

FORCOAST



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

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of Services and their implementation

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Executive Summary

This is the second deliverable of FORCOAST WP2. The main objective of D2.2 is to engage users in the co-design and co-creation of FORCOAST services to ensure that these services effectively support decision-making in the frame of their business activities (this guaranteeing their final uptake). In this process, WP2 will focus on the identification of user needs, requirements and concerns in terms of specific information that are required on any aspect of the marine state, to support decision-making in the frame of the business activity of three key sectors (wild fisheries, bivalve mariculture and oyster restoration).

User engagement is, at all stages of the project, the core of the co-design process. The collaboration of pilot leaders and internal FORCOAST users is key as the main providers of feedback and the gate to reach additional external users, for a complete evaluation of FORCOAST services. The early set-up of the stakeholder Advisory Board was another key milestone achieved during the first months of the project.

After the initial analysis of FORCOAST users requirements performed WP2 in Task 2.1 and presented in deliverable D2.1, the following steps of Task 2.2, presented in this deliverable, were to:

i - Transfer the users needs and requirements into design/implementation specifications (Sectorial Meetings – Nov 2020), in collaboration with WP3 and WP4

ii - Obtain early feedback on the first graphic prototypes (mockups) of the developed services (MS4, finally conducted the FORCOAST General Assembly User's Day, February 2021)

The outcomes of Task 2.2 and milestone MS4 (Early analysis of the services through end-users feedback) of WP2 are provided in this deliverable. The feedback on the service prototypes was mainly gathered through the organisation of a specific User's Day in the FORCOAST General Assembly, held in February 2021. In this event, we gathered 18 external users from the three FORCOAST sectors, which provided active feedback through an online questionnaire tool (mentimeter.com) on the mockups of the central platforms and the different services.

It is worth noting that due to the covid-19 interactions with final users, initially foreseen in the form of in-person meetings, were adapted to be held online. Although online contacts are efficient in terms of lower travel costs and time, it remains to be determined to what extent the lack of human interaction reduces the richness and diversity of results. Indeed, at that time it was challenging to engage external users to participate in online calls and to use the online mentimeter tool, which was new to most of them (even for most of us). To ensure representation of all the sectors, in some cases, it was necessary to ask intermediate users (like known R&D experts working closely with these sectors in FORCOAST partner institutions) to act as representatives of the missing final users. The drawbacks and difficulties encountered during this event are also discussed in this deliverable, and used as background for the design of future user events. Nonetheless, FORCOAST Users' Day enabled us to assess whether the first service conceptual models fitted users needs or expectations and what were the needed adjustments.

In general terms, all Services were evaluated positively, and users showed medium to high interest in all of them. For each service, the need to include additional variables or layers of information were identified by the users, including: Alarm systems, additional historical data, information on the reliability of forecast and tools, etc. According to the Users' Day feedback, users intend to use the FORCOAST Services for a variety of reasons, with an emphasis on work planning. Most of them (73%) already use similar services (i.e. services based on coastal marine observational data or modelling products more or less fitted to their activities ¹), however, in several cases those services do not work very well in the desired area. Regarding the economic aspect, it was possible to conclude by the responses of the users that they believe money will be saved by using these services but they do not expect to reach large amounts in those savings. To consider paying for these services, users need to believe that the service is useful to them in each case and geographic area.

¹ Given that the question whether voters already use any similar service ("Do you normally use marine data or derived information services for your daily activities?"») was made within the scope of the «Final Feedback» and not in the sections of questions devoted to the specific services that were presented, it is not possible to determine in which services users already use pre-existing services. The cost of these services currently used was also not questioned. Both of this information should be collected in future interactions with users.

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1. FORCOAST USERS and main interaction channels

1.1. Introduction

A better understanding of the coastal environment and an integrated monitoring and forecasting of the coastal environment by the use of data from different sources (including Earth Observation from satellites) is key to minimize the potential impacts of human activities on the coastal area. This activity can also be crucial in the development of added-value operational products that will clearly represent a new market uptake and facilitate the deployment of those sectors in Europe.

FORCOAST project aims to foster market development exploiting the added value of integration of Copernicus Products (remote, local data and model forecasts) and other data sources (local, regional or global) with Information and Communication Technologies - ICT (enhancing new frontiers opened by web and cloud computing) across different market segments through the delivery of tailored co-designed products and services encouraging their uptake by **three specific economic sectors: fisheries, oysterground restoration efforts, and bivalve mariculture.**

To guarantee the uptake of the products and services FORCOAST must ensure they are co-designed, from the beginning of the project, by the collaboration between academic and research organisations working together with SMEs which are partners in the consortium and also with a wide range of stakeholders (i.e. parties with a stake or interest on the project results), including users, scientists, decision-makers, investors, etc.) and also with shareholders (parties investing money in the development of products).

The main objective of WP2 is to engage users in the co-design and co-creation of FORCOAST services to ensure that these services effectively support decision-making in the frame of their business activities (this guaranteeing their final uptake). The specific aims are to ingest user needs requirements and feedback in the design of the system, and to analyse and translate user feedback in terms of products and service specifications to feed WP3, in the implementation of the services to feed WP4 and its demonstration and validation (WP5). As schematized in Figure 1 WP2 can be seen as the starting point of the Service Designs Process with a direct link with WP3, but it must also ensure the interaction at many levels to fit the needs of work package 4 and 5 and also Business and Communication strategies (WPs 6 and 7).

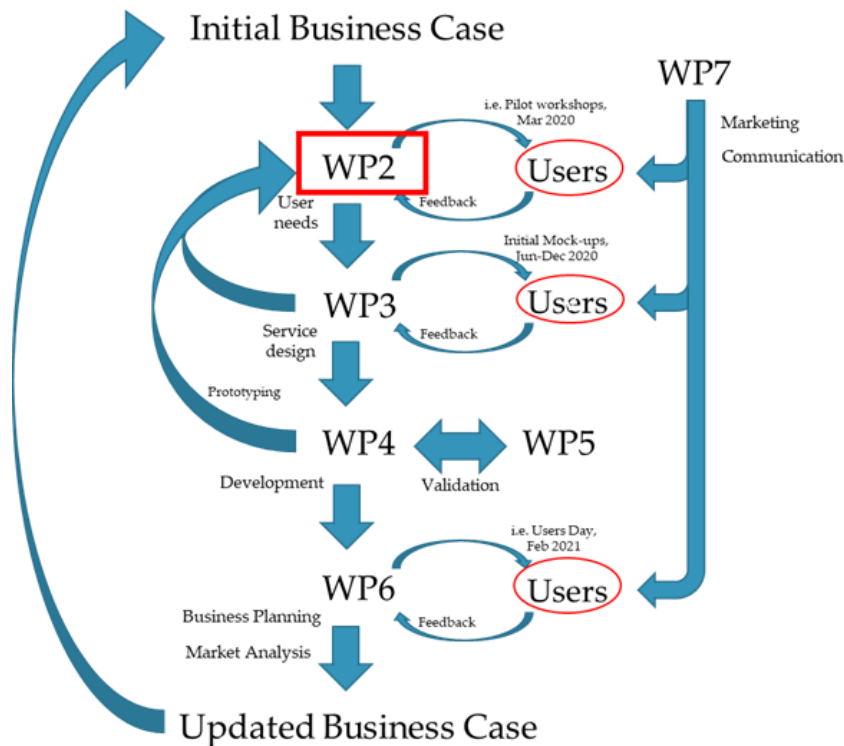


Figure 1. FORCOAST user interaction workflow, including WP2 links with other WPs

User engagement is, at all stages of the project, the core of the co-design process. The collaboration of pilot leaders and internal FORCOAST users is key as the main providers of feedback and the gate to reach additional external users, for a complete evaluation of FORCOAST services. The early set-up of the stakeholder Advisory Board was another key milestone achieved during the first months of the project.

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1.2. FORCOAST users

The first outcome of Task 2.1 of WP2, was to elaborate a cross-pilot and cross-sector analysis of the stakeholders and shareholders relevant to FORCOAST. This exercise enabled a better understanding of the user's needs in terms of information and specific requirements. The results of this analysis are summarized in FORCOAST D2.1, and only some main concepts are reminded here.

FORCOAST users are both stakeholders and shareholders, and they are divided in three groups.

- **Internal users:** users inside the FORCOAST consortium (i.e. FORCOAST partners);
- **External users:** users and stakeholders interested in the three FORCOAST target sectors (wild fisheries, bivalve mariculture, and oysterground restoration) at each pilot site (not partners in the consortium and potentially beyond the pilot at regional level);
- **Other users at wider spectrum** with activities in other marine sectors that could also benefit from the project outcomes.

We also consider jointly two levels of users: **intermediate users**, those organizations who use the data to produce tailored services/products (and are very close to their end-users, thus having a strong knowledge of their needs and requirements) and **end-users** as the ones who are the final users of the products/services for their specific activities. FORCOAST internal users are both final and intermediate and span the three main target sectors. The sector of bivalve mariculture is widely represented by the internal users (10 including both intermediate and final users) while for oyster restoration and wild fisheries the number of internal users is lower (2 and 4, respectively and including only intermediate users in the case of fisheries).

The main common drivers for tailored services were detailed and analysed through the exchanges with FORCOAST internal users and presented in D2.1. The collected information on variables and spatiotemporal resolution needs of specific technical solutions was the backbone for the conception and design of FORCOAST services (internally called FORCOAST Service Modules) in FORCOAST WP3 (as further detailed in *D3.9 Sector-specific decision workflow synthesis*) and for establishing the bases for services implementation (Figure 2) in FORCOAST WP4. As showcased in Figure 2, the core of the design process is the interaction with users, the ingestion of user needs and feedback and then the transformation of this feedback in terms of products and services specifications for the design of the services. After a first design phase, the implementation of a suited operational system is needed to make the services work, and build prototypes for demonstration and validation, and engage further feedback until we converge into an optimal configuration.

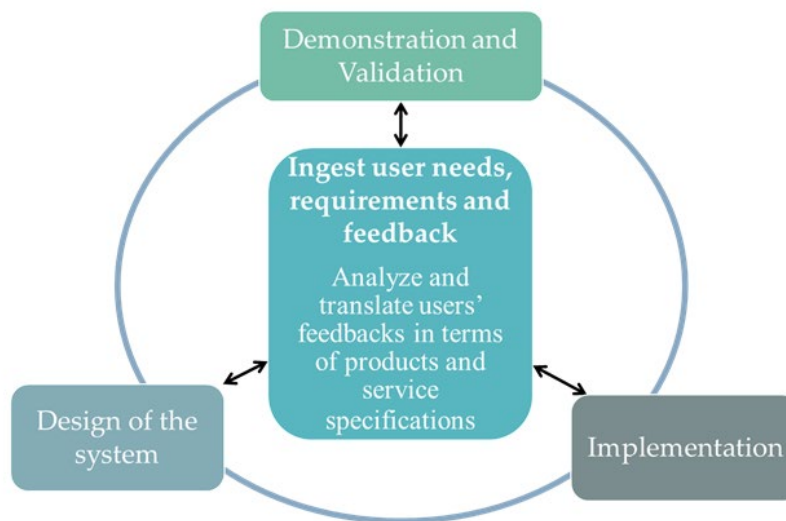


Figure 2. Central role of users in FORCOAST service co-design and co-creation

1.3. Main channels of interaction

The main steps undertaken to ensure user contribution to the design of services are described in Figure 3.

I- Elaboration of a **first list of users needs and requirements (November 2019- April 2020)**: First exchanges with users provided specific feedback on users needs and requirements, and laid down the first idea on the need for specific services for the different sectors gathered through a common central platform (D2.1 - MS 3 and 4)

II- Held a series of **sectoral meetings & exchanges with internal users (November 2020)**: **Second round of exchanges** to build the services conceptual models or mock-ups through the use of a collaborative wireframing tool: Balsamiq. (Outputs on the technical aspects and workflow for the implementation of the SMs are provided in D3.9, the contribution of users to the definition of the SMs is provided in SECTION 2.1)

III - Organization of the **FORCOAST General Assembly User's Day** (highlighted in yellow in Figure 3) with the first collection of feedback on these service conceptual models or mock-ups (Feb 2021, MS4): This exchange enabled to assess whether the first service conceptual models fit users needs or expectations, what would be the elements to change/add/improve. The feedback on the services mock-ups gathered and additional details on the format and outcomes of this event are provided in Section 2.2.

IV - The next step, once the concept is validated, is to build the prototype services to a final iteration with users towards the final operational implementation of the system (MS5: Demonstration phase completed and D2.3: End user survey results).

Finally, it is worth highlighting the Interactions with the SAB at different moments including various CCT meetings and participation in the General Assembly, where their experience in relevant FORCOAST stakeholders and advice given has been of great value in different aspects of the project.



Figure 3. Main steps in the co-design process in FORCOAST

2. SM and Platform mock-ups early co-design

2.1. Towards the building of the first prototypes at pilot-level

The building of the first prototypes at pilot level was done through two main mechanisms: the Sectorial meetings and the use of the Balsamiq tool in cooperation with internal users. The characteristics and outcomes of these two actions are summarized in Table 1.

Action (dates)	Aim - Characteristics	Main outcome
Sectorial meetings (November 2020):	To define the Service Module concepts and a first list of specific, cross-sectorial SMs. <ul style="list-style-type: none"> The list of user's needs and requirements was completed (completing the initial list in D2.2). A pool of services needed was defined. Group the services into prototype Service Modules 	Establishment of a list of SMs and their main characteristics and requirements for their implementation (as described in D3.9)
Balsamiq tool (November 2020 - present):	Graphic prototyping (wireframing) tool used to work collaboratively in the graphic design and expected interaction between the users and the Service Modules. Balsamiq allows to create and iterate on 'mockups', or graphic prototypes. By working together on these 'mockups', we intend to: <ul style="list-style-type: none"> Have a common vision between SM development teams and FORCOAST central platform implementation team. Have a method of verifying with the users the products satisfy their needs, minimizing the risk of developing products that are not of their interest 	Interact with users (internal) to refine characteristics and design

Table 1. Mechanisms used to develop the first service prototypes

FORCOAST WP3 D3.9 *Sector-specific decision workflow synthesis* describes the setup of an Operation Workflow to come to each of these specific Service Modules. As stated in D3.9 and from the perspective of an end-user, we define a **Service Module** as something to which the user can subscribe to, in order to enhance the overall production, competitiveness or sustainability of his/her business. An overview of available services should thus be accessible in a **central catalogue**, with a **summary** and **illustration** of what this service would provide. The service should also be adapted to one's specific case (activity), so an input of **personal parameters** to implement a generic service to a personal service should be provided. It is also important that the end-user knows in what way the

information needed will be delivered through the Service Module, e.g. in a map, time series or “go or no-go”.

The identified Service Modules from the Sectorial Meetings are listed in Table 1. As explained before this list was built by the interactions with internal and external users, during the sectorial meetings. Their main aim, characteristics and specific technical elements are detailed in D3.9.

Sector Aquaculture
SM-A1 – Operational scheduler
SM-A2 – Exposure to Harmful Land Discharges Service
SM-A3 – Prospection for new sites
SM-A4 – Assistance for spat captures
SM-A5 – Marine conditions at farming site
Sector Oyster ground restoration
SM-R1 – Retrieve sources of contamination
Sector Fisheries
SM-F1 – Suitable Fishing Areas
SM-F2 – Front detection

Table 2. Identified Service Modules at the sectorial meetings

All these services are presented on a central platform, which serves as a central hub from where the user can navigate to the service they are interested in, selecting the respective Service Module in their geographical area of interest.

For the FORCOAST User’s Day, SM A1 and A5 were merged and presented as a unique service called “Marine Conditions at farming site”. The main characteristics of the Platform and the Services, as they were presented to the final users in the Users’ Day are described in the following.

2.1.1 - FORCOAST Central Platform

The FORCOAST Central Platform acts as the access point to the different FORCOAST information services. The users would be able to access the Service Modules at the available sites, which can run based on their input. The Service Modules are implemented in the Central Platform, and connect to live data from the Pilots or Remote Sensing services.

Based on an initial graphic prototype (mockup), shaped by comparable web-application platforms, following easy-to-use and interpret principles, a first implementation of the platform has been achieved based on the initial conceptualisation (Figure 4). Gathering feedback showing an initial version that can be related as functional allowed us to convey more clearly the idea of the platform we wanted to depict.



Figure 4. Initial Central Platform mockup (left) and first implementation of the web-application

2.1.2 - Marine Conditions at farming site

This service provides hourly forecasts of marine environment conditions, including sea level, water temperature, salinity and currents in the service area, with detailed presentation on the targeted locations and parameter intervals.

