Meta data base:
"EnvEurope Metadata Specification for Dataset Level"

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These are Dublin Core metadata elements. See for more details and examples http://www.dublincore.org/

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Contents

1. **Introduction**

This document defines the metadata specification, which has been developed for the EnvEurope project for data set level description. The document corresponds to the Action 1 deliverable: Data collection and management, sub-action 1.1 Metadata collection and more specifically task A.1.1.2b Adapt dataset level metadata model.

This document provides a list of the metadata elements necessary for the description of resources collected within the LTER-Europe domain (European Long-Term Ecosystem Research Network) on the dataset level. The EnvEurope project does not include all of the LTER-Europe community (about 400 research sites). However it intends to provide standards and guidelines for the entire LTER -Europe network based on the experience gained within a group of actively involved representative beneficiaries (about 67 research sites from 11 European countries). The metadata standard has been defined as a result of user requirements exercises performed within the target stakeholder groups. The user requirements for content were then compared with the Inspire and Ecological Metadata Language (EML) specifications. Moreover many consultations with the experts from the project advisory board, involved beneficiaries, or other related projects (EXPEER[1]) have supported the final definition of this metadata specification.

The general objective of this metadata specification is to provide list of elements defined as important within the data exchange in the LTER-Europe community. By data exchange we mean data discovery, evaluation and use. This specification intends to cover all three levels of metadata (discovery, evaluation, synthesis); however, the primary focus is devoted to discovery and evaluation levels. In other words it focuses on those content area that will allow for the discovery of data that would potentially be useful for meta-analysis or or other synthetic activities, and to perform a perliminary evaluation of the suitability of the the dataset for further analysis or synthesis.

In addition, this metadata specification aims to ensure feasible interoperability level with other levels of LTER network. The US LTER (United States Long Term Ecological Research) network as a part of the International LTER has been taken into consideration regarding the data management approach that has been used since longer time. Therefore an EML (Ecological Metadata Language) specification has been defined as a reference metadata standard for the EnvEurope (LTER-Europe) metadata profile.

This metadata specification has also the requirement to provide metadata from the LTER Europe domain to the European Spatial Data Infrastructure defined by INSPIRE directive framework on the data themes to support policy makers decisions within the ecological domain. To fulfil this goal a metadata crosswalk between the EnvEurope metadata (EML) and INSPIRE metadata defined by Commission Regulation (EC) No 1205/2008 of 3 December 2008 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards metadata[2] (based on EN ISO 19115:2005 Geographic information – Metadata) has been developed. More details about this part are described in the chapter 6.

The core part of this specification (chapter 5) provides list of the metadata elements to be implemented for each data set collected within the EnvEurope data exchange system. Each metadata element is described in a tabular form and provides following details:
-   The name of EnvEurope metadata element

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[1] http://www.expeeronline.eu/
[2] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32008R1205:EN:NOT

- Basic definition given by EML[3] specification and amended by EnvEurope expert community
- Obligation/condition for the metadata element (Required or Optional)
- Multiplicity (Number of times an element may appear). Examples: 1 (only 1 and mandatory); 1..* (one required, more than one allowed); 0..* (optional, but many allowed); 0..1 (optional, but only one allowed)
- Corresponding metadata element in INSPIRE/EN ISO metadata model with reference[4]
- An example from EnvEurope domain dataset
- An example of XML encoding in EML
- An example of XML encoding in INSPIRE (EN ISO)

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[3] EML – Ecological Metadata Language - http://knb.ecoinformatics.org/software/eml/
[4] Reference in INSPIRE means pertaining number in metadata regulation - http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:326:0012:0030:EN:PDF and in ISO means number of metadata element defined inside the data dictionary in ISO1 9115 standard

2. **Normative references**

The following normative documents are indispensable for the development and application of this document:

COMMISSION REGULATION (EC) No 1205/2008 of 3 December 2008 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards metadata

EN ISO 19115:2005 - Geographic information - Metadata (ISO 19115:2003)

EN ISO 19115:2005/AC:2008 - Geographic information - Metadata (ISO 19115:2003/Cor 1:2006)

CEN ISO/TS 19139:2009 - Geographic information - Metadata - XML schema implementation (ISO/TS 19139:2007)

Ecological Metadata Language (EML) Specification

3. **Terms and definitions**

For the purposes of this metadata specification the following definitions and terms apply.

1. *Dataset*

Collection of data. A the dataset is a collection of single parameters stored in a specific site. The dataset is not time dependent; each dataset can cover different time period with different frequency.

ALTERNATE DEFINITION

A dataset represents one or more data tables (text file,spreadsheet), GIS layers or database views which the metadata describes. A dataset represents the file or files that will be provided to a person requesting the data. For example, if an Excel spreadsheet is being provided, then the spreadsheet can be considered to be a dataset. If the spreadsheet has three worksheets, then it is a dataset with three data tables. If the site stores its data in a relational database, then the data to be shared would be an exported view (query). The EnvEurope/ExpeER metadata standard does not require documenting the data table. For EnvEurope, a common data model is planned. The data table of the common model can be documented once and appended by the metadata entry tool to the higher level metadata document. For legacy data, documenting at the data table level is encouraged, but not required.

2. *EML or Ecological Metadata Language*

Metadata specification development for ecology discipline and ecological dataset (Michener et al., 1997). EML is implemented as a series of XML document types that can used in a modular and extensible manner to document ecological data. Each EML module is designed to describe one logical part of the total metadata that should be included with any ecological dataset (http://knb.ecoinformatics.org).

3. *EPSG*

Numeric codes, published by the OGP Surveying and Positioning Committee and created by European Petroleum Survey Group, to identify the geodetic reference systems adopted in different national realities.

4. *EUNIS*

The European Nature Information System developed and managed by the European Topic Centre on Biological Diversity (ETC/BD in Paris) for the European Environment Agency (EEA) and the European Environmental Information Observation Network (Eionet). 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.

5. *GEMET or GEneral Multilingual Environmental Thesaurus*

Indexing, retrieval and control tool for the European Topic Centre on Catalogue of Data Sources (ETC/CDS) and the European Environment Agency (EEA). The basic idea for the development of GEMET was to use the best of the presently available excellent multilingual thesauri, in order to save time, energy and funds. GEMET was conceived as a "general" thesaurus, aimed to define a common general language, a core of general terminology for the environment. Specific thesauri and descriptor systems (e.g. on Nature Conservation, on Wastes, on Energy, etc.) have been excluded from the first step of development of the thesaurus and have been taken into account only for their structure and upper level terminology.

6. *INSPIRE*

An European Community Directive entered into force on May 15, 2007. This Directive lays down a general framework for created a Spatial Data Infrastructure (SDI) for the purposes of European Community environmental policies and policies or activities which may have an impact on the environment.

7. *INSPIRE theme*

The INSPIRE Directive addresses 34 spatial data themes needed for environmental applications. These themes are subdivided in the three annexes of the directive (see http://inspire.jrc.ec.europa.eu for a list of themes).

8. *LTER-Europe Community*

Community composed by all Long Term Ecological Research sites. It focuses on different types of ecosystems: marine, lacustrine (lake), river and terrestrial. The mission of the Long Term community is: to track and understand the effects of global, regional and local changes on socio-ecological systems and their feedbacks to environment and society; to provide recommendations and support for solving current and future environmental problems (http://www.lter-europe.net/).

9. *Metadata*

Information about a dataset including, but not limited to, the people/organizations involved in creating the data, methods used, keywords, how to retrieve the data, data use policies, geographic, temporal, and taxonomic coverage. This information is used to discover, evaluate, and retrieve a dataset.

10. *NaturaSDI+*

European Project which aims at establishing a Best Practice Network dealing with a cluster of the data themes listed in the Annexes I and III of the INSPIRE Directive and focused on the nature conservation issues.

11. *Thesaurus*

List words grouped together according to similarity of meaning (synonyms). In addition to a list of semantcally similar terms in one language, e.g. "arid", "dry", "desert", it may contain, translations into different languages. Also a thesaurus may contain more specific ontology-based definition of the concept represented by the terms in a given thesaurus entry.

12. *UID or Unique Identifier*

Identifier which is guaranteed to be unique among all identifiers used for those objects and for a specific purpose.

13. *URI or Uniform Resource Identifier*

String of characters used to identify a name or a resource on the Internet.

14. *URL or Uniform Resource Locator*

Type of URI that specifies where a known resource is available and the mechanism for retrieving it.

15. *Web Service*

Method for communication between two electronic devices over a network. Web Services were intended to solve three main problems, that is Firewall Traversal, Complexity, and Interoperability.

16. *XML or Extensible Markup Language*

Set of rules for encoding documents in machine-readable form.

4. **Symbol and abbreviated terms**

For the purposes of this metadata specification the abbreviations apply:.

EC	European Commission
EU	European Union
EML	Ecological Metadata Language
INSPIRE	Infrastructure for Spatial Information in Europe
HTML	Hypertext Markup Language
ISO	International Organization for Standardization
URI	Uniform Resource Identifier
URL	Uniform Resource Locator
XML	eXtensible Markup Language
XSD	XML Schema Definition
XSLT	Extensible Stylesheet Language Transformations

5. Metadata specification

The following chapter provides detail description of individual elements implemented within the EnvEurope (LTER-Europe) metadata profile for data sets description purposes. Each metadata element may have more then one sub elements described within the element definition. Examples are given for both EML and ISO/Inspire. In most cases there is a one-to-one mapping between EML and ISO/Inspire, however, this is not always the case. In order to be able to produce valid metadata for both systems, the metadata entry tool may ask for information that is needed by one system, and not by the other. For example, Metadata Date is required by Inspire but is not an element in EML. EML has a method for creating custom structures (<additionalMetadata>) which will be used to provide this element. In other situations, EML may require something that Inspire does not. For example, EML requires a field of <altitudeUnits> while Inspire does not. In cases like that, the metadata entry tool will ask for <altitudeUnits> even though this is not used by ISO/Inspire. In general, if Inspire requires an element that is not part of EML, then an <additionalMetadata> element will be created to provide that information. Conversely, if EML requires something that is not part of Inspire, then the tool will not make a parallel structure for Inspire. In the case of individual parts of a concept such as geographic coverage, the two structures may not map directly. For example, Inspire incorporates the datum as part of any geographic reference. EML does not. No attempt would be made to create a custom geographic reference structure for EML to include datum information.

1. *Dataset title*

Metadata element name	1. Dataset title
Definition	Provides a name of the dataset that is being documented as is known within the community described in detail by following elements.
Obligation/condition	Mandatory
Multiplicity	1
INSPIRE/EN ISO element	1.1 Resource title/360. title
Example	Density and Biomass of phytoplankton in Lake Candia (1986)
Example EML XML encoding	<title> Density and Biomass of phytoplankton in Lake Candia (1986)</title>
Example INSPIRE CEN ISO/TS XML encoding	<gmd:title> <gco:CharacterString> Density and Biomass of phytoplankton in Lake Candia (1986)</gco:CharacterString> </gmd:title>

2. *Dataset identifier*

Metadata element name	2. Dataset identifier
Definition	Provides unique identifier for the dataset and namespace uniquely identifying the context of the identifier code (might be a name or identifier of the person or organization responsible for the dataset) The internal identifier (code) is a combination of LTER Site Code (derived automatically from the Site name provided by user) and free choice of alphanumeric value defined by the data owner. It's recommended to use following structure of the identifier: [Organization-ID_within_Organization]. In example: CNR_ISE-abio_chem_ao_001. Country code will be taken from the site name defined above. The final identifier will have following form **LTER_EU_CountryCode_SiteNumber-Organization-ID**, in example LTER_EU_IT_008-CNR_ISE- temp_candia_ao_1987. Code space is defined as LTER – Europe by default.
Obligation/condition	Mandatory
Multiplicity	1

INSPIRE/EN ISO element	1.5. Unique resource identifier/207. code /208.1 codeSpace
Example	08 Southern Alpine Lakes- CNR_IREA_ISE-phyt_candia_ao_1986 LTER-Europe Southern Alpine Lakes
Example EML XML encoding	<eml:eml packageId=" LTER_EU_IT_008- CNR_IREA_ISE-phyt_candia_ao_1986" system="http://enveurope.geocatalogue.ise.cnr.it/europe/" xmlns:eml="eml://ecoinformatics.org/eml-2.1.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="eml://ecoinformatics.org/eml-2.1.0 eml/eml.xsd">
Example INSPIRE CEN ISO/TS XML encoding	<gmd:identifier> <gmd:RS_Identifier> <gmd:code> <gco:CharacterString> LTER_EU_IT_008- CNR_IREA_ISE-phyt_candia_ao_1986</gco:CharacterString> </gmd:code> <gmd:codeSpace> <gco:CharacterString>LTER-Europe Southern Alpine Lakes </gco:CharacterString> </gmd:codeSpace> </gmd:RS_Identifier> </gmd:identifier>

3. *Dataset creator and contact points*

Metadata element name	**3. Dataset creator and contact points**
Definition	Defines sub elements that provide information about the full name of the person, organization name, created the resource or who plays a contact point role. The list of creators/contact points represents cited for the resource. At least the name and surname of the dataset creator (required by EML), the full the data and electronic mail address must be provided. Role is always taken as a point of contact (poi For EML the <creator> and <contact> are separate elements. Both are required.
Obligation/condition	Mandatory
Multiplicity	1..*
INSPIRE/EN ISO element	9. Responsible organization/29. pointOfContact
Example	Alessandro Oggioni CNR-IREA(Institute for Electromagnetic Sensing of the Environment) a.oggioni@irea.cnr.it
Example EML XML encoding	<creator> <individualName> <givenName>Alessandro</givenName> <surName>Oggioni</surName> </individualName> <organizationName>CNR-IREA(Institute for Electromagnetic Sensing of the Environment)</organization <electronicMailAddress>a.oggioni@irea.cnr.it</electronicMailAddress> </creator>
Example INSPIRE CEN ISO/TS XML encoding	<gmd:pointOfContact> <gmd:CI_ResponsibleParty> <gmd:individualName> <gco:CharacterString>Alessandro Oggioni</gco:CharacterString>

```
          </gmd:individualName>
          <gmd:organisationName>
           <gco:CharacterString> CNR-IREA(Institute for Electromagnetic Sensing of the Environment)</gco:Cha
          </gmd:organisationName>
          <gmd:contactInfo>
           <gmd:CI_Contact>
            <gmd:address>
             <gmd:CI_Address>
              <gmd:electronicMailAddress>
               <gco:CharacterString>irea.cnr.it</gco:CharacterString>
              </gmd:electronicMailAddress>
             </gmd:CI_Address>
            </gmd:address>
           </gmd:CI_Contact>
          </gmd:contactInfo>
          <gmd:role>
           <gmd:CI_RoleCode
codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Code
codeListValue="originator">originator</gmd:CI_RoleCode>
           </gmd:role>
          </gmd:CI_ResponsibleParty>
         </gmd:pointOfContact>
```

4. *Metadata provider*

Metadata element name	4. Metadata provider
Definition	Provides the full name of the person, organization, or position that created documentation for the organization responsible for metadata and electronic mail address shall be provided.
Obligation/condition	Mandatory
Multiplicity	1..*
INSPIRE/EN ISO element	10.1 Metadata point of Contact/8. contact
Example	Tomas Kliment CNR – ISMAR t.kliment@ismar.cnr.it

Example EML XML encoding	`<metadataProvider>`
	` <individualName>`
	`  <givenName>Tomas</givenName>`
	`  <surName>Kliment</surName>`
	` </individualName>`
	` <organizationName>CNR - ISMAR</organizationName>`
	` <electronicMailAddress>t.kliment@ismar.cnr.it </electronicMailAddress>`
	`</metadataProvider>`

Example INSPIRE CEN ISO/TS XML encoding	`<gmd:contact>`
	` <gmd:CI_ResponsibleParty>`
	`  <gmd:organisationName>`
	`   <gco:CharacterString>CNR - ISMAR</gco:CharacterString>`
	`  </gmd:organisationName>`
	`  <gmd:contactInfo>`
	`   <gmd:CI_Contact>`
	`    <gmd:address>`

```
    <gmd:CI_Address>
     <gmd:electronicMailAddress>
    <gco:CharacterString> t.kliment@ismar.cnr.it</gco:CharacterString>
     </gmd:electronicMailAddress>
     </gmd:CI_Address>
    </gmd:address>
    </gmd:CI_Contact>
   </gmd:contactInfo>
   <gmd:role>
    <gmd:CI_RoleCode
codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Code
codeListValue="pointOfContact">pointOfContact</gmd:CI_RoleCode>
    </gmd:role>
    </gmd:CI_ResponsibleParty>
   </gmd:contact>
```

5.   *Metadata date*

Metadata element name	5. Metadata date
Definition	Provides date of metadata creation or last update.
Obligation/condition	Mandatory
Multiplicity	1
INSPIRE/EN ISO element	10.2 Metadata date/9. dateStamp
Example	2011-11-22
Example EML XML encoding	Note: This concept is a required element for Inspire but is not represented in the EML schema. As a result the elements must be added using the <additionalMetadata> structure. <additionalMetadata> <describes>Provides date of metadata creation or last update. </describes> <metadata> <metadataDate>2011-11-22</metadataDate> </metadata> </additionalMetadata>
Example INSPIRE CEN ISO/TS XML encoding	<gmd:dateStamp> <gco:Date>2011-11-22</gco:Date> </gmd:dateStamp>

6.   *Dataset publication date*

Metadata element name	6 Dataset publication date
Definition	Represents the date when the resource (the data) was first published on the EnvEurope data port amendment) is documented as a date of last revision. For legacy data, this represents the date when paper publication). If the data has not been published , then this element should not be filled in.
Obligation/condition	Optional
Multiplicity	0.*
INSPIRE/EN ISO element	5.2 Date of publication/394. date

Example	2011-11-10
Example EML XML encoding	<pubDate>2011-11-21</pubDate>
Example INSPIRE CEN ISO/TS XML encoding	<gmd:date> <gmd:CI_Date> <gmd:date> <gco:Date>2011-11-10</gco:Date> </gmd:date> <gmd:dateType> <gmd:CI_DateTypeCode codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Code codeListValue="publication">publication</gmd:CI_DateTypeCode> </gmd:dateType> </gmd:CI_Date> </gmd:date>

7. *Dataset language*

Metadata element name	**7. Dataset language**
Definition	The language in which the textual parts of dataset are written. For instance the names of features and t or the data itself. Any other language used in textual information shall be referenced here as well.
Obligation/condition	Mandatory
Multiplicity	1.
INSPIRE/EN ISO element	1.7 Resource language/39. language
Example	Eng
Example EML XML encoding	<language>eng</language>
Example INSPIRE CEN ISO/TS XML encoding	<gmd:language> <gmd:LanguageCode codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Code codeListValue="eng">eng</gmd:LanguageCode> </gmd:language>

8. *Dataset abstract*

Metadata element name	**8. Dataset abstract**
Definition	A brief overview of the resource that is being documented. The abstract should include basic information that summarizes the resource.
Obligation/condition	Mandatory
Multiplicity	1
INSPIRE/EN ISO element	1.2 Resource abstract/25. abstract
Example	Dataset provides information about water temperature collected in Lake Candia during the year 1987. The temperature within this dataset concerns the surface water and an average, of water temperature, within the depth scales from 0 to 6 m.

