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Ocean Data Interoperability Platform

Deliverable D5.5: Common ODIP standards submitted to the IODE Ocean Data Standards (ODS) process

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Author (s)	Sissy Iona		HCMR
Author (s)			
Author (s)			
Author (s)			
Authorized by	Helen Glaves		NERC - BGS
Reviewer			
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Contents

1 Introduction

The Ocean Data Interoperability Platform (ODIP) project aims to create an EU/USA/Australia/IOC-IODE coordination platform which supports and promotes activities to establish interoperability between the regional ocean and marine data management infrastructures and also with the relevant global systems e.g. ODP, POGO, GEOSS etc. To demonstrate this coordination several joint prototype interoperability solutions are being developed that ensure persistent availability and effective sharing of data across scientific domains, organisations and national boundaries.

The dialogue between key representatives from the European, US and Australian ocean and marine data management communities is taking place via regular joint ODIP workshops where the project partners and other invited experts review and compare existing marine data standards in order to identify major differences between them, and propose how to overcome these through the development of interoperability solutions and/or the adoption of common standards.

As part of this strategy, several standards and best practices have been adopted by the ODIP project for wider implementation by the regional data infrastructures. The experts participating in ODIP in partnership with the SeaDataNet project have jointly identified the SeaDataNet Controlled Vocabularies for submission to the IODE/JCOMM Ocean Standard and Best Practices (ODSBP) process. These vocabularies have been developed by the Technical Task Team of the SeaDataNet Project and discussed further during the ODIP workshops. They have now been submitted jointly to the ODSBP for acceptance as global standards by the wider ocean and marine community.

The ODSBP project is a continuation of the Ocean Data Standards Pilot Project (ODS), established and implemented jointly between JCOMM and IODE. The ODSBP project was established by IODE-XXII (2013) through Recommendation IODE-XXII.6

This deliverable documents the first joint ODIP/SeaDataNet submission of the controlled vocabularies proposal to the IODE/JCOMM Ocean Standard and Best Practices (ODSBP) process.

2 Submitted proposal

In April 2015 a proposal for the “SeaDataNet Controlled Vocabularies” (see Annex 1) was submitted jointly by ODIP and the EU-funded FP7 Pan European Infrastructure for Ocean & Marine Data Management (SeaDataNet) project, to the IODE/JCOMM Ocean Standard and Best Practices (ODSBP) process for approval. The aim of this proposal was to make the SeaDataNet Controlled Vocabularies the acknowledged and accepted regional (i.e. European) standard used in metadata descriptions for marine and oceanographic datasets.

The proposal is currently under review (http://www.oceandatastandards.org/submitted-proposals-mainmenu-49) and when complete acknowledgment of this SeaDataNet/ODIP standard by IODE/JCOMM will further promote common data management practices and interoperability across the marine and oceanographic community.

Note: The postponement of the submission of this standard to the ODSB process until April 2015 (M31) has been necessary in order to align this activity with the technical developments that were also being undertaken as part of the SeaDataNet project. However, this delay has not had an impact on the scheduling and delivery of other ODIP activities.

3 Review Process

In line with the stated procedure, the proposal was submitted to the IOC Project Office for IODE (IODE-PO) (p.pissierssens@unesco.org) for the initiation of the review. The process is overseen by the Project Steering Group and includes the following steps:

Step 1 - Proposal submission: Proposals are prepared in a standard template and submitted to the IODE-PO

Step 2 - Internal review: Steering Group conducts a review of the fitness of the proposal and responds in 15 days

Step 3 - Expert review: Expert team conducts a technical review of the fitness of the proposal and responds within 3 months

Step 4 - Community review: The review is open to the community to determine the fitness of the proposal and responds within 3 months

Step 5 - Recommended: The proposal is recommended for wide use

More detailed information on this process can be found at: http://www.oceandatastandards.org/the-standards-process-mainmenu-50, Ocean Data Standards and Best Practices Review Process (2012 revision)

Annex Terminology

Term	Definition
GEOSS	Global Earth Observation System of Systems: international initiative linking together existing and planned observing systems around the world http://www.earthobservations.org/geoss.php
JCOMM	WMO-IOC Joint Technical Commission for Oceanography and Marine Meteorology
IOC	Intergovernmental Oceanographic Commission of UNESCO (IOC/UNESCO).
IODE	International Oceanographic Data and Information Exchange (part of IOC)
ODP	Ocean Data Portal: data discovery and access service, part of the IODE network
POGO	The Partnership for Observation of the Global Oceans: a forum created by the major oceanographic institutions around the world to promote global oceanography. http://www.ocean-partners.org/
SeaDataNet	EU-funded project developing and operating a pan-European infrastructure for ocean data management

Annex B Proposal documentation

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SeaDataNet Controlled Vocabularies for describing Marine and Oceanographic Datasets

A joint proposal by SeaDataNet and ODIP projects

March 2015

Document type: Standard

Current status: Proposal

Submitted by:

Dick M.A. Schaap
Technical Coordinator SeaDataNet
MARIS
The Netherlands

Roy Lowry, Justin Buck
BODC
UK

Michele Fichaut
Coordinator SeaDataNet
IFREMER
France

Helen Glaves
Coordinator ODIP
BGS
UK

Title: SeaDataNet Controlled Vocabularies for describing Marine and Oceanographic Datasets - A joint Proposal by SeaDataNet and ODIP projects.

Scope: Proposal to acknowledge SeaDataNet Controlled Vocabularies Version 2 as a standard used in metadata and data formats descriptions of Marine and Oceanographic Datasets. In particular, the proposal aims to promote the ControlledVocabularies as a regional (i.e. European) standard.

SeaDataNet Controlled Vocabularies content governance has been done by a combined SeaDataNet and MarineXML Vocabulary Content Group (SeaVoX), moderated by BODC, and including experts from SeaDataNet, MMI, MOTIIVE, JCOMMOPS and more international groups. Its wide usage both by data centres within SeaDataNet and by external organizations makes it also a de-facto standard in the Europe region.

The Ocean Data Interoperability Platform (ODIP) project (www.odip.org) aims to establish an EU / USA / Australia/ IOC-IODE coordination platform, the objective of which is to develop interoperability between existing regional marine e-infrastructures in order to create a global framework for marine and ocean data management, and to demonstrate this coordination through several joint EU-USA-Australia-IOC/IODE prototypes that demonstrate effective sharing of data across scientific domains, organisations and national boundaries. During dedicated Workshops experts from the global oceanographic community review and compare existing marine data standards in order to identify major differences between them, and propose how to overcome these through the development of interoperability solutions and/or common standards including the improved usage and access of the SeaDataNet Controlled Vocabularies.

The acknowledgement of SeaDataNet Controlled Vocabularies as a standardfor describing metadata and data by IODE/JCOMM will further favour interoperability and data management in the Marine and Oceanographic community.

Envisaged publication type: The proposal target audience includes all the European bodies, programs and projects that manage and exchange marine and oceanographic data. Besides, the proposed document informs all the international community dealing with marine and oceanographic data about the SeaDataNet Controlled Vocabularies.

