



CIBBRiNA WP5.1

Workshop on effort data 2026

Dates: 3–5 February 2026

Venue: IPMA, Lisbon, Portugal (hybrid via Microsoft Teams)

1. Acronyms	3
2. Executive Summary	3
3. Introduction	4
4. Effort data concepts	5
5. Data effort sources – fleet level	6
5.1. EU Fisheries Dependent Information (FDI)	6
5.2. ICES RBDES (Regional Database and Estimation System)	7
5.3. ICES VMS (Vessel Monitoring System)	8
5.4. Data confidentiality and approaches for presenting fishing effort data	8
Data confidentiality	8
Approaches for presenting spatial fishing effort data	10
5.5. Solution for sharing effort data in the CIBBRiNA project	11
6. High-resolution effort estimation with <i>iapesca</i>	11
7. Effort data availability by CIBBRiNA case study	13
Case study 1 – Northern gillnets	15
Case study 2 – Southern nets	17
Case study 3 – UK static nets	19
Case study 4 – Deepwater longlines in Portuguese waters	20
Case study 5 – Surface longlines in Madeira waters	23
Case study 6 – UK longlines	24
Case study 7 – Pelagic trawl fisheries	25
Case study 8 – Demersal trawl fisheries	27
8. Relevance for Bycatch Assessment (WP6)	28
9. Conclusions and next steps	29



10. List of participants	31
11. References.....	32
Annex 1: Overview availability of fleet level effort data.....	33
Annex 2a: Effort data formats for WP6 – data on different aggregation levels	34
Annex 2b: Effort data formats for WP6 – VMS data on different aggregation levels	35
Annex 2c: Effort data formats for WP6 – FDI data on different aggregation le	36



1. Acronyms

AIS	Automatic Identification System. Security position system for vessels. Variable frequency, but up to around 3 minutes. Can be switched off, data need to be picked up by a receiver, and is not available for all scientific institutes.
CIBBRiNA	Coordinated Development and Implementation of Best Practice in Bycatch Reduction in the North Atlantic, Baltic and Mediterranean Regions
CS	Case study
EU	European Union
EWG	Expert Working Group
FDI	EU Fisheries Dependent Information
GFCM	General Fisheries Commission for the Mediterranean
ICES	International Council of the Sea
MS	Member States
RCG	EU DCF Regional Coordination Group
RDBES	ICES Regional Database and Estimation System.
STECF	EU Scientific, Technical and Economic Committee for Fisheries
WGBYC	Working Group on Bycatch of Protected Species
VMS	Vessel Monitoring System. Requirement in EU control regulation to report positions with maximum 2-hour intervals. All vessels > 12 m oal (with some exemptions for vessels < 15 m oal)
WP	Work Package

2. Executive Summary

The CIBBRiNA WP5.1 workshop on fishing effort data was held from 3–5 February 2026 in Lisbon, with hybrid participation from partners across WP3 (Incentives, perceptions, and socio-economics), WP5 (Data collection toolkit), WP6 (Bycatch assessment toolkit), WP7 (Case studies), and the #REDUCE project. The workshop aimed to strengthen harmonised approaches for estimating fishing effort to support bycatch assessment across the project’s diverse fisheries.

Fishing effort is a critical component of bycatch estimation, where total bycatch is calculated by combining bycatch per unit effort (BPUE) with total fishing effort. Current assessment approaches rely largely on *Days at Sea* (DaS) because it is consistently available across fleets, gear types, and regions. However, DaS may not always reflect actual fishing activity, particularly for passive gears such as gillnets and longlines.

The workshop addressed effort estimation at two complementary levels. First, participants reviewed fleet-level effort data from established sources, including EU Fisheries Dependent Information (FDI), ICES RDBES, and ICES VMS, assessing data availability, resolution, and confidentiality constraints across CIBBRiNA case studies. Second, hands-on testing of the

iapesca R package demonstrated how high-resolution positional data can be used to derive gear-specific effort metrics such as net length and soaking time.

Results confirmed that DaS provides a necessary common reference for linking effort data across sources and scales, while more detailed effort metrics can substantially improve characterisation of fishing activity where data are available. Testing showed strong performance of *iapesca* for gillnet fisheries, with further development needed for longlines.

The workshop clarified practical approaches for handling data confidentiality and agreed on common output formats to support integration across work packages. Overall, it strengthened alignment between data collection, effort estimation, and bycatch modelling, providing a solid foundation for WP5.1 deliverables and improved bycatch assessment in WP6.

3. Introduction

The CIBBRiNA workshop on fisheries effort brought together partners across project work packages WP3 (Incentives, perceptions, and socio-economics), WP5 (Data collection toolkit), WP6 (Bycatch assessment toolkit) and WP7 (Case studies) to advance the development, harmonisation, and application of fishing effort metrics for use in bycatch assessment. Additionally, the workshop also had participation from the #REDUCE project.

Work Package 5.1 (WP 5.1) on estimating fishing effort in case studies focuses fishing effort estimation across the project. Data from existing available data sources are extracted by case study fleets and additionally, methods for deriving effort measures from high-resolution geo-spatial data are being developed (the *iapesca* package). The purpose is to improve methods that facilitate accurate and complete effort data. WP 5.1 provides total effort estimates for each case study fleet for bycatch estimation, drawing on existing available data sources and monitoring information collected under WP7.

The CIBBRiNA case studies are structured around specific combinations of gears, area and countries and includes the gear types: gillnets, longlines, and trawls (demersal and pelagic), and are also defined by a spatial extent and specific countries participating in the case studies. The specific definitions of these case studies are important to extract the effort data correctly from existing data sources. The workshop examined the availability, quality, and analytical use of effort data across the different case studies.

The workshop progressed toward the WP 5.1 milestones and deliverables. MS10 (August 2026) to produce publicly available scripts to calculate effort variables for passive and active gears from high resolution geo-spatial data and sensor data. MS11 (December 2026) to provide total effort estimates for the CS fisheries, based on inputs from WP7, for use in WP6 bycatch-estimation models. This includes identification of the appropriate fishing effort metrics to estimate total bycatch effectively and accurately. In parallel, Deliverable 5.1 (August 2026), led by IFREMER, will provide an R package with a dedicated tutorial for effort estimation, supporting reproducible and harmonised workflows across the project.

The objectives of the workshop were to allocate dedicated time for hands-on work with effort data, address the needs for effort data from bycatch-assessment methodologies, and ensure that project partners have sufficient support to apply the *iapesca* R package to high-resolution positional data. During the workshop, there were two sub-groups: one

focusing on case study fleet level effort using existing available aggregated sources of data (FDI, ICES RDBES, ICES VMS, and national datasets), and one focusing on fine-scale positional data using the *iapesca* workflow. A key aim was to build shared understanding of effort data needs and constraints across CIBBRiNA work packages, particularly regarding data availability, confidentiality, and the degree of resolution needed for WP6 modelling.

Existing available data sources during the workshop included:

- EU STECF FDI public effort data (2013–2024), provided at ICES/GFCM area and rectangle level;
- ICES RDBES submissions (2021–2024), including optional fields relevant to bycatch mitigation such as net dimensions and mitigation-device use;
- ICES VMS data at higher spatial resolution (0.05°); and
- Iceland’s publicly available fisheries effort overview.

Currently the WGBYC bycatch assessment is based on the effort metric Days at Sea. Additional gear-specific variables relevant to characterise bycatch include, for gillnets soak time, net dimensions, mesh size, mitigation devices, and validated positional and activity data. For longlines, relevant variables comprise soak time, number of hooks and lines, line length, bait type, and mitigation devices. For trawls, key variables include hours fished, engine power (kW), gear opening dimensions, towing speed, manoeuvring behaviour (stops/turns), and mitigation devices. Responses from case-study leads indicated that most trial-related variables can be made available, although scaling these to fleet-level estimates varies across fisheries and countries, and such information is not currently included in the available fleet level effort data.

Through these activities, the workshop advanced the understanding of relevant effort data and its use, and agreed on an approach whereby data from different data sources and at different scales can be linked through common data formats. These methodologies will be used to achieve the WP5.1 milestones and deliverables.

4. Effort data concepts

For understanding the effort data, some general concepts and principles are described. The general effort concepts summarized below are generally agreed and applied by EU Member States (MS) for reporting effort data to data calls (RDBES, FDI etc.).

Nicosia report and principles

In 2016 the JRC initiated the 2nd Workshop on transversal variables, see Ribeiro et al., 2016. The definition of the effort measures *Days at Sea* and *Fishing days* were reviewed and agreed, also several scenarios for calculating fishing effort were identified and the R script for calculating fishing effort 'fecR' was started. This script is now maintained by the RCG ISSG on Metier and transversal variables and hosted at JRC GitLab: <https://dcallnet.jrc.ec.europa.eu/gitlab/r-packages/fecR>.

- **Days at Sea:** the number of 24-hour periods during which a vessel is absent from port and engaged in fishing activity. It is calculated as $DaS = (\text{arrival time} - \text{departure time})/24$, and rounded up to nearest integer.
- **Fishing days:** counts of vessel fishing days (dates) that include active fishing operations.

During a trip there can be more fishing days (calendar dates) than days at sea (24-hour periods), as a vessel can depart in the evening with a fishing activity before midnight and after midnight and come back the next morning. This would result in 1 day at sea and 2 fishing days.

Vessel effort and gear effort

Fishing effort can be related to the vessel (as vessel tracking is) and to the fishing gear.

- **Vessel effort:** the effort by the fishing vessels, e.g., days at sea, fishing days or recording of the vessel positions.
- **Gear effort:** the effort and characteristics of the gear deployed in the water, e.g., net length, soaking time, net height, number of hooks, number of pots.

In the case of active gears, the gear effort is closely linked to the vessel effort. However, for passive gears, the vessel effort is related to the activity, namely setting and hauling of the gear, while the gear effort is not directly linked to the vessel. Both measures are essential, as the vessel effort is used by economists, e.g., to calculate fuel cost, while the gear effort is used by biologists e.g., to relate to catches or risks of bycatch of ETP species, for marine spatial planning and ecosystem impacts. For small-scale fishery, where logbook data are not available, and in the absence of contradictory information, the commonly applied assumption used is: 1 sales note = 1 fishing trip = 1 day at sea = 1 fishing day.

