Biodiversity survey of West Qurna2 oil field, Basrah, Southern, Iraq

Cite as: AIP Conference Proceedings **2394**, 020020 (2022); https://doi.org/10.1063/5.0122620
Published Online: 08 November 2022

Nadia Al-Mudaffar Fawzi, Malik H. Ali, Hanaa H. Mohammed, et al.

Biodiversity Survey of West Qurna2 Oil Field, Basrah, Southern, Iraq

Nadia Al-Mudaffar Fawzi [a)], Malik H. Ali[b)], Hanaa H. Mohammed, Abdulkareem T. Yesser and Dawood S. Abdullah

Marine Science Center, University of Basrah, Basrah, Iraq.

[a)] *Corresponding author:nadia.fawzi.nf@gmail.com*
[b)]*Malik.ali1954@gmail.com*

Abstract. A collective biodiversity survey was conducted at West Qurna-2 Oil field, Basrah, Southern Iraq during the period March-April 2017. The sites are a ten (10) Km^2 area, which naturally is a part of the Mesopotamian marshland. Ten representing sites were collected covered six terrestrial and four aquatic locations. The results of biodiversity evaluation via walk-over transect at each terrestrial site show twenty-three total floral genera and twenty-seven species. Forty species of phytoplankton belonging to 22 genera, 5 species of macrophytes were identified in the aquatic sites. Generally, all sites were poor in biodiversity of terrestrial fauna and birds. Aquatic fauna was more rich combined of many species of Rotifers, Copepods, Cladocera, Microbenthic invertebrates, and fish species previous estimate for 2015. In conclusion, the biodiversity of WQ-2 site values is highly respectable; good environmental management could play an important role in protecting some emic and migratory shrimp, fishes, and birds.

INTRODUCTION

Qurna is a city in southern Iraq about 74 km northwest of Basra. Qurna is located at the confluence of the Tigris and Euphrates rivers to form the Shatt Al-Arab, it is considered to be the site of the Garden of Eden according to local folklore. The Mesopotamia Marshes of Iraq have the aridest circumstances and lowest precipitation. The Marshlands were heavily impacted due to massive drainage in the 1990s but have partially recovered after 2003 [1-3]. On the other hand, mismanagement, climate change, lack of water, and droughts remain the largest threat to the marshes and their recovery. The Qurna marshes located at the eastern edge of the central marsh depend on floodwaters from both the Tigris and Euphrates rivers. Similar to the rest of the Mesopotamian Marshes it was adversely affected by the embankment of the Euphrates and the diversion of the Tigris into the Main Outfall Drain (MOD); a channel about 565Km in length, that drains agricultural lands from southern Baghdad southwards to the Arabian Gulf via Shatt Al-Basrah [4]. Agriculture is the main source of income for rural communities in the Basrah governate including Qurna. However, over the last several decade's farmers have lost the use of much of their land due both to the reduced amount of available water flow into the Tigris and Euphrates through the upstream damming projects development that has stopped winter floods from flushing out salts in the soils and the salinization of the water that damages soil and kills plants [5]. Also located within the boundaries of this city one of the largest oils producing fields in the world West Qurna-2 field. It is one of Iraq's and the world largest oil fields, believed to hold 43 billion barrels (6.8×109 m^3) of recoverable reserves. The oil industry poses a major threat to the region not only due to pollution but also, because of land-use change as vast areas of the marshes and arable lands are affected by the oil industry. This survey was conducted on the outer perimeter of the borders of West Qurna-2 oil field to assess the possible impact of West Quran-2 Oil fields during services execution at facilities, construction operations, vehicles movement on the ecology of the surrounding landscape components and comparing it with the results of a study carried out by Lukoil company responsible for the oil production of this giant field in 2013-2015[6].

1st Samarra International Conference for Pure and Applied Sciences (SICPS2021)
AIP Conf. Proc. 2394, 020020-1–020020-13; https://doi.org/10.1063/5.0122620
Published by AIP Publishing. 978-0-7354-4243-6/$30.00

MATERIALS AND METHODS

West Qurna-2 (WQ-2) is located in southern Iraq, in the province of Basrah. LUKOIL who is managing this giant oil field has initiated a comprehensive plan to conduct environmental monitoring of its WQ-2 Contract Area to assess the effectiveness of operational controls and demonstrate compliance with the requirements of Iraq's environmental laws. In this biodiversity survey, ten representing sites are selected from the sites that were previously monitored in 2013-2015 the diverse ecological regions surrounding the field. The biodiversity assessment for 2017 (March - April) surveyed six terrestrial locations with the codes: SAN-1, SAN-4, SAN-5, SAN-7, SAN-11, and SAN-13, as well as four aquatic locations with the codes: WS-1, WS-2, WS-3, and WS-6. The selected sites are presented, Table (1), show the survey sites coordinate.

