

# First Record of Scalloped hammerhead shark *Sphyrna lewini* (Carchariniiformes : Sphyrnidae) in freshwater habitat

*By Arum Setiawan*

## First record of scalloped hammerhead shark *Sphyrna lewini* (Carcharhiniformes: Sphyrnidae) in freshwater habitat

MUHAMMAD IQBAL<sup>1\*</sup>, DONI SETIAWAN<sup>2</sup>, ARUM SETIAWAN<sup>2</sup> & INDRA YUSTIAN<sup>2</sup>

<sup>1</sup>Biology Program, Faculty of Science, Sriwijaya University, Jalan Padang Selasa 524, Palembang, Sumatera Selatan 30129, Indonesia.

<sup>2</sup>Department of Biology, Faculty of Science, Sriwijaya University, Jalan Raya Palembang-Prabumulih km 32, Indralaya, Sumatera Selatan 30662, Indonesia.

\* Corresponding author [kpbosos26@yahoo.com]

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### Abstract

A scalloped hammerhead shark *Sphyrna lewini* (Griffith & Smith, 1834) with c. 40 cm of total length was stranded and photographed on 6 April 2020 in Mahakam river, East Kalimantan province, Indonesia. This unexpected finding is represent a first ever know inland record of *S. lewini* in freshwater habitat.

**Key words:** *Sphyrna lewini*, record, freshwater, Kalimantan, Indonesia.

### Introduction

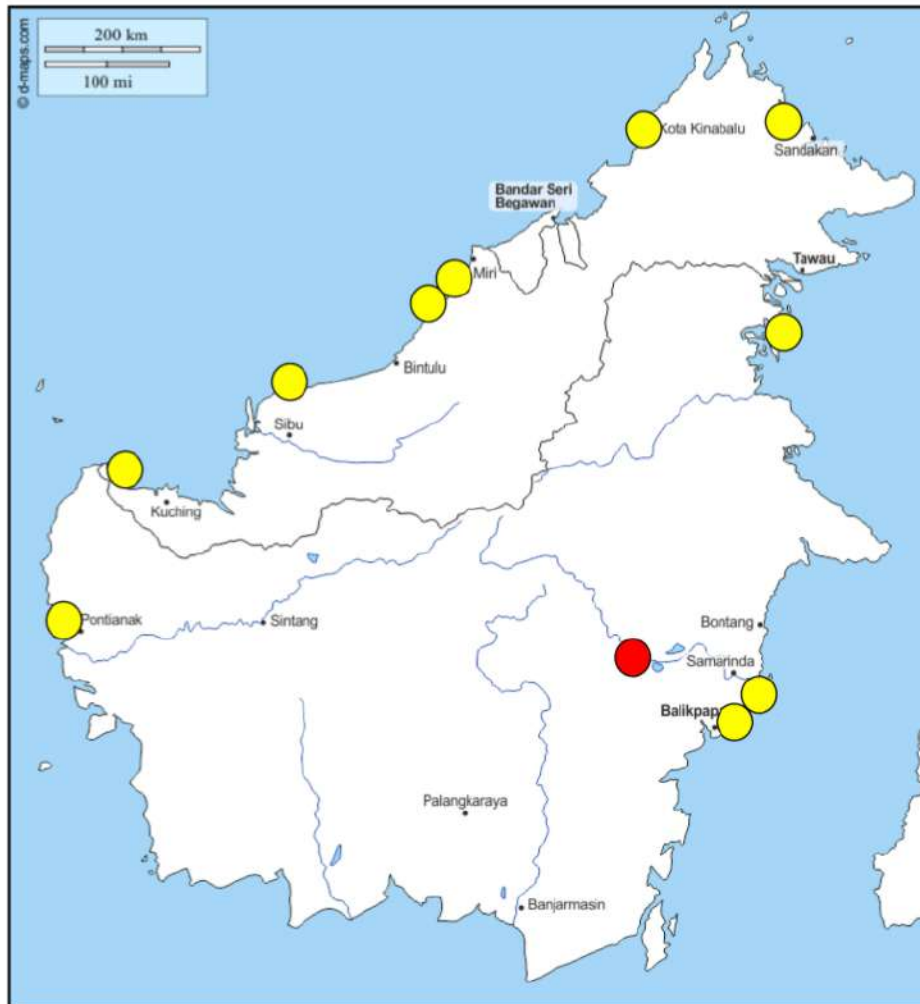
The hammerhead sharks (family Sphyrnidae) unmistakable sharks have unique head shape with the eyes located at the tips of laterally expanded blades which resemble an hammer (Last & Stevens 1994). These function as a submarine-like bow plane to improve manouvability and increase sensory capacity by enhancing stereoscopic vision and ability to triangulate sources of scent and electromagnetic signals (Compagno *et al.* 2005). The hammerhead sharks feed mainly at night, good reason for having well-developed senses other than vision (Moyle & Cech 2004).

