

EMIRATES MARINE ENVIRONMENTAL GROUP



Hawksbill Turtle Report



Hawksbill Turtle Seasonal Nesting Report 2020 Sir Abu Nu 'Ayr Island

Environment and Protected Areas Authority
Emirates Marine Environmental Group

Under the leadership of Major Ali Saqer Sultan Al Suwaidi

The following report has been prepared by Dr. Tiffany Claire Delport
of Emirates Marine Environmental Group (EMEG) to inform Hawksbill turtle
conservation management strategy for Sir Abu Nu' Ayr Island, Sharjah.

November 2020

TABLE OF CONTENTS

Hawksbill Turtle Report 2020

Sir Abu Nu ‘Ayr Island, Sharjah

Abstract	v
Emirates Marine Environmental Group organisation profile	vi
Emirates Marine Environmental Group Hawksbill turtle project members	vii
Acknowledgements	viii
1. Introduction	1
1.1 Sir Abu Nu ‘Ayr Island, Sharjah	2
1.2 Hawksbill turtles of Sir Abu Nu ‘Ayr Island, Sharjah	4
1.3 Marine debris-imposed threats on marine habitat conservation	7
1.4 Marine debris impact on Hawksbill turtles of Sir Abu Nu ‘Ayr Island	7
1.5 Study aims and objectives	10
2. Method	11
2.1 Survey site	12
2.2 Monitoring protocol	13
2.3 Inventory protocol	13
2.4 Coastal clean-up campaign	13
3. Results	16
3.1 Nest distribution	16
3.2 Distance traversed for nest laying	19
3.3 Nest status	20
3.4 Nest inventory	20
3.5 Hawksbill turtle flipper span observations	23
4. Discussion and recommendations	24
4.1 Hawksbill turtle nesting observation and recommendations	25
4.2 Nest status and considerations	27
4.3 Nest inventory and hatchling observation	27
4.4 Marine debris on Hawksbill turtles nesting beaches of Sir Abu Nu ‘Ayr Island	29
4.5 Closing remarks	30
Reference	31

List of figures

Figure 1: Sir Abu Nu 'Ayr Island, Sharjah	3
Figure 2: Mature Hawksbill turtle at Sir Abu Nu 'Ayr Island, Sharjah	5
Figure 3: Hawksbill turtle hatchling at Sir Abu Nu 'Ayr Island, Sharjah	6
Figure 4: Marine debris on Sir Abu Nu 'Ayr Island, Sharjah	8
Figure 5: Coastal beaches of Sir Abu Nu 'Ayr Island, Sharjah	12
Figure 6: Hawksbill turtle nest inventory on Sir Abu Nu 'Ayr Island, Sharjah	14
Figure 7: Hawksbill turtle nesting distribution 2020	16
Figure 8: Coastal zones and nest distance measurements	19
Figure 9: Excavated Hawksbill turtle nest	21
Figure 10: Hawksbill turtle eggs	22
Figure 11: Observations of Sir Abu Nu 'Ayr Hawksbill turtle flipper spans	23
Figure 12: Hawksbill turtle nests on Beach ID1, Sir Abu Nu 'Ayr Island	25
Figure 13: Excavation of Hawksbill turtle nest on Beach ID1	28
Figure 14: Marine debris on Sir Abu Nu 'Ayr Island	29

List of tables

Table one: Beach specific nest distribution on Sir Abu Nu 'Ayr Island	17
Table two: Spatial distribution of Hawksbill nests	18
Table three: Temporal variation of Hawksbill nest laying	18
Table four: Nest disturbance	20
Table five: Nest inventory	20

ABSTRACT

The Hawksbill turtle (*Eretmochelys imbricata*) is a critically endangered member of the Arabian Gulf marine ecosystem. Over the last three generations global populations of the Hawksbill turtle have declined more than 80% and it is estimated there are currently only ~8,000 nesting turtles annually (Mortimer & Donnelly, 2008). In addition to natural population decline, Hawksbill turtles are threatened by habitat destruction and nesting habitat pollution with marine debris. Coastal beaches of Sir Abu Nu 'Ayr Island, Sharjah, are favoured by the Hawksbill turtle for nesting, therefore, it is crucial that nesting habitat is observed to inform long-term conservation management strategy for the island's resident population. During the nesting season of 2020 (March - June) Hawksbill turtles were observed hauling out and laying nests (n= 409) on nineteen coastal beaches of Sir Abu Nu 'Ayr Island, Sharjah, United Arab Emirates. East coast beaches were favoured by Hawksbill turtles for nesting (n= 150, 36.67%) followed by south (n= 117, 28.61%), north (n= 94, 22.98%) and west (n= 48, 11.74%) respectively. Hawksbill turtles deposited the highest number of nests in May (n= 183, 44.74%) while the lowest density of nest laying was observed in June (n= 29, 7.09%). The average distance of nests from the crest of the beach was approximately ~19.90m, the closest nest observed at 10m and furthest 30m. Track monitoring indicated majority of turtles achieved successful nesting on the first attempt. There was no evidence of nest disturbance or predation by local terrestrial wildlife. Representative sample of randomly selected nests (n= 35, ~9%) indicated moderate yield of successfully hatched eggs (n= 1577, 64.71%) with a lower proportion of unhatched eggs (n= 860, 35.29%). In order to better understand factors contributing to egg hatch rate, future studies focused on environmental contributing factors including tidal impact to sand compaction of nests and thermal fluctuations at nesting beaches must be conducted. Such studies, accompanied by seasonal population monitoring, can be used to inform effective conservation management strategy for the Hawksbill turtle. Future studies in-field focused on marine debris removal and understanding of diffuse and point sources of habitat pollution will further assist in conservation of Hawksbill turtle nesting habitat and promote healthy nesting ecosystems for sea turtles.

Emirates Marine Environmental Group organisation profile

Emirates Marine Environmental Group (EMEG) is a non-profit organisation based in Dubai, United Arab Emirates. Established in 1996 under the patronage of Her Highness Sheikha Manal bint Mohammed bin Rashid Al Maktoum and leadership awarded to Major Ali Saqer Sultan Al Suwaidi. As the first marine environmental group in the United Arab Emirates, EMEG provides services and solutions for a variety of projects focusing on a range of marine and terrestrial environmental issues in the region.

The Emirates Marine Environmental Group mission is to preserve biodiversity in the United Arab Emirates by:

- i. Protecting endangered wildlife through effective conservation management strategy
- ii. Actively participating in endangered species conservation efforts
- iii. Advancing scientific research through collaboration with academic bodies
- iv. Promoting environmental education within the local community
- v. Conserving fragile ecosystems for future generations

In addition, the organisation is responsible for maintenance and management of the coastal sanctuary of Jebel Ali Marine Reserve on the western border of Dubai, United Arab Emirates. The marine reserve is used as a base to develop and organize educational camps for schools, community members and corporate groups in an effort to increase awareness and understanding of regional environmental threats and issues. These structured programs focus on the cultural heritage of the United Arab Emirates and incorporate traditional values and skills into each activity.

