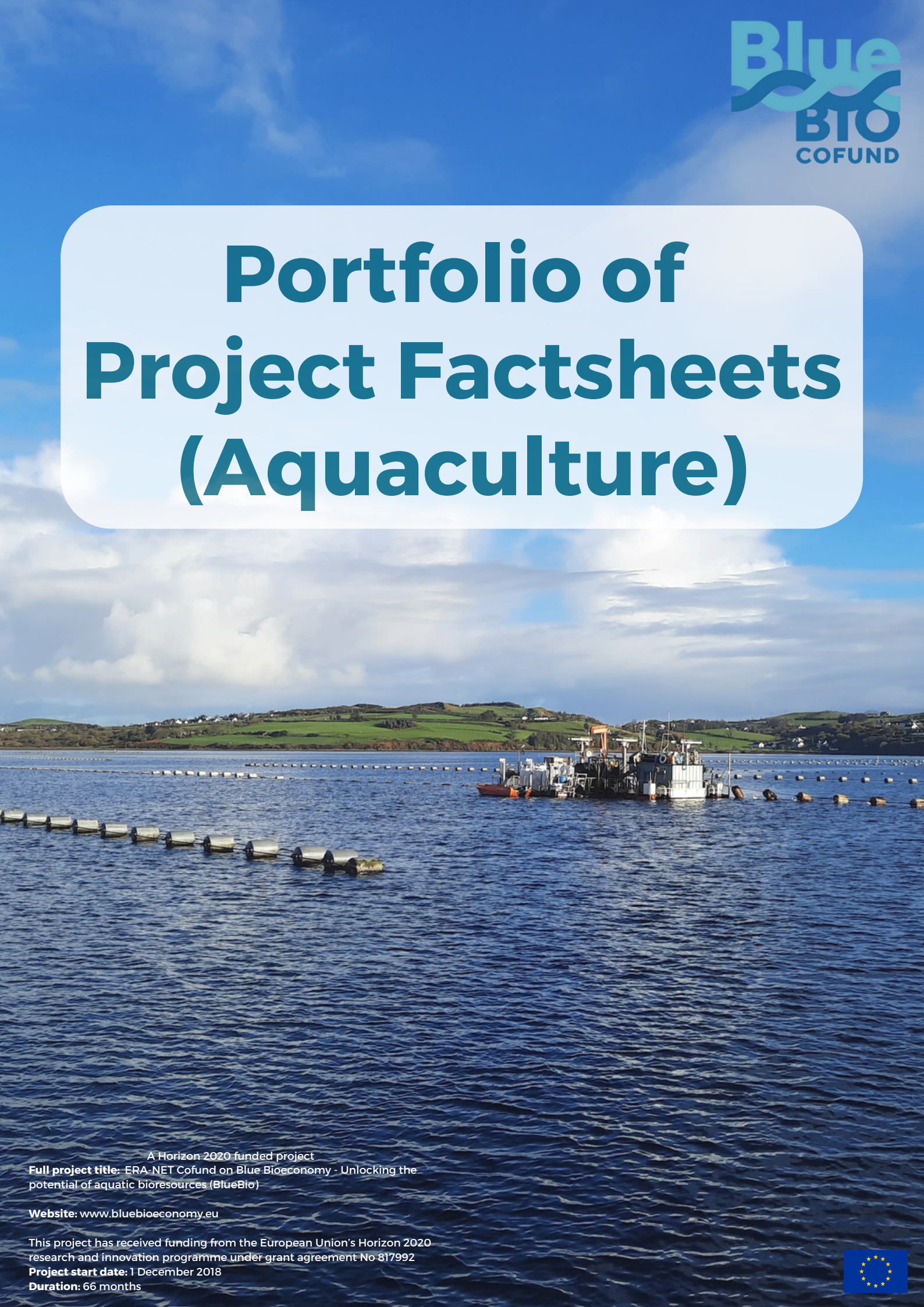
Portfolio of Project Factsheets (Aquaculture)



A Horizon 2020 funded project
Full project title: ERA-NET Cofund on Blue Bioeconomy - Unlocking the potential of aquatic bioresources (BlueBio)

Website: www.bluebioeconomy.eu

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 817992
Project start date: 1 December 2018
Duration: 66 months

Overview

These factsheets outline the outputs and commercialisation needs for the 36 BlueBio funded projects as of November 2023. This includes 17 projects from the cofunded call ( ), 9 projects from the 1st additional call ( ), and 7 from the 2nd additional call ( ).

