HiSea Deliverable 2.2

Interim Report 1 on the Users Feedback

Work Package Number: 2

Work Package Title: User Engagement

HISEA Project Information	
Project full title	High Resolution Copernicus-Based Information Services at Sea for Ports and Aquaculture
Project acronym	HiSea
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Deliverable Information	
Work package number	2
Work package title	User Engagement
Deliverable number	2.2
Deliverable title	Report I on the user's feedback
Description	The task will gather feedback from users and analysis and identify points and ways forward in the process and possible adjustment. The task will be carried out throughout the whole project in iterative way to ensure that the user's community requirements are met at all stages of the project and to facilitate the uptake of their needs and requirements in the process, to confirm their uptake in the on-going improvement of the services and its usefulness and value to the users themselves. The users' opinion is of prime importance to adjust the way the services are being provided and getting wider acceptance. This deliverable will be the second report of four deliverables in total.
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Lead Author(s)	Nikos Katribouzas, Julie Maguire and Mark Tanner
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1. Executive Summary

The HiSea project is developing a set of services focused on different coastal users' needs based on feedback from various end-users and stakeholders within and beyond the consortium. This deliverable D2.2: Interim report I on user's feedback, refers to the outputs of work done in Task 2.2: End-user's feedback analysis, and is the follow-on to WP2's first deliverable 2.1.

The Stakeholder Advisory Board's role is to advise the consortium regarding service design and the development and operation of the information systems highlighting information and user requirements necessary for the specifically focused maritime sectors. 2019 has proven to be a challenge to keep a continuous communication flow with users, especially during the Covid19-pandemic situation. The HiSea team has continued to work on the user communication flow to gather feedback and provide the partners with user information and proceed with the platform and fine-tuning developments. Such feedback has contributed to the fine-tuning of functionalities, design features and further definitions on the end product's business cases.

This deliverable summarises explicitly the output of the two Hisea Users' Webinars which were held to:
1. gather new feedback on port and aquaculture-user's activities, interests, data and information needs;
2. updating and informing new users about the HiSea service capacities and potential benefits for their activities;
3. establishing relationship with new users; and
4. demonstrating the HiSea platform's advancements.

The initial Workshop user demonstrations I (MS6) was planned as a physical workshop to be hosted at the Port Authority of Valencia's facilities on the 4th and 5th of March 2020. The new scenarios caused by COVID-19 had an important impact on this as it was no longer an option due to lock-down and for safety reasons. Physical meetings prove to be more efficient to obtain feedback and user opinions, especially after the lessons learned from and during MS5. The physical workshop was eventually substituted by an online webinar carried out on the 4th of June 2020, and which only focused on ports. Aquaculture was not included to avoid dispersing the users' attention to matters out of their interest and to avoid exceeding a specific duration. The aquaculture webinar was therefore carried out at a later stage, 10th of December 2020.

The aquaculture partner, Selonda, suffered some difficulties during this time due to the company's merging, which also contributed to the delay of the deliverable as feedback could not be provided on their behalf to meet the initial deadline. This situation was solved once the merging was solved when a new member of Selonda took the lead of the aquaculture section. Additional actions in order to get back on track were taken, by strengthening the Stakeholder Advisory Board for Aquaculture with the addition of a new partner BMRS. Also, Selonda after the merging, represents a total of 80.000 mT production per year, organized in over 80 aquaculture sites in Greece and 10 sites in Spain and Canary Islands. So Selonda gained access to many different end users that provided feedback related to the services.

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Due to the difficulties of obtaining feedback from ports, new approaches to a port user have been carried out, such as contacting the MEDports Association's Sustainability Committee, where there is an important number of representatives from Mediterranean ports. The results from the new approach will be briefly defined in this document but detailed in the revised deliverable 7.5.

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2. State of the Art

Ports

The Port Authority of Valencia works to minimise possible effects on water quality through various initiative. In D2.1, a description of the water quality activities and procedures followed by the ports under the umbrella of the Port Authority of Valencia (ports of Valencia, Sagunto and Gandía) was already provided and up until this day these activities currently follow the same lines of action.

The cleaning of floating waste from water surface was briefly introduced in D2.1. Complementary to this, since 2003 when the Maritime Safety and Rescue Society, which belongs to the Directorate General of the Merchant Navy, ceded the vessel LIMPIAMAR III (see image below) to the Port Authority of Valencia to take over the responsibility for this service. It is currently managed by a private company.

This vessel is mainly responsible for collecting solid and liquid waste from the water and contributing to the service of fighting accidental marine pollution, of which it is considered one more unit.

In the 2019 period, through LIMPIAMAR III, a total of **155.40 m3** of floating waste was removed and managed, mainly plastic, wood and derivatives.

Figure 1: Limpiamar III, Port Authority Valencia

Pollution caused by spills

In the previous deliverable, D2.1, a brief introduction to the Port Authority's contingency plan and Emergency Control Centre was provided.

In further detail, port operations, port services, maintenance and upkeep are all centralised to ensure improved coordination which enables the Port Authority of Valencia (PAV) to reduce accident rates to a large extent. The Emergency Control Centre (ECC) is the tool through which the PAV undertakes this coordination. The ECC monitors port activities 24/7, 365 days a year. Decisions that need to be made about safety and security issues and the management of emergencies can be taken thanks to the information the Centre has at its disposal. Therefore, emergencies related to all types of spills are also coordinated by the CCE.

The port's interior emergency plan (contingency plan) is based on 3 levels of severity. Level 1, related to emergencies within the waters under the port's jurisdiction and that can be handled with the port's own resources. Level 2, also emergencies within waters under the port's jurisdiction, but cannot handle the emergency with its own resources,

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and therefore requires external means. Level 3 is activated when an emergency exceeds the ports jurisdiction limits, and therefore the emergency event is coordinated by the Maritime Safety and Rescues Society (SASEMAR).

Port users have an increasing concern regarding pollution and their actions to reduce it, especially port authorities. For a long time, ports have been and are still under the microscope of authorities and society regarding contamination, as they are the "home" or "hub" of many ships and contaminating sources.

Pollution is a global topic and a severe concern for many organizations, therefore prime importance to monitor and keep under control. User feedback helped the HiSea team identify different business cases, were one of them relates to "Fight against pollution caused by oil spills". Although this issue in ports, especially ports with sufficient resources, is apparently under control as most ports have 24/7 surveillance, it is still of prime importance to optimize mitigation actions. Thus it is still an area under development and with room for improvement. Ports with fewer resources could be highly benefitted from the services provided by HiSea.

An example of historical spillage data from a small port like Melilla, shows that since 2005 up until 2020, the Port of Melilla has registered 23 different cases of spills affecting the port and requiring cleaning actions, averaging 1.5 accidents a year. A varied number of the different products were identified, such as oil, fuel, bilge water, carbon, aged fuel-oil, petrol, hydrocarbons, hydraulic liquid, a mix of oil and fuel and, none identified.

The Port of Valencia, on the other hand, has registered from 2013 to 2019, a total of 85 spills originating at sea, which averages just over 12 accidents per year.

INCIDENTS	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Total spills	37	32	20	20	11	27	34
Spills originated at sea	11	16	16	12	4	9	17
Spills originated on land	26	6	4	8	7	18	17

Table 1: Spill incidents Port Authority of Valencia

Note that the information provided regarding spills originated on land does not indicate the percentage of accidents with an impact on the water, and therefore are not included in the numbers. Note also that each port has its way of registering accident data, and consequently it has been challenging to obtain this information.

A risk assessment analysis provided by the PAV shows that crude oil derivatives such as marine fuel oil, gas oil, petrol, asphalt based products, oils for marine engines, MARPOL I residues, and LNG are the main products that can cause water pollution in the event of a spill in the port.

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Port depth management

Ports are required to support the safe navigation of vessels. Part of their activities to guarantee safe navigation is to perform regular hydrographic surveys in the port's areas such as channels, berths and interior navigation areas.

Port agitation and siltation are the main factors that reduce the depth of inner port waters, so bathymetric information is needed to plan suitable basin maintenance intervals. These intervals are determined by performing a risk analysis of the port, which in larger ports are usually done by in-house surveying department. Surveys can also be outsourced to a specialized survey company.

The most important information from a hydrographic survey is the accurate measurement of water depth. Valencia uses a Kongsberg EM 2040 Dual multibeam echosounder, mounted on a boat. The end products of the survey are, for example, sounding sheets or volumes to be dredged. Bathymetric data is used to aid many operations of the port, like in maintenance and traffic departments. More sophisticated technologies are becoming more common in the areas of port maintenance.

A port's basin maintenance is always required, but what varies from one port to another is the frequency this maintenance is to be carried out. This frequency depends on the siltation rate and inner port agitation, which depend on a number of factors such as: a port's layout, location, cargo types and wind. Ports with high agitation are more likely to experiment bathymetry changes affecting channel depth and berth depths which eventually lead to ship operation risks. Also, the type of cargo handled has an impact on port depth, for example, dry bulk terminals (sand, gravel, coal, grain, etc.) produce a lot of dust particles during cargo operations and wind, where a percentage ends up in the water and sinking to the basin. See image below as an example of a dry bulk terminal.

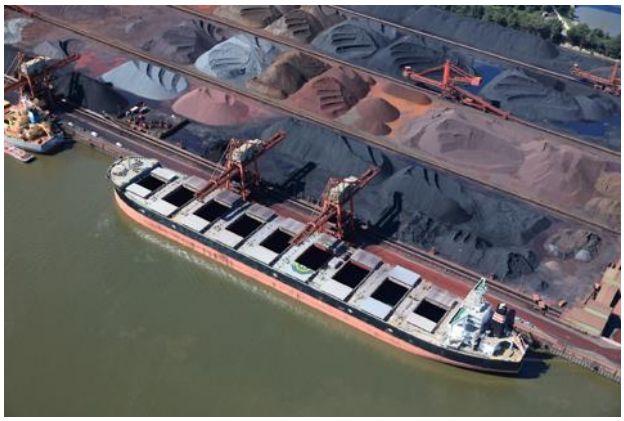

Figure 2: Hansport, Germany's largest seaport terminal for dry bulk

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In the case of Valencia, there is very little inner agitation, which favours maintenance frequency allowing topographers to carry out a global campaign once a year for bathymetry maintenance purposes. Although the port has a dry bulk terminal, user feedback confirms that it is not big enough to create a huge impact on siltation.

Ports with river outlets and floodgates into the port have potential scenarios for siltation and additional maintenance. These situations normally happen during heavy rainy seasons.

Algal bloom control

Harmful Algal blooms detection and monitoring are one of the features provided by the HiSea platform. In relation to ports, based on information obtained from the port users interviewed, it is not a major issue at this point. Again, this is based on specific ports, which means there could be other ports where algal blooms could pose an important threat.

Algal blooms contain organisms that can severely lower oxygen levels in natural waters, killing organisms in marine or fresh waters, which is one of the reasons why it is no concern to a port unless the port has internal aquaculture sites. Blooms can last from a few days to many months. In Valencia's case, the port Authority explained that when there are high temperatures, there can be algal appreciation but nothing relevant enough to cause a threat clears-up in a few days. After the bloom dies, the microbes which decompose the dead algae use up even more of the oxygen (generating a "dead zone"), which can create fish die-offs. When these zones of depleted oxygen cover a large area for an extended period of time neither fish nor plants are able to survive, hence its importance in the aquaculture industry.

Higher water temperature and low circulation are contributing factors to these blooms. For example, smaller ports with low traffic or low traffic areas and relatively low water circulation are more likely to be victims of this type of threat. The Port of Melilla Again, this is a port profile that has not yet been analyzed under the HiSea project, and is therefore within the scope of future investigation.

Considering that algal blooms cause significant harm to animals, the environment and economies, and that they have been increasing in size and frequency worldwide, a fact that many experts attribute to global climate change, it is worth keeping in mind for the future as it could eventually pose a threat to ports. Even if they do not pose a threat to ports, blooms can produce an unpleasant odour that could resonate with social activity in the port vicinity areas such as beaches or cities.

