Project co-financed by the European Regional Development Fund

Acronym: AMAre

Project Title: AMARe - Actions for Marine Protected Areas

Priority Axis 3: Protecting and promoting Mediterranean natural and cultural resources

Specific Objective: 3.2 To maintain biodiversity and natural ecosystems through strengthening the management and networking of protected areas

https://amare.interreg-med.eu/

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Hellenic Centre for Marine Research (HCMR)

Euro-Mediterranean Centre on Climate Change (CMCC)

National Research Council (CNR)

Spanish National Research Council (CSIC)

French Research Institute for Explotation of the Sea (IFREMER)

National Inter-University Consortium for Marine Sciences (CoNISMA)

University of Malta (UdM)

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Summary

List of abbreviations and terms

CDI – Common Data Index

CMCC - Euro-Mediterranean Centre on Climate Change (

CoNISMA - National Inter-University Consortium for Marine Sciences

db – database

gdb – geodatabase

fk – foreign key

pk – primary key

GIS - Geographic information system

HCMR - Hellenic Centre for Marine Research

IFREMER - French Research Institute for Explotation of the Sea

MPA – Marine Protected Area

OCG: Open Geospatial Consortium

SDI – Spatial Data Infrastructure

UdM - University of Malta

UML – Unified Modeling Language

WMS: Web Map Service

Executive summary

Design of a common architecture and implementation of a geodatabase to store, manage and share data for monitoring biodiversity and environmental data within the three MPAs. We will capitalize on past experience in this field (see the Repository of CoCoNet, http://coconetgis.ismar.cnr.it/). The geodatabase represents a critical tool for managing and networking the protected areas, homogenizing and standardizing data and indicators useful for monitoring changes in biodiversity and the services it provides. In this way a shared and standard protocol for data storing and sharing will be implemented strengthening the networking of the protected areas at management level. It will be friendly enough to be visualized and used by different stakeholders.

1. Introduction

This document represents a user guide for Marine Protected Area (MPA) managers and in general for all the users of the AMAre Geodatabase and the AMAre Geoportal. The document describes in detail the conceptual model and all elements of the physical models. It contains an explanation of each group deriving from the INSPIRE themes, a detail description of each elements of the geodatabase including all feature datasets, feature classes, object classes and relationship classes. It is a fundamental document to understand the meaning of the data stored in the geodatabase that should last for a long term usage of this spatial tools for management purposes. This document intends to give the instructions for a the geodatabase maintenance after the end of the AMAre project by the MPAs managers. Furthermore, the document depicts the spatial geoportal explaining all tools available and all OGC services. It provides training material for geoportal users.

2. Conceptual model

The conceptual data model comes from the INSPIRE Directive, started on 15 May 2007 and implemented in various stages, with full implementation required by 2019. The INSPIRE Directive establishes an infrastructure for spatial information in Europe to support Community environmental policies, addressing 34 spatial data themes needed for environmental applications, with key components specified through technical implementing rules.

The Infrastructure for Spatial Information in Europe (INSPIRE) is a directive passed by the European Commission to establish a European-wide Spatial Data Infrastructure (SDI). Its goal is for an internet-accessible infrastructure of technologies and permissions to tie European geospatial information producers and users together into a single geospatial information-sharing community to improve decision making and operations in service of a productive and sustainable Europe. This will enable sharing of environmental spatial information among public sector organizations and better facilitate public access to spatial information across Europe.

INSPIRE is based on a number of common principles:

- Data should be collected only once and kept where it can be maintained most effectively.
- It should be possible to combine seamless spatial information from different sources across Europe and share it with many users and applications.

- It should be possible for information collected at one level/scale to be shared with all levels/scales; detailed for thorough investigations, general for strategic purposes.
- Geographic information needed for good governance at all levels should be readily and transparently available.
- Easy to find what geographic information is available, how it can be used to meet a particular need, and under which conditions it can be acquired and used.

The CoCoNet project is one of the first attempt to apply the INSPIRE conceptual model to reality. In this framework we use the data specifications as starting point to develop the CoCoNet logical models. The result was a no-compliant structure, that meets the project needs and deals an understandable language. The model has been simplified in order to fit with the requests of a WebGIS platform and to catch a wide range of stakeholders.

3. Logical model

We started from the CoCoNet logical data models:

1. ProtectedSites
2. OffshoreWindFarms
3. HabitatsAndBiotopes
4. Biodiversity
5. Threats
6. Socioeconomics
7. Oceanography
8. Geology
9. MaritimeUnits
10. BiogeographycalAndSeaRegions
11. Elevation
12. Connectivity
13. HabitatMApping

to obtain a unique structure, integrating all aspects concerning a MPA from management to distribution of habitats and threats.

We modeled the logical schema win Enterprise Architect software, a standards-based modeling environment who defines mappings between UML 2 and ArcGIS concepts, and prototypes an automated import and export capability for ArcGIS geodatabase schemas represented in UML.

The model consists of 17 feature datasets managing 76 feature classes, 59 relationship classes, 39 tables and 13 raster catalogs. The elements are described in this document by 10 thematic groups: Administration, Biodiversity, Elevation, Geology, Habitats and biotopes, Hydrography, Monitoring, Oceanography, Socioeconomics, Threats.

3.1. Administration

This thematic group deals with administrative features and consists of one feature dataset “Administration” with five feature classes:

- Boundary
- LegalVertex
- MPA
- OtherProtectedSite
- Zoning

and six object classes:

- ActivitiesManagement
- DesignationType
- Documents
- Indicators
- ManagementBody
- ManagementPlan

The following table shows how the feature classes are related to the object classes:

Name	Multiplicity	Origin class	Destination class	Primary key	Foreign key
ZoningHas ActivitiesManagement	1→1..*	Zoning	ActivitiesManagement	ZoneID	ObjectIDfk
MPAhas DesignationType	1→1..*	MPA	DesignationType	SiteID	ObjectIDfk
MPAhasDocuments	1→1..*	MPA	Documents	SiteID	ObjectIDfk
MPAhasIndicators	1→1..*	MPA	Indicators	SiteID	ObjectIDfk
MPAhas ManagementPlan	1→1..*	MPA	ManagementPlan	SiteID	ObjectIDfk

MPAhas ManagementBody	1→1..*	MPA	ManagementBody	SiteID	ObjectIDfk
OtherProtectedSiteHas DesignationType	1→1..*	OtherProtectedSite	DesignationType	SiteID	ObjectIDfk
OtherProtectedSiteHas Documents	1→1..*	OtherProtectedSite	Documents	SiteID	ObjectIDfk
OtherProtectedSiteHas Indicators	1→1..*	OtherProtectedSite	Indicators	SiteID	ObjectIDfk
OtherProtectedSiteHas ManagementPlan	1→1..*	OtherProtectedSite	ManagementPlan	SiteID	ObjectIDfk
OtherProtectedSiteHas ManagementBody	1→1..*	OtherProtectedSite	ManagementBody	SiteID	ObjectIDfk

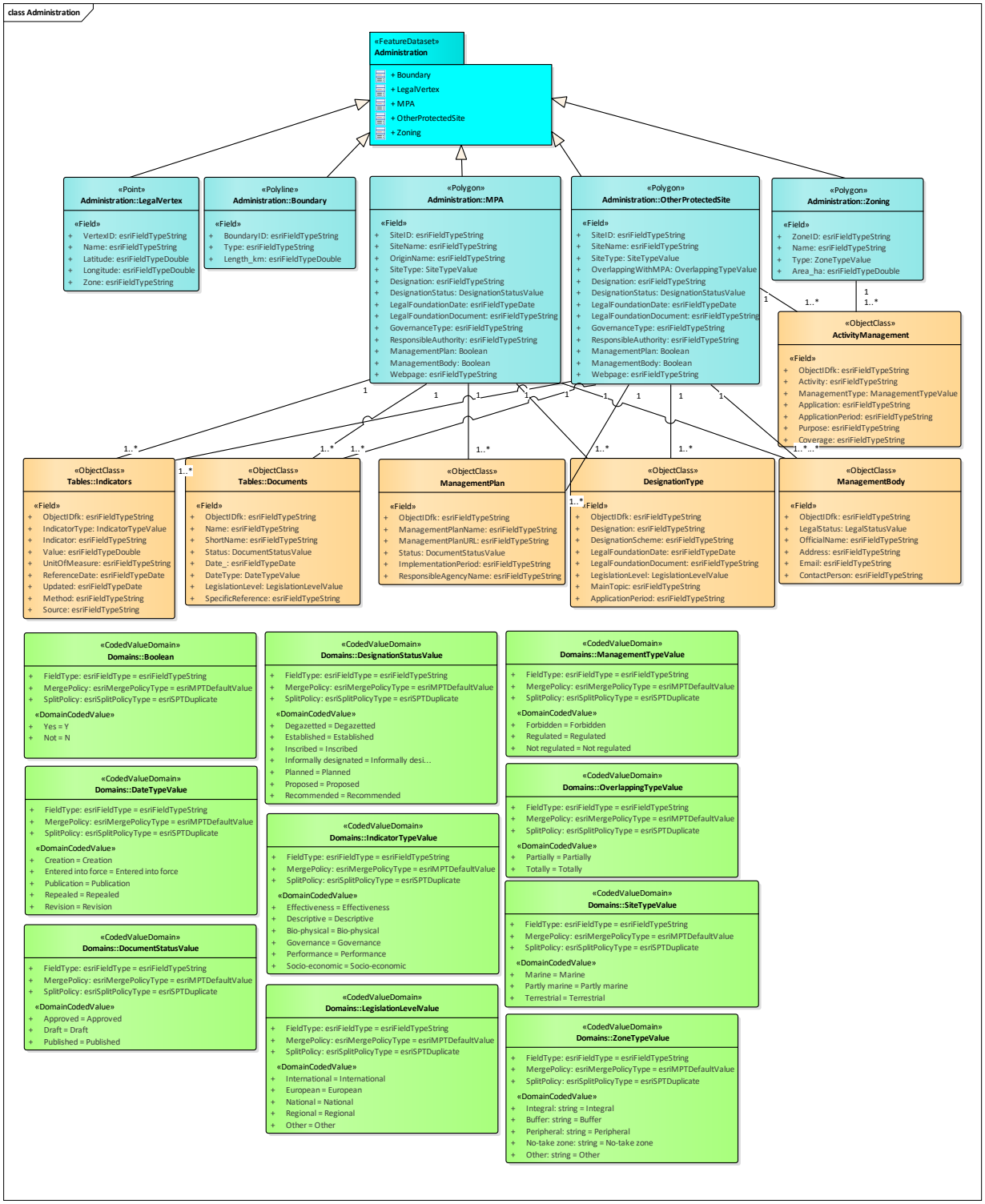

Fig.1 – UML schema of the “Administration” theme.

3.1.1. Feature Class: Boundary

Description: outer boundaries of the MPA.

GeometryType: polyline

Field	Type	Restriction	Description
BoundaryID	String	None	Identification string of the boundary
Type	String	None	Type of boundary
Length_km	Double	None	Length of the boundary in kilometers

3.1.2. Feature Class: LegalVertex

Description: verteces of the zones of the MPA coming from legal document.

GeometryType: point

Field	Type	Restriction	Description
VertexID	String	None	Identification string of the vertex.
Name	String	None	Legal name of the vertex
Latitude	Double	GG,YYYYYY	Legal latitude of the vertex
Longitude	Double	GG,XXXXXX	Legal longitude of the vertex
Zone	String	None	Zone/zones to witch the vertex belongs

3.1.3. Feature Class: MPA

Description: extent of the Marine Protected Area (MPA).

GeometryType: polygon

Field	Type	Restriction	Description
SiteID	String	None	Identification string of the site.
SiteName	String	None	English name of the site
OriginName	String	None	Name of the site in the original language
SiteType	String	Domain: SiteTypeValue	Type of site (marine, partly marine, terrestrial)
Designation	String	None	Type of designation
DesignationStatus	String	Domain:	Legal status of the designation

		DesignationStatusValue	
LegalFoundationDate	Date	dd/mm/yyyy	Date of the foundation of the MPA
LegalFoundationDocument	String	None	Name or link of the document of the foundation
GovernaceType	String	None	Type of governance
ResponsibleAuthority	String	None	Name of the responsible authority
ManagementPlan	String	Domain: Boolean	Presence or absence of a legal management plan
ManagementBody	String	Domain: Boolean	Presence or absence of a legal management body
Webpage	String	URL	Link of the official webpage of the MPA

3.1.4. Feature Class: OtherProtectedSite

Description: extent of the other designated protected sites that coexist on the same territory of the MPA.

GeometryType: polygon

Field	Type	Restriction	Description
SiteID	String	None	Identification string of the site.
SiteName	String	None	English name of the site
SiteType	String	Domain: SiteTypeValue	Type of site (marine, partly marine, terrestrial)
OverlappingWithMPA	String	Domain: OverlappingTypeValue	Type of overlapping between the protected site and the MPA
Designation	String	None	Designation of the site
DesignationStatus	String	None	Legal status of the designation
LegalFoundationDate	Date	dd/mm/yyyy	Date of the foundation of the MPA
LegalFoundationDocument	String	None	Name or link of the document of the foundation
GovernaceType	String	None	Type of governance
ResponsibleAuthority	String	None	Responsible authority
ManagementPlan	String	Domain: Boolean	Presence or absence of a legal management plan
ManagementBody	String	Domain: Boolean	Presence or absence of a legal management body

Webpage	String	URL	Link of the official webpage of the MPA

3.1.5. Feature Class: Zoning

Description: extent of the zones of the MPA.

GeometryType: polygon

Field	Type	Restriction	Description
ZoneID	String	None	Identification string of the zone
Name	String	None	Name of the zone
Type	String	None	Type of protection
Area_ha	Double	None	Area in hectares

3.1.6. Object Class: ActivityManagement

Description: table describing the activities in the MPA.

Field	Type	Restriction	Description
ObjectIDfk	String	None	Identification string of the zone (foreign key)
Activity	String	None	Type of activity
ManagementType	String	Domain: ManagementTypeValue	Type of management of the activity
Application	String	None	Application of the activity
ApplicationPeriod	String	None	Period of application of the activity
Purpose	String	None	Purpose of the regulation
Coverage	String	None	Coverage of the regulation

3.1.7. Object Class: DesignationType

Description: table describing the designations of the site.

Field	Type	Restriction	Description
ObjectIDfk	String	None	Identification string of the site (foreign key)
Designation	String	None	Designation of the site
DesignationScheme	String	None	Scheme of designation
LegalFoundationDate	Date	dd/mm/yyyy	Date of foundation
LegalFoundationDocument	String	None	Name or link of the document of foundation
LegislationLevel	String	Domain: LegislationLevelValue	Level of legislation

MainTopic	String	None	Main topics of the designation
ApplicationPeriod	String	None	Application period of the designation

3.1.8. Object Class: Documents

Description: table describing the documents related to the site.

Field	Type	Restriction	Description
ObjectIDfk	String	None	Identification string of the site (foreign key)
Name	String	None	Name of the document
ShortName	String	None	Short name or alternative title of the document
Status	String	Domain: DocumentStatusValue	Status of the document
Date_	Date	dd/mm/yyyy	Date of creation, publication or revision of the document
DateType	String	Domain: DateTypeValue	Type of date indicated in “Date_”
LegislationLevel	String	Domain: LegislationLevelValue	The level at which the legislative instrument is adopted
SpecificReference	String	None	Reference to a specific part of the document
Link	String	URL	Link to an online version of the document

3.1.9. Object Class: Indicators

Description: list of indicators.

Field	Type	Restriction	Description
ObjectIDfk	String	None	Identification string of the site (foreign key)
IndicatorType	String	Domain: IndicatorTypeValue	Type of indicator
Indicator	String	None	Name of the indicator
Value	Double	None	Value of the indicator
UnitOfMeasure	String	None	Unit of measure of the indicator
ReferenceDate	Date	dd/mm/yyyy	Date which the value refers
Updated	Date	dd/mm/yyyy	Date of the last update
Method	String	None	Method used for obtain the value
Source	String	None	Source of the value

3.1.10. Object Class: ManagementBody

Description: table describing the management body of the site.

Field	Type	Restriction	Description
ObjectIDfk	String	None	Identification string of the site (foreign key)
LegalStatus	String	Domain: LegalStatusValue	Legal status of the body
OfficialName	String	None	Name of the body
Address	String	None	Address of the body
Email	String	None	E-mail of the body
ContactPerson	String	None	Name of the contact person

3.1.11. Object Class: ManagementPlan

Description: table describing the management plan of the site.

Field	Type	Restriction	Description
ObjectIDfk	String	None	Identification string of the site (foreign key)
ManagementPlanName	String	None	Name of the management plan document
ManagementPlanURL	String	URL	Link to an online version of the document
Status	String	Domain: DocumentStatusValue	Year the document entered into force
ImplementationPeriod	String	None	Reference period of the plan
ResponsibleAgencyName	String	None	Name of the responsible agency

3.2. Biodiversity

This thematic group deals with biological features and consists of one feature dataset “Biodiversity” with five feature classes:

- NestingSite
- SpawningAndNurseryArea
- SpeciesAbsenceUnit
- SpeciesDistributionUnit
- SpilloverArea

and two object classes:

- DistributionType
- Indicators
- SpeciesNameType

The following table shows how the feature classes are related to the object classes:

Name	Multiplicity	Origin class	Destination class	Primary key	Foreign key
SpeciesDistributionUnit HasDistributionType	1→1..*	SpeciesDistributionUnit	DistributionType	UnitID	ObjectIDfk
SpeciesDistributionUnit HasIndcators	1→1..*	SpeciesDistributionUnit	Indcators	UnitID	ObjectIDfk
SpeciesDistributionUnit HasSpeciesNameType	1→1	SpeciesDistributionUnit	SpeciesNameType	SpeciesIDpk	ReferenceSpeciesIDfk
SpawningAndNurseryArea HasIndicators	1→1..*	SpawningAndNurseryArea	Indicators	AreaID	ObjectIDfk
SpawningAndNurseryArea HasSpeciesNameType	1→1	SpawningAndNurseryArea	SpeciesNameType	SpeciesIDpk	ReferenceSpeciesIDfk
NestingSiteHas Indicators	1→1..*	NestingSite	Indicators	SiteID	ObjectIDfk
NestingSiteHas SpeciesNameType	1→1	NestingSite	SpeciesNameType	SpeciesIDpk	ReferenceSpeciesIDfk
SpilloverAreaHas Indicators	1→1..*	PresentSpecies	Indicators	AreaID	SpeciesIDfk
SpilloverAreaHas SpeciesNameType	1→1	PresentSpecies	SpeciesNameType	SpeciesIDpk	ReferenceSpeciesIDfk
SpeciesAbsenceUnitHas SpeciesNameType	1→1	SpeciesAbsenceUnit	SpeciesNameType	SpeciesIDpk	ReferenceSpeciesIDfk

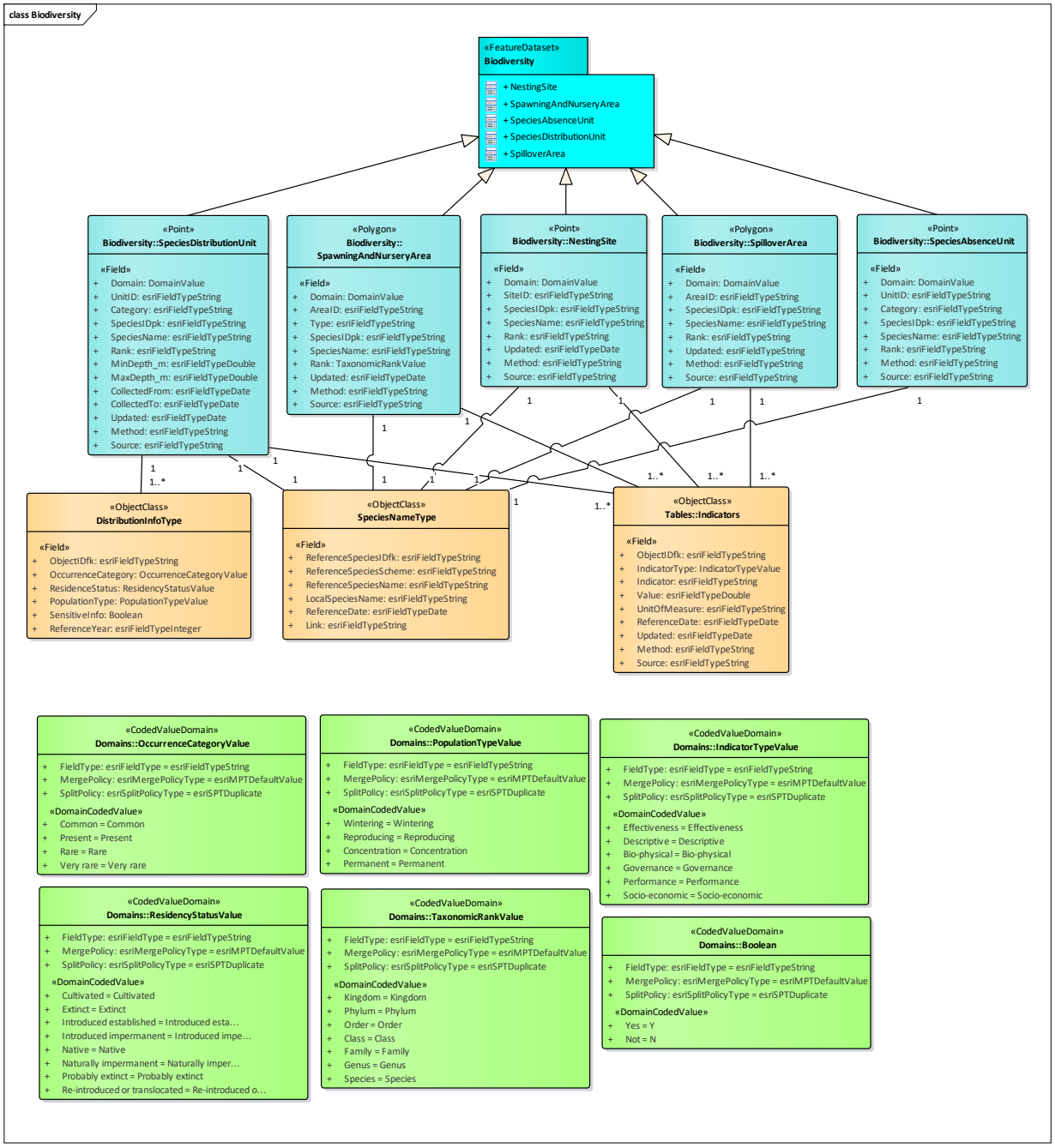

Fig.2 – ULM Schema for the “Biodiversity”group.

