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## ISOLATED RE-INCUBATION OF FIVE-DAY OLD WHITE-SPOTTED EGGS OF *CHELONIA MYDAS* IN A BEACH HATCHERY: IS HATCH RATE IMPROVED?

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### ABSTRACT

Nineteen clutches of five-day old *Chelonia mydas* eggs in a beach hatchery were excavated to segregate fertile eggs from infertile eggs for re-incubation. Fertile eggs were selected on the basis of the development of a white spot on the eggshell. Three egg types were recognised: "spotted", "un-spotted", and mottled or "off-white" eggs. "Spotted" eggs and "un-spotted" combined with "off-white" eggs were re-incubated separately in two sub-clutches. Segregated fertile eggs had a significantly higher hatch rate than overall hatch rate, but not all fertile eggs hatched. Egg handling and smaller subclutch size did not appear to affect hatchability or overall hatch rate. The hypothesis that isolated re-incubation of "spotted" improved hatch rate was supported. The experimental technique may be used to recover fertile eggs from nests that are at risks from abnormal spring tides for artificial incubation.

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## INTRODUCTION

Fertility rates of sea turtle eggs have been reported to range from 80-90% or higher (Hughes, 1970; Miller, 1985; Ehrhart, 1995). High hatch rate is seldom realized through artificial incubation in beach hatcheries. Published hatch rates of green turtle *Chelonia mydas* egg clutches vary widely, from 55 - 75%; the variation reflects differences in fertility rates among populations, as well as differences in hatchery management and operations. In the Sarawak Turtle Islands, Malaysia, mean hatch rates of green turtle egg clutches in the hatchery show wide fluctuations in the years, averaging 60 - 70% from 1970 - 1980 and to about 60% in the last 10 years (Leh, 1989, 1994). In order to assist recovery of the declining green turtle population, hatchery incubation must strive to improve existing hatch rates (Diong *et. al.* 1999).

Several human and environmental factors can act singularly or in combination to increase embryonic mortality, and mortality of pipped individuals or emerging hatchlings during incubation. These mortality factors dampen hatchability of viable eggs by lowering hatch rates. Handling of eggs or delay in egg replanting can adversely affect the development of embryos and hence their hatchabilities (Balasingam, 1967). Replanting of large clutches of more than 120 eggs was reported to produce lower hatch rates than do smaller egg clutches (Hewavisenthi, 1994). However, at the Sarawak Turtle Islands hatcheries, clutch size was not significantly related to hatch rates (Leh, 1989). Overcrowding of artificial incubation pits, microbial or fungal infection, rainfall, inadequacy of gaseous and moisture exchanges of developing eggs in their nest environments, and overall hygiene and standards of hatchery practices are factors that can further depress hatch rates of otherwise viable eggs. Unlike fertile eggs, infertile eggs do not generate metabolic heat to help create an optimum thermal environment for nest incubation. Infertile eggs have been suspected to have a dampening effect on hatchability of viable eggs.

Fertile eggs alone start to develop a small white spot on their uppermost part within 24 hours. The white spot is the site of adherence between the vitelline membrane and the shell membrane (Ewert, 1985, 1989). It enlarges as incubation progresses until the whole egg is opaque white in colour. Chan (1989) noted that selection of fertile clutches based on white spot appeared promising. The objectives of this field study were: (i) to investigate whether fertile eggs can be accurately distinguished from infertile eggs in five-day old eggs in hatchery nests, and (ii) to determine the hatch rate of fertile eggs when they are reincubated separately from infertile eggs of the same clutch. We hypothesize that if fertile eggs were segregated from infertile eggs before they were replanted, then, hatch rate should improve.

## MATERIALS AND METHODS

Fieldwork was conducted from June to August 1998 at the beach hatchery on Talang Talang Besar, the largest of three turtle islands situated off the southwest coast of Sarawak, Malaysia. Hatchery incubation had been used since early 1950s to manage this stock of green turtle. In this operation, entire clutches of eggs were collected for replanting in a beach hatchery. *In situ* conservation has since been implemented and evaluated alongside with traditional hatchery practice.

Nineteen five-day old hatchery nests of *C. mydas* were used in this study (Table 1). Each of the nests was dug and eggs were removed and placed on moist sand. Eggs with a spherical, uniformly opaque, chalky white spot were