Example EML XML encoding	```<abstract>```
	 ``` <section>```
	 ``` <para>``` The dataset covers the evolution of biomass and density of phytoplankton in Lake Candia for the year 1986. The sampling was carried out according to sampling classic centre of the lake, the point of maximum depth, using the tear-off bottle. Samples were collected every meter of depth and then integrated into a single rate of water, in order to obtain a sample between 0 and 6 m deep.
	 ``` </para>```
	 ``` </section>```
	 ```</abstract>```

Example INSPIRE CEN ISO/TS XML encoding	```<gmd:abstract>```
	 ``` <gco:CharacterString>```Dataset provides information about water temperature collected in Lake Candia during the year 1987. The temperature within this dataset concerns the surface water and an average, of water temperature, within the depth scales from 0 to 6 m.
	 ``` </gco:CharacterString>```
	 ```</gmd:abstract>```

9. *Dataset keyword set*

Metadata element name	9. Dataset keyword set
Definition	Provides a set of related keywords describing the content of the dataset coming from EnvThes vocabu recommended to be used in order to describe each dataset: 1. Ecosystem structure part – defines the part of the ecosystem structure in perspective with the content three values – biotic, abiotic and socio-economic 2. Ecosystem type – defines ecosystem types in EnvEurope project – provides a list with these values – terre 3. Observed parameter - value of the parameter within the dataset from EnvEurope list of parameters 4. EUNIS habitat type – provides habitat types tree according to EUNIS habitat type hierarchical view. 5. GEMET and other related repositories – provides keywords describing the content of dataset derived Environmental thesaurus GEMET (http://www.eionet.europa.eu/gemet). Use this thesaurus (theme information about the type of ecosystem, for example, terrestrial ecosystem, marine ecosystem, freshwa 6. Related INSPIRE theme (Environmental monitoring facilities, Habitats and Biotopes, Species distribution a 7. Other keyword controlled vocabulary types: for example, Getty Thesaurus of Geographic Names, UL-LTEF 8. Free keyword – use this only if there is a concept needed that is not found in one of the previous systems
	Mandatory
Multiplicity	1..*
INSPIRE/EN ISO element	3.1 Keyword value/53. keyword
Example	1. Ecosystem structure part: biotic 2. Ecosystem type: lakes 3. Observed parameter: biomass, bulk density 4. EUNIS habitat type: C: Inland surface waters, C1.3 : Permanent eutrophic lakes, ponds and pools 5. GEMET: ecosystem ecology, phytoplankton, 6. INSPIRE theme: Species distribution, Environmental Monitoring Facilities 7. Any other free keywords: use this only if there is a concept needed that is not found in one of the previous sys

Example EML XML encoding	```<keywordSet>```
	 ``` <keyword>```Biotic parameters```</keyword>```
	 ``` <keyword>```Biomass```</keyword>```

	```<keyword>Density</keyword>```
	```<keywordThesaurus>EnvEurope Thesaurus ;2012-02-01</keywordThesaurus>```
	```</keywordSet>```
	```<keywordSet>```
	```<keyword>ecology</keyword>```
	```<keyword>phytoplankton</keyword>```
	```<keyword>lake</keyword>```
	```<keyword>eutrophication</keyword>```
	```<keyword>freshwater ecosystem</keyword>```
	```<keywordThesaurus>GEMET - Concepts version 2.4;2010-01-13</keywordThesaurus>```
	```</keywordSet>```
	```<keywordSet>```
	```<keyword>C : Inland surface waters</keyword>```
	```<keyword>C1.3 : Permanent eutrophic lakes, ponds and pools</keyword>```
	```<keywordThesaurus>EUNIS biodiversity database - Habitat types;2009-02-01</keywordThesaurus>```
	```</keywordSet>```
	```<keywordSet>```
	```<keyword>Habitats and Biotopes</keyword>```
	```<keyword>Species distribution</keyword>```
	```<keyword>Environmental Monitoring Facilities</keyword>```
	```<keywordThesaurus>INSPIRE Feature Concept Dictionary;2008-12-05</keywordThesaurus>```
	```</keywordSet>```
	```<keywordSet>```
	```<keyword>Lago di Candia</keyword>```
	```<keywordThesaurus>Getty Thesaurus of Geographic Names;2010-01-13</keywordThesaurus>```
	```</keywordSet>```

