Stranding records of dugong (*Dugong dugon*) in Thailand

KANJANA ADULYANUKOSOL[1], CHAIYAPAT PRASITTIPORNKUL[1], SOMCHAI MAN-ANANSAP[2] AND PANTARUK BOUKAEW[1]
[1]*Phuket Marine Biological Center, P.O.Box 60, Phuket 83000, Thailand*
[2] *Eastern Marine and Coastal Research Center, 237, Kram, Klaeng, Rayong 21190, Thailand*
Email : k_adulyanukosol@yahoo.com

ABSTRACT
The information of stranded dugongs (*Dugong dugon*) has been recorded by the Phuket Marine Biological Center from the Andaman Sea coast and the Gulf of Thailand. The data were obtained from the records of fishermen, stranded dugongs, and specimens preserved in the museums, temples or institutions. Two hundred and eighty two records of stranded dugong were recovered from 1962 through February 2008. Of these 71.6% of the records were from the Andaman Sea, 25.8% of the records from the Gulf and 2.6% of the records had no information of the stranding place. Some 22.7% of the records were male, 22.3% female and 55.0 % of unidentified sex. The highest record of stranded dugong per year was in 1996 and the place where most stranding was found was in Trang province. The mean length of stranded mature dugong was 2.52±0.18 m in male (n=12) and 2.5±0.16 in female (n=19) while the maximum length was 2.94 m. The smallest calf was 0.97 m in length and 14 kg in weight. The maximum weight of 310 kg was recorded in a male dugong with 2.75 m in body length. The number of stranding sizes of the dugong ranging from 0-1.5 m long, >1.5-2.0 m long and >2.0-3.0 m long was 20.8%, 31.7% and 47.5%, respectively (n=101). The body length (m) and body weight (kg) relationship equation was $Y = 19.108 \times ^{2.8103}$ and R = 0.945 (n=65). Most dugongs died by unidentified cause. However a generally high proportion of deaths was from gillnets among identified causes of the stranding.

KEYWORDS: dugong, stranding, causes of death, length-weight relationship, Andaman Sea, Gulf of Thailand

INTRODUCTION

Dugongs (*Dugong dugon*) are distributed along both coastlines of Thailand, the Gulf of Thailand and the Andaman Sea (Adulyanukosol et al., 1997; Adulyanukosol, 2000, 2004, Hines et al., 2005a). The number of dugongs in the Andaman Sea was higher than that of the Gulf (Adulyanukosol, 2004). Presently the largest group of dugongs has been reported in Trang waters particularly in the area of Muk-Talibong Islands (Adulyanukosol et al, 1997, 2005, 2006; Hines et al, 2005a). The population of dugong was estimated at about 123 animals in Trang in 2001 (Hine et al., 2005). The best conservation of dugong and seagrass efforts in Thailand is in Trang province (Adulyanukosol, 2004, Hines et al., 2005b).

The research on dugong in Thailand was mainly conducted by the Phuket Marine Biological Center (PMBC), Department of Marine and Coastal Resources and Marine National Park, Wildlife and Plant Department. All information has been obtained from the analysis of carcasses of the animals that were opportunistically collected when the animals were incidentlly entangled in fishing gears or stranded by other causes. The majority of dugong carcasses or live dugongs were transferred to PMBC for studies. The necropsies will be done for all obtained specimens. The tissues were collected for DNA analysis, heave metal and organochlorine accumulation. About 45 skulls of the dugongs were preserved in PMBC.

This report shows the current understanding of dugongs life history in Thai waters including the threats to Thai dugongs. This information is helpful for understanding the basic dugong bilogy and the management plan of the dugong population.

MATERAIL AND METHODS

The Phuket Marine Biological Center (PMBC) has collected the data of stranded dugongs along both coastlines, the Andaman Sea and the Gulf of Thailand since getting the first dugong in 1979. This report shows the data collected until February 2008. Necropsies were done when specimens were received. The data were classified to; 1) period, number, and location of strandings, 2) type, size, and sex of the specimens, 3) length-weight relationship, and 4) causes of strandings.

