

and the Fisheries Department of Maharashtra started a compensation scheme in December 2018, under which fishers who cut or otherwise damage their fishing gear to release a marine animal protected under WPA 1972 were given monetary compensation. Several awareness and outreach workshops were carried out in the coastal districts of Maharashtra by the Mangrove Cell to popularise the said scheme and to build a network of fishers to collect secondary data of endangered marine animals. Subsequently, this record of a leatherback sea turtle was shared by a fisher based in Bharadkhol (18.15° N, 72.83° E), a small coastal village in the Raigad district. The turtle was caught in a gill net on 25th May 2018 and was released back to the sea safely by fishers cutting the net. This is the first photographic record (Figure 1) of a leatherback sea turtle from Maharashtra. Using ImageJ software, the estimated length of the turtle was ~1.2m.

More needs to be known about the occurrence of leatherback sea turtles off the Maharashtra coastline, and could be gathered from similar reports from fishers or a research study.

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Literature cited:

- Anil, M.K., H.J. Kingsly, B. Raju, K.K. Suresh & R.M. George. 2009. Note on the leatherback turtle *Dermochelys coriacea* (Vandelli, 1761) rescued at Vizhinjam, Kerala. *Marine Fisheries Information Service, Technical and Extension Series* 200: 23.
- Dodge, K.L., J.M. Logan & M.E. Lutcavage. 2011. Foraging ecology of leatherback sea turtles in the Western North Atlantic determined through multi-tissue stable isotope analyses. *Marine Biology* 158: 2813-2824.
- Giri, V. 2001. Survey of marine turtles along the coast of Maharashtra and Goa. *Kachhapa* 4: 16-18.
- Hatkar, P., D. Vinhenkar & D. Kansara. 2019. Rescue and rehabilitation of loggerhead sea turtles *Caretta caretta* from Dahanu Coast, Maharashtra, India. *Marine Turtle Newsletter* 156: 26-29.
- Karbhari, J.P. 1985. Leatherback turtle caught off Devbag near Malvan. *Marine Fisheries Information Service, Technical and Extension Series* 64: 23.
- Sanaye, S.V. & H.B. Pawar. 2009. Sea turtle conservation in Sindhudurg district of Maharashtra. *Indian Ocean Turtle Newsletter* 9: 3-4.
- Shanker, K. 2004. Marine turtle status and conservation in the Indian Ocean. *FAO Fisheries Report* 738: 85-134.
- Wallace, B.P., M. Tiwari & M. Girondot. 2013. *Dermochelys coriacea*. *The IUCN Red List of Threatened Species* 2013: e.T6494A43526147. <https://dx.doi.org/10.2305/IUCN.UK.2013-2.RLTS.T6494A43526147.en>. Accessed on April 19, 2020.

SILKY SHARK FEEDING ON A JUVENILE GREEN TURTLE IN OFFSHORE WATERS OF PAKISTAN, NORTHERN ARABIAN SEA

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Turtles play an important role in coastal and offshore ecosystems as they feed on organisms such as jellyfish, crustaceans, mollusks, and seaweed (Bjorndal, 1997). They, on the other hand, are preyed upon by a number of animals and form an important part of their diet (Hirth, 1971; Stancyk, 1981; Witzell, 1987). Sharks are among the major predators of sea turtles (Cabrera-Chavez-Costa *et al.*, 2010; Hammerschlag *et al.*, 2015; Estupiñán-Montaño *et al.*, 2018). For example, Heithaus

(2001) and Simpfendorfer *et al.* (2001) found that turtles are an important component in the diet of tiger sharks (*Galeocerdo cuvier*). However, less information has been published on the diet or feeding habits of the silky shark (*Carcharius falciformis*). Cabrera-Chavez-Costa *et al.* (2010) reported that silky sharks in the Gulf of Mexico (Atlantic Ocean) mainly preyed on teleost fish and in the Gulf of Tehuantepec (Pacific Ocean) on the crab *Portunus xanthusii affinis*. Galvan *et al.* (1989)

