Al-Qadisiyah Journal of Agriculture Sciences
(QJAS)
| 2077-5822 |

Re Extrapolation For The Iraq Marshes Which Falling Within The World Heritage List (A Literature Review)

Kadhim J.L. Al- Zaidy [1], Giuliana Parisi [2]

1 Department of Agri-Food Production and Environmental Sciences, Animal Sciences Section, Università di Firenze, Via delle Cascine 5, Florence 50144, Italy;

2 Department of Agri-Food Production and Environmental Sciences, Animal Sciences Section, Università di Firenze, Via delle Cascine 5, Florence 50144, Italy;

Submission Track

Received : 9/7/2017
Final Revision :19/7/2017

Keywords

Iraq, Mesopotamia, Cultural Heritage, Biological Diversity, Invasive Species.

Corresponding

giuliana.parisi@unifi.it
jkadhim9@gmail.com

Abstract

The Mesopotamian Marshlands or The Garden of Eden, lies in the southern part of Iraq with estimated area of 15000-20000 km^2. Historically, the area had pioneering role in the human civilization for over 5000 years. The indigenous people of the area are called "Marsh Arabs" or "Ma'dan" who are the descendants of the Sumerians and Semitic people. The former Iraqi regime (Saddam Hussein) had violently led an aggressive campaign to drain the marshes in 1991. Only %7 of the total area survived this campaign, which caused a mass destruction of the ecosystem and dwellers' displacement. In 2003, water started to flow back to the area. Yet, the reflooding did not restore the whole former area of the wetlands. Moreover, the new ecosystem influenced the diversity and characteristics of the co-existing species in the area. In 2016, due to the importance of the Mesopotamian Marshlands, the International Union for Conservation of Nature (IUCN) listed three marshes from the area as World Heritage Sites requiring conservation, namely: Hammar, Hwezeh and Central Marshes. The aim of this study is to re-evaluate the ecosystem of those three sites from a biological perspective by examining some challenges that should be dealt with to restore stability to this multi-thousand-year-old system.

Introduction

Iraq lies in the Middle East with a total area of 438320 km^2 (1). It is surrounded by six countries, namely: Turkey to the north, Iran to the east, Kuwait and Saudi Arabia to the south and southwest, and Jordan and Syria to the west; besides its outlet on the Arabian Gulf to the southeast. The marsh area lies in the southern part of the country on the juncture of Tigris and Euphrates Rivers. The marsh area has unique properties that are hard to be found in any other spot on the planet, which makes it one of the most important wetlands on the global level (2). The dominant environment of the area varies depending on several factors among which water temperature, water salinity, water availability and nutrients availability (3). The marshes are mainly fed from Tigris and Euphrates which are originated from Turkey. The wrong water policy adopted by the former Iraqi regime has led to water scarcity, which affected the marsh area and rendered most of the area dry during the 1990s. The dried marshes transformed into barren lands covered with salt. The destruction reached human, animal and plant lives in the marshes (4). This loss was not limited to only species lost, but also the genetic diversity, the functional communities and the interactions among the living organisms in the area (5). Such catastrophic results provoked the environmental experts and Human Rights activists all over the world (6) along with the UNEP. The issue was brought up in the European Parliament in several occasions (7). Upon governmental and non-governmental

Al-Qadisiyah Journal of Agriculture Sciences
(QJAS)
| 2077-5822 |

efforts for over a decade, three sites in the marshes were chosen (Hammar, Hwezeh, and Central Marshes) for the World Heritage List (8). The UNESCO had adopted in November 1972 a convention to protect the cultural and natural heritage to aid the efforts of the international community for the conservation of sites of global value as they belong to the future generations. Signatories to this convention were 192 countries. The list attached to the convention included many unique sites from all over the world. The inclusion to the list means that the site is belongs to many unique other sites. The southern marshes of Iraq were included in July 17th 2016. This represents an international recognition of their global value according to United Nations Environment Program (4). As one of the largest inland systems in the globe under such sever heat and dryness (9), its recognition from the IUCN is a kind of fairness which could represent a new stage for a civilization that lived for over 5000 years. This requires preserving the area as a joint responsibility that is accomplished by international cooperation (9).

The Evolution of the Mesopotamian Marshlands

Many studies have discussed the origin and evolution of the Mesopotamian Marshlands, and perhaps the most acceptable theories relevant to the subject are those which indicate that the marshlands formed at the end of the Pleistocene Age (20000-37000 years ago). During that age, some kind of a Tsunami stroke due to an elevation of sea level **(10)**. The area faced a second era represented by climate changes in the northern polar regions of Europe, Asia and North America some 12000 to 17000 years ago. Such changes led to a decrease in oceanic level of about 130 meters. This resulted in a severe decline in the levels of coastal basins to become dry lands, like the transformation of the Persian Gulf area into an almost dry land and the ancient rivers at that time (Tigris, Euphrates and Karon) became directly pouring out in Oman Gulf. This helped form fresh water ecologies. Accordingly, wetlands formed in the depressions about 11000 to 13000 years ago **(11)**. The third era took place in the end of the Pleistocene Age about 10000 years ago. Here, another significant marine swift happening took place, which formed the coastal line of the Arabian Gulf with the spread of river-based freshwater marshes. This continued until 9000 years ago. The coastal line of the Arabian Gulf and the southern part of Mesopotamia formed in the Post-Ice Age. **(12)** has identified four climatic stages of the marshes in the last 10000 years:

1. The last 7000 years: semi-dry area characterized by saline lake formations.
2. The last 6000 to 7000 years: wet area characterized by heavy rain and high sea level (floods).
3. The last 4000 to 6000 years: semi-dry area characterized by water level retreat and the reshape of the marshlands.
4. The last 3000 years: dry area with characteristics as seen today.

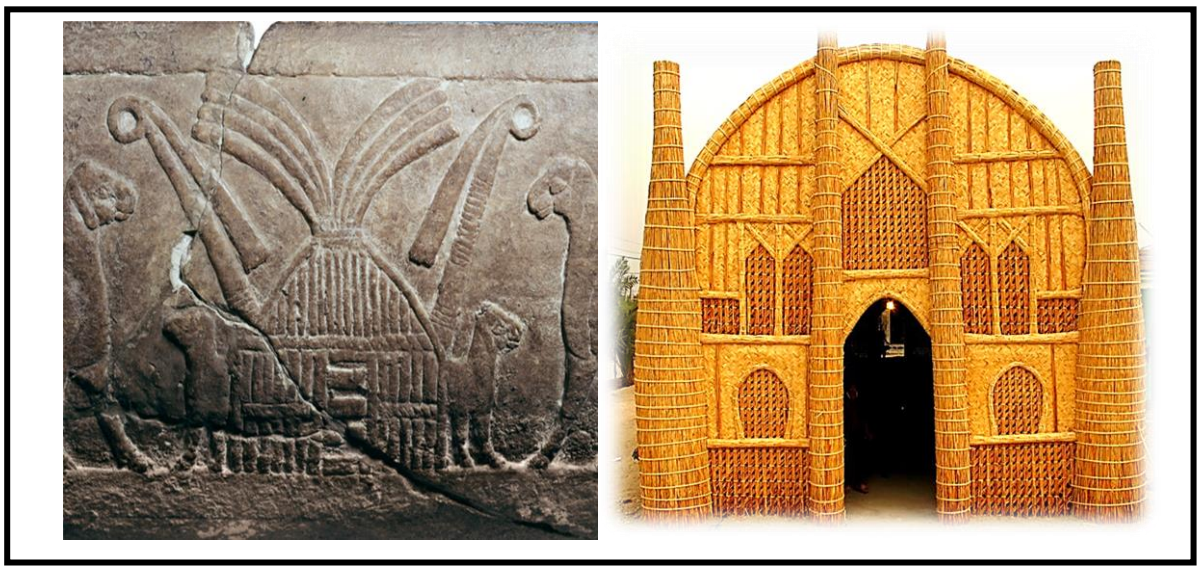
The precipitation of the organic materials in the Mesopotamian Marshlands through the ages helped the human settlement as there is a significant connection between the environmental factors that formed the marshes and the use of these marshes by man as a means of living (13), especially with the existence of the desert formation surrounding the marshes (14).

