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Eurofleets+ data sets catalogue

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1 Introduction

Eurofleets+ will facilitate open free of charge access to a unique fleet of state-of-the-art research vessels, AUVs and ROVs from European and international partners. This will be arranged by competitive transnational access calls which are published at the Eurofleets+ portal. A Data Policy has been adopted which aims at making Eurofleets+ research data to be findable, accessible, interoperable and reusable (FAIR). Therefore, data management is an integral part of the Eurofleets+ workplan, and different aspects can be found in several work packages, in particular WP3, WP4 and WP9. The latter WP has a focus on dissemination and promotion and includes a Task 9.4 - Exploitation and Promotion of the scientific data. This task aims to ensure that the research data collected during the funded cruises, and the en-route data collected by the vessels are made widely available in line with FAIR and Open Research Data principles. An overall approach and workflow for achieving these objectives has already been documented in D1.3 – Eurofleets+ Data Management Plan. The present document D9.5 is further elaborating the details of the Eurofleets+ information system components which will support the data management workflow. In particular, it will give a draft set-up of the Eurofleets+ data sets catalogue that will facilitate the publication and dissemination of the data as collected by the Eurofleets+ TA cruises.

2 Eurofleets+ data management workflow

The Eurofleets+ fleet comprises twenty-seven research vessels operated by European and international research organisations that will provide shiptime as part of the transnational access (TA) calls for deploying Eurofleets TA cruises. A major objective of the Eurofleets+ data management plan is to ensure that metadata and data of TA cruises will become available for dissemination. For that purpose, the research vessels of the Eurofleets+ fleet will be equipped with a shipboard system to gather and transfer metadata and data as acquired during TA cruises. This will be done as part of WP3 in Task T3.1.3. In the first two years of the project, the research vessels will be equipped with the so-called EARS V2 system. This applies for those research vessels that will be engaged with TA cruises in that time period.

EARS V2 is the shipboard software suite that has been developed in predecessor Eurofleets projects. It consists of four major components:

- EARS (Eurofleets Automatic Reporting System), developed by RBINS;
- Data Acquisition System, developed by IFREMER;
- En-route Ship Summary Report (SSR) system, developed by CSIC with contributions from IFREMER;
- Web Services, developed by CSIC with contributions from IFREMER.

As part of WP3, T3.1.2, these components will be upgraded by each by their original developers, also in the first two years of the project. This should result in an upgraded Eurofleets+ shipboard software suite that will replace the initial EARS V2 installations. The ambition is to install and configure the upgraded system in the third and fourth years of the project on all Eurofleets+ vessels in various configurations, depending on the existing situations at these research vessels. This is required as each research vessel has a different local configuration, uses other instruments, and thus requires adaptations and flexibility from the Eurofleets+ ship board system.

The EARS V2 system and its successor Eurofleets+ shipboard software suite will be instrumental for gathering the full set of cruise data that is acquired during the operations of an Eurofleets+ TA cruise. This comprises metadata and data from:

- En-route (underway) data acquisition by fixed sensors on the platform: location, meteorology, thermosalinometry, FerryBox,
- Human operations: physical measurements such as a CTD profile or water transparency; measurements and observations derived water, sediment or biota samples; occurrence observations
- Long-term timeseries by sensors deployed on frames, ROVs, AUVs or floats

The **en-route data** will be gathered, stored, and transferred at a regular interval to the data centre of the vessel operator and, after local validation, also made available by web service in a standard json protocol to MARIS, as manager of the **Eurofleets+ EVIOR (European Virtual Infrastructure in Ocean Research) platform**. This will allow for publishing the en-route data and metadata per cruise at the EVIOR portal as part of the '**Dynamic Vessel Tracking & Events System'**. The project strives for establishing this en-route data exchange not only for Eurofleets+ TA cruises, but also for all other cruises that Eurofleets+ research vessels, equipped with the shipboard system, will undertake.

