) White spot development, incubation and hatchling success of leatherback turtle (*Dermochelys coriacea*) eggs from Rantau Abang, Malaysia. *Copeia* **1989**, 42-47.
- Chan EH, Eckert S, Liew HC, Eckert K (1991) Locating the interesting habitats of leatherback turtles (*Dermochelys coriacea*) in Malaysian waters using radio telemetry. In 'Biotelemetry XI: Proceedings of the eleventh international symposium on biotelemetry'. Yokohama, Japan. (Eds A Uchiyama and C Amlaner)
- Chan EH, Liew HC (1989) 'The leatherback Turtle: a Malaysian Heritage. Malaysia.' (Tropical Press).
- Chan EH, Liew HC (1989) The offshore protection of Malaysian leatherback turtles. In 'Proceedings of the Twelfth Annual Seminar of the Malaysian Society of Marine Sciences' pp. 213-217
- Chan EH, Liew HC (1995) An offshore sanctuary for the leatherback turtles of Rantau Abang, Malaysia. *National Oceanic and Atmospheric Administration Technical Memorandum National Marine Fisheries Service South East Fisheries Service Center*. **361**, 18-20.
- Chan EH, Liew HC, Mazlan AG (1988) The incidental capture of sea turtles in fishing gear in Terengganu, Malaysia. *Biological Conservation* **43**, 1-7.
- Chan, E. H., Salleh, H. U. & Liew, H. C. 1985. Effects of handling on hatchability of eggs of the leatherback turtle, *Dermochelys coriacea* (L.). *Pertanika* **8**:265-71.
- Chan EH, Solomon S (1989) The structure and function of the eggshell of the leatherback turtle, (*Dermochelys coriacea*) from Malaysia, with notes on infective fungal forms. *Animal Technology* **40**, 91-102.
- Chantrapornsy S (1996) The Status of Marine Turtles in Thailand. In 'SEAFDEC (1) Workshop on Marine Turtle Research and Conservation, January 15 -18'. Malaysia pp. pp. 77-92.
- Chantrapornsy S (2000) Status and conservation of sea turtles in Thailand. In 'Proceedings of the First SEASTAR 2000 Workshop.' pp. 55-60. (SEASTAR2000)
- Chua T (1988) Nesting population and frequency of visits in *Dermochelys coriacea* in Malaysia. *Journal of Herpetology* **22**, 192-207.
- Chua TH, Furtado JJ (1988) Nesting frequency and clutch size in *Dermochelys coriacea* in Malaysia. *Journal of Herpetology*. **22**, 208-218.
- Choudhury BC, Sharma SC, Mukherjee SK (2000) The sea turtle conservation agenda of India. In 'Sea Turtles of the Indo-Pacific: Research Management and Conservation.' (Eds N Pilcher and G Ismail) pp. 100-106. (London: ASEAN Academic Press.)
- Deraniyagala PEP (1930) The Testudinata of Ceylon. (B). *Ceylon Journal of Science (B)* **16**, 43-88.
- Deraniyagala PEP (1932) Notes on the development of the leathery turtle *Dermochelys coriacea*. *Ceylon Journal of Science (B)* **17**.
- Deraniyagala PEP (1939) The Tetrapod Reptiles of Ceylon. Volume I. Testudinates and Crocodylians. *Ceylon Journal of Science (B)*, 1-412.
- Deraniyagala PEP (1953) 'A Coloured Atlas of Some Vertebrates of Ceylon. Vol 2. Tetrapod Reptilia. Ceylon.' (Ceylon Government Press.)
- de Rooij N (1915) 'The Reptiles of the Indo-Australian Archipelago.' (Brill, E. J. Ltd: Leiden.)
- de silva A (1996) 'Proposed Action Plan: Restoration and Management of the Testudines and their Habitats in Sri Lanka.' (University of Peradeniya: Sri Lanka)
- Dutton PH, Bowen BW, Owens DW, Barragan A, Davis S (1999) Global phylogeography of the leatherback turtle (*Dermochelys coriacea*). *Journal of Zoology* **248**, 397-409.
- Eckert S (1992) Bound for deep water. *Natural History*. *Natural History* **3**, 29-35.
- Eckert SA, Eckert KL, Ponganis P, Kooyman GL (1989) Diving and foraging behavior of leatherback sea turtles (*Dermochelys coriacea*). *Canadian Journal Zoology* **67**.
- Eckert SA, Liew HC, Eckert KL, Chan EH (1991) Shallow water diving by gravid leatherbacks in the South China Sea. In 'Proceedings 10th Annual Workshop on Sea Turtle Biology and Conservation, 20-24 February 1990.' South Carolina, U.S.A
- Frair W, Ackman RG, Mrosovsky N (1972) Body temperature of *Dermochelys coriacea*: warm turtle in cold water. *Science* **177**, 791-793.
