

- 1. Date this sheet was completed/updated** 1/6/1998
- 2. Country:** Greece
- 3. Name of wetland:** Messolongi Lagoons
- 4. Geographical co-ordinates:** lon: 21⁰ 15' lat: 38⁰ 20'
- 5. Altitude** (average and/or max. & min.): 0.5 m (Scattered hills from 50 m up to 450 m)
- 6. Area** (in hectares): 33,687

7. Overview (general summary, in two or three sentences, of the wetland's principal characteristics):

It is an extensive coastal zone with a wetland complex consisting of a double delta formed by Acheloos and Evinos rivers, extensive lagoons and saltmarshes, restricted freshwater marshes, relicts of a riparian forest, coastal spits with dune formations, and scattered rocky hills in and around the area.

8. Wetland type (please circle the applicable codes for wetland types as listed in Annex I of the Explanatory Note and Guidelines document):

marine-coastal: A · B · C · D · E · F · G · H · I · J · K

inland: L · M · N · O · P · Q · R · Sp · Ss · Tp

Ts · U · Va · Vt · W · Xf · Xp · Y · Zg · Zk

man-made: 1 · 2 · 3 · 4 · 5 · 6 · 7 · 8 · 9

Please now rank these wetland types by listing them from the most to the least dominant: J, F, H, Sp, Ss, K, A, 5, B, M, I, D, E, Xf, Y, 3, 4, 9, 1.

9. Ramsar Criteria: (please circle the applicable criteria; see point 12, next page)

1a · 1b · 1c · 1d | 2a · 2b · 2c · 2d | 3a · 3b · 3c | 4a · 4b

Please specify the most significant criterion applicable to the site: 3c

10. Map of site included? Please tick yes or no

(Please refer to the Explanatory Note and Guidelines document for information regarding desirable map traits)

11. Name and address of the compiler of this form:

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12. Justification of the criteria selected under point 9, on previous page

Criterion 1: see Section 16

Criterion 2: see Sections 17 and 18

Criterion 3: see Section 18

Criterion 4: see Section 18

13. General location: It is situated in Western Greece at the western part of Sterea Ellas, Aitolokarnania. The town of Messolonghi (12,103 inhabitants) is directly neighbouring the wetland site and it is the administrative centre of the Prefecture of Aitolokarnania.

14. Physical features:

Geology and geomorphology: The site was formed by the action of two rivers: the Acheloos to the west, and Evinos to the east. The Messolonghi lagoon (11,200 ha) predominates in the centre of the wetland complex. There is also a number of smaller lagoons. To the north the Aitoliko lagoon (1,400 ha), to the east the Klissova (3,000 ha) and to the west at the foot of the Koutsilaris hill, the lagoons of Gourounopoules and Tholi (800 ha). Geologically the area belongs to the Ionian and Gavrovo zones and is composed mainly of sedimentary rocks (upper cretaceous limestone, eocenic limestone and flysch, triassic crystalines and evaporites, jurassic limestone with certoliths).

Origins: It is a natural ecosystem, quite modified by human interventions.

Hydrology: The several hydrogeological entities that constitute the wider area, directly or indirectly influence the lagoon system, mainly via the Acheloos and Evinos rivers. The average annual discharge of Acheloos River depends on the function of the upstream hydrologic power station, built more than 25 years ago, and ranges between 500-900 m³/sec. The average annual discharge of Evinos river is 30 m³/sec. Messolonghi lagoon is separated from the open sea (Gulf of Patraikos) by a sandbar which is interrupted at intervals, forming long and narrow islets. The Aitoliko lagoon is connected with the Messolonghi lagoon by two small channels near the town of Aitoliko. The Klissova lagoon has been converted into salinas by constructing dikes in the late sixties. Later (since 1973) because of problems caused by penetration of freshwater, it was converted into fish ponds. Now some of the upper basins are used as primary evaporation basins, to provide water of high salinity to the main saltworks found north-west of the town of Messolonghi. Gourounopoules lagoon is separated from the sea by a sandbar. It is connected with the Gulf of Patraikos by two short channels made for fishery purposes. In 1990 dikes and channels were constructed.