5. Data effort sources – fleet level

The available effort data sources EU FDI (only for EU Member States), ICES RDBES and ICES VMS (on a higher spatial resolution) are described below.

5.1. EU Fisheries Dependent Information (FDI)

The Fisheries Dependent Information (FDI) data call is requested under the EU Data Collection Framework (DCF), through which Member States submit datasets on fishing capacity, effort, landings, discards and biological data to the European Commission. The data call is issued annually and is managed by the Joint Research Centre (JRC) of the European Commission.

The Scientific, Technical and Economic Committee for Fisheries (STECF) FDI Expert Working Group (EWG) reviews the quality and completeness of the data submitted, assessing coverage across fishing areas, fleet segments, gears, and species. FDI data are available from 2013 onwards (for the United Kingdom until 2020 only). Considerable work has been undertaken to improve harmonisation over time, particularly with respect to effort

calculation methods, the standardisation of métier codes, and the procedures used for assigning métiers.

Public access to FDI datasets is provided through the STECF data dissemination platform, where aggregated data on effort, landings, catches, fleet capacity, and biological variables are available for the period 2013–2024. Aggregated effort and landings datasets at ICES rectangle level are also published.

Within the FDI data call, fishing effort is reported by fleet segment, gear type, and fishing area. Effort metrics reported include Days at Sea and Fishing Days. Fishing effort data submitted by Member States are derived from vessel activity data, most commonly based on logbooks, coastal logbooks or sales notes. These data may be scientifically adjusted using Vessel Monitoring System (VMS) positional data, or national monitoring systems. The FDI data call defines the required aggregation levels and allows data to be flagged as confidential. However, there is variation between countries in how confidentiality is applied. For example, some Member States mark data as confidential when fewer than three vessels are represented within an aggregation cell, while others apply different thresholds or do not flag such cases as confidential.

Public data from EU STECF Fisheries Dependent Information data call can be downloaded from: https://stecf.ec.europa.eu/data-dissemination/fdi_en. Total fishing effort data on EU level (without country-level detail) are available, as well as data by EU Member State, where data that Member States has flagged as confidential are not included. Consequently, when using FDI effort data to describe the CIBBRiNA case study fleets, which are defined by gear, area and one or more countries, there is a trade-off. Effort can either be extracted for all countries operating within a given gear and area, retaining the full effort information but without national breakdowns, or it can be extracted by gear, area and country, in which case part of the effort may be missing due to confidentiality exclusions. Data at ICES rectangle level are only available for the combined effort of all EU vessels and are not disaggregated by country.

5.2. ICES RBDES (Regional Database and Estimation System)

The Regional Database and Estimation System (RDBES) is currently being implemented by ICES and is intended to replace existing databases such as InterCatch and the Regional Database (RDB). Effort data have been submitted to RDBES following a joint data call coordinated by ICES and the Regional Coordination Groups (RCGs), requesting data for the period 2021–2024.

Within RDBES, commercial fishing effort data (Commercial Effort, CE) are reported at two spatial resolutions: ICES fishing areas and ICES statistical rectangles. The data call requests standard effort measures such as Days at Sea and Fishing Days. In addition to these core mandatory variables, the data call includes several optional variables that are particularly relevant for bycatch assessment and mitigation analyses. These optional variables include gear-specific measures, such as net length multiplied by soaking time, which can serve as a proxy for effective fishing intensity in static gear fisheries, as well as information on the presence or use of incidental bycatch mitigation devices.

These additional variables provide increased resolution for evaluating gear selectivity, operational fishing practices, and potential bycatch risk, particularly for protected, endangered, and sensitive species. All RDBES data are subject to confidentiality conditions defined by the applicable data licence.

5.3. ICES VMS (Vessel Monitoring System)

ICES issues an annual data call requesting Vessel Monitoring System (VMS) and logbook data from national authorities, with a specified spatial resolution of 0.05 degrees. These data are used in ICES advice products that rely on spatially resolved estimates of fishing effort, including analyses of fishing pressure, spatial activity patterns, and ecosystem overviews.

Countries have been requested to submit data covering the period 2009–2024, following the formats, standards, and workflows defined by ICES. A dedicated R-based workflow has been developed collaboratively by the ICES Working Group on Spatial Fisheries Data (WGSFD) to support national data preparation. This workflow includes preprocessing of positional (TACSAT) and logbook (EFLALO) data, assignment of fishing activity, and aggregation to the required spatial and operational resolution.

Submitted VMS data consist of aggregated vessel position records, which are linked to logbook information to produce spatially resolved estimates of fishing effort. These datasets are subsequently used in ICES processes that generate indicators such as swept area ratios and spatial fishing pressure maps. Governance of VMS and logbook data is overseen by the Working Group on Spatial Fisheries Data Governance (WGSFDGOV). ICES VMS and logbook datasets are subject to specific confidentiality conditions as defined in the data call and associated data licence.

5.4. Data confidentiality and approaches for presenting fishing effort data

Data confidentiality

All work with fishing effort data in the CIBBRiNA project is carried out under strict confidentiality rules, guided by the CIBBRiNA Data Management Plan (DMP) and the conditions set by National Correspondents (NCs) and other data providers. The effort data used in the workshop fall under data sensitivity levels 3 and 4, meaning that they may contain information that could potentially allow identification of individual vessels or operators if not appropriately handled. For this reason, data access, processing, and dissemination within the project follow a controlled and carefully regulated approach.

The legal basis for data confidentiality primarily derives from EU fisheries legislation. Under the EU Control Regulation (Regulation (EC) No 1224/2009), fishing-related information, including logbooks, sales notes, and Vessel Monitoring System (VMS) data, is reported by fishers to national control authorities. While originally collected for control purposes, these data are made available for scientific use through the EU Data Collection Framework (DCF). According to the EU Multiannual Programme (EU-MAP; Commission Implementing Decision (EU) 2021/1167), primary data collected under the Control Regulation must be provided to national scientific institutes implementing their work plans. Variables related to vessel activity (EU-MAP Table 6) should be accessible to scientific end-users, subject to confidentiality conditions specified by Member States.

In practice, many countries require that data used in analyses or publications represent the activities of a minimum number of vessels, typically three to five, in order to prevent direct or

indirect identification. ICES data calls for effort data, including RDBES and VMS/logbook data, operate within this framework, and NCs retain the authority to grant, condition, or restrict access. These conditions were essential in shaping how the data could be used during the workshop and within the CIBBRiNA project more broadly.

To enable the use of ICES RDBES and VMS/logbook effort data in the CIBBRiNA project, formal requests for data access were submitted to the relevant national authorities. For EU Member States, requests were addressed to the National Correspondents responsible for DCF-related submissions, while for non-EU countries, communication was channelled via members of the ICES Advisory Committee (ACOM). All requests explicitly confirmed that confidentiality requirements and data licence conditions would be fully respected.

Responses from NCs varied between countries. Several granted permissions for direct use of the data, often subject to specific conditions such as deletion of the data after the project, compliance with minimum aggregation thresholds, and assurances that no outputs would allow vessel identification. Countries that granted permission include Denmark, France, Germany, Iceland, the Netherlands, Norway, Poland, Spain, Sweden, and the United Kingdom. Some Member States, notably Belgium, Ireland, and Portugal, were unable to authorize sharing of raw data due to national arrangements with control authorities. Instead, they agreed to run CIBBRiNA-provided analytical scripts locally and share only aggregated outputs that met their national confidentiality standards. Permissions were granted exclusively for the defined case study fleets.

During the workshop, a set of practical procedures was applied to ensure compliance with all confidentiality requirements. RDBES and VMS/logbook data were extracted by the ICES Secretariat, and access to these datasets was restricted to a limited number of individuals who had formally signed ICES conditions of use. These individuals applied agreed R scripts to aggregate and filter the data according to the CIBBRiNA case studies.

Both RDBES and VMS/logbook datasets include anonymised vessel identifiers, allowing vessel counts to be calculated during aggregation. This enabled filtering of outputs so that only aggregates representing more than three vessels were retained, in line with common confidentiality thresholds. Workshop participants who had signed the CIBBRiNA Data Sharing Agreement (Annex 1 of the DMP) were granted access to processed, aggregated outputs via a shared folder. To facilitate collaborative analysis while respecting national restrictions, data processing scripts were shared within the group so that partners without access to raw data could run the analyses locally and contribute compliant aggregated results.

All results generated during the workshop are intended for use exclusively within the CIBBRiNA project. Throughout the project, all handling of RDBES and VMS/logbook data complies with the ICES Data Policy, national conditions set by NCs, and the CIBBRiNA Data Management Plan. By adhering to these frameworks, the project ensures that sensitive effort data are handled responsibly, securely, and in full compliance with all applicable legal and institutional requirements.



Approaches for presenting spatial fishing effort data

Three approaches for presenting spatial fishing effort data while respecting confidentiality requirements have been explored using UK iVMS data and was presented at the workshop. Subject to agreement by National Correspondents, these approaches could potentially be applied more broadly to VMS and iVMS datasets.

Kernel Density Estimation (KDE)

One approach explored for representing fishing effort and catch data is the use of Kernel Density Estimation. In this method, iVMS and VMS data were compiled into spatial grids (e.g., 1 km resolution, though other sizes are possible). Fishing activity was summarised as the number of days at sea per grid cell, calculated by counting unique vessel day combinations. Multiple positional records from the same vessel on the same day were counted as a single day of fishing. These values were aggregated over the relevant temporal period.

The centroid of each grid cell was then assigned a weight corresponding to the number of days at sea, and KDE was applied to produce a smoothed distribution of relative fishing effort. Smoothing distances of 5 km and 10 km were tested. This method offers advantages for confidentiality, as the underlying raw positions are transformed through multiple modelling steps. The outputs present relative effort rather than explicit effort values and do not rely on fixed spatial units in the final display. Importantly, the same method can be applied consistently across different temporal scales (e.g., monthly, seasonal, annual).

Locfit Smoothing

Another method currently under evaluation uses a *locfit* model to generate smoothed maps of fishing effort and at sea catches from VMS data. This follows the approach used in the Atlas of Commercial Fisheries Around Ireland and in related methodological studies. The model smooths vessel positions using local regression, weighted by either time spent fishing (calculated from time intervals between consecutive positions) or by species specific catch weight.

