

The Ecological Status of *Mauremys caspica caspica* and *Rafetus euphraticus* Turtles in Southern Iraq's East Hammar Marsh

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Abstract:

Two species of turtle, *Mauremys caspica caspica* and *Rafetus euphraticus*, were surveyed monthly from Al-Burgah, Al-Mashab, and Al-Sallal stations in the East Hammar tidal mesohaline marsh from November 2019 to October 2020. Air and water temperatures fluctuated between (12- 41 C⁰) and (12 to 35 C⁰) in winter and summer, respectively. Salinity varied between (2.4- 6.2 PSU) and pH (7.2-8.4). In total, 90 specimens of both species were collected from the marshes. Al-Mashab station occupied the highest rank in the number of individuals collected 39 followed by Al –Sallal station (30) and in the lowest rank was Al-Burgh station with 21 individuals. The highest *M .caspica caspica* (16 individuals) were recorded in November 2019 at air and water temperatures 24 and 23 C⁰, respectively. The highest number of *R. euphraticus* was observed in eight individuals in March 2020 at air and water temperatures of 17 and 16 C⁰, respectively. Salinity fluctuations affected the specimens collected (21 and 9 individuals) at 2.0 and 6.2 PSU, respectively. The highest density of *M. caspica* was 0.00054 ind/m²/yr at the Al-Mashab station in November 2019, and the lowest was zero in April and September 2020. The highest density for *R. euphraticus* was 0.00023 ind/m²/yr in March 2020 and the lowest in January, May, and September.

Keywords: turtles, Hammar marsh, Iraq, survey

Introduction:

Southern Iraq is characterized by the formation of vast wetlands and is considered the largest in the Middle East, covering an area of approximately 15, 000 km² (Al-Abbawy&Alwan, 2008; Al-Hilli *et al.*, 2009). Several reptile species have been found in southern marshes at varying abundance rates. Marshes offer excellent habitat for reptiles for feeding, protection, and nesting. Basking turtles were commonly observed on the banks of marshes. Reptiles play a major role in connecting aquatic and terrestrial environments by transporting materials between habitats (IUCN, 2010).

Little information is available on reptile species in Iraq. Most previous studies have dealt with the taxonomy and general geographical distributions of different species and provided precise data on the species' habitat (Al-Barazengy *et al.*, 2015; Rhadi *et al.*, 2015a, b; Afrasiab *et al.*, 2018; Salman, 2019).

Aquatic turtles occupy several environments, such as marine and freshwater environments, with different species (Leviton *et al.*, 1992). They are considered important components of the aquatic environment and their kin tortoises in terrestrial habitats. Turtles are vital in the aquatic food chain as herbivores, predators, and prey (Congdon & Gibbons, 1989).

Turtle shuttling movements between aquatic and terrestrial environments for feeding and nesting

formed strong relations between the two environments through energy transport and plant seed spreading and transportation to other localities (Lovich *et al.*, 2018).

Two species of water turtles (the Caspian turtle *Mauremys caspica caspica* and *Rafetus Euphrates*) belong to two families inhabiting Basra Province (Yousif, 2016). *M. caspica caspica* is a yellow-striped neck turtle with a previous synonym *Clemmys caspica* belonging to the family (Geomydidae). It is a medium-sized turtle that lives in freshwater and is widespread in Turkey, Iran, Syria, Jordan, Iraq, and other Middle Eastern countries (Fritz & Freitag, 1993).

R. euphraticensis is a medium-sized turtle belonging to the Trionychidea family. The natural range of this soft-shelled turtle is confined to the Tigris and Euphrates basins of Turkey, Syria, and Iraq. Their range in Iran is restricted to the southwestern province of

Khuzestan (Ihlow *et al.* 2014). Previously, it had another generic name (*Trionyx euphraticus*). The soft Euphrates turtle is an endangered species according to the International Red List for Conservation of Nature (IUCN) (Taskavak and Atatur, 1998).

Turtles are considered one of the most globally threatened groups of vertebrates, where 61% of the 356 are threatened or extinct due to habitat destruction, overexploitation, and pollution (Gibbons, 2000).

