EMODnet Sea-basin checkpoints

Lot n° 2 – Atlantic

EASME/EMFF/2014/1.3.1.3/lot2/SI2.710838

Start date of the project: 26/08/2015

Final Report

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Work Package number	**16**
Work Package title	**Management**
Deliverable number	**D16.2**
Title	**Final report**
Short description	This final report describes the Atlantic Checkpoint's achievements with regard to technical developments and time spent, deliveries and dissemination of the results. It concludes on data adequacy and most salient gaps in the basin and formulates recommendations on how these could be addressed with the support of Panel experts' comments. It suggests a follow-on procedure based on the implementation within EMODnet of a Quality Management System using ISO tools and methods developed in the project.
Keywords	Checkpoint, data adequacy, metadata, thematic products, availability
Editor / Organisation	Jacques Populus / Ifremer
Deliverable due date	M36
Comments	

Dissemination level		
PU	Public	**x**
CO	Confidential for project partners and EU Commission only	

Contents

1. Executive summary

[Max 750 words]

This Atlantic Checkpoint Project intended to give an account of the marine data landscape of the Atlantic Ocean by analysing the contribution (or the lack) of data sets to the creation of products in the frame of eleven thematic challenges. The methodology, based on metadata catalogues and quality measures derived from ISO, builds a quantitative comparison between the specifications of the products, their actual results and how suitably the existing data sets contributed to them.

At the time the 53 products across these eleven challenges were specified, a catalogue of products was implemented in the GIS server Sextant and populated with the products specifications expressed by way of eight quantitative quality measures derived from ISO 19157. Similarly upon completion the products were assessed again using the same measures, which permitted the computation of the discrepancies between the two sets of quality measures. All these measures were illustrated by bar charts for each quality measure showing at a glance where the gaps are.

The data sets contributing to the challenges were also assessed along the same indicators and reported in spreadsheet form under the characteristic they refer to.

Data analysis was conducted from three angles:

- The challenges, i.e. marine thematic domains, specifically which ones had least performed and why;

- The characteristics (or variables), by assessing for each inadequate product what were their shortcomings using quality measures;

- The main EU data providers (EMODnet, CMEMS and the DCF).

In the synthesis a few key characteristics were selected according to their higher relevance to the challenges and recommendations were formulated in three areas of potential action:

- Data assembly when data exist but need to be pulled together;

- Data availability when data exist but for some reasons are too difficult to use;

- Gap bridging by surveys when either coverage or resolution is lacking.

From the Challenges web page a table gives access to the specifications of the products, their scores, their metadata including appropriateness and use limitations, and also download facilities via a DOI and a view of the geospatial layers in the Web GIS.

It is reminded that the Checkpoint was intended not only to be used by DG/MARE who commissioned the work but also by the larger providers' community. This was the reason for us to develop objective and quantitative tools enabling these providers to search their characteristics of interest by application and discover the specifications and related data shortcomings as a basis for improvement of their data quality management.

2. Introduction

Provide a short (max 2 pages) introduction to set the stage (start date, main goals, background, consortium, key components and characteristics of the lot).

[Max 2 pages]

Rationale

After a time when observations of the sea have been made for specific purposes, e.g. for specific national purposes or to demonstrate a technological capability, the European Commission has now moved to a new paradigm where data are collected once and used them for as many purposes as possible. This means relying preferably on users rather than producers to assess existing data sets and data sources and promote recommendations for a better satisfaction of their needs.

The EMODNET Atlantic Checkpoint (http://www.emodnet-atlantic.eu/) objective was to evaluate the fitness-for-use of current observations and data assembly programs for eleven marine applications and suggesting recommendations as how optimize and develop monitoring systems and data streamlining at the scale of the North Atlantic Ocean.