Because the method does not rely on fixed spatial grids, it avoids issues related to grid-based confidentiality requirements such as the three-vessel rule. Nearest neighbour weighting ensures that smoothing adapts to local fishing intensity, with more smoothing applied in areas with sparse activity. The method is implemented in R, offering potential flexibility, for example, to incorporate vessel numbers as weights or to enable data providers to run the script locally, limiting data exchange to processed outputs. However, at small temporal scales (e.g., monthly), lower activity levels may result in very smoothed patterns of effort.

Nested Grids

A third method uses nested, unequally sized grids, following previously published approaches. Grid sizes are determined such that each cell contains data from at least three vessels, thereby meeting confidentiality requirements. While effective for compliance, the grid structure must be recalculated for each temporal period, which increases complexity when comparing inter annual or seasonal variations.

A related variant involves combining low activity grid cells, such as those on the periphery of fishing grounds, into larger polygons to ensure vessel count thresholds are met. This allows

finer grids to be retained in core fishing areas while still adhering to confidentiality constraints, though the resulting spatial units are non-uniform.

5.5. Solution for sharing effort data in the CIBBRiNA project

When working with ICES RDBES and VMS effort data, a key trade-off exists between the level of detail provided (i.e. the number of variables and disaggregation levels) and compliance with data confidentiality requirements. As the level of detail increases, a larger share of the data may be excluded from outputs because aggregation cells containing fewer than three vessels must be removed or suppressed.

The solution agreed at the workshop for sharing RDBES and VMS effort data with WP6 within the CIBBRiNA project is to provide data aggregated at multiple levels, using a set of common core variables. This approach ensures that total fishing effort is known at broader aggregation levels, while more detailed datasets provide partial effort information where confidentiality constraints permit. The overall structure of this solution is illustrated in Annex 2.

Annex 2a presents the aggregation levels for RDBES data, Annex 2b for ICES VMS data, and Annex 2c for EU FDI data. Aggregation Level 1 provides total fishing effort by year and FAO area. Aggregation Level 2a disaggregates effort by quarter to illustrate seasonal patterns, while Aggregation Level 2b provides spatial detail by ICES statistical rectangle and gear type, without temporal disaggregation by quarter. Aggregation Level 3 offers higher spatial resolution and may also include additional effort metrics, such as net length and soaking time, derived from iVMS data or other calculation methods.

In conjunction with these aggregated datasets, accompanying tables are produced showing the proportion of total effort by year and area that has been excluded due to confidentiality constraints. These tables provide transparency regarding data coverage and allow users to assess the potential impact of confidentiality-driven data removal on subsequent analyses.

6. High-resolution effort estimation with *iapesca*

Within the CIBBRiNA Horizon project, WP5.1, a standardised workflow was developed for being applied to the various case studies included in the project. The workflow is based on the R package *iapesca*, which was previously developed and subsequently enhanced to provide simplified access to machine-learning models and geocomputational processing, as described in Mendo et al. (2023). The package includes functionality for C-square aggregation and spatial mapping using *terra*. In this package, an anonymized toy example is provided for demonstration purposes, the workflow being designed to be applicable to any dataset containing partially qualified fishing operations.

A step-by-step tutorial describing the workflow using the toy example has been developed and is publicly available at: https://gitlab.ifremer.fr/iapesca/r-tutorial_iapesca/-/tree/main, associated with the DOI 10.13155/112293

For broader application during the workshop, an R script implementing the workflow was prepared and made available via the dedicated Microsoft Teams channel for Subgroup 1, together with a presentation introducing *iapesca* functionalities, the principle and structure of

the workflow together with a combined harbour repository from *vmstools R-package* (Hintzen & al., 2012) and the Ifremer SIH.

For active gears (CS7 and CS8), typically used by larger vessels, extensive observational datasets are already available through self-sampling programs. These data enable the production of accurate, high-resolution effort maps. In contrast, comparable levels of detailed operational information are not consistently available across all gears and countries, and are often lacking for small-scale fisheries using passive gears.

Applications of the *iapesca* workflow were conducted for northern gillnets (CS1) and UK longlines (CS6). High-resolution effort outputs were successfully produced for Danish gillnet fisheries. However, further development of the package will be required to improve performance and outputs for longline fisheries. For most case studies, the availability of suitable validation datasets, comprising both detailed descriptions of fishing operations and high-resolution geolocation data, will be essential.

Overall, the generation of high-resolution effort outputs appears feasible across case studies, provided that high-resolution positional data can be reliably linked to accurate observations of fishing activity. Some outputs are already available, allowing preliminary applications to be tested within the project.

Depending on the fishery and the level of detail required, alternative effort metrics may be necessary. To integrate information from the FDI, RDBES, and, where relevant, ICES VMS/logbook data calls, it is essential that outputs from these different sources, available at varying spatial and temporal resolutions, can be linked. *Days at Sea (DaS)* provides a key common metric enabling this integration.

The RDBES database offers broad coverage for most CIBBRiNA case studies. To align high-resolution *iapesca* outputs with RDBES data, the high-resolution results should be aggregated to a quarterly or annual temporal scale. Furthermore, DaS derived from high-resolution datasets must be available at a spatial resolution that allows identification of the proportion of effort that can be reliably described at a common spatial unit, namely the ICES statistical rectangle.

To support these comparisons, additional developments within *iapesca* are required. In particular, outputs of effort by fishing trip, days at sea, and ICES rectangle, together with vessel counts, will be essential for linking datasets and ensuring compliance with anonymisation requirements.

Issues and developments identified during the workshop for *iapesca*:

The following issues and development needs for *iapesca* were identified during the workshop and have been documented in the project issue tracker:

https://gitlab.ifremer.fr/iapesca/r-packages_iapesca/-/boards

- Interest in a function that allows positions to be qualified regarding vessel behavior based on observation data. *match_Obs2Pos* was created for this purpose. To be tested on other datasets (action with Maria Mateo, AZTI).
- Provision of a method developed by DTU Aqua (J. Olsen & J. Stounberg) for estimating the fishing effort of Danish seines

- Creation of an ICES rectangle grid - function similar to the one that creates *SpatRaster* C-squares grids - Link between the data available in data calls and outputs from high-resolution data.
- *Positions2Cibbrina*: rename function and check weird error message fishing trip columns.
- Handle datetime as yyyy/mm/dd (slashes) in Char2Time
- Optimize *Create_NetsByBoat*: a comment by Jonathan Stounberg from DTU: this step could be optimized. Using `data.table::rbindlist` instead of `do.call(rbind)` could help and have a check on *Create_Nets* function to see if it can be optimized.
- Rasterize DAS: compute the link between DAS and the right effort metrics by fishing trips and DAS or fishing days - Link between the data available in data calls and outputs from high-resolution data.
- HEADING renamed to COG: a remark by Tania Mendo from St-Andrews University: heading actually corresponds to course over ground and should be renamed.

7. Effort data availability by CIBBRiNA case study

An overview of fishing effort data availability was compiled for all CIBBRiNA case studies, drawing on EU Fisheries Dependent Information (FDI), ICES Regional Database and Estimation System (RDBES), ICES Vessel Monitoring System (VMS), and high-resolution datasets where available (see Annex 1). The aim was to establish a consistent understanding of which effort data are available across fleet segments, countries, and gears, and to assess the implications for subsequent analyses, particularly bycatch estimation in WP6.

Across the eight case studies, a number of general patterns emerged. EU FDI provides long time series with complete EU coverage and therefore represents a key baseline dataset for all fleets. However, FDI data are available at relatively coarse spatial and operational resolution and are subject to confidentiality filtering, which can reduce effective coverage for small-scale fleets. ICES RDBES improves the linkage between effort metrics and operational variables and offers enhanced temporal resolution, but coverage varies across countries and fleets, and access is sometimes restricted by national permissions. ICES VMS data enable spatially explicit analyses and derivation of fishing hours, but are typically limited to larger vessels due to reporting thresholds, restricting applicability to small-scale fleets. High-resolution data sources, such as Electronic Monitoring (EM), AIS, self-sampling, and observer programmes, are only available for selected fleets, but where present they support detailed characterisation of fishing effort and gear use.

Data availability and resolution vary substantially by country, gear type, vessel size, and access conditions, and no single data source is sufficient to meet all analytical needs. *Days at Sea* and *Fishing Days* are the effort metrics most consistently available across data sources (with the exception of ICES VMS), and therefore provide a critical common reference for integration across datasets.

Where data availability was unclear (indicated by orange cells in Annex 1), WP5.1 leads will follow up with the relevant case study leads. Where RDBES or VMS data were not available, this generally reflects one of two situations: (1) data have not yet been submitted to ICES, or (2) permission for use of the data within the CIBBRiNA project has not been granted. In cases of pending submission, WP5.1 leads will contact the relevant national authorities with

specifications for the required data format and fleet definition. Where permission has not been granted, scripts capable of generating filtered and aggregated outputs from RDBES or VMS data will be made available via GitHub, allowing countries to run analyses locally and decide whether the resulting outputs can be shared with the project.

Workshop Subgroup 2 focused on developing a clear and comparable overview of fishing effort at fleet level across the CIBBRiNA case studies. During the workshop, participants compiled structured tables and descriptive summaries of effort data availability by case study and country, drawing on FDI, ICES RDBES, and ICES VMS. HTML reports were reviewed to assess the availability of key effort variables, including days at sea, fishing days, number of hauls or sets, soaking time, and hours fished. A central task was to compare summary statistics across data sources to identify inconsistencies, methodological differences, and gaps.

The eight CIBBRiNA case studies cover a broad spectrum of European fisheries, including static nets, longlines, pelagic trawls, and demersal trawls, and represent diverse fleet structures, spatial footprints, and monitoring regimes. Together, they illustrate both the strengths and limitations of existing effort data sources when applied to bycatch-relevant analyses.

Static net fisheries (CS1–CS3) generally show good coverage in EU FDI and ICES RDBES, with consistent availability of days at sea across countries. However, spatial resolution is frequently constrained by confidentiality thresholds, particularly for small-scale fleets. High-resolution data are only available for selected segments, but where present, such as Danish and UK gillnet fleets, model-based approaches demonstrate strong potential for estimating detailed effort metrics such as net length and soaking time. Differences in national reporting practices and confidentiality rules remain an important source of variability.

