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STRANDING OF A NEONATAL DUGONG CALF IN WADI EL GEMAL NATIONAL PARK: IMPLICATIONS FOR DUGONG CONSERVATION IN EGYPT

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ABSTRACT

A male dugong calf(Dugong dugon) of 120 cm long wasobserved stranded at Wadi El Gemal National Park on September 29th2015. Thecalf hadscars on the head and body skins.It was released back to the sea but wasfound dead on October4th2015. Photo-identificationtechnique onfirmed that it was the same individual at the two incidences. Its behaviour was observed,and recorded at the two sites. The time budget of the different behaviouralactivitiescomprising travelling, surfacing, and resting-wasregistered before and after stranding. After strandingthe calf frequently surfaced to breath, rested more and travelled less. Itdied 12 days after of the first observationduring September 22nd.All possible measurements were taken.The study recommends considering Ras Baghdady in Wadi El Gemal National Park as a nursery ground for dugongs.

KEYWORDS: *Dugong dugon, calf, stranding,Wadi El Gemal, conservation.*

INTRODUCTION

Stranding has been definedby Geraci and Loundsbury (1993) as"sick, injured or dead dugongs that were washed ashore or encountered at sea; in addition to dugongs which were entangled in fishing nets/synthetic debris or rescued from a situation where they would have died had they not been rescued."Causes of stranding have been classified by Abulyanukosol*et al*. (2009) into six categories; gillnets, trawlers, stationary traps or stake traps, other fishing gear, and non-fishing gear (caught by hands, boat strikes, shark attacks, etc.). They concluded that44%of dugongs died by unknown causes while85.7% died due to trapping in stationary traps.Meager(2013) determined other causes of dugong stranding and mortality for populations in southern Queensland.These includedfundamental reasons (i.e., disease and ill health, shark predation), rescued and natural escape, human-related (i.e., boat strike/fractures, entanglement in float lines and ropes, netting, entanglement, Queensland shark control program, ingestion of fishing line/ hooks and hunting).

Stranding of calves was recorded in some regions around the world such as Thailand (Abulyanukosol*et al*., 2009) and Australia (Blanshard, 2006; Limpus*et al.*; 2002; Greenland andLimpus, 2006).March *et al*.(1984c) reportedthat,death and stranding of dugongs less than one yearwere encountered on the shorelines of Queensland, Australia.The same authors (1984a) concluded that the death of dugong calves might have occurred due to some problems at birth related to theplacenta.Data collected from dugong carcasses have contributed to research in areas such as life history (Marsh, 1980, 1999; Marsh *et al.* 1984a,c; Marsh *et al.*, 2001); feeding biology (Lawler & Andre 2001; Marsh *et al.*, 1982; Preen, 1995) and investigating the stock structure/genetics of dugongs (McDonald 2006; Tikel 1998). On the other hand, signs of natural and human-induced causes of death can be provided by necropsy examinations (Eros *et al*., 2007).

This study aims at through light on the impact of stranding on the behaviour of a calf dugong in the wild within Wadi El Gemal National Park area (WGNP), South Red Sea. Morphological-data werealso collectedfrom the dugong carcass-safter deathtoprovide essential information on its biology to determine a reason of death. These results would support decision makers to detect the primary impacts to a population in particular areas and hoped toestablish a management plan for dugong conservation in the southern Red Sea.

MATERIALS AND METHODS

Photo identification of the calf:

Underwater photographs of the dugon′s calf were taken from the studied sites using a HD

Camera (Go Pro Hero 4 silver) with a red filter. Photos taken were processed and matched using the"ACDSee" software program.

Behaviouralbudget:

Three main behaviouralcategories (travelling, resting and surfacing)were recorded according to Hodgeson(2004) using underwater video recording. The proportion of time the calf spent within each behavioural category was recorded and divided into bouts. A bout comprises a particularbehaviourcarried outconsistently andinterrupted only by surfacing behaviour. During the bout, surfacing time was incorporated in the boutlength. However, surfacing time was considered a separate behaviourwhen it took place in the transition between different behavioural categories. The proportion of time the calfspent carrying out surfacing behaviour was calculated using all surfacing, together with those within bouts. The mean proportion of time the calfspent in a bout of each behavioural category was used to calculatethe overall time budget (Hodgeson, 2004).

