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PHOTO IDENTIFICATION OF DUGONGS IN MARSA ALAM AND WADI EL GEMAL NATIONAL PARK, EGYPTIAN COAST OF THE RED SEA

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ABSTRACT

A total of 30 dugongs were recorded at the Egyptian Red Sea coast between December 2015 and October 2017 using Photo ID technique. Out of them, 16 individuals were identified at Marsa Alam and 14 at Wadi El Gemal National Park. Males were seven times more than females and calves were also recorded. A Photo ID catalogue was prepared for the individuals with records of their occurrence among sites and the presence of particular dugongs for specific sites was confirmed. Long and short distance movement among the study sites were recorded for eight different dugongs. This is the first study to document the population number of dugongs in the inshore area of the Egyptian Red Sea coast. Further studies are recommended offshore sites in WGNP for better documentation of this group of animals.

KEYWORDS : *Dugong dugon*, Photo ID, Site fidelity, Marsa Alam, WGNP

INTRODUCTION

Field studies of photo identification based on body markings and colouration have been used to examine numerous free-ranging marine mammal species (Hammond *et al.* 1990). The image of the camera has appeared as an important means for monitoring, from individuals to populations and communities up to the whole marine ecosystems (Bicknell *et al.* 2016). This technique has been used effectively in studies on marine mammals such as the ecology and behaviour of dolphins (Currey *et al.* 2008a), and dugongs (Anderson 1995).

For the long-term study of the population, dedicated and continued monitoring and photo-documentation are necessary, as the acquisition of any new features could alter an individual's appearance, potentially making it difficult or impossible to reidentify the animal at a later date (Hines *et al.* 2012). Information on calving intervals/reproductive rates and age at sexual maturity as determined from resightings of individuals is necessary for evaluating recovery of the species (Koelsch 1998). The appearance of an individual could be change over time as new features added or other erased. Therefore it is essential that the photo-ID effort is consistent and continued, especially in areas where the

acquisition of new marks is frequent (Hines *et al.* 2012).

In the present study, photo-identification technique was used to identify the dugongs inhabiting the regions of WGNP and Marsa Alam; information regarding their occurrence, distribution and abundance were displayed, and an identification catalogue was created. This is the first study to shed some light on the status of the population of dugongs using this technique in the Egyptian Red Sea western coast.

MATERIALS AND METHODS

Study sites:

The study was undertaken between December 2015 and October 2017. The data were collected from 22 different sites located in two regions; Marsa Alam and Wadi El Gemal National Park (WGNP) (Figure 1). A Total of 14 sites were selected in Marsa Alam comprised: Marsa Tondoba, Marsa Alam Harbour, Marsa Assalaya, Marsa Eglia, Marsa Gabal Elrossaas, Marsa Shagra, Marsa Hermez, Marsa Abou Dabbab, Marsa Moreen, Marsa Shooni Elsoghayar, Marsa Shooni Elkebeer, Fayroz Plaza Jetty, Marsa Mobarak and Port Ghaleb Harbour (Figure 1). While at WGNP eight sites were selected comprised: Marsa

Alfokeiri, Gorgonia Beach, Shams Alam, Ras Baghdady, Marsa Om Elabbas, Abou Ghossoon, Hamata Harbour and Marsa Wadi Lahmy (Figure 1). These sites were selected based on previous observations of seagrass beds and dugong occurrence.

Methods:

Underwater observations:

Survey sites were accessed from the shore or by boats; observations were carried out by snorkelling and SCUBA diving one hour before and after the high tide. Hamata Harbour was an exception where observation was made from the surface of the boat due to the fast swimming motion of dugongs. Underwater photographs were taken using an HD camera Go Pro Hero 4 silver with a red filter whereas those taken from the surface were done using a Nikon Camera D7000 18-105mm with SLR lens 70-30mm.

