

[Unofficial translation of Spanish language text by John Jenkinson,  
19.6.95]

**7ES018**

**AIGUAMOLLS DE L'EMPORDA**

1. - PHYSICAL ENVIRONMENT

1.1. - GEOGRAPHICAL LOCATION. DELIMITATION

The Nature Park of los Aiguamolls de l'Empordá is situated in the north-eastern corner of the Iberian Peninsula. Its coordinates are 42°18'-42°10'N and 3°03'-3°10'E.

Lying in the province of Gerona, in the region of Alto Empordá, it is bounded by France to the north, the region of Garrotxa y Geronés to the west, and the region of Bajo Empordá to the south. It includes the towns of Castelló d'Empúries, Sant Pere Pescador, Palau-Saverdera, Peralada, Pau, Pedret i Marzá, l'Escala, Roses and l'Armentera.

The Nature Park is divided into two officially designated development areas, which incorporate three integral reserves. These areas are located to the north and the south of the River Muga and are more or less separated by an urban development, Ampuriabrava, which bisects the natural landscape.

1.2. - CLIMATOLOGY

Apart from certain irregular features, the climate of the area is notable for its warm summers and mild winters, with spring and autumn being the seasons of maximum rainfall. It has been described as a maritime-Mediterranean climate.

A climatic feature of much importance in the Alto Empordá region is the tramontana, a northerly or north-easterly wind which is frequent in the area but, with the Pyrenees acting as a barrier, is absent from the rest of Catalonia.

Within the confines of the low-lying Park, mild temperatures prevail for more than eight months of the year. The average annual temperature lies in the range 13-16°C (max. 20-21°C, min. 10-12°C).

With one peak in autumn and a second, lower, peak in spring, the level of rainfall tends to fluctuate over the year, as indeed it does from one year to the next, since the lowest recorded annual total is 506 mm and the highest 880 mm.

1.3.- HYDROLOGICAL AND HYDROGRAPHICAL FEATURES

The alluvial plain of the bahía de Roses was shaped by the action of three rivers, the Muga, the Fluviá and the Ter, although only the first two still meet the sea at the same point. From the hydrological point of view, the contribution of these rivers is of much importance, as it is on a scale comparable to that of the

largest delta of the Eastern Pyrenees - the Llobregat.

The Quaternary materials constitute a hydrogeological entity fed by the rains and the Fluviá and the Muga, while the natural discharge processes are effected by evapotranspiration and the runoff of surface- and groundwaters towards the sea.

The upper aquifer is located above the alluvial area and consists of gravels and sands overlaid with mud. Towards the sea, these materials gradually lose their granularity until finally, on the banks of the Muga, they appear as mud. The lower aquifer is continuous and consists of impermeable facies of Pliocene or Plioquaternary origin, together with old Quaternary clay-sand material. Intermediate aquifers are to be found between the Fluviá and the Muga riverbasins. These lie below the clays but are separated from the lower aquifer by a stratum of mud. Between the two rivers the mud strata are less permeable, which makes the whole aquifer formation significantly thicker.

In summer, the surfacewaters are below sea-level, so that the area acts like a continuous drainage basin; as the water evaporates, so the saline concentration increases.

In the marsh area, salts are an inherent component of the substratum. This salinity derives both from geological factors and from the fact that the area is a flat and depressed terrain bordering on a sea without tidal variations, with a climate characterized by a high level of evapotranspiration. The salt content has been increased by the extraction of water for agricultural purposes and, in particular, for tourism (supply of water to built-up areas), with the result that many wells close to the sea have become salified by over-exploitation of the aquifer and the sea's consequent encroachment.

#### 1.4.- GEOMORPHOLOGY

As stated above, the Nature park of los Aiguamolls de l'Empordá is situated in Alto Empordá, in the lower course of the Muga and the Fluviá.

The area has been described as a tectonic depression, created by the folding of the Pyrenees and subsequently filled by Tertiary materials, which evolved within the Catalan Eocene basin.

An account of the strata should perhaps begin with a reference to the Cretaceous marmoreal limestones of l'Escala (southern edge of the Park), which are covered by a layer of sandy limestones. The Cretaceous series ends with yellowish sandy limestones on thin strata. The outcrops traverse the plain of l'Empordá in a south-east to north-east direction.