Before death

Amaledugong′scalfhadbeen seen observed alone in several sites south of Marsa Alam, Red Sea, Egypt (Figure 1). Firstly, on September 22nd 2015,the calf was seenswimming for a quitelong timein Marsa Nakari (Lat. 24.927335° and Long. 34.964136°) located16km south of Marsa Alam City. The diving centre staffstookvideos for the calf that was fast swimming in circles near the surface in an area of16m depth.On September 29th 2015, local people reported a stranded calf dugong on the beach to the Rangers of Wadi El Gemal National Park, located 50km south of Marsa Alam and 4km north of Ras Baghdady (24° 68' 5816" N and 35°08' 4380"E). The calf wasreleased back to the sea on the same day with the help of one ofthe tourists who was swimming in the water at that time. The rangers stayedwith the calf in the water for many hours to stop him from stranding again by wave action sinceit was trying to swim towards the reef flat several times. The calf was then seen swimming slowly and rested many times at the surface and the bottom. The whole incidence was filmed and documented by the WGNP rangers and Wadi El Gemal diving center staffs. When the calfswam away to the open water, it returned directly to the reefuntil it disappeared by the end of the day. Several surveys around the area were conducted the next day by the National Park and Wadi El Gemal diving center staffsin search of the calf but were entirely unsuccessful.

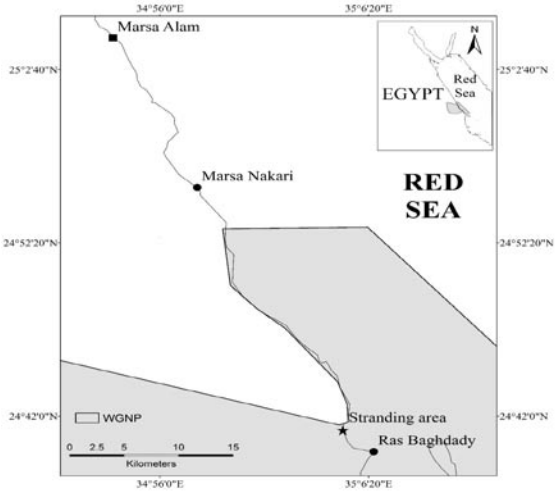

Figure (1) Mapshowing the stranding sites South Wadi El Gemal National Park, the Egyptian Red Sea.

After death

OnOctober 4th2015 at 10:15 AM,the calf wasfound dead on the reef closetothestrandingsite at2m depth. The carcass was bloated but in a relatively good condition.A total of 41 measurements were taken according to Heinsohn (1981), comprised 16 for the ventral side, 18 for the dorsal, 3 for the mandibles and 4 for the other parts (Figure 2). All lengthswere taken in centimeter and they are outlined as following:

1- **Ventral side:**Chin,fluke,fluke outside curved,fluke notch depth,tailstock girth,umbilicus length,genital opening length,anal opening length,snout to thecentre of theanal opening, snout to thecentre of genital opening and snout to thecentre of theumbilicus were measured.

2- Dorsal side: The length of total body,nostrils,head plus neck,head,neck, maximum girth,eye,between two eyes,snout, snout girth,snout to eye,snout to nostrils,eye to nostril,eye to external auditory meatus,external auditory meatus diameter,flipper base,anterior flipper andposterior flipper were measured.

3- Mandible: Mandible main straight length,upper width and sprocketwere measured.

4-Other parts: These parts comprised measurements of blubber layer,lung,penis outside andpenis inside at the base.

