

POPULATION STATUS AND CONSERVATION OF MARINE TURTLES AT JORDAN'S GULF OF AQABA, RED SEA

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Introduction

Five species of marine turtles can be found in the Red Sea. Of these, the green, loggerhead and hawksbill are the most common, with the leatherback and olive ridley being infrequently seen, with no recorded nesting. All marine turtles share a similar life history which has made them similarly threatened by human activities. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) lists all marine turtles in its Appendix I (prohibited from international trade). IUCN lists the loggerhead turtle *Caretta caretta* as Vulnerable and all other species are listed as Endangered or Critically Endangered. Marine turtles migrate and disperse over vast distances; this means that conservation strategies must occur over a wide area and in a wide range of marine and coastal habitats. Until recently, most research on marine turtles in the Red Sea region dated back more than 15-20 years and was relatively limited in scope (summarized by Ross & Barwani, 1982). Green turtle populations were studied in detail in Saudi Arabia (Miller, 1989; Al-Merghani *et al.*, 2000), Yemen, (Hirth & Carr, 1970; Hirth *et al.*, 1973), and more recently through a UNEP study (UNEP/IUCN 1996). Recent surveys on turtles in the region estimated an annual nesting population of about 500 female hawksbills (Frazier & Salas, 1984). Hawksbills have been studied in Somalia, (IUCN 1997; Schleyer & Baldwin, 1999), Sudan (Abdel Latif, 1980; Hirth & Abdel Latif 1980), Yemen including the island of Socotra (FAO 1973; Green, 1996), the Egyptian Red Sea (Frazier & Salas, 1984) and Saudi Arabia (Miller, 1989; Pilcher, 1999).

The Gulf of Aqaba has an unusual water body structure, reaching 200 km long and 25 km at the widest point. It is famous for its rich coral reefs, and it therefore is likely to provide an extensive feeding habitat for sea turtles that inhabit coral reefs. Nevertheless, very little information is available for sea turtles in the Gulf of Aqaba. There is still a shortage of data on the marine turtles along the Jordanian coast in particular with regard to their abundance, distribution and foraging sites. Therefore, preliminary work was conducted to fill in some of this gap. The aim of this study was to investigate population structure and distribution of sea turtles inhabiting the Gulf of Aqaba.

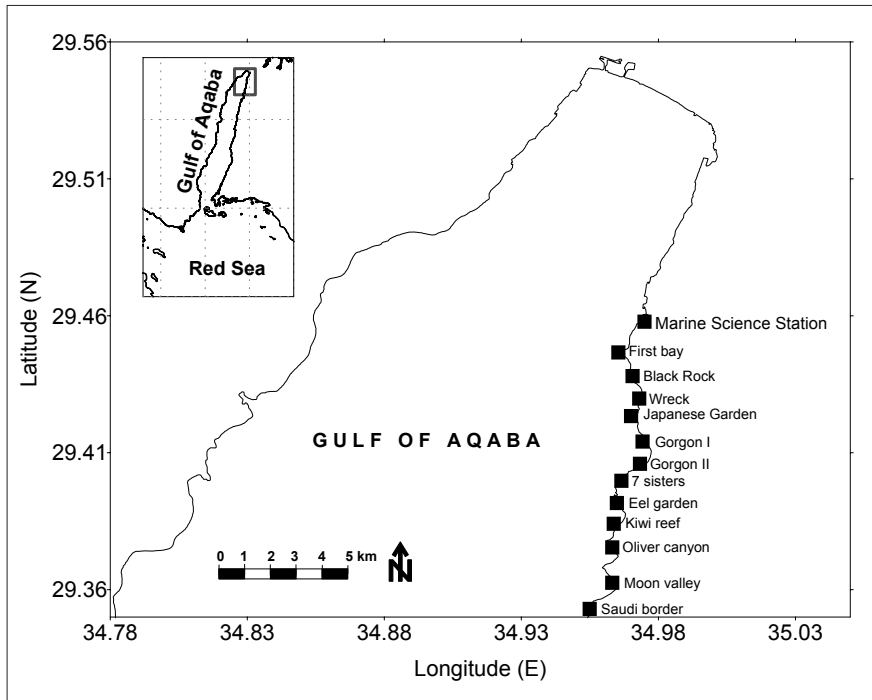


Fig.1. Turtle study sites at the most popular diving spots along the Jordanian coast of the Gulf of Aqaba, Red Sea.

