The freshwater pearl mussel and its habitats in Sweden – a LIFE project 2004 – 2009
Freshwater pearl mussels live in running water with gravel and stony riverbeds, as here in the stream Sollumsån.
The freshwater pearl mussel and its habitats in Sweden
– a LIFE project 2004–2009

The freshwater pearl mussel is a fascinating species that is under threat. It is therefore important to put measures in place to ensure the long term survival of the species. This work also has greater dimensions; creating favourable conditions for freshwater pearl mussels also benefits almost all other species in the watercourse. The freshwater pearl mussel is a flagship species for aquatic nature conservation!

WWF would like to extend particular appreciation to:
• the European Commission that financed half of the project costs
• the Swedish Environmental Protection Agency that financed a substantial portion of the project
• the project partners who contributed financially and also carried out the practical measures
• everybody who was involved in and worked with the project.
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Background
In Central Europe, the population of freshwater pearl mussel, *Margaritifera margaritifera*, has fallen by 95 percent. The species is therefore classified by IUCN as ‘endangered’. The species is also included in the EU Habitat Directive and is therefore protected in the Natura 2000 system. Sweden and other Scandinavian countries are home to a large part of the world’s remaining freshwater pearl mussel population. These countries therefore have an international responsibility for the species’ long-term survival.

The dramatic fall in the freshwater pearl mussel population drove WWF Sweden to initiate the project in the autumn of 2004. Co-financing was provided by EU’s LIFE-Nature fund, the Swedish Environmental Protection Agency and the project’s partners. The aim of the project was to develop methods to improve conditions in 21 forest watercourses that have populations of freshwater pearl mussel and brown trout, but with either no or poor recruitment.
These watercourses have now been restored and documented. The work has also focused on informing landowners and other forestry stakeholders. All practical experiences from the project have been summarized in a manual. The manual is to help in future restoration work and maintenance of freshwater pearl mussel waters.

The manual can be found at www.wwf.se/fpm

LIFE – an opportunity for nature conservation work within Natura 2000 sites

The EU’s environmental fund, LIFE, provides co-financing for environmental protection and nature conservation projects with the aim of implementing and developing the EU’s environmental policies. LIFE-Nature provides support for implementing the EU’s Habitat Directive. The Habitat Directive lists habitats and species that should be protected, such as the freshwater pearl mussel.

Natura 2000 is a network of protected areas within the EU. Natura 2000 was established to halt the loss of animal and plant species and to prevent the destruction of their habitats. The aim is to conserve different kinds of environments and species that are of common interest within the EU. Each member state is responsible for protecting and conserving their areas and ensuring that the conservation values are maintained.

Short facts about the LIFE project "Freshwater pearl mussel and its habitats in Sweden"

Project period: November 2004 - November 2009
Total budget: 1 006 983 EURO
Project leader: WWF Sweden
Project partners: County Administrative Boards in the counties of Kalmar, Västmanland, Örebro and Västra Götaland, Swedish Forest Agency, Karlstad University and the City of Göteborg
Financiers: LIFE-Nature 50 %, Swedish Environmental Protection Agency 16%, partners 28% and WWF 6%.
**Background**

Pauliström, a tributary of the stream Emån with freshwater pearl mussels, has been left uncleared, which means that large boulders still lie on the riverbed and stabilise it. Photo: Jakob Berggren.

**Freshwater pearl mussel – an indicator for clean water!**

The freshwater pearl mussel has fascinated humans for centuries. The reason for the interest is that in rare cases, the mussel can grow valuable pearls. This led to extensive pearl fishing across the country. Pearl fishing has been forbidden in Sweden since 1994. The mussel has an exciting biology, with a parasitic larval stage dependent on trout or salmon before it develops into a mussel only half a millimetre in size. When the mussel then settles on the riverbed, it digs itself down between the sand and stones. As adults, mussels grow to be 10–16 centimetres long and keep approximately a third of their shell buried. They can live to be over 280 years old! Reasons for the mussel’s decline include acidification, pollution, clogged riverbeds and shortage of host fish.
Freshwater pearl mussel as a flagship species
The presence of freshwater pearl mussel of varied ages in a watercourse is clear evidence of a watercourse where the interaction between species is undisturbed. On the other hand, a decrease in the number of freshwater pearl mussel, or no recruitment, is a warning sign that the environment has deteriorated. That which benefits freshwater pearl mussel also benefits other aquatic species — the freshwater pearl mussel is a flagship species!

What happens on land affects life in the water
Forestry and agriculture have a great responsibility for our flowing water. It is particularly important to minimize the input of sludge and nutrient leaching. With proper planning, users can prevent vehicle damage and ensure that a natural buffer zone with trees and shrubs are left along watercourses.

