1.1 ALGERIA

Introduction

With an area of 2 381 745 km^2 Algeria is the second largest country in Africa. It has a population of 20 500 000 (1983) and thus a mean population density of 8.6 persons/km2. It is bounded by Mali and Niger in the south, by Libya and Tunisia in the east, by the Mediterranean Sea in the north, and by Morocco, Western Sahara and Mauritania in the west. It extends approximately 1985 km from north to south, between latitudes 18°57' and 37°08'N, and 2080 km from east to west between longitudes 12°00'E and 8°39'W, and has a coastline of 1355 km.

The Mediterranean fringe of Algeria is mountainous. The coastal strip is narrow, and only in the vicinity of Oran (35°43'N/0°43'W) are there significant lowland area less than 100 m above sea level. These comprise two blocks, one just inland behind the heights of Oran, and the other close by at the head of the Bay of Arzew. Along the rest of the coast the Tell Atlas rises steeply and crosses the country from west to east. This range is separated from the Saharan Atlas which lies inland along the fringe of the desert, by the High Plateau. The plateau is really a great basin set between the parallel mountain ranges. It is 940 km long and extends into Algeria from Morocco (700 km in Algeria), attaining a width of 190 km and ending west of Biskra (34°50'N/5°41'E). Its floor is mostly close to 1000 m asl, but it rises to 1200-1400 m as it approaches the mountains, and descends into a number of depressions along its central axis. These get progessively deeper from west to east and provide vast wetland areas known generically as chotts. The floor of the westernmost, the Chott Ech Chergui, has a low point of 984 m, but is mostly over 993 m. The floor of the Zahrez Rharbi is lower, 827 m, while that of the Zahrez Chergui is 756 m, and that of the Chott el Hodna, at the eastern end of the plateau, is only 391 m asl. While the Chott Ech Chergui can be said to ‘lie on the plateau’, the middle two pans are contained in a SW-NE oriented depression in the middle of the plateau. Here parallel scarps, several hundred metres high, descend from the plateau to the floor of the trench in which the pans lie. The Chott el Hodna occupies the lowest part of a great bowl-shaped depression at the eastern end of the plateau.

The peaks of both the Tell and Saharan Atlas Ranges rise to between 1800 and 2000 m, with high points of 2321 m at Djebel Mahmel (35°21'N/6°15'E) in the Tell Atlas and 2187 m at Djbel Mzi (32°29'N/1°08'E) in the Saharan Atlas, but the highest points in the country are far to the south in the A'Haggar Massif in the Sahara Desert. Here Mt. Tahat rises to 2981 m (23°19'N/5°34'E), Mt. Assekrem rises to 2728 m (23°18'N/ 5°41'E), and several other peaks exceed 2300 m.

The interior of Algeria is desert. The southwestern extremity of Algeria is occupied by the very dry, stony Hamada du Draâ, a shelf of high land extending into the country from Morocco. The central southeastern flanks of the Saharan Atlas slope down for some 250 km to a central depression 200-500 m asl, which, like most major physiographical features in North West Africa, is oriented SW-NE. The depression is filled by sand desert, by

the Erg Iguidi, which enters Algeria from Mauritania in the SW, by the Grand Erg Occidental in the centre, and by the Grand Erg Oriental in the east. Plateaux of higher land emerge above the sand desert in places, e.g. in the southwest the circular Mcherrah Aftout, which reaches 1200 m, separates the Erg Iguidi from the Erg Chech which stretches into central Algeria from northern Mali. The land rises again, south of the sand deserts, up to the stony Plateau of Tademait. From here one may proceed southwestwards, down into the Tidikelt Depression, less than 200 m asl, or southeastwards, up through various minor ranges to the long NW-SE ridge of the Tassili N'Ajjer. From there one may pass to the massifs of the Adrar (Mt. Afao - 2158 m) and A'Haggar, the latter reaching south to within 230 km of the border with Niger.

Drainage from the coastal ranges is by numerous short streams which flow directly to the Mediterranean Sea, or by others which discharge onto the High Plateau, where their flood waters accumulate in the chotts. Drainage from the Saharan Atlas is either northwards to the plateau or southeastwards into the desert. Along the southeastern flank many intermittent streams flow in parallel, often in very deep gullies or canyons, to the Ergs Iguidi and Occidental where they lose themselves under the sand. In the western central region some streams rise in the Moroccan Atlas, where rainfall is comparatively high, and some, e.g. the Oueds Rheris and Guir are perennial in their upper courses. These flow southeastwards into Algeria, and the Oued Saoura, the continuation of the Oued Guir system, carries water each year for distances of 500-700 km into the desert, terminating in a series of pans between Adrar (27°51'N/0°19'W) and Reggane (26°42'N/0°13'W). At the far eastern end of the Saharan Atlas range other intermittent watercourses drain eastwards to the great depression of the Chott Melrhir, part of which is below sea level. In the far west of Algeria, rainfall is so scant over the Hamada du Draâ that there are few fixed watercourses, and any run-off from occasional storms is dissipated by ephemeral streams.

Climate

During the northern summer the Azores anticyclone produces a northerly airstream over almost the entire North African region, but although this crosses the Mediterranean, it is a dry stream and brings virtually no rain. These dry winds blow right across Algeria to the Tropic of Cancer. High pressure prevails over the Sahara during the northern winter and winds then blow off the desert towards the southwest and northeast. They are hot, dry and dusty, but a stream of humid westerly air from the Atlantic penetrates along the northern coasts at this time, and brings rain to the coastal fringe. Consequently, northern Algeria has a Mediterranean type of climate with cool wet winters and hot dry summers.

Rainfall is reliable only along the Mediterranean fringe where falls of 600-1100 mm may be received at the coast, with a summer drought of 3-4 months. However, some coastal stations are in rain-shadows and are extremely arid, with mean annual falls of 150 mm or less. Generally, falls increase on the seaward slopes of the coastal mountains, but rainfall decreases quickly in moving inland across the High Plateau to the Saharan Atlas. South of this latter range rainfall is unreliable and most of the interior receives less than 100 mm/yr, with stations in the central south receiving less than 20 mm/yr. Stations in the desert may be completely rainless for several years on end.

Along the coast mean annual precipitation is 384 mm at Oran (35°43'N/0°43'W),

increasing to 762 mm at Alger (36°42'N/3°08'E) and to 1038 mm at Cape Bougaroun (37° 10'N/6°30'E). Some 60 km inland from Oran, at Mascara (35°20'N/0°09'E), 590 m up on the seaward slopes of the Tell Atlas, mean annual rainfall (34°06'N/0°02'E) on the shores of the Chott Ech Chergui on the High Plateau, it is 155 mm, while towards the eastern end, 1160 m asl, at Djelfa (34°30'N/3°20'E), it is 308 mm. Over the mountains on the fringe of the desert at Laghouat (33°50'N/2°59'E), at an altitude of 767 m asl, it is 167 mm. In the central desert Timimoun (29°15'N/0°14'E), 293 m asl, has a mean annual rainfall of 10 mm; Ouallene Bordj (24°37'N/1°13'E), at an altitude of 346 m asl receives 36 mm/yr, while Bordj Omar Driss (28°04'N/6°39'E) at 375 m, receives a mean total of 28 mm/yr.