Cultural Heritage

The use of the term Mesopotamia is related to the concept of the marshlands. Mesopotamia, a Greek word indicating to the land between two rivers (**15**). Hence, the term points out to all the lands between the two rivers including the southern marshlands. The inhabitants of Mesopotamia are habituated to living next to water, therefore the marshlands represent ideal environment of living on and benefit from its natural resources (**16**). Thus, the discussion of the history of Mesopotamia normally implies the cultural heritage of the marshlands, which are historically known as Garden of Eden (in the Holy Scriptures) or the land of Abraham or the land of Sumer. Pottery relics found in Tel Ubaid- Eridu indicate the Sumerians settled in the marshlands 5000 years ago (**17**). There is

Al-Qadisiyah Journal of Agriculture Sciences
(QJAS)
| 2077-5822 |

an indication to the marshlands in the Sumerian literature (**18**), which is the first written literature in the history of mankind (**19**). The Sumerians had their own language, which is not connected to any other linguistic family and is considered one of the most ancient languages on earth (**20**). Besides, the Sumerians were founders of the urban civilization along with their precedence in breedinganimals and agriculture and first of the invention of writing , also, they have the world's oldest examples of water engineering for agriculture purposes (**21; 22; 23; 24; 10; 25**; **26**; **27**; **28**, **29**; **30**; **31**; **31**; **32**; **33**, **34**). Their remains are still land marking their great civilization and cities on the edges of the marshlands like Lagash, Ur and Uruk (**13**). Marsh dwellers lived and a somehow buffered environment and conserved their original lifestyle through the centuries (**14**). The present marsh dwellers (Marsh Arabs or Ma'dan) are the descendants of the Sumerians and they are the living connection between the Iraqis of today and the ancient Sumerians (**20**). Ma'dan (Shiite Muslims) live on the edges of the marshes or in small artificial isles made of reed within the marshes (**4**). Their lifestyle significantly resembles that of the ancient Sumerians (**35**) as they depend on hunting/fishing, buffalo milk products and the use of reed for building houses. The famous reed guesthouse (Mudheef) represents the peak of the social and cultural system of the Ma'dan (**4**). It is built in the same Sumerian layout surviving 5000 years (Picture 1).



Picture 1:In the left, The *mudheef* in southern Iraq. In the right, A Sumerian reed hut or *mudheef* before 3,000 year ago. (4).

Additionally, there is remarkable resemblance between the traditional clothing style of the Ma'dan with the fashion style of the ancient Sumerians indicated in their relics (Picture 2). This unique social texture suffered greatly upon Saddam's campaign to drain the marshes in 1991 and the consequential aggressive displacement and genocide of thousands of the Ma'dan (**36**). This campaign was considered one of the greatest crimes in Iraq's modern history. The UNEP launched the project of "Support of the Environmental Management of the Iraqi Marshlands" in 2004 funded by the USA, Italy and Japan, with the aim of supporting the restoration of the marshlands as a glimpse of hope for those who were displaced to regain their lives and marshes.

Al-Qadisiyah Journal of Agriculture Sciences
(QJAS)
| 2077-5822 |

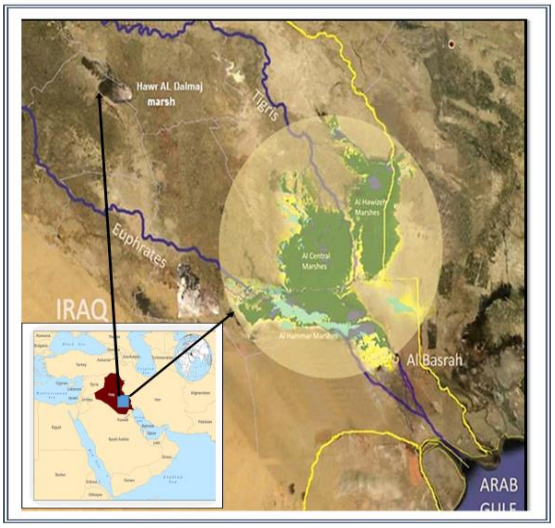
Picture 1:In the left, Sumerian statuette of a female covering her head in a headdress in the southern Iraq style. Museum of Fine Arts, Boston. In the right, female of southern Iraq.
http://tammuz.tumblr.com/post/19178715516/statuette-of-a-female-wearing-a-headdress-in-the

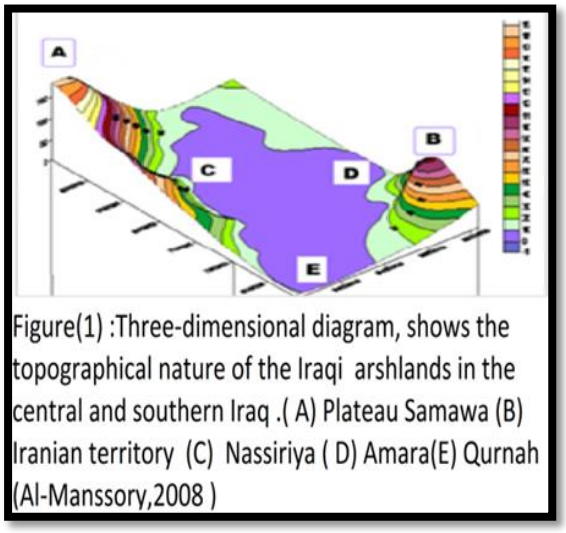
Geographical Location

The marshes of southern Iraq form an aquatic triangle with its head in Amara city and its base extending between Basra and Nasiriyah cities, and expanding northward to Kut city including marshes like Shwecheh, Delmaj and Afaq (**37**). Hammar and Hwezeh marshes and the Central Marshes lie in the Lower Mesopotamian Basin in southern Iraq (**1**) as shown in (Figure 1) and (Table 1). Tigris and Euphrates represent the main sources feeding the marshes (**38**). Water level of the marshes varies from 1 to 2 meters above sea level and about 22 meters above sea level near the borders with Iran. Water depth in the marshes does not exceed 2 meters in most marsh sites, but it sometimes reaches 7 meters as in Hwezeh (**39**).The marsh area is a depression as is apparent in (Figure 2) for 3D graphic of the area . Hammar marsh lies to the south of Euphrates and extends from Nasiriyah city to the west to the outskirts of Basra

Al-Qadisiyah Journal of Agriculture Sciences
(QJAS)
| 2077-5822 |

city to the east.





Figure(1) :Three-dimensional diagram, shows the topographical nature of the Iraqi arshlands in the central and southern Iraq .(A) Plateau Samawa (B) Iranian territory (C) Nassiriya (D) Amara(E) Qurnah (Al-Manssory,2008)

The total area of this water body is about 2800 to 4500 km^2 in the flood season. Water depth is about 1.8 to 5 meters (6). the supply of water to the Hammar Marsh by Euphrates with less water quantities from Tigris (**40**).

Al-Qadisiyah Journal of Agriculture Sciences
(QJAS)
| 2077-5822 |

Table (1): Geographical subdivision and terminology used for the three marshes with the subdivisions by various authors.

