INTERNATIONAL HYDROGRAPHIC ORGANIZATION

ORGANISATION HYDROGRAPHIQUE INTERNATIONALE

STANDARDIZATION of NAUTICAL PUBLICATION WORKING GROUP (SNPWG)

[A Working Group of the Hydrographic Services and Standards Committee (HSSC)]

Chairman:	Jens SCHRÖDER-FÜRSTENBERG	jens.schroeder-fuerstenberg@bsh.de
Vice-Chairman:	Thomas LOEPER	thomas.loeper@noaa.gov
Secretary:	vacant	

SNPWG Letter: 03/2013

To SNPWG Members Date 1 October 2013

Dear Colleagues,

Subject:

1. **Submission Paper for TSMAD 27**
2. **MPA Application Schema**
3. **MPA Context Features if being a stand-alone product**

During the last few months we circulated various files to seek feedback from the SNPWG. We are very grateful to those who replied on the files.

The versions of the files provided at the annexes reflect the current status and this status should be ready for official checks by the SNPWG now.

1. The submission paper for TSMAD27 bases on the SNPWG initiative to integrate code lists into the S-100 framework.
2. The MPA application schema paper shows how the various components of the product would work together.
3. This would become important if HSSC5 endorses the proposed SNPWG work plan. Particularly, the collection of features would support the stand-alone version of an MPA product and provides a "charted layout" of the product.

We expect that you will discuss the papers with your colleagues and require comments, suggestions, improvements and any other contributions on these files latest by the 31 October.

Yours sincerely,

Jens Schröder-Fürstenberg

Annex 1

TSMADXX-XX

Paper for consideration by TSMAD

Codelists

Submitted by:	SNPWG / Jeppesen / NGA
Executive Summary:	This is a proposal for adding code lists to S-100 Edition 2.0.0.
Related Documents:	(1) S-100 Ed. 1.0.0
Related Projects:	(1) S-100

1 Introduction/Background

Codelists are described in ISO 19103 as "open" enumerations. Standards in the ISO 191xx series use codelists for lists of values which depend on domain and circumstances. The ISO 191xx series of standards, GML, and the INSPIRE project guidelines make extensive use of **Codelist** data types.

ISO 19103 states that *CodeList*s can be extended during runtime. It also mentions long lists of potential values as another situation where codelists can be used. ISO 19115 (Metadata) defines several codelists, because it needs to define enumerated types whose membership is determined by domain and circumstances (e.g., distribution media).

ISO 19118 includes models of "dictionary" and "codelist." GML develops the ISO 19118 dictionary concept into an XML dictionary package that can be used for code lists. GML prescribes two different ways of encoding code lists – as an enumeration that also allows "extra" values, or using an external dictionary. GML 3.3 (OGC 10-129r1) broadens the scope of dictionary implementations to allow other current Web technologies for dictionaries..

The INSPIRE project makes extensive provisions for code lists from the modelling and application schema perspective. The INSPIRE guidelines [IN.D.2.5] recommend the use of code list for an attribute type with coded values, if the set of allowed values "may be extended by user communities or without a major revision of the data specification".

S-100 Edition 1.0.0 does not define a *CodeList* data type. § 1-4.8.1 states that code lists are to be implemented as ordinary enumeration types. On the other hand § 4a-5.1 mentions "dictionaries to implement the ISO 19115:2005 code lists". Implementations are not currently available.

This paper describes a proposal for the inclusion of code lists in S-100 Edition 2.0.0..The content is based on ISO 19103, ISO 19136, OGC 10-129r1, and the INSPIRE guidelines.

2 Terms and Abbreviations

INSPIRE Infrastructure for Spatial Information in Europe (EU project)

3 References

IN.D.2.5: D2.5: Generic Conceptual Model, Version 3.4rc3. INSPIRE draft document D2.5_v3.4rc3, 05 April 2013.

IN.D2.7: D2.7: Guidelines for the encoding of spatial data, Version 3.3rc3. INSPIRE draft document D2.7_v3.3rc3, 11 June 2013.

ISO 19103: Geographic Information – Conceptual Schema Language.

ISO 19115: Geographic information – Metadata

ISO 19118: Geographic information – Encoding

ISO 19136: Geographic Information – Geography Markup Language

OGC 10-129r1: Geographic Information – Geography Markup Language (GML) – Extended schemas and encoding rules

SKOS: SKOS – Simple Knowledge Organization System – Reference. W3C Recommendation, 2009. http://www.w3.org/TR/2009/REC-skos-reference-20090818/.

4 Discussion/Analysis

4.1 Modelling considerations

ISO 19103 states that "if all the elements of the list are known, an enumeration shall be used; if only the likely values of the elements are known, a code list shall be used." The INSPIRE guidelines [IN.D.2.5] recommend the use of code list if the set of allowed values "may be extended by user communities or without a major revision of the data specification".
S-100 products should also consider practical criteria, namely the size of the encoded list and the likelihood of its reuse in different product specifications – long lists which are likely to be reused in multiple domains are good candidates for becoming independent packages, which can be maintained as UML packages and XSD files, independently of any particular product specification and can be imported into different application schemas or XML schemas.

4.2 Extending S-100 with code lists

There are 4 ways to model/implement code lists in S-100:

A. Ordinary enumerations (as now). Edition 1.0.0 does not provide for open enumerations, i.e., the "other: …" construct for "extra" allowed values is not mentioned. This merges codelists completely into feature catalogues and is the most complex and least flexible to maintain but simplest to implement.

B. External Enumerations, implemented as ordinary enumerations but maintained separately and imported into feature catalogues. This is more flexible to maintain and distribute than ordinary enumerations but more complex to implement. This is in essence an ordinary enumeration with different technical features and maintenance and update procedures.

C. Enumeration with pattern, implemented as a union of an enumeration with a pattern in the format "other: ...". Doing anything very useful with the "extra" values (i.e., using them in portrayal rules, defining business logic around them, etc.) risks fragmentation of the base product specification into unofficial variants. There are limited circumstances in which this is useful and a use case for this option is described in Section **Error! Reference source not found.**.

D. As an external dictionary, using the GML or INSPIRE dictionary format and published as an Internet resource. This is the most capable and functional implementation but also the most complex to implement. For example, additional meta-information such as aliases can be made available to the application.

This proposal describes how Options C and D can be added to S-100. Option B is basically the same as Option A but uses some of the advanced capabilities of UML modelling tools and XML[1], and may be better covered by an "Informative" clause in S-100 or as part of a separate publication.
Product specifications should balance all relevant considerations when deciding which approaches to use. Guidance for specification authors is provided in Annex A.

[1] Essentially, the use of separate UML packages for widely-used enumerations along with XML schemas or schema fragments, perhaps also FC and PC fragments. The fragments can be used with "import" or "include" statements, or merged into other XML schemas or documents. If such common enumerations are listed in a separate section of the GI registry they would be conveniently available to specification developers. Persistent links to the relevant XML mini-schemas, FC and PC fragments, would be provided in the same place.

4.3 Application schemas

Code lists are modelled as classes with tagged values. Code lists corresponding to Option C list the known literals as attributes. In the Option D, no attributes are listed. Figure 1 shows two examples of codelists. The Languages codelist is an example of a codelist modelled as an extensible enumeration (indicated by the tagged values *asDictionary=false* and *extensible=true*) and the Countries codelist is an example of a codelist modelled by an external dictionary (indicated by tagged value *asDictionary=true*) whose location is given by its *vocabulary* tagged value. The proposed tags are similar to those defined in GML and the INSPIRE guidelines [IN.D.2.5] except that extensibility is simplified to true/false instead of the four options allowed by INSPIRE.

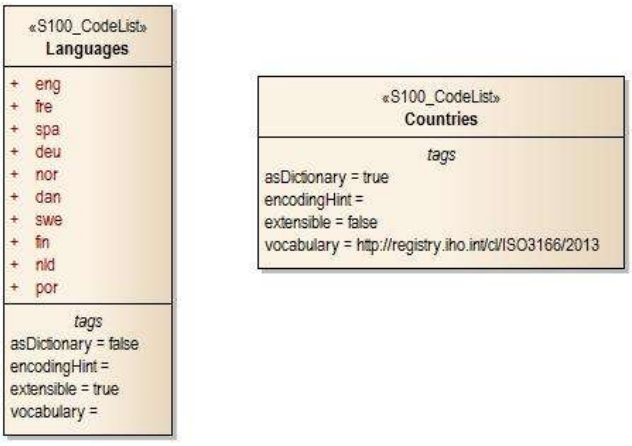

Figure 1. Two examples of CodeLists

4.4 Current Implementations

In the ISO 191xx series, code lists are defined using a Dictionary type (code-value bindings). They may be implemented as Internet resources.

