FORCOAST

Earth Observation Services For Wild Fisheries, Oyster grounds Restoration And Bivalve Mariculture Along European Coasts

PROJECT DELIVERABLE REPORT

Deliverable Number: D6.1
Deliverable: Initial Market Analysis
Author(s): Alec Reid
Work Package Number: WP6
Work Package Title: Innovation Management, Exploitation & Business Planning

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FORCOAST Project Information	
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Deliverable Information	
Work package number	WP6
Work package title	Innovation Management, Exploitation & Business Planning
Deliverable number	D6.1
Deliverable title	Initial Market Analysis
Description	This initial deliverable addresses an analysis of barriers to the market for the three target sectors (i.e. bivalve mariculture, oysterground restoration, and wild fisheries), the sustainability of the service and the impact of no longer having access to free data provided by the EU (task 6.1). In D6.1 the market barrier will be addressed, such as the scale of the market, the positioning in the market, the product differentiation and the strength of potential competitors, the capital requirement for keeping in the market after EU funding, the government policy (for example, licensing requirements, competition agreements).
Lead beneficiary	Cuan Beo
Lead Author(s)	Alec Reid
Contributor(s)	Luis Rodriguez, Daniel Twigt, Ghada El Serafy, Daan Delbare, Pilot Leaders
Revision number	3
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Dissemination level (Public (PU), Restricted to other program participants (PP), Restricted to a group specified by the consortium (RE), Confidential for consortium members only (CO))	PU

Document History			
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Initial Draft Review	11/05/2021	Review, comments and formatting	Luis Rodriguez
Second Draft	16/05/2021	Drafting, addressing comments	Alec Reid
Second Draft	17/05/2021	Review	Ghada El Serafy
Second Draft	17/05/2021	Review and formatting	Luis Rodriguez
Review Draft	23/05/2022	Address the reviewers' comments by expanding the competition analysis (Annex 1)	Alec Reid
Review Draft	14/10/2022	Inclusion of "Reviewer comments and reply" table below, referencing to the right deliverable and section where the points of attention are addressed.	Luis Rodriguez

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Approvals				
	Name	**Organisation**	**Date**	**Signature (initials)**
Coordinator	Ghada El Serafy	Deltares	14/10/2022	GES
WP Leaders	Daan Delbare	ILVO	14/10/2022	DD

Reviewer comments and reply		
Date	**Comment**	**Reply**
Sep 2022	It was initially difficult to understand what changes have been made to address the reviewers' comments as a table had not been provided as per other revised deliverables. The start of Section 2.4 provides some text indicating the changes are within Annex 1. For this Annex, it is not clear why some of the mentioned **organisations** are analysed and others not e.g., for Section 1.3.3 (Hydrodynamic and Ocean Modelling Solutions) it is only HYPACK. Also, IFREMER (misspelt) is not analysed for Section 1.3.2. It was expected this analysis to form an **input to the main document**, being described as "the centre point of this deliverable", but it doesn't appear that Section 2.4 or 3 takes it into account.	The complete competition analysis is presented in deliverable *D6.2 – Final Market Analysis* Section 3, including all relevant organisations. This includes naming and positioning of competitors, and a Strengths-Weaknesses (SW) Analysis for the three project target sector. The information on competitors is used across D6.2, D6.4 and D6.6 as a basis for, among others, positioning FORCOAST in the market, identifying service value proposition and drafting business penetration scenarios.

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Executive Summary

In order to start an Initial Market Analysis, a workflow was followed with Oysterground Restoration or Oyster Reef Restoration (ORR) as model. ORR was the appropriate industry to select as the model for conducting the initial market analysis as it is the smallest industry and therefore easier to evaluate fully, which can be used as a foundation for expanding the market analysis to the wild fishery and bivalve aquaculture sectors in *Deliverable D6.2 – Final Market Analysis*. Furthermore, ORR is the industry of the SME 'Cuan Beo' who have been tasked with conducting the initial market analysis and accordingly they were less likely to be affected in evaluating this industry as opposed to any other during Coronavirus restriction measures as they already had a working relationship with a number of stakeholders involved with Oyster Reef Restoration:

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Initial Market Analysis Work Conducted for Oyster Reef Restoration Industry
Industry workshop with Scientific, State and Community groups involved in Irish Oyster Reef Restoration.
Industry workshop with Co-Operative Societies involved in Irish Native Oyster Fishery Management
Participation and Engagement with European Native Oyster Restoration Alliance (EUROPE) study on the procedure of site selection for Native Oyster Reef Restoration.
Participation and Engagement with Native Oyster Restoration Alliance (EUROPE) industry conference on Oyster Restoration in Europe
Participation and Engagement in industry workshop hosted by Native Oyster Network UK and Ireland.
Engagement with International Oyster Restoration Groups.
Community engagement with Galway Bay User's (Recreational, Commercial, State, Scientific and Other)
Monthly meetings between service module developers (Marine Institute) and end-users (Cuan Beo) to refine requirements and assess available data sources for model validation and roll out.
Promotion of Forcoast activities in newsletters, industry workshops and early model demonstrations with end-users.
Engagement with Irish Seafood Development Agency (Bord Iascaigh na Mhara) and Irish State Scientific Institute (Marine Institute) on current systems for monitoring marine environmental conditions.
Recorded and document feedback received directly from potential end-users.

A number of direct and indirect users involved in Oyster Reef Restoration in Ireland and Europe were identified and segmented into different categories depending on their requirements. These users were additionally evaluated to determine their specific user requirements and feedback received directly from these users formulated the market need for this industry. The competition was identified and the stability of their services to meet the ORR market need was determined. In a further step, the relevant regulations and restrictions must be identified, with an assessment of whether these identified regulations and restrictions present a barrier to entry to the market. Regulations will differ greatly depending on the user's individual country.

The Oyster Reef Restoration (ORR) sector is the smallest of the three industries currently being serviced by the FORCOAST system with only 19 ORR groups identified within Europe. ORR groups have also been identified in America, Canada, Australia and Asia and 3 of the largest of these have been included in this Initial Market Analysis. Commercial Oyster Fishery groups have also been including in this Initial Market Analysis as their market need is similar to that of ORR groups given that they work with the same species.