- Gaffney E (1991) The fossil turtles of Australia. In 'Vertebrate Palaeontology of Australia'. (Eds P Vickers-Rich, J Monaghan, R Baird and R TH) pp. 704-720. (Pioneer Design Studio: Lilydale)
- Goff GP, Lien J (1988) Atlantic leatherback turtles, *Dermochelys coriacea*, in cold water off Newfoundland and Labrador. *The Canadian Field-Naturalist* **102**, 1-5.
- Greer AE, Lazell JD, Wright RM (1973) Anatomical evidence for a counter current heat exchanger in the leatherback turtle (*Dermochelys coriacea*). *Nature* **244**, 181.
- Harrison T (1947) Turtles in tribulation. *Sarawak Gazette* **November**, 207-209.
- Harrison T (1951) The edible turtle (*Chelonia mydas*) in Borneo. 1. Breeding season. *Sarawak Museum Journal* **5**, 593-596.
- Harrison T (1952) Breeding the edible turtle. *Nature* **169**, 198.
- Harrison T (1954) The edible turtle (*Chelonia mydas*) in Borneo. 2. Copulation. *Sarawak Museum Journal* **6**, 126-128.
- Harrison T (1955) The edible turtle (*Chelonia mydas*) in Borneo. 3. Young turtles (in captivity). *Sarawak Museum Journal* **6**, 633-640.
- Harrison T (1956a) Tagging green turtles. *Nature* **178**, 1479.
- Harrison T (1956b) The edible turtle (*Chelonia mydas*) in Borneo. 4. Growing turtles and the growing problems. *Sarawak Museum Journal* **7**, 233-239.

- Harrison T (1956c) The edible turtle (*Chelonia mydas*) in Borneo. 5. Tagging turtles (and why). *Sarawak Museum Journal* **7**, 504-515.
- Harrison T (1958) Notes on the edible green turtle (*Chelonia mydas*). 7. Long-term tagging returns, 1952-8. *Sarawak Museum Journal* **8**, 772-778.
- Harrison T (1959) Notes on the edible green turtle (*Chelonia mydas*). 8. First tag returns outside Sarawak. *Sarawak Museum Journal* **9**, 277-278.
- Harrison T (1961) Notes on the green turtle (*Chelonia mydas*). 9. Some new hatchling observations. *Sarawak Museum Journal* **10**, 293-299.
- Harrison T (1962) Notes on the green turtle (*Chelonia mydas*). 11. West Borneo numbers, the downward trend. *Sarawak Museum Journal* **10**, 614-623.
- Harrison T (1962) Notes on the green turtle (*Chelonia mydas*). 12. Monthly laying cycles. *Sarawak Museum Journal* **10**, 624-630.
- Hendrickson JR (1958) The Green Sea Turtle, *Chelonia mydas* (Linn.) in Malaya and Sarawak. *Proceedings of the Zoological Society of London* **130**, 455-535.
- Hendrickson JR (1961) Conservation investigations on Malayan turtles. *Malayan Nature Journal (21st Anniversary Special Issue)* **214**, 23.
- Hendrickson JR (1962) The program for conservation of the giant leathery turtle, 1961. *Malayan Nature Journal* **16**, 64-69.
- Hendrickson JR, Albert ER (1957) Nesting populations of sea turtles on the east coast of Malaya. *Proceedings IX Pacific Science Congress* **16**, 137-138.
- Hendrickson JR, Albert ER (1961) Nesting populations of sea turtles on the east coast of Malaya. *Bulletin Raffles Museum Singapore* **26**, 190-196.
- Hendrickson JR, Balasingham E (1966) Nesting beach preferences of Malayan sea turtles. *Bulletin of the National Museum Singapore* **33**, 69-75.
- Hendrickson JR, Winterflood JS (1961) Hatching leatherback turtle eggs. *Bulletin Raffles Museum Singapore* **26**, 187-189.
- Hughes GR (1969) 'Report to the survival service commission on marine turtles in Southern Africa. ' I.U.C.N. Publication New Series: Supplementary Papers 20:56-66.
- Hughes GR (1971a) The marine turtles of Tongaland V. *The Lammergeyer* **13**, 7-24.
- Hughes GR (1971b) 'Sea turtle research and conservation in South east Africa.' IUCN Publications New Series Supplementary Paper 31:57-67.
