



Benchmark[®]

AQUACULTURE FIT FOR THE FUTURE: ADDRESSING THE DISEASE CHALLENGE

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**SUSTAINABLE FOOD
PRODUCTION IS ONE
OF THE BIGGEST
CHALLENGES TODAY**





AQUACULTURE PLAYS A KEY ROLE IN SUSTAINABLY MEETING INCREASING GLOBAL PROTEIN DEMAND

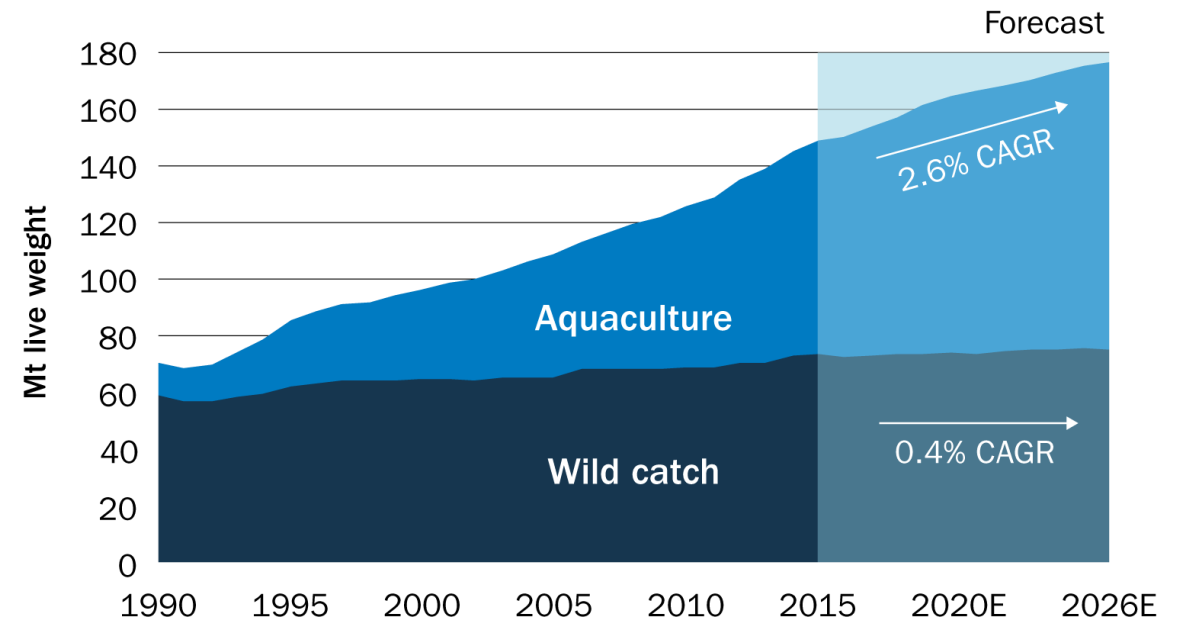
Top aquaculture credentials:

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


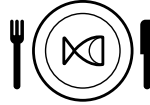
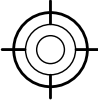
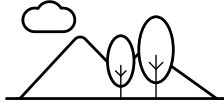



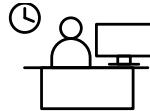
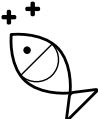
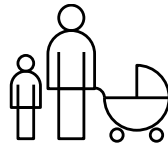


Source: United Nations, OECD-FAO Agricultural Outlook 2017-2026



INCREASING AWARENESS OF THE ISSUES – FAIRR REPORT

ESG risks and opportunities in aquaculture

- | | | | | | |
|---|---|--------------------------|----|---|---|
| 1 |  | Antibiotic use | 6 |  | Transparency and food fraud |
| 2 |  | Disease | 7 |  | Habitat destruction and biodiversity loss |
| 3 |  | Greenhouse gas emissions | 8 |  | Effluents |
| 4 |  | Fish Welfare | 9 |  | Working conditions |
| 5 |  | Fish feed supply | 10 |  | Community resistance |



... AND MULTIPLE DRIVERS FOR POSITIVE CHANGE

Drivers for change

Producers

Drive for productivity, efficiency, and growth

Regulators

Ensure that the sector is sufficiently regulated to address sustainability concerns leading to tighter regulations



