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Nesting Beach Preferences of Malayan Sea Turtles[1]

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At the 9th Pacific Science Congress held in Bangkok in 1957, Hendrickson and Alfred (1958 & 1961) reported on nesting populations of Sea Turtles on the east coast of Malaya and gave an indication of their nesting concentrations and species distribution. They showed that, in all, four species of marine turtles (*Chelonia mydas* (Linn.), *Dermochelys coriacea* (Linn.), *Lepidochelys olivacea* (Esch.), and *Chelonia imbricata* (Linn.) nest along the east coast of Malaya, and called attention to the extraordinary lack of homogeneity in distribution of breeding beaches of these species. Investigations have continued since then and it is observed that these differences in nesting concentrations and species distribution appear to be largely due to the selectivity shown by different species of turtles in chosing their nesting beaches. The present writers have paid particular attention to the possible factors underlying selectivity of beach types by different species of turtles.

In 1958 the turtle beaches from the Thailand border to South Trengganu were revisited during the nesting season. In all, 30 licensed areas were surveyed[2]. These areas comprise over 90 per cent of the 165 miles of coast line concerned. In each area the turtle egg licencee or his egg collectors were interviewed and detailed studies were made of the nesting beaches. During the interview, questionnaires were filled in. These were designed to gather information on nesting concentrations, nesting seasons, and species of turtle utilising each licensed area, as well as to obtain information on the economics of the turtle-egg collection industry to be used in another study. The design of the questionnaire included provision for cross-checks on the accuracy of the information obtained. In a number of areas (particularly those where the information obtained by interview was suspected to be inaccurate) the writers spent a night or two on the beaches concerned in order to gain first-hand experience of nesting conditions.

Studies conducted at the time of the visits to the nesting beaches included plotting the profiles of selected beach transects and collecting sand samples from various levels of the beach. (high beach platform, littoral slope, etc.) along these transects. Such observations were made at 50 different points.

1. Presented at the 10th Pacific Science Congress, Honolulu, Hawaii, 1961.
2. The taking of sea turtle eggs in Malaya is controlled by law. Exclusive rights to collect turtle eggs on specified areas of beach are granted by Government licences, tenders being accepted annually and the licences usually going to the highest bidders.

Data obtained through questionnaires indicates that of the four species listed above, the Hawksbill (*Chelonia imbricata*) occurs infrequently in Malayan waters and its contribution to the total egg production is negligible. The Pacific Ridley (*Lepidochelys olivacea*) nests in somewhat larger numbers (approximately one to every ten *Chelonia mydas*), but shows no tendency to congregate in particular areas for nesting; it has not been possible to define any particular area on the east coast of Malaya where this species characteristically nests in predictable numbers. The Green Turtle (*Chelonia mydas*) and the Giant Leathery Turtle (*Dermochelys coriacea*), however, nest in much larger numbers and the areas predominantly used by each species are well defined. An area in Central Trengganu is used almost exclusively by *Dermochelys coriacea* and the beaches north and south of this are used predominantly by *Chelonia mydas* (as well, all the suitable island beaches are used by *Chelonia mydas*).

The nest densities (i.e., the number of turtle nests per mile per annum) along the *Dermochelys* beaches are generally much higher than those of the *Chelonia beaches* (fig. 1). This is particularly true of Rantau Dalam and adjoining licenced areas in Central Trengganu, where the maximum nest density reaches 2,500 nests per mile per annum. In this area there is hardly any admixture of other species of turtles. The nest densities along the *Chelonia* beaches on the other hand are comparatively low, but this species also shows a tendency to congregate for nesting on relatively small areas of the beach. The contribution of *Dermochelys coriacea* to egg production on these *Chelonia* beaches is negligible.

