



Project Title: AQUACOSM: Network of Leading European AQUATIC MesoCOSM Facilities
Connecting Mountains to Oceans from the Arctic to the Mediterranean

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Abstract	Deliverable D5.3 presents the AQUACOSM Innovation Forum, so-called ACIF. The ACIF is a gathering of stakeholders that have expressed interest in mesocosm research, and will work with the consortium to define services to and develop collaboration with the private sector. The ACIF encompasses representatives of the agriculture, aquaculture and oil & gas industry, together with providers of aquatic technology and mesocosm furniture. The ACIF will benefit WP2 and its activities related to sustainability through innovation. The ACIF will meet once a year.
Keywords	Mesocosm, innovation, public-private partnership, sustainability, stakeholders, technical providers, users



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1 Background

As the only European network focusing on aquatic ecosystem-scale experimental facilities, successfully providing access and services to the international research community, the AQUACOSM consortium considers it essential to secure the sustainability of the infrastructure. Several manners of supporting financial sustainability are explored as part of the AQUACOSM project. Among those, support to innovation and services to the private sector are investigated.

1.1 Innovation as a factor of sustainability

AQUACOSM explores how mesocosm research facilities can support innovation in the private sector, and especially SMEs. Both the potential of each AQUACOSM site as standalone facilities serving local stakeholders, and AQUACOSM as a network of European facilities are investigated.

The innovation process towards successful commercialization often requires testing and demonstrating new products under operational conditions. For aquatic sensors, this phase is generally performed in tanks simulating different conditions. However, both industrial and scientific users have voiced concerns about the reliability of tests performed by technology providers as many instruments have shown lower performance than guaranteed in the technical specifications, when deployed in real and sometimes rough, environments. To help improving this, AQUACOSM therefore wants to explore and assess a business model where technology providers are offered opportunities to test products in real but controlled environments. We believe that the network of mesocosms provided by AQUACOSM covering both fresh- and marine waters under many different environmental conditions is a yet underexplored but potentially very efficient way of testing and demonstrating aquatic instrumentations, e.g. environmental sensors, and thereby consolidating the specifications both before and after commercialisation and deployment at user sites. Furthermore, we expect that an increased awareness about the range of use of mesocosms and their accessibility would generate new opportunity for innovation through tighter collaboration between research and industry, following a private-public partnership model.

Mesocosms are research infrastructures that are generally little known by the industry. Increasing visibility and knowledge of the AQUACOSM capacity in terms of infrastructure and related expertise is therefore crucial for achieving the innovation goal of the project and supporting the activity in WP2.3 and 5.5. A general strategy is therefore being elaborated for improving the visibility, the knowledge and the attractiveness of the AQUACOSM infrastructure for industry-based research.

The development of the above-mentioned business model requires dialogs with potential industrial users of AQUACOSM, in order to identify key innovations that can lead to a leap in attractiveness of mesocosm facilities for industry-based research. In particular, we aim to establish dialogues and cooperation with the aquaculture, oil and gas (hereafter referred to as O&G) industry, on the one side, and with (sensor) technology providers, on the other side, as we predict that this will support a paradigm shift in mesocosm-based research and industry use, effectively supporting industrial development. In AQUACOSM, we have therefore decided to put emphasis upon SMEs specialised in mechanical engineering, instrument/sensor development and those providing services to aquaculture and O&G companies.

Consultation and dialog with industry will be pursued through the AQUACOSM Innovation Forum – ACIF.



1.2 Objectives of the ACIF

The ACIF is intended to be a link between AQUACOSM's scientific community and a combination of industrial providers of mesocosm technologies and industrial users of the facilities. This will create synergy for maximising innovation and economic outputs. The ACIF, activated in WP5.5, will play a major role in assessing the sustainability-through-innovation model (WP2.3).

2 The AQUACOSM Innovation Forum

The ACIF members have been selected based on interest and relevance among the AQUACOSM stakeholder list (section 2.1) established at an early stage in the project. The criteria for selection are:

- Representing a variety of relevant industries
- SMEs
- Easily accessible
- Interest and motivation to take part in and allocate time to the ACIF.

