Comparative analysis on biological diversity and institutional management of the Marshlands of Southern Iraq

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Wetlands INTERNATIONAL

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Cover photo: Hawizeh Marshes, Iraq. Photo by Frank Hoffmann (Wetlands International)

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Executive Summary

Framework and goal of the comparative analysis

The government of Iraq, assisted by UNESCO, UNEP and IUCN, is currently preparing the nomination of the Iraqi or Mesopotamian Marshlands as a World Heritage site under the name *Marshlands of Southern Iraq*. Wetlands International was requested by UNEP-DTIE-IETC to carry out an independent comparative analysis of the Marshlands of Southern Iraq to other wetlands in the world to be used for the nomination process. This analysis has two goals:

1. Compare the biological diversity to provide scientific background for the nomination file.
2. Compare the institutional management to suggest possible improvements to the current management structure for the long-term conservation of the Marshlands of Southern Iraq.

Seven sites were selected for comparison

1. Marshlands of Southern Iraq (Iraq)
2. Djoudj National Bird Sanctuary (Senegal)
3. Okavango Delta (Botswana)
4. Inner Niger Delta (Mali)
5. Danube Delta (Romania)
6. Doñana National Park (Spain)
7. Everglades National Park (Florida, USA)

The sites are river fed wetlands in an inland or coastal delta, five sites have estuarine or marine influences. All except one (Everglades) are situated in semi-arid to arid climates with low to very low precipitation. The Marshlands of Southern Iraq have the most arid circumstances and lowest precipitation. All sites have or had varying degrees of human impacts. The most natural site is the Okavango Delta. The Iraqi Marshlands were the most heavily impacted due to massive drainage in the 1990s, but have partially recovered after 2003. Five sites have a UNESCO World Heritage status, two are nominated on the Tentative List, and all are at least partially designated under the Ramsar Convention on Wetlands of International Importance.

Biological diversity

Total species numbers

- No single site has the highest species number across all taxonomic groups considered (vascular plants, fish, amphibians, reptiles, mammals, birds, and Odonata).
- The Marshlands of Southern Iraq do not have the highest total number of species. However despite the negative historical impacts on the marshes, the biodiversity values are highly respectable compared with the other globally important sites.

Summary table of total species numbers of various taxonomical categories reported for the seven wetland sites. Shaded colours indicate ranking of sites within taxonomic group: green= highest, blue= second highest, yellow = lowest.

Site	Plants	Fish	Amphibians	Reptiles	Mammals	Birds	*Vertebrates*	Odonata
Marshlands of Southern Iraq	86	43	3	18	39	224	*327*	25
Djoudj NBS	121-132	92	6	n.a.	29	327	*>448*	n.a.
Okavango Delta	1078-1276	71	29	64	123	444	*731*	94-98
Inner Niger Delta	189	138	n.a.	n.a.	>14	125	*>263*	n.a.
Danube Delta	2383	134	10	12	54	341	*551*	35
Doñana NP	1362	27	12	23	37	224	*323*	29
Everglades NP	1146	238	21	58	36	366	*719*	40

Endemic and threatened species

- The Marshlands of Southern Iraq have a high relative number of endemic species; the absolute number of endemic species is within the same range as other globally important wetland sites.
- The Okavango Delta is the opposite of the Marshlands of Southern Iraq: the former is well connected and has high absolute species numbers but few endemic species; the latter are very isolated, have an extreme (arid) climate, relatively low total species numbers but relatively and absolutely high numbers of endemic species and subspecies.
- The number of currently assessed and recorded globally threatened species is highest in the Okavango Delta and Doñana. The Marshlands of Southern Iraq rank intermediate.

Summary table of endemic species numbers per wetland site. Spp= species, subs= subspecies, N.A. = data not available or unknown. Shaded colours indicate ranking of sites within taxonomic group: green= highest, blue= second highest, yellow = lowest (only for total).

Site	Plants	Fish	Amphibians & Reptiles		Mammals		Birds		Odonata	*Total*
	spp	spp	spp	subs	spp	subs	spp	subs	spp	
Marshlands of Southern Iraq	at least 1	6	1	0	1 (3)	1	2	4	2	*20*
Djoudj NBS	n.a.	9	n.a.	n.a.	n.a.	n.a.	0	0	n.a.	*9*
Okavango Delta	n.a.	1	0	0	0	0	0	(1)	0	*2*
Inner Niger Delta	at least 1	24	n.a.	n.a.	n.a.	n.a.	0	0	n.a.	*25*
Danube Delta	3	5	0	0	0	0	0	0	0	*8*
Doñana NP	5	1	13	0	1	0	1	0	0	*21*
Everglades NP	65	3	1	9	0	0	0	2	n.a.	*80*

Summary table of globally threatened species per wetland site. n.a. = not available and/or not assessed. Shaded colours indicate ranking of sites within taxonomic group: green= highest, blue= second highest, grey= not assessed.

Site	Plants	Fish	Amphibians	Reptiles	Mammals	Birds	Odonata	*Total recorded or assessed*
Marshlands of Southern Iraq	n.a.	0	0	1	3	12	1	*17*
Djoudj NBS	n.a.	n.a.	0	0	4	3	0	*7*
Okavango Delta	7	2	0	0	7	7-8	0	*24-25*
Inner Niger Delta	n.a.	3	n.a.	0	3	6	n.a.	*12*
Danube Delta	1	11	0	1	3	5	0	*21*
Doñana NP	8	1	3	4	2	5	0	*23*
Everglades NP	n.a.	5	0	3	2	4	0	*14*

Conclusions regarding biological diversity

1. The Marshlands of Southern Iraq are one of the world's largest wetland ecosystems in an extreme desert climate. Compared to other lowland wetland systems they have a high absolute and relative number of endemic species.
2. Species diversity across several taxonomical groups is comparable to other globally important wetland properties, including those nominated as World Heritage Sites.
3. The Marshlands of Southern Iraq are globally important for waterbirds and migratory birds; the number of waterbird species and the absolute number of waterbirds is similar to other globally relevant wetlands. Populations of at least sixteen waterbird species tentatively exceed 1% of the entire flyway population based on recent count information.

Institutional management

Legal status and protection

- All properties analysed have varying degrees of legal protection. Only the Marshlands of Southern Iraq do not yet have a protected status for the entire property. Designating the Central Marshes as a national park was a crucial first milestone. Further steps towards legal protection are being prepared by Iraq.
- Legal protection needs to be extended to the other parts of the marshes to meet the requirements from the Operational Guidelines for World Heritage.
- For ensuring the integrity of a future World Heritage site, legal protection of certain sites may also be needed outside the delineation. For example for the protection of water or in buffer zones
- For all properties various environmental and protective general laws at different levels are applicable. Iraq is at present updating its legislation. This process may be helped by an analysis of the current legislation as compared to the needs for the protection of the Marshlands of Southern Iraq. This will help to identify legal gaps, identify double or hampering legislation, and highlight enforcement and implementation needs.
- Regulations regarding environmental impact assessments (EIA) should be a priority. EIA can enable planning economic activities without harming the marshlands, including external effects from outside the protected areas. For example, for oil and gas companies, equal and strict standards for all companies should be implemented and enforced. Experiences with impact assessment regulations can be drawn from e.g. the Ramsar Handbook 'Guidelines on Impact Assessment' or the EU policies regarding Habitat and Bird Directives and Water Framework Directives, including the implementation in various EU member states.

Coordination and cooperation

- Site management in all designated World Heritage properties and the Okavango delta is coordinated by an institution or board. These vary between top-down state organisations and broad stakeholder platforms. In Iraq a management body or institution for the area is currently not extant.
- A coordinating institution is urgently needed. Several national ministries and three governorates are involved in management, local communities, industrial activities and other stakeholders. As a first step, Iraq will install a National Committee for World Heritage under the Ministry of Environment.
- It is recommended that this committee will set out a 'roadmap' towards building a management institution or coordination body. Aspects to be considered are the type of institution (top-down or a broad platform), whether it will be specific for the World Heritage Property, for the Iraqi Marshlands at large, or for all protected areas in Iraq.
- Stakeholder involvement or representation is vital in such a coordination body. For local communities and tribes, agriculture, fisheries, hunting and reed harvesting are important marshland ecosystem services that need to be taken into consideration. The oil and gas sector should also be involved.
- Adequate river and water management at national and international level is needed to ensure the survival of the marshes. The Euphrates-Tigris basin currently has no international cooperation at basin level, such as exist for the Senegal, Okavango and Danube rivers. River basin cooperation involving all countries within the basin will be essential for sharing the limited water resources, effective transboundary management and preventing future conflicts on water.

Management plans

- All the analysed sites have management plans in various stages of development, review and implementation.
- For Iraq, the content of existing management plans could contribute towards plans for a World Heritage nomination. However, at present none of these plans would be a suitable template for this purpose.
- As part of the nomination procedure management plans for each of the four components of the Marshlands of Southern Iraq are being developed. After this the plans need to be implemented and an overarching framework is needed for the four plans. A first step will be a roadmap to implementation and to plan a revision trajectory after the first years of implementation. Experience in the other countries has shown that the planning process takes time, as it is also important to include various stakeholder groups, both at national and local level.

Monitoring and conservation

- Most properties have coordinating monitoring institutions that are differing in nature. Also the monitoring effort and the parameters measured vary between the sites. In Iraq monitoring is carried out by various institutions and NGOs, both systematic and at an *ad hoc* basis. This has resulted in a considerable amount of useful base-line information for the Marshlands.
- A coordinating body for monitoring does not yet exist in Iraq. Given the various threats for the marshes and for proper management such an institution will be vital to make monitoring efforts more efficient, coherent and scientifically robust.
- Negative human activities severely degraded several of the properties in the past. Various conservation and restoration measures were taken and are still being carried out in these areas the experiences of which can be used examples for restoration plans in the Marshlands of Southern Iraq.
- Restoration will require considerable efforts as the marshes have not yet recovered from the severe degradation in the 1990s. Water management, water availability, preventing unsustainable use and defining realistic conservation and restoration goals are essential ingredients for such efforts. Nominating the marshlands as World Heritage may help initiate an overarching vision and bring together existing restoration plans. Also the prevention of negative effects from industry, urban developments and agriculture through legislation, combined with good spatial planning are important aspects. The oil and gas sector in the area might contribute positively through using some of the revenues for marshland restoration.

1. Introduction

The Iraqi or Mesopotamian Marshlands are a vast wetland complex in the confluence of the Mesopotamian rivers Euphrates and Tigris. The Marshlands are supporting a diverse array of flora and fauna species and are a vital site for migratory birds in the flyway between Central Asia, Eastern Europe and East Africa. However, the marshes, the people living in them and their biodiversity have suffered from massive changes in the recent past: large scale drainage, mostly by the Saddam Hussein regime, led to their demise. By the year 2000 up to 90% of the marshes were destroyed. After the fall of the regime around 30%-60% of the marshes were reflooded again. Much of the biodiversity of the past could be restored, even though not all problems could be resolved yet.

The Marshlands were registered on UNESCO's Tentative List in 2003 in preparation for nomination as a World Heritage site under the name "Marshlands of Southern Iraq". The nomination is currently being prepared by Iraq and assisted by the UNESCO Iraq Office, the United Nations Environment Programme (UNEP) and IUCN. The nomination should include a statement of the Outstanding Universal Value (OUV) of the property and a description of the intended institutional management. Wetlands International was requested by UNEP-DTIE-IETC to carry out an independent comparative analysis that can be used as a background scientific study to formulate the OUV and that provides recommendations for institutional management.

The goal of this report is a comparative analysis of the Marshlands of Southern Iraq to other wetlands in the world. The report focuses on:

1. Biological diversity to provide scientific background that can be used to assess the Outstanding Universal Value of the Marshlands of Southern Iraq as a World Heritage Site;
2. Institutional management to suggest possible improvements to the current management structure for the long-term conservation of the Marshlands of Southern Iraq.

This report has the following sections: Chapter 2 describes how the sites in this analysis were selected. Chapter 3 provides an overview of the characteristics of the sites, including physical and climatic features, habitats, major threats and impacts and a general description per site. Chapter 4 contains the comparison on biological diversity. Chapter 5 provides the comparison on institutional management including suggestions for improvement with experience from other countries and properties.

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2. Selection of sites to be compared

A comparative analysis is an essential requirement of a World Heritage nomination, and needs to consider whether the values that are ascribed to a nominated property are of global significance. Among the key principles to be considered in preparing a Global Comparative Analysis for World Heritage nominations are that the analysis should be objective, maintain a global scope and should be supported by available scientific information (IUCN 2008). Sites to which the nominated property is compared should share several physical and biological features with that nominated property in order to prevent comparing apples and oranges. In the present study important selection features were river fed wetlands or wetland complexes in an arid or semi-arid climate, situated in an inland or coastal delta. Furthermore, sites should preferably, but not necessarily, have a World Heritage status or be nominated on the Tentative List, or be a Ramsar site. Both indicate the global relevance of a certain property. A further criterion was global distribution of sites, as advised by the IUCN in the key principles.

Garstecki and Amr (2011) concluded in an IUCN screening study that there are no sites that exactly share all properties and criteria with the Marshlands of Southern Iraq and the following sites proposed a following list: Danube Delta (Romania), Everglades NP (USA), Doñana NP (Spain), Volga Delta (Russia), Srebarna (Bulgaria), Djoudj (Senegal). These sites served as a basis for selecting sites in the present study. In addition, we considered a number of additional and alternative sites. In our selection process we included sites from the Americas (Pantanal in Brazil, Paraná Delta in Argentina), South Asia (Keoladeo National Park in India), Southeast Asia (Tonle Sap in Cambodia) and Oceania (Kakadu National Park and Macquarie in Australia) at first.

Table 1: Properties deselected for the comparative analysis

Potential site	Country	Reasons for not including
Keoladeo National Park	India	Artificial area sharing to few features with Marshlands of Southern Iraq; data availability
Tonle Sap	Cambodia	Climate (tropical)
Kakadu National Park	Australia	Climate (tropical)
Volga Delta	Russia	Data availability; already two other sites in Europe
Srebarna	Bulgaria	Site too small in comparison to Marshlands of Southern Iraq; already two other sites in Europe
Pantanal	Brazil	Climate (tropical)
Paraná Delta	Argentina	Data availability; climate; not World Heritage or Ramsar site

Of the total potential list we deselected sites for combinations of reasons, e.g. incomparable systems or climate, data would be too difficult to obtain, size, or there was no proof of global importance such as a World Heritage or Ramsar status. Some sites were completely artificial (e.g. Keoladeao National Park) and could not be justifiably compared to the Marshlands of Southern Iraq. Table 2 provides an overview of the finally selected sites, figure 1 shows their location. In chapter 2 the characteristics of the sites will be discussed in detail.

The Djoudj, Danube Delta, Doñana and the Everglades were recommended before in the screening study by Garstecki & Amr (2011). Additional sites in arid to semi-arid circumstances are the Okavango Delta in Botswana and the Inner Niger Delta in Mali. The Everglades, though climatologically much wetter than the other sites, was included as this site adds to the global geographic spread. Furthermore, it is a useful site for comparison regarding institutional management.

Table 2: Selected wetland sites for comparison, with country, listing as World Heritage Site with criteria, Ramsar site category, number of IBA (Important Bird Area) and EBA (Endemic Bird Area) locations within a site.

