Sustainable Blue Economy Partnership

GENERAL INFORMATION ON SELECTED PROPOSALS

2023 First Joint Transnational Co-Funded Call

“The way forward: a thriving sustainable blue economy for a brighter future»

Version 19 December 2023

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SUMMARY TABLE

AQUABALANCE

Title: Balancing economic, environmental, and social sustainability in the European aquaculture industry

Priority Area: PA4 - Green transition of Blue Food production

Sea-basins: Mediterranean Sea; North Sea; Atlantic Ocean

Countries: Denmark; Ireland; Italy; **Norway**

Consortium:

Coordinator:

Western Norway University of Applied Sciences, HVL, Norway

Partners:

- Università degli Studi di Verona, UNIVR, Italy
- University of Copenhagen, UCPH, Denmark
- Mary Immaculate College, University of Limerick, MIC, Ireland
- The Seafood Innovation Cluster, TSIC, Norway

Keywords: aquaculture, sustainability transitions, socio-economic effects, carbon footprint, multi-actor approach, sustainable aquaculture business models, pan-European perspective, policy roadmap

Abstract: Sustainable development of aquaculture is one of the main objectives of the common fisheries policy. Despite rather high profitability, the industry has been confronted with several (and mounting) environmental and ethical issues. It is therefore a need to strengthen the legitimacy of the aquaculture industry, reduce its negative environmental impact and increase its positive societal impact.

To address this need, AQUABALANCE will identify barriers and drivers for ongoing transition processes, investigate dilemmas associated with rebalancing the economic, environmental, and social dimensions, analyse how the aquaculture industry can ensure legitimacy, and explore the role of policy for these transition processes.

The project follows a pan-European perspective by focusing on different geographical locations and different sea-basins (North Sea, Mediterranean Sea, Atlantic Ocean), and maps existing and promising solutions boosting the sustainability and viability of the aquaculture industry.

Specifically, based on a mix of qualitative and quantitative methods, it will create new knowledge about how the European aquaculture industry can develop onwards in ways that are not environmentally harmful, and contribute to value creation and value capture

both locally, nationally, and internationally.

By combining several theoretical perspectives (economic geography, socio-technical transition studies, and literature on sustainable business models), the proposed project will provide valuable research-based insight and action points on an efficient and smart industry policy in order to successfully cope with the societal challenges of promoting economically robust, environmentally friendly, and socially inclusive industrial activities.

Moreover, the project follows the multi-actor approach and includes a substantial degree of stakeholder engagement through various activities such as workshop and seminar series and a policy lab, which will allow a high potential for impact beyond the academic world and contribute to the uptake of AQUABALANCE's research findings.

As a result, AQUABALANCE will provide pan-European and regional industry and policy advice and a policy roadmap that has a transnational perspective and also can be adapted to the regional specificities. These recommendations will serve as a background for a more sustainable growth of the aquaculture industry, contributing to achieving the goals of the EU Farm to Fork strategy, solving grand challenges of climate change and social justice, and thereby generating significant value for the whole society.

AquaUp

Title: Aquafeed Upgraded: Enhancing Immune Function with Seaweed-modified Functional Compounds

Priority Area: PA3 - Climate-neutral, environmentally sustainable and resource-efficient blue food and feed

Sea-basins: North Sea; Atlantic Ocean

Countries: Ireland; Italy; Netherlands; **Norway**

Consortium:

Coordinator:

Norwegian Institute of Bioeconomy Research, NIBIO, Norway

Partners:

- NORCE Norwegian Research Centre, NORCE, Norway
- Alma Mater Studiorum Università di Bologna, UNIBO, Italy
- University College Cork, UCC, Ireland
- Technological University Dublin, TU Dublin, Ireland
- Wageningen University, WU, Netherlands

Self-funded Partners:

- Seaweed Solutions AS, Norway
- Arctic Seaweed, Norway

Keywords: blue economy, biorefining, algae, feed-ingredient, low-trophic, gut microbiota, immunomodulation, disease-resistance, blue-to-blue, impact assessment

Abstract: The aquaculture industry is anticipating intensive production growth to meet future food demand. Yet, this growth is constrained by a number of challenges, not least including disease spread and use of antibiotics and chemicals to combat or reduce disease outbreaks.

To support fish health, alternative aquatic feeds need to be added with immune-stimulating functional ingredients. Seaweed is a promising aquaculture feed crop due to its rapid growth rate, carbon sequestration properties, and valuable biomass supply it provides without the need for fertilization. It also can potentially be a valuable source of nutrients in fish feed.

However, the use of unrefined seaweed is hampered by the presence of anti-nutritional compounds such as high levels of non-starch polysaccharides, phytases, and tannins that reduce nutritional digestibility and, consequently, fish health and aquaculture productivity.

Pre-treatment technology to sustainably (cost-effective, scalable, and environmentally

responsible) unlock the potential of seaweed bioactive compounds is not well-established.

In response, a biorefinery process can help extract seaweed's nutritional components and convert them to high-value products for various applications. However, the current extraction process involves harmful chemicals (acid or alkali).

Therefore, significant progress is needed to develop extraction and purification technologies that can contribute to a sustainable and circular blue economy.

Screening and identification of seaweed-derived functional compounds are also required to assess their functional properties like immunomodulatory, antimicrobial, antioxidant, and prebiotic effects. Here, in-vitro cell culture is an efficient screening tool for assessing the functionality of novel bioactive molecules as it enables efficient and cost-effective control and manipulation of experimental conditions for compound screening.

This needs to be complimented and validated using in vivo studies. While several studies have investigated native compounds' effects on immune function in fish, determining the functionality of seaweed-derived compounds is in its early stage of R&D. Finally, there is a lack of information on the environmental and economic impacts of seaweed-based functional ingredients compared to existing conventional functional ingredients.

The above knowledge gaps identified will be addressed in this project to use of seaweed-modified ingredients in aquaculture. Our objective is to investigate seaweed-modified functional compounds in aquatic feed to improve growth, immune response, and disease resistance.

ARCFISH

Title: Digital Twin of the Ocean for Arctic Fisheries

Priority Area: PA5 - Digital Twin of the Ocean (DTO) test use cases at EU sea-basins and the Atlantic Ocean

Sea-basins: Arctic

Countries: Denmark; Iceland; **Norway**; Poland; Portugal

Consortium:

Coordinator:

STIFTELSEN NANSEN SENTER FOR MILJO OG FJERNMALING, NERSC, Norway

Partners:

- Kongsberg Discovery, Kongsberg, Norway
- EurOcean Foundation, EurOcean, Portugal
- Institute of Oceanology Polish Academy of Sciences, IOPAN, Poland
- AARHUS UNIVERSITET, AU, Denmark
- Matís Ohf., Matis, Iceland
- Trackwell hf., Trackwell, Iceland

Self-funded Partners:

- Brim hf., Brim, Iceland

Keywords: Arctic, fisheries, digital twin of the ocean

Abstract: ARCFISH will develop a pilot Digital Twin of the Ocean (DTO) Platform delivering new data products and services in support of sustainable Arctic Fisheries.

These data products and services will be co-designed with stakeholders in the fisheries sector and used to create products such as ecosystem indices that can be applied in fisheries planning and management.

Available data sources and gaps will be analysed to fulfil user needs and ingest relevant data into the Blue Insight DTO Platform. They include:

(1) oceanographic data from research vessels, autonomous mobile platforms, fixed buoys, and ships of opportunity such as e.g., fishing vessels,

(2) met-ocean-ice forecasts and reanalysis from models (e.g., from CMEMS and INTAROS),

(3) fisheries management data (e.g., fisheries stocks, species) from ICES and national sources, and

(4) reference data (e.g., bathymetry, economic zones, AIS data).

