

**Report on Biodiversity in Water Bodies and the Wider Riparian area of the Megalo Rema Rafina
(Attica)**

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INTRODUCTION

This report was carried out following a request from individual and association applicants against the 27-7-18 Approval of Environmental Terms and Conditions for the project "Arrangement - Delineation of the Rafina River". Local associations and individuals are interested in the effects of a major flood protection project that has been designed and approved for implementation. The project concerns the management of the Great River of Rafina which is administratively under the municipalities of Rafina - Pikermi, Spata - Artemida, Pallini and Peania of the Attica Region and includes the section of the river from its estuary to the sea to the Spaton Avenue, with a total length of approximately 15 kilometers. The Project Operator will be the Directorate of Flood Prevention and Land Improvement Projects of the Ministry of Infrastructure and Transport.

The specific report is drawn up after a review of the literature, the relevant databases and sampling by the researchers of the Inland Waters Sector of the Hellenic Center for Marine Research (ELKETHE). It also offers unpublished scientific information in general about the area's biodiversity. Obviously this work is not comprehensive or a complete study. It is also documented that with regard to the biodiversity of inland waters, the area has not been studied to a satisfactory extent compared to other river basins of Attica.

The catchment area of Rafina's Great River includes an area of 160 square kilometers (about 20% of the area is in urban areas). The basin is divided into three water bodies based on the monitoring application of the Community Water Framework Directive (WFD 2000/60) (Figure 1). The water bodies are distinct river sections and their condition is monitored in a project supervised by the Special Water Secretariat of the Ministry of Environment and Energy. Members of the Inland Waters Department of the Hellenic Center for Marine Research (ELKETHE) have conducted sampling of the aquatic fauna and flora in some parts of the three water bodies of the river. In this report we mainly refer to the fish fauna which is one of the four biotic quality elements for the assessment of the ecological status of rivers under the WFD 2000/60 but we also offer other information that may be useful for the assessment of Environmental Impact Studies (as in species groups and habitat types protected by Community Directive 92/43).



Figure 1. Delineation map of the Great River watershed. One can distinguish the flow of the three river water bodies that have been officially recognized and monitored by the Special Water Secretariat.

PART 1. Fish fauna

The fish fauna of Rafina's Great Rafina includes 7 species that are regularly observed in the fresh waters of the river system. Listed below are the fish fauna species by water body and their presence is mapped, as recorded in recent ELKETHE samplings in Figure 2. The underlined species below are in need of protection at national or international level.

Down stream of the Great River EL0626R000100010N:

Marathon minnow *Pelagus marathonicus*, European eel *Anguilla anguilla*, Thicklip grey mullet, *Chelon labrosus*, Flathead grey mullet *Mugil cephalus*, Thinlip mullet *Chelon ramada*, Peacock blenny *Salaria pavo*, peacock blenny *Salaria fluviatilis*. The mouth of the river also receives various species of marine origin that usually do not regularly live in inland waters.

Valanari stream EL0626R000100011N:

European eel *Anguilla anguilla*. The lower course of the river Water Body has not been surveyed.

Άνω Ρου Μεγάλου Ρέματος EL0626R000100012N:

Marathon minnow *Pelagus marathonicus*, European eel *Anguilla anguilla*.

The eel *Anguilla anguilla*

The eel is a migratory fish species whose populations have recently declined by up to 90% in many areas of Europe (Jacoby & Gollock 2014). It has been classified as a critically endangered species on the red list of the International Union for the Conservation of Nature and Natural Resources (IUCN) and since 2007 it has been the subject of a European recovery plan (Koutsikopoulos 2009). In the inland waters of Attica, the geographical distribution of the eel has decreased and is limited to certain streams and coastal wetlands. The species has been identified in only three streams of the Basin, Kifissos, the stream of Picrodafni, and the stream of Trachones (the once large populations in Lake Koumoundourou have also declined (Mentzafou et al. 2016). It has been identified in many parts of the Rafina river, in the Estuary of Asopos, Erasinos, while significant populations were also found in the wider region of Schinia-Marathona. In rivers like Rafina, the eels enter from the sea and usually survive from 8 to 12 years in the fresh water until they return for the migratory breeding trip to the sea. These relatively long-lived fish require suitable conditions within inland waters (adequate cover, food, stable hydrological conditions and relatively good condition or quality of habitats). While they can survive in polluted water for short periods, mass kills of eels have been observed in areas with highly polluted waters.

