RESPONSEABLE

Interactive Platform

as tool for ocean literacy

Work Package 5

Deliverable 5.7

March 2018

Project coordinator:

ACTeon environment research & consultancy

Project beneficiaries:

GRID ARENDAL, OÉ Gaillimh NUI Galway, proSea marine education, Universidade Lusófona, INCDDD TULCEA, NIVA Norwegian Institute for Water Research, CSP, BEF Germany, azti tecnalia, themarinefoundation, 7SEVEN Solutions for the Environment Sustainable Engineering, UBO université de bretagne occidentale, Marine & Coastal Policy with Plymouth University, tv/e

This project has received funding from the European Union's Horizon 2020 Framework Programme for Research and Innovation (H2020-BG-2014-1) under grant agreement No. 652643.
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Interactive platform

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Interactive Platform Overview

Developing an interactive platform as part of ResponSEAble

Task 5.7 of WP5 of the ResponSEAble (H2020 project) has been led by NIVA and constitutes the development of an interactive platform that contributes to raising awareness on everybody's responsibility and interest in a healthy and sustainable ocean. The main focus region for the content has been the marine resources of the North Sea, but the final platform can easily be extended to cover other regions.

The platform was developed so that it can be used by people of all ages and be installed in public places such as commercial ferries, in museums, or centrally located in research institutions. The only requirement is access power supply and internet for live content, but defaults to static/offline content if no internet is available.

The content for the interactive platform has been developed and is currently being tested prior to installation in public places. The interactive platform consists of a touch-screen which is installed into a console (wave shaped, vertical structure). The screen is positioned at the height where 8-9 year olds can easily reach the screen and it is also angled so that adults can easily use the touch screen. The platforms will be installed on two commercial ferries operating in the North Sea and along the coast of Norway. We have reached an agreement with the ferry companies, Color Line and Hurtigruten. Both companies have shown enthusiasm to be able to host the platforms onboard their ferries with the intention of teaching kids and adults about our marine resources and how to better care for them.

The development of the interactive content for the platforms had delivery deadline mid-March and the installation of the platforms will take place in early April after agreement with the companies. We have been given designated places on the two boats where we can install the platforms where we have access to power and internet (we will be able to update the content continuously as the boat moves e.g. once or twice every hour).

Interactive content overview

Ocean currents – visualization of ocean currents for the World Oceans with the ability to zoom into explore local ocean current dynamics. These are dynamics images/videos of the currents from ocean models (updated to near current date).

Marine Maps – Visualization of fishing boats and other boats using AIS, location of coral reefs, spawning and feeding locations of several fish species and stocks including cod and herring for the North Sea, Norwegian Sea, and the Barents Sea.

Ferrybox is a complex instrument with several sensors installed on several ferries and commercial cargo ships in the North Sea and Norwegian Sea. As the boat moves through the water, the Ferrybox instrumentation monitors the water characteristics at 5 m depth. This provides us with access to continuous monitoring of the waters where these ferries operate such as the North Sea. As part of the interactive platform we have developed a module that allows the users to view the various components of the water that is currently being measured such as salinity, temperature, chlorophyll etc. The users can view information on the changes in each of the water properties over the last 7 days, 1 month, or 1 year. This provides a unique opportunity to explore how the water where the ferry operates changes with time and season. Currently the module will show the observations made by the two ferries where the interactive platform will be installed as well as from a cargo ship that sails between Norway and Svalbard. The background of the plot showing the ocean properties will contain statistical values of e.g. ocean temperature and chlorophyll which can then be compared to current values (e.g. is the water warmer today than last year?). An info box will be shown informing as to why it's important to observe the oceans and how these kinds of observations can be utilized in weather forecasting, ecological assessments etc.

