EMODnet Thematic Lot n° 6

EMODnet Phase III

-Task report -

"Analyze compliance with INSPIRE”

Y. Sagarminaga[1], O. Solaun[1].

1. AZTI, Marine Research Division.
Herrera Kaia - Portualdea z/g. E-20110 Pasaia – GIPUZKOA (Spain)
ysagarminaga@azti.es

Date: 06/02/2018

EMODNET human activities data models: towards compliance with INSPIRE DATA Specifications.

1. Background.

The INSPIRE Directive, that came into force on 15 May 2007, aims to create a European Union spatial data infrastructure for the purposes of EU environmental policies and policies or activities which may have an impact on the environment.

This European Spatial Data Infrastructure will enable the sharing of environmental spatial information among public sector organizations, facilitate public access to spatial information across Europe and assist in policy-making across boundaries.

To ensure that the spatial data infrastructures of the Member States are compatible and usable in a Community and transboundary context, the INSPIRE Directive required that common Implementing Rules (IR) were adopted for:

- Metadata
- **Data Specifications**
- Network Services
- Data and Service Sharing
- Spatial Data Services
- Monitoring and Reporting

Datasets in scope of INSPIRE are the ones which come under one or more of the 34 spatial data themes (below).

ANNEX: 1


Addresses


Administrative units


Cadastral parcels


Coordinate reference systems


Geographical grid systems


Geographical names


Hydrography


Protected sites


Transport networks

ANNEX: 2


Elevation


Geology


Land cover


Orthoimagery

ANNEX: 3


Agricultural and aquaculture facilities


Area management / restriction / regulation zones & reporting units


Atmospheric conditions


Bio-geographical regions


Buildings


Energy Resources


Environmental monitoring Facilities


Habitats and biotopes


Human health and safety


Land use


Meteorological geographical features


Mineral Resources


Natural risk zones


Oceanographic geographical features


Population distribution and demography


Production and industrial facilities


Sea regions


Soil


Species distribution


Statistical units


Utility and governmental services

2. Objectives.

Within this task, each dataset contained in the EMODnet Human Activities' portal has been analyzed to look at what needs to be done to align the actual data models to INSPIRE's Data Specifications.

The INSPIRE Implementing Rules on interoperability of spatial data sets and services (IRs) and Technical Guidelines (Data Specifications) specify common data models, code lists, map layers and additional metadata on the interoperability, to be used when exchanging spatial datasets.

Within this task, a first analysis has been made to compare the EMODnet Human Activities' datasets to the INSPIRE Application Schemas developed by the INSPIRE thematic groups and published online.

Based on the outcome of the analysis, it is expected that (i) some data models may already be compliant with INSPIRE and no action will have to be taken; (ii) some data models will only require minor modifications; (iii) some data models will differ to a great extent from INSPIRE's and major modifications will be required.

3. Methodology

The first step has been to make the inventory of currently published EMODnet Human Activities' datasets, get their current data schemas, and look for the best fit INSPIRE Application Schema(s) and spatial objects or featuretypes, according to the INSPIRE documentation and the tools that are made available by INSPIRE to achieve these tasks.

Moreover, we have consulted the documentation and blogs maintained by the different thematic clusters created to support INSPIRE implementation in the Member States (see Table 1).

Cluster Name *Facilitator*	INSPIRE Themes	Theme Abbreviations
Statistical Cluster *Mirosław MIGACZ*	Statistical Units, Population Distribution, Human Health and Safety Statistical Units, Population Distribution, Human Health and Safety	(SU-PD-HH)
Marine and Atmosphere Cluster *Keiran MILLARD*	Oceanographic Geographical Features, Sea Regions, Atmospheric Conditions and Meteorological Geographical Features	(OF, SR, AC, MF)
Earth Science Cluster *Amelia Baptie*	Geology, Soil, Natural Risk Zones, Mineral resources, Energy resources	(GS-SO-NZ-MR-ER)
Land Cover and Land Use Cluster *Lena HALLIN-PIHLATIE*	Land Use, Land Cover	(LU-LC)
Elevation, Orthoimagery, Reference Systems, Geographical Grids	Elevation, Orthoimagery, Coordinate Reference Systems, Geographical Grid	(EL-OI-RS-GG)

Cluster *Jordi ESCRIU*		
Environmental Monitoring and Observations Cluster *Katharina SCHLEIDT*	Environmental Monitoring Facilities, Observations and Measurements	(EF-OM)
Biodiversity and Management Areas Cluster *Stefania MORRONE*	Protected Sites, Area Management/Restriction/Regulation Zones and Reporting Units, Habitats and Biotopes, Species Distribution, Bio-geographical Regions	(PS-BR-HB-SD-AM)
Facilities, Utilities and Public Services Cluster *Angel LOPEZ ALOS*	Facilities, Utilities and Public Services	(PF, AF, US)
Topographic and Cadastral Reference Data *Anja HOPFSTOCK*	Hydrography, Geographical Names, Administrative Units, Cadastral Parcels, Addresses, Buildings, Transport Networks	(HY-GN-AU-CP-AD-BU-TN)

Table 1. Thematic clusters created to support the implementation of INSPIRE data specifications. Source: https://themes.jrc.ec.europa.eu/.

We have used the HALE Studio (The HUMBOLDT Alignment Editor) open software tool, to visually compare the current EMODnet dataset's schemas with the INSPIRE selected schemas. The HUMBOLDT Alignment Editor (hale studio) is a tool for defining and evaluating conceptual schema mappings. hale studio allows domain experts to create logically and semantically consistent mappings and to transform geodata based on these mappings.

4. Results

Matchup of EMODnet Human Activities' datasets and INSPIRE Application Schema(s).

Currently, these are the 54 featuretypes included in the EMODnet Human Activities' portal (see Figure 1)

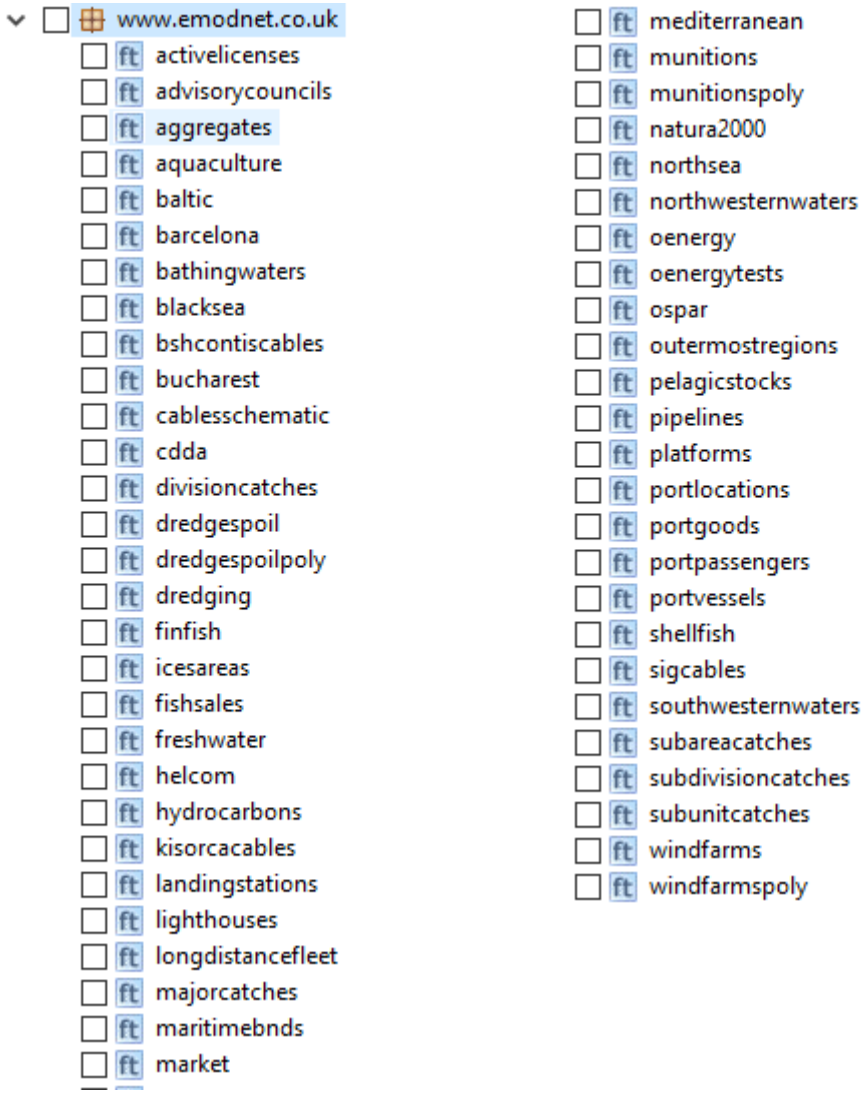


Figure 1. List of featuretypes served by EMODnet human activities WFS Service.

Summary of candidate INSPIRE models retained for EMODnet's human activities datasets.

For each EMODnet's human activities portal dataset, we have identified the INSPIRE application schemas, featuretypes and codelists included in Table 2. In some cases, there are more than one possible application schema that could be related to an EMODnet's dataset. The selected INSPIRE elements included in the table include a link to the INSPIRE web pages that fully describe and define these elements.

EMODnet's portal thematic category	EMODnet's dataset name (from WFS)	INSPIRE Application Schema	INSPIRE Featuretype	Remarks
Aggregate Extraction	aggregates	Annex III: Mineral Resources model	Mining Activity	Dredge mining: Mining Activity Type value
Aquaculture	freshwater	Annex III: Agricultural and Aquaculture Facilities Model	holding, Site, FarmAnimalSpecies	Aquaculture Species Value
	finfish	Annex III: Agricultural and Aquaculture Facilities Model	holding, Site, FarmAnimalSpecies	Aquaculture Species Value
	shellfish	Annex III: Agricultural and Aquaculture Facilities Model	holding, Site, FarmAnimalSpecies	Aquaculture Species Value
Cultural Heritage	lighthouses	Annex III: Building Base	Building	lighthouse: buildingNature value
Dredging	dredging	Annex III: Mineral Resources model Annex II: Geology model	Mining Activity Geomorphologic Feature	Mining Activity Type value dredged channel: AnthropogenicGeomorphologicFeatureTypeValue
Environment	cdda	Annex I: Protected Sites simple models. Annex I: Protected Sites Full	ProtectedSite, DesignationType	DesignationValue
	Natura2000	Annex I: Protected Sites simple models. Annex I: Protected Sites Full	ProtectedSite	Natura2000DesignationValue
	bathingwaters	Annex III: INSPIRE Human Health application schema	EnvhealthDeterminantStatisticasData	Water: envHealthDeterminantTypevalue
Fisheries	icesareas	Annex III: Area Management Restriction and Regulation Zones model	ManagementRestrictionOrRegulatiion Zone	Marine region: Zone Type
	divisioncatches	Annex III: Statistical Units Vector	Vector Statistical Unit	

		Annex III: Area Management Restriction and Regulation Zones model	ManagementRestrictionOrRegulatiion Zone	Marine region: Zone Type
	majorcatches	Annex III: Statistical Units Vector Annex III: Area Management Restriction and Regulation Zones model	Vector Statistical Unit ManagementRestrictionOrRegulatiion Zone	Marine region: Zone Type
	subareacatches	Annex III: Statistical Units Vector Annex III: Area Management Restriction and Regulation Zones model	Vector Statistical Unit ManagementRestrictionOrRegulatiion Zone	Marine region: Zone Type
	subdivisioncatches	Annex III: Statistical Units Vector Annex III: Area Management Restriction and Regulation Zones model	Vector Statistical Unit ManagementRestrictionOrRegulatiion Zone	Marine region: Zone Type
	Sub-unit	Annex III: Statistical Units Vector Annex III: Area Management Restriction and Regulation Zones model	Vector Statistical Unit ManagementRestrictionOrRegulatiion Zone	Marine region: Zone Type
	Fishsales (error?)	Annex III: Statistical Units Vector Annex I: Water Transport Network model	Vector Statistical Unit portnode	
Hydrocarbon	activelicenses	Annex III: Area	ManagementRestrictionOrRegulatiion	prospecting and mining permit area: Zone Type

Extraction		Management Restriction and Regulation Zones model	Zone	
	hydrocarbons	Annex III: Energy Resources Vector Annex III: Mineral Resources model	Fossil Fuel Resource, Fossil Fuel Resource Type Exploration Activity	Fossil Fuel Value liquidhydrocarbons/oil or gaseous hydrocarbons: commoditycodeValue
	platforms	Annex III: Energy Resources Vector	Fossil Fuel Resource	Fossil Fuel Value
Main Ports	Portlocations	Annex I: Water Transport Network model	portnode	
	Portgoods	Annex III: Statistical Units Vector Annex I: Water Transport Network model	Vector Statistical Unit portnode	
	portpassengers	Annex III: Statistical Units Vector Annex I: Water Transport Network model	Vector Statistical Unit portnode	
	portvessels	Annex III: Statistical Units Vector Annex I: Water Transport Network model	Vector Statistical Unit portnode	
Ocean Energy Facilities	oenergy	Annex III: Energy Resources Vector	Renewable and Waste Resource	“tide, wave, ocean”: Renewable and waste value
	oenergytest	Annex III: Energy Resources Vector	Renewable and Waste Resource	“tide, wave, ocean”: Renewable and waste value
Other Forms of Area Management/Design	baltic	Annex III: Area Management Restriction and Regulation Zones model	Management Restriction Or Regulation Zone	Marine region: Zone Type

ation	Longdistancefleet	Annex III: Area Management Restriction and Regulation Zones model	Management Restriction Or Regulation Zone	Marine region: Zone Type
	mediterranean	Annex III: Area Management Restriction and Regulation Zones model	Management Restriction Or Regulation Zone	Marine region: Zone Type
	northsea	Annex III: Area Management Restriction and Regulation Zones model	Management Restriction Or Regulation Zone	Marine region: Zone Type
	outermostregions	Annex III: Area Management Restriction and Regulation Zones model	Management Restriction Or Regulation Zone	Marine region: Zone Type
Other Forms of Area Management/Design ation	market	Annex III: Area Management Restriction and Regulation Zones model	Management Restriction Or Regulation Zone	Marine region: Zone Type
	Aquaculture	Annex III: Area Management Restriction and Regulation Zones model	Management Restriction Or Regulation Zone	Marine region: Zone Type
	blacksea	Annex III: Area Management Restriction and Regulation Zones model	Management Restriction Or Regulation Zone	Marine region: Zone Type
	northwesternwaters	Annex III: Area Management Restriction and Regulation Zones model	Management Restriction Or Regulation Zone	Marine region: Zone Type
	pelagicstocks	Annex III: Area Management Restriction and Regulation Zones model	Management Restriction Or Regulation Zone	Marine region: Zone Type
	southwesternwaters	Annex III: Area Management Restriction	Management Restriction Or Regulation Zone	Marine region: Zone Type

		and Regulation Zones model		
	barcelona	Annex III: Area Management Restriction and Regulation Zones model	Management Restriction Or Regulation Zone	Marine region: Zone Type
	bucharest	Annex III: Area Management Restriction and Regulation Zones model	Management Restriction Or Regulation Zone	Marine region: Zone Type
	Helcom	Annex III: Area Management Restriction and Regulation Zones model	Management Restriction Or Regulation Zone	Marine region: Zone Type
	ospar	Annex III: Area Management Restriction and Regulation Zones model	Management Restriction Or Regulation Zone	Marine region: Zone Type
	maritimebnds	Annex I: Maritime Units	Baseline Maritime Zone Maritime Boundary	
Cables	bshcontiscables	Common Utility Network Elements.	Telecommunication cable, Utility link	
	kisorcacables	Common Utility Network Elements.	Telecommunication cable, Utility link	
	sigcables	Common Utility Network Elements.	Telecommunication cable, Utility link	
	cablesschematic	Common Utility Network Elements.	Telecommunication cable, Utility link	
	landingstations	Common Utility Network Elements.	Utility node, Appurtenance	Telecommunications Appurtenance Type Value
Pipelines	pipelines	Common Utility Network Elements. Existing Land Use, Sampled Land Use, Planned Land Use	Pipe, Utility link	Utilities: HILUCS Land Use Value - Code list

Waste Disposal	dredgespoil	Mineral Resources model Area Management Restriction and Regulation Zones Geology application schema	Mining waste ManagementRestrictionOrRegulatiion Zone Geomorphologic Feature	area For Dumping Of Waste: Zone Type dump: AnthropogenicGeomorphologicFeatureTypeValue
	dredgespoilpoly	Mineral Resources model Area Management Restriction and Regulation Zones Geology application schema	Mining waste ManagementRestrictionOrRegulatiion Zone Geomorphologic Feature	area For Dumping Of Waste: Zone Type dump: AnthropogenicGeomorphologicFeatureTypeValue
	munitions	Geology application schema Area Management Restriction and Regulation Zones	Geomorphologic Feature	dump: AnthropogenicGeomorphologicFeatureTypeValue restricted zones around contaminated sites: Zone Type
	munitionspoly	Geology application schema Area Management Restriction and Regulation Zones	Geomorphologic Feature	dump: AnthropogenicGeomorphologicFeatureTypeValue restricted zones around contaminated sites: Zone Type
Wind Farms	windfarms	Annex III: Energy Resources Vector	Renewable And Waste Resource	Wind: Renewable and waste value
	windfarmspoly	Annex III: Energy Resources Vector	Renewable And Waste Resource	Wind: Renewable and waste value

Table 2. Summary of matchup analysis for EMODnet's human activities portal datasets against the INSPIRE application schemas.

Aggregates extraction & Dredging

The dataset on **aggregate extractions** in the EU is the result of the aggregation and harmonization of datasets provided by several sources from all across the EU. The database contains points representing aggregate extraction sites, by year (although some data are indicated by a period of years), in the following countries: Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Poland, Spain, Sweden, The Netherlands and United Kingdom.

The dataset on **dredging** in the EU is the result of the aggregation and harmonization of datasets provided by several sources from all across the EU. The database contains points representing dredging sites in the following countries: Belgium, Bulgaria, Cyprus, Denmark, Estonia, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Latvia, Lithuania, Malta, Norway, Poland, Portugal, Spain, Sweden, The Netherlands and United Kingdom.

For both datasets, we have identified the INSPIRE Mineral Ressources model and the "Mining Activity" featuretype, as the most adapted schemas for the EMODnet's aggregates and dregding datasets.