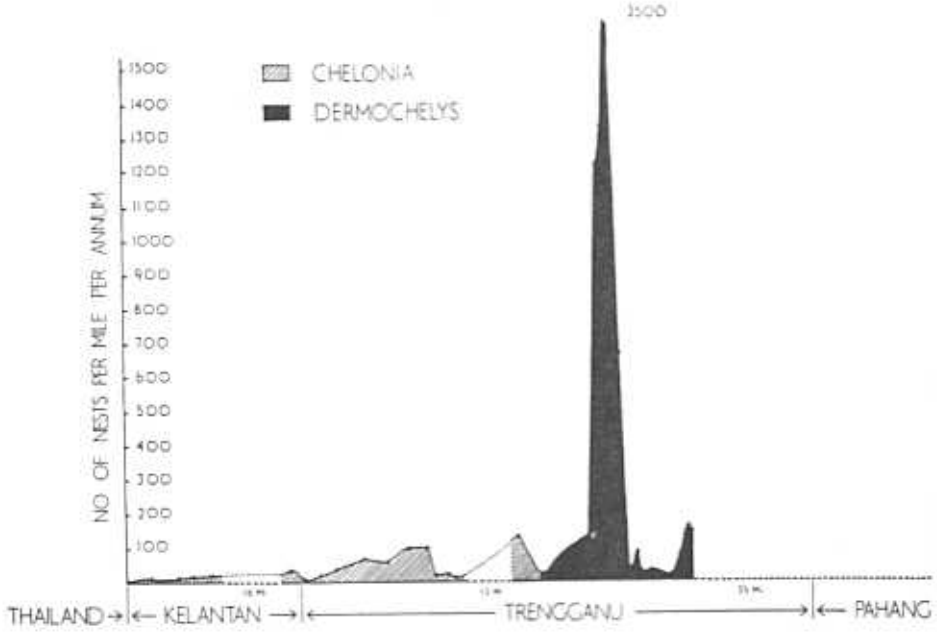

Figure 1. Number of nests per mile per annum.

An exhaustive preliminary analysis (for particle size, water retentivity, contained air volume, carbonate content, and organic content) of sixteen sand samples collected from two contrasting beach types, "known *Chelonia* beach" (Pantai Chinta Brahi and Pantai Hiboran in Kelantan) and "known *Dermochelys* beach" (Rantau Dalam in Trengganu), showed contrasting results particularly with reference

to particle size (figs. 2 & 3). On the basis of these findings, the sand samples from the remaining 48 sites were tested for particle size. This analysis shows that there is a predominance of "fine" sand, i.e. sand passing through a 44 mesh (0.0139 inches or 353 microns) sieve, in *Chelonia* beaches and of "coarse" sand, i.e. sand held in a 30 mesh (0.0197 inches or 500 microns) sieve, in *Dermochelys* beaches.

