

Coastal Research Library 36

Laith A. Jawad *Editor*

# Southern Iraq's Marshes

Their Environment and Conservation



Springer

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Editor

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*Editor*

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Night at the southern marshes of Iraq



Houses and rest home in the marshes of Iraq.



Marsh Arabs in part of their daily life.



Upper photo, Iraqi bread; lower photo, water buffalo grazing.



*Dedicated to every member of my delightful  
family who wonders if I'm devoting this work  
for them.  
I am*

# Preface

I am always fascinated by the southern marshes of Iraq and the way of life that the Marsh Arabs are living in. This captivation has augmented when I read the works of the British explorer Wilfred Thesiger, a retired soldier, who spent several years in the marshes between 1951 and 1957 and published his memoirs, *The Marsh Arabs* and Gavin Young, a British journalist, visited the region and befriended Thesiger with whom he photographed the area during the 1950s. Young published his remembrances about the marsh areas in his well-known book “*Return to the Marshes*”. These works have created an idea in my mind of writing a book about the marshes of Iraq and their inhabitants, but in different ways that the previous writers have done. This was sometimes in the early 1970s and since then and for more than 50 years I am embracing this idea that accompanied my travels through the countries until I settled down in New Zealand and decided to put this idea on paper.

The new technology of the internet and fast communication have assisted my goal in producing my book on the southern marshes of Iraq. Inputting the proposal of the book and the preliminary contents table, I visited hundreds of literature, videos and television programs about the marshes of Iraq. Such materials enrich my idea with several aspects of the marshes ranging from the environment to the Marsh Arabs lifestyle.

When I decided to edit a book about the southern marshes of Iraq, the idea that I had in mind is to see this book having information that not have been dealt with anybody previously. Therefore, I decided the contents of the book should include wide range spectrum of aspects about the marshes of Iraq including the historical, geological, environmental, the fauna and flora, the fisheries, the impacts and challenges that the marshes experiencing, the conservation of the marshes and finally the daily life particulars of the Marsh Arabs.

The longest chapter in the present book is that on the daily life of the Marsh Arabs. Although several authors have written on the habits and habitats of the Marsh Arabs in the form of books and articles in magazines and journal, I decided this chapter to hold information that has never been told before. Such differences are placed in attaining facts about the daily life of the dwellers of the marshes

accompanied by figures. A step that never been presented in any book about the marshes of Iraq before. This chapter takes more than 4 months to finish as I used to relate each daily act and habit of the Marsh Arabs to the ancient Mesopotamian and see whether there is any similarity can be derived. In doing so, I explored an extensive number of kinds of literature on ancient Mesopotamian and retrieved from these kinds of literatures what are comparable to the life of their present-day descendants that inhabit the marsh area in Iraq. Besides, I included several facts about the daily life of the Marsh Arabs that I assume to be documented for the first time. Among these are answers for many questions such as, why the number of the main pillars of the guesthouse “Al-Madhif” of the Marsh Arab and pot of coffee in this guesthouse is always odd and even? Are the Marsh Arabs recognise several types of water buffaloes? If so, what are the names of these types? Are the Marsh Arabs specialised in making different food items such as bread, milk products and sweets? In order of not ruining the surprise that readers of this book in general and the chapter about the daily life of the Marsh Arabs in particular, I shall not give the answers for these questions here and leave it for the readers to discover them while they are reading this book.

I would like to convey my thanks to all the contributors of this book that agree to share their scientific work as chapters are written about different aspects of the southern marshes of Iraq in order make it accessible by the readers in all over the world. Also, my sincere thanks should go to Springer Publisher that agrees to publish this book and make my dream a reality.