Soil type and chemistry: The soil of the area has originated from erosion of the above mentioned rocks. The lagoons consist of clay deposited in salt water, while the coastal ridge consists of sand.

Water quality (physico-chemical characteristics): High salinity in summer is caused by evaporation and is tempered by freshwater flowing into the lagoon. The salinity of the Messolonghi lagoon close to the sea coincides with that of the sea (30-36 ‰). Towards the

inland, the salinity decreases and reaches values of 10-25 ‰. The Aitoliko lagoon is brackish (salinity of 10-15 ‰). Gourounopoules lagoon has a high salinity (40-50 ‰). The pH values range between 6.5-8.5. Concentrations of nutrients range considerably at different time periods, Aitoliko lagoon having higher concentrations than Messolonghi. Increased nutrient concentrations have been observed also in Klissova lagoon.

Depth, fluctuations and permanence of water: Messolonghi is a shallow lagoon with a maximum depth of 1.5 m, but depth mostly varies between 0.2 m and 0.8 m. The maximum depth of Aitoliko lagoon is 30 m, but near the banks the depth is much smaller (1-2 m). The Klissova lagoon is shallow (0.2-0.5m) surrounded by dikes. Gourounopoules is a very shallow lagoon (0.1-0.4m).

Tidal variations: The tidal range is very narrow, varying usually between 0.3-0.4m, depending on the weather.

Catchment area: The catchment of lagoons is divided in three sub-catchments of Messolonghi, of Aitoliko and of Klisova. All these belong to the wider catchment area of the downstream part of Acheloos River, which has a total catchment area of 5,470 km². The catchment area of Evinos River is 1130 km².

Climate: The climate is characterised as temperate. The average annual precipitation is 786 mm. The hottest months are July and August with an average temperature of 27°C. The coldest month is January with an average temperature of 9.9°C. The maximum temperature reaches 40.5°C and the minimum -5.2°C. Winds of west direction predominate, with secondary winds of north-west and south-west direction.

15. Hydrological value:

Main hydrological values are groundwater recharge, flood attenuation, sedimentation trapping and maintenance of water quality.

16. Ecological features:

The site has a central position the the line of coastal wetlands of western Greece (., Kalogria, Lamnia and Kotychi to the south and Amvrakikos gulf and Kalamas Delta to the north) which supports waterbird migration along the western Balkan Peninsula. Messolonghi wetlands also play a role in an east-west migration along the Gulf of Korinthiakos and the Aegean Sea. Despite land reclamation carried out in the 70's and early 80's, extensive areas of salt marshes, sand banks and mudflats still exist. An important part of this site is the pure *Fraxinus* forest (65 ha), remnant of older alluvial forest, composed of big trees of *Fraxinus exelsior*, *F. ornus*, *F. oxycarpa* (the only one in Greece) that is located near the Lessini village. Relicts from such a riparian forest occur also at the eastern banks of the Evinos river. These areas have high ornithological and ecological value. In the western part of Messolonghi lagoon there are extensive saltmarshes with *Salicornia*, *Arthrocnemum*, *Halocnemum*., which compose one of the most important wader feeding grounds. Alongside the saltmarshes, mudflats appear, especially in the spring. In fields close to the saltmarshes the agricultural production is usually not very successful, so parts of these areas have halophile grass vegetation or are still barren land and serve as a substitute habitat for bird species like *Burhinus oedicephalus*, and *Glareola pranticola*. Also at the end of spring a part of the arable land is transformed into rice fields where heron and tern species are attracted. The extensive saltworks serve as a resting and feeding place for waders and terns. Of great ecological importance is also the dunes. In the dunes there is an interesting vegetation of hard-leaved bushes like *Juniperus phoenicea* and *Pistacia lentiscus* accompanied by *Nerium oleander*. Closer to the sea, characteristic vegetation is formed by *Agropyrum*, *Ammophila*, *Cacile*. Reedbeds (*Phragmites australis*,

P. communis, *Typha latifolia*) are restricted; these areas are used by many herons, waders and terns for feeding. Lagoons are characterised by rich submerged vegetation (*Zostera*, *Ruppia*, etc.)