The final list of ACIF members is presented in section 2.2

2.1 AQUACOSM stakeholders

Company (SME, industry)	Country	Website of the company	Description of Products and Service provided by the company	Areas of Expertise of the company
<u>Pelagia AS</u>	Norway	pelagia.com	Fish and ingredient/by-products	
<u>COVARTEC</u>	Norway	-	Sustainability of European RIs, Consulting in EU research arena	EU research and innovation
<u>Aquabiotech</u>	Malta	aquabt.com	RAS, aquaculture development	RTI
<u>Lerøy seafood AS</u>	Norway	leroyseafood.com	Aquaculture producer	Salmon production
<u>Oxyguard</u>	Denmark	oxyguard.dk/	Aquatic monitoring	
<u>Xylem - Aanderaa</u>	Norway	xylem.com/en-sg/brands/aanderaa/	Robust and reliable instrument solutions for environmental measurements.	Oceanography
<u>Wsense</u>	Italy	wsense.com	IoT and under water communication	Underwater communication, smart sensors
<u>Bioceanor</u>	France	bioceanor.com	IoT and Big data analytics for aquaculture	Marine microbiology, synthetic biology, machine learning, artificial intelligence



OGP - cluster O&G	Norway	-	The International Association of Oil & Gas Producers (IOGP) is the petroleum industry's global forum in which members identify and share best practices to achieve improvements in health, safety, the environment, security, social responsibility, engineering and operations	O&G
SAIV	Norway	saivas.no	Pressure depth sensors and recorders	Pressure depth sensors and recorders
bbe Moldaenke GmbH	Germany	bbe-moldaenke.de	Sensors such as the FluoroProbe	Wide range of aquatic sensors
terra4 GmbH	Germany	terra4.de	> 30 YSI6600 sondes, LiCor light sensors and 3 NORTEK Signature 1000 ADCP and more	Wide range of aquatic sondes, sonar systems, ADCPs etc
Cambridge Environmental Assessment Ltd	United Kingdom	cea.adas.co.uk	Environmental assessment of use of chemicals by Agriculture companies	
Bellamare, LLC	USA	ocean-innovations.net/companies/bellamare	Deep Focus in situ imagers enabling high volume water scanning for larger plankton	In situ imaging systems
EofE Ultrasonics Co., Ltd.	Korea	echologger.com	Echologger 900 scanning sonar	Precision hydro-acoustic echosounders
Xylem Water solutions And Xylem Innovative Systems GmbH	Germany	ISG-DO.com	Production and modification of large volume and minimal disturbance water pumps, used to fill and mix large mesocosms	Rebuilding, adaption and repair of pumps
Werner Bernhardt	Germany	folien-bernhardt.de	Plastic foils for mesocosms	Plastic foils for agriculture and food industry
ISW Wassermesstechnik	Germany	isw-wasser.com	Computer controlled winches for mesocosm profilers	Fine mechanical innovation and construction
MBT GmbH	Germany	m-b-t.com	Underwater technology	UW sensors
Faltsilo GmbH	Germany	faltsilo.de	Mesocosm bags and roof-tarpaulins including polyurethane constructions	Welding and sewing of foils



Seaflex	Sweden	seaflex.net	Mooring equipment and mooring solutions.	Specialized in mooring solutions
M Kenneman Svetsat AB	Sweden	svetsat.se	Metal constructions	Metal constructions
SWECO Structure AB	Sweden	sweco.se/en	Safety services	Safety solutions and testing
Mittel	Sweden	mittel.se/en	HDPE constructions	Welding of HDPE
Thermomed Medikal ve Analitik Cihazlar Tic. Ltd. Şti.	Turkey	thermomed.com.tr	Sensors, sondes, mobile laboratory gears, water analyses	Sondes, sensors, mobile laboratories, water analyses
Nel Elektronik Cihazlar Imalat Ve Ticaret A.Ş.	Turkey	nel.com.tr	Sensors, sondes, water analyses,	Sensors, all kinds of laboratory instruments, water analyses
NEOTEK SAS	France	neotek-web.com	Oceangraphic instruments incl. Aanderaa Conductivity sensors and Oxygen optodes	Instruments and technologies for measurement, transmission and data processing in oceanography
EMS	Spain	ems-sistemas.com	Oceanographic instruments including Wetlabs Fluorometer for Chlorophyll-a fluorescence measurement	Instrumentation and technology in oceanography
Campbell Scientific	France	campbellsci.fr	Monitoring instruments and technology including in situ temperature sensors and data-loggers	Instrumentation, technology and scientific solutions for the field
LI-COR Biosciences GmbH	Germany	licor.com/env	Instruments for measurements of gas exchange and analysis, algal physiology, light including spherical underwater quantum sensor	Instruments for biology, environmental sciences, climatology, and translational research
Fisher Connectors	France	fisherconnectors.com	Connectors and cable assemblies	Design and manufacture of rugged, circular connectors and cable assemblies