Objectives:

- 5-7 day forecast service for monitoring
- Alerts: short term meteo-ocean alerts
- Historical conditions

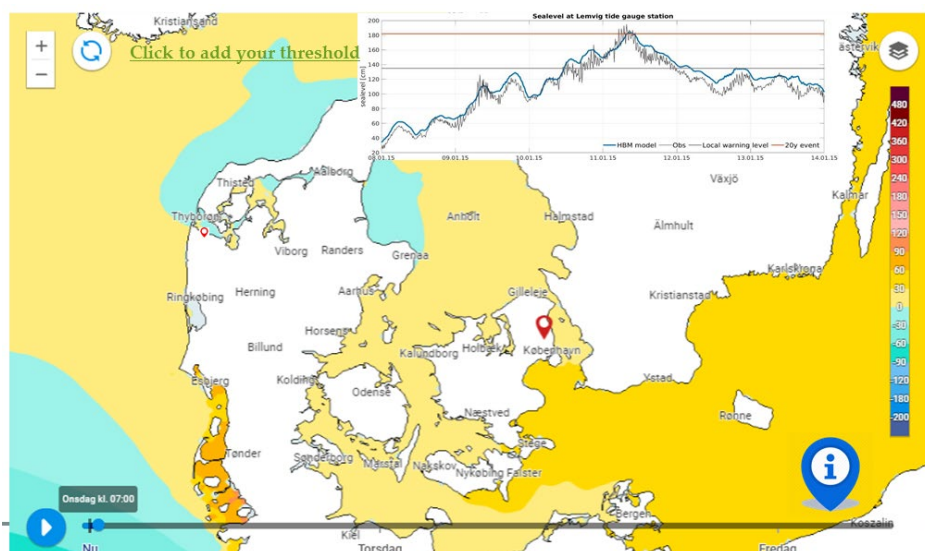


Figure 5. Example of forecasting service: 2D forecast animation and forecast time series of sea level at farming site Lemvig, Limfjorden

The proposed service functions have been discussed with Oyster Boat, with positive feedback. User-defined information, e.g., locations, criteria for warning and variables selection are important. It would be useful to present observations in the past week, if available, together with forecasts. Historical data (hindcast and statistics) are also interesting. Quality information is also important.

As SM-A1 - Operational scheduler was merged into SM-A5 – Marine conditions at farming site, Exporsado (Portuguese pilot) has also participated in the definition of the requirements of this service, through IST/MARETEC, namely regarding the variables to be measured, its admissible limits, the form of access and expectations in general.

2.1.3 - Exposure to Harmful Land Discharges

Nearshore farming infrastructures are exposed to land discharges, which in some cases carry harmful substances (eg. E. Coli, pollutants). These were the main concerns expressed by potential users of Galway Bay, who have been grappling with this problem for a long time. High-resolution circulation forecasts can be used to assess the likelihood of a farm being affected by material released from potentially harmful sources. This service aims to support quality control, by providing a measure of the probability for farming sites to be affected by harmful land discharges.

The **user interface** allows him to locate, (point-and-click) :

- sources of harmful releases (sewage stations, outgassing discharges, water treatment).
- farms (as polygons).

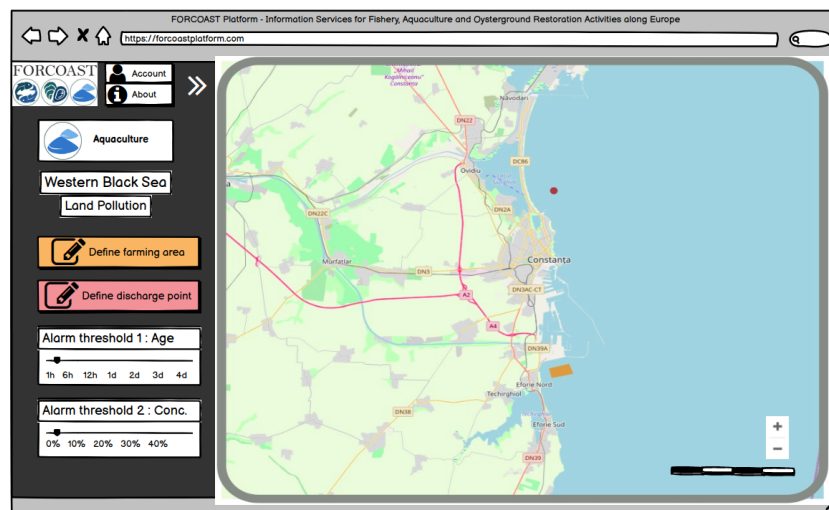


Figure 6. Mock-up of the Exposure to Harmful Land Discharges service module

The **feedback to users** is updated daily, and consists of :

- A graphical representation of the **mean age** of released material (time elapsed since release upon reaching the farm), and of the **fraction** of release reaching the farm, for the coming days. This is made available from the platform/app.

- Alarms are raised when predictions overpasses user-defined thresholds on **age** and **fraction** (indicated by red triangles). For each alarm, a more detailed representation of the flow is provided, to give an idea of retention zones.

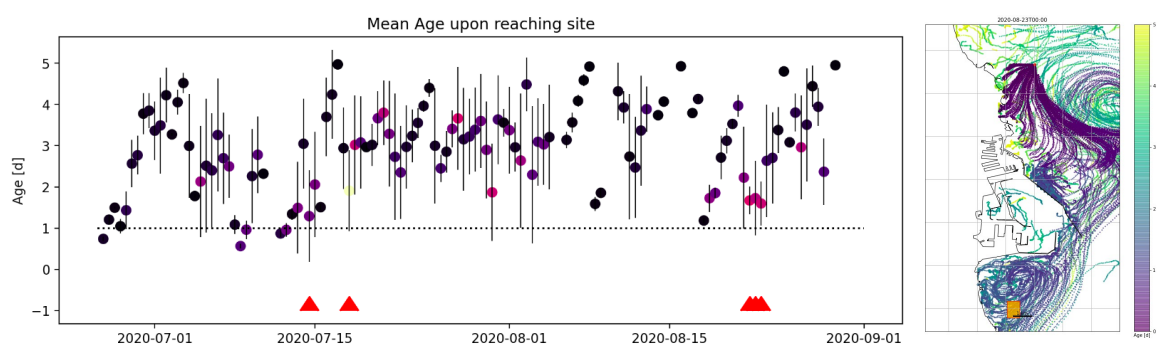


Figure 7. Detail on feedback provided to users in the Exposure to Harmful Land Discharges service module

This service was designed from reports of users having to close their farms after contamination issues. Alarms may raise attention and be used to trigger intensified testing on-site. In most cases, contamination may be mitigated, while no particular action can be taken to avoid it even if notified a few days in advance. The danger to avoid at all cost is to harvest without noticing contamination and to bring contaminated harvest to the market. The basic version of the service module did not prescribe any specific nature or proper dynamics to the released material, which was treated as a passive tracer. Only age, and fraction of release was considered at this stage. However, it was an objective of the GA to question users on their capacity to characterize harmful releases in their area (eg. nature, flows).

2.1.4- Prospection of New Sites

The purpose of the service module is to identify areas with the highest growth potential for flat oysters and thereby increase harvest potential. The users tend to face challenges with high spat mortality and variable year-to-year growth depending on environmental conditions.

The service module will show maps of monthly means (+/- standard deviations) of selected environmental variables important for oyster growth (temperature, phytoplankton (chl a) concentration, detritus, hypoxia) as these were the variables identified by potential users as being the most suitable to show potential oyster growth at selected sites. This information can be used in the planning of new sites for aquaculture.

A3 Prospection for new sites

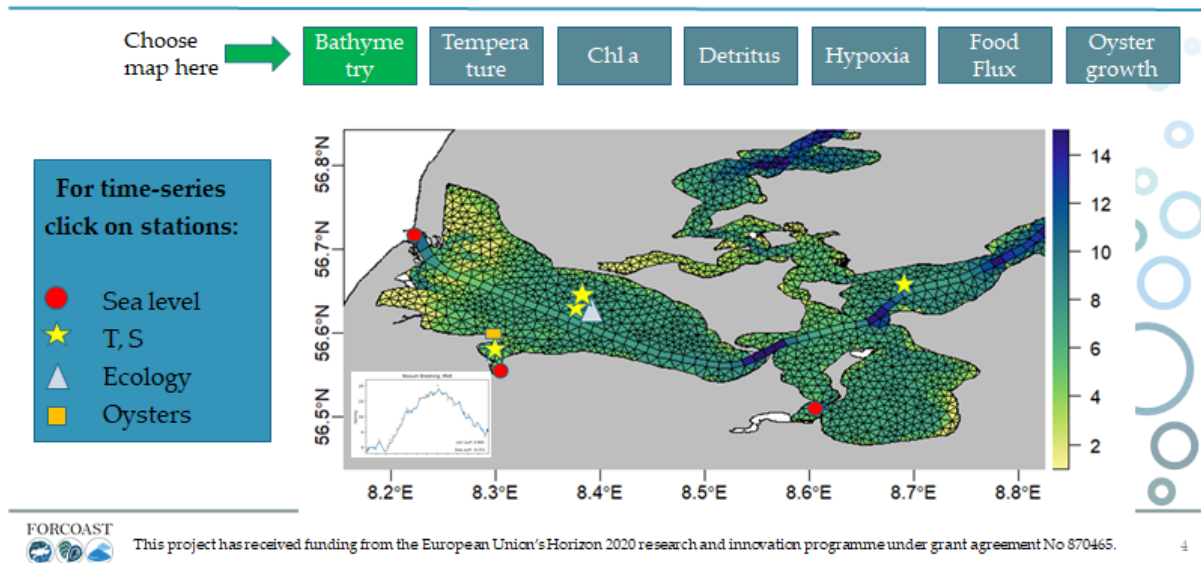


Figure 8. Mock-up of the Prospection of New Sites service module

Following user's requirements and feedback during the sectorials meetings, the service design and the needed information were defined. The services was set in a way that allows the user choose to 1) see maps of monthly mean values and variability of selected environmental variables by clicking on the top boxes or 2) see the time-series of model validation against data from the monitoring program (sea level, temperature, salinity, chl a, nutrients, oxygen, oyster growth) by clicking on the items in the blue box to the left.

2.1.5 - Assistance for Spat Captures

The majority of marine bivalves reproduce by releasing large amounts of gametes into the water column where the 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 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).

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 in phytoplankton, the shorter the larval development period. 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,). The importance of these conditions was also mentioned by potential users of this service.

Especially for spat of the European flat oyster (*Ostrea edulis*) the condition of the substrate is important, as spat of this species will not settle on 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 substrates. 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 it is possible that the farming site is 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).

The Service Module Assistance for spat capture will give as output to the end-user:

- An alarm system in the source location(s) is needed to determine likely spawning events: In the aim to determine by advance this event, this alarm is preferentially based on forecast if the information is available. This forecast can be provided by hydrodynamic model (temperature, wave) and/or biogeochemical model (chlorophyll). Satellite information can also be used for chlorophyll data. A colour code system will allow to quickly know if the potential period of spat capture already started (green), is imminent (orange) and spat collectors need to be prepared, or not (red)
- Forecast of the time window with the highest probability of spat settlement at a specific location (farm or oyster reef). The output will provide the potential starting and ending of the spat arrival from each of the source locations. In addition to the arrival period from each source location, the whole period of potential arrival is also estimated by combining all source locations. The output is a table summarizing the likely arrival period for the target species selected and the source location(s) associated with the arrival. The end-users will receive weekly a table summarizing the likely period to collect the selected species at a specific location according to a format defined with the users in advance (ex. Personal access to a Web page, email).

During 2020 spat collectors were deployed every two weeks (if possible) during the period oyster spat settlement was expected. At the end of September 2020 the spat collectors were analysed for oyster spat. The first inspection shows that the oyster reproduction takes place when the water hits the 18°C.

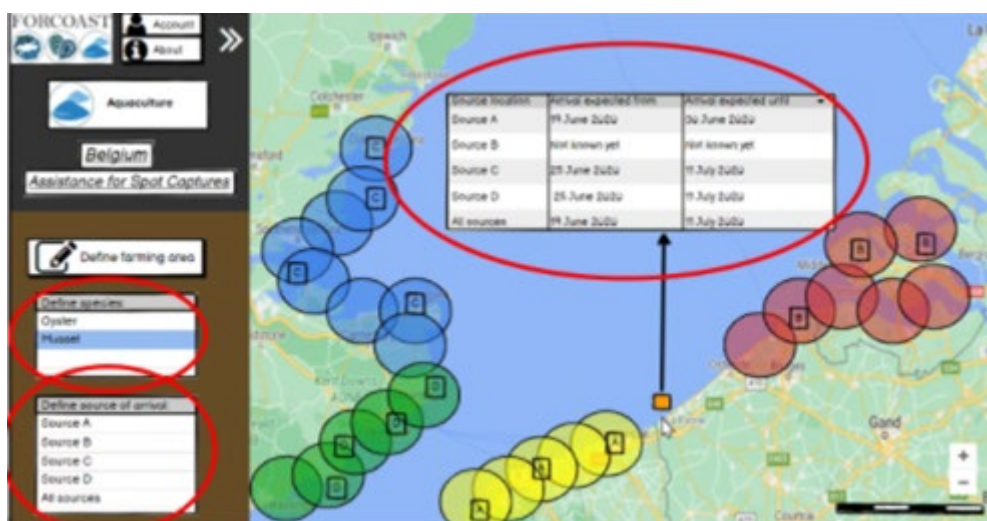


Figure 9. Mockup of the Assistance for spat capture Service Module

The end-users must provide the location and the species of interest (blue mussel or European flat oyster) in addition to other information which is site/species specific and can help to implement the Service Module. Feedback from the end-users to the service developer on spat collection during the service utilization will help to calibrate/validate locally the services.

2.1.6 - Retrieve Source of Contaminants

Water pollution poses a serious threat to the health of aquaculture species and human consumers. Often, farmers suffer from huge economic losses after a water pollution event has occurred. When the origin of the pollution is unknown, farmers are often interested in determining the source of contamination. It is possible to provide stakeholders with an estimation of the source of contaminants by combining hydrodynamic modelling with backward particle-tracking modelling. Getting to know the source of contamination was one of the main wishes expressed by the producers during the pre-mock-up phase of the project.

By accessing this service module, end-users will be provided with information about the origin of contaminants affecting their farms. This information may be displayed either as the actual paths followed by the pollutants or as the time-varying density distribution map, highlighting the areas with a higher probability to be the source of contamination.

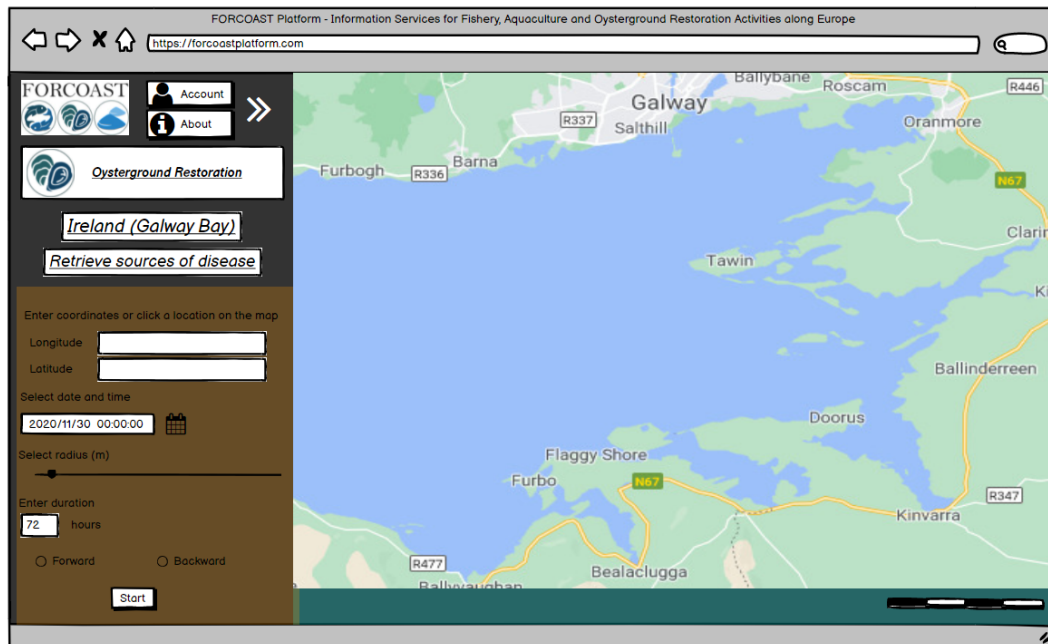


Figure 10. Mock-up proposed for the Retrieving Source of Contaminants service module

According to the first prototype (Figure 10), the end-users will be able to interact with the application in different ways, for instance by selecting the location of their farm on a map and the date and time when the contamination was detected.

2.1.7 - Suitable Fishing Areas

The service is developed as a decision support tool for the fisheries engaged stakeholders in the north-western Black Sea. It will provide access to valuable information, such as upwelling events and areas favorability for some species, in order to help fishermen to maximize the economic efficiency of their activities. The service directly addresses multiple categories of stakeholders, from individual fishermen, to mid-size and industrial fishing companies in Bulgaria and Romania.

The main objective of this service module is to offer stakeholders valuable information to identify the most favourable conditions for fishing. It is worth to highlight that this information will also indirectly contribute to the sustainability of the fishing activity by lowering environmental costs and exploitation costs through a reduced carbon footprint and/or ensuring less mix of species in the fishing area or presence of adequate sizes, lowering or preventing by-catches. In this sense, both services 2.1.7 and 2.1.8 (Front detection) will contribute towards achieving the EU's ambition of sustainable fishing.