TABLE 1. Survey sites coordinate.

Sampling Code	Coordinates (UTM, Zone, 38R)	
	Easting	Northing
SAN-1	0720062	3441501
SAN-4	0723046	3436793
SAN-5	0723722	3434022
SAN-7	0717686	3437454
SAN-11	0721494	3431916
SAN-13	0719584	3428721
WS-1	0726028	3439817
WS-2	0727118	3430918
WS-3	0727159	3429754
WS-6	0714777	3432903

The biodiversity survey of the terrestrial sites was carried out using a representative (25X100m) transect at each site. A thorough walk-over was conducted to determine the presence of key habitats and species to identify and record existing flora and fauna (including tracks). The biodiversity survey includes both (flora and fauna) of terrestrial and aquatic species, the assessment of the biodiversity was through sightings and evidence of fauna such as scat, tracks, and burrows, etc. are recorded and documented. All opportunistic sightings of species like birds and wild animals during the survey period recorded and a species list compiled. A combination of quadrats transects and opportunistic surveys technique was used to study the biodiversity in the ten sites. Specimens of terrestrial and aquatic sites (flora and fauna) were identified based on [7-16].

SITES DESCRIPTION

Terrestrial Sites

The soil nature of the terrestrial sites indicates that it was mostly an abandoned cultivated area. The presence of remnants of freshwater shells of bivalves and gastropods.

SAN-1 is about 5.5 km north of the Central Processing Facility (CPF) areas. Along the fence of the WQ-2 where a strip of trees *Tamarix* sp. and the presence of a herd of buffalo was documented. Some dry plants were seen spread over the rest of the site. Only some collared doves were spotted, water Buffalo tracks and dung observed, and some insects' species. SAN-4 is about 3.6 km east-northeast of the Central Processing Facility (CPF) areas. The site was marked by the presence of a remnant of a watercourse. Sounds of various birds were heard in the surrounding area. Willow Warbler *Phylloscopus trochilus* was observed on this site. The presence of several burrows of different sizes indicates the presence of small mammals. SAN-5 is about 3.9 km east-southeast of the CPF areas. The site is covered with dry *Salicornia perennans*. Good numbers of animal borrow were observed ranged in the diameter between (3-20cm). Finally, the strip of medium-height trees, dominated by the *Tamarix sp*. of good density was present. SAN-7**,** this site is further away about 1.7 km north of the CPF areas. There were many birds' nests. The area is dotted with burrows of ants and beetles.

SAN-11 was covered by dead and green plants. Some small animal and insect borrows were observed ranged in diameter between (2.0 – 5.0 cm). SAN-13 is about 6 km south of the CPF areas. The site was mainly barren land covered with scrap metal. Small pools of stagnant saline water were spread on the site. No plants or animals spotted except for scattered green and dry *S. perennans*

Aquatic Sites

WS-1, located on a small stream about five meters (5.0 m) wide, branched from the man-made irrigation channel. There is a water regulator at the intersection of the stream with the public street inside the company's site. This waterbody has a high density of rooted submerged plants especially macrophytes dominated by *Potamogeton* sp., *Ceratophyllum* sp. and reeds (*Phragmites australis*) dispersed on the banks and the waterway.

WS-2 represents a wide and shallow stream at the final section of the water channel before it flows into the Euphrates River. The stream and its banks are covered with filamentous algae, indicating water pollution; the water is enriched with nutrients as it passes through agricultural lands. There are few submerged plants near the banks of several meters long covered with semi-aquatic plants.

WS-3 and WS-6, are located on the banks of the Euphrates River and the environment are natural and lively in general, there is a good cover of submerged vegetation such as *Cyperus rotundus*, *Aster tripolium*, reeds, and the filamentous algae *Potamageton* on the tidal region of the river's bank and floating and submerged in the water, both banks of the river are covered with lush green *Phragmites australis* and other plants and is characterized by dense vegetation on both sides. Also, a dense cover of submerged and floating flora on the banks of the river, especially the plant *Ceratophyllum demersum*.

RESULTS AND DISCUSSION

Terrestrial Biodiversity

Tamarix and Salicornia were the main plants prevailing in terrestrial locations. Some sites contained only covers of the remains of these plants or their remnants. However, SAN-7 was the only site that had dense *Tamarix* sp. with an average height of approximately (2-3m).

