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Mussel farming under harsh conditions

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Description

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Abstract
In this section, a method for mussel farming at sea is presented. The method turns natural bioprocesses into efficient animal food production and simultaneously enhances nature's ability to cope with nitrogen and phosphorus pollution in maritime environments. The financial side of applying the method is briefly illustrated to verify that it can be a profitable business if the benefit for society of an improved sea climate is taken into account. The smooth model type, is behaving with the nature/sea and not against it. This is of great importance when we are dealing with harsh conditions.

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Additional information

Contents

Description	**4**
1. Åland as an environment for mussel farming	**6**
2. A (recommended) model of mussel farm	**6**
3. Harvesting	**8**
4. Calculating cost and Revenue	**9**
5. Experience from other projects	**10**

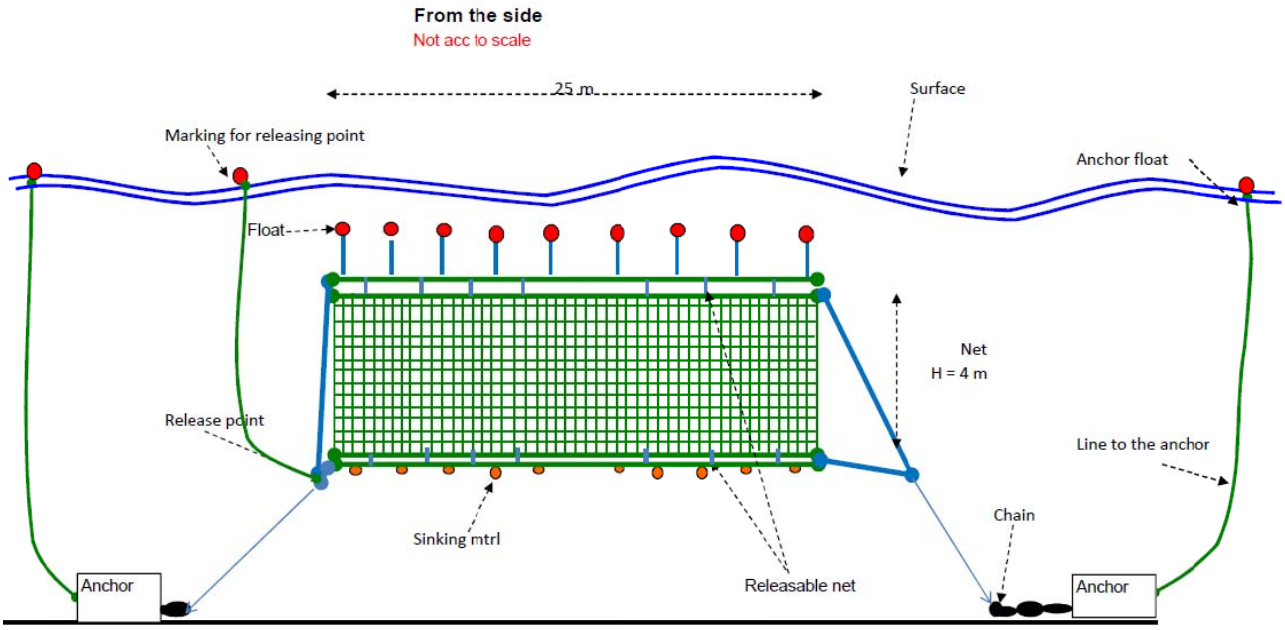
1. Åland as an environment for mussel farming

Farming mussels in the waters around Åland has its own set of obstacles and difficulties. For example, cold winters may produce huge layers of ice and farmers of mussels have to take that into account when they design their farms. Experience tells us that the thickness of the ice may be several meters if the winter is hard. Generally speaking, though, the local conditions in terms of the quality of the sea-bed as well as the hydrological circumstances, and from the point of view of mussel farming, may vary from place to place. Therefore, it is recommended that the local conditions are well mapped and analyzed before making any decision to proceed with any farming endeavor of a larger scale. Further, this presentation is based on the assumption that the mussel will be used as animal food and not served in fancy restaurants. The latter do most certainly require other kinds of considerations than those presented below.

2. A (recommended) model of mussel farm

The easiest way to manage a mussel farm under the conditions indicated above is wha generally referred to as a Smooth Model Type (SMT). The enclosed picture shows a SMT. Using buoys are recommended due to the fact that this is an inexpensive method to keep the mussel nets floating. Another advantage is that this solution also allows the depth of the nets to be varied and adjusted. As a rule of thumb, the distance between the floating line and the buoy should be approximately 1.5 meter. However, local conditions may suggest something else.

The optimal situation is if the mussel farm is located in an area where there are no boats of any kind passing. This can, of course, be easily accomplished if the concern is commercial sea traffic (ferries, carries etcetera) for the simple reason that they use fairways. The more important problem, though, is that small pleasure boats might pass the area where the mussel farm is located. However, with a solution based on buoys as suggested above, the floating line is at a depth of about 3 to 3.5 meters allowing most minor sea vehicles to pass without causing any damage. However, experience tells us that due to the rich presence of fish in the neighborhood of mussel farms this tends to attract both commercial and sport fishermen which of course may be a problem.



