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SHORT NOTE

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Recent observations on green turtle *Chelonia mydas* movements and nesting in the Egyptian Red Sea

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ABSTRACT – Conservation of sea turtles requires identifying vital habitats such as nesting beaches and feeding grounds. Through a citizen science programme that records flipper tags and takes ID photos, we identified a new green turtle migration path between Zabargad Island and Abu Dabbab bay, Egypt. This bay also experienced nesting in 2022, but not in 2021 and 2023. The identification of this migration route supports an earlier assessment that Zabargad is one of the most valuable green turtle rookeries in the Red Sea and that Abu Dabbab bay is an important feeding bay for sea turtles. We also recorded an event in which a tagged green turtle was harvested for consumption, which suggests that females may be vulnerable to this threat during the nesting season. Our data justifies protecting any historic nesting beach in the Red Sea based upon its potential as future nesting activity could be the result of turtles returning from a hatching event 20–30 years ago and nesting beaches may not be used each year.

INTRODUCTION

Conservation of sea turtles requires identifying vital habitats such as nesting beaches and feeding grounds (Godley et al., 2008; Shimada, et al., 2021a; 2021b; Tanabe et al., 2023). Green turtles *Chelonia mydas* are a globally endangered species, in which very little is known about their populations in Egypt's Red Sea (Hanafy, 2012; Attum, 2014; Mancini et al., 2015; Fouad et al., 2022). Green turtles are particularly vulnerable to anthropogenic disturbances at their nesting beaches, inter-nesting habitat and feeding grounds due to their dense aggregations (Godley et al., 2008). Our knowledge of green turtle movement patterns between nesting and feeding grounds in the Red Sea is understudied compared to other regions (Godley et al., 2008), with our knowledge of these patterns being less studied in Egypt (Attum et al., 2014) than on the eastern side of the Red Sea in Saudi Arabia (Al-Mansi et al., 2021; Shimada et al., 2021b; Tanabe et al., 2023).

Green turtle nesting on Egypt's mainland beaches is characterised by low density, widely dispersed nests (Hanafy, 2012; Shimada et al., 2021b). In contrast, Zabargad Island in the Red Sea has a much higher nesting density and thus is believed to be the most important green turtle rookery in Egypt (El-Sadek et al., 2016; Hanafy, 2012; Shimada et al., 2021b). Red Sea islands were historically safe nesting sites for sea turtles, when compared to the mainland, given the lack of mammalian predators and remoteness from anthropogenic disturbance (Attum & Nagy, 2024). We report on a new migration path from Zabargad Island to

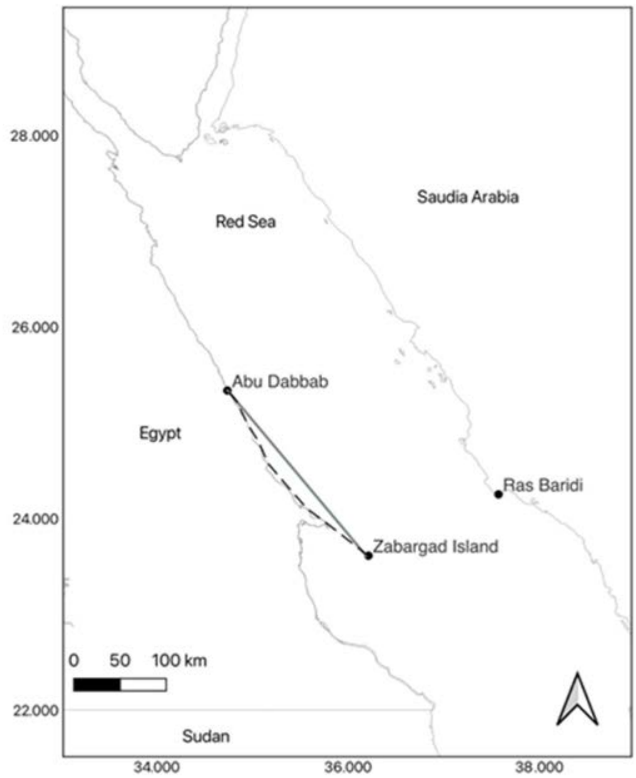

Figure 1. Map of Red Sea showing direct (solid line) and proposed (hashed line) migration route between Zabargad Island and Abu Dabbab bay, Egypt

the Abu Dabbab bay feeding ground, discovered by using a combination of a flipper tag and photo ID. We also report on recent nesting activity on a historic nesting beach in Egypt.

MATERIALS & METHODS

For identification purposes, turtles were photographed at popular snorkel and dive sites by an ongoing citizen science programme, The Red Sea Project (Fouad et al., 2022). Important identification features are facial and carapace profiles or unique scars and other morphological features (Jean et al., 2010; Reisser et al., 2008). Turtles identification was then undertaken manually or by using the Internet of Turtles online platform (https://iot.wildbook.org), which employs the Hot Spotter algorithm (Dunbar et al., 2021) and a multispecies deep learning approach (Otarashvili, 2024).

