FORCOAST

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

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Executive Summary

This is the third and last deliverable of FORCOAST WP2. 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, thus guaranteeing their final uptake. In this process, WP2 focuses on the identification of user needs, requirements and concerns in terms of specific information that is 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 has been, 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 in Task 2.1 and presented in deliverable D2.1, and the analysis of the End-users contribution to the design of the services performed in Task 2.2 and presented in D2.2.

This deliverable D2.3 aims to provide:

i- The last evaluation of the services by the end users gathered during t**he interacion with users in the Pilot/Services workshops**

ii- **The rationale and structure of the end-users final survey**, launched at the end of the project.

It is worth noting that due to the covid-19 almost all the 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.

In general terms, all Services were evaluated positively. The users were satisfied with the proposed services and assigned marks ranging from 6.6 to 10 points to different aspects of the services, from the navigation through the platform, the understandability of instructions, the usefulness of the information provided and the fit-for-purpose of the outputs of the service. Most of the users expressed their usefulness on their daily operations, within the limitations enforced by the nature of their fieldwork and saw an added value to the solution based on tailored Telegram bulletins. Among the suggestions for improvement, we can highlight The possible combination of some services in a unique solution; The need for larger trial periods for a better evaluation of benefits; The addition of information and more granularity for some of the services.

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1 Introduction

A better understanding of the coastal environment and integrated monitoring and forecasting of the coastal environment by the use of data from different sources (including Earth Observation from satellites) is key to minimising 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.

The FORCOAST project aims to foster market development by 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 marine and ocean economic sectors: fisheries, oysterground restoration efforts, and bivalve mariculture.**

To guarantee the uptake of the products and services FORCOAST have ensured 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).
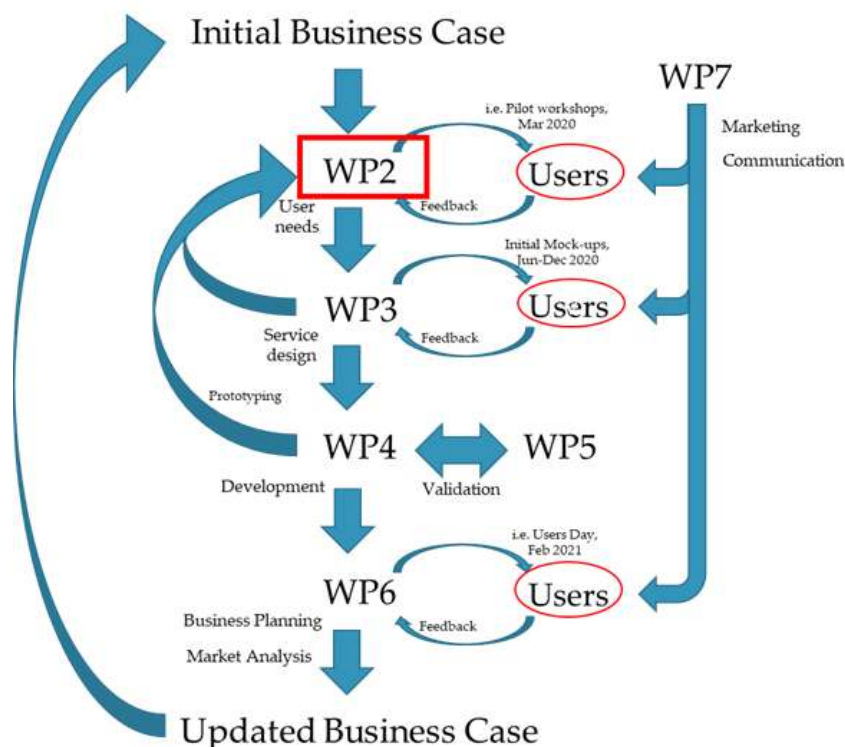
Figure 1. FOROCAST user interaction workflow, including WP2 links with other WPs

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, 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 in 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 WP4 and WP5 as well as the Business and Communication strategies (WP6 and WP7).

In the last part of WP2 we have concentrated the efforts on gathering the final feedback of FORCOAST users on the developed services, focusing on aspects as: user serviceability and the delivery of the information, and the development of services with interfaces tailored to their requirements.

2. Service co-design and evaluation methodology

2.1 Service co-design process

The key to the development of fit-for-purpose services that effectively support decision-making has been to engage users in the co-design and co-creation of services by ensuring:

- The ingestion of user needs, requirements and feedback in the design of the system (WP3), its implementation (WP4), and its demonstration and validations (WP5)

- The correct analysis and translation of users' feedback in terms of products and service specifications.

- Ensure the users be also active in the dissemination of the capability of the service to others within their sectors (WP6-Bussines WP7-Communication)

The main steps undertaken in the co-design with users of FORCOAST fit-for-purpose services are schematized in Figure 2.

Task 2.1 focused on understanding the needs and how these could be translated in terms of technical specifications for the design of the services. Task 2.2 main aim was to ensure that the services in development were tailored to the users' needs identified and also suited to their use in the field. Task 2.3 focuses on gathering user final feedback on the services while promoting the services through a free-trial demonstration.
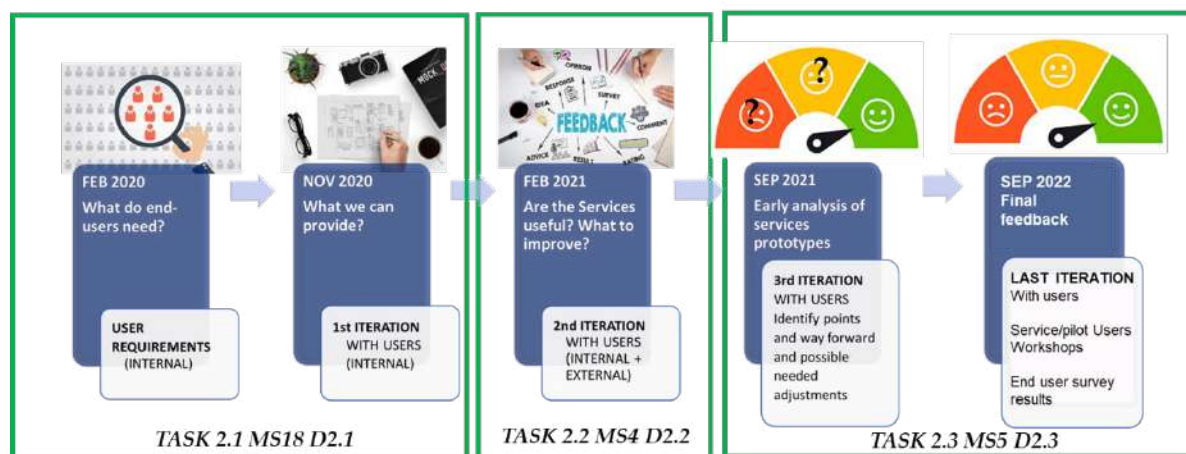
Figure 2. User engagement and the co-design process in the different phases of WP2

2.2 Evaluation methodology

The main milestones related to the evaluation of the services and de co-design process have been:

I- The elaboration of a **first list of user's 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 - MS3 and MS4)

II- A series of **sectorial 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 graphic 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 - The **FORCOAST General Assembly User's Day** with the first collection of feedback on these service conceptual models or mock-ups with external stakeholders (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.

After prototype services are finalised, **set a final round of iteration with users towards the final operational implementation of the system** (MS5: Demonstration phase completed and D2.3: End user survey results), through:

IV -The interaction with users in the Pilot/Services workshops

V- The launch of the end-users final survey

Table 1 summarizes these milestones, the dates and the corresponding deliverables, where the results of each of them have been reported. It is worth highlighting that steps iii and iv were added to the initial plan to reinforce and improve the iteration with final users following the recommendations of the mid-term review as specified in the Improvement Plan.

Table 1. Main milestones achieved for the interaction with end-users in WP2

Steps in the co-creation	Dates/period	TITLE - Outcomes	Reported in
i	Nov 2020	**EARLY CO-DESIGN** Transfer the users needs and requirements into design/implementation specifications (Sectorial Meetings), in collaboration with WP3 and WP4	D2.1
ii	February 2021	**FORCOAST General Assembly User's Day.** Obtain early feedback on the first graphic prototypes (mockups) of the developed services (MS4)	D2.2
iii	December 2021	**FORCOAST Demonstration Day** Obtain feedback on the Use of Platform and services (Interface Design)	D5.2
iv	May – August 2022	**Service/Pilot User Workshops** Obtain detailed feedback on the use/benefits of the services	D2.3
v	October 2022	**End User survey** Final feedback on the Platform and Services (MS5)	D2.3

Finally, it is worth highlighting the interactions with the SAB at different moments including various CCT meetings and participation in the General Assembly, and in the Final Conference, where their experience with relevant FORCOAST stakeholders and advice given was a great value input in different aspects of the project.

For the online interaction with users in the steps ii, iii and iv the 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. Generally, four different types of questions were prepared:

1- Questions about the audience, provenance (country, sector), expertise, and 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.

2- General questions on the platform and services: common to every Service Module (SM) these questions (level of interest in the service and if there is any missing functionality of the service for them). This helped to measure the interest and the potential need for feature improvements 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.

For the interactions with users in steps iii and iv, some of the questions used in step ii were reformulated and reformatted to ensure a more qualitative analysis of the received feedback, following the recommendations of the mid-term review as specified in the Improvement Plan.

For the last interaction with the users through the FORCOAST Final Survey, the open-source tool Google Forms was used to allow for asynchronous feedback collection, as is presented in Section 4.

3 Evaluation of the final services

3.1 Summary of FORCOAST final services

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 data retrieved from the Pilots or Remote Sensing core services.in addition to the access provided through the Central Platform, additional efforts in WP4 have allowed proposing, developing and implenting additional information access solutions, based on the instant messaging Telegram application for mobile devices. For the registered users in Telegram, tailored bulletins are sent to the users with the most key information of the last hours or days in the same bulletin format, which allows obtaining the already produced information portably at any point.