Material and methods:

Three stations were chosen from the East Hammar Marsh to perform this study. A Global Positioning System (GPS) was used to determine the exact locations of the stations. These stations were Al-Burgah, Al Mashab, and Al-Sallal, and their coordinates are shown in Table (1).

Table (1): East Hammar Marsh stations and their GPS coordinates.

Stations	GPS co-ordinations
Al-Burgah	N:30° 41' 18" E:47° 35' 23"
Al- Mashab	N:30° 40' 18" E:47° 38' 19"
Al-Sallal	N:30° 39' 12" E:47° 38' 15"

Samples collection:

Turtle samples were collected monthly from November 2019 to October 2020 using several local fishing seine nets with dimensions of lengths between 120-150 m and mesh sizes ranging from 30 × 30 mm to 40 × 40 mm as direct field witnesses counting in water and waterbody banks. Some dead turtles were transferred to the laboratory for further examination. Air and Water temperature, salinity, and pH were recorded using a TRI-METER pH /EC-983. The soil texture at each station was examined at the Department of

Geology/College of Science. Morphometric measurements were recorded for each specimen was measured using a digital caliper and measuring ruler.

1- Turtles' density:

The density of turtles was calculated by summing the individuals that appeared in the net and calculated by the following equation: -

$$D = N / (A * S)$$

D, density; N, number of recorded turtles; A, net length; S, distance covered by the net during collation.

Results

Air and Water temperature

The air and water temperature results showed monthly variations at all three stations. The lowest air temperature was 12C⁰ at Al-Burgah station in December 2019, and the highest was 42C⁰ at Al-Sallal station in August 2020. The lowest water temperature was recorded in January 2020 at the Al-Burgah station, and the highest was recorded in August at the Al-Sallal station. The results showed no statistical differences ($P > 0.05$) between the water and air temperature stations.

Salinity:

The salinity values showed monthly variation at the three stations. The lowest salinity value was 2.4 g/l (PSU), recorded at Al-Sallal station in November and the highest was 6.5 g/l (PSU) at

Al-Burgah station in June. The salinity averages at Al-Burgah, Al-Mashab, and Al-Sallal stations were 3.5, 3.6, and 3.5, respectively. There were no significant differences in salinity among the stations ($P > 0.05$).

pH:

pH values showed monthly variations in all three stations, the lowest recorded pH value was 7.1 in Al-Sallal station in June and the highest was 8.7 in Al-Mashab station in December. pH average values in Al-Burgah, Al-Mashab and Al-Sallal were 7.9, 7.9 and 7.7, respectively.

Soil texture:

The soil texture of the Al-Burgah banks was silty mud, while that of the Al-Mashab and Al-Sallal stations was silty sand. Table (2) shows the soil particle percentages on the banks of the station.

Table (2): Soil texture of (Al-Burgah, Al-Mashab, and Al-Sallal) station banks in the East Hammar marsh.

Soil type	Clay	Silt	Sand	Station
silty-mud	42%	43%	15%	Al- Burgah
silty-sand	14%	63%	23%	Al-Mashab
silty-sand	18%	59%	23%	Al-Salale

Aquatic plants:

Several aquatic plant species were observed at the three stations, including *Phragmites australis*, *Typha domingensis*, *Schoenoplectus litoralis*, and the submerged plants *Ceratophyllum demersum* and *Najas minor*. Other aquatic submerged plants, such as *Juncus rigida* and *Potamogeton pectinatus*, were observed only at Al-Sallal and Al-Masahb stations.

Fishes:

The fish were captured during turtle sampling using seine nets. These fish are native, exotic, and marine migratory species. The following

fish species were recorded in the sampling seine nets: *Cyprinus carpio*, *Carassius gibelio*, *Leuciscus vorax*, *Oreochromis aureus*, *Tenuulosa ilisha*, *Planiliza subviridis*, *Silurus triostegus*, *Hypophthalmichthys molitrix*, *tilapia zilli*, *Heteropneustes fossilis*, and *Poecilio latipinna*.

Composition of the turtle assemblages

Ninety specimens of two turtle species, *M. caspica caspica* (Fig.1) and *R. euphraticus* (Fig.2), were collected from three stations in the East Hammar Marsh. Al-Masahb station ranked first in the number of individuals collected (39), followed by Al-Sallal station

(30 individuals) and Al-Burgah station (21 individuals). The highest monthly number of

individuals was recorded in November 2019.



