The El Kala wetlands of Algeria and their use by waterfowl

J. SKINNER and M. SMART

Importance of the El Kala wetland complex

The importance of the complex of wetlands around El Kala in northeast Algeria has long been recognised. This importance has been most firmly established through the international midwinter waterfowl counts, organised since 1967 by the International Waterfowl Research Bureau: these counts were carried out in the El Kala area at first by expatriate expedition (Johnson & Hafner 1972); Hovette & Kowalski 1972; Goldschmidt & Hafner 1973; Smart 1974; Johnson *et al.* 1975), but since 1977 January counts have been made by a team of ornithologists based at the Institut National Agronomique (INA), El Harrach, near Algiers (Jacobs *et al.* 1977; Ochando & Jacobs 1978; Bellatrèche *et al.* 1983). The counts have shown that El Kala is the major site in Algeria for wintering ducks, with an average of 93,000 birds from 1974–78 (Ochando & Jacobs 1978).

Though the data are much less complete, it seems likely that the area is also important for breeding waterfowl (van Dijk & Ledant 1983), and it is clearly a major staging-point for bird migrants in spring and autumn. The birds of prey of the area are varied and spectacular at all seasons.

The complex of wetlands is no less important from a botanical and limnological point of view (Thomas 1975; Morgan 1982). For all these reasons they figure in recent compilations of wetlands of international importance established on the basis of scientific criteria (Carp 1980; Scott 1980). In 1983, the Algerian government formally established the El Kala national park (78,000 ha) which includes a considerable part of the wetland complex, together with areas of mountain and forest. Two of the lakes, Oubeira and Tonga, have been designated for the List of Wetlands of International Importance under the Ramsar Convention.

Description of the area (Figure 1)

Northeast Algeria receives the highest rainfall of any part of the country. The climate is typically Mediterranean, with rainfall in the winter months and a long dry summer. The wetland complex is situated around the small town of El Kala in the coastal plain between the Tunisian border and the mouth of the Oued Maffragh, which is watered by rainfall from the hills inland. Originally, the area of wetland extended farther west to Annaba, but the land between Oued Maffragh and Annaba has largely been drained and is now under cultivation.

The principal components of the complex are four lakes (Tonga, Oubeira, Melah, Lac des Oiseaux), an extensive marsh (Garaet el Mekhada) and the reservoir behind the Cheffia Dam on the Oued Bounamoussa. The first five sites lie along 50 km of the coast, comprising a total of over 120 km²; the Cheffia Dam is inland, in the hills overlooking the plain. The following descriptions are taken largely from Morgan (1982).

Lake Tonga, classified by Morgan as a Grade 1 seasonal *Phragmites* and *Scirpus lacustris* marsh, covers 2000 ha. Attempts to drain the marshy basin in the 1920's by cutting a drainage channel to the sea were abandoned because the bottom of the marsh is slightly below sea level. There is a dense central zone of emergent vegatation, covering most of the lake, which explains why its main waterfowl importance is for breeding birds.

Lake Oubeira, a Grade 1 oligohaline lowland lake according to Morgan, covers 2100 ha, and is of a type rare in the Maghreb. The water is permanent, fresh in winter, though the salinity probably rises into the oligohaline range in summer. The lake is run as a commercial fishery and all the common winter ducks occur in large numbers on its open waters.

Lake Melah (= salt lake in Arabic) covers 879 ha and as its name implies is formed in an old river valley invaded by the sea. It is classified by Morgan as Grade 1 (North African or international importance). In winter freshwater flows in from the south, and the spatial and temporal variation in salinity produces the biological richness and variation of this site. There is a rich fish fauna (leading to some commercial exploitation) and the high invertebrate and fish production supports large numbers of

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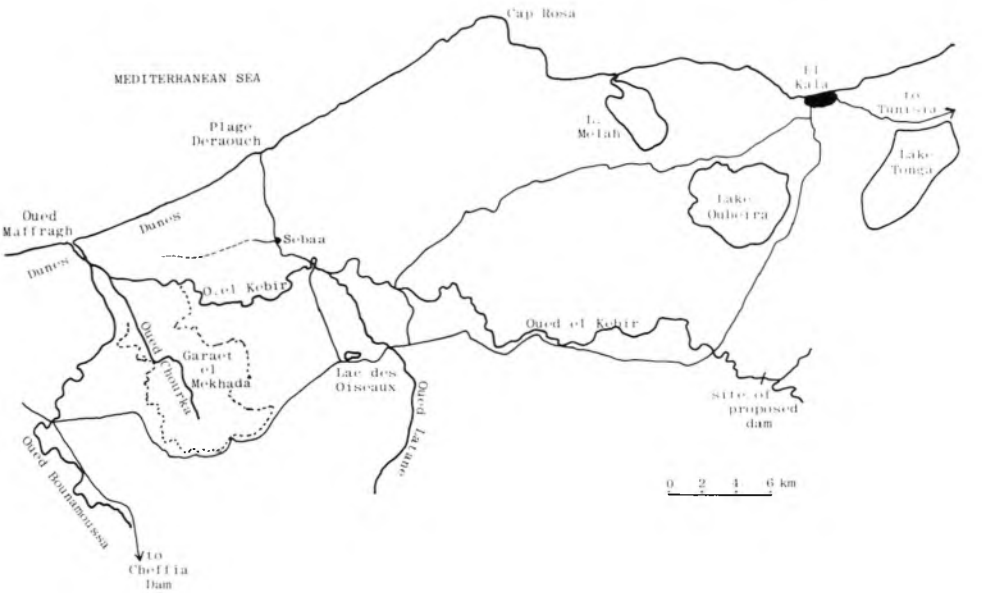

Figure 1. Map of north-east Algeria showing locations of major wetlands.

waterfowl in winter, notably Tufted Duck *Aythya fuligula*, scarce elsewhere in North Africa.

