INSPIRE
Infrastructure for Spatial Information in Europe

D2.8.III.19 Data Specification on Species Distribution – Draft Guidelines

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Foreword
How to read the document?

This document describes the *"INSPIRE data specification on Species Distribution - Guidelines"* version 2.0 as developed by the Thematic Working Group (TWG) *Bio-geographical Regions / Habitats and Biotopes / Species Distribution* using both natural and a conceptual schema language. This version is now available for the public consultation. Based on the results of the consultation (received comments and the testing reports), the final version 3.0 will be prepared by the TWGs.

The data specification is based on a common template used for all data specifications and has been harmonised using the experience from the development of the Annex I data specifications.

This document provides guidelines for the implementation of the provisions laid down in the draft Implementing Rule for spatial data sets and services of the INSPIRE Directive.

This document includes two executive summaries that provide a quick overview of the INSPIRE data specification process in general, and the content of the data specification on *Species Distribution* in particular. We highly recommend that managers, decision makers, and all those new to the INSPIRE process and/or information modelling should read these executive summaries first.

The UML diagrams (in Chapter 5) offer a rapid way to see the main elements of the specifications and their relationships. The definition of the spatial object types, attributes, and relationships are included in the Feature Catalogue (also in Chapter 5). People having thematic expertise but not familiar with UML can fully understand the content of the data model focusing on the Feature Catalogue. Users might also find the Feature Catalogue especially useful to check if it contains the data necessary for the applications that they run. The technical details are expected to be of prime interest to those organisations that are/will be responsible for implementing INSPIRE within the field of *Species Distribution.*

The technical provisions and the underlying concepts are often illustrated by examples. Smaller examples are within the text of the specification, while longer explanatory examples and descriptions of selected use cases are attached in the annexes.

In order to distinguish the INSPIRE spatial data themes from the spatial object types, the INSPIRE spatial data themes are written in *italics.*

The document will be publicly available as a 'non-paper'. It does not represent an official position of the European Commission, and as such cannot be invoked in the context of legal procedures.

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Interoperability of Spatial Data Sets and Services – General Executive Summary

The challenges regarding the lack of availability, quality, organisation, accessibility, and sharing of spatial information are common to a large number of policies and activities and are experienced across the various levels of public authority in Europe. In order to solve these problems it is necessary to take measures of coordination between the users and providers of spatial information. The Directive 2007/2/EC of the European Parliament and of the Council adopted on 14 March 2007 aims at establishing an Infrastructure for Spatial Information in the European Community (INSPIRE) for environmental policies, or policies and activities that have an impact on the environment.

INSPIRE will be based on the infrastructures for spatial information that are created and maintained by the Member States. To support the establishment of a European infrastructure, Implementing Rules addressing the following components of the infrastructure are being specified: metadata, interoperability of spatial data themes (as described in Annexes I, II, III of the Directive) and spatial data services, network services and technologies, data and service sharing, and monitoring and reporting procedures.

INSPIRE does not require collection of new data. However, after the period specified in the Directive[1] Member States have to make their data available according to the Implementing Rules.

Interoperability in INSPIRE means the possibility to combine spatial data and services from different sources across the European Community in a consistent way without involving specific efforts of humans or machines. It is important to note that “interoperability” is understood as providing access to spatial data sets through network services, typically via Internet. Interoperability may be achieved by either changing (harmonising) and storing existing data sets or transforming them via services for publication in the INSPIRE infrastructure. It is expected that users will spend less time and efforts on understanding and integrating data when they build their applications based on data delivered within INSPIRE.

In order to benefit from the endeavours of international standardisation bodies and organisations established under international law their standards and technical means have been utilised and referenced, whenever possible.

To facilitate the implementation of INSPIRE, it is important that all stakeholders have the opportunity to participate in specification and development. For this reason, the Commission has put in place a consensus building process involving data users, and providers together with representatives of industry, research and government. These stakeholders, organised through Spatial Data Interest Communities (SDIC) and Legally Mandated Organisations (LMO)[2], have provided reference materials, participated in the user requirement and technical[3] surveys, proposed experts for the Data Specification Drafting Team[4] and Thematic Working Groups[5].

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[1] For all 34 Annex I,II and III data themes: within two years of the adoption of the corresponding Implementing Rules for newly collected and extensively restructured data and within 5 years for other data in electronic format still in use

[2] Number of SDICs and LMOs on 8/6/2011 was 461 and 249 respectively

[3] Surveys on unique identifiers and usage of the elements of the spatial and temporal schema,

[4] The Data Specification Drafting Team has been composed of experts from Austria, Belgium, Czech Republic, France, Germany, Greece, Italy, Netherlands, Norway, Poland, Switzerland, UK, and the European Environmental Agency

[5] The Thematic Working Groups of Annex II and III themes have been composed of experts from Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Latvia, Netherlands, Norway, Poland, Romania, Slovakia, Spain, Sweden, Switzerland, Turkey, UK, the European Commission, and the European Environmental Agency

This open and participatory approach was successfully used during the development of the data specification on Annex I data themes as well as during the preparation of the Implementing Rule on Interoperability of Spatial Data Sets and Services[6] for Annex I spatial data themes.,

The development framework elaborated by the Data Specification Drafting Team aims at keeping the data specifications of the different themes coherent. It summarises the methodology to be used for the data specifications and provides a coherent set of requirements and recommendations to achieve interoperability. The pillars of the framework are four technical documents:

- The Definition of Annex Themes and Scope[7] describes in greater detail the spatial data themes defined in the Directive, and thus provides a sound starting point for the thematic aspects of the data specification development.

- The Generic Conceptual Model[8] defines the elements necessary for interoperability and data harmonisation including cross-theme issues. It specifies requirements and recommendations with regard to data specification elements of common use, like the spatial and temporal schema, unique identifier management, object referencing, a generic network model, some common code lists, etc. Those requirements of the Generic Conceptual Model that are directly implementable will be included in the Implementing Rule on Interoperability of Spatial Data Sets and Services.

- The Methodology for the Development of Data Specifications[9] defines a repeatable methodology. It describes how to arrive from user requirements to a data specification through a number of steps including use-case development, initial specification development and analysis of analogies and gaps for further specification refinement.

- The "Guidelines for the Encoding of Spatial Data"[10] defines how geographic information can be encoded to enable transfer processes between the systems of the data providers in the Member States. Even though it does not specify a mandatory encoding rule it sets GML (ISO 19136) as the default encoding for INSPIRE.

Based on these framework documents and following the successful development of the Annex I Data specifications (Technical Guidelines) and the Implementing Rules, the new Thematic Working Groups have created the INSPIRE data specification for each Annex II and III theme. These documents – at the version 2.0 – are now publicly available for INSPIRE stakeholders for consultation. The consultation phase covers expert review as well as feasibility and fitness-for-purpose testing of the data specifications.

The structure of the data specifications is based on the "ISO 19131 Geographic information - Data product specifications" standard. They include the technical documentation of the application schema, the spatial object types with their properties, and other specifics of the spatial data themes using natural language as well as a formal conceptual schema language[11].

A consolidated model repository, feature concept dictionary, and glossary are being maintained to support the consistent specification development and potential further reuse of specification elements. The consolidated model consists of the harmonised models of the relevant standards from the ISO 19100 series, the INSPIRE Generic Conceptual Model, and the application schemas[12] developed for

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[6] Commission Regulation (EU) No 1089/2010 *implementing Directive 2007/2/EC of the European Parliament and of the Council as regards interoperability of spatial data sets and services*, published in the Official Journal of the European Union on 8th of December 2010.

[7] *http://inspire.jrc.ec.europa.eu/reports/ImplementingRules/DataSpecifications/D2.3_Definition_of_Annex_Themes_and_scope_v3.0.pdf*

[8] *http://inspire.jrc.ec.europa.eu/reports/ImplementingRules/DataSpecifications/D2.5_v3.3.pdf*

[9] *http://inspire.jrc.ec.europa.eu/reports/ImplementingRules/DataSpecifications/D2.6_v3.0.pdf*

[10] *http://inspire.jrc.ec.europa.eu/reports/ImplementingRules/DataSpecifications/D2.7_v3.2.pdf*

[11] UML – Unified Modelling Language

[12] Conceptual models related to specific areas (e.g. INSPIRE themes)

each spatial data theme. The multilingual INSPIRE Feature Concept Dictionary contains the definition and description of the INSPIRE themes together with the definition of the spatial object types present in the specification. The INSPIRE Glossary defines all the terms (beyond the spatial object types) necessary for understanding the INSPIRE documentation including the terminology of other components (metadata, network services, data sharing, and monitoring).

By listing a number of requirements and making the necessary recommendations, the data specifications enable full system interoperability across the Member States, within the scope of the application areas targeted by the Directive. They will be published (version 3.0) as technical guidelines and will provide the basis for the content of the Amendment of the Implementing Rule on Interoperability of Spatial Data Sets and Services for data themes included in Annex II and III of the Directive. The Implementing Rule Amendment will be extracted from the data specifications keeping in mind short and medium term feasibility as well as cost-benefit considerations. The Implementing Rule will be legally binding for the Member States.

In addition to providing a basis for the interoperability of spatial data in INSPIRE, the data specification development framework and the thematic data specifications can be reused in other environments at local, regional, national and global level contributing to improvements in the coherence and interoperability of data in spatial data infrastructures.

Species Distribution – Executive Summary

The Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 (the INSPIRE Directive) has set generic rules for establishing an Infrastructure for Spatial Information in the European Community. It has been anticipated that, in order to build such an infrastructure, spatial data sets and services will require a certain level of standardisation in order to achieve interoperability. The thematic areas affected by the Directive are listed in the Annexes of the Directive, and one of these themes is Species Distribution (Annex III).

There are strong interdependencies between many of the themes. Species Distribution, together with Protected Sites (Annex I), Bio-geographical Regions (Annex III) and Habitats and Biotopes (Annex III) comprises a sub-group of biodiversity themes, focussed on biological organisms and biological communities. As an Annex I theme, Protected Sites has already been specified and is now part of the INSPIRE regulations. This is important for Species Distribution, because Protected Sites has supplied candidate feature types for Species Distribution which require consideration. Since a habitat can be defined as the spatial environment of a specific species, it is apparent that there is a strong correlation between Species Distribution and Habitats and Biotopes. Additionally relevant to Species Distribution are the Annex III themes Area Management/Restriction/Regulation Zones and Reporting Units and Environmental Facilities.

The INSPIRE data specification on Species Distribution has been prepared following the participative principle of a consensus building process. The stakeholders, based on their registration as a Spatial Data Interest Community (SDIC) or a Legally Mandated Organisation (LMO) had the opportunity to bring forward user requirements and reference materials, propose experts for the specification development, and to participate in the review of the data specifications. The Thematic Working Group responsible for the specification development was composed of experts coming from Austria, Belgium, Denmark, Germany, Latvia, Netherlands, Norway, Romania, Slovakia, United Kingdom and the European Topic Center for Biodiversity. The specification process took place according to the methodology elaborated for INSPIRE respecting the requirements and the recommendation of the INSPIRE Generic Conceptual Model, which is one of the elements that ensures a coherent approach and cross theme consistency with other themes in the Directive.

The INSPIRE Directive defines Species Distribution as geographical distribution of occurrence of animal and plant species aggregated by grid, region, administrative unit or other analytical unit [Directive 2007/2/EC].

The first point to note is that the definition refers to a “distribution of occurrence” of a given species. The defintion is not intended to cover the ‘raw’ field observation data. Therefore the Thematic Working Group have taken occurrence to mean the spatial representation of a species at a specific location, rather than being equivalent to an observation. A second point to note is in regard to the term “species”. The concept of a “species” is fundamentally a human expert judgement placed on nature, and human judgements in this area, as in many others, are subject to debate and dispute. This means that there is not yet a consistent taxonomy across Europe, although progress is being made in this regard. A third point is in regard to the term “aggregated”, which most commonly means to form into a class or cluster. It is closely related to (but not synonymous with) the term “amalgamated”, which means to combine to form one structure. Both terms are used throughout this document, as being suitable for describing the process of converting raw observations into a distribution of occurrence. A final point resulting from the definition is that the distributions may be represented in a wide range of formats, such as points, grid cells at different scales or polygons of specific defined areas.

The major results of the work of the Species Distribution TWG can be summarised as falling into three sections: the Coverage description, the Distribution Information description and the Source Information description.

It was agreed that the optimum conceptual structure for Species Distribution is as a coverage, i.e. a continuous surface such as a density model (similar to a digital elevation model, but with the ‘elevation’ in this case being the density of the given species’ population). Such a coverage could be a multi-surface e.g. a TIN (triangulated irregular network), an isoline (contour) surface, or it could be a rectified grid e.g. a gridded set of points or a gridded set of cells. A featureType

SpeciesDistributionCoverage has therefore been designed with this requirement in mind and incorporated into the schema (data model). However, it should be noted that most of the thematic community currently seem to encode their Species Distribution data as feature collections i.e. sets of individual features such as polygons. This is particularly likely if a data provider use polygons of specific defined areas (such as administrative units) as the format for their Species Distribution data. Conversion from one structure (feature collections) to the other (coverages) is therefore a pertinent issue.

The SpeciesDistributionCoverage feature Type currently comprises five parts (dataTypes), three of which (inspireID, beginLifespanVersion and endLifespanVersion) are standard for all INSPIRE schema and so will not be discussed further in this summary. The two remaining dataTypes (referenceSpeciesID, referenceSpeciesScheme) address the situation alluded to in a previous paragraph, namely lack of a consistent taxonomy across Europe. The dataType referenceSpeciesScheme refers to a choice of three widely known reference lists (PESI-Eunomen is the preferrred option, but EUNIS and Natura2000 are acceptable alternatives), and referenceSpeciesID refers to an ID from that reference list for the given species of interest.

The second section concerns the featureType SpeciesDistributionUnit, which is made up of one dataType, namely distributionInfo. A very basic level of attribution has been included within distributionInfo to allow the representation of attributes such as residency status, population size within the spatial unit, and data sensitivity. This dataType also allows for attribution to spatial units where the given species has been searched for but not found (proved absent) and where the species has not been searched for (unknown). This information is essential for providing a complete picture of the known distribution of the given species, additionally providing insight as to areas of uncertainty. DataType distributionInfo has thus been kept to the minimum number of attributes, in order to minimise any difficulties for data providers and to facilitate harmonisation. It should be noted that most ‘raw’ observational data are considerably more attribute rich than this schema. This is appropriate as such attribute richness is often necessary for the scientific analyses of ‘raw’ data which will ultimately lead to amalgamated distributions of species occurrence. The schema presented here, therefore, is not suitable for any except the most simple observational data – this is in keeping with the INSPIRE Directive’s definition of Species Distribution, as detailed above.

The final major section in this specification is regarding the featureType SourceInformation. There exists a multitude of approaches and methodologies both for collecting data on species observations and actually deriving the species distribution from these. In order to ascertain whether a distribution for a given species from a given country is directly comparable with a distribution for the same species for a different country, it is necessary to know the details of the methodologies used. It is important, therefore, that this information is adequately described in the associated metadata. SourceInformation is feature-level metadata linked to distributionInfo in order to describe methodology information about specific instances of distribution information. These metadata can be shared among several species distributions, but when downloaded by a user they appear as part of the dataset GML rather than with the dataset-level metadata in the associated XML. SourceInformation comprises seven elements, these being aggregationMethod, sourceMethod, methodReference, sourceProvider, validFrom, validTo and localSpeciesName. Of particular note is AggregationMethod - this offers a choice between observationAggregation (based on aggregating species observations within the area of the spatial unit) and scientificAnalysis (based on scientific interpretation of observations, surveys, literature and knowledge of habitats and biotopes – it is therefore an amalgamation rather than a simple aggregation). SourceMethod provides even more information, offering a codelist including “gridMapping” and “random”, amongst other options. The first comprises occurrences/ observations collected by systematic surveys in grid cells, and is an approach with a low level of error and uncertainty. The second comprises observations collected by randomly distributed collection sites – this would cover many of the observation data that are currently available, supplied by volunteers from local ‘citizen-science’ recording groups, but often with major spatial areas lacking data – thus with a high level of error and uncertainty. This level of detail for sourceInformation is in keeping with the INSPIRE Directive’s definition of Species Distribution, as detailed above. Finally, in recognition that it will be important for many data providers to retain the link to any national taxonomic classification, localSpeciesName refers to the scientific name (note: not the vernacular name) for the given species coming from the national nomenclature.

The intention of this data specification is to create a generic application schema that can be broadly used to enable maximum data distribution between various data sources. For this reason, only three of the dataTypes are currently (Version2.0) mandatory: inspireID, referenceSpeciesID, and referenceSpeciesScheme. Despite this minimalist approach, it is recognised that it may not be possible to have one common application schema which will support all approaches and methodologies across all stakeholders. Feedback from SDICs and LMOs on this and other issues as a result of this version (2.0) is keenly anticipated by the members of the TWG.

Acknowledgements

Many individuals and organisations have contributed to the development of these Guidelines.

The Thematic Working Group Bio-geographical Regions + Habitats and Biotopes + Species Distribution (BR-HB-SD) included:
Dirk Hinterlang (TWG Facilitator), Anders Friis-Christensen (TWG Editor), Peteris Bruns, Margaret Carlisle, Robert Jongman, Tomas Kliment, Brian Mac Sharry, Iurie Maxim, Rudolf May, Johannes Peterseil, Sabine Roscher, Anne Schmidt, Diederik Tirry, Nils Valland, Mareike Vischer-Leopold, Martin Tuchyna (European Commission contact point).

Other contributors to the INSPIRE data specifications are the Drafting Team Data Specifications, the JRC data specifications team and the INSPIRE stakeholders - Spatial Data Interested Communities (SDICs) or Legally Mandated Organisations (LMOs).

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Table of contents

1 Scope

This document specifies a harmonised data specification for the spatial data theme *Species Distribution* as defined in Annex III of the INSPIRE Directive.

This data specification provides the basis for the drafting of Implementing Rules according to Article 7 (1) of the INSPIRE Directive [Directive 2007/2/EC]. The entire data specification will be published as implementation guidelines accompanying these Implementing Rules.

2 Overview

2.1 Name

INSPIRE data specification for the theme Species Distribution.

2.2 Informal description

Definition:

Geographical distribution of occurrence of animal and plant species aggregated by grid, region, administrative unit or other analytical unit [Directive 2007/2/EC].

Description:

Data content
The "Species Distribution" category of spatial data defined in the INSPIRE Directive is one of several themes in a wider grouping of biological organisms and biological communities - biodiversity. Species distribution includes species occurrence as points, grid cells at different scales or polygons of specific defined areas.

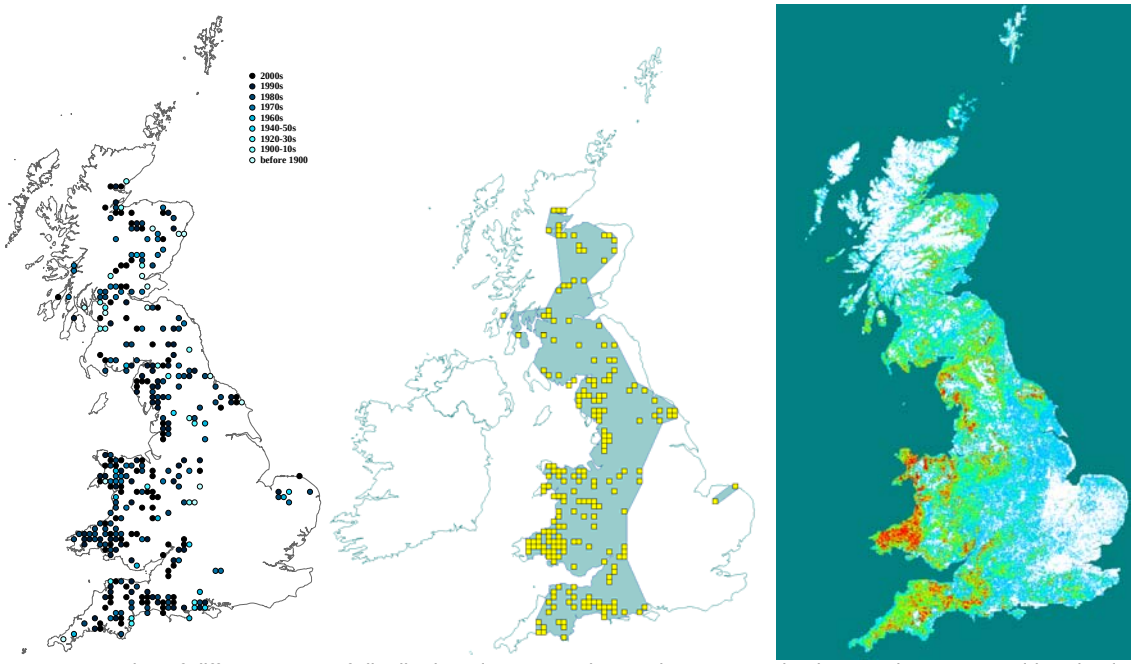
The definition refers to a “distribution of occurrence”, and as such it is important to stress that this definition is not intended to cover the actual ‘raw’ observations that are the basis of any given species distribution; such data are better covered under the Environmental monitoring facilities theme. Rather the current definition deals with aggregations and amalgamations of these raw observations to create more general distributions. However, in extreme cases the distinction between the raw and the aggegated can be vague. For example if the distribution represents the outputs of a grid based sample programme at a single point in time. As the standard needs to cope with such scenarios it has been designed to make it possible to use it for raw observations, but this is not the intention.