Each factsheet contains the following information:

- Project Name
- Brief description/tagline
- Relevant Blue Invest sectoral opportunity icon (see next page for description)
- Website (if applicable)
- Country flags of industry partners in the consortium
- Outputs (including Technology Readiness Level (TRL), brief description, Intellectual Property Rights (if provided)
- Commercialisation Needs or Next Steps

More information on the projects available on **www.bluebioeconomy.eu**

Blue Invest Sector Opportunities

Aquaculture

 Aquafeed

 Equipment

 Broodstock

 Rearing/ Harvesting

 Disease battling & fish welfare

Blue Biotechnology

 Biofuels

 Nutraceuticals

 Cosmetics

 Pharmaceuticals

 Food & Feed

 Waste Reduction

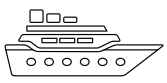
 General

Blue Biotechnology

 Fishery Services

 Fishing Gear

 Fishing

 Ship Equipment

From Blue Invest report: An Ocean of Opportunities available at https://blueinvest-community.converve.io/

Blue BTO COFUND

AquaHealth

Microalgae Microbiomes - A natural source for the prevention and treatment of diseases in aquaculture

https://aquahealth-project.com

Portfolio of Outputs and Commercialisation Needs

Project consortium includes 1 SME:

Outputs

Advanced meta'omics toolbox

TRL 4-5

Screening techniques

Cultivation and DSP methods

TRL 7+

Cultivation of microalgae and down stream processing methods

Microalgal microbiomes

TRL 3-4

Utilisation of bioactive molecules from microalgal biomes for aquaculture health management

LCA Models

TRL 4-5

Life Cycle Assessment models for microalgae cultivation and fish aquaculture

Commercialisation Needs

- **Higher efficiency/ productivity of cultivation system**
- **Lower energy consumption (cultivation phase and downstream processing)**
- **Antimicrobial/ antiviral assessment of bioactives**
- **Upscaling production of bioactives**
- **User friendly model with graphical interfaces, API, or apps**

Blue BIO COFUND

AquaTech4Feed

Portfolio of Outputs and Commercialisation Needs

Aquaculture technologies for the production of innovative feeds for improved fish stocks

https://aquatech4feed.atb-potsdam.de/de/project

Project consortium includes 3 companies:

Outputs

Biofloc cultivation

TRL 6

Optimised tank cultivation using aquaculture wastewater.

Duckweed cultivation

TRL 7

Optimised open pond cultivation, using aquaculture wastewater.

Insect Cultivation

TRL 6

Optimised cultivation of Black Soldier Fly using fish waste.

Micro and macro-algal cultivation

TRL 7

Optimised cultivation using aquaculture wastewater.

Commercialisation Needs

- **Upscaling and integration into real environments**
- **Development of standardised processes**
- **Case studies for social acceptance and feasibility**
- **HEU funded IMPRESS project to develop higher TRL (duckweed & microalgae)**
- **Hygiene and safety assessment of the produced biomass**

Blue BIO COFUND

BEST BROOD
Improving Fish Reproduction

Identification of broodstock performance indicators and markers to boost the aquaculture of emerging fish species

site.nord.no/bestbrood

Portfolio of Outputs and Next Steps

Project consortium includes 3 enterprises:

Outputs

Spotted wolffish

TRL 5

Gamete quality and genetic markers identified. Broodstock diets developed. Scale up of sperm cryopreservation protocols.

