

Nesting Populations of Sea Turtles on the East Coast of Malaya¹

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IN MALAYA, as in many other parts of the world, the eggs of sea turtles are sought after for food. They are collected almost everywhere sea turtles nest in any numbers, and they find a ready market at all times. It is estimated that roughly two million eggs, constituting something over fifty tons of high grade protein food, are consumed each year in Malaya. There is reason for considerable interest in the local breeding populations of sea turtles, and for giving thought to their proper management in order to ensure continuance of this protein resource.

Basic to any management program, of course, is information on just what there is to be managed. For wild populations of sea turtles, such information may not be easy to obtain, particularly as regards quantitative data. Owing to a combination of circumstances which is apparently almost peculiar to Malaya, it has been possible to obtain information not only on the qualitative aspects of our management problem (the different species nesting and their relative proportions up and down the coast), but also on its quantitative aspects.² This paper consists principally of the writers' estimate of the situation in Malaya, the structure on which future management programs can be based. While the assumptions necessary for the estimates to be presented have been made with all possible caution and are based on the best information obtainable at the present time, it must be stressed that the writers are fully conscious of the possibility of error and that they hope the figures will be accepted for no more than what they are intended to be—interesting first approximations to the actual facts.

The present study has been confined to the East Coast of Malaya, north of the State of Johore. Sea turtle nesting occurs mainly on the East Coast; the shore on the southern and central portions of the West Coast, facing the Straits of Malacca, is in general flat and muddy, with much mangrove frontage and few sandy beaches suitable for sea turtle nesting. There are nesting beaches in the area north of the Straits of Malacca, particularly on the Malayan and Siamese islands, but little data is at present available on this area, and the total number of eggs marketed from there appears to be small as compared with the East Coast production. Owing to a Johore government

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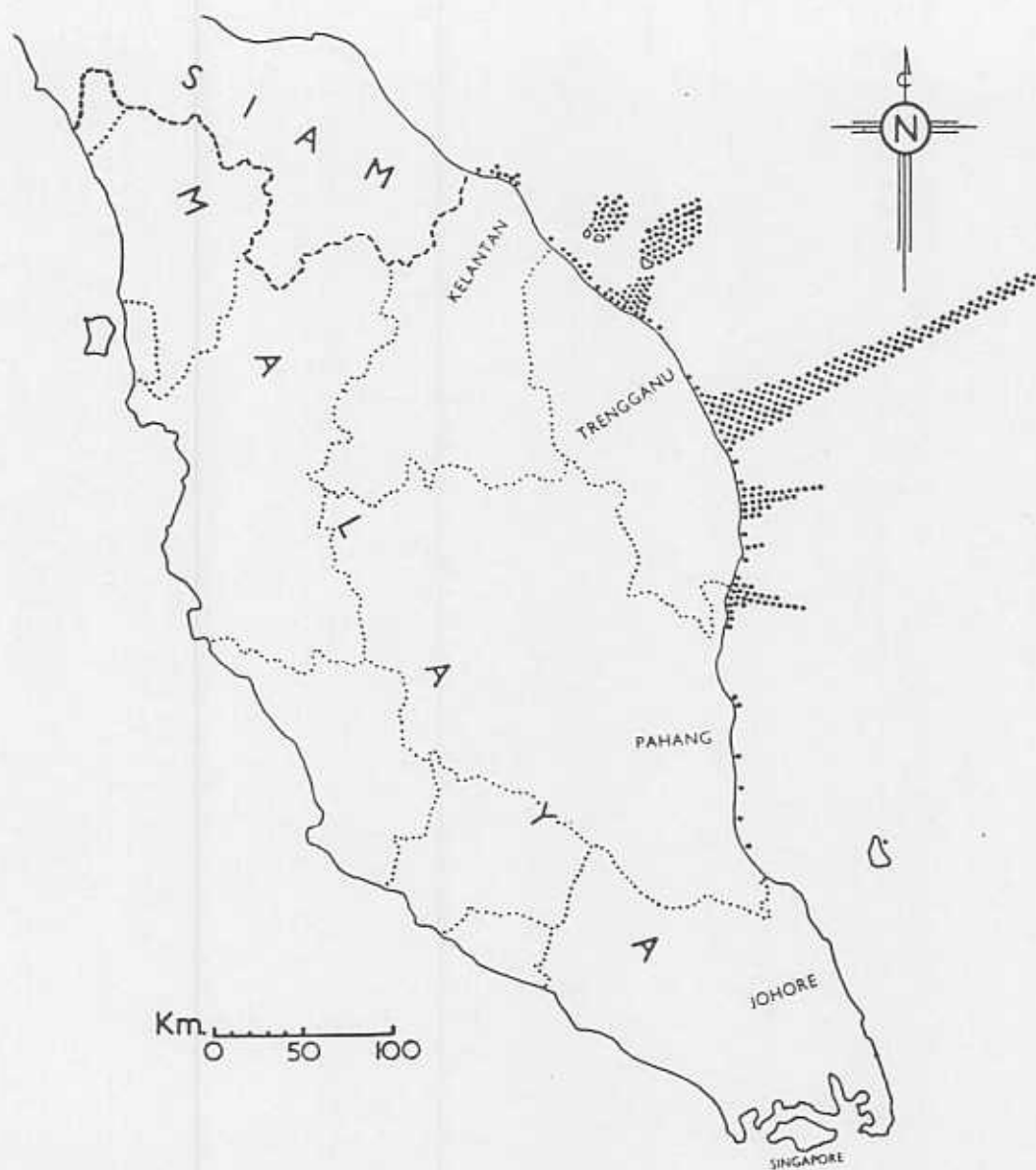