Ruiz Industrie	France	ruizindustrie.com	Inox structure, dome and accessories for mesocosm	Precision engineering components and tooling
Sterne Voiles	France	sternevoiles.com	Transparent clear PVC film domed covers for mesocosms	Sails, rigging and marine upholstery for boat
Insinööri toimisto Haikonen Oy	Finland	haikonenworks.fi	Mesocosm bag construction reinforced PE	Plastic field mesocosms
Plastika Kritis SA	Greece	plastikakritis.com	Industry specialised in polymer manufacturing and R&D. Provides materials for the CretaCosmos mesocosms	Materials
UWITEC	Austria	uwitec.at	Winches, mooring, platforms	Mesocosms & equipment
PSI	Czech Republic	psi.cz	Fluorometers, incubators, light sensors	Sensors
CHELSEA Technologies Group Ltd	United Kingdom	chelsea.co.uk	Profilers, sensors	Sensors
WALZ	Germany	walz.com	PAM fluorometers; light sensors (retailer of LICOR)	Sensors
Eijkelkamp Soil and Water	Netherlands	eijkelkamp.com	Sensor and sampling equipment	Soil and Water
Kemira	Netherlands	kemira.com	Chemicals	Water research related chemicals
Blueleg Monitor	Netherlands	bluelegmonitor.com	Sensor and sampling equipment	Water quality monitoring
Waterinsight	Netherlands	waterinsight.nl	Water quality remote sensing products and services	Water quality monitoring
FIALab	USA	flowinjection.com	Flow injection analyzers for nutrients	Automated analyzers
Lumiplastique	France	lumiplastique.fr	Plastic technologies	Plexiglass indoor mesocosms



2.2 The ACIF members

The following persons and organizations have confirmed their interest to participate in the ACIF.

Members outside the consortium

Company (SME, industry)	Address	Country	Website	Products and Service provided by the company	Areas of Expertise	Main contact	Email
COVARTEC	Bergen	Norway	-	Sustainability of European Ris, Consulting in EU research arena	EU research and innovation	Dominique Durand	dominique.durand@covartec.eu
Bioceanor	Sophia Antipolis	France	Bioceanor.com	IoT and Big data analytics for aquaculture	Marine microbiology, synthetic biology, machine learning, artificial intelligence	Samuel Dupont	samuel.dupont@bioceanor.com
OGP - cluster O&G		Norway	-	Consortium of O&G industry	Oil degradation	Catherine Boccadoro	cabo@norcerese.arch.no
Cambridge Environmental Assessments Ltd	Battlegate Road, Boxworth Cambridge CB23 4NN	UK	cea.adas.co.uk/	Environmental assessment of use of chemicals by Agriculture companies on their		Nadine Taylor	Nadine.taylor@cea-res.ca.uk
Faltsilo GmbH	FaltSilo GmbH Am Hasselt 3 D-24576 Bad Bramstedt	Germany	http://www.faltsilo.de	Mesocosm bags and roof-tarpaulins including polyurethane based constructions.	Welding and sewing of foils	Felix Lieckfeld	flieckfeld@faltsilo.de

Through its members, the ACIF represents five industrial sectors, i.e. agriculture, aquaculture and O&G, technology providers and consulting in innovation.

2.3 Approach for reaching the ACIF's objectives

The initial specific actions:

- Agree on cluster membership and invite participants,
- Establish the ACIF
- Perform questionnaire, phone interviews and direct bilateral meetings with ACIF members.
- Carry out three ACIF workshops, tentatively on M12, M24 and M36, but rather focused on relevant international research and technology events (e.g. Ocean Business, Ocean International, EGU)

It has proven difficult to gather the ACIF into a workshop during the two first years of the project because of different constraints at members. We therefore decided to collect the first round of information through bilateral interviews with members, based on a common questionnaire. The result of this process is presented in the following sections for each member, separately.