Example INSPIRE CEN ISO/TS XML encoding	```<gmd:descriptiveKeywords>```
	```<gmd:MD_Keywords>```
	```<gmd:keyword>```
	```<gco:CharacterString>Biotic parameters</gco:CharacterString>```
	```</gmd:keyword>```
	```<gmd:keyword>```
	```<gco:CharacterString>Biomass</gco:CharacterString>```
	```</gmd:keyword>```
	```<gmd:keyword>```
	```<gco:CharacterString>Density</gco:CharacterString>```
	```</gmd:keyword>```
	```<gmd:thesaurusName>```
	```<gmd:CI_Citation>```
	```<gmd:title>```
	```<gco:CharacterString>EnvEurope Thesaurus </gco:CharacterString>```
	```</gmd:title>```
	```<gmd:date>```
	```<gmd:CI_Date>```
	```<gmd:date>```
	```<gco:Date> 2012-02-01</gco:Date>```
	```</gmd:date>```
	```<gmd:dateType>```
	```<gmd:CI_DateTypeCode```
	```codelist="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Codelist/ML_g```
	```codeListValue="publication">publication</gmd:CI_DateTypeCode>```
	```</gmd:dateType>```
	```</gmd:CI_Date>```
	```</gmd:date>```

	</gmd:CI_Citation> </gmd:thesaurusName> </gmd:MD_Keywords> </gmd:descriptiveKeywords>

10. *Dataset access and use constraints*

Metadata element name	10. Dataset access and use constraints
Definition	Provides a list of rules defining permissions for this dataset. The Inspire directive states that metadata will be publicly available. As a result, the standard permissions for metadata will be— public:read; data owner:all. This will allow the metadata entry tool to generate EML documents that are valid for a Metacat server. A second use of this element is used to describe the permissions for the data. In this context, metadata will not be provided in EML format, but will allow the metadata provider to specify permissions that will be used by the EnvEurope data management system. In general, the LTER-Europe data policy, as well as the INSPIRE data use policy requires that most data be made freely available after a reasonable period (three years from date of collection is the norm). As a result, new data may be available to EnvEurope members, but not to others. It is important for the system to be able to recognize when the data is to be made available. It is recommended that the 3-year rule be implemented and that the data owner must take specific actions to change this.
Obligation/condition	Mandatory
Multiplicity	1..*
INSPIRE/EN ISO element	8.1. Conditions applying to access and use/68. useLimitation
Example	Principal: EnvEurope (LTER-Europe) with permission type: Free Principal: Public with permission type: Restricted
Example EML XML encoding	<access authSystem=" http://enveurope.geocatalogue.ise.cnr.it/europe "> <allow> <principal> EnvEurope (LTER-Europe)</principal> <permission>all</permission> </allow> <allow> <principal>public</principal> <permission>read</permission> </allow>
Example INSPIRE CEN ISO/TS XML encoding	<gmd:useLimitation> <gco:CharacterString>Allowed for EnvEurope (LTER-Europe) group with permission type Free. </gco:CharacterString> </gmd:useLimitation> <gmd:useLimitation> <gco:CharacterString>Allowed for Public group with permission type Free upon request </gco:CharacterString> </gmd:useLimitation>

11. *Dataset intellectual rights*

Metadata element name	11. Dataset intellectual rights
Definition	Typically, an Intellectual Rights element will contain a rights management statement for the reso provides such licensing information. Rights information encompasses Intellectual Property Rights Moreover these rights might include requirements for use, requirements for attribution, or other red select list has been proposed[5] to be used and contains following options: - Co-authorship on publications resulting from use of the dataset - The data provider must be offered co-authorship for publications using this dataset at least w - Formal acknowledgement of the dataset providers - The opportunity to collaborate on the project using the dataset - At least part of the costs of dataset acquisition, retrieval or provision must be recovered. - The opportunity to review the results based on the dataset - Reprints of articles using the dataset must be provided to the data provider - The dataset provider is given a complete list of all products that make use of the dataset - Legal permission for dataset use is obtained - Mutual agreement on reciprocal sharing of data - The data provider is given and agrees to a statement of uses to which the dataset will be put - Any others
Obligation/condition	Optional
Multiplicity	0..*
INSPIRE/EN ISO element	8.2. Limitations on public access/72. otherConstraints
Example	Co-authorship on publications resulting from use of the dataset

Example EML XML encoding	`<intellectualRights>`
	`  <section>`
	`   <para> Co-authorship on publications resulting from use of the dataset </para>`
	`  </section>`
	`</intellectualRights>`

Example INSPIRE CEN ISO/TS XML encoding	`<gmd:useConstraints>`
	`  <gmd:MD_RestrictionCode`
	`codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Co`
	`codeListValue="intellectualPropertyRights"/>`
	`</gmd:useConstraints>`
	`<gmd:otherConstraints>`
	`  <gco:CharacterString> Co-authorship on publications resulting from use of the dataset.`
	`  </gco:CharacterString>`
	`</gmd:otherConstraints>`

12. *Dataset online distribution*

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[5] This list has been proposed based on article Data Sharing by Scientist: Practices and Perceptions written by authors C. Tenopil etal.

Metadata element name	**12. Dataset online distribution**
Definition	A Uniform Resource Locator (URL) may retrieve the data directly (EML function:download), or provide information about how to acquire the data (EML function:information). Within EnvEurope some data will be available centrally while most data will be retained by the data owner. How data is distributed is determined by the data owner. A function:download URL might be to either a file or a service.
Obligation/condition	Mandatory
Multiplicity	1..*
INSPIRE/EN ISO element	1.4 Resource locator/277. onLine
Example	Sensor Observation Service Get Capabilites request http://sos.ise.cnr.it/sos?service=SOS&request=GetCapabilities

Example EML XML encoding	`<distribution>`
	 `<online>`
	  `<onlineDescription>`Sensor Observation Service Get Capabilites request`</onlineDescription>`
	  `<url function="download" >`
	http://sos.ise.cnr.it/sos?service=SOS&request=GetCapabilities
	  `</url>`
	 `</online>`
	
	`<distribution>`
	 `<online>`
	 `<onlineDescription>`LTER-Romania Data catalog `</onlineDescription>`
	 `<url function="information" >` http://lter-romania/data/
	 `</url>`
	 `</online>`

Example INSPIRE CEN ISO/TS XML encoding	`<gmd:onLine>`
	 `<gmd:CI_OnlineResource>`
	 `<gmd:linkage>`
	  `<gmd:URL>`http://sos.ise.cnr.it/sos?service=SOS&request=
	  GetCapabilities`</gmd:URL>`
	 `</gmd:linkage>`
	 `<gmd:description>`Sensor Observation Service Get Capabilites request`</gmd:description>`
	 `</gmd:CI_OnlineResource>`
	`</gmd:onLine>`

13.   *Dataset geographic bounding coordinates*

Metadata element name	**13. Dataset geographic bounding coordinates**
Definition	Provides four bounding coordinates defining bounding box of the dataset spatial extent. The bounding box is an Inspire requirement. It must be understood that this can give an exaggerated picture of the geographic extent, if, for example, the sampling area is a diagonal transect or river section. The bounding box shall be expressed with westbound and eastbound longitudes, and southbound and northbound latitudes in decimal degrees, with a precision of at least two decimals. As a default coordinate reference system of bounding box shall be used ETRS89 (EPSG: 4258).

Obligation/condition	Mandatory
Multiplicity	1..*
INSPIRE/EN ISO element	4.1 Geographic bounding box/343. EX_GeographicBoundingBox
Example	7.88749 7.93573 45.34080 45.31461
Example EML XML encoding	\<boundingCoordinates> \<westBoundingCoordinate>7.88749\</westBoundingCoordinate> \<eastBoundingCoordinate>7.93573 \</eastBoundingCoordinate> \<northBoundingCoordinate>45.34080\</northBoundingCoordinate> \<southBoundingCoordinate>45.31461\</southBoundingCoordinate> \</boundingCoordinates>

Example INSPIRE CEN ISO/TS XML encoding	\<gmd:EX_GeographicBoundingBox>
	 \<gmd:westBoundLongitude>
	  \<gco:Decimal>7.88749\</gco:Decimal>
	 \</gmd:westBoundLongitude>
	 \<gmd:eastBoundLongitude>
	  \<gco:Decimal>7.93573 \</gco:Decimal>
	 \</gmd:eastBoundLongitude>
	 \<gmd:southBoundLatitude>
	  \<gco:Decimal>45.34080\</gco:Decimal>
	 \</gmd:southBoundLatitude>
	 \<gmd:northBoundLatitude>
	  \<gco:Decimal>45.31461\</gco:Decimal>
	 \</gmd:northBoundLatitude>
	\</gmd:EX_GeographicBoundingBox>

14. ***Dataset geographic bounding altitudes or depths***

Metadata element name	**14. Dataset geographic bounding altitudes or depths**
Definition	This optional element provides bounding altitudes for defined bounding box. This element is defined by two numbers (minimum and maximum altitudes) defining height above or below sea level, and the unit of measure. As a default vertical coordinate reference system of bounding altitudes shall be used Mean sea level height (EPSG: 5714). \<altitudeUnits> is required by EML but not by Inspire. This is not to be confused with sampling depth for lake, river or marine systems. For example, the Dead Sea would have altitude of -500 meters, Lake Titicaca would have an altitude of +3,800 meters. Most marine systems would have altitudes of zero meters even if the sampling were done at -4,000 meters.
Obligation/condition	Optional
Multiplicity	0..*
INSPIRE/EN ISO element	-/354. EX_VerticalExtent
Example	220 226 meter
Example EML XML encoding	\<boundingCoordinates> \<boundingAltitudes>

	`<altitudeMinimum>220</altitudeMinimum>`
	`<altitudeMaximum>226</altitudeMaximum>`
	`<altitudeUnits>meter</altitudeUnits>`
	`</boundingAltitudes>`
	`</boundingCoordinates>`

Example INSPIRE CEN ISO/TS XML encoding	`<gmd:EX_VerticalExtent>`
	`<gmd:minimumValue>`
	`<gco:Real>220</gco:Real>`
	`</gmd:minimumValue>`
	`<gmd:maximumValue>`
	`<gco:Real>226</gco:Real>`
	`</gmd:maximumValue>`
	`<gmd:verticalCRS>`
	`<gml:VerticalCRS gml:id="crs.msl_height">`
	`<gml:identifier codeSpace="urn:ogc:def:crs:EPSG">5714</gml:identifier>`
	`<gml:scope>not known</gml:scope>`
	`<gml:verticalCS/>`
	`<gml:verticalDatum/>`
	`</gml:VerticalCRS>`
	`</gmd:verticalCRS>`
	`</gmd:EX_VerticalExtent>`

15.   ***Dataset temporal extent***

Metadata element name	15. Dataset temporal extent
Definition	Provides information about the time, or date ranges – time period covered by the content of the dataset.
Obligation/condition	Mandatory
Multiplicity	1..*
INSPIRE/EN ISO element	5.1 Temporal extent/350. EX_TemporalExtent
Example	start: 1986-03-06 end: 1986-12-17

Example EML XML encoding	`<temporalCoverage>`
	`<rangeOfDates>`
	`<beginDate>`
	`<calendarDate>1986-03-06</calendarDate>`
	`</beginDate>`
	`<endDate>`
	`<calendarDate>1986-12-17</calendarDate>`
	`</endDate>`
	`</rangeOfDates>`
	
	`<temporalCoverage>`
	`<singleDateTime>`
	`<calendarDate>1996-10-21 </calendarDate>`
	`</singleDateTime>`
	`</temporalCoverage>`
	`</temporalCoverage>`

Example INSPIRE CEN ISO/TS XML encoding	`<gmd:EX_TemporalExtent>`
	`<gmd:extent>`
	`<gml:TimePeriod gml:id="gml">`
	`<gml:beginPosition>1986-03-06</gml:beginPosition>`

	<gml:endPosition>1986-12-17</gml:endPosition> </gml:TimePeriod> </gmd:extent> </gmd:EX_TemporalExtent>

16.   *Dataset taxonomic coverage*

Metadata element name	16. Dataset Taxonomic Coverage
Definition	Provides information about the taxonomic classification of the organisms represented in the data. This element has two components: <taxonRankName> (class, family, order, etc.) and <taxonRankValue> (mammalia, carnivora, Felidae). This field is applicable only for biotic data. Depending on the content of the dataset, provide information about the most common level of taxonomy aggregation (plants: family, marine invertebrates: phylum or class, etc.) Recommendation is to use common catalogue of species, for example, Catalogue of Life http://www.catalogueoflife.org/browse/classification> , GBIF http://www.gbif.org , EUNIS http://eunis.eea.europa.eu/species-names.jsp .
Obligation/condition	Conditional – mandatory only for biotic data
Multiplicity	0..*
INSPIRE/EN ISO element	3.1 Keyword value /53. Keyword -/54.Type
Example	Class Species
Example EML XML encoding	<taxonomicClassification> <taxonRankName>Class</taxonRankName> <taxonRankValue>Chrysophyceae</taxonRankValue> </taxonomicClassification> <taxonomicClassification> <taxonRankName>Species</taxonRankName> <taxonRankValue>Mallomonas akrokomos</taxonRankValue> </taxonomicClassification>
Example INSPIRE CEN ISO/TS XML encoding	<gmd:descriptiveKeywords> <gmd:MD_Keywords> <gmd:keyword> <gco:CharacterString>Chrysophyceae</gco:CharacterString> </gmd:keyword> <gmd:type> <gmd:MD_KeywordTypeCode codeList="http://pending.geotoolkit.org/apidocs/org/geotoolkit/naturesdi/NATSDI_RankNameCode.htm codeListValue="Class">Class</gmd:MD_KeywordTypeCode> </gmd:type> </gmd:MD_Keywords> </gmd:descriptiveKeywords> <gmd:descriptiveKeywords> <gmd:MD_Keywords> <gmd:keyword> <gco:CharacterString>Mallomonas akrokomos</gco:CharacterString> </gmd:keyword> <gmd:type> <gmd:MD_KeywordTypeCode codeList="http://pending.geotoolkit.org/apidocs/org/geotoolkit/naturesdi/NATSDI_RankNameCode.htm

	codeListValue="Class">Species</gmd:MD_KeywordTypeCode> </gmd:type> </gmd:MD_Keywords> </gmd:descriptiveKeywords>

17. ***Dataset methods description***

Metadata element name	17. Dataset methods description
Definition	Provides repeated sets of elements that document a series of procedures followed to produce any dataset object. These shall include information about procedure steps, software used within individual steps, source data and any quality measures taken. It may provide a general description of the method steps defined by previous research or documented in methodologies, guidelines, specifications, and standards in the <title>. The element shall provide a general explanation of the data producer's knowledge about the lineage of a dataset. All information included here should help a future data user to understand more about the data content. The methods section is important to allow the user to determine whether the user would be able to combine this data with his own, etc. It's recommended to provide a method title from the list established within ENVEurope project and link to its further description in ENVEurope thesaurus. If the method is not included in the list description and some reference are important to be written. Datasets produced prior to ENVEurope may need methodologies not in the list of ENVEurope methods.
Obligation/condition	Mandatory
Multiplicity	1..*
INSPIRE/EN ISO element	-/87. description 6.1 Lineage /83. statement
Example	Water column sampling with different levels (depths) for phytoplankton
Example EML XML encoding	<description> <section> <title>Water column sampling with different levels (depths) for phytoplankton</title> <para>http://www.enveurope.eu/envthes/en/collections/methods </para> </section> </description>
Example INSPIRE CEN ISO/TS XML encoding	<gmd:description> <gco:CharacterString> Water Water column sampling with different levels (depths) for phytoplankton (http://www.enveurope.eu/envthes/ en/collections/methods) </gco:CharacterString> </gmd:description>

18. ***Dataset instrumentation description***

Metadata element name	18. Dataset instrumentation description
Definition	Provides information about any instruments used in the data collection or quality

	control and quality assurance. The description should include vendor, model number, optional equipment, etc.
Obligation/condition	Mandatory
Multiplicity	1..*
INSPIRE/EN ISO element	-/88. rationale 6.1 Lineage /83. statement
Example	● Tear Bottle, year of production 1999, Model number:SJ900AXCD
Example EML XML encoding	<instrumentation>Tear Bottle, year of production 1999, Model number:SJ900AXCD </instrumentation>
Example INSPIRE CEN ISO/TS XML encoding	<gmd:rationale> <gco:CharacterString>Tear Bottle, year of production 1999, Model number:SJ900AXCD</gco:CharacterString> </gmd:rationale>

19. ***Dataset sampling description***

Metadata element name	19. Dataset sampling description
Definition	Allows for a text-based/human readable description of the actual sampling procedures used within the dataset collection. This element shall include information about dataset lineage - general explanation of the data producer's knowledge about the lineage of a dataset. This element shall also provide a description or geographical definition of the representative area of sampling.
Obligation/condition	Mandatory
Multiplicity	1..*
INSPIRE/EN ISO element	6.1 Lineage /83. statement
Example	Each sample 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.
Example EML XML encoding	<samplingDescription> <para>Each sample 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. Sampling frequency: monthly.</para> </samplingDescription>
Example INSPIRE CEN ISO/TS XML encoding	<gmd:statement> <gco:CharacterString>Each sample 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.Sampling frequency: monthly.</gco:CharacterString> </gmd:statement>

20. ***Dataset legal obligation reporting***

Metadata element name	20. Dataset legal obligation reporting
Definition	Provides information whether a dataset has been reported to the local, or regional or national bodies to
Obligation/condition	Optional
Multiplicity	0..*

INSPIRE/EN ISO element	7.1 Specification/130. specification; 131. explanation 7.2 Degree/ 132. pass
Example	Water Framework Directive (00/60/EEC)
Example EML XML encoding	Not included in EML XML
Example INSPIRE CEN ISO/TS XML encoding	``` <gmd:report> <gmd:DQ_DomainConsistency> <gmd:measureIdentification> <gmd:RS_Identifier> <gmd:code> <gco:CharacterString>Legal obligation conformity</gco:CharacterString> </gmd:code> <gmd:codeSpace> <gco:CharacterString>ChecklistReportingNatureDirectives</gco:CharacterString> </gmd:codeSpace> </gmd:RS_Identifier> </gmd:measureIdentification> <gmd:result> <gmd:DQ_ConformanceResult> <gmd:specification> <gmd:CI_Citation> <gmd:title> <gco:CharacterString> Directive 2000/60/EC of the European Parliament and of the Council of 23 Oc policy </gco:CharacterString> </gmd:title> <gmd:date> <gmd:CI_Date> <gmd:date> <gco:Date>2000-10-23</gco:Date> </gmd:date> <gmd:dateType> <gmd:CI_DateTypeCode codeListValue="creation" codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Code </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> ```

6. EnvEurope (EML) metadata crosswalk to the INSPIRE (EN ISO) metadata profile

Metadata crosswalk (transformation) has been developed in accordance with methodology described in detail within the book Geographic information metadata for spatial data infrastructures (Nogueras-Iso, J. et al., 2005) and shown in figure 1.
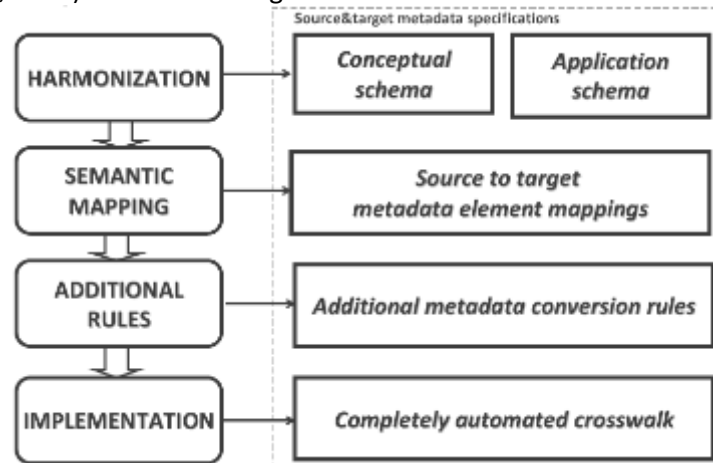
Fig. 1 Metadata crosswalk methodology schemata (based on Nogueras-Iso, J. et al., 2005)

First part of this chapter provides an overview of standards and specifications to be crosswalked. The second part describes in detail each steps made within the metadata crosswalk realization. Moreover an example of EML metadata record and its ISO/INSPIRE compliant form is given in annexes together with ISO and INSPIRE validation report.

1. Ecological Metadata Language (EML) Specification overview

Ecological Metadata Language (EML) is a metadata specification developed by the ecology discipline and for the ecology discipline. It is based on prior work done by the Ecological Society of America and associated efforts (Michener et al., 1997, Ecological Applications). EML is implemented as a series of XML schemas that can be used in a modular and extensible manner to document ecological data. Each EML module is designed to describe one logical part of the total metadata that should be included with any ecological dataset.

The EML standard is made up of 23 modules (EML). The modules are grouped into the following groups:

- Root-level structure: **eml** module (metadata container) and **eml-resource** module (provides base information for all resources)
- Top-level resource: **eml-dataset** (data sets description), **eml-literature** (citation specific information), **eml-software** (software specific information) and **eml-protocol** module (research protocol specific information)
- Supporting modules: **eml-access** (access control rules for resources), e**ml-physical** (physical file format information), **eml-party** (people and organization information), **eml-coverage** (information about geographic, temporal and coverage extents), eml-project (research projects information) and **eml-methods** (methodological information for the resource)
- Data organization: **eml-entity** (entity level information within dataset), **eml-attribute** (attribute level information) and **eml-constraint** (information about relation ships among and within individual data sets)