The market need for oyster reef restoration is generally uniform and standard for every ORR group as the activities undertaken and challenges faced are the same. The market needs can be grouped under a comment title of 'Habitat Suitability and Potential to Restore 'which refers to the potential of a particular area of the shore for oyster reef restoration. A detailed list of the market need for this can be found in the above market need section but they can be summarised to include (a) Sedimentation Modelling, (b) Water

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Quality Analysis and (c) Larval and Particle Dispersion and Trajectory. Providing a service that can meet these market needs would be widely desired in the ORR community.

In order to extend this initial market analysis to all Pilots, all services and all sectors a working group has been set up with representatives of all Pilots, who are the link with the end-users of the Pilots and beyond. All contributions from the working group will be documented in one document which will become the market analysis for the FORCOAST consortium.

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1. Introduction

The current deliverable is part of the comprehensive work of WP6 of setting up a Business Model for the FORCOAST project, which consists of Market Analysis, Busines Planning and Exploitation Strategy. A market analysis is of key importance in FORCOAST as it allows to know how many individuals or companies perform a similar activity (information services for the target sectors) to the proposed one, as well as its specifications and the willingness to pay for the offered service.

In order to make a Market Analysis, a workflow shown in Figure 1 is followed.

1. First, the user segment must be identified: which are the end-users and what are the categories.
2. Then the target market must be identified with the comparison of the identified users and to group them, accordingly.
3. The market need must be identified which determines the user requirements (see WP2) and assesses whether services will meet the end-user needs.
4. Then the competition must be identified: who are the competitors and what are the competitor services.
5. In a further step, the relevant regulations and restrictions must be identified, with an assessment of whether these identified regulations and restrictions present a barrier to entry to the market (Figure 1).

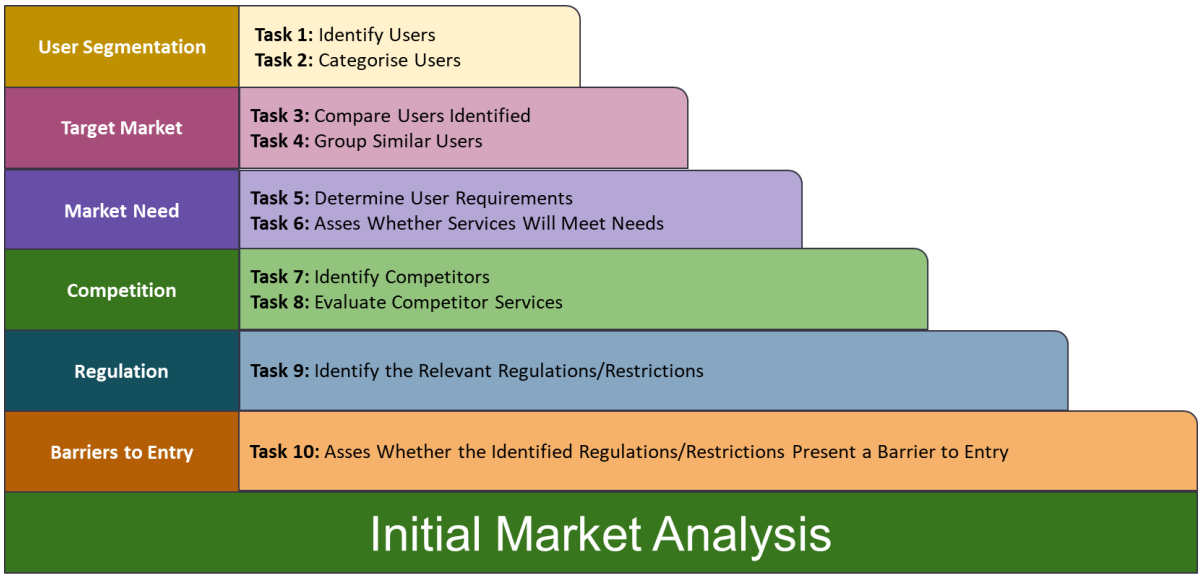

Figure 1. Workflow to set up a market analysis for the service module business.

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2. Initial market analysis for oyster reef restoration

2.1 Target market

Oyster Reef Restoration (ORR) involves the restoration of historical oyster reefs that have suffered extinction or the rejuvenation of active oyster reefs that have suffered a decline in population. ORR generally involves establishing an area for restoration, deploying suitable substrate to promote larval settlement, identifying the distribution of critical habitat for native oysters including modelling of temperature and salinity, developing spatial management of oyster fisheries that will include closed areas for oyster reef development and improving coastal water quality. Additional works including ocean modelling, artificial substrate construction and marine environment monitoring are also undertaken depending on the individual project.

9 ORR groups have been identified in the pilot country Ireland, 19 ORR groups have been identified in Europe and 3 large ORR groups have been identified outside of Europe.

ORR Group	**Location**	**Project type**
Ireland (9 ORR groups)		
Galway Bay Oyster Restoration Project (Cuan Beo)	Galway Bay, Co. Galway, Ireland	The project aims to restore native oyster habitats through strategic cultch deployment to promote larval settlement, to identify the distribution of critical habitat for native oyster including modelling of temperature and salinity, develop spatial management of fisheries that will include closed areas for oyster reef development, to gain a more in-depth knowledge of native oyster habitat restoration through practical research, to monitor the prevalence of Bonamia and to improve coastal water quality in Galway Bay.
Clarinbridge Oyster Co-op Society Ltd	Clarin Bridge, Co. Galway	Oyster Fishery Management
Loughs Agency	Lough Foyle, Co. Derry	Oyster Reef Restoration in Lough Foyle.
Tralee Oyster Co-op Society Ltd	Fenit, Co. Kerry	Oyster Fishery Management
North Mayo Oyster Development Co-op Society Ltd	Belmullet, Co. Mayo	Oyster Fishery Management
Achill Oyster Group	Achill Island, Co. Mayo	Oyster Fishery Management