Lac des Oiseaux is of the same type as Oubeira, but much smaller (only ca. 10 ha) and therefore ranked only as Grade 2 by Morgan. It is permanent, with abundant invertebrates and submerged vegetation. As its name implies, it holds for its size a wide variety and quantity of wintering waterfowl, mainly because it has for many years been a well-respected non-hunting area, and thus serves as a refuge on hunting days (N. Zerdoumi, pers. comm.).

Garaet el Mekhada (the Arabic word 'garaet' is consistently used in Algeria and Tunisia to indicate a freshwater marsh, as opposed to 'sebkhet', which is a salt basin that dries out leaving a thick salt crust) is placed by Morgan in the same category as Lake Tonga, and also given Grade 1 classification. In appearance, however, it is quite different, being a flat marshy expanse of 8900 ha behind the coastal dunes, rather than an enclosed basin. It is fed by three major rivers but dries out completely in summer. Emergent vegetation extends over 90% of the marsh; the site exhibits the greatest richness in species of aquatic vegetation of any site visited by Morgan and this may be related to its naturalness.

The Cheffia Dam covers 1557 ha. Though it is devoid of vegetation and benthos because of the water regime, Morgan classifies it as Grade 1 because of the numbers of waterfowl which take refuge there on days of heavy shooting. The best documentation of this refuge role comes from a visit by one of the authors (MS) on 6 February 1974 (a Wednesday, and thus surprisingly a non-hunting day) when the water level had been drawn down to an abnormally low level. This came about because the reservoir burst its banks in February 1973, causing considerable damage, and water levels were lowered for repairs and as a precaution in February 1974. Much of the water surface was covered with ducks (predominantly Wigeon with a few Teal and Pintail), and total numbers were estimated to be of the order of 100,000. While many observers (including the author) have expressed misgivings about the accuracy of the count, the fact remains that very large numbers of birds were present; they may have been feeding in Mekhada which held little water in the dry winter of 1973–4 (total of 7000 Wigeon recorded on 7 February 1974) and therefore was largely unsuitable as a roosting area.

The richness and variety of the complex will be obvious from the brief descriptions

above, and it should be added that this mosaic of wetlands includes a large number of smaller sites–dune slacks, woodlands of alder *Alnus*, and smaller ponds and marshes. Set in forested hills covered mainly with cork oak *Quercus suber* there is no doubt that the El Kala wetlands, less well known perhaps than other famous Mediterranean wetland like Coto Donana or the Camargue, are of equivalent importance and merit more detailed study.

Scope of the present paper

As indicated above, midwinter counts of waterfowl have been made at El Kala for more than ten years. These counts have not however been carried out by local residents, but by expatriates or ornithologists coming the 500 km from Algiers for a brief visit. Given these conditions, the size of the wetlands and the difficulty of access, little information is available on how waterfowl use the wetlands.

The proximity of the wetlands to one another and the diversity of habitats presented by the whole, suggest that waterfowl move back and forth between the sites, using different sites in different ways. Owen (1973) showed that Wigeon *Anas penelope* may feed up to 16 km from their daytime roosting areas, while Tamisier (1974) found that Teal *Anas crecca* moved an average of 15 km between roosting and feeding areas. The present paper, based on two short visits in December 1981 and December 1983/January 1984, seeks to explore these interrelationships, and to compare the functioning of El Kala with that of Ichkeul in Tunisia, another major wintering area carrying upwards of 150,000 waterfowl. The possibility of extensive movements of waterfowl between El Kala and Ichkeul, which are are only 140 km apart, is also considered.

Extensive ecological data on Ichkeul are available (Bredin & Skinner 1983) largely as the result of a detailed study carried out in cooperation with the Tunisian national park authorities by personnel from University College, London and the French National Council for Scientific Research (CNRS, Camargue), who have been based on site throughout the winter since autumn 1982. A similar detailed study at El Kala is to be carried out in conjunction with the Algerian national park authorities, as a development of the two brief visits described in this paper.

The participants in the December 1981 visit to El Kala were A. Halisse (University of Annaba), G. E. Hollis (University College London) and M. Smart. In 1983–84, the participants were the authors.

Background to the two field visits

The difference in water levels at Mekhada marsh between 1981–2 and 1983–4 illustrates the range of conditions to which wintering waterfowl have to adapt. The autumn of 1981 was exceptionally dry and in December only a few scattered pools dotted round the marsh held any water at all; on the other hand all four major lakes and the Cheffia Dam had adequate water levels. Similar conditions obtained at Ichkeul, where the marshes surrounding the lake were practically dry. In December 1983, on the other hand, the whole of the Mekhada marsh was covered by shallow water, and conditions were ideal for Greylag Geese *Anser anser* and dabbling ducks.