Purpose and Justification: Provide details based wherever practicable.

1. Describe the specific aims and reason for this Proposal, with particular emphasis on the aspects of standardization covered, the problems it is expected to solve or the difficulties it is intended to overcome.

   By acknowledging SeaDataNet Controlled Vocabularies as a standard for describing Marine and Oceanographic datasets, multiple objectives are sought:
   - Wider adoption of SeaDataNet Controlled Vocabularies by additional marine data centres around European waters. The process will favour further harmonisation and standardisation of European ocean and marine metadata as well as interoperability by solving the problem of ambiguities associated with data markup and by offering data sets various possibilities for computer aided manipulation, distribution and long term reuse. Organizations adopting this standard will be able to document their datasets using well-managed common controlled vocabularies, therefore the data

management and exchange of marine and oceanographic information will be eased in many ways (see following point 2).

- Ease interoperability and outreach towards international communities and initiatives. The existence of a recognized standard at European level will favour its understanding also at a broader level.

  Example given, international marine and oceanographic communities will be able to correctly understand metadata fields populated by a collection of common concepts.

2. Describe how this proposed standard supports data management, exchange or interoperability. When applicable include mention of what data management functions (e.g. date transport, quality control, archive) the proposal supports.

   SeaDataNet Controlled Vocabularies support data management by providing standardized lists describing a wide range of entities relevant to marine metadata and data such as parameters, sea area names, platform classes, instrument types, and so on that help to document consistently individual datasets and collections managed and archived by Pan-European marine data centres.
   The availability of heavily populated, well-managed controlled vocabularies provide the basis for interoperability within the Pan-European marine data centres.
   The content of relevant SeaDataNet Controlled Vocabularies (NVS2.0) has also been rendered as ISO XML Codelists, to provide a mechanism for inclusion of the Controlled Vocabularies in the Common Data Index (CDI) and Cruise Summary Report (CSR) INSPIRE compliant ISO19139 XML documents.

3. Describe the main interests benefitting from or affected by the proposed standard, such as industry, consumers, governments, distributors. Identify any relationships and/or dependencies.

   Adoption by IODE/JCOMM of SeaDataNet Controlled Vocabularies as a standard will give extra momentum to European marine and ocean data centres adopting SeaDataNet. This will also benefit users from all over the world from various sectors. Moreover, it will benefit efforts for global interoperability (such as ODIP project activities). Anybody developing future marine data systems in any sector will benefit from the content delivered by the standard which will obviate the need for them to develop their own vocabulary set. This both prevents duplication of effort and enhances semantic interoperability.

4. Describe the feasibility of implementing the proposed standard. Include any factors that could hinder the successful establishment or global application of the Proposed standard. Are there any associated issues? Identify resource implications resulting from the recommendations.

   The feasibility and practicality of using the SeaDataNet Controlled Vocabularies can be, and has already been successfully accomplished at 57 data centres within the SeaDataNet partnership. Moreover, another 47 data centres in Europe at present are using theControlledVocabularies for their managed data sets that help them to ensure consistent spellings and syntax, prevent metadata misunderstandings, and also t maintain a static

relationship between metadata fields and the real world. The results of these activities can be followed at the operational ControlledVocabularies web services, thatare part of the SeaDataNet portal (http://www.seadatanet.org). The usage and well-managed mapping of data sets with the common vocabulary terms is supported by dedicated Training Workshops which deal with presenting the standards and the associated tools and which provide hands-on training activities to get fully acquainted with them. The training material is also documented in Vademecums for study and consultation.

5. Considering the needs of other fields or organizations, indicate the timeliness, target date(s), or if proposing a series of standards, suggest priorities. List any statutory requirement or other driving factors.

   There are no statutory requirements for adoption of the SeaDataNet Controlled Vocabularies standard as the collection of concepts for populating given metadata fields. The National Oceanographic Data Centres in Europe are bound to implement the standard within their contractual obligations of several EU projects. The NODCs also motivate other data centres in their countries to use the same vocabularies. The IOC recommendation will add to this process. The time needed for a data centre to mapits collection to the SeaDataNetControlled Vocabularies is approximately one month.

6. Describe the possible benefits gained by the implementation of the proposed standard. Alternatively, describe the loss or disadvantage(s) if no standard is established within a reasonable time.

   The advantage of using the SeaDataNet Controlled Vocabularies standard in Europe is described in (2) and (3). There are no anticipated disadvantages to adopting it.

7. Indicate whether the proposed standard is or may become the subject of regulations or may require the harmonization of existing regulations. Describe any impacts of this activity.

   The SeaDataNet Controlled Vocabularies is a core component of the SeaDataNet infrastructure that is a de-facto standard in Europe. SeaDataNet is increasingly prescribed in calls for proposal and contracts by the European Commission for framework programmes and the EMODNET implementation as part of the EU Marine Directive. SeaDataNet is also expanding in international level in the context of the ODIP project.

Current Operational Implementations:At present already 57 National Ocean Data Centers (NODC's) and marine data centres within the SeaDataNet partnership successfully use the SeaDataNet Controlled Vocabularies standard for their locally managed data sets that are additionally maintained at the metadata directories and accessed by the data access service of the SeaDataNet infrastructure (see http://www.seadatanet.org). Another 47 data centres in Europe at present use the SeaDataNet ControlledVocabularies standard as part of related EU funded projects (FP6-Upgrade Black Sea SCENE, FP6-CASPINFO, FP7/Geo-Seas, EMODNET Projects, FP7-EuroFleets, FP7-JERICO, FP7-CitClops, FP7-Micro B3). The results of these activities can be followed at the SeaDataNet portal.

Access to the lists of the controlled terms is given by the NERC Vocabulary Server Version 2.0 at: NVS2.0) (http://www.bodc.ac.uk/products/web_services/vocab/.

A client interface has been set up for querying the NERC Vocabulary Server at: http://seadatanet.maris2.nl/v_bodc_vocab_v2/welcome.asp

In addition, SeaDataNet has been adopted as the leading component for data management in the development of the European Marine Observation and Data Network (EMODNet) which was initiated in the framework of the MSFD. This contributes to SeaDataNet perspective towards long term sustainability.

Different software tools are using the SeaDataNet Controlled Vocabularies, such as the MIKADO metadataXML editor and the NEMO tool for converting any type of ASCII format to the SeaDataNet ODV and Medatlas ASCII data transport.

Operational content management for the vocabularies used in SeaDataNet metadata is provided by the SeaDataNet and MarineXML Vocabulary Group (SeaVox). More information may be found at https://www.bodc.ac.uk/data/codes_and_formats/seavox/

Relevant Documents:
(attached to the current proposal)

- NERC Vocabulary Server version 2.0 documentation, April 2012, published at http://www.bodc.ac.uk/products/web_services/vocab/documents/nvs2.0_documentation.pdf

Cooperation and liaison:

1. **Existing Community**: All the organizations listed in the '***Current Operational Implementations'*** section are using SeaDataNet ControlledVocabularies in an operational environment and represent the SeaDataNet CDI community. In particular BODC, MARIS and IFREMER have been involved in the drafting and publication of the SeaDataNet ControlledVocabularies standard (together with the rest of the SeaDataNet Technical Task Team) and are responsible for the current proposal submission.

