FORCOAST

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

PROJECT DELIVERABLE REPORT

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Executive Summary

FORCOAST aims to offer information services, with the emphasis on the use of novel Copernicus-based data, co-designed with end users, which provide high-resolution data of water quality and met-ocean variables at coastal zone and nearshore that are used to give focused answers to specific questions from the targeted wild fisheries, bivalve mariculture, and oysterground restoration sectors. FORCOAST is developing, testing and demonstrating, in operational mode information services that will incorporate Copernicus Marine, Land and Climate Services Products, local monitoring data and advanced modelling in the service. This allows improving operation, planning and management of different marine activities in these sectors. Such information service includes among others: early warning service, real time crisis management, key performance indicators, and information for planning operations.

FORCOAST's target market focuses on three different sectors, namely the fisheries, bivalve mariculture and oysterground restoration. All markets have been emerging over the last few decades. Within the proposal of project FORCOAST it was decided to use the Business Model Canvas in order to set up a business plan for each of the Service Modules. With the input from the end user groups per Pilot and the information from the stakeholders present at the General Assembly meeting in February 2021, a first exercise was performed, with the initial make up of three building blocks of the Business Model Canvas: Value proposition, Customer segments and Revenue streams. Afterwards, the exercise was extended to the nine building blocks of the Business Model Canvas for each of the Service Modules. The outcomes of these exercises are summarised in D6.3 Initial Business Plan.

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1 Introduction

FORCOAST aims to offer information services, with an emphasis on the use of novel Copernicus-based data, co-designed with end users, which provide high-resolution data of water quality and met-ocean variables at coastal zone and nearshore that are used to give focused answers to specific questions from the targeted wild fisheries, bivalve mariculture, and oysterground restoration sectors. FORCOAST is developing, testing and demonstrating, in operational mode information services that will incorporate Copernicus Marine, Land and Climate Services Products, local monitoring data and advanced modelling in the service. This allows improving operation, planning and management of different marine activities in these sectors. Such information service includes among others: early warning service, real time crisis management, key performance indicators, and information for planning operations.

The demand for such services is increasing as the marine-related business has been observed to be growing in economic value. This value depends on the efficiency and effectiveness in the operations and productivity while decreasing the pressures on the marine and coastal environment. The increasing availability of data and technological advancements will contribute to a better and deeper understanding of the surrounding environment. Europe in particular, through programs such as Copernicus, has been making significant investments to make data publically available that can make important contributions to the operations productivity in different sectors.

The purpose of FORCOAST is to make data available to the end user in a understandable manner and, even more importantly, in an applicable way in the form of Service Modules. It is important to set up a viable business plan answering the following question:

‘What entrepreneur/organization can successfully deliver the proposition(s), via what strategy?’

That question can be answered by addressing the following sub-questions:

1. What kind of entrepreneur/organization would fit the foreseen propositions?
2. Which proposition do we / can they use to target the identified market (segment)?
3. What is the business strategy (who, what, where, when, how)?
4. How do we fund the business (initial start-up & operation)?
5. What are the steps to be taken to commercialization?

In order to set up this business plan, various preliminary assessments have been done. D6.1 revealed feasible product-market-combination(s) based on current insights. The initial business plan (D6.3), explored the strategy and range of organisations that could deliver the FORCOAST products and services. So, in other words, it revealed the best business-market combination. This was followed by the exploitation strategy and a strategic action plan (D6.5).

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2 FORCOAST Organisation Setup

The FORCOAST organisation setup is planned to consist of two parts. The first one is a steering committee that is formed to keep the FORCOAST platform and services alive for a period of two years. The chair will be decided in the first meeting and the group will be formed. The IPR will be stating this information, including that this will be possible due to in-kind contributions. The responsibility of each of the services will be the partner users themselves that also developed them.

The second one is a commercial organisation/entity to maintain the services and exploit them, which is planned to be carried out for some of them by Hidromod (https://hidromod.com/). This does not mean competition between FORCOAST and the existing services offered by Hidromod, but synergistic pathways into exploitation since the FORCOAST target sectors are not in their current services while also being in the marine sector.