Fig 1: *M. caspica caspica* (Gmelin 1774)



Fig 2: *R. euphraticus* (Daudin, 1802)

Temperature influence:

The highest abundance of *M. caspica caspica* (16 individuals) was recorded in November 2019 at air and water temperatures 24 and 23 C⁰, respectively. The highest abundance of *R.*

euphraticus (8 individuals) was observed in March 2020 at air and water temperatures of 17 and 16 C⁰, respectively. The coefficient of multiple correlations between air and water temperatures was $R^2 = 0.654$.

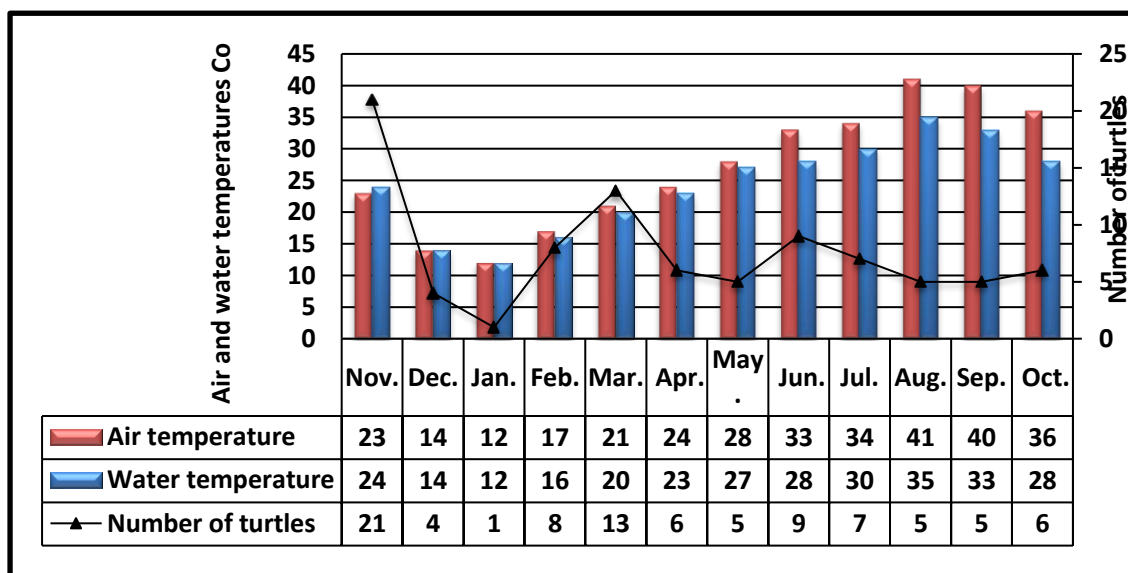


Fig (3) Relation between the abundance of *M. caspica* and *R. euphraticus* and air and water temperatures in East Hammar Marsh from November 2019 to October 2020.

Salinity influence:

The abundance of *M. caspica caspica*, and *R. euphraticus* was recorded even with an increase in water salinity at the three sampling stations.

The highest salinity recorded was 6.27 PSU in November 2020, and 21 specimens were captured. The correlation value of the number of turtles and salinity was $R^2 = 0.181$

