



Assessing hatchery management as a conservation tool for sea turtles: A case study in Setiu, Terengganu



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ABSTRACT

In this study, we have investigated contemporary sea turtle hatchery management practices based on successive yearly hatching rates from 2009 until 2012. Compiled data were taken from a hatchery at Setiu, Terengganu, Malaysia, and the turtle eggs originated from five beaches nearby. We assessed hatchery management by comparing the successive hatching rates in terms of i) location; ii) year; iii) type of shading; and iv) egg condition. There was no significant difference between the beaches, but 2011 showed a significantly higher rate of successful hatching. The shaded hatchery had a significantly higher rate of successful hatching, while the open hatchery had a significantly shorter time of hatching. The majority of the eggs relocated in the hatchery were successfully hatched (73.9%), while only 0.5% was naturally predated. The low rate of egg predation indicates that natural predators at the hatchery were under control. We suggest that while beach protection efforts are rigorously conducted, stricter legislation should be considered, especially to curb the threat of illegal poaching. Increased monitoring duration is suggested to intensify beach protection, while increasing the workforce may improve the efficiency of the process of egg relocation to hatcheries.

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1. Introduction

Sea turtles face a number of threats in each life stage (Spotila et al., 2000). These threats collectively affect their survival, threatening extinction. Generally speaking, sea turtles face threats from natural factors and anthropogenic activities. Natural factors that negatively affect the survival of sea turtle include predation, erosive waves, and flooding, among others (Cornelius, 1986; Wetterer and Lombard, 2010). However, anthropogenic factors are considered to have a greater effect on sea turtle populations than natural factors (Chan and Shepherd, 2002; Eguchi et al., 2010, 2012). Examples of anthropogenic pressures include harmful fishing gear, illegal poaching for turtles' body parts (meat, carapace, and eggs), various types of pollution, and so on (Chan and Shepherd, 2002; Yender and Mearns, 2003; Ibrahim, 2006). Due to these continuous pressures, four of the sea turtle species found in Malaysia are facing extinction. The leatherback turtle (*Dermochelys coriacea*) is considered to be critically endangered, as its population

has plummeted dramatically in Malaysia in recent decades. Green turtles (*Chelonia mydas*) are categorized as endangered species, alongside the hawksbill turtle (*Eretmochelys imbricata*). In addition, the Olive Ridley turtle (*Dermochelys olivacea*) has been classified as vulnerable (IUCN, 2012).

Tackling the issues of conservation requires a combination of integrated planning and management (Ibrahim, 2006; Troeng and Rankin, 2005; Wallace et al., 2011, 2010). One conservation strategy places emphasis on protecting the nesting beaches (Garcia et al., 2003; Dutton and Dutton, 2006) through the establishment of reserved areas and extensive monitoring, which reduces the harvesting of turtle eggs for illegal trade (Ibrahim, 2006; Yeo et al., 2007; Dutton and Dutton, 2006). However, despite existing legislation, clashes in policies occur periodically since certain Malaysian state laws still allow turtle eggs to be marketed (Chan and Liew, 1996; WWF, 2009). Only leatherback turtle's eggs are banned from open trade, but eggs from other species are still widely marketed, especially in Terengganu, Malaysia (Quilter and Azmin, 2010; Abd Mutalib et al., 2013). The inconsistency in implementing policy and legislation necessitates other measures, such as relocating eggs and incubating them in hatcheries. These two measures increase hatchling success and curb illegal poaching activities (Garcia et al., 2003).

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There are several reasons why hatchery management is considered an important *ex situ* conservation method. Nests might be inappropriately located at a beach, whether too near the tide line or overlapped by other nesting clutches. Nests that are too near to the tide line might be affected should there be erosive waves or flooding, causing eggs to be damaged by salty sea water. In addition, natural predators often feed on the egg clutches; these predators include ghost crabs, ants, feral pigs, and monitor lizards, among others (Ekanayake et al., 2002; Ali et al., 2004).

Another major factor supporting to hatchery implementation is that the eggs are devastatingly poached by the public, even in the reserved areas. This activity is influenced by the traditional customs since turtle egg is a rather renowned local delicacy. The eggs can be simply prepared either raw or boiled, and are considered tasty and traditionally consumed as a male aphrodisiac (Abd Mutalib et al., 2013; Aguirre et al., 2006; Senko et al., 2011, 2009). Selling turtle eggs is highly profitable, due to their exclusivity and high price, attracting poachers (Abd Mutalib et al., 2013; Campbell, 1998; Abd Mutalib et al., 2014). A recent report found that a minimum 20,255 sea turtle parts had been seized in Malaysia during the past 4 years (2004–2012). Ninety-nine percent of the seized parts were sea turtle eggs (Shepherd and Sharma, 2013). In June 2013, smugglers were convicted in the coastal area of Sabah with more than 5000 turtle eggs smuggled, indicating a massive loss of potential hatchlings (Shepherd and Sharma, 2013).