Data sources and data production process
Species are distributed according to their ecological requirements and behaviour. Our understanding of these is rarely definitive and in any case they are subject to change through time. The distributions may be represented in a wide range of formats, including administrative or statistical units, grid based maps of observations (potentially with attributes associated with each grid square), polygons that have boundaries of their own, and predicted surfaces. Box 1 shows examples of the last three formats.

Different countries or communities use different methods both for collecting the data and for actually deriving the species distribution from these data. The collection methods are wide-ranging, and include:

- random species sightings (such as data supplied by volunteers from local ‘citizen science’ recording groups);
- scientific specimen collections;
- systematic surveys either geographically continuous or in reference grids, and;
- species monitoring programmes.

Similarly the methods used to derive the distribution can involve a variety of techniques and physically change through time. It is therefore important that the details of the methodology used to derive the distributions are clearly and adequately described in the associated metadata. In addition a single species distribution may represent the amalgamation of a range of separate sources and given that the quality of these may vary it is important that the sources are adequately described and that it is possible to identify what each source contributed to the overall distribution. The sources for the raw material and the provider of the aggregated/amalgamated dataset are key attributes to give the end user the option to interpret a specific species distribution.



Box 1 Examples of different types of distribution plots. Raw observations summarised to a 10km square grid and coloured according to year last recorded, a polygon summary of the data for a particular time period and a predictive probability plot for the species derived using Maxent model.

At this point we have to define that when we talk about "species" throughout this specification the correct scientific term that is addressed is "taxon" It defines a group of organisms that are judged by a taxonomist to belong to a defined class reflecting phylogenetic relationships. Taxa are described at different systematic levels like subspecies, species, genus or family level. These could also be meant when the term "species" is used in this specification. The concept of a “species” is fundamentally, a human expert judgement placed on nature. As a result it is neither definitive nor fixed. Different workers have their own opinions on both where the lines for a particular species concept are defined and what that concept should be called. Although nomenclature defines a set of rules how valid names have to be assigned to these concepts, the concept originally assigned to a name may have or will change over time. Given that a key objective of sharing species distributions through INSPIRE has to be the creation of a single picture consolidated across a range of sources there needs to be a mechanism to deal both with the individual opinions of the data providers and the need to amalgamate the various opinions to a single picture. Recently there has been great progress towards the establishment of a consistent taxonomy across Europe but there is still further work to do before this can be regarded as complete.

There are a range of attributes that can be associated with the species itself such as formal legal status (EU directives, international conventions, national law), redlist status, national responsibility or other interests - these have yet to be coded. While these may be essential for particular applications, such attribution is considered beyond the current data specification.

Scope

The scope of this data specification, Species Distribution, includes the full range of distributions outlined above. It specifies choice of a “species” identifier (=scientific name) from one of three widely known EU reference lists, A very basic level of attribution has been included to allow the representation of distribution attributes such as residency status, population size within the spatial unit, data sensitivity (this is a particularly important issue for Species Distribution as some rare species are subject to wildlife crime and so their locations are particularly sensitive), and whether the species has been actively searched for. However, more attribute rich observational data is excluded. While, as the model is defined, it could be used to represent relatively simple observational data (i.e. where there are no additional attributes recorded) it is not the intention for it to be used in this way. The data

specification also has a very basic level of attribution to allow the representation of methodology information about specific instances of a species distribution, including attributes such as the colletion method and the method used to derive the distribution, It also explicitly allows for the retention of the original species name and assigned taxonomic concept recognised and used by the data provider.

Use cases
The general purposes for the collection of data on species and the modelling of their occurrence and distribution are traditionally considered as follows:

- Scientific research. Needed in order to provide knowledge upon which nature conservation activities can be built;
- Nature conservation. Assignment and management of protected sites, often in response to legal instruments such as Areas of Special Conservation Interest under the Bern Convention. Also, outwith protected areas, use of financial instruments such as agri-environment schemes designed to increase nature conservation value in agricultural areas;
- Resource management. Use of legal instruments such as SEA strategic environmental assessment (for policies, plans and programmes) and EIA environmental impact assessment (for projects) as well as spatial planning in general;
- Policy making. Reporting of EU member states to the EC on the “conservation status” of species, and deriving future policies from this information.

In Species Distribution, 5 specific uses cases are defined for users at different levels (Europe-wide, expert user/regional government including European Commission and European Environment Agency, national or regional or cross-border users). These use cases are as follows: Reporting under Article 17 of the Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora; Simple query and view; Expertly query, view, visualize and analyze; Download data; Providing Species Distribution data according to Inspire Directive. These use cases are detailed in Annex B.

References

Council directive 92/43/EEC of 21 may 1992 on the conservation of natural habitats and of wild fauna and flora. *Official Journal of the European Communities, 206*(22), 7.

European Commission, 2006. Assessment, monitoring and reporting under Article 17 of the habitats Directive: explanatory notes & guidelines. Final draft 5, October 2006. European Commission, Brussels.

Wawer, R. and Tirry. D. (2010) NatureSDIplus D3.4 Data Exchange Models. Pilot application schemas for INSPIRE biodiversity themes. Deliverable report.

2.3 Normative References

[Directive 2007/2/EC] Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)

[ISO 19107] EN ISO 19107:2005, Geographic Information – Spatial Schema

[ISO 19108] EN ISO 19108:2005, Geographic Information – Temporal Schema

[ISO 19108-c] ISO 19108:2002/Cor 1:2006, Geographic Information – Temporal Schema, Technical Corrigendum 1

[ISO 19111] EN ISO 19111:2007 Geographic information - Spatial referencing by coordinates (ISO 19111:2007)

[ISO 19113] EN ISO 19113:2005, Geographic Information – Quality principles

[ISO 19115] EN ISO 19115:2005, Geographic information – Metadata (ISO 19115:2003)

[ISO 19118] EN ISO 19118:2006, Geographic information – Encoding (ISO 19118:2005)

[ISO 19123] EN ISO 19123:2007, Geographic Information – Schema for coverage geometry and functions

[ISO 19135] EN ISO 19135:2007 Geographic information – Procedures for item registration (ISO 19135:2005)

[ISO 19138] ISO/TS 19138:2006, Geographic Information – Data quality measures

[ISO 19139] ISO/TS 19139:2007, Geographic information – Metadata – XML schema implementation

[OGC 06-103r3] Implementation Specification for Geographic Information - Simple feature access – Part 1: Common Architecture v1.2.0

NOTE This is an updated version of "EN ISO 19125-1:2006, Geographic information – Simple feature access – Part 1: Common architecture". A revision of the EN ISO standard has been proposed.

[Regulation 1205/2008/EC] Regulation 1205/2008/EC implementing Directive 2007/2/EC of the European Parliament and of the Council as regards metadata

[Regulation 1089/2010/EC] Regulation 1089/2010/EC implementing Directive 2007/2/EC of the European Parliament and of the Council as regards interoperability of spatial data sets and services

2.4 Terms and definitions

General terms and definitions helpful for understanding the INSPIRE data specification documents are defined in the INSPIRE Glossary[13].

Specifically, for the theme Species Distribution, the following terms are defined:

(1) Aggregation
To form multiple objects into a class or cluster.

(2) Amalgamation
To combine multiple objects to form one structure.

2.5 Symbols and abbreviations

[13] The INSPIRE Glossary is available from http://inspire-registry.jrc.ec.europa.eu/registers/GLOSSARY

2.6 Notation of requirements and recommendations

To make it easier to identify the mandatory requirements and the recommendations for spatial data sets in the text, they are highlighted and numbered.

IR Requirement X	Requirements that are reflected in the Implementing Rule on interoperability of spatial data sets and services are shown using this style.

DS Requirement X	Requirements that are not reflected in the Implementing Rule on interoperability of spatial data sets and services are shown using this style.

Recommendation 1 Recommendations are shown using this style.

2.7 Conformance

DS Requirement 1	Any dataset claiming conformance with this INSPIRE data specification shall pass the requirements described in the abstract test suite presented in Annex A.

3 Specification scopes

This data specification does not distinguish different specification scopes, but just considers one general scope.

NOTE For more information on specification scopes, see [ISO 19131:2007], clause 8 and Annex D.

4 Identification information

NOTE Since the content of this chapter was redundant with the overview description (section 2) and executive summary, it has been decided that this chapter will be removed in v3.0.

5 Data content and structure

IR Requirement 1 Spatial data sets related to the theme **Species Distribution** shall be provided using the spatial object types and data types specified in the application schema(s) in this section.

IR Requirement 2 Each spatial object shall comply with all constraints specified for its spatial object type or data types used in values of its properties, respectively.

Recommendation 1 The reason for a void value should be provided where possible using a listed value from the VoidValueReason code list to indicate the reason for the missing value.

NOTEThe application schema specifies requirements on the properties of each spatial object including its multiplicity, domain of valid values, constraints, etc. All properties have to be reported, if the relevant information is part of the data set. Most properties may be reported as “void”, if the data set does not include relevant information. See the Generic Conceptual Model [INSPIRE DS-D2.5] for more details.

5.1 Basic notions

This section explains some of the basic notions used in the INSPIRE application schemas. These explanations are based on the GCM [DS-D2.5].

5.1.1 Stereotypes

In the application schemas in this sections several stereotypes are used that have been defined as part of a UML profile for use in INSPIRE [INSPIRE DS-D2.5]. These are explained in Table 1 below.

Table 1 – Stereotypes (adapted from [INSPIRE DS-D2.5])

Stereotype	Model element	Description
applicationSchema	Package	An INSPIRE application schema according to ISO 19109 and the Generic Conceptual Model.
featureType	Class	A spatial object type.
type	Class	A conceptual, abstract type that is not a spatial object type.
dataType	Class	A structured data type without identity.
union	Class	A structured data type without identity where exactly one of the properties of the type is present in any instance.
enumeration	Class	A fixed list of valid identifiers of named literal values. Attributes of an enumerated type may only take values from this list.
codeList	Class	A flexible enumeration that uses string values for expressing a list of potential values.
placeholder	Class	A placeholder class (see definition in section 5.1.2).
voidable	Attribute, association role	A voidable attribute or association role (see definition in section 5.1.3).
lifeCycleInfo	Attribute, association role	If in an application schema a property is considered to be part of the life-cycle information of a spatial object type, the property shall receive this stereotype.
version	Association role	If in an application schema an association role ends at a spatial object type, this stereotype denotes that the value of the property is meant to be a specific version of the spatial object, not the spatial object in general.

5.1.2 Placeholder and candidate types

Some of the INSPIRE Annex I data specifications (which were developed previously to the current Annex II+III data specifications) refer to types that thematically belong and were expected to be fully specified in Annex II or III spatial data themes. Two kinds of such types were distinguished:

- *Placeholder types* were created as placeholders for types (typically spatial object types) that were to be specified as part of a future spatial data theme, but which was already used as a value type of an attribute or association role in this data specification.

  Placeholder types received the stereotype «placeholder» and were placed in the application schema package of the future spatial data theme where they thematically belong. For each placeholder, a definition was specified based on the requirements of the Annex I theme. The Annex II+III TWGs were required to take into account these definitions in the specification work of the Annex II or III theme.

  If necessary, the attributes or association roles in the Annex I data specification(s) that have a placeholder as a value type shall be updated if necessary.

- *Candidate types* were types (typically spatial object types) for which already a preliminary specification was given in the Annex I data specification. Candidate types did not receive a specific stereotype and were placed in the application schema package of the future spatial data theme where they thematically belong. For each candidate type, a definition and attributes and association roles were specified based on the requirements of the Annex I theme. The Annex II+III TWGs were required to take into account these specifications in the specification work of the Annex II or III theme.

  If the type could not be incorporated in the Annex II or III data specification according to its preliminary specification, it should be moved into the application schema of the Annex I theme where it had first been specified. In this case, the attributes or association roles in the Annex I data specification(s) that have the type as a value type shall be updated if necessary.

Open issue 1: For all Annex II+III themes for which placeholders and candidate types were specified in an Annex I data specification, it should be clearly indicated in the data specification, how the placeholder and candidate types were taken into account. If the proposed solution would require any changes to an Annex I data specification (and the corresponding section in the IR for interoperability of spatial data sets and services), this should also be clearly indicated.

A thorough investigation of the implications of the proposed changes of candidate types (in particular related to requirements of Annex I maintenance) will have to be performed for v3.0 of the data specifications.

5.1.3 Voidable characteristics

If a characteristic of a spatial object is not present in the spatial data set, but may be present or applicable in the real world, the property shall receive this stereotype.

If and only if a property receives this stereotype, the value of *void* may be used as a value of the property. A *void* value shall imply that no corresponding value is contained in the spatial data set maintained by the data provider or no corresponding value can be derived from existing values at reasonable costs, even though the characteristic may be present or applicable in the real world.

It is possible to qualify a value of void in the data with a reason using the VoidValueReason type. The VoidValueReason type is a code list, which includes the following pre-defined values:

- *Unpopulated*: The characteristic is not part of the dataset maintained by the data provider. However, the characteristic may exist in the real world. For example when the “elevation of the water body above the sea level” has not been included in a dataset containing lake spatial

objects, then the reason for a void value of this property would be 'Unpopulated'. The characteristic receives this value for all objects in the spatial data set.
- *Unknown*: The correct value for the specific spatial object is not known to, and not computable by the data provider. However, a correct value may exist. For example when the "elevation of the water body above the sea level" *of a certain lake* has not been measured, then the reason for a void value of this property would be 'Unknown'. This value is applied on an object-by-object basis in a spatial data set.

NOTE It is expected that additional reasons will be identified in the future, in particular to support reasons / special values in coverage ranges.

The «voidable» stereotype does not give any information on whether or not a characteristic exists in the real world. This is expressed using the multiplicity:
- If a characteristic may or may not exist in the real world, its minimum cardinality shall be defined as 0. For example, an if an Address may or may not have a house number, the multiplicity of the corresponding property shall be 0..1.
- If at least one value for a certain characteristic exists in the real world, the minimum cardinality shall be defined as 1. For example, if an Administrative Unit always has at least one name, the multiplicity of the corresponding property shall be 1..*.

In both cases, the «voidable» stereotype can be applied. A value (the real value or void) only needs to be made available for properties that have a minimum cardinality of 1.

5.1.4 Code lists and Enumerations

5.1.4.1. Style

All code lists and enumerations use the following modelling style:
- No initial value, but only the attribute name part, is used.
- The attribute name conforms to the rules for attributes names, i.e. is a lowerCamelCase name. Exceptions are words that consist of all uppercase letters (acronyms).

5.1.4.2. Governance of code lists

Two types of code lists are defined in INSPIRE. These two types are distinguished using the tagged value "extendableByMS" in the UML data model:
- *Code lists that **may not** be extended by Member States.* For these code lists, the tagged value is set to "false". They shall be managed centrally in the INSPIRE code list register, and only values from that register may be used in instance data.
- *Code lists that **may** be extended by Member States.* For these code lists, the tagged value is set to "true".

5.2 Application schema SpeciesDistribution

5.2.1 Description

5.2.1.1. Narrative description

Species are distributed in 'real world' according to their ecological requirements and behaviour. There exists a multitude of approaches and methodologies both for collecting data on species observations and actually deriving the species distribution from this. Most likely one common application schema can not support all approaches and methodologies across all stakeholders. The intention of this data specification is to create a generic application schema that can be broadly used to enable maximum data distribution between various data sources. Nevertheless, due to the heterogeneity of species distribution concepts i.e different approaches, definitions and terms and resulting data sources, it can

be expected that not all species distribution datasets can be mapped against the proposed application schema. The application schema “SpeciesDistribution” as described here has been developed according the Rules for applicaton schemas defined in ISO 19109, and can be considered as an instrument for generating pan-European representations of species distributions.

The aggregation or distribution units are modelled in this application schema as coverages, namely *SpeciesDistributionCoverage*. *SpeciesDistributionCoverage* is a subclass of *CoverageByDomainAndRange* from the generic conceptual model which again is a realization of the ISO 19123 standard that defines the Coverage representation from a conceptual point of view. The coverage representation should be applied in order to present species distribution data aggregated over grid cells, administrative areas, or areas of any other analytical unit. The coverage representation must allow for retrieving subsets of speciesDistribution objects defined by filtering on the attributes given by the *distributionInfoType* or *sourceInformationType*.

In order to solve underlying interoperability problems related to the naming and classifications of species, the spatial object type *SpeciesDistributionCoverage* has been designed to incorporate reference to a given species via an ID coming from a widely known reference list.

Detailed information on the properties of the distribution of a species are provided through the spatial object type *SpeciesDistributionUnit* which has one central attribute on distribution info of datatype *DistributionInfoType*. The distribution info covers information on the quantification of the species within the distribution unit, its residency status and information on the sensitiveness i.e. whether the combination of location and species in a specific case is sensitive.

Further metadata information on the distribution can be provided through the spatial object type *SourceInformation*. It is highly recommended that information on the aggregation method and the way how data on species distribution was collected (for example through field surveys or statistical samples) are documented as metadata to the distribution units of the coverage. This type of information is essential to interpreting the species distribution information correctly. *SourceInformation* also supports the use of a scientific name coming from the national nomenclature.

If required, it is also possible to provide a reference from the distribution units to observation data. This is done via a reference from spatial object type *SpeciesDistributionUnit* to the relevant observations. This is done by applying a reference to the theme Environmental Monitoring Facility which again links to single observations. The observation model is the ISO 19158 Observations and Measurements standard.

Finally, it should also be realized that a major link exists between the species distribution application schema and the Annex I Protected Sites theme, and consideration was also given to the Annex III themes Habitats&Biotopes and Biogeographical Regions

5.2.1.2. UML Overview

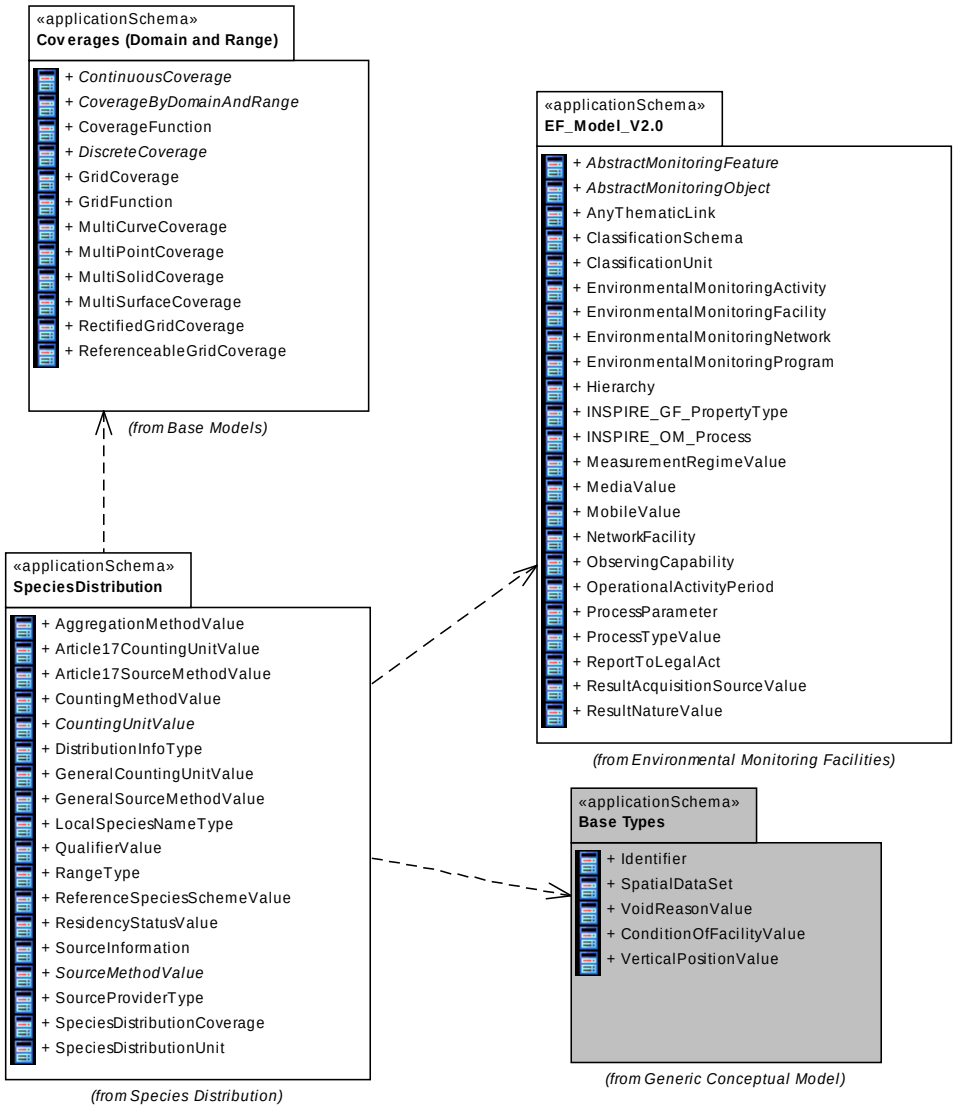


Figure 1 – UML package diagram: Overview of the *Species Distribution* application schema package dependencies

An overview of the SpeciesDistribution package and referenced packages is depicted in Figure 1. The diagram shows the relations between the SpeciesDistribution packages and packages defined in the INSPIRE General Conceptual Model and other themes. Besides the specification of base types the GCM also includes an implementation profile of the relevant ISO 19123 types that can be applied within all INSPIRE data specifications to represent different types of Coverages in a consistent and harmonized way. Finally there is a reference to the theme Environmental Monitoring Facility in order to be able to link to single observations if required.