In order to achieve it, the following information will be provided:

- Fishing Suitability Index – optimal conditions for specific species
- Upwelling information – upwelling events are known to generate the most fertile marine ecosystems.
- Information on waves coming from nested wave model for the Northern Black Sea

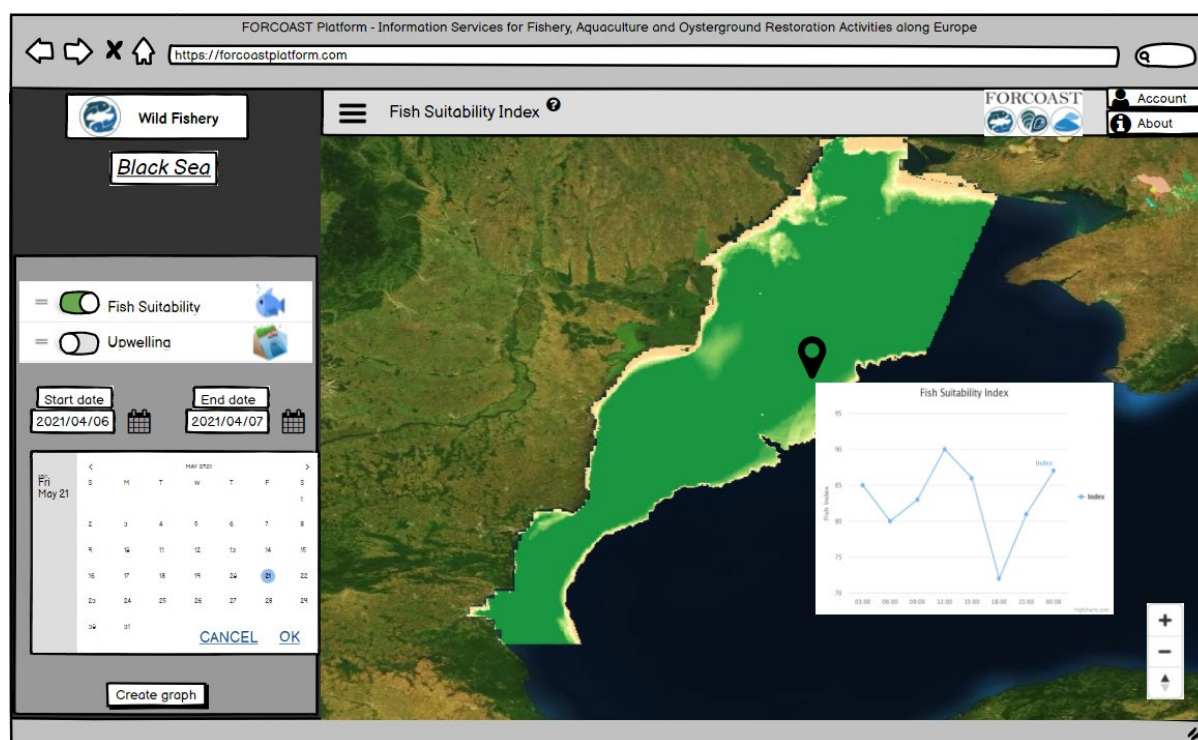


Figure 11. Proposed mock-up for Suitable Fishing Areas service module

The web interface, developed in accordance with user requirements (Figure 11) will allow them to:

- Interact with service module products in an elegant and efficient manner.
- Included tools and functionalities, such as 'calendar', 'measure tool', 'profile tool' and 'get info tool', will ease the interaction with the products.

2.1.8 - Front detection

Ocean fronts are narrow areas in the sea surface where a sharp gradient between two water masses with different hydrodynamic properties occur. Across frontal areas, there is a strong gradient in a short horizontal distance in the physical and biochemical properties of the sea water. There are different types of fronts depending on their location, persistence, and size. Frontal areas play an important role in the ecosystems and in different human activities, such as fisheries since there is usually a higher concentration of commercial fisheries along fronts. In this Service Module, we will focus on the following fronts: shelf, shelf-break, coastal-upwelling and estuarine fronts; as well as, on frontal areas in the deep ocean. Ocean fronts information together with other ocean information is useful in fisheries to search for suitable habitat for small pelagic and avoid other species. This information would reduce the costs associated with days at sea (person-work, fuel, fungible...); thus, optimizing the operations in the sea cost.

In short, the Fronts Detection service module is addressed to the fisheries sector by providing them with another source of information about the ocean conditions in order to reduce the time at sea and the distance travelled. With the final purpose of contributing to a more efficient activity.

In Pilot 2, supported by a hydrodynamic model (not BGC) only sea surface temperature fronts will be provided, but in Figure 12 we show a mockup of the appearance of this service module, both for phytoplankton (green lines) and sea surface temperature (red lines) fronts.

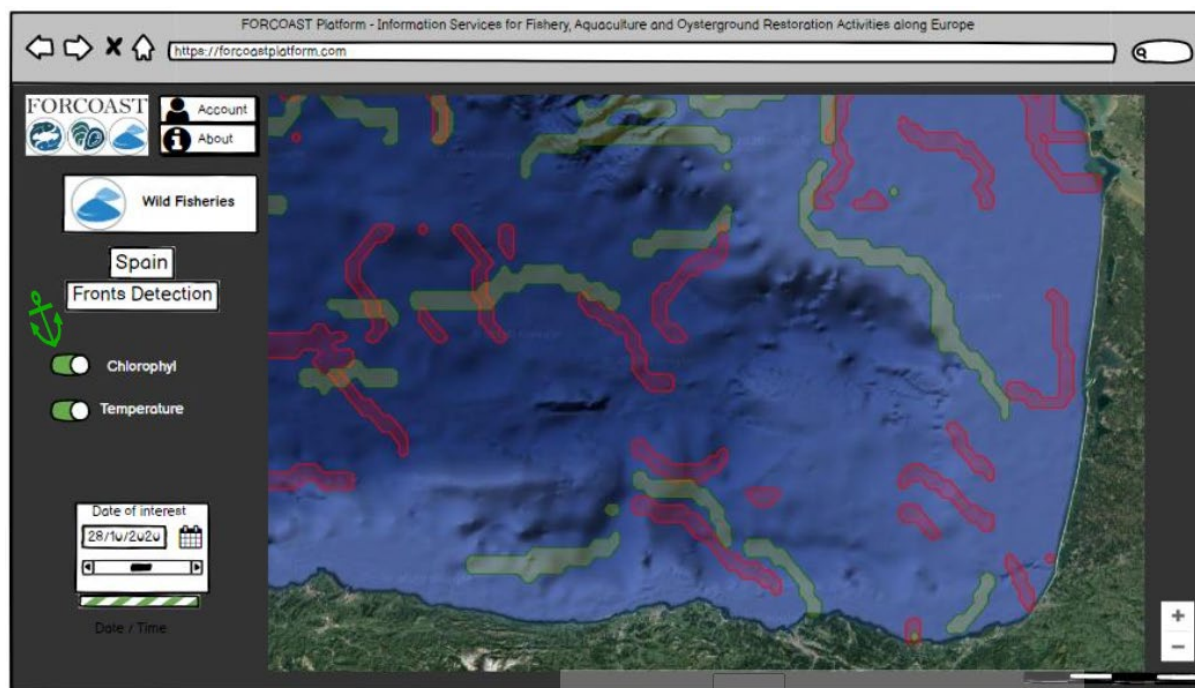


Figure 12. Mock-up proposed for the Front detection service module

This first prototype was proposed based on the knowledge of the intermediate users (e.g. Marine Instruments and AZTI) of the wild fisheries sector. This information is valued by the end-users as transferred in different meetings with the skippers.

2.2. First evaluation of the proposed SMs and Platform prototypes by FORCOAST users

Due to the covid-19 interactions with final users, initially foreseen in the form of in-person meetings, were adapted to be successfully held online during a specific event in the FORCOAST GA, February 2021. This event was organized in the form of a User's Day workshop where the mock-ups of the Central Platform and the different Service Modules were presented to the Users one by one. After each presentation and a round of Q&A, the online tool mentimeter.com was used. This allowed us to interact with the users and gather their feedback on a list of predefined questions. The questions were prepared beforehand in collaboration with SMs leads, WP3, 4 5 and 6 leads. Four different types of questions were prepared:

1- Questions about the audience, provenance (country, sector), expertise, role of the Users attending the workshop → to be able to analyse the feedback This allowed us to segment the responses by

geographic origin and sector of activity, as presented in sections 2.2.1 to 2.2.9. However, some difficulties were encountered in achieving these objectives. The question that was asked in the metimeter and that could indicate the country and sector of origin of the voter allowed open type answers, as opposed to have pre-defined choices: «About yourself: marine sector you work in, your profile/role, which activities you perform and where, etc.». This open format did not prove to be efficient for the voter's characterization because the voters' answers did not always include the sector of activity and/or the country. It was necessary to cross another type of information contained in other metimeter answers to determine these elements, from which the provision of voters' email addresses stands out. In future metimeters, the identification of the voter's country and sector of activity will be obtained through direct questions with pre-defined choices to answer.

2- General questions on the platform and services: Common to every SM these questions (level of interest in the service and if there is any missing functionality of the service for them) helped to measure the interest and the needs from the improvement of every service.

3- Specific questions to ask the potential users about each Specific Service that will help its development approach from a more technical point of view. These may be, for example, about the way of having the information/results displayed, if they could provide a certain input.

4- Final questions on the Provision of Service and questions related to the business case.

The questions, as they were presented are detailed here:

1- FORCOAST General Assembly

1.1- Distribution of voters by response intervals.

2- About Yourself

2.1 Marine sector you work in, your profile/role, which activities you perform and where, etc.
– Total Voters per Country.

2.2 Marine sector you work in, your profile/role, which activities you perform and where, etc.
– Total Voters per Sector.

3- FORCOAST Central Platform

3.1- Would it be beneficial to you to combine the different FORCOAST services in one central platform?

3.2- At first glance, would interacting with an interface like this pose a challenge for you?

3.3- In which way(s) would you access a platform like this one?

4- Marine Conditions Service

4.1- Is the service presented and what it can offer clear for you? If not, please write those aspects that need further explanation.

4.2- From 1 to 10, how much is your level of interest in the presented service?

4.3- What change or additional functionality (if any) would significantly increase your interest in this service?

4.4- Which marine variables would be the most interesting ones for you?

5- Exposure to Harmful Land Discharges Service

5.1- Is the service presented and what it can offer clear for you? If not, please write those aspects that need further explanation.

5.2- From 1 to 10, how much is your level of interest in the presented service?

5.3- What change or additional functionality (if any) would significantly increase your interest in this service?

5.4- How difficult would it be for you to define the following characteristics of potentially harmful discharge sources?

5.4.1- Location of the source.

5.4.2- Variations in the discharge.

5.4.3- Nature of the released material.

6- Prospection for New Sites Service

6.1- Is the service presented and what it can offer clear for you? If not, please write those aspects that need further explanation.

6.2- From 1 to 10, how much is your level of interest in the presented service?

6.3- What change or additional functionality (if any) would significantly increase your interest in this service?

6.4- For oyster growth evaluation and prospection of new sites, which information is most important for you?

7- Assistance for Spat Captures Service

7.1- Is the service presented and what it can offer clear for you? If not, please write those aspects that need further explanation

7.2- From 1 to 10, how much is your level of interest in the presented service?

7.3- What change or additional functionality (if any) would significantly increase your interest in this service?

7.4- How accurately would you be able to provide the natural area location the larvae come from to your area?

8- Retrieve Source of Contaminants Service

8.1- Is the service presented and what it can offer clear for you? If not, please write those aspects that need further explanation

8.2- From 1 to 10, how much is your level of interest in the presented service?

8.3- What change or additional functionality (if any) would significantly increase your interest in this service?

8.4- Would you prefer having the information displayed on a map, or as a time-series plot of pollutants entering a farm?

9- Suitable Fishing Areas Service

9.1- Is the service presented and what it can offer clear for you? If not, please write those aspects that need further explanation

9.2- From 1 to 10, how much is your level of interest in the presented service?

9.3- What change or additional functionality (if any) would significantly increase your interest in this service?

9.4- Which type of information would you find more valuable as a result of this service in your case?

10- Front Detection Service

10.1- Is the service presented and what it can offer clear for you? If not, please write those aspects that need further explanation

10.2- From 1 to 10, how much is your level of interest in the presented service?

10.3- What change or additional functionality (if any) would significantly increase your interest in this service?

10.4- Are you familiar with ocean fronts? In this case, do you find this information important?

10.5- At sea, do you have access to internet connection to access online information?

11- Final Feedback

11.1- For which purpose(s) do you think the presented FORCOAST information services could be useful in your particular case?

11.2- Do you normally use marine data or derived information services for your daily activities?

11.3- If you answered 'yes' in the previous question, which ones and for what purpose? If you answered 'no', why not?

11.4- By using information services such as the ones presented, how much revenue could you gain? (per year)

11.5- Would you make use of the FORCOAST platform and service products presented?

11.6- Would you like to follow the progress of the FORCOAST services along their development and be contacted for future events?

The various pilots that form FORCOAST addressed invitations to different stakeholders from each of its regions of influence, as well as the project coordination invited transnational entities to participate in the user's day, as was the case with EATIP - European Technology platform on aquaculture. The invitations tried to cover all sectors of activity of interest to the project, namely:

- Maritime safety
- Water pollution management
- Offshore energy
- Tourism & recreational activities
- Coastal protection management
- Ports & shipping
- Sustainable Marine living Resources
- Weather & climate
- Basic and applied research in coastal oceanography
- Legislative entities

Not all invitations resulted in attendance, and not all attendance resulted in voters in mentimeter. As an example we present the case of the Portuguese pilot, who addressed 10 invitations and managed 6 or 7 participations, resulting in 4 voters:

Name	Institution			Status	
	Acronym	Name	Type	Invited	Attended
Fátima Évora	APSS	Administração dos Portos de Setúbal e Sesimbra	Maritime safety / Ports & shipping	Yes	Don't know
Cristina Falcão	ICNF	Instituto da Conservação da Natureza e da Floresta	Water pollution management / Sustainable Marine living Resources	Yes	Yes
Rodrigo Mateus	CMS	Câmara Municipal de Setúbal	Legislative entities / Tourism & recreational activities	Yes	Yes
Ricardo Salgado	EST/IPS	Escola Superior de Tecnologia / Instituto Politécnico de Setúbal	Basic and applied research in coastal oceanography	Yes	Yes
Célia Rodrigues		NEPTUNPEARL	Final User	Yes	Yes
António Correia + other		AQUANOSTRA	Final User	Yes	Yes
Pedro Ferreira		EXPORSADO	Final User	Yes	Yes
Amparo Gonçalves	IPMA	Instituto Português do Mar e da Atmosfera	Weather & climate / Basic and applied research in coastal oceanography	Yes	No
	CPS/AMN	Capitania do Porto de Setúbal / Autoridade Marítima Nacional	Maritime safety / Water pollution management	Yes	No
Cristina Borges	DGRM	Direcção-Geral de Recursos Naturais, Segurança e Serviços Marítimos	Maritime safety / Water pollution management	Yes	No

Table 3. Portuguese Pilot invitation list

We estimate that the number of participants in the Mentimeter was 22 persons, however the maximum unique voters per question was 15 persons. The exact number of unique participants and unique voters per question is not possible to determine because the breaks in the call and the voters re-entry in the session generate a new entry, thus doubling the participation.

Regarding the segmentation of the participants in the Mentimeter (or voters), it was possible to understand that their distribution by country and sector of activity was as follows:

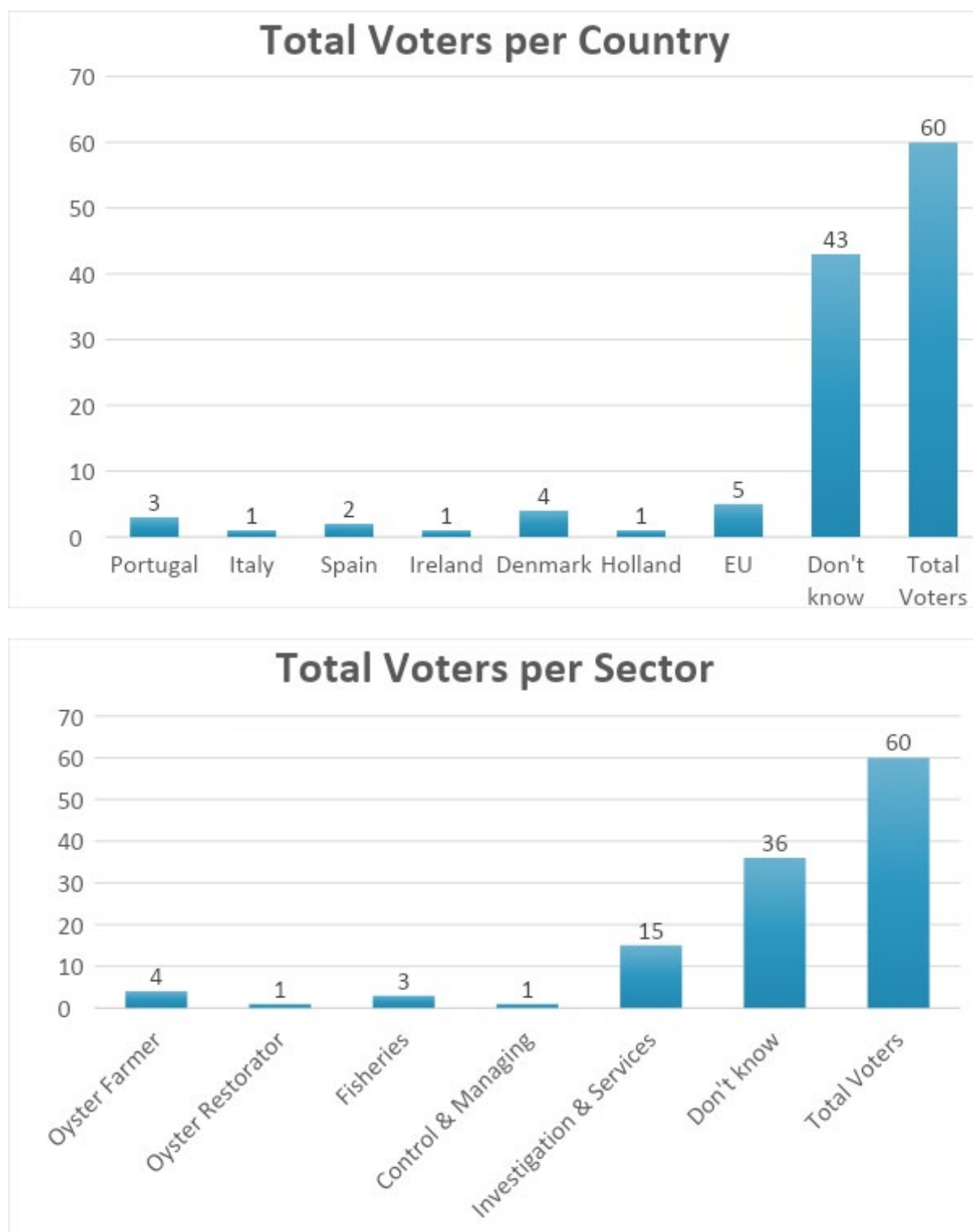


Figure 13. Voters distribution per country and sector

Overall, 15 users were providing active feedback through mentimeter. Every target sector was represented, with the fishery sector accounting for the least amount of participants, due to the proportion of fishery-oriented Pilots in the project. A brief summary is found below:

AQUACULTURE

- 2 people EATiP - European Technology platform on aquaculture
- UCN , NGO representative, Aquaculture and marine conservation program, links with research and local stakeholders, worldwide
- researchers on Aquaculture
- President of italian shellfish farmer association

OYSTER/RESTORATION

- Oyster farmers & 1 oyster Aquaculture Manager
- native oyster restoration officer

FISHERES

- 3 Intermediate users (researchers & service developers with strong link with fisheries sector)

OTHER

- DMI, service provider
- Ocean Data provider, Service development, Fisheries, marine environment
- researchers (Earth Observation, physics and clima, products and services, modelling)

We have to point out that getting the field workers to physically participate by attending the session is challenging and getting them to participate materially by voting for the mentimeter is even more difficult. For that reason, some intermediate users (in some case, from partner institutions) were asked to act as representatives or proxies of the sector's final users and vote consequently to the mentimeter questions. Intermediate users are also part of the target audience of the FORCOAST services as they have the potential as well to subscribe to the service offer.