RESULTS AND DISCUSSION

Due to the low reproductive rate of dugong, long generation times, and high parental investment, dugongs are particularly vulnerable to even small declines in adult survivorship (Nishiwaki and Marsh, 1985, Marsh et al. 2002). These life history traits, combined with anthropogenic impacts affecting coastal environments in Thailand probably explain their diminished population size and limited areas of occurrence. Although little quantitative data are available for assessing threats, accidental killing in gillnets and stake traps is believed to be the greatest source of human-caused mortality of dugongs in Thailand, even though it is assumed that intentional killing of dugongs did not occur in Thailand for over 50 years (Adulyanukosol, 1995, 1999, 200, 2004, Adulyanukosol and Poovachiranon, 2007).

So far the effects of natural disasters such as storms on the dugong were poorly understood (Marsh, 1989; Marsh et al, 2002). The mass stranding of at least 27 dugongs in northern Australia by cyclone in 1984 was firstly reported by Marsh (1989). Subsequently there were cyclone and flood in Harvey Bay, Queensland that caused damage to seagrass area over 1,000 km^2 and most of the dugongs inhabiting this bay died 6-8 months after this phenomenon (Preen and Marsh, 1995). In Vietnam, Typhoon 'Linda' in 1997 caused damage to the seagrass beds at Con Son Bay in Con Dao Island however there was no report of stranded marine mammals (Hoa, 2001). In Thailand, although there were concessionary natural disasters such as depression and flood, but there was no evidence of the stranding of dugong and cetaceans (Adulyanukosol, 1999, 2004). An exception was that only one male dugong that was washed up near a mangrove area about 1 km from the shoreline by the Indian Ocean Tsunami disaster on December 26, 2004 (Poovachiranon et al., 2006). In this study the result from known threats were mainly from fishing gears.

Period, number, and location of the strandings

Following our investigation of dugong specimens in the museums, temples and other institutions since 1979, the oldest record of dead dugong was found in 1962. In total 282 stranded dugongs were recorded from 1962 through February 2008. The records were gradually increasing and reached the highest number of stranded dugong per year in 1996, 24 dugongs or 8.5% of total record (Fig 1). The obtained data might be biased because of the conservation pressure. In Thailand there had been a high interest in the dugong and seagrass conservation activities by many organizations, NGOs and local people during around 1992-3. PMBC received more data of stranded dugong soon after the period. We believe that the continuity of the conservation of dugong and seagrass was very helpful for the people to understand how to conserve the dugongs and their food habitat. This might have led to the reduction in the deaths of dugong in recent years.

Two hundred and eighty-two stranded dugongs were recovered from 1962 through February 2008. Of these 71.6% of the records were from the Andaman Sea, 25.8% of the records from the Gulf and 2.6% of the records had no information of the stranding place. In general there were; 0-5% of total records found in the most stranding locations (11 provinces), >5-10% of total records found in Rayong province and >10% of total records found in Phang-nga, Krabi and Trang provinces (Fig 2).

The dugong population in Thai waters was estimated at about 250 dugongs (200 in the Andaman Sea and 50 in the Gulf, Adulyanukosol, 2004). The largest population of dugong inhabited Trang waters (Adulyanukosol et al., 1997; Adulyanukosol, 2000; Hines et al., 2005) and the population was estimated at about 123 dugongs (Hines et al., 2005). The highest number of strandings found was in the Andaman Sea coast, particularly in Trang province, 94 dugongs or 33.3% of the total records and followed by Krabi, Phang-nga and Rayong provinces (Fig 3). The number of stranded dugongs and stranding locations were in correspondence with the sighting places of dugong (Adulyanukosol et al. 1997; Adulyanukosol, 2004).

