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(RESEARCH ARTICLE)

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The fragile ecology in Iraq's Mesopotamian marshlands endangered and restructured by a sharp increase in salinity

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Abstract

In southern Iraq, the Mesopotamian marshes have suffered for decades from a decrease in freshwater input from both rivers Tigris and Euphrates. The Shatt Al-Arab River and East Hammar marsh in southern Iraq were affected by a salt wedge that advanced from the Arabian Gulf during July and August 2018, causing a rapid and sharp increase in salinity levels. A monthly monitoring program has revealed an invasion of saltwater species from the Gulf accompanied by the disappearance of native species of freshwater. Seven submerged aquatic plant species disappeared. Thus, the number of freshwater phytoplankton species decreases. It was found that the quality and quantity of small zooplankton significantly changed, resulting in the disappearance of many freshwater species, and the number of freshwater mollusks significantly decreased. A marsh was invaded by two species of marine shrimp that were previously unrecorded, and native freshwater fish species were drastically affected. East Hammar's fragile ecology is rapidly shifting from oligosaline to estuarine, devastating an important environmental resource and endangering a culturally unique setting.

Keywords: East Hammar marsh; Habitat deterioration; Invasive marine species; Marsh habitat; Salinity increase

1. Introduction

Located in the vast, arid Middle East, Mesopotamian marshlands are a unique ecosystem. They are characterized by several biotopes and rich biodiversity. During migration from the Arabian Gulf, thousands of migrating birds use marshes in southern Iraq and southwestern Iran as refuge and spawning grounds for fish and shrimp [1].

The livelihood of indigenous inhabitants in marshes has historically relied on - and still depends on the products of the freshwater ecosystem. Even now, the ecosystem of marsh provides them with essential resources and material access used every day and enables them to go on with their lifestyle, albeit more restrictive, into the future. To sustain themselves, these demand freshwater, reeds, fish, birds (especially waterbirds), and buffalo are needed. These four elements are neatly overlapping and require a steady freshwater ecosystem to exist.

The purpose of the current study was to determine the modern prerequisites for amplifying salinity in the biota of the East Hammar marsh. Our direct engagement began in in the 2003-2006 U.S. The Agency for International Development (USAID) Marshlands Restoration Program (IMRP) conducted an impact assessment funded by the DAI in 2017-2018., which explored the IMRP's sustainability and impact 12 years after its completion [2].

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East Hammar marsh water is well oxygenated, with an alkaline pH and grey mud-silt sediments. However, the decreasing of freshwater entering to East Hammar marsh exchange the surroundings from formerly freshwater to be oligosaline in nature [3, 4, 5]. Decreased freshwater impulses to the marsh from both rivers, Tigris, and Euphrates, from diversions upriver during the past several decades have devastated the entire area of the Mesopotamian marshlands. In July and August 2018, a salt tide advanced from the Arabian Gulf via the Shatt Al-Arab River to the East Hammar marsh, inflicting a rapid and sharp increase in salinity. Salinity spiked from 3.7 to 16.1 PSU in March to August.

Monthly monitoring indicated an invasion of many marine species from the Gulf, accompanied by the disappearance of native freshwater species. Seven submerged aquatic plant species disappeared: *Ceratophyllum demersum, Potamogeton crispus*, *Potamogeton pectinatus, Potamogeton perfoliatus, Myriophyllum verticillatum***,** *Chara spp., and Najas marina*. Thus, the number of freshwater phytoplankton species decreases. Most of the species recorded all through the monitoring length had been marine and estuarine. Many marine diatom species were recorded in the marsh, including *Campylodiscus clypeus, Gyrosigma sinense, Nitzschia bicapitata, N. prolongata, N. increta, N. longissima, N. prolongata* and *Tryblionella granulata*. Zooplankton species in July and August confirmed a large shift in the quantity and quality of tiny zooplankton (meioplankton) due to the surprising rise of salinity, mainly to the absence of more freshwater organisms' groups. There was also a clear reduction in the number of freshwater mollusk species, *Bellamya bengalensis, Melanopsis nodos,* and *Physa acuta*. Several bivalves, isopods, and insect species have vanished, and two previously recorded species of marine shrimp, *Exopalaemon styliferus* and *Penaeus semisulcatus,* have invaded the marsh.

Freshwater native fish species are drastically affected. Several native cyprinid species disappeared and were replaced by exotic tilapia and marine species, accounting for more than 78 percent of the total species met. The two most dominant freshwater species in East Hammar, freshwater mullet *Planiliza abu* and Mesopotamian catfish *Silurus triostegus*, disappeared in July and August, respectively. Mass deaths decreased the populations of marsh frogs *Pelophylax ridibandus*, freshwater turtles *Mauremys caspica caspica*, and smooth shell turtles *Rafetus euphraticus*. However, bird species showed no signs of being affected.

East Hammar marsh stands for the southeastern phase of the enormous Iraqi southern wetlands. The marsh consists of good sized tidal and intertidal zones extending for greater than 37 kilometers to the west from the inlet sector at tidal part to the higher intertidal reaches close to outer skirt of the Rumaila oil field. The marsh discharge channel, the 10.5 kilometer lengthy Karmet Ali River, connects the easterly to the Shatt Al-Arab River. The marsh is uncovered to semidiurnal tides from the Arabian Gulf by the Shatt Al Arab (1-1.5 meters), with various ranges during neap and spring tides. The local weather extends to very warm summers and quick bloodless winters. Northwesterly winds are the most dominant winds, with a mentioned impact on the vicinity.