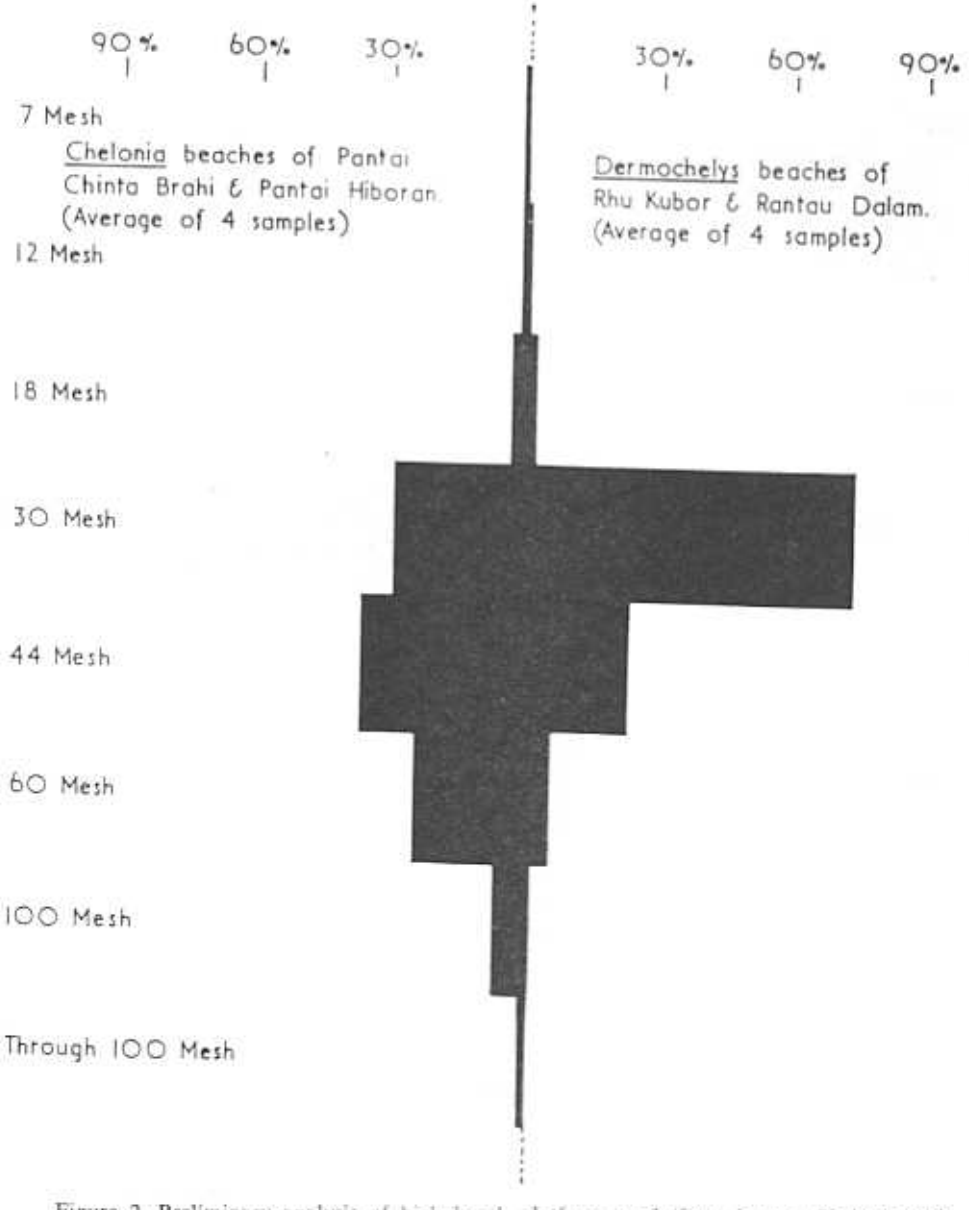

Figure 2. Preliminary analysis of high beach platform sand (from known *Chelonia* and *Dermochelys* beaches) for particle size by volume.

A rough gradient exists from about 90 per cent by volume of "fine" sand and less than 10 per cent by volume of "coarse" sand in the north (*Chelonia* area) to about 10 to 20 per cent "fine" sand and 80 per cent or more "coarse" sand in the Central