Use of Meteorological and Oceanographic data in ports

The Spanish public port system is governed at state level by Puertos del Estado (State Ports) and is composed by 28 port authorities. Puertos del Estado has developed and maintains systems for the measurement and forecasting of the marine environment with the main objective of providing the Spanish Port System with the ocean and meteorological data essential for their design and operation, allowing for reduced costs and increased efficiency, sustainability and safety of port operations.

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Figure 3: Spanish ports governed by Puertos del Estado

The benefits of this activity are not solely limited to the port environment, instead, it also intends to be a service open to society and other institutions. This is mainly provided through the Puertos del Estado website and the Imar application for mobile devices, available on iOS and Android

The system consists of measurement networks (buoys, tidal gauges and high frequency radars), forecasting services (waves, sea level, currents and water temperature) and climatic sets, which describe both the current maritime climates and change scenarios for the 21st century.[1]

The public organisation, Organismo Público Puertos del Estado (OPPE), together with the Agencia Estatal de Meteorología (AEMET) run and distribute a twice-a-day wave and wind fields forecast for the Northern Atlantic and the Western Mediterranean area. Wind forecasts, used to force the wave models, come from the HARMONIE-AROME model, running operationally at AEMET.

Wave forecast system starts a new execution twice a day, at 5 and 17 hours. Model output are available on Puertos del Estado web site one hour later (maps, plots and tables). The system is based on a set of model applications forced withHARMONIE-AROME forecasted wind fields provided by AEMET. The forecast horizon is 72 hours for all the domains. 1-hour-outputs are generated.[2]

The following images are examples of the state ports on-line system. Figure 4 shows the general interface, in this case, showing the port of Valencia. At the same time, it shows a list of the possible readings it can provide. Within these there are Forecast data, Real-time data and Historical data[3].

[1] http://www.puertos.es/es-es/oceanografia/Paginas/Intro---FAQ.aspx
[2] http://www.puertos.es/es-es/oceanografia/AccesoSimplificado/Paginas/Accesosimplificado.aspx
[3] http://www.puertos.es/en-us/oceanografia/Pages/portus.aspx

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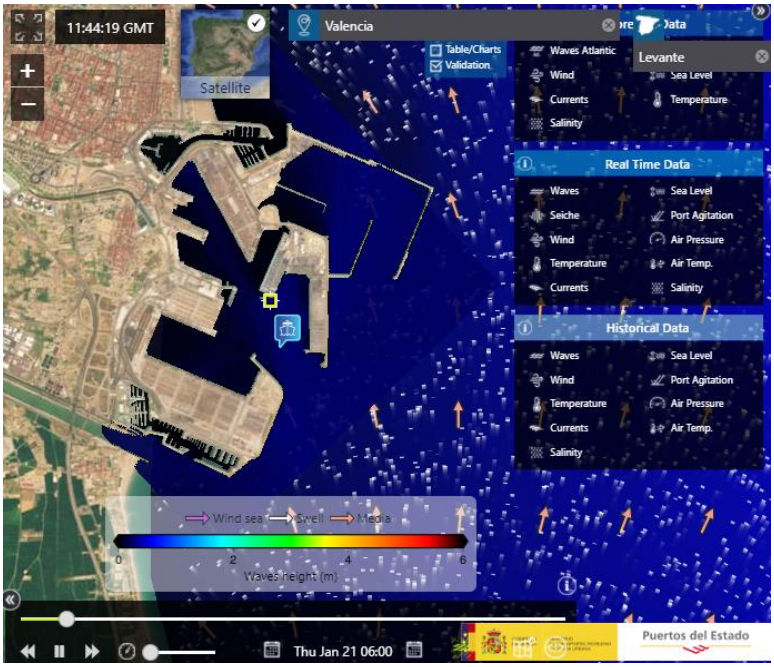

Figure 4: Puerto del Estado's on-line tool for Swell prediction, sea level; buoys and tide gauges

In the second image (below), also obtained from the Puertos del Estado web, shows a number of different widgets related to forecasts and current state of the sea in the Port of Valencia. In this case, graphs are representing the time-laps, real-time data indicators and a daily forecast for high and low tide levels.

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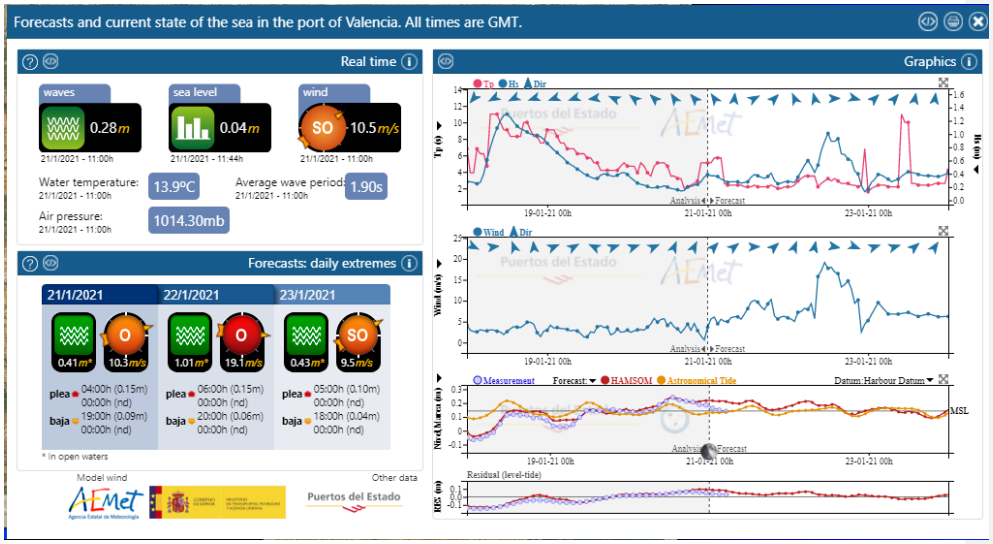

Figure 5: Puerto del Estado's on-line tool. Graphics and real-time values

Aquaculture

Selonda

The activities of Selonda post-merger shows that the Group is the leader in Mediterranean aquaculture, with an annual production of 80.000 tons of sea bream and sea bass. The company operates 90 sea-cage fish farms in Greece and Spain with a total annual production capacity of 80 .000 tonnes as well as 10 hatcheries in Greece and Spain with an annual production capacity of 250 million fries.

The company prioritises water quality for two reasons:

- Water quality is of paramount importance for fish welfare and growth rate. Hence water quality is directly linked with the company's productivity.
- Sustainability and water quality preservation is one of the company's goals. Achievement of this goal directly affects consumers and local communities' perception of aquaculture products.

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However, water quality monitoring is time consuming and costly. At the moment parameters like temperature and oxygen are monitored daily but physicochemical analysis for many parameters is done only every few months. Real time or even high frequency data are not available and tools for alerting to changes in water quality are lacking.

Bantry Marine Research Station

Bantry Marine Research Station (BMRS) is a privately-owned aquaculture research company based in Bantry Bay in Ireland, it is focused on delivery of marine biomass, bio-based products and processes. With a multi-species aquaculture research licence (all native species), BMRS' on-shore commercial production activities encompass lumpfish production, sea urchin and seaweed hatcheries, and a fish disease experimental unit. At sea the company has two seaweed farms in Bantry Bay (6Ha) and Crookhaven (16.5Ha) and a 4.5 Ha sea urchin farm in Dunmanas Bay. Research activities include: micro- and macro-algae production and analysis and biomass conversion to bio-products. BMRS is a R&D driven SME with a multidisciplinary team which has taken part in several international and national projects (many of which BMRS has co-cordinated).

BMRS – Description of pilot

Bantry Bay is famous for its mussel production. Rope grown blue mussels (*Mytilus edulis*) are the second most important aquaculture undertaking in Bantry Bay after salmon farming, with an annual production of 2000T and point of sale value of €1.3M. Mussel farms in the inner bay are concentrated along the eastern shore of Whiddy Island with other farms situated just north west of Cove (Figure 1). There are 20 sites configured in several contiguous blocks.

Mussels spawn in April and May and at this time operators put out collector ropes to capture the spat settling from the plankton. These then grow up to 10-25mm by October and in October/ November they are put into cotton socks, at the rate of 1,000-1,200 per meter of rope. These are then removed the following July when they have grown significantly and are declumped and thinned out to 750 per meter for continued growth to market size, which may arrive in December/January giving a growth cycle of 18-20 months.

Mussel farming first began in Bantry Bay in 1981 with production for live export to Europe the main route to market. However, in the early 1990s there was a shift to selling processed mussel products, largely as a result of difficulties associated with distribution of live perishable product and closures of the bay due to naturally occurring Harmful Algal Blooms (HABs). HABs are still the main challenge to mussel production in Bantry, various phytoplankton species produce a range of toxins, which mussels accumulate during a bloom. The severity of the problem varies from year to year and has a seasonal component. In the summer DSP (Diarrhetic Shellfish Poison) and PSP (Paralytic Shellfish Poison) tend to be more prevalent, while later in the year another toxin AZP (Azaspiracid Shellfish Poison) is more frequent. Mussels from all the growing areas are tested by the Marine Institute for toxins on a weekly basis throughout the year. However, sampling is conducted on Mondays with the results the following Thursday so most farmers are left guessing the result and have little information to base their decision on whether to harvest or not. Any real time information on phytoplankton presence (in the form of **chlorophyll a**) could be invaluable to them on when to harvest and avoid the product recalls that they frequently experience.

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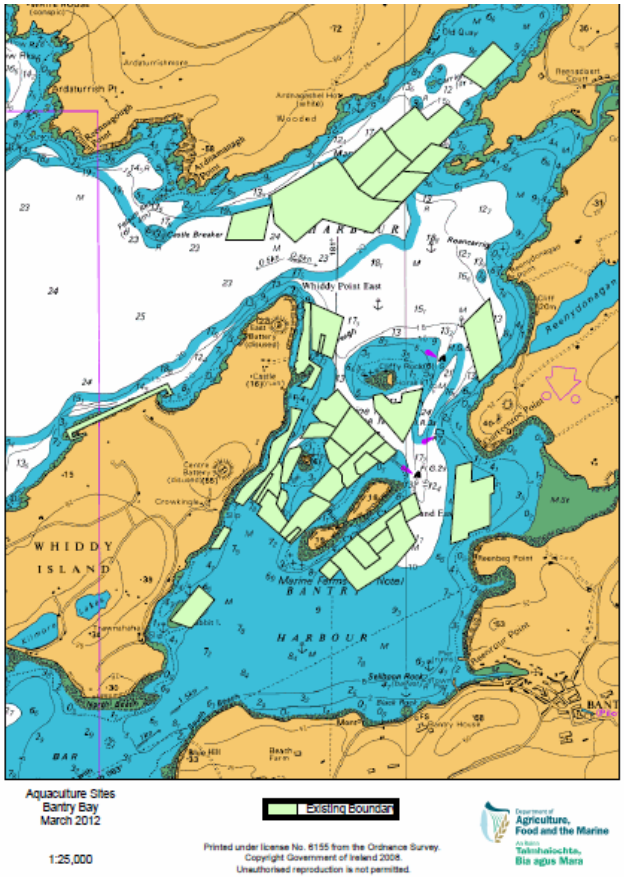

Figure 6: Mussel aquaculuture sites in Bantry Bay

Brainstorming between Selonda and BMRS

Many brainstorming sessions took place in late 2020 between Nikos Katribouzas (Selonda) and Julie Maguire (BMRS) and various Hi-Sea partners on the needs of the aquaculture industry. The following needs were identified:

- 3-7 days forecast for wave / storm / wind / current direction and speed
- Historical data of wave/weather/water quality reports: in order to compare with AI models and to predict annual fish production.