Observations were made by maintaining a distance of 1 to 3m from the individual. Individual's size, sex, notches, scars on the different body parts were noted and photo-documented. Observations and photography

were focused on the right and left flippers as well as the tail edges (flukes). Notches were mostly used in identification since they are more permanent than scars which can heal in a couple of months or more (personal observation). Sex was determined by observing the distance between the genital slit and the anus; in males, the two openings are far apart while in females they are close together (almost touching) (Plate 1). Nipple size is also a factor, being very small in males (< 2 cm) and around >5.0 cm long in females (Plate 2). In some cases where sex could not be determined due to observation difficulties, individuals were recorded as "unidentified."

All observed dugongs were listed, assigned a five-digits identification number based on the location of initial sighting (Koelsch 1998). The first letters of the site name were written followed by the number of the individual. For example, the code of the dugong in Hamata Harbour would be HHA03 while that of Marsa Abou Dabbab would be MAD18. Notes on the sex of the individual as well as the date, location and number of re-sighting were also taken.

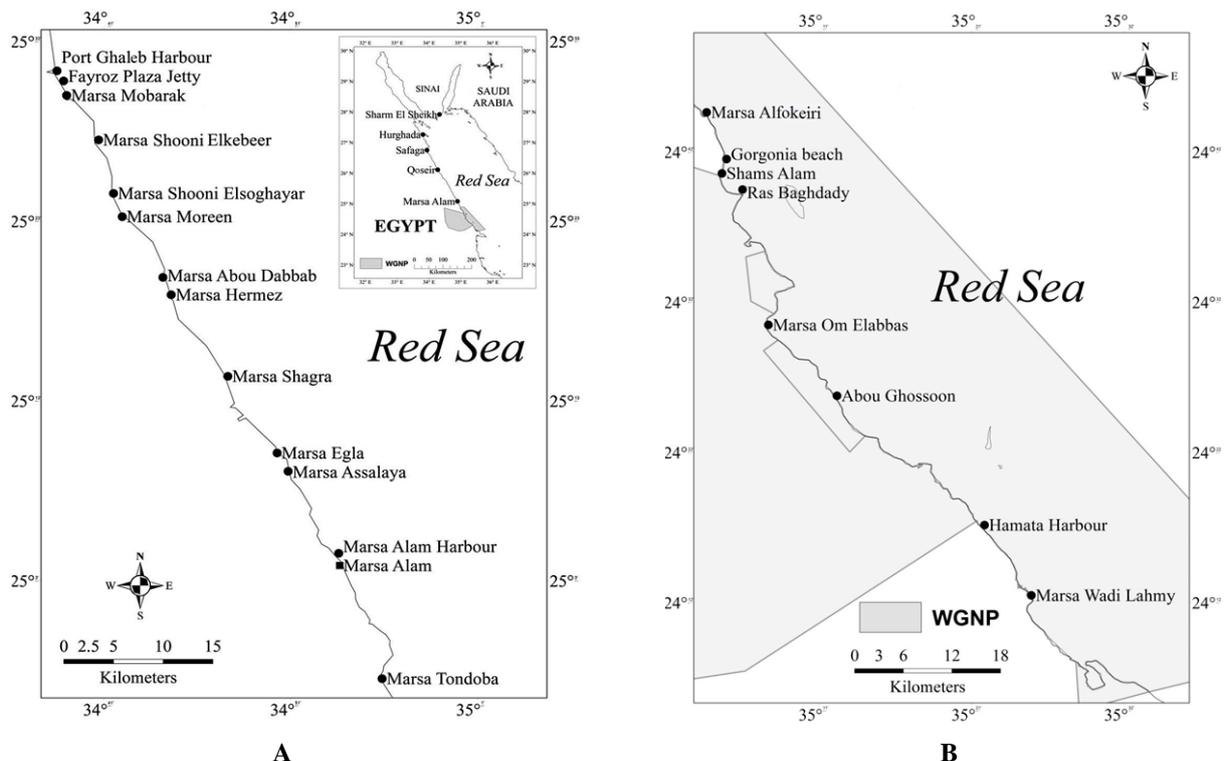


Figure (1): Map shows Maras Alam (A) and Wadi El Gemal (B) study sites, Red Sea, Egypt.