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Lough Swilly Wild Oyster Society Ltd	Buncrana, Co. Donegal	Oyster Fishery Management
Comharchumann Sliogeisc Chonamara Teo	Kilkieran, Co. Galway	Oyster Fishery Management
Native Oyster Reef Restoration Ireland	Arklow, Co. Wicklow	Training and educating local community about biomimetic restoration.
Belgium (1 ORR group)		
Belgian pilot of UNITED	Belgium	Belgian United is combining the culture of flat oyster and sugar kelp, and compares the characteristics of sugar kelp grown nearshore and offshore.
Croatia (1 ORR group)		
University of Dubrovnik (Mali Stone Bay)	Mali Stone Bay, Croatia	The University of Dubrovnik is the main research body working in Mali Ston Bay which is the largest native oyster aquaculture production area in the Mediterranean.
United Kingdom (7 ORR groups)		
Essex Native Oyster Restoration Initiative (ENORI)	Blackwater, Essex, England	ENORI is a collaboration between the oystermen, scientists, conservationists and the UK government to restore native oysters in Essex UK.
Marine Infrastructure Effects Initiative (Marineff)	English Channel, England	The MARINEFF project was selected under the European cross-border cooperation Programme INTERREG VA France (Channel) – England co-funded by the ERDF and involves 9 French and British partners. The project aims to demonstrate new biomimetic marine structures to improve the ecological status of inshore waters, as well as to involve professionals and stakeholders in the project.
Solent Oyster Restoration Project	Solent, England	The Solent Oyster Restoration Project, spearheaded by the Blue Marine Foundation (BLUE), is restoring native oyster populations on a large scale on England's south coast.
Wild Oyster Project (Self-sustaining populations of Native Oysters for the UK Seas)	- Conwy Bay, Wales - Firth of Clyde, Scotland - Tyne&Wear, England	The Wild Oyster Project is a new three-year restoration project that launched in June 2020, developed as part of a new collaboration between the Zoological Society of London (ZSL), Blue Marine Foundation (BLUE) and British Marine. The aim of the project is for the UK seas to have self-sustaining populations of native oysters which provide clean water, healthy fisheries, plentiful biodiversity and on land there is a re-ignited national love of this iconic species.

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The Dornoch Environmental Enhancement Project (DEEP)	Dornoch Firth, Scotland	Oyster reef restoration in Dornoch Firth.
Ecological Restoration, Rewilding, Preservation (Kilchoan Estate)	Kilchan Estate, Scotland	Kilchoan Estate has been working with Seawildng to create a native oyster restoration project at the head of Loch Melfort.
Restore the Native Oysters in Loch Craignish (Seawilding)	Loch Craignish, Scotland	Oyster reef restoration in Loch Craignish.
France (1 ORR group)		
Flat Oyster Recruitment and Growth (FOREVER)	-Brest, France -Quiberon, France	The project consists of 3 complementary actions. The first action aims to inventory the main populations of wild flat oyster in Brittany and to describe their health and genetic characteristics. The second action focuses on the ecology and the dynamics of the two remarkable beds still remaining in the bays of Brest and Quiberon. The last action promotes restoration and management measures for these beds in partnership with local actors (fisheries and shellfish farming bodies, regional authorities, environmental management organizations such as Natura 2000).
Germany (2 ORR groups)		
Seed Oyster Production for Ecological Restoration (PROCEED)	Helgoland, Germany	PROCEED is engaged in implementing an oyster hatchery on the German offshore island Helgoland to establish a healthy broodstock and a sufficient seed oyster production for ecological restoration.
Ecological Restoration of the Native Oyster Species Ostrea edulis (Restore)	Borkum Reefground, Germany	Restore involves the construction of a pilot oyster reef in the Natura 2000 site Borkum Reefground.
The Netherlands (2 ORR groups)		
Blauwind and the Rich North Sea Oyster Pilot	The Netherlands	The Rich North Sea and Blauwwind have joined forces to expand this plan to gain more understanding of the influences of habitat conditions on biodiversity and how we stimulate flat oyster reef development.

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Voordelta, Wadden Sea, Brokum Stones Restoration Projects	- Voordelta - Wadden Sea - Brokum	3-D printing of reef structures and other hard substrate material and starting a Bonamia free Ostrea Edulis population.
Spain (1 ORR group)		
Knowledge and Tools for a Future Oyster Restoration Action (Mar Menor)	Mar Menor, Spain	The project aims to gain knowledge about the feeding physiology of the oyster and its nutrient capability throughout a phytoplankton bloom and to develop the necessary tools for a future oyster restoration action.
Sweden		
The Bilvalve Project	Sweden	Identification of existing pressures on Swedish oyster populations, knowledge development for best management structures, initiate stock enhancement strategies.
Total project in Europe: 16		
Outside Europe		
United States of America		
Billion Oyster Project	New York, America	Restoring oyster reefs in New York Harbour through public education initiatives
Cheasapeake Bay Foundation Cooks Point Sanctuary Reef, Maryland	Cooks Point Sanctuary Reef, Maryland, America	Restoring oyster reefs in Chesapeake Bay
Australia		
Australian Shellfish Reef Restoration Network	- Australia - New Zealand	The Australian Shellfish Reef Restoration Network is a community of practice that brings together organisations and individuals interested in shellfish reef education, conservation, restoration and management

Table 1. List of ORR groups with their location and project type.

2.2 User segment

Target Market User

The ORR target market user is unique depending on the oyster restoration project. Users vary from scientific institutions, state institutions, community groups and aquaculture producer groups. Some oyster restoration groups are actively involved in reef restoration, others are involved in reef restoration as part of a larger marine habitat conservation project, and others are only involved in raising awareness and