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- Accurate data based on data satellite + sensors + models versus sensors +/- models
- Diseases forecast for example Amoebic gill disease (interesting for salmon producers only)
- Jellyfish forecast (relevant for the Atlantic for finfish production)
- Harmful Algal Bloom forecast (relevant for shellfish farmers)

In addition, potential customers were identified and their varying needs discussed:

- Customers segmentation according the kind of fish/shellfish species produced (eg HABs important for shellfish, jellyfish for finfish, waves and water quality important for all)
- Mediterranean sites versus Atlantic's sites (for jellyfish, in Ireland it is a critical issue but not in Greece or Spain)
- Small farms versus larger farms with multiple sites
- "Hitech" farms (sensors, data visualization, AI models.) versus traditional farms
- Government agencies: they are the decision makers regarding which areas new fish farms can be implemented. In addition, they also classify production area according to water quality.
- Development agencies: these organisations promote the aquaculture sector and administer grants they may become a customer to provide the service to their clients
- Consultancy agencies: design of farms, Environmental Impact Assessment (water quality measurement, wave height history, sea depth…)

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3. Stakeholder Webinar

The stakeholder webinar is related to milestone 6, which was initially planned as a physical workshop for end users of the HiSea platform. The workshops are one of the main sources of information regarding user feedback for the projects partners, as it intends to provide a thorough explanation and demonstration of HiSea's project and platform functionalities, making it a dynamic, interactive and hands-on event between consortium partners and attendees.

The pandemic situation with COVID-19 has harmed this activity timeframe, delaying it to the 4th of June in the case of the ports and to the 10th of December in the case of aquaculture. Considering that D2.2's main source of feedback is provided by the user information gathered during the workshops, again, the pandemic situation has had a knock-on effect delaying considerably this activity.

Ports

Figure 7: Port demonstration webinar poster

Object

The object of this webinar was to:

- Update potential users already familiar with the project
- Raise awareness to new users
- Demonstrate the HiSea platform to all attendees

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- Gather feedback from attendees

The webinar started off with a warm welcome by Agora to the attendees and briefly going over the object of the actual webinar and the HiSea team's expectations from it. It then followed up with the project's presentation by Deltares and the Fundación Valenciaport, where the project was detailed together with the benefits for ports using high-resolution earth observation data services for ports. At all times, the attendees were encouraged to ask questions any questions via the chat. Taking into account that there were no technical attendees, the actual presentation did not elaborate excessively on technical details.

Once the project was explained, Hidromod was in charge of leading on with a thorough demonstration of all the platforms functionalities as well as commenting on its improvements since the first workshop held in 2019. This allowed the attendees to clearly view what the platform's current developments have to offer from the available services to its modern and attractive layout and design. Also showing how one of its most recent features allows it to create new projects for personalized user experience.

Attendees

The results of the people who registered and finally attended the webinar held on the 4th of June 2020, show that at least 115 representatives from at least 21 different countries were aware of the event (Table below left). Out of these, only 59 attended the actual webinar, with representatives from 13 different countries (Table below right). The final turn-out to the webinar was much less than expected and this clearly impacted the feedback expected to be gathered.

Country	Registers per country
Argentina	3
Brazil	3
Bulgaria	3
Canada	1
Chile	1
Cyprus	1
France	1
Germany	3
Greece	8
Holland	3
India	1
Indonesia	1
Iran	6
Ireland	1
Italy	3
Malta	4
Others	2
Peru	1
Portugal	28
Spain	41
Suez	1
New Zealand	1
Total Registers	**117**

Table 3: Webinar registration per country

Country	Total Attendees
Brazil	1
Bulgaria	1
France	1
Germany	2
Greece	4
Holland	3
India	1
Iran	6
Ireland	1
Italy	3
Malta	1
Portugal	20
Spain	15
Total Attendees	**59**

Table 2: Webinar attendees per country

Out of both the people registered and final attendees, there are two countries with turnouts that clearly stood out from the rest, these are Portugal and Spain.

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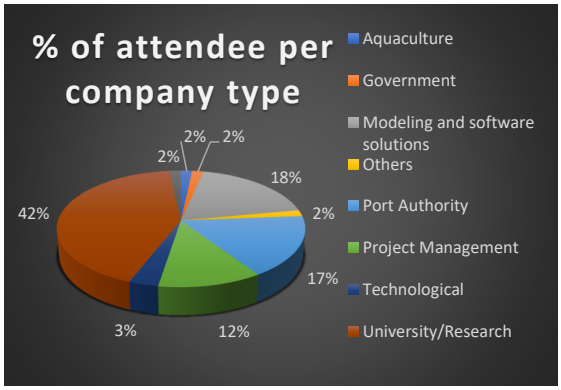
Each attendee represents a company with an interest in the HiSea project and its developments. As with the first workshop, we decided to classify these types of companies in specific groups depending on their trade expertise.

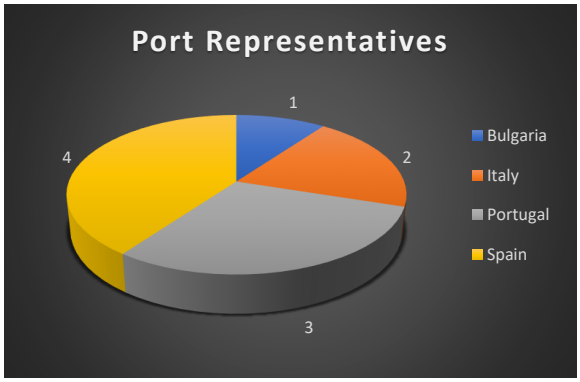
In the chart below, we have included the 8 different types of companies represented by the 59 attendees. One representative was unable to be identified.



Out of these, we can point out that university and research representatives, with a 42% turnout, were more than double than those from any other type, followed up by a close draw between port authorities, with a 17% turnout, and an 18% companies related to modelling and software solutions.

Out of the total attendees, only 10 of them were port representatives, as shown in the following chart. This turnout was much less than expected, as initially there were a total of 30 registers, 26% of the total.

Figure 8: % of attendees per company type



The 10 that did attend were from the 4 ports represented in the chart here on the left. Out of these, 3 formed the Port of Melilla (AB member), 2 were from the Port of Ravenna (AB member), 3 from the Port of Leixoes, 1 from the Port of Santa Cruz de Tenerife and finally 1 from the Bulgarian Ports Infrastructure Company.

Unfortunately, 2 of the AB members did not attend (Piraeus and Valencia), and neither did representatives from SASEMAR, with experience in the satellite imagery and oil spill detection, nor the Valencian Regional Government.

Figure 9: Port representatives at webinar per country

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Questions asked during webinar

During the webinar there was little participation on behalf of the attendees even though the partners worked on encouraging and asking questions.

The more daring attendees asked the following questions which were answered on the spot by a HiSea partner.

Questions from audience:

Port of Melilla: I would like to know more about merging local data with the tool

Democritus University of Thrace (DUTH): Oil simulation run that is produced on the fly is available publicly after the run?

BMRS: Is there a plan for roll out and commercialisation?

University of Malta: Can you please explain how the interface was accessed? thanks.

Government of Menorca: Do you plan on sharing the platform and/or data to environmental NGOs?

Faculdade de Engenharia da Universidade do Porto: Is there any way we can register to receive the news from where the product is in the betastage?

IHCantabria: Which is the DIAS platform that you are using (or planning to use) and which are the good and bad things about the DIAS platform selected for the HiSea Platform?

Administração dos Portos do Douro, Leixões e Viana do Castel: In the agenda there was an item - Safe Port Depth - detect sediment and map the depth of ports to ensure safety of ships. Can we have access to detailed information how you plan to develop/manage this tool?

Democritus University of Thrace (DUTH): I want to ask how the oil spill model is initialized. Is remote sensing being used?

University of Malta: another question please: would you be sharing the link to the recording? It would really help me to go through the virtual demo again. thanks!

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Aquaculture

Figure 10: Aquaculture webinar poster

Object

A demonstration online webinar of the Hi-Sea aquaculture services took place on the 10th December 2020. The objective of the workshop was to obtain feedback from potential aquaculture users so that the services could be improved to fulfil their expectations and ascertain how much they would be willing to pay for such a service.

Specifically, the webinar focused on:

- Real time, historical data and forecast of weather and water quality information including currents, waves, oxygen levels, turbidity, microbiology or sea and air temperatures to implement effective and efficient aquaculture management;
- Improvement of procedures with impact on daily operation such as tide forecasts;
- Advanced data analytics and performance indicators
- Early warning and anticipation of harmful events by means of forecasting their probable timing, magnitude and location. By allowing the simulation of alternative actions, the service can contribute to mitigate adverse effects on operations and environmental impacts.

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Attendees

In total 151 participants registered for the event. During the event, the audience were asked to take part in a real time questionnaire (Mentimeter). 43 participants out of the 81 participants online, took part and the following figures represent the profile of the attendees who answered the questions.

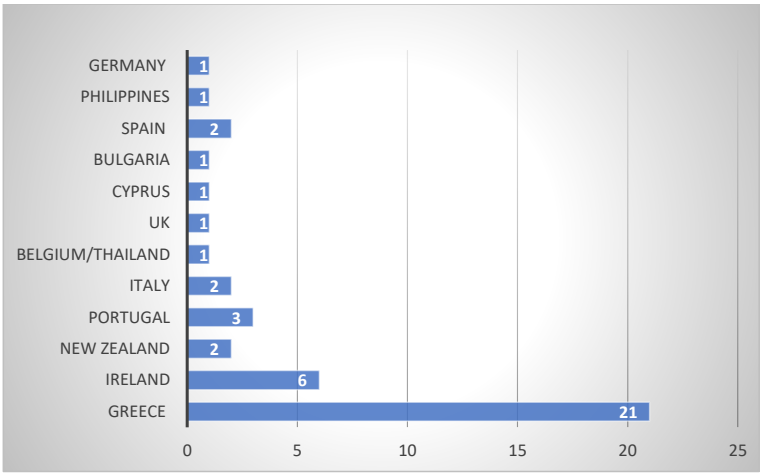

Figure 11: Participants per country

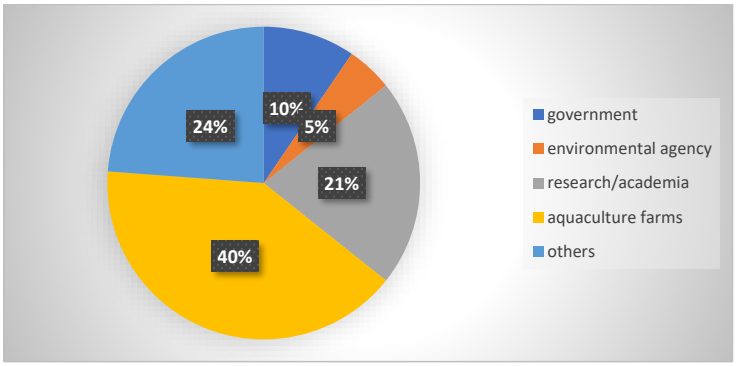

Figure 12: Organisation type

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Questionnaire

The following questions were asked during the webinar through the mentimeter programme:

General Questions:

1. From which country are you?
   See Figure 11

2. Which organization type are you from?
   Options: government – environmental agency – research/academia – software development – aquaculture farms – others

   See Figure 12

3 Which parameters do you measure/use?
   Options: weather forecast – hydrodynamic (current speed and direction – waves) - water quality (chlorophyll, nutrients, pH, oxygen, temperature, etc.) - – all the above