Lumpfish

TRL 6

Enhanced and sychronised gamete production in wild and farmed broodstock, improved sperm storage protocols.

Senegalese Sole

TRL 6

Gamete quality and genetic markers developed. Enhanced gamete production techniques. Scaling of artificial fertilisation methods.

Greater Amberjack

TRL 8

Enhanced spermiation and sperm production.

Next steps

- **Bring research findings into use of existing tools available in the market**
- **Explore opportunities to scale up in different settings**
- **Engagement with different stakeholders for impact**
- **Financial support to further develop outputs**
- **Stakeholder engagement (farmers) to adopt technology developed**

Blue BTO COFUND

Portfolio of Outputs and Commercialisation Needs

Optimizing land-based fish production in next generation digital recirculation

http://www.digiras.org/

Project consortium includes 2 large, 1 medium, 1 small and 1 micro sized enterprises:

Outputs

Microbial water quality analysis

TRL 6

Procedures for mapping & absolute quantification of priority microbes in fish & production environments using DNA/RNA-based technologies. Potential of machine learning supported NGS data processing for developing early warning tool demonstrated.

H2S- Sensor

TRL 4

Cost-effective hydrogen sulfide sensor prototype with high sensitivity developed.

Covalent Organic Framework Based Absorbent

TRL 3

Novel approach for absorption of off-flavour compounds demonstrated

Fish Welfare Monitoring System

TRL 6

Novel fish welfare monitoring technology based on camera systems (under & over water) and machine learning assisted fish behavious analysis established.

Microalgae Bioreactor

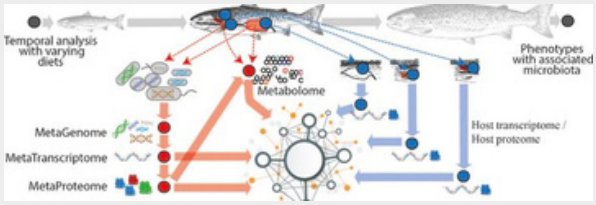
TRL 3

Use of microalgae for recovering nutrients and production of fatty acid rich biomass from RAS water demonstrated.

Commercialisation Needs

- More R&D for process optimisation and technology development
- Further development and testing of prototypes
- Extended testing and optimisation in commercial systems
- Licensing and spin-off
- Marketing and promotion

ImprovAFish



Improving aquaculture sustainability by modulating the feed-microbiome-host axis in fish

www.nmbu.no/en/research/projects/improvafish

Project consortium includes 2 enterprises:

Portfolio of Outputs and Next Steps

Outputs

Tailored mannan fibres

TRL 5

Tested as new feed ingredient to select for putative beneficial microbiota in the Atlantic salmon gut.

Breeding strategies

TRL 5

Use of breeding to improve microbiome composition and function in broodstock.

Microbial Resources

TRL 4

Microbial biobanks for dietary and health implications.

Next Steps

Scale up genomic and culture based microbial resources

Upscale of data analysis to associate microbiome structure to breed

Testing of impact of future microbial isolates in a probiotic setting

Blue BTO COFUND

InEVal

Increasing echinoderm value chains

https://www.awi.de/en/science/special-groups/aquaculture/aquaculture-research/projects/ineval.html

Project consortium includes 2 SMEs:

Portfolio of Outputs and Commercialisation Needs

Outputs

Sea cucumber technology

TRL 6

Sea cucumber aquaculture production system for fish farm site remediation.

Sea urchin technology

TRL 7

Land-based systems to ripen sea urchins on land and bespoke live urchin transport systems.

Sea star harvesting technology

TRL 8

Highly selective sea star harvesting systems for mussel farms and non-dredge/mop areas.

Sea star based shrimp feed

TRL 7

Optimised shrimp feeds incorporating low-cost sea star meal.