3.2.1. Feature Class: NestingSite

Description: a place chosen by species for building nest and/or laying eggs.

GeometryType: point

Field	Type	Restriction	Description
Domain	String	Domain: DomainTypeValue	The domain of the feature (marine, terrestrial)
SiteID	String	None	Identification string of the nesting site.
SpeciesIDpk	String	None	Identification string of the taxon
SpeciesName	String	None	Taxon
Rank	String	Domain: TaxonomicRankValue	Taxonomic level of identification
Updated	Date	dd/mm/yyyy	Date of the last update
Method	String	None	Method used for obtain the information
Source	String	None	Source of the information

3.2.2. Feature Class: SpawningAndNurseryArea

Description: areas of water where aquatic animals spawn, or produce their eggs and a subset of all habitats where juveniles of a species occur, having a greater level of productivity per unit area than other juvenile habitats.

GeometryType: polygon

Field	Type	Restriction	Description
Domain	String	Domain: DomainTypeValue	The domain of the feature (marine, terrestrial)
AreaID	String	None	Identification string of the area.
Type	String	None	Type of area
SpeciesIDpk	String	None	Identification string of the taxon
SpeciesName	String	None	Taxon
Rank	String	Domain: TaxonomicRankValue	Taxonomic level of identification
Updated	Date	dd/mm/yyyy	Date of the last update
Method	String	None	Method used for obtain the information
Source	String	None	Source of the information

3.2.3. Feature Class: SpeciesAbsenceUnit

Description: investigated points where the reference taxon is not present.

GeometryType: point

Field	Type	Restriction	Description
Domain	String	Domain: DomainTypeValue	The domain of the feature (marine, terrestrial)
UnitID	String	None	Identification string of the point
Category	String	None	Category of the species (e.g. bird, seagrass)
SpeciesIDpk	String	None	Identification string of the taxon
SpeciesName	String	None	Taxon
Rank	String	Domain: TaxonomicRankValue	Taxonomic level of identification
Updated	Date	dd/mm/yyyy	Date of the last update
Method	String	None	Method used for obtain the information
Source	String	None	Source of the information

3.2.4. Feature Class: SpeciesDistributionUnit

Description: Occurrence of animal and plant species aggregated by grid, region, administrative unit or other analytical unit.

GeometryType: point

Field	Type	Restriction	Description
Domain	String	Domain: DomainTypeValue	The domain of the feature (marine, terrestrial)
UnitID	String	None	Identification string of the point
Category	String	None	Category of the species (e.g. bird, seagrass)
SpeciesIDpk	String	None	Identification string of the taxon
SpeciesName	String	None	Taxon
Rank	String	Domain: TaxonomicRankValue	Taxonomic level of identification
MinDepth_m	Double	None	Minimum depth of sighting
MaxDepth_m	Double	None	Maximum depth of sighting
CollectedFrom	Date	dd/mm/yyyy	Starting date of sighting
CollectedTo	Date	dd/mm/yyyy	Ending date of sighting
Updated	Date	dd/mm/yyyy	Date of the last update
Method	String	None	Method used for obtain the information
Source	String	None	Source of the information

3.2.5. Object Class: SpilloverArea

Description: taxa observed with the sampling.

GeometryType: polygon

Field	Type	Restriction	Description
Domain	String	Domain: DomainTypeValue	The domain of the feature (marine, terrestrial)
AreaID	String	None	Identification string of the spillover area
SpeciesIDpk	String	None	Identification string of the taxon
SpeciesName	String	None	Taxon
Rank	String	Domain: TaxonomicRankValue	Taxonomic level of identification
Updated	Date	dd/mm/yyyy	Date of the last update
Method	String	None	Method used for obtain the information
Source	String	None	Source of the information

3.2.6. Object Class: DistributionInfoType

Description: the description of the status of the subject of distribution within the species distribution unit, including the indication of the abundance by counting, estimation or calculation of the number of occurrences or population size of the particular species.

Field	Type	Restriction	Description
ObjectIDfk	String	None	Identification string of the object (foreign key)
OccurrenceCategory	String	Domain: OccurrenceCategoryValue	The species population density in the species distribution unit
ResidencyStatus	String	Domain:ResidencyStatusValue	Information on the status of residency of a species regarding nativness versus introduction and permanency
PopulationType	String	Domain:PopulationTypeValue	The permanency of populations, particularly with regard to migratory species within a given species distribution unit.
SensitiveInfo	String	Domain:Boolean	Boolean value that indicates whether the location of a specific species is sensitive
ReferenceDate	Integer	yyyy	Date which the information refers

3.2.7. Object Class: Indicators

Description: list of indicators.

Field	Type	Restriction	Description
ObjectIDfk	String	None	Identification string of the object (foreign key)
IndicatorType	String	Domain: IndicatorTypeValue	Type of indicator
Indicator	String	None	Name of the indicator
Value	Double	None	Value of the indicator
UnitOfMeasure	String	None	Unit of measure of the indicator
ReferenceDate	Date	dd/mm/yyyy	Date which the value refers
Updated	Date	dd/mm/yyyy	Date of the last update
Method	String	None	Method used for obtain the value
Source	String	None	Source of the value

3.2.8. Object Class: SpeciesNameType

Description: Identifier and scientific name, including the author, taken from an international reference list, optionally completed by a locally used name and its taxonomic concept relationship to the reference name.

Field	Type	Restriction	Description
ReferenceSpeciesIDfk	String	None	Identifier of one of the reference lists given by ReferenceSpeciesScheme
ReferenceSpeciesScheme	String	None	Reference list defining a nomenclatural and taxonomical standard to which all local names and taxonomic concepts shall be mapped.
ReferenceSpeciesName	String	None	The scientific name, including the author, used in the authorized ReferenceSpeciesScheme.
LocalSpeciesName	String	None	Local name of the species
ReferenceDate	Date	dd/mm/yyyy	Date of the research
Link	String	None	Link to the ReferenceSpeciesScheme (e.g. WoRMS)

3.3. Elevation

This thematic group deals with bathymetric features and consists of one feature dataset “ElevationVectorElements” with three feature classes:

- BreakLine
- ContourLine
- SpotElevation

and one raster dataset “ElevationGridCoverage”.

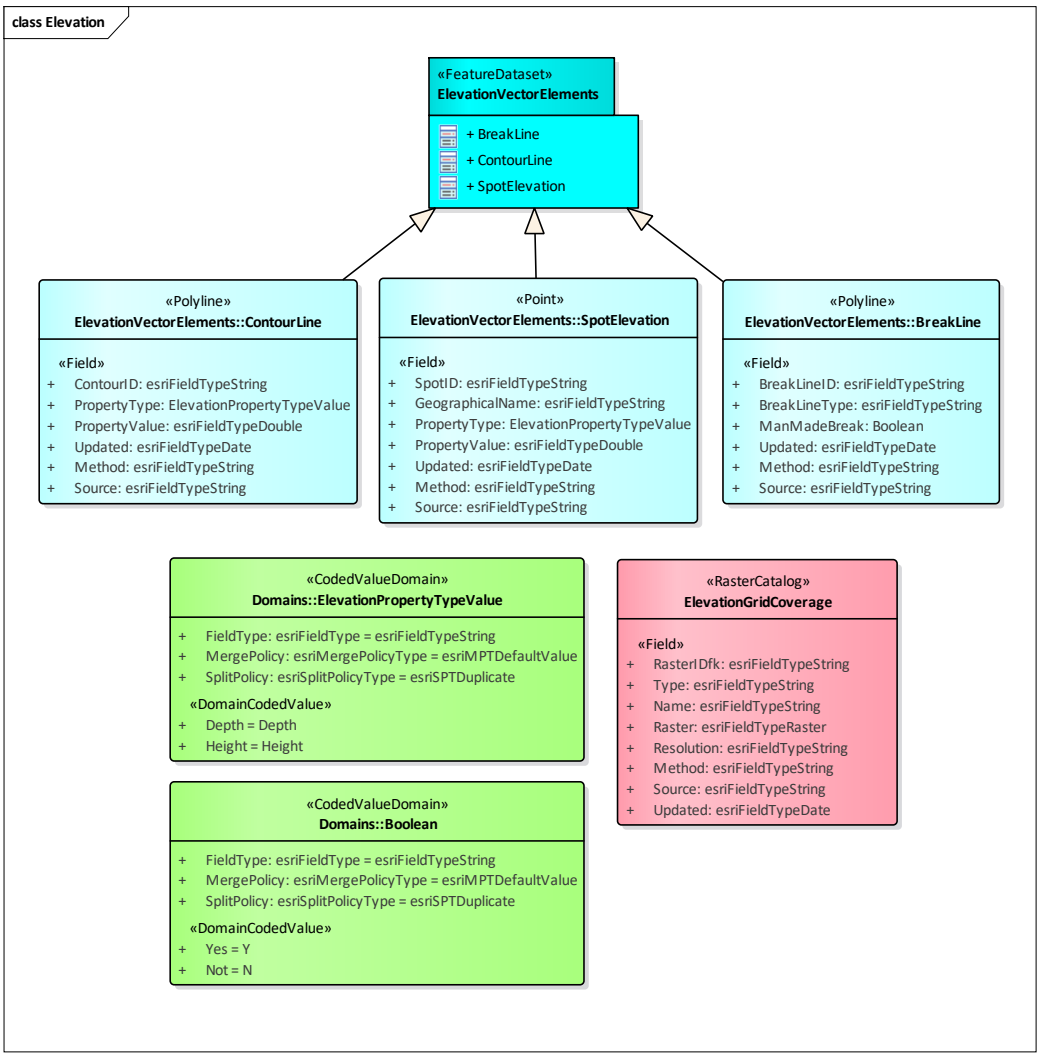

Fig.3 – UML Schema for the “Elevation” group.

3.3.1. Feature Class: BreakLine

Description: a line of a critical nature which describes the shape of an elevation surface and indicates a discontinuity in the slope of the surface (i.e. an abrupt change in gradient). Triangles included within a TIN model must never cross it.

GeometryType: polyline

Field	Type	Restriction	Description
BreakLineID	String	None	Identification string of the break line.
BreakLineType	String	String	The type of break line with regard the natural or man-made real world characteristic it represents, or the specific function it has in calculating a Digital Elevation Model (DEM)
ManMadeBreak	String	Domain: Boolean	Line which represents an elevation break due to an artificial or man-made construction present on the terrain
Updated	Date	dd/mm/yyyy	Date of the last update
Method	String	None	Method used for obtain the value
Source	String	None	Source of the value

3.3.2. Feature Class: ContourLine

Description: linear spatial object composed of a set of adjoining locations characterized by having the same elevation property value. It describes, together with other contour lines present in the area, the local morphology of the Earth's surface.

GeometryType: polyline

Field	Type	Restriction	Description
ContourID	String	None	Identification string of the contour.
PropertyType	String	Domain: ElevationPropertyTypeValue	Attribute categorizing the elevation vector object as a land-elevation or a bathymetry spatial object. It determines the elevation property represented by the object
PropertyValue	Double	None	Value of the elevation property of the spatial object referred to a specific vertical coordinate reference system
Updated	Date	dd/mm/yyyy	Date of the last update
Method	String	None	Method used for obtain the value

Source	String	None	Source of the value

3.3.3. Feature Class: SpotElevation

Description: point spatial object which describes the elevation of an Earth's surface at a specific location. It provides a single elevation property value.

GeometryType: point

Field	Type	Restriction	Description
SpotID	String	None	Identification string of the elevation object
GeographicalName	String	None	A geographical name that is used to identify a named land or water body's floor location in the real world, which is represented by the spot elevation spatial object
PropertyType	String	Domain: ElevationPropertyTypeValue	Attribute categorizing the elevation vector object as a land-elevation or a bathymetry spatial object. It determines the elevation property represented by the object
PropertyValue	Double	None	Value of the elevation property of the spatial object referred to a specific vertical coordinate reference system
Updated	Date	dd/mm/yyyy	Date of the last update
Method	String	None	Method used for obtain the value
Source	String	None	Source of the value

3.3.4. Raster Dataset: ElevationGridCoverage

Description: continuous coverage which uses a systematic tessellation based on a regular rectified quadrilateral grid to cover its domain, where the elevation property value is usually known for each of the grid points forming this domain.

GeometryType: raster

Field	Type	Restriction	Description
RasterID	String	None	Identification string of the elevation object
Type	String	None	Type of elevation object
Name	String	None	Name of the elevation object
Raster	Raster	None	Raster file

Resolution	String	None	Spatial resolution of the elevation object
Updated	Date	dd/mm/yyyy	Date of the last update
Method	String	None	Method used for obtain the value
Source	String	None	Source of the value

3.4. Geology

This thematic group deals with geological, geophysical, geomorphological and hydrographic features and consists of three feature datasets “Geology”, “Geophysics” and “Hydrography”.

The feature dataset “Geology” consists of 13 feature classes:

- ArcheologicalFeature
- CoastType
- CoastalStatus
- GeologicUnit
- GeologicalRisk
- SeabedSubstrate
- Shoreline
- GeologicPunctualStructure
- GeologicLinearStructure
- GeologicArealStructure
- GeomorphoPunctualStructure
- GeomorphoLinearStructure
- GeomorphoArealStructure

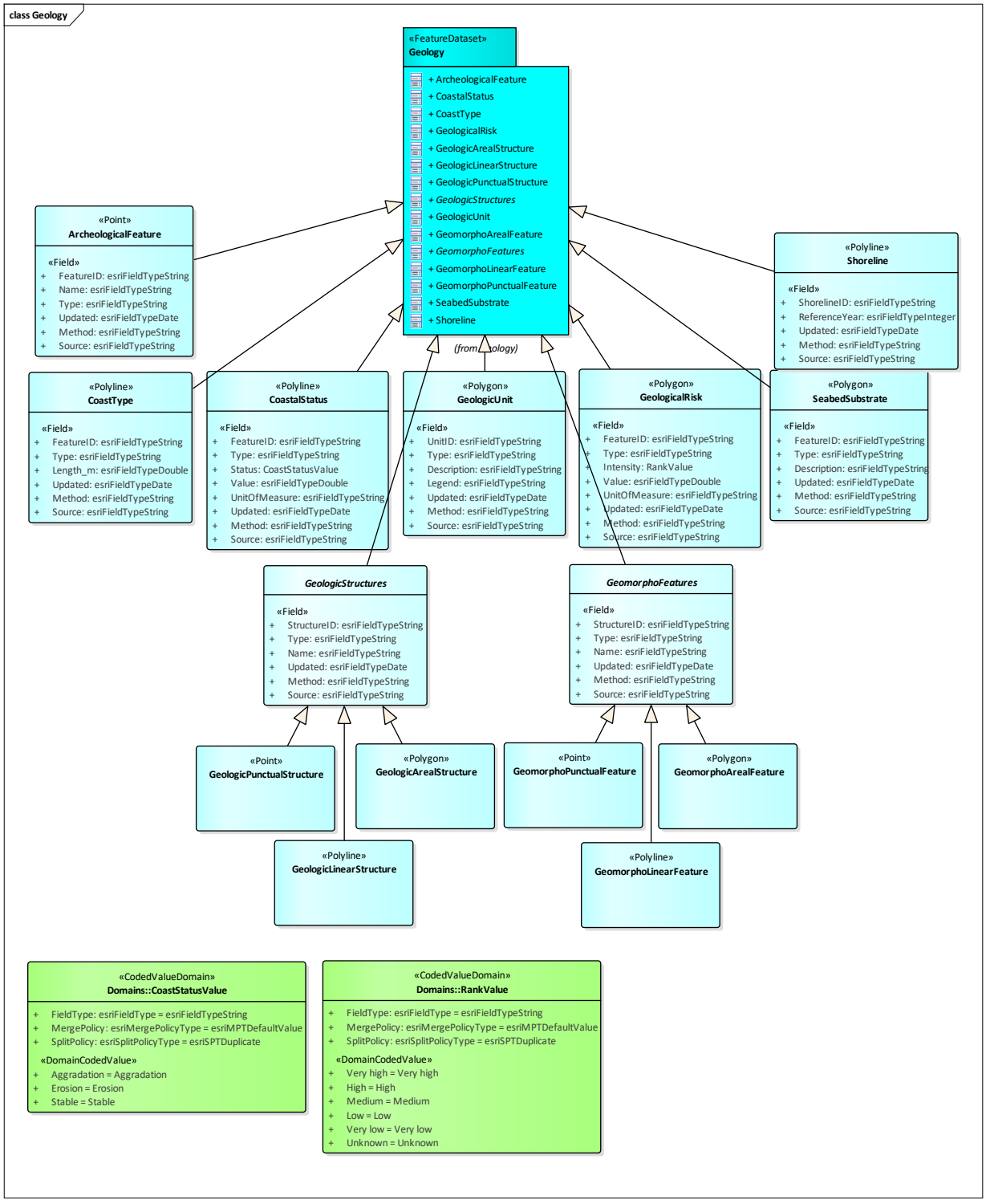

Fig.4 – UML of the “Geology” group.