The southern marshes had been drained by Saddam Hussein regime from 1990 to 2003, decreasing the region to about 7% of their authentic size, that time was a fatal blow to area's flora and fauna. After 2003, these marshes were randomly inundated with most than 1/2 reclaimed during a period with few effective government controls or oversight. The marshlands noticed the return of vegetation and fauna at with one-of-a-kind tiers in every of the three principal marshes [1].

The marsh was mostly covered by the aquatic plants *Phragmites australis,Typha domningensis*, and *Schinoplactus littoralis*.During spring and summer seasons several marine fish migrate to Hammar marsh mainly anadromus species *Tenualosa ilisha* ,several Mugilidae *spp* and Penaeidae shrimps *Metapenaeus affinis*, for spawning or feeding or as nursery ground . Recent studies indicated that the marsh is characterized by high productivity as shown by several authors [6].

The construction of several dams for irrigation on the Tigris and Euphrates rivers in source countries Turkey, Syria, Iran, and Iraq resulted in a sizable discount in freshwater inflow, each qualitatively and quantitatively to the southern marshes. East Hammar marsh now receives most of its water from the Shatt Al-Arab and from groundwater seepage[7, 8]

2. Material and methods

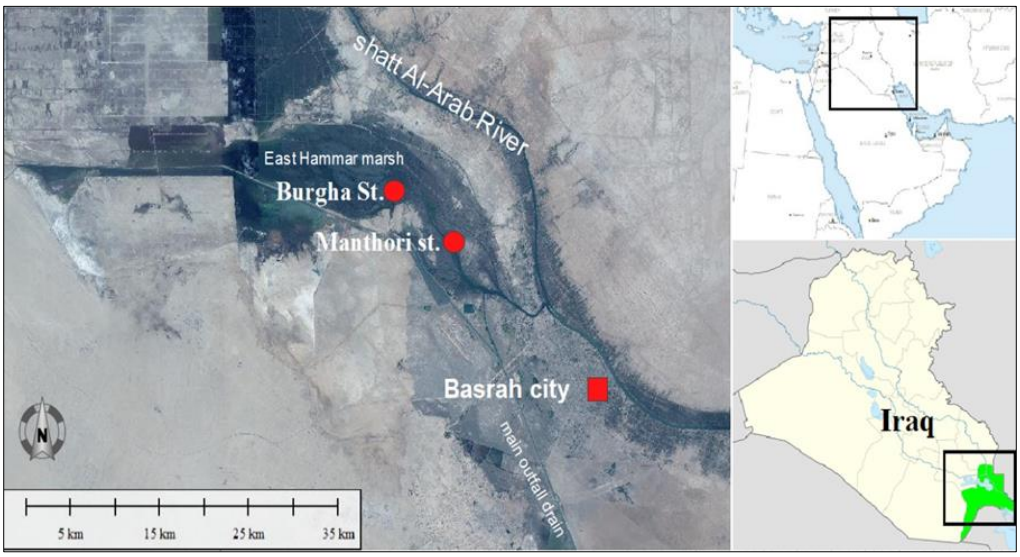
2.1. Stations and Sampling

Two research stations were chosen to be the various biotopes of the East Hammar marsh (Map 1).

- **Manthori station** stands for a wide channel marsh with permanent deep tidal water, which is essential for fishing and transportation, with coordinates (N:30^0 40$'$ 26$''$) (E:47^0 37$'$ 57$''$).

- **Burgha Station** is an open marsh with shallow water depth and a vast intertidal zone becoming nearly dry at ebb, which is important for fishing and aquatic bird hunting, with coordinates (N:47⁰ 33' 2") (E:30⁰ 41' 44").

The sampling period from March to August 2018 lasted for six months during the hottest and driest period of the year. Surface water samples and biota (macrophytes, phytoplankton, zooplankton, macrobenthos, fish, and birds) were collected from both stations once a month, with careful attention also given to frogs and aquatic reptiles. Water samples were collected using horizontal water samplers. Quadrates were used for the macrophyte sampling. Phytoplankton were sampled using plankton nets (20 μm) and zooplankton nets (60 μm). A bottom dredge was used for macrobenthic sampling. Seine nests, cast nets and electrical fishing were used to collect fish and shrimps.



Map 1 Map of East Hammar Marsh with the Locations of Manthori (channel marsh), and Burgha (open marsh), respectively

3. Results

3.1. Evidence of the Changing Ecology of East Hammar Marsh Water Salinity and Electrical Conductivity

As result of the progressing of a salt wedge from Arabian Gulf to East Hammar marsh one hundred ten kilometers to north, the salinity degree multiplied in four months from 3.74 to 5.1 PSU from March and July 2018. The salinity level reached its 16.1 PSU height at the end of August, the highest ever recorded in the marsh. In March, the conductivity values were 8.4 (mS/cm) in Manthori and 9.5 in Burgha, which increased to 25.4 and 25.9 (mS/cm) in August at the two stations. Water temperatures also increased in March from 14.0 °C in Menthori and 16.0 °C in Bergha to 30.4 °C and 31 °C in August, respectively (Table. 1) .

