



SUREAQUA

Nordic Centre of Excellence

Coordinated by the
International Research Institute of Stavanger



IRIS

Funded through the
Nordic Bioeconomy Programme of



NordForsk

RESEARCH PARTNERS



SUREAQUA

Nordic Centre of Excellence



IRIS



Technical University of Denmark



European Centre for Environment & Human Health



Norges miljø- og biovitenskapelige universitet



Universitetet i Stavanger

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UNIVERSITY OF GOTHENBURG



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UNIVERSITY OF EASTERN FINLAND



Aquaculture Research Station of the Faroes

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Bioeconomy Science Center

BELLONA



umhvørvistovan
environment agency



Innovation Center
Iceland



ROGALAND
FYLKESKOMMUNE



ICELAND
OCEAN
CLUSTER



water
footprint
network



Validé



NCE AQUATECH CLUSTER
Norwegian Aquaculture Technology

Knowledge Sharing

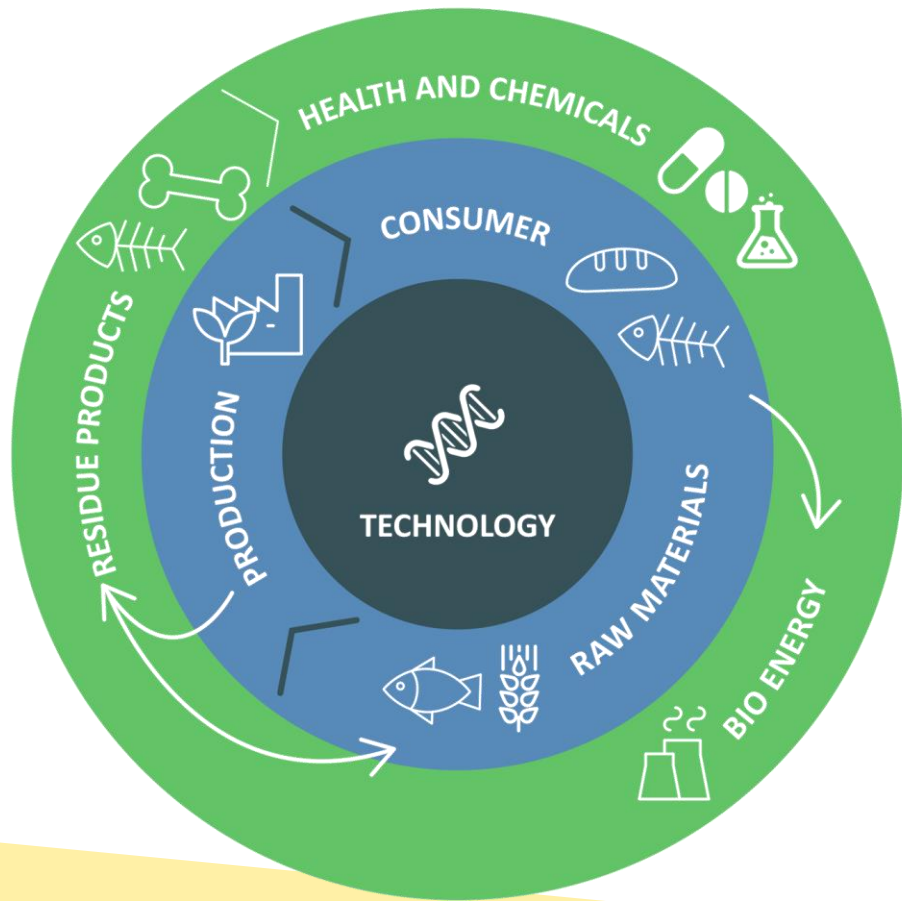
- Public outreach
- Webinars
- Traineeship with industry
- Researcher education
- Student & researcher exchange
- Summer school and courses
- Participate in policymaking



Photo. Aftenbladet, Cornelius Munkvik

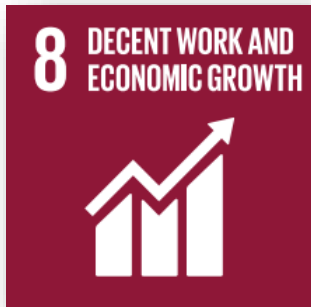
[Click here: Bioeconomy movie](#)