2.1 Expertise and experience

- Commercial entity:
  - Marketing and sales
  - Provision of services, which includes technical expertise, for example:
    - To set up and maintain the regional implementation of operational ocean models requires generally requires skills in Fortran programming and High Performance Computation clusters usage. In addition, the handling of meteorological and boundary conditions requires a good knowledge of common geoscientific available datasets and related conventions. More specifically, a regional model should be adapted to local environmental dynamics, which is why it is preferable that local institutions be involved, knowing of the dominant oceanic processes for a given region, specific calibration, and local validation datasets.
    - The Land pollution service module is based on the python Ocean Parcel lagrangian tracking module. Adapting this service to a new kind of oceanic model requires python programming skills, and an understanding of the various processes affecting lagrangian dispersion in order to set optional processes most appropriately, and to link those processes to the correct state variables (eg. Waves for Stokes Drift, internal turbulence for random diffusion, etc …)
    - Required further development of the service module demands specific calibration of the particles' behaviour to mimic the life cycle of the bacteria E. Coli. To produce such behaviour, further biological expertise is required, i.e. To condition bacterial growth and decay to environmental conditions such as temperature, salinity light conditions, nutrients, etc.
    - Dissemination activities, visualisations
  - Business administration to make the invoicing, contracts, subscriptions, etc. to get income
  - Technical support helpdesk, to redirect to the steering committee, or the relevant partner when necessary
- Steering committee:
  - Strategic activities
    - Safeguarding the identity of the FORCOAST partner organisation
    - Executing strategical analysis and developing a strategical vision for the future of the services,

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        - Executing business analyses of new trends to evolve the service provision.
        - Seeking funding from regional organisations and/or entities, including governmental bodies.
        - Seeking new key partnerships (i.e. modellers, local entities) to keep on providing the services and/or broaden the offer.
    - Tactical activities
        - Translating user feedback into additional or improved features to offer a better experience, improve accuracy, define new functionalities, debugging, issue-solving, etc.
        - Prioritising the requirements and needs gathered to be carried out.
    - Operational activities
        - Keep the data, models and system architecture up and running as it is at the end of the project
        - Further development of the services, further service evolution. This includes the involvement of future partners that can provide data to transfer the services to other areas for further users, or add extra services to the FORCOAST catalogue.

2.2 Networks and Partners

Three types of partners in the network are identified to be included at the end of the project:

- Scientific, technical and data science: Operational oceanography is a well-established community, with several institutions at national, European and UN levels, establishing common standards in terms of product data format, conventions, etc.. Also, those standards are evolving fast, as is the databases and distributions platform. A good acquaintance with operational oceanography coordination frameworks (e.g. CMEMS, EuroGOOS, ICES, PICES) would help ensure the update of the interface between the actual FORCOAST products and their upwind dependencies. Other broad initiatives of relevance to the provision of data would provide further opportunities to FORCOAST, such as EMODnet. Also, Blue growth at large is fast expanding, and several consortiums gather their members, for instance at the European level. Keeping contact with those large-scale consortiums (e.g. The EATIP) is a must to keep up to date with user technical evolution, and their updated requirements.
- Production and branch organisations: Production organisations such as Reders Centrale (Belgium)
- Visualisation and dissemination: examples like windy.com that already account with a user base

2.3 Capacity and Financial Resources

The steering committee needs to have the capacity to keep the platform and services for two years. The commercial entity incorporates part of the service catalogue into its activities, already accounting for the required capacity.

It is necessary to have enough financial resources to make the investments to set up marketing and sales campaigns That must be enough to carry out the first commercial activities, including those in their existing activities for the FORCOAST clients. Also, enough financial resources to do so until the revenues of the FORCOAST resources pay off. For further information about financial investments to

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carry out the activities for the first years beyond the project, see deliverable *D6.2 – Initial Market Analysis* Section 6.

2.4 Identity and Organisational Cause

The steering committee, with its chair to be elected at the beginning of its formation, will be in charge of defining the identity and define paths for further development as defined in section 2.1.

For the commercial entity, Hidromod is an organisation that is active in adjacent sectors to FORCOAST and will expand to incorporate the FORCOAST target sectors among their focus areas.

2.5 Choice of Future Commercial Partner

In the past months our relationship with Hidromod had extended to such a degree, that we are convinced Hidromod is a suitable partner to the consortium. Not only do they have the commercial expertise and drive within the company, but they also have familiarity with our scope, the services we provide and the capacity and financial resources. They have proven to become a respected future partner, adding value and. Missing expertise to the consortium. We are setting up the partnership agreement and will frequently revisit our relationship as well as the obtained results once we are commercially underway.

Given the presence of a good future partner, we did not seek further to find others, as is not only inexplicable but also unlogical to do so. We are very eager to collaborate with them and we are confident with them in the upcoming commercial phase.

2.6 Continuity in the Next Two Years

As will appear in the value propositions, described in the coming paragraphs, the products, or better; services are set up as minimum viable products. This means that both the initial revenues are relatively small, and the expenditures as well. This means that we can validate our business model with only all small economical risks, and build upon our developed services based on the user feedback that we will gather.