Flora

Summary results of plants observed at the six terrestrial sampling sites of the WQ-2 contract area are as shown in Table 2. While Fig. 1, shows the average floral cover of the sites.

TABLE 2. Terrestrial plants were observed at the six locations surveyed. *Salicornia* not mentioned in the table.

Species	SAN-1	SAN-4	SAN-5	SAN-7	SAN-11	SAN-13
Alhagi graecorum	*	*	*	*	*	--
Suaeda (2 species)	*	*	*	*	✓	*
Aster tripolium	*	*	*	*	*	--
Melilotus sp.	*	*	*	*	*	--
Malva sylvestris	✓	--	--	--	--	--
Paspalum paspaliodes	✓	--	--	--	✓	--
Hordeum sp.	*	*	*	*	--	--
Cardaria draba	✓	--	--	--	--	--
Phalaris minor	✓	--	--	--	--	--
Promus sp.	✓	--	--	--	--	--
Sinapis arrensis	*	--	--	--	--	--
Phragmites australis	--	--	--	✓	✓	--
Tamarix (2 species)	--	--	--	✓	✓	--
Aeluropus lagopoides	--	--	--	--	✓	--
Carthamus sp.	--	--	--	--	*	--
Centaurea sp.	--	--	--	--	*	--

Key: (✓) Green (*) Dry (--) no plants

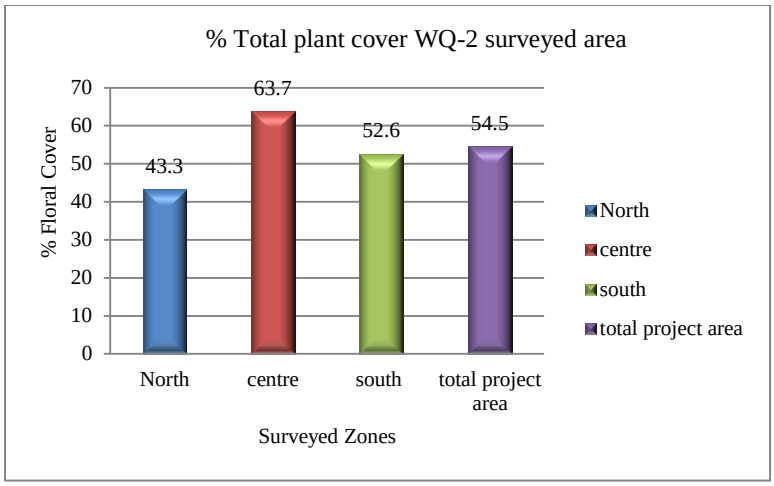

FIGURE 1. Average Floral Covers in different zones of the project site as surveyed in March-April, 2017.

Comparing the above figure with the 2015 Dome report [6] indicate a slight increase in the plant cover of the central and south zones, while the north zone showed a reduction in the plant cover. These slight differences might be due to different seasons/months of sampling rather than due to degradation or improvement of the site.

Twenty-three total floral genera and twenty-seven species were identified in the WQ-2 surrounding sites. *Suaeda* sp., *Triticum sp.*, and *Tamarix* sp. represented the dominant floral species. They covered 34%, 21%, and 17% respectively of the WQ-2 project area (Fig 2). This diversity is almost similar to that previously recorded in the 2015 report. However, we should note that some species were mostly dry/dead remnants part of the plants as shown in Table (2). While the area outside the fixed surveyed sites (SAN-1, SAN-4, SAN-5, SAN-7, SAN-11 & SAN-13) has good floral diversity particularly date palms, agricultural land, and wild flora of importance. This indicates that the project selected sites don't reflect the whole biodiversity of the area.

