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Short Communication

Observation of whale shark *Rhincodon typus* Smith, 1828 in oceanic waters of the Bay of Bengal, India

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Abstract
The present study was based on sighting of whale shark, *Rhincodon typus* Smith, 1828 on 13th and 14th October 2016 incidentally in oceanic waters of Bay of Bengal at a depth of 3340 and 3270 m. These two sightings were thus confirmed by photographs. Whale sharks were reported in the coastal and near shore regions of India by many of the researchers and this is the first observation of *R. typus* in oceanic waters of east coast of India.

Keywords: Whale shark; *Rhincodon typus*; oceanic waters; Bay of Bengal.

1 | INTRODUCTION

The whale shark *Rhincodon typus* (Orectolobiformes: Rhincodontidae) is the largest elasmobranches found in the tropical and temperate seas worldwide including coastal, neritic and pelagic habitat (Colman 1997; Couturier *et al.* 2012). Despite their wide range of distribution, very little is known of their pelagic distribution. *R.typus* are most frequently observed in areas of fish spawning events (Heyman *et al.* 2001; Robinson *et al.* 2013) and areas of major zooplankton blooms (Motta *et al.* 2010), although the surface zooplankton may only be a constituent of their diet (Rohner *et al.* 2013).

The whale shark is listed as "Endangered" by the International Union for the Conservation of Nature and Natural Resources (IUCN 2016). Additionally, whale sharks are protected in India under Schedule–I of the Indian Wildlife (Protection) Act-1972 (WPA 2003). The whale shark is also listed on Appendix II of the Convention on the International Trade in Endangered Species (CITES 2002). The whale shark is also included in the Agreement on Stranding Fish Stocks and Highly Migratory Fish Stocks of the United Nations Convention on the Law of the Sea (UNCLOS 1982).

Whale shark occurrence and distribution has been well documented in Indian waters (Prater 1941). It was reported from the coastal waters off Mumbai (Kulkarni 1948), Madapally (Chacko and Mathew 1954), Mangalore (Kaikini *et al.* 1959), Tuticorin (Silas and Rajagopalan 1963), Cannanore (Thomas and Kartha 1964), Andhra Pradesh (Rao 1992), Gujarat (Hanifee 2001), Karnataka (Kemparaju *et al.* 2002), Maharashtra (Jadhav *et al.* 2005); Tamil Nadu (Rajapackiam *et al.* 2006), Kerala (Paul 2008), West Bengal and Goa (Pravin 2000; Choudhry 2008), and Odisha (John 2010). From the earlier reports well established that the frequent observations of *R. typus* were made along the west coast than the east coast of India. Most of the reports available in India are based on the incidental catches stranded on beaches and sightings of shallow water areas and none of them are in reference to

the availability in oceanic waters. The present two sightings of whale shark in oceanic waters off Krishnapatnam, South Andhra Pradesh, India is the first report on the observation of whale shark in oceanic waters in India.

2 | METHODOLOGY

The study is maiden attempt to record the occurrence of whale sharks in the oceanic waters of Bay of Bengal. Whale sharks were sighted in oceanic waters off Krishnapatnam (Figure 1). Two occasions it was sighted in the subsurface area during the routine exploratory survey of oceanic tuna and allied fishery resources carried out by monofilament tuna long liner in the east coast of India by Fishery Survey of India's survey vessel *Matsya Drushti.* During the course of sighting, photographs were taken with the handy cams. The identification of aquatic animals to their species level on board ocean-going vessels is often difficult. However, as *R. typus* can be observed swimming just below the surface during feeding times and as have unique colouration patterns i.e. has brownish to dark blue-grey with white round spots on the body stripes above white below (Rowat and Brooks 2012), which gives good viewing conditions, the positive identification of these species at sea is feasible. Moreover, the citizen science contributing to "Wild book for Whale Sharks" (www.whaleshark.org) can help match individual *R. typus* and work of Arzoumanian *et al.* (2005) were used for the taxonomical identification. Water depth was measured by eco-sounder (SIMRAD EQ60). Water temperature was recorded by using Conductivity Temperature and Depth (CTD).