The principal site of Palaeocene-Eocene materials is in the south-east area of the Park, on the outskirts of Garrigolas. Superficially, these seem to be of continental Eocene origin, formed by a conglomerate alternating with argillaceous and sandy marls belonging to the stretch of detritus above. The Eocene layer rests directly on Palaeozoic slates.

The superficial Pliocene materials consist mainly of sands, marls and clays, overlaid by a layer of Plioquaternary conglomerates.

The outcrops of igneous materials are insignificant and without interest; they occur in the vicinity of Vilamacolum and consist of trachytes and basalts.

The Quaternary strata cover the entire area of the golfo de Roses (120 km<sup>2</sup>). They end where they come into contact with the Pliocene strata, except on the southern edge, where they meet granite and other Palaeozoic materials. The confluence of the Muga and the Fluviá was thus the cause of the deltaic formation deposited on the Pliocene base of the golfo de Roses.

The tectonics of the area are uncomplicated, as the only distinctive feature is a tract of rugged terrain crossing the Ampurdán plain in a south-south-east to north-north-west direction, which causes the Cretaceous limestones to lie above the Eocene materials, while the direction of the dip is north to north-east.

#### 1.5. - DESCRIPTION OF THE FLORA. PLANT COMMUNITIES

Areas of saline soils have coarse halophilic plants, the most common of which are *Salicornia herbacea*, *Arthrocnemum fruticosum*, *Plantago crassifolia*, *Inula crittmoidea* and *Halimione portulacoides*; there are also a few rush species such as *Juncus maritimus*, *Spartina patens*, *Triglochin maritima* and *Schoenus nigricans*. In soils of a very fine texture (muds, clays), shrublike plants of the genus *Salicornia* (*Arthrocnemum fruticosum*) predominate, while in rarely flooded saline soils communities of *Limonium* sp. and *Artemis gallica* flourish; small plants such as *Salicornia herbacea* and *Sueda maritima* are common in pools that dry up in summer. In areas of well-drained soils of low salinity we find meadows, which may be carpeted with graminaceous plants such as *Agropyron* and *Puccinella* and juncaceous plants such as *Juncus maritimus*. (Some of these meadows have spectacular displays of flowering *Iris spuria* in May-June).

The coastal sands and dunes constitute a very special environment, since they provide a dry and poor soil type that can be colonized only by very specialized plantlife; communities of plants such as *Agropyron junceum* and *Sporolobus pungens*, graminaceae with powerful subterranean rhizomes, are to be found on the shoreline, while *Ammophila arenaria*, *Convolvulus soldanella*, *Eringium maritimum*, *Euphorbia paralias* and *Echinophora spinosa* grow on top of the dunes.

The entire alluvial plain of the Fluviá and the Muga is criss-crossed by drainage channels which are home to important plantlife communities dominated by reeds and other similar plants. Mention should be made of two subspecies of *Phragmites australis*: ssp. *ruscinonensis* (which tolerates quite salty water) and ssp. *australis* (which needs fresh water). Other species typical of this environment are *Typha latifolia*, *T. angustifolia*, *Scirpus lacustris*, *Iris pseudacorus*, *Alisma plantagoaquatica*, *Althaea officinalis* and *Lytrum salicaria*. We should also mention the vegetation of the meadows which are naturally or artificially flooded with fresh water for a given period and in which, together with submerged grassland edged by tall reeds (*Carex riparia* and *C. otrubae*) and *Eleocharis palustris*, good-quality pasture is to be found. Lastly, a special type of arboreal vegetation is to be found close to the rivers and irrigation channels, consisting of small riparian woods of *Salix alba*, *Populus alba*, *P. nigra*, *Alnus glutinosa*, *Ulmus minor*, *Fraxinus angustifolia*, *Tamarix gallica*, etc.

The aquatic vegetation of the lagoons and watercourses is also of great importance; noteworthy plants are those of the genus *Ranunculus*, because of their abundance, and those of the genera *Potamogeton*, *Naja*, *Chara* and *Callitriche*, because of their rarity.

