

# The BIAS soundscape planning tool for underwater continuous low frequency sound

## User Guide

## BIAS - Baltic Sea Information on the Acoustic Soundscape

The EU LIFE+ project *Baltic Sea Information on the Acoustic Soundscape* (BIAS) started in September 2012 for supporting a regional implementation of underwater noise in the Baltic Sea, in line with the EU roadmap for the Marine Strategy Framework Directive (MSFD) and the general recognition that a regional handling of Descriptor 11 is advantageous, or even necessary, for regions such as the Baltic Sea.

BIAS was directed exclusively towards the MSFD descriptor criteria 11.2 *Continuous low frequency sound* and aimed at the establishment of a regional implementation plan for this sound category with regional standards, methodologies, and tools allowing for cross-border handling of acoustic data and the associated results.

The project was the first one to include all phases of implementation of a joint monitoring programme across national borders. One year of sound measurements were performed in 2014 by six nations at 36 locations across the Baltic Sea. The measurements, as well as the post-processing of the measurement data, were subject to standard field procedures, quality control and signal processing routines, all established within BIAS based on the recommendations by the Technical Subgroup on Underwater Noise (TSG-Noise).

The measured data were used to model soundscape maps for low frequent continuous noise in the project area, providing the first views of the Baltic Sea soundscape and its variation on a monthly basis. In parallel, a GIS-based online soundscape planning tool was designed for handling and visualizing both the measured data and the modelled soundscape maps. The tool provides a number of functionalities to evaluate the spatial and temporal sound characteristics within a user-defined geographical region. The year-by-year change of these features directly relate to the current definition of the indicator for ambient noise.

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When presenting or publishing data and results acquired with help of the tool, please use the following citation: *"These results have been extracted with help of the BIAS soundscape planning tool, which was developed within the EU LIFE+ project Baltic Sea Information on the Acoustic Soundscape (BIAS LIFE11 ENV/SE 841); [www.bias-project.eu](http://www.bias-project.eu)".*

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# 1 Background

This web-based planning tool for underwater was created as one of the deliverables of the EU LIFE+ project Baltic Sea Information on the Acoustic Soundscape (BIAS). The target group for the tool are managers of the marine environment and its purpose is to handle and visualize measured acoustic data and modelled soundscapes in the context of the Marine Strategy Framework Directive (MSFD) descriptor criterion 11.2, continuous low frequency sound [W1][W2].

The development of the soundscape planning tool has been coordinated by AquaBiota Water Research (AquaBiota) under the lead of the BIAS coordinator Swedish Defence Research Agency (FOI) and the involvement of all BIAS partners. Also, the opinions from the target users on the intention and features of the tool has been incorporated along the developing process through questionnaires and meetings with relevant authorities. The technical foundation was provided by the Cartesia/Sokigo Addnode Group.

This User Guide is aimed to provide technical “hands-on” instructions for working with the tool. Details on the background on parameter choices etc. are available in the BIAS Implementation Plan [1], which is the summarizing document for the BIAS project results and which points further to additional reports on standards and methodologies, quality assurance and modelling procedure used in the project.

## 2 About the tool

The tool consists of a Map View and a Graph Panel, which together give the user insights into the spatial and temporal sound characteristics of one or several areas of interest in the Baltic Sea. Currently, the tool holds soundscape data for the BIAS field programme year 2014, but is prepared for importing more measurement data or modelled soundscape maps from monitoring efforts in the years to come.

### 2.1 Map View

The main panel of the tool (Map View) is an interface visualising various types of spatial data. Here, one can explore a geographical presentation of the modelled soundscape and overlay supplementary GIS-information such as maps of species distributions or species densities, polygons for protected areas or detailed environmental layers.

The tool contains the measured and modelled soundscape data from BIAS as well as information on seabed substrate, bathymetry (water depth), and ship traffic density. It is possible to upload additional GIS-layers (polygon files), which may be used for visual comparisons or for further analysis displayed in the Graph Panel. Read more about each of these data layers in Section 3.

### 2.2 Graph Panel

In the second part of the tool (Graph Panel), three types of graphs may be used to visualize temporal and spatial characteristics of the measured or modelled data. The results can be restricted to one or several user-specified areas of interest. The graphs provide quantitative measures related to the management of underwater noise and MSFD indicator 11.2.1, as a means to express and evaluate the underwater acoustic levels e.g. in terms of environmental status. Read more about each of these graphs in Section 5.3.

### 2.3 Access to the tool

The tool is accessed via your web browser and is primarily tested in Google Chrome where it operates best. It is functional also in other common web browsers, but all features cannot be guaranteed due to differences in the software development between browsers.

Start using the tool by logging in to <http://bias.cartesia.se/>, using your username and password (Figure 1). If you are a new user, please send your request for a user account by email to [info@aquabiota.se](mailto:info@aquabiota.se), marked “BIAS Soundscape Planning Tool: request for user account”.