Data formats may use "code list extractions" created by extracting codes or values from a codelist dictionary. The effect is to allow data formats to use either an external dictionary for code lists or convert them to ordinary enumerations for practical implementation purposes. The decision as to which alternative to use in any particular product specification should depend on the circumstances of the data product and its use environment.

INSPIRE requires that code lists be represented as dictionaries. This is the most flexible and capable implementation but will be the most complex in specification and implementation, because the specification must also specify the dictionary format and implementations must be able to utilize (access and/or parse) dictionaries.

INSPIRE codelists can be subsets of other codelists. Super-class/sub-class relationships can be used to create partitions of code lists. Code lists can be designated in INSPIRE application schemas as fixed or extensible.

4.5 Candidate code lists

ISO 693 codes for languages: Draft S-10x product specifications use ISO 639-3 (alpha-3 codes). The set of languages expected to be used in maritime information is relatively large compared to most enumerated attributes - 30-40 of the ISO language codes may be needed[2] though the number may grow to over 100 after variants, sub-national languages, and coastal and riparian states which are not IHO members are considered. Data products cannot necessarily be restricted to a small number of languages - English can be the mandatory language for crucial information such as ENCs but other publications and local information are likely to be published only in other languages (and data products will contain extracts from these). Changes to the list of codes are expected to be rare. The set of language codes will certainly be shared by most S-10x product specifications. Official lists are maintained by registration authorities (SIL International for ISO 639-3).

ISO 3166 Country codes: There are currently 249 officially assigned codes. The number or country codes used in maritime information will be comparable to the number for language codes, for much the same reasons, but will probably be lower though not significantly so. ISO 3166-1 defines alpha-2, alpha-3, and 3-

[2] ISO 639-3 (the standard mentioned in current S-1xx documents) is intended to include all natural languages. The official list of has over 7000 language codes. The number of languages likely to be used in maritime information is closer to the number of coastal states. IHO currently has 80 member states.

digit numeric codes. ISO provides the alpha-2 codes free, in text, online, and XML forms. ISO 3166-2 defines codes for the names of principal subdivisions (provinces/states). Current drafts of S-10x product specifications use the alpha-2 code.
NGA World Port Index: This lists over 4000 ports, shipping facilities, and oil terminals throughout the world. It gives the country, location, characteristics, known facilities, and available services of ports selected based on criteria established by the NGA.
Radio channels and frequency assignments: Radio communications information includes frequency assignments to specific channels defined by the International Telecommunications Union (ITU) and consists of long collections of codes (channel designators), transmitting/receiving frequencies, and permitted uses. Tables of maritime communications information include VHF, MF, HF channels. Entries describing channels are often annotated with additional notes on geographic areas, regional variations, availability, etc.

4.6 Data formats

Specification authors should note that data formats can be distinguished from the normative model yet synchronized with it, e.g., it is possible to transform an extract from a dictionary (option **Error! Reference source not found.**) into an XML fragment which is merged into a feature catalogue which treats the attribute as an ordinary enumeration (option **Error! Reference source not found.**), obviously an additional procedure is involved for future maintenance of the FC and product specification, which procedure is specific to that product specification.

4.6.1 GML and other XML data formats

The normative format is determined by the tagged value *asDictionary* attached to the corresponding UML class in the application schema. GML 3.3 (OGC 10-129r1) amends GML 3.2 (ISO 19136) to allow "any suitable syntax or encoding" for the external list, and suggests that contemporary Web technologies including semantic web representations be considered. The normative formats for the two CodeList options are:
Option C, Enumeration with pattern: Encode in conformance to ISO 19136 Clause E.2.4.9 as a union of an enumeration and a pattern of the form "other: \w{2,}" that allows for text values prefixed with "other: ". For example, assuming a codelist which explicitly lists "Norwegian" but not Nynorsk and Bokmål:

```
<language>nor</language>          <!-- Norwegian is an explicitly enumerated value -->
<language>other: nno<language>    <!-- Norwegian Nynorsk is not an enumerated value -->
```

Option D: External Dictionary: Encode in the instance document as a reference to the dictionary entry and define the dictionary (vocabulary) in any standard dictionary format (ISO and W3C define formats). Assuming the IHO maintains a dictionary of ENC aggregated features (with code 1 corresponding to "Range System"), data products could refer to the range system thus:

```
<categoryOfAggrFeature xlink:href="http://registry.iho.int/cl/s101/aggr/ver03/1"/>
```

Dictionary version information can be indicated ("ver03" in the example). The dictionary must be available on the Internet and may be included with distributed software. A format for the dictionary is not being specified at this time, for the same reasons as OGC 10-129r1 (no clearly dominant format at present).

4.6.2 ISO 8211 encodings

Option C, Enumeration with pattern: To accommodate producer-defined values ("other: xyz") this can be encoded either as a "text" type (character string) or as a complex attribute with an integer sub-attribute (for the listed allowed values) and a text sub-attribute (the "other:..." values).
Option D: External Dictionary: This can be encoded in two ways:

1) A URI data type with value a URI constructed by combining the URI for the vocabulary (dictionary) and the item code. E.g., http://registry.iho.int/codelist/s23/1953/1 for the Baltic Sea (item 1 in the 1953 edition of IHO publication S23 – Limits of Oceans and Seas).
2) A complex attribute with two sub-attributes: Vocabulary location (URI) and item code (text). To use the same example: sub-attributes are *vocabulary*= http://registry.iho.int/codelist/s23/1953/ and *itemCode*=1.

Method 1 is recommended for Option D, as it reduces data complexity. No change to the ISO 8211 format is needed, but obviously the attribute will have to be encoded as a string-valued attribute instead of a numeric-valued attribute.

4.7 Dictionary formats

The reasonably mature formats for dictionaries are currently GML [ISO 19136, OGC 10-129r1], and SKOS [SKOS]; RDF and OWL are less preferable possibilities. This paper recommends use of GML or SKOS formats.

4.8 Registry, Distribution, and Maintenance

A code list register would be useful for facilitating reuse of codelists in product specifications as well as applications.

Codelists are generally maintained by a central responsible body. The maintenance of codelists should follow normal GI registry procedures including versioning, change control, etc. Codelists could be maintained by a domain expert group just like product specifications, and their other treatment and metadata in the GI registry can be similar to product specifications, except that the artefacts involved are basically just parts of a product specification - fragments of application schemas, feature catalogues, and XML schemas, and perhaps a fragment or templates for portrayal catalogues. We suggest the GI registry should treat them like product specifications with the unnecessary clauses and metadata omitted. Metadata for citation of the parent source (e.g., ISO standards), lineage, versioning, representation language, official Internet URIs of the vocabulary, XML schemas, etc., is obviously required.

Applications may download code lists but applications using only a local copy are susceptible to content changes and divergence – in the maritime domain this means a maintenance/distribution regime is needed and deletions from external code lists may need to be limited or linked to new versions of product specifications.

5 Recommendations

Recommendation 1: Add a CodeList type to S-100.

Recommendation 2: Add a codelists register to the GI registry, structured like the product specifications register but omitting the components and metadata elements not applicable to codelists.

6 Justification

Allowing codelist types in S-100 will provide product specification developers with the flexibility to design data products for the constraints prevailing in different application domains, including distribution and maintenance considerations as well as implementation. Codelists will also facilitate reuse of data models.

7 Impacts

Product specifications currently being prepared need not change unless specification writers desire to implement one of the “open form” implementations described in this paper.

Implementers of specifications which use a “dictionary” data format will need to adapt implementations to implement CodeLists data type and lookup items in the named vocabularies. Implementers of specifications which provide an enumerated data format will not need to change. Specification authors will need to develop translation tables between different data formats.

8 Conclusion

Codelists provide a way to model open, flexible enumerations. They provide specification authors with the capability to design specifications with more flexible distribution and maintenance regimes and facilitate reuse of the work of external organizations and reuse across domains. Current standards provide two methods of modelling and implementing them. This paper recommends addition of both methods to S-100 Edition 2.0.0 and also the addition of a codelists register to the IHO GI registry to facilitate reuse.

9 Actions Requested

TSMAD is requested to:

- Add codelist types to S-100; if agreed, consider the further actions below:
- Adopt both Options C (enumeration with pattern) and Option D (external dictionary) as representations of codelist types.
- Review and amend the changes suggested in the accompanying change proposal form and include the finalized changes in S-100 Edition 2.0.0;
- Add a codelists register in the IHO GI registry.

Annex A. Guidance for product specification authors

Product specifications should balance all relevant considerations, e.g., implementation costs, application operational environment, cross-domain reuse, and reduction of maintenance and distribution efforts, when deciding which approach to use for any particular attribute.