Situation in the Rafina's Great River

ELKETHE's records show that in Megalo Rema Rafina a significant population of eels is maintained in several places downstream and in the middle stream (Figure 2). Eels were observed in places with dense riparian vegetation, in river ponds, under boulders and rubble as well as in the estuary area. It is certain that food for this species is abundant here: dense populations of frogs, toads, and migratory fish from the sea (cephalopods, etc.) were recorded. This confirms the three water bodies of the stream are in functional health with a rich food web. The eel is of great value as a managed species and as an indicator species for the protection of river biodiversity in Europe.

Marathon minnow *Pelagus marathonicus*

The species is an endemic fish of Eastern Central Greece and Attica, with a very limited global distribution. It survives in small isolated populations in springs, wetlands and lowland rivers with clear water and rich aquatic vegetation. It does not frequent parts of rivers with strong flowing waters, so the ability to disperse and recolonize is limited. It feeds on plankton, insects and plant debris in quiet parts of rivers (e.g. in river lakes and in riparian wetlands). Its limited range is due to the fact that the species faces a multitude of threats, many of which have proved fatal to some subpopulations: the species has been extirpated from many wetlands especially following prolonged droughts and wetland drainage projects. It has been classified as Near Threatened in the red list of the International Union for the Conservation of Nature and Natural Resources (IUCN) and is listed as Endangered in the Red Book of Threatened Animals of Greece. In Attica, however, we know that populations survive in the following watersheds: Erasinos, Schinias, Haradros and in the Rafina's Great

River. Small remnant populations also survive within the prefecture of Attica and in the Asopos watershed and a small tributary of the Kifisos.

Situation in the Rafina's Great River

One of the most important populations in Attica is located in the Upstream branch of Rafina's Great River "EL0626R000100012N" where there are suitable habitats with extensive reedbeds and river lakes (Figure 2). This population was discovered in 2018 by ELKETHE researchers. More generally, the species maintains a population in a limited area of the middle and lower reaches of the water body EL0626R000100012N, while it has also been observed in the lower reaches of the River (Figure 2). The population is particularly vulnerable to changes in the natural habitats of the riverbed and riparian zone (because the species is "limnophilous" and requires constant "quiet" waters with riparian marshes).

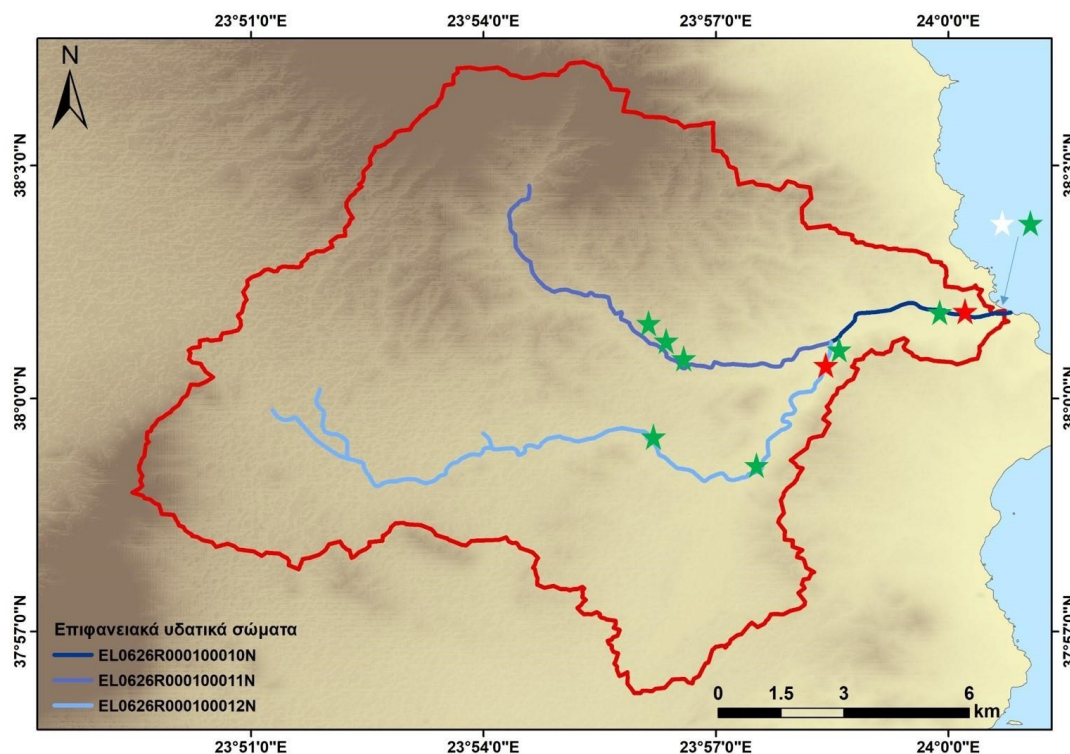


Figure 2. Map of the points where fish fauna has been identified by members of the inland waters sector of ELKETHE. Reference to the three most important species: Green star: Eel *Anguilla anguilla*, Red star: Marathon minnow *Pelagus marathonicus*, White star: Freshwater blenny *Salaria fluviatilis*.

