QUIETSEAS - Assisting (sub) regional cooperation for the practical implementation of the MSFD second cycle by providing methods and tools for D11 (underwater noise)

D9.1 Guidelines for Competent Authorities on a reporting method for continuous noise appropriate for the GES assessment and the establishment of thresholds

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No	Participant organization name	Participant short name	Country
1	Centro Tecnológico Naval y del Mar	CTN	Spain
2	Permanent Secretariat of the Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area	ACCOBAMS	Monaco
3	Service hydrographique et océanographique de la marine	Shom	France
4	Politecnico di Milano-Department of Civil and Environmental Engineering	POLIMI-DICA	Italy
5	Hellenic Centre for Marine Research	HCMR	Greece
6	Inštitut za vode Republike Slovenije/Institute for water of the Republic of Slovenia	IZVRS	Slovenia
7	Specially Protected Areas Regional Activity Centre	SPA/RAC	Tunisia
8	Maritime Hydrographic Directorate	MHD	Romania
9	Department of Fisheries and Marine Research	DFMR	Cyprus
10	International Council for the Exploration of the Sea	ICES	Denmark

Dissemination level	
PU: Public	X
PP: Restricted to other programme participants (including the Commission Services)	
RE: Restricted to a group specified by the consortium (including the Commission Services)	
CO Confidential, only for members of the consortium (including the Commission Services)	

Date	Revision version	Company/Organization	Name and Surname
31/03/2023	Draft0	CTN	Tania Vera
16/05/2023	Draft1	ACCOBAMS	Alessio Maglio Maylis Salivas
18/05/2023	Final Version	CTN	Tania Vera

Abstract

This document is the Deliverable "D9.1 Guidelines for Competent Authorities on a reporting method for continuous noise appropriate for the GES assessment and the establishment of thresholds" of the QUIETSEAS project funded by the DG Environment of the European Commission within the call "DG ENV/MSFD 2020". This call funds projects to support the implementation of the second cycle of the Marine Strategy Framework Directive (2008/56/EC) (hereinafter referred to as the MSFD), in particular to implement the EU Commission Decision 2017/848 of 17 May 2017 as well as Programmes of Measures according to Article 13 of the MSFD. QUIETSEAS aims to support the practical development of the second implementation cycle under the MSFD for D11 (underwater noise).

The object of this document is to describe the method proposed to countries to report underwater continuous noise data under the scope of the MSFD-D11. In particular, this document addresses the reporting of data for regional and sub-regional assessments. These are indeed the scales of assessment where the quality of data and consistency of monitoring methodologies are more challenging and that ACCOBAMS is tackling to ensure coherent regional and sub-regional GES assessments.

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List of Abbreviations

CTN	Centro Tecnológico Naval y del Mar
ACCOBAMS	Permanent Secretariat of the Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area
DFMR	Department of Fisheries and Marine Research
IZVRS	Inštitut za vode Republike Slovenije/Institute for water of the Republic of Slovenia
HCMR	Hellenic Centre for Marine Research
UM	University of Malta -The Conservation Biology Research Group
POLIMI-DICA	Politecnico di Milano-Department of Civil and Environmental Engineering
SPA/RAC	Specially Protected Areas Regional Activity Centre
ICES	International Council for the Exploration of the Sea
Shom	Service hydrographique et océanographique de la marine
MHD	Maritime Hydrographic Directorate
MSFD	Marine Strategy Framework Directive
GES	Good Environmental Status
MS	Member States
MED	Mediterranean Sea
BS	Black Sea
CA	Competent Authority
NR	National representative
SO	Specific Objective
TB	Thematic Block

1. Introduction

The QUIETSEAS Project is funded by DG Environment of the European Commission within the call "DG ENV/MSFD 2020". The QUIETSEAS project aims to enhance cooperation among Member States (MS) in the Mediterranean Sea Region to implement the third Cycle of the Marine Directive and in particular to support Competent Authorities and strengthen cooperation and collaboration in the Mediterranean Sea and Black Sea regions.

This deliverable is the result of work done on Activity 6, testing applicability of the methodologies and tools of QUIETSEAS to promote the consolidation of indicators by performing an operational pilot on GES assessment for D11 (D11C1 and D11C2) and support the achievement of the following specific objectives of the project:

- Specific objective 1 (SO1): To identify relevant indicators for criterion D11C2 (Anthropogenic continuous low-frequency sound in water).
- Specific objective 2 (SO2): To promote the consolidation of relevant indicators for D11 and support the operationalisation of indicators on the state, pressure and impacts of underwater noise in close coordination with TG Noise.
- Specific objective 3 (SO3): To promote harmonisation of regional work on threshold values with TG Noise recommendations.