Based on the stakeholder needs, a use case for sustainable fisheries will be implemented using the ingested data and tools for generating customised products. The use case will address two geographic regions,

the west coast of Greenland centred around the rich fishing grounds surrounding Disko Bay, and the region around Iceland, northwards to the Svalbard archipelago and the Barents Sea. Using the compiled data and developed tools, a regional database of climate, environmental, and fisheries data will be created and made available through an open data repository to support sustainable Arctic Fisheries.

This important asset will contribute to the Sustainable Blue Economy Partnership (SBEP) program by providing new data products that can be utilised in digital twin platforms to support decision-making in fisheries management.

The Blue Insight Platform developed by Kongsberg Discovery, Norway, will be part of the Digital Twins of the Ocean (DITTO) program of the UN Decade of Ocean Science for Sustainable Development. As part of DITTO and through engagement with other running Digital Twin projects and initiatives such as EDITO, ILIAD, Blue-Cloud2026 and EOSC, ARCFISH development will follow standards for data exchange and implementation of services and tools in the EU DTO.

ARCFISH will prepare training material for using the Blue Insight DTO and organise capacity building events for stakeholders and other SBE projects.

Training will be organised in conjunction with project meetings and SBEP seminars. Furthermore, the regional database, developed services and tools, training and promotional material will be promoted through the iAOS portal from INTAROS, a public project website linked to relevant DTO sites, and dedicated social media channels.

ARCFISH results will also be promoted through the partners extensive network of Arctic observing and data management, digital technologies, capacity building in ocean literacy, stakeholder interaction and fisheries.

Blue Bio Boost

Title: Boosting seaweed farming through better utilization of genetic resources

Priority Area: PA3 - Climate-neutral, environmentally sustainable and resource-efficient blue food and feed

Sea-basins: North Sea; Atlantic Ocean; Skagerak

Countries: Belgium; Ireland; **Norway**; Sweden

Consortium:

Coordinator:

Norwegian University of Life Sciences, NMBU, Norway

Partners:

- Seaweed Solutions AS, SES, Norway
- University of Gothenburg, GU, Sweden
- EIGEN VERMOGEN VAN HET INSTITUUT VOOR LANDBOUW- EN VISSERIJONDERZOEK, EV-ILVO, Belgium
- SINTEF Ocean AS, Norway
- Irish Seaweed Consultancy Ltd., ISC, Ireland
- Marine Institute, MI, Ireland

Keywords: aquaculture, biodiversity, breeding, cultivation, genetic resources, macroalgae, sea lettuce, Seaweed, strains, sugar kelp

Abstract: The European macroalgae industry has a considerable potential to contribute to critical societal challenges such as carbon neutrality, access to nutritious and sustainable food, and a sustainable and circular European bioeconomy.

We aim for sustainable economic development of the macroalgae industry by:

(i) improving the efficiency of propagation and selection of suitable genotypes,

(ii) better exploiting genetic variation, while at the same time maintaining local genetic diversity and minimizing the potential for genetic pollution of natural populations, and

(iii) actively involving stakeholders in creating a plan for future macroalgae breeding in Europe.

In the proposed Blue Bio Boost (BBB) project, we will test innovative strategies and novel methods that utilize properties of macroalgal life cycles, hybrid vigour (heterosis), and the adaptation to the local environment and culturing conditions, to obtain this goal

Through a Proof of Concept experiment we will test a simple way of utilizing local genetic variation and heterosis for improved productivity that will result in minimal change in

allele frequencies relative to the surrounding natural population, thus mitigating the potential effect of genetic exchange. BBB will create a biodiversity collection of kelp gametophytes, identify methods to increase gametophyte growth rates, and develop gametophyte phenotyping protocols for growth rate and light and temperature tolerance. Building on results from this experiment, we will design future strategies for optimized use of hybrid vigour.

Finally, BBB will develop tools based on ploidy manipulation and determination for breeding purposes and explore the utility of giant sea lettuce in aquaculture.

The developed methods and technologies will create strong incentives-to-invest in future algae breeding, while access to high-yield seeding materials adapted to local conditions will stimulate seaweed aquaculture production and processing that channel customized biomass to dedicated seaweed applications, and all associated material and service providers, thus providing food, feed and raw materials for a growing population.

Furthermore, BBB will provide crucial insights into the genetic diversity of natural populations and cultivated material, and allow monitoring, evaluating, and/or mitigating the extent of genetic exchange from the onset of large-scale cultivation in co-existence with natural populations.

As an alternative to developing seeding materials for production sites, breeding methods that create seeding materials with specific genetic compositions may also be used for kelp forest restoration.

Since our approach promotes using local natural resources for local aquaculture production, it will stimulate coastal livelihoods and short-chain production systems, while utilizing the climatic, environmental and genetic diversity along the European coastline, creating impact at scale.

Blue Boost

Title: Culture of a wide range of low trophic species to boost sustainable production of Blue Food and reduce environmental footprint

Priority Area: PA3 - Climate-neutral, environmentally sustainable and resource-efficient blue food and feed

Sea-basins: Mediterranean Sea; Baltic Sea; Atlantic Ocean

Countries: Brazil; Finland; Italy; Poland; Portugal; **Spain**; Sweden; United Kingdom

Consortium:

Coordinator:

IRTA, Spain

Partners:

- University of Helsinki, UH, Finland
- S2AQUA - Collaborative Laboratory, Association for a Sustainable and Smart Aquaculture, S2AQUA, Portugal
- West Pomeranian University of Technology in Szczecin, ZUT, Poland
- International Marine Centre, IMC, Italy
- Universidade Federal do Rio Grande - FURG, FURG, Brazil
- CREA, Italy
- Federal University of Santa Catarina, UFSC, Brazil
- RISE Research Institutes of Sweden, RISE, Sweden
- Piscicultura Vale da Lama Lda, PVL, Portugal

Self-funded Partners:

- Notpla Ltd., Notpla Ltd, United Kingdom
- ASSOCIAZIONE PISCICOLTORI ITALIANI, API, Italy
- Ministero dell'agricoltura, della sovranità alimentare e delle foreste, MASAF, Italy
- Water Science and Technology Institute - H2O SciTech, H2OScitech, Poland
- Associazione Mediterranea Acquacoltori,, AMA, Italy
- UNIVERSIDADE DO VALE DO ITAJAI, UNIVALI, Brazil
- Empresa de Pesquisa Agropecuária e Extensão Rural de Santa Catarina, EPAGRI, Brazil
- Federation of Mollusc Producers of the Ebro Delta, FEPROMODEL, Spain

Keywords: Aquaculture; Integrated Multitrophic Aquaculture; Life cycle assessment; Omnivorous fish; Macroalgae

Abstract: BLUEBOOST fits priority area 3.2.3 and aims to demonstrate that co-culture of a wide range of low trophic species with established species can boost current European

aquaculture of blue foods and feeds while reducing the environmental footprint and moving towards a carbon-neutral aquaculture blue economy.

The consortium consists of partners from eight countries (Spain, Portugal, Poland, Italy, Brazil, Sweden, UK, Finland) and three seas / oceans (Atlantic – north and south, Mediterranean, Baltic). Partners are experts in the ecology, hydrobiology, culture of low trophic species, integrated multitrophic aquaculture (IMTA), economics and life cycle assessment (LCA) of blue food and feed production.

