



SEASTAR



Co-funded by
the European Union

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Blue Economy call EMFF Work Programme 2018
Call for Proposals EMFF-2018-1.2.1.7

SEASTAR PROJECT FACTSHEET



Addressed Challenge

Aquaculture is one of the most prominent food industry segment in Europe and globally. A steady growth is expected for many years to come, as by 2050 it is expected that most of the food for the 9.7 billion humans will come from sea-based farms.

The sector, however, still suffers from high production costs which challenge its expansion. Many daily operations and monitoring activities are performed manually or with costly in-situ interventions. Moreover, the following challenges are affecting the industry:

- Mortality rates reduce the sector efficiency
- Feed spills can be further reduced
- There is the need to get real time fish welfare information, to forecast risks for optimal risk management and mitigation.

SEASTAR project aims at addressing such challenges thanks to the complementary unique skills and expertise of the consortium which is composed by WSense S.r.l. (Project Coordinator), WSense AS, Lerøy Seafood Group, Lerøy Vest and the University of Bergen



W-Piconode



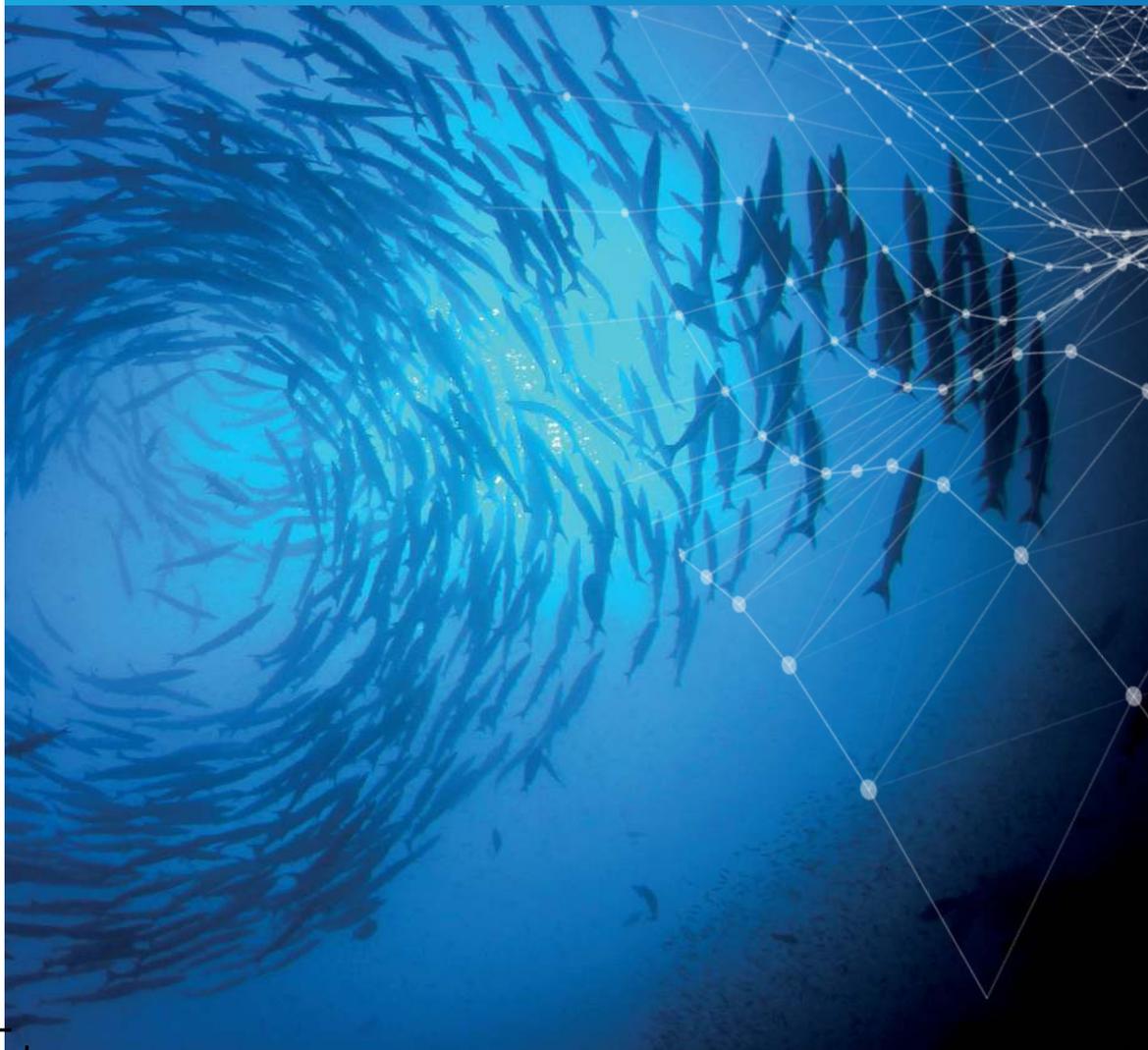
SEASTAR SMART AQ SYSTEM: ENABLING AQUACULTURE 4.0

SEASTAR has addressed the need for full digitalization of the aquaculture sector, by exploiting innovative Internet of Underwater Things Technologies and integrating them with last-generation miniaturized wearable sensors to be placed on fish. The resulting system provides an innovative underwater wireless monitoring infrastructure that, for the first time, will allow fish farmers to monitor the health of fish remotely, in real time, and to gather relevant data (water quality and cage structural integrity) for accurate risk assessment, forecasting and management. In order to achieve such ambitious goals, the project has been planned in order to implement the following activities:

- A.** to equip fish in each cage with wearable sensors to gather data on their health status (e.g., position, swimming speed, heart rate) in real time via miniaturized acoustic pico-modems;
- B.** to build a sensing and communications infrastructure that can be easily placed outside/on/inside the cage;
- C.** to build a gateway node placed on the cage ring equipped with up to three acoustic modems (able to receive the signal from underwater network) and with different radio communication technologies for above water communication of data;
- D.** to develop a software platform to integrate, store, analyse, and visualize gathered data and to support remote control and management of the system;
- E.** to demonstrate the integrated system through dedicated pilots carried out in Norway and Italy.



**In situ real-time continuous monitoring
of the underwater environment, enabling
fish welfare and cage structural
integrity monitoring**



01

PROJECT CONCRETE RESULTS

The project has resulted in a fully validated market ready monitoring system displayed in the next page which is made of the following products:



W·Node

UNDERWATER
SENSOR NODE



W·Gateway

CONNECTING UNDERWATER
AND TERRESTRIAL NETWORKS



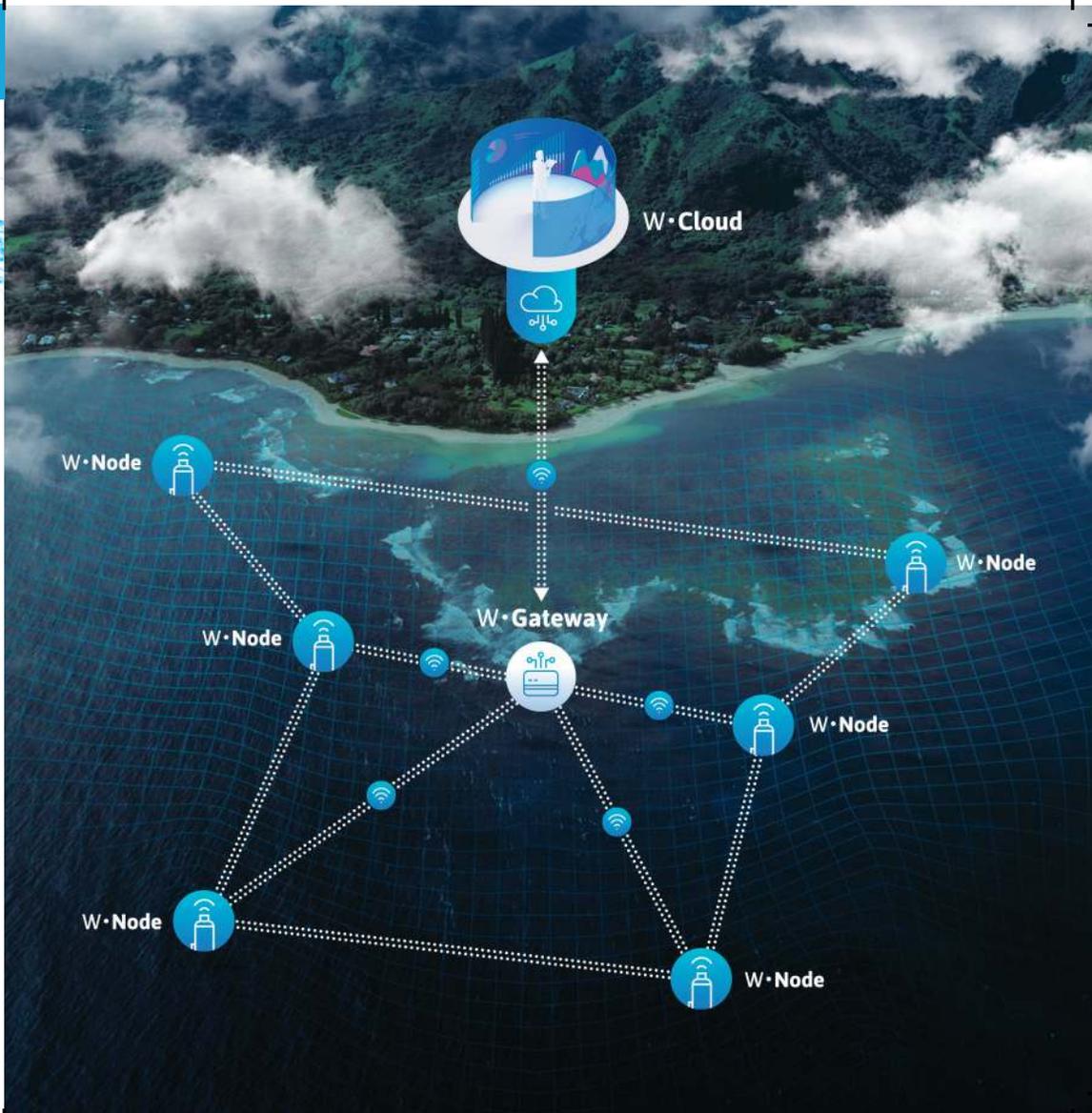
W·Cloud

CLOUD SOFTWARE
PLATFORM



W·Pico

PICOMODEM





W·Node

It is the underwater sensor node which is connected to sensors and actuators; the W-Node receives and compresses the data and it securely and reliably transmits such data through our underwater wireless mesh networks to a gateway. It integrates different vendor sensors (e.g., able to monitor DO, temperature, currents, Ph, Salinity, turbidity, chlorophyll, structural stresses) providing wireless connectivity and power to the sensors for one year operation, thanks to WSense's power management module. The W-Node also provides depth measurements and supports underwater GPS capability.



W·Gateway

The W-Gateway is the device which translates underwater signals into radio signals transmitting the information to either a remote control center or to our W-Cloud software platform via WiFi, 4G/5G or satellite networks. The