Table 1 Air, Water Temperatures, Salinity, and Electrical Conductivity at Manthori and Burgha sites (March to August 2018)

Water Characteristic	Manthori						Burgha					
	March	April	May	June	July	August	March	April	May	June	July	August
Salinity (PSU)	5.1	3.74	4.74	4.9	10.3	16.1	5.83	5.25	4.5	6.13	10.6	16.3
Conductivity (mS/cm)	8.4	6.23	7.91	8.16	16.3	25.4	9.5	8.75	7.53	10.1	16.7	25.9
Air temperature (°C)	17.6	30.9	32.1	39.9	36	38	19.1	28.8	35.3	34.9	39.5	42.1
Water temperature (°C)	14	23.8	26.9	27	29	30.4	16	26	29.5	26	31.4	31

3.2. Aquatic Plants

Through the observation period (March-August), four emerging plant species were recorded, which were the most common species in the southern marshes. Seven submerged plant species, each of which was the most dominant species, were seen. No floating plant species were seen in the marsh.

A rise in salinity from 5.1 PSU in March to 16.1 PSU in late August resulted in the absence of floating plants and decreased density of emerged and submerged species. The effects of increased salinity on the aquatic plants are shown in Figure.1. We observed the disappearance of seven highly abundant freshwater submerged species: *Ceratophyllum demersum, Potamogeton crispus*, *Potamogeton pectinatus, Potamogeton perfoliatus,Myriophyllum verticillatum, Najas marina,* and *Chara spp*.

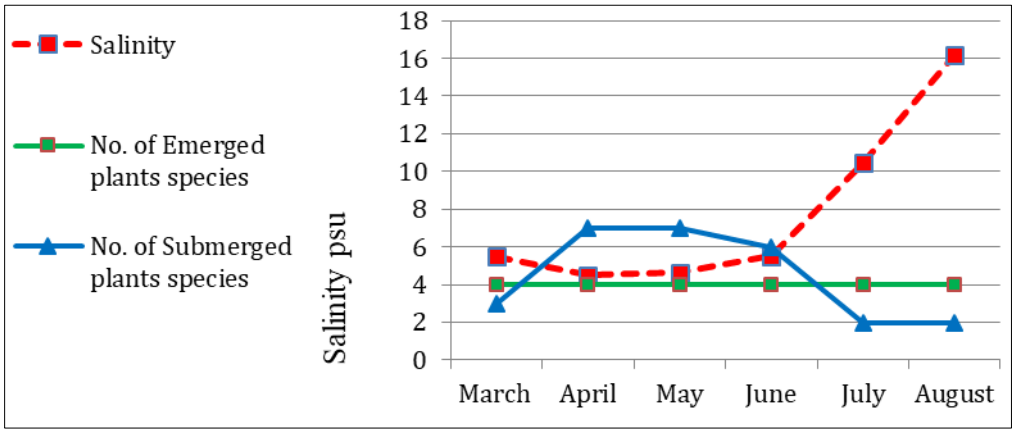


Figure 1 Impact of Sharp Increase in salinity on aquatic plant occurrence in East Hammar Marsh (March to August 2018)

3.3. Phytoplankton

A total of 75 phytoplankton taxa belonging to 5 companies and 37 genera were identified in the current study. Bacillariophyta used to be the frequent team in our samples forming eighty percent of the discovered phytoplankton taxa, while Chlorophyta used to be 9 percent, Cyanophyta eight percent, and solely two percentage for Euglenophyta and one percentage for Pyrrophyta.

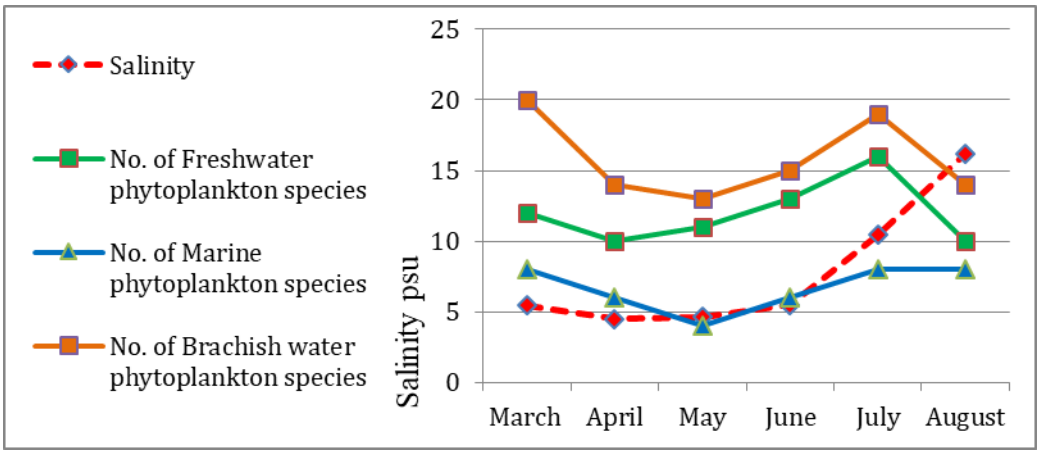


Figure 2 Impact of sharp salinity increase on phytoplankton species occurrence in East Hammar Marsh (March–August 2018)

Cyanophyta was represented via 6 taxa, two of them, *Oscillatoria limnetica* and *O. formosa* was found in all samples at some stage in the six-month duration of data collecting, the best quantity of Cyanophyta species taking place in June. Chlorophyta incidence in seven species belonging to exclusive genera, most of them appear in June and July but quickly disappear in August.