Consumers & NGOs

Growing awareness of sustainability issues

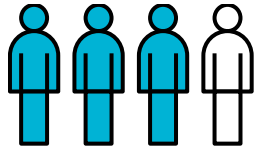
Increasing consumer scrutiny

Investors

Paying more attention to the issues. Increasing focus on environmental, social and governance risks in investment

3 out of **4**

Millennials willing to pay extra for sustainable offerings



A failure to address the problem of antibiotic resistance could result in:

Costing



10m

deaths by 2050

£66

trillion

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

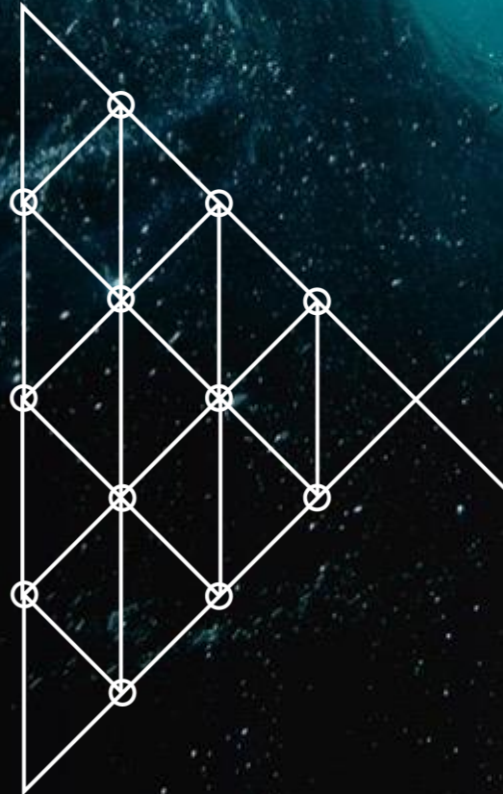
Technologies to build resilience
and reduce challenge

BUILD RESILIENCE

Latest genomic tools

Vaccines

Advanced Nutrition



MANAGE CHALLENGE

Medicines

Biosecurity

Veterinary services

Data Health Portal

Knowledge Services



Genetics



Advanced Nutrition

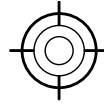


Animal Health





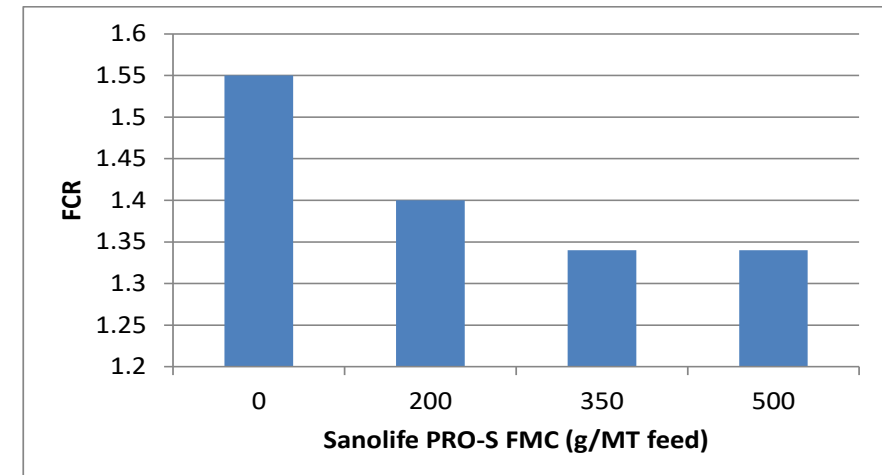
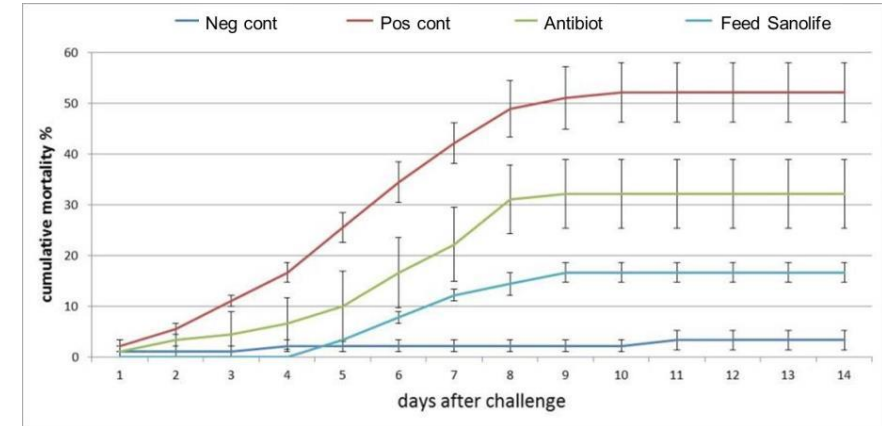
DISEASE NUTRITION



