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A Survey on the flora and the fauna of the Fereydunkenar International wetland for better conservation management

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Abstract

Fereydunkenar international wetland (registered in Ramsar Convention) covers 5427 hectares at the south of Caspian Sea in Mazandaran province. Identifying the district's flora and fauna, a four-year survey was conducted in direct observation method; as a result of which a variety of species were recognized including trees(18), mammals(7), fishes(10), reptiles(6), amphibians(5) and birds(88). The trees are mostly woody among which the Box tree (*Buxus hyrcana*) is in extinction peril and the European otter (*lutra lutra*) (a kind of mammal) has the highest population. About 28% of the wetland's birds are indigenous and others are migratory including those who just pass the zone, winter birds and egg-layer ones. Among the wetland's birds, the seabirds and water fowl species are more numerous than others. On the other hand, Red breasted goose (*Branta ruficollis*), lesser white-fronted goose (*Anser erythropus*) and Siberian cranes (*Grus leucogeranus*) are among the rarest birds of the world which are mostly at extinction risk. Overhunting and destroying their environment and rest zones have led to severe reduction of their population; so that there has remained just one crane in the wetland. However, the international Fereidunkenar wetland has a very specific situation from the view point of fauna and flora, despite of all threats and destructions.

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Introduction

Biodiversity is an essential case for life continuance, economical affairs and ecosystems function and resistance (Singh, 2002). Generally biodiversity measurement typically focuses on the species level and species diversity is one of the most important scales (Ardakani, 2004). Generally the site biodiversity is impressed by environmental factors and the physiographic factor of land as the height from sea level is one of the most important factor in this case (Maranon *et al.*, 1999; Schuster and Diekmann, 2005).

Iran has over 250 wetlands with about 2.5 million hectares area, among which 22 ones with an area about 1.8 million hectares have been registered and known as international wetlands according to Ramsar Convention (Ahmadpour *et al.*, 2011).

There have been numerous wetlands along with Caspian shore strip. They cover habitats for many different kinds of birds, plants and other aquatic creatures. In some cases, They are changing into farms due to agricultural activities. Except for a few, several wetlands remind with great global importance and protected by the Department of the Environment (DOE). Others have been destroyed completely or changed basically. Wetland destruction has led to extinction of indigenous species whose life depends perfectly on particular habitat (UNEP, 2001). Wetlands are world's cradles for living creatures. They provide them with water, reproduction and so play a crucial role in preserving uncountable number of creatures. They protect the masses of birds, reptiles, amphibians, fishes and invertebrates. That is why DOE announced some zones as wildlife refuge to compensate the damages exerted to nature. The zones include; Fereydunkenar, Semaskands, Dasht Naz, Dodange and Miankale, Fereydunkenar, Sorkhrud and Azbaran lagoons were registered as international wetlands and hunt-prohibited zones in the Ramsar convention (Ahmadpour *et al.*, 2011). The refuges are in Mazandaran and considered as wetland-woody ecosystem. They are of ecologic, economic, social and environmental quality improvement values etc. Such

ecologic and environmental values make the zones protect and welcome a variety of plants and animals (Ahmadpour *et al.*, 2011). Study and knowing the ecosystem's flora and fauna are very crucial in managing the environment resources. In such studies, recognition of fauna and flora seems too important special for having ecological surveys base in animals' study and plants geography. They provide proper solutions for determining the area's capabilities in various aspects. Moreover, they are efficient factors to measure and to evaluate the current situation and to predict the future of ecosystem management. To manage wetlands, we should firstly study the zone's wildlife and collect data; then we should prepare the wetland's database, aiming at protecting it and its creatures (Hall, 1999). We may recognize any probable threat to wetlands and any ecological changes through continuous consideration of population and species changes as well as creatures' environmental conditions.

Materials and methods

The area under study

Fereydunkenar, Sorkhrud and Azbaran lagoons were registered as international wetlands in Ramsar Convention and announced as hunt- prohibited areas. The refuge is in south of the Caspian Sea in Mazandaran province 3-7 km to southern Fereidunkenar city and 15 km to Babolsar city (Fig. 1). The area's geographical coordinates are 52° 33' eastern longitude and 36° 40' northern latitude. And the ecosystem is of wetland-woody type. This wetland covers 5427 hectares and contains important habitats in central Hirkany known as Damgah (trap place) in Iran. Damgahs are considered as low slope plains devoted to rice cultivation where the migratory birds live in cold seasons; because underground water and precipitation are high and the surface is leveled and so the land is in the form of fallow or being flooded. Most often, they are surrounded by hedges and fences made by straw in order to keep the birds calm and not being disrupted by traffic.

