

After two decades: extremely rare records of dugongs, *Dugong dugon* (Sirenia: Dugongidae), in the Iranian Persian Gulf

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Abstract

The world's second-largest dugong, *Dugong dugon* (Müller), population after that of Australia forages among rich seagrass meadows along the Arabian coast of the Persian Gulf; however, the relatively seagrass-poor Iranian coast is considered an exceptional habitat for the species. The last modern dugong records along the Iranian Persian Gulf occurred two decades ago, which, however, are unsupported. Here we present two new documented records of *D. dugon* from an area in the Iranian coastal waters of Bushehr Province, near the Mond River estuary (Mond Protected Area), northeastern Persian Gulf. These include one individual, probably female, of ca. 2.5–3 m body length found floating, in moderate decomposition, in offshore waters of the Motaf fishing ground on 30 April 2021, and one ca. 3 m female encountered entangled in a set gillnet in inshore waters of the same area on 29 December 2022, and which was successfully released alive. The potential of the area as a possible historical habitat for dugongs, and further implications, are discussed.

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The dugong, *Dugong dugon* (Müller, 1776), is one of the four living sea cow species (Order Sirenia), and the only species of the family Dugongidae (Jefferson et al., 2008). It is distributed along shallow (up to about 40 meters) tropical and subtropical Indo-Pacific waters (Jefferson et al., 2008) (Marsh and Soltzick, 2019). In 1982, the species was categorized for the first time as Vulnerable on the IUCN Red List of Threatened Species, and despite all conservation efforts, presently remains in this category (Marsh and Soltzick, 2019). *Dugong dugon* is also currently listed in Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES; Marsh and Soltzick, 2019).

Based on surveys conducted by Preen (2004) at the end of the twentieth century between 1986 and 1999, the Persian Gulf hosts the world's second-largest dugong population (an estimation of 6,000 individuals) after that of Australia and is known as the most important habitat for the species in the western half of its distribution range (Preen, 2004; Preen et al., 2012). Persian Gulf dugongs are aggregated along the Arabian coast of the sea, mainly in three aggregation centers including near Murawah Island of the United Arab Emirates (UAE); in northwestern Qatar from the Zekreet Peninsula and the Hawar Islands to Ras Ushayriq and offshore to Fasht Adhm (Bahrain); and in the coastal region of Saudi Arabia between the UAE and Qatar (Fig. 1; Marsh et al., 2002; Preen, 2004).



Figure 1: The map shows two present confirmed records of the dugong *Dugong dugon* along the Iranian coastline (red circles), previous unsupported modern records (yellow circles; Green, 2000; Keijl and van der Have, 2002; Firouz, 2005), and historical (before 1950) records (green circles; Al-Abdulrazzak and Pauly, 2017). Non-filled large blue circles show the concentration areas for *D. dugon* along the Arabian coastline of the Persian Gulf (Marsh et al., 2002; Preen, 2004). Green areas represent known seagrass beds and green cross-hatched areas represent a possible presence of seagrass beds (Naderloo et al., 2023).

Conversely, the Iranian coast of the Persian Gulf is thought not to be inhabited by dugongs (Preen, 2004; Braulik et al., 2010). This may be because seagrasses (Order Alismatales), which dugongs exclusively depend on for food (Jefferson et al., 2008), are not distributed uniformly across the sea (Erfemeijer and Shuail, 2012). While the shallow waters of the Arabian coast of the Persian Gulf accommodate rich seagrass meadows (e.g., UAE waters host more than 80% of all known Gulf seagrass beds), seagrasses are sparse and patchy along the usually deeper Iranian coast of the sea (Erfemeijer and Shuail, 2012); moreover, they are poorly documented (Naderloo et al., 2023). This discontinuous seagrass distribution leads to large marine herbivores of the Persian Gulf (i.e., *D. dugon*, and sub-adult and adult individuals of the green turtle, *Chelonia mydas* Linnaeus) being aggregated in the lush seagrass meadows of the Arabian coast, while the Iranian waters are mostly inhabited by smaller grazers, i.e., mainly juvenile individuals of *C. mydas* (Rezaie-Atagholipour et al., 2021).

After more than two decades without any records, this study presents two confirmed new cases of *D. dugon* along the Iranian waters of the Persian Gulf (Fig. 1). The first case (Fig. 2) involved a dead specimen in moderate decomposition with a body length estimated at 2.5–3 m, probably female, as determined from the posterior position of the ruptured anogenital area (Geraci and Lounsbury, 2005). The individual floated at the surface and was

seen by an anonymous boater on 30 April 2021 in Motaf waters, one of the most important fishing grounds of Iran, on the coast of Bushehr Province, northern Persian Gulf (Fig. 1). The observer could not be located, and the known information about the animal is derived from a short video posted on Instagram (@oceanairan; see Fig. 2). However, the date and approximate position (27°50' N, 51°27' E) were estimated through direct talks (by H. A.) with local fishers in nearby villages.