A.1. Modelling

When deciding between using a codelist and enumeration, consider the completeness, stability, source, reuse, and application dependencies of the list of values.

- If the set of allowed values is fixed and reasonably short (say, fewer than 20 values?), an enumeration must be used.
- If the list is fixed but long, an enumeration is preferred but a "dictionary model" codelist may be used.
- If only the likely values of an enumeration are known, or the list may be extended by data producers or the user community, a codelist must be used. Whether the "dictionary" or "open" form is preferable depends on who might add values – if it is maintained by an organization, the dictionary form is preferable, if user communities or data producers may add values, the "open" form is preferable.
- If the allowed values change frequently and the list should be updated without major revisions of the product specification, a codelist may be used. The "dictionary" form may be preferable under these circumstances.
- If application logic or portrayal rules depend on values, an enumeration is preferred but a codelist may be used if the logic/rules can be written to cover all possible values (e.g., using wildcards or defaults), or otherwise allow graceful recovery from unanticipated values.
- Collections which have internal structure (e.g., types and subtypes of vessels) should be modelled as "dictionary" codelists, pending discussion of the matter by ISO TC211.

A.1.1. Hierarchies of codelists

A code list may also be used as a super-type for more specific code lists. The vocabulary of the super-type is the union of the vocabularies of its sub-types[3]. If additional values are permitted the super-type must have tag *extensible=true*, otherwise it must have *extensible=false*. Practically, this allows vocabularies developed by different domain expert groups or organizations to be merged.

A.2. Codelists maintained by external organizations

If there is an existing well-established codelist maintained by a responsible source, it can be referenced in an application schema. The code list should meet the following requirements[4]:

- It must be managed by a responsible source – an official national or international standards body, long-established user community, group, or consortium.
- The codelist and its values must be identified by persistent HTTP URIs.
- The list should be well-maintained i.e. all its values must remain available forever, even if they have been deprecated, retired or superseded.
- The list should be in a dictionary language accepted for use in S-10x product specifications.

The IHO may be requested to arrange for the translation, reproduction, and maintenance of codelists meeting only some of the above requirements. Note that this may necessitate a discussion between the IHO and the source.

---

[3] Note that the super-type cannot augment the union set with additional definitions. This conforms to the INSPIRE usage but may be worth reconsidered if an argument for such augmentation is made by OEMs, TSMAD, or SNPWG.

[4] Adapted from reference IN.D2.5.

A.3. Data formats of codelist typed attributes

The codelist model in S-100 is designed to be flexible by decoupling application schema from data format to some extent. Data formats may use "code list extractions" created by extracting codes or values from a codelist dictionary and treat them as ordinary enumerations. The effect is to allow data formats to use either an external dictionary or ordinary enumerations. For example, an XML data format might convert an *ISO3166CountryCodes* codelist maintained by IHO into an XML Schema type:

```
<xs:simpleType name="ISO3166CountryCodesType">
  <xs:restriction base="xs:string">
    <xs:enumeration value="EN"/>
    <xs:enumeration value="FR"/>
    ... other country codes ...
```

As far as implementations using that schema are concerned, it is indistinguishable from an ordinary enumeration. The decision as to which alternative(s) to use in any particular product specification should depend on the circumstances of the data product and its use environment. The decision should be made by the product specification authors when developing the data format. Obviously allowing different data formats to use different representations introduces additional maintenance requirements relating to some data formats, these would be limited to the formats which use "closed" representations (i.e., convert the codelist to an ordinary enumeration).

A.3.1. GML and other XML data formats

Enumeration with pattern: The data format in XML schemas must conform to ISO 19136 E.2.4.9, i.e., a union of an enumeration and a pattern of the form "other: \w{2,}".
Examples of use (assuming a codelist which explicitly lists "Norwegian" but not Nynorsk and Bokmål):

```
<language>nor</language>          <!-- Norwegian is an explicitly enumerated value -->
<language>other: nno<language>    <!-- Norwegian Nynorsk is not an enumerated value -->
```

External Dictionary: The data format in XML schemas must be the XML Schema built-in types *anyURI*. The use of spaces is discouraged.
Example:
In XML schema: Type definition: `<xs:simpleType name="namedSeaType" type="xs:anyURI">` and later (in feature definition): `<xs:element name="namedSea" type="namedSeaType"/>`
In dataset: `<namedSea xlink:href="http://registry.iho.int/cl/s23/1953/1"/>`

A.3.2. ISO 8211 encodings

Enumeration with pattern: To accommodate producer-defined values ("other: xyz") this can be encoded either as a "text" type (character string) or as a complex attribute with an integer sub-attribute (for the listed allowed values) and a text sub-attribute (the "other:..." values).
External Dictionary: This can be encoded in two ways:

1. A URI data type with value a URI constructed by combining the URI for the vocabulary (dictionary) and the item code. E.g., `http://registry.iho.int/codelist/s23/1953/1` for the Baltic Sea (item 1 in the 1953 edition of IHO publication S23 – Limits of Oceans and Seas).
2. A complex attribute with two sub-attributes: Vocabulary location (URI) and item code (text). To use the same example: sub-attributes are *vocabulary*= `http://registry.iho.int/codelist/s23/1953/` and *itemCode*=1.

The first method is recommended as it reduces data complexity.

A.4. Dictionary formats

Use of GML dictionary or SKOS format is recommended. Other formats may be considered under compelling circumstances or after the development of standards in ISO or elsewhere.

Annex 2

Draft of application schema content for the MPA product specification

1 Data Content and Structure

1.1 Introduction

The UML model shown below illustrates a simplified version of the MPA application schema. It includes a general description of elements used to construct the application schema, and the relationships between them. These elements include features types, information types, simple attributes, complex attributes, aggregations and associations. A brief description of these is provided below and the full description is in the feature catalogue.

A feature is an abstraction of real world phenomena. **GF_FeatureType** is a metaclass that is instantiated as classes that represent individual feature types. A certain feature type is the class used for all instances of that feature type. The instance of a class that represents an individual feature type is called feature instances. In object-oriented modelling, feature types are equivalent to classes and feature instances are equivalent to objects.

An information type is an identifiable object that can be associated with features in order to carry information pertaining to the associated features. **S100_GF_InformationType** is the class intended for information types within S-100. A primary object carrying a Chart Note for example, may contain text in English and an associated supplementary information object may be used to carry the same text in another language.

Simple attributes can be enumerations, codelists or simple types (e.g. integer or character string).

Complex attributes are properties of a feature which can be divided into multiple sub attributes and are used where objects have properties that better fit a hierarchical structure. They provide a better construct for encoding list attributes on objects such as light sectors.

An association is a relationship that links instances of one feature or information type with instances of the same or different feature and information types. Each relationship has a name and two roles thus giving a more detailed representation of the real world relationships within the dataset.

1.2 Application Schema

The MPA application schema is presented as a UML model in the figures that follow.
Figure 2 shows a simplified diagram of the features defined in the MPA application schema. The four geographic features **Marine Protected Area**, **Marine Service**, **Restricted Area** and **Sea Area** are all derived from the abstract type **FeatureType** and inherit its simple and complex attributes. Some of the four also have their own attributes, defined in the feature catalogue but omitted from this figure for simplicity. The allowed multiplicities of attributes are also indicated in the figure.
Feature types can have spatial primitives associated with them and also metadata, indicated by the links to the *Geometry* and *Metadata* packages.
The complex attribute **feature name** is also a complex sub-attribute of **source indication**. The note attached to the aggregation relationship between the two indicates that when **feature name** is a sub-attribute of **source indication**, it is to be used to encode the name of the authority responsible for the source document described by **source indication**.