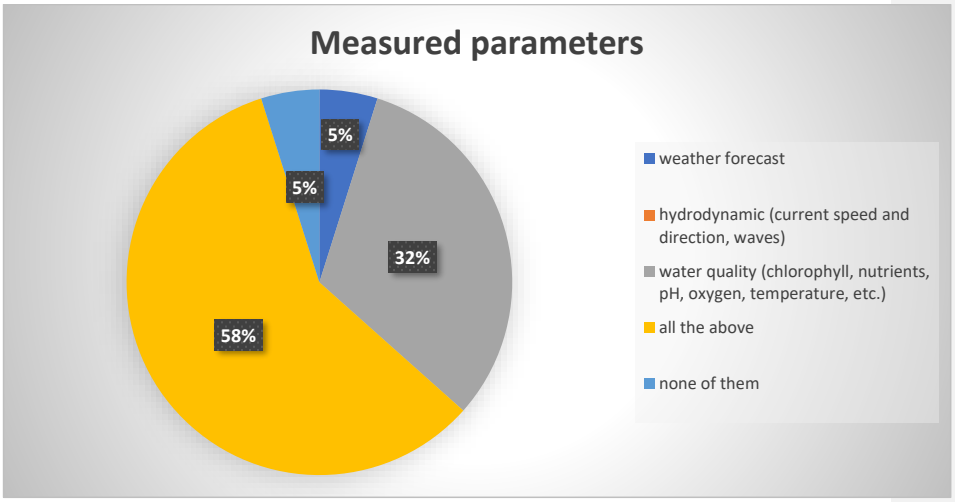

Figure 13: Measured parameters

4 How much does it cost you per site to measure these parameters?

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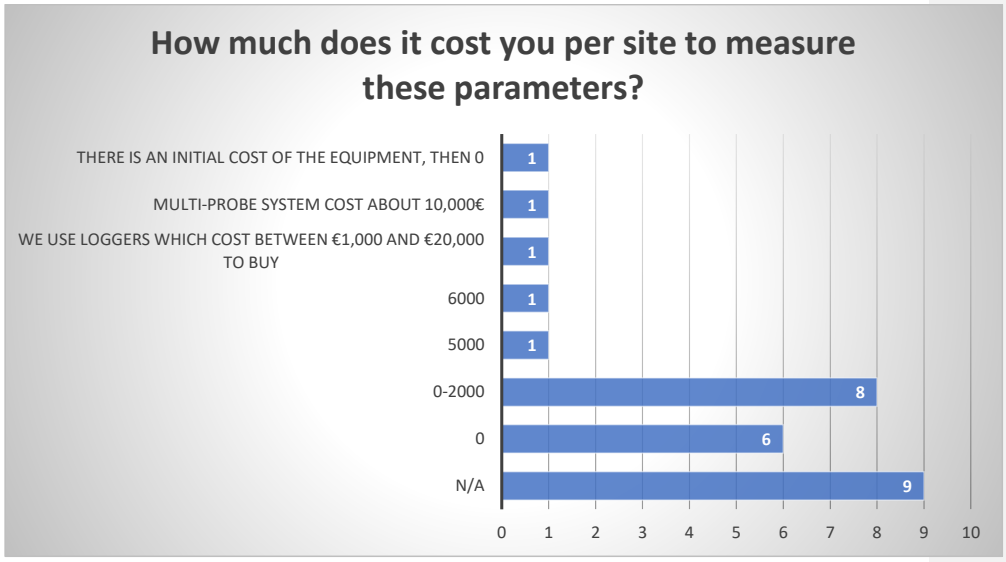

Figure 14: Measurement costs

5. Which kind of company is furnishing you these information (outsourcing, institutions, partners…)?

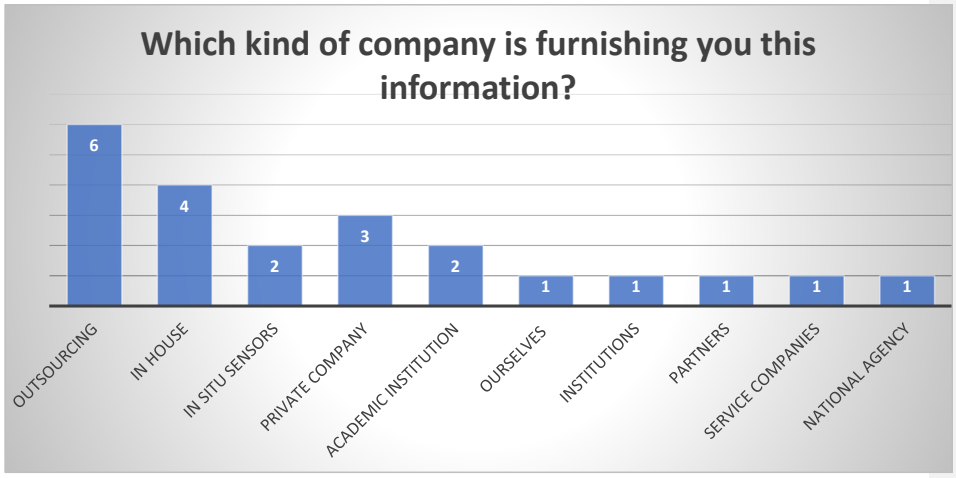

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Figure 15: Marine data source providing information (above)

6. Which parameters would you like to monitor?
   Options: significant wave height current speed and direction – maximum waves — temperature – suspended matter - chlorophyll - nutrients - oxygen concentration – others

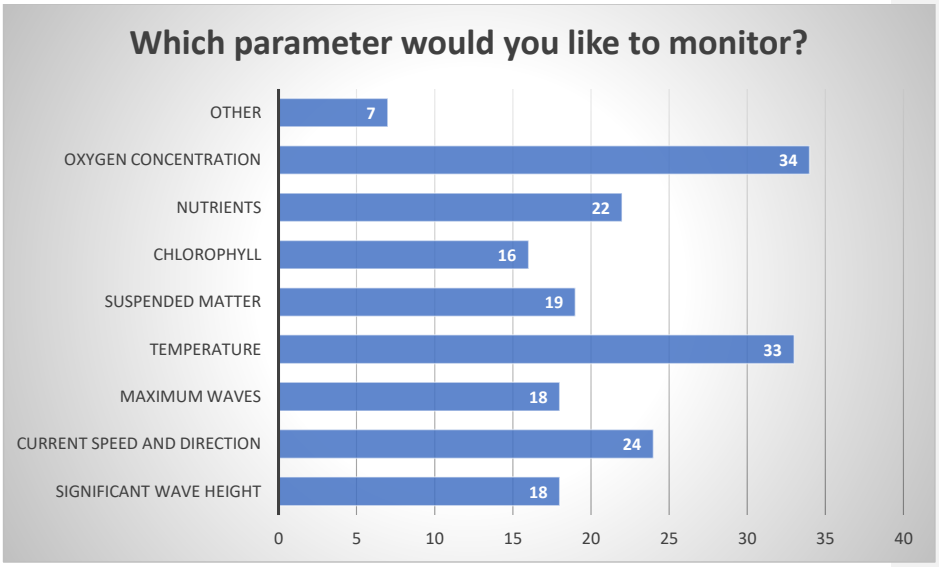

Figure 16: Desired parameters to be measured

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7. How often would you like access to these data?
   Options: daily, weekly, monthly, annually

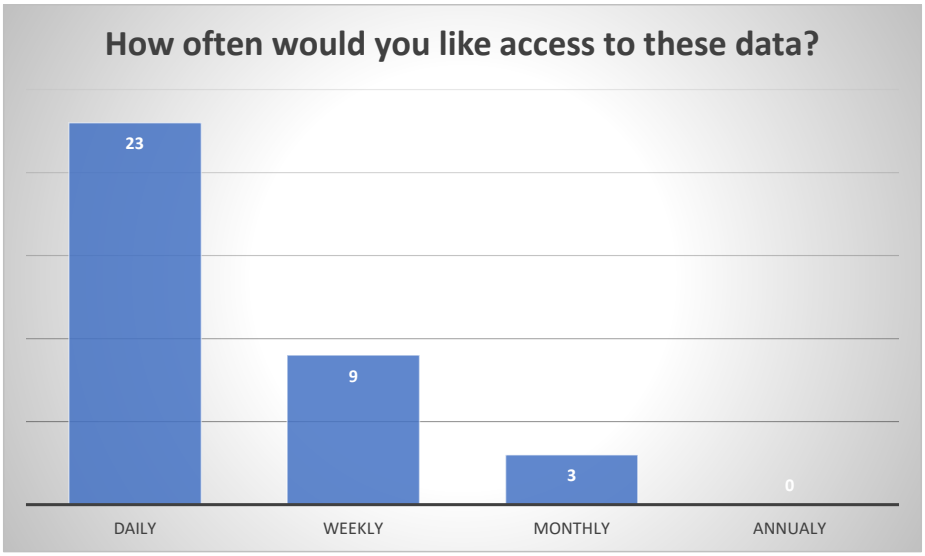

Figure 17: Data frequency availability

After each demonstration of the service for - Acuinova (Portugal), Aquavalor (Portugal), Selonda (Greece), Bantry (Ireland)

However, there were some issues with Mentimeter at this point and not all respondants were able to cast their vote for each demo. The results of the Selonda demo are as follows:

1. What do you think of the demo?

Slide type: scale. People can choose a number from 0 (strongly disagree with the statement) to 5 (strongly agree with the statement). The statements are:

- I like the way data are visualized
- The employed visualization does not cover my needs
- I would like to choose and define the way of visualization
- I am not interested / data are not relevant to me

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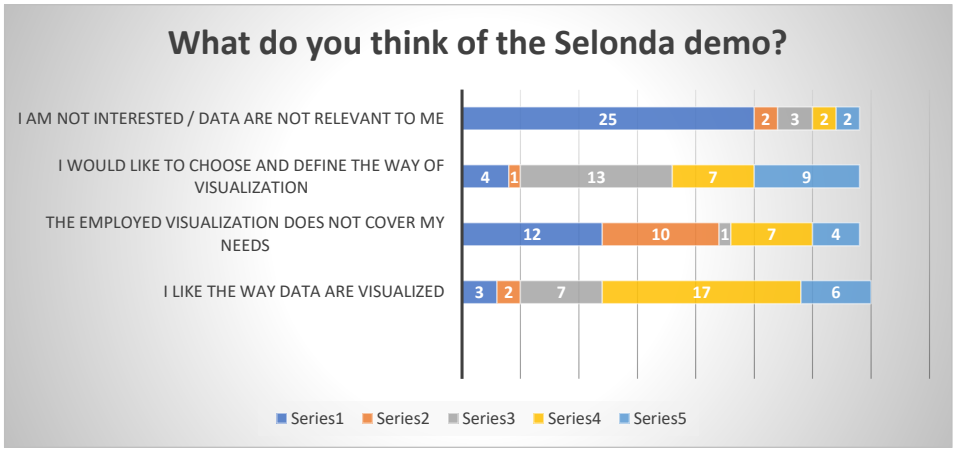

Figure 18: Aquaculture demonstration feedback

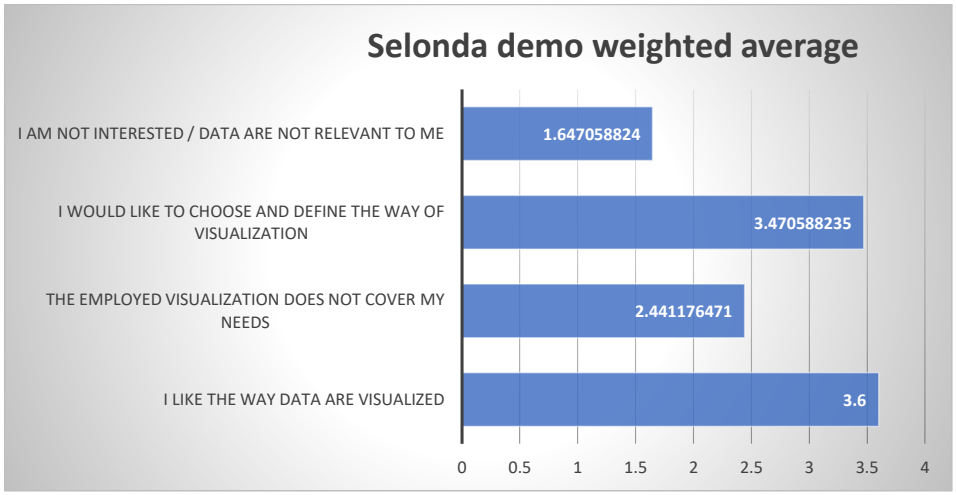

Figure 19: Attendee opinion

2. What would you like to change to get a more valuable service? Open question

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Answers included

- Forecasts
- Automation of measurements to a central database
- More maps
- Data on currents
- Combine environmental data with farm growth/biomass data
- Oxygen data
- Historical datasets
- Salinity data
- Nutrient data
- Grants for implementation of platform from national governments of EU
- Free access
- Analyse the data to see how it affects the final quality of the product

***

After all demonstrations were presentated

1. HiSea Platform

Slide type: scale. People can choose a number from 0 (strongly disagree with the statement) to 5 (strongly agree with the statement). The statements are:

- Do you find the HiSea platform easy to use?
- Do HiSea services fit your activities?
- Can HiSea service improve operation efficiency (e.g. daily management, planning operations, etc.)

