Market and Technology Trends in Offshore Aquaculture

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Dr. Karl C Strømsem
Global Maritime AS and OffTek AS
The export value of Atlantic salmon from Norway is 1.5 b€ larger than the total export of wine from France

Norwegian Fisheries State Secretary, TekMar Trondheim 7 Dec. 2017
Aquaculture represent a large growth opportunity

International aquaculture production and wild capture (million tonnes)

- International aquaculture market estimated to USD 160 billion though the accessible market for offshore is approximately 12-14% of this total
- Aquaculture exceeded wild capture in 2014
- Production from wild capture at a maximum — all further growth to be supplied from aquaculture
- Salmon aquaculture production comprise ~5% of the total international aquaculture market and Norwegian salmon market comprise 50% of the salmon aquaculture market

- 2050 we will be 9 billion people
- Demand 70% increase food production
- 30% land area - 70% ocean area
- 95% Land prod - 5% Ocean prod
- 50% land area used for agriculture

The Norwegian gov. roadmap, salmon
Norwegian aquaculture market is at all-time high

Norwegian salmon export value (NOK billions)

- Salmon by far the largest species in the Norwegian aquaculture market
- Value of Norwegian salmon export has grown at 12.5% CAGR 2001 – 2016
- A combination of high price growth and volume growth
- 2016 export value: NOK 64 billion (6.8 b€)
- Compared to NOK 350 billion (37 b€) total O&G export (O&G and technology where technology is around NOK 14 b€)
Background
The market for technology to develop the industry has to a very large extent been driven by the temporarily R&D concession scheme that was open from 2015 to November 2017.

R&D concession scheme:
- Considerable innovation
- Considerable investment
- Solve Environmental issues
- Solve area limitations

R&D concessions are awarded to applicants with highly innovative and capital intensive ideas. A concession is free of charge and can be converted into conventional concessions, if successful results, for a consideration of NOK 10 million (market price approximately NOK 80-120 million).

Per 17. November 2017 closure date, has been submitted 140 applications of which five have been approved and 18 have been rejected.
The Future of Aquaculture Farming, hypotheses

**Aquaculture Value Chain**

**Current**
- Smolt Facility → Traditional Farm → Processing Facility

**FARMING (Current Value Chain)**
- Smolt (0-250g, 0 - 0.5y)
- Traditional Farm (250g - 1kg, 0.5y - 1y)
- Processing Facility (1kg - 5kg, 1y - 2y)

**TO MARKET**
- 250g - 5kg
- 0.5y - 2y

**Future**
- Smolt Facility → Closed Containment System (CCS) → Traditional Farm → Large Closed Containment System → Processing Facility
- Offshore Fish Farming

- **Current technology does not allow for production growth due to threat of lice infection and decases**
- **Extremely high profitability of farming leads to high willingness to invest in new production technology**
- **The future farming solutions, all with the aim of reducing lice infection, will make the aquaculture value chain more complex with higher intensity of technology and assets.**
- **Currently very high innovation and technological development. The temporarily R&D concession scheme has accelerated the development.**
- **Current development moving towards expansion of the value chain to introduce three new technologies**
  - i) small Closed Containment Systems (CCS)
  - ii) Large CCSs
  - iii) offshore fish farms
From offshore technology to cage technology

1970

Semi-Submersible

p.t.

Grøntvedt-Merda

Current cage technology
Salmon aquaculture faces a large technological leap

Traditional fish farms

Offshore fish farms
From offshore technology to cage technology
Inspection draft
Size Comparison the Goliat Platform

- Main Hull Diameter = 90.0m
- Keel diameter = 112.0m
- Lightship weight = 57,500 [T]
Size comparison the Salmar Offshore Cage

- Main Hull Diameter = 110.0m
- Keel diameter = 126.0m
- Lightship weight = 7.709 [T]
Timeline

- Concept study 2013
- FEED study 2013 – Feb 2014
- On hold!.... Remaining of 2014
- Detail design Jan 2015 – Juni 2016
- Constr. follow-on Mars 2016 – Juni 2017
- Transport 16/6 – 5/9
- Float-off/stability Sept 2017
- «First fish» Tuesday 28/9
Preline is a closed containment system for breading post smolt (salmon up to 1 kg)
Travelling crane:
- Fish handling and feeding
- Cleaning, handling, replacement and general maintenance of the net

Module based feed storage:
- Silos with approx. 70mT capacity
- 6 silos -> 420mT

Module based containers for:
- Accommodation, technical rooms, generator, workshop etc.

Crane(s):
- Accordance to client requirement (available vessels etc. sets criteria)
North Sea Fish Farm