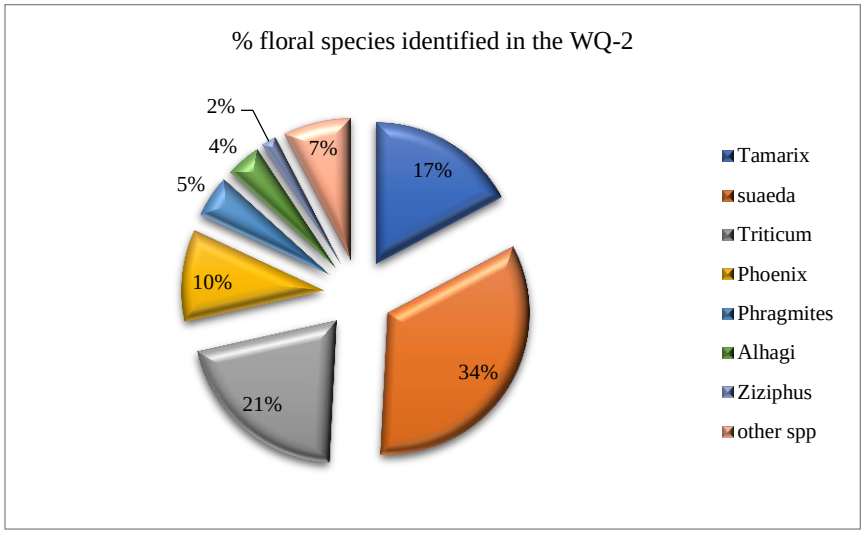

FIGURE 2. Percentage Compositions of floral Species of WQ-2 surveyed in March-April, 2017.

Terrestrial Fauna

Table 3 shows the presence of classes and species of fauna in the terrestrial surveyed sites. Generally, all the sites were poor in the biodiversity of fauna. However, that could be due to the limited time of the day the survey was carried on and the season of the survey. Even though a limited number of individuals were spotted, the presence of

some burrows of different sizes indicates the presence of small mammals and insects. Also, animal tracks, scat nests, and sounds of birds are an indication of the presence of different species. A resident living in the vicinity of the perimeters of the WQ-2 complex informed us about the spotting of *Canis aurens*, *Herpestes javanicus*, *Sus scrofa*, and *Rattns norregicus* at night. But none were observed by our team during the field visit which was all during the day.

TABLE 3. Terrestrial Fauna surveyed in March-April, 2017.

Mammals				**SAN -1**	**SAN -4**	**SAN -5**	**SAN -7**	**SAN -11**	**San -13**
Class: Mammalia	Order:Artiodactyla Family: Bovinae	*Bubalus bubalis*	Water Buffalo						
		Ovia aries	Domestic Sheep						
	Order: Carnivora Family: Canidae	*Canis l.familiaris*	Dogs						
Class: Reptiles	Order: Squamata Family: Lacertidae	*Acanthoductylus sp.*	Lizard		*				
Class: Insecta	Order: Hymenoptera Family: Formicidae	*Cataglyphis sp.*	Red ants	*	*	*	*	*	*
		Formica sp.	Big size ants	*	*	*	*	*	*
		Sp.	Black mid-size ants		*		*		
	Order: Odonata Family: Coenagriondae	*Ischnura evance*	Dragonflies' adults (small Odonata)				*		
	Order: Odonata Family: Libellulidae	*Brachythemis sp.*	Wide wings Odonata	*	*		*		
	Order: Coleoptera Family: Coccinellidae	*Coccinellid sp.*	Ladybird small flying beetle				*		
	Order: Coleoptera Family: Tenebrionidae	*Adesmia cancellata*	Pitted beetle	*	*		*		
	Order: Coleoptera Family; Buprestidae		Jewel beetle	*	*		*		
	Order: Coleoptera Family; Lucanthidae		Lucanid beetle				*		
	Order: Coleoptera Family; Corixidae		Corixid beetle						
Hoopoe		*Upupa epops*							
Collared Dove *Streptopelia decaocta*		*Streptopelia risoria*							
Moorhen *Gallinulua chloropus*		*Gallinula sp.*							
Coot *Fulica atra*		*Fulica sp.*							
Phylloscopus trochilus		*Phylloscopus trochilus*							

Aquatic Flora

Table 4. shows the presence of aquatic flora for the four survived sites.

TABLE 4. Aquatic flora for the four surveyed sites.

Flora		WS-1	WS-2	WS-3	WS-6
Macrophytes	*Potamogeton sp*	*			*
	Ceratophyllum demersum	*			*
	Myrophyllum sp	*			*
	Phragmites australis	*			*
filamentous algae	*Enteromorpha intestinalis*		*	*	*

More than 41 species of phytoplankton belonging to 21 genera have been identified. Although it was a short sampling investigation, the result reflects a good richness of the area, as well as the type of flora found (Table 5).

TABLE 5. List of Phytoplankton species identified in the aquatic sites surveyed in WQ-2 Area, during March-April, 2017.

Genera	Species
Amphora	(3 species)
Campylodiscus	(2 species)
Bacillaria sp.	(1 species)
Cymbella	(2 species)
Cymatopleura sp.	(1 species)
Caloneis sp.	(1 species)
Eunotia sp.	(1 species)
Epithemia	(2 species)
Diploneis sp.	(1 species)
Gomphonema	(2 species)
Gyrosigma	(2 species)
Fragilaria	(2 species)
Mastogloia	(4 species)
Navicula	(2 species)
Nitzchia	(5 species)
Pinnularia sp.	(1 species)
Stauroneis sp.	(1 species)
Surirella	(2 species)
Synedra	(2 species)
Cocconeis	(2 species)
Cyclotella	(2 species)

Aquatic Fauna

Zooplankton biodiversity (Table 6) presented mainly of the Rotifera, Copepoda, and Cladocera.