The Bacillariophyta group had 60 species belonging to 26 genera, the most common genus Nitzschia, and 14 species. Some Bacillariophyta species were recorded at each station in all samples throughout the study period. These are *Cyclotella meneghiniana*, *Entomoneis alata*, *Gyrosigma acuminatum*, and *G. attenuatum*, as well as, other species suggested in most samples, together with *Campylodiscus clypeus*, *C. sp*., *Gyrosigma fasciola, G. scalproides, G. sinense, Navicula sp., Nitzschia bilobata, N. longissima, N*. *sigma, N. sp. and Pleurosigma sp*. Sharp salinity increased in July and August, which altered the phytoplankton assemblage with lowered freshwater and brackish water environmental organization and increased marine forms in the East Hammar marsh (Figure 2).

Diatom types differed in their habitat preferences. Brackish water diatoms recorded the best percentage of prevalence with forty percent of the complete species, whilst the freshwater species got here in 2d region with a share of 25 percent. The 1/3 vicinity was once 14 percent for fresh-brackish and marine species, and seven percent for brackish-marine diatom (Figure 3).

The marine diatom species recorded were *Campylodiscus clypeus, Gyrosigma sinense, Nitzschia bicapitata, N. prolongata, N. increta, N. longissima, N. prolongata* and *Tryblionella granulata.*

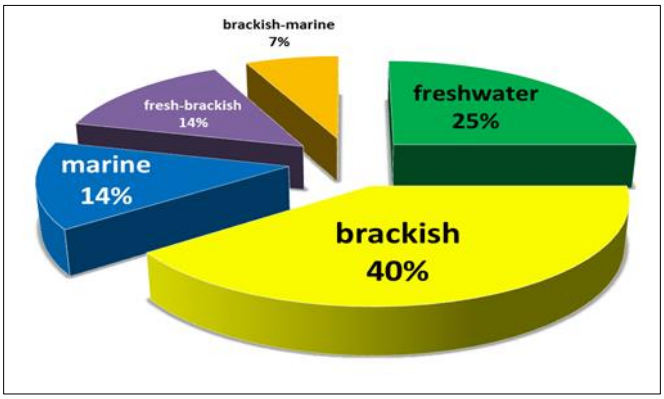


Figure 3 Phytoplankton Habitat Preferences in East Hammar Marsh (March–April 2018)

3.4. Zooplankton

Both tiny (meioplankton) and minute zooplankton (microplankton) appeared in March, April, May, and June in the Menthori and Bargha sites. The most abundant category was Cirripedia larvae, specifically the larvae of *Apocyclops*. Other groups of *Cyclops*, also present in dense, mostly the genus Cyclopoida, plenty of in low salinity environments.

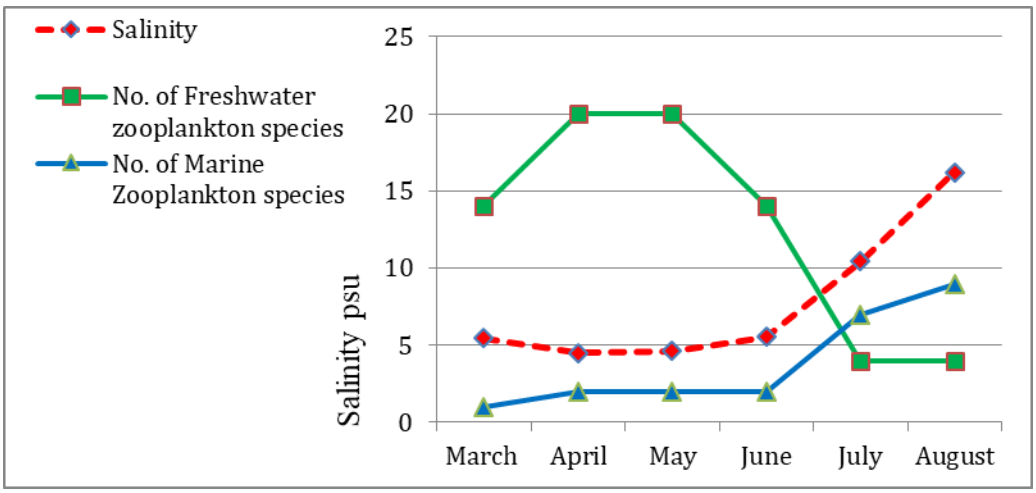


Figure 4 Impact of Sharp Salinity Increases on Occurrence Zooplankton Groups in East Hammar Marsh (March–August 2018)

The zooplankton abundant categories at each site were Cirripedia larvae with excessive density due to water turbidity. The freshwater Copepoda genus *Apocyclops*, *Cyclops*, and *Eucyclops* also happened at high concentration. Through these

4 months, Cyclopoida passed off in excessive concentration, at some stage in the first three months. In May, Cladocera seems in large numbers, specifically the genus *Moina*, which prefers freshwater habitats, accompanied by the presence of jellyfish. The excessive salinity in July and August resulted in the absence of freshwater Cladocera.

