

Green Sea Turtle (*Chelonia mydas*): A historical review with relevance to population size in Sarawak

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Received: July 12, 2021. Revised: January 12, 2022. Accepted: February 11, 2022. Published: March 27, 2022

Abstract—Green sea turtles (*Chelonia mydas*) are using selected Sarawak sandy beaches for nesting. Its small-scale conservation efforts have started since the 1950s. However, the success of the effort is still debatable. Moreover, public participation in the conservation effort is still at an infancy stage. This study involved analysing nesting data of green turtles of Sarawak Turtle Islands (STIs) in terms of numbers of turtle landing, eggs collected, eggs incubated, and eggs hatched for Sarawak's green turtle population from 1949 to 2016 with addition of estimation of the egg-laying females and their remigration interval. There was a sharp decline in terms of number of turtle landings from 1949 to the 1970s. The exact cause of this pattern could only be confirmed from old articles of historical value due to limited information on the events happening during those 30 years period. From 1980 to 2016, the annual nesting trend of turtles on STIs shows irregular fluctuation pattern and remigration interval of every 3 to 4 years with interesting frequency of 3. Turtle eggs were harvested annually, with a 36-year average of 223,558 eggs per year. Detailed analysis for data 1980 to 2016 shows that the lowest percentage of eggs incubated was in 1981 (20.4 %) and starting from the year 1991, egg incubation at STIs reached between 90 to 100 percent. There is an upward trend of egg hatching rate for the past 36 years, especially from the 1990s to 2000s, with the latest seven years average of 60%. The results imply that conservation of green turtle in Sarawak have been successful at different levels. However, there is still a need for relevant state agencies to modify and step-up efforts related to conservation of green turtles in Sarawak especially in terms of male:female ratio of hatchlings from STI's hatcheries.

Keywords— green turtle, nesting, eggs, population size, Sarawak.

I. INTRODUCTION

Green turtles are listed as Endangered by the IUCN Red List and are protected from human exploitation in most countries under CITES [1]. Green turtles are widely distributed with the largest Southeast Asian nesting populations being from Sarawak Turtle Islands and Turtle Islands Heritage Protected Area (TIHPA) [2]. In Sarawak, all species of marine turtle (Cheloniidae and Dermochelyidae) are listed as Totally Protected Animal and are fully protected legislatively under the Wild Life Protection Ordinance 1998. Those found in possession of a sea turtle part or derivatives may face imprisonment of two years and a fine of RM25,000 [3].

Comprehensive knowledge on the nesting behaviour and the ecology of marine turtles is important to ensure that the current conservation status and efforts are working. Information on the age, size, growth rate and relative reproductive output of individuals is fundamental in understanding the demography of a population [4]. Assessment of population size should be as accurate as possible, including whether a population is stable, increasing, or declining; they are the foundation on which all management decisions should be based on [5].

Monitoring beach nesting is the easiest and the least expensive means to assess green turtle population and abundance [6]. However, surveys carried out less than 10 years are inadequate because green turtles are long-lived, and the females have been observed to skip several nesting seasons due to nutritional constraints [7].

With respect to behaviour, nesting season of mature females could differ in timing and duration, even among rookeries in the same region. [8], [9] mentioned that this is because some locales could support both nesting and feeding aggregates and non-migratory populations may exist at these sites. Furthermore, global warming phenomenon has negative impact to the sea turtles as the increase in temperature could lower hatching success, leading to a gradual shift towards a feminisation of sea turtle populations [10], affect inter-nesting interval and nesting patterns of sea turtles [11]. Although the trend of female nesters was estimated to remain the same as the past