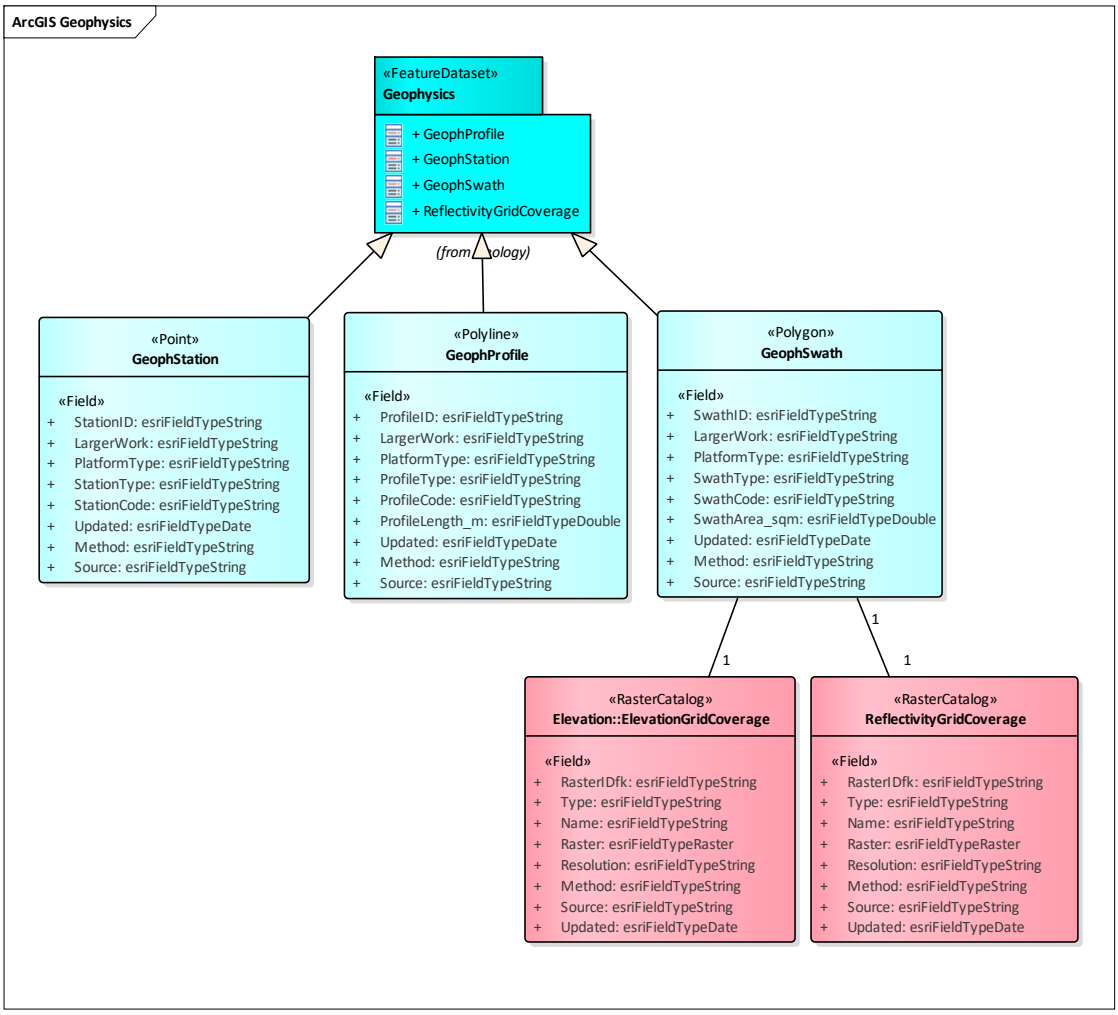

Fig.5 – UML of the “Geophysics” group.

The feature dataset “Geophysics” consists of three feature classes:

- GeophStation
- GeophProfile
- GeophSwath

and two relationship classes:

Name	Multiplicity	Origin class	Destination class	Primary key	Foreign key
GeophSwathHas ElevationGridCoverage	1→1..*	GeophSwath	ElevationGridCoverage	Swath Code	RasterID fk

GeophSwathHas ReflectivityGridCoverage	1→1..*	GeophSwath	ReflectivityGridCoverage	Swath Code	RasterID fk

The feature dataset “Hydrogeology” consists of three feature classes:

- HydrogeologicalPunctualObject
- HydrogeologicalLinearObject
- HydrogeologicalArealObject

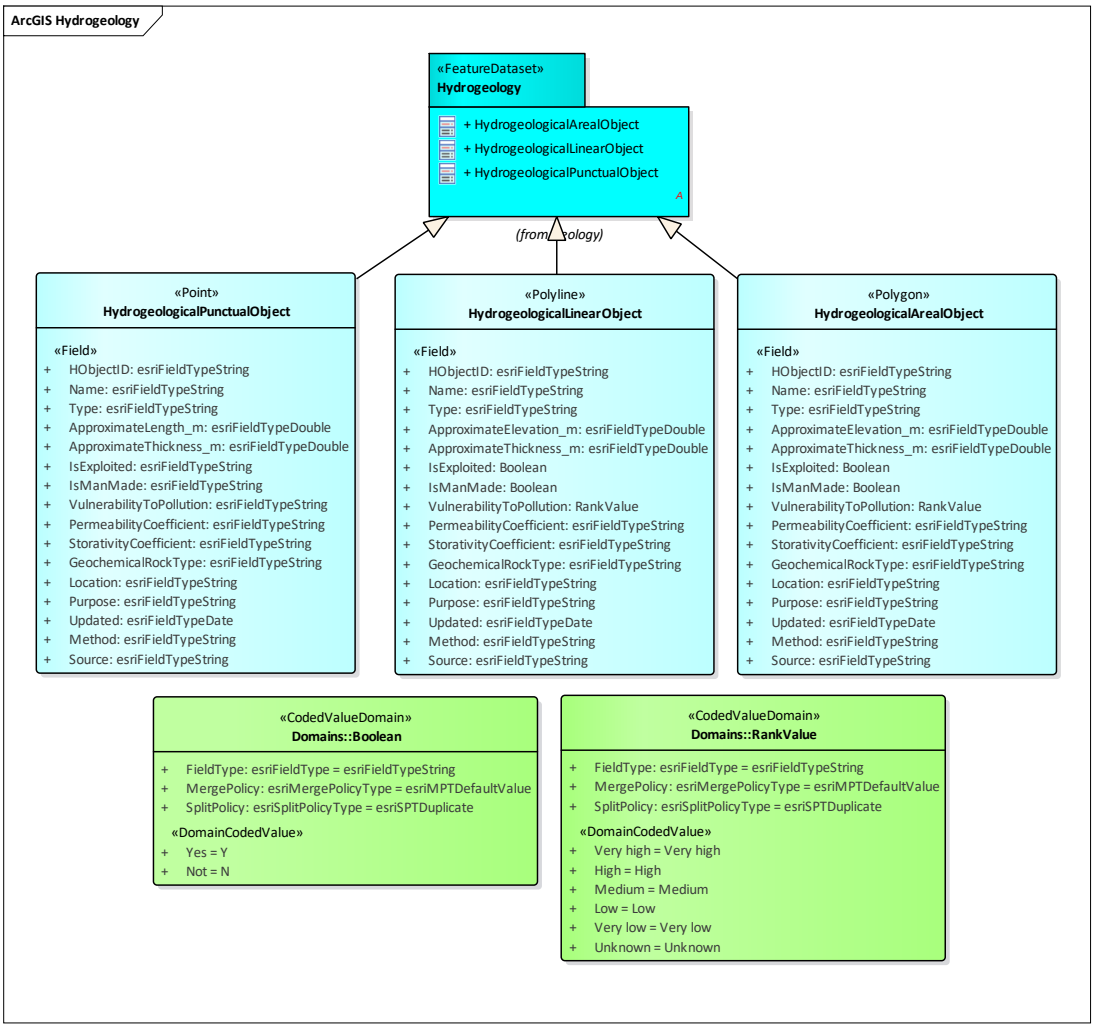

Fig.6 – UML of the “Hydrogeology” group.

3.4.1. Feature Class: ArcheologicalFeature

Description: punctual position of archeological objects.

GeometryType: point

Field	Type	Restriction	Description
FeatureID	String	None	Identification string of the object
Name	String	None	Name of archaeological object
Type	String	None	Type of archaeological object
Updated	Date	dd/mm/yyyy	Last update of the dataset
Method	String	None	Model used for create the dataset
Source	String	None	Source of the dataset

3.4.2. Feature Class: CoastType

Description: linear representation of the coast showing the typology.

GeometryType: polyline

Field	Type	Restriction	Description
FeatureID	String	None	Identification string of the object
Type	String	None	Type of coast
Length_m	Double	None	Length of the segment of the coast in meters
Updated	Date	dd/mm/yyyy	Last update of the dataset
Method	String	None	Model used for create the dataset
Source	String	None	Source of the dataset

3.4.3. Feature Class: CoastalStatus

Description: linear representation of the coast showing the status during the years.

GeometryType: polyline

Field	Type	Restriction	Description
FeatureID	String	None	Identification string of the object
Type	String	None	Type of observation

Status	String	Domain: CoastStatusValue	Status of the coast
Value	Double	None	Quantity of change
UnitOfMeasure	String	None	Unit of measure of the change
Updated	Date	dd/mm/yyyy	Last update of the dataset
Method	String	None	Model used for create the dataset
Source	String	None	Source of the dataset

3.4.4. Feature Class: GeologicUnit

Description: map of the geological units. It includes both formal units (i.e. formally adopted and named in an official lexicon) and informal units (i.e. named but not promoted to the lexicon) and unnamed units (i.e. recognizable and described and delineable in the field but not otherwise formalized).

GeometryType: polygon

Field	Type	Restriction	Description
UnitID	String	None	Identification string of the object
Type	String	None	Type of geological unit
Description	String	None	Description of the unit
Legend	String	None	Legend of the unit
Updated	Date	dd/mm/yyyy	Last update of the dataset
Method	String	None	Model used for create the dataset
Source	String	None	Source of the dataset

3.4.5. Feature Class: GeologicalRisk

Description: map of the geological risk.

GeometryType: polygon

Field	Type	Restriction	Description
UnitID	String	None	Identification string of the object
Type	String	None	Type of risk
Intensity	String	Domain: RankValue	Intensity of the risk
Value	Double	None	Quantity of risk

UnitOfMeasure	String	None	Unit of measure of the risk
Updated	Date	dd/mm/yyyy	Last update of the dataset
Method	String	None	Model used for create the dataset
Source	String	None	Source of the dataset

3.4.6. Feature Class: SeabedSubstrate

Description: map of substrate.

GeometryType: polygon

Field	Type	Restriction	Description
FeatureD	String	None	Identification string of the object
Type	String	None	Type of substrate
Description	String	None	Description of the substrate
Updated	Date	dd/mm/yyyy	Last update of the dataset
Method	String	None	Model used for create the dataset
Source	String	None	Source of the dataset

3.4.7. Feature Class: Shoreline

Description: position of the shoreline during the years.

GeometryType: polyline

Field	Type	Restriction	Description
ShorelineID	String	None	Identification string of the object
ReferenceYear	Integer	None	Year of observation
Updated	Date	dd/mm/yyyy	Last update of the dataset
Method	String	None	Model used for create the dataset
Source	String	None	Source of the dataset

3.4.8. Feature Classes: GeologicPunctual/Linear/ArealStructure

Description: geologic structures that can be represented as points, polylines or polygons.

GeometryType: point, polyline, polygon

Field	Type	Restriction	Description
StructureID	String	None	Identification string of the object
Type	String	None	Type of structure
Name	String	None	Geographical name of the structure
Updated	Date	dd/mm/yyyy	Last update of the dataset
Method	String	None	Model used for create the dataset
Source	String	None	Source of the dataset

3.4.9. Feature Classes: GeomorphoPunctual/Linear/ArealStructure

Description: geomorphological structures that can be represented as points, polylines or polygons.

GeometryType: point, polyline, polygon

Field	Type	Restriction	Description
StructureID	String	None	Identification string of the object
Type	String	None	Type of structure
Name	String	None	Geographical name of the structure
Updated	Date	dd/mm/yyyy	Last update of the dataset
Method	String	None	Model used for create the dataset
Source	String	None	Source of the dataset

3.4.10. Feature Classes: HydrogeologicalPunctual/Linear/ArealObject

Description: the hydrogeology is an area of geology that deals with the distribution and movement of groundwater in the soil and rocks of the Earth's crust (commonly in aquifers). The hydrogeological objects that can be represented by points, polylines or polygons.

GeometryType: point, polyline, polygon

Field	Type	Restriction	Description
HObjectID	String	None	Identification string of the hydrogeologic object
Name	String	None	Name of the object
Type	String	None	Type of object

ApproximateLength_m	Double	Only for puntual structures	Length of the punctual object in meters
ApproximateElevation_m	Double	Only for linear and areal structures	Elevation of the linear/areal object in meters
ApproximateThickness_m	Double	None	Thickness of the object in meters
IsExploited	String	Domain: Boolean	Is the object exploited?
IsManMade	String	Domain: Boolean	Is the object man-made?
VulnerabilityToPollution	String	Domain: StatusValue	How is the vulnerability of the object?
PermeabilityCoefficient	String	None	Coefficient of permeability
StorativityCoefficient	String	None	Coefficient of storativity
GeochemicalRockType	String	None	Geochemical characteristic of the rock
Location	String	None	Geographical name of the location of the s object
Purpose	String	None	Purpose of the object
Updated	Date	dd/mm/yyyy	Last update of the dataset
Method	String	None	Model used for create the dataset
Source	String	None	Source of the dataset

3.4.11. Feature Class: GephStation

Description: punctual station for geophysical measures (e.g. borehole).

GeometryType: point

Field	Type	Restriction	Description
StationID	String	None	Identification string of the object
LargerWork	String	None	Work or project in which the surveys are made
PlatformType	String	None	Platform by which the surveys are made
StationType	String	None	Type of station (e.g. buoy)
StationCode	String	None	Code of the station
Updated	Date	dd/mm/yyyy	Last update of the dataset
Method	String	None	Model used for create the dataset
Source	String	None	Source of the dataset

3.4.12. Feature Class: GephProfile

Description: linear profile of geophysical measures (e.g. chirp profiles).

GeometryType: polyline

Field	Type	Restriction	Description
ProfileID	String	None	Identification string of the object
LargerWork	String	None	Work or project in which the surveys are made
PlatformType	String	None	Platform by which the surveys are made
ProfileType	String	None	Type of profile
ProfileCode	String	None	Code of the profile
ProfileLength_m	Double	None	Length of the profile in meters
Updated	Date	dd/mm/yyyy	Last update of the dataset
Method	String	None	Model used for create the dataset
Source	String	None	Source of the dataset

3.4.13. Feature Class: GephSwath

Description: areal swath of geophysical measures (e.g. multibeam surface).

GeometryType: polygon

Field	Type	Restriction	Description
SwathID	String	None	Identification string of the object
LargerWork	String	None	Work or project in which the surveys are made
PlatformType	String	None	Platform by which the surveys are made
SwathType	String	None	Type of swath
SwathCode	String	None	Code of the swath
SwathArea_sqm	Double	None	Area of the swath in square meters
Updated	Date	dd/mm/yyyy	Last update of the dataset
Method	String	None	Model used for create the dataset
Source	String	None	Source of the dataset

3.5. HabitatsAndBiotopes

This thematic group stores data about habitats and biotopes, it consists of one feature dataset with one feature classes:

- Habitat

and three tables:

- HabitatTypeCoverType
- HabitatStatus
- HabitatSpeciesType

Two raster calatogs belong to these group too:

- HabitatSuitabilityModel
- RiskAnalysis

The elements are connected between the following relationship classes:

Name	Multiplicity	Origin class	Destination class	Primary key	Foreign key
HabitatHas HabitatTypeCoverType	1→1..*	Habitat	HabitatTypeCoverType	HabitatID	HabitatIDfk
HabitatHas HabitatStatus	1→1..*	Habitat	HabitatStatus	HabitatID	HabitatIDfk
HabitatHas HabitatSpeciesType	1→1..*	Habitat	HabitatSpeciesType	HabitatID	HabitatIDfk
HabitatSpeciesTypeHas SpeciesList	1→1	HabitatSpeciesType	SpeciesList	Reference SpeciesID	SpeciesIDfk

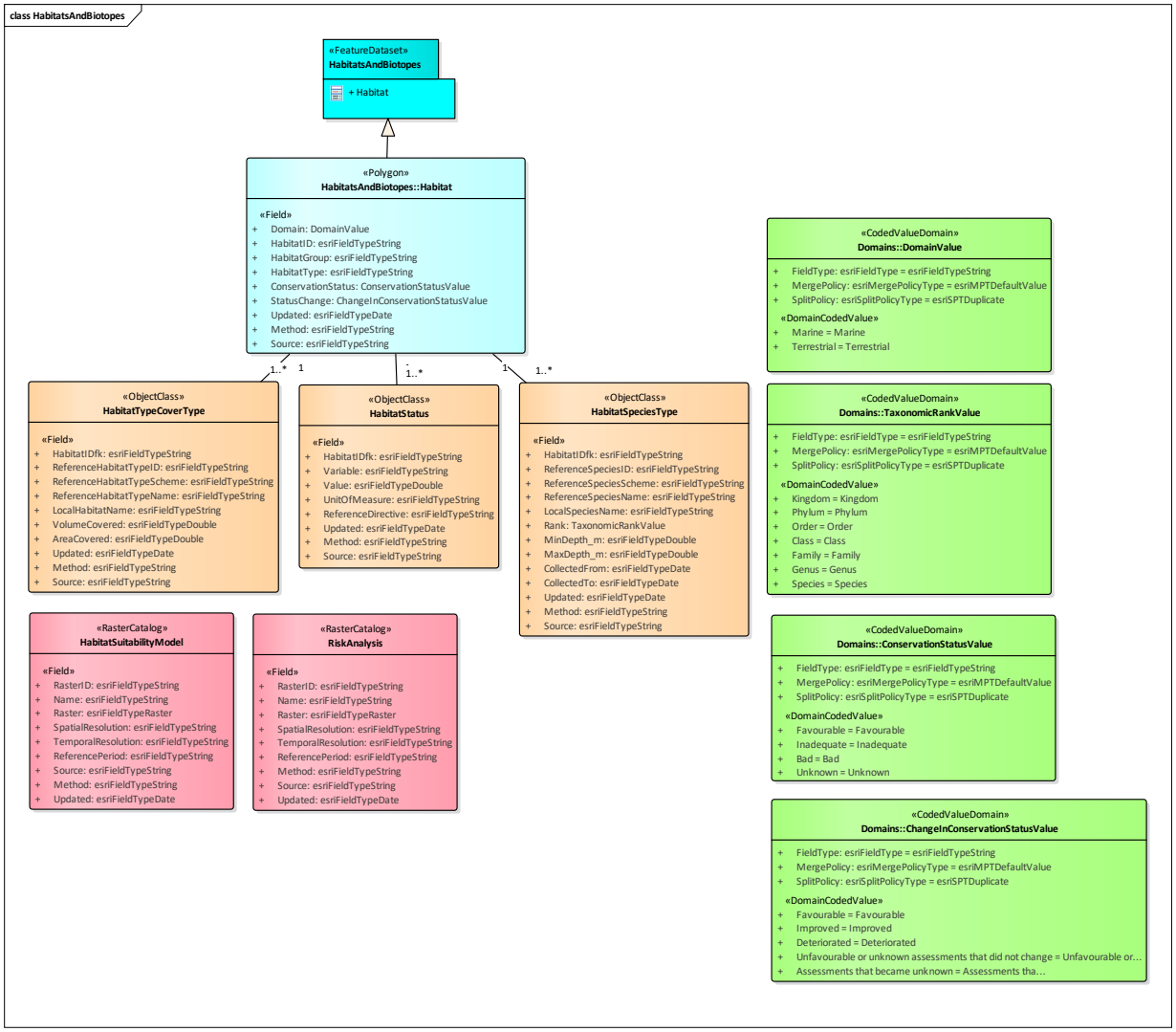

Fig.7 – UML of the “Habitat and Biotopes” group.

3.5.1. Feature Class: Habitat

Description: geographical areas characterized by specific ecological conditions, processes, structures, and functions that physically support the organisms that live there.

GeometryType: polygon

Field	Type	Restriction	Description
Domain	String	Domain: DomainTypeValue	Domain the habitat belongs (terrestrial, marine)

HabitatID	String	None	Identification string of the habitat
HabitatGroup	String	None	Group of the habitat (e.g. Seagrass)
HabitatType	String	None	Type of habitat
ConservationStatus	String	Domain: ConservationStatusValue	Status of conservation of the habitat unit. The values come from the Habitat Diective
StatusChange	String	Domain: ChangeInConservationStatusValue	Changes in the conservation status of the habitat unit. The values come from the Habitat Diective
Updated	Date	dd/mm/yyyy	Last update of the dataset
Method	String	None	Model used for create the dataset
Source	String	None	Source of the dataset

3.5.2. Object Class: HabitatTypeCoverType

Description: Habitat type according to an international, national or local habitat classifications scheme. The table includes additional information on covered area, covered length, or containing volume.