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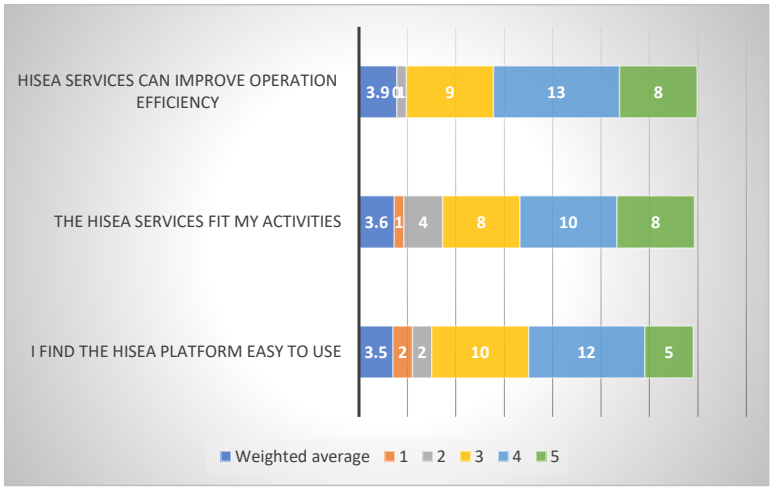

Figure 20: Attendee opinion

2. Would you/your company pay for such services (e.g. subscription, ad hoc)? Open question

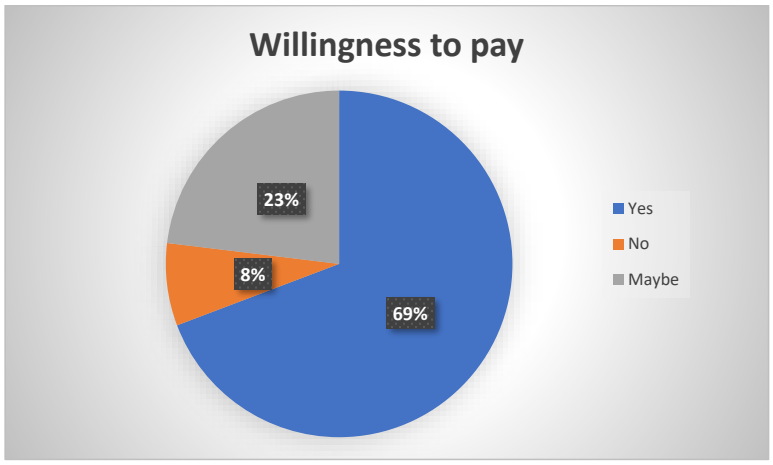

Figure 21: Attendee opinion

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3. Is there any other information/data HiSea is missing for you to use?? Open question

Answers included:

- pH
- Currents
- Oxygen
- Salinity
- Toxic chemicals
- Very high resolution data
- Comparison of different sites

4. Do you think it is worth acquiring the HiSea services? If no, why? Open question

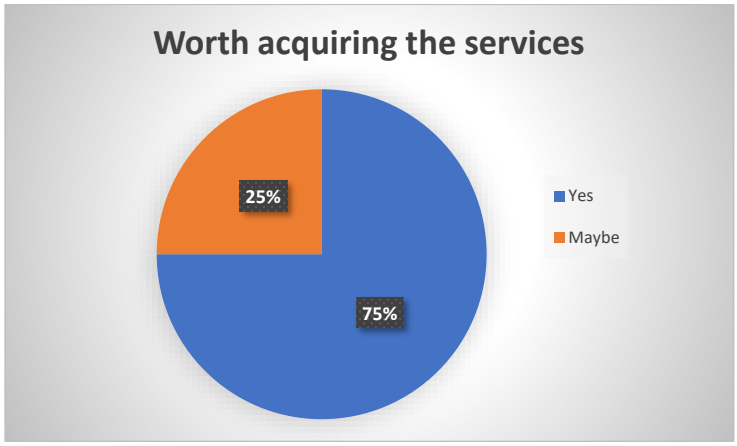

Figure 22: Attendee opinion

Comments included:

- If knowledge/data sharing is required from both parties, this would need to be reflected in the price
- Not yet as services not ready
- I honestly think that this would be very beneficial as the aquaculture industry in our region needs major technological improvement
- I could see the future in sustainable aquaculture using this platform

5. Can you see HiSea used in other organizations/sectors (environmental agency, ports, etc.)?? Open question

Yes – Government agencies, consultancy and construction companies.

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4. User feedback

User feedback is obtained with a combined action of different approaches, such as:

- Emails
- Telephone calls
- On-line meetings. For example, via Teams
- Webinar
- Questionnaire
- On-line Mentimeter questionnaire

Unfortunately, no physical meetings have taken place due to the pandemic situation.

Ports

Questionnaire

In line with the questionnaire, an improved questionnaire was prepared for the attendees (see Annex 2), which was focused mainly on first-time users or newcomers that had not assisted to the first workshop.

The object with this first questionnaire was to:

- Start a communication flow with new users
- Obtain user feedback
- Identify new needs and uses for HiSea

This approach did not have a good effect on feedback, as very little responses were received.

Other consortium partners that also sent out the questionnaire to the invited users did not receive any replies neither.

Feedback from attendees after webinar

During the webinar there was very little participation on behalf of the attendees. Questions were formulated by the project's partners to try and get people to interact with the team and share their thoughts and opinion on the project and the platform's demonstration. Gathering feedback via a webinar format proved to be more difficult than expected and unfortunately during the webinar, very little feedback was gathered from the attendees.

Straight after the webinar, attendees were approached via email to kindly invite them to answer some questions and share their opinion. From previous experiences, sending a direct questionnaire did not result to be very efficient, therefore the first attempt of approach in order to start a communication flow was with 8 simple questions regarding what they had seen during the demonstration. These questions were related to:

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- Whether the platform seemed useful or not?

- Did the platform fit their port's Water Quality activities?

- Would the attendee add anything to make it better fit their activities?

- Whether the platform looked easy or complicated to use?

- Did they like the design of the interface?

- Were there any doubts on how the platform works?

- Did the platform lack of functionalities?

- Others (indicate suggestions/comments...)

The results to this approach were also very difficult to accept as there were very little responses. At this point the summer vacation was approaching supposing a new threat to obtain more feedback before most people disconnected from work. Reminders were sent and from these, only one response was received.

Potential users that did not attend the webinar were contacted and kindly asked to view the demonstrations via video, as this part of the webinar was recorded. This way, users unable to attend had a resource to see the demo. Unfortunately, this approach was not effective and the team did not receive any replies.

On behalf of the Agora partners, a newsletter with a questionnaire was sent out after the webinar. The stats show that 25% of the people who received the newsletter, did not even check the questionnaire.

Feedback after webinar:
Government of Menorca (oceanographer and marine technician):

1. *Interesting, useful and functional.*
2. *A database of air quality history could be included. I do not know how it works in other ports, but at least in the Balearic ports that belong to State ports, they have air quality readers and the data is public, but it is very complicated to download a historic with the parameters separately, so it complicates a lot the work of making a correct reading of whether it a parameter is altered.*
3. *The platform looks complicated to use. Surely with the correct training of a couple of hours it would be solved.*
4. *Must test the platform for further feedback to see if it lacks functionalities.*
5. *To be honest, when I registered for the webinar I had no idea what it was about, but little by little I understood the concept and found it useful in my field. This means that I see the platform as a useful tool for environmental protection but I imagine that others will see it as a business. I think it would be a great protection tool if it could be made available to the public or at least to environmental NGOs and/or administrations.*

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Foundation for Research and Technology-Hellas (works with port authorities, coast guard and shipping companies, mostly on providing them waves and oil spill forecasts):

1. *Very interesting. The platform is excellent, at least the idea and set-up, and it is good that can be modified as an open tool for the needs of port authorities and other end-users. At the moment, I do not have any other particular points, as I have not explored and followed closely the tool and capabilities, however, I would really like to stay informed about future developments in relation to HiSea, evaluate the beta version of the platform, propose collaboration with colleagues in Greece, etc.*

Universidad de Cantabria and the Government of Cantabria, represented through the Foundation for the Institute of Environmental Hydraulics of Cantabria:

1. *My field of work is to generate software solutions from environmental data and methodologies generated by our researchers at IHCantabria. Therefore, the HiSea project fits perfectly with my field of work and I found it very interesting to be able to check the progress of the project.*
2. *The Webinar was open and therefore it is understandable that they did not go into too much technical detail. From my point of view, or from the point of view of a company related to the world of software development (start-up etc), it would be very interesting to know the possibilities for consuming, in an interoperable way (machine-to-machine communication), different sections of the HiSea platform. For example, a start-up could be interested in having its software connected to the hydrocarbon trajectory service because its business model needs it, another company could be interested in generating automatic reports with on-site data and remote sensing data. How could they do this? Does the HiSea platform have APIs that allow other software to attack the services?*
3. *The interface is easy to use and intuitive, I liked it very much.*
4. *I think it's clear how it works. If there are any doubts, I would incorporate a video of the system or a test user with which those attending the talk can interact with the system.*
5. *I would like the platform to have APIs, maybe it already has them and I don't know.*
6. *I believe that these Projects could favour innovation ecosystems by acting as providers of environmental data. This project integrates data from the past (hindcasting and sampling), real-time data (sensor and satellite) and forecast data (numerical simulations). These data can be indispensable for new ideas and therefore must be accessible in an open and interoperable way. The HiSea project has clear use cases, but there are endless possibilities to generate more solutions with these data. My suggestion is that the platform should not only be used for the project's use cases, but that it should also allow SMEs and start-ups to access the data, and even processing services (calculation of spill trajectories), to be used in their business models.*

INTECMAR

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1. *I found it very useful and intuitive. I have been working with similar products for some years now and I found the look and feel of this one fantastic. The only thing I would add would be an export of the results to image or shapefile or to some exchange format, to include these results in other tools.*

Others:

1. *The forecasts for extreme weather would help planning the entrance of ships into the ports, the measures to be taken and which ships could be unloaded or not. This would lead to less damages incurred.*
2. *Services to detect sediment better and map the depth of ports to ensure safety of ships would allow to reduce the use of ships for similar measurements and could easily save up to EUR 100,000.*
3. *Oil spill models of course will reduce the costs of cleaning, but also may allow to have less measures in place in advance in case of an oil spill.*

Stakeholder Advisory Board feedback

The Stakeholder Advisory Board members are the group of port experts that provide feedback to the HiSea team for the fine-tuning of the HiSea platform.

Multiple approaches have been made to the AB member from the Port of Ravenna. After kindly encouraging them to communicate and help the HiSea team as initially expressed in their letter of support, unfortunately, they have lacked considerably with their support to the HiSea team. Even though, the team will continue engaging communication with this member.

The rest of the Advisory Board members (Piraeus, Valencia and Melilla) have shown more cooperation, although less than we ideally would have liked and expected. Members have continued to be informed and kept up to date with relevant developments of the platform. When required, they have been contacted to ask for opinions, feedback, sent reminders and invitations to events. For specific feedback, in order to make the communication friendlier, instead of the main communication means via email, individual TEAMS meetings have been organised to suit AB member availability.
It is important to take into account that a port authority is composed of different departments or areas of expertise, and in most cases specific feedback is not received directly from the person of contact.