Site	Country	World Heritage Criteria	Ramsar Category	IBA	EBA
Marshlands of Southern Iraq	Iraq	Tentative List (ix, x) Recommended as mixed site	Inland wetlands	4	1
Djoudj National Bird Sanctuary	Senegal	vii, x	Inland wetlands	1	0
Okavango Delta	Botswana	Tentative List (vii, viii, ix, x)	Inland wetlands	1	0
Inner Niger Delta	Mali	Not inscribed	Inland wetlands Human-made wetlands	4	0
Danube Delta	Romania	vii, x	Inland wetlands Marine & coastal wetlands	0	0
Doñana National Park	Spain	vii, ix, x	Human-made wetlands Marine & coastal wetlands Inland wetlands	1	0
Everglades National Park	Florida, USA	viii, ix, x	Inland wetlands Marine & coastal wetlands	1	0

Figure 1: Map depicting locations of the study sites. DJ: Djoudj National Bird Sanctuary, DDBR: Danube Delta Biosphere Reserve, DNP: Doñana National Park, EG: Everglades National Park, IM: Marshlands of Southern Iraq, IND: Inner Niger Delta, OD: Okavango Delta.

3. Characteristics of the study sites

3.1 Geography, climate and hydrology

The seven study sites are distributed over West Asia, Africa, Europe and North America. Table 3 below summarizes the physical characteristics of these sites. All sites are large and continuous wetland systems, except Djoudj, which is only a small part of the entire Senegal River Delta. Five sites are situated in flat, lowland areas at sea level or only few metres above sea level, close to or at the coast. Of these, Danube Delta, Doñana and Everglades include coastal and marine areas within their delineations. Two sites are situated far inside the African continent in flat areas situated at around 1000 m.a.s.l. (Okavango, no connection to the sea at all), and around 260-270 m.a.s.l. (Inner Niger Delta).

Table 3: Physical characteristics of the study sites. Sources of climate data: Köppen-Geiger: Peel et al. (2007); Average Annual precipitation: Worldclimate (2013), Average Annual PET (potential evapotranspiration): ESRI et al. (2013); Aridity Index: FAO (2012).

Site and geographical position (centre)	Size (ha)	Climate (Köppen-Geiger)	Average annual precipitation (mm)	Average annual PET (mm)	Aridity index (range)	Position in river basin
Marshlands of Southern Iraq 30°-31° N 46°5'-47°5' E	>1,500,000 (1973) 418,542 (current)	BWh Hot desert	149	0-500	Arid (0.05-0.20)	Inland delta, close to estuary
Djoudj NBS 16°20'00"N 016°12'00"W	16,000	BWh / BSh Hot desert / Hot semi-arid	269-376	0-500	Arid (0.05-0.20)	Inland delta, close to estuary
Okavango Delta 19°17'00"S 022°54'00"E	5,537,400	BSh Hot semi-arid	558	0-750	Semiarid (0.20-0.50)	Inland delta, no sea connection
Inner Niger Delta 15°12'00"N 004°06'00"W	4,119,500	BSh Hot semi-arid	521	250-750	Semiarid-Arid (0.05-0.50)	Inland delta, mid-continental
Danube Delta 45°10'00"N 029°15'00"E	647,000	Dfa Dry- hot summer	401	250-750	Semiarid (0.20-0.50)	Coastal delta with estuary
Doñana NP 37°01'00"N 006°25'00"W	111,646	Csa Hot-summer Mediterranean	534	250-500	Semiarid (0.20-0.50)	Coastal delta with estuary
Everglades NP 25°33'00"N 080°55'00"W	567,017	Cfa Humid subtropical	1578	500- >1000	Humid (>0.65)	Coastal and inland marshland, estuary, partially marine

Six out of the seven sites are situated in climate zones with at least a hot season, low to very low precipitation and semi-arid to arid circumstances. The Marshlands of Southern Iraq have the most extreme climate with the lowest precipitation and most arid circumstances, followed by the Djoudj at the transition from the Sahara to the Sahel. Two sites are in hot semi-arid climates: the Inner Niger Delta, getting drier and more arid towards the north (semi-arid to arid) just south of the Sahara, and the Okavango Delta, being close to the Kalahari Desert and Savannah. Two sites are situated in Mediterranean-like climates: Doñana, which is typical for the Mediterranean climate, and Danube Delta having a more continental influence with colder winters. The Everglades are the only site in a humid and subtropical zone with high average annual precipitation.

All sites show seasonality regarding temperatures and/or precipitation (see fig. 2). The average annual temperature range is most extreme for the Marshlands of Southern Iraq and most constant for the Djoudj. The Danube Delta has the least variability in average monthly precipitation, the Marshlands of Southern Iraq and Doñana have winter rains, and the other four sites predominantly summer rains or summer precipitation peaks.

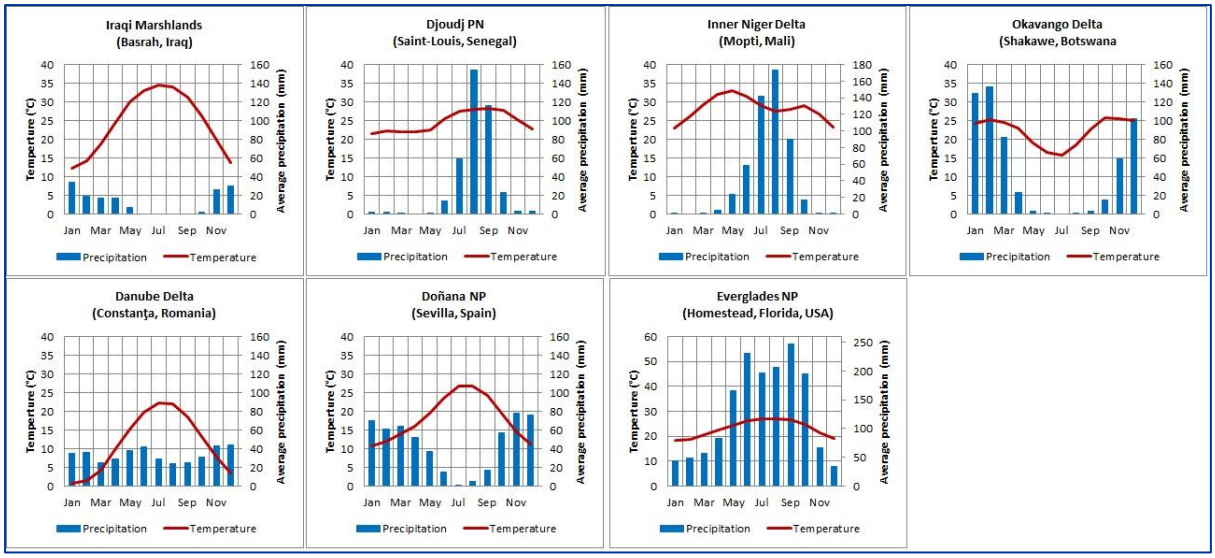

Figure 2: Climate diagrams of locations near the study sites: monthly mean of the daily (24 hour) temperature and mean monthly precipitation. Note that the Okavango is on the southern hemisphere and seasonal order is reversed as compared to the other sites. (Data source: Worldclimate, 2013).

Five sites are part of major river systems: the Marshlands of Southern Iraq are associated with the Euphrates and Tigris, Djoudj with the Senegal River, Okavango Delta with the Okavango River, Inner Niger Delta with the Niger, and the Danube Delta with the Danube. The Doñana is associated with the Guadalquivir, southern Spain's largest river. The Everglades are associated to several smaller rivers and a larger lake (Lake Okeechobee) as important water sources. All sites depend to varying degrees on river discharge for flooding and water availability, the relative contribution of the river systems being larger with increasing aridity of a site. For example, the Marshlands of Southern Iraq almost entirely depend on the Euphrates and Tigris. At most sites a time lag exists between the annual average precipitation peak (fig. 2) and peak river discharge, varying between weeks and several months. For example, the average natural peak flooding (river discharges) for the Marshlands of Southern Iraq is in April-May (CIMI 2010), Inner Niger Delta in November-December (Zwarts et al. 2009), Okavango in March-June (Ashton et al. 2003), and Danube Delta around April (Gâştescu 2012). Groundwater flows and marine or estuarine influences are also important hydrological factors at all sites except Okavango Delta and Inner Niger Delta. It should be noted that the hydrology of most sites is severely altered, controlled or even entirely artificial. The most natural and intact site is the Okavango Delta. In all areas there are also long-term patterns in precipitation and flooding due to local and regional climate variability that can be cyclic or erratic. Moderate to severe drought periods are known for the Middle East including Iraq (Trigo et al. 2010), the Sahel (Zwarts et al. 2009), and the Okavango Basin (Ashton et al. 2003, Zwarts et al. 2009). Also in Florida (Everglades) on average every ten years severe droughts can occur, related to the El Niño cycle (Richardson 2010).

3.2 Major habitats and vegetation types

The table below provides an overview of major habitats and vegetation types per site. All sites are dominated by wetland habitats but also contain smaller or larger portions of dry habitat types, either along the edges or on elevated locations (islands, dunes, river banks, etc.) within a site. Three sites (Danube Delta, Doñana and Everglades) encompass marine habitats, and all sites except Okavango and Inner Niger Delta have at least parts with estuarine influences. At all sites various freshwater or brackish helophytic vegetation types (e.g. reed, papyrus or sawgrass marshes) are occurring, often covering relative large areas within each site. Also pools, lakes, rivers and streams are habitats found at all sites. The most diverse assemblies of habitats are found at the Everglades, followed by Doñana, Danube Delta: these contain a whole array of marine to freshwater habitats, dry habitats and wetlands, and various types of dry and flooded forests. The Marshlands of Southern Iraq are the only site entirely surrounded by desert habitats, apart from the estuarine connection to the Persian/Arabian Gulf.

Table 4: Major habitats and vegetation types at each site (with indicated literature sources). The Ramsar wetland types per site can be found in Appendix 3.

Marshlands of Southern Iraq
Rivers, streams and artificial canals; freshwater pools and lake; mudflats; brackish and saline ponds and lakes; permanent marsh or reeds (helophytic vegetation); seasonal and intermittent marshes; woody marsh vegetation; salt pioneer swards; deserts; unvegetated saline lands; dry woodlands and shrub; grasslands and steppe (Abdulhasan et al. 2009, Ramsar 2013)
Djoudj
River channels and streams; permanent freshwater lakes and pools; seasonally inundated brackish lakes and pools; various types of reeds or marsh (helophytic vegetation); Sahelian *Tamarix* shrub; savannah. (UNESCO 2013; Ramsar 2013)
Okavango
Rivers and channels; permanent lakes and pools; permanent marshes or swamps with reed and papyrus (helophytic vegetation); seasonally flooded grasslands and savannahs; occasionally flooded grasslands and savannahs; riverine woodlands; dry woodlands; dry savannahs (Junk 2006, Ramberg et al. 2006, UNESCO 2013)
Inner Niger Delta
Rivers and streams; permanent freshwater lakes and pools; seasonal marshes; natural and artificial bourgou (floating grass) fields; low-lying *Cyperus* marshes (helophytic vegetation); wild rice marshes and arable fields; flood forests; dry savannah and grasslands. (Zwarts et al. 2005, Ramsar 2013)
Danube Delta
Rivers and streams; permanent lakes and pools; flooded islets; reed marshes (helophytic vegetation); riverine flood forests of willows and poplars, cane-fields, sandy and muddy beaches; river sandbanks; wet meadows; various dry grasslands and meadows; sandy and rocky areas; non-flooded deciduous forests; marine levees; brackish lagoons (Gâştescu 2008, Ramsar 2013, UNESCO 2013)
Doñana
Rivers and streams; tidal rivers and estuaries; permanent freshwater pools and lakes; mud and sand flats; lagoons (including saltwork basins); helophytic vegetation; salt marshes, salt pastures and salt steppes; fixed and mobile coastal sand dunes; sand beaches; heath; scrub; maquis and garrigue; phygrana; dry grasslands and steppes; deciduous and coniferous woodland; artificial forest monoculture; extensive agriculture (Junta de Andalucia 2005, Ramsar 2013).
Everglades
Permanent ponds and pools; streams and artificial canals; sloughs; wet sawgrass prairies; cypress swamps; periodically flooded and non-flooded tree islands; non-flooded pinelands or pine rocklands; tropical hardwood hammocks; mangroves; coral reefs; seagrass fields; saltwater marshes (Junk 2006, Richardson 2010, UNEP 2012).

3.3 Human impacts

All seven sites have or had varying degrees of human impacts, activities and system modifications. The most natural site is the Okavango Delta, not being impacted by any waterworks or dams and by hardly any agriculture or land conversions at all. The most heavily impacted site in recent times is the Iraqi Marshlands that were severely drained by the previous regime (see below in the site descriptions). Although the marshes have partially recovered after the regime, the site is still not back to its original size. Also other sites have seen severe human impacts, particularly regarding their hydrology. The Senegal River and its Delta, in which the Djoudj is situated, has many dams and artificial water works. The water regime in the Djoudj is entirely artificial and the site suffers from negative inputs from agriculture. The hydrology of the Everglades is strongly altered to such an extent that it is currently listed as a World Heritage Site in Danger. Other factors that contribute to this state are the many invasive species that have a negative impact on the native species and agricultural pressure. Agriculture and related land conversion, pollution, and sometimes irrigation are impacts at all sites except Okavango. Tourism is regulated at most sites but still has some negative impacts in at least Doñana, Danube Delta and Everglades. Climate change will affect all sites, with the notion that all sites will suffer from more frequent and longer drought events (particularly the Sahel, Middle East and Mediterranean) or more frequent and stronger tropical storms (Everglades) (Christensen et al. 2007, Trigo et al. 2010).The table below provides an overview of human impacts on the seven sites.

Table 5: Reported anthropogenic impacts and threats (based on literature citations in the site descriptions). Crosses only indicate that a certain impact or threat occurs, but do not indicate the strength of the impact or threat.

Impact or threat	Marshlands of Southern Iraq	Djoudj	Okavango Delta	Inner Niger Delta	Danube Delta	Doñana	Everglades
Altered hydrology and waterworks within the site	X	X		X	X	X	X
Dams and waterworks outside the site	X	X		X	X	X	X
Land conversion for agriculture	X	X		X	X	X	X
Irrigation	X	X		X		X	
Pollution by agricultural runoff (pesticides and fertilisers)	X	X		X	X	X	X
Grazing		X		X		X	
Fishing	X			X			
Aquaculture	X			X	X	X	X
Hunting and poaching	X	X	X	X		X	
Tourism		X	X	X	X	X	X
Urban expansion							X
Industrial developments and shipping routes					X	X	
Mining (including oil and gas)	X				X	X	
Exotic species	X	X	X	X	X	X	X
Climate change (drought, storms)	X	X	X	X	X	X	X
Unexploded remnants of war, recent armed conflicts	X			X			

3.4 Site descriptions

Marshlands of Southern Iraq

The Mesopotamian Marshlands or Marshlands of Southern Iraq are situated in the lower floodplain of the Euphrates and the Tigris and are almost entirely surrounded by desert and semi-desert areas. The marshes are consisting of four sub-systems or components: the Central, East Hammar, West Hammar and Hawizeh (Huwaiza) Marshlands. The latter are extending into Iran, but the Iranian part is not included in the World Heritage nomination. The area is a vast complex of freshwater reed marshes, lakes, seasonal and intermittent brackish and saline marshes, canals and streams. They were once the largest wetlands in the Middle East. However, large-scale damage to the marshes started in the 1980s during the Iran-Iraq war. A major onslaught occurred during the late 1990s when almost 90% of the area was drained by the Saddam Hussein regime. Enormous engineering works were constructed for intentional drainage and redirection of incoming waters. The main purpose of the drainage was to crush a popular uprising in southern Iraq after the Gulf War of the early 1990s and to rid the area of its inhabitants and their economic basis. After the fall of the regime and by the end of 2006 between 40 and 60% of the destroyed marshes had standing water again and vegetation appeared to expand, although with lower species diversity and abundances than before the drainage. Between 2008 and 2010 a severe drought has partially reversed the recovery.