As a further illustration of the variable conditions, it should be added that winter 1982–3, when the El Kala wetlands were not visited by the authors, rainfall in northeast Algeria and northern Tunisia was exceptionally heavy. The lake level at Ichkeul reached 2.50 metres above sea level, whereas 0.95 is considered to present optimum conditions. It is likely that water levels in the El Kala complex were equally high at this time.

During the 1981 visit, greater attentional was paid to Greylag Geese than to ducks. The principal aim of the visits to El Kala and to Ichkeul and other Tunisian wetlands was to obtain comprehensive counts of Greylags wintering in northwest Africa, and thus to answer the question (posed in Smart 1982) 'How many geese are there?' In winter 1983–4, too, the main emphasis was on goose studies, though as many data as possible were gathered on ducks and their use of the wetlands.

An introductory note is also required on waterfowl hunting in Algeria and Tunisia because of its effects on waterfowl behaviour, which will be elucidated below. In Algeria, hunting is permitted only on Fridays and on public holidays; the Lac des Oiseaux and the Cheffia Dam are non-shooting areas; it is not yet clear whether

hunting will be permitted in some parts of the newly-established national park, but it has traditionally been practised on the four other major wetlands of the El Kala complex. This legislation appears to be well enforced by the authorities and respected by local hunters, who come in relatively large numbers, particularly from the nearby city of Annaba (population of several hundred thousand). In Tunisia, waterfowl hunters in the whole country number only a few hundred, though there is naturally a concentration in the Ichkeul area; Tunisian national park legislation prohibits hunting within the limits of a park; since the Ichkeul national park was established in 1980, hunting has greatly decreased, but, as tradition dies hard, there is still a small and irritating amount of illegal hunting.

Observations by site in December 1981

Garaet el Mekhada

Efforts were concentrated here because of the large area and difficulty of access. The area was covered from all sides on 29 December 1981 (Tuesday, a non-hunting day; only one hunter was noted). A total of about 10,000 ducks was observed, mainly Wigeon with, in descending order of frequency, some Teal, Shoveler *Anas clypeata,* Pintail *Anas acuta* and Mallard *Anas platyrhynchos.* No Greylag Geese were seen or heard, though in the perfect conditions of wind and light it seems unlikely that they could have been overlooked. The INA team who visited the area on 10 and 12 January 1982 counted respectively 130 and 950 Greylags and commented on the extreme drought (Bellatreche *et al.* 1982). Local people from villages in the sand dunes between marsh and sea told us that, when disturbed by hunters, geese sit on the sea by day and return to the marsh at night, a report already noted by A. R. Johnson (in Morgan 1982).

Lac des Oiseaux

Visited on 29 December 1981 when about 5000 ducks and coot (1500 Wigeon, 500 Shoveler, 500 Pintail, 200 Pochard *Aythya ferina,* 150 Tufted Duck and 2000 Coot *Fulica atra*) were recorded on this small pool, even though it was a non-hunting day.

Cheffia Dam

Visited on Wednesday 30 December 1981, a non-hunting day. Even so there was a large flock of 11,000 Teal, mostly sitting on the rather choppy water, but flying about a good deal in search of the most sheltered area. Very few were attempting to feed (and food would in any case have been scarce) and it was clear that the area was being used as a day roost. The only other ducks seen were 10 Pintail.

Oubeira

Also visited Wednesday 30 December 1981, when the total number of birds on the water was estimated at 50,000–much the largest concentration found in the El Kala complex in 1981. Of these 5000 were Wigeon, 10,000 Shoveler, 10,000 Pochard, 5000 Tufted Duck and 20,000 Coot. A report reached A. Halisse of 150 Greylag Geese in flight over Oubeira early the same morning. This indirect report was the only record of Greylages in Algeria during our visit.

Lake Tonga

A very rapid visit was made on 30 December 1981. Only insignificant numbers of ducks were seen in the thick vegetation.

Observations by site in December 1983 and January 1984

Garaet el Mekhada

Efforts were again concentrated on Garaet el Mekhada. During our visit water levels were high. Water was flowing slowly along the Oued Chourka through the hole in the old railway embankment (water level on stageboard 73 cm; conductivity 2900 micromhos/cm) and also out to sea via the Oued Maffragh as shown by the low conductivity of the water (2500 mmhos/cm; seawater 60,000 mmhos/cm). The water depth ranged from 30–60 cm over large areas and hunters were observed in up to one metre of water. The greater part of this marsh therefore seems to be accessible to people on foot.

The first count on Thursday 29 December found a minimum of 42,000 birds comprising 5000 Greylag Geese, 25,000 Wigeon, 6000 Shoveler, 2600 Pintail, 1900 Teal, 100

Mallard, 300 Gadwall *A. strepera,* 1000 Pochard, 100 Tufted Duck, 200 Shelduck *Tadorna tadorna* and 1000 Coot. Most of these birds were in the open water areas to the southern and western sides of the marsh, and other groups which may have been scattered in pools in the inaccessible areas to the north and east will have been missed.