“ The Emirates Marine Environmental Group mission is to preserve biodiversity in the United Arab Emirates.

Our organisation plays a key role in Hawksbill turtle conservation in the United Arab Emirates. It is our duty to ensure the survival of this species for future generations. ”

*Major Ali Saqer Sultan Al Suwaidi
President, EMEG*



Emirates Marine Environmental Group Hawksbill turtle project members



Major Ali Saqer Sultan Al Suwaidi
President, EMEG

Major Ali Saqer Sultan Al Suwaidi is the President of EMEG and has over 25 years' experience in marine conservation in the United Arab Emirates. Since its establishment in 1996, Major Ali has expanded operations to encompass regional marine wildlife and terrain conservation management, artificial coral reef development projects, heritage pearl diving experiences, educational programs for local community and schools, as well as numerous conservation projects for government and private sector clients. Major Ali has been widely recognized for his work and received numerous awards for his unique contributions in the United Arab Emirates.



Dr. Tiffany Claire Delport
Director of Marine Environmental Operations, EMEG

Dr. Tiffany Claire Delport is the Director of Marine Environmental Operations at EMEG and has over 5 years' experience in marine conservation in Australia and the United Arab Emirates. Tiffany received her doctorate in Marine Conservation from Macquarie University, Australia, primarily focused on Australian Sea Lion (*Neophoca cinerea*) conservation management strategy. Since joining EMEG in March 2019, Tiffany has been involved in coral translocation and Hawksbill turtle conservation projects on behalf of the group in Abu Dhabi, Dubai and Sharjah.



Dinu Dassan
Project Coordinator, EMEG

Mr. Dinu Dassan has over 10 years' experience in Hawksbill turtle monitoring. Dinu is responsible for marine fieldwork including daily nest monitoring, establishing nest protection measures, completing seasonal nest inventory and data collection for the Hawksbill population on Sir Abu Nu' Ayr Island.



Saif Bin Dismal
Project Manager, EMEG

Mr. Saif Bin Dismal is a Project Manager and responsible for transportation logistics planning.

Acknowledgements

A project of this nature would not be possible without the support of local regulatory bodies and contributors. On behalf of Emirates Marine Environmental Group, we acknowledge the below contributors.

We thank the following regulatory bodies for their ongoing support and permission approvals at Sir Abu Nu ‘Ayr Island, Sharjah;

Environment and Protected Areas Authority Sharjah (EPAA)
Sharjah Police

Our gratitude to faculty from Emirates Marine Environmental Group (EMEG) for ongoing project support, fieldwork management, data collection and analysis;

Major Ali Saqer Sultan Al Suwaidi, *President*
Dr. Tiffany Claire Delpont, *Director of Marine Environmental Operations*
Dinu Dassan, *Project Coordinator*
Abdul Razak, *Project Coordinator*
Saif Bin Dismal, *Project Manager*

Sincere thanks to support team members from EMEG for transportation assistance, food preparation and facilities maintenance;

Mohamed Ali
Mahbob Almade
Jacob Hassan
Nizamuddin Panhwar Abdul Latif Panhwar
Sulaiman Kalathilparabil

It has been a privilege to assist with conservation efforts of the Hawksbill turtle on Sir Abu Nu ‘Ayr Island, Sharjah. Our team look forward to ongoing monitoring and the continued development of effective conservation management strategy.

EMIRATES MARINE ENVIRONMENTAL GROUP



Introduction

1. INTRODUCTION

1.1 Sir Abu Nu 'Ayr Island, Sharjah

Sir Abu Nu 'Ayr is a tear drop shaped island belonging to Sharjah, United Arab Emirates. The island is located in the Arabian Gulf at latitude 25.21875 and longitude 54.23725. The island has an area of approximately 1500 ha, with a maximum length of 5.4km and maximum width 3.9 km (Figure 1). Sir Abu Nu 'Ayr Island was created by the upward movement of buoyant and less evaporitic salt into a denser, overlying rock as a result of regional tectonic activity. The centre of the island contains a mountainous region featuring ravines, rocky ridges, valleys and rocky outcrops, with flat stony areas in the northern region and flat valley floors commonly found on the eastern side of the island as well as the central valleys.

The United Arab Emirates Ministry of Climate Change and Environment (2017) identified primary marine habitats of conservation interest to encompass:

- i. Extensive areas of seagrass beds important for local fish nurseries, feeding grounds for Hawksbill turtle (*Eretmochelys imbricata*) and Green sea turtle (*Chelonia mydas*) populations
- ii. Sandy beaches and coastal areas used as breeding grounds by critically the endangered Hawksbill turtle (*E. imbricata*)
- iii. Small, dense patches of hard coral communities and sensitive table corals
- iv. Mixed coral communities containing diverse seasonal brown macro-algae populations and sparse but numerous colonies of poritid and faviid hard corals
- v. Natural coral reefs and coral colonized breakwaters that support rich communities of fishes associated with high relief hard bottom habitats

As an ecologically significant marine area (EBSA), conservation of Sir Abu Nu 'Ayr Island, Sharjah, is of national importance to preserve its significant value not only to local communities of the United Arab Emirates but for humanity as a whole. Sir Abu Nu 'Ayr Island is an important conservation area for the Hawksbill turtle that functions as a:

- i. Primary feeding ground in the United Arab Emirates for the critically endangered Hawksbill turtle (*E. imbricata*)
- ii. A protected nesting habitat with combination of deep sand and extensive beaches beyond the high tide line



Figure 1

Sir Abu Nu 'Ayr Island, Sharjah
Google Maps, 2020

In recognition of Sir Abu Nu 'Ayr Island's cultural and natural significance, the island is recognized as a Marine Protected Area (MPA) under the management of the Sharjah Environment and Protected Areas Authority.

The marine protected area accounts for the highest density of Hawksbill turtle nesting in the United Arab Emirates. As such, the development and implementation of long-term conservation strategy is crucial.

1.2 Hawksbill turtles of Sir Abu Nu 'Ayr Island, Sharjah

The Hawksbill turtle (*Eretmochelys imbricata*) is a critically endangered species of sea turtle. Observation of Hawksbill population dynamics have indicated decline by 80% over the last three generations leading to 1996 with no significant increase (Mortimer & Donnelly, 2008). As a result of ongoing conservation efforts, the species is listed on the IUCN Red List of Threatened Species and in Appendix I of the Convention on International Trade in Endangered Species prohibiting the import or export of products, kill, capture or harassment of Hawksbill turtles (CITES, 2006).

