

1. Date this sheet was completed/updated: 1/6/1998

2. Country: Greece

3. Name of wetland: Artificial Lake Kerkini

4. Geographical coordinates: lon: 23⁰ 08' 00'' lat: 41⁰ 13' 00''

5. Altitude (average and/or max. & min.): 40 m

6. Area (in hectares): 10,996

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

Kerkini is a large, artificial freshwater lake located at the place of a former swamp. It is used for irrigation and flood control purposes, and it is fed by River Strymon flowing in Greece from Bulgaria, which forms an inland delta. at the mouth of the lake. It is surrounded by well forested mountains (Kerkini, Mavrovouni) and it supports a very interesting aquatic vegetation and rich ornithofauna.

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 · 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: 6, O, M, Tp, Ts, L, 9

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: 3b

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: Lake Kerkini lies 47 km from the Greek-Bulgarian border. It consists a regulatory and storage reservoir and it is fed by Strymon River. The river is 256 km long but only 122 km belong to Greece. It rises in Bulgaria and discharges in Kerkini forming an inland delta. Because of its geographical location, at the centre of Strymon plain, the lake of Kerkini consists the main pass for migratory birds which fly to Aegean sea or to the inland Balkan, while also, through Danube river to the Black sea or to the Hungary steppes. See also 14, 16

Criterion 2: The increased biological productivity, the existence of rare plant species (*Marsilea quadrifolia*, *Utricularia vulgaris* etc.) and also rare and diverse fauna (fish, mammals, amphibians, reptiles) within the site and in the surrounding forest ecosystems increases the ecological value of the area. See section 17 and 18.

Criterion 3: Kerkini supports rich bird population, throughout the whole year, in terms of both numbers and diversity (at least 300 species = 65% of the total number of species inventoried in Greece), including rare and endangered species. It is very important as a feeding ground for birds of prey nesting in the nearby forests, as a wintering and intermediate station for migratory birds, as well as a breeding area for a large number of birds. See section 18.

Criterion 4: See section 18.

13. General location:

Artificial lake Kerkini, lies in Northern Greece, at the central part of Makedonia (Macedonia). The town of Serres, which is the administrative center of the Prefecture of Serres, with 50,390 inhabitants lies south-east from the lake at a distance of 20 km. A smaller town, Sidirokastro, with 5,916 inhabitants, lies east from the lake at a distance of 10 km.

14. Physical features:

Geology and geomorphology: Lake Kerkini occupies an alluvial plain between two mountain massives (Kerkini, Mavrovouni). It receives a large quantity of sediments from the river Strymon which drains a large area in southwestern Bulgaria. The metamorphic rocks of Rila-Rhodope and the Serbomacedonia massifs are mainly schists, gneiss, marbles, amphibolites and granitic intrusions and these are the basis for the river Strymon sediments. The eastern, south-eastern and western sides of the lake are dyked.

Origins: It is an artificial lake. It was created on the site of a former natural swamp, after the construction of a dam across the Strymon river in 1932. Following siltation by river sediments, which led to a loss of 61% of the Kerkini storage capacity, and an increase in the surface of irrigated land, it proved necessary to build a new, higher dam and a new dyke to the west.

Hydrology: Artificial lake Kerkini is fed by the River Strymon, which is 256 km long, of which 122 km are within the Greek territory. The average discharge of Strymon is 65-83 m³/s. During summer months (end of June till September) the Strymon flow is interrupted

because the water is blocked in Bulgaria. Several intermittent torrents including the perennial Kerkinitis torrent, also flow into the reservoir. The Kerkinitis torrent flows into the west of the reservoir, but its contribution is negligible (maximum discharge 180 m³/sec).

Soil type and chemistry: The area consists of alluvial soils.

Water quality (physico-chemical characteristics): The lake has a high alkalinity and the water is turbid. The oxygen concentration has a minimum value of 2.5 mg/l, the total phosphorus concentration varies between 0.001 and 0.32 mg/l, and the total hardness lies between 42 and 120 mg/l CaCO₃. The artificial lake Kerkini is considered to be eutrophic.