The location (8)	Governorate (9)	Centre point coordinates (42)	The approximate (area 43)		The marshes affiliated the main marsh			
			Property (ha)	Buffer zone (ha)	(45)	(44)	(45)	(41)
The Huwaizah Marshes	Maysan	N 31 33 44 E 47 39 28	48131	42561	Hawizeh	Hawizeh	Hawizeh	Haur Al-Hawizeh
					Majnoon			Haur om am Nyjah
					Al-Sanaaf			
The Central Marshes	Maysan, Dhi Qar	N 31 05 07 E 47 03 15	62435	83958	Chibayish	Central		Haur Uwainah
					Al-Islah			Haut Al Rayon & Um Osbah
					Dawaya	Abu-Zirig		
					Prosperity River			Haur Auda
					Glory River			
The Hammar Marshes	Al Basrah (East Hammar)	N 30 44 21 E47 26 19	20342	12721	East Hammar	Hammar	East Hammar	Haur Hammar
	Dhi Qar (West Hammar)	N30 50 30E46 41 03	79991	68403	West Hammar		Suq Shuyukh	
								Haur Chubaisah

The Central Marshes (Qurna) are the heart of the southern marshes and are located in the juncture of Tigris-Euphrates. The water flows to the Central Marshes through a number of tributaries of the Tigris. The total area of the Central Marshes is about 3000 square kilometers reaching up to 4000 km^2 in flood season. Water depth is about 3 meters inside the Central Marshes (**46**). Hwezeh Marsh lies to the east of Tigris and is divided by the Iraq-Iranian borders. Its main supplies by freshwater are Msharrah and Kahla rivers and Sannaf Marsh, while Kassarah and Sweb rivers are the main drainage. Hwezeh Marshes cover about 3000 km^2 reaching up to 5000 km^2 in flood season, with depth of about 7 meters (**47**).

The Draining of the Marshes

Saddam regime conducted the draining of the marshes in 1991 via separating and blocking Tigris tributaries flowing Hwezeh Marshes in Amara city (**48**). Two embankments were built to form an artificial canal of 1200-2000 meter width and 90 km length (**49**) beginning from Al-Salam Sub-district in Amara city and southward to Qurna city to drain in Euphrates (**50**). Another embankment was built to divide the marshes into smaller areas for practicality reasons in terms of gaining less evaporation times or water draining. This method was used in all marsh areas (**51**). Also, Euphrates was diverted to the MOD (Main Outfall Drain) course some 5 kilometers to the east of Nasiriyah city. This operation made change to the historical and natural course of Euphrates with the purpose of eliminating of the river's feed to Hammar Marsh (**33**). Hammar Marsh

Al-Qadisiyah Journal of Agriculture Sciences
(QJAS)
| 2077-5822 |

was completely disappeared between 1992 and 1994 with all its former length of about 120 kilometers (**52**). Figure (3) shows the stages of the marshes draining until 2010, when the total area decreased to only %7 of the historical area (**7**). The division of the marshes was accomplished when water flow was eliminated. The draining project was accompanied by aggressive campaign of arrests, killings, household burnings and displacements of the endogenous marsh dwellers in thousands. By throwing napalm bombs in different parts of the marshes (**53**). Addition to using a chemicals weapons, artillery and minefields (**54**).Over 75000 of the Ma'dan population fled to Iran and lived in refugee camps for more than a decade (**36**). The number of the Ma'dan significantly decreased during the 1990s besides other catastrophic changes that blew the area's ecosystem.

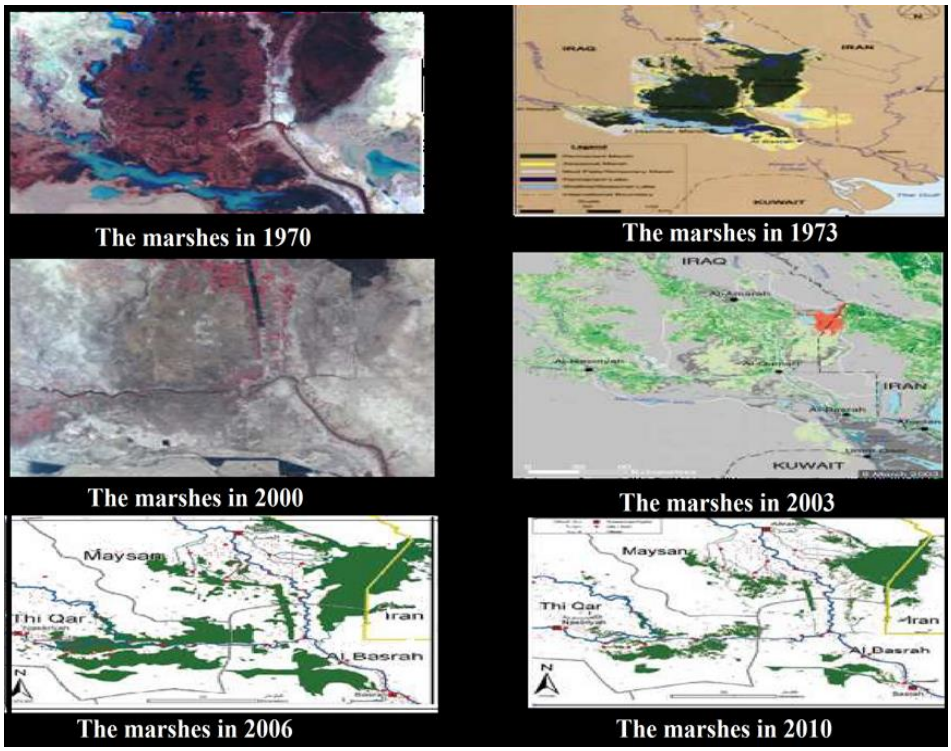


Figure (3) shows the stages of the marshes draining until 2010
The source: - (**55**). (**56**).

Table (2) shows some of the changes in the marshes population, total areas, plan populations, and fishing quantities before and after the draining campaign. Soil salinity in the drained areas elevated due to water over-evaporation which was originally saline (**57**).

Table (2): The changes in some traits of the marshes before and after the drying.

Trait studied		Before drying the marshes in 1991	After drying the marshes in 1991
number of the Arab marsh		300,000 -500,000 (18,58)	75,000 - 85,000 (59)
Water Discharge (m3/s) (60)	Hwezeh	145	81
	Hammar	231	21
	The Central Marshes	253	0.97
Total Wetlands km^2 (4)		8,926	1,296.9

Al-Qadisiyah Journal of Agriculture Sciences
(QJAS)
| 2077-5822 |

the dominant plants (61)	**18**	**7**
Catch of fish by tonnes (62)	**13200 in (1989)**	**2000 in (1993)**

Such sabotage included fisheries and fishing quantities, which deteriorated due to the draining of vast water bodies along with the oppression against people in that period (**63**). The deliberate draining of the marshes resulted in almost total loss in species, populations and habitats of birds, as the marshes are vital resting spots for migrant birds in the rout of West Asia and East Africa (**63**). As well as this, the area was extremely polluted as a result of the use of army munitions and poison gas (**38**; **64**). Several mammal species were affected by the draining as (**37**) mentioned that the deliberate draining of the marshes led to global extinction of *Nesokia bunnii sp.* and *Lutrogale perspicillata maxwelli spp*. The UNEP described the draining project damaged the biological diversity of the occurring non-aquatic species of plants, birds, invertebrates, in addition to the destruction of the biological diversity of the aquatic species like fisheries, amphibians (**4**).

Biological Diversity

Life came back to the drained marshes in 2003 yet in in the anisotropic form. Most plants, fisheries and waterfowls were restored but in less numbers that before the draining (**65**). Numbers and species of insects reached 45 as to 2006 (**66**), while they were about 104 before the draining (**67**). Table 3 shows the biological diversity in the marshes in 2005-2012. More than 100 invertebrate species were found in the restored marshes along with fish, amphibians, birds, mammals, and reptiles (**68**).

Table 3: The biological diversity in the Iraqi marshes.