Auckland, New Zealand

Laith A. Jawad

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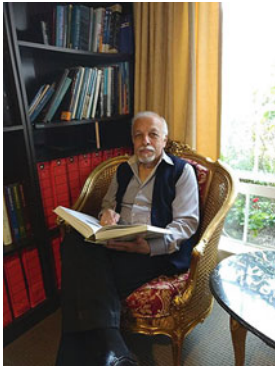
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**Laith A. Jawad** obtained a degree (MSc) in fish taxonomy from the Zoology Department, University of Bristol, UK, in 1980. He continued as fish taxonomist at Basrah University, Iraq, where he worked for more than 20 years before he immigrated to New Zealand in 1997. During this time, he started the biochemical taxonomy of fishes of Iraq and published over 385 scientific papers and book reviews in leading scientific journals. He is the author and co-author of several textbooks in biology published in Arabic. Recently, he contributed five chapters to a book about coastal fishes, *Coastal Fishes: Habitat, Behavior and Conservation*, published by Nova Publishers, Canada. And authored a book about *Dangerous Fishes of the Eastern and Southern Arabian Peninsula* published by Springer in 2017. He served as fish biodiversity expert and consultant at the Ministry of Agriculture and Fisheries in Oman for the period 2008–2012 during which he co-authored two papers describing a new fish species from the Omani waters and reported over 80 fish species as a new record to the Omani waters. He authored a guide to the fishes of the southern coasts of Oman published by the Ministry of Agriculture and Fisheries in Oman in 2018. He also published over 90 papers on fish fauna of Oman, Iraq, Kuwait, and Saudi Arabia. In 2013, he broadened his scientific contact and started to collaborate with over 60 scientists from more than 50 countries around the world in researches dealing with different aspects of fish taxonomy and ichthyology.

# Chapter 1

## Introduction



**Laith A. Jawad**

**Abstract** The Near Eastern wetlands are the vast marshes of southern Iraq (al-ahwār) in the lower Mesopotamian region, an impression shaped tectonically as a consequence of the Arabian plate being subducted beneath the Iranian or Eurasian plate. These are considered the famous among the lower lands in the Middle East. These wetlands covered in 1970 an estimated area ranging from 15,000 to 20,000 square kilometres. The eastern margins of the marshlands spread over the boundary into south-western Iran, and they therefore create a transboundary ecosystem under shared responsibility. Euphrates River is the prime supplier of marshes with water, with contributions from tributaries of Tigris River. The fundamental region of the marshes is located in the area around the convergence of the Tigris and Euphrates. Therefore, the whole marsh area is divided into three major areas: (i) Al Hammar Marshes; (ii) the Central Marshes and (iii) Al Hawizeh Marshes. These three chief marsh zones have been at the centre of the great fluctuations that have been in process over the years. Marsh inhabitants who experienced a mixture of pastoralist, inactive and marsh existence grounded on the periodic growth, and collapse of the marsh waters have been recognized including the Ma‘dān (Marsh Arabs) of southern Iraq. The majority of the area of the marshes in Iraq is covered with aquatic plants that are dominated by reed (*Phragmites communis*) and reed mace (*Typha augustata*) in the transient seasonal zone. Situated on the routes of the migratory birds, the marshes are chiefly significant for birds. The marshlands set up a main wintering and staging area for waterfowl travelling between breeding grounds. The environment of the marsh area in Iraq has experienced several kinds of influences. Among such impacts was the influence of the changes in the water supply due to building dams in the upper Mesopotamian plain in Turkey and Iran and the ecocide that Saddam Hussein has implemented when he ordered to dry the marshes. The results of drying the marsh areas have impacted the life of the inhabitants of the marshes in early 1990s; accordingly, the Marsh Arabs have been compulsory to flee their areas. Besides to the engineering workings, their birthplace converted to be one

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of the chief areas of fighting that overwhelmed southern Iraq in 1991–1993. Owing to the huge loss in the marsh areas, the wildlife and biodiversity have severely influenced. Such impacts were extended outside the borders of Iraq and showed effects on both the regional and the international levels.

