EuroShrimp Ltd.

Innovation Proposal to AddVenture

Hørsholm, December 2006

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Summary

The business idea is to develop a minimal impact shrimp culture system, which can be used for culturing shrimp under indoor controlled conditions anywhere in the world. The system must be cost competitive with traditional production systems, however with the added advantage of being minimal impact in relation to environment.

EuroShrimp Ltd. will initially aim to cover the increasing European market for black tiger shrimp (Peneaus monodon), which now is plus 10.000 tons/yr. to a current wholesale value of 70 Mio. USD/yr. Secondly EuroShrimp Ltd. will go for a significant share of the total world production of cultured shrimp, which is now app. 1.6 mil.[1] tons/year with a wholesale value of 9.4 billion USD.

The new culture system will be based on recirculation of water under controlled conditions, to keep the shrimp growing under optimal conditions all year round. The key technological problem is to grow the shrimp in high enough densities for the costs in investment for buildings, tanks etc. to be competitive. The key advantage in relation to traditional culture systems is the ability to isolate the shrimp from virus diseases, which under the traditional open conditions are severely limiting the expansion of this type of culture.

It is proposed to make a pilot scale facility with a production capacity of 20 t shrimp/yr at an existing experimental fish farm[2] at Asnæsværket in Kalundborg. If, after 2 years, the production results are within the expected range for commercial feasibility, then establish a 1000 t/y production facility.

The first phase in the project will be to make a detailed plan and budget for the pilot scale research. As of now it is estimated that the pilot project will take 2 years and the accumulated risk will be about 6.000.000 kr. , which may be covered by a combination of R/D grants and share capital.

The second phase is to establish a commercial size production facility at a suitable site in the EU.

Business Idea

The business idea is to develop a minimal impact shrimp culture system, which can be used for culturing shrimp under indoor controlled conditions anywhere in the world. The system must be cost competitive with traditional production systems, however with the added advantage of being minimal impact in relation to environment.

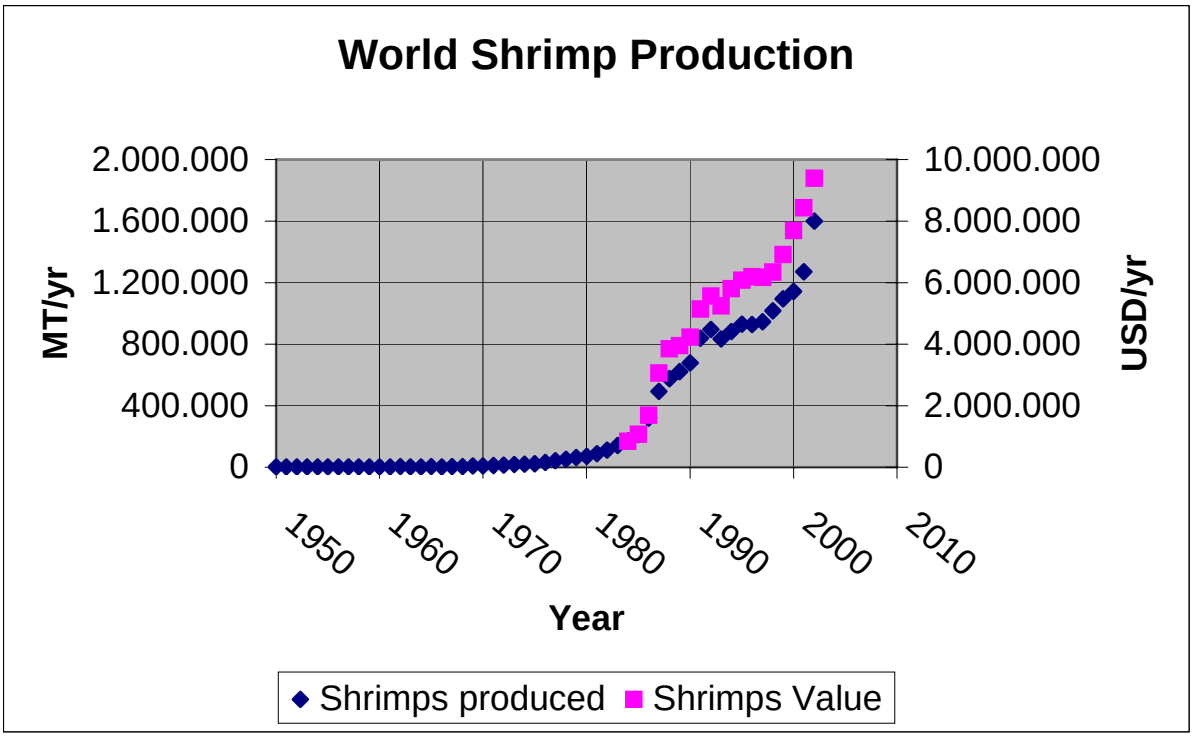
EuroShrimp Ltd. will aim to be a major player in global shrimp farming, and take a significant part of the existing and expanding world market for cultured shrimp.

