



World Heritage Sites

Protected Areas and World Heritage



ICHKEUL NATIONAL PARK TUNISIA

Lake Ichkeul is the last of a chain of shallow freshwater lakes which once extended all along the northern African seaboard. The lake and its surrounding marshes are an important stop-over point for the extremely high numbers of wintering Palaearctic waterfowl: ducks, geese, storks and pink flamingoes among others which feed and nest there. It is often eutrophic and brackish but is seasonally expanded and flushed out by floodwaters.

Threats to the Site: Construction of three dams on rivers supplying the lake cut off almost all the fresh water inflow, causing a destructive increase in salinity. Reed beds, sedges and other fresh-water species were replaced by halophytes, causing a sharp reduction in the numbers of migratory birds which depended on the former habitat; all reed-dependent species disappeared. There was also agricultural encroachment onto the marshes.

In 1996 the Park was inscribed on the List of World Heritage in Danger. In June 1998 the IUCN noted that the salinity of the lake may have precluded any chance of recovering the World Heritage values of the site. It was concerned at the slow pace and lack of effectiveness of the rehabilitation program. The emergency was mitigated by ample rainfall during winters between 2003 and 2005, so the site taken out of danger.

COUNTRY

Tunisia

NAME

Ichkeul National Park

NATURAL WORLD HERITAGE SITE

1980: Inscribed on the World Heritage List under Natural Criterion x.

1997-2006: Listed as a World Heritage site in Danger from increasing salinity.

STATEMENT OF OUTSTANDING UNIVERSAL VALUE

The UNESCO World Heritage Committee issued the following Statement of Outstanding Universal Value at the time of inscription:

Brief Synthesis

Lake Ichkeul is the last great freshwater lake of a chain that once stretched the length of North Africa. Characterised by a very specific hydrological functioning based on a double seasonal alternance of water levels and salinity, the lake and the surrounding marshes constitute an indispensable stop-over for the hundreds of thousands of migratory birds that winter at Ichkeul.

Criterion (x): Ichkeul National Park contains important natural habitats as an essential wintering site for western Palaearctic birds. Each winter, the property provides shelter to an exceptional density of water fowl with, in certain years, numbers reaching more than 300,000 ducks, geese and coots at the same time. Among these birds, the presence of three species of worldwide interest for their protection: the white-headed duck (*Oxyura leucocephala*), the ferruginous duck (*Aythya nyroca*) and the marbled duck (*Marmaronetta angustirostris*). With such a diversity of habitats, the property possesses a very rich and diversified fauna and flora with more than 200 animal species and more than 500 plant species.

Integrity

The boundaries of the property include the three types of habitat characteristic of the site, that is, the Djebel Ichkeul, the Lake and the adjacent marshes and also include the natural hydrological functioning processes of the lake-marsh system and the associated biological and ecological processes. The proposed construction of three dams on the water courses that feed the wetlands constitutes a potential threat for the integrity of the property. If these projects were implemented, it is fundamental that the existing salinity of the lake be maintained.

Protection and Management Requirements

The property has strict legal protection and a management plan. The ecological functioning of the lake-marsh system is closely controlled by the flow of fresh water from upstream and exchanges with the seawater downstream, both subject to the strong natural intra- and inter-annual variability characteristic of Mediterranean climates. The water management of the lake-marsh system is therefore a primordial element in the management of the property. In 1996, the property was inscribed on the List of World Heritage in Danger due to the negative effects of the freshwater on the ecosystem following the construction of the dams. The property was removed from the Danger List in 2006, following an improvement in the situation and restoration of the ecosystem is progressing satisfactorily. The essential concerns are for the judicious management of the property to control impacts on the ecosystem during less rainy winters, to control effects on Ichkeul with the increased demand for water in Tunisia in general, the full restoration of the marshes and the reed belt, and especially to reconstitute the numbers of wintering water fowl. The implementation of regular scientific monitoring of the principal biotic parameters and abiotic indicators of the state of conservation of the ecosystems, and the use of a mathematical model to forecast their needs in water are essential to complete the systems established and result in the optimal use of the water resources for the conservation of the ecosystems.

INTERNATIONAL DESIGNATIONS

1977: Recognised as a Biosphere Reserve under UNESCO's Man and the Biosphere Programme (15,000 ha);

1980: Designated a Wetland of International Importance under the Ramsar Convention (14,100 ha).