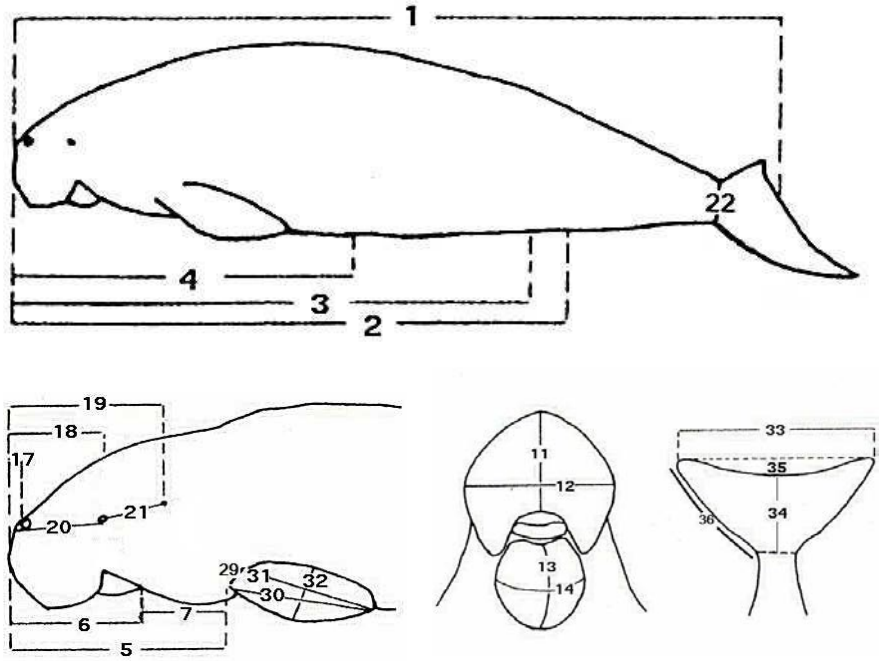

Figure (2): Dugong morphometric measurements(AfterHeinsohn, 1981).

Thecarcasswas slit open from the anus up to the chinby means of a scalpel. Sea grasses found where identified according to El Shaffai (2016).Measurements of the thickness of the blubber layer, length and width of the left lung were carried out. The mandibles were cleaned with hydrogen peroxide solution by means of a toothbrush and was left to dry. It was given a liquid plastic coat of Polyurethane for preservation. The weight of the carcass was estimated using the equation ofAdulyanukosol*et al*. (2009) as following:

$Y = 19.108 \times^{2.8103}$

Where Y=body weight (kg) and X= body length (m)

RESULTS

Identification of the calf:

The calf was identified as the same individual in both sites by matching the small notch in the middle of the fluke margin (Plate 1a, b).

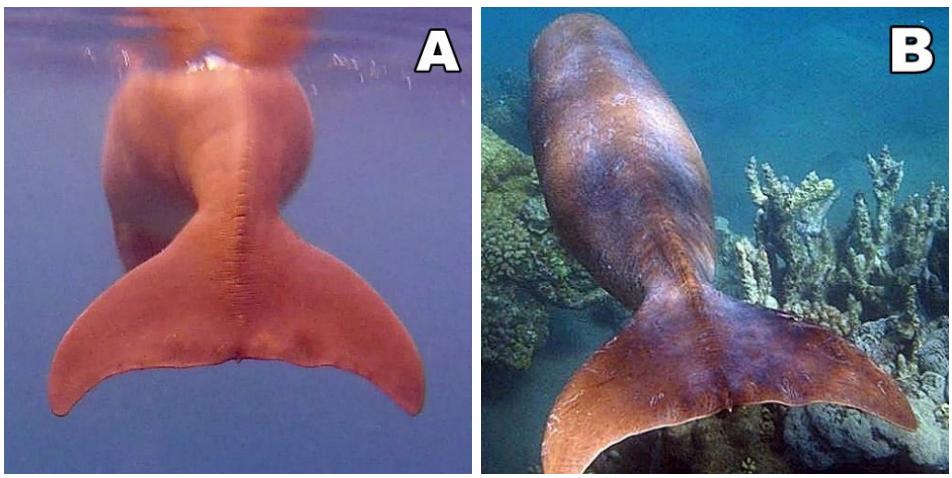

Plate (1 A, B): Photos of the fluke margin of the calf taken at Marsa Nakari (a) and WGNP (b).

Behaviouralactivities:

A- Before stranding:

AtMarsa Nakari, the calf was seenina goodcondition with no sign of physical stress, wounds or scratches. It was observed swimming in circlesbefore ascending to thesurface to take a quick breath and was seencontinuously touchingitsmuzzle with itsflippersproducinga chirping like sound. The mean and median length of bouts for each behavioural category is presented in Table (1). These data were calculated using only those bouts where both the onset and cessation were recorded, however, those that occurred at the beginning and the end of boutwere excluded. According to both mean and median estimates, bouts of travelling tended to be longer than all other behavioural categories, followed by resting and surfacing.