Technology at the Centre

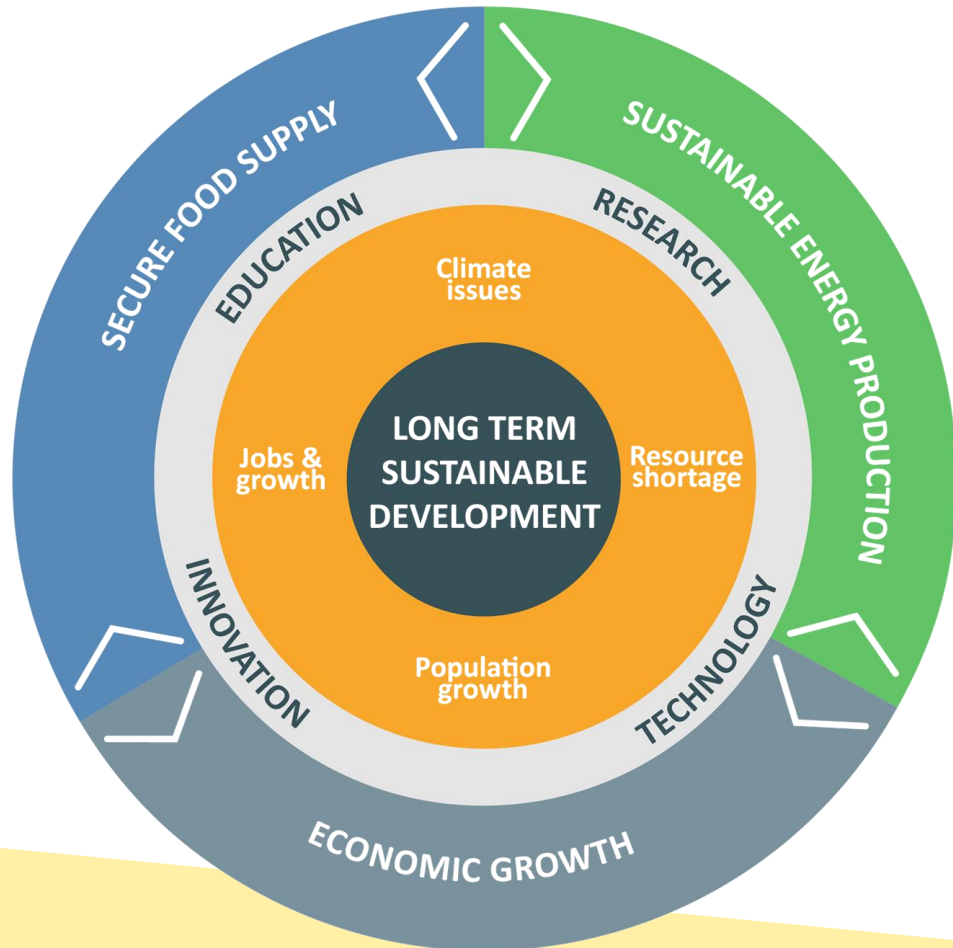


The bioeconomy encompasses the **production of renewable biological resources and their conversion into food, feed, bio-based products and bioenergy.**

SUSTAINABLE DEVELOPMENT GOALS



Securing Long-Term Sustainable Development



- Employment and Value Creation
- Growing the Nordic Bioeconomy
- Global Food and Nutrient Security
- Value Added Products and Energy

Aquatic Production: Resilience and Challenges

Resilience

Limitation of fish meal/oil

Diseases

Escapees

Robustness

Forecast
possible
future
changes

Resistance
to
forecasted
changes

Adaptability

Perception
of current
changes

Fast
reaction
to
perceived
changes

Discharges

Climate
changes
(storms/waves/
winds/precipit.)