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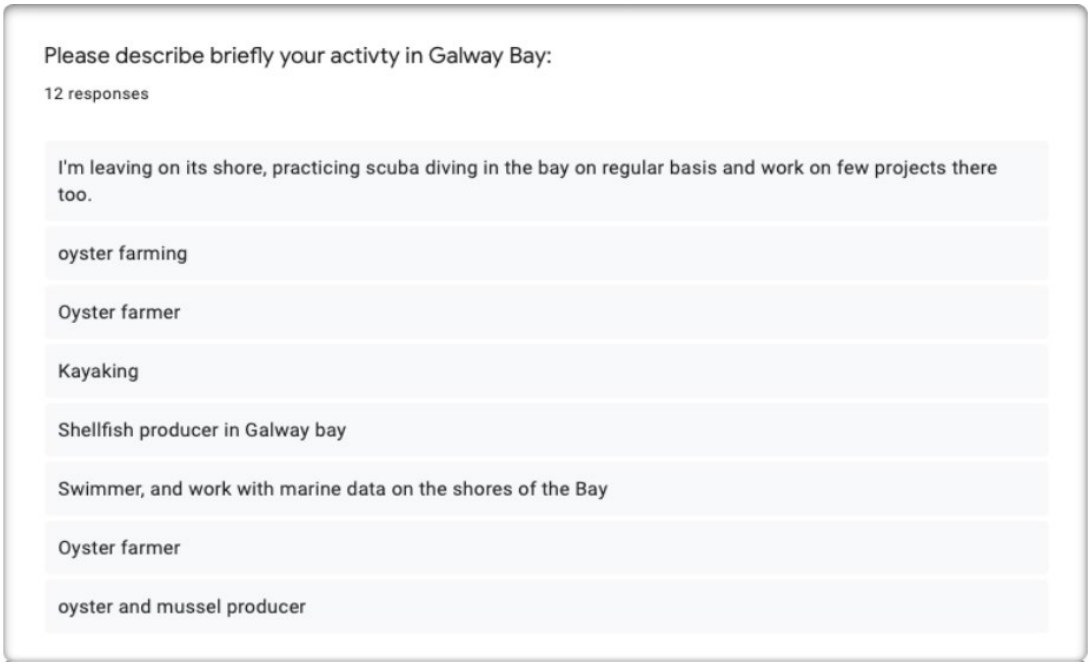
creating educational materials. The ORR users can be segmented into 3 categories (a) Active Restoration, (b) Passive Restoration and (c) Partial Restoration.

Figure 2. Case sample for pilot 5 ireland "galway bay oyster restoration project".

Potential Additional Users

ORR projects generally take place in a large area in which other groups including state institutions, scientific institutions, educational institutions, recreational groups and water safety groups also operate. These additional groups may also be interested in marine environmental condition monitoring and data.



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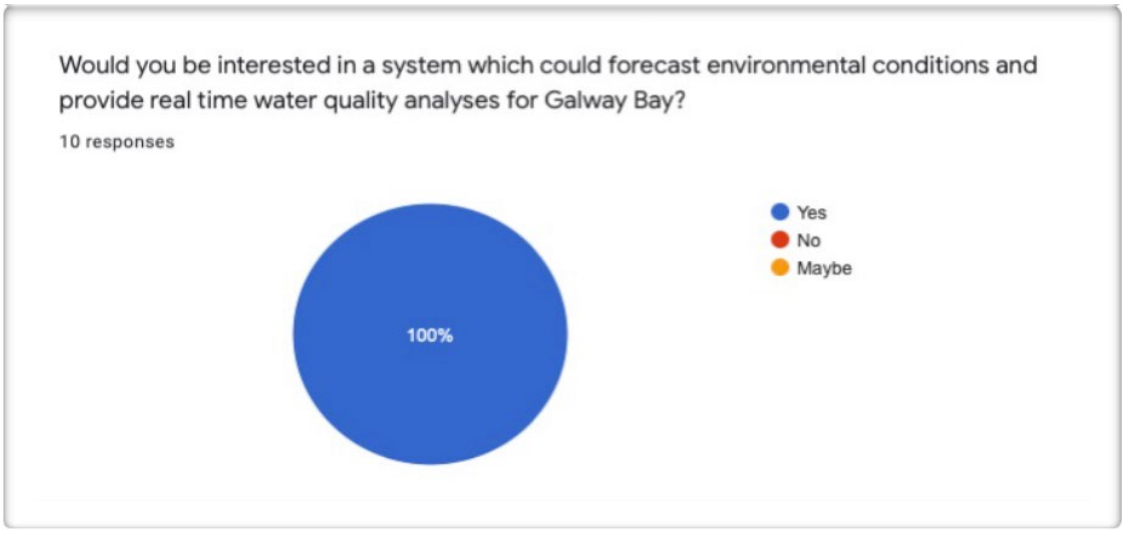

Figure 3. Questionnaire feedback from additional users identified in Pilot 5 ireland oyster reef restoration.

2.3 Market need

Market Need - 'Potential to Restore'

The potential to restore native oyster populations is closely linked to present and future environmental characteristics at restoration sites. Choosing sites and areas within sites for restoration does not simply involve looking historically at distribution but future-proofing against changes in the environment expected due to climate change and human activities and development. There is a market need to understand the following physical characteristics at or close to the seabed:

a. Sediment Composition
b. Sediment Mobility and Suspension
c. Sedimentation
d. Turbidity - Reflecting Particulates in Suspension
e. Current Strength and Seabed Stress
f. Salinity Concentration and Temperature
g. Water Circulation - (Circulation patterns will control the retention or dispersal of larvae from spawning sites)

The value of achieving this information will help in 'Site Selection for Native Oyster Reef Restoration'. When the minimum and maximum levels for the desired physical and biochemical characterisers for reef restoration are within favourable conditions the likelihood for reef restoration is drastically improved. Accordingly, knowing this information will save costs in substrate deployment and monitoring which are usually the largest costs in oyster reef restoration projects. Also the information is extremely valuable in that it will inform whether an oyster reef is capable to survive and thrive in the chosen site for reef restoration. At the moment, there is no dedicated service on the market that currently achieves this for Oyster Reef Restoration Groups.

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Parameters	Units of measurement	Minimum levels	Maximum levels	Life of historical process
Bed shear stress	N/m^3	1	10	Survival
Seabed mobility	cm/day	0	0.8	Survival
Sediment composition	mg/L	0	50	Growth & survival
Temperature (mature)	°C	3	30	Growth & survival
Temperature (larvae)	°C	18	30	Larval development & settlement
Turbidity	Nephelometic Units	/	/	Suspended solids & irritate oyster gills
Salinity	g/L or ppm	25	35	Feeding, growth & survival
Chlorophyll a	µg/L	1.68		For spawning to occur
Circulation patterns	-Direction in ° -Velocity in m/s	/	/	Retention of larvae or delivery of larvae to suitable areas for settlement

Table 2. Minimum and Maximum Levels for the desired physical characteristics to be recorded.