In the last mentimeter which will be carried out later in the project, voters will be identified and characterised not only according to their geographical and sectoral origin, but also in terms of their status as a partner in the project or a dependent relationship with a partner, in order to prevent any conflicts of interest.

The analysis of the results from the questionnaire are presented below.

2.2.1 - FORCOAST Central Platform

All voters find it useful to centralize services on a single platform and in general they have no difficulty with this type of interface. 60% of voters prefer to access the platform through mobile devices, while 40% prefer to access it through PC or tablet. The way in which the « Access to Platform» question was posed in the mentimeter allowed multiple answers and did not consider which of the answers would be more preferred by each voter:

«In which way(s) would you access a platform like this one?

1. PC, via browser
2. Tablet, via browser
3. Phone, via browser
4. Phone application
5. Other»

So, for example, each voter who chose “PC, via browser” could also have chosen any of the other options. A more detailed analysis of the responses leads to the conclusion that there were only 15 unique voters for a total of 31 selected options.

That is, voters chose on average 2 response options each.

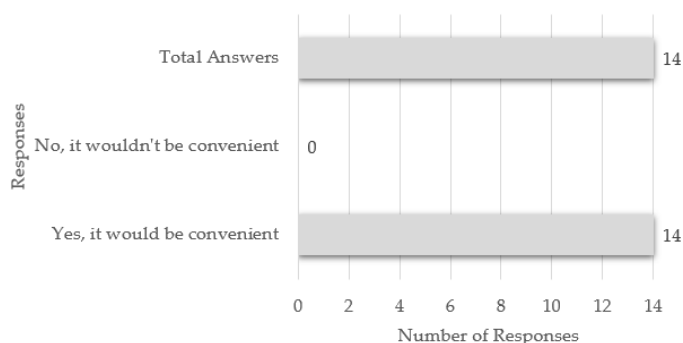
9 out of 15 voters chose one of the access options via mobile phone and only 6 out of 15 voters chose an access option that excludes the mobile phone.

Thus, 60% of voters prefer using mobile phone to access the FORCOAST services via the platform.

The difficulty in getting present field workers in the mentimeter session is real and it is even more difficult to get them to effectively participate in the mentimeter by voting - digital literacy is usually not the highest and one must not forget that the online questionnaires sessions were not so common in February 2021, the date on which the User's Day mentimeter was held.

However, the low participation of field workers does not seem to have changed the expected result of greater adherence to mobile phone access.

3.1 - Would it be beneficial to you to combine the different FORCOAST services in one central platform?



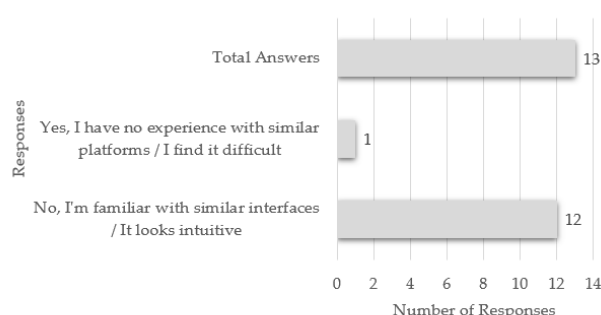
COMMENTS:

- All voters find it useful to centralize services on a single platform.

SEGMENTATION BY COUNTRY	Yes, it would be convenient	No, it wouldn't be convenient
Portugal	2	
Italy	1	
Spain	1	
Ireland	1	
Denmark	1	
Holland		
EU	3	
Don't Know	5	
	14	14

SEGMENTATION BY ACTIVITY	Yes, it would be convenient	No, it wouldn't be convenient
Oyster Farmer	2	
Oyster Restorator	1	
Fisheries	1	
Control & Managing		
Investigation & Services	8	
Don't Know	2	
	14	14

3.2 - At first glance, would interacting with an interface like this pose a challenge for you?



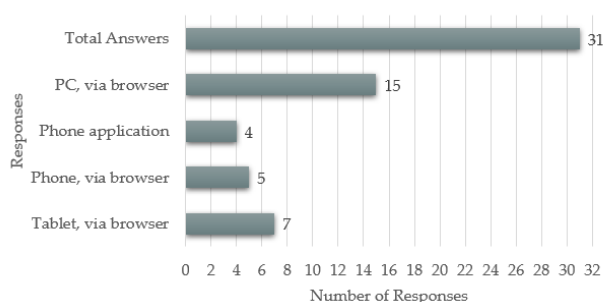
COMMENTS:

- Almost every voters say they have no difficulty with this type of interface.

SEGMENTATION BY COUNTRY	No, I'm familiar with similar interfaces / It looks intuitive	Yes, I have no experience with similar platforms / I find it difficult
Portugal	2	1
Italy	1	1
Spain	1	1
Ireland	1	1
Denmark	1	1
Holland	1	1
EU	2	1
Don't Know	4	1
	12	1

SEGMENTATION BY ACTIVITY	No, I'm familiar with similar interfaces / It looks intuitive	Yes, I have no experience with similar platforms / I find it difficult
Oyster Farmer	2	1
Oyster Restorator	1	1
Fisheries	1	1
Control & Managing	1	1
Investigation & Services	6	1
Don't Know	2	1
	12	1

3.3 - In which way(s) would you access a platform like this one?



COMMENTS:

- Only 15 out of 31 answers correspond to unique voters. 9 out of 15 voters chose one of the access options via mobile phone, thus 60% prefer mobile access to platform.
- The amount of «Total Answers» is affected by the multiple choices option in this question.

SEGMENTATION BY COUNTRY	Tablet, via browser	Phone, via browser	Phone application	PC, via browser
Portugal	1	1	1	2
Italy	1		1	1
Spain				2
Ireland		1		1
Denmark	1			2
Holland				1
EU	2	1	1	3
Don't Know	2	2	1	4
	7	5	4	15

SEGMENTATION BY ACTIVITY	Tablet, via browser	Phone, via browser	Phone application	PC, via browser
Oyster Farmer	2	1	1	3
Oyster Restorator		1		1
Fisheries				2
Control & Managing				1
Investigation & Services	4	2	3	7
Don't Know	1	1	1	2
	7	5	4	15

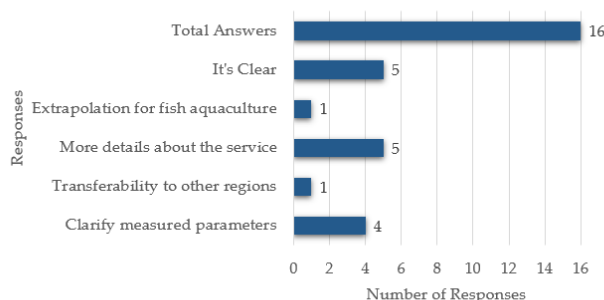
Figure 14. FORCOAST Central Platform survey results

2.2.2 - Marine Conditions at farming site

In the Marine conditions service, more than 50% of voters feel they need more information, and the average level of interest of them is 7,5 on a scale of 1 to 10.

Voters want to know more about the measured parameters and whether any input from users will be needed to obtain them. In this service, alerts would be valued, although there is a large dispersion of interests among voters. If the service has a parameter menu that allows the user to choose it would also be important.

4.1 - Is the service presented and what it can offer clear for you? If not, please write those aspects that need further explanation



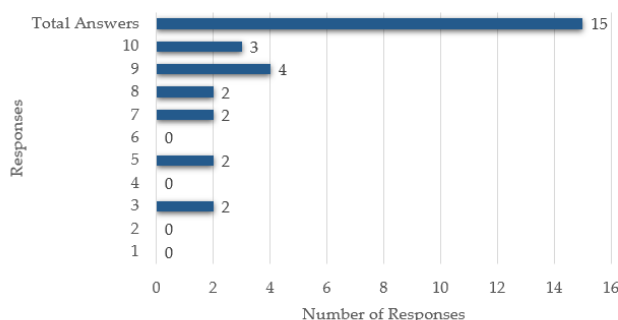
COMMENTS:

- This service needs clarification, more than 50% of voters feel they need more information

SEGMENTATION BY COUNTRY	Clarify measured parameters	Transferability to other regions	More details about the service	Extrapolation for fish aquaculture	It's Clear
Portugal			1		1
Italy					1
Spain			1		1
Ireland	1				
Denmark	1		1		
Holland					
EU	2		1	1	
Don't Know		1	1		2
	4	1	5	1	5

SEGMENTATION BY ACTIVITY	Clarify measured parameters	Transferability to other regions	More details about the service	Extrapolation for fish aquaculture	It's Clear
Oyster Farmer	1		1		1
Oyster Restorator	1				
Fisheries			1		1
Control & Managing					
Investigation & Services	2	1	2	1	2
Don't Know			1		1
	4	1	5	1	5

4.2 - From 1 to 10, how much is your level of interest in the presented service?



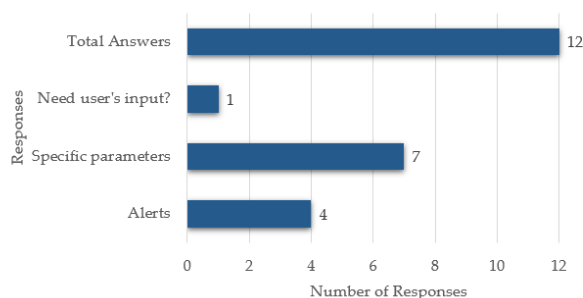
COMMENTS:

- Average level of interest: 7,5.

SEGMENTATION BY COUNTRY	1	2	3	4	5	6	7	8	9	10
Portugal							1			1
Italy									1	
Spain			1		1					
Ireland					1					
Denmark								1		1
Holland										
EU							1	1	1	
Don't Know			1						2	1
			2		2		2	2	4	3

SEGMENTATION BY ACTIVITY	1	2	3	4	5	6	7	8	9	10
Oyster Farmer							1			2
Oyster Restorator					1					
Fisheries			1		1					
Control & Managing										
Investigation & Services							1	2	4	
Don't Know			1						1	
			2		2		2	2	4	3

4.3 - What change or additional functionality (if any) would significantly increase your interest in this service?



COMMENTS:

- Voters want to know more about the measured parameters and whether any input from users will be needed to obtain them;
- Alerts are valued by voters.

SEGMENTATION BY COUNTRY	Alerts	Specific parameters	Need user's input?
Portugal	1	1	
Italy	1		
Spain		1	
Ireland			1
Denmark		2	
Holland			
EU		3	
Don't Know	2		
	4	7	1

SEGMENTATION BY ACTIVITY	Alerts	Specific parameters	Need user's input?
Oyster Farmer	1	2	
Oyster Restorator			1
Fisheries		1	
Control & Managing			
Investigation & Services	2	4	
Don't Know	1		
	4	7	1

4.4 - Which marine variables would be the most interesting ones for you?

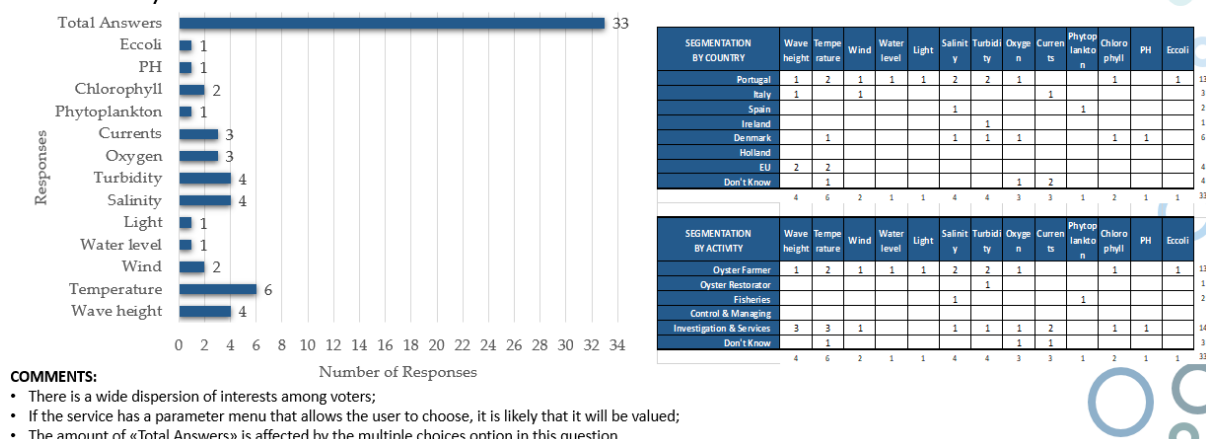


Figure 15. Marine Conditions at Farming Site service survey results

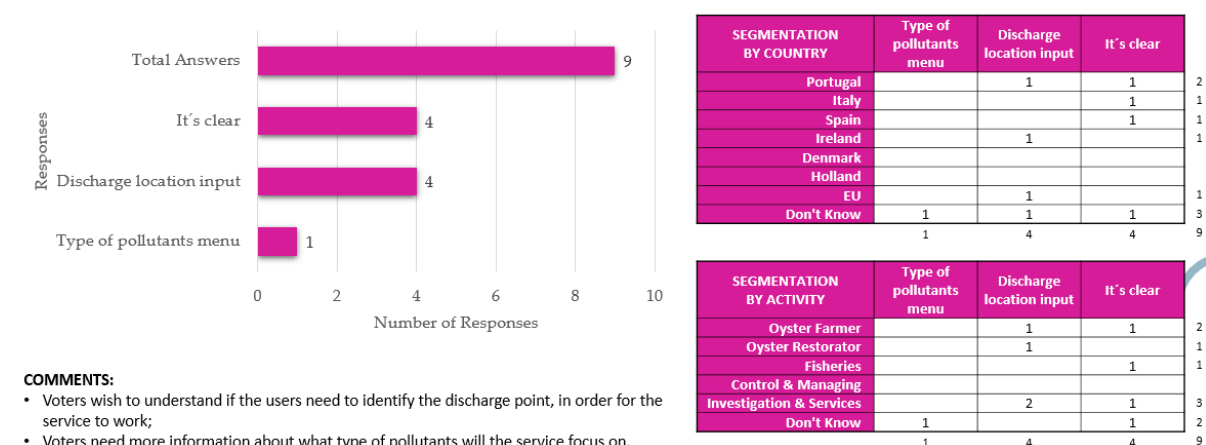
2.2.3 - Exposure to Harmful Land Discharges

Voters from Exposure to Harmful Land Discharges Service need more information about the way to identify the discharge point, in order for the service to work, and about what type of pollutants the service will focus on.

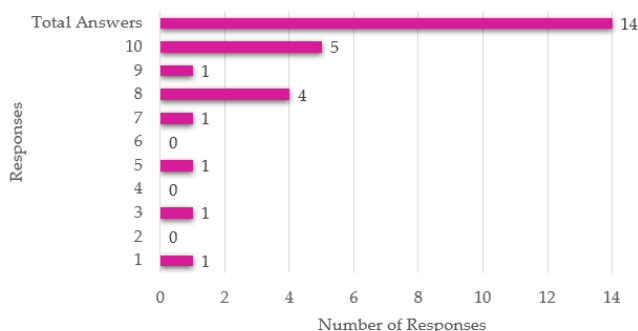
The average level of interest of voters is 7,6 on a scale of 1 to 10. The characterization of pollutants and the mapping of discharges seem to be important for voters.

On a scale of 1 to 10 the average difficulty for the voters to define a location of the source is 4,7; 6,0 to define variations in the discharge; and 7,0 to define the nature of the released material.

5.1 - Is the service presented and what it can offer clear for you? If not, please write those aspects that need further explanation.



5.2 - From 1 to 10, how much is your level of interest in the presented service?