The species has a worldwide distribution where two major subpopulations are known in the Atlantic and Indo-Pacific (CITES, 2006). In the Indian Ocean Hawksbill turtles are distributed in warm tropical waters along the east coast of Africa, coastal Indian subcontinent and south-eastern Asian coast including the Persian Gulf and Red Sea (Pilcher et al., 2014). Over the last decade, Hawksbill turtles (*E. imbricata*) have been observed hauling out and nesting on coastal beaches of Dubai, Abu Dhabi, Sharjah and associated islands in the United Arab Emirates.

Hawksbill turtles (*E. imbricata*) are a valuable member of the Arabian Gulf marine ecosystem. Mature Hawksbill turtles are typically ~1m length and weigh approximately ~80kg (Figure 3) (Boulon, 1994). The hawksbill's appearance is similar to that of other marine turtles. In general, it has a flattened body shape, a protective carapace, and flipper-like limbs, adapted for swimming in the open ocean. *E. imbricata* is easily distinguished from other sea turtles by its sharp, curving beak with prominent tomium, and the saw-like appearance of its shell margins. Hatchlings typically weigh approximately <24g, their heart-shaped carapaces measuring ~2.5cm in diameter and <2.4cm in length (Figure 4) (Boulon, 1994).

Mature Hawksbill turtles' nest between March – June on Sir Abu Nu' Ayr Island, Sharjah. The adult female makes passage towards high areas on the beach using its flippers, this process may involve crawling over reefs and rocky areas to a secluded nesting site. Once an appropriate location is selected above the high tide line, a clutch of eggs is laid.



Figure 2
Mature Hawksbill turtle at Sir Abu Nu ‘Ayr Island, Sharjah.
EMEG, 2020

Hawksbill turtles’ nest on coastal beaches of Sir Abu Nu ‘Ayr Island between the months of March – June each year. The adult female emerges from the ocean and progresses towards high areas on the beach to establish a nest.



Figure 3
Hawksbill turtle hatchling at Sir Abu Nu ‘Ayr Island, Sharjah.
EMEG, 2020

Hawksbill hatchlings emerge from established nests between the months of May – August each year. Successful hatchlings proceed to the ocean to begin a long oceanic life, and upon maturity return to the island to lay nests.

The majority of nests succeed to hatch; however, a few are poached by terrestrial predators and humans for eggs. Between May - August approximately 45 - 70 days post incubation in the sand, hatchlings emerge and make their way to the sea. Successful hatchlings begin a long oceanic life, once matured, the females returning to land to lay eggs.

1.3 Marine debris-imposed threats on marine habitat conservation

Marine debris accounts for human-made waste that has been discharged into coastal or marine environments resulting from activities at land or sea (Al-Cibahy et al., 2012). The majority of marine litter is composed of plastic materials which are generally divided into macroplastics and smaller microplastics (Löhr et al., 2017). Macroplastics generally originate from direct sources such as irresponsible disposal of litter in the marine environment and indirect sources originating from rivers. Fishing activities account for a large proportion of macroplastics due to abandoned fishing nets, rope, traps and buoys or items lost at sea (Löhr et al., 2017). Microplastics encompass those items made intentionally including pellets and secondary microplastic particles resulting from fragmentation of larger plastic items. While plastic is highest in density of all marine debris items, wood, glass, metal, cloth and rubber materials form a large contribution to the marine debris issue.

Management of marine debris accumulation in our oceans is an urgent issue and development of effective strategy for its management is crucial (UNEP & NOAA, 2011). The Honolulu Strategy defines guidelines for immediate management and development of sustainable long-term action planning for ecologically or biologically significant marine areas (EBSA) which may be utilized in areas such as Sir Abu Nu 'Ayr Island, Sharjah (UNEP & NOAA, 2011). It is crucial that action be taken immediately in instances where marine debris has the potential to contribute to habitat disturbance in EBSA's and global population decline of critically endangered marine species such as the Hawksbill turtle.

1.4 Marine debris impact on Hawksbill turtles of Sir Abu Nu 'Ayr Island

The density of marine debris varies between the beaches and coastal vegetation zones of Sir Abu Nu 'Ayr Island. Beaches with greater length of ocean coastline tend to accumulate the most debris. Marine debris items commonly found on Sir Abu Nu 'Ayr beaches include items composed of plastic, wood, metal and glass materials (Figure 4).



Figure 4
Marine debris on Sir Abu Nu ‘Ayr Island, Sharjah.
EMEG, 2020

The greatest accumulation of marine debris exists on beaches of Sir Abu Nu ‘Ayr Island with greater length of ocean coastline. Year on year, marine debris accumulates raising concern for the health of localized populations and nesting Hawksbill turtles.

The high density of marine debris pollution in endangered Hawksbill turtle habitat is cause for concern and requires:

- i. Immediate treatment through removal of existing debris items and,
- ii. Ongoing management of marine debris accumulation on coastal beach and vegetation zones.

As a Ramsar recognized site of ecological significance, it is crucial that steps be taken to manage the issue of marine debris and conservation management strategy developed to ensure ongoing ecosystem health.

The accumulation of marine debris on Sir Abu Nu 'Ayr coastal beaches has a direct impact on nesting Hawksbill turtles. The average distance from crest of the ocean to Hawksbill turtle nests on Sir Abu Nu 'Ayr Island is ~16.81m. Passage to nest area is energy consuming for nesting turtles and nesting success rate impacted by the need to bypass large marine debris items in immediate pathway. The high density of marine debris pollution on coastal beaches creates obstacles for nesting Hawksbill turtles and may prevent successful clutch deposit on the first attempt. In order to facilitate successful nesting attempts and ensure safety of Hawksbill turtles on coastal beaches of Sir Abu Nu 'Ayr Island, marine debris must be cleared from nesting habitats and the impact of its presence be better understood.

Marine debris may impact successful Hawksbill hatchling emergence and progression to the ocean. Hatchlings emerge under cover of darkness and instinctively crawl into the sea, attracted by the reflection of the moon on the water. This process can be disrupted by reflection of light off reflective plastic and glass debris items in their pathway. These items also form obstacles that hatchlings must manoeuvre around contributing to time delay in reaching the ocean. Hatchlings that do not reach the water by daybreak are typically preyed upon by local marine predators. As a result, marine debris in Hawksbill turtle nest habitat may have a direct impact on hatchling success and survival rate. In order to better understand the impact of marine debris on hatchling success rate, baseline nest marine debris survey may be conducted and analysed to form foundation of knowledge for future studies.

1.5 Study aims and objectives

The Hawksbill turtle (*Eretmochelys imbricata*) is a unique member of the Arabian Gulf marine ecosystem and important resident of Sir Abu Nu ‘Ayr Island, Sharjah. In collaboration with Environment and Protected Areas Authority, Emirates Marine Environmental Group (EMEG) conservation initiatives with Hawksbill turtles on Sir Abu Nu ‘Ayr Island, Sharjah, include monitoring of breeding population, nesting frequency, hatchling success rate and mitigation of potential impact to nesting habitat.