Within the "Mining Activity" featuretype, the attribute "Mining Activity Type value" (see Figure 2) includes two terms that can be associated to the dredging and aggregate extraction activities.

dredging - [INSPIRE Code list value dredging]

Definition: *A form of open pit mining in which the digging machinery and processing plant are situated on a floating barge or hull.*

dredge mining - [INSPIRE Code list value dredge mining] - (Parent: underwater mining)

Definition: *Excavation of underwater mineral resources by floating equipment. Dredging systems are classified as mechanical or hydraulic, depending on the method of material transport.*

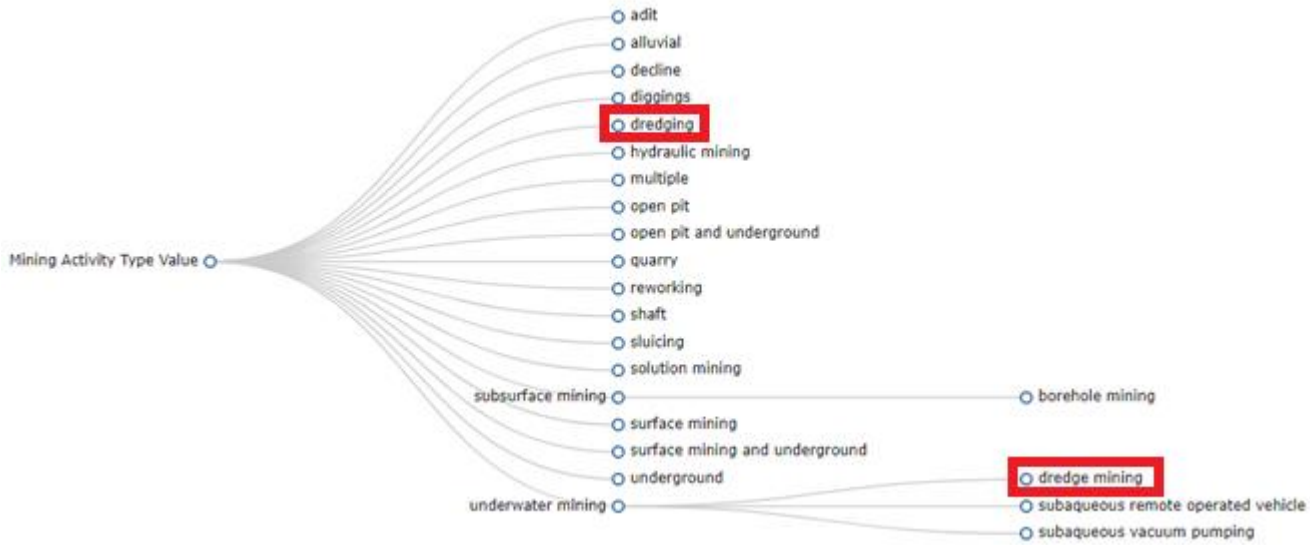


Figure 2. Mining Activity Type value code list elements.

Moreover, under the INSPIRE Geology application schema and under the "Geomorphologic Feature" featuretype, we find the AnthropogenicGeomorphologicFeatureTypeValue codelist (Figure 3) that contains "dredge channel" element defined as follows:

dredged channel - [INSPIRE Code list value dredged channel]

Definition: *A roughly linear, deep water area formed by a dredging operation for navigation purposes*

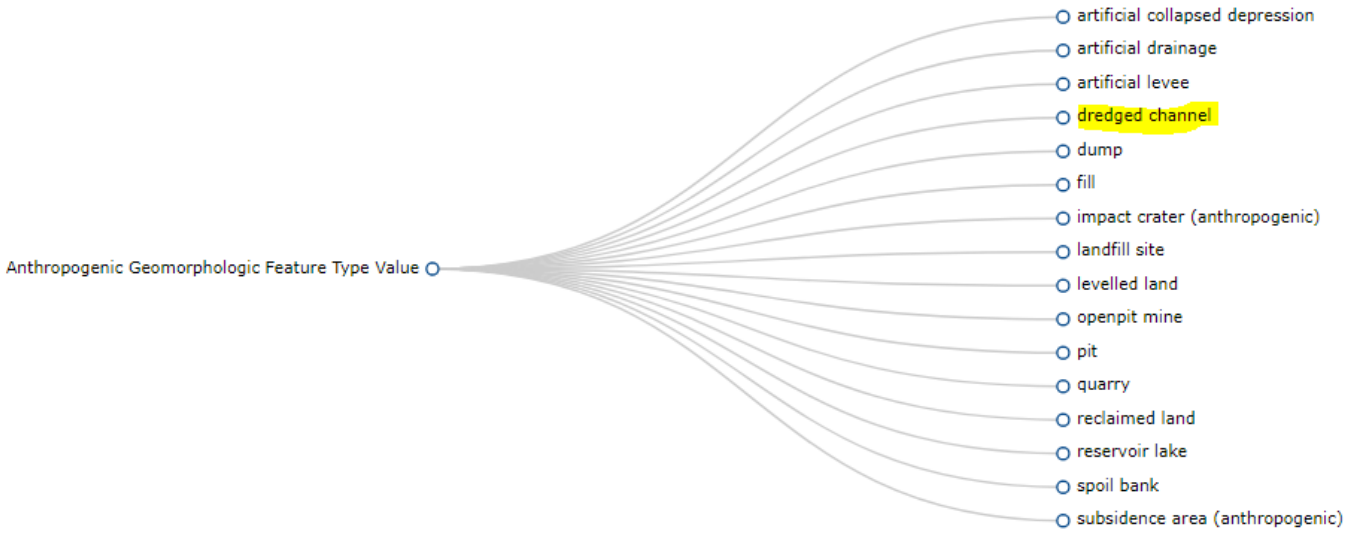


Figure 3. Dredge channel element in the AnthropogenicGeomorphologicFeatureTypeValue codelist.

The detailed comparison between EMODnet's aggregate dataset schema and the INSPIRE "Mining Activity" featuretype is presented in Table 3, and the comparison of dredging dataset schema with the INSPIRE "Geomorphologic Feature" is presented in Table 4.

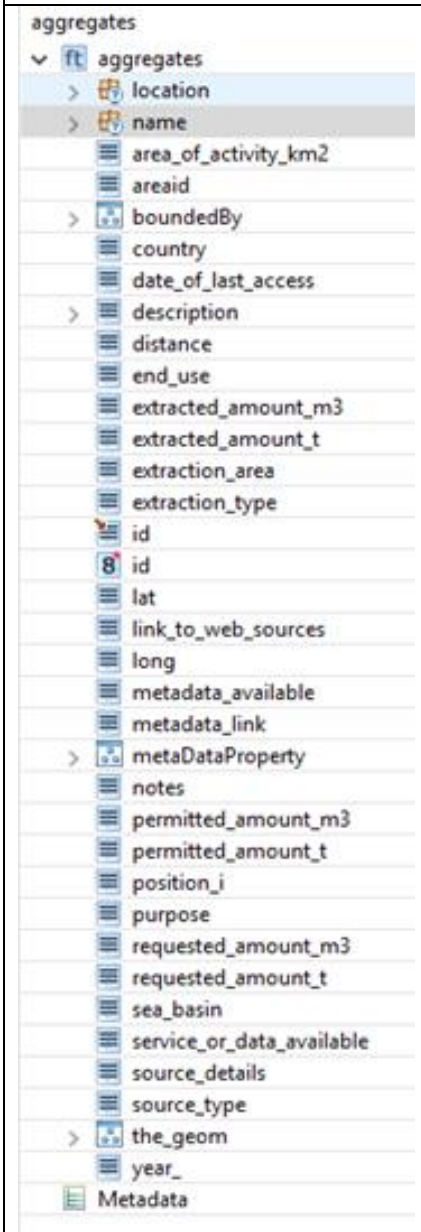
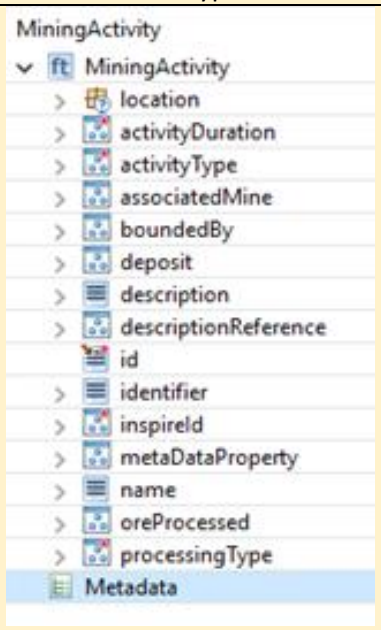
EMODnet's aggregates dataset schema.	INSPIRE "Mining Activity" featuretype schema.
	

Table 3. Comparison of EMODnet's aggregate extraction and dredgings data models with the INSPIRE's MiningActivity featuretype.

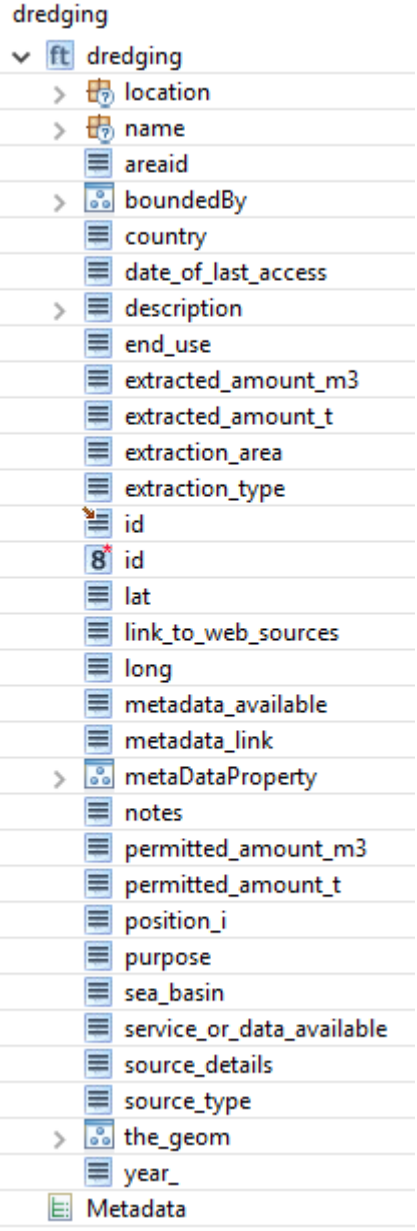
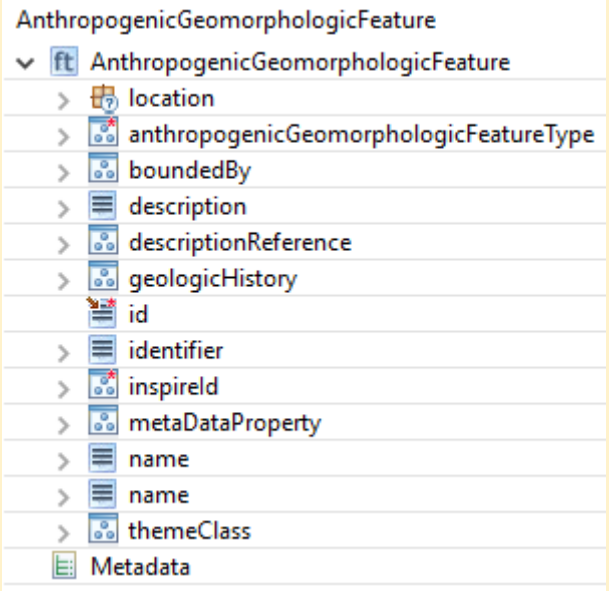
EMODnet's dredging dataset schemas	INSPIRE "Geomorphologic Feature" featuretype schema.
	

Table 4. comparison of dredging dataset schema with the INSPIRE "Geomorphologic Feature"

Aquaculture

Within EMODNET's human activities portal, the **finfish** dataset provides information about the location of seawater finfish farms in the EU and partner countries where data are available. There is an obligation for MS to inventory all authorized aquaculture sites under the Council Directive 2006/88/EC on animal health requirements. Despite this obligation, the availability of data varies significantly among MS from no data available at all to a complete regularly updated dataset (e.g.in Scotland). Most MS with only a marginal finfish production are not able to provide a list with the geolacation of farms. In the main producer countries, there is usually a public list of authorized farms with geolocation data and sometimes information on the species. Data is provided here for Cyprus, Denmark, Greece, Ireland, Finland, Norway, Spain and the UK. There are no sea-based finfish farms in Belgium, Bulgaria, Latvia, Lithuania, the Netherlands and Poland. Data are still missing in other EU MS.

The **freshfish** dataset provides information about the location of freshwater finfish farms in the EU and partner countries where data are available.

The **shellfish** dataset provides information about the location of shellfish farms. It relies on the EUROSHELL project (http://www.euroshell-fp7.eu/Mapping-with-Sextant/Catalogue) for France, Ireland, Italy, the Netherlands and the UK (for England and Wales only). Euroshell data come from professional, scientific and governmental sources (Associazione Mediterranea Acquacoltori in Italy, the Sea Fisheries Protection Authority in Ireland, the Comité National de la Conchyliculture and IFREMER in France, Wageningen in the Netherlands). Data for other countries were not available in the Euroshell database so we used the lists of registered production sites under Council Directive 2006/88/EC on animal health. Points represented in the map correspond to different definitions depending on the source. They represent farm sites in Denmark, Greece, Ireland, Italy, Spain and the UK while they represent the centre of production areas for France and the Netherlands.

Within INSPIRE, under Annex III there is the Agricultural and Aquaculture Facilities Model that would be the one to take into account for data harmonisation. Under this model there are two featuretypes that could be relevant, the "holding" and the "Site" defined as:

Holding

Spatial object type

Definition: The whole area and all infrastructures included on it, covering the same or different "sites", under the control of an operator to perform agricultural or aquaculture activities. The holding includes one specialisation of ActivityComplex, ie. Activity. the values of ActivityType are expressed conform the classification of the economic activity of the holding, according to the NACE rev. 2.0 coding.Holding is a thematic extension of the generic Class "Activity Complex" shared with other thematic areas describing entities related with Economical Activities (Legal Entity Class – Business).

Site

Spatial object type

Definition: All land at a same or distinct geographic location under the management control of a holding covering activities, products and services. This includes all infrastructure, equipment and materials. The geometry of the site must be a point or a surface. Multipoint or multisurface is not allowed.

Moreover, the species has to be designated under the "FarmAnimalSpecies" datatype, that for aquaculture species, establishes as the reference code list, the **ASFIS (Aquatic Sciences and Fisheries Information System)** List of Species for Fishery Statistics Purposes published by the Food and Agriculture Organization of the United Nations.

In Table 5 are presented the detailed schemas of EMODNETs data models for aquaculture datasets, and in Table 6 the detailed schemas of INSPIRE Agricultural and Aquaculture Facilities Model featuretypes.

EMODNETs' shemas of aquaculture datasets		
finfish finfish location name arctic_char boundedBy cod country description distance_to_coast_m finid halibut id lumpfish meagre metaDataProperty other_species owner_name point_info position_coastline production purpose salmon seabass seabream species_detailed species_harmonised status the_geom trout tubot tuna wolffish wrasse Metadata	shellfish shellfish location name boundedBy costal_inland country description distance_to_shore_m id metaDataProperty position_info shellid site_name site_typology species the_geom Metadata	freshwater freshwater location name boundedBy carp catfish country description eel farm_type id metaDataProperty ornamental other owner_name point_info pond_fish production salmon site_id species_de status sturgeon the_geom tilapia trout Metadata

Table 5. EMODNETs data models for aquaculture datasets.

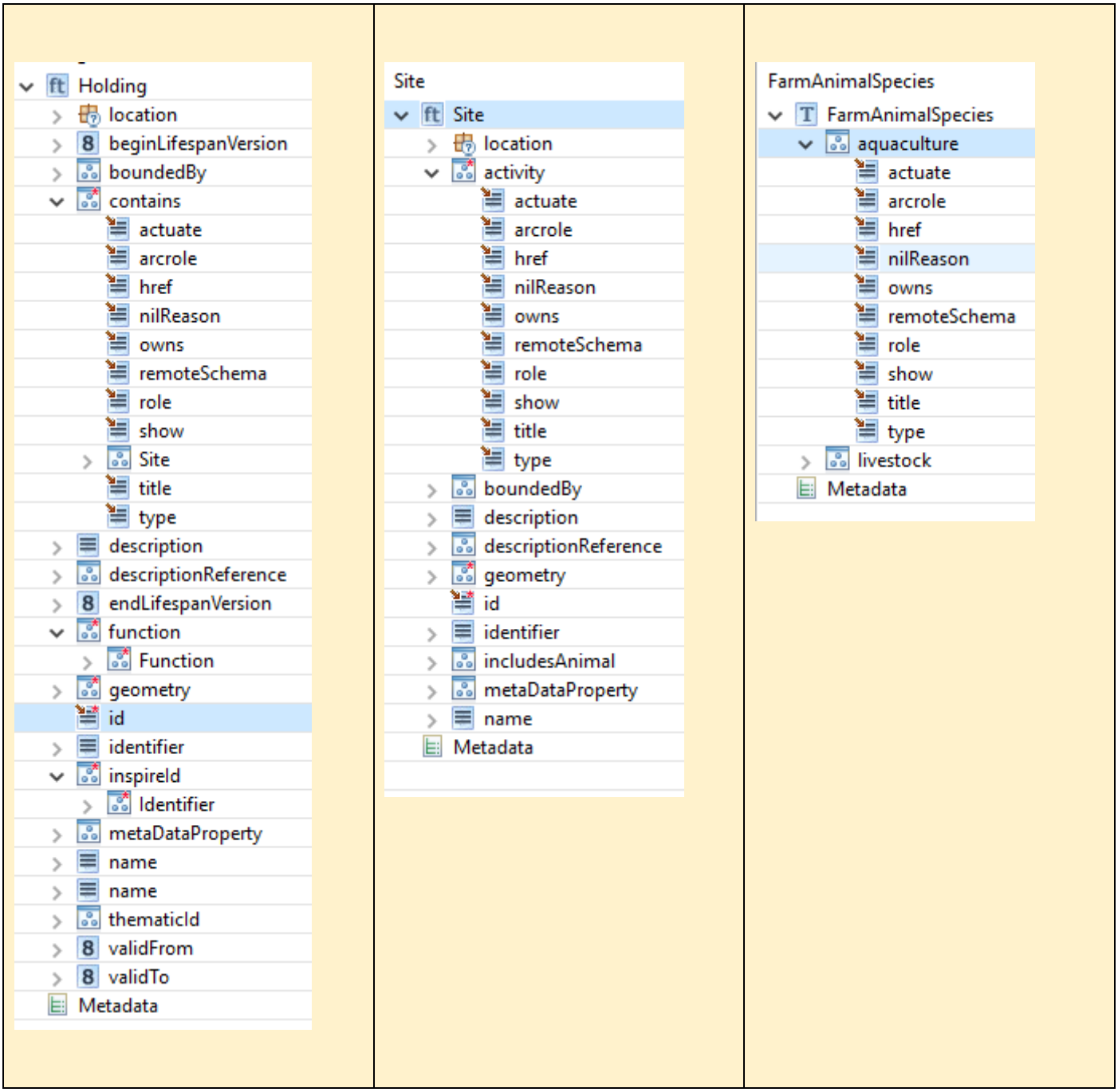


Table 6. Featuretypes and instances within the INSPIRE Annex III: Agricultural and Aquaculture Facilities Model 4.0.

