



CONSERVATION OF *MARGARITIFERA AURICULARIA* IN ARAGON

LIFE04NAT/ES/0033

LAYMAN'S REPORT

Margaritifera auricularia is a big fresh water bivalve, that measures more than 17cm, and thus is one of the greatest of the Iberian Peninsula. It has strong shells due to the nacre that is formed inside, while the outside has a brownish nearly black colour.

Like other Naiads, the name of this bivalve group, they need a host fish to complete their reproductive cycle. Their larvae, named Glochidium, mature in fish tissues and are released to the water as juvenile mussels.



In the past *Margaritifera auricularia* was present in a large number of rivers of Western Europe, but today it only can be found in the Ebro basin and some French rivers as the Loire where only about 100 individuals survive.

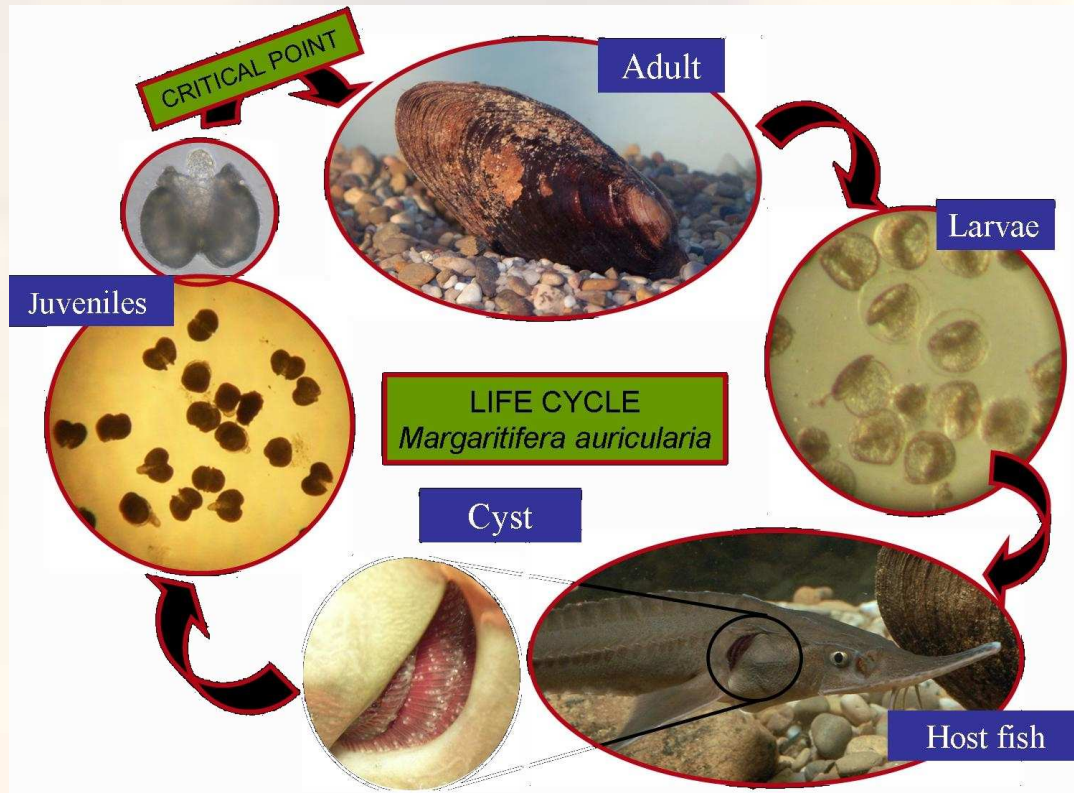
The known populations of the Ebro, that provided nacre to the cutler craftsmen of Sástago, suffered a tremendous decline. Today the river holds only 200 individuals in the lower Catalan Ebro and 40 in Aragón. Besides of that 100 specimen are known in the Channel of Tauste in Navarre, while the aragonese section of this channel holds 75 individuals. The greatest population of *Margaritifera* with slightly more than 3.500 animals is concentrated in the Imperial Channel of Aragón, being this the largest population of the world.