Methods

The study area included 13 diving sites along the coastline of the Jordanian Gulf of Aqaba (Fig.1). Between 2003 and 2004, a group of 10 divers from three diving centres in Aqaba observed and recorded foraging sea turtles at all diving spots. Records were on the location, date, species, carapace length, sex and habitat. About 80% of dives were in coral reef habitat distributed along the southern part of the Gulf of Aqaba at major diving spots along the Jordanian coast. Monthly sightings of turtles were recorded at these diving sites. Monthly catch per unit effort (CPUE) was estimated as follows:

$CPUE = \frac{CAm}{(Tm \times By)}$, where *CAm* is the total number of sighted turtles per month, *Tm* is the number of dives per month, and *By* is the number of divers per month during the study period (modified from Simón *et al.*, 1996). Gender was determined using only obvious sexually dimorphic traits evident in adults or sub-adults; males were distinguished from females by observing tail length. The adult male has a long, thick tail that extends well beyond the posterior margin of the carapace, often as long as the hind limb. On the other hand, adult females have short tails that do not extend appreciably



Measurement of a hawksbill turtle before tagging and release at the marine Science Station.

All captures as well as those observed in the field were hawksbill turtles. Therefore, the hawksbill is the dominant species within waters of the Jordan's Gulf of Aqaba. Observations revealed that the majority of the turtle population is in its sub-adult stage (45-60 cm CCL, curved carapace length). Adults were classified as turtles with carapace length greater than 65-80 cm (Amorocho, 2001). Population abundance and CPUE by site are shown in Fig. 2.

The Black Rock showed the highest abundance of turtles, while Moon valley, Seven Sisters, and Oliver Canyon showed the lowest. Black Rock and Gorgon I are highly developed coral reef habitats while the other sites also contain grass beds and sandy bottoms. CPUE also showed higher values at sites with high abundance of turtles. However, the fluctuation in CPUE values between the different sites was a function of changes in the number of dives as well as divers during the study period.

The sex ratio of the observed population fluctuated throughout the year, with greatest numbers between July and December, with females consistently more abundant (Fig.3).

In January and February only females were seen. An overall estimation of the total number of both sexes during the survey period indicated that there are slightly more females than males. The majority of the turtles observed

beyond the hind margin of the carapace.

With the help of local fishermen, a tagging programme (Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden – PERSGA) was also implemented on animals found in their catch. Incidentally captured turtles were tagged with Titanium turtle tags (Stockbrands Co. Ltd.) at the trailing edge of the left front flipper following Balazs, (1999). Eight specimens were tagged during a period of one year. Tagging activities are currently still in progress.

Results

Data were collected between January 2003 and January 2004 over 13 diving locations.

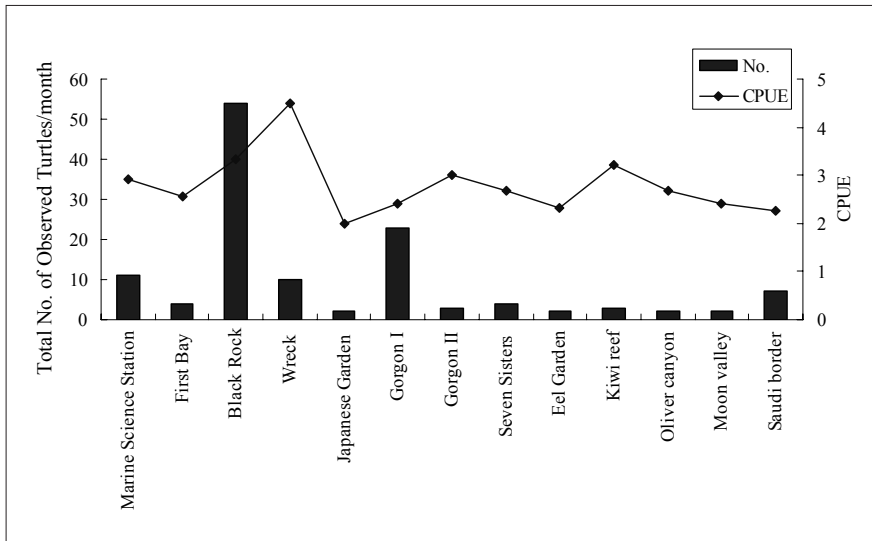


Fig.2. Monthly number of the observed turtles at all investigated sites in the Gulf of Aqaba and the catch per unit effort (CPUE) at each site.