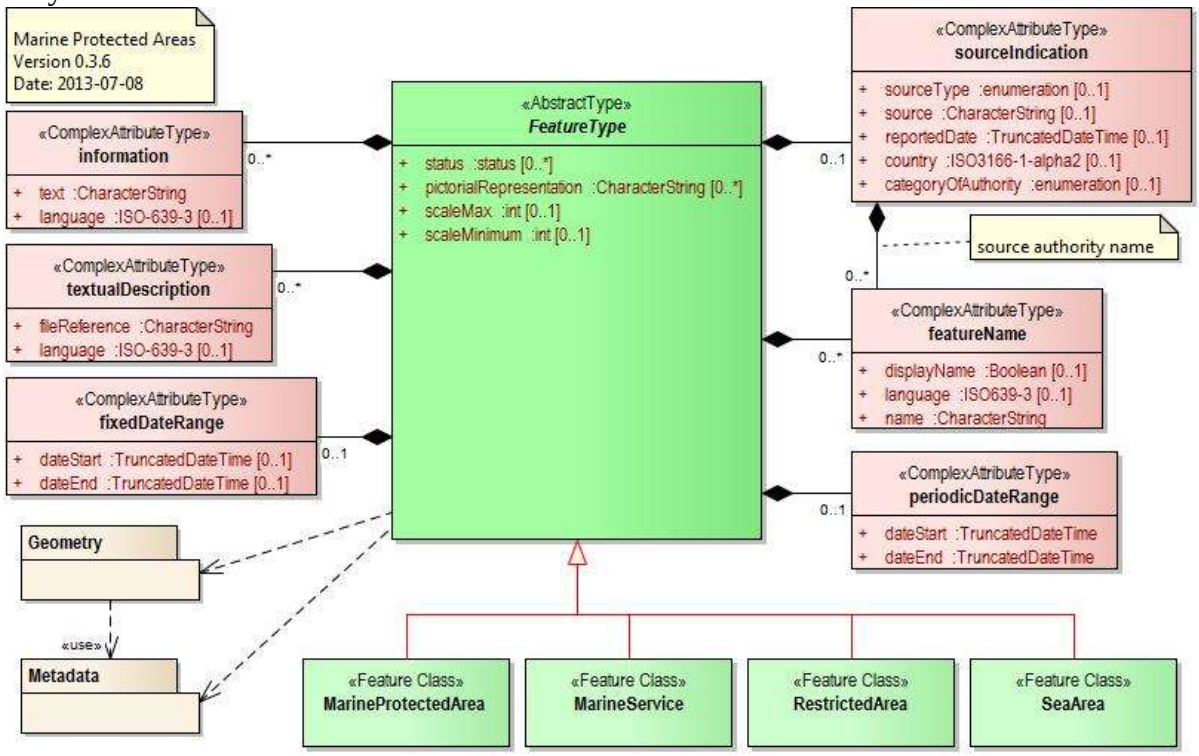

Figure 2. Feature Types

Figure 3 shows a simplified diagram of the information types. In addition to the 6 information types derived directly from the root abstract type **InformationType**, there is a derived abstract type **AbstractRXN** which is itself a parent of the information types **Regulations**, **Restrictions**, **Recommendations** and **Nautical Information**. These four types thereby inherit the attributes of both **AbstractRXN** and its super-type **InformationType**. The attributes bound directly to the various information types are omitted from this diagram for clarity, but are given in the feature catalogue.

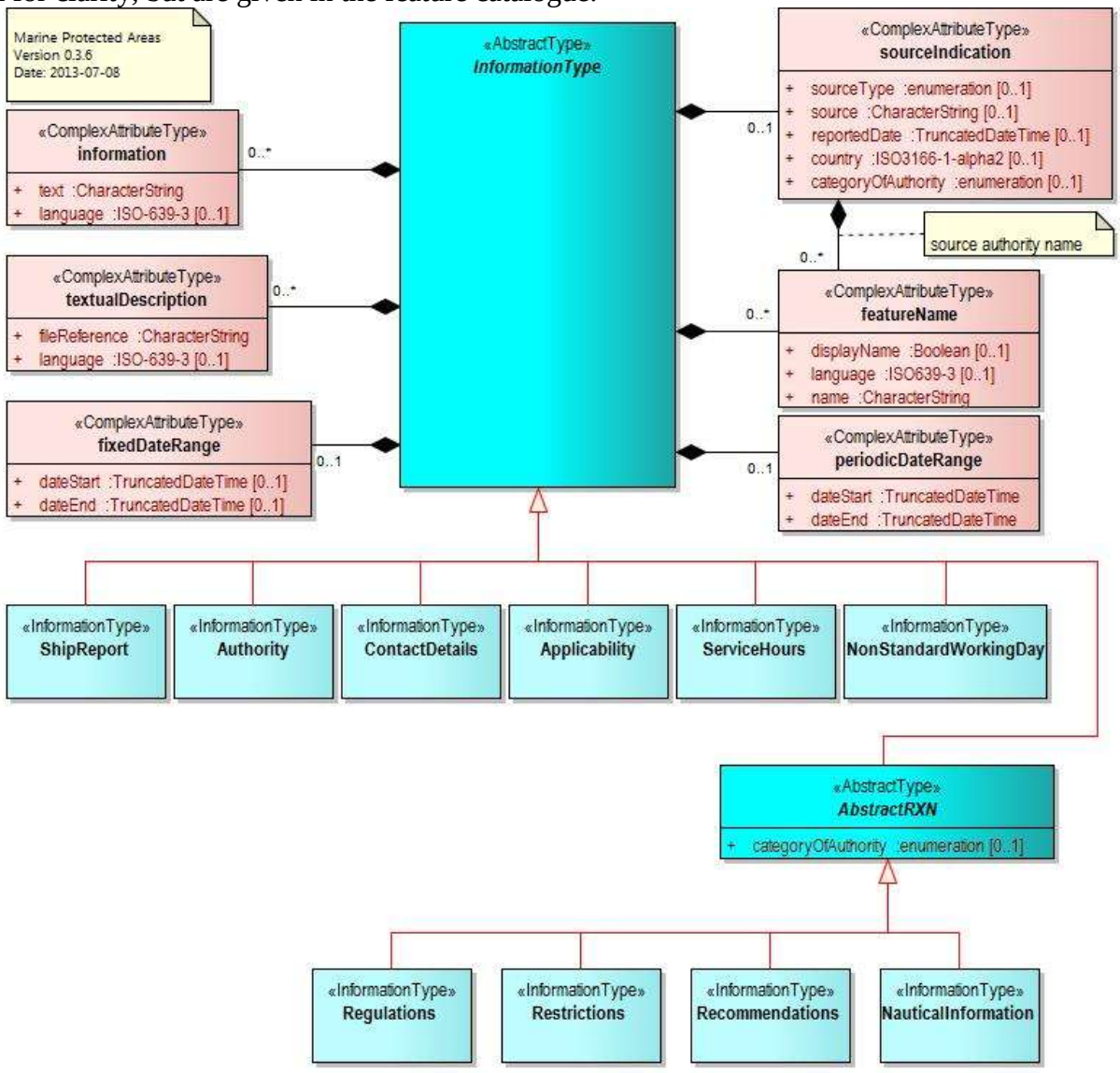

Figure 3. Information Types

Figure 4 shows more details about the abstract type **AbstractRXN** and its sub-types. **AbstractRXN** has one simple attribute, **category of authority**, and one complex attribute, **text content**. **AbstractRXN** is a sub-type of **Information Type**, and therefore inherits the simple and complex attributes of **Information Type**. Its sub-types **Regulations**, etc., inherit its attributes as well as those of **Information Type** (through **AbstractRXN**).

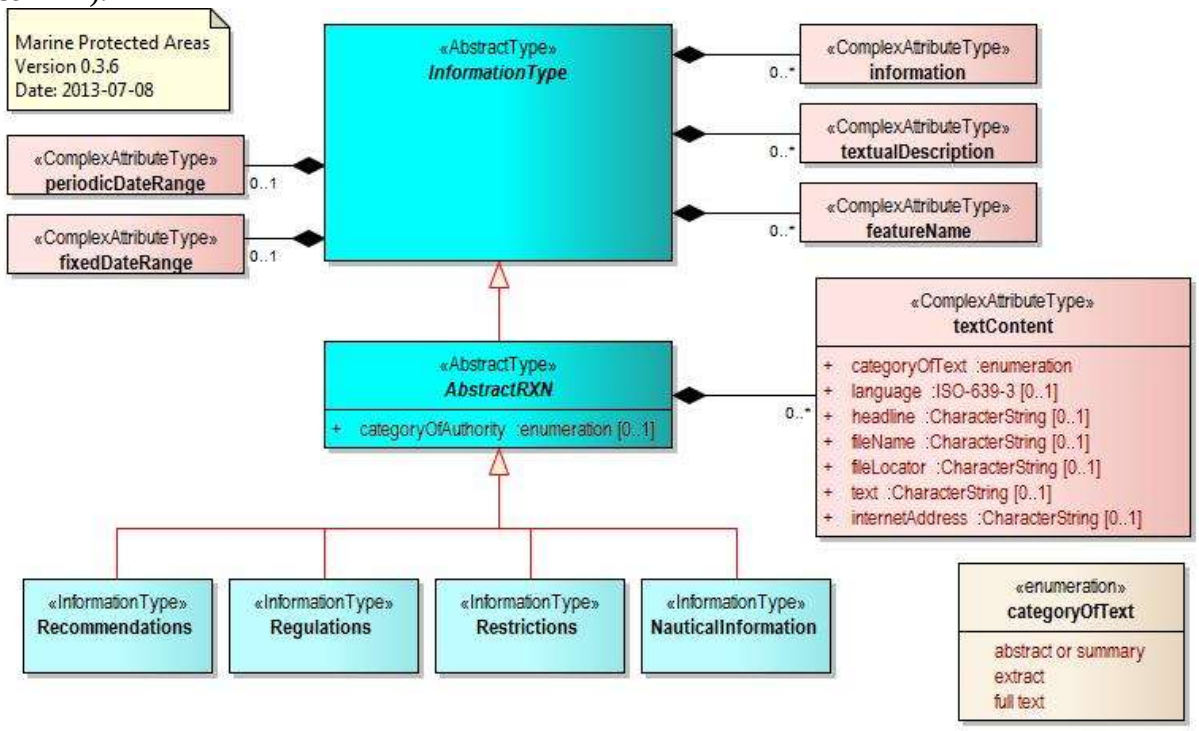

Figure 4. Regulations, Restrictions, Recommendations, and Nautical Information

Figure 5 shows the part of the application schema that describes the authorities responsible for (or otherwise associated with) a protected area and their contact information. An authority and its contact information are described by information types **Authority** and **Contact Details** respectively. The relevant **Authority** for a **Marine Protected Area** object is associated to the **Marine Protected Area** by an association with role *responsibleAuthority*.