17. Noteworthy flora:

The species *Centaurea niederi* is a rare Greek endemic that is listed in Annex II of 92/43/EEC Directive, in the Bern Convention, in the WCMC Plant Database under the category “endangered”, and is also protected by a Greek Presidential Decree. Of the Greek endemic plants, *Teucrium halacsyanum*, and *Ophrys argolica* are classified as “rare” in the WCMC database. The last one is also protected by a Greek Presidential Decree. In addition, *Salvinia natans* is a plant with interesting geographical distribution classified as “endangered” in the WCMC database and protected by a Greek Presidential Decree; *Scabiosa tenuis*, *Malcolmia graeca subsp. bicolor*, *Fritillaria thessala subsp. reiseri* and *Stachys spinulosa* are Balkan endemics.

18. Noteworthy fauna:

The area is very important for wintering and breeding birds. Seventy one species are listed in Annex I of 79/409/EEC Directive. Also, 173 migratory species breed, winter or stage in the area. Among them, 61 species are listed in Annex I of 79/409/EEC Directive. It is especially important for *Egretta garzetta* (150-300 individuals winter), *Egretta alba* (50-150 individuals winter), *Plegadis falcinellus* (200-400 individuals stage), *Himantopus himantopus* (60 pairs breed), *Recurvirostra avosetta* (130 pairs breed), *Glareola pratincola* (20 pairs breed), *Celochelidon nilotica* (120 pairs breed), *Sterna albifrons* (400-500 pairs breed), *Sterna hirundo* (about 200 pairs), *Galandrella brachydactyla* (1200 pairs), *Charadrius alexandrinus* (200 pairs breed and about 500 individuals winter). All the above species, except the last one, are listed in Annex I of 79/409/EEC Directive. Also, the Messolonghi wetlands hold important numbers of wintering *Podiceps nigricollis* (501-1000), *P. cristatus* (501-1000), *Pelecanus crispus* (10-30), *Anas penelope* (6000), *A. crecca* (7000), *A. platyrhynchos* (>1000), *A. acuta* (1000), *Aythya ferina* (2500), *Fulica atra* (20000), *Calidris alpina* (>1600), *Larus genei* (>1000). A great number of waders reaching 10-15000 individuals (among them *Pluvialis apricaria* - more than 1000 individuals) are wintering in the area.

Of the other fauna, the following species that are threatened in Greece are mentioned in the national Red Data Book: *Lutra lutra*, *Delphinus delphis* are under the category “vulnerable”, and *Monachus monachus*, *Carreta carreta*, *Chelonia mydas*, *Pipistrellus pipistrellus*, *P. nathusii* are under the category “endangered”. The fish species *Scardinius acarnicus* is an endemic to western central Greece.

19. Social and cultural values: (e.g. fisheries production, forestry, religious importance, archaeological site etc.)

The Messolonghi wetland is one of the most productive fishing grounds in Greece, because of the local climate, topography and morphology. Income from fishing is very high. At least 1000 families earn their living directly or semi-directly by that resource (fisherman, boat makers, fish marketing, fish restaurants etc.).

Grazing in and around the area also offers an important income.

The archaeological interest is extremely high in and around the wetland complex. Most outstanding is the history of Messolonghi where during the fight for independence (19th

century), many "filellenes" (foreigner supporters), fought and died in the Messolonghi Exodus (holocaust)

Since 1993, there was an increased recognition of the value of the site as a protected area.. Moreover the area is of great scientific value in the fields of biology, ecology, hydrology and geology.