There are conflicting opinions between the application of hatchery (*ex situ* conservation) against leaving the nests at the

beach (*in situ* conservation) (Garcia et al., 2003; Ekanayake et al., 2002). Other studies have suggested that relocating the eggs to hatcheries might cause a lower hatching success (Chan and Liew, 1996). However, since leaving the eggs on their natural beaches appears to be more risky at Penarik, a hatchery is the best option to prevent turtle eggs from being poached.

Our research will investigate whether any improvements or changes are needed in hatchery management based on successive hatching rates over the years and hatching beaches location. In this study, we also examine egg conditions after the nests had been excavated. We have also evaluated the effects of shading on duration of incubation and successive hatching rates.

2. Material and method

2.1. Study sites

The study was carried out in Setiu, (5°35'–5°41' N, 102°43'–102°50' E) Terengganu, Malaysia. We collected the eggs from five beaches in Setiu, Terengganu, Malaysia, which were Kuala Baharu Utara (KBU), Kuala Baharu Selatan (KBS), Mengabang Sekepeng (MKS), Telaga Papan (TP), and Kuala Tok Cha (KTC). The hatchery was located at Kampung Penarik, which was approximately at the middle point of the five beaches. The location of each point has been shown in Fig. 1. Two (KBS and TP) out of five beaches were managed collaboratively by the Department of Fisheries (DoF) and World Wide Fund for Nature (WWF) Malaysia. These areas have

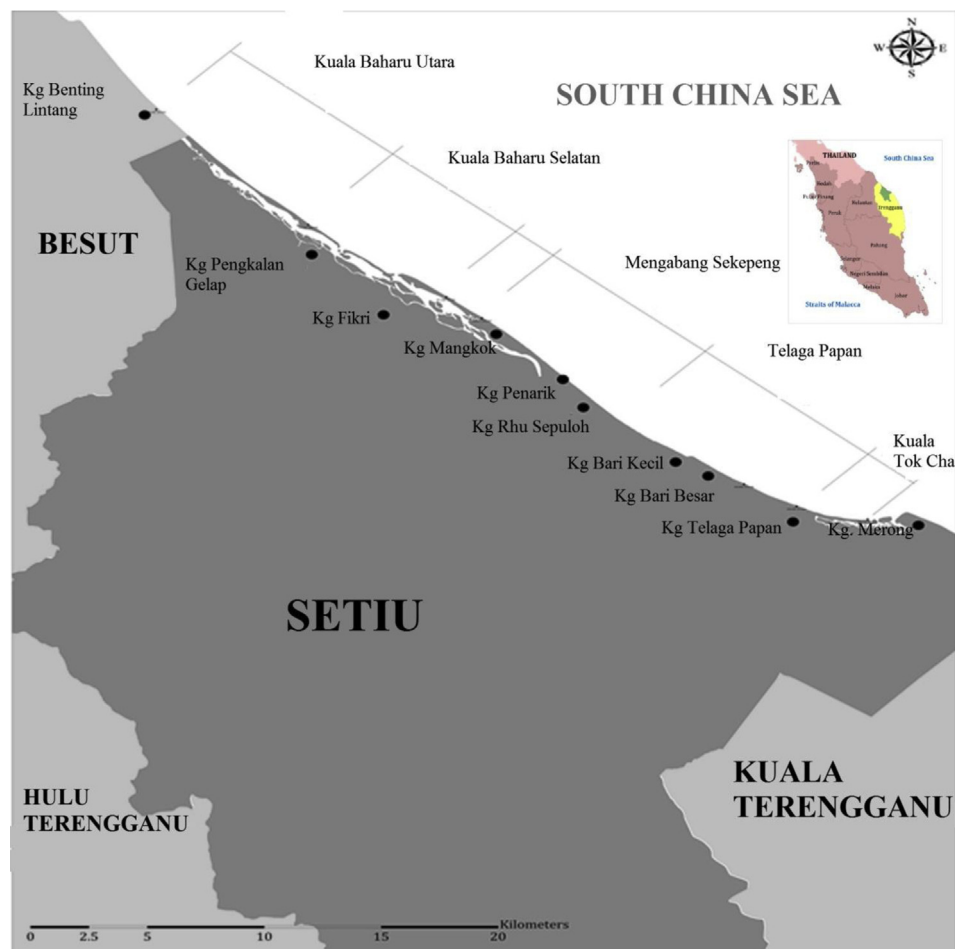


Fig. 1. Location of the beach. Small inset shows the location of Terengganu in Peninsular Malaysia.

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