Mean annual temperatures are 18.3°C at Alger and 18.0°C at Cape Bougaroun, falling to 17.0°C at Mascara, on the seaward side of the mountains, and to 17.3°C at Laghouat, on the landward side of the mountains. On the High Plateau at Djelfa the mean temperature is only 13.4°C. Mean temperatures in the desert increase southwards away from the Atlas Mountains, thus at both Timimoun and Bordj Omar Driss it is 23.9°C, but 27.7°C at Ouallene Bordj. The mean monthly temperature of the warmest month (July) is 34°C at Adrar, and that of the coolest month (January) 13°C, with absolute maxima and minima of above 50°C and below -4°C, having been recorded at this centre. Diurnal temperature ranges are greater in the mountains and in the desert than at the coast. Daily amplitudes of 35-40°C are not uncommon in the latter places. Absolute minima of -10°C are known from the Atlas Mountains, and -20°C has been recorded in the A'Haggar.

Wetlands

Some coastal wetlands exist in both the west and extreme east of Algeria. The northern rivers of the Atlas are all short, and subject to great seasonal variation in flow rates. Some may flood their banks locally but they support no wetlands of significance. Among the southern rivers, only the Oued Saoura is important. This carries water into the desert each year, producing a series of semi-permanent pools and patches of humid sand. The major wetlands are the chotts, vast shallow temporary lakes of saline character. There are numerous oases in the interior.

List of Wetlands Described

1. Coastal Wetlands
    (a) The Sebkha d'Oran
    (b) The Salines d'Arzew
    (c) Marshes of the Plain of Habra
    (d) Marshes of the Plain of Guerbes
    (e) Lake Fetzara
    (f) Floodplain of the Oued el Kebir
    (g) Melah Lagoon
    (h) Lake Oubeira

(0 Lake Tonga

(j) Garaet el Mekhada

2. The Oued Saoura

3. The Chotts

(a) Chott Ech Chergui

(b) Zahrez Rharbi

(c) Zahrez Chergui

(d) Chott el Hodna

(e) Chotts of the Sétif & Constantine Region

(f) The Chott Melrhir & Merouane Complex

(g) The Chotts of el Malah

(h) Sebkhet Safioune

4. Oases

(a) The Gueltas of Ziza

(b) The Gueltas of the Tassili N'Ajjer

(c) The Gueltas of the A'Haggar Massif

(d) The Gueltas of the Mouydir Mountains & Tidikelt Depression

5. Artificial Impoundments

(a) The Barrage of Cheffia

(b) Lake Boughzoul

1. Coastal Wetlands

Wetland Name: THE SEBKHA D'ORAN

Country: Algeria

Coordinates: 35°27'-35°37'N/0°34'-1°01'W
Area: 40 000 ha
Altitude: 90-102 m asl
Nearest Towns: Oran (15 km N); Mostaganem (68 km WNW)
General: This is a saline endorheic system. The principal basin, subject to fluctuating levels of inundation after winter rains, is shown on all reliable maps as 43 km long with a mean width of 8.6 km, giving it an area close to 40 000 ha, though various authors, e.g. Carp (1980) and Scott (1980) state that its area varies from 50 000-150 000 ha. The basin slopes from west to east, having an altitude of 102 m asl at the western end adjacent to the railway. Thus flooding is deepest at the eastern end and spreads westwards with heavy rains. The eastern end of the basin

is just below 90 m asl.
Flora & Fauna: The shores and some affluent streams are fringed by *Phragmites australis,* with *Arthrocnemum glaucum, Juncus acutus, Scirpus* sp., and *Suaeda fruticosa* dominant on the seasonally inundated salt flats. The fauna is as described in the regional introduction. *Phoenicopterus ruber* and *Recurvirostra avosetta* have been recorded.
Human Impact & Utilisation: The area is a popular hunting area and hunting pressure on birds is high.
Conservation Status: Unprotected.

Wetland Name: THE SALINES D'ARZEW
Country: Algeria
Coordinates: 35°39'-35°46'N/0°15'- 0°23W
Area: c. 6500 ha
Altitude: near sea level
Nearest Towns: Arzew (15 km N); Oran (25 km WNW)
General: These comprise two saline marshy areas south of the coastal town of Arzew. The largest and most eastern marsh is 15 km long and 4 km wide, and contains a permanent lake. Both Salinas are fed by small streams but derive much of their water from direct precipitation. Both have typical halophilic coastal floras and both are important habitats for birds.
Human Impact & Utilisation: Grazing occurs on the peripheral marshes and there is some hunting.
Conservation Status: Unprotected.

Wetland Name: MARSHES OF THE PLAIN OF HABRA
Country: Algeria
Coordinates: 35°36'-35°46'N/0°02'-0°12'W
Area: 3000-12 000 ha variable
Altitude: 1-13 m asl
Nearest Towns: Mostaganem (30 km NNE); Oran (55 km WNW)

General: This is a marshland system on the Plain of Habra, immediately south of the coastal town of La Macta, and otherwise known as the Marais de la Macta. The system comprises three permanent marshes, with large areas of open water, and intervening areas subject to temporary inundation following winter rains. Water depths are never very great, and the area was subject to an unsuccessful drainage operation in the early 1960s, but it became re-flooded by the 1970s. The marshland extends almost to the sea from which it is cut off by dunes, and reaches an elevation of 13 m at its southern extremity. The seaward area is saline. The marshes and lakes are fed by direct precipitation and by a small stream which enters the southern end.

Flora & Fauna: Typical halophyte flora near the dunes, with *Sarcocornia fruticosa* and *Juncus acutus,* and with bushes of *Arthrocnemum glaucum* and *Tamarix gallica.* Fauna as

described in the regional introduction. An important site for waterfowl.

Human Impact & Utilisation: No further attempts at drainage are in progress, but irrigation agriculture takes place on nearby land. Some cattle are grazed on the fringes and there is still some hunting.

Conservation Status: The semi-permanently flooded area has been proclaimed as a nature reserve.

Wetland Name: MARSHES OF THE PLAIN OF GUERBES
Country: Algeria
Coordinates: 36°52'N/7°15'E
Area: 0-10 m
Altitude: c. 50 000 ha
Nearest Towns: Annaba (45 km E); Alger (372 km W)

General: An extensive system of marshes is situated on the alluvial coastal plain of the Oued el Kebir. Coastal dunes impede the free drainage of the area and the marshes extend upstream from the mouth for over 30 km and at one point reach nearly 20 km in width. The plain is hemmed in by hills all round, but is open to the Mediterranean Sea at the northwest. During the winter, maximum water depths of 2 m are attained.

Flora & Fauna: The marshes comprise vast tracts of dense vegetation, brackish in the lower reaches, dominated upstream by *Phragmites australis* with much *Typha capensis* and several species of *Carex, Cladium, Juncus* and *Scirpus.* Some sizeable stands of *Alnus glutinosa,* rich in ferns, are subject to semi-permanent inundation, both along the river and in depressions. Lake Freitis is a shallow (4 m) lake along the Oued el Kebir. The area is an important wintering ground for *Anser anser, Gallinago gallinago* and *Vanellus vanellus* amongst other birds. Most of the small mammals recorded in North African Wetlands occur here; *Genetta genetta* is locally common, and *Mungos mungo widringtonii* has been recorded.

