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# Results of the Aerial Survey of marine wildlife and habitats of Abu Dhabi Waters: February-March 2004

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هيئة البيئة - أبوظبي  
**Environment Agency-ABU DHABI**

أبحاث • تنمية • حماية  
RESEARCH • DEVELOPMENT • PROTECTION

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### DECLARATION

This is an interim report of the study “*Study on the biology, distribution and conservation of dugongs in the UAE*” conducted by Marine Environment Research Center of EAD. The project is funded by TOTAL ABU AL BUKHOOSH and LA FOUNDATION D’ENTERPRISE TOTAL.

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## **1. 0 Introduction**

The United Arab Emirates supports a dugong population of international significance. Almost all the dugong population in the UAE occurs in the waters off the Emirate of Abu Dhabi. An initial study to evaluate the status of dugongs in the UAE was completed in 2003. This study, which was conducted by the Marine Environment Research Center (MERC) of the Environment Agency- Abu Dhabi (EAD), was funded by TOTAL.

Key deliverables of the study were:

- 1- Estimation of dugong population size in UAE waters
- 2- Assessment of the status and mapping of dugong habitats
- 3- Determination of threats to the dugong population and its habitats in the UAE
- 4- Development of a conservation plan for the dugong population and its habitat.

The findings of phase 1 of the study contributed towards establishing the first Marine Protected Area in the UAE and encouraged further research on the species and habitat.

The objectives of the current study (2003-2005) include:

- 1- Quantifying the distribution and monitoring the abundance and habitats of species,
- 2- Studying the biology, life history and migration of dugongs,
- 3- Implementing the conservation plan,
- 4- Encouraging regional and international cooperation on dugong research and conservation through exchange of information and conducting of international / regional seminars on the results of the study, and conservation of dugongs in the UAE.

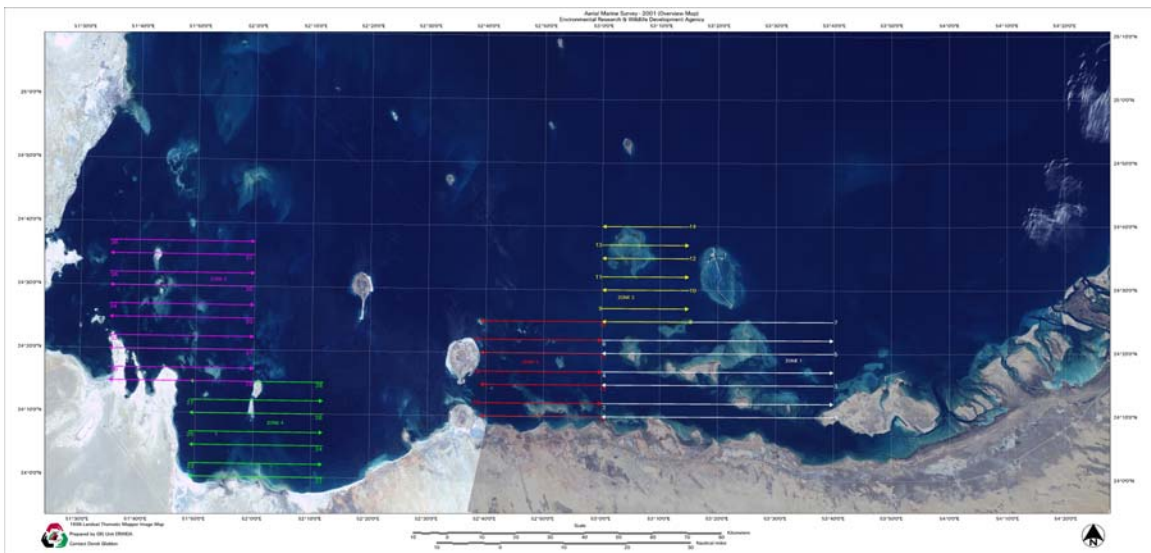
As part of the monitoring program of dugongs, an aerial survey was carried out in February 2004 by the Marine Environment Research Centre. The survey covered an area of about 6500 km<sup>2</sup> involving flights over 5 zones comprising 36 transects in 11 hours extended over a period of 6 days. During the survey sightings of dugongs, other marine wildlife (sea turtles, dolphins, sharks etc.), marine habitats (seagrass, seaweeds, corals, mangroves and coastal features) and human activities (fishing, boat traffic, development on islands) were recorded.

## 2.0 Methods

### 2.1 Logistics and Procedures

An aerial survey using a Puma helicopter from the General Headquarters of the Armed Forces was conducted to record sightings of dugongs and other marine wildlife and habitats in Abu Dhabi waters following Marsh et al. 1996, Marsh and Saalfeld 1989, 1991, Ligon 1982.