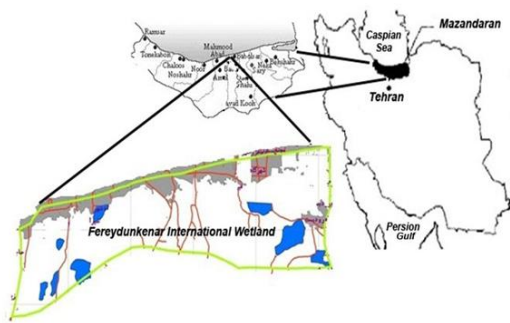


Fig. 1. Geographic position of the Fereydunkenar International Wetland in Ramsar site-Iran.

Table 1. Trees in Fereydunkenar wetland.

Row	English name	Scientific name	Family name
1	Maple tree	<i>Acer insigne</i>	Aceraceae
2	Alder Tree	<i>Alnus glutinosa</i>	Betulaceae
3	Box tree	<i>Buxus hyrcana</i>	Buxaceae
4	Oriental hornbeam	<i>Carpinus orientalis</i>	Coryllaceae
5	Oriental beech	<i>Fagus orientalis</i>	Fagaceae
6	Chestnut-leaved oak	<i>Quercus castaneifolia</i>	Fagaceae
7	Persian parrotia	<i>Parrotia persica</i>	Hamalidaceae
8	Daucdsian wingut	<i>Pterocaryo fraxinifolia</i>	Juglandaceae
9	Fig common	<i>Ficus carica</i>	Moraceae
10	European ash	<i>Fraxinus excelsior</i>	Oleaceae
11	Pomegranate tree	<i>Punica granatum</i>	Punicaceae
12	Black poplar	<i>Populus nigra</i>	Salicaceae
13	White willow	<i>Salix alba</i>	Salicaceae
14	Tree – of – heaven	<i>Ailanthus altissima</i>	Simarubaceae
15	Large-leaved linden	<i>Tilia rubra</i>	Tiliaceae
16	Sugar hackberry	<i>Celtis australis</i>	Ulmaceae
17	Persian polar	<i>Populus capsica Bornm</i>	Salicaceae
18	Eastern poplar	<i>Populus deltoides Marsh</i>	Salicaceae

This wetland contains 7 mammal species from 6 families among which European otter (*Lutra lutra*) and Jungle cat (*Felis chaus*) have been increasing considerably in recent years (Table 2).

Beside the hedges and fences, the Damgahs has been secured using a tree strip to the 40-60m width. In this way the Damgahs have been kept as an isolated place. The preserved area has wide lagoons containing a variety of wetland plants. They are safe refuge for migratory birds, especially for Siberian crane who select this zone for their winter habitat (Ahmadpour *et al.*, 2011). It also receives one third of all winter migratory birds in the country. This

habitat has ecologic, economic, social and environment quality development values.

Materials and methods

This study was conducted in two sections: field study and library method; and in a 4-year (October 2007-March 2011) period in Fereydunkenar wetland. The birds were identified and recognized through direct observation and applying a 10×50 mm binocular. Also, trees, amphibians, reptiles, mammals and fishes were identified through direct observation and the library resources were referred for complementary studies. In this research, study has been the wild life of the fereidunkenar wetland containing trees, mammals, fishes, reptiles,

amphibians and birds. Lastly, the important characteristics of some species of the wetland were studied regarding Flora and Fauna Survey

Guidelines (Australian Resuscitation Council, 2003).