2. **Expanded Community:** Firstly, other relevant marine and oceanographic data centres in Europe that are not yet engaged in the NODC national networks and/or any of the EU projects and would like to adopt SeaDataNet ControlledVocabularies as standardized terms for metadata and data.

   Moreover, other marine and oceanographic data centres worldwide eager to discover, evaluate and access SeaDataNet CDI datasets at full. In this regard, SeaDataNet is establishing exchanges from its infrastructure and portal to GEOSS, Ocean Data Portal (ODP) of IOC-IODE, EurOBIS and the European Nucleotide Archive (ENA) of EMBL-EBI. These activities have been extended with the active participation of SeaDataNet in the Ocean Data Interoperability Platform (ODIP) project where cooperation takes place with leading oceanographic data infrastructures from the USA (US NODC, IOOS, R2R), Australia (IMOS) as well as IOC-IODE to explore common standards and interoperability solutions.

Contact information:

Name: BODC Vocabulary Management Group
Organization: British Oceanographic Data Centre
Email Address: enquiries@bodc.ac.uk

BODC Vocabulary Management Group Co-Chairs
Rob Thomas (room@bodc.ac.uk)
Gwen Moncoiffe (gmon@bodc.ac.uk)
BODC ODIP Project Contact
Justin Buck (juck@bodc.ac.uk)

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List of Acronyms:

- API - Application Programming Interface
- BODC – British Oceanographic Data Centre
- CDI – Common Data Index metadata format
- CSR – SeaDataNet Cruise Summary Reports directory
- EMODNET – European Marine Observation and Data Network
- EU – European Union
- EuroFleets – EU FP7 project Towards an Alliance of European Research Fleets
- Geo-Seas - EU FP7 project for a Pan-European Infrastructure for Marine Geological and Geophysical Data Management
- INSPIRE - Infrastructure for Spatial Information in the Europe Community
- IOC – Intergovernmental Oceanographic Commission
- IODE – International Oceanographic Data and Information Exchange
- ISO – International Organization for Standardization
- JCOMM - Joint Technical Commission for Oceanography and Marine Meteorology
- JCOMMOPS - JCOMM *in situ* Observations Programme Support Centre
- MIKADO – SeaDataNet metadata editor software tool
- MMI – Marine Metadata Initiative
- MOTIIVE - Marine Overlays on Topography for Annex II Valuation and Exploitation
- MSFD - Marine Strategy Framework Directive

- NDG - NERC DataGrid
- NEMO- Conversion of any ASCII format to the SeaDataNet ODV4 ASCII format software tool
- NODC – National Oceanographic Data Center
- NVS - NERC Vocabulary Server
- OGC - Open Geospatial Consortium
- SeaDataNet – EU FP6 project for a Pan-European Infrastructure for Marine and Oceanographic Data Management
- SeaVox - SeaDataNet and MarineXML Vocabulary Content Governance Group
- SKOS - Simple Knowledge Organization System
- Upgrade Black Sea SCENE - EU FP7 project for an Upgrade Black Sea Scientific Network
- W3C - World Wide Web Consortium's
- WS -Web Service
- XML – Extensible Mark-up Language

Other Attachments: No other attachments.

NERC Vocabulary Server version 2.0

Author: Adam Leadbetter (alead@bodc.ac.uk)
Intended audience: NERC Vocabulary Server Version 2.0 users

Document revision history

Revision	Revision date	Summary of changes
1.0	13/04/2012	First issue - incorporating comments on draft version from BODC staff.

Contents

Introduction

The NERC Vocabulary Server provides access to groupings of standardised terms that cover a broad spectrum of disciplines of relevance to the oceanographic and wider environmental sciences communities.

Using standardised sets of terms (otherwise known as "controlled vocabularies") in metadata and to label data solves the problem of ambiguities associated with data markup and also enables records to be interpreted by computers. This opens up data sets to a whole world of possibilities for computer aided manipulation, distribution and long term reuse.

An example of how computers may benefit from the use of controlled vocabularies is in the summing of values taken from different data sets. For instance, one data set may have a column labelled "Temperature of the water column" and another might have "water temperature" or even "temperature". To the human eye, the similarity is obvious but a computer would not be able to interpret these as the same thing unless all the possible options were hard coded into its software. If data are marked up with the same term, this problem is resolved.

In the real world, it is not always possible or agreeable for data providers to use the same terms. In such cases, controlled vocabularies can be used as a medium through which data centres can map their equivalent terms.

The controlled vocabularies delivered by the NERC Vocabulary Server contain the following information for each term:

- Key — a compact permanent identifier for the term, designed for computer storage rather than human readability
- Label — the text string representing the term in human-readable form
- Abbreviation — a concise text string representing the term in human-readable form where space is limited
- Definition — a full description of what is meant by the term

Both labels and definitions may be delivered in multiple human-readable languages.

All of the vocabularies are fully versioned and a permanent record is kept of all changes made.

Version 2.0 of the server (NVS2.0) represents a complete rewrite of the internal software with both increased functionality and performance. Although the V1.1 code will remain operational for the foreseeable future, existing users are urged to convert to 2.0 as soon as possible and the development of new V1.1 applications is strongly discouraged. The V1.0 and V1.1method specifications are maintained as historical documents.

Terminology

- W3C The World Wide Web Consortium, the main international standards organisation for the World Wide Web

- RDF The Resource Description Framework is a family of W3C specifications for making statements about resources on the World Wide Web in the form of "subject-predicate-object" expressions, known as triples.

- SKOS Simple Knowledge Organization System. A W3C recommendation for the representation of knowledge in a format understandable to computers. SKOS is built on top of RDF.

- Concept A SKOS concept can be viewed as an idea or notion; a unit of thought. The notion of a SKOS concept is useful when describing the conceptual or intellectual structure of a knowledge organization system, and when referring to specific ideas or meanings established within that system.

- Concept Collection A concept collection is useful where a group of concepts shares something in common, and it is convenient to group them under a common label. In NVS2.0, concept collections are synonymous with controlled vocabularies or code lists.

- Concept Scheme A concept scheme can be viewed as an aggregation of one or more SKOS concepts. Semantic relationships (links) between those concepts may also be viewed as part of a concept scheme. A concept scheme is therefore useful for containing the concepts registered in multiple concept collections but which are related to each other as a single semantic unit, such as a thesaurus.

- API An Application Programming Interface is specification intended to be used as an interface by software components to communicate with each other

- ReST / ReSTful Representational State Transfer is a design of API in which web services are viewed as resources and can therefore be identified by their Uniform Resource Locators (URLs).

- SOAP Is a design of API for exchanging structured information across computer networks as the result of calls to web services. It relies upon XML (eXstensible Markup Language) documents for passing messages.