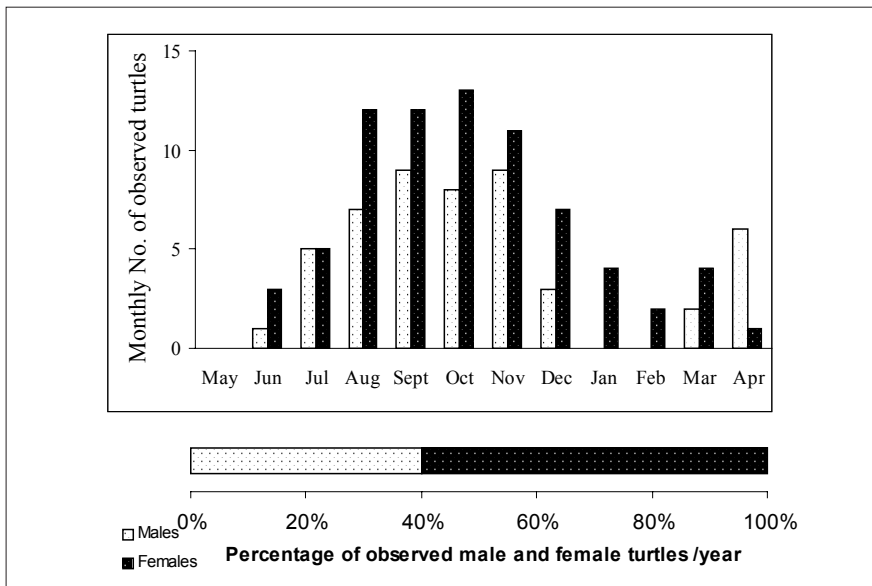


Fig.3. Monthly number of males and females and both sex percentage over the study period.

(85%) were in the coral reef habitat of the Gulf of Aqaba (Fig.4). The rest were in grass bed (10%) and sandy seafloor habitats (5%).

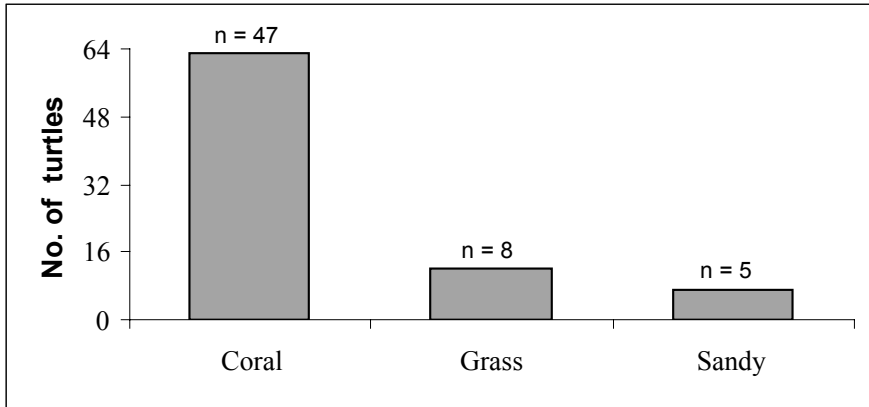


Fig. 4. Total abundance of turtles recorded at three habitats in Jordan's Gulf of Aqaba.

The morphometric measurements of the eight tagged hawksbills are presented in Table 1. These incidentally captured turtles were measured and tagged at the site of capture and released.

Table 1. Linear measurements (Bolten, 1999) in cm and body weight in kg of eight tagged specimens of hawksbill turtles (*Eretmochelys imbricata*) incidentally caught from various locations along the Jordanian coast of the Gulf of Aqaba.