The feedback has been grouped into different topics. The following table, shows a summary of the collected feedback per topic, while above a more detailed explanation is given.

Feedback Topic	Related Feedback
Algal blooms	Relevance for ports
	Costs related

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Bathymetry	Reluctant to its precision
	Current bathymetry process, precision, equipment, frequency Reluctant to its precision
HiSea Platform	Frequency of data availability
	Opinion and suggestions for user access
	Opinion on platform interface
HiSea APP	General opinion
	Precision (GPS signal at sea)
	Priority functionality list
	Main use for workers on-site
	APP USE
	Agile emergency updates
	Agile emergency notifications
	Main use for workers on-site
Data	Port Bathymetry
	WQ surveys up to 2019
	Water quality campaign measures and historical data. Water quality parameters and values
	WQ survey 2020
	Number of incidents related to spills on shore and off shore
	Port Bathymetry
	Historical of spills (incidents) and floating objects
Back Tracking	Oil spill source
	Scrubber discharge source Bilge water discharge source Ballast water discharge source Unidentified spills causing potential threats
	Historical of satellite images every 3h, for oil source detection
New Parameter	Bilge water
	Ballast water
	Maintenance leaks (hydraulic liquids,…)
	Scrubber discharge water
Spill Action plan	3 level emergency plan. For emergency response
	Inner Maritime Plan. For emergency response
Sensors	Tide gauge

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	Experience with sensors on buoys
New uses for HiSea	Search and Rescue
	Bathymetry scans for sunken objects
	Air quality
Barriers	Subscription costs
	Available human resources
	Service reliability Standard recognition by Authorities
	Power cuts
	Internet problems
	Cyber security Training efforts

Algal blooms

After consulting users regarding the relevance of algal blooms in ports, it has resulted to be irrelevant as it does not pose a threat to ports. Nevertheless, algal blooms are still an issue to be aware of in the future, especially in smaller ports and locations with high temperatures. Climate change could influence these events in the future.

Port bathymetry

Port bathymetry maintenance is known to require extremely precise readings of up to 3-5cm precision, carried out with specific equipment and qualified workers. The engineers in charge of this maintenance are interested in this type of service although very reluctant to how reliable satellite readings will be. They worry about how turbidity and dull days can affect the readings.

The HiSea bathymetry service would not be a daily-use service, as bathymetry monitoring can be in many cases an annual activity. Changes in bathymetry are mainly influenced by siltation and inner port agitation. Therefore, ports with higher siltation sources (bulk terminals) and high agitation are more likely to profit from a service of this type. Most ports dispose of their own equipment for bathymetry monitoring, especially bigger ports. If the service can be proven reliable to port expectations, then it would clearly save costs and time.

HiSea APP related feedback

Users helped the HiSea team establish a priority list for the app's design and functions.
In general, the users can see the potential of developing the HiSea App. They see it as a practical tool in the sense of an agile communication means between port workers, especially workers at sea level. Also, any type of tool that can streamline emergency notifications is added value. Knowing that a port has 24/7 surveillance, users wonder if the

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apps notifications can beat the human eye. Users also wonder how precise location sending would be once out on the water.

Marine data related feedback

Regarding data, the ports have provided different sets of marine data for the HiSea technical teams to work with. The type of data ranges from in-situ water quality campaigns and historical, the actual reports obtained from the analysis of the in-situ measurements and also the inner port bathymetry. Updated data for the end of 2020 and beginning of 2021 has already been requested.
The port of Melilla has been able to provide a historical list of all the incidents related to spill and floating objects detected in port waters.

Back tracking service related feedback

Ports are extremely interested in being able to locate the contaminant sources of spills, and therefore the HiSea backtracking service is one of their potential favorites service. Spills can be caused by different reasons, but one way or another they badly impact the environment and also contribute to giving ports a bad name, and in many cases ports must cover the cleaning costs. Ports are not only interested in oil spills, but also wish to be able to detect and identify any type of contaminating spill that can be caused at sea whether inside or outside the ports, and especially when low visibility is a handicap.

Apart from hydrocarbons and oil spill, ports are interested in being able to identify the following parameters: Bilge, ballast and scrubber discharge waters. Also lighter oils that can be caused be maintenance related, such as hydraulic liquids.

New parameter related feedback

Apart from hydrocarbons and oil spill, ports are interested in being able to identify the following parameters: Bilge, ballast and scrubber discharge waters. Also lighter oils that can be caused be maintenance related, such as hydraulic liquids.

Spill action plan related feedback

All ports must have defined an interior port action plan for emergency spill mitigation. This information details how the ports react and proceed in the face of an emergency and helps the HiSea team understand how the corresponding HiSea service fits in to help port operations.

Sensor related feedback

Of the four ports in the Advisory Board, only one of them has sensor-related experience. In the past, the port of Valencia had its own buoy, but due to tedious maintenance and high costs, it was eventually decided extract and stop using. Currently, the only sensors installed in marine waters and providing the Port of Valencia with marine

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data is the Puertos del Estado buoy, located off the coast of Valencia, as well as a tide gauge located within the port itself. Both sensors feed real-time data to the State Ports service.

New HiSea uses related feedback

Following discussions with the different ports, some additional uses have been identified for future development and improvement. Among them is the use of HiSea for life-saving and rescue. High resolution satellite technology is already being used for such uses.

The use of HiSea for seabed scanning has also emerged among the users, taking advantage of the bathymetry monitoring service for the identification of sunken objects. Finally, and already mentioned in the first deliverable, the ports find it interesting that HiSea also includes air quality monitoring services, given that this is one of the most striking issues in ports today. Ports are aware that this topic is not within the HiSea scope.

Barrier encountered related feedback

During the discussions with the ports, as expected, the issue of barriers to using the HiSea platform arose. Firstly, the issue of costs came up, with users expressing that there must be a balance between the reliability of the service and its value to the public. Users stated that if the service is not reliable and proven, they will not be willing to pay for it.

Secondly, they point out that they have few human resources to assign to the use of the HiSea service. This feedback is not so relevant, because if HiSea demonstrates its reliability, then the ports will be willing to allocate resources.
In terms of the effectiveness of the service, users have expressed the importance of standardisation of sampling, as in-situ measurements must follow a standardised protocol for subsequent reporting and submission to the competent authorities. Therefore, they see it complicated at the moment that the complete water quality monitoring is fully executed by HiSea, and therefore in terms of measurements and report execution they see it more as a support tool.

On the other hand, they also take into account that the use of the platform requires a training period. In some cases, they see this process as a barrier because of the time it required. Again, if the platform is proven to improve efficiency, then we do not see this training as a problem.
Finally, fear also emerged regarding the use of online tools versus conventional methods. Users understand that the evolution of organisations clearly tends to implement new technologies, but there is an inevitable fear of exposure and being an easy target for cyber-attacks, leaving them more vulnerable regarding the use of current the methods.

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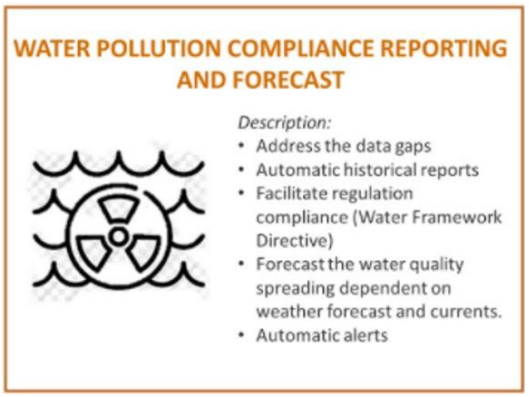
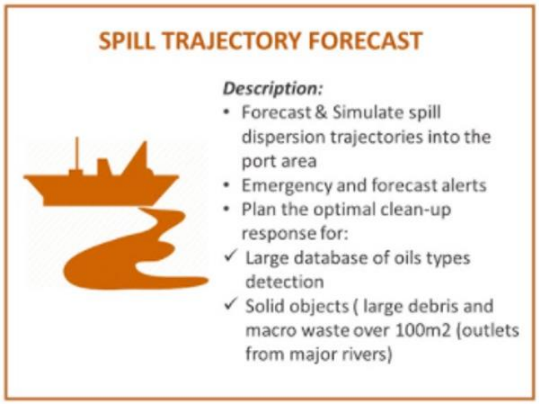
Business Cases and product Sell Sheet

Advisory board feedback has also contributed to the fine-tuning of the HiSea business cases, by helping identify and opening the scope to another 3 cases. We initially started with water quality and control, and it has now been increased by the following three:

1. WATER POLLUTION COMPLIANCE REPORTING AND FORECAST



2. SPILL TRAJECTORY FORECAST



3. SAFETY AND OPERATION MANAGEMENT BASED ON MET-OCEAN

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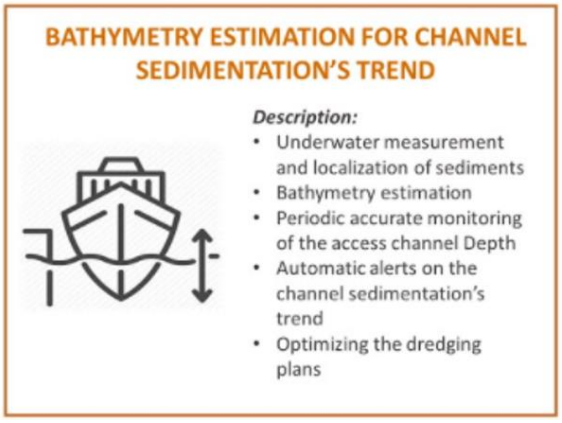
4. AUTOMATIC CHANNEL DEPTH TREND ALERTS

Commented [MT1]: Check names



After establishing the new business cases with the contribution of user feedback, HiSea partners were then able to define a product Sell Sheet for the platforms services. This will be further detailed in the corresponding deliverable.

Commented [MT2]: To be checked by Agora

User Test

The preparation of a "user test" was planned to be carried out. During and after the webinar this same issue arose in order for users to be able to try the platform's functionalities by themselves and put to the test what they had seen during the webinars demonstrations. Hidromod prepared the platform for users to easily access it remotely

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and test its functionalities. For this, the user test was set-up based on a Valenciaport scenario showing the ports map, sample points and parameter values. The services were available to test as shown in the platform's demonstration during the webinar.

The user test was initially sent to the Port of Valencia as the data was based on their scenario. Feedback was provided without going into detail on service functionalities, mainly relating to the design aspect of the platform. Due to this, the user test was sent to other users, where at this point it was the run-up to the summer holidays, which posed a threat to responses. Again, no feedback was provided from the other users.

The user test was available for a specific period of time and was eventually disabled by technical partners as the platform was undergoing further developments. Hidromod is currently working on improvements and preparing a new version of the user test which will be sent out again.

User feedback for service implementation

This section is related to the feedback provided by the users in order to contribute to the developments of WP5, more precisely to Task 5.2: Implementation of web and mobile clients.

During the review meeting in Delft (February 2020), partners presented an initial draft on the Mobile App design and potential functionalities to be assessed by the partners with an internal brainstorming with partners. One of the premises was to design the app to be quick and easy to use and prioritize its functionalities due to an app's own limitations. Advisory board members were approached, where they received an explanation of the HiSea Teams' intentions and potential of developing the HiSea Mobile App. The ideas discussed in Delft were transmitted to the AB members to set a starting point, resulting in the following list of priorities:

1. Implement some form of the communication interface between the user of the Dashboard and user of the Mobile Apps (e.g. shared notes or chat).

2. Convey information and gather information through the App and Dashboard:

    a. Display alerts that are being sent from the HiSea Platform's Dashboard when parameters cross various thresholds, including alerts when e.g. an oil spill was detected or a specific event is predicted.
    b. Download and display reports from the Platform's Dashboard.
    c. Display data from the Dashboard on the Mobile App (needs to be more specified as to which data specifically and in what form). This includes sending a location to the Mobile App user. and the opposite PIN a location on the Mobile App to dashboard.
    d. Enable App user to send the current location and send data specifically for that location back to the platform.
    e. Enable the Mobile App user to enter text-based or numerical data to be transmitted to the Dashboard.