Table (1):Summary of the length of bouts of each behavioural activityrecorded by usingthe video footages including incomplete boutsat Marsa Nakari before stranding.

Behavioural categories	Mean bout length ± SE (s)	Median (s)	Range (s)	Maximum bout lengthincluding incomplete bouts(s)
Travelling	36.5± 5.0	19.5	0 -35	274
Resting	13.9± 1.8	7.0	0 -18	104
Surfacing	1.1± 0.1	1.0	0 -1	8

Legend (s) = seconds.

Travellingwas the most common behaviour and averaged 71±12% (N=36, 19.57±18.92 sec), followed by resting with 27±11% (N=10 7.42±6.83 sec) (Figure 3). Surfacing was done at rare instances 2±1.3% (N=16, 0.57±0.51 sec). The majority of travelling was carried out at a cruising speed (44%) followed by fast and slow travels (14%, 13%), respectively. During resting, the calf stayed mainly at the surface (24%) than at mid-water (3%).The depth in which the calf existed ranged between 7-18 m. During the calf dive cycles, thefrequency of submergence intervals was higher than the surface ones (2.7±0.4 and 1.7±0.4), respectively, while the mean number of breathing at the surface was 2±0.5.

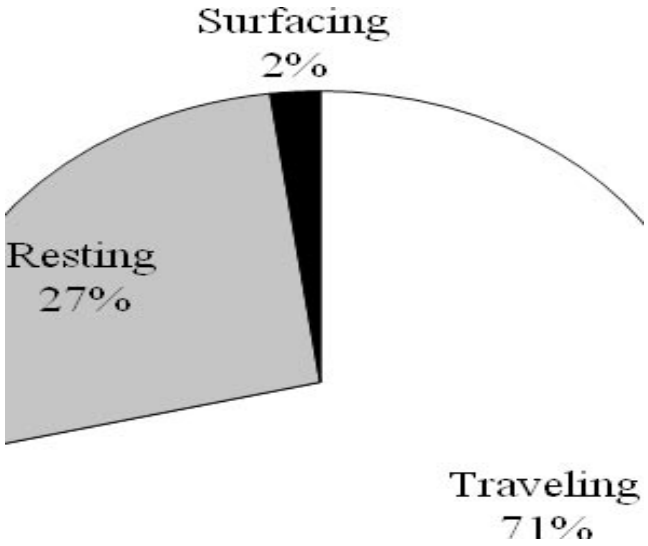

Figure (3) Time budgets of the calf spent within each behaviour activity and for specific behaviours within categories at Marsa Nakari.

B- After stranding at WGNP:

A total of 5 videoswere recordedfor the dugong calf after strandingwith a total of 417 seconds. The calf was ina poorcondition;the skin was pale and had several scars all over. The mean and median length of bouts for each behavioural category is presented in Table (2). Bouts of travelling tended to be longer than all other behavioural categories, followed by resting and surfacing.

Table (2): Summary of the length of bouts of each behaviouralactivity recorded in the video footages including incomplete bouts at WGNP after stranding.

Behavioural categories	Mean bout length ± SE (s)	Median (s)	Range (s)	Maximum bout length (s) including incomplete bouts
Traveling	60.3± 24.4	41.5	6-181	362
Resting	63.6± 26.4	47	6-190	380
Surfacing	2.7± 1.2	2.5	6 -8	16

The resting behaviour was the most common and averaged 56±24% (N=11, 47±2.3 sec), followed by travellingaveraged 42±24% (N=16, 36±5.7 sec) (Figure 4), while surfacing was at rare instances with 1±0.6% (N=5, 1.5±0.8 sec). The majority of resting was done at the surface (30%) then on the bottom and mid-water (15%, 11%), respectively. As for travelling, the calf showed less swimming (28%) than cruising (14%).The dive cycle was recorded in mean depth of 1.2±0.2m. The average frequency of the calf dive cycles for the submerged and surface intervals was 3±1 and 2.7±1.7 dive respectively, while the average number of breathing at the surface was 1.2±0.4.