Service Suitable Fishing Areas
(available at pilot: Western Black Sea – Bulgaria)

The presence of areas with high concentrations of fish resources is highly influenced by seasonal variations. In addition, spatial distribution of zones with high fish resources could represent an issue – large distances between fishing areas and collecting centres. The aim of the Fishing Suitability Index developed within this service module is to address these specific stakeholder needs by offering information regarding the localization of optimal conditions for fishing activities in the area of interest (Figure 3). The service provides a forecast map with an index for Fish Suitability for Whiting fish in this case as it is one of the main species of interest. The index has values ranging from 0.1 (less suitable) and 1.0 (best condition). The index is based on values of temperature, salinity, and bathymetry in the area.
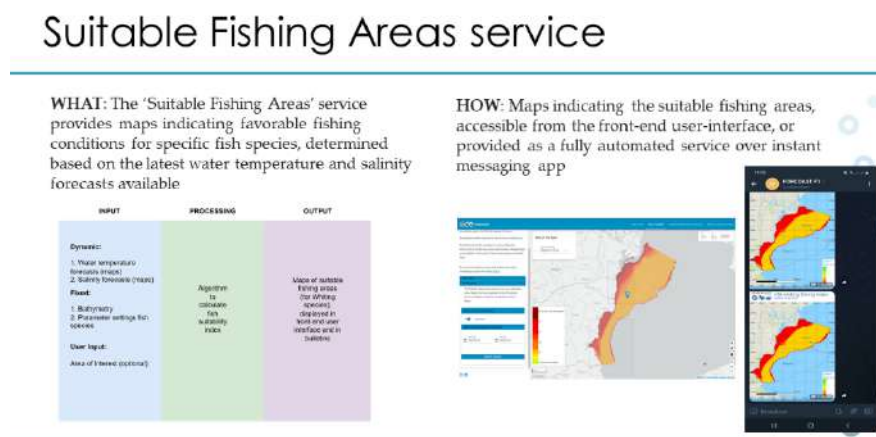

Figure 3. Suitable Fishing areas service highlights

Service Fronts Detection
(available at pilots: Northern Adriatic Sea – Italy, and Bay of Biscay - Spain)

Frontal areas are those where there is a sharp gradient in certain properties of seawater, such as temperature or chlorophyll-a concentration. These areas are characterized by higher-than-normal biological activity, and therefore can be used as an indicator of the presence of certain commercial fish species, helping the user identify potential fishing grounds. This service module allows for

identifying the areas of interest immediately, with the subsequent reduction in the time spent at sea and fueling usage. The service produces a map with an indication of where strong-, weak- or no fronts will be present. The types of fronts that can be forecasted are the temperature and chlorophyll fronts.
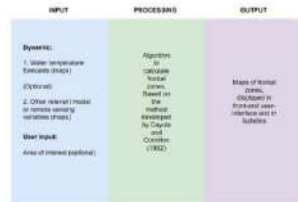

Figure 4. Fronts Detection service highlights

Service Marine Conditions and Scheduler

(available at pilots: Sado Estuary -Portugal and Limfjorden-Denmark)

Ocean state variables such as water level are important factors to consider when planning daily operations. This service offers forecasts of the water level of a selected point of interest along with other environmental conditions for up to 48 hours, starting from the selected date in the present or past. The resulting bulletin will display the water level in relation to working environments like wind, precipitation, and daylight. A working limit can be set, for which the bulletin will provide some additional visual support, enabling faster information extraction. The predictions are based on hourly mean forecast data.

Figure 5. Marine Condition service highlights

Service Land Pollution

(available at pilots: Eforie area - Bulgaria, Northern-Adriatic Sea – Italy, and the Galway Bay – Ireland)

Nearshore farming infrastructures are exposed to land discharges, which in some cases carry harmful substances (e.g. E. coli, pollutants). 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 risk for farming sites to be affected by harmful land discharge. By selecting a pollution source and an area in which the farm is located, the pollution risk of the farm can be forecasted. The bulletin that is generated will provide the user with an animated map of the spread of the pollutants over time and a risk graph and risk indicator, providing information on the risk of the farm being affected by the released pollutants.
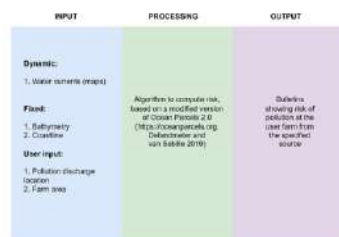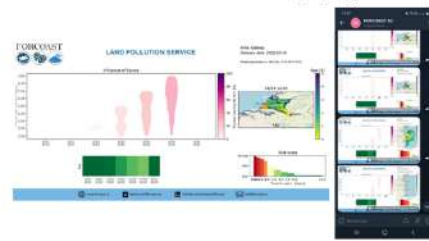

Figure 6. Land Pollution service highlights

Service Site Prospection

(available at pilot: Limfjorden - Denmark)

The purpose of the service module is to identify areas with the highest growth potential and lowest mortality for flat oysters, Ostrea edulis, and thereby increase harvest and restoration potential. Oyster farmers tend to face challenges with high spat mortality and variable growth depending on environmental conditions. The service module can also be applied to other species, e.g., blue mussels, with the user knowledge of the species' characteristics. The output is a map showing an index of the most suitable sites for oyster farmers. The index created for this service is based on the bottom salinity, oxygen content, temperature, chlorophyll concentration and the resuspension of sediments.
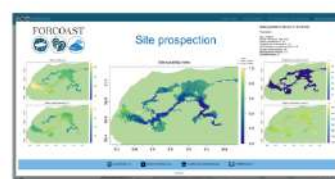

Figure 7. Site Prospection service highlights

Service Spat Capture Assistance

(available at pilot: Southern-North Sea – Belgium)

The service module offers a time window estimate in which spats are likely to arrive at a farming site from different source locations. Based on environmental condition (i.e. sea water temperature) service module detect spawning events, hence the module computes a spawning period and a delay between spawning and spat settlement to assess the period where spat could be collected. The service offers two different methods for calculating the likely arrival time of the spats. The method that can be used by the user is dependent on the data the user has about its farming site and species of interest. Pre-sets are also provided for the farming of mussels and oysters. After the service is run, an information bulletin is generated showing the potential spawning sites of the spats and their respective first- and last arrival times for each location source in the farm location. Lastly, even if the service is mainly applied in Belgium by internal users, with the correct input, the service can be applied and used for most of the North Sea and even the English Channel.

Figure 8. Spat Capture Assistance service highlights

Service Contaminant Source Retrieval

(available at pilots: Southern-North Sea – Belgium, and Galway bay -Ireland)

Contaminants can affect a farming or oysterground location negatively. Therefore, this service provides the means to assess the most likely source location of the identified contaminants that can affect a given area negatively (e.g. by inducing diseases). This service provides a way to backtrack the contaminant to its potential and most likely source locations. To run this service, a location where the contaminants are present, the duration of the backtracking simulation, and the starting time must be given. The service is currently available for the Southern-North Sea and Galway bay. The service output is a bulletin with an animated map following the likely path of the contaminants from the source to its target location. Additional maps are shown visualizing all possible source locations and the locations with the highest contaminant exposure time. The data used currently for this service are provided by Marine Institute and the Royal Belgian Institute of Natural Sciences (RBINS) for Galway Bay and North Sea respectively.
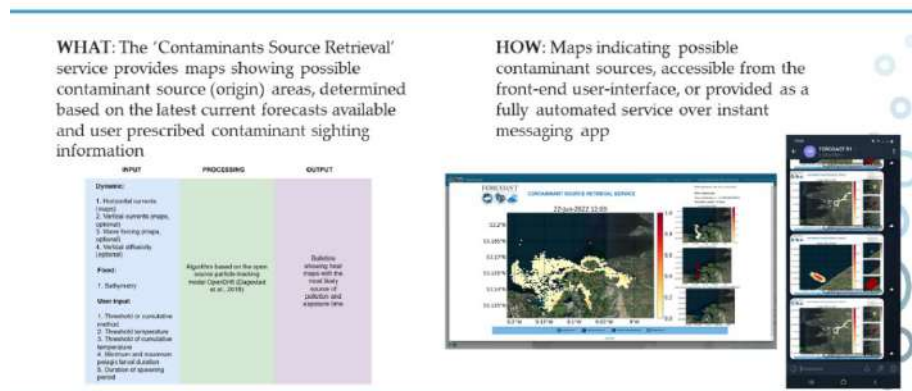
Figure 9. Contaminants Source Retrieval service highlights

3.2 Pilot/service User Workshops

The evaluation of the final services was conducted through the organization of four Pilot/Service Workshops. These services/pilots-oriented workshops provided further opportunities for engaging specific users of each of the developed services. The focus was not on having a high number of users, but rather to join a more manageable number of key stakeholders and ensure valuable feedback and engaged participation during the event. In addition to the gathering of feedback, these workshops were also planned as means to enable a more continuous engagement in time with the users and a way of promoting the final services through a free-trial demonstration of the services, both in their web app version and their derivation into Telegram messages.

- For these meetings, access to the FORCOAST Platform was granted to the users prior to the meeting so they could have the chance to get familiar with the service in the demo version available online, with some instructions from our side.
- During the meeting, we performed a live demo, gave the option to have a live Q&A and discussion part with the users and asked for the details needed to set up scheduled SM runs and a Telegram channel for each of them (coordinates of their working location/farm, thresholds, parameter, etc and phone number with Telegram).
- Users were then granted access to a free trial version of the full service (receive automated bulletins for their conditions).

Four Pilot/Service user workshops were held. The summary of locations and dates is shown in Table 2. Details of each of the workshops and the collected feedback are given in the next subsections.

Table 2. Summary of Services/pilots worhsops locations and dates

PILOT	SECTOR	SERVICE MODULE	DATE	Format
Spain		Fronts Detection	Monday 30th May	In-person
Bulgaria		Suitable Fishing Areas	Monday 27th june	Online
Italy		Fronts Detection + Land Pollution	Friday 24th june	Online
Denmark		Site Prospection + Marine Conditions	Monday 27th june	Online

Fronts detection – Spain WS

During the front detection WS in Spain, both the FORCOAST Project and the Service were presented to an audience of 15 users who visited in person AZTI premises in Pasaia, Spain. Users were also offered the possibility to test the Telegram Application. The main results are summarized in Figure 10. The users were in general satisfied with the Service, with marks between 6.9 and 7.4 and the majority expressed the willingness to subscribe to the Service in its final form. From their comments during the session and in the Mentimeter survey the reasons for low marks were linked to the cost/benefits of the service, and the need of having a longer trial period. Some comments suggested that future improvements could be done by: adding other fronts (linked to winds, we guess this refers to lower scales e.g. Langmuir circulation), adding information on wind intensity (Beaufort Scale); service oriented to different commercial species (tuna, anchovy etc.).
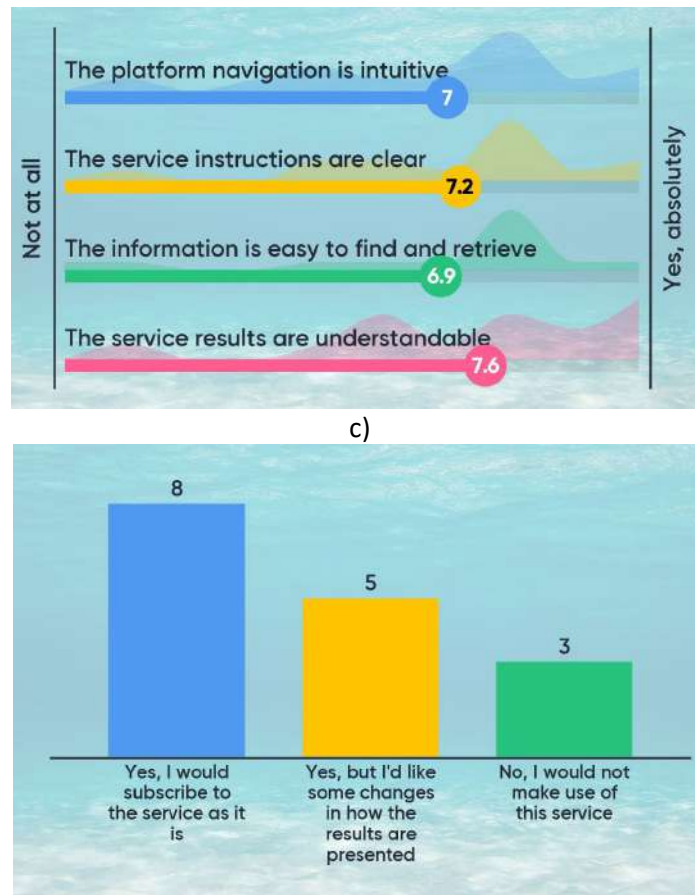
a)

