1.4 MOROCCO

Introduction

Morocco lies at the northwestern extremity of the African continent, being bounded by Western Sahara in the south, by Algeria in the east, by the Mediterranean Sea in the north and the Atlantic Ocean in the west. It occupies 458 730 km^2, has a population (1982) of 21 000 000, and thus a mean population density of 45.8 persons/km^2. It stretches 1100 km from north to south, between the Strait of Gibraltar and the parallel 26°N, and approximately 1240 km from east to west between longitudes 0°59' and 12°10'W.

The country is dominated by the great mass of the Atlas Mountains which run SW to NE, parallel with the sea. In the centre the High Atlas forms a chain, 450 km of which is almost continuously over 3000 m, with maximum heights of 4165 m at Jbel Toubkal (31°03'N/7°55'W) and 4071 m at Irhil M'Goun (30°30'N/6°26'W). Adjacent to this great ridge, on the south side, is the volcanic massif of Jbel Sarhro (31 °N/6°W), which connects with a subsidiary mountain range, the Anti-Atlas, running SW-NE to the sea at Cape Rhir (30°38'N/9°54'W), parallel with the main range but separated from it by the ever-widening valley of the Oued Sous. On the north side of the High Atlas, the Middle Atlas Range branches off NNE, culminating in the peak of Jbel Bou (33°35'N/3°53'W), 3340 m asl. The valley of the Oued Moulouya, which leads down to the Mediterranean Sea, separates these last two ranges. Yet another mountain range, rather lower, but still exceeding 2000 m, runs roughly W-E along the coast from the Gibraltar strait to the mouth of the Moulouya. This is the Rif Atlas, and it is the most ancient of the Moroccan mountains.

Most of the country is above the 500 m contour, and the few lowlands, below the 100 m contour, are located along the coast. The coast is often very rocky and of high relief, but in the far south, along the border with Western Sahara there is an extensive lowland containing the saline pans of Sabkhat Tah. Farther north, the Plage Blanche at the mouth of the Oued Draa, is alluvial and extends alongshore for 75 km and inland for 15 km. Yet farther north, another alluvial plain, 75 km long and 15-20 km wide, occurs at the mouth of the Oued Sous which rises on the slopes of Jbel Toubkal some 200 km distant. However, the largest coastal plain extends NE from Essaouira (31°31'N/9°46'W) to Casablanca (33°37'N/7°35'W), a distance of over 350 km, and in the north it widens to 45 km. This is another alluvial plain, having been built up by the floods of the Oued Tensift and Oued Oum or Rbia. At the far north of the Atlantic coast, between Rabat (34°02'N/6°50'W) and Tanger (35°48'N/5°48'W) are the Rharb Plains, lying at the foot of the Rif Atlas from which they have been derived. The coastal strip is very narrow, or non-existent along the Mediterranean coast.

To the southeast of the High Atlas Range the land slopes quite steeply to the Algerian border, but in the northeast of Morocco, it flattens into a high plateau between 1000-1600 m asl.

Drainage of the complex of Atlas Ranges is either directly to the sea, or to the Sahara. Because rainfall is highly seasonal, and even then may come in short rainstorms, the rivers of the Atlas are quickly turned into torrents. The southernmost rivers, including the Oued Drak flow only intermittently, but the Oued Sous, and all more northern streams are perennial, though highly seasonal in terms of their volumetric discharge. All rivers flowing down from the northwestern slopes of the High Atlas have floodplains, and those of the Oued Sous, Oued Tensift, Oued Rbia, Oued Sebou and Oued Loukkas have led to the development of the alluvial plains so important to Moroccan agriculture. On the Mediterranean coast, the Oued Moulouya also has a floodplain. Flow in this stream varies from 991 m^3/sec in winter to 5 m^3/sec in summer. The most important streams draining the drier southeastern slopes of the Atlas are the Oued Draa, the Oued Ziz and the Oued Guir. These are all intermittent streams, but they flow strongly in their upper courses each year. The waters of the latter pair reach the desert and are dissipated in a series of saline pans, but by contrast the Oued Drai, after collecting the waters of several affluents, swings southwestwards to the sea which it enters near Cape Drai in the far south.