The complete application schema for the theme *Species Distribution* is shown in Figure 2 and described in detail below.

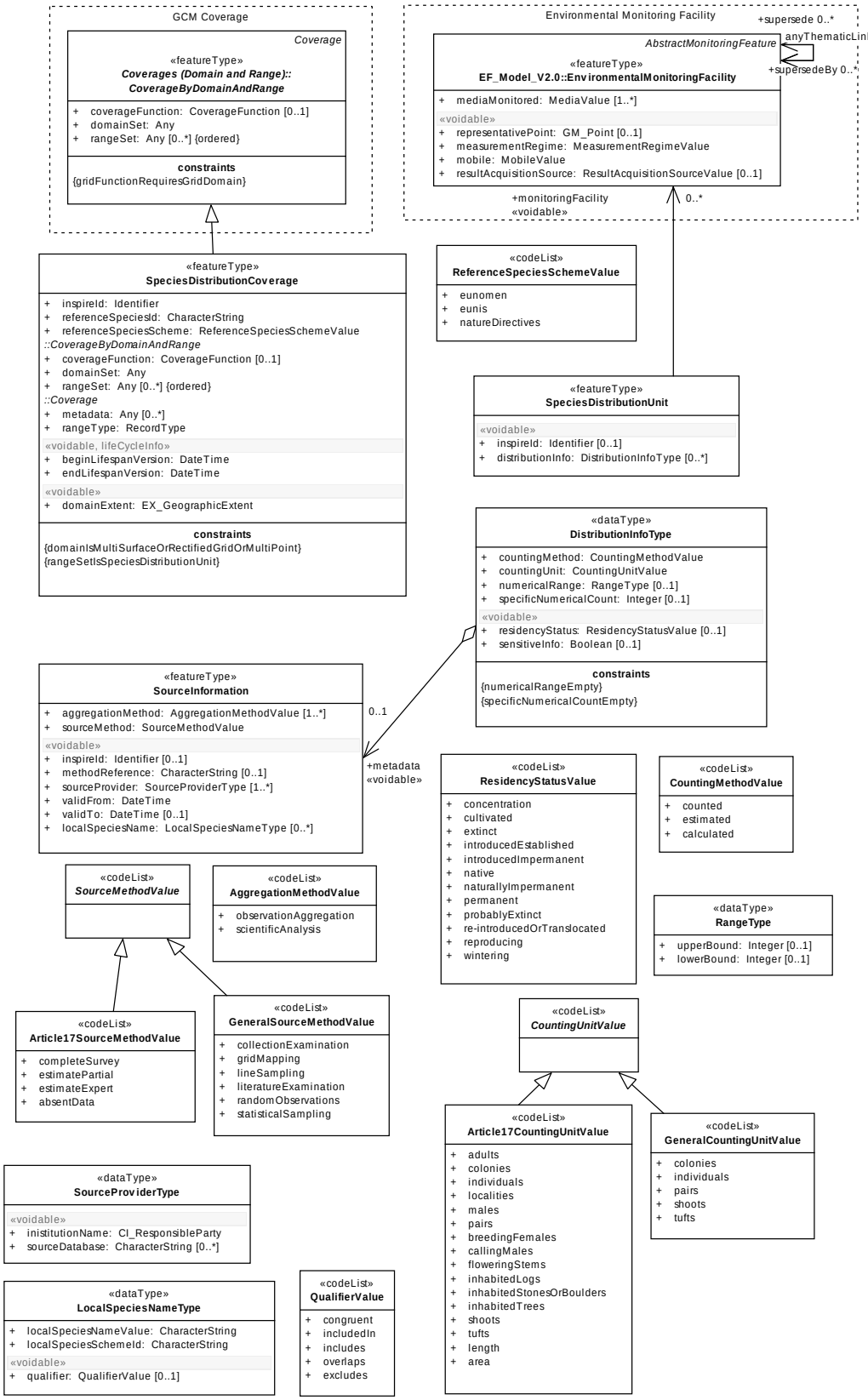


Figure 2 – UML class diagram: Overview of the *Species Distribution* application schema

The main spatial object type for the Species Distribution theme is the *SpeciesDistributionCoverage*. Information on occurrences of species or population estimates is aggregated within this spatial object type. The domain and range properties of the coverage specify the building blocks of the distribution, see Figure 3.

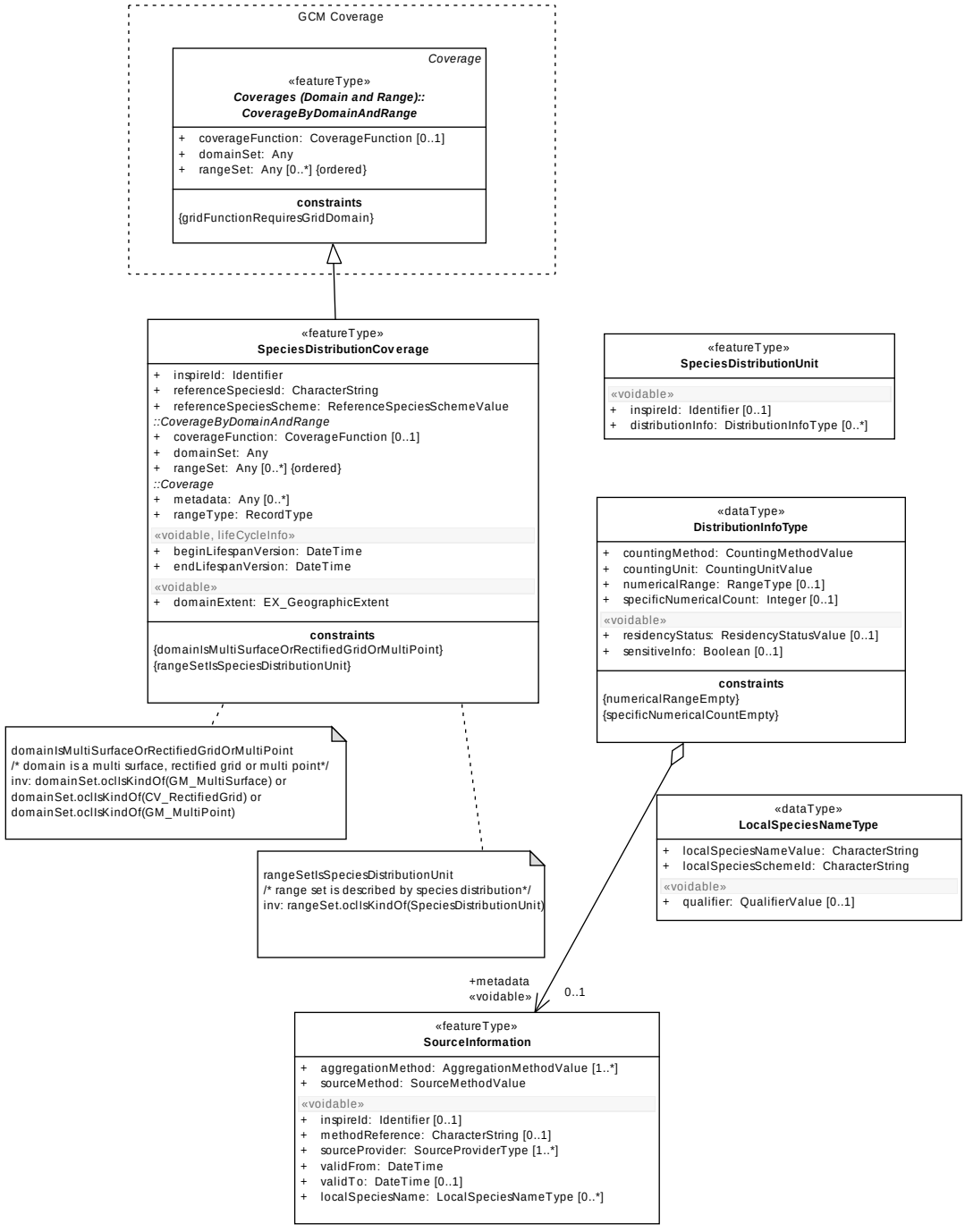


Figure 3 – Coverage representation with constraints for domain and range.

The INSPIRE Directive defines Species Distribution as a ”distribution of occurrence”, not ‘raw’ field observation data. Therefore it is important to emphasize that information on the location of individual observations is outside of the scope of this specification. As information on Species Distribution is most likely aggregated using grids or polygons, even polygons from other themes (e.g. administrative,

statistical, biogeographical or other analytical units), the domain of the Coverage will be a Multi Surface, Multi point, or Rectified Grid.

Open issue 2: The relationships to administrative, statistical, biogeographical or other analytical units are not specified for version 2.0 of the specification. It is still an open issue how (and if) this will be done.

IR Requirement 3	The Grid_ETRS89-LAEA as defined in Regulation 1089/2010/EC shall be used when defining a rectified grid.

NOTE The Grid_ETRS89-LAEA is hierarchical, with resolutions of 1m, 10m, 100m, 1 000m, 10 000m and 100 000m. The grid orientation is south-north, west-east.

In the species distribution application schema the type of Coverage shall be a discrete coverage that returns the same feature attribute values (attributes of the *SpeciesDistributionCoverage* spatial object type) for every direct position within any single spatial object in its domain. It implies that each 'unit' of the discrete coverage, regular or irregular, has an aggregated/amalgamated number for a given species. The information for each unit is represented by the *SpeciesDistributionUnit* spatial object type which is the core spatial object type of the UML class diagram (to be further explained below). Thus, the *SpeciesDistributionUnit* spatial object type is the *rangeSet* of the Coverage, which are specified using a constraint.

"*SpeciesDistributionCoverage*" is also a central spatial object type of the UML class diagram. Each single species grid cell/multi-surface unit is described by a species distribution classification as described above. The classification system is specified by 2 mandatory attributes *referenceSpeciesId* and *referenceSpeciesScheme* that provide information on respectively the classification value and the classification scheme that is applicable to the instance according the proposed scheme. The value for referring to the species concerned shall be a unique ID and not a name. Many different classification systems exist at different levels; the current application schema includes for the moment being information on the classification scheme and species IDs of 3 well-known and recognised European Classification systems, but the application schema may be extended to include other classification systems by extending the codelist (*referenceSpeciesSchemeValue)*. However, this has to follow the normal procedure for extending INSPIRE codelists and cannot be done by member states alone.

Each "*SpeciesDistributionCoverage*" instance has one (harmonized) encoding from a "*ReferenceSpeciesSchemeValue*", The code list comprises currently Eu-Nomen, EUNIS and Natura2000. In these sources harmonized species GUIDs and names are maintained by institutions with an assignment outside INSPIRE and the species names are to be retrieved through webservices using GUIDs.

- EU-NOMEN
  The EU-nomen portal enables the correct use of species names and their classification, to more accurately manage information on animals and plants. This is the first all-taxa inventory for European species. (Source: EU-nomen website).
  The portal is one of the outcomes of the PESI (Pan-European Species directories infrastructure) project. The objective of this project was to integrate and secure taxonomically authoritative species name registers that underpin the management of biodiversity in Europe. PESI will integrate the three main all-taxon registers in Europe, namely the *European Register of Marine Species*, *Fauna Europaea*, and *Euro+Med PlantBase* in coordination with EU based nomenclators and the network of EU based Global Species Databases. (Source: PESI website)

- EUNIS
  EUNIS data are collected and maintained by the *European Topic Centre on Biological Diversity* for the *European Environment Agency* and the *European Environmental Information Observation Network* to be used for environmental reporting and for assistance to the NATURA2000 process (EU Birds and Habitats Directives) and coordinated to the related EMERALD Network of the Bern Convention.

The Species part of EUNIS contains information about more than 275 000 taxa occuring in Europe. However, the amount of information collected on each species varies in accordance with the potential use of the data. (Source: EEA EUNIS website)

- NATURA2000
  Natura 2000 is a European network of important ecological sites under the Birds Directive and Habitats Directive and has the aim of conserving biodiversity on land and at sea by protecting the most seriously threatened habitats and species across Europe. This legislation is called the Habitats Directive (adopted in 1992) and complements the Birds Directive adopted in 1979. Within the legislation special attention is paid to two groups of species. The first consists of fauna species listed in Annex II to the Habitats Directive. These include a number of marine mammals and certain fish. Secondly, various sea birds are also very important to the Natura 2000 network. These are protected under the Birds Directive, and their prevalence, population size and distribution are criteria for the nomination of Special Protection Areas (SPAs) that form part of Natura 2000.

EXAMPLE The reference list could be www.eu-nomen.eu

IR Requirement 4	ReferenceSpeciesID and referenceSpeciesScheme shall have assigned values.

Recommendation 2	EU-nomen is the preferred reference list to be used, but EUNIS and Natura2000 are accceptable alternatives.

The spatial object type "*SpeciesDistributionUnit*", is attributed with a voidable attribute "*DistributionInfo*" which allows the description of more details on the distribution information belonging to a single distribution unit. The *DistributionInfo* datatype contains several attributes which are of importance for user interpretation of a "*SpeciesDistributionUnit*" object. It is a dataType with a multiplicity of [0..*]. For example for the group of "Birds" there can be *distributionInfo* for the resident population but at the same time *distributionInfo* can be reported for the staging (*naturallyImpermanent*) population. The *DistributionInfo* attribute should be used very carefully as it also implicitly contains information on the presence or absence of a species, as detailed in the requirements below.

IR Requirement 5	When a species type is not searched for "*DistributionInfo*" shall be void with reason "unknown",

IR Requirement 6	In the case that a species is searched for, but not found, the value of attribute "*specificNumericalCount*" of *DistributionInfoType* shall be 0.

Figure 4 below depicts the three different scenarios.

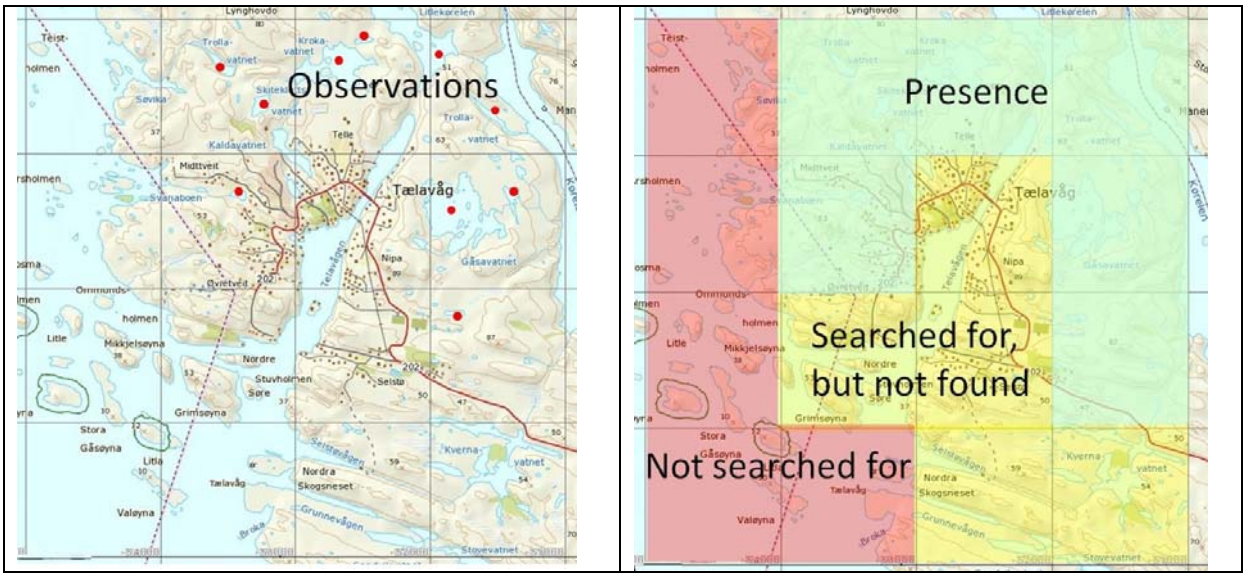


Figure 4 – Example of precence/absence in 1x1 km grid cells aggregated from observations.

The *DistributionInfo* dataType involves the following attributes:

- *countingMethod*: The"*CountingMethodValue*" refers to a codelist of parameters with quality categories.
- *residencyStatus*: Category of the residency of the occurrences/estimated population. The values can be selected from the enumeration *ResidencyStatusValue*;
- *specificNumericalCount*: Number to indicate the count of occurrences or the estimated population size with *countingUnitValue* as unit of measure;
- *numericalRange*: A range value indicating the occurrences/observations or the estimated population using upper and lower bounds. It should only used if the *specificNumericalCount* is not known;

IR Requirement 7	One and only one of the above two attributes (*specificNumericalCount* and *numericalRange*) shall have a value assigned if distributionInfo is reported for a specific unit.

- *countingUnit*: The unit used to express the number of occurrences/observations or the estimated population size. The values can be chosen from the codelist *CountingUnitValue*;
- *sensitiveInfo:* Boolean value that indicates whether the combination (location/aggregation unit + species) is sensitive. This can be an attribute to filter out sensitive data.

The distributionInfoType datatype is also linked to the *SourceInformation* spatial object type in order to describe metadata information about specific instances of distribution info. These metadata can be shared among several species distributions.
The SourceInformation contains the following attributes:

- *aggregationMethod:* a description of how observations have been aggregated to the species distribution unit
- *sourceMethod:* the method used in collecting the source data either in the field of from analog written texts and/or maps.

If available, additional information on the data provider, bibliographic references, and temporal extent (at feature level) can be provided within this spatial object type, via the following attributes:

- *methodReference:* a reference to any kind of method used in the aggregation process.
- *sourceProvider:* institutional name and/or source database.
- *validFrom:* DateTime for individual unit
- *validTo:* DateTime for individual unit

Finally, data providers can make use of a voidable attribute:

- *localSpeciesName:* A scientific name (and author) used in their national nomenclature and with an indication of the *localSpeciesScheme*.defining the local taxonomic concept. Additionally the voidable *qualifierValue* within the *localSpeciesNameType* can be used to define the relationship between the local taxonomic concept and the concept defined by the *referenceSpeciesID*. If this attribute is void the concepts are assumed to be congruent.

The Feature Catalogue for Species Distribution described in section 5.2.2 provides a complete list of the features, their attributes and their possible values arranged in codeLists or enumerations.

5.2.1.3. Consistency between spatial data sets

There are no other consistency rules than those defined within the application schema. No consistency rules between Species Distribution and other spatial datasets have been identified.

5.2.1.4. Identifier management

Only one spatial object has a mandatory identifier attribute specified (*SpeciesDistributionCoverage*) needs to provide a unique identifier. This identifier shall be maintained by the national or regional authority. The identifier shall consist of two parts: the namespace and a local id (see also the Generic Conceptual Model [DS-D2.5]).

5.2.1.5. Modelling of object references

Internal references: An aggregation construct is modelled between *DistributionInfoType* and *SourceInformation*. This basically means that many instances of *DistributionInfoType* can share the same source information. An attribute in *DistributionInfoType* will contain a reference to the *SourceInformation* object.

External references: If required the aggregation of observations represented by SpeciesDistributionUnit can be linked to single observations. This link is represented *SpeciesDistributionUnit* and *EnvironmentalMonitoringFacility* from the Environmental Monitoring Facilities theme (see Figure 5). EnvironmentalMonitoringFacility links to single observations.

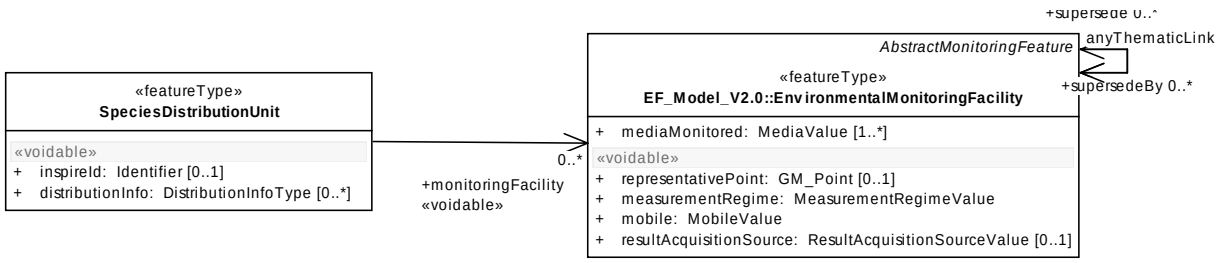


Figure 5 – External reference to the Environmental Monitoring Facilities theme.

Open issue 3: The link to single observations may be done by linking directly from SpeciesDistributionUnit to Observations and Measurements ISO standard (ISO 19157).

5.2.1.6. Geometry representation

IR Requirement 8	The value domain of spatial properties used in this specification shall be restricted to the Simple Feature spatial schema as defined by EN ISO 19125-1.