- Hughes G (1974a) 'The sea turtles of South-east Africa.I. Status, morphology and distributions.' Oceanographic Research Institute of South Africa, Durban, pp 35.
- Hughes G (1974b) 'The sea turtles of South-east Africa.II. Investigational Report.' Oceanographic Research Institute of South Africa. Durban, pp 36.
- Hughes GR (1989) Sea turtles. In 'Oceans of Life off South Africa'. (Eds AIL Payne and RJM Crawford) pp. 230-243. (Cape Town: Vlaeberg Publishers)
- Hughes GR, Bartholomew W (1998) 'The Tongaland sea turtle project 1 April 1997 - 31 March 1998.' Natal Parks Board Annual Research Report, May:1-12.
- Hughes GR, Bass AJ, Mentis MT (1967) Further studies on marine turtles in Tongaland I. *The Lammergeyer* **7**, 5-54.
- Hughes GR, Brent B (1972) The marine turtles of Tongaland 7. *The Lammergeyer* **17**, 40-62.
- Hughes GR, Mentis MT (1967) Further studies on marine turtles in Tongaland II. *The Lammergeyer* **7**, 55-72.
- Islam MZ (2002) Threats to sea turtles in St. Martin's Island, Bangladesh. *Kachhapa* **6**, 6-10.
- Kapurusinghe T (2000) Community participation in turtle conservation in Sri Lanka. In 'Sea Turtles of the Indo-Pacific: Research Management and Conservation'. (Eds N Pilcher and G Ismail) pp. 35-44. (London: ASEAN Academic Press)
- Kiew BH (1975) Report on the leathery turtle conservation program at Rantau Abang, Trengganu. *Malayan Nature Journal* **29**, 31-32.
- Leong T, Siow K (1980a) Sea turtles in the east coast of Peninsula Malaysia and their economic importance. In 'Coastal resources of east coast Peninsula Malaysia'. (Eds T Chua and J Charles). (Universiti Sains, Malaysia).
- Leong TSS, K. T. (1980) Tourism in the east coast of Peninsular Malaysia. In 'Coastal Resources of East Coast Peninsular Malaysia'. (Eds TE Chua and JK Charles) pp. 302-318. (Universiti Sains Malaysia)
- Limpus CJ (1993) 'Recommendations for conservation of marine turtles in Peninsula Malaysia.' Report to Department of Fisheries, Minister of Agriculture, Malaysia.
- Liew HC, Chan EH (1995) Radio tracked leatherback turtle hatchlings during their swimming frenzy. In 'Proceedings of the 12th annual symposium on sea turtle biology and conservation'. (Eds J Richardson and T Richardson). (NOAA Technical Memorandum NMFS-SEFSC-361)
- Loveridge A, Williams EE (1957) Revision of the African Tortoises and Turtles of the Suborder Cryptodira. *Bulletin of the Museum of Comparative Zoology* **115**, 1-557.
- Mack D, Duplaix N, Wells S (1979) 'The sea turtle: An animal of divisible parts.' World Wildlife Fund Special Report 1:1-86.
- Morgan JP (1989) 'The occurrence of leatherback turtles (*Dermodochelys coriacea*) in the British Isles in 1988 with reference to a record specimen.' National Oceanographic and Atmospheric Administration Technical Memorandum NMFS-SEFC 232: 119-120.

- Maturbongs JA (1995) Turtles nest on Wafor Beach, Biak Numfor Regency, Irian Jaya. *Marine Turtle Newsletter* **68**, 19-20.
- Maturbongs JA (1996) Sea turtles at Inggresau Beach, Irian Jaya. *Marine Turtle Newsletter* **74**, 13-14.
- Maturbongs JA, Rumaikewi H, Rumaropen J, Sangganafa A (1993) 'Report of population and egg laying place of turtles observation at Inggresau Beach Yapen Waropen Regency in Irian Jaya. Jayapura:.' WWF Project ID 0085-12.
- Nababan MG, Jacob B (1996) 'Kondisi penyu belimbing (*Dermochelys coriacea*) dan Suaka Margasatwa Pantai Jamursba Medi serta masa depan Pengelolaannya .' Workshop Marine Turtle Research and Management in Indonesia Di Jember 18-22 November 1996. Pp.1-14.
- Phasuk B (1983) 'Her Majesty the Queen supported sea turtle conservation project in Thailand.' Fact Sheet on Thailand.
- Polunin NVC (1975) 'Sea turtles: Reports on Thailand, West Malaysia and Indonesia with a synopsis of data on the 'conservation status' of sea turtles in the Indo-west Pacific Region. .' Unpublished Report to IUCN. Pp. 1-113.