At present lack of water remains the largest threat to the marshes and their recovery. Agricultural schemes and inefficient irrigation, embankments and large dams in Iraq and neighbouring countries have reduced the flood pulse, quantity and quality of the inflow water for the marshes. Pollution from agriculture, non-treated urban sewage waters and the nearby oil industry are other sources of pollution. The oil industry as such can also pose a major threat if developments are not well planned. Significant other human disturbances are fishing and hunting, and possibly reed harvesting, especially during the bird breeding season. These used to be traditional and sustainable activities but can pose a threat under the current disturbed situation of the marshes. Presence of unexploded ordinance as a result of several wars continues to be a danger. In spite of all this and after the partial recovery from the large drainage the marshes still encompass much of the characteristic biodiversity. Recent developments are the designation of a National Park in the Central Marshes and increased water levels due to a wet winter and spring in 2013. *Sources: CIMI 2010, Ramsar 2013, Nature Iraq 2010, Richardson & Hussain 2006, Salim 2013, UNESCO 2013.*

Djoudj National Bird Sanctuary (Senegal River Delta)

The Djoudj National Bird Sanctuary is situated within the Senegal River Delta and is consisting of a complex of river channels, streams, ponds, seasonally inundated marshes and a large lake. Djoudj is internationally important for large numbers of various waterbird species that use the site for breeding, staging and wintering. Principal human activities are extensive grazing and ecotourism. Surrounding areas are used for rice cultivation, livestock rearing, and hunting. The Senegal River Delta is strongly altered by artificial waterworks, irrigation works and agriculture. A dam in the estuarine part of the delta prevents any marine salt water intrusion into most of the delta, including Djoudj. This has had negative effects on the vegetation composition of the Djoudj. Other large dams further upstream and irrigation canals for rice cultivation have altered the natural flood pulse of the river and affected the flood plain ecosystems. Water levels in Djoudj are artificially controlled to mimic past flood patterns. Before the artificial flooding, Djoudj used to be listed as a World Heritage Site in Danger and as a Montreux-listed Ramsar Site. *Sources: Ramsar 2013, UNEP, UNESCO 2013, World Heritage Committee 2008, Zwarts et al. 2009*.

Okavango Delta

The Okavango Delta System is located in northern Botswana and is linked to the Okavango River that originates in the Angolan highlands. The Delta is the largest inland delta in the world and is situated within the Kalahari Desert and Savannah woodland region. It is characterised by a hydrological gradient from permanent streams and swamps to seasonal floodplains, riparian woodlands, and dry woodlands. The Delta is one of the most diverse ecosystems in Sub-Saharan Africa supporting a large and diverse array of terrestrial and aquatic species. The high species diversity is considered normal for the southern African region. Very little anthropogenic transformation has taken place so that it is still operating in near natural state. There are no manmade dams and major hydrological infrastructural developments such as canals or water abstraction. The only significant developments are related to limited tourism activities. *Sources: Junk et al. 2006, Ramberg et al. 2006, UNESCO 2013*.

Inner Niger Delta

The Inner Niger Delta in Mali is one of the few free flowing floodplains in the Sahel. It is the largest inland wetland in West Africa and the second largest wetland in Africa, after the Okavango Delta. It supports a high number of animal and plants species and is a refuge for very large numbers of migratory birds, although many of the large mammals, typical for Africa, have disappeared. The human impact on this area is significant as nearly one million people live on the resources of the delta ecosystems, by agriculture, fishing, hunting and tourism. There are several threats: the fishing pressure is very high and the floodplains are grazed by two million cattle and four million sheep and goats. This overgrazing has a severe impact on the natural vegetation and is one of the reasons the once ubiquitous flood forests are on the edge of extinction. Also agriculture (rice cultivation) poses a threat to the natural ecosystems. Finally, water diversion and dams upstream reduced flooding in the Delta. *Sources: Wymenga et al. 2002, Ramsar 2013, Zwarts et al. 2009*.

Danube Delta

The Danube Delta is situated at the Black Sea in northeast Romania and adjoining Ukraine, forming the best preserved delta and the largest continuous marshland in Europe. The reserve, situated in Romania only, comprises of numerous freshwater lakes interconnected by channels and includes the largest area of reed marshlands in the world. It constitutes critical habitats for migratory birds and other animals and supports currently endangered flora and fauna. It is a major wetland on the flyway between central and Eastern Europe, the Mediterranean, Middle East and Africa. Major threats are changes in conditions upstream in the Danube as well as changes in the delta itself. Straightened riverbeds and construction of polders during the former communist regime, flood protection dams and groins cut the river from the floodplain and thus significantly diminish the amount of available sediments. Other threats are waterway navigation and harbour developments in the region, unsustainable tourism, worsening of water quality during the last fifty years, and agriculture, fish farming and forestry. In spite of this the overall basic hydrological and ecological system of the delta is still intact. *Sources: Danube Delta Biosphere Reserve Authority 2013, Gâştescu 2008, Ramsar 2013, World Heritage Committee 2008, UNESCO 2013*.

Doñana National Park

The Doñana National Park in Andalusia, southern Spain, occupies the right bank of the Guadalquivir River at its estuary on the Atlantic Ocean. The site is notable for lagoons and pools, marshlands, fixed and mobile dunes, scrub woodland and maquis. The park supports important resident populations of threatened species of birds and animals. It is the most important non-breeding site for waterbirds in Spain and is a major stop-over on the route to and from Africa for migrating Palaearctic birds. Doñana faces several threats including drainage of marshes and conversion to agriculture, grazing, fisheries, mineral and salt exploitation, hunting, harvesting of wetland vegetation, forestry plantations, use of pesticides, urban development, road construction, tourism and over-grazing. Although it has been affected by these activities and suffered from toxic pollution by a mining incident further upstream in 1998, Doñana is a resilient system. At present the main threats have been averted and restoration activities are under way. *Sources: Junta de Andalucia 2005, UNESCO 2013, World Heritage Committee 2013, WWF España 2013.*

Everglades National Park

The Everglades National Park in the south of Florida, USA, is the largest sub-tropical reserve on the North American continent. The Everglades are a network of wetlands and forests fed by rivers and streams flowing out of Lake Okeechobee, southwest into Florida Bay. Everglades National Park is part of a large, interconnected freshwater system called the Kissimmee-Lake Okeechobee-Everglades Watershed. From the Bay the water moves through the island passes into the Florida Keys. It is a shallow basin tilted to the south-west and underlain by extensive Pleistocene limestone. Its juncture at the interface of temperate and sub-tropical America, fresh and brackish water, shallow bays and deeper coastal waters creates a complex of habitats. Major threats are alterations of the hydrological regime, adjacent urban (Miami, among others) and agricultural expansion, invasive exotic species, and tourism. Mainly because of the hydrological situation and the high number of exotic species the Everglades were included in the List of World Heritage in Danger in 2010. *Sources: Richardson 2010, World Heritage Committee 2013, UNEP 2012, UNESCO 2013*.

4. Comparison of biological diversity

4.1 Methodology

For this comparative analysis existing data on species occurrence from the seven wetland sites were used. The following taxonomic groups were considered: vascular plants, fish, amphibians, reptiles, mammals, birds, and Odonata (dragonflies and damselflies). Per taxonomic group the following species data were collected: total number of species, endemic species and subspecies, exotic species, and globally threatened species. The data ideally cover the period 2003-2013. If no data from this period were available, historic data were used instead (indicated in the results below).

Data were retrieved from relevant and verifiable literature, site specific official monitoring sites, or were kindly provided by local monitoring institutions or organisations (see Acknowledgements in Chapter 1). In addition, for waterbirds we used data from the International Waterbird Census (IWC). Appendix 2 provides an overview of all data sources per category. In the results below individual data sources are not shown.

Endemic species

An endemic species is defined as a species which is only found in a given region or location and nowhere else in the world (Vreugdenhil et al. 2003). The IUCN Red List also uses the definition as "species occurring naturally within one country only" (IUCN 2013). However, national and political region endemism of large countries or regions has far less significance than endemism of small countries and very limited range endemism (Vreugdenhil et al. 2003). This would result in a bias towards large-sized countries (for example, USA or Mali vs. Iraq or Spain as related to the properties in the present study). Instead of endemic species, BirdLife International uses the geo-political neutral term restricted-range-species: a restricted-range bird species is a land bird which is judged to have had a breeding range of less than 50,000 km^2 throughout historical times (since 1800) (Stattersfield et al. 1998).

For this comparative analysis we used a geographically definition of endemics: e.g. an entire river delta, a wetland system, or part of a river basin. The geographic definition of an endemic species will also in part depend on the size of a species or its ability to migrate, e.g. a plant is sessile whereas a bird can cover larger distances. For this study it was not possible to analyse all data of species categorized as endemic in literature. In most cases we relied on literature sources that categorized a species as endemic. Species that were mentioned in literature as endemic solely by using national or political boundaries were excluded. It should be noted that none of the endemic species is solely confined to any of the sites analysed. However, frequently they are key sites within the distribution of the endemic species.

Threatened species

Species threat status was determined based on the IUCN global Red List. We compared available species lists with the online global Red List (period 2000-2012). Otherwise we relied on IUCN Red List data recently cited in literature sources or as provided by monitoring institutions listed in Appendix 2. Threatened species considered for this report belong to the categories critically endangered, endangered or vulnerable. However, not all areas and species groups were yet completely assessed for the global Red List. In some cases we referred to national red lists as an indication in the text but did not use these data in the comparison between sites.

4.2 Vascular plants

Data of vascular plant species are not complete or were not fully investigated in several sites. The most reliable and complete data are available for the Danube Delta, Doñana, Everglades and Okavango Delta. The table below provides the recorded vascular plant diversity at the seven sites.

Table 6: Estimates of species numbers of vascular plants reported for the seven wetland sites: total species number, number of aquatic species, endemic species, and threatened species. Footnotes: [1]historically 371 species are known from the area, these are from a larger area than the Marshes and several species were not (yet) found back since the reflooding in 2003; [2]not fully investigated, minimum number; [3]at least 40 aquatic and wetland plant species were recorded in the Central Marshes after reflooding, 99 were recorded historically; [4]26-33 endemic species known for Senegal as a whole (DPN 2010); [5]mostly concentrated in the rocky pinelands on the eastern Everglades and often species with humid tropical affinity; [6]not assessed; 5 species are listed as "of conservation concern"; [7]around 35 species are listed as threatened federally in the USA.

Site	Total	Aquatic or wetland plant species	Endemic species	Globally threatened species
Marshlands of Southern Iraq	86[1]	>40[3]	at least 1	0[6]
Djoudj NBS	121-132	n.a.	n.a.[4]	n.a.
Okavango Delta	1078-1276	208	n.a.	7
Inner Niger Delta	189[2]	n.a.	at least 1	n.a.
Danube Delta	2383	142	3	1
Doñana NP	1362-1535	367	5	8
Everglades NP	1146	>100	65[5]	n.a.[7]

Due to the lack of complete data on vascular plants at some sites, including from Iraqi, species numbers are difficult to compare across the sites. However, though not all exact, the numbers are at least indicative for plant species richness in all sites except the Inner Niger Delta. Species numbers are highest in the Danube Delta, followed by Doñana, Everglades and Okavango Delta. The number of plant species is much lower in the Iraqi Marshlands, which is related to the arid climate and the absence of habitats such as coastal dunes, calcareous wet and dry grasslands and various forest types that are present in the aforementioned four sites. The low number of plant species in Djoudj can be related to the relative small area compared to the other sites.

All sites include many plant species that are not wetland species. The number of aquatic plants is included to indicate the importance of the site as a wetland habitat. However, data for aquatic plants was only available for four sites. The definition of aquatic and wetland species differs between the sites or was not specified in literature sources. Nevertheless, it indicates that in the most plant species rich sites the majority of plant species are not considered as wetland or aquatic species.

The number of endemics is not known for many sites. The highest numbers are known for the Everglades. Few species are known to occur in the Marshlands of Southern Iraq, Inner Niger Delta and the Danube Delta. The globally threatened status was not yet assessed for the majority of plant species of the sites analysed.

4.3 Fish

Fish are one of the best investigated taxonomic groups primarily because subsistence and/or commercial scale fishery is an important economic activity in all seven areas. For example, of the confirmed 43 fish species in the Marshlands of Southern Iraq at least 18 are economically important, including exotic species (Salim 2013). The table below provides an overview of the ichthyofauna of the seven sites.

Table 7: Estimates of species numbers of fish reported for the seven wetland sites: total species number, freshwater species, marine and euryhaline species, endemic species, exotic species, and threatened species. Footnotes: 1excluding exotic species; 2around 85 species are known from the entire Okavango River system; 3due to a dam the connection to sea is lost; 4mostly coral reef and mangrove species; 595% of fish biomass caught in Doñana consists of exotic species; 6not all species assessed due to continuous new additions; 7not assessed; assessment carried out present, 11 species are listed as "of conservation concern"; 8additionally 5 species are listed as near threatened; 9all marine species, freshwater unknown or not assessed

Site	Total	Freshwater	Marine, euryhaline	Endemic species	Exotic	Globally threatened species
Marshlands of Southern Iraq	43[1]	25	18	6	7	0[7]
Djoudj NBS	75-92	n.a.	0[3]	9	n.a.	n.a.
Okavango Delta	71[2]	71	0	1	possibly 1	2
Inner Niger Delta	138	138	0	24	n.a.	3[8]
Danube Delta	134	74	75	5	9	11
Doñana NP	27	18	9	1	7[5]	1
Everglades NP	238	30	208[4]	3	>35[6]	5[9]

The Everglades hold the highest number of fish species. However, the majority of these are marine species from coral reef and mangrove habitats. The number of true freshwater species is only 30, which is much closer to the species numbers of the sites with the lowest species numbers, the Marshlands of Southern Iraq (25) and Doñana (18). It seems likely that the subdivision of species according to salinity was undertaken with different methods and criteria in each country or region. Furthermore, extent to which fish species are adapted to differing salinity levels is a continuum. The 'marine and euryhaline' group includes salt-tolerant species, true marine species, but also migrating fish. The species for the Okavango Delta and the Inner Niger Delta were all grouped as freshwater species as there is either no or only a very remote connection to seawater. However, these areas will also have more saline habitats due to the semi-arid character of the wetlands, and therefore the occurrence of some salt-tolerant fish species is likely. The number of marine and migrating fish species demonstrates the importance of the deltaic wetlands close to the coast for marine species, particularly for the Marshlands of Southern Iraq and the Danube Delta. The Danube and Iraqi deltas are comparable for two reasons: they are large lower delta regions with estuarine influence that have extensive reed areas. The Marshlands of Southern Iraq are actually the largest freshwater wetland site in the Persian/Arabian Gulf area connected to the sea.

Although the absolute number of fish species in the Marshlands of Southern Iraq is low compared to most of the other sites it is still higher than in the Doñana, which is also a World Heritage Site. It is also probable that more fish species will be found in the area in future: there are at least 44 native freshwater species described for the lower part of the Euphrates-Tigris River Basin, of which 14 are endemic (Coad 1996, 2010). For example, the recently new described endemic fish species *Aphanius mesopotamicus* (Coad 2009) was recently also found near the Iranian part of the Hawizeh Marsh (Keivani 2012).

Contrary to the total species number, the relative and absolute number of endemic species is high in the Marshlands of Southern Iraq compared to most other sites of which data are available. It is possible that the isolation and the extreme climate of fluctuating water and salinity levels are driving forces behind the level of endemism, but may also be the cause for the lower total number of species that can tolerate these conditions.

The number of exotic fish species is high in some of the sites, particularly in the Everglades. In Florida in general species were introduced for fisheries or are escaped/released tropical aquarium fish (NPS 2013, UNEP 2012). In the Doñana up to 95% of the fish biomass and 98% of the abundance caught are exotic fish species (Moreno-Valcárcel 2013). All native fish species in Doñana are at least "vulnerable" at national level. Only in the in the Okavango River and Delta apparently no alien introductions of fish have been reported (Ramberg 2004), although this information is nearly ten years old. In the nearby Zambezi basin at least one exotic species (Nile Tilapia) is known and may have reached the Okavango, too (Tweddle, 2007). Exotic species are an actual or potential threat to indigenous and endemic fish species. For example, the invasive species of numerous taxonomic groups, including fish, were judged as a major threat to the OUV of the Everglades (UNEP 2012) and as mentioned above form the bulk of biomass in the Doñana.