The contact details for a specific authority are given by associating a **Contact Details** instance with the **Authority**. An authority may have zero, one, or more **Contact Detail** instances associated to it. Any particular **Contact Details** may be associated with more than one authority. Since an instance of **Contact Details** may be associated with other types, it is not a requirement that an instance of **Contact Details** be associated with an **Authority**, whence the "0" lower bound on multiplicity.

The **Contact Details** class binds several simple attributes for describing postal and Internet addresses, telephone numbers, codes, etc., and also the complex attribute **frequency pair** which describes frequency pairs for radio transmission/reception. Since **Contact Details** is a sub-type of the base type **Information Type** it also inherits the attributes of that type.

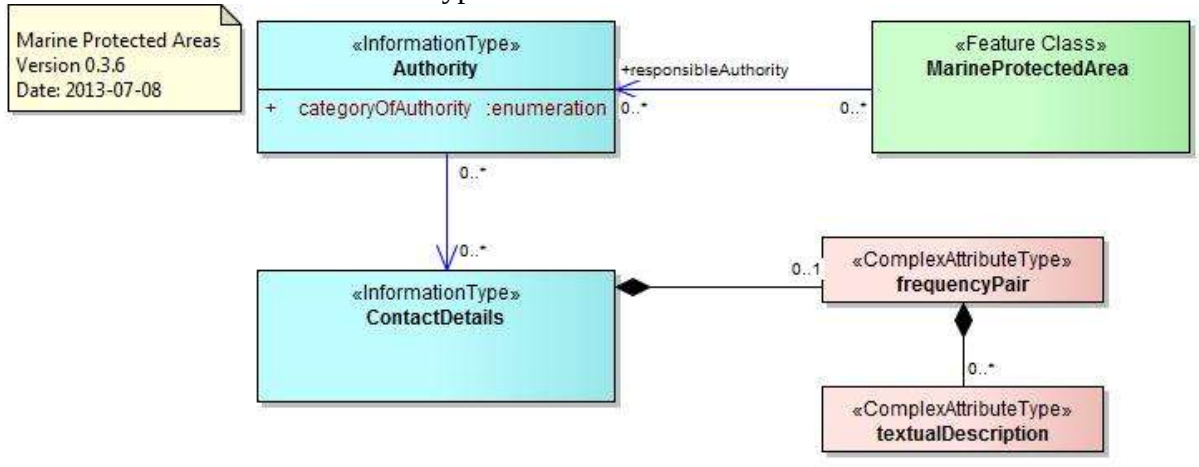

Figure 5. Relevant Authorities and their Contact Information

Figure 6 shows the model for business hours or other working hours or an authority. The information type **Service Hours** is associated to the authority and its complex attribute **working schedule** describes the normal working schedule. Days (other than regular weekly closing days) when services are not available are described by the information type **Non-Standard Working Day**.
The complex attribute **working schedule** allows at most one range of weekdays (e.g., Monday-Friday) to be specified using the complex sub-attribute **day of week range**. It also allows individual weekdays to be listed in the simple attribute **day of week**. Business hours for the days specified by the values of attributes **day of week** and **day of week range** are described by the complex attribute **working hours of day**. Note that a Service Hours object may have more than one instance of attribute **working schedule** bound to it. This allows encoding of different business hours for different days of the week.
Example: One instance of **working schedule** lists the days Monday, Wednesday, and Friday, while a second instance lists the days Tuesday and Thursday. The first has a sub-attribute **working hours of day**, specifying working hours of 0800-1700. The second has a sub-attribute **working hours of day**, specifying working hours of 0900-1300. The business hours are therefore 0800-1700 on Mondays, Wednesdays, and Fridays and 0900-1300 on Tuesday and Thursday.
Details about encoding working schedules and holidays will be provided in the Data Classification and Encoding guide. Encoders and/or data validation rules should check for duplicative encoding of working days in different instances of **working schedule** bound to the same instance of **Service Hours**.

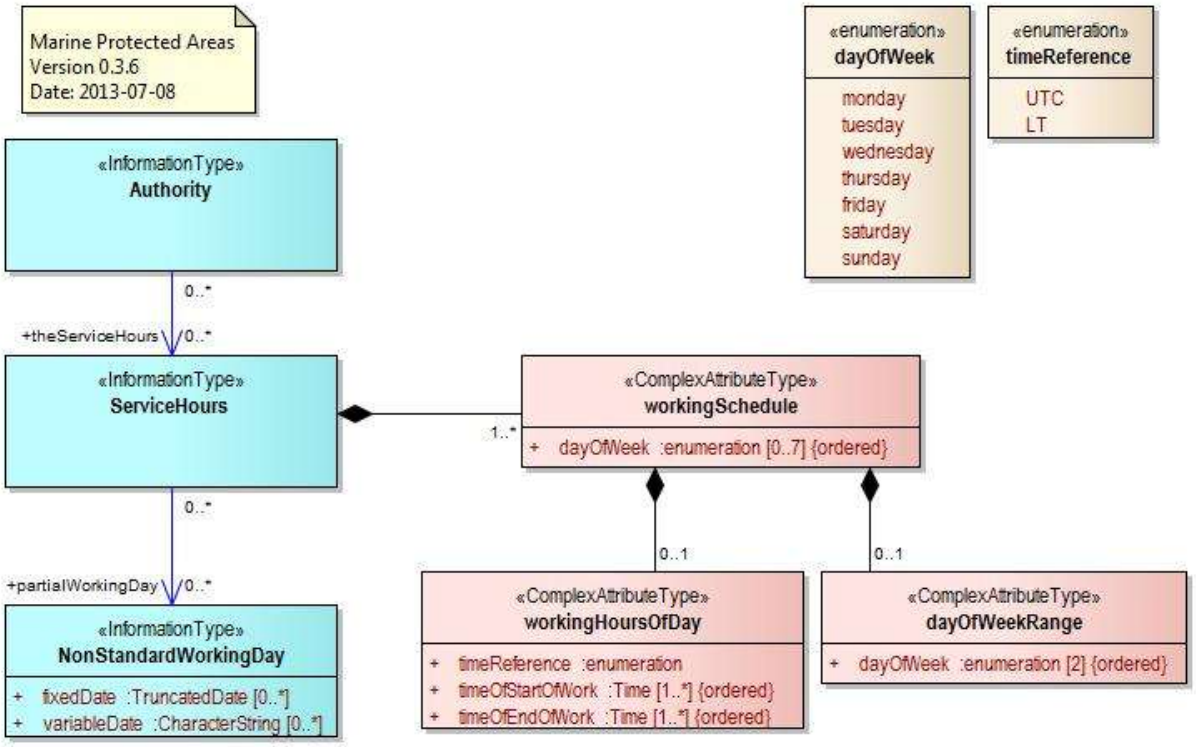

Figure 6. Business Hours for Authorities

Figure 7 describes the receiver and time-of-filing requirements for reporting requirements for vessels transiting protected areas and the relevant ship reporting systems, if any. Such a reporting requirement must be modelled by defining a **Marine Service** feature and associating it with an instance of **Ship Report**. The authority with which the report must be filed is defined by associating an **Authority** object with the **Ship Report**. The relevant VHF channel information, email, or other addressing data are provided by an associated **Contact Details** information object. The type, content, and time of filing are described by the simple and complex attributes of **Ship Report**.

Determining whether a vessel must file the report is done by means of the associated **Applicability** instance(s). Each associated **Applicability** instance defines a set of vessels determined by ship dimensions, cargo type, etc. The use of Applicability to describe different sets of vessels is described later. The type of association between **Ship Report** and **Applicability** determines whether the vessel described by an instance of **Applicability** is subject to or exempt from filing the report (these association types are described elsewhere in this clause).