The biogenic group	The Huwaizah Marshes	The west of Hammar	The east of Hammar	The Central Marshes	The total number	References
Bacteria	**4**	**3**	**7**	**#**	**7**	**(69)**
Fungus	**10**	**-**	**67**	**13**	**90**	**(70)**
Phytoplanktons	**92**	**89**	**64**	**74**	**132**	**(71)**
Aquatic plants	**36**	**24**	**28**	**33.3o**	**51**	**(61); (72)**
Zooplanktons	**49**	**43**	**42**	**-**	**87**	**(73)**
Oligochaete	**20**	**2**	**10**	**8**	**26**	**(74)**
Fish	**17**	**14**	**39**	**17**	**41**	**(75)**
Amphibians	**2**	**2**	**2**	**#**	**2**	**(76)**
Reptiles	**3**	**2**	**3**	**#**	**3**	**(76)**
Birds	**62**	**53**	**77**	**#**	**159**	**(76)**
Mammals	**10**	**2**	**16**	**9**	**18**	**(77)**

Health and integrity of any environment is measured by the occurrence of resident rare, not common, species. Accordingly, as an optimistic indicator of the marshes recovery, Euphrates Soft-shell Turtle (*Rafetus euphraticus*), among the rare amphibian marsh species indicating the marshes health, was found in the restored marshes although registered as endangered species. Additionally, nine resident or visiting marsh bird species were recorded though being marked globally vulnerable (78). These numbers might be increasing with the improvement of the environmental status in the restored marshes. Bird communities in the marshes consist of Resident, Summer/winter visitor and passing birds. In terms of populations, they are either common or rare including region-restricted species to the marshes. (79) recorded 151 bird species in southern Iraq, 53 of which were breeding, 10 possibly breeding, 44 residents, 110 winter visitors from their breeding areas in

Al-Qadisiyah Journal of Agriculture Sciences
(QJAS)
| 2077-5822 |

Europe and Asia. Pygmy Cormorant (*Phalacrocorax pygmaeus*) is dominant in Hwezeh marshes as resident bird species, while Little Egret (*Egretta garzetta*) dominates Hammar Marsh along with gulls and terns (72). The importance of the marshes increases due to the occurrence of the migrant and waders as they play an important environmental role via transporting nutrients from one place to another, and their faeces are also nutrition sources for the plants besides their role as primary and secondary consumers of seeds, aquatic plants, tiny invertebrates, fish, frogs, snakes (80).

Fish Communities

Conditions; like dissolved oxygen, water depth, pH, salinity, temperature, etc.; influence distribution and occurrence of fisheries in the freshwater systems (81). (82) stated that there are 44 fish species recorded in the Mesopotamian Marshlands, of which 14 are resident, 24 are freshwater species and 20 are marine species, and most of fish species occur in Hammar Marsh. Hwezeh Marshes include 17 freshwater fish species and no marine fish species. The Central Marshes include 14 freshwater fish species. Figure 4 shows the distribution of fish communities in the three marshes. Fish community in East Hammar Marsh, which is fed by Euphrates and Shat Al-Arab rivers, differ from other marshes and this explains the regular occurrence of marine and mixed fish species along with the original and alien freshwater fish species (83). Therefore, Hammar Marsh is of vital importance for fish species due to the tidal dynamics between the marsh and the Gulf. This character supports fish movements between the marsh and the Gulf, which in turn provides environmental corridor to many marine species for hatching periods, nutrition and shelter. Consequently, Hammar Marsh plays important role in the breeding fish coming from the Gulf, which significantly contribute to the total fishing quantities all over the Gulf area (84).

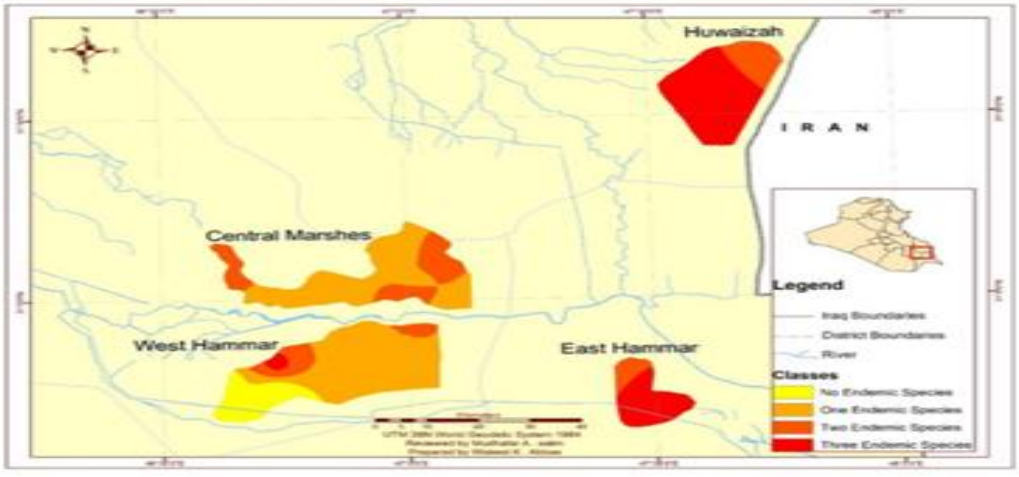


Figure 4: Distribution of Endemic Fish in the three marshes (78).

The Iraq Marshes include many economic fish species. (85) mentioned 18 fish species of economic importance in the marshes: *Barbus barbulus, Barbus esocinus, Arabibarbus grypus, Mesopotamichthys sharpeyi, Luciobarbus xanthopterus, Carasobarbus luteus, Leuciscus vorax, Carassius auratus, Ctenopharyngodon idella, Cyprinus carpio Hypophthalmichthys molitrix, Tenualosa ilisha, Planiliza abu, Nematalosa nasus, Silurus triostegus, Alburnus mossulensis, Mugil dussumieri and Acanthopagrus latus*.Fish species comprising the fish community in the restored marshes can be described as ilmnophilic, that is, they come from the lower parts of Tigris and Euphrates and they prefer the quiet environment with less water current. The restored fish species came to the marshes from Tigris and Euphrates, that is, they are river species, not the original marsh

Al-Qadisiyah Journal of Agriculture Sciences
(QJAS)
| 2077-5822 |

species which existed and adapted to the area for thousands of years, yet lost forever. Many studies were conducted to examine fish communities in the post-draining marshes. (**86**) presented a comparison of fish communities in three marsh site southern Iraq: Soog Al-Shiyookh, Hwezeh and East Hammar. The researchers pointed out that these marsh site include equal populations of the original species with East Hammar is distinguished for including the largest population of the original species due to the occurrence of marine species. *P. abu* species dominated the southern marshes followed by *C. auratu*, for the availability of suitable conditions and nutrient sources like organic materials, aquatic plants and algae being the main food for them. The former species is resident and the latter is alien to the Iraqi environment (86). (87) showed that 31 species were found in Hammar Marsh belonging to 14 families and dominance was held by *Cyprinidae* in terms of the number of species, while *P. abu* was dominant in terms of population as it was %35.85 of the total collected sample. Fish were divided into three categories: resident (%45.1), alien (%19.4) and marine (%35.5). Fish occurrence differed as 10 species were resident and 5 were seasonal, as well as there were 16 rare species. Mohamed *et al*. (2009) studied the nature of fish community in Hwezeh Marshes in 2005-2006. The total number of the species was 15 with the dominance of *P. abu* (%37.1) followed by *C. luteus* (%29.4), *Carassius auratus* (%15.3), *Alburnus mossulensis* (%4.88) and *L. vorax* (%4.14). Post-draining stage in the marshes included difference in the nutrition system for some fish species of the marshes. (83) mentioned the changed in nutrition of some fish species in Hammar Marsh. Researchers indicated that change happened to *C. luteus* from herbivorous to omnivorous. The same applies to *C. carpio* from omnivorous to carnivorous. Also, *S. triostegus* and *L. vorax shift* had their feeding system completely changed to be totally predatory to small fish. Such change also found *M. mastocemblus*, which became more opt to fish predator. These changes can be related to the evolved environment as well as food scarcity after many years of draining. The co-occurrence of varied fish communities (herbivorous, carnivorous, omnivorous, detritivorous and predators) in one ecosystem, though in various rates, indicates that the food hierarchy is disordered and abnormal in that ecosystem (72). Thus, determinants of environmental stability and balance off the marshes should be addressed, especially those which contribute to the rehabilitation of the marshes like salinity and invasive species occurrence.