Southern net fisheries in Galicia (CS2) benefit from access to multiple data sources, including FDI, RDBES, and VMS, but spatial completeness is limited by partial VMS coverage and the inability to distinguish sub-areas within ICES divisions when using coarse datasets. Although effort metrics are broadly consistent across sources, anomalies in specific years underline the need for careful interpretation and cross-validation. Longline fisheries (CS4–CS6) show pronounced contrasts between fleet segments. Deep-water and surface longline fleets in Madeira (CS4 and CS5) rely primarily on FDI due to incomplete RDBES coverage and the limited representativeness of VMS data, as most vessels fall below reporting thresholds. Observer coverage is sparse, and REM data are only expected to become available in future years, constraining current validation. The information on deep-water longline fleet in Portugal mainland (CS4) relies on FDI and RDBES due to unreported VMS data and observer data is being collected within CIBBRiNA. In contrast, UK longlines (CS6) benefit from improved access to RDBES and VMS, although limited reporting of optional operational variables restricts fine-scale effort characterisation.

Pelagic trawl fisheries (CS7) are dominated by large vessels with wide spatial distribution and generally good availability of FDI, RDBES, and VMS data for most countries. However, access restrictions for some fleets, notably Ireland, limit full international comparability. Methodologically, pelagic trawls remain challenging for high-resolution effort estimation, as

vessel speed alone is insufficient to reliably identify fishing activity, and AIS-based machine-learning approaches show inconsistencies relative to self-reported haul data.

Demersal trawl fisheries (CS8) exhibit strong data availability for the Dutch fleet, with good access to RDBES, VMS, and optional effort variables such as the number of hauls, supporting both temporal trend and spatially explicit analyses. By contrast, assessments for Belgium are restricted to aggregated FDI data due to limited access to higher-resolution datasets, constraining comparability.

Across all case studies, *Days at Sea* emerges as an effort metric consistently available across data sources, making it an anchor for data integration. Data completeness, spatial resolution, and analytical potential vary strongly by fleet structure (particularly vessel size), gear type, and national data access conditions. While high-resolution approaches and emerging tools such as REM show strong promise, their current availability remains uneven. A central overarching challenge for the project is therefore to balance confidentiality requirements with the need for sufficiently detailed and comparable effort data to support robust bycatch risk assessments across diverse fisheries.

Case study 1 – Northern gillnets

Case study fleet definition

Gears: GND, GNS, GTN, GTR

Countries: Sweden, Germany, Poland, Denmark, Norway, Iceland

Areas: 27.3.a.20, 27.3.a.21, 27.3.b.23, 27.3.c.22, 27.3.d.24, 27.3.d.25, 27.3.d.26, 27.4.a, 27.4.b, 27.4.c, 27.5.a

Further clarification is required regarding whether the fleet definition includes vessel length constraints (e.g. small-scale fisheries below 12 m or 15 m LOA), and whether the spatial definition is correct, particularly for the North Sea areas (27.4.a, 27.4.b, 27.4.c).

Data sources available fleet level effort during the workshop

The table summarises country coverage, data sources, and years for which effort data were available during the workshop. Case Study 1 includes both EU and non-EU countries.

FDI, ICES RDBES, and ICES VMS data are available for Denmark, Germany, Poland, and Sweden. RDBES data were not available for Iceland and Norway; however, ICES VMS data are available for Iceland for the period 2021–2024 and for Norway from 2021 onwards. This does not imply that RDBES-type data do not exist for these countries, but rather that data have not yet been submitted or formatted according to the agreed specifications. Data will be requested once the final format has been agreed and tested.

Country	EU FDI	ICES RDBES	ICES VMS
Denmark	2013-2024	2021-2024	2021-2024
Germany	2013-2024	2021-2024	2021-2024
Iceland	Not EU	Data not submitted	2021-2024
Norway	Not EU	Data not submitted	2021
Poland	2013-2024	2021-2024	2021-2024
Sweden	2013-2024	2021-2024	2021-2024

Fleet level effort

The table summarises the main effort parameters across data sources. For German gillnets, the number of vessels could not be derived from RDBES because encrypted vessel identifiers were not included in the submitted dataset

Country	EU FDI – Average days at sea 2021-2024		ICES RDBES			ICES VMS	
	Days at sea (avg 2021-2024) Excl. Confidential rows	Fishing days (avg 2021-2024) Excl. Confidential rows	Days at sea (avg 2021-2024)	Fishing days (avg 2021-2024)	Number of vessels (avg 2021-2024)	Fishing hours (avg 2021-2024)	Number of vessels (avg 2021-2024)
Denmark	18106	17592	21964	21238	695	41462	34
Germany	35015	37258	13407	13337	NA	4709	5
Iceland	NA	NA	NA	NA	NA	58590	193
Norway	NA	NA	NA	NA	NA	3173 (only 2021)	7 (only 2021)
Poland	35211	35222	35203	35220	611	942	22
Sweden	4482	4513	4478	4508	149	NA*	NA*

* There are too few vessels in the Swedish VMS data (vessels > 12 m) to show in the table

Based on RDBES data for Denmark, Germany, Poland, and Sweden, the following observations were made: Data are available by month and for all countries.

- Monthly data are available for all countries.
- Spatial coverage includes the North Sea (4a, 4b), Skagerrak (3a20), Kattegat (3a21), Western Baltic (3b23, 3c22, 3d24), and Eastern Baltic (3d25, 3d26).
- The optional RDBES field Incidental Bycatch Mitigation Device is reported as Unknown, NotRecorded, or None, and therefore provides no usable information.
- The optional field Scientific number of hauls or sets was reported by Germany, Denmark, and Sweden.
- Sweden reported data for the optional field Soaking Meter Hour.
- Denmark and Germany reported data for the optional field Vessel fishing hour.
- The majority of effort originates from vessels below 12 m LOA, with only a small fraction of activity from vessels above this length.
- Sweden provided data for the optional field Gear dimensions, reported as total gillnet length (m).
- The dominant gear type is set gillnets (GNS), followed by trammel nets (GTR), with only minor use of drift nets (GND).

When comparing Days at Sea between FDI and RDBES, values are similar for Poland and Sweden. For Denmark, lower values in FDI are primarily due to confidentiality filtering, whereby aggregation cells with fewer than three vessels are suppressed. For Germany, Days at Sea are substantially higher in FDI than in RDBES. This difference was clarified to result from differing estimation methods used by national data submitters.

CS1 *iapesca* application

For the Danish component of Case Study 1 (Northern gillnets), Electronic Monitoring (EM) data were available for eight vessels, covering the period 2018–2024. These data include information on hauling and setting events, net length, and soaking time.

Using the *iapesca* package, a model was trained to estimate net length and soaking time, with internal cross-validation performed using the same dataset. Model performance was good, with an average accuracy of approximately 91 % for detection of hauling operations and a standard deviation of soaking-time prediction errors of around 2.5 hours.

RDBES data for the same vessels were extracted to compute *Days at Sea*, enabling comparison across different effort metrics. Scaling this approach to fleet level will require improved uncertainty estimates, particularly when moving from high-quality positional data (e.g. EM) to data sources such as AIS, which may have spatial or temporal gaps. For broader fleet-level metrics, additional information on data coverage will be required, such as the number of vessels covered or the proportion of total catch represented.

At the time of the workshop, Swedish EM data were expected to become available. These data would allow retraining of the model to improve performance and enable fleet-level estimation of net length and soaking time using HELCOM AIS data, which are also expected to be accessible. Additional validation is planned using Swedish logbook data, which include reported net lengths and soaking times.

VMS coverage for this case study is currently incomplete; however, it is anticipated that position data can be retrieved from the HELCOM AIS database to supplement existing sources.

Case study 2 – Southern nets

Case Study 2 was conducted in ICES Divisions 27.8.c and 27.9.a, primarily in waters off Galicia, in collaboration with the local gillnet fishing fleet. During 2024 and 2025, experimental trials were carried out to evaluate the performance and operational integration of acoustic deterrent devices (pingers) onboard fishing vessels. Four pinger models were tested: the “*Banana*” pingers from Fishtek Marine, the *NetGuard* from Future Oceans, the *Pinger v2.2* from Tecnología Marina Ximo, and the DD03H from STM Products.

The study assessed device deployment, data collection procedures, and preliminary effectiveness under real fishing conditions. Onboard observers ensured systematic monitoring throughout the trials. In total, seven vessels participated, completing 131 fishing days and 408 hauls, including both experimental and control sets. The trials demonstrated strong fleet engagement, consistent technical performance of the devices, and generated valuable operational data, including cetacean sightings and acoustic recordings from autonomous hydrophones.

Case study fleet definition

Gears: GND, GNS, GTR

Countries: Spain

Areas: 27.8.c,27.9.a

Gear definitions were clarified during the workshop. Galician netters operate only in the northern part of area 27.9.a. Spanish netting effort also occurs in the southern part of this division, but this can only be filtered out when data are available at higher spatial resolution (ICES rectangle or finer). At the level of total ICES areas, this distinction cannot be made.

Data sources available for effort data on fleet level during the workshop

The table summarises the data sources and temporal coverage available for Case Study 2 during the workshop.

Country	EU FDI	ICES RDBES	ICES VMS
Spain	2013-2024	2021-2024	2021-2024

Fleet level effort

The table summarises the main effort parameters across the available data sources. Note that *Fishing Days* exceed *Days at Sea*. This difference arises because *Days at Sea* are calculated as 24-hour periods (arrival time minus departure time, divided by 24 and rounded up), whereas *Fishing Days* represent the number of calendar days with fishing activity (see Ribeiro et al., 2016).

Country	EU FDI		ICES RDBES			ICES VMS	
	Average days at sea 2021-2024 Excl. Confidential rows	Average Fishing days 2021-2024 Excl. Confidential rows	Days at sea (avg 2021-2024)	Fishing days (avg 2021-2024)	Number of vessels (avg 2021-2024)	Fishing hours (avg 2021-2024)	Number of vessels (avg 2021-2024)
Spain	68406	69227	71843	72315	1410	80987	42

The following observations were made based on Spanish RDBES data:

Data are available for seven months of the year (March and August–September).

Spatial coverage includes ICES areas 27.8.c and 27.9.a.

- The optional field *Incidental Bycatch Mitigation Device* is reported as *Unknown* and therefore does not provide usable information.
- The optional field Scientific number of hauls or sets has not been reported.
- The optional fields *Soaking Meter Hour* and *Vessel fishing hour* have not been reported.
- The majority of effort originates from vessels below 12 m LOA, with a smaller fraction from vessels above this length.
- The dominant gear types are trammel nets (GTR) and set gillnets (GNS), with only limited use of drift nets (GND).
- Spatially disaggregated effort by ICES rectangle indicates fishing activity in both the northern and southern parts of area 27.9.a.