Concerning the steering committee and non-commercial partners; they are committed to participating and contributing in kind for the coming two years. And with that, keeping the service up and running for that period.

Concerning Hidromod; they will contribute with their commercial drive to the success of FORCOAST service modules, and are with that committed to the overall success of the partnership. As their usual daily operation includes commercial tasks as required, the additional efforts are relatively low. The additional costs can be covered by our new partner as the exploitation of the service modules will create revenue that will level the expenditures.

With this, the continuity of the service models, as well as the FORCOAST platform is guaranteed for the coming two years.

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3 Business Strategy

The business strategy consists of the business model and the marketing and sales strategy. The business model is covered through paragraphs Target customer (3.2), Business penetration scenarios (3.3) and Value proposition (3.4).

The marketing and sales strategy is described by the basic 4P approach of Product, Price, Place, and Promotion [1]. It will reveal a detailed way in order to raise awareness for the innovation that has to be marketed. To proceed towards a concrete exploitation strategy, the promotion strategy indicates the best way to penetrate the market and it will set the different phases, iterations and milestones that will help achieve success for that innovation.

The marketing & sales strategy is covered through paragraphs Place description (3.5), Pricing strategy (3.6) and promotion strategy (3.7).

3.1 Target Customers per Service Module

This paragraph lists the different end user groups. Specific clients can be interested in your product according to their requirements. This can be sectorial, but can also be across sectors. End users can be grouped into segments distinguished by common needs, common behaviours, or other attributes. In this way it is possible to make a conscious decision as to which segments to serve and which segments to ignore, thus allowing to focus on matters that vitally affect the business.

3.1.1 Service Module R1 – Contaminants Source Retrieval

The targeted customers are:

Oyster Restoration - Eight oyster restoration/fisheries groups in Ireland could be potential customers, furthermore, the Native Oyster Network UK and Ireland (NON) have several groups across the UK and Ireland who could be potential customers and the Native Oyster Restoration Alliance (NORA) have many members across Europe who could potentially be interested in the service. Outside of Europe, there are a number of large scale restoration groups operating in America, Canada Australia and New Zealand.

Oyster Producers - 126 active pacific gigas oyster farmers in Ireland could potentially be customers for the oyster service modules.

Galway Bay - There are a number of potential users in Galway Bay including recreational, state and scientific who could be potential customers for the service.

3.1.2 Service Module A1 – Marine Conditions

The targeted customers are:

- Fishermen operating at the sea.

3.1.3 Service Module A2 – Land Pollution

The targeted customers are:

- Owners/managers of aquaculture.
- The emerging Romanian marine aquaculture farms (at this moment, in Romania there is only one emerging mussel farm).
- Also, the Institutions regulating marine aquaculture products and activities in Romania might use the service.

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To some extent, research institutes can use some data, for specific case studies or actions. 3.2.4 Service Module A3 – Site Prospection

The targeted customers are:

- The SM is primarily relevant to the shellfish (oysters and mussels) primary producers and the processing industry.

3.1.4 Service Module A4 – Spat Capture Assistance

The targeted customers are:

- Shellfish farmer
- Oyster reef restorators that want to seed the oyster reefs with local oyster spat can gain from this Service Module.
- Operators that use bivalve biogenic reefs as coastal protection.

3.1.5 Service Module F1 – Suitable Fishing Areas

The targeted customers are:

- Individual fishers, small to large fishing vessels.
- Institutions that can provide to final users. Other segments: Researchers and Education purposes
- Regulators

3.1.6 Service Module F2 – Front Detection

The targeted customers are:

- Shipowners of the wild fisheries sector
- Fisheries products organizations of the wild fisheries sector

3.2 Business Penetration Scenarios

In this Section two different business penetration scenarios are presented with their respective approach strategy for FORCOAST services.

- Scenario for small-medium bivalve aquaculture, small fishing fleet and oysterground restoration:
    - Medium organisations are needed to approach them since most of the fisheries are independent not belonging to bigger overarching initiatives.
    - The offer would consist of providing something cheap, easy to use, simplified and ideally stimulating competition between the different companies. On a technical level, offering a sustainable system, highly technical and accurate, proven useful and validated.
    - The product should be stand-alone operable, mobile, and simple.
- Scenario for large scale fishing fleet:
    - Emphasize relevance to policy making, addressing legal issues, and bigger scope.
    - Adaptative system, very technical, highly interoperable with open source data and their own, and with very high accuracy.