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f. Display a map and enable the Dashboard user to send a request to the Mobile Application user who is sent to investigate a location or a marked area on the map.

This list served as ideas for possible App features as a baseline for the followed software development process.

When explained to port users the potential of developing an APP and its possible functionalities, in general the users expressed that it is a very practical idea to be able to communicate and send/receive locations of spills in the field. Considering that nowadays everything is managed by mobile phones.

Some of the user comments:

"*Very practical to be able to communicate and send/receive location to users in the field. Nowadays everything is provided and managed via mobiles. If caught out of the office and an emergency situation is detected, brilliant idea to receive a notification of the situation, etc.*"

Aquaculture

Selonda reached out to aquaculture farmers operating sea cages in Greece and Spain. A valuable input was provided also from the farm managers of the new companies of the Group, Andromeda and Nireus.

Selonda group launched in 2018 a large scale monitoring plan in order to evaluate the biomass production potencial in several farms in Greece and Spain. The main conclusions of all this information are included in the end user requirements below:

Temperature:

Temperature is critical for the determination of the feeding rate supplied to the fish. All farms measure temp, with very cheap thermometers, and some with in situ sensors.

It has value for the farmers to

1. Have online- web based – real time graphs of temp in order to adjust feeding rates
2. Have graphs of yearly temp for the last 2 years
3. Have temp forecasts, if available and if accuracy is better than 1 celsius unit.
4. Comparison of yearly temp profiles of different sites

   Service No2 and 4 are also valuable for Government agencies that are producing or approving Aquaculture exploitation maps, marine engineers, companies that undertake farm design and licencing for designing a farm.

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Oxygen:

It is essential for the growth of the fish. In Sea cages the fluctuations of O2 are between 80 and 105% saturation at 99% of the cases. It is measured by most sites occasionally with handy O2 meters, and in some cases (<20%) with in situ sensors.

The important O2 fluctuations are happening inside the cages, either during feeding, or when nets are dirty due to algal fouling, or as a result of very low currents. This O2 measurements can ot be provided without in situ sensors.

It is of some value for the farmers to have web-based O2 graphs, but not critical, as experience shows that outside the cages, O2 very rarely drops below 80%.

Currents:

Currents are a very important aspect in finfish aquaculture related to, a) fish performance b) application of feeding strategies c) dimentioning of mooring systems d) specifications of nets and cages

Farms do usually do not measure currents, as the only traditional way to do it is with expensive (12.000 Euros) in sity sensors. Not more than 10% of the exisiting fish farms are using today in situ current sensors. Current measurements are also done by outsourcin, usually by universities for a very limited period of time.

Current data form the extensive monitoring that Selonda group perfomed the last 4 years shows that currents are on average from 3 to 15 cm/sec in the Meditteranean. Daily and hourly fluctuation are important. Daily fluctuations can be for 0,5cm/sec to 20cm/sec. In some sites during storms currents can reach 30cm/sec and in others 80cm/sec, which has a huge impact on moorings, cages and nets specifications.

Currents could be of important value, provided that high resolution models are created and validated. Selonda has provided current data from in situ measurements for several sites to consortium partners, and creation of high resolution models and validation is in progress.

<u>End user requirements</u>

1. Web based – real time monitoring of currents (with updated ideally every a few hours) for farmersu

2. Yearly graphs of current speed (and direction) for the last 2 years for farmers and Aquaculture companies. This service is very interesting also for Government agencies that are producing or approving Aquaculture exploitation maps, marine engineers, companies that undertake farm design and licencing for designing a farm (positioning, orientation, specifications, mooring analysis). Today these type of data are provided by buoy operated by the government and are usually far away from the farms, making the data less reliable.

   This service has an important value for the users, as the alternatives are expensive or less reliable.

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Waves:

Waves are very important for the Sea farms, as they dictate the daily operations that are possible, the farm equipment specifications, the lost feeding days due to bad weather. Farmers are interested in maximun wave height, significant wave height, and wave direction.

<u>End user requirements</u>

Max wave height (Hm) and significant wave height (Hs) and wave direction in degrees are the data. Here it is maybe possible that low resolution models of 1km by 1km are adequate for the job. Exception is that farms embedded in special geographies, (for example ,protected by an Island) may need high resolution models to provide adequate accuracy.

1. Web based – real time Tmeline graph for Hm and Hs (Hm and Hs scale , time period, should me possible to be adjusted by the user
2. Current rose diagram indicating Hm and Hs for every direction monthly and yearly
3. Comparison of Hs, Hm over a user specified period between two or more selected sites
4. Accurate Hs and Hm predictions 3-7 days (provided we can demonstrate accuracy of prediction models).

Services 2 and 3 are important for Government agencies that are producing or approving Aquaculture exploitation maps, marine engineers, companies that undertake farm design and licencing for designing a farm.

Chlorophyll is not relevant to finfish aquaculture. However, it is important for forecasting Harmful Algal Blooms (HABS) for the shellfish industry. Harmful Algal blooms act in two main ways: either algae which are directly toxic to marine life or humans can grow and cause direct harm, or algae which are not directly harmful to marine life can be concentrated by filter feeding shellfish, such as mussels. These algae produce toxins which when concentrated in the shellfish and when consumed by humans can lead to serious illness and, on occasion, can be fatal.

These blooms can therefore lead to the loss of stock and even product recalls, which has been estimated to cause losses globally of $200 million annually. Understanding the occurrence and movement of toxic algal blooms is therefore a key commercial/economic factor in marine aquaculture enterprises. Planning activities so as to reduce and minimize the commercial impact of such blooms has the potential to save large sums of money for these operators.

A HAB forecast system (which includes chlorophyll monitoring) will enable aquaculture clients to:

- Optimise ongrowing and harvesting techniques to reduce mortality due to anoxia and/or allow shellfish farmers time to harvest before a prolonged closure and thus enhancing productivity
- Increase efficiencies, production and sales by optimizing harvesting schedules and reducing mortalities on farms

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- Save money and maximise their resources by avoiding such losses
- Remove the guesswork involved in when bay closures will occur so that farmers can make informed choices
- Move or harvest stock to avoid the impact of blooms
- Plan husbandry work in relation to future bloom or non-bloom events
- Reduce errors in husbandry practices and harvesting schedules
- Reduce downtime for processors if product can be stockpiled in advance before the onset of a bloom
- Improve the service to their customers with a more reliable supply of product

In addition, for government agencies and scientists the forecast system will provide them with time to plan their sampling schedule more efficiently particularly when a severe or unusual bloom is expected.

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5. Reach out to other users

Ports

A new action and approach to users is the reach-out to the MEDports Association, more specifically to its Sustainability Committee, which aims at studying environmental, economic, social topics for the maritime and port sector and finding solutions to reduce the carbon footprint, improving relationships with cities and people' s mobility.

The Association is composed by a number representative from Mediterranean ports. Each port is unique and has its own characteristics, such as location, traffic types, needs, knowledge and expertise. This reach out provides a great opportunity to introduce the HiSea project to a large variety of ports with different profiles.

Contact has already been established with two of the Association's Chairmen. A meeting to present the project was set up to raise awareness and explain the HiSea consortium's intentions of reaching out to MEDports. The presentation was then sent to all the members following with an easy online mentimeter questionnaire to gather initial feedback. This action is currently at an early stage and will be detailed further on in the project.

During the communications with MEDports, our main person of contact expressed the importance of explaining what the Association will get out of helping us with their feedback to the HiSea project. This was translated into that members might not be willing to "work for free" and expect some type of return. The benefits to them were explained and then circulated among the MEDports' members.

A list of the MEDports' representative ports is:

Country	Port
Algeria	Port of Arzew
Algeria	Port of Bejaia
Algeria	Port of Skikda
France	Port of Bastia
France	Port of Marseille-Fos
France	Port of Toulon
Italy	Port of Rome
Italy	Port of Taranto
Italy	Port of Venice
Lebanon	Port of Beirut
Malta	Malta Freeport Corporation
Morocco	Tangier Med Port Authority
Slovenia	Port of Koper

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Spain	Algeciras Bay Port Authority
Spain	Port of Barcelona
Spain	Ports of Catalonia
Spain	Valencia Port Authority
Spain	Port of Cartagena
Tunisia	Office of Merchant Marine and Ports (OMMP)

Other ports in close relation to the Port of Valencia have been contacted and are currently unavailable to help with the HiSea project. The people of contact kindly explained that they are suffering from high workloads and currently do not have time to dedicate to providing help. We understand that this lack of interest could be also related to the difficulties companies have experienced with adapting to remote working due to the pandemic situation and effecting work load and organisation. Also, contacts have kindly asked about budget issues related to providing their feedback, data and their time., resulting again in a lack of interest.

The reach out process to new users is currently an ongoing activity.

Aquaculture

The following table outline key users that could be contacted for feedback of the Hi-Platfom in Ireland:

Sector	**Stakeholders**	**Name**
Private sector		
Primary production	Finfish farmers	MOWI Ireland (IE)
	Shellfish farmers	Bantry Harbour Mussels Ltd. (IE)
	Seaweed farmers	Bantry Marine Research Station (IE)
	Hatchery	Cartron Point Shellfish (IE)
	Processors	Bantry Bay Seafoods (IE)
	Insurance companies	Sunderland Marine Insurance (IE/UK)
	Marine engineers (farm design)	John J O'Sullivan & Associates (IE)
Secondary production	Environmental monitoring and assessors	AquaFact (IE),

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Service Providers	Aquaculture Associations	Ambio (GR), APC (GR) Nays (GR) Federation of European Aquaculture Producers (EU) European Aquaculture Society (EU) Appromar (SP) Elopy (GR) Irish Farmers Association (IE)
State Agencies Planners Development Monitoring	Licensing and coastal zone managers Industry promoters and grant providers Food safety and environmental	Dept of Agriculture Food and Marine (IE) Sea Fisheries Protection Authority (IE) Bord Iascaigh Mhara (IE) Food Safety Authority (IE) Marine Institute (IE) Environmental Protection Authority (IE)
Public research Aquaculture	Universities Other public research organisations	Aquaculture Dev Centre (UCC) (IE) Marine Institute (IE)

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6. Barriers encountered

The barriers encountered during the development of this deliverable are related to:

1. The Covid-19 year has proven to be a difficult challenge for many organizations. Studies have shown its effect at both personal and company level, where many actions and changes have been required to build resilience in the face of this unexpected pandemic situation. As already mentioned, this situation has effected some of the projects activities leading to delays. The pandemic has clearly been a barrier for the HiSea project.

2. Covid-19, shift the priorities to the aquaculture sector to critical operations and all other aspects were receiving less attention.

3. One of the consortium's partners has experienced a company merge process which also has led to difficulties to carry out some activities as planned. This situation required a new approach to accelerate the delayed activities and therefore decided to include a new partner to the consortium, which also required its own process and time.

4. Some farmers are lacking knowledge of the importance and the value of the measurements. Market education through newsletters, or through some interviews with marine engineers could help

5. The lack of knowledge of the value of these information, is leading the End users to underestimate the value of these data, reducing their willingness to pay for the services.

6. Eventually, the project's consortium came to a consensus and decided to request a 6-month extension in order to dispose of more time to effectively carry activities with difficulties.

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7. Conclusions

This section provides the general conclusions obtained from the feedback provided by the different users encountered with during 2019 period.

PORTS

One way or another and based on the consortiums experience with user communication, a conventional questionnaire approach is not the most efficient way to retrieve user feedback, especially in the port sector.

The consortium is working on new approaches in order to maintain this flow and establish new communication flows with new users. Contacts to the attendees from both workshops and webinars have been made and will continue to be made in the future.