Five zones, containing 36 transects, covering an area of 6454 km<sup>2</sup> were surveyed during the winter period (Feb – March) of 2004 (Figure 1). These zones, which cover the maximum possible coastal area for dugong occurrence, were selected following a synoptic aerial and field survey of the UAE waters.



**Figure 1.** A GIS map of the coast of the UAE showing the five zones and line transects for aerial surveys.

During the survey, the helicopter, which was equipped with navigational aids and a GPS, flew at altitudes between 300 and 560 feet and traversed transects at speeds ranging from 120 to 175 km/hr. Sightings of dugongs and other wildlife were recorded by observers sitting on the left and right hand sides of the helicopter. The side doors of the helicopter were kept opened and observers were able to safely sit on the sides and have a clear view of the coastline with the aid of safety belts. All sightings within the 1 m<sup>2</sup> imaginary quadrat were recorded. Transects were flown in an east-west direction in all zones since

this direction was noticed to cause the least amount of glare from the reflection of the sunlight. Effort was made to undertake the survey during the high visibility period of the day that ranged from 07.00 hrs to 14.00 hrs.

## *2.2 Correction factors*

The abundance of dugongs and other wildlife was estimated by correcting sightings for availability bias and correction bias (Marsh and Sinclair 1989). Availability bias is corrected by standardizing the proportion of animals (dugongs and sea turtles) “at surface” against the equivalent proportion over very clear shallow waters where all animals (both surface and underwater) are seen. This approach assumes that a constant proportion of animals are at the surface across the survey areas. Perception bias occurs when animals are visible in the survey transect but missed by observers. A factor is derived based by comparing the proportion of animals seen by different observers.

Each observer recorded data on flight details, weather, and visibility, sightings of wildlife species and habitats, as well as human activities within the survey area. Transects in the survey area were not uniform in length and consequently the area within different transects was unequal. This factor was taken into account in the analysis. Accordingly, the ratio method was used to calculate population estimate for each zones separately using the formula below.

$$E = (N / At) \times A \times CFa \times CFp$$

Where,

E = Estimated population

N = Total number of dugongs sighted in the transect sampling

At = Area covered in the transect sampling

A = Total area of the survey zone

CFa = Availability correction factor

CFp = Perception Bias Correction Factor

### 3.0 Results

#### 3.1 Correction Factors

The application of correction factors is necessary to derive a more reliable estimate of a given population from the raw data (actual sighting data) in an aerial survey (Marsh et al. 1994). Perception bias correction factors and mean-group size correction factors could not be derived from the set of data collected during this survey but the availability correction factor following Marsh and Sinclair (1986) was derived to be 2.478 (considered 2.5 for analysis). The correction factors derived elsewhere included 3.74 for Red sea (Preen 1989) and 1.4 to 3.04 for Australia (Marsh et al. 1994). Availability correction factor for sea turtles was calculated to be 3.01 (considered 3.0 for analysis).

#### 3.2 Species

##### 3.2.1 Dugong



**Figure 2. A large herd of dugongs (>100) was sighted in zone 5.**

The winter aerial survey of 2004 covered an area of 6454 km<sup>2</sup> (5 zones, 36 transects).

The population of dugongs during the survey (winter 2004) was estimated to be 2925 compared to 2185 during winter 2001. Most of the dugongs occurred alone – group size 1, (60 % of cases) and the occurrence of dugongs in groups >1 was observed in less than 30% of the cases. The largest group observed had six individuals.

A herd of around 100 dugongs was sighted and photographed in zone 5 but was not considered for calculation due to its occurrence outside the quadrat. Mother and calf groupings were observed in 8.4 % of the cases which is less than that of 2001 where 9.8 % sightings were mother-calf pairs. Calves were never observed alone. Two dead dugongs were observed during the survey in zones 1 and 3.