- Entity types: **eml-dataTable** (information about data table entities), **eml-spatialRaster** (information about regularly gridded geospatial image data), **eml-spatialVector**

(information about non-gridded geospatial image data), **eml-storedProcedure** (information about data tables resulting from procedures stored in a database) and **eml-view** (information about data tables resulting from a database query)
- Utility modules: **eml-text** (text field formatting) **eml-unitTypeDefinitions** (unit definition)

The EML modules used can vary depending on the intended use as described in table below. Each level includes the modules described in lower levels.

adapted from: http://im.lternet.edu/im_practices/metadata/guides/EML_levels

Table 1 EML modules versus metadata levels

Level	Usage	Modules (elements) Involved
L1	Identification	title, creator, contact, abstract, keywords, publisher, publication date
L2	Discovery	eml-coverage (geographic, temporal, taxonomic)
L3	Evaluation	Intellectual Rights, project, methods, dataTable/entityGroup, dataTable/attributes
L4	Access	eml-access, eml-physical
L5	Integration	attributeList (full descriptions), contraint, quality control

Identification level usage of EML provides the minimum level to identify the data: Minimum content for adequate data set discovery in a general cataloging system or repository.

Discovery level usage includes Level 1 content plus coverage information to support targeted searches

Evaluation includes Level 2 content plus data set details to enable end-user evaluation of the methodology and data entities

Access level includes Level 3 content plus data access details to support automated data retrieval

Integration level Includes Level 4 content plus complete attribute and quality control details to support computer-assisted data integration and re-sampling

EN ISO 19115:2005 - Geographic information - Metadata (ISO 19115:2003) standard overview

ISO 19115:2003 defines the schema required for describing geographic information and services. It provides information about the identification, extent, quality, spatial and temporal schema, spatial reference, and distribution of digital geographic data.

ISO 19115:2003 is applicable to the cataloguing of datasets, clearinghouse activities, and the full description of datasets; geographic datasets, dataset series, and individual geographic features and feature properties.

ISO 19115:2003 defines: mandatory and conditional metadata sections, metadata entities, and metadata elements; the minimum set of metadata required to serve the full range of metadata applications (data discovery, determining data fitness for use, data access, data transfer, and use of digital data); optional metadata elements - to allow for a more extensive standard description of geographic data, if required; a method for extending metadata to fit specialized needs.

Though ISO 19115:2003 is applicable to digital data, its principles can be extended to many other forms of geographic data such as maps, charts, and textual documents as well as non-geographic data.

Metadata for geographic data is presented in UML Packages. Each package contains one or more entities (UML Classes), which can be specified (sub classed) or generalized (super classed). Entities

contain elements (UML class attributes) which identify the discrete units of metadata. Entities may be related to one or more other entities. Entities can be aggregated and repeated as necessary to meet the mandatory requirements stated in this International Standard as well as additional user requirements.

ISO 19115 metadata standard is made up of 14 top-level packages (ISO, 2003):

- **Metadata entity set information**: metadata container and contains metadata about metadata (metadata responsible party, creation date, language, identification and others)
- **Identification information**: basic information required to uniquely identify a resource
- **Constraint information**: restrictions on the access and use of a resource or metadata
- **Data quality information**: package contains a general assessment of the quality of the dataset
- **Maintenance information**: information about the scope and frequency of updating
- **Spatial representation information** (includes grid and vector representation): contains information concerning the mechanisms used to represent spatial information in a dataset
- **Reference system information:** contains the description of the spatial and temporal reference system(s) used in a dataset
- **Content information:** information identifying the feature catalogue used and/or information describing the content of a coverage dataset
- **Portrayal catalogue information:** contains information identifying the portrayal catalogue used
- **Distribution information:** contains information about the distributor of, and options for obtaining, a resource
- **Metadata extension information:** contains information about user specified metadata extensions
- **Application schema information:** contains information about the application schema used to build a dataset
- **Extent information:** contains information about the geographic, temporal and the vertical extent of the dataset
- **Citation and responsible party information:** contains information about the party responsible for dataset

ISO19115 is a complex model that provides more then 300 metadata elements (86 classes, 282 attributes, 56 relations) to describe spatial but also no-spatial datasets. Most of them can be applied optionally. However standard defines only a conceptual schema based on UML models and related data dictionaries. Therefore technical specification CEN ISO/TS 19139:2009 Geographic information - Metadata - XML schema implementation (ISO/TS 19139:2007) defines Geographic MetaData XML (gmd) encoding, an XML Schema implementation derived from ISO 19115.

2. *INSPIRE metadata regulation overview*

INSPIRE directive was established in 2007 and had to be transposed into EU member states legislation within 2 years. INSPIRE defines an infrastructure for spatial information in Europe, which consists from 5 components: spatial data, metadata, network services, data sharing and monitoring and reporting. For each abovementioned component EC approves commission regulations. Among others, metadata regulation has been approved in year 2008 and defines metadata elements to be included within the datasets and service description in order to be compliant with INSPIRE legal requirements. This regulation provides within its annex metadata implementing rules where each required metadata element is defined via its identification, name, description and obligation with multiplicity and condition.

INSPIRE metadata regulation is made up of 10 groups containing following elements:

- **Identification** - provides general identification information distributed via these metadata elements: **Resource title, Resource type, Resource locator, Unique resource identifier, Coupled resource and Resource language**
- **Classification of spatial data and services** – provides categorization of the resources via elements **Topic category** and **Spatial data service type**
- **Keyword** – provides further description by keywords with elements **Keyword value** and **Originating controlled vocabulary**
- **Geographic location** – provides spatial extent definition via element **Geographic bounding box**
- **Temporal extent** – provides temporal aspect definition either for temporal range via **Temporal extent** element or just a single date of an event within resource lifecycle via **Date of publication, Date of last revision and Date of creation**
- **Quality and validity** – provides summary information about resource quality via elements **Lineage** and **Spatial resolution**
- **Conformity** – provides information about conformity to particular implementing rules as well as the its degree via **Specification** and **Degree elements**
- **Constraints related to access and use** – provides a set of conditions applying to access and use and limitations on public access via **Conditions applying to access** and use and **Limitations on public access** elements
- **Organisations responsible for the establishment, management, maintenance and distribution of spatial data sets and services** – provides information about responsible parties via **Responsible party** (name, organisation and e-mail address) and **Responsible party role** elements
- **Metadata on metadata** – provides information describing metadata itself via **Metadata point of contact** (name, organisation and e-mail address), **Metadata date** and **Metadata language** elements.

It is important to mention that this metadata description is planned to provide information mainly for spatial data sets and services discovery and partially for evaluation, access and use purposes. Further metadata elements mainly devoted to resource evaluation is then defined within implementing rules for spatial data sets according to particular INSPIRE spatial data themes (defined 34 spatial data themes within INSPIRE framework).

INSPIRE metadata regulation implementation is based on application schema defined by ISO/TS 19139. Therefore the same rules for data types definition, multiplicity and obligatory shall be valid. However it is important to mention here that positive validation message against ISO does not mean that this applies also for INSPIRE validation. For example an instance of Lineage class is within ISO Core profile optional and within the INSPIRE metadata regulation mandatory.

3. *Metadata crosswalk step 1 - harmonization*

This is an initial and very important step of metadata transformation, which aims to examine both standards in order to understand the definition of individual elements before the semantic mapping. In particular element identification, names, semantic definition, obligation, multiplicity, hierarchical organization, constraints and data types have to be known.

Therefore to understand each metadata element properly we had studied in detail EML specification, ISO19115 standard, and an INSPIRE Metadata regulation briefly introduced in the previous sub-chapters.

EML provides a conceptual framework via online specification in HTML format. For each metadata element is provided following descriptive information (element description component + example):

- **Name**: title
- **Type**: NonEmptyStringType
- **Description of this field**: The 'title' field provides a description of the resource that is being documented that is long enough to differentiate it from other similar resources. Multiple titles may be provided, particularly when trying to express the title in more than one language (use the "xml:lang" attribute to indicate the language if not English/en)
- **Example**: Vernal pool amphibian density data, Isla Vista, 1990-1996
- **Use:** required
- **How many:** unbounded

ISO provides different approach of a conceptual definition, each metadata elements as a discrete unit is defined as an attribute of UML classes (metadata entities) grouped into metadata packages. The second part is data dictionary where following details of each element have taken their place:

- **Identifier:** 360.
- **Name/Role name:** title
- **Short Name:** resTitle
- **Definition:** name by which the cited resource is known
- **Obligation/Condition:** M
- **Maximum occurrence:** 1
- **Data type:** CharacterString
- **Domain:** Free text

INSPIRE metadata regulation provides similar approach as EML (without UML model), since it is based on ISO model. However it has defined some changes relative to ISO definitions, especially in elements naming and their obligation/condition and at same cases also definition (Metadata date). Metadata element details are given as follows:

- **Reference:** 1.1
- **Metadata element:** Resource title
- **Definition:** This a characteristic, and often unique, name by which the resource is known
- **Value domain:** free text
- **Multiplicity:** 1
- **Condition:** textual description of a condition when optional element (element with multiplicity value 0 or 0..* shall appear as mandatory

In order to get ready for the second step each metadata element intended to be mapped and described as can be seen above was studied. Only high level knowledge and semantic understanding of each metadata element might initiate semantic mapping described in the next sub-chapter.

4. *Metadata crosswalk step 2 - semantic mapping*

The second step is aimed at determine the semantic correspondence between the standards to be mapped. This step implies matching between each source and semantically equivalent target element. Therefore a clear and precise definition of each element made in previous harmonization step is very important.

The result of this step might be a matching table where on the left part is listed all metadata elements from source specification to be mapped and on the right part semantic equivalents defined at the target metadata specification. An example of such a matching table is shown in figure 2 below (first section represents the EML elements; second sections shows the ISO19139 elements; the third section shows the corresponding INSPIRE elements).

Fig. 2 Fragment of matching table made between EML and ISO

Metadata crosswalk - EML2ISO - matching table

ISO 19115 Geographic information - metadata (EML elements)

No	Element name	Obligation	Multiplicity	Xpath	Data type
1	title	M	N	eml/dataset/title	NonEmptyStringType
2	abstract	O	1	eml/dataset/abstract	TextType
3	Resource Type: Not defined within EML as an element - a constant has been defined with value 'dataset'				
4	url	M	1	eml/dataset/distribution/online/url	urlType

ISO 19115 Geographic information - metadata (ISO)

Element ID	Element Name	Obligation	Multiplicity	Xpath	Data type	
360	title	M	1..*	gmd:MD_Metadata/gmd:identificationInfo/gmd:MD_DataIdentification/gmd:citation/gmd:CI_Citation/gmd:title/gco:CharacterString	CharacterString	
25	abstract	M	1	gmd:MD_Metadata/gmd:identificationInfo/gmd:MD_DataIdentification/gmd:abstract/gco:CharacterString	CharacterString	
139	level	M	1	nfo/gmd:DQ_DataQuality/gmd:scope/gmd:DQ_Scope/gmd:level/gmd:MD_ScopeCode/@codeListValue	anyURI	
397	linkage	M	1	gmd:MD_Metadata/gmd:distributionInfo/gmd:MD_Distribution/gmd:transferOptions/gmd:MD_DigitalTransferOptions/gmd:onLine/gmd:CI_OnlineResource/gmd:linkage/gmd:URL	URL	

INSPIRE Metadata regulation

Element ID	Element name	Obligation	Number	Xpath	Data type
1.1	Resource title	M	1	derived from ISO 19139	character string
1.2	Resource abstract	M	1	derived from ISO 19139	character string
1.3	Resource type	M	1	derived from ISO 19139	codeList
1.4	Resource locator	C	0..*	derived from ISO 19139	character string expressed as URL

This matching table is then used within the last fourth step a crosswalk implementation. It is often necessary to define additional rules in order to get metadata from the particular source

position to the related target position within nested XML structure. Moreover many more transformation functions may appear. The next section explains the additional transformation rules.

5. *Metadata crosswalk step 3 - additional rules*

This step describes the additional transformation functions that may be required to convert source to target metadata. This implies content conversion rules (simple types, code-lists, complex types), element to element mapping considering obligation (something optional in one system may be required in another), multiplicity (how many times an element may occur) and element occurrence and hierarchical and structural organization (EML and ISO/INSPIRE may differ in the order and element nesting) .

In order to develop a crosswalk which provides ISO equivalent metadata transformed from EML the following transformation functions (available in Altova MapForce software) have been applied:

- **concat: c**oncatenates (appends) two or more values into a single result string. All input values are automatically converted to type string
- **group-by:** groups the input sequence by distinct keys and outputs the series of groups along with their keys
- **string-join: c**oncatenates all the values of the input sequence into one string delimited by whatever character you choose to use as the delimiter character
- **substring-before:** this function returns that part of incoming string that occurs before the predefined test string within it
- **substring-after:** similar as previous one just returns the string occurring after the test string
- **exists:** function which returns true if the node exists, else returns false
- **if-else:** condition function
- **substitute-missing:** function is used to map the current field content if the node exists in the source file, otherwise use the item defined as "replace-with" parameter within function.
- **constants:** function that supplies fixed data to output fields

6. *Metadata crosswalk step 4 - implementation*

The last step implements all the rules defined within the previous steps within the most appropriate technical solution based on metadata application schema transformation.

In our case this task was slightly simplified due to existing application schemas for both metadata EML and ISO based on XML technology as XSD schemas. Altova MapForce is being used to define the transformation rules. This tool provides an easy to use drag and drop data mapping, conversion and integration environment. XML files, databases, flat files, Excel files and Web services can be used as data to be mapped among each other. Mapforce also has code generation (XSLT 1.0/2.0, XQuery, Java, C# and C++) component that allows the transformation to be performed on systems that do not have MapForce installed. MapForce also has a report generator (HTML, RTF or DOC formats) to create more understandable versions of mapping rules within the project. Such a report has been generated from our mapping and is attached to this document as annex V.

We have created a project using Altova MapForce environment called EML2ISO and applied all required steps defined previously (semantic mapping and additional rules). Working environment is shown in figure 3 below.
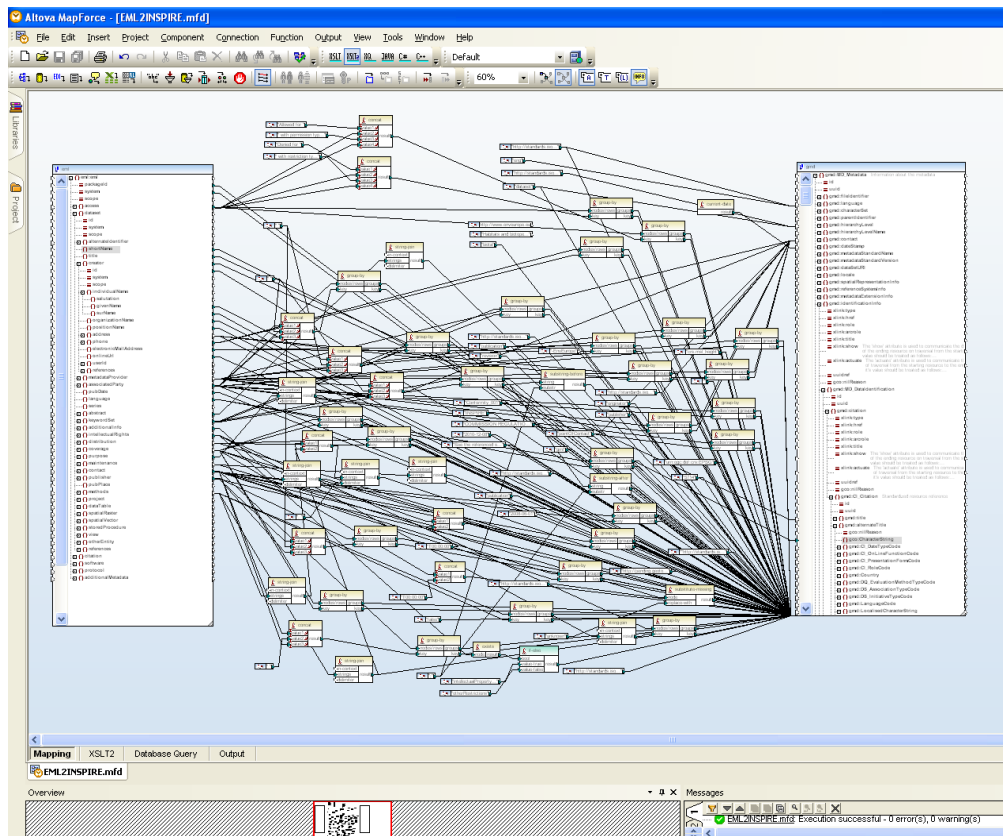
Fig. 3 EML2ISO metadata crosswalk in MapForce mapping environment

MapForce's environment provides a view of XSLT code as well as view of result XML file generated after transformation of input file. The final product of our work is XSLT file eml2iso.xslt, which might be used to transform EML XML metadata record to ISO and INSPIRE compliant metadata record. Obviously an XSLT engine must be used in order to perform such a transformation. Most XML software has XSLT processor embedded as for instance XML Spy or oXygen. We have used both applications to transform EML metadata example into ISO form successfully. The resulting XML files need some editing because there are elements in INSPIRE that do not appear in EML. More information about the result validation procedure is written in annex III. Final product of the transformation eml2iso.xslt file is pasted in annex IV and might be used to perform transformation from any EML XML file to ISO INSPIRE compliant XML metadata record. Apache's Xalan processor is a free alternative and used extensively in Java servlets to perform XSLT.

In practical terms, a web-based metadata entry system will be used. This system is adapted from one developed by the US-LTER. It has been modified to meet the needs of INSPIRE and follows the community profile. It is anticipated that eventually the tool will produce both EML and INSPIRE compliant XML documents directly. Initially the tool will produce the INSPIRE compliant metadata through an XSLT as outlined above.

References

Commission Regulation (EC) No 1205/2008 of 3 December 2008 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards metadata

GEOSS INSPIRE and GMES an Action in Support. Project final report, publishable summary.

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)

EML: Ecological Metadata Language (EML) Specification

ISO (2003): ISO 19115:2003 – Geographic information – Metadata. ISO, Switzerland, 2003

ISO (2007): ISO/TS 19115:2007 – Geographic information – Metadata - XML schema implementation. ISO, Switzerland, 2007

Michener, William K., James W. Brunt, John J. Helly, Thomas B. Kirchner, and Susan G. Stafford. 1997. Nongeospatial metadata for the Ecological Sciences. Ecological Applications 7:330–342.

Michener et al., 1997, Ecological Applications

NATURE-SDIplus Metadata Specification, 2010

Nogueras-Iso, J. et al. (2005) Geographic Information Metadata for Spatial Data Infrastructures - Resources, Interoperability and Information Retrieval. Springer Verlag

Tenopir C, Allard S, Douglass K, Aydinoglu AU, Wu L, et al. (2011) Data Sharing by Scientists: Practices and Perceptions. PLoS ONE 6(6): e21101. doi:10.1371/journal.pone.0021101

Annex I   An example of EnvEurope (EML) metadata record coded in XML