Finally, the Park contains various plant species which are seriously threatened. These are *Hydrocharis morsus-ranae*, *Centaurea seridis*, *Plantago cornuti*, *Euphorbia palustris*, *Thalictrum morisonii*, *Ceratophyllum submersum*, *Ranunculus pseudofluitans*, *Orchis laxiflora*, *Trapa natans* and *Sagittaria sagittaefolia*.

#### 1.6.- DESCRIPTION OF THE FAUNA. COMMUNITIES OF VERTEBRATES

*Aphanius iberus* and *Gasterosteus aculeatus* are the most noteworthy fish species, on account of their rarity. Other, common, species in the area are: *Anguilla anguilla*, *Atherina boyeri*, *Blennius fluviatilis*, *Bellone bellone*, *Lepomis gibbosus*, *Cyprinus carpio*, *Barbus meridionalis*, *Leuciscus cephalus cabeda*, *Alosa fallax nilotica*, *Scardinius erythrophthalmus*, *Esox lucius*, *Pomatochistus microps*, *Mugil cephalus*, *Liza ramada*, *Chelon labrosus*, *Gambusia affinis*, *Umbrina cirrosa*, *Argyrosomus regius*, *Dicentrarchus labrax*, *Solea lascaris* and *Sparus aurata*.

Amphibians of particular interest include *Discoglossus pictus*, *Hyla meridionalis*, *Triturus helveticus* and *Mauremys caspica*, while the most common reptiles are *Lacerta viridis*, *Chalcides chalcides*, *Psamodromus hispanicus*, *Natrix natrix* and *Natrix maura*.

Mammals are well represented in the Park. *Crossidula russula* is without doubt the most numerous species, but *Arvicola sapidus*, *Mus spretus* and *Microtus agrestis* are also present. The rabbit (*Oryctolagus cuniculus*) population has been decimated by myxomatosis, whereas the hare (*Lepus capensis*) population is expanding in fruit-tree areas. Other noteworthy species are the polecat (*Putorius putorius*), which is well-established, and the otter (*Lutra lutra*), which is recovering after a period of decline.

The Park provides one of the few permanent habitats, if not the only permanent habitat, in the Iberian Peninsula for nest-building birds such as *Botaurus stellaris* or *Anas querquedula* and *Lanius minor*. Also important are the established populations of *Ardea purpurea*, *Ixobrychus minutus*, *Anas querquedula*, *Circus aeruginosus*, *Himantopus himantopus*, *Burhinus oedicephalus* and *Acrocephalus melanopogon*. Lastly, mention should be made of the important wintering birds. These are *Gavia arctica*, *Bubulcus ibis*, *Anser anser*, *Somateria mollissima*, *Melanitta fusca*, *Burhinus oedicephalus*, *Vanellus vanellus* and *Pluvialis apricaria*. At present, plans are being made to reintroduce the nest-building White Stork (*Ciconia ciconia*) and Purple Swamphen (*Porphyrio porphyrio*).

## 2. - LAND MANAGEMENT AND USE

### 2.1.- LAND USE

Activities which disturb the plant- or wildlife are generally prohibited in all the integral reserves, unless they are expressly permitted by the Park's management authorities and are beneficial to the area, e.g. control of the vegetation, shepherding, rice

cultivation without pesticides, etc. Within the Nature Park, but outside the reserves, traditional activities may continue but are duly controlled to prevent any harmful consequences (use of pesticides, tree-felling, tree-planting, ploughing, etc.).

Efforts are being made in los Aiguamolls to promote traditional methods of rice cultivation with a view to increasing the area and the duration of flooding by the Park's expanses of water, given their fundamental importance for many of the aquatic bird species.

The meadows ('closes'), with their surrounding riparian vegetation, are areas of great importance in which a balanced mix of pastures is maintained. At present, however, there is pressure to have them converted into maizefields.

## 2.2.- LAND TENURE/OWNERSHIP

Of the 867.5 ha comprising the integral nature reserves and the Nature Park, 538.6 ha are public land, managed directly by the Park's authorities, while the 334 ha constituting the Interior Reserve are currently in private hands. Plans to purchase this land will be realized shortly. The rest of the land is privately owned.

At present, then, the areas of public land comprise the coastal lagoons between the mouths of the Fluviá and the Muga (integral nature reserve), a number of adjoining fields and the island of Caramany. The Interior Reserve will be added to these in the near future.