Human Impact & Utilisation: The area has been little disturbed and the interiors of the marshes are relatively inaccessible. There is very little hunting.

Conservation Status: Unprotected.

Wetland Name: LAKE FETZARA

Country: Algeria

General: This once great freshwater lake was drained, but remains a wintering site for many wildfowl and still appears on maps as a lake, for which reason it is included. It is situated some 20 km southwest of Annaba and 390 km east of Alger.

Wetland Name: FLOODPLAIN OF THE OUED EL KEBIR

Country: Algeria

Coordinates: 36°45'-36°52'N/7°55'-8°13'E
Area: 8000-12 000 ha variable
Altitude: 0-3 m asl
Nearest Towns: Annaba (20 km NW); Alger (435 km W)

General: This wetland, sometimes referrred to as the Garaet el Mkhada, comprises the coastal floodplain of the Oueds Bounamoussa, el Kebir (not to be confused with another river of the same name flowing to the sea on the Plain of Guerbes west of Annaba) and Mafrag, and their tributaries. Water backs up behind the coastal dune system, producing a large marshy area with several shallow lagoons in continuity with the river and one small isolated and permanent lake, the Lac des Oiseaux.

Hydrology & Water Quality: The total wetland area varies with the amount of winter rain, but the mean depth seldom exceeds 30 cm. Direct precipitation amounts to some 750 mm/yr, while evapotranspiration is closer to 1000 mm/yr. The marsh therefore depends upon the floodwaters of the affluent streams and annual variations in the area flooded can be quite dramatic. The waters are oligohaline and generally well oxygenated.

Flora & Fauna: Typical of the habitat and region. Emergent macrophytes cover more than 90% of the area, with *Juncus maritimus, Phragnzites australis, Scirpus lacustris, S. littoralis, S. maritimus* and *Typha capensis* covering large areas, and occluding many shallow lagoons. Submerged vegetation includes *Chara* and *Ruppia spiralis* near the sea, with *Callitriche* and *Ranunculus* spp., and *Zannichellia palustris* farther inland. There are small stands of *Alnus, Salix* and *Tamarix,* some of which are subject to inundation. Fish, including *Mugil cephalus,* and eels are caught near the river mouth. The avifauna is rich and includes *Anser anser* and *Oxyura leucocephala,* many birds of prey and the vultures *Gyps fulvus* and *Neophron percnopterus.* Mammals include *Cervus elaphus, Felis caracal, F. sylvestris, Genetta genetta, Lutra lutra* and *Sus scrofer.*

Human Impact & Utilisation: Some hunting pressure, but the system is largely undisturbed.

Conservation Status: Unprotected.

Wetland Name: MELAH LAGOON

Country: Algeria

Coordinates: 36°53'N/8° 17'E
Area: 880 ha
Altitude: sea level
Nearest Towns: Annaba (40 km W); Alger (460 km W)

General: A complex of wetlands including this lagoon, Lakes Oubeira and Tonga, and the Garaet (Marsh) of el Mekhada, is situated on the coastal plain near the town of El Kala (36°53'N/8°29'E). The lagoon is a small salt water body with an outlet to the sea at the northern end, having a maximum depth of 6 m. It is 4 km long and 2 km wide and is fed by the Oueds Aroug and Melah which both enter at the southern end. There are broad

peripheral strips of salt-marsh, but fresh water influence extends some 200 m into the lake from the mouths of the two affluent streams which flow in winter.

Flora & Fauna: The submerged mudbanks are dominated by *Ruppia spiralis,* but with *Zostera noltii* present on the emergent ones. The margins carry typical tidal salt-marsh vegetation as described in the regional introduction, with an extensive sward of *Juncus maritimus* at the southern end. Fish present include *Dicentrarchus labrax, Sparus aurata* and *Solea* sp. *Gambusia holbrookii* has been introduced. The lagoon is an important habitat for wildfowl, and the mammal fauna of the periphery includes *Sus scrofer.*

Human Impact & Utilisation: The lagoon is fished commercially, using fish traps, and the mouth is maintained by dredging. Some hunting occurs but the use of boats on the water is restricted.

Conservation Status: Presently unprotected but will possibly be included in El Kala National Park which was formally established in 1983.

Wetland Name: LAKE OUBEIRA
Country: Algeria
Coordinates: 36°49'-36°51'N/8°22'-8°25'E
Area: 2100 ha
Altitude: c. 2 m asl
Nearest Towns: Annaba (55 km WNW); Alger (470 km W)

General: This is a freshwater lake, 2-3 m deep, which is subject to seasonal variations of up to 2.5 m. The lake is some 7 km long and 3 km wide, and is situated 10 km from Melah Lagoon and 5 km from the sea at the nearest point. A channel from the Oued Kebir feeds the lake at the southeastern end when the floods rise. When the river water begins to recede gates are closed to prevent the return of water from the lake to the river. The water in the lake usually has a pH of 7.2-7.6 and is generally well aerated.

Flora & Fauna: The lake is fringed by *Phragmites australis* and some rushes and sedges and is filled with dense beds of *Ceratophyllum demersum, Myriophyllum spicatum, Potamogeton* spp and *Trapa natans.* It contains a rich invertebrate fauna, including leeches, e.g. *Hirudo medicinalis,* and a variety of fresh water fish including *Anguilla anguilla, Atherina* sp., and *Alosa* sp. *Gambusia affinis* has been introduced. It is an important habitat for aquatic birds, among which *Plegadis falcinellus* is an occasional visitor.

Human Impact & Utilisation: Hunting and commercial fishing occur on the lake.

Conservation Status: Included in El Kala National Park and designated as a Wetland of International Importance under the Ramsar Convention.

Wetland Name: LAKE TONGA
Country: Algeria
Coordinates: 36°49'-36°52'N/8°29'-8°33'E
Area: 2000 ha (mostly marshland)

Altitude: 0-1 m asl
Nearest Towns: Annaba (65 km WNW); Alger (485 km W)

General: The 'lake' proper is some 7 km long and just over 3 km wide at maximum. It is surrounded by a zone of temporary inundation and there is little open water (perhaps 3%) as the lake is densely covered by emergent macrophytes. Maximum depths recorded after heavy rain are close to 2 m, but the mean depth is near 70 cm. The lake is fed by direct precipitation, peripheral run-off and water from intermittent streams. It is situated some 5 km from the sea at the nearest point. It is separated from Lake Oubeira to the west by a ridge 5 km wide which carries both a road and a railway.