Increased
CO² levels /
Ocean
acidification

Adapted from Wieland et al. 2013

Sustainable and Resilient Aquatic Production

Feed resources



Production



Processing



Integration of Value Chains

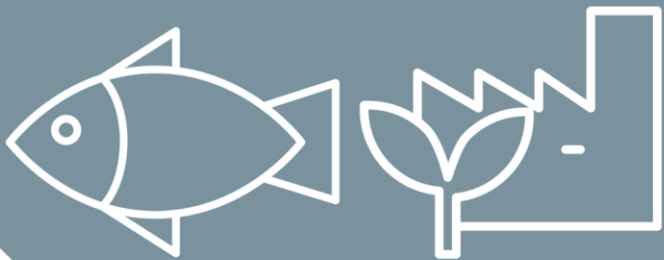


Themes of SUREAQUA



Theme 1

TECHNOLOGY AND BIOREFINERY



Developing and benchmarking technology and biorefinery approaches:

- from proof of concept to market implementation;
- for alternative feed resources and use of by-products; and
- for production.

Theme 2

TECHNOLOGY
AND BIOREFINERY



ENVIRONMENTAL QUALITY AND SUSTAINABILITY



Assessing environmental sustainability of proposed solutions for transitioning to a bioeconomy, from feed to production, and from value chain modelling to use of energy from renewable sources.

Theme 3

TECHNOLOGY
AND BIOREFINERY



ENVIRONMENTAL
QUALITY AND
SUSTAINABILITY



SOCIAL & ECONOMIC SUSTAINABILITY



Assessing social and economic factors, bioeconomic models, and market acceptance of existing and novel aquatic production chains.

Theme 4

TECHNOLOGY
AND BIOREFINERY



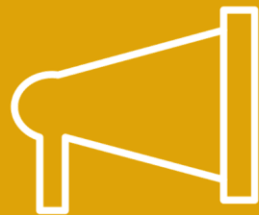
ENVIRONMENTAL
QUALITY AND
SUSTAINABILITY



SOCIAL &
ECONOMIC
SUSTAINABILITY



GOVERNANCE AND COMMUNICATION



- Assessment of legal and regulatory frameworks and incentives tools;
- Effective communication methods towards general public, stakeholders, authorities and suggestions for improved; and
- Adaptive governance at local, national and global level.



Sustainable and resilient aquatic production

Feed resources

- LCA analysis
- environmental impact assessments
- social and economic assessments

Production

- LCA analysis
- fish welfare assessments
- carrying capacity
- environmental impact assessments
- social and economic assessments

Processing

- LCA analysis
- environmental impact assessments
- social and economic assessments

Concrete examples of SUREAQUA Centre activities

Activity 1: Feed resources

- Chemical and biochemical analysis of novel feed ingredients to increase nutrient content.
- Assess metabolic and physiological responses to ingredient and impact on fish health
- Environmental and socio-economic assessments of novel feed ingredients



Output:

- Information on how different pre-treatment methods affect nutritional value of raw material.
- Knowledge on how new feeds impact nutritional value of fish, fish welfare, feed yield and quality