Figure 1

policy of virtually complete prohibition of the taking of sea turtle eggs, no detailed information was available from the southernmost portion of the East Coast. What information is available indicates that Johore is comparable with Pahang, immediately to the north, in the proportions of different species of sea turtles nesting there. Much of the shore, like that of the West Coast, is unsuitable for sea turtle nesting; there is every reason to believe that quantitatively Johore is even less important than Pahang (see Fig. 1).

The taking of sea turtles and their eggs in Malaya is controlled by law (in no case known to the writers is killing of adult turtles sanctioned). Exclusive rights to collect turtles' eggs on specified areas of beach are granted by government licences, tenders being accepted annually for the licences, which usually go to the highest bidder. Extensive inquiry indicates that the bidding for licences is highly competitive. It seems quite clear that the amount of each successful bid for a year's licence bears a direct relationship to the profit which past experience indicates may be expected from sale of the eggs laid annually on the allotted beach. There is considerable evidence that the size of the harvest, the market price, and (therefore) the amount of the bid for the licence in each area have remained fairly constant during the years since the last world war.

Through the co-operation of officials in the various State governments it has been possible to collect information on the entire East Coast north of the State of Johore, delineating all the licensed areas and recording the amounts paid for their licences in recent years. Table 1 summarises the information obtained for the licensing year, 1956.

TABLE 1
Turtle Egg Licensing on the East Coast of Malaya

	KELANTAN	TRENGGANU	PAHANG	TOTAL
Approximate Length of Coastline	80 km. (no important islands)	305 km. (65 km. on islands)	260 km. (55 km. on islands)	645 km. (120 km. on islands)
Unlicensed Areas ³ (1956)	1 (= 15 km.)	6 (= 40 km.)	6 (= 65 km.)	13 (= 120 km.)
Licensed Areas (1956)	6 (= 65 km.) (av. 11 km. each)	40 (= 265 km.) (av. 6.5 km. each)	7 (= 195 km.) (av. 28 km. each)	53 (= 525 km.)
1956 License Fees ⁴	\$1,342.00 (2%)	\$58,199.00 (92%)	\$3,950.00 (6%)	\$63,491.00 (100%)

3. Unlicensed areas are of two sorts: those for which no bids have been tendered because few turtles nest on the areas, and those areas designated as royal preserves for the Sultans of Trengganu and Pahang. The latter areas are mainly around river mouths; they are used by the "freshwater" terrapin *Batagur baska* (Gray), for nesting. This species is known as *Tuntong* in Malay; collection of its eggs is a royal prerogative of long standing. Relatively few sea turtles nest on the royal preserves.