NOTE The specification restricts the spatial schema to 0-, 1-, 2-, and 2.5-dimensional geometries where all curve interpolations are linear.

NOTE The topological relations of two spatial objects based on their specific geometry and topology properties can in principle be investigated by invoking the operations of the types defined in ISO 19107 (or the methods specified in EN ISO 19125-1).

5.2.1.7. Temporality representation

The application schema(s) use(s) the derived attributes "beginLifespanObject" and "endLifespanObject" to record the lifespan of a spatial object.

The attributes "beginLifespanVersion" specifies the date and time at which this version of the spatial object was inserted or changed in the spatial data set. The attribute "endLifespanVersion" specifies the date and time at which this version of the spatial object was superseded or retired in the spatial data set.

NOTE 1 The attributes specify the beginning of the lifespan of the version in the spatial data set itself, which is different from the temporal characteristics of the real-world phenomenon described by the spatial object. This lifespan information, if available, supports mainly two requirements: First, knowledge about the spatial data set content at a specific time; second, knowledge about changes to a data set in a specific time frame. The lifespan information should be as detailed as in the data set (i.e., if the lifespan information in the data set includes seconds, the seconds should be represented in data published in INSPIRE) and include time zone information.

NOTE 2 Changes to the attribute "endLifespanVersion" does not trigger a change in the attribute "beginLifespanVersion".

Recommendation 3	If life-cycle information is not maintained as part of the spatial data set, all spatial objects belonging to this data set should provide a void value with a reason of "unpopulated".

5.2.2 Feature catalogue

Table 3 - Feature catalogue metadata

Feature catalogue name	INSPIRE feature catalogue SpeciesDistribution
Scope	SpeciesDistribution
Version number	2.0
Version date	2011-06-14
Definition source	INSPIRE data specification SpeciesDistribution

Table 4 - Types defined in the feature catalogue

Type	Package	Stereotypes	Section

Type	Package	Stereotypes	Section
AggregationMethodValue	SpeciesDistribution	«codeList»	5.2.2.3.1
Article17CountingUnitValue	SpeciesDistribution	«codeList»	5.2.2.3.2
Article17SourceMethodValue	SpeciesDistribution	«codeList»	5.2.2.3.3
CountingMethodValue	SpeciesDistribution	«codeList»	5.2.2.3.4
CountingUnitValue	SpeciesDistribution	«codeList»	5.2.2.3.5
DistributionInfoType	SpeciesDistribution	«dataType»	5.2.2.2.1
GeneralCountingUnitValue	SpeciesDistribution	«codeList»	5.2.2.3.6
GeneralSourceMethodValue	SpeciesDistribution	«codeList»	5.2.2.3.7
LocalSpeciesNameType	SpeciesDistribution	«dataType»	5.2.2.2.2
QualifierValue	SpeciesDistribution	«codeList»	5.2.2.3.8
RangeType	SpeciesDistribution	«dataType»	5.2.2.2.3
ReferenceSpeciesSchemeValue	SpeciesDistribution	«codeList»	5.2.2.3.9
ResidencyStatusValue	SpeciesDistribution	«codeList»	5.2.2.3.10
SourceInformation	SpeciesDistribution	«featureType»	5.2.2.1.1
SourceMethodValue	SpeciesDistribution	«codeList»	5.2.2.3.11
SourceProviderType	SpeciesDistribution	«dataType»	5.2.2.2.4
SpeciesDistributionCoverage	SpeciesDistribution	«featureType»	5.2.2.1.2
SpeciesDistributionUnit	SpeciesDistribution	«featureType»	5.2.2.1.3

5.2.2.1. Spatial object types

5.2.2.1.1. SourceInformation

SourceInformation

Definition: Contains metadata about specific instances of species distribution.
Description: May be shared among several species distributions.
Status: Proposed
Stereotypes: «featureType»
URI: null

Attribute: aggregationMethod

Value type: AggregationMethodValue
Definition: Description of how observations are aggregated to the species distribution unit.
Description: Values are provided by an extensible codelist. 0 to many single observations are usually aggregated within analytical units to provide the information about the distribution in a given area. These analytical units can be regularly shaped polygons like grids or irregular shaped polygons like administrative units, biogeographical regions or with boundaries of their own.
Multiplicity: 1..*

Attribute: inspireId

Value type: Identifier
Definition: External object identifier of the spatial object.
Description: An external object identifier is a unique object identifier published by the responsible body, which may be used by external applications to reference the spatial object. The identifier is an identifier of the spatial object, not an identifier of the real-world phenomenon.
Multiplicity: 0..1
Stereotypes: «voidable»

Attribute: localSpeciesName

Value type: LocalSpeciesNameType

SourceInformation

Definition: Scientific name plus author used in national nomenclature with its national taxonomic concept.
Description: The LocalSpeciesName provides nomenclatural and taxonomical information about the locally used species name and the taxonomic concepts implied by the use of this name according to a given reference. If omitted the name and concept given by the referenceSpeciesId according to the referenceSpeciesScheme has been used locally.
Multiplicity: 0..*
Stereotypes: «voidable»

Attribute: methodReference

Value type: CharacterString
Definition: Bibliographic reference or URL to a description of aggregation method.
Multiplicity: 0..1
Stereotypes: «voidable»

Attribute: sourceMethod

Value type: SourceMethodValue
Definition: Method by which the data on species distribution is collected.
Description: Refers to the methods hows observations have been made or recorded that are aggregated by using a given aggregationMethod assigned to the species distribution unit.
Multiplicity: 1

Attribute: sourceProvider

Value type: SourceProviderType
Definition: Name of institution compiling data from source databases to a complete dataset.
Multiplicity: 1..*
Stereotypes: «voidable»

Attribute: validFrom

Value type: DateTime
Definition: The time when the phenomenon started to exist in the real world.
Description: Starting date where observations have been aggregated by the given aggregation method.
Multiplicity: 1
Stereotypes: «voidable»

Attribute: validTo

Value type: DateTime
Definition: The time from which the phenomenon no longer exists in the real world.
Description: Ending date where observations have been aggregated by the given aggregation method.
Multiplicity: 0..1
Stereotypes: «voidable»

5.2.2.1.2. SpeciesDistributionCoverage

SpeciesDistributionCoverage

Subtype of: CoverageByDomainAndRange
Definition: The spatial representation of a species occurrence.
Description:
Status: Proposed
Stereotypes: «featureType»
URI: null

SpeciesDistributionCoverage

Attribute: beginLifespanVersion

Value type:	DateTime
Definition:	Date and time at which this version of the spatial object was inserted or changed in the spatial data set.
Description:	NOTE This date is recorded to enable the generation of change only update files.
Multiplicity:	1
Stereotypes:	«voidable,lifeCycleInfo»

Attribute: domainExtent

Value type:	EX_GeographicExtent
Definition:	The geographic extent of the domain of the coverage.
Multiplicity:	1
Stereotypes:	«voidable»

Attribute: endLifespanVersion

Value type:	DateTime
Definition:	Date and time at which this version of the spatial object was superseded or retired in the spatial data set.
Description:	NOTE This date is recorded primarily for those systems which "close" an entry in the spatial data set in the event of an attribute change.
Multiplicity:	1
Stereotypes:	«voidable,lifeCycleInfo»

Attribute: inspireId

Value type:	Identifier
Definition:	External object identifier of the spatial object.
Description:	An external object identifier is a unique object identifier published by the responsible body, which may be used by external applications to reference the spatial object. The identifier is an identifier of the spatial object, not an identifier of the real-world phenomenon.
Multiplicity:	1

Attribute: referenceSpeciesId

Value type:	CharacterString
Definition:	ID of one of the reference lists given by the referenceSpeciesScheme.
Multiplicity:	1

Attribute: referenceSpeciesScheme

Value type:	ReferenceSpeciesSchemeValue
Definition:	Reference list defining a nomenclatural and taxonomical standard where all local names and taxonomic concepts have to be mapped to.

SpeciesDistributionCoverage

Description:	Closed codelist of accepted PAN-european taxonomical reference lists defining the nomenclature and taxonomical concept of a given species name. This must not be regarded as the ultimate taxonomic truth: this will always change. It serves as a definition of a taxonomic concept described by systematic and synonym relations where other names and there inherent taxonomic concepts can be mapped to. The code list comprises of Eu-Nomen, EUNIS and Natura2000. In these sources harmonized species GUIDs and names are maintained by institutions with an assignment outside INSPIRE and the species names are to be retrieved through webservices using GUIDs. Only one of these list must be used for one taxon. The priority is as follows: 1) EU-Nomen, 2) EUNIS, 3) Natura2000. This implies: if a taxon is listed in EU-Nomen, this reference must be used as first choice. If it is not listed in EU-Nomen, the second choice is EUNIS, if not in EUNIS, Natura2000 can be used.
Multiplicity:	1

Constraint: domainIsMultiSurfaceOrRectifiedGridOrMultiPoint

Natural language:	domain is a multi surface, rectified grid or multi point
OCL:	inv: domainSet.oclIsKindOf(GM_MultiSurface) or domainSet.oclIsKindOf(CV_RectifiedGrid) or domainSet.oclIsKindOf(GM_MultiPoint)

Constraint: rangeSetIsSpeciesDistributionUnit

Natural language:	range set is described by species distribution
OCL:	inv: rangeSet.oclIsKindOf(SpeciesDistributionUnit)

5.2.2.1.3. SpeciesDistributionUnit

SpeciesDistributionUnit

Definition:	Occurrence of animal and plant species aggregated by grid, region, administrative unit or other analytical unit.
Description:	Pan-European, national or local mapping initiatives, resulting in spatial data for species in terrestrial and marine environments, e.g. for birds, insects, mammals, amphibians, reptiles, fish or vascular plants. NOTE 1 The definition in INSPIRE Directive proposal does not include individual observations or other point based data, but focuses on aggregated versions of data about geographical distribution of species. Aggregation can be at any level of resolution, e.g. in geographical grid systems divided into 100x100 meter grid or 50x50km grid cells. Possibly also point-based observations and isolines generation between occurrences should be accepted and included in INSPIRE. Possibly these can be defined as options in the "other analytical unit". Aggregation may also be interpreted not only as space-based aggregation, but time-based aggregation as well. NOTE 2 Only species are mentioned in the INSPIRE definition. But earlier INSPIRE documents (INPIRE IMS, 2003) mentions both species or species grouped e.g. to families. So we interprete species as taxa, which means taxonomic units at any systematic rank, like subspecies, species, genus, family etc.
Status:	Proposed
Stereotypes:	«featureType»
URI:	null

Attribute: distributionInfo

Value type:	DistributionInfoType

SpeciesDistributionUnit	
Definition:	The description of the subject of distribution (observations or population), the indication of the count of observations or populationsize of the particular species, species group or taxon rank and its distribution/isolation within the aggregation unit.
Multiplicity:	0..*
Stereotypes:	«voidable»
Attribute: inspireId	
Value type:	Identifier
Definition:	External object identifier of the spatial object.
Description:	An external object identifier is a unique object identifier published by the responsible body, which may be used by external applications to reference the spatial object. The identifier is an identifier of the spatial object, not an identifier of the real-world phenomenon.
Multiplicity:	0..1
Stereotypes:	«voidable»
Association role: monitoringFacility	
Value type:	EnvironmentalMonitoringFacility
Definition:	A link to a monitoring facility and associated observations.
Description:	
Multiplicity:	0..*
Stereotypes:	«voidable»

5.2.2.2. Data types

5.2.2.2.1. DistributionInfoType

DistributionInfoType	
Definition:	The description of the status of the subject of distribution within the aggregation unit, like the indication of the abundance by counting, estimation or calculation of the number of occurences or populationsize of the particular species.
Status:	Proposed
Stereotypes:	«dataType»
URI:	null
Attribute: countingMethod	
Value type:	CountingMethodValue
Definition:	Method of providing a number for the indication of the abundance of a species.
Multiplicity:	1
Attribute: countingUnit	
Value type:	CountingUnitValue
Definition:	Defines what has been counted, estimated or calculated when compiling information on the abundance of a species within the speciesAggregationUnit.
Multiplicity:	1
Attribute: numericalRange	
Value type:	RangeType
Definition:	A range value indicating the counted, estimated or calculated occurrences or populationsizes using upper and lower bounds.
Description:	NOTE Only used if the specific numerical count is not known.
Multiplicity:	0..1
Attribute: residencyStatus	
Value type:	ResidencyStatusValue

DistributionInfoType	
Definition:	Information on the status of residency regarding nativeness versus introduction and permanency.
Multiplicity:	0..1
Stereotypes:	«voidable»
Attribute: sensitiveInfo	
Value type:	Boolean
Definition:	Indicates whether the combination (location, species) is sensitive. This can be a attribute to filter out sensitive data.
Description:	A species location e.g. breeding location, of vulnerable, endangered or protected species may by law be spatially generalised from detailed locations to lower resolutions in more extensive grid cells to avoid environmental crime.
Multiplicity:	0..1
Stereotypes:	«voidable»
Attribute: specificNumericalCount	
Value type:	Integer
Definition:	Number to indicate the count, estimation or calculation of occurrences or population size as described by the counting method.
Description:	If the number is 0 this means that within a given unit the occurrence of the species has been investigated, but no observation has been made.
Multiplicity:	0..1
Association role: metadata	
Value type:	SourceInformation
Definition:	Contains metadata about specific instances of species distribution.
Multiplicity:	0..1
Stereotypes:	«voidable»
Constraint: numericalRangeEmpty	
Natural language:	If no numericalRange exists, specificNumericalCount is required.
OCL:	inv: self.numericalRange ->isEmpty() implies self.specificNumericalCount->notEmpty()
Constraint: specificNumericalCountEmpty	
Natural language:	If no specificNumericalCount exists, numericalRange is required.
OCL:	inv: self.specificNumericalCount ->isEmpty() implies self.numericalRange ->notEmpty()

5.2.2.2.2. LocalSpeciesNameType

LocalSpeciesNameType	
Definition:	Species name in national nomenclature with reference to a taxonomic concept defined by a local species scheme.
Status:	Proposed
Stereotypes:	«dataType»
URI:	null
Attribute: localSpeciesNameValue	
Value type:	CharacterString
Definition:	Scientific name plus author used in national nomenclature.
Multiplicity:	1
Attribute: localSpeciesSchemeId	

LocalSpeciesNameType	
Value type:	CharacterString
Definition:	Name of local species classification scheme (bibliographic reference).
Multiplicity:	1
Attribute: qualifier	
Value type:	QualifierValue
Definition:	Specifies how the relationship is to the combination of reference species id plus reference species scheme.
Multiplicity:	0..1
Stereotypes:	«voidable»

5.2.2.2.3. RangeType

RangeType	
Definition:	Value indicating the upper and lower bounds of the counting, estimation or calculation of occurences.
Description:	NOTE Only used if the specific numerical count is not known.
Status:	Proposed
Stereotypes:	«dataType»
URI:	null
Attribute: lowerBound	
Value type:	Integer
Definition:	The lower bound of the range. If the value of this attribute is null and upperBound is populated, this implies that the value is between the upperBound and zero.
Multiplicity:	0..1
Attribute: upperBound	
Value type:	Integer
Definition:	The upper bound of the range. If the value of this attribute is null and lowerBound is populated, this implies that the value is between the lowerBound and infinity.
Multiplicity:	0..1

5.2.2.2.4. SourceProviderType

SourceProviderType	
Definition:	Identifier of the source of data on species distribution.
Status:	Proposed
Stereotypes:	«dataType»
URI:	null
Attribute: inistitutionName	
Value type:	CI_ResponsibleParty
Definition:	Name of the owner or operator of the source database.
Multiplicity:	1
Stereotypes:	«voidable»
Attribute: sourceDatabase	
Value type:	CharacterString
Definition:	Name of the database where the species distribution data is retrieved from.
Multiplicity:	0..*
Stereotypes:	«voidable»

5.2.2.3. Code lists

5.2.2.3.1. AggregationMethodValue

AggregationMethodValue	
Definition:	Categories of aggregation methods used to represent species distribution in the aggregated unit.
Description:	Aggregations is either based on aggregating species observations within the area of the spatial unit og based on scientifc analysis; interpretation of observations, surveys, literature and knowledge of habitats and biotopes – it is therefore an amalgamation rather than a simple aggregation.
Status:	Proposed
Stereotypes:	«codeList»
Governance:	May be extended by Member States.
URI:	http://inspire-registry.jrc.ec.europa.eu/registers/CLR/AggregationMethodValue
Value: observationAggregation	
Definition:	The unit of species distribution is based on aggregating zero to many species observations within the area of the aggregation unit.
Value: scientificAnalysis	
Definition:	The unit of species distribution is based on scientific interpretation of species observations, surveys, literature and/or specific knowledge of the species ecological og behavioural requirements.

5.2.2.3.2. Article17CountingUnitValue

Article17CountingUnitValue	
Subtype of:	CountingUnitValue
Definition:	The unit used in reporting for Article 17 Report. Expresses counted or estimated number for the abundance within a SpeciesAggregationUnit (e.g. ocurrences or the population size).
Description:	NOTE The values of the list are found here: http://bd.eionet.europa.eu/activities/Natura_2000/Folder_Reference_Portal/Population_units.pdf
Status:	Proposed
Stereotypes:	«codeList»
Governance:	May not be extended by Member States.
URI:	http://bd.eionet.europa.eu/article17/reference_portal
Value: adults	
Definition:	Adult individuals.
Value: area	
Definition:	Area (km^2).
Value: breedingFemales	
Definition:	Breeding females.
Value: callingMales	
Definition:	Calling males.
Value: colonies	
Definition:	Colonies.
Value: floweringStems	
Definition:	Flowering stems.
Value: individuals	
Definition:	Individuals.

Article17CountingUnitValue
Value: inhabitedLogs Definition: Inhabited logs.
Value: inhabitedStonesOrBoulders Definition: Inhabited stones or boulders.
Value: inhabitedTrees Definition: Inhabited trees.
Value: length Definition: Length (km).
Value: localities Definition: Localities.
Value: males Definition: Males.
Value: pairs Definition: Pairs.
Value: shoots Definition: Shoots are counted when it is not possible to distinguish individuals, e.g. due to clonal growth.
Value: tufts Definition: Tufts.

5.2.2.3.3. Article17SourceMethodValue

Article17SourceMethodValue
Subtype of: SourceMethodValue Definition: What are the methods that have been used in the sources for compiling the information about the occurences of the species within an aggregation unit for article 17 purposes. Description: Describes how the information about the occurences of the species within a speciesAggregationUnit has been compiled. NOTE The values of the list are found here: http://circa.europa.eu/Public/irc/env/monnat/library?l=/habitats_reporting/reporting_2007-2012/reporting_guidelines/reporting-formats_1/_EN_1.0_&a=d Status: Proposed Stereotypes: «codeList» Governance: May not be extended by Member States. URI: http://bd.eionet.europa.eu/article17/reference_portal
Value: absentData Definition: Absent data.
Value: completeSurvey Definition: Complete survey.
Value: estimateExpert Definition: Estimate based in expert opinion with no or minimal sampling.
Value: estimatePartial Definition: Estimate based on partial data with some extrapolation and/or modelling.

5.2.2.3.4. CountingMethodValue

CountingMethodValue	
Definition:	Method for producing numbers for the abundance of a species within an aggregation unit.
Status:	Proposed
Stereotypes:	«codeList»
Governance:	May be extended by Member States.
URI:	http://inspire-registry.jrc.ec.europa.eu/registers/CLR/CountingMethodValue
Value: calculated	
Definition:	The units defined by the countUnitValues have been calculated by some modelling technique.
Value: counted	
Definition:	The units defined by the countUnitValues have been counted.
Value: estimated	
Definition:	The units defined by the countUnitValues have been estimated.

5.2.2.3.5. CountingUnitValue

CountingUnitValue (abstract)	
Definition:	The unit used to express counted or estimated number for the abundance within a SpeciesAggregationUnit (e.g. ccurrences or the population size).
Description:	Subclasses for specific domains can be added by member states.
Status:	Proposed
Stereotypes:	«codeList»
URI:	null

5.2.2.3.6. GeneralCountingUnitValue

GeneralCountingUnitValue	
Subtype of:	CountingUnitValue
Definition:	The unit used to express counted or estimated number for the abundance within a SpeciesAggregationUnit (e.g. ccurrences or the population size).
Status:	Proposed
Stereotypes:	«codeList»
Governance:	May not be extended by Member States.
URI:	http://inspire-registry.jrc.ec.europa.eu/registers/CLR/GeneralCountingUnitValue
Value: colonies	
Definition:	Colonies.
Value: individuals	
Definition:	Individuals.
Value: pairs	
Definition:	Pairs.
Value: shoots	
Definition:	Shoots are counted when it is not possible to distinguish individuals, e.g. due to clonal growth.
Value: tufts	
Definition:	Tufts.