Depth, fluctuations and permanence of water: Kerkini is a shallow lake with a maximum depth of 10 m, characterised by large fluctuations in water level (more than 5 m), caused by the current irrigation-oriented water management. The water level in the Kerkini reservoir falls to a minimum each year between September and February and rises to a maximum level between early May and early June.

Catchment area: The Kerkini catchment coincides with the River Strymon catchment. The total catchment area of the Strymon upstream of Kerkini is 1,152,000 ha of which 1,077,500 ha lie in Bulgaria.

Downstream area: The plain area downstream of Kerkini lake is about 100,000 ha.

Climate: The climate of the region is intermediate between Mediterranean and Mid-European. The maximum difference between the mean monthly temperatures among seasons is greater than 20⁰C and the driest period coincides with the warmest one. The driest month is September (average precipitation 21 mm) and the wettest month is November (average precipitation 51,9 mm). Precipitation during the year is not high (average 444,6 mm) and has two peaks, the main one in the cold period of the year and a second in May-July. The periods with lowest rainfall are July - August and February - April.

15. Hydrological value:

The main hydrological values are flood control, and irrigation-water storage. Other values are the recharge and discharge of groundwater, and maintenance of water quality.

16. Ecological features:

In the site main habitat types identified include: *Magnopotamion* or *Hydrocharition* type vegetation, *Paspalo-Agrostidion*, *Salix alba* and *Populus alba* galleries, Residual alluvial forests (*Alnion glutinosae*), Eastern (*Galio-Carpinetum*) oak-hornbeam forests, Mixed oak-elm-ash forests of great rivers. The adjacent area is occupied by extended crop cultures.

One of the most important ecological features of the wetland is the riparian forest at the N-NE of the lake, consisting mainly by *Salix alba*, *Salix hybrids*, and individuals of *Salix pentandra*, and *Salix amplexicaulis*. It is the most important habitat of the wetland not only for birds but also for reptiles, amphibians and fishes. It is the nesting and feeding habitat for a lot of rare bird species during long periods and it is used from fish species for spawning. The reedbeds which occupied a large area (1,200 ha) till 1983 and consisted a valuable reproduction and feeding habitat for bird, reptile, amphibian, mammal, and fish species are now of limited ecological value due to their shrinkage. The “nuphar” formation, mainly with *Nymphaea alba* in the deeper parts and *Nymphoides peltata* in shallow waters, replaced the reeds at the NW part of the lake and is now dominating having the largest surface area in Greece (300 ha in 1990 and almost 50 ha in 1997). It is one of the most important feeding and nesting habitats for bird and fish species. Other important flora

species like *Marsilea quadrifolia* (there is a unique reference from Greece), *Nymphoides peltata*, *Trapa natans*, *Salvinia natans*, *Polygonum amphibium* create extended aquatic beds which are valuable habitats for a big number of fauna species.

17. Noteworthy flora:

A great number (785) of vascular plants has been recorded. Among them, 2 taxa (*Salvinia natans*, *Trapa natans*) are included in WCMC database and one taxon (*Himantoglossum hircinum*) is protected by the Greek Presidential Decree (67/1981). The species *Nymphaea alba* and *Nymphoides peltata* have the greatest surface area in Greece. The moss *Riccia fluitans* and water-fern *Marsilea quadrifolia* are unique references for Greece, and the rare species *Najas gracillina* which is found in the lake is also a unique reference for Greece. The species *Trapa natans* has prevailed in Lake Kerkini since 1983 and has completely changed the physiognomy of the wetland. This species has been classified as “vulnerable” by the IUCN catalogue. During the last few years, the species decreased severely and faced extinction and is currently found only in patches. The species *Azolla filiculoides* and *Salvinia natans* developed extensively in eutrophic standing waters and cover the old riverbed of Strymon and the canals. There is a small population of the species *Tamarix parviflora* at the north-eastern edge of the site. At this time only some individuals of the species *Amorpha fruticosa* have remained. This species have been introduced from Bulgaria, through Strymon river.

