Halibut farming in Europe

St. John
February 19th

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General Manager
Fiskey Ltd.
Challenges of Halibut farming

• **Juvenile production**
  – Complicated larval rearing
  – Quality of juveniles (pigmentation, eye migration and growth potential)
  – Disease (IPN and VNN)

• **On growing**
  – Needs surface area for growth
  – Long growth cycle
  – Capital intensive production

• **Market Development**
Juvenile production
FISKEY (Fiskeldi Eyjafjardar)

- The company was established in 1987
- The aim was the mass production of halibut juveniles for on-growing and marketing of farmed halibut.

Successful mass production of juveniles in 1998
First fish on the market in 1999
Largest juvenile producer in the world for the last 5 years
Organization chart

Fiskeldi Eyjafjarðar hf.

- FISKEY 100%
  - Juvenile production
  - On-growing
  - Iceland
- Scotian Halibut 50%
  - Juvenile production
  - On-growing
  - Nova Scotia

Established 1997

Transfer of technology
Fiskey´s production sites

Grow-out site

Broodstock site

Hatchery
Juvenile production
Historical data

- Canada: 2-3 producers
- Scotland: 2-3 producers
- Iceland: 1 producer
- Norway: 10-15 producers

FISKEY Ltd
Focus on intensive production since 1991

- Indoor facilities where all environmental parameters can be controlled
- Brood stock spawning time manipulated (light manipulation)
- Live feed cultivation (predicted quality and quantity)

Stable and gradual increase in production

<table>
<thead>
<tr>
<th>Year</th>
<th>Number (&gt;5g)</th>
</tr>
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<tbody>
<tr>
<td>1996</td>
<td>35.000</td>
</tr>
<tr>
<td>1997</td>
<td>50.000</td>
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<tr>
<td>1998</td>
<td>220.000</td>
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<td>1999</td>
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<td>2001</td>
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<td>2002</td>
<td>440.000</td>
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<td>2003E</td>
<td>700.000</td>
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</table>
Juvenile Quality

• Metamorphosis
  – Halibut larvae go through a complex change from symmetric larvae (round fish) to an asymmetric juvenile (flatfish)
  – Deficient nutrition before and during metamorphosis results in poor developed fish.
    • Poor eye migration
      – Reduced performance in on-growing (visual feeder)
    • Malpigmented fish
      – Lack of pigment cells on skin results in vulnerability to sun exposure (sunburn)
      – Marketing complications?
Juvenile Quality - Fiskey

- Malpigmented
- Bad eye migration

Juvenile Health - Fiskey

- **Disease free status**
  - Intensive production allows for better health management.
  - Regular screening for pathogenic virus and bacteria
    - Long history of disease free status

- IPN and VNN has successively caused problems in Norway and Scotland.
Juvenile Performance

• **Healthy fish.**
  – Successful juvenile production (high survivals) indicate optimal conditions and is therefore likely to result in undamaged fish with good growth potential.

• **Ultimate measurement of quality is overall performance up to market size fish.**
  – Implementing breeding program (genetic enhancement) is vital.
    • Breed out early maturing males.
    • Breed in fast growing fish of good flesh quality.
    • Latest DNA technology is a useful aid.

Work on first generation (F1) as soon as possible
Increased production and automation can reduce Labour cost

Increased survival reduces feed cost

Depreciation and interest not included

Juvenile cost

Labour 48%
Feed 26%
Power 8%
Oxygen 2%
Insurance 2%
Maintainance 3%
Other 11%
On growing
Recent developments in Norway look promising.

- Nursery stage prolonged (0.5-2 kg)
  - Optimal conditions up to 1 kg can reduce total growth time 8-12 months
  - Lower mortality in land based tanks than cages which is important because of the high value of each fish.

- Shelf system designed
  - Improves growth and FCR
  - Better yields from each cage

- Automatic feeding system
  - Improves FCR
  - Save labour cost
Growth – Impact of temperature control

Data from Marine Harvest Norway
Providing optimal conditions when growth potential is high (below 1 kg) is important.
On Growing – Need for Nursery

- Maintaining optimal temperature for fish below 1 kg is essential to reduce growth cycle.
- Small fish have higher growth potential than large fish.