When comparing *Days at Sea* between FDI and RDBES, values are of similar magnitude, though lower in FDI. This difference is primarily explained by confidentiality filtering in the FDI data call, where aggregation cells containing fewer than three vessels are suppressed, resulting in hidden effort for some rows.

For Case Study 2, effort data for the Spanish netting fleet were available from all major sources: FDI, ICES RDBES, and ICES VMS. Overall coverage was good; however, ICES VMS data were only available for ICES subdivision 8c and not for 9a, limiting the spatial completeness of the VMS dataset.

For the purpose of fleet definition, gear codes required correction to ensure consistency with the gears used in the trials (GNS, GND, GTR). Importantly, the experimental trials included in this case study were conducted exclusively with Galician netters and therefore do not represent fishing activity in the southern part of area 27.9.a, where fleet composition and fishing practices differ.

A key objective was to understand the structure of fleet effort at finer spatial and temporal scales, particularly how *Days at Sea* are expressed when examined at higher resolution. In the FDI dataset, *Days at Sea* and *Fishing Days* were available alongside kW-days at sea and kW-fishing days. However, the 2019 data exhibited unexpected patterns, including marked increases in effort and changes in vessel length categories between areas. These anomalies suggest potential data issues and highlight the need for careful interpretation of *Days at Sea* and *Fishing Days* metrics.

The RDBES dataset contained *Days at Sea* and *Fishing Days* for the same vessels represented in FDI, enabling direct comparison between sources. In addition, RDBES included information on *Fishing Hours*, providing an additional effort metric that supports cross-validation and more detailed operational analyses.

ICES VMS data, while limited to vessels larger than 12 m LOA (with derogations applied up to 15 m), provided valuable spatial and temporal detail. Fishing hours were estimated from vessel position data reported at two-hour intervals, allowing reconstruction of vessel activity patterns and development of finer-scale effort indicators, albeit only within subdivision 8c. Taken together, these datasets provide a broad but uneven picture of fishing effort in Case Study 2. While data availability is strong for the Galician segment of the fleet, limitations related to VMS coverage in 9a and anomalies in the 2019 FDI data highlight key gaps that should be addressed in future analyses.

Case study 3 – UK static nets

Case study fleet definition

Gears: Set gillnets (GNS) and trammel nets (GTR)

Countries: United Kingdom

Areas: ICES areas 27.4, 27.6, and 27.7.d–j

Data sources available for effort data on fleet level during the workshop

The table summarises the effort data sources and years available for Case Study 3. Following the UK’s exit from the EU, FDI data are only available until 2020, while ICES RDBES and ICES VMS data are available for the period 2021-2024.

Country	EU FDI	ICES RDBES	ICES VMS
UK	2014-2020 (until exit from EU)	2021-2024	2021-2024

Fleet level effort

The table summarises the main effort parameters derived from the available data sources. As EU FDI data are not available for the UK after 2020, effort estimates for the period 2021-2024 are based on ICES RDBES and ICES VMS data only.

Country	EU FDI		ICES RDBES			ICES VMS	
	Average days at sea 2021-2024	Average fishing days 2021-2024	Days at sea (avg 2021-2024)	Fishing days (avg 2021-2024)	Number of vessels (avg 2021-2024)	Fishing hours (avg 2021-2024)	Number of vessels (avg 2021-2024)
UK	NA	NA	17669	17306	749	6848	19

The following observations were made based on UK RDBES data:

- Data are available for all months of the year.
Spatial coverage includes ICES areas 27.4.a, 27.4.b, 27.4.c, 27.6.a, 27.6.b, and subdivisions 27.7.d, 27.7.e, 27.7.f, 27.7.g, 27.7.h, and 27.7.j.
The optional RDBES field Incidental Bycatch Mitigation Device is reported as Unknown and therefore does not provide meaningful information.
The optional field Scientific number of hauls or sets has not been reported.
- The optional fields *Soaking Meter Hour* and *Vessel fishing hour* have not been reported.
- The majority of fishing effort originates from vessels smaller than 10 m LOA, with a smaller proportion from vessels above this length.
- The dominant gear type is set gillnets (GNS), followed by trammel nets (GTR), with only a negligible contribution from drift nets (GND).
- Spatially disaggregated effort by ICES rectangle indicates that the highest fishing effort is concentrated along the southern coast of the United Kingdom.

Case study 4 – Deepwater longlines in Portuguese waters

Case study fleet definition

Gears: Drifting longlines (LLD, PT-Madeira), set longlines (LLS, PT-Mainland)

Countries: Portugal (Mainland and Madeira)

Areas: CECAF 34.1.2 (Madeira), ICES 27.9.a (Mainland)

Métier (level 5):

- *LLS_DWS* (Mainland)
- *LLD_DWS* (Madeira)

Case Study 4 focuses on the drifting longline fleet operating under the métier *LLD_DWS* in CECAF Division 34.1.2, and on the set longline fleet operating under the métier *LLS_DWS* in ICES Subdivision 27.9.a, targeting scabbardfishes in waters around Madeira and Portugal mainland, respectively.

The Madeiran fleet comprises a mix of vessel sizes, with more than 50 % of vessels exceeding 12 m LOA. Onboard observer coverage in the Madeiran deep-water longline fishery is extremely limited. Fleet characteristics strongly influence both the availability and the quality of monitoring data. Fishing trips targeting deep-water species typically last approximately two weeks, making observer deployment logistically demanding and resource intensive. In addition, many vessels operating in this fishery are old and exhibit structural

limitations, outdated equipment, and a higher probability of mechanical failures. These factors significantly constrain safety and working conditions for extended observer deployments far from the coast.

Onboard sampling programmes only began in 2025. While these programmes generate valuable operational data, the limited number of trips and short time coverage currently prevent robust fleet-level inference.

The Portugal mainland fleet is composed by a small number of vessels (n=15) with LOA over 15 m operating year-round, in non-overlapping areas. These areas are well delineated and consistently used by the same vessel. Onboard observations are being collected within CIBBRiNA.

EU FDI data constitute the main consistent source of effort indicators for this fleet and are publicly available. These data provide standardised effort metrics such as *Days at Sea* and *Fishing Days*, enabling an overview of annual fishing activity. However, as for other métiers in the region, these aggregated indicators lack the spatial and temporal resolution required for operational-scale analyses.

At present, the ICES RDBES system does not provide complete effort variables (e.g. *Days at Sea* and *Fishing Days*) for the Madeiran fleet across all years. These fields are expected to become available in future data submissions, but their current absence limits the ability to cross-validate effort estimates between FDI and RDBES.

VMS coverage for the Madeiran *LLD_DWS* fleet is substantially stronger than for fleets dominated by smaller vessels, as a large proportion of vessels exceed the 12 m reporting threshold. VMS data are available for the period 2021–2024 and offer relatively complete spatial and temporal coverage for a large share of the fleet's activity in CECAF 34.1.2. These data allow reconstruction of fishing patterns, including fishing events and spatial hotspots.

Nevertheless, in Madeira, a subset of vessels remains below the 12 m threshold, meaning that fleet activity is not fully captured. For these vessels, manually completed logbooks represent the primary source of operational information. Logbook completeness and reporting quality vary, introducing additional uncertainty when estimating effort for the smallest vessels.

More recently, four vessels have been equipped with Remote Electronic Monitoring (REM) systems. These systems are expected to start generating usable data only from late 2025 onwards and into 2026 and therefore do not contribute to reconstruction of historical or present-day effort. Once fully operational, REM is expected to substantially improve monitoring precision, particularly for gear deployment and retrieval processes and catch handling practices.

In Portugal mainland, RDBES data are available since 2021 and VMS raw data are available for 2025, which can be validated with the onboard observation data collected in 2025. For this area, FDI data are available, but most part of the information reported is marked as confidential.

Data sources available for effort data on fleet level during the workshop

The table summarises the availability of effort data sources for Case Study 4 during the workshop.

Country	EU FDI	ICES RDBES	ICES VMS
PT Madeira	2013-2024	Data not submitted	Data not submitted
PT mainland	2013-2024	2021-2024	Data not submitted

Fleet level effort

The table summarises effort metrics derived from the available datasets. Due to missing or confidential RDBES data and the absence of submitted ICES VMS data during the workshop, the estimates below should be interpreted with caution.

Country	EU FDI		ICES RDBES			ICES VMS
	Average days at sea 2021-2024 Excl. Confidential rows	Average Fishing days 2021-2024 Excl. Confidential rows	Days at sea (avg 2021-2024)	Fishing days (avg 2021-2024)	Number of vessels (avg 2021-2024)	Fishing hours
PT Mainland	4083 in 2024	1539	~3500 in 2023, ~2600 in 2024	~1500 in 2023, ~1300 in 2024	NA	NA
PT Madeira	3741	2785	NA	NA	NA	NA

The following observations were derived from mainland Portuguese RDBES data:

- Data for 2021–2022 are confidential; publicly available data cover only 2023 and 2024;
- Monthly data coverage is complete for the available years;
- Spatial coverage is limited to ICES area 27.9.a;
- The optional field Incidental Bycatch Mitigation Device is reported as None and therefore provides no usable information;
- The optional field Scientific number of hauls or sets has not been reported.
- The optional field Soaking Meter Hour has not been reported;
- The majority of fishing effort originates from vessels larger than 15 m LOA; in 2023 a smaller fraction of vessels below 15 m LOA is observed;
- The reported longline gear type is set longlines (LLS);
- Days at Sea show a marked decrease between years, from approximately 3 600 in 2023 to around 1 600 in 2024;
- The corresponding reduction in Fishing Days is less pronounced, decreasing from 1 566 in 2023 to 1 337 in 2024.

Overall, Case Study 4 benefits from relatively strong FDI coverage and good VMS potential for the Madeiran segment of the fleet due to larger vessel sizes. However, incomplete RDBES variables, the absence of submitted ICES VMS data during the workshop, limited observer coverage, and delayed availability of REM data currently restrict the degree of validation and spatially detailed effort reconstruction. Addressing these gaps will be essential for improving effort estimates and bycatch assessments for deep-water drifting longline fisheries in future project phases.