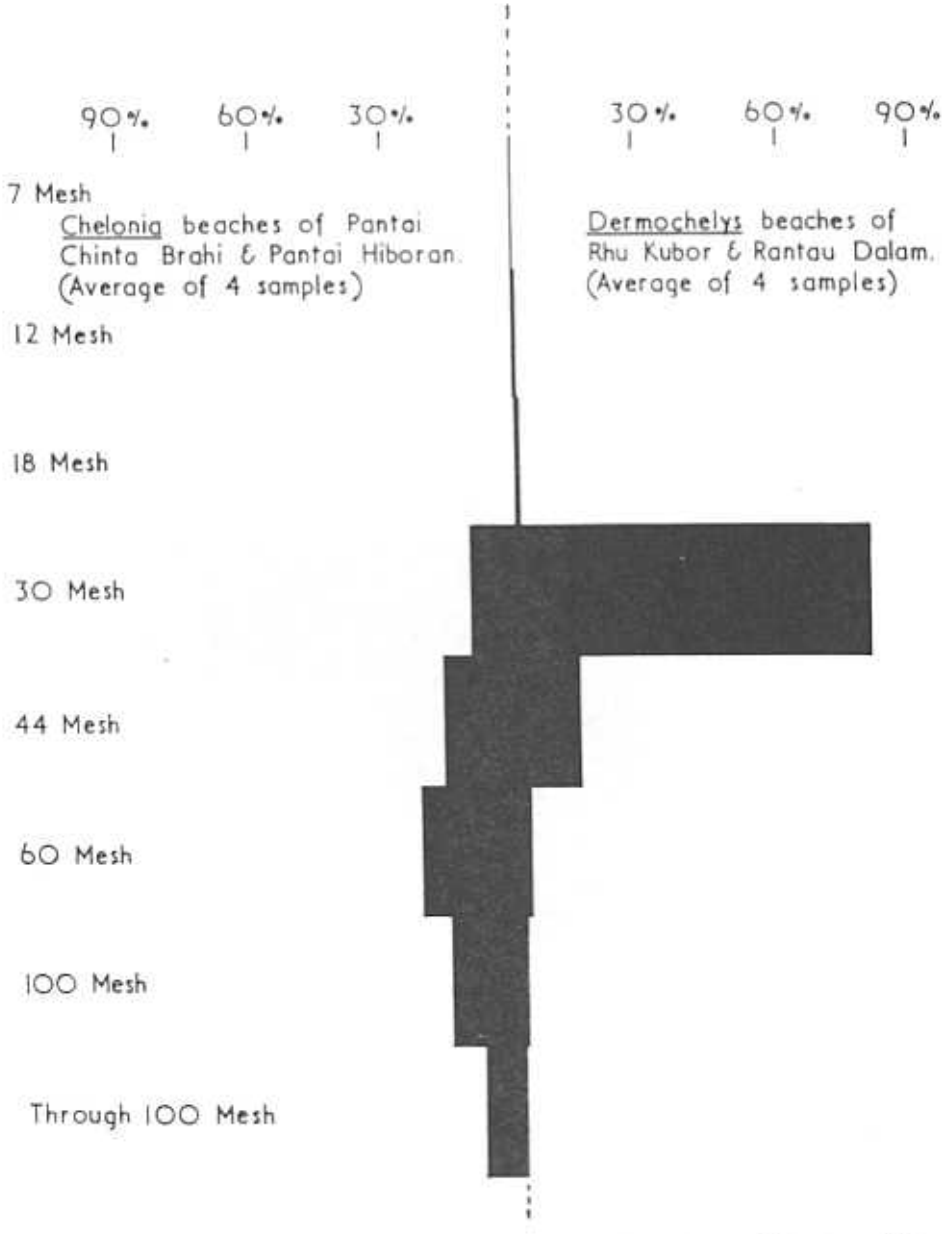

Figure 3. Preliminary analysis of littoral slope sand (from known *Chelonia* and *Dermochelys* beaches) for particle size by volume.

Trengganu area used by *Dermochelys* (figs. 4, 5 & 6). This difference in particle size is most marked in the case of the littoral slope sand which turtles first contact upon emergence from the sea to nest. It produces a marked difference in texture which may well be detectable by arriving turtles. It therefore seems possible that the "feel" of the sand may influence the female turtles' selection of a nesting beach.

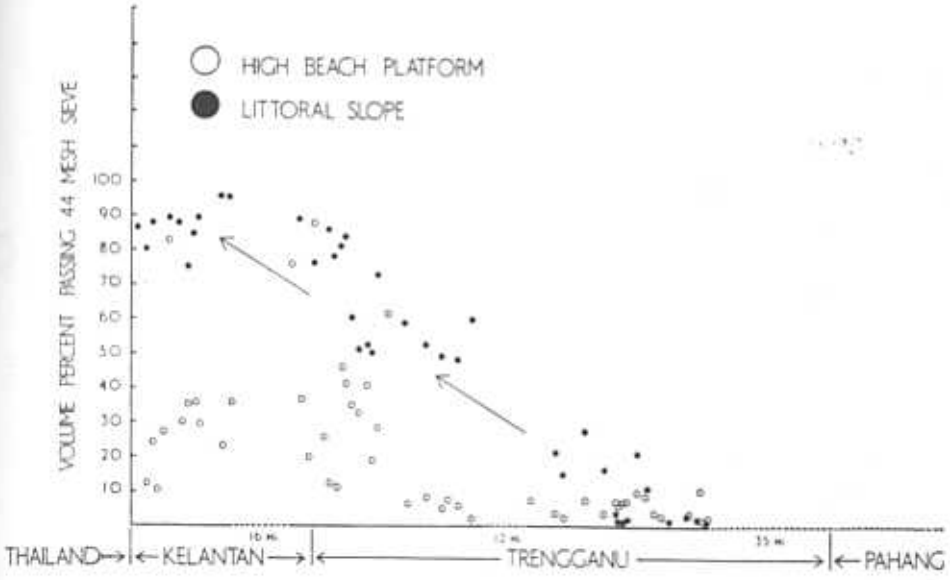

Figure 4. Percentage "fine" sand at beach transects.