All sites and the river systems they belong to, except the Okavango, are severely impacted by human activities, such as artificial hydrology and dams, pollution, drainage, agricultural activities, overfishing and the aforementioned release of exotic species. This explains the number of species that are threatened, although for many species the global threat assessments have not been completed, including the Iraqi species, and so it is possible that this number may rise in the future.

4.4 Amphibians and Reptiles

Data availability of amphibians and reptiles varies widely between the seven wetland sites. While the two European sites, the Okavango Delta and the Everglades are relatively well studied, data from Iraq and particularly the two West-African wetlands are deficient. Table 8 below provides an overview of the available herpetofauna data.

Table 8: Estimates of species numbers of amphibians (A) and reptiles (R) reported for the seven wetland sites: total species number, endemic species and subspecies, exotic species, and threatened species. Footnotes: [1]minimum number of species confirmed; [2]most exotic reptile species are not included, [3]not all exotic species are assessed due to continuous additions; [4]the Euphrates Soft-shelled Turtle (*Rafetus euphraticus*), its status needs to be updated (IUCN 2013).

Site	Total		Endemic species		Endemic subspecies		Exotic species		Globally threatened species	
	A	R	A	R	A	R	A	R	A	R
Marshlands of Southern Iraq	3	18	0	1	0	0	n.a.	n.a.	0	1[4]
Djoudj NBS	6[1]	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0	0
Okavango Delta	29	64	0	0	0	0	n.a.	n.a.	0	0
Inner Niger Delta	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0
Danube Delta	10	12	0	0	0	0	0	0	0	1
Doñana NP	12	24	5	8	0	0	0	1	3	4
Everglades NP	21	58[2]	0	1	2	7	4	>40[3]	0	3

The number of amphibian species is lowest in the Marshlands of Southern Iraq. Even though amphibians in Iraq are under-investigated, it is not likely that further investigations will drastically increase the number of species in the Marshlands of Southern Iraq. There are no records of additional frog, toad or newt species from the marshes from the past (Amr 2009, Garstecki & Amr 2011). The recent history of the area as well as the extreme climate and its relative isolation may have resulted in this lower species richness.

Nearly complete and reliable reptile data exist from the Marshlands of Southern Iraq, Okavango delta, Danube Delta, Doñana and Everglades. At all sites the number of species includes species of both dry and wet habitats. In the Iraqi Marshlands there are several true wetland species, including the Tessellated Water Snake (*Natrix tessellata*), the Caspian Terrapin (*Mauremys caspica*) and the endemic Euphrates Soft-shelled Turtle (*Rafetus euphraticus*). For the Inner Niger Delta only large species are mentioned, e.g. Python (*Python sebae*), Nile Crocodile (*Crocodylus niloticus*) and Nile Monitor (*Varanus niloticus*) (Wymenga et al. 2002), although it is likely that the area is inhabited by other species as well.

The (potential) number of reptile species for the Marshlands of Southern Iraq falls within the range of the Danube Delta and Doñana. The number of reptile (and amphibian) species is highest in the Okavango Delta, followed by the Everglades. In the Everglades the type of species is particularly rich, including several reptiles that are confined to marine habitats (four sea turtles and some mangrove species), many snakes, terrapins, and two species of crocodile. As the number of exotic (invasive) reptile species in the Everglades is also very high and the status is not always clear, they are not all included in the total species number. Particularly the Burmese python is causing severe damage to the indigenous fauna in southern Florida (Krysko et al. 2011, UNEP 2012).

Endemic species are only known from the Everglades (2 amphibians and 7 reptiles) and the Marshlands of Southern Iraq (1 reptile). The presence of endemic species is unknown for Djoudj and the Inner Niger Delta. It is confirmed that endemic amphibians and reptiles were not found in the Okavango, Danube Delta and Doñana.

4.5 Mammals

Reliable and recent species numbers of mammals exist for the Marshlands of Southern Iraq, Djoudj, Okavango Delta, Danube Delta, Doñana and Everglades. For Djoudj it is not sure whether all smaller mammal species (e.g. rodents and insectivores) are included in the data. An overview of recorded mammal species numbers is provided in the table below.

Table 9: Estimates of species numbers of mammals reported for the seven wetland sites: total species number, endemic species, exotic species, and threatened species. Footnotes: [1]unclear weather small mammals are included; [2]exotic species not included; [3]one endemic and two near-endemic species.

Site	Total	Endemic species	Endemic subspecies	Exotic species	Globally threatened species
Marshlands of Southern Iraq	39	1 (3)[3]	1	1	3
Djoudj NBS	29[1]	0	0	n.a.	4
Okavango Delta	123	0	0	n.a.	7
Inner Niger Delta	>14	n.a.	n.a.	n.a.	3
Danube Delta	54	0	0	n.a.	3
Doñana NP	37	1	0	0	2
Everglades NP	36[2]	0	0	17	2

Investigations have confirmed the presence of 39 mammal species in the Marshlands of Southern Iraq. These include Grey Wolf (*Canis lupus*), Jungle Cat (*Felis chaus*), Long-eared Hedgehog (*Hemiechinus auritus*), and Small Indian Mongoose (*Herpestes auropunctatus*), the restricted range species Euphrates Jerboa (*Allactaga euphratica*) and Harrison's Gerbil (*Gerbillus mesopotamiae*). Also the two species of Otter, Eurasian otter (*Lutra lutra*) and Maxwell's smooth-coated otter (*Lutragale perspicillata maxwelli*, an endemic sub-species) were confirmed in both Iraq (Omer et al. 2012) and Iran (Mirzaei et al. 2010). Investigations with e.g. life-traps were limited so far; the occurrence of the endemic Bunn's Short-tailed Bandicoot Rat (*Nesokia bunnii*) could therefore not yet be reconfirmed. However, other recent new findings show that the presence of several other mammal species could be well confirmed with additional monitoring efforts.

The African continent is known for its rich mammal fauna, particularly the megafauna. This is reflected in the number of species in the Okavango Delta, where a large part of the African megaherbivores are occurring: e.g. White Rhinoceros (*Ceratotherium simum*), Hippopotamus (*Hippopotamus amphibius*), Giraffe (*Giraffa camelopardalis*), the African Elephant (*Loxodonta africana*), and 18 species of Antelopes and Buffalo. Also African Lion (*Panthera leo*) and hyenas are part of the fauna (Ramberg 2004). However, the other two African sites have very impoverished mammal faunas. A large part of the wildlife, particularly the megafauna, of the western Sahel and Sudan zones has been exterminated or at the verge of extinction (Zwarts et al. 2009). In Djoudj, and also the Senegal River Delta at large, none of the larger species remains, including Lions, Giraffes, and Elephants remain (APAAT 2009, Zwarts et al. 2009). In the Inner Niger Delta a complete mammal inventory was never carried out; only larger species are known, including small populations of Hippopotamus (*Hippopotamus amphibius*) and the African manatee (*Trichechus senegalensis*) (Wymenga et al. 2002, Zwarts et al. 2009).

The number of mammal species in the Marshlands of Southern Iraq is in the same range as the World Heritage Sites Doñana (37), Everglades (36) and Danube Delta (54). Even though several mammal species are not typical wetland species, they are drawn to the areas due to the wetland. For example the number of mammal species in Botswana would be much lower in the dry Savannah climate of Botswana without the Okavango (Ramberg 2004). For the Marshlands of Southern Iraq, situated in a much drier desert climate, this is even more evident. Here one endemic subspecies and potentially three (near) endemic mammal species occur. The only other site with a known endemic mammal is Doñana, harbouring an important population of the critically endangered Iberian Lynx (*Lynx pardinus*). All seven sites analysed, including the Marshlands of Southern Iraq, are important for several globally threatened mammal species.

4.6 Birds

Birds are one of the best investigated taxonomic groups in all seven sites. The table below provides an overview of the recorded avifauna diversity. The data include all bird species, breeding, migratory and resident.

Table 10: Estimates of species numbers of birds reported for the seven wetland sites: total species number, endemic species and subspecies, species with isolated or satellite populations, exotic species (if available), and threatened species. Footnotes: [1]264 species recorded before drainage; [2]near-endemic sub-species

Site	Total	Endemic species	Endemic subspecies	Isolated or satellite populations	Exotic species	Globally threatened species
Marshlands of Southern Iraq	224[1]	2	4	2	0	12
Djoudj NBS	327	0	0	0	n.a.	3
Okavango Delta	444	0	0	1[2]	n.a.	7-8
Inner Niger Delta	125	0	0	0	n.a.	6
Danube Delta	341	0	0	n.a.	n.a.	5
Doñana NP	224	1	0	0	0	5
Everglades NP	366	0	2	n.a.	12	4

Similarly to fish, the total recorded diversity is comparably low in the Marshlands of Southern Iraq, but the number of endemic species and subspecies is relatively high. All the sites included in the assessment are internationally important.

4.7 Waterbirds

Waterbirds often constitute the majority of bird in wetland habitats and are monitored at many of the sites in this study under the International Waterbird Census (IWC). This is one of the world's largest and longest running citizen science monitoring programmes. Under the IWC a coordinated count in the middle of January each year is undertaken at tens of thousands of sites across Africa, Asia, the Caribbean, Europe and South America. Of the sites considered in this report, the following have been monitored under the IWC: the Marshlands of Southern Iraq, the Djoudj, Okavango, Inner Niger Delta, Danube and Doñana. Comparing counts from the IWC has several advantages, as counts are undertaken at a similar time of year with a broadly similar methodology. However, the counting effort and coverage varies between these sites and between years within sites. For example, in some years large parts of the Okavango Delta are inaccessible in January because water levels are not deep enough for a boat and constantly changing courses of rivers also impose restrictions on determining and counting monitoring sites on an annual basis. The Marshlands of Southern Iraq are partially inaccessible for security reasons and in some areas, e.g. in Mali, there are not enough specialists to cover a huge area. On the other hand, a relatively small and accessible site such as Doñana can be covered fairly consistently and completely year after year. Consequently, figures should be interpreted with due caution and in no way considered a definitive estimation of species richness or abundance. The census also concentrates on waterbirds, other bird species are erratically considered and other species groups are not included at all. In the analysis below, only waterbird species are discussed.

Waterbird species richness from the IWC

In January, each of the sites considered has a different significance for waterbirds. The Marshlands of Southern Iraq are an important non-breeding (northern wintering) site for many Palaearctic species, including the globally threatened Black-tailed Godwit *Limosa limosa*. The marshlands also host a particularly large diversity of northern wintering Anatidae (ducks and geese – sixteen species) and Scolopacidae (waders – seventeen species).

Table 11: Recorded waterbird species richness. Numbers in brackets for Djoudj NBS indicate the numbers recorded in the Senegal Delta as a whole, including the Diawling National Park in Mauritania.

Site	Number of Families	Number of Species
Marshlands of Southern Iraq	14	82
Djoudj NBS	19 (20)	93 (102)
Okavango Delta	20	100
Inner Niger Delta	18	91
Danube Delta	12	67
Doñana NP	17	97

In addition, the Marshlands of Southern Iraq are also extremely important for passage migrants, moving from the breeding grounds in Western Siberia to the non-breeding (northern wintering) areas in southern and eastern Africa. By January, many of these waterbirds have moved on to their non-breeding grounds and so are not recorded (or if so, then not in large numbers) during the IWC count. This is also the case for the Danube and Doñana. This may also partly explain the extremely high species richness of the more southerly Okavango Delta and Djoudj. Despite this, sixteen populations of species in the Marshlands of Southern Iraq in the period 2003 - 2012 have exceeded the 1% of population size during the IWC January count at least once (Table 12). This means under Criterion 6 of the Ramsar Convention, the Marshlands of Southern Iraq are of international importance for these populations. Currently the area of the marshlands designated as a Ramsar site considers Criterion 6 only for Pygmy Cormorant *Phalacrocorax pygmeus*, though this should perhaps be reconsidered particularly for the extremely high counts of Marbled Teal *Marmaronetta angustirostris* in recent years. The Marshlands of Southern Iraq harbour a very large proportion of Marbled Teal of the entire flyway. In fact, the population appeared to be much larger once water bird census data were collected again in Iraq after 2003.

Table 12: Waterbird populations with globally significant numbers in the Marshlands of Southern Iraq IWC counts, 2003-2012[1]

Species	Population	Max count	1%[2]
Northern Shovellor *Anas clypeata*	W Siberia/SW Asia NE & Eastern Africa	10257	4000
Common Teal *Anas crecca*	crecca, Western Siberia/SW Asia & NE Africa	17526	15000
Great White Egret *Casmerodius albus*	albus, Western Asia/South-west Asia	2078	1000
Kentish Plover *Charadrius alexandrinus*	alexandrinus, SW & Central Asia/SW Asia & NE Africa	3216	1000
Eurasian White Stork *Ciconia ciconia*	Western Asia/South-west Asia	1080	270
Little Egret *Egretta garzetta*	garzetta, Western Asia/SW Asia NE & Eastern Africa	3016	1000
Black-winged Stilt *Himantopus himantopus*	himantopus, W C & SW Asia/SW Asia & NE Africa	464	460
Slender-billed Gull *Larus genei*	West South-west & South Asia (bre)	6827	1500
Limosa limosa	limosa, West-central Asia/SW Asia & Eastern Africa	2498	1000
Marbled Teal *Marmaronetta angustirostris*	South-west Asia	38218	480
Great White Pelican *Pelecanus onocrotalus*	Europe & Western Asia (bre)	1803	260
Pygmy Cormorant *Phalacrocorax pygmeus*	South-west Asia	12059	1000
Eurasian Spoonbill *Platalea leucorodia*	(major), Western Asia/South-west & South Asia	514	230
Glossy Ibis *Plegadis falcinellus*	falcinellus, South-west Asia/Eastern Africa	1644	1000
Little Grebe *Tachybaptus ruficollis*	iraqensis	1394	60
White-tailed Lapwing *Vanellus leucurus*	SW Asia/SW Asia & North-east Africa	480	250

Table 13: Site count totals of waterbirds in the IWC counts, 2003-2012

Site	Min Count	Max Count	Year max
Marshlands of Southern Iraq	13000	87000	2010
Djoudj NBS	134000	463000	2006
Okavango Delta	1000	43000	2008
Inner Niger Delta	67000	102000	2009
Danube Delta	39000	202000	2006
Doñana NP	115000	329000	2008

The counted total numbers at each site illustrate the complexity of comparing IWC counts directly between these sites. The smaller and relatively simpler site complexes (Danube, Djoudj and Doñana) have apparently larger numbers of birds, which is an artefact of comprehensive coverage and accessibility. This is also demonstrated by the much larger numbers (>1million) counted under aerial surveys from the Inner Niger Delta than during IWC ground/boat based counts that are unable to cover the most important sites. These counts do however provide information on a minimum number of birds occurring in an area, and all sites greatly exceed the threshold for Ramsar criterion 5 (sites which regularly support >20,000 waterbirds). The highest count from the Marshlands of Southern Iraq complex is four times this threshold, clearly demonstrating the international importance of the site for waterbirds. The actual numbers at the site throughout the year are likely to be far higher still.

[1] Population estimates of waterbirds in Western Asia are often relatively uncertain. This table indicates species that may occur in globally or regionally significant numbers in the January IWC count of the Marshlands of Southern Iraq, but more research is needed to confirm definitively the importance of the marshlands for these species and populations, during January and at other times during the year.