BLUEBOOST aims to provide knowledge based solutions that will enable the aquaculture industry to overcome bottlenecks that inhibit Governments and businesses, following an impact pathway that can increase the volume and diversity of aquaculture products, reduce environmental footprint towards a carbon-neutral economy, raise the circularity and competitiveness of the blue economy, provide new products, restore ecosystems, create jobs and increase ecosystems resilience against climate change.

The partners will work with six different IMTA systems and a wide range of species from different trophic levels to evaluate the use of waste streams from traditionally farmed species to provide nutrients and feed for low trophic species. The nutrients and carbon fluxes will be mapped, and the environmental footprint of six systems with and without IMTA, determined employing LCA to demonstrate the benefits and trade-offs of incorporating extractive low trophic species in combination with traditional aquaculture species.

Self-financed partners will examine new products, use of macroalgae for sustainable food packaging and test low trophic blue feed ingredients in the diets of marine organisms.

To restore ecosystems, threatened oysters species will be farmed in Italy and Spain, whereas coastal ponds of the Ebro Delta will be offered as new aquaculture sites and protection against climate change related sea level rise and storm intensification.

We envisage that BLUEBOOST will involve (co-creation/co-design) and impact all stakeholder levels providing societal value creation such as:

(a) technical advances that provide new sustainable production methods and products;

(b) reduced environmental footprint of blue food and feeds;

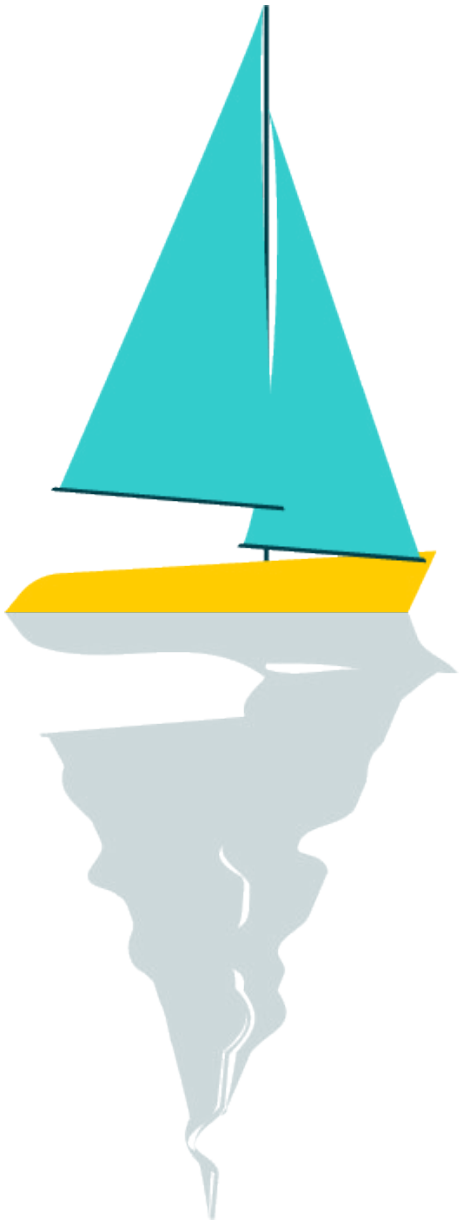
(c) environmental restorative aquaculture practices;

(d) improved economics with increased volume and diversity of production;

(e), policy-making to provide conditions for and to drive desired change and

(f) low carbon products and business investments to meet

consumer demand. This win-win scenario will deliver improved diversification of blue foods and feeds and, at the same time, increase production volumes and quality, to improve the competitiveness of European and Brazilian aquaculture while reducing the industries environmental footprint.



BluEcho

Title: From science to policy: assessing impacts and developing solutions for ship traffic and offshore wind farms through detailed soundmaps

Priority Area: PA1 - Planning and managing sea uses at the regional level

Sea-basins: Mediterranean Sea; Baltic Sea; North Sea; Norwegian Sea, Polar Oceans

Countries: Germany; **Italy**; Norway; Sweden

Consortium:

Coordinator:

University of Trieste, UNITS, Italy

Partners:

- Havforskningsinsituttet, IMR, Norway
- Chalmers tekniska högskola AB, Chalmers, Sweden
- National Institute of Oceanography and Applied Geophysics, OGS, Italy
- Alfred-Wegener-Institute Helmholtz Centre for Polar and Marine Research, AWI, Germany

Keywords: wind farms, ship traffic, sound propagation modeling, sound speed maps, economic analysis, marine ecosystems, low-underwater noise areas

Abstract: Owing to the synergy among research institutions from Italy, Germany, Sweden, and Norway, BluEcho aims to improve the sustainability of the shipping and wind farm industries and conserve species biodiversity by assessing noise impacts on marine fauna and evaluating the efficiency of various acoustic mitigation measures to reduce noise levels.

Our comprehensive approach will adopt a combination of numerical simulations, fieldwork, and desktop studies to provide critical data for the design of low-noise Marine Protected Areas implemented in the Mediterranean Sea, the North Sea, the Baltic Sea, the Norwegian Sea, and the Polar Oceans.

Data from the more pristine polar regions will serve as a benchmark for comparison with areas with high shipping traffic recorded in the other sea basins.

Sound produced by wind turbines and ship propellers will be reproduced in detail with cutting-edge numerical techniques and will serve as input for producing detailed sound maps. In particular, the Hywind Tampen wind farm case study in the Norwegian Sea will serve as a starting point to develop similar sustainable technologies in other

sea basins. Model validation, resulting from the joint effort of the partners, will lead to fine-tuning and optimization processes for the numerical tools.

The numerical modeling will generate accurate three-dimensional sound maps resulting from existing models and in-house codes that will provide useful information on the effective noise-generation mechanisms. The maps will guide the process of identification of mitigation measures of noise emission.

Noise reduction measures already taken into consideration by various ship-building firms will be evaluated for their effectiveness with a science-based approach. Underwater noise impacts will be assessed on selected marine taxa tailored to each sea basin.

The joint effort among the partners will contribute to implementing a coordinated international approach to effectively manage underwater noise pollution.

The project will deliver an economic analysis of costs and benefits coupled with a marine spatial planning analysis. Given the difficulty to reliably monetize benefits, a cost effectiveness analysis is suggested to find the best balance between noise reduction and economic cost minimization. Starting from the list of measures that can be adopted to reduce noise, we will analyze their cost components: investment and variable cost.

The project's results will use marine data from Copernicus Marine service and EMODnet and will be broadly available and accessible to decision-making bodies and represent a benchmark for the relevant stakeholders.

Long term impacts of BluEcho will be:

1) the contribution to the development of new decision-support tools;

2) the promotion and integration of initiatives and support to interconnectivity of policies among regional sea basins;

3) the enhanced cooperation, co-design, and activity alignment with stakeholders beyond academia.

BLUEWAYSE

Title: BLUE WAY to a Sustainable Europe

Priority Area: PA3 - Climate-neutral, environmentally sustainable and resource-efficient blue food and feed

Sea-basins: Mediterranean Sea; Baltic Sea; North Sea; Atlantic Ocean

Countries: Italy; **Norway**; Portugal; Spain; Sweden

Consortium:

Coordinator:

Nofima AS, Nofima, Norway

Partners:

- Seagarden AS, SEA, Norway
- Consiglio Nazionale delle Ricerche - Istituto di Scienza, Tecnologia e Sostenibilità per lo Sviluppo dei Materiali Ceramici, CNR-ISSMC, Italy
- Lund University, LUND, Sweden
- University of Valencia (UVEG), UVEG, Spain
- A4F - Algafuel, SA, A4F, Portugal
- Algikey, Algae Based Solutions SA, ALGIKEY, Portugal
- Instituto Superior de Agronomia, ISA - UL, Portugal

Keywords: fish sidestreams, algae biorefinery, healthy food, functional feed, nutritional supplements, safer cosmetics, bioblocks

Abstract: The atmospheric CO2 levels recently reached levels that are 50% higher than in the pre-industrial times.