b)

c)
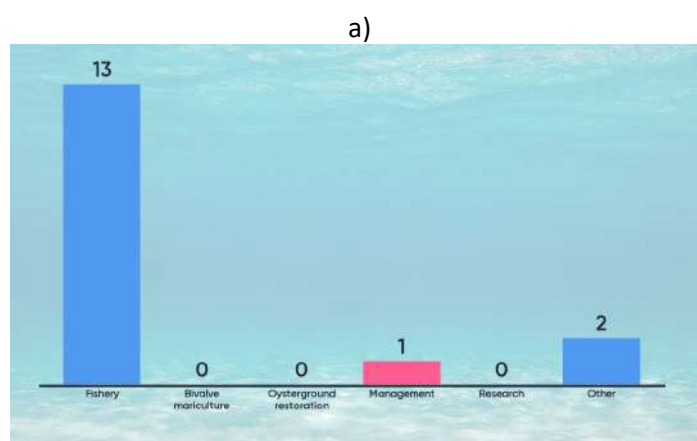
Figure 10. Summary of End user response (total number of responses = 15) to the following questions: a) Please indicate in which sector(s) you perform your activities;b) What is your impression of the use service via the platform of the following aspects?; c) Would you make use of the FOCOAST Fronts Detection service?

Suitable Fishing Areas – Bulgaria WS

The suitable Fishing areas Workshop in Bulgaria was held online, gathering 12 users of different sectors (including fisheries, aquaculture, management and research). Users were presented with the platform and the services and also offered the possibility to test the Telegram Application. The main results are summarized in Figure 11. The users were in general satisfied with the Service, with marks between 8.8 and 9.3 and the majority expressed the willingness to subscribe to the Service in its final form. From their comments during the session and in the Mentimeter survey the users find the service very useful and express their interest in having a longer trial period and the possibility to test it in the field.
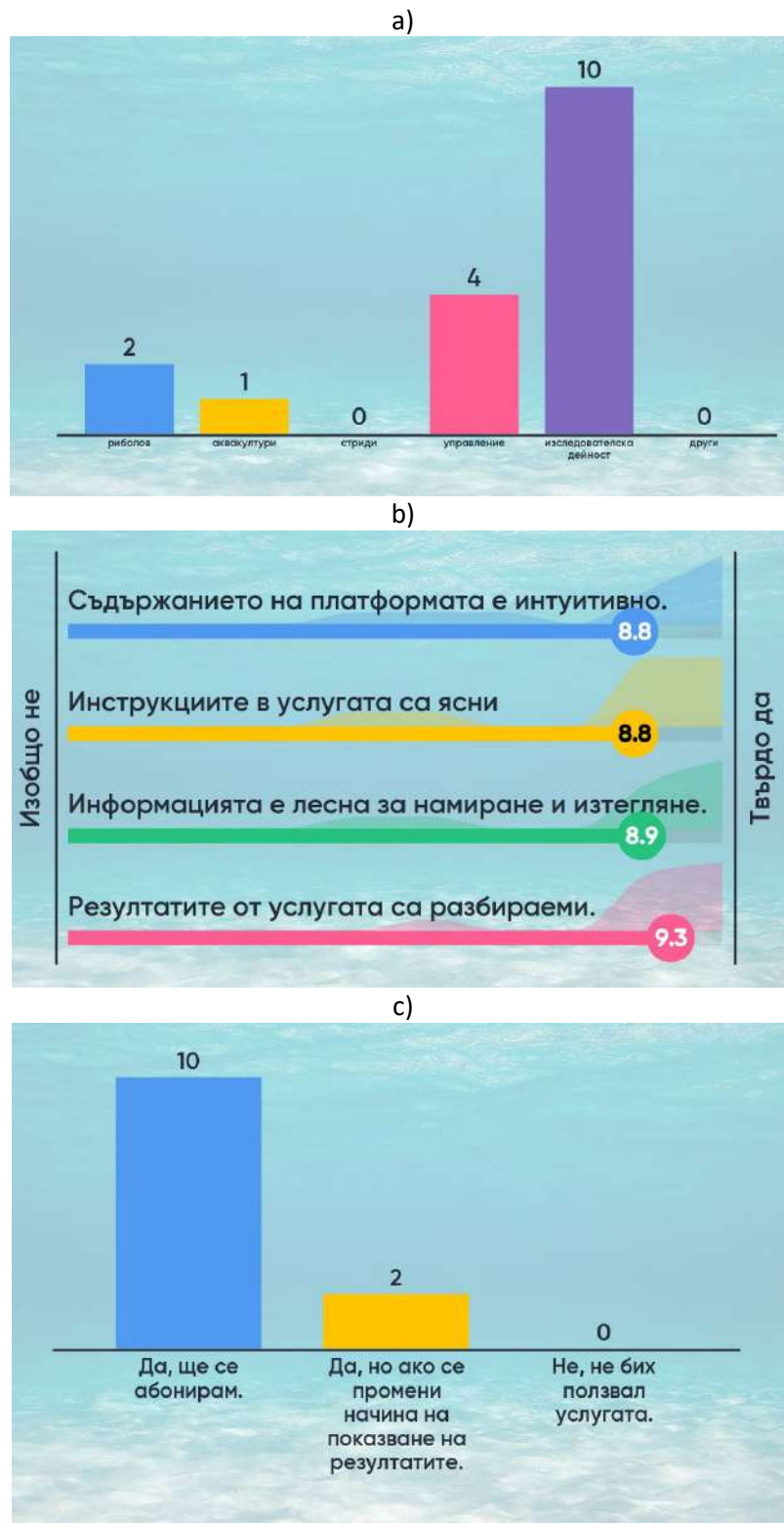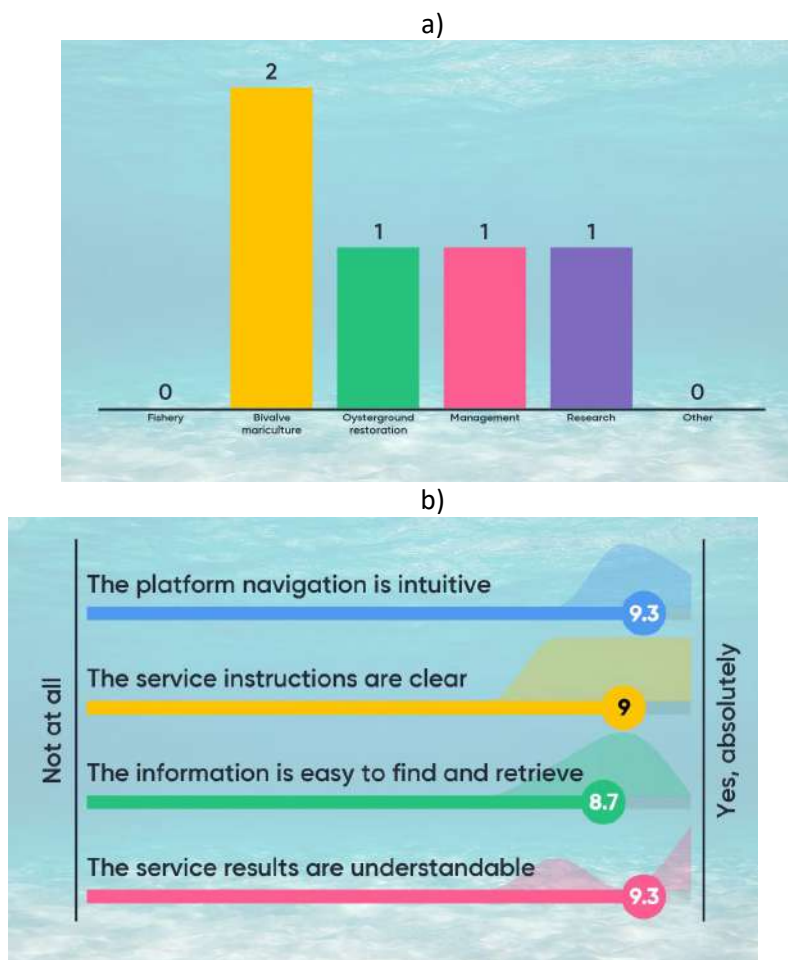
a)

b)

c)

Figure 11. Summary of End user response (total number of responses = 12) to the following questions: a) Please indicate in which sector(s) you perform your activities (translation from left to right: Fhiseries, aquaculture, Oysterground restoration, management, research activity, other) ;b) What is your impression of the use service via the platform of the following aspects? (translation from up to bottom: The platform navigation is intuitive, the service instructions are clear, the information is easy to find and retrieve, the service results are understandable); c) Would you make use of the FOCOAST Fronts Detection service? (translation from left to right Yes, I would subscribe to the service as it is ; Yes, but I'd like some changes in how the results are presented; No, I would not make use of this service)

The platform navigation is intuitive, the service instructions are clear, the information is easy to find and retrieve, and the service results are understandable

Fronts detection and Land Pollution – Italy WS

The Front detection and Land Pollution workshop in Italy was held online, gathering 5 users of different sectors (including aquaculture, oystergroud restoration, management and research). Users were presented with the platform and both services and also offered the possibility to test the Telegram Application. The main results are summarized in Figure 12 and Figure 13. The users were in general satisfied with both Services. In this case, Front detection services obtained marks between 8.7 and 9.3 (Figure 12b), although the service was not initially conceived for the sector of aquaculture ti could be interesting for the detection of river plumes and thus eutrophic or polluted waters. From their comments during the session, the use of the services(both solutions, web and telegram) in real-time would have limitations because of wet hands, not always a reliable connection and also concern very few situations a year (the time of use foreseen is very little, around 5 days/year). Concerning the Land pollution service, marks were very high, between 9 and 10 (Figure 13a) and the two users voting will be interested in the daily use of the service for the operations in its final form. It was suggested that there was somehow an overlap between the two services, pointing to the fact that they could be combined in the future. Also, access to historical data was pointed out as an interesting feature.
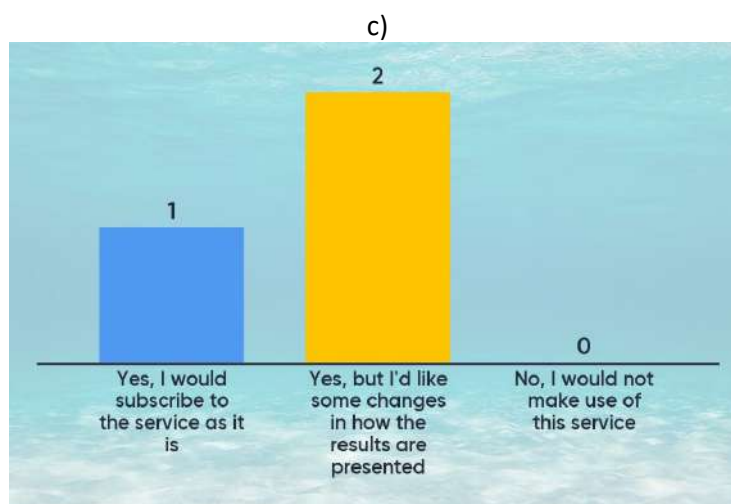
a)

b)

c)