Connectivity

Consumers may access the vocabulary server either using the ReSTful URLs described below or via SOAP.

SOAP consumers should generate their client implementation from the WSDL available at http://vocab.nerc.ac.uk/vocab2.wsdl.

Collection, concept and scheme URIs

Collections, concepts and schemes are presented to the server as Uniform Resource Identifiers (URIs) (in this case actually URLs) having the syntax

Collections:	http://vocab.nerc.ac.uk/collection/
	http://vocab.nerc.ac.uk/collection/colRef/colVer/
	http://vocab.nerc.ac.uk/collection/colRef/colVer/status/
Concepts:	http://vocab.nerc.ac.uk/collection/colRef/colVer/conRef/
Schemes:	http://vocab.nerc.ac.uk/scheme/
	http://vocab.nerc.ac.uk/scheme/schemeRef/

where

http://vocab.nerc.ac.uk/collection/ and *http://vocab.nerc.ac.uk/scheme/* respectively provide catalogues of the available concept collections and concept schemes.

colRef is an internal opaque identifier for the concept collection, e.g. `P02` for the SeaDataNet Parameter Discovery Vocabulary.

colVer may be a valid concept collection version number or '`current`' to specify the latest version of the collection.

status may be '`all`', '`accepted`' or '`deprecated`' to indicate whether all concepts related to a collection should be returned, or only the accepted or deprecated concepts.

conRef is an internal opaque identifier for the concept within the concept collection, e.g. `TEMP` for 'Temperature of the water column' in the SeaDataNet Parameter Discovery Vocabulary.

schemeRef is an internal opaque identifier for the concept scheme, e.g. `ICANCOERO` for the International Coastal Atlas Network Coastal Erosion Thesaurus.

ReSTful and SOAP API Method Details

GetCollections

The `GetCollections` method allows the client to retrieve a list of the available SKOS concept collections from NVS2.0. This allows a client to discover the content of NVS2.0 which is available through the concept collection paradigm.

API	*Method Call Details*
ReST	**Base URL:** http://vocab.nerc.ac.uk/ **URL suffix:** collection/ **Example fully encoded URL:** http://vocab.nerc.ac.uk/collection/ **Returns:** A SKOS concept collection RDF XML document
SOAP	**Method:** getCollections **Input Parameters**: No Parameters needed **Returns:** ConceptCollection complex data type

GetConceptCollection

The `GetConceptCollection` method allows the client to retrieve all of the available metadata and all of the concepts and associated information for a given SKOS concept collection identified by its URL.

API	*Method Call Details*
ReST	**Base URL:** http://vocab.nerc.ac.uk/collection/ **URL suffix:** collectionID/versionID/status versionID is optional. If it is omitted, the versionID defaults to "current", which may also be used as a valid versionID, and returns the most up to date version of the concept collection. status is also optional. If omitted the status defaults to "all" which returns all concepts registered to the specified concept collection. Other values for status which are valid are "accepted" and "deprecated". **Example fully encoded URLs:** http://vocab.nerc.ac.uk/collection/A01/ http://vocab.nerc.ac.uk/collection/C19/2/ http://vocab.nerc.ac.uk/collection/A01/current/ http://vocab.nerc.ac.uk/collection/A01/current/all/ http://vocab.nerc.ac.uk/collection/A01/current/accepted/ http://vocab.nerc.ac.uk/collection/A01/current/deprecated/ **Returns:** A SKOS concept collection RDF XML document
SOAP	**Method:** getConceptCollection(*collectionURL,status*) **Input Parameters:** *collectionURL*: String - concept collection URL e.g. http://vocab.nerc.ac.uk/collection/A01/ *status*: String of value "all", "accepted" or "deprecated" **Returns:** ConceptCollection complex data type

GetConcept

The `GetConcept` method allows the client to retrieve all available information about a given concept, identified by its URL.

API	*Method Call Details*
ReST	**Base URL:** http://vocab.nerc.ac.uk/collection/ **URL suffix:** collectionID/versionID/conceptID versionID may either be the string "current" to return the most up to date version of the concept, or an integer number to return the version of the concept from a given version of the concept collection. **Example fully encoded URLs:** http://vocab.nerc.ac.uk/collection/C18/current/72/ http://vocab.nerc.ac.uk/collection/A01/current/Human_Responses_to_Coastal_Change **Returns:** A SKOS concept RDF XML document
SOAP	**Method:** GetConcept(*conceptURL*) **Input Parameters:** *conceptURL*: String - concept URL e.g. http://vocab.nerc.ac.uk/collection/C18/current/72/ **Returns:** concept complex data type

GetSchemes

The `GetSchemes` method allows the client to retrieve a list of and the descriptions of the concept schemes available through NVS2.0.

API	*Method Call Details*
ReST	**Base URL:** http://vocab.nerc.ac.uk/ **URL suffix:** scheme/ **Example fully encoded URL:** http://vocab. nerc.ac.uk/scheme/ **Returns:** A SKOS concept scheme RDF XML document
SOAP	**Method:** GetSchemes **Input Parameters**: No Parameters needed **Returns:** ConceptScheme complex data type

GetConceptScheme

The `GetConceptScheme` method allows the client to retrieve all of the available metadata and all of the concepts and associated information for a given SKOS concept scheme, as identified by its URL.

API	*Method Call Details*
ReST	**Base URL:** http://vocab.nerc.ac.uk/scheme/ **URL suffix:** schemeID/ **Example fully encoded URL:** http://vocab.nerc.ac.uk/scheme/ICANCOERO/ **Returns:** A SKOS concept scheme RDF XML document
SOAP	**Method:** GetConceptScheme(*schemeURL*) **Input Parameters:** *schemeURL*: String - concept Scheme URL e.g. http://vocab.nerc.ac.uk/scheme/ICANCOERO/ **Returns:** ConceptScheme complex data type

GetRelatedConcepts

The `getRelatedConcepts` method allows the client to access all of the concepts which are related to a given concept, identified by that concept's URL.

A relationship type flag is provided to the method call to determine which types of relationship are returned by the method call. This will allow, for example, the selection of only narrower matches or only broader matches facilitating relationship tree building in client interfaces. The flag is a four digit number where each integer value may be 1 or 0 to determine if the relationship should be returned or not. e.g.:

broader	narrower	sameAs	related
0	0	1	0

searches only for related concepts which are synonyms to the specified concept.

The method returns a representation of the input concept along with individual concept records of the related concepts.

This method is not available through the ReST API, only through the SOAP API.

API	***Method Call Details***
ReST	This method is unavailable through the ReST API.
SOAP	**Method:** getRelatedConcepts(*conceptURL*, *relationshipType*, *status*) **Input Parameters:** *conceptURL*: String - concept URL e.g. http://vocab.nerc.ac.uk/collection/P01/current/PSALCU01/ *relationshipType*: Integer indicating level of relationship to return as defined above *status*: String of value "all", "accepted" or "deprecated" **Returns:** RelatedConcepts complex data type

GetTopConcepts

The `getTopConcepts` method allows the client to access the concepts which are explicitly stated to be the entry points of a given SKOS concept scheme, identified by its URL.