BLUEWAYSE proposes a significant cut in the CO2 emissions of the food and feed sectors, creating synergies and exploiting opportunities to achieve environmental and health benefits via economic sustainability.

BLUEWAYSE will develop and promote novel, zero-waste biorefinery approach-based blue ways of exploiting marine resources, paving the way for a climate-neutral, environmentally sustainable, and resource-efficient food and feed sectors in Europe.

Fisheries and aquaculture sidestream biomass will be processed to create food supplements and the sidestreams thereof will be used for:

a) the production of biomaterials using the bone and scales biomass,

b) the production of low marine salmon feeds and

c) the cultivation of microalgae using fish hydrolysate nanofiltration permeates rich in minerals and water soluble nitrogenous compounds of small molecular weight until

now discarded.

The cultivated microalgae biomass will be fractionated for maximum value creation by application-specific fraction optimization. Solids will be used in functional food products, such as bread, and oil and water soluble fractions, rich in antioxidants and immune stimulating compounds will be exploited as aquaculture feed additives, nutritional supplements to enhance male fertility and healthier sunscreen creams.

The safety of the BLUEWAYSE ingredients and products will be evaluated against regulative standards, environmental, social and economic sustainability. The project results will be communicated early on to inspire and promote collaboration and product co-creation with stakeholders, and disseminated through popular and scientific publications, concluding by the BLUEWAYSE conference.

CliN-BluFeed

Title: A low CO2 smart autonomous multiplatform system to monitor and forecast Calanus finmarchicus stock - a new sustainable climate neutral blue fish feed

Priority Area: PA3 - Climate-neutral, environmentally sustainable and resource-efficient blue food and feed

Sea-basins: North Sea; Atlantic Ocean; Norwegian Sea; Barents Sea

Countries: Cyprus; Germany; **Norway;** Poland; Portugal

Consortium:

Coordinator:

akvaplan.niva, APN, Norway

Partners:

- Instytut Oceanologii Polskiej Akademii Nauk, IO PAN, Poland
- ASSOCIACAO PARA O DESENVOLVIMENTO DO ATLANTIC INTERNATIONAL RESEARCH CENTRE, AIR Centre, Portugal
- Cyprus Subsea Consulting and Services C.S.C.S. Ltd, CSCS, Cyprus
- Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforschung, AWI, Germany

Keywords: Low Co2 emission monitoring system, autonomous vehicles, smart sensors, remote sensing, climate neutral blue fish feed, resource management

Abstract: The CliN-BluFeed project ambitions to develop and use a low-CO2 smart autonomous multiplatform system to monitor and forecast Calanus finmarchicus stock which is a new sustainable climate neutral blue fish feed for the growing aquaculture industry.

The project addresses priority No. 3 “Climate-neutral, environmentally sustainable, and resource efficient blue food and feed” of JPI Oceans SBEP 2023. It covers the three highlighted issues of priority no. 3:

(i) reduction of bycatch,

(ii) exploration of the potential of low trophic level species in fisheries for fish feed production for the aquaculture industry and

(iii) Increasing the supply of blue food by utilizing new sustainable marine resources.

We aim to broaden the spatial, temporal and biological resolution and coverage of C. finmarchicus in-situ monitoring by combining optical and acoustic sensors on autonomous surface (Sailbuoy with echosounder) and underwater (Seaglider ; Slocum with UVP6 and echosounder) vehicles and earth-orbiting satellites (LIDAR and RGB).

We will use this in-situ data in

tandem with ex-situ experimental assays and mechanistic simulation modelling to generate real-time predictions of C. finmarchicus abundance, biomass, population dynamics and the vertical and horizontal distributions of the stock in the Norwegian Sea.

The project will:

1) optimize an optical sensor (UVP6) for real-time in-situ identification of C. finmarchicus and other co-occurring plankton and micronekton, and estimation of their abundances and size-structure.

2) characterize the zooplankton and micronekton community characterization and quantification towards identification of potential bycatch composition and reduction of bycatch during harvesting operations using optical and acoustic sensors installed on autonomous vehicles.

3) advance the present understanding of how external environmental variables influence C. finmarchicus vertical behavioral and abundance dynamics during the harvesting season.

4) Describe C. finmarchicus transcriptomic rhythmicity in the field and determine to what extend different environmental cues and internal rhythm regulators drive diel behavior.

5) Map the three-dimensional spatial distributions of C. finmarchicus in the harvesting area using ocean color and LiDAR remote sensing technologies and

6) forecasting of C. finmarchicus stock size and 3D spatial distributions.

The project will deliver processed data products to multiple stakeholders and end users (regulatory agencies, state owned data portal, repository database, fishery etc).

CliN-BluFeed will promote a climate neutral fish feed production for a growing aquaculture industry across Europe and the world through the delivery of cutting-edge high-quality data to stakeholders for managing the stock of C. finmarchicus in a sustainable manner.

The project will ultimately ensure the growing production of blue food for the European and world population and support the green deal.

DTO-TRACK

Title: Digital Twin of the Ocean: Animal Tracking

Priority Area: PA5 - Digital Twin of the Ocean (DTO) test use cases at EU sea-basins and the Atlantic Ocean

Sea-basins: Mediterranean Sea; Baltic Sea; North Sea; Atlantic Ocean

Countries: Belgium; Canada; Denmark; France; Germany; **Ireland;** Netherlands; Norway; Sweden

Consortium:

Coordinator:

Loughs Agency, LA, Ireland

Partners:

- Flanders Marine Institute, VLIZ, Belgium
- Technical University of Denmark, DTU, Denmark
- France Energies Marines, FEM, France
- NORCE NORWEGIAN RESEARCH CENTRE AS, NORCE, Norway
- GEOMAR Helmholtz Centre for Ocean Research Kiel, GEOMAR, Germany
- Swedish University of Agricultural Sciences, SLU, Sweden
- Wageningen University, WU, Netherlands
- Institut Français de Recherche pour l'Exploitation de la Mer, IFREMER, France

Self-funded Partners:

- Dalhousie University, Ocean Tracking Network, OTN, Canada

Keywords: analytics, marine, biodiversity, digital twin, telemetry, fish movements, connectivity, marine fauna migrations, integrated data management, multi-species

Abstract: The ocean is a wickedly challenging area to conduct scientific research. Marine fish evolve in an environment that is not readily accessible (immersed, offshore) leading to fragmented, and sometimes non-existent, knowledge of species distribution and ecology.

The concept of generating digital twins of the ocean is borne from the necessity of having tools and methodologies available to support research and management activities on Europe's seas.

In this context, data and tools derived from mapping and animal tracking can support efforts aimed at facilitating modelling and simulations for fisheries management and

spatial planning. Digital twins have largely focused on physical features of the oceans, especially bathymetric mapping, water circulation, and physicochemical properties; however, biological digital twins developed from animal tracking are highly promising to support management actions and key policy like the EU Common Fisheries Policy and the Marine Strategy Framework Directive.

Animal tracking (acoustic, archival telemetry) has emerged as a valuable scientific tool for marine ecology and oceanography. Animal movement is an essential ocean variable1, but one that is generally challenging to ascertain because of the highly dynamic nature of animal movement at the immense scale at which it must be observed, and because GPS signals cannot reach satellites from under water.

