

The Ecology and Conservation of the Leathery Turtle *Dermochelys coriacea* (LINN.) in Malaya¹

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Introduction

At the 10th Pacific Science Congress held in 1961, in Honolulu, Hawaii, Hendrickson and Balasingam (1966) reported on the nesting beach preferences of Malayan sea turtles, and indicated some of the possible factors underlying beach selectivity of the species. They showed that the breeding population of *Dermochelys coriacea*, (Leathery Turtle), in Malaya is small and their nesting grounds restricted. Investigations have continued since then, with particular emphasis on the conservation of the species. Each year approximately 10,000 eggs are transplanted into a hatchery in Rantau Dalam, Trengganu, Malaya, and the emerging hatchling turtles released at sea in an effort to enhance the population. This paper deals with the hatchery operational methods as well as an analysis of the hatchery data² for the past five years (1961-65).

Hatchery Operational Methods

The hatchery was first set up in 1961, under the jurisdiction of the local Department of Fisheries, and has been in operation since then. It is situated at Rantau Dalam, in a heavy Leathery Turtle nesting area, twelve miles north of Kuala Dungun, and consists of an enclosure approximately 120 ft. × 30 ft. at the high beach platform level. The fence is of half inch woven wire mesh about 3 ft. high, buried 6 inches deep in the sand and supported by wooden posts planted 3 ft. apart.

By special arrangement with the licensee at Rantau Dalam, about 10,000 eggs are purchased annually at market price. The eggs are collected as they are laid on the beach (i.e. as soon as nests are discovered) and are transplanted immediately into holes at the hatchery. The series of distinctly small eggs without yolk produced at the end of laying are eliminated from the count and discarded.

The eggs to be hatched are handled with care throughout the transplanting operation. They are carefully counted at the time of collection as well as during burial in the hatchery thereby enabling a double check on the numbers transplanted. During 1961-64 the eggs to be transplanted were maintained in their original clutches. In 1965, however, as a result of findings from analysis of the hatchery data for the previous years the egg transplanting method was modified

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Table I. Modified egg-transplanting method (1965)

Clutch size	Group	Transplantation method
Less than 46 eggs	A	Not used
46-90 eggs	B, C, D	Only 46-50 eggs used
91-105 eggs	E	Divided into 2 halves (± 1). Buried in 2 egg holes
More than 105 eggs	F, G, H	Only 100 eggs used. Buried in 2 holes, 50 eggs in each hole

as shown in Table I.

Hatchery holes are spaced approximately 3 ft. from each other and at least 2 ft. away from the hatchery fence. They are prepared by digging approximately $2\frac{1}{2}$ ft. deep into sand, with a fairly small diameter at the top and later widening the bottom of the hole so as to form a chamber about 12 inches in diameter (as close as possible to the type of hole dug by the female turtle). The eggs are then placed in the hole and about 6 inches of damp sand is pushed in and tamped with the flat of the hand (thus duplicating the pressure which the female turtle applies with her rear flippers when she covers up the nest after egg-laying). The process is repeated by pushing in another 6 inches of damp sand and finally the hole is completely covered by pushing in all the remaining sand and treading on it. A small marker (indicating date of transplantation, clutch number, and clutch size) is planted in the sand beside the filled area and circles of wire netting are placed over each incubating nest, in order to allow accurate daily counting of the young emerging from each nest.

A watchman (employed by the Department of Fisheries) remains at the hatchery throughout the period of stocking the hatchery and until such time as the hatchling turtles emerge, to prevent disturbance of the hatchery or poaching.

Hatchling turtles emerge from the nests in 53-60 days, after the eggs are transplanted. During the 1961 hatchery programme the baby turtles were taken by boat and distributed at sea. Before so doing they were maintained on shore, in containers, for as much as 6 days. Many died as result of this treatment. The following year releases by boat were made at least twice a week and this ensured low mortality. During 1963, 1964 and 1965 no attempt was made to retain the hatchlings in captivity. Instead they were released daily (before 8 a.m.) at the edge of the sea.