Water Status in the Marshes

The key and determinant factor in the restoration of the marshes, including people communities and biological diversity, is the availability of incoming water to the marshlands. Via Tigris and Euphrates. This in turn depends on the upstream countries of the two rivers (Turkey, Syria and Iran). Turkey dams built on Tigris are 17 with storage capacity of 25.3 billion cubic meters, and those built on Euphrates are 40 with storage capacity of 95 billion cubic meters (**88**). For example, Ataturk's dam was built in Turkey as part of Southeast Anatolia Irrigation Project (Great Anatolia Project = GAP) in 1998 with storage capacity of over 307 billion cubic meters of water flowing annually from Turkey to Iraq via Euphrates and it is said that it could alone dry out Euphrates (2). In Syria, 4 dams were built with storage capacity of 16.1 billion cubic meters. So, Tigris and Euphrates flows witnessed decreases of %15 and %43 of the original quantities in 1972 respectively (**89**). This could in future lead to lessen the average annual flow of the two rivers up to 52 billion cubic meters per year in 2020 (90). The status queue, if continues with the same rate of inflow decrease, Tigris and Euphrates would be no more by 2040 (**91**). Water requirements to restore the marshes to their former shape in the 1980s (12900 square kilometers) are about 42 billion cubic meter per year (92). Since water demands from Tigris and Euphrates for the coming periods in terms of agricultural, service and industrial uses would rise to about 70.6 billion cubic meter per year, a water deficit of 8.6 billion cubic meters per year would strike taking into account groundwater resources with that give 1.2 billion cubic meters per year, (%2) of the total water

Al-Qadisiyah Journal of Agriculture Sciences
(QJAS)
| 2077-5822 |

resources in Iraq (93). Therefore, the issue needs a re-consideration in the water plans and programs to be efficiently used according to the strategic importance. The use of the MOD water to stabilize Hammar Marsh and the Central Marshes might be one of the reasonable solutions, especially with the suitable quantities of water in the MOD in terms of discharge (220) cubic meters per second (94).

Salinity

Salinity is one of the most important environmental factors influencing fish survival, development and distribution (95). Environmental disturbs resulting from water quality influence the quality of biological productivity. This leads to alter the structure and a nutrition behavior of the biological communities, reduce native species populations that are more sensitive and increase alien species (96). Consequently, salinity increases contribute directly to population decreases in the aquatic environment (75). It is well-known that salinity in Tigris and Euphrates increases southward (97). This negatively reflects on the biological diversity in the southern marshes (98). Salinity increases in soil due to the deliberate draining campaign led to impose extra loads on water inflows from the two rivers (**99**) which are already not sufficient to cover the actual demand for the restoration of the marshes (89). It is important to think systematically in this deteriorating situation. The investment in drain water for irrigation and re-fertilizing lands to reach soil salinity balance or upon mixing drain water with freshwater, is one applicable solution. Soil cleanse with drain water then with river water saves %20-30 of cleansing freshwater (90). the fundamental resolution of salinity problem is no easy task, and for this not to negatively reflect on the fish status in the Iraqi marshes, efforts should be intensified to study the impact of salinity acclimatization on the local fish communities. Most inhabitant freshwater fish are categorized as stenohaline fish as they cannot tolerate high salinity and witness enormous mortalities when salinity crosses the tolerable boundaries (**100**). However, several studies confirmed the potentiality of solving this issue and enhancing salinity acclimatization of fish via using salt feeding technique that refers to incorporating certain salt amounts in the food of those fish (**101**), given that local fish general exposure to high salinity in their natural environment is not confined to specified age, but all age groups from egg to adult.

Invasive Species

Biotic factors like interspecies interactions including competition, predation and environmental needs interdependence; play important and influential role in the species diversity and richness (**102**). Invasive species contribute to many negative environmental impacts that are not easily discovered and lead to great loss in the local biological diversity due to the direct environmental interactions among species, let alone the genetic overlap when they mix with local species (**103**). Many invasive species invaded the Iraqi marshes before and after the draining like *Cyprinus carpio*, *Ctenopharyngodon idella* and *Carassius carassius*, which comes second in dominance following *P. abu* in the southern marshes. The dominance of invasive fish species in the Iraqi marshes is due to their ability to use the available diet sources; they are not recognized by the enemies of the local fish species like waterfowl, predator fish and reptiles; and their ability to tolerate disturbed conditions (**81**). Invasive fish species compete with local species if they diet on the same diet components or occupy the same territory leading to the displacement of either of them (**87**). Hussain showed the types of food overlapping between local and alien fish species as in Table 4. Eight out of 12 fish species with low food overlapping were included in the study. Also, there is considerable food overlapping among 4 local and alien species, besides the overlapping between alien species like *Cyprinus carpio* and *Carassius carassius*. Accordingly, immediate management interference is required to uplift and stabilize the productivity of the food chain on the long run, and then ensuring the stability of fish diversity in the aquatic environment (**59**).

Al-Qadisiyah Journal of Agriculture Sciences
(QJAS)
| 2077-5822 |

Table (4): Food overlap between the local and alien species in the marshes using Morisita Index (72).

The scientific name	The overlap weak (≤ 50)	The overlap median (50-69)	The overlap high (≥70)
Carassius carassius*× *Cyprinus carpio	**21**		
Cyprinus carassius*×*Acanthobrama marmid	**22**		
CarassiusCarpio* × *Alburnus mossulensis	**39**		
***Alburnus mossulensis*× Carasobarbus luteus**	**35**		
***CarassiusCarpio*×Carasobarbus luteus**	**41**		
CarassiusCarpio*× *Alburnus mossulensis	**41**		
Acanthobrama marmid*×*Alburnus mossulensis		**51**	
CarassiusCarpio*×*Luciobarbus xanthopterus		**69**	
Carasobarbus luteus×*CarassiusCarpio*			**90**
Silurus triostegus* ×*Leuciscus vorax			**90**

Conclusions

- Iraqi southern wetlands play important role in keeping the regional and global biological diversity.
- The draining of the marshes is an organized crime that led to complicated issues of damaging effects to the natural and social aspects of the environment.
- Iraq faces drastic water shortage coinciding with the completion and operation of water projects upstream Tigris and Euphrates causing severe decline in river flows.
- Draining operations impacted the ecosystem in general and species populations and food behaviors in fish communities in particular.
- Salinity increases in the southern marshes is a serious threat to the biological diversity in general and to fish species in particular.
- The marshes suffer from shortage in water inflows and experience ongoing deterioration due to the absence of short-term or long-term strategies to deal with such issues. This urges to intensify future study of the different disciplines concerning wetlands management.

Recommendations

- Activating the international agreements to ensure sufficient water inflows in Tigris and Euphrates and monitoring water quality and water pollution.
- Developing informed programs for the optimal use of water resources to rehabilitate the Iraqi marshes.
- Conducting regular survey for the populations and species of wetland communities of fish, birds and plants.
- Engaging relevant NGOs in the programs of the preservation of the biological diversity and educating marsh locals about coping with the environmental status queue without exhausting the riches in those areas.

Developing future programs by the governmental agencies and NGOs for the professional and craft development for the marsh population to maintain human communities in those areas.

Reference:

1-Al-Ansari, N.A. and Knutsson, S. (2011) Possibilities of Restoring the Iraqi Marshes Known as the Garden of Eden,Water and Climate Change in the MIDDLE EAST AND NORTH AFRICA-Region. *International Conference*, Germany,28-29 April 2011.

2-Partow H. (2001). The Mesopotamian Marshlands: Demise of an Ecosystem. Nairobi (Kenya): Division of Early Warning and Assessment, United Nations Environment Programme.

Al-Qadisiyah Journal of Agriculture Sciences
(QJAS)
| 2077-5822 |

UNEP publication UNEP/DEWA/ TR.01-3.

3-Richardson, C. J. and Hussain, N. A. (2007). "Ecological functional assessment and biodiversity as indices of restoration in the Mesopotamian marshes of southern Iraq." Ecological Society of America Annual Meeting Abstracts.

4-UNEP (2001). The Mesopotamian marshlands: the demise of an ecosystem. Early Warning and Technical Assessment Report, UNEP/DEWA/TR.01-3.