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3.3 Value Proposition per Service Module (Product Description)

This is without any doubt the most important block because this block will show you why they should do business with you rather than with your competitors and makes the benefits of your products or services crystal clear from the outset. It is the description of the product that will be offered in the marketing and sales trajectory.

3.3.1 Service Module R1 – Contaminants Source Retrieval

Faecal contamination causes massive economic loss in the aquaculture and oysterground restoration sectors. This service module addresses the need to assess the disease status of native oysters by tracing viruses and bacteria. The objective of this service module is to track seawater contaminants, assumed to behave as perfect passive tracers. The particle-tracking model used is OpenDrift (Dagestad et al., 2018). Both forward and backward particle tracking is available to the end user. Backward tracking allows the user to investigate the origin of the contamination affecting their farm, whereas forward tracking can be used when the source of contamination is known. The focus is given in the backwards tracking part due to the user-identified need of identifying sources of contaminants, causing diseases.

The user can select any location on the map within the boundaries defined by each pilot. After the request has been processed, the user is provided with maps showing: (a) the location of the contaminants (see e.g. Figure 7 below), (b) probability density maps based on the concentration of contaminants, (c) an estimation of the local exposure time (Du et al., 2020), which measures the residence time of contaminants within an area.

We deliver a forecasting and mapping service of environmental conditions and larval dispersion with a high level of detail (i.e., high resolution) that is not otherwise available for Inner Galway Bay. We are aiming at helping to solve the following problems:

- What are the sources of contamination affecting the farms?
- What is the geographic distribution of suitable seabed habitats for native oysters?
- What is the distribution of oyster larvae spawned from the main oyster beds in the bay?
- What is the exposure to suboptimal temperature and salinity and how this exposure impacts mortality and growth?

Products and services addressing the above are expected to be bundled under one service module supporting the native oyster restoration. We are satisfying the needs of environmentalists and oyster growers in the region by supporting them with identifying suitable habitats for native oysters (combined sedimentation and temperature and salinity) and identifying target areas for spat collection.

3.3.2 Service Module A1 – Marine Conditions

Service Module A1 aims to provide shellfish farmers with forecast information about marine conditions at their farming sites, which will support them with scheduling their daily operations and planning and reducing associated costs, including winds, temperature, salinity, tide, storm surge and currents with a model grid of about 200 m. The SM has been implemented in an operational service platform both for mobile and fixed location terminals. Currently, SM provides forecasts for two areas: Limfjord in Denmark and Sado estuary in Portugal.

In the two areas, there are no high resolution forecast services available yet. In the Limfjord area, the existing service only provides weather and storm surge forecasts. During the project, in the SM design phase, external shellfish farmers in the two areas have been consulted to determine the key

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parameters and way of service by internal users via either face-to-face meetings or phone conversations. Their opinions were taken into account in the platform design. In the development phase, the high-resolution forecast model was developed and validated to show robust results. A user workshop was organized in December 2021, including users in Limfjord and Sado estuary to improve the platform presentation. A preliminary platform was presented to users and feedback was obtained. The outcomes have been used to improve the platform. After the platform was put into operation, all internal users received a mobile service from SM A1. Another dedicated user meeting was organized in June 2022 for the Limfjord external shellfish farmers, to explore potential uses of SM A1 and A3. Both the internal and external exploitations show that the SM A1 is usable, and can provide value-added information for the interested areas.

Data production in current SM A1 in Limfjord is operational and ready to provide a real time service. The TRL level is above 7. A key issue for the business model is cost-effectiveness. The forecast production relies on the daily production of the high resolution Limfjord forecasting system. Maintenance of a forecasting system with decent quality needs a certain amount of resources to do routine checks and validations. Whenever boundary conditions from CMEMS change, the forecasting system will need to be returned and verified. This needs extra resources. The cost is estimated as ~20K€/yr. On the other hand, the amount of aquaculture farms in Limfjord is estimated as less than 10, which is too few. A sustained business model needs an upscale solution, in the dimension of space and value-added service.

The upscaling in space means that the forecast system can be extended to cover a much large area, e.g., all of the European Sea coast. The maintenance fee per square km will significantly decrease while the user community will significantly increase. The upscaling in value-added service means that the service scope can be enlarged, e.g., in parameters and service types. Currently, we only have a tide and sea level tailored service. One may add SST and salinity-based tailored service, and even provide wave and ice forecasts, which are essential for aquaculture farmers in certain areas.

