Sustainable Blue Economy Partnership

GENERAL INFORMATION ON THE PROPOSALS RECOMMENDED FOR FUNDING BY THE CALL STEERING COMMITTEE

2024 Second Joint Transnational Co-Funded Call

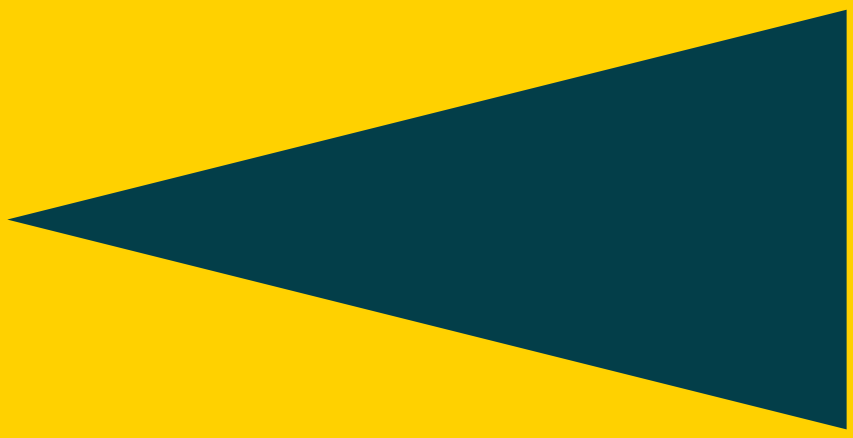
"Unified paths to a climate-neutral, sustainable, and resilient blue economy: engaging civil society, academia, policy, and industry"

Version 31 March 2025

Co-funded by the European Union

co-branded by

2021 2030 United Nations Decade of Ocean Science for Sustainable Development



General information on the proposals recommended for funding by the Call Steering Committee

Contact info:
The Joint Call Secretariat 2024
sbep.call-secretariat@agencerecherche.fr

SUMMARY TABLE

AQUASPECT

Title: Advancing QUality Assessment of Spatial Patterns and Ecosystem Characteristics through Technological Advancement

Priority Area: PA1 - Digital Twins of the Oceans (DTO) at regional sub basin scale

Sea-basins: Mediterranean Sea, North Sea, Baltic Sea

Countries: Belgium, France, Germany, Spain

Consortium:

Coordinator:

Sorbonne University, SU, France

Partners:

- WISIP SARL, WISIP, France
- GEOMAR Helmholtz Centre for Ocean Research Kiel, GEOMAR, Germany
- Vlaams Instituut voor de Zee, VLIZ, Belgium
- Balearic Islands Coastal Observing and Forecasting System, SOCIB, Spain

Keywords: DTO, uvp, time-series glider, baltic, mediterranean, north-sea, plankton, EOV, EBV

Abstract: AQUASPECT addresses priority no. 1 “Digital Twins of the Ocean (DTO) at regional sub-basin scale” of the SBEP 2024 call. It covers three of its four subtopics: (i) existing data collection and representation, (ii) ecological modelling, and (iii) propose a new monitoring scheme with new or existing sensors. It targets a data-driven approach, combined with Artificial Intelligence tools, to better assess the state of coastal ecosystems and improve knowledge of ocean biological and biogeochemical processes occurring at regional scale. AQUASPECT is embedded in a dynamic network of projects related to instrument development, FAIR data flows, and Digital Twins, all in the service of the Mission “Restore our Oceans and Waters by 2030”. The project focuses on phyto- and zooplankton, which provides many services to humans, from carbon sequestration to sustaining fisheries, and is recognised as an Essential Ocean/Biodiversity Variable (EOV, EBV) and used for MSFD evaluations.

Specifically, the project will:

1. Complete the development of and bring to market a new in situ plankton imagery instrument (the UVP6m) involving Small and Midsize Enterprises. It will count particles from 10µm and identify organisms from 100µm, to complement the existing in situ imaging sensors including UVP6.

2. Augment existing monitoring efforts with these instruments to sample plankton at previously unattainable spatio-temporal resolutions, which will be relevant for policymakers and regional

stakeholders. Sensors will be deployed in three contrasting subbasins (the oligotrophic Mediterranean Sea, the eutrophic North Sea and the low salinity Baltic Sea), at sites with extensive physical and biogeochemical sampling as well as existing or developing regional DTOs.

3. Integrate the resulting large datasets of EBVs and concomitant environmental data into European data infrastructures, including EMODnet and the EDITO data lake, as well as the three regional DTOs. This will build on existing efforts to improve plankton data FAIRness through standard data formats and controlled vocabularies.

4. Provide more relevant information to stakeholders and the general public by exploiting these unprecedented datasets through the regional DTOs. Particular applications will focus on biodiversity hotspots and carbon export at submesoscale near a marine national park, ecosystem state indicators for the Marine Strategic Framework Directive, and effects of anoxia on local ecosystems and fisheries.

CODEBLUE

Title: Harmonised ocean data sets for blue sustainable eutrophication management of the North-East Atlantic Ocean and Baltic Sea (CodeBlue)

Priority Area: PA1 - Digital Twins of the Oceans (DTO) at regional sub basin scale

Sea-basins: Mediterranean Sea, Black Sea, Baltic Sea

Countries: Belgium, Denmark, Estonia, Finland, France, Germany, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden

Consortium:

Coordinator:

Swedish Meteorological and Hydrological Institute, SMHI, Sweden

Partners:

- Leibniz Institute for Baltic Sea Research Warnemuende, IOW, Germany
- Institute of Marine Research, IMR, Norway
- Marine Institute, MI, Ireland
- +Associação para um Laboratório Colaborativo do Atlântico, +ATLANTIC, Portugal
- Centro Nacional Instituto Español de Oceanografía - Consejo Superior de Investigaciones Científicas, IEO-CSIC, Spain
- ETT S.p.A., ETT, Italy
- Royal Belgian Institute of Natural Sciences, RBINS, Belgium
- French research institute for exploitation of the sea, Ifremer, France
- Stichting Nederlandse Wetenschappelijke Onderzoeksinstituten - Koninklijk NIOZ, NIOZ, Netherlands
- Aarhus Universitet, ECOSCIENCE, ECOS, Denmark
- Tallinn University of Technology, TalTech, Estonia
- Finnish Environment Institute, Syke, Finland
- AquaEcology GmbH & Co. KG, AE, Germany
- OCEANDATALAB, ODL, France

Keywords: Eutrophication management, eutrophication policy, digital twin of the ocean, good environmental status, eutrophication assessment, ocean modeling, North-East Atlantic Ocean and Baltic Sea, nutrient river loads, climate effects on the sea

Abstract: Eutrophication is a critical issue in areas of the Northwest European Shelf and the Baltic Sea, diminishing water quality and inhibiting sustainable blue economy sectors. The

challenging yet urgent need for international collaboration across the area regarding marine eutrophication is a true code blue for our seas. Information is still lacking to produce an efficient and long-lasting eutrophication policy in a changing climate based on conventions' recommended nutrient input levels.

CodeBlue will compile observational river data to build a unique and harmonised set of model forcing data to be used in front-line physical-biogeochemical models. CodeBlue will consider the long-term aspects of biogeochemistry cycles (e.g. sea bed nutrient storage, climate change), and the effect of nutrient transport from adjacent basins. A set of long-term model simulations (>50 years) will be generated, including base line hindcasts and "what if scenarios" of low riverine nutrient load and no climate change scenarios as well as climate projections, including a nutrient scenario of "Maximum Allowable Input". CodeBlue will use a weighted ensemble model approach to combine results and estimate uncertainties at regional scales, and aims to quantify the relative role of enhanced nutrient loads versus climate change in establishing present-day eutrophication as well as evaluate if suggested maximum input levels of nutrients will be effective in a changing climate.

The new information will be tailored in a two-way communication with key stakeholders in an active co-design board to find a way forward in eutrophication management considering environmental changes, targeting a de-eutrophied North-East Atlantic Ocean and Baltic Sea. In addition, the regional scenario results will be used by local models at blue pilot cases in the Baltic Sea, North Sea and Western Iberia (Galicia and Sado estuary) to establish how the implemented measures will affect blue economy activities (e.g. aquaculture) and local marine management.

CodeBlue has the ambition to make knowledge readily available to blue food entrepreneurs, local marine managers, scientists and policy-makers by providing **i**nnovative, user-driven, interactive visualisation tools tailored to stakeholder needs. The CodeBlue web portal will display large open access (available on EMODnet), transparent and homogenous datasets following the FAIR principles, while stakeholder involvement from start to finish will ensure applicability. Policy briefs facilitate knowledge transfer to stakeholders, while results embedded in existing structures

will secure the project's legacy in the longer term. CodeBlue is by essence a true test use case of the Digital Twin of the Ocean for the North-East Atlantic Ocean and the Baltic Sea, with results aimed at impacting policies at a regional and European Union scale, not only on eutrophication, but also to improve the overall quality of our marine waters and support sustainable blue food production.