The project is developed by a consortium made up of 10 entities coordinated by CTN and it has a duration of 28 months starting on 1st February 2021.

2. Reporting method for continuous noise

2.1. Context

The reporting method has been developed as part of the 1st Data Call for Continuous Noise data launched by ACCOBAMS in 2022 and addressed to Competent Authorities in Contracting Parties to ACCOBAMS. The methodology has been built upon the following elements:

- Previous experience with data calls in Regional Seas such as the Calls launched by ICES and ACCOBAMS for impulsive noise respectively in the Northern and in the Mediterranean, Black Sea and contiguous Atlantic Area,
- The existing data management tools used by ACCOBAMS,
- The discussions held during QUIETSEAS among the different partners and stakeholders.

The method is made up of different parts described hereafter.

2.2. Scope

Countries are requested to provide, on a voluntary basis and under the scope of MSFD-D11 (and EcAp Ecological Objective 11), data concerning continuous noise levels in the Mediterranean and Black Sea. These data are needed to assess the environmental status of the Mediterranean and Black seas relative to underwater noise pollution levels.

For the definition of continuous noise, we refer to the Commission Decision 2017/848, where the criteria element for continuous noise is “Anthropogenic continuous low-frequency sound in water” (D11C2).

Continuous Noise data of interest are the following:

- **Sound maps** produced based on underwater sound propagation models.
- **Underwater sound values** deriving from in-situ measurements.

2.3. Reference period

Ideally, Continuous noise data should be reported annually. Each year (N) countries should provide data for the year N-1.

2.4. Data formats

The choice of data formats considers the recommendations issued by the EU Working Group on GES (WG-GES) and the work carried under the following EU-funded projects:

- JONAS (https://www.jonasproject.eu/)
- JOMOPANS (https://northsearegion.eu/jomopans/)

- QUIETSEAS (https://quietseas.eu/).

FOR UNDERWATER SOUND VALUES DERIVING FROM IN-SITU MEASUREMENTS: Data should be submitted as **HDF5** files.

FOR SOUND MAPS: Data should be submitted as GIS-readable files such as geoTIFF, NetCDF and GeoPackage files.

Specific requirements for data, metadata and further requested information are attached to this document (Sections 2.7 and 2.8).

2.5. Data management

Contributors shall indicate the terms and conditions attached to the data.

For the sake of simplicity, contributors may indicate their choice among the licensing options available hereafter, all related to the Creative Commons licensing framework:

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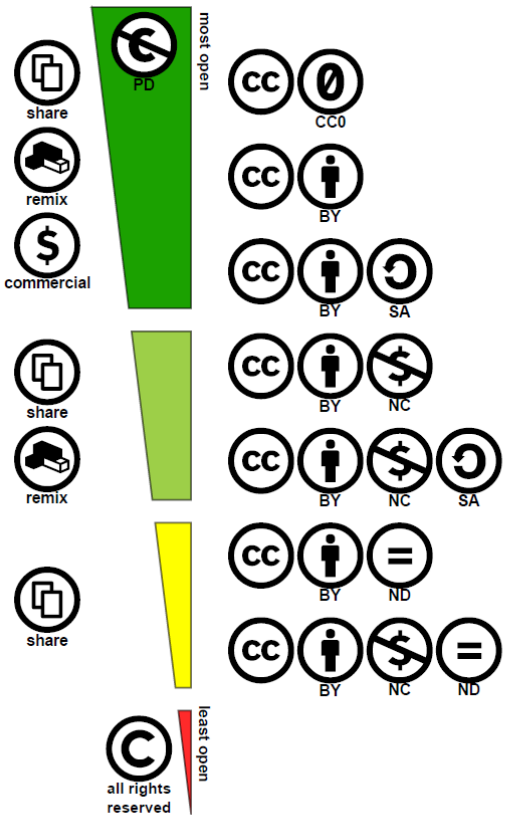