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 Morocco to the Sahara. 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 and central Morocco have a Mediterranean type of climate with cool wet winters and hot dry summers. In the Rif and northern part of the Middle Atlas mean annual precipitation may exceed 850 mm and the dry season lasts only 3 months. Falls of up to 1600 mm/yr may occur on the peaks of the High Atlas, but in moving over the mountains towards the interior, and in moving south, annual rainfall decreases and the dry season lengthens. In the central south, arid conditions prevail, and in the extreme southwest the desert reaches the sea.

At the coast at Tan Tan (28°30'N/11°02'W) mean annual precipitation is 97 mm. At Agadir (30°24'N/9°36'W) it is 224 mm, and at Safi (32°18'N/9°20'W) 327 mm, while Casablanca receives 406 mm of rain per year and Tanger 887 mm. Rainfall then decreases slightly along the Mediterranean coast but is generally greater than 750 mm/yr. Inland, at an altitude of 470 m asl on the northwestern slopes of the High Atlas, Marrakech (31°38'N/8°00'W) has a mean annual rainfall of 253 mm. Here, some rain falls every month, but in no month does the mean exceed 50 mm. Precipitation is highest in November and March, and lowest in July. At greater altitude (830 m asl) and farther north, Khenifra (23°00'N/5°40'W) receives 627 mm of rain/yr and no month is totally rainless. By contrast, the southeastern side of the mountains is in a rainshadow and falls are much lower. Here, at 1117 m, Ouarzazate (30°57'N/6°50'W) has a mean annual receipt of 107 mm, and Midelt at 1501 m (32°41'N/4°43'W) receives only 229 mm/yr.

Tanger has a mean temperature of 12°C in January and 24°C in August, while the respective figures

for Casablanca are 12 and 23°C and those for Essaouira are 15 and 20°C. Inland the range is greater, being 10 and 25°C at Meknes (33°54'N/5°33'W) and 11 and 28°C at Taza (34°13'N/4°01'N). In the High Atlas the temperature often falls to -20°C, and snow above 2000 m persists for many months each year. When the hot dusty wind (chergui) is blowing from the Sahara, temperatures in almost any lowland part of the country may exceed 40°C, and even the mountains become very warm.

Wetlands

Tidal wetlands occur along the Moroccan coast, principally in lagoons, and in the south there are large saline pans along the border with Western Sahara. Most rivers crossing the coastal strip have small floodplains and there are a number of permanently marshy areas along the rivers in their lower courses. There are a number of natural lakes and bogs in the mountains and over 30 reservoirs with a total combined area in excess of 50 000 ha.

List of Wetlands Described

1. Tidal Wetlands
    (a) Sebkha Tazra (Khnifiss Lagoon)
    (b) Merja Zerga
    (c) Nador Lagoon
2. Coastal Pans & Marshes
    (a) Oualidia & Sidi Moussa Lagoons
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3. River Systems
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5. Artificial Impoundments

1. Tidal Wetlands

(a) Sebka Tazra (Khnifiss Lagoon)

Country: Morocco
Coordinates: 28°03'N/12°15'W
Area: 5000 ha
Altitude: sea level
Nearest Towns: Tarfaya (25 km SW); Agadir (425 km NE)
General: This lagoon has a narrow mouth through the barrier of sand dunes which separates it from the Atlantic Ocean. It is fully tidal, being mostly inundated by high spring tides, and with large mudflats being exposed by all tides. To landward there are the vast salt flats of the Sabkha Tah along the border with Western Sahara. These latter are very seldom inundated, except perhaps by occasional direct precipitation which is less than 100 mm/yr in this area.
Flora & Fauna: As described in the regional introduction. *Ruppia* and *Zostera* occur on the mudflats, *Juncus, Limoniunt, Salicornia* and *Suaeda* on the salt flats. The lagoon is an important wintering and staging post for wading birds. *Phoenicopterus ruber* sometimes nests here, e.g. 750 pairs in 1974, and it is the only Moroccan nesting site for *Sterna hirundo. Larus genei* also nests here. Further details are available in Pienkowski (1975).
Human Impact & Utilisation: Considerable hunting pressure.
Conservation Status: Unprotected. Listed under Ramsar Convention.