Case study 5 – Surface longlines in Madeira waters

Case study fleet definition

Gears: Drifting longlines targeting large pelagic fish (LLD_LPF, métier level 5)

Countries: Portugal (Madeira)

Areas: CECAF Division 34.1.2

Data sources available for effort data on fleet level during the workshop

The table summarises the availability of effort data sources for Case Study 5 during the workshop

Country	EU FDI	ICES RDBES	ICES VMS
Portugal - Madeira	2013-2024	Not in ICES area	Not in ICES area

Fleet level effort

The table summarises effort metrics derived from the available datasets.

Country	EU FDI		ICES RDBES			ICES VMS
	Average days at sea 2021-2024 Excl. Confidential rows	Average Fishing days 2021-2024 Excl. Confidential rows	Days at sea (avg 2021-2024)	Fishing days (avg 2021-2024)	Number of vessels (avg 2021-2024)	Fishing hours
PT Madeira	1445	1303	NA	NA	NA	NA

Case Study 5 focuses on the surface drifting longline fleet operating under the *LLD_LPF* métier, targeting large pelagic species in CECAF Division 34.1.2.

Publicly available EU FDI data provide the primary source of effort information for this fleet, offering a baseline description of activity through aggregated metrics such as *Days at Sea* and *Fishing Days*. However, these indicators are reported at a coarse spatial and temporal resolution and do not describe fine-scale operational fishing behaviour.

At present, the ICES RDBES dataset does not include effort variables (e.g. *Days at Sea*, *Fishing Days*) for this métier, which limits its use for cross-validation or integrated analysis with FDI data. Inclusion of this métier in future RDBES submissions is anticipated and would significantly improve harmonisation and comparability across data sources.

VMS data are available only for vessels larger than 12 m LOA for the period 2021–2024. While these data offer valuable spatial and temporal detail, their applicability is constrained by fleet structure: the majority of vessels operating under *LLD_LPF* are smaller than 12 m and are therefore exempt from VMS reporting. As a result, only a small fraction of fleet activity can be reconstructed using VMS positions, and VMS-derived indicators are not representative of the fleet as a whole.

For vessels below the VMS size threshold, logbooks constitute the main source of operational information. However, variability in reporting consistency and detail introduces additional uncertainty in effort estimation.

Several supplementary data sources partially compensate for these limitations. A small number of self-sampling trips carried out in 2025 provide higher-resolution information on fishing hours, gear deployment, and operational patterns. In addition, Remote Electronic Monitoring (REM) systems have been installed on three vessels, although no data are yet available; meaningful REM outputs are expected from 2026 onwards. Fourteen onboard observer trips are also available, contributing valuable but limited snapshots of fishing activity.

Overall, the currently available datasets provide a broad but uneven overview of surface longline activity in CECAF 34.1.2, with significant gaps remaining for the small-vessel segment of the fleet.

Case study 6 – UK longlines

Case study fleet definition

Gears: Longlines (LL), including set longlines (LLS) and drifting longlines (LLD)

Countries: United Kingdom

Areas: ICES areas 27.6.a, 27.7.b, 27.7.j, 27.4.a

Data sources available for effort data on fleet level during the workshop

The summarises the effort data sources and temporal coverage available for Case Study 6.

Country	EU FDI	ICES RDBES	ICES VMS
UK	2014-2020 – after that not EU MS	2021-2024	2021-2024

Fleet level effort

The table summarises effort metrics derived from the available datasets. As EU FDI data are not available for the UK after 2020, effort estimates for 2021–2024 rely on ICES RDBES and ICES VMS data.

Country	EU FDI	ICES RDBES	ICES VMS

	Average days at sea 2021-2024	Average fishing days 2021-2024		Fishing days (avg 2021-2024)	Number of vessels (avg 2021-2024)	Fishing hours (avg 2021-2024)	Number of vessels (avg 2021-2024)
UK	NA	NA	3267	2640	47	8289	12

Based on ICES RDBES data for the UK longline fleet, the following observations were noted:

- Data are available for all months of the year.
- Spatial coverage includes ICES areas 27.4.a, 27.6.a, 27.7.b, and 27.7.j.
- The optional field Incidental Bycatch Mitigation Device is reported as Unknown and therefore provides no usable information.
- The optional field Scientific number of hauls or sets has not been reported.
- The optional field Vessel fishing hour has not been reported.
- Most fishing effort originates from vessels smaller than 12 m LOA, with a notable secondary component from vessels between 24 m and 40 m LOA.
- The dominant fishing methods include handlines and hand operated pole and line (LHP) and set longlines (LLS), with drifting longlines (LLD) contributing a smaller share of effort.
- Spatially disaggregated effort maps by ICES rectangle indicate that the highest longline fishing effort is concentrated along the northern coast of the United Kingdom, particularly around Scotland.

Case Study 6 benefits from good temporal coverage in ICES RDBES and VMS datasets following the UK's exit from the EU, enabling fleet-level effort estimation for recent years. However, the dominance of smaller vessels and the limited reporting of optional operational variables constrain the level of detail available for fine-scale analyses and bycatch assessments.

Case study 7 – Pelagic trawl fisheries

Case study fleet definition

Gears: Pelagic otter trawls (OTM), pelagic pair trawls (PTM)

Countries: Denmark, Netherlands, Ireland, United Kingdom

Areas: ICES areas 27.4.a, 27.4.b, 27.4.c, 27.6.a, 27.6.b, 27.7.a, 27.7.b, 27.7.c, 27.7.d, 27.7.e, 27.7.f, 27.7.g, 27.7.h, 27.7.j, 27.7.k, and 27.8.a

Data sources available for effort data on fleet level during the workshop

The table summarises the availability of effort data for Case Study 7 during the workshop.

Country	EU FDI	ICES RDBES	ICES VMS
UK	2013-2024	2021-2024	2021-2024
Denmark	2013-2024	2021-2024	2021-2024

Ireland	2013-2024	No permission to access data	No permission to access data
Netherlands	2013-2024	2021-2024	2021-2024

Fleet level effort

Effort data for the pelagic trawl fleet are available through EU FDI for all countries throughout the study period. Access to more detailed ICES RDBES and ICES VMS data was granted for Denmark, the Netherlands, and the UK, but not for Ireland. For Ireland, effort estimates at higher resolution could therefore not be assessed during the workshop.

Country	EU FDI		ICES RDBES			ICES VMS	
	Average days at sea 2021-2024 Excl. Confidential rows	Average Fishing days 2021-2024 Excl. Confidential rows	Days at sea (avg 2021-2024)	Fishing days (avg 2021-2024)	Number of vessels (avg 2021-2024)	Fishing hours (avg 2021-2024)	Number of vessels (avg 2021-2024)
Denmark	1733	997	2502	1458	46	15333	44
Ireland	1450	639	NA	NA	NA	NA	NA
Netherlands	794	780	3356	2623	10	4384	9
UK	NA	NA	1865	1025	47	4438	34

Based on ICES RDBES data for Denmark, the Netherlands, and the UK, the following observations were made:

- Monthly data are available for all contributing countries.
- Spatial coverage includes ICES areas 27.4.a–c, 27.6.a–b (including subdivisions 27.6.b.1 and 27.6.b.2), 27.7.a–h, 27.7.j (including 27.7.j.2), 27.7.k (including 27.7.k.1 and 27.7.k.2), and 27.8.a.
- The optional RDBES field *Incidental Bycatch Mitigation Device* is reported as *Unknown*, and therefore does not provide usable information.
- The optional field *Scientific number of hauls or sets* has been reported by Denmark, but not consistently by other countries.
- Denmark has reported data for the optional field *Vessel fishing hour*.
- The majority of fishing effort originates from vessels larger than 18 m LOA.
- The dominant gear type is pelagic otter trawls (OTM), with a smaller contribution from pelagic pair trawls (PTM).
- Spatially disaggregated effort by ICES rectangle indicates that pelagic trawling effort is widely distributed across the defined study areas rather than concentrated in a few hotspots.

CS7 high resolution effort data

Well-established and validated methods exist to estimate fishing effort for demersal trawl fisheries, most commonly based on vessel speed profiles. However, defining fishing effort for pelagic trawl fisheries is considerably more complex. Results reported by Hintzen

et al. (2025) indicate that while vessel speed and pelagic trawling activity are correlated, the relationship is too weak and variable to serve as a generic rule for identifying fishing activity across fleets.

Alternative approaches using machine-learning methods applied to AIS data, such as those routinely implemented by Global Fishing Watch, have shown substantial discrepancies when compared to self-reported haul information from pelagic trawlers. These discrepancies relate both to the identification of haul events and to estimates of haul duration.

Some pelagic fleets in the EU and the UK systematically record haul-level information, including shooting and hauling positions and timestamps. For these fleets, fishing effort can be calculated directly using reported operational data. However, part of the international pelagic trawl fleet does not routinely collect or report such detailed haul information. For these fleets, additional methodological development will be required to estimate fishing effort reliably from available positional data sources.

Case study 8 – Demersal trawl fisheries

Case study fleet definition

Gears: Demersal otter trawls (OTB), twin trawls (OTT)

Countries: Netherlands, Belgium

Areas: ICES areas 27.3.a.20, 27.4.b, 27.4.c, 27.7.d

Data sources available for effort data on fleet level during the workshop

The table summarises the availability of effort data for Case Study 8 during the workshop.

Country	EU FDI	ICES RDBES	ICES VMS
Belgium	2013-2024	No permission to access data	No permission to access data
Netherlands	2013-2024	2021-2024	2021-2024

For Belgium, access to ICES RDBES and ICES VMS data was not granted, and therefore only aggregated FDI data could be used during the workshop. For the Netherlands, detailed effort information was available from all major data sources.

Effort data sums from data sources

The table summarises the main effort parameters derived from the available datasets. For Belgium, effort estimates beyond EU FDI could not be assessed due to data access restrictions.

Country	EU FDI		ICES RDBES			ICES VMS	
	Average days at sea 2021-2024 Excl. Confidential rows	Average Fishing days 2021-2024 Excl. Confidential rows	Days at sea (avg 2021-2024)	Fishing days (avg 2021-2024)	Number of vessels (avg 2021-2024)	Fishing hours (avg 2021-2024)	Number of vessels (avg 2021-2024)
Belgium	1110	975	NA	NA	NA	NA	NA
Netherlands	2984	2799	20959	19686	40	54423	39

Differences between FDI and RDBES Days at Sea for the Netherlands reflect confidentiality filtering in FDI, where aggregation cells with fewer than three vessels are suppressed, as well as methodological differences between national data submissions.

