Noble crayfish farming

A handbook based on experiences with a future perspective
The aim of the project is also to gain new knowledge through scientifically sound and innovative experiments. These new results and experiences gained will also contribute to the conservation and fishing of noble crayfish in Lake Stävresjön, located in Sala municipality in the county of Västmanland.

Project aim and content
The project will develop a comprehensive handbook with details and guidelines in order to successfully farm noble crayfish in Sweden. The handbook will contain recommendations in several steps, based on current scientific knowledge on crayfish farming. In addition to this, experiments and investigations conducted during the project will add new and crucial information on how to maintain sustainable production. This will involve production in outdoor ponds but also farming in greenhouse environments. Such information is still lacking. Even though the project focuses on farming of noble crayfish in Sweden, the guidelines in the handbook will be valuable for farming of most cool-water crayfish species.

The Lake Stävresjön area – conditions for noble crayfish farming
The interest in noble crayfish farming in the area around Lake Stävresjön located in the municipality of Sala, has increased in recent years. Noble crayfish have for example been abundant in the river Svartån located in the northern part of Västmanland. As in many other parts of Sweden, the premiere of fishing crayfish in the beginning of August and all the traditions following that event is important to the people in the area. Up till 1950, Västmanland was one of the best counties in Sweden considering noble crayfish catches. Hence, it is natural that great efforts have been put in place in order to conserve and increase noble crayfish farming in Lake Sävresjön and its surroundings. For example, several excursions and seminars have been held together with experts in noble crayfish farming. These seminars have considerably increased the interest of local landowners to start farming noble crayfish. In addition to this, also in other parts of the municipality and also in the county the interest in farming noble crayfish has increased. It became evident that a comprehensive handbook for the farming of noble crayfish was urgently needed. Increased farming of noble crayfish being it at a side line level or at a commercial level will increase the chances of preventing the noble crayfish from local extinction and subsequently result in socio-economic benefits.

The socioeconomic benefits of noble crayfish fishing in Sweden was large before the crayfish plague struck many lakes and streams in Sweden, starting in 1907. Below is a translation of an article written by O. Nybelin in 1936. It was published in a magazine distributed by The Rural Economy and Agricultural Societies in Sweden.

“"The rapid mortality of crayfish caused by a disease called the crayfish plague has eliminated a majority of the crayfish populations in Sweden. In terms of monetary values and effects on avocations, this is the most devastating disease that has struck Swedish farmers. I will just briefly mention that the exceptionally abundant noble crayfish population in the large Lake Hjälmaren was eliminated by crayfish plague in six months in 1908. The yearly catch of harvestable sized noble crayfish prior to this outbreak was estimated to be in range of 3-4 million crayfish. This catch was about a third of the total catch of noble crayfish in Sweden. Back then, our export of crayfish exceeded those of the import, a situation that now is reversed. Thus, the crayfish plague has caused a significant decline on the national level, and it has been a complete disaster for landowners with fishing permits. This is because the economic benefits from crayfish fishing in Swedish freshwaters are without competition the highest."

In another article printed about the same time, it was stated that the consequences of the lost benefits from crayfish fishing in some cases even resulted in suicide. Today, the commercial fishing in Lake Hjälmaren is primarily for the
introduced pikeperch and signal crayfish, supporting about 30 families.

The premiere for crayfish fishing and crayfish parties in Sweden is traditionally in the beginning of August. In media you can often read about “Swedish crayfish”, but the public is often not aware of that this in most cases refers to the non-indigenous signal crayfish that was introduced from North America starting around 1960. Today only a fraction of the crayfish sold in Sweden are native noble crayfish. When visiting some of the best known and most prestigious fish markets in Stockholm, they say that most customers expect them to sell native noble crayfish. If sold out on the occasion, most people will wait until they are available.

People living on and off the countryside continuously need to develop new products in order to make their living. It is evident that farming of noble crayfish in outdoor ponds has the potential to be such a product. If you also develop methods for farming noble crayfish in greenhouses, then you have the ability to also farm crayfish in colder parts of the country. This is not possible today due to thermal constrains affecting crayfish reproduction and growth.

The market for farmed noble crayfish

In Sweden, the yearly consumption of freshwater crayfish is about 4000 tons, corresponding to about half a kg of crayfish per person. Most of these crayfish are imported and sold frozen, predominantly the North American red swamp crayfish. The market value is about 450 million SEK. Most live or fresh crayfish sold in Sweden today are signal crayfish harvested in lakes and rivers. The market value corresponds to about 300 million SEK. There is also commercial fishing of signal crayfish in “the three big lakes” in Sweden, with a turnover of about 25 million SEK. It can be concluded that about 50% of the crayfish consumed in Sweden on a yearly basis consist of imported frozen crayfish, and almost exclusively of species not native to Europe. According to Swedish legislation it is forbidden to import live crayfish, this also holds for the aquaria trade. Subsequently the farming and marketing of a high quality product such as the noble crayfish should be rewarding. But there is a catch, there is no comprehensive handbook containing information and guidelines on how to start a farm and how to make the farming successful.