Technological advances in aquatic animal telemetry technologies have allowed for near-continuous remote observation of marine animals after initial capture. Innovations driven forward by the European Tracking Network (ETN) are entrenching telemetry as a key tool for tracking aquatic species in Europe, and will support the development of a digital twin of the North Sea fauna in this project. DTOTrack will leverage existing telemetry infrastructure in eight different European nations along with a dedicated international digital infrastructure housed at VLIZ (ESFRI LifeWatch and Horizon Europe Bioflow), and the new Horizon Europe STRAITS project, which is instrumenting major acoustic telemetry receiver lines along the Danish Straits and the Celtic Straits to develop a digital twin of North Sea fauna.

In this project, eight North Sea member states will collaborate to deploy regional infrastructure (tags and receivers), and leverage existing physical (STRAITS project lines) and digital infrastructure (LifeWatch ETN database) to develop a digital twin of the North Sea's fauna.

Funding will be leveraged to coordinate animal tagging studies across countries to test hypotheses about animal migration and behaviour, overlap with offshore developments, and to address 'what if' scenarios of interest to managers, developers, and conservation organisations, using novel data streams and integrated tools.

FAMOS

Title: Sustainable, Reliable and Socially Acceptable Modular Floating IslAnds for Multi-use Offshore Spaces

Priority Area: PA2 - Development of offshore marine multi-use infrastructures to support the blue economy

Sea-basins: Mediterranean Sea; Baltic Sea; North Sea

Countries: Cyprus; **Italy;** Norway; Poland

Consortium:

Coordinator:

Università degli Studi di Firenze, UNIFI, Italy

Partners:

- University of Agder, UIA, Norway
- Jagiellonian University, JU, Poland
- University of Cyprus, UCY, Cyprus

Keywords: multi-use offshore spatial concepts, multi-use offshore infrastructures, Floating Islands, Floating Breakwaters, Marine Renewable Energies, Numerical Modelling, Experimental Modelling, Social Acceptance, Theory of Change

Abstract: The growth of the world's population over the past decades has been impressive. Present estimates show that the process is likely to achieve a peak of 11 billion within the next 100 years. Such massive growth implies an ever-increasing need for space (urban, infrastructural, industrial), resources (water, energy, food) and economy.

The ocean plays a crucial role in this challenge. FAMOS aims to contribute to the thematic priority of development of offshore marine multi-use spatial concepts.

From our perspective, pivotal questions include: is humanity ready to live on the ocean surface due to a lack of functional land? How do we create sustainable, reliable, and socially acceptable multi-use offshore spaces?

Adopting floating structures appears more sustainable than using bottom founded structures both in terms of environmental and economic aspects. Although some aquaculture or solar energy devices have been developed based on floating sub-structures, most of them are limited to near-shore areas in relatively shallow waters and mild wave conditions.

To fully exploit exposed offshore marine areas, FAMOS must go beyond the state of the art by addressing significant challenges posed by possible occurrences of enormous waves. Considering

the size of FAMOS in respect to the call, to balance resources and efforts the project will focus on the achievement of the following detailed objectives:

1) Design and demonstrate novel floating island concepts in three European basins: Mediterranean, North, and Baltic Seas.

2) Assess the synergies among the islands and breakwater and understand the risks and failure of key structural components.

3) Develop efficient and accurate computational models for prediction of hydrodynamics, structural dynamics, and power performance of the multiple renewable energy devices.

4)To boost the impact beyond the academic world by involving relevant stakeholders from the conceptualization phase up to the uptake of research findings into decision-making processes and policymaking.

FAMOS will benefit from the other assets already developed and available to its partners via participation in EU projects, namely: MARINET1 FP7 No262552, MARINET2 H2020 No731084, WECANET Cost Action 17105, MODENERLAND Cost Action 20109, Energy-SHIFTS H2020 No826025, gEneSys Horizon Europe No 101094326.

The project team adopts an interdisciplinary approach and considers various aspects: social and environmental, concept and configuration, floating structure technology, numerical and experimental methods.

The pathways to achieve expected outcomes and impacts are driven by the logic of the theory of change.

This transdisciplinary and participatory approach focuses on the actors and the context of change to achieve real and desired socio-technical change. It goes beyond mere social acceptance concepts and offers more inclusivity in involving social actors from the beginning, during, and at the end of the research and technology development process.

FOODIMAR

Title: sustainable climate-Friendly quality fOOD Ingredients from MArine side-stReams

Priority Area: PA3 - Climate-neutral, environmentally sustainable and resource-efficient blue food and feed

Sea-basins: Mediterranean Sea; Baltic Sea; North Sea

Countries: Belgium; Denmark; **Germany**; Norway; Sweden; Türkiye

Consortium:

Coordinator:

SUBMARINER Network for Blue Growth EEIG, SUB, Germany

Partners:

- Sintef Ocean AS, SINTEF, Norway
- Chalmers University of Technology, CHALMERS, Sweden
- Tetis Biyoteknoloji Arastırmaları ve Egitim Danısmanlıgı Hizmetler A.S., TETIS, Türkiye
- Syddansk Universitet (University of Southern Denmark), SDU, Denmark
- Universiteit Gent, UGENT, Belgium

Keywords: fisheries, aquaculture, side-streams, by-catch, valorisation, sustainability, functional ingredients, healthy food, innovation, bioactives

Abstract: Today's food systems face numerous challenges, with climate change being a major one. Fisheries and aquaculture are particularly vulnerable to the adverse effects of climate change. Simultaneously, seafood plays a critical role in the transition towards more sustainable and nutritious food systems.

How can we enhance the resilience of the European seafood value chains?

How to improve resource use efficiency and sustainability within the seafood industry?

The seafood processing industries generate substantial quantities of side-streams, often discarded, or used for low-value purposes such as animal feed or fish oil. However, these side-streams represent a valuable source of bioactive compounds with the potential for added value in higher-end markets, such as nutraceuticals and functional foods.

FOODIMAR aims to develop new industry-relevant solutions from fisheries and aquaculture side-streams for climate-friendly, cost-effective, sustainable, and high-quality food market applications. The project centers

around three pilot studies:

(1) the Norwegian pilot focuses on fisheries side-streams from the North Sea,

(2) the Danish pilot revolves around the utilization of jellyfish by-catch from the Baltic Sea, and

(3) the Turkish case deals with aquaculture side-streams from the Mediterranean Sea.

These pilot studies serve a dual purpose: they showcase representative value chains in European regions and sea basins while simultaneously developing solutions tailored to each unique context. This approach ensures that the solutions are not only effective at the local level but also possess broad applicability across Europe.

FOODIMAR's consortium comprises six partners, including a commercialization partner from Turkey, all of whom bring substantial knowledge and expertise gained from projects like WaseaBi, GoJelly!, SeaSnacks, and Baltic Blue Biotech Alliance. This collective experience in the valorization of marine resources and innovation is a cornerstone of the project's success.

FOODIMAR is committed to developing innovative, cost-effective, and climate-friendly methods to produce high-quality marine collagen, gelatin, and glycosaminoglycans (GAGs) to meet the industry and consumers' needs.

The smart valorisation of side-streams and a shift towards a circular economy, contribute not only to the physical and economic resilience of the European seafood value chains but also to the environmental and ecological sustainability of the industry.

FOODIMAR's innovations exceed current standards and facilitate further development, assessment, training, knowledge transfer, diversification, industry uptake, and job creation. In the long term, FOODIMAR's impact will yield a clear, reproducible blueprint for high-quality resilient, ecologically sound food-grade solutions, ensuring food and nutrition security within planetary boundaries.