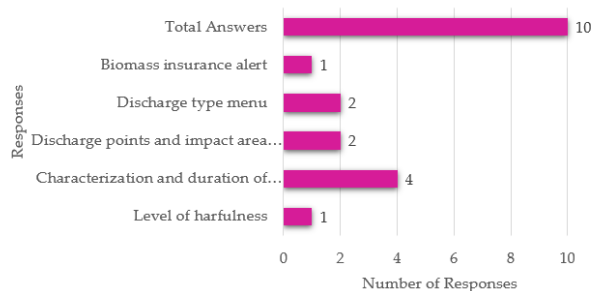
COMMENTS:

- Average level of interest: 7,6.

SEGMENTATION BY COUNTRY	1	2	3	4	5	6	7	8	9	10	
Portugal									1	2	3
Italy										1	1
Spain	1		1								2
Ireland								1			1
Denmark					1						1
Holland											
EU							1	2			3
Don't Know								1	1	2	3
	1		1		1		1	4	1	5	14

SEGMENTATION BY ACTIVITY	1	2	3	4	5	6	7	8	9	10	
Oyster Farmer									1	2	3
Oyster Restorator								1			1
Fisheries	1		1								2
Control & Managing											
Investigation & Services					1		1	2		1	5
Don't Know								1	1	2	3
	1		1		1		1	4	1	5	14

5.3 - What change or additional functionality (if any) would significantly increase your interest in this service?



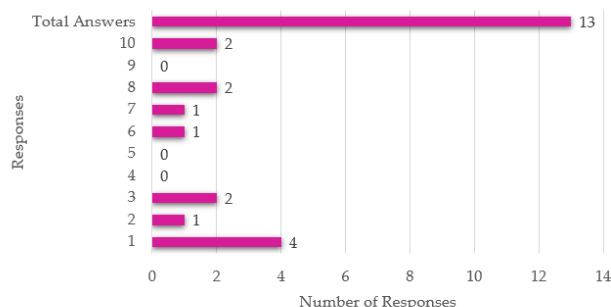
COMMENTS:

- The characterization of pollutants and the mapping of discharges seem to be important for voters.

SEGMENTATION BY COUNTRY	Level of harmfulness	Characterization and duration of substances	Discharge points and impact area	Discharge type menu	Biomass insurance alert	
Portugal			1	1		2
Italy				1		1
Spain						
Ireland		1				1
Denmark		1			1	2
Holland						
EU	1	1	1			3
Don't Know						1
	1	4	2	2	1	10

SEGMENTATION BY ACTIVITY	Level of harmfulness	Characterization and duration of substances	Discharge points and impact area	Discharge type menu	Biomass insurance alert	
Oyster Farmer			1	1	1	3
Oyster Restorator		1				1
Fisheries						
Control & Managing						
Investigation & Services	1	2	1	1		5
Don't Know		1				1
	1	4	2	2	1	10

5.4.1 - How difficult would be for you to define the following characteristics of potentially harmful discharge sources? Location of the source.



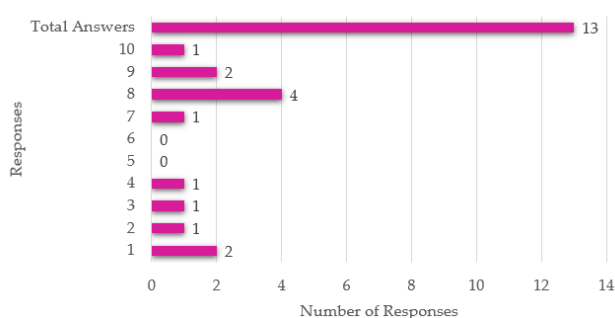
COMMENTS:

- Average difficulty to define location of the source: 4,7

SEGMENTATION BY COUNTRY	1	2	3	4	5	6	7	8	9	10	
Portugal		1					1	1			3
Italy			1								1
Spain											
Ireland	1										1
Denmark							1		1		2
Holland											
EU						1			1		2
Don't Know	3		1								4
	4	1	2			1	1	2		2	13

SEGMENTATION BY ACTIVITY	1	2	3	4	5	6	7	8	9	10	
Oyster Farmer		1					1	1		1	4
Oyster Restorator	1										1
Fisheries											
Control & Managing											
Investigation & Services			1			1		1		1	4
Don't Know	3		1								4
	4	1	2			1	1	2		2	13

5.4.2 - How difficult would be for you to define the following characteristics of potentially harmful discharge sources? Variations in the discharge (eg. outflow of water treatment station, or events of harmful releases).



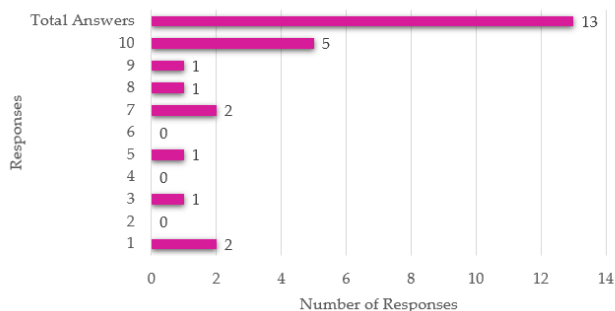
COMMENTS:

- Average difficulty to define variations in the discharge: 6,0

SEGMENTATION BY COUNTRY	1	2	3	4	5	6	7	8	9	10	
Portugal							1	1	1		3
Italy				1							1
Spain											
Ireland		1									1
Denmark								1		1	2
Holland											
EU								1	1		2
Don't Know	2		1					1			4
	2	1	1	1			1	4	2	1	13

SEGMENTATION	1	2	3	4	5	6	7	8	9	10	
Oyster Farmer							1	1	1	1	4
Oyster Restorator		1									1
Fisheries											
Control & Managing											
Investigation & Services				1				2	1		4
Don't Know	2		1					1			4
	2	1	1	1			1	4	2	1	13

5.4.3 - How difficult would be for you to define the following characteristics of potentially harmful discharge sources? Nature of the released material (eg. concentrations, substances).



COMMENTS:

- Average difficulty to define the nature of the released material: 7,0

SEGMENTATION BY COUNTRY	1	2	3	4	5	6	7	8	9	10	
Portugal							1		1	1	3
Italy							1				1
Spain											
Ireland					1						1
Denmark										2	2
Holland											
EU								1		1	2
Don't Know	2		1							1	4
	2		1		1		2	1		5	13

SEGMENTATION	1	2	3	4	5	6	7	8	9	10	
Oyster Farmer							1		1	2	4
Oyster Restorator					1						1
Fisheries											
Control & Managing											
Investigation & Services							1	1		2	4
Don't Know	2		1							1	4
	2		1		1		2	1	1	5	13

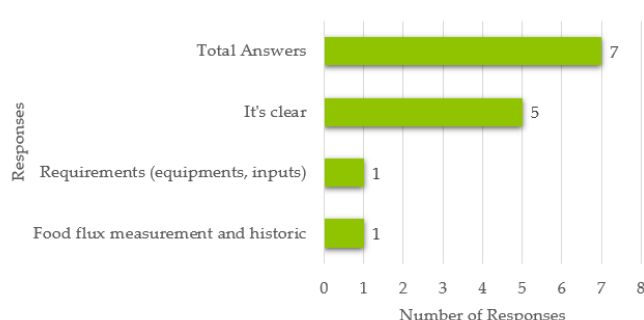
Figure 16. Exposure to Harmful Land Discharges service survey results

2.2.4 - Prospection for New Sites

Voters from Prospection for New Sites Service find it quite clear and express an interest in it.

Although there is a dispersion of responses, what would motivate the interest of voters in this service would be the access to the historical data of the place and general knowledge of the region.

For assessing oyster growth and prospecting for new locations, most voters chose the condition index 6.1 - Is the service presented and what it can offer clear for you?
If not, please write those aspects that need further explanation.



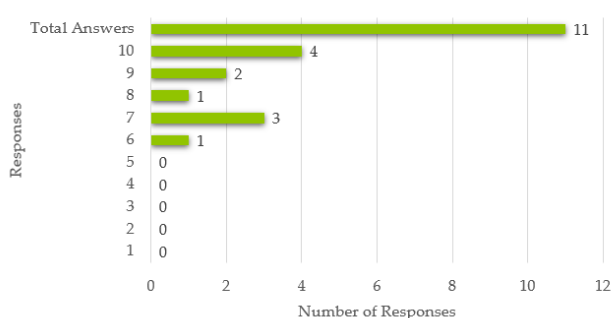
COMMENTS:

- Voters find this service rather clear.

SEGMENTATION BY COUNTRY	Food flux measurement and historic	Requirements (equipments, inputs)	It's clear	
Portugal	1		1	2
Italy			1	1
Spain				
Ireland		1		1
Denmark			1	1
Holland				
EU			1	1
Don't Know			1	1
	1	1	5	7

SEGMENTATION BY ACTIVITY	Food flux measurement and historic	Requirements (equipments, inputs)	It's clear	
Oyster Farmer	1		1	2
Oyster Restorator		1		1
Fisheries				
Control & Managing				
Investigation & Services			3	3
Don't Know			1	1
	1	1	5	7

6.2 - From 1 to 10, how much is your level of interest in the presented service?



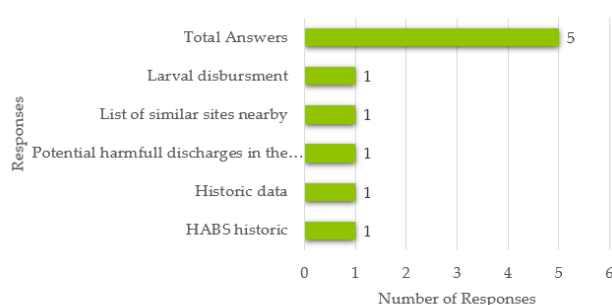
COMMENTS:

- Low dispersion of results. All voters seem interested in this service.

SEGMENTATION BY COUNTRY	1	2	3	4	5	6	7	8	9	10	
Portugal						1	1				2
Italy									1		1
Spain											
Ireland								1			1
Denmark										2	2
Holland											
EU							1		1	1	3
Don't Know							1			1	2
							1	3	1	2	11

SEGMENTATION BY ACTIVITY	1	2	3	4	5	6	7	8	9	10	
Oyster Farmer						1	1			1	3
Oyster Restorator								1			1
Fisheries											
Control & Managing											
Investigation & Services							2		2	2	6
Don't Know										1	1
							1	3	1	2	11

6.3 - What change or additional functionality (if any) would significantly increase your interest in this service?



COMMENTS:

- Although the answers are scattered, the common element is the history of the place and knowledge of the region

SEGMENTATION BY COUNTRY	HABS historic	Historic data	Potential harmful discharges in	List of similar sites nearby	Larval disbursement	
Portugal		1				1
Italy						
Spain						
Ireland					1	1
Denmark						
Holland						
EU	1		1			2
Don't Know				1		1
	1	1	1	1	1	5

SEGMENTATION BY ACTIVITY	HABS historic	Historic data	Potential harmful discharges in	List of similar sites nearby	Larval disbursement	
Oyster Farmer		1				1
Oyster Restorator					1	1
Fisheries						
Control & Managing						
Investigation & Services	1		1	1		3
Don't Know						
	1	1	1	1	1	5

6.4 - For oyster growth evaluation and prospection of new sites, which information is most important for you.

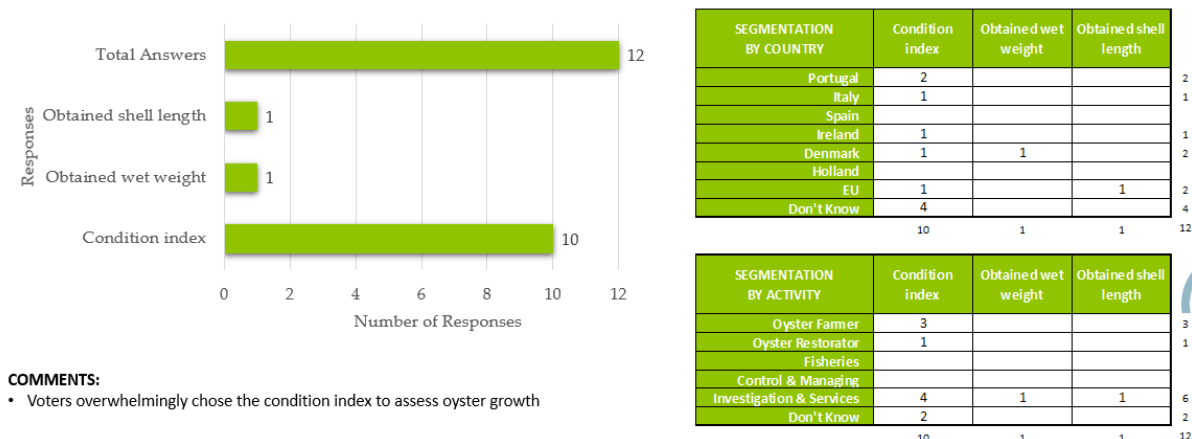


Figure 17. Prospection for New Sites service survey results

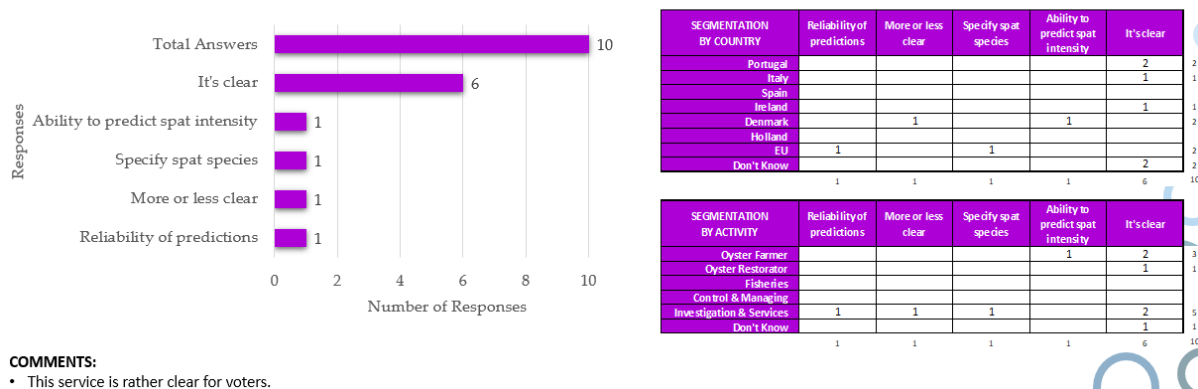
2.2.5 - Assistance for Spat Captures

Voters from Assistance for Spat Captures Service, in a scale from 1 to 10, have an average level of interest of 6,7.

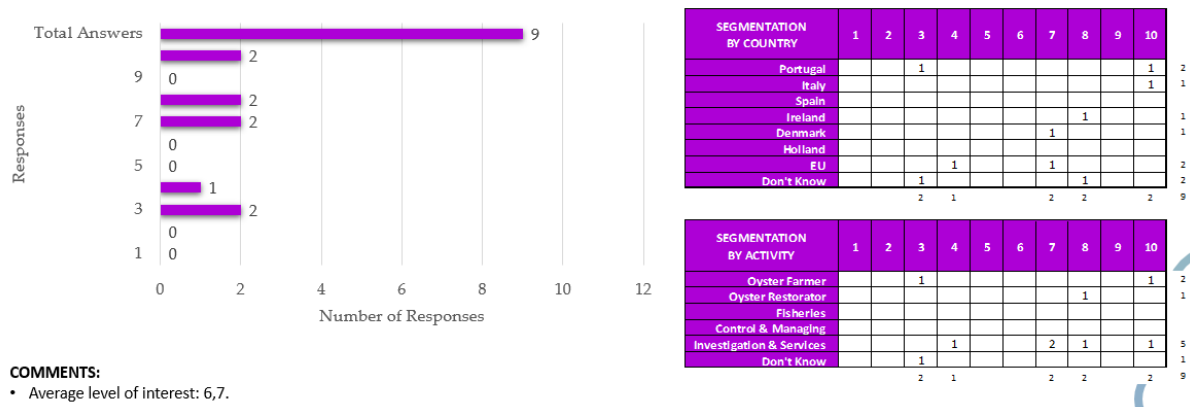
There are several questions regarding the service, we highlight that voters need to see the service in a more developed version to better understand and trust it.

According to the voters' responses, their average level of precision for determining the origin of the larva is 4,4, on a scale of 1 to 10.

7.1 - Is the service presented and what it can offer clear for you? If not, please write those aspects that need further explanation.



7.2 - From 1 to 10, how much is your level of interest in the presented service?



7.3 - What change or additional functionality (if any) would significantly increase your interest in this service?



7.4 - How accurately would you be able to provide the natural area location the larve come from to your area?