Commercialisation Needs

Linking biomass providers with users/processors

Moving to commercial scale

Blue BIO COFUND

MedSpon

Characterization of new antibiotic principles against WHO priority pathogens of sustainably produced marine sponges for nutraceutical applications

Portfolio of Outputs and Commercialisation Needs

Project consortium includes 2 SMEs:

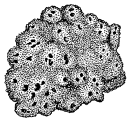
Outputs

Sponge collagen-based product

TRL 7

Contract manufacturing solutions and co-development opportunities for larger scale production.

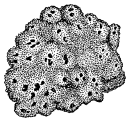
Sponge RAS production technology



TRL 4

Sustainable land-based production in closed systems for enhanced growth.

Sponge mariculture production technology



TRL 5

Sustainable production on novel artificial reefs and evaluation of in situ parameters for RAS production.

R&D sponge-based antimicrobial applications

TRL 4

Academic and industry partnerships with expertise in antimicrobial agents, genetics, and probiotic nutraceuticals.

Commercialisation Needs

- **Scale up aquaculture systems (incl. RAS)**
- **Scale up extraction methods**
- **Increase impact and market readiness**
- **Engage with academia and commercial partners**
- **Establish joint product developments**

RASBiome

Microbial management in Recirculating Aquaculture Systems for sustainable aquaculture production

https://loom.ly/VxXP440

Project consortium includes 3 enterprises:

Portfolio of Outputs and Commercialisation Needs

Outputs

Anammox bacteria for nitrogen removal from RAS water

TRL 2

Using partial nitrification combined with anammox for removal of nitrogen from Recirculating Aquaculture System (RAS) water.

Heterotrophic assimilation of dissolved N and P from RAS water

TRL 6

The Het-N strategy uses carbon-based biopellets for heterotrophic bacterial assimilation of dissolved nitrogen from Recirculating Aquaculture System (RAS) water. This allows faster start-up of systems supplementing or replacing nitrification and ensures stable water quality and reduced discharge.

Commercialisation Needs

- **Control of Dissolved Oxygen levels (Annamox)**
- **Testing in relevant lab and pilot-scale systems (Annamox)**
- **Upscaling and dimensioning (Het-N)**
- **Process design, hydraulic retention time and mixing (Het-N)**
- **Testing other types of biopellets (Het-N)**

Blue BIO COFUND

BlueBioChain

Novel biorefinery supply chains for wastewater valorisation and production of high market value bio products using microalgae

https://www.bluebiochain.eu/

Project consortium includes 1 SME & 1 LE:

Portfolio of Outputs and Commercialisation Needs

Outputs

Microalgae cultivation in wastewater

TRL 5

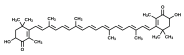
Optimised valorisation of waste water by cultivation of microalgae.

Skin cream

TRL 5

Production of cosmeceuticals from microalgae.

Food colouring agents



TRL 5

Production of food additives from microalgae.

Aquafeed

TRL 5

Production of aquaculture feeds from microalgae.

Commercialisation Needs

- **Upscaling**
- **Continue to monitor resource efficiency impact**
- **Further develop market analysis, projection scenarios, value chains**
- **Environmental impact mapping**
- **Networking with industry** (e.g. feed and cosmetics companies, aquaculture farms)

BlueBio COFUND

MuMiFaST

Mussel mitigation feeds and supply system technological development

https://bluebioeconomy.eu/mussel-mitigation-feeds-and-supply-system-technological-development/

Portfolio of Outputs and Commercialisation Needs

Project consortium includes 1 SME and 3 large enterprises:

Outputs

Commercial mussel meal

TRL 5

Bioprocessing of waste material from mussel production, including optimisation of raw product and industrial-scale processing of meals.

Waste stream byproducts

TRL 4

By-products generated from waste streams of mussel production and processing of mussel meals.