20. Land tenure/ownership of:

Site: About 1500 ha (drained saltmarsh) were given to local communities for cultivation.. The islets of Oxia and Petalas as well as parts of the hills included in the whole site (almost 500 ha) are private.. The rest is owned by the state. Klissova lagoon is state owned but essentially used by the Municipality of Messolonghi.

Surrounding area: The surrounding area is both privately and state owned. Cultivation is owned by individuals whereas most of the hilly zone by the state.

21. Current land use:

Site: Traditional fishing by co-operatives and private companies is extended in a surface of 15,000 ha. The total annual production amounts about 800 tons. The important species exploited are *Sparus aurata*, *Anguilla anguilla* and different species of *Mugil* spp. Saltworks occupy a surface of 12,400 ha. Other current land uses are crop cultivation in drained land (weed, maize, cotton) and grazing (1,300 cattle, 20,000 sheep and goats).

Surroundings/catchment: Crop cultivation and grazing.

22. Factors (past, present or potential) adversely affecting the site's ecological character, including changes in land use and development projects:

Even though the flow of River Acheloos into the estuary has been regulated by the Dam of Stratos already since 1950, a major issue connected with the site was the possible effects of the planned upstream partial diversion of River Acheloos to the site. Relevant studies however, elaborated in 1994, have shown that the aquifer of the lagoons is hydrologically independent from the aquifer of the river mouth. due to the existence of impermeable geological formations. In the light of all relevant information and according to the decision of the State Council in 1994, the Greek Government having reassessed the initial diversion plans, proceeded in a holistic Environmental Impact Assessment (1995). The new decision is that the diversion of $600 \times 10^6 \text{ m}^3/\text{year}$ of Acheloos water to the Thessalia plain instead of $1,100 \times 10^6$ according to the initial plan, is the optimum alternative, fulfilling the initial objectives, in every aspect (environmental, management of water resources, regional development).

Within the site, various construction works (port of Messolonghi, creation of salt pans in 1970) led to the deposition of soils that changed the hydrology (water circulation) and geomorphology of the area., with a negative impact on fish populations. On the aftermath, however, salt pans proved to be an excellent feeding ground for avifauna.

Large parts of the delta had in the past been reclaimed for agricultural use, but pressures for this process is very limited today since crop production is usually very poor in the reclaimed polders. Marshes are in some cases filled with disposals from digging, aiming to extending peripheral fields or other private land.

Water quality problems are not considerable, even though an amount of agrochemicals and nutrients as well as organic substance from grazing cattle are estimated to reach the wetlands. Pressure from industrial effluents is very low, with only a number of olive oil mills seasonally producing wastes. A management plan for pollution deriving from land reclamation has been prepared..

The largest town of the area, Messolonghi, has a station for biological treatment of sewage effluents since 1972, which was modernised and put in operation again recently. A biological station is also operating in Aetoliko town. Solid waste disposal by the Municipality of Messolonghi. causes problems to Klissova lagoon and this important threat has been dealt with the construction of a Sanitated Landfill outside the catchment area will soon be constructed.

Another threat identified was the resort house building over the habitats, especially the coastal stripes and sand-dunes. For these areas, Louros and Tournida, specific studies for the arrangement of the problem are carried out..

Fishing is a traditional activity, which mostly takes place in natural lagoons in a rather traditional way; however intensive fishing techniques cause problems. Works for fisheries management have been carried out by the Ministry of Agriculture following strict environmental terms. Sand removal in parts of Evinos river is also regulated.

The *Fraxinus* forest was considered under grazing pressure, which has been dealt with fencing since 1993. Cattle grazing in the salt marshes was noted having negative impact on some threatened breeding birds, especially the Collared Pratincole and the estimation of the grazing capacity and proper grazing practises is a matter of priority for management.. Hunting pressure is managed by regulations in force, with some incidents of illegal hunting having been reported.