[1] Hereof 800.000 tons tiger shrimp

[2] Owned by Billund Aquaculture Service, and for time being used for “Torskeprojektet”

Market: Can We Sell it?

The global world production and market for cultured shrimp is pr. 2002: .1.6 million MT at wholesale value of 9.4 billion USD[3]. See figure below for the development with time:



The average prices have more or less been constant since 1984 and are at present a bit less than 6 USD pr kg of shrimp. This includes big variations according to size where the bigger sizes (a bit less than 100 grams) cost about twice as much as the small sizes (about 25 grams).

The future market size will be very much dependent on the pricing of the shrimps. The shrimps are delicious and well received on the market. However, they are at present seen as rather expensive. It is likely, that as production costs are brought down by the technological advances developed by EuroShrimp, we will see a situation similar to the salmon market, where market and production are increased every year and prices gradually declining to a level marginally higher than the production cost of the most efficient producers.

A best estimate for this situation would be for the shrimp to compete well against other animal production and a market size of 10 Mio. MT[4] /yr at a value of 30 to 40 billion USD/yr would not be out of range.

The main competitors for the cultured shrimp market are of course the existing traditional producers, which are using outdoors open ponds in tropical areas. If they can intensify the production and keep cutting costs quickly enough, they may be able to keep EuroShrimp out of business. However, the traditional producers have some major disadvantages. They are seen, par-

[3] FAO, Wold Review of Fisheries and Aquaculture 2002
[4] The total shrimp production including culture is now 4 million MT plus

ticularly by the European consumer, as producing shrimps in an environmentally damaging manner[5]. That is actually not a fair description of modern shrimp culture. However, it is true that the traditional culture systems demands much space, and are open, i.e. discharging their waste to the environment. The openness produces high risk for diseases, resulting in high use of harmful substances including antibiotics for disease control. EuroShrimp will produce *Green Shrimp* with a minimal impact on the environment, which would give a competitive advantage in Europe, and may even result in a premium on the price.

There are a few competitors[6],[7], which are thinking along the same line as EuroShrimp. They are in initial stages of development and can be passed by a resolute and knowledgeable effort.

Production Technology: Can We Produce It?

Tiger shrimp is obviously a product, which can be sold in big quantities at cost competitive prices. The key question is here: can EuroShrimp develop a technology, which can out compete existing productions systems?

The new production system is a minimal impact method growing shrimp in very high densities in recirculated water.

The waste water treatment technologies used for fish farming in recirculated water are very well developed in Denmark. Denmark is the technological leader in this field, where the original development took place at DHI (former VKI) with the aim of producing European eels. We have a strong front position in this part of the basic production technology. To keep the water clean and with optimal quality for the shrimp is an important precondition for solving the intricate problems of keeping shrimp in high densities.

In modern intensive fish farming it is normal to produce about 100 kg/m2 tank area/yr, as most fish species can thrive under quite dense conditions (about 100 kg/m3).

This is not the case for shrimp farming. Crustaceans, including shrimps, are aggressively cannibalistic creatures, which will happily eat each other given a chance. As one cynical shrimp farmer has put it: *The best food for shrimp is other shrimps.* During the moulting phase, when the shrimp sheds its exoskeleton, it is extremely vulnerable to its nearby cousins, who gladly will attack and devour the pitiful naked shrimp.

As of now the highest commercially feasible stocking densities in the industry is about 1 kg/m^2 directly before harvest. Under optimal conditions 3 production cycles and 3 harvests per year can be done. This gives a production of 3 kg/m2 production area/yr which is far below the fish farming results and far below the level needed for paying the investment costs in tanks, buildings and treatment technology used in the minimal impact production technology.

Consequently the key technological challenge in the EuroShrimp project is to find ways of increasing stocking densities and particularly production pr area unit at least a factor 30.

There is as of now no proven way of doing that. EuroShrimp, however find it likely that it can be done using one or more of the following methods:

[5] http://www.ecocouncil.dk/global/global_okologi_2001/0103_thairejer.PDF
[6] eg.: http://www.megafisch.de/superintensiveshrimpfarming.htm
[7] http://happyshrimp.nl/

- Optimal management and control

Traditional shrimp farming are taking place in outdoor open systems subject to random weather based inputs, and the shrimps are accordingly stressed with lower growth rates and higher disease risks as a result. The method is furthermore using phytoplankton growth in the ponds for removing ammonia and for keeping the water turbid to hide the shrimp from direct sunlight.