18. Noteworthy fauna:

Most outstanding element of the biodiversity of the lake, is its avifauna (at least 300 species out of the 407 species of Greece). Two of them, the Dalmatian Pelican (*Pelecanus crispus*) and the Pygmy Cormorant (*Phalacrocorax pygmaeus*) are threatened by extinction worldwide. It is the most important area in Europe for migration and wintering of the Dalmatian Pelican (at least 1000 individuals in autumn of 1994). It hosts the most important colonies of herons (*Nycticorax nycticorax*, *Ardeola ralloides*, *Egretta alba*, *Egretta garzetta*, *Ardea cinerea*, *Ardea purpurea*), cormorants, spoonbills and glossy ibises in the southern Balkans. It also hosts rare birds of prey like *Aquila heliaca*, *Aquila chrysaetos*, *Falco peregrinus*, *Aquila clanga*, *Haliaeetus albicilla*, *Aquila pomarina*, and *Circaetus galligus* (the last two nest). Regarding the other categories of fauna, in the area have been recorded 28 mammal species (one of them *Lutra lutra* with more than 30 individuals in the area, is included in Annex II of Council Directive 92/43/EEC; moreover, most of the water buffaloes remaining in Greece are found there; ie about 500 individuals), 12 reptiles, 9 amphibians (*Triturus cristatus*, *Bombina variegata*, *Emys orbicularis*, *Mauremys caspica* are included in Annex II of Council directive 92/43/EEC), 8 invertebrates (*Lucanus cervus* is included in Annex II of Council directive 92/43/EEC) and 27 fishes. Among the recorded fish species the following four are endemic: *Orthrias brandti bureschi*, *Alburnus alburnus strumicae*, *Alburnoides bipunctatus strymonicus*, *Barbus cyclolepis strumicae*; the following four are included in Annex II of Council directive 92/43/EEC: *Aspius aspius*, *Rhodeus sericeus amarus*, *Barbus plebejus*, *Cobitis taenia*; and the following are economically important: *Cyprinus carpio* (the most dominant), *Rutilus rutilus*, *Leuciscus cephalus*, *Aspius aspius*, *Chondrostoma vardarensis*, *Alburnus alburnus strumicae*, *Vimba melanops*, *Carassius auratus gibelio*, *Silurus glanis*, *Perca fluviatilis*, *Stizostedion lucioperca*, *Esox lucius*, *Scardinius erythrophthalmus*. The last three species are not found frequently any more. In the running waters of the area around the village Agistro, there is a population of wild trout, *Salmo macrostigma* which is endangered by neighbouring cultures of the species *Oncorhynchus mykiss*.

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

Lake Kerkini has one of the highest commercial fish production among the inland lakes in Greece. The fish production is more than 150 kg/ha/year and reaches about 1000-1500 tones. Fish production has shown negative trends mainly due to inappropriate management practices used, and to interactions among the multiple water uses.

In the wider area there are considerable sites of religious and archaeological importance (Monastery of St. George of 19th century, the school building in N. Petritsi community, the Theodorides house typical of the Makedonian architecture etc.)

Since 1993, the social value of the site as a protected area has increased and has led to the development of a value for eco-tourism, environmental education and bird watching, although relevant facilities are small. Moreover the area is of great scientific value in the fields of biology, ecology, hydrology and geology.

20. Land tenure/ownership of:

(a) site: It is public property. Fishing rights are ceded to private local fishing companies every 5 years.

(b) surrounding area: The agricultural land is privately owned but forest land is public property.

21. Current land use:

Site: The management of the reservoir is mainly for irrigation and flood control purposes. No settlement is within the Ramsar site. Fishing is allowed in parts of the site. Grazing and agriculture consist present uses of the site, however they are limited in space. Hunting also occurs in the wetland, but it is regulated.