5.2.2.3.7. GeneralSourceMethodValue

GeneralSourceMethodValue

GeneralSourceMethodValue	
Subtype of:	SourceMethodValue
Definition:	What are the methods that have been used in the sources for compiling the information about the occurences of the species within an aggregation unit.
Description:	Describes how the information about the occurences of the species within a speciesAggregationUnit has been compiled.
Status:	Proposed
Stereotypes:	«codeList»
Governance:	May not be extended by Member States.
URI:	http://inspire-registry.jrc.ec.europa.eu/registers/CLR/GeneralSourceMethodValue
Value: collectionExamination	
Definition:	Occurrences/observations collected from examinations of collections.
Description:	EXAMPLE Herbaria, zoological collections etc.
Value: gridMapping	
Definition:	Occurrences/observations collected by systematic surveys in grid cells.
Value: lineSampling	
Definition:	Occurrences/observations collected by systematic surveys along linear transsects.
Value: literatureExamination	
Definition:	Occurrences/observations collected from litterature examinations like Floras, Faunas or printed maps in distribution atlases.
Value: randomObservations	
Definition:	Occurrences/observations collected by randomly distributed collection/observation sites randomly outside a systematic survey.
Value: statisticalSampling	
Definition:	Occurrences/observations collected on locations selected by statistical sampling methods.

5.2.2.3.8. QualifierValue

QualifierValue	
Definition:	Defines the relation between the taxonomic concepts of a local species name to the reference species name given by reference species id plus reference species scheme.
Status:	Proposed
Stereotypes:	«codeList»
Governance:	May not be extended by Member States.
URI:	http://inspire-registry.jrc.ec.europa.eu/registers/CLR/QualifierValue
Value: congruent	
Definition:	The concepts are identical.
Value: excludes	
Definition:	The concepts exclude each other.
Value: includedIn	
Definition:	The concept of the localSpeciesName is included in the concept of the referenceSpeciesName.
Value: includes	

QualifierValue	
Definition:	The concept of the localSpeciesName is includes the concept of the referenceSpeciesName.
Value: overlaps	
Definition:	The concepts overlap, but each one has a part that is not included in the other.

5.2.2.3.9. ReferenceSpeciesSchemeValue

ReferenceSpeciesSchemeValue	
Definition:	Defines the Reference Lists that have to be used as standard for mapping local species names to the standard defined by the given lists.
Status:	Proposed
Stereotypes:	«codeList»
Governance:	May not be extended by Member States.
URI:	http://inspire-registry.jrc.ec.europa.eu/registers/CLR/ReferenceSpeciesSchemeValue
Value: eunis	
Definition:	Names and taxonomic concepts as defined by the EUNIS Species list.
Value: eunomen	
Definition:	Names and taxonomic concepts as defined by the Pan European Species Inventory, published by eunomen.eu/portal.
Value: natureDirectives	
Definition:	Names and taxonomic concepts as defined by the nature directives species list.

5.2.2.3.10. ResidencyStatusValue

ResidencyStatusValue	
Definition:	Category of the residency of the occurrences/estimated population within a given aggregation unit.
Description:	These values are used for Natura2000 (revised SDF). NOTE One or more categories of population may be listed in the dataset, giving population size of e.g. permanent and wintering populations.
Status:	Proposed
Stereotypes:	«codeList»
Governance:	May not be extended by Member States.
URI:	http://inspire-registry.jrc.ec.europa.eu/registers/CLR/ResidencyStatusValue
Value: concentration	
Definition:	Site used for staging or roosting or migration stop/over or for moulting outside the breeding grounds and excluding wintering.
Value: cultivated	
Definition:	Species is cultivated, not occurring in the wild.
Value: extinct	
Definition:	Species has been extincted.
Value: introducedEstablished	
Definition:	Species has been introduced and is reproducing with stable populations.
Value: introducedImpermanent	
Definition:	Species has been introduced, but has no stable, reproducing populations.
Value: native	

ResidencyStatusValue	
Definition:	Species is occuring natively.
Value: naturallyImpermanent	
Definition:	Species is naturally introduced (by natural migration), but has no stable, reproducing populations.
Value: permanent	
Definition:	To be found throughout the year on the site (non-migratory species or plant, resident population of migratory species).
Value: probablyExtinct	
Definition:	Species has not been observed by recent surveys, but no positive proof of extinction is possible.
Value: re-introducedOrTranslocated	
Definition:	An extinct population of formerly native species has been re-introduced as a nature conservation measure.
Value: reproducing	
Definition:	Uses the site to raise young (e.g. breeding, nesting).
Value: wintering	
Definition:	Uses the site during the winter.

5.2.2.3.11. SourceMethodValue

SourceMethodValue (abstract)	
Definition:	Abstract class defining the methods that have been used in the sources for compiling the information about the occurences of the species within an aggregation unit.
Description:	Subclasses for specific domains can be added by member states.
Status:	Proposed
Stereotypes:	«codeList»
URI:	null

5.2.2.4. Imported types (informative)

This section lists definitions for feature types, data types and enumerations and code lists that are defined in other application schemas. The section is purely informative and should help the reader understand the feature catalogue presented in the previous sections. For the normative documentation of these types, see the given references.

5.2.2.4.1. Boolean

Boolean	
Package:	INSPIRE Consolidated UML Model::Foundation Schemas::ISO TC211::ISO 19103:2005 Schema Language::Basic Types::Primitive::Truth [Include reference to the document that includes the package, e.g. INSPIRE data specification, ISO standard or the GCM]

5.2.2.4.2. CI_ResponsibleParty

CI_ResponsibleParty	
Package:	INSPIRE Consolidated UML Model::Foundation Schemas::ISO TC211::ISO 19115:2006 Metadata (Corrigendum)::Citation and responsible party information [Include reference to the document that includes the package, e.g. INSPIRE data specification, ISO standard or the GCM]

5.2.2.4.3. CharacterString

CharacterString

CharacterString	
Package:	INSPIRE Consolidated UML Model::Foundation Schemas::ISO TC211::ISO 19103:2005 Schema Language::Basic Types::Primitive::Text [Include reference to the document that includes the package, e.g. INSPIRE data specification, ISO standard or the GCM]

5.2.2.4.4. CoverageByDomainAndRange

CoverageByDomainAndRange (abstract)	
Package:	INSPIRE Consolidated UML Model::Generic Conceptual Model::Base Models::Coverages (Domain and Range) [Include reference to the document that includes the package, e.g. INSPIRE data specification, ISO standard or the GCM]
Definition:	coverage which provide the domain and range as separate properties

5.2.2.4.5. DateTime

DateTime	
Package:	INSPIRE Consolidated UML Model::Foundation Schemas::ISO TC211::ISO 19103:2005 Schema Language::Basic Types::Primitive::Date and Time [Include reference to the document that includes the package, e.g. INSPIRE data specification, ISO standard or the GCM]

5.2.2.4.6. EX_GeographicExtent

EX_GeographicExtent (abstract)	
Package:	INSPIRE Consolidated UML Model::Foundation Schemas::ISO TC211::ISO 19115:2006 Metadata (Corrigendum)::Extent information [Include reference to the document that includes the package, e.g. INSPIRE data specification, ISO standard or the GCM]

5.2.2.4.7. EnvironmentalMonitoringFacility

EnvironmentalMonitoringFacility	
Package:	INSPIRE Consolidated UML Model::Themes::Annex III::Environmental Monitoring Facilities::EF_Model_V2.0 [Include reference to the document that includes the package, e.g. INSPIRE data specification, ISO standard or the GCM]
Definition:	An Environmental Monitoring Facility is a georeferenced object directly collecting and or processing data or hosting other Environmental Monitoring Facility objects collecting data about features whose properties (e.g. physical, chemical, biological or other aspects of environmental conditions) are repeatedly observed/measured using static or mobile, in-situ or remote methods. An Environmental Monitoring Facility encompasses notions of platform/site/station/sensor often found within various thematic domains.
Description:	NOTE 1: An Environmental Monitoring Facility is not a Facility from an Inspire annex Building perspective NOTE 2: Laboratories are not Environmental Monitoring Facilities from INSPIRE perspective as the exact location of the laboratory does not add further information to the measurement. The methodology used in the laboratory should be provided with observational data. NOTE 3: From INSPIRE perspective, an Environmental Monitoring Facility requires the provision of Observations only in the case that these have been required under a given reporting obligation or a commonly agreed voluntarily based one.

5.2.2.4.8. Identifier

Identifier	
Package:	INSPIRE Consolidated UML Model::Generic Conceptual Model::Base Types [Include reference to the document that includes the package, e.g. INSPIRE data specification, ISO standard or the GCM]
Definition:	External unique object identifier published by the responsible body, which may be used by external applications to reference the spatial object.
Description:	NOTE1 External object identifiers are distinct from thematic object identifiers. NOTE 2 The voidable version identifier attribute is not part of the unique identifier of a spatial object and may be used to distinguish two versions of the same spatial object. NOTE 3 The unique identifier will not change during the life-time of a spatial object.

5.2.2.4.9. Integer

Integer	
Package:	INSPIRE Consolidated UML Model::Foundation Schemas::ISO TC211::ISO 19103:2005 Schema Language::Basic Types::Primitive::Numerics [Include reference to the document that includes the package, e.g. INSPIRE data specification, ISO standard or the GCM]

6 Reference systems

6.1 Coordinate reference systems

6.1.1 Datum

IR Requirement 9	For the coordinate reference systems used for making available the INSPIRE spatial data sets, the datum shall be the datum of the European Terrestrial Reference System 1989 (ETRS89) in areas within its geographical scope, and the datum of the International Terrestrial Reference System (ITRS) or other geodetic coordinate reference systems compliant with ITRS in areas that are outside the geographical scope of ETRS89. Compliant with the ITRS means that the system definition is based on the definition of the ITRS and there is a well established and described relationship between both systems, according to EN ISO 19111.

6.1.2 Coordinate reference systems

IR Requirement 10 INSPIRE spatial data sets shall be made available using one of the three-dimensional, two-dimensional or compound coordinate reference systems specified in the list below.

Other coordinate reference systems than those listed below may only be used for regions outside of continental Europe. The geodetic codes and parameters for these coordinate reference systems shall be documented, and an identifier shall be created, according to EN ISO 19111 and ISO 19127.

1. Three-dimensional Coordinate Reference Systems
   - Three-dimensional Cartesian coordinates
   - Three-dimensional geodetic coordinates (latitude, longitude and ellipsoidal height), using the parameters of the GRS80 ellipsoid

2. Two-dimensional Coordinate Reference Systems
   - Two-dimensional geodetic coordinates, using the parameters of the GRS80 ellipsoid
   - Plane coordinates using the Lambert Azimuthal Equal Area projection and the parameters of the GRS80 ellipsoid
   - Plane coordinates using the Lambert Conformal Conic projection and the parameters of the GRS80 ellipsoid
   - Plane coordinates using the Transverse Mercator projection and the parameters of the GRS80 ellipsoid

3. Compound Coordinate Reference Systems
   - For the horizontal component of the compound coordinate reference system, one of the two-dimensional coordinate reference systems specified above shall be used
   - For the vertical component on land, the European Vertical Reference System (EVRS) shall be used to express gravity-related heights within its geographical scope
   - Other vertical reference systems related to the Earth gravity field shall be used to express gravity-related heights in areas that are outside the geographical scope of EVRS. The geodetic codes and parameters for these vertical reference systems shall be documented and an identifier shall be created, according to EN ISO 19111 and ISO 19127
   - For the vertical component measuring the depth of the sea floor, where there is an appreciable tidal range, the Lowest Astronomical Tide shall be used as reference surface. In marine areas without an appreciable tidal range, in open oceans and effectively in waters that are deeper than 200 m, the depth of the sea floor shall be referenced to the Mean Sea Level
   - For the vertical component measuring depths above the sea floor in the free ocean, barometric pressure shall be used
   - For the vertical component in the free atmosphere, barometric pressure, converted to height using ISO 2533:1975 International Standard Atmosphere shall be used

6.1.3 Display

IR Requirement 11 For the display of the INSPIRE spatial data sets with the View Service specified in D003152/02 Draft Commission Regulation implementing Directive 2007/2/EC of the European Parliament and of the Council as regards Network Services, at least the two dimensional geodetic coordinate system shall be made available.

6.1.4 Identifiers for coordinate reference systems

IR Requirement 12 For referring to the non-compound coordinate reference systems listed in this Section, the identifiers listed below shall be used.

For referring to a compound coordinate reference system, an identifier composed of the identifier of the horizontal component, followed by a slash (/), followed by the identifier of the vertical component, shall be used.

- ETRS89-XYZ for Cartesian coordinates in ETRS89
- ETRS89-GRS80h for three-dimensional geodetic coordinates in ETRS89 on the GRS80 ellipsoid
- ETRS89-GRS80 for two-dimensional geodetic coordinates in ETRS89 on the GRS80
- EVRS for height in EVRS
- LAT for depth of the sea floor, where there is an appreciable tidal range
- MSL for depth of the sea floor, in marine areas without an appreciable tidal range, in open oceans and effectively in waters that are deeper than 200m
- ISA for pressure coordinate in the free atmosphere
- PFO for Pressure coordinate in the free ocean
- ETRS89-LAEA for ETRS89 coordinates projected into plane coordinates by the Lambert Azimuthal Equal Area projection
- ETRS89-LCC for ETRS89 coordinates projected into plane coordinates by the Lambert Conformal Conic projection
- ETRS89-TMzn for ETRS89 coordinates projected into plane coordinates by the Transverse Mercator projection

6.2 Temporal reference system

IR Requirement 13 The Gregorian Calendar shall be used for as a reference system for date values, and the Universal Time Coordinated (UTC) or the local time including the time zone as an offset from UTC shall be used as a reference system for time values.

6.3 Theme-specific requirements and recommendations on reference systems

There are no theme-specific requirements or recommendations on reference systems.

7 Data quality

This chapter includes a description of data quality elements and sub-elements as well as the associated data quality measures (section 7.1). The selected data quality measures should be used to evaluate quality of data sets for a specific data quality element / sub-element. The evaluation can be performed at the level of spatial object, spatial object type, dataset or dataset series.

The results of the evaluation are then reported at the spatial object type or dataset level in metadata utilising the same data quality elements and measures (see chapter 8).

NOTE The selection of appropriate data quality measures represents the first step towards the harmonisation of documenting data quality.

In addition, for some of the data quality elements described in section 7.1, minimum data quality requirements or recommendations may be defined. These are described in the section 1.2.

Recommendation 1 If data quality information is required at spatial object level then it should be modelled in the data model as an attribute of a relevant spatial object type.

7.1 Data quality elements and measures

No data quality elements for quantitative evaluation are defined for this theme.

Open issue 4: Data quality requirements based on real use cases

In case stakeholders participating on consultation & testing will identify via comments requirements for data quality and related measures based on real use cases these can be introduced for ver. 03 of this Data specification.

7.2 Minimum data quality requirements and recommendations

No minimum data quality requirements are defined.

8 Dataset-level metadata

Metadata can be reported for each individual spatial object (spatial object-level metadata) or once for a complete dataset or dataset series (dataset-level metadata). Spatial object-level metadata is fully described in the application schema (section **5**). If data quality elements are used at spatial object level, the documentation shall refer to the appropriate definition in section 7. This section only specifies dataset-level metadata elements.

For some dataset-level metadata elements, in particular on data quality and maintenance, a more specific scope can be specified. This allows the definition of metadata at sub-dataset level, e.g. separately for each spatial object type. When using ISO 19115/19139 to encode the metadata, the following rules should be followed:

- The scope element (of type DQ_Scope) of the DQ_DataQuality subtype should be used to encode the scope.
- Only the following values should be used for the level element of DQ_Scope: Series, Dataset, featureType.
- If the level is featureType the levelDescription/MDScopeDescription/features element (of type Set< GF_FeatureType>) shall be used to list the feature type names.

NOTEThe value featureType is used to denote spatial object type.

Mandatory or conditional metadata elements are specified in Section 8.1. Optional metadata elements are specified in Section 8. The tables describing the metadata elements contain the following information:

- The first column provides a reference to a more detailed description.
- The second column specifies the name of the metadata element.
- The third column specifies the multiplicity.

- The fourth column specifies the condition, under which the given element becomes mandatory (only for Table 2 and Table 3).

8.1 Common metadata elements

IR Requirement 14 The metadata describing a spatial data set or a spatial data set series related to the theme **Species Distribution** shall comprise the metadata elements required by Regulation 1205/2008/EC (implementing Directive 2007/2/EC of the European Parliament and of the Council as regards metadata) for spatial datasets and spatial dataset series (Table 2) as well as the metadata elements specified in Table 3.

Table 2 – Metadata for spatial datasets and spatial dataset series specified in Regulation 1205/2008/EC (implementing Directive 2007/2/EC of the European Parliament and of the Council as regards metadata)

Metadata Regulation Section	Metadata element	Multiplicity	Condition
1.1	Resource title	1	
1.2	Resource abstract	1	
1.3	Resource type	1	
1.4	Resource locator	0..*	Mandatory if a URL is available to obtain more information on the resource, and/or access related services.
1.5	Unique resource identifier	1..*	
1.7	Resource language	0..*	Mandatory if the resource includes textual information.
2.1	Topic category	1..*	
3	Keyword	1..*	
4.1	Geographic bounding box	1..*	
5	Temporal reference	1..*	
6.1	Lineage	1	
6.2	Spatial resolution	0..*	Mandatory for data sets and data set series if an equivalent scale or a resolution distance can be specified.
7	Conformity	1..*	
8.1	Conditions for access and use	1..*	
8.2	Limitations on public access	1..*	

9	Responsible organisation	1..*	
10.1	Metadata point of contact	1..*	
10.2	Metadata date	1	
10.3	Metadata language	1	

Table 3 – Mandatory and conditional common metadata elements

INSPIRE Data Specification Species Distribution **Section**	**Metadata element**	**Multiplicity**	**Condition**
8.1.1	Coordinate Reference System	1	
8.1.2	Temporal Reference System	0..*	Mandatory, if the spatial data set or one of its feature types contains temporal information that does not refer to the Gregorian Calendar or the Coordinated Universal Time.
8.1.3	Encoding	1..*	
8.1.4	Character Encoding	0..*	Mandatory, if an encoding is used that is not based on UTF-8.
8.1.5	Data Quality – Logical Consistency – Topological Consistency	0..*	Mandatory, if the data set includes types from the Generic Network Model and does not assure centreline topology (connectivity of centrelines) for the network.

8.1.1 Coordinate Reference System

Metadata element name	**Coordinate Reference System**
Definition	Description of the coordinate reference system used in the dataset.
ISO 19115 number and name	13. referenceSystemInfo
ISO/TS 19139 path	referenceSystemInfo
INSPIRE obligation / condition	mandatory
INSPIRE multiplicity	1
Data type(and ISO 19115 no.)	189. MD_CRS
Domain	Either the referenceSystemIdentifier (RS_Identifier) or the projection (RS_Identifier), ellipsoid (RS_Identifier) and datum (RS_Identifier) properties shall be provided. NOTE More specific instructions, in particular on pre-defined values for filling the referenceSystemIdentifier attribute should be agreed among Member States during the implementation phase to support interoperability.
Implementing instructions	
Example	referenceSystemIdentifier: code: ETRS_89 codeSpace: INSPIRE RS registry

Example XML encoding	<gmd:referenceSystemInfo> <gmd:MD_ReferenceSystem> <gmd:referenceSystemIdentifier> <gmd:RS_Identifier> <gmd:code> <gco:CharacterString>ETRS89 </gco:CharacterString> </gmd:code> <gmd:codeSpace> <gco:CharacterString>INSPIRE RS registry</gco:CharacterString> </gmd:codeSpace> </gmd:RS_Identifier> </gmd:referenceSystemIdentifier> </gmd:MD_ReferenceSystem> </gmd:referenceSystemInfo>
Comments	

8.1.2 Temporal Reference System

Metadata element name	**Temporal Reference System**
Definition	Description of the temporal reference systems used in the dataset.
ISO 19115 number and name	13. referenceSystemInfo
ISO/TS 19139 path	referenceSystemInfo
INSPIRE obligation / condition	Mandatory, if the spatial data set or one of its feature types contains temporal information that does not refer to the Gregorian Calendar or the Coordinated Universal Time.
INSPIRE multiplicity	0..*
Data type(and ISO 19115 no.)	186. MD_ReferenceSystem
Domain	No specific type is defined in ISO 19115 for temporal reference systems. Thus, the generic MD_ReferenceSystem element and its reference SystemIdentifier (RS_Identifier) property shall be provided. NOTEMore specific instructions, in particular on pre-defined values for filling the referenceSystemIdentifier attribute should be agreed among Member States during the implementation phase to support interoperability.
Implementing instructions	
Example	referenceSystemIdentifier: code: GregorianCalendar codeSpace: INSPIRE RS registry

Example XML encoding	<gmd:referenceSystemInfo> <gmd:MD_ReferenceSystem> <gmd:referenceSystemIdentifier> <gmd:RS_Identifier> <gmd:code> <gco:CharacterString>GregorianCalendar</gco:CharacterString> </gmd:code> <gmd:codeSpace> <gco:CharacterString>INSPIRE RS registry</gco:CharacterString> </gmd:codeSpace> </gmd:RS_Identifier> </gmd:referenceSystemIdentifier> </gmd:MD_ReferenceSystem> </gmd:referenceSystemInfo>
Comments	

8.1.3 Encoding

Metadata element name	**Encoding**
Definition	Description of the computer language construct that specifies the representation of data objects in a record, file, message, storage device or transmission channel
ISO 19115 number and name	271. distributionFormat
ISO/TS 19139 path	distributionInfo/MD_Distribution/distributionFormat
INSPIRE obligation / condition	mandatory
INSPIRE multiplicity	1
Data type (and ISO 19115 no.)	284. MD_Format
Domain	See B.2.10.4. The property values (name, version, specification) specified in section 9 shall be used to document the default and alternative encodings.
Implementing instructions	
Example	name: **Species Distribution** GML application schema version: version **2.0**, GML, version 3.2.1 specification: D2.8.**III**.**19** Data Specification on **Species Distribution** – Draft Guidelines
Example XML encoding	<gmd:MD_Format> <gmd:name> <gco:CharacterString> **Species Distribution** GML application schema </gco:CharacterString> </gmd:name> <gmd:version> <gco:CharacterString>**2.0**, GML, version 3.2.1</gco:CharacterString> </gmd:version> <gmd:specification> <gco:CharacterString>D2.8.**III**.**19** Data Specification on **Species Distribution** – Draft Guidelines</gco:CharacterString> </gmd:specification> </gmd:MD_Format>
Comments	

8.1.4 Character Encoding

Metadata element name	**Character Encoding**
Definition	The character encoding used in the data set.
ISO 19115 number and name	
ISO/TS 19139 path	
INSPIRE obligation / condition	Mandatory, if an encoding is used that is not based on UTF-8.
INSPIRE multiplicity	0..*
Data type (and ISO 19115 no.)	
Domain	
Implementing instructions	
Example	-
Example XML encoding	<gmd:characterSet> <gmd:MD_CharacterSetCode codeListValue="8859part2" codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Codelist/ML_gmxCodelists.xml#CharacterSetCode">8859-2</gmd:MD_CharacterSetCode> </gmd:characterSet>
Comments	

8.1.5 Data Quality – Logical Consistency – Topological Consistency

Metadata element name	**Data Quality – Logical Consistency – Topological Consistency**
Definition	Correctness of the explicitly encoded topological characteristics of the dataset as described by the scope
ISO 19115 number and name	18. dataQualityInfo
ISO/TS 19139 path	dataQualityInfo
INSPIRE obligation / condition	Mandatory, if the data set includes types from the Generic Network Model and does not assure centreline topology (connectivity of centrelines) for the network.
INSPIRE multiplicity	0..*
Data type (and ISO 19115 no.)	115. DQ_TopologicalConsistency
Domain	Lines 100-107 from ISO 19115
Implementing instructions	This metadata should be filled, at least, with these elements: - valueUnit: UnitOfMeasure - value: Record
Example	
Example XML encoding	
Comments	See clauses on topological consistency in section 7 for detailed information. This metadata element is mandatory if connectivity is not assured for network centrelines in the dataset. In this case the *Connectivity tolerance* parameter – as described in section 7 – must be provided in order to ensure automatic and unambiguous creation of centreline topology in post-process.