CORRASBLUE

Title: Coastal Corrosion Risk Management through Digital twin model for a Sustainable Blue Economy

Priority Area: PA1 - Digital Twins of the Oceans (DTO) at regional sub basin scale

Sea-basins: Mediterranean Sea, North Sea, Atlantic Ocea

Countries: Cyprus, Denmark, France, Germany, Netherlands, Norway, Portugal, Slovenia, Sweden, Türkiye

Consortium:

Coordinator:

Norwegian Research Centre (NORCE), Norwegian, Norway

Partners:

- Norges Teknisk-Naturvitenskapelige Universitet NTNU, NTNU, Norway
- Bundesanstalt für Materialforschung und –prüfung, BAM, Germany
- IA University College, VIA, Denmark
- FCiências.ID - Associação para a Investigação e Desenvolvimento de Ciências, FC.ID, Portugal
- Faculty of Mechanical Engineering, University of Ljubljana, Slovenia
- ISE AB, RISE AB, Sweden
- Duzce University, Türkiye
- Istanbul University, Istanbul U, Türkiye
- Delft University of Technology, TUD, Netherlands
- WavEC Offshore Renewables, WavEC, Portugal
- Corrosion Advice ApS, Denmark
- La Rochelle Université, France
- Institut de la Corrosion SASU, IC, France

Self-funded Partners:

- CORRODYS, CORRODYS, France
- Endures B.V., Endures, Netherlands
- MetriCorr ApS, Denmark
- Fibrobeton Yapı Elemanları Sanayi ve İnşaat A.Ş., Fibrobeton, Türkiye
- Microbial Analysis, Microbial, Netherlands
- Erevnitiko Idrima P. L., UNRF, Cyprus

Keywords: Corrosion risk management, Digital twin, corrosion prediction, materials sustainability, biocorrosion, coastal infrastructure, sensor integration, life cycle assessment, mitigation

Abstract: CORRASBlue aims to deliver a cross-sectoral digital platform to the marine and maritime industries by 1) maximizing materials

sustainability, 2) minimizing corrosion-associated environmental and ecological risks, 3) providing decision makers and industry a 'win-win' approach for infrastructure management and control, and 4) producing a flexible, long-term data-integration system for future innovative developments. The CORRASBlue consortium encompasses multi-disciplinary and cross-sectoral experts across 10 countries and 3 sea basins (Atlantic Ocean, Mediterranean Sea, and North Sea). We have gathered a significant number of experts across research, industry, and policymaking sectors with the aim to de-fragmentalize the current landscape of corrosion management and drive the innovation needed to advance sustainability of our knowledge-based society and economy and to meet the EU Green Deal and future EU Blue Deal targets.

Main objective of CorrasBLUE is to develop a novel Coastal Corrosion Risk Management (CCRM) digital twin that will integrate holistic sensor measurements, corrosion state, and mitigator effectiveness to enhance corrosion management, enabling comprehensive monitoring and maintenance strategies to safeguard marine infrastructure and ecosystem health.

The project will be divided in to 4 main phases:

Phase 1: Data fusion by gathering and integrating data from various sources including sensors, published data, non-disclosed stakeholder data

Phase 2: Model development using cleansed data from phase 1 and produced real-time complimentary data

Phase 3: Model recalibration, optimization and validation of predictive analytics for corrosion management

Phase 4: Final dissemination, model deployment and commercialization

The consortium has extensive experience with application of machine learning techniques from disciplinary data analysis. Several partners (academic and industry) in the consortium have strong internal collaborators specialising on method development for machine learning and artificial intelligence, which will be used in daily discussions. The female-led consortium consists of 12 interdisciplinary research institutions and 8 companies as partners, including 6 SMEs and 5 corporate partners joining the consortium with in-kind contributions. In addition, BAM (DE) is a senior scientific and technical Federal institute with responsibility to the German Federal Ministry for Economic Affairs and Climate Action and gives direct input to authorities

on materials-related questions in relation to policy making and regulation. Overall, 8 female and 12 male senior experts will be involved including 7 postdocs, 11 masters students, 7 engineers, and 10 early-stage researchers.

The state-of-the-art corrosion prevention strategies produced from this project will reduce failures and related emission, thus benefit the marine ecosystem and indirectly safety of sea food and the marine environment.

DIVE

Title: Digital Twin for Innovation in Oceanic Visualization and Exploration (DIVE)

Priority Area: PA1 - Digital Twins of the Oceans (DTO) at regional sub basin scale

Sea-basins: Mediterranean Sea, Black Sea, North Sea, Atlantic Ocean

Countries: France, Germany, Norway, Romania

Consortium:

Coordinator:

National University for Science and Technology Politehnica Bucharest, UPB, Romania

Partners:

- Deutsches Zentrum für Luft- und Raumfahrt EV, DLR, Germany
- Institut français de recherche pour l'exploitation de la mer, Ifremer, France
- Akvaplan.niva, APN, Norway
- National Institute for Marine Research and Development "Grigore Antipa", NIMRD, Romania
- France Energies Marines, FEM, France

Keywords: Digital twin, artificial intelligence, ocean visualizer, climate change, what-if explorer, causal explorer

Abstract: The DIVE proposal is responding to the Priority Area 1: Digital Twins of the Ocean (DTO) at regional sub-basin scale and considers the following European sea basins: Black Sea, North Norwegian Sea, Mediterranean Sea and the Atlantic Ocean. DIVE aims at contributions to environmental objectives 1. Climate change mitigation, 2. Climate change adaptation, 3. The sustainable use and protection of water and marine resources.

DIVE elaborate a novel paradigm AI4Ocean. It implements 3 complementary functions to the exiting DTO systems and beyond the state of the art: the "what-if" and "causal" exploration DTO components and the "ocean visualizer". DIVE novelty lays in focusing on physic informed models, performing beyond the classification and prediction tasks, elaborating multi-modal generative models for the ocean dynamic states and the discovery of causal relations. An ocean visualizer, easy to use and intuitive visualization tool, will enable operation and access to the results of what-if and causal explorers. Users can generate explanations, recognize rules and associations and generate new knowledge for informed decision making processes.

The methods will be validated and demonstrated on 3 use

cases: i) currents and sediment transports within the Western Black Sea coastal areas, ii) Lofoten-Vesterålen (LoVe) Blue Economy Digital Twin, and iii) Rain radars application to offshore wind.

The project's concept (Theory of Change) refers to a research accelerator with the ambition towards stakeholder and end-user engagement. The project adopts the collaborative learning and research approach for new knowledge creation in a Quadruple Helix (QH) innovation framework. The recurrent QH aims to increase the validity of research results, shorten the time from research and practical applications and support a sustainable impact in society.

The expected impact ranges from bridging the gap between oceanographers and AI scientists, the development of a new field - AI4Ocean -, establish a sustainable Blue Economy partnership engaging Civil Society, Academia, Policy, and Industry via the activities of a Living Lab. Through collaborative actions, will be anticipated the evolution of the sectors involved, scenarios will be defined, included in the DTO and evaluated against national, EU and international policies and strategies. Thus, aiming to strengthen ecosystem management, focusing to the needs and requests of the local communities, industries, and management, generating societal and economic benefits to multiple stakeholders.

DTO4OWE

Title: Digital Twin of the Ocean for Offshore Wind Energy

Priority Area: PA1 - Digital Twins of the Oceans (DTO) at regional sub basin scale

Sea-basins: Baltic Sea, North Sea

Countries: Belgium, Denmark, Estonia, Finland, Germany, Italy, Norway, Poland, Sweden

Consortium:

Coordinator:

Tallinn University of Technology, TalTech, Estonia

Partners:

- Danish Meteorological Institute, DMI, Denmark
- Helmholtz-Zentrum hereon GmbH, HEREON, Germany
- Instytut Oceanologii Polskiej Akademii Nauk, IOPAN, Poland
- ILMATIETEEN LAITOS, FMI, Finland
- SINDBAD scarl, SINDBAD, Italy
- Swedish Meteorological and Hydrological Institute, SMHI, Sweden
- Norsk Institutt for Vannforskning, NIVA, Norway

Self-funded Partners:

- Estonian Environment Agency, ESTEA, Estonia
- Vattenfall Vindkraft A/S, Vattenfall, Sweden
- University of Liège, ULiège, Belgium

Keywords: offshore wind energy, Digital Twin, numerical modelling, ecological modelling, hydrodynamics, biogeochemistry, waves, ice, North Sea, Baltic Sea

Abstract: The DTO4OWE project brings together stakeholders from academia, industry, governmental agencies, and the public to address the challenges associated with the growing Offshore Wind Energy (OWE) sector. With more than 300 offshore wind farms scheduled for EU waters in the coming decade, questions arise about their potential impact on marine ecosystems. Conversely, the OWE sector requires relevant and high-quality marine data to plan its activities up to 50 years ahead in a changing climate. We will address these two contrasting but interconnected themes using digital twins of the oceans (DTOs). The first objective is to develop fit-for-purpose sub-regional DTOs for assessing OWE impacts in the Baltic Sea and North Sea. Depending on the application, DTOs will encompass the physical-ecological environment and cover short-to-long term periods (up to 50 years), offering improved resolution and quality compared to the state-of-the-art. The second objective involves creating a suite of tools for OWE sector-specific What-If Scenarios,

including on-demand models, AI-based data-simulation fusion, forecasting, and downscaling tools which are integrated with Destination Earth Data Lake and EDITO_infra. In the long term, DTO4OWE aims to support the sustainable growth of the offshore wind energy sector by adopting digital twin technologies of the ocean environment. The project outcomes can be incorporated into OWE sector decision-making processes, which ultimately has large scale impacts on future OWE production. The developed DTO applications are upscalable for other sub-regions and applicable to monopile, gravity-based, and floating offshore wind farms.