A procedure for approval of Environmental Terms for a number of works and activities through Environmental Impact Studies has been established in Greece in 1990. Aiming to holding back the further loss and degradation of the site, all relevant planned works have been examined under this procedure by the Environmental Authorities. The majority of projects concerning agricultural improvements, intensive fisheries management and housing were rejected.

23. Conservation measures taken: (national category and legal status of protected areas - including any boundary changes which have been made: management practices: whether an officially approved management plan exists and whether it has been implemented)

A set of measures and delimitation of zones are enforced since September 1993 by the Ministries of Agriculture, Environment and Development, which were renewed in January 1996. Four spatial zones have been defined along the coastline and within each zone core areas comprising the most sensitive bird habitats were identified..

A short description of the zones and measures is as follows.

Zone I includes downstream parts of Evinos, lagoon of Klisova, salt pans, parts of the drained area and shallow coastal water.

Zone II includes salt pans, drained areas, islets, lagoons of Messolonghi and Aetoliko, spit lands, marshes and shallow coastal areas.

Zone III includes drained land, downstream parts of Acheloos and marshes

Zone IV includes islets of Echinades

In all four zones, outside the core areas, permitted activities (under specific terms) are: scientific research, daily visits, environmental education and relevant constructions; car traffic and parking places are identified; management works for the conservation of species and habitats; agriculture as it is practised today; restriction in the use of agrochemicals and fertilisers; apiculture and animal raising as it is practised today and improvement of existing stables; construction of small stables; grazing except for goats (grazing capacity of the area is to be evaluated); maintenance and improvement of existing irrigation and drainage network; periodical cleaning of ditches; professional fishing; use of lagoons for aquaculture and works for their preservation (establishment of new ones is prohibited); amateur fishing according to the regulations; preservation and improvement of the road network and regulated hunting.

Specifically in parts of zone I, sand removal; grazing under terms; reflooding of some drained areas for extensive aquaculture; light tourist facilities; cutting of reedbeds; digging for deepening of areas; disposal of treated effluents of the city of Messolonghi; removal of litter and sanitation of areas and salt extraction are allowed.

In parts of zone II, tourist facilities under terms; grazing; preservation of small harbouring places; digging for deepening of wetlands; removal of silt deposits; disposal of treated effluents from Aetoliko; salt extraction; reflooding of drained areas; water sports; protection of islets from erosion; access to islets only from professional fishing boats; management of pumped water and management of forested areas are allowed.

In parts of zone III, access by boat only for scientific purposes; works for protection from erosion; reflooding of drained land; grazing; restoration of a quarry; excavation in archaeological places under terms; land restoration; pumping of water from the reedbeds under terms; construction of aquaculture units and light constructions for fisheries and light tourist facilities are allowed..

In parts of zone IV, grazing under terms and light constructions for fisheries are allowed.

Zones I, II and III comprise the Ramsar site. Zones I, II, III and IV have been proposed for inclusion in the NATURA 2000 network under the code GR2310001 and are already an SPA under the same code. Fraxinus forest has been declared as a Natural Monument since 1985. The site is a game refuge.

A Preliminary Management Scheme has been established in 1997 on the site by a Programme Agreement signed by the Ministers of Environment and Agriculture, the Regional Environmental Services and Local Authorities. It comprises a Joint Committee for the steering of the implementation, it has a flexible administration and the required secretariat/ co-ordination support provided is by a Local Development Institution. The Programme Agreement has an Annex with the planned works and activities, their timetable (1997-1999) and budget. Priority actions include the operation of an Information Centre, works for the ecological development of the area (placement of signs, construction of warden houses, observation towers etc.), training of the personnel, warding of the site, improvement of tern breeding areas; management of Fraxinus forest; management of coastline; establishment of cultural Museum at Messolonghi lagoon.