Probiotics can help control pathogenic bacteria and improve feed utilisation (with better FCR and growth)

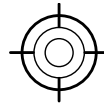


BMK Advanced Nutrition Probiotics

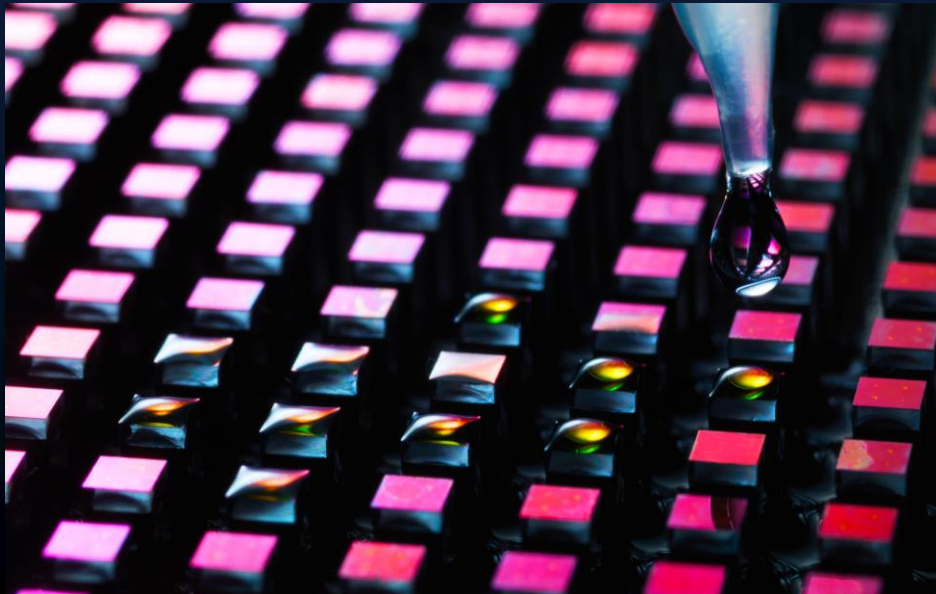




DISEASE GENETICS



- 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

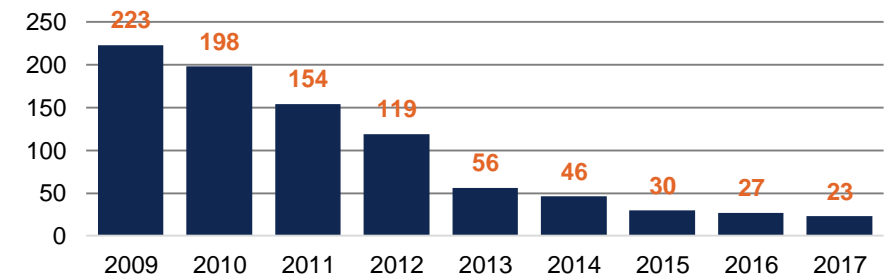
Benchmark genetics are targeted at the major disease challenges in salmon, shrimp and tilapia

BMK salmon genetic products 2018/2019

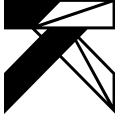
DISEASE	SalmoProtect	SalmoSelect-PD	SalmoSelect-ISA
Infectious pancreatic necrosis (IPN)	✓	✓	✓
Sea lice	✓	✓	✓
Growth on farm (sea cages)		✓	
Pancreas Disease (PD)		✓	
Infectious salmon anaemia (ISA)			✓
Cardiomyopathy syndrome (CMS)		Optional	Optional
Amoebic gill disease (AGD)		Optional	Optional