For the **research data** the gathering and dissemination will be implemented in two major steps:

- As a first step, the Principal Investigator (PI) or Chief Scientist of an Eurofleets+ TA cruise should report a metadata summary of the completed cruise with information of scientific measurements made and samples taken. This should be done by compiling a **SeaDataNet Cruise Summary Report (CSR)**, by making using of events information as registered in the Eurofleets+ shipboard system. The SeaDataNet Cruise Summary Report (CSR) is the usual means for reporting on completed cruises. The reporting should be done by the PI within two weeks after the cruise and either a) to his/her National Oceanographic Data Centre (NODC), or b) in the case where no such NODC exists, by requesting to furnish a CSR directly via the online Cruise Summary Report Content Management System. In any case, the CSR of a completed TA cruise must be included in the SeaDataNet CSR database two weeks after the cruise. This way it will be published by the CSR User Interface at the SeaDataNet portal and by a **dedicated Eurofleets+ CSR User Interface at the Eurofleets+ EVIOR platform**. The CSR metadata will include a reference to the Eurofleets+ project (by means of an entry in the SeaDataNet EDMERP directory) and a reference to the research vessel (by means of an entry in the SeaDataNet C17 Vocabulary and the Eurofleets+ Eurocean Research Vessel database).
- As a second step, the PI together with the team of researchers of the Eurofleets+ TA cruise, must organise that all cruise datasets (trajectories, timeseries, CTD profiles, sample-based measurements and observations) including relevant metadata and documentation are compiled and submitted as one package to the **EMODnet Data Ingestion service** within two months after the result has been obtained. The package should contain a reference to the Cruise Summary Report (by means of an entry in the SeaDataNet / Eurofleets+ CSR database) and a reference to the Eurofleets+ project (by means of an entry in the SeaDataNet EDMERP directory), so that the masters of the EMODnet Data Ingestion service can easily recognise it as the results of an Eurofleets+ TA cruise and assign the submission to one of the three appointed Eurofleets+ reference data centres, RBINS (Belgium), OGS (Italy), or HCMR (Greece).

The basis of the following image 1 is derived from D1.3 and it has been expanded for illustrating the complete Eurofleets+ data management workflow as planned.
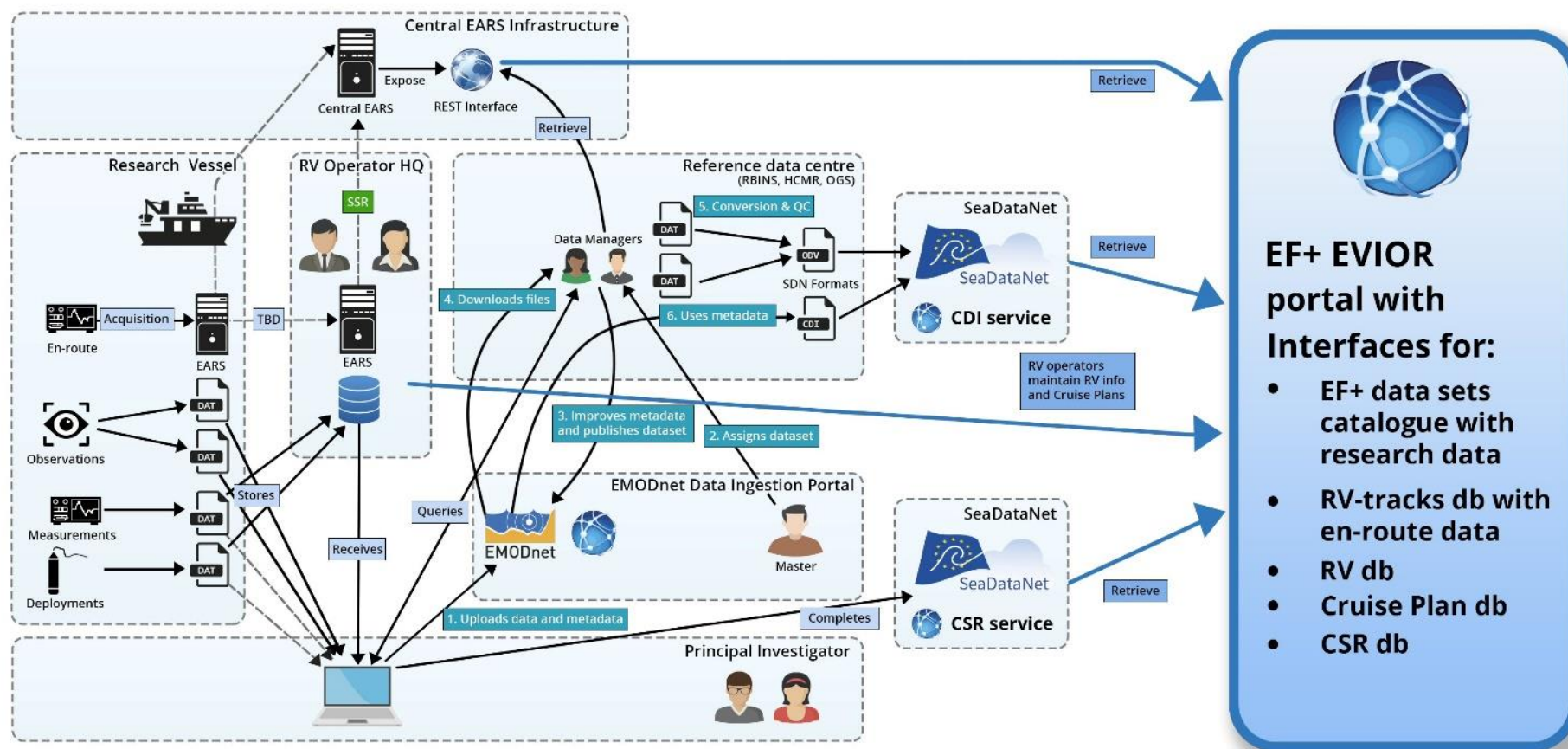

