LIFE-Nature project no. LIFE2002NAT/D/8458

Large Freshwater Mussels Unionoidea in the Border Area of Bavaria - Saxony - Czech Republic

LIFE-Nature project

to protect the

freshwater pearl mussel and the common river mussel in the

border area of Bavaria - Saxony - Czech Republic

Bezirk Oberfranken

Bayerisches Staatsministerium für Umwelt, Gesundheit und Verbraucherschutz

Bayerischer Naturschutz-fonds

Landkreis Hof

Zweckverband „Naturpark Erzgebirge/Vogtland“

Contents

Summary

The aim of the LIFE-Nature project is to protect the freshwater pearl mussel *Margaritifera margaritifera* and the common river mussel *Unio crassus* in the border area of Bavaria - Saxony – Czech Republic.

The project shall **reduce the mud drag-in**. Altogether eight semi-natural mud collectors were built in front of the mouths of side streams. They keep away 20 to 30 m^3 of mud from the main brook every year. Five drains were opened to retain harmful iron mud (ochre). Three sites for cattle passage were developed into reinforced fords.

The **habitat** of the mussel and its host fish was improved: A cased side brook was given back its brook bed. At altogether ten sites, silty gravel was cleaned in the mussel brooks so that young mussel and fish spawn can live here again. The fish population was clearly improved by newly designed small structures in the streams made of deadwood and rootstocks and by levelling the banks.

The **rejuvenation** of the mussel populations was supported. For one, host fish were caught and infected on the spot with larvae of the common river mussel and placed back in the streams. Also, brown trout in a fish farming facility were infected with freshwater pearl mussel larvae and young mussel was collected. As a result, altogether more than 100,000 common river mussels and 300,000 freshwater pearl mussels could be directly released into the brooks.

Guided tours and road shows, as well as press conferences in the area made the mussel protection and the project **public**. Display boards on the grounds, information material and a project exhibition support the public awareness even beyond the runtime of the project. A special sign of hope for the long-term success of the project measures and for the protection of the freshwater pearl mussel altogether is represented by the rare **find of** more than 50 **naturally grown young mussels**.

The area

Directly at the former 'Iron Curtain', in the tri-border region of Bavaria - Saxony - Czech Republic, a manifold and species-rich man-made landscape with a high percentage of grassland has been preserved. The area is sparsely populated and there is little industry.

Many threatened species and plants, among them the freshwater pearl mussel *Margaritifera margaritifera* and the common river mussel *Unio crassus,* live in the streams that, to a large extent, are still close to natural and low in nutrients.
The existence of the freshwater pearl mussel has been known since the beginning of the 18th century. Shells and the very rare pearls were once collected and made into jewellery and art objects.

In the course of the 20th century the number of freshwater pearl mussels decreased significantly. However, the populations in the project area are still among the largest in Central Europe.
In order to preserve the species in the tri-border region, and to give back to the streams their original quality, measures have been implemented since the early 1980s in the framework of cross-border cooperation between Bavaria, Saxony and the Czech Republic. These measures include the creation of marginal strips on the banks, the restoration of the main and side streams, the extensification of land and pond use and the diversion of waste water from the whole water catchment area of the mussel existence.

Freshwater pearl mussel *Margaritifera margaritifera*

The freshwater pearl mussel lives in summer-cool, oxygen-rich streams that are very low in nutrients and lime. Nevertheless, these animals that grow up to 14 cm form a thick lime shell which is covered by a deep black organic coating to protect against corrosion. The freshwater pearl mussel is endangered worldwide and threatened with extinction.

Common river mussel *Unio crassus*

Measuring 4 to 7 cm the common river mussel is a bit smaller than its relatives. It populates brooks, rivers and lake outlets that are a bit richer in nutrients and lime. In the past it was so widespread that it was even fed to pigs. Today, it is also in danger of extinction.

