Survival prospects and conservation needs of the dugong in Sri Lanka

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ABSTRACT
Sri Lanka is a northern Indian Ocean island where the dugong (*Dugong dugon*) was once common in the Gulf of Mannar off the northwestern coast. While this population has declined due to excessive hunting and accidental bycatch, its recent status was unknown, due to a dearth of studies during the past three decades. An interview survey was undertaken in areas of previous dugong occurrence to fill this knowledge gap. The survey determined the continued presence of the dugong in these waters despite a drastic decline in numbers. Local fishing communities were knowledgeable about dugong occurrence, life history, threats and population decline. Despite the dugong being legally protected in Sri Lanka, the remaining population continues to be illegally hunted due to inadequate implementation and enforcement of existing legislation. The problem is exacerbated by the existence of a demand driven market for dugong flesh which is considered a delicacy among the human population. Therefore this already depleted dugong population continues to be threatened with local extirpation if immediate conservation measures are not initiated. Given the impoverished socio-economic circumstances of local fishing communities, innovative community-based conservation approaches are needed and recommended in order to ensure the long-term survival of this dugong population.

KEYWORDS: *Dugong dugon*, occurrence, threats, conservation, Sri Lanka

INTRODUCTION

The dugong (*Dugong dugon*) is the only extant aquatic herbivore of the Order Sirenia, inhabiting tropical and subtropical waters of the Indo-Pacific. Throughout most of its range, available knowledge on the species is based on incidental sightings, accidental catches and anecdotal reports. Habitat is fragmented and dugong populations are dwindling in many parts of their range but the degree of loss is unknown (Marsh *et al.,* 2002). Based on declining numbers, shrinking area of occurrence, degrading habitat quality and effects of human exploitation, the IUCN Red List of Threatened Species (Hilton-Taylor, 2000) classifies the dugong as vulnerable on a global scale.

Sri Lanka is a 62,000km^2 island located at N 5° 55´ - 9° 50´ N; E 79° 42´ - 81° 53 in the northern Indian Ocean (Figure 1). Dugongs were abundant in the Palk Strait and Gulf of Mannar areas off the north/northwest coast of the island in historical times (Haley, 1883; Phillips, 1927). It is documented that in the district of Mannar alone, fishermen captured 265 dugongs in 1958/1959 (Norris, 1960). Although dugongs were occasionally caught off the east coast in the distant past there are no recent records (Bertram and Bertram, 1970). Presently the remaining population is believed to occur in the Gulf of Mannar from Adam's Bridge south towards the Puttalam lagoon (Figure 1) and around associated islets off the northwest coast (Ilangakoon *et al.,* 2004). The extensive shallow coastal waters in this area still support some seagrass beds suitable as feeding grounds for the dugong (Marsh *et al.,* 2002).