FunSea

Title: Functional processing of cultivated seaweeds for novel food products

Priority Area: PA3 - Climate-neutral, environmentally sustainable and resource-efficient blue food and feed

Sea-basins: Baltic Sea; Atlantic Ocean

Countries: Denmark; Germany; **Norway**; Sweden

Consortium:

Coordinator:

SINTEF AS, SINTEF, Norway

Partners:

- Seaweed Solutions AS, SES, Norway
- Aalborg University Department of Planning, AAU, Denmark
- Lund University, ULUND, Sweden
- Fraunhofer Gesellschaft zur Förderung der angewandten Forschung EV (FHG), Fraunhofer, Germany
- wunderfish GmbH, BettaF!sh, Germany
- Marine centre Simrishamns municipality, MC, Sweden

Keywords: Algae, seaweed, residual raw material, fermentation, plant-based food, enzymes

Abstract: One of our most pressing societal challenges today is feeding the growing world population in a sustainable manner.

The present global food system causes major environmental problems, including land degradation, loss of biodiversity, greenhouse gas emissions, water usage and pollution.

There is thus a great need for novel food resources that are healthy, safe, and nutritious, and at the same time cause less emission of greenhouse gases, pollutants, and excess nutrients, and do not further compromise the sustainability and biodiversity of natural resources.

Cultivated macroalgae are a staple of the Asian diets and can have a bigger contribution to more sustainable food systems, but still faces challenges in penetrating western markets due to an inherently low nutritional content, low versatility and inclusion rates in foods because of sensory properties, lacking innovation in product development, and knowledge gaps regarding safety and health benefits.

The FunSea project aims to enhance nutritional quality, safety and functional properties of

cultivated brown and green algae as food ingredients, through development of new sustainable processing technologies and utilization of side streams and residual biomass from seaweed production as well as other aquaculture industries and fisheries.

The project will further develop and characterize novel food prototypes toward a wide European market, and assess environmental, economic, and regulatory aspects along the value chain from biomass production to finished products.

The consortium consists of four research partners (SINTEF, Lund University, Aalborg University, Fraunhofer IMTE), one public body (Marine centre Simrishams municipality) and two industry partners (Seaweed Solutions, Bettafish) representing four countries (Norway, Sweden, Denmark, and Germany) and will utilize marine resources from the Atlantic Ocean and Baltic Sea.

Key technologies in the project include biomass cultivation and pre-processing, enzymatic and microbial processing, food technology, and environmental analysis.

The FunSea project will develop new knowledge, methodology and prototypes based on renewable and sustainable marine biomasses, contributing to the growth of the blue economy, development of scientific excellence, and solutions toward key societal challenges.

INSPIRE

Title: Innovative design and operation for rare earth material reduction and optimized lifetime for next generation offshore wind-based hydrogen production

Priority Area: PA2 - Development of offshore marine multi-use infrastructures to support the blue economy

Sea-basins: Baltic Sea; North Sea; Atlantic Ocean

Countries: Belgium; Germany; **Norway**

Consortium:

Coordinator:

Norges teknisk-naturvitenskapelige universitet, NTNU, Norway

Partners:

- Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V., Fraunhofer, Germany
- University of Bremen, IALB, Germany
- Vrije Universiteit Brussel, VUB, Belgium
- Siemens AG Technology, Technology, Germany

Keywords: green hydrogen, Offshore wind turbine, rare earth elements

Abstract: In the green hydrogen - the hydrogen from renewable energy such as offshore wind - the rare earth materials (REE) play an important role in the magnet and catalyst needed for both offshore wind and the hydrogen production, respectively.

The high production concentration, a growing Chinese domestic market demand and an increased worldwide geopolitical political tensions can pose a high supply risk for Europe. REE production comes also with significant environmental impacts.

Some estimations show that for every ton of REE, 2,000 tons of toxic waste, including radioactive waste, are produced . Therefore, as a key pathway for the EU's net zero commitment, hydrogen produced by wind energy's potential needs to be fully unlocked.

This requires disruptive technologies to achieve this goal. INSPIRE is born in response to the priority area "Development of offshore marine multi-use infrastructures to support the blue economy" to combine marine renewable energy constructions with hydrogen production, to develop multi-use structures and materials to reduce, recycle, reuse and being resistance to extreme environmental conditions.

To reach these goals we have set

up a consortium of industrial and research partners to optimize green hydrogen system design methodology with minimum REE, to deliver a reference design of an optimized open access 25x15 MW floating wind-hydrogen with minimized REE and optimized lifetime, to implement AI-based wind-hydrogen production optimization and to establish a pathway towards implementation in policy and industrial standards.

The core ambition of INSPIRE is to deliver innovative optimized design for REE reduction, and AI-based optimized operation for integrated hydrogen-wind system as well as road maps for EU policy makers.

MEDSEAPLAN

Title: Data and Scenarios for a Sustainable Mediterranean Blue Economy

Priority Area: PA1 - Planning and managing sea uses at the regional level

Sea-basins: Mediterranean Sea

Countries: Cyprus; **France**; Germany; Italy; Malta; Netherlands; Spain; Türkiye

Consortium:

Coordinator:

World Ocean Council Europe, WOC, France

Partners:

- Malta College of Arts, Science and Technology, MCAST, Malta
- Fondazione Institute for Sustainable Society and Innovation, ISSNOVA, Italy
- CMMI – Cyprus Marine and Maritime Institute, CMMI, Cyprus
- University of Twente, UT, Netherlands
- Werover GmbH, Werover, Germany
- Ocean Ecostructures S.L., OE, Spain
- Centre d'études et d'expertise sur les risques, l'environnement, la mobilité et l'aménagement, Cerema, France
- ADERA, France
- BANDIRMA ONYEDİ EYLÜL UNIVERSİTY, BANU, Türkiye
- Bursa Technical University, BTU, Türkiye
- ELKON ELEKTRIK SANAYI TİCARET ANONIM SIRKETI, ELKON, Türkiye
- KARADENIZ TEKNIK UNIVERSITESI, KTU, Türkiye
- Asociación Centro Tecnológico Naval y del Mar, CTN, Spain
- Consejo Superior de Investigaciones Científicas (CSIC), CSIC, Spain

Keywords: Data, Sustainable, MSP, Mediterranean, Blue Economy, Future, Scenarios, Regional, Holistic

Abstract: The World Ocean Council Europe is proposing to lead a consortium of 15 partners representing research institutes, universities, enterprises and institutions linked to Maritime Spatial Planning (MSP), to implement the MEDSEAPLAN project ('Data and Scenarios for a Sustainable Mediterranean Blue Economy) over 36 months.

The project will focus on future-proof Maritime Spatial Planning,

the need for advanced data and an increased inclusion of maritime industry in the development of MSP-relevant foresight scenarios.

MEDSEAPLAN aims to operationalise impactful change in sea basin-level multi-sectoral MSP development with data-driven and industry-based input. The project will focus on assessing current and future data needs for regional MSP, and flowing from this, on innovative solutions to create data for MSP (and transforming it into information that can be used by MSP planners).

Concrete pathways to collect innovative data sets for MSP will revolve around nature-based solutions for improved biodiversity; including data from maritime industry vessels; and the design and demonstration of innovative floating data buoys.

The strength of MEDSEAPLAN lies in its multi-sectoral, multi-actor and cross-border approach. The project will design a set of scenarios, which will be co-developed with stakeholders through assessing their data needs and testing these scenarios to assess potential solutions to future impacts brought forward by the maritime industry leaders.

In this way, MEDSEAPLAN will contribute to the development of MSP that is of a more robust knowledge-based and data-driven nature, realising a more sustainable Blue Economy in the Mediterranean Region.

