

A New Inland Record of the Bull Shark *Carcharhinus leucas* (Müller & Henle 1839) from Peninsular Malaysia

(Suatu Rekod Daratan Baru Jerung Lembu *Carcharhinus leucas* (Müller & Henle 1839) dari Semenanjung Malaysia)

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ABSTRACT

A single specimen of a bull shark *Carcharhinus leucas* (Müller & Henle 1839) with c. 102 cm of total length was landed and photographed on 25 March 2019 in Sungai Mawai Lama, about 25 km inland, Kota Tinggi District, Johor, Peninsular Malaysia. This rare finding represents only the second record of *C. leucas* in inland Peninsular Malaysia. This shark was identified as *C. leucas* by the snout much shorter than the width of mouth and bluntly rounded, first dorsal fin triangular, rearward sloping, originating over or slightly behind pectoral insertion, second dorsal fin much smaller than the first dorsal fin ($< 3.1:1$), and lack of an interdorsal ridge. The coloration of fresh specimen: greyish back and white belly, the dark coloration on the tip of the caudal fins and second dorsal fin. This species is currently listed as a vulnerable species based on the IUCN Red List Status. Further study and monitoring are needed to assess the possibility of the importance of Sungai Mawai Lama as critical habitat of *C. leucas*.

Keywords: Biogeography; Carcharhinidae; elasmobranchs; freshwaters; requiem sharks

ABSTRAK

Satu spesimen tunggal daripada jerung lembu *Carcharhinus leucas* (Müller & Henle 1839) dengan panjang keseluruhan c. 102 cm telah mendarat dan difotograf pada 25 Mac 2019 di Sungai Mawai Lama, kira-kira 25 km ke daratan, Daerah Kota Tinggi, Johor, Semenanjung Malaysia. Penemuan yang jarang berlaku ini merupakan rekod kedua *C. leucas* di pedalaman Semenanjung Malaysia. Jerung ini dikenal pasti sebagai *C. leucas* melalui moncongnya yang jauh lebih pendek daripada lebar mulut dan bulat tumpul, sirip dorsal pertama segitiga, miring ke belakang, bermula dari atas atau sedikit di belakang sisipan sirip pektoral, sirip dorsal kedua jauh lebih kecil daripada sirip dorsal pertama ($< 3.1: 1$) dan kurang sisi intradorsal. Warna spesimen segar: belakang kelabu hitam dan perut putih, warna gelap di hujung sirip kauda dan sirip dorsal kedua. Spesies ini pada masa ini disenaraikan sebagai hampir terancam berdasarkan Status Senarai Merah IUCN. Kajian lanjut dan pemantauan diperlukan untuk menilai kemungkinan pentingnya Sungai Mawai Lama sebagai habitat *C. leucas*.

Kata kunci: Air tawar; biogeografi; Carcharhinidae; elasmobranchia; jerung requiem

INTRODUCTION

Requiem sharks (Carcharhinidae) are one of the largest shark families that is spread in the temperate, subtropical, and tropical waters worldwide (Compagno 1984; Compagno & Niem 1998). Although most species inhabit continental coastal and offshore marine waters, the family includes the only euryhaline shark species (Compagno 2002; Ebert et al. 2013) with a few members that are capable to enter fresh and brackish waters. The bull shark *Carcharhinus leucas* (Müller & Henle 1839) is one of the few requiem sharks that are fully euryhaline

and is a common species that occur in marine and coastal riverine environments including estuaries, rivers, and lakes (Gausmann 2021; Werry et al. 2011).

Southeast Asia comprises many archipelagic states and has rivers that are potential nursery grounds for *C. leucas*, although its rivers are not as big as the major streams of Australia, Africa, America, and mainland Asia (Last et al. 2010). The information about *C. leucas* and its distribution in inland Southeast Asia has increased over the past decades (Boeseman 1964; Kottelat 2013; Iqbal et al. 2019a, 2019b; Hasan & Islam 2020; Hasan & Widodo 2020). However, Peninsular Malaysia is not included in

the inland distribution map of *C. leucas* in many important non-marine elasmobranchs references (Compagno & Niem 1998; Ebert et al. 2013; Last et al. 2010). Thus, records of *C. leucas* from freshwater habitats of Peninsular Malaysia are scarce. It is likely that *C. leucas* had not been considered in these works because euryhaline sharks of Peninsular Malaysia were not been explored enough, especially in the major rivers. There exists a previous record of *C. leucas* from a freshwater environment of Peninsular Malaysia deriving from the Perak River on the west side of this headland (Boeseman 1964; Compagno & Cook 1995; Kottelat 2013). In this paper, we report a further record from Peninsular Malaysia by the presence of *C. leucas* in the Mawai Lama River, Kota Tinggi District, Johor, Peninsular Malaysia, which documents one of the few records from this Peninsular and an extension of the known range for this species in the Southeast Asia Region.