If there is no associated **Applicability**, the reporting requirement applies to all vessels.

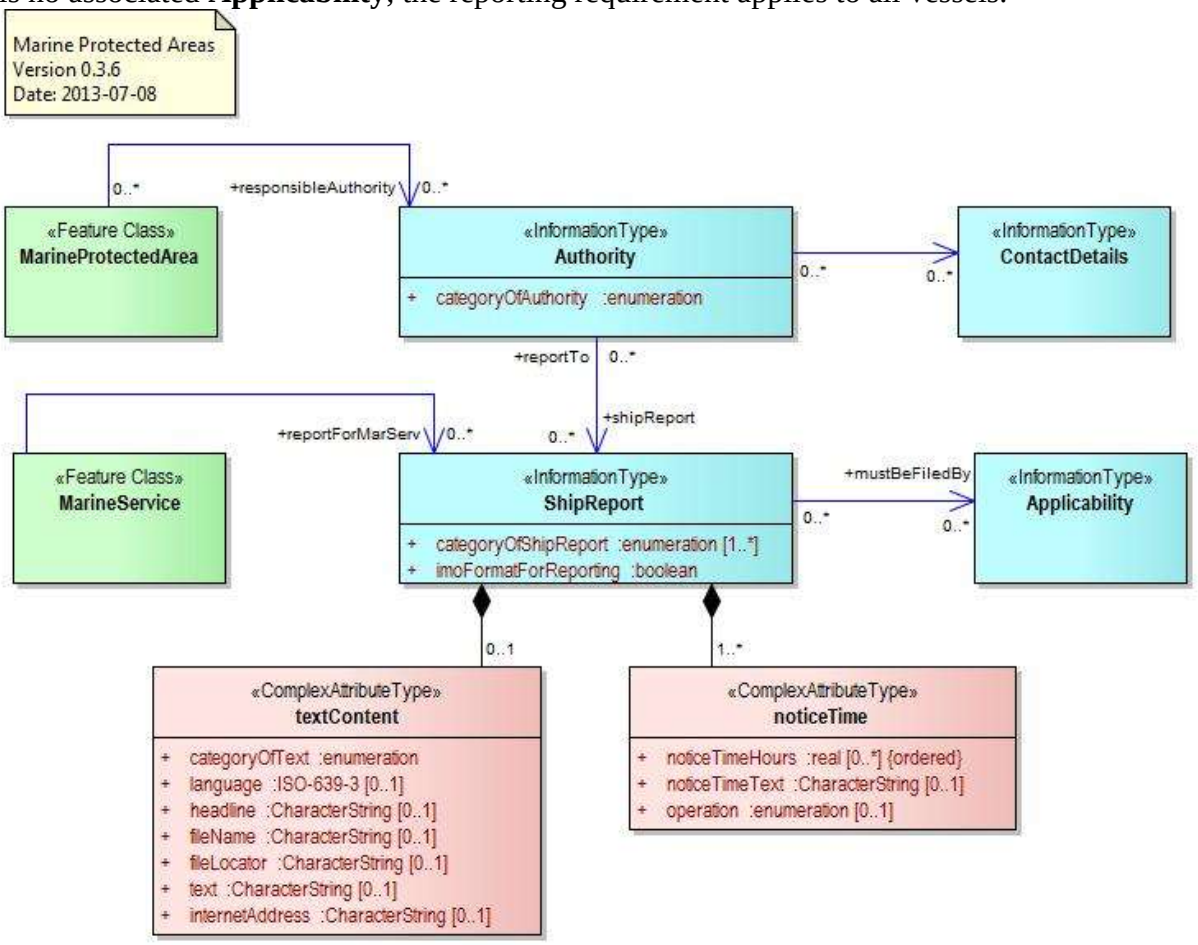

Figure 7. Reporting

The information type **Applicability**, shown in Figure 8, defines subsets of ships in terms of vessel dimensions, cargo types, and equipment characteristics. Vessel dimensions are described by the complex attribute **vessels measurements**. Each instance of this complex attribute describes an arithmetic expression comparing the characteristic named by **vessels characteristics** (e.g., "*length overall*") to the value specified by **vessels characteristics value** and **vessels characteristics unit** (e.g., "*100 metre*") with the operator specified by the sub-attribute **comparison operator** (e.g., "*greater than*"). If there are multiple conditions (e.g., multiple instances of **vessels measurements** bound to the Applicability instance), the value of attribute **logical connective** is used to specify whether the conditions must be combined with logical OR (disjunction) or logical AND (conjunction).

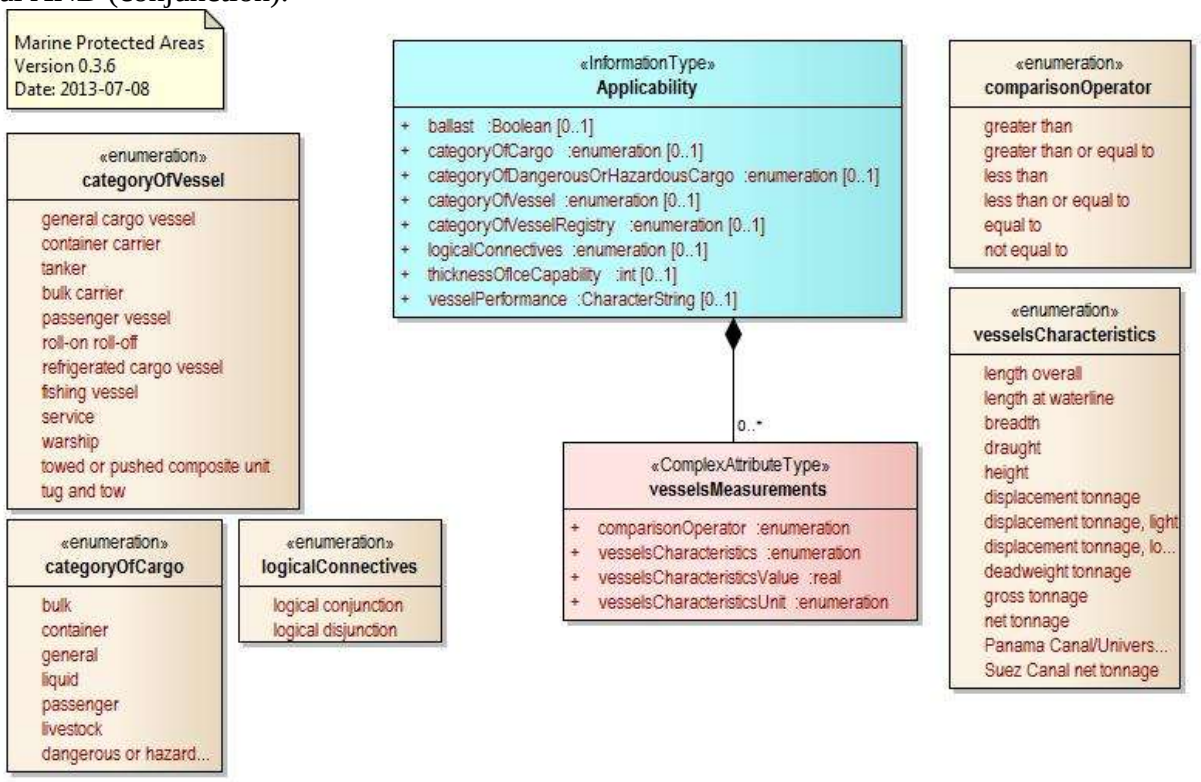

Figure 8. Defining Vessel Categories by Cargo and Ship Dimensions

Figure 9 describes the use of **Applicability**. This part of the application schema describes three contexts in which **Applicability** is used:

1) An association between instances of **Ship Report** and **Applicability** indicates that the vessels described by the **Applicability** object must file the indicated ship report (see also Figure 7).

2) The association class **Permission Type** describes the kind of association between features of any type and **Applicability**. This association class has a single attribute named **category of relationship**, which can take values *prohibited*, *permitted*, etc. The **Permission Type** instance describes whether use of (or transit through) the feature is prohibited (or required, recommended, etc.) to the vessels described by the associated **Applicability** instance.

   Example: An association between an **Applicability** instance with attribute **categoryOfDangerousOrHazardousCargo** = *Class 3* and an instance of feature **Sea Area**, with **Permission Type**'s attribute **categoryOfRelationship** = *prohibited*, means that transit through the specified area is prohibited to vessels carrying flammable liquids (hazardous cargo type class 3 in the IMDG Code).

3) The association class **Inclusion Type** describes the kind of association between instance of sub-types of **AbstractRXN** and vessels described by an associated instance of **Applicability**. **Inclusion Type** has a single attribute which can have the value *included* or *excluded*, describing whether the vessels are subject to or exempt from the regulation (or restriction, recommendation, etc.).