Consortium

A consortium was built with ten partners issued from the five EU Atlantic countries. There was an reasonable mix of the academic and private sectors with respectively six and three partners. The challenge leaders were basically scientists knowledgeable in the area of their challenges. They had little knowledge in data management, a specific area of expertise of the coordinator Ifremer. The data management nature of the work had been under-estimated upon project submission, which resulted in somewhat heavy constraints as the work developed.

Timeframe and phases

The Checkpoint started in August 2015 for a 3-year period with the idea of setting up a quantitative assessment system strongly based on up-to-date ISO and EU prescriptions on data management.

Specific checkpoint features

The lot was rather specific in its geography when compared to the other basins due to the very large size of the Atlantic Ocean. Basically the area can be split into three blocks: (i) EU waters, (ii) north American waters and (iii) the rest, from the Equator to the Polar Circle, three regions very different in terms of development and marine management. The partners were able to thoroughly describe EU data as well as a number of North American sources, however found it mostly impossible or a daunting task to find data in the many other adjacent countries.

Another unique feature is the historic presence of two organizations with a strong remit in terms of data management, namely OSPAR and the ICES, both very well-organized and efficient structures managing and delivering a wealth of marine data. On hand this is obviously an advantage for the sake of making good products, on the other hand it may be a complicating issue when redundancies of data are observed between them and data originators.

3. Summary of the work done

Provide a summary of the work done and an overview of the main tasks. **Please make sure that main results as specified in annex I (tender specifications) and in annex IIa of the contact (technical offer) are covered.** *In particular ensure that each of the tasks specified in Section 1.4.5 of the Tender Specifications are covered.*

[Max 2 pages]

The literature review

The first step was to look at the data landscape around the eleven challenges by way of a literature survey, namely a series of use cases, which helped the challenges identify which characteristics and associated data sets they would need to build their products. So 22 use cases were studied with the idea on one hand to help the challenges build good products by selecting as many relevant data types (characteristics) as possible, on the other hand to assess the quality of these data sets. The conclusion was that authors very seldom inform the quality of their data, to the point of not saying what their spatial resolution is. What probably happened was that people did not report those data that did not meet their requirements (whether they use them or junk them). What appeared to be more frequently described was the availability of data, i.e. especially when data were tricky to get, time-consuming or at a cost. The main – and not the least - output of the literature survey was the identification of the data sets thought to be necessary for the products, which amounted to about 660.

The challenges

Most of the challenges had a remit to cover the whole Atlantic, which some did (e.g. Bathymetry, MPA) and others justified it was a daunting task after thoroughly examining the issues. 53 challenge products were achieved, either because the tender clearly requested to deliver several products within a challenge or because the partners deemed it necessary to split their deliverable into several sub-products. These are mostly maps but also spreadsheets in cases of time change issues and they can be found in the project web site (http://www.emodnet-atlantic.eu/Challenges) under the challenge section.

On the Challenge page each product appears with its score (from inadequate to excellent). Upon choosing between "Specifications" and "Results" users are taken to the Sextant products catalogue that displays all the quality measures and in the Results page, the percentage of fulfillment of each of these measures for each characteristics forming the lineage of the product. By clicking on "Download" users are taken to the product landing page and DOI giving key information such as: date, authors, point of contact, publisher, DOI identifier, abstract, keywords, utilization and citation. Finally the webGIS URL opens the product, e.g:

http://www.ifremer.fr/sextant_doc/atlcheckpoint/product/CH_4_product_1.zip

The assessment

The data adequacy assessment was carried out in two phases.

Data adequacy report 1

Following the literature survey, the partners went out querying and downloading the 660 data sets deemed necessary to make their products. While so doing, they informed the data sets in terms of their availability,

including the project or program of origin, the organization making /delivering it, t(he URL, along with several measures of availability derived from ISO. These data were captured using Geonetwork in the Sextant metadata server (ISO and INSPIRE-compliant), after the challenge leaders has been trained to it. This was reported in the first adequacy report and a comparison made with the other two checkpoints (MedSea and Black Sea) which were using the same method (initiated by the former). The first data adequacy report (DAR) was delivered by mid-project to give a detailed status of data availability, with a focus on how the main EU providers (DCF, EMODnet and CMEMS) scored in this area of adequacy.