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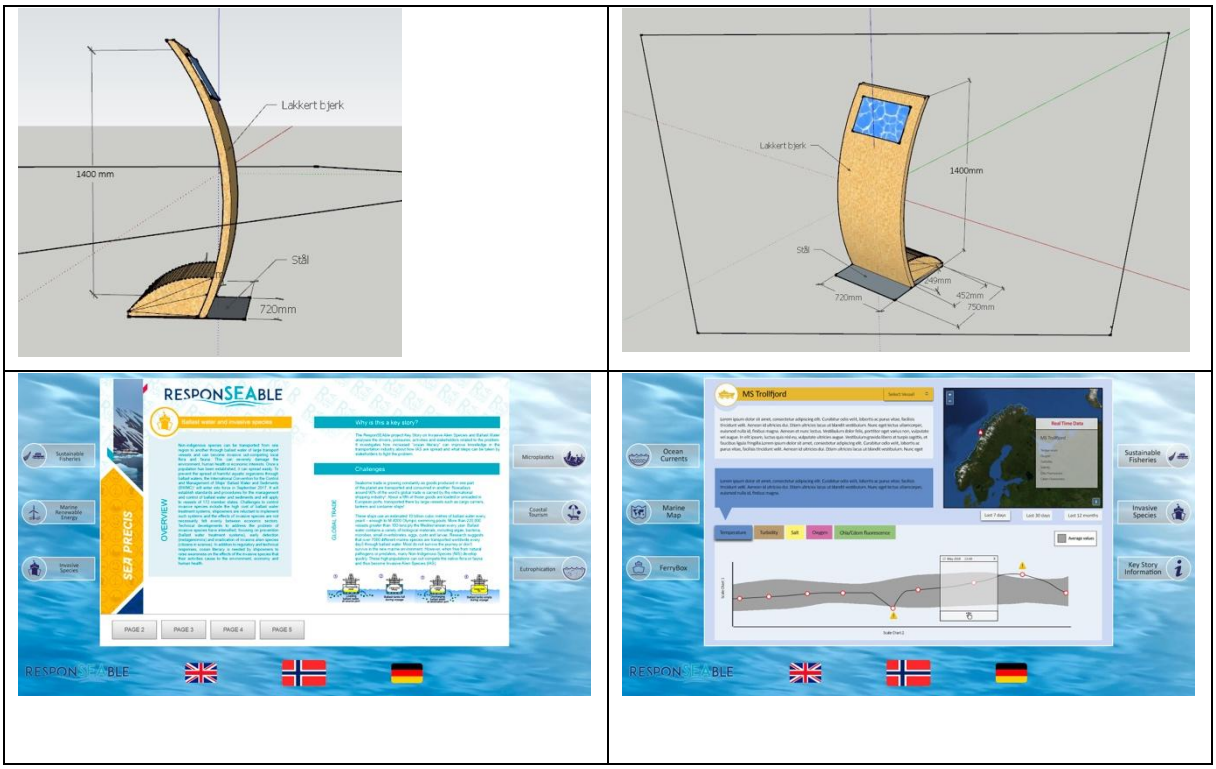
Sustainable fisheries – this module contains a fisheries challenge game that allow the user to manage the number of fishing vessels that can operate in the North Sea simultaneously while at the same time sustaining the fisheries. The fisheries will also be affected by climate conditions and we will have an info button as to how climate and fisheries both needs to be considered to sustainably manage fish stocks. This content will also contain a link to the Sustainable Fisheries Key story.

Invasive species – this page will contain a video showing the impact of invasive species- The page will also contain a button to the Invasive Species Key story.

Key story information – This is the page showing the 6 key stories. The information is cut and paste from the PDFs created by ResponSEAble.

Some modules containing quiz has also been implemented but these are documented as part of Task 5.9.

Below are a number of images showing the gradual development of the content and the console from drawing board to finish.



Picture 1 The two top images show the design of the interactive platform installation. The touch screen is situated at about 140 cm height which is ideal for kids and adults to be able to use it. The two images below show mock-ups of two screens showing content left) the static information about the 6 key stories in ResponSEAble right) a dynamic map and plot showing the data measured by the Ferrybox instrument onboard the ship, or alternatively on 2 other ships. The plot shows the information measured now or in the past for temperature, salinity, CDOM (organic carbon), chlorophyll-a (plankton biomass proxy), turbidity (particles in water), and oxygen. The interactive content will be available in German (one ferry where platform will be installed operating between Oslo and Kiel), English, and Norwegian.

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Picture 2 The four images shows the production of the interactive platform console. The console is hand made using birch wood.

Target Audience

Our target audience includes kids (6 years and older), and adults. Some of the content is perhaps more attractive to younger kids than adults such as the fish challenge (find the optimal combination of fishing vessels over time to manage a fish population sustainably). Other content, such as the details of the 6 ResponSEAble key stories are better suited at older kids or adults due to their detail level and more serious content.

Ocean Literacy Goals

To develop a broader understanding of how important the marine resources are for your everyday. The fact that the ferry that the person is currently onboard is collecting data used to manage the ocean would hopefully stir some deeper interest into why that is important and how to do it.

Design & Development Process, including implementation of the Living Lab process

Design and development has been a gradual process led by NIVA with several participants (GRID Arendal, Seven, GDM). A Norwegian company (GDM) was used to deliver the “interactive engine” for the content as developing such tools from scratch for touch screens would take years. Some of the content has also been coded by the same company in collaboration with researchers at NIVA and Seven. As part of the development of the interactive platform we created a detailed requirements specification document containing all of the details and responsibilities of the content to be included. This document is included in the next section and shows how all of the participants have contributed to various parts of the development. NIVA has been leading this task in coordination with GRID Arendal, and Seven, while a Norwegian company Global Digital Media was contracted to deliver the online platform and the physical consoles and touch screens. The content was jointly developed among NIVA, Seven, GDM, and GRID Arendal. Some of the final content differs from what was originally planned for but for the most part we followed the structure of the document below for the development.

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System Specification

GDM will provide the platform and support all partners in the implementation of their modules

System architecture

1. The System under development will be based on a platform developed by GDM. It is a client-server system where the client is running on a Windows environment installed on a PC and the server is on the cloud operated by GDM.
2. The system will be connected with a GPS with antenna, ensuring that the reception signal is strong.