Field	Type	Restriction	Description
HabitatIDfk	String	None	Identification string of the habitat
ReferenceHabitatTypeID	String	None	Habitat type unique identifier (code) according to one official classification scheme
ReferenceHabitatTypeScheme	String	None	One of the official classification schemes, that are widely used in international frameworks.
ReferenceHabitatTypeName	String	None	Name of habitat type according to one official classification scheme
LocalHabitatName	String	None	Local name of the habitat
AreaCovered	String	None	Area covered by a certain habitat within the entire habitat extent
VolumeCovered	String	None	Volume covered by a certain habitat within in the entire habitat extent
Updated	Date	dd/mm/yyyy	Last update of the dataset
Method	String	None	Model used for create the dataset
Source	String	None	Source of the dataset

3.5.3. Object Class: HabitatStatus

Description: list of indices/variables/indicators that describe the environmental status of the habitat.

Field	Type	Restriction	Description
HabitatIDfk	String	None	Identification string of the habitat
Variable	String	None	Type of variable
Value	Double	None	Value of the variable
UnitOfMeasure	String	None	Unit of measure of the variable
ReferenceDirective	String	None	Directive of reference
Updated	Date	dd/mm/yyyy	Last update of the dataset
Method	String	None	Model used for create the dataset
Source	String	None	Source of the dataset

3.5.4. Object Class: HabitatSpeciesType

Description: Species which occurs in a certain habitat at the time of mapping.

Field	Type	Restriction	Description
HabitatIDfk	String	None	Identification string of the habitat (foraing key)
ReferenceSpeciesID	String	None	Code of the species in an recognize classification scheme. Reccomandation: WoRMS
ReferenceSpeciesScheme	String	None	Recognize classification scheme. Reccomandation: WoRMS
LocalSpeciesName	String	None	Local name of the species
Rank	String	Domain: TaxonomicRankValue	Taxonomic level of identification
MinDepth_m	Double	None	Minimum depth of sighting
MaxDepth_m	Double	None	Maximum depth of sighting
CollectedFrom	Date	dd/mm/yyyy	Starting date of sighting
CollectedTo	Date	dd/mm/yyyy	Ending date of sighting
Updated	Date	dd/mm/yyyy	Date of the last update
Method	String	None	Method used for obtain the information
Source	String	None	Source of the information

3.5.5. Raster Catalog: HabitatSuitabilityModel

Description: catalog collecting habitat suitability models.

GeometryType: raster

Field	Type	Restriction	Description
RasterID	String	None	Identification string of the raster
Name	String	None	Name of the raster
Raster	Raster	None	Raster file
SpatialResolution	String	None	Spatial resolution of the raster
TemporalResolution	String	None	Temporal resolution of the raster
ReferencePeriod	String	None	Temporal period the model takes into account
Method	String	None	Model used for create the raster
Source	String	None	Source of the raster
Updated	Date	dd/mm/yyyy	Last update of the raster

3.5.6. Raster Catalog: RiskAnalysis

Description: catalog collecting risk analysis.

GeometryType: raster

Field	Type	Restriction	Description
RasterID	String	None	Identification string of the raster
Name	String	None	Name of the raster
Raster	Raster	None	Raster file
SpatialResolution	String	None	Spatial resolution of the raster
TemporalResolution	String	None	Temporal resolution of the raster
ReferencePeriod	String	None	Temporal period the model takes into account
Method	String	None	Model used for create the raster
Source	String	None	Source of the raster
Updated	Date	dd/mm/yyyy	Last update of the raster

3.6. Hydrography

Hydrography collects three feature classes in a feature dataset named “Hydrography”:

- HydroPunctualObject
- HydroLinearObject
- HydroArealObject

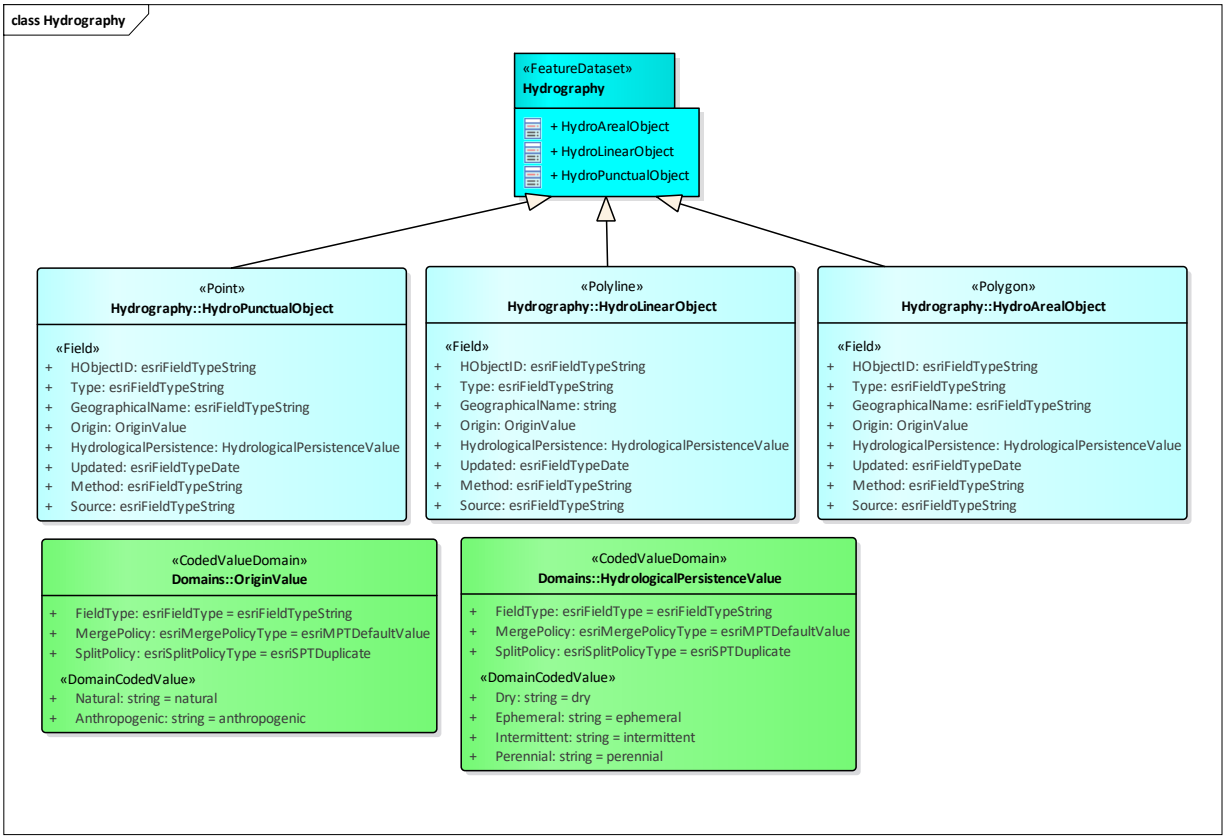

Fig.8 – UML of the “Hydrography” group.

3.6.1. Feature Classes: HydroPunctual/Linear/ArealObject

Description: hydrography is the branch of applied sciences which deals with the measurement and description of the physical features of oceans, seas, coastal areas, lakes and rivers, as well as with the prediction of their change over time, for the primary purpose of safety of navigation and in support of all other marine activities, including economic development, security and defense, scientific research, and

environmental protection.an identity base for hydrographic (including man-made) objects in the real world. The representation of the hydrographic objects can be by points, polylines or polygons.

GeometryType: point, polyline, polygon

Field	Type	Restriction	Description
HObjectID	String	None	Identification string of hydrographic object
Type	String	None	Type of hydrographical object
GeographicalName	String	None	A geographical name that is used to identify a hydrographic object in the real world
Origin	String	Domain: OriginValue	Origin of the object (man-made or natural)
HydrologicalPersistence	String	Domain: HydrologicalPersistenceValue	Type of hydrological persistence
Method	String	None	Model used for create the object
Source	String	None	Source of the r object
Updated	Date	dd/mm/yyyy	Last update of the object

3.7. Monitoring

The thematic group “Monitoring” collects data about experimental designs, sampling features and measurements. It consists of two feature datasets “SamplingFeatures” with three feature classes:

- Station
- Transect
- SurveyArea

And one table:

- ExperimentalDesign

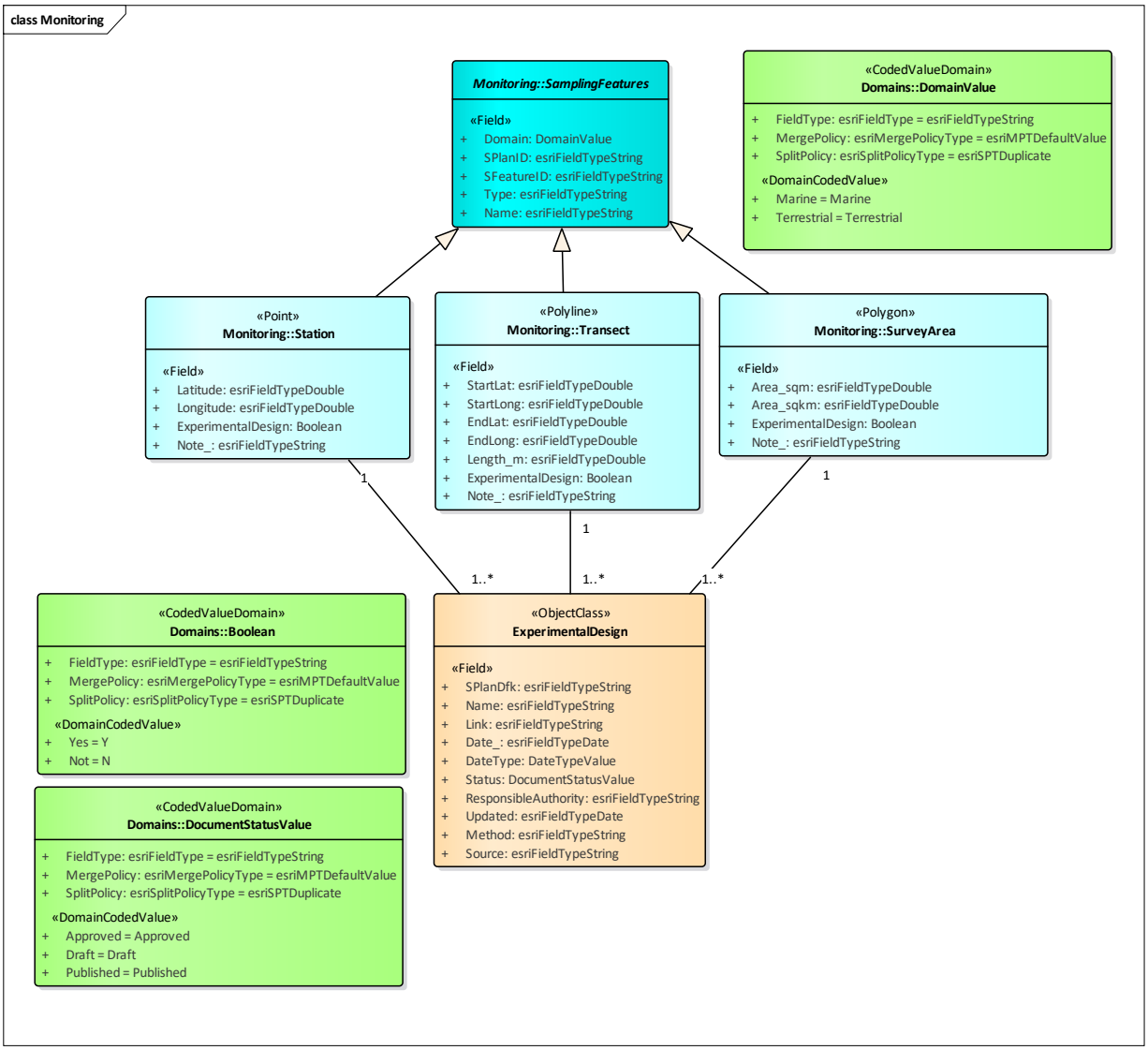

Fig.9 – UML of the "SamplingFeatures" section in the "Monitoring" group.

And "Samples" with two feature classes:

- PunctualSample
- LinearSample

And two tables:

- Measurments
- Images

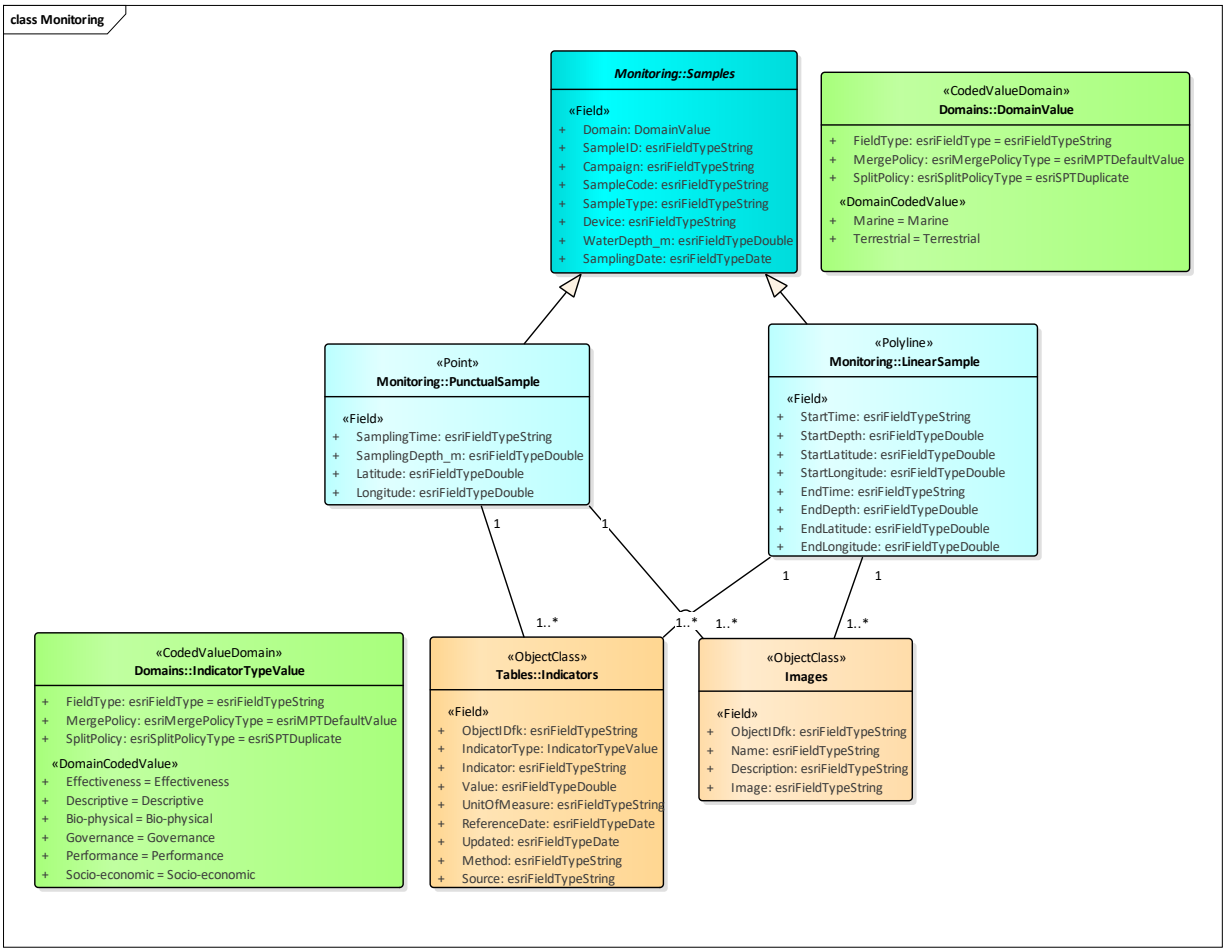

Fig.10 – UML of the “Sample” section in the “Monitoring” group.

The elements are connected between the following relationship classes:

Name	Multiplicity	Origin class	Destination class	Primary key	Foreign key
StationHasExperimentaDesign	1→1..*	Station	ExperimentaDesign	SPlanID	SPlanID fk
TransectHasExperimentaDesign	1→1..*	Transect	ExperimentaDesign	SPlanID	SPlanID fk
SurveyAreaHasExperimentaDesign	1→1..*	SurveyArea	ExperimentaDesign	SPlanID	SPlanID fk
PunctualSampleHasIndicators	1→1..*	PunctualSample	Indicators	SampleID	ObjectID fk
PunctualSampleHasImages	1→1..*	PunctualSample	Images	SampleID	ObjectID

					fk
LinearSampleHasIndicators	1→1..*	LinearSample	Indicators	SampleID	ObjectID fk
LinearSampleHasImages	1→1..*	LinearSample	Images	SampleID	ObjectID fk

3.7.1. Feature Class: Station

Description: punctual station for sampling and measurements.

GeometryType: point

Field	Type	Restriction	Description
Domain	String	Domain: DomainTypeValue	Domain the object belongs (terrestrial, marine)
SPlanID	String	None	Identification string of sampling plan
SFeatureID	String	None	Identification string of the station
Type	String	None	Type of station
Name	String	None	Name of the station
Latitude	Double	GG.yyyyyy	Latitude of the station
Longitude	Double	GG. xxxxxx	Longitude of the station
ExperimentalDesign	String	Domain: Boolean	Presence or absence of an experimental design
Note_	String	None	Notes

3.7.2. Feature Class: Transect

Description: punctual station for sampling and measurements.

GeometryType: polyline

Field	Type	Restriction	Description
Domain	String	Domain: DomainTypeValue	Domain the object belongs (terrestrial, marine)
SPlanID	String	None	Identification string of sampling plan
SFeatureID	String	None	Identification string of the profile
Type	String	None	Type of profile
Name	String	None	Name of the profile
StartLatitude	Double	GG.yyyyyy	Starting latitude of the profile
StartLongitude	Double	GG. xxxxxx	Starting longitude of the profile
EndLatitude	Double	GG.yyyyyy	Ending latitude of the profile

EndLongitude	Double	GG. xxxxxx	Ending longitude of the profile
Length_m	Double	None	Length of the profile in meters
ExperimentalDesign	String	Domain: Boolean	Presence or absence of an experimental design
Note_	String	None	Notes

3.7.3. Feature Class: SurveyArea

Description: area for sampling and measurements.

GeometryType: polygon

Field	Type	Restriction	Description
Domain	String	Domain: DomainTypeValue	Domain the object belongs (terrestrial, marine)
SPlanID	String	None	Identification string of sampling plan
SFeatureID	String	None	Identification string of the survey area
Type	String	None	Type of the survey area
Name	String	None	Name of the survey area
Area_sqm	Double	None	Area of the survey area in square meters
Area_sqkm	Double	None	Area of the survey area in square kilometers
ExperimentalDesign	String	Domain: Boolean	Presence or absence of an experimental design
Note_	String	None	Notes

3.7.4. Feature Class: PunctualSample

Description: sample representable with a point.

GeometryType: point

Field	Type	Restriction	Description
Domain	String	Domain: DomainTypeValue	Domain the object belongs (terrestrial, marine)
SampleID	String	None	Identification string of sampling plan
Campaign	String	None	Name of the campaign for sampling
SampleCode	String	None	Code of the sample
SampleType	String	None	Type of the sample
Device	String	None	Device used for sampling
WaterDepth_m	Double	None	Water depth in the point of sampling in meters
SamplingDate	Date	dd/mm/yyyy	Date of sampling

SamplingTime	String	hh:mm:ss	Time of sampling
SamplingDepth_m	Double	None	Depth of sampling in meters
Latitude	Double	GG.yyyyyy	Latitude of the sample
Longitude	Double	GG. xxxxxx	Longitude of the sample

3.7.5. Feature Class: LinearSample

Description: sample representable with a polyline.