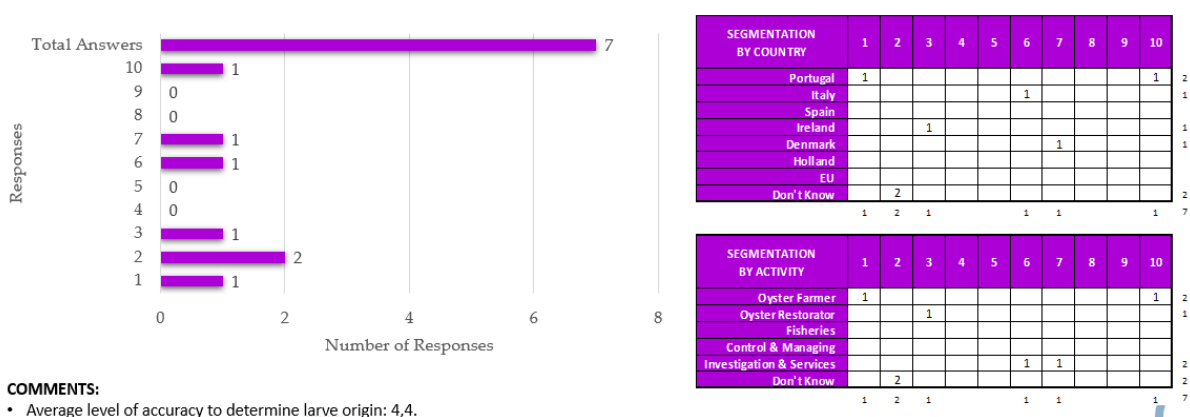


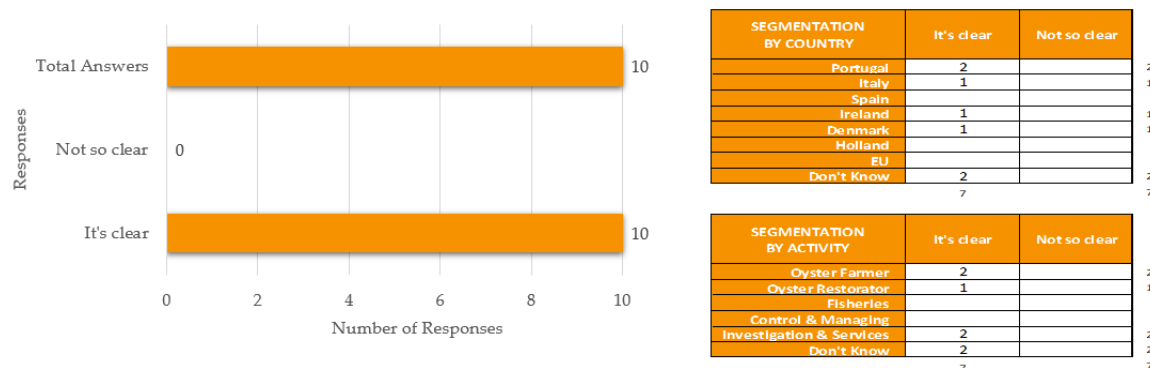
Figure 18. Assistance for Spat Captures service survey results

2.2.6 - Retrieve Source of Contaminants

The Retrieve Source of Contaminants Service is very clear to the voters, and they show 7,3 interest in it, on a scale of 1 to 10.

Voters' responses show interest in historical data and slightly prefer information displayed as a layer on a map instead of a time-series plot.

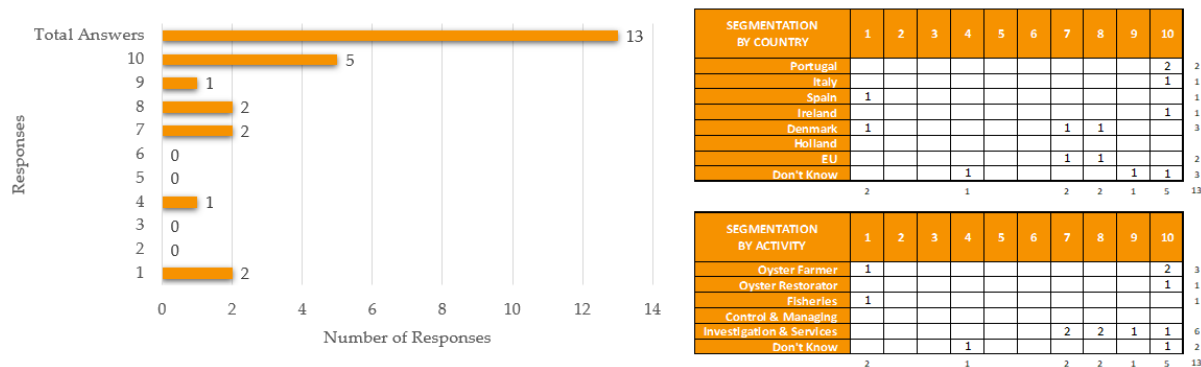
8.1 - Is the service presented and what it can offer clear for you? If not, please write those aspects that need further explanation



COMMENTS:

- This service is clear for all the voters.

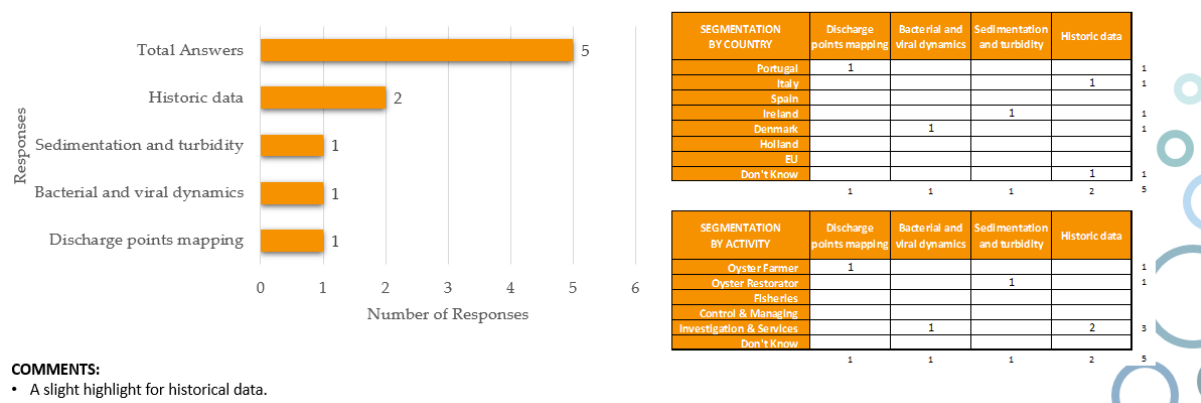
8.2 - From 1 to 10, how much is your level of interest in the presented service?



COMMENTS:

- Average level of interest: 7,3.

8.3 - What change or additional functionality (if any) would significantly increase your interest in this service?



8.4 - Would you prefer having the information displayed on a map, or as a time-series plot of pollutants entering a farm?

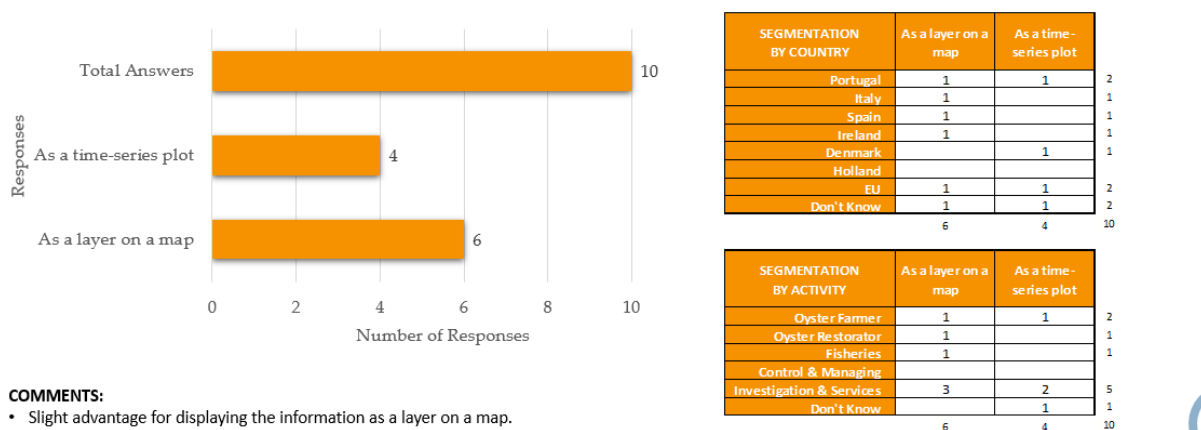


Figure 19. Retrieve Sources of Contaminants service survey results

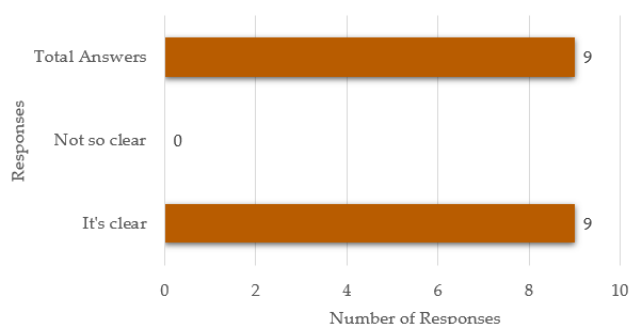
2.2.7 - Suitable Fishing Areas

The Suitable Fishing Areas Service is clear for all the voters, and they show 5,3 interest in it, on a scale of 1 to 10.

Only one voter came up with a suggestion, more users should be encouraged to participate in future discussions.

Voters clearly prefer maps over time-series.

9.1 - Is the service presented and what it can offer clear for you? If not, please write those aspects that need further explanation



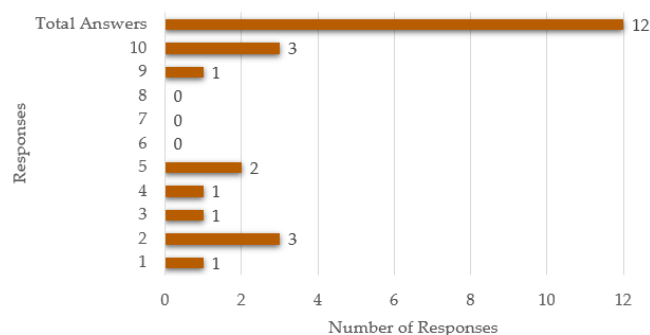
COMMENTS:

- This service is clear for all the voters.

SEGMENTATION BY COUNTRY	It's clear	Not so clear
Portugal	2	2
Italy	1	1
Spain	1	1
Ireland	1	1
Denmark	1	1
Holland		
EU		
Don't Know	3	3
	9	9

SEGMENTATION BY ACTIVITY	It's clear	Not so clear
Oyster Farmer	2	2
Oyster Restorator	1	1
Fisheries	1	1
Control & Managing		
Investigation & Services	4	4
Don't Know	1	1
	9	9

9.2 - From 1 to 10, how much is your level of interest in the presented service?



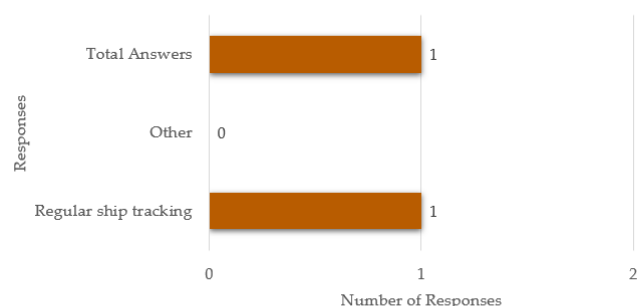
COMMENTS:

- Average level of interest: 5,3.

SEGMENTATION BY COUNTRY	1	2	3	4	5	6	7	8	9	10
Portugal		1		1						
Italy				1						
Spain									1	
Ireland			1							
Denmark	1				1					
Holland										
EU		2								
Don't Know									1	2
	1	3	1	1	2				1	3

SEGMENTATION BY ACTIVITY	1	2	3	4	5	6	7	8	9	10
Oyster Farmer	1	1		1						
Oyster Restorator			1							
Fisheries									1	
Control & Managing										
Investigation & Services		2			2				1	1
Don't Know									1	1
	1	3	1	1	2				1	3

9.3 - What change or additional functionality (if any) would significantly increase your interest in this service?



COMMENTS:

- Only one voter made a suggestion;
- More users should be encouraged to participate on future discussions.

SEGMENTATION BY COUNTRY	Regularship tracking	Other
Portugal		
Italy		
Spain		
Ireland		
Denmark		
Holland		
EU		
Don't Know	1	
	1	

SEGMENTATION BY ACTIVITY	Regularship tracking	Other
Oyster Farmer		
Oyster Restorator		
Fisheries		
Control & Managing		
Investigation & Services	1	
Don't Know		
	1	

9.4 - Which type of information would you find more valuable as a result of this service in your case?

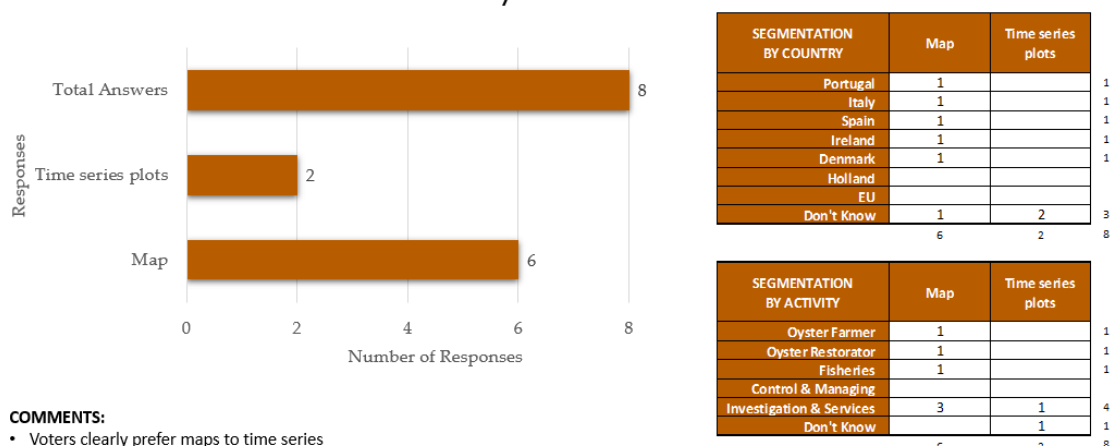


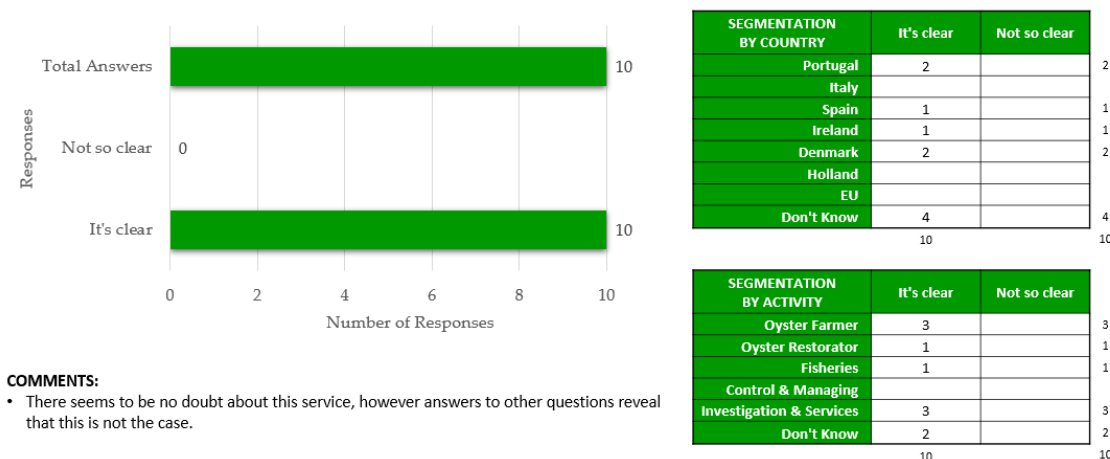
Figure 20. Suitable Fishing Areas service survey results

2.2.8 - Front Detection

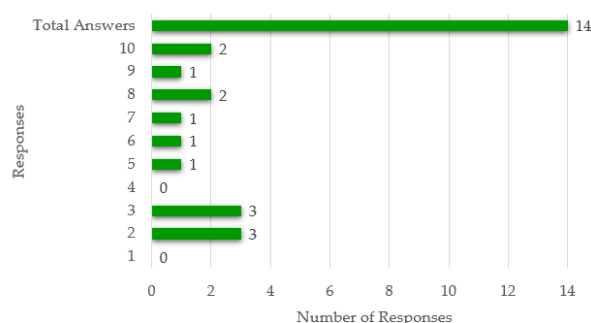
Voters show an average level of interest of 5,6, on a scale from 1 to 10 and good mapping seems to be key to the success of this service.

There is a lack of awareness and familiarity on the information that would be provided and its benefits in their activities. However, this is likely due to the bias in the attendees towards the aquaculture and restoration sectors, while this information is more relevant to the fishery one. Internet availability at sea is a problem.

10.1 - Is the service presented and what it can offer clear for you? If not, please write those aspects that need further explanation



10.2 - From 1 to 10, how much is your level of interest in the presented service?



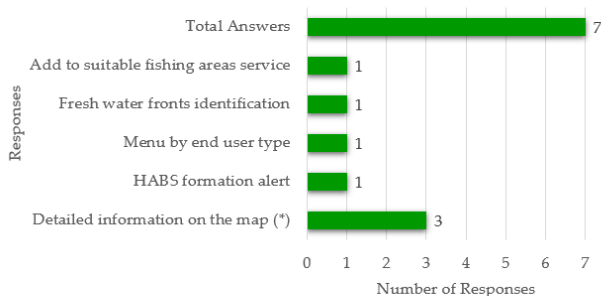
COMMENTS:

- Average level of interest: 5,6.

SEGMENTATION BY COUNTRY	1	2	3	4	5	6	7	8	9	10
Portugal			1			1				
Italy		1								
Spain									1	
Ireland							1			
Denmark		1						1		
Holland										
EU		1	1							
Don't Know			1		1			1	1	1
	3	3			1	1	1	2	1	2

SEGMENTATION BY ACTIVITY	1	2	3	4	5	6	7	8	9	10
Oyster Farmer			1			1		1		
Oyster Restorator							1			
Fisheries									1	
Control & Managing										
Investigation & Services		3	1		1				1	1
Don't Know			1					1		2
	3	3			1	1	1	2	1	2

10.3 - What change or additional functionality (if any) would significantly increase your interest in this service?