Data adequacy report 2

After an expert panel meeting convened midway through the project had given its feedback with regards to the methodology and first quantitative project's outputs, the challenges started making the above – reported products. Upon product making the emphasis was set on data appropriateness, which really is the suitability of the data to fulfill the achievements. Challenge leaders were requested to inform their product specifications in a Sextant interface of quality measurements, e.g. by specifying which resolution, coverage or data freshness they wanted. After terminating their products, they informed their characteristics using the same quality measures as used in the specifications, hence providing a quantitative measurement of the discrepancy between specified / realised. This was the main subject of the second data adequacy report, whose assessment was carried out by a second expert panel meeting in June 2018.

4. Main results for the respective challenges – data adequacy assessments

Provide a summary of the main results of the data adequacy assessments. **Please make sure that main results in each of the challenges specified in Section 4.1.5.2 of the Tender Specifications are covered.**

[Max 3 pages]

A web page

This is available at: http://www.emodnet-atlantic.eu/
Each challenge has delivered maps for spatial data or spreadsheets for time-series which are available for viewing and downloading where appropriate. The landing page is a DOI which gives access to the catalogue of products (both specifications and results) and from there to the catalogue of data sets. The Panel comments were: "The maps were largely done and well implemented in Sextant GIS server. The digital data layers are compatible with INSPIRE, EMODnet and OGS. Significant effort has been put into project into metadata side".

Confidence limits

Confidence limits on the products were not assessed because this is recognized to be an overwhelming and impossible task today as long as data providers do not align with ISO19157 quality requirements as stated by the Panel were: "Setting confidence limits was too big a challenge to be addressed in this project. Recommendation is that this should be expressed in the report".

A list of the data sources used and data providers.

This list of 104 data sets actually used in making the products is provided as Annex 4 of DAR2. Data providers were referenced but not data originators. We recognize knowing the originators would have helped trace redundancies but in many cases they are far too many to be reported, especially in the area of human activities (e.g. NODCs, Member States, individual organizations). Redundancies were notably mentioned in Eutrophication, a challenge which confronted many data availability issues.

An analysis of the usefulness of each data source in terms of location, price, attributers, delivery and usability

This is basically the core content of the DAR2. The tables presented in its Annexes 5 and 6 show for each characteristic all the data sets used and give a full description of their adequacy by way of quality measures. For data sets not found, they give the identification of the characteristic concerned.

A summary of effort (person days) spent on meeting the challenge broken down into effort spent on: a) collecting the data, (b) processing it into a form suitable for analysis, (c) performing the analysis

This summary consists in a table of the persons*days allocated to each challenge split into these three categories. The Panel recommended: " Perhaps rather than presenting a breakdown that would have to be interpreted with caution it would be better to ask each task leader: 'Was this harder than they expected it to be?', along with a short explanation". Accordingly short comments are given below for each challenge, which may be of relevance for future work.

Windfarm: Overall the challenge was feasible, even though some data may be too coarse. Whether looking at 4 sites allows drawing conclusions relative to the whole Atlantic basin remains a pending issue.

MPA: The first two products were feasible, although some data (mostly human activities) had many gaps. The third product about the influence of climate change on MPAs would need to be better specified.

	Collecting the data	Processing the data into a form suitable for analysis (including Sextant metadata editing)	Performing the analysis (including report writing)	Total
	Person*days	Person*days	Person*days	
Wind Farm - IPMA	58	156	70	284
MPA - Anouar Hamdi	40	75	40	155
Oil leak - CLS	44	37	14	58
Climate- Cefas	22	45	44	111
Coast - Eurogoos	42	95	72	209
Fisheries management - AZTI	35	80	25	140
Fisheries impact - MI	70	51	99	220
Eutrophication - Cefas	34	105	46	185
River inputs - ACRI	109	156	27	292
Bathymetry - HRW	19	56	19	94
Alien species - AZTI	50	150	50	250

Oil leak: the challenge was successful because the fake spill occurred at a good distance from the coast. If it had been closer, both oil spill drift monitoring and impact at the coast would have largely failed.

