Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic area, concluded under the auspices of the Convention on the Conservation of Migratory Species of Wild Animals (CMS)

Accord sur la Conservation des Cétacés de la Mer Noire, de la Méditerranée et de la zone Atlantique adjacente, conclu sous l'égide de la Convention sur la Conservation des Espèces Migratrices appartenant à la Faune Sauvage (CMS)

Seventh Meeting of the Parties to ACCOBAMS

Istanbul, Republic of Turkey, 5 - 8 November 2019

31/10/2019
English
Original: English
ACCOBAMS-MOP7/2019/Inf 42Rev1

TECHNICAL GUIDE ON ACCOBAMS REGIONAL REGISTER FOR IMPULSIVE NOISE

Technical guide on the ACCOBAMS Regional register for impulsive noise

Key concepts of Deliverable 4.1 of QUIETMED

October 2019

QUIETMED – Joint programme on noise (D11) for the implementation of the Second Cycle of the MSFD in the Mediterranean Sea.

quietMED

Deliverable:	D4.1 International impulsive noise register for the Mediterranean basin
Document Number:	QUIETMED - D4.1
Delivery date:	5th December 2018
Call:	DG ENV/MSFD Second Cycle/2016
Grant Agreement:	No. 11.0661/2016/748066/SUB/ENV.C2
Downloadable from	www.quietmed-project.eu
Report realised by	Alessio Maglio

SINAY MARITIME DATA SOLUTION

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Acknowledgements

The INR-MED was developed in line with Commission Decision 2017/848 and following guidance documents from TG-Noise. The conception is based on the first demonstration tool developed by ACCOBAMS in 2016 for the Mediterranean Sea and the Black Sea and took advantage of the work done by OSPAR, HELCOM and ICES on the same topic on their area of competence.

SINAY developed the original deliverable under the supervision of ACCOBAMS (as leader of the corresponding Work Package) and with the contribution of QUIETMED partners: Centro Tecnológico Naval y del Mar (CTN), Insituto español de oceanografía (IEO), Universitat Politècnica de València (UPV), Service Hydrographique et Océanographique de la Marine (SHOM), Instituto Superiore per la Protezione e la Ricerca Ambientale (ISPRA), Inštitut za vode Republike Slovenije (IZVRS), The Conservation Biology Research Group, the University of Malta (UoM), Institute of Oceanography and Fisheries of Croatia (IOF), Foundation for Research and Technology – Hellas (FORTH).

Abstract

This document is a summary of principle concepts contained in the Deliverable “D4.1 International impulsive noise register for the Mediterranean basin.” of the QUIETMED project funded by the DG Environment of the European Commission within the call “DG ENV/MSFD Second Cycle/2016”. The QUIETMED project aimed to enhance cooperation among Member States (MS) in the Mediterranean Sea to implement the Second Cycle of the MSFD and in particular to assist them in the preparation of their assessment reports by 2018.

This document briefly describes the Impulsive Noise Register in the Mediterranean Sea (INR-MED), a web tool built during QUIETMED to host data on underwater impulsive noise sources and to display indicators related to Descriptor 11-Criterion 1 (D11C1: *Anthropogenic impulsive sound in water*) at the regional scale.

1 IMPULSIVE NOISE REGISTER IN THE MEDITERRANEAN REGION

The tool described in this document is the International Noise Register in the Mediterranean region, INR-MED. The INR-MED comes after the development by the International Council for the Exploration of the Sea (ICES) of the international noise register for the North-east Atlantic area (including the North Sea, the Celtic Sea, and the English Channel) and the Baltic Sea, i.e. the areas covered by the Regional Seas Conventions OSPAR and HELCOM, and has the same global objectives. It is indeed conceived to support ACCOBAMS in producing information that will feed regional assessments on underwater noise pollution, and its Contracting Parties to report on anthropogenic impulsive sounds either for the process relative to the Marine Strategy Framework Directive (MSFD) or the Ecosystem Approach (EcAp) led by Barcelona Convention.

In providing a tool to respond to the relevant MSFD and EcAp processes, this document addresses important objectives of the Memorandum of Understanding between the Secretariats of ACCOBAMS and UNEP/MAP on topics related to underwater noise monitoring and assessment, and relevant provisions of ACCOBAMS Resolutions dealing with the management of the impact of anthropogenic noise on cetaceans (though limited to the Mediterranean Sea).

The INR-MED is based on the Impulsive Noise Register Demonstrator developed by ACCOBAMS for the Mediterranean and the Black Sea (Maglio et al., 2017) and the development took advantage of the work done by ICES for the OSPAR and HELCOM regions on the same topic (Holdsworth and Pinto, 2016).

Therefore, the tool was developed in line with Commission Decision 2017/848 and following guidance documents from TG-Noise (Dekeling et al., 2014). The INR-MED was conceived as a user-friendly tool which consists in a web GIS application that allows reporting noise events in a MS Excel spreadsheet template. Once the data are uploaded by the user, the reported noise events are displayed in a map interface and different types of indicators are calculated automatically and displayed. Furthermore, additional functions allow creating graphs, filtering relevant data, searching for metadata, and more. In addition, the application includes a download section where users can retrieve the data contained in the database.

The INR-MED calculates different indicators associated to Criterion 1 of Descriptor 11 of the MSFD (D11C1: Anthropogenic impulsive sound in water), i.e. quantities associated to the spatial and temporal distribution of underwater impulsive noise sources.

