EVALUATION OF THE PRACTICE OF SPLITTING SEA TURTLE EGG CLUTCHES UNDER HATCHERY CONDITIONS IN MALAYSIA

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In the 1960's, Balasingam concluded that splitting the egg clutches of leatherback turtles (*Dermochelys coriacea*) into complements of 50 eggs each increased the rate of hatching success in the hatchery at Rantau Abang, Terengganu. Although he published his conclusions (Balasingam, 1967) he never demonstrated whether the apparent increase in hatching success was statistically significant. Since then, most Malaysian hatcheries have continued the practice of splitting egg clutches.

Ideally, conditions in an artificial hatchery should duplicate those of the natural nest, and manipulation should be avoided except where benefits have been clearly demonstrated. In the present study, we conducted controlled experiments to determine quantitatively whether or not splitting egg clutches into smaller complements increases egg clutch survivorship in a hatchery.

METHODS

We conducted experiments on two species at two sites: 1) On leatherback turtle eggs at the Rantau Abang, Terengganu hatchery during the 1990 season; and 2) On hawksbill turtle eggs (*Eretmochelys imbricata*) at the Pengkalan Balak, Melaka hatchery during the 1991 season.

Throughout the nesting season, egg clutches brought to these hatcheries for burial were alternately assigned to one of two treatment groups: 1) The "Controls" which were buried in their entirety in a single egg hole; and 2) The "Experimentals" which were split into two or more equal parts (each containing about 40 to 60 eggs), and each part was buried in a separate hole in the beach hatchery.

Detailed records were kept of the stages at which mortality occurred in each clutch. For each species, the Mann-Whitney U test (α = 0.05) was used to test observed differences between the survivorship in clutches exposed to the two treatments.

RESULTS

For both species, the average rates of egg survival were higher in the "Experimental" (i.e. split) egg clutches than in the "Control" group. The rates of emergence success (i.e. % live hatchlings produced) in leatherback eggs were 55.2% in the split clutches (N = 24) and 44.9% in the control clutches (N = 28); while for hawksbill eggs they were 52.7% in the split clutches (N = 83) and 47.0% in the control clutches (N = 111). However, there was no statistical difference between the % emergence success of split and control clutches in either species.

Mortality during the pipping stage was significantly lower for split egg clutches of both species. Mortality of late stage embryos within intact eggs was significantly lower in the split egg clutches of the hawksbills, but not in those of the leatherbacks. The number of dead hatchlings encountered in the hawksbill nests was also significantly lower in the split clutches; no dead hatchlings were reported in the leatherback nests.

DISCUSSION AND CONCLUSIONS

We conclude that splitting egg clutches is a management tool that can be used to slightly improve the survivorship of eggs buried in beach hatcheries. However, we are at some loss to conclusively explain the mechanism responsible for the enhanced survivorship we observed.

There is evidence that excessively high sand temperatures may exist in the hatcheries at both Rantau Abang (Chan and Liew, pers. comm.) and at Pengkalan Balak (Mortimer and Zaid, 1992; Mortimer, Zaid and Safee, MS in prep.). In a previous report (Mortimer et al., 1992), we suggested that under excessively warm conditions the production of metabolic heat during pipping might be lethal to some turtles. A reduction in the numbers of eggs in a nest reportedly lessens the production of metabolic heat (Kraemer, 1979). Thus, we concluded that smaller complements of eggs in a nest could lessen the production of metabolic heat, thereby decreasing mortality in late stage embryos and young hatchlings. Further support for our theory includes the fact that significantly higher rates of hatching success was observed in eggs incubated in the cooler temperatures within styrofoam boxes at both Rantau Abang (Chan, 1989) and at Pengkalan Balak (Mortimer and Zaid, 1992).

However, a closer analysis of the survival rates of hawksbill eggs incubated in the styrofoam boxes at Pengkalan Balak in 1991 (Mortimer, Zaid and Safee, MS in prep.) indicates that even within styrofoam boxes, smaller egg clutches enjoyed higher rates of hatching success than did the larger clutches. Thus, we must conclude that temperature alone does not explain the reduction in the mortality of late stage embryos and hatchlings that we observed in the split egg clutches. Other reasons why eggs incubated in smaller clutches or in styrofoam boxes enjoy higher survival rates may include the following: 1) There is a shorter distance for gas to diffuse between the edge and the center of the clutch; and 2) The process of pipping might be facilitated by better mobilization of minerals from the eggshell resulting either from closer contact with the substrate in the beach or from better moisture control in the styrofoam boxes.

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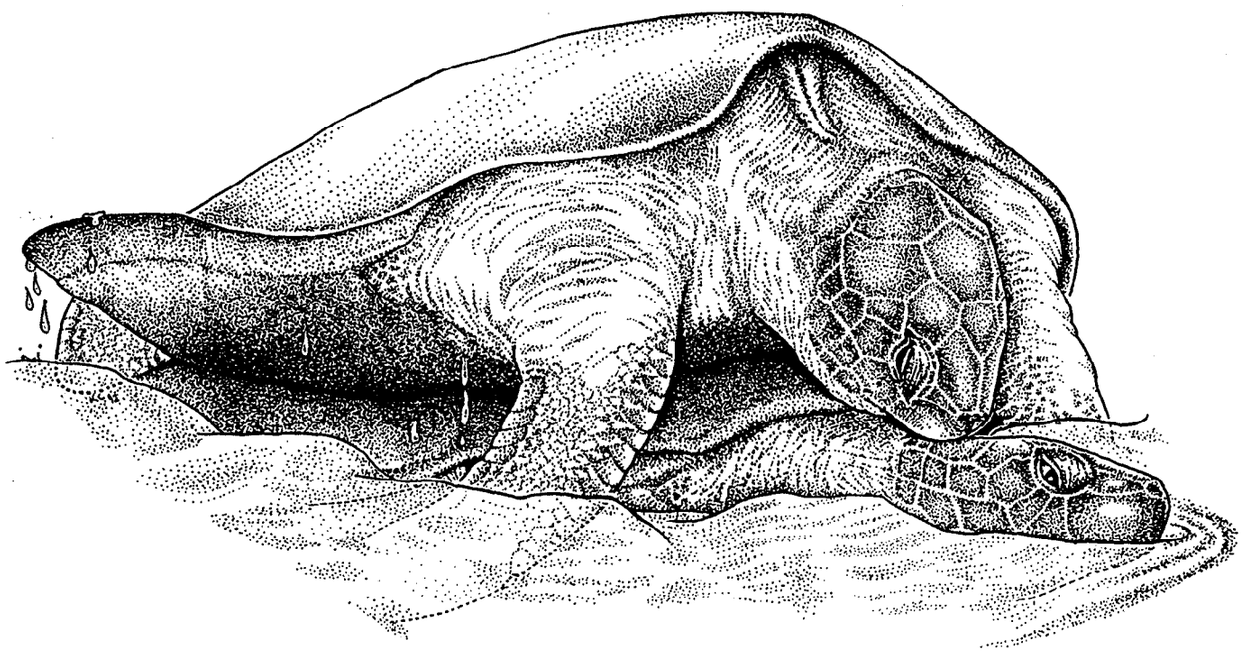

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