Commercialisation Needs

- **Upscaling of raw product and processing lines**
- **Informed regulatory framework for expanding industry**
- **Valorisation of ecosystem services**
- **Raising Awareness**
- **Product development for sidestream fermentation**

Blue BIO COFUND

Portfolio of Outputs and Commercialisation Needs

Preservation of underutilized fish biomasses for improved quality, stability and utilization

https://profius-project.com/

Project consortium includes: 2 SMEs & 1 Large Enterprise

Outputs

Preservation methods

TRL 5/6

Lumpfish Roe and Carcass, no relevant IPR

Processing to production of gelatin and collagen

TRL 6

BioPol IPR

Processing to production of FPH

TRL 5

Fish feed from tuna side-stream

TRL 5

Work in Malta for use by Maltese tuna industry

Commercialisation Needs

- **Testing in controlled RAS systems (ABT)**
- **Production facilities for gelatin and collagen production**
- **Lumpfish biomass e.g. from salmon farms**
- **Use of sidestreams from gelatin and collagen production**
- **Networking with industry e.g. feed companies, RAS designers**

Portfolio of Outputs and Commercialisation Needs

Enhancing and controlling the quality of cultivated seaweeds for large-scale production and a sustainable supply chain to food and feed markets

https://bluebioeconomy.eu/enhancing-and-controlling-the-quality-of-cultivated-seaweeds-for-large-scale-production-and-a-sustainable-supply-chain-to-food-and-feed-markets/

Project consortium includes 1 large enterprise and 2 SMEs:

Outputs

Preservation methods

TRL 6

Criteria for choice of preservation method, e.g. added acids or fermentation, based on composition and intended use of the biomass.

Methods for assessing biomass quality

TRL 5

Rapid, instrumental methods for determining biomass composition and state, for decisions about use and preservation method.

Monitoring and tracking systems

TRL 6

Sensors and logging systems for real-time decisions related to processing and logistics planning, and for biomass tracking.

Management Model

TRL 4

Supply chain management model for strategic planning and decisions.

Commercialisation Needs

- **Dedicated equipment and storage solutions for scale-up of preservation**
- **User demonstration and testing of hardware and digital tools**
- **Product development & demonstration** (Food, functional ingredients, materials)
- **Outreach to seaweed farmers and processors**
- **Market development**

SmartChain

Blue Bioeconomy Solutions

Smart solutions for advancing supply systems in blue bioeconomy value chains

Portfolio of Outputs and Commercialisation Needs

https://www.sintef.no/en/projects/2021/smartchain/

Project consortium includes 2 SMEs:

Outputs

Simulation Model

TRL 3

Proof of concept simulation model for sustainable utilisation, production planning, logistics optimisation and traceability to facilitate the transfer of bio-resources in fisheries and aquaculture value chains.

Data Modelling

TRL 2/3

Data modelling of the blockchain-based traceability system and the key data for the seafood supply chain.

Sustainability and Supply Chain

TRL 3

Indicators for sustainability assessment and supply-chain decision making.

Processing Co-Streams

TRL 4

Optimised scaled technological solutions for processing co-streams into high-value and functional ingredients (marine collagen production).

Next Steps

- Capacity Building
- Raising Awareness
- Upscaling
- Increased stakeholder involvement
- System Design

Blue BTO COFUND

SuMaFood

Sustainable preservation of marine biomass for an enhanced food value chain

https://sumafood.eu/

Portfolio of Outputs and Commercialisation Needs

Project consortium includes 3 enterprises:

Outputs

Demonstration cases

TRL 6

Two cases (salmon slaughter & seaweed) established waste reduction, product range extension, enhanced product quality & stability, and provision of unique products.

Marine biomass powders

TRL 6

Production of fish and seaweed powders to be used as food, ingredients or feed.

Optimised processes

TRL 6

Optimised techniques for separation and fractioning of fish residues and preservation techniques for marine biomasses.

Food Products

TRL 6

Bakery products, instant soups, pasta, and sauces with fish protein hydrolysate or seaweed.

Drying technology

TRL 7

Optimised novel drying technologies applied to marine biomass.