5-Naeem, S.(2006). Expanding scales in biodiversity-based research: challenges and solutions for marine systems. *Marine Ecology Progress Series*, 311, 273-283.

6-Maltby, E. (1994). An environmental and ecological survey of the marshlands of Mesopotamia. AMAR Foundation, May 1994.

7-Brasington, P.(2002). Monitoring marshland degradation using multispectral remote sensed imagery. The Iraqi Marshlands: a Human and Environmental Study. E. Nicholson and P. Clark. London, *Politico's Publishing:* 151-168.

8-IUCN. (2016c). Evaluations of Nominations of Cultural and Mixed Properties. report for the World Heritage Committee 40th ordinary session, Istanbul, 10 – 20 July 2016. http://whc.unesco.org/en/decisions/6794.

9-IUCN. (2016b)." World Heritage Evaluations" Evaluations of Nominations of Natural and Mixed Properties to the World Heritage List. Evaluation Report – May 2016. http://whc.unesco.org/en/decisions/6794.

10-Lees, G. M. and Falcon, N. L. (1952). The geographical history of the Mesopotamian Plains. *Geographical Journal*, 118, 24-39.

11-Sanlaville,P.(2001).The deltaic complex of the lower Mesopotamian plain and its evolution through Millennia. In: Clark,P. and Magee,S.(eds.).The Iraqi marshlands, A human and environmental study.AMAR .*International Charitable Foundation*,London.pp:94-109.

12-Aqrawi, A. A. M., (1995). Correction of Holocene sedimentation rates for mechanical compaction: The Tigris-Euphrates Delta, Lower Mesopotamia. *Marine and Petroleum* (12) 4: 409- 416.

13-Soltysiak, A. (2006). Physical anthropology and the "Sumerian problem". Studies in Historical Anthropology, 4145-158.

14-Kliot, N. (1996). Hydropolitics and geopolitics in the Tigris-Euphrates river basin. Paper presented at the conference 'Water in the Middle East–a source of conflict or cooperation?' August 26, 1996, Odense University, Denmark.

15-McCarthy, M. (2001). How Saddam has drained life from his precious wetlands and left a people damned. The Independent 19 May 2001.

16-Scoones, I. (1999). New Ecology and the social sciences: what prospects for a fruitful engagement? Annual Review of Anthropology 28:479-507.

17-Al-Jwaybirawhie, J. (1993). *Salaaman Aytuha Al-Ahwar: Lamahat Tarikhya wa Jeoghrafiya wa Turathya* (Peace on You Marshlands: Notes on History,Geography and Folklore). Ministry of Culture and Information, Baghdad, Iraq.

18-Young G. (1977). Return to the Marshes: Life with the Marsh Arabs of Iraq.London: Collins.

19-Hallo, W. H. (2010). The World's Oldest Literature. Studies in Sumerian Belles-Lettres. Leiden, The Netherlands, Koninklijke Brill NV.

20-Al-Zahery, Maria.; Pala; Vincenza;Battaglia; Viola Grugni; Mohammed, A.;Hamod; Baharak; Hooshiar, K.;Nadia, ashani; Anna, Olivieri; Antonio, Torroni; Augusta, S., Santachiara-Benerecetti1 andOrnella, Semino.(2011). In search of the genetic footprints of Sumerians: a survey of Y-chromosome and mtDNA variation in the Marsh Arabs of Iraq. *Evolutionary Biology*, 11:288 :2-15.

Al-Qadisiyah Journal of Agriculture Sciences
(QJAS)
| 2077-5822 |

21-Ionides, M.G. (1937). *The regime of the rivers Euphrates and Tigris*. London, 278 pp.

22-Lloyd, S.H. (1943). *Twin Rivers*. Oxford University Press, Oxford.

23-Adams, R.M. (1958). Survey of ancient water courses and settlements in central Iraq. *Sumer*, 14(1-2), 101-103.

24-Haigh, F.F. (1951). *The control of the Rivers of Iraq and the utilization of their waters*. Baghdad.

25-Lees, G.M. (1955). Recent earth movements in the Middle East. *Geologische Rundschau*, 43, 221-226.

26-Buringh, P. (1957). Living conditions in the lower Mesopotamian plain in ancient times. *Sumer*, 13(1-2), 30-46.

27-Harris, S.A. and Adams, R.M. (1957). A note on canal and marsh stratigraphy near Zubediyah. *Sumer*, 13(102), 157-162.

28-De Vaumas, E. (1955). Etudes Irakiennes, première Série. *Bulletin de la Société Géographique d'Egypte*, 28, 125-194.

29-De Vaumas, E. (1958). Le Contrôle et l'Utilisation des Eaux du Tigre et de l'Euphrate. *Revue Géographique Alpine*, 1958, 235-331.

30-Nelson, H.S. (1962). An abandoned irrigation system in southern Iraq. *Sumer*, 18, 67-72.

31-Adams, R. McG. And Nissen, H.J. (1972). *The Uruk Countryside: The Natural Setting of Urban Societies*. The University of Chicago Press, Chicago, 241 pp.

31-Rzóska, J. (1980). *Euphrates and Tigris, Mesopotamian Ecology and Destiny*. Dr. W. Junk bv. Publishers, The Hague.

32-Wagstaff, J.M. (1985). *The Evolution of Middle Eastern Landscapes: An Outline to A.D. 1840*. Croom Helm, London, 304 pp.

33-Naff, T. and Hanna, G. (2002). The marshes of southern Iraq: a hydro-engineering and political profile. *In:* Nicholson, E. and Clark, P. (Eds.), *The Iraqi Marshlands: a Human and Environmental Study*. The Amar International Charitable Foundation, AMAR Publications, London.

34-Green M.W. (1980). Animal Husbandry at Uruk in the Archaic Period.*JNES* 39, 1-35.

35-Al-Hilli, M.R. (1977). Studies on the plant ecology of the Ahwar region in southern Iraq. PhD thesis University of Cairo.

36-Nicholson, E.; Clark P. *et al.* (2002). The Iraqi Marshlands: A Human and Environmental Study. London: Politico's.

38-Al-Ansari, N.A.; Knutsson, S. and Ali, A. (2012) Restoring the Garden of Eden, Iraq. *Journal of Earth Science and Geotechnical Engineering*, 2, 53-88.

39-Islam, A.K.M. (1982). Marsh alage from southern Iraq. Int. Rev.hes. *Hydroiol.*, 67,2:245-260.

40-Awad,N.A.A. and Abdulsaahib, H.T.(2007).Determintaion of mercury in the aquatic plants ,wtera and sediments of the southern marshes of Iarq (Al-Amarah and Al-Basrsah)and Shatt-AlArab river by cold vapor Atomic absorption spectrometry. *Marsh Bulletin*,2:137-146.

41-BirdLife-International.(2010). "World Bird Database" Retrieved 1 October, 2010, from http://www.birdlife.org/datazone

42-IUCN. (2016a). "CONVENTION CONCERNING THE PROTECTION OF THE WORLD CULTURAL AND NATURAL HERITAGE".Fortieth session. Istanbul, Turkey. 10-20 July 2016. http://whc.unesco.org/en/decisions/6794.

43-New Eden Project for Integrated Water Resources (2010). Mesopotamia Marshland National Park Management Plan. Site Description. The New Eden Project for Integrated Water Resources. Baghdad. *New Eden Project*. 232 pp.

44-Abed, J. M. (2007). "Status of water birds in restored southern Iraqi marshes." *Marsh Bulletin* 2(1): 64-79.

45-CIMI. Canadian-Iraq Marshlands Initiative. (2010). Atlas of the Iraqi marshes. Victoria, BC, University of Victoria: 72 pp.

46-UNEP (2006). Iraqi marshlands observation system. UNEP Technical report. UNEP,74pp.

Al-Qadisiyah Journal of Agriculture Sciences
(QJAS)
| 2077-5822 |

47-Evans, M. I. (1994). Important Bird Areas in the Middle East. Birdlife Conservation Series No.2. Cambridge, UK, BirdLife International: 410 pp.