GeometryType: Polyline

Field	Type	Restriction	Description
Domain	String	Domain: DomainTypeValue	Domain the object belongs (terrestrial, marine)
SampleID	String	None	Identification string of sampling plan
Campaign	String	None	Name of the campaign for sampling
SampleCode	String	None	Code of the sample
SampleType	String	None	Type of the sample
Device	String	None	Device used for sampling
WaterDepth_m	Double	None	Water depth in the point of sampling in meters
SamplingDate	Date	dd/mm/yyyy	Date of sampling
StartTime	String	None	Starting time of sampling
StartDepth	Double	None	Depth in the starting point of sampling in meters
StartLatitude	Double	None	Starting latitude of sampling
StartLongitude	Double	None	Starting longitude of sampling
EndTime	String	None	Ending time of sampling
EndDepth	Double	None	Depth in the ending point of sampling in meters
EndLatitude	Double	None	Ending latitude of sampling
EndLongitude	Double	None	Ending longitude of sampling

3.7.6. Object Class: ExperimentalDesign

Description: table describing the document of the experimental design.

Field	Type	Restriction	Description
SPlanIDfk	String	None	Identification string of the sampling plan
Name	String	None	Name of the document

Link	String	URL	Link at an online version of the document
Date_	Date	dd/mm/yyyy	Date of creation, publication or revision of the document
DateType	String	Domain: DateTypeValue	Type of date indicated in “Date_”
Status	String	Domain: DocumentStatusValue	Status of the document
ResponsibleAuthority	String	None	Name of the responsible authority
Method	String	None	Model used for create the object
Source	String	None	Source of the r object
Updated	Date	dd/mm/yyyy	Last update of the object

3.7.7. Object Class: Images

Description: List of images.

Field	Type	Restriction	Description
ObjectIDfk	String	None	Identification string of the sample
Name	String	None	Name of the image
Description	String	None	Description of the image
Image	String	URL	Link to the image

3.7.8. Object Class: Indicators

Description: list of indicators.

Field	Type	Restriction	Description
ObjectIDfk	String	None	Identification string of the site (foreign key)
IndicatorType	String	Domain: IndicatorTypeValue	Type of indicator
Indicator	String	None	Name of the indicator
Value	Double	None	Value of the indicator
UnitOfMeasure	String	None	Unit of measure of the indicator
ReferenceDate	Date	dd/mm/yyyy	Date which the value refers
Updated	Date	dd/mm/yyyy	Date of the last update
Method	String	None	Method used for obtain the value
Source	String	None	Source of the value

3.8. Oceanography

This thematic group collects time series measurements of the oceanographic variables and consists of one feature datasets “Oceanography” with eight feature classes storing the time series of eight variables by points:

- Chlorophyll_s
- Nutrients_m
- Oxigen_m
- SeaSurfaceCurrent_m
- SeaSurfaceSalinity_m
- SeaSurfaceTemperature_m
- SeaSurfaceTemperature_m
- Transparency_s

seven raster catalogs:

- Chlorophyll
- Nutrients
- Oxigen
- SeaSurfaceCurrent
- SeaSurfaceSalinity
- SeaSurfaceTemperature
- Transparency

and twenty five object classes:

- CHL_sat_y, CHL_sat_s, CHL_sat_m
- SST_sat_y, SST_sat_s, SST_sat_m
- TRA_sat_y, TRA_sat_s, TRA_sat_m
- NUT_mod_y, NUT_mod_s, NUT_mod_m
- OX_mod_y, OX_mod_s, OX_mod_m
- SSC_mod_y, SSC_mod_s, SSC_mod_m
- SSS_mod_y, S_mod_s, S_mod_m
- OceanographicData

This group of elements can be improved by users, adding other variables of interest.

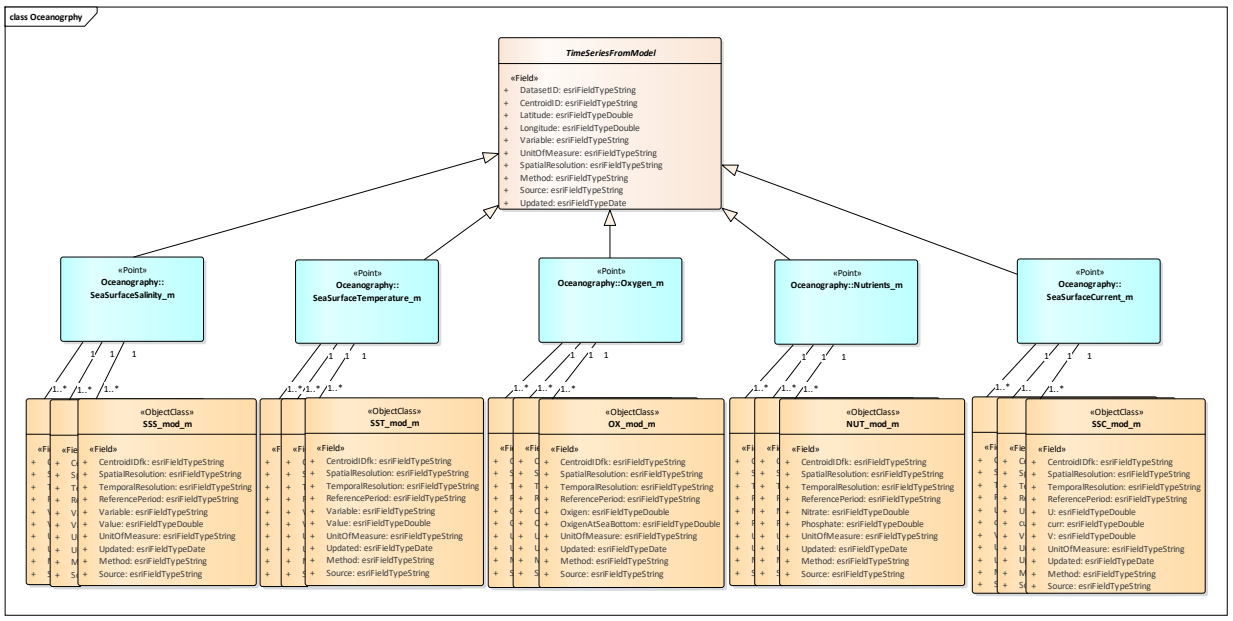

Fig.11 – UML of the "Oceanography" group about time series from models.

3.8.1. Feature Classes: Nutrients_m, Oxygen_m, SeaSurfaceCurrent_m, SeaSurfaceSalinity_m, SeaSurfaceTemperature_m

Description: punctual representation of the distribution of the oceanographic variable from models. The points are the centroids of the raster datasets.

GeometryType: Point

Field	Type	Restriction	Description
DatasetID	String	None	Identification string of the dataset the centroid belongs
CentroidID	String	None	Identification string of the centroid
Latitude	Double	GG.yyyyyy	Latitude of the centroid
Longitude	Double	GG.xxxxxx	Longitude of the centroid
Variable	String	None	Variable code
UnitOfMeasure	String	None	Unit of measure of the variable
SpatialResolution	String	None	Spatial resolution of the dataset
Method	String	None	Model used for create the dataset
Source	String	None	Source of the dataset
Updated	Date	dd/mm/yyyy	Last update of the dataset

3.8.2. Object Class: NUT_mod

Description: table with time series of nutrients coming from models. The suffix _y indicates the tables with the annual averages. The suffix _s indicates the tables with the seasonal averages and the suffix _m indicates the tables with the monthly averages.

Field	Type	Restriction	Description
CentroidIDfk	String	None	Identification string of the centroid
SpatialResolution	String	None	Spatial resolution of the dataset
TemporalResolution	String	Domain: TemporalResolutionTypeValue	Temporal resolution of the dataset
ReferencePeriod	String	None	Period the average refers
Nitrate	Double	None	Value of the variable
Phosphate	Double	None	Value of the variable
UnitOfMeasure	String	None	Unit of measure of the variable
Updated	Date	dd/mm/yyyy	Last update of the dataset
Method	String	None	Model used for create the dataset
Source	String	None	Source of the dataset

3.8.3. Object Class: OX_mod

Description: table with time series of oxygen and oxygen at the bottom coming from models. The suffix _y indicates the tables with the annual averages. The suffix _s indicates the tables with the seasonal averages and the suffix _m indicates the tables with the monthly averages.

Field	Type	Restriction	Description
CentroidIDfk	String	None	Identification string of the centroid
SpatialResolution	String	None	Spatial resolution of the dataset
TemporalResolution	String	Domain: TemporalResolutionTypeValue	Temporal resolution of the dataset
ReferencePeriod	String	None	Period the average refers
Oxygen	Double	None	of the variable
Oxygen at the bottom	Double	None	Value of the variable
UnitOfMeasure	String	None	Unit of measure of the variable
Updated	Date	dd/mm/yyyy	Last update of the dataset

Method	String	None	Model used for create the dataset
Source	String	None	Source of the dataset

3.8.4. Object Class: SSC_mod

Description: table with time series from models of the three components of the sea surface current. The suffix _y indicates the tables with the annual averages. The suffix _s indicates the tables with the seasonal averages and the suffix _m indicates the tables with the monthly averages.

Field	Type	Restriction	Description
CentroidIDfk	String	None	Identification string of the centroid
SpatialResolution	String	None	Spatial resolution of the dataset
TemporalResolution	String	Domain: TemporalResolutionTypeValue	Temporal resolution of the dataset
ReferencePeriod	String	None	Period the average refers
U	Double	None	Value of the longitudinal vector component of the current
V	Double	None	Value of the longitudinal vector component of the current
curr	Double	None	Value of the module of current intensity
UnitOfMeasure	String	None	Unit of measure of the variable
Updated	Date	dd/mm/yyyy	Last update of the dataset
Method	String	None	Model used for create the dataset
Source	String	None	Source of the dataset

3.8.5. Object Class: SSS_mod, SST_mod

Description: table with time series coming from models. The suffix _y indicates the tables with the annual averages. The suffix _s indicates the tables with the seasonal averages and the suffix _m indicates the tables with the monthly averages.

Field	Type	Restriction	Description
CentroidIDfk	String	None	Identification string of the centroid
SpatialResolution	String	None	Spatial resolution of the dataset
TemporalResolution	String	Domain: TemporalResolutionTypeValue	Temporal resolution of the dataset

ReferencePeriod	String	None	Period the average refers
Variable	String	None	Variable code
Value	Double	None	Value of the variable
UnitOfMeasure	String	None	Unit of measure of the variable
Updated	Date	dd/mm/yyyy	Last update of the dataset
Method	String	None	Model used for create the dataset
Source	String	None	Source of the dataset

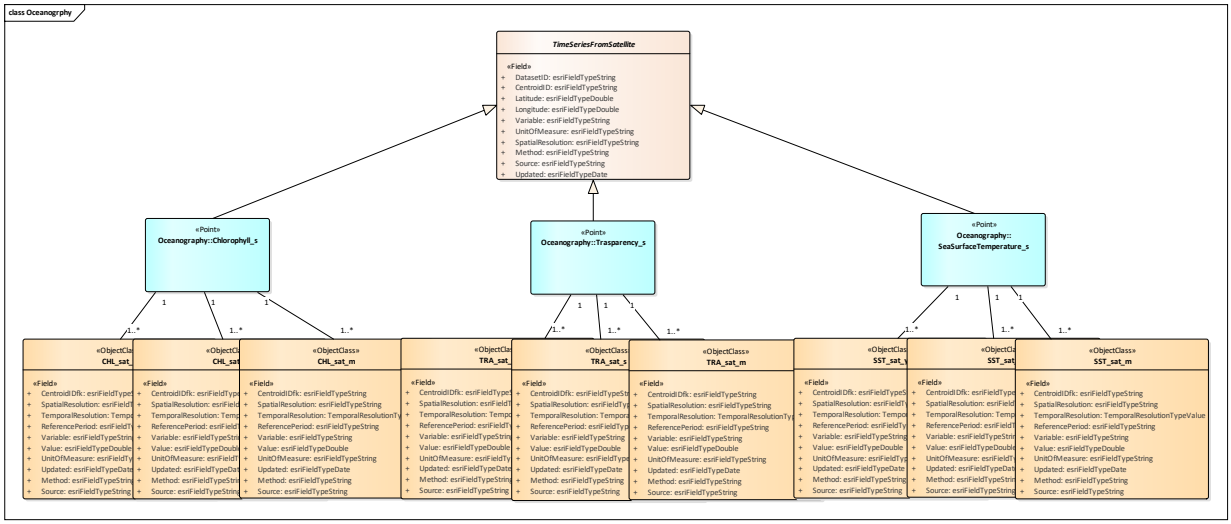

Fig.12 – UML of the "Oceanography" group about time series from satellites.

3.8.6. Feature Classes: Chlorophyll_s, SeaSurfaceTemperature_s, Trasparency_s

Description: punctual representation of the distribution of the oceanographic variable from satellites. The points are the centroids of the raster datasets.

GeometryType: Point

Field	Type	Restriction	Description
DatasetID	String	None	Identification string of the dataset the centroid belongs
CentroidID	String	None	Identification string of the centroid
Latitude	Double	GG.yyyyyy	Latitude of the centroid
Longitude	Double	GG.xxxxxx	Longitude of the centroid
Variable	String	None	Variable code

UnitOfMeasure	String	None	Unit of measure of the variable
SpatialResolution	String	None	Spatial resolution of the dataset
Method	String	None	Model used for create the dataset
Source	String	None	Source of the dataset
Updated	Date	dd/mm/yyyy	Last update of the dataset

3.8.7. Object Class: CHL_sat, SST_sat, TRA_sat

Description: table with time series coming from satellites. The suffix _y indicates the tables with the annual averages. The suffix _s indicates the tables with the seasonal averages and the suffix _m indicates the tables with the monthly averages.

Field	Type	Restriction	Description
CentroidIDfk	String	None	Identification string of the centroid
SpatialResolution	String	None	Spatial resolution of the dataset
TemporalResolution	String	Domain: TemporalResolutionTypeValue	Temporal resolution of the dataset
ReferencePeriod	String	None	Period the average refers
Variable	String	None	Variable code
Value	Double	None	Value of the variable
UnitOfMeasure	String	None	Unit of measure of the variable
Updated	Date	dd/mm/yyyy	Last update of the dataset
Method	String	None	Model used for create the dataset
Source	String	None	Source of the dataset

3.8.8. Object Class: OceanographicData

Description: list of available oceanographic data for each MPA.

Field	Type	Restriction	Description
DatasetIDfk	String	None	Identification string of dataset
Variable	String	None	Name of the variable
VariableCode	String	None	Code of the variable
UnitOfMeasure	String	None	Unit of measure of the variable
SpatialResolution	String	None	Spatial resolution of the dataset
TemporalResolution	String	Domain: TemporalResolutionTypeValue	Temporal resolution of the dataset

Updated	Date	dd/mm/yyyy	Last update of the dataset
Method	String	None	Model used for create the dataset
Source	String	None	Source of the dataset

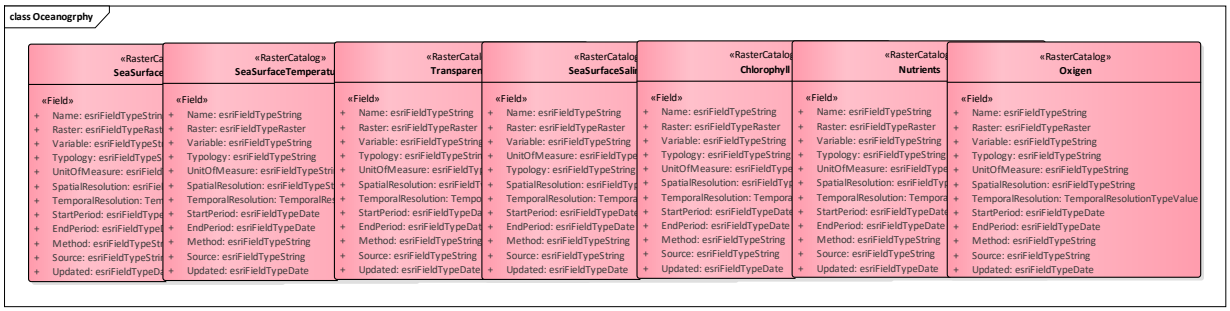

Fig.14 – UML of the "Oceanography" group showing raster catalogs.

3.8.9. Raster Catalogs: Chlorophyll, Nutrients, Oxygen, SeaSurfaceCurrent, SeaSurfaceSalinity, SeaSurfaceTemperature, Trasparency

Description: catalogs of rasters representing the distribution of the variables. User can download the rasters of interest from dedicated repositories and store them in these catalogs.

Field	Type	Restriction	Description
Name	String	None	Name of the raster file
Raster	Raster	None	Raster file
Variable	String	None	Variable code
Typology	String	None	Type of value
UnitOfMeasure	String	None	Unit of measure of the variable
SpatialResolution	String	None	Spatial resolution of the raster
TemporalResolution	String	Domain: TemporalResolutionTypeValue	Temporal resolution of the raster
StartPeriod	Date	dd/mm/yyyy	Start date of the period considered for the average
EndPeriod	Date	dd/mm/yyyy	End date of the period considered for the average
Updated	Date	dd/mm/yyyy	Last update of the dataset
Method	String	None	Model used for create the dataset

Source	String	None	Source of the dataset

3.9. Socioeconomics

This thematic group deals with social and economic data and information, it consist of a feature dataset “Socioeconomics” with five feature classes:

- CorineLandCover
- LandUse
- Locality
- MaritimeUse
- Municipality

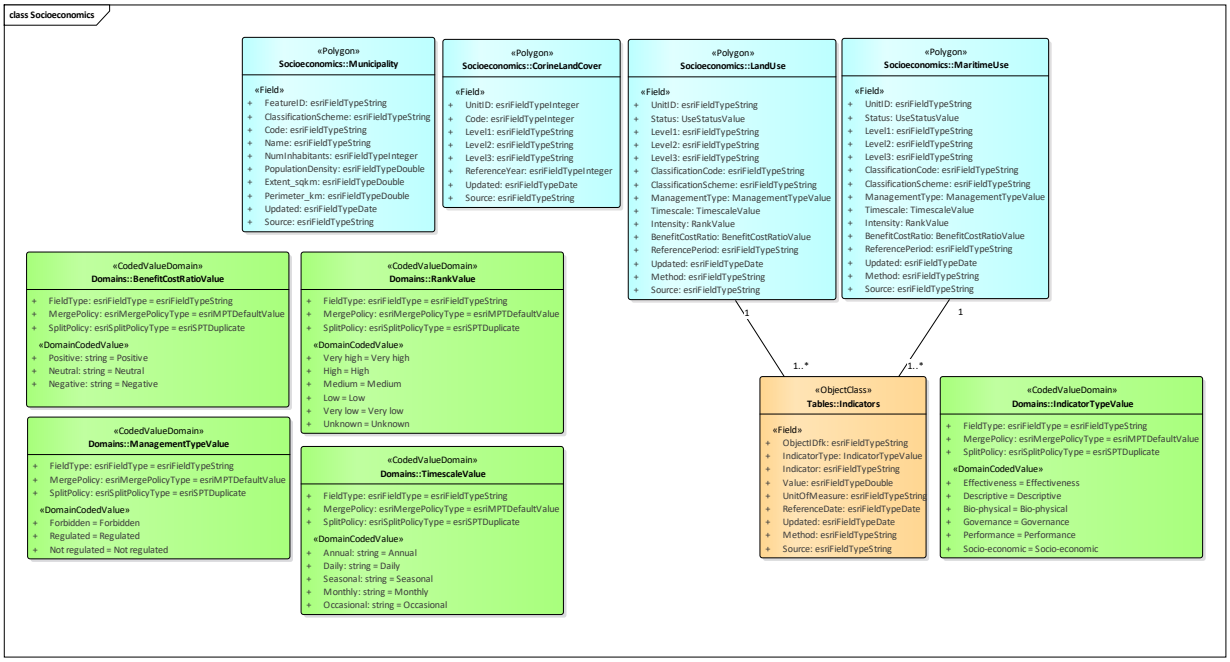

Fig.13 – UML of the “Socioeconomics” group.

3.9.1. Feature Class: CorineLandCover

Description: Corine Land Cover (CLC) map.