[2] The 1% of populations are derived from the Waterbird Populations Estimates V (2012)

4.8 Odonata

Dragonflies and damselflies (Odonata) are the only invertebrate taxonomic group included in this analysis as they are potentially the best studied group and are strongly connected to wetlands. Even so, data are lacking from many sites or are incomplete. For most sites except Doñana and the Danube Delta the number of species is an estimate.

Table 14: Estimates of species numbers of Odonata reported for the seven wetland sites: total species number, endemic species and subspecies and threatened species. Footnotes: [1]total number is an estimate based on recent and historic records; [2]one endemic was actually observed in the Marshlands of Southern Iraq after 2003; [3]Most species are not assessed at neither international nor national level; [4]estimate of reported species.

Site	Total	Endemic species	Endemic subspecies	Globally threatened species3
Marshlands of Southern Iraq	25[1]	1 (2)[2]	0	1
Djoudj NBS	n.a.	n.a.	n.a.	0
Okavango Delta	94-98	0	0	0
Inner Niger Delta	n.a.	n.a.	n.a.	n.a.
Danube Delta	35	0	0	0
Doñana NP	29	0	0	0
Everglades NP[3]	40[4]	n.a.	n.a.	0

The deficiency of data makes a profound comparison of sites difficult. The number of species in the Marshlands of Southern Iraq, actually or historically observed, is lowest, but not much lower than the species number in Doñana. In Iraq as a whole up to 41 species were recorded (Garstecki & Amr 2011). It is therefore possible that in future more species may be found in the Marshlands of Southern Iraq. One endemic and globally vulnerable species, *Brachythemis fuscopalliata*, was recorded recently in the Marshlands of Southern Iraq.

4.9 Total species numbers

The table below provides an overview of the total species numbers per taxonomical group in the seven sites.

Table 15: Estimates of total species numbers of various taxonomical categories reported for the seven wetland sites. Details per taxonomical group are discussed in detail below. Shaded colours indicate ranking of sites within taxonomic group: green= highest, blue= second highest, yellow = lowest. Footnotes: [1]estimates of reported species; [2]majority are marine fish species. Species numbers partially include exotic species as the status is not always clear and not all data sets or reports clearly distinguish exotic species (for the Marshlands of Southern Iraq these are excluded).

Site	Plants	Fish	Amphibians	Reptiles	Mammals	Birds	*Vertebrates*	Odonata
Marshlands of Southern Iraq	86	43	3	18	39	224	*327*	25[1]
Djoudj NBS	121-132	92	6	n.a.	29	327	*>448*	n.a.
Okavango Delta	1078-1276	71	29	64	123	444	*731*	94-98
Inner Niger Delta	189[1]	138	n.a.	n.a.	>14	125	*>263*	n.a.
Danube Delta	2383	134	10	12	54	341	*551*	35
Doñana NP	1362	27	12	23	37	224	*323*	29
Everglades NP	1146	238[2]	21	58	36	366	*719*	40[3]

Due to differing sampling methods and deficiency of data at some properties calculating a total number of species would be misleading. Instead, the total species numbers per taxonomic group are compared. Only data of vertebrates are summed. The latter underestimates the number of species for the two Sahelian sites as they have deficient data of amphibians and reptiles.

Climate, surface area of a given site, the number of different habitats at a site or property, and the age of a system are important factors influencing species numbers (e.g. Junk 2006). For example, the number of species in desert and arctic climates is usually lower than in tropical or humid climates.

No single site has the highest species number across all taxonomic groups considered. However, the Okavango Delta has the highest number of species in five out of seven considered taxonomic groups (plus the total number of vertebrate species), and the Everglades are second highest with four out of seven taxonomic groups considered (plus total number of vertebrate species). Both properties are (near) tropical and have a diverse number of habitats. The Marshlands of Southern Iraq are the only true desert wetland, but nevertheless only have the lowest number of species for three of the taxonomical groups. Therefore it can be concluded that even

though the Marshlands of Southern Iraq are at the lower range regarding total species numbers, for some of the taxonomical groups the marshes still rank equal to or slightly higher than some designated World Heritage sites.

4.10 Endemic species

The table below provides an overview of the number of endemic species recorded at each site.

Table 16: Endemic species numbers per wetland site. spp= species, subs= subspecies, n.a. = data not available or unknown. Shaded colours indicate ranking of sites within taxonomic group: green= highest, blue= second highest, yellow = lowest (only for total). Specific remarks and footnotes can be found in the discussions per taxonomic group above.

Site	Plants	Fish	Amphibians & Reptiles		Mammals		Birds		Odonata	*Total*
	spp	spp	spp	subs	spp	subs	spp	subs	spp	
Marshlands of Southern Iraq	at least 1	6	1	0	1 (3)	1	2	4	2	*20*
Djoudj NBS	n.a.	9	n.a.	n.a.	n.a.	n.a.	0	0	n.a.	*9*
Okavango Delta	n.a.	1	0	0	0	0	0	(1)	0	*2*
Inner Niger Delta	at least 1	24	n.a.	n.a.	n.a.	n.a.	0	0	n.a.	*25*
Danube Delta	3	5	0	0	0	0	0	0	0	*8*
Doñana NP	5	1	13	0	1	0	1	0	0	*21*
Everglades NP	65	3	1	9	0	0	0	2	n.a.	*80*

The Everglades have both a high species number and a large number of endemic species, largely because of the subtropical location of the site, and the large number of endemic plant species. The Okavango has the lowest number of endemic (sub)species, although it is likely to have at least several endemic plant species (no verifiable data exist). This wetland system is well connected to other African areas and nearly all species within the considered taxonomic groups have a wider distribution throughout southern or sub-Saharan Africa. In this perspective the Okavango Delta is the opposite of the Marshlands of Southern Iraq: the latter are very isolated, have an extreme (arid) climate, relatively low total species numbers but relatively and absolutely high numbers of endemic species and subspecies. The Marshlands of Southern Iraq have the highest number of recorded (near) endemic species and subspecies for 3 out of 6 taxonomical groups.

4.11 Threatened species

The table below summarizes the number of threatened species per site. Threatened categories follow the IUCN criteria and include the categories critically endangered, endangered and vulnerable.

Table 17: Globally threatened species n.a. = not available and/or not assessed. Specific remarks and footnotes can be found in the discussions per taxonomic group above. Shaded colours indicate ranking of sites within taxonomic group: green= highest, blue= second highest, grey= not assessed.

Site	Plants	Fish	Amphibians	Reptiles	Mammals	Birds	Odonata	*Total recorded or assessed*
Marshlands of Southern Iraq	n.a.	0	0	1	3	12	1	*17*
Djoudj NBS	n.a.	n.a.	0	0	4	3	0	*7*
Okavango Delta	7	2	0	0	7	7-8	0	*24-25*
Inner Niger Delta	n.a.	3	n.a.	0	3	6	n.a.	*12*
Danube Delta	1	11	0	1	3	5	0	*21*
Doñana NP	8	1	3	4	2	5	0	*23*
Everglades NP	n.a.	5	0	3	2	4	0	*14*

As not all species groups and sites were assessed at global level, it is difficult to compare the sites. For all sites at least some globally threatened species are recorded. Nearly all sites assessed suffered and suffer from negative anthropogenic impacts (see chapter 2) and/or are important as a refuge amid (even more) affected areas. The occurrence of threatened species, both nationally and globally, reflects this. The number of currently assessed and recorded globally threatened species is highest in the Okavango Delta and Doñana. The number may be higher for several of the other sites, including the Marshlands of Southern Iraq, when more species are assessed and more data become available. It highlights the global importance of all sites for threatened species, including the Marshlands of Southern Iraq.

4.12 Conclusions for the Marshlands of Southern Iraq

The Marshlands of Southern Iraq were compared with six wetlands sites or properties that are globally important, e.g. because they are nominated as World Heritage Sites, on the tentative list and/or a Ramsar site. It is evident that more data on biodiversity and its distribution are needed to assess the full extent of the importance of the Marshlands of Southern Iraq. Having the most extreme and arid climate of all seven sites, the Marshlands of Southern Iraq do not rank highest regarding the total number of species. In spite of this and of the negative impacts of the past on the marshes, the marshes have values that compare with the other globally important sites. The Marshlands of Southern Iraq have the lowest number of species for only two of the seven taxonomical groups that were assessed. They have a high relative number of endemic species; the absolute number of endemic species is within the same range as other globally important wetland sites. Regarding waterbirds and migratory birds the Marshlands of Southern Iraq play an important role at regional, flyway and global levels: the number of waterbird species and the absolute number of waterbirds is at a similar level to sites that have been nominated as a World Heritage Site, and sixteen waterbird species exceeded 1% of the flyway population.

In summary, the following can be stated for the Marshlands of Southern Iraq:

1. The Marshlands of Southern Iraq are one of the world's largest wetland ecosystems in an extreme desert climate with a specific combination of species. Compared to other lowland wetland systems they harbour a high absolute and relative number of endemic species.
2. Species numbers across several taxonomical groups are comparable to other globally important wetland properties, including those nominated as World Heritage Sites.
3. The Marshlands of Southern Iraq are globally important for waterbirds and migratory birds; the number of waterbird species and the absolute number of waterbirds is similar to other globally relevant wetlands. Populations of at least sixteen waterbird species tentatively exceed 1% of the entire flyway population based on recent count information.

5. Comparison of institutional management

5.1 Introduction

Management and legal protection are vital aspects for the conservation of protected natural areas such as World Heritage properties. This chapter provides a comparison of the institutional management of six of the wetland sites selected in chapter 2. The comparison on institutional management focuses only on sites that are either a World Heritage property or are on the Tentative List. Therefore the Inner Niger Delta was not included in the analysis in this chapter.

We focused on aspects relevant for managing and protecting World Heritage properties. The Operational Guidelines for the Implementation of the World Heritage Convention specifies requirements for the protection and conservation of World Heritage properties (UNESCO World Heritage Centre 2012). The Operational Guidelines section II.F (Protection and Management) is relevant, specifically the following (in summary):

- All properties inscribed on the World Heritage List must have adequate long-term legislative, regulatory, institutional and/or traditional protection and management to ensure their safeguarding, at the national, regional, municipal, and/or traditional level.
- Legislative and regulatory measures and its implementation at national and local levels should assure the survival of the property and its protection against development and change that might negatively impact the Outstanding Universal Value, or the integrity and/or authenticity of the property.
- Each nominated property should have an appropriate management plan or management system which must specify how the Outstanding Universal Value of a property should be preserved, preferably through participatory means (involvement of partners and stakeholders). Management systems may vary according to different cultural perspectives, the resources available and other factors.
- Monitoring and assessment of the impacts of trends, changes, and of proposed interventions.
- World Heritage properties may support a variety of ongoing and proposed uses that are ecologically and culturally sustainable and which may contribute to the quality of life of communities concerned. The State Party and its partners must ensure that such sustainable use or any other change does not impact adversely on the Outstanding Universal Value of the property. Impact assessments for proposed interventions are essential for all World Heritage properties.

In this study, we considered the following aspects for institutional management and conservation:

1. Legal status and protection
2. Coordination and cooperation
3. Management plans
4. Monitoring and conservation

For each aspect overviews of the absence or presence of relevant features are provided and a brief summary of their nature. As there are many different constructions of legal and management systems in each property and country, only some example cases are presented for each aspect. Full descriptions of management aspects of all sites are beyond the scope of this study. Rather than providing a full detailed overview of all aspects, this chapter is meant to derive relevant advice for the nomination process of the Marshlands of Southern Iraq and provide examples of solutions for institutional management and conservation that can be useful for the nomination process in Iraq.

5.2 Legal status and protection

This section considers the legal and protection status of the properties. Legal protection can be achieved by the status of the delineated property such as a restricted reserve or national park. To investigate the legal status of each property the following features are used: the IUCN categories for protected areas, the national or international legal status, and the international status through conventions and other treaties. The table below provides an overview of the legal and protected status of each property.

Table 18: Legal and protected status and international conventions or treaties. See text for explanations of the IUCN protected area categories.

Site	Reported IUCN protected area category	National and international legal protected status	International conventions
Marshlands of Southern Iraq	None reported. Indicative: II and/or VI	National: Only for two components: 1. Central Marshes National Park (as of 2013) 2. Asafiya Wildlife Park (part of Hawizeh Marshes; currently dry and outside the proposed World Heritage delineation) International: none	World Heritage: Tentative List (serial nomination for four components of the Mesopotamian Marshes) Ramsar: only one component of the property (Hawizeh Marshes)
Djoudj	II (Whole property)	National: Djoudj National Bird Sanctuary (status of national park; whole property) International: none	World Heritage: whole property Ramsar: whole property; other sites in vicinity within Senegal River Delta
Okavango Delta	IV (Moremi Game Reserve)	National: 1. Moremi Game Reserve (larger part of the property) 2. Various Controlled Hunting Areas (CHAs) and Wildlife Management Areas (WMAs) International: none	World Heritage: Tentative list (whole property) Ramsar: whole property
Danube Delta	V (whole property) Ia-VI (various subparts)	National: Danube Delta Biosphere Reserve (whole property) International: Natura2000 (EU Birds and Habitat Directives)	World Heritage: whole property in Romania, not the Ukrainian part of the delta Ramsar: whole property in Romania; other sites in vicinity within the delta
Doñana	II (national park area) V (buffer zone)	National: Doñana National Park (whole property) International: Natura2000 (EU Birds and Habitat Directives)	World Heritage: whole property Ramsar: whole property
Everglades	Ib (whole property) IV (outside property)	National: Everglades National Park (whole property) International: none	World Heritage: whole property, not the rest of the wetland system. Ramsar: whole property; other sites in vicinity within the wetland system Other: Cartagena Convention & SPAW

The IUCN protected area management categories classify protected areas according to their management objectives. They are recognised by international bodies such as the United Nations and by many national governments as the global standard for defining and recording protected areas (Dudley 2008). The following categories are discerned:

- Ia Strict Nature Reserve
- Ib Wilderness Area
- II National Park
- III Natural Monument or Feature
- IV Habitat/Species Management Area
- V Protected Landscape/ Seascape
- VI Protected area with sustainable use of natural resources

The World Database on Protected Areas WDPA (IUCN & UNEP 2013) was used as a source for IUCN categories reported per property. In July 2013 the designation of the Central Marshes (component of the Marshlands of Southern Iraq) as the first Iraqi national park has been decided (Nature Iraq 2013). This new status has not yet been assessed by the WDPA. The aims of the National Park are to conserve the biological and aesthetic values of the site along with their associated cultural heritage, sustainable socio-economic development, and local livelihood improvement. Applying these aims to the guidelines for protected area categories (Dudley 2008), the Central Marshes National Park may be assigned to category II (National Park) or (portions of the area) as category VI (Protected area with sustainable use of natural resources). In addition, the national and international legal status was listed in the table above as they are provided by official national or regional authorities (various sources, mostly from the official websites of the management authorities or the management plans, see next sections). The World heritage status is assessed from the UNESCO World Heritage Centre (UNESCO 2013), and the status as a Wetland of International Importance (Ramsar site) from the Ramsar Sites Information service (Ramsar 2013).

All properties described have varying degrees of legal protection. The legal status varies between the properties from national park, wilderness area to protected landscape. Also within a property the strictness of regulations can vary, e.g. within the Danube Delta. The Marshlands of Southern Iraq were until recently the only property without a delineated legal protection status. The designation of the aforementioned Central Marshes National Park is a crucial first step towards protection. The government of Iraq is presently working on a strategy and law for assigning protected areas in the country under the 'National Protected Areas Network Project'. In the coming years, the other three components of the marshes are foreseen to be designated as a protected area. The two European sites, Danube Delta and Doñana, also have an international legal status as they are designated under the European Union (EU) Birds and Habitats directives. These EU regulations have binding legal status for the member states. Unlike with many international conventions, such as World Heritage and Internationally Important Wetlands (Ramsar sites), the EU regulations can have legal penalties should states not comply with the regulations.