Preliminary Management Schemes have a three-fold aim: 1) to respond quicker to the matters that arise concerning the every day management problems of the sites and 2) to carry out projects concerning infrastructure, monitoring and management, and 3) to co-ordinate relevant authorities in working out the further priorities for the management of the sites.

Unauthorised actions exerting pressures on the environment (rice cultivation & road construction) have been averted by the Environmental Service of Aetoloakarnania .

Mitigation measures for the fresh water supply to the Messolonghi lagoons have been elaborated and works for the maintenance of eels upstream the lagoons have also started.

The site is included in the Montreux Record since 1990. Under the Management Guidance Procedure a mission that visited Greece in 1988 described the main problems of the area.. Another mission that visited Greece in 1989 described the situation further.

24. Conservation measures proposed but not yet implemented: (e.g. management plan in preparation; officially proposed as a protected area etc.)

The site is proposed for the category of National Wetland Park, according to the Law 1650/86 (legal text under preparation, in form of a Presidential Decree).

Further management proposals not yet officially approved, have been elaborated for many aspects of the management of the site, as part of the documentation required for the establishment of the National Wetland Park including the establishment of a permanent Management Scheme. The conservation actions proposed are in accordance with the "Guidelines on Management Planning for Ramsar sites and other Wetlands" and include: facilities for scientific research, management of coastal areas of the lagoons, pilot fish capturing installations in order to enhance the water circulation and to reduce the use of nets and the presence of fishermen in the lagoon. A study for the tertiary treatment of the urban wastes of Messolonghi is being conducted.

A project of incentives for the voluntary implementation of management measures in agricultural land (using the agroenvironmental regulation 2078/92) is to be submitted for approval. The project includes forwarding of biological cultivation, reduce of grazing, long-term pause and reduce of the amount of fertilises used.

25. Current scientific research and facilities: (e.g. details of current projects; existence of field station etc.)

A program for inventorying waterfowl and measures for the conservation of *Numenius tenuirostris* are being taken by the General Secretariat of Forests and Natural Environment of the Ministry of Agriculture in co-operation with the Hellenic Ornithological Society. A project for the improvement of the reproduction of sea gulls is ongoing by the Programme Agreement.

There exists a research field station, mainly for bird ringing in Klisova lagoon. Located in the mouth of Acheloos the Fish Culture Centre (IXTHYKA), is also carrying out research on issues related to aqua- culture.

26. Current conservation education: (e.g. visitors centre, hides, information booklet, facilities for school visits etc.)

A fully equipped Information Centre is established in Aetolikon, accompanied by constructions for bird watching, guardhouses etc. This infrastructure supports the activities of information - public awareness, environmental education, monitoring etc. Specific actions of information and public awareness are being planned until the end of 1999 which include special publications, video tapes, CD Roms, organisation of workshops and guided tours of visitors and schools.

27. Current recreation and tourism: (state if wetland is used for recreation/tourism; indicate type and frequency/intensity)

The wetland is not used for tourism, except small parts of the coastal zone. Hotels and recreation facilities are very limited and controlled recreation activities have not been organised yet.

28. Jurisdiction: (territorial e.g. state/region and functional e.g. Dept of Agriculture/Dept. of Environment etc.)

Territorial jurisdiction over the site has the Region of Western Greece. Concerning the functional (conservation) jurisdiction, co-ordination lies with the Ministry of Environment in collaboration with the Ministry of Agriculture, the Prefecture of Aetoloakarnania and Local Authorities.

29. Management authority: (name and address of local body directly responsible for managing the wetland)

No single body legally responsible for the direct local conservation of the wetland exists. The Preliminary management Scheme is guided by a Joint Committee presided by a representative of the Ministry of Environment. Secretarial assistance is provided by :

Information Centre of Messolonghi

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30. Bibliographical references: (scientific/technical only)

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