The primary aims of this study were to:

- i. Determine nesting population density and distribution on Sir Abu Nu’ Ayr Island
- ii. Determine nest clutch density and hatch success rate of Hawksbill turtles
- iii. Identify types of marine debris items impacting nesting habitat
- iv. Interpret data to contribute to IUCN Red List global knowledge database
- v. Propose recommendations for the development of effective long-term conservation management strategy of Hawksbill turtle nesting habitat on Sir Abu Nu ‘Ayr, Island

The findings from this report will be used as a foundation to inform effective conservation management strategy to be determined by Environment and Protected Areas Authority Sharjah (EPAA), as well as inform Hawksbill turtle conservation status on the IUCN Red List of Threatened Species.

“At EMEG it is our mission to contribute to regional Hawksbill turtle conservation management strategy.

The findings from this report will be used to inform Hawksbill turtle conservation status on the ICUN Red List of Threatened Species, last assessed in 2008.”

Dr. Tiffany Claire Delpont
Director of Marine Environmental Operations, EMEG



EMIRATES MARINE ENVIRONMENTAL GROUP



Method



2. METHOD

2.1 Survey site

Sir Abu Nu 'Ayr Island is located in the Arabian Gulf at latitude 25.21875 and longitude 54.23725. Coastal beaches were allocated a reference identification number (Beach ID 1-19) to allow for comparison of turtle activity on different shores (Figure 5).

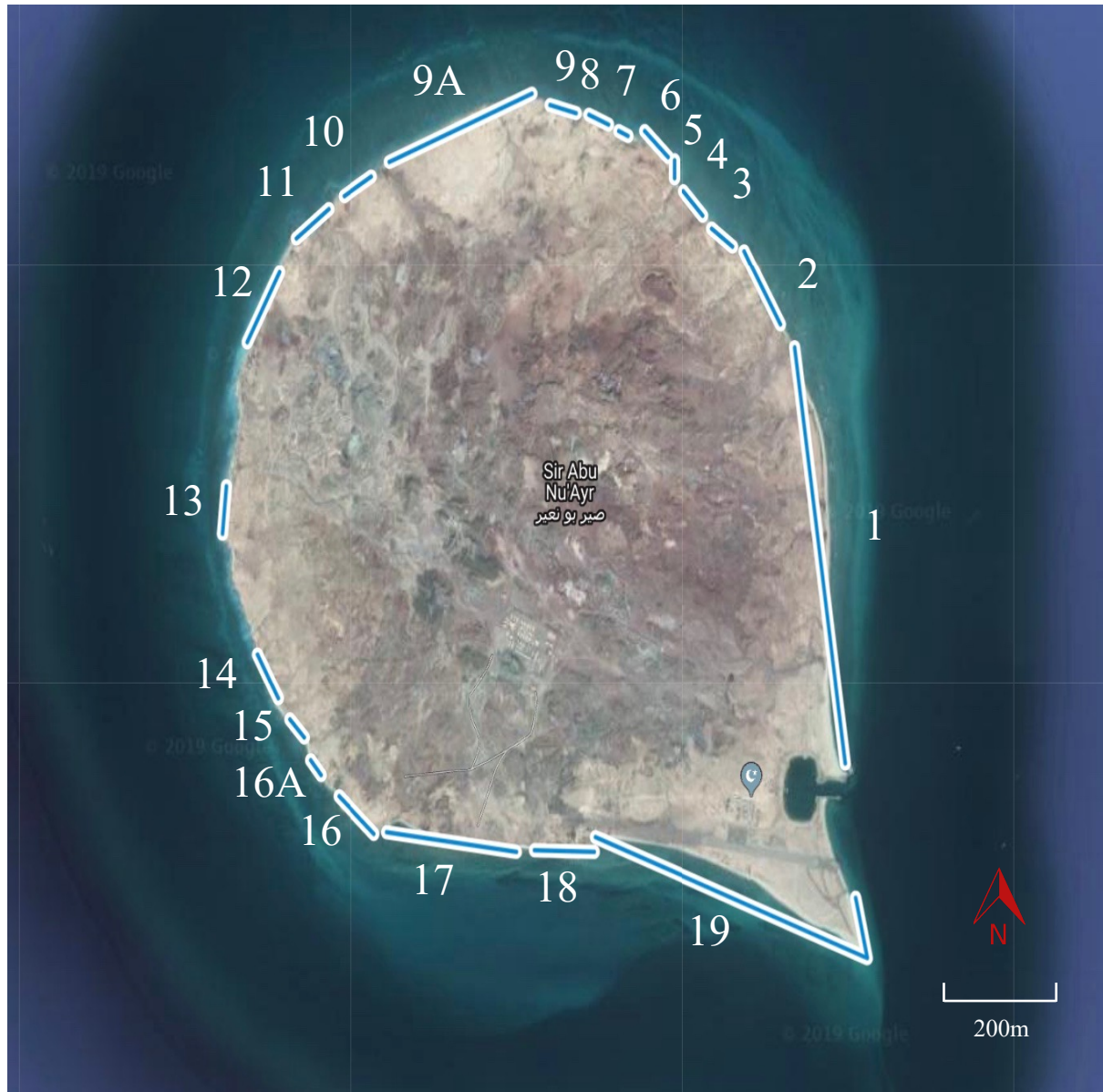


Figure 5
Coastal beaches of Sir Abu Nu 'Ayr Island, Sharjah
Google Maps, 2020

Coastal beaches were allocated a unique ID number (Beach ID 1-19) to allow for comparison of turtle nesting activity on different sides of the island.

2.2 Monitoring protocol

Hawksbill turtle nesting on Sir Abu Nu 'Ayr Island was observed between 12 March - 16 June 2020. Nesting was observed on each beach of the island using the aforementioned identification reference points (Beach ID 1-19) for comparison of turtle activity. Throughout the nesting and hatching season beaches were patrolled twice a day, in the morning between 08:00am and 13:00pm and evening patrols post 18:00pm. The primary aim of the morning patrol was to locate nests or tracks from the previous evening, while the objective of the evening patrol was to monitor turtle visitation and observe nesting events. Nest GPS coordinates were recorded from the centre of the nesting site. GPS coordinates of tracks were identified as the ocean emergence point and distance to nest recorded. Observation of track characteristics were used to identify characteristics of the turtle.

2.3 Inventory protocol

Nest inventory (n= 35) was conducted between the 6 August - 9 September 2020. Egg size, variation and structure were counted and examined to determine the average clutch size and hatchling success rate as a reflection of total seasonal eggs and hatchlings (Figure 6).

2.4 Coastal clean-up campaign

In celebration of World Environment Day, an event was organized on 5 June 2020 to clean coastal beaches of Sir Abu Nu 'Ayr Island. EMEG faculty collected marine debris from Hawksbill nesting beaches (Appendix). Additional marine debris removal was performed over a duration of two weeks following on from the event.