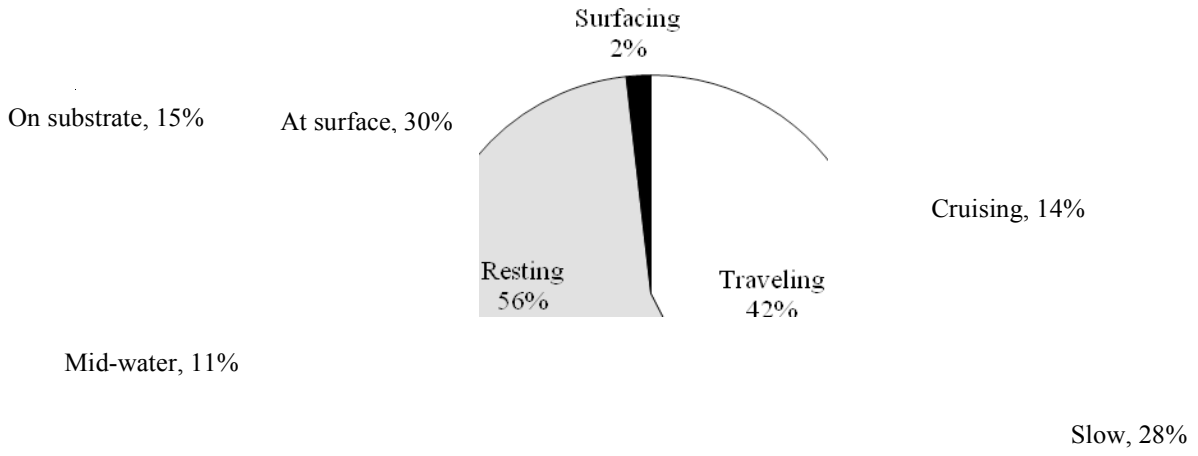

Figure (4): Time budgets of the calf spent within each behaviour activity and for specific behaviours after stranding.

Measurementsof the carcassand observations on the internal organs:

The results of all measurements are taken in centimeter and represented in Table (3). The carcass was 120 cm long (Plate 2);its head length was nearly 1/5th of the total length. The Fluke notch depth and the distance between the anal and the genital opening measured approximately 1/4thand 1/15thof the total length, respectively. The mandible length(Plate 4A) was 13cm and represents 2.5 times bigger than the width (5 cm). The outsidelength of the fully erected penis was more than 1/37 the total length (Plate 3). The width of the sprocket base was1.1cm, equals to that of the length (Plate 4 C, D).

Internal organs were totally liquefied except for the left lung. Parts of the skeletal systemsuch as the mandibles, chest ribs and the vertebrae were completely loose. Intact leaves of the seagrass of the genus *Halodule uninervis*were observed at the upper part of the chest area.

Subsequent records of calfsighting in WGNP:

After the calf's death, several surveyswere conducted within the WGNP areaover a period of six months and calves were sighted on severaloccasions(Table 5). A mother with its calfwas observed once in Hamata harbour, while a single calf was seenin Ras Baghdady. Small feeding trails also were seen in Ras Baghdady-and Wadi El Gemal Island(Figure 4).

Table (3) Measurements of the carcass.

No.	Measurements	Units (cm)
1	Total body length	120
2	Distance from snout to centre of anal opening	103.5
3	Distance from snout to centre of genital opening	95.5
4	Distance from snout to centre of umbilicus	75.5
5	Head plus neck length	27
6	Head length	25
7	Neck length	2
8	Genital opening length	3
9	Anal opening length	1.9
10	Blubber layer thickness	0.4
11	Snout length	18.4
12	Snout width	12.2
13	Chin length	7
14	Chin width	12
15	Penis outside length	3.2
16	Penis outside width	1.1
17	Snout to nostrils	2.3
18	Snout to eyes	6.2
19	Distance from snout to external auditory meatus	17.3
20	Distance between eye and nostril	8.3
21	Distance between eye and external auditory meatus	9
22	Tailstock girth	29
23	Total nostril width	2.2
24	Eye height	0.9
25	Eye length	1.2
26	Distance between two eyes	16
27	Nostril height	1.2
28	Nostril width	1.2
29	Flipper base	8
30	Anterior flipper length	17.3
31	Posterior flipper length	15
32	Flipper width	9
33	Fluke width	33
34	Fluke length	18
35	Fluke notch depth	30
36	Fluke outside curved length	25
37	External auditory meatus diameter	1.1
38	Umbilicus length	1.1
39	Maximum girth	20
40	Lung length	18
41	Lung width	7