RESULTS

Sighting records:

A total of 396 sightings were completed during 510 field days carried out in the 22 sites in which a total of 30 individuals were sighted with an average of 13.2 sightings/ individual. At WGNP, 14 individuals in 116 sightings (averaged 8.3 sightings/ individual), were carried out from December 2015 to September 2016. These sights comprised: five sightings were completed in four days at Marsa Alfokeiri, four in 13 days at Abou Ghossoon, 12 in 20 days at Hamata Harbour, two sightings in five days at Marsa Om Elabbas, two in 13 days at Ras Baghdady, 85 in 65 days at Shams Alam, four in five days at Gorgonia Beach and two in five days at Lahmy Bay (Appendix 1).

At Marsa Alam, a total of 16 individuals in 280 sighting within 14 sites (averaged 20 sightings/ individual) were done from October 2016 to October 2017. These sights comprised: six sightings were completed in 15 days at Marsa Tondoba, one in nine days at Marsa Alam Harbour, 72 in 65 days at Marsa Eglia, six in 10 days at Marsa Assalaya, one in five days at Marsa Gabal Elrossaas, 15 in 15 days at Marsa Hermez, 87 in 105 days at Marsa Abou Dabbab, two in eight days at Marsa Moreen, one in 37 days at Marsa Shagra, one in five days at Marsa Shooni Elsoghayar, 12 in 15 days at Marsa Shooni Elkebeer, one in one day at Fayroz Plaza Resort, 84 in 45 days at Marsa Mobarak and one in 45 days at Port Ghaleb Harbour (Appendix 1).

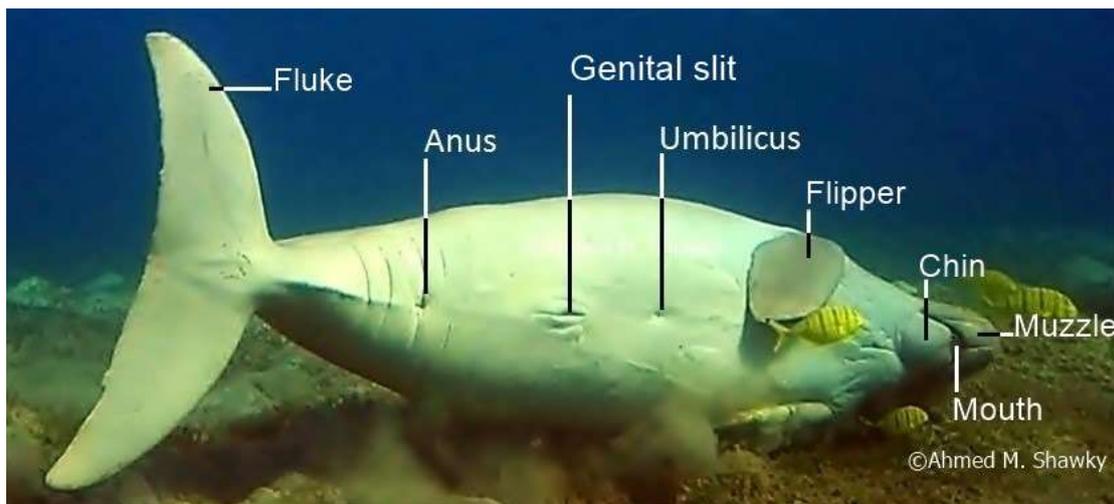


Plate (1): Ventral view of male dugong showing the position of the genital slit and anus.