**Keywords** Marshes. Iraq · Basrah · Mesopotamia · Marsh Arabs

## 1.1 Geological Perspectives

In general, the area of any water body on this globe is under the rules of geology (Kornfeld 2009). Prior to 10,000 BCE, a glacial ice sheet enclosed a considerable area of the Northern Hemisphere, containing the area north of the Arabian Sea (University of California 1995). At 6500 BCE, the ice sheet had retreated from Europe and the Middle East, and the climate warmed similar to what is now (Dellapenna 1996).

Maybe the most famous of the Near Eastern wetlands are the vast marshes of southern Iraq (*al-ahwār*) in the lower Mesopotamian region, an impression shaped tectonically as a consequence of the Arabian plate being subducted beneath the Iranian or Eurasian plate (Baeteman et al. 2005).

Located for the main part in southern Iraq (29° 55' to 32° 45' N and 45° 25' to 48° 30' E), the wetlands covered in 1970 an estimated area ranging from 15,000 to 20,000 square kilometres. The eastern margins of the marshlands spread over the boundary into south-western Iran, and they therefore create a transboundary ecosystem under shared responsibility.

Geomorphologic investigations in the area have acknowledged the development and enlargement of the marshes as an advanced trait that augmented over time (Baeteman et al. 2005). The preliminary development intricate natural and physical variations in the climate and sea level, pre- and during the Holocene period, prepare the site for wetland creation in several phases (Asa 2011). Originally, throughout the Last Glacial Maximum (16,000 BCE), the marshes were not existing owing to the very low groundwater, and the Arabian Gulf was rather shallow. At that time, the sea level ascended during the Postglacial (12,000 BCE), carrying the coastline more inland (Sanlaville 2002). In the third phase, the aridity of the weather and descent in sea level, inaugurating in the third millennium BCE and enduring into the second millennium, alleviated the deltaic progradation of the coasts and instigated the waters of the Arabian Gulf and coastline to retreat considerably to their present location, sending off a clean basin that gradually filled in with saline-brackish lagoons (salt marshes) and tidal flats (*sabkha*) over the extended delta land (Sanlaville 2002). Ultimately, these established into small, everlasting freshwater marshes and lakes by the first millennium BCE

## 1.2 Hydrology and Precipitation Aspects

The hydrology of the Euphrates and Tigris Rivers and precipitation causing more stream flow and flooding further added to marsh creation. Euphrates River is the prime supplier of marshes with water, with contributions from tributaries of Tigris River (Hritz 2005). Subsequently, the steadiness of the coasts and sea level, flooding and sedimentation of the lower courses of the river were the chief reasons of the formation of marshes (Sanlaville 2002). The water flow from the highland at Zagros Mountains brings with it a huge amount of sediments that precipitate in the marsh area.

Soils of the marsh area made from sedimentation are another significant physical factor to marsh formation. Sedimentation can be produced by natural or anthropogenic issues causing erosion from the surrounding sandstone and limestone uplands ((Heyvaert and Baeteman 2007). Though less important, sedimentation can also be carried by dust storm (aeolian) activity or stuck sediment in seawater in the salt marshes and *sabkhas* from tidal activity (Heyvaert and Baeteman 2007). Throughout avulsion, the stiffest sediments established near the riverbanks and formed high levees. It is in these regions where silty clay was dumped, creating waterlogged beds for marshes and lakes (Sanlaville 2002). By the seventh century CE, the development of marsh creation had alleviated into an enormous wetland (370 × 90 km). Additionally, the passage of the Tigris and Euphrates Rivers into the Gulf (the Shatt al-Arab River) established in the eighth–tenth centuries (Aqrawi 2001). It is probable that this channel delivered both a drain for the marshes and access from the Gulf through them to Baghdad. The heart of the wetlands of the lower Euphrates and Gulf outlets (the Ahwār marshes), the enduring freshwater Lake Hammar (Hawr al-Hammar) and the secondary Lake al-Azim (Hawr al-Hawiza) were relatively recent creations, as was the Shatt al-Arab (Pournelle 2003).