Operation modes

1. With respect to the connectivity of the system, it will be capable to operate in two different modes: online and offline
2. The system will be able to automatically identify whether a connection to the internet exists or not and switch to the respective mode without any human intervention.
3. The offline mode will differ from the online mode in the following:

   Instead of the current data, the most recent available data from the Ferrybox system will be displayed (see section 0).

   AIS data will be displayed only as long as they are not older than 12 hours (see section 0)

   Forecasts will be displayed only if they are not older than 24 hours (see section 0).

   Maintenance of the client system is only possible when in online mode.

   Downloading of statistical data is possible only when in online mode (see section 0)

Languages

NIVA to provide the content in the format specified by GDM.

1. Two languages will be supported by the system which will be used for presentation of content and for all textual elements of the UI (menu, navigation etc.)
2. For the initial implementation these languages would be Norwegian and English.
3. The system will be pre-configured to a default language.
4. The user will be able to switch to any one of those languages by clicking on the respective flag icon which will be placed on the main page.
5. The system may be easily adapted to support another pair of languages if desired in the future.
6. Textual information that needs to be translated will be stored in separate textfiles having an open format.

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Various issues

1. The response time of the system to a user input will in no case be longer than five seconds.
2. Update of the content will be possible anytime during the licensing period by the administrator remotely using the CMS of the GDM Media Platform.
3. Replacing existing data e.g. map layers or correction of the text in specific modules will be carried out by authorized users without the need of an intervention by the developers of the platform.
4. Independently developed new web applications (modules) using technologies HTML5, CSS and Javascript, can be seamlessly integrated into the GDM Media Platform, as long as no access to external resources is needed.

Startup and screensaver

Responsible partner is GDM.

1. On system startup and while the system is in idle state, the screensaver will be activated.
2. The screensaver will cover the whole screen. It will show a lively and playful animation related with activities in and near the marine environment.
3. Upon touching the screen the screensaver will become the main pane of the main screen (see Section 0).
4. After X minutes of inactivity, the system will return to the screensaver mode.

Main screen

Responsible partner is GDM

1. The main screen will be divided into the following parts:

   The main pane in the middle of the screen.

   Buttons on the left and/or the right side of the screen which represent the modules of the platform.

   The remaining part of the screen including: a) icons of flags representing the supported languages and b) a link navigating to more information about this project and including contact information (e.g. email) of a project representative.

Figure 2 shows an example of the main screen.

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Figure 2: Example of the main screen

2. The main pane can contain clickable elements, corresponding to the buttons of the left and right side of the screen.

3. When a user clicks on a button or clickable element, the respective module will be launched.

4. All content will be shown in the main pane while the other elements of the screen will remain active and visible, except for when the system is in screensaver mode.

5. The user may return to the main screen at any time or navigate to one of the modules directly by pressing the respective button.

Modules

Introductory video

Responsible partner to provide the videos is GRID-Arendal. GDM to develop the module

1. Every time a user starts a module, a brief introductory video, up to one minute, may optionally be shown according to the system's configuration settings. Upon finishing of the video the module starts immediately.

2. At any time during the video play the user may end it and start the actual module immediately ("skip" button) or repeat the video from the start ("replay" button).

3. It will be possible to store one video for every available language and the system will play that video that corresponds to the currently selected language.

4. In case there is no video for a language to play, based on configuration settings, the system may select the video of another language or start the module directly.

5. The system will at least support mp4 video format.

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Fish Fleet Challenge

GDM is responsible for this module. NIVA and Seven will contribute.

The purpose of this game is to maximize the catch of the of a fish fleet over a longer time period and at the same time maintain a sustainable fishing strategy. The game is based on a simple fishery model (the Gordon-Schaefer model).

1. A graphical representation (icons) of the boats and the fish stock in the ocean should be visible.
2. The user will be asked to specify the fishing effort represented by the number of fishing boats to be deployed in each round (year) over a period of several years. It is assumed that the capacity of all boats will be the same.
3. The user should be able to modify the fleet number for each year (higher, lower, or the same as the previous number). As the game starts, the number of fishing boats is usually low.
4. The output after each round will be:

   A visual presentation (e.g., a pile of fish) representing the number of fish caught during the last round

   A graph representing the tons of fish caught over time

   A graph representing the tons of fish available in the ocean

   An overall score representing the percentage of the achieved yield compared to the maximum sustainable yield (pre-calculated) over all years

6. The input of the user will be used to run the model for one more year, and the output graphs will be updated (see Figure 4).
7. Predefined configuration parameters of this module are the following:

   the number of rounds (years)

   the initial population of fish and fishing boats

   the model parameters: rate of population increase, the carrying capacity of the fish population, and the catchability coefficient of the model

8. In case the score is among the best 20 ones, the user will be asked to enter his name in the “Hall of Fame”.
9. Additional information may be requested from each player in order to calculate his rank among other players (e.g. male/female, age between 20-30 years). This information will then be used for statistical analyses (see section 0)
10. Instructions on how to play the game will be provided by pressing on the respective button which will be always visible on the screen.
11. It should be possible for the user to get additional information related with a specific graph (e.g. fish stock), if available, in form of HTML code or video (mp4).
12. Cross link navigating to the Fisheries Key Story (see section 0) will be provided.