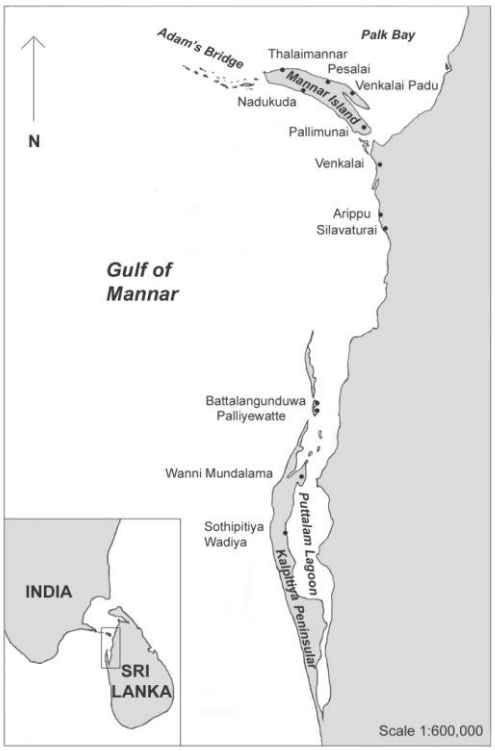

Fig. 1 Study area of dugong survey

Sri Lanka's northwestern waters are highly productive fishing grounds and as such, are under intensive fishing pressure. Extensive use of gillnets in this area result in accidental bycatch of dugongs. Dugong flesh has been considered a delicacy among local populations since time immemorial, creating a demand driven market which leads to deliberate hunting. Organized hunting ceased after the dugong was legally protected under the Fauna and Flora Protection Ordinance of Sri Lanka in 1970, but illegal hunting continues. Destructive fishing practices prevalent in some areas pose a threat to the continued survival of the dugong and its habitat, while more recently the Sethu Samudram ship canal to be constructed off the Tamil Nadu coast of India involves large scale dredging of the seabed between India and Sri Lanka and could cause fragmentation of the remaining dugong habitats in the Gulf of Mannar.

No comprehensive surveys have been carried out on the remaining dugong population off Sri Lanka in the past three decades due to an ethnic conflict which prevailed in the north of the island, and made the area inaccessible to researchers. The most recent studies in the early 1980's, were limited to brief aerial surveys of 1-2 day's duration, resulting in a few animals (1981) or none (1983) being sighted (Leatherwood and Reeves, 1989). Meanwhile, the sale of dugong flesh in certain areas on the west coast was reported in the course of cetacean bycatch surveys in the mid-1980s (Leatherwood and Reeves, 1989).

In order to fill the knowledge gaps created by the paucity of recent data on the status of this dugong population a locally focused interview survey was undertaken in 2004. This survey was done with the primary objective of producing qualitative baseline data on the status of the dugong population inhabiting the Gulf of Mannar, off Sri Lanka. The aim of this survey was to ascertain if this dugong population in the waters bordering northwest Sri Lanka still persists and if so, to assess its future survival prospects and conservation needs. Such baseline data was a prerequisite for designing more extensive quantitative surveys and was also considered to be essential for recommending immediate conservation action.

MATERIALS AND METHODS

Through a review of literature documenting previous dugong occurrence and preliminary site visits, 12 active coastal fishing villages adjacent to the last documented habitat of the dugong, were selected for the survey. The survey was conducted in 2004 and the study area covered the coastline from the northwestern tip of Mannar Island (near Adam's Bridge), southwards along the mainland to the Puttalam lagoon and associated islets (Figure 1). The selected sites included the fishing villages of Thalaimannar, Nadukuda, Pesalai, Venkalai Padu, Pallimunai, Venkalai, Arippu, Silavaturai, Battalangunduwa, Palliyawatta, Wanni Mundalama and Sothipitiya Wadiya. A standard semi-structured questionnaire including both closed and open-ended questions was designed (adapted from Hines, 2002) for the interviews. The questionnaire focused on traditional knowledge regarding the dugong, its historical and present occurrence, threats, use and local attitudes towards conservation. Five randomly picked persons from each site were individually interviewed and the questionnaire was administered in the local language.

RESULTS

The majority (88%) of interview respondents were fishermen, while the rest included government officials attached to the fisheries sector and other knowledgeable persons in the communities such as teachers, members of the clergy, fish buyers and vendors. The sample was gender biased as only males are traditionally engaged in the fisheries industry in Sri Lanka. Therefore, all respondents were male, with ages ranging between 29 and 74 years.

Dugong occurrence and life history

At least one dugong had been seen within the preceding year by 88% of respondents and the other 12% had seen one within the past five years. The general consensus among respondents at all sites was that dugongs occur in the shallow coastal waters of the Gulf of Mannar, south of Adam's Bridge, between Thalaimannar in the north and the Kalpitiya Peninsular in the south (Figure 1). Respondents reported sighting dugongs 1- 5 km offshore, while those from sites bordering the Puttalam lagoon reported occasional sightings within the lagoon, including one near Sothipitiya Wadiya (Figure 1) in 2003 and an accidental bycatch in the same area in 2002. Some older fishermen observed that more dugongs were found closer to the coast 20-30 years back but are now seen further offshore due to disturbance caused by growing numbers of mechanized boats.