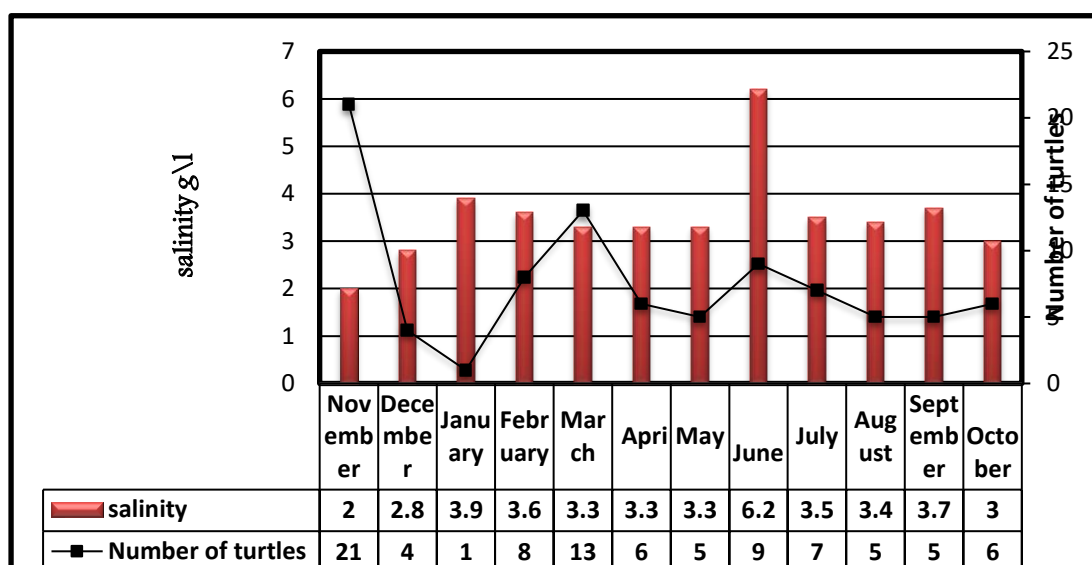


Fig (4) Relation between the abundance of *M. caspica* and *R. euphraticus* and salinity in the East Hammar marsh from November 2019 to October 2020.

pH influence:

The relationship between *M. caspica* and *R. euphraticus* with pH in the study area is shown in fig. (5). The lowest recorded pH value (7.2) was recorded during November, and the total number of individuals captured was 21 in the

same month. The highest pH value (8.4) was recorded in December, but only four individuals were recorded. The coefficient of multiple correlations between the total turtle population and the pH was $R^2 = 0.611$

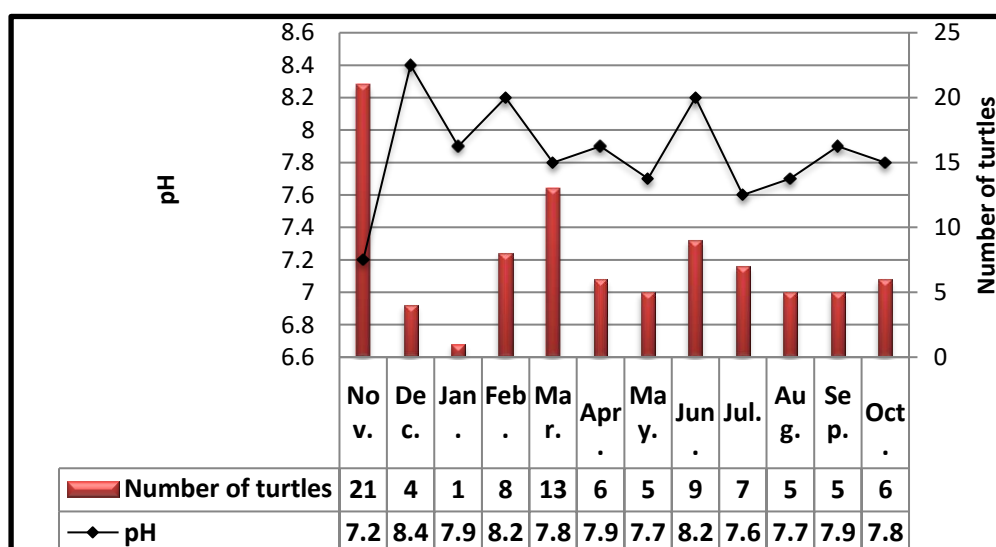


Fig (5) Relation between the abundance of *M. caspica* and *R. euphraticus* and pH in the East Hammar marsh during the study period from November 2019 to October 2020.

Turtles Density:

The highest density of *M. caspica* was 0.00025 ind/m²/yr at the Al-Burgah station in September 2020, and the lowest was zero in December 2019, January, June, and October 2020. The highest density for *R. euphraticus* was 0.00011 ind/m²/yr in May and the lowest was zero in eight months.