W-Gateway is also an edge computer, which implements signal processing and machine learning algorithms; this component can implement a local digital twin for the aquaculture sector..



W·Cloud

The W-Cloud software platform allows to store, analyze and visualize in real time data. We have IP protection on W-Cloud proprietary 3D user interface. Following the opposite path, through a web interface a user can send commands to the W-Cloud which then forwards such commands to the W-Gateway and from the gateway through the underwater network to a set of nodes. This allows to change the sensors to activate, how often data should be recorded and transmitted and the alarm thresholds; all these aspects can be changed in real time.



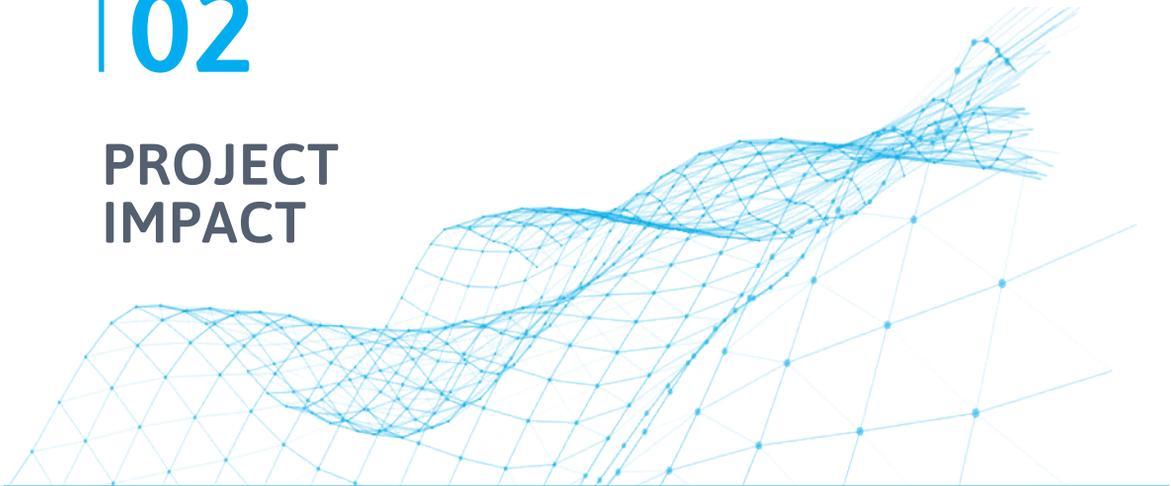
W•Pico

The W-Pico is the smallest existing modem (1cm by 5cm), with an integrated sensing board for fish welfare and fish activity monitoring (fish position and depth, fish activity). We are currently piloting a new sensing board for measuring heart rate.