With respect to seasonality of dugong sightings (Figure 2), 62% reported more sightings during the north-east monsoon (November-April), 19% during the inter-monsoonal period (August-October) and 7% during the south-west monsoon (May-August). A further 5% stated that more dugongs were seen from the beginning of the inter-monsoonal period through the north-east monsoon (August- April) and 7% reported more sightings from the beginning of the south-west monsoon through the inter-monsoonal period (May-October).

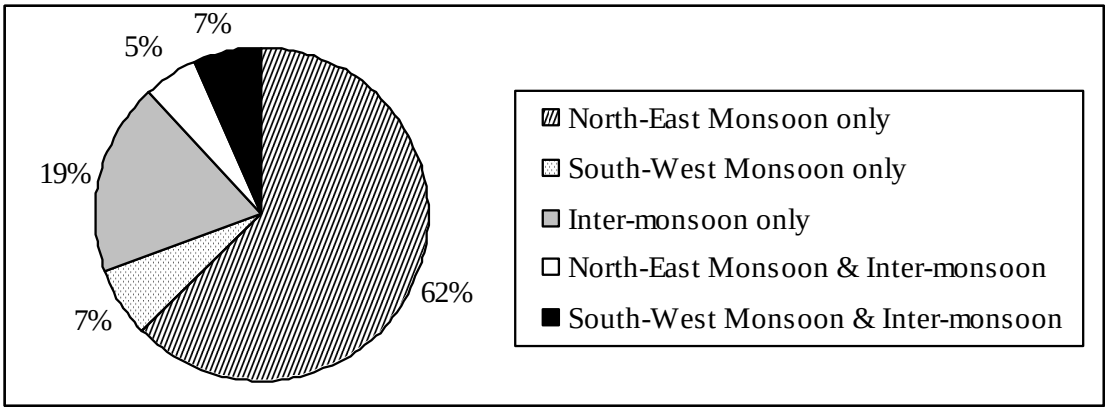

Fig. 2 Seasonality of dugong sightings

Only 13% of questionnaire respondents reported sighting groups of dugongs while 85% reported sighting single animals or two when a calf was present. Those that reported seeing groups had observed groups numbering 2-5 animals in recent times but stated that twenty years back groups of 10-15 animals could sometimes be encountered. Of the total sample 60% had seen calves. Of those, 55% reported sighting calves during the inter-monsoonal period, 19% observed that there was no particular time of year for sighting calves, 14% reported sightings during the north-east monsoon and 11% in the south-west monsoon.

Eighty-eight percent of respondents had observed dugongs feeding and all were aware that dugongs are herbivores. Of these 97% reported that they fed exclusively on seagrass, while 3% stated that they feed on a mixture of seagrass, algae and all types of marine vegetation. Some of the older fishermen from Venkalai, Venkalai Padu, Pesalai and Thalaimannar described observing male dugongs with long tusks using them to dig up seagrass from the bottom and explained that only males grow long canines that can be used in this manner.

Human interaction, threats and use

In relation to the reaction of dugongs in the presence of boats, 88% responded that dugongs generally avoid boats while 5% reported that they actively flee from boats by rapidly moving away. All respondents were in unanimous agreement that dugongs never approached boats, even in the past when they were more numerous in the area. The majority of respondents also reported that dugongs never interfered with fishing activities and none had ever seen a dugong get injured due to a boat collision. However, all (100%) respondents reported that dugongs get accidentally entangled in fishing nets. If a live dugong was found entangled in a net, only 2% would consider releasing it while, 93% would kill the animal. All the respondents (100%) were aware that dugongs were protected by law but observed that they were still illegally hunted for human consumption. At least one dugong had been killed in the preceding year at all twelve survey sites but only one legal prosecution for the offence of killing a dugong and selling its flesh had taken place within the same period.