85% reduction in IPN with introduction of QTL

(Incidence of IPN in farmed salmonids 2009–2017)



Source: Veterinary Institute Norway



EFFLUENTS: TECHNOLOGY



- 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

10,625
tons medicines*
in 2016 in Norway

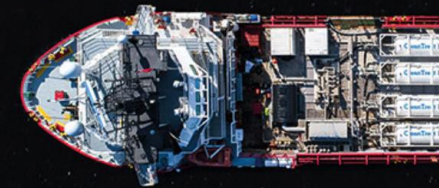
*Azamethiphos, Cypermethrin, Deltamethrin, Diflubenzuron, Emamectin, Teflubenzuron (excluding hydrogen peroxide)

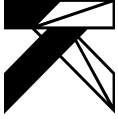
Source: The Health Situation in Norwegian Aquaculture 2017, Norwegian Veterinary Institute

BMK Environmental Intervention CleanTreat®

- 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

CleanTreat®
by Benchmark

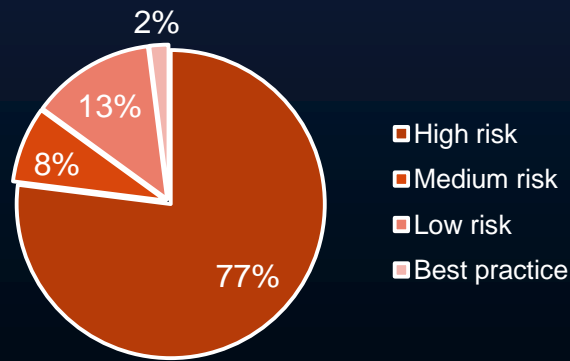




DISEASE: MANAGEMENT

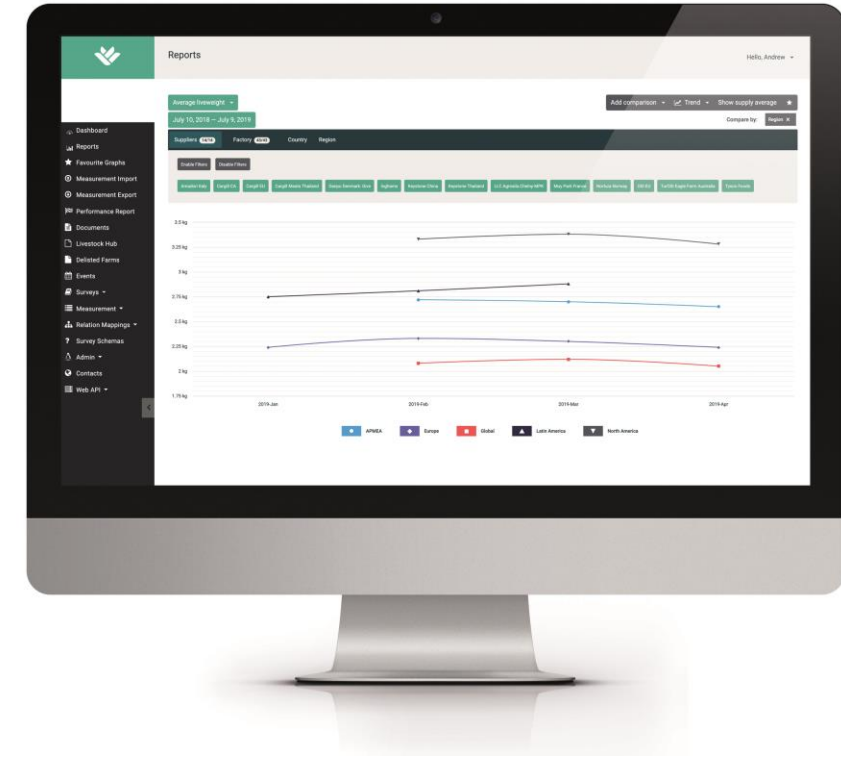


- 15 WHO critically or medically important antibiotics, a number are routinely used in aquaculture
- Oral treatment contributes to sub-therapeutic doses, which can lead to antibiotic resistance
- Inconsistent regulations create export risks
- In 2016, the US FDA refused a record number of Asian shrimp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



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.

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



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