Based on ICES RDBES data for the Netherlands, the following observations were made:

- Monthly data coverage is complete for the period 2021–2024.
- Spatial coverage includes ICES areas 27.4.b, 27.4.c, and 27.7.d.
- The optional RDBES field *Incidental Bycatch Mitigation Device* is reported as *Unknown* and therefore does not provide usable information.
- The optional field *Scientific number of hauls or sets* has been reported and provides additional operational detail.
- The majority of fishing effort originates from vessels larger than 18 m LOA.
- The dominant gear type used is demersal otter trawls (OTB), with limited use of other demersal trawl configurations.
- A general decline in total fishing effort is observed over the period 2021–2024.

8. Relevance for Bycatch Assessment (WP6)

Bycatch estimates are obtained by multiplying a measure of bycatch per unit effort (BPUE), derived from monitoring data, by the total fishing effort for the area and period of assessment. Currently, ICES uses the BEAM framework to estimate annual bycatch using Days at Sea (DaS) as a unit of effort, aggregated at broad spatial scales (e.g. ecoregions and ICES area). DaS was selected as the primary unit of effort because it is consistently available across métiers and regions, while spatial aggregation at broad spatial scales prevents vessel-level identifiability, thereby encouraging data submission and reporting.

While DaS is widely available, it remains uncertain whether it is a suitable and, most importantly, a measure that allows us to precisely and accurately predict bycatch estimates of fishing effort from estimated BPUEs in every situation. It may in some cases introduce bias if a day at sea poorly represents true fishing operations, or if fishing activity varies substantially within a day or across space.

A key objective of WP6 (task 5.2) is therefore to assess whether using DaS as a unit of effort is appropriate across all contexts, or whether it introduces bias in some cases (e.g. some métier in some ecoregions) and to develop bias-corrected methods for estimating bycatch rates and total bycatch where needed.

Access to finer-scale data from the different case studies, such as alternative units of effort more closely related to fishing operations (e.g. number of hauls, nets, soaking time) and smaller spatial scales (e.g. ICES rectangles), would enable direct comparison between precise and aggregated effort metrics. This would allow us to better describe what a day at sea looks like in terms of fishing operations, and whether this varies across space, métier, or season for instance. Using these characterisations, we would then be able to quantify how the choice of effort unit and spatial scale affects the bycatch estimate and assess the usefulness of DaS, rather than other units of effort, to predict it from BPUE.

The ideal situation would be to access, within the same case study, both monitoring data and fishing effort data expressed in multiple units of effort (e.g. days at sea, fishing days, number of operations, operation characteristics such as hours, meters...), as well as at multiple spatial scales (e.g. ICES area versus ICES rectangle). This would enable direct appraisal of biases and implications for bycatch rate and total bycatch estimation.

Where monitoring data are not available for all effort units, access to fishing effort at multiple spatial or operational scales remains valuable, as WP6 can combine multiple data sources and simulate BPUEs informed by observed relationships between days at sea and actual fishing activity.

Overall, finer-scale data from the different case studies can provide multiple opportunities to understand when DaS is an appropriate proxy for effort, when it is not, and how spatial and operational heterogeneity propagates into bycatch estimates.

9. Conclusions and next steps

The workshop led to a substantially clearer and shared understanding of the work undertaken within WP5.1 and its relevance for WP6. In particular, it clarified that different types of fishing effort data, ranging from aggregated fleet-level indicators to high-resolution operational metrics, should be explicitly related to *Days at Sea (DaS)* as the common reference unit across data sources and analytical scales.

Discussions confirmed that fishing effort can be represented at multiple levels of detail and spatial resolution, but that both data availability and data formats vary widely across sources and case studies. As a result, a flexible but structured approach is required to ensure that effort data can be consistently interpreted and integrated across work packages.

In relation to WP6, it was agreed that fleet-level effort will primarily be summarised at the ICES division level to ensure coverage across all case studies and compliance with confidentiality constraints. Where possible, additional levels of detail will be retained and documented, including disaggregation to ICES rectangles, VMS C-squares, or outputs derived from high-resolution approaches such as *iapesca*. These more detailed datasets may only be available for subsets of fleets, but they nevertheless provide valuable insights into the relationship between aggregated effort metrics and actual fishing operations.

A key question identified during the workshop was whether high-resolution data can be used to scale up and represent total fleet activity. In some cases, particularly for passive gears where operational metrics such as soak time and net length can be linked to Days at Sea, this appears feasible at annual or seasonal scales. However, this requires careful treatment of uncertainty and explicit documentation of coverage and representativeness.

Further development of the *iapesca* package is needed to ensure that Days at Sea are included as a core output variable and that aggregation and disaggregation procedures follow established principles, such as those agreed during the Nicosia workshop on effort data. Clear reporting of case study scope is also essential, as not all fleets operating in a given area or métier are included in each case study. This limitation should be explicitly stated in reporting and analysis.

The workshop also highlighted important differences between reporting systems. EU FDI provides consistent coverage for EU Member States, while ICES RDBES extends coverage to all ICES Member States and is expected to become an increasingly important data source for future WGBYC work. For active gears, relatively detailed effort information is already available, whereas for passive gears such as longlines and gillnets, the *iapesca* workflow shows strong potential to improve effort estimation. Testing during the workshop

demonstrated good performance for gillnet fisheries, and extension to longline fisheries appears feasible where suitable data are available.

Improved qualification of fishing trips, such as clearer identification of setting, hauling, and other operational phases, was identified as a key requirement for further methodological development. This can be supported through observer data, electronic monitoring, or simpler solutions such as GPS or app-based tracking during trials, particularly for near-coastal fisheries. Although the CIBBRiNA case studies primarily focus on mitigation measures, they also offer a valuable opportunity to collect the operational variables needed to improve effort characterisation. The workshop facilitated direct interaction between WP5.1 participants and case study leads, which should strengthen ongoing dialogue on data needs and data collection priorities.

Finally, it was recognised that not all case studies had complete or sufficiently detailed datasets available during the workshop. Additional data may become accessible at later stages, and further *iapesca* analyses can be conducted as these data become available.

Next steps

Following the workshop, several strands of follow-up work were identified to consolidate the fleet-level effort analyses and prepare inputs for the next project phases.

A first priority is the finalisation of case study fleet definitions. While many definitions were clarified during the workshop, some remain unresolved and will require targeted follow-up with case study leads. This includes confirmation of vessel length classes, gear specifications, spatial coverage, and whether fleets target specific assemblages. In some cases, further clarification is needed regarding area definitions (e.g. inclusion of ICES areas 4b and 4c in Case Study 1). Where effort data are still missing, for example for Norway and Iceland, new data requests will be issued using the agreed formats.

In parallel, each case study will be accompanied by a concise data availability summary, describing which effort datasets are currently available and recommending which should be used in subsequent analyses. This will include identification of the most complete and appropriate data sources (FDI, ICES RDBES, ICES VMS), and, where possible, compilation of these data into the standardised aggregation framework described in Annex 2. The intention is to provide both a highly aggregated overview of total effort and more disaggregated summaries by year, quarter, area, métier (level 4), and Days at Sea. Where feasible, the number of vessels contributing to each case study will also be documented.

A core component of the follow-up work will be the systematic comparison of effort estimates across data sources, with discrepancies and inconsistencies explicitly documented. This is essential both for correct interpretation of the data and for determining which dataset or combination of datasets should serve as the primary input to WP6. It is anticipated that WP6 will rely on an aggregated dataset for high-level analyses, complemented by more detailed and linkable datasets for fine-scale and exploratory modelling. Data quality and completeness assessments, potentially stratified by métier, will be prepared to support downstream users in WP3, WP6, and WP7.

To support reproducibility and collaboration, processing scripts for RDBES and VMS data will be made available via GitHub. This is particularly important for partners in Ireland and Belgium, where analyses must be run locally due to data access restrictions. Technical issues identified during the workshop, including those recorded in the *iapesca* issue tracker, will be addressed as part of this process.

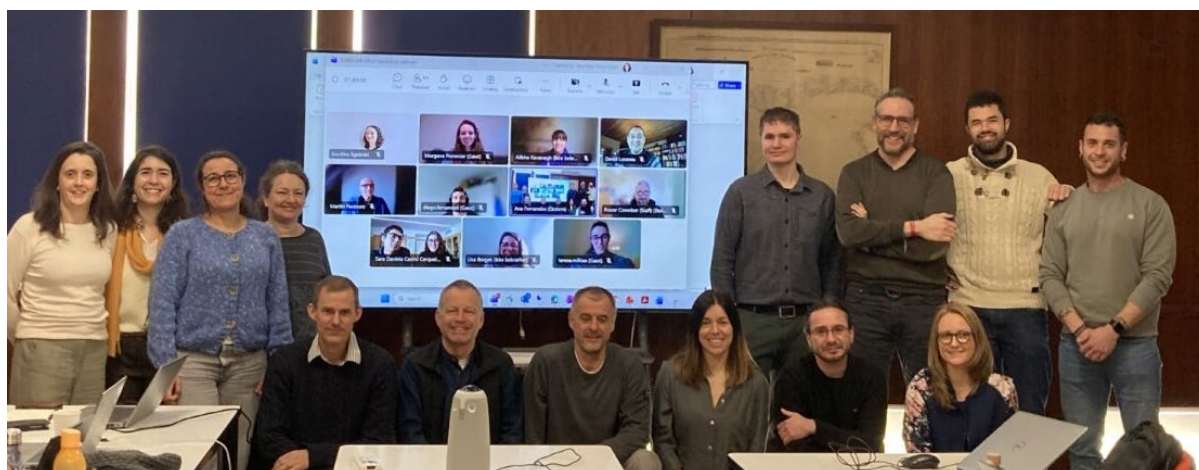
The outcomes of this follow-up work, including validated fleet definitions, documented comparisons between data sources, recommended datasets for WP6, and a consolidated assessment of data availability and quality, will be presented at relevant CIBBRiNA meetings. This will ensure that workshop outcomes are fully integrated across work packages and provide a coherent foundation for the next phase of analyses.