Climate: the challenge was feasible as such but the reasons for making the products should have been better explained, resulting in a likely better result. Only phytoplankton knowledge in the ocean was severely missing.

Coasts: Managing sea level data was possible in spite of low data density. No work could be produced for the estimate of erosion/deposition at the coast because descriptive data are severely lacking, let alone forecast data.

Fisheries management: The challenge was very partially delivered. Fisheries by-catch and discard data need to be improved, before these data are made public, by way of adequate sampling protocols and estimation methodologies, including coverage of all fleets. In EU more DCF funding is advisable.

Fisheries impact: Environmental data about the seabed were all right, however VMS data were lacking for quite a number of countries, as well as for boats less than 12m long, which made the analysis incomplete (remit of EMODnet Human activities and EMSA).

Eutrophication: Chlorophyll estimates from remote sensing were successful however this was not sufficient to tackle the issues. The challenge mostly reports an acute lack of co-located chemical data in the coastal zone where eutrophication occurs and redundancies in data sources (remit EMODnet Chemistry)

River inputs: River inputs suffer from shortcomings, a) too few rivers are equipped with multi-parameter stations, b) inter-calibrations of flux / concentration measurements are needed.

Bathymetry: Overall, the specification of the challenge offered sufficient scope to analyse the bathymetry provision for the North Atlantic. If a future bathymetry challenge is undertaken, it is recommended that the challenge includes an aspect of the numerical modelling of waves and currents since the accuracy and utility of bathymetry data plays a key role in these processes.

Alien species: The citation table was rather comprehensive (over 80%), however the confidence in the citations is low, which jeopardizes confidence in indicators. Improvements could come from a research and management program for alien species dynamics and impacts including citation quality control.

A summary of the lessons learned doing the analysis

Were the results accurate enough?

a) Regarding the products, they were scored in order to reflect whether overall they were fit for use, which is what the tender asked for. Regarding data, we built a quantitative assessment based on declarations from challenge leaders as to the quality they would like to have for their products and the quality they got expressed by four quality measures. The system then computed the discrepancy in % between both of them and reported it in tables and bar charts for visual assessment. These discrepancies are objective and

accurate but they are based on declarations from the challenges which sometimes need to be taken with caution. For example some people may have unconsciously relaxed their specifications upon their knowledge of limited quality of existing data. In such cases, the discrepancy lessens and so do the recommendations about the data in scope.

Where are the main gaps in the data?

Data gaps are reported in detail for each challenge in section 5 below. Gaps may be expressed respectively in m, km² or days for spatial resolution, coverage or time measures, but also in % for specific items such as observing stations, mapping units etc.

If there are different sources for similar parameters, which data source is the most useful?

There were not many cases of redundancies mentioned by the challenges but still DAR2 section 4.2.5 dwells on recommendations for improving data assembly by strengthening the links between various TACs, even within EMODnet itself, when dealing with joint needs of physical/chemical data, biological/habitat data, bathymetry/elevation and erosion issues (Bathymetry and Geology lots). Consistent spatial sampling and measurement protocols should be applied to get harmonized and co-located data. Institutions such as EMODnet, OSPAR, the EMSA or ICES would benefit from working in a closer relationship.

Is the availability of data improving or worsening?

The answer to this issue definitely is that the data landscape is steadily improving. We have moved recently from data discovery (compulsory in INSPIRE, using tools such as ISO 19115 and ISO 19139) to data qualification both to allow end-users to determine by themselves the usability of the data they need and providers to protect themselves against any misuse of their data and liability costs. Completeness is the first concern of users which such queries as: "In this place what can I find?" and if something is found "Is data resolution good enough?" and finally "Is it recent enough?". The quality items developed in this Checkpoint to answer these questions are being implemented by spatial data providers such as NODCs under ISO 19157 but the process is still at a very early stage.