Freshwater blenny *Salaria fluviatilis*

In the spring of 2018, individuals of a population of the freshwater blenny were collected near the mouth of the Megalo Remos in Rafina. This is the only population of the species in Attica (and the genetic samples are under examination). This species is extremely vulnerable to changes in flow regime and river habitats. While the species has a wider distribution in rivers and lakes in the Mediterranean Basin many populations have disappeared due to anthropogenic pressures and degradation. The sample collected from Rafina is being investigated to determine the status of the population.

PART II. Habitat types of special interest for biodiversity conservation

The dominant and characteristic natural habitat types that have been identified in the river water bodies of the Rafina's Great River basin are as follows.

Lower part of Rafina's Great River EL0626R000100010N:

- Intermittent Mediterranean rivers from Paspalo-Agrostidion (3290)
- Estuaries (1130)
- Reedbeds with Phragmites/Typha (72A0)
- Platanus orientalis forests (92C0)
- Southern riparian forests-stems and heaths (Nerio-Tamaricetea)(92D0)

Valanaris EL0626R000100011N:

- Intermittent Mediterranean rivers from Paspalo-Agrostidion (3290)
- Reedbeds with Phragmites/Typha (72A0)
- Platanus orientalis forests (92C0)
- Southern riparian forests-groves and groves (Nerio-Tamaricetea) (92D0)

Upper part of Rafina's Great River EL0626R000100012N:

- Intermittent Mediterranean rivers from Paspalo-Agrostidion (3290)
- Gallery forests with Salix alba and Populus alba (92A0)
- Mediterranean sea bream (*Juncetalia maritimi*) (1410)
- Reed beds with Phragmites/Typha (72A0).

Some habitat types are in a very degraded state with many alien species as well as the expansion of the invasive tame reed (*Arundo donax*). However, there are impressive stands of riparian vegetation and riparian forest in several places. Riparian stands next to continuously flowing rivers are particularly rare formations in Attica. Of particular interest are the habitats "Forests of galleries with *Salix alba* and *Populus alba* (92A0)" in the Upper Rous of Megalo Remata in the Petreza area where there are stands of *Salix alba* (*Salix alba*) of a relatively young age together with isolated specimens of silver-white (*Populus alba*). These clumps may have expanded after the water settlement and flow increase projects in the Petreza branch (after 2000). Similarly, in the area of this branch there are extensive riparian wetlands of high interest for biodiversity (especially because these formations are rare in Attica).

PART 3. Other species of fauna and flora

Bird fauna

On the basis of available data, the area of the Estuary, Etos and Loutro (in the plain of Spata) is of outstanding importance for migratory birds and especially aquatic, wetland and wetland bird species. In the wider area of the estuary and lower reaches of the Great Stream, 110 species have been officially recorded, while in the branch of Petreza and Loutros in the Plain of Spata at least 156 species. Bird populations especially in the plain of Spata are important during the spring migration and in the area of Etos rare species of predators have also bred. The importance of the area goes beyond local or regional value because many threatened migratory species are regularly observed (and several of which are on the Red List of Threatened Species globally).

The value of the area for avifauna has been upgraded due to the increase in flows (and the change in the flow regime in the Petreza branch after 2000). Recent analyses of ornithological data have shown us that in combination with the small Artemida wetland, the area of the Estuary of Rafina's Great River and Petreza (together with Loutro and the Plain of Spata) meets the inclusion criteria for the designation of an Important Bird Area (IBA) and a Special Conservation Zone within the Natura 2000 network.

Amphibians and Reptiles

In the area of the Great River, the following species of reptiles and amphibians have been recorded in the river bed: *Natrix natrix*, *Pelophylax kurtmuelleri*, *Bufo viridis*, *Hyla arborea*. The presence of the water snake (*Natrix natrix*) is considered important at a local level because this species requires areas with water and is vulnerable to land use changes in dry-thermal Mediterranean landscapes. A complete herpetological survey of the area has not been done.