The INR-MED can be accessed and explored from the following URL:

http://80.73.144.60/CTN_Geoportal/home/

Picture 1. *Home page of INR-MED*

1.1 TERRITORIAL SCOPE

The INR-MED is intended to be applied in the Mediterranean Sea basin regions, subregions and subdivisions. According to MSFD, the designed marine region is the Mediterranean Sea and the marine subregions are: Western Mediterranean Sea, the Ionian Sea and Central Mediterranean Sea, the Adriatic Sea and the Aegean-Levantine Sea[1]. The INR-MED yet does not address the subdivision level since the process of defining subdivisions was ongoing during the development phase[2]. Therefore, D11C1 calculation will be found in two spatial scales: marine region and marine subregions.

The Mediterranean Sea geographic boundary was defined by MSFD GIS data files[3]. This geographic boundary is used to set the working area of the Mediterranean noise register. However, due to the extent of the Agreement area under ACCOBAMS competence, the Black Sea region is added to the map visualization in order to highlight the future development lines of the tool.

1.2 DESCRIPTION AND FUNCTIONALITIES

The functionalities of the impulsive noise register are divided in two groups:

- The functionalities belonging to the **noise register interface** group address the administration of the register, as well as the upload and download of data.
- The **Web map GIS** group address the functionalities associated to the map application tool.

[1] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32008L0056&from=EN

[2] Two workshops were held on this matter: 1st and 2nd Workshop for the delineation of subdivisions relevant for MSFD assessments/reporting in the Mediterranean Sea, in Rome on June 21-22, 2017 and Athens on February 20th, 2018.

[3] See https://www.eea.europa.eu/data-and-maps/data/msfd-regions-and-subregions-1

1.3 NOISE REGISTER INTERFACE

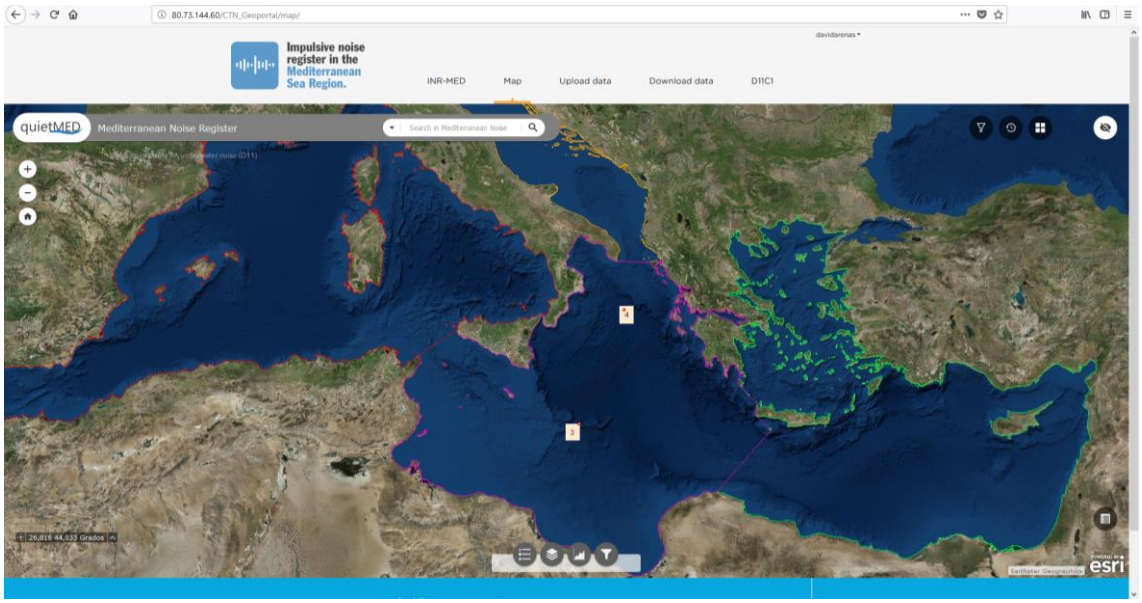
1.3.1 INR-MED HOMEPAGE

This section (http://80.73.144.60/CTN_Geoportal/home/) is an introduction of the joint register of impulsive underwater noise in the Mediterranean Sea Region. The home page explains the aim of the Marine Directive 2008/56/CE (MSFD).

1.3.2 MAP

The collected data in the noise register is displayed in a map as points, lines, or polygons. Once collected data is processed, it is instantly displayed by the web application (this action occurs at the submission of data to the register database). The application also calculates the corresponding pulse-block days (see Annex 6.1 – Criterion calculation) and the result is displayed in the map.

The data visualization in the web map is powered by the web service visualization of ArcGIS for Server that provides style symbology, layer order, legend information among others. In the map page, several common web GIS tools can be found such as filters, pop-ups, table of attributes and metadata, legends, and more. All these tools will be deeply described in Section 2.2.2.