ROMEO

Title: smaRt Online Multisensory systEm for microplastic quantificatiOn and water quality assessment

Priority Area: PA1 - Digital Twins of the Oceans (DTO) at regional sub basin scale

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

Countries: Brazil, Cyprus, Italy, Romania, Türkiye

Consortium:

Coordinator:

Consiglio Nazionale delle Ricerche, CNR, Italy

Partners:

- Universidade federal fluminense, UFF, Brazil
- BEIA Cercetare, BEIA, Romania
- Istanbul University, Istanbul U, Türkiye
- Management Consortium of Porto Cesareo Marine Protected Area, PCMPA, Italy
- SK EMBIO Diagnostics Ltd, EMBIO, Cyprus

Keywords: water quality, online microplastics detection, diatom detection, environmental monitoring, coastal monitoring, artificial intelligence, open data, fish health

Abstract: ROMEO is a low-cost and open multi-sensory system that monitors and digitises our aquatic ecosystems to understand their state, ecological health and functioning, with the concept of any sensor, anytime, anywhere. It is made of multi-sensory system that perceive and reason about underwater abiotic and biotic conditions of our critical natural resources by building a digital aquatic world that understands the considered ecosystem conditions and forecasts their evolutions. The ROMEO multi-sensory system will address knowledge gaps for cross-aquatic basins information exchange. This proposal will establish an aquatic-basins database on several standard environmental parameters, and with novel and innovative online sensors for micro-plastics/diatoms, to act on policies of “Restore our Oceans and Waters” lighthouse initiatives. It will integrate and enrich the Copernicus service with a new monitoring scheme that includes new sensing technologies, allowing anyone to use data: scientists, policymakers, entrepreneurs and citizens.

Further, it fully complies with the EU Marine Strategy Framework Directive, for preserving the marine environment, since it represents a sentinel of human

activities with a sustainable use of multi-sensor carrier.

All the acquired data will be ingested into an open database engine, which will provide a coherent, multivariable and multi-dimensional description of the aquatic environment, biodiversity and populations/ resources dynamics, from inland and transitional to coastal water, from marine physics to ice to biogeochemistry, from the surface to deep water, allowing a digital exploration in time and space of the aquatic ecosystems accordingly.

The open database and platform will give all stakeholders the power to make informed decisions, backed by science and data, to monitor and implement the conservation strategies and restore the aquatic habitats, support a sustainable blue economy and mitigate and adapt to climate change.

BLUEPORTLAB

Title: Multi-use Infrastructure Spatial Concepts for the Blue Economy: Leveraging on Sustainable Port Ecosystems through Living Labs

Priority Area: PA2 - Blue economy sectors, development of marine multi-use infrastructures

Sea-basins: Mediterranean Sea, Baltic Sea, North Sea

Countries: Denmark, Germany, Italy, Slovenia, Sweden

Consortium:

Coordinator:

Copenhagen Business School, CBS, Denmark

Partners:

- University of Genoa, UniGe, Italy
- Chalmers University of Technology, CTH, Sweden
- Kühne Logistics University gGmbH (KLU), KLU, Germany
- DANMARKS TEKNISKE UNIVERSITET, DTU, Denmark
- Autorità di Sistema Portuale del Mare Adriatico centro settentrionale, ADSPRA, Italy
- Port of Aalborg, R&D, POARD, Denmark

Self-funded Partners:

- Trelleborg Hamn AB, Sweden
- Euro-Mediterranean University, EMUNI, Slovenia

Keywords: Seaports, living labs, energy transition, biodiversity, spatial concepts

Abstract: BluePortLab focuses on transforming European maritime ports into sustainable, low-carbon energy hubs pivotal for the blue economy's transition. Recognizing ports' significant role at the intersection of land and sea, the initiative seeks to rethink maritime ports' function to enhance energy efficiency, biodiversity, and sustainable growth. This aligns with the EU's goals for a clean energy future and sustainable ocean principles.

BluePortLab argues for a transformative vision where ports expand on their traditional roles to become multifunctional spaces driving regional development, social cohesion, and environmental sustainability. It introduces multi-use spatial concepts within ports, incorporating renewable energy, green technologies, and practices to address challenges like greenhouse gas emissions and energy consumption. This approach envisions ports as catalysts for clean energy, promoting synergies among maritime activities to facilitate a climate-neutral blue economy.

Scientifically, the project aims to develop innovative spatial concepts enhancing energy efficiency and biodiversity, assess socio-economic and

environmental impacts, and establish a governance framework for resilient and sustainable port management. Research questions delve into maximizing synergies between energy production, biodiversity, and economic development, understanding socio-economic impacts, and optimizing governance for multi-use spatial concepts. The novelty lies in the holistic perspective on ports, integrating them into broader energy and economic systems for societal benefits. The project introduces Living Labs Networks (LLNs) for real-world testing and co-creation of multi-use infrastructures, fostering collaborative innovation.

Methodologically, a multidisciplinary mixed-methods approach will be employed, structured around LLNs in key maritime regions. This includes developing LLNs, conducting co-creation workshops, launching pilot projects for prototyping, and using data analysis for evaluation. Stakeholder feedback and iterative refinements will ensure adaptability, with successful concepts scaled up for wider application.

The impact plan is based on the Theory of Change, aiming for environmental sustainability, economic competitiveness, social cohesion, and policy influence. The project seeks to embed renewable energy and biodiversity initiatives in port operations, stimulate regional economies, and ensure inclusive transition to a sustainable blue economy. European cooperation is emphasised through transnational collaboration, involving the ports of Ravenna, Aalborg, Trelleborg, and other ports linked to the research network of the partners, e.g. Hamburg, Rotterdam, Naples, Valencia, Antwerp to share experiences and foster innovative solutions. The involvement of port stakeholders will be central to the project. Stakeholder engagement involves academia, industry, government, and civil society, ensuring inclusive and transparent collaboration.

BLUESHORES

Title: Developing hybrid multifunctional foreshore infrastructure that optimises environmental and blue economy benefits (blue-shores)

Priority Area: PA2 - Blue economy sectors, development of marine multi-use infrastructures

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

Countries: Cyprus, Denmark, Greece, Ireland, Italy, Netherlands, Spain

Consortium:

Coordinator:

University of Padova, UNIPD, Italy

Partners:

- Netherlands Institute for Sea Research, NIOZ, Netherlands
- National Institute for Aquatic Resources, Technical University of Denmark, DTU Aqua, Denmark
- Fundación Instituto de Hidráulica Ambiental de Cantabria, FIHAC, Spain
- University College Cork, UCC, Ireland
- Athina-Erevnitiko kentro kainotomias stis technologies tis pliroforias, ton epikoinonion kai tis gnosis, Athena RC, Greece
- Technologiko Panepistimio Kyprou, CUT, Cyprus

Self-funded Partners:

- Provveditorato interregionale per le Opere pubbliche Veneto- Trentino Alto Adige - Friuli Venezia Giulia, PIOPP, Italy
- Veneto Region, VR, Italy

Keywords: Hybrid Nature-Based Solutions, Multi-Use Foreshore Design Concept, Ecosystem Based Coastal Defence, Saltmarsh and Oyster Restoration, Lower Concrete Footprint of Marine Infrastructure, Numerical Modelling, Experimental Pilot Tests, Social Acceptance, Participatory approaches, Low-Elevation Coastal Zones

Abstract: One quarter of the world's coastline is currently protected by static hard infrastructure that is inadequate to mitigate the impacts of sea level rise and climate change. BLUESHORES moves beyond this static concept and tests an innovative and modular hybrid, nature-based design (referred to as HBGI). Our approach combines one soft (3D biodegradable BESE-elements® for kickstarting saltmarsh restoration) and two hard (wooden breakwalls and oyster-based reefs) eco-engineering elements, designed to maximise wave dissipation and reduce foreshore erosion, and to enhance ecological and societal benefits. Pilot trials have shown that the three elements can be

deployed in combination from the foreshore to the backshore of eroding shorelines (breakwalls followed by oyster reefs followed by BESE elements) in a way that exploits the biogeomorphological synergies of these elements to increase the performance of HBGI to mitigate against storm events. This improved performance will enable deployment of HBGI in moderate to high energy sites with moderate to steep slopes, where use of HBGI has previous been viewed as unsuitable and static hard infrastructure used instead. The hybrid design will be deployed and tested in the field at three sites: Venice Lagoon (Mediterranean Sea), Cork Harbour (Atlantic) and the eastern Scheldt Estuary (North Sea). These sites experience different tidal ranges (micro-, meso-, and macro-tidal, respectively, which is considered a critical structural parameter that currently challenges hybrid foreshore designs), as well as different biogeographical, societal and cultural contexts important to HBGI uptake. At all sites, set-up will be in two stages: first, deployment at sheltered, moderately sloping shorelines, which will then inform a second deployment at more energetic, steeply sloping sites. Field test data will be used to develop (i) validated models that characterise and allow optimisation of the energy flux attenuation capability of HBGI, (ii) multi-criteria indicators for analysing the technical, ecological, and societal performance of

HBGI and for proving its benefits and cost/effectiveness compared to traditional grey infrastructure GI, iii) a full economic evaluation of the HBGI to facilitate future business opportunities, and (iv) guidelines to inform decision-making and design of HBGI at other sites. BLUESHORES comprises a multidisciplinary team of marine ecologists, coastal engineers, numerical modellers, environmental economists, environmental psychologists, and environmental managers from seven European countries. The team will work with local communities and stakeholders from the outset to overcome current inefficiencies in the design, assessment, and implementation of hybrid projects, in order to boost application of blue-green urbanism beyond academia and pave the way for marine eco-engineering practitioners and coastal managers to confidently explore and adopt HBGI for future application for foreshore protection.