Figure 6
Hawksbill turtle nest inventory on Sir Abu Nu 'Ayr Island, Sharjah

Eggs were excavated from Hawksbill turtle nests, counted and sorted into categories for analysis.

EMIRATES MARINE ENVIRONMENTAL GROUP



Results

3. RESULTS

3.1 Nest Distribution

During the nesting season of 2020 (March - June) Hawksbill turtles were observed hauling out and laying nests (n= 409) on nineteen coastal beaches of Sir Abu Nu 'Ayr Island, Sharjah, United Arab Emirates (Figure 7). East coast beaches were favored by Hawksbill turtles for nesting (n= 150, 36.67%) followed by south (n= 117, 28.61%), north (n= 94, 22.98%) and west (n= 48, 11.74%) respectively.



Figure 7
Hawksbill turtle nesting distribution 2020

The highest number of Hawksbill turtle nests (n= 409) were recorded during the nesting season of 2020. Green turtle nesting (n= 3) was also observed on Sir Abu Nu 'Ayr Island.

Beach ID	Number of nests	Percentage of season aggregate (%)
1	115	28.12
2	6	1.47
3	16	3.91
4	13	3.17
5	1	0.24
6	9	2.20
7	12	2.93
8	10	2.44
9	17	4.16
9A	13	3.18
10	11	2.69
11	21	5.13
12	10	2.44
13	5	1.22
14	13	3.17
15	14	3.42
16	6	1.47
16A	5	1.22
17	47	11.49
18	16	3.91
19	49	12.0
TOTAL	409	100

Table one

Beach specific nest distribution on Sir Abu Nu 'Ayr Island

Hawksbill turtles nested with differing frequency across allocated beaches (Beach ID1-19). The east coast of the island (Beach ID1, Beach ID2, Beach ID3, Beach ID4) was most densely populated with nests (n= 150, 36.67%). In contrast, beaches on the western side of the island (Beach ID12, Beach ID13, Beach ID14, Beach ID15, Beach ID16A) were observed to have to the lowest quantity of nests (n= 48, 11.74%).

Coastal beach area	Number of nests	Percentage of season aggregate (%)
East	150	36.67
North	94	22.98
West	48	11.74
South	117	28.61
TOTAL	409	100

Table two

Spatial distribution of Hawksbill nests

East coastal beaches were favored by Hawksbill turtles for nesting (n= 150, 36.67%) followed by south (n= 117, 28.61%), north (n= 94, 22.98%) and west beaches (n= 48, 11.74%) respectively.

Month	Number of nests	Percentage of season aggregate (%)
March	34	8.31
April	163	39.85
May	183	44.74
June	29	7.1
TOTAL	409	100

Table three

Temporal variation of Hawksbill nest laying

Resident Hawksbill turtles deposited the highest number of nests in May (n= 183, 44.74%) followed by April (n= 163, 39.85%) and March (n= 34, 8.31%) respectively. The lowest density of nest laying was observed in June (n= 29, 7.1%).

3.2 Distance traversed for nest laying

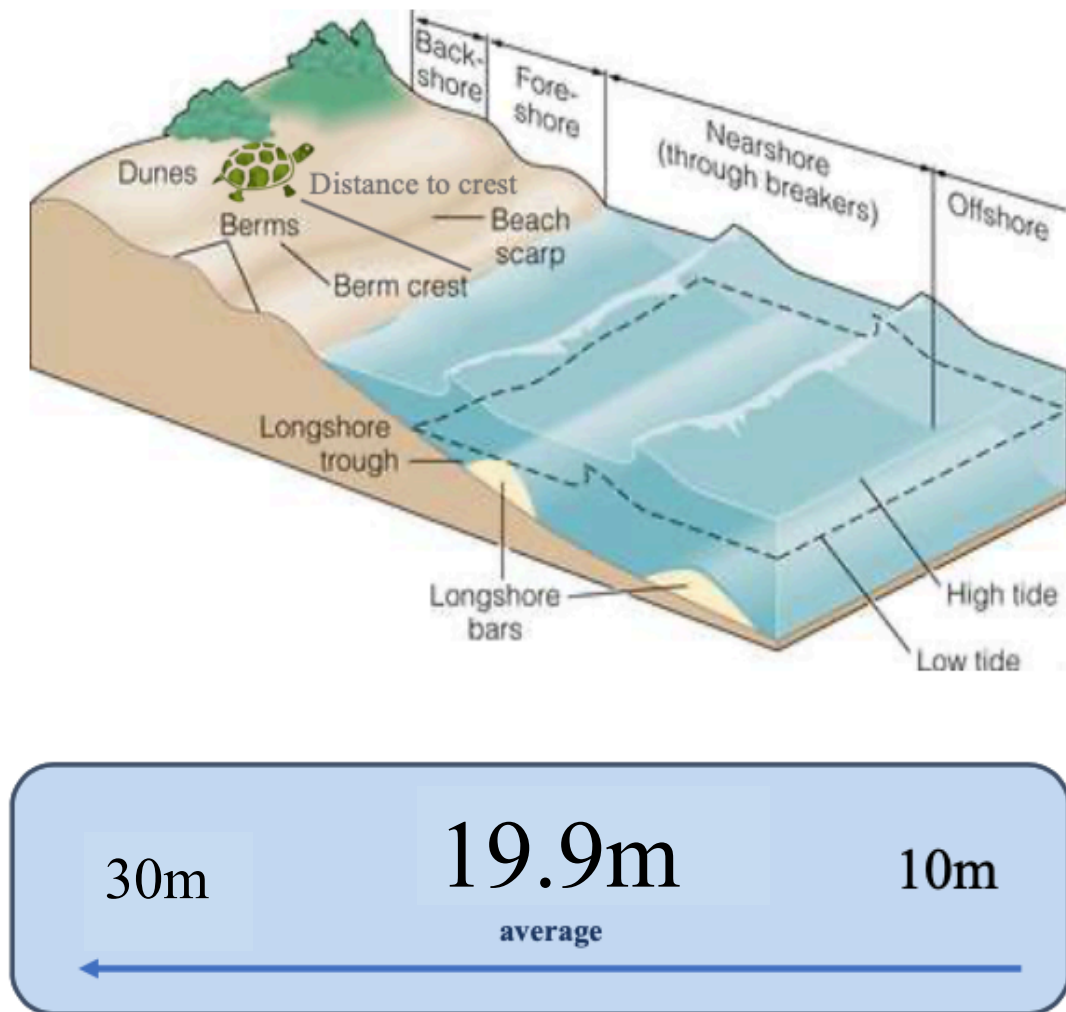


Figure 8

Coastal zones and nest distance measurements

Image adapted from Brooks Cole-Thomson, 2005

Observations of turtle nesting behaviour indicate the average distance of Hawksbill turtle nests from the crest of the beach was 19.90m with the closest nest observed at 10m and furthest 30m. Track monitoring indicates that majority of turtles are successful at nesting on the first attempt. Observations of the highest recorded number of attempts displayed numerous varied track transitions (n=5).