Picture 2. *Map page (http://80.73.144.60/CTN_Geoportal/map/)*

1.3.3 UPLOAD

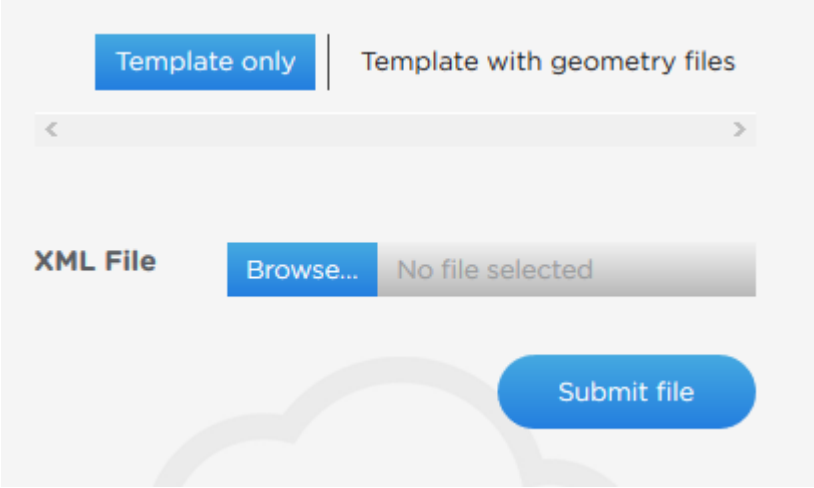
To ensure compatibility with other the OSPAR and HELCOM registers, the same reporting system of those areas is adopted, based on the use of an Excel template. The reporting procedure is as follows:

1. The user downloads the "Underwater Noise Register Template for the Mediterranean Region" in Excel format (available at http://80.73.144.60/CTN_Geoportal/upload/)
2. Fulfills the required fields of the downloaded template as described in Annex 6.5- *Excel template for data reporting from Member-States*
3. Transforms the Excel template in XML format by clicking on the button "Export data to XML for QUIETMED". The button is located in the Excel template (sheet *_Instructions_Export*)

4. Uploads the generated XML using one of the options described below (Picture 4 and 5) and clicking on “Submit file”.
5. If the upload process is successful, the application will show the message “Data uploaded successfully”.
6. Data are printed in the map.

There are two possibilities to report spatial data:

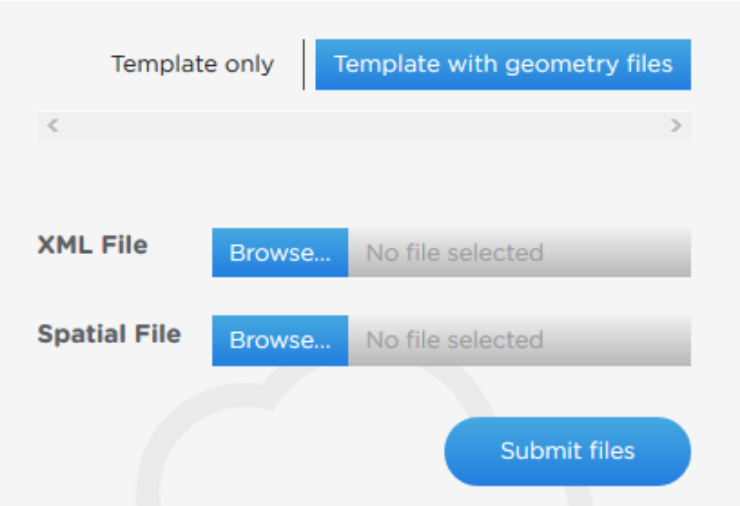
- Report underwater noise data with only XML template: For noise events (which are represented as points in the map) such as pile driving and explosions, indicates its latitudes and longitudes in the Excel template. This is particularly handy for specific users, i.e. country’s institution(s) with the responsibility to report about this kind of phenomena. In the case of events represented by polygons (e.g. moving noise sources like seismic sources, or sonars), the adoption of the regular spatial grid of the General Fisheries Commission for the Mediterranean (GFCM) is conserved from the ACCOBAMS Register Demonstrator (see **Annex 6.4** of this document); this option implies that the user indicates the identifier (ID) of the GFCM statistical rectangles (referred to as just grid cells in this document) where noise sources appear. Also, as for the OSPAR and HELCOM regions, the register is conceived to allow countries to report noise events using their own national spatial grids. We must underline that the national grid system would be only to report, i.e. to indicate in what nationally-designated grid cell noise events occurred. To compute the indicators, the register will use the regional GFCM grid. Currently, the only existent national grid system included in the register is from France. To report noise event with through any of these reporting options the user shall select the desired geometry type in the INR-MED template.



Picture 3. *Template form for XML data upload (http://80.73.144.60/CTN_Geoportal/upload/)*