Surroundings/ catchment: Twenty-one villages lie within a radius of 10 km of the lake, with 66% of the population earning a living from agriculture, livestock rearing (cattle and sheep), and fishing. At the wider area the main land uses are agriculture (29% of the area consisting by 27,819 ha of arable land, 820 ha of horticulture, 1,223 ha of tree cultivation, 90 ha of vineyards, and 3000 ha of abandoned farmland) grazing (24,1% of the area grazed by 20,822 cattle, 49,988 sheep, 26,116 goats, and 8,485 pigs) and forestry (34% of the area).

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

Lake Kerkini was created in a marshland through a dam construction in the bank of River Strymon in 1932. However, the high quantity of sediments carried by River Strymon to the lake gradually decreased the volume of the reservoir. This process created the demand of raising the dykes, in order to increase the irrigation capacity of the lake and the protection against flooding. In 1982 a new dam was constructed and the dyke to the east was raised up to 39 m whereas a new dyke was built to the west, leading to the increase of maximum water level from 33 m above sea level in 1982 to 36 m today. Further proposals to raise the dykes for flood control were examined by the environmental authorities and the environmental terms imposed from the Ministry of Environment in 1995 define the maximum water level at 36 m.

The 1982 raise of water level and the management of irrigation water (with more than 5 m fluctuations of the water level during the year) had caused several changes to the aquatic vegetation and the avifauna of the site. Each year many trees of the riparian forest die due to prolonged inundation, natural regeneration is practically annihilated for the same reason whereas a loss in plant biodiversity is also obvious. The high water levels recorded in the last years, have already caused a marked loss of shallow marshes, reedbeds, and half of the riparian forest (700 ha in 1980 - 325 ha in 1990) On the contrary, the association of *Nymphoidetum peltatae* at the east part of the lake was positively influenced.

Some of the breeding bird populations have been affected by the degradation of the riparian forest which is an important nesting area. Since 1990, conservation actions have been taken by the Forest Service in co-operation with the Department of Biology of the University of Thessaloniki and the Hellenic Ornithological Society for *Pelecanus crispus*. and proposals are elaborated in order to identify similar measures for other important species.

Mud flat habitats have also shrunk since 1982 and a big number of waders which used them for feeding and nesting appear now in the wetland only during the migratory period. The coincidence of the breeding period with the period of highest water level is another factor of pressure, to some species, while others like cormorants have increased in numbers.

The same changes induced in 1982, had caused changes in fish species representativity in the reservoir, in favour of the species of low or no market value and leading commercially important species to extinction.

Agricultural run-off has contributed to an increase of eutrophication state in the water, but there are no incidents of pollution. Since 1981, a decision at a Prefectural level defines the use of the water of River Strymon as well as the terms of disposing effluents and industrial wastes. An important threat was identified with the increased levels of radioactivity in the sediments of the lake as well as of pesticides in River Strymon despite the prohibition of their usage since 1972. This persisting factor possibly originates from the industrial activity outside the borders of Greece. In order to deal with transboundary pollution incidents, on-line monitoring of water quality is being conducted and any exceeding values are automatically communicated to the Prefecture and the Ministry of Environment. Hunting pressure is managed by regulations in force, however a few incidents of illegal hunting have been reported. Uncontrolled visits to the flooded forest and the bird colonies is another factor disturbing the site.

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 animal farms, and/ or agricultural improvement was rejected whereas only the absolutely necessary and less disturbing ones have been permitted.

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 were established in July 1993 by the Ministries of Agriculture, Environment and Development and were renewed in April 1996.

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

Zone A includes the reservoir, the mouth and part of the river bed of Strymon, flooded areas, the riparian forest and part of the mountains to the south. Core areas consisting the most sensitive bird habitats are defined within this zone.

In zone A, apart from core areas, permitted activities (under specific terms) are: agriculture as it is practised today; fisheries and construction of relevant light infrastructure; felling of tree cultivation; conservation of existing infrastructure for flood control and construction of new, water management with regard to conservation; apiculture; free grazing of sheep, cattle and water buffaloes except in cores of absolute protection; measures for the conservation of water buffaloes; reintroduction of extinct species, aqua-culture except in core areas; scientific research and daily visits for environmental education, nature observation.