A second visit on Friday 30 December, a hunting day, found 39 cars parked on the central embankment and many more along the main road to the south of the marsh from where some 25 hunters were easily visible. The total number of hunters probably approached 100 and only 300 Coot and 1000 duck were present. Small flights of geese were occasionally seen circling but no large numbers were observed. Similar conditions were observed on Sunday 1 January, when hunting was also allowed as it was a public holiday.

Lac des Oiseaux

Our two counts amply demonstrated this site's value as a refuge; numbers can increase fourfold on hunting days.

The first count on 29 December found 1700 Coot, 750 Shoveler, 240 Pochard, 150 Teal, 150 Wigeon, 10 Pintail, 10 Gadwall and 3 White-headed Duck *Oxyura leucocephala.* The following day 12,500 birds were present, with the increase mainly due to Shoveler (up 5000) and Pintail (3000). A pair of Garganey *Anas querquedula* was also present.

Cheffia Dam

We visited the dam on 30 December, a hunting day when disturbance on Mekhada was at a maximum and birds could be expected to take refuge on the dam. Only 3000 Wigeon and 4 Pintail were present.

The sea between Sebaa (Plage Deraouch) and Oued Maffragh

This area was visited from the western side of the Oued Maffragh on 29 December when some 400 Wigeon were found off the mouth of the river. In addition large movements of Wigeon (11,000–12,000) were observed arriving from the south and dropping down on the sea at some distance west of the river mouth, between 16.45 and 17.00 hrs. The following day we found large flocks of duck sitting just beyond the breakers at Plage Deraouch and extending several kilometres along the shore. The numbers were estimated at around 30,000, mostly Wigeon but with some Shoveler and Pintail. Exact numbers were difficult to assess because of the effect of the waves, birds being alternately hidden and visible. No geese were seen on the sea on this occasion, although small groups of geese (5–10) had earlier been seen heading in this direction.

The same site was visited on the afternoon of 1 January to confirm that the ducks were still present and had not changed their roost to Lac Oubeira where several tens of thousands of ducks had been counted the same morning. On this visit, 200 geese were also seen on the sea which was rather calmer than on 30 December but nonetheless with a considerable swell. On the same evening after sunset, large movements of Wigeon between the sea and Mekhada, just 2 km west of Sebaa, indicated that these birds seem to feed at the east end of Mekhada at night.

Oubeira

During a visit on 1 January, the total number of waterfowl present was estimated at 60,000 (cf. total of 50,000 on 30 December 1981). Unfortunately, bad light conditions meant that it was impossible to establish the species composition in detail. However, half of the lake could be accurately counted; extrapolation giving estimates of 20,000 Wigeon, 15,000 Coot, 10,000 Gadwall, 2000 Tufted Duck and 13,000 'others', a mixture of Shoveler, Pintail and Pochard. A flock of 217 White-headed Ducks and 12 Greylag Geese were also present. The vast majority of these birds were at the southern end of the lake, and the figures include 5000 Coot and 2000 Tufted Ducks counted at the north end on 30 December.

Tonga

Visited on three separate occasions, 28 December, 1 and 2 January. We never saw more than 100 ducks, although Tufted Duck, Shoveler, Teal, Pintail, Mallard and Wigeon were all represented. 4 Greylag Geese were seen circling one morning but did not settle. The only thorough visit, however, was on 1 January when hunters were present. We may therefore have considerably underestimated the diurnal use of the area by ducks when undisturbed by hunting.

The observation of 27 geese heading east on a hunting day may indicate a reverse movement to Ichkeul caused by excessive disturbance.

Melah

Looked at only briefly on 30 December from the southern end. A single raft of around 4000 Coot was the only species noted.

Use made of sites by birds

Tamisier (1970) has shown that the gregariousness of Teal on diurnal roosts can be explained as a predator avoidance mechanism, and points out that roosts generally form in open areas with good all-round visibility. In contrast, feeding areas are frequently enclosed, the birds are considerably dispersed, and must therefore feed at night to avoid avian predators. Gregariousness and diurnal feeding in many areas are therefore mutually exclusive. Tamisier (1974) goes on to propose 'functional units' for Teal in the Camargue comprising suitable feeding and roosting areas which may be 20 km apart, and shows that individuals use the roost associated with their preferred feeding area, so that birds from different roosts do not generally mix on the feeding sites.

This section examines how the complex of wetlands at El Kala may satisfy the different needs of the wintering waterfowl populations in terms of this functional unit concept, with a view to establishing priorities for the conservation under the Ramsar Convention and National Park legislation, of the elements considered vital to the wintering Anatidae.

The general requirement for both ducks and geese is for an undisturbed, inaccessible roosting area with good all-round vision and little emergent vegetation. Although ducks usually feed at night, they may also do so during the day if suitable feeding areas satisfy some of the conditions of a roost, namely that large numbers of individuals can feed together, thereby satisfying the criteria of gregariousness as a protection from diurnal predators (Tamisier 1970), and the area affords good visibility. Shoveler particularly seem to prefer areas where roosting and feeding may take place at a single site (Cramp & Simmons 1977).

