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Guidance for submitting Essential Fish Habitat (EFH) data v3.0

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1 Introduction

The purpose of this document is to introduce standardised formats to simplify the process of collecting and combining multiple Essential Fish Habitats (EFH) maps from partners/third parties and to make the information easier to understand. These standardised formats share some useful attribute fields, originally present in the Data Exchange Format (DEF) used to collect Seabed Habitat maps (adopted from MESH DEFs originally published as part of the EU-funded MESH project and updated by EMODnet) ([EMODnet Seabed Habitats - Habitat Map Submission Process \(emodnet-seabedhabitats.eu\)](http://emodnet-seabedhabitats.eu)).

For submission to EMODnet Seabed Habitats thematic lot, every EFH map should be submitted within a data 'package' with the following ESRI shapefile (.shp) data storage format (preferentially) or raster format, complemented with matching metadata:

- **Essential Fish Habitat (EFH)** map – supplies the main GIS EFH information (Type: vector/raster).
- **Study Area** – supplied the study area polygons of the entire EFH (Type: vector)
- **Metadata** – supplies useful and additional information about the study area and used methods (Type: xml)

Each of the Data Exchange Format is described below. Guidance for the use of a confidence score matrix for the submitted data is also included.

A shapefile and a metadata Inspire template can be found here ([Template for the Guide for Submitting EFH](#))

1.1 How we define EFH?

In this project we adopt the European definition of EFH (STECF, 2006) aligned with the Common Fisheries Policy (CFP) recommendations for Fish Stock Recovery Areas (FSRA) (EU Regulation No 1380/2013), i.e. nursery and spawning areas of exploited fish species (see appendix for further information). Nonetheless, where available, maps of other important EFHs such as “migration corridors” and “Feeding grounds/foraging grounds” will also be integrated, giving a broader overview of the complexity of EFH.

For the purposes of this project the following EFHs are accepted:

- **Spawning grounds** – areas where there is clear evidence of spawning areas.
- **Nursery grounds** – areas where there is clear evidence of heavy concentrations of fish below minimum conservation reference size
- **Feeding grounds** – marine areas where there is clear evidence of feeding aggregations.
- **Migration corridors** – routes used by highly mobile species during their lifecycle

1.2 Objectives

This document is intended to support the task D2.11 (A data submission process and protocol for Essential Fish Habitats maps) of the EMODnet Phase V (WP2: Data Collation). The specific objectives for the rest of this document are to:

- Describe a Data Exchange Format (DEF) for EFH.
- Describe required Metadata for submitted data
- Describe a Confidence Score Assessment tool (CAT) for submitted data (.xlsx).
- Give information on how the EFH data should be packaged and submitted.
- Give an historical background of EFH definitions (appendix).

2 Data Exchange Format (DEF)

2.1 EFH map

All maps should be submitted in unprojected World Geodetic System (WGS84). All file names should include the EFH 8-digit GUI reference code (see below).

2.1.1 Categorical – vector format (preferred)

Datasets to be submitted include the core information of the EFH and must include the fields listed below in the shapefile's (.shp) attribute table. Fields marked as "(M)" are mandatory and must be completed for the submission to be accepted. Optional fields must still be included in the submission, even if left empty. Fields marked with "*" are also used for Seabed Habitat submitting process and adopted for the EFH submission process. Preferably each map should be supplied for each species

individually, but multi-species maps are also accepted when in compliance with the EU INSPIRE data specification (see “COMP_TYPE” field below). Similarly, to what is required for the habitat dataset submissions, when two or more species co-occur in the same EFH area the following steps must be made before data is ready for submission:

- For any partial overlaps, the overlapping area must be intersected to create spatially identical ‘partial’ polygons for the overlapping area, with one polygon per EFH;
- If a single feature originally describes more than one species EFH, the feature must be split into spatially identical duplicates; one duplicate for each of the species originally described. All duplicates retain the same “POLYGON” identifier.

See the [Data Submission Technical Guidance](#) (Duncan, 2017) report for the habitat submissions for further details. File names should be equal to the EFH 8-digit GUI reference code followed by “_EFH” (see below).