Endangered habitat

Wherever freshwater pearl mussels or common river mussels exist and reproduce naturally the brooks are clean and biologically intact. Even mild contamination from pollutants and nutrients can lead first of all to the absence of mussel offspring and then to the dying off of the older mussel.

Also the siltation of the bottoms of the streams which has been observed over the past decades resulted in missing offspring of mussel and fish species that spawn in gravel. Fry and young mussels suffocate in the gravel under the thin sediment overlay.

Development cycle

Common river mussels and freshwater pearl mussels live buried in the brook bed. They filter out their food directly from the water. The freshwater pearl mussel is a true starving expert and grows very slowly. While doing so it reaches an age of more than 100 years. The maximum age of the common river mussel is 'only' about 20 years.

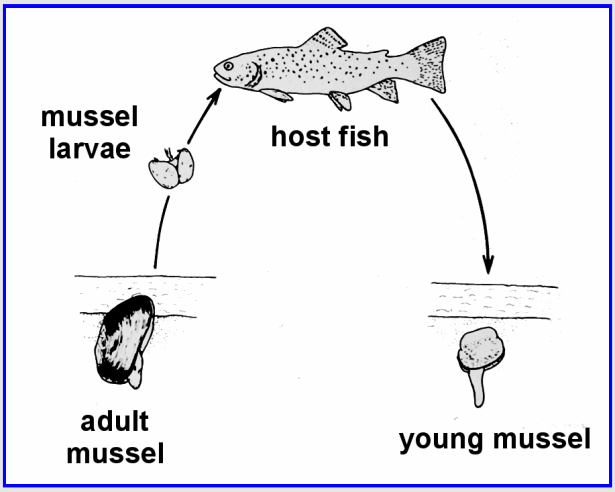


Diagram: Annick Servant/ Gerhard Bauer

During the period of reproduction the female mussel ejects between 10,000 and several million tiny larvae (glochidia) into the brook water. These must be inhaled by an appropriate host fish. They develop into mussel at its gills. After a few weeks to months the 0.5 mm sized young mussel falls onto the bottom of the brook. Then it lives completely hidden in the sediment for several years.

- **Eutrophications of streams**

Algae and mud coatings in ditches and brooks indicate the eutrophication of the streams. Main sources of the nutrient contamination are sewage from scattered settlements, pond waste waters and fertilizer surplus from agriculture.

Although the agricultural utilization of the catchment areas of the streams in the tri-border region is relatively extensive, the nutrient input into the streams has increased due to the increased use of fertilizers. Apart from direct planar drainage, e.g. with strong rain, there is also an import from areas more distant to the brooks via side streams, ditches and drainage channels.

Mud and iron ochre

The mud in the streams consists of washed down arable soil or is generated on the spot out of strongly growing algae which is fertilized by nutrient imports. In the brook the mud seals the gaps in the gravel. As a result, oxygen runs short and toxic hydrogen sulphide (H_2S) and nitrite (NO_2) may form.

A specially fine and harmful form of mud is iron ochre. Iron that is leached out of the soil directly reaches the brook through drains. It is oxidized in oxygen-rich water and precipitated in flakes.

Young mussels die off in silty gravel. The adult common river mussel (in the picture on the left) and freshwater pearl mussel (in the picture on the right) filter at the surface of the sediment. They can survive despite siltation. However, in order to excrete ochre and mud they must continuously expend energy. This results in a decreased life expectancy. In addition, with strong mud contamination pregnant females eject their mussel larvae at an immature stage.

Lack of host fish

All local freshwater mussels live as parasites on fish. In the relevant area the brown trout is the only host fish of the freshwater pearl mussel. Hosts of the common river mussel are minnows, chubs, rudds and bullheads.

Brook regulation, obstruction and siltation may result in a lack of appropriate spawning grounds and shelters in the streams. Wherever host fish are missing, e.g. due to impediments to migration, the evolution cycle of the mussel is disrupted.