The highest density of *M. caspica* was 0.00054 ind/m²/yr at the Al-Mashab station in November 2019, and the lowest was zero in

April and September 2020. The highest density for *R. euphraticus* was 0.00023 ind/m²/yr in March 2020 and the lowest in May, September, and October.

The highest density for *M. caspica* was 0.00041 ind/m²/yr at the Al-Sallal station in November 2019, and the lowest was zero in five months. However, the highest density for *R. euphraticus* was 0.00016 ind/m²/yr and the lowest was zero in January, May and September 2020.

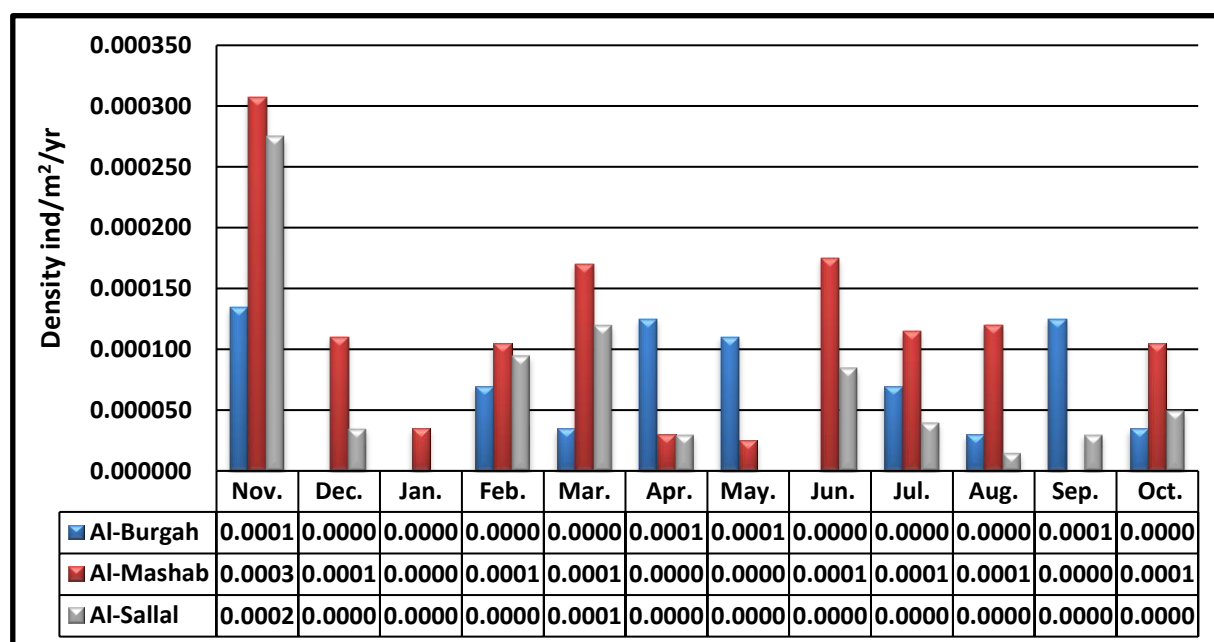


Fig (6) Monthly variations in *M.caspica caspica* and *R. euphraticus* density (ind/m²/yr) in Al-Burgah, Al-Mashab and Al-Sallal stations in East Hammar marsh during the study period .

Discussion:

East Hammar marsh represents the southern part of the vast southern Iraqi marshes. It differs from other marshes in that it is subjected to semidiurnal tides from the Arabian Gulf via the Shatt Al-Arab River (Richardson and Hussain 2006).

In recent years, the influx of freshwater from the Tigris River was decreased radically, led to the invasion of the salt wedge from the Arabian Gulf to Shatt Al-Arab River, Consequently, the East Hammar marsh face fluctuations in salinity concentrations.

The abundance of *R. euphraticus* and *M. caspica caspica* in the East Hammar tidal mesohaline marsh represents these two freshwater turtles' most southern distribution limit.

These two freshwater turtle species significantly enrich the biodiversity of the East Hammar marsh and play a vital role in the food chains of terrestrial and aquatic communities and in the exchange of materials between these two habitats.