This method is not available through the ReST API, only through the SOAP API.

API	*Method Call Details*
ReST	This method is unavailable through the ReST API.
SOAP	**Method:** getTopConcepts(*schemeURL*) **Input Parameters:** *schemeURL*: String - concept Scheme URL e.g. http://vocab.nerc.ac.uk/scheme/ICANCOERO/ **Returns:** A list of Concept complex data type objects enclosed by <getTopConcepts><topConcepts>…</topConcepts></getTopConcepts> tags

SearchVocab

The `searchVocab` method allows the client to search the knowledge encoded within NVS2.0. The input incorporates:

This method is not available through the ReST API, only through the SOAP API. Note, there is no guaranteed consistency to the order in which the concepts are returned.

API	***Method Call Details***
ReST	This method is unavailable through the ReST API.
SOAP	**Method:** searchVocab(*query*, *case_sensitivity*, *term_type*, *max_results*, *multilang*, *uri_list*, *status*) **Input Parameters:** *query***:** The search term to be acted on. Valid wildcard characters are: * = 1 or more characters e.g. Searches for "Salinity*" and "*alinity*" on http://vocab.nerc.ac.uk/collection/P01/current/ will yield different result sets. *case_sensitivity***:** Optional Boolean value: *true* or *false*. Default action is *false*. *term_type*: String of value "uri", "preflabel" or "altlabel" *max_results*: An optional integer to limit the number of resturned results *multilang***:** Optional Boolean value to search on non-English labels: *true* or *false*. Default action is *false*. This option is included to significantly reduce the response time for searches in which multilingual functionality is not required. *uri_list*: A list of the concept collection URLs to search e.g. http://vocab.nerc.ac.uk/collection/P01/current/,http://vocab.nerc.ac.uk/collection/P02/current *status*: String of value "all", "accepted" or "deprecated" **Returns:** SearchResults complex data type

VerifyConcept

The `verifyConcept` method is used to check the existence of a given concept within NVS2.0, as identified by its URL, its preferred label or its alternative label. This is of particular use to a client that is validating the markup of its metadata or data. The return of this method is a Boolean value, equal to `true` if the concept in question exists in NVS2.0 and `false` if it does not.

This method is not available through the ReST API, only through the SOAP API.

API	*Method Call Details*
ReST	This method is unavailable through the ReST API.
SOAP	**Method:** verifyConcept(*concept*, *collectionURI*, *conceptType*, *status*) **Input Parameters:** String - concept Collection URL, String – Concept label or URL *concept*: String of one of the following: The full URL to the concept to be verified – use with *conceptType* = *"*uri" e.g. http://vocab.nerc.ac.uk/collection/P01/current/PSALCU01 or the concept preferred label or alternative label to be verified – use with *conceptType="*preflabel*" or conceptType="*altlabel" e.g. "Practical salinity of the water body by CTD and computation using UNESCO 1983 algorithm and NO calibration against independent measurements" collectionURI: String - The URL to the concept collection against which the concept should be verified e.g. http://vocab.nerc.ac.uk/collection/P01/ *conceptType*: String of value "uri", "preflabel" or "altlabel" *status*: String of value "all", "accepted" or "deprecated" **Returns:** Boolean value, i.e.: <verifyConcept><verified>true</verified></verifyConcept> <verifyConcept><verified>false</verified></verifyConcept>

ReSTful Interface XML Payload Details

The ReSTful URL access methods return XML documents conforming to the W3C's Simple Knowledge Organization System model. The use of XML tags outside the scope of that specification within these payload documents is explained in detail below.

Namespaces used

DC	http://purl.org/dc/elements/1.1/
GRG	http://www.isotc211.org/schemas/grg
OWLXML	http://www.w3.org/2006/12/owl2-xml#
RDF	http://www.w3.org/1999/02/22-rdf-syntax-ns#
RDFS	http://www.w3.org/2000/01/rdf-schema#
SKOS	http://www.w3.org/2004/02/skos/core#
XSD	http://www.w3.org/2001/XMLSchema#

skos:Collection

A SKOS concept collection is a group of related concepts. Each controlled vocabulary served from NVS2.0 are formalised in their representation as a `skos:Collection`. Each concept which is a member of a `skos:Collection` is enclosed by a `skos:member` tag.

dc:title and skos:prefLabel

- Mandatory
- Number
    - One per concept collection document

The Dublin Core metadata element set provides the `dc:title` tag to present the formal name given to a resource. In this instance, the `dc:title` and `skos:prefLabel` tags will carry the title of the concept collection.

dc:alternative and skos:altLabel

- Optional
- Number
    - One per concept collection document

Where a resource has more than one title by which it is known, the `dc:alternative` and `skos:altLabel` tags provides a method of encoding the alternative titles.

dc:description

- Optional
- Number
    - One per concept collection document

Often, the formal name (or names) of a resource cannot carry enough information to make the resource both discoverable and usable. In this case, a plain text description of the resource can aid in the usage of the resource. In this case, the account of the content of the resource shall be contained within `dc:description` tags.

dc:date

- Mandatory
- Number
  - One per concept collection document

The Dublin Core metadata element `dc:date` allows the inclusion of an important point in the lifecycle of the resource. In this case we use the time and date of creation of the version of the concept collection requested.

```
<dc:date>
        2011-05-31T08:00:20.136+0000
</dc:date>
```

owlxml:versionInfo

- Mandatory
- Number
  - One per concept collection document

The `owlxml:versionInfo` tag gives the published version number of the concept collection.

```
<owlxml:versionInfo>
        2
</owlxml:versionInfo>
```

dc:creator

- Mandatory
- Number
  - One or more per concept collection document

The Dublin Core metadata elements provide the creator element defined as "the entity primarily responsible for making the resource". The Dublin Core guidelines give examples of a creator as "include a person, an organization, or a service. Typically, the name of a Creator should be used to indicate the entity." Therefore a `dc:creator` tag will be used to store the content governance body for a given concept scheme.

```
<dc:creator>
        SeaVox: SeaDataNet and MarineXML Vocabulary Content Governance Group
</dc:creator>
```

grg:RE_RegisterOwner

- Mandatory
- Number
    - One or many per concept collection document

The `grg:RE_RegisterOwner` tag allows the inclusion of ISO19135 compatible information regarding the person or body who owns a concept collection.

```
< grg:RE_RegisterOwner>
        SeaVox: SeaDataNet and MarineXML Vocabulary Content Governance Group
</ grg:RE_RegisterOwner>
```

rdfs:comment

- Optional for inclusion in concept collection documents
- Number
    - Zero, one or many per concept collection document