(b) Merja Zerga

Country: Morocco
Coordinates: 34°46 ' -34°58 'N/6°13'-6°18'W
Area: 6000 ha wetland
Altitude: 0-2 m asl
Nearest Towns: Tanger (110 km NNE); Kenitra (70 km S)
General: This Atlantic wetland is on the seaward edge of the Rharb alluvial plain. The total wetland area is 12.5 km long and up to 7 km wide. It consists of a lagoon (7x3.5 km) surrounded by saline marshland and mudflats, separated from the sea by a beach barrier system. A small river, the Oued Drader, enters the northeastern end of the lagoon, and leaves it at the northwestern extremity to reach the sea through a deep tidal channel set in an area of salt-marsh. The lagoon itself is shallow, with a maximum depth of 6 m. The mean annual temperature is 17.4°C. Mean annual maxima and minima are 23°C and 12°C respectively.
Hydrology & Water Quality: Direct precipitation over the lagoon varies between 600-700 mm/yr, but the mean annual discharge of the Oued Drader into the lagoon has been less than 1 m^3/sec since the construction of a barrage upstream. The tidal channel at the northwestern end experiences currents of up to 1 m/sec and tidal amplitude at the mouth is 1.56 m. A canal now drains the higher marshes at the southern end of the lagoon. Surface water temperatures range from 28°C in the lagoon in summer, to 12.8°C in winter, while bottom water temperatures range from 29°C to 12°C. Salinities range from 36‰ in the tidal channel and northern part of the lagoon, to less than 2‰ near the mouth of the Oued Drader in winter.
Flora & Fauna: Essentially as described in the regional introduction. *Ruppia spiralis* and *Zostera noltii* occur on the lower mudflats of the lagoon, while the upper levels are

dominated by *Juncus maritimus* with some *Cladium marsicus* and *Scirpus maritimus,* and locally, some beds of *Phragmites australis.* Salinity increases towards the mouth at the northern end and the salt-marsh there is dominated by *Salicornia arabica, S. europaea* and *Juncus acutus. Iris pseudacorus, Phragmites australis* and *Scirpus lacustris* occur along the Oued Drader and along the Canal du Nador in the south.
Carcinus moenas, Crassostraea angulata, Mytilus sp., *Nassa* sp., *Ostrea stentina* and *Pholas dactylus* occur in the tidal channel. *Cerastoderma edule, Solen marginatus, Uca tengeri* and *Venerupis semidecussata* occur around the lagoon. The fishes of the tidal channel are principally marine and here *Mullus* spp. and *Torpedo ocellata* predominate, while in the lagoon *Anguilla anguilla* and *Dicentrarchus* spp. are common. Amphibians present include *Pelobates varaldii, Pleurodeles waltii* and *Rana esculenta,* while *Natrix maura* is the commonest snake. This is a very important site for birds, harbouring hundreds of thousands of wintering and migrating species each year. Among the most abundant are species of *Alias, Calidris, Charadrius, Lirnosa* and *Tringa.* Other species of special interest are *Asio capensis, Glareola pratincola, Hirnantopus himantopus, Recurvirostra avosetta, Sterna albifrons* and *Vanellus vanellus.* Small mammals in the system include *Gerbillus cainpestris, Lepus capensis* and *Mus spretus.*
Human Impact & Utilisation: Hunting, which was once intense, has been prohibited since 1978. Some 8000 people live in the vicinity and make a living from fishing and making rush mats.
Conservation Status: Included in a biological reserve since 1978. Hunting is forbidden, but the local population is still permitted to fish. This is a site listed under the Ramsar Convention.

(c) Nador Lagoon
Country: Morocco
Coordinates: 35°07'-35°16'N/2°44'-2°56'W
Area: c. 10 000 ha open water
Altitude: sea level
Nearest Towns: Tanger (270 km WNW); Nador (on lagoon)
General: This lagoon on the Mediterranean coast is 22 km long with a maximum width of 6 km. It opens to the sea at the northwestern end to the southeast of which it is separated from the sea by a 20 km long spit with dunes up to 20 m high. To landward there is a saline alluvial plain, separated by hills rising to 772 m, from the Moulouya Estuary to the east. Wind speeds are moderate, with a mean daily maximum of about 11 km/hr. Mean annual maximum and minimum temperatures are 22.3°C and 13.1°C.
Hydrology & Water Quality: Precipitation over the lagoon ranges between 320 and 400 mm each year, and tidal amplitudes within the lagoon are small. The lagoon is fed by some small intermittent streams, and water from irrigation projects discharges into it. Salinities are always high, generally ranging from 30-35‰ but concentrations of 40‰ were recorded in 1961. Surface temperatures range from maxima of 26°C in summer to minima of 15°C in winter. Bottom temperatures are always close to 15°C and there is little stratification.
Flora & Fauna: Essentially as described in the regional introduction. *Salicornia europaea* is dominant on the shores, with beds of *Zostera marina* to depths of 3.5 m,