3.3.3 Service Module A2 – Land Pollution

Customers have no or low means to assess the risk of exposure to harmful land discharges. Along with the lack of information regarding the oceanographic variables, the main problem is the lack of information regarding the outflows from the on-shore wastewater treatment plants. The emerging aquaculture farms are placed somehow close to the Constanta city wastewater treatment plants, which sometimes, during summer - touristic periods - may outflow untreated water, containing possibly some bacterial inputs, such as *E. coli.* So the main need is to have timely information on the movements of the water bodies coming from the treatment plants, and the dispersal and direction of the particles. This knowledge could trigger actions from the farm managers, such as early harvest (if the model predicts a sufficient time period until potential contamination), or delayed harvest (allowing the mussels to self-purify, after the contaminated water has passed the farm area), in order not to threaten public health. SM-A2 targets aquaculture farmers as main users. It is built on the flexible assumption that users only have limited means to characterize the source of pollutants. As a first approach we consider that users won't be able to gather sufficient knowledge regarding nature, and temporal variations of pollutants, at least not precisely, but should have the means to characterize at least the potentially harmful release location.

SM-A2 uses surface circulation hindcast and forecast model data to provide an estimate of the potential risk of being affected by user-identified sources of pollution, i.e. to assess if the local marine conditions are such that an effective release at the pollution source has a significant probability to

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reach the farm. A constant watch is set, updated daily to consider the most recent circulation conditions. As the best proxies attainable within this context, alarms are raised based on the relative concentration and age of the released substance. That is, users are notified if a substantial fraction (1) of the release may reach the farm in a relatively short time (2). (1) and (2) respectively correspond to "Fraction" and "Age" thresholds, that the user may modify to parameterize notification.

The knowledge that marine conditions are such that releases from pre-identified sources have large chance to reach the farming area (and notification of when this risk arises at least three days in advance) could trigger actions from the farm managers. This includes early harvest (if the model predicts a sufficient time period until potential contamination), delayed harvest (allowing the mussels to self-purify, after the contaminated water has passed the farm area), or extra/enforced quality control procedures in order not to threaten public health.

At its current stage, the service should be coupled with user knowledge as actual releases. So our routine watch warns the user that, based on current circulation conditions, any release has a certain chance to reach the farm. This information needs to be coupled with user knowledge on the likelihood of actual release events, based for instance on meteorological conditions, touristic season, warnings released by local authorities, etc.

The service module is available as an MPV (minimum viable product) which means that, providing that a user knows the location of its farms and the location of potentially pollution release, the service can be readily set up (approximately at a day's work, to ensure operational implementation) and provided a daily watch is executed on the likelihood of being affected in case of pollutant release.

3.3.4 Service Module A3 – Site Prospection

Lack of knowledge of best locations for oyster culturing. We deliver maps of environmental variables (means and SD) and oyster growth potential. Optimise planning for new sites. (*Pilot#8 - Spatial and temporal patterns of biogeochemical tracers for monitoring and assessing conditions and risks of aquaculture sites and potential shellfish growth rates; the main problem of customers is understanding, monitoring and predicting physical (e.g., SST) and biogeochemical properties over the potential new sites. We offer modelling and satellite products which can tackle both physical and biogeochemical issues, also including river inputs.*)

3.3.5 Service Module A4 – Spat Capture Assistance

This Service Module will estimate the period of blue mussel/flat oyster spat settlement and their distribution in a given area and will enable mussel/oyster farmers or flat oyster reef restoration operators:

1. To employ their bivalve spat collectors at the best period of the year, in order to enable the highest efficiency of the spat collectors
2. To employ their oyster spat collectors in the areas with the highest densities of oyster spat in a given period and area, in order to collect the highest yield of spat

According to the requirements of the Customers of this Service Module, it must generate output on two levels:

- Forecast of the time window with the highest probability of spat settlement at a specific location (farm or oyster reef)
- Forecast with distribution and density map within a specific area (Belgian part of the North, Galway Bay, Limfjorden, Black Sea, etc.)

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The majority of marine bivalves reproduce by releasing large amounts of gametes into the water column where fertilisation takes place. The fertilized egg cells and the consecutive larval stages float in the water column (pelagic phase) and are transferred to other areas by currents. The reproduction is mainly driven by temperature, while the development of the larvae is mainly driven by temperature and feed availability. The higher the temperature (within the optimal range) and/or the higher density of phytoplankton, the shorter the larval development period. The growth of the shell of the larva causes the larva to sink to the bottom and start its benthic phase. This is the period that the larva needs to find a suitable substrate. In some cases, like for the blue mussel (*Mytilus edulis*), the spat can still detach itself and uses its byssal threads as a parachute in the water current to attain a better place. In the case of the flat oyster, this is otherwise (see below).