Field name	Data type	Length/Precision	Description
GUI (M)*	Text	8	The globally unique identifier (GUI) of the EFH map. Consists of 2 letter country code (which corresponds to ISO3166-1) plus 6 digits. For example, a dataset from Sweden would be written SE000001. This value can be obtained from each country's project partner and should be the same for all features within an EFH map
POLYGON (M)*	Text	10	Permanent identifier, unique for each polygon within a dataset, or polygon group in the case of spatially identical polygons reflecting a composite EFH for more than one species. Can be created as ascending integers 1, 2, 3... etc. This label for each polygon is necessary to identify the original polygon because the FID field may change during the processing of datasets.
EFH_TYPE (M)	Text	20	Type of Essential Fish Habitat area. The value must be one of the five options: “Spawning grounds”, “Nursery grounds”, “Breeding grounds”, “Feeding grounds” or “Migration corridors”.
COMP_TYPE (M)*	Text	20	Field describing the type of composition for the EFH within overlapping areas: “Single species” or “multiple species”
FAO_CODE (O)	Text	3	The FAO 3-Alpha Species Code (ASFIS) of the species making use of this EFH. ASFIS list of species includes 13 060 species according to their interest or relation to fisheries and aquaculture. Example: HKE for European Hake, <i>Merluccius merluccius</i> .

			Source: https://www.fao.org/fishery/en/species/search
APHIA_ID (M)	integer	10	Unique and persistent identifier for the species making use of this EFH, as provided on the Aphia platform. Aphia also provides the taxonomic backbone for several initiatives, such as (Eur)OBIS, GBIF and EMODnet Biology. Example: 126484 Source: https://www.marinespecies.org/aphia.php
FULL_NAME (M)	Text	40	The Darwin Core full scientific name of the species making use of this Essential Fish Habitat Example: <i>Merluccius merluccius</i> . Source: https://www.marinespecies.org/aphia.php
STBILITY (O)	Text	8	Degree of suitability for the EFH area. The value must be one of the four options(low/medium/high/unknown)
COMMENTS (O)	Text	100	Used for additional information

2.1.2 Continuous - raster format

Continuous outputs of habitat suitability models for EFH are also accepted. These should be submitted as floating point GeoTiffs (.tif) and contain values between 0 and 1 indicating the suitability for a particular EFH (e.g. Katara et al., 2021). If a Continuous – raster format file is being submitted, the following fields required in the Categorical – vector format must be included in the study area (table below): **"EFH_TYPE"**, **"FAO_CODE"**, **"APHIA_ID"** and **"FULL_NAME"**. File names should be equal to the EFH 8-digit GUI reference code followed by "_EFH" (see above).

2.2 Study Area map

Additional information displaying the study rectangular bounding box area of the EFH. Must contains all fields listed below on the attribute table of the shapefile (.shp). Fields marked as "(M)" are also mandatory and must be completed for the submission to be accepted. Optional fields must still be included in the submission, even if left empty.

In ArcGIS, this can be achieved using the "Minimum bounding geometry" tool selecting "ENVELOPE" as the "Geometry Type" and grouping by the "GUI" field while in QGIS using the "Extract layer Extent" tool. File names should be equal to the EFH 8-digit GUI reference code followed by "_StudyArea_DEF".

Field name	Data type	Length/Precision	Description
GUI (M)*	Text	8	The globally unique identifier (GUI) of the EFH map. This value is the same used for the Essential Fish Habitat (EFH) dataset and connect the study area to its respective EFH

UUID (M) (M)*	Text	36	<p>Universally unique identifier (UUID) of ICES Geonetwork metadata record in the form of: xxxxxxxx-xxxx-xxxx-xxxx-xxxxxxxxxxxx</p> <p>If the EFH map already has valid metadata on the ICES Geonetwork portal then the "UUID" value should be entered.</p> <p>This value can be found in two ways:</p> <ol style="list-style-type: none"> 1. The value after "/metadata/" in the URL of the permanent link to the metadata record, for example the UUID of this record is 579a3f6f5ae22d240ecd0f0cd1419628. 2. The value of "File identifier" within the ICES GeoNetwork metadata itself. <p>Warning: The UUID must be entered exactly as stated in the metadata and must conform to the pattern xxxxxxxx-xxxx-xxxx-xxxx-xxxxxxxxxxxx (including all dashes) to pass validation.</p> <p>Example: 095217c1-4766-48ef-95bf-4c77803820ede</p>
AVAILABLE (M)*	Text	13	<p>Availability of the EFH map on the EMODnet portal.</p> <p>The value must be one of the three options:</p> <ul style="list-style-type: none"> • View/Download • View only • Not available <p>If you wish your data to be fully available to the public, please enter the value of "View/Download".</p> <p>If you do not wish users to be able to download your data, but allow them to view your data on our map viewer or Web Map Service (WMS), please enter the value of "View only".</p> <p>"Not available" should be used if the EFH data provided is not intended for distribution but informs users of its existence. Users will be able to see the study area bounding box and will be directed to the data owner (via email) for access to the data itself.</p>
SUM_CONF (O)	integer	3	<p>This is the value of the confidence score given to the map during the data submission process. Further below, the tool for the confidence score calculation is described</p>

3 Metadata

Metadata should be supplied in compliance to the EU's INSPIRE metadata standard in .xml format. File names should be equal to the EFH 8-digit GUI reference code followed by "_Metadata".