Hatchery Results

Brief reports of the Leathery Turtle Conservation Programme together with results of the Dungun Turtle Hatchery have appeared in the *Malayan Nature Journal* from time to time. Table II summarises this data for 1961-65. For more detailed analysis, the clutches of eggs transplanted during the first four years (1961-64) are grouped according to clutch sizes (Table III) and percentage hatch (Table IV and Figure 1). Table V and Figure 2 indicate the relationship between clutch sizes and their average percentage hatch. The results of the modified egg transplanting method employed in 1965 are shown, and compared with those of the previous years in Table VI and Figure 1.

In all 627 clutches containing 51,582 eggs were transplanted during the past five years. Of these 35 nests (2,959 eggs) were sterile. From the remaining 592

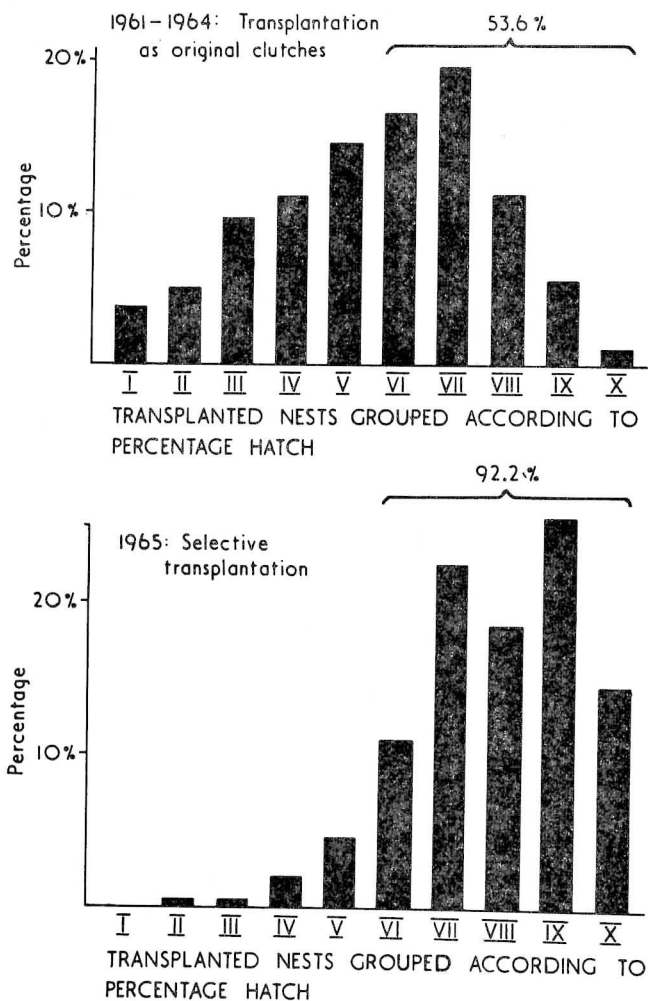


Fig. 1. Transplanted nests grouped according to clutch size (1961-1964 compared with 1965).

nests (48,623 eggs) 26,581 hatchling turtles were recovered. This represents 54.7% hatch (Table I). More than 26,000 hatchling turtles have hitherto been released at sea, in Trengganu waters.

The data for 1961-64 shows that the proportion of transplanted nests of different clutch sizes is somewhat the same for all four years (Table III). The majority (58%) of the transplanted nests fall into groups D and E (76-105 eggs). Only 3 group H nests (more than 135 eggs) have been recorded during these years. It is also seen from Table IV that more than 70% of the transplanted nests attain hatches of more than 40%. Only 5 of the 444 transplanted nests gave more than 90% hatch.