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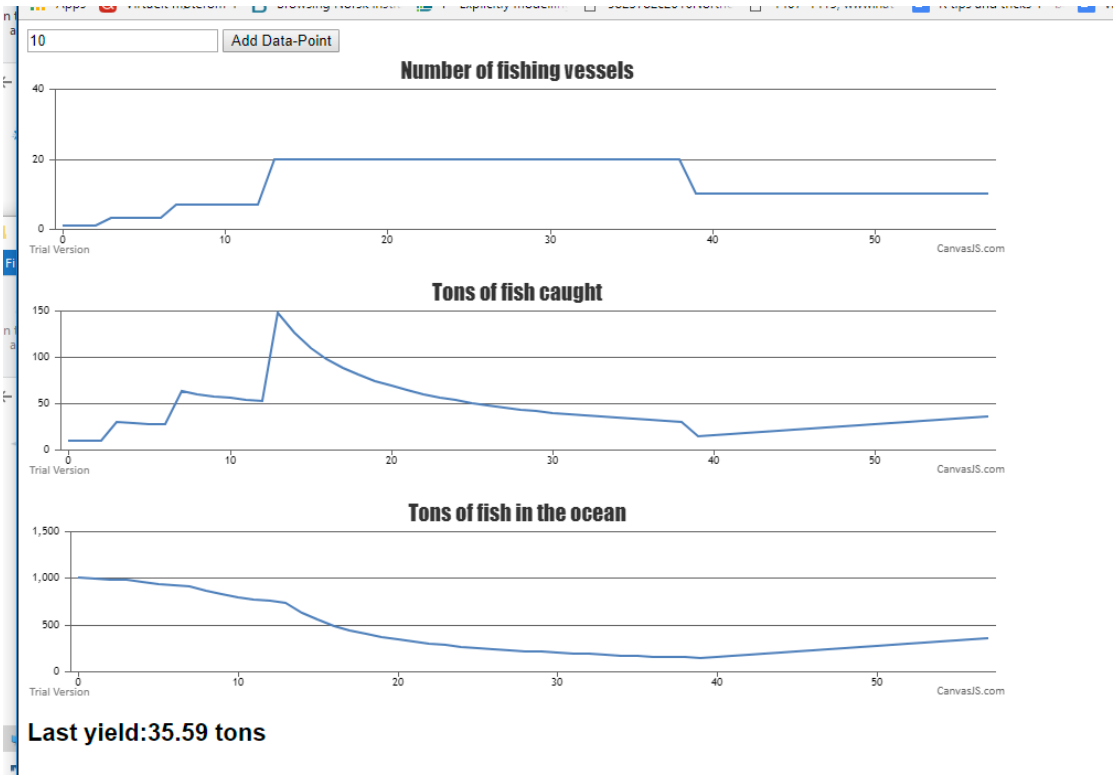

Figure 3: Graph-based sketch of the Fish Fleet challenge

Graph trajectory estimation (Fish stock estimation challenge)

GDM will develop the module. NIVA will provide the required data to create the graphs.

1. The user will be presented with a 2D graph representing the development of a parameter (e.g. fish stock) over a certain period in time, while another part of the graph representing a more recent period, will remain hidden.
2. Users will be asked to guess the trajectory of the graph until the recent years by drawing the remaining part of the curve with their finger on the screen.
3. After that, the real trajectory will be revealed and compared with the estimation of the user.
4. The system will be capable to store up to 10 different graphs and present them in random or predefined order (based on configuration settings). In case there are more than two graphs available, and the order is random, the system will not select the same graph as the previous one.
5. A score will be calculated e.g. based on the sum of squared residuals.
6. In case the score is among the best 20 ones, the user will be asked to enter his name in the “Hall of Fame”.
7. Additional information may be requested from each player in order to calculate his rank among other players (e.g. male/female, age between 20-30 years). This information will then be used for statistical analyses (see section 0)
8. Instructions on how to play the game will be provided by pressing on the respective button which will be always visible on the screen.

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9. It should be possible for the user to get additional information related with a specific graph (e.g. fish stock), if available, in form of HTML code or video (mp4).

10. Cross link navigating to the Fisheries Key Story (see section 0) will be provided.

11. The module will be extensible, i.e. it will be easy to exchange the current set of graphs with newer ones.

Figure 4 shows a variation of this game estimating the unemployment rate (from https://www.nytimes.com/interactive/2017/01/15/us/politics/you-draw-obama-legacy.html)[1].