When creating your metadata, it is critical that the "Alternate title" is equal to the map's 8 digit GUI reference code. This is so that the map viewer can communicate with the metadata catalogue.

On the general guide for “Submission process for contributing habitat maps” (Step 6: Create the metadata) within the Seabed Habitats portal (www.emodnet-seabedhabitats.eu) there is support information on how to create the metadata ([EMODnet Seabed Habitats - Habitat Map Submission Process \(emodnet-seabedhabitats.eu\)](#)).

4 Data provider agreement

The Data Provider Agreement Template should be filled in for each EFH Map to be submitted.

On the general guide for “Submission process for contributing habitat maps” (Step 7: Complete the data provider agreement) within the Seabed Habitats portal (www.emodnet-seabedhabitats.eu) it is possible to download the template ([EMODnet Seabed Habitats - Habitat Map Submission Process \(emodnet-seabedhabitats.eu\)](#)).

5 EFH Confidence Assessment Tool

The Confidence Assessment Tool (CAT) is useful to assign a quality and suitability to each EFH map. The confidence methodology focusses on the quality and suitability of the mapping process, rather than being an assessment of accuracy. The global score is a weighted average based on several factors related to data acquisition technique (How good was the data acquisition?) (Table 1) and data interpretation (How good is the interpretation?) (Table 2). An Excel Confidence Score Assessment tool (CAT) for submitted data can be found here ([Confidence Score Assessment tool](#)). A glossary of terms is available on Table 3.

The CAT was originally used to assign a score to the Seabed Habitat maps (originally published as part of the EU-funded MESH project) and adapted for Essential Fish Habitat score calculation. On the [MESH project archive](#)¹ there is support information on how to understand the CAT concept.

Table 1. list of confidence score field used to assign a Data Acquisition score

Confidence field	Confidence group	Confidence question	Scoring guidelines
AcquisitionTechnique	How good is the data acquisition?	Were the survey techniques used appropriate for the species type?	3 = technique(s) highly appropriate 2 = technique(s) moderately appropriate 1 = technique(s) slightly appropriate
SamplingPointDensity	How good is the data acquisition?	What density of distribution of sampling point did the survey covered?	3 = good coverage density 2 = moderate coverage density 1 = poor coverage density
SourceData	How good is the data acquisition?	What is the data source?	3 = data originated from fisheries independent surveys 2 = data originated from fisheries dependent surveys 1 = data originated from interviews/questionnaires
Standard	How good is the data acquisition?	Were standards applied to the collection of the data?	3 = data collected from standardized methods 1 = data originated from non-standardized methods
StudyVintage	How good is the data acquisition?	How recent is the data?	3 = < 5yrs 2 = 5 to 10 yrs. 1 = > 10 years

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<https://webarchive.nationalarchives.gov.uk/ukgwa/20101014083419/http://www.searchmesh.net/Default.aspx?page=1635>

TimeSeries	How good is the data acquisition?	How long is the time-series?	3 = > 5 years 2 = 1 to 5 yrs. 1 = < 1yrs
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Table 2. list of confidence score field used to assign a Data selection and Interpretation score

Confidence field	Confidence group	Confidence question	Scoring guidelines
DataAdequacy	How good is the data selection?	Is data adequate?	3 = EFH areas defined on the basis of suitable biological-criteria * 2 = EFH areas defined at least on the basis abundance data 1 = EFH areas defined solely on the basis presence/absence data *Example: areas with highest concentrations of individual below size at first maturity or mature females to define nursery or spawning areas, respectively.
Environmental Quality	How good is the data selection?	What is the spatial resolution temporal extent of data?	3 = Most environmental data with suitable spatial resolution AND temporal extent 2 = Some environmental data with suitable spatial resolution OR temporal extent 1 = Environmental data with no suitable spatial resolution or temporal extent 0 = No environmental data used
Interpretation	How good is the interpretation?	Were the data appropriately interpreted?	3 = Appropriate technique used 2 = Moderately appropriate technique used 1 = Inappropriate technique used Note that interpretation techniques can range from species distribution models with statistical classification techniques to fisher's anecdotal information.