Image 1. Complete Eurofleets+ data management workflow as planned

The assigned SeaDataNet data centre will then undertake further processing and dissemination of the submitted TA cruise data package, most probably in communication with the TA cruise team of researchers. Activities will include a first phase of checking and completing the EMODnet Data Ingestion metadata form for publishing it 'as-is' at the EMODnet Ingestion portal. In a second phase, it will include checking and completing all detailed metadata of the data sets in the data package, quality assessment and control of these data sets, conversion of the validated data to standard formats, and uptake of the validated metadata and data in the data management system of the assigned SeaDataNet data centre. Thereafter, the assigned SeaDataNet data centre will convert the validated and stored TA cruise metadata and data into a series of entries for the SeaDataNet CDI data discovery and access service and will populate this service.

In addition, the operators of the Eurofleets+ research vessels are requested to maintain the details and features of their research vessels in the Research Vessel database that EurOcean is operating and managing. Furthermore, the rv operators are requested to maintain summaries of planned cruises, including Eurofleets+ TA cruises, regularly in the Eurofleets+ Cruise Programme database.

In the next chapter more details will be given on the Eurofleets+ information system components and how all the gathered information and data sets will be widely published for users.

3 Eurofleets+ Information system components

Dynamic Vessel Tracking & Events system

The '**Dynamic Vessel Tracking & Events system**' should become a common system for giving public e-access to the en-route metadata and data from sailing Eurofleets+ research vessels. In the previous Eurofleets2 project already a prototype has been configured. It consists of a user interface, hosted at the **EVIOR platform** and developed by MARIS, which allows users to retrieve 1) dynamic charts of the momentary position of RVs with position, speed, and bearing, 2) track-charts of cruises completed by RVs with option to re-run the tracks as animations, and 3) 24 hour Ship Summary Reports (SSR) by clicking on any position of the vessel track. The SSR includes options to retrieve the event logs for the fixed instruments and collected underway data series. The user interface gives access to metadata and data as collected by the EARS V2 system at a few RVs, operated by CSIC and Ifremer that were configured as demonstrators for the prototype of the 'Dynamic Vessel Tracking & Events system'. Activities are underway in WP3 for upgrading and further elaborating the prototype system to an operational system. This is done in activity JRA3.1 - Advancing shipboard data management and data access. Results will be reported in time in related WP3 Deliverables.