3.3 Nest status

Travel restrictions prompted by Covid-19 prohibited non-essential visitation of Sir Abu Nu ‘Ayr Island. Regional lockdown, annual sailing festival cancelation and decline in vessel movement in coastal waters, resulted in significantly lower island visitation than previous years. Consequently, there were no recorded events or observations of Hawksbill turtle nest disturbance during the nesting season of 2020 (Table four).

Nest status	Number of nests	Percentage of season aggregate (%)
Uncompromised	409	100
Compromised	0	0
Seasonal nest disturbance	0	0

Table four

Nest disturbance

All nests (n= 409) deposited on coastal beaches of Sir Abu Nu ‘Ayr Island in the 2020 nesting season were safe from poachers and naturally occurring wildlife on the island.

3.4 Nest inventory

Representative sample of randomly selected nests (n= 35) indicated moderate yield of successfully hatched eggs (n= 1577, 64.71%) with lower proportion of unhatched eggs (n= 860, 35.29%) (Table five). Deceased hatchlings free in nest and pipped eggs were not observed in the inventory sample (Figure 9, Figure 10).

Egg inventory	Count	Percentage of season aggregate (%)
Hatched	1577	64.71
Unhatched	860	35.29
Total	2437	100



Figure 9
Excavated Hawksbill turtle nest
EMEG, 2020

A proportion of Hawksbill turtle nests were excavated by the EMEG field team to perform assessments on nest composition and hatchling emergence success rate.



Figure 10
Hawksbill turtle eggs
EMEG, 2020

Egg size, variation and structure were counted and examined to determine the average clutch size and hatchling success rate as a reflection of total seasonal eggs and hatchlings.

Table five

Nest inventory

Representative sample of randomly selected nests (n= 35) indicated moderate yield of successfully hatched eggs (n= 64.71%) with lower proportion of unhatched eggs (n= 35.29%) (Table five).

3.5 Hawksbill track width and turtle flipper span observations

Observations of turtle flipper spans indicate the average flipper span is approximately 65.28cm in width. There exists a broad range in distribution of track width on the island, the narrowest track width approximately 59cm and largest recorded 85cm.

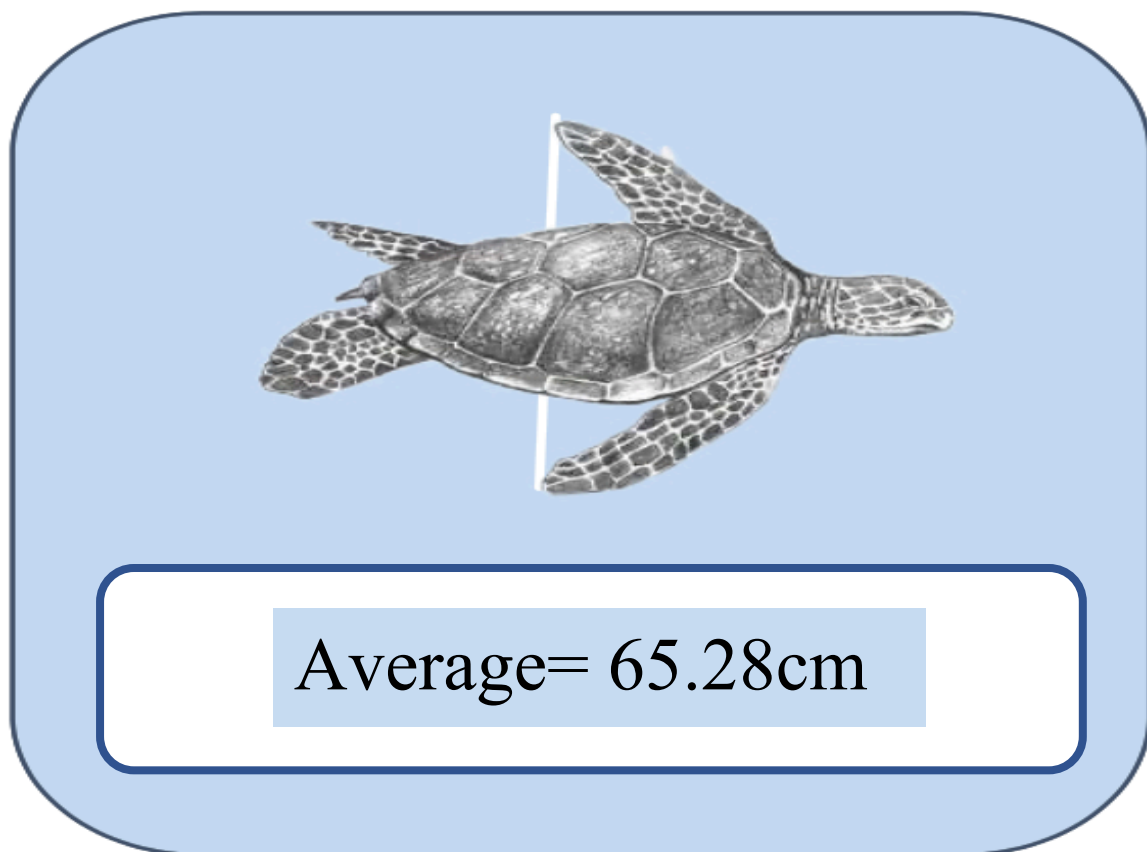


Figure 11

Observations of Sir Abu Nu 'Ayr Hawksbill turtle flipper spans

Observations of Hawksbill turtle track width on the island indicate a broad distribution, the narrowest track width approximately 59cm and broadest recorded 85cm.

EMIRATES MARINE ENVIRONMENTAL GROUP



Discussion and Recommendations

4. DISCUSSION AND RECOMMENDATIONS

4.1 Hawksbill turtle nesting observation and recommendations

Sir Abu Nu 'Ayr Island is an important ecological area within the United Arab Emirates for regional nesting Hawksbill turtle population. The frequency and density of nesting on the island is remarkably higher than currently observed on other coastal beaches. Beach ID1 continues to be the most frequently visited, accounting for over 28% (n= 115) of the seasons nesting. This is consistent with previous years, 2019 (n= 25%) 2016 (n= 19%) and 2017 (n= 28%). The primary reason for favouritism of Beach ID1 is the extended length of shoreline, approximately 2.15km long supporting multiple nests.



Figure 12

Hawksbill turtle nests on Beach ID1, Sir Abu Nu 'Ayr Island

During the coastal clean-up campaign, Hawksbill turtle nests on Beach ID1 were cleared of marine debris items and wood nesting markers returned to site.