The LIFE-Nature project: Aims

The LIFE-Nature project serves to protect the mussel in the Natura-2000 areas called *"North-East-Bavarian brook valleys around the town of Rehau"* and *"Green Line Bavaria – Saxony"*. The areas comprise the brooks and their direct surroundings.

LIFE-Nature

By means of the sponsorship programme **LIFE-Nature** the European Union promotes projects which preserve and develop rare wild animal and plant species and their habitats within the nature reserve system **Natura 2000**. As a prerequisite

- the project area must be a designated SAC site under the EC Habitats Directive or a SPA site under the Birds Directive and
- the animal and plant species must be listed in the appendices II and IV of the Habitats Directive and in appendix I of the Birds Directive.

Information on LIFE-Nature:
http://ec.europa.eu/environment/life/

Thus, the **project measures** begin directly in and at the brook:

1) Reduction of mud drag-in

Mud drag-in is detained at junctions in the matter cycles of the streams. Such sites are the mouths of side streams, ditches and drainage channels on the one hand, at which the matter reaches the brook from the environs. On the other hand, they are ponds close to the brook, which collect and retain mud but also primarily form and release it.

2) Improvement of the habitat

At some sites cased side brooks were opened, brook sediments were cleaned out and new locations for fish were created. As a result, the mussel and its host fish are directly supported.

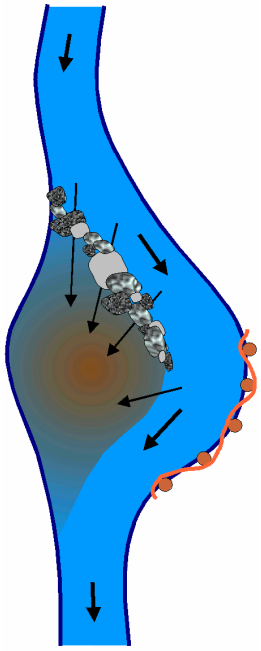
3) Population support

The decreasing and overaged mussel populations were systematically rejuvenated. The development of mussel larvae via host fish to young mussels is naturally connected with high loss and is especially susceptible to disturbance. Artificial host fish infections may reduce the loss and support the rejuvenation.

Reduction of the drag-in

Mud

Mud collectors that are semi-natural are constructed at the mouths of eight tributaries of the mussel brooks.



The side brooks were thus expanded to their fivefold and tenfold width. The main water flow is maintained through a barrier of interlocked stones and the brook can transport gravel to the main brook during high waters. At normal water levels, mud is deposited. Depending on the size of the side streams one to three of such expansions were constructed one after another. The mud must be removed every year. In the spring of 2006 the mud collector in the picture contained 8.2 m³ of mud with three expansions.

At the passage sites of a mother cow herd through the brook, the bank was severely trampled down and muddy. The cattle drive passage sites were developed into reinforced fords. This enabled the containment the mud drag-in.

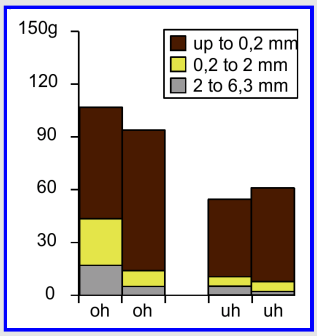
Evaluation

The effects of the measures on the habitat were examined.

Nail test

Ungalvanised nails were placed into the bottom of the brook as an oxygen indicator. They rust as far as the depth where the gravel is well flown through. Grey and polished nails are a sign of lack of oxygen. Here, young mussel cannot survive. The four nails on the left side of the picture were placed in cleaned sediment; the nails on the right were placed in the original, uncleaned sediment of the stream.

Sediment collector



In order to test the efficiency of the mud collectors two boxes each filled with gravel were installed above (oh) and beneath (uh) the collector into the bottom of the brook. After four weeks, the boxes beneath had collected less fine sediment and sand, which means they were less silty.