Cruise Summary Reports db system

The long-time existing SeaDataNet Cruise Summary Reports database will be populated with CSRs of each Eurofleets+ TA cruise, in addition to the regularly incoming CSRs for most European research vessels. For preparing and submitting CSRs use is to be made of the SeaDataNet standard format, tools and procedure. The CSR database itself is managed by BSH. The completed CSRs of TA cruises will be published through existing CSR user interfaces at the EVIOR portal, SeaDataNet portal, and POGO CID portal. Activities are underway in WP3 as part of JRA3.1 for adapting and upgrading the look & feel of

the CSR user interfaces at both the Eurofleets+ EVIOR and POGO CID portals. This will be reported in Deliverable D3.1. end M8.

Cruise Programme db system

The existing Eurofleets Cruise Programme database will be populated with Cruise Plans for as many research vessels as possible from European operators (all RVs) and international operators (all ocean-going RVs). This will include Cruise Plans for each Eurofleets+ TA cruise. For preparing and submitting CPs use is to be made of the Eurofleets standard format, tools and procedure. The CP database itself is managed by MARIS. The completed CPs will be published through existing CP user interfaces at the EVIOR portal, and POGO CID portal. Activities are underway in WP3 as part of JRA3.1 for adapting and upgrading the look & feel of the CP user interfaces at both the Eurofleets+ EVIOR and POGO CID portals. Moreover, activities are underway for approaching RV operators and gathering their CPs. The initial activities and progress will be reported in Deliverable D3.1. end M8.

Research Vessel db system

The existing Research Vessel database will be updated with RV details for as many research vessels as possible from European operators (all RVs) and international operators (all ocean-going RVs). For entering and maintaining RV details use is to be made of the standard format, tools and procedure as managed by EurOcean. The completed RV entries are currently published through existing RV user interfaces at the EVIOR portal, and POGO CID portal. However, EurOcean is undertaking a major upgrading of its series of infobases, integrating these into a common user interface for several categories of research infrastructures, of which RVs and special equipment are components. More details and progress with the upgrading, updating, and adaptations for Eurofleets+ and POGO will be reported in Deliverable D3.1. end M8.

Eurofleets+ data sets catalogue

The **research data** from each Eurofleets+ TA cruise will be incorporated and made available for users as part of the SeaDataNet CDI data discovery and access service. This service gives harmonized discovery and access to a large volume of marine and ocean data sets, both from research and monitoring organisations, which increasingly are major input for developing added-value services and products that serve users from government, research and industry. Major products are for instance developed by EMODnet lots, Copernicus Marine Environmental Monitoring Service (CMEMS), and SeaDataNet itself. To illustrate: EMODnet Chemistry delivers harmonized and validated aggregated data collections for eutrophication, contaminants and marine litter for all European sea basins which serve the Marine Strategy Framework Directive (MSFD and have been taken up by Regional sea Conventions, EU DG-Environment and European Environment Agency (EEA) for supporting assessments and deriving indicators. EMODnet Bathymetry generates the market leading Digital Terrain Model (DTM) for the European seas which finds its way towards many numerical modellers for tide and wave forecasting, offshore industry such as oil & gas companies, wind farm operators, dredging companies, pipeline engineering companies, coastal protection managers, and many others. CMEMS deploys pan-European capacity for Ocean Monitoring and Forecasting. SeaDataNet and CMEMS have an MOU in place for mutual exchanges of data, adoption by CMEMS of SeaDataNet standards, and for developing joint products such as climatologies. Next to serving organised communities, the SeaDataNet CDI service also serves individual users, mostly from research sectors.