Flora & Fauna: Much of the 'lake' is occluded by emergent vegetation, principally *Blisma plantago aquatica, Glyceria maxima, Iris pseudacorus, Phragmites australis, Schoenoplectus* sp., *Sparganium erectum* and *Typha capensis,* and it could perhaps be more correctly called a reed swamp. There are waterlilies in channels and open patches, and under the open water there are beds of *Ceratophyllum* and *Potamogeton.* Zooplankton is dominated by *Ceriodaphnia megops* with *Metacyclops minutus* and *Myxodiaptus incressatus,* while benthic invertebrates include *Hirudo medicinalis* and *Asellus* sp. It supports many species of fish, including *Anguilla anguilla,* a rich avifauna, and a wide spectrum of terrestrial vertebrates including *Sus scrofer.*

Human Impact & Utilisation: Attempts to drain the 'lake' to the sea by a canal in 1860-1865 were abandoned because the bottom of the lake is so close to mean sea level. However, although this failed, water was pumped out for various purposes until 1935. Since then the area has been relatively undisturbed, but has become subject to intense hunting pressure and there is some fishing.

Conservation Status: Included in El Kala National Park and designated as a Wetland of International Importance under the Ramsar Convention.

Wetland Name: GARAET EL MEKHADA
Country: Algeria
Coordinates: 36°29'N/7°51'E
Location: (centre of wetland)
Area: 8900 ha
Altitude: 5-10 m asl
Nearest Towns: Annaba (20 km NNW); El Kala (40 km ENE)

General: This is a freshwater marsh situated along the Oued Chourka above its confluence with the Oued el Kebir. Its flat marshy expanse is isolated from the sea by the coastal dunes west of Cape Rosa. In winter, water enters the marsh from the two streams mentioned, but the Oued Bounamoussa also contributes some water to the lower, northern, end of the marsh. In summer the marsh dries completely. The marsh is largely covered by emergent macrophytes, dominated by *Phragmites australis* and *Scirpus lacustris* and the fauna includes the small mammals indicated in the regional introduction, as well as *Sus scrofer.*

2. The Oued Saoura

General: The Oued Saoura is the most extensive intermittent river in the Sahara. It has several sources at the eastern end of the High Atlas in Morocco, the principal ones being at 32°20'N/4°05'W where the Oued Guir rises, and at 33°03'N/2°52'W where its major affluent rises. The Oued Guir is a perennial river in its upper course and carries surface water across the Algerian border to a point south of Meridja each year. Here it enters a pan system (31°12'N/2°54'W) above Abadla and on emerging from this it is joined by the Oued Zousfana at Igli (30°27'N/2°17'W). This latter stream rises to the northeast (32°02'N/1°09'W), in Morocco, in the Mountains of Ksour, a ridge extending from the High Atlas. From Igli, the watercourse becomes known as the Oued Saoura and runs southwestwards into the desert, flowing on the surface to the vicinity of El Ouata, a village just south of the town of Beni Abbès. Thereafter it is an intermittent stream and crosses the stony lands of the Hamada du Guir and then penetrates the sand desert. It runs between the dunes of the Ergs Iguidi and Chech to the west, and those of the Grand Erg Occidental to the east. The sands of these systems encroach upon the river valley, and indeed upon the river bed, which provides a string of moist sands, pans and pools (gueltas) for a distance of 650 km.

A large area subject to surface flooding, 40 km long and 10 km wide, used to occur (30°46'-31°08'N/2°39'-2°54'W) near Adabla, and another smaller pan occurs at Mar-houma (29°58'N/2°00'W). At a point below Ksabi (29°05'N/1°00'W) the Oued Saoura bifurcates and continues in parallel, the westerly course being known as the Oued Tsebat and the easterly one as the Oued Messaoud. Farther south, surface water used to appear regularly on both the Oueds Tsebat and Messaoud, at 28°05'N/0°39'W and 28°05'N/ 0°33'W respectively. Other pans, or sebkhets, up to 180 km long and 12 km wide occur between Adrar (27°51'N/0°19'W) and Reggane (26°42'N/0°13'W), but these are very much drier than the northern pans. Between them, the Oueds Tsebat and Messaoud carry subterranean water as far south as the well of Boura (26°13'N/0°15'W) to where there is little doubt that surface floods penetrated at least once during the 18th Century.

Hydrology & Water Quality: Mean annual precipitation over the system is minimal, 50 mm at Beni Abbès, 18 mm at Adrar and 10 mm at Reggane, and has virtually no effect on surface flooding. However, there are strong annual variations in rainfall, and while Adrar may receive 0 mm for several successive years, it has recorded falls of 65 mm/yr. Floods in the river are chiefly due to heavy rainfall in the Atlas Mountains, and they may occur several times a year. Occasionally floods arise because of storms over the lower reaches of the Oueds Guir and Zousfana. Surface waters used periodically to reach far into the desert. According to Dubief & Cornet (1958), the river flooded south for 800 km from the source of the Oued Guir in 1959, and since 1900 has sent surface water 500 km downstream 5 times, 400 km 6 times, 300 km 13 times and 200 km 33 times. Floods are reputed to have reached Reggane in 1915, 975 km from the source of the Oued Guir, but while this is not substantiated, it is recorded in historical documents that slaves were sent north from

Reggane by boat in the 16th Century. However, since the Oued Guir has been impounded at Djorf Torba, these floods no longer occur. The Oued Guir usually carries water of low conductivity, but downstream, with progressive evaporation, this increases and eventually a crust of salts may be left on the stream bed.

Flora & Fauna: Since water levels are very variable, emergent macrophytes are generally absent from the stream bed, although they are not entirely absent and they occur along irrigation channels at oases. Here *Phragmites australis* is usually dominant, with *Typha capensis* and species such as *Cynodon dactylon, Juncus maritimus, Scirpus holoschoenus, Sonchus maritimus,* all salt tolerant species. There are some *Hyphaene* palms and occasional stunted figs *(Ficus sycomorus)* along the oued, and locally thickets of *Nerium oleander* and *Tamarix* spp., but *Phoenix dactylifera* has been extensively planted in the valley and is by far the most common tree. Pools and semi-permanent pools contain a dense, if not rich, invertebrate fauna. Among fishes, the typical Atlas species occur in the upper, freshwater reaches, extending downstream with the flood, and moving back again as it dissipates. Downstream only euryhaline species persist, including *Aphanius fasciatus* and *A. iberus.* Among amphibia, *Bufo mauritanicus, Discoglossus pictus* and *Rana ridibunda* have been recorded in the middle valley, and are abundant at oases. Among mammals there are desert rodents, and carnivores such as *Fells margarita.*

Human Impact & Utilisation: The Oued Saoura has been a major caravan route across the Sahara from time immemorial and the centres of Beni Abbès, Marhouma, Aguedal, Guerzim, Kerzaz, Timoudi, Ksabi and El Kseïbat have developed at points in its bed where water is freely available. The waters are used for various purposes, including irrigation, at centres along most of its upper course. However, a consequence of the damming of the Oued Guir is that the subterranean waters of the Oued Saoura are becoming more saline. The valley of the Oued Saoura is comparatively densely populated, and has probably been a centre of population since Neolithic, and indeed Palaeolithic times. Fossil evidence suggests that a cattle farming society existed here during a Neolithic period. Tourism in the valley is increasing as there is now a good sealed road, but pollution is becoming a problem at some centres where sewage, either treated or untreated, is discharged directly into the oued, e.g. at Beni Abbès.

Conservation Status: Unprotected.