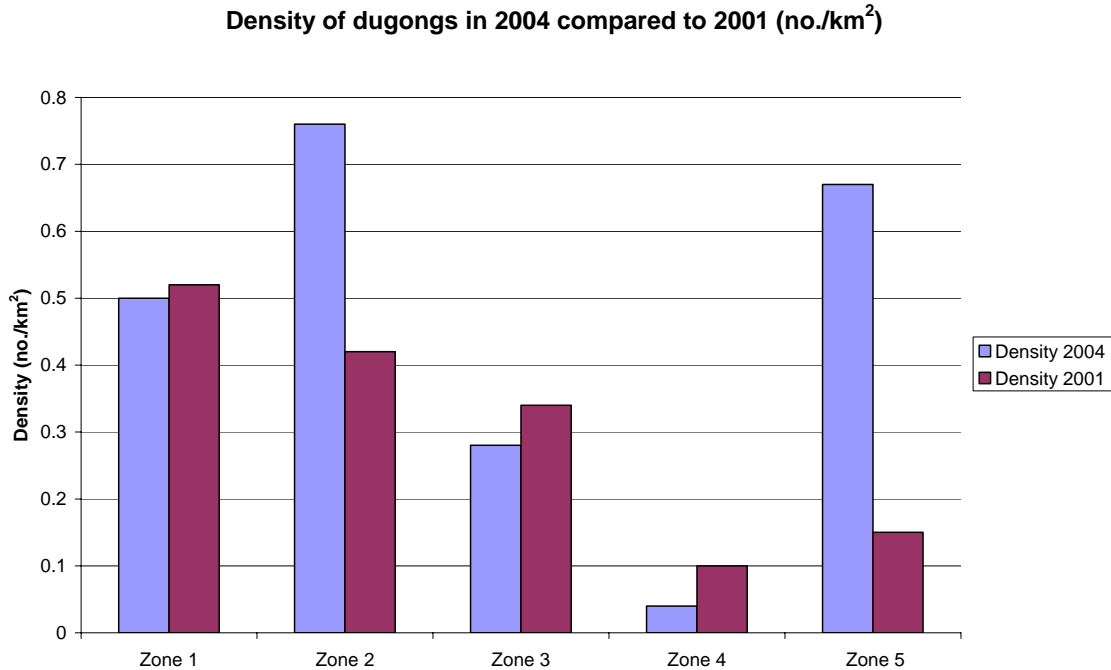
Table 1 provides information on the distribution of dugongs by zone during the winter of 2001 and 2004. The highest dugong density was observed in zone 2 (0.76 / km<sup>2</sup>) followed by zone 5 (0.67 / km<sup>2</sup>). Approximately 58 % of the entire recorded populations were sighted in Marawah Marine Protected area (zones 1 and 2). The density of dugongs in zone 5 increased from 0.15 / km<sup>2</sup> 2001 to 0.67 / km<sup>2</sup> 2004. This sudden rise in dugong density warrants continuous monitoring and investigation.

Since sea conditions and visibility was good, sightings were recorded at the water surface as well as underwater. In 70 % of the cases, dugongs were observed in deep water areas (> 10 meters depth). Almost 20 % of the dugongs sighted were observed in seagrass beds, whereas only 10 % of those sighted were found in other habitats such as seaweed and coral reefs.

**Table 1 Estimated population and density of dugongs in each zone during the winter surveys of 2001 and 2004.**

Zones	Number of transects	Area covered in square km	Estimated dugong population (Density per km <sup>2</sup> )	
			Feb 2001	Feb 2004
Z 1	7	2100	1096 (0.52)	1050 (0.50)
Z 2	7	850	358 (0.42)	650 (0.76)
Z 3	7	1068	372 (0.34)	300 (0.28)
Z 4	7	1140	124 (0.10)	50 (0.04)
Z 5	10 (8)	1539 (1296)	235 (0.15)	875 (0.67)
<b>TOTAL</b>	<b>38 (36)</b>	<b>6697 (6454)</b>	<b>2185</b>	<b>2925</b>

Two transects (29 and 30) in Zone 5 not flown. Missing area of 243 sq km. Availability CF 2.5, survey area 10% of total area.



**Figure 3 Density of dugongs – winter 2001 and 2004**

### 3.2.2 Sea Turtles

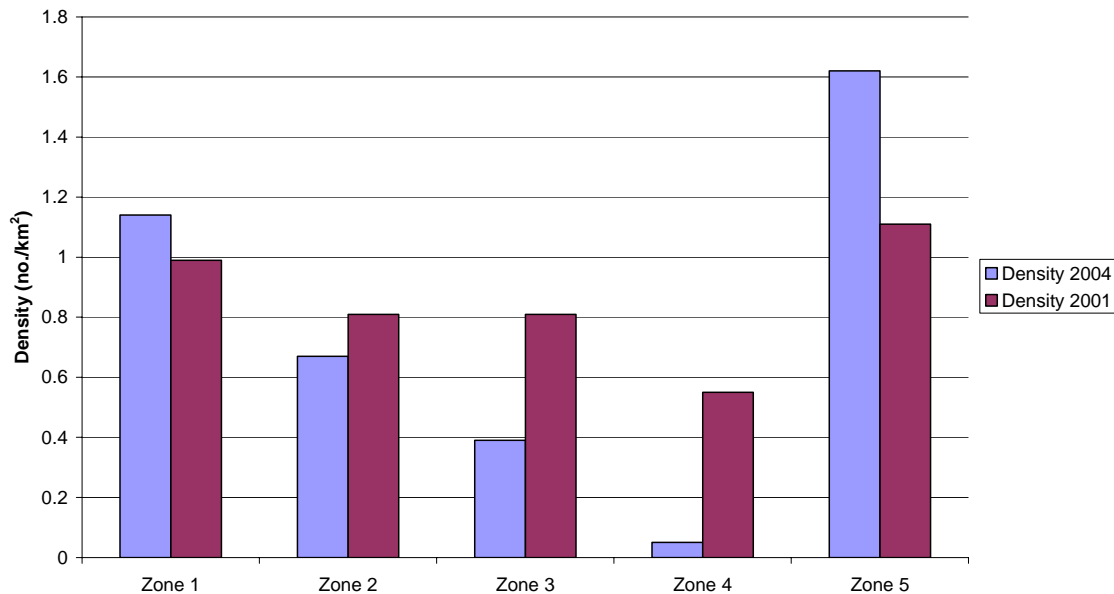
The estimated population of foraging population of sea turtles during the aerial survey was estimated to be 5500 sea turtles (table 2). The foraging population size and distribution was not estimated during the aerial survey of winter 2001 as the correction factors could not be derived. During the survey of 2004, the availability correction factor was calculated as 3.01 (used as 3.0 for analysis). The same factor was used to estimate population size for data collected in 2001 also. Table 2 and Figure 4 provide a zone wise comparison of estimated population and density.