Cultural Heritage

The **lighthouses** dataset provides the location of lighthouses inventoried by the Amateur Radio Lighthouse Society (ARLS). It includes both existing lighthouses and historical ones that have been removed, relocated or destroyed (column Status). The dataset includes the name of the lighthouse, its code in the ARLSH database and the gridsquare within which it is located. Coordinates are approximate for most of the lighthouses.

Within INSPIRE, lighthouses are considered as a "Building" featuretype under the INSPIRE AnexIII buildings 2d model with a buildingNature value named "lighthouse". (Figure 4)

Building Nature Value - Code list

Definition: Values indicating the nature of a building.
Description: NOTE 1: This code list does not aim to be exhaustive as the attribute buildingNature addresses only noticeable buildings. NOTE 2: The values included in this code list address mainly (but not only) two international use cases: air flights where buildings may be obstacles and marine navigation where buildings may be landmarks. NOTE 3: This code list should only be applied for buildings, even if it may be applicable to other constructions (for example, not all dams are buildings).

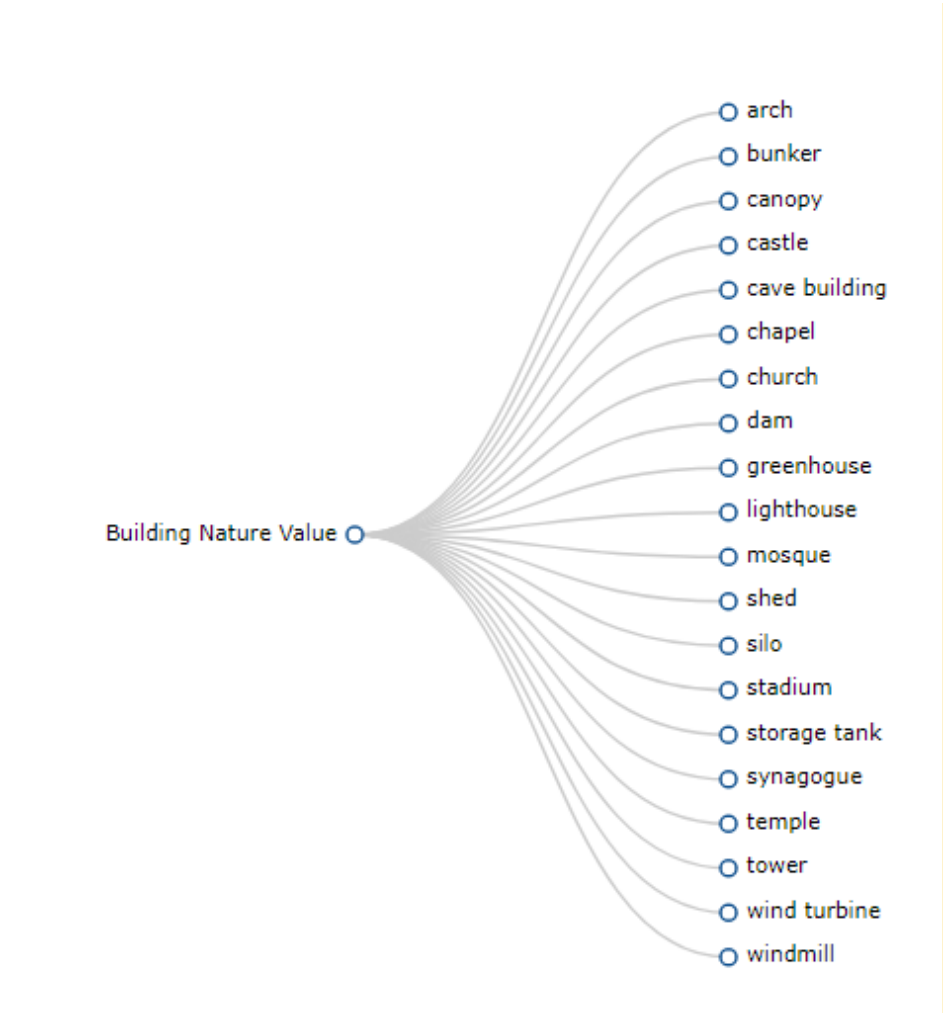


Figure 4. Building Nature value code list elements.

In Table 7 are represented the schema of the EMODNETs lighthouses data model compared with the Building featuretype included in the INSPIRE Buildings2D application schema.

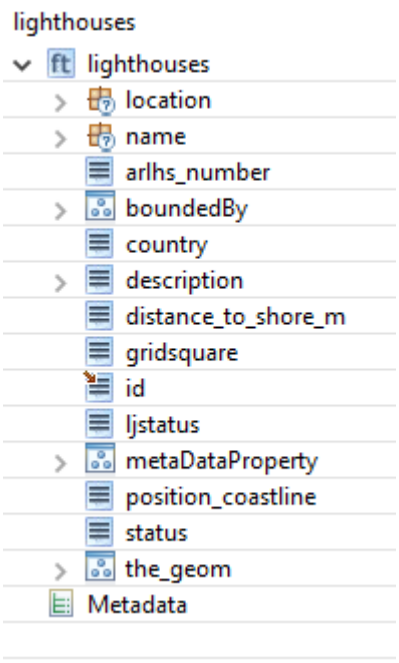
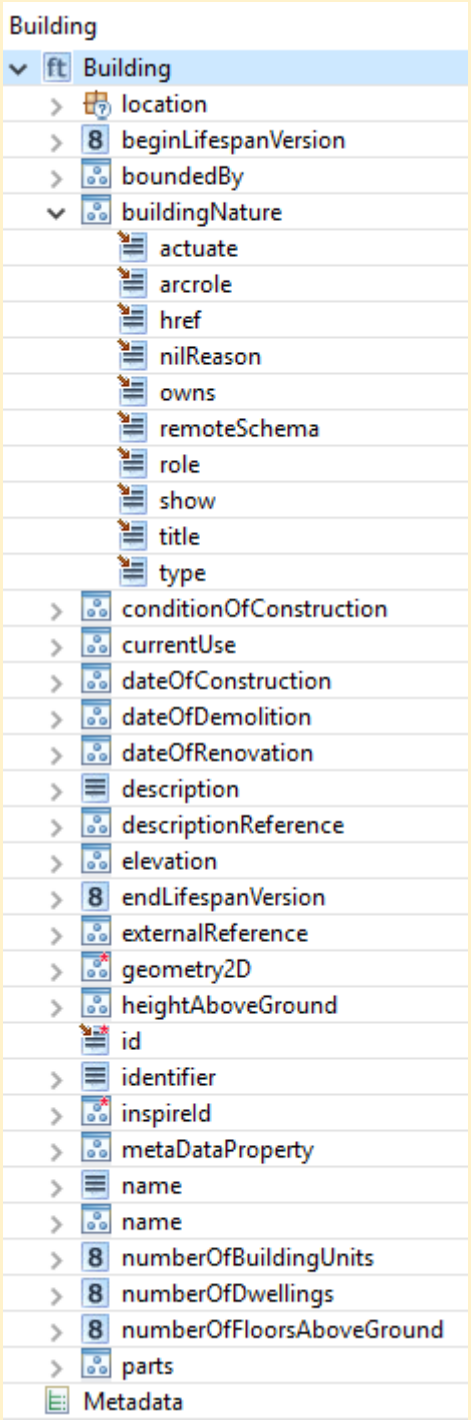
EMODnet's data model for lighthouses.	INSPIRE data model for Buildings2d including lighthouse as a buildingNature value.
	

Table 7. Comparison of EMODnet's lighthouse data models with the INSPIRE's Building featuretype.

The **wrecks dataset** has been developed under the MACHU EU project, involving seven EU MS (BE, DE, NL, PL, PT, UK, SE). The MACHU GIS database provides information about wrecks, sites and objects underwater. MACHU is an application on Underwater Cultural Heritage providing historic and archaeological information. MACHU is not intended to give exact positions of wrecks a site, in the aim of ensuring their protection.

The **archeological sites** dataset has been developed under the SPLASHCOS EU project, involving 20 EU Member States plus Norway, Russia, Ukraine and Switzerland. SPLASHCOS - Submerged Prehistoric Archaeology and Landscapes of the Continental Shelf - is a four-year research network (2009 to 2013) funded by the European Commission under its COST program (Cooperation in Science and Technology) as COST Action TD0902.Its aim is to bring together archaeologists, marine geoscientists, heritage agencies, and commercial and industrial organizations interested in researching, managing and preserving the archives of archaeological and palaeoclimatic information locked up on the drowned prehistoric landscapes of the European continental shelf, and to disseminate that knowledge to a wider audience.

These two last described datasets are not served through the WFS Service of EMODNET and they are not being maintained under the EMODnet's project, thus we will skip the analysis of their data model as won't be able to perform any further harmonization process. However, it's worth mentioning that we have found an initiative to propose a data model under the INSPIRE initiative to hold the spatial data related to cultural heritage: http://digital.csic.es/handle/10261/94227

Environment

Under the Environment thematic category we find three datasets: Natura2000, ccda and bathingwaters.

The **Natura2000** and **ccda** datasets are entirely based on the European Environmental Agency's (EEA) datasets "Natura 2000" and "Nationally designated areas (CDDA)". Natura 2000 is an ecological network composed of sites designated under the Birds Directive (Special Protection Areas, SPAs) and the Habitats Directive (Sites of Community Importance, SCIs, and Special Areas of Conservation, SACs). The Common Database on Designated Areas (CDDA) is more commonly known as Nationally designated areas. The inventory began in 1995 under the CORINE programme of the European Commission. It is now one of the agreed Eionet priority data flows maintained by EEA with support from the European Topic Centre on Biological Diversity. It is a result of an annual data flow through Eionet countries. The EEA publishes the dataset and makes it available to the World Database of Protected Areas (WDPA). The CDDA data can also be queried online in the European Nature Information System (EUNIS).

Both EEA's datasets have been filtered by Cogea to show only maritime areas and sites (i.e. areas entirely at sea), and coastal areas and sites(internal areas that intersect and/or are tangent, using 1 km buffer, to the marine regions and subregions geographic boundaries shapefile, available at https://www.eea.europa.eu/data-and-maps/data/msfd-regions-and-subregions). For further information please visit EEA's website. Compared with the previous version, this version of includes: update to 'CDDA v14' and 'Natura 2000 End 2016', both published by the EEA in 2017; new fields have been added to CDDA, reporting the lowest possible level code of the Nomenclature of Territorial Units for Statistics (NUTS1, NUTS2 or NUTS3) in which the geographical entity is located, the percentage of the total area of marine ecosystems in the site, the major ecosystem type, additional notes about sites; new fields have beed added to Natura 2000 with area of site (ha), and the percentage of the site considered marine.

Within INSPIRE, these datasets can be aligned with the INSPIRE Annex I Protected Sites full, or the Protected Sites simple models.

Below are detailed the schemas of the natura2000 and ccda datasets compared with the INSPIRE ProtectedSite featuretypes in Protected sites full and simple models.

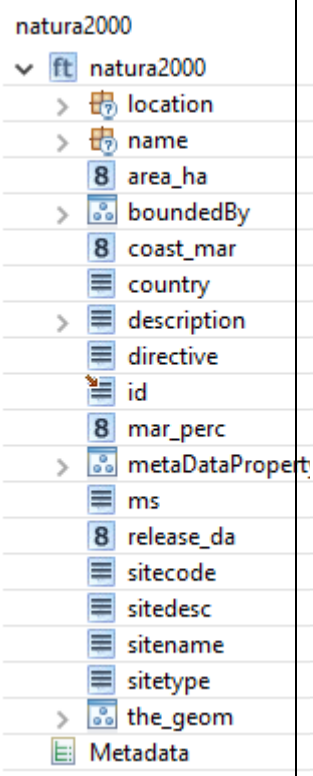
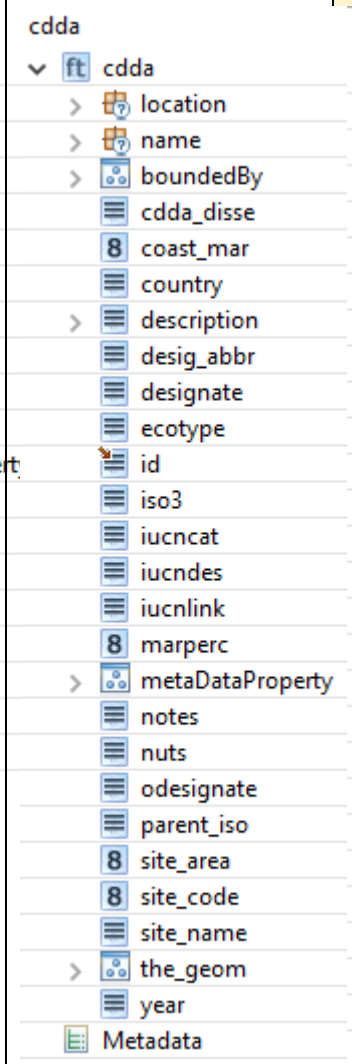
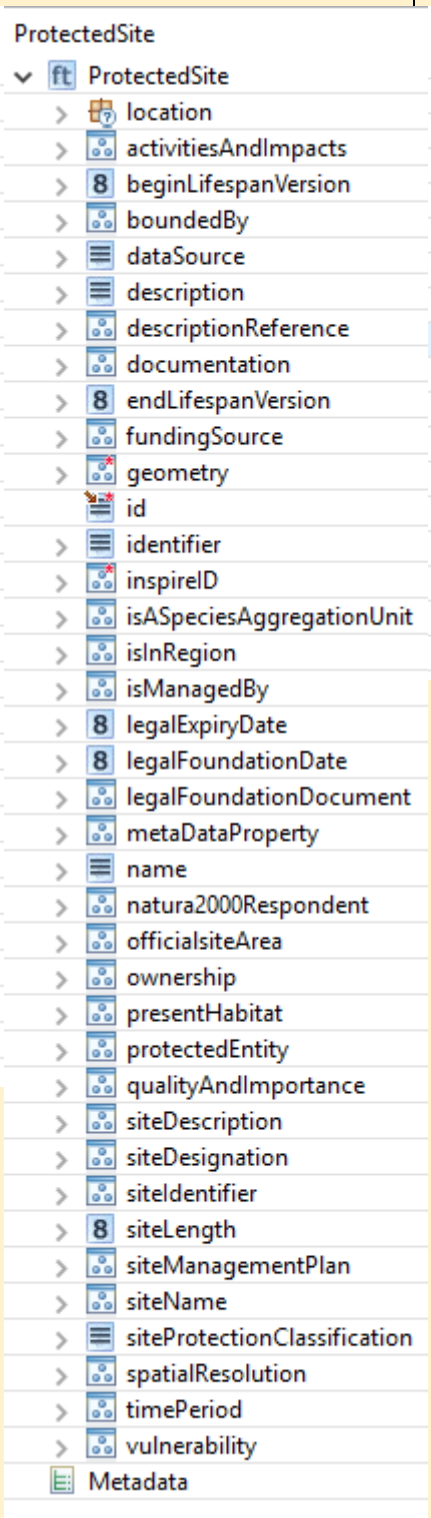
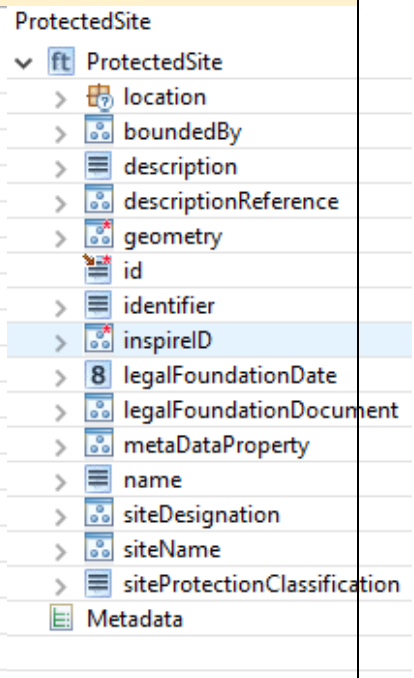
EMODnet's natura2000 dataset schema	EMODnet's ccda dataset schema	INSPIRE Protected sites full model's ProtectedSite featuretype.	INSPIRE Protected sites simple model's ProtectedSite featuretype.
			

Table 8. Comparison of the schemas in current EMODnets ccda and nature2000 datasets with the INSPIRE Protected sites models

The **bathingwaters** dataset is based on the dataset "Bathing Water Directive - Status of bathing water" provided by The European Topic Centre on Water and made available by the European Environment Agency at https://www.eea.europa.eu/data-and-maps/data/bathing-water-directive-status-of-bathing-water-9.

For **bathingwaters dataset**, the most similar featuretype found in INSPIRE corresponds to the "EnvhealthDeterminantStatisticasData" in the INSPIRE Human Health application schema. Below is a description on the main attributes that have to be provided to this featuretype.

The "envHealthDeterminantTypevalue", which in our case would be "water" from the codelist shown in Figure 5.

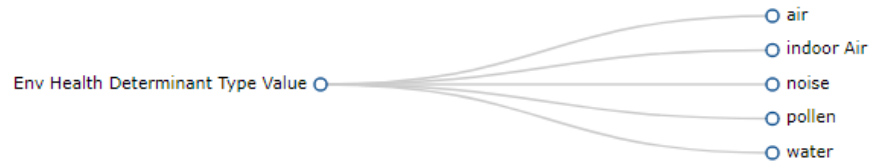


Figure 5. Env Health Determinant Type Value code list elements.

Nevertheless, under the statistical Aggregation method under this INSPIRE model we cannot find the complex statistical aggregation methodologies used to derive the bathing quality indicator given in the EMODnet's dataset which corresponds to the indicator provided for the EU Bathing waters Directive (see Figure 6).

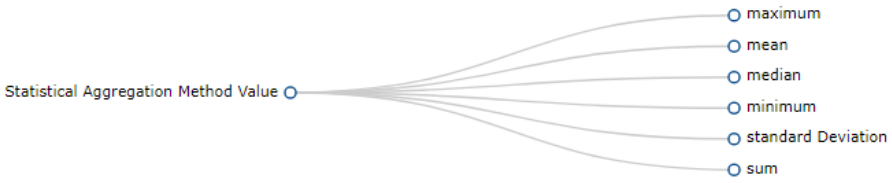


Figure 6. Statistical Aggregation Method Value code list elements.

For the information related to the Statistical Unit we should align to the VectorStatisticalUnit under the INSPIRE Statistical Units Base application schema.

The comparison of current EMODNET's dataset schema with the INSPIRE's EnvhealthDeterminantStatisticasData featuretype is presented in Table 9.