Land based Nursery essential

Resirculation systems improve economy of operation and provide better temperature control.
Halibut cage system

Uneaten feed collected and refed

Feeding Station
Cage systems

- Low investment compared to land based farms.
  - 1000 tn land based farm costs 15-20 million $ (CAN)
  - 1000 tn cage system costs 1.5-2.0 million $ (CAN)
- Shelves allow for much better yield from the cages
  - Up to 50-75 kg/m$^2$ can be expected.
- Deep cages (>10 m)
  - Fish better protected from sun
  - More stable conditions (temperature, salinity, current etc.)
Halibut production

• There are few Halibut producers and they will tend to be big
  – Economy of scale reached at 500-1000 mt
  – Intensive capital investment (buildup of biomass for 3-4 years)

• The production in Europe for the next 3-4 years will reach 3000-5000 MT
  – Largest producers will probably be:
    • Marine Harvest (Norway)
    • Dönna Marin (Norway)
    • Stolt Sea Farm (Norway)
    • Nordic Seafarms (Norway)
    • Marine Harvest (Scotland)
Production Cost in Norway

Land based on growing
2 sea sites
Yearly production level (MT) 1,000
Juveniles put to sea 225,000
Price per juvenile 5,60 USD
FCR 1,25
Av. harvesting weight 5 kgs
Av. production time 36 months

<table>
<thead>
<tr>
<th></th>
<th>USD</th>
<th>USD/kg</th>
<th>%</th>
<th>USD/kg</th>
<th>%</th>
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<tbody>
<tr>
<td>Cost of juvenile</td>
<td>1,260,000</td>
<td>1,26</td>
<td>18,8%</td>
<td>0,30</td>
<td>12%</td>
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<tr>
<td>Feeding costs</td>
<td>1,400,000</td>
<td>1,40</td>
<td>20,9%</td>
<td>1,10</td>
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<tr>
<td>Insurance costs</td>
<td>392,000</td>
<td>0,39</td>
<td>5,9%</td>
<td>0,05</td>
<td>2%</td>
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<tr>
<td>Wages and benefits</td>
<td>700,000</td>
<td>0,70</td>
<td>10,5%</td>
<td>0,20</td>
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<tr>
<td>Energy, O2 costs</td>
<td>224,000</td>
<td>0,22</td>
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<td>0,12</td>
<td>5%</td>
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<tr>
<td>Depreciation</td>
<td>490,000</td>
<td>0,49</td>
<td>7,3%</td>
<td>0,12</td>
<td>5%</td>
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<tr>
<td>Other operating exp.</td>
<td>560,000</td>
<td>0,56</td>
<td>8,4%</td>
<td>0,37</td>
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<tr>
<td><strong>Cost of production</strong></td>
<td><strong>5,026,000</strong></td>
<td><strong>5,03</strong></td>
<td><strong>75,1%</strong></td>
<td><strong>2,14</strong></td>
<td><strong>84%</strong></td>
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<tr>
<td>Process. and transp.</td>
<td>756,000</td>
<td>0,76</td>
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<tr>
<td>Net financing costs</td>
<td>910,000</td>
<td>0,91</td>
<td>13,6%</td>
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<tr>
<td><strong>Total costs</strong></td>
<td><strong>6,692,000</strong></td>
<td><strong>6,69</strong></td>
<td><strong>100,0%</strong></td>
<td><strong>2,56</strong></td>
<td><strong>100%</strong></td>
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</table>

= 3,0 USD/Lbs.
= 1,2 USD/Lbs.

Data from Nordic Seafarms (Norway)
Prospects

• Atlantic halibut is one of the most highly prized edible fishes
  – Tasty, firm white meat.
  – Can be prepared as steaks or fillets
• High price niche product.

• Atlantic Halibut farmed in less than 1000 MT today
Wild Cach of Halibut

Seasonal catch (March-November)

Main markets:
- **Atlantic Halibut:** UK, Sweden, Germany, USA
- **Pacific Halibut:** USA, Canada and Japan

MT

<table>
<thead>
<tr>
<th>Year</th>
<th>Pacific Halibut</th>
<th>Atlantic Halibut</th>
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<tbody>
<tr>
<td>1990</td>
<td>43000</td>
<td>1000</td>
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<td>1000</td>
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<tr>
<td>2000</td>
<td>20000</td>
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Market Development

• Largest market for Halibut is in North America

• Most of the fish produced in Europe will be sold on the European market.
  – Some production will enter North American market but then there is an additional 20% transport cost.

Canadian producers benefit from closeness to the market
Thank you