Commercialisation Needs

- Venture capital to scale up hydrolysis process of marine residual raw materials
- Close collaboration with fish processing industry
- Inquire into regulations pertaining to novel marine powders
- Increase impact and market readiness of marine ingredients
- Promotion of new ingredients for enhanced consumer acceptance

Blue BIO COFUND

TACO ALGAE

Total value chain optimisation of harvested *Furcellaria lumbricalis* and cultivated *Schizymenia valentinae*

https://nofima.com/projects/dye-from-red-algae/

Portfolio of Outputs and Commercialisation Needs

Project consortium includes 2 SMEs:

Outputs

Algal Harvesting

TRL 7

Furcellaria lumbricalis harvesting methodology.

Algal Cultivation

TRL 4

Schizymenia valentinae cultivation methodology.

Biorefinery

TRL 4

A complete Life Cycle Analysis for environmental, economic & social sustainability.

R-phycoerythrin & Biostimulants

TRL 4

Production of R-phycoerythrin and biostimulants from harvested and cultivated seaweeds.

Life Cycle Sustainability — Validation of value chain using Life Cycle Sustainability approach.

Commercialisation Needs

- Upscaling phycoerythrine production & purification
- Evaluation and validation of food prototypes
- Validation of pilot scale processing of seaweed
- Minimise growth of diatoms in land based cultivation tanks
- Validation of biostimulants in the field

Blue BTO COFUND

TraceMyFISH

Traceability and quality monitoring throughout the fish value chain

http://tracemyfish.hi.is/

Project consortium includes 2 SMEs:

Portfolio of Outputs and Commercialisation Needs

Intellectual Property Rights of components of the iFMS belong to **Videometer** (SME) and **SCiO** (SME) as indicated below.

iFishManagement System

Risk assessment framework for fish safety

TRL 5

Ready to be incorporated into prototype solution

Spectral imaging-based detection devices

TRL 6

VideometerLite:
- portable & wireless
- 365 - 850nm

VideometerLab:
- 365 - 970nm

AI models for fish safety assessment

TRL 5

- Tests with realistic artificial data complete
- Integrated as part of the iFMS framework

IP for AI models belongs to
- *Videometer (developed in VideometerLab software)*
- *SCiO (developed in SCiO Qvantum)*

Data platform for fish safety

TRL 5

SCiO Qvantum: supports AI-powered analytics for facilitating decision making in food systems

VideometerLab Software: desktop software for analysis and processing of spectral images

Videometer Cloud Workspace: cloud solution for data structuring and storage

Commercialisation Needs

- Generating Awareness
- Interviews with end users in seafood value chain
- User testing
- Participation in events and forums
- Alternative & innovative channels for sales

Blue BTO COFUND

BIORAS SHRIMP

Improvement and innovation of a BIO-secure Recirculating Aquaculture System for SHRIMP and additional biomass circular production

www.bioras-shrimp.eu

Portfolio of Outputs and Commercialisation Needs

Project consortium includes 4 SMEs:

Outputs

Clear water RAS

TRL 6

Recirculating aquaculture system for shrimp rearing with improved technology and husbandry efficiency.

Hybrid RAS-BFT farming system

TRL 5

Recirculating aquaculture system for shrimp rearing using biofloc as a protein rich feed source.

Effluent Treatment

TRL 7

State-of-the-art stream treatment technology for management and reuse of waste solids and dissolved substances.

AI-based water quality monitoring system

TRL 4

Optimised system design using Artificial Intelligence (AI), real time sensors, and Internet of Things (IoT) to facilitate daily operations.

Algae Culture and Aquaponics

TRL 3

Integrated systems to valorise nutrients from shrimp effluent and biomass production for expression of valuable bioactive molecules.

Commercialisation Needs

- **Scale up of closed aquaculture systems (RAS & RAS-BFT)**
- **Facilities for fertiliser production from effluent waste**
- **Scale up of 'green' extraction methods**
- **New product development from plant and microalgal extracts**
- **Market analysis for side products valorisation**

Blue BIO COFUND

BIVALVI

Advancing European bivalve production systems

Portfolio of Outputs and Commercialisation Needs

https://bluebioeconomy.eu/advancing-european-bivalve-production-systems/

Project consortium includes 1 Large enterprise, 1 SME, and associated industry partners:

Outputs

Disease identification

from TRL 1 to >6*

List of diseases in bivalve production in Norway and Ireland.