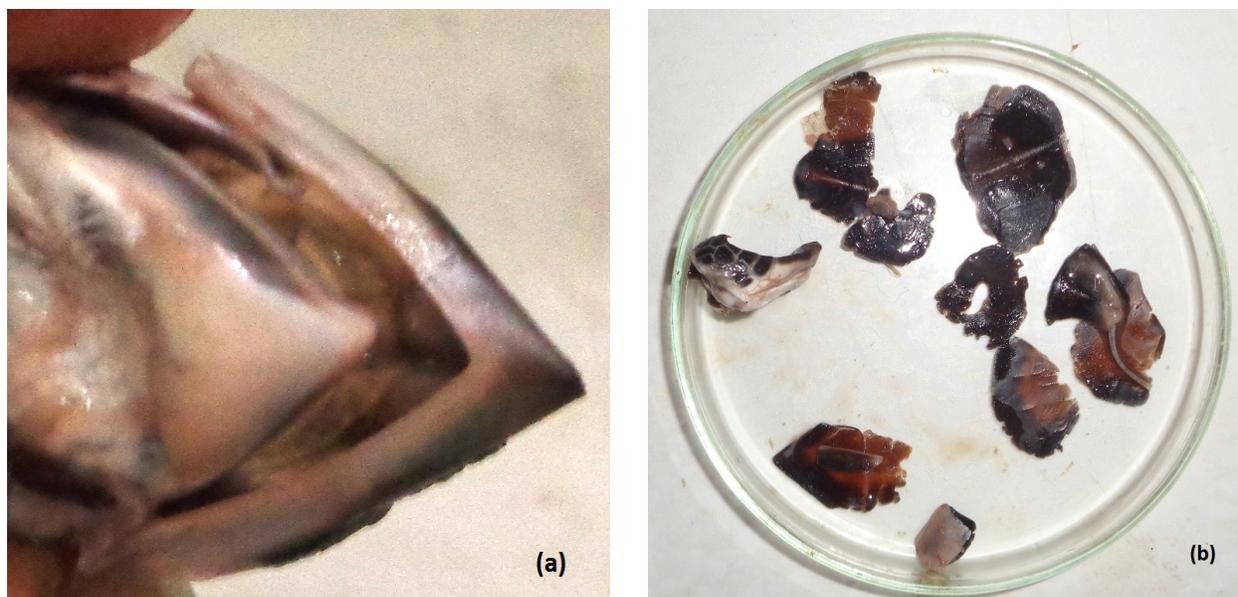


Figure 1. Stomach contents of silky shark (*Carcharhinus falciformis*) showing pieces of green turtle (*Chelonia mydas*) (a) part of head (b) pieces of turtle body.

found that silky sharks from the Gulf of California mainly fed on the red crab (*Pleuroncodes planipes*) and to a lesser extent on fish and benthic crustaceans in Baja California. This paper describes an observation of a silky shark feeding on a juvenile green turtle (*Chelonia mydas*) in Pakistan (Northern Arabian Sea).

Fishers caught a 1.35m long female silky shark on the 1st January 2017, approximately 65km south of Ormara, Balochistan. The authors observed the shark in the Karachi Fish Harbour on the 4th January and found its distended stomach to be of interest. The authors dissected the specimen, removed the stomach, and took it to a laboratory at the Marine Fisheries Department, Karachi.

Eight undigested fragments (Figure 1) of tissue and carapace of what appeared to be an individual juvenile green turtle were found. No other material was present in the stomach, and the remainder of the turtle may have been lost or eaten by another carnivore. The flesh and carapace scutes of the juvenile green turtle had retained their original colour, suggesting that the digestion process was in an early stage. The upper and lower jaws of the turtle were intact and measured 2.2cm in length (Figure 1). Based on the relationship between body length and mouth width from other silky shark specimens, the shark mouth was estimated as 10.7cm wide. These measurements indicate that the 1.35m long silky shark would not have been able to swallow the green turtle in a single gulp. The eight fragments indicate that the shark must have ingested the turtle in multiple bites during a series of lunges.