02

PROJECT
IMPACT





Enviromental impact

The integrated underwater wireless monitoring system has been piloted in three sites in the Bergen and Dønna areas (Norway) and in La Spezia areas (Italy) each for at least six months. Piloting activities have also included the assessment over time by third party scientists of the accuracy of the water quality monitoring system.



Social impact

The project has contributed to the definition of the AquaCloud 2.0 standard and has developed a full implementation of the standard, which allows integration of sensor data from different farms and sensors manufacturers for risk assessment and forecasting. The W-Gateway product and the W-Cloud in particular have been extended with modules implementing the standard. The improvement of the standards together with the increase of the monitoring activities to be performed remotely, which will reduce in situ operation and risks for human personnel, are part of the project social impact.



Economic impact

Together with a reduction in the aquaculture production costs and potential increase in revenues as a general impact of the project on the sector, SEASTAR has also implied an economic impact on the consortium partners. As a matter of fact, the leading technology developer, WSense group, has doubled its team during the course of the project and has attracted €2,5 million of private investments in a round closed just at the end of the project. WSense S.r.l. has also developed an aggressive exploitation plan to bring the technologies to the global scale, opening a new round for taking the company and the technology to the next level. The round has been launched at the Blue Invest day where Wsense S.r.l. won the Blue Invest Award 2022, category Ocean Observation.



Contributions to EU Policies

The project provides enabling technologies to support EU policies for more sustainable and competitive EU aquaculture, i.e., European Green Deal and the Farm to Fork Strategy. A main objective is the development of innovative technologies for the assessment, forecasting and effective management of risks related to animal health and for developing even better practices on fish welfare during farming. The developed Internet of Underwater Things technologies also provide quantitative in situ monitoring systems supporting European regions in defining the best areas for aquaculture and offshore renewables, in line with the Maritime Spatial Planning Directive. They also provide tools to assess the impact of the aquaculture development on the marine environments and to develop a sustainable aquaculture which can even contribute to mitigate climate change. As an example, as part of the project we have started working with mussel farmers in quantifying the positive impact of the sector for in water CO₂ absorption.



Relevant Sea Basins

Piloting activities have focused on the North Sea / Norwegian Sea and Mediterranean sea basins. However, the developed technologies have potential applications across all sea basins and the project exploitation plan includes an assessment of all sea basins.



The Internet of Underwater Things: A Revolution Across the Blue Economy

Further applications of developed technologies to other sectors have been identified in synergy and collaboration with different Blue Economy stakeholders. The following are examples of use cases which have been identified and which project partners are currently bringing to the market.

- A.** In situ real time continuous monitoring through developed Internet of Underwater Things technologies can extend existing environmental monitoring infrastructures and has been identified as an enabler for the Digital Twin of the Oceans;
- B.** Developed technologies also have application to structural monitoring of moorings and of offshore renewable plants;
- C.** Developed systems provide the underwater data requested to support harbor monitoring and efficient harbor management.

KEY INFORMATION



Project Information and Contacts

NAME OF THE PROJECT

Grant Agreement: 863731 — Real time monitoring and Surveillance of Aquaculture farms with networks of underwater sensors (SEASTAR)

FUNDING BENEFICIARIES

WSense S.r.l. (Project Coordinator), WSense AS, Lerøy Seafood Group, Lerøy Vest, University of Bergen

LOCATION

Italy and Norway

WEBSITE

<https://www.seastar-project.eu>

DURATION

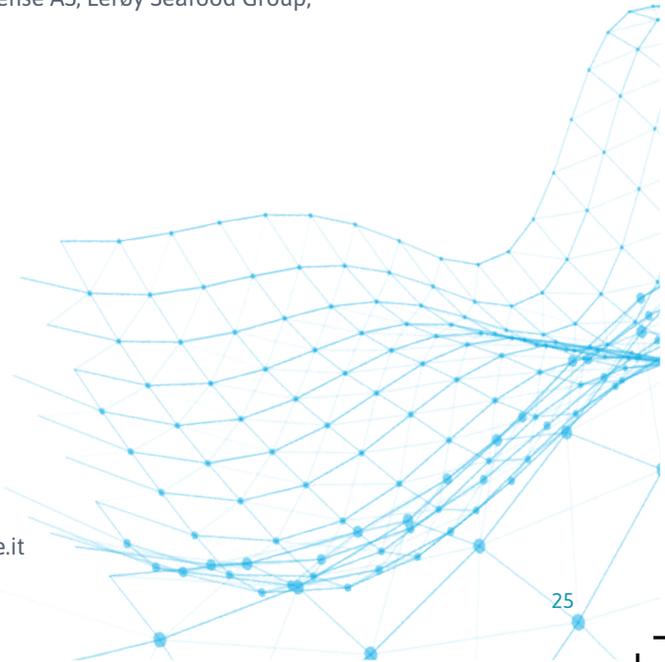
30 months (01/10/2019 – 31/03/2022)