below which *Posidonia caulinii* is dominant. On the saline plain to landward, *Sarcocornia fruticosa* and *Limonium sebkharum* are common. Among invertebrates *Carcinus moenas* and *Leander serratus* are the principal crustaceans while *Cardium tuberculatum, Mactra* spp., *Octopus vulgaris, Pinna nobilis, Sepia officinalis* and *Venerupis decussata* are the chief molluscs. *Anguilla anguilla, Chrysophrys aurata, Mugil* spp., *Mullus barbatus, M. surnzuletus* and *Pagellus mormyrus* are common fishes. The avifauna includes a number of species which are locally uncommon, e.g. *Himantopus hinzantopus, Recurvirostra avosetta* and *Sterna albifrons,* but is otherwise typical of the Mediterranean coast.
Human Impact & Utilisation: Prior to the construction of the port of Beni Anzar, outside the lagoon, the mouth was dredged to facilitate an important fishery, which involved both marine and lagoonal waters, but since 1981 the mouth has very largely closed and the fishery has become centred upon Beni Anzar. As a consequence, direct human interference with the lagoon has declined. However, the discharge of irrigation effluent into the lagoon carries pesticides, and since the mouth has become closed, concentrations of pesticides have begun to build up in the lagoonal food chains. Further, the effluents of a new iron and steel industry will also be discharged into the lagoon.
Conservation Status: Unprotected.

2. Coastal Pans & Marshes

(a) Oualidia & Sidi Moussa Lagoons

Country: Morocco
Coordinates: 32°44'-33°00'N/8°50'-9°08'W
Area: c. 1000 ha
Altitude: sea level
Nearest Towns: El Jadida (50 km NE); Safi (50 km S)
General: A chain of lagoons, 15 km long and 200-700 m wide, on the seaward edge of the Doukkala Plain. The lagoons are parallel with the Atlantic Ocean and separated from it by a dune covered beach. They are not normally open to the sea, and are flooded mainly by direct precipitation and run-off. Salt-marsh vegetation dominates the lagoon floors, with some reed beds around pools and along minor watercourses. On the landward side the marsh grades into agricultural land.
Flora & Fauna: Vegetation as described in the regional introduction for coastal sites. An important wintering and passage site for wading birds, including the rare *Numenius tenuirostris.* Further details are available in Pienkowski (1972, 1975).
Human Impact & Utilisation: There is heavy hunting pressure, domestic cattle graze the area, and reeds are cut for thatching and making mats. Some artificial ponds have been constructed for oyster culture. Part of the Oualidia Lagoon has been drained for development projects.
Conservation Status: Unprotected.

(b) Douiya Sidi Bou Rhaba (Mehdiya Lagoon)

Country: Morocco
Coordinates: 34°15'N/6°40'W
Area: 200 ha
Altitude: sea level
Nearest Towns: Kenitra (10 km NE); Rabat (60 km SSW)
General: This is a narrow brackish coastal marsh, no longer in permanent contact with the sea, from which it is separated by a wide dune system. It is flooded each winter by direct precipitation.
Flora & Fauna: The vegetation is dominated by meadows of *Juncus,* but with some *Phragmites* and *Scirpus.* Fauna as described in the regional introduction for coastal wetlands, but an important passage site for migrating waders, and a wintering site for small numbers of herons. Breeding species include *Bubulcus ibis, Egretta garzetta, Fulica cristata, Mannaronetta angustirostris* and *Nycticorax nycticorax.*
Human Impact & Utilisation: This is a proposed biological reserve and hunting is presently prohibited. Recreational activities, particularly camping, are having an adverse effect upon the marsh and its wildlife.
Conservation Status: Unprotected. Site listed under the Ramsar Convention.

(c) Merja Sidi Ben Mansour & Merja Daoura
Country: Morocco
Coordinates: 34°35'N/6°30'W
Area: 8000 ha
Altitude: sea level
Nearest Towns: Kenitra (25 km SW); Larache (80 km NE)
General: These are two lagoons behind the barrier beach just north of Kenitra. They are no longer connected with the sea, and receive water from the overflowing Sebou River. Following drainage operations they have ceased to be permanent water bodies and now become dry each summer.
Flora & Fauna: As described in the regional introduction. Important wintering and passage sites for wading birds.
Human Impact & Utilisation: Drainage of adjacent land for development has altered the nature of these wetlands. Cattle are grazed on the peripheral meadows.
Conservation Status: Unprotected.