The situation at Mekhada is such that when there is no human disturbance, the areas of shallow open water provide ideal conditions for both roosting and feeding. All species were observed actively feeding on 29 December when they were undisturbed. However, there is no part of the marsh which is sufficiently deep to prevent the intrusion of hunters or people on horseback, and when the shallow areas are heavily disturbed, the immediate reaction of the birds is to head for a safe roost. The sea, Cheffia Dam, and Lac des Oiseaux are the only areas which satisfy the relevant criteria, and entail flights of 4, 6 and about 20 km respectively from the main diurnal roosts observed in southwest Mekhada. We have no idea of what happens to the majority of the geese on shooting days; a few were observed on the sea, others were seen circling before moving east or west, and around 100 birds were present on the heavily grazed areas of the east side of Mekhada, and appeared fairly undisturbed by hunters.

A functional unit for waterfowl at Garaet el Mekhada may therefore be as shown in Fig. 2.

For the lakes around El Kala itself it has been suggested by van Dijk & Ledant (1983) that Lac Oubeira forms the main diurnal roost for birds feeding at Lac Tonga (5 km), which may by day hold several thousand Shoveler and Wigeon when undisturbed (Jacobs *et al.* 1977). We did not see any movements between Melah, Oubeira and Tonga, although most time was devoted to Mekhada. The Tufted Ducks and Pochard on Oubeira may well feed extensively in Melah where in the past sizeable concentrations of both species have been found, 9000 and 12,000 respectively (van Dijk & Ledant 1983).

The functional unit for these three areas may therefore be as shown in Fig. 3.

The major effect of hunting and disturbance in this instance seems to be to prevent a diurnal roost building up on the small, open water areas of Tonga, although most parts of this lake are unsuitable for diurnal roosts due to the extensive stands of dense vegetation. Oubeira, however, is rich in submerged aquatic macrophytes which form food for ducks and it remains to be seen whether the scale of the feeding movements to Tonga is large in relation to the numbers present on Oubeira. Oubeira and Melah seem to be sufficiently large that the fishing activities do not cause significant

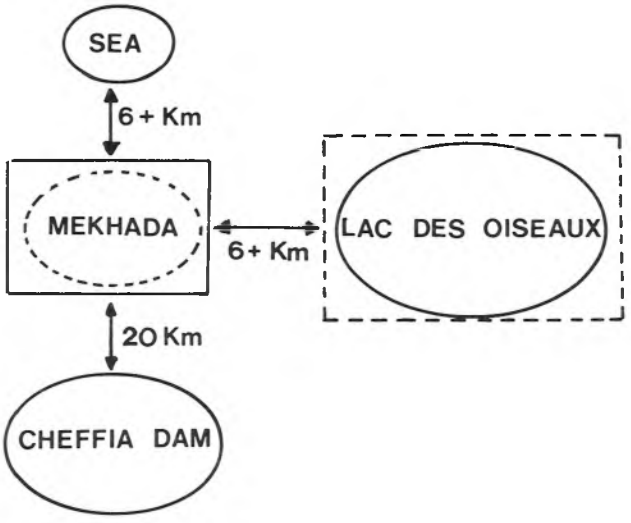

Figure 2. Functional unit for Garaet el Mekhada. Key: ovals = roosting sites; squares = feeding sites; broken line = minor importance; solid line = major importance.

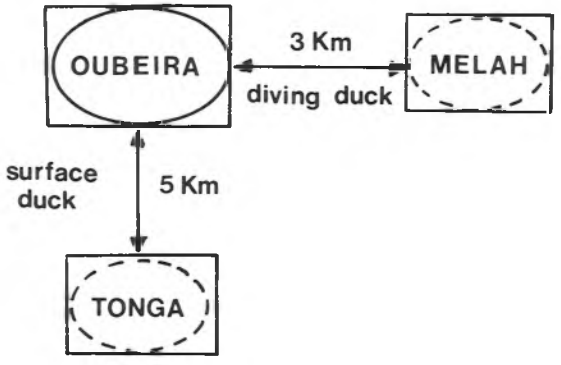

Figure 3. Functional unit for Lakes Oubeira, Melah and Tonga. (Key as Fig. 2).

disturbance in either area.

Comparison with Lac Ichkeul (Tunisia)

Ichkeul National Park (11,000 ha) integrates both lake and marshland at the same site (Fig. 4) and the major vegetation types, *Potamogeton* in the lake (up to 20 km^2) and *Scirpus* spp dominated marshland (600 ha), resemble Oubeira and Mekhada respectively. There are, however, major topographical and hydrological differences. Ichkeul connects with, and lies below, the level of the sea; never drying out, salinities may rise to 40 gl^{-1} by the end of the summer as the sea flows in, and only after the winter rains does the water freshen sufficiently to provoke growth of aquatic macrophytes.