- Pritchard PCH (1979) 'Encyclopedia of Turtles.' (T.F.H. Publications, Inc.: Neptune, New Jersey)
- Pritchard PCH (1996) Are leatherbacks really threatened with extinction? *Chelonian Conservation and Biology* **2**, 302-305.
- Rhodin AGJ, Ogden, J. A. & Conlogue, G. J. (1981) Chondro-osseous morphology of *Dermochelys coriacea*, a marine reptile with mammalian skeletal features. *Nature* **290**, 244-246.
- Rhodin JAG, Rhodin, A. G. J. & Spotila, J. R. (1996) Electron microscopic analysis of vascular cartilage canals in the humeral epiphysis of hatchling leatherback turtles, *Dermochelys coriacea*. *2*(2): 250-260. *Chelonian Conservation and Biology* **2**, 250-260.
- Salleh BB, Chan, E. & bin Kassim, A. R. (1987) 'An update on the population status and conservation of the leatherback turtle of Terengganu.' Proceedings 10th Annual Seminar of the Malaysian Society of Marine Sciences, pp. 69-77.
- Salm R (1984) 'Sea turtle trade.' (IUCN/WWF Report: Bogor). Pp.1-59.
- Siow KT (1978) 'Leathery turtle (*Dermochelys coriacea*) conservation program in Rantau Abang, the State of Terengganu, Malaysia.' Proceedings 1st Marine Science Conference, Universiti Pertanian Malaysia, 5-6 August 1978. pp.1-13.
- Siow KT (1987) 'Saving the Leathery turtle (*Dermochelys coriacea*) in Terengganu, Malaysia.' Report of Workshop on Sea Turtle Conservation and Management in Malaysia, Tanjong Jara, Terengganu, 14-17 December 1987. pp.1-16.
- Siow K-T, Moll D (1982) Status and conservation of estuarine and sea turtles in west Malaysian waters. In 'Biology and conservation of sea turtles'. (Ed. KA Bjorndal) pp. 339-347. (Smithsonian Institution Press: Washington)
- Smith MA (1931) 'The fauna of British India including Ceylon and Burma.' (Taylor and Francis: London)
- Spotila JR, Dunham AE, Leslie AJ, Steyermark AC, Plotkin PT, Paladino FV (1996) Worldwide decline of *Dermochelys coriacea*: are leatherback turtles going extinct? *Chelonian Conservation and Biology* **2**, 209-223.
- Standora EA, Spotila JR, Keinath JA, Shoop CR (1984) Body temperature, diving cycles, and movement of a subadult leatherback turtle, *Dermochelys coriacea*. *Herpetologica* **40**, 169-176.
- Starbird CH, Suarez MH (1994) 'leatherback sea turtle nesting on the north Vogelkop coast of Irian Jaya and the discovery of a leatherback sea turtle fishery on Kei Kecil Island.' National Oceanographic and Atmospheric Administration Technical Memorandum National Marine Fisheries Service Southeast Fisheries Science Center 351:143-6.
- Suarez A (2000) The sea turtle harvest in the Kai Islands, Indonesia. In 'Sea Turtles of the Indo-Pacific: Research Management and Conservation'. (Eds N Pilcher and G Ismail) pp. 3-12. (London: ASEAN Academic Press)
- Suarez A, Starbird C (1996) Subsistence hunting of leatherback turtles, *Dermochelys coriacea*, in the Kei Islands, Indonesia. *Chelonian Conservation and Biology*, 190-195.
- Tho YP (1974) The management of the giant leathery turtle resource in Peninsular Malaysia. *Malayan Nature Journal* **27**, 118-123.
- Tiwari M (1994) 'A survey of sea turtles in the Andaman and Nicobar Islands.' National Oceanographic and Atmospheric Administration Technical Memorandum National Marine Fisheries Service Southeast Fisheries Science Center 351:152-3.
- Tweedie MWF (1953) The breeding of the leatherback turtle. *Proceedings Zoologica Society London* **123**, 273-275.
- Wyatt-Smith J (1960) The conservation of the leathery turtle *Dermochelys coriacea*. *Malayan Nature Journal* **14**, 194-199.
- Wycherley PR (1969) 'Conservation in Malaysia - a manual of the conservation of Malaysia's renewable natural resources.' IUCN Publications (New Series) Supplementary Paper 22:116-23.
- Yamasaki K (1991) 'A report on the nesting beach of the leatherback turtle at Vogelkop (Doberi Peninsula) and the present condition of sea turtles in Cenderwasih Marine National Park in Irian Jaya.' Report to PHPA, Ministry of Forestry, Indonesia. Pp.1-25.