Figure 12. Summary of End user response concerning the Front Detection Service (total number of responses = 5) to the following questions: a) Please indicate in which sector(s) you perform your activities;b) What is your impression of the use service via the platform of the following aspects?; c) Would you make use of the FOCOAST Fronts Detection service?
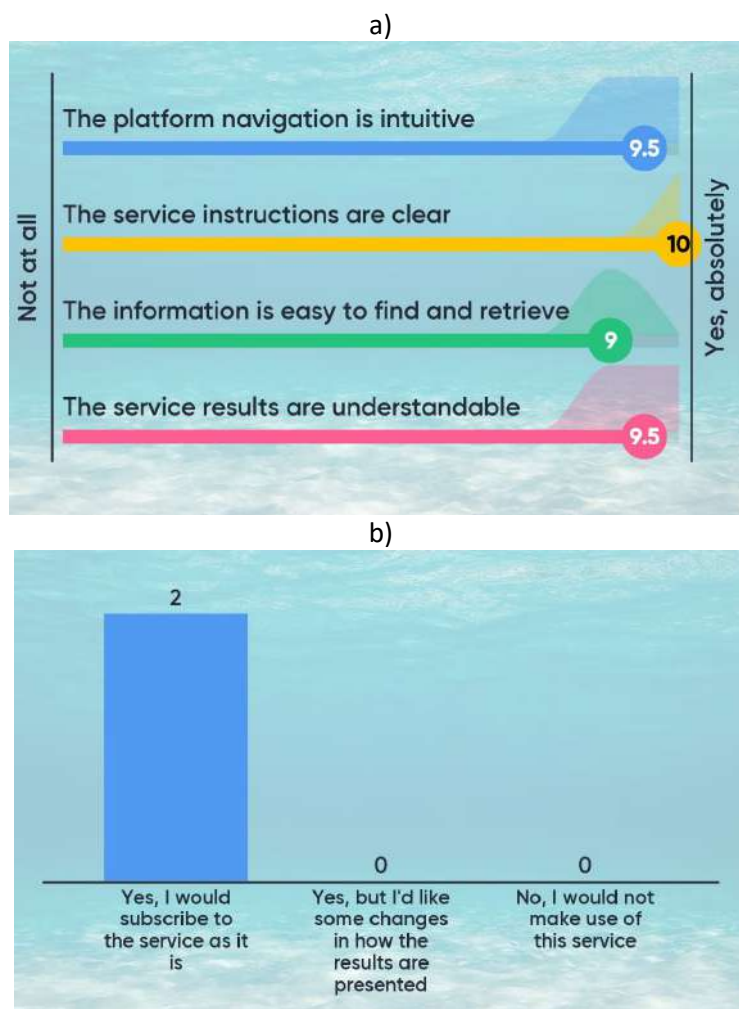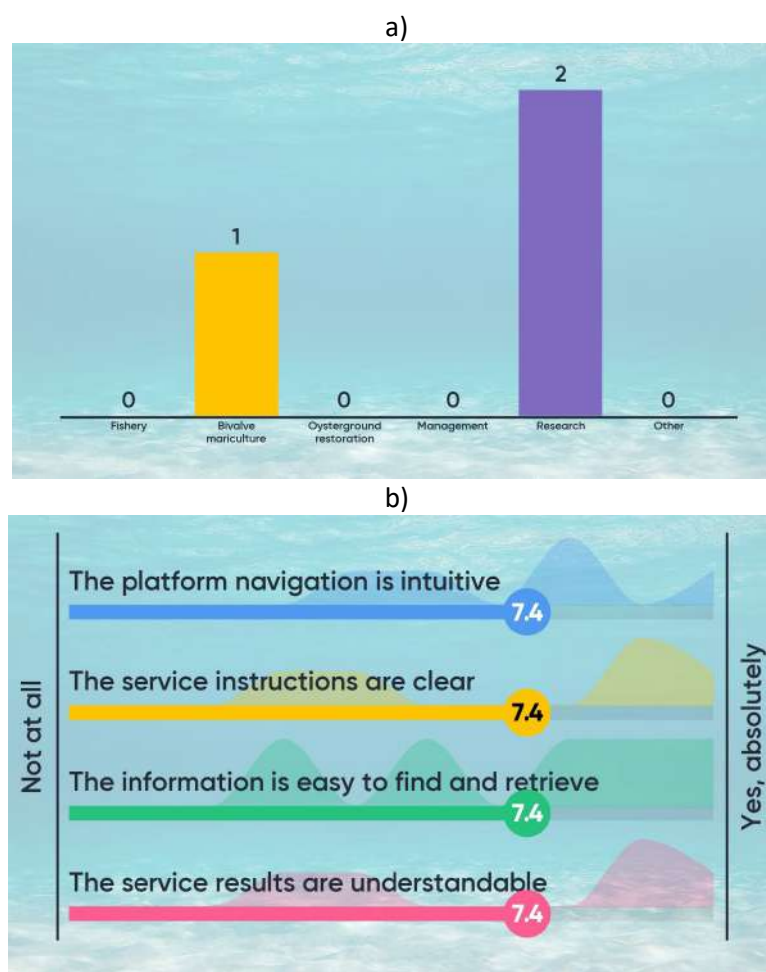
a)

b)

Figure 13. Summary of End user response concerning the Land Pollution Service (total number of responses = 3) to the following questions: a) Please indicate in which sector(s) you perform your activities;b) What is your impression of the use service via the platform of the following aspects?; c) Would you make use of the FORCOAST Fronts Detection service?

Site Prospection and Marine Conditions -Denmark WS

The Site Prospection and Marine Conditions workshop in Denmark was held online, gathering 6 users of the sectors of aquaculture and research. Users were presented with the platform and both services and also offered the possibility to test the Telegram application of the services. The main results are summarized in Figure 14 and Figure 15. The users were in general satisfied with both Services. In this case, Site Prospection service obtained grades of 7.4 in the different aspects related to user satisfaction (Figure 14b), and 2 of five users responding to the second question expressed their interest in using the service in its final form (one of the users stated that they will use the service only after some modification). Concerning the Marine Conditions service marks were obtained between 6.8 and 8 (Figure 15a) and half of the users voting expressed their interest in using the service for their operations in its final form. It was highlighted that the information provided by the service was very valuable and unique and may prove crucial to stabilise production.
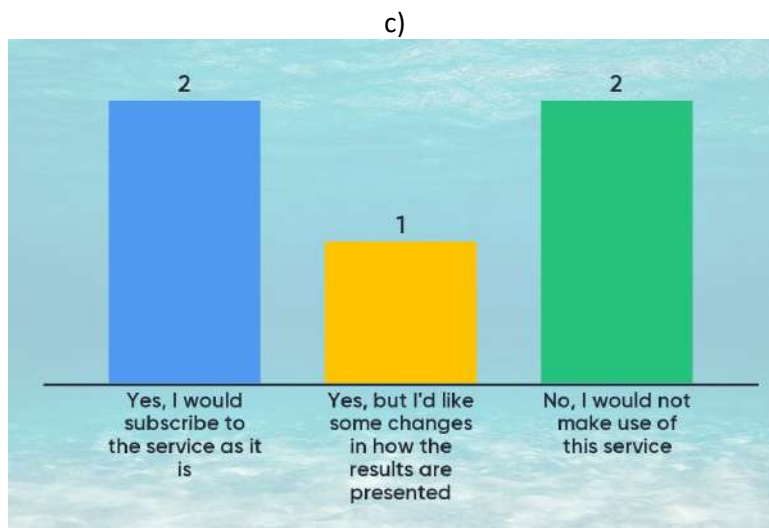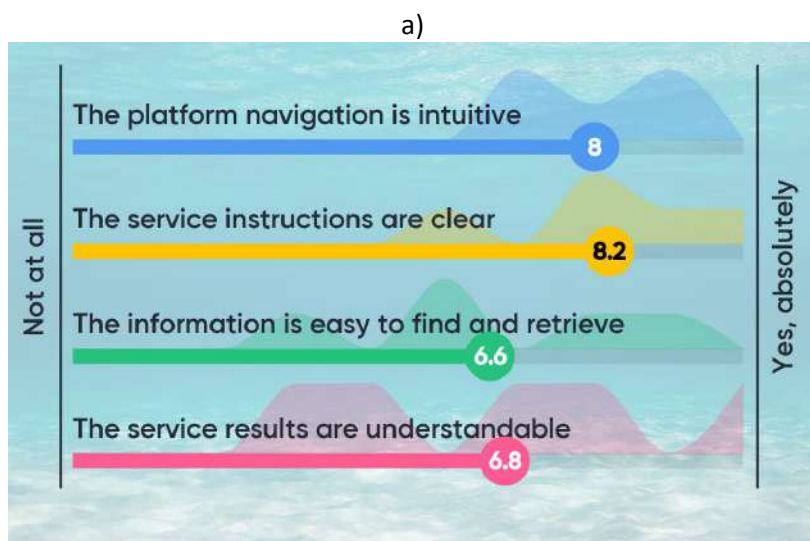
a)

b)

c)

Figure 14. Summary of End user responses for the site Prospection services (total number of responses = 6) to the following questions: a) Please indicate in which sector(s) you perform your activities;b) What is your impression of the use service via the platform of the following aspects?; c) Would you make use of the FOCOAST Fronts Detection service?
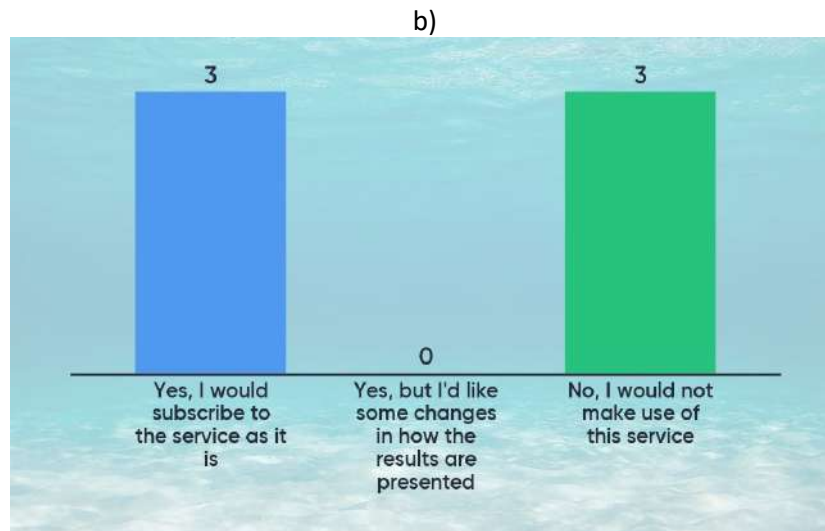
a)

b)

Figure 15. Summary of End user response for the Marine Conditions service (total number of responses = 6) to the following questions: a) Please indicate in which sector(s) you perform your activities;b) What is your impression of the use of service via the platform of the following aspects?; c) Would you make use of the FOCOAST Fronts Detection service?