An RDF Schema (RDFS) comment is added to the NVS2.0 payload in order to provide further information about the body in charge of the content governance for the concept collection or concept scheme.

```
<rdfs:comment>
        Group set up under the joint auspices of the SeaDataNet project and the
        Intergovernmental Oceanographic Commission MarineXML Steering Group for
        controlled vocabulary governance in the marine domain
</rdfs:comment>
```

grg:RE_RegisterManager

- Mandatory
- Number
    - One per concept collection document

The `grg:RE_RegisterManager` tag allows the inclusion of ISO19135 compatible information regarding the person or body appointed by a register owner to manage a register.

```
< grg:RE_RegisterManager>
        British Oceanographic Data Centre
</ grg:RE_RegisterManager>
```

dc:publisher

- Mandatory
- Number
    - One per concept collection document

The `dc:publisher` tag allows the inclusion of the publisher of the resource

```
<dc:publisher>
      Natural Environment Research Council
</dc:publisher>
```

skos:scheme

SKOS concept schemes represent an aggregation of concepts with interconnecting semantic relationships. A concept scheme is likely to contain a hierarchy, so the SKOS collections (or parts thereof) in NVS2.0 which form thesauri may be grouped together and formalised as concept schemes. The definition of a SKOS concept scheme gives the entry points to the broadest concept definitions within the hierarchy, which are referred to as the top concepts. Each top concept is also declared to be the top concept of a concept scheme, and each concept member of a concept scheme is declared to be a member of each scheme to which it belongs.

dc:title and skos:prefLabel

- Mandatory
- Number
    - One per concept scheme document

The Dublin Core metadata element set provides the `dc:title` tag to present the formal name given to a resource. In this instance, the `dc:title` and `skos:prefLabel` tags will carry the title of the concept scheme.

dc:alternative and skos:altLabel

- Optional
- Number
    - One per concept scheme document

Where a resource has more than one title by which it is known, the `dc:alternative` and `skos:altLabel` tags provides a method of encoding the alternative titles.

dc:description

- Optional
- Number
    - One per concept scheme document

Often, the formal name (or names) of a resource cannot carry enough information to make the resource both discoverable and usable. In this case, a plain text description of the resource can aid in the usage of the resource. In this case, the account of the content of the resource shall be contained within `dc:description` tags.

dc:date

- Mandatory
- Number
  - One per concept scheme document

The Dublin Core metadata element `dc:date` allows the inclusion of an important point in the lifecycle of the resource. In this case we use the time and date of creation of the current version of the concept scheme.

```
<dc:date>
        2011-05-31T08:00:20.136+0000
</dc:date>
```

owlxml:versionInfo

- Mandatory
- Number
  - One per concept scheme document

The `owlxml:versionInfo` tag gives the published version number of the concept scheme.

```
<owlxml:versionInfo>
        2
</owlxml:versionInfo>
```

dc:creator

- Mandatory
- Number
  - One per concept scheme document

The Dublin Core metadata elements provide the creator element defined as "the entity primarily responsible for making the resource". The Dublin Core guidelines give examples of a creator as "include a person, an organization, or a service. Typically, the name of a Creator should be used to indicate the entity." Therefore a `dc:creator` tag will be used to store the content governance body for a given concept scheme.

```
<dc:creator>
        SeaVox: SeaDataNet and MarineXML Vocabulary Content Governance Group
</dc:creator>
```

rdfs:comment

- Optional for inclusion in concept scheme documents
- Number
  - Zero or one per concept scheme document

An RDFS comment is added to the NVS2.0 payload in order to provide further information about the body in charge of the content governance for the concept collection or concept scheme.

```
<rdfs:comment>
      Group set up under the joint auspices of the SeaDataNet project and the
      Intergovernmental Oceanographic Commission MarineXML Steering Group for
      controlled vocabulary governance in the marine domain
</rdfs:comment>
```

dc:publisher

- Mandatory
- Number
  - One per concept scheme document

The `dc:publisher` tag allows the inclusion of the publisher of the resource

```
<dc:publisher>
      Natural Environment Research Council
</dc:publisher>
```

skos:concept

- Mandatory
- Number
    - One if the payload is in response to a request for a concept by identifier (URI)
    - Many if the payload is returned in response to a request for a list or thesaurus or a request for a concept using a query parameterized by anything other than a concept's URI

A `skos:Concept` is the base unit of currency within the NERC Vocabulary Server, on which other units such as lists and thesauri are built. Therefore each NVS response to a request shall return at least one concept. Each `skos:Concept` opening tag shall also contain the URL to the concept as an `rdf:about` subtag, e.g.:

```
<skos:concept rdf:about="http://vocab.nerc.ac.uk/collection/collid/ver/concept/">
</skos:concept>
```

Each `skos:Concept` may have associated annotations (including human-language translations), mappings, concept collections, concept schemes and provenance information.

skos:prefLabel

- Mandatory
- Number
    - A maximum of one per human readable language into which the concept has been translated

A `skos:Concept` returned from NVS2.0 shall have a preferred label in at least one human readable language. The `skos:prefLabel` is to contain the preferred human readable representation of the concept.

```
<skos:prefLabel xml:lang="en">
      Adriatic Sea
</skos:preLabel>
```

skos:altLabel

- Optional
- Number
    - Zero or one per concept

The `skos:altLabel` element can be used to provide alternative spellings or synonyms to a given concept, or to provide a lexical label for use in alternative circumstances, e.g. axes labels in plotting software.

```
<skos:altLabel xml:lang="en">
      Haloc_WC
</skos:altLabel>
```

skos:definition

- Mandatory
- Number
    - One per human readable language into which the concept has been translated

The `skos:definition` tag is used to carry supporting information which describes a concept in greater detail than is carried in the human readable title of the concept enclosed in `skos:prefLabel`. For concepts which require structured information to be carried with them, the contents of the `skos:definition` tag may be encoded as a JavaScript Object Notation (JSON) string.

```
<skos:definition xml:lang="en">
      {"country": "Italy",
      "platformclass": "self-propelled boat",
      "callsign": "IMNQ",
      "length": "19.05",
      "built": "1977",
      "notes": "Leased tugboat"}
</skos:definition>
```

dc:identifier and skos:notation

- Mandatory
- Number
    - One per concept

Version 1.X of the NVS uses the `skos:externalID` property to define the SeaDataNet Uniform Resource Name (URN) of a given concept. However, this property was deprecated in 2004, and the recommended replacement is the `dc:identifier` property from the Dublin Core metadata element set. `dc:identifier` is defined as "an unambiguous reference to the resource within a given context" which fits the usage of the property to declare the SeaDataNet URN or any other external identifiers given to a concept. The `skos:notation` tag is defined as a character string, not normally recognizable as a word or sequence of words in any human readable language, used to uniquely identify a concept within the scope of a concept scheme. This formal scope restriction is the reason that both `dc:identifier` and `skos:notation` tags are used for the same content.

```
<dc:identifier>
        SDN:C191::3_1_2_4
</dc:identifier>

<skos:notation>
        SDN:C191::3_1_2_4
</skos:notation>
```