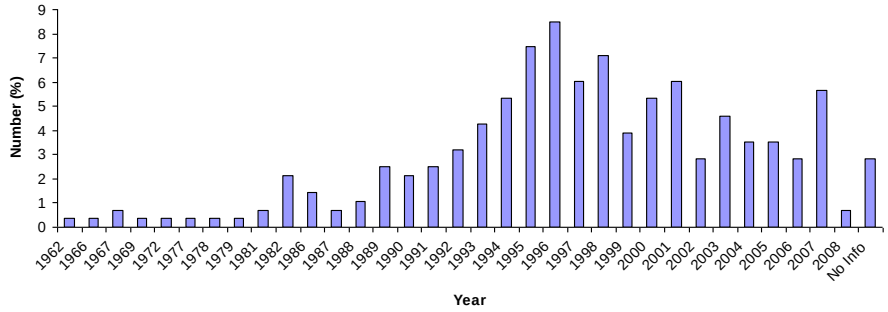


Fig. 1 Number of stranded dugong during 1962-February 2008 (n= 282)

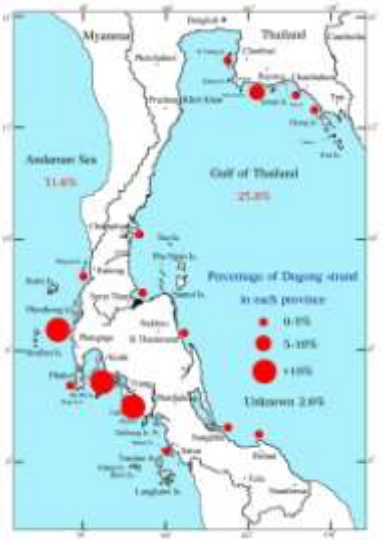


Fig. 2 Map of the coast of Thailand showing the dugong stranding in each location as recorded during 1962-February 2008 (n= 282). 71.6% of the records were in the Andaman Sea, 25.8% of the records were in the Gulf of Thailand and 2.6% of the records had no information of stranding place.

Type, size, and sex of the specimens

Of the 282 specimens found; 80.5% were dead specimens, 13.1% were live dugongs, 4.3% were skeletal specimens and 2.1% were stuffed specimens. Of these 22.7% were male, 22.3% were female and 55.0 % of unidentified sex. If the unidentified sex specimens are excluded, the sex ratio of male specimens: female specimens was about 1:1.

Dugong calves are 1-1.25 m in length and 20-35 kg in weight (Nishiwaki and Marsh, 1985, Bledshard, 2000). Dugongs reach maturity at about 9-10 years old in both sexes and the length of mature size would be longer than 2.5 m (Marsh, 1995). The length of dugong specimens in this study was known in 101 records. Among these number of specimens, the highest number of stranded dugongs of 47.5% (or 48/101) was sub-adult to adult size (>2.0-3.0 m long) followed by immature size >1.5-2.0 m long (31.7% or 32/101) and juvenile 0-1.5 m long (20.8% or 21/101) (Fig 4). It was hard to speculate why most of stranded dugongs were sub-adult to adult size. Information on the attempts of escaping from fishing gear among different size classes of dugong was not available. Dugongs utilized macrohabitat and some migrated remote distances (Clivers et al, 2004; Marsh and Rathbun, 1990). The tendency for dugongs to track the bottom on large-scale movements may increase their vulnerability to incidental capture in bottom set gill nets (Sheppard et al, 2006). In addition small dugong (about 1-2 years old) always migrated with mother and/ or together with other large size dugongs in group of 2-5 animals (Adulaynukosol and Thongsukdee, 2005, 2006; Adulyanukosol et al, 2008) which might be an advantage for the young animal in term of social communication. Nevertheless if we combined the number of juvenile and immature sizes (0-2.00 m long), it was slightly higher than the sub-adult to adult size (> 2.00 m long) (53:48). Since dugongs are long living animals and it takes 9-10 years for them to attain the reproduction stage (Nishiwaki and Marsh, 1985; Marsh, 1980, 1995), the majority of the number of dead dugongs of sub-adult to adult size would be very significant for the recovery of the population.