(d) The Rio Martine Lagoons & Marshes
Country: Morocco
Coordinates: 35°36'-35°46'N/5° 16'5°22'W
Area: c. 3000 ha (500 ha open water)
Altitude: sea level
Nearest Towns: Sebta (30 km N); Tanger (55 km NW)
General: This is a group of small lakes (lagoons) on he floodplain of the Oued Martine which reaches the sea at the village of Rio Martine on the Mediterranean Coast. They are (or were) fringed by *Juncus* and *Phragmites,* and with narrow beds of *Phragmites* and *Typha* extending upstream. A further isolated lake occurs 10 km north, just north of Cape

Negro. None of these lagoons is fully tidal, but all are brackish. Their floras and faunas are as described in the regional introduction.

3. River Systems

(a) The Oued Drai

General: This is the longest river of Morocco. It has several headwater tributaries, all of which rise in the High Atlas. One of its principal affluents, the Oued Dades, rises (31°52'N/5°35'W) at 2800 m and flows southwestwards along the mountain flanks of Irhil M'Goun, receiving the eastern drainage from that mountain, to the vicinity of Ouarzazate (30°55'N/6°55'W) where it is impounded behind the Barrage d'El. The lake receives several affluents, draining the high peaks of Jbel Toubkal and Jbel Siroua, and overflows the barrage as the Oued Draa. From here it flows SE for 175 km, descending swiftly to Tagounite (29°58'N/5°35'W), where it swings sharply to the SW and traverses the feet of the Anti-Atlas for 550 km, again receiving numerous tributaries en route. The Iriqui Depression (29°46'-29°55'N/6°30'W) occupies about 20 000 ha north of the course of the Oued Draa, and this may be flooded by seepage after heavy winter rains. It then becomes an important site for birds of passage, and occasionally, e.g. in 1968, it is an important breeding site for such species as *Anas acuta, Himantopus himantopus, Mannaronetta angustirostris, Phoenicopterus ruber, , Recurvirostra avosetta* and *Tadorna ferruginea.* Over its final 200 km the valley of the Oued Draa becomes deeply entrenched as it flows along the Jbel Ouarkziz, after which it swings northwestwards to reach the Atlantic coast immediately south of Cape Draa and just north of Tan Tan (28°31'N/11°05'W). The sections of the system above the barrage are perennial, but below the barrage they no longer flow continuously. The river seeps into the sands below Tagounite, but reappears at the surface in places and forms a saline surface stream near its mouth. Here it is sluggish and semi-stagnant, just 6 -10m wide in summer, but in winter it often swells and floods some adjacent marshy land.

Flora & Fauna: As described for coastal marshes in the regional introduction. The zone subject to inundation each winter is dominated by *Salicornia* sp. with bushes of *Arthrocnemum* and *Tamarix* spp. on the least deeply flooded sites. Inland, the subterranean river produces strips of humid sand on which *Acacia* and *Tamarix* trees grow profusely, thus these trees follow the river upstream in a long, but discontinuous, riparian woodland.

Human Activity & Utilisation: In the past the area flooded freely after heavy rain in the catchments, and the river flowed at the surface throughout its length, but since the impoundment at Ouarzazate the floods have ceased.

Conservation Status: Unprotected.

(b) The Oued Massa & the Oued Sous

General: The Oued Massa is a short steep river which rises on the seaward slopes of Jbel Lekst (2359 m) in the Anti-Atlas. It is dammed some 60 km from the sea, but prior to impoundment it used to inundate a coastal floodplain regularly. This plain extends

northwards and merges with the floodplain of the Oued Sous, a much larger river. The Oued Sous rises high on the seaward slopes of The! Siroua and flows almost due west down a deep and dramatic valley for 200 km to the sea. The river descends swiftly throughout its course, but begins to meander about 40 km from the sea when its bed flattens on the coastal plain. It floods a considerable area each year and there are several hundred hectares of marshland on its plain.

Flora & Fauna: The surviving marshes support typical marshland vegetation as described in the regional introduction, but no major wetlands occur upstream in the valley of the Oued Sous.

Human Impact & Utilisation: The dam on the Oued Massa has greatly reduced its capacity to flood each year, but the floodplain is now used for irrigation agriculture, indeed the entire plain is intensively cultivated and much marshland has been drained.