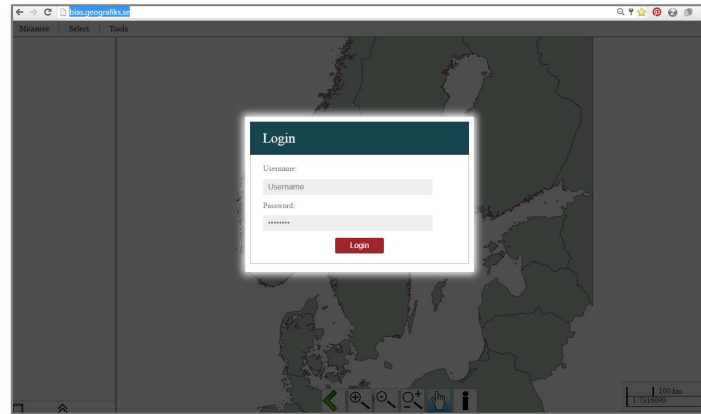


Figure 1. Log in window.

### 2.4 Coordinate reference system

The tool utilizes the EPSG:3035 (ETRS89/ETRS-LAEA) coordinate reference system.

### 2.5 Technical Support

For support on tool functions please contact: [info@aquabiota.se](mailto:info@aquabiota.se).

### 2.6 Citation

When presenting or publishing data and results acquired with help of this tool, please use the following citation: *“These results have been extracted with help of the BIAS soundscape planning tool, which was developed within the EU LIFE project Baltic Sea Information on the Acoustic Soundscape (BIAS LIFE11 ENV/SE 841); [www.bias-project.eu](http://www.bias-project.eu)”*.

## 3 Metadata for map layers

The default GIS-layers in Map View are the measurement locations (point shapefile), soundscape maps (GeoTiff rasters), sea-bed substrate (polygon shapefile), bathymetry (GeoTiff raster) and ship traffic density maps (polygon shapefiles). All map layers are projected in the EPSG:3035 (ETRS89/ETRS-LAEA) coordinate reference system.

### 3.1 Measurement locations (point shapefiles)

The **Rig positions** map layer currently shows the 36 BIAS hydrophone locations at which the underwater sound pressure level (*SPL*; dB re 1  $\mu$ Pa) was recorded from January to December 2014. Monthly and annual *SPL* values (exceeded levels) from these locations are available for further use in the Graph Panel (Section 5).

### 3.2 Soundscape maps (GeoTiff rasters)

The **Soundscape maps** show the *SPL* values (dB re 1  $\mu$ Pa) as modelled with the Quonops© noise management and forecasting system by Quiet-Oceans [2]. The modelled maps are generated for each month of 2014, three frequency bands, three depth intervals and seven statistical sound levels for areas deeper than 10 meters in the Baltic Sea. Further information on these parameter options are given in Section 4.2.

### 3.3 Sea-bed substrate (polygon shapefile)

The **Substrate** layer shows sea-bed substrate as produced by the EMODNET-Geology project (final version from 28.6.2012; <http://www.emodnet-geology.eu/>). This classification scheme consists of four substrate classes defined on the basis of the modified Folk triangle (1. *mud to sandy mud*; 2. *sand to muddy sand*; 3. *coarse sediment*; 4. *mixed sediment*) and two additional substrate classes (6. *diamicton (till)*; 7. *bedrock/boulders*).

### 3.4 Bathymetry (GeoTiff raster)

The **Bathymetry** layer provides water depth information is provided by the Baltic Sea Bathymetry Database version 0.9.3 of the Baltic Sea Hydrographic Commission, as downloaded from <http://data.bshc.pro/> in January 2016.

### 3.5 Ship density (polygon shapefiles)

Information on ship traffic density (ships/km<sup>2</sup>) is provided by Quiet-Oceans for each month of 2014 based on the HELCOM AIS and VMS data utilized in the soundscape modelling (see 3.2).



### 3.6 Supplementary GIS-data (polygon shapefiles)


It is possible to import additional GIS-data (polygon shapefiles) to the **Zones** folder for user-accustomed overlays with the soundscape maps in Map View. These data could be the outline of regions of special interest, data describing values of special interest, etc. Such data layers may also be utilized in the Graph Panel. For more information on how polygon shapefiles can be generated or imported see 5.2.1.