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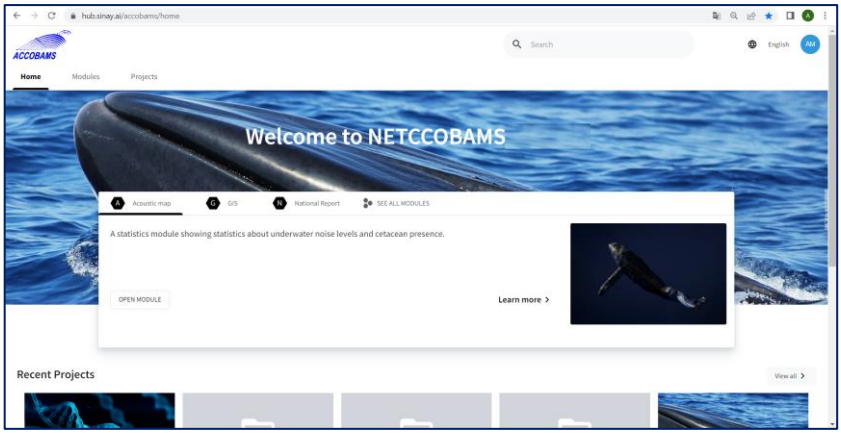
2.6. Data submission instruction

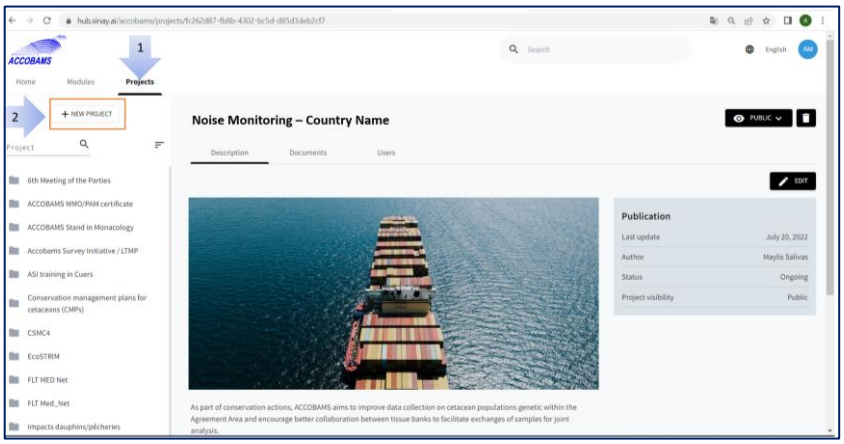
Two alternative options are available:

1. Data can be forwarded by email and/or other common internet services (cloud services, FTP, etc.) and addressed to secretariat@accobams.net. In such a case the ACCOBAMS Secretariat will take care of loading and storing the data into the NETCCOBAMS platform.
2. Registered users of NETCCOBAMS may directly upload data on the platform through the following simple steps:

1) Login to NETCCOBAMS

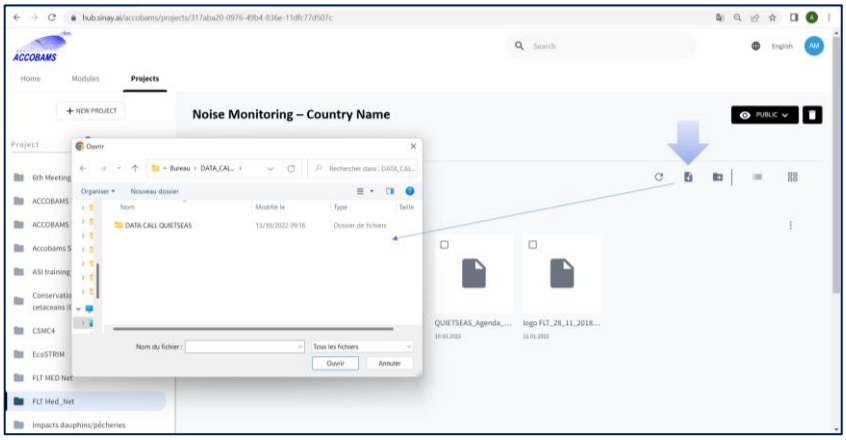


2) Create a new project



3) Select and add new data

- HDF5 for in-situ measurements
- GIS-readable formats for sound maps



2.7. Data reporting format for sound maps

GIS-readable underwaters sound maps are sought under this Data Call. These data must be accompanied by a set of metadata (an **Identity Card** of the sound maps) that enable a correct interpretation as well as the comparison with data produced by other contributors. The specifications on metadata were defined during the QUIETMED project and are extensively analysed in the document *Best practice guidelines on acoustic modelling and mapping (QUIETMED Deliverable 3.3)*[1]. Five metadata groups are necessary, hereinafter referred to as *Map ID Layers*. The following forms need to be completed and sent along with sound maps.

[1] Taroudakis, M. I., Skarsoulis, E. K., Papadakis, P., Piperakis, G., Maglio, A., Drira, A., Gervaise, C., & le Courtois, F. (2018). Best practice guidelines on acoustic modelling and mapping (Deliverable 3.3). *No. 11.0661/2016/748066/SUB/ENV.C2*.