Bycatch fishing, the oil industry, nest destruction, and random turtle killings were the major threats facing the *R. euphraticus* and *M. caspica* communities in the East

Hammar marsh. IUCN (2010) declared that *R. euphraticus* is a threatened species in Iraq. In other countries, such as Oman, marine turtle eggs were consumed by local inhabitants (Birici and Turga, 2011), and in East Hammar, marsh nests were destroyed when citizens used bank soils to build their houses.

Environmental factors such as air and water affect the occurrence of turtles. The lowest water temperatures that were recorded in December 2019 and January 2020 were 12.4 and 14.0 °C, respectively in East Hammar marsh coinciding with the lowest number of specimens of both species collected. This could be due to the hibernation period of the turtles during cold weather. It is a well-known fact that turtles hibernate during low temperatures in winter. In contrast, the highest abundance of both turtle species coincided with a temperature of 24 °C in November 2019, which might mean that these temperatures are the optimum water temperatures for their activity, even though this was not the highest recorded temperature. In contrast, very high-water temperatures negatively affect turtle activity (Yazarloo and Kami, 2017).

The abundance of *R. euphraticus* and *M. caspica caspica* in East Hammar marsh is known to be affected by semidiurnal tides; daily and seasonal salinity fluctuations indicate that these two species could tolerate high salinity concentrations as it has been recorded during a salinity of 6.27 PSU in June in East Hammar marsh. Mass deaths of both species were recorded in the East Hammar marsh at a very high salinity (16.1 PSU) by Hussain and Resis (2018).

Other environmental factors, such as soil texture, submerged plant density, and water depth, seemed to control the densities of *R. euphraticus* and *M. caspica caspica* in the East Hammar marsh. These factors affect feeding performance, nesting, and protection. The highest densities of *M. caspica caspica* *R. euphraticus* in Al-Mashab station could be due to suitable soil texture (silt-sand) for nesting, thick aquatic plant and terrestrial canopy and suitable water depth. The lowest densities were recorded in Al-Burgah station, characterized by thin plant cover, silty-mud

bank soil texture and shallow water depth. In conclusion, it seems that turtles in East Hammar marsh prefer habitats with slow water currents, dense aquatic plants, terrestrial plants canopy and silty-sand soil texture banks, which makes it easier for digging nests and eggs oxygenation.

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الوضع البيئي لسلحاف *Mauremys caspica caspica* و *Rafetus euphraticus* في هور الحمار الشرقي

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المستخلص

تم مسح نوعين من السلحاف، *Mauremys caspica caspica* و *Rafetus euphraticus* شهرياً من محطات البركة والمسحب والصلال في هور الحمار الشرقي المتأثر بالمد والجزر المتوسط الملوحة من تشرين الثاني 2019 إلى تشرين الأول 2020. تذبذبت درجات حرارة الهواء والماء بين (12-41°C) و (12-35°C) في الشتاء والصيف على التوالي. تراوحت الملوحة بين (2.4- 6.2 PSU) ودرجة الحموضة (7.2-8.4). تم جمع 90 عينة من كلا النوعين من الأهوار. احتلت محطة المسحب المرتبة الأولى في عدد الأفراد المجمعين 39 فرداً تلتها محطة الصلال (30) وفي أدنى مرتبة كانت محطة البركة بعدد 21 فرداً. تم تسجيل أعلى *M. caspica caspica* (16 فرداً) في تشرين الثاني 2019 في درجات حرارة الهواء والماء 24 و 23 درجة مئوية على التوالي. ولوحظ أعلى عدد من *R. euphraticus* في ثمانية أفراد في آذار 2020 عند درجات حرارة الهواء والماء عند 17 و 16 درجة مئوية على التوالي. أثرت تقلبات الملوحة على العينات التي تم جمعها (21 و 9 أفراد) عند 2.0 و 6.2 PSU، على التوالي. كانت أعلى كثافة لـ *M. caspica* هي 0.00054 ind / m² / year في محطة المسحب في تشرين الثاني 2019، وأدناها كانت صفراً في نيسان وأيلول 2020. وكانت أعلى كثافة لـ *R. euphraticus* في آذار 2020 والأدنى في كانون الثاني وأيار وأيلول.

الكلمات المفتاحية: السلحاف، هور الحمار، العراق ، مسح بيئي