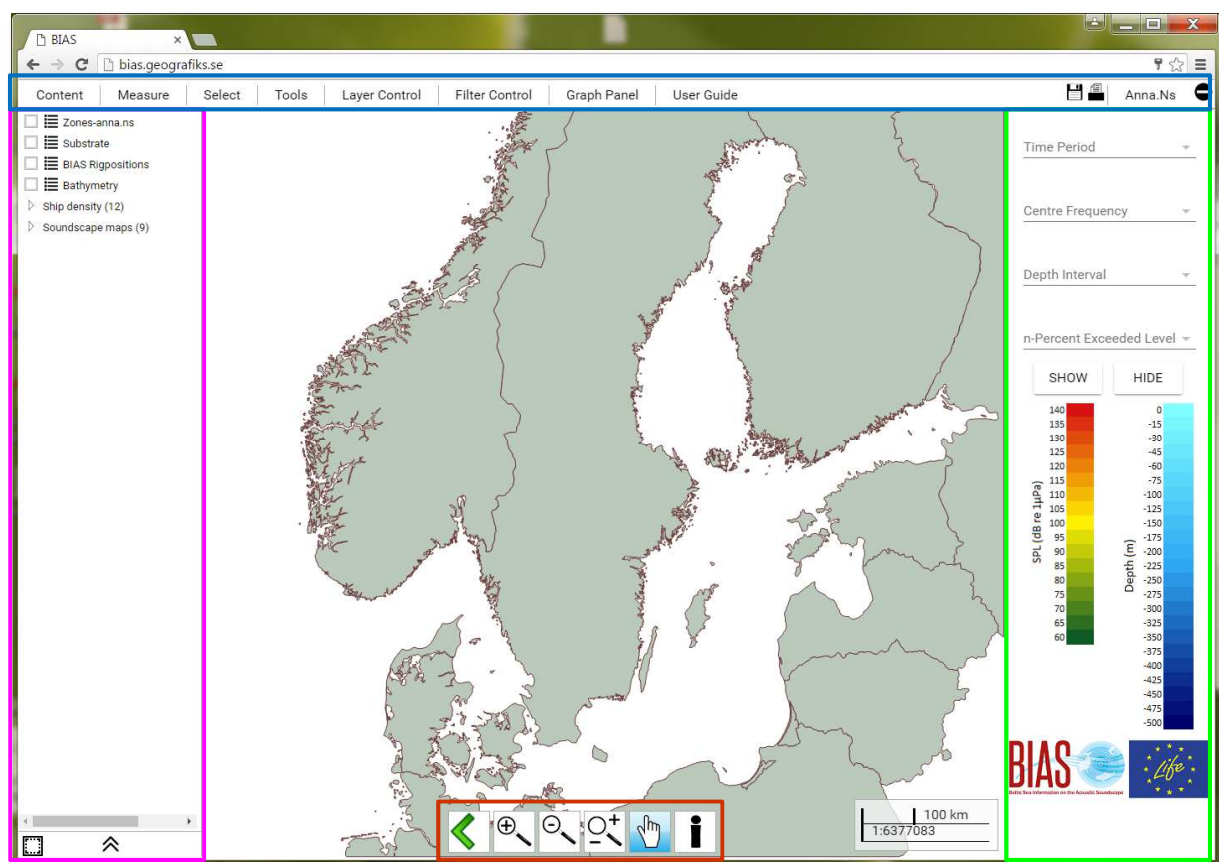


## 4 Using the Map View

The first view after login (2.3) is the Map View, with a top menu bar, left and right panels, a bottom toolbar and a map window in the centre (see Figure 2).

The top menu bar contains nine tabs: **Content**, **Measure**, **Select**, **Tools**, **Layer Control**, **Filter Control**, **Graph Panel** and **User Guide** and the options to Save  and Print , all explained in more detailed in the below sections. As default, the **Content** (left panel) and **Filter Control** (right panel) are open at login.

The bottom toolbar allows for zooming and changing position in the map window, and provides an info button  used to get more detailed information on polygon features.







**Figure 2.** Default view after login. The tool has a top menu bar (blue), left (pink) and right (green) vertical panels, a bottom toolbar (red), and a map window in the centre.



## 4.1 Navigate in the map window

Zooming and changing position in the map window is done with help of the bottom toolbar. Choose the different commands by clicking on the different symbols:

-  and  Zoom in and out of the map,
  - click in the map window and drag the mouse with the primary mouse button held in to create a square,
  - click on the positions for zoom in to or zoom out from.
-  Continuous zooming using the mouse wheel.
-  Panning mode.

## 4.2 View a soundscape map

The **Filter Control** is used to select the desired soundscape map, and is accessed by the **Filter Control** tab in the top menu bar. Use the dropdown menus to choose Time Period, Centre Frequency, Depth Interval and n-Percent Exceeded Level (percentile level) and then click **SHOW**. The soundscape map will appear in the map window together with a text legend (see Figure 3). Please always refer to this legend (as opposed to the filter options) for knowing which map is currently shown. All soundscape maps follow the green-to-red symbology shown in the **Filter Control**.