IUCN MANAGEMENT CATEGORY

II National Park

BIOGEOGRAPHICAL PROVINCE

Mediterranean Sclerophyll (2.17.06)

GEOGRAPHICAL LOCATION

Ichkeul National Park is in northern Tunisia in the Bizerte district on the Mateur plain, 20 km southwest of Bizerta and some 15 km south of the Mediterranean coast at 37° 10'N and 09° 40'E.

DATES AND HISTORY OF ESTABLISHMENT

1891: Jebel Ichkeul acquired by the state government;

1926: All Garaet el-Ichkeul became state property;

1974: Most of the Ichkeul marshes ceded to the *Direction des Forêts* in 1974 for conservation;

1977: Recognised as a UNESCO Biosphere Reserve;

1980: National Park status for the area ratified by Presidential Decree 80-1608;
Designated a Ramsar Wetland;

1990: Added to Montreux record of wetlands in danger;

1997-2005: Listed as endangered because damming of freshwater supplies turned the lake saline.

LAND TENURE

The lake, mountain, and some marshland are state property, owned by the *Direction des Forêts*, *Direction des Ressources en Eau* and *Terres Dominales*; most of the marshland is private. Six government departments have responsibility for different aspects of the Park: for administration, lake waters, marshland, fisheries, agriculture and environmental planning.

AREA

Total: 11,231 ha: Lac Ichkeul, 8564 ha, land 2,607 ha (IUCN, 1999). The lake is normally about 8,700 ha, but may flood the surrounding marshes to ~11,400 ha in the rainy season (Baccar *et al.*, 2000).

ALTITUDE

From 1.5m below sea-level (lake bottom) to 511m at the top of Jebel Ichkeul.

PHYSICAL FEATURES

The Park consists of an isolated wooded mountain and a permanent brackish water lake surrounded by freshwater marsh. The lake varies from ± 0.9 m deep in summer to ± 2.5 m deep in winter, and can extend up to 2,700 ha over the marshes surrounding it on the south, west and northwest (extending from about 6 km long to some 15 x 5 km wide). The lake is connected to the sea via the Oued Tinja canal leading to a marine lagoon, Lac de Bizerte. It is fed by six main rivers, from the west and south: Oueds Douimis, Sejenane, Malah, Rhezala, Joumine (which is canalised across the marshes) and Tine, a tributary of the Joumine.

Before dams were built the average total inflow was about 350 million cubic metres per annum. Of this some 230 -270 million cu.m. still reaches the lake - a shortfall of 80-120 million cu.m. The supply dries out in summer when a lack of fresh water, high levels of evaporation and inflowing sea water cause the lake level to fall and its salinity level to rise. From July to October the salinity can be as high as 38 gm per litre; after the autumnal rains it can fall as low as 1.7 gm per litre (Gryn-Ambroes, 1980). Drought from 1999-2002 caused its salinity to rise to twice that of the sea. The lake basin and marshland soils are alluvial (Andre, 1953; Hollis *et al.*, 1977). Jebel Ichkeul, the low mountain on its southern shore, is composed of Triassic and Jurassic metamorphosed limestones with fossiliferous pseudo-dolomitic marbles exposed in quarries on its south-western slopes (ONM, 1976).

CLIMATE

The climate is typically Mediterranean. The mean monthly January temperature is 11.3°C and the winter minimum is 0°C. The mean monthly July temperature is 25.2°C and the summer maximum 40°C. The average annual rainfall is 625mm, only 4 per cent falling in summer. About 300 million cu.m of rainwater per year entered the lake when it was first measured (Hollis *et al.*, 1977), but between 1996 and 2003 damming and four years of drought drastically diminished its freshwater supply; an average annual release of a minimum of 80 million cubic metres was hard to meet. But rainfall was plentiful during the winters of 2002-2005, the dry marshlands were flooded once more and the salt left by four years of drought was flushed out.