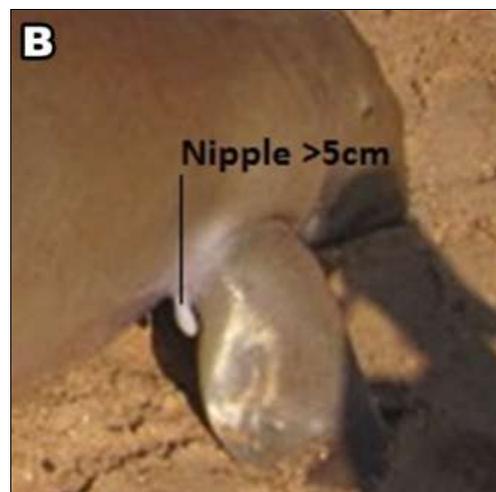
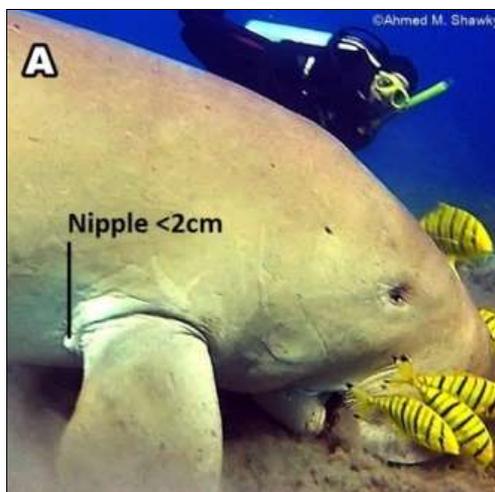


Plate (2): Male (A) and female (B) dugong showing different nipple size.

Sex determination:

For sex determination, out of the 30 individuals sighted all over the 22 study sites, 21 were males (73%), three females and three calves (10% each) and two unidentified (7%). At the 14 sites surveyed in Marsa Alam, 16 individuals were sighted comprised 12 males, two females and two calves. While as at WGNP, the 14 sighted individuals in the eight sites surveyed comprised 10 males, one female, one calf and two unidentified. The results of all photo-identification effort are summarized in Appendix (1).

Description of notches used in photo identification:

The most four dugongs identified with reliable notches were the individuals with the following identification numbers: ID#SAL10, ID# MEG15, ID#MAD18, and ID#MMO26 (Plate3). The first dugong was observed opposite to Shams Alam Resort (24.689231° N and 35.086923° E). The average depth of sighting was 6m at a distance of 250 m from the shoreline, but sometimes it was sighted at 2m depth and 100m offshore distance. This individual was about 2.5m long with one distinct V-shaped notch on the middle of posterior edge of the left flipper. Other notches were observed along the left fluke margin with a prominent crescent-shaped one.

The second dugong was sighted mainly in Marsa Eglā (25.172733°N and 34.843211°E) at 3m average depth of sighting and 230m a distance from the shore line. This individual was about 3m long with a distinct v shaped notch on the middle of posterior edge of the left flipper. The right flipper had four notches on the middle margin, one big V-shaped, two ushaped and one little notch above the big. A clear v shaped notch was seen on the right fluke together with some minuscule ones on the tail margin.

The third dugong was sighted in Marsa Abou Dabbab (25.338303°N and 34.739802°E) at an average depth of 7m depth and 200m distance from the shoreline but sometimes was seen at 15m and 500m. This individual was

about 3m long with one small v shaped notch in the middle of posterior edge of the left flipper. The right flipper had one large deep notch together with other three above.

The fourth dugong was sighted mainly in Marsa Mobarak (25.509911°N and 34.652568°E) at an average depth of 3m and 230m distance from the shoreline. The individual was about 3m long with two visible notches on the left flipper; the first is a large V-shaped located on the lower third of the flipper while the second is a slight V-shape slightly above. There was also one clear tiny notch on the right fluke as well as a v shaped one on the tail in addition to two minuscule ones near to the margin on the left. A catalogue of the 30 identified dugongs in WGNP and Marsa Alam is presented in Appendix 1.

Scars:

Scars were seen on the dugong background and varied in colour between white and very dark brown. Superficial scars appeared as pale lines or patches. Scars observed on the dugong ID#SAL10 on October 15th, 2015 in Shams Alam was seen to be recovered during the second sighting on February 14th, 2016 (Plate 4). Lines, as well as the white spots on the flukes, disappeared completely when the individual has seen afterwards as well.