Family Sphyrnidae is a small group of sharks containing two genera, with eight or ten described species (Ebert *et al.* 2013; Nelson *et al.* 2016; Gallagher & Klimley 2018). The scalloped hammerhead shark *Sphyrna lewini* is one of species of family Sphyrnidae that cosmopolitan in tropical and warm temperate seas (Last & Stevens 1994). The *S. lewini* is a large shark (370-420 cm of total length) with a maximum age of up to 35 years (Ebert *et al.* 2013). However, this species is recently listed as Critically Endangered by IUCN because global population trend estimated median reductions of 76–97%, with the highest probability of >80% reduction over three generation lengths or about 72 years (Rigby *et al.* 2019). As other species of hammerhead sharks, *S. lewini* inhabit marine, primarily continental shelf and occasionally brackish in Atlantic, India and Pacific (Nelson *et al.* 2016; Marie *et al.* 2017); including in Indonesian waters, from Sumatra in the west to the West Papua in the east (Gloerfelt-Tarp & Kailola 1984, Fahmi 2010, Chodriyah & Setyadji 2015; Sentosa *et al.* 2016).

A recent inland record of *S. lewini* on the basis photographic evidence was reported in Mahakam river, East Kalimantan, Indonesia. This record presented a first ever know world wide record of *S. lewini* in freshwater habitat.

### Materials and Methods

A specimen of *S. lewini* (c. 40 cm of total length) was stranded and photographed on 6 April 2020, at Mahakam river, Muara Baroh village, Muara Pahu subdistrict, Kutai Barat district, East Kalimantan province, Indonesia (00°19'25"S, 116°03'46"E) (Fig. 1). This area is in inland freshwater habitat located c. 150 km distance from mouth of river. Photos of this shark were shown to us by local people. There is no specific details on measurements, but this small size suggest this species is very early young male juvenile shark, when small claspers are present (Fig. 2). Specimen is unpreserved for a museum collection. It is reported that this specimen requested by a staff of local animal conservation NGO in East Kalimantan, but we are unable to track further for checking specific informations. Identification is therefore based on the features that are visible in the photographs. Proportional morphological characters expressed as percentage of total length based on the photographs shown in Table 1.



**Figure 1.** Location of known *S. lewini* in Borneo. Yellow circles are *S. lewini* recorded in Bornean waters after Last *et al.* (2010), and red circle is recent inland record from Mahakam river, East Kalimantan province.



**Figure 2.** The *S. lewini* which stranded in Mahakam river at Muara Baroh village, Muara Pahu subdistrict, Kutai Barat district, East Kalimantan province (Photo: Yuni Sri Wahyuni).



**Figure 3.** Another side of *S. lewini* which stranded on 6 April 2020 in Mahakam river at Muara Baroh village, Muara Pahu subdistrict, Kutai Barat district, East Kalimantan province (Photo: Yuni Sri Wahyuni).

**Table 1.** Proportional morphological characters of *S. lewini* expressed as percentage of total length based on the photographs. S1 = specimen from Mahakam river, S2 = other specimens on the basis of Quattro *et al.* (2013).