VEGETATION

The Park has a typically semi-arid flora of about 400 species dominated by pan-Mediterranean plants. Distinct habitat types within the park include the mountain and its foothills, well-drained lowland ridges, freshwater marshes, and the lake and reed beds, which are eutrophic and subject to fluctuating salinity. This wide range of habitats attracts a great variety and number of waterbirds, both migrant and resident. The mountain is dominated by a woodland of wild olive *Olea Europea* and fairly dense maquis of lentisc *Pistacia lentiscus* with *Phillyrea angustifolia* and *Smilax aspera*, also by open maquis with *Euphorbia dendroides* co-dominant on south-eastern slopes, and *Juniperus phoenicea* on northern slopes. *Chamaerops humilis* grows on rocky ridges. Other mountain shrubs are carob *Ceratonia siliqua*, *Tetraclinis articulata* (R) and *Cistus salvifolius* (INRAT, 1967; Morgan, 1982). A rich variety of northern Tunisian plant species includes the locally endemic *Teucrium schoenenbergeri* and *Crypsis aculeata* (listed in Hollis *et al.*, 1977).

The vegetation of the area is distinctly zoned. The lake was fringed by a belt of *Phragmites communis* reeds, reduced but now returning, and African tamarisk *Tamarix africana*. Growing submerged in the marsh pools and low salinity open water are narrow-leaved pondweed *Potamogeton pectinatus*, *Zannichellia palustris*, *Ekebergia* spp., *Callitriche* spp. and *Ruppia maritima*. The potamogeton used to be

abundant in the west of the lake, covering a third of the lake, and was the major food of some 200,000 wintering and migrant waterbirds. During the 1990s it was replaced by more salt-tolerant and less palatable species such as *Ruppia cirrhosa*, altering the lake's pattern of use by birds (Skinner, 1985; Baccar *et al.*, 2000). Further inland the marshland is dominated by cordgrass *Scirpus maritimus* and *S. littoralis* which are the main food of greylag geese, require annual inundation and are not salt-tolerant; also *Juncus subulateus*. These are being replaced by more halophytic *Ammi visnaga* and *Scolymus maculatus*. *Ranunculus ophioglossifolius* and *Sparganium erectum*, recorded at only a few sites in Tunisia, also grow in the marshes (INRAT, 1967; Hollis *et al.*, 1977; Morgan, 1982). The unique lake and freshwater vegetation of Joumine and Malah marshes ranges from emergent plant associations such as *Scirpus lacustris*, *Typha angustifolia* and *Phragmites communis* through a belt of halophytes, *Salicornia arabica*, *Suaeda maritima* and *Arthrocnemum fruticosum* to grass pastures with shrubby *Tamarix africana* (Hollis *et al.*, 1977; Morgan, 1982). In drier areas and on the well drained ridges are associations of *Hordeum maritimum* with *Lolium multiflorum* and *Daucus carota* or *Nerium oleander* and *Ziziphus lotus*. (Posner, 1988)

FAUNA

The Ichkeul wetland was the most productive wetland for waterfowl in North Africa, classified as an Important Bird Area by BirdLife International. With Doñana, the Camargue and El Kala in Algeria it has been one of the four most important sites in the western Mediterranean region for wintering northern Palaearctic and breeding southern Palaearctic species. Past records show up to 300,000 to 400,000 birds present at one time. 226 species of birds including 34 breeding residents were recorded by Skinner *et al.*, in 1986. The most numerous species are wigeon *Anas penelope* (10,000-50,000:112,000 in the 1970s), common pochard *Aythya ferina* (10,000 -90,000: 120,000 in 1971) and coot *Fulica atra* (2,000-45,000:188,000 in 1973). High records for greylag goose *Anser anser* (3,200: 18,000 in the 1970s) show that Ichkeul is their most important wintering site in northwest Africa (Bousquet, 1988). Between 50 and 200 marbled teal *Marmoronetta angustirostris* (VU) breed and 600 (4% of known world population) of the threatened white-headed duck *Oxyura leucocephala* (EN), were seen wintering in 1977. The long-billed curlew *Numenius tenuirostris* (CR) has been recorded. Other wintering wetland birds include the ferruginous duck *Aythya nyroca*, and corncrake, *Crex crex*; also high numbers of green-winged teal *Anas crecca*, northern shoveler *A. clypeata*, northern pintail *A. acuta*, and black-winged stilt *Himantopus himantopus*. Flamingoes *Phoenicopterus ruber* summer on the lake (Gryn-Ambroes, 1980; Skinner *et al.*, 1986; Posner, 1988). However, by 2002 as a result of the lack of fresh water and subsequent inflow from the sea, the lake's waterfowl population was mostly of salt-tolerant species.

