# BLACKTIP REEF SHARK ABUNDANCE, POPULATION STRUCTURE, SITE FIDELITY, AND TROPHIC ROLE AT CHAGAR HUTANG SEA TURTLE SANCTUARY, REDANG ISLAND

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## INTRODUCTION

This project is the first of its kind in Malaysia, aimed at investigating the abundance, population structure, residency patterns, and trophic role of threatened blacktip reef sharks (Carcharhinus melanopterus) at an important sea turtle conservation site in Redang Island Marine Park in Malaysia's Marine Protected Area (MPA). The long-term conservation management of nesting green turtles (Chelonia mydas) at the Chagar Hutang Turtle Sanctuary (Figure 1) by the Sea Turtle Research Unit (SEATRU) over the past 30 years has resulted in the preservation of the bay's pristine coral reef habitat and the annual production of tens of thousands of hatchlings that ultimately disperse across the predator-rich shallow water habitats of the bay on their journey towards the open ocean. Previous studies carried out at Chagar Hutang by Bashir et al. (2020) and Oñate-Casado et al. (2021) have identified that juvenile blacktip reef sharks primarily predate on neonate turtle hatchlings during the annual nesting season and that approximately 20% of turtle hatchlings are consumed within the first 500m of Chagar Hutang Bay's shoreline waters during dispersal away from the nesting beach. A



Figure 1. Map of Chagar Hutang Bay, Redang Island, located off the northeastern coast of Terengganu State in Peninsular Malaysia.

better understanding of the abundance of blacktip reef sharks as well as their residency and foraging patterns may allow us to clarify their role as apex predators at Chagar Hutang Bay and further elucidate the unique predator-prey relationship between blacktip reef sharks and green turtle hatchlings there.

Despite the ecological importance of reef sharks to coral reef ecosystems, limited research has been carried out in Malaysia regarding their ecology and conservation status within Marine Parks. My research will quantify the abundance, size frequency, age distribution, and sex ratio of blacktip reef sharks captured along the nesting beach shoreline, to answer the question: what is the population structure of sharks in the bay? To determine if juvenile blacktip reef sharks show high site fidelity to the shallow water habitats of Chagar Hutang Bay, and the extent of their home range, I will use both mark and recapture and passive acoustic telemetry methods to determine their site fidelity to the bay and track their movement patterns and the extent of their home range along the Northernmost coast of Redang Island. Stable isotope analysis (SIA) of blood and tissue samples taken from juvenile blacktip reef sharks (Figure 2) at Chagar Hutang will reveal the composition of their diet and answer the question: do juvenile sharks primarily prey upon sea turtle hatchlings during the nesting season at the sea turtle sanctuary site?

#### **METHODS**

This study will use baited remote underwater video (BRUV) surveys (Figure 3) and drone video transects to assess the abundance and density of blacktip reef sharks at Chagar Hutang Bay. The abundance and densities of sharks will be compared spatially among reef habitat zones (shoreline, mid-reef, and forereef) as well as temporally throughout the green turtle nesting season. Sharks along the shoreline will be captured to quantify their population structure in the bay, by measuring individual sharks' weight and length and by determining



Figure 2. Dissecting fin tissue samples for stable isotope analysis of a naturally deceased blacktip reef shark. (Photo credit: Syamsyahidah Samsol)

their sex and maturity status. During morphological measurements, I will collect blood and tissue samples, mark individuals with individual plastic identification tags (dart and roto tags), and implant several individuals with acoustic transmitters. Regular fishing attempts will be carried out at Chagar Hutang and its neighbouring study sites to recapture previously marked individuals in order to calculate their residency patterns and home range extent. The acoustic transmitting tags will be detected by an array of underwater acoustic receivers stationed within Chagar Hutang Bay and along the northern coastline of Redang Island. The passive acoustic telemetry array can continuously record data on the presence or absence of tagged sharks, allowing for a more in-depth understanding of their habitat use and movement patterns within Redang Island Marine Park. Blood and tissue samples collected from juvenile sharks will be frozen in the field until they can be transported and processed in the laboratory. Samples will be dehydrated, crushed into a homogenised powder, and analysed for the composition of heavy carbon and nitrogen values in each sample. By comparing the values of heavy carbon and nitrogen among sharks, sea turtle hatchlings, and other components of the marine food web, including meso-predatory fish, primary consumers,



Figure 3. Juvenile blacktip reef sharks captured on Baited Remote Underwater Video (BRUV) equipment deployed at Chagar Hutang Turtle Sanctuary in Redang Island Marine Park. BRUV units are comprised of (A) one GoPro camera, (B) a weighted frame, (C) a 1m long bait arm, and (D) a bait bag containing 500g oily fish.

and producers, we can better understand the trophic role of juvenile sharks and the proportions of their diet contributing to sea turtle hatchlings.

All methods were approved by the Animal Ethics Committee of Universiti Malaysia Terengganu, and the research was supported by the Department of Fisheries Malaysia.

# **RELEVANCE TO SEA TURTLE CONSERVATION**

A better understanding of the abundance and residency patterns of sharks at Chagar Hutang is necessary to determine whether the area can be characterised as a shark nursery site and a hotspot for conservation. Further clarifying the role that reef sharks play as primary predators of neonate hatchlings at the important sea turtle sanctuary site will provide more insight into the natural predation rate of hatchlings and further help inform management efforts toward the conservation success of these two keystone marine species in the region.

### Literature cited:

Bashir, Z., M.M. Abdullah, M.A. Ghaffar & M.U. Rusli. 2020. Exclusive predation of sea turtle hatchlings by juvenile blacktip reef sharks *Carcharhinus melanopterus* at a turtle nesting site in Malaysia. *Journal of Fish Biology* 97: 1876-1879.

Oñate-Casado, J., D.T. Booth, K. Vandercamere, S.P. Sakhalkar & M.U. Rusli., 2021. Offshore dispersal and predation of sea turtle hatchlings I: A study of hawksbill turtles at Chagar Hutang Turtle Sanctuary, Malaysia. *Ichthyology and Herpetology* 109: 180-187.