Zone A comprises the Ramsar site and is already an SPA under the code GR1260008.

A buffer Zone B was also defined which includes agricultural area, grazing fields and mountainous area surrounding zone A

In this zone, permitted activities under terms are: agriculture as it is practised today; land reclamation; conservation of infrastructure for animal breeding and construction of new ones; grazing of buffaloes, cattle, sheep and goats and construction of basic infrastructure; apiculture; stations for the production of electric power from wind; scientific research; mild tourism (environmental education, nature observation); drilling and construction of new drainage networks; road construction; preservation of the existing industries; excavation; house building within the boundaries of communities; construction of hotels; aquaculture, extension and modernisation of aquaculture; litter disposal; forestry and hunting according to regulations.

The wider / catchment area includes mainly mountainous area, agricultural land and grazing fields.

In this zone agriculture, apiculture and animal breeding are maintained as they stand; regulated forestry and hunting; scientific research; mild tourism (environmental education, nature observation); excavation; litter disposition under terms; drilling, and land reclamation works; building; establishment of small units for the processing of products of the area as well as every activity allowed in zones A and B are allowed under terms.

A much larger area, including zones A, B, C, has been proposed for inclusion in the NATURA 2000 network under the code GR1260001.

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 named "Development company of Serres". The Programme Agreement has an Annex with the planned works and activities, their time-table (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.

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 coordinate relevant authorities in working out the further priorities for the management of the sites

During the MEDWET-ACNAT project (1994-96) the site had been selected as the Greek test site and three sub-projects on a) inventory and monitoring, b) training, and c) information and public awareness were implemented successfully. Two management tools have been produced during this project: a 1:25,000 scale wetland habitat digital map of the lake Kerkini, and a special publication regarding the wise water management of the lake.

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 visited the site in 1989 and reported its status.

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 development of biological cultivation, protection of pathogenic soils, decrease of consumption of agrochemicals, study for the increase of productivity of degraded agricultural land, study for the regeneration of the riparian forest, study for the management of reedbeds to the north of the lake, study for the construction of breeding places for birds, study for the reinforcement of the free grazing of buffaloes etc.

A project of financial incentives for the voluntary implementation of environmental measures in agricultural land, under the agri-environmental regulation 2078/92, is to be submitted for approval. The project includes promotion of biological cultivation, reduction of grazing, long-term pause of cultivation and reduction of the amount of fertilisers used.

Protection measures for wild buffaloes under the national law for the rare domestic animal have been proposed. Also local development projects have been submitted regarding mainly ecotouristic development, construction of paths for educational purposes, the establishment of a Natural History Museum.

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

A project for monitoring and conservation actions is in progress for *Phalacrocorax pygmaeus* and *Anser erythropus*, undertaken by WWF and the Hellenic Ornithological Society.

The Tour du Valat Biological Station is monitoring the population of the Pelican species (since 1983). A study for fish migration in the Strymon river is also in progress by the same station.

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

A fully equipped Information Centre is established at the site, accompanied by constructions for bird watching, guardhouses etc. This infrastructure supports the activities of information - public awareness, environmental education, monitoring. Specific actions of information and public awareness 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 recreation and sports, however it has become quite famous for its natural beauty and visitation is increasing during the last 5 years. Visitors can hire boats or drive on the dikes. Tourism infrastructure is limited in the whole of the wider area. The most attractive places are a ski resort at the mountain, some archaeological sites and a SPA hostel near Sidirokastron. The site is attractive for Greek and foreign students and scientists due to its noteworthy fauna, flora and habitats.

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 Kentriki Macedonia. Concerning the functional (conservation) jurisdiction, co-ordination lies with the Ministry of Environment in collaboration in collaboration the Ministry of Agriculture, the Prefecture of Serres 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 Kerkini

Kerkini

GR-620 55 Kato Poroia

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30. Bibliographical references: (scientific/technical only)

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