Residence pattern along the study sites as indicated by the photo-ID technique:

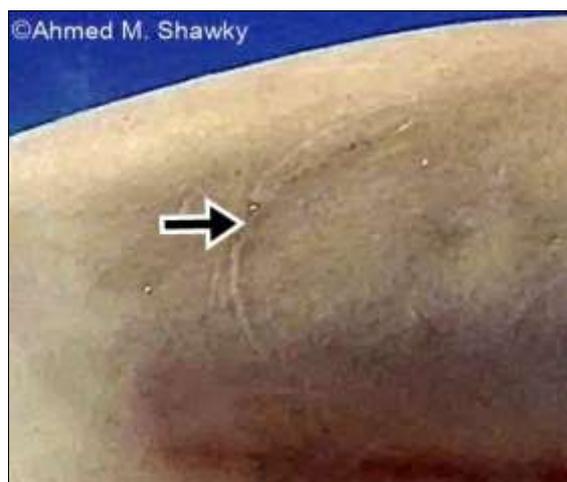
None of the identified dugongs was observed moving to or from WGNP and Marsa Alam. However, individual ID#-SAL10 was the only dugong from WGNP that was re-sighted between Gorgonia Beach Resort and Shams Alam Resort travelling a distance of 2.5 km. In Marsa Alam area, out of the 16 identified dugongs, only seven were seen moving along its different sites. The individual with the least movement was ID#-MEG17 which travelled a distance of 3 km between Marsa Eglā and Marsa Assalaya while individual ID#-MEG18 travelled 36 km from Marsa Abou Dabbab to Marsa Alam Port. For the total seven individuals, the mean distance travelled within the home range was 16.6±14.0 km.

Code	Left flipper	Fluke	Right flipper
SAL10			
MEG15			
MAD18			
MMO26			

Plate 3: Identified dugongs with reliable notches.



First sighting (15.10.2015)



Second sighting (14.02.2016)

Plate 4: Dugong ID#SAL10 is showing body scars during the first sighting (left) and recovered ones in the second (right). Sighting date is shown.

DISCUSSION

The photo-ID technique was used for the first time in the identification of dugongs inhabiting the Egyptian Red Sea coastline. Along the 180 km surveyed during the present study, a total of 30 individuals were identified. Previous studies are scarce; where Gohar (1957) recorded 16 individuals within 70 km between Hurghada and Ras Gemsha along a period of 14 years. He obtained his specimens using specially made fishing nets. Hanafy *et al.* (2006) reported 12 to 17 individuals between 2001 and 2003 based on interview surveys in the area of Hurghada and Shalateen. They reported eight adults and three juveniles in the area of Marsa Alam and six adults and one juvenile in Wadi El Gemal. The authors stated that they “do not know if some individuals were observed at different sites in the same year.” The methodology they used does not give an actual determination of the real number of individuals. Therefore, the present results, which are based on actual observation of individuals underwater, indicate that the areas of Marsa Alam and WGNP encompass a bigger population than previously recorded.

Males outnumbered females in this study by a ratio of 7:1 in both areas. Calves were also recorded for the first time. In his study area, Gohar (1957) recorded ten females and six males and no calves. Hanafy *et al.* (2006) did not determine the sex of the recorded individuals. However, they reported three juveniles (i.e., less than 2m) in Marsa Alam and one in WGNP. The fact that females were not as common as males in our study suggest that females are inclined to visit those areas to feed at a much quieter time in the day for example early morning or late at night thus avoiding disturbances caused by human activities. Nocturnal foraging has been reported in dugongs by several researchers and explained as a means to avoid human activities, fishermen and hunters (Kwan 2002, Hodgson 2004).

In this study, dugongs' sex was determined by an observation of the genital parts. Lanyon *et al.* (2009) studied the sexing in sirenians using visual discrimination of sex by photographing the ventrum of dugong that shows the relative distance between the caudal anus and cranial genital opening in Queensland, Australia. Gohar (1957) studied the anatomy of the dugong collected from the Red Sea, Egypt. He reported that in males, the distance between

the anal and genital opening is approximately 1/7th the total length of the animal while in females the distance between the vulvar and the anal clefts was between 2.5 to 3.5cm. Nipple length is likely to be greater in more mature females (Lanyon *et al.* 2009). When females approach maturity, the nipples protrude until they become in adult non-pregnant females about 2.5cm long and 1.8cm in diameter at their base. During pregnancy, the nipples grow, and in a lactating female 2.88m long they were cone-shaped, 8.5cm long and 5.5cm in diameter at their base (Gohar 1957).