Finally, further testing and development of the *iapesca* package will continue. Identified enhancements, including calculation and aggregation of Days at Sea, have been logged as GitLab issues. Additional case-study-specific testing will be conducted as new data become available.

10. List of participants

Participant	Email	WP	CS
Ailbhe Kavanagh	ailbhe.kavanagh@marine.ie	WP6	
Ana Cláudia Fernandes	acfernandes@ipma.pt	WP5	
Anne-Sophie Pencreac'h	Anne.Sophie.Pencreach@ifremer.fr	WP5	
Christian von Dorrien	christian.dorrien@thuener.de	WP5	
David Lusseau	davlu@aqu.dtu.dk	WP6	
Diego Fernandez	diego.fernandez@ieo.csic.es	#REDUCE	
Estanis Mugerza	emugerza@azti.es	WP5	
Frazer Coomber	f.coomber@bangor.ac.uk	WP6	
Hugo Regalado Fraile	hregalado@cetmar.org	WP3	CS2
Iago Ferreira	iago.izquierdo@ieo.csic.es	WP7	CS2
Inês Farias	ifarias@ipma.pt	WP7	CS4
Jeppe Olsen	jepol@aqu.dtu.dk	WP5	
Jonathan Stounberg	jostou@aqu.dtu.dk	WP5	
Josefine Egekvist	jsv@aqu.dtu.dk	WP5	
Julien Rodriguez	julien.rodriguez@ifremer.fr	WP5	
Lisa Borges	lisa.fixfish@gmail.com	WP5	
Maria Mateo	mmateo@azti.es	WP5	
Martin Pastoors	martinpastoors@mpff.nl	WP7	
Morgane Pommier	morgane.pommier@marine.ie	WP6	
Niels Hintzen	nhintzen@pelagicfish.eu	WP7	CS7

Participant	Email	WP	CS
Sara Daniela Castro Cerqueira	sara.dc.cerqueira@madeira.gov.pt	WP7	CS5
Sebastien Demaneche	sebastien.demaneche@ifremer.fr	WP5	
Tania Mendo	tania.mendo@st-andrews.ac.uk	WP5	
Teresa Militão	teresa.militao@uc.pt	#REDUCE	



11. References

European Commission, Joint Research Centre (2026): 2025 - Fisheries effort, landings, catches, capacity, biological data up to 2024.. [Dataset] doi: 10.2905/JRC.KJFN63G; 10.2905/bf5c5f9a-87d6-4470-a380-458347b7813a PID: <http://data.europa.eu/89h/bf5c5f9a-87d6-4470-a380-458347b7813a>

European Commission, Joint Research Centre (2026): 2025 - Fisheries landings & effort: data by c-square. Data up to 2024. [Dataset] doi: 10.2905/JRC.AC0EMW8; 10.2905/f847528b-1734-4bb8-8361-f4877ba395ed PID: <http://data.europa.eu/89h/f847528b-1734-4bb8-8361-f4877ba395ed>

Mendo, T., Glemarec, G., Mendo, J., Hjorleifsson, E., Smout, S., Northridge, S., Rodriguez, J., Mujal-Colilles, A., James, M. 2023. Estimating fishing effort from highly resolved geospatial data: Focusing on passive gears. *Ecological Indicators*. 154. 110822 (9p.). <https://doi.org/10.1016/j.ecolind.2023.110822>.

Ribeiro, C.(editor), Holmes, S.(editor) and Scott, F.(editor), Publications. 2016. Report on the 2nd workshop on transversal variables – Nicosia, Cyprus, 22-26 February 2016 – A DCF ad-hoc workshop. <https://data.europa.eu/doi/10.2788/042271>

Annex 1: Overview availability of fleet level effort data

Y (green) = data available, N (red) = data not available, ? (orange) = unclear if data will be made available.

N – S = data not available, but results can be provided if script is made available.

Case study	Country	EU STECF FDI	ICES RDBES	ICES VMS	High resolution position data	Validation data
CS1 – Nets	Denmark	Y (2013-2024)	Y – (2021-2024)	Y >=12 (2021-2024)	Y (EM, AIS)	Y (EM)
CS1 – Nets	Sweden	Y (2013-2024)	Y – (2021-2024)	Y >=12 (2021-2024)	Y (EM, HELCOM AIS)	Y (EM)
CS1 – Nets	Germany	Y (2013-2024)	Y – (2021-2024)	Y >=12 (2021-2024)	?	?
CS1 – Nets	Poland	Y (2013-2024)	Y – (2021-2024)	Y >=12 (2021-2024)	?	?
CS1 – Nets	Norway	NA	Not submitted	Not submitted	?	?
CS1 – Nets	Iceland	NA	Not submitted	Y >=12 (2021-2024)	?	?
CS2 – Nets	Spain	Y (2013-2024)	Y – (2021-2024)	Y >=12 (2021-2024)	?	?
CS3 – Nets	UK	N (2014-2020)	Y – (2021-2024)	Y >=12 (2021-2024)	?	?
CS4 – Longlines	Portugal – Mainland	Y (2013-2024)	N – Not in ICES area	Not in ICES area	?	?
CS4 – Longlines	Portugal – Madeira	Y (2013-2024)	N – S	Not submitted	Y (4 vessels EM)	Y (4 vessels EM)
CS4 – Longlines	Madeira	Y (2013-2024)	N – Not in ICES area	Not in ICES area	?	?
CS6 – Longlines	UK	N (2014-2020)	Y – (2021-2024)	Y >=12 (2021-2024)	?	?
CS7 – Pelagic trawl	Netherlands	Y (2013-2024)	Y – (2021-2024)	Y >=12 (2021-2024)	E-log haul by haul.	E-log haul by haul.
CS7 – Pelagic trawl	Denmark	Y (2013-2024)	Y – (2021-2024) 4)	Y >=12 (2021-2024)	VMS, AIS, E-log haul by haul.	E-log data.
CS7 – Pelagic trawl	UK	N (2024-2020)	Y – (2021-2024)	Y >=12 (2021-2024)	?	?
CS7 – Pelagic trawl	Ireland	Y (2013-2024)	N – S	N – S	?	?
CS8 – Demersal trawl	Netherlands	Y (2013-2024)	Y – (2021-2024)	Y >=12 (2021-2024)	?	?
CS8 – Demersal trawl	Belgium	Y (2013-2024)	N – S	N – S	?	?

Annex 2a: Effort data formats for WP6 – data on different aggregation levels

	Aggregation level 1 RDBES	Aggregation level 2a RDBES	Aggregation level 2b RDBES	Aggregation level 3 <i>iapesca/VMS/haul information</i>
Data	Case study Year ICES/FAO area Days at sea Fishing days kW*days at sea kW*Fishing days Number of vessels	Case study Year ICES/FAO area Quarter Days at sea Fishing days kW*days at sea kW*Fishing days Number of vessels	Case study Year ICES/FAO area ICES rectangle Gear Days at sea Fishing days kW*days at sea kW*Fishing days Number of vessels	Case study Year ICES/FAO area ICES rectangle Spatial reference (0.01/0.05 degrees) Gear Days at sea (vessel) Fishing days (vessel) Soak time (nets, longlines) Length (nets, longlines) Hours fished – (vessel, trawl) Number of hauls – (vessel, trawl) Number of vessels
Coverage	Case study Year % Days at sea confidential % Fishing days confidential % kW*DAS confidential % kW*FD confidential	Case study Year Area % Days at sea confidential % Fishing days confidential % kW*DAS confidential % kW*FD confidential	Case study Year Area % Days at sea confidential % Fishing days confidential % kW*DAS confidential % kW*FD confidential	Case study Year Area % Days at sea confidential % Fishing days confidential % kW*DAS confidential % kW*FD confidential

Annex 2b: Effort data formats for WP6 – VMS data on different aggregation levels

	Aggregation level 1 ICES VMS	Aggregation level 2a ICES VMS	Aggregation level 2b ICES VMS	Aggregation level 3 ICES VMS
Data	Case study Year ICES/FAO area Fishing hours kW*Fishinghours Number of vessels	Case study Year ICES/FAO area Quarter Fishing hours kW*Fishinghours Number of vessels	Case study Year ICES/FAO area ICES rectangle Gear Fishing hours kW*Fishinghours Number of vessels	Case study Year ICES/FAO area ICES rectangle Spatial reference (0.05 degrees) Gear Fishing hours kW*Fishinghours Number of vessels
Coverage	Case study Year % fishing hours confidential % kW*FH confidential	Case study Year Area % fishing hours confidential % kW*FH confidential	Case study Year Area % fishing hours confidential % kW*FH confidential	Case study Year Area % fishing hours confidential % kW*FH confidential

Annex 2c: Effort data formats for WP6 – FDI data on different aggregation I

Data not filtered by CS country	<p>Aggregation level 1</p> <p>EU FDI (not filtered by CS country)</p> <p>All effort data</p>	<p>Aggregation level 2a</p> <p>EU FDI (not filtered by CS country)</p> <p>All effort data</p>	<p>Aggregation level 2b</p> <p>EU FDI (not filtered by CS country)</p>
	<p>Case study</p> <p>Year</p> <p>ICES/FAO area</p> <p>Days at sea</p> <p>Fishing days</p> <p>kW*days at sea</p> <p>kW*Fishing days</p>	<p>Case study</p> <p>Year</p> <p>ICES/FAO area</p> <p>Quarter</p> <p>Days at sea</p> <p>Fishing days</p> <p>kW*days at sea</p> <p>kW*Fishing days</p>	<p>Case study</p> <p>Year</p> <p>ICES/FAO area</p> <p>ICES rectangle</p> <p>Gear</p> <p>Fishing days</p>
Data filtered by CS country	<p>Aggregation level 1</p> <p>EU FDI (filtered by CS country)</p> <p>Exclude data marked as confidential</p>	<p>Aggregation level 2a</p> <p>EU FDI (filtered by CS country)</p> <p>Exclude data marked as confidential</p>	
	<p>Case study</p> <p>Year</p> <p>ICES/FAO area</p> <p>Days at sea</p> <p>Fishing days</p> <p>kW*days at sea</p> <p>kW*Fishing days</p>	<p>Case study</p> <p>Year</p> <p>ICES/FAO area</p> <p>Quarter</p> <p>Days at sea</p> <p>Fishing days</p> <p>kW*days at sea</p> <p>kW*Fishing days</p>	