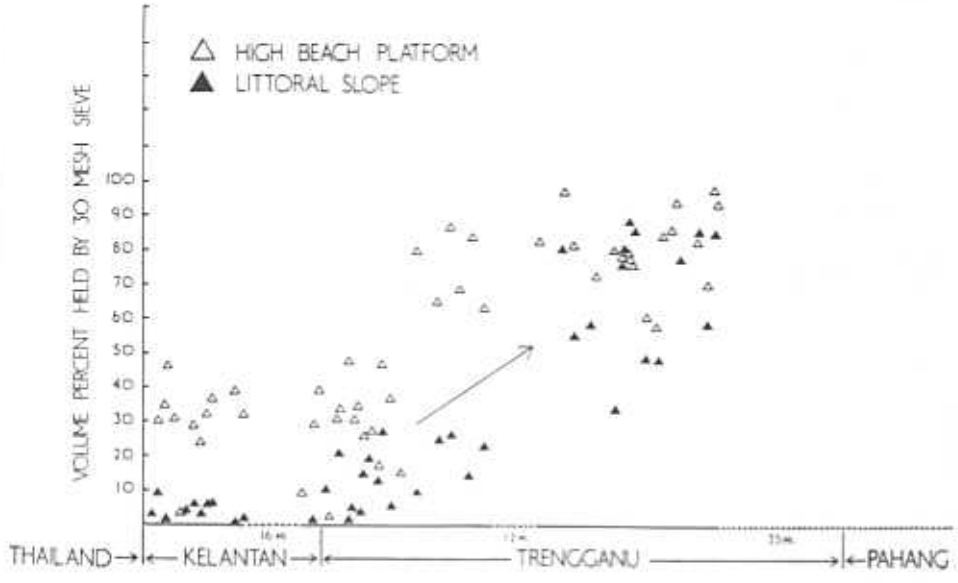

Figure 5. Percentage "coarse" sand at beach transects.

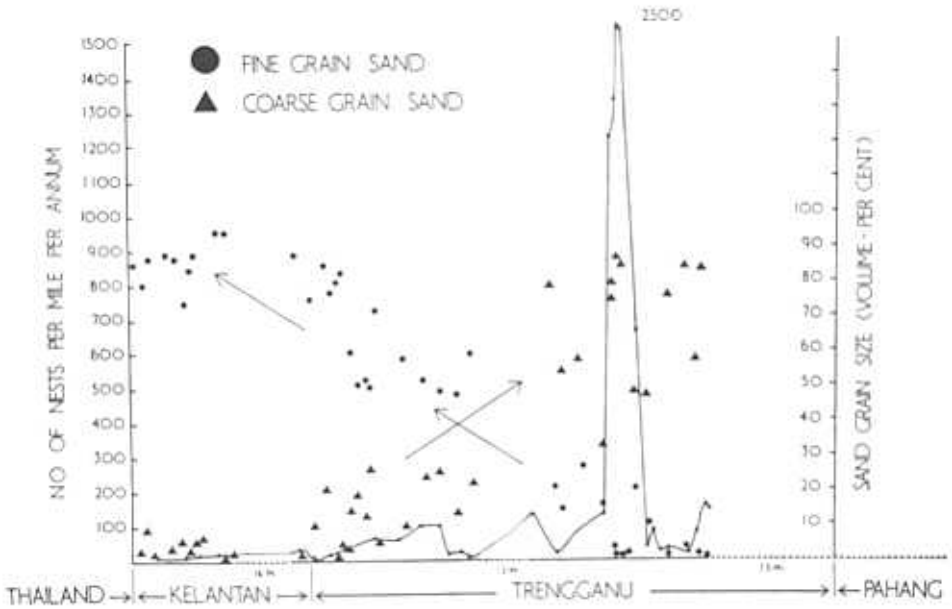

Figure 6. Relationship of nest abundance to sand grain size (littoral slope).