dc:date

- Mandatory
- Number
    - One per concept

The Dublin Core metadata element `dc:date` allows the inclusion of an important point in the lifecycle of the concept. In this case we use the time and date of creation of this version of the concept.

```
<dc:date>
        2011-05-31T08:00:20.136+0000
</dc:date>
```

owlxml:versionInfo

- Mandatory
- Number
    - One per concept scheme document

The `owlxml:versionInfo` tag gives the version number of the concept included in the document.

```
<owlxml:versionInfo>
        2
</owlxml:versionInfo>
```

skos:note

- Mandatory
- Number
    - One per concept

The `skos:note` tag is designed to allow ancillary information about a SKOS concept. In the context of the payload documents under discussion here it is used to define a concept's publication status. A concept may be "accepted", "proposed" or "deprecated". This value is set respectively according to whether it has been accepted by the content governance body, it is being considered by the content governance body or the concept has been deprecated by the governance body.

```
<skos:note xml:lang="en">
        accepted
</skos:note>
```

owlxml:deprecated

- Mandatory
- Number
    - One per concept

The `owlxml:deprecated` tag encloses a Boolean value indicating if the concept has been deprecated ("false") or not ("true").

```
<owlxml:deprecated>
        true
</owlxml:deprecated>

<owlxml:deprecated>
        false
</owlxml:deprecated>
```

Multi-lingual provisioning

The encoding of which human language a SKOS annotation tag is written in should follow the World Wide Web Consortium guidelines of language encoding in XML. These recommendations state that the language tags from the Internet Assigned Numbers Authority (IANA) repository should be used with a hierarchy of

Primary language – extended language – script – region – variant – extension – private use

For the purposes of the NERC Vocabulary Server, a primary language encoding is the deepest the hierarchy need go.

```
<skos:prefLabel xml:lang="en">
      colour
</skos:preLabel>

<skos:prefLabel xml:lang="fr">
      couleur
</skos:preLabel>
```

Mappings

- Optional
- Number
    - Zero or many per concept or concept collection

Mappings, or semantic relations, indicate the links that a given concept has to another concept. Mappings in the original version of the SKOS specification could be broader, narrower, exact or close. However, in the latest version of the specification the concepts of exact and close matches have been superseded by the related tag.

Broader relations indicate that the current concept has a narrower definition than the concept to which it is related, narrower relations imply the inverse, and close matches imply that the two concepts are more loosely coupled.

Broader and narrower matches may also have the transitive property associated with them, which allows the use of a semantic inference engine. When a thesaurus is delivered through concept scheme in NVS2.0, the mappings internal to that thesaurus are supplied as transitive and those external to the thesaurus are supplied as non-transitive.

```
<skos:narrower rdf:resource="http://a/Term/Url" />

<skos:narrowerTransitive rdf:resource="http://a/Term/Url" />

<skos:broader rdf:resource="http://a/Term/Url" />

<skos:broaderTransitive rdf:resource="http://a/Term/Url" />
```

Loosely coupled concepts are tagged using the `skos:related` tag thus:

```
<skos:related rdf:resource="http://a/RelatedTerm/Url" />
```

Finally, synonyms (which were identified using the `skos:exactMatch` tag in version 1 of the NVS) are now specified using the Web Onotology Language's `sameAs` tag, thus:

```
<owlxml:sameAs rdf:resource="http://a/synonym/Url" />
```

It should be noted that `skos:exactMatch` has not been deprecated from the latest version of the SKOS specification, but has been specified only within the scope of concept schemes. As the concepts in NVS2.0 are registered to concept collections, `skos:exactMatch` cannot be used to signify synonymous relationships between concepts in NVS2.0.

SOAP Complex Data Types

The service returns results as XML documents. The major data types of which are discussed below.

ConceptCollection

XML conforming to the following XML Schema fragment is returned for each matching concept collection.

```
<xsd:complexType name="ConceptCollection">
  <xsd:sequence>
    <xsd:element name="error" type="xsd:string" minOccurs="0"/>
    <xsd:element name="collectionURI" type="xsd:string" minOccurs="0" maxOccurs="1"/>
    <xsd:element name="collectionTitle" type="xsd:string"/>
    <xsd:element name="collectionAltTitle" type="xsd:string" minOccurs="0"/>
    <xsd:element name="collectionDescription" type="xsd:string" minOccurs="0"/>
    <xsd:element name="collectionCreator" type="xsd:string" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element name="collectionComment" type="xsd:string" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element name="collectionPublisher" type="xsd:string" nillable="false"/>
    <xsd:element name="collectionVersion" type="xsd:int" nillable="false"/>
    <xsd:element name="modified" type="xsd:dateTime" nillable="false"/>
    <xsd:element name="related" type="voctype:related" nillable="true" minOccurs="0"
      maxOccurs="unbounded"/>
    <xsd:element name="broadMatch" type="voctype:broadMatch" nillable="true" minOccurs="0"
      maxOccurs="unbounded"/>
    <xsd:element name="sameAs" type="voctype:sameAs" nillable="true" minOccurs="0"
      maxOccurs="unbounded"/>
    <xsd:element name="narrowMatch" type="voctype:narrowMatch" nillable="true" minOccurs="0"
      maxOccurs="unbounded"/>
    <xsd:element name="members" type="voctype:collectionMembers" minOccurs="0" maxOccurs="1"/>
  </xsd:sequence>
  <xsd:attribute name="uri" type="xsd:string"/>
</xsd:complexType>
```

Where

- error – A response reporting an error in the SOAP call
- collectionURI – URI, in this case the URL, for a particular concept collection
- collectionTitle – The preferred human-readable label for a concept collection
- collectionAltTitle – An alternative human-readable label for a concept collection
- collectionDescription – A description of the commonality which links the members of the collection
- collectionCreator – The person or body responsible for the content governance of a concept collection
- collectionComment – A description of the body described by collectionCreator
- collectionPublisher – The body responsible for publishing the concept collection

- collectionVersion – The version of the concept collection accessed by the call to the SOAP method
- modified – The date on which the concept collection version was modified
- related – Links to collections containing loosely related concepts
- broadMatch – links to collections containing concepts at a broader semantic granularity
- sameAs – links to collections containing synonymous concepts
- narrowMatch - links to collections containing concepts at a narrower semantic granularity
- members – Zero, one or many concepts reported as the Concept complex data type representing the concepts registered to the collection

ConceptScheme

XML conforming to the following XML Schema fragment is returned for each matching concept collection.

```
<xsd:complexType name="ConceptScheme">
  <xsd:sequence>
    <xsd:element name="error" type="xsd:string" minOccurs="0"/>
    <xsd:element name="schemeTitle" type="xsd:string" nillable="false"/>
    <xsd:element name="schemeAltTitle" type="xsd:string" nillable="false"/>
    <xsd:element name="schemeURI" type="xsd:string" nillable="false"/>
    <xsd:element name="schemeDescription" type="xsd:string" nillable="false"/>
    <xsd:element name="schemeCreator" type="xsd:string" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element name="schemePublisher" type="xsd:string" nillable="false"/>
    <xsd:element name="schemeVersion" type="xsd:int" nillable="false"/>
    <xsd:element name="modified" type="xsd:dateTime" nillable="false"/>
    <xsd:element name="topConcept" type="xsd:string" nillable="false" maxOccurs="unbounded"/>
    <xsd:element name="members" type="voctype:collectionMembers" minOccurs="0" maxOccurs="1"
      nillable="false"/>
  </xsd:sequence>
  <xsd:attribute name="uri" type="xsd:string"/>
</xsd:complexType>
```