Telegram solution: an added value

All the users showed interest in the Telegram solution, and considered the use of Telegram would add value to their experience with the services (Figure 16). However, the Telegram solution was best evaluated by the fisheries sector and showed much less value for the Site Prospection and Fronts applied to Oyster restoration and aquaculture.
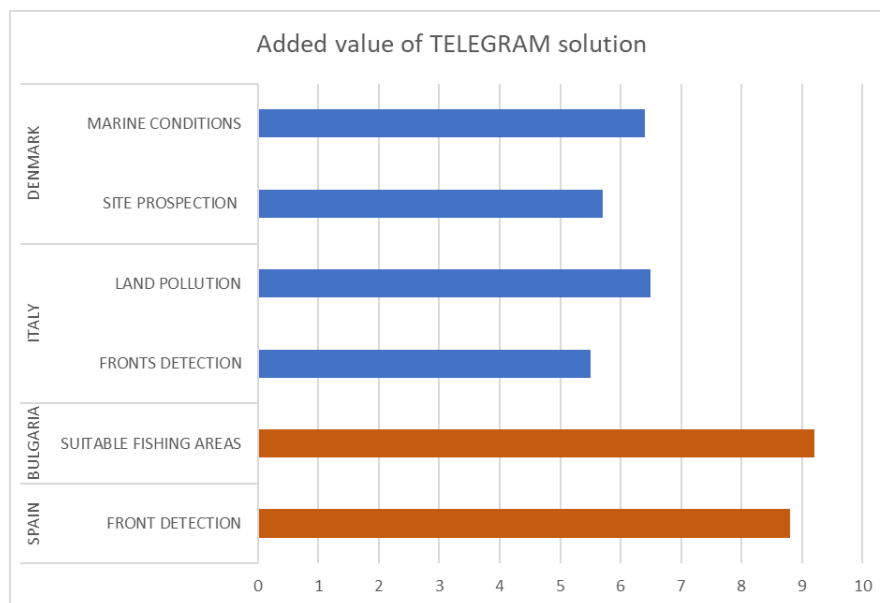

Figure 16. Overall evaluation of the added value of the Telegram solution by Pilot and Servcice

3.3 Main Outcomes of the Pilot/Service user Workshops

Although the nature of the Pilot/services Workshops prevented obtaining a quantitative evaluation of the services due to the low (and varying) number of users engaged in the events, they provide a unique

opportunity for the detailed exchange of impressions with the end-users and the promotion of the services through a live demonstration.

In general, the users were satisfied with the proposed services and assigned marks from 6.6 to 10 points for the different aspects of the services, from the navigation through the platform, and the understandability of instructions, to the usefulness of the information provided and outputs of the service.

Most of the users expressed the usefulness on their daily operations, within the limitations enforced by the nature of their fieldwork and saw an added value to the solution based on tailored Telegram bulletins

Among the suggestions for improvement to highlight it can be found:

-The possible combination of some services in a unique solution.

-The need for larger trial periods for a better evaluation of benefits.

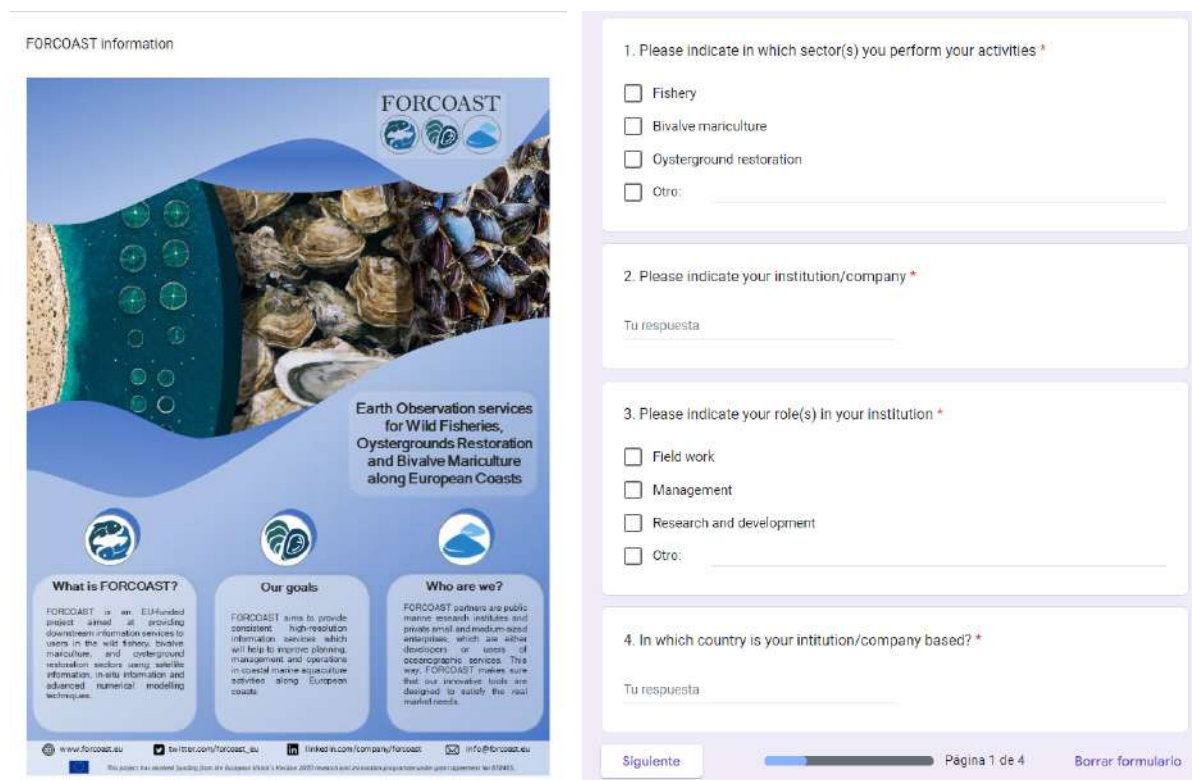-The addition of information and more granularity for some of the services.

4 End User Survey

4.1 Structure of the survey

The final survey was elaborated in the form of a Google Form for asynchronous participation, with a list of simple questions, focused to:

- i- Intro section containing a Leaflted of FORCOAST Platform and services and the link to the website of the project and the Services Catalogue. In addition, a special call was made to engage users in the TELEGRAM solution.
- ii- User identification
- iii- Final Service evaluation
- iv- Measure overall satisfaction and engagement in future developments

The contents of the survey are showcased in Figure 17, Figure 18 and Figure 19. The survey was launched on October 19th and the compilation of responses is ongoing. We consider that the Final Survey should be left open to gather final users' feedback beyond the end of the FORCOAST grant and used as a tool for measuring the popularity of the service and proposed solutions with time.

Figure 17. Snapshot of Final Survey Introduction and User identification sections

FORCOAST services - User survey

annarubio1504@gmail.com Cambiar de cuenta

*Obligatorio

Service Usage

5. Have you tested any of the FORCOAST services? *

○ Yes

○ No. Please check https://forcoast.netlify.app/ before continuing

Atrás   Siguiente   Página 2 de 4 Borrar formulario

Service Evaluation

6. Which of FORCOAST's services have you tested? *

○ Marine Conditions

○ Land Pollution

○ Site Prospection

○ Assistence for Spat Capture

○ Suitable Fishing Areas

○ Fronts Detection

○ Contaminants Source Retrieval

7. How did you test this service? *

☐ Via the web-application platform (free, link in description)

☐ Via Telegram (premium)

8. Please rate the following aspects of the information obtained from the selected service.

The information is clearly presented: *

	1	2	3	4	5	6	7	8	9	10	
Not at all	○	○	○	○	○	○	○	○	○	○	Yes, absolutely

The information is accurate enough: *

	1	2	3	4	5	6	7	8	9	10	
Not at all	○	○	○	○	○	○	○	○	○	○	Yes, absolutely

The information is useful/needed for my operations: *

	1	2	3	4	5	6	7	8	9	10	
Not at all	○	○	○	○	○	○	○	○	○	○	Yes, absolutely

The interaction with the services through the platform or Telegram are suited to my needs: *

	1	2	3	4	5	6	7	8	9	10	
Not at all	○	○	○	○	○	○	○	○	○	○	Yes, absolutely

9. Would you be interested in having a training on how to use the platform and services? *

○ Yes

○ No

Atrás   Siguiente   Página 3 de 4 Borrar formulario

Figure 18. Snapshot of Final Survey Final Service evaluation section

Figure 19. Snapshot of Overall satisfaction and engagement section

4.2 Target audience and dissemination

The target audience for the dissemination of the Final Survey was the list of End-Users participating in the different co-design events throughout the development period of the FORCOAST project.

The final survey has been disseminated to more than 50 people by email. A second email was addressed to Pilots and Service leaders to complete the dissemination among other potential users active in their pilots that may not be on the first list.

In addition to that, the survey was published in the FORCOAST web page News and Events section and further disseminated through social media. The survey dissemination to not targeted users is twofold: to advertise the end of the project and its results, and to engage new users and users from new sectors.

https://forcoast.eu/news-events/

https://twitter.com/forcoast_eu/status/1582737964341526530

Our recommendation and way forward are to leave the survey open for at least two years from the end of the project, while including its link on the website and the platform prototype.

5 Conclusions, recommendations and follow-up actions

Users are at the core of the FORCOAST services co-creation process. The project has aimed to set up useful services with market potential. In that perspective, WP2's main objective has been 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 five milestones:

I- The elaboration of a **first list of users' needs and requirements (November 2019- April 2020**)

II- A series of **sectoral meetings & exchanges with internal users (November 2020)**

III - The **FORCOAST General Assembly User's Day** (Feb 2021)

IV -The interaction with users in the **Pilot/Services workshops** to gather the final feedback on the developed Services (May-August 2022)

V- The **launch of the end-users final survey** (October 2022)

This deliverable collects the outputs of the Pilot/Services Workshops which provided a unique opportunity for the detailed exchange of impressions with a reduced number of end-users and the promotion of the services through a live demonstration. In general, the users were satisfied with the proposed services and confirmed the fit-per-purpose and the usefulness of their daily operations, within the limitations enforced by the nature of their fieldwork. Most of the users saw an added value in the solution based on tailored Telegram bulletins and suggested several ways for improvement, to be considered in future development.