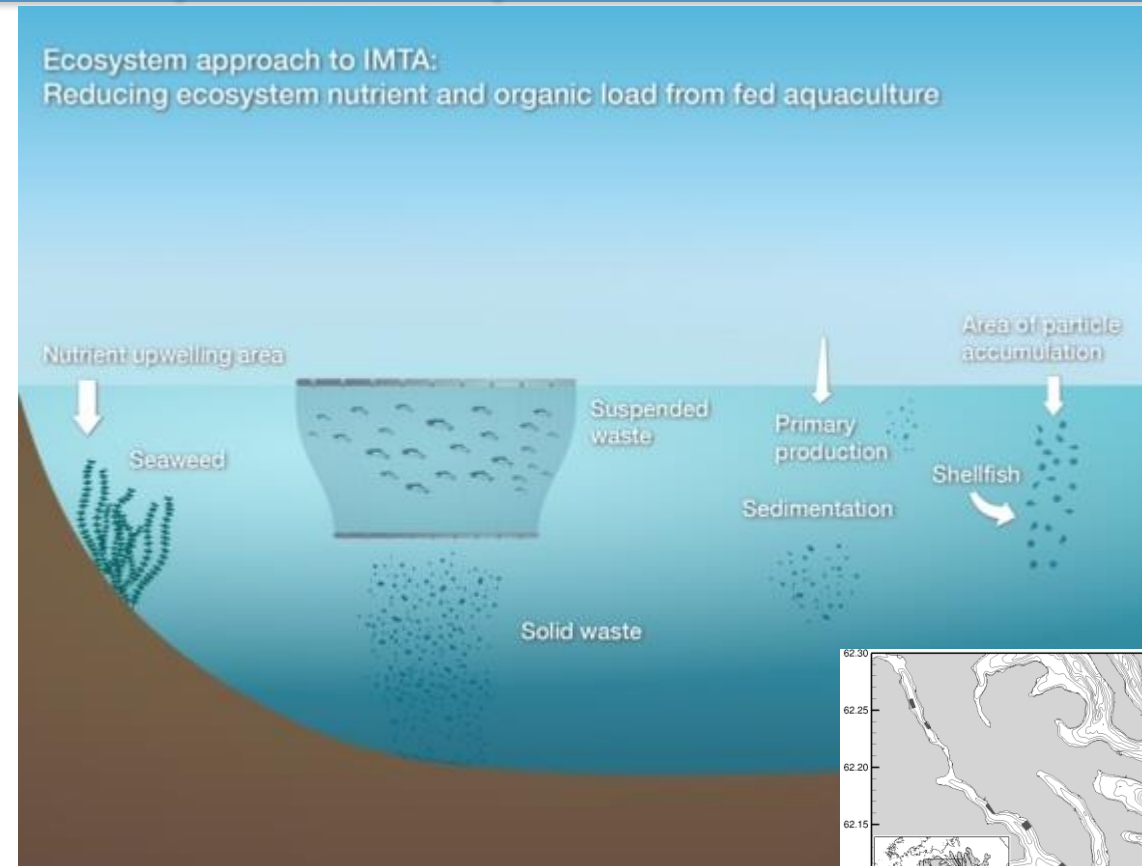


Activity 2: Integrated Multitrophic Aquaculture

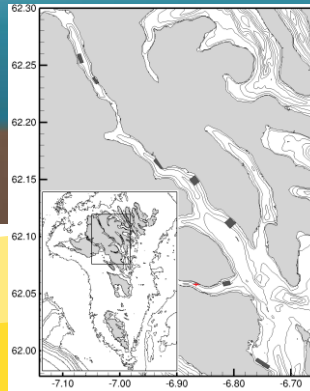
- Combined hydrodynamic and particle tracking modelling to find suitable location for seaweed and bivalves
- Testing organisms growth and assimilation capacity
- Assess impact of novel production regimes and technology on fish welfare
- Quantify organic and nutrient waste and assess environmental impact for a single and multiple farms

Output:

- Understand and mitigate safety risks (including pathogens) involved in Blue-Green production



Picture source: Fiskaaling



Activity 3: New sensors for Aquaculture

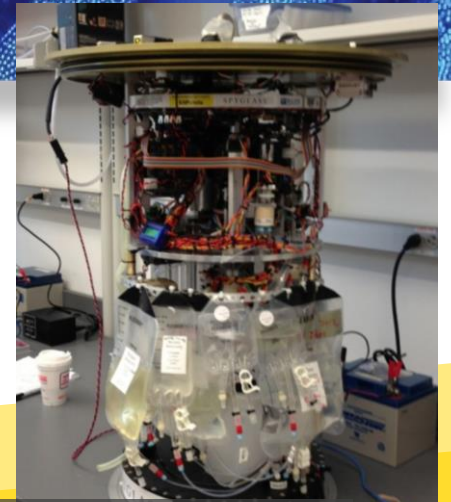
- Development of Lab-on Chip tools
- Enable early warning with near real-time and continuous monitoring
- Near Real-Time sensors key parameters
 - ✓ Fish welfare
 - ✓ Water quality
 - ✓ Biomass
 - ✓ Contaminants
- Link molecular based sensors with abiotic data