RE-BLUE

Title: Resource efficient blue food production from small underutilized pelagic fish species (RE-BLUE)

Priority Area: PA3 - Climate-neutral, environmentally sustainable and resource-efficient blue food and feed

Sea-basins: Baltic Sea; North Sea

Countries: Denmark; Finland; Poland; **Sweden**

Consortium:

Coordinator:

Chalmers University of technology, Chalmers, Sweden

Partners:

- Technical University of Denmark, Department: National Food Institute, DTU, Denmark
- Teknologian tutkimuskeskus VTT Oy, VTT, Finland
- West Pomeranian University of Technology in Szczecin, WPUT, Poland

Self-Funded Partners:

- Hailia Nordic Oy, Hailia, Finland
- Werner Larsson Fiskeeksport A/S, WL, Denmark

Keywords: Herring (Clupea harengus), Sprat (spattus sprattus), blue food, valorization, value chain, mince, fish sauce, pulled fish, fermentation, marination

Abstract: Herring (Clupea harengus) and sprat (Sprattus sprattus) are two low trophic level fish species which dominate the fisheries of many Northern/ Central European countries. They are, however, massively underutilized in food production.

This is increasingly questioned viewed against the current geopolitical situation raising the need of affordable, nutrient dense and locally produced food, and against the ongoing dietary protein shift where consumers seek healthy and sustainable protein sources to replace red meat.

Herring and sprat have as low climate footprint as pulses and are rich in high quality proteins, important fatty acids, vitamins and minerals; many of which are missing in red and/or green protein sources. Combining climate impact and nutrient density data, herring/sprat were recently ranked as the most favorable animal protein sources common to the EU.

Based on these incentives, the multi-actor RE-BLUE project will explore new scalable food value chains from the large parts of

the herring/sprat catches that either do not enter the food chain (whole fish landed as feed) or leave it (filleting rest raw materials, RRM, also going to feed). Together, these biomass streams make up ca. 60-95% (!) of total herring/sprat catches in the countries of this consortium.

Our specific aims are to design, align and combine process-steps which are tailored to tackle the very small size of the "fodder fish", presence of enzyme-dense organs, high levels of pigments/ pro-oxidants/small bones and occasional abundance of dioxins, dioxin-like (DL) PCB´s and PFAS.

An innovative cutting/filleting line which gradually can trim off head, intestines, viscera, and spine even from very small herring/sprat (55g) forms a project core. Whole fish, fish subjected to different degrees of trimming, or sorted regular RRM will then be used in:

(i) mechanical mince production, washing and freezing,

(ii) conversion of pre-frozen minces to "falafel" balls/burgers/ sausages with and without antioxidant-rich plant RRM or seaweed,

(iii) enzymatic hydrolysis into savory ingredients,

(iv) fermentation with salt into a fish sauce,

(v) direct mixing and extrusion into a "pulled fish product", with/ without plant-based proteins and

(vi) acid marination.

(i)-(vi) are evaluated with and without pre-dipping of raw materials in new antioxidant solutions. Product prototypes will be characterized in terms of e.g., ash, nutrients, sensorial and volatile compound profiles, color, lipid oxidation, lipolysis, proteolysis, microbial growth and when required, dioxins/PCBs/ PFAS.

In parallel, fundamental understanding on how enzymatic/non-enzymatic reactions in small pelagic fish respond to different processing variables will be gained. Results can be extended to other European small fish species regarded invasive (e.g., round goby) or underutilized (e.g., sand eels, sardines) and are expected to have major societal impact related to e.g., food preparedness, public health, and national/EU policies.

SEAFOODTURE

Title: Integral valorisation of seaweed biomass for the development of sustainable, high nutritional quality food products

Priority Area: PA3 - Climate-neutral, environmentally sustainable and resource-efficient blue food and feed

Sea-basins: Mediterranean Sea; Baltic Sea; North Sea; Atlantic Ocean

Countries: Estonia; Iceland; Ireland; Italy; Norway; Portugal; **Spain**; Türkiye

Consortium:

Coordinator:

Consejo Superior de Investigaciones Científicas, CSIC, Spain

Partners:

- University of Tartu, UT, Estonia
- Universidade de Santiago de Compostela, USC, Spain
- Tarsus University, TAU, Türkiye
- PORTO-MUIÑOS, Spain
- DICMA of SAPIENZA University of Rome, SAP, Italy
- University of Aveiro, UAveiro, Portugal
- Innovate Food Technology LTD. T/A Innovate Solutions, IFT, Ireland
- Matís ohf, Matis, Iceland
- SINTEF Ocean AS, SINTEF, Norway

Keywords: seaweed, valorisation, food, ingredients, packaging, proteins, nutrition, fibres, biomass, sustainability

Abstract: SEAFOODTURE is an ambitious project which aims to contribute towards an integral valorisation of seaweeds for the production of sustainable, high nutritional quality food products.

The project combines research activities dealing with: sustainable cultivation of seaweeds; development of protein-rich ingredients and seaweed-based food products through green technologies; production of bio-based packaging materials; structural and techno-functional characterization; assessment of nutritional quality and digestibility; sensorial and consumer studies to bring the products closer to the final markets; and life cycle assessment (LCA) and socio-economic analysis, to ensure the environmental social and economic sustainability.

This will be achieved by combining the complementary and multidisciplinary expertise of the European academic and industry partners involved in this proposal and the participation of

relevant stakeholders.

The food industry is facing great challenges, motivated by society's needs and environmental concerns. The rapid population growth is pushing food production towards its limits, and reliance on animal-based protein sources puts additional strain on the environment. Moreover, plant protein sources need to be complemented by novel cultivars, less dependent on the use of water and lands.

Thus, there is an urgent need to develop additional protein-rich food products with high nutritional quality by exploiting non-traditional sources.

Seaweeds are attracting great interest due to their advantages over land biomass; however, they are still largely unexplored as foods, which is mostly due to

(i) the lack of sustainable and robust strategies for the supply of seaweed biomass,

(ii) the scarce knowledge on their techno-functional and nutritional properties, which makes it challenging to process them and ensure product stability/safety at industrial scale,

(iii) the knowledge gap with regards to the digestibility and bioaccessibility of their proteins and

(iv) the low awareness of consumers in European countries towards seaweed-based products.

In this project, we aim to exploit the full potential of seaweeds as an alternative and sustainable protein source by investigating the techno-functional and nutritional properties of protein-rich products in which proteins will be combined with other components such as dietary fibres, providing health and techno-functional benefits.

Furthermore, with the aim of minimizing the amount of waste generated through the manufacturing process, residues obtained after the extraction of protein-rich ingredients will be used to generate bio-based food packaging materials. This will allow to develop novel seaweed-based food products through a circular economy approach.

The project is expected to have a strongly positive impact on the seaweed industry, fostering an efficient biomass utilization to generate high added value products and promoting the consumption of seaweed-based foods amongst EU consumers.

SEAREFINERY

Title: IMPROVED VALORIZATION OF MARINE SOURCES AND PROCESSING WASTE FOR RESOURCE EFFICIENT BLUE FOOD/FEED AND ENVIRONMENTALLY SUSTAINABLE MATERIALS DEVELOPMENT

Priority Area: PA3 - Climate-neutral, environmentally sustainable and resource-efficient blue food and feed

Sea-basins: Mediterranean Sea; Black Sea; Baltic Sea; North Sea; Atlantic Ocean

Countries: Italy; Norway; Spain; **Sweden**; Türkiye

Consortium:

Coordinator:

KTH Royal Institute of Technology, KTH, Sweden

Partners:

- University of The Basque Country, EHU, Spain
- Norwegian University of Life Sciences, NMBU, Norway
- Istanbul University - Institute of Marine Sciences and Management, IU-DEBIEN, Türkiye
- Istanbul Technical University, ITU, Türkiye
- National Council of Research of Italy, IPCB-CNR, Italy
- Italbiotec srl, ITB, Italy

Keywords: algae, marine derived biopolymers, meat analogues, cheese analogues, functional bread, collagen based nanofiber, smart and active packaging, biochar based biosensor, aquaculture waste, single cell protein

Abstract: Impact-oriented utilization pathways for new sustainable, unexploited low trophic marine resources and fish/aquaculture wastes are one of the key pillars of sustainable transformation of EU blue economy.