Nesting trends over five years can be used to determine changes in size and status nesting Hawksbill turtle population of Sir Abu Nu ‘Ayr Island. Analysis of datasets indicates that there is a general trend of over 300 nests per season with variation in the year 2017. The nesting density of 2020 was the highest recorded in recent history (n= 409) indicating increased visitation to the island by the Hawksbill turtle.

Year	Number of nests
2010	326
2011	376
2015	378
2017	260
2019	352
2020	409
ANNUAL MEAN	350

Table five

Variation in Hawksbill turtle nesting frequency on Sir Abu Nu ‘Ayr Island

Variation in the number of nests year-on-year is normal due to female turtles nesting frequency varying between calendar years. The nesting season of 2020 was the most productive with a substantial increase in the number of clutches deposited on the island.

In order to maintain data integrity, a few recommendations are described specifically relating to in-field nesting attempt documentation and the use of sustainable nest markers. In order to reduce repeat entry of turtle visitation to Sir Abu Nu ‘Ayr Island it is recommended that the current monitoring methodology be expanded to include the marking of each nesting attempt. After each nest is evaluated and documented, the nest is marked by a deep line in the sand across the nesting track. Marked nests will then be photographed by field monitor to visibly show that the nest or track has been recorded and reduce bias in data collection procedures.

Marking Hawksbill nests in field is crucial to identifying nesting sites and planning for hatchling emergence. Currently, wood markers composed of marine debris found on surrounding beaches are labelled with a nest identification number. While this method has proven successful in previous seasons, it is recommended that a more sustainable option with

the option to include data pertaining to date of nest establishment and approximate expectation of hatchling emergence be considered. The use of sustainable markers will facilitate easier data collection in the field and can be used for multiple nesting seasons, further reducing the amount of wood-based marine debris on coastal beaches and supporting ecosystem prosperity.

4.2 Nest status and considerations

During the course of 2020 there were no recorded instances of animal predation or poacher activities on Hawksbill turtle nests on the island. Due to Covid19 and regional lockdown visitation to the island was significantly lower than in previous years. While it is unclear whether or not Covid19 visitation restrictions had a direct impact on limited nesting disturbance in the area remains unclear.

4.3 Nest inventory and hatchling observation

Nest inventory indicated that approximately a third of all eggs ($n=35$, ~9%) in the randomly selected sample did not hatch. This is a significant improvement on the nesting season of 2019. In order to gain further insight into hatchling success rate on Sir Abu Nu 'Ayr Island, focus on egg count and hatch success is documented. At this point in time, field faculty of Emirates Marine Environmental Group (EMEG) conduct nest inventory on 10% of seasonal total of nests. To enhance understanding of hatchling success rate, it is recommended the below additional factors be included in progressive seasonal surveys:

i. Egg measurements:

Measurement of egg circumference can be used to more accurately assess the size of eggs in Hawksbill nests. In addition, comprehensive data on varied egg abundance in nests can give an indication of the impact of climate change on Hawksbill turtle clutch deposits over progressive nesting seasons.

ii. Egg weight:

Assessment of egg weight can be used to more accurately determine the proportion of filler, hatched and unhatched eggs in Hawksbill nests on Sir Abu Nu 'Ayr Island.

iii. Egg photographs:

Photographs of eggs aligned by size will enhance seasonal data collection and representation.

Understanding factors impacting hatchling development and more accurate assessment methodology of nest inventory should be a core focus of the 2021 monitoring season.



Figure 13
Excavation of Hawksbill turtle nest on Beach ID1

Hawksbill turtle eggs are excavated from nests to determine the average clutch size. In order to improve upon current data collection integrity, it is important to analyse the content of eggs to determine a true count of those with potential for hatchling development.

4.4 Marine debris on Hawksbill turtle nesting beaches of Sir Abu Nu ‘Ayr Island

The accumulation of marine debris on Sir Abu Nu ‘Ayr coastal beaches has a direct impact on nesting Hawksbill turtles. The average distance from crest of the ocean to Hawksbill turtle nests on Sir Abu Nu ‘Ayr Island is ~19.9m. Passage to nest area is energy consuming for nesting turtles and nesting success rate impacted by the need to bypass large marine debris items in immediate pathway. The high density of marine debris pollution on coastal beaches creates obstacles for nesting Hawksbill turtles and may prevent successful clutch deposit on the first attempt. In order to facilitate successful nesting attempts and ensure safety of Hawksbill turtles on coastal beaches of Sir Abu Nu ‘Ayr Island, removal of marine debris from nesting habitats should be an area of priority for the 2021 nesting season.



Figure 14
Marine debris on Sir Abu Nu ‘Ayr Island

As the density of plastic items in Hawksbill turtle habitat can lead to animal entanglement and other issues relating to ingestion, it is crucial that the accumulation of marine debris on Sir Abu Nu ‘Ayr Island be addressed prior to the 2021 nesting season.

In order to enhance habitat conservation of nesting beaches on Sir Abu Nu 'Ayr Island the below recommendations are offered:

- i. Preparation of coastal beaches of Sir Abu Nu 'Ayr Island prior to Hawksbill visitation for nesting
- ii. Ongoing habitat maintenance for nesting season duration to ensure nesting turtle well-being and support hatchling success rate
- iii. Marine debris survey to determine diffuse and point source contributing to marine debris accumulation in Hawksbill nesting habitat at Sir Abu Nu 'Ayr Island

4.5 Closing remarks

The Hawksbill turtle monitoring programme at Sir Abu Nu 'Ayr Island is a valuable tool forming the foundational knowledge of endangered species nesting on the island. In order to generate meaningful conservation initiatives within the region, it is recommended that island conservation efforts and ongoing, detailed survey collection focus on bettering our understanding of nesting and hatchling success rates on the island. The conservation status and protection measures implemented on Sir Abu Nu 'Ayr Island have contributed to a habitat undisturbed by human impact. In order to ensure future visitation of the species for nesting and reduce risk of injury to this endangered reptile, the marine debris issue on the island must be addressed.