EVOLVE

Title: Economically viable integrated floating energy islands maximizing social welfare through LCOE optimisation preserving local content and multi-usage considerations

Priority Area: PA2 - Blue economy sectors, development of marine multi-use infrastructures

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

Countries: Belgium, Denmark, France, Germany, Greece

Consortium:

Coordinator:

Vrije Universiteit Brussel, VUB, Belgium

Partners:

- Ecole Centrale de Nantes, ECN, France
- Fraunhofer Institute for Energy Economics and Energy System Technology, IEE, Germany
- Aalborg University, AAU, Denmark
- National Technical University of Athens - NTUA, Greece
- FARWIND Energy SAS, FARWIND, France

Keywords: energy islands, multi-use, wind farms, hydrogen production

Abstract: Within the European Green Deal, targets are set to have an installed capacity of offshore wind of least 60 GW in 2030. To fully leverage the potential of the European Sea Basins, the transition to floating structures is essential, allowing to move beyond construction in the relatively shallow waters. Floating wind is a relatively new market, with only a total installed capacity of 232MW in 2023. This is expected to grow with 5000% by 2030, which means that rapid maturation of this market is needed. Due to the increasing distance between farms and shore, the additional challenges are not only limited to the design of the sub-floater, but also consist of establishing suitable transport vectors between these farms and the mainland, optimizing the operating and maintenance (O&M) strategy of farms, quantifying the energy losses due to wake effects in floating wind, and considering deployment limitations such as conservation, tourism and fishing areas. This means that a competitive Levelized Costs of Energy (LCOE) needs to be achieved compared to conventional energy sources, while increasing the social acceptance of wind energy. These challenges can in part be mitigated by the construction of offshore energy islands.

EVOLVE aims to fill these gaps by delivering technologies and

methodologies to achieve the integration of different offshore energy technologies at the level of energy islands in a way that optimizes the LCOE and social welfare.

Market scenario analyses are performed for different sites across the European sea basins to estimate a maximum viable LCOE, based on regulations, policy constraints and potential incentivization schemes.

Hotspot and potential area analyses are performed for the European sea basins in an multi criteria decision analysis based on estimates of production yield, environmental conditions and multi-use constraints (e.g., fishery, tourism, transport).

Hydrogen production is integrated and optimal transport vectors and routes are investigated to allow for transport of hydrogen in addition to the direct use of electricity. To this end, the use FARWIND's energy ship in combination with floating energy islands is investigated.

In addition, different designs of sub-floaters are developed and tested in both a simulation and lab setup, to maximize production capacity on the floater and increase lifetime.

Finally, an integrated operational strategy is developed to balance the intermittent multi-use renewable energy systems installed on the energy island, to further minimize operational costs and increase production.

OCEAN-H2

Title: Offshore Clean Hydrogen Production for Multi-use Purposes

Priority Area: PA2 - Blue economy sectors, development of marine multi-use infrastructures

Sea-basins: Mediterranean Sea, Baltic Sea, North Sea

Countries: France, Germany, Italy, Malta, Sweden

Consortium:

Coordinator:

L-Universita ta Malta, UM, Malta

Partners:

- RISE Research Institutes of Sweden, RISE, Sweden
- Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e. V., Fraunhofer, Germany
- Università di Napoli Federico II, UNINA, Italy
- Université de Technologie de Belfort-Montbéliard, UTBM, France

Keywords: Green hydrogen, demand and generation Forecasting, offshore renewables, microgrids

Abstract: OCEAN-H2 tackles climate change head-on by pioneering large-scale green hydrogen production using offshore renewable energy sources. This clean alternative to fossil fuels has the potential to significantly reduce greenhouse gas emissions across various sectors, from power generation and transportation to industrial processes.

OCEAN-H2 recognizes the delicate balance between progress and environmental protection. The project implements rigorous environmental impact assessments to minimize harm to marine ecosystems during operation and decommissioning of offshore facilities. Strategies to address potential impacts on marine life, noise pollution, and seabed disturbance will be developed and implemented based on these assessments. The project also prioritizes a holistic approach to sustainability. While focusing on climate mitigation, it adheres to the “Do No Significant Harm”principle. For instance, unlike traditional methods, OCEAN-H2 utilizes seawater electrolysis, eliminating the need for vast quantities of freshwater. Additionally, pollution prevention is addressed through investigating leak-proof storage and transportation solutions for hydrogen, alongside responsible waste management practices.

Through continuous monitoring and evaluation of its environmental and social performance, OCEAN-H2 fosters continuous improvement. Collaboration with a diverse range of stakeholders, including

researchers, policymakers, and civil society organizations, is crucial for achieving this goal. By prioritizing sustainability and responsible development, OCEAN-H2 strives to be a driving force in the transition towards a clean energy future powered by green hydrogen.

MSP4MORE

Title: MSP tools for integrating Multiple sustainability objectives under expansion of Offshore Renewable Energy

Priority Area: PA3 - Planning and managing sea-uses at the regional level

Sea-basins: Mediterranean Sea, Baltic Sea, North Sea

Countries: Belgium, Estonia, Finland, Greece, Latvia, Norway, Sweden

Consortium:

Coordinator:

Swedish University of Agricultural Sciences, SLU, Sweden

Partners:

- University of Tartu, UTartu, Estonia
- Suomen ymparistokeskus ("Finnish Environment Institute"), Syke, Finland
- Panteion University of Social and Political Sciences, PUNIV, Greece
- Hellenic Centre Marine Research, HCMR, Greece
- Institute of Marine Research, IMR, Norway
- Institut Royal des Sciences Naturelles de Belgique, RBINS, Belgium
- University of Antwerp, UAntwerpen, Belgium
- Institute of Food Safety, Animal Health and Environment "BIOR", BIOR, Latvia
- Eigen Vermogen van het Instituut voor Landbouw- en Visserijonderzoek (ILVO), Belgium

Keywords: offshore wind, multi-use, coexistence, marine protected area, nature-inclusive design, fisheries, spatial optimization, cumulative impact assessment, ecosystem services, risk assessment

Abstract: MSP4MORE responds to the urgent challenge of maritime spatial planning (MSP) to enhance offshore renewable energy production while balancing this goal with parallel policy targets. These include expanding marine protected areas (MPAs), promoting ecosystem restoration and minimising competition for space with other sea uses. Currently, efforts to achieve these multiple policy objectives often lack coordination. There is a clear need to consider their trade-offs, associated risks for sustainable development, and potential synergies. The project aims to optimise the design and location of offshore wind farms (OWFs) to align with diverse policy goals across the Baltic, North, Mediterranean, and Barents Seas. Through integrative research in seven study areas and by leveraging findings from

various ongoing initiatives, MSP4MORE fosters innovation through collaborative efforts with stakeholders from government, industry, academia, and civil society. To support sustainable OWF planning and decision-making, the project explores how OWF can provide added value through nature-inclusive designs and multi-use applications. It also examines socio-cultural factors that influence OWF implementation and acceptance and advances tools to assess the cumulative effects of various OWF different designs and levels of expansion at the sea basin scale. Integrated into its research plan, the project develops stakeholder-inclusive knowledge, tools and approaches for optimising planning solutions. The goal is to enable the sustainable co-existence of various sea uses through identifying and dealing with trade-offs and enhancing synergies, based on effects on net impacts on species, habitats and a range of ecosystem services, while also considering the implications of climate change. Strategies for minimising negative impacts and enhancing positive outcomes are emphasised, guided by the principle of "mitigating the bad, promoting the good". MSP4MORE will synthesise findings into best practices and practical decision support for local, national, and regional MSP challenges related to OWF expansion. These outcomes will advance the efficiency of MSP in reaching targets for renewable energy and support EU policies on nature conservation and restoration, aligning with the EU Biodiversity Strategy, the Habitats and Birds Directives, Marine Strategy Framework Directive, and Nature Restoration Law, and the goals of the EU Blue Growth strategy, ultimately promoting goals for climate mitigation and biodiversity.

ALFUNFEED

Title: Fungal single cell protein from macroalgal waste fermentation: improving sustainability and reducing the carbon footprint of fish aquafeeds

Priority Area: PA4 - Blue Bioresources

Sea-basins: Mediterranean Sea, Atlantic Ocean

Countries: Greece, Italy, Portugal, Spain

Consortium:

Coordinator:

Universidad de Vigo, UVIGO, Spain

Partners:

- Università politecnica delle Marche, UNIVPM, Italy
- ODS PROTEIN S.L., ODS, Spain
- Interdisciplinary Centre of Marine and Environmental Research, CIIMAR, Portugal
- University of Thessaly, UTH, Greece

Self-funded Partners:

- Federazione Nazionale delle Imprese di Pesca, Federpesca, Italy
- Axencia Galega de Innovacion, GAIN, Spain
- Conselleria do Mar - Xunta de Galicia, Spain

Keywords: Single-cell protein, macroalgae, fungi, sea bass, appetite, inmunology, nutrition, intestine, microbiota, welfare

Abstract: AlFunFeed aims to transform aquafeed production through innovative biotechnological processes. Its primary objective is to replace plant protein (PP) sources in aquafeeds for carnivorous fish species with single-cell protein (SCP) derived from fungal fermentation of macroalgae-based substrates. AlFunFeed is driven by a multidisciplinary approach, harnessing expertise across various fields. The initial phase lead by ODS focuses on developing SCPs from three strains of filamentous fungi (Neurospora crassa, Rhizopus oryzae, and Fusarium venenatum) and considering four variables in production (temperature, pH, oxygenation, and medium composition) resulting in 3 SCPs to replace 15% PP in diets for European seabass (Dicentrarchus labrax), as a model of carnivorous fish species. With optimal conditions defined, 3 diets will be formulated with SCP from each strain to feed juvenile seabass in a pilot study including feed trial and evaluation of immune status (CIIMAR), feed intake regulation, nutritional profiling, and digestive function (UVigo), gut microbiota (UTH), and fish welfare (UNIVPM). The most promising SCP from pilot study will undergo a validation study under EFSA

recommendations with different levels of PP replacement (15-25%) to determine optimal substitution without compromising fish robustness. Cost analysis and environmental impact of SCP and whole aquafeed production will be also evaluated. Partners of the consortium from key European aquaculture-producing countries (Greece, Spain, Italy and Portugal) representing Mediterranean and Atlantic basins, aim to generate valuable insights and data to benefit aquaculture practices globally. This collaborative effort embodies the quadruple helix model, involving academia, industry, government, and civil society to advance the aquaculture sector towards sustainability and resilience. The project emphasizes sustainability and circular economy principles by valorizing macroalgae discards as a valuable resource for SCP production. AlFunFeed contributes to development of more equitable and environmentally conscious ocean economy aligning with specific challenges outlined in the UN Decade of Ocean Science, such as sustainable ocean economy development and global food security, thus addressing critical global issues. AlFunFeed also prioritizes awareness-raising and engagement activities to promote ocean literacy and responsible aquaculture practices. Through dissemination efforts, the project aims to reach diverse audiences and foster a deeper understanding of the importance of marine resource preservation. The successful implementation of AlFunFeed could lead to the widespread adoption of sustainable aquafeed formulations on industrial scale. Comprehensive dissemination and intellectual property management strategies are in place to ensure responsible exploitation of project outcomes, maximizing its impact and facilitating the transition towards a more sustainable aquaculture sector.