3 Preliminary feedbacks from the ACIF

3.1 Cambridge Environmental Assessment Ltd - CEA

Contact person: Nadine Taylor - Nadine.taylor@cea-res.ca.uk

3.1.1 Background of the company / business case

Cambridge Environmental Assessments (CEA) is a UK based SME established in 2001 and part of RSK ADAS Ltd. The core business of CEA is to deliver dossier support for chemical and product registrations across Europe. The company encompasses expertise from industry, research and regulatory authorities.

CEA provides specialist regulatory support and consultancy to agrochemical industry clients and their associations (ECPA) seeking to (re-)register and steward their plant protection products at the European and national levels. These encompass all aspects of the process including: Advocacy, Exposure Modelling, Environmental Fate, Spatial Analysis & Statistics, Ecotoxicology, Aquatic Testing, Toxicology, Risk Assessment, Dossier Section Preparation, Software Development, Training, Product Stewardship.

CEA's consultancy runs a higher tier mesocosm testing facility for environmental regulation of chemicals, including agrochemicals, biocides, pharmaceuticals and veterinary medicines (see link for more info <http://www.cea.adas.co.uk/Agrochemicals/Aquatic-Testing>).

3.1.2 Use of Mesocosms

CEA has a 10-year experience in using mesocosms for testing of ecotoxicologic impacts of agrochemicals, such as pesticides, biocides, veterinary medicine, industrial chemicals.

3.1.3 Own facility

The infrastructure is made of 2-m long freshwater tanks, accommodating mini low-trophic level ecosystems (phytoplankton, macroalgae, zooplankton).

CEA owns ca. 200 mesocosms, using 50 at a time.

Studies conducted by CEA typically take 4-5 months, letting large capacity available for cooperative research.

3.1.4 What type of service

CEA is contracted by companies seeking marketing approval through GLP (Good Laboratory Practices) and scientifically independent trials.

The company provides comprehensive studies, gathering data required to demonstrate impact of agrochemicals in a way that must be entirely reproducible based on the report. It complies with UK standard and legislation.

3.1.5 Interest in AQUACOSM capacity

CEA is mostly interested in freshwater facility and in considering linking its own facility to AQUACOSM, by making use of the available capacity of CEA for R&D, innovation and services.

CEA is also interested in training programmes- transfer of know-how and training industry personnel on the use of mesocosms.

CEA has no specific application requiring geographical or climate gradient.



3.1.6 Innovation potential

CEA is interested in contributing and expanding the capability of present mesocosm infrastructure to perform robust chemical testing in closed environments (tanks) and in developing new services for industry:

- Test of technology (sensors)
- Other to be defined

3.2 The international Association of Oil & Gas Producers - OGP

Contact person: Cate Boccadoro (IRIS/NORCE), principal contractor of OGP for mesocosm study in rough and extreme environments. Project leader for a large project for OGP.

3.2.1 Background of the company / business case

The International Association of Oil & Gas Producers (OGP) is the petroleum industry's global forum in which members identify and share best practices to achieve improvements in health, safety, the environment, security, social responsibility, engineering and operations.

3.2.2 Use of Mesocosms

The project performed by IRIS was directly funded by the O&G industry. It was the first of its kind, deploying mesocosms in pristine environments in the Arctic, during both winter and spring and studying natural biodegradation of different oil compounds. Successful outcomes resulted in an increased interest from the companies to use mesocosm as a R&D approach for assessing their own activities.

Using mesocosms for studying hydrocarbon biodegradation in Arctic environments:

- Oil exposure on marine arctic environment
- Seawater sea ice oil spill response/remediation methods
- Near field exposure, possibility of weathering,
- Real atmospheric and sea water conditions
- Use of different response technologies/approach (burning, surfactants and biodegradation by microbes).

Industry were impressed by the outcomes of the project, which provided results that were much closer to real conditions and therefore knowledge that was directly applicable by the industry for their mitigation and readiness plans.

3.2.3 Own facility

Mesocosms were funded by the industrial consortium but gave away to the R&D consortium after the project, as it is usually the case with R&D projects for the O&G sector.

3.2.4 What type of service

No service was considered by the industry following the project but interest in renewing mesocosm experiments in other context was expressed.



3.2.5 Needs for additional facility/access

No specific needs for additional facilities was proclaimed by the OGP, but interest in using existing mesocosms for additional activities was suggested.

Especially, it is foreseen that access to mesocosm infrastructures in regions of intensive O&G exploitation (incl. Mediterranean) would be beneficial to the industry, and possibly the basis of new applied projects.

