

Blue lines indicate the area meeting the ISRA Criteria; dashed lines indicate the suggested buffer for use in the development of appropriate place-based conservation measures

## INDUS ESTUARY ISRA

### Western Indian Ocean Region

#### SUMMARY

Indus Estuary is located in Pakistan and encompasses the wide Indus River delta in the northeastern Arabian Sea. The area extends from Korangi Creek (Karachi) to the Pakistan-India border and includes the lower reaches of the Indus Delta. The Indus River discharges to the Arabian Sea through an elaborate system of creeks which are partially or totally covered with mangroves mostly consisting of Grey Mangrove *Avicennia marina*. Indus Estuary overlaps with two Ecologically or Biologically Significant Marine Areas, one Key Biodiversity Area, and one Ramsar site (Wetland of International Importance). Within this area there are: **threatened species** (e.g., Ganges Shark *Glyphis gangeticus*); and **reproductive areas** (e.g., Bull Shark *Carcharhinus leucas*).

#### CRITERIA

##### Criterion A - Vulnerability; Sub-criterion C1 - Reproductive Areas

PAKISTAN

0-10 metres

3,073.76 km<sup>2</sup>





## DESCRIPTION OF HABITAT

Indus Estuary is located in Pakistan in the northeastern Arabian Sea. It extends between Korangi Creek in the northwest to the Pakistan/India border in the southeast and includes the lower reaches of the Indus Delta. The Indus Delta is the 5<sup>th</sup> largest delta and 7<sup>th</sup> largest mangrove forest in the world (Ramsar 2023). The Indus River discharges to the Arabian Sea through an elaborate system of creeks which are partially or totally covered with Grey Mangrove *Avicennia marina*. The area has a diversity of habitat types including mudflats, sandflats, and marshes, with a complex system of creeks and channels in the delta.

The area is influenced by the repeated reversal of the monsoon which causes deep convective mixing, especially during the northeast monsoon (February) bringing nutrient-rich water to the surface supporting high productivity in the Arabian Sea (Wiggert et al. 2000; Marra & Barber 2005). For most of the year, the wave action is intense, especially during the southwest monsoon (mid-May to mid-September), however, during the rest of the year the sea conditions remain calm or with moderate wave action. During November and February, the current in the area flows counterclockwise, whereas, during the rest of the year, it is clockwise.

The area overlaps with the Indus Estuarine Area and Associated Creeks Ecologically or Biologically Significant Marine Area (EBSA), the Khori Great Bank EBSA (CBD 2023a, 2023b), the Outer Indus Delta Key Biodiversity Area (KBA) (KBA 2023), and the Indus Delta Ramsar Site (Wetland of International Significance) (Ramsar 2023).

This Important Shark and Ray Area is benthopelagic and is delineated from inshore and surface waters (0 m) to a depth of 10 m based on the bathymetry of the area.

## ISRA CRITERIA

### CRITERION A – VULNERABILITY

Four Qualifying Species considered threatened with extinction according to the IUCN Red List of Threatened Species™ regularly occur in the area. These are the Critically Endangered Ganges Shark (Rigby et al. 2021a) and Scalloped Hammerhead (Rigby et al. 2019), and the Vulnerable Bull Shark (Rigby et al. 2021b) and Brown Numbfish (VanderWright et al. 2021).

### SUB-CRITERION C1 – REPRODUCTIVE AREAS

Indus Estuary is an important reproductive area for three shark and one ray species.

Karachi Fish Harbour falls within the area and is the major fish landing site where fisheries operating in Indus Estuary land their catch. Daily monitoring of landings was undertaken between December 2016 and March 2020 to record catches of sharks (Osmany & Moazzam 2022). Fishers were also interviewed through a collaboration with the Fishermen's Cooperative Society based in Karachi Fish Harbour to ascertain where catches were made (in this case, confirming the Qualifying Species were caught in the area) through the fisher's local ecological knowledge (LEK) (Osmany & Moazzam 2022). The Indus Estuary is the only suitable nearshore habitat for early life-stage Bull Sharks, Ganges Sharks, and Scalloped Hammerheads in Pakistan as this is the principal area of estuarine and mangrove habitat.

Bull Sharks are the most common large demersal shark landed at Karachi Fish Harbour and were observed in 29 of 39 study months (Osmany & Moazzam 2022). Early life-stage (neonates/young-of-the-year) Bull Sharks are primarily a bycatch of coastal gillnet fishing occurring at the mouths of creeks in Indus Estuary (Osmany & Moazzam 2022). Fisher LEK indicated that adult Bull Sharks occur in deeper creeks of the lower parts of the estuary where they stated that the sharks give birth, and that neonate sharks are known throughout the complex estuarine and creek system. Landings at Karachi Fish Harbour have included pregnant females with late-term embryos indicating they were close to giving birth locally (Osmany & Moazzam 2022). Local catch locations of early life-stage Bull Sharks within Indus Estuary include Khobbar Creek and Sajjan Wari (Osmany & Moazzam 2022). LEK revealed that young juvenile Bull Sharks have a specific local name in Sindh ('more') indicating the familiarity that fishers have with the species (Osmany & Moazzam 2022).