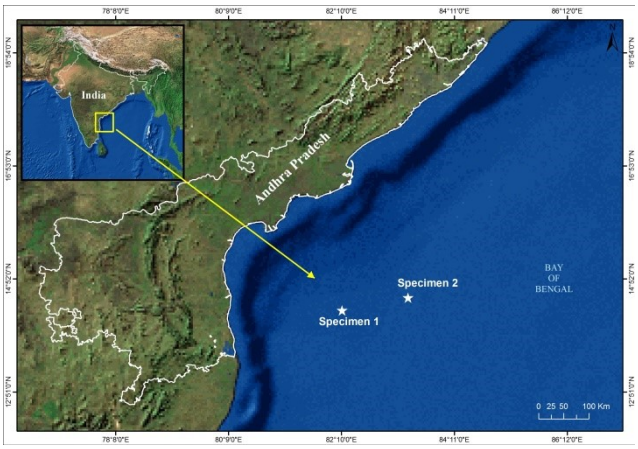

FIGURE 1 Map showing the locations of two sightings of a *Rhincodon typus* in Krishnapatnam waters, Bay of Bengal

3 | RESULTS

The first sight of *R. typus* was observed at subsurface water (Figure 2) on 13th October, 2016 at 05.45 hours approximately 193km off Krishnapatnam (14°17.9'N and 82°10.8'E), where the recorded depth was 3,340 m and the size of the whale shark was approximately 2 to 3 m. The sea surface temperature at the first sighted location was 28.3°C. Second sight was observed on 14th October 2016 (Figure 3), at 6.00 hours in the area (14°31.9' N and 83°21.6'E), 296 km off Krishnapatnam and the size of the whale shark was approximately 4 to 5m and bigger than the first sighted. The sea surface temperature at the second sighted location was 28.6°C.

The sighted whale shark was easily distinguished by brownish to dark blue-grey with white round spots on the body stripes above white below. Elongate body, flattened head with wide mouth positioned at the tip of snout. Upper jaw with long labial fold. Very wide gill openings and five massive gill slits at the side of the head. Forked tail, upper lobe longer than lower (heterocercal). On both occasions, *R. typus* has sighted approximately at 5–10m depth below the sea surface.

FIGURE 2 Whale Shark *Rhincodon typus* observed off Krishnapatnam on 13th October 2016

FIGURE 3 Whale Shark (*Rhincodon typus*) with associates of suckerfish photographed on 14th October, 2016

Whale sharks distribution and biology are very meager in oceanic waters whale sharks are susceptible to worldwide exploitation ranging from incidental by-catch in fisheries to direct capture in some regions (Colman 1997; Hanfee 2001). In the present observations provide important information on the occurrence and distribution of this species in the oceanic waters of India. The distribution and abundance of whale sharks is known to be influenced by oceanographic factors such as sea surface temperature, salinity, current and primary productivity (Colman

1997; Hoffmayer *et al.* 2005). Krishnapatnam Coast has dynamic oceanographic features and high productivity of this area. Productivity is also high off southern Pulicat due to freshwater outflow from the Pennar River which can cause peaks in primary productivity around 200–300 km from river mouth during the monsoon period. These conditions could produce localized areas for the enhanced planktonic and nektonic population on which the whale sharks might came for feeding (Bhasha *et al.* 2016).

The whale shark landings increased in recent years along the Indian coast. Silas (1986) considered the whale shark as a highly vulnerable species and opined that increase in any directed effort of capture may result in great imbalance. Now the whale shark is listed as "Endangered" by the International Union for the Conservation of Nature and Natural Resources (IUCN 2016).The conservation of whale shark is dependent on international, multinational and multi-institutional collaboration in research and management. As whale shark fishing in the Indian coast is imposing serious restrictions or banning of fishing can trigger conflicts between different interest groups forest departments such as fisheries, students, social, economical and political implications.

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CONTRIBUTION OF THE AUTHORS

CB primary data collection; **CB & KS** data processing; **KS** manuscript preparation; **AT & CB** technical correction