Table2. The identified mammals in Fereydunkenar

Row	English name	Scientific name	Family name
1	Sourthern white-breasted hedgehog	Erinaceus europaeus	erinaceidae
2	Greater white-toothed shrew	Cerocidura russula	soricomorpha
3	House mouse	Mus musculus	murinae
4	Holden jackal	Canis aureus	canidae
5	Least weasel	Mustela nivalis	mustelidae
6	European otter	Lutra lutra	mustelidae
7	Jungle cat	Felis chaus	Felidae

Table 3. Identified fishes in Fereydunkenar wetland

Row	English name	Scientific name	Family name
1	Transcaucasian	Alburnus charusini	cyprinidae
2	Usach bulatmai	Barbus capito	cyprinidae
3	Lenkoran	Capoeta capoeta gracilis	cyprinidae
4	Goldfish	Carassius auratus	cyprinidae
5	Caspian shemaya	Chalcalburnus chalcoides	cyprinidae
6	Common carp	Cyprinus carpio	cyprinidae
7	Tench	Tinca tinca	cyprinidae
8	Caspian vimba	Vimba vimba persa	cyprinidae
9	Mosquitofish	Gambusia holbrooki	Poeciliidae
10	Stickleback	Gasterosteus aculeatus	Gasterosteidae

Table 4. The identified reptiles in Fereydunkenar wetland

Row	English name	Scientific name	Family name
1	European Pond Turtle	Emys orbicularis	testudinidae
2	Caspian Pond Turtle	Mauremys caspica caspica	testudinidae
3	caspian green lizard	Locerta strigata	lacertidae
4	Ringed Snake	Natrix natrix	colubridae
5	Dice Snake	natrix lesselata	colubridae
6	Spotted Desert Racer	Coluber karelini	colubridae

Table5. The identified amphibians in Fereydunkenar wetland

Row	English name	Scientific name	Family name
1	common Toad	Bufo bufo	bufonidae
2	Green taod	Bofo viridis	bufonidae
3	Frog Tree	Hyla savignyi	hylidae
4	Common Tree-frog	Rana macnemis	ranidae
5	March frog	Rana ridibunda	ranidae

Table 6. The identified birds in Fereydunkenar wetland.

Row	English name	Scientific name	Family name	Native	Migrant		Habitat			
					Passing	Wintering	Egg-laying	Aquatic	Wader	Xerophilous
1	Dalmatian pelican	<i>Pelecanus crispus</i>	Pelecanidae		*		*			
2	Great cormorant	<i>Phalacrocorax carbo</i>	Phalacrocoracidae		*		*			
3	Pygmy cormorant	<i>Phalacrocorax pygmaeus</i>	Phalacrocoracidae		*		*			
4	Grey Heron	<i>Ardea cinerea</i>	Ardeidae		*			*		
5	Great white heron	<i>Egretta alba</i>	Ardeidae		*			*		
6	Little egret	<i>Egretta garzetta</i>	Ardeidae		*			*		
7	Night heron	<i>Nycticorax nycticorax</i>	Ardeidae		*			*		
8	Eurasian Spoonbill	<i>Platalea leucorodia</i>	Threskiornithidae		*			*		
9	Greater Flamingo	<i>Phoenicopterus ruber</i>	Phoenicopteridae		*			*		
10	mute swan	<i>Cygnus olor</i>	Anserinae		*			*		
11	whooper swan	<i>Cygnus cygnus</i>	Anserinae		*			*		
12	greylag goose	<i>Anser anser</i>	Anserinae		*			*		
13	white-fronted goose	<i>Anser albifrons</i>	Anserinae		*			*		
14	lesser white-fronted goose	<i>Anser erythropus</i>	Anserinae		*			*		
15	red-breasted goose	<i>Branta ruficollis</i>	Anserinae		*			*		
16	shelduck	<i>Tadorna tadorna</i>	Shelduck		*			*		
17	ruddy shelduck	<i>Tadorna ferruginea</i>	Shelduck		*			*		
18	mallard	<i>Anas platyrhynchos</i>	Anatinae		*			*		
19	Falcated Duck ¹	<i>Anas falcated</i>	Anatinae		*			*		
20	Common teal	<i>Anas crecca</i>	Anatinae			*		*		
21	gadwall	<i>Anas strepera</i>	Anatinae			*		*		
22	wigeon	<i>Anas penelope</i>	Anatinae			*		*		
23	pintail	<i>Anas acuta</i>	Anatinae			*		*		
24	shoveler	<i>Anas clypeata</i>	Anatinae			*		*		
25	pochard	<i>Aythya ferina</i>	Anatinae			*		*		
26	tufted duck	<i>Aythya fuligula</i>	Anatinae			*		*		

¹ Falcated Duck in the population peak years for study area each year has been observed by the authors in the month of February and March. Since, the mentioned species had been reported in Iran so far, the authors believe that more studies are needed to ensure and only having a complete check list from FDK protected wetland.

