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Are dugongs, *Dugong dugon*, in the Arabian Gulf safe?

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In 1986, a survey conducted by the Saudi Arabian Meteorological and Environmental Protection Administration (MEPA) established an estimated population of dugongs in the Arabian Gulf of 7307 ± 1302 S.E. (Preen, 1989). Larger numbers are known only from Australia (Preen, 1989). The MEPA report concluded that the Arabian Gulf must be viewed as the most important dugong habitat in the western half of the dugong's range. The occurrence of accidental net capture and direct hunting of dugongs was noted during the survey and the issue was included in management recommendations for the conservation of dugongs in the area. However, no attempt was made at estimating the impact of fisheries on dugongs. During this survey, which included a large portion of the coast of the United Arab Emirates (UAE), a total of 24 dugong carcasses was recorded.

Formerly, dugongs of the Arabian Gulf were hunted for their meat, considered a delicacy in many parts of the region, but this practice has been outlawed in the UAE in recent years. No evidence of the continuing practice was found. However, it is unlikely that any dugongs found alive in nets are released, as dugong meat is still prized and eaten or sold. The number of animals caught by direct hunting methods has never been documented, but it is likely that incidental net captures equal or exceed this number. Increasing gill net fisheries and the market for shark fins may be leading causes of dugong mortality.

On 11 and 12 March 1995, the islands of Murawah and Fiyyah, off the coast of the UAE, approximately 150 kilometres west of Abu Dhabi, were surveyed by boat, four-wheel-drive vehicles and on foot. The larger of the two islands, Murawah, is approximately ten kilometres in length by two kilometres wide. Fiyyah is less than one quarter this size. A small fibreglass boat was used to reach the islands. Selected beaches and fishing villages were searched for dugong remains, in the latter instance, contained in the accumulated remains of fishermen's catch.

In two days of searching, the remains of a total of 28 dugongs were found in, or in close proximity to, four fishing villages. Five of the 28 dugongs found were judged to have died more than two years previously and were excluded from any mortality estimates (cf. below). Estimates of the age of the remains were based upon the amount of weathering of bone and skin; for example, not one of the bones included in the calculations showed signs of degradation and many still had tissue attached. Older bones, judged to be more than two years of age, showed clearly the weathering effects of the intense sun and heat. Remains discovered included several complete skeletons, bones and fragments of bone, dried skin, dried tails and drying meat. Despite this, the number of dugongs was estimated based only on the number of pairs of lower jaws discovered and can, therefore, be considered a conservative estimate.

Relatively few large tusks were found and many adult skulls retained small tusks, indicating that females constituted the majority of dead animals. Information obtained from interviews with local fishermen also suggested that females were caught most often. Fishermen apparently value the tusks of the males. One almost complete skull of a male dugong, estimated to have died no more than two weeks previously, retained the left tusk, though the right had clearly been removed. At least five other skulls had both tusks removed. Though most remains were of adult animals, skeletal remains of three very young animals were also found. Measurements of the complete skeletons of two of these suggested that the animals were approximately one metre in length, while the third animal was probably less than one metre.

There was no indication of the exact cause of death in any instance, other than the fact that most animals were found in fish dumps along with a catch of numerous sharks, batoids and other fishes, turtles and cetaceans. Interviews with local fishermen suggested that all dugongs were accidentally caught in fishing nets, most often 14–18 centimetre gill nets, sometimes 60 metres or more in length, set for 'kingfish' and sharks. In the majority of cases, the dugong remains were charred, the burning clearly limited to the remains of dugongs and

turtles, and may have been an attempt to hide the evidence. Drying meat, no more than two weeks old, and barrels of what appeared to be dugong oil, were found at two sites. The meat was suspended and drying in strips, alongside shark fins. Anecdotal evidence obtained from an interview with fishermen on Murawah Island suggested that dry dugong meat can be sold to neighbouring villages, or in fish markets, for the equivalent of US$7.5 per kilogram. An entire, freshly caught dugong apparently sells for US$210. This is comparable to figures quoted by MEPA that vary between US$0.30 and US$2.70 per kilogram (Preen, 1989).

Little is known of population dynamics of unexploited dugong populations, though the reproductive biology of the species indicates that, as for other long lived and slow reproducing large mammals, adult female and calf moralities need to be low for population maintenance (Marsh *et al*., 1984). However, if the reproductive rates of dugongs are similar to those of cetaceans of similar life history, then even annual mortality rates of a little as 2% may not be sustainable (Anon, 1994). Yet, the estimated annual dugong mortality in only four fishing villages of the UAE approximates 0.16% (11.5 of 7000) of the total number of dugongs estimated to inhabit the Arabian Gulf (Preen, 1989). Assuming that catch levels of dugongs at other fishing villages in the Gulf are similar to those surveyed, then the catches by fishermen at as few as 50 villages would be unsustainable. Though the number of fishing villages in the Arabian Gulf is unknown and the catches of these 'artisanal' fishermen unrecorded, the extent of the catch in the UAE alone is cause for concern, especially since: the estimated number of dugongs harvested annually is conservative; fishermen obviously attempt to hide evidence of dugong catches; female dugongs appear to account for the majority of those harvested. However, the islands surveyed are located within an area of high dugong density (Preen, 1989) and, as a result, catches of dugongs in this area may be higher than in others.

Nevertheless, studies on the distribution and status of dugongs in the waters of the Arabian Gulf, especially those in previously identified 'high density' areas, are needed. These should include mapping and assessment of dugong habitat and the study of dugong movements and behaviour. Particular attention should be given to the impact of fisheries activities on dugongs and the formulation of coastal zone management recommendations with reference to dugongs.

An awareness campaign highlighting the conservation requirements of dugongs in the region has already begun in the hope of attracting the attention of both local and international support for essential research and management oriented action. Skin and muscle samples for genetic analyses have been collected for comparison with animals in Australia and, pending results, from samples taken in southern and East Africa. Hopefully, comparative analyses may provide insight into the world-wide taxonomic status of dugongs.

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