Sea Turtle Monitoring Sites

Zabargad Island

Zabargad Island (4.72 km^2) is located in the southern Egyptian Rea Sea, approximately 52 km from the mainland (Fig. 1). Green turtles nest on the sandy beaches located at the southern (2.5 km) and eastern side (1.5 km) of the island (El-Sadek et al., 2016). Human access is limited mostly to liveaboard dive and fishing boats, both legal and illegal. On Zabargad Island in 2008, 2009, 2010, 2012, 2013 and 2014, walking surveys of nests were undertaken usually between July–August for a minimum of three nights (El-Sadek et al., 2016). Metal (Monel) tags were attached at the trailing edge of the front flipper as turtles returned to the water, as part of the programme of the Red Sea Protectorates (Egyptian Environmental Affairs Agency).

Abu Dabbab bay

Green turtle nesting activity was monitored in Abu Dabbab bay (Fig. 1) between 2021 and 2023. Abu Dabbab is a small seagrass bay (0.17 km^2; width 317–430 m) that is part of a complex of feeding grounds used by sea turtles (Fouad et al., 2022; Mancini et al., 2015; Montagna et al., 2023). The bay is also a historic nesting beach for green turtles (Hanafy, 2012). Nesting was observed opportunistically during walks or brought to our attention by hotel and dive centre management as part of an outreach programme.

OBSERVATIONS

Zabargad Island

A female green turtle EG 0197 (curved carapace length 109 cm) was tagged at Zabargad Island on 26 August 2013. She has been recorded in Abu Dabbab for almost twenty years (2005, 2006, 2011, 2012, 2022, 2023 and 2024). The straight-line distance between Zabargad Island and Abu Dabbab bay is 241 km. If we assume that EG 0197 moved in a similar path to previously satellite-tagged turtles, she crossed the Red Sea, moved north-west towards the Berenice peninsula, which is the shortest distance between Zabargad Island and the mainland. She likely then followed the coast north to Abu Dabbab (Al-Mansi et al., 2021; Attum et al., 2014). This proposed distance between the feeding ground and nesting site would be approximately 248 km. Although, the exact migration path of this turtle is unknown, the final destination is the point of maximum displacement for 99 % of sea turtles (Hays & Scott, 2013).

Green turtle EG 093 was tagged between July–August 2008 and found dead a few days later on the same nesting

Figure 2. Green turtle (EG 0197) showing position of flipper tag (red arrow) and detail of the tag in the inset

beach on Zabargad Island. She was apparently harvested for consumption by local fishermen. Although turtles or their eggs are not regularly consumed in the Red Sea (Mancini, 2015), fishermen are known to occasionally consume eggs (El-Sadek et al., 2016). Our record indicates that in more remote locations, some fishermen do consume green turtles. This observation also suggests that females may be vulnerable to fishing during the aggregations of the nesting season (Attum et al., in press).

Abu Dabbab bay

In 2022, four live nesting events were observed (11/08, 12/09, 19/09 and 02/11), in addition we also observed the tracks and covered pits of three additional nesting events (16/8, 24/09 and 28/09). Nine additional emergences, false crawls, were recorded for a nesting success rate of 44 % (7 nests/16 total nesting emergences). No nests were observed in 2021 or 2023.

DISCUSSION

The use of flipper tags and photo-ID has increased our understanding of migration routes of green turtles nesting at Zabargad Island. The identification of this migration route between Zabargad Island and Abu Dabbab bay supports an earlier assessment that that Zabargad Island is one of the most valuable green turtle rookeries in the Red Sea (Shimada et al., 2021b). Five turtles tracked from their nesting beach in Zabargad used disparate feeding grounds spanning the length of the northern and southern Red Sea (Attum et al., 2014). The identification of this migration path also further highlights the importance of Abu Dabbab as a vital feeding ground for sea turtles in the Red Sea that nest in Egypt and internationally (Montagna et al., 2023).

Current nesting observations also suggest that Abu Dabbab is an intermittent and low-density nesting site. The nesting succuss of green turtles in Abu Dabbab is on the lower range of values for green turtles (46–65% Hanafy, 2012; 40–52% Bourjea et al., 2015; 63%, Shimada et al., 2021a). Following best practices to reduce nightlight would likely improve beach nesting success and use (Salmon, 2005; Siqueira-Silva et al., 2020), while allowing human recreational activities to continue (Weishampel et al., 2016). Our data does justify protecting any historic sea turtle nesting beach in the Red Sea based upon its potential, as current nesting activity could be the result of turtles returning from a hatchling event 20–30 years ago and nesting beaches may not be used each year (Attum & Nagy, 2024). The loss of even a single nesting beach could result in a permanent, irreversible decline of sea turtle populations (McClellan & Read, 2009). Although sea turtles in the Egyptian Red Sea have not been well studied compared to other regions, our knowledge of sea turtle ecology should be increasing given the numerous and ongoing citizen science initiatives in the region (Mancini & Elsadek, 2019).

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