ALGFLAVOR

Title: AlgFlavor - Enhancing algal biomass consumer acceptance for food markets

Priority Area: PA4 - Blue Bioresources

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

Countries: Belgium, Brazil, Cyprus, Denmark, Netherlands, Norway, Portugal, Sweden

Consortium:

Coordinator:

Flanders Research Institute for Agriculture, Fisheries and Food, ILVO, Belgium

Partners:

- Ghent University, UGent, Belgium
- NWO-I's full name is Foundation for Dutch Scientific Research Institutes, Royal Netherlands Institute for Sea Research (NWO-I, NIOZ), NIOZ, Netherlands
- Danmarks Tekniske Universitet, DTU, Denmark
- Nofima AS, Nofima, Norway
- University/research/testsite, Chalmers, Sweden
- S2AQUA - Collaborative Laboratory, Association for a Sustainable andSmart Aquaculture, S2AQUA, Portugal
- STRATAGEM ENERGY LTD, STRATA, Cyprus
- Agriculture Research Brazilian Company, Embrapa, Brazil

Keywords: Consumer acceptance, seaweed, microalgae, flavor, upscaling, food prototypes, seafood alternatives, Life Cycle Sustainability Assessment, risk-benefits analysis, co-creation

Abstract: As society shifts away from animal-based diets driven by environmental sustainability, health, and animal welfare concerns, both seaweeds and microalgae (referred to as algae) have emerged as promising sustainable food sources due to their carbon capture capabilities and interesting nutrient profile, including proteins, minerals and omega-3 fatty acids. Despite their potential, the widespread adoption of algal biomass in food faces significant hurdles on the European markets, primarily stemming from consumer acceptance regarding their impact on taste, aroma, and visual appeal in food products.

AlgFlavor addresses several knowledge gaps and challenges hindering the integration of algae into European diets. Recent research shows the broad diversity of flavor profiles among different algae, which also depend on cultivation and processing conditions. The potential of specific marine algae was highlighted for developing

seafood alternatives due to their intrinsic seafood flavor. AlgFlavor will identify the optimal cultivation and processing conditions to improve the seafood flavor of the algae. Production conditions with desired flavor qualities will then be scaled while maintaining consistency. Through in-depth flavor analysis and consumer acceptance tests, AlgFlavor seeks to enable efficient formulation of food containing algae, focusing on seafood alternatives. Furthermore, the behavior of algal flavor within different food matrices (e.g. lipids, protein or carbohydrates), in presence of flavor enhancers as well as after different types of processing or storage will be investigated; both as model systems and food products. AlgFlavor prioritizes consumer engagement to increase awareness and acceptance of algal-containing food products, thereby promoting healthier and more sustainable dietary choices. Furthermore, environmental, social, and economic impacts of algal production and the algal-containing food will be integrated in AlgFlavor. A risk-benefit study will be carried out to evaluate the effects of consuming algal-containing food products. This assessment will focus on the nutritional impacts and claims of incorporating these food formulations into the regular diets of different population groups within the studied areas.

AlgFlavor adopts a multidisciplinary approach encompassing cultivation science, food technology, food chemistry, sensory evaluation, consumer behavior research, and sustainability and risk-benefit assessment. This approach will bridge the gap between algal producers and the food industry, creating a resilient blue economy. By supporting the growth of the seafood alternatives sector using low trophic species, the project has a positive environmental impact through reducing the pressure on marine animal stocks. As a result, AlgFlavor aligns with the EU's Blue Bioresources priority area by promoting sustainable food production and reducing pressure on marine ecosystems.

BILGEUP

Title: Upcycling of bilge water into biobased solutions for ghost-fishing and oil-spilling

Priority Area: PA4 - Blue Bioresources

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

Countries: Brazil, Cyprus, Italy, Spain, Türkiye

Consortium:

Coordinator:

University of Naples Federico II, UNINA, Italy

Partners:

- Technofluids srl, TF, Italy
- Universitat Jaume I, UJI, Spain
- GTE Karbon Sürdürülebilir Enerji Eğt. Dan. Tic. ve A.Ş., GTE, Türkiye
- Advanced Institute of Technology and Innovation, IATI, Brazil

Self-funded Partners:

- C.I.P. Citizens in Power, CIP, Cyprus

Keywords: bilge water, sludge, surfactants, marine bacteria, marine fungi, polyhydroxyalkanoates, biodegradable fishing gears

Abstract: The BilgeUP project was born with the idea of valorizing a neglected waste product of the maritime industry: bilge water. During navigation, ships of various types, including merchant vessels, fishing boats, and pleasure craft, accumulate bilge water. This wastewater results from activities such as cleaning engine rooms and bilge areas, as well as condensation from air-conditioning systems. It comprises a mixture of oil, grease, and organic and inorganic substances, salts, and metals. Discharging oil residues into marine environments is prohibited by regulations such as those of the International Maritime Organization (IMO) and the European directive 2000/59/EC, hence bilge water must be properly treated on board or disposed of at reception facilities on land. Some ships use fractionation systems to separate the oily fraction from bilge water, resulting in a waste product known as sludge, which is stored on board and then typically incinerated or used in tar production on land. BilgeUP aims to utilize bilge water and sludge, sampled in different European sea basins (Mediterranean Sea, Atlantic Ocean and Black Sea), as starting material for two processes. In the first one, bilge water will serve as a growth medium for marine bacteria and fungi already known as biosurfactants (BS) producers. This bioprocess not only will reduce the environmental impact of bilge water disposal but will produce extremely useful

molecules. Indeed, in the second bioprocess biosurfactants will be added to sludge to make this waste a bioavailable nutrient for the growth of bacteria able to produce polyhydroxyalkanoates (PHA).

The BS produced by the first bioprocess will be tested as dispersing agents in the cleanup of oil spills, thus addressing one of the major causes of marine pollution. While the PHAs produced in the second bioprocess will be applied in the manufacturing of biodegradable fishing gears, these new types of equipment will not only replace the fossil plastic ones but also be proposed as possible mitigation of ghost fishing problems. Indeed, derelict fishing gears continues to fish and trap animals, entangle and potentially kill marine life, smother habitat, and act as a hazard to navigation. Thanks to the production of biosurfactants and biodegradable fishing gears BilgeUP proposes the development of processes that, starting from wastes from various basins, produce products beneficial to the entire marine ecosystem, transforming waste not only into value but even into a concrete solution.

The project's objectives include sampling and characterizing bilge water and sludge from various basins, designing bioprocesses for biosurfactant and PHA production, designing and evaluating biodegradable materials for fishing gear, evaluating the effectiveness of the produced biosurfactants in oil spill cleanup, and assessing the circularity, economic feasibility, and market potential of the final products.

BIOVAL

Title: Microalgal biomass valorization for sustainable production of functional food and feed ingredients

Priority Area: PA4 - Blue Bioresources

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

Countries: Cyprus, France, Ireland, Italy, Netherlands, Norway, Portugal, Spain

Consortium:

Coordinator:

Stazione Zoologica Anton Dohrn, SZN, Italy

Partners:

- Université du Mans, UM, France
- University of Almería, UAL, Spain
- University College Dublin, National University of Ireland, NUID UCD, Ireland
- UiT the Arctic University of Norway, UiT, Norway
- NB PHARMATOX, France
- Instituto Politécnico de Viana do Castelo, IPVC, Portugal
- Algamol Ltd., Cyprus

Keywords: microalgae, functional food ingredients, anti-obesity, biorefinery, solvent-free extraction, biomass valorization

Abstract: The main aim of this proposal is the development of innovative and efficient microalgal cultivation and biomass extraction processes, in order to improve the environmental sustainability of the production of value-added compounds, with particular interest in the development of food supplements and feed for aquaculture. The project will explore a cascade approach to efficiently and selectively extract bioactive lipids from selected microalgal species, focusing on innovative extraction procedures to reduce the environmental impact of toxic solvents. Major attention will be paid to the production of monoacylglycerols (MAGs), bioactive molecules with anti-inflammatory and cancer-prevention activity, but still poorly developed as potential nutraceuticals. The beneficial effects and safety of these compounds will be assessed through in vitro and in vivo assays. These molecules could contribute to increasing the pool of novel marine-derived metabolites providing health benefits as dietary/food supplements, offering valid alternatives to animal-derived food, such as fish oil. The side-stream delipidified microalgae biomass containing mainly proteins and carbohydrates will be exploited for the production of feed for aquaculture. The remaining mass can provide

biofertiliser for agriculture, pointing at creating a zero-waste bio-refinery model. To address the scalability issues inherent in traditional production systems for microalgae cultivation, we will employ Photobioreactor-As (PBR-A) technology, an innovative modular design that allows end users, such as nutraceutical companies and animal feed manufacturers, to deploy PBR-As onsite, ensuring a reliable supply of algae biomass tailored to specific commercial needs. Overall the project will provide new knowledge for efficient cultivation and extraction processes to improve the environmental sustainability of valuable compounds production from microalgal biomass for food supplement and aquaculture feed, in line with the objectives of the GreenDeal and the Sustainable Development Goals.