Freshwater macroinvertebrates

There is no comprehensive list of species (at species level). Lists exist at the family level and a more detailed record is in progress. Important habitats for some rare species are the river sections with continuous flow, the karst springs (foothills of Penteli) and areas with rich natural riparian vegetation.

The Rafina's Great River, as one of the few remaining natural water systems of Eastern Attica, hosts a significant number of aquatic macroinvertebrates. The study of aquatic macroinvertebrates, and especially of the class of insects, is of great ecological importance since these organisms have a high potential as decomposers of dead organic matter, while at the same time they can be used as biological indicators of the state of aquatic ecosystems. Thanks to the diversity of the habitats of the Rafina river, there are numerous species of dragonflies, such as *Crocothemis erythraea*, *Calopteryx virgo*, *Sympetrum striolatum*, *Lestes macrostigma*, *Platycnemis pennipes*, *Anax imperator* etc. Also

Trichoptera of the species *Hydropsyche peristerica*, and various species from the families Hydroptilidae and Glossosomatidae, while a significant number of Coleoptera are found in the sections of the stream with enough vegetation and with moderate or stagnant flow (e.g. *Scarodytes halensis*). Various species of gastropods (aquatic snails) such as *Physella acuta* (*Pneumophora*) have also been collected. In the riparian zone, several Lepidoptera (butterflies) are found, such as *Glaucopsyche alexis*, *Pieris manni*, *Satyrium ilicis*, *Maniola jurtina* and several moths such as *Hyles euphorbiae*. Finally in crustaceans, there are populations of the freshwater crab *Potamon fluviatile*, and especially in sections of continuous flow like in Valanaris. This species is classified as "Near Threatened" (NT) on the Red List of the International Union for Conservation of Nature and Natural Resources (IUCN).

GENERAL CONCLUSIONS

Without being able to do a comprehensive analysis of the impacts in this summary report we refer to some serious issues in the management project proposal as described in the relevant Environmental Impact Study.

As the project is expected to develop, it will have serious negative effects on all three Water Bodies. Natural habitat types will be degraded and some that have a very limited distribution in the area will disappear. In the middle and upper reaches of the water body of the Upper Part of the Great River ELO626R000100012N (Petreza branch) some habitat types rare in Attica will disappear, such as "Forests with *Salix alba* and *Populus alba* (92A0)" and "Mediterranean grasslands (*Juncetalia maritimi*) (1410)". Almost all riparian marshes or other wetland features currently present in the riparian zones of all three Water Bodies will disappear. Because the survey of the fauna and flora has not been completed to a satisfactory extent, the total damage to the area's biodiversity cannot be easily estimated. It is certain, however, that some species will disappear from the Great River's watershed and there will be a complete degradation of natural formations without the ecosystems being able to recover to the degree of structure and function they are today.

As for the fish fauna, it is very likely that the species *Pelagus marathonicus* and *Salaria fluviatilis* will disappear, and there will be catastrophic effects on the local population of *Anguilla anguilla*. The population of *Pelagus marathonicus* is particularly vulnerable to changes in the spatially restricted habitat as the species uses the shallow banks and the riparian zone as well. Moreover, after the works it will probably be impossible for this species to survive in the new altered conditions.

A significant change will also occur in the area of the stream's mouth which is currently protected as a Priority 1 wetland (according to Law 4277/2014 defining the new Athens-Attica Regulatory Plan) and demarcated in 2017 (Greek Biotope/Wetland Centre - EKBY 2017). The project envisages the complete management of the entire estuary and mouth of the stream (with serious negative effects on many groups of aquatic fauna).

Finally, the proposed project could apparently offer a more "environmentally friendly solution" that protects parts of the natural river and implements "bed widening" measures where expropriations

can take place. There is also a need to create a low dam in the Petreza branch due to the diversion of water from adjacent basins and the recent artificial increase in water supply in this branch.

Unfortunately, the dam is not foreseen in the first phase of the project but in the second phase (within a decade or so). We emphasize that in this particular case the retention dam if carefully designed for biodiversity could enhance the values of the area for many species of wetland fauna (and especially for avifauna).

Also, the maintenance of a wider riparian zone with natural vegetation in parts of the Petreza branch could also have a positive effect on flood protection (e.g. slowing the flood flow downstream). A new approach to flood protection with the provision for river corridor widening projects is necessary.

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