Conservation Status: Unprotected.

(c) The Oued Sebou & the Oued Rbia

General: The Oued Tensift has sources on the southwestern slopes of Jbel Igdet and Jbel Toubkal in the High Atlas. One of its headwater streams, the Oued Nfiss is impounded, as discussed later. The river descends steeply to the coastal plain flowing west for 250 km. It floods a narrow plain along its final 20 km, after exceptionally heavy rain, and there is an estuarine wetland at its mouth.

The Oued Rbia has sources farther east, on the southwestern slopes of Irhil M'Goun and in the Middle Atlas. Two of its headwater tributaries are impounded, the Oued Tessaout and the Oued el Abid, also discussed in the section on artificial impoundments. The Oued Rbia is further impounded downstream at Imfout (32°46'N/7°57'W) and Boulaouane (32°54'N/8°03'W), after which it meanders for 75 km across the northern end of the Doukkala Plain before reaching the Atlantic Ocean at Azemmour (33°18'N/8°25'W). Once it flooded its banks in its lower course following heavy rain in the catchments, but the impoundments upstream now preclude this. There is a small estuarine wetland at the river mouth.

(d) Oued Sebou & the Rharb Plains

General: The Oued Sebou has sources in the Middle and Rif Atlas Mountains and is the most important river in Morocco. There is a major impoundment on one of its headwater tributaries, the Oued Inaouene just above the confluence with the Oued Sebou. Thereafter the river flows slowly across the full width of the Rharb Plain to the Atlantic Ocean at Kenitra (34°20'N/6°34'W), receiving several meandering affluents on the way. The most important of these are the Oueds Ouerrha and Beth. Immediately north of Kenitra there is an extensive wetland oriented E-W, cut by both the Oued Sebou and the main coast road from Kenitra to Larache (35°11'N/6°09'W). This area of marshland and floodplain (34°20'-34°30'N/5°53'-6°33'W) once covered 42 000 ha, but it has been depleted by drainage in recent years. Two smaller isolated wetland areas lie to the north. One of these, 15 km long and 2 km wide (34°30'-34°37'N/6°21'W), is oriented due N-S, and occupies 3000 ha, while the other is a circular area (34°39'N/6°16'W) which covers 960 ha. The last area is entirely separate from the river channel, but the others both lie alongside the river for short distances. Floodwaters may pass into the depressions from the river each year, and also accumulate in them from direct precipitation and peripheral run-off. Towards the river mouth the major depression becomes saline and tidal, but most of it is above sea level. These areas are covered by rushes, sedges and wetland grasses, and

support a fauna as described in the regional introduction. They are currently being converted for agriculture.

To the north a wetland occurs on the Oued Loukkos (35°04'-35°15'N/5°50'-6°09'W), upstream from its mouth at Larache, to the confluence with the Oued Mekhasene some 13 km inland. From here the wetland continues up the Oued Loukkos for 7 km and up the Oued Mekhasene for 15 km, and also up one of its minor affluents for 7 km. In the region of the confluence of the Oueds Loukkos and Mekhasene the wetland is over 12 km wide. It is saline and tidal at the river mouth where salt extraction pans have been established, but it grades into brackish and then freshwater marshes upstream, and these support extensive beds of *Phragrnites australis* and *Typha capensis (= T. latifolia).* In total there were 18 000 ha of wetland here, but some areas away from the rivers have recently been drained. Another small marsh, 5 km long, lies just to the south (34°59'N/5°58'W) covering 500 ha near the town of El Ksar el Kbir. Both sites are important for their avifaunas.

Still farther north there are two small wetlands just south of Tanger on the Atlantic Coast of the Rharb Plain. One lies along the lower courses of the Oueds Hachef and Mharhar which reach the sea in a common estuary (Tahadart Estuary) 25 km south of Tanger, and the other is at the mouth of an un-named stream 7 km south of Tanger. The first of these wetlands (35°31'- 35°40'N/5°48'-6°00'W) comprises estuarine tidal marshes and brackish marshes farther inland along both rivers. In total it is 20 km long, up to 5 km wide and covers some 8000 ha. The second marsh (35°43'N/5°55'W) is saline and covers about 600 ha. Both carry floras and faunas similar to those described in the regional introduction, and both are wintering sites for waterfowl.