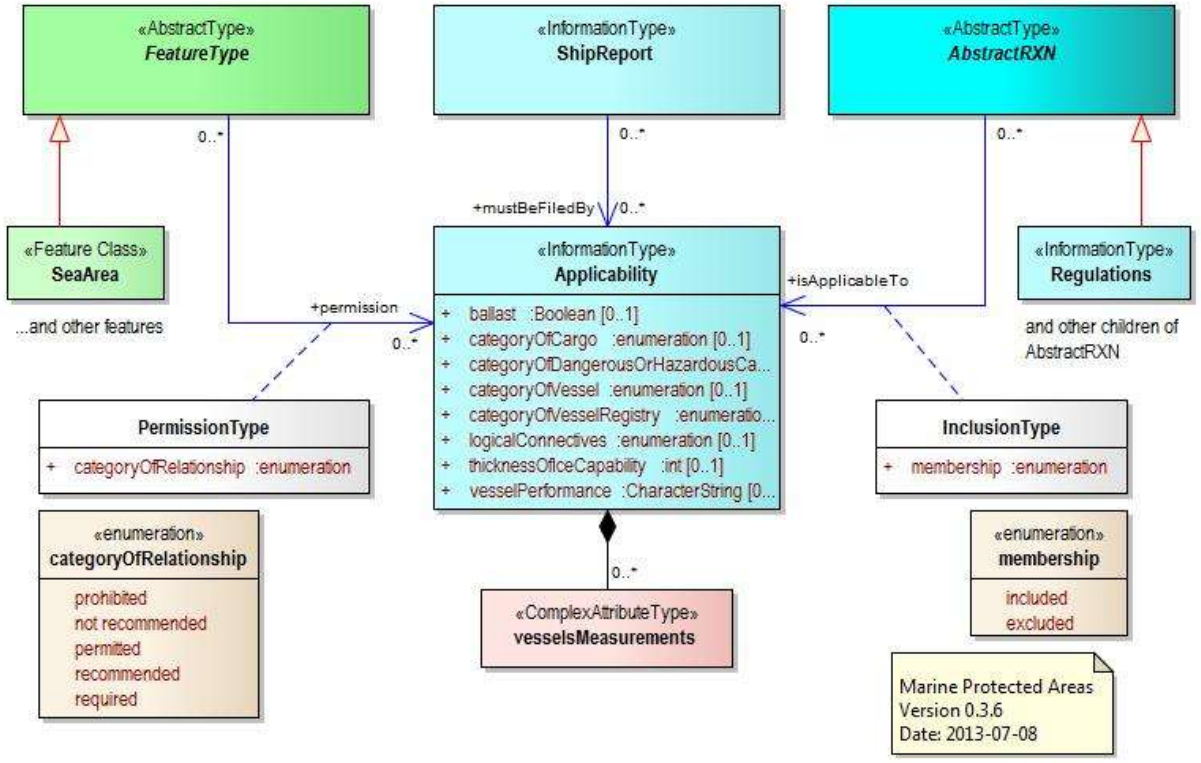

Figure 9. Applicability of Reporting Requirements, Rules, etc. to Vessel Categories

1.2.1 Conventions for Roles in the Application Schema

The following conventions apply to role names which are suppressed from the UML diagrams but needed for another purpose (such as a particular encoding format):

1) Feature / feature and information / information associations:

   a) If only one end of an association is given an explicit name "<rolename>", the other end shall have the default name "inv_<rolename>".

   b) If neither end of the association is given an explicit name, the default name of the association end is "the<target class name>" (the name of class at that end of the association).

2) Feature / information associations:

a) An unnamed feature end shall have the default name “additionalInformation”.

b) An unnamed information end shall have the default name “the<information type name>”.

3) The previous two rules may result in duplicate role names. Encoding format specifications or other situations that need unique names may define conventions for suffixes to the explicit or default names that are sufficient to disambiguate names to the extent needed.

Example (informative): An association label (“<label>”) is generated by concatenating the names of the classes at each end of the association, in alphabetic order, and the role names are defined as “<rolename>_<label>”.

Annex 3

SNPWG xx-xx

Draft 2 – 26 August 2013

Work in Progress - Contingent on MPA becoming a standalone product specification

Context feature types for the MPA product specification

Submitted by:	Jeppesen
Executive Summary:	This paper proposes the addition of some feature types to the Marine Protected Areas product specification in order to make it more acceptable as a standalone product specification.
Related Documents:	(1) S-100
Related Projects:	(1) MPA

2 Introduction/Background

The MPA data product was originally intended to be an overlay to S-101 ENC data. Additional features may be needed to provide context if MPA is to be a "standalone" product, e.g., depicted without S-101 ENC data. For example, showing the underlying land and water areas is necessary to provide a human viewer with meaningful portrayal of MPA information, even when the MPA specification ultimately becomes part of the Traffic Management product specification.

3 References

TBD

4 Discussion/Analysis

The basic question is exactly what "context" is needed. Tentative criteria for "context" features are:

- Provide a portrayal context for MPA data (e.g., support correct portrayal)
- Provide physical, topographic, operational, thematic, legal, or administrative context for MPA information

The boundaries of polygons are often designed by a human based on cartographic considerations rather than distinct physical identity, e.g., the boundaries of Depth Area polygons are often at depth contours made by a cartographer. Nautical publications data is expected to be scale-independent. Datasets should therefore use features at the best scale and with minimal cartographic alteration.
Likely candidates for "context" features in addition are listed in the table below, with justifications. This list is just a starting point for SNPWG to work with.
To consider other feature types, or for more information about the features mentioned below see the SNPWG Wiki and the most recent available S-101 documents. The S-101 Product Specification is TSMAD26/DIPWG5 10.2B and the DCEG is DCEG 3 (Word) and DCEG1 (PDF) on the TSMAD 26 documents page. The URLs are:
http://www.iho.int/mtg_docs/com_wg/TSMAD/TSMAD26/TSMAD26_DIPWG5Docs.htm and
http://www.fuerstenberg-dhg.de/mediawiki/index.php/SNPWG.
Attributes: The attributes bound to a feature in MPA do not have to be the same as in S-101. It might be helpful to give some consideration to S-101 attributes (in the S-101 DCEG) when deciding which features should be added as context.
"Priority" is the priority for including the feature in the MPA data product (and product specification). The features listed here are in a sense "auxiliary" to the main MPA model.

Feature Type	Special condition if any	Justification and notes	Priority (1=high)

Feature Type	Special condition if any	Justification and notes	Priority (1=high)
Skin of the earth			
Depth Area (DEPARE), Dredged Area (DRGARE), Unsurveyed Area (UNSARE)		skin of the earth topographic context	1
Land Area LNDARE	If and only if spatial primitive is Surface	skin of the earth Topographic context. In S-101 LNDARE can be of spatial type point, curve, or surface. The S-101 DCEG says "**Land Area** features of type surface are part of the Skin of the Earth."	1
Floating dock (FLODOC), Hulk (HULKES), Pontoon (PONTON)	If and only if spatial primitive is Surface	These are part of the skin of the earth in S-57 but not in S-101. Included as a hook for discussing possible data conversion issues while creating MPA datasets from current spatial data or from S-57 ENCs. Leaving it out may make holes in the skin of the earth for some cells, which must be corrected during conversion.	TBD
Marks			
Beacon, Special Purpose/General (BCNSPP) Buoy, Special Purpose/General (BOYSPP) Associated equipment: Daymark, ~~Fog Signal,~~ Light[5], ~~Radar Station, Radio Station,~~ Retroreflector, ~~Radar Transponder Beacon, Signal Station Traffic, Signal Station Warning~~	Only if relevant to an MPA, e.g., boundary marks, or warning signs.	Physical and operational context for protected areas. If the boundaries of protected areas are sometimes marked, it is useful for mariners to know what marks are used and where they are located. The same reasoning applies to buoys with signboards. S-101 DCEG Clause 17 lists several structure objects for navigation aids: Beacon Cardinal, Beacon Isolated Danger, Beacon Lateral, Beacon Safe Water, Beacon Special Purpose/General, Buoy Cardinal, Buoy Installation, Buoy Isolated Danger, Buoy Lateral, Buoy Safe Water, Buoy Special Purpose/General, Bridge, Building, Crane, Daymark, Floating Dock, Fortified Structure, Fishing Facility, Hulk, Light Float, Light Vessel, Landmark, Mooring/Warping Facility, Offshore Platform, Pile, Pontoon, Pylon/Bridge Support, Obstruction, Shoreline Construction, Wreck. This note assumes that the stricken "equipment" features mentioned in the S-101 DCEG (e.g., radar transponder beacon) are not used in conjunction with marking MPAs – OK?	2
AIS Aid to Navigation AISATN	Only if relevant to an MPA, e.g., boundary marks	Physical and operational context for protected areas, boundary marks.	2
Bathymetry			
Depth Contour DEPCNT	within coverage	Bathymetric context, depths in or near protected areas and elsewhere in the coverage	2
Sounding SOUNDG	in or near protected area?	Bathymetric context, depth values in or around protected areas. Q: W ill providing sounding data (or too much sounding data) entice mariners into using MPA datasets for navigation in spite of the disclaimer they will no doubt be issued with?	2

[5] Replaced in S-101 by different features for different types of lights. In the latest draft of the S-101 DCEG, these are Light All Around, Light Sectored, Light Fog Detector, Light Air Obstruction.