Other birds include Egyptian vulture, *Neophron percnopterus*, Bonelli's eagle *Hieraetus fasciatus*, booted eagle *H. pennatus*, marsh harrier *Circus aeruginosus*, pallid harrier *Circus macrourus*, Montague's harrier *C. pygargus*, hen harrier *C. cyaneus*, lanner falcon *Falco biarmicus*, Eleonora's falcon *F. eleonorae*, peregrine falcon *F. peregrinus*, long-legged buzzard *Buteo rufinus*, collared pratincole *Glareola pratincola* and Moussier's redstart *Phoenicurus moussieri*. Migrant marsh harrier *Circus cyaneus* and reed warbler *Acrocephalus scirpaceus* are common, also the threatened migrant white stork *Ciconia ciconia*. The rare black stork *Ciconia nigra* and glossy ibis *Plegadis falcinellus* are recorded.

One of the most notable of the mammals recorded at Ichkeul is the Eurasian otter *Lutra lutra*, which has been hunted for its meat. Less than ten animals were recorded in 1987 (H. Miles, pers. comm.) and it has probably not survived. Of the larger mammals there are large populations of wild boar *Sus scrofa*, and introduced wild water buffalo *Bubalus bubalis*; also a number of crested porcupine *Hystrix cristata*, jackal *Canis aurea*, genet *Genetta genetta*, Egyptian mongoose *Herpestes ichneumon*, wild cat *Felis silvestris lybica* and four species of bat. Lists of fauna are recorded in the London University College report (Hollis *et al.*, 1977).

The herpetofauna varies with water level and salinity. The marsh frog *Rana ribibunda* is common in the marshes. There are also painted frog *Discoglossus pictus*, three species of toad, two harmless species of snake and one lacertid. Two pond turtles, Iberian *Clemys leprosa* and European *Emys orbicularis* are found in the lake (Gryn-Ambroes, 1980; Posner, 1988). The lake and marshes, especially the dense

Potamogeton beds, support huge populations of a few species of marine and brackish water invertebrates. Species include *Nereis diversicolor*, *Gammarus locusta*, *Corophium volutator*, *Sphaeroma hookeri*, *Idotea* spp., *Hydrobia* spp., *Abra* spp. and *Cerastoderma glaucum* (Morgan, 1982); freshwater invertebrate species also occur on the edge of the saltmarsh. Shore crab *Carcinus mediterraneus* and *Balanus amphitrite* occur near the Tindja canal. The principal fish dependent on this teeming life are eel *Anguilla anguilla*, mullets *Mugil cephalus* and *M. ramada*, sole *Solea solea*, sea bass *Dicentrarchus labrax*, barbel *Barbus barbus*, shad *Alosa fallax* and anchovy *Engraulis encrasicolus*. In shallow water Mediterranean killifish *Aphanius fasciatus* and seahorse *Syngnathus abaster* are found.

The site has internationally important Pleistocene (Villafranchian) fossil deposits in late Tertiary and early Quaternary outcrops on the northern shore. They include unique assemblages of mammal remains, notably hominid and primate records, but also bones of *Elaphas planifrons*, *Stylohipparion libycum*, *Libytherium maurusium*, *Anacus osiris*, *Testudo gigans* and *T. emys* (Arambourg and Arnould, 1949; OMN, 1976).

CONSERVATION VALUE

Garaet Ichkeul is the last of a chain of lakes which used to extend across the north African littoral and one of the four most important remaining wetlands in the western Mediterranean. It has been designated a Ramsar Wetland and lies within a WWF Global 200 Ecoregion, a Conservation International-designated Hotspot and a UNESCO Biosphere Reserve. The National Park was created to safeguard this wetland with its diversity of terrestrial and aquatic ecosystems. The lake and marshes are of particular importance for the extremely high numbers of wintering Palaearctic waterfowl which still totalled over 90,000 in 1999/2000 and included globally threatened species (Baccar *et al.*, 2000). The Park also protects important fossil mammal deposits and is scenically beautiful.

CULTURAL HERITAGE

The lake, marshes and mountain have been settled by man for millennia. In Carthaginian times Lake Ichkeul surrounded the mountain. A nearby Roman mosaic depicts a purple gallinule *porphyrio porphyrio*, which bred in the reedbeds until a decade ago. In 1240 Jebel Ichkeul and the lake were already managed as a hunting reserve for the Hafsid rulers of Ifriqiya, centred on Tunis. Water buffalo were present then, and were re-introduced from Italy in 1729. The herd was decimated in 1957 for food but has recovered. (Müller, 1970; Ministère de l'Agriculture, 1980). Lake sedimentation and the subsequent growth of *Potamogeton* increased in the late C19th with increased farming and the cutting of the Bizerta ship canal in 1895 (Stevenson, 1991).