Where

- error - A response reporting an error in the SOAP call
- schemeTitle – The preferred human-readable label for the concept scheme
- schemeAltTitle – An alternative human-readable label for the concept scheme
- schemeURI – The URI, in this case actually the URL, to the concept scheme
- schemeDescription – A plain text description of the content of the concept scheme
- schemeCreator – The body responsible for creating the concept scheme
- schemePublisher – The body responsible for publishing the concept scheme
- schemeVersion – The version of the concept scheme returned
- modified – The date and time of publication of the version of the concept scheme returned
- topConcept – URL of a concept which is an entry point into the concept scheme
- members – Zero, one or many concepts reported as the Concept complex data type representing the concepts in the concept scheme

Concept

XML conforming to the following XML Schema fragment is returned for each matching concept.

```
<xsd:complexType name="Concept">
  <xsd:sequence>
    <xsd:element name="error" type="xsd:string" minOccurs="0"/>
    <xsd:element name="conceptID" type="xsd:string" minOccurs="0" maxOccurs="1"/>
    <xsd:element name="prefLabel" type="voctype:prefLabel" minOccurs="0" maxOccurs="unbounded"
      nillable="false"/>
    <xsd:element name="altLabel" type="voctype:altLabel" minOccurs="0" maxOccurs="unbounded"
      nillable="true"/>
    <xsd:element name="definition" type="voctype:definition" minOccurs="0" maxOccurs="unbounded"
      nillable="true"/>
    <xsd:element name="modified" type="xsd:dateTime" nillable="false" minOccurs="0" maxOccurs="1"/>
    <xsd:element name="memberScheme" type="voctype:memberList" nillable="false" minOccurs="0"
      maxOccurs="unbounded"/>
    <xsd:element name="version" type="xsd:int" nillable="true"/>
    <xsd:element name="isTopConcept" type="voctype:isTopConcept" nillable="false" minOccurs="0"
      maxOccurs="1"/>
    <xsd:element name="isDeprecated" type="xsd:boolean" minOccurs="0" maxOccurs="1"/>
    <xsd:element name="memberCollection" type="voctype:memberList" minOccurs="0"
      maxOccurs="unbounded"/>
    <xsd:element name="identifier" type="xsd:string" nillable="true" minOccurs="1" maxOccurs="1"/>
    <xsd:element name="related" type="voctype:related" nillable="true" minOccurs="0"
      maxOccurs="unbounded"/>
    <xsd:element name="broadMatch" type="voctype:broadMatch" nillable="true" minOccurs="0"
      maxOccurs="unbounded"/>
    <xsd:element name="sameAs" type="voctype:sameAs" nillable="true" minOccurs="0"
      maxOccurs="unbounded"/>
    <xsd:element name="narrowMatch" type="voctype:narrowMatch" nillable="true" minOccurs="0"
      maxOccurs="unbounded"/>
    <xsd:element name="transitiveNarrowerMatch" type="voctype:transitiveNarrowerMatch" nillable="true"
      minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element name="transitiveBroaderMatch" type="voctype:transitiveBroaderMatch" nillable="true"
      minOccurs="0" maxOccurs="unbounded"/>
  </xsd:sequence>
  <xsd:attribute name="uri" type="xsd:string"/>
</xsd:complexType>
```

Where

- error - A response reporting an error in the SOAP call
- conceptID – Opaque label uniquely identifying a concept within a collection
- prefLabel – The preferred human-readable label of the concept
- altLabel – An alternative human-readable label for the concept, often an abbreviation
- definition – Supporting information which describes the concept in greater detail
- modified – The time and date on which the concept was last updated
- version – The current version of the concept
- isTopConcept – True if the concept is a top concept in the response to a request for a concept scheme
- isDeprecated – True if the concept is deprecated
- memberCollection – The concept collection to which the concept is registered
- identifier – An external identifier for the concept (the concept's URN)
- related – Links to loosely related concepts
- broadMatch – Links to concepts at a broader semantic granularity

- sameAs – Links to synonymous concepts
- narrowMatch - Links to concepts at a narrower semantic granularity
- transitiveNarrowMatch - Links to concepts at a narrower semantic granularity within the same response to a request for a concept scheme
- transitiveBroadMatch - Links to concepts at a broader semantic granularity within the same response to a request for a concept scheme

RelatedConcepts

XML conforming to the following XML Schema fragment is returned for all matching related concepts.

```
<xsd:complexType name="RelatedConcepts">
  <xsd:sequence>
    <xsd:element name="error" type="xsd:string" minOccurs="0"/>
    <xsd:element name="concept" type="voctype:Concept"/>
    <xsd:element name="narrowMatches" type="voctype:collectionMembers" minOccurs="0" maxOccurs="1"
       nillable="true"/>
    <xsd:element name="broadMatches" type="voctype:collectionMembers" minOccurs="0" maxOccurs="1"
       nillable="true"/>
    <xsd:element name="related" type="voctype:collectionMembers" minOccurs="0" maxOccurs="1"
       nillable="true"/>
    <xsd:element name="sameAs" type="voctype:collectionMembers" minOccurs="0" maxOccurs="1"
       nillable="true"/>
  </xsd:sequence>
</xsd:complexType>
```

Where

- error - A response reporting an error in the SOAP call
- concept – An object of the Concept complex data type which represents the subject of the query
- narrowMatches – A number of objects of the Concept complex data type at a narrower semantic granularity than the subject concept
- broadMatches - A number of objects of the Concept complex data type at a broader semantic granularity than the subject concept
- related - A number of objects of the Concept complex data type loosely related to the subject concept
- sameAs - A number of objects of the Concept complex data type synonymous with the subject concept

SearchResults

```
<xsd:complexType name="SearchResponse">
  <xsd:sequence>
    <xsd:element name="error" type="xsd:string" minOccurs="0"/>
    <xsd:element name="query" type="xsd:string" minOccurs="0"/>
    <xsd:element name="noOfResults" type="xsd:int" nillable="false"/>
    <xsd:element name="noOfMemberCollections" type="xsd:int" nillable="false"/>
    <xsd:element name="results" type="voctype:collectionMembers" minOccurs="0"
       maxOccurs="1"/>
  </xsd:sequence>
</xsd:complexType>
```

Where

- error - A response reporting an error in the SOAP call
- query – A verbatim duplication of the query sent in the SOAP method call
- noOfResults – The number of concepts matching the query
- noOfMemberCollections – Returns zero
- results - Zero, one or many concepts reported as the Concept complex data type representing the concepts matching the query sent in the SOAP method call