Map ID Layer 1: Shipping information form	
Item	**To be completed by contributor**
Source of ship data (Position, size, speed)	e.g., AIS, the provider of such data, if they include Sat-AIS, etc.
Source depth approximation	*Concise description of method and choice of value*
Source Level model for emission levels and spectrum	e.g., RANDI, ROSS, other

Map ID Layer 2: Environment form	
Item	**To be completed by contributor**
Bathymetry	*Source of data* *Spatial resolution*
Sound speed profile ▪ Temperature and Salinity data	*Sources of data* *Spatial and temporal information* *Concise description of choices of values and approximations done*
Geoacoustic properties of the bottom ▪ Number of layers (sediment layers, sub-bottom, etc.) ▪ Thickness of each layer (in meters) ▪ Velocity profile of sediment (also called com pressional speed, m/s) ▪ Density (kg/m^3) ▪ Attenuation of compressional and shear wav es (db/)	*Sources of data* *Spatial and temporal information* *Concise description of choices of values and approximations done*

ID Layer 3: Computational scheme	
Item	**To be completed by contributor**
Approach ▪ Temporal or probabilistic approach (*sensu* QUIETMED Deliverable 3.3)	*General description*
Acoustic propagation model	e.g., spherical spreading, cylindrical spreading, normal mode, ray tracing, parabolic equation...
Model setup	*Selection of values for each item*

▪ Angular resolution ▪ Maximum propagation distance from source ▪ Horizontal resolution ▪ Vertical resolution ▪ Nb of frequencies for each source	
Model output and metrics	e.g., arithmetic mean SPL values in dB re 1µPa; median, percentile XX, etc.

ID Layer 4: Calibration and validation form	
Item	**To be completed by contributor**
Active calibration methods	*Concise description*, e.g.: emission of controlled signals in-situ
Passive calibration methods	*Concise description*, e.g., comparison with in-situ measurements
Other adjustments	e.g., test of different SL to best fit in-situ measurements
Estimation of uncertainty	*Concise qualitative or quantitative estimation of uncertainty; may include remarks about residual deviance after calibration*

ID Layer 5: Results, formatting and displaying form	
Item	**To be completed by contributor**
Assessment period	*Start and End dates*
Spatial grid resolution	e.g. 100 m x 100 m; 5 km x 5 km, etc.
Metrics	e.g., SPL in dB re 1µPa; SEL in dB re 1µPa^{2}s; etc.
Sample size (for temporal approach)	*The number of instant noise maps produced by the model and used to derive statistics*
Depth layer shown in the map	*In metres (may be a range of values)*
Vertical averaging	*Concise description of method to average in the vertical dimension (if any)*
Statistics in grid cells	e.g., arithmetic mean, median, percentiles, etc.

2.8. Data reporting format for SPL values

The Continuous Underwater Noise format has to be submitted in HDF5 file format, and consists of three groups, each containing several datasets. A description of each group can be found in the subsections below. In the tables below, the "Field" column defines the datasets in each group, the "Status" column describes whether the dataset is mandatory, conditionally mandatory, or optional, the "Data type" column defines the data format in each dataset, the "Field definition" column describes the dataset, and the "Reference" column links to the controlled vocabulary for the corresponding dataset, when existent. A dataset is considered to be conditionally mandatory when a specified value is present in a related dataset.

Dataset length per file:

File size should be max one month. A single file for each month and measurement station should be provided.

File information group

Field	Status	Data type	Field definition	Reference
Email	Mandatory	String(50)	Creator of the HDF5 file/ who holds responsibility for data QA and creation of the submited hdf5 file.	
CreationDate	Mandatory	DateTime(21)	Date of file creation. UTC DateTime in ISO 8601 format: YYYY-MM-DDThh:mm[:ss] or YYYY-MM-DD hh:mm[:ss] . Seconds are optional. For example: 2020-04-01 11:36Z, or 2020-04-01 11:36:23Z	https://en.wikipedia.org/wiki/ISO_8601
StartDate	Mandatory	DateTime(21)	Measurement collection start date. UTC DateTime in ISO 8601 format: YYYY-MM-DDThh:mm[:ss] or YYYY-MM-DD hh:mm[:ss]. Seconds are optional. For example: 2020-04-01 11:36Z, or 2020-04-01 11:36:23Z	https://en.wikipedia.org/wiki/ISO_8601
EndDate	Mandatory	DateTime(21)	Measurement collection end date. UTC DateTime in ISO 8601 format: YYYY-MM-DDThh:mm[:ss] or YYYY-MM-DD hh:mm[:ss]. Seconds are optional. For example: 2020-04-01 11:36Z, or 2020-04-01 11:36:23Z	https://en.wikipedia.org/wiki/ISO_8601
Institution	Mandatory	String(6)	Institution which acquired the data.	EDMO Code
Contact	Mandatory	String(255)	Contact of all future external queries/who submits/holds responsibility for submission	
CountryCode	Mandatory	String(4)		
StationCode	Mandatory	String(10)	The station code and its associated coordinates can be found in the ICES station dictionary	