Characters	S1	S2 (range)
Head length	24	20-24
Pre-first dorsal fin	28	24-28
Pre-second dorsal fin	61	57-61
Prepectoral length	24	19-24
Prepelvic length	47	43-47
Preanal length	59	59
Snout-vent length	48	44-48
Interdorsal space	20	20-25
Second dorsal-caudal space	6	5-6
Pectoral-pelvic space	20	15-20

## Results and Discussions

An individual of stranded shark found in Mahakam river has brownish grey dorsally and pale ventrally, head laterally expanded into prominent keels resembling an hammer with maximum width 24-30% of total length; body fusiform and moderately slender; anterior profile of hammer curved anteriorly with median and lateral indentations; first dorsal fin origin about over or slightly behind pectoral fin insertion, first dorsal fin broad and relatively erect, pelvic fin posterior margin nearly straight, no other fin markings (Figs. 2 and 3). These characters are fitted well to the characters of *S. lewini* (Compagno & Niem 1998; Compagno *et al.* 2005; Last *et al.* 2010; Ebert *et al.* 2013). The *S. lewini* is very resemble to smooth hammerhead *S. zygaena*, its closest relative; but *S. lewini* is distinguished from *S. zygaena* by a median indentation (scallop) on anterior margin of head (Fig. 2 and 3) (Gilbert 1967). The Carolina hammerhead *Sphyrna gilberti* in western Atlantic Ocean is a cryptic species of *S. lewini*, and morphologically can only separate with *S. lewini* in the number of precaudal vertebrae (Quattro *et al.* 2013).

The *S. lewini* is a large endangered shark with a world wide distribution, observed in the open ocean but linked ontogenetically to coastal embayments for parturition and juvenile development (Daly-Engel *et al.* 2012). Populations from different locations are generally distinct (Compagno *et al.* 2005; Duncan *et al.* 2006; Ebert *et al.* 2013); and two distinct forms have been identified from molecular analysis of Borneo specimens but, these forms have not yet been clearly distinguished (Last *et al.* 2010). Some aspects of reproductive biology of the *S. lewini* have been studied (eg. Hazin *et al.* 2001; Duncan 2006; Bejarano-Alvarez *et al.* 2010; Salinas-de-León *et al.* 2017; Marie *et al.* 2019), but it is still lacking in Indonesia and Borneo still (Last *et al.* 2010; Wahyudin *et al.* 2019).

The occurrence of up to 150 inland *S. lewini* of in Mahakam river is unexpected. This record is a first ever known report for *S. lewini* in freshwater habitat. *Sphyrna lewini* and other hammerhead sharks are among the most intriguing yet imperiled groups of large sharks globally that understanding of their ecology, diet, life histories and movements was challenged by a lack of studies (Gallagher & Klimley 2018). Nursery populations of *S. lewini* linked by continuous coastline have high connectivity, but that oceanic dispersal by females is rare (Duncan *et al.* 2006). This species is a cosmopolitan and seasonal marine migratory species where they can move up to 600 to 1.700 km away (Diemer *et al.* 2011; Ketchum *et al.* 2012; Hoyos-Padilla *et al.* 2014), but there is no information on movement to freshwater habitat.

Specimen of *S. lewini* found in Mahakam river is a very young individual based on its small size of c. 40 cm of total length. The present of very young *S. lewini* in Mahakam river indicate this river possibly a nursery area for this species. No information available if *S. lewini* occur in freshwater or tolerate low salinities (Compagno & Niem 1998; Compagno 2002; Compagno *et al.* 2005; Last *et al.* 2010; Ebert *et al.* 2013; Gallagher & Klimley 2018). In Indonesia, recent records of young sharks entering freshwater habitat

have been significantly increase (Iqbal *et al.* 2019a, b, c). The invasion to freshwater habitats has been known independently many times in sharks and other elasmobranchs evolution (Lucifora *et al.* 2015). The reasons why affecting the poor penetration of sharks into freshwater habitat are still unclear, however, an important assumption could be the high urea requirement of many proteins in marine sharks (Ballantyne & Robinson 2010). More information and further research are needed to confirm the status of *S. lewini* in freshwater habitat, particularly in Mahakam river and other parts of Bornean waters. Further study in the future should have address if it is an incidental or a regular movements.

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