(e) The Oued Moulouya

General: The Oued Moulouya has sources above 2000 m in both the High and Middle Atlas Ranges, from where it flows swiftly northeastwards for 575 km to the Mediterranean Sea which it reaches in a short flat alluvial valley on that part of the coast known as the Sebkha Bou Areg, just east of Nador Lagoon. In the lowest reaches of its valley there is an area of lagoons and brackish marshes which are separated from the sea by dunes, and the lower part of the valley is subject to flooding in winter. The lowest lying areas are covered by dense beds of *Salicornia europaea,* with meadows of sedges and rushes on higher, but semi-permanently wet, ground behind. Most of these meadows are close to sea level, and water depths in the winter are seldom more than a dozen centimetres. Altogether there are approximately 3000 ha of wetland close to the river mouth and in the lower river valley.

Flora & Fauna: As described for coastal and estuarine sites in the regional introduction. This is a wintering area for various *Ardeidae*, *Platalea leucorodia, Phoenicopterus Tuber, Porphyrio porphyrio* and numerous ducks and waders. *Larus audouinii,* a rare gull, has been observed here in considerable numbers. This species nests on Isabella Island (a Spanish possession) some 10 km NW of the river mouth, and the local population may account for as much as 60% of the world population. Some account of the importance of this locality to the survival of this gull is given by Brosset & Olier (1966).

Human Impact & Utilisation: A pumping station takes water from the river and there is an impoundment upstream, both of which influence the extent of flooding.

Conservation Status: Unprotected.

4. Natural Lakes

(a) Merja de Douiyet
Country: Morocco
Coordinates: 34°05'N/5°00'W
Area: 100 ha
Altitude: c. 625 m asl
Nearest Town: Fes (7 km)
General: This is a shallow depression fed by springs and run-off from the peripheral land. It is semi-permanent, drying completely in the summers of some years. The water is brackish and the margins are fringed by dense beds of *Phragrnites australis.* The fauna is as described in the regional introduction for inland natural lakes. The lake is royal property and is therefore protected from public interference.

(b) Lake Iseli & Tislu
Country: Morocco
Coordinates: 32° 13 'N/5°40 'W
Area: c. 400 ha (both lakes)
Altitude: c. 2200 m asl
Nearest Towns: Midelt (90 km NE); Tanger (400 km N)
General: These are two small oligotrophic montane lakes about which very little information has been gathered. They have depths approaching 100 m and are reputed to contain interesting fish faunas, but we have no detailed information.
Human Impact & Utilisation: The lakes are fished for sport but are otherwise undisturbed.
Conservation Status: Unprotected.

(c) Lake D'Ifni
Country: Morocco
Coordinates: 31°02 'N/7°53 'W
Area: 40 ha
Altitude: 2300 m asl
Nearest Towns: Marrakech (60 km NNW); Ouarzazate (100 km WSW)
General: This is a high montane lake near the western end of the High Atlas, on the slopes of Jbel Toubkal, with a maximum water depth of 65 m. The lake is a natural impoundment, the waters of a stream having built up behind a landslip. The lake is used for sport fishing and is unprotected. We have no information regarding its flora and fauna.

(d) Small Montane Lakes

General: There are a large number of small lakes high in the mountains, at elevations of 500-2500 m. Most are mesotrophic, support beds of submerged macrophytes and are fringed by reeds. Some, such as Lake d'Affenourir (380 ha), are moderate size. Aguelmane Azigza Lake (29°58'N/5°27'W) is alkaline and especially rich in phytoplankton.

5. Artificial Impoundments

General: There were some 25 impoundments in Morocco by 1980, the most important being on the Oueds Massa (29°47'N/9°18'W), Dra[g] (30°59'N/6°40'W), Nfiss (31°23'N/8°06'W), Tersaout (31°41'N/7°14'W), Ziz (32°00'N/4°22'W), El Abid (32°07'N/6°22'W), Rbia (32°44'N/7°57'W) and (33°00'N/8°06'W), Mellah (33°25'N/7°14'W), Brou Regreg (33°52'N/6°43'W), Beth (34°01'N/5°54'W), Sebou (34°13'N/4°49'W), Moulouya (34°43'N/2°56'W) and Loukkos (35°00'N/5°50'W). Water from some of these dams is used for power generation, but all are utilised for irrigation and it is expected that the total area under irrigation will reach 1 000 000 ha in the late 1980s. Details of some bodies of standing water are given by Morgan & Boys (1982) and Morgan (1982a,b).