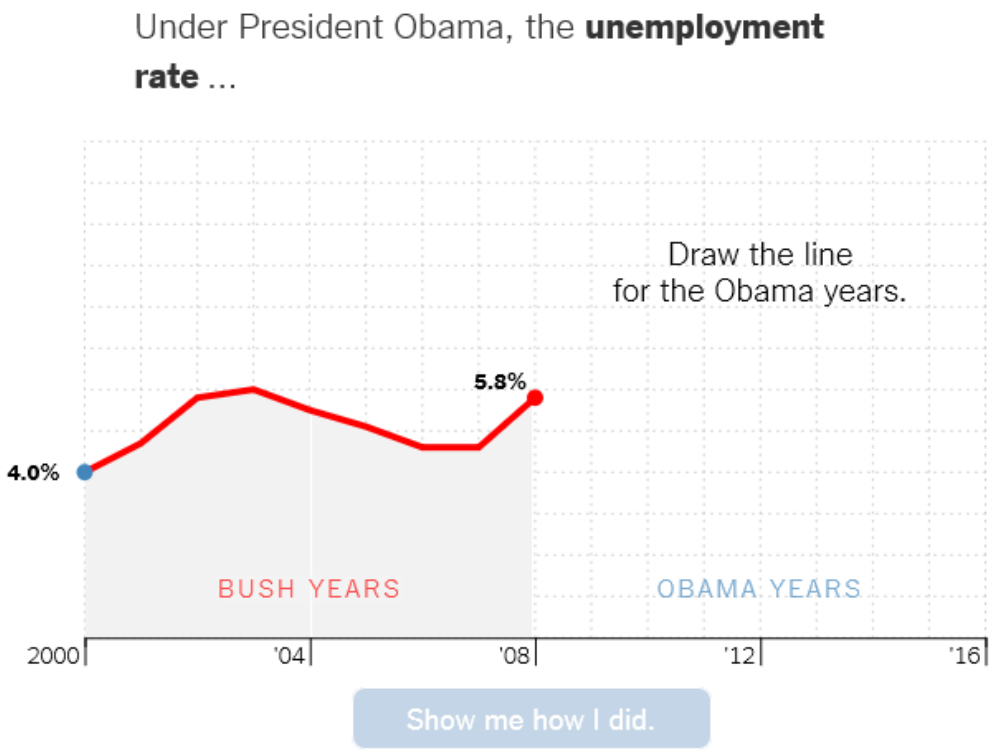

Figure 4: Example of a graph trajectory estimation game

Key Story Information

GDM to develop this module based on material provided by NIVA and Seven.

This module should provide information about the six Key Stories of the ResponSEAble project: a) Microplastics and cosmetics in the EU, b) Eutrophication and agriculture, c) Sustainable Fisheries, d) Marine Renewable Energy, e) Invasive Species and Ballast Water-Hull Fouling and f) Coastal Tourism.

1. For the presentation of the information a common template will be used for which content and design will be based on the leaflet produced by the ResponSEAble project.

2. The template will support text, hypertext, images and videos.

Visualization of environmental parameters from the Ferrybox system

GDM to develop this module in cooperation with NIVA.

[1] Related code using D3.js: https://bl.ocks.org/1wheel/07d9040c3422dac16bd5be741433ff1e

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This module retrieves and presents environmental information from the Ferrybox system.

1. A map will appear on the screen showing the region in which one or more ferry boats are cruising.
2. The user will be able to pan and zoom focusing on a specific area. However, panning and zooming will be limited to the area of interest.
3. The user will be able to specify a time period for which up to three environmental parameters may be retrieved from the Ferrybox systems on board of up to three ferry boats.
4. In case data for a specific time period is not available, the selection of these dates will be deactivated.
5. The first time this module is launched a default period will be pre-selected which will include the most recent period for which data will be available.
6. Buttons will facilitate a quick selection of the next/previous day or week with respect to the currently selected period.
7. The current position of the ferry boats will be displayed on the map using appropriate graphical elements (e.g. boat icons). In case the current position is unknown the last known position will be displayed, indicating the corresponding date and time.
8. The names of the ferry boats will be displayed and the ferry boat the user is on will be highlighted.
9. The routes of the ferry boats for the specified period will be displayed on the map.
10. The time series of the parameters for the specified time period and for the given ferry boats will be displayed on a graph.
11. Up to three additional pre-defined time series may be displayed on the same graph (e.g. mean annual parameter values or thresholds)
12. The graph and the map will be both visible on the screen (see Figure 5).
13. Upon touching the screen on the graph the position of the vessels at the corresponding date and time will be displayed on the map while detailed information will be displayed (e.g. exact value of all measured parameters).
14. Related information will be provided in a suitable way e.g. describing the importance of monitoring the environment with respect to understanding the consequences of environmental changes to fish.