```xml
<?xml version="1.0" encoding="UTF-8"?>
<eml:eml packageId="CNR_IREA_ISE-phyt_candia_ao_1986" system="http://enveurope.eu/dataportal"
xmlns:eml="eml://ecoinformatics.org/eml-2.1.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="eml://ecoinformatics.org/eml-2.1.0
http://10.12.150.11/svn/enveurope/branches/A1_DataManagement/Metadata/EML2INSPIRE/emlMod/eml.xsd">
<access authSystem="http://enveurope.geocatalogue.ise.cnr.it/europe/">
        <allow>
                <principal>EnvEurope (LTER-Europe)</principal>
                <permission>Free</permission>
        </allow>
        <allow>
                <principal>Public</principal>
                <permission>Free upon request</permission>
        </allow>
</access>
<dataset>
        <title>Density and Biomass of phytoplankton in Lake Candia (1986)</title>
        <creator>
                <individualName>
                        <givenName>Alessandro</givenName>
                        <surName>Oggioni</surName>
                </individualName>
                <organizationName>CNR-IREA(Institute for Electromagnetic Sensing of the
Environment)</organizationName>
                <electronicMailAddress>a.oggioni@irea.cnr.it</electronicMailAddress>
        </creator>
        <creator>
                <individualName>
                        <givenName>Giuseppe</givenName>
                        <surName>Morabito</surName>
                </individualName>
                <organizationName>CNR-ISE(Institute of Ecosystem Study)</organizationName>
                <electronicMailAddress>g.morabito@ise.cnr.it</electronicMailAddress>
        </creator>
        <metadataProvider>
                <individualName>
                        <givenName>Tomas</givenName>
                        <surName>Kliment</surName>
                </individualName>
                <organizationName>CNR-ISMAR (Institute for Marine Sciences)</organizationName>
                <electronicMailAddress>t.kliment@ismar.cnr.it</electronicMailAddress>
        </metadataProvider>
        <metadataDate>2011-11-22</metadataDate>
        <pubDate>2011-11-21</pubDate>
        <language>ita</language>
        <abstract>
                <section>
                        <para>The dataset covers the evolution of biomass and density of phytoplankton in Lake
Candia for the year 1986. The sampling was carried out according to sampling classic centre of the lake, the point of
maximum depth, using the tear-off bottle. Samples were collected every meter of depth and then integrated into a single
rate of water, in order to obtain a sample between 0 and 6 m deep.</para>
                </section>
        </abstract>
        <keywordSet>
                <keyword>biotic</keyword>
                <keyword>biomass</keyword>
                <keyword>bulk density</keyword>
```

```xml
                <keyword>lakes</keyword>
                <keywordThesaurus>EnvEurope Thesaurus;2012-02-01</keywordThesaurus>
        </keywordSet>
        <keywordSet>
                <keyword>ecosystem ecology</keyword>
                <keyword>phytoplankton</keyword>
                <keywordThesaurus>GEMET - Concepts version 2.4;2010-01-13</keywordThesaurus>
        </keywordSet>
        <keywordSet>
                <keyword>C : Inland surface waters</keyword>
                <keyword>C1.3 : Permanent eutrophic lakes, ponds and pools</keyword>
                <keywordThesaurus>EUNIS biodiversity database - Habitat types;2009-02-01</keywordThesaurus>
        </keywordSet>
        <keywordSet>
                <keyword>Species distribution</keyword>
                <keyword>Environmental Monitoring Facilities</keyword>
                <keywordThesaurus>INSPIRE Feature Concept Dictionary;2008-12-05</keywordThesaurus>
        </keywordSet>
        <keywordSet>
                <keyword>Lago di Candia</keyword>
                <keywordThesaurus>Getty Thesaurus of Geographic Names;2010-01-13</keywordThesaurus>
        </keywordSet>
        <intellectualRights>
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                        <para>Co-authorship on publications resulting from use of the dataset</para>
                </section>
        </intellectualRights>
        <distribution>
                <online>
                        <onlineDescription>Sensor Observation Get Observation request</onlineDescription>

        <url>http://sos.ise.cnr.it/sos?request=GetObservation&amp;service=SOS&amp;OFFERING=lake_level&amp;obser
vedproperty=urn:ogc:def:property:OGC:1.0.30:lake_level&amp;version=1.0.0&amp;RESPONSEFORMAT=text/xml;subtype=
%22om/1.0.0%22</url>
                </online>
                <online>
                        <onlineDescription>Sensor Observation Service Get Capabilites request</onlineDescription>
                        <url>http://sos.ise.cnr.it/sos?service=SOS&amp;request=GetCapabilities</url>
                </online>
                <online>
                        <onlineDescription>URI of the resource within the ISE institute subversion
server</onlineDescription>
        <url>http://10.12.150.11/svn/enveurope/branches/A1_DataManagement/Metadata/EML2INSPIRE/aoggioni.8.1_
EML.xml</url>
                </online>
        </distribution>
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                        <boundingCoordinates>
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                                <eastBoundingCoordinate>7.93573</eastBoundingCoordinate>
                                <northBoundingCoordinate>45.34080</northBoundingCoordinate>
                                <southBoundingCoordinate>45.31461</southBoundingCoordinate>
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                                        <altitudeMaximum>226</altitudeMaximum>
                                        <altitudeUnits>meter</altitudeUnits>
                                </boundingAltitudes>
                        </boundingCoordinates>
                </geographicCoverage>
```

```xml
<temporalCoverage>
	<rangeOfDates>
		<beginDate>
			<calendarDate>1986-03-06</calendarDate>
		</beginDate>
		<endDate>
			<calendarDate>1986-12-17</calendarDate>
		</endDate>
	</rangeOfDates>
</temporalCoverage>
<taxonomicCoverage>
	<taxonomicClassification>
		<taxonomicClassification>
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			<taxonRankValue>Chrysophyceae</taxonRankValue>
		</taxonomicClassification>
		<taxonomicClassification>
			<taxonRankName>Species</taxonRankName>
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		</taxonomicClassification>
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		</taxonomicClassification>
		<taxonomicClassification>
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			<taxonRankValue>Mallomonas akrokomos</taxonRankValue>
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		<taxonRankValue>Rhabdogloea smithii</taxonRankValue>
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			<taxonRankName>Species</taxonRankName>
			<taxonRankValue>Scenedesmus biyugatus</taxonRankValue>
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			<taxonRankValue>Staurastrum gracile</taxonRankValue>
		</taxonomicClassification>
		<taxonomicClassification>
```

```
                              <taxonRankName>Species</taxonRankName>
                              <taxonRankValue>Staurastrum lunatum</taxonRankValue>
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  <maintenance>
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         <maintenanceUpdateFrequency>daily</maintenanceUpdateFrequency>
  </maintenance>
  <contact>
         <individualName>
                <surName>Oggioni</surName>
         </individualName>
         <electronicMailAddress>a.oggioni@ise.cnr.it</electronicMailAddress>
  </contact>
  <methods>
         <methodStep>
                <description>
                       <section>
                              <title>Water column sampling with different levels (depths) for
phytoplankton</title>
                              <para>http://www.enveurope.eu/envthes/en/collections/methods</para>
                              <para>
The phytoplankton sampling design was carried out usign Ruttner's bottle,
equal rates of water were collected every meter of depth between 0 and 4 meters, in the euphotic zone.
All the water so taken was mixed together so as to obtain a integrated sample.
It 'been taken a sub-sample of 100 ml, placed in a glass bottle and fixed with solution
Lugol.
```

The quantitative and qualitative analysis of phytoplankton was carried out inverted microscope accordin to Utermöhl method(1931), bearing in mind the considerations of Lund, Kipling and Le Cren (1958).
Utermöhl, H. 1931. Uber das umgekehrte mikroscop. Arch. Hydrobiol. Plankt., 22: 643-645.
Lund, J.W.G., C. Kipling and E.D. Le Cren. 1958. The inverted microscope metod of estimating algal numbers and the statistical basis of estimation by cunting. Hydrobiologia, 11: 143-170.

```
                                        </para>
                                </section>
                        </description>
                        <instrumentation>Tear Bottle, year of production 1999, Model
number:SJ900AXCD</instrumentation>
                </methodStep>
                <sampling>
                        <studyExtent>
                                <description>Lake Candia
                                </description>
                        </studyExtent>
                        <samplingDescription>
                                <para>Each sample 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.</para>
                        </samplingDescription>
                </sampling>
        </methods>
</dataset>
</eml:eml>
```

Annex II   EnvEurope (EML) metadata record transformed to INSPIRE (EN ISO) compliant metadata record

```xml
<?xml version="1.0" encoding="UTF-8"?>
<gmd:MD_Metadata xmlns:gco="http://www.isotc211.org/2005/gco" xmlns:gmd="http://www.isotc211.org/2005/gmd"
xmlns:gml="http://www.opengis.net/gml" xmlns:gsr="http://www.isotc211.org/2005/gsr"
xmlns:gss="http://www.isotc211.org/2005/gss" xmlns:gts="http://www.isotc211.org/2005/gts"
xmlns:xlink="http://www.w3.org/1999/xlink" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.isotc211.org/2005/gmd
http://schemas.opengis.net/iso/19139/20060504/gmd/gmd.xsd">
<gmd:language>
        <gmd:LanguageCode
codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Codelist/ML_gmxCodeli
sts.xml#LanguageCode" codeListValue="eng">eng</gmd:LanguageCode>
</gmd:language>
<gmd:hierarchyLevel>
        <gmd:MD_ScopeCode
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</gmd:hierarchyLevel>
<gmd:contact>
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                </gmd:individualName>
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                <gmd:role>
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                </gmd:role>
        </gmd:CI_ResponsibleParty>
</gmd:contact>
<gmd:dateStamp>
        <gco:Date>2011-11-22+01:00</gco:Date>
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<gmd:identificationInfo>
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                <gmd:citation>
```

```
<gmd:CI_Citation>
    <gmd:title>
        <gco:CharacterString>Density and Biomass of phytoplankton in Lake
Candia (1986)</gco:CharacterString>
    </gmd:title>
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            <gmd:date>
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            </gmd:date>
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sts.xml#CI_DateTypeCode" codeListValue="publication">publication</gmd:CI_DateTypeCode>
            </gmd:dateType>
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    </gmd:date>
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        <gmd:RS_Identifier>
            <gmd:code>
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phyt_candia_ao_1986</gco:CharacterString>
            </gmd:code>
            <gmd:codeSpace>
                <gco:CharacterString>http://enveurope.eu/dataportal</gco:CharacterString>
            </gmd:codeSpace>
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    </gmd:identifier>
</gmd:CI_Citation>
</gmd:citation>
<gmd:abstract>
    <gco:CharacterString>The dataset covers the evolution of biomass and density of
phytoplankton in Lake Candia for the year 1986. The sampling was carried out according to sampling classic centre of the
lake, the point of maximum depth, using the tear-off bottle. Samples were collected every meter of depth and then
integrated into a single rate of water, in order to obtain a sample between 0 and 6 m deep.</gco:CharacterString>
</gmd:abstract>
<gmd:pointOfContact>
    <gmd:CI_ResponsibleParty>
        <gmd:individualName>
            <gco:CharacterString>Alessandro Oggioni</gco:CharacterString>
        </gmd:individualName>
        <gmd:organisationName>
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the Environment)</gco:CharacterString>
        </gmd:organisationName>
        <gmd:positionName/>
        <gmd:contactInfo>
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                        <gmd:electronicMailAddress>
                            <gco:CharacterString>a.oggioni@irea.cnr.it</gco:CharacterString>
                        </gmd:electronicMailAddress>
                    </gmd:CI_Address>
                </gmd:address>
                <gmd:onlineResource>
                    <gmd:CI_OnlineResource>
                        <gmd:linkage/>
                    </gmd:CI_OnlineResource>
                </gmd:onlineResource>
            </gmd:CI_Contact>
```