In the county of Värmland several investments and projects are related to farming of noble crayfish today. A company from China is one investor. In Denmark you can find an association for commercial farmers of crayfish, predominantly the noble crayfish. About 90 farmers and companies are members of the association in Denmark. The situation in Finland is similar to Denmark, but such an organisation does not exist anymore in Sweden.

Recently, the signal crayfish along with other non-indigenous crayfish species in Europe including the red swamp crayfish were put on “EU’s invasive alien species black list” containing the most damaging species in the EU. The regulation was put in place in January 2016. This situation further strengthens the arguments and concerns for protecting and farming the native noble crayfish in Sweden for many years to come.

Overall, this project is not only of considerable interest to potential farmers around Lake Stävresjön in Västmanland, the handbook should be of interest to anyone interested in aquaculture and particularly those interested in farming cool-water crayfish species.

Our extensive work on improving the water quality in Lake Stävresjön has been appreciated and prised. The work includes for example construction of wetlands at the lake inlet to reduce the input of nutrients. These are among the largest wetlands for trapping nutrients in the county of Västmanland, and further show our aim to improve the water quality and to protect the biological values of Lake Stävre-sjön.

In this context we will also acknowledge the constructive support given by Sala municipality, the County Administrative Board of Västmanland, and the group of crayfish experts for developing the ideas of the project. The focus has always been to preserve and develop the farming of the critically endangered native noble crayfish in Sweden. In fact, the national action plan for the conservation of the noble crayfish highlights the importance of noble crayfish farming in order to prevent the species from going extinct.

A working group of experts and enthusiasts have developed the concept and content of the project and will also be responsible for writing the handbook (content below).

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In order to finalize a comprehensive handbook and guide, several studies and investigations need to be conducted. The content of the handbook should also help farmers to improve their farming methods, but also function as a source of knowledge where you can get support and suggestions if something does not work as expected. The handbook should therefore be of considerable interest also to established farms with noble crayfish and can be used as a manual. The handbook will apart from informative texts also contain illustrations and photos of high quality. Since the content of handbook will be of interest also to farmers outside Sweden, an English summary will be included. The handbook will be finished in 2020.

Content and chapters of the handbook 2017 – 2020

Foreword
English summary
Chapters of the handbook
1. Introduction – project goal and why a handbook is needed
2. Noble crayfish in Sweden – history and current distribution
3. Life cycle, bottle necks and habitat demands
4. Noble crayfish in outdoor ponds
5. Noble crayfish and indoor farming
6. Noble crayfish and greenhouse farming
7. How to start a noble crayfish farm – the phase of establishment
8. Investments
9. Economy and budget
10. Financial support – loans and possibilities to get funding from external sources
11. Insurances – for the farm and its activities
To gain new knowledge
In order to develop a handbook that can be used as a manual for noble crayfish farming today and in the future, gaps in the current knowledge need to be identified and filled. The first step is to get an update on the current scientific knowledge (find the gaps) that can be found in published papers and reports. The next step is to conduct our own and complementary investigations. With all this information we aim to give recommendations on how farmers with certain farming conditions can optimize their crayfish production and methods, but also what protocol they need to follow to get the necessary data themselves.

In this project we will for example evaluate an alternative method to indoor hatching and production of juveniles for stocking. By rearing and hatching juveniles in a greenhouse setting we expect to produce large and viable stocking material. Greenhouse farming will also make it possible to farm noble crayfish in the northern parts of the country where noble crayfish reproduction is constrained by cool temperatures.

Growth and production in outdoor ponds
In an existing farm we will monitor the crayfish population in order to get the following data:
1) What effects do the harvesting have on the population size, and how large is the natural mortality not associated with fishing?
2) How large are individual growth rates and what effects do supplementary feeding have on growth and mortality rates?

Juvenile production in greenhouses – the best practise for the future?
We will test if juvenile survival and growth can be increased in ponds located in a modern greenhouse setting in comparison to traditional rearing in outdoor ponds. This will be the most innovative approach of the project.

Visits and travels
We plan to include information and requests from noble crayfish farmers when developing this handbook. Several visits to farmers are therefore also planned to receive on site information.

Aquaculture has a long tradition in China and is still very wide-spread. Tomas Jansson is one of the experts and authors in this project and has visited crayfish farms in China. Furthermore, a Chinese company that owns a noble crayfish farm in Värmland has been advised by Bo Andersson, also an expert, commercial crayfish farmer and author in this project.

Final seminar – experiences and exchange of knowledge
Before the handbook is finished, a seminar will be organised and experienced noble crayfish farmers will be invited. Also commercial farmers from other countries such as Denmark will be invited. This seminar will enable us to discuss and finalize the content of the handbook before it is printed.

Project financing and expenses (2017-2020)
The project is financed by the European Maritime and Fisheries Fund and will be conducted in close cooperation with Sala municipality, who also is the applicant of the project. The project includes costs for the greenhouse and for the project staff involved in the literature review, scientific experiments and for writing different chapters in the handbook. The budget also includes costs associated with:

- Project coordination
- Photos and illustrations
- Printing of the handbook
- Distribution of the handbook
- Noble crayfish farming – production of a YouTube film
- Seminars and meetings

A working group including staff with expertise in necessary fields is responsible for the execution of the project and the writing of the chapters in the handbook:

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![Image of a noble crayfish being measured](image_url)