## 1.3 The Major Wetland Divisions

The marshlands of lower Mesopotamia extend from Samawa on the Euphrates and Kut on the Tigris (150 km south of Baghdad) to Basrah on the Shatt al-Arab. The wetlands create a series of almost interrelated marsh and lake developments that overflow one into another (UNEP 2001). Throughout periods of high floods, large areas of desert are under water. Thus, some of the previously discrete marsh units combine together, forming larger wetland complexes. In the marsh area, there are wetlands and lakes separated by small islands. These comprise stable and periodic marshes, shallow and deepwater lakes and mudflats that are frequently flooded during periods of elevated water levels (UNEP 2001). The fundamental region of the marshes is located in the area around the convergence of the Tigris and Euphrates. Therefore, the whole marsh area is divided into three major areas: (i) Al-Hammar Marshes, (ii) Central Marshes and (iii) Al-Hawizeh Marshes. These three chief marsh zones have been at the centre of the great fluctuations that have been in process over the years.

### ***1.3.1 Al-Hammar Marshes***

The set of marshes that are known as Al-Hammar are located completely south of the Euphrates, traversing from near Al-Nasiriyah in the west to the outskirts of Basrah City on the Shatt al-Arab River in the east (UNEP 2001). This marsh broadened at its south end, with the presence of broad mud shoreline. The estimated area of this marsh ranges between 2899 km<sup>2</sup> and 4.500 km<sup>2</sup>. The water of this marsh is slightly brackish owing to its location near the Arabian Gulf, eutrophic and shallow. It reaches a maximum depth of 1.8 m and about 3 m at high water mark (Maltby 1994). Euphrates River is the main supplier of water to this marsh. A substantial amount of water from the Tigris River, spilling over from the Central Marshes, also sustains the Al-Hammar Marshes. The set of marshes of Al-Hammar support one of the most imperative waterfowl areas in the Middle East, both in terms of bird numbers and species diversity (UNEP 2001). The enormous and thick reed beds offer ideal environment for breeding populations, while the mudflats sustenance for shorebirds. International important focusses of migratory waterfowl have been reported during winter, and although not correctly surveyed, the area is likely to host similarly high numbers during the spring and autumn seasons (Scott 1995).

### ***1.3.2 The Central Marshes***

This marsh is situated just north of the convergence of Euphrates and Tigris Rivers. The Central Marshes are at the focal point of the Mesopotamian wetland ecosystem (UNEP 2001), and the region is coarsely bordered by a triangle between Al-Nasiriyah, Qalat Saleh and Al-Qurnah. These marshes obtain water directly from the Tigris River (branches of Shatt al-Muminah and Majar al-Kabir in addition to the Euphrates from its southern side). These marshes extend over 3000 km<sup>2</sup> and during flood, they encompass to about 4000 km<sup>2</sup>. Included with these marshes are smaller marshes such as Al Zikri Marsh and Hawr Umm al Binni, which are situated around the middle of the Central Marshes (Thesiger 1964).

### ***1.3.3 Al-Hawizeh Marshes***

These marshes are located at the eastern side of the Tigris River, overlapping the Iran-Iraq border (UNEP 2001). The Iranian fragment of the marshes is known as Hawr Al Azim. They receive their water supply from branches of Tigris River near Al-Ammarah City known as the Al-Musharah and Al-Kahla. An additional water supply enters these marshes through the Karkheh River in the east. These marshes showed to have a length of about 80 km from north to south and a width of 30 km from east to west and with an approximate area of not less than 3000 km<sup>2</sup>. These marshes are characterised as having water in the north and middle parts around the



year, and the southern part is seasonal. Water of these marshes links Shatt al-Arab River 15 km south of Al-Qurnah via the Al-Swaib River.