Are the data layers made available through Copernicus, EMODnet or Data Collection Framework in fisheries useful or is it necessary to go back to the original data?

There are two areas where the need to work with original data was expressed: a) vessel position data which are important for several challenges but not necessarily as standard outputs, b) gridded data (either from models or remotely sensed) where users may want to derive specific statistics from the original data which may not be available from off-the-shelf products.

Are there more data available that could not be used for this challenge because they were too expensive or complicated to access?

Although it was not assessed in challenge reports along with other availability measures, cost did not appear to be a limitation, even for challenge leaders who were not from the academic sector. Panel comments were: "It would be nice if cost was there but we appreciate it is generally very difficult to obtain without significant effort".

Data complicated to access are those featuring very large volumes, with sometimes the need to download these large volumes before knowing whether the data are suitable. In these cases the project recommended the use of the cloud and associated discovery services.

What would be the main priority for data collection or assembly in order to improve the accuracy of the results or the difficulty in producing them?

DAR2 provided a discussion on priorities. Priorities very much depend on the EU policy strategy so recommendations about such or such characteristic is awkward to voice. Regardless of characteristic type, the overarching recommendation from the project is that thrashing out assembly and availability issues in the first place would be more cost-effective than collecting new data. Regarding the challenges, the Panel stated: "Why prioritize the challenges, we have concern over the consequence of prioritization. The challenges could also be prioritized in different ways, e.g. 'easiest to rectify'".

5.   Main gaps encountered for the respective challenges

Provide an overview of the main gaps encountered for the respective challenges and the measures taken/solutions proposed to address them.

[Please, provide information in table]

Main gaps	Measures taken/solutions proposed
Windfarm: Insufficient wind data	Improved horizontal and vertical resolution wind series from global models
Windfarm: insufficient wave data	Upgrade or new models
MPA: Human activity data	Foster assembly of marine activities data with focus on recreational fisheries (EMODnet)
MPA: Intensify EBSA mapping and extend to OSPAR zone	
Oil leak: digital ESI atlas (Environmental Sensitivity Index) lacking	Improve assembly. These data may exist in most countries, however in paper form for some
Oil leak: Wind data	Improved horizontal and vertical resolution wind data in costal zones
Climate: no data on three most abundant phytoplankton species	Careful consideration of an appropriate metric to define a set of time series to give something useful. Combination of CPR and fixed station based analyses to identify and track a set of appropriate plankton based climate indicators.
Climate: Heat content of the ocean	The Ocean Heat Content is a well used and respected metric of change in the storage of energy in the ocean, but it has no metadata vocabulary in this analysed state (remit of EMODnet Physics)
Coasts: Insufficient number of tidal gauges or the lack of available long time	Additional gauges for a number of coastal stretches, sustained funds for getting long time series and GPS corrections
Coasts: Sediment load and its translation into erosion/siltation effects mostly unknown for the main coastal stretches.	Compute series of high resolution satellite imagery enabling an estimate of the situation and trend in each coastal stretch of coast.
Fishery management: The reliability of by-catch and discard data	Implement adequate sampling protocols and estimation methodologies based on further research to guarantee soundness in the implementation of the DCF.
Fishery management: Offical data on discards in the EU are incomplete	Coverage of all fleets is advisable for comprehensive scientific and technical evaluation (DCF)
Fishery impact: gaps in VMS and logbook data	The availability of the VMS/Logbook data and the sensitivity / secrecy surrounding VMS are issues. EMODnet/EMSA remit.
Eutrophication: In situ data for dissolved oxygen concentrations, chlorophyll-a and dissolved inorganic nitrogen concentrations not meeting spatial and time coverage requirements	In situ data are made available through various portals, which creates a risk of duplication and could be addressed by an improved coordination between data providers. Data access could be more friendly (EMODnet). The access to satellite data for Chlorophyll-a could be improved by enabling users to access a cloud facility both for storage and data processing.