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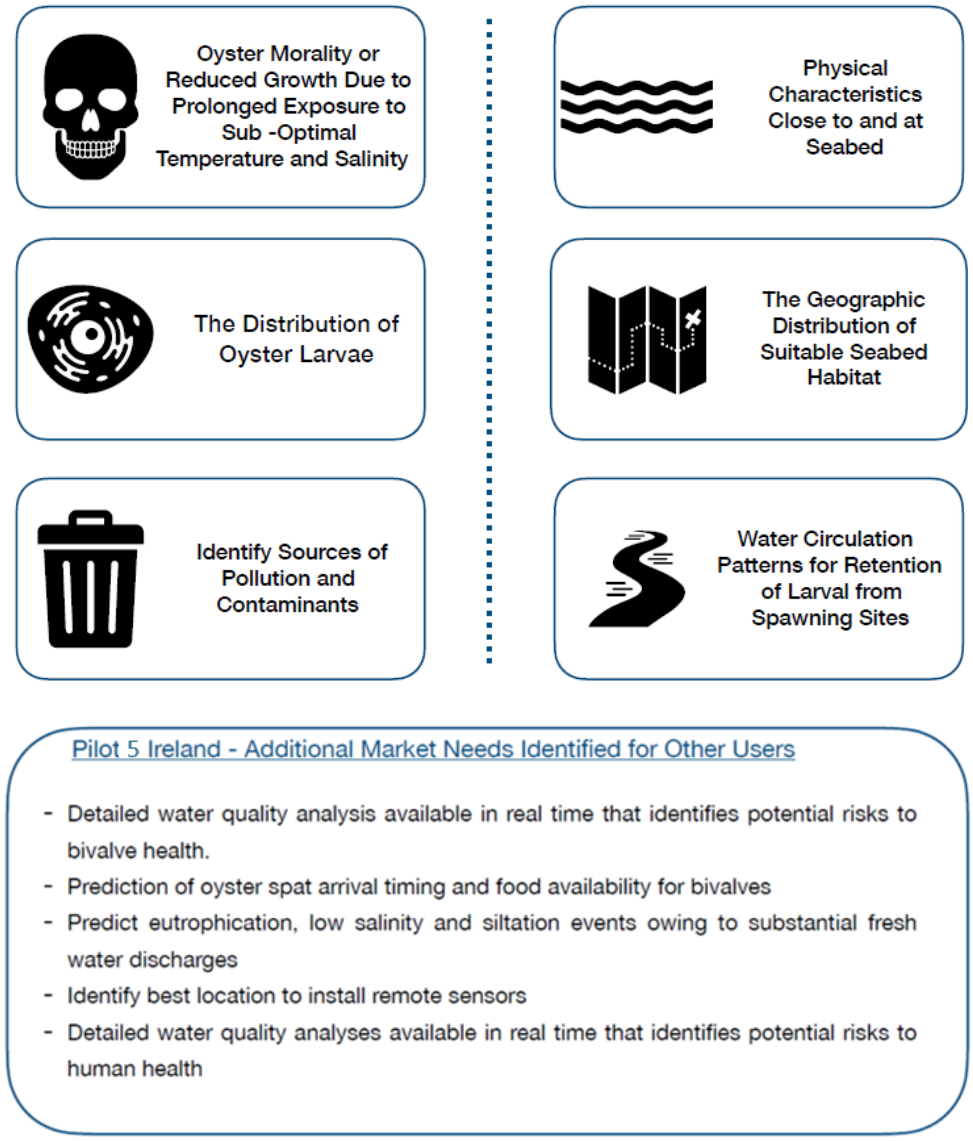

Figure 4. Market needs identified by partners and additional market needs identified by other users.

2.4 Competition

In order to address the reviewers' comments from the Review Report (11/02/2022), Annex 1 contains a detailed competition analysis to complete this aspect, as it is the centre point of this deliverable report remarks.

Competition Overview

There are very few services available to meet the specific market needs for ORR as outlined in the above 'Market Need 'section, however, there are two options available for ORR groups to conduct marine environmental condition analysis. These are to; a) Deploy remote sensors and record data manually and calculate how the data affects ORR works or; b) Subscribe to a service that will record marine

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environmental data and calculate how the data affects ORR works. Neither of these services meets the specific requirements for ORR. Alternatively, they are designed either for monitoring marine conditions or aquaculture farm management and are simply the closest thing available to a marine environmental condition monitoring service for ORR. Below is contained a list of the most suitable sensors and services currently on offer to assess the ORR industry.

Sensing + Aqua

Sensing + Aqua collects real-time data from sensors that sit in the water to analyse water quality, and above water to measure a variety of climate conditions. Sensing + Aqua then builds a picture of your microclimate in a range of conditions. This information is shared directly with you via a web app. Sensing + Aqua have worked in conjunction with a company named Bosch to develop a sensor box that is deployed directly on oyster farms and takes localised readings of water quality and conditions. The system is designed for aquaculture producers, however could be utilised by ORR groups to a similar effect.