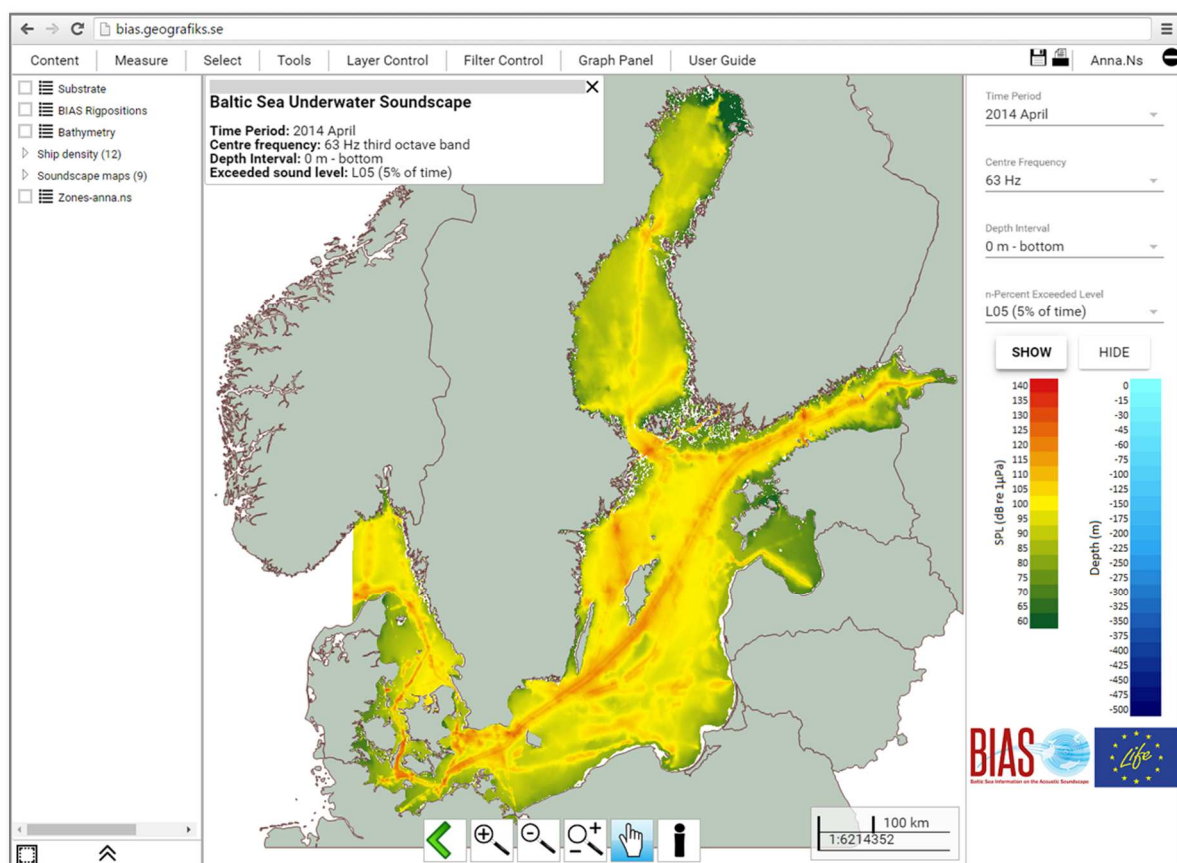


Figure 3. Use the dropdown menus in the **Filter Control** to select Time Period, Centre Frequency, Depth Interval and n-Percent Exceeded Level (percentile level) and then click **SHOW** to view a soundscape map.

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The available parameters, and filter options, for the soundscape maps are the following:

**Time period:** the modelled soundscape maps are provided as monthly values for all months of 2014.

**Centre frequency:** the measured and modelled *SPL* values for 2014 are provided for a frequency band with one third (1/3) of an octave bandwidth around the centre frequencies of 63, 125, and 2000 Hz, respectively. The first two frequency bands (63 and 125 Hz) are specified by the MSFD indicator 11.2.1 while the 2000 Hz frequency band was selected in BIAS as a proxy to assess the impact of ship-generated sound on species sensitive to higher frequencies.

**Depth intervals:** the modelled exceeded sound level values have been calculated for three different depth intervals:

- 0 m – bottom: the entire water column from surface to bottom.
- 0 – 15 m: from the surface to 15 meters depth.
- 30 m – bottom: from 30 meters depth to the bottom.

These intervals were selected to give the user the possibility to distinguish among some different depth ranges and facilitate investigations of species with different living environments and depth preferences. The BIAS project area covers the areas deeper than 10 meters in the Baltic Sea.

**n-Percent exceeded level:** the measured and modelled sound data are quantified as *percentile levels*, also commonly called *exceeded levels* within noise engineering and management. The *n*-percent exceeded level (*Ln*) is defined as the *SPL* exceeded *n* percent of the time interval considered. For example, *L05* is the *SPL* exceeded 5% of the time. For the rest of the time, the *SPL* is at or below *Ln*. *L05* is often used as a measure for the maximum sound level. Accordingly, *L50* is the level exceeded 50% of the time, and the median of all noise levels. *L90* is the level exceeded 90% of the time and, together with *L95*, considered as representative for the background or ambient (minimum) noise level. The BIAS data for 2014 are given for *n* = 5, 10, 25, 50, 75, 90 and 95%.

### 4.2.1 Hide soundscape map


To hide an activated soundscape map in the viewing window, click **HIDE** in the **Filter Control**. The map can also be hidden via the **Soundscape maps** folder in the **Content** menu by unchecking the check box ☒ next to an activated soundscape map.

## 4.3 View and handle other map layers

There are some basic features available for handling the default GIS-layers in Map View (**Rig Positions**, **Substrate**, **Bathymetry**, **Ship density**, and **Zones**).

### 4.3.1 Display layers in map window


To activate other GIS-layers than a soundscape map, make sure that the **Content** menu is activated and visible in the left-hand panel. The check ☒ box next to each layer indicates whether a layer is displayed or not.



To zoom in on any layer you can either use the bottom toolbar buttons, or click the list button next  to the layer in the **Content** menu and select **View Entire** (Figure 2).

### 4.3.2 Symbology and drawing order

The **Bathymetry** layer follows the blue symbology shown in the **Filter Control**. The symbology of layers in shapefile format is shown by the **Legend** in **Layer Control** (right hand panel). The order of layers within the **Layer Control** specifies their drawing order in the map window. To change the drawing order of a layer, click on the layer name (header gets blue/active) and drag it to the wanted position in the list (see Figure 4).

### 4.3.3 View attribute table of map layer

To view the attribute table of each GIS-layer click the list button  next to the layer in the **Content** menu and select “View tables”.

For detailed information about single shapefile features click the  button in the bottom toolbar and select the shapefile feature you are interested in. This generates a pane displaying the name of the chosen feature. There are also selection functions available, which basically gives you the same information as when using the  button. Selections can either be done by a point, line or area (polygon) which you draw in the map window. Click the **Select** tab in the top menu bar and choose which tool you want to use. Use the primary mouse button to draw a line or polygon and finish by clicking the secondary mouse button. This generates a pane displaying the name of the chosen feature or features.