To date, there are no specific guidelines concerning what constitutes adequate legislative and regulatory measures, with only a few countries having enacted specific legislation on natural World Heritage. From a practical point of view, the more complex the legal protective status of the World Heritage property, the more complicated management can become, and conflicts can arise at regional or local levels from a lack of harmonisation of legal tools. Commonly protected areas at national level are subject to a wide range of laws (UNESCO et al. 2012). For the six properties analysed in this chapter an array of non-site-specific, national, regional and local laws, regulations and policies indeed apply. The most important of these are related to environmental and species protection, water management and protection, or spatial planning procedures. The nature, coverage and level of enforcement of these laws vary greatly between countries. An in-depth analysis of all relevant laws and regulations is out of scope of this study, but examples are provided here. The first concerns the two properties that are in the process of nomination as World Heritage sites. Botswana is preparing the nomination for the Okavango Delta. Here, relevant legislation is provided by the Environmental Impact Assessment Act of 2005, Wildlife Conservation and National Parks Act of 1992, Monuments and Relics Act of 2001, Forest Act of 1976 and Water Act of 1968. Land use is strictly controlled by the local Tawana Land Board which is the land authority representing the government (UNESCO 2013). Iraq, preparing the Iraqi Marshland nomination, has suffered from decades of political violence, war and a repressive regime. At present the country has not yet fully stabilised and recovered, but nevertheless efforts are being made in reviewing its legislation. For example, relevant laws recently updated are the Protection and Improvement of the Environment Law No.27 (2009) and the Wildlife Protection Law No.17 (2010). A regulation for protected areas, the Protected Areas Establishment and Management Bylaw, is currently being drafted.

A second example is Environmental impact assessments (EIA), an important instrument for avoiding and reducing negative effects on protected areas and species. The USA, the two EU countries and Botswana have various clear and strict EIA procedures. However, in Senegal these are weaker and in Iraq adequate EIA laws or procedures are only under development. In particular for expected developments the oil and gas sector but also other industries, infrastructure developments and agriculture developing and implementing EIA procedures will be important to prevent negative impacts on the Marshlands of Southern Iraq while still enabling necessary economic activities.

Legal status and protections: conclusions and recommendations

All six properties analysed have varying degrees of legal protection. However, only the Marshlands of Southern Iraq at present do not yet have a protected status for the entire property. The designation of the Central Marshes National Park was a crucial first step towards protection. Legal protection needs to be extended to the other parts of the marshes to meet the requirements from the Operational Guidelines for World Heritage. A protected area status does not imply that all parts need to be a national park. There can be varying degrees of protection, as long the integrity of the area is ensured. Varying degrees of protection are present in some of the other properties analysed. Further steps towards legal protection are being prepared by the Iraqi government. The type of protected status should co-depend on the occurrence of rare species, sensitivities of habitats and the sustainable use by the local population and other economic sectors, including the oil and gas industry and future tourism developments. For ensuring the integrity of a future World Heritage site, legal protection of certain sites may also be needed outside the delineation. For example for the protection of water or in buffer zones.

For all properties various environmental and protective general laws at different levels are applicable. Iraq is at present updating its legislation. This process may be helped by an analysis of the current legislation as compared to the needs for the protection of the Marshlands of Southern Iraq. This will help to identify legal gaps, identify double or hampering legislation, and highlight enforcement and implementation needs. Regulations regarding environmental impact assessments (EIA) should be a priority. EIA can enable planning economic activities without harming the marshlands, including external effects from outside the protected areas. For example, for oil and gas companies, equal and strict standards for all companies should be implemented and enforced. Experiences with impact assessment regulations can be drawn from e.g. the Ramsar Handbook 'Guidelines on Impact Assessment' or the EU policies regarding Habitat and Bird Directives and Water Framework Directives, including the implementation in various EU member states.

5.3 Coordination and cooperation

Coordination: authorities and institutions

Coordination of the various public, private, and state actors is crucial for management, monitoring, policy, use and conservation of protected sites. Several models for coordinating organisational bodies exist, varying from centralised top-down organisations to multi-stakeholder platforms.

Table 19 below provides an overview of existing management institutions and bodies for the six sites. Management at three sites is coordinated by top-down state bodies: Djoudj and Everglades at national or federal level, and Doñana at regional level. The responsible management bodies for the Okavango and Danube Deltas are broad platforms involving several stakeholders, national and local, private and public parties. In both cases these bodies are still officially coordinated by a national ministry. For the Marshlands of Southern Iraq an overarching coordinating body does not exist. There are several ministries, governorates, local authorities, private companies and tribal communities that manage the area. At present an inter-departmental Drafting Team of World Heritage Nomination is functioning as an intermediate body to structure the management of the area, pending the development of a coordinating body. In 2014 a National Committee for the World Heritage will be installed as a first step towards a management institution.

Table 19: Coordinating management institutions and bodies

Site	Institutions and bodies	Level and type
Marshlands of Southern Iraq	Drafting Team of World Heritage Nomination National government Ministry of Environment Ministry of Water Resources Regional and local administrations Traditional (tribal) land use and rights	National, but under various Ministries. There is no overarching or coordinating management institution for the entire property yet, temporary coordination by the interdepartmental Drafting Team of World Heritage Nomination and Iraqi National Committee for Protected Areas.
Djoudj NBS	National Parks Direction (Direction des Parcs Nationaux, DPN)	National; DPN is part of the Senegalese Ministry of Environment
Okavango Delta	Okavango Wetland Management Committee (OWMC) Department of Environmental Affairs (DEA)	OWMC has a multi-sectorial composition of various ministries, district authorities, communities, NGO and research institutions. Coordination by Department of Environmental Affairs (DEA) of the Ministry of Environment, Wildlife and Tourism.
Danube Delta	Danube Delta Biosphere Reserve Authority (DDBRA)	Public body lead by a Scientific Council including representatives from DDBRA and from all other organizations involved in the reserve (local authorities, ministries, health services, research institutions, Romanian Academy of Science, economic companies etc.). Officially it falls under the national Ministry of Environment and Sustainable Development (MESD).
Doñana NP	Department of Environment and Land Planning (Consejería de Medio Ambiente y Ordenación del Territorio)	Regional; Department of the regional Andalusian Government
Everglades NP	National Park Services (NPS)	National; NPS is part of the USA federal Ministry of the Interior

Local participation and stakeholder involvement

One of the central aims of the World Heritage Convention is to encourage participation of the local population in the preservation of their cultural and natural heritage, as outlined in the current Strategic Objectives of the World Heritage Committee, also referred to as the '5 Cs': Credibility, Conservation, Capacity-building, Communication and Communities. It is an essential part of World Heritage site management that all stakeholders possibly affected by the listing of a site should be made aware of, consulted and involved in the interpretation and assessment of its values, the preparation and presentation of the nomination and subsequent management systems (UNESCO et al. 2012).

The number and type of stakeholders, and local, national and international actors varies between the six sites. At all sites, either within or close to the property delineation, communities are living that use, influence and are economically dependent on the site, e.g. through farming, fishing, hunting or tourism. Tribal communities are present at the Marshlands of Southern Iraq, Djoudj, Okavango and Everglades. For example, Iraqi Marshlands were traditionally divided amongst tribes with very clear boundaries and transaction systems, but without any official recognition. Rather, land rights are recognized for respective tribes related to specific areas. In Botswana local tribes were also traditionally using and managing the Okavango Delta. This traditional management is slightly adapted and included in current management schemes for the area.

At all sites except Okavango intensive agriculture is an important sector. Nearby large urban areas with more than half a million inhabitants are present near the Everglades (Miami) and the Marshlands of Southern Iraq (e.g. Basra and Nassiriya). Industrial, shipping, mining, and oil and gas sectors are present near the Marshlands of Southern Iraq, Djoudj, Danube Delta, and Doñana. In some cases stakeholders are involved in the management bodies themselves (Okavango and Danube Delta), through developing and acting on the site management plans (e.g. Djoudj, Okavango and Everglades), or through special programmes (e.g. Doñana). Stakeholder involvement is a constant process, and at most sites it has increased during recent years. In the Marshlands of Southern Iraq, stakeholder involvement is still in its infancy. A special example of broad stakeholder involvement and management is shown in Box 1 about Lake Chilika, India. This can be a relevant example for the Marshlands of Southern Iraq as it shows how local communities, water management, fisheries and industrial sectors are integrated in a complex wetland area in a low-income country.

BOX 1: Example of stakeholder involvement at Lake Chilika, Odisha (India)

Lake Chilika is a brackish coastal lagoon situated in Odisha, India, and forms the livelihood basis for more than 0.2 million fishers and 0.4 million farmers. Lake Chilika consists of shallow marine, brackish and freshwater ecosystems and is a hotspot of biodiversity. Over a million migratory birds commonly winter here. It provides the basis of rich a fishery contributing to over 6% of Odisha's foreign exchange earnings and sustains a large tourism sector. Over the years, the lagoon has encountered several human induced problems leading to an overall loss of biodiversity and productivity, adversely affecting local livelihoods and economy. Problems included siltation due to littoral drift and sediments from the inland river systems, decline of the water surface area, and conflicts between fishermen and non-fishermen communities about fishing rights. Also rapid expansion of commercial shrimp aquaculture has contributed significantly to the decline of fisheries and bird populations. Concerted action was initiated by the Odisha State Government with support from the Government of India to adopt adaptive conservation and management actions.

Chilika Development Authority

The Government of Odisha, concerned by ecosystem degradation and recognising the dependence of many people on the lake's resources, set up the Chilika Development Authority (CDA) in 1991 under the aegis of Department of Forests and Environment of the state. It was meant as a nodal agency to undertake measures for ecosystem protection through interventions, research, collaboration and networking. The Governing Body is chaired by the Chief Minister and consists of secretaries of various government departments, members of two district legislative assemblies, collectors of three districts with wetland responsibility, agriculture production commissioners, and NGOs.

Despite having very limited human resources to deliver its functions, CDA has effectively adopted a model of networking wherein it coordinates the delivery of various elements of an implementation plan through various state government agencies. An extensive partner and a collaboration network also helps provide strategic input to wetland management. A crucial feature of the current institutional arrangements is the linkage with grass root level community organisations. CDA has facilitated a federation of local NGOs and CBOs to support the organisation and delivery of various programmes. These programmes are primarily related to livelihoods and advocacy, and involve boatmen association, bird protection committee, watershed associations, and the Chilika Lake Fishermen Central Cooperative Society Limited. Major actions undertaken by the CDA include hydrological intervention, participatory watershed management, awareness raising, sustainable tourism, improving community infrastructure and livelihoods, community managed fisheries, building knowledgebase, and management planning. Two examples of actions are described in further detail:

Participatory watershed management
Degradation of catchments, particularly over the last six decades, had led to siltation of the lagoon. CDA initiated a massive participatory watershed management to restore the vegetative cover, improve soil moisture and enhance resources for community livelihoods. Through dedicated capacity building, conflict resolution and trust building, CDA enabled formulation of watershed management plans, and also provide resources for their implementation. This has led to increase in overall forest cover, improvement in soil conditions, rejuvenation of commons such as village ponds, grazing lands, and ultimately reduction in overall silt loading into Chilika.

Community managed fisheries
Fishing in Chilika was historically managed by community institutions. However, weak capacities and economic viability led to their gradual decline, with the fishers falling in a debt trap to scrupulous moneylenders. In 2010, CDA through technical collaboration with Japan International Cooperation Agency (JICA) formulated a Fisheries Resource Management plan (FRMP) based on over 3 years of resource survey, assessment of biology and ecology of eight commercially important high value fish, prawn and mud crab species; modelling for various conservation and management options; wide- range stakeholder consultations and ratification by an expert committee. The plan entails convergence in fisheries governance to ensure sustainable fish production through wise use of fisheries resources as well secure livelihoods of fishers. The plan recommends a co-management strategy with active participation of fishers, such as the establishment of a new Central Fishermen Cooperative Society and an initiative to provide ice boxes to the fishers so that the catch could be maintained for longer time and fishers could choose their preferred point of sale.

Source: Wetlands International South Asia (Mr Ritesh Kumar); Kumar & Pattnaik 2012.

International cooperation

International cooperation is particularly relevant for sites that are close to international borders or are situated in river basins that encompass several countries. This is the case for Djoudj (Senegal River basin and at the border to Mauritania), Danube Delta (Danube river basin and at the border to Ukraine and Moldova), Okavango Delta (Okavango River Basin and close to border with Namibia), and the Marshlands of Southern Iraq (Euphrates-Tigris River basin and at the border to Iran). As countries share the river basin, they also share the water resources, which may be a cause for conflicts. Population growth, industry, agriculture, tourism, climate change, and food security place increasing constraints on water resources and ecosystems. Transboundary water management and coordination is therefore needed to effectively and equably manage this resource and prevent disputes (INBO & GWP 2012). International river basin organisations have been established for this purpose. These exist for the Senegal River (Djoudj), Okavango (Okavango Delta) and Danube (Danube Delta), but not for the Euphrates-Tigris Basin. Box 2 below provides a description of existing river basin organisations relevant for the properties. The two main methods of conflict resolution adopted by institutional frameworks on International Rivers are water allocation and benefit sharing. Water allocation involves determining how much water each country should use from the river, while benefit sharing involves treating the entire river system as a

whole and sharing the benefits that accrue as a result of using the river's waters. Recently, benefit sharing has become the preferred method of conflict resolution in International River basins. For example, benefit sharing on the Senegal River has been successful in resolving conflict among the Senegal River basin countries (Ayaa 2012).

BOX 2: Examples of International River Basin Organisations

Senegal River Basin Development Authority (OMVS)
The OMVS (Organisation pour la mise en valeur du fleuve Sénégal) is an organisation for jointly managing the Senegal River basin consisting of Guinea, Mali, Mauritania and Senegal. The OMVS's legal and regulatory framework, the fundamental conventions of 1972 and the Senegal River Water Charter of 2002, state that river water must be allocated to the various use sectors. The resource is not allocated to riparian states in terms of volumes of water to be withdrawn, but rather to uses as a function of possibilities. These uses can be for agriculture, fishing and fish farming, livestock raising, biodiversity, hydroelectric energy production, drinking water supply, health, industry, navigation and the environment. Mali's principal interests are the maintenance of river levels so as to obtain navigable access to the sea and energy produced by the Manantali dam. This dam, although located in Mali, belongs to all the members of the OMVS. Mauritanian and Senegalese interests converge in power production and irrigation, while Senegal seeks to improve livelihoods for local populations.

Source: www.portail-omvs.org; Ayaa (2012)

The Permanent Okavango River Basin Water Commission (OKACOM)
The Permanent Okavango River Basin Water Commission advises the three riparian states Angola, Botswana and Namibia about the best possible use of the river's natural resources. The OKACOM Agreement (1994) commits the member states to promote coordinated and environmentally sustainable regional water resources development, while addressing the legitimate social and economic needs of each country. The 1994 OKACOM Agreement gives it legal responsibility to:

- Determine the long term safe yield of the river basin
- Estimate reasonable demand from the consumers
- Prepare criteria for conservation, equitable allocation and sustainable utilisation of water
- Conduct investigations related to water infrastructure
- Recommend pollution prevention measures
- Develop measures for the alleviation of short term difficulties, such as temporary droughts

The three countries recognise the implications that developments upstream of the river can have on the resources downstream. Most of the river is currently undeveloped and is recognised as one of the few "near pristine" rivers in the world. Water-based tourism is the second largest foreign currency earner for Botswana, and most tourism activities are centred on the delta system, which forms part of the larger Okavango River system. The river sustains over half a million people who use the plant and animal resources found in the river to support livelihoods.