In July and August months, there used to be a primary shift in the quality and amount of meioplankton due to the increase in salinity suddenly, mainly due to the absence of many freshwater categories such as Cyclopoida and Cladocera and decrease in the number of other categories (Cirripedia larvae), and the presence of marine species earlier recorded solely in the Arabian Gulf (Figure 5).

Marine zooplankton present in high concentration, like a Calanoida family, particularly the genus *Bestiolina* accompanied through the appearance of jellyfish of Coelenterate. The larval phases of shrimps, crabs, and Mysida were common for the duration of monitoring, and their amount did not suffer from a high in water salinity. The shift in salinity should attract new marine zooplankton to the marsh, changing in the zooplankton assemblage considerably (Figure 4).

3.5. Macrobenthos

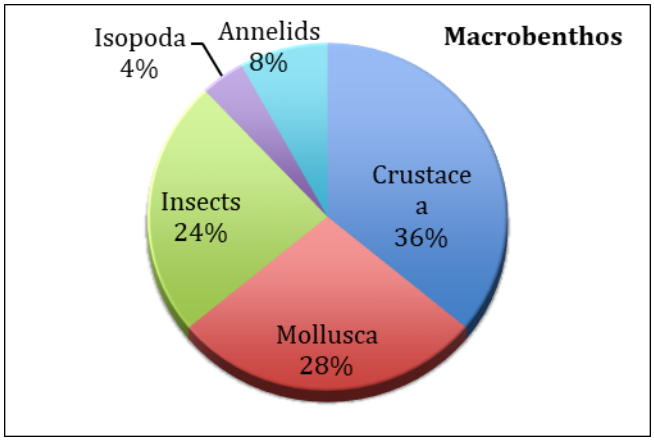


Figure 5 Percentage of Macroinvertebrate Groups Occurring in East Hammar Marsh (March - August 2018)

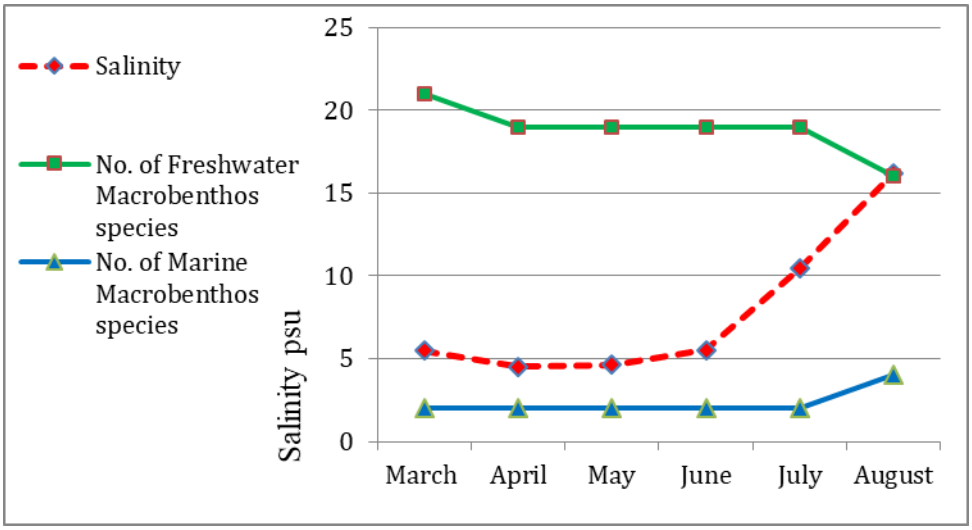


Figure 6 Impact of Sharp Salinity Increases on the Occurrence of Macrobenthos in East Hammar Marsh (March–August 2018)

A total of 25 macrobenthic species were collected from both stations through the sampling period. Two species of marine shrimp, *Exopalaemon styliferus* and *Penaeus semisulcatus*, in no way previously recorded, invaded the marsh. They commonly exist in the Shatt Al-Arab Estuary and Arabian Gulf. These marine shrimps were recorded in August 2018, corresponding with the absolute best increases in salinity. Simultaneously, there was an important minimization in the quantity of freshwater mollusca species *Bellamya bengalensis, Melanopsis nodos,and Physa acuta*, again coinciding with multiplied salinity, because these are freshwater species. Differences did take place between the two stations in a

wide variety of species and individuals. The amplest crew used to be Crustacea, observed through mollusca and then insects (Figure 5 and 6). Some species, such as freshwater shrimp and two species of Mollusca, were absent from the Burgha station. An assessment of the variety of macrobenthos taxa shows a substantial reduction in number of freshwater macrobenthos due to the sharp salinity amplify in East Hammar marsh.