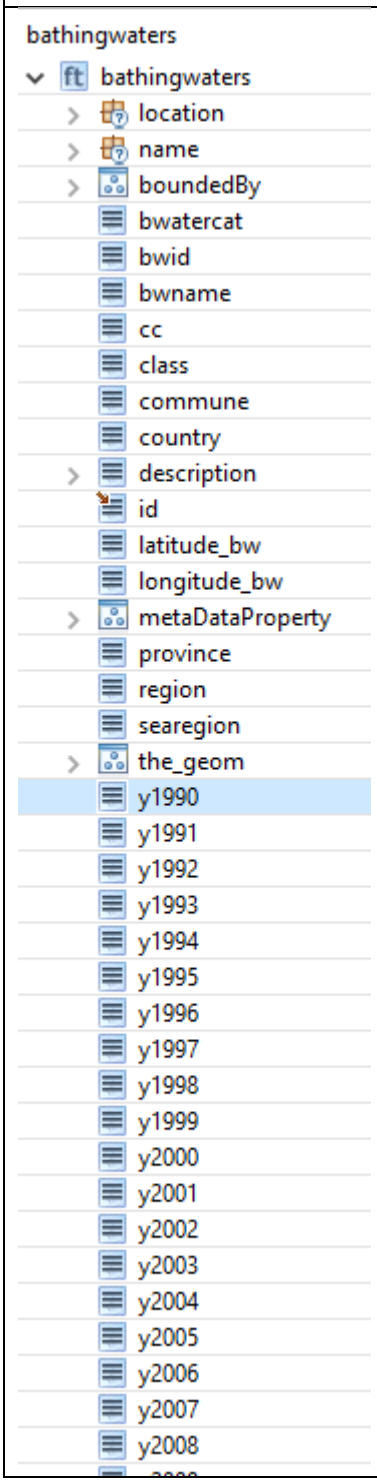
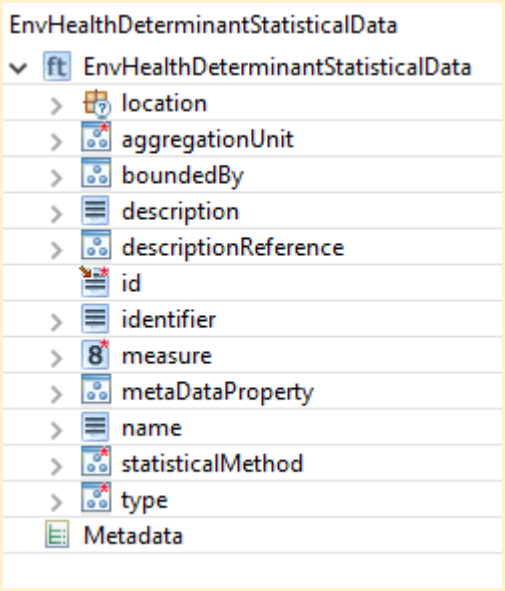
EMODnet bathingwaters dataset schema	INSPIRE EnvhealthDeterminantStatisticasData featuretype in the Human Health application schema
	

Table 9. Comparison of current EMODNET's bathingwaters dataset schema with the INSPIRE's EnvhealthDeterminantStatisticasData featuretype.

Fisheries

Under EMODnet's datasets related to Fisheries we find:

Icesareas dataset that delineates the ICES divisions and subdivisions of FAO Major Fishing area 27. The ICES Statistical Areas are used **as** bounding areas for calculation of fish statistics, e.g. catch per unit effort (CPUE) and stock estimates.

As these areas are bounded to statistics, the INSPIRE Statistical Units Vector application schema would be the most appropriate one. However, as these areas are also used for regulation purposes (set fisheries quotas and regulations), the INSPIRE's Annex III: Area Management Restriction and Regulation Zones model could also be a candidate.

In Table 10 are presented the schema of EMODnet's icesarea dataset compared with the INSPIRE "AreaStatisticalUnit" and "ManagementRestrictionOrRegulatiionZone" featuretypes.

EMODnets icesareas dataset	INSPIRE's Annex III: Area Management Restriction and Regulation Zones-ManagementRestrictionOrRegulatiionZone featuretype	INSPIRE's Annex III: Area Management Restriction and Regulation Zones-ManagementRestrictionOrRegulatiionZone featuretype
icesareas icesareas location name area_km2 boundedBy description ices_area id metaDataProperty the_geom Metadata	AreaStatisticalUnit AreaStatisticalUnit location administrativeUnit areaValue beginLifespanVersion boundedBy country description descriptionReference endLifespanVersion evolutions geographicalName geometry id identifier inspireId landAreaValue livableAreaValue lowers metaDataProperty name predecessors referencePeriod successors tesselation thematicId uppers validityPeriod Metadata	ManagementRestrictionOrRegulationZone ManagementRestrictionOrRegulationZone location beginLifespanVersion boundedBy competentAuthority description descriptionReference designationPeriod endLifespanVersion environmentalDomain geometry id identifier inspireId legalBasis metaDataProperty name name plan relatedZone specialisedZoneType thematicId zoneType Metadata

Table 10. Comparison of current EMODNET's bathingwaters dataset schema with the INSPIRE's EnvhealthDeterminantStatisticasData featuretype.

The datasets on fish catches in the EU (**Divisioncatches, majorcatches, subareacatches, Subdivisioncatches, and subunitscatches**) are the result of the aggregation of EUROSTAT's fish catches datasets fish_ca_atl 27, fish_ca_atl 34, fish_ca_atl 37. EUROSTAT data have been related to FAO's georeferenced fishing statistical areas. Fish species have been grouped by EUMOFA's larger aggregations such as EUMOFA's Commodity Groups (CG) and Main Commercial Species (MCS). Tonnes live weight is provided for each fish species caught in EU fishing statistical area, by year of reference, fish species, CG, MCS and country. The dataset is updated yearly, as soon as new data from EUROSTAT is released. It covers a time series from 1950 to 2015.Compared with the previous version this new version includes data for 2015, as well as the new Main Commercial Species identified by the EUMOFA in 2015.

As in the former dataset, for these dataset that hold statistics related to areas, the INSPIRE Statistical Units Vector application schema would be the most appropriate one to be harmonized with (see Table 10). Under this model, the "AreaStatisticalUnit" and "Statistical tessellation" featuretypes should be used to define the different areas, sub-areas, divisions, subdivisions, etc

In Table 11 are presented the EMODnet's FAO catches datasets' current schemas.

EMODnet's FAO catches datasets' schemas

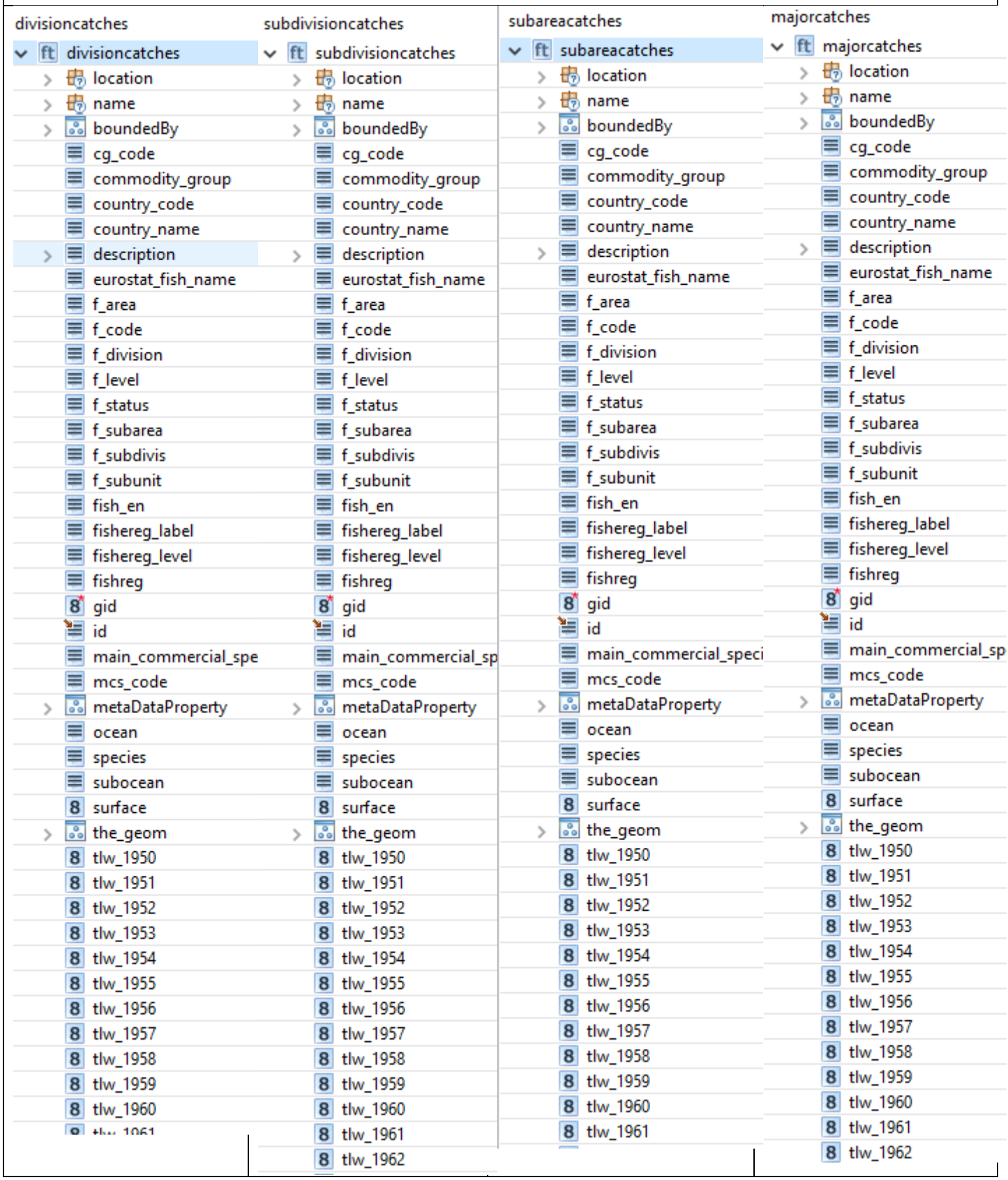


Table 11. EMODnet's FAO catches datasets' schemas

Fishsales dataset originates from the data on monthly first sales of fish made available by the European Market for Fisheries and Aquaculture products (EUMOFA). EUMOFA data have been related to the first-sale place locations. Fish species have been grouped into EUMOFA's aggregations such as Commodity Groups (CG) and Main Commercial Species (MCS). For each fish species in each place of sale, volume (net weight in kg), value (Euro) and price (Euro/kg) are provided on a monthly basis by year of reference, CG, MCS and country. The 2017 update of the dataset also includes information on fish presentation (e.g. whole, headed, gutted, etc.) and preservation state (e.g. fresh, frozen, etc.). Information on presentation and preservations state are also retrieved from EUMOFA. The geographical coverage of data is: Belgium, Germany, Denmark, Estonia, France, Ireland, Italy, Latvia, Lithuania, the Netherlands, Norway, Poland, Portugal, Spain, Sweden and the UK. The dataset is updated twice a year. It covers a time series from 2007 to 2017 (not complete). The EUMOFA is a fully-fledged observatory but is also a work in progress: its coverage may be extended in the future.

Again, the fishsales statistics can be related to areas using the INSPIRE Statistical Units Vector application schema and the "Vector Statistical Unit Geometry" featuretype. In Table 12 is presented the EMODnet's fishsales dataset's schema along with the INSPIRE's "ManagementRestrictionOrRegulatiionZone" featuretype

EMODnet's fishsales dataset's schema	INSPIRE's Annex III: Area Management Restriction and Regulation Zones- ManagementRestrictionOrRegulatiionZone featuretype
fishsales fishsales location name boundedBy commoditycode commoditydescript country description id id lat loc_code loc_name loc_name_eumof loccode lon metaDataProperty month monthno presentation preservation price speciescode speciesdescript the_geom value volume year Metadata	AreaStatisticalUnit AreaStatisticalUnit location administrativeUnit areaValue beginLifespanVersion boundedBy country description descriptionReference endLifespanVersion evolutions geographicalName geometry id identifier inspireId landAreaValue livableAreaValue lowers metaDataProperty name predecessors referencePeriod successors tesselation thematicId uppers validityPeriod Metadata

Table 12. EMODnet's fishsales dataset's schema.

Hydrocarbon Extraction

There are three datasets under the EMODnet's Hydrocarbon Extraction thematic category:

Activelicenses dataset is the result of the aggregation and harmonization of datasets provided by several EU and non-EU sources. It is updated every year and contains polygons representing active offshore hydrocarbon licences in the following countries: Croatia, Denmark, France, Germany, Ireland, Italy, Malta, Netherlands, Norway, Poland, Portugal, Spain and UK. Where available each polygon has the following attributes: country, code, name, type (exploration, exploitation), licensing round (it includes also pending applications in France and Spain), area (square km), area info (it indicates if the area value is original from the source or has been calculated), starting year, ending year, operator.

Within INSPIRE, the most appropriate model to align with would be the Annex III: Area Management Restriction and Regulation Zones model, which includes the "ManagementRestrictionOrRegulatiionZone" featuretype.

Under the Area Management Restriction and Regulation Zones model, the Active licenses for hydrocarbons extraction could be considered as a "*prospecting and mining permit area"* included in the Zone Type *Code* codelist.

prospecting and mining permit area - [INSPIRE Code list value prospecting and mining permit area]

Definition: *The area on which the prospection or extraction of any mineral has been authorised and for which that right or permit is granted.*
Description: *EXAMPLE: Directive 94/22/EC on conditions for granting and using authorisations for the prospection, exploration and production of hydrocarbons, stipulates that the limits of the geographical areas covered by an authorisation and the duration of that authorisation must be determined in proportion to what is justified in terms of the best possible exercise of the activities from an economic and technical point of view.*

The comparison between EMODnet's Activelicenses dataset schema and the ManagementRestrictionOrRegulatiionZone featuretype is presented in Table 13.

EMODNETs Activelicenses featuretype schema	INSPIRE's Annex III: Area Management Restriction and Regulation Zones- ManagementRestrictionOrRegulatiionZone featuretype

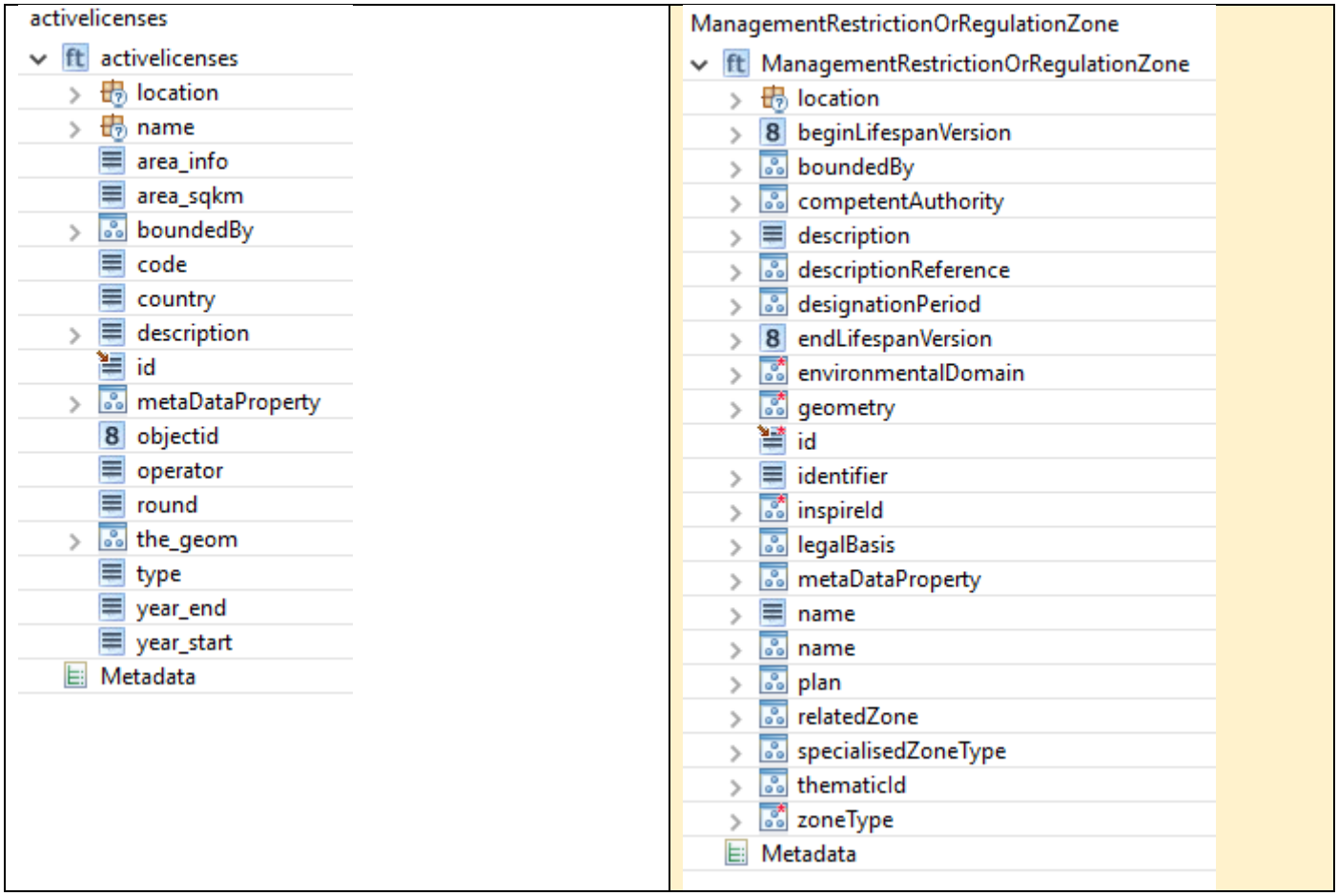


Table 13. Comparison of EMODnet's Activelicenses dataset schema with the INSPIRE's Annex III: Area Management Restriction and Regulation Zones-ManagementRestrictionOrRegulatiionZone featuretype.

The platforms (offshore installations) dataset, is modelled on OSPAR's dataset on offshore installations, having the same fields and attributes. OSPAR monitors the development of offshore installations and maintains an updated inventory of all oil and gas offshore installations in the OSPAR maritime area, the OSPAR Oil and Gas Offshore inventory. The database includes the name and ID number, location, operator, water depth, production start, current status, category and function of the installation. At present more than 1500 offshore installations are operational in the OSPAR maritime area, most of them sub-sea steel installations and fixed steel installations. Contracting Parties with oil and gas industry offshore installations are: Denmark, Germany, Ireland, the Netherlands, Norway, Spain and the United Kingdom. In addition, data on Italian offshore installations have been collected and harmonized from the Italian Ministry of Economic Development, from Marine Traffic and Helcom data on Polish and Russian installations in the Baltic Sea, from Marine Traffic data on Bulgarian, Russian and Ukrainian installations in the Black Sea, Lybian and Spanish installations in the Mediterranean Sea, from the Croatian Hydrocarbon Agency data on Croatian installations in the Adriatic Sea.