Source: www.okacom.org

ICPDR - International Commission for Protection of Danube River
The International Commission for the Protection of the Danube River (ICPDR), established in 1998, is a transnational body, which has been established to implement the Danube River Protection Convention. The Contracting Parties include Austria, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Germany, Hungary, Moldova, Montenegro, Romania, Slovakia, Slovenia, Serbia, Ukraine and the European Union. National delegates, ministerial representatives, technical experts, and civil society and scientific representatives cooperate to ensure the sustainable and equitable use of waters in the Danube River Basin. The ICPDR promoted policy agreements and the setting of joint priorities and strategies for improving the

state of the Danube and its tributaries. This includes improving the tools used to manage environmental issues in the Danube basin, such as the Accident Emergency Warning System, the Trans-National Monitoring Network for water quality, and the information system for the Danube (Danubis). The ICPDR was nominated as the platform for the implementation of all transboundary aspects of the EU Water Framework Directive (WFD). In concert with the ICPDR, cross border cooperation also takes place in the Danube Delta under the "Danube Delta Transboundary Biosphere Reserve", involving Romania, Ukraine and Moldova. A common monitoring programme for the Danube Delta, including specialists from both sides of the Danube Delta has been elaborated and implementation of the joint monitoring programme started in 2008. In spite of this, not all water issues between the Delta countries could be resolved yet.

Source: www.icpdr.org; WHC (2009)

Even though the organisations described in Box 2 certainly have not solved all problems, they are very relevant for the conservation and protection of the properties, especially since these organisations more and more also take biodiversity, climate and conservation areas into consideration. Recent and current conflicts in the Middle East may have prevented the establishment of a river basin organisation for the Euphrates-Tigris basin. The general water scarcity is posing a risk for new conflicts in the Middle East. Cooperation at basin level may contribute to more efficient sharing of resources between countries, have a positive effect on water availability for the marshlands and may thereby also reduce the potential for conflicts over water.

Coordination and cooperation: conclusions and recommendations

Management in all designated World Heritage properties and the Okavango delta is coordinated by an institution or board. These vary between top-down state organisations and broad stakeholder involving platforms. In Iraq the interdepartmental Nomination Team is functioning as a temporary coordinating body as a management body or institution for the area is currently not extant. Given the size of the area, that several national ministries and three governorates are involved in management, in addition to local communities, industrial activities and other stakeholders, a coordinating institution is urgently needed. As a first step, Iraq will install a National Committee for World Heritage under the Ministry of Environment. It is recommended that this committee, together with the Ministry, will set out a 'roadmap' towards building a management institution or coordination body. Aspects to be considered are the type of institution (top-down or a broad platform), whether it will be specific for the World Heritage Property, for the Iraqi Marshlands at large, or for all protected areas in Iraq. Stakeholder involvement or representation is also vital in such a coordination body. For local communities and tribes, agriculture, fisheries, hunting and reed harvesting are important marshland ecosystem services that need to be taken into consideration. Also the oil and gas sector is an important economic actor that should be involved or consulted.

Limited water availability is one of the main threats to the integrity and quality of the Marshlands of Southern Iraq. Therefore adequate river and water management at national and international level is needed to ensure the survival of the marshes. The Euphrates-Tigris basin is at present an area without international cooperation at basin level, such as exist for the Senegal, Okavango and Danube rivers. River basin cooperation involving all countries in the basin will be essential for sharing the limited water resources, effective transboundary management and prevent future conflicts on water.

5.4 Management plans

Management plans take various forms and for natural World Heritage sites the planning process and format is often guided by national protected area policy. The most basic requirement is that the management plan describes the overall goal of the site, details the specific objectives for the natural and cultural resources, and identifies the management activities needed to achieve those objectives (UNESCO et al. 2012).

Table 20: Management Plans for the six properties.

Site	Management plans	Remarks
Marshlands of Southern Iraq	• New Eden Master Plan for Integrated Water Resources Management in the Marshlands Area (New Eden Group 2006). • Management Plan for the Al-Hawizeh Marsh Ramsar Site of Iraq (Nature Iraq 2008). • Mesopotamia Marshland National Park Management Plan (New Eden Project for Integrated Water Resources 2010) • Managing for Change. The Presence and Future of the Marshes of Southern Iraq (Canada-Iraq Marshlands Initiative 2010).	Plans developed for various purposes and often under difficult circumstances. A major concern regarding all existing management plans for the Marshes is that none of them is being implemented currently. See Garstecki & Amr 2011 for a complete overview. New management plans are under development for each component site as part of the World Heritage nomination.
Djoudj NBS	• Management plan for Djoudj NBS 2010 – 2014 (Plan de gestion du Parc National des Oiseaux du Djoudj 2010 – 2014)	Follow-up plan of the previous "Plan d'amenagement et de gestion du Parc National des Oiseaux du Djoudj (PNOD) et sa periperie." The plan describes goals, management, budgets, stakeholder involvement, conservation goals, water management and monitoring.
Okavango Delta	• Okavango Delta Management Plan ODMP (2008)	Required by the National Wetlands Policy and Strategy and the Ramsar Convention. Includes long-term vision, overarching framework and contextual guidelines for all other district strategies, research needs, capacity building, and monitoring. Main principles include strengthening ownership through accountability and the active participation of all stakeholders both during development and implementation of the plan. It also applies sensitivity to aspects of gender, HIV and AIDS.
Danube Delta	• Master Plan for Danube Delta Biosphere Reserve (Rezervația Biosferei Delta Dunării Master Plan) 2005 • Strategic plan for sustainable tourism in the Danube delta (Plan strategic pentru dezvoltarea turismului durabil în Delta Dunării) 2009	Master plan for the Danube Delta, including institutional, physical and economic context, site description, management goals, and monitoring. A separate plan was made for sustainable tourism.
Doñana NP	• Natural Resources Management plan for Doñana (Plan de Ordenación de los Recursos Naturales de Doñana) • Plan for sustainable development in Doñana (Plan de Desarrollo Sostenible de Doñana)	Natural Resources Management Plan by regional government in line with EU regulations for Natura2000. It includes natural, social, economic and cultural site characterisations, goals, zoning of access and activities, environmental planning and monitoring goals. The Plan for Sustainable Development describes the sustainable economic use, tourism and stakeholder involvement.
Everglades NP	Comprehensive Everglades Restoration Plan (CERP) Everglades National Park - General Management Plan (GMP), under development	The Comprehensive Everglades Restoration Plan (CERP) is a framework and guide to restore, protect, and preserve the water resources of central and southern Florida. A draft for an all-encompassing master plan (GMP) was developed including stakeholder involvement and was released for public consultation and comment in 2013.

For all six sites one or several plans exist. In all cases these plans are not only specifically developed for the World Heritage status, but combine the needs for conservation at local, national and international level and for various types of protected areas. All plans describe overall goals, conservation and restoration needs, management bodies, budgets, stakeholder involvement and monitoring. Separate plans can exist for e.g. conservation measures (Everglades) sustainable use (Doñana) and tourism (Danube Delta). It should be noted that many properties did not have management plans at the time of nomination as a World Heritage site meeting the modern requirements of today. Several management plans were composed or updated recently

(see the table above). For the Everglades the development process of a new management plan is close to be finalised. For the Marshlands of Southern Iraq management plans exist for only some of the components, but these do not yet meet the requirements of the World Heritage as the plans were aimed at a wide range of objectives and had varying geographical focuses (Garstecki & Amr 2011). As part of the nomination process new plans are being developed for each of the four components. Starting the development of these plans should be a high priority for the Iraq, as the process will take time given the necessary stakeholder involvement.

Management plans: conclusions and recommendations

All the analysed sites have management plans in various stages of development, review and implementation. For Iraq, the existing management plans and frameworks have the potential to contribute to developing one or several management plans for a World Heritage nomination. However, at present none of these plans would be a suitable template or basis that could be adapted and used for this purpose. As part of the nomination procedure management plans for each of the four components of the Marshlands of Southern Iraq are being developed. After this the plans need to be implemented and an overarching framework is needed for the four plans. A first step will be a roadmap to implementation and plan a revision trajectory after the first years of implementation. Experience in the other five sites has shown that the planning process takes time, as it is also important to include various stakeholder groups, both at national and local level.

5.5 Monitoring and conservation

Monitoring

Monitoring is a fundamental part of managing, for World Heritage sites as well as any protected area. It provides the information needed to assess how the site is performing over time with respect to a wide variety of social and ecological issues, allowing managers to adapt as necessary (UNESCO et al. 2012). Monitoring is an important instrument to measure the state of a conservation area or property and the success of management, conservation and restoration efforts.

Monitoring at most properties is organised through various institutional bodies (see Table 21 and Box 4 below). These can be state institutions as part of the site management authorities (e.g. Marshlands of Southern Iraq, Djoudj and Everglades), designated scientific or university institutions (e.g. Okavango and Doñana) or mixed institutions (Danube Delta). The various institutions have differing goals and monitor different indicators for each site. The monitoring programmes for Okavango Delta, Doñana and Everglades are the most diverse and complete. Monitoring in for example Djoudj is mostly focused on water management, birds, tourism and socio-economic development. The process for assembling the biodiversity data for the previous chapter showed that also at well-monitored sites gaps may exists. These gaps can reflect lack of capacity and staff, varying priorities, or accessibility to sites due to remoteness and security. At all sites monitoring is a joint effort by state and private institutions and involving volunteers. In Iraq various monitoring schemes are distributed over several state bodies, NGOs (e.g. Nature Iraq) and universities. In the recent past various national, local and international initiatives for scientific investigations were initiated, some of which are still extant. Given the precarious security situation in Iraq it was and sometimes still is difficult to get data for the area. At present a centralised monitoring institution does not exist for the Marshlands of Southern Iraq. In view of the various threats and constraints for the area and for proper management an institution to coordinate, plan, and integrate the various monitoring systems, institutions and programs will be vital. Furthermore, the effort to fill data gaps of various taxonomical groups has to be increased. However, the latter is also applicable to several of the sites in other countries.

Table 21: Monitoring institutions

Site	Institutions	Indicators and items monitored
Marshlands of Southern Iraq	Ministry of Environment-Technical Department Ministry of Water Resources, Planning and Research Section - Marshlands and Wetlands Rehabilitation Center (CRIMW) Non-governmental organisations: Nature Iraq Various universities with monitoring or scientific programs	1. Water quantity and quality 2. Flooding levels 3. Bird monitoring 4. Ad-hoc monitoring of other taxonomical groups 5. Social and ecological status
Djoudj NBS	Djoudj Biological Station (Station biologique du Djoudj), under Direction des Parcs Nationaux (DPN)	1. Bird monitoring 2. Water quantity and quality 3. Invasive species 4. Vegetation
Okavango Delta	Okavango Research Institute O.R.I.	1. Biodiversity of most taxonomical groups 2. Systems ecology and vegetation 3. Water quantity and quality 4. Flooding levels 5. Weather 6. Fire 7. Climate, Land-use, Institutions and People 8. Human health 9. Integrated scientific research
Danube Delta	Danube Delta Biosphere Reserve Authority (DDBRA)	1. Climate and air quality; 2. Hydrology, hydrobiology and water quality; 3. Soil quality; 4. Biodiversity of most taxonomical groups 5. Natural resources; 6. Economic activities and human population.
Doñana NP	Doñana Biological Station (DBS)	1. Biodiversity of most taxonomical groups 2. Meteorology and climate 3. Geomorphology 4. Hydrology and water management 5. Vegetation and fauna management 6. Land use 7. Integrated scientific research
Everglades NP	South Florida Natural Resources Center (SFNRC), as part of National Park Service (NPS)	1. Biodiversity of most taxonomical groups 2. Hydrology and water quality 3. Restoration and management 4. Invasive plant and animal species 5. Land use 6. Marine and estuarine resources 7. Tourism 8. Management

BOX 3: Examples of monitoring institutions

Okavango Research Institute (O.R.I.)

O.R.I. (formerly the Harry Oppenheimer Okavango Research Centre) is part of the University of Botswana. It is a research institute for the study and conservation of the Okavango Delta and other southern African wetlands, river basins, watersheds and surrounding drylands. It was founded in response to plans to use the Okavango for a large scale water supply programme. Apart from scientific research it manages a monitoring programme for the Okavango Delta, the Okavango Delta Information System (ODIS). ODIS is a knowledge management system which brings together scientific data and information (spatial and non-spatial) to facilitate research and information sharing about the Okavango Delta and Basin amongst researchers, resource users and managers.

Source: www.orc.ub.bw

Danube Delta Biosphere Reserve Authority (DDBRA)
DDBRA has an Integrated Monitoring Program for the biosphere reserve, with three main goals:

- Provide information based on research in physics, biology and social sciences to the scientific community, administration and politics.
- Support systematic exchanges of scientific information.
- Support the integrated monitoring of the biosphere reserve, especially concerning biological diversity, ecosystem management, human impacts, global change and sustainable development.

The objectives of the integrated monitoring system are supervision of the natural capital's evolution, conservation of biological diversity and genetic resources in the Danube Delta and assisting the decision making process the socio-economical management.

Source: www.ddbra.ro

Doñana Biological Station (DBS; Estación Biológica de Doñana)
DBS is an Institute for Research of the Spanish Council for Scientific Research (CSIC). The Spanish Interministerial Commission of Science and Technology (CICYT) recognized DBS as Singular Scientific and Technological Infrastructure (ICTS) to the Doñana Scientific Reserve, with the following main goals:

- Provide communication and scientific infrastructures for the Doñana National Park allowing automatized and standardised monitoring and the development of scientific research activities.
- Provide access to these facilities to the scientific community in Spain and the EU.
- Conservation activities in Doñana.

Source: www.ebd.csic.es

South Florida Natural Resources Center (SFNRC)
SFNRC is a division of Everglades National Park of the US federal National Park Services (NPS) that provides scientific information and environmental assessments to the National Park Service units of south Florida and to the Department of the Interior. SFNRC scientists seek to conserve and, where necessary, restore the normal suite of interactions between the biological and physical elements of the environment in order to ensure a functional ecosystem and its associated biological diversity. Reflecting the holistic nature of the ecosystem, the centre works to integrate applied science with management actions toward the preservation of resources for the enjoyment of future generations.

Source: www.nps.gov

Conservation and restoration programmes

As shown in the overview of human induced threats and impacts in chapter 2 (table 5) at all sites there are negative impacts caused by human activities. The most strongly altered sites, especially concerning hydrology, are the Marshlands of Southern Iraq, Djoudj and the Everglades. But also in the Danube Delta and Doñana several hydrology changes, management issues and pollution have led to degradation of the systems. Two sites even had a status of World Heritage in Danger in the past (Doñana and Djoudj), and at present the Everglades still has this status. For Doñana various measures to clean the property after a mining incident in the 1990s and a new management system improved the area in such a way that it was removed from the endangered list. Conservation Restoration and reflooding efforts in the Marshlands of Southern Iraq and examples of measures for Djoudj and the Everglades are described in the box below. For Djoudj, Doñana, and the Everglades integral restoration programmes were developed to try to counter the damage that was inflicted on the sites. External pressure, e.g. from World Heritage Commission evaluations, contributed to initiate such programmes and projects. In Iraq several initiatives, plans and ideas exist for restoration of the marshlands. However, there is not yet a comprehensive overarching restoration plan or national vision for the area.