The second record (Fig. 3) was of a 3 m female individual of *D. dugon* entangled in a set gillnet in inshore water of the same area (i.e., the beach of Banak, a small city in the central district of Kangan County; 27°50'22'' N, 51°59'47'' E; Fig. 1). In this case, details were obtained by directly interviewing the recreational fishers (see Acknowledgements) who observed and filmed the animal. The location is a sandy shore near a planted mangrove stand and some shrimp farms and fish cages. On 29 December 2022, the fishers deployed a 300 m set gillnet (mesh size 6 cm), with one end fixed on the shore and the other end anchored 150 m seaward, which targeted barramundis, *Lates calcarifer* (Bloch), which are not native but escape from fish cages. After a few minutes, the fishers realized something heavy entangled in the net; they immediately retrieved the net and untangled the dugong by cutting the net, then waited two hours for high tide to rise before releasing the animal into the sea.



Figure 2: Dugong *Dugong dugon* carcass found floating in Motaf waters of the Persian Gulf, southern Iran, on 30 April 2021: (a) Head and pectoral fin; (b) Ruptured anogenital area with a conspicuously posteriad position suggestive of a female.

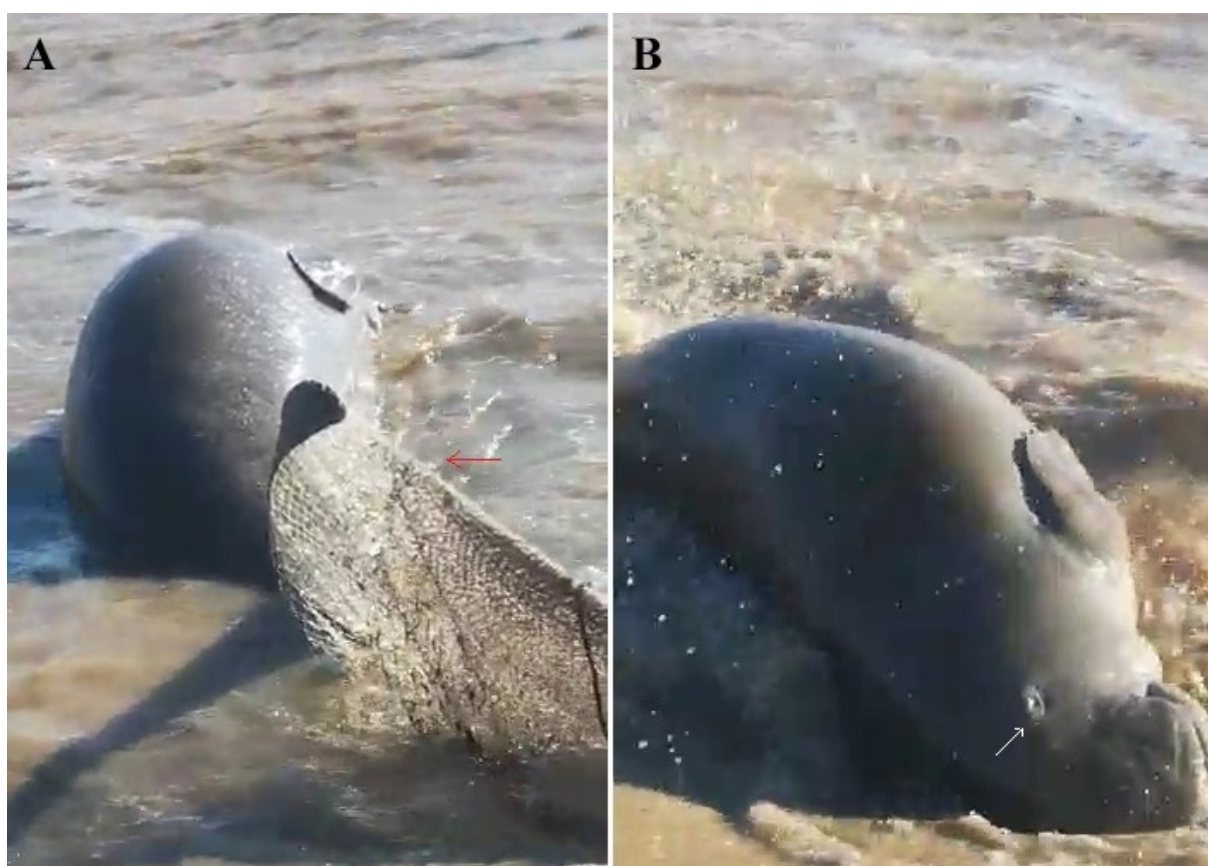


Figure 3: Live dugong *Dugong dugon* struggling to shed small-mesh gillnet at Banak, Kangan County on 29 December 2022: (a) Entangled tail flukes in the gillnet (red arrow); (b) Head and anterior body. Note left eye (white arrow).