The **Hydrocarbons (boreholes)** dataset contains points representing offshore hydrocarbon boreholes drilled in the following countries: Croatia, Cyprus, Denmark, Faroe Islands, France, Germany, Greece (only for western coast), Ireland, Italy, Latvia, Malta, Montenegro, Netherlands, Norway, Poland, Portugal, Spain, and UK. Each point has the following attributes (where available): status (active, abandoned, suspended, other), country, code, name, year (spud date), purpose (exploration, exploitation, other), content (crude oil, natural gas, crude oil and natural gas, dry, other), operator, drilling company/facility, distance to coast (metres) and water depth (metres). The distance to coast (EEA coastline shapefile) has been calculated using the original data map projections, where available. In the other cases it was used the UTM WGS84 Zone projected coordinate system where data fall in. Compared with the previous version this new version has been not only updated but was also reviewed (dataset schema and attributes values) in order to make it more compliant with INSPIRE.

These two datasets contain information that corresponds to the INSPIRE Annex III: Energy Resources Vector application schema, and below this the "Fossil Fuel Resource" type. Nevertheless, in hydrocarbons dataset there is a mixed information about exploitation and exploration sites under the "purposes" attribute. The exploration activity within INSPIRE is taken into account within the Mineral Resources model, as "Exploration Activity" featuretype, which should be linked to a commodity featuretype whose "*commoditycodeValue*" should be liquidhydrocarbons/oil or gaseous hydrocarbons (see Figure 7).

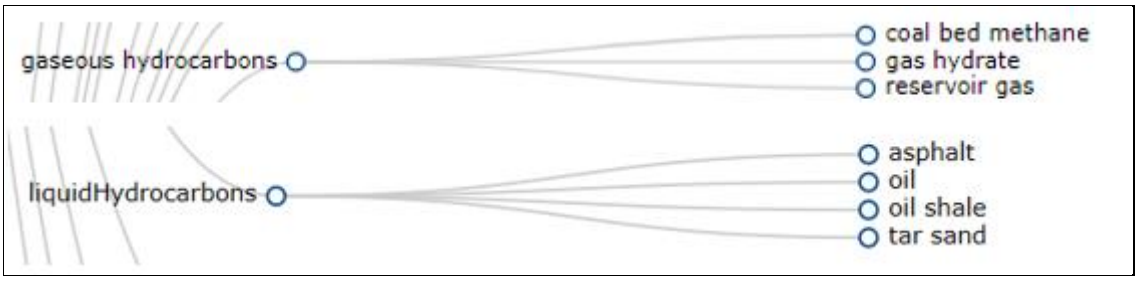


Figure 7. Values for liquidhydrocarbons and gaseous hydrocarbons contained in the commoditycodeValues codelist.

In Table 14 are represented the schemas of platforms and hydrocarbons datasets included in EMODnet's WFS service compared with the VectorEnergyResource featuretype in INSPIRE.

EMODnet's human activities datasets		INSPIRE's VectorEnergyResource from Energy Resources Vector application schema
platforms	hydrocarbons	VectorEnergyResource
platforms	hydrocarbons	VectorEnergyResource
location	location	location
name	name	beginLifespanVersion
boundedBy	boundedBy	boundedBy
category	code	ClassificationAndQuantificationFramework
class	company	description
coast_dist	country	descriptionReference
country	depth	endLifespanVersion
current_status	description	exploitationPeriod
description	distance	geometry
function	hydrocarbon	id
id	id	identifier
latitude	metaDataProperty	inspireId
location_blocks	operator	metaDataProperty
longitude	purpose	name
metaDataProperty	status	reportingAuthority
operator	the_geom	resourceName
platformid	year	verticalExtent
primary_production	Metadata	Metadata
production_start		
remarks		
the_geom		
water_depth		
weight_sub		
weight_top		
Metadata		

Table 14. Comparison of EMODnet's platforms and hydrocarbons datasets with the INSPIRE's VectorEnergyResource from Energy Resources Vector application schema.

Main Ports

There are four datasets in EMODnets Human Activities Ports category. These include a **portlocations** dataset which identifies the different ports in Europe and the **portgoods, portpassengers and portvessels** datasets which include some statistics associated to the EU ports (schemas presented in Table 15).

These datasets are the result of the aggregation and harmonization of datasets provided to EUROSTAT by ports in EU Member States and Norway. EUROSTAT data have been related to GISCO's georeferenced ports. These datasets are updated on an annual basis where the most recent update includes annual data from 2014, 2015 and 2016 (where available). Goods and Passengers data are available from 2001 while vessel is maintained from 2006 onwards. Goods traffic data are reported in thousand tonnes by type of cargo and direction. Passengers traffic data are reported in thousand passengers (excluding cruise passengers) by direction and traffic type. Vessels traffic data are reported in unit and gross tonnage (thousand) of vessels by vessel size class and vessel type. Original data is reported quarterly by EUROSTAT but has been aggregated on an annual basis to produce this dataset.

Within INSPIRE, the best fit model related to this information is the Annex I: Water Transport Network model, that includes the "portnode" or "portarea" featuretypes (Table 16). Within this model, there are not attributes that can be related to the statistics included in EMODnet. A possible alternative would be to align these attributes to the INSPIRE Statistical Units Vector application schema and the "Vector Statistical Unit Geometry" featuretype.

EMODnets' port datasets schemas

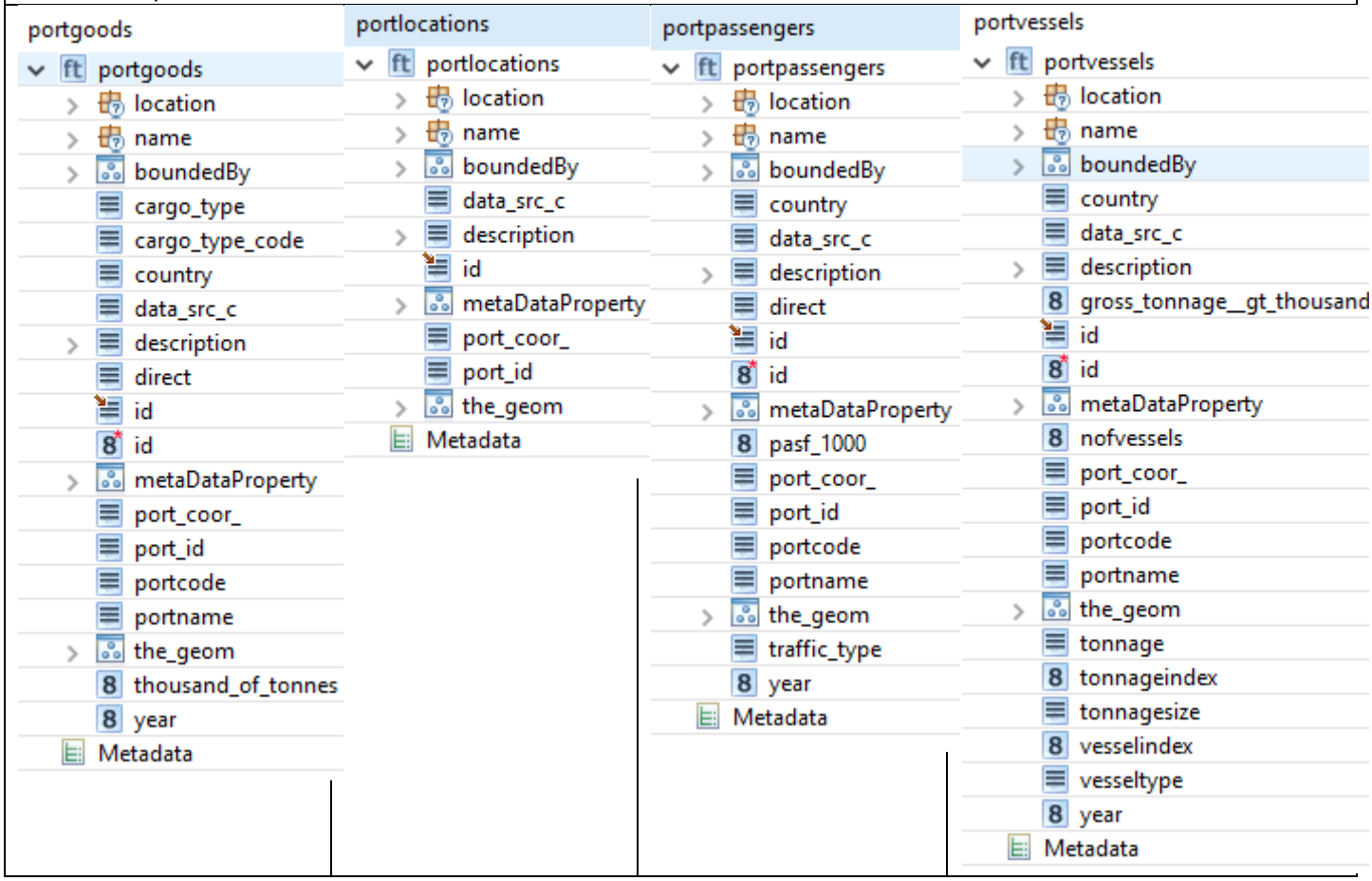


Table 15. EMODnets' Port's datasets schemas.

INSPIRE Annex I: Water Transport Network model's PortNode and PortArea featuretypes'schemas.

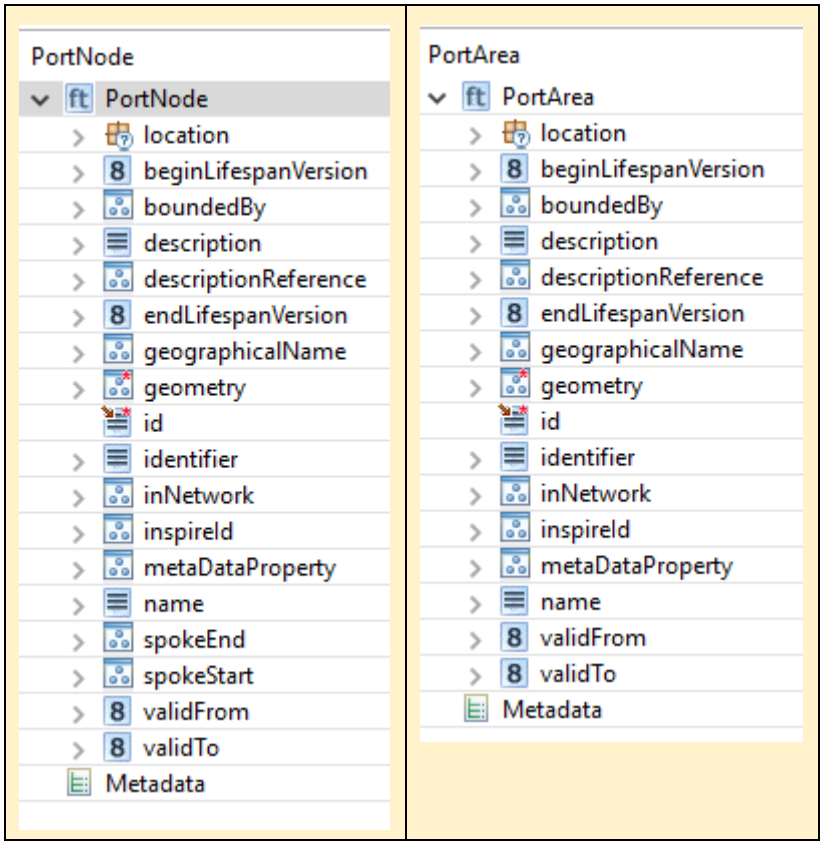


Table 16. INSPIRE PortNode and PortArea featuretypes'schemas.

Ocean Energy Facilities & Wind farms

There are two datasets within EMODNET's Ocean energy Facilities category, the **oenergy (project locations)** and the **oenergytests** which include information representing Ocean Energy project sites and Ocean Energy test sites in Europe.

The **oenergy (project locations)** dataset is the result of the aggregation and harmonization of datasets provided by several sources from all across the EU. It is updated every year. The database contains points representing Ocean Energy project sites in the following countries: Belgium, Denmark, Finland, France, Ireland, Italy, Norway, Portugal, Russia, Spain, Sweden, The Netherlands and United Kingdom. Where available, each point has the following attributes: site code (ID_1), project code (ID), name, location, country, sea basin, distance to coast (metres), resource type (wave, tidal, salinity gradient, wave/wind), starting year, ending year, lease status, technology (Based on www.aquaret.com/), device, device scale (Full scale, prototype, etc.), project scale (Commercial, Demonstrator Array, etc.), project status (operational, completed, etc.), project capacity (KW), promoter, and position info (it indicates if the attribute value is original from the source or has been estimated or calculated the polygon centroid).

The **oenergytests** database contains polygons representing Ocean Energy test sites in the following countries: Denmark, France, Ireland, Norway, Portugal, Spain, Sweden, The Netherlands and United Kingdom. Where available, each polygon has the following attributes: test site code, name, location, country, sea basin, distance to coast (metres), resource type (wave, tidal), starting year, ending year, lease status, site status, capacity (kW), depth (metres), area (square km), grid connection, number of berths, developer, and position info (it indicates if the attribute value is original from the source or has been estimated).

The most related INSPIRE model for these dataset would be the Annex III: Energy Resources Vector application schema and below this the "Renewable And Waste Resource" Spatial object type, where the **Renewable and waste value** would be "*tide, wave, ocean*" (cf. Figure 8).

The comparison of **oenergy (project locations)** and **oenergytests** datasets schemas with the Renewable And Waste Resource schema is presented in Table 17.

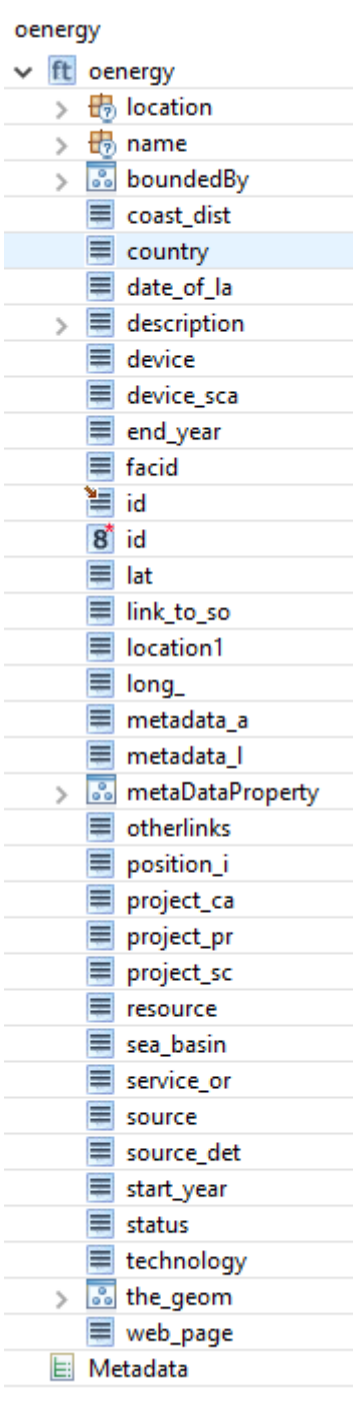
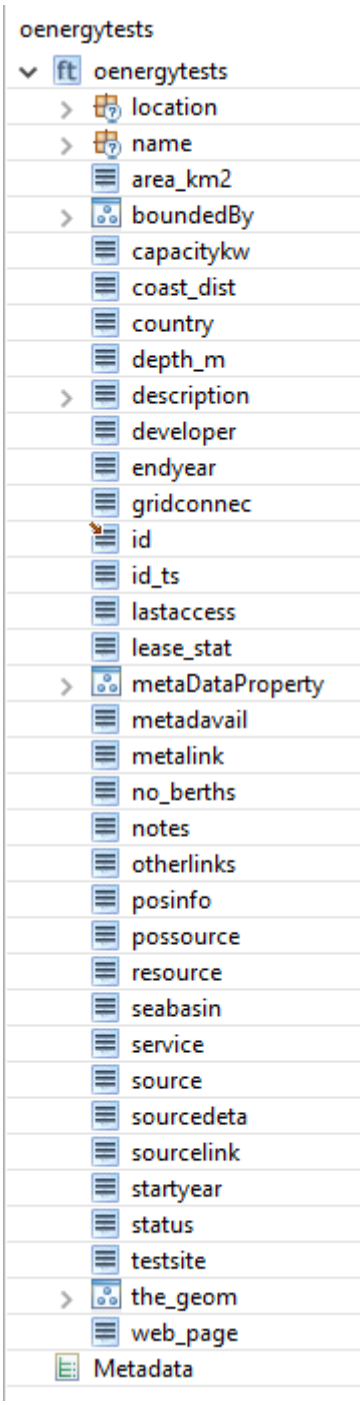
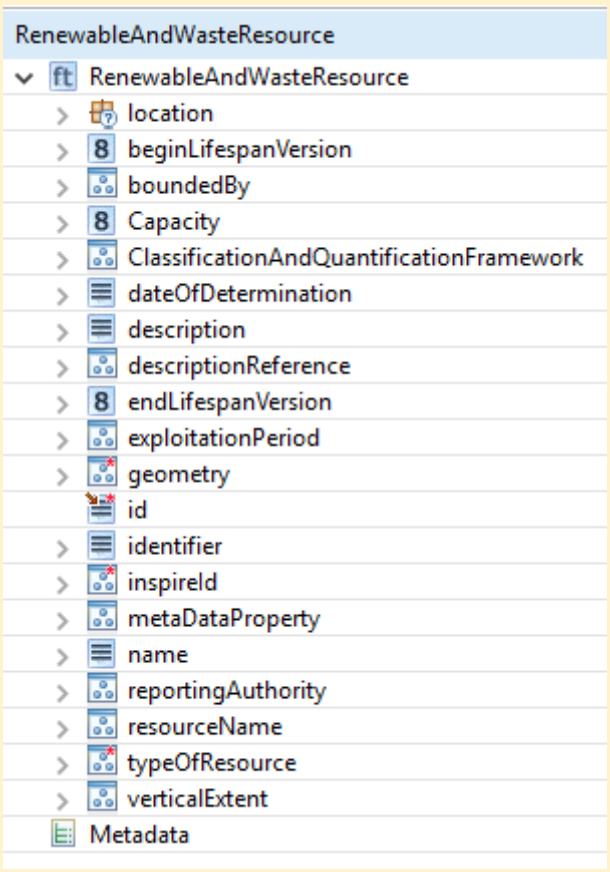
EMODNETs oenergy datasets schemas		INSPIRE's Annex III: Energy Resources Vector application schema - Renewable And Waste Resource featuretype
		

*Table 17. Comparison of **oenergy (project locations) and oenergytests** datasets schemas with the Renewable And Waste Resource schema.*

For **wind farms** datasets that result from the aggregation and harmonization of datasets provided by several sources from across the EU, contain points and/or (where available) polygons representing offshore wind farms in the following countries: Belgium, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania,

Netherlands, Norway, Poland, Portugal, Spain, Sweden and United Kingdom. Each point has the following attributes (where available): Name, Nº of turbines, Status (Authorized, Operational, Planned, Under Construction), Country, Year, Website, Power (MW), Distance to coast (meters), Perimeter (kilometres), Surface (square kilometres) only for polygons.