27	black kite	Milvus migrans	Kites	*		*
28	White-tailed Eagle	Haliaeetus albicilla	Accipiteridae		*	*
29	imperial eagle	Aquila heliaca	Accipiteridae	*		*
30	greater spotted eagle	Aquila clanga	Accipiteridae		*	*
31	Common buzzard	Buteo buteo	Accipiteridae	*		*
32	marsh harrier	Circus aeruginosus	Accipiteridae		*	*
33	peregrine falcon	Falco peregrinus	Falconidae	*		*
34	water rail	Rallus aquaticus	Rallidae	*		*
35	little crake	Porzana parva	Rallidae	*		*
36	moorhen	Gallinula chloropus	Rallidae	*		*
37	Common coot	Fulica atra	Rallidae		*	*
38	Siberian crane	Grus leucogeranus	Gruidae		*	
39	black-winged stilt	Himantopus himantopus	Recurvirostridae	*		*
40	lapwing	Vanellus vanellus	Charadriidae			*
41	white-tailed plover	Vanellus leucurus	Charadriidae	*		*
42	european golden plover	Pluvialis apricaria	Charadriidae		*	*
43	grey ploer	Pluvialis squatarola	Charadriidae		*	*
44	black-tailed godwit	Limosa limosa	Scolopacidae		*	*
45	whimbrel	Numenius phaeopus	Scolopacidae	*		*
46	curlew	Numenius arquata	Scolopacidae		*	*
47	redshank	Tringa totanus	Scolopacidae			*
48	marsh sandpiper	Tringa stagnatilis	Scolopacidae		*	*
49	greenshank	Tringa nebularia	Scolopacidae		*	*
50	green sandpiper	Tringa ochropus	Scolopacidae		*	*
51	common sandpiper	Actitis hypoleucos	Scolopacidae			*
52	woodcock	Scolopax rusticola	Scolopacidae	*	*	*
53	great snipe	Gallinago media	Scolopacidae	*		*
54	common snipe	Gallinago gallinago	Scolopacidae		*	*
55	jack snipe	Lymnocyptes minimus	Scolopacidae		*	*
56	ruff	Philomachus pugnax	Scolopacidae	*		*

57	common gull	Larus canus	Laridae	*	*
58	Herring Gull	Larus argentatus	Laridae	*	*
59	great black-headed gull	Larus ichthyaeetus	Laridae	*	*
60	slender-billed gull	Larus genei	Laridae	*	*
61	little gull	Larus minutus	Laridae	*	*
62	common tern	Sterna hirundo	Sternidae	*	*
63	common cuckoo	Cuculus canorus	Cuculidae	*	*
64	Kingfisher	Alcedo atthis	Alcedinidae	*	*
65	european bee-eater	Merops apiaster	Meropidae		*
66	persian bee-eater	Merops superciliosus	Meropidae		*
67	crested lark	Galerida cristata	Alaudidae	*	*
68	white wagtail	Motocilla alba	Motacillidae	*	*
69	meadow pipit	Anthus pratensis	Motacillidae		*
70	wern	Troglodytes troglodytes	Troglodytidae	*	*
71	european robin	Erithacus rubecula	Turdidae	*	*
72	bluethroat	Luscinia svecica	Turdidae	*	*
73	blackbird	Turdus merula	Turdidae		*
74	song thrush	Turdus philomelos	Turdidae		*
75	redwing	Turdus iliacus	Turdidae		*
76	cettis warbler	Cettia cetti	Sylviidae	*	*
77	moustached warbler	Acrocephalus melanopogon	Sylviidae	*	*
78	common chiffchaff	Phylloscopus collybita	Sylviidae		*
79	great tit	Parus major	Paridae	*	*
80	corn bunting	Miliaria calandra	Emberizidae	*	*
81	reed bunting	Emberiza schoeniclus	Emberizidae	*	*
82	chaffinch	Fringilla coelebs	Fringillidae	*	*
83	house sparrow	Passer domesticus	Passeridae	*	*
84	starling	Sturnus vulgaris	Sturnidae	*	*
85	golden oriol	Oriolus oriolus	Oriolidae		*
86	common magpie	Pica pica	Corvidae	*	*
87	carrion crow	Corvus corone cornix	Corvidae	*	*
88	rook	Corvus frugilegus	Corvidae	*	*