DORIS

Title: Development of Modular and Mobile By-Product and Wastes Bio-refiney Valorisation Systems and Supporting Structures for Fisheries and Aquaculture SME Industries

Priority Area: PA4 - Blue Bioresources

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

Countries: Belgium, Greece, Ireland, Norway, Poland

Consortium:

Coordinator:

Atlantic Technological University Sligo, ATU, Ireland

Partners:

- Politechnika Lodzka, TUL, Poland
- Norsk institutt for bioøkonomi, NIBIO, Norway
- Hellenic Centre for Marine Research, HCMR, Greece
- Université libre de Bruxelles, ULB, Belgium

Keywords: Biorefinery, valorisation, fisheries and aquaculture wastes, circular economy, blue econmy, small and medium enterprises, blue resources, biomass conversion, mobile, modular

Abstract: The DORIS project is an ambitious innovative project which proposes solutions to improve the the availability of valorisation oppourtunities, uptake, and potential financing/ funding mechanisms for waste biomass processing in EU Blue SMEs. The main objective of the project is the research and development of lab-scale mobile and modular biorefinery conversion systems for use in Blue processing SMEs operating in diverse EU Basin locations. This is with the goal of advancing and testing practical flexible and scalable valorisation technology prototypes for the cost-effective conversion of fishery and aquaculture by-products and wastes to medium and high value products. The project focuses on the conversion of the main blue by-product types in EU sea basins i.e. Finfish, crustacean and mollusc wastes. To ensure the suitability and relevance of the developed outputs, the effectiveness and feasibility of the proposed valorisation approaches through specific case study considerations relevant to SMEs and EU Basin production scenarios will be tested and validated. The DORIS project will also afford a detailed mapping and estimation of practical exploitable by products and wastes resources in the Sea Basin regions, coupled with an assessment of the economic viability, environmental impact, and societal benefits of the developed biorefinery systems.

With lack of capital, and knowledge of funding approaches a major barrier to the uptake of valorisation technologies by Blue SMEs, DORIS will further investigate and propose practical funding and ownership models for the developed valorisation systems. The project also reflects on and considers the legislative requirements to ensure compliance and enhanced uptake of developed technologies, and will also inform the development of policy support instruments. The project activities and execution which is designed with full quadruple helix engagement of all relevant stakeholders and actors affords an ambitious multi-disciplinary knowledge and innovation exchange between research, local policy and engaged enterprise sectors, aimed at informing policy and strengthening the local industry capacities to institute sustainable and cost-effective circular economy.

FORSEA

Title: Formulation of seaweeds to high-value ingredients for food and nutraceuticals markets

Priority Area: PA4 - Blue Bioresources

Sea-basins: Baltic Sea, Atlantic Ocean

Countries: Denmark, Norway, Portugal, Sweden

Consortium:

Coordinator:

Lund University, ULUND, Sweden

Partners:

- Seaweed Solutions AS, SES, Norway
- University of Copenhagen, UCPH, Denmark
- ISI Food Protection ApS, ISI-FP, Denmark
- University of Copenhagen, UCPH, Denmark
- NOVA University of Lisbon, NOVA, Portugal
- Instituto de Biologia Experimental e Tecnológica, IBET, Portugal
- MØREFORSKING AS, MF, Norway

Keywords: Alaria esculenta, Saccharina latissima, Ulva sp, Fucus vesiculosis, fermentation, lactic acid bacteria, health-promoting, clinical trial, sensory evaluation, prebiotics

Abstract: One of the biggest societal challenges today, is to feed the growing world population. The global food system today causes major environmental problems (e.g. loss of biodiversity, greenhouse gas emissions, water overuse, and pollution) and there is a great need to implement a sustainable system. Cultivated macroalgae have the potential to be a pillar in such a sustainable system. Macroalgae are a staple food in Asian diets and are a resource that can be cultivated without the need for freshwater, with no fertilizers, and at the same time sequestering CO2, avoiding further compromise of the sustainability and biodiversity of natural resources. Seaweeds, however, still face challenges in penetrating western markets due to low nutritional content, and low inclusion rates in foods because of sensory properties, needing innovation in product development, and closing of knowledge gaps regarding safety and health benefits. The ForSea project aims to enhance the nutritional, safe, and functional properties of cultivated brown and green seaweeds and formulate food and food ingredients, via sustainable processing technologies, including fermentation, and utilization of both complete harvests and residual biomass from the developed processes.

The project will further develop, characterize, and formulate novel food prototypes, evaluated by sensory trials, and with validated health-promoting properties via prebiotics verification and a clinical trial on a selected promising product. In addition, environmental and economic, aspects will be assessed at different process stages, along the value chain. The consortium consists of 8 partners and 4 subcontractors (including universities, research institutes, industry partners (SMEs), and a municipality center) representing four countries (Norway, Sweden, Denmark, and Portugal) and will utilize marine resources from both the Atlantic Ocean and Baltic Sea. Key technologies in the project include biomass cultivation, pre-processing, extraction (by solvents and enzyme aided), microbial processing, food formulation, and safety, sensory and clinical trials as well as environmental and techno-economic assessments. New knowledge, methodology and prototypes will be developed based on renewable and sustainable marine biomasses, contributing to the growth of the blue economy, via development of scientific excellence, and work towards solving key societal challenges.

PALMARIAPLUS

Title: Advance the production and market viability of red seaweeds in Europe by improving reproduction and cultivation techniques as well as developing novel tools and approaches to quantify and control product quality

Priority Area: PA4 - Blue Bioresources

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

Countries: Denmark, Ireland, Norway, Sweden

Consortium:

Coordinator:

Norwegian Institute of Food, Fisheries and Aquaculture Research, NOFIMA, Norway

Partners:

- University of Gothenburg, UGOT, Sweden
- National Institute of Aquatic Resources, DTU AQUA, Denmark
- Atlantic Technological University, ATU, Ireland
- Cartron Point Shellfish Ltd, CPS, Ireland

Keywords: Seaweed dulse aquaculture low-trophic palmaria

Abstract: Seaweed farming is regarded as a cornerstone of the future sustainable blue bioeconomy in Europe. It is broadly recognised that increased seaweed utilisation by Europeans would substantially benefit marine ecosystems, coastal economies, human health, and mitigate climate impacts of other human activities. Seaweed farming is also much more gender balanced than other sectors of agriculture or aquaculture and is rapidly growing both in Europe and across the globe. For all its societal benefits, however, seaweed farming in Europe faces challenges at present due to the difficulties in utilising kelp, the primary seaweed species we are able to grow. In order for seaweed farming to proliferate and generate the benefits that have been promised, the industry must find ways to diversify production by domesticating new species, developing new cultivation techniques, and innovating new tools to measure and control seaweedquality.

PalmariaPlus will generate improved techniques for efficient cultivation of red macroalgae (Palmaria palmata and Chondrus crispus) across Northern Europe. Specific activities include:

1) Developing new methods to increase seed supply of juvenile macroalgae in hatcheries;

2) Testing optimal conditions for efficient cultivation in tank systems, modifying water flow, areation, lighting, etc.;

3) Evaluating farm performance

at sea sites across Norway, Sweden, Denmark, and Ireland, and investigating the effects of numerous environmental parameters on growth at sea;

4) Developing novel imaging tools to rapidly quantify the content of valuable biochemicals in red seaweeds;

5) Testing genetic aspects of growth performance and environmental sensitivity across macroalgae populations in Europe. Results will be communicated directly to seaweed farmers and industry consumers. Broader engagement and dissemination will be achieved through workshops and training courses which will highlight the findings and innovations to the seafood industry and public.

The outcomes of PalmariaPlus will unlock the potential for seaweed farmers to begin cultivating these high-value red seaweeds and provide valuable production benchmarks at a regional scale to strategize expansion of seaweed farms. The introduction of these new cultivated products to the market, and the promotion by this project, will also stimulate the supply chain to foster increased utilization of these health-positive ingredients by European consumers. By diversifying the species portfolio for seaweed aquaculture, new market opportunities will be created and the potential for this nature-positive industry will expand.

RESEALIENCE

Title: Unlocking the Potential of Seaweeds and Halophytes through Biorefinery for Enhanced Resilience in the Aquaculture Agri-Food and Chemical Industries

Priority Area: PA4 - Blue Bioresources

Sea-basins: Mediterranean Sea, Atlantic Ocean

Countries: Belgium, Brazil, Cyprus, Denmark, Greece, Norway, Portugal, Spain, Sweden, Tunisia, Türkiye

Consortium:

Coordinator:

Lulea Tekniska Universitet, LTU, Sweden

Partners:

- Ege University, EGE, Türkiye
- SINTEF Ocean AS, SINTEF, Norway
- ELLINIKOS GEORGIKOS ORGANISMOS – DIMITRA, DIMITRA, Greece
- Fundación Centro Tecnológico de Acuicultura de Andalucía, CTAQUA, Spain
- ISOTECH LTD, ISOTECH, Cyprus
- Institut National des Sciences et Technologies de, INSTM, Tunisia
- Universidade Federal de Santa Catarina, UFSC, Brazil
- Universidade Federal do Rio Grande - FURG, FURG, Brazil
- ENORM Biofactory, ENORM, Denmark
- Interdisciplinary Centre of Marine and Environmental Research, CIIMAR, Portugal
- Aalborg University, Denmark
- Haloderma ApS, HALODERMA, Denmark
- Halorefine ApS, HALOREFINE, Denmark
- Soieries Elite N.V., SE, Belgium

Keywords: Sustainable Marine Biorefinery, Seaweed Valorization, Halophyte Bioconversion, Seaweed nutrient upcycle, Green Extraction Technologies, Blue Economy Innovation, Marine Biodiversity Conservation, Aquaculture Sustainability, Bioproducts Development, Integrated Multi-Trophic Aquaculture

Abstract: The ReSEAlience project, titled “Unlocking the Potential of Seaweeds and Halophytes through Biorefinery for Enhanced Resilience in the Aquaculture, Agri-Food, and Chemical Industries,” seeks to revolutionize marine biomass use by developing a universal biorefinery model. This model focuses on the sustainable processing of Salicornia (a halophyte) and seaweed biomass, exploiting their synergistic

potentials within Integrated Multi-Trophic Aquaculture (IMTA) systems to address eutrophication effectively. By sourcing biomass from diverse marine environments like the Atlantic Ocean and Mediterranean Sea, the project ensures a broad approach to biomass utilization across different settings.