The smallest clutch recorded during the past five years contained 33 eggs,

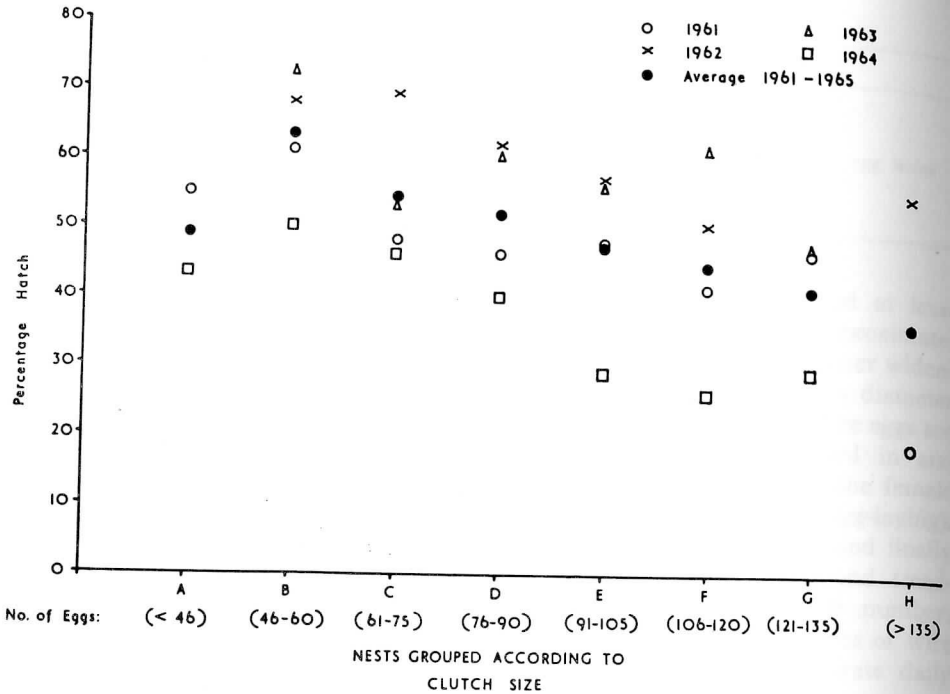


Fig. 2. Relationship between clutch size and percentage hatch.

Table II. Hatchery Productivity 1961-1965 (* Av. % hatch for the five years).

Year	No. transplanted		No. sterile		No. of hatchlings emerged from fertile nests	% Hatch (based on fertile eggs)
	Nests	Eggs	Nests	Eggs		
1961	95	8,366	11	876	3,699	49.4
1962	130	11,654	10	949	6,300	58.9
1963	112	9,956	3	250	5,580	57.5
1964	137	11,535	6	484	3,803	34.4
1965	153	10,071	5	400	7,199	74.4
Total:	627	51,582	35	2,959	26,581	54.7*

Table III. Transplanted nests grouped according to clutch size (1961-1964)

Group	Clutch size	No. of Nests each year				Total
		1961	1962	1963	1964	
A	Less than 46 eggs	5	0	0	3	8
B	46-60 eggs	7	4	8	13	32
C	61-75 eggs	13	19	20	26	78
D	76-90 eggs	20	44	31	42	137
E	91-105 eggs	31	41	34	32	138
F	106-120 eggs	16	20	12	20	68
G	121-135 eggs	2	0	7	1	10
H	More than 135 eggs	1	2	0	0	3
Total:		95	130	112	137	474

Table IV. Transplanted nests grouped according to percentage hatch (1961-1964)

Group	% Hatch	No. of Nests				Total
		1961	1962	1963	1964	
I	0-10%	1	2	3	11	17
II	10.01-20%	6	2	4	10	22
III	20.01-30%	8	1	3	30	42
IV	30.01-40%	12	9	6	22	49
V	40.01-50%	19	21	15	21	76
VI	50.01-60%	16	22	20	15	73
VII	60.01-70%	12	29	28	17	86
VIII	70.01-80%	5	20	21	4	50
IX	80.01-90%	5	12	7	0	24
X	90.01-100%	0	2	2	1	5
Total:		84	120	109	131	444

Table V. Relationship between clutch size and percentage hatch

Group	Average percentage hatch				
	1961	1962	1963	1964	1961-1964
A	55.0	—	—	43.6	49.3
B	61.3	68.0	74.7	49.9	63.5
C	48.4	69.1	53.1	45.8	54.1
D	46.3	62.1	59.9	39.7	52.0
E	47.5	56.8	56.0	28.7	47.3
F	41.1	50.0	61.4	26.1	44.7
G	46.4	—	46.6	29.6	40.9
H	19.3	55.0	—	—	37.2