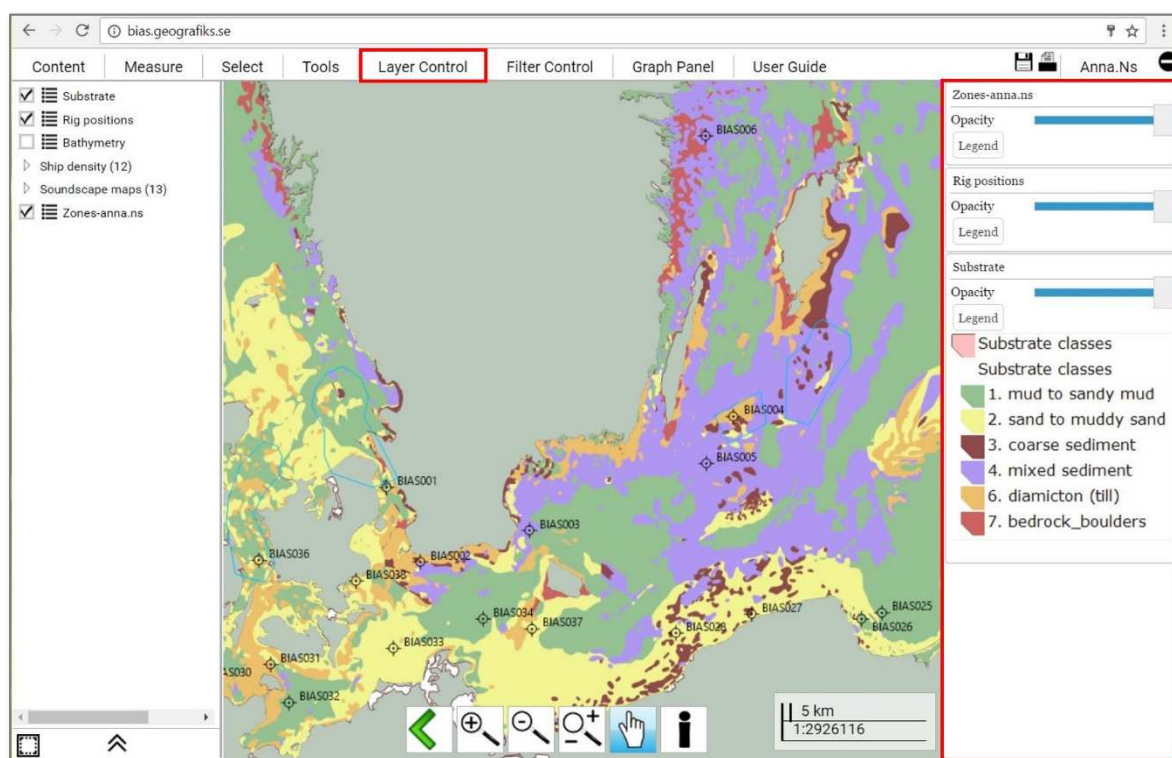



Figure 4. Use the **Layer Control** (red squares) to view the symbology of a shapefile and to specify the drawing order in the map window. The **Layer Control** is opened from the top menu bar and appears as a right-hand panel.

### 4.3.4 Export map layer

It is possible to export the shapefiles available in the Map View (**Rig positions**, **Substrate**, **Ship density** and **Zones**). In the **Content** menu, click the list button  next to the layer and select **Export**. This opens a window where you set the desired coordinate system and file format. The file is generated as a zip-file to be saved on your computer. If nothing seems to happen, please check the

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pop-up settings in your web browser – you may find the file in “Downloads”. Note that this **Export** function does not work for layers in the GeoTiff format.

### 4.4 Measure in map

To measure distances and areas in the map window click the **Measure** tab in the top menu bar. This gives you two options in a roll-down-menu: **Distance** and **Area**.

To measure, use the primary mouse button to draw a line (for distance) or polygon (for area) in the map and finish by clicking the secondary mouse button. This opens a pane displaying the length of the drawn line in meters or area of the drawn polygon in square metres and its circumference in meters.

### 4.5 Coordinate tools

To view the coordinates of the mouse position, activate **Current Coordinate** by clicking the check box in the **Tools** menu, found in the top menu bar. The coordinates appear in the lower left corner of the map window and change as you move the mouse over the map. Another option is to activate **Show Coordinates** in the **Tools** menu. By clicking in the map window, a pane opens in the top left corner of the map window displaying the coordinates of that exact location.

To zoom into a given coordinate, select **Go To** in the **Tools** menu, found in the top menu bar. This opens a pane in which you fill in the coordinates and their coordinate (georeference) system and click the **Apply** button.

### 4.6 Map opacity

The opacity of a single map layer can be managed in the **Layer Control**, activated from the top menu bar. The entire map window opacity can be altered in **Set mask opacity** in the **Tools** menu, found in the top menu bar.

## 5 Using the Graph Panel

The measured data and soundscape maps may be analysed further in the Graph Panel with help of some statistical graphs for a user-specified interest area. The **Graph Panel** is opened from the top menu bar as a separate window. The statistics are generated for a selection of **Data type**, **Interest area**, and **Graph type** and the corresponding parameter filter options as in Map View (Figure 5), all described in the below sections. For further discussion on which type of management questions the graphs may be used for, please see the BIAS Implementation Plan [1].