Ochre

Five drains were opened and turned into ditches. The ochre now even precipitates in the ditches and solidifies to harmless iron oxides. The farmers of the drained meadows put up with the impediment caused by the ditches since the water now drains off better.

The ideal solution for the ochre problem would be the extensive renewed moisturizing of the brook pastures, according to the point of view of the mussel protection. However, this would make agricultural use and tending more difficult or even impossible.

Improvement of the habitat

Restoration

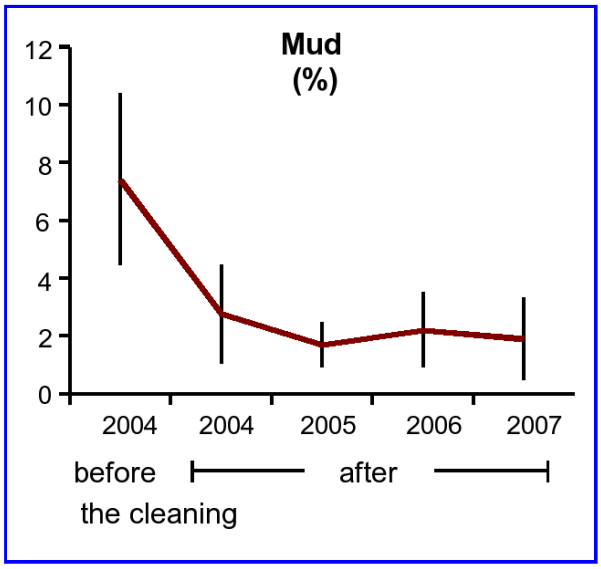
A cased side brook was restored along a length of 400 m and now flows again as an open meadow brook. This turned the last cased stream section in the Saxon region into a vivid brook again. Above the restored section the brook ran through a pond contaminated by waste water. The brook was diverted around the pond so that it is no longer directly contaminated and the pond provides a secondary treatment of the waste water.

Creation of small structures

In one of the stream sections there are both common river mussel and freshwater pearl mussel. Here, spruce treetops were placed and anchored in the brook. Between the twigs minnows and other small fish find shelter from their natural enemies. At some places the banks were levelled out as grounds for the spawning and upbringing of small fish. The population of the most important host fish species of the common river mussel, the minnow, noticeably increased as a result.

Sediment cleaning

The silty bottom of the brook was cleaned at ten sections. For this, the sediment is removed using a digger and loaded onto a tipper. The sediment is washed with brook water on the tilted tipper surface. Simultaneously the mud flows from the bearing surface onto the meadow close to the bank.



Complemented by quarry gravel the cleaned brook gravel is again transferred into the brook. Although there is danger that the cleaned sediment will again become silty, the mud content stayed low at most of the sites over the past three years.

Young mussel findings

Before the cleaning of sediment the brook is thoroughly searched for mussels in order to place them in adjacent brook sections until after the measure. On this occasion, more than 50 young freshwater pearl mussel were collected. They are barely visible in the brook gravel and are thus difficult to detect (see circle).

Here mussels already reproduce naturally again.

This rare discovery raises great hope that it will be possible to preserve the freshwater pearl mussel in the tri-border region on a long-term basis.

Population support

That the habitats of the mussel are damaged is always initially shown by the fact that young mussels no longer grow up. The rejuvenation of the mussel populations may be supported artificially. However, this is only useful wherever the quality of the brooks has noticeably improved again.

Minnows and chubs are electrically caught in the brook, infected with larvae of the common river mussel and released again. After four weeks the young mussel falls off of the fish. In this way, about 115,000 young mussels were released.

In the year 2007 four year old common river mussels where found. They derive from the artificial infection of the year 2003.

About 330,000 young freshwater pearl mussels were directly released. Brown trout were infected with mussel larvae in a fish farm. After 9 months the young mussels come off the fish and are collected from the fish tanks using fine sieves and are infiltrated into the cleaned bottom of the brook via a tube.