Specimen No.	Location of capture	CCL	CCW	PL	PW	TL	Wt
1	Black Rock	48	41.5	28	22		12.5
2	Gorgon II	66	60	34	40	27.5	28.3
3	Wreck	56	54.8	31.2	27.4		14.3
4	Wreck	31	28	29	26		6.8
5	Gorgon II	61	59	41		45	20.4
6	Black Rock	44.1	40.7	29	22		
7	Gorgon I	64	63	42	40		
8	Japanese Garden	59	50				

CCL: curved carapace length, CCW: curved carapace width, SCL: straight carapace length, SCW: straight carapace width, PL: plastron length, PW: plastron width, TL: tail length, Wt: weight (kg)

Discussion

The Gulf of Aqaba encompasses a variety of marine and coastal habitats, containing complex and unique tropical marine ecosystems with high biological diversity and many endemic species (Hulings, 1989; Khalaf & Disi, 1997; Dubnesky, 1990). The Red Sea harbours major shipping traffic due to rapid urbanization along the entire coastline. Environmental threats of habitat destruction, over-exploitation of the coastline and pollution are increasing rapidly, requiring action for conservation of coastal and marine environments.

The present study is the first of its kind in Jordanian waters. It could be possible that coral reef, which dominates this area, provides shelter as well as food for this species (Carr & Stancyk, 1975; Meylan, 1988). In contrast, the grass beds are extremely limited along the coast, which may explain also the relative rarity of other species like the green turtle. Green turtles were reported to feed mostly on seagrass (Hirth, 1997) and were rarely seen roaming in the area.

An assessment of the distribution and status of critical habitat in the Gulf of Aqaba and the protection of such habitat from threats is fundamental to the conservation of marine turtles. There is little suitable habitat for turtle nesting on the Jordanian coast and, perhaps accordingly, low density of nesting turtles. Rapid urbanization in the past three decades including shoreline development of the Jordanian coast (e.g. refinery facilities, artificial lighting, coastal sand mining, and beachfront stabilization structures) could have reduced nesting habitat. The major threats to inwater habitats in Jordan include industrial activities, fishing practices and other forms of marine pollution, including persistent marine debris (Poiner & Harris, 1994; Hutchinson & Simmonds, 1992). The conservation and restoration of degraded habitats and coral reefs that have been recognized as foraging grounds of marine turtles should be a priority. However, there is still a need for long-term monitoring to detect changes in turtle populations or reef structure and size. Although some progress has been made with regard to determining the effects of human actions on regional turtle populations, there is still a wide gap between present knowledge and information needs.

We believe that the turtle population in Jordan forages in this area, and then migrates to other places such as the Saudi Arabian or Egyptian coastlines or even further for nesting (Frazier & Salas, 1984; Green, 1996). Nevertheless, there must be a commitment to continuing the work over a long period so that tag returns and recaptures in future surveys provide a better understanding of the population dynamics. Tagging has resulted in the understanding of migration patterns for turtles in the southern Red Sea and the Gulf of Aden, through which it is now known that turtles migrate to and from Socotra and the southern coast of Yemen to Oman, and from Sri Lanka, Oman and Socotra to Djibouti (UNEP/IUCN 1996; Green, 1996).



A hawksbill turtle foraging in the coral reef, Gulf of Aqaba.

PERSGA has made significant progress in the standardization of research methods, with a training course for instructors held in Yemen in December 2000, and the development of standardized survey methods (SSMs) for marine turtles in nesting and foraging habitats of the region (PERSGA 2003a-e). However, surveys since that time have been limited by funding and the practical experience of the survey teams, and more complete nationwide surveys are still needed to determine the extent and distribution of key habitats. Certain measures were taken towards conservation of marine turtles in Jordan, being a member of PERSGA together with other countries surrounding the Red Sea.

Recently, a national action plan was prepared for Jordan with logistical support from PERSGA similar to the other seven countries of the Red Sea. Jordan's National Action Plan for the Conservation of Marine Turtles and their Habitats (NAP) addresses a number of key objectives and obligations to reduce threats to marine turtle populations. It considers the importance of protecting and conserving marine turtles and their feeding habitat, research and monitoring, community education and participation in conservation

activities. It further provides a set of priority actions for the national agencies to carry out the necessary management activities and to enforce legislation, securing funding for turtle conservation measures. NAP is now available for execution by governmental institutions and NGOs in Jordan in order to coordinate with the global initiative to protect and conserve these endangered species.

The participation of local communities in conservation actions and decision-making is critical to the success of management interventions particularly when these affect livelihoods or traditional cultures. Eventually, stakeholders need to become the stewards of those resources as it is to their advantage that these resources survive through time.

Acknowledgments

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