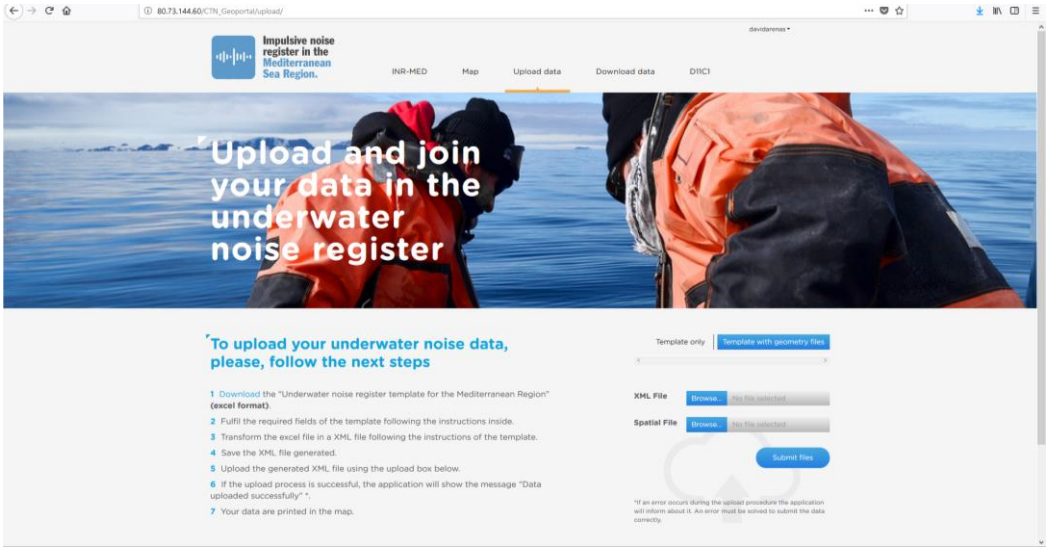
- Report underwater noise data with XML and spatial files: the upload functionality supports noise reporting with spatial files. Available formats of spatial files are KML and SHP, and the supported geometry types for the noise register are points, lines and polygons. This option requires to complete and upload the Excel template (transformed in XML file) like in the first case because the information describing the reported underwater noise event (start and end dates, intensity, etc.) is collected in the XML file, while the spatial objects only contain information about geometries of the noise event. The main advantage of this option is that

the user can upload noise events using his own geometries. Noise event data submitted in such a way will be standardized spatially by the web application through the intersection with the GFCM grid.



Picture 4. *Template form for spatial file upload (http://80.73.144.60/CTN_Geoportal/upload/)*

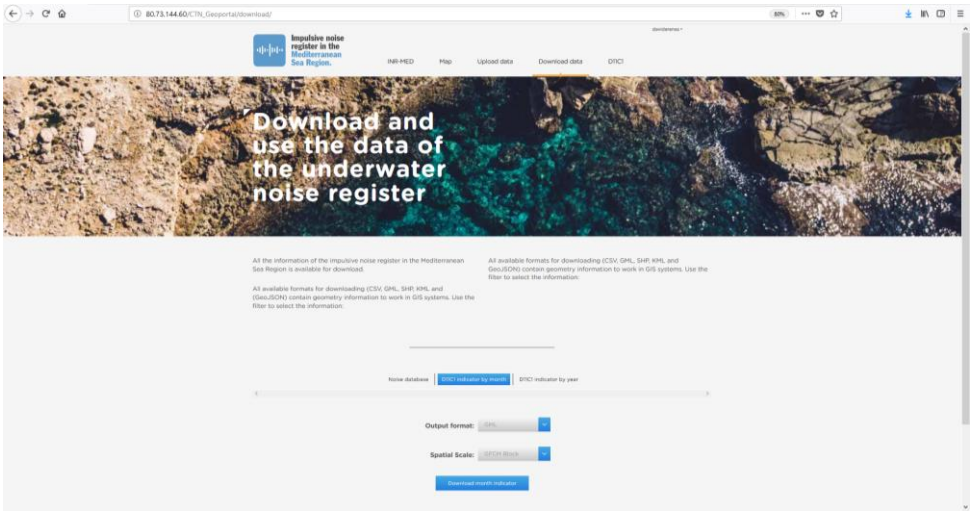
During the upload process, the XML file is automatically checked for errors. An alert message will pop up to the user if a problem happens during the upload procedure. The alert contains detailed information on the error occurred.



Picture 5. *Upload noise events section (http://80.73.144.60/CTN_Geoportal/upload/)*

1.3.4 DOWNLOAD

Information contained in noise register is available for download. The user can download noise events or the different kinds of noise indicators. Supported file extension are SHP, KML, GeoJSON, GML and CSV. User has the option to download a specific amount of data from the database applying filters directly to the data. With this possibility the user can select only the desired data for download avoiding waiting times on large data requests.



Picture 6. *Download noise data section (http://80.73.144.60/CTN_Geoportal/download/)*

1.3.5 ADMIN INTERFACE

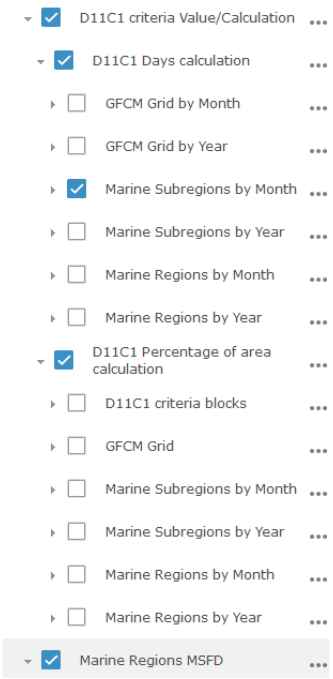
An admin interface was implemented to the noise register to allow its management by administrators. The admin interface capabilities are user management and database functions principally. Administrators can search, view, filter, add, update and remove data in the noise register by accessing to the database tables section.

The remove function on noise data reported by member states recalculates the D11C1 results in order to show the correct value of days with impulsive sources per month/year. When a noise data is deleted the application checks if the deleted noise is involved in any D11C1 calculation. If the deleted noise data is not involved in any D11C1 calculation the application deletes the noise event without any other action. Otherwise, if the deleted noise data participates in D11C1 calculation the application deletes the noise data and recalculates D11C1 values for the GFCM grid, marine subregions and marine regions involved with the deleted noise data.