EMIRATES MARINE ENVIRONMENTAL GROUP



Reference

REFERENCE

- Al-Cibahy, A., Al-Khalifa, K., Böer, B. & Samimi-Namin, K. 2012. Conservation of marine ecosystems with a special view to coral reefs in the Gulf. Coral Reefs of the Gulf. Springer, Dordrecht.
- Aspinall, S. 1996. Time for a protected area network in the UAE. *Tribulus*, 6 (1): 5-9.
- Boulon, R. 1994. Growth Rates of Wild Juvenile Hawksbill Turtles, *Eretmochelys imbricata*, in St. Thomas, United States Virgin Islands. *Copeia*, 3: 811-814
- Brooks Cole-Thomson, 2005. Longshore Drift and Longshore Currents. Accessed 14 July 2019 from: <http://thebritishgeographer.weebly.com/coasts-of-erosion-and-coasts-of-deposition.html>
- CITES, 2006. Convention on International Trade in Endangered Species of Wild Flora and Fauna, Appendices. Archived from the original (SHTML) on 2007-02-03. Retrieved 07-2019.
- Diez, C. & Van Dam, R. 2002. Habitat effect on hawksbill turtle growth rates on feeding grounds at Mona and Monito Islands, Puerto Rico. *Marine Ecology Progress Series*, 234: 301-309.
- Google Maps, 2019. Google Maps, map of Sir Abu Nu 'Ayr Island, Sharjah, United Arab Emirates. Retrieved 10 November 2019.
- Gutierrez, Y., Guillen, L., Escobar, A. & Veliz, J. 2019. Risk factors in ecosystem of hawksbill turtles (*Eretmochelys imbricata*) from ila playita of machalilla national park. *International journal of life sciences*, 3 (1): 31-40.
- Hitchins, P., Bourquin, O. & Hitchins, S. 2004. Nesting success of hawksbill turtles (*Eretmochelys imbricata*) on Cousine Island, Seychelles. *Journal of Zoology*, 264 (2): 383-389.
- Kamel, S. & Delcroix, E. 2009. Nesting Ecology of the Hawksbill Turtle, *Eretmochelys imbricata*, in Guadeloupe, French West Indies from 2000–07. *Journal of Herpetology*, 43 (3): 367-376.
- Löhr, A., Savelli, H., Beunen, R., Kalz, M., Ragas, A. & Van Belleghem, F. 2017. Solutions for global marine litter pollution. *Current opinion in environmental sustainability*, 28: 90-99.
- Loop, K., Miller, J. & Limpus, C. 1995. Nesting by the hawksbill turtle (*Eretmochelys imbricata*) on Milman Island, Great Barrier Reef, Australia. *Wildlife Research*, 22 (2): 241-251.

Lutz, P. & Musick, J. 1997. The Biology of Sea Turtles. Boca Raton, Florida: CRC Press. ISBN 978-0-8493-8422-6.

Moncada, F., Carrillo, E., Saenz, A. & Nodarse, G. 1999. Reproduction and Nesting of the Hawksbill Turtle, *Eretmochelys imbricata*, in the Cuban Archipelago. Chelonian Conservation and Biology, 3 (2): 257-263

Mortimer, J. & Donnelly, M. 2008. IUCN SSC Marine Turtle Specialist Group. "*Eretmochelys imbricata*". IUCN Red List of Threatened Species. IUCN. 2008: e.T8005A12881238. Retrieved 07-2019.

Musick, J. & Limpus, C. 1996. Habitat Utilization and Migration in Juvenile Sea Turtles. In Lutz, P. & Musick, J. (eds.). The Biology of Sea Turtles. 137-163. ISBN 978-0-8493-8422-6.

Nelms, S., Duncan, E., Broderick, A., Galloway, T., Godfrey, M., Hamann, M., Lindeque, P. & Godley, B. 2015. Plastic and marine turtles: a review and call for research. ICES Journal of Marine Science, 73 (2): 165-181.

Pilcher, N., Antonopoulou, M., Perry, L., Abdel-Moati, M., Al Abdessalaam, T., Albeldawi, M., Al Ansi, M., Al-Mohannadi, S., Al Zahlawi, N., Baldwin, R. & Chikhi, A. 2014. Identification of important sea turtle areas (ITAs) for hawksbill turtles in the Arabian region. Journal of experimental marine biology and ecology, 460: 89-99.

Project AWARE Foundation 2015 , Dive Against Debris[®] Survey Guide. Version 2.0. Retrieved 07-2019 from: www.projectaware.org

Rizzi, M., Rodrigues, F., Medeiros, L., Ortega, I., Rodrigues, L., Monteiro, D., Kessler, F. & Proietti, M. 2019. Ingestion of plastic marine litter by sea turtles in southern Brazil: abundance, characteristics and potential selectivity. Marine pollution bulletin, 140: 536-548.

Sale, P., Feary, D., Burt, J., Bauman, A., Cavalcante, G., Drouillard, K., Kjerfve, B., Marquis, E., Trick, C., Usseglio, P. & Van Lavieren, H. 2011. The growing need for sustainable ecological management of marine communities of the Persian Gulf. Ambio, 40 (1): 4-17.

UNEP & NOAA. 2011. Honolulu Strategy: A Global Framework for Prevention and Management of Marine Debris. Retrieved 07-2019 from: <http://wedocs.unep.org/handle/20.500.11822/10670>

United Arab Emirates Ministry of Climate Change and Environment. 2017. Ecotourism: Jabal Ali Marine Sanctuary. Retrieved 07-2019 from: <https://www.moccae.gov.ae/en/open-data/ecotourism/jabal-ali-marine-sanctuary.aspx>

Wilcox, C., Puckridge, M., Schuyler, Q., Townsend, K. & Hardesty, B. 2018. A quantitative analysis linking sea turtle mortality and plastic debris ingestion. *Scientific reports*, 8 (1): 12536.

Wildermann, N., Gredzens, C., Avens, L., Barrios-Garrido, H., Bell, I., Blumenthal, J., Bolten, A., McNeill, J., Casale, P., Di Domenico, M. & Domit, C. 2018. Informing research priorities for immature sea turtles through expert elicitation. *Endangered Species Research*, 37: 55-76.

Witzell, W. 1983. Synopsis of biological data on the hawksbill turtle, *Eretmochelys imbricata* (Linnaeus, 1766). Food & Agriculture Org, 137.

EMIRATES MARINE ENVIRONMENTAL GROUP



Appendix



Historical Island Record

EPAA and EMEG Hawksbill Turtle Conservation

Sir Abu Nu 'Ayr Island, Sharjah

Emirates Marine Environmental Group, in collaboration with Environment and Protected Areas Authority – Sharjah, are pleased to announce a historical Sharjah Island record.

**As of 12th June 2020,
400 Hawksbill turtle nests are on Sir Abu Nu 'Ayr Island,
the highest nesting density ever recorded.**

Through shared vision and belief, EPAA and EMEG set a noble example for proactive conservation efforts of endangered marine turtles.



Major Ali Saqer Sultan Al Suwaidi
President, EMEG



EPAA and EMEG Coastal Clean-up Campaign

In celebration of World Environment Day under the theme 'Time for Nature', Emirates Marine Environmental Group, in cooperation with Environment and Protected Areas Authority – Sharjah, organized an event at Sir Abu Nu 'Ayr Island.

The event involved the clean-up and removal of marine debris from coastal shores. Marine debris negatively affects the ability of marine turtles and migratory birds to successfully nest on the island.

Through such campaigns, EMEG and EPAA contribute to the implementation of successful long-term conservation management strategy for Sharjah's natural islands.



Emirates Marine Environmental Group

P.O. Box 12399

Dubai, United Arab Emirates

E-mail: emeg.responses@gmail.com

Website: www.emeg.me