For these datasets, the same INSPIRE model should be used with the difference that in this case, the **Renewable and waste value** would be "wind" (see Figure 8)

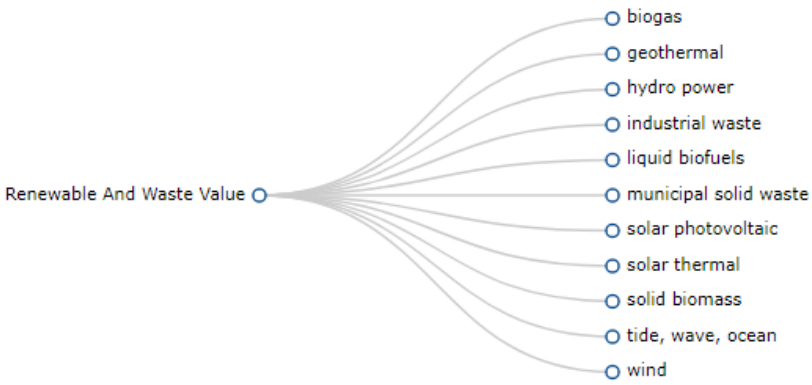


Figure 8. Renewable and waste Value code list elements.

The current EMODnet's windfarms datasets schemas and the Renewable And Waste Resource schema are presented in Table 18.

EMODnet's windfarms datasets' schemas	INSPIRE's Annex III: Energy Resources Vector application schema - Renewable And Waste Resource featuretype

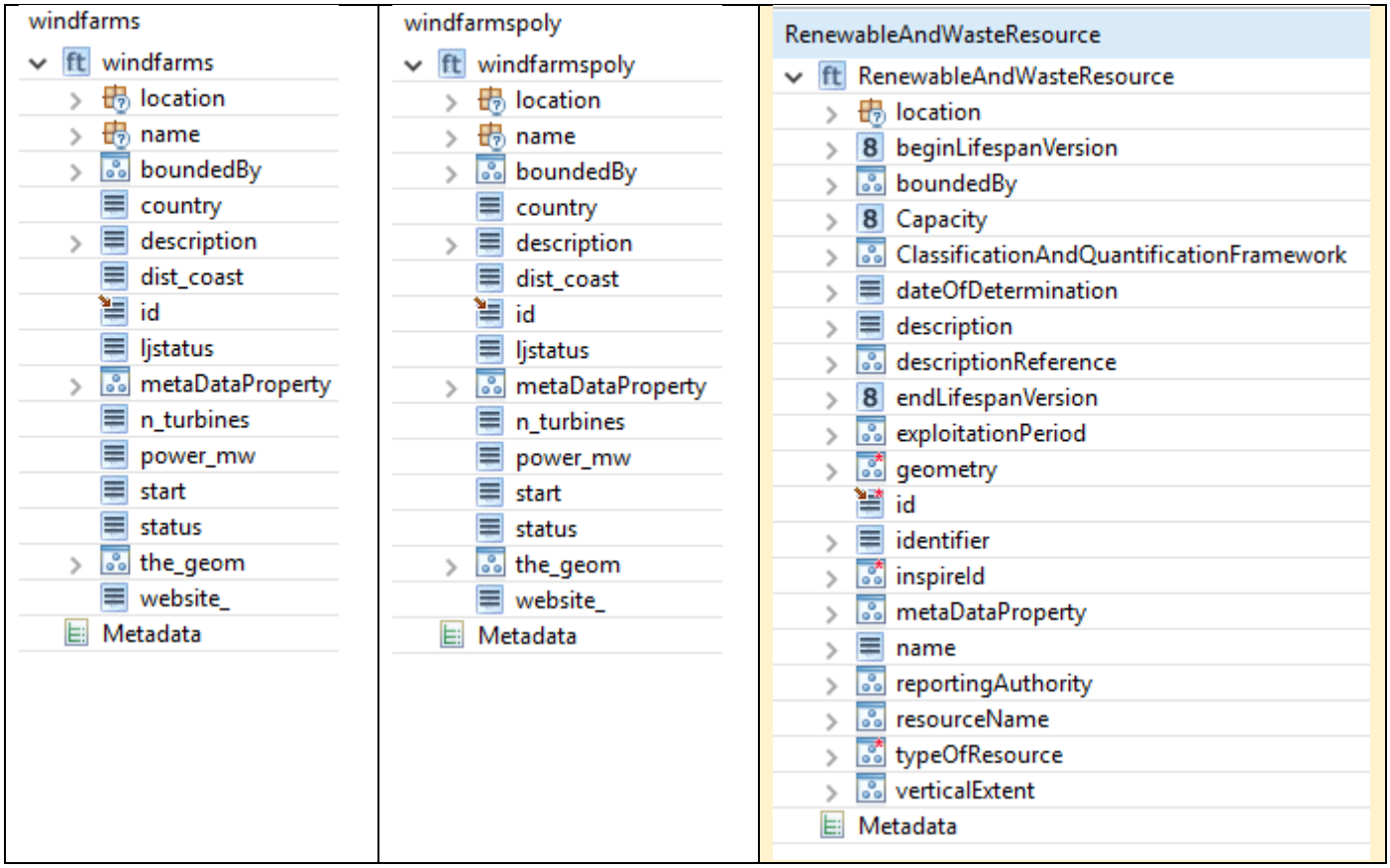


Table 18. Comparison of EMODnet's windfarms datasets' schemas with the [Renewable And Waste Resource] schema.

Other Forms of Area Management/Designation

Under this thematic category, EMODnet's human activities Portal includes several datasets:

The **baltic**, **mediterranean**, **northsea**, **northwesternwaters**, **southwesternwaters**, **pelagicstocks** and **longdistancefleets** datasets include the Regional Advisory Councils (RAC) areas. These RACs have been created after the reform of the common fisheries policy (CFP), and seek to involve stakeholders in the fisheries sector more closely in the decision-making process in this field. The RAC areas are meant to be management units areas based on biological criteria. In EMODnet, they are represented like polygons as exposed in the Atlas of the Seas. The schemas of these datasets are presented in Table 19.

EMODnets' datasets schemas covering the Regional Advisory Councils (RAC) areas.

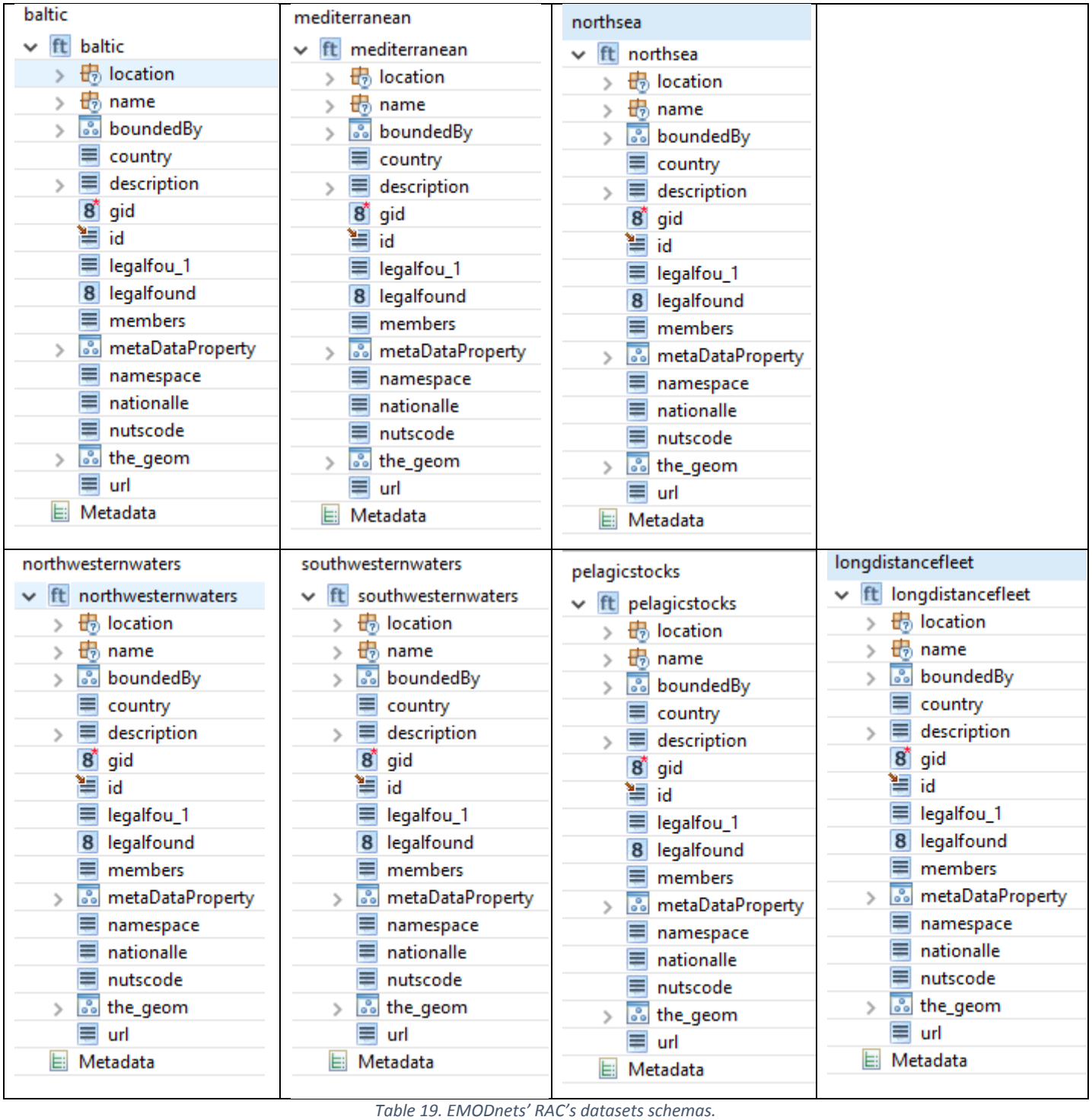


Table 19. EMODnets' RAC's datasets schemas.

Other datasets (**blacksea**, **aquaculture**, **markets**, and **outermostregions**) in this category include areas managed by other Advisory councils. The schemas of these datasets are presented in Table 20.

EMODnets' datasets schemas covering other international Advisory Councils areas.

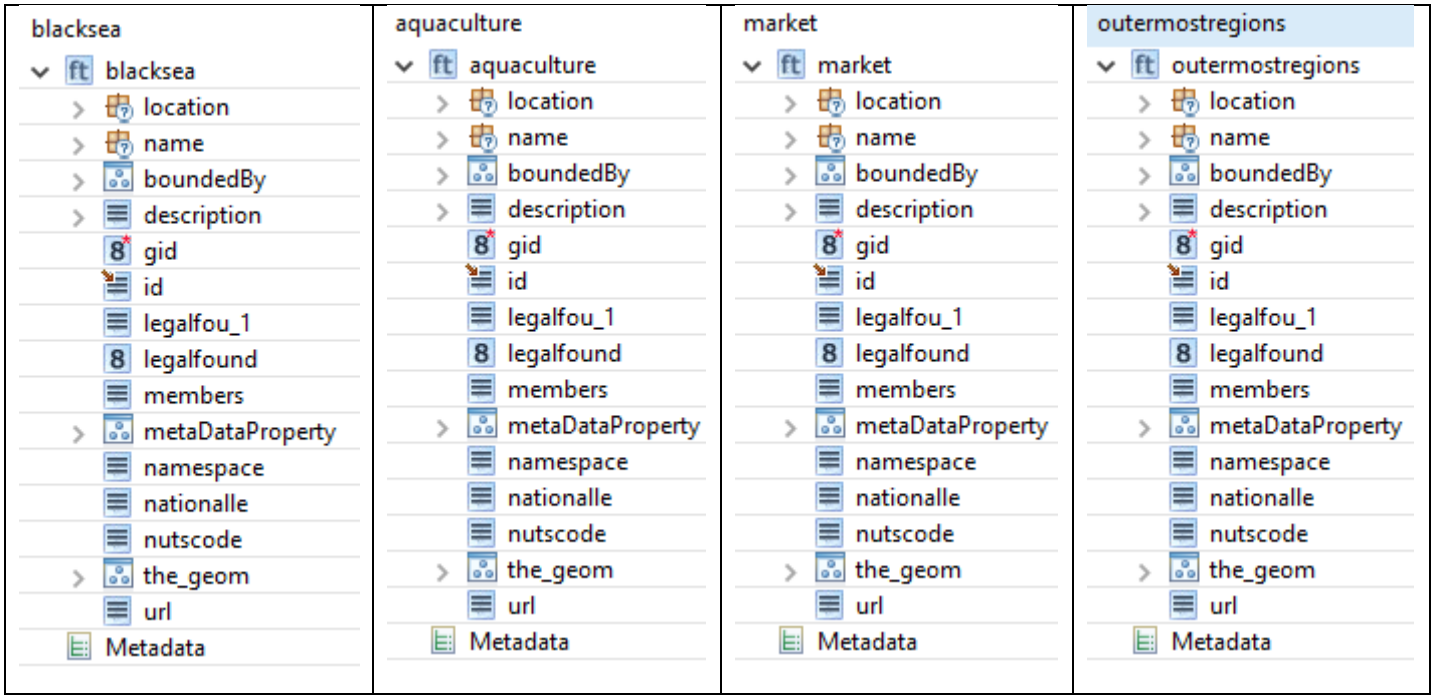


Table 20. EMODnets' european advisory councils' datasets schemas.

Furthermore, this thematic category in EMODnet's human activities portal includes datasets representing the areas covered by the Barcelona, Bucharest, HELCOM and OSPAR International Conventions. Bucharest Convention dataset was locally created by cutting marine area of Black Sea and Sea of Azov. HELCOM dataset was downloaded or connect via WMS to http://maps.helcom.fi/ArcGIS/services/DataDelivery/MapServer/WMSServer. The schemas of these datasets are presented in Table 21.

EMODnets' datasets schemas covering European Regional Sea Convention areas.

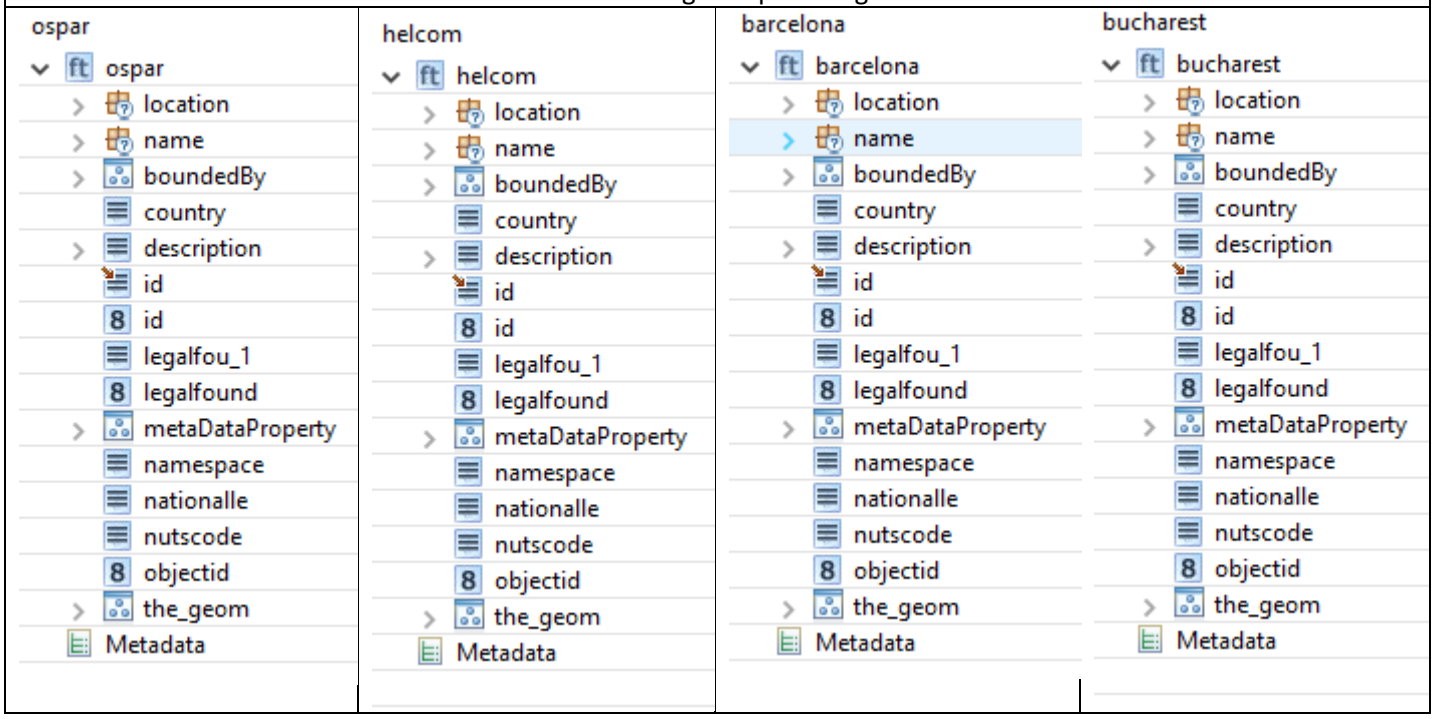


Table 21. EMODnets' RSC's datasets schemas.