**Table 2** Estimated population and density of sea turtles during the winter surveys of 2001 and 2004.

Zones	Number of transects	Area covered in square km	Estimated population of sea turtles (foraging) in Abu Dhabi waters (Density per sq km)	
			Feb 2001	Feb 2004
Z 1	7	2100	2070(0.99)	2400(1.14)
Z 2	7	850	690 (0.81)	570(0.67)
Z 3	7	1068	870(0.81)	420(0.39)
Z 4	7	1140	630(0.55)	60(0.05)
Z 5	10 (8)	1539 (1296)	1440 (1.11)	2100(1.62)
<b>TOTAL</b>	<b>38 (36)</b>	<b>6697 (6454)</b>	<b>5700</b>	<b>5550</b>

Two transects (29 and 30) in Zone 5 not flown in Feb 2004. Missing area of 243 sq km. Availability CF 3.0, survey area 10% (approximately) of total area.

### Sea turtle density in 2004 compared to 2001



**Figure 4 Density of sea turtles of winter 2001 and 2004**

The highest sea turtle density was observed in zone 5 which includes the islands of Al Yasat and Al Muhayimat followed by zone 1 which includes the Marawah Marine Protected Area. Approximately 58 % of the entire recorded populations were sighted within the Marawah Marine Protected area (zone 1 and 2). The results show an increase in the density of sea turtles in zones 1 and 5 compared to 2001. However, densities in zones 2, 3 and 4 density were slightly lower than in 2001. In 60 % of the cases, sea turtles were observed in deep water areas (> 10 meters depth). Almost 30 % of the sea turtles sighted were observed in seagrass beds whereas only 10 % of those sighted were found around coral reefs.

### 3.3 Habitats

The location and extent of marine and coastal habitats including seagrasses, seaweeds, corals, mangroves and inter-tidal habitats was recorded during the survey. The data collected will be ground checked with follow-up field surveys in the coming months. Once this is done a resource atlas can be developed and management strategies reviewed.



**Figure 5 Extensive seagrass meadows within Marawah Marine Protected Area**

### 3.4 Human activities

The nature and location of human activities was recorded during the survey. These data are being validated with field visits. Island development was the main activity observed during the aerial survey. Only six fishing boats were observed during the survey of over 6000 km<sup>2</sup> area. Summer aerial surveys and follow up field surveys will help to provide more information as to the impact of these activities on marine habitats and wildlife.



**Figure 6 Coastal developmental activities on offshore islands**

#### **4.0 Discussion**

Preliminary analysis of aerial survey data of Feb 2004 indicates the following:

(1) Compared to the winter 2001 data, there was a sharp increase in both dugong and sea turtle populations during the 2004 winter survey. However, except in zone 5 where significantly higher densities of both dugongs and sea turtles were recorded, there was no significant change in population in the other zones. The increase in overall dugong and sea turtles populations and the significant increase in populations of the two species in zone 5 may be attributed to:

- Extensive cover of coral reefs and marine flora in the area
- A noticeable lack of human activities in the area traffic, and
- Possible pressure beyond the international border which may have forced these species to migrate into this zone.

This matter needs to be further investigated, however and will constitute the focus of upcoming studies.

- (2) Other marine wildlife namely dolphins, sharks (rays included), sea snakes and birds were observed but were found to be less abundant than dugong and sea turtles.
- (3) Critical marine habitats such as mangroves, seagrass, seaweeds, and corals are distributed all over Abu Dhabi waters.
- (4) Human activities, especially development and construction work on islands and the coastline on the mainland, are very common and require control and regular monitoring.

A summer aerial survey of the area has been planned to further monitor marine habitats and human activities. This will enable for the seasonal distribution of species to be determined.

## 5.0 References

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