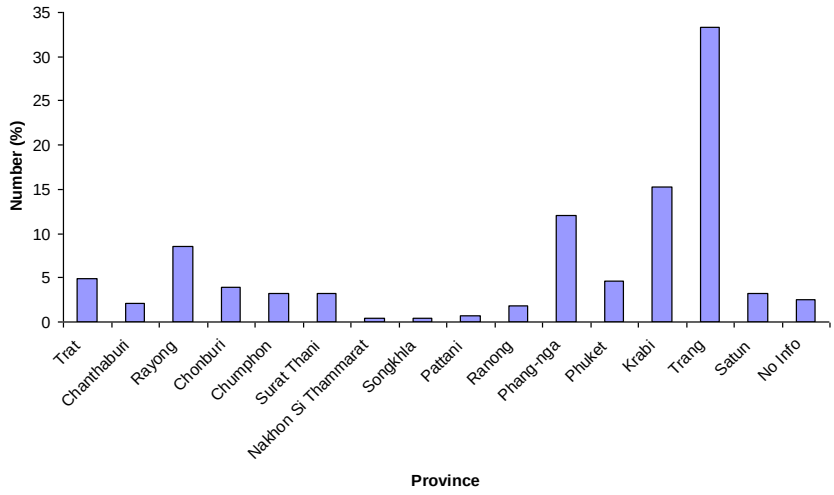


Fig. 3 Number of stranded dugong in each province from 1962-February 2008 (n= 282)

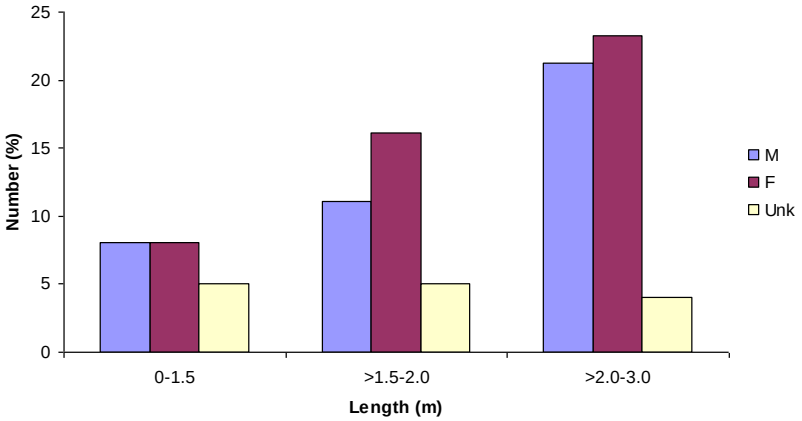


Fig. 4 Size range of stranded dugong (n= 101). Juvenile was about 0-1.5 m long, immature was >1.5-2.0 m long and sub-adult to adult was >2.0-3 m long. M=male, F= female and Unk= unknown sex.

Length-weight relationship

Adulyanukosol et al (1998) first developed the growth curve of Thai dugong. Marsh (1995) reported that the body length of dugong as an indicator of age was unsatisfactory except in the young animals. In this study, the mature dugongs were considered from; 1) the study of Adulyanukosol et al (1998), and 2) the length and shape of the tusks including the number and shape of the available molar teeth according to Marsh (1980). The mean length of stranded mature dugong was 2.52±0.18 m in male (n=12) and 2.5±0.16 m in female (n=19). The smallest calf was 0.97 m in length and 14 kg in weight. In our records, a male dugong 2.75 m long had the maximum weight of 310 kg. A male without information of weight had the maximum length of 2.94 m. The measurement was the straight length. The curve length was about 10-15 cm greater than the straight length (Adulyanukosol, 2004). Marsh (1995) suggested that dugongs of less than 2.2 m long were immature, whereas those longer than 2.5 m were probably mature. She also estimated that the mean birth length was 1.15 m.

There were only 65 dugongs which had both length and weight measured. The body length (m) and body weight (kg) relationship equation was; $Y = 19.108 \times ^{2.8103}$ and R = 0.945 (Fig 5).

Causes of strandings

It was difficult to identify the causes of dead or live stranding. Because there were less evidences from the external of dugong body. Most dugongs died by unidentified cause (44%). We classified the causes of stranding into 6 categories; gillnets, trawler, stationary trap or stake trap, other fishing gear, non fishing gear (caught by hands, boat strike, shark attack, etc) and no information. However a generally high proportion of deaths was caused by gillnets (Fig 6, 7a).