This means that the shellfish farmer must have an idea of when the spawning takes place (when the temperature threshold is reached) and how long the larval development will take (amount of temperature x hours/days) before the spat settlement will take place, in order to deploy the spat collectors (*e.g.* dropper lines, empty shells).

Especially for the spat of the European flat oyster (*Ostrea edulis*) the condition of the substrate is important, as the spat of this species will not settle on the substrate which has already substantial fouling. This means that when the spat collectors are put into the water too long in advance of the spat settlement, biofouling organisms will have the chance to colonize the substrate, preventing the flat oyster spat to settle on the substrate. Subsequently, with low yields of spat on the collectors. If the spat collectors are deployed too late, then the farmer will miss the window of spat settlement, with subsequently low yields of spat. As the settlement of flat oysters takes place after the first settlement peak and before the second peak of settlement for blue mussels. This provides only a small window to deploy the spat collectors for European flat oysters.

Furthermore, it is also interesting for the shellfish farmer to have an idea about the distribution of the bivalve larvae in the water column. Because the farming site may be situated in an area with low bivalve recruitment due to low connectivity with natural bivalve grounds (*e.g.* mussel beds or oyster reefs). It is, therefore, necessary that the Service Modules can provide a forecast of spat distribution and density, in order to pinpoint the ideal settlement locations for spat of the target species next to the culture sites. In this way, spat collectors can be deployed at these locations and subsequently transfer the juveniles to the farming site(s).

A similar service is non-existent. Currently, hind- and a 5 days forecast information is freely available for any end user on sea surface elevation and due to astronomical tide, wind speed, mean waves period, peak wave period, significant wave height, surface and bottom current speed, sea surface and bottom temperature, and sea surface and bottom salinity for 42 locations in BPNS, four locations in the Dutch part, five locations in the German part, one location in the Danish part and six locations in the UK part of the North Sea (https://odnature.naturalsciences.be/marine-forecasting-centre/en/graphs/sea_bottom_temperature/Ostend).

On the other hand, the LARVAE&CO model is not yet made available to the public and would be made available through the Service Module – Assistance for spat capture under the umbrella of FORCOAST.

There is a lack of knowledge to identify the best period to install collectors and maximise the capture of spat. If the spat collectors are installed too early, the spat collectors can be overgrown by fouling organisms, preventing spat to settle on the collectors (especially in the case of the flat oyster). If the spat collectors are commissioned too late, the settlement of spat can be missed, with inefficient spat collection as a result.

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The A4 Spat capture service module is available as an MPV (minimum viable product), which means that, providing that a user knows the location of its farms and the location of the potential source area, as specific parameterization of the species in the location. A default value can be used, but with uncertainties on the likelihood outside the North Sea.

3.3.6 Service Module F1 – Suitable Fishing Areas

Main problem: lack of information regarding the suitability of specific species. Need to have access to ocean variables.
Components of the service: Global suitability index for species in the Black Sea, upwelling events assessment, improved wave products.

3.3.7 Service Module F2 – Front Detection

The delivery of forecast operational data about frontal oceanic areas could serve as indicators of high biological activity areas and could be applied to different pilots since it is easy to apply to model outputs. Any information that could reduce the search time and areas will benefit the sector and the environment. This user-friendly application only needs a smartphone. This service module will daily locate the main temperature and chlorophyll fronts within the sea surface. This information could help small pelagic fishing fleets to have more relevant information in their search for rich fishing grounds. Any information that could reduce the search time and locate more efficient areas will benefit the sector and the environment.

Sea fronts can be identified from remote sensing and/or model imagery. But since the fishing sector needs more processed data to take fast decisions, this Service Module has been designed for a fast identification of frontal areas.

3.4 Place Description

It is suggested that the Service Module will be made available to end users via mobile or desktop apps and on the different websites with links to the FORCOAST central platform and thus to the Service Module – Marine conditions for supporting aqua-farmers' daily operations.

It is suggested that the Service Module will be made available to end users via a mobile or web app and on the different websites with links to the FORCOAST central platform and thus to the Service Module – Assistance for spat capture. For example, the Marine Living Lab webpage of ILVO, the webpage for forecasts of ODNature, a webpage of VLIZ and a webpage of the Flemish Aquaculture Platform in order to increase the visibility of this Service Module. The same can be carried out on webpages of other European knowledge institutes and sector groups, and beyond, with the extension of the Service Module to other species and areas.