1.3.6 WEB MAP GIS

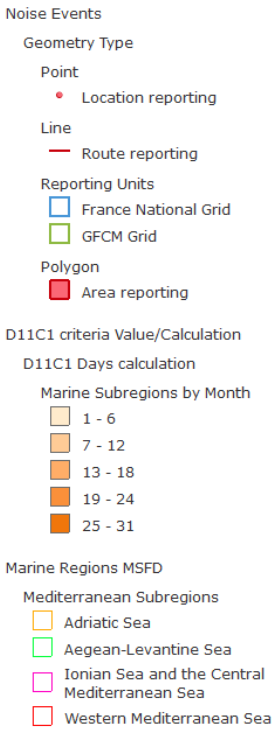
Several GIS functions are implemented in the map page of the INR-MED, allowing the user to navigate, search and viewing noise event data, viewing D11C1-related indicators and exploring metadata:

- Layer Switcher: Tool to select layers to be displayed in the map. The user can interact with this tool selecting the desired available layers in INR-MED to be visible. However, notice that INR-MED includes approximately twenty selectable layers. Selecting a big amount of this layers may produce a low performance in time loads and poor visualization experience for the user. For example, D11C1 layers will contain a huge amount of information over the years, a property of GIS is that overlapping layers are not shown under the top layer, so in some cases there are some layers that are loaded in the map but are not visible. To solve this issue a tool for filtering (D11C1 Visualizer) was developed to achieve a better visualization and time loads using preestablished selectable parameters. With this procedure the user can see information contained in the noise register easily and faster, avoiding mistakes in layer selection.



Picture 7. *Layer siwitcher widget*

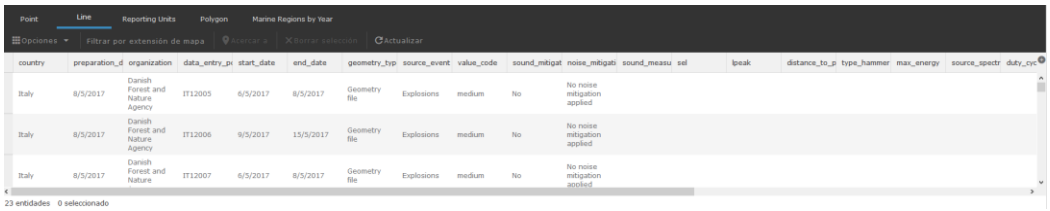
- Legend: the legend of the INR-MED is dynamic because is designed to adapt to changes set in the map visualization. This tool shows the symbology and description of each represented element of the map.



Picture 8. *Legend of INR-MED*

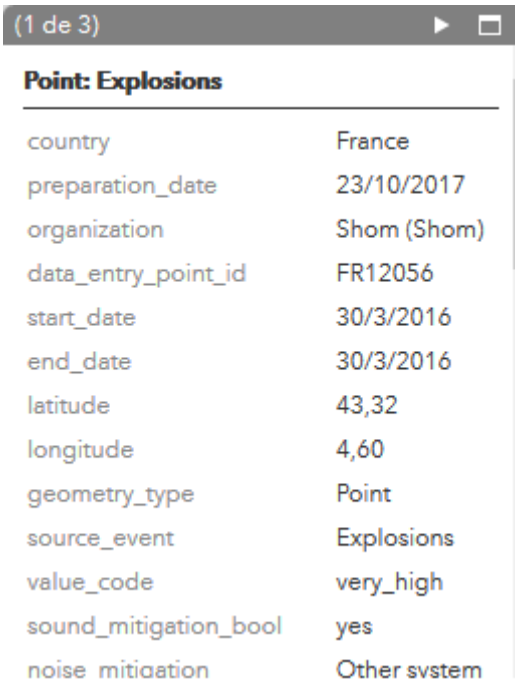
- Table of attributes: Geographic data usually has associated information and metadata. INR-MED has implemented a table of attributes tool to see the associated information to the geographic data, to select database records (e.g. noise events) or apply filters to data. The

table functionality allows the user to select the data from the table and see the selected records in the map. Filtering data is the most powerful functionality of table of attributes. With this feature is possible to show only desired data in the map and it can be applied over all the layers belonging the noise register.



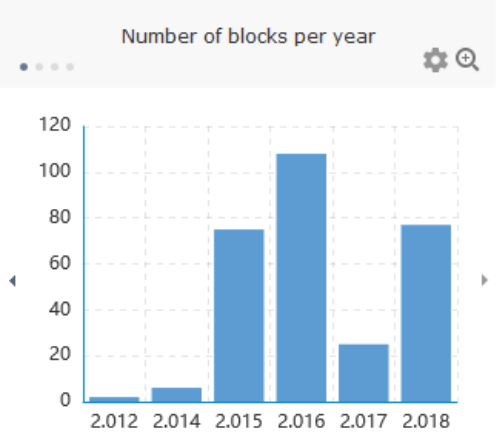
Picture 9. *Table of attributes widget*

- Pop-ups: Pop-ups are based on a floater window that is shown when the user clicks on noise events in the map. The principal advantage of pop-ups is that the user can see the selected record in the map directly. The information appearing in the pop up is retrieved from the database. However, pop-ups window only provides information about the selected elements one by one.