Electrofishing

By means of gentle electrofishing fish populations in the mussel streams are controlled, and also host fish are collected for the artificial infection with mussel larvae.

Wood structures were placed into the stream for the host fish of the common river mussel and banks were levelled. Fishing shows that the population of minnows, the most important host fish in the area, has noticeably increased. The brown trout, the only local host fish of the freshwater pearl mussel, shows good populations and reproduces naturally.

Other endangered fish species, e.g. burbot, bullhead and brook lamprey, were found in the mussel brooks.

The LIFE-Nature project in public

By means of personally designed media mussel protection in general and as project work is represented in public. One part of the project is an exhibition which is on display at several locations and is also used for guided school tours. Info sessions were performed with agricultural and fish farmers, but also with students and experts from other nature conservation projects.

The project presentation is complemented by a leaflet and on the internet.

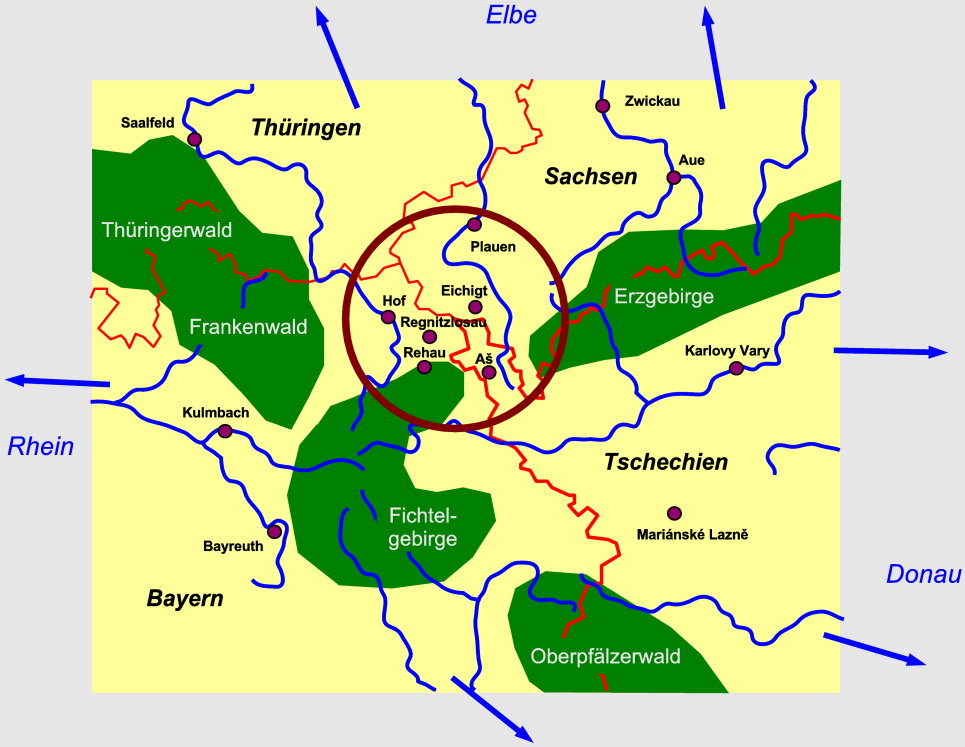
In order to inform a wider public, press conferences were held, e.g. on the occasion of the presentation of the project information boards on the grounds by politicians and participating specialised authorities. In the framework of a workshop of the project, measures to protect unionid mussels were discussed with experts and information was exchanged regarding experience with LIFE-Nature projects abroad.

LIFE-Nature project Large Mussel Unionoidea in the Tri-Border Region of Bavaria - Saxony - Czech Republic

Project data

- Running time: November 2002 until July 2007
- Project area: 267 ha (FFH areas of the project brooks)
- Catchment areas of the project brooks: 8.900 ha
- Budget: 1.056.000 €
- EU aid: 50 %

Location: Tri-border region of Bavaria – Saxony – Czech Republic



Project partnership

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ec.europa.eu/environment/life

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