A subjective comparison of profiles of transects for all the 50 sites shows that the "coarse" sand *Dermochelys* beaches consistently have steeper slopes from the high beach platform to the sea (fig. 7), so that the linear distance from the sea to the nesting sites (on the high beach platform) is much shorter on *Dermochelys* beaches than on *Chelonia* beaches. The shorter crawl overland may be important to the much larger and heavier *Dermochelys* and could, perhaps, account in part for the beach selection (estimated weight of *Dermochelys coriacea* over 800 lb. as opposed to average *Chelonia mydas* weight: 250 lb.). The concept of: "the larger the turtle,

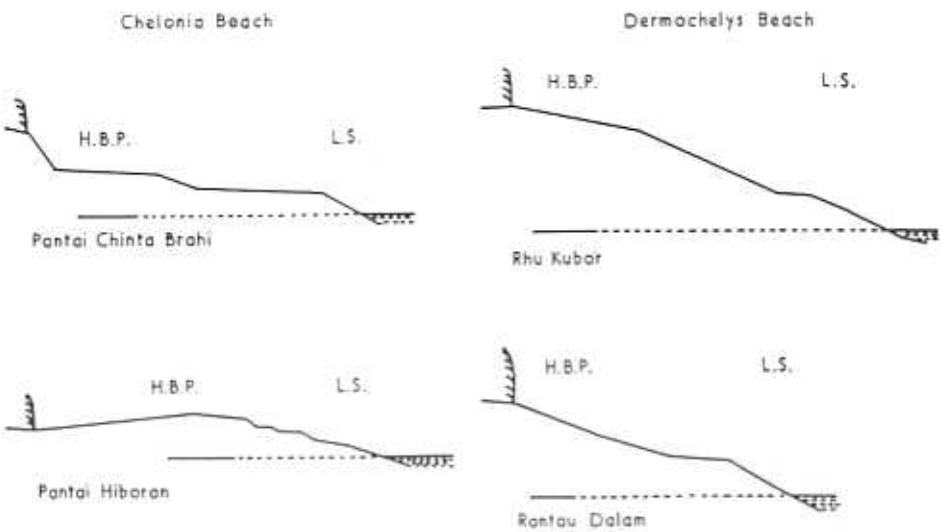

Figure 7. Profile diagram of turtle beaches. Vertical scale: Horizontal scale = 2:1. H.B.P. = High Beach Platform. L.S. = Littoral Slope.

the shorter the chosen crawl" is not contradicted by *Lepidochelys olivacea* (weight of about 100 lb.), which is smaller and more active on land than *Chelonia mydas*, and which commonly nests well above high tide line on very broad flat beaches not used by the heavier turtles.

Examination of the sea bottom topography of the east coast of Malaya (fig. 8) shows that in the *Dermochelys* areas, particularly at Rantau Dalam and the immediately adjacent licenced areas, the 10 and 15 fathom bottom contours pass much closer to the coast line than in other areas. The presence of comparatively deep water close inshore at the *Dermochelys* areas may be important to this species, which is more truly an inhabitant of the open seas than are the other marine turtles.