Output

- Sensor arrays targeted for relevant parameters, implemented on fixed or mobile sensor platforms



lab-on-a-chip



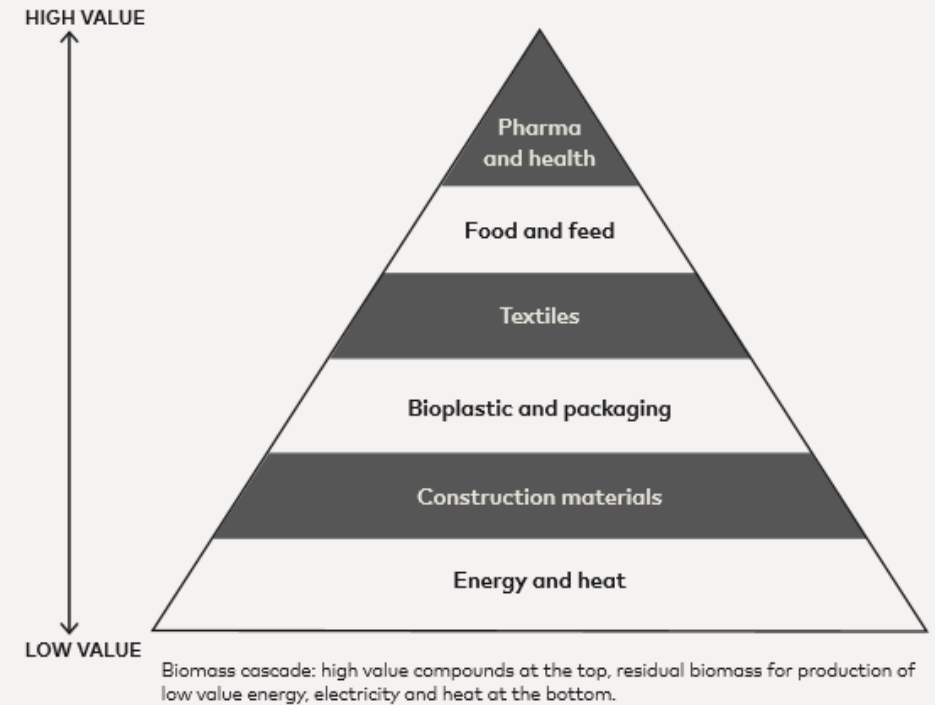
Environmental Sample Processor

Activity 4: Value creation based on by-products

- Use of by-products and underused resources to generate high-value products
- Develop relevant and cost-efficient methods for large scale separation, extraction, purification and biotransformation
- Assessments of existing legal and regulatory frameworks

Output:

- Enhanced potential for use of resources not currently used or unde-used as source of feed or chemicals
- Upscaling bio-processing to commercial level.
- Focus on economically viable microbial based large scale enzyme production



Source: Nordic Bioeconomy: 25 cases for sustainable change

Facilities available within the SUREAQUA consortium



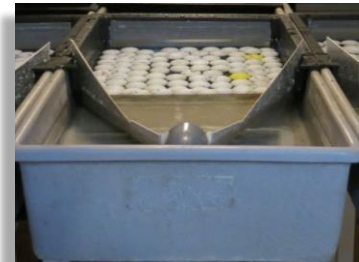
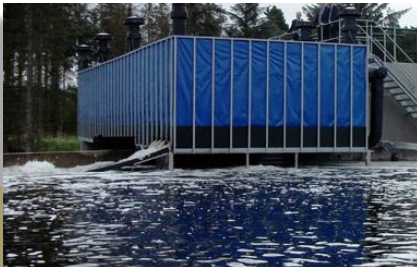
- hatchery for salmonids and marine fish, larval rearing
- recirculation systems / exposure systems
- laboratories for: fish health, histology, microbiology, molecular biology, chemistry, ecotoxicology, respiration
- feed production
- bioproduction and bioprocessing: fermentation for R&D, upscaling and production, down-stream processing
- several research stations



Bjørn Eirik Larsen/Nofima



Jon-Are Berg-Jacobsen / Nofima



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