Wetland Name: CHOTT ECH CHERGUI
Country: Algeria
Coordinates: 34°03%34°36'N/0°24'W-1°11'E
Area: c. 150 000 ha
Altitude: 982 m asl
Nearest Towns: Oran (180 km NNW); Alger (290 km NE)

General: The Chott Ech Chergui is the largest, highest and most western of the temporary shallow water bodies on the High Plateau. It is oriented WSW-ENE and is 160 km long, with a maximum widths of 26 km near the eastern end. It is endorheic and occupies a shallow depression on the plateau into which some 25 intermittent streams

discharge. The seasonal flood waters lie at about 982 m and throughout the chott areas above 984 m are permanently dry. There are several of these dry areas, the highest reaching 1017 m, and in the central part of the chott they occupy more land than the zone subject to inundation. In a wet year as much as 150 000 ha can be flooded. The water is saline, increasing in salt content as the season progresses. Water depths vary from 1 m to a few centimetres.

Flora & Fauna: Essentially as described in the regional introduction. Due to great variations in the water level there are few reeds, but low growing halophytes abound along the shores where *Sarcocornia fruticosa* is dominant over large areas. All the chotts are of importance to wintering and migrating waterfowl, and the Chott Ech Chergui supports large numbers of ducks, including *Anas acuta, A. penelope, Tadorna tadorna,* together with *Charadrius morinellus, Grus grus, Phoenicopterus ruber* and *Recurvirostra avosetta.*

Human Impact & Utilisation: The chotts provide excellent shooting, and hunting pressure on the avifauna is severe. Some salt is extracted, cattle are grazed on the periphery, and locally, salt-tolerant strains of cereals are grown on adjacent land.

Conservation Status: Unprotected.

Wetland Name: ZAHREZ RHARBI

Country: Algeria

Coordinates: 34°51'-34°58'N/2°36'-2°58'W
Area: 22 000 ha
Altitude: 826 m asl
Nearest Towns: Oran (310 km NW); Alger (200 km N)

General: The inundated zone of the Zahrez Rharbi is 25 km long and up to 10 km wide, fringed on the south and east by expanses of humid sand. The system is endorheic and saline. The depression lies at the western end of a trough 30 km wide, running WSW-ENE for 140 km along the High Plateau. The sides of the trough rise steeply from the floor, to altitudes of 1200-1370 m asl on the north, and to 1550 m on the south side. The flora and fauna are similar to that of the Chott Ech Chergui, as is human impact on the site.

Conservation Status: Unprotected.

Wetland Name: ZAHREZ CHERGUI
Country: Algeria
Coordinates: 35°08'-35°19'N/3°24'-3°43'E
Area: 19 500 ha
Altitude: 755 m asl
Nearest Towns: Alger (170 km NNW); Laghouat (150 km SSW)

General: This chott occupies the eastern and lowest end of the trough holding the Zahrez Rharbi. The depression is fed by 11 oueds and the area subject to inundation, 34 km long and up to 9 km wide, is bounded by humid sands along the southern shore. An area of permanent swamp occurs at the western end, and the land rises from the eastern end to a high ridge separating this endorheic system from the Chott el Hodna farther east. Conditions on the chott are similar to those described above for the Chott Ech Chergui**.**

Conservation Status: Unprotected.

Wetland Name: CHOTT EL HODNA
Country: Algeria
Coordinates: 35°18'-35°32'N/4°15'-5°06'E
Area: c. 85 000 ha
Altitude: 390 m asl (lowest point in basin)
Nearest Towns: Alger (200 km NW); Biskra (80 km SE)

General: This chott occupies the lowest, almost central, part of a basin at the eastern end of the High Plateau. The basin is oriented WNW-ESE and is 220 km long, and 90 km wide at maximum, set between mountains reaching altitudes of 1800-1900 m asl on the north side and 900-1600 m on the south side. Some of the affluent streams, such as the Oueds Djenane and Sbisseb, are perennial in their upper courses and the Oued M'Sila tends to flow throughout its length for much of the year. At least 22 major streams discharge into the chott and in addition it is fed by several freshwater springs around its southern periphery. The area flooded each year varies but is usually in excess of 80 000 ha and is some 77 km long and up to 19 km wide. The chott holds water only in the winter and is saline, with salts encrusting the muddy periphery in summer. Some authors (e.g. Carp 1980) state that the pan extends at least 90 km from east to west in wet years and that the inundation zone can reach 400 000 ha. However, while the flood may exceed 77 km in length, an area of 400 000 ha implies a water body with a mean width in excess of 45 km reaching from M'Sila (472 m asl) in the north to the feet of the Djebel Meharga in the south, with maximum water depths approaching 80 m. It seems unlikely that such a water body has ever developed this century as a lake 80 m deep would be perennial.

Flora & Fauna: The flora of the shore is halophytic, and includes a number of coastal species such as *Juncus acutus* and *Sarcornia fruticosa,* but reeds, rushes and sedges, and some palms, grow around springs and along water courses leading to the chott. The area is very important to wintering and migrating waterfowl.

Human Impact & Utilisation: The area is not densely populated. Cattle are grazed on the periphery and some crops, including dates and cereals, are grown locally. Although the chott is ringed by roads, approaching to within 15 km of the northern shore, hunting pressure is said to be light.

Conservation Status: Unprotected.

Wetland Name: CHOTTS OF THE SETIF & CONSTANTINE REGION
Country: Algeria
General: A discontinuous band of wetlands extends for 175 km from a point south of Setif (36°09'N/5°26'E) to one southeast of Constantine (36°25'N/6°43'E). This comprises a series of pans, located from west to east, as follows: un-named pan (36°00'N/5°20'E); Sebkhet el Amiet (35°54'-35°56'N/5°31'-5°35'E); Chott el Fran (35°53'-35°59'N/5°37'-5°42'E); Sebkhet Bazer (36°02'-36°04'N/5°37'-5°45'E); Chott Bekla (35°53 '-36°00'N/5°45 '-5°53'E); un-named pan (35°49'N/6°11'E); Chott GadaIne (35°45 ' -35 °53 'N/6°12 ' -6°23 'E); Sebkhet Zemoul (35°51 ' -35°54 'N/6°31 '-6°36'E); Sebkhet Djendli (35°42'-35°45'N/6°31'-6°36'E); Garaet et Mahrsel (35°49'-35°51'N/ 6°44'-6°48'E); Garnet Ank Djeme (35°44 '-35°49 'N/6°47 ' -6°54 'E); Garaet Guellif (35°44'-35°49'N/6°55'-7°01'E); and Garnet et Tarf (35°33'-35°45'N/6°56'-7°13'E).

These pans are situated on a high plain, 30 km wide at the western end, but broadening along an E-W axis to 80 km at the eastern end. The plain is hemmed in by mountains to both north and south, rising to 2321 m at Djebel Mahmel and 2326 m at Djebel Chèlia due south of Constantine. The plain is crossed by many watercourses, both intermittent and perennial, especially towards its western end. In the main it lies 950-1000 m asl and is studded with hills, rising in places more than 400 m above this. However, Chott Gadaïne, in a central southerly position, is less than 900 m asl. The largest pan, Garaet et Tarf, occupies some 25 000 ha when fully inundated and measures 28 km in length with a maximum width of 17 km. It has a belt of humid sand around much of its periphery. The pans are flooded to variable depths and extents each year, and there are numerous marshy areas in the vicinity of springs around the edges of the plain.