BOX 4: Examples of conservation issues

Reflooding and restoration efforts in the Marshlands of Southern Iraq

Restoration of the Marshlands of Southern Iraq started right after the fall of the Saddam Hussain regime. Local residents and the Ministry of Water Resources took efforts to start reflooding the marshlands again. Uncoordinated breaching of dikes and earthen embankments together with other measures were used to release back water from the Euphrates and Tigris into the marshland area. Later a number of national and international projects were launched for a more coordinated reflooding of the area. At the beginning of 2004 nearly 20% of the marshes were reflooded and by the end of 2006 between 40 and 60% of the destroyed marshes had standing water. Between 2008 and 2010 a severe drought has partly reversed the recovery. The reflooding and quick vegetation regrowth after 2003, together with the notion that the marshlands are an inherently dynamic and resilient system, lead to initial expectations and hope that with enough water restoration of the marshes would be successful soon. The drought and subsequent retreat of the marshes damped these expectations. Furthermore, it is often not clearly understood that reflooding is not equal to wetland restoration. Altered hydrology, reduced water availability, and pollution remain some of the problems and it takes time for species to return or recover. Several projects and organisations have been established that address water resources in the nation of Iraq as a whole and the entire southern marshes area, including: The Centre for the Restoration of the Iraqi Marshlands (CRIM), New Eden Project, Canada-Iraq Marshlands Initiative (CIMI) (2004-2010), Iraq Marshlands Restoration Program (USAID) (2003-2006), UNEP project for Environmental Management of the Iraqi Marshlands (2004-2009), and UNEP-UNESCO Joint Project in 2009 on "Natural and Cultural Management of the Iraqi Marshlands" (2009-present). To date, there is no overarching restoration plan or national vision for the marshlands.

Source: Al-Hilli et al. 2009; CIMI 2010; Richardson & Hussain 2006

Conservation issues in Djoudj

Djoudj was inscribed on the List of World Heritage in Danger in 2000 as a result of increasing problems with the invasive plant species *Salvinia molesta*, which was closing all open water bodies in the property and thus threatening the water bird populations. The invasive aquatic species project, Projet de Gestion Intégrée des Végétaux Aquatiques Envahissants (GIVAQUE) has supported the establishment of five village committees to help combat invasive plants. The Action Plan, developed in the context of the removal of the property from the List of World Heritage in Danger focuses on three areas: 1) preservation and restoration of the ecological characteristics of the property, 2) development of ecotourism facilities and products, 3) integration of the property within the socio-economic and environmental landscape. Furthermore, the building of the Dama dam had permanently stopped salt water from entering the property and changed the hydrology. This further facilitated the spread of invasive species and reduced food availability to the birdlife. The changes to hydrology lead to salinization of soils due to lack of flushing, reduced amplitude in water levels, shrinking of bird colonies of certain species and disappearance of others. The property was removed from the List of World Heritage in Danger in 2006, as the *Salvinia* problem was brought under control through biological control and following the initiation of an artificial hydrological management system. Although the partially reconstructed hydrology had very positive effects on the ecology in Djoudj, some negative effects of the changed hydrology in the Senegal Delta and the river basin at large continue to persist.

Source: WHC 2009; Zwarts et al. 2009

World Heritage in Danger: the Everglades, restoration and fighting invasive species

Over the last 100 years, the greater Everglades wetland ecosystem of South Florida has been reduced by more than 50% as a result of development and drainage for intensive agricultural production and urban development. The remainders of this once larger ecosystem have been declared protected areas, including the Everglades National Park and World Heritage Site. Also at present, human-induced modifications still deteriorate the condition of the area, in particular as a result of alterations of the hydrological regime, urban and agricultural,

increased nutrient pollution from upstream agricultural activities and protection and management of Florida Bay resulting in significant reduction of both marine and estuarine biodiversity. The Comprehensive Everglades Restoration Plan (CERP) provides a framework and guidance to restore, protect, and preserve the water resources of central and southern Florida, including the Everglades. The CERP was designed to capture, store and redistribute fresh water previously lost to tide and to regulate the quality, quantity, timing and distribution of water flows. It includes more than 60 elements and was estimated to take at least 30 years to complete. Some of the major components are surface and underground water storage, water preserve areas, management of Lake Okeechobee as an ecological resource, improved water deliveries to the Everglades and the estuaries, removal of barriers, reuse of wastewater, pilot projects, and improved water conservation.

The CERP and a number of other plans such as the Everglades Invasive Species Early Detection and Rapid Response Plan have resulted in improved conditions for the park. However, the restoration process will still take more than 10 years and the desired state of conservation has not yet been achieved. Therefore the World Heritage Committee decided in 2013 to retain the Everglades on the List of World Heritage in Danger.

Source: NPS 2013; WHC 2013; www.evergladesplan.org (2013)

Monitoring and conservation: conclusions and recommendations

Most properties have coordinating monitoring institutions that are differing in nature. Also the monitoring effort and the parameters measured vary between the sites. In Iraq monitoring is carried out by various institutions and NGOs, both systematic and at an *ad hoc* basis. This has resulted in a considerable amount of useful information for the Marshlands. However, a coordinating body for monitoring does not yet exist. Given the various threats for the area and for proper management such an institution will be vital to make monitoring efforts more efficient, coherent and scientifically robust.

Negative human activities severely degraded several of the properties in the past. Various conservation and restoration measures were taken and are still being carried out in these areas. Also for the Marshlands of Southern Iraq restoration will require considerable efforts as the marshes have not yet recovered from the severe degradation in the 1990s. Water management, water availability, preventing unsustainable use and defining realistic conservation and restoration goals are essential ingredients for such efforts. Nominating the marshlands as World Heritage may help initiate an overarching vision and bring together existing plans. Also the prevention of negative effects from industry, urban developments and agriculture through legislation, combined with good spatial planning are important aspects. The oil and gas sector in the area might contribute positively through using some of the revenues for marshland restoration.

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Appendix 2: Sources of biodiversity data

Table 22. Marshlands of Southern Iraq: Many data were kindly provided by and checked by Nature Iraq (Mr Mudhafar Salim; NI pers. comm.), Baghdad University - Natural History Museum (Mr Dr. Mohammed Kadhem; BU pers. comm. 2013) and the Iraqi Ministry of Environment (Mr Ali Haloub Al Zaidawi, ME pers. comm. 2013).

Site	Plants	Fish	Amphibians	Reptiles	Mammals	Birds	Odonata
All species	ME pers. comm. 2013, Salim 2013, Garstecki & Amr 2011	Salim 2013, Coad 2010, BU pers. comm. 2013	Amr 2009	Amr 2009, BU pers. comm. 2013	BU pers. comm. 2013	Salim 2013, NI pers. comm. 2013	Garstecki & Amr 2011
Endemic species and subspecies	ME pers. comm. 2013	Salim 2013, Coad 2010, BU pers. comm. 2013	Garstecki & Amr 2011	Amr 2009	BU pers. comm. 2013, Omer et al. 2012	Garstecki & Amr 2011, Salim 2013	Garstecki & Amr 2011
Exotic species	-	Salim 2013, BU pers. comm. 2013	n.a.	n.a.	BU pers. comm. 2013	n.a.	n.a.
Globally threatened species	IUCN 2013	IUCN 2013	IUCN 2013	IUCN 2013	IUCN 2013	IUCN 2013	IUCN 2013

Table 23. Djoudj National Bird Sanctuary. Part of the data were kindly provided by: Wetlands International Africa (Dakar, Senegal) kindly provided data (Mr Gabin Agblonon: WIA pers. comm. 2013).

Site	Plants	Fish	Amphibians	Reptiles	Mammals	Birds	Odonata
All species	Guisse et al. 2003 Noba et al 2010	WIA pers. comm. 2013, DPN 2010	EU 2010	n.a.	EU 2010	WIA pers. comm. 2013	n.a.
Endemic species and subspecies	n.a.	WIA pers. comm. 2013	n.a.	n.a.	EU 2010	WIA pers. comm. 2013	n.a.
Exotic species	-	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Globally threatened species	IUCN 2013	IUCN 2013	EU 2010, IUCN 2013	IUCN 2013	EU 2010, IUCN 2013	EU 2010, IUCN 2013	IUCN 2013

Table 24. Okavango Delta

Site	Plants	Fish	Amphibians	Reptiles	Mammals	Birds	Odonata
All species	Ramberg et al. 2006	Ramberg et al. 2006	le Roux 2010	Ramberg et al. 2006	Ramberg et al. 2006	Junk et al. 2010	Kipping 2010
Endemic species and subspecies	n.a.	Tweddle 2007	le Roux 2010	Ramberg et al. 2006	Ramberg et al. 2006	Ramberg et al. 2006	Kipping 2010
Exotic species	-	Tweddle 2007	n.a.	n.a.	n.a.	n.a.	n.a.
Globally threatened species	Farrington 2007	Tweddle 2007	IUCN 2013	IUCN 2013	IUCN 2013, Ramberg et al. 2006	IUCN 2013	IUCN 2013

Table 25. Inner Niger Delta. Part of the data were kindly provided by Wetlands International Mali (Mr Mori Diallo: WI Mali pers. comm. 2013).

Site	Plants	Fish	Amphibians	Reptiles	Mammals	Birds	Odonata
All species	Marie 2000	WIMali pers. comm 2013	n.a.	n.a.	Wymenga et al. 2002, Zwarts et al. 2009	WIMali pers. comm 2013	n.a.
Endemic species and subspecies	Marie 2000	WIMali pers. comm 2013	n.a.	n.a.	Wymenga et al. 2002, Zwarts et al. 2009	WIMali pers. comm 2013	n.a.
Exotic species	-	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Globally threatened species	n.a.	Ticheler 2000	n.a.	n.a.	IUCN 2013	IUCN 2013	n.a.

Table 26. Danube Delta. Part of the data were kindly provided by the Danube Delta National Institute for Research and Development / Institutul Național de Cercetare şi Dezvoltare "Delta Dunării" (INCDDD 2013, Mrs. Camelia Caprita and Mr. Aurel Năstase).

Site	Plants	Fish	Amphibians	Reptiles	Mammals	Birds	Odonata
All species	INCDDD 2013, Doroftei 2013	INCDDD 2013	Onciu 2010	Onciu 2010, Török 2013 pers. comm.	Onciu 2010	INCDDD 2013, Török 2010	Griebler 1994, INCDDD 2013
Endemic species and subspecies	INCDDD 2013	Otel 2007, Năstase 2009	Onciu 2010	DDNI pers. com. 2013	Onciu 2010	INCDDD 2013	Dijkstra 2006
Exotic species	-	Năstase 2013 pers. comm.	Onciu 2010	DDNI pers. com. 2013	n.a.	INCDDD 2013	n.a.
Globally threatened species	Sârbu et al 2006	Năstase 2013 pers. comm.	Onciu 2010, IUCN 2013	INCDDD 2013, IUCN 2013	IUCN 2013	IUCN 2013	IUCN 2013

Table 27. Doñana. Many of the data were kindly provided by the Estación Biológica de Doñana (CSIC 2013, Mrs. Guyonne Janss).

Site	Plants	Fish	Amphibians	Reptiles	Mammals	Birds	Odonata
All species	CSIC 2013	CSIC 2013	CSIC 2013	CSIC 2013	Junta de Andalucia 2005, CSIC 2013	CSIC 2013	Grao et al. 2009
Endemic species and subspecies	CSIC 2013	CSIC 2013	CSIC 2013	CSIC 2013	CSIC 2013	CSIC 2013	Dijkstra 2006
Exotic species	-	Moreno-Valcárcel 2013	CSIC 2013	CSIC 2013	CSIC 2013	CSIC 2013	Grao et al. 2009
Globally threatened species	CSIC 2013	CSIC 2013	CSIC 2013	CSIC 2013	CSIC 2013	CSIC 2013	IUCN 2013

Table 28 Everglades. SFNRC 2012 refers to a complete species dataset of the Everglades National Park from the South Florida Natural Resources Center (SFNRC, division of Everglades National Park) as annex to a report by UNEP (2012).

Site	Plants	Fish	Amphibians	Reptiles	Mammals	Birds	Odonata
All species	SFNRC 2012, Brown et al. 2006	SFNRC 2012, Junk 2006	SFNRC 2012	SFNRC 2012	SFNRC 2012	SFNRC 2012	Brown et al. 2006
Endemic species and subspecies	Junk 2006	Muller 1989	Muller 1989, Rice et al. 2006	Muller 1989, Rice et al. 2006	Muller 1989	Muller 1989	n.a.
Exotic species	UNEP 2012	UNEP 2012	UNEP 2012	UNEP 2012	UNEP 2012	UNEP 2012	n.a.
Globally threatened species	n.a.	IUCN 2013	IUCN 2013	IUCN 2013	IUCN 2013	IUCN 2013	IUCN 2013

Appendix 3: Ramsar wetland types per site

Table 29: Ramsar wetland types per site (the Marshlands of Southern Iraq only encompass the Hawizeh Marshes.

Ramsar Category	Marshlands of Southern Iraq	Djoudj	Okavango delta	Inner Niger Delta	Danube Delta	Doñana	Everglades
Aquaculture (e.g. fish/shrimp) ponds (1)						x	
Canals and drainage channels, ditches (9)	x						
Coastal brackish/saline lagoons; brackish to saline lagoons with at least one relatively narrow connection to the sea (J)							x
Estuarine waters; permanent water of estuaries and estuarine systems of deltas (F)					x	x	x
Excavations; gravel/brick/clay pits; borrow pits, mining pools (7)						x	
Freshwater, tree-dominated wetlands; includes freshwater swamp forest, seasonally flooded forest, wooded swamps; on inorganic soils (Xf)					x		x
Intertidal forested wetlands; includes mangrove swamps, nipah swamps and tidal freshwater swamp forests (I)							x
Intertidal marshes; includes salt marshes, salt meadows, saltings, raised salt marshes; includes tidal brackish and freshwater marshes (H)						x	x
Intertidal mud, sand or salt flats (G)						x	x
Irrigated land; includes irrigation channels and rice fields (3)	x					x	
Non-forested peatlands; includes shrub or open bogs, swamps, fens (U)						x	x
Permanent freshwater lakes (over 8 ha); includes large oxbow lakes (O)	x				x	x	x
Permanent freshwater marshes/pools; ponds (below 8 ha), marshes and swamps on inorganic soils; with emergent vegetation water-logged for at least most of the growing season (Tp)	x		x		x		
Permanent inland deltas (L)		x	x	x			
Permanent rivers/streams/creeks; includes waterfalls (M)	x	x	x		x		
Permanent saline/brackish/alkaline lakes (Q)							x
Permanent shallow marine waters in most cases less than six metres deep at low tide; includes sea bays and straits (A)						x	x
Ponds; includes farm ponds, stock ponds, small tanks; (generally below 8 ha) (2)	x						
Salt exploitation sites; salt pans, salines, etc. (5)						x	
Sand, shingle or pebble shores; includes sandbars, spits and sandy islets; includes dune systems and humid dune slacks (E)					x	x	
Seasonal/intermittent freshwater lakes (over 8 ha); includes floodplain lakes (P)			x		x		x
Seasonal/intermittent freshwater marshes/pools on inorganic soil; includes sloughs, potholes, seasonally flooded meadows, sedge marshes (Ts)	x		x		x	x	x
Seasonal/intermittent saline/brackish/alkaline lakes and flats (R	x	x					x
Seasonal/intermittent saline/brackish/alkaline marshes/ pools (Ss)	x	x					
Seasonal/intermittent/irregular rivers/streams/creeks (N)		x	x				
Seasonally flooded agricultural land (including intensively managed or grazed wet meadow or pasture) (4)	x						
Shrub-dominated wetlands; Shrub swamps, shrub-dominated freshwater marsh, shrub carr, alder thicket; on inorganic soils (W)					x		
Water storage areas; reservoirs/barrages/dams/impoundments; (generally over 8 ha) (6)	x						

About this report

This report is the result of a comparative analysis of the Marshlands of Southern Iraq to six other wetlands in the world. The study was carried out as input for the nomination process of the Marshlands of Southern Iraq as a World Heritage Site. The comparison focuses on two aspects: Firstly, on biological diversity to provide a scientific background to assess the value of the Marshlands as a World Heritage Site. Secondly, on institutional management to suggest possible improvements to the current management structure for long-term conservation, including useful experience from other countries and sites.

The United Nations Environment Programme, Division of Technology, Industry and Economics, International Environmental Technology Centre (UNEP-DTIE-IETC).

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