Farming technology

from TRL 4 to >7*

Protocols for farming technology for Manila clam.

Clam Selective Breeding

from TRL 2 to >6*

Selective breeding programme for Manila clam.

Blue Mussel Selective Breeding

from TRL 2 to >4*

Pilot selective breeding programme for Blue mussel with sterile end products.

Disease resistance genes

from TRL 1 to >5*

Candidate genes for bivalve disease resistance.

*indicates changes in TRL level during project

Commercialisation Needs

- **Identify biotic and abiotic threats for bivalve production**
- **Advance bivalve production systems**
- **Ensure seed supply from healthy and well performing bivalves**
- **Develop selective breeding programmes for bivalves**
- **Engage with stakeholders**

Blue BIO COFUND

BlueGreenFeed

Synergy of blue and green sectors for resilient biomass production and processing to develop sustainable feed ingredients for European aquaculture

Portfolio of Outputs and Commercialisation Needs

https://www.sintef.no/en/projects/2022/bluegreenfeed/

Project consortium includes 5 enterprises:

Outputs

Methodologies for pre-treatment & processing

TRL 4-6

Optimised methodologies for pre-treatment and processing of feathers and grass pulp to increase digestibility and bioavailability for use in feeds.

Feed ingredients

TRL 2-5

Feed ingredients from feather and grass pulp for low trophic animals (crickets, meal worms) & aquatic invertebrates (gammarid shrimps, polychaete worms).

Methodologies for processing & stabilisation

TRL 5-6

Optimised methodologies for processing and stabilising valuable ingredients from low trophic species.

Aquafeed Ingredients

TRL 5-6

Production of high value proteins and lipids for feed industry from low trophic species.

Commercialisation Needs

- **Upscaling**
- **Commercial trials**
- **Market analysis**
- **Regulatory issues**

BlueBio COFUND

Portfolio of Outputs and Next Steps

Value creation and ecosystem services of European seaweed industry by reducing and handling potentially toxic elements from breeding to soil

https://bluebioeconomy.eu/value-creation-and-ecosystem-services-of-european-seaweed-industry-by-reducing-and-handling-potentially-toxic-elements-from-breeding-to-soil/

Project consortium includes 2 large enterprises, 2 SMEs and 1 medium enterprise:

Outputs

Genetic parameters in sugar kelp for selective breeding

Advancing to TRL 5

Knowledge on phenotypic measures, and genetic parameters of sugar kelp as basis for selective breeding for different traits (e.g. growth, Potential Toxic Elements (PTE) content).

Safe soil amendment application

Advancing to TRL 5

Fundamental studies to ensure safe application of seaweed and seaweed residues as soil amendments in relation to health and environmental risks completed.

Next Steps

- **PTE analysis, estimation of phenotypic variance and correlations, interaction between genotype and environment**
- **Arsenic analysis in soil and crop samples (experiments)**
- **Carbon sequestration study in soil following application of seaweed amendment**
- **LCA, economic feasibility, cost-benefit analysis of ecosystem services, regulatory barriers, incentives**
- **Dissemination (interviews, workshops, multi-stakeholder platform) and human capacity building**

Blue Invest Sector Opportunities

Aquaculture

 Aquafeed

 Equipment

 Broodstock

 Rearing/ Harvesting

 Disease battling & fish welfare

Blue Biotechnology

 Biofuels

 Nutraceuticals

 Cosmetics

 Pharmaceuticals

 Food & Feed

 Waste Reduction

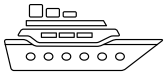
 General

Blue Biotechnology

 Fishery Services

 Fishing Gear

 Fishing

 Ship Equipment