While dugong is trapped in a stationary trap or stake trap, it tries to get free. The dugong smacks against the bamboo, net and wire of the trap which causes many external wounds on its body. Afterwards the dugong dies very soon after being trapped for about only an hour or less, particularly in the stationary trap located in shallow water (Fig 7b). The shallow water stationary trap is exposed during low tide while the deep water stationary trap is still submerged during the lowest tide. Only 3 of 21 dugongs being trapped were alive and released back to the sea. That means 85.7% of dugongs being trapped in stationary trap had died. Dugongs are a very delicate animal. Dugong easily panic, rapidly weakened and die under unusual environments *i.e.* being trapped in a dry condition, being entangled in a net, being chased by speed boat or attack by shark (Heihsohn et al. 1976; Nishiwaki and Marsh, 1985, Adulyanukosol, 2004). In case of being trapped in a shallow water stationary trap, dugong had suffered from dehydration, and with no surrounding sea water to bear its high body weight the dugong couldn't breathe easily although it was in the air. In case of being trapped in a deep water stationary trap, dugong could survive for a couple of days (Adulyanukosol, 2004).

Only one case of shark attacked on dugong was reported, in Trang province (Fig 7c). Boat strike was reported in 3 cases; 1 in the Andaman Sea (Phuket province) and 2 in the Gulf (Chonburi province). Some dugong probably died from fighting with other male during courtship behavior. Male dugong may use its tusks on another male or female which can cause many wounds and probably caused death to some dugong (Fig 7d).

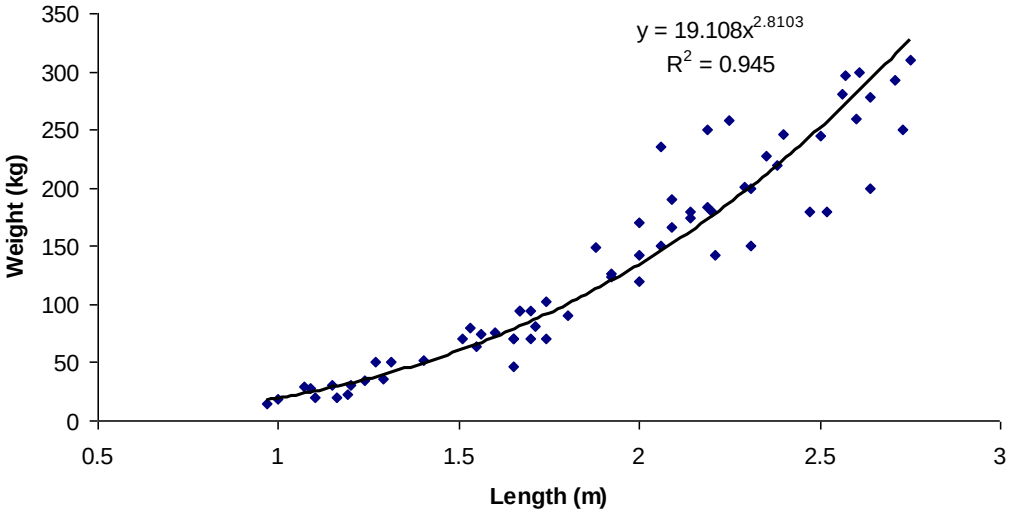


Fig. 5 Length-weight relationship (N= 65)