Feature Type	Special condition if any	Justification and notes	Priority (1=high)
Underwater/Awash Rock UWTROC Obstruction OBSTRN Wreck WRECKS Depth – no bottom found	in or near protected area?	Bathymetric context in or around protected areas. Depth – no bottom found is new in the S-101 DCEG. Q: W ill providing this data (or too much detail of this particular data) entice mariners into using MPA datasets for navigation in spite of the disclaimer they will no doubt be issued with?	2
Administrative and Legal			
Administration area ADMARE	if overlapping a protected area	Administrative and legal context.	3
Territorial sea area TESARE	if overlapping a protected area	Administrative and legal context.	3
Straight territorial sea baseline	if overlapping a protected area	Administrative and legal context. For providing a complete picture, if features like TESARE, CONZNE and EXEZNE are included.	3
Contiguous zone CONZNE	if overlapping a protected area	Administrative and legal context. The coastal state may exercise certain control in this zone subject to the provisions of International Law.	3
Continental shelf area COSARE	if overlapping a protected area	Administrative and legal context. According to the S-101 DCEG "The coastal State exercises sovereign rights over the Continental Shelf for the purpose of exploring it and exploiting its natural resources"	3
Exclusive economic zone EXEZNE	if overlapping a protected area	Administrative and legal context. "The coastal State has sovereign rights for the purpose of exploring and exploiting, conserving and managing the natural resources, whether living or non-living, of the waters superjacent to the sea-bed and of the seabed and its subsoil..."	3
Environmental features			
Vegetation VEGATN	if overlapping or near a protected area AND CATVEG =7 or 21	Add thematic context to protected area information. E.g., CATVEG = 7 (mangroves), 21 (mangrove tree).	3
Seabed area SBDARE	if overlapping or "near" a protected area AND NATSUR =14	Add thematic context to protected area information. NATSUR = 14 (coral), coral reefs are often protected.	3
Weed/kelp WEDKLP	if overlapping or near a protected area	Add thematic context to protected area information. CATWED has 4 allowed values 1 (kelp), 2 (seaweed), 3 (seagrass), 4 (sargasso). Seagrass is protected.	3
Land region LNDRGN	Adjacent to or overlapping a protected area AND CATLND in (1, 2, 3, 4, 11, 12, 20)	Add thematic context to protected area information. LANDRGN is for land areas but some CATLND values denote marshes or swamps which may be relevant to adjacent marine protected areas especially if they are defined including both coastal land and water. 1: fen 2: marsh 3: moor/bog 4: heathland 11: parkland 12: swamp 20: cay	3

Feature Type	Special condition if any	Justification and notes	Priority (1=high)
Restricted area (RESARE)	intersecting or adjacent to a protected area AND CATREA in (4, 5,6,7, 20, 22, 23, 26, 27, 28)	RESARE is already part of the MPA application schema. This condition adds RESAREs providing thematic context to protected areas. CATREA is optional in S-101. 4 : nature reserve 5 : bird sanctuary 6 : game reserve 7 : seal sanctuary 20 : research area 22 : fish sanctuary 23 : ecological reserve 26 : recreation area 27 : environmentally sensitive sea area 28 : particularly sensitive sea area	2
Additional Topography			
Coastline COALNE	Curve	Physical feature that adds relevant topographic detail and gives important visual context to MPA data. Demarcates border of LNDARE features. COALNE is used for natural sections of coastlines, lakeshores and river banks. See also S-101 DCEG Clause 5.2.1 quote below.	2
Shoreline construction SLCONS	Curve OR Surface and WATLEV = 1, 2, or 6	Physical feature that adds relevant topographic detail and gives important visual context to MPA data. SLCONS is used for artificial structures in the water and/or adjoining the land, i.e., artificial sections of coastlines, lakeshores, riverbanks, canal banks and basin borders. SLCONS is used for breakwaters, jetties, sea walls, etc. See also S-101 DCEG Clause 5.2.1 quote below.	2
Gate (GATCON), Dam (DAMCON)	Spatial primitive is Curve AND sharing geometry of LNDARE of type Surface	Even more topographic context for MPA data, but not as important as SLCONS and COALNE(?). Extract from S-101 DCEG clause 5.2.1 (5.4.1 in Oct 2013 DCEG): The limits of a **Land Area** of type surface must share the geometry of at least one of the following features: ○ **Coastline**, **Shoreline Construction**, **Gate**, **Dam** of type curve; ○ **Data Coverage**, **Gate**, **Dam**, **River**, **Tunnel**, **Dry Dock**, **Canal**, **Lake**, **Lock Basin**, **Dock Area**, **Land Area** of type surface; ○ **Causeway**, **Shoreline Construction**, **Mooring/Warping Facility**, **Wreck**, **Obstruction**, **Pylon/Bridge Support** of type surface; and having attribute **water level effect** = *1* (partly submerged at high water), *2* (always dry) or *6* (subject to inundation or flooding).	Exclude?
Gate (GATCON), Dam (DAMCON), River (RIVERS), Tunnel (TUNNEL). Dry dock (DRYDOC), Canal (CANALS), Lake (LAKARE), Lock Basin (LOKBSN), Dock Area	Spatial primitive is Surface AND sharing geometry of LNDARE or UNSARE of type Surface	As for Gate and Dam curve features, above. The list of features is derived from one of the bullet items in the S-101 DCEG extract quoted above.	Exclude?

Feature Type	Special condition if any	Justification and notes	Priority (1=high)
Causeway, Mooring/Warping Facility (MORFAC), Wreck, Obstruction, Pylon/Bridge Support (PYLONS)	Spatial Primitive is Surface AND WATLEV = 1, 2 or 6 AND sharing geometry of LNDARE of type Surface	As for Gate and Dam curve features, above. The list of features is derived from one of the bullet items in the S-101 DCEG extract quoted above. WATLEV values: 1: partly submerged at high water 2: always dry 6: subject to inundation or flooding If we include PYLONS we may need BRIDGE too, for complete context.	Exclude?
Land elevation (LNDELV), Slope topline (SLOTOP), Sloping ground (SLOGRD) Ice Area (ICEARE)	Near a protected area	Natural features providing topographic detail and context. Unlikely to be useful for an MPA dataset? On the other hand Category V is "protected landscape/seascape.	Exclude
Operational context			
Restricted area (RESARE)	intersecting or adjacent to a protected area AND RESTRN in (any) or TXTDSC or INFORM populated	Add operational context. RESTRN is optional in S-101. Some RESAREs carrying restrictions are already included in the sample MPA datasets, but if MPA is to be a standalone data product all RESAREs with a RESTRN add "operational context". RESARE without RESTRN or CATREA values *might* be relevant.	2
Small craft facility	If physically and thematically relevant to an MPA. E.g., geometry intersects or is "close enough" to an MPA AND CATSCF=25 or 28	Operational context for protected areas, for pleasure craft? CATSCF: 25: camping site 28: landing/launching place for boats	Exclude

Information types in addition to those currently included in the MPA application schema are listed in the table below.

Information Type	Special condition if any	Justification	Priority (1=high)
(none)			

5 Justification and Impacts

Justification: MPA data needs context in order to be suitable for use as a standalone dataset.
Impacts: More work on preparing datasets will be needed, including conversion from S-57 data, and also some editing of spatial features (since they are likely to have only partial coverage of the MPA cells, will need to be pulled from different ENCs, and will need the deleted skin-of-the-earth features removed.

6 Recommendations

Update the MPA product specification as needed and add the features designated priority 1 to the MPA sample datasets in (immediately after SNPWG agrees on the concept and priorities – Spring 2014?). Add Priority 2 and 3 data objects in (when?).

7 Conclusion

TBD.

8 Actions Requested

Contingent of approval of MPA as a standalone data product.

SNPWG is invited to:

- endorse the proposal to add context feature types to MPA as a standalone product
- review and amend the list of candidate types
- define the strategy for adding context features to MPA data products