Also, a new approach and action underway is the reach-out to the MEDports Association, composed by a number representative from Mediterranean ports. Each port is unique and has its own characteristics, such as location, traffic types, knowledge and expertise and needs. Contact has already been established with the two of the Association's Chairmen, were a meeting to present the project was set up to raise awareness and explain the HiSea consortiums intentions of reaching out to MEDports. The presentation was then sent to all the members following with an easy online mentimeter questionnaire from initial feedback. This action is currently at an early stage and will be detailed further on in the project.

All ports have already established work procedures to carry out their daily activities, which among many others includes water quality management, bathymetry control and monitoring, oil spill detection and mitigation and also safe berthing operations influenced by met-ocean data. For this reason, many ports are reluctant to introducing new technologies until they are completely proven with quality standards, which in many cases is due to lack of knowledge.

Some users have also expressed the threat new technologies can have on current jobs. In many cases port activities are carried out with on-site hands-on conservative methods of work and therefore some are worried about disruptive technologies in specific jobs.

It is a fact that as these technologies are emerging and by the day people are more aware of them, people are starting to believe more in their possibilities and reliability. There is still a long way to go.

In general, according to user feedback, the development of the HiSea app has been generally accepted as a practical tool for people working on the field, and for emergency notifications. This will have to compete against the ECC's 24/7 surveillance. Although, issues did arise regarding its accuracy for sending GPS locations of accidents in a timely manner.

It is still an early stage for port users to change from their current and conservative methods to using a more sophisticated set of technologies. In some cases, for them it seems too easy for it to be true.

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They can see the platform currently working as a support tool to their current methods until it has gained maturity and been officially validated.

The age of the workers in the port ia also another factor related to being reluctant to these technologies or not. We have clearly experienced that the older generation of workers have a more negative view over the use of new technologies whereas the younger ones are more flexible. Nevertheless, we must bare in mind that most of the contacts made within the port sector come from a numerical background, which in most cases expect precision results.

The user test must be evaluated again by the users with a more tailored approach. This means a one-on-one demo with them to explain the services in a training session and allow them to test the platform shortly after or even at the same time.

AQUACULTURE

Water quality is a critical factor when culturing any aquatic organism. Optimal water quality varies by species and must be monitored to ensure growth and survival. The quality of the water in the production systems can significantly affect the organism's health and the costs associated with getting a product to the market. Water quality parameters that are commonly requested by the aquaculture users are temperature, oxygen, currents, chlorophyll (blooms) and waves. Aquaculture users have expressed the value of easy access to the service, accuracy, but overall, a forecast system that usually in situ measurement are not capable of that.

The app application has been very appreciated since operational people need remote and rapid access to the latest water quality information.

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8. Annexes

Annex 1: Webinar Agendas

PORTS

HiSea Demonstration Workshop

HiSea is an EU-funded project that aims to develop, test and demonstrate information services that provide high-resolution data of water quality at sea. The project is developing an innovative service that will provide **information and alerts** to ports and aquaculture sectors **to enable real time crisis management and improve future operations**. The HiSea platform incorporates and processes data that are being obtained through the marine, land and climate services as well as local monitoring data and advanced modelling. The platform will enable users to **improve operation, planning, and management of different marine activities**, with a focus on the port and aquaculture sectors.

HiSea services will deliver high resolution information which will be readily available and fit seamlessly into user's operation and management requirements. HiSea aims at **co-designing the service** together with the **end-users** to ensure that the high resolution water quality information will answer specific questions from the targeted ports and the aquaculture sectors.

In order to confirm that HiSea products and services will fulfill users' expectations, a **User demonstration webinar** has been scheduled for **Thursday, 4th of June 2020**. The aim of the workshop is to demonstrate the high resolution service offered by HiSea. It is a **hands-on workshop**, where potential users can interact with HiSea Platform, provide feedback and get to know how they can incorporate the HiSea tools into their workflow.

We kindly invite you to join this workshop to learn about and interact with the HiSea Platform. We are confident that your experience and insight in the **Ports and Aquaculture** sectors, as well as in **marine activities,** will help us to shape and improve the HiSea services and products to best suit the Ports and Aquaculture information demands.

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Main focus of the Webinar: How ports can benefit from High-Resolution Water Quality Data

Date: 4th June 2020

Registration: Link

AGENDA

Timing	Activity
09:00-09:10	**Welcome to the workshop** Welcome and Expectations by Bracha Ehrman (Agora)
09:10-09:20	**Presentation of the HiSea project** **Benefits of high-resolution, Earth-Observation data services for ports** Ghada El Serafy (Deltares) and Rafa Company & Mark Tanner (Fundación Valenciaport)
09:20-9:50	**Demonstration of HiSea Platform and Apps for Ports and Aquaculture stakeholders** Pedro Galvão (Hidromod)
09:50-10:20	**Roundtable: End-user feedback and discussion** Moderator: Edward Melger (Deltares) Questions and comments from participants
10:20-10:30	**Closing remarks** Bracha Ehrman (Agora)

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AQUACULTURE

INVITATION TO THE WEBINAR:

THE BENEFITS OF HIGH-RESOLUTION WATER QUALITY INFORMATION FOR THE AQUACULTURE INDUSTRY

THURSDAY, DECEMBER 10, 2020

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How can Aquaculture Benefit from High-Resolution Water Quality Data Services?

The EU-funded HiSea Project invites you to participate in a virtual **demonstration workshop** focused on using the HiSea services to improve **aquaculture operations**, improve performance and anticipate damaging events to mitigate negative impact.

What will you gain from the HiSea webinar?

HiSea is developing innovative services for the aquaculture sector to provide **reliable and accurate historical data, forecasts and alerts** regarding water quality parameters and weather conditions, without the need to install instruments on site, by using data obtained from satellites. Co-designed with end-users, to answer the real needs of the targeted aquaculture sector, the services will be demonstrated to receive your feedback and update the final product to fulfil expectations. We invite you to **interact with the HiSea Platform and help us shape it to fit your needs and workflow best.**

The webinar on Thursday, December 10, 2020, will focus on:

- **Real time, historical data and forecast of weather and water quality information** including currents, waves, oxygen levels, turbidity, microbiology or sea and air temperatures to implement effective and efficient aquaculture management;
- **Improvement of procedures** with an impact on a daily operation such as tide forecasts;
- **Advanced data analytics** and **performance indicators**
- **Early warning and anticipation of harmful events** through forecasting their probable timing, magnitude and location. By allowing the simulation of alternative actions, the service will contribute to mitigating adverse effects on operations and environmental impacts.

Registration link https://register.gotowebinar.com/register/2472649229394690061

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AGENDA

Timing	Activity
09:00-09:10	**Welcome to the workshop** Milena Mirkis (Agora)
09:10-09:20	**In depth look at the benefits of high-resolution, Earth-Observation data services for aquaculture** Ghada El Serafy (Deltares) - Case study
09:20-9:30	**Introduction of use cases** Nikos Katribouzas (Selonda) • Acuinova Portugal - Recycling systems (high control enclosed systems) • Aqualvor Potugal - Land-based systems) • Selonda Greece - Water-based systems) • Bantry Marine Research Station - Water-based systems)
09:30-10:50	**Innovative tools for use in specific scenarios – a demonstration** Pedro Galvão (Hidromod). - • Acuinova Portugal - Recycling systems * • Aqualvor Portugal - Land-based systems* • Selonda Greece - Water-based systems * • Bantry Marine Research Station - Water-based systems * ** 15 min demonstration and 5 min Q&A*
10:50-11:20	**Roundtable: End-user feedback and discussion** Julie Maguire (BMRS) Questions and comments from participants
11:20-11:30	**Closing remarks by Milena Mirkis (Agora)**

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Annex 2: Questionnaires

Initial contacts for assessing value/demand:

Name and Surename:

From which Country are you from?

In which sector and area of expertise are you working in? (e.g. port authority, aquaculture, government, research, software development, environment, etc.)

Information requested:

General questions:

1. Do you use marine data and/or models? If yes, which type of data, how? If no, is it cost-related?
2. Do you have experience with such data portals in your profession?
3. Have you identified similar platforms or tools you would like to use or that you are currently using? If yes, which ones?

Platform/Demo related questions:

4. Do you find the HiSea platform useful and easy to use?
5. Do its services fit your activities?
6. Can its services improve operation efficiency (e.g. daily management, planning operations…)?
7. Have you identified negative points? If yes, which ones? (e.g. complicated to use, lack of functionalities, insufficient Water Quality parameters, reliability, etc.)
8. Would you/your company pay for such services (e.g. subscription, ad hoc) – range (100 to 1000 euros/month, more than 1000…)

Improving HiSea to fit your activities

9. What would you add to HiSea to better fit your company's activities?
10. Can the proposed services lead to new products or product lines?
11. Can you see HiSea used in other areas of exploitation?

To the extent possible:

1. Interested in free of charge information or updates about the project.
2. Is further contact desired?
3. What are the main challenges you might encounter in using the HiSea platform?
4. Would you be willing to help us improve the HiSea platform?

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AQUACULTURE (mentimeter format)

Final version of the questionnaire – 09-12-2020

General Questions:

3. From which country are you?
   Open question
4. Which organization type are you from?

- OPTIONS: government – environmental agency – research/academia – software development – aquaculture farms - others

3 Which parameters do you measure/use?

- Options: weather forecast – hydrodynamic (current speed and direction – waves) - water quality (chlorophyll, nutrients, pH, oxygen, temperature, etc.) - – all the above

5 How much does it cost you per site to measure these parameters?
Open question

8. Which kind of company is furnishing you these information (outsourcing, institutions, partners…)?
9. Which parameters would you like to monitor?
   Options: significant wave height current speed and direction – maximum waves –– temperature – suspended matter - chlorophyll - nutrients - oxygen concentration – others

10. How often would you like access to these data?

- Options: daily, weekly, monthly, annually

After each service

2. What do you think of the Acuinova Portugal - demo?
   Slide type: scale. People can choose a number from 0 (strongly disagree with the statement) to 5 (strongly agree with the statement). The statements are:

- I like the way data are visualized
- The employed visualization does not cover my needs
- I would like to choose and define the way of visualization
- I am not interested / data are not relevant to me

3. What would you like to change to get a more valuable service? Open question

1. What do you think of the Aqualvor Portugal - land-based system demo?
   Slide type: scale. People can choose a number from 0 (strongly disagree with the statement) to 5 (strongly agree with the statement). The statements are:

- I like the way data are visualized
- The employed visualization does not cover my needs
- I would like to choose and define the way of visualization

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- I am not interested / data are not relevant to me

2. What would you like to change to get a more valuable service? Open question

1. What do you think of the Selonda Greece - water-based system demo?:

Slide type: scale. People can choose a number from 0 (strongly disagree with the statement) to 5 (strongly agree with the statement). The statements are:

- I like the way data are visualized
- The employed visualization does not cover my needs
- I would like to choose and define the way of visualization
- I am not interested / data are not relevant to me

What would you like to change to get a more valuable service? Open question

What do you think of the Bantry Bay – near shore system demo?:

Slide type: scale. People can choose a number from 0 (strongly disagree with the statement) to 5 (strongly agree with the statement). The statements are:

- I like the way data are visualized
- The employed visualization does not cover my needs
- I would like to choose and define the way of visualization
- I am not interested / data are not relevant to me

What would you like to change to get a more valuable service? Open question

After Pedro's presentation

6. HiSea Platform

- Slide type: scale. People can choose a number from 0 (strongly disagree with the statement) to 5 (strongly agree with the statement). The statements are:
  - Do you find the HiSea platform easy to use?
  - Do HiSea services fit your activities?
  - Can HiSea service improve operation efficiency (e.g. daily management, planning operations, etc.)

7. Which services are relevant to you?
8. Would you/your company pay for such services (e.g. subscription, ad hoc)? Open question
9. Is there any other information/data HiSea is missing for you to use?? Open question
10. Do you think it is worth acquiring the HiSea services? If no, why? Open question
11. Can you see HiSea used in other organizations/sectors (environmental agency, ports, etc.)?? Open question

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