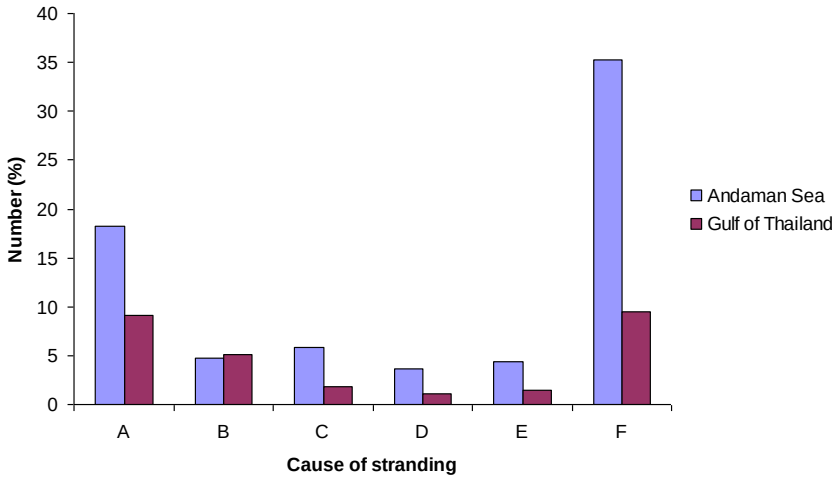
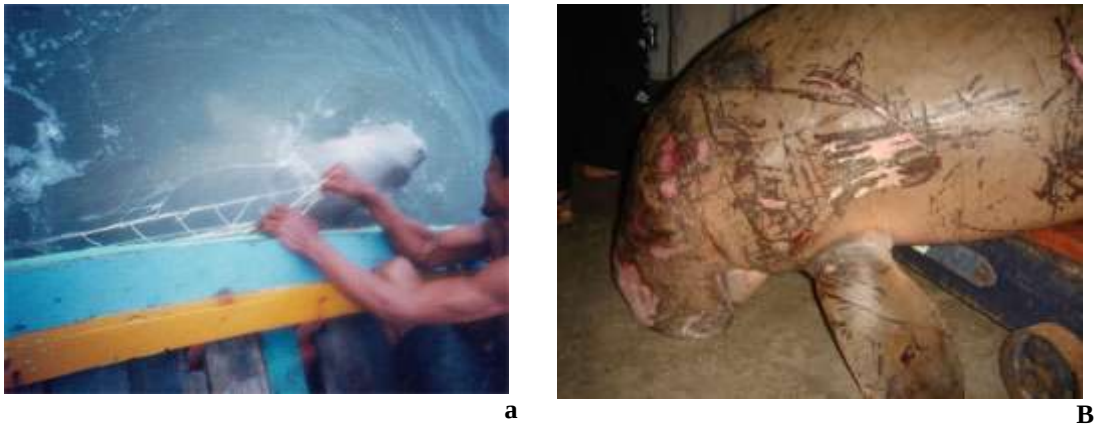


Fig. 6 Number of stranded dugong and the causes of stranding (n= 275). A= gillnets, B= trawler, C= stationary trap, D= other fishing gears (excluding gill nets, trawler and stationary trap), E= non fishing gear (boat strike or shark attack or others), F= no information



a **B**

Fig. 7 (a) Fisherman releasing a dugong from a gillnet at Phrathong Island, Phang-nga province in 2003, (b) External wounds on the dugong body found in Phuket province caused by stationary trap,

c

d

Fig. 7 (c) A calf was attacked by shark in Trang province, and
(d) Many wounds on the dugong body taken from Trang province might have been caused by sexual offence by another mature male. The parallel pairs of wounds caused by the tusks (arrow). [Photo7a: Courtesy by the people from Phrathong Island.]

Seagrasses are the principal food of dugong. In Thailand, changes in seagrass area over the last decades have not been assessed, since the first comprehensive survey has only been completed recently. The main threats to seagrass are known and include pollution and sedimentation from industrial, housing and tourism developments, effluent from shrimp farms, disturbance from push and trawl net fishing, and siltation from tin mining (Adulaynukosol et al, 2005; Chansang and Poovachiranon, 1994). The losses of seagrass bed habitats also threaten the viability of Thai dugong's population. However there are still abundant seagrasses particularly in the Andaman Sea for the utilization of the small population size of dugong in Thai waters (Adulyanukosol, 2004, Adulaynukosol and Poovachiranon, 2007; Poovachiranon et al, 2006).

The Department of Marine and Coastal Resources (DMCR) has been providing information on dugong status and threats to raise awareness among coastal communities. Activities were conducted to disseminate information on the species' importance, as well as conservation and recovery of their habitats. The DMCR works in collaboration with government agencies such as the Marine National Park, Wildlife and Plant Department, universities, non-government organizations (e.g. Yadfon Association and the Wildlife Conservation Society – Thailand Program), and local communities. Thailand was comparatively leading in the status of dugong studies in Southeast Asia (Adulaynukosol et al, 2005). This implies that Thailand has to be fully responsible for the dugong protection and that timely conservation action can be effective in facing the present threats.

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