All these datasets should be **aligned** with the INSPIRE's Annex III: Area Management Restriction and Regulation Zones model (already mentioned in the fisheries section concerning the **icesareas** dataset), using the "Management Restriction Or Regulation Zone" featuretype (Table 10) and choosing the "marine region" element from the Zone Type Code codelist (Figure 9), whose definition is exposed below.

marine region - [INSPIRE Code list value marine region]

Definition: *Marine regions and their subregions are sea regions designated under international, Union, national or sub-national legislation for the purpose of assessment, management and regulation.*
Description: *EXAMPLE 1: For each Marine Region a marine strategy shall be developed and implemented to maintain and improve good environmental status.\nSOURCE: Marine Strategy Framework Directive (2008/56/EC).\n\nEXAMPLE 2: Convention on the Protection of the Marine Environment of the Baltic Sea Area (Helsinki Convention) shall apply to the protection of the marine environment of the Baltic Sea Area which comprises the water-body and the seabed including their living resources and other forms of marine life.\n\nEXAMPLE 3: The Convention for the Protection of the marine Environment of the North-East Atlantic (OSPAR Convention) is dealing with specific areas like: prevention and elimination of pollution from land-based sources; prevention and elimination of pollution by dumping or incineration; prevention and elimination of pollution from offshore sources and assessment of the quality of the marine environment.\n\nEXAMPLE 4: Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (Barcelona Convention) aims to to prevent, abate and combat pollution of the Mediterranean Sea area and to protect and enhance the marine environment in that area.\n\nEXAMPLE 5: The Convention on the Protection of the Black Sea Against Pollution (Bucharest Convention) aims to prevent, reduce and control the pollution and protect the biodiversity and the marine living resources. \n\nEXAMPLE 6: UNEP Regional Seas Programme aims to address the accelerating degradation of the world's oceans and coastal areas through the sustainable management and use of the marine and coastal environment.*

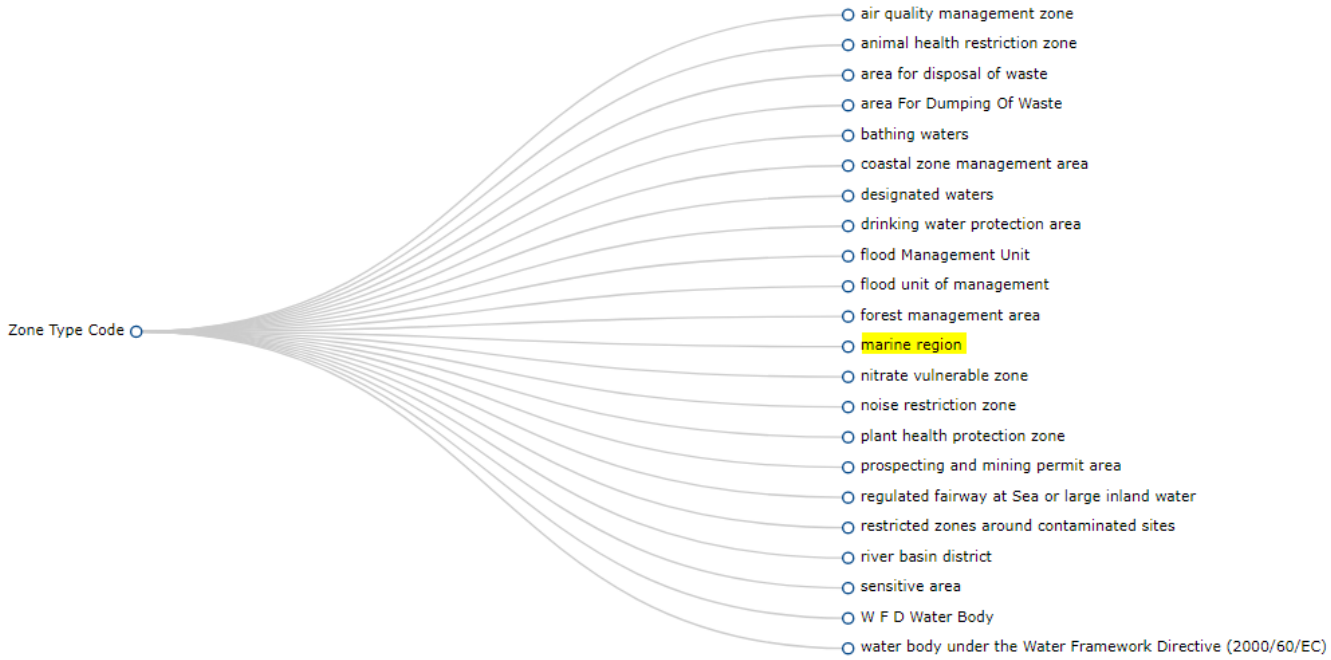


Figure 9. Elements included in the Zone Type code codelist in the INSPIRE Area Management Restriction and Regulation Zones model

It is worth mentioning that within INSPIRE there is also the Sea Regions model where a Sea Region is defined as:

a 2D geometry of an area or line with common (physical or chemical) characteristics that is covered by an ocean, sea or similar salt water body. The model allows the concept of named seas, as well subdivisions and aggregation of seas according to physical or chemical properties. The Sea Regions theme provides mechanisms to describe both the sea bed and sea surface as well as inter-tidal areas and the shoreline.

Thus, we consider that the EMODnet's management areas datasets are conceptually aligned to the INSPIRE's Annex III: Area Management Restriction and Regulation Zones model.

The **Maritime boundaries** dataset list the coordinates of points which are the vertices of segments which, in turn, define the maritime boundaries. This layer therefore features the following elements: - The textual content of international conventions establishing maritime boundaries in Europe. Maritime boundaries featured in this layer include territorial waters, bi- or multi-lateral boundaries (e.g. in the North Sea) as well as contiguous and exclusive economic zones. Some fishing areas are also defined. - The coordinates of points listed in these conventions are vertices of maritime boundaries - The maritime boundaries themselves, defined as the segments which links the different points listed in the international conventions. This layer covers the coast and surrounding seas of EU-25 as well as the sea around Iceland and Greenland. Restrictions are those cases where no regulatory text exists within the UNCLOS till now. Missing lines have been updated from marineregions.org even with no information about treats or regulatory text.

For this dataset the most appropriate INSPIRE data application schema would be the ANNEXI: Administrative Units/ Maritime Units model, where there are various featuretypes that may be applicable depending on the type of boundary (see different featuretypes and their definitions below).

Application schema - Maritime Units

Baseline - Spatial object type
The line from which the outer limits of the territorial sea and certain other outer limits are measured.
Maritime Zone - Spatial object type
A belt of sea defined by international treaties and conventions, where coastal State executes jurisdictional rights.
Maritime Boundary - Spatial object type
A line depicting the separation of any type of maritime jurisdiction.

The schemas of EMODnet's maritimebnds dataset and the INSPIRE Maritime Units model's featuretypes are presented in Table 22.

EMODnet's maritimebnds dataset schema	INSPIRE Maritime Units model's featuretypes shemas

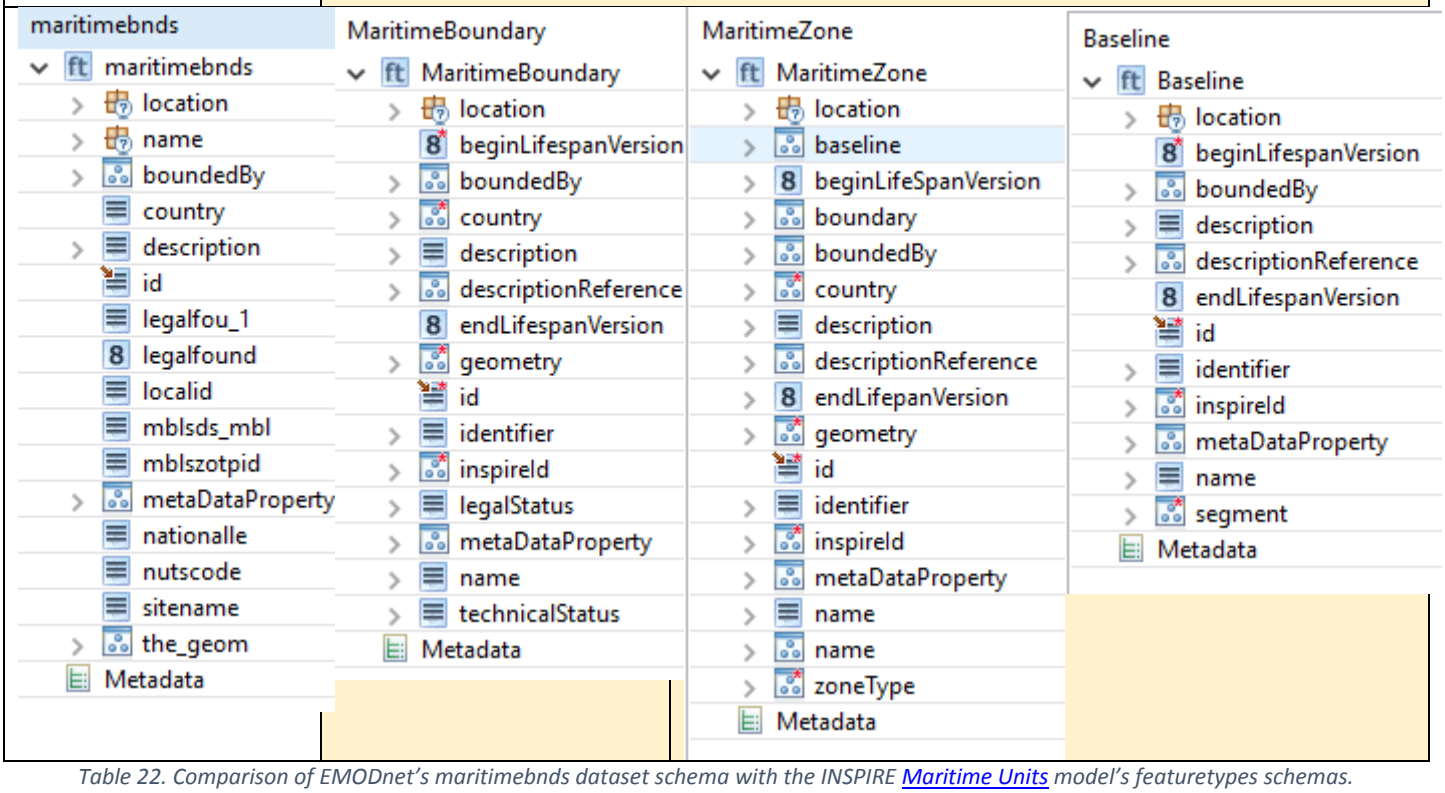


Table 22. Comparison of EMODnet's maritimebnds dataset schema with the INSPIRE Maritime Units model's featuretypes schemas.

Pipelines and Cables

The **bshcontiscables**, **kisorcables** and **sigcables** datasets contain lines representing actual submarine telecom cable routes locations. The underlying data are collated from a variety of sources: SIGCables (managed by Orange), the Federal Maritime and Hydrographic Agency (BSH Contis), and Greg's Cable Map (via Kis-Orca). Their schemas are presented in Table 23.

EMODnet's cables datasets schemas.

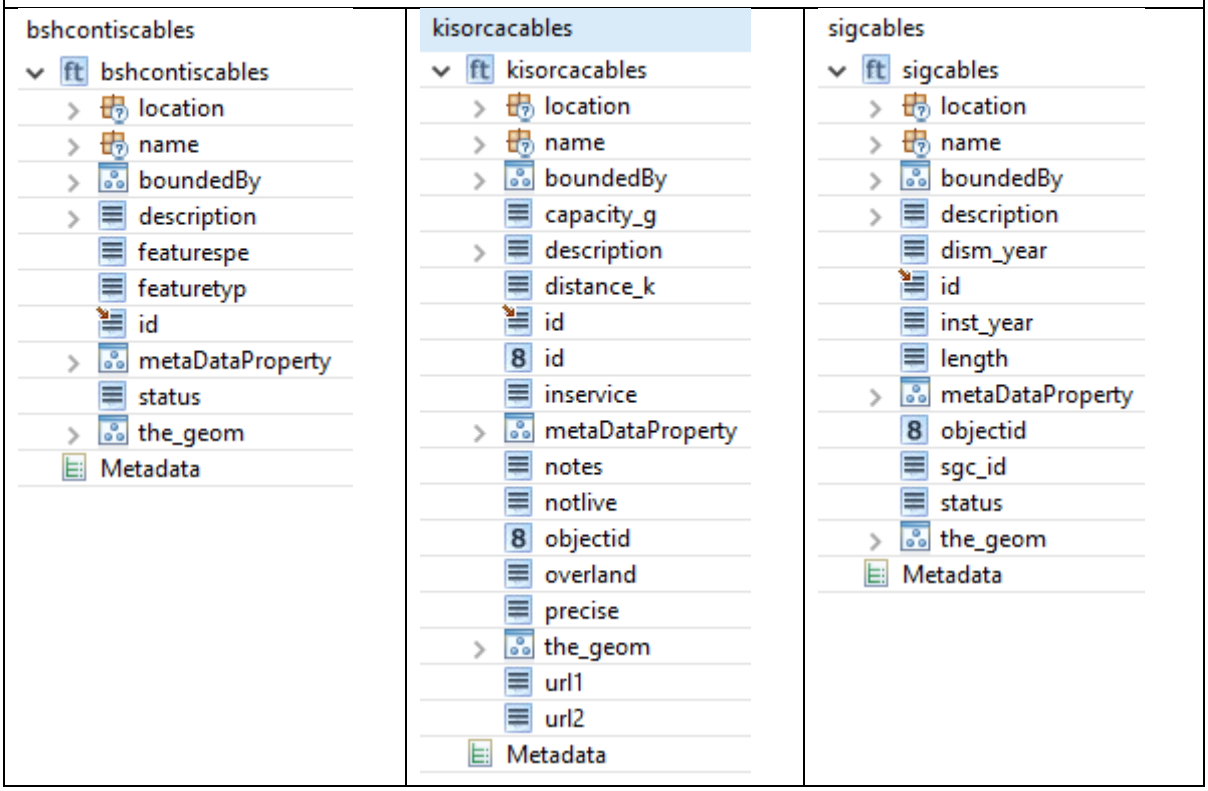


Table 23. EMODnets cables datasets schemas.

The **cableschematic** and **landing** datasets contain lines and points representing cables and related landing points for Telecommunication network: The underlying data is property of Telegeography and is available online at https://github.com/telegeography/www.submarinecablemap.com. Compared with the previous version, this version of includes the gigabit per second values that come from the Cable System Database of the Packet Clearing House organization and are available online at https://prefix.pch.net/applications/cablesystem/. Cables are represented as stylised paths, as actual cable routes locations are not available in most cases. The dataset includes any cable that crosses the EU waters (Marine regions). Marine regions and subregions boudaries are defined in Article 4 of the Marine Strategy Framework Directive (MSFD) and available online at https://www.eea.europa.eu/data-and-maps/data/msfd-regions-and-subregions. Their schemas are presented in Table 24.

EMODnets cablesscematic and landings datasets schemas	
cablesschematic	landingstations
ft cablesschematic location name boundedBy capacity capacity_g description id id landing_po lenght_km metaDataProperty owners rfs source the_geom url_1 url_2 Metadata	ft landingstations location name boundedBy description id metaDataProperty source the_geom Metadata

Table 24. EMODnets cablesscematic and landings datasets schemas

Within INSPIRE, there is an application schema dedicated to cable transport networks. This schema is meant for cableway transports infrastructures such as those included in the Cableway Type Value codelist (Figure 10), and thus cannot be aligned with the cables datasets in EMODnet.

Figure 10. Elements in the Cableway Type Value codelist.

The INSPIRE application schema that includes information on telecommunication cables is the Common Utility Network Elements. This application includes several featuretypes that may be associated to the cable lines and landing points (if considered as nodes). All these featuretypes are listed here. Among these featuretypes we will outline the Telecommunication cable featuretype (subtype of cable featuretype) that could be aligned with EMODnet's cables datasets and the Appurtenance (appurtenance is a node object that is described by its type via the attribute "appurtenanceType"), which is a subtype of Utility node featuretype. A subtype of Appurtenance is the Telecommunications Appurtenance Type Value code list that includes the following elements:

- antenna
- copper
- Maintenance Loop
- copper Repeater
- digital Cross Connect
- digital Loop Carrier
- exchange
- fiber Interconnect
- joint Closure
- load Coil
- main Distribution Frame
- multiplexer
- optical Maintenance Loop
- optical Repeater
- patch Panel
- splice Closure
- splitter
- terminal
- termination
- notice Board

Besides, in the Common Utility Network Elements model we also find the Utility link feature type that is described as *"a linear spatial object that describes the geometry and connectivity of a utility network between two points in the network."*

In Table 25 are presented the alternative featuretypes in INSPIRE's Common Utility Network Elements model to represent the EMODnet's cables and landings datasets.

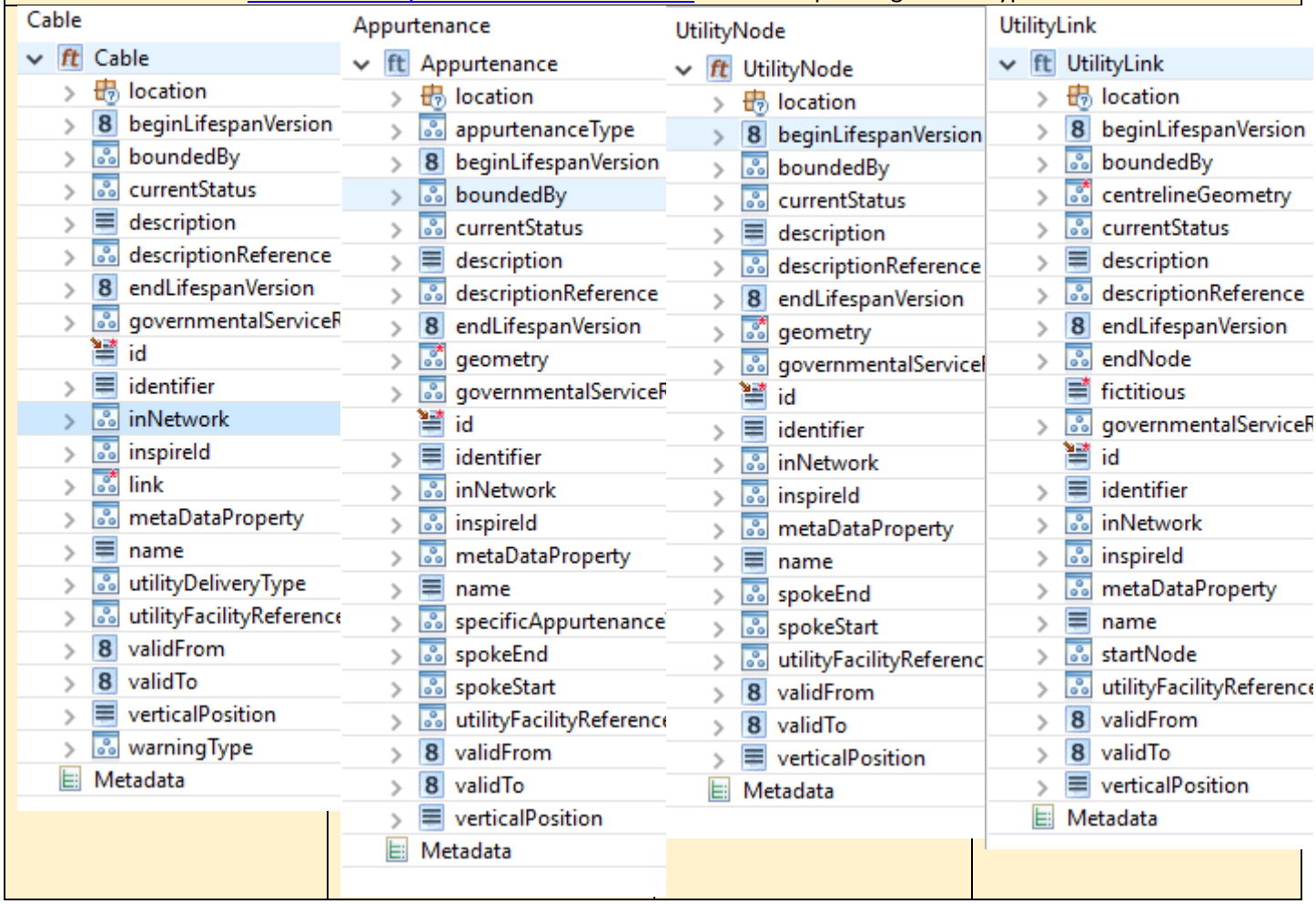
INSPIRE Common Utility Network Elements mode and corresponding featuretypes schemas


Table 25. INSPIRE Common Utility Network Elements mode and corresponding featuretypes schemas.