The figure shows a software window titled 'Graph Panel' with a close button (X) in the top right corner. The window is divided into several sections:

- Data:** A dropdown menu set to 'Modelled'.
- INTEREST AREA:** A button to open the selection window.
- Graph type:** A dropdown menu set to 'Spatial Analysis'.
- Time Period Start:** A dropdown menu.
- Time Period End:** A dropdown menu.
- Spatial coverage of modelled noise levels:** A text box containing the description: 'The proportion of the interest area for which a Sound Pressure Level (SPL) value is exceeded a certain percentage of time (Ln) for the specified month or year, centrefrequency, and depth interval.'
- Centre Frequency:** Three checkboxes for 63 Hz, 125 Hz, and 2000 Hz.
- Depth Interval:** Three checkboxes for 0 - 15 m, 0 m - bottom, and 30 m - bottom.
- n-Percent Exceeded Level:** Seven checkboxes for L05 (5% of time), L10 (10% of time), L25 (25% of time), L50 (50% of time), L75 (75% of time), L90 (90% of time), and L95 (95% of time).
- CALCULATE:** A button at the bottom right.

Figure 5. **Graph Panel** default settings.

### 5.1 Selection of data type

The first choice is whether to analyse **Modelled** or **Measured** sound data. The default value is **Modelled** data. Use the **Data** drop-down menu to select your preference.

### 5.2 Selection of interest area

Depending on your selection of data type, you must choose at least one zone of interest (modelled data) or rig position (measurement data) for which the graph is made. Click **INTEREST AREA** to open the selection window (Figure 6). Select among the available areas or rig positions on the left side and use the arrows to move them to the right side. All areas or rig positions on the right side of the pane will be included in the graphical analysis. If you choose more than one, these will be shown in separate graphs (managed by the **Next** and **Previous** buttons above the graph window). Finalize your selections by clicking **DONE**.

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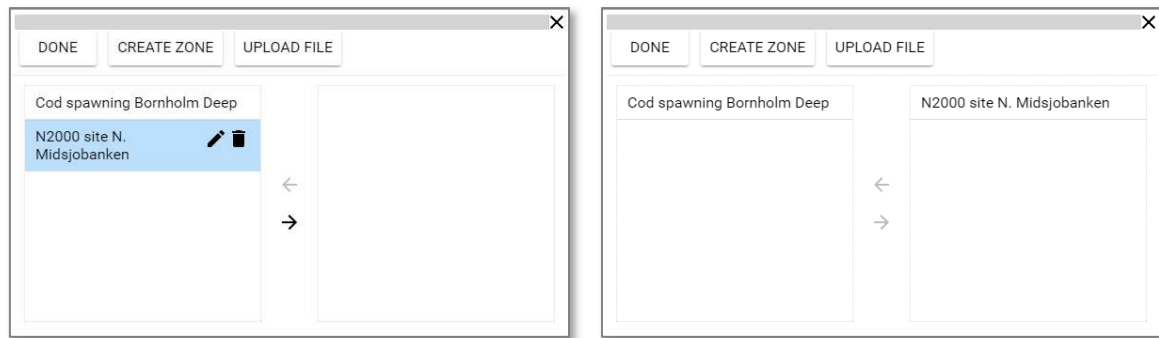


Figure 6. The interest areas are managed and selected in a window opened through the **INTEREST AREA** button in the **Graph Panel** (here shown for **Modelled** data).

### 5.2.1 Management of interest areas for modelled data

The interest areas (zones) for **Modelled** data are managed from the selection window in Figure 6. Here, you can change the name of a zone by selecting it in the table and clicking the pen symbol or permanently delete it by clicking the trash can symbol.

New interest areas (polygon shapefiles) for **Modelled** data can be drawn by hand in the map. Click **CREATE ZONE** in the selection window. This hides the **Graph Panel** and gives you access to the **Map View**. Use the primary mouse button to draw a polygon and finish by clicking the secondary mouse button. This generates a pane where you are asked to name the new interest area. Click **OK** to save the new zone and return to the **Graph Panel**. Your new zone is now selectable on the left side of the selection window.

New interest areas for **Modelled** data can also be imported from your own computer (note that the coordinate reference system must be EPSG:3035; ETRS89/ETRS-LAEA). First, make a compressed file (.zip) of all files in the polygon shapefile collection (Figure 7). Click **UPLOAD FILE** in the **Graph Panel** and select this zip-file. When prompted, select the field in the shapefile holding the zone name (here: Test\_area). The new area will be listed as a new Zone to be used (eg. Figure 6).