## 1.4 Settlement

The economy in Mesopotamia is based on agriculture mainly grains and became the basis of civilisation, agreeing development of humans and the growth of villages (Leick 2002). By 3000 BCE, the Sumerians had built a mature civilisation, with prosperous town centres (Leveson 1980). Leveson (1980) proposed that the upsurge of civilisation and cities that took place in the Middle East was not by chance. In the southern plains, between modern-day Baghdad and the Shatt al-Arab, as well as the Persian Gulf, the Sumerians settled and built the cities of Eridu, Kish, Lagash, Nippur, Ur, Uruk and Susa (Leveson 1980). The alluvial soils that the floodwaters of the Tigris and Euphrates Rivers discarded here were not homogeneous, comprising diverse minerals, unlike the fertile soils in the north—the land of the Akkadians and Assyrians. Though the southern plains were flat and possibly productive, they got slight rain. Therefore, these soils remain unplanted until the Sumerians learnt how to adapt to this environment, considerably over control of the waterways by means of canals and dykes (Leick 2002). With this, the first large-scale societies started to progress, and people increased beyond existence farming to produce an excess, expand their cultural actions and live in increasingly large numbers in a new form of cooperative communal, the city (Leick 2002).

It is challenging to accept an inert settlement form that evaded the marshes and adhered to the fringe dry zones (Asa 2011). Wetlands are crucial ecological means both for settlement and existence, their yearly converted resources given that reeds and other plant material for building supplies (along with animal fodder) and wildlife such as fish and waterfowl for food (Pournelle 2003). Settling in the wetland can be performed alongside the two old-style Near Eastern existence policies of wheat/barley cultivation and sheep/goat breeding. 91

Marsh settlement happens in two places: either on the many ancient rise area that upsurge above the waters or on small islands (*īshān*) built of stacked reeds and mud and surrounded by reed barriers. 95 The huts and almost the whole thing else are made of reeds merged with clay and water buffalo dung. In Iraq, these frequently take up as intricate buildings of thick reed pillars and barrel-curved reed roofs. The door and window openings are of adaptable reed mats. Throughout floods, the floor planes are effortlessly elevated or low barriers are built around the islands (Asa 2011).

Conveyance between huts and across the marshes is and always has been by small boat known locally as *masshuf* or *tarrāda*. These are built with wood and waterproofed with tar, a significant supply in ancient Mesopotamia (Asa 2011). Marsh inhabitants survive by raising water buffalo, fishing, hunting and growing rice. Water buffalos are used mostly for their milk (and milk products such as butter, *kaymar*, *labban* and cheese) and dung, which provides fuel and mortaring material (Asa 2011).

Marsh inhabitants who experienced a mixture of pastoralist, inactive and marsh existence grounded on the periodic growth, and collapse of the marsh waters has been recognised including the Ma'dān (Marsh Arabs) of southern Iraq. Marsh actions such as fishing, hunting and reed cutting are accomplished all year round; the reeds are used as fodder for the grazing sheep of the pastoralists, cattle/water buffalo of the farmers and mats for settlements.

It may be expected that the establishment of human in ancient times trailed analogous routes and therefore was not limited only to the dry edges. The dependence on short-lived means promotes the question of their conspicuousness within an archaeological landscape (Hritz 2007). In southern Iraq, early sign for wetland settlement and land use originates from a small site (H3) dated to the Ubaid (5500–5300 BCE) near the sea on the Kuwaiti coast northwest of Failaka Island. Besides the remains of the marine fish and fowl, wetland catfish and freshwater shells were characteristic of those from the southern Mesopotamian marshes (Asa 2011). In addition, faunal mark for nurturing livestock and pastoralism in sheep/goat and cattle bones was also available. Among other artefacts that are obtained is a boat made of reeds and coated with tar thoroughly like Ma'dān's watercraft (Asa 2011). Establishment of human in the southern marshes of Iraq occurred in the Jemdet Nasr period (3200–2900 BCE) settlements, where detached chains of elevated land alienated by canals, similar to the huts style of Ma'dān settlements (Asa 2011). The signs for the settled groups of human in the marshes of Iraq can be traced through the figures of water buffalo that are depicted on clay tablets in the third millennium BCE (Adams and Nissen 1972).