8.2 Metadata elements for reporting data quality

Information concerning the metadata elements for reporting data quality for this version (ver.02) is only defined in Chapter 8.4.

Open issue 5: Metadata for data quality reporting

In case stakeholders participating on consultation & testing will identify via comments requirements for data quality and related measures based on real use cases (to be defined in chapter 7), relevant metadata elements for reporting data quality can be introduced for ver. 03 of this Data specification.

Recommendation 2 For reporting the results of the data quality evaluation quantitatively, the data quality elements and measures defined in chapter 7 should be used.

The scope for reporting may be different from the scope for evaluating data quality (see section 7). If data quality is reported at the data set or spatial object type level, the results are usually derived or aggregated.

Metadata element name	**See chapter 7**
Definition	See chapter 7
ISO 19115 number and name	80. report
ISO/TS 19139 path	dataQualityInfo/*/report
INSPIRE obligation / condition	optional
INSPIRE multiplicity	0..*
Data type (and ISO 19115 no.)	Corresponding DQ_xxx element from ISO 19115, e.g. 109. DQ_CompletenessCommission
Domain	Lines 100-107 from ISO 19115 100. nameOfMeasure : CharacterString [0..*] 101. measureIdentification : MD_Identifier [0..1] 102. measureDescription : CharacterString [0..1] 103. evaluationMethodType : DQ_EvaluationMethodTypeCode [0..1] 104. evaluationMethodDescription : CharacterString [0..1] 105. evaluationProcedure : CI_Citation [0..1] 106. dateTime : DateTime [0..*] 107. result : DQ_Result [1..2]
Implementing instructions	**Recommendation 3** For each DQ result included in the metadata, at least the following properties should be provided: 100. nameOfMeasure NOTE This should be the name as defined in Chapter 7. 103. evaluationMethodType 104. evaluationMethodDescription NOTE If the reported data quality results are derived or aggregated (i.e. the scope levels for evaluation and reporting are different), the derivation or aggregation should also be specified using this property. 106. dateTime NOTE This should be data or range of dates on which the data quality measure was applied. 107. result NOTE This should be of type DQ_QuantitativeResult
Example	

Example XML encoding	
Comments	See Chapter 7 for detailed information on the individual data quality elements and measures to be used.

Open issue 6: In the ongoing revision of ISO 19115 and development of new ISO 19157 standard (Geographic Information – Data quality), a new element is introduced (DQ_DescriptiveResult). This element enables to describe and report qualitative results of the data quality evaluation and could be used instead of DQ_QuantitativeResult. Once the new (version of the) standards are approved, these guidelines will be revisited and be updated if necessary.

Open issue 7: For reporting compliance with minimum data quality requirements and recommendations specified in section 7, the INSPIRE conformity metadata element should be used.

However, since this issue is part of the larger discussion on the Abstract Test Suite and the definition of conformance classes for the data specification, detailed instructions on how to provide metadata on compliance with minimum data quality requirements and recommendations will only be provided for v3.0.

8.3 Theme-specific metadata elements

No mandatory theme-specific metadata elements are defined for this theme.

Recommendation 4 The metadata describing a spatial data set or a spatial data set series related to the theme **Species Distribution** should comprise the theme-specific metadata elements specified in Table 4.

Table 4 – Optional theme-specific metadata elements for the theme Species Distribution

INSPIRE Data Specification Species Distribution **Section**	**Metadata element**	**Multiplicity**
8.3.1	Maintenance information	0..1
8.3.2	Purpose	0..1

8.3.1 Maintenance information

Metadata element name	**Maintenance information**
Definition	Information about the scope and frequency of updating
ISO 19115 number and name	30. resourceMaintenance
ISO/TS 19139 path	identificationInfo/MD_Identification/resourceMaintenance
INSPIRE obligation / condition	Optional

INSPIRE multiplicity	0..1
Data type (and ISO 19115 no.)	142. MD_MaintenanceInformation
Domain	This is a complex type (lines 143-148 from ISO 19115). At least the following elements should be used (the multiplicity according to ISO 19115 is shown in parentheses): – maintenanceAndUpdateFrequency [1]: frequency with which changes and additions are made to the resource after the initial resource is completed / domain value: MD_MaintenanceFrequencyCode: – updateScope [0..*]: scope of data to which maintenance is applied / domain value: MD_ScopeCode – maintenanceNote [0..*]: information regarding specific requirements for maintaining the resource / domain value: free text
Implementing instructions	
Example	resourceMaintenance: maintenanceAndUpdateFrequency: weekly updateScope: dataset maintenanceNote: The raw data received from the sensor has to be translated from CSV to the XML and then uploaded to the database using SOS request (InsertObservation)
Example XML encoding	<gmd:resourceMaintenance> <gmd:MD_MaintenanceInformation> <gmd:maintenanceAndUpdateFrequency> <gmd:MD_MaintenanceFrequencyCode code-List="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Codelist/gmxCodelists.xml#MD_MaintenanceFrequencyCode" codeList-Value="weekly">weekly</gmd:MD_MaintenanceFrequencyCode> </gmd:maintenanceAndUpdateFrequency> <gmd:updateScope> <gmd:MD_ScopeCode codeList-Value="dataset" code-List="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Codelist/gmxCodelists.xml#MD_ScopeCode">dataset</gmd:MD_ScopeCode> </gmd:updateScope> <gmd:maintenanceNote> <gco:CharacterString>The raw data received from the sensor has to be translated from CSV to the XML and then uploaded to the database using SOS request (InsertObservation)</gco:CharacterString> </gmd:maintenanceNote> </gmd:MD_MaintenanceInformation> </gmd:resourceMaintenance>
Comments	

8.3.2 Purpose

Metadata element name	**Purpose**
Definition	summary of the intentions with which the resource(s) was developed
ISO 19115 number and name	26. purpose
ISO/TS 19139 path	identificationInfo/MD_DataIdentification/purpose
INSPIRE obligation / condition	Optional

INSPIRE multiplicity	0..1
Data type (and ISO 19115 no.)	CharacterString
Domain	Free text
Implementing instructions	
Example	Purpose: Dataset has been developed to fulfil INSPIRE requirements to provide information about species distribution. Degree of conformance with INSPIRE and legal requirements is evaluated in the Conformity INSPIRE metadata element.
Example XML encoding	<gmd:purpose> <gco:CharacterString>Dataset has been developed to fulfil INSPIRE requirements to provide information about species distribution.Degree of conformance with INSPIRE and legal requirements is evaluated in the Conformity INSPIRE metadata element. </gco:CharacterString> </gmd:purpose>
Comments	

8.4 Guidelines on using metadata elements defined in Regulation 1205/2008/EC

8.4.1 Conformity

The *Conformity* metadata element defined in Regulation 1205/2008/EC allows to report the conformance with the Implementing Rule for interoperability of spatial data sets and services or another specification. The degree of conformity of the dataset can be *Conformant* (if the dataset is fully conformant with the cited specification), *Not Conformant* (if the dataset does not conform to the cited specification) or *Not evaluated* (if the conformance has not been evaluated).

Recommendation 5 The Conformity metadata element should be used to report conceptual consistency with this INSPIRE data specification. The value of Conformant should be used for the Degree element only if the dataset passes all the requirements described in the abstract test suite presented in Annex A. The Specification element should be given as follows:
- title: “INSPIRE Data Specification on <Theme Name> – Draft Guidelines”
- date:
  - dateType: publication
  - date: 2011-06-15

Open issue 8: Conformance testing is still an open issue under discussion.

Instructions on conformance testing and a common abstract test suite (including detailed instructions on how to test specific requirements) will be added at a later stage.

This may also lead to an update of the recommendations on how to fill the conformity metadata element.

This metadata element will also allow data producers to report that a specific dataset fulfils the obligations from particular legal regulation.

NOTE 1 In order to improve the interoperability, domain templates and instructions for filling these free text elements (descriptions) are specified in an Annex C of this data specification.

8.4.2 Lineage

Recommendation 6 Following the ISO 19113 Quality principles, if a data provider has a procedure for quality validation of their spatial data sets then the data quality elements listed in the Chapters 7 and 8 should be used. If not, the *Lineage* metadata element (defined in Regulation 1205/2008/EC) should be used to describe the overall quality of a spatial data set.

According to Regulation 1205/2008/EC, lineage "is a statement on process history and/or overall quality of the spatial data set. Where appropriate it may include a statement whether the data set has been validated or quality assured, whether it is the official version (if multiple versions exist), and whether it has legal validity. The value domain of this metadata element is free text".

The Metadata Technical Guidelines based on EN ISO 19115 and EN ISO 19119 specify that the statement sub-element of LI_Lineage (EN ISO 19115) should be used to implement the lineage metadata element.

Recommendation 7 To describe the transformation steps and related source data, it is recommended to use the following sub-elements of LI_Lineage:
- For the description of the transformation process of the local to the common INSPIRE data structures, the LI_ProcessStep sub-element should be used.
- For the description of the source data the LI_Source sub-element should be used.

NOTE 1 This recommendation is based on the conclusions of the INSPIRE Data Quality Working Group to avoid overloading of the overall lineage statement element with information on the transformation steps and related source data.

NOTE 2 In order to improve the interoperability, domain templates and instructions for filling these free text elements (descriptions) are specified in an Annex C of this data specification.

Open issue 9: The suggested use of the LI_Lineage sub-elements needs to be discussed as part of the maintenance of the INSPIRE metadata Technical Guidelines.

8.4.3 Temporal reference

According to Regulation 1205/2008/EC, at least one of the following temporal reference metadata elements shall be provided: temporal extent, date of publication, date of last revision, date of creation. If feasible, the date of the last revision of a spatial data set should be reported using the *Date of last revision* metadata element.

9 Delivery

9.1 Delivery medium

DS Requirement 2	Data conformant to this INSPIRE data specification shall be made available through an INSPIRE network service.

DS Requirement 3	All information that is required by a calling application to be able to retrieve the data through the used network service shall be made available in accordance with the requirements defined in the Implementing Rules on Network Services.

EXAMPLE 1 Through the Get Spatial Objects function, a download service can either download a pre-defined data set or pre-defined part of a data set (non-direct access download service), or give direct access to the spatial objects contained in the data set, and download selections of spatial objects based upon a query (direct access download service). To execute such a request, some of the following information might be required:

- the list of spatial object types and/or predefined data sets that are offered by the download service (to be provided through the Get Download Service Metadata operation),
- and the query capabilities section advertising the types of predicates that may be used to form a query expression (to be provided through the Get Download Service Metadata operation, where applicable),
- a description of spatial object types offered by a download service instance (to be proviced through the Describe Spatial Object Types operation).

EXAMPLE 2 Through the Transform function, a transformation service carries out data content transformations from native data forms to the INSPIRE-compliant form and vice versa. If this operation is directly called by an application to transform source data (e.g. obtained through a download service) that is not yet conformant with this data specification, the following parameters are required:
Input data (mandatory). The data set to be transformed.

- Source model (mandatory, if cannot be determined from the input data). The model in which the input data is provided.
- Target model (mandatory). The model in which the results are expected.
- Model mapping (mandatory, unless a default exists). Detailed description of how the transformation is to be carried out.

9.2 Encodings

9.2.1 Default Encoding(s)

DS Requirement 4	Data conformant to the application schema(s) defined in section 5.2 shall be encoded using the encoding(s) specified in this section.

9.2.1.1. Default encoding for application schema SpeciesDistribution Implementation

Name: SpeciesDistribution Implementation GML Application Schema
Version: version 2.0, GML, version 3.2.1
Specification: D2.8.**III**.**19** Data Specification on **Species Distribution** – Draft Guidelines
Character set: UTF-8

The GML Application Schema is distributed in a zip-file separately from the data specification document.

9.2.1.1.1. Implementation UML model used for generating the GML application schema

The GML application schema was not derived directly from the conceptual model described in section 5, but from an implementation model (for a schematic illustration of this process, see Figure 6).

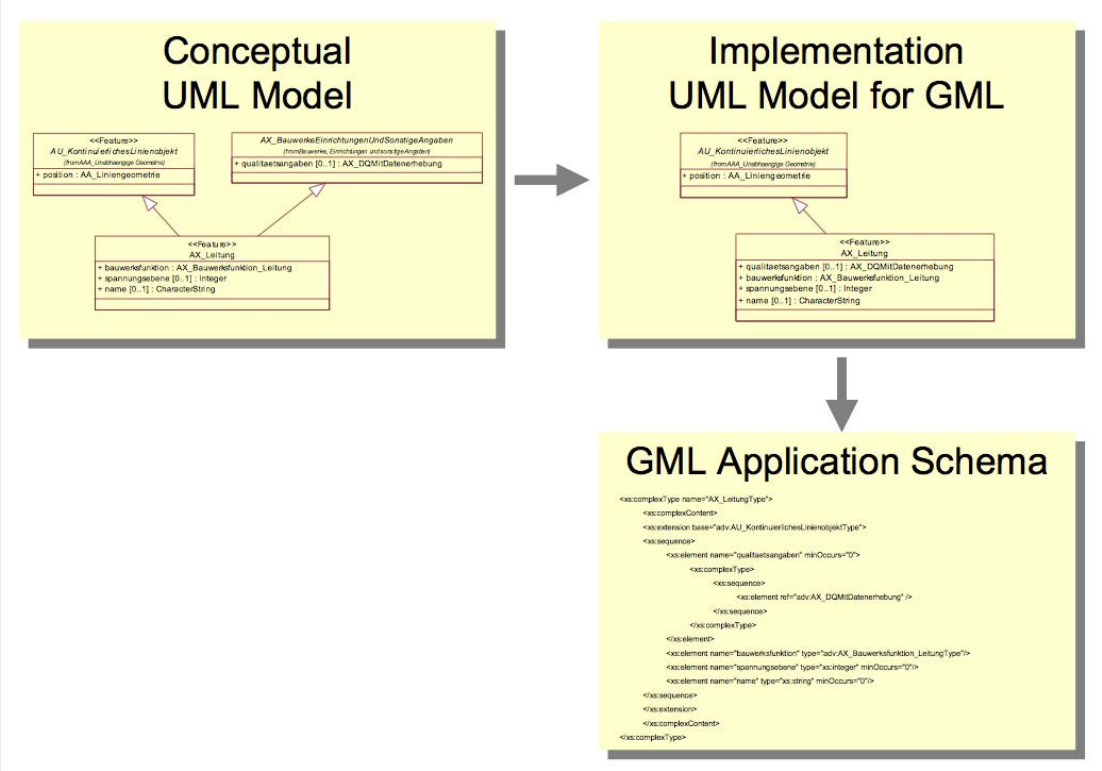


Figure 6 – Process of creating the GML application schema (from [DS-D2.7])

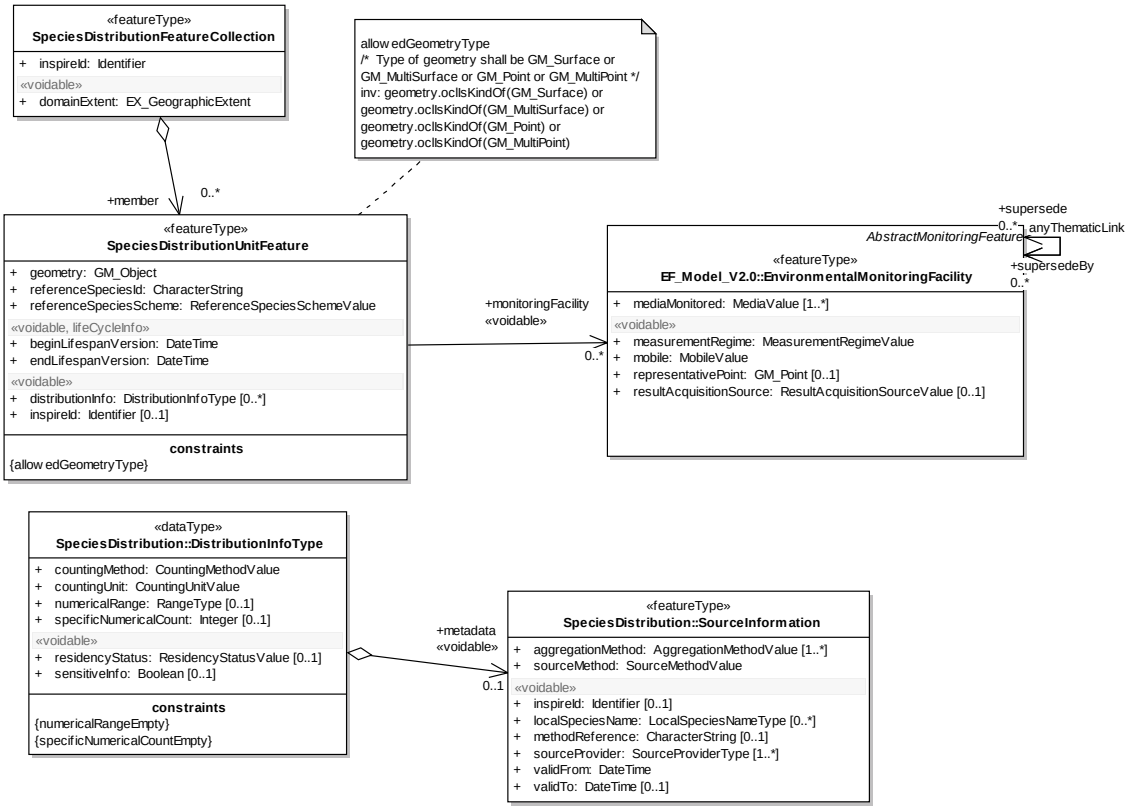


Figure 7 – UML class diagram: Overview of the implementation model for the Species Distribution **application schema**

The implementation model replaces the conceptual coverage type with a feature collection pattern. The main reason is that the specific coverage types specified in the conceptual model are not supported by current implementations. Basically two new feature types are introduced: *SpeciesDistributionFeatureCollection* and *SpeciesDistributionUnitFeature*. *SpeciesDistributionUnitFeature* represents each unit in a conceptual coverage as individual features. *SpeciesDistributionFeatureCollection* represents collection of features (*SpeciesDistributionUnitFeature*). This allows for a dataset level attribute, the *domainExtent* which represents the spatial coverage of the dataset.

All other feature types, data types, and code lists remain the same as in the conceptual model. For the full model see Figure 8.