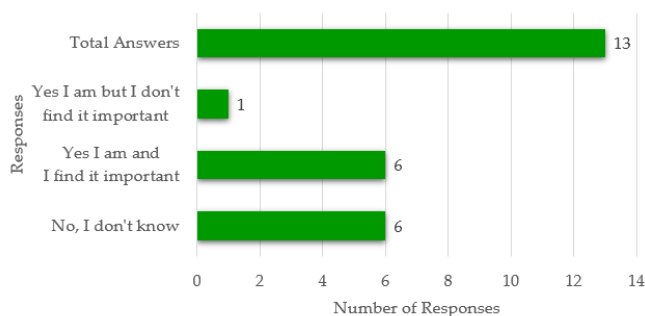
COMMENTS:

- Good mapping seems to be key to the success of this service

SEGMENTATION BY COUNTRY	Detailed information on the map (*)	HABS formation alert	Menu by end user type	Fresh water fronts identification	Add to suitable fishing areas service
Portugal		1			
Italy					
Spain	1				
Ireland					
Denmark			1		1
Holland					
EU					
Don't Know	2			1	
	3	1	1	1	1

SEGMENTATION BY ACTIVITY	Detailed information on the map (*)	HABS formation alert	Menu by end user type	Fresh water fronts identification	Add to suitable fishing areas service
Oyster Farmer		1			
Oyster Restorator					
Fisheries	1				
Control & Managing					
Investigation & Services	1		1	1	1
Don't Know	1				
	3	1	1	1	1

10.4 - Are you familiar with ocean fronts? In this case, do you find this information important?



COMMENTS:

- There is a lack of awareness on this subject

SEGMENTATION BY COUNTRY	No, I don't know	Yes I am and I find it important	Yes I am but I don't find it important
Portugal	1		
Italy	1		
Spain		2	
Ireland	1		
Denmark	1		1
Holland			
EU	1	1	
Don't Know	1	3	
	6	6	1

SEGMENTATION BY ACTIVITY	No, I don't know	Yes I am and I find it important	Yes I am but I don't find it important
Oyster Farmer	1		1
Oyster Restorator	1		
Fisheries		2	
Control & Managing			
Investigation & Services	3	2	
Don't Know	1	2	
	6	6	1

10.5 - At sea, do you have access to internet connection to access online information?

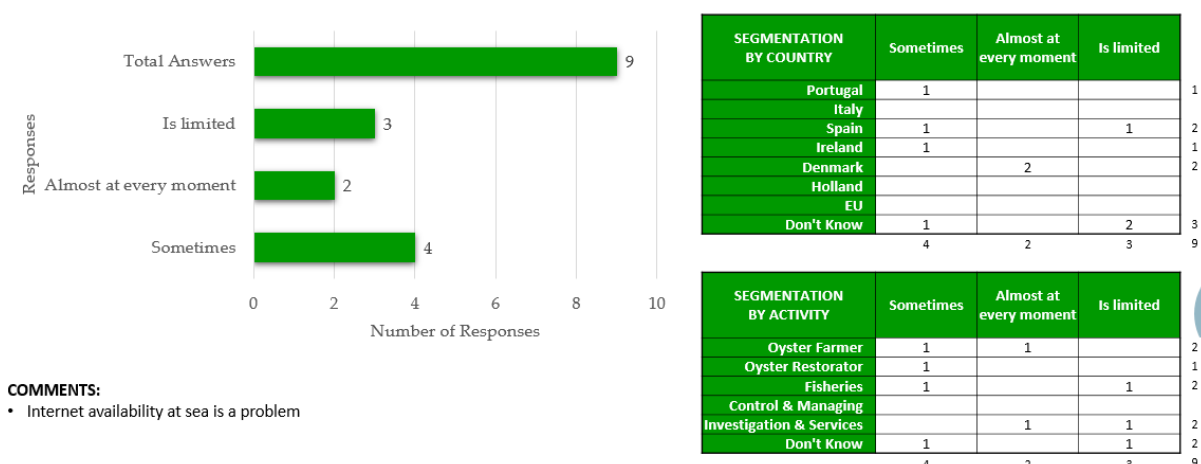


Figure 21. Front Detection service survey results

2.2.9 - Final Feedback

The following questions are addressing the reception, feasibility and market allocation of FORCOAST, and are used as input for the business case development of the product. Voters intend to use the FORCOAST services for a variety of reasons, with an emphasis on work planning. Most of them (73%) already use similar services (i.e. services based on coastal marine observational data or modelling products more or less fitted to their activities ²), however, in several cases those services do not work very well in the desired area.

Voters believe that they will save money by using these services but do not expect to reach large amounts in those savings. To consider paying for these services, voters need to believe that the service is useful to them in each particular case and geographic area.

Regarding the willingness to pay for services, it should be noted that in the mentimeter it was decided to measure the willingness of users to pay for the service by calculating the annual savings generated by its use. Most of the answers received were in the first range (0 to 1000€), which can either indicate that voters think that savings will be relatively low with respect to the other options, or that they do not know how to calculate the level of savings. This is indeed an exercise that requires some cognitive effort. Furthermore, this was most voters' first contact with the service idea, thus it is likely that they did not have a sufficient vision of the services to be able to calculate savings.

In any case, we have to recognize that in terms of establishing the value to be charged for the service, it is below the desired level in this initial [assessment](#): either it can mean that the savings are 0€ and

² Further interactions with users will include specific questions to determine in which services users already use pre-existing services, as well as the cost of these services.

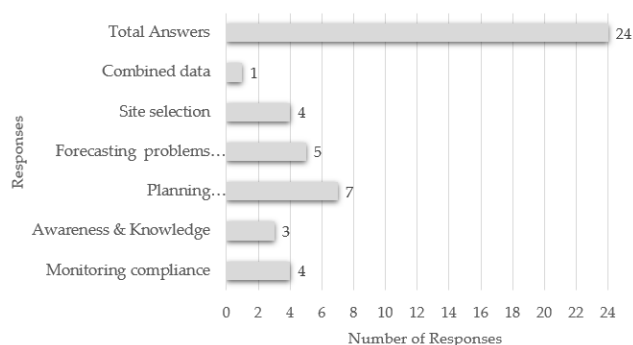
therefore there is no interest in paying, or it can mean that the savings can reach 1000 €, but we don't know what percentage of that gain the user will be willing to pay for the service.

The question of the amount to pay for a service is always delicate and within users there are very different realities:

1. Countries with large purchasing power disparities;
2. Sectors with different economic capacities;
3. Companies/Institutions with non-comparable dimensions.

In future user surveys as foreseen within FORCOAST , a change of strategy is foreseen, based on the fact that separate service-oriented sessions will be held (and not every service grouped as in the User's Day) where the country and the size of the companies/institutions will be identified in advance. More interaction will be promoted with users, guiding about the relevant aspects for our feedback collection, achieving an order of magnitude for the value of the products.

11.1 - For which purpose(s) do you think the presented FORCOAST information services could be useful in your case?



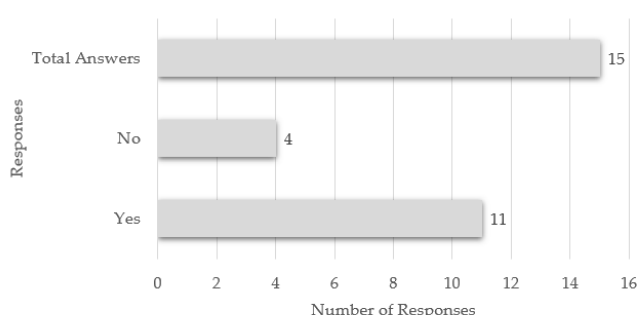
COMMENTS:

- Voters intend to use the services for a variety of reasons, with an emphasis on work planning.
- The amount of «Total Answers» is affected by the multiple choices option in this question.

SEGMENTATION BY COUNTRY	Monitoring compliance	Awareness & Knowledge	Planning (spat, tide, work in general)	Forecasting problems (solution)	Site selection	Combined data
Portugal			2	2		4
Italy			1	1		1
Spain			1			1
Ireland	1	1	1	1	1	5
Denmark		1			1	2
Holland						
EU	2	1	2		1	6
Don't know	1		1	1	1	5
	4	3	7	5	4	24

SEGMENTATION BY ACTIVITY	Monitoring compliance	Awareness & Knowledge	Planning (spat, tide, work in general)	Forecasting problems (solution)	Site selection	Combined data
Oyster Farmer		1	2	2	1	6
Oyster Restorer	1	1	1	1	1	5
Fisheries			1			1
Control & Managing						
Investigation & Services	2	1	2	1	1	8
Don't know	1		1	1	1	4
	4	3	7	5	4	24

11.2 - Do you normally use marine data or derived information services for your daily activities?



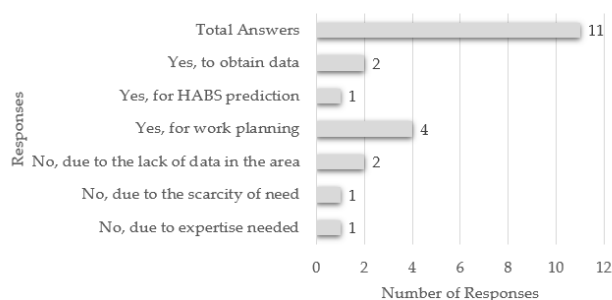
SEGMENTATION BY COUNTRY	Yes	No
Portugal	3	3
Italy	1	1
Spain	2	2
Ireland		1
Denmark	2	2
Holland		
EU	3	2
Don't Know	3	1
	11	4

SEGMENTATION BY ACTIVITY	Yes	No
Oyster Farmer	4	4
Oyster Restorator		1
Fisheries	2	2
Control & Managing		
Investigation & Services	4	6
Don't Know	1	2
	11	4

COMMENTS:

- Most voters already use similar services.

11.3 - If you answered 'yes' in the previous question, which ones and for what purpose? If you answered 'no', why not?



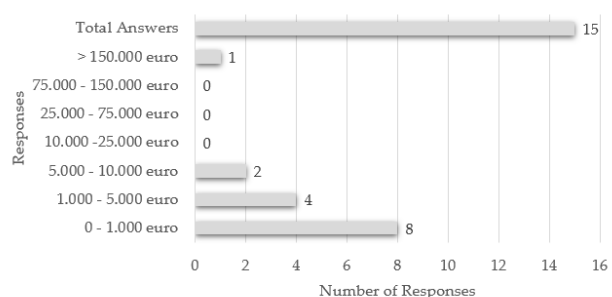
SEGMENTATION BY COUNTRY	No, due to expertise needed	No, due to the scarcity of need	No, due to the lack of data in the area	Yes, for work planning	Yes, for HABS prediction	Yes, to obtain data
Portugal				1	1	1
Italy						
Spain				1		
Ireland			1			
Denmark				2		
Holland						
EU	1	1	1			1
Don't Know	1	1	2	4	1	2

SEGMENTATION BY ACTIVITY	No, due to expertise needed	No, due to the scarcity of need	No, due to the lack of data in the area	Yes, for work planning	Yes, for HABS prediction	Yes, to obtain data
Oyster Farmer				2	1	
Oyster Restorator			1			
Fisheries				1		
Control & Managing						
Investigation & Services	1	1	1	1		2
Don't Know	1	1	2	4	1	2

COMMENTS:

- Work planning stands out for the positive answers;
- Existing services may be out of range for the desired area.

11.4 - By using information services such as the ones presented, how much revenue could you gain? (per year).



SEGMENTATION BY COUNTRY	0 - 1.000 euro	1.000 - 5.000 euro	5.000 - 10.000 euro	10.000 - 25.000 euro	25.000 - 75.000 euro	75.000 - 150.000 euro	> 150.000 euro
Portugal		1					1
Italy							
Spain		1					
Ireland							
Denmark							
Holland							
EU	2	2	2				
Don't Know	6	2	2				

SEGMENTATION BY ACTIVITY	0 - 1.000 euro	1.000 - 5.000 euro	5.000 - 10.000 euro	10.000 - 25.000 euro	25.000 - 75.000 euro	75.000 - 150.000 euro	> 150.000 euro
Oyster Farmer		1					1
Oyster Restorator							
Fisheries		1					
Control & Managing							
Investigation & Services	2						
Don't Know	6	2	2				

COMMENTS:

- Voters believe that they will save money by using the service but do not expect to reach large amounts in savings.

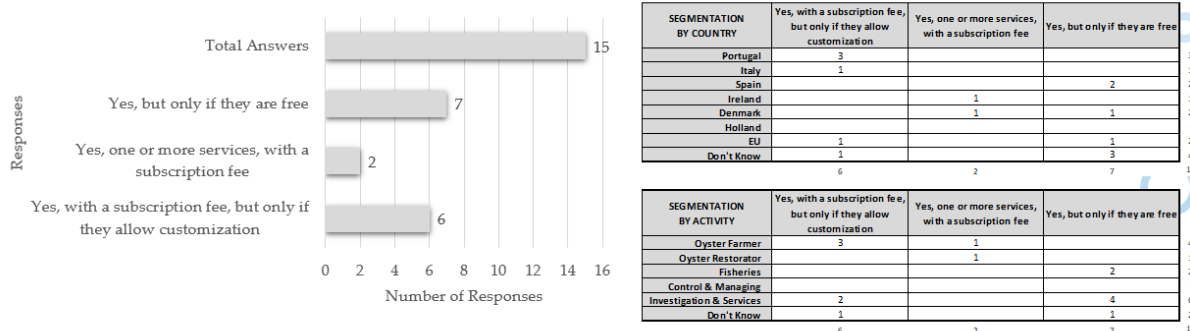
There is a large standard deviation in the number of voters whose sector was not possible to identify for the revenue gains answer (#10 voters), in relation to other mentimeter questions (usually #2 to #4 voters).

Although no direct cause was possible to identify, it may be related to one of the following causes:

1. Voters who have re-entered the mentimeter session and therefore are accounted as new voters;
2. Difficulty of “regular” voters to answer a question whose content requires reflection and calculation, something that not all users are able to do or be comfortable to do.

The first cause is the most likely to have happened.

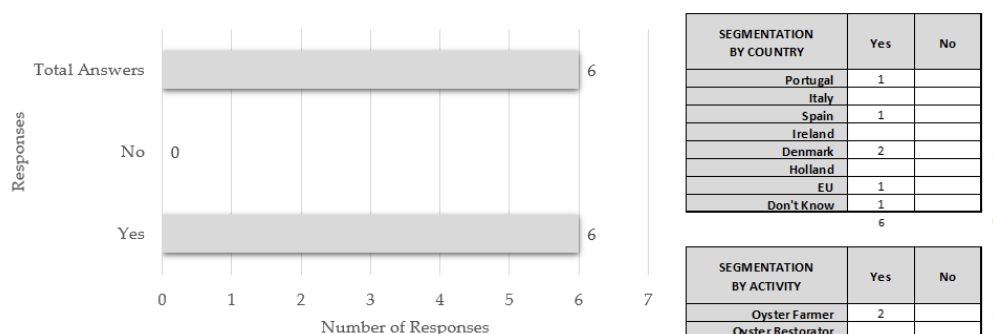
11.5 - Would you make use of the FORCOAST platform and service products presented?



COMMENTS:

- In order to consider paying, voters need to believe that the service is useful to them in their particular case.

11.6 - Would you like to follow the progress of the FORCOAST services along their development and be contacted for future events?



COMMENTS:

- 4 of the 6 voters left contact. It is possible that the remaining interested parties already belong to the consortium.

Figure 22. Final feedback survey results

In the last question of the final feedback, a significant decrease in the number of responses was noted. 6 people answered, all of them saying that they were interested in following the project's updates.

It is natural that, given the lateness of the session, some people did not stay until the end of the mentimeter or that they simply did not respond. From this fact it cannot be inferred that there is no interest, as no one replied that they would not be interested in following the project updates.

However, it is possible that the diversity and quantity of services presented (#7 services) have resulted in the fatigue of the assistance and that the lack of interest in some services has taken away the general interest in the project for some users.

From this experience, all future interaction sessions with users will be service-oriented, thus promoting the participation and interest of voters, who are potential future users of the services, in the ones that specifically keep their interest.

2.3. User-driven adjustments in the SMs and Platform prototypes

As showcased in the previous section, the FORCOAST GA User's Day provided a unique opportunity to gather feedback on the SMs mock-ups and Platform presented. The following subsections summarize how the first prototypes of Central Platform and Service Modules will be adjusted in terms of designs and specific aspects for their implementation in order to meet user's expectation, whenever this is possible.

2.3.1 - FORCOAST Central Platform

One of the main conclusions when it comes to the Central Platform feedback comes to the grouping or clustering of the different services into a single platform. This option is the preferred alternative by the entirety of the voters, as opposed to having every service provided via separate interface instances. This outcome reinforces the interoperability philosophy of FORCOAST, where all the services provided are unified into a single platform, which contributes towards a unified market uptake and it conveys the message that the services are available across different regions.

The majority of the attendees found the potential interaction with the showed interface intuitive, helped by the fact that many of them also have experience working with comparable information services. Emphasis is being put into the easy-to-use design of the interface, and efforts will be kept on being made in this UX aspect to ensure smooth interaction of the users with the interface.

Regarding the way of access (Figure 23), 60% of the audience would use the platform from their mobile phone. As the question about this topic allowed for multiple options, we observe that around half of the voters would, additionally, like to access it on a PC, via browser. This is possible via compatibility via desktop and mobile web applications, and it is an aspect that we will keep on considering.

3.3 - In which way(s) would you access a platform like this one?

