Feature report

Introduction

The Taxon Concept Schema (TCS) is the TDWG standard for exchanging taxonomic data. It is one of the '2005' group of standards, together with Access to Biological Collections Data (ABCD) and Structured Descriptive Data (SDD), that consists of an XML Schema. Unlike ABCD, TCS did not have a dedicated group of users or maintainers and has not been maintained since shortly after it was ratified. Any problems that people might have with TCS were never fixed, because there was no mechanism for making formal changes to the XML Schema.

As TCS is an XML Schema, data delivered as TCS has to be XML, which was the predominant format for data exchange at the time. A few years after TCS was ratified, another format, Comma-delimited Values (CSV), became people's preferred format for shipping around large amounts of data, at least in the Biodiversity Data domain. Another issue people have with TCS is that it can only be used for complete data sets and not for individual Taxon Concepts or Taxon Names.

Since Darwin Core was ratified in 2009, the Darwin Core Taxon class has been the main vehicle for shipping around taxonomic data. Darwin Core, because it is a vocabulary standard, can be delivered in various formats, including CSV.

There has been dissatisfaction with the Darwin Core Taxon class for exchanging taxonomic data, however, predominantly because people feel it is too permissive. Darwin Core Taxon data may be syntactically correct but have a meaning that is incompatible with the consumer's data model. The Darwin Core Taxon class also has references to objects that are not defined and its implementation allows for data artefacts that are not taxa by any definition, including that of the Darwin Core Taxon itself.

These issues were the reason that the Darwin Core RDF Guide (Darwin Core and RDF/OWL Task Groups 2015 [darwin_core_and_rdfowl_task_groups_darwin_2015]) concluded that the creation of functional `dwc:Taxon` instances described using RDF was not possible at the time of writing and that the task of describing taxonomic entities would have to be an effort outside of Darwin Core. TCS 2 is that effort.

In 2017, the Vocabulary Maintenance Standard (VMS) and Standard Documentation Standard (SDS) were ratified, which established a mechanism by which existing TDWG standards should be maintained and documented. In 2018, the then Taxonomic Names and Concepts Interest Group (TNC)—which was also responsible for the creation of TCS 1—set out to review TCS, the TDWG Taxon Concept and Taxon Name LSID Ontologies, the Darwin Core Taxon class and other systems for exchanging taxonomic data that were out there. In 2020, a new charter for the TNC was ratified, which made the TNC the Interest Group that maintains TCS and which lead to a change of the name of the Interest Group to TCS Maintenance Group. A charter for the TCS 2 Task Group, to create the new version of TCS, was ratified in 2021.

TCS 2, which we now bring to public review, takes TCS out of its XML Schema and converts it to a vocabulary standard, like Darwin Core, that does not impose a data format and can be maintained under the VMS.

Parameters

The purpose of the current work is to make TCS useable again by changing it from an XML Schema to a vocabulary standard. Changes we propose are as far as possible only structural and do not affect the meaning of terms. Because TCS 2 is a vocabulary standard we have had to provide new definitions for many of the terms, as in TCS 1 the meaning of elements and attributes was largely implicit, but the