MATERIALS AND METHODS

A single specimen of a sub-adult *C. leucas* with c. 102 cm of total length (Figure 1) was landed and photographed on 25 March 2019 in Sungai Mawai Lama, Kota Tinggi District, Johor, Peninsular Malaysia (1°52'18"N; 103°57'13"E) (Figure 2). Sungai Mawai Lama is tributary to the larger Sungai Sedili Besar which drains into the South China Sea. The site of the capture is in inland Peninsular Malaysia at a freshwater habitat located in c. 25 km distance from the estuary. This specimen was collected by a local fisherman using medium sized hook. Photo material of this specimen was submitted to the first author for examination. Diagnostic morphological characters of the single specimen were analyzed under consideration of the methods by Compagno (1998) and Ebert et al. (2013) (Figure 3).



FIGURE 1. *Carcharhinus leucas*, Sungai Mawai Lama, Kota Tinggi District, Johor, Peninsular Malaysia (Photo: Sungai Mawai Lama)



FIGURE 2. Location of *C. leucas* (yellow square) found in Sungai Mawai Lama, Kota Tinggi District, Johor, Peninsular Malaysia

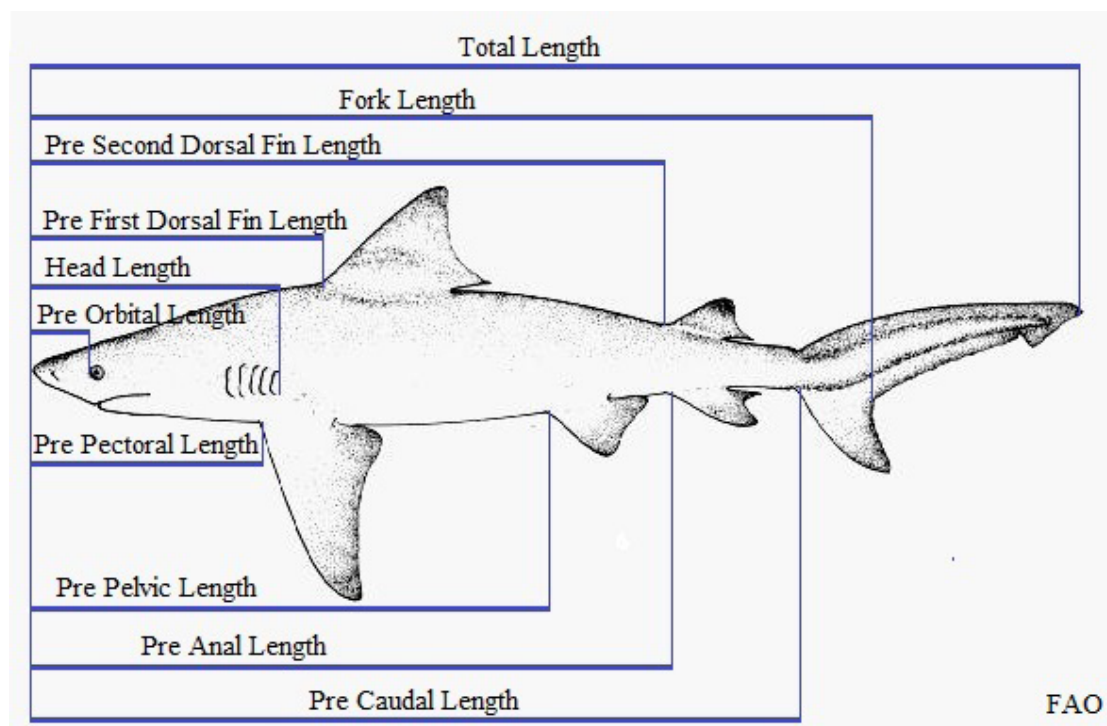


FIGURE 3. Morphometric measurements of *Carcharhinus leucas* according to Compagno (1984) and Ebert et al. (2013)

RESULTS AND DISCUSSION

Morphometric characters of the captured specimen are given in Table 1. The specimen of *C. leucas*, which was found in Sungai Mawai Lama, has a size of 102 cm of TL and displays specific characters of a juvenile individual (Compagno & Niem 1998). The size of a juvenile of *C.*

leucas in Sungai Mawai Lama are harmonizing with other records of juveniles of this species from around the world, including specimens of *C. leucas* from the Indian River Lagoon system in Florida, USA, ranging from 120-180 cm TL (Snelson et al. 1984), and from the Brisbane River, Australia, ranging from 85-130 cm TL (Pillans 2006).