## 1.5 The People of the Marsh Area

The people settled in the marsh area of Iraq are locally recognised as the Ma'dan or "Marsh Arabs", whose population is estimated to range from 350,000 to 500,000. Successors of the Sumerians and Babylonians, the inhabitants of the marshes act as a relic of the ancient Mesopotamia (UNEP 2001). From the ethnological perspective, the Marsh Arabs communities have been heavily subjective by arrivals and inter-marriages with the Persians to the east and Arab Bedouins to the west (Thesiger 1964). The marsh people are Shi'ite Muslims, and their way of life is mostly grounded on the traditions of the Arab Bedouin (UNEP 2001).

The people of the marshes have developed an exclusive sustenance way of life that is decisively originated from their aquatic environment. For the Marsh Arabs, water buffalos are considered members of the family as they contribute to their socio-economic life, a relationship similar to that of the Bedouin and their camels (Thesiger 1957). The buffalos eat young reed shoots and give milk, butter and yoghurt, as well as energy and crop fertiliser in the form of fuel dung and manure (UNEP 2001). Fishing, waterfowl hunting and partially farming are the main professions of the Marsh Arabs.

The Marsh Arabs were confined to their marshes, and no connections with the people at the urban areas were made until the start of the First World War in 1914, where they got mixed with the remaining population of Iraq after the encouragement of the central government extended to remote parts of the country. In the early 1930s, Marsh Arabs started to move out of their environment and inhabit slum areas near the large cities such as Baghdad, Basrah, Ammarah and Nasiriyah (Batatu 1978).

## 1.6 Flora and Fauna

The majority of the area of the marshes in Iraq is covered with aquatic plants that are dominated by reed (*Phragmites communis*) and reed mace (*Typha angustata*) in the transient seasonal zone (UNEP 2001). Other types of aquatic plants are found in mudflats such as *Carex* and *Juncus* spp. and *Scirpus brachyceras*. Submerged plants were usually available in deeper areas of the marsh, and these are represented by hornwort (*Ceratophyllum demersum*), eel grass (*Vallisneria* sp.) and pondweed (*Potamogeton lucens* spp.), as well as bottom vegetation such as stonewort (*Chara* spp.). Floating vegetation are present in smaller lake, and among these are water lilies (*Nymphaea* and *Nuphar* spp.), water soldier (*Pistia stratiotes*) and duckweed (*Lemna gibba*) (Scott 1995; Rechinger 1964).

Situated on the routes of the migratory birds, the marshes are chiefly significant for birds. The marshlands set up a main wintering and staging area for waterfowl travelling between breeding grounds in the Ob and Irtysh river basins in western Siberia to wintering quarters in the Caspian region, Middle East and northeast Africa (UNEP 2001). Two-thirds of West Asia's wintering wildfowl, estimated at several millions, are believed to reside in the marshes of Al-Hammar and Al-Hawizeh (UNEP 2001).

Among the birds that are chiefly reliant on the marshlands are the Dalmatian pelican, pygmy cormorant, marbled teal, white-tailed eagle, imperial eagle, slender-billed curlew and an endemic subspecies of the little grebe (*Tachybaptus ruficollis iraquensis*) (UNEP 2001). The Goliath heron, sacred ibis and African darter, whose world population has been progressively dwindling, are also known to propagate in the marshes (UNEP 2001). The marsh area supports almost the entire global population of two species, the Basra reed warbler and Iraq babbler, as well as most of the world population of grey hypocolius (Maltby 1994; Scott 1995).