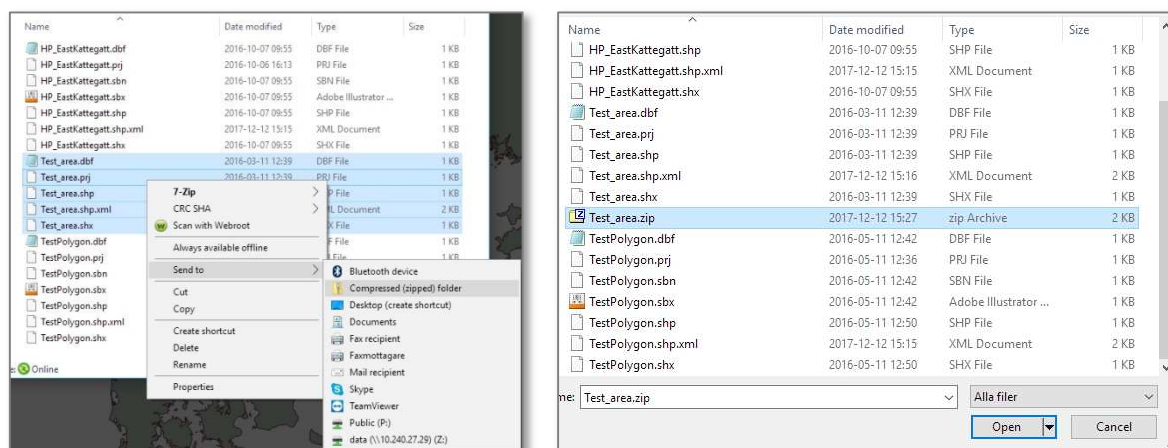


Figure 7. To import a new interest area, all files in the polygon shapefile collection must be uploaded as a zip file. Note that it is not the folder containing the shapefile that is compressed.



### 5.3 Selection of graph type

Three graphs may be used to visualize some temporal and spatial characteristics of the acoustic data, two for the modelled maps and one for measured data.

#### 5.3.1 Graph types for modelled data

There are two options for which the **Modelled** data can be analysed. Use the drop-down menu **Graph Type** to choose between Spatial analysis or Temporal analysis (for more information on the background of these different graphs, please see the BIAS Implementation Plan):

**Spatial coverage of modelled noise levels:** The proportion (%) of an interest area for which the *SPL* value is exceeded a certain percentage of time (*Ln*) for the user-specified time period, centre frequency, and depth interval.

**Temporal variation of spatial coverage above a noise threshold:** The proportion (%) of the interest area for which the exceeded sound level (*Ln*) surpass the user-defined *SPL* threshold, for a specified time period, centre frequency, and depth interval.

#### 5.3.2 Graph type for measured data

The **Measured** data can only be drawn as time series, see Figure 8:

**Temporal variation of measured noise level:** the measured *SPL* value which is exceeded a certain percentage of time (*Ln*) at a measurement location, for a specified time period, centre frequency, and depth interval.

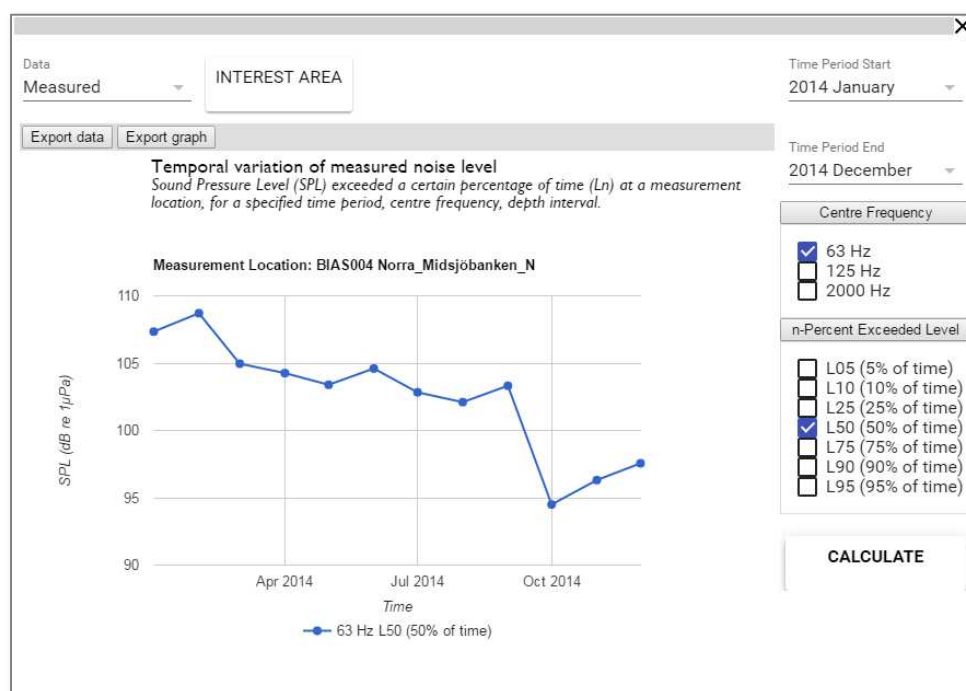


Figure 8. The **Graph type** available for measured data at one or more rig locations.



### 5.4 Selection of underlying data

For generating a graph you need to specify the **Time period**, **Centre frequency**, **Depth interval** (only modelled data) and **n-Percent Exceeded Level** (percentile level) for your selected **Data type** (see description of each parameter in section 4.2). **Start** and **end time** are chosen separately via two drop-down menus. If you are only interested in one month, choose the same start and stop time. Press **CALCULATE** to draw the graph.

Selections of frequency, depth level (only modelled data) and n-percent exceeded level are made by clicking the associated check-boxes (Figure 8). You can choose more than one option per parameter at a time, but only for one of the categories. For example, you may look at more than one percentile levels with one frequency and one depth interval specified, or you may look at more than one frequencies with one depth interval and one percentile level specified.

For the **Temporal analysis** graph (**Modelled** data) you also need to specify the sound pressure level Threshold to be applied in the graph (Figure 9). The default value is 100 dB re 1µPa.