To the best of our knowledge, except for the two described cases above, there are just a few modern records of *D. dugon* along the Iranian coastal waters (Fig. 1). Firouz (2005) mentioned that dugongs were seen in the Mond River estuary, which is close to our study area (~100 km; Fig. 1); in Hara Biosphere Reserve (HBR), the largest mangrove forest of the Persian Gulf (area ~900 km²), situated at the channel between Qeshm Island and the Iranian mainland at the Strait of Hormuz; and in Gwater at the eastern Iranian coast of the Gulf of Oman near the Pakistan border (Fig. 1). However, all these statements are unsupported (i.e., no photo nor video) and undocumented (e.g., number of sightings, date, exact location, description unavailable). Keijl and van der Have (2002) reported an individual of *D. dugon* briefly seen on 29 January 2000 and Green (2000) reported a sighting of three individuals on 1 November 2000, in HBR. Unfortunately, none of these authors presented any supporting materials for their sightings. It raises the suspicion that perhaps some of the sightings may have been opportunistic, made by non-scientists, and could have confused the Indo-Pacific finless porpoise, *Neophocaena phocaenoides* (G. Cuvier), common in HBR, with *D. dugon*. *Neophocaena phocaenoides* is widely distributed in the Persian Gulf, including in the shallow Iranian waters (Baldwin et al., 1999; Braulik et al., 2010), and due to their gray color and lack of dorsal fin, are most likely to be confused with *D. dugon* where their habitats overlap in shallow tropical Indo-Pacific waters (Jefferson et al., 2008).

The area of our new records contains some of the few seagrass beds distributed along southern Iranian waters (Fig. 1; Naderloo et al., 2023). Nonetheless, there is no evidence that these two animals were accidental vagrants in Iranian waters. They may be part of a remnant, autochthonous Iranian population, or may have migrated to these seagrass beds from the southern coast of the Persian Gulf in search of new habitats, perhaps to reclaim historical feeding grounds in case a single Gulf population exists. Either hypothesis seems possible because the Iranian coast of the Persian Gulf used to be part of a historical distribution range of *D. dugon*, and the locality of one early dugong record (before 1950) exactly overlapped with our records area (Fig. 1; Al-Abdulrazzak and Pauly, 2017). However, molecular genetics research will be required to unravel the population identity issue.

Despite their unhurried nature, sirenians can undertake long-distance journeys, usually repeatedly, in the form of round-trip seasonal migrations, but sometimes independent of seasonal patterns (Deutsch et al., 2022). Due to their limited thermoregulatory physiology for coping with “cold” waters (i.e., below ~18 °C), Preen (2004) suggested that low water temperatures during winter could be a limitation for

dugongs to reside in Iranian waters of the Persian Gulf. Nonetheless, if significant modern climate change persists, it could impact sirenians in different ways, including changing their movement behavior (Deutsch et al., 2022; Marsh et al. 2022). Therefore, because habitat degradation has already posed a threat to Persian Gulf dugongs (Marshall et al., 2018), and sea surface temperatures across the sea have risen recently (Beni et al., 2021), it would not be surprising if the movement behavior of *D. dugon* in the Gulf changes.

In order to provide a better insight into the movement patterns of threatened marine wildlife along Iranian national waters, monitoring programs need to be developed across national waters, especially involving citizen science (e.g., Mwangi’mbi et al., 2021). For this purpose, local fishers are a putative option. From an animal welfare and conservation point of view, the second case of *D. dugon* in this study was highly indicative of positive changes in local fishermen’s attitudes. After the fishers realized they had caught a rare animal, they cut and sacrificed their fishing net and spent two hours on the beach to release the animal safely to the sea without injuries. There are several other examples of Iranian fishers releasing threatened species (e.g., marine turtles, small cetaceans) entangled in fishing nets, which have been posted on social media (e.g., Instagram). However, in most cases, evidently due to ignorance, fishers did not do this safely, e.g., causing additional stress to a dolphin by inappropriate handling, including hugging it before releasing or damaging a turtle carapace by removing epibiotic barnacles using a sharp knife (Rezaie-Atagholipour, personal observations), which appear to be an educational failure. Evidently, while there has been progress, vast environmental and animal welfare education efforts are still necessary to guide coastal native people on how to safely handle and release marine mammals and sea turtles and avoid adverse treatment.

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Author contributions

MAT, MRA, MAH, and KVV conceived the study. MRA wrote the initial version of the manuscript and provided the distribution map. KVV reviewed the manuscript and analyzed the photos and videos of the animals. EA and HAA collected information for the first record. MAT, HAA, MAH, and FA collected information for the second record. All authors read and approved the final version of the manuscript.

Conflict of interest

The authors declare that there is no conflicting issue related to this short communication.

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