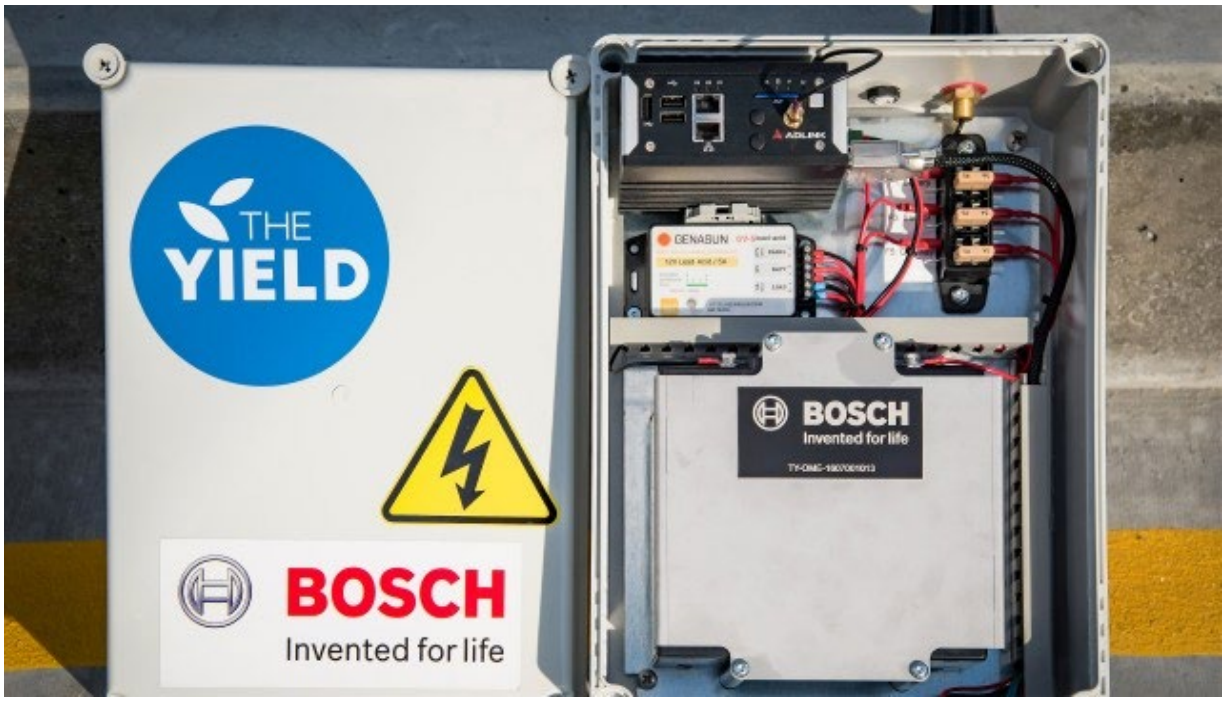

Figure 5. Sensing+ Aqua sensor box developed by BOSCH.

Feature	Description

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Assessment and Analysis	The sensor box collects the following data; - Air Pressure - Wind, Speed & Air Direction - Air Temperature - Rainfall - Sea Tide Height - Salinity - Temperature - Dissolved Oxygen - Water Depth
Digital Record of Activity	Allows the user to record harvest details such as dates, grading and mortality rates.
Prediction Software	By tracking multiple water and weather points in your area sensing + aqua can tell you how your localised environment reacts to certain conditions.
Data Sharing	The software can pass on anonymised data to public researchers.
Price €	Unknown

Table 3. Features and description of the Sensing+Aqua Box by BOSCH.

System advantages	System shortcomings
Remote sensing	No ocean modelling
Meteorological arrays/weather forecasting	No Geographical Distribution of Suitable Seabed Habitat
Data dashboard	No Distribution of Oyster Larvae
Low user input required	No Sedimentation Modelling
Data sharing	No Particle Tracking
Software support team available	No Oyster Mortality Analyses due to Prolonged Exposure to Sub Optimal Temp/Salinity
Mobile app available	No Physical Characteristics Close to and at the Seabed
Web portal available	No Water Circulation Patterns for Retention or Dispersal of Larvae from Spawning Sites

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No set-up data required	No Retrieving Source of Contaminants No dissolved Carbon/Nitrate Detection

Table 4. Sensing + aqua suitability for achieving oyster reef restoration market needs

Tech Works Marine

Tech Works Marine supply real-time integrated monitoring products by deployed data buoys and sending data to shore using telemetry methods including GPRS, WiFi, HSDPA and Iridium and UHF modem. Systems range for a variety of applications including;

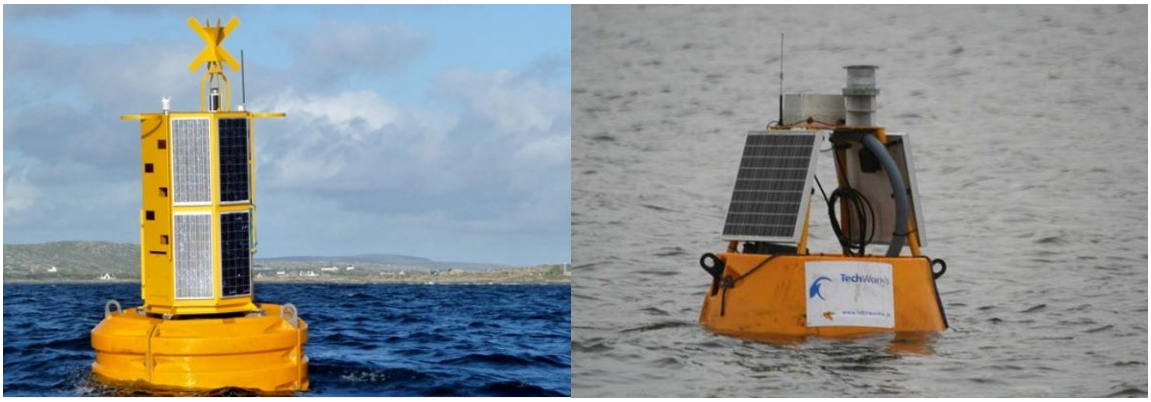

Figure 6. Data bouys available from Tech Works Marine.

Feature	**Description**
Meteorology arrays	Weather conditions
Current Profiling	Water current velocity over a depth range
Directional Wave	Wave direction and trajectory
Water Quality	Water quality
Climate Monitoring	Weather conditions
Remote Sensing Ground Truthing	Image data related to real features and materials on the ground
National Observing Networks	National Observation Networks
Conductivity, Temperature and Depth (CTD) Sensors	Conductivity, Temperature and Depth
Chlorophyll Fluorescence Sensors	Light re-emitted by chlorophyll molecules
Turbidity Sensors	Turbidity Monitoring
Carbon Dissolved Organic Matter Sensors	Dissolved Carbon Detection

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Partial Pressure Carbon Dioxide Sensors	Partial Pressure Carbon Dioxide Sensors
Nitrate Sensors	Nitrate Sensors
Automated Water Samplers (rule-based or manual trigger options)	Automated Water Samplers (rule-based or manual trigger options)
Inductive Modems	Inductive Modems
Live Video	Live Video
Price €	Unknown

Table 5. Capabilities of Individual Tech Work Marine Buoys.

System advantages	Systems shortcomings
Software support team available	No Oyster Mortality Analyses due to Prolonged Exposure to Sub Optimal Temp/Salinity
Software system available	No Physical Characteristics Close to and at the Seabed
Large network of data sharing	No Water Circulation Patterns for Retention or Dispersal of Larvae from Spawning Sites
No set-up data required	
Ocean modelling available	
Turbidity monitoring available	
Dissolved carbon, oxygen, nitrate detection	

Table 6. Tech Work Marine buoys suitability for achieving Oyster Reef Restoration market needs.

Ocean Seven 310 CTD Multi-parameter probe

The OCEAN SEVEN 310 CTD Multi-parameter incorporates up to 14 analogue and 3 digital sensors, with sampling rates up to 28Hz, contained in a CTD. The sampling rate can be adjusted according to the required activity based on user preferences. The basic configuration includes pressure, temperature and conductivity sensors, with the possibility of adding extra ones.