GeometryType: polygon

Field	Type	Restriction	Description
UnitID	String	None	Identification string of the unit

Code	Integer	None	CLC code
Level1	String	None	First level of CLC
Level2	String	None	Second level of CLC
Level3	String	None	Third level of CLC
ReferenceYear	Integer	yyyy	Year of the mapping
Source	String	None	Source of the map
Updated	Date	dd/mm/yyyy	Date of the last update

3.9.2. Feature Class: LandUse

Description: map of the total of arrangements, activities, and inputs that people undertake in a certain land cover type. It involves the management and modification of natural environment or wilderness into built environment such as settlements and semi-natural habitats such as arable fields, pastures, and managed woods.

GeometryType: polygon

Field	Type	Restriction	Description
UnitID	String	None	Identification string of the unit
Status	String	Domain: UseStatusValue	Status of the activity
Level1	String	None	First level of description of the activity
Level2	String	None	Second level of description of the activity
Level3	String	None	Third level of description of the activity
ClassificationCode	String	None	Code of the activity that refers to a recognized classification scheme
ClassificationScheme	String	None	Recognized classification scheme used for classify the activity
MenagementType	String	Domain: ManagementTypeValue	Type of management
Timescale	String	Domain: TimescaleValue	Frequency of activity
Intensity	String	Domain: RankValue	Intensity of the activity
BenefitCostRatio	String	Domain: BenefitCostRatioValue	Qualitative estimation of the Benefit/Cost ratio
Updated	Date	dd/mm/yyyy	Date of the last update
Method	String	None	Method used for obtain the information
Source	String	None	Source of the information

3.9.3. Feature Class: Locality

Description: position of the major localities.

GeometryType: point

Field	Type	Restriction	Description
FeatureID	String	None	Identification string of the object
ClassificationScheme	String	None	Recognized classification scheme used for classify the locality
Code	String	None	Code of the locality that refers to a recognized classification scheme
Name	String	None	Name of the locality that refers to a recognized classification scheme
NumInhabitants	Integer	None	Number of inhabitants
PopulationDensity	Double	None	Number of inhabitants per sq. km
Extent_sqkm	String	None	Surface covered by the locality in square kilometers
Updated	Date	dd/mm/yyyy	Date of the last update
Method	String	None	Method used for obtain the information
Source	String	None	Source of the information

3.9.4. Feature Class: MaritimeUse

Description: map of the total of arrangements, activities, and inputs that people undertake in a certain maritime zone. It involves the management and modification of natural environment or wilderness into built environment such as maritime traffic, and fishery.

GeometryType: polygon

Field	Type	Restriction	Description
UnitID	String	None	Identification string of the unit
Status	String	Domain: UseStatusValue	Status of the activity
Level1	String	None	First level of description of the activity
Level2	String	None	Second level of description of the activity
Level3	String	None	Third level of description of the activity
ClassificationCode	String	None	Code of the activity that refers to a recognized classification scheme
ClassificationScheme	String	None	Recognized classification scheme used for

			classify the activity
MenagementType	String	Domain: ManagementTypeValue	Type of management
Timescale	String	Domain: TimescaleValue	Frequency of activity
Intensity	String	Domain: RankValue	Intensity of the activity
BenefitCostRatio	String	Domain: BenefitCostRatioValue	Qualitative estimation of the Benefit/Cost ratio
Updated	Date	dd/mm/yyyy	Date of the last update
Method	String	None	Method used for obtain the information
Source	String	None	Source of the information

3.9.5. Feature Class: Municipality

Description: extent of the municipalities.

GeometryType: polygon

Field	Type	Restriction	Description
FeatureD	String	None	Identification string of the object
ClassificationScheme	String	None	Recognized classification scheme used for classify the municipality
Code	String	None	Code of the municipality that refers to a recognized classification scheme
Name	String	None	Name of the municipality that refers to a recognized classification scheme
NumInhabitants	Integer	None	Number of inhabitats of the municipality
PopulationDensity	Double	None	Number of inhabitats per square kilometers
Extent_sqkm	Double	None	Extent of the municipality in square kilometers
Perimeter_m	Double		Perimeter of the municipality in meter
Updated	Date	dd/mm/yyyy	Date of update of information
Source	String	None	Source of the information

3.9.6. Object Class: Indicators

Description: list of indicators.

Field	Type	Restriction	Description

ObjectIDfk	String	None	Identification string of the object (foreign key)
IndicatorType	String	Domain: IndicatorTypeValue	Type of indicator
Indicator	String	None	Name of the indicator
Value	Double	None	Value of the indicator
UnitOfMeasure	String	None	Unit of measure of the indicator
ReferenceDate	Date	dd/mm/yyyy	Date which the value refers
Updated	Date	dd/mm/yyyy	Date of the last update
Method	String	None	Method used for obtain the value
Source	String	None	Source of the value

3.10. Threats

The thematic group “Threats” consists of six feature datasets “ArtificialInfrastructures”, “CoastalPressures”, “FishingActivities”, “FishingEffort”, “MarinePollution” and “SystemModifications” and a raster catalog “Threats”.

“ArtificialInfrastructures” has three features classes:

- PunctualInfrastructure
- LinearInfrastructure
- ArealInfrastructure

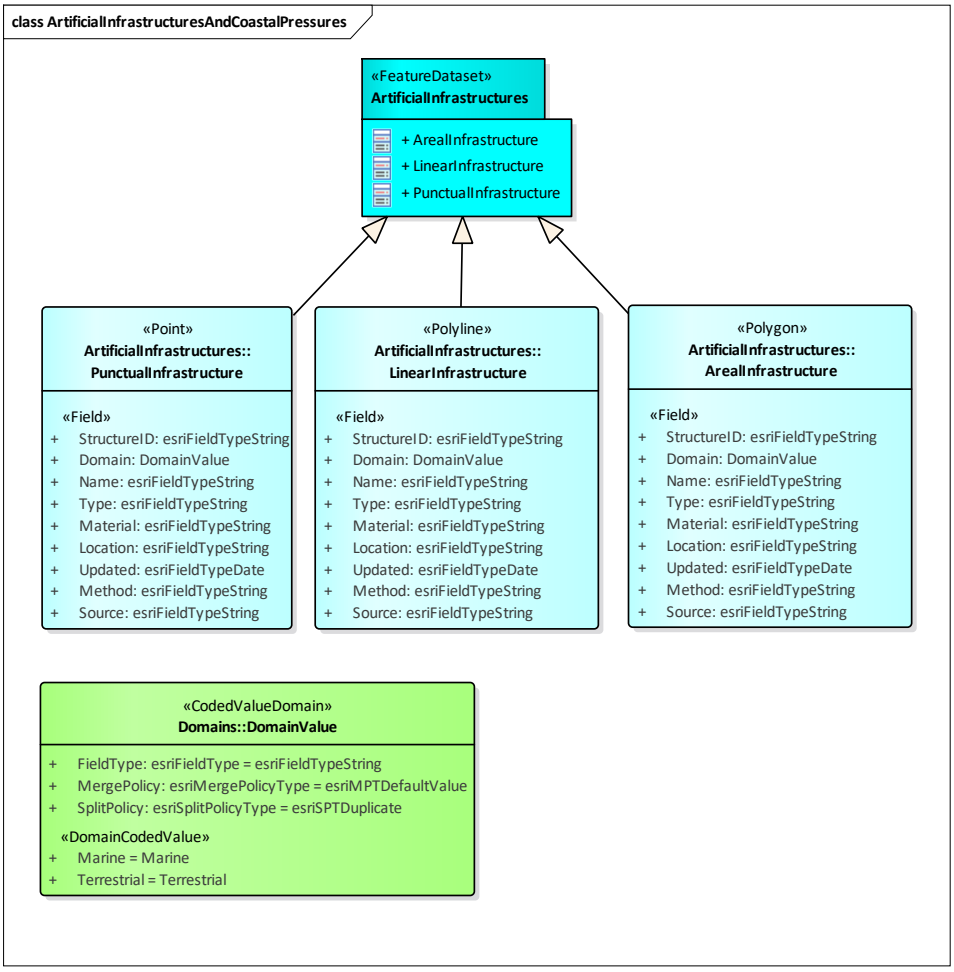

Fig.15 – UML of the “ArtificialInfrastructure” feature dataset.

“CoastalPressures”, has three features classes:

- AnthropicActivityAndStructure
- CoastalDevelopment
- HumanFrequentation

The elements are connected between the following relationship classes:

Name	Multiplicity	Origin class	Destination class	Primary key	Foreign key
AnthropicActivityAndStructure HasIndicators	1→1..*	AnthropicActivityAndStructure	Indicators	ActivityID	ObjectID fk
CoastalDevelopment HasIndicators	1→1..*	CoastalDevelopment	Indicators	FeatureID	ObjectID fk
HumanFrequentation HasIndicators	1→1..*	HumanFrequentation	Indicators	FeatureID	ObjectID

					fk

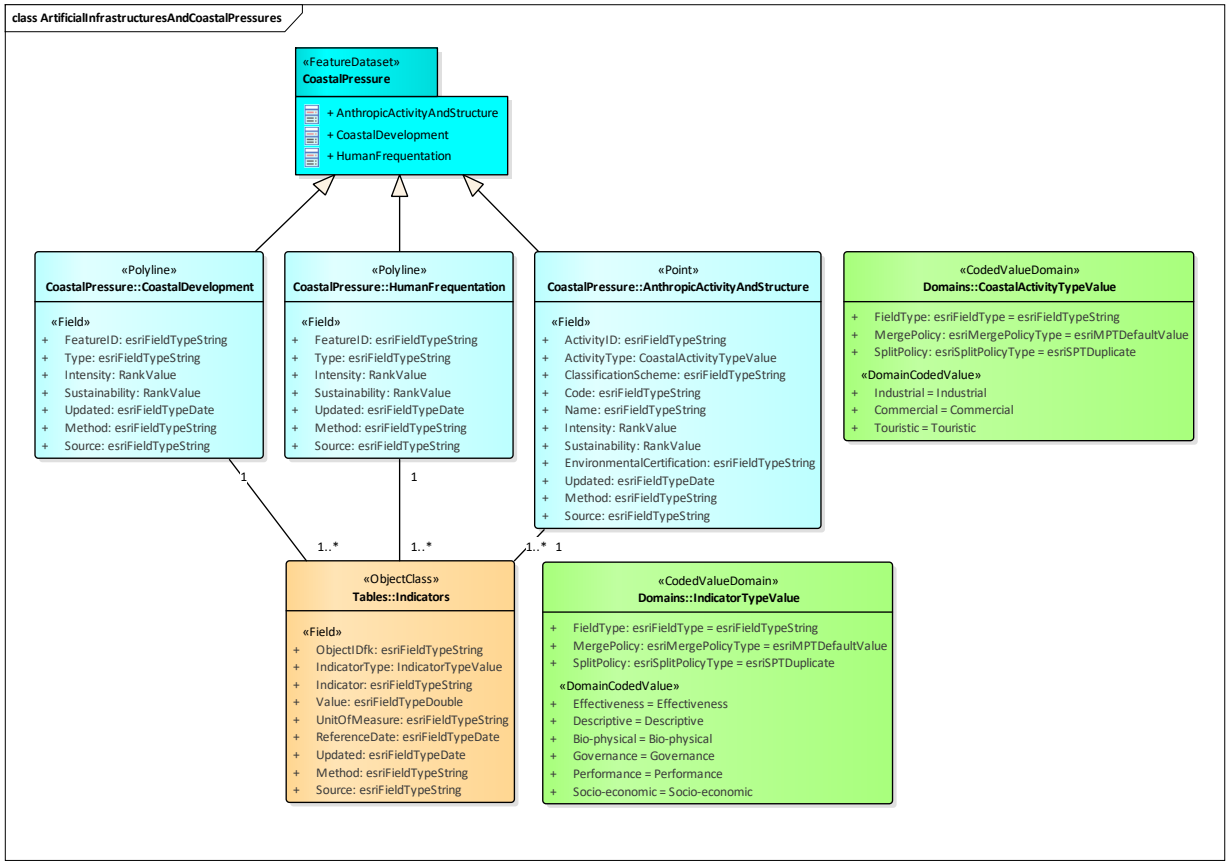

Fig.16 – UML of the “CoastalPressures” feature dataset.

“FishingActivities” has tree feature classes:

- Aquaculture
- Fishery
- FishingRoute

The elements are connected between the following relationship classes:

Name	Multiplicity	Origin class	Destination class	Primary key	Foreign key
AquacultureHasIndicators	1→1..*	Aquaculture	Indicators	ActivityID	ObjectID fk
FisheryHasIndicators	1→1..*	Fishery	Indicators	ActivityID	ObjectID fk

FishingRouteHasIndicators	1→1..*	FishingRoute	Indicators	ActivityID	ObjectID fk

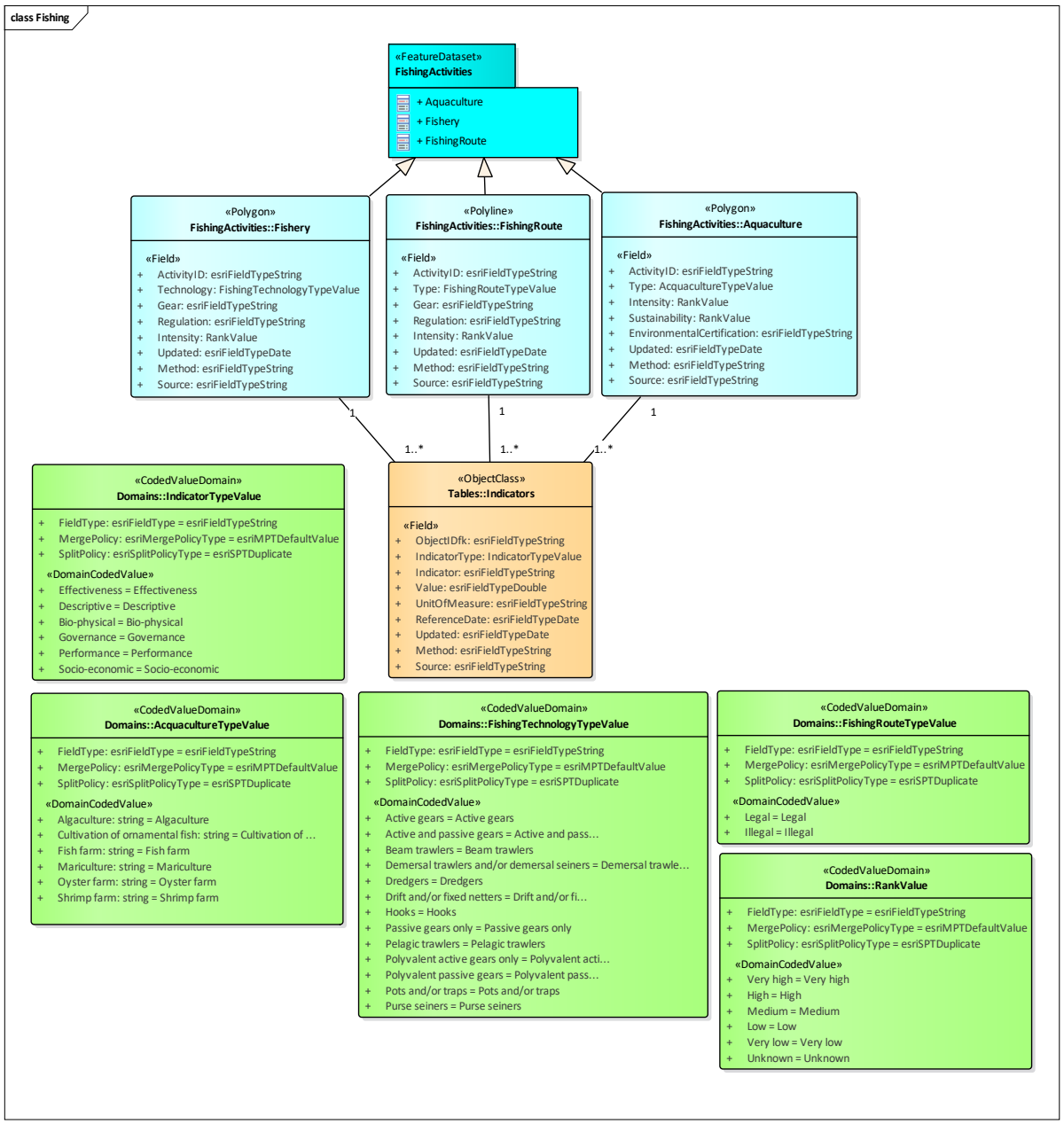

Fig.17 – UML of the “FishingActivities” feature dataset.

“FishingEffort” has four feature classes:

- PurseSeiners

- RecreationalFishing
- SmallScaleFishing
- Trawlers

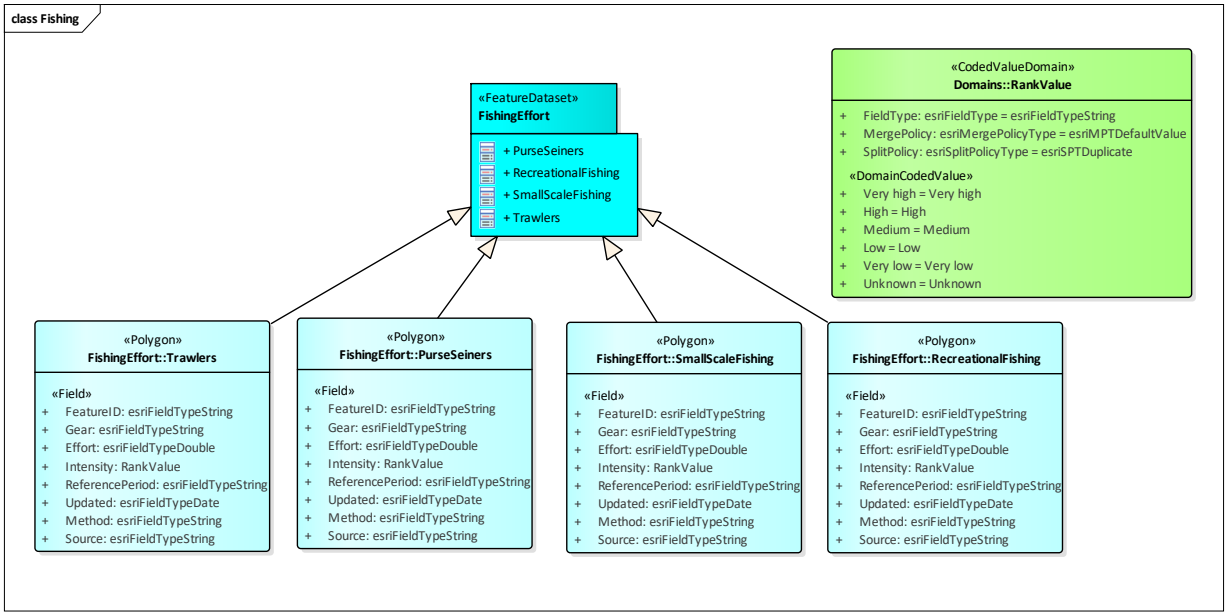

Fig.18 – UML of the “FishingEffort” feature dataset.