Therefore the species is one of the most threatened on earth. The reasons for the decrease are many: alterations of the rivers, urban, industrial, and agricultural pollution, or the introduction of exotic species as the Zebra mussel (*Dreissena polymorpha*), whose recent expansion in Aragón represents another stroke for *Margaritifera*.

River and water alterations also affect their host fishes. One of the two fish species to which the reproductive cycle of the mussel is adapted, the sturgeon (*Acipenser sturio*) has disappeared from the Ebro basin more than 50 years ago, while the second species the freshwater Blenny (*Salaria fluviatilis*) is very scarce and catalogued in Aragón as "in danger of extinction".

In 2004 the European Union accepted the LIFE project of the Government of Aragón "Conservation of *Margaritifera auricularia* in Aragón", through which, co-financed by both organisations, management and conservation actions were carried out for this species.

The principal problem of *Margaritifera* besides the decrease of adults in known populations, is the lack of juvenile individuals. This interruption of the life cycle may condemn it to extinction in the near future.



Life cycle of *Margaritifera auricularia*

Principal activities carried out within the framework of the LIFE project “Conservation of *Margaritifera auricularia* in Aragón”

In view of the alarming situation, the Government of Aragón has carried out various activities within the scope of the mentioned LIFE project. One has been the publication of a Recovery Plan of *Margaritifera auricularia* (Decree 187/2005 BOA Nr. 120 of 07/10/2005). This rule plans and regulates all actions regarding species and habitat conservation, and is legally binding upon private persons and different competent Civil services. Likewise a Recovery Plan of the freshwater Blenny (*Salarias fluviatilis*), has been prepared, that at the moment is in the last phase previous to its approval. It includes the management of all waters where the species can be found as well as the management of exotic species in this waterbodies and schedules a revision of the area of implementation if new freshwater Blenny populations will be found.

One of the actions that required intensive dedication, was to coordinate the survival of the species with construction and maintenance works in the Imperial Channel and to a lesser degree in the Channel of Tauste. Numerous rangers (APNs) and technical staff of the Environmental Agency have taken part in these tasks. Each new located bivalve was labelled by following a sequential numeration. Like that it was possible to establish an inventory of localized specimen, conduct growth studies, and detect cases of mortality.



Activities of exploration and rescue of *Margaritifera auricularia*

The interruption of watersupply in the Imperial Channel provided the opportunity to increase the knowledge of the species, and has been used to conduct studies on the ecological requirement of *Margaritifera* in this habitat.

The results show that *Margaritifera* survives better when it selects areas dominated by fine gravel (2 to 64 mm). It colonizes mainly the central part of the watercourse, being this the microhabitat, where it finds the best life conditions due to a greater velocity of the current, a greater depth, and lesser accumulation of fine particles. It avoids areas with large stones or abundant slime and sands, which on the other hand are preferred by *Anodonta* sp., another Naiad species, that selects the most opposite habitat to *Margaritifera*. The predominant species in the Imperial Channel is a third Naiad, *Potomida littoralis*, because of its flexibility in environmental requirements compared to *Margaritifera*. It is the most frequent companion of the latter distributed in a radius of one meter around each specimen of *Margaritifera*.

Breeding of *Margaritifera* in captivity and semi freedom

In view of the current situation, breeding in laboratory and semi free conditions, seems to be the only way to save the species. But these procedures present difficulties that until now could not have been overcome. The infection of host fish by larvae of *Margaritifera* and the release of juvenile mussels does not present problems, but the critical point of all experiments realized to date in Aragón, in Catalonia, and in the Museum of Natural Science of Madrid, is the growth of these young mussels. In 2007 new installations in Aragón provided more space and better water quality permitting a considerable progress in the experiments.

100 sturgeons were infected and released more than 115.000 juvenile mussels. These were distributed among seven different experiments including some long term studies and some using growth vats, that are frequently employed in Naiad research in the United States. The most successful of all experiments, utilizing substratum and a "half-opened" water circuit, resulted in the survival of juvenile *Margaritifera* for 10 weeks. Other experiments are pending to be evaluated in the future like the release of juveniles proceeding from laboratory at controlled points of the Imperial Channel.



Development of the captive breeding programme



Conservation of the freshwater Blenny (*Salaria fluviatilis*)

Nowadays the freshwater Blenny is the only host fish and thus it is essential to preserve *Margaritifera auricularia*. Therefore, to a great extent conservation actions are addressed to this species. When surveys demonstrated the critical situation in the Ebro, where only two populations could be found, some habitat improvements were undertaken.