Table 3. Glossary of terms to the EMODNet Confidence Scoresheet tool-EFH

Id	Confidence field	Definition
1	AcquisitionTechnique	Data collection quality is highly dependent on the selection of an appropriate sampling methods. For instance, pelagic trawling might be very appropriate sampling methods for pelagic species, while is less optimal when sampling benthic species. On the other hand, the use of too much large mesh sizes might lead to an unrepresentative catch of juveniles.
2	SamplingPointDensity	An indication of point density obtained for the species under assessment, and to a lesser extent of any additionally environmental parameters used in in the EFH modeling process.
3	SourceData	The data source is much more reliable and accurate if it comes from research cruises than from fisheries-dependent surveys or even more than data from interviews or questionnaires on fishermen's perceptions.
4	Standard	Standardized sampling is defined as using appropriate sampling method with the same characteristics, during the same season and in the same way over time to ensure accuracy, reliability in a way that keeps sampling bias and precision constant.
5	StudyVintage	An indication of the age of the data collation rather than the date of the EFH mapping.
6	TimeSeries	An indication of the length (in years) of the time series data used to produce the EFH map.
7	Data Adequacy	An indication of the level of detail and heterogeneity of used data to define the Essential Fish Habitat (e.g., analysis of biological and environmental data, abundance data only or presence/absence data only).
8	Interpretation	An indication of the type of scientific technique or model used to define the Essential Fish Habitat (e.g., techniques used may range from species distribution models with statistical classification techniques to anecdotal information from fishermen).
9	MapValidation	An indication of obtained level of accuracy in the model development.

6 Submission process for contributing habitat maps

The following should be included on the data 'package' of files to be submitted:

- **EFH map - shapefile (.shp) for categorical data or geotiff (.tif) for continuous data**
- **Study area - shapefile (.shp)**
- **Confidence assessment score sheet (.xlsx)**
- **Metadata (.xml)**
- **Data Provider Agreement (.docx)**

7 References

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Appendix

Historical/original definition

Marine species are highly dependent on healthy ecosystems to survive and reproduce. Essential Fish Habitats (EFH) are defined as the waters and substrates considered crucial and necessary to fish for **spawning, breeding, feeding** or **growth** to maturity (US Magnuson-Stevens Fisheries Conservation and Management Act 1996). Here, the term “fish” is defined as “finfish, but also molluscs, crustaceans, and all other sorts of marine animal and plant life other than marine mammals and birds” are considered (*Magnuson-Stevens Act Provisions; Essential Fish Habitat (EFH)*, 2002; Stevens, 1996). The term “waters” comprise all aquatic areas and their biological, chemical, and physical properties, while “substrate” incorporates the associated biological communities that make these areas appropriate fish habitats used at any time during the species’ life cycle (Rosenberg et al., 2000).

Since the early 90s in the US, the National Oceanic and Atmospheric Administration has been working to define marine areas that might require special protection to improve sustainability to the exploited species (Bergmann et al., 2004), such as the following EFHs (*Magnuson-Stevens Act Provisions; Essential Fish Habitat (EFH)*, 2002):

- **Spawning grounds** – areas where there is clear evidence of spawning areas.
- **Nursery grounds** – areas where there is clear evidence of heavy concentrations of fish below minimum conservation reference size
- **Feeding grounds** – marine areas where there is clear evidence of feeding aggregations.
- **Migration corridors** – routes used by highly mobile species during their lifecycle
- **Habitat Areas of Particular Concern** (“HAPC”) – marine areas that provide important ecological functions or are especially vulnerable to degradation (e.g., coral, seamounts, nearshore nursery areas). HAPCs are focused on conservation, management, and research efforts. A similar concept was adopted in the Mediterranean sea as “Sensitive habitat” (SH) (e.g. *Posidonia oceanica* beds, Coralligenous and Mäerl beds (STECF, 2006))

Ecosystem Approach in Europe

An Ecosystem Approach that recognizes the complexity of ecosystems is an essential objective followed by the European Community. In Europe, EFH have been viewed as an important fisheries

management tool, but with a slightly different definition: “habitats identified as essential to the ecological and biological requirements for **critical life history stages of exploited fish species**” (STECF, 2006).

The concept was adopted by **HELCOM** (2018/2019) and **Malta MedFish4Ever Declaration** (2017) and was integrated in several fisheries policies and legislations including the **European Common Fisheries Policy (CFP)**. This is related with an **ecosystem-based approach** and specially with the importance of establishing **Fish Stock Recovery Areas (FSRAs)** (CFP: Article 8). These protected areas are characterised by their **biological sensitivity** and include areas “where there is clear evidence of **heavy concentrations of fish below minimum conservation reference size** and of **spawning grounds**” (CFP: Article 8.1). Article 8.2 requires EU Member States **to identify suitable areas** whenever possible that may form a **coherent network** and article 8.3 opens the possibility of a **multiannual plan to establish such biologically sensitive protected areas**.