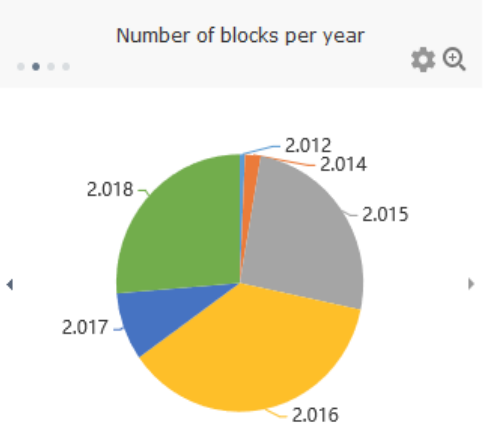


Picture 10. *Pop-up related to a point feature*

- Graphics and charts: This tool plots information contained in INR-MED as graphics in different formats (bar, columns, pie and line charts). Graphic tool enables the analysis of information in a visual way. For example, charts can show in what year there are more reported noise events as can be seen in the pictures below.

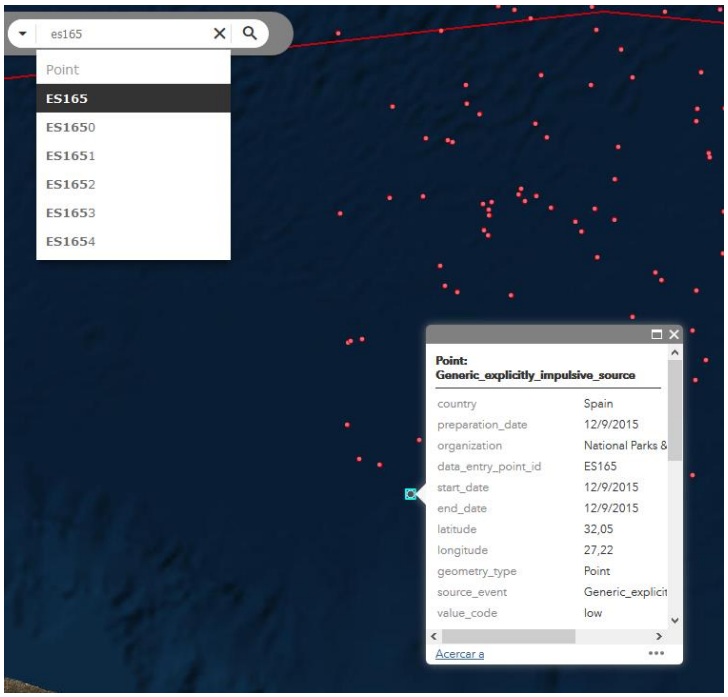


Picture 11. *Column graph generated by Mediterranean noise register*



Picture 12. *Pie chart generated by Mediterranean noise register*

- Geocoder: This function consists in a search bar configured to search and reach data in the map by typing the information related to searched data (codes, dates, etc.). This means that the user can search a noise data by the identifier value and zoom it automatically when the search button is pressed. This functionality is combined with the pop-up tool (Picture 14).



Picture 13. Search widget looking for ES165 noise event

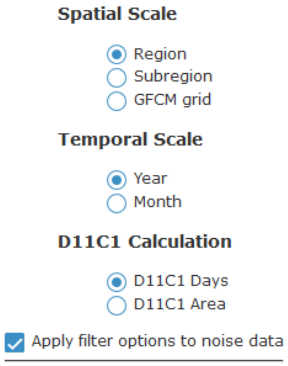
- Get coordinates: this tool aims to take a coordinate from the map view with user click interaction. The available geographic coordinate system in INR-MED are the next:
    - WGS 1984.
    - ETRS 1989.

The tool works by pressing the get coordinates button (left icon of element shown in Picture 15) and pressing in a map zone to obtain the coordinates.

Coordinates are shown in decimal degrees.

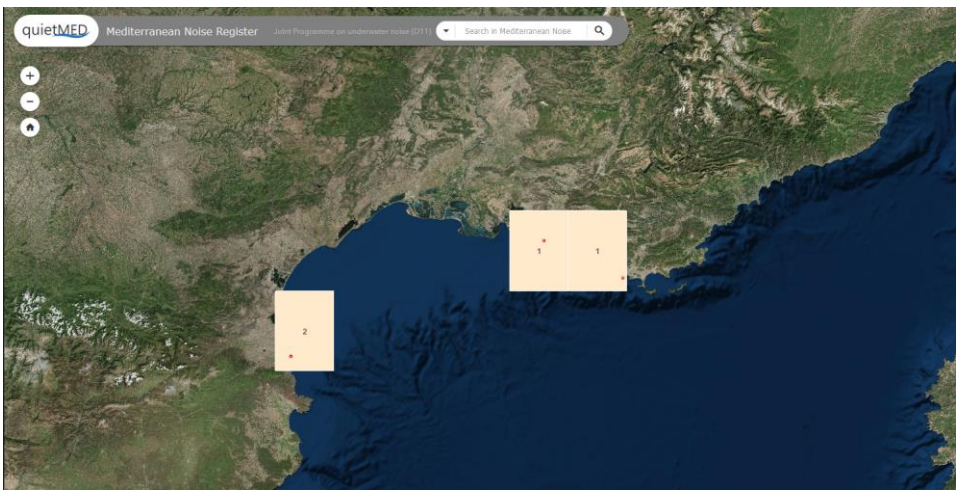
Picture 14. *Get coordinates widget*

- D11C1 filter: This tool was created to give a comfortable user experience in viewing data from many layers. The D11C1 filter allows the user to select a spatial scale (Region, Subregion or GFCM grid), a temporal scale (year or month) and a calculation type (days or area percentage) to show D11C1 values. Once those parameters are selected, the user indicates what year and what month the data will be shown in the map. Furthermore, an optional checkbox (apply filter options to noise data) is provided to apply the same filter to noise event data.