* This symbol is indicates a feature of target species

Results

18 tree species identified in this wetland belonging to 15 families. Their numbers were close to each other; however, Box tree (*Buxus hyrcana*) is at extinction risk (Table 1)

Ten Fishes have been identified in this wetland. They belong to 3 families among bony fishes. The most diversity is seen in carp fish (*Cyprinidae*) with 8 species while the least diversity belongs to gambusia (*Poeciliidae*) and fishbone (*Gasterosteidae*) each with just 1 species (Table 3).

There are 6 reptile species belonging to 3 families; snake family (*Cloubriidae*) with 3 species; tortoise family (*Testudinidae*) with two species and the lizard family (*Lacertidae*) with just one species (table 4).

There are 5 amphibian species belonging to 3 families: toads family (*Bufo*) and frogs (*Ranidae*) with 2 species and tree frog family (*Hylidae*) with one species, (table 5)

There are 88 bird Species in this wetland belonging to 28 families among which the goose family (*Anatidae*) with 17 species; waders (*Scolopacidae*) with 13 species and *Accipitridae* and *Laridae*, each with 6 species have the most diversity.

Among the identified birds, the most species belong to migratory group (about 72% of species) and in this group the winter migratory birds have the most species. Then passing and egg-laying migratory birds have highest diversity.

About 28% of the wetland's birds are indigenous species (Table6). The table shows that the water fowl birds are more numerous than aquatic birds.

Discussion

No other ecosystem in the world has experienced damages out of human's short sightedness and selfishness as much as wetlands.

S., Khodadadi *et al.*, (2009) studied the share of flora and habitat in Estil (Astara) wetland in North-west Iran. They found out that there are 11 indigenous plant species in the area. They also reported other species for the first time.

Finally they conclude that therophytes form a vast share of the plant population in this area.

Also, Parkyn (2007) studied the blue biota of Rotokawa Lake and Parariki Stream. He compared the effect of PH on the two lakes fauna diversity and found out that the Rotokawa lake (PH 2.1) is an unprecedented and unique cold acidity habitat containing a highly rich fauna. Then he compared it with two acidity rivers in Rotorua-Taupo district i.e. Rotowhero (PH 3.1) and Opal Lake (PH 4.3); and concluded that the more acidity lake is less diverse in fauna.

Among the identified tree species which were mostly woody trees, the Fig (*Ficus carica*) was also seen. Since, such species are thermophile; the region has relatively high temperature and humidity in summer. There is also Box tree as the only sample of this species. Box tree is in extinction danger (Jalili and Jamzad, 1999).

Box tree is a shadowphile species with low density; it seems that distances among the trees restrict the shadow volume; as a result box tree may not grow enough.

Among the identified mammals, there is also European otter which was very rare in the past but today its population is growing. Also, two Jungle cats (*Felis chaus*) were seen in the wetland in 2010 while they were never seen before. Since, the species is at the peak of the food pyramid, the increase of which reveals the environment health. So the Fereidunkenar wetland is a pleasant zone for this kind of mammal.

There is Tench fish (*Tinca tinca*) among the identified Fish species. Of course, it is a very rare.

Seemingly, overfishing, destroying habitat through sediment removal in lagoons, and applying the pesticides are the main reasons for this rareness. Another main factor is aquaculture activities in Fereydunkenar wetland's lagoons and devoting too many hectares of the surface water to one or two species. Among the species belonging to *Cyprinidae* family, the species of Usach bulatmai (*Barbus capito*) Caspian shemaya (*Chalcalburnus chalcoides*), Common carp (*Cyprinus carpio*) and specially Lenkoran (*Capoeta capoeta gracilis*) are of economic value. According to IUCN classification the Caspian shemaya fish is at extinction risk and its reservoirs are dwindling, however Mosquito fish (*Gambusia holbrooki*) and Stickleback fishes (*Gasterosteus aculeatus*) lack economic value and are considered as non-indigenous fishes. They have found their way into Iran waters, through activities such as: aquaculture, sport fishing, aquariums, pesticide and weed controlling (Coad and Abdoli, 1993). Since the above mentioned activities are not conducted in this zone, the two species have come here along with other fishes.