TABLE 6. List of Zooplankton abundance and species composition in the aquatic sites (WS-1, WS-2, WS-3, and WS-6).

	Rotifera	**Copepoda**	**Cladocera**
Mean density	5 ind/L	5030 ind/m^3	1050 ind./m^3
Species composition	*Brachionus*	Cyclopoida	
	Keratella	*Measocyclops* sp.	*Alona* spp.
	Monostyla	*Thermocyclops* sp.	*Monia* sp.
	Trichocerca	*Microcyclops* sp.	*Macrotherix* sp.
	Others	*Macrocyclops albides*	*Pleuroxus* sp.
		Eucyclops sp.	*Diaphanosoma* sp.
		Acanthocyclops sp.	*Ceriodaphnia* sp.
		Ectocyclops sp.	*Chydrous* sp.
		Harpacticoida	
		Onychocamptus sp.	
		Delavelia longifurca	
		Nitocra sp.	
		Nannocamptus sp.	
		Calanoida	
		Phyllodiaptomus irakiensis	
		Acanthocyclops denticorns	
		Arctodiaptomus (Rh.) salinus	

Common macrobenthos species (Table 7). The mean density for the four surveyed aquatic sites was (204 ind./m^2). These are underestimated values due to the loss of several Caridean shrimp juveniles during sample collection. These values represent moderate biodiversity in the sampled area.

Different species of fish were recorded in the four aquatic sites(Table 8), some are considered common species in the region (*Carasobarbus luteus, Crassius auratus; Cyprinus carpio, Liza abu,* and *Coptodon zillii*), while others were rare including (*Alburnus caeruleus; Arabibarbus grypus; Mystus pelusius*) [17,18].

Wide variation in fish weight, for example, mean weight range of (31.23g) for *Alburnus mossulensis* and (220.39 g) for *Silurus triostegus.* These differences in weight are influenced by ecological parameters such as water quality, food availability, an abundance of predators, and feeding type. This difference in size can also be due in part to prolonged marsh drying and a lack of food resources (algae and aquatic plants) for the herbivorous fish species compared to the carnivorous [6].

The present biodiversity assessment was based on data collected for four days survey (26-29 March 2017) and covered ten locations at the WQ-2 contract area. The month of March represents mid of the spring season in the region. Biologically this time represents the season of reproduction and growth for most life forms. For terrestrial plants, semi-aquatic plants, macrophytes, and other vegetation, it's a high growth period. For most fauna, it's the onset of the reproductive season, but the new broods have not yet been produced. Therefore, most of the population has its lowest density.

The survey indicated a noticeable decrease in floral cover was nearly 66% of the six terrestrial sites compared with the Dome Report 2015[6] appeared as an arid or semi-arid dry land) in the (25X100m transects). However, these points do not reflect the status of the floral cover diversity for the whole site. A prominent strip of *Tamarix* trees in the SAN-7 site; represent from a conservation point of view a very important key plant species for many fauna species observed in the site, particularly birds and insects.

Blocking of the canals and creeks was the main factor causing the aridity of the area and consequently low floral cover, leading to continuous changes in the habitat and the loss of biodiversity. Buffalo and Sheep were mostly observed in the North East of the WQ-2 site, which seems to be due to the large plant cover of reeds as well as good marshes water. The low diversity and populations of birds spotted in the present survey can be attributed to the aridity of the sites and lower flora cover and the industrial operations and anthropogenic activities in the general site of WQ-2.

TABLE 7. Aquatic fauna surveyed in March-April, 2017.

Aquatic Fauna								
Macrobenthos			**WS1**	**WS2**	**WS3**	**WS6**	**IUCN**	**Notes**
Class: Crustacea	Caridean shrimps	*Ataephyra d. mesopotamica*	*	*	*	*		Very abundant species associated with aquatic plants, migratory species breeds in marine water and migrating to inland brackish water
		Caridina b. basrensis	*	*	*	*		Very important productive taxa in the marshes habitat
		Metapenaeus affinis			*	*		Edible shrimp reproduce in marine water, migrate to the marsh for growing
Class: Amphipoda	Family: Talitridae	Parhyale basrensis	*		*			Small productive crustacea very abundant in Basrah marshes and Shatt al-Arab
Class: Gastropoda	Order: Architaenioglossa Family: Vivipasidae	*Bellamya bengalensis*	*	*		*	LC	Abundant in the marshes and river. Freshwater species disappeared from the Shatt Al-Arab River. Edible in some Asian countries, but not locally in Iraq.
	Order: Sorbeoconcha Family: Thiaridae	*Melanoides tuberculata*	*	*	*	*		Native species distributed in the marshes and Shatt Al-Arab Habitat are found on aquatic .