48-Dempster, C. (2007) Resilience of Social-Ecological Systems (SESs): A Case Study of Water Management in the Iraqi Marshlands. M.Sc. Thesis, Queen's University.

49-Al-Rubaie, A.k.(2008). Ecological and morphological study of Iraqi southern marsh. *MARINA MESOPOTAMICA*, 23(2)437-453.

50-Schwartzstein, P. (2015) Iraq's Famed Marshes Are Disappearing—Again, National Geographic, 9 July 2015.

51-Pearce, F. (1993). Draining life from Iraq's marshes. *New Scientist*, 1869, 17 April 1993, 11-12.

52-Munro, D. C. and Touron, H. (1997). "The estimation of marshland degradation in southern Iraq using multitemporal Landsat TM images." *International Journal of Remote Sensing* 18(7): 1597-1606.

53-Sluglett, P. (2003). The Marsh Dwellers in the history of modern Iraq. In E. Nicholson, & P.Clark (Eds.), The Iraqi Marshlands: A human and environmental Study (2nd ed., pp. 223-239).London: *Politico's Publishing* .

54-United Nations (UN). (2002). The Demise of Mesopotamian Marshlands. *UN Chronicle*, 34. UN, New York, USA. University of Basrah: 114 pp.

55-Garstecki, Tobias and Amr, Zuhair. (2010). Biodiversity and Ecosystem Management in the Iraqi Marshlands-Screening Study on Potential World Heritage Nomination-2011 International Union for Conservation of Nature and Natural Resources IUCN ROWA, IUCN REGIONAL OFFICE FOR WEST ASIA-Jordan.

56-UNEP-GRID-Arendal Maps and Graphics Library. (2009). Restoration of the Mesopotamian marshes in Iraq".

57-Hassan, H.A. and Al-Kubaisi, Q.Y. (2002). Pliocene groundwater evolution of the Dibdiba aquifers, Iraq. *In:* Youssef, E-S.A.A. (Ed.), *Geology of the Arab World. Agenda and Abstrcts of the Sixth International Conference on Geology of the Arab World*, Cairo University, Giza, Egypt, February 2002, p. 67.

58-Coast, E. (2002). Demography of the Marsh Arabs. Pages 19–35 in Nicholson E, Clark P, eds. The Iraqi Marshlands:A Human and Environmental Study. *London: Politico's*.

59-Dudgeon, D.; Arthington, A. H.; Gessner, M.O.; Kawabata, Z.; Knowler, D.; Leveque, J. C. and R.J.DAI (Development Alternatives, Inc). (2004). Iraq Marshlands Restoration Program Action Plan. Washington (DC): US Agency for International Development.

60-Al-Mahmood, H.K.; Abdullah, S.S. And Al–Mahdi, A.A. (2008). The Interaction between Water Masses of the Marshes and the Shatt Al-Arab River (South of Iraq). *Mar.Meso*.23 (1): 181-199.

61-Alwan A. R. A. (2006). Past and present status of the aquatic plants of the marshlands of Iraq. *Marsh Bulletin*. 2, 160-172.

62-Tkachenko, A. (2002). The economy of the Iraq Marshes in the 1990s. The Iraqi Marshlands: a Human and Environmental Study. E. Nicholson and P. Clark. London, *Politico's Publishing*: 36-63.

63-Mitchell, C. (2002). Assault on the Marshlands. The Iraqi Marshlands: *a Human and Environmental Study*. E. Nicholson and P. Clark. London, *Politico's Publishing*: 64-100.

64-Benvenisti, E. (2003). Water conflicts during the occupation of Iraq. The American Journal of International Law, 97(4), 860-872.

65-IMRP (Iraq Marshland Restoration Program). (2006). Monitor marsh ecosystem recovery. final Report, USAID/Development Alternative Inc.528 PP.

66-Richardson C. J. and Hussain, N. A. (2006). Restoring of the garden of Eden: An ecological Assessment of the Marshes of Iraq. *BioScience*, Vol.56 No.6, 477-489.

Al-Qadisiyah Journal of Agriculture Sciences
(QJAS)
| 2077-5822 |

67-Scott, D. A., Ed. (1995). *A Directory of Wetlands in the Middle East*. Gland, Switzerland, IUCN.

68-UNEP (2010). Support for Environmental Management of the Iraqi Marshlands 2004 - 2009. Nairobi, UNEP: 104 pp.

69-Al-Taee, A.M.R.; Al-Imarah, E.A.A.; Farhan, F.J. and Al-Imarah, F.J.M. (2006). Microbial quality of southern Iraqi marshland water and sediments after rehabilitation in 2003 and it's suitability for different uses. *Marina Mesopotamica*. 21(2): 163-173.

70-Abdullah, S.K.; Al-Dossari, M.N. and Al-Imara, F.J. (2010). Mycobiota of surface sediments in marshes of southern Iraq. *Marsh Bulletin.*, 5(1): 14–26.

71-Hassan, F. M., Al-Kubaisi, A. A. and Talib, A. H. (2011). Phytoplankton primary production in southern Iraqi marshes after restoration. *Baghdad Sci. J., 8*(1), 519-527.

72-Hussain, N. A. (2014). The Handbook of Biotopes of Iraq Marshlands. Difaf publishing.432PP.

73-Al-Sodani, H.M.; Abed, J.M.; Al-Essa, S.A.K. and Hammadi, N.S. (2007). Quantitative and qualitative study on zooplankton in restored southern Iraqi marshes. *Marsh Bulletin 2(1),43-63*.

74-Jaweir, H.J. and Al-Janabi, E.S.O. (2012). Biodiversity and abundance of aquatic oligochaetes- family Naididae in the middle sector of Euphrates river, al Al-Mussayab City/ Iraq. *The International Journal of the Environment and Water*, Vol. *1, No.1, pp.122-130.*

75-Hussain, N. A.; Ali, A. H. and Lazem, L. F. (2012). Ecological indices of key biological groups in Southern Iraqi marshland during 2005-2007.*Mesopot. J. Mar. Sci.* (27)2: 112 – 125.

76-ARDI (Agriculture Reconstruction and Development Program for Marshland Monitoring Iraq). (2006). Final Report to USAID. Washington DC.assemblages to characterize rivers of the Seine Basin, France. *Hydrobiologia*, 228, 117-130.

77-Al-Sheikhlym O.F., Nader I.A. (2013). The status of Iraq smooth-coated Otter *Lutrogale perspicillata maxwelli* Hayman 1956 and Eurasian Otter *Lutra lutra* Linnaeus 1758 in Iraq. IUCN Otter Specialists Group Bulletin 30(1): 18–30.

78-IUCN. (2010). "The IUCN Red List of Threatened Species." Retrieved 2 June, 2010, from www.iucnredlist.org .

79-Salim, S. M.; Porter, D. R. *et al*. (2009). "A summary of birds recorded in the marshes of southern Iraq, 2005-2008." *BioRisk* 3: 205-219.

80-Mitsch, W.J. and Gosselink, J.G. (2000). Wetlands, 3rd ed. John Wiley, New York.

81-Van dear Valk,A.G.(2006).The biology of freshwater wetlands. Oxford University Press. 173PP.

82-Coad, B. (2010). Freshwater Fishes of Iraq. *Academica Pr Llc*. 274 pp.

83-Hussain, N. A.; M. Mohamed A-R, *et al.* (2006). Species composition, ecological indices, length frequencies and food habits of fish assemblages of the restored Iraqi Marshes. Basrah, University of Basrah: 114 pp.

84-Al-Dubakel, A.Y. (2011). Commercial fishing and marketing of hilsa shad *Tenualosa ilisha* (Hamilton-Buchanon, 1822) in Basrah-Southern Iraq. *Emirates Journal of Food and Agriculture* 23(2): 178-186.

85-Abd, I. M.; C. Rubec, *et al.* (2009). Key Biodiversity Areas: Rapid assessment of fish fauna in southern Iraq. Environment, Biodiversity and Conservation in the Middle East (First Middle Eastern Biodiversity Congress) Aqaba, Jordan.