3.6. Fish

There used to be an essential shift in fish composition reflecting a quintessential trade in the East Hammar habitat from freshwater to mesosaline/estuarine. Sharp salinity increases led to the absence of most of the formerly plentiful native cyprinid freshwater species in the past and were substituted by wonderful tilapia fish and marine migratory species, accounting for more than 78 percentage of the species encountered, excluding for two dominant freshwater species: *Planiliza abu* (khishni) *and Silurus triostegus* (juri). Their absence from the marsh in July and August coincides with the sharp increase in water salinity. The occurrence of estuarine/marine species, such as the bull shark *Carcharhinus leucas* in the East Hammar marsh, was not recorded in marshes after the partial restoration of southern marshes in 2003. The fish in each station at East Hammar marsh were dominated by invasive species and marine migratory species from Arabian Gulf (Figure 7).

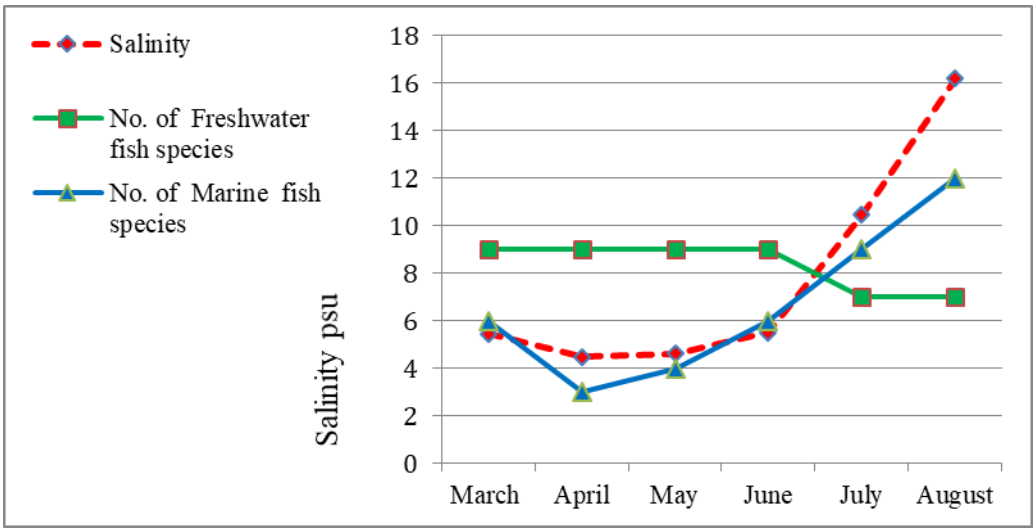


Figure 7 Impact of Sharp Salinity Increases on the Occurrence of Freshwater and Marine Migratory Fish Species in East Hammar Marsh (March–August 2018)

3.7. Amphibians

The marsh frog *Pelophylax ridibundus* was only observed in small numbers, mostly at Manthori site. The tree frog *Hyla savignyi* formerly recorded in the marsh was absent.

3.8. Reptiles

Two species of freshwater turtles were recorded: tough shell turtles *Mauremys caspia caspia* and smooth shell turtles *Rafetus euphraticus* in the East Hammar marsh. Through March, April, May, and June, countless freshwater reptile species were observed, mostly at the Manthori station. Freshwater snakes *Natrix tessellata* are also abundant. With sharp increases in salinity in July and August, most reptiles suffered radically, and various events died (plate 1). Many turtles of each species left the marsh searching for shelters.

Plate 1 Dead Hard-Shell Freshwater Turtles *Mauremys caspia caspia* in East Hammar Marsh during Sharply Increased Salinity (July and August 2018)

3.9. Birds

Field outcomes confirmed that forty-six and thirty-nine bird species have been recorded in Manthori and Burgha sites, respectively. The biggest number of bird species was recorded in Manthori through May, and the minimum number was recorded in July, when 30 species were observed. In Burgha site, 32 was the maximum number, recorded in April and May, and 29 was the minimum number recorded in June, July, and August (Figure 8 and 9). Most of the birds were migrants, either winter or summer visitors, and some of them had passed migrants. The rest were residents or natives, commonly nesting with summer visitors. The winter visitors come back in spring to their original home for reproduction. These were late through spring, and summer was non-reproductive. The decrease in the number of species recorded was because of the short observation period. coverage two seasons in Iraq spring and summer (hotter months during year) and did not have the fall and winter which are the better time for bird watching especially migrants. During the watching period from March to August 2018, fifty-seven bird species had been recorded belonging to 9 orders. Watching results showed that the number of species was without changing by sharp high salinity.

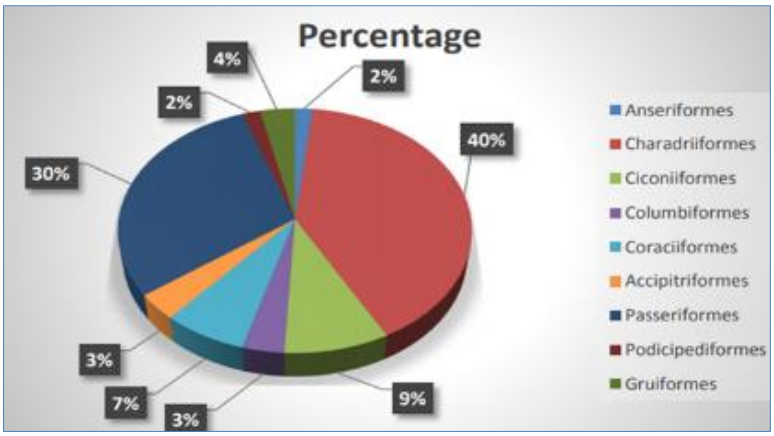


Figure 8 Percentage of species in each bird order observed in East Hammar Marsh (March–August 2018)