The **pipelines** dataset is the result of the aggregation and harmonization of datasets provided by several sources from all over the EU (plus Norway). The database contains lines representing the actual routes of offshore pipelines (where available) in the following countries: Croatia, Denmark, Estonia, Finland, Germany, Ireland, Netherlands, Norway, Poland, Russia, Spain (Andalucía). Each line has the following harmonized attributes (where available): status (in service, decommissioned, under construction, proposed, planned), country, code, name, year, medium (air, condensate, 'control', cooling water, gas, geothermal heating, glycol, methanol, oil, sewage, water), operator, from and to locality or facility, length (meters) and size (inches).

Under INSPIRE Common Utility Network Elements model we find the Pipe featuretype, that includes different subtypes according to the type of pipe:

- Oil Gas Chemicals Pipe
- Sewer Pipe
- Thermal Pipe
- Water Pipe

The comparison between EMODnet's pipelines dataset schema and INSPIRE Common Utility Network Elements model's pipe featuretype schema is presented in Table 26..

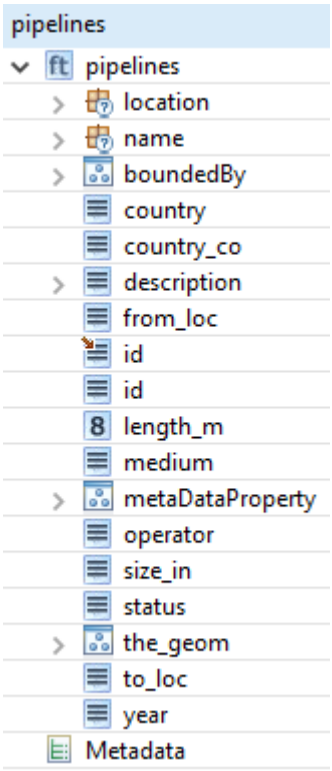
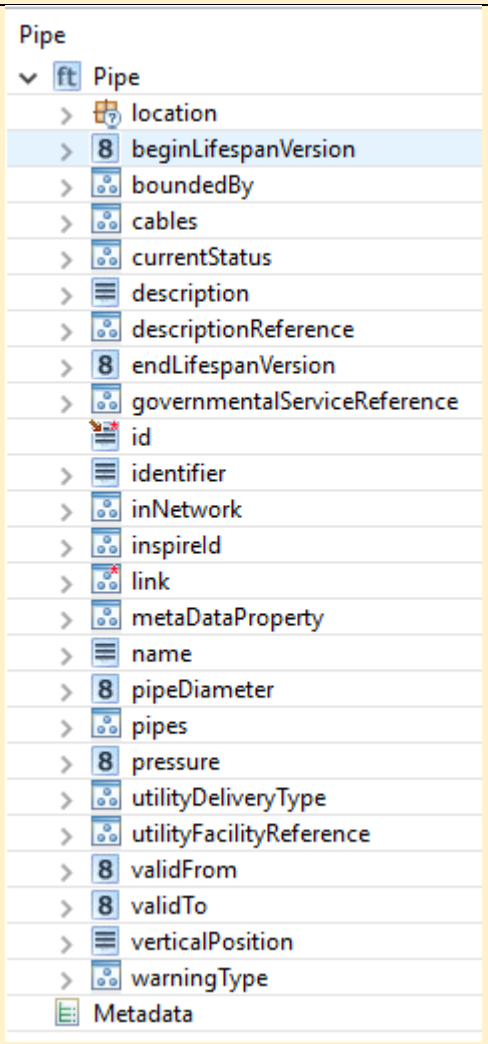
EMODnet's pipelines dataset schema	INSPIRE Common Utility Network Elements model's pipe featuretype schema
	

Table 26. Comparison between EMODnet's pipelines dataset schema and INSPIRE Common Utility Network Elements model's pipe featuretype schema.

When looking into the whole INSPIRE domain, pipelines for water, sewage and fuel/gas are also included under Land Use theme: Existing Land Use, Sampled Land Use and Planned Land Use. Within these application schemas, cables and pipes are considered as Land Use attribute. The Land Use attribute uses elements from the HILUCS Land Use Value - Code list that among many other elements, includes the utilities shown in Figure 11.

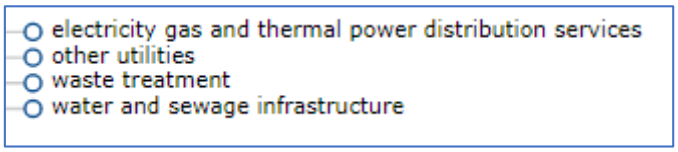


Figure 11. Utility elements included in the HILUCS Land Use Value - Code list

Waste Disposal

The **dredgespoil** and the **munitions** datasets contain information about either polygons and points representing sites where dredge dumping and dumping of munitions is performed. in Baltic Sea, North Sea, Celtic Seas, Iberian Coast and Bay of Biscay, Macaronesia and Mediterranean Sea. Information was picked form different sources depending on the country.

In INSPIRE we have found the following featuretypes that may be aligned to these datasets:

For **dredgespoil**, under the INSPIRE Mineral Resources model there is a featuretype called Mining waste which is a subtype of "Miningfeature" featuretype and whose definition and attributes are shown Figure 12.

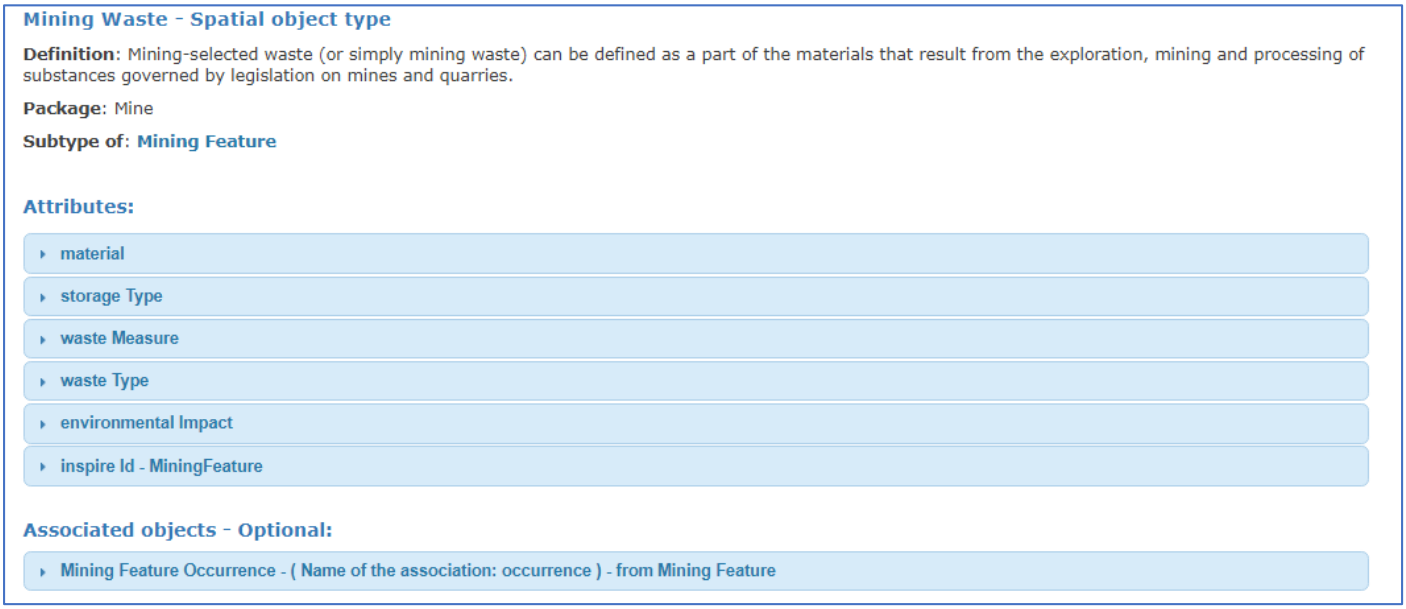


Figure 12. Mining Waste featuretype's atributes

Under the INSPIRE Area Management Restriction and Regulation Zones model, and as an attribute of its "ManagementRestrictionOrRegulatiionZone" featuretype, we have found under the Zone Type codelist, which includes the "area For Dumping Of Waste" (Figure 13) defined as follows:

area For Dumping Of Waste - [INSPIRE Code list value area For Dumping Of Waste]

Definition: *Area affected by uncontrolled disposal of waste as defined in Waste Framework Directive (2006/12/EC) Art 4.*

Figure 13. area For Dumping Of Waste element within the Zone Type codelist.

Finally, under the INSPIRE Geology application schema and under the "Geomorphologic Feature" featuretype, we find the AnthropogenicGeomorphologicFeatureTypeValue codelist (Figure 14) that contains "dump" element defined as follows:

dump - [INSPIRE Code list value dump]

Definition: *An area of smooth or uneven accumulations or piles of waste rock, earthy material, or general refuse that without major reclamation are incapable of supporting plants.*

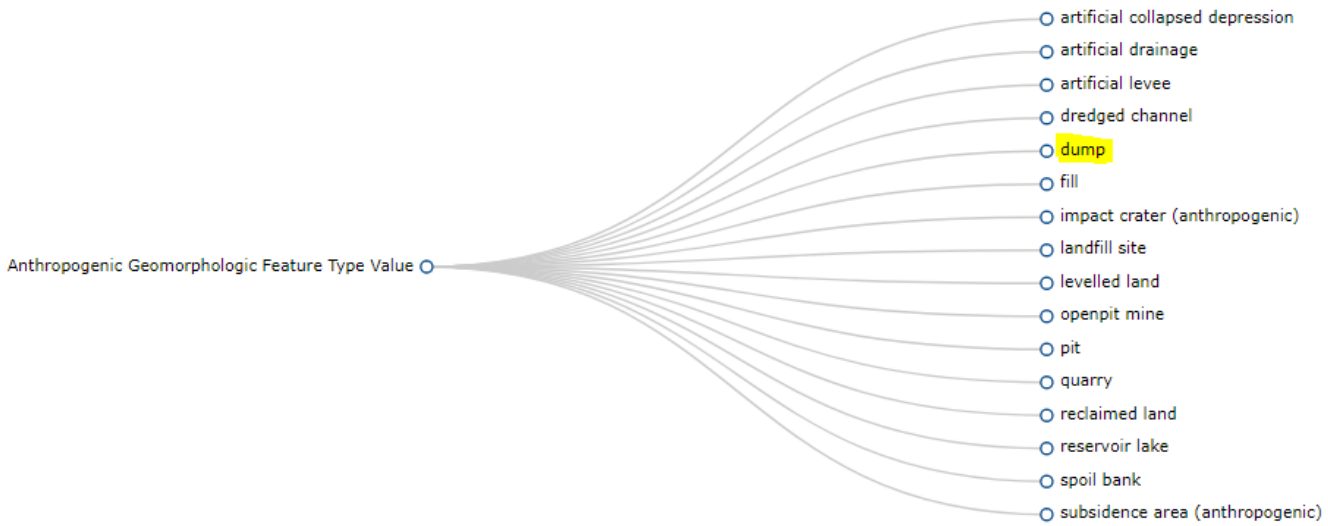


Figure 14. "Dump" element within the AnthropogenicGeomorphologicFeatureTypeValue codelist.

In Table 27 are presented the EMODnet's dredgespoil dataset's schema and the ManagementRestrictionOrRegulatiionZone & AnthropogenicGeomorphologicFeature featuretypes.

EMODnet's dredgespoil dataset schema.	INSPIRE's Annex III: Area Management Restriction and Regulation Zones- ManagementRestrictionOrRegulatiionZone featuretype	INSPIRE's Annex III: Geology- AnthropogenicGeomorphologicFeature featuretype
dredgespoil dredgespoil location name boundedBy country depth__m_ description dist_coast id metaDataProperty objectid oscom_code status the_geom updateyear year_opera Metadata	ManagementRestrictionOrRegulationZone ManagementRestrictionOrRegulationZone location beginLifespanVersion boundedBy competentAuthority description descriptionReference designationPeriod endLifespanVersion environmentalDomain geometry id identifier inspireId legalBasis metaDataProperty name name plan relatedZone specialisedZoneType thematicId zoneType Metadata	AnthropogenicGeomorphologicFeature AnthropogenicGeomorphologicFeature location anthropogenicGeomorphologicFeatureTy boundedBy description descriptionReference geologicHistory id identifier inspireId metaDataProperty name name themeClass Metadata

Table 27. EMODnet's dredgespoil dataset's schema compared with the ManagementRestrictionOrRegulatiionZone & AnthropogenicGeomorphologicFeature featuretypes schemas.

In the case of the munition dumping dataset, only the ManagementRestrictionOrRegulatiionZone featuretype seems to be alignable with the munition dupmping dataset if we 'd consider munition as a type of waste. If munition dumping zones should be better considered as hazardous areas, the same featuretype could be applied but then the zonetype would correspond to "a restricted zone around contaminated sites"

restricted zones around contaminated sites - [INSPIRE Code list value restricted zones around contaminated sites]

Definition: *Zones established to protect human, plant and animal health and control movement and development within a contaminated site.*
Description: *EXAMPLE: Chernobyl Nuclear Power Plant Exclusion Zone which was established to evacuate the local population and to prevent people from entering the heavily contaminated territory.\n\nEXAMPLE: Zone established around an area suffering from soil contamination to restrict development and protect human health.*

We may mention that for Hazardous events, there is a INSPIRE model for Natural Risk Zones that consider a list of hazard types in the Natural Hazard Classification codelist. This codelist includes many natural hazards but not anthropogenic ones such as munitions. In Table 28 is presented the schema of EMODnet's munition dataset.

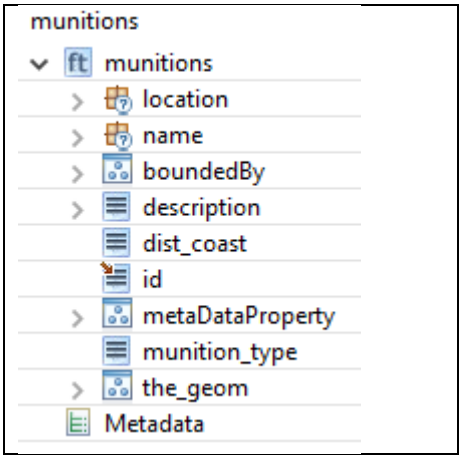


Table 28. Schema of EMODnet's munition dataset

Recursive attributes in EMODnet's datasets and their consideration in INSPIRE

There are some recursive attributes in EMODnet's datasets such as countries, data sources, etc., for which we have looked at, in INSPIRE data specifications.

Countries

The INSPIRE Application schema Base Types 2, contains the CountryCode codelist that includes the Country code as defined in the Interinstitutional style guide published by the Publications Office of the European Union.

When several countries share some authority over the same area, the INSPIRE Administrative Units application schema includes the Condominium featuretype defined as *"An administrative area established independently to any national administrative division of territory and administered by two or more countries".*

Related partys

For attributes that include a reference to a related party (data provider, authority, etc) the INSPIRE Administrative Units application schema includes the Related Party data type (see Figure 15)

Related Party - Data type

Definition: An organisation or a person with a role related to a resource.

Description: NOTE 1 A party, typically an individual person, acting as a general point of contact for a resource can be specified without providing any particular role.

INSPIRE Application schema: **Base Types 2** - [INSPIRE Application schema Base Types 2]

Attributes:

- individual Name
- organisation Name
- position Name
- contact
- role

Constraints:

- individual, organisation or position name shall be provided

Figure 15. Attributes of the INSPIRE Related Party data type included in the INSPIRE Administrative Units application schema.

Dates and Time intervals (periods)

For these kind of attributes INSPIRE includes a valuetype called TM_GeometricPrimitive that includes “TM_Instant” and a related “TM_Period” to hold both individual dates and periods (see Figure 16)

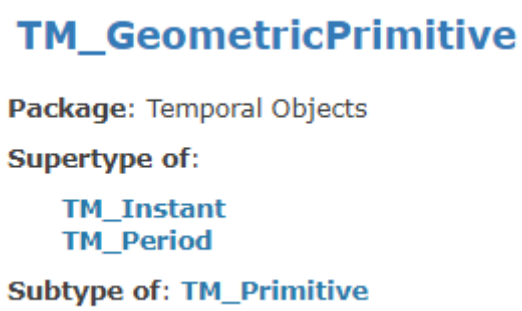


Figure 16.INSPIRE TM_GeometricPrimitive Valuetype.

Conclusions and Discussion

After the first analysis of current EMODnet's datasets schemas against the elements (application schemas, featuretypes, codelists, etc.) in INSPIRE, we can conclude:

Thematic alignment:

- ✓ Most datasets in EMODnet human activities can be related to an existing INSPIRE application schemas and featuretypes.
- ✓ Some datasets can be related to more than one INSPIRE application schemas, so a deeper analysis should be made to decide to which of these different application schemas it aligns best.
- ✓ There are some INSPIRE models that are directly (thematically) related to the EMODnet datasets (i.e. aquaculture) and others that are related more indirectly (i.e. munition dumping).

Similarity of spatial objects and attributes

Even in the cases where the EMODnet's datasets are directly related to an INSPIRE application schema and featuretype, the differences between the models are important and the harmonization process to define and implement the transformation rules can be rather complex.

Some recursive attributes on common attributes such as country, dates, etc. could be already transformed to the INSPIRE specifications (i.e countrycodes, commodities, Date attributes).

For the cases where some of the information contained in EMODnet data models is not considered within the related INSPIRE application schema there may be two alternatives:

- ➢ Transform the data model using a combination of different INSPIRE application schemas (for example in the cases where some areas (i.e. portnodes or portareas) have different statistics associated to them (portgoods, portpassengers, portvessels).
- ➢ Propose/create and extending INSPIRE data model with attributes that are included in the EMODnet model. This alternative would be much more time consuming and should involve INSPIRE Maintenance and Implementation Group.

At this moment we'd need to analyse better how these alternatives should be implemented, and which solutions would be most suitable, based on the recommendations of INSPIRE experts and other data managers experience.

Data lineage

In many cases the EMODnet's datasets are got from Official administrations or organisms that are also subjected to implement INSPIRE data models.

Considering the INSPIRE principle on "input once, use many", a possible recommendation could be to contact those organizations in order to check about their plans to align their datasets to INSPIRE data specifications and try to harmonize only those datasets and parts of datasets produced within the scope of EMODnet's data gathering tasks.

Next steps

This analysis will be presented to INSPIRE experts to confirm that the results of this analysis are correct, and to ask for advice on the best way to proceed with harmonization.