Eutrophication: Data on inputs from rivers to support eutrophication assessment did not meet spatial and temporal requirements	Need for increased measuring stations and co-location of measurements in space and time. Intercalibration of local measurements to estimate concentrations at local and regional scale, and computation of monthly mean values.
Rivers: Too few rivers equipped with measuring stations	Recommended implementation of more multi-parameter measuring stations with upgraded measurement frequency; Data should be streamlined to be more easily made available to users (EMODnet Physics).
Bathymetry: Unavailability of original survey results and with sufficient accompanying metadata.	Maintaining accessible records of all metadata and lineage was determined as being the main priority for data collection / assembly (EMODnet remit). It is recommended that metadata be stored by survey in a simple, standard form.
Banthetry: Confidence	Creation of a simple, standardized way of determining the quality of bathymetry survey measurements would allow cross-comparison of different sources (EMODnet remit).
Alien species: Gaps and lack of confidence in citation files	A research and management program for Marine Alien Species dynamics and impacts based on a geo-referenced database should be established for the whole basin; Many citation data are uncertain, therefore citation quality-control should be implemented in a management program.

6. Outreach and communication activities

Please list all the relevant communications activities or products you have developed/executed during this period (including presentations, lectures, trainings, demonstrations and development of communication materials such as brochures, videos, etc.).

Relevant scientific and/or popular articles you know have been published using/referring to EMODnet must also be reported here.

[Please, provide information in table]

Date	Media	Title	Short description and/or link to the activity
14-15 Feb. 2017	Stakeholders meeting	Break-out session (Chairs Eric Moussat and Mickaël Vasquez)	• 180 stakeholders' names to DG/MARE for this event. • 19 stakeholders convened in the Atlantic break out session chaired by the coordinator to discuss major findings and propose solutions and recommendations
June 2017	Sextant GIS Server	AtlantOS Project	• The AtlantOS Project got in touch with the Atlantic Checkpoint with a view to use its metadata catalogue for their purposes (WP8), so we created an infrastructure within Sextant that they can use without interfering with us. This is a good example of "collect once and use many times" process.
June 2017	Liaison		• The European Space Agency (ESA) questioned the Atlantic Checkpoint on issues about implementing ISO 19157 for their own products.
23-24 Nov. 2017	Meeting	Copernicus information and training session	• Challenge 9 (River inputs) was discussed and it was reported that river data were generally difficult to obtain and that Copernicus should keep their provision on their agenda.
8 Nov. 2017	Meeting	AORA -CSA Workshop (Mapping the Atlantic Seabed), Bergen, NORWAY (30+ People)	• Atlantic Checkpoint advertised by the Marine Institute
15 Nov. 2017	Seminar	INFOMAR Annual Seminar, Cork, IRELAND (100+ People)	• Atlantic Checkpoint advertised by the Marine Institute
13 Dec. 2017	Conference	AGU Fall Meeting, New Orleans, USA (100+ People)	• Atlantic Checkpoint advertised by the Marine Institute
20-22 Mar. 2018	French Mérigéo Conference	"Evaluation de la capacité des systèmes d'information européens à répondre aux défis maritimes de l'UE"	• This presentation was given by Erwann Quimbert on behalf of the participants to the EMODnet Atlantic, Mediterranean and Black Sea to provide the audience with an overview of the rationale, methods and preliminary results of the adequacy assessment.
10 Apr. 2018	EGU Conference	"EMODNET Atlantic Checkpoint - Using ISO quality elements standards to assess existing monitoring systems in the Atlantic Ocean".	• A presentation was given by Erwann Quimbert in session ESSI2.1 "Metadata, Data Models, Semantics, and Collaboration" convened by Paolo Diviacco.
24 May 2018	AtlantOS webex	Training AtlantOS WP8 staff to the Checkpoint method	• A couple of webex meetings were organized between Ifremer and AtlantOS staff to train them to use the Sextant catalogue for the data assessment of their seven use cases
3 Jul. 2018	Dyneco	The EMODnet Atlantic	• A presentation was given by Jacques Populus in