4. Amounts of fees are given in Malayan dollars. For approximate equivalents, multiply by seven for ticals, divide by three for U.S. dollars.

It will be noted that the State of Trengganu is conspicuously the major producer of the three States, with 92 per cent of the total licence fees (which are proportional to the volume of egg production). Trengganu has a larger number of licensed areas, which are of smaller average size than in other states. Pahang is seen to have the least intensive production; the licensed areas are much larger than in the other two States in order to include sufficient beach so that an egg collection industry of worthwhile volume can be carried on by the license holders.

While the figures for average size of licensed areas are useful in some ways, they must not be taken to imply that there is any particular homogeneity in the density of nesting within any one State. Inspection of the map in Figure 1 will reveal the extraordinary lack of homogeneity in concentration of breeding beaches.

During the course of the peak breeding season (June-August) of 1956, most of the East Coast and all of the major turtle nesting beaches were visited. On the basis of extensive field observation and interrogation of local residents, the following conclusions were reached concerning the number and distribution of species of sea turtles nesting on the Malayan East Coast. The four species nesting in the area are the Leathery Turtle, *Dermochelys coriacea* (Linn.), the Green Turtle, *Chelonia mydas* (Linn.), the Ridley, *Lepidochelys olivacea* (Cantor), and the Hawksbill, *Chelonia imbricata* (Linn.). The Hawksbill appears to nest on Malayan beaches so infrequently and so irregularly that its contribution to the local egg production is negligible; it is at present impossible to define any particular areas where it characteristically occurs in any predictable numbers. Except for this mention, the species will be ignored in this report.

Leathery Turtles nest in impressive concentrations on a limited area of beach in Trengganu north of the town of Dungun. Although the very existence of this apparently unique concentration of Leathery Turtles—certainly the largest concentration known in the world at present—was made known to the scientific world only a few years ago (Tweedie, 1953), it produces more revenue in the form of licence fees than all other Malayan turtles combined. The *Dermochelys* nesting beaches are of a distinctive type; there is very little mixture of other species nesting in the same area. Aside from the thirty kilometers or so of Trengganu beach which is used almost exclusively by *Dermochelys* for nesting, the species appears to nest on Malayan beaches only infrequently. No significant production of *Dermochelys* eggs is known from any areas outside the special Trengganu beaches.

The main expanse of the Malayan sea beaches on the East Coast of the Peninsula is used for nesting by Green Turtles and Ridleys. Aside from a few areas of particular concentration of Green Turtles, it is estimated that Ridley and Green Turtles nest in a ratio of roughly one Ridley for every ten or twelve Greens. Ridleys nest more generally up and down the coast, showing little tendency to congregate for nesting on any one area of beach; Green Turtles, while appearing on almost all beaches, also show strong tendencies to aggregate into large groups using relatively small areas of beach for nesting. This is particularly true of the island beaches; the Perhentian Islands and Redang Island off the northern coast of Trengganu produce large numbers of Green Turtle eggs and almost none of the other species.

For collection of quantitative information on the Malayan sea turtle populations, special investigations were carried out in five different licensed areas which were major egg producers. Spot checks were made on the numbers of turtles nesting per night during the peak season, and an extensive program of interrogation was carried out among the license holders, their employees, and knowledgeable local residents, including headmen of local villages. Based upon the seasonal curves of Green Turtle egg production observed in Sarawak (Hendrickson, 1958), estimates of total annual egg production for each area were made from the nightly census figures obtained while in the field. A separate set of estimates was made on the basis of general information obtained from the local people. The two sets of figures matched closely in all five test areas.

When the estimates of egg production from the five areas were translated into terms of money by multiplying estimated monthly egg yields by average sale price for each month,⁵ the resultant estimated annual gross profit was in each case roughly twice the amount of the recorded license fee as obtained from government records. It is believed that these cases are representative of the situation in general throughout the East Coast, competitive bidding for the annual licences forcing each successful bidder to pay out about one half of his gross profit for the year in order to obtain the exclusive licence to exploit an area.