86-Hussain, N. A., H. A. Saoud, *et al*. (2008). Species composition and ecological indices of fishes in the restored marshes of southern Mesopotamia. *Marsh Bulletin* 3(1): 17-31.

87-Hussain, N.A.; Mohamed, A.R.M.; Noor, S.S.; Mutlak, F.M.; Abed, M.I. M. and Coad, B.W. (2009). Structure and ecological indices of fish assemblage of the recently restored Al- Hammar marsh, southern Iraq. *Bio Risk, 3*: 173-186.

88-Ozis,U.(1983).The DevelopmentPlant of the Western Tigris Basin in Turkey,

Al-Qadisiyah Journal of Agriculture Sciences
(QJAS)
| 2077-5822 |

Water Resources Development ,vol.1,No.4,PP.343-352.

89-University of Victoria. (2010). Dams in the Tigris Euphrates river basins, online map, http://hdl.handle.net/1828/2400, last access: 29-January-2013.

90-Nomas,H.B.(2005). The Potential water supply for the rehalitation in the southern marshes of Iraq. *Marina Mesopotamica*,20(1):105-126.

91-United Nations (UN). (2010). Water Resources Management White Paper, United Nations Assistance Mission for Iraq, United Nations Country Team in Iraq, 20 p.http://iq.one.un.org/documents/100/white%20paper-eng_Small.pdf >

92-Polservice. (1979). Shatt Al-Arab Project, Studies of Salinity Problem, Feas. Rep., Voll,Vlll, Part A Text, Basrah , IRAQ, Tab.(2.2),(6.3) and PP. 139-148

93-World Bank. (2006). Iraq: Country Water Resources, Assistance Strategy: Addressing Major Threats to People's Livelihoods, Report no. 36297-IQ, 97p.

94-Al-Mahmood, H.K. (2009). The monthly variation of discharge and its effect on total dissolved solids and salinity in Shatt Al-Arab River (South of Iraq*). Iraqi J. Sci*., 50, 355–368.

95-Holliday, F. G. T. (1969). The effects of salinity on eggs and Larvae of Teleost, P: 293-311. In W.S. Hoar and D. J. Randall., (eds.): *Fish Physiology*, VoI. I: Excretion, Ionic Regulation and Metabolism. Academic Press, New York.

96-Raderr, D., Batzera, P., ND, S.A. W~SSINGE (ERD S.). (2001). Biomonitoring and management of North American freshwater wetlands. John Wiley and Sons, *New York*.489pp.

97-AL-Lami, A. A.; Sabri, A. W.; Kassim, T. I. and Rasheed, K. A. (1996). The ecological effects of Diyala river on Tigris river, 1. Limnology. J. Coll. Educ. Women, Univ. Baghdad. 7 (1): 84-92.

98-Nielsen, D. L.; Brock, M. A.; Rees, G. N. and Baldwin, D. S. (2003). Effect of increasing salinity on freshwater ecosystems in Australia. Astralian. *J. of Botany*, 51: 655-665.

99-Tahir, M. A., A. K. Risen, *et al.* (2008). Monthly variation in the physical and chemical properties of the restored southern Iraqi marshes.*Marsh Bulletin* 3(1): 81-94.

100-Jackson, A. G. (1981). Salinity tolerance and osmotic behavior of European carp (*Cyprinus carpio* L.) from the river Murray. Australia Trans.*R.Soc. Aus*., 103 (7) :185- 189.

101-Lawson, E.O. and Alake, S.A. (2011). Salinity adaptation and tolerance of hatchery reared comet Goldfish *Carassis auratus* (Linnaeus 1758). Int. J.Zool.Res., 7: 68-76.

102-Oberdorff, T. and Hughes, R. M. (1992), Modification of an Index of Biotic Integrity based on fish assemblages to characterize rivers of the Seine Basin, France. *Hydrobiologia*, 228, 117-130.

103-Saunders,D.L.; Meeuwig, J.J. and Vincent, A.C.J.(2002). Freshwater protected areas: strategies for conservation. *Conserv Biol* 16:30–41.

Al-Lami, A. A. (1986). An ecological study on phytoplankton for some of marshes Southern Iraq. Msc. thesis. University of Basrah. 96p.

Al-Manssory, Faiq Younis. (2008). Future Assessment of Southern Iraqi Marshes. PhD. Thesis, University of Basrah .174 pp.

CRIM. (2007). Study the rehabilitation of Al Huweizah marsh ecological system, Ministry of Water Resources, Center of Restoration of Iraqi Marshes, V.1 to 7.

Hussain, N.A.; Al-Najar, H.H.; Al-Saad, H.T.; Usif, A.H. and Al-Saboonchi, A.A. (1991). essential scientific study on Shatt Al-Arab. MSC. Univ. Basrah.391PP

Mahmood, H.K.; Abdullah, S.S. And Al–Mahdi, A. A. (2008). The Interaction between Water Masses of the Marshes and the Shatt Al-Arab River (South of Iraq). *Mar.Meso*.23 (1): 181-199.

Maulood, B.K..; Hinton, G.C.F.; Kamees, H.S.; Saleh, F. A. K..; Shaban, A. A. and Al-Shahwani, S.M.H. (1979). An

Al-Qadisiyah Journal of Agriculture Sciences
(QJAS)
| 2077-5822 |

ecological survey of some aquatic ecosystems in southern Iraq. *Tropical Ecology* 20 (1): 27-40.

Scott, D. A. and Evans, M. I. (1993). Wildlife of the Mesopotamian mashlands. Report prepared for Wetlands Ecosystem Research Group. Exeter, UK, University of Exeter: 146.

اعادة استقراء للأهوار العراقية التي تقع ضمن لائحة التراث العالمي (دراسة مرجعية)

[1] كاظم جواد لفته الزيدي، [2] Giuliana Parisi

1Department of Agri-Food Production and Environmental Sciences, Animal Sciences Section, Università di Firenze, Via delle Cascine 5, Florence 50144, Italy.

2 *Department of Agri-Food Production and Environmental Sciences, Animal Sciences Section, Università di Firenze*, Via delle Cascine 5, Florence 50144, Italy;

الخلاصة :

تقع اهوار بلاد ما بين الرافدين أو جنة عدن، الجزء الجنوبي من العراق، وتحتل مساحة 15-20,000كم^2 . تاريخيا ، كان لهذه المنطقة دورا رائدا في الحضارة الإنسانية يمتد لأكثر من 5000 عام . يسكن الاهوار اقوام يطلق عليهم"عرب الاهوار" او" المعدان" ، الذين هم ورثة السومريين وشعوب السامية.قاد صدام حسين بهمجية حملة شرسة على هذه المناطق في عام 1991 ، ادت الى تجفيف الاهوار . لم يسلم من هذا الدمار سوى 7٪من المساحة الكلية للأهوار. تسبب هذا الفعل في تدمير شامل للنظام الإيكولوجي، وتهجير سكان الأهوار.في عام 2003، بدأت المياه بالتدفق من جديد إلى هذه المناطق .اعادة الاغراق ، لا يضمن استعادة جميع مناطق الأراضي الرطبة في جنوب العراق كما في الوضع السابق. كما ان النظام البيئي الجديد اثر على تنوع وخواص الانواع المتعايشة في تلك المناطق. في عام 2016 وبالنظر لأهمية اهوار بلاد ما بين النهرين ، ادرجت منظمة (IUCN) ثلاثة من الاهوار العراقية وهي هور الحمار ،هور الحويزة واهوار الوسط ضمن لائحة التراث العالمي كارث حضاري يجب المحافظة علية .الهدف من هذه الدراسة، هو إعادة تقويم النظام البيئي في هذه المناطق الثلاث من منظور البيولوجي ومن خلال استعراض بعض التحديات التي يجب التعامل معها لاسترداد الاستقرار إلى نظام البيئي يمتد لآلاف السنين.