Open Ocean Salmon farming in Portugal Vision, Opportunities and Threats for Portuguese industry

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MSc, Civil Engineering, PhD, Hydrodynamics, Norway and IFP Paris,
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Paal Hylin, Chief Executive Officer
MSc, Industrial Economics, Norway, Master of Energy Economics, IFP Paris
30 years + in O&G industry holding CEO, COO positions in 250 mill USD turnover companies with 600+ employees.

Morten Lyssand, Chief Technology Officer
MSc, Nautical Science, Norway. Second Mate, international oil & gas tankers
25 years + in O&G-, risk management and aquaculture industries.

Together 95 years experience from the International O&G industry and working offshore. Nord all about Project Development and attracting investors
“Visions” and perspective for Portugal, i.e. present plan

By 2030

• Open Ocean Salmon production with a potential of 100 000 tonnes /year
• Value of yearly production 500 M€
• Total capital investment 500 M€ +
• 1500 direct jobs in the production
• 1500 indirect jobs in service industry
• 2 to 5 Hatcheries
• 1 to 2 processing plants
• New service industry within technology, ships, equipment with potential for export of open ocean technology abroad.

I.e. industrialization of open ocean aquaculture within the Blue Economy
Open Ocean Farm System, the production system

Farm unit consisting of disconnectable-, winch operated, submersible cages with feed and power from central remotely operated feed platform
- Fish optimally placed in water column w.r.t. temperature and wave forces
- Light weight, low cost, efficient operation and maintenance
- Segregated biomass, increased bio-security, continuous harvesting throughout the year

A full-size fish farm production unit will produce up to 4,800 t per year.

The size of the system is not decided and will depend on cage size, feeding system and operation envelope.

The feed platform structure will be based on a SPAR buoy concept (proven concept for harsh environment in offshore oil & gas industry).

The cage will be a two-point moored cage that will carry up to 80,000 fish. The cage has a bottom structure which includes winch, umbilical connection and dead-fish collector

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<table>
<thead>
<tr>
<th>Feed SPAR:</th>
<th>Cage:</th>
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<tbody>
<tr>
<td>10-13m in diameter</td>
<td>25-30m in diameter</td>
</tr>
<tr>
<td>20-25m high</td>
<td>20-30m high</td>
</tr>
<tr>
<td>Draft 15-18m</td>
<td></td>
</tr>
<tr>
<td>5-600 t displacement</td>
<td></td>
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<td>5-600 t displacement</td>
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Offshore Fish farm field:
- 18 cages
- Radius 150-200 m
- Capacity 4-5000 tons per year
**Economics**

<table>
<thead>
<tr>
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<th>Value</th>
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<tbody>
<tr>
<td><strong>System Capacity</strong></td>
<td>101 200 tons/yr</td>
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<tr>
<td><strong>Smolt Size</strong></td>
<td>250 g</td>
</tr>
<tr>
<td>Transport cost, smolt</td>
<td>1,5 EUR/smolt</td>
</tr>
<tr>
<td>Mortality</td>
<td>20% from hatch to slaughter</td>
</tr>
<tr>
<td>OPEX (incl smolt and slaughter)</td>
<td>3,57 EUR/kg (HOG)</td>
</tr>
<tr>
<td>Sales price</td>
<td>5,10 EUR/kg (HOG)</td>
</tr>
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- Total investment: 400+ mill EUR
- Annual gross revenues: 500+ mill EUR
- Annual net cash-flow: 150+ mill EUR
- Net Present Value (20 year, 10% disc.rate): 300+ mill EUR
- Return on total capital: ~20%
Open Ocean Farm System, Opportunities for Portuguese Industry
Open Ocean Farm System, potential threats

Norway:
New areas for offshore fish farming (green)

China
- offshore submersible salmon cage built

GM Proposal for offshore cage

Potential threats are other locations
Technology being developed elsewhere, capital is going other places, production licences are delayed

Speed is of essence and question is:

How fast can we move in Portugal!!?

6 months is a long time
Thank you!