The last step in the end-user interaction was the launch of the Final Survey among the list of End-Users participating in the different co-design events throughout the development period of the FORCOAST project. In addition to that, the final survey has been published in the Forcoast web page News and Events section and through social media with the aim to advertise the end of the project and its results, and to engage new users and users from new sectors.

We believe the survey should be left open for at least two years from the end of the project and used as a tool for measuring the popularity of the service and proposed solutions with time.

Annex 1- Workshop presentations
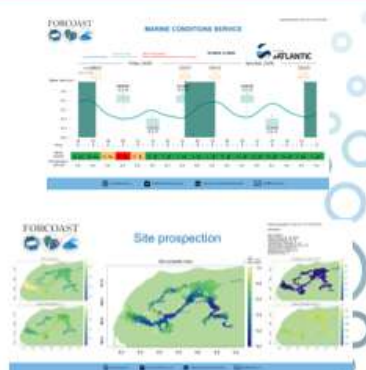
General introduction adapted to each workshop

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 870465.

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FORCOAST Services

Service	Areas
Suitable Fishing Areas	Western Black Sea
Fronts Detection	Bay of Biscay, Northern Adriatic Sea
Marine Conditions	Sado Estuary, Limfjord
Land Pollution	Northern Adriatic Sea, Western Black Sea, Galway Bay
Site Prospection	Limfjord
Spat Capture Assistance	Southern North Sea
Contaminants Source Retrieval	Galway Bay, Southern North Sea

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FORCOAST

Thank You

Luis Rodriguez Galvez

Deltares

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Fronts detection – Spain WS

FORCOAST

FORCOAST – Earth Observation services for wild fisheries, oysterground restoration and bivalve mariculture along European coasts
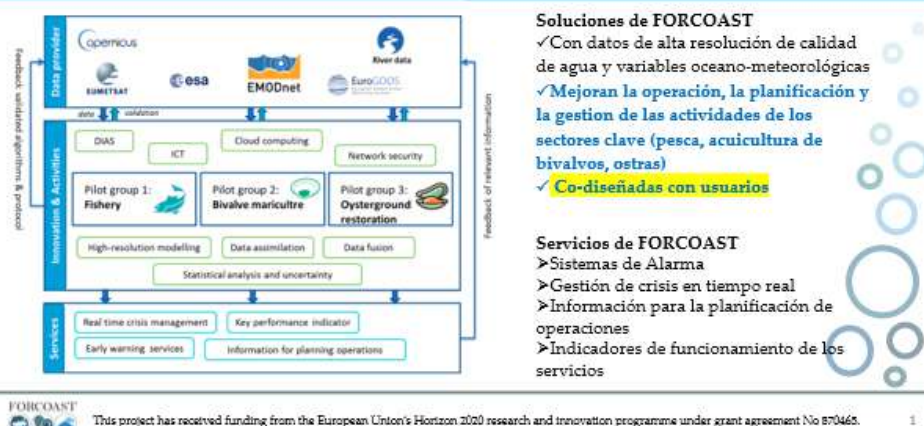
Resumen y objetivos del proyecto

Anna Rubio, Ainhoa Caballero & FORCOAST team

Deltares
Enabling Delta Life

AZTi
MEMBER OF
BASQUE RESEARCH
& TECHNOLOGY ALLIANCE

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 870465.

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FORCOAST Cadena de Servicops

Soluciones de FORCOAST
✓Con datos de alta resolución de calidad de agua y variables oceano-meteorológicas
✓**Mejoran la operación, la planificación y la gestion de las actividades de los sectores clave (pesca, acuicultura de bivalvos, ostras)**
✓ **Co-diseñadas con usuarios**

Servicios de FORCOAST
➤Sistemas de Alarma
➤Gestión de crisis en tiempo real
➤Información para la planificación de operaciones
➤Indicadores de funcionamiento de los servicios

FORCOAST This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 870465. 1
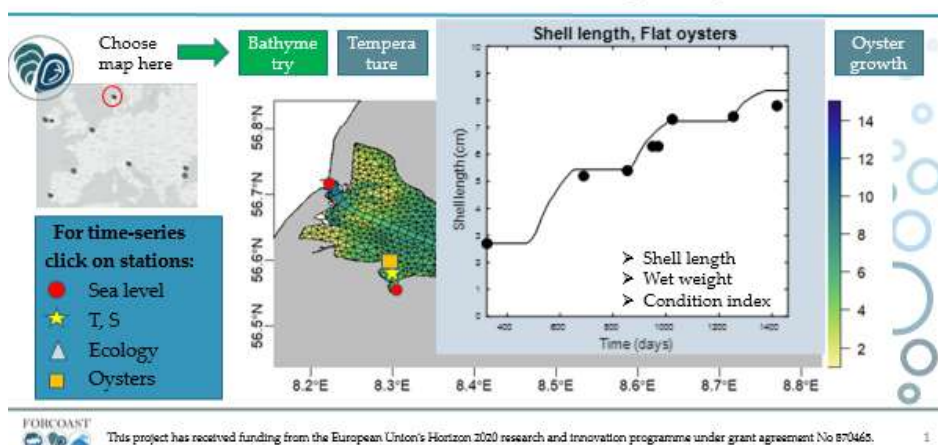
Servicios de FORCOAST

➤ Planificar las operaciones de los días siguientes
➤ ¿Cuándo ir a recoger los mejillones de las bateas? ¿Cómo asegurar menores pérdidas ante malas condiciones?

➤ Asegurar /monitorizar las disponibilidad de comida , los índices de crecimiento
➤ Planificar nuevas instalaciones

➤Hábitat de especies clave ¿dónde centrar los esfuerzos?
➤Condiciones para la pesca ¿cuándo salir a pescar?

FORCOAST This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 870465. 1

Servicios de FORCOAST – ejemplos I
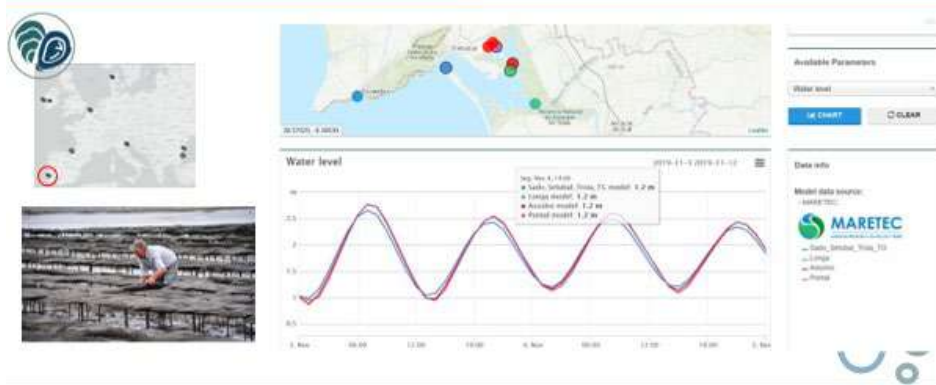
FORCOAST This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 870465. 1
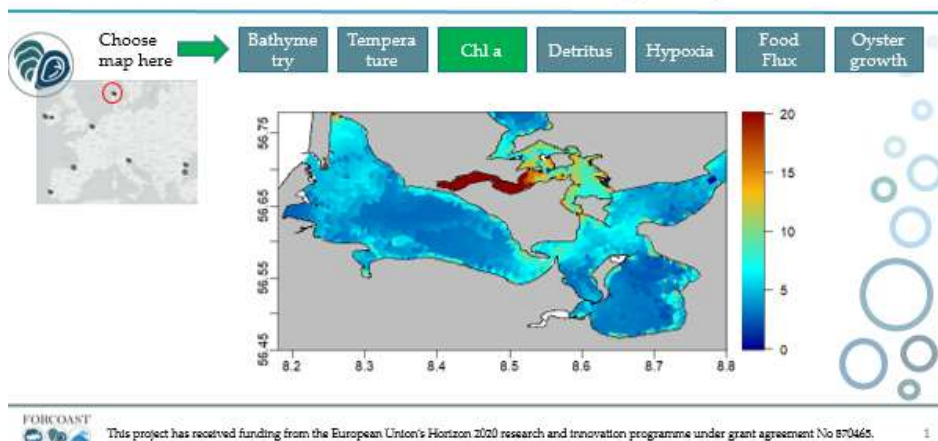
Servicios de FORCOAST – ejemplos I
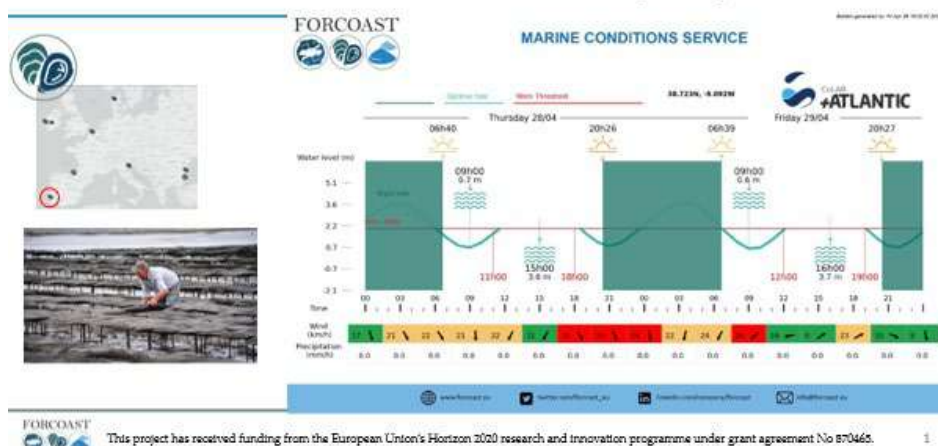
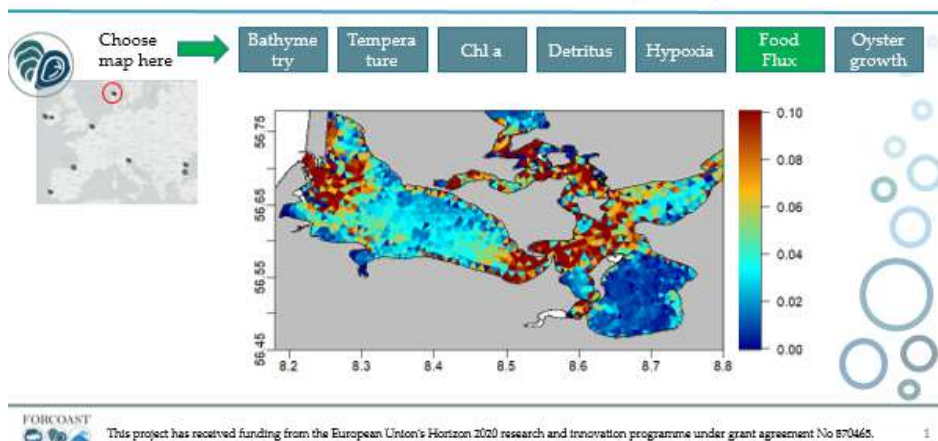## Servicios de FORCOAST - ejemplos II
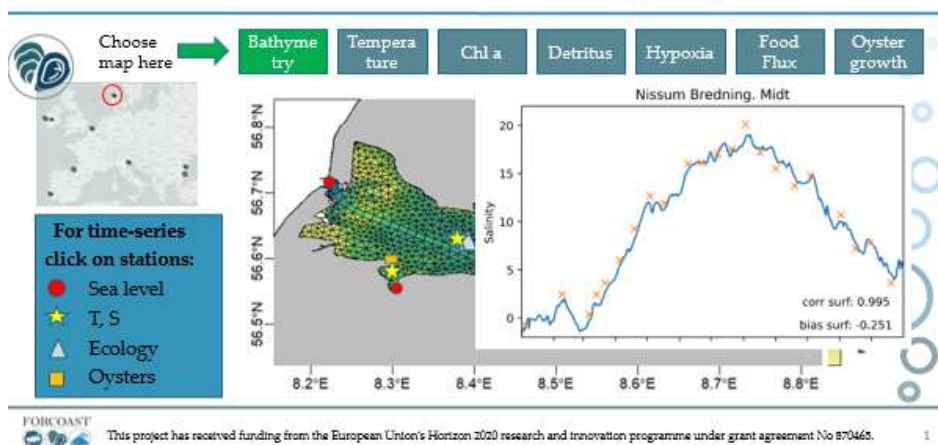
Servicios de FORCOAST - ejemplos II