Applications in the field of assessing the environmental footprint of O&G activities, including produced waters, drill cuttings and oil spill could be interesting to consider in the context of AQUACOSM.

OGP showed special interest in open marine mesocosms, which are expected to provide more realistic responses than labs/tanks/closed systems.

3.2.6 Interest in AQUACOSM capacity

- Mostly marine sites in the vicinity of offshore activity
- Freshwater in connection with study of pollution of groundwater or river basin.
- Access to different environments with harmonised facilities could be interested.

3.2.7 Innovation potential

The O&G industry is showing interest in mesocosm for supporting the development of online monitoring capability and in testing new technology before deployment at exploitation sites.

3.3 COVARTEC AS

3.3.1 Background of the company / business case

COVARTEC is a recently established SME carrying out research & Innovations and providing consulting services in the EU research area in general and on the valorization of the coastal ocean through technology and innovation in particular. The company is a provider of new knowledge, technical solutions and innovation within the fields of marine environment, marine observing systems, satellite remote sensing and biotechnology. The company gives recommendations and advice on state-of-the-art marine monitoring and observations to decision-makers and policymakers, with a dedicated focus on the potential impact of anthropogenic activities in the marine environments.

3.3.2 Use of Mesocosms

COVARTEC is not using mesocosms itself, but is working on developing business opportunities for marine research infrastructure, and is therefore interested in evaluating the potential of AQUACOSM in this context.

3.3.3 Own facility

No own mesocosms

3.3.4 What type of service

COVARTEC is involved in several research infrastructure projects, developing sustainability models through science, innovation, governance and business development.



COVARTEC is also working closely with the fish-farming industry on digitizing the aquaculture sector, following the aquaculture 4.0 agenda.

3.3.5 Needs for additional facility/access

No need

3.3.6 Interest in AQUACOSM capacity

Because of its connection to other RIs (JERICO, DANUBIUS, EMSO, FixO3), COVARTEC is interested in investigating how value creation can be achieved through coupling experimental and observational research infrastructure.

COVARTEC will also support defining business opportunity and innovation potential (in terms of products and services) in AQUACOSM, especially in relation with technological development for the aquaculture sector.

3.3.7 Innovation potential

COVARTEC is interested in promoting AQUACOSM facilities and expertise towards the aquaculture sector and in increasing awareness of fish-farmers on the capability of mesocosms as vector of innovation and technology testing, prior to investment and/or deployment at production sites.

3.4 Bioceanor SA

Contact person: Maxime Lafont, R&D manager - <https://www.bioceanor.com/>

3.4.1 Background of the company / business case

Bioceanor SAS, is a deep-tech start-up, providing smart solutions and services for aquaculture, water and ocean monitoring. Bioceanor develops and commercializes services for environmental monitoring and especially for sea-farmers. Innovations of Bioceanor services are based on big-data and machine learning to generate algorithms for predictions. Bioceanor was selected into the first open call for project in the framework of AgileIoT (<http://agile-iot.eu>).

3.4.2 Use of Mesocosms

Bioceanor is not presently using mesocosms in its activities, but is involved in a new H2020 project on Aquaculture 4.0, in which it is planned to make use of European mesocosm infrastructures.

3.4.3 Own facility

Bioceanor has no own mesocosm facility.

3.4.4 What type of service



3.4.5 Needs for additional facility/access

3.4.6 Interest in AQUACOSM capacity

As part of the H2020-iFISHiENCi project, it is considered to make use of both marine and freshwater AQUACOSM-RI. The geographical distribution of the AQUACOSM facilities may be an asset for testing of smart technology in different environments before deployment at production sites.

3.5 Faltsilo GmbH

Faltsilo is a mesocosm provider, working closely with several AQUACOSM partners. The company has delivered polyurethane bags and roof tarpaulin to the first two AQUACOSM prototypes.

Although the company are actively involved in mesocosm production, we have not yet received the answers from Faltsilo GmbH to the questionnaire yet. But is expected to be included in the further process and next report.



4 Next steps

The first ACIF workshop is planned to be conducted at the occasion of the third General Assembly of AQUACOSM, to be held in Evora, Portugal in March 2019.

The main goal will be:

- to consolidate innovation targets with the members
- to jointly develop communication approach for drastically increasing visibility of the AQUACOSM facility
- to establish project-based cooperation between AQUACOSM and the ACIF members