	Seminar at Ifremer	Checkpoint: Data adequacy to EU challenges	Ifremer internal seminar cycle (also open to staff from Institut Universitaire Européen de le Mer) about why subscribe to EMODnet and strive to help in streamlining marine data from observations to users.
5-7 Nov. 2018 (after contract end)	IMDIS Conference Barcelone	EMODnet Atlantic checkpoint: data adequacy to EU challenges	• This presentation will be given after the end of the contract. The emphasis will be placed on the way providers can query the Sextant catalogues of data sets using a web interface and obtain a full assessment of their data sets in the frame of a combination of different uses.

7. Recommendations for follow-up actions by the EU

Please, give a list of recommendations and suggestions for the EU to consider and take action.

[Max 1 page]

An "EMODnet Quality Management System (QMS)" could be an entity parallel to the thematic lots interacting strongly with them, which would be feasible if EMODnet was turned into a permanent structure. Whether to give this service precedence over the lots remains to be decided when time comes, under the aegis of the EMODnet governance. It is interesting though to note that in most organizations Quality Services are located under direct supervision of the Chief Executive, in an attempt to remain distant from a possible "lobbying effect" on the part of actual working units.

Regarding governance, the Project felt that it was not yet in place within DG/MARE and that there was no single responsible point of contact to coordinate progress towards the aims by:

- Prioritizing issues depending on the ultimate purpose of the data strategy, e.g. MSFD, Blue Growth, MSP, Climate.
- Developing a clear steering hierarchy for QMS with an oversight across all data collection activities, with the implementation of quality standards. After gaps have been pointed out by the checkpoints, a corrective mechanism needs to be set up. This would be made easier by stating which are the key questions that have to be answered for the next 10 years.
- Better involving end-users in specifying the challenges. The system could be useful for wider users wishing to tackle current marine issues;
- Should the checkpoints be rerun, a shorter time bound would be helpful to keep testing whether there have been improvements, with better cross-correlation with other checkpoints.
- For the specific case of the Atlantic international collaboration could be further extended to non-EU countries and challenge leaders encouraged to make better use of international networks e.g. ICES, NWAFO or OSPAR Regional Seas Convention.
- The use of standards such as ISO and SeaDataNet are recommended as they offer well-identified and stable vocabularies and INSPIRE compatible metrics.
- The unprecedented collection of metadata that can be searched by a web query tool should be maintained and possibly strengthened in the future while making it available to the providers' community for them to take corrective action in view of better fitting multi-purpose requirements.

Annex : Other documentation attached

List in Annex if you wish to provide any additional information.

List of abbreviations and acronyms

AORA	Atlantic Ocean Research Alliance
CMEMS	Copernicus Marine Environment Monitoring Service
CPR	Continuous Plankton Recorder
DAR	Data Adequacy Report
DOI	Digital Object identifier
DCF	Data Collection Framework
EMSA	European Maritime Safety Agency
ESI	Environmental Sensitivity Index
QMS	Quality Management System
MSP	Marine Spatial Planning
ICES	International Council for the Exploration of the Seas
MESA	Monitoring for Environment and Security in Africa
MSFD	Marine Strategy Framework Directive
MSP	Marine Spatial Planning
NODC	National Oceanographic Data Centre
NWAFO	Northwest Atlantic Fisheries Organization
OGS	Open Geospatial Consortium
OSPAR	Oslo-Paris Convention
QMS	Quality Management System
TAC	Thematic Assembly Centre