“MarinePollution” has three feature classes:

- Marine Litter
- PointSourcePollution
- NonpointSourcePollution

The elements are connected between the following relationship classes:

Name	Multiplicity	Origin class	Destination class	Primary key	Foreign key
MarineLitterHasIndicators	1→1..*	MarineLitter	Indicators	FeatureID	ObjectID fk
PointSourcePollutionHasIndicators	1→1..*	Fishery	Indicators	FeatureID	ObjectID fk
NonpointSourcePollutionHasIndicators	1→1..*	NonpointSource Pollution	Indicators	FeatureID	ObjectID fk

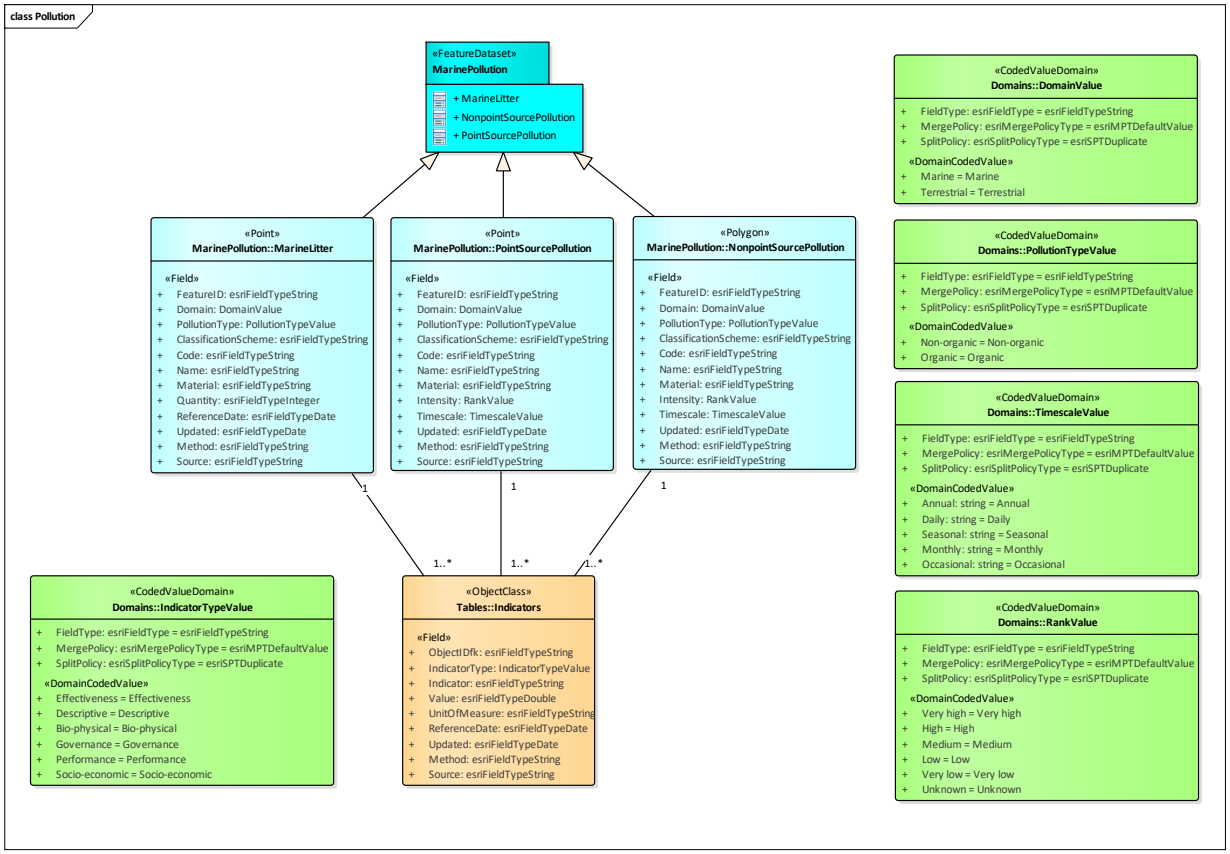

Fig.19 – UML of the “MarinePollution” feature dataset.

“SystemModifications” has four feature classes:

- BioticAndAbioticActivity
- BioticAndAbioticProcess
- Erosion
- ProblematicSpecies

The elements are connected between the following relationship classes:

Name	Multiplicity	Origin class	Destination class	Primary key	Foreign key
BioticAndAbioticActivityHasIndicators	1→1..*	BioticAndAbioticActivity	Indicators	FeatureID	ObjectIDfk
BioticAndAbioticProcessHasIndicators	1→1..*	BioticAndAbioticProcess	Indicators	FeatureID	ObjectIDfk
ErosionHasIndicators	1→1..*	Erosion	Indicators	FeatureID	ObjectIDfk

ProblematicSpeciesHasIndicators	1→1..*	ProblematicSpecies	Indicators	FeatureID	ObjectID fk

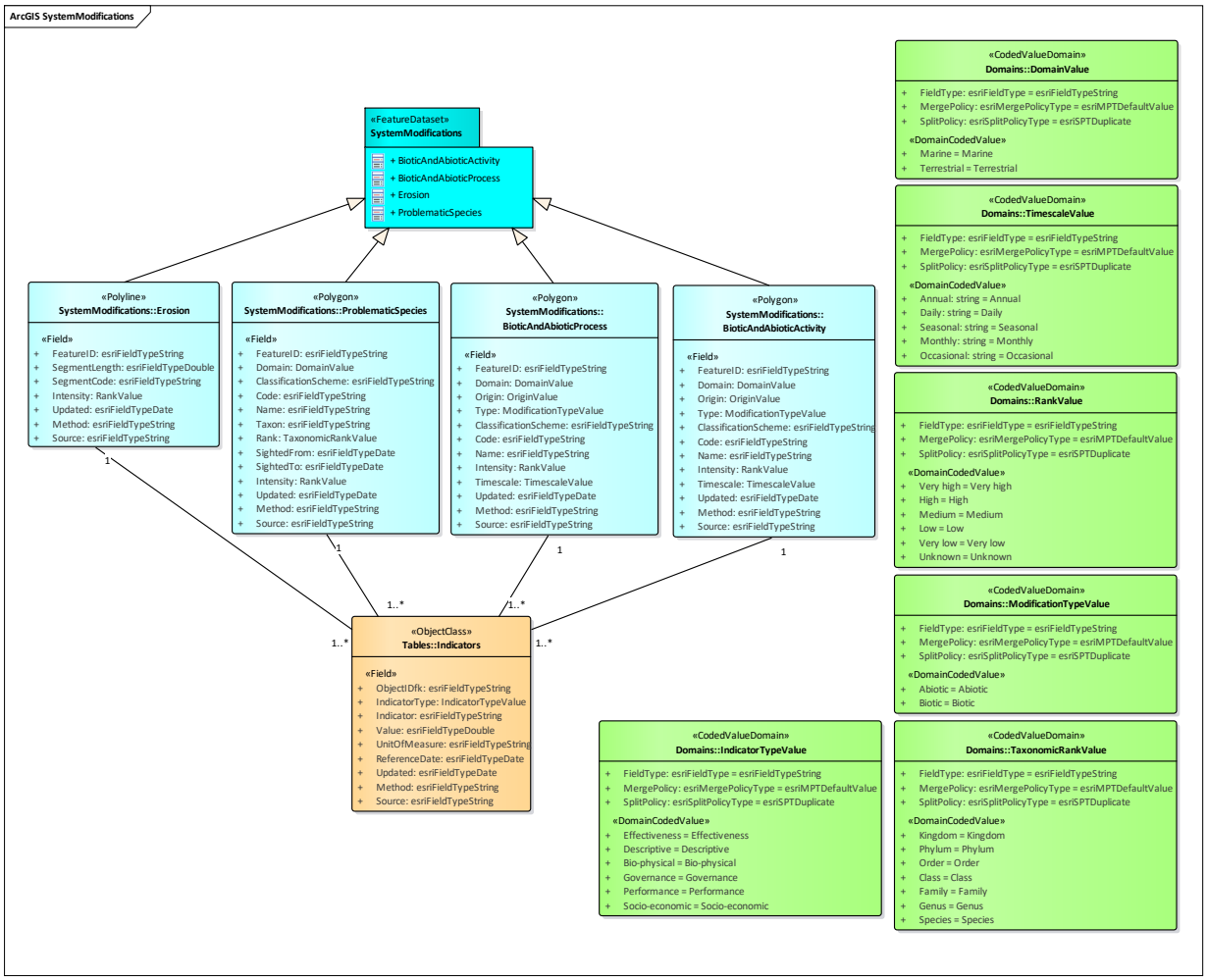

Fig.20 – UML of the “SystemModifications” feature dataset.

3.10.1. Feature Class: AnthropicActivityAndStructure

Description: anthropic activity and structures along the coast.

GeometryType: point

Field	Type	Restriction	Description
ActivityID	String	None	Identification string of the activity or structure
ActivityType	String	Domain: CoastalActivityTypeValue	Type of activity or structure

ClassificationScheme	String	None	Recognized classification scheme used for classify the activity and structure
Code	String	None	Code of the activity or structure that refers to a recognized classification scheme
Name	String	None	Name of the activity or structure that refers to a recognized classification scheme
Intensity	String	Domain: RankValue	Intensity of the activity
Sustainability	String	Domain: RankValue	Qualitative degree of suistainability of the activity
EnvironmentalCertification	String	None	List of environmental certifications (if present)
Updated	Date	dd/mm/yyyy	Date of the last update
Method	String	None	Method used for obtain the information
Source	String	None	Source of the information

3.10.2. Feature Class: Aquaculture

Description: according to the Food and Agriculture Organization (FAO), aquaculture "is understood to mean the farming of aquatic organisms including fish, mollusks, crustaceans and aquatic plants. Farming implies some form of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators, etc. Farming also implies individual or corporate ownership of the stock being cultivated.

GeometryType: polygon

Field	Type	Restriction	Description
ActivityID	String	None	Identification string of the activity
Type	String	Domain: AquacultureTypeValue	Type of plant
Intensity	String	Domain: RankValue	Intensity of the activity
Sustainability	String	Domain: RankValue	Qualitative degree of suistainability of the activity
EnvironmentalCertification	String	None	List of environmental certifications (if present)
Updated	Date	dd/mm/yyyy	Date of the last update
Method	String	None	Method used for obtain the information

Source	String	None	Source of the information

3.10.3. Feature Class: Areal/Linear/PunctualInfrastructure

Description: artificial infrastructure that can be represented by points, polylines or polygons.

GeometryType: point, polylines, polygons

Field	Type	Restriction	Description
StructureID	String	None	Identification string of the structure
Domain:	String	Domain: DomainValue	Domain the infrastructure belong (marine, terrestrial)
Name	String	None	Name of the infrastructure
Type	String	None	Type of the infrastructure
Material	String	None	Material of the infrastructure
Location	String	None	Location of the infrastructure
Updated	Date	dd/mm/yyyy	Date of the last update
Method	String	None	Method used for obtain the information
Source	String	None	Source of the information

3.10.4. Feature Class: BioticAndAbioticActivity

Description: biotic or abiotic activity that brings a system modification.

GeometryType: polygon

Field	Type	Restriction	Description
FeatureID	String	None	Identification string of the feature
Domain	String	Domain: DomainValue	Domain the activity takes place (marine, terrestrial)
Origin	String	OriginValue	Origin of the activity
Type	String	Domain: ModificationTypeValue	Type of activity
ClassificationScheme	String	None	Recognized classification scheme used for classify the activity
Code	String	None	Code of the activity that refers to a recognized classification scheme
Name	String	None	Name of the activity that refers to a recognized

			classification scheme
Intensity	String	Domain: RankValue	Intensity of activiy
Timescale	String	Domain: TimescaleValue	Period of manifestation of the activity
Updated	Date	dd/mm/yyyy	Date of the last update
Method	String	None	Method used for obtain the information
Source	String	None	Source of the information

3.10.5. Feature Class: BioticAndAbioticProcess

Description: biotic or abiotic process that brings a system modification.

GeometryType: polygon

Field	Type	Restriction	Description
FeatureID	String	None	Identification string of the feature
Domain	String	Domain: DomainValue	Domain the process takes place (marine, terrestrial)
Origin	String	OriginValue	Origin of the process
Type	String	Domain: ModificationTypeValue	Type of process
ClassificationScheme	String	None	Recognized classification scheme used for classify the process
Code	String	None	Code of the process that refers to a recognized classification scheme
Name	String	None	Name of the process that refers to a recognized classification scheme
Intensity	String	Domain: RankValue	Intensity of process
Timescale	String	Domain: TimescaleValue	Period of manifestation of the process
Updated	Date	dd/mm/yyyy	Date of the last update
Method	String	None	Method used for obtain the information
Source	String	None	Source of the information

3.10.6. Feature Class: CoastalDevelopment

Description: linear representation of the coastal development along the coast.

GeometryType: polyline

Field	Type	Restriction	Description
FeatureID	String	None	Identification string of the feature
Type	String	None	Type of development
Intensity	String	Domain: RankValue	Intensity of the development
Sustainability	String	Domain: RankValue	Qualitative degree of sustainability of the development
Updated	Date	dd/mm/yyyy	Date of the last update
Method	String	None	Method used for obtain the information
Source	String	None	Source of the information

3.10.7. Feature Class: Erosion

Description: linear representation of the regression of the coast.

GeometryType: polyline

Field	Type	Restriction	Description
FeatureID	String	None	Identification string of the feature
SegmentCode	String	None	Identification string of the segment
SegmentLength	Double	None	Length of the segment
Intensity	String	Domain: RankValue	Intensity of the erosion
Updated	Date	dd/mm/yyyy	Date of the last update
Method	String	None	Method used for obtain the information
Source	String	None	Source of the information

3.10.8. Feature Class: Fishery

Description: routes where fishing is usual, constant and recorded.

GeometryType: polyline

Field	Type	Restriction	Description
FeatureID	String	None	Identification string of the feature
Technology	String	Domain: FishingTechnologyTypeValue	Type of technology for fishing
Gear	String	None	Devices used for fishing
Regulation	String	None	Type of regulation of the fishery

Intensity	String	Domain: RankValue	Intensity of the fishery
Updated	Date	dd/mm/yyyy	Date of the last update
Method	String	None	Method used for obtain the information
Source	String	None	Source of the information

3.10.9. Feature Class: FishingRoute

Description: routes where fishing is usual, constant and recorded.

GeometryType: polyline

Field	Type	Restriction	Description
FeatureID	String	None	Identification string of the feature
Technology	String	Domain: FishingRouteTypeValue	Type of fishing route
Gear	String	None	Devices used for fishing
Regulation	String	None	Type of regulation
Intensity	String	Domain: RankValue	Intensity of shipping related to fishery
Updated	Date	dd/mm/yyyy	Date of the last update
Method	String	None	Method used for obtain the information
Source	String	None	Source of the information

3.10.10. Feature Class: HumanFrequentation

Description: qualitative degree of human frequentation of the coast.

GeometryType: point

Field	Type	Restriction	Description
FeatureID	String	None	Identification string of the feature
Type	String	None	Type of frequentation
Intensity	String	Domain: RankValue	Intensity of the frequentation
Sustainability	String	Domain: RankValue	Qualitative degree of sustainability of the frequentation
Updated	Date	dd/mm/yyyy	Date of the last update
Method	String	None	Method used for obtain the information
Source	String	None	Source of the information

3.10.11. Feature Class: MarineLitter

Description: position and quantity of macro marine litter.

GeometryType: point

Field	Type	Restriction	Description
FeatureID	String	None	Identification string of the sighting
Domain:	String	Domain: DomainValue	Domain where the litter has been sighted (marine, terrestrial)
PollutionType	String	Domain: PollutionTypeValue	Type of pollution
ClassificationScheme	String	None	Recognized classification scheme used for classify the activity and structure. Recommendation: Guidance on Monitoring of Marine Litter in European Seas, 2013 (Annex 8.1 - Master List of Categories of Litter Items)
Code	String	None	Code of the litter that refers to a recognized classification scheme. Recommendation: Guidance on Monitoring of Marine Litter in European Seas, 2013 (Annex 8.1 - Master List of Categories of Litter Items)
Name	String	None	Name of the litter that refers to a recognized classification scheme. Recommendation: Guidance on Monitoring of Marine Litter in European Seas, 2013 (Annex 8.1 - Master List of Categories of Litter Items)
Material	String	None	Material of sighted litter
Quantity	Integer	None	Quantity of sighted litter
ReferenceDate	Date	dd/mm/yyyy	Date of sighting
Updated	Date	dd/mm/yyyy	Date of the last update
Method	String	None	Method used for obtain the information
Source	String	None	Source of the information

3.10.12. Feature Class: NonpointSourcePollution

Description: Nonpoint source pollution generally results from land runoff, precipitation, atmospheric deposition, drainage, seepage or hydrologic modification. Nonpoint source (NPS) pollution, unlike pollution from industrial and sewage treatment plants, comes from many diffuse sources. NPS pollution is caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries

away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters and ground waters (EPA definition).

GeometryType: polygon

Field	Type	Restriction	Description
FeatureID	String	None	Identification string of the feature
Domain:	String	Domain: DomainValue	Domain the pollution refers (marine, terrestrial)
PollutionType	String	Domain: PollutionTypeValue	Type of pollution
ClassificationScheme	String	None	Recognized classification scheme used for classify the activity and structure.
Code	String	None	Code of pollution that refers to a recognized classification scheme.
Name	String	None	Name of pollution that refers to a recognized classification scheme.
Material	String	None	Material of pollution
Intensity	String	Domain: RankValue	Intensity of pollution
Timescale	String	Domain: TimescaleValue	Period of manifestation of pollution
Updated	Date	dd/mm/yyyy	Date of the last update
Method	String	None	Method used for obtain the information
Source	String	None	Source of the information

3.10.13. Feature Class: PointSourcePollution

Description: The term "point source" means any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include agricultural storm water discharges and return flows from irrigated agriculture (EPA definition).

GeometryType: point

Field	Type	Restriction	Description
FeatureID	String	None	Identification string of the feature
Domain:	String	Domain: DomainValue	Domain the pollution refers (marine, terrestrial)

PollutionType	String	Domain: PollutionTypeValue	Type of pollution
ClassificationScheme	String	None	Recognized classification scheme used for classify the activity and structure.
Code	String	None	Code of pollution that refers to a recognized classification scheme.
Name	String	None	Name of pollution that refers to a recognized classification scheme.
Material	String	None	Material of pollution
Intensity	String	Domain: RankValue	Intensity of pollution
Timescale	String	Domain: TimescaleValue	Period of manifestation of pollution
Updated	Date	dd/mm/yyyy	Date of the last update
Method	String	None	Method used for obtain the information
Source	String	None	Source of the information

3.10.14. Feature Class: ProblematicSpecies

Description: location of problematic species, for example invasive species.

GeometryType: polygon

Field	Type	Restriction	Description
FeatureID	String	None	Identification string of the feature
Domain	String	Domain: DomainValue	Domain the species belongs (marine, terrestrial)
ClassificationScheme	String	None	Recognized classification scheme used for classify the species. Recommendation: WoRMS
Code	String	None	Code of the species that refers to a recognized classification scheme. Recommendation: WoRMS
Name	String	None	Name of the species that refers to a recognized classification scheme. Recommendation: WoRMS
Rank	String	Domain: TaxonomicRankValue	Taxonomic level of identification
SightedFrom	Date	dd/mm/yyyy	Date of first sighting
SightedTo	Date	dd/mm/yyyy	Date of last sighting
Intensity	String	Domain: RankValue	Intensity of manifestation
Updated	Date	dd/mm/yyyy	Date of the last update

Method	String	None	Method used for obtain the information
Source	String	None	Source of the information

3.10.15. Feature Classes: PurseSeiners, RecreationalFishing, SmallScaleFishing, Trawlers

Description: intensity of the fishing in the space.

GeometryType: polygon

Field	Type	Restriction	Description
FeatureID	String	None	Identification string of the feature
Gear	String	None	Type of major device
Effort	Double	None	Intensity of the effort
Intensity	String	Domain: RankValue	Intensity of effort
ReferencePeriod	String	None	Temporal period the model refers
Updated	Date	dd/mm/yyyy	Date of the last update
Method	String	None	Method used for obtain the information
Source	String	None	Source of the information

3.10.16. Object Class: Indicators

Description: list of indicators.

Field	Type	Restriction	Description
ObjectIDfk	String	None	Identification string of the object (foreign key)
IndicatorType	String	Domain: IndicatorTypeValue	Type of indicator
Indicator	String	None	Name of the indicator
Value	Double	None	Value of the indicator
UnitOfMeasure	String	None	Unit of measure of the indicator
ReferenceDate	Date	dd/mm/yyyy	Date which the value refers
Updated	Date	dd/mm/yyyy	Date of the last update
Method	String	None	Method used for obtain the value
Source	String	None	Source of the value

3.10.17. Raster Catalog: Threats

Description: catalog of the raster about threats.

GeometryType: raster

Field	Type	Restriction	Description
RasterID	String	None	Identification string of the raster
Name	String	None	Name of the raster
Type	Double	None	Type of raster
Raster	String	Domain: RankValue	Raster file
SpatialResolution	String	None	Spatial resolution of the raster
TemporalResolution	Date	dd/mm/yyyy	Temporal resolution of the raster
Method	String	None	Method used for obtain the raster
Source	String	None	Source of the raster

4. Physical model

We imported the UML model in a ArcGIS geodatabase, a database used primarily to store, query, and manipulate spatial data. Geodatabases store geometry, a spatial reference system, attributes, and behavioral rules for data. Various types of geographic datasets can be collected within a geodatabase, including feature classes, attribute tables, raster datasets, network datasets, topologies, and many others. Geodatabases can be stored in IBM DB2, IBM Informix, Oracle, Microsoft Access, Microsoft SQL Server, and PostgreSQL relational database management systems, or in a system of files, such as a file geodatabase (ESRI definition).