Macrobenthos			WS1	WS2	WS3	WS6	IUCN	Notes
	Order: Sorbeoconcha Family: Melamopsidae	*Melanopsis nodosa*	*	*	*	*		Native species distributed in the marshes and Shatt Al-Arab Habitat are found on aquatic plants, stones, and mud.
	Order: Cycloneritimorpha Family: Neritidae	*Theodoxus jordani*	*	*		*	LC	Wide range in western Asia. Abundant in Marshes and Shatt Al-Arab on aquatic plants and stones, Mud
Mullusca		*Limneya sp*		*				
Class: Bivalvia	Family: Corbiculidae	*Corbicula fluminalis*				*		
	Order: Unionoida Family: Unionidae	*Unio tigridis*	*				threatened species	Found in the bottom of the river. One individual St. 6 IUCN Red List of Threatened species.
Insecta	Order: Odonata Family: Coenagriondae	*Ischnura evance*	*	*	*	*		Larvae of different stages
	Family: Libellulidae	*Brachythemis sp*	*	*	*	*		
	Order: Hemiptera Family: Corixidae	*Corixid sp*	*		*	*		
Chordata								
Class: Amphibia	Order: Anura Family: Ranidae	*Rana ridibunda (synonym: Pelophylax rihbundus*	*	*		*		
Class: Reptiles	Order: Testudines Family: Geoemydidae	Mauremys caspica (*synonym: Clemmys caspica*)	*	*		*		
		Rafetus euphraticus				*		

Two important native bird species were spotted in SAN-7 sites (*P. leucotis* (Bilbul) and collared doves *S. risoria)*, another small bird species *Phylloscopus trochilus* were seen in good numbers building their nests on the *Tamarix* trees.

Insects of the terrestrial sites were dominated by beetles and ants' colonies. In general, there were (13 species) recorded which is relatively higher than that observed in the 2013-2015 monitoring study which reported (only 6 species) [6].

The results of the aquatic sites survey indicated good habitat richness compared to the terrestrial sites. The aquatic flora composed mainly of the common macrophytes species (*Ceratophyllum demersum*, and *Myriophyllum*

verticillatum, *M. specatum*) and the *phragmites australis*. These floras are characteristic species of marshland habitat which indicate the common and healthy state of the surveyed sites generally accept site WS-2 which appeared to be polluted and nutrient-enriched. The high vegetation of the intertidal and subtidal zones of the river forming a highly productive environment and shelter for many species of meo- and macroinvertebrates. Most macro-benthos live associated with macrophytes whereas more or less absent in the mud and sediments collected by the grab sampler. The most abundant benthic species were the two Caridean shrimps *Atyaephyra desmaresti mesopotamica* and *Caridina babaulti basrensis*. Moreover, the presence of the gastropod *Bellamya bengalensis* and the bivalve *Corbicula fluminalis* and *Unio tigridis*, confirm the typical wetlands habitat conditions at these sites. These benthic species either showing a decline in their numbers or became absent in the Shatt Al-Arab and Hammar marshes compared to the surveyed sites [12]. Barnacle *Balanus amphitrite amphitrite* is the main fouling species in the Shatt Al-Arab River and upstream for the last three decades causing industrial problems. In the present survey no, live barnacles were found in the surveyed aquatic sites.

TABLE 8. List of fish species; total Number of individuals, relative abundance, and weight of fish collected from the WQ -2 sites (WS-1, WS-2, WS-3, and WS-6).