For these reasons it is very difficult to control what happens in the ponds, as you can actually not see the shrimps.

The EuroShrimp system will optimize and control all the key growth factors during the production cycle. Factors like oxygen, ammonia, temperature, salinity, light regime etc. will be kept at or very near optimal levels. Registration of the shrimp behaviour during feeding will furthermore facilitate optimal feeding of the shrimp.

The tanks and treatment facilities will be fully instrumented and modern process control procedures using numerical models will be used for management of the farm.

It is expected that this "optimized management" will make it possible to triple production per unit area due to a combination of lower cannibalism and higher growth rates.

- Vertical Growth

Besides the cannibalism, another reason for the shrimps being low-density creatures is, that they are "2D" animals crawling on the bottom of the pond and not like most cultured fish species swimming freely in 3 dimensions.

So an obvious way of increasing stocking densities would be to make vertical structures in the ponds: e.g. shelves or artificial plants. This would make it possible for the shrimps to find sitting and hiding places in the vertical direction.

In this way it is expected that the density and area specific productivity can be increased 5 to 10 times.

- Biotechnology

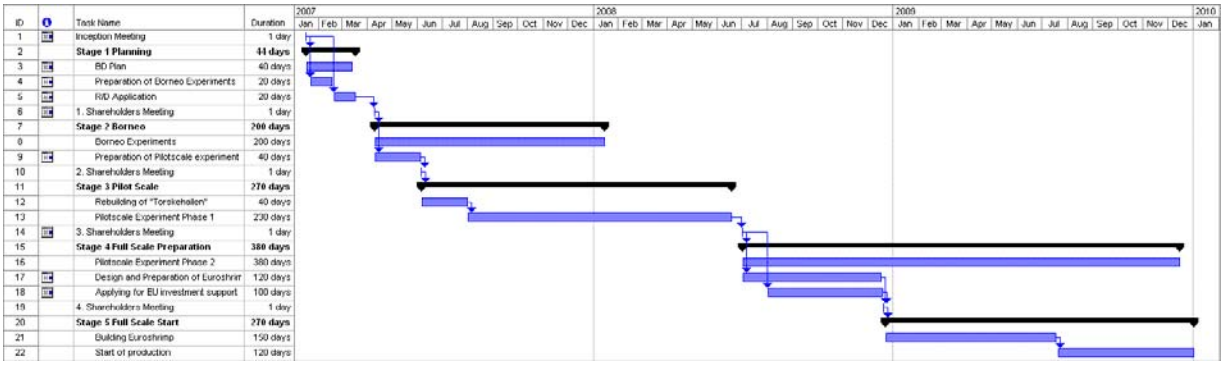
Over time it may be possible to decrease the aggressiveness and increase the ability to thrive in high densities by a biotechnological approach. This could be based on classic breeding methods, which are favourable in relation to shrimps as they have high numbers of eggs pr female and very low generation times.

When public acceptance is ready, GMO methods may be interesting in this context.

Making a non-aggressive shrimp, which will move around freely in 3D space in dense schools will make production rates of 100 kg/m^2/yr quite possible.

How to proceed?

Below is given a preliminary list of activities and a draft timeschedule.



ID	Task Name	Duration
1	Inception Meeting	1 day
2	**Stage 1 Planning**	**44 days**
3	BD Plan	40 days
4	Preparation of Borneo Experiments	20 days
5	R/D Application	20 days
6	1. Shareholders Meeting	1 day
7	**Stage 2 Borneo**	**200 days**
8	Borneo Experiments	200 days
9	Preparation of Pilotscale experiment	40 days
10	2. Shareholders Meeting	1 day
11	**Stage 3 Pilot Scale**	**270 days**
12	Rebuilding of "Torskehallen"	40 days
13	Pilotscale Experiment Phase 1	230 days
14	3. Shareholders Meeting	1 day
15	**Stage 4 Full Scale Preparation**	**380 days**
16	Pilotscale Experiment Phase 2	380 days
17	Design and Preparation of Euroshrir	120 days
18	Applying for EU investment support	100 days
19	4. Shareholders Meeting	1 day
20	**Stage 5 Full Scale Start**	**270 days**
21	Building Euroshrimp	150 days
22	Start of production	120 days

1. Inception Meeting. The potential investors meet to discuss the project and to decide on stage 1

2. Business Plan / Company Plans etc. To be developed.

3. Preparation of Borneo Experiments. Danaq owns a shrimp farm in Borneo and will be able to start cost-effective experiments with high density shrimp culture on short notice

4. R/D Application. We can make an application to several sources for R/D support. We need to protect the IPR though, so we can only get 50% funding

5. 1. Shareholders meeting. At this meeting we need to decide for the experimental stage: stage 2.