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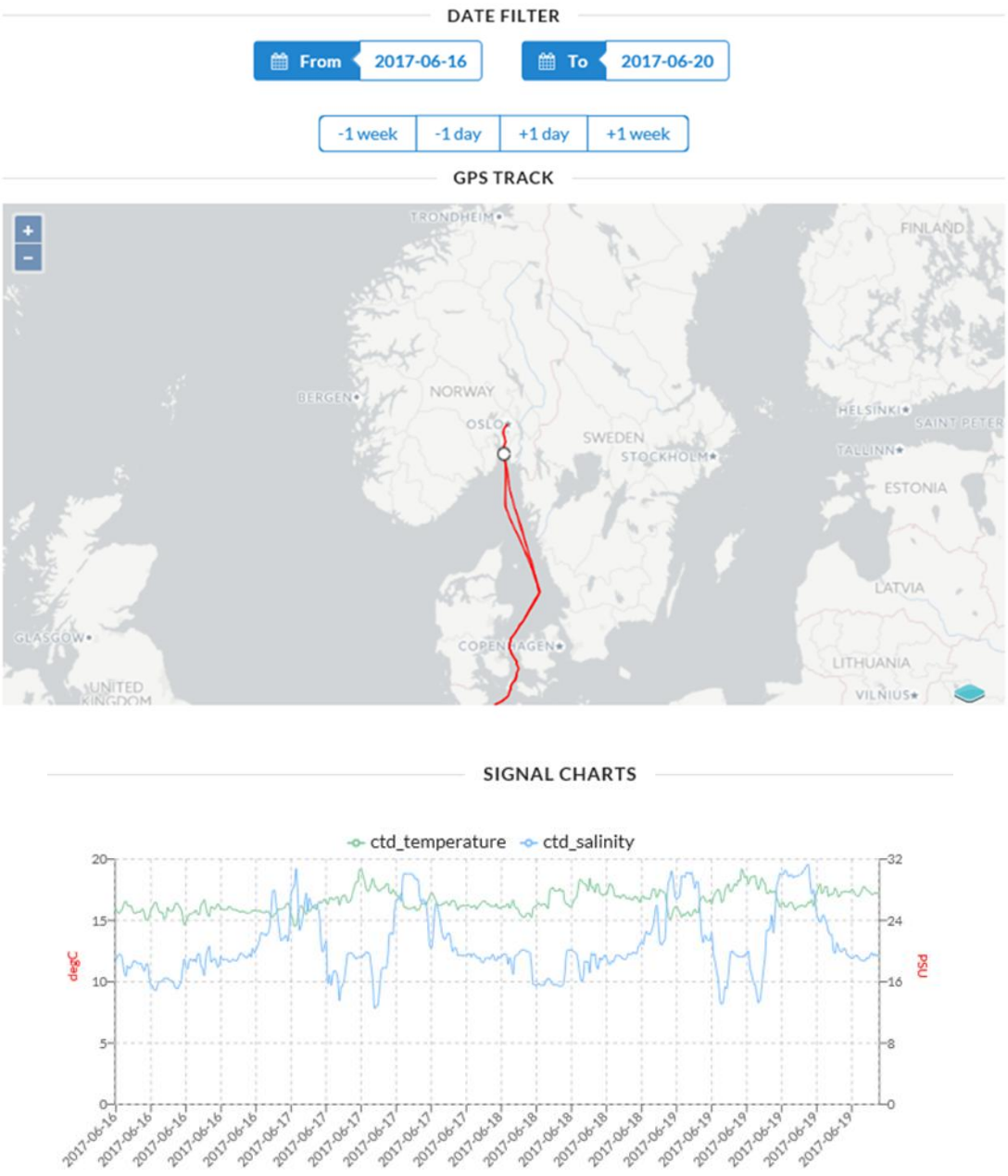

Figure 5: Map showing the route of the vessel between Oslo and Kiel (above) and a graph showing the sea temperature and salinity along this route (below).

Geospatial information

Seven is responsible for the development of a mapping environment. GDM will provide access to the base layer (Point 1), the GPS system (Point 3) and will support the development of local web applications (e.g. by providing a sample local-web-application).

This module shows georeferenced information on a map

1. OpenStreetMap will be used as base layer cached locally as WMS tiles in offline mode.
2. The user will be able to zoom (up to a maximum zoom level) and pan on the map even if the system is working in offline mode.
3. The current position of the ferry boat, as long as this is available, will always be projected on the map. Panning and zooming will be limited to the area of interest.

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4. Up to ten different layers with geospatial information may be projection on the map and uses will be able to switch each one of them on and off. A suitable legend for each layer will be displayed.

5. This module will be extensible, i.e. existing layers may be removed and new static layers can be easily added to the existing ones.

6. The system will support at least the following formats: KML, WMS, WFS and GeoJSON.

Static layers

Responsible partner: NIVA to provide all static layers in a supported format. Seven will support the mapping.