The availability of refuges for retreat and reproduction is usually limited for this species. Therefore throughout the Imperial Channel 276 units of an artificial refuge were placed consisting of four bricks each, while in the most suitable places of the Ebro natural slabs and gabions of stones were used. The experience of the channel was not satisfying, among other things due to the accumulation of sediments that filled up the majority of the installed refuges. The experience of the river seems to give better results but cannot be quantified yet.

Blennies have also been bred in semi-freedom with very good results. They were reared as well in small basins in the Alfranca as in four irrigation basins located in Caspe and the river Matarraña. The latter were used in collaboration with the farmers, owners of the basins. The same good results were obtained when Blennies were intensively bred in laboratory, a pilot study carried out by the team of Adolfo de Sostoa within an agreement of the University of Barcelona and the Government of Aragon, that for the first time completed the reproduction of this fish under laboratory conditions.

Adding some rescued individuals from drying-out basins, about 160 of the reared Blennies could be released in suitable habitats, being previously infected by *Margaritifera* larvae.



Actions of public information and formation of consciousness

Different actions of public information and formation of consciousness have been carried out within the LIFE project "Conservation of *Margaritifera auricularia* in Aragón".

In 2006 a seminar was organized in which different speakers resumed the knowledge and current problems of the species. Representatives of the two Channels, the Confederation Hidrográfica del Ebro, and the Government of Aragón took part in the round table discussion. The seminar raised a wide-spread interest with more than 120 participants debating actively the problems and had a broad diffusion in press.

In November 2007 in a Technical Conference more than 80 participants presented the conducted experiments and the obtained progress during the realization of the LIFE project and debated on the problems of preserving naiads, breeding in captivity, and actions of habitat improvements in rivers.

Different divulgation materials were prepared throughout the LIFE project: a pamphlet, a poster and a DVD, where the characteristics of the species, its problems, and the undertaken actions of conservation are reflected. These materials have been distributed among all involved agencies and are placed at disposal of all interested people in the web-side of the project and at the offices of the Environmental Agency of the Government of Aragón.

The web-side of the project, within the internet portal of the Government of Aragón (aragon.es), includes information about the LIFE project, about the species, its problems, and the conservation actions. Apart of that it includes a gallery of images of *Margaritifera* to approximate this species to all interested persons.





Experience and continuation

The critical situation of the species requires continuation and consolidation of the actions. Aragón plays a leading part because the main world population is located in its territory. The activities started in the LIFE project "Conservation of *Margaritifera auricularia* in Aragón" will continue by means of the Recovery Plan of *Margaritifera auricularia*, especially those that are carried out in the new laboratory of captive breeding.

The first advancements in captive breeding were obtained as a result of the acquired experience in the experiments carried out during the four year validity of the project (2004–2007). Managing to complete the life cycle in captivity or semi freedom would be a success without precedents and is the object that is pursued.

Once obtained this goal, the instruction protocols of population reinforcement of *Margaritifera*, that had been designed during the LIFE project, could be executed in the natural environment, similar to the ones of the freshwater Blenny.

During the project it had been necessary to reinforce the tasks of sampling in potential zones for *Margaritifera* in the Imperial Channel and redouble the supervision efforts especially when maintenance works were carried out. These works temporally leave the individuals of *Margaritifera* without the necessary watercover that permits its survival. Therefore avoidance of direct death of individuals becomes a fundamental necessity. At the same time interruptions of the watersupply permit to conduct ecological studies of the species and the accompanying naiads, and to carry out population censuses.

It is also necessary to continue improving the quality of our rivers, since it is useless to manage the reproduction of the species in captivity if afterwards it is impossible to reintroduce it in its natural environment. Changes in the natural characteristics of the rivers do not only affect the survival of Naiads but also the host fish populations, without which the birth of new specimen is impossible. Besides the alterations of riverbeds that cause habitat loss and the pollution that alters nutrient cycles and transports harmful substances, control of introduction and expansion of exotic species must be reinforced, because they may convert to or are already invasive species that constitute a direct threat of the aquatic ecosystems.