LOCAL HUMAN POPULATION

The area immediately around the Park is very densely populated, with the towns of Bizerta, Mateur and Menzel Bourguiba 20, 10 and 5 km away respectively and Tindja village on its eastern edge. The government is committed to a plan for the improvement of the Mateur plain, which requires the local water for drinking and irrigation. Hunting, fishing, grazing and quarrying are officially illegal within the Park. However, there are up to 2,500 cattle, sheep and goats and 800 ha of cultivation within the park boundary (Anon., 1988). On its fringes there are intensive arable farming, orchards and pasture. The village on the Park boundary near the quarry is growing and may absorb the 130 families squatting in the Park (Anon., 1988; Bousquet, 1988). Most of these were employed in the large illegal stone quarries on the south and northwest slopes of Jebel Ichkeul (Drucker, 1987). The local fishery, run by the government, produces 200 tonnes per year (Baccar *et al.*, 2000).

VISITORS AND VISITOR FACILITIES

After the *Direction des Forêts* and the Tourist Directorate extensively promoted natural history tourism, 23,000 visited the Park in 1987 and more than 2,500 people visited the area over six weeks in spring 1988. These included 41% in school groups and 6.6% foreign tourists. Many locals visit the hot springs (hammams) on the northeastern edge of the mountain (Anon., 1988). An eco-museum and information centre built with the help of the British Museum for Natural History and the WWF opened in spring 1989. The visitor facilities, including exhibits and audio-visual displays are also sited on the northeastern corner

of the Jebel (Drucker, 1987; Bousquet, 1988). There are no accommodations or camping facilities within the park.

SCIENTIFIC RESEARCH AND FACILITIES

Some of the earliest scientific studies were the palaeontological excavations in 1947-49 (Arambourg & Arnould, 1949). Stratigraphic and palaeontological studies were carried out by the Tunisian National Bureau of Mines (ONM, 1976). Research on Lake Ichkeul was done by the University of Tunis, the *Institut National Scientifique et Technique d'Océanographie et de Pêche*, Tunis (INSTOP) and University College London. A program of waterfowl observations by University College London with IWRB, Slimbridge and the Tour de Valat CNRS Biological Station, Camargue, France, has run since 1963 (Bousquet, 1988). These consultants recommended a series of measures to manage the lake's water regimen (Hollis *et al.*, 1986). Research facilities in the Park opened at the eco-museum in the 1990. The Ramsar Convention Bureau sent out Advisory Missions in 1988, 1989 and 2000. An Ichkeul Scientific Management Committee exists to advise on sustainable management of the lake.

MANAGEMENT

The Park is managed by the *Direction des Forêts*, but the Ministry of the Environment and Sustainable Resources is responsible for it as a World Heritage site. In 1983 and 1994 respectively dams were built upstream on Oued Joumine and Oued Sejanine to supply local populations with drinking water and to irrigate their fields. Despite the central objectives of a 1977 management plan (incorporated into the National Park statutes) to control the level and salinity of the lake and to maintain and develop the major food source *Potamogeton* (Hollis *et al.*, 1986; Bousquet, 1988), the dams cut off nearly all the flow of fresh water to the lake, turning it saline. The EEC and the French Ministry of the Environment, funded a management study between 1982 and 1985 by University College, London, the IWRB, the Tour du Valat station and consultant engineers SOGREAH to counter the effects of the dams and canalising the marshland. This recommended a sluice on Oued Tindja to restrict seawater from entering, and contain the loss of fresh water, which was built by 1996. It condemned the dredging and embankment of the Joumine and Malah canals which dry out the marshes, encourage halophyte growth and access by poachers, and recommended a visitor centre and cleaning the pollution at the hammams.