1. A number of static layers will be prepared and projected upon request such as the following:

   Aquaculture sites

   Migration routes, spawning grounds and fishing grounds for some major fish stocks such as North Sea and North-East Arctic cod, North Sea herring, North-East Atlantic mackerel, Atlantic Salmon

Real time layers

Additionally to the static layers, other layers with (near) real time data will be available as described in the following subsections

AIS

Responsible for the development of this layer is NIVA and GDM GDM is responsible for fetching AIS data.

1. AIS data from a vessel traffic service provider will be obtained and displayed on the screen (example in Figure 6).

2. This layer will focus on the fishing boat activity and therefore by default only fishing boats will be displayed. However, it will be possible for the user to display the current position of all other vessels.

3. Cross links to the following key stories will be provided:

   a) Fisheries (cross-link provided when the fishing boats are displayed),

   b) Invasive Alien Species (cross-link provided when all boats are displayed).

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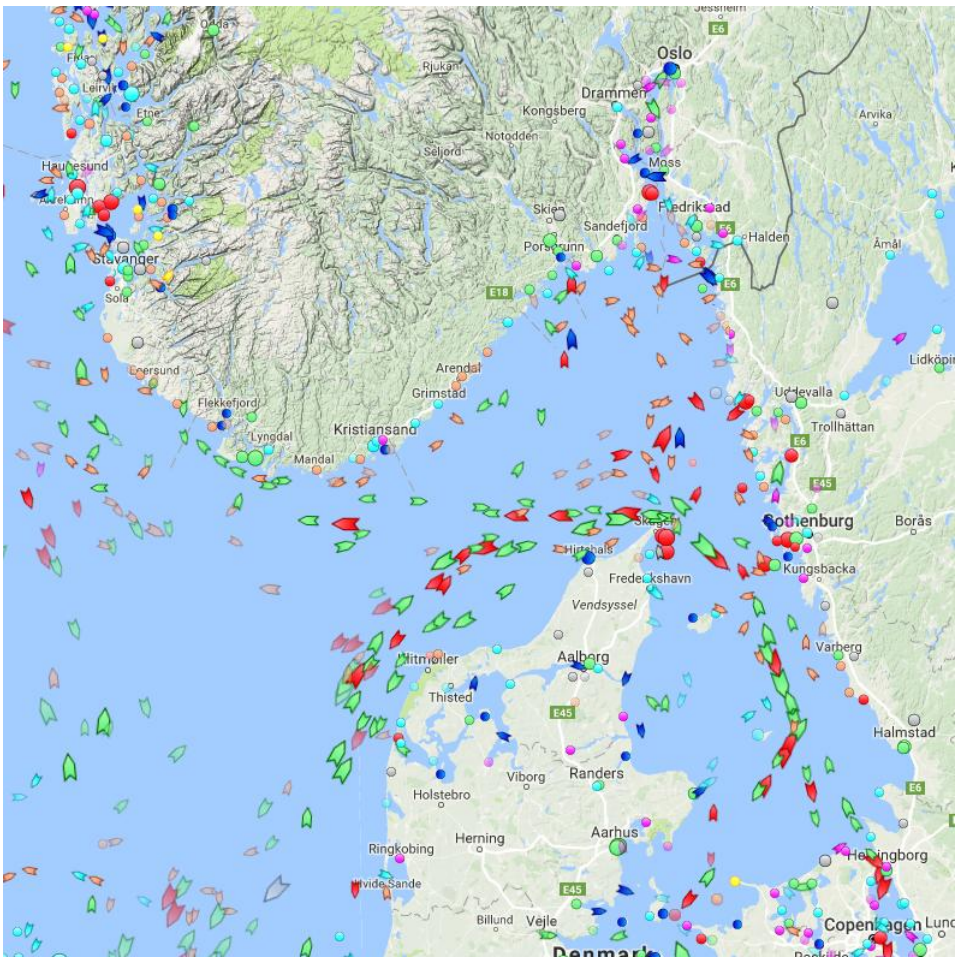

Figure 6: Example of AIS data from MarineTraffic[2].

Current and forecasted oceanographic conditions

Responsible for the development of this layer is GDM

1. Data form a forecasting service provider will be obtained and projected on the map in real time as shown in the example of Figure 7. The current and forecasted values for the following parameters will be shown as separate layers: a) currents, b) wave heights and c) sea temperature.

2. Information may be displayed describing how the current conditions affect the fish migration matters.

3. Cross links to the Fisheries Key Story will be available as well as links to additional information on how the weather affects the fishermen working conditions (e.g. video with interviews of fishermen).