TABLE 1. Morphometric characters of *Carcharhinus leucas*

Characters	Morphometric (cm)
Total length	102
Fork length	87.4
Pre first dorsal length	30.7
Pre second dorsal length	57.3
Head length	26
Pre orbital length	8.2
Pre pectoral length	23.7
Pre pelvic length	53
Pre anal length	66
Pre caudal length	79.3

A single shark specimen that was captured in Sungai Mawai Lama (Peninsular Malaysia) has features of the requiem sharks family: broad and short snout; large, elongated, and arched mouth; small eyes on the side of the head; two dorsal fins: the first dorsal fin was moderately large, much shorter than the caudal fin, and its base is located over the interspace between pectoral and pelvic fin bases; broad pectoral fins, with narrow pointed tips. This shark was identified as *C. leucas* by the snout much shorter than the width of mouth and bluntly rounded, first dorsal fin triangular, rearward sloping, originating over or slightly behind pectoral insertion, second dorsal fin much smaller in height than the first dorsal fin (< 3,1:1), and lack of an interdorsal ridge. The coloration of fresh specimen: greyish back and white belly, the black coloration on the tip of the caudal fins and second dorsal fin. These characters are fitted well to the features of sub-adult *C. leucas* (Compagno et al. 2005; Ebert et al. 2013). The size class of *C. leucas* in Sungai Mawai Lama is similar to further records of subadults and juveniles of this species from other parts of the world, including specimens of *C. leucas* from the Mearim River, Brazil (130 cm of total length) (Feitosa et al. 2016), Nerang River, Australia (94 cm of total length) (Werry et al. 2012), and Batang Hari River, Indonesia (79 cm of total length) (Tan & Lim 1998).

The evidence of *C. leucas* in Sungai Mawai Lama, Kota Tinggi District, Johor, Peninsular Malaysia, represents only the second record of this species in inland Peninsular Malaysia, and only the fifth inland record beyond previous published records from the Southeast Asian region (Indonesia, Borneo Malaysia, Vietnam, and Philippines) (Boesman 1964; Compagno & Cook 1995; Gausmann 2021). Among other biological topics, new records of vulnerable non-marine elasmobranchs is an important contribution to raise an understanding of species diversity and biogeography (Grant et al. 2019; Hasan et al. 2021a). As reported in this paper, the new record of *C. leucas* will contribute to improve the knowledge of the species as it extends the distribution range of the species in the Southeast Asian Region.

The discovery of *C. leucas* in Sungai Mawai Lama indicates that this freshwaters habitat could be a further nursery ground for this species in the Southeast Asian Region. In the future, data collection assisted by local fisherman is needed to assess the occurrence of *C. leucas* and evaluate the importance of Peninsular Malaysia as a habitat and migration route for bull sharks. Unlike rivers on other main islands in Indonesia, rivers in Peninsular Malaysia have many dams as a consequence of intensification of agriculture, so the potential to displace *C. leucas* habitats into settlements is very large

(Werry et al. 2012). Dam buildings represent a potential threat for migrating fish species like bull sharks and may prevent their upstream migration. These intensive human activities greatly affect the life cycle of several amphidromous fish such as freshwater eels and sicydiinae gobies, not only *C. leucas* (Gani et al. 2021; Hasan et al. 2021b). The bull shark is assessed as Vulnerable (VU) on a global scale on the IUCN Red List (Rigby et al. 2021). Simpfendorfer and Burgess (2003) gave the information that the occurrence of *C. leucas* in estuaries and freshwater makes this species very vulnerable to human impact and habitat modification.

Just like any other shark species, *C. leucas* is not the main commodity of fisheries in Malaysia because the species seems to be not very common in these waters. There is no official record of how many *C. leucas* are caught because these fish are not a target species in Malaysia's commercial fisheries. Although *C. leucas* are not normally targeted, they are commonly taken in commercial and recreational fisheries for their fin meat, fins, and oil (Dulvy et al. 2014; Davidson et al. 2016). The Malaysian Government needs to strictly prohibit the practice of catching sharks, including *C. leucas* (Compagno & Cook 1995; Booth et al. 2018). At least, the exploitation of sharks in the Southeast Asian Region should be restricted to a sustainable level.

Although there is no evidence of a nursery ground of *C. leucas* in Sungai Mawai Lama as it is defined by Heupel et al. (2007), the record of an immature specimen of *C. leucas* in this river makes proof that even on Peninsular Malaysia, freshwater habitats are utilized by the bull shark as places for the protected growing of the offspring. The lifetime of juvenile bull sharks in rivers and lakes is an effective strategy to reduce mortality caused by predators and a guarantee for a high percentage of surviving immature individuals (Heupel et al. 2018), and therefore part of the natural life cycle of bull sharks (Simpfendorfer et al. 2005; Werry et al. 2011). Under the consideration of the circumstance that *C. leucas* rely on low salinity habitats for reproduction, the rivers of eastern Peninsular Malaysia should be more deeply investigated regarding the occurrence of freshwater elasmobranchs, due to their potential function as breeding ground for bull sharks.

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