In 1996 the Tunisian Ministry of the Environment commissioned a report on measures to reverse the degradation; some have been taken (ANPE, 1996). Three smaller proposed dams were cancelled for the time being, water from existing dams was to be released to the lake and a pumped supply from Sidi El-Barrak dam (127km west) made available but the necessary pumping station had not been built by 2002. The illegal quarries have been closed and water treatment plants installed for nearby towns. Government action is to include agreement among the six departments responsible for making decisions about the area of the Park, for water supply, rural engineering, fishing, grazing and agriculture, forestry, local populations and environmental planning. The canals were to be filled in and the marsh restored. Monitoring of the water, lake siltation, flora and bird species were to be continued and the analysed information made available to decision-makers (Baccar *et al.*, 2000). A government report of 2001 summarising measures for the lake's protection was taken by the IUCN as the basis for establishing the appropriate conditions for annual monitoring and rehabilitation, for which funding was requested (UNESCO, 2002).

In 2003 the Tunisian government asked the IUCN and the Centre for Mediterranean Cooperation for help in restoring the lake, with funding from UNESCO (IUCN/WCPA, 2003). However, the Ministry of Water Resources could then promise only 20-25 million cu.m, a quarter of that needed. Other recommendations were for the establishment of benchmarks, indicators and a timetable for scientific monitoring. However, a major GEF-funded project was granted to prepare and start implementing a management plan between 2003 and 2008. By 2006, the excellent rainfalls of 2004-5 had replenished the lake, salinity had been reduced from 30 to 10 grams per litre and the pondweeds essential to the ecosystem, and large numbers of waterbirds, fish and eels had returned. Regular reporting on and monitoring of the conditions was being done. Three further dams were to be built to supply the national water system, but also to keep Ichkeul supplied, instead of irrigating fields (UNESCO, 2006a) and by 2009 the flow of the Joumine River had been restored. The creation of a permanent management structure with effective decision-making powers and

completion of a GEF-funded participatory management plan, both specific to Ichkeul, and commitment of an increased annual water release of an average of 80-120 million cu.m. into the lake, were all still considered necessary. But the property could be considered out of danger (UNESCO, 2006b).

MANAGEMENT CONSTRAINTS

The site was placed on the List of World Heritage Sites in Danger between 1996 and 2006 because the upstream dams had cut off nearly all the flow of fresh water to the lake. This had greatly increased its salinity, dried up the marshes allowing livestock to degrade them, and caused a very serious loss of biological diversity. It altered the food chain by greatly reducing the area of the vital food source *Potamogeton* from 3000 to 500 ha by 1988/9, (Stevenson, 1991). With replacement at the same time of *Scirpus maritimus* and *Phragmites* by more salt tolerant species, there was a potential loss of 20 per cent of the marshland food plants (Bousquet, 1988; Baccar *et al.*, 2000). Reed-dependent species disappeared with the lakeshore reed beds, and the number of migrating birds declined. Wintering waterfowl and greylag goose numbers decreased from 200,000 to 50,000 and 20,000 to less than 1,000 respectively (Baccar *et al.*, 2000). Decrease of the fresh water supply could eventually convert the lake into a seawater lagoon.

In 2004 the Park Director still lacked sufficient authority, budget, clear park boundaries, a trained and uniformed staff and an updated management plan. An adequately funded administrative structure advised by a team of scientists is needed to implement the integrated management plan drawn up by the ANPE report team and monitor development. There were still six government departments with different responsibilities for and attitudes towards the Park. The marsh canals were unreclaimed through fear of the effect on groundwater. The stone quarries which provided work but degraded much of the south side of the Park had been closed. Families numbering some 1000 people squatting in the Park were still the cause of overgrazing and land clearance. The whole area remained under threat from commercial fishing, logging, poaching, agricultural expansion, and pollution by pesticides, fertilisers and tourism.

However, after heavy winter rain the ecosystem partially recovers and the number of birds wintering in the west end of the lake increases, but numbers were still low. The whole area of and around both lake and mountain, the bird populations and the World Heritage status of the Park remain at risk from the effects of global warming, periodic drought, inadequate mitigation and, until recently, lack of government authorisation for the release of sufficient water to keep the lake in health (IUCN, 1996, 1997; Baccar *et al.*, 2000; UNESCO, 2001). Nevertheless, by 2004, restoration of the water control structures had begun, and the government had accepted that the health of the lake required an adequate annual water supply (UNESCO, 2004). By 2008 through cooperation with the local authorities the water supply had increased, improving the condition of the vegetation and wildlife on site (UNESCO, 2008).

STAFF

A National Park Director and wardens have been appointed, based in the *Commissaire Regional au Developpement, Agricole de Bizerte* (CRDA) (Drucker, 1987).