Mammals have been under massive impact. For example, lions were completely removed from the marsh area once the rifle was introduced during the First World War. The last lion shot in the area is stated to have been in 1945 (UNEP 2001). Among the threatened mammal species that inhabit the marsh area are the grey wolf, the long-fingered bat and a subspecies of the smooth-coated otter which is endemic to the marshes. Other large animals, notably the honey badger, striped hyena, jungle cat, goitered gazelle and Indian crested porcupine, have been recorded in the marsh area (UNEP 2001), in which they became very rare species and probably became extinct in 1980. Formerly, the utmost well-known mammal in the marshes was the wild boar, which sits as the main threat to the marsh dwellers' crops and was their

chief opponent, and it declined in number drastically. Other usually seen mammals are the small Indian mongoose, the Asiatic jackal and the red fox. The usual reptiles seen in the marshes are the Caspian terrapin, a softshell turtle and a variety of snakes.

The fish accommodate a rich fauna in the marsh area; however, the invasive fish species such the species of carp have competed with the native species and later disappear from the marshes or their number has been reduced significantly. The dominant species living in the marsh area of Iraq are those belonging to the family Cyprinidae “the carp family”. Members of other families such the catfish family Siluridae are represented in several species, with *Silurus triostegus* as the main species. Individuals of this species reach large sizes. Among the marine fish species that enter the marsh area for spawning are the well-known hilsa fish, *Tenualosa ilisha*, and to a lesser extent the pomfret *Pampus argenteus*. Many other marine fish species ascend in the Shatt al-Arab River reaching the marsh areas for feeding and reproduction purposes especially in recent years when the salinity of water started to increase notably. Together with the marine fish species, the penaeid shrimp *Metapenaeus affinis* was also among the attendees of the environment of the marsh area (Banister et al. 1994).

## 1.7 Impacts on the Marsh Area

The environment of the marsh area in Iraq has experienced several kinds of influences. Among such impacts was the influence of the changes in the water supply due to building dams in the upper Mesopotamian plain in Turkey and Iran and the ecocide that Saddam Hussein has implemented when he ordered to dry the marshes. In this section, a short notification will be given about the impacts of these two factors on the marsh areas.

The impacts on the marshes of Iraq were huge and comparable to those big events that happened somewhere else in the world such as the deforestation rates of Amazonia and the desiccation of the Aral Sea (UNEP 2001). The main reason behind such devastations is the constructions of dams in the upper reaches of Mesopotamia, i.e. Turkey, Syria and Iran. Such drastic changes in the environment of the marshes of Iraq had led to a noteworthy loss in one of the world’s largest and most important wetland ecosystems. Among the marshes that has been severely affected is Al-Hammar, which is formerly considered as the largest lake south of the Euphrates River (UNEP 2001). Most of Al Hawizeh Marsh in Iraq has been diminished and changed into unfertile land. Only a small northern section remains and its shorelines are in steady retreat. The following are the major issues that happened to the environment of the marshes owing to drainage changes (UNEP 2001).

### **1.7.1 Habitat Loss**

This section is too small to give the complete picture about the habitat loss in the marsh area; therefore, highlights of what happened will be given below:

1. At least 7600 km<sup>2</sup> of main wetlands (leaving out the seasonal and temporary flooded regions) disappeared between 1973 and 2000. Most of the change, however, happened between 1991 and 1995 (UNEP 2001).
2. The most extremely impacted are the Central and Al-Hammar Marshes. Of the original 3121 km<sup>2</sup> area of the Central Marshes in 1973, only 98 km<sup>2</sup> or 3% remained in 2000 (UNEP 2001).
3. Al-Hammar has diminished to 6% of its original extent. Once more, the enduring area is largely concentrated around the canals and does not constitute a real part of the original wetland system (UNEP 2001).
4. Al-Hawizeh has experienced a comparatively less severe decrease in its surface area. However, it has also diminished by 2000 km<sup>2</sup>, leaving in place only a third of the original coverage. The shoreline of Hawr Al Hawizeh/Al Azim has been in stable withdrawal throughout the last decade (UNEP 2001).
5. The problem of shortage of water is likely to hasten as a consequence of considerable water retaining by the Karkheh Dam and plans to transfer water from its reservoir to Kuwait (UNEP 2001).
6. The impacts of the changes in the drainage influenced not only the marsh environment itself but also the north-western part of the Arabian Gulf. The reduction in the freshwater discharge from Shatt al-Arab River and the cessation of the filtering action of the marshes have led to drastic changes in the marine environment around Warbah Island at the Iraq-Kuwait border, and the water quality degraded with possibly harmful impacts on regional fish resources (UNEP 2001).