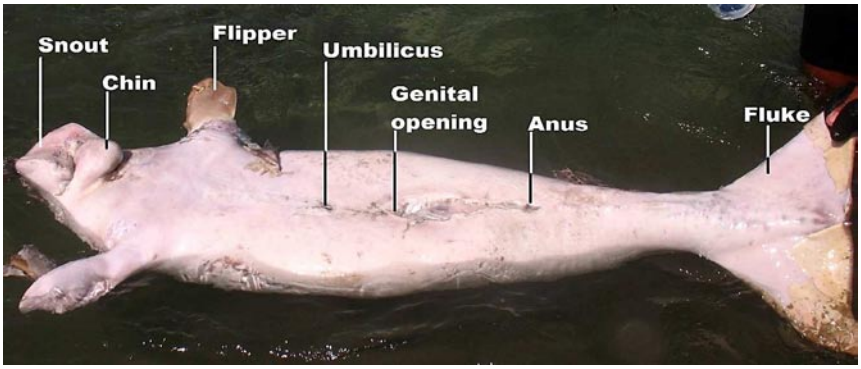

Plate (2): Ventral view of the dugong's calf carcass.

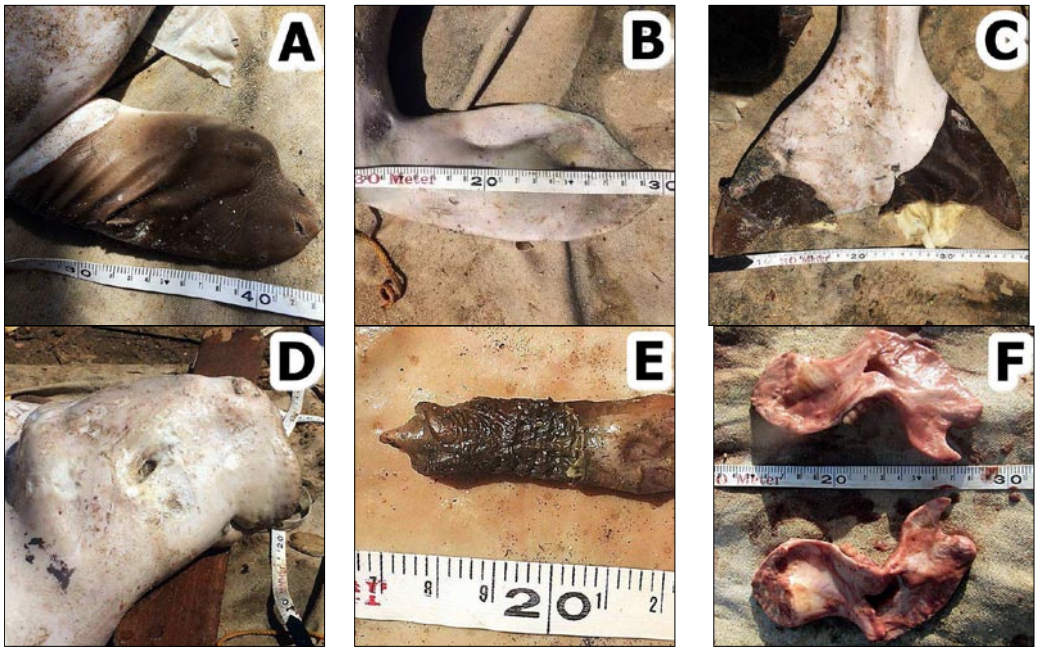

Plate (3):Measurements the calf dugong; A)dorsal flipper, B) ventral flipper, C) dorsal fluke, D) head, E) erected penis and F) mandibles.