Assuming the competitive bidding for licences produces a stable relationship between amount of license fee and annual gross profit, and given that the market price for eggs follows a constant pattern through the season, it is possible to calculate the annual egg production from each area, based on its license fee. In each of the five test areas it was observed that, instead of month-by-month calculations following the rhythm of egg prices, a conservative approximation of the total annual egg production figures could be obtained by dividing the amount of the license fee by a constant. In the case of Ridley and Green Turtle nesting areas, this constant was .03 (roughly \$.06 year-round average egg price, half of which is represented in the license fee). For Leathery Turtle areas, the operative constant was .04 (half of the average price of \$.08). As has been pointed out, while there is mixing of Ridelys and Green Turtles in the same areas, there is virtually no combination of Leathery Turtles and the smaller species in the same areas. Fortunately, therefore, it is possible to apply the one constant to the calculations for the highly restricted *Dermochelys* grounds in Trengganu and to use the other constant everywhere else.

Fig. 1 shows estimated annual egg production for the East Coast States of Kelantan, Trengganu, and Pahang, as obtained by plotting the limits of all licensed areas, multiplying the license fee for each area by the appropriate constant, and allowing each dot to represent 5,000 eggs. Table 2 gives the estimates by States and by species of turtle.

⁵ The large (billiard ball-sized) eggs of *Dermochelys* sell for from seven or eight cents Malayan each during the peak breeding season to fourteen or fifteen cents each when they are scarce. The smaller (ping pong ball-sized) eggs of *Chelonia* and *Lepidochelys* bring from about five to about eight cents each, depending on the state of the season (\$.15 Malayan equals about 1 tical, or \$.05 U.S.). Although *Lepidochelys* eggs are slightly smaller than *Chelonia* eggs, there appears to be no price differential between the two.

TABLE 2
Estimated Annual Yields of Sea Turtle Eggs

	KELANTAN	TRENGGANU	PAHANG	TOTALS
<i>Dermochelys coriacea</i>	Negligible	853,700	Negligible	853,700
<i>Chelonia mydas</i> ⁶	40,200	770,200	118,500	928,900
<i>Lepidochelys olivacea</i> ⁶ ..	4,500	40,500	13,200	58,200
TOTALS ..	44,700	1,664,400	131,700	1,840,800

While the foregoing data does not constitute an actual census of sea turtles, it does give a fair indication of the relative distribution and concentration of the breeding populations on Malaya's East Coast.

As discussed in other publications (Hendrickson, 1958), the present collection of turtle eggs in Malaya appears to be very nearly 100 per cent. One of the first management procedures which should be applied, it is felt, is the conservation of a small percentage of nests for hatching purposes, ensuring a steady annual flow of young turtles as a measure against diminution of the present populations by over-exploitation.

Preliminary studies have indicated that as little as two or three per cent of the nests, handled properly, could probably provide sufficient recruitment to the wild populations to keep them at their present level, provided other circumstances remain unchanged. It seems probable that there would be little or no resistance from the industry toward saving such a small percentage as this. The main problem would be one of administration to ensure that the burden is fairly shared among license holders and that the incubating eggs and hatching turtles receive proper care.

The work reported here, by giving at least a rough index to the sizes of the populations to be dealt with, provides a basis for determining how many clutches of eggs should be set aside for hatching. By demonstrating the marked lack of homogeneity in the distribution of the breeding concentrations, it allows considerable administrative simplification of the proposed hatchery program. All hatching for the entire coast could be carried on in a relatively small number of areas which happen to be worked by particularly co-operative and reliable licence holders, supervised by local government officers. A calculated percentage of each license fee, paid into a central fund, would ensure equal sharing of the financial burden between all license holders. The money could then be used to finance the simple hatcheries and to pay the prevailing market prices for the eggs reburied by those license holders selected to keep the hatcheries.

6. The proportions of one *Lepidochelys* to *Chelonia mydas* have been followed in apportioning the production from area where the species are mixed. The large populations of almost pure *Chelonia mydas* which have been mentioned as occurring in Trengganu bring the general ratio for that state of one *Lepidochelys* to about twenty *Chelonia mydas*.

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