Servicios de FORCOAST - ejemplos II

Servicios de FORCOAST - ejemplos II

FORCOAST co-diseño de servicios

Impactos esperados

- Beneficios esperados para los usuarios
  - Recibir información de calidad
  - Accesos a datos integrados
  - Recibir productos de datos en forma de reports diarios, alarmas, alertas

- Impactos de los Servicios de FORCOAST
  - ✓Mejorar la vida de los usuarios
  - ✓Hacer que la información que existe sea mucho más disponible
  - ✓Disminuir costes
  - ✓Ofrecer servicios sostenibles

FORCOAST

¡Gracias!

FORCOAST

Servicios de observación de la Tierra para la pesca, restauración de criaderos de ostras y maricultura de bivalvos en las costas europeas

Piloto 2: Sureste del golfo de Bizkaia
Servicio de detección de frentes

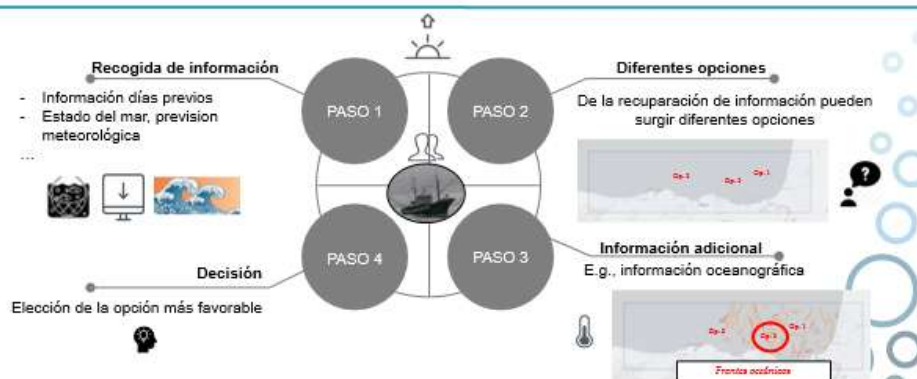Presentación para el IES Naútico
Pesquero Blas de Lezo

Presentación del Piloto 2

Zona de estudio: SE del golfo de Bizkaia, principalmente.
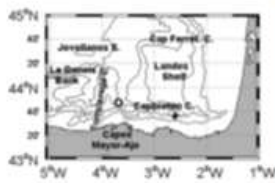
Objetivo: proveer de información oceanográfica de apoyo a una pesca más eficiente (una fuente más de información sobre las condiciones del océano para reducir el tiempo en el mar y la distancia recorrida).

Planificación ruta

Recogida de información
- Información días previos
- Estado del mar, prevision meteorológica
...

PASO 1 PASO 2

Diferentes opciones
De la recuparación de información pueden surgir diferentes opciones

PASO 4 PASO 3

Información adicional
E.g., información oceanográfica

Decisión
Elección de la opción más favorable

Frentes oceánicos

Diferentes fuentes de datos utilizados
2. Imágenes de satélite

Satélite Modis-ESA

Programa europeo de observación de la tierra Copernicus
- Imágenes de temperatura superficial del mar.
- Imágenes de concentración de clorofila en la superficie del mar.
- Imágenes diarias, sin prevision.
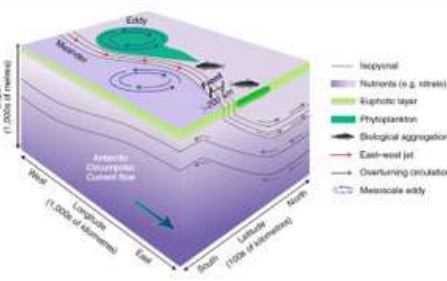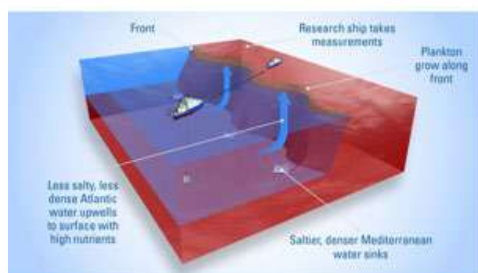- Resolución espacial: 4 km.
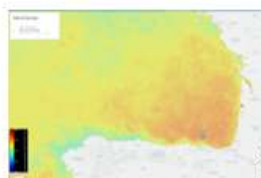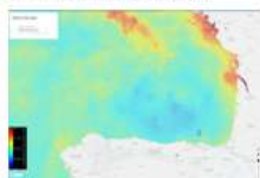
Importancia de los frentes oceánicos

- En estas zonas tienen lugar importantes intercambios océano-atmósfera.

- Por tanto, tienen una fuerte influencia en el sistema climático, biológico y ecológico.

- Se producen procesos de mezcla y/o afloramientos de aguas profundas ricas en nutrientes que dan lugar a crecimientos locales de fitoplancton.

- Este crecimiento de fitoplancton atrae a otras especies a las zonas frontales.

- Pueden actuar como frontales, actuando como fronteras en la distribución de organismos pelágicos. Pueden actuar como fronteras en zonas biogeográficas (distribución geográfica de especies).

Importancia de los frentes oceánicos

https://www.whoi.edu/oceanus/feature/forecasting-where-ocean-life-thrives/. (Eric S. Taylor, Tim Silva, Jack Cook, WHOI Creative Studio)

Chapman et al., 2020 (Nature) https://dot.org/10.1038/s41558-020-0705-4

APP WEB

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 870465.

31
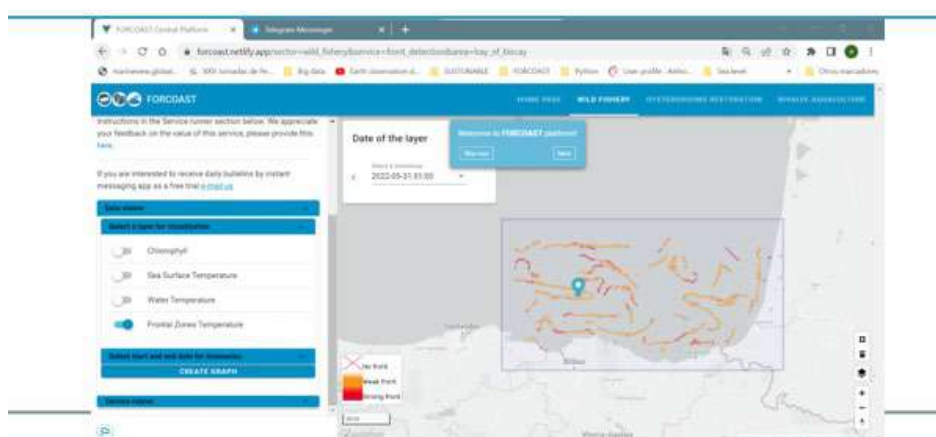
TELEGRAM

- Envío de gifs cada día u hora
- Frentes en la zona deseada

Suitable Fishing Areas – Bulgaria WS

FORCOAST

TERRASIGNA

Работна среща –
Идентифициране на подходящи райони за риболов
27 юни 2022, 15.30 ч., online

User Workshop –
Identifying the Suitable Fishing Areas
27 June 2022, 15.30h EET, online

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 870465.

FORCOAST AT A GLANCE

- FORCOAST is EU-funded project that aims to offer information services co-designed with stakeholders, in support of wild fisheries, bivalve mariculture, and oysterground restoration sectors.

- FORCOAST is developing, testing and demonstrating, in operational mode, novel Copernicus-based downstream information services that will incorporate Copernicus Marine, Land and Climate Services Products, local monitoring data and advanced modelling in the service.

- FORCOAST Coordinator: Deltares, Netherlands

21 partners from The Netherlands, Belgium, Denmark, Ireland, Portugal, Spain, Italy, Romania and Bulgaria.

FORCOAST
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 870465.
2

THE PARTNERS IN FORCOAST

- The partnership is between 6 SMEs, 3 academic institutions and 11 research organizations.
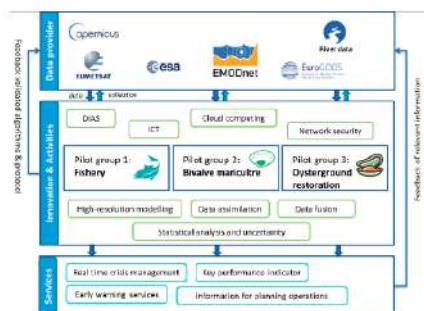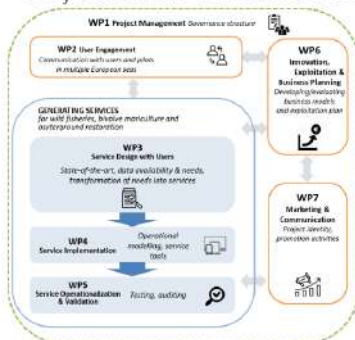
WORK PACKAGES AND GENERAL CONCEPT

Project start: November 2019   Project end: October 2022

PILOT STUDIES - 8 sites in the European seas

- Pilot 1: Sado Estuary (Atlantic), Portugal
- Pilot 2: Bay of Biscay (Atlantic), Spain
- **Pilot 3: Black Sea, Bulgaria**
- Pilot 4: North Sea, Belgium
- Pilot 5: Galway Bay (Atlantic), Ireland
- Pilot 6: Baltic-North Sea Transition, Denmark
- Pilot 7: Black Sea, Romania
- Pilot 8: Northern Adriatic Sea, Italy

BLACK SEA ACTIVITIES IN FORCOAST

Pilot 3: Wild fishery in the Black Sea

- The pilot study considers the Black Sea with a focus on north-western part. Two partners will work in collaboration: Sofia University and Terrasigna.
- The pilot case will emerge as a downstream service, based on EO data information regarding key oceanographic variables. A service will be developed, to be used to identify the most favorable fishing zones.
- Target audience - fishery: multiple categories of users, from individual fishermen, to mid-size and industrial fishing companies in Bulgaria and Romania.