```
                              </gmd:contactInfo>
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property=urn:ogc:def:property:OGC:1.0.30:lake_level&amp;version=1.0.0&amp;RESPONSEFORMAT=text/xml;subtype=%22
om/1.0.0%22</gmd:URL>
                                                    </gmd:linkage>
                                                    <gmd:description>
                                                            <gco:CharacterString>Sensor Observation Get
Observation request</gco:CharacterString>
                                                    </gmd:description>
                                            </gmd:CI_OnlineResource>
                                    </gmd:onLine>
                                    <gmd:onLine>
                                            <gmd:CI_OnlineResource>
                                                    <gmd:linkage>
                            <gmd:URL>http://sos.ise.cnr.it/sos?service=SOS&amp;request=GetCapabilities</gmd:URL>
                                                    </gmd:linkage>
                                                    <gmd:description>
                                                            <gco:CharacterString>Sensor Observation Service Get
Capabilites request</gco:CharacterString>
                                                    </gmd:description>
                                            </gmd:CI_OnlineResource>
                                    </gmd:onLine>
                                    <gmd:onLine>
                                            <gmd:CI_OnlineResource>
                                                    <gmd:linkage>
                <gmd:URL>http://10.12.150.11/svn/enveurope/branches/A1_DataManagement/Metadata/EML2INSPIRE/aoggio
ni.8.1_EML.xml</gmd:URL>
                                                    </gmd:linkage>
                                                    <gmd:description>
                                                            <gco:CharacterString>URI of the resource within the
ISE institute subversion server</gco:CharacterString>
                                                    </gmd:description>
                                            </gmd:CI_OnlineResource>
                                    </gmd:onLine>
                            </gmd:MD_DigitalTransferOptions>
                    </gmd:transferOptions>
            </gmd:MD_Distribution>
</gmd:distributionInfo>
<gmd:dataQualityInfo>
        <gmd:DQ_DataQuality>
                <gmd:scope>
                        <gmd:DQ_Scope>
                                <gmd:level>
                                        <gmd:MD_ScopeCode
codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Codelist/ML_gmxCodeli
sts.xml#MD_ScopeCode" codeListValue="dataset">dataset</gmd:MD_ScopeCode>
                                </gmd:level>
                        </gmd:DQ_Scope>
                </gmd:scope>
                <gmd:report>
                        <gmd:DQ_DomainConsistency>
                                <gmd:measureIdentification>
                                        <gmd:RS_Identifier>
                                                <gmd:code>
                                        <gco:CharacterString>Conformity_001</gco:CharacterString>
                                                </gmd:code>
                                                <gmd:codeSpace>
                                                        <gco:CharacterString>INSPIRE</gco:CharacterString>
                                                </gmd:codeSpace>
                                        </gmd:RS_Identifier>
                                </gmd:measureIdentification>
                                <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/Codelist/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:lineage>
                    <gmd:LI_Lineage>
                        <gmd:statement>
```

<gco:CharacterString>Methods description: Water column sampling with different levels (depths) for phytoplanktonhttp://www.enveurope.eu/envthes/en/collections/methods
The phytoplankton sampling design was carried out usign Ruttner's bottle, equal rates of water were collected every meter of depth between 0 and 4 meters, in the euphotic zone. All the water so taken was mixed together so as to obtain a integrated sample. It 'been taken a sub-sample of 100 ml, placed in a glass bottle and fixed with solution Lugol. The quantitative and qualitative analysis of phytoplankton was carried out inverted microscope accordin to Utermöhl method(1931), bearing in mind the considerations of Lund, Kipling and Le Cren (1958).
Utermöhl, H. 1931. Uber das umgekehrte mikroscop. Arch. Hydrobiol. Plankt., 22: 643-645.
Lund, J.W.G., C. Kipling and E.D. Le Cren. 1958. The inverted microscope metod of estimating algal numbers and the statistical basis of estimation by cunting. Hydrobiologia, 11: 143-170. Sampling description: Each sample 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. Instrumentation used: Tear Bottle, year of production 1999, Model number:SJ900AXCD</gco:CharacterString>

```
                        </gmd:statement>
                    </gmd:LI_Lineage>
                </gmd:lineage>
            </gmd:DQ_DataQuality>
        </gmd:dataQualityInfo>
    </gmd:MD_Metadata>
```

Annex III   Metadata validation report against INSPIRE and ISO

Sample EML metadata record *Density and Biomass of phytoplankton in Lake Candia (1986)_EML.xml* (pasted in annex I) has been firstly transformed to ISO form using XSLT file *eml2iso.xslt* via processors embed in Altova XML Spy and oXygen. The same tools provide also validation functionality against XSD schema either referenced directly from XML file via xsi:schemaLocation attribute in the root element or externaly from either local directory or URL schema destination. The file resulting from transformation using oXygen *Density and Biomass of phytoplankton in Lake Candia (1986)_ISO_oXygen.xml* has been validated against ISO gmd schema with 0 validation errors (figure 4).
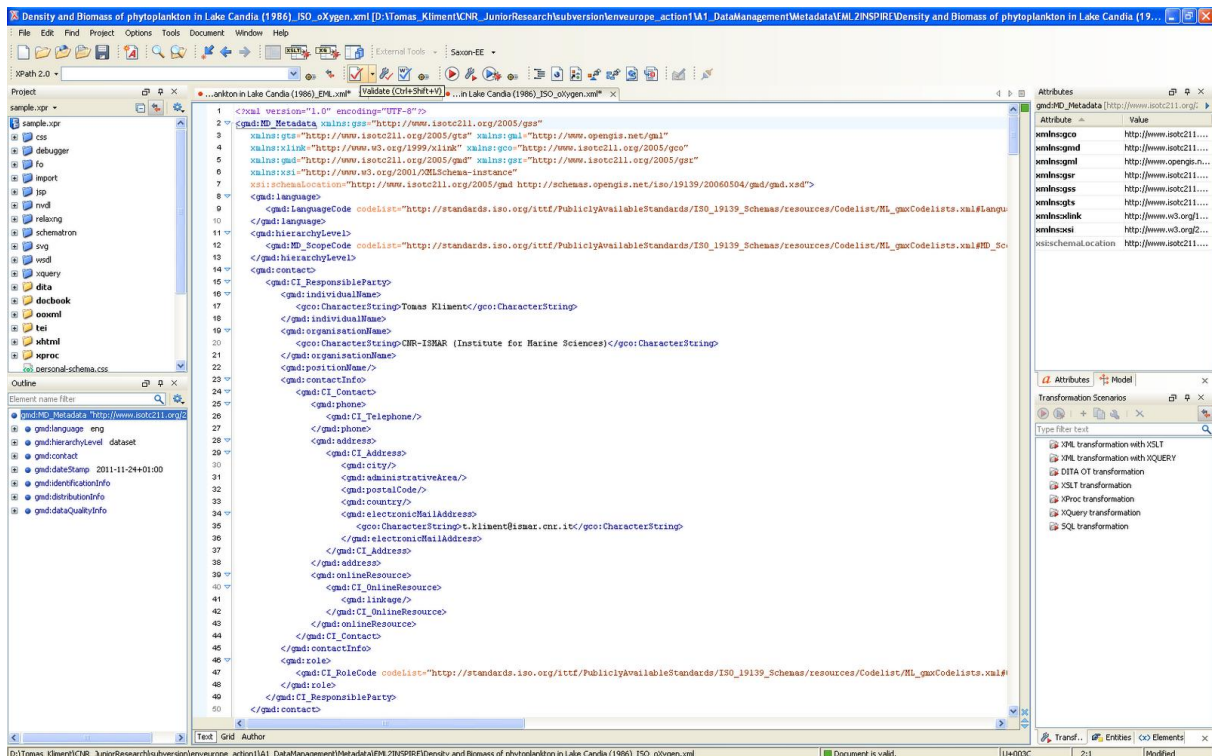
Fig. 4 Validation in oXygen

The same process (transformation and validation) has been performed also using Altova XML Spy. The new created file *Density and Biomass of phytoplankton in Lake Candia (1986)_ISO_Spy.xml* has been validated using embedded XML parser with the same results 0 validation errors (Figure 5). In order to check transformation and validation procedures between both tools a file comparison function has been used with positive results. Both transformed files are with the same content and structure. Regarding the validation this povided again good results without any valdiation errors. This XSD schema has been used for valiation: http://schemas.opengis.net/iso/19139/20060504/gmd/gmd.xsd
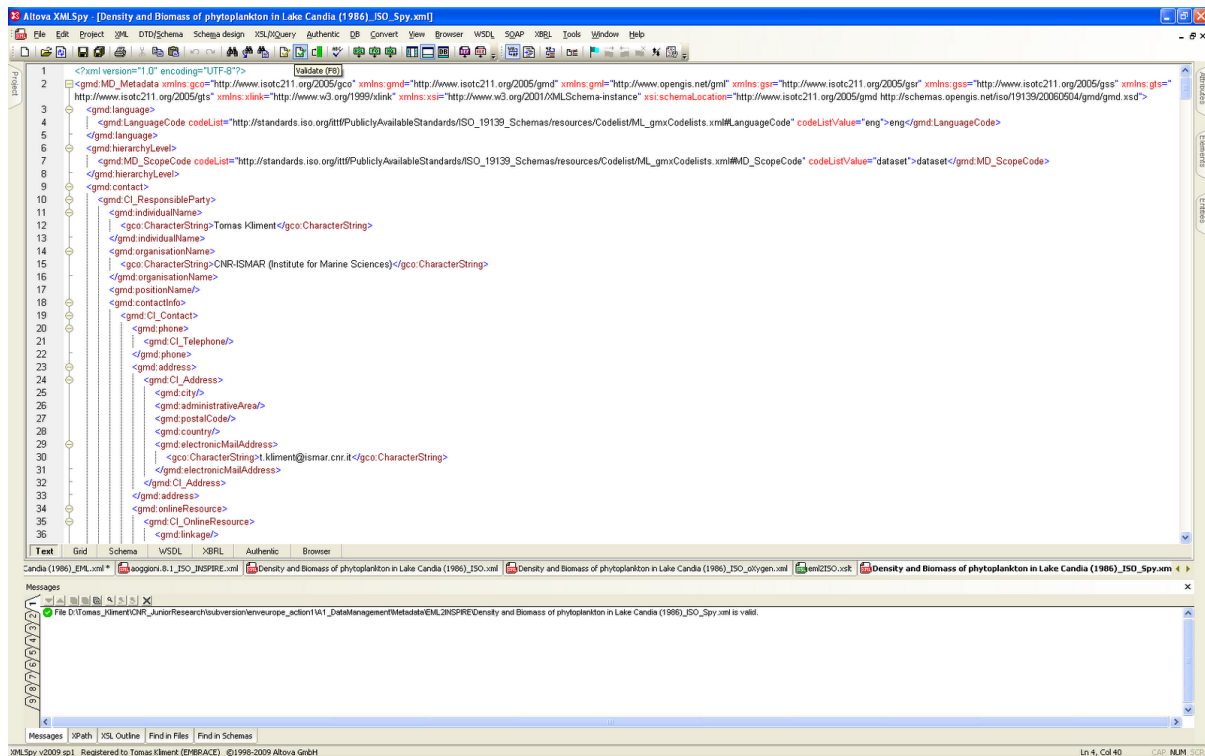
Fig. 5 Validation in Altova XML Spy

The second important step of validation procedure was to do the same with INSPIRE validation service. Since we had only 2 metadata record to be validated, we have used web-based client of this service provided via INSPIRE Geoportal web page (http://www.inspire-geoportal.eu/). A web page part metadata validator provides an interface where any user can upload his metadata record in ISO XML form and performs validation against INSPIRE requirements.
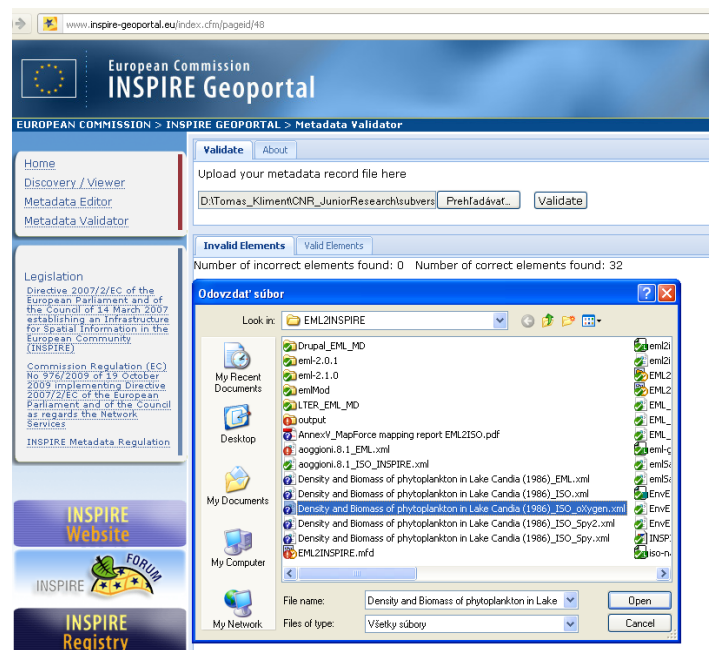
Fig. 6 Validation in INSPIRE Geoportal Metadata Validator

Validation against INSPIRE brought positive results for both files: 0 incorrect and 32 correct elements.

Annex IV   XSLT transformation file eml2iso.xslt

```xml
<?xml version="1.0" encoding="UTF-8"?>
<!--
This file was generated by Altova MapForce 2009sp1

YOU SHOULD NOT MODIFY THIS FILE, BECAUSE IT WILL BE
OVERWRITTEN WHEN YOU RE-RUN CODE GENERATION.

Refer to the Altova MapForce Documentation for further details.
http://www.altova.com/mapforce
-->
<xsl:stylesheet version="2.0" xmlns:xsl="http://www.w3.org/1999/XSL/Transform"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:acc="eml://ecoinformatics.org/access-2.1.0"
xmlns:att="eml://ecoinformatics.org/attribute-2.1.0" xmlns:con="eml://ecoinformatics.org/constraint-2.1.0"
xmlns:cov="eml://ecoinformatics.org/coverage-2.1.0" xmlns:dat="eml://ecoinformatics.org/dataTable-2.1.0"
xmlns:ds="eml://ecoinformatics.org/dataset-2.1.0" xmlns:doc="eml://ecoinformatics.org/documentation-2.1.0"
xmlns:n="eml://ecoinformatics.org/eml-2.1.0" xmlns:ent="eml://ecoinformatics.org/entity-2.1.0"
xmlns:cit="eml://ecoinformatics.org/literature-2.1.0" xmlns:md="eml://ecoinformatics.org/methods-2.1.0"
xmlns:rp="eml://ecoinformatics.org/party-2.1.0" xmlns:phys="eml://ecoinformatics.org/physical-2.1.0"
xmlns:proj="eml://ecoinformatics.org/project-2.1.0" xmlns:prot="eml://ecoinformatics.org/protocol-2.1.0"
xmlns:res="eml://ecoinformatics.org/resource-2.1.0" xmlns:sw="eml://ecoinformatics.org/software-2.1.0"
xmlns:sr="eml://ecoinformatics.org/spatialRaster-2.1.0" xmlns:spref="eml://ecoinformatics.org/spatialReference-2.1.0"
xmlns:sv="eml://ecoinformatics.org/spatialVector-2.1.0" xmlns:sp="eml://ecoinformatics.org/storedProcedure-2.1.0"
xmlns:txt="eml://ecoinformatics.org/text-2.1.0" xmlns:unit="eml://ecoinformatics.org/units-2.1.0"
xmlns:v="eml://ecoinformatics.org/view-2.1.0" xmlns:gco="http://www.isotc211.org/2005/gco"
xmlns:gmd="http://www.isotc211.org/2005/gmd" xmlns:gsr="http://www.isotc211.org/2005/gsr"
xmlns:gss="http://www.isotc211.org/2005/gss" xmlns:gts="http://www.isotc211.org/2005/gts"
xmlns:gml="http://www.opengis.net/gml" xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:xs="http://www.w3.org/2001/XMLSchema" xmlns:fn="http://www.w3.org/2005/xpath-functions"
xmlns:grp="http://www.altova.com/Mapforce/grouping" exclude-result-prefixes="acc att cit con cov dat doc ds ent fn grp
md n phys proj prot res rp sp spref sr sv sw txt unit v xs xsi xsl">
<xsl:output method="xml" encoding="UTF-8" indent="yes"/>
<xsl:function name="grp:key06fb0ee8">
        <xsl:param name="cur"/>
        <xsl:for-each select="$cur/calendarDate">
                <xsl:sequence select="xs:string(xs:string(.))"/>
        </xsl:for-each>
</xsl:function>
<xsl:function name="grp:key072a39c8">
        <xsl:param name="cur"/>
        <xsl:for-each select="$cur/individualName">
                <xsl:variable name="var56_individualName" as="node()" select="."/>
                <xsl:for-each select="givenName">
                        <xsl:sequence select="fn:concat(fn:concat(xs:string(.), ' '),
xs:string($var56_individualName/surName))"/>
                </xsl:for-each>
        </xsl:for-each>
</xsl:function>
<xsl:function name="grp:key071df8f0">
        <xsl:param name="cur"/>
        <xsl:for-each select="$cur/individualName">
                <xsl:variable name="var92_individualName" as="node()" select="."/>
                <xsl:for-each select="givenName">
                        <xsl:sequence select="fn:concat(fn:concat(xs:string(.), ' '),
xs:string($var92_individualName/surName))"/>
                </xsl:for-each>
        </xsl:for-each>
</xsl:function>
```

```
<xsl:function name="grp:key070b0b80">
        <xsl:param name="cur"/>
        <xsl:for-each select="$cur/individualName">
                <xsl:variable name="var130_individualName" as="node()" select="."/>
                <xsl:for-each select="givenName">
                        <xsl:sequence select="fn:concat(fn:concat(xs:string(.), ' '),
xs:string($var130_individualName/surName))"/>
                </xsl:for-each>
        </xsl:for-each>
</xsl:function>
<xsl:function name="grp:key0732a750">
        <xsl:param name="cur"/>
        <xsl:for-each select="$cur/individualName">
                <xsl:variable name="var166_individualName" as="node()" select="."/>
                <xsl:for-each select="givenName">
                        <xsl:sequence select="fn:concat(fn:concat(xs:string(.), ' '),
xs:string($var166_individualName/surName))"/>
                </xsl:for-each>
        </xsl:for-each>
</xsl:function>
<xsl:function name="grp:key073b6018">
        <xsl:param name="cur"/>
        <xsl:for-each select="$cur/keywordThesaurus">
                <xsl:sequence select="xs:string(.)"/>
        </xsl:for-each>
</xsl:function>
<xsl:function name="grp:key070d7e38">
        <xsl:param name="cur"/>
        <xsl:for-each select="$cur/keyword">
                <xsl:sequence select="xs:string(.)"/>
        </xsl:for-each>
</xsl:function>
<xsl:function name="grp:key07172698">
        <xsl:param name="cur"/>
        <xsl:for-each select="$cur/taxonRankValue">
                <xsl:sequence select="xs:string(.)"/>
        </xsl:for-each>
</xsl:function>
<xsl:function name="grp:key070ca570">
        <xsl:param name="cur"/>
        <xsl:for-each select="$cur/allow">
                <xsl:variable name="var221_allow" as="node()" select="."/>
                <xsl:for-each select="principal">
                        <xsl:variable name="var223_principal" as="node()" select="."/>
                        <xsl:for-each select="$var221_allow/permission">
                                <xsl:sequence select="fn:concat(fn:concat(fn:concat('Allowed for ',
xs:string($var223_principal)), ' with permission type '), xs:string(xs:string(.)))"/>
                        </xsl:for-each>
                </xsl:for-each>
        </xsl:for-each>
</xsl:function>
<xsl:function name="grp:key0711d6f8">
        <xsl:param name="cur"/>
        <xsl:for-each select="$cur/deny">
                <xsl:variable name="var231_deny" as="node()" select="."/>
                <xsl:for-each select="principal">
                        <xsl:variable name="var233_principal" as="node()" select="."/>
                        <xsl:for-each select="$var231_deny/permission">
                                <xsl:sequence select="fn:concat(fn:concat(fn:concat('Denied for ',
xs:string($var233_principal)), ' with restriction type '), xs:string(xs:string(.)))"/>
                        </xsl:for-each>
</xsl:function>
```