Ninety-seven percent of respondents stated that dugongs were utilized only as food, while 3% said they were used both as food and medicine. Respondents also stated that dugong flesh is very popular and has traditionally been valued for its superior taste. Dugong flesh presently sells at 250-350 Sri Lankan Rupees (US$ 2.50 - 3.50) per kilogram and an entire carcass weighing 200-500kg is sold within a few hours of being brought ashore. When questioned further about the medicinal use of dugongs, it was stated that there is a belief that dugong flesh has a cooling effect on the human body and dugong tail soup can cure back pain.

Dugong population trends and conservation prospects

Of the survey respondents 98% stated that dugong numbers were declining in this area and 2% that it was remaining unchanged, while none reported an increase in the population. When asked for reasons for this decline, 45% of respondents attributed it to continuous hunting alone, 5% to habitat disturbance and 18% to a combination of factors including direct hunting, accidental bycatch in fishing gear, destructive fishing practices such as the use of explosives and disturbance caused by increasing numbers of mechanized boats in dugong habitat (Figure 3). The remaining 32% had observed a decline in numbers but could not give a reason for it.

Only 18% of respondents attached importance to conserving the dugong while 80% were neutral and 2% had a negative attitude (Figure

4). When asked about the need to conserve seagrass, only 12% considered it important while 87% were neutral and 2% negative. However, 40% thought it was important to conserve mangroves and 60% were neutral. With respect to conserving other endangered species only 15% considered it important while 85% were neutral. Of the total respondents 80% were negative towards the idea of areas being designated off-limits for fishing to conserve an endangered animal or system, while 15% were neutral and only 5% were positive.

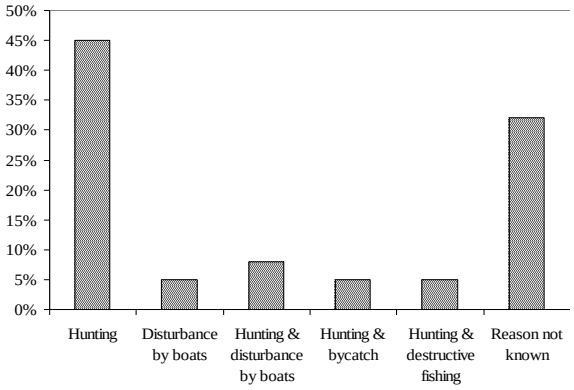

Fig. 3 Reasons for dugong population decline

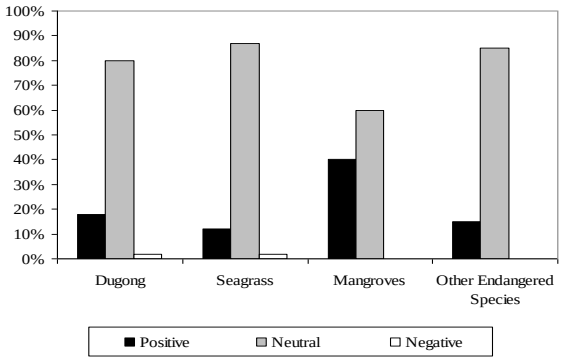

Fig. 4 Natural resource conservation trends

DISCUSSION

The survey data, though qualitative, was indicative of the present status of the dugong in the study area. Results clearly indicate that the species still persists in the near-shore waters off northwestern Sri Lanka, despite declining numbers and continued hunting pressure. It is also apparent that local fishing communities are knowledgeable about dugong occurrence and life history, while being aware of a recent decline in numbers.

Throughout the study area, a majority of respondents reported more frequent dugong sightings during the north-east monsoon. This is in contrast to Bertram and Bertram, (1870) who observed that dugong appearance is sporadic and unpredictable everywhere with no evidence of seasonal movements. However, it should be noted that this area is adversely affected by the south-west monsoon and the main fishing season begins in the inter-monsoonal period and extends into the north-east monsoon when the sea is generally calm. More dugongs may therefore be sighted during the north-east monsoon due to increased fishing effort at this time of year. Calm seas may also facilitate sightings despite the dugong's extremely cryptic surfacing behaviour (Jonklaas, 1961).