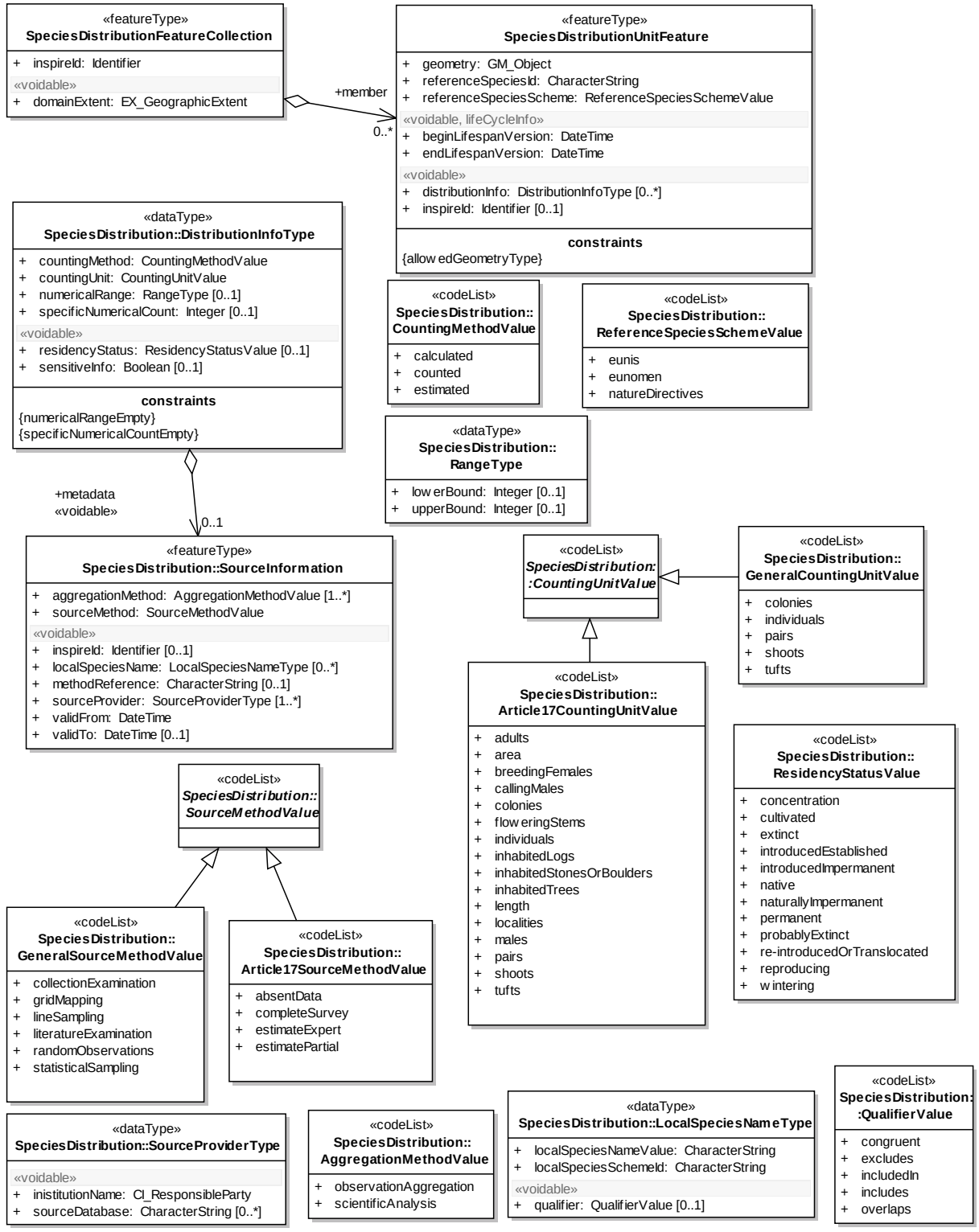


Figure 8 – UML class diagram: Full implementation model for the Species Distribution **application schema**

9.2.2 Alternative Encoding(s)

Recommendation 8 It is recommended that also the encodings specified in this section be provided for the relevant application schemas.

9.2.2.1. Alternative encoding for application schema SpeciesDistribution

As an alternative encoding, the GML coverage representation is also provided.

Name: SpeciesDistribution GML Application Schema
Version: version 2.0, GML, version 3.2.1
Specification: D2.8.**III**.**19** Data Specification on **Species Distribution** – Draft Guidelines
Character set: UTF-8

The GML Application Schema is distributed in a zip-file separately from the data specification document.

10 Data Capture

There is no specific guidance required with respect to data capture.

11 Portrayal

This clause defines the rules for layers and styles to be used for portrayal of the spatial object types defined for this theme.

In section 11.1, the *types* of layers are defined that are to be used for the portrayal of the spatial object types defined in this specification. A view service may offer several layers of the same type, one for each dataset that it offers on a specific topic.

Section 11.2 specifies the styles that shall be supported by INSPIRE view services for each of these layer types.

In section 11.3, further styles can be specified that represent examples of styles typically used in a thematic domain. It is recommended that also these styles should be supported by INSPIRE view services, where applicable.

Where XML fragments are used in these sections, the following namespace prefixes apply:

- sld="http://www.opengis.net/sld" (WMS/SLD 1.1)
- se="http://www.opengis.net/se" (SE 1.1)
- ogc="http://www.opengis.net/ogc" (FE 1.1)

IR Requirement 15	If an INSPIRE view services supports the portrayal of data related to the theme **Species Distribution**, it shall provide layers of the types specified in this section.

DS Requirement 5	If an INSPIRE view network service supports the portrayal of spatial data sets corresponding to the spatial data theme **Species Distribution**, it shall support the styles specified in section 11.2. If no user-defined style is specified in a portrayal request for a specific layer to an INSPIRE view service, the default style specified in section 11.2 for that layer shall be used.

Recommendation 9	In addition to the styles defined in section 11.2, it is recommended that, where applicable, INSPIRE view services also support the styles defined in section 11.3.

11.1 Layers to be provided by INSPIRE view services

Open issue 10: PLEASE NOTE: This section has not been finalized. There are several uncertainties, e.g., is it at all possible to agree on a common portrayal? Also a default very simple style in which polygons/points are e.g. gray or black does not really make sense for a distribution dataset. What we have done in the current specification is simply to include an example. Of course this will be changed for a version 3.0. We appreciate any feedback from the stakeholders on this issue.

Layer Name	Layer Title	Spatial object type(s)	Keywords
SD.SpeciesDistributionFeature	Species Distribution (Features)	SpeciesDistributionUnit Feature	distribution, dispersal, range, species, taxa,
SD.SpeciesDistributionCoverage	Species Distribution (Coverage)	SpeciesDistributionUnit	distribution, dispersal, range, species, taxa,

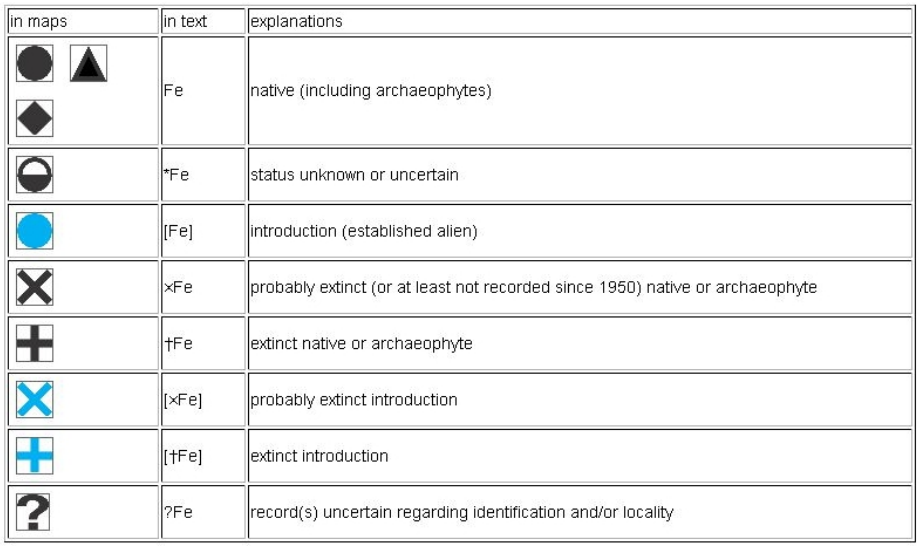
11.1.1 Layers organisation

None.

11.2 Styles to be supported by INSPIRE view services

11.2.1 Styles for the layer SD.SpeciesDistributionFeature

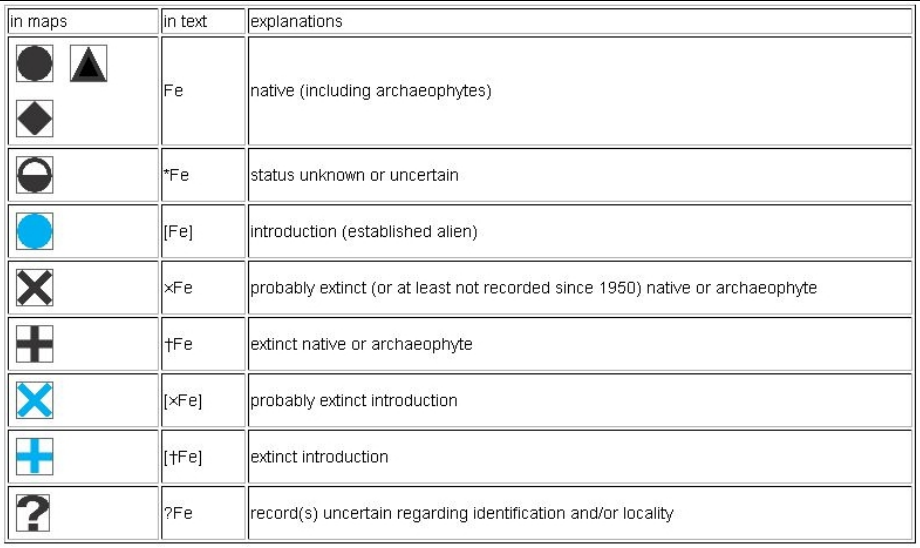
Style Name	SD.SpeciesDistributionFeature.Default
Default Style	Yes
Style Title	Species Distribution (Features) Default Style

Style Abstract	This layer type is for the representation of species distribution data as centroid points, e.g. of grid cells. Different plot symbols can be assigned to represent different values of residencyStatus or time ranges where the occurrence of a species in the given spatial analytical unit was valid. The size of a plot symbol should not be larger than the area (e.g. grid cell size) it represents. The size could be varied to represent abundance values assigned to a SpeciesDistributionUnit via numericalRange or specificNumericalCount values within the DistributionInfoType.
Symbology	An example is:  in maps / in text / explanations Fe — native (including archaeophytes) *Fe — status unknown or uncertain [Fe] — introduction (established alien) ×Fe — probably extinct (or at least not recorded since 1950) native or archaeophyte †Fe — extinct native or archaeophyte [×Fe] — probably extinct introduction [†Fe] — extinct introduction ?Fe — record(s) uncertain regarding identification and/or locality
Minimum & maximum scales	<min scale> - <max scale>

11.3 Other recommended styles

11.3.1 Styles for the layer SD.SpeciesDistributionCoverage

Style Name	**SD.SpeciesDistributionCoverage.Default**
Default Style	Yes
Style Title	Species Distribution (Coverage) Default Style
Style Abstract	This layer type is for the representation of species distribution data as centroid points, e.g. of grid cells. Different plot symbols can be assigned to represent different values of residencyStatus or time ranges where the occurrence of a species in the given spatial analytical unit was valid. The size of a plot symbol should not be larger than the area (e.g. grid cell size) it represents. The size could be varied to represent abundance values assigned to a SpeciesDistributionUnit via numericalRange or specificNumericalCount values within the DistributionInfoType.
Symbology	An example is:

	
Minimum & maximum scales	<min scale> - <max scale>

in maps	in text	explanations
	Fe	native (including archaeophytes)
	*Fe	status unknown or uncertain
	[Fe]	introduction (established alien)
	×Fe	probably extinct (or at least not recorded since 1950) native or archaeophyte
	†Fe	extinct native or archaeophyte
	[×Fe]	probably extinct introduction
	[†Fe]	extinct introduction
	?Fe	record(s) uncertain regarding identification and/or locality

Bibliography

Open issue 11: Version 3.0 of the specification will contain a proper bibliography.

Atlas Flora Europaea: http://www.fmnh.helsinki.fi/english/botany/afe/
http://www.biologie.uni-hamburg.de/b-online/ibc99/IDB/afe.html
Atlas of amphibians and reptiles in Europe: http://www.mnhn.fr/publication/spn/cpn29.html
Common European Chorological Grid Reference System (CGRS) :
http://dataservice.eea.eu.int/dataservice/metadetails.asp?id=625
Eunis: species: http://eunis.eea.eu.int/species.jsp (SRO)
Eunis taxonomy: http://eunis.eea.eu.int/species-taxonomic-browser.jsp
EuroMed, Fauna Europae, at: http://www.euromed.org.uk
http://www.emplantbase.org/home.html (SRO)
European Reference grids. Proceedings and recommendations. Proposal for a European Grid Coding System. IES/JRC. http://eusoils.jrc.it/projects/alpsis/Docs/ref_grid_sh_proc_draft.pdf (BMA)
Fauna Europea data base, at: http://www.faunaeur.org/
Global Biodiversity Information Facility www.gbif.org
LÖBF: OSIRIS-Datenmodell (Germany)
Natura 2000 Interpretation manual.
NATURA 2000: Identification & GIS Classification of Flora Habitants in Significant Reservation Areas: Greece (E)
NATURE-GIS Guidelines: Data Infrastructure for Protected Areas. Editor: Ioannis KASCllopoulos (EC – JRC) with the support of GISIG and the contribution of the NATURE-GIS Partners.

[DS-D2.3] INSPIRE DS-D2.3, Definition of Annex Themes and Scope, v3.0, *http://inspire.jrc.ec.europa.eu/reports/ImplementingRules/DataSpecifications/D2.3_Definition_of_Annex_Themes_and_scope_v3.0.pdf*

[DS-D2.5] INSPIRE DS-D2.5, Generic Conceptual Model, v3.3, *http://inspire.jrc.ec.europa.eu/documents/Data_Specifications/D2.5_v3_3.pdf*

[DS-D2.6] INSPIRE DS-D2.6, Methodology for the development of data specifications, v3.0, *http://inspire.jrc.ec.europa.eu/reports/ImplementingRules/DataSpecifications/D2.6_v3.0.pdf*

[DS-D2.7] INSPIRE DS-D2.7, Guidelines for the encoding of spatial data, v3.2, *http://inspire.jrc.ec.europa.eu/documents/Data_Specifications/D2.7_v3.2.pdf*

[ISO 19101] EN ISO 19101:2005 Geographic information – Reference model (ISO 19101:2002)

[ISO 19103] ISO/TS 19103:2005, Geographic information – Conceptual schema language

[ISO 19107] EN ISO 19107:2005, Geographic information – Spatial schema (ISO 19107:2003)

[ISO 19108] EN ISO 19108:2005 Geographic information - Temporal schema (ISO 19108:2002)

[ISO 19111] EN ISO 19111:2007 Geographic information - Spatial referencing by coordinates (ISO 19111:2007)

[ISO 19115] EN ISO 19115:2005, Geographic information – Metadata (ISO 19115:2003)

[ISO 19118] EN ISO 19118:2006, Geographic information – Encoding (ISO 19118:2005)

[ISO 19135] EN ISO 19135:2007 Geographic information – Procedures for item registration (ISO 19135:2005)

[ISO 19139] ISO/TS 19139:2007, Geographic information – Metadata – XML schema implementation

[OGC 06-103r3] Implementation Specification for Geographic Information - Simple feature access – Part 1: Common Architecture v1.2.0

Annex A
(normative)

Abstract Test Suite

Any dataset conforming to this INSPIRE data specification shall meet all requirements specified in this document.

Open issue 12: Conformance testing is still an open issue under discussion.

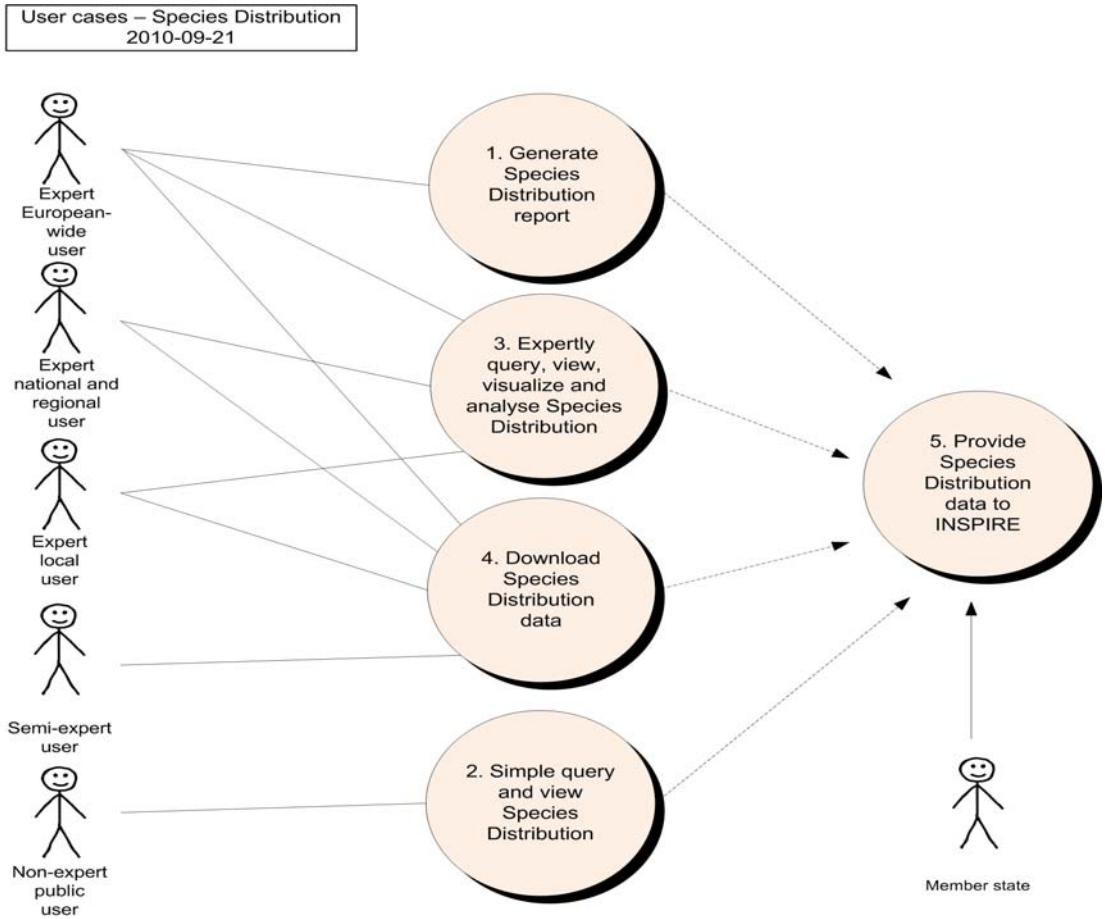
Instructions on conformance testing and a common abstract test suite (including detailed instructions on how to test specific requirements) will be added at a later stage.

Annex B
(informative)
Use Cases

This document describes the use cases for the INSPIRE Species Distribution theme and associated data product specification. The first part provides a use case diagram showing the interactions between the five use cases that have been defined and the actors. The remaining parts describe each of the five use cases in turn. The use cases are:

1. Generate European Species Distribution spatial data report (Europe-wide, expert user/regional government including European Commission and European Environment Agency).
2. Simple query and view Species Distribution (local, regional and Europe-wide; non-expert/public user).
3. Expertly query, view, visualise and analyse Species Distribution (local, regional, cross-border; to support environmental impact assessment and decision making in resource management and spatial planning).
4. Download Species Distribution data (expert /semi-expert user for specialised analyses in statistical, administrative or other geographical units).
5. Provide Species Distribution data according to EU legal obligations and dataflow (EU/EEA Member State).

The selected use cases are intended to encompass the range of uses of Species Distribution data, as well as the different scales, user groups and outputs, and to identify any issues of particular relevance for the theme.



Use case 1: Generate European Species Distribution Spatial Data Report

The scenario for the Generate European Species Distribution Spatial Data Report is that a European expert user would like to collate all necessary information on Species Distribution in a GIS-database or application for generating standard overviews and/or tabulations on all available Species Distribution data across Europe. The results will contribute to special reporting obligations at the European level (for example, biodiversity indicators, European Commission composite reports under Art. 17 Habitat Directive, The Birds Directive, reporting to Convention on the Conservation of European Wildlife and Natural Habitats), the RAMSAR-convention and the Convention on Migratory Species.