```
                        </xsl:for-each>
                </xsl:for-each>
</xsl:function>
<xsl:function name="grp:key0722c840">
        <xsl:param name="cur"/>
        <xsl:for-each select="$cur/url">
                <xsl:sequence select="xs:string(xs:anyURI(.))"/>
        </xsl:for-each>
</xsl:function>
<xsl:template match="/">
        <gmd:MD_Metadata>
                <xsl:attribute name="xsi:schemaLocation" separator=" ">
                        <xsl:sequence select="'http://www.isotc211.org/2005/gmd
http://schemas.opengis.net/iso/19139/20060504/gmd/gmd.xsd'"/>
                </xsl:attribute>
                <xsl:variable name="var1_instance" as="node()" select="."/>
                <gmd:language>
                        <gmd:LanguageCode>
                                <xsl:attribute name="codeList">
                                        <xsl:sequence
select="xs:string(xs:anyURI('http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Codeli
st/ML_gmxCodelists.xml#LanguageCode'))"/>
                                </xsl:attribute>
                                <xsl:attribute name="codeListValue">
                                        <xsl:sequence select="xs:string(xs:anyURI('eng'))"/>
                                </xsl:attribute>
                                <xsl:sequence select="'eng'"/>
                        </gmd:LanguageCode>
                </gmd:language>
                <gmd:hierarchyLevel>
                        <gmd:MD_ScopeCode>
                                <xsl:attribute name="codeList">
                                        <xsl:sequence
select="xs:string(xs:anyURI('http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Codeli
st/ML_gmxCodelists.xml#MD_ScopeCode'))"/>
                                </xsl:attribute>
                                <xsl:attribute name="codeListValue">
                                        <xsl:sequence select="xs:string(xs:anyURI('dataset'))"/>
                                </xsl:attribute>
                                <xsl:sequence select="'dataset'"/>
                        </gmd:MD_ScopeCode>
                </gmd:hierarchyLevel>
                <gmd:contact>
                        <gmd:CI_ResponsibleParty>
                                <xsl:for-each select="$var1_instance/n:eml/dataset/metadataProvider">
                                        <xsl:variable name="var2_metadataProvider" as="node()" select="."/>
                                        <xsl:if test="$var2_metadataProvider/@id">
                                                <xsl:attribute name="id">
                                                        <xsl:sequence
select="xs:string(xs:ID(xs:string(@id)))"/>
                                                </xsl:attribute>
                                        </xsl:if>
                                </xsl:for-each>
                                <gmd:individualName>
                                        <xsl:for-each
select="$var1_instance/n:eml/dataset/metadataProvider/individualName">
                                                <xsl:variable name="var4_individualName" as="node()" select="."/>
                                                <xsl:for-each select="givenName">
                                                        <gco:CharacterString>
                                                                <xsl:sequence
select="fn:concat(fn:concat(xs:string(.), ' '), xs:string($var4_individualName/surName))"/>
```

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```
                                </gco:CharacterString>
                            </xsl:for-each>
                        </xsl:for-each>
                    </gmd:individualName>
                    <gmd:organisationName>
                        <xsl:for-each
select="$var1_instance/n:eml/dataset/metadataProvider/organizationName">
                            <gco:CharacterString>
                                <xsl:sequence select="xs:string(.)"/>
                            </gco:CharacterString>
                        </xsl:for-each>
                    </gmd:organisationName>
                    <gmd:positionName>
                        <xsl:for-each
select="$var1_instance/n:eml/dataset/metadataProvider/positionName">
                            <gco:CharacterString>
                                <xsl:sequence select="xs:string(.)"/>
                            </gco:CharacterString>
                        </xsl:for-each>
                    </gmd:positionName>
                    <gmd:contactInfo>
                        <gmd:CI_Contact>
                            <gmd:phone>
                                <gmd:CI_Telephone>
                                    <xsl:for-each-group
select="$var1_instance/n:eml/dataset/metadataProvider/phone" group-by="xs:string(.)">
                                        <xsl:variable
name="var14_cur_result_groupby" as="xs:string" select="current-grouping-key()"/>
                                        <gmd:voice>
                                            <gco:CharacterString>
                                                <xsl:sequence
select="$var14_cur_result_groupby"/>
                                            </gco:CharacterString>
                                        </gmd:voice>
                                    </xsl:for-each-group>
                                </gmd:CI_Telephone>
                            </gmd:phone>
                            <gmd:address>
                                <gmd:CI_Address>
                                    <xsl:for-each-group
select="$var1_instance/n:eml/dataset/metadataProvider/address/deliveryPoint" group-by="xs:string(.)">
                                        <xsl:variable
name="var18_cur_result_groupby" as="xs:string" select="current-grouping-key()"/>
                                        <gmd:deliveryPoint>
                                            <gco:CharacterString>
                                                <xsl:sequence
select="$var18_cur_result_groupby"/>
                                            </gco:CharacterString>
                                        </gmd:deliveryPoint>
                                    </xsl:for-each-group>
                                    <gmd:city>
                                        <xsl:for-each
select="$var1_instance/n:eml/dataset/metadataProvider/address/city">
                                            <gco:CharacterString>
                                                <xsl:sequence
select="xs:string(.)"/>
                                            </gco:CharacterString>
                                        </xsl:for-each>
                                    </gmd:city>
                                    <gmd:administrativeArea>
```

```
                                                            <xsl:for-each
select="$var1_instance/n:eml/dataset/metadataProvider/address/administrativeArea">
                                                                <gco:CharacterString>
                                                                    <xsl:sequence
select="xs:string(.)"/>
                                                                </gco:CharacterString>
                                                            </xsl:for-each>
                                                        </gmd:administrativeArea>
                                                        <gmd:postalCode>
                                                            <xsl:for-each
select="$var1_instance/n:eml/dataset/metadataProvider/address/postalCode">
                                                                <gco:CharacterString>
                                                                    <xsl:sequence
select="xs:string(.)"/>
                                                                </gco:CharacterString>
                                                            </xsl:for-each>
                                                        </gmd:postalCode>
                                                        <gmd:country>
                                                            <xsl:for-each
select="$var1_instance/n:eml/dataset/metadataProvider/address/country">
                                                                <gco:CharacterString>
                                                                    <xsl:sequence
select="xs:string(.)"/>
                                                                </gco:CharacterString>
                                                            </xsl:for-each>
                                                        </gmd:country>
                                                        <xsl:for-each-group
select="$var1_instance/n:eml/dataset/metadataProvider/electronicMailAddress" group-by="xs:string(.)">
                                                            <xsl:variable
name="var30_cur_result_groupby" as="xs:string" select="current-grouping-key()"/>
                                                            <gmd:electronicMailAddress>
                                                                <gco:CharacterString>
                                                                    <xsl:sequence
select="$var30_cur_result_groupby"/>
                                                                </gco:CharacterString>
                                                            </gmd:electronicMailAddress>
                                                        </xsl:for-each-group>
                                                    </gmd:CI_Address>
                                                </gmd:address>
                                                <gmd:onlineResource>
                                                    <gmd:CI_OnlineResource>
                                                        <gmd:linkage>
                                                            <xsl:for-each
select="$var1_instance/n:eml/dataset/metadataProvider/onlineUrl">
                                                                <gmd:URL>
                                                                    <xsl:sequence
select="xs:string(xs:anyURI(.))"/>
                                                                </gmd:URL>
                                                            </xsl:for-each>
                                                        </gmd:linkage>
                                                    </gmd:CI_OnlineResource>
                                                </gmd:onlineResource>
                                            </gmd:CI_Contact>
                                        </gmd:contactInfo>
                                        <gmd:role>
                                            <gmd:CI_RoleCode>
                                                <xsl:attribute name="codeList">
                                                    <xsl:sequence
select="xs:string(xs:anyURI('http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Codelist/ML_gmxCodelists.xml#CI_RoleCode'))"/>
                                                </xsl:attribute>
```

```
                                                    <xsl:attribute name="codeListValue">
                                                            <xsl:sequence
select="xs:string(xs:anyURI('pointOfContact'))"/>
                                                    </xsl:attribute>
                                                    <xsl:sequence select="'pointOfContact'"/>
                                            </gmd:CI_RoleCode>
                                    </gmd:role>
                            </gmd:CI_ResponsibleParty>
                    </gmd:contact>
                    <gmd:dateStamp>
                            <gco:Date>
                                    <xsl:sequence select="xs:string(xs:string(xs:string(fn:current-date())))"/>
                            </gco:Date>
                    </gmd:dateStamp>
                    <gmd:identificationInfo>
                            <gmd:MD_DataIdentification>
                                    <gmd:citation>
                                            <gmd:CI_Citation>
                                                    <gmd:title>
                                                            <xsl:for-each
select="$var1_instance/n:eml/dataset/title">

                                                                    <gco:CharacterString>
                                                                            <xsl:sequence
select="xs:string(.)"/>

                                                                    </gco:CharacterString>
                                                            </xsl:for-each>
                                                    </gmd:title>
                                                    <gmd:alternateTitle>
                                                            <xsl:for-each
select="$var1_instance/n:eml/dataset/shortName">

                                                                    <gco:CharacterString>
                                                                            <xsl:sequence
select="xs:string(.)"/>

                                                                    </gco:CharacterString>
                                                            </xsl:for-each>
                                                    </gmd:alternateTitle>
                                                    <gmd:date>
                                                            <gmd:CI_Date>
                                                                    <gmd:date>
                                                                            <xsl:for-each
select="$var1_instance/n:eml/dataset/pubDate">

                                                                                    <gco:Date>
                                                                                            <xsl:sequence
select="xs:string(xs:string(xs:string(xs:string(.))))"/>

                                                                                    </gco:Date>
                                                                            </xsl:for-each>
                                                                    </gmd:date>
                                                                    <gmd:dateType>
                                                                            <gmd:CI_DateTypeCode>
                                                                                    <xsl:attribute name="codeList">
                                                                                            <xsl:sequence
select="xs:string(xs:anyURI('http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Codeli
st/ML_gmxCodelists.xml#CI_DateTypeCode'))"/>

                                                                                    </xsl:attribute>
                                                                                    <xsl:attribute
name="codeListValue">

select="xs:string(xs:anyURI('publication'))"/>

                                                                                            <xsl:sequence

                                                                                    </xsl:attribute>
                                                                                    <xsl:sequence
select="'publication'"/>
```

```
                                                    </gmd:CI_DateTypeCode>
                                                </gmd:dateType>
                                            </gmd:CI_Date>
                                        </gmd:date>
                                        <xsl:for-each-group
select="$var1_instance/n:eml/dataset/coverage/temporalCoverage/singleDateTime" group-by="grp:key06fb0ee8(.)">
                                            <xsl:variable name="var44_cur_result_groupby"
as="xs:string" select="current-grouping-key()"/>
                                            <gmd:date>
                                                <gmd:CI_Date>
                                                    <gmd:date>
                                                        <gco:Date>
                                                            <xsl:sequence
select="xs:string(xs:string($var44_cur_result_groupby))"/>
                                                        </gco:Date>
                                                    </gmd:date>
                                                    <gmd:dateType>
                                                        <gmd:CI_DateTypeCode>
                                                            <xsl:attribute
name="codeList">
                                                            <xsl:sequence
select="xs:string(xs:anyURI('http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Codeli
st/ML_gmxCodelists.xml#CI_DateTypeCode'))"/>
                                                            </xsl:attribute>
                                                            <xsl:attribute
name="codeListValue">
                                                            <xsl:sequence
select="xs:string(xs:anyURI('revision'))"/>
                                                            </xsl:attribute>

            </gmd:CI_DateTypeCode>
                                                        </gmd:dateType>
                                                </gmd:CI_Date>
                                            </gmd:date>
                                        </xsl:for-each-group>
                                        <gmd:identifier>
                                            <gmd:RS_Identifier>
                                                <gmd:code>
                                                    <xsl:for-each
select="$var1_instance/n:eml">

                                                        <gco:CharacterString>
                                                            <xsl:sequence
select="xs:string(@packageId)"/>

                                                        </gco:CharacterString>
                                                    </xsl:for-each>
                                                </gmd:code>
                                                <gmd:codeSpace>
                                                    <xsl:for-each
select="$var1_instance/n:eml">

                                                        <gco:CharacterString>
                                                            <xsl:sequence
select="xs:string(xs:string(@system))"/>

                                                        </gco:CharacterString>
                                                    </xsl:for-each>
                                                </gmd:codeSpace>
                                            </gmd:RS_Identifier>
                                        </gmd:identifier>
                                    </gmd:CI_Citation>
                                </gmd:citation>
                                <gmd:abstract>
                                    <gco:CharacterString>
```

```xml
<xsl:variable name="var50_map_select_eml" as="xs:string?">
    <xsl:for-each
select="$var1_instance/n:eml/dataset/abstract">
        <xsl:sequence select="xs:string(.)"/>
    </xsl:for-each>
</xsl:variable>
<xsl:sequence select="fn:string-join($var50_map_select_eml,
'')"/>
                </gco:CharacterString>
            </gmd:abstract>
            <gmd:purpose>
                <gco:CharacterString>
<xsl:variable name="var53_map_select_eml" as="xs:string?">
    <xsl:for-each
select="$var1_instance/n:eml/dataset/purpose">
        <xsl:sequence select="xs:string(.)"/>
    </xsl:for-each>
</xsl:variable>
<xsl:sequence select="fn:string-join($var53_map_select_eml,
'')"/>
                </gco:CharacterString>
            </gmd:purpose>
<xsl:for-each-group select="$var1_instance/n:eml/dataset/creator" group-
by="grp:key072a39c8(.)">
    <xsl:variable name="var61_cur_result_groupby" as="item()+"
select="current-group()"/>
    <xsl:variable name="var62_cur_result_groupby" as="xs:string"
select="current-grouping-key()"/>
    <gmd:pointOfContact>
        <gmd:CI_ResponsibleParty>
            <xsl:for-each select="$var61_cur_result_groupby">
                <xsl:variable
name="var64_cur_result_groupitems" as="item()" select="."/>
                <xsl:if
test="$var64_cur_result_groupitems/@id">
                    <xsl:attribute name="id">
                        <xsl:sequence
select="xs:string(xs:ID(xs:string(@id)))"/>
                    </xsl:attribute>
                </xsl:if>
            </xsl:for-each>
            <gmd:individualName>
                <gco:CharacterString>
                    <xsl:sequence
select="$var62_cur_result_groupby"/>
                </gco:CharacterString>
            </gmd:individualName>
            <gmd:organisationName>
                <xsl:for-each
select="$var61_cur_result_groupby/organizationName">
                    <gco:CharacterString>
                        <xsl:sequence
select="xs:string(.)"/>
                    </gco:CharacterString>
                </xsl:for-each>
            </gmd:organisationName>
            <gmd:positionName>
                <xsl:for-each
select="$var61_cur_result_groupby/positionName">
                    <gco:CharacterString>
```

```
                                                                    <xsl:sequence
select="xs:string(.)"/>
                                                            </gco:CharacterString>
                                                    </xsl:for-each>
                                            </gmd:positionName>
                                            <gmd:contactInfo>
                                                    <gmd:CI_Contact>
                                                            <gmd:phone>
                                                                    <gmd:CI_Telephone>
                                                                            <xsl:for-each-
group select="$var61_cur_result_groupby/phone" group-by="xs:string(.)">
                                                                            <xsl:variable
name="var72_cur_result_groupby" as="xs:string" select="current-grouping-key()"/>
                                                                    <gmd:voice>

        <gco:CharacterString>

        <xsl:sequence select="$var72_cur_result_groupby"/>

        </gco:CharacterString>

        </gmd:voice>
                                                                            </xsl:for-each-
group>
                                                                    </gmd:CI_Telephone>
                                                            </gmd:phone>
                                                            <gmd:address>
                                                                    <gmd:CI_Address>
                                                                            <xsl:for-each-
group select="$var61_cur_result_groupby/address/deliveryPoint" group-by="xs:string(.)">
                                                                            <xsl:variable
name="var76_cur_result_groupby" as="xs:string" select="current-grouping-key()"/>

        <gmd:deliveryPoint>

        <gco:CharacterString>

                <xsl:sequence select="$var76_cur_result_groupby"/>

        </gco:CharacterString>

        </gmd:deliveryPoint>
                                                                            </xsl:for-each-
group>
                                                                    <gmd:city>
                                                                    <xsl:for-each
select="$var61_cur_result_groupby/address/city">
                                                    <gco:CharacterString>

        <xsl:sequence select="xs:string(.)"/>

        </gco:CharacterString>

                                                                    </xsl:for-each>
                                                                    </gmd:city>

        <gmd:administrativeArea>
select="$var61_cur_result_groupby/address/administrativeArea">

        <gco:CharacterString>
                                                                    <xsl:for-each
```

```
<xsl:sequence select="xs:string(.)"/>

</gco:CharacterString>
                                                                          </xsl:for-each>

</gmd:administrativeArea>
                                                          <gmd:postalCode>
                                                                <xsl:for-each
select="$var61_cur_result_groupby/address/postalCode">
                                             <gco:CharacterString>

                        <xsl:sequence select="xs:string(.)"/>

                </gco:CharacterString>

</xsl:for-each>

</gmd:postalCode>

<gmd:country>

<xsl:for-each select="$var61_cur_result_groupby/address/country">

                <gco:CharacterString>

                        <xsl:sequence select="xs:string(.)"/>

                </gco:CharacterString>

</xsl:for-each>

</gmd:country>

<xsl:for-each-group select="$var61_cur_result_groupby/electronicMailAddress" group-by="xs:string(.)">

<xsl:variable name="var88_cur_result_groupby" as="xs:string" select="current-grouping-key()"/>

<gmd:electronicMailAddress>

                <gco:CharacterString>

                        <xsl:sequence select="$var88_cur_result_groupby"/>

                </gco:CharacterString>

</gmd:electronicMailAddress>

</xsl:for-each-group>

</gmd:CI_Address>
                                                                          </gmd:address>
                                                                          <gmd:onlineResource>

<gmd:CI_OnlineResource>

<gmd:linkage>

<xsl:for-each select="$var61_cur_result_groupby/onlineUrl">

                <gmd:URL>
```

```
                    <xsl:sequence select="xs:string(xs:anyURI(.))"/>

                </gmd:URL>

            </xsl:for-each>

        </gmd:linkage>

        </gmd:CI_OnlineResource>
                                                </gmd:onlineResource>
                                            </gmd:CI_Contact>
                                        </gmd:contactInfo>
                                        <gmd:role>
                                            <gmd:CI_RoleCode>
                                                <xsl:attribute
name="codeList">

                                                    <xsl:sequence
select="xs:string(xs:anyURI('http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Codeli
st/ML_gmxCodelists.xml#CI_RoleCode'))"/>

                                                </xsl:attribute>
                                                <xsl:attribute
name="codeListValue">

                                                    <xsl:sequence
select="xs:string(xs:anyURI('originator'))"/>

                                                </xsl:attribute>
                                                <xsl:sequence
select="'originator'"/>

                                            </gmd:CI_RoleCode>
                                        </gmd:role>
                                    </gmd:CI_ResponsibleParty>
                                </gmd:pointOfContact>
                            </xsl:for-each-group>
                            <xsl:for-each-group
select="$var1_instance/n:eml/dataset/associatedParty" group-by="grp:key071df8f0(.)">
                                <xsl:variable name="var97_cur_result_groupby" as="item()+"
select="current-group()"/>
                                <xsl:variable name="var98_cur_result_groupby" as="xs:string"
select="current-grouping-key()"/>
                                <gmd:pointOfContact>
                                    <gmd:CI_ResponsibleParty>
                                        <xsl:for-each
select="$var97_cur_result_groupby">

                                            <xsl:variable
name="var100_cur_result_groupitems" as="item()" select="."/>

                                            <xsl:if
test="$var100_cur_result_groupitems/@id">

                                                <xsl:attribute
name="id">

                                                    <xsl:sequence
select="xs:string(xs:ID(xs:string(@id)))"/>

                                                </xsl:attribute>
                                            </xsl:if>
                                        </xsl:for-each>
                                        <gmd:individualName>
                                            <gco:CharacterString>
                                                <xsl:sequence
select="$var98_cur_result_groupby"/>

                                            </gco:CharacterString>
                                        </gmd:individualName>
                                        <gmd:organisationName>
```

```
                                                              <xsl:for-each
select="$var97_cur_result_groupby/organizationName">

                                                                       <gco:CharacterString>
                                                                              <xsl:sequence
select="xs:string(.)"/>

                                                                       </gco:CharacterString>
                                                              </xsl:for-each>
                                                       </gmd:organisationName>
                                                       <gmd:positionName>
                                                              <xsl:for-each
select="$var97_cur_result_groupby/positionName">

                                                                       <gco:CharacterString>
                                                                              <xsl:sequence
select="xs:string(.)"/>

                                                                       </gco:CharacterString>
                                                              </xsl:for-each>
                                                       </gmd:positionName>
                                                       <gmd:contactInfo>
                                                              <gmd:CI_Contact>
                                                                     <gmd:phone>

<gmd:CI_Telephone>

<xsl:for-each-group select="$var97_cur_result_groupby/phone" group-by="xs:string(.)">

<xsl:variable name="var108_cur_result_groupby" as="xs:string" select="current-grouping-key()"/>

<gmd:voice>

        <gco:CharacterString>

               <xsl:sequence select="$var108_cur_result_groupby"/>

        </gco:CharacterString>

</gmd:voice>

</xsl:for-each-group>

</gmd:CI_Telephone>

                                                                     </gmd:phone>
                                                                     <gmd:address>

<gmd:CI_Address>

<xsl:for-each-group select="$var97_cur_result_groupby/address/deliveryPoint" group-by="xs:string(.)">

<xsl:variable name="var112_cur_result_groupby" as="xs:string" select="current-grouping-key()"/>

<gmd:deliveryPoint>

        <gco:CharacterString>

               <xsl:sequence select="$var112_cur_result_groupby"/>

        </gco:CharacterString>

</gmd:deliveryPoint>

</xsl:for-each-group>
```

```
<gmd:city>

<xsl:for-each select="$var97_cur_result_groupby/address/city">

        <gco:CharacterString>

                <xsl:sequence select="xs:string(.)"/>

        </gco:CharacterString>

</xsl:for-each>

</gmd:city>

<gmd:administrativeArea>

<xsl:for-each select="$var97_cur_result_groupby/address/administrativeArea">

        <gco:CharacterString>

                <xsl:sequence select="xs:string(.)"/>

        </gco:CharacterString>

</xsl:for-each>

</gmd:administrativeArea>

<gmd:postalCode>

<xsl:for-each select="$var97_cur_result_groupby/address/postalCode">

        <gco:CharacterString>

                <xsl:sequence select="xs:string(.)"/>

        </gco:CharacterString>

</xsl:for-each>

</gmd:postalCode>

<gmd:country>

<xsl:for-each select="$var97_cur_result_groupby/address/country">

        <gco:CharacterString>

                <xsl:sequence select="xs:string(.)"/>

        </gco:CharacterString>

</xsl:for-each>

</gmd:country>

<xsl:for-each-group select="$var97_cur_result_groupby/electronicMailAddress" group-by="xs:string(.)">

<xsl:variable name="var124_cur_result_groupby" as="xs:string" select="current-grouping-key()"/>
```

```
<gmd:electronicMailAddress>

        <gco:CharacterString>

                <xsl:sequence select="$var124_cur_result_groupby"/>

        </gco:CharacterString>

</gmd:electronicMailAddress>

</xsl:for-each-group>

</gmd:CI_Address>
                                                            </gmd:address>
                                                            <gmd:onlineResource>

<gmd:CI_OnlineResource>

<gmd:linkage>

<xsl:for-each select="$var97_cur_result_groupby/onlineUrl">

        <gmd:URL>

                <xsl:sequence select="xs:string(xs:anyURI(.))"/>

        </gmd:URL>

</xsl:for-each>

</gmd:linkage>

</gmd:CI_OnlineResource>
                                                            </gmd:onlineResource>
                                                    </gmd:CI_Contact>
                                                </gmd:contactInfo>
                                                <gmd:role>
                                                    <gmd:CI_RoleCode>
                                                        <xsl:attribute
name="codeList">
                                                            <xsl:sequence
select="xs:string(xs:anyURI('http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Codeli
st/ML_gmxCodelists.xml#CI_RoleCode'))"/>
                                                        </xsl:attribute>
                                                        <xsl:for-each
select="$var97_cur_result_groupby">
                                                            <xsl:attribute
name="codeListValue">
        <xsl:sequence select="xs:string(xs:anyURI(xs:string(role)))"/>
                                                            </xsl:attribute>
                                                        </xsl:for-each>
                                                    </gmd:CI_RoleCode>
                                                </gmd:role>
                                            </gmd:CI_ResponsibleParty>
                                        </gmd:pointOfContact>
                                </xsl:for-each-group>
                                <xsl:for-each-group select="$var1_instance/n:eml/dataset/contact"
group-by="grp:key070b0b80(.)">
```

```
                                                    <xsl:variable name="var135_cur_result_groupby" as="item()+"
select="current-group()"/>
                                                    <xsl:variable name="var136_cur_result_groupby" as="xs:string"
select="current-grouping-key()"/>
                                                    <gmd:pointOfContact>
                                                        <gmd:CI_ResponsibleParty>
                                                            <xsl:for-each
select="$var135_cur_result_groupby">
                                                                <xsl:variable
name="var138_cur_result_groupitems" as="item()" select="."/>
                                                                <xsl:if
test="$var138_cur_result_groupitems/@id">
                                                                    <xsl:attribute
name="id">
                                                                        <xsl:sequence
select="xs:string(xs:ID(xs:string(@id)))"/>
                                                                    </xsl:attribute>
                                                                </xsl:if>
                                                            </xsl:for-each>
                                                            <gmd:individualName>
                                                                <gco:CharacterString>
                                                                    <xsl:sequence
select="$var136_cur_result_groupby"/>
                                                                </gco:CharacterString>
                                                            </gmd:individualName>
                                                            <gmd:organisationName>
                                                                <xsl:for-each
select="$var135_cur_result_groupby/organizationName">
                                                                    <gco:CharacterString>
                                                                        <xsl:sequence
select="xs:string(.)"/>
                                                                    </gco:CharacterString>
                                                                </xsl:for-each>
                                                            </gmd:organisationName>
                                                        <gmd:positionName>
                                                    <xsl:for-each select="$var135_cur_result_groupby/positionName">
                                                                <gco:CharacterString>
                                                                    <xsl:sequence select="xs:string(.)"/>
                                                                </gco:CharacterString>
                                                            </xsl:for-each>
                                                        </gmd:positionName>
                                                    <gmd:contactInfo>
                                    <gmd:CI_Contact>
                            <gmd:phone>
                            <gmd:CI_Telephone>
                                                    <xsl:for-each-group select="$var135_cur_result_groupby/phone" group-by="xs:string(.)">
                                        <xsl:variable name="var146_cur_result_groupby" as="xs:string" select="current-grouping-key()"/>
                                        <gmd:voice>
                                                    <gco:CharacterString>
                                                                                    <xsl:sequence
select="$var146_cur_result_groupby"/>
                                                    </gco:CharacterString>
                                                            <xsl:for-each-group>
                                                    </gmd:voice>
                                                                </xsl:for-each-group>
                        </gmd:CI_Telephone>
                        </gmd:phone>
                        <gmd:address>
                        <gmd:CI_Address>
```

```xml
<xsl:for-each-group select="$var135_cur_result_groupby/address/deliveryPoint" group-by="xs:string(.)">
    <xsl:variable name="var150_cur_result_groupby" as="xs:string" select="current-grouping-key()"/>
    <gmd:deliveryPoint>
        <gco:CharacterString>
            <xsl:sequence select="$var150_cur_result_groupby"/>
        </gco:CharacterString>
    </gmd:deliveryPoint>
</xsl:for-each-group>
<gmd:city>
    <xsl:for-each select="$var135_cur_result_groupby/address/city">
        <gco:CharacterString>
            <xsl:sequence select="xs:string(.)"/>
        </gco:CharacterString>
    </xsl:for-each>
</gmd:city>
<gmd:administrativeArea>
    <xsl:for-each select="$var135_cur_result_groupby/address/administrativeArea">
        <gco:CharacterString>
            <xsl:sequence select="xs:string(.)"/>
        </gco:CharacterString>
    </xsl:for-each>
</gmd:administrativeArea>
<gmd:postalCode>