Oubeira does not dry either, remaining

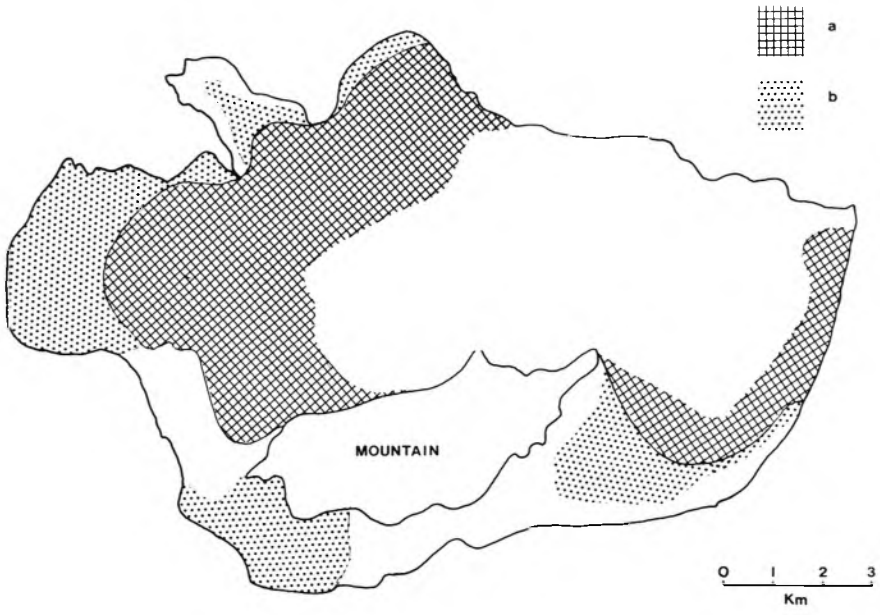

Figure 4. Map of Ichkeul showing major habitat and vegetation types. Key: a = distribution of *Potamogeton pectinatus;* b = = distribution of *Scirpus* spp. marshes.

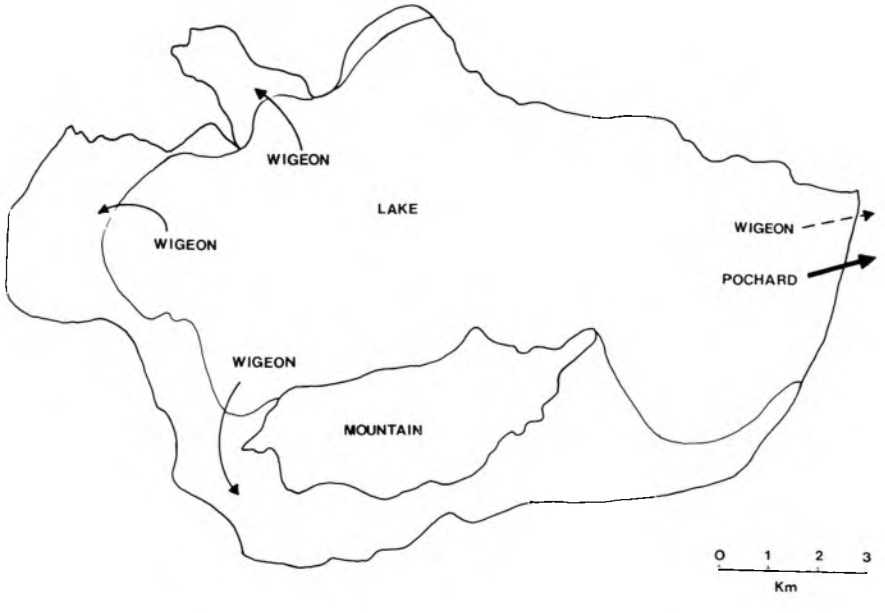

Figure 5. Crepuscular movements of Wigeon and Pochard at Ichkeul (after Bredin & Skinner 1983, and pers. obs.).

largely fresh all year, and the vegetation is therefore rather more diverse. Mekhada is dry for 3 months of the year and begins to fill up following the autumn and winter rains. This affects the food available to ducks, Coot and geese, particularly herbivorous species such as Wigeon.

Wintering birds at Ichkeul number 100,000–200,000 individuals with the dominant species usually Coot (70,000), Wigeon (50,000), Pochard (40,000) and Greylag Goose (10,000). Numbers, however, vary greatly from year to year depending on water level and other factors (Bredin & Skinner 1983). Most of the birds are found on the lake itself where the major food plant for the ducks and Coot is *Potamogeton pectinatus*.

The lake is large (90 km²), and during the day big flocks of birds feed and roost in the west and southeastern parts. Bredin and Skinner (1983) showed movements of some species off the lake to nocturnal feeding grounds outside the National Park (Fig. 5), but concluded that the majority feed on the lake and occasionally in the surrounding marshes, particularly later in the year.

The birds are largely undisturbed on the lake, where there is some commercial fishing activity, as the lake bed sediments are too soft to carry a man's weight in shallow water, but disturbance by hunters or shepherds on the marshes may preclude their use during the day. The vast majority of birds therefore seem to satisfy their roosting and feeding requirements within the National Park which forms the functional unit for all species. The main reason for this may simply be that the major food, *Potamogeton*, is sufficiently dense and in shallow open water, so that feeding and gregariousness are possible simultaneously in an area with little human disturbance.