Flora & Fauna: Essentially as described in the regional introduction for chotts of the high plateaux. Reeds, rushes, sedges and trees grow along some of the watercourses, and in permanent marshy areas around springs. The pans are endorheic and saline, and have typical low growing halophyte floras on their muddy salt encrusted margins, where species of *Salicornia, Sarcocornia* and *Sueda* are abundant. All pans and freshwater marshes are important sites for wintering and migrating waterfowl, especially *Anas acuta, A. penelope, Charadrius morinellus, Grus grus, Phoenicopterus ruber, Recurvirostra avosetta* and *Tadorna tadorna.*

Human Impact & Utilisation: A number of roads cross the plain including that between Batna and Constantine. The eastern pans are more accessible than the western ones and are subject to greater hunting pressure during the winter. Some agriculture occurs on the plain, but apart from hunting and some salt gathering, the pans, *per se,* are little interfered with.

Conservation Status: Unprotected.

Wetland Name: THE CHOTTS MELRHIR & MEROUANE COMPLEX
Country: Algeria
Coordinates: 33°50'-34°29'N/5°57'-7°25'E

Area: c. 275 000 ha
Altitude: below sea level
Nearest Towns: Biskra (60 km NE); Touggourt (85 km S)

General: Chott Melrhir is 65 km long and has a mean width of 29 km. It contains extensive areas of humid sand and its land surface descends to 36 m below sea level. It is separated from Chott Merouane to the south, by a narrow corridor of permanently dry land, only 4 km wide in places. The northern part of Chott Merouane lies 40 m below sea level. A series of small seasonally flooded wetlands extends eastwards, almost continuously from the southeastern extremity of Chott Melrhir into Tunisia. These are, from west to east, the Chotts es Setal, el Aquila, Djerabaa, Zebabir, Zhilhif, Aslaudi and Khalla. The last named chott crosses the national border and lies in the same depression as the Chott el Rharsa in Tunisia. The lowest parts of the depressions are permanently flooded, and the system is saline and endorheic, since although the depression continues eastwards, it tends to drain back into Chott Melrhir.

Flora & Fauna: The inundated zones are fringed by low growing halophytes, including species of *Arthrocnemum, Limonium, Juncus, Salicornia, Sarcocornia, Scirpus* and *Suaeda.* The fauna is as described in the regional introduction for chotts. There is a rich avifauna including several species of *Anas, Chlamydotis undulata* and *Phoenicopterus ruber.*

Human Impact & Utilisation: The area is comparatively inaccessible and hunting is more or less confined to the zones along the road which runs between the two major chotts.

Conservation Status: Unprotected.

Wetland Name: THE CHOTTS OF EL MALAH

Country: Algeria

Coordinates: 32°41 '-33°01'N/5°29'-5°40'W
Area: 23 000 ha
Altitude: 90-98 m asl
Nearest Towns: Biskra (205 km N); Touggourt (50 km NE)

General: This is a system of three separate chotts (or sebkas) which are very irregularly flooded. The southernmost pan measures some 11x8 km and is 90 m asl. The central pan, 24x8 km, is about 95 m asl, while the northernmost pan is 98 m asl. The chotts lie just north of the collection of mesas at El Hadjira, with tops at 165 m asl, and there are palm plantations between the scarps and the chotts. The flora and fauna of the system is as described in the regional introduction. Some hunting takes place on the chotts which are unprotected.

Wetland Name: SEBKHET SAFIOUNE

Country: Algeria

Coordinates: 32°14 '-32°24 'N/5°17 '-5°25'E
Area: c. 11 000 ha
Altitude: 101 m asl

Nearest Towns: Touggourt (105 km NE); Biskra (275 km N)

General: This is a large saline and endorheic pan at the end of the Oued en Nsa, an intermittent watercourse 195 km long. This stream rises at an altitude of over 600 m asl, as the Oued el Ferch, and runs SE, receiving several tributaries. At first it runs along the foot of a broken escarpment on the south side, but becomes deeply entrenched and then, as the Oued en Nsa, flows eastwards for 70 km through a narrow and ever deepening gorge in a plateau set between 265-270 m asl. Finally, its waters, when in flood, spill onto a plain some 110 m asl at the eastern edge of the plateau, and spread southwards to collect in the sebkhet. Inselbergs rise nearly 100 m from the floor of the pan at its southeastern end and the escarpment of the plateau lies 5-12 km to the west. There are date palm plantations to the south, between the sebkhet and the escarpment of the plateau. Some hunting occurs on the sebkhet when it is flooded and attracts waterfowl. The system is not protected.

4. Oases

Wetland Name: THE GUELTAS OF ZIZA

Country: Algeria

Location: 23°32'N/2°34'E
Area: a few m^2
Altitude: c. 515 m asl
Nearest Towns: Tamanrasset (310 km ESE); Oran (1360 km N)

General: This is one of the most isolated occurrences of free surface water in the Sahara. It is situated near the southwestern extremity of the plateau, Adrar Nahalet, which extends westwards from the massif of the A'Haggar. The permanent guelta (pool), 13 m wide when full and 6 m deep, is inside a volcanic crater which partly encloses a valley. It collects water from two oueds which drain Ziza Mountain, to the south, and is reputed to have no underground input. Several small temporary pools also occur in the bed of the main oued draining Mt. Ziza. The water of the guelta is fresh. There are no macrophytes or vertebrates in the guelta, and life forms are restricted to blue-green algae, some zooplankton, and a few insects. The water of the guelta supports a dozen people and their domestic animals. The guelta is unprotected.

Wetland Name: THE GUELTAS OF THE TASSILI N'AJJER

Country: Algeria

General: Over 300 permanent gueltas (ponds) are known to occur in the Tassili N'Ajjer which is a high sandstone plateau extending northeastwards from the A'Haggar Massif. It descends to a lower plateau along a scarp line running in a gentle arc from southeast to northwest, while a mountainous ridge surmounts the plateau, running roughly parallel to the escarpment, but some 30-50 km back from it. The highest point on the ridge, at 2158 m, is Mt. Afao (25°09'N/8°12'E). Maximum temperatures on the high plateau are seldom in excess of 32°C, while winter minima are usually 1-2°C, although frosts occur on the peaks and snow has been recorded several times. The slopes of this Mt. Afao are drained by a dendritic system of oueds,

culminating in the Oued Imirhou. This watercourse, and its principal affluents, the Oueds Iherir and Torset, all traverse deep gorges running NE to the lower plain where they swing NW to lose themselves under the sands of the Erg Issaounane west of Illizi (26°32'N/8°33'E), 535 m asl. The Oued Imirhou drains a basin larger than 12 500 km^2 and rises about 1800 m asl in innumerable gullies on the Mt. Afao Massif. Permanent and temporary ponds occur on all three oueds in an area 25°10'-25°36'N/8°00'-9°20'E, the Oued Iherir alone contains 45 permanent gueltas, has been known to carry flowing surface water for distances of up to 20 km. The gueltas occur between altitudes of 1100-1200 m asl, vary in depth from 4-15 m, and may be connected by streams or waterfalls after rain. A hot spring (45°C) is situated at the junction of the Oueds Imirhou and Torset, which supplies a guelta known as Tihoubar ti-n-Afella.