At the heart of this innovative initiative is the HALOREFINE extraction technique, a legacy from the H2020 Aquacombine project. This method extracts bioactive compounds from marine biomass without toxic solvents, thus minimizing environmental impact and safeguarding ecosystem health. The remaining biomass undergoes further processing into valuable products such as cellulose for the textile industry and fermentable sugars, along with proteins and fats suitable for bioconversion into sustainable, high-value feed alternatives. This process is emblematic of a zero-waste philosophy, utilizing the entirety of the biomass to avoid waste.

A notable expansion of the project involves the use of residual biomass for textile production. Through a process known as organosolv fractionation, specifically adapted for Salicornia, this method efficiently separates cellulose. In parallel, alginate is extracted from seaweed using an alkaline extraction process. These processes yield cellulose and alginate from marine biomass, which are then transformed into high-quality fibers for the textile industry, providing a renewable, sustainable alternative to traditional materials. This innovation not only diversifies the applications of marine biomass but also contributes to a more sustainable textile industry by offering an eco-friendly resource alternative.

Moreover, the project explores the innovative cultivation of Black Soldier Fly Larvae (BSFL) and marine Thraustochytrids, using the partially processed residual biomass as feed to transforms the biomass into a rich source of proteins and fats, demonstrating an advanced approach to waste valorization within the biorefinery model.

ReSEAlience is committed to engaging a wide range of stakeholders, including industry, academia, and policymakers, throughout its lifecycle. This ensures that the project's outputs are closely aligned with societal needs, facilitating integration into existing value chains and maximizing the impact on the sustainable blue economy. Through interdisciplinary collaboration and pioneering biorefinery models, ReSEAlience underscores the significant potential of sustainable marine biomass utilization to support economic growth and ecosystem health across key industries such as aquaculture, agri-food, and chemicals.

SEABIOCAT

Title: Biocatalytic refining of seaweed carbohydrates for producing higher-value, polymer precursors

Priority Area: PA4 - Blue Bioresources

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

Countries: Denmark, Faroe Islands, Iceland, Netherlands, Sweden

Consortium:

Coordinator:

Matís ltd., Matís ltd., Iceland

Partners:

- Lund University, ULUND, Sweden
- Technical University of Denmark, Novo Nordisk Foundation for Biosustainability, DTU, Denmark
- LL-BioEconomy, LL-Bio, Denmark
- University of Amsterdam, UvA, Netherlands

Self-funded Partners:

- Ocean Rainforest Sp/F, ORF, Faroe Islands

Keywords: Seaweed, biocatalytic refining, enzymes, polymers, sustainability, replacing fossil-based chemicals

Abstract: The SEABIOCAT is a marine-biotechnology proposal which aligns with the priority area Blue Bioresources – Blue Biotechnology of the Sustainable Blue Economy Partnership. SEABIOCAT addresses major global challenges of energy and the environment, developing sustainable next generation macroalgal biomass as an alternative to fossil-fuel- and 1st generation biomass for bulk generation of biobased platform-chemical. Specifically, SEABIOCAT will establish a one-reactor Cell-Free System (CFS) utilizing robust thermostable enzymes for refining polysaccharides from brown macroalgae to building blocks for biopolymers/bioplastic synthesis. The biopolymer market is forecasted to grow immensely in the foreseeable future, and bioresources are needed to replace fossil-fuel based feedstock. The expansion is anticipated to be hampered by a scarcity of sustainable biomass. Brown macroalgae are an abundant underexploited bioresource, which can be cultivated in bulk, not competing with terrestrial plant crops for space, water or nutrients, biomass, and they are new to industry as an industrial feedstock resource. SEABIOCAT will increase utilization of this mostly untapped vast bioresource supplementing or supplanting terrestrial feedstocks and develop bioconversion technologies for processing and production of

important value-added platform-chemicals and biopolymers. It will help to make the macroalgal biorefinery and associated biobased chemical producers economically more viable, by increasing bulk production of biobased products, by increasing resource efficiency and by expanding product range. Life Cycle Assessment (LCA) will be a vital part of the project for assessing the sustainability and environmental impacts of the process and products. This is important because to succeed on the market, bio-based products need to prove their sustainability and lower environmental impact when compared to petrochemical products. SEABIOCAT is of special significance for Northern Europe with long shorelines and access to vast sea areas for offshore cultivation of brown macroalgae. It focuses especially on the north Atlantic Ocean (Artics) sea-basins. However, the proposed biorefinery process can be implemented everywhere close to sea to maintain sustainability. The Baltic sea and the North See have representatives in the consortium. SEABIOTEC will help economic growth and job creation in rural coastal regions where macroalgae are cultivated and harvested, increase employment and countereffect declining maritime industry in these regions.

The consortium brings together groups with highly competent and complementary expertise and experience in the supply and pre-processing of biomass, production optimization, and process and product design. MATIS (Iceland), an R&D organisation, with a long experience and expertise in marine biotechnology, will be responsible for overall management and coordination of the project including the organizational and financial management.

SEALGAEPOWER

Title: Sustainable development of microalgae-based products using waste streams from aquaculture and seafood processing industry as feedstock

Priority Area: PA4 - Blue Bioresources

Sea-basins: Mediterranean Sea, North Sea

Countries: Brazil, Denmark, Ireland, Italy, Malta, Norway, Portugal, Sweden

Consortium:

Coordinator:

University of Gothenburg, UGOT, Sweden

Partners:

- Chalmers University of Technology, Chalmers, Sweden;
- NORCE Norwegian Research Centre AS, NORCE, Norway
- University of Aveiro, UAveiro, Portugal
- University of Palermo, UNIPA, Italy
- Sustainable Innovation Technology Services Ltd, SITES, Ireland
- RISE Research Institutes of Sweden, RISE, Sweden
- Blue EcoTech Ltd., BET, Malta
- Nordicflexhouse, NFH, Denmark
- Danish Technological Institute, DTI, Denmark
- Universidade de Sao Paulo, USP, Brazil
- Norwegian Institute of Bioeconomy Research, NIBIO, Norway

Self-funded Partners:

- Klädesholmen Seafood AB, Klädesholm, Sweden
- RAGN-SELLS HAVBRUK AS, Ragn-Sells, Norway

Keywords: marine microalgae, aquaculture, seafood processing industry, wastewater remediation, microalgae cultivation, cascade biorefinery, biomass valorization, microalgae-based products, bioactive properties of microalgae, value-chain circularity

Abstract: The fast-growing land-based aquaculture and seafood processing industry generate large amounts of nutrient-rich wastewater, posing a high cost for discharge and environmental impact. At the same time, there is an increasing demand for new resources intended for carbon-neutral production of food, material and energy. The ability of microalgae to perform photosynthesis and efficiently convert dissolved nutrients into valuable biomass could contribute to solving this dual problem. The overall objective of the SEAlgaePower

is to develop microalgae-based technologies to clean wastewater from the aquaculture and seafood processing industry while simultaneously producing biomass for novel ingredients in a sustainable way. The specific aims are to: (i) select suitable microalgae species/strains from the North and the Mediterranean Sea in a lab-scale cultivation system based on the ability to grow in different wastewater types; ((ii) develop pilot-scale algae cultivation protocols and wastewater cleaning; (iii) develop biorefinery protocols for protein, lipid and carbohydrate recovery from the microalgal biomass; (iv) develop microalgae-based prototypes and ingredients; (v) assess environmental and socio-economic aspects associated with the project solutions on wastewater cleaning, microalgae cultivation and biomass valorisation, and (v) maximise the project impact, visibility, and legacy.

SEAlgaePower consortium consists of fourteen partners from eight countries with well defined roles according to their expertise. UGOT, NORCE and UNIPA will provide microalgae strains. UGOT will employ a two-stage cultivation in laboratory conditions and select those strains which in combination with wastewater from salmon aquaculture and process water from the seafood industry (Klädesholmen SeaFood) give the highest biomass yield and the cleanest water. NORCE and DTI will scale-up the cultivation in wastewater from salmon aquaculture (Ragn-Sells and NFH, respectively), and optimize it for selected microalgae to achieve maximal nutrient removal via conversion to proteins, omega-3 fatty acids, carbohydrates, and carotenoids. The biomass will be sequentially fractionated by UAveiro together with Chalmers and DTI. Depending on the composition of different fractions, prototypes and ingredients will be developed for fibers in Medtech (RISE), fish feed (DTI), food (Chalmers), and fertiliser (NIBIO). The bio-activities of the extracts will be tested by UNIPA and UAveiro for use as ingredients in MedTech, nutra- and pharmaceuticals. Environmental and socio-economic assessment of the project, dissemination of the results to stakeholders and public will be performed by Blue EcoTech, SITES, and ISP. SEAlgaePower will contribute to establish a EU climate-neutral, sustainable, resilient blue economy, leveraging microalgae-based technologies which can turn a current cost of seafood producing and processing companies into an income source through valorization of their wastewaters.