Figur 1. Smooth model type farm under water.

Having the floating line approximately 1.5 to 2 meters below surface alsoprevent the growth of other biomass then mussels on the nets. The surface water promotes the growth of biomass. However, the impact of sunlight is substantially reduces already at depths around 2 meters.
Further, the buoys should be located approximately 0.5 meters below surface.That may call for some calculations depending on whether or not the water level tends to vary. It is not unusual that the water level changes about 1 meter over a yearly cycle. And, the mussel farm should, of course, be kept under the water surface with two exceptions, inspections and harvesting. That is why calculations of the variations in the water level becomes important.

Our experience tells us that plow anchors are the best anchor solution due to the fact that they are easy to handle from a boat. The anchor can be placed on the long side, tight to the freeboard. We use an only 10 meter long boat with a GWD of about 10 tons. A land-based crane is recommended to put the anchors on the boat since the anchors needed for a 75 meters farm weigh around 500 kilos.
When anchors are dropped, you only have to cut the lines that were connected to the boat to keep the anchors in the surface water. The anchor should of course be connected to the nets already. Using a line about 28 millimeters thick to attach the anchor is recommended and it should be approximately twice the depth of where the anchor will be placed.

A second, or extra line connected to the anchor, is useful for the purpose of pulling the anchor into the correct position once it has been released from the boat.

Using an estimated length between the water surface and the buoys of 0.5 meters, and a floating line around 1.5 meters, adds up to 2 meter. It is further recommended that the sinking line of the net is yet another 4 meters. And since the nets should be placed between 2 and 4 meters above the seabed, the depth of the water where a mussel farm is located should have a minimum depth of approximately 10 meters.

3. Harvesting

From the point of view of harvesting, there are two kinds of nets each calling for slightly different methods. One allows the floating line and sinking line to be removed. Then the floating and sinking lines are kept in the water and harvesting is done from the removable sections. Thus, the nets are taken to thesurface in sections of 25 meters. The alternative is to take up the entire net (100 meters) in one piece and then proceed with the harvest. This second solution requires that the net can be removed from each of the four corners as well as from the anchor lines and floating and sinking lines respectively.

Towing the net into land is the easiest harvesting method brushing off the net with high-pressure streaming water. In many harbors there are boat slips for the purpose of handling fishing boats. The very same wagon can be used to put a container and the nets can be pulled carefully over the container. Blowing off the mussels into the container is accomplished with high-pressure streaming water. For obvious reasons, the container has to have some kind of drainage arrangement.

The procedure is the same offshore however requires the ability to lift the net as well as having a container alongside. Of course, the container cannot have any kind of drainage solution. That procedure has to be done at the shore if the used boat isn't big enough to have the container on deck.

Yet another option when harvesting mussel farms is renting a catamaran that can be provided by us. The fee for the catamaran is around 3,000 Euro/day. Transportations forth and back will of course be an additional cost as well as the time for preparations etcetera.

Catamaran used when Gamlebyviken was harvested in 2011.

Foto Kingfisher Offshore AB

Foto Kingfisher Offshore AB

Most time will be spent on using the boats to transport mussels the realeasable containers into shore. Small containers are used and the total cost depends on the distance between the farm and the harbor facilities. With either harvesting method – at sea or in harbor – it is important to pull the anchors tighter together so the net will move easily to the surface and, thus, makes the procedures to handle it easier. Harvesting at sea requires a crane onboard to be done. However, bringing the nets to a harbor can be accomplished without a facility of that kind on the boat being used. When using at boat with crane you easily lift up the nets alongside the boat and blow of the mussels directly into a container, which shall be placed under the net at the same side. Towing the net to the harbor has the advantage that costs can be reduced and the control over the entire process is better. Working at sea is more difficult than doing it on shore. It tends to call for better and therefore more expensive equipment in terms of for example the vehicles that are used.

Before harvesting it is important to have the farm checked. In fact, the process of harvesting allows the farm facilities to be inspected even more closely by those doing the harvest. Anchors can be easily lifted up and pulled towards the net and the net will then surface allowing an inspection of the stages and growth of mussels.

4. Calculating cost and Revenue

The concept of nets with buoys makes farming of mussels a low cost enterprise compared to other methods of framing. No additional equipment is required. All that is required is already there once the farm is established or in the immediate neighborhood in terms of experienced fishermen with properly equipped boats etcetera.

We offer 100 meters farms, using removable nets and a type of 200 millimeter knot to knot and a thread about 8 millimeter thick. The price charged is around 20,000 Euros/net including everything in terms of equipment and launching it too, however costs for boats etcetera excluded. Some costs will vary depending on the location of the farm and the circumstances during which the farm is put in place.