    <xsl:for-each select="$var135_cur_result_groupby/address/postalCode">
        <gco:CharacterString>
            <xsl:sequence select="xs:string(.)"/>
        </gco:CharacterString>
    </xsl:for-each>
</gmd:postalCode>
<gmd:country>
    <xsl:for-each select="$var135_cur_result_groupby/address/country">
        <gco:CharacterString>
            <xsl:sequence select="xs:string(.)"/>
        </gco:CharacterString>
    </xsl:for-each>
</gmd:country>
<xsl:for-each-group select="$var135_cur_result_groupby/electronicMailAddress" group-by="xs:string(.)">
    <xsl:variable name="var162_cur_result_groupby" as="xs:string" select="current-grouping-key()"/>
    <gmd:electronicMailAddress>
```

```xml
            <gco:CharacterString>

                    <xsl:sequence select="$var162_cur_result_groupby"/>

            </gco:CharacterString>

        </gmd:electronicMailAddress>

        </xsl:for-each-group>

        </gmd:CI_Address>
                                                                    </gmd:address>
                                                                    <gmd:onlineResource>

        <gmd:CI_OnlineResource>

        <gmd:linkage>

        <xsl:for-each select="$var135_cur_result_groupby/onlineUrl">

                <gmd:URL>

                        <xsl:sequence select="xs:string(xs:anyURI(.))"/>

                </gmd:URL>

        </xsl:for-each>

        </gmd:linkage>

        </gmd:CI_OnlineResource>
                                                                </gmd:onlineResource>
                                                            </gmd:CI_Contact>
                                                        </gmd:contactInfo>
                                                        <gmd:role>
                                                            <gmd:CI_RoleCode>
                                                                <xsl:attribute
name="codeList">
                                                                    <xsl:sequence
select="xs:string(xs:anyURI('http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Codeli
st/ML_gmxCodelists.xml#CI_RoleCode'))"/>
                                                                </xsl:attribute>
                                                                <xsl:attribute
name="codeListValue">
                                                                    <xsl:sequence
select="xs:string(xs:anyURI('pointOfContact'))"/>
                                                                </xsl:attribute>
                                                            </gmd:CI_RoleCode>
                                                        </gmd:role>
                                                    </gmd:CI_ResponsibleParty>
                                                </gmd:pointOfContact>
                                            </xsl:for-each-group>
                                            <xsl:for-each-group select="$var1_instance/n:eml/dataset/publisher"
group-by="grp:key0732a750(.)">
                                                <xsl:variable name="var171_cur_result_groupby" as="item()+"
select="current-group()"/>
                                                <xsl:variable name="var172_cur_result_groupby" as="xs:string"
select="current-grouping-key()"/>
                                                <gmd:pointOfContact>
                                                    <gmd:CI_ResponsibleParty>
```

```
                                                        <gmd:individualName>
                                                            <gco:CharacterString>
                                                                <xsl:sequence
select="$var172_cur_result_groupby"/>

                                                            </gco:CharacterString>
                                                        </gmd:individualName>
                                                        <gmd:organisationName>
                                                            <xsl:for-each
select="$var171_cur_result_groupby/organizationName">

                                                                <gco:CharacterString>
                                                                    <xsl:sequence
select="xs:string(.)"/>

                                                                </gco:CharacterString>
                                                            </xsl:for-each>
                                                        </gmd:organisationName>
                                                        <gmd:positionName>
                                                            <xsl:for-each
select="$var171_cur_result_groupby/positionName">

                                                                <gco:CharacterString>
                                                                    <xsl:sequence
select="xs:string(.)"/>

                                                                </gco:CharacterString>
                                                            </xsl:for-each>
                                                        </gmd:positionName>
                                                        <gmd:contactInfo>
                                                            <gmd:CI_Contact>
                                                                <gmd:phone>

        <gmd:CI_Telephone>

        <gmd:voice>

        <xsl:for-each select="$var171_cur_result_groupby/phone">

                <gco:CharacterString>

                        <xsl:sequence select="xs:string(.)"/>

                </gco:CharacterString>

        </xsl:for-each>

        </gmd:voice>

        </gmd:CI_Telephone>

                                                                </gmd:phone>
                                                                <gmd:address>

        <gmd:CI_Address>

        <gmd:deliveryPoint>

        <xsl:for-each select="$var171_cur_result_groupby/address/deliveryPoint">

                <gco:CharacterString>

                        <xsl:sequence select="xs:string(.)"/>

                </gco:CharacterString>

        </xsl:for-each>
```

```
</gmd:deliveryPoint>

<gmd:city>

<xsl:for-each select="$var171_cur_result_groupby/address/city">

        <gco:CharacterString>

                <xsl:sequence select="xs:string(.)"/>

        </gco:CharacterString>

</xsl:for-each>

</gmd:city>

<gmd:administrativeArea>

<xsl:for-each select="$var171_cur_result_groupby/address/administrativeArea">

        <gco:CharacterString>

                <xsl:sequence select="xs:string(.)"/>

        </gco:CharacterString>

</xsl:for-each>

</gmd:administrativeArea>

<gmd:postalCode>

<xsl:for-each select="$var171_cur_result_groupby/address/postalCode">

        <gco:CharacterString>

                <xsl:sequence select="xs:string(.)"/>

        </gco:CharacterString>

</xsl:for-each>

</gmd:postalCode>

<gmd:country>

<xsl:for-each select="$var171_cur_result_groupby/address/country">

        <gco:CharacterString>

                <xsl:sequence select="xs:string(.)"/>

        </gco:CharacterString>

</xsl:for-each>

</gmd:country>

<gmd:electronicMailAddress>
```

```
<xsl:for-each select="$var171_cur_result_groupby/electronicMailAddress">

        <gco:CharacterString>

                <xsl:sequence select="xs:string(.)"/>

        </gco:CharacterString>

</xsl:for-each>

</gmd:electronicMailAddress>

</gmd:CI_Address>

                                                        </gmd:address>
                                                        <gmd:onlineResource>


<gmd:CI_OnlineResource>

<gmd:linkage>

<xsl:for-each select="$var171_cur_result_groupby/onlineUrl">

        <gmd:URL>

                <xsl:sequence select="xs:string(xs:anyURI(.))"/>

        </gmd:URL>

</xsl:for-each>

</gmd:linkage>

</gmd:CI_OnlineResource>

                                                        </gmd:onlineResource>
                                                    </gmd:CI_Contact>
                                                </gmd:contactInfo>
                                                <gmd:role>
                                                    <gmd:CI_RoleCode>
                                                        <xsl:attribute
name="codeList">
                                                            <xsl:sequence
select="xs:string(xs:anyURI('http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Codeli
st/ML_gmxCodelists.xml#CI_RoleCode'))"/>
                                                        </xsl:attribute>
                                                        <xsl:attribute
name="codeListValue">
                                                            <xsl:sequence
select="xs:string(xs:anyURI('publisher'))"/>
                                                        </xsl:attribute>
                                                    </gmd:CI_RoleCode>
                                                </gmd:role>
                                            </gmd:CI_ResponsibleParty>
                                        </gmd:pointOfContact>
                                    </xsl:for-each-group>
                                    <gmd:resourceMaintenance>
                                        <gmd:MD_MaintenanceInformation>
                                            <gmd:maintenanceAndUpdateFrequency>
                                                <gmd:MD_MaintenanceFrequencyCode>
                                                    <xsl:attribute name="codeList">
```

```
                                                                              <xsl:sequence
select="xs:string(xs:anyURI('http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Codeli
st/gmxCodelists.xml#MD_MaintenanceFrequencyCode&quot;'))"/>
                                                                              </xsl:attribute>
                                                                              <xsl:variable
name="var195_map_select_eml" as="xs:string?">
                                                                                  <xsl:for-each
select="$var1_instance/n:eml/dataset/maintenance/maintenanceUpdateFrequency">
                                                                                      <xsl:sequence
select="xs:string(.)"/>
                                                                                  </xsl:for-each>
                                                                              </xsl:variable>
                                                                              <xsl:variable
name="var194_cond_result_exists" as="xs:string?" select="(if (fn:exists($var195_map_select_eml)) then
$var195_map_select_eml else 'unknown')"/>
                                                                              <xsl:if
test="fn:exists($var194_cond_result_exists)">
                                                                                  <xsl:attribute
name="codeListValue">
                                                                                      <xsl:sequence
select="xs:string(xs:anyURI($var194_cond_result_exists))"/>
                                                                                  </xsl:attribute>
                                                                              </xsl:if>
                                                                          </gmd:MD_MaintenanceFrequencyCode>
                                                                      </gmd:maintenanceAndUpdateFrequency>
                                                                      <gmd:maintenanceNote>
                                                                          <gco:CharacterString>
                                                                              <xsl:variable
name="var198_map_select_eml" as="xs:string?">
                                                                                  <xsl:for-each
select="$var1_instance/n:eml/dataset/maintenance/description">
                                                                                      <xsl:sequence
select="xs:string(.)"/>
                                                                                  </xsl:for-each>
                                                                              </xsl:variable>
                                                                              <xsl:sequence select="fn:string-
join($var198_map_select_eml, '')"/>
                                                                          </gco:CharacterString>
                                                                      </gmd:maintenanceNote>
                                                                  </gmd:MD_MaintenanceInformation>
                                                              </gmd:resourceMaintenance>
                                                          <xsl:for-each-group select="$var1_instance/n:eml/dataset/keywordSet"
group-by="grp:key073b6018(.)">
                                                              <xsl:variable name="var204_cur_result_groupby" as="item()+"
select="current-group()"/>
                                                              <xsl:variable name="var205_cur_result_groupby" as="xs:string"
select="current-grouping-key()"/>
                                                              <gmd:descriptiveKeywords>
                                                                  <gmd:MD_Keywords>
                                                                      <xsl:for-each-group
select="$var204_cur_result_groupby" group-by="grp:key070d7e38(.)">
                                                                          <xsl:variable
name="var211_cur_result_groupby" as="xs:string" select="current-grouping-key()"/>
                                                                          <gmd:keyword>
                                                                              <gco:CharacterString>
                                                                                  <xsl:sequence
select="$var211_cur_result_groupby"/>
                                                                              </gco:CharacterString>
                                                                          </gmd:keyword>
                                                                      </xsl:for-each-group>
                                                                      <gmd:thesaurusName>
```

```xml
<gmd:CI_Citation>
    <gmd:title>

        <gco:CharacterString>

            <xsl:sequence select="fn:substring-before($var205_cur_result_groupby, ';')"/>

        </gco:CharacterString>

    </gmd:title>
    <gmd:date>
        <gmd:CI_Date>

            <gmd:date>

                <gco:Date>

                    <xsl:sequence select="xs:string(xs:string(fn:substring-after($var205_cur_result_groupby, ';')))"/>

                </gco:Date>

            </gmd:date>

            <gmd:dateType>

                <gmd:CI_DateTypeCode>

                    <xsl:attribute name="codeList">

                        <xsl:sequence
select="xs:string(xs:anyURI('http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Codelist/ML_gmxCodelists.xml#CI_DateTypeCode'))"/>

                    </xsl:attribute>

                    <xsl:attribute name="codeListValue">

                        <xsl:sequence select="xs:string(xs:anyURI('publication'))"/>

                    </xsl:attribute>

                    <xsl:sequence select="'publication'"/>

                </gmd:CI_DateTypeCode>

            </gmd:dateType>

        </gmd:CI_Date>

            </gmd:date>
        </gmd:CI_Citation>
    </gmd:thesaurusName>
</gmd:MD_Keywords>
</gmd:descriptiveKeywords>
</xsl:for-each-group>
<xsl:for-each-group
select="$var1_instance/n:eml/dataset/coverage/taxonomicCoverage/taxonomicClassification/taxonomicClassification"
group-by="grp:key07172698(.)">
    <xsl:variable name="var216_cur_result_groupby" as="item()+"
select="current-group()"/>

    <xsl:variable name="var217_cur_result_groupby" as="xs:string"
select="current-grouping-key()"/>

    <gmd:descriptiveKeywords>
```

```
                                                        <gmd:MD_Keywords>
                                                            <gmd:keyword>
                                                                <gco:CharacterString>
                                                                    <xsl:sequence
select="$var217_cur_result_groupby"/>
                                                                </gco:CharacterString>
                                                            </gmd:keyword>
                                                            <gmd:type>
                                                                <xsl:for-each
select="$var216_cur_result_groupby/taxonRankName">

        <gmd:MD_KeywordTypeCode>

                                                                        <xsl:attribute
name="codeList">

        <xsl:sequence
select="xs:string(xs:anyURI('http://pending.geotoolkit.org/apidocs/org/geotoolkit/naturesdi/NATSDI_RankNameCode.html'
))"/>
                                                                        </xsl:attribute>
                                                                        <xsl:attribute
name="codeListValue">

        <xsl:sequence select="xs:string(xs:anyURI(xs:string(.)))"/>
                                                                        </xsl:attribute>
                                                                        <xsl:sequence
select="xs:string(.)"/>

        </gmd:MD_KeywordTypeCode>
                                                                </xsl:for-each>
                                                            </gmd:type>
                                                        </gmd:MD_Keywords>
                                                    </gmd:descriptiveKeywords>
                                            </xsl:for-each-group>
                                            <gmd:resourceConstraints>
                                                <gmd:MD_LegalConstraints>
                                                    <xsl:for-each-group
select="$var1_instance/n:eml/access" group-by="grp:key070ca570(.)">
                                                        <xsl:variable
name="var229_cur_result_groupby" as="xs:string" select="current-grouping-key()"/>
                                                        <gmd:useLimitation>
                                                            <gco:CharacterString>
                                                                <xsl:sequence
select="$var229_cur_result_groupby"/>
                                                            </gco:CharacterString>
                                                        </gmd:useLimitation>
                                                    </xsl:for-each-group>
                                                    <xsl:for-each-group
select="$var1_instance/n:eml/access" group-by="grp:key0711d6f8(.)">
                                                        <xsl:variable
name="var239_cur_result_groupby" as="xs:string" select="current-grouping-key()"/>
                                                        <gmd:useLimitation>
                                                            <gco:CharacterString>
                                                                <xsl:sequence
select="$var239_cur_result_groupby"/>
                                                            </gco:CharacterString>
                                                        </gmd:useLimitation>
                                                    </xsl:for-each-group>
                                                    <gmd:useConstraints>
                                                        <gmd:MD_RestrictionCode>
                                                            <xsl:attribute name="codeList">
```

```
                                                                    <xsl:sequence
select="xs:string(xs:anyURI('http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Codeli
st/gmxCodelists.xml#MD_RestrictionCode'))"/>
                                                                </xsl:attribute>
                                                                <xsl:attribute
name="codeListValue">
                                                                    <xsl:variable
name="var241_cond_result_exists" as="xs:string" select="(if (fn:exists($var1_instance/n:eml/dataset/intellectualRights))
then 'intellectualPropertyRights' else 'otherRestrictions')"/>
                                                                    <xsl:sequence
select="xs:string(xs:anyURI($var241_cond_result_exists))"/>
                                                                </xsl:attribute>
                                                            </gmd:MD_RestrictionCode>
                                                        </gmd:useConstraints>
                                                        <xsl:for-each-group
select="$var1_instance/n:eml/dataset/intellectualRights" group-by="fn:string-join(xs:string(.), '')">
                                                            <xsl:variable
name="var244_cur_result_groupby" as="xs:string" select="current-grouping-key()"/>
                                                            <gmd:otherConstraints>
                                                                <gco:CharacterString>
                                                                    <xsl:sequence
select="$var244_cur_result_groupby"/>
                                                                </gco:CharacterString>
                                                            </gmd:otherConstraints>
                                                        </xsl:for-each-group>
                                                    </gmd:MD_LegalConstraints>
                                                </gmd:resourceConstraints>
                                                <xsl:for-each-group select="$var1_instance/n:eml/dataset/language"
group-by="xs:string(.)">
                                                    <xsl:variable name="var248_cur_result_groupby" as="xs:string"
select="current-grouping-key()"/>
                                                    <gmd:language>
                                                        <gmd:LanguageCode>
                                                            <xsl:attribute name="codeList">
                                                                <xsl:sequence
select="xs:string(xs:anyURI('http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Codeli
st/ML_gmxCodelists.xml#LanguageCode'))"/>
                                                            </xsl:attribute>
                                                            <xsl:attribute name="codeListValue">
                                                                <xsl:sequence
select="xs:string(xs:anyURI($var248_cur_result_groupby))"/>
                                                            </xsl:attribute>
                                                            <xsl:sequence
select="$var248_cur_result_groupby"/>
                                                        </gmd:LanguageCode>
                                                    </gmd:language>
                                                </xsl:for-each-group>
                                                <gmd:topicCategory>
                                                    <gmd:MD_TopicCategoryCode>
                                                        <xsl:sequence select="'biota'"/>
                                                    </gmd:MD_TopicCategoryCode>
                                                </gmd:topicCategory>
                                                <gmd:extent>
                                                    <gmd:EX_Extent>
                                                        <gmd:geographicElement>
                                                            <gmd:EX_GeographicBoundingBox>
                                                                <gmd:westBoundLongitude>
                                                                    <xsl:for-each
select="$var1_instance/n:eml/dataset/coverage/geographicCoverage/boundingCoordinates">
                                                                        <gco:Decimal>
```

```
                    <xsl:sequence select="xs:string(xs:decimal(westBoundingCoordinate))"/>
                                                                            </gco:Decimal>
                                                                        </xsl:for-each>
                                                                    </gmd:westBoundLongitude>
                                                                    <gmd:eastBoundLongitude>
                                                                        <xsl:for-each
select="$var1_instance/n:eml/dataset/coverage/geographicCoverage/boundingCoordinates">
                                                                            <gco:Decimal>

                    <xsl:sequence select="xs:string(xs:decimal(eastBoundingCoordinate))"/>
                                                                            </gco:Decimal>
                                                                        </xsl:for-each>
                                                                    </gmd:eastBoundLongitude>
                                                                    <gmd:southBoundLatitude>
                                                                        <xsl:for-each
select="$var1_instance/n:eml/dataset/coverage/geographicCoverage/boundingCoordinates">
                                                                            <gco:Decimal>

                    <xsl:sequence select="xs:string(xs:decimal(southBoundingCoordinate))"/>
                                                                            </gco:Decimal>
                                                                        </xsl:for-each>
                                                                    </gmd:southBoundLatitude>
                                                                    <gmd:northBoundLatitude>
                                                                        <xsl:for-each
select="$var1_instance/n:eml/dataset/coverage/geographicCoverage/boundingCoordinates">
                                                                            <gco:Decimal>

                    <xsl:sequence select="xs:string(xs:decimal(northBoundingCoordinate))"/>
                                                                            </gco:Decimal>
                                                                        </xsl:for-each>
                                                                    </gmd:northBoundLatitude>
                                                                </gmd:EX_GeographicBoundingBox>
                                                            </gmd:geographicElement>
                                                            <gmd:temporalElement>
                                                                <gmd:EX_TemporalExtent>
                                                                    <gmd:extent>
                                                                        <gml:TimePeriod>
                                                                            <xsl:attribute
name="gml:id">

            <xsl:sequence select="xs:string(xs:ID('gml'))"/>
                                                                            </xsl:attribute>
                                                                            <xsl:for-each
select="$var1_instance/n:eml/dataset/coverage/temporalCoverage/rangeOfDates/beginDate/calendarDate">

            <gml:beginPosition>

            <xsl:sequence select="xs:string(xs:string(fn:concat(xs:string(xs:string(.)), 'T00:00:00')))"/>

            </gml:beginPosition>
                                                                            </xsl:for-each>
                                                                            <xsl:for-each
select="$var1_instance/n:eml/dataset/coverage/temporalCoverage/rangeOfDates/endDate/calendarDate">

            <gml:endPosition>

            <xsl:sequence select="xs:string(xs:string(fn:concat(xs:string(xs:string(.)), 'T00:00:00')))"/>

            </gml:endPosition>
                                                                            </xsl:for-each>
```

```
                                                    </gml:TimePeriod>
                                                </gmd:extent>
                                            </gmd:EX_TemporalExtent>
                                        </gmd:temporalElement>
                                        <gmd:verticalElement>
                                            <gmd:EX_VerticalExtent>
                                                <gmd:minimumValue>
                                                    <xsl:for-each
select="$var1_instance/n:eml/dataset/coverage/geographicCoverage/boundingCoordinates/boundingAltitudes">
                                                        <gco:Real>

        <xsl:sequence select="xs:string(xs:double(xs:decimal(altitudeMinimum)))"/>

                                                        </gco:Real>
                                                    </xsl:for-each>
                                                </gmd:minimumValue>
                                                <gmd:maximumValue>
                                                    <xsl:for-each
select="$var1_instance/n:eml/dataset/coverage/geographicCoverage/boundingCoordinates/boundingAltitudes">
                                                        <gco:Real>

        <xsl:sequence select="xs:string(xs:double(xs:decimal(altitudeMaximum)))"/>

                                                        </gco:Real>
                                                    </xsl:for-each>
                                                </gmd:maximumValue>
                                                <gmd:verticalCRS>
                                                    <gml:VerticalCRS>
                                                        <xsl:attribute
name="gml:id">

        <xsl:sequence select="xs:string(xs:ID('crs.msl_height'))"/>

                                                        </xsl:attribute>

        <gml:identifier>

        <xsl:attribute name="codeSpace">

        <xsl:sequence select="xs:string(xs:anyURI('urn:ogc:def:crs:EPSG'))"/>

        </xsl:attribute>

        <xsl:sequence select="'5714'"/>

        </gml:identifier>
                                                        <gml:name>

        <xsl:sequence select="''"/>

                                                        </gml:name>
                                                        <gml:scope>

        <xsl:sequence select="''"/>

                                                        </gml:scope>

        <gml:verticalCS/>

        <gml:verticalDatum/>

                                                    </gml:VerticalCRS>
                                                </gmd:verticalCRS>
                                            </gmd:EX_VerticalExtent>
                                        </gmd:verticalElement>
                                    </gmd:EX_Extent>
                                </gmd:extent>
```

```
<gmd:supplementalInformation>
    <gco:CharacterString>
        <xsl:variable name="var266_map_select_eml"
as="xs:string*">
select="$var1_instance/n:eml/dataset/additionalInfo">
select="xs:string(.)"/>
        </xsl:for-each>
    </xsl:variable>
    <xsl:sequence select="fn:string-
join($var266_map_select_eml, '')"/>
    </gco:CharacterString>
</gmd:supplementalInformation>
</gmd:MD_DataIdentification>
</gmd:identificationInfo>
<gmd:distributionInfo>
    <gmd:MD_Distribution>
        <gmd:transferOptions>
            <gmd:MD_DigitalTransferOptions>
                <xsl:for-each-group
select="$var1_instance/n:eml/dataset/distribution/online" group-by="grp:key0722c840(.)">
                    <xsl:variable
name="var272_cur_result_groupby" as="item()+" select="current-group()"/>
                    <xsl:variable
name="var273_cur_result_groupby" as="xs:string" select="current-grouping-key()"/>
                    <gmd:onLine>
                        <gmd:CI_OnlineResource>
                            <gmd:linkage>
                                <gmd:URL>

    <xsl:sequence select="xs:string(xs:anyURI($var273_cur_result_groupby))"/>

                                </gmd:URL>
                            </gmd:linkage>
                            <gmd:description>
                                <xsl:for-each
select="$var272_cur_result_groupby/onlineDescription">

    <gco:CharacterString>

    <xsl:sequence select="xs:string(.)"/>

    </gco:CharacterString>

                                </xsl:for-each>
                            </gmd:description>
                        </gmd:CI_OnlineResource>
                    </gmd:onLine>
                </xsl:for-each-group>
            </gmd:MD_DigitalTransferOptions>
        </gmd:transferOptions>
    </gmd:MD_Distribution>
</gmd:distributionInfo>
<gmd:dataQualityInfo>
    <gmd:DQ_DataQuality>
        <gmd:scope>
            <gmd:DQ_Scope>
                <gmd:level>
                    <gmd:MD_ScopeCode>
                        <xsl:attribute name="codeList">
```

```
                                    <xsl:sequence
select="xs:string(xs:anyURI('http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Codeli
st/ML_gmxCodelists.xml#MD_ScopeCode'))"/>
                                    </xsl:attribute>
                                    <xsl:attribute
name="codeListValue">
                                                    <xsl:sequence
select="xs:string(xs:anyURI('dataset'))"/>
                                    </xsl:attribute>
                                    <xsl:sequence select="'dataset'"/>
                                </gmd:MD_ScopeCode>
                            </gmd:level>
                        </gmd:DQ_Scope>
                    </gmd:scope>
                    <gmd:report>
                        <gmd:DQ_DomainConsistency>
                            <gmd:measureIdentification>
                                <gmd:RS_Identifier>
                                    <gmd:code>
                                        <gco:CharacterString>
                                                <xsl:sequence
select="'Conformity_001'"/>
                                        </gco:CharacterString>
                                    </gmd:code>
                                    <gmd:codeSpace>
                                        <gco:CharacterString>
                                                <xsl:sequence
select="'INSPIRE'"/>
                                        </gco:CharacterString>
                                    </gmd:codeSpace>
                                </gmd:RS_Identifier>
                            </gmd:measureIdentification>
                            <gmd:result>
                                <gmd:DQ_ConformanceResult>
                                    <gmd:specification>
                                        <gmd:CI_Citation>
                                            <gmd:title>

        <gco:CharacterString>

        <xsl:sequence select="'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>

                        <xsl:sequence select="xs:string(xs:string('2010-12-08'))"/>

                </gco:Date>

        </gmd:date>

        <gmd:dateType>
```

```
<gmd:CI_DateTypeCode>

    <xsl:attribute name="codeList">

        <xsl:sequence
select="xs:string(xs:anyURI('http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Codeli
st/ML_gmxCodelists.xml#CI_DateTypeCode'))"/>

    </xsl:attribute>

    <xsl:attribute name="codeListValue">

        <xsl:sequence select="xs:string(xs:anyURI('publication'))"/>

    </xsl:attribute>

    <xsl:sequence select="'publication'"/>

</gmd:CI_DateTypeCode>

</gmd:dateType>

</gmd:CI_Date>
                                                        </gmd:date>
                                                    </gmd:CI_Citation>
                                                </gmd:specification>
                                                <gmd:explanation>
                                                    <gco:CharacterString>
                                                        <xsl:sequence
select="'See the referenced specification'"/>
                                                    </gco:CharacterString>
                                                </gmd:explanation>
                                                <gmd:pass>
                                                    <gco:Boolean>
                                                        <xsl:sequence
select="xs:string(((('0' != 'false') and ('false' != 'false')) and fn:boolean('false')))"/>
                                                    </gco:Boolean>
                                                </gmd:pass>
                                            </gmd:DQ_ConformanceResult>
                                        </gmd:result>
                                    </gmd:DQ_DomainConsistency>
                                </gmd:report>
                                <gmd:lineage>
                                    <gmd:LI_Lineage>
                                        <gmd:statement>
                                            <gco:CharacterString>
                                                <xsl:variable
name="var277_map_select_eml" as="xs:string*">
                                                    <xsl:for-each
select="$var1_instance/n:eml/dataset/methods/methodStep/instrumentation">
                                                        <xsl:variable
name="var280_map_select_eml" as="xs:string*">

    <xsl:for-each select="$var1_instance/n:eml/dataset/methods/methodStep/description">

    <xsl:sequence select="xs:string(.)"/>

    </xsl:for-each>
                                                        </xsl:variable>
```

```
                                                                    <xsl:variable
name="var281_map_select_eml" as="xs:string*">

        <xsl:for-each select="$var1_instance/n:eml/dataset/methods/sampling/samplingDescription">

        <xsl:sequence select="xs:string(.)"/>

        </xsl:for-each>

                                                                    </xsl:variable>
                                                                    <xsl:sequence
select="fn:concat(fn:concat(fn:concat(fn:concat(fn:concat(fn:concat('Methods description:  ', fn:string-
join($var280_map_select_eml, '')), ' '), 'Sampling description:  '), fn:string-join($var281_map_select_eml, '')),
'Instrumentation used:   '), xs:string(.))"/>
                                                                    </xsl:for-each>
                                                                    </xsl:variable>
                                                                    <xsl:sequence select="fn:string-
join($var277_map_select_eml, '. ')"/>

                                                        </gco:CharacterString>
                                                  </gmd:statement>
                                          </gmd:LI_Lineage>
                                    </gmd:lineage>
                              </gmd:DQ_DataQuality>
                        </gmd:dataQualityInfo>
                  </gmd:MD_Metadata>
        </xsl:template>
</xsl:stylesheet>
```

Annex V   MapForce mapping report EML2ISO