AQUACULTURE FIT FOR THE FUTURE: ADDRESSING THE DISEASE CHALLENGE

Prof. Michael Fontaine, Head of Vaccine R&D
SUSTAINABLE FOOD PRODUCTION IS ONE OF THE BIGGEST CHALLENGES TODAY
AQUACULTURE PLAYS A KEY ROLE IN SUSTAINABLY MEETING INCREASING GLOBAL PROTEIN DEMAND

**Top aquaculture credentials:**

- Offsets demand for wild caught fish and associated impacts
- Sale of high-quality and accessible animal proteins to global consumers
- Local employment opportunities in coastal communities

- Aquaculture accounts for 50% of the world’s fish consumed as food
- Fish consumption is growing faster than all other major animal protein sources

*Source: United Nations, OECD-FAO Agricultural Outlook 2017-2026*
## Increasing Awareness of the Issues – FAIRR Report

### ESG risks and opportunities in aquaculture

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1</strong></td>
<td>Antibiotic use</td>
<td><strong>6</strong></td>
</tr>
<tr>
<td><strong>2</strong></td>
<td>Disease</td>
<td><strong>7</strong></td>
</tr>
<tr>
<td><strong>3</strong></td>
<td>Greenhouse gas emissions</td>
<td><strong>8</strong></td>
</tr>
<tr>
<td><strong>4</strong></td>
<td>Fish Welfare</td>
<td><strong>9</strong></td>
</tr>
<tr>
<td><strong>5</strong></td>
<td>Fish feed supply</td>
<td><strong>10</strong></td>
</tr>
</tbody>
</table>
## Drivers for change

<table>
<thead>
<tr>
<th>Category</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Producers</strong></td>
<td>Drive for productivity, efficiency, and growth</td>
</tr>
<tr>
<td><strong>Regulators</strong></td>
<td>Ensure that the sector is sufficiently regulated to address sustainability concerns leading to tighter regulations</td>
</tr>
<tr>
<td><strong>Consumers &amp; NGOs</strong></td>
<td>Growing awareness of sustainability issues</td>
</tr>
<tr>
<td></td>
<td>Increasing consumer scrutiny</td>
</tr>
<tr>
<td><strong>Investors</strong></td>
<td>Paying more attention to the issues. Increasing focus on environmental, social and governance risks in investment</td>
</tr>
</tbody>
</table>

### Millennials willing to pay extra for sustainable offerings

- **3 out of 4**

### Costing

- **£66 trillion**
  - A failure to address the problem of antibiotic resistance could result in:
    - **10 million deaths by 2050**
DISEASE IS A SIGNIFICANT BARRIER TO SUSTAINABLE PRODUCTION

- Growth is constrained by disease
- Diseases significantly increase production costs (price of treatment & loss of stock)
- Chile: ISAV outbreak cost the sector $2 billion and 20,000 jobs

Sea lice - estimated annual cost to industry¹
$1bn+

PD impact in Norway²
$250m

40% losses due to disease in shrimp
BENCHMARK’S BALANCED HEALTH APPROACH

Technologies to build resilience and reduce challenge

BUILD RESILIENCE

- Latest genomic tools
- Vaccines
- Advanced Nutrition

MANAGE CHALLENGE

- Medicines
- Biosecurity
- Veterinary services
- Data Health Portal

Knowledge Services
Genetics
Advanced Nutrition
Animal Health
Probiotics can help control pathogenic bacteria and improve feed utilisation (with better FCR and growth)
DISEASE GENETICS

- Disease in aquaculture can lead to mass fish mortality
- Mitigating, preventing and controlling the spread of disease is critical to aquaculture operations
- Fish farms in Northern Europe, South America and Asia are all susceptible to diseases

BMK Genetic Selection
Resilient genetics

Benchmark genetics are targeted at the major disease challenges in salmon, shrimp and tilapia

BMK salmon genetic products 2018/2019

<table>
<thead>
<tr>
<th>DISEASE</th>
<th>SalmoProtect</th>
<th>SalmoSelect-PD</th>
<th>SalmoSelect-ISA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infectious pancreatic necrosis (IPN)</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Sea lice</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Growth on farm (sea cages)</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pancreas Disease (PD)</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infectious salmon anaemia (ISA)</td>
<td></td>
<td></td>
<td>✔️</td>
</tr>
<tr>
<td>Cardiomyopathy syndrome (CMS)</td>
<td>Optional</td>
<td></td>
<td>Optional</td>
</tr>
<tr>
<td>Amoebic gill disease (AGD)</td>
<td>Optional</td>
<td></td>
<td>Optional</td>
</tr>
</tbody>
</table>

85% reduction in IPN with introduction of QTL

(Incidence of IPN in farmed salmonids 2009–2017)

Source: Veterinary Institute Norway
Medicines are one of the biggest objections to the salmon farming industry.

Concern over pollution and negative impact on biodiversity.

Lack of new medicines is a significant barrier to future growth.

**EFFLUENTS: TECHNOLOGY**

- Water purification system that removes medicines from treatment water.
- Working with leading producers in Norway.
- Purified 300,000m³ of medicated treatment water in 1st year of operation.
- Potential for use with most available sea lice medicines.

**BMK Environmental Intervention CleanTreat®**

- Purification system removes medicines from treatment water.
- Works with leading producers in Norway.
- Purified 300,000m³ of medicated treatment water in 1st year of operation.
- Suitable for most available sea lice medicines.

10,625 tons medicines* in 2016 in Norway.

*Azamethiphos, Cypermethrin, Deltamethrin, Diflubenzuron, Emamectin, Teflubenzuron (excluding hydrogen peroxide).

Source: The Health Situation in Norwegian Aquaculture 2017, Norwegian Veterinary Institute.
**DISEASE: MANAGEMENT**

- 15 WHO critically or medically important antibiotics, a number are routinely used in aquaculture
- Oral treatment contributes to sub-therapeutic doses, which can lead to antibiotic resistance
- Inconsistent regulations create export risks
- In 2016, the US FDA refused a record number of Asian shrimp shipments due to contamination with banned antibiotics

**BMK Management & Equipment: The Antibiotic Tracker**

- Used by some of the world’s largest food companies
- Captures antibiotic measures within a supply chain
- Aids better recording allowing producers to predict and prevent disease, thereby reducing prophylactic antibiotic use

-Forty-six companies (77%) valued at $250 billion and with revenues of $260 billion, are categorised as ‘high risk’, including 22 who have no policy on antibiotics use and do not disclose the quantities or types of antibiotics used on their farms.