Protecting aquatic environments is very challenging because they have no clear geographical boundary; they are a part of a larger basin. In addition, water flows through areas with different stakeholders and landowners. A migration obstacle far downstream stops fish and other animals from migrating up the water system and pollution far upstream also affects the flora and fauna downstream. It is therefore important to spread information and knowledge throughout the basin and not only in the areas classified as Natura 2000.
The watercourses are now in better condition!
The project has carried out measures in 21 watercourses in southern Sweden. All watercourses are Natura 2000 areas, but have been affected by forestry and agriculture, or migration obstacles. Before restoration measures were implemented, landowners and forestry stakeholders were advised and informed in order to minimize any future impacts on the watercourse.

Elimination of migration obstacles for host fish
The elimination of migration obstacles means opening up free migration routes for host fish. Migration opportunities were created by removing obstacles, fixing incorrectly placed road culverts, or building bypasses around migration obstacles. Measures have been carried out in 10 of the project’s watercourses.

In the stream Lillsjöbäcken, eight incorrectly placed road culverts were fixed. The culvert in the photo had a drop of approximately a half metre – a partial migration obstacle for brown trout. Three collection reservoirs were built using geotextile, stones and boulders. This raised the water level and decreased the drop from the culvert. Stones were placed inside the culvert so as to reduce the water flow and create an easier passage for migrating fish. The result is that migrating fish can now pass through the road culvert and continue further upstream.

The following watercourses are Natura 2000 areas and are included in the project:
1. Kvarnbäcken-Lärkesån
2. Grängshytteforsarna
3. Lillsjöbäcken-Järlehyttebäcken
4. Håltjärnsbäcken
5. Silverån
6. Sällevadsån
7. Pauliströmsån
8. Nötån
9. Bratteforsån
10. Lärjeån
11. Kolarebäcken
12. Sollumsån
13. Stommebäcken
14. Gullsjöälven
15. Älgån-Mörtebäcken
16. Slorudsälven
17. Dalsälven
18. Öjenäsbäcken
19. Torgilserudsälven
20. Billån
21. Rattån
An incorrectly placed road culvert was a migratory obstacle at low water in the stream Lillsjöbäcken. By placing large stones downstream and sealing with a geotextile, the water level was raised. Two steps were created so that a gradual water level rise was achieved.
The stream Nötån has a fishway (bypass) built around an existing dam. The dam is 1.8 metres tall and is a clear migration obstacle. In order to create a passage with appropriate flow, a fishway of at least 80 metres in length was necessary. The best solution was to build the bypass through a garden next to the dam. Since the dam is very old and has cultural values, a detailed cultural-historical study of the dam embankment was done before work began.
**Biotope measures in the buffer zone**

In order to restore more natural buffer zones, the project has removed planted spruce along two streams in order to benefit the deciduous trees. The result is a more ecologically functional buffer zone.

A total of 4.5 hectares buffer zone have been thinned and cleared along the streams Sollumsån and Bratteforsån. Work along the stream Sollumsån was primarily carried out manually with a chainsaw. The wood was removed using a small machine, an “iron horse”, in order to minimize damage to the soil. Along the stream Bratteforsån, the volumes were much larger and logging was carried out using conventional forestry machines. The work was done when the ground was frozen so that the machines would not cause significant impact to the soil. Now the aim is to maintain, and in some areas create a natural riparian zone along watercourses.

Before, a dense forest of planted spruce lined the stream Bratteforsån reaching down the river bank, instead of mixed deciduous trees and bushes. Parts of the buffer zone along the stream Sollumsån were also made up of planted spruce that hindered the growth of deciduous trees. The photos show the riparian zones before and after the project measures.
Project measures

**Biotope measures for freshwater pearl mussel**

This measure involved placing out gravel and stones, 5–40 mm in size, at appropriate locations in the watercourse. The aim is for small juvenile mussels to be able to find suitable substrate in areas where sedimentation may have caused declines in recruitment. Riverbeds are also spawning grounds for brown trout. When creating new riverbeds, the underlying cause to the sedimentation must of course be addressed first so that the new bottoms do not become clogged by new sediment. Advice to forestry stakeholders is of utmost importance in this measure. The preservation or restoration of wetlands is important as they can act as filters, collecting sediments. Ditches that flow into the watercourse should be blocked as they are a major source of sediment and pollution.

New riverbeds were created in nine of the project’s watercourses.

150 cubic metres of gravel of appropriate size have been spread out along the streams Pauliströmsån and Sällevadsån. The most appropriate locations were difficult to reach due to nearby bogs and dense buffer zones. The operation was therefore carried out with the help of a helicopter. Using a helicopter can be a very effective solution as it causes no damage to the buffer zone.