Metadata group

Field	Status	Data type	Field description	Reference
HydrophoneType	Mandatory	String(255)	This field describes the manufacturer and the used hydrophone type/model e.g. 'Brüell&Kjaer 8106'. This field needs to be an array if there	

			are multiple channels (one per channel).	
HydrophoneSerialNumber	Mandatory	String(50)	e.g. "SN#1234". This field needs to be an array if there are multiple channels (one per channel).	
RecorderType	Mandatory	String(50)	Recorder/data logger type e.g. "Soundtrap"	
RecorderSerialNumber	Mandatory	String(50)	Recorder serial number e.g. "SN#2345"	
MeasurementHeight	Mandatory	Float	Height above the seafloor, in meters	
MeasurementPurpose	Mandatory	String(10)	Description of why the continuous underwater noise measurements reported were monitored	
MeasurementSetup	Conditional Mandatory	String(10)	Description of deployment. Mandatory in case the purpose is "HELCOM monitoring"	
RigDesign	Conditional Mandatory	String(10)	Description of deployment construction. Mandatory in case the purpose is "HELCOM monitoring"	
FrequencyCount	Mandatory	Integer	Number of frequency bands	
FrequencyIndex	Mandatory	Float	Third octave band nominal center frequencies. This field is an array of frequencies, with as many columns as the number of frequency bands reported under FrequencyCount.	
FrequencyUnit	Mandatory	String(10)		
ChannelCount	Mandatory	Integer	Number of channels used	
MeasurementTotalNo	Mandatory	Integer	Number of measurements	
MeasurementUnit	Mandatory	String(10)	Unit in which the values are in e.g. dB re 1µPa	
AveragingTime	Mandatory	Integer	Averaging time in seconds	
ProcessingAlgorithm	Optional	String(225)	Algorithm used to process the data e.g. computation method for third octave band (fft, filter bank ...)-analysis	
DataUUID	Mandatory	String(255)	Unique identification number, linking the data submission to the corresponding raw data. It should be used for resubmissions of the same data; matlab function available: uuid = char(java.util.UUID.randomUUID);	
DatasetVersion	Mandatory	String(255)	Indicates version of the submitted dataset. It should be changed upon resubmission	
CalibrationProcedure	Conditional Mandatory	String(255)	Method used to check the measuring chain. e.g. point calibration with pistonphone, functionality test with microphone and loudspeaker (frequency dependent), or other method used to check the measuring chain. e.g. point calibration with pistonphone, functionality test with microphone and loudspeaker (frequency dependent), or other. Mandatory in case the purpose is "HELCOM monitoring"	
CalibrationDateTime	Contional Mandatory	DateTime(21)	Date of when the system was last calibrated. Mandatory in case "CalibrationProcedure" is specified UTC DateTime in ISO 8601 format: YYYY-MM-DDThh:mm[:ss] or YYYY-MM-DD hh:mm[:ss]. Seconds are optional. For example: 2020-04-01 11:36Z, or	https://en.wikipedia.org/wiki/ISO_8601

			2020-04-01 11:36:23Z	
Comments	Optional	String(255)		

Data group

Field	Status	Data type	Field description	Reference
DateTime	Mandatory	DateTime(21)	UTC DateTime in ISO 8601 format: YYYY-MM-DDThh:mm[:ss] or YYYY-MM-DD hh:mm[:ss]. Seconds are optional. For example: 2020-04-01 11:36Z, or 2020-04-01 11:36:23Z	https://en.wikipedia.org/wiki/ISO_8601
LeqMeasurementsOfChannel1 LeqMeasurementsOfChannel… LeqMeasurementsOfChannelN	Mandatory	Float	Equivalent continuous sound pressure level measurements over time for all covered frequency bands. One frequency per column. In case there are multiple channels, there should be an array of values for each channel. If there are 3 channels, there would be three arrays called LeqOfChannel1, LeqOfChannel2, LeqOfChannel3. In case of channel failure, please report NAN values.	