The screenshot shows the 'Temporal analysis' graph settings for 'Modelled' data. The 'SPL threshold' is set to '100 (dB re 1µPa)' and is highlighted with a red square. The 'Graph type' is 'Temporal Analys...'. The 'Time Period Start' and 'Time Period End' are set to 'Time Period Start' and 'Time Period End' respectively. The 'Centre Frequency' section has three checkboxes: '63 Hz', '125 Hz', and '2000 Hz'. The 'Depth Interval' section has three checkboxes: '0 - 15 m', '0 m - bottom', and '30 m - bottom'. The 'n-Percent Exceeded Level' section has seven checkboxes: 'L05 (5% of time)', 'L10 (10% of time)', 'L25 (25% of time)', 'L50 (50% of time)', 'L75 (75% of time)', 'L90 (90% of time)', and 'L95 (95% of time)'. A 'CALCULATE' button is at the bottom right.

Data: Modelled

INTEREST AREA

Graph type: Temporal Analys...

SPL threshold: 100 (dB re 1µPa)

Time Period Start: Time Period Start

Time Period End: Time Period End

Centre Frequency:

- ☐ 63 Hz
- ☐ 125 Hz
- ☐ 2000 Hz

Depth Interval:

- ☐ 0 - 15 m
- ☐ 0 m - bottom
- ☐ 30 m - bottom


n-Percent Exceeded Level:

- ☐ L05 (5% of time)
- ☐ L10 (10% of time)
- ☐ L25 (25% of time)
- ☐ L50 (50% of time)
- ☐ L75 (75% of time)
- ☐ L90 (90% of time)
- ☐ L95 (95% of time)

CALCULATE

Figure 9. For the **Temporal analysis** graph of **Modelled** data you need to specify a sound pressure level (SPL) threshold (red square).

### 5.5 Troubleshooting

Generating a graph may take a while. If the graph does not show, please start with dragging the **Graph Panel** sideways to see whether there is a throbber  available, implying that the tool is performing the calculation. Double-check that you have selected at least one interest area (section 5.2), that the start and end dates are specified, and that at least one check-box for each parameter category is active (e.g. Figure 8).

## 6 Technical specifications

The BIAS web tool is built on pure html/javascript for most of the basic map control functionality, and polymer web components and Javascript for the more specific tools of the Graph control. The map rendering, spatial operations and management of mapping resources are all implemented with SuperMap Objects 6.

All data are stored in Microsoft SQL Server 2012 in a structure dictated by SuperMap Objects. All data have Spatial Indexes applied to them.

The technical foundation was provided by the Cartesia/Sokigo Addnode Group. For details and information regarding development and maintenance please visit [www.sokigo.com](http://www.sokigo.com) or email [info@sokigo.com](mailto:info@sokigo.com).

## 7 References

*The following BIAS documents are available from the project webpage [www.bias-project.eu](http://www.bias-project.eu) >> Downloads >> Deliverables.*

**[1] BIAS Implementation Plan:**

Nikolopoulos A., Sigraý P., Andersson M., Carlström J., Lalander E., 2016: BIAS Implementation Plan - Monitoring and assessment guidance for continuous low frequency sound in the Baltic Sea, BIAS LIFE11 ENV/SE/841, <https://biasproject.files.wordpress.com/2013/11/bias-implementation-plan.pdf>

**[2] BIAS Modelling Report:**

Folegot T., Clorennec D., Chavanne R., and Gallou R., 2016: Mapping of ambient noise for BIAS. Quiet-Oceans technical report QO.20130203.01.RAP.001.01A, Brest, Franc. <https://biasproject.files.wordpress.com/2017/01/qo-20130203-01-rap-001-01b-foi-bias-modelingreport.pdf>

**[3] BIAS Standards for noise measurements:**

Verfuß U.K., Andersson M., Folegot T., Laanearu J., Matuschek R., Pajala J., Sigraý P., Tegowski J., and Tougaard J., 2015: BIAS Standards for noise measurements - Background information, Guidelines and Quality Assurance. Amended version.

**[4] BIAS Standards for signal processing:**

Betke K., Folegot T., Matuschek R., Pajala J., Persson L., Tegowski J., Tougaard, J., Wahlberg M., (Editors) Verfuß U.K., Sigraý P., 2015: BIAS Standards for Signal Processing - Aims, Processes and Recommendations. Amended version.

### **Web references**

**[W1] EU Marine Strategy Framework Directive:**

Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy: <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32008L0056>.

**[W2] EU MSFD criteria and methodological standards:**

- (a) Commission Decision 2010/477/EU of 1 September 2010 on criteria and methodological standards on good environmental status of marine waters: [http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32010D0477\(01\)](http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32010D0477(01))
- (b) Commission Decision (EU) 2017/848 of 17 May 2017 laying down criteria and methodological standards on good environmental status of marine waters and specifications and standardised methods for monitoring and assessment, and repealing Decision 2010/477/EU: <http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1513008582929&uri=CELEX:32017D0848>.

### **Access to the BIAS Soundscape Planning Tool:**

<http://bias.cartesia.se/> or via the BIAS project web page [www.bias-project.eu](http://www.bias-project.eu) >> Tasks >> Tools.

### **Access to the BIAS Database:**

For further access to the database of acoustic measurement data and soundscape maps please visit the BIAS project web page [www.bias-project.eu](http://www.bias-project.eu).

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