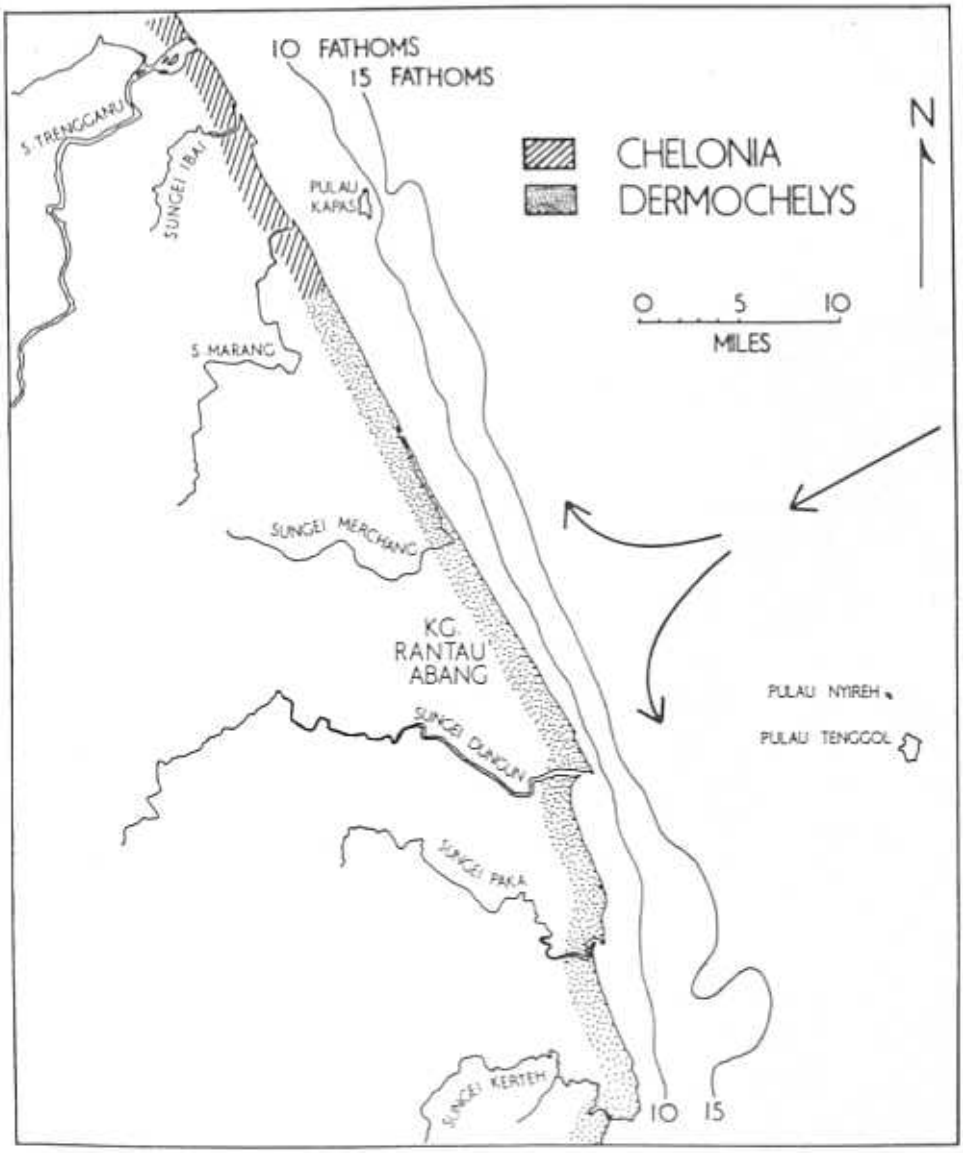

Figure 8. Trengganu coast, subtidal contours and postulated currents.

Further, the rapidly shelving bottom at the water line must facilitate the approach of the larger, much heavier turtles to the beach. In the *Chelonia* nesting areas on the mainland there are commonly wide zones of shallow water, often exposed at low tides, and the incoming turtles must sometimes make their way over these without sufficient depth of water to allow floatation. On the island beaches used by *Chelonia* there are usually fringing coral reefs and it is common to find turtles clambering over exposed reefs during periods of low tide. None of these conditions prevail on the *Dermochelys* beaches.

Aerial photographs of the Trengganu coast show that to the north and south of Rantau Dalam (the site of peak nesting concentration for *Dermochelys*), the river spits extend north and south respectively (fig. 8). This is believed to be due to the influence of a fairly strong onshore current striking the coast perpendicularly at Rantau Dalam. The presence of such a current would also explain the more rapidly shelving beach and sea bottom at this point and the coarser sand of the beach (the current tending to carry sand grains of all sizes straight in towards the shore, dropping the heavier grains as it loses its force and divides to flow north and south along the shore). Such an onshore current might act as a focussing element, routing incoming *Dermochelys* to particular points on the coast.

It is known (Carr and Ogren, 1960) that Green Turtles (*Chelonia mydas*) in the Carribean move in shoals, and it is suggested that both the *Chelonia mydas* and the *Dermochelys coriacea* of the South China Sea probably do likewise. It is thought that this herd instinct probably intensifies the tendency to utilise particular small areas of beach for nesting and accounts in part for the extremely high concentrations found, particularly in the case of *Dermochelys coriacea*. It may be that, once large numbers of *Dermochelys coriacea* begin to use an area, the smaller species may be discouraged by competition from using the same area.

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