Picture 15. *D11C1 filter widget*

The *Apply filter options to noise data* checkbox synchronizes the noise event data with D11C1 criterion values as it can be seen in the figure hereafter.



Picture 16. *Screenshot of INR-MED. D11C1, pulse-block days in June 2016 represented in GFCM blocks, with corresponding noise events within the blocks, represented as red points (courtesy of SHOM)*

2 ANNEX

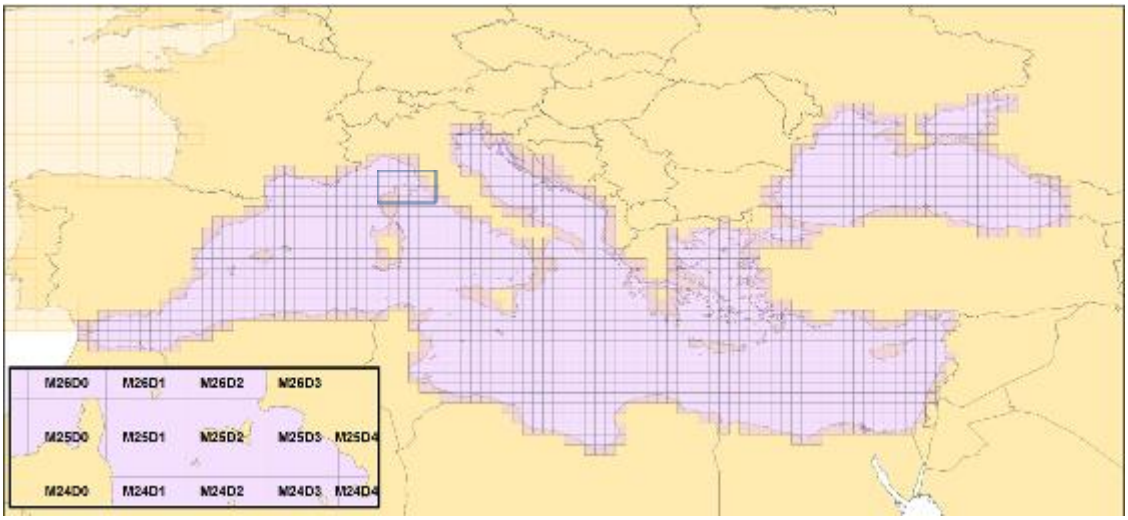
2.1 UNITS OF MEASURE: *PULSE-BLOCK DAYS*

The TG-Noise recommended metric for the impulsive noise indicator is pulse-block days, i.e. the number of days that a certain threshold (pulse) is exceeded in an area (block), for a calendar year (Dekeling et al., 2014). It is noteworthy that the number of pulses occurring in a given block in a single day is not relevant for the computation of the indicator value, which is 1 for such a case, regardless of the number of pulses. In practice, in the case of a noise source emitting several times in the same day (e.g. an airgun for seismic surveys, or during a piling work), or where two or more noise sources are emitting in the same block in the same day, the computation results in 1 pulse-block day, for that day and that block.

The pulse-block-days metric appears simple and straightforward to implement. The procedure to get the indicator value consists simply in locating the activities that used noise sources and calculate how many days the noise sources were used. This calculation is done over a regular spatial grid and the result is a hotspot map as described in the chapter 3 of Deliverable 4.1 of QUIETMED. This metric is currently used in the noise register for the OSPAR and HELCOM regions.

2.2 GFCM GRID AND CODING SYSTEM

The codification of a rectangle in the GFCM statistical grid is a 5 digits' code: (i) Latitude is covered by a composed 3-digits code of a letter (M) and a number (Table 7). Maximum range from M00 (30°N) up to M34 (47°30'N); (ii) Longitude is covered by a composed code of a letter and a number (Table 8). The letter range is from A to J and number range per letter is from 0 to 9. Maximum range from A0 (6°W) up to J5 (42°E). Figure 13 presents an overview of the grid.



GFCM grid in the Mediterranean and Black Sea with an example of the coding system for the northern Tyrrhenian Sea6. This picture shows also the ICES statistical rectangles in the Atlantic (yellow cells).

Coding for Latitudes. All values are in decimal degrees (WGS84) in the Northern hemisphere (all positive values).

CODE	FROM	TO
M00	30	30.5
M01	30.5	31
M02	31	31.5
M03	31.5	32
M04	32	32.5
M05	32.5	33
M06	33	33.5
M07	33.5	34
M08	34	34.5
M09	34.5	35
M10	35	35.5
M11	35.5	36
M12	36	36.5
M13	36.5	37
M14	37	37.5
M15	37.5	38
M16	38	38.5
M17	38.5	39
M18	39	39.5
M19	39.5	40
M20	40	40.5
M21	40.5	41
M22	41	41.5
M23	41.5	42
M24	42	42.5
M25	42.5	43
M26	43	43.5
M27	43.5	44
M28	44	44.5
M29	44.5	45
M30	45	45.5
M31	45.5	46
M32	46	46.5
M33	46.5	47

M34	47	47.5

Coding for Longitudes. Values are in decimal degrees (WGS84). Negative values mean West coordinates.