Family	Species	No. individual	Relative Abundance (%)	Weight (g)	Dominance
Cyprinidae	*Carasobarbus luteus* (Heckel, 1843)	36	8.6	25.1-96.8 61.14	Dominant
	Leuciscus vorax (Heckel.1843) *(Aspius vorax)*	10	2.41	25.1- 216.9 59.66	present
	Carassius auratus (Linnaeus, 1758)	49	11.83	20.5- 113.5 68.5	Dominant
	Cyprinus carpio (Linnaeus, 1758)	25	6.03	27.9-78.6 53.5	Dominant
	Alburnus mossulensis (Heckel, 1843)	4	0.96	26.7-37.2 31.23	Rare
	Luciobarbus xanthopterus (Heckel, 1843)	3	0.72	15.7-60.7 41.18	present
	Mesopotamichthys sharpeyi (Günther, 1874) (*Barbus sharpeyi)*	5	1.20	15.7-130 42.44	present
	Arabibarbus grypus (Heckel, 1843)	1	0.24	59.5 59.5	Rare
Mugilidae	*LIZA ABU* (HECKEL, 1843)	58	14.32	9.7-44.1 28.99	Dominant
Siluridae	*Silurus triostegus* (Heckel, 1843)	14	3.45	120-310.5 220.39	present
Cichilidae	*Coptodon zillii* (Gervais, 1848)	197	48.64	16.4-42.6 29.06	Dominant
Mastacembelidae	*Mastacembelus mastacembelus* (Banks & Solander, 1794)	8	1.97	90-235.87 165.29	present
Bagridae	*Mystus pelusius*	4	0.24	28.6-35.2 31.33	Rare
Total		414			

Zooplankton species are good ecological indicators of the marsh. Their short life cycles and mobility allow quick responses to changes in environmental conditions [2]. Cladocera and Rotifera are predominantly freshwater species; Rotifera is more sensitive to water salinity than the Cladocera. Also, *Brachionus plicatilis* is one of the abundant rotifers in this study, which is common in alkaline and brackish waters [11]. Rotifers were also the dominant group in Shatt Al-Arab [13]. The community of copepods includes at least 14 freshwater species, 7 belong to Cyclopoida, 4 species to Harpacticoida, and 3 calanoid species were recorded in the southern marshes [12]. A total of 28 species of copepods were recorded in Iraqi southern marshes [9].

Fishes were mostly freshwater species. The number of the recorded species in this survey represents about 60% of the total freshwater species present in southern Iraq. Another important observation was the total catch was low. One of the most dominated species in the catch was the invasive species the Redbelly Tilapia *C. zillii.*

A terrestrial habitat map (Fig.3 by the author).was plotted after a ground-truthing of the surrounding area of the WQ-2 area. The map revealed that the area surrounding the WQ-2 site is still thriving, to the north of the study site the area is still mainly a productive agricultural land, the Euphrates River to the south and east of the site supports good aquatic biodiversity.

FIGURE 3. Updated Terrestrial Habitat Map 2017 updated from the 2015 map.

Environmental degradation of a specific ecosystem affects productivity and biodiversity as a result of improper land use. Since the 1970s of the last century oil and gas production in southern Iraq has caused the drainage of large sections of the Mesopotamian wetlands as well as causing oil spills and pollution related to oil production. Agricultural runoff threatens water quality and results in increasing salinity in many areas of this ecoregion. A study by [8] shows that during the period 1990 to 2003 Basrah Province experienced a decrease in surface water body area with Al-Qurna showing the highest reduction of about 2.8 km^2 per year. factors that contribute to a decrease in surface water, including upstream damming, miss management of the water resources, irrigation, and climate change. On the other hand, the drainage of Mesopotamia marshes during the nineties of the last century, the dumping of untreated industrial, agricultural and human waste into the rivers affected the quality of the water and consequently affected the environment and biodiversity in general [4].

The study area surrounding the West Qurna-2 oil field is located along the eastern borders of the central marshes, which was inscribed on UNESCO's World Heritage List in 2016 [3]. In 2015 the government designated Central Marshes and Hammar Marsh as Wetlands of International Importance ('Ramsar Sites') under the Ramsar Convention on Wetlands. The WQ-2 site environment was expected to benefit from the conservation status of the central marshes by improving site conservation and sustainable management, especially the quality of water from the Ezz River feeding the small streams at sites WS1 and WS2, but this does not seem to have helped to improve the quality of the environment. On the other hand, as the site is located within the boundaries of the West Qurna-2 oil field project (restricted area) it means that it is the company's responsibility to make greater efforts to improve the environmental situation through cooperation with the local community directly or through cooperation with academics to restore the natural marshes environment instead the site was left to degrade and turn into decertified and salinized land, the evidence is the types of main vegetation of the site which is mainly (*Tamarix* sp. and *S. perennans*) halophyte plants. Inappropriate human activities such as the excessive exploitation of natural resources and mismanagement of land have, to a certain extent, contributed to the observed environmental destruction [18].

Despite the negative historical impacts on the marshes, the biodiversity of the WQ-2 site values is highly respectable compared with the other sites. Since the site is off limit for the public; with good environmental management, it could play an important role in protecting some endemic and migratory fish and bird species.