Although at first sight similar to each other in many respects, particularly vegetation, it is clear that the conditions available to waterfowl in these two important wintering areas are very different. Birds at El Kala probably spend a lot more time flying between roosting and feeding sites than those at Ichkeul, the one day of intensive hunting apart. The level of disturbance in Mekhada due to hunting and shepherds is probably rather similar to that on the marshes at Ichkeul. The fundamental differences, however, are the lack of a safe roost to which ducks and geese can resort within Mekhada and the fact that Ichkeul is always wet in late autumn when birds arrive, whereas Mekhada is dependent on seasonal rain for inundation. Oubeira is wet at this time although probably unsuitable for geese. At Ichkeul, birds on the marshes are never more than 2 km from the lake, and usually much less. This means it is relatively easy for ducks and particularly geese to return to feeding areas rapidly after human disturbance (often within 10 minutes). In contrast extensive disturbance at Mekhada entails flights to roost of at least 5 km and usually more. Each prospective flight, of birds returning to the feeding areas to see if the cause of disturbance has now passed so that they can resume feeding, therefore becomes very costly in energetic terms, particularly if disturbance is frequent or prolonged.

Table 1. Historic counts of Greylag Geese at El Kala

Date	Site	No. of geese	Reference
Nov. 1971	Tonga	61	Johnson & Hafner (1972)
Nov. 1971	Garaet el Mekhada	5	Johnson & Hafner (1972)
Feb. 1972	"	–	Hovette & Kowalski (1972)
Jan. 1973	"	390	Goldschmidt & Hafner (1973)
Jan. 1975	"	600+	Johnson, *et al.* (1975)
Jan. 1977	Lac des Oiseaux	5000	Jacobs *et al.* (1977)
Jan. 1978	Garaet el Mekhada	8000	Orchando & Jacobs (1978)
Dec. 1981	"	– (dry)	This paper
Jan. 1982	"	950	Bellatrèche *et al.* (1982)
Jan. 1983	"	8	Bellatrèche *et al.* (1983)
Dec. 1983	"	5000	This paper
?	Tonga	'thousands'	J. Dalmas*

* in van Dijk & Ledant (1983).

Movements of Greylag Geese

The number of Greylag Geese counted in the area of El Kala in the last 10 years has varied considerably from one year to another, with a maximum of 8000 in 1978 (Table 1). The majority of observations are from Mekhada.

The tendency towards larger counts in recent years may only reflect better coverage and annual variations in water levels.

Geese wintering at Ichkeul feed predominantly on the underground rhizomes of *Scirpus* spp (Fay 1980), and as these are also the dominant species at Mekhada they are likely to form the main food item there. This impression was reinforced during our visit when no birds were found grazing on surrounding pasture, as is occasionally the case at Ichkeul (Bredin & Skinner 1983). The possibility of grazing at night should, not, however, be ruled out.

The general requirement of Greylag Geese for feeding on rhizomes is that these should lie in soft mud covered by less than 50 to 60 cm of water; when obliged to feed in water depths of 40 to 60 cm, the geese do so by upending. Naturally, as Mekhada dries out in the summer, these conditions are only satisfied when the marsh contains water following the autumnal rains, and the area is therefore unsuitable for geese until the first floods. At Ichkeul, in contrast, the water is permanent, and in general food is always available, even in the absence of substantial autumn rain.

As long ago as 1971, one of the authors (MS) suggested that Greylag Geese might come first to Ichkeul in November and subsequently move on into eastern Algeria (*in* Rooth 1971). This stopover, which makes sense in terms of the uncertain availability of suitable habitat at Mekhada early in the season, has recently been proved by observations of individually marked birds at Ichkeul in November 1983 seen subsequently in Algeria in January 1984, reinforcing earlier observations of birds leaving Ichkeul and flying high to the west (Bredin, pers. com. for 1982; pers. obs. in 1983).

Observations of individually marked birds

Greylag Geese are marked with individually numbered neck collars, readable with a telescope, in both Czechoslovakia and Austria. Over 70 individuals have been seen at Ichkeul since 1981 and most flocks of geese have one or two birds wearing collars.

Particular efforts were made to read goose collars at Mekhada in 1983–4 and nine marked birds were found in 1500 birds, of which five had been seen at Ichkeul earlier in the winter (Table 2).

Observations at Ichkeul

Numbers of geese wintering at Ichkeul are tightly correlated with water levels, as the maximum available feeding areas lie at relatively low water levels. (See Bredin & Skinner (1983) for more details.) In both November 1982 and the 1983–4 winter, geese were recorded leaving Ichkeul at dawn and flying high to the west (Table 3).

At a level of 0.50–0.60 m, the depth of water over large areas in the western Ichkeul marshes reaches or exceeds the upper limit for goose feeding, and the birds become concentrated in the shallower areas of the delta of the Oued Melah. This may act as a stimulus for birds to seek new

Table 2. Observations of individually marked Greylag Geese at Ichkeul and El Kala.

Collar no.	Colour	Country of marking	Date seen Ichkeul	Date seen El Kala
A61	White	Austria	18 Nov. 1983	2 Jan. 1984
A95	"	"	–	21 Dec. 1983
A58	"	"	–	2 Jan. 1984
A42	Red	Czechoslovakia	–	31 Dec. 1983
A42	"	"	–	2 Jan. 1984
A98	"	"	27 Nov. 1983	31 Dec. 1983
C04	"	"	26 Nov. 1983	2 Jan. 1984
E12	"	"	–	31 Dec. 1983
E13	"	"	–	31 Dec. 1983
41	"	"	18 Dec. 1983	2 Jan. 1984

Table 3. Numbers of geese observed leaving Ichkeul at dawn and heading westwards.