Market price of mussels, at a quality that is useful for feeding animals, is varying however for calculation purposes it can be estimated to 0.5 Euro/kilo. Calculating a farm of four nets, each net 100 meters and placed at a depth of 4 meters, constitutes a total 1,600 square meters of projecting mussel farm area.The investment for such a farm is approximately 80,000 Euros. The cost for harvesting is around 12,000 Euro. And since the farm can be used between 10 and 16 years, an approximation of the annual depreciation (based on 13 year) is 6,200 Euro. All and all, the net yearly cost (inflation is assumed to add to the costs as much as to revenues) is 12.200 Euro.

The estimated yearly revenue is 7.5 tons of mussels at a price of 0.5 Euro/kilo. Thus the yearly net loss for those running such a mussel farm is 3.750 - 12.200 euro or 8,450 Euro per year. With this noticed here are some comments and remarks.

First a disclaimer: what has been stated above should not be considered as an offer but rather as a calculation and example to illustrate the economy of farming mussels.

Secondly: there will be some additional cost for transportations etcetera from the place of harvest to the customers buying the mussels.

Thirdly: the cost of yearly harvest (12.000 euro) can be drastically reduced if one is proceeding parts of the process oneself. If it is done entirely with resources of your own, the cost can be lowered even more. This is of most importance, we truly believe, that harvesting (all 4 nets) in a port directly loaded to a container will reduce cost to about 2000 -4000 Euro. *Then the annual cost/revenue would be a breakeven case, instead of a lost.*

Fourthly; the calculation above did only take into account the actual incomes and costs as they appear in terms of real cash-flows. The important revenue from farming mussels, though, is of course the environmental effects in terms of reduced levels of nitrogen and phosphorus. Thus, what is making farming of mussels truly beneficial from the perspective of mankind and society is the contributions to a sustainable environment and climate. Thus, utterly the questions become: How much is it worth to keep the levels of nitrogen and phosphorus in the waters around Åland at a sustainable level and who should be paying for achieving that?

5. Experience from other projects

We have in my company managed several implementations of mussel farms projects and are in the process of discussing even more projects in Sweden as well as abroad. Here are some examples of recent projects.

We constructed and launched a mussel farm with pipes outside of Västervik in Sweden. It was expensive to launch and will be expensive to remove. But that was no issues for the simple reason that the municipal had other objectives with the project. However, the facility has worked well and accomplished what was intended. Enclosed you find a picture of the harvesting from this particular farm. The last slides in the Power-Points presentation are from the launching of a 25 meters mussel farm in Rödesand in Denmark. A picture of the actual launching is enclosed. Do notice the timetable in the right-hand corner. Only few hours was needed to complete the launching.

Rödby port Time 07:10

Foto Grönt Center, DK

Eon's windpark Rödesand 8:20

Foto Grönt Center, DK

Launching the last anchor in Rödesand Time 10:09

Launching completed time 10:35

Foto Grönt Center, DK

Foto Grönt Center, DK

The difficulties with using this boat is the high freeboard, but as you see we did manage it.

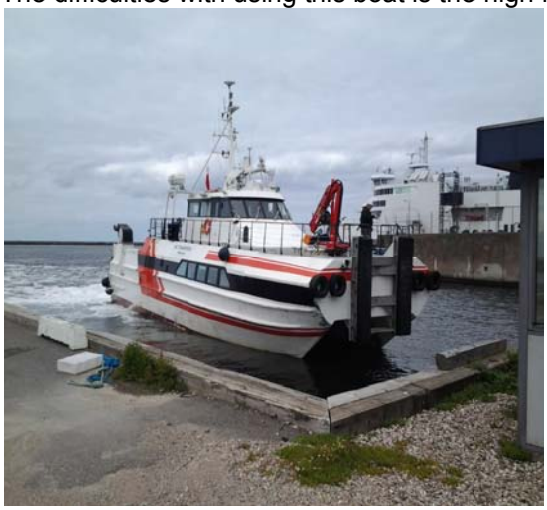


Foto Grönt Center, DK

However, the launch had been even faster if we had used a different boat. But the representatives of Eon, who is the owner of the wind park, insisted on having a trip to some windmills and had arranged with a larger vessel. The time for making this excursion is included in the time table adding to the launching time however providing an educational journey beneficial for the future collaboration with Eon. As can be seen in the pictures, the catamaran is difficult to use for mussel launching due to its very high freeboard. The closer you are to the surface the easier it is.

Currently, we are launching five mussel rigs outside Malmö, each of them being approximately 75 meter. We tried using a small boat, only 10 meter and about 7 ton GWD in the process. A picture of the boat in enclosed as well as others showing concrete blocks (700 kilos each) being loaded on the boat.

These two boat where used under our launching of 5 x 75 m mussel farm.
As you can see almost any boat will do as you use the SMT.

Foto Kingfisher Offshore AB

Foto Kingfisher Offshore AB

The smaller boat carrying concrete block about 700 kg/ each.
When we are using the nature in the correct maner / not exploring our sea or nature.
We can obtain fantastic results in this case using the lifting power of water, we do reduce weight substantially.

Foto Kingfisher Offshore AB

Foto Kingfisher Offshore AB

This being an example of our constant strives to improve the methods of launching mussel farming facilities, thereby contributing to the promotion of a truly sustainable climate and environment.

John Tyrstrup