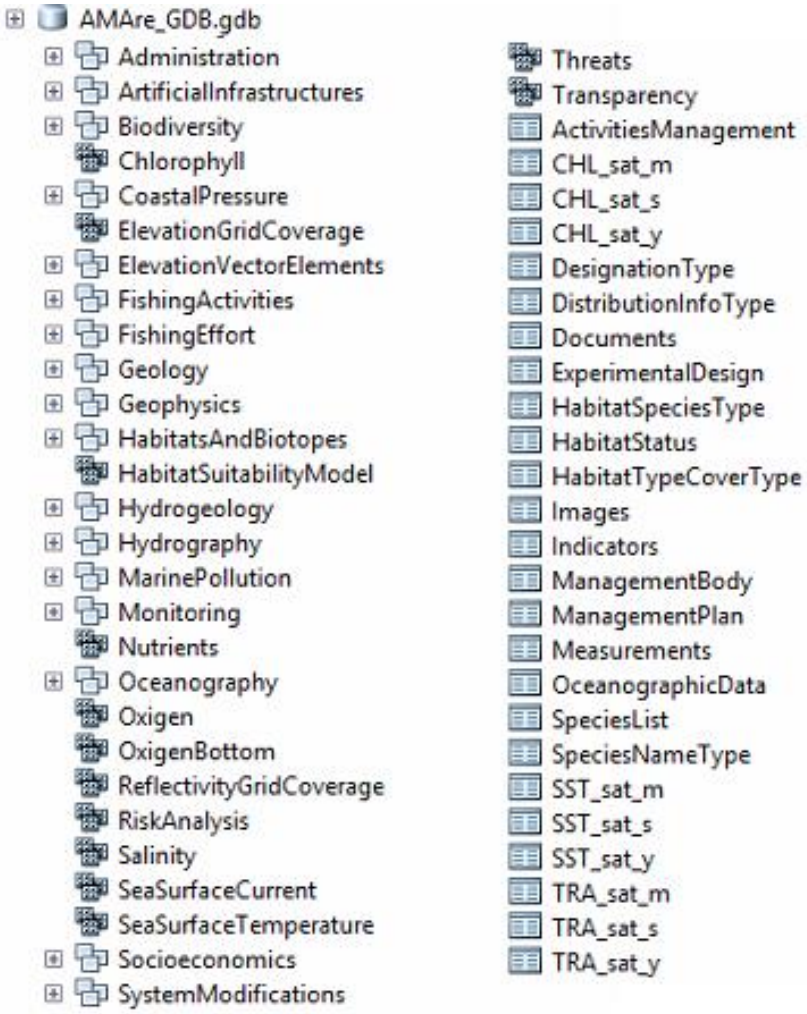

Fig 21 – Part of the File geodatabase implemented in the framework of the AMAre project for MPAs (ArcCatalog view).

Each MPA has your file geodatabase for a personal use on desktop, while all the structures of the four MPAs are merged in an Oracle database that is the data source of the AMAre geoportal.

5. Geoportal

We created and published the AMAre WebGIS platform (HTML5 technology) though the software ArcGIS Server 10 and the Moka CMS (Content Management System GIS). The Moka CMS GIS system is the core of the GIS infrastructure. The CMS is a tool for creating GIS application using cartographic object organized in a catalogue.

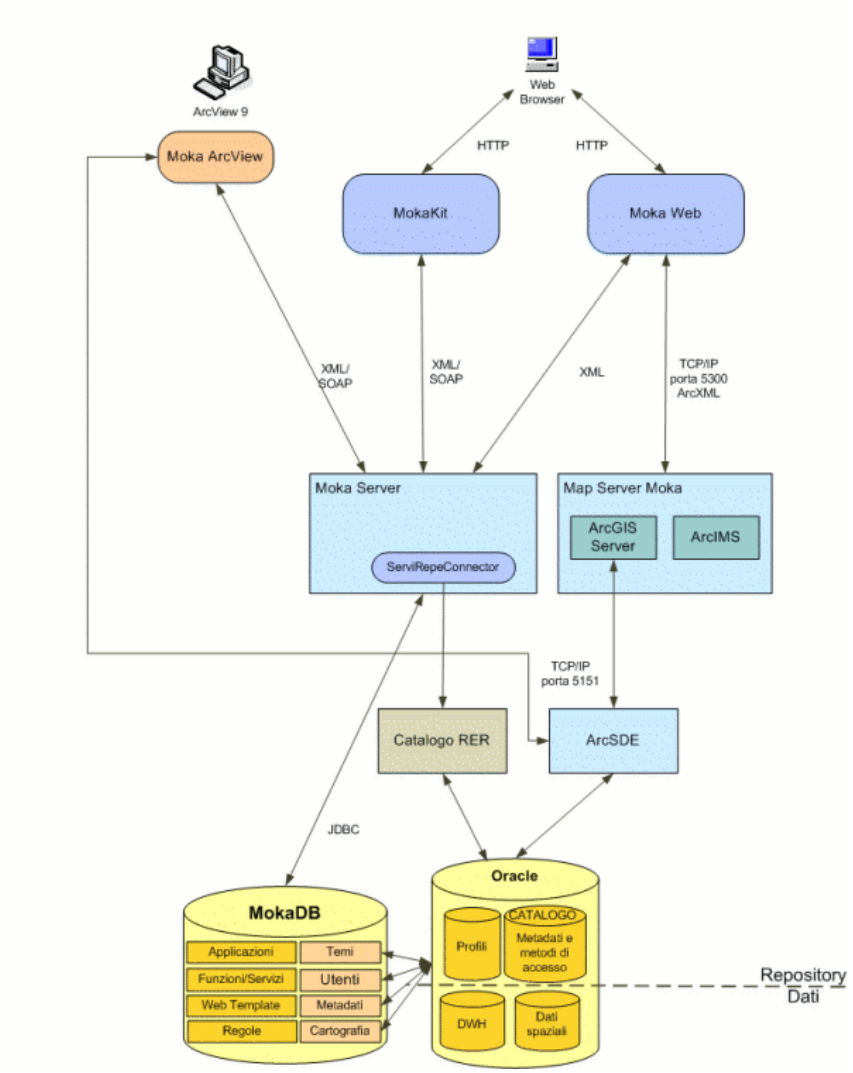

Fig 22 – System architecture (Image from the Help of the Moka Web).

The AMAre WebGIS is web-based portal for interactive visualization of the spatial data collected in the Project and organized in a common spatial infrastructure. The portal combines Geographic Information Science (GIS) principles and tools to harmonize a relatively large and multi-dimensional datasets, including several themes: administration, biodiversity, elevation, geology, habitats and biotopes, hydrography, monitoring, oceanography, socioeconomic, threats. The tool combines intelligent web maps with graphs, charts, tables, and text to unlock, make accessible and re-usable the data relevant for the management of the MPAs in a coordinated manner.

The AMAre WebGIS platform is free accessible at the link:

http://gismarblack.bo.ismar.cnr.it:8080/mokaApp/apps/AMAV1H5/index.html

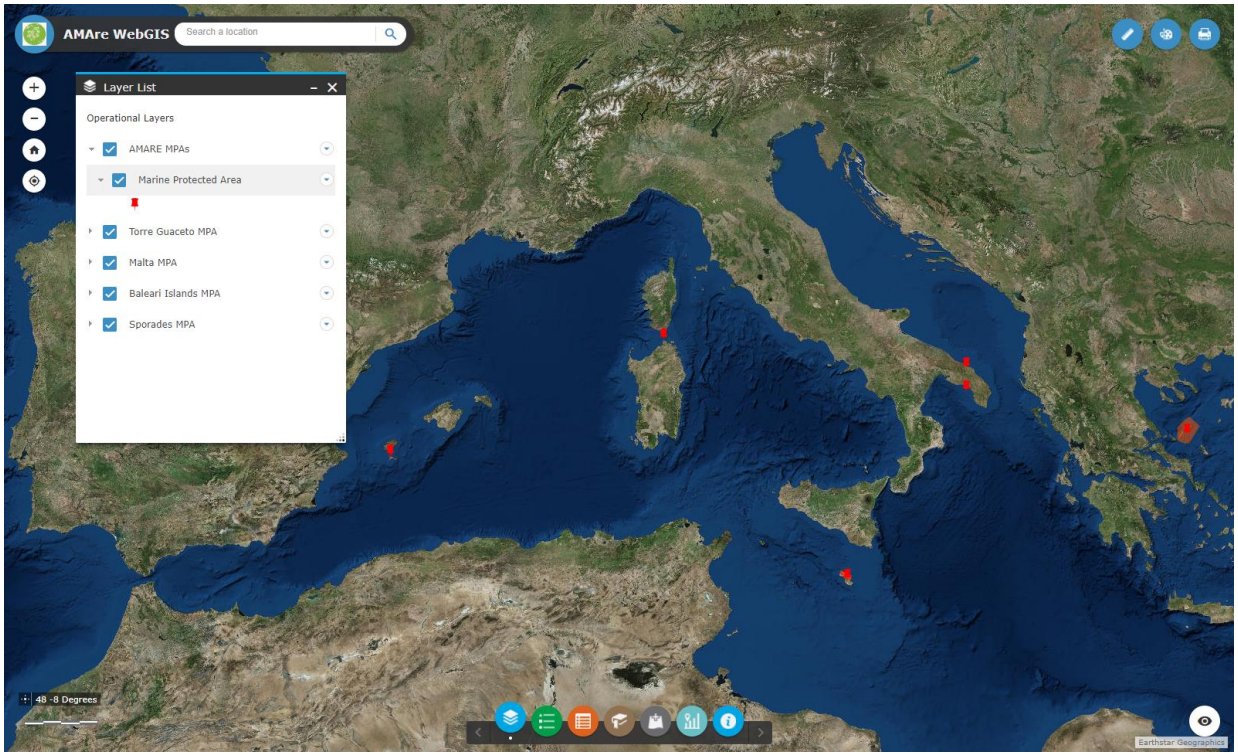

Fig 23 – The AMAre WebGIS.

The portal allows to visualize and query data. The user can navigate through the layers, download features and tables, customize your view (for example adding external layers) and print maps. The following paragraphs show the list of functions available on the portal.

5.1. Off-panel functions

The off-panel functions are on the map:

1. search a location (for searching toponyms)
2. zoom, home, overview (for moving on the maps)
3. coordinates, scale bar (to be informed about position and scale)

Fig 24 – The off-panel functions of the AMAre WebGIS.

5.2. Place holder functions

The place holder contains in-panel functions:

1. Layer list (that is the Table Of Contents showing all the available layers)
2. Legend (showing the legends of the active layers)
3. Attribute Table (opening the tables related to the object)

4. Bookmarks (allows to add customized bookmarks)
5. Add data (allows to add external shapefile or Web Map Services)
6. Related Table Charts (builds graphs from variables in the related tables)
7. Information (gives information about metadata, OGS services and data policy)

Fig 25 – The functions in the place holder of the AMAre WebGIS.

5.3. Toolbar functions

The toolbar contains in-panel functions:

1. Measure (for take measure on the map)
2. Draw (for drawing on the maps)
3. Print (for printing maps .pdf, .jpeg, etc)

Fig 26 – The functions in the toolbar of the AMAre WebGIS.

5.4. Download function

It is possible download data by the table of attributes. The standard option allows everybody to export the textual information in the table as .csv, while an authorized user can download also the data as shapefile. If an user want to access the download function has to fill the format in the data policy document and sent it to the referents.

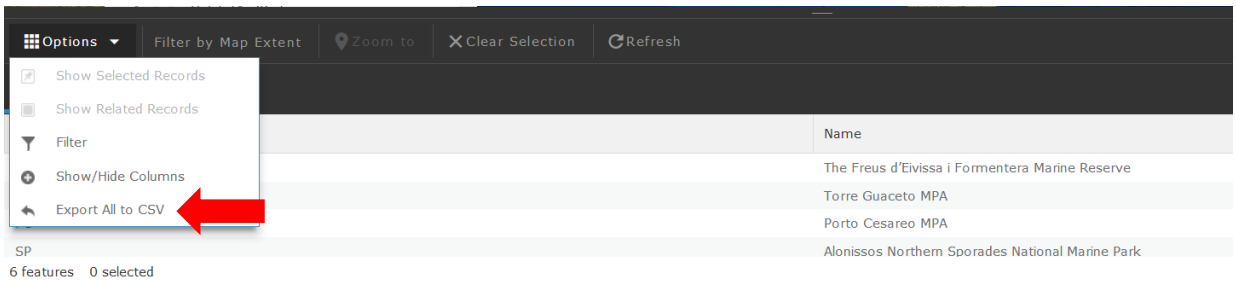

Fig 27 – The download function in the AMAre WebGIS.

6. Metadata and OGC services

Each layer of the geoportal has your metadata form, that is information that describes the content, quality, condition, origin, and other characteristics of data or other pieces of information. Metadata for spatial data may describe and document its subject matter; how, when, where, and by whom the data was collected; availability and distribution information; its projection, scale, resolution, and accuracy; and its reliability with regard to some standard. Metadata consists of properties and documentation. Properties are derived from the data source (for example, the coordinate system and projection of the data), while documentation is entered by a person (ESRI definition).

Metadata are crucial for search and sharing data, the AMAre metadata are available thought the metadata catalog at the link:

http://libeccio.bo.ismar.cnr.it:8080/geonetwork/srv/ita/catalog.search#/home

The metadata contain also the links to OGC service, that is web services making maps and data available in an open, internationally recognized format over the web to anyone with a supported client application. These OCG standards depend on a generalized architecture (Abstract Specification) and serve specific needs for interoperable location and geospatial technology, including GIS.

MPA	Service	Link
Torre Guaceto MPA	WMS	http://gismarblack.bo.ismar.cnr.it:6080/arcgis/services/published_moka/Torre_Guaceto_MPA_65/MapServer/WmsServer?
Maltese MPA	WMS	http://gismarblack.bo.ismar.cnr.it:6080/arcgis/services/published_moka/Malta_MPA_66/MapServer/WmsServer?
Balearic Islands MPA	WMS	http://gismarblack.bo.ismar.cnr.it:6080/arcgis/services/published_moka/Baleari_Islands_MPA_69/MapServer/WmsServer?
Sporades MPA	WMS	http://gismarblack.bo.ismar.cnr.it:6080/arcgis/services/published_moka/Sporades_MPA_68/MapServer/WmsServer?

7. Final considerations

The AMAre Geoportal is a tool able to unlock, make accessible and re-usable the data relevant for the management of the MPAs in a coordinated manner. The main difference from the geoportals dealing with large scale datasets (e.g. CoCoNet WebGIS, EMODnet, Adriplan) is that this one was conceived for the MPAs and designed specifically for their needs. Starting from the MPA boundaries that comes from the document officially used within the areas. We involved since the beginning of the project the MPA managers to check the architecture of the geodatabase, that is the core of the geoportal, and we adapted the INSPIRE standard conceptual model to be effective in the MPAs day by day usage. All data stored in the geodatabase.

The data were validated by the MPAs managers through dedicated meetings and by GIS experts making this product reliable for management purposes in a long term perspective and close to real needs of the MPA directors. The geodatabase architecture is in common with all MPAs involved and all data stored in an homogeneous way making possible a better coordination between MPAs and an effective comparison between activities and relevant management issues. This geodatabase structure could be used also by MPAs not involved in the project. taking into account that it is common tool for facilitate management and decision support system.

Glossary

Code Value Domain: A type of attribute domain that defines a set of permissible values for an attribute in a geodatabase. A coded value domain consists of a code and its equivalent value. For example, for a road feature class, the numbers 1, 2, and 3 might correspond to three types of road surface: gravel, asphalt, and concrete. Codes are stored in a geodatabase, and corresponding values appear in an attribute table.

Feature Class: a collection of geographic features with the same geometry type (such as point, line, or polygon), the same attributes, and the same spatial reference. Feature classes can be stored in geodatabases, shapefiles, coverages, or other data formats. Feature classes allow homogeneous features to be grouped into a single unit for data storage purposes. For example, highways, primary roads, and secondary roads can be grouped into a line feature class named "roads." In a geodatabase, feature classes can also store annotation and dimensions

Feature Dataset: In ArcGIS, a collection of feature classes stored together that share the same spatial reference; that is, they share a coordinate system, and their features fall within a common geographic area. Feature classes with different geometry types may be stored in a feature dataset.

Foreign key: An attribute or set of attributes in one table that match the primary key attributes in another table. Foreign keys and primary keys are used to join tables in a database.

Geodatabase: A database or file structure used primarily to store, query, and manipulate spatial data. Geodatabases store geometry, a spatial reference system, attributes, and behavioral rules for data. Various types of geographic datasets can be collected within a geodatabase, including feature classes, attribute tables, raster datasets, network datasets, topologies, and many others. Geodatabases can be stored in IBM DB2, IBM Informix, Oracle, Microsoft Access, Microsoft SQL Server, and PostgreSQL relational database management systems, or in a system of files, such as a file geodatabase.

Metadata: information that describes the content, quality, condition, origin, and other characteristics of data or other pieces of information. Metadata for spatial data may describe and document its subject matter; how, when, where, and by whom the data was collected; availability and distribution information; its projection, scale, resolution, and accuracy; and its reliability with regard to some standard. Metadata consists of properties and documentation. Properties are derived from the data source (for

example, the coordinate system and projection of the data), while documentation is entered by a person (for example, keywords used to describe the data).

Object Class: In a geodatabase, a collection of nonspatial data of the same type or class. While spatial objects (features) are stored in feature classes in a geodatabase, nonspatial objects are stored in object classes.

OCG standard: OGC(R) standards are technical documents that detail interfaces or encodings. Software developers use these documents to build open interfaces and encodings into their products and services. These standards are the main "products" of the Open Geospatial Consortium and have been developed by the membership to address specific interoperability challenges.

Web Map Service (WMS): The OpenGIS® Web Map Service Interface Standard (WMS) provides a simple HTTP interface for requesting geo-registered map images from one or more distributed geospatial databases. A WMS request defines the geographic layer(s) and area of interest to be processed. The response to the request is one or more geo-registered map images (returned as JPEG, PNG, etc) that can be displayed in a browser or GIS application.

Polygon: On a map, a closed shape defined by a connected sequence of x,y coordinate pairs, where the first and last coordinate pair are the same and all other pairs are unique.

Point: A geometric element defined by a pair of x,y coordinates.

Polyline: In ArcGIS software, a shape defined by one or more paths, in which a path is a series of connected segments. If a polyline has more than one path (a multipart polyline), the paths may either branch or be discontinuous.

Raster: A spatial data model that defines space as an array of equally sized cells arranged in rows and columns, and composed of single or multiple bands. Each cell contains an attribute value and location coordinates. Unlike a vector structure, which stores coordinates explicitly, raster coordinates are contained in the ordering of the matrix. Groups of cells that share the same value represent the same type of geographic feature.

Raster Catalog: A collection of raster datasets defined in a table of any format, in which the records define the individual raster datasets that are included in the catalog. Raster catalogs can be used to display adjacent or overlapping raster datasets without having to mosaic them together into one large file.

Raster Dataset: In ArcGIS, a raster spatial data model that is stored on disk or in a geodatabase. Raster datasets can be stored in many formats, including TIFF, JPEG 2000, Esri Grid, and MrSid.

Relationship Class: An item in the geodatabase that stores information about a relationship. A relationship class is visible as an item in the ArcCatalog tree or contents view.

Subtype: In geodatabases, a subset of features in a feature class or objects in a table that share the same attributes. For example, the streets in a streets feature class could be categorized into three subtypes: local streets, collector streets, and arterial streets. Creating subtypes can be more efficient than creating many feature classes or tables in a geodatabase.

Vector: A coordinate-based data model that represents geographic features as points, lines, and polygons. Each point feature is represented as a single coordinate pair, while line and polygon features are represented as ordered lists of vertices. Attributes are associated with each vector feature, as opposed to a raster data model, which associates attributes with grid cells.

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