EU CONTRIBUTION

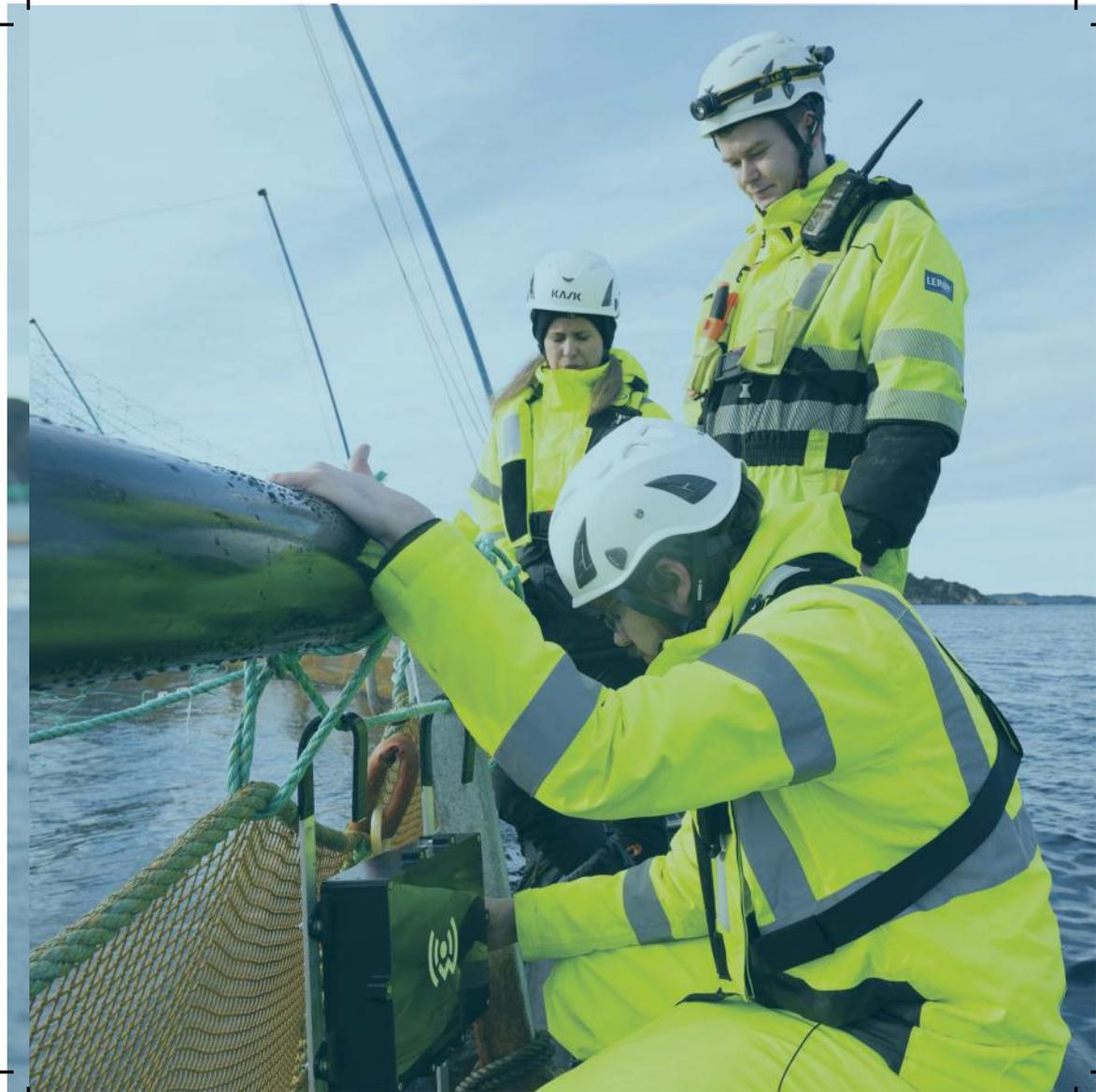
989.637 euro

PROJECT COORDINATOR

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WWW.SEASTAR-PROJECT.EU