BUDGET

The gross annual budget allocated for the Park averaged 16,000 Tunisian dinars. The EEC and French Ministry of the Environment funded the 1982-85 management study by University of London, the IWRB and the Tour du Valat station. The eco-museum was built with assistance from the WWF; the World Heritage Fund donated a vehicle for Park surveillance (Bousquet, 1988). In 2002 the WWF gave an emergency grant of \$US50,000 for a workshop, held in January 2003, to improve the monitoring of the rehabilitation of the lake to be summarised in a report to be submitted later in 2003 (UNESCO, 2002). In 2005-6, US\$100,000 was provided by WHF for technical assistance, training activities and emergency assistance.

LOCAL ADDRESS

M. le Directeur, Parc National de l'Ichkeul, Direction des Forêts, 30 Rue Alain Savary, 7029, Bizerta, Tunis.

REFERENCES

The principal source for the above information was the original nomination for World Heritage status.

- André, H. (1953). *Le lac Ichkeul, étude hydrogéologique*. Archives du Ministère de l'Agriculture. Tunis.
- Anon. (1988). *Two Problematical National Parks in the Mediterranean Region*. Field Report, pp.3.
- NPE (Agence Nationale pour la Protection de l'Environnement) (1996). *Etude pour le Sauvegarde du Parc National d'Ichkeul*. Report prepared for the Ministry of the Environment, Tunis.
- Arambourg, C. & Arnould, M. (1949). Notes sur les fouilles paléontologiques exécutées en 1947, 1948 et 1949 dans le gisement Villafranchian de la Garaet Ichkeul. *Bulletin de la Société des Sciences Naturelles de Tunisie II*.
- Baccar, H. (1982). *The Role of Ichkeul National Park in Conserving Genetic Resources*. Report for the Commission on National Parks and Protected Areas/IUCN.
- Baccar, L., Smart, M., Tiega, A & Triplet, P. (2000). *Report on a Mission to Ichkeul National Park, 28 Feb.-4 March, 2000*. Ramsar Advisory Mission Report No.41. Ramsar Convention Bureau.
- Bel Hadk Kacem, S. (1985). *La Conservation de la Faune et de la Flore Sauvages en Tunisie*. Seminaire sur la Conservation du Patrimoine Forestier National, Octobre 1985 à l'INPPSA de Sidi-Thabet.
- Bousquet, B. (1988). *Rapport de Mission du Parc National de l'Ichkeul et Autres Aires Protegees de Tunisie Septentrionale et Centrale*. MAB-UNESCO et Fonds du Patrimoine Mondial.
- Carp, E. (1980). *A Directory of Western Palaearctic Wetlands*. IUCN, Gland, Switzerland.
- El-Hamrouni, A. (1986). Parcs naturels et réserves de la biosphère en Tunisie. Plan d'action pour les réserves de la biosphère dans la région Méditerranéenne. *Atelier de Florac (MAB)*, 9-12 Sept. 1986.
- Grimmett, R. (1987). *A Review of the Problems Affecting Palaearctic Migratory Birds in Africa*. ICBP, Cambridge, U.K.
- Gryn-Ambroes, P. (1980). *Preliminary Annotated Lists of Existing and Potential Mediterranean Protected Areas*. UNEP/IUCN report. UNEP/IG.20/INF5.
- Hollis, G. (ed.) (1977). *A Management Plan for the Proposed Parc National de l'Ichkeul, Tunisia*. Conservation Report No.10. Ecology & Conservation Unit, University College, London.
- (1986). *The Modelling and Management of the Internationally Important Wetland at Garaet el Ichkeul, Tunisia*. Ecology & Conservation Unit, University College, London for the Ministère de l'Agriculture, Tunis. IWRB special publication No.4, Slimbridge, Glos, U.K. 121pp.
- INRAT (1967). Carte phyto-écologique de la Tunisie septentrionale. *Annales de l'Institut National de la Recherche Agronomique de Tunisie*, Vol. 40 fasc. 1 Tunis. 340 pp.
- IUCN/WCPA (2003). *World Heritage Spotlight. Restoring Ichkeul Through Sharing Knowledge*.
- IUCN (2003). *Report on the State of Conservation of Natural and Mixed Sites Inscribed on the World Heritage List*. Gland, Switzerland
- (1997) *State of Conservation of Natural World Heritage Properties*. Report by IUCN for the World Heritage Bureau, 21st session, UNESCO, June. Paris. 7 pp.
- (1996) *Monitoring the State of Conservation of Natural World Heritage Properties*. Report prepared

for the 20th session of the World Heritage Committee, Mexico.