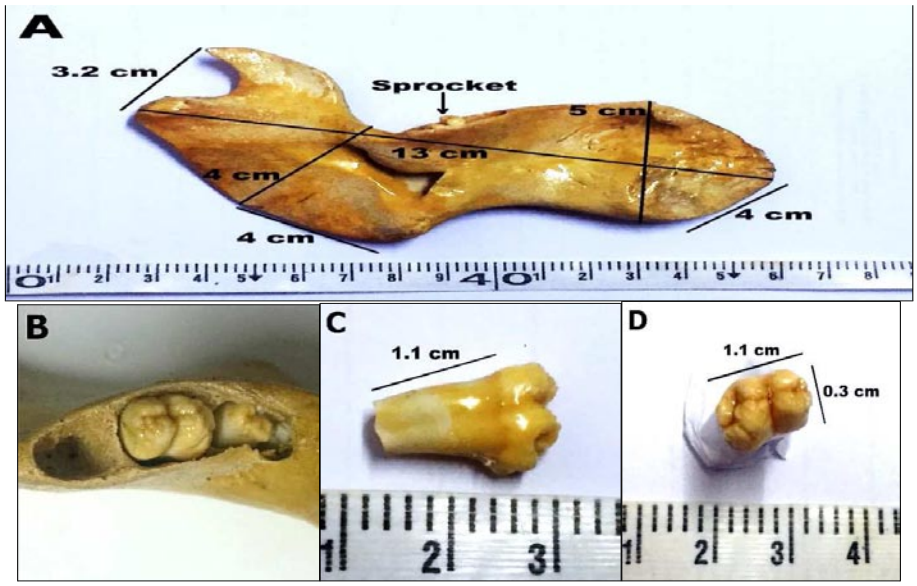

Plate (4): Calf dugong mandible; A) lateral view of right mandible with measurements, B) upper view of sprocket area, C) lateral view of the single sprocket, D) upper view of the single sprocket.

Table (5) Evidences of calves' occurrence inthe WGNP area.

Done by	Date	Observations	Areas	Time
A tourist	October 7th 2015	Calf swimming with three bottlenose dolphins.	Ras Baghdady	Morning
First author	October 11th 2015	Small feeding trail of 11cm width	Ras Baghdady	Afternoon
First author	October 14th 2015	Small feeding trail of 7cm width.	Ras Baghdady	Morning
The Egyptian Dugong Team (EDT)	February12th2016	Mother dugong with its calf.	Hamata Harbour	Morning
First author	March 14th 2016	Small feeding trails of 11 cm width beside another of 24cm width.	Wadi El Gemal Island	Morning

Figure (4): Small feeding trailobserved at Ras Baghdadyin WGNPon October 14th2015.

DISCUSSION

In this study, the change in the calf behavioural activities after stranding was observed in terms of increased resting and decreased travelling by almost 30% for both. This reduced vitality and beings reasonable due to the physical stress to which the calf was exposed to during stranding as well as to the restricted access to milk after separationfrom the mother.During stranding on the beach, the calf suffered from some injuries due to collision with the coral reefs as a result of wave action. It also suffered from dehydration because of the long time exposure to sunlight-with no enough water to cover its body.Adulyanukosol*et al*.(2009)stated that dugongs are very delicate animals that are easily panicked, rapidly weakened and perish under unfamiliar environments such as being trapped in dry conditions.

Death of the present calf was presumably due to its trapping between reefs. The calf might not have been able to release itself after being strongly weakened due to starvation.Consequently, itdid not hasthe ability to rise to the surface to breathe and therefore suffocated. This conclusion is supported by the observation that the body of the calf lacked any wound marks that might indicate anypossible attacks or predation propabilities.Adulyanukosol*et al*.(2009) reported a stranded dugongbeing trapped in a shallow water stationary trap in Phuket Island(Thailand), got dehydrated and died in an a hour or less as itcould not breathe easily although it was in the air.In the present study, the calf could have survived if received instant medical care at the time of rescue. Maintaining rescued calves in captivity have been reported in several areas of the world. Some successful attempts were made where calves were given human care and raised on milk and sea grassuntil weaning age then released back to the sea(Kataoka*etal,*.1995; Blans hard,2000;Adulyanukosol*et al*. 2004).