This is further stimulated, inter alia through cooperation with the evolving European Open Science Cloud (EOSC). At present the SeaDataNet CDI service has > 110 connected data centres, and provides metadata and access to more than 2.3 Million data sets, originating from more than 650 organisations in Europe, covering physical, geological, chemical, biological and geophysical data, and acquired in European waters and global oceans.

The master version of the CDI service can be queried at the SeaDataNet portal. However, the CDI service is also feeding other portals, such as EMODnet thematic portals, the Blue Cloud portal (under development), regional sea basin portals, and global portals, such as IODE Ocean Data Portal and the GEOSS portal. For each of these portals a dedicated filter has been configured, generating automatically a subset and/or aggregation of the CDI entries, following the particular requirements of the target portals. Moreover, depending on the target portal, use is made of web services and/or customised user interfaces that are fitted to the house style and focus of the target portals.

For Eurofleets+ a comparable solution will be implemented in order to outfit the **EVIOR portal** with an extra component: the **Eurofleets+ data sets catalogue**. This component will consist of a dynamic overview table giving an overview of Eurofleets+ TA cruises. For each entry, links will be incorporated to relevant attributes, to be detailed by EVIOR components. The following table gives a draft overview of planned attributes.

Attribute	Links
Eurofleets+ TA Cruise ID	To be agreed with WP4 team who oversee Calls and follow-up for TA cruises
Cruise Plan	Dedicated link to retrieve details from **EF+ Cruise Programme database**
Research Vessel	Dedicated link to retrieve details from **EF+ Research Vessel database**
Cruise Summary Report	Dedicated link to retrieve details from **EF+ Cruise Summary Reports database**
En-route data	Dedicated link to retrieve details from **EF+ Dynamic Vessel Tracking & Events system**
Research data	Dedicated link to retrieve details from **CDI data discovery and access service** (shortlist of CDI entries with data access)

Table 1: Draft table of attributes of the Eurofleets+ data sets catalogue

This way, users will have a direct overview of Eurofleets+ TA cruises and options for retrieving details, when these become available over time, starting with details of the Cruise Plan and the Research Vessel. Later in time, this is expanded with the ship tracks and en-route information and data while sailing and after completion of the cruises, followed by the Cruise Summary Reports, and finally overview and access to the collected and validated data sets. The primary user interface will be a table; however, several of the detail pages of the attributes will include dynamic mapping options for displaying the ship tracks and the detailed positions of data acquisitions.

The Eurofleets+ data sets catalogue will be further developed in the coming months in synergy with WP3 and WP4, to be ready in time for supporting the implementation of the data management plan for the Eurofleets+ TA cruises. During this activity, possibly extra attributes might be added to the Eurofleets+ data sets catalogue table, such as names of involved organisations concerning RV operators and PIs (by means of EDMO codes) and cruise dates.

4 Planned activities for Task 9.4

The **Eurofleets+ data sets catalogue** and its supporting components will be further developed in the coming months in synergy with WP3 and WP4, to be ready in time for supporting the implementation of the data management plan for the Eurofleets+ TA cruises. During this activity, possibly extra attributes might be added to the Eurofleets+ data sets catalogue table, such as names of involved organisations concerning RV operators and PIs (by means of EDMO codes) and cruise dates. This will be decided together with WP3, WP4 and WP9 partners.

Once launched, the Eurofleets+ data sets catalogue will be maintained and populated, giving an up-to-date status overview of Eurofleets+ TA cruises with planning, implementation, and results.

As indicated in chapter 3, the EF+ research data, once incorporated in the SeaDataNet CDI data discovery and Access service, will be automatically disseminated to several other portals to which the CDI service contributes. This way the EF+ TA data will find their way to many potential users.

The collected en-route data will be pushed forward and submitted to large scale international programmes collecting "en-route" data such as GOSUD, GO-SHIP, and GTS, to increase also their visibility and use.

As part of Task 9.4 the progress will be reported by MARIS in the following Deliverables:

- D9.11: En-Route data collection exploitation and promotion interim report (M24);
- D9.15 Research and en-route data collection exploitation and promotion final report (M48).