Johnson, A. & Hafner, H. (1972). *Denombrement de Sauvagine en Automne sur des Zones Humides de Tunisie et d'Algérie*. Station Biologique de la Tour du Valat, le Sambuc, France.

MAB Bureau (1977). *Parc National de Ichkeul*. Biosphere Reserves MAB, Project 8.

Maaher A. (1984). *National Parks and Natural Reserves in the Arab World*. Arab League of Education, Culture & Science Organisation (ALECSO). Report 80/001/ 1984, Science division, Tunis.

Mezzi, F. (1988). Jebel Ichkeul défend son cadre de vie. *La Presse*. 2 Janvier 1988.

Ministère de l'Agriculture (1980). *Parcs Nationaux de Tunisie*. L'Ichkeul. Ministère de l'Agriculture, Direction Generale des Forets. Tunis.

Morgan, N. (1982). An ecological survey of standing waters in North-west Africa: II Site descriptions for Tunisia and Algeria. *Biological Conservation* 24: 83-113.

Müller, H. (1970). *Die wasserbuffel Tunisiens*. Säugetierliche, Mitteilungen 18 Jhg. Heft 3.

Office National des Mines (OMN) (1976). *Contributions a l'Etude Stratigraphie et Paleontologique de Djebel Ichkeul*. Office Nationale des Mines, Tunisie.

Patterson, J. (1989). Conserving Lake Ichkeul. *IWRB News*. No. 1.

Posner, S. (1988). *Biological Diversity and Tropical Forests in Tunisia*. Report prepared for the Washington D.C. and Tunis Offices of the Agency for International Development.

Riney, T. (1964). *Potential Use of the Wildlife Resource on Tunisian Forest Lands*. Report to the Government of Tunisia. FAO, Rome.

Scott, D. (1980). *A Preliminary Inventory of Wetlands of International Importance for Waterfowl in Western Europe and North-west Africa*. IWRB special pub. no 2. 127 pp.

Skinner, J. (1985). Lake in the desert. *Birds* 10 (7): 29-33.

Skinner, J.,Rehfish, M. Wood, J. Fay, Smart, M. & Gauthier T. (1986). *The Birds of the Ichkeul National Park, Tunisia*. Conservation Reports No. 13. University College, London.

Smart, M. (1974). *The Wetlands of North Africa and Their Importance to Waterfowl*. IWRB. Slimbridge,U.K.

----- (1975). *Recensement des Oiseaux D'eau en Tunisie, Janvier 1975*. IWRB report, Slimbridge,U.K.

----- (1988). *Ichkeul, Tunisia*. Ramsar Advisory Mission: Report No.3,. Ramsar Conv. Bureau.

Smart, M. & Hollis,G. (1989). *Ichkeul Tunisia*. Ramsar Advisory Mission: Report No.15, Ramsar Convention Bureau.

Stevenson, A. (1991). Palaeoecological and documentary records of recent environmental change in Garaet El Ichkeul. *Biological Conservation*. 58: 275-95.

Tamisier, A. (1988) Ichkeul, Parc National. Etat des Lieux en 1988. Report to UNESCO from Director of Research, CNRS, Arles, France

UNESCO, World Heritage Committee (2001). Report on the 25th Session of the Committee, Paris.

----- (2002). *Report on the 26th Session of the Committee*, Paris.

----- (2004). *Report on the 28th Session of the Committee*, Paris.

----- (2006a). *Report on a World Heritage Mission to Ichkeul National Park, Tunisia*. Paris.

----- (2006b). *Report on the 30th Session of the Committee*, Paris.

----- (2008). *Report on the 32nd Session of the Committee*, Paris.

Warren, A., Ichkeul, the problems of a wet park in a dry country. Hollis, G., Wood, J. Hooper, M. & Fisher, R.C. (1979). *Parks* 4 (3): 6-10.

WWF (1987). *List of Approved Projects, March 1987*. Vol. 4. p. 131.

Zaouli, J. (1976). *Contribution à L'étude Ecologique du Lac Ichkeul*. INSTOP, Tunis.

DATE

1988. Updated 5-1989, 12-1989, 8-1997, 7-2002, 3-2003, 7-2006, 2-2007, 7-2009, 5-2011, January 2012.