Date	No. of birds	Water level[1]
30 Nov. 1982	1150	0.65+[2]
24 Nov. 1982	1450	0.55
16 Dec. 1983	1400	0.60
17 Jan. 1984	200	0.60

[1] Water level above sea level, measured in metres to nearest 5 cm.
[2] Exact water level uncertain as level rose 1.10 m in 3 days. (D. Bredin, pers. com.)

feeding areas. This cannot, however, be the whole story as birds were also observed leaving in mid January when lake levels were declining from their mid-December peak of 0.65 m, although in rather smaller numbers. Ichkeul and Mekhada therefore seem to work in tandem and complement one another in providing habitat for wintering geese. If conditions are dry, Ichkeul provides large areas of suitable habitat when Mekhada may not yet be inundated. This was the case in December 1981 when some 17,000 geese were present at Ichkeul in a drought year, at a time when Garaet el Mekhada was completely dry. When water levels begin to rise at Ichkeul, it is highly likely that Mekhada is also inundated, as the catchment area for each forms the extreme eastern end of the Atlas Mountains and are close together, rivers flowing east to Ichkeul and northwest to El Kala. If conditions are limiting at Ichkeul, as in 1982–3 when the water level rose to 2.15 m, it is highly probable that feeding areas are optimal at Mekhada.

The only flaw in this latter argument is the apparent absence of large numbers of geese at Mekhada (total count 8, Table 1) in 1982–3, when only 4000 birds were present at Ichkeul, and therefore counts of 10,000+ might have been expected at Mekhada.

Man-induced changes to either of these wetlands may have critical consequences for the Central European breeding population of Greylag Geese.

At Ichkeul, dams are being built outside the national park on all six of the major inflow rivers; this will lead to an increase in salinity in both lake and marshes, and major ecological changes; possible compensatory measures are being studied by the University College, London and CNRS teams. At El Kala, a large dam is planned inside the national park at Mexenna on the Oued el Kebir; this would further reduce fresh water supplies (already restricted by the Cheffia Dam) to Mekhada.

Movement of ducks between El Kala and Ichkeul

There is as yet no evidence that ducks show similar movements, but as these two important wintering areas are so close together, and may hold a significant proportion of the flyway population, this would not be at all surprising.

Conclusions

The general conclusion is that the wetlands at El Kala should be considered as a whole rather than as separate entities. The importance of Mekhada has been emphasised throughout this account, principally because it currently lies outside the El Kala National Park and yet is both an integral part of the local complex and of great importance in a Maghreb context, particularly for Greylag Geese which move regularly from Ichkeul to El Kala. Mekhada also experiences intensive hunting, and the accessibility of the area presents problems of disturbance for the birds. The major conclusion is that the area lacks a safe, undisturbed water surface within the marsh to which birds could flee on hunting days. This probably reduces its carrying capacity, particularly for geese. The area of suitable feeding habitat for this species, when the marsh is inundated greatly exceeds that at Ichkeul, and the disturbance factor would appear to be the only reason why more geese are not present. It is not known where the majority of geese go on hunting days, although some were seen on the sea. The observation of 27 geese heading east at Tonga may even be evidence of a movement back to Ichkeul.

A recent count of perhaps as many as 10,000 geese at nearby Lake Fetzara (60 km west of Mekhada) in January 1984 (Bellatreche, pers. com.) may indicate that this lake, which was drained in 1937, is regaining its former importance following a change in the management of the sluice gates towards water retention for irrigation rather than drainage for agriculture. It is possible that geese displaced from Mekhada by hunting

disturbance found refuge in the marshlands of Lake Fetzara.

It is suggested that Garaet el Mekhada should be included in the El Kala National Park. A part, probably the area south of the railway embankment, should be a strictly enforced non-shooting refuge. The impact of disturbance by fisheries at Lake Melah should be investigated further in view of the lower number of waterfowl recorded in 1983–4 than in previous years. A study of Oubeira should be made to determine whether there are sufficient food supplies present in shallow water for the 60,000 birds present, or whether they are mainly feeding elsewhere (Melah, Tonga) and simply using Oubeira as a diurnal roost.

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Summary

The El Kala wetland complex in northeast Algeria is of equivalent importance to better-known Mediterranean wetlands such as the Camargue and Coto Donana. Large numbers of waterfowl winter on the varied mosaic of lakes and marshes. During two short visits in December 1981 and December 1983, preliminary enquiries were made into the use made of the area by waterfowl, with special reference to the effects of disturbance by hunters. The situation at El Kala is compared to that at Ichkeul in Tunisia, and movements of birds, notably Greylag Geese *Anser anser*, between these two major North African wetlands are described. Some suggestions on possible conservation measures and further research are put forward.

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J. R. Skinner, c/o Dept. of Geography, University College, London, 26 Bedford Way, London, WC1.
M. Smart, International Waterfowl Research Bureau, Slimbridge, Gloucester, GL2 7BX, U.K.