In the present study, the calf was firstly observed in Marsa Nakari, then in Wadi El- Gemal one week later. It was not able to specifically locate the place where it lost its mother or be certain whether it travelled those 34km on its own or together. The calf tarvelled this distance in 7 days, therefore, it could be postulated that this slow travelling rate was done due to its physical weaknessin search of the mother. Adulaynu-

kosol and Thongsukdee (2005, 2006); Adulyanukosol *et al*.(2008) stated thatdugong calves of less than two-year do not migrate alone, but in a group of large dugongs (two to five dugongs) as well as with the mother.Sheppard *et al*. (2006) reported that adult dugongs and calves could move to long distance.Migration might be an advantage for the young animal in terms of social communication (Adulyanukosol *et al*., 2009). On the other hand, Christophe (2015)observed that a calfcould travel a distance by resting on its mother back or side.

The weight of the dead calf could not be precisely measured due to bloating of the carcass. However, the results obtained from the equation by Adulyanukosol*et al*.(2009)was similar to that estimated by Marsh *et al*.(1984c) who stated that the weight of the newborn dugong ranged from 20 to 35 kg within 1.0 to 1.3 m length in north Queensland, Australia.The present findings are the first data on the measurement of dugong calves inhabiting the Egyptian Red Sea coasts. The only published report was that by Gohar (1957) who gave a list of measurements for 16 adult dugongs (10 females and six males) from Hurghada, northern Red Sea.

Leaves of the seagrass *Halodule uninervis*were were observed in the cardiac region of the calf's stomach. The fact that the calf fed on sea grasses before death indicates that sea grasses are insufficient for nutrition and that nursing is essential for survival. El Shaffai (2011, 2016) reported 12 species of sea grasses in Wadi El Gemal area, of which *H. uninervis*was one of the most abundant. Marsh *et al*. (1982) reported that dugong feeding before death reflects thepresence of seagrass beds near to place it was encountered.Lipkin(1975) examined the stomach contents of six dugongs along the South Sinai along the Gulf of Aqaba and concluded that the food was exactly the same type of seagrass present in the capture area.

On the basis of food availability and sighting of calves in Ras Baghdady, the present worksuggests that this area could be declared as a nursery ground for dugong calves similar to the Dugong Protection Areas (DPA) suggested by Marsh *et al.* (2002) in Queensland, Australia.This declaration should be considered when management plans are madesince the mortality rate of dugong calves is very critical for population rehabilitation. The present study emphasizes the necessity of consideringthe conservation of the dugong population in this area. Regulations shouldbe made to allow the Egyptian Environmental Affairs Agency (EEAA) authorities to declare Ras Baghdadyas the first Dugong Protected Area (DPA) in the Egyptian Red Sea.

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جنوح وليد عروس البحر وتعلقه بالشاطيء فى محمية وادى الجمال: مقترحات للحفاظ على عروس البحر فى مصر

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تم فى هذا البحث ملاحظة ذكر وليد عروس البحر بطول 120 سم عالقا فى محمية وادى الجمال بتاريخ 29 سبتمبر 2015. وكانت هناك آثار لجروحوخدوش على رأسه وجسده. ولقد تم أرجاع الوليد إلى البحر ثانية ولكنه وجد ميتا بتاريخ 4 أكتوبر 2015. وقد أستعملت تقنية التعريف بالتصويرالفوتوجرافى للتأكد من أنه نفس الفرد. وبدراسة سلوكه قبل وبعد التعلق تم تقدير الوقت المستخدم للأنشطة المختلفة خاصة التحرك والصعود إلى السطح والراحة. و قد أوضحت الدراسة أن الوليد كان يصعد إلى السطح كثيرا للتنفس بعد التعلق، ولكنه كان يتحرك ويرتاح بشكل أقل. وعند نفوقه بعد 12 يوما من هذه الملاحظات تم أخذ القياسات الممكنة لأبعاد الجثة. وقد أوصت الدراسة أعتبارمنطقة رأس بغدادى بمحمية وادى الجمال كحضانة طبيعية لحيوان عروس البحر بالشواطيء المصرية للبحر الأحمر.