## 2.3.- CONSERVATION MEASURES

The wetlands of the bahía de Roses (Alto Empordá) were named a Protected Nature Area by the Catalan Parliament on 13 October 1983. The relevant legislation is as follows:

- Law 21 of 28 October 1983 naming los Aiguamolls de l'Empordá a Nature Site of National Importance and [an Area of] Integral Zoological and Botanical Reserves (DOGC No. 380 of 11/11/83);
- Decree 136 of 17 April 1984 developing Law 21 of 28 October 1983 naming los Aiguamolls de l'Empordá a Nature Site of National Importance (see also Decree 171/1986 altering the composition of the management authorities) (DOGC No. 436 of 23/5/84);
- Law 12 of 13 June 1985 on Nature Areas (name changed to Nature Park) (DOGC No. 556 of 28/6/85);
- Decree 231 of 15 July 1985 specifying the topography and limits of the Nature Park of National Importance and the Integral Reserves of Zoological and Botanical Importance of los Aiguamolls de l'Empordá (change of name to Nature Park and Integral Nature Reserve confirmed) (DOGC No. 582 of 30/8/85); and
- Decree 123 of 12 March 1987 naming Partial Nature Reserves for the Protection of Animal Species in Danger of Extinction in Catalonia. (Name given to the seashore and the island of Caramany, which includes the Interior Nature Reserve of the same name). (DOGC No. 839 of 29/4/87).

## 3. - INTERNATIONAL IMPORTANCE CRITERIA

### 3.1. - AQUATIC BIRDS

The Nature Park of los Aiguamolls de l'Empordá meets the international category criteria inasmuch as it has the nest-building species *Botaurus stellaris*, *Ixobrychus minutus* and *Porzana pusilla*.

The criteria are also met in those years when the nest-building *Porzana parva* and the wintering *Butor ibis* are present. It is hoped that both these species will soon consolidate their status. It is necessary to point out that, according to the counts made, the populations of wintering Anatidae and coots are increasing year after year and that the minimum number for inclusion in the international importance category, viz. 10,000 specimens, is expected to be exceeded in the near future.

Leaving aside the strictly numerical criteria, the importance of the Park is enhanced in another significant way, in that it is an established refuge on the western Mediterranean migratory route.

### 4. -UTILIZATION AND MANAGEMENT PLAN

Because the legislation on the Park's status does not provide specifically for a master management plan, no such plan has been drawn up to date. Nevertheless, a series of management plans have been introduced since the Park's creation. These are detailed below.

A re-inundation plan exists for Interior Nature Reserve 1. It is proposed that an encircling channel should replace the existing channels crossing the Reserve's centre to act as a barrier between the Reserve and the adjacent fields and to allow the former to be re-inundated permanently without affecting the latter. This same plan provides for the regeneration and re-inundation of Interior Nature Reserve 2 (so far, a few lagoons adjacent to the Massona have been regenerated and an 'estany' (= lake ?) has been created at Cortalet) and for consolidation of the rice plantations. Cultivation of rice ceased totally in the region in 1968 and steps are now being taken to reintroduce it, while avoiding the use of pesticides and leaving the fields flooded in winter for use by birds.

There is also a biotopes conservation plan, which incorporates a plan for protecting the 'closes' (at the study stage), a plan for protecting and regenerating the riparian woods (at the design stage) and a plan for conserving the dunes (at the implementation stage). An amplified version of the latter plan is at the study stage.

Lastly, there is a habitats management plan, which includes a plan for creating islands for nest-building birds (at the implementation stage) and a meadows conservation plan (at the implementation stage).

As far as fauna-management is concerned, the authorities have given priority to restoring the White Stork and Ardeidae populations. To this end, artificial nests have been built in the hope that they will be used by injured specimens or specimens born in captivity. The plan for reintroducing the Purple Swamphen is now at the implementation stage, with specimens being brought in from the Guadalquivir marshes, while that for reintroducing the otter hinges

on the construction of artificial lairs in safe places.

In conclusion, walks and observatories have been designed for visitors with the aim of affording good views while minimizing the possibility of disturbing the Park's fauna.