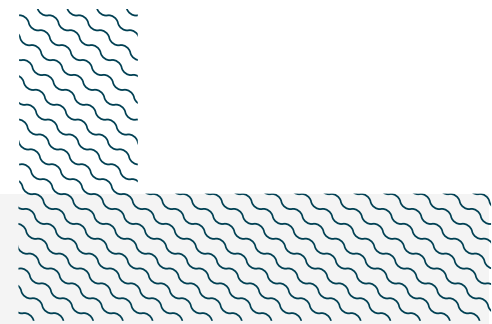
An early life-stage Ganges Shark was landed locally at Keti Bandar in the Indus Estuary at some point during the period 2016–2020. The species was identified as a Bull Shark in Osmany & Moazzam (2022), but re-examination of the photograph revealed that it was an exceptionally rare record of the Ganges Shark. This species is Critically Endangered, appears to be extinct from much of its former range, and contemporary records are exceptionally rare (Jabado et al. 2018). Indus Estuary was well known for the species historically, but contemporary records have been lacking. The recent Indus Estuary record is the: (i) first documented record in Pakistan since 2005; (2) the second record anywhere in the species' historically wide Indo-West Pacific range since 2005; and (3) possibly the first juvenile to be documented in several decades (Jabado et al. 2018). It therefore represents the only contemporary evidence of breeding in a global geographic range that once extended from Pakistan to Borneo (Li et al. 2015).

The individual was photographed on top of two modular floating dock squares which usually have a standard width of 50 cm, suggesting the shark measured ~100 cm TL. Based on ages of the congeneric Speartooth Shark *Glyphis glyphis* which grows to a similar size, has very similar morphology, and inhabits similar habitats, this would put the Indus Estuary animal at ~3 years of age (Kyne et al. 2022). Age-at-maturity in Speartooth Shark is not until >11 years (Kyne et al. 2022) suggesting that the Indus Estuary Ganges Shark is at a young age relative to maturity. While only a single record, evidence of a remnant breeding population of this species persisting is of immense importance globally.

Early life-stage Scalloped Hammerheads are frequently found in nearshore environments of Indus Estuary (Moazzam & Osmany 2022). Monitoring of landings indicate that most specimens are in the size range 65–85 cm total length (TL) (Moazzam & Osmany 2022). Size-at-birth is 38–56 cm TL (Ebert et al. 2021) highlighting the predominance of early life-stages in Indus Estuary. Monitored landings at Karachi Fish Harbour have also included pregnant females with late-term embryos (44–47 cm TL; April and June) indicating they were close to giving birth locally (Moazzam & Osmany 2022). Apart from Indus Estuary, there is a lack of suitable nursery ground habitat for the species in eastern Pakistan where the habitat is dominated by drier coastlines lacking mangroves and significant estuaries. The importance of Indus Estuary for the species is further supported by knowledge of the ecological requirements of the species at early life-stages, in particular, the species' specific habit of using estuaries and mangroves as nursery grounds (e.g., Duncan & Holland 2006; Yates et al. 2015).

Catch monitoring of benthic-set gillnets operating in the lower reaches of the area during 2021–2022 documented pregnant and neonate Brown Numbfish (M Moazzam et al. unpubl. data 2021–2022). Pregnant females of 17.1–28.7 cm TL (n = 63 in 2021; n = 41 in 2022) were observed in the lower reaches of the area during the boreal summer months (July to September). Pregnant females contained two embryos except for three individuals which carried three embryos each (M Moazzam et al. unpubl. data 2021–2022). Pupping takes place in late October and November and juveniles are frequently caught between December and April. Measured neonates (n = 119) ranged in size 5.2–6.2 cm TL (M

Moazzam et al. unpubl. data 2021–2022) which aligns with the reported size-at-birth of ~6 cm TL (Last et al. 2016).



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Muhammad Moazzam Khan (WWF-Pakistan) and Peter M Kyne (IUCN SSC Shark Specialist Group - ISRA Project) contributed and consolidated information included in this factsheet. We thank all participants of the 2023 ISRA Region 7 - Western Indian Ocean workshop for their contributions to this process.

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### **Suggested citation**

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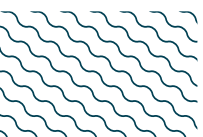
## QUALIFYING SPECIES

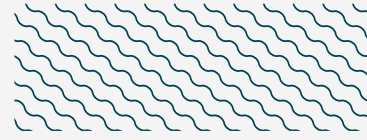
Scientific Name	Common Name	IUCN Red List Category	Global Depth Range (m)	ISRA Criteria/Sub-criteria Met									
				A	B	C1	C2	C3	C4	C5	D1	D2	
<b>SHARKS</b>													
<i>Carcharhinus leucas</i>	Bull Shark	VU	0-256	X		X							
<i>Glyphis gangeticus</i>	Ganges Shark	CR	0-50	X		X							
<i>Sphyrna lewini</i>	Scalloped Hammerhead	CR	0-1,043	X		X							
<b>RAYs</b>													
<i>Narcine timali</i>	Brown Numbfish	VU	5-50	X		X							

## SUPPORTING SPECIES

Scientific Name	Common Name	IUCN Red List Category
<b>RAYS</b>		
<i>Maculabatis arabica</i>	Pakistan Whipray	CR
<i>Maculabatis bineeshi</i>	Shorttail Whipray	CR
<i>Maculabatis randalli</i>	Arabian Banded Whipray	LC
<i>Pristis pristis</i>	Large-tooth Sawfish	CR
<i>Pristis zijsron</i>	Green Sawfish	CR

*IUCN Red List of Threatened Species Categories are available by searching species names at [www.iucnredlist.org](http://www.iucnredlist.org). Abbreviations refer to: CR, Critically Endangered; EN, Endangered; VU, Vulnerable; NT, Near Threatened; LC, Least Concern; DD, Data Deficient.*





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