The silky shark was caught in the offshore waters of

Pakistan (Northern Arabian Sea) where the water depth was ~700m. Small green turtles probably inhabit these waters during the oceanic juvenile stage of their life cycle (Bolten, 2003). The capture site was ~65km south of Ormara, a green turtle nesting beach (Groombridge, 1989), so there is the potential for interactions between silky sharks and breeding turtles, hatchlings, and/or turtles of other life stages feeding in the Arabian Sea. Since this report is based on a single observation of a silky shark feeding on a juvenile green turtle, we recommend closer inspection of other shark specimens at harbours to increase the understanding of shark predation and other in-water threats to turtles at different life stages and in different habitats.

Literature cited:

Bjorndal, K.A. 1997. Foraging ecology and nutrition of sea turtles. In: *The Biology of Sea Turtles Volume I* (eds. Lutz, P.L. & J.A. Musick). Pp. 199-231. CRC Press: Boca Raton FL, USA.

Bolten, A.B. 2003. Variation in sea turtle life history pattern: Neritic vs. oceanic developmental stages. In: *The Biology of Sea Turtles Volume I* (eds. Lutz, P.L., J.A. Musick & J. Wyneken). Pp. 243-257. CRC Press: Boca Raton FL, USA.

Cabrera-Chavez-Costa, A.A., F. Galvan-Magana & O. Escobar-Sanchez. 2010. Food habits of the silky shark *Carcharhinus falciformis* (Muller & Henle, 1839) off the western coast of Baja California Sur, Mexico. *Journal of Applied Ichthyology* 26: 499-503.

Estupiñán-Montaño, C., F. Pacheco-Triviño, L.G. Cedeño-Figueroa, F. Galván-Magaña & J.F. Estupiñán-Ortiz. 2018. Diet of three shark species in the Ecuadorian Pacific, *Carcharhinus*

- falciformis*, *Carcharhinus limbatus* and *Nasolamia velox*. *Journal of Marine Biological Association of the United Kingdom* 98: 927-935.
- Galvan, F., H. Nienhuis and P. Klimley. 1989. Seasonal abundance and feeding habits of sharks of the lower Gulf of California, Mexico. *California Fish and Game* 75: 74-84.
- Groombridge, B. 1989. Aerial survey of the Baluchistan coast (Pakistan). *Marine Turtle Newsletter* 46: 6-9.
- Hammerschlag, N., A.C. Broderick, J.W. Coker, M.S. Coyne, M. Dodd, M.G. Frick *et al.* 2015. Evaluating the landscape of fear between apex predatory sharks and mobile sea turtles across a large dynamic seascape. *Ecology* 96: 2117-2126.
- Heithaus, M.R. 2001. The biology of tiger sharks, *Galeocerdo cuvier*, in Shark Bay, Western Australia: Sex ratio, size distribution, diet, and seasonal changes in catch rates. *Environmental Biology of Fishes* 61: 25-36.
- Hirth, H.F. 1971. Synopsis of biological data on the green turtle, *Chelonia mydas* (Linnaeus) 1758. FAO Fisheries Synopsis No. 85. <http://www.fao.org/publications/card/en/c/b70844c8-f438-5e01-a6cf-1ddc76d88384>. Accessed on May 9, 2020.
- Simpfendorfer, C.A., A.B. Goodreid & R.B. McAuley. 2001. Size, sex and geographic variation in the diet of the tiger shark, *Galeocerdo cuvier*, from Western Australian waters. *Environmental Biology of Fishes* 61: 37-46.
- Stancyk, S.E. 1981. Nonhuman predators of sea turtles and their control. In: *Biology and Conservation of Sea Turtles* (ed. Bjorndal, K.A.). Pp. 139-152. Smithsonian Institution Press: Washington DC, USA.
- Witzell, W.N. 1987. Selective predation on large cheloniid sea turtles by tiger sharks (*Galeocerdo cuvier*). *Japanese Journal of Herpetology* 12: 22-29.