3.5 Pricing Strategy

Based on the current market and economic figures, three possible scenarios have been developed in the Description of Action (DoA) once the FORCOAST project is finished (i.e. after public funding of the project). It is very difficult at this stage to give estimates of real turnover; a percentage has been used instead. For all scenarios, an inflation rate of 1.5% is considered. The total costs are the sum of indirect and direct costs. Fixed costs are equal to the maintenance of the service and exploitation activities, whereas variable costs are those related to setting up new customized FORCOAST services. For all scenarios, fixed costs are adjusted only by the inflation rate:

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1. Scenario 1: Low market penetration expressed as 400,000 € annual turnovers with an annual increase of 5%. 8 PM (Person Months) are assumed for this scenario.
2. Scenario 2: Moderate market penetration expressed as 800,000 € annual turnovers with an annual increase of 10%. 10 PM are assumed for this scenario.
3. Scenario 3: High market penetration expressed as 1,200,000 € annual turnovers with an annual increase of 15%. 12 PM are assumed for this scenario.

Table 1 indicates the estimated costs, some of which are attached to the maintenance of the service after the duration of the project and others are related to new requests for setting up such service. In order to break even, the first commercial year must generate a turnover of more than 50,000 €.

Year	Fixed cost	Scenario 1: Low market penetration			Scenario 2: Moderate market penetration			Scenario 3: High market penetration		
		Cost	Turnover	Revenue	Cost	Turnover	Revenue	Cost	Turnover	Revenue
	(A)	(B)	(C)	(C-B-A)	(B)	(C)	(C-B-A)	(B)	(C)	(C-B-A)
2021	41.000	170.000	400.000	189.000	210.000	800.000	549.000	250.000	1.200.000	909.000
2022	41.615	178.500	420.000	199.885	220.500	880.000	617.885	262.500	1.380.000	1.075.885
2023	42.239	187.425	441.000	211.336	231.525	924.000	650.236	275.625	1.449.000	1.131.136

Table 1. Turnover and cost forecast (amount in K€)

Three major pricing strategies, namely cost-based pricing, competition-based pricing and value-based pricing can be distinguished. Each pricing strategy has its particular focus, which will be discussed in more detail below.

- **Cost-based pricing**: A pricing method in which a fixed sum or a percentage of the total cost is added (as income or profit) to the cost of the product to arrive at its selling price.
- **Competition-based pricing**: A pricing method in which a seller uses prices of competing products as a benchmark instead of considering their own costs or the customer demand.
- **Value-based pricing**: Pricing method based on the perceived worth of a good or service to its intended customers.

Taking into account the study carried out in Task 6.2 (Business plan), in which the revenue streams by customer segment are defined, it is suggested to go to the market with a value-based pricing strategy.

The benefits of this strategy can help consolidate the FORCOAST platform among customers, since the price set supports product image, the added value helps increase product sales, and finally, differentiation attracts new customers. In addition, this economic plan translates into benefits such as increased efficiency, satisfaction or stability on the part of the customer. This is key for the FORCOAST platform for its consolidation over time.

The consortium is, however, aware that this strategy has its drawbacks, such as the following:

- Calculations may ignore product costs.
- It might forget about existing competitors.
- It might require great selling techniques.

Therefore, it is very important to highlight that the FORCOAST services can provide added value and contribute to cost savings in each of the sectors studied in the scope of this project. In this way, the price of the different products could be adjusted annually to be closer to the cost of their production once the customer loyalty has been gained.

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When setting a final price, we must bear in mind that most of the models used to create the final products are available to everyone free of charge. On the other hand, FORCOAST facilitates access via the platform to specific data and tailor-made products. This creates a problem upon deciding a final price. The final product needs to be wanted by the customer, while a need is created in the final client. Keeping this in mind, and following the value-based pricing strategy, the price of the end product must be competitive in a market when there is an open and easily accessible flow of data.

Once further information about the market situation is obtained from the WP6 partners, a more precise picture of the pricing strategy will emerge. As a first approximation, an initial exploitation plan is presented in which each service has a monthly fixed fee and an additional assessment fee upon demand for additional information or more expert advice.

Figure 1 shows an example of the different services provided by the project. In this case, each service has a monthly fee of 100€, and a further 25€ for an optional weekly report delivered by an expert involved in that service. Depending on the number of users that as a group hire one of these services, a wholesale price may be considered with a small discount and other benefits included.

However, the fee for each of the services does not necessarily have to be the same in all cases. Some services will be more generic than others, so it is assumed that the number of customers will vary and therefore the fees for making the service profitable will be different.