Other gueltas occur to the west along the Oued Tadjeradjeri and its upper tributaries, in an area 25°10'-25°50'N/7°50'-8°00'E. The most important of these lie along the bed of an affluent, the Oued Aharhar. There is a small lake, 500 m long and about 4 m deep, at about 26°N in the main valley at an altitude of 1120 m asl. It is situated in a flat open area and supports dense *Typha* beds, which extend well out into the lake. Springs occur in some of the higher valleys. Farther west there is a fossil floodplain, some 1160 m asl (25°12'-25°26'N/7°36'-7°45'E) at the confluence of three gorges. Of these, the Oued Tin Bawendi contains a series of gueltas over a stretch of several kilometres, the gueltas being separated by *Typha* beds along the watercourse. On the mountainous ridge to the east of Mt. Afao, at altitudes close to 1600 m asl (25°12'N/8°28'E), there are gueltas in a number of short gorges at Assar.

Hydrology & Water Quality: Rain over the Tassili N'Ajjer is scant and annually very variable. The mean annual receipt is probably close to 25 mm, but in some years as much as 150 mm may be received locally. This usually falls as a consequence of storms arising from temporary and very turbulent projections of the intertropical front, which push northwards to the A'Haggar region. The maximum recorded flood on the Oued Imerhou extended 270 km below the source, and flowing surface water has persisted in the Oued Iherir for up to 6 months of the year. Floods in this latter watercourse regularly extend 20 km downstream. The gueltas quickly become stagnant after floods, but are well oxygenated immediately after them. Salinity varies considerably from guelta to guelta. The upper ones tend to be fresh after rain, and salinity in the lower gueltas declines with the frequency of flushing, but high salinities occur in the lowest ones. Magnesium and sulphate concentrations are high in some gueltas and these tend to be the principal ions throughout the system.

Flora & Fauna: Filamentous green algae occur around the rims of rocky gueltas, and *Volvox* spp. are common in the phytoplankton of some. However, the margins of most are fringed by stands of *Typha capensis,* in belts up to 10 m wide, but *Phragmites australis* is less important, and is absent from many gueltas. *Polygonum* sp. occurs on the margins of a few. Submerged species include *Ceratophyllum demersum, Myriophyllum spicatum, Potamogeton* spp., and *Utricularia* spp. and Characeae. *Nerium oleander* and *Tamarix gallica* are abundant along the oued beds in most valleys, with *Acacia nilotica* and *Hyphaene thebaica* on the banks of many. Occasional trees of *Olea laperrinii* grow along the Oued Iherir. *Phoenix dactylifera* has been planted in great numbers in suitable sites in all valleys.

Among animals the poriferan *Spongilla carteri* has been recorded in some gueltas, together with the bryozoan *Fredericella sultana.* There is in fact, a remarkably diverse invertebrate fauna, including several relict species, and with representatives of both the Afrotropical and Palaearctic realms. This includes the vectors of bilharzia and malaria. Among the fishes are *Barbus biscarensis* (Palaearctic), *Barbus deserti* (Afrotropical), *Clarias anguillaris, C. gariepinus* and *Tilapia zillii.* These species do not necessarily occur together. *Bufo viridis, Ptychadena occipitalis* and *P. mascareniensis* are the principal amphibians. *Crocodylus niloticus* is now extinct, but survived here at least until 1924. Among notable mammals, *Felis chaus,* a true wetland species, occurs here (other occurrences in the A'Haggar and Nile Delta), together with *F. margarita.*

Human Impact & Utilisation: The area has certainly been continuously inhabited since Neolithic times. Cereals (wheat), dates, figs, grapes, and root crops are produced in the valleys, where the resident population has fluctuated this century but has generally been several thousand, continuously more than 1000 along the Oued Iherir alone. Fish are taken from the gueltas and camels, cattle and goats are grazed. *Typha* is used for thatching and making mats, and part of the stem is eaten as a vegetable. There is some tourism, people coming to visit the frescoes found on the plateau, but very little interference. A number of wells have been dug in the Oued Tadjeradjeri system, together with irrigation canals to lead the water to the village of Arharhar, but these have fallen into disuse since the development of oil fields at In Amenas. This development has probably reduced the population throughout the region in recent years.

Conservation Status: The valley of Iherir is protected as a nature park, administered by the Ministry of Fine Arts, but protection does not extend to the flora and fauna, only to the frescoes.

Wetland Name: THE GUELTAS OF THE A'HAGGAR MASSIF

Country: Algeria

General: The dramatically dissected A 'Haggar Mountains, rising to 2918 m at Mt. Tahat, drain principally to the south and west. The massif comprises Precambrian granite, but the highest parts, over 1900 m, are covered by Tertiary and Quarternary lavas. The climate of the massif is more temperate than that of the surrounding lowlands. Rainfall increases with altitude, from less than 20 mm/yr on the Plain of Tanzerouft, to 50 mm/yr at Tamanrasset (22°50'N/5°28'E) situated 1400 m asl on the SW slopes, and to 125 mm/yr at Assekrem Peak (2728 m). Annual variations are marked, as is general in deserts, and while annual falls of less than 10 mm have been recorded at Tamanrasset, 160 mm fell in 1933. Similarly, Mt. Assekrem, which has had total annual receipts less than 35 mm, recorded 260 mm in 1957. The mean annual temperature of the warmest month (July) at Tamanrasset is 29°C, and that of the coolest month (January) 12°C. The mean annual temperature is 21°C, significantly lower than on the Tanzerouft Plain, and frost occurs at Tamanrasset on an average of 29 days each year, with an absolute minimum reading of -6°C. Snow is common on the high peaks, where temperatures of -12°C have been recorded.

The most important of the western drainage systems is the Oued Tamanrasset, which once bore its waters to the Atlantic before being captured by the Niger. Today it carries occasional floods onto the Tanzerouft Plain, but gueltas, which freeze in winter, occur in its upper reaches, in a system of deep gorges. The most gueltas are those of Imaoulaouene, which occur in a tributary gorge near the city of Tamanrasset. A fault across the river bed, at an altitude of 1540 m asl, causes a current of subterranean water to surface and cascade in several steps through a series of ponds, before once again disappearing underground at 1500 m.

Many gueltas occur around the edge of the Atakor, i.e. around the rim of volcanic lavas that top the massif between 1800-2100 m. Many are situated in fairly open river beds, as strings of pools among rocks and boulders, and these are connected by flowing surface water for a good part of the year, since rainfall, though scant, is more or less aseasonal. Other gueltas are plunge pools beneath ledges over which waterfalls descend periodically, yet others are in kettleholes (marmites de gèant) worn into the granite.