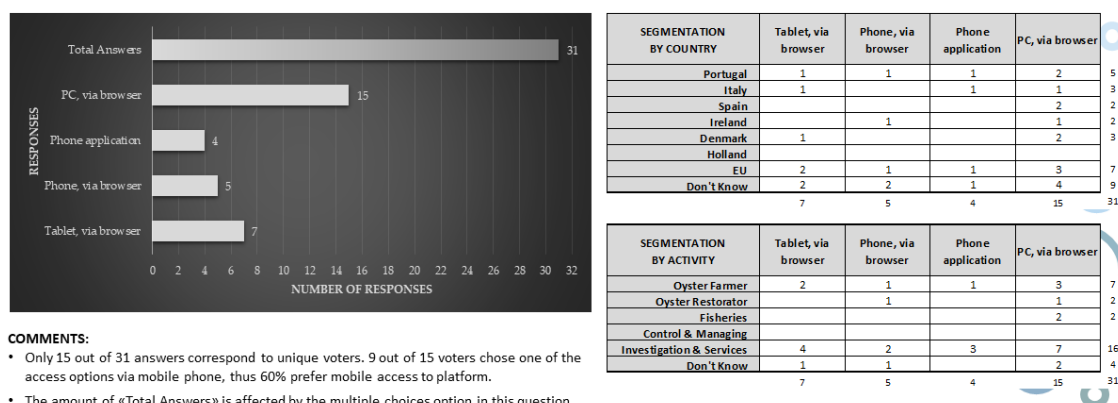


Figure 23. Final feedback survey results on the way of access to the Platform

2.3.2 - Marine Conditions at farming site

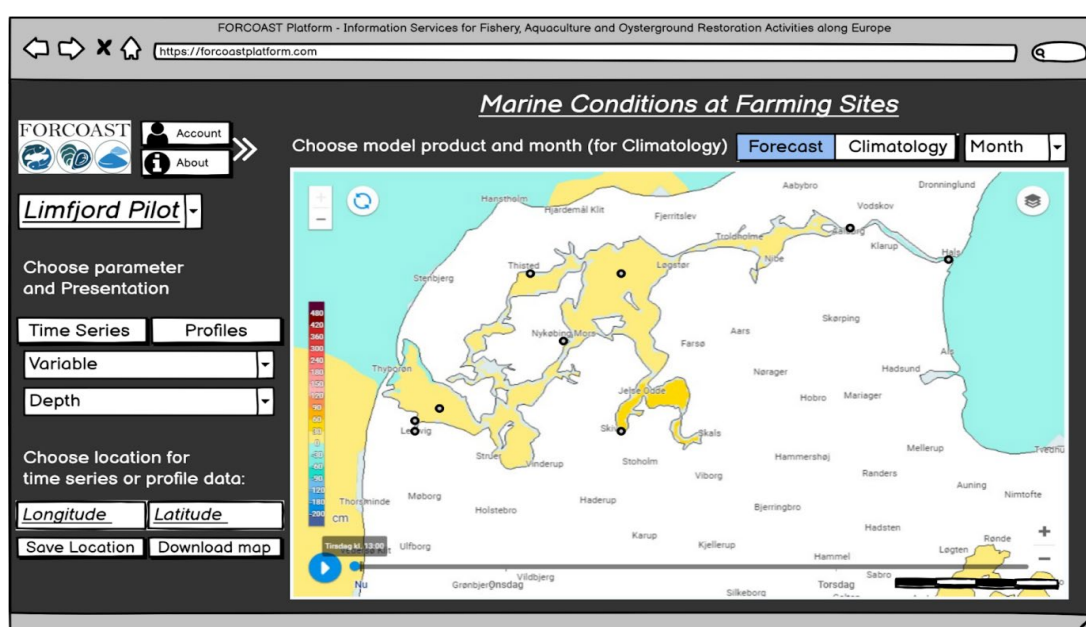


Figure 24. Example wireframe of the marine conditions website after Adjustment. Functionalities have been added to provide animation of forecast parameter and climatological maps, as well as time series and profiles for fixed stations

The demonstration design of the marine conditions website was updated with functionality to select either climatology or forecast layers for the presentation as 2D maps at a certain depth. It is possible to choose a certain month for the climatology, but the forecast that will be presented will always be the most recent one. The length of one forecast in pilot 6: Denmark is 5 days, which will be presented as one continuous animation and time series. Time series for certain locations can be extracted providing information about variable, latitude, longitude and depth. It will be possible to extract profiles for certain locations, providing information about latitude, longitude and time. The system is set up in such a way that the 2D maps show the parameter that can be extracted as time series or profile as well. The time series will show the entire forecast for a given location and the profiles will show the entire depth range for the location and time (when the animation is stopped.) It is possible to specify the locations by “clicking” on the map, or by providing information about latitude and

longitude of the station. It will be possible to save the location. Safed locations will be visible as circle buttons on the map. These buttons will provide easy access to the time series or profile plots. It will be possible to download maps, time series plots and profile plots from the website.

The wireframe design can easily be extended to other areas and domains. There is a “Combo Box”, a selection field, where the domain can be specified. In the presented design, it is set to the Limfjord Pilot. The functionality of the website will be the same for all domains. The only change will be the data that is provided.

2.3.3 - Exposure to Harmful Land Discharges

In summary, the service was clearly presented and raised a fair interest among the users. This interest could be further enhanced if the service could be complemented with means to characterize the nature of harmful substances, and the corresponding duration of risk induced by the released material. This calls for substantial technical developments involving the parameterization of substance-specific dynamical models, and also for detailed data inputs (nature and time-varying discharge for released substances).

It appears from the user survey that characterizing potentially problematic sources appears to users as feasible (average difficulty: 4,7). Yet it seems more difficult to characterize temporal variations in the discharge (6.0) and nature of released material (7.0). Nature or discharge rate of harmful material are typically very local issues, with potential data providers being known only at a local scale. It thus does not appear feasible to attempt automatizing the identification of release points, nature and discharge rate at this stage, although this aspect is retained as a point of attention.

Given the difficulty for users to characterize this essential information, a default version of SM-A2 is developed that provides the best user-feedback while requiring minimal inputs. Only source location is considered, while assuming a constant discharge rate. The risk is evaluated from a combination of age since release, and fraction of release reaching the farm. The first operational release of SM-A2 will be based on the approach. Yet, the possibility to embed substance-specific reaction models (forced by marine conditions along drifting tracks) will be further evaluated, together with the possibility to support users in characterising local information for this second level version of SM-A2.

2.3.4 - Prospection of New sites

The feedback from Mentimeter showed a wish for more historical data. This will be accommodated by showing monthly values of selected variables from 2009 to 2018. Unfortunately, we cannot provide a longer time-series in the present project due to lack of forcing data. Warning of harmful algal blooms is not a feature that the model can resolve at the moment. The toxic algae are most often dinoflagellates that are not always toxic and water samples are needed to examine this. Hence, they have no specific signal as e.g. blue green algae in the Baltic Sea that can be observed from remote sensing data. More research would be needed to elucidate what triggers these blooms. There was an interest in information not only on shell length and wet weight of the flat oysters, but also conditions index. We hope to be able to accommodate this from the dynamic energy budget model, which is under development in collaboration with Wageningen University and Ghent University.

2.3.5 - Assistance for Spat Captures

The prototype of the Service Module has been adapted on the base of the results of the mentimeter, but also after internal deliberation with the Forecast partners on the new prototype of the Service Module centred around the oysterground restoration sector. It was decided that the different aspects of the new oysterground restoration SM prototype could be incorporated into the different aquaculture Service Modules. One aspect, the spat dispersal/distribution to identify optimal oyster reef restoration ground, can be taken up by the spat capturesService Modules) Assistance for spat capture. The model is able to show maps on distribution and density of spat within a specific area (Belgian part of the North Sea) based on hindcast data. These maps enable the end user to identify the areas with the highest spat densities.

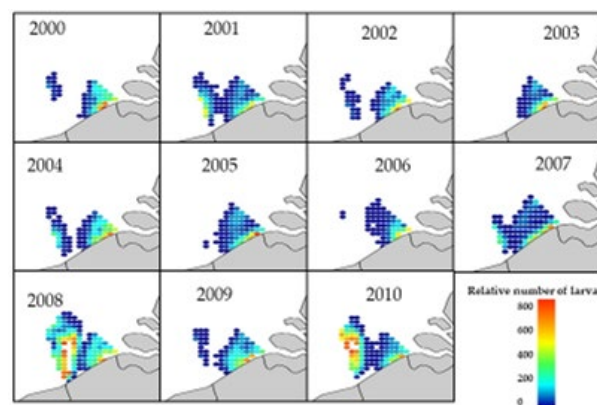


Figure 25. Distribution/density map for spat, here for a period between 2000 and 2010

In a further step, the area range could be extended to Galway Bay, with the coupling of the hydrodynamic model of this area to the LARVAE&Co model. In a next step, maybe a 5-days forecast can be made with spat distribution/density maps. In a last step, additional areas, such as Limfjorden, Black Sea, etc. could be coupled (if hydrodynamic models are readily available).

2.3.6 - Retrieve Source of Contaminants

According to the answers from the mentimeter, the Retrieve Sources of Contaminants service module is clear to end-users and generates a high level of interest. The majority of the voters showed a preference for the information to be displayed on a map (as in the presented prototype) rather than as a time series. According to these results, no adjustments would be needed in the first prototype.

Finally, users declared a slight interest in historical data. This service may be provided by allowing end-users to access previous particle-tracking model runs, showing the potential sources of contamination during previous water pollution events. Such functionality would require that the final platform stores the particle-tracking model output files in a server.

2.3.7 - Suitable Fishing areas

The first prototype of the Suitable Fishing Areas Service was accepted well by the participants in the workshop, the graphical interface was assessed as clear. On average ~10 voters expressed their interest in the service and they approved the approach taken to show the information as maps and time plots. Not many additional functionalities were proposed by the voters, the only suggestion is to include ship tracking. However, this is out of the scope of the current project and might be considered in future developments. It became clear that raising awareness about the project results among the fishermen community in Bulgaria is necessary and the activity to inform and attract more potential end-users is ongoing.

2.3.8 - Front detection

After the evaluation of the Front detection first prototype different adjustments could be carried out. First, since the internet connection on board is limited in some cases, the information to be sent would be as reduced as possible. There is another popular suggestion for improving this service, that proposes to add detailed information on the map, e.g. temperature, duration and intensity. For achieving this objective, the frontal maps should be plotted superimposed to the corresponding sea surface temperature map that would show the warmer/colder side of the front and the intensity. Regarding the duration, if the data are sent regularly the duration may be consulted contrasting the evolution of consecutive days.

3. Next steps in the co-design process

Once the concept of central platform and SMs have been validated through the main mechanisms detailed in the previous sections, the next steps will be:

- To consolidate the central platform design and its final functionalities (WP3)
- To consolidate the list of SM and their final functionalities (WP3)
- To consolidate a first operative version of the Central Platform and Service Modules for a first demonstration (WP4)
- Further iteration with users towards the final operational implementation of the system (WP2, WP5).

3.1 Further iteration with users

Due to the covid-19 crisis, interactions with final users, initially foreseen in the form of several in-person meetings, needed to be adapted to online format. After the experience of the first FORCOAST User's Day online meeting held during the GA, the need for the organisation of additional events (not initially foreseen in the DoA) in different formats was identified, as described in the following subsections.

3.1.1 The FORCOAST Demonstration Day

This second event, called "FORCOAST Demonstration Day" was held on December 10th as an online event, and again feedback was gathered by means of a mentimeter questionnaire (where users were specifically asked to identify their sectors and country of activity from a closed list). During this event, a total of 39 participants from 24 organisations responded to the mentimeter survey. This included FORCOAST internal users and external users. The participants were from 10 EU member states, including Belgium (6), Denmark (3), Ireland (6), Italy (3), Bulgaria (6), Romania (6), Norway (1), Portugal (3), Spain (2) and France (2). Among the participants 29 of them gave their working sectors: 3 from fishery, 12 from bivalve mariculture, 6 from oyster ground restoration, 2 from management, 19 from research and 3 from others (these were further specified as: seaweed cultivation, general environmental characterization under WFD and consulting). One responder might choose more than one working sector.

This additional milestone also served as a starting point for the service validation by the users, who were offered demonstrations of different Service Modules. Feedback collected from the demonstrated services involved aspects like service performance and accuracy, operationalisation, service implementation and platform design. The outputs of this second user event will be gathered and analysed in D5.2 (Evaluation report of the pre-operational platform by end users). D5.2 will provide an evaluation report of the pre-operational platform by end-users, on items such as user-friendliness, intuitiveness, response time, etc. and will be key to further refine the FORCOAST platform and services, transitioning from pre-operational state to fully operational (Task 5.2: Pre-operational service testing and validation), and towards the completion of MS5 (Demonstration phase completed).

3.1.2 Final end-user contribution to the design of the services: Service Module User Workshops

In addition to the two wider events presented in sections 3.1.1 and 3.1.2, specific Service Module User Workshops. This final contribution of identified end-users of the FORCOAST services will take place sequentially starting in May 2022 in the form of individual workshops for each service in the catalogue. It will be a series of single service module - oriented workshops with more focus on the specific hands-on use of each service as opposed to the broader scope of previous events organised with users. The evolution in this aspect lays in the necessities of the services at different stages of the project, at the moment the aspect that the services need refinement is in how the information is presented and its format, since the core functionality of the services has already been defined to meet user requirements.

In order to get the necessary specific feedback to validate the information given to the end-users, we will work with a curated list of dedicated, key potential users for each service in the Pilot areas of interest to be able to get valuable input and continuous engagement.

Access to the FORCOAST Platform will be granted prior to the meeting to the attending users. They will have a chance to get familiar with the service in the demo version available online, with instructions from our side. During the workshops, they will do a live demo which they already had the chance to try out by themselves. This will clarify any aspect they could have when it comes to using the service from the platform prototype front-end. Subsequently, we will also have a live Q&A and discussion part with the users at the workshop sessions.

Afterwards, still during the workshops, we will present the full value of the service: receiving bulletins on a regular basis with up-to-date information produced from that SM. We will conclude by asking them to send us by mail the details needed to set up scheduled SM runs and a Telegram channel for each of them (coordinates of their working location/farm, thresholds, parameters... and phone number with Telegram). We will grant them a free trial version of the full service (receive automated bulletins for their conditions) for 1 month, where we will be in touch about their experience, for us to have useful feedback to do a final refinement in the way the information is presented. Also, that will serve as last user feedback for us for the aspects required mainly for deliverables D2.3 - End user survey results and D5.2 - Evaluation report of the pre-operational platform by end users.

3.1.3 The FORCOAST end-user survey

Finally, an end-user survey will be sent around after a final Demonstration of FORCOAST services, this will be the last exchange with users and will lead to the completion of D2.3, the final deliverable of WP2. This deliverable will summarise the results of the end-user survey, where users will evaluate the final service, the fit-for-purpose and the benefits to the different pilots and FORCOAST target sectors.

4. Conclusions

Users are at the core of the FORCOAST services co-creation process. WP2's main objective is to ensure the interaction with users is effective and that user needs requirements and feedback are ingested and become the backbone of the system and services design (WP3), implementation (WP4) and demonstration (WP5). This has been fulfilled through three main mechanisms:

I- **Elaboration of a first list of users needs and requirements** to define a first idea on the specific services needed for the different sectors

II- -Build the services conceptual models or mock-ups through in exchange with users and the use of a collaborative tool

III - Organization of the **FORCOAST General Assembly User's Day to collect** feedback on these service conceptual models or mock-ups.

FORCOAST Users' Day enabled us to assess whether the first service conceptual models fitted users needs or expectations and what were the needed adjustments. In general terms, all Services were evaluated positively, and users showed medium to high interest in all of them. For each service, the need to include additional variables or layers of information were identified by the users, including: Alarm systems, additional historical data, information on the reliability of forecast and tools, etc. According to the Users' Day feedback, users intend to use the FORCOAST Services for a variety of reasons, with an emphasis on work planning. Most of them already use similar services as already explained before, however, in several cases, those services do not work very well in the desired area. Further iterations with users should be devoted to gain a deeper insight on the pre-existing services and their specific costs to complete the business strategy of forcoast services. Regarding the economic aspect, it was possible to conclude by the responses of the users that they believe money will be saved by using these services but they do not expect to reach large amounts in those savings. To consider paying for these services, users need to believe that the service is useful to them in each case and geographic area.

These inputs have been analysed and ingested towards the development of the first Platform and Services prototypes.

The next step in the co-creation process was the consolidation of the Central Platform and Service Modules design and their preoperational implementation and the organisation (in December 2021) of a hands-on demonstration and iteration with users towards the final operational implementation of the system. This milestone will be reported in D5.2, and will also serve as a starting point for service validation by the users. Activities involving feedback collection regarding aspects like service performance and accuracy, operationalisation, service implementation and platform design will play an important role in order to further refine the FORCOAST platform and services, transitioning from pre-operational state to fully operational (Task 5.2: *Pre-operational service testing and validation*).

An additional step for gathering final inputs on the FORCOAST Services will be the organisation of the FORCOAST Service Modules User Workshops, which will provide further opportunity for engaging specific users of each of the developed services. Finally, an end-user survey will be sent around after a final Demonstration of FORCOAST services, this will be the last exchange with users and will lead to the completion of D2.3 and WP2.

Meanwhile, feedback on the functionality of the proposed services offered is collected by parallel continuous interaction with internal users parallel to the Service Module further refining. This feedback will keep on giving shape to better adapt the services to what is required by the user. This continuous and iterative process ensures that at the end of the project the final product is tailored to the necessities of the sector, appealing to the stakeholders that have been involved in the co-design (and co-creation) process.

Ingesting the collected feedback into the business planning activities carried out in the project, allows for the final product to be adapted to the current market scenario. From a similar perspective, besides feedback on platform and services functionality, information about willingness to pay, commercialization of the services and product interaction channels will be collected, and integrated into the activities of Market Analysis, Business Planning and Exploitation Strategy being carried out in WP6.