SERVICE MODULES	MONTHLY FEE	ASSESMENT EXPERT (e.g. 1 report per week)
Operational Scheduler: informing on operation windows based on the ocean state.	100 €	25 €
Harmful Substances Outbreak: assessing the effect of pollutant discharge at farming sites.	100 €	25 €
Prospection for New Sites: identifying suitable new sites for bivalve aquaculture.	100 €	25 €
Assistance for Spat Captures: providing estimates of spat arrival times.	100 €	25 €
Marine Conditions at Farming Sites: informing on environmental variables at farming sites.	100 €	25 €
Retrieve Source of Contaminants: tracking down pollution sources affecting farming sites.	100 €	25 €
Suitable Fishing Area: identifying favourable areas for fishing.	100 €	25 €
Front Detection: mapping chlorophyll and temperature ocean fronts.	100 €	25 €

Prices are an EXAMPLE

Initial Proposal

DISCOUNT

User \Time	6 months	12 months *expert assesment included	24 months *expert assesment included
0 to 5 Users	5%	8%*	15%*
5 to 10 Users	10%	13%*	20%*
10+ Users	15%	18%*	25%*

Figure 1. Example of pricing strategy for the different Service Modules. The final price depends on the number of end-users

Upon analysis and still to be decided, perhaps a free trial period should be included, or a minimum amount of information should be free, following the example of several successful online meteorology platforms. The price should also be managed by the number of subscriptions and a contract agreed for a set duration, such as 12 or 24 months. In any case, neither permanence nor churn rates are contemplated when hiring the service, in order to gain customer loyalty.

This strategy will depend on the conclusions reached after a thorough analysis of the market in each activity area.

Based on the FORCOAST Deliverable D6.3 results, there appears to be a high number of clients in the overall market, yet these clients are limited and upon all not willing to pay high amounts for services as their daily working costs are already elevated, above market prices. That is why a low price has been set up for the initial plan, even bearing in mind that this pricing does not fully match the likely

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costs of the services, including expertise and validation costs. These assumptions and calculations are alarming with costs versus price versus clients yet the only viable way to enter and add value to the product and market is entering via a low-price strategy.

After the end of EU funding, sustainability will depend on the further commercial success of the service. For this purpose, the following key components will already be addressed within the period of the project:

- Dissemination activities defined in the Marketing and Communication Plan in WP7 shall be market-oriented and have a high degree of professionalism.
- Businesses plan (WP6), which will determine the project's progress. Every action or process, such as algorithmic modules or data infrastructure, is analysed in the context of the value proposition.
- There is an initial agreement among the partners to maintain their part of the service after the project's lifetime. Nevertheless, within WP6 this aspect will be further addressed in detail and fully specified in *D6.6 – Final Exploitation Strategy* as part of WP6, the front-end, back-end, licenses, IPRs and collaboration agreements are being defined.

3.6 Promotion Strategy

The promotion strategy process includes the following steps: 1) Identify and approach customers; 2) Create trust and nurture relations; 3) Pitch value proposition; 4) Tease the prospect with a demo; 5) Make the sales and after-sales. The list below gives an indication of the required activities per phase in the sales funnel.

1) Identify and approach customers

Goal: to get in touch with prospects.

Activities:

- List already present (launching) customers, and gross list, and then shortlist future customers (see D6.2)
- Approach these via existing contacts, existing projects, the professional network, and branch organisations.
- Use a personal, specific and relevant approach (call/e-mail), in which the value to the potential customer is explained, and in which the threshold for future communication is removed.

2) Create trust and nurture relations

Goal: to become a trusted and skilled contact

Activities:

- Show YouTube videos with the service module in operation
- Stay in contact with branch organisations and individual customers
- Present at relevant conferences and publish in relevant magazines
- Use regional authorities and regional industry leaders to promote the usage of the service modules

3) Pitch value proposition

Goal: to provide a clear understanding with the client about the value for him of her work(processes)

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Activities:

- Set up a presentation with future client-related applications, industry characteristics, and usage of the service module
- Email or call the shortlisted contacts and propose an online presentation via MS-Teams
- Do the presentation and listen to their comments, assumed barriers and objections.

4) Tease the prospect with a demo

Goal: to provide user experience with the client

Activities:

- Organize Live and online demo events with end-users showing all present features, and all features under development

5) Make the sales and after-sales

Activities:

- Stay in contact via direct e-mails, e-mail newsletters and telephone calls and try to close the deal
- Stay in contact and see in what way we can help them do their jobs easier and better.

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