Innumerable gueltas, of similar nature to those described above, occur in the deep ravines leading south out of the central massif, in particular those of the Oueds Azrou, Afrahouhine, Sersouf, Tin Tarabine, Afara and Takalous, between longitudes 6° and 7°30'E. Ultimately these watercourses all join the Oued Tin Tarabine which passes to the east of a long N-S oriented inselberg at a point 22°08'N/6°39'E. Near here there is a permanent pool, and from here the Oued Tin Tarabine trends SE. Floods in very wet years have extended far past the inselberg. Another long and deeply entrenched valley, that of the Oued Tagrira, begins 40 km south of the inselberg and runs towards the SW. This latter system has a bed of humid sand, floods occasionally, and carries arborescent vegetation at points.

Hydrology & Water Quality: The gueltas and cascades of Imaoulaouene are permanent and there may be several floods on the system in a single year, but virtually all of the upper oueds in the massif flow for several days each year. Heavy floods, leading to surface water in the lower oueds, are uncommon, but the Oued Tamanrasset has carried water to the Tanzerouft Plain half a dozen times this century, and to its centre in 1950 and 1951. The upper pools vary in depth from 2-5 m. Salinity of the water in the gueltas varies, as might be expected, with the degree and frequency of flushing which they receive. Salts crystallise around some gueltas, and remarkably, on the stems of *Typha capensis.* Conductivities generally range from 150-1500 µSiemens/cm.

Flora & Fauna: *Nerium oleander* and *Tamarix gallica* is common in the beds of oueds where the water table is close to the surface. *Acacia nilotica* and *Hyphaene thebaica* also occur near gueltas, but have largely been replaced by *Phoenix dactylifera.* There are occasional trees of *Ficus sycomorus* and *Olea laperinii* in inaccessible side gullies. Stands of *Typha capensis* are commonplace, sometimes in association with *Phragmites australis.* This latter species occurs in some sites which become temporarily dry. Other emergent macrophytes include *Juncus buffonius, Scirpus holoschoenus* and the grass, *Polypogon monspelliensis.* Submerged macrophytes include *Ceratophyllum demersum, Myriophyllum spicatum* and *Potamogeton* spp. Algae include species of *Chara, Cladophora, Closterium, Cosmarium, Dictyosphaerium, Microcystis, Oedogonium, Scenedesmus, Ulothrix, Volvox* and *Zygnema.*

Among fishes, *Tilapia zillii* is the most widespread, being found in a great many of the upper, permanent, ponds, but it is excluded from the highest ones by low winter temperatures. *Barbus biscarensis* is abundant in some systems and *B. deserti* has also been recorded from the massif. *Bufo viridis* and *Rana ridibunda* are widespread amphibians.

Human Impact & Utilisation: The upper gueltas of the Atakor are little disturbed and little visited, except by tourists who can visit a number using 4 wheel drive vehicles. Picknicking beside and swimming in the gueltas then occurs but has no significant influence upon the ecosystem at present. There are no permanent human habitations at the upper gueltas. The lower gueltas of the Oued Tamanrasset system no longer supply water for human habitation directly, but camels, cattle and goats drink from them and are grazed nearby. Some agriculture and horticulture is carried out along the lower oueds and there are *Phoenix dactylifera* plantations.

Conservation Status: Unprotected.

Wetland Name: THE GUELTAS OF THE MOUYDIR MOUNTAINS & TIDIKELT DEPRESSION

Country: Algeria

General: The granitic Mouydir Mountains comprise a chain oriented SSW-NNE, rising to heights of 1100-1680 m, and lying 100-150 km northwest of the A'Haggar Massif. Geologically they are related to the Precambrian core of this massif. The principal drainage lines from the Mouydir Mountains are NW , to the Tidikelt Depression. A number of gueltas occur in gorges leading out the mountains, e.g. that in the Gorge of Arak (25°17'N/3°41'E). Here several permanent and semi-permanent gueltas occur in the upper canyon beginning about 700 m asl, while in the lower and wider gorge, at an altitude of 560 m asl, there is a second series of shallow semi-permanent pools, created where groundwater reaches the surface. At still lower altitudes, and farther west, along the borders of the Tidikelt Depression, but still on oueds, there are numerous pools, notably those of Aït Elkra (24°31'N/2°32'E), Talohak (24°45'N/2°20'E), Aguelman Tadjelet (24°52'N/1°45'E), Bou Rhanet (25°12'N/1°18'E), Tikkindine (25°31'N/ 1°25'E), I-n-Rellal (25°41'N/2°03'E) and Ti-n-Atanan (25°52'N/1°38'E). Ultimately the water from the eastern highlands seeps into the ground beneath the great saline pans of the depression, the Sebkras Azz el Matti and Mekerrhane.

Hydrology & Water Quality: The water of the Arak gueltas is generally fresh, as is that of the pools bordering the Tidikelt Depression, but the pans, and subsurface water of the depression is saline. Rain over the Mouydir Mountains is generally light, c. 10 50 mm/yr, and unreliable.

Flora & Fauna: The pools of the Arak Gorge are fringed by *Phragmites australis, Typha capensis* and *Scirpus holoschoenus,* while submerged species include *Ceratophyllum demersum, Myriophyllunt spicatum* and *Ruppia spiralis,* the last a species with strong coastal affinity. The humid soils of the oueds throughout the region support *Nerium oleander* and *Tamarix gallica,* with occasional stands of *Acacia nilotica* and *Hyphaene thebaica.* There are no fish in the lower pools but *Tilapia zillii* occurs in the permanent

high gueltas of the Arak Gorge. *Bufo mauretanicus* and *B. viridis* occur in the district. The usual desert mammals are present, as referred to in the regional introduction.

5. Artificial Impoundments

Wetland Name: THE BARRAGE DE CHEFFIA

Country: Algeria

Coordinates: 36°45 'N/8°05 'N
Area: c. 3000 ha (at capacity)
Altitude: 170 m asl
Nearest Towns: Annaba (35 km NW); Alger (448 km W)

General: This barrage is on the Oued Bounamoussa well above its entry to the marshy alluvial plain (Garaet el Mekhada) which it shares on the coastal plain with the Oued el Kebir. The open water area is set round by hills and has a maximum depth of 20 m. The reservoir provides a refuge for birds when shooting is in progress on the lower wetlands of the coastal plain. Hunting is not permitted.

Wetland Name: LAKE BOUGHZOUL
Country: Algeria
Coordinates: 35°39'-35°45'N/2°50'E
Area: 5000 ha total wetland (1100 ha open water)
Altitude: 635 m asl
Nearest Towns: Alger (120 km N); Djelfa (120 km S)

General: The Oued Touil crosses the High Plateau from the south side, with a wide wet sandy bed, flowing almost due north for 125 km before it joins the perennial Oued Nahr Quassel on its right bank. This latter stream flows down from the northern mountains, and just below the confluence mentioned, is joined by the Oued ech Chemara, another intermittent stream. The Oued Nahr Quassel then traverses a permanent marsh some 10 km long before expanding into Lake Boughzoul which has an open water surface in excess of 1000 ha. This is the largest artificial lake on the High Plateau and is situated close to the Djelfa-Media road. The vegetation of the permanent marsh is lush and includes *Phragmites* and *Typha.* The entire wetland provides an important habitat for waterfowl including wintering *Charadrius alexandrinus, Gelochelidion nilotica, Himantopus himantopus* and *Podiceps cristatus.* The lake is unprotected.