6. Borneo Experiments. Experiments are implemented on high density shrimp culture.

7. Preparation of pilot scale Experiments. An experimental fish farm ("Torskehallen") owned by Billund Aquaculture A/S will be available in autumn 2007. It is now being used for cod raising, and can relatively easily be rebuild to shrimp culture.

8. 2. Shareholders meeting. Decisions on stage 3 of the project to be taken

9. Rebuilding of "Torskehallen". The building including has to be refitted for shrimp production

10. Pilotscale experiment starts. The aim is to produce 4 batches/yr of 25 kg/m2 in all 100 kg/m2/yr

11. 3. Shareholders meeting. Decisions on stage 4 to be taken.

12. Continued pilot scale experiments. The process is continued relating to results from phase 1.

13. Design and preparation of Euroshrimp. The 1000 tons / yr full scale facility is designed and the Euroshrimp company expanded.

14. Application for EU funding. As the project is very innovative it may be possible to get up to 50% support for the investment.

15. 4. Shareholders meeting. Decisions on stage 5. to be taken

16. Building of full scale facility.

17. Start of production

Economy

The cost for the first stage is proposed to be carried by the potential shareholders according to their own input. A value of this work can be negotiated for the forming of the share capital.

A very preliminary estimate of the costs for stage 2-4 is given below:

Activity	**Cost**
Stage 2 Borneo	
-Borneo Experiments	1000
-Preparation of Pilotscale experiment	100
Stage 3 Pilot Scale	
-Rebuilding of "Torskehallen"	500
-Pilotscale Experiment Phase 1	1500
Stage 4 Full Scale Preparation	
-Pilotscale Experiment Phase 2	1500
-Design and Preparation of Euroshrimp	1000
-Applying for EU investment support	100
Total 2-4	5700

It may be possible to get an R/D support to about 2.000 mio. kr. for these stages.

A preliminary budget for the full scale Euroshrimp project with a production capacity of 1000 tons year of 25 gram shrimp is given below:

Production, tons / yr	Unit use / kg prod.	Unit	Unit Price, kr		1.000	Price/kg	
Income			kr	20,00	20.000.000	kr	20,00
Energy	3,00	kwh	kr	0,75	2.250.000	kr	2,25
Feed	1,30	kg	kr	6,00	7.800.000	kr	7,80
Larvae	60,00	pieces		0,025	1.500.000	kr	1,50
Misc.					1.000.000	kr	1,00
Variable Costs					12.550.000	kr	12,55
Coverage I					7.450.000	kr	7,45
Personnel					1.500.000	kr	1,50
Coverage II					5.950.000	kr	5,95
Depreciation Build	30,00	years	kr	12.000.000,00	400.000	kr	0,40
Depreciation Equip.	10,00	years	kr	19.000.000,00	1.900.000	kr	1,90
Financial Costs	0,05	%	kr	31.000.000,00	1.550.000	kr	1,55
Capital Costs					3.850.000	kr	3,85
Coverage III					2.100.000	kr	2,10

Investment								
4 cycles pr. year		25	kg/m2		100	kg/m2/yr		
Building	kr	12.000,00	m2	kr	1.000,00	kr/m2	kr	12.000.000,00
Tanks	kr	10.000,00	m2	kr	600,00	kr/m3	kr	6.000.000,00
Equipment	kr	1.300,00	tons foder / år	kr	10,00	kr/kg/foder	kr	13.000.000,00
Total							kr	31.000.000,00

On two accounts the budget is depending on the development of high density culture technology:

1. The food conversion ratio is lower than industry standard projecting that better control of water quality etc. will mean less food waste and better growth

2. The density and growth is projected to be much higher because of optimal conditions and 3D growth structures.

Project Organisation & Partners

The initiating partners are:

- **DHI** (formerly VKI) pioneers and experts in waste water treatment technology for fish farming, process monitoring and modelling technology in association with **Danaq consult Ltd**, a leading Danish aquaculture consulting company, heavily involved in shrimp farming in Thailand as well as in advanced fish farm design.

The project has been discussed with below companies as potential shareholders:

- A venture capital company: Vækstfonden: http://www.vaekstfonden.dk/

- A leading supplier of high tech aquaculture equipment: Billund Aquaculture Service: http://www.billund-aqua.dk/

- A leading producer of fish feed: Aller Aqua: http://www.aller-aqua.dk/index.asp?id=2680

- An fish trading company: J.P.Klausen & Co A/S: http://www.jpkfisk.dk/

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