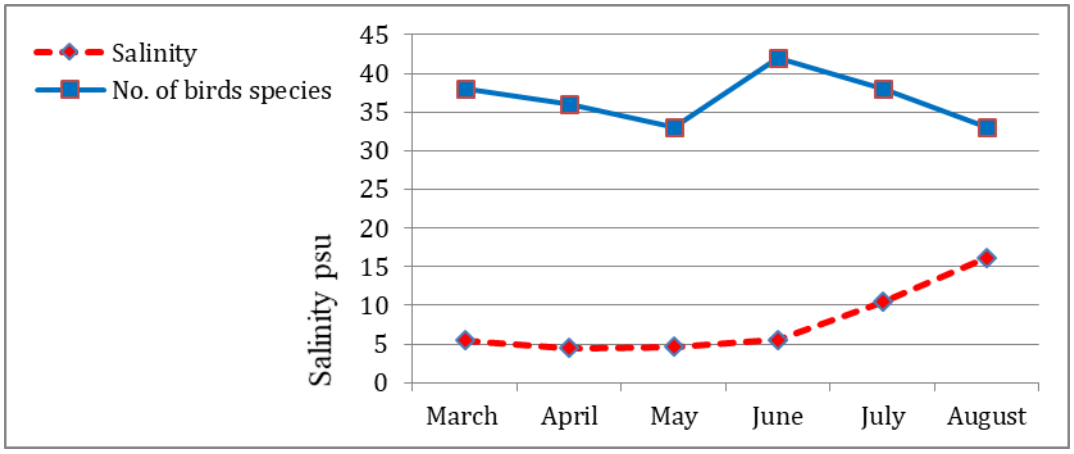


Figure 9 Number of Bird Species Recorded Monthly at Burgha and Manthori site in East Hammar Marsh (March–August 2018)

4. Discussion

Marsh Arabs rely in giant section on the merchandise of the marsh freshwater ecosystem, which is transferring due to sharp will increase in salinity levels. These modifications in the ecosystem threaten to break the livelihood of Marsh Arabs existing close to marsh banks. If the style continues, the aquatic vegetation disappears from the marsh. This leads to unavailability of fodders for their buffalo herds, they will migrate once more to different area searching for fodder and freshwater, this time now not due to the fact of genocidal insurance policies and movements of the central authorities however due to the fact of the pressures imposed by way of a surroundings in flux. [9] suggested that in many components of the world, salinization of water sources threatens freshwater biodiversity and the livelihood of people. This is the case in the southern marshes in Iraq.

People living in marshes rely on buffalo dairy products [10] and freshwater fish as part of their daily diet. Due to the increase in salinity, two favored freshwater fish species, Cyprinidae, two sorts of yellow barbell, bunni, and hemri in Arabic, disappeared, to be replaced by non-favorite invasive tilapia and small marine species.

In freshwater marshes, the sharp amplification in salinity is a signal of environmental deterioration, illuminates greater integral trade in the complete ecosystem from oligosaline to estuarine. Estuarine and marine taxa have replaced the native freshwater flora and fauna. [11] stated that will increase in salinity influence the bodily and organic aspects of aquatic ecosystems in Australia. This is an increasing number of cases in the southern marshes.

Al-Nagar *et al.* [12], reported that the water quality index in the East Hammar marsh through 2018, was bad from where of safeguard of aquatic life, irrigation, and potable water. Aquatic plants recorded throughout the study period were less than that formerly recorded by [13, 14].

Freshwater aquatic plant species have been severely affected using saline water, mainly submerged varieties. Only riparian emerged species have thrived due to their high tolerance to saline water and partial exposure. Another cause for the limited incidence of aquatic flora in Manthori is boat trafficking, whose outboard motors destroy the submerged flowers by way of their propellers. Buffalo herds additionally play a major position in lowering emerged plant life canopies by using grazing.

A whole 75 phytoplankton taxa have been recognized in existing study; this number was less than consequences confirmed elsewhere. [15] listed ninety-nine species in East Hammar marsh, the number increased to one hundred and five species [16]. However, this found out about found a reduction in phytoplankton.

Five principal groups of phytoplankton in marshes, Bacillariophyta, Chlorophya, Cyanophyta, Euglenophya and Pyrrophyta, have been recorded in the modern study. This finding is of the same opinion as current studies, such as (16). However, three other organizations Cryptophyta, Crysophyta, and Rhodophyta that have been observed in the Central marsh [17] steadily disappeared because of the deterioration of the environmental prerequisites in the marshlands.

Most of the Chlorophyta species that were present in June and July coincided with an increase in temperature; however, they disappeared once more in August due to elevated water salinity. There is a strong relationship between phytoplankton existence and water temperature, salinity, and turbidity. In conclusion, the most of species recorded through the monitoring period had been marine and estuarine, indicating that the freshwater surroundings of East Hammar marsh is altering to an mesosaline/estuarine habitat, if the present-day hydrological conditions prevail. Certainly, the prerequisites will influence different biota, like freshwater aquatic plants, zooplankton, invertebrates, fishes and birds.