CODE	FROM	TO
A0	-6	-5.5
A1	-5.5	-5
A2	-5	-4.5
A3	-4.5	-4
A4	-4	-3.5
A5	-3.5	-3
A6	-3	-2.5
A7	-2.5	-2
A8	-2	-1.5
A9	-1.5	-1
B0	-1	-0.5
B1	-0.5	0
B2	0	0.5
B3	0.5	1
B4	1	1.5
B5	1.5	2
B6	2	2.5
B7	2.5	3
B8	3	3.5
B9	3.5	4
C0	4	4.5
C1	4.5	5
C2	5	5.5
C3	5.5	6
C4	6	6.5
C5	6.5	7
C6	7	7.5
C7	7.5	8
C8	8	8.5
C9	8.5	9

D0	9	9.5
D1	9.5	10
D2	10	10.5
D3	10.5	11
D4	11	11.5
D5	11.5	12
D6	12	12.5
D7	12.5	13
D8	13	13.5
D9	13.5	14
E0	14	14.5
E1	14.5	15
E2	15	15.5
E3	15.5	16
E4	16	16.5
E5	16.5	17
E6	17	17.5
E7	17.5	18
E8	18	18.5
E9	18.5	19
F0	19	19.5
F1	19.5	20
F2	20	20.5
F3	20.5	21
F4	21	21.5
F5	21.5	22
F6	22	22.5
F7	22.5	23
F8	23	23.5
F9	23.5	24
G0	24	24.5
G1	24.5	25
G2	25	25.5
G3	25.5	26
G4	26	26.5
G5	26.5	27
G6	27	27.5

G7	27.5	28
G8	28	28.5
G9	28.5	29
H0	29	29.5
H1	29.5	30
H2	30	30.5
H3	30.5	31
H4	31	31.5
H5	31.5	32
H6	32	32.5
H7	32.5	33
H8	33	33.5
H9	33.5	34
I0	34	34.5
I1	34.5	35
I2	35	35.5
I3	35.5	36
I4	36	36.5
I5	36.5	37
I6	37	37.5
I7	37.5	38
I8	38	38.5
I9	38.5	39
J0	39	39.5
J1	39.5	40
J2	40	40.5
J3	40.5	41
J4	41	41.5
J5	41.5	42

2.3 EXCEL TEMPLATE FOR DATA REPORTING FROM MEMBER-STATES

This annex reports the name of fields that are part of the data form (downloadable from the register web pages) and describes the content of such fields. The form (an Excel template) is made of 4 worksheets:

- Instructions_Export
- File information

- Noise register data
- Vocabularies

Data on noise events are to be entered in the “noise register data” worksheet (Table 5). Additional information are to be entered in the “file information” worksheet concerning the preparation of the form: what country, what organization in that country, and preparation date (Table 6). The worksheet called “Instructions_Export” shall provide instruction on filling the data form and on how to upload it in the register web portal, while the “vocabularies” worksheet will present available options for multi-option fields.

Worksheet noise_register_data

Column	Field	Content	Type
A	data_entry_point_ID	String	Mandatory
B	start_date	ddmmyyyy	Mandatory
C	end_date (ddmmyyyy)	ddmmyyyy	Mandatory
D	Latitude	Decimal degrees WGS84	Mandatory
E	Longitude	Decimal degrees WGS84	Mandatory
F	Geometry_type	Point, GFCM Grid, National Grid, other grid system	Mandatory
G	polygon_ID	GFCM sub-rectangle ID, National block ID or spatial object filename	Mandatory
H	source_event	Airgun arrays/Explosions/Pile driving/ Sonar or acoustic deterrent/Generic noise source	Mandatory
I	value_code	NA/very_low/low/medium/high/very_high	Mandatory
J	sound_mitigation_bool	Yes/no	Mandatory
K	data_quality	1 to 4	Mandatory
L	NMS_type	Type of noise mitigation system (from list provided in the vocabularies worksheet / ACCOBAMS Resolution 4.17)	Optional
M	sound_measurement_bool	yes/no	Optional
N	SEL	Sound Exposure Level expressed as dB re 1µPa²s	Optional
O	Lpeak	Zero-to-peak level expressed as dB re 1µPa	Optional
P	distance_to_pile	Decimal metres	Optional
Q	type_hammer	Model number of hammer used, e.g. S-2000, 3000S	Optional
R	max_energy	Kj	Optional
S	source_spectra	Units to be determined	Optional
T	duty_cycle	Decimal	Optional
U	start_time	hhmm	Optional
V	duration	seconds, integer	Optional
W	directivity	decimal	Optional
X	source_depth	metres, decimal	Optional
Y	platform_speed	knots, decimal	Optional
Z	Remarks	Free text	Optional

Worksheet file_information

Column	Field	Content	Type
A	Country	ISO 1366 code from list provided	Mandatory
B	Preparation Date	ddmmyyyy	Mandatory
C	Organization	EDMO code from list provided	Mandatory