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Figure 7. Ocean Seven 310 CTD Multi-parameter probe.

Feature	**Description**
Temperature	Temperature
Salinity	Salinity
Oxygen	Oxygen (polarographic) Oxygen (optical)
pH	pH
Fresh water	Frehwater
Turbidity	C-Flour Turbidity meter
Further characteristic (see below)	

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Buoy buoyancy (kg)	Minke (500)	Beluga (650)	Orca (2000)	Fin (4000)	Narwahl (8000)
Sensor					
Salinity		●	●	●	●
Conductivity	●	●	●	●	●
Temperature	●	●	●	●	●
Depth	●	●	●	●	●
Chlorophyll	●	●	●	●	●
Turbidity	●	●	●	●	●
CDOM	●	●	●	●	●
Dissolved Oxygen	●	●	●	●	●
Profiling Current	●	●	●	●	●
Meteorology	●	●	●	●	●
Waves		●	●	●	●
Nitrate		●	●	●	●
Phosphate			●	●	●
ppCO2				●	●
Water Sampler				●	●
Telemetry					
GPRS					
GSM					
Satellite	●	●	●	●	●
UHF/VHF	●	●	●	●	●

Software	Windows Indronaut Redas-5 software
Bluetooth	Bluetooth adapter
Price €	22.580

Table 7. Capabilities Ocean Seven 310 CTD Multi-parameter probe.

System advantages	Systems shortcomings
Software support team available	No Oyster Mortality Analyses due to Prolonged Exposure to Sub Optimal Temperature/Salinity
Software system available	No Physical Characteristics Close to and at the Seabed
Large network of data sharing	No Watter Circulation Patterns for Retention or Dispersal of Larvae from Spawning Sites

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No set up data required	
Ocean modelling available	
Turbidity monitoring available	
Dissolved carbon, oxygen, nitrate detection	

Table 8. Ocean Seven 310 CTD Multi-parameter probe suitability for achieving Oyster Reef Restoration market needs.

Libelium-SmartVillage Smart water solution kit Sigfox

Libellium is an established water sampling manufacture providing solutions for water quality monitoring.

Figure 8. Libelium Iot vertical kit.

Feature	**Description**
	Plug & Sensor Smart Water 868/900
Conductivity	Conductivity sensor probe + Conductivity Calibration Kit
Oxygen	Dissolved Oxygen Sensor Probe
pH	Ph Sensor Probe + Ph Calibration Kit
Oxygen-Reduction potential	ROP sensor probe
Energy source	External solar panel
Data transfer	Meshlium Visual Interface

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Price €	5.200

Table 9. Capabilities of Libelium-SmartVillage Smart water solution kit Sigfox.

System advantages	Systems shortcomings
Remote Sensing	No Retrieving Source of Contaminants
Software System Available	No Geographical Distribution of Suitable Seabed Habitat
Data Dashboard	No Distribution of Oyster Larvae
Dissolved Carbon, Oxygen, Nitrate Detection	No Sedimentation Modelling
No Set Up Data Required	No Particle Tracking
Software Support Team Available	No Oyster Mortality Analyses due to Prolonged Exposure to Sub Optimal Temp/Salinity
	No Physical Characteristics Close to and at the Seabed
	No Water Circulation Patterns for Retention or Dispersal of Larvae from Spawning Sites
	High User Input Required
	No Ocean Modelling Available

Table 10. Libelium-SmartVillage Smart water solution kit Sigfox suitability for achieving Oyster Reef Restoration market needs.

2.5 Barriers to entry

Barriers to Entry Overview

The primary barrier to entry facing a potential user for the FORCOAST system is their ability to provide the required 'set up data 'to run the desired service model, including its validation. ORR groups vary in their ability to provide 'set up data 'depending on their structure, capabilities and years in action.

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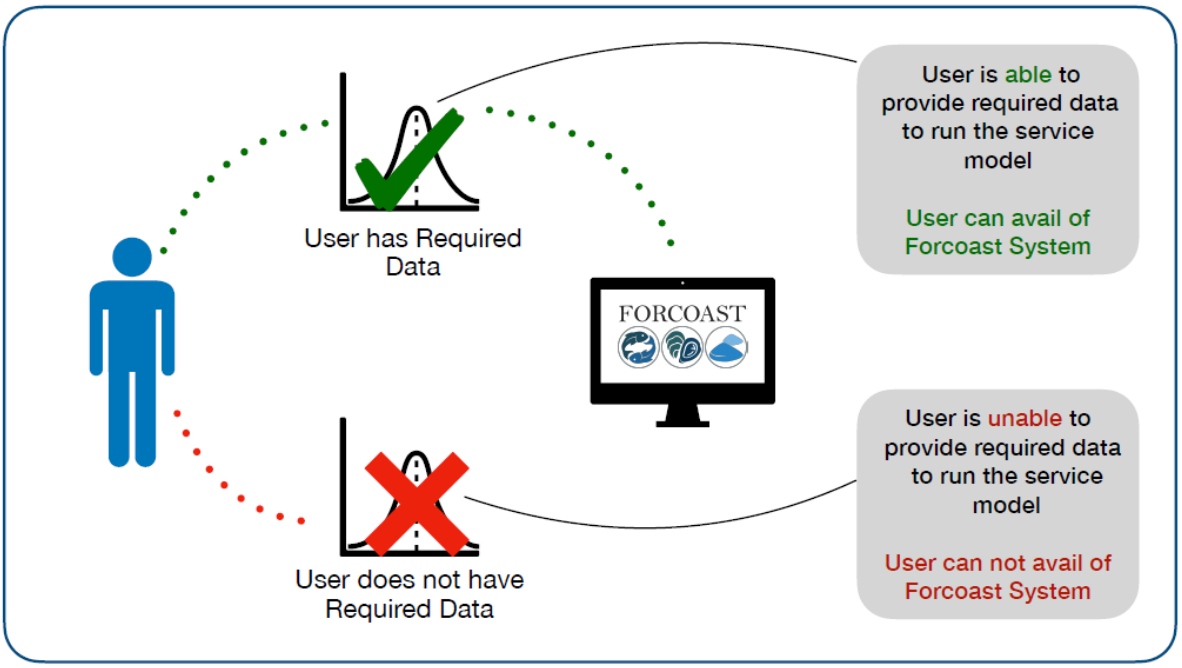

Figure 9. Set up data requirement diagram.