The sudden increase in salinity in July and August 2018 caused a reduction in the quantity and quality of tiny freshwater zooplankton (meioplankton), leading to the absence of most freshwater main groups such as Cyclopoida and *Cladocera* and a diminution in the number of other groups(Cirripedia larvae). Salman *et al*. [18]and Ajeel *et al*. [19] postulated that zooplankton of marsh consisted mainly of Cirripedialarva and Cladocera formed 88.5 percent and 10.6 percent, respectively. However, this is not the case under high salinity conditions.

With excessive salinity in East Hammar, marsh marine zooplankton flourished and grew abundant. Calanoidafamily, mainly in the genus Bestiolina, accompaniment by the presence of jellyfish of Coelenterae, grew to become dominant forms. The larval levels of shrimps, crabs, and Mysida grew to become relatively considerable also. The increase in salinity motivated the invasion of marine zooplankton into the marsh and the extermination of freshwater forms.

The occurrence of freshwater macroinvertebrates in the East Hammar marsh has been drastically reduced, mainly because of the disappearance of many freshwater gastropods, shrimps, and bivalves that dominated the marsh in the past [20]. Simultaneously, the invasion of marine shrimp *Penaeus semisulcatus*, *Exopalaemon styliferus*, and jellyfish was highlighted with the aid of [21]. Mollusca species have been reduced by half, with a substantive discount in different taxa together with amphipods and freshwater crabs and the disappearance of the aquatic spider. Data recorded by [22]on the fate of aquatic insects in the East Hammar marsh showed that a predominant discount in a wide variety of species and individuals occurred due to high salinity increases.

Increases in salinity play a principal role in changing the composition of fish assemblages in marshes. Exotic and marine species stood for the bulk of the population qualitatively and quantitatively, as reported by[23]). The constant increase in salinity of the marsh may be the major reason for the disappearance of untolerated freshwater species, such as *Luciolbarbus xanthopterus*, *Mesopotamichthys sharpeyi*, *Carasobarbus luteus*, and *Leuciscus vorax*, considering that these species can only tolerate limited expansions in salinity[24].The expand of salinity has created environmental prerequisites that choose extraordinary tilapia species and invite more marine species to invade and inhabit the marsh. This was a battle for survival.

In June 2018, the East Hammar marsh included only two native freshwater fish species: *Planiliza abu* and *Silurus triostigus*. The exotic and marine invaders remained, but later in July and August the two nature species disappeared, as well.

The mass deaths of marsh frogs and freshwater turtles coincided with sharp salinity increases in the marsh. This increase seems to exceed the tolerance limit for both species of turtles *Mauremys caspica caspica* and *Rafetus euphraticus* and the marsh frog *Pelophylax ridibundus.*

The results showed that bird species were not directly affected by the increase in water salinity but may be influenced by the lack of prey, which is particularly associated with wading and shorebirds. The present number recorded in this study is lower than previously recorded by [25]and [26], but the low number may be because the limited watching duration covered only the months of summer and spring (the hotter months during year) and did not include the fall and winter seasons, which are the better durations for bird watching, mainly for the migrant ones.

The sudden increase in salinity in the East Hammar marsh added fundamental adjustments to the constituents of the plant and fauna communities from freshwater/oligosaline to estuarine communities. Hart *et al*. [27] reported deadly and sub-lethal results of salinity on character species inside aquatic organisms' microbes (mainly bacteria), macrophytes and micro-algae, riparian vegetation, invertebrates, fish, amphibians, reptiles and mammals and water birds.

Endangered for more than a decade by way of a central government that was once desperate to ruin it, the southern marshlands of Iraq inexorably suffered. Non-stop earthworks, installation of big canals, close to the total diversion of upstream waters, and the repeated, forced displacement of the Marsh Arabs almost destroyed the region–its flora, fauna, and human population. Nearly gone, it was given some other risk with partial, disorganized, and haphazard reflooding

at the opening of this century. However, primary components of the southern marshes now face a task not much less threatening than beforehand and virtually equally insidious. It is the ticking bomb of environmental degradation that permanently threatens its ecology. If allowed to continue, it may no longer be reversed as it was after the fall of the ultimate regime. This did not need to happen, and the marshlands were distributed upstream of freshwater. If so, Gulf waters would now not have overtaken the area, accompanied by using invading marine forms. What happens subsequent is a test, not of the legal guidelines of nature, however of the resolve of a united states and a human being to protect and maintain its herbal and cultural wealth for itself and its posterity.

5. Conclusion

The current study reported sever effected of environment and their live structure of Hammar marsh by salt wedge moved from the Arabian Gulf. Salt wedge causing a rapid and sharp increase in its salinity level, East Hammar's fragile ecology is rapidly shifting from oligosaline to estuarine, this event led to an invasion of many marine species from the Gulf, as well as the extinction of freshwater native species.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of ethical approval

This research was conducted with the ethical approval of the University of Basrah, which granted permission to collect water and animal samples from the study area.

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