SEAREFINERY aims to establish a novel bio-based blue food/feed and blue food packaging materials production platform by embracing marine-based sources and wastes targeting five seas.

The SEAREFINERY concept will be designed within a multidisciplinary and smart collaboration platform for developing a breakthrough eco-centric strategy considering the local sources, economic and social perspectives at transnational level within the EU.

The specific aims of SEAREFINERY includes extraction of high value-added compounds from invasive species, low trophic organisms and marine derived by-products, utilisation of marine-based extracted

materials for development of blue food analogues (meat and cheese), functional bread, and smart and active food packaging materials, valorisation of aquaculture and fish waste for blue feed production via bacterial fermentation and microalgae cultivation, a systematic evaluation of the products based on environmental impacts, market analysis, and consumer acceptance followed by a multi-criteria decision making analysis.

At the end of the project, this pin-point novel approach will fulfill the needs for restoring and preservation of the marine ecosystem, the need for valorisation of marine resources for sustainable blue economy, the needs and requirements of society and end-users as well as it will allow for new business models and investment schemes.

SHELLFISHBOOST

Title: Boosting the resilience of European shellfish production against climate change-related challenges through genetic selection

Priority Area: PA3 - Climate-neutral, environmentally sustainable and resource-efficient blue food and feed

Sea-basins: Mediterranean Sea; Atlantic Ocean

Countries: France; **Italy**; Norway; Portugal; Spain

Consortium:

Coordinator:

Università degli Studi di Padova, UNIPD, Italy

Partners:

- AQUAGOMA - Productos do Rio e Mar LDA, AQUAGOMA, Portugal
- Ifremer, IFREMER, France
- Syndicat des sélectionneurs avicoles et aquacoles français, SYSAAF, France
- Nofima AS, Nofima, Norway
- CIIMAR | Interdisciplinary Centre of Marine and Environmental Research of the University of Porto, CIIMAR, Portugal
- Universidad de Santiago de Compostela, USC, Spain
- International Marine Centre, IMC, Italy
- Institut national de recherche pour l'agriculture, l'alimentation et l'environnement, INRAE, France
- MARINOVE, MVE, France
- Vendée Naissain, VN, France

Keywords: climate change, sustainable aquaculture, shellfish farming, selective breeding, genomics, ecosystem services, blue bioeconomy

Abstract: Bivalve aquaculture has become increasingly important sector of global blue bioeconomy in recent years due to its numerous environmental, economic, and social benefits.

Shellfish farming is considered sustainable and environmentally-friendly compared with other aquaculture species as it is low trophic, has a very limited carbon footprint, and it provides multiple ecosystem services.

Shellfish production is already facing major challenges due to direct and indirect effects of climate change and such challenges will become even more serious in the future.

The long-term goal of ShellFishBoost is to mitigate the effects of climate change on the bivalve production with the ultimate impact of protecting and developing a vital blue bioeconomic sector in Europe.

The main objectives of ShellFishBoost are the development/optimisation of advanced tools for genetic selection (molecular tools, optimized breeding schemes) and the estimate of genetic parameters for key traits (growth, resistance to heat-waves, salinity stress, summer mortalities, and presence of harmful algal toxins).

A third major objective is the co-creation of best practices for selective breeding in each target species, together with industrial partners of ShellFishBoost and other relevant stakeholders (producer associations and other bivalve hatcheries).

Project activities will be divided into five problem-focused workpackages (WPs).

WP1 will develop and optimize advanced tools for genetic selection.

WP2 will estimate genetic parameters and identify Quantitative Trait Loci (QTLs) for disease resistance in oysters and clams.

WP3 will estimate genetic parameters and identify QTLs for resilience to climate-related challenges in oysters and clams.

WP4 will estimate genetic parameters and identify QTLs for reduced toxin accumulation in mussels.

WP5 will co-create best practices and strengthen the capacities for selective breeding in bivalves. ShellFishBoost fully embraces the approach based on the “Theory of Change”.

WP5 objective is to effectively translate projects outputs into positive outcomes for European shellfish farming sector, to achieve the ultimate impact of improving the resilience of the sector against climate change effects.

WASTE2TASTE

Title: From waste to taste: exploring innovative food applications of postharvest fish losses

Priority Area: PA3 - Climate-neutral, environmentally sustainable and resource-efficient blue food and feed

Sea-basins: Mediterranean Sea; Black Sea; Atlantic Ocean

Countries: **Italy**; Malta; Norway; Spain; Türkiye

Consortium:

Coordinator:

Stazione Zoologica Anton Dohrn, SZN, Italy

Partners:

- Universita' ta' Malta (University of Malta), UM, Malta
- SINTEF AS, SINTEF, Norway
- Agencia Estatal Consejo Superior de Investigaciones Científicas, CSIC, Spain
- Tetis Biyoteknoloji Arastırmaları ve Egitim Danısmanlıgı Hizmetler A.S., TETIS, Türkiye
- UiT The Arctic University of Norway, UiT, Norway
- Koc University, Koc, Türkiye
- Ulker Chocolate, ULKER, Türkiye

Keywords: valorization, postharvest fish losses, green processes, collagen, chitin/chitosan, fish oils, marine bioactive compounds, nutraceuticals, food applications, waste reduction

Abstract: WASTE2TASTE is a network of 8 European partners including academia, research centers, and SME's, with proven expertise in higher education and endowed with state-of-the-art scientific and technical expertise aimed at the development of commercially viable products by using postharvest fish losses (PHFL), including unwanted fishery by-catch species (e.g., non-indigenous species (NIS) and cartilaginous fish with low commercial value) and by-products from fish processing and aquaculture industries.

The main WASTE2TASTE objective is the valorization of PHFL, showing potential applications in a circular economy and an eco-friendly vision by developing protocols for sustainable exploitation of underused and/or wasted marine resources, to obtain high-value products for food applications.

The base of WASTE2TASTE is to utilize PHFL, naturally rich in proteins and bioactive compounds, to develop innovative green and cost-effective bioprocesses for the production of marine ingredients

(e.g., collagen, chitin/chitosan, and fish oil), reducing extraction time and use of hazardous solvents/enzymes allowing, at the same time, to minimize pollution into the ecosystem.

Therefore, WASTE2TASTE will:

(i) contribute to reducing the waste volume through the development of appropriate PHFL management measures,

(ii) allow to address the European "ZeroWaste" goal aiming at the 3R principle "Reduce, Reuse and Recycle",

(iii) contribute to achieve a resilient and sustainable development for marine/maritime sector and, in an indirect way,

(iv) allow to mitigate the NIS, which cause damage to marine ecosystems and humans.

The challenge is to gain insights into market opportunities that will be profitable and will satisfy new and different attitudes/demands of consumers.

Overall, WASTE2TASTE will fully exploit the potential of underutilized marine biological resources, from laboratory to industrial scale production of marine collagen and chitosan-based products, with potential commercial uses that reach Technological Readiness Level 7.

WASTE2TASTE will create a nutritional end product targeting different end-users' health issues (e.g., exercise performance, muscle growth, joint problems, gut health, and obesity).