None of the above mention marine environmental monitoring systems outlined in the competition section requires set-up or historical data to be available for their services to be applied. This is a significant barrier to entry unique to the FORCOAST system that represents a challenge for availability.

Table 11. Forcoast Service Modules Required Set Up Data

		Target locations	Source locations	Obstacles	Waterlevel	Sunlight	Wind conditions	Waves	Water currents	Volume of pollutants	Period of pollution	Bathymetry	Temperature	Salinity	Oxygen	Turbidity	Detritus	Food supply	Chlorophyll a	Cue conditioning release events	Duration of release events		Hind cast	Forecast
F1	Suitable fishing areas											X	X	X	X	X		X		X	X		X	X
F2	Front detection											X	X	X	X	X		X		X	X		X	X
A1	Operation scheduler	X			X	X	X	±	±															X
A2	Land pollution	X	X	X			X	X	X	X	X												X	X
A3	Prospection for new sites								X			X	X	X	X	X	X	X	X				X	
A4	Assisstance spat capture	X	X					X	X				X						X	X	X		X	X
R1	Oyster ground restoration	X	X					X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X

In *Deliverable D3.9 – Sector-specific Decision Workflow Synthesis* a list and extensive explanation of the different initial Service Modules listed in Table 11 can be found.

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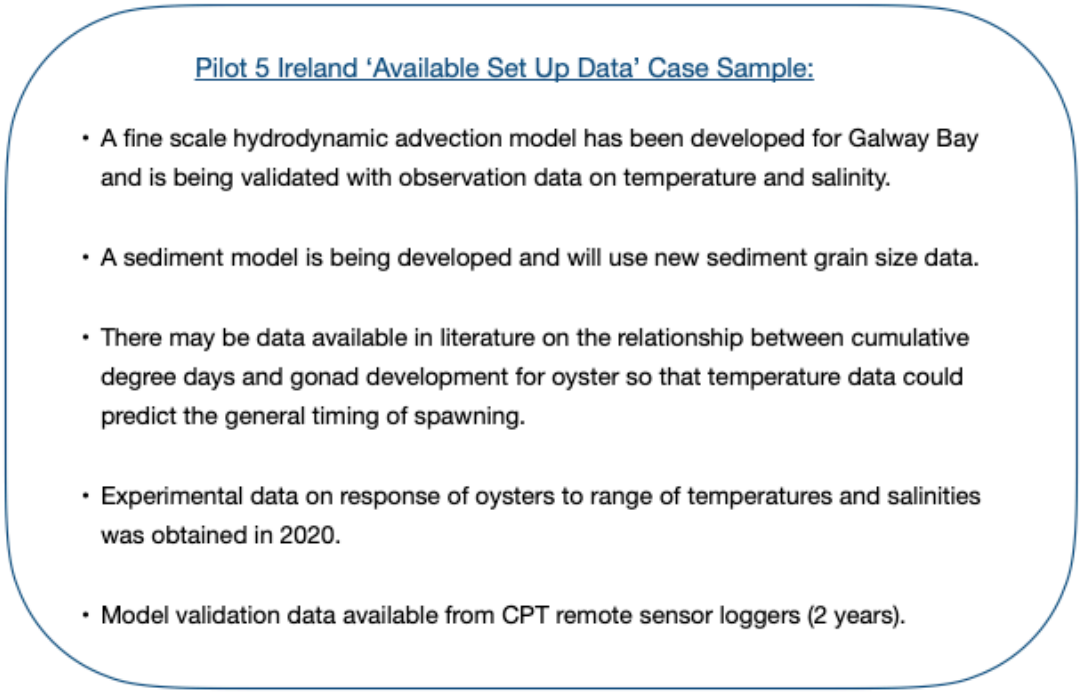

Figure 10. Case sample for Pilot 5 Ireland available set-up data.

3. Conclusions

3.1. Target Market/ User Segmentation

The Oyster Reef Restoration (ORR) sector is the smallest of the three industries currently being serviced by the FORCOAST system with only 19 ORR groups identified in Europe. ORR groups have also been identified in America, Canada, Australia and Asia and 3 of the largest of these have been included in this Initial Market Analysis. Commercial Oyster Fishery groups have also been including in this Initial Market Analysis as their market need is similar to that of ORR groups given that they work with the same species (Ostrea edulis), work on the seabed and suffer oyster moralities owing to the same environmental challenges facing ORR. In the ORR Pilot country Ireland there are 8 Commercial Oyster Fisheries identified. ORR projects also often take place within a larger programme of Marine Habitat Conservation and accordingly a number of third party users including State Institutions, Scientific Institutions, Community Groups and Educational Institutions are often involved. This adds a wide range of 'Additional Potential Users' who have a similar market need for marine environmental condition monitoring.

3.2. Market Need

The market need for oyster reef restoration is generally uniform and standard for every ORR group as the activities undertaken and challenges faced are the same. The market needs can be grouped under a comment title of 'Habitat Suitability and Potential to Restore' which refers to the potential of a particular area of the shore for oyster reef restoration. A detailed list of the market need for this can be found in the above market need section but they can be summarised to include (a) Sedimentation Modelling, (b) Water Quality Analysis and (c) Larval and Particle Dispersion and Trajectory. Providing a service that can meet these market needs would be widely desired in the ORR community.

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3.3. Future work

The effect of Coronavirus restriction measures has had a considerable effect on the ability of a number of pilot sites to engage effectively with potential end-users of their industry. This is because the online tools such as google forms, zoom and Microsoft teams used by Cuan Beo to engage with ORR users was determined to be unusable by some pilot sites whose potential users don't use these tools and require to meet physically to provide feedback. It is hoped that the easing of restriction measures will allow pilots to engage more effectively with the potential end-users and gain the required feedback to complete the initial market analysis for the remaining aquaculture and fisheries industries. However, Coronavirus restriction measures have also required a lot more people to engage with online meeting platforms and accordingly the above-mentioned difficulty may have subsided in some pilot sites.

In order to extend this initial market analysis to all Pilots, sectors and services, a working group has been set up with representatives of all Pilots, who are the link with the end-users of the Pilots and beyond. All contributions from the working group will be documented in one document which will become the market analysis for the FORCOAST consortium.

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Annex 1 – Detailed Competition Analysis

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