CONCLUSION

In conclusion, we propose the following to restore the original marsh environment and preserve the region's biodiversity through:

1. Refolding some of the streams and the water channels in the contracted area to protect the biodiversity of the site.
2. The strip of the Tamarix trees in the SAN-7 site to be protected as an important bird nesting site.
3. Also, it's highly recommended that LUKOIL support the community in the surrounding area, particularly near the aquatic sites to preserve biodiversity through fishing management and environmental awareness.

ACKNOWLEDGMENT

This work was supported by funding from the Lukoil company. We would like to thank Marine Science Centre, Univ. Basrah for various supports throughout the survey.

REFERENCES

1. F., Hoffmann; T. Langendoen and T. Mundkur . Comparative analysis on biological diversity and institutional management of the Marshlands of Southern Iraq. Wetlands International, Ede, the Netherlands. Published by Wetlands International www.wetlands.org. (2013).
2. M. Abdullah, N. Al-Ansari and J. Laue. Water Resources Projects in Iraq, Main Drains. Journal of Earth Sciences and Geotechnical Engineering, Vol.9, No. 4, 275-281 ISSN. (2019).
3. N. A.M. Fawzi, K. P., Goodwin; B. A. Mahdi and M. L., Stevens. Effects of Mesopotamian Marsh (Iraq) desiccation on the cultural knowledge and livelihood of Marsh Arab women. Ecosystem Health and Sustainability. 2(3): e01207. doi: 10.1002/ehs2.1207. (2016).
4. Mohammed, and S. D. Salman. Copepoda of the Southern Iraqi Marshes 1. Calanoida. Marsh Bulletin 4(2):148-161. (2009).
5. C. Helman "The World's Biggest Oil Reserves". Forbes https://www.forbes.com/2010/01/21/biggest-oil-fields-business-energy-oil fields.html#656b92712ab0. (2010).
6. XuanZhou JEnvironmental Degradation assessment in arid areas: a case study from Basra Province, southern Iraq. Environ Earth Sci . 70:2203–2214. DOI:10.1007/s12665-013-2290-6. (2013).
7. B. W. Coad. Freshwater fishes of Iraq. Pensoft Publishers, Sofia- Moscow, 294 p. (2010).
8. S. A. Hussein; A. A. M.; Abdullah; S. A., Abdullah, Ecology and fish structure in the Southern sector of the Euphrates River, Iraq. Basrah Jour-nat of Agriculture Science, 28(1): 95-108. (In Arabic). (2015).
9. S. S. Al-Noor and A. H. J. Abdullah. Structural diversity of fish communities in the North part of Shatt Al-Arab River-North of Basrah- Qurna. Basrah Journal of Agriculture Science, 28(2):14-27. (2015).
10. M. H. Ali, and A. H. Ghazi. Rotifera composition and density along of the Shatt Al-Arab river from Qurna to Fao, Southern Iraq. Marine Science Conference, 23-25 Dec., Mar. Sci.Centre, Basrah Univ. (2008).
11. Ramsar . Ramsar Sites Information Service. www.ramsar.wetlands.org., (2013)
12. H. H., Mohammed, and S. D. Salman. Copepoda of the Southern Iraqi Marshes 1. Calanoida. Marsh Bulletin 4(2):148-161. (2009).
13. H., H., Mohammed; S.D. Salman, and M.F. Abbas. Zooplankton In: Biodiversity of the Inland waters of Basrah, following the 2003 Marshlands Restoration Project (An Overview), (edt.) Ali, M.H. (in press) (in Arabic). (2020).
14. M. T. Jabbar and XuanZhou JEnvironmental Degradation assessment in arid areas: a case study from Basra Province, southern Iraq. Environ Earth Sci . 70:2203–2214. DOI:10.1007/s12665-013-2290-6. (2013).
15. N. A. Abdulhasan, M. A. Salim, G. S. Al-Obaidi, H. J. Ali, M. A. Al-Saffar, I. M. Abd, & M. Sh. Minjil. Habitat Mapping and Monitoring Project Classification and Description of Southern Iraqi Marshlands (National Park Area). Report Nature Iraq, Sulaimania, Kurdistan, Iraq. (2009).

16. Salim, M. Summary report on the status of the marshes of lower Mesopotamia: Central Marshes, East Hammar, Hawizeh, and West Hammar. Nature Iraq/Iraqi Ministry of Environment.(2013).
17. Ramsar 2013. Ramsar Sites Information Service. www.ramsar.wetlands.org.
18. Ramsar website https://rsis.ramsar.org/ris/2241 (accessed 19th March 2020).