Continued sighting of calves indicates that this population is still breeding, while most births appear to occur during the north-east monsoon. This is in agreement with previous observations, including Phillips, (1927) who stated that the Ceylon (Sri Lanka) dugong is believed to breed during the north-east monsoon and Norris, (1960) who documented the capture of a pregnant female in September 1957. Observations on the herbivorous feeding habits of the dugong and insight about the use of tusks by males for feeding purposes add weight to the credibility of the data, as studies on feeding behaviour of captive dugongs have indicated such use of tusks (Marshal *et al.*, 2003).

Results indicated that visible interactions between dugongs and people are limited to accidental bycatch and deliberate hunting. However, though dugongs do not interfere with fishing activities it is not known if human activities interfere with the natural behaviour of dugongs in this area resulting in adverse impacts. Likewise, though dugongs do not get injured through accidents with boats in this area, it is of interest that some accidental boat injuries have been reported from the Indian side of the Gulf of Mannar (Ilangakoon *et al*, 2004). Therefore it is possible that dugongs do get injured by boats in this area too, but are not sighted and go unnoticed by fishermen.

Accidental bycatch in fishing nets is prevalent at all sites surveyed and even when an animal is found alive the chances of it being released are extremely low. Likewise, deliberate hunting still occurs throughout the area despite knowledge of the dugong's legally protected status. The continuing popularity and demand for dugong flesh creates a high market value which adds impetus to illegal hunting. Due to this demand driven market fishermen in the area still view the dugong as a lucrative resource to be exploited in order to supplement their income.

While the dugong is used extensively for human consumption throughout the study area, other uses appear to be minimal. This is in contrast to other countries in the Asian region such as Thailand, where superstitious beliefs prevail and dugong body parts are extensively used for purposes other than as food (Hines *et al.*, 2005).

Local communities have observed a visible and drastic decline in the dugong population off northwest Sri Lanka in the past 30 years. Continued illegal hunting and increasing accidental bycatch in the expanding gillnet fishery are the major causes of this decline. There is also indication of some habitat degradation due to destructive fishing methods. The proposed Sethu Samudram ship canal project in Indian waters adjacent to the study area will add to habitat fragmentation on a larger scale in the near future. It is also apparent that law enforcement is presently inadequate, and does not deter illegal hunting.

Attitudes towards conserving natural resources were not positive in these communities other than where a direct financial benefit was envisaged. This was apparent in the fact that awareness of the importance of mangrove areas as nursery grounds for commercially important fish and crustaceans made people more conducive towards mangrove conservation. Seagrass in contrast is given low priority as local people do not utilize it for anything. Likewise, dugongs and other endangered species are worth more dead than alive, as short-term economic gain is important to these impoverished fishing communities. The generally negative attitude towards protected areas and no-fishing zones in order to conserve endangered species, also clearly indicates that people in these fishing communities are not yet ready to accept conservation measures that would have any kind of negative impact on their income.

Successfully protecting this depleted dugong population through conventional conservation strategies alone is difficult because these communities do not yet have the socio-economic stability that is conducive to the adoption of such priorities. However, there is a clear indication that local communities can be more positive about conservation if there is a direct financial incentive. Therefore, adoption of a community based conservation approach, where conventional techniques like strengthened law enforcement go hand-in-hand with innovative incentive-based methods, is recommended as a priority in order to achieve dugong conservation goals in Sri Lanka. At the same time it is important to raise awareness among local populations about dugong conservation through increased education. Improving the long-term survival prospects of this dugong population that is already facing local extirpation will only be possible through such innovative approaches where dugong conservation will benefit impoverished local communities who are educated about the need for conservation. To ensure the long-term survival of this dugong population, future management decisions should be based on solid scientific data. In order to generate the necessary quantitative data more detailed studies of the remaining dugong population are urgently needed.

ACKNOWLEDGMENTS

This survey was financially supported by Sirenian International.

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