Use Case Description	
Name	Generate European Species Distribution Spatial Data Report
Priority	high
Description	The user analyzes cross-border datasets on Species Distribution (for example, those created in Use Case 5 up to a European extent by means of a GIS-application to create overview-maps and/or tabulations on Species Distribution data. The results will be part of special reports of different kinds such as progress in area coverage of Species Distribution per category in the EU/EEA (indicators) and composite assessments of the implementation of the EU Directives at the European or biogeographical level
Pre-condition	Quality controlled Species Distribution data sets from the Member States are available to the user in line with INSPIRE specifications and the INSPIRE registry provides all necessary information for standardised access to data. The user has access to the INSPIRE Generate Report Web Processing Service.
Flow of Events – Basic Path	
Step 1.	The user calls a Web Processing Service, specifying the area of interest. This would commonly encompass all of Europe, but may also be restricted to a particular country or geographical region (using administrative boundaries or boundaries of bio-geographical regions or other statistical units as defined in INSPIRE). The user also selects the reporting items required. The following items are available:
Step 2.	The Web Processing Service generates a report using source data from each of the member states in the selected area or across Europe.
Step 3.	The user receives the report and uses it to determine the status of Species Distribution across Europe.
Post-condition	The report may be for later comparison of versions. GIS-analyses and resulting data have to be described and stored for later use.
Data source: INSPIRE-Conformant Species Distribution Data Set Provided by Member State	
Description	Report data generated for Species Distribution to provide summary details across Europe.
Data provider	Each member state or national focal points.
Geographic scope	Europe wide, although a smaller area may be selected.
Thematic scope	INSPIRE Annex III 19. Species Distribution.
Scale, resolution	As made applicable by data provider.
Delivery	Textual report and associated geometry information.
Documentation	INSPIRE Species Distribution Data Product Specification

Use Case 2: Simple Query and View Species Distribution

The scenario for the Simple Query and View Species Distribution use case is that a user would like to find out about Species Distribution in his or her neighbourhood. It is assumed that the user is aware of and has access to a basic publicly accessible (probably web based) GIS that contains the relevant data. For example, outdoor person or a field naturalist may be interested in finding out about the countryside he walks in and which species is living there. In this scenario, the user would use a publicly accessible GIS to zoom/pan to or find, by gazetteer search, the location of interest, display the data on screen and even print out a map.

Use Case Description	
Name	Simple Query and View Species Distribution
Priority	High
Description	The user uses a publicly accessible (probably web based) GIS to zoom/pan to or find, by gazetteer search, the location of interest and display the data on screen.
Pre-condition	Species Distribution are available in line with INSPIRE specifications to the user by relevant Web Map Services and Web Feature Services. The user has access to a publicly accessible (probably web based) GIS that displays data using the INSPIRE rules.
Flow of Events – Basic Path	
Step 1.	The user uses the GIS to zoom and/or pan to the area of interest, or selects a particular place or administrative area name from a list (this list comes from the INSPIRE Geographic Names data set).
Step 2.	The GIS queries the relevant Web Map Service and presents the data in the client application. It also optionally displays contextual information about the Species Distribution. Habitat types, protected areas and other types of land designations or statistical units that are related to Species Distribution are layers that can be switched on and off.
Step 3.	The user uses an information tool in the client application to click on a Species Distribution feature on the map to retrieve the species object (polygon, line, point or grid cell) features as species name, data source, collection date, coordinate precision, redlist status or other relevant available map object features.
Step 4.	The GIS queries the relevant Web Feature Service and presents the attribute data for the selected Species Distribution feature in the client application. In addition to the attributes, this service may also provide links to related information about habitat, protected areas and feature condition information..
Post-condition	
Data source: Member State Web Map Service and Web Feature Service on Species Distribution	
Description	This use case uses Web Map Services and Web Feature Services from each of the EU/EEA member states that serve their Species Distribution data in the INSPIRE GML map projection parameters (for web map service) and application schema format (for web feature service).
Data provider	Each member state.
Geographic scope	All EU/EEA member states, but GIS application selects and displays only a subset of that area, depending on the extents of the current map being viewed. Such a map would normally show a relatively small area for the purposes of a simple user.
Thematic scope	Species Distribution and geographic names.
Scale, resolution	Data is served at the most appropriate scale and resolution. This will vary depending on the scale of the map being viewed, and will be controlled within the parameters of the GIS and the client application.

Delivery	INSPIRE Species Distribution GML Application Schema, graphical map.
Documentation	INSPIRE Species Distribution Data Product Specification.

Use Case 3: Expertly Query, View, Visualise and Analyse Species Distribution

The scenario for the Expertly Query, View, Visualise and Analyse Species Distribution use case is that a user needs to ensure that the species site/locality will not be adversely affected by any proposed land-use change. This is a routine requirement of any agency responsible for administering Species Distribution systems through formal consultation from other legitimate land use planning agencies. In this scenario, the user would start with a proposal generated by developer and supplied to the user through an agreed consultation process. The user would then use information on Species Distribution to evaluate the potential impact of the proposed development on the species site features and purposes. A typical such example could be a consultation on the route of a road construction across countryside or spatial planning for housing/industry through Environmental Impact Assessment legislation.

Use Case Description	
Name	Expertly Query, View, Visualise and Analyse Species Distribution
Priority	High
Description	The user creates a view of Species Distribution within the planning proposal area and assesses potential impacts.
Pre-condition	Species Distribution are available in line with INSPIRE specifications to the user and INSPIRE registry provides all necessary information for standardised access to data. The user has access to a client GIS with basic selection tools.
Flow of Events – Basic Path	
Step 1.	***Define the scope of the potential impact area:*** The user is provided with the geographical boundary of the planning proposal, with detail of the proposed infrastructure, construction access routes, storage/disposal areas, construction plant locations and operating details. These details are supplied as digital GIS data, or are digitised from paper maps.
Step 2.	***Display Species Distribution boundaries or localities on scope area:*** The user downloads[14] or include WMS/WFS Species Distribution data to his or her local GIS tool and views the relationship between the Species Distribution and the proposed land use changes, both during and after construction.
Step 3.	***Categorise protected features subject to protection:*** The user identifies the protected features on each site that falls within, or intersects the scope area, optionally distinguishing between species Redlist status, habitat types and other site related features.
Step 4.	***Assess sensitivity of protected features:*** The user uses specialist advice (either using existing procedures, or in consultation with relevant specialists) to determine the sensitivity of each feature to the type of development proposed (eg. only affected if development crosses the protected site boundary, or affected if disturbance is within 2km of the boundary). The sensitivity depends upon the type of development and includes both construction impacts and operating impacts post-construction.
Step 5.	***Categorise potential impacts of development:*** The user, in consultation with relevant experts, assesses the likely affects on the species of the proposed development (land take; impacts on water, soil and air; etc.) during and after construction).

[14] See use case 4.

Use Case Description	
Step 6.	***Assess the spatial extent of development impacts:*** The user creates boundary information for each of the relevant impacts predicted to arise from the development in his or her own GIS.
Step 7.	***Apply constraints check***: The user applies a buffer to each protected site that reflects the sensitivity of the site. The outline of the buffer provides the potential impact area on each identified feature on the Species Distribution and is used in all further assessment of impact. The buffer distance can be several kilometres when groundwater, diffuse pollution or air pollution is involved.
Step 8	***Assess overall impact of development on Species Distribution:*** The user runs a query to tabulate the overlap between the sensitivity of site features and the anticipated impacts of the development proposal.
Step 9.	**Impact assessment:** The user identifies conflicts between development and existing Species Distribution and the influenced species features.
Post-condition	The user has an audit trail of the impact assessment for use in contested inquiries to resolve any conflicts.
Data source: INSPIRE Species Distribution for each member state	
Description	This use case uses Species Distribution data from national sources, often from scientific institutions or organisations. Cross border assessments will require consistent standards of species site definition in order to maintain a coherent defence case in any planning enquiry.
Data provider	Each member state.
Geographic scope	All EU/EEA member states, but with appropriate cross border cooperation where necessary.
Thematic scope	Species Distribution.
Scale, resolution	The species site data will need to be available at the scale relevant to the application. Localised development proposals may use base maps at 1:2,500 or better and legal constraints of conflicting land uses (roads vs nature conservation) may require accurate site or boundary matching.
Delivery	INSPIRE Species Distribution GML Application Schema.
Documentation	INSPIRE Species Distribution Data Product Specification.

Use Case 4: Download Species Distribution Data

The scenario for the Download Species Distribution Data use case is that a user would like to download Species Distribution data for use on their own systems (a desktop GIS for example). For example, a non-government environmental agency may be interested in using the Species Distribution data in their own, advanced analysis with their own and other data sets. In this scenario, the user would select the area and feature types of interest and receive the appropriate Species Distribution feature types in the appropriate area.

Use Case Description	
Name	Download Species Distribution Data
Priority	Medium
Description	The user downloads Species Distribution data and associated metadata in a selected area and with selected feature types included.
Pre-condition	Species Distribution are available in line with INSPIRE specifications to the user and INSPIRE registry provides all necessary information for standardised access to data. The user has access to a client GIS with basic selection tools.
Flow of Events – Basic Path	
Step 1.	The user selects the area of interest graphically on a map (this can be part

	of a member state, a whole member state or more than one member state) of from a textual list of countries (selecting either one or more than one country).
Step 2.	The user selects the feature types of interest from a list of all of the Species Distribution feature types (one or more[15]).
Step 3.	The user invokes the download.
Step 4.	The system calls the relevant Web Feature Services to retrieve the information from the member states[16].
Step 5.	The response is provided to the user in the GML Application Schema generated from the Species Distribution package of the INSPIRE data model.
Step 6.	The user handles the response in his or her chosen manner (for example, by saving the GML data returned by the web service/s to the local computer).
Post-condition	The user has a copy of the Species Distribution data according to his or her geographical and feature type selection saved in the format of the GML application schema generated from the Species Distribution package of the INSPIRE data model.
Data source: Member State Species Distribution Web Feature Service for each member state	
Description	This use case uses web feature services from each of the EU member states that serve their Species Distribution data in the INSPIRE GML application schema format.
Data provider	Each member state.
Geographic scope	All EU member states, but user can select only a subset of that area, either a subset of member states, a single member state or only part of a member state. In the latter case, a web feature service filter is required.
Thematic scope	Species Distribution. This use case could be expanded to include all themes, as it is generic.
Scale, resolution	Data is provided at the most detailed scale and resolution available. The user may be given the option to select scale and resolution if required.
Delivery	INSPIRE Species Distribution GML Application Schema.
Documentation	INSPIRE Species Distribution Data Product Specification.

Use Case 5: Provide Species Distribution Data Using INSPIRE Specifications

The scenario for the Provide Species Distribution Data Using INSPIRE Specifications use case is that a member state or other organisation (for example, the European Environment Agency) is to provide data according to the INSPIRE process. This use case involves data input according to INSPIRE, rather than output/use. All of the other use cases involve INSPIRE data output or use. This use case identifies the different steps that the member state might go through in providing data.

This use case describes a generic process that is envisaged after INSPIRE is implemented. As background material, Appendix A contains use cases describing the current data flows for two particular member states (Norway and Sweden), which contributes data from national focal point institutions directly to INSPIRE.

[15] It is not yet clear how many species feature types there will be.

[16] For multiple member states, this may be returned either as a series of separate responses for each member state, or using an amalgamation web service to combine the responses from the web feature service for each member state. The web service architecture is beyond the scope of the current activity, so this aspect is not further detailed here.

Use Case Description	
Name	Provide Species Distribution data using INSPIRE data model
Priority	High
Description	The user is an EU member state, and prepares and provides its data using the INSPIRE specifications, in the form of a static or dynamic data set,
Pre-condition	Agreement to reporting data specifications and formats at the European level such the species national redlist status, species names status, and on data collection cycle and reporting deadlines
Flow of Events – User 1	
Step 1.	Before expiration of a reporting deadline, the user prepares the national data for submission including mapping from the national data to the INSPIRE Species Distribution Data Product Specification.
Step 2.	The user uploads the national data according to agreed INSPIRE standards. She or he can upload an entire data set, or only a part of that data set, selected by geographical area of Species Distribution category.
Step 3.	The system generates a quality check report for the uploaded data and determines whether there are any issues. The quality control report assesses issues of match between the different member states' data sets (e.g. species name, cross border issues) and compliance with the INSPIRE Data Product Specification.
Step 4.	The user reviews the quality check report and modifies the data set as required to ensure compliance.
Step 5.	The user uploads the modified national data to the agreed repository
Step 6.	The system generates a quality check report for the second upload.
Step 7.	The user reviews the quality check report and verifies that no further changes are needed (if further changes are required, the flow of events returns to Step 4.
Step 8.	The user provides metadata to the agreed repository
Step 9.	The user publishes the data and metadata according to INSPIRE regulations in multiple, appropriate forms. Such forms are likely to at least include OGC web services for the data served by the member state (most importantly Web Map Service and Web Feature Service), registered with the INSPIRE registry.
Post-condition	The member state's data set is available in line with INSPIRE standards.
Data source: Member State Data Set	
Description	This use case uses data sets from each member state and submits them to an INSPIRE compatible infrastructure.
Data provider	Each EU/EEA member state as well as some other related organisations (for example, the European Environmental Agency).
Geographic scope	All EU member states and the pan-European area, or parts thereof.
Thematic scope	Species Distribution.
Scale, resolution	The highest resolution that the member state can provide.
Delivery	Data is to be delivered in the form of the INSPIRE GML application schema, either directly or through OGC web services.
Documentation	INSPIRE Species Distribution Data Product Specification, member states data set documentation.

Use Cases for the Current Data Supply Flow in Norway

Norway undergoes internal processes to prepare data for supply to INSPIRE through a national focal point institution (Norwegian Mapping Authority (NMA)/Norway Digital), which performs its own process

to prepare the data for supply to INSPIRE. These uses case illustrate the current process and can be used to gain a more detailed understanding of the changes involved in moving towards the described Use Case 5 for the INSPIRE project.

Use Case A: Provide Norwegian Species Distribution Data to INSPIRE

This scenario is for the collation of data on Species Distribution within member states for submission to Europe. Example is for Norway where the Biodiversity Information Centre (NBIC) in Norway collate GI data on Species Distribution from a number of national or international data providers within the country. This is formerly submitted by the Norwegian Government to the EU Commission as a consolidated data layer with supporting database for incorporation into the European dataset. The user case presented here describes the process by which species data on distribution and species observations are added to the existing cumulative data layer for reporting through to INSPIRE.

The cumulative data layer contains GI objects for all designated species as a single version showing the original, subsequently amended, object type (polygon, line, point or grid cell), species name, object precision features, provider and source file name. Amended objects are extensions or deletions to the original objects that have been subject to stakeholder consultation and approved by the relevant authority in each member state.

Use Case Description	
Name	Provide Norwegian Species Distribution Data to INSPIRE
Priority	High
Description	The user (collating body=NBIC) receives Species Distribution data and associated metadata from the species data providers within the Member State and though the national focal point NMA creates a single contribution to the European reporting process.
Pre-condition	The national focal point (NMA) has access to a client GIS with basic selection tools and NBIC provide data to known standards and quality from the species data providers. There are previous versions of the cumulative data layer held by the INSPIRE on behalf of Europe.
Flow of Events – Basic Path for SACs	
Step 1.	The user (collator=NBIC) requests data on new and amended species data from national or international institutions/providers as part of a coordinated exercise to provide a batched update to INSPIRE.
Step 2.	The user (collator = NBIC) provide the species data as a .shp or equivalent file with specific attributes (e.g.object type, species name, site name, provider, collection date). An alternative is WFS.
Step 3.	The national focal point (NMA) undertake a minimal quality check on the species data and codes are correct, and assumes that the collating body (NBIC) has applied geometry and other validation procedures.
Step 4.	The NMA then adds the new/amended species objects and attribute data and deletes all old objects with same site code from the cumulative data layer and replaces them with amended species object data.
Step 5.	The cumulative layer and the supporting database are then submitted or opened by WFS to INSPIRE for incorporation into the European layer.
Post-condition	The NMA has a copy of the current cumulative species objects and database and INSPIRE further process this to create the combined European layer.
Data source: Internal systems of each member state	
Description	This use case uses country derived data created according to nationally agreed standards. This data is used in GIS within each user agency and also made available through web-mapping systems[17] and websites.

Data provider	Country (=regional) agencies create and own the data and pass this to Europe through the Norwegian collator body NBIC and the national focal point for INSPIRE, NMA.
Geographic scope	Similar process must operate in all EU/EEA member states.
Thematic scope	Species Distribution.
Scale, resolution	Data is provided at the most detailed scale and resolution available at the time of the official site submission to Europe. Subsequent improvements in resolution/accuracy are not captured by the current process. Many of these changes are driven by changes to the base mapping layer
Delivery	Data files direct to INSPIRE
Documentation	Flow not documented

Issues to note:

1. The current process does not allow member states to update the cumulative data layer with the 'accurate' species object available. The only way to make such changes "official" according to the EU is for the member state to resubmit the entire updated/changed (with amended maps, data forms and supporting database).

2. Cross border specie objects are dealt with through an agreed protocol between the countries; one country takes the lead in defining and providing NMA with relevant species objects. This is done in cooperation with the adjoining country to ensure that the species objects are defined consistently across the country border.

Annex C
(informative)
Examples

This Annex provides examples of use metadata elements defined in Regulation 1205/2008/EC.

C.1 *Examples on using metadata elements defined in Regulation 1205/2008/EC*

C.1.1 Conformity

This metadata element will also allow data producers to report that a specific dataset fulfils INSPIRE requirements as well as obligations from particular legal regulation.

Conformity example:

```
<gmd:report>
    <gmd:DQ_DomainConsistency>
    <gmd:result>
        <gmd:DQ_ConformanceResult>
            <gmd:specification>
                <gmd:CI_Citation>
                    <gmd:title>
                        <gco:CharacterString>COMMISSION REGULATION (EU) No 1089/2010
of 23 November 2010 implementing Directive 2007/2/EC of the European Parliament and of the
Council as regards interoperability of spatial data sets and services</gco:CharacterString>
                    </gmd:title>
                    <gmd:date>
                        <gmd:CI_Date>
                            <gmd:date>
                                <gco:Date>2010-12-08</gco:Date>
                            </gmd:date>
                            <gmd:dateType>
                                <gmd:CI_DateTypeCode
codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Cod
elist/ML_gmxCodelists.xml#CI_DateTypeCode"
codeListValue="publication">publication</gmd:CI_DateTypeCode>
                            </gmd:dateType>
                        </gmd:CI_Date>
                    </gmd:date>
                </gmd:CI_Citation>
            </gmd:specification>
            <gmd:explanation>
                <gco:CharacterString>See the referenced specification</gco:CharacterString>
            </gmd:explanation>
            <gmd:pass>
                <gco:Boolean>false</gco:Boolean>
            </gmd:pass>
        </gmd:DQ_ConformanceResult>
    </gmd:result>
    </gmd:DQ_DomainConsistency>
</gmd:report>
<gmd:report>
    <gmd:DQ_DomainConsistency>
    <gmd:result>
        <gmd:DQ_ConformanceResult>
            <gmd:specification>
```

```
                        <gmd:CI_Citation>
                            <gmd:title>
                                <gco:CharacterString>Council Directive 92/43/EEC of 21 May 1992 on
the conservation of natural habitats and of wild fauna and flora</gco:CharacterString>
                            </gmd:title>
                            <gmd:date>
                                <gmd:CI_Date>
                                    <gmd:date>
                                        <gco:Date>1992-05-02</gco:Date>
                                    </gmd:date>
                                    <gmd:dateType>
                                        <gmd:CI_DateTypeCode codeListValue="creation"
codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Cod
elist/ML_gmxCodelists.xml#CI_DateTypeCode">publication</gmd:CI_DateTypeCode>
                                    </gmd:dateType>
                                </gmd:CI_Date>
                            </gmd:date>
                        </gmd:CI_Citation>
                    </gmd:specification>
                    <gmd:explanation>
                        <gco:CharacterString>See the referenced specification</gco:CharacterString>
                    </gmd:explanation>
                    <gmd:pass>
                        <gco:Boolean>false</gco:Boolean>
                    </gmd:pass>
                </gmd:DQ_ConformanceResult>
            </gmd:result>
            </gmd:DQ_DomainConsistency>
        </gmd:report>
```

C.1.2 Lineage

This metadata element will also allow data producers to report as well as data users to see what kind of transformation methodologies were used to transform local data to common INSPIRE structures, including description of the source data.

Example for Lineage element is available in Annex C

```
        <gmd:lineage>
          <gmd:LI_Lineage>
            <gmd:statement>
              <gco:CharacterString>Source observation data has been aggregated to distribution
data using spatial operators buffer and intersect.</gco:CharacterString>
            </gmd:statement>
            <gmd:processStep>
              <gmd:LI_ProcessStep>
                <gmd:description>
                  <gco:CharacterString>For the data transformation from local to the INSPIRE
model, the following methodology has been used: 1. Harmonization between the source and target
(INSPIRE) data model. 2. Semantic mapping of individual featuers and their attributes. 3. Additional
rules for data conversion, as data type conversions, data grouping, data concatenate, constants
definition. 4. Implementation of the transformation means completely automated crosswalk by means
of the application of some type of tool (Geoserver - Application schema extension and XML
MapForce)</gco:CharacterString>
                </gmd:description>
              </gmd:LI_ProcessStep>
            </gmd:processStep>
            <gmd:source>
              <gmd:LI_Source>
                <gmd:description>
```

<gco:CharacterString>Each sample within the source dataset was collected at the point of maximum depth of the lake, incorporating identical aliquot of water taken between 0-2 m, 3 m, 4 m and between 5-6 m deep. The sampling frequency was every month. Tear Bottle, year of production 1999, Model number:SJ900AXCD has been used for sampling.</gco:CharacterString>
</gmd:description>
</gmd:LI_Source>
</gmd:source>
</gmd:LI_Lineage>
</gmd:lineage>