IDENTIFIED GAPS RELATED TO FISHERY

- At present there is lack of operational activities addressing fisheries activities in the Black Sea region, based on Earth Observation data. The SkyFISH platform is a starting point to become operational in 2020.
- Sparse in-situ data collection makes validation activities difficult
- End-users do not have access to the appropriate technology required to receive the information in a timely manner.
- Need for new dissemination methods

Implementations in Pilot 3

- Provide a demonstration service with multi-scale integrated information for the western Black Sea related to fishery.
- Ensure an integration of EO data and products that are made available via the Copernicus services.
- Develop added value products based on EO data (satellite derived, modelled, in-situ) for fisheries sectors in the western Black Sea region: algal blooms, extreme waves, upwelling events / temperature changes.
- Setup an interface to the dissemination geo-portals, based on open standards for visualization and analysis of spatial information.
- Seek a dialog with end-users and stakeholders in the western Black Sea at national and trans-national level facing the demands of the pilot case end-users related to fishery.

Service Module - Suitable Fishing Area

Implementation of a service in support of wild fishery which covers the EEZ zone of Bulgaria and Romania. It consists of three major components:

- layer with the Fish Suitability Index, based on the biogeochemistry products coming from CMEMS
- layer with waves with fine resolution coming from a nested wave model for the Western Black Sea
- layer with information on the upwelling events in the region of interest, based on the products coming from CMEMS

Habitat Suitability Index -Whiting

Context

Issue: **Fish stocks decreasing trend** and offshore general migration of the remaining ones can trigger **longer search times** and, therefore, **increased costs**.

Challenges of the declining fishing sector in the Black Sea:

- The presence of areas with high concentrations of fish is seasonal;
- The large distances between zones with high fish resources and collecting centers;
- The outdated technology.

Proposed **solution** for improvement of search times: development of a **Habitat Suitability Index (HSI)** that can map the probabilities to find a particular fish species over the continental shelf, in specific days.

The HIS can be used as a **decision support tool** for finding the most favorable fishing zones.

The probability distribution model was calibrated using in-situ data (records concerning fish catches during scientific cruises).
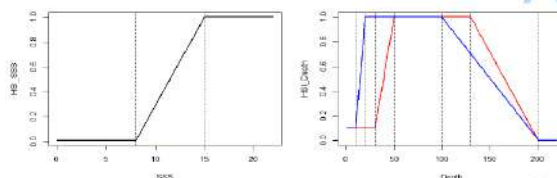
Whiting Habitat Suitability Index (HSI)

- **Whiting (Merlangius merlangus euxinus)** - important fish species, from economical point of view, in the western Black Sea basin;

- **Optimal conditions** were identified based on literature references and local experts;

- A **Suitability Index** was determined for **each parameter** (with values ranging from 0.1 – less suitable to 1 – best conditions).

Source: wikipedia.org

Whiting Habitat Suitability Index (HSI)

- **Measured Fishing Efficiency (MFE):**

$$MFE=C/D/T$$

  - Where:
    - C=Catch (Kg)
    - D=Distance (Km)
    - T=Time (hours)

- Matchup with satellite-derived products:
  - **SST** - SST_BS_SST_L4_NRT_OBSERVATIONS_010_006
  - **SSS** - BLKSEA_REANALYSIS_PHYS_007_004
  - **Bathymetry** - EMODnet Digital Terrain Model (DTM)

Different seasonal conditions
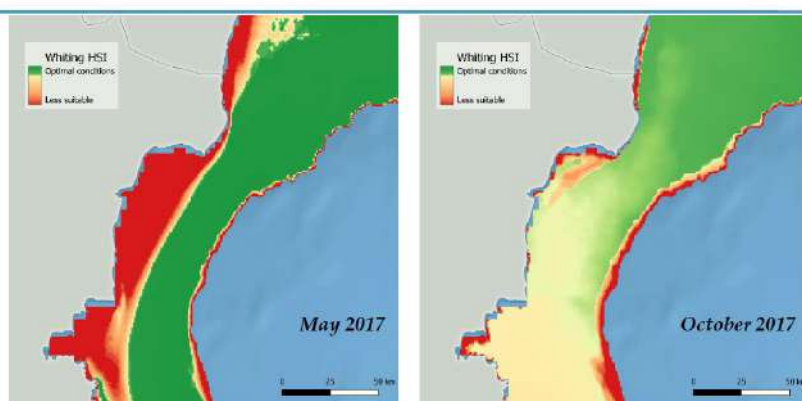
May 2017

October 2017

36

Daily dynamics

Lat: 42.52 / Long:27.99
(in front of Golf of
Burgas)

Whiting HSI

Water temperature

15 May 2022   22 May 2022   29 May 2022   05 Jun 2022   12 Jun 2022   19 Jun 2022
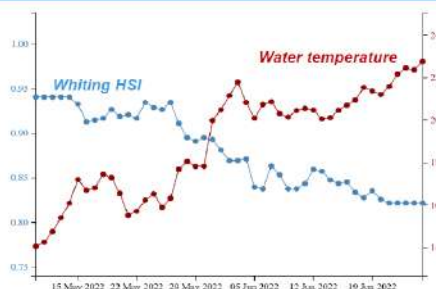
Take home messages:

- Habitat Suitability Indices can be a useful tools for fishing campaigns preparation.
- Distribution models can be developed for other species as well. Catch data are required in order to calibrate such models.

Fine spatial resolution wave modelling

Nested Wave Model

- Impacts on the coastal environment, operation and maintenance

- Long-term wave statistics for the Black Sea are critical for operation and planning

- High-resolution wave models can help improve the downscaling of general sea state forecasts, locate hotspots of different wave height properties

- Applications of wave information can further include information for environmental assessment and planning

Nested Wave Model
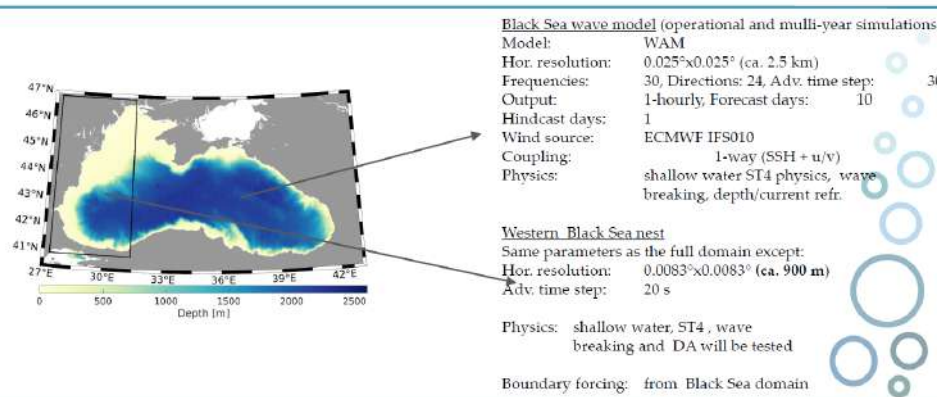

Validations
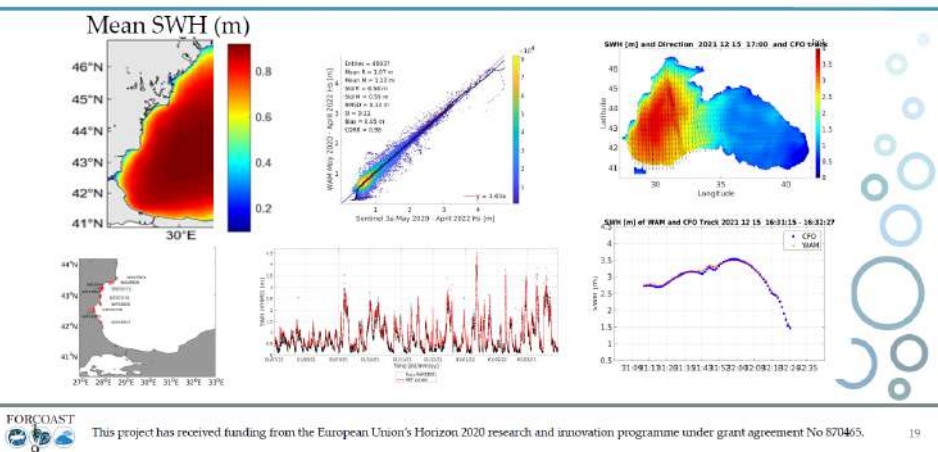
Identification of upwelling zones

Upwelling events
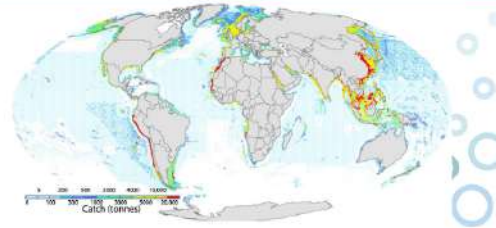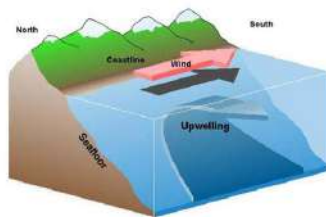
- The upward movement of the deep cold water is called upwelling.
- The deeper water that rises to the surface during upwelling is rich in nutrients. These nutrients "fertilize" surface waters, encouraging the growth of plant life, including phytoplankton.
- These phytoplankton serve as the ultimate energy base in the ocean for large animal populations higher in the food chain, providing food for fish, marine mammals, seabirds, and other critters.

Mapping the upwelling events- example
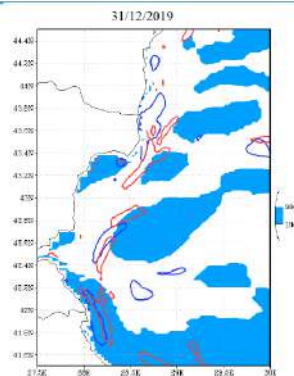
- Blue contour denotes the area with a drop in the SST more than 0.5 deg/day;
- Red contours indicate zones with cyclonic circulation of the surface current more than 2.10^{-5} 1/s, this leads to upward motion;
- Light blue shades are the area where the integral water transport is offshore, with a western component, which leads to upward motion also.

!Where the three areas coincide should be a good possibility to find the upwelling.

FORCOAST

Нека проследим демонстрацията. Now let us see the demo.

Благодаря за вниманието! Thank You!

elfa@phys.uni-sofia.bg

joanna.staneva@hereon.de

sorin.constantin@terrasigna.com