A new method to improve riverbeds was tested in the stream Bratteforsån. A pump and hose were used to rinse away sediment through a screen frame, leaving a clean, oxygen-rich bottom substrate.
Gravel was placed out along the stream Lillsjöbäcken by a truck and excavator and then raked out by hand. The stream’s banks are steep and this section is located approximately 50 metres from the road. Geotextile was therefore used along the banks of the stream and a quad with trailer transported the gravel to the stream.
Project measures

Biotope measures for freshwater pearl mussel

This measure involved replacing stones that had been removed in connection with dredging for activities such as timber floating. This helps re-create a more natural habitat for the fish.

In the stream Sollumsån, an 800 metre long stretch was restored, and large stones have been placed in the watercourse. The work was carried out both manually and with the help of an excavator. Before the operation was carried out, the mussels were placed somewhere safe so as to not risk getting damaged. In some places, dredging for timber floating has a high cultural and historical value that needs to be considered.
Blocking ditches

Studies in the 21 LIFE watercourses have shown that there is a connection between the poor recruitment of freshwater pearl mussel and clogging up of the riverbeds. Fine sediment clogs up the riverbeds where the small mussels live.

Leakage of fine sediment is due largely to dredging, clearing of ditches, vehicle damage in the watercourse and poor buffer zones. “Plugs” have been created in 17 ditches in order to prevent leakage of fine sediment.

When ditches are blocked, the water that seeps out downstream is clear and clean. The water upstream of the plug becomes still and the fine sediment settles and gets trapped in the plug.

Plugs were made of spruce trees approximately 10 centimetres in diameter that were felled near the ditch. The trees were cut up into two metre-long pieces. Geotextile was placed at the bottom of the plug to make it denser and more stable.
Reintroduction of freshwater pearl mussels

One of the project measures was to reintroduce freshwater pearl mussel into the stream Silverån. Earlier restoration measures in the stream had resulted in a recovered, naturally-functioning watercourse. 1 000 mussels were collected from a nearby watercourse in the same basin. Mussels were placed out in nine different locations with suitable conditions. To date, no glochidia have been found in trout gills, but recruitment is expected within the coming 10–20 years.

Dam repair

Repairing a dam that regulates the water flow into the stream Lillsjöbäcken resulted in improved water supply. The leaking dam allowed water to flow into the lake during the spring, which resulted in a low water discharge in the summer and thus risked eliminating both mussels and fish. The dam by the outlet of the lake Storsjön was replaced by a Thomson dam. The V-shaped spillway (see photo below) provides self-regulating management of water into the stream. This resulted in favourable water flow year-round in the stream Lillsjöbäcken.
Monitoring populations of host fish is done according to the standard method recommended by the Swedish Environmental Protection Agency. Electric fishing gear is used here to catch fish that are counted and examined before being released.

**Monitoring freshwater pearl mussel and host fish**

Monitoring of freshwater pearl mussel populations is done in all of the project’s watercourses. Inventories are done using an Aquascope or peep box. Freshwater pearl mussel populations are monitored according to the standard method recommended by the Swedish Environmental Protection Agency.
Monitoring riverbed substrates
This measure involved documenting the rate of sedimentation of riverbeds. The distribution of substrate size, from silt to boulder, is analyzed.

Turbidity of the water and the level of sedimentation are measured during the period June through September.

Analyses showed that a watercourse with high turbidity and sedimentation has little or no recruitment.

Many of the measures carried out in this LIFE project aim at decreasing sedimentation. This in turn should improve conditions for recruitment.
Advice and information to landowners and other forestry stakeholders

It is not practically feasible to protect an entire watercourse as this would mean that the entire catchment would need to be protected. It is therefore very important to provide information and competency to stakeholders in the area.

Landowners have both received individual advice and also been invited to information meetings. The project has produced information material in the form of brochures, posters, information boards and a movie that have been used in conjunction with counseling.

As a part of the project, advice has been provided to both landowners and the general public. They have been informed about the ecology of the freshwater pearl mussel and key threats, the important role of water, and what considerations should be taken.
The life after LIFE

This LIFE project has demonstrated how to improve living conditions for the freshwater pearl mussel and its host fish. The County Administrative Boards will monitor recruitment of freshwater pearl mussel in all of the project’s watercourses. Sedimentation will be studied in the hope of showing that it has decreased. The manual will be an aid and a source of inspiration to continue working with maintenance and protection of watercourses. The project partners will continue to restore waters where freshwater pearl mussels live.

WWF, with some five million supporters, is one of the world’s largest independent conservation organisations. WWFs mission is to stop the degradation of the planet’s natural environment and to build a future in which humans live in harmony with nature, by:

- conserving the world’s biological diversity
- ensuring that the use of renewable natural resources is sustainable
- promoting the reduction of pollution and wasteful consumption.