Notches were the tools by which photo-identification was carried out in the present study. Würsig & Jefferson (1990) reported that natural marks could usually be used for the identification of vertebrates. Hillman *et al.* (2003) used a matching process that depended on the pattern of nicks and notches usually found along the trailing edge of the dorsal fin of many Delphine species. Identification of dugong using scars and notches allowed to re-sighting the same individuals many times and in different sites (Souza & Patankar 2009). The irregularity of the flukes' margin was used in the identification of dugongs in the present study by photographing the tail when it was raised above the bottom during grazing on seagrasses. This comes in agreement with Anderson (1994) who noted that flukes showed different shapes and scars and that the raised flukes, though difficult to photograph, may provide another means of identification under favourable sea conditions.

Anderson (1995) noted that most adult dugongs were found to carry scars that permit repeated identification of individuals and described nine types of them in Shark Bay, Western Australia. In their study on dugongs of Andaman and Nicobar Islands, India, Souza and Pantakar (2009) identified three independent immature sized individuals using their distinctive scars. In the present study, the observation showed that scars have recovered

and disappeared completely over a period of four months or more indicates that they cannot be used for the identification of dugongs over a long period. This observation was different to Anderson (1995) who assumed that deeper scars are permanent and could assist to identify individuals over periods of several years or throughout the remaining life of the individual. Scarring varies from light and irregular scars to heavy and prominent coalesced (Lanyon *et al.* 2010). The new scars are white and become darker with age. However, deeper scars can be expected to last indefinitely, although they may or may not be repigmented (Anderson 1995).

Understanding the movement capabilities of dugongs is essential for their conservation, particularly about population connectivity and re-colonization (Hobbs *et al.* 2007). Dugong photo-identification studies can successfully document distinct dugongs during different seasons, at different locations (Rathbun *et al.* 1995). The obtained results of this study documented the re-sighting of some individuals more than once at different sites. The relative proximity of these sites and the short amount of time required for travel must have assisted with the movement of individuals. This observation is similar to that of Sheppard *et al.* (2006) who recorded that male and female dugong, including cows with calves, exhibited large-scale movements (15km to < 100km) in Queensland, Australia.

Dugongs were not re-sighted among the different regions. This finding might imply that each dugong show an implicit preference towards one site over the others. The absence of some individuals from the sites for more than a month might be explained by their movement for another feeding area to avoid disturbance. High site fidelity to areas of core habitat has been reported for of Florida manatees (Weigle *et al.* 2001 and Deutsch *et al.* 2003). Their movements appeared to be influenced by seasonal and regional fluctuations in biomass and nutritional content

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PHOTO IDENTIFICATION OF DUGONGS IN MARSA ALAM AND WADI EL GEMAL NATIONAL PARK, EGYPTIAN COAST OF THE RED SEA

التعرف على عروس البحر باستخدام تقنية التصوير
بمحميتي مرسى علم ووادي الجمال، البحر الأحمر، مصر

الملخص العربي

توضح هذه الدراسة استخدام تقنيات التعرف بالتصوير في التعرف على 30 فرد من عروس البحر و إعداد قائمة تعريفية مصورة لكافة الأفراد في 22 موقعا بالمياه المصرية للبحر الأحمر، شملت 16 موقعا بمرسى علم 14 موقعا بمحمية وادي الجمال. كما أوضحت نتائج الدراسة بأنه لم يتم تسجيل أي فرد من عروس البحر المسجلة في مرسى علم في محمية وادي الجمال أو العكس. وقد لوحظ غياب بعض الأفراد عن مواقع معينة لفترة تزيد عن شهر وقد يرجع ذلك إلى تحرك تلك الأفراد بين المناطق لإيجاد غذائها وتجنب الإزعاج، كما تم تسجيل تحركات 8 أفراد لمسافات طويلة وقصيرة بين المواقع المختلفة.