The least diversity among the Fereidunkenar wetland fauna belongs to amphibians. The most and the least populated species are Marsh frogs (*Rana ridibunda*) and Green toad (*Bufo viridis*), respectively. One of them is Frog tree (*Hyla savignyi*) whose wet body is highly prepared for bacteria and fungi growth; however the substance secreted from the skin has anti-microbial characteristic (Sardari *et al.*, 2000; Douglas *et al.*, 2005). Probably, it will be used for pharmacy and may overcome one of difficulties related to the pathogens resistance against antibiotics.

Generally speaking the most identified species belong to birds. It seems that this distinct number is rooted in their suitable habitat and their proper feeding behavior. Having characteristics of an artificial wetland, Fereidunkenar is a nice environment for birds and especially for aquatic and aquatic fowl species. Appropriate environment

attracts thousands of winter migratory birds. This is confirmed by presence of rare birds such as Siberian crane, Red-breasted goose, Lesser white-fronted goose and White-tailed eagles (*Haliaeetus albicilla*) in the wetland. Shallow wetland, invertebrates profusion, rice stalks and the foods scattered by the Damgah holders make the area pleasant for ducks. Vast shares of the species are hunting and branch nested birds seen all over the year.

Despite of threats to the Fereydunkenar international wetland including illegal hunting, urbanization, habitat destruction and industrial activities, the area still possesses distinct flora and fauna. The presence of White Crane (Fastidious species) is a reason for proof of this claim. This makes it necessary to have a responsible view over the wetland.

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References

Ahmadpour M, SinkaKarimi MH, Ghasempouri SM, Ahmadpour M, Yaghobzadeh Y. 2011. A three years study of the diversity and density of waterfowl and waders in Sorkhrud International Wetland (October 2007 – March 2010). *Scientific Research and Essays* **6**, 6317-6324.

Ardakani MR. 2004. Ecology. Tehran University Publishing, p. 340.

Australian Resuscitation Council. 2003. Aims and objectives of the Australian Resuscitation Council. Guideline 1.1. Available at: http://www.resus.org.au/policy/guidelines/section_1/guideline1-1march03.pdf.

Coad BW, Abdoli A. 1993. Exotic fish species in the freshwater of Iran. *Zoology in the middle east*. Heidelberg 9, 65-80.

Douglas WC, Louise AR, Reinert L, Cynthia C, Michael J, Tyler RA. 2005. Population trends associated with skin peptide defenses against Chytridiomycosis in Australian frogs. *Oecologia* 1, 1-10.

Hall k. 1999. The effects of fishing on marine ecosystems and communities. Blackwell Science, p. 274.

Jalili A, Jamzad Z. 1999. Red data book of Iran. Research Institute of Forests and Range-lands, p. 748.

Maranon T, Ajbilou R, Ojeda F, Arroyo J. 1999. Biodiversity of woody species in oak woodland of southern Spain and northern Morocco. *Forest Ecology and Management* 115, 147-156.

Khodadadi S, Saeidi Mehrvarz SH, Naqinezad AS. 2009. Contribution to the flora and habitats of the estil wetland (Astara) and it's surroundings, northwest Iran. *Rostaniha* 10, 44-63.

Parkyn S. 2007. Literature review of the aquatic biota of lake Rotokawa and Parariki stream. NIWA client report, National Institute of Water and Atmospheric Research, New Zealand.

Sardari S, Amin GH, Sekhon A, Micetich RG, Daneshtalab M. 2000. Antifungal activity of *diplotaenia damavandica*. *Pharmacy and Pharmacology Communication* 6, 455-458.

Schuster B, Diekmann M. 2005. Species density and Environmental factors in deciduous forests of northwest Germany. *Forest Ecology and Management* 206, 197-205.

Singh JS. 2002. The biodiversity crisis: a multifaceted review. *Current Science* 82, 499-500.

United Nations Environment Programme. 2001. The mesopotamian marshlands: demise of an ecosystem, early warning and assessment report, UNEP/DEWA/TR.01-3 Rev.1, division of early warning and assessment, nations environmental program, Nairobi, Kenya.