Table VI. Percentage hatch of transplanted nests grouped according to clutch size (1961-1964 compared with 1965)

Group	1961-1964: Transplantation as original clutches		1965: Modified egg transplantation	
	No. of nests	Percent hatch	No. of nests	Percent hatch
A (less than 46 eggs)	8	49.3	—	—
B (46-60 eggs)	32	63.5	8	72.9
C (61-75 eggs)	78	54.1	36	78.4
D (76-90 eggs)	137	52.0	53	76.0
E (91-105 eggs)	138	47.3	20	76.2
F (106-120 eggs)	68	44.7	22	68.0
G (121-135 eggs)	10	40.9	2	67.0
H more than 135 eggs	3	37.2	—	—

laid on the night of 18th June, 1961. The highest record was 140 eggs laid on 1st July, 1962. The highest percentage hatch hitherto attained among nests transplanted as original clutches was 91.2%. This clutch contained 68 eggs and was laid on the night of 30th June, 1962.

It is observed that small clutches of eggs generally attain a higher percentage hatch than larger ones (Table V and Figure 2). These small clutches are laid

throughout the season. There is no appreciable difference in the egg-nest ratio or the percentage hatch between early and late egg laying season.

Discussion

The breeding season of *Dermochelys coriacea* (the Leathery Turtle), extends from April to September each year. The average clutch size of eggs laid by this species is 85-90 eggs per nest. The eggs develop into hatchling turtles in about 53-60 days. Within any one clutch the majority of baby turtles emerge on the first and second days of hatchling.

Of the 627 nests transplanted during 1961-65, 35 were sterile. The occurrence of totally sterile clutches of eggs appears to be a sporadic phenomenon distributed throughout the season. Moreover, these nests do not belong predominantly to any particular clutch size group. This total sterility may be due to a number of factors, namely the presence of a few old females within the population, an inherent genetic factor in certain individuals of the population or the inability of the two sexes to locate each other to effect fertilisation. It is however comforting to note that the percentage of totally sterile nests is low, and there has been no increase in the number of sterile nests over the past five years.

Analysis of the hatchery results of the first four years (1961-64) indicate that group B nests (46-60 eggs) yield the maximum percentage hatch. With increase in clutch size (groups C-H) the percentage hatch appears to decrease. It is possible that these small clutches of eggs are laid by young females turtles and hence the higher percentage hatch. But on the other hand, the percentage hatch of a small sample (8 nests) of group A nests (below 46 eggs) appears to be somewhat lower than that of group B nests. It is probable that the clutch size, as determined by the number of eggs contained, might be an important factor in influencing the percentage hatch. Hendrickson (1958) has shown that in the case of incubating *Chelonia mydas* nests, there is a considerable rise in temperature (up to 35°C) within the egg mass. He pointed out that the temperature differential between developing egg masses and the surrounding sand may be an important factor in the development of incubating eggs. It is possible that the same is true of *Dermochelys coriacea* nests. It is very likely that extremely small clutches of eggs would lose a fair proportion of the metabolic heat produced by developing eggs to the surrounding sand, while in abnormally large clutches of eggs, the heat produced may be so excessive as to be detrimental to normal development of at least a small proportion of the contained eggs, particularly those in the very centre of the egg mass. This however, requires experimental verification. Meanwhile, the 1965 hatchery results clearly indicate that the percentage hatch or turtle hatchling output can be increased considerably, by maintaining the clutch size of transplanted nests at approximately 50 eggs (Table VI). Whereas during 1961-64, the annual percentage hatch varied from 34.4-58.9%, the percentage hatch obtained in 1965 was 73.8. This is due to the fact that when eggs are transplanted as original clutches, only a small proportion of them (53.6%) attain more than 50% hatch, while 92.2% among these transplanted in clutches of approximately 50 eggs yield more than 50% hatch (Figure 1).

Acknowledgments

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