[2] https://www.marinetraffic.com/en/ais/home/centerx:6.6/centery:56.2/zoom:7

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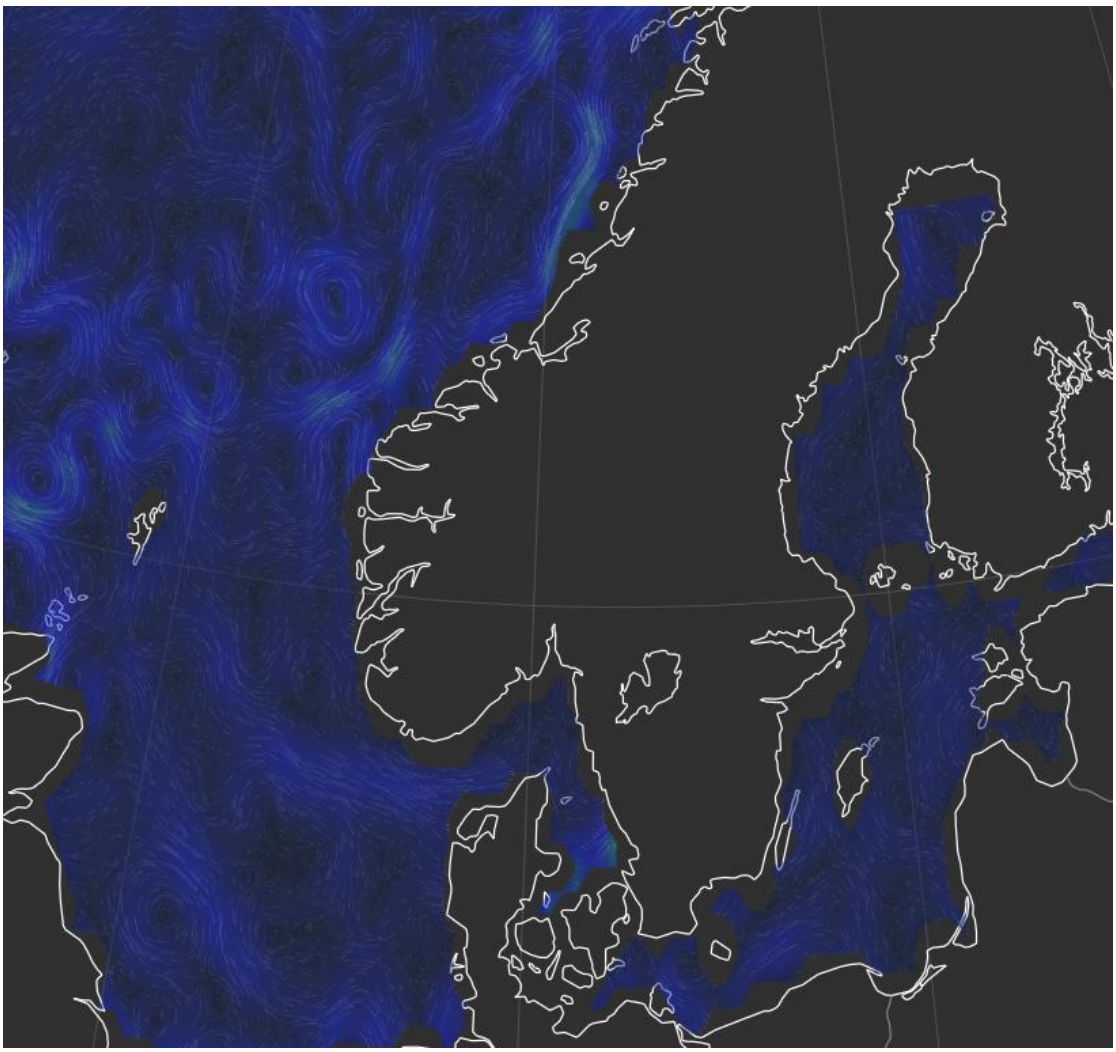

Figure 7: Sea currents map (source: nullschool.net)

Fish species life cycle

Three species particular for the region will be presented through Simple Show how the life cycle of the species are.

From larva to adult. How the larva behaves with currents and how the eggs of the adult depend on the density and currents

How do juvenile/adult behave during night and day, and winter and summer.

What is the effect of change in temperature/salinity? And the effect of change on the seabed due to less kelp for instance.

Supermarket

Through a film, could we follow how the fish travels from being caught to it ends up on your plate? David Eidsvoll Pettersen on NIVA is really good on making films. Maybe we could ask him to work on the project for us?

Interactive Visualisations and Maps

Responsible partner: NUIG

This module will be developed under Task 5.9 using HTML5/Javascript/CSS.

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Statistical information

NUIG has to develop the interface (web services) to the Central Ocean Literacy Database and to further specify the measured data.
GDM is responsible to implement this module.

1. The system will be capable to collect statistical information concerning the behavior and opinion of users and provide means for authorized users to download this information using open standards and protocols.

2. When the system is online it will be able to connect and send measurements to the Central Ocean Literacy Database to be developed by NUIG.

Data collected automatically by the system

1. At least the following anonymous information will be collected continuously by the system:

   Number of users accessing the main screen and each one of the modules.

   Estimate of the average time users spent in each module

2. Additional information will be requested from the users:

   Age range

   Degree of concern about environmental issues related with each module

Data provided by the user

The system should provide incentives for the user to give further information, e.g. his age group or gender in order to rank his achieved score among other players of his age/gender(see for instance sections 0 and 0).

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