SEANERGIES

Title: Cell-cultured octopus production through sustainable marine biomass valorization

Priority Area: PA4 - Blue Bioresources

Sea-basins: Mediterranean Sea, Atlantic Ocean

Countries: Brazil, Italy, Netherlands, Norway, Portugal

Consortium:

Coordinator:

Wageningen University & Research, WUR, Netherlands

Partners:

- CS2AQUA - Laboratório Colaborativo, Associação para uma Aquacultura Sustentável e Inteligente, S2AQUA, Portugal
- Associação Oceano Verde - Laboratório colaborativo para o desenvolvimento de tecnologias e produtos verdes do oceano, GreenCoLab, Portugal
- Nord University, NORD, Norway
- Stazione Zoologica Anton Dohrn, SZN, Italy
- Associazione Cephalopod Research-ETS, CephResETS, Italy
- Federal University of Paraná / Universidade Federal do Paraná, UFPR, Brazil

Self-funded Partners:

- Agricoltura Cellulare Italia APS, AC IT, Italy

Keywords: cultivated seafood, octopus, sustainability, environment, food production, bio-based products, valorization, microalgae, seaweed, circularity

Abstract: The world's population is projected to surpass nine billion by 2050, posing significant challenges for global food production and security. Current livestock farming and fishing practices are unsustainable owing to their greenhouse gas emissions and pollution. Fisheries and aquacultures are major causes of marine litter, ocean damage, and habitat destruction. In addition, factory farming or aquaculture practices, often characterized by overcrowded and unsanitary conditions, have been linked to an increased risk of zoonotic diseases, posing a serious threat to human health and animal welfare. As a result, there is a need for more sustainable and ethical food alternatives. Cultivated meat is an emerging technology where meat is produced using animal cell culture and is seen as a viable alternative, as it mitigates the impacts of conventional livestock and fishing practices. Nevertheless, major technological challenges still need to be addressed to achieve large-scale and cost-efficient cultivated

meat bioprocesses. These include the development of i) immortalized cell lines, ii) cost-efficient animal-free media, and iii) biocompatible scaffolds for cell culture. While this technology has primarily focused on terrestrial species, there is increasing interest in cultivated seafood. The octopus, known for its remarkable tissue regeneration capabilities, is a culturally significant food source globally. The increasing demand for octopus has led to the overexploitation of wild populations.

SEANERGIES hypothesizes that octopus cells involved in muscle regeneration could be utilized to create cell lines with enhanced growth and differentiation for cultivated octopus production. To tackle the challenges of media and scaffolds, micro- and macroalgae will be investigated for formulating animal-free, cost-effective culture media and developing biocompatible scaffolds.

WP2 will identify and characterize cell populations involved in octopus muscle regeneration. WP3 aims to establish culture protocols and continuous cell lines for octopus muscle cells. WP4 will develop animal-free culture media using microalgae, assessing various formulations for optimal cell growth. In, WP5 we will develop biocompatible scaffolds for octopus cell culture using decellularized seaweed. WP6 involves designing a preliminary bioprocess for cultivated octopus production and conducting techno-economic analyses. WP7 will focus on studying the social impact cultivated octopus may bring to different stakeholders. Finally, WP8 will be focused on dissemination, communication, and engagement with relevant stakeholders to maximize impact.

By integrating the establishment of high-performing octopus muscle cell lines, with the development of animal-free microalgae-derived culture media and seaweed-based scaffolds, SEANERGIES aims at advancing the state-of-the-art in cultivated seafood alternatives by laying the foundation for cultivated octopus production.

SEAWEAVE

Title: Novel functional textiles from red and brown seaweed

Priority Area: PA4 - Blue Bioresources

Sea-basins: Mediterranean Sea, Atlantic Ocean

Countries: Denmark, Italy, Netherlands, Norway, Spain, Sweden

Consortium:

Coordinator:

Kungliga Tekniska Hoegskolan, KTH, Sweden

Partners:

- Aalborg Universitet, AAU, Denmark
- University of Foggia, UNIFG, Italy
- SINTEF AS, SINTEF, Norway
- RISE Research Institutes of Sweden AB, RISE, Sweden

Self-funded Partners:

- Zeefier, zeefier, Netherlands
- PYRATES Smart Fabrics SL, PYRATEX®, Spain

Keywords: Macroalgae, seaweed, textiles, dyes, fibers, composites, biorefinery

Abstract: Today's global textile and garment industry is characterized by overproduction and little reuse in so-called "fast fashion", accompanied by an increased use of synthetic materials that are non-renewable and contribute to 35% of microplastics pollution in the Oceans, along with toxic and non-degradable dyes. Biobased textiles are today produced from land-based resources which require large amounts of arable land and fresh water resources, and we must now look to the marine environments for more sustainable feedstocks. Macroalgae are fast growing low-trophic organisms found all around the world in wild populations and represent the world's largest aquaculture industry (>35 million tons/year). The European seaweed industries, however, make up only 0.8% of the global production and is predominantly from wild harvest, and seaweed cultivation has a large potential for growth. Due to the fast growth, versatile applications, and important ecosystem services of farmed and wild seaweed, expansion of this industry can be a significant contributor to meeting global sustainability targets.

The SeaWeave project will establish new knowledge and develop technologies for the conversion of macroalgae from the Atlantic Ocean and Mediterranean Sea into textile fibers and dyes. The project consortium consists of seven partners from six countries in a highly cross-disciplinary

collaboration to develop technology and solve societal challenges along the entire value chain from raw material to products.

SeaWeave will focus on cultivated biomass and other sustainable seaweed feedstocks, and study how the biomass composition and structure is related to its properties for textile applications. We will develop pre-treatment and biorefinery processes to extract and maintain polysaccharides and pigments in an integrated and circular process. Innovative fibers will be developed through functionalization and innovative combination of materials and manufacturing methods, providing functional textiles that can be scaled in an environmentally and economically feasible manner. New fabric prototypes will be developed toward the fashion and furniture industries, as well as functionalized fibers. Lastly, the project will perform environmental and social assessments along the value chain, to understand the short- and long-term impacts of the developed technology and products, in close collaboration with stakeholders.

VASEACAD

Title: Valorising seafood side streams, residues, unwanted catches and discards for production of bioactive protein hydrolysates and high added value biomolecules

Priority Area: PA4 - Blue Bioresources

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

Countries: Cyprus, Greece, Ireland, Malta, Norway, Spain, Türkiye

Consortium:

Coordinator:

Hellenic Centre for Marine Research, HCMR, Greece

Partners:

- Technological University Dublin, TU Dublin, Ireland
- Frederick Research Center, FRC, Cyprus
- Blue EcoTech Ltd., BET, Malta
- Institute of Agrifood Research and Technology, IRTA, Spain
- SINTEF Ocean, SINTEF, Norway
- Karadeniz Technical University, KTU MSF, Türkiye
- Blue Island Holdings Plc, BlueIsland, Cyprus
- Kimagro Fishfarming LTD, KIMAGRO, Cyprus
- BioAtlantis Limited, BIOAT, Ireland

Keywords: side streams valorisation, bioactive protein hydrolysates, high added value biomolecules, inter-species recycling, discards, blue fin tuna, European seabass, gilthead seabream, European sprat, blue whiting

Abstract: The VASEACAD project aims to maximize the value derived from marine fish biomass side streams within the aquaculture and fisheries sectors. Its primary objective is to enhance the efficiency and circularity of these industries while promoting sustainable practices and value creation from underutilized resources. Focusing on species such as blue fin tuna (BFT), European seabass, gilthead seabream, European sprat and blue whiting, the project aims to extract high-value biomolecules for various applications.

A fundamental challenge in the Mediterranean region is the fragmented and small quantities of side streams compared to those in Northern Europe. Addressing this, SINTEF's Mobile Sealab integrates a setup aimed at recovering valuable resources such as oil, protein-rich fractions and other nutrients from waste generated by the fisheries sector. Hydrolysates play a crucial role in preserving biomass, maintaining nutrient content, extending shelf life, reducing environmental

impact, adding value, and providing health benefits. Despite currently being repurposed into neutraceuticals and ingredients for animal feed in Northern Europe, there is potential to extract high-quality Omega-3 fish oil and proteins from these underutilized raw materials even in the Mediterranean and Black Seas.

With 7 scientific objectives guiding its efforts, VASEACAD tackles critical knowledge gaps and challenges. These include effectively extracting biomolecules from seafood side streams, developing bioactive hydrolysates to mitigate chronic inflammatory diseases, scaling up production of protein hydrolysates, utilizing solid spent residue for aquafeeds, promoting inter-species recycling, evaluating economic and environmental implications and advancing knowledge and policy development for European inter-species recycling.

The methodology is comprehensive and collaborative, organized into six distinct work packages (WPs) covering coordination, bioactive hydrolysate generation, valorization of side streams, feeding trials, economic viability analysis, and dissemination. Through these WPs, VASEACAD leverages the expertise of consortium members from various institutions and countries to ensure a holistic approach.

Ethical considerations are central, with a commitment to compliance with national and international guidelines, transparent stakeholder engagement and health and safety measures. Stakeholder engagement follows a quadruple helix model, involving research organizations, industry partners, government agencies and societal representatives, ensuring alignment with societal needs and values.

In terms of expected impacts, VASEACAD aims to valorise seafood side streams, contributing to food security, resource utilization and environmental sustainability. It is anticipated that the project will lead to industry adoption of optimized processes, policy integration, economic growth, job creation and improved environmental sustainability in the aquaculture and fisheries sectors.