### **1.7.2 Refugees**

The results of drying the marsh areas have impacted the life of the inhabitants of the marshes in the early 1990s; accordingly, the Marsh Arabs have been compulsory to flee their areas. Besides the engineering workings, their birthplace was converted to be one of the chief areas of fighting that overwhelmed southern Iraq in 1991–1993 (UNEP 2001). Many marsh villages were surrounded and harmed and fire was set in their huts. Different chemicals were reported to be added to the water of the marshes (Human Rights Watch 1993, 1994; United Nations 1993, 1994, 1999; Wood 1993). For those who remained inside Iraq, poor documentations about their life status were provided in which high percentage of them were dispersed in the outskirts of the big cities (AMAR ICF 2001; UNHCR 1996).

The Marsh Arabs who have forced to leave their homeland are entitled to have the designation of “environmental refugees”. Such term was demarcated in a UNEP-commissioned study “as those who had to leave their habitat, temporarily or permanently, because of a potential environmental hazard or disruption in their life-supporting ecosystems” (El-Hinnawi 1985).

### 1.7.3 *Wildlife Decline and Extinction*

Owing to the huge loss in the marsh areas, the wildlife and biodiversity have severely influenced. Such impacts were extended outside the borders of Iraq and showed effects on both regional and international levels (UNEP 2001). Wildlife specialists agree that devastation of the wetlands would virtually positively lead to the global disappearance of the endemic smooth-coated otter subspecies and the bandicoot rat as they were exclusively reliant on this special habitat for their life. It can also lead to the vanishing in the Middle East of the African darter and the sacred ibis and the extermination in Iraq of the pygmy cormorant and Goliath heron (Scott and Evans 1994).

The great effects of the drying of the marshes were severe on the migratory birds. The event of drying of the marshes affected bird's populations from the Arctic region to southern Africa (UNEP 2001), where about 66% of the bird's species visiting the marsh area are an internationally significant number and they are at risk (UNEP 2001). On the other hand, the global populations of the Iraq babbler and the Basra reed warbler and the regional population of the Dalmatian pelican are likely to fall and may be diminished as a result. It is assessed that the world populations of Harrison's gerbil, an endemic subspecies of the little grebe and the marbled teal, may have declined by 50%. Moreover, chief drops in the regional populations of the eastern white pelican (*Pelecanus onocrotalus*, 30–60%), purple heron (*Ardea purpurea*, >10%), little bittern (*Ixobrychus minutus*, >10%), glossy ibis (*Plegadis falcinellus*, >10%), tufted duck (*Aythya fuligula*, >20%), marsh harrier (*Circus aeruginosus*, >10%), purple gallinule (*Porphyrio martinicus*, >50%) and coot (*Fulica atra*, 10–20%) are expected (Scott and Evans 1994).

### 1.7.4 *Regional Weather Alteration*

Speedy drying of over 9000 km<sup>2</sup> of wetlands and lakes is destined to have noteworthy consequences on the local microclimate (UNEP 2001). As the controlling part of the wetlands is removed, evapotranspiration and humidity levels will abruptly decrease. Rainfall designs will be altered. Temperatures will always increase, chiefly throughout the hot and long summers. Strong and dry winds attaining temperatures of over 40 °C, formerly broken by the reed beds, will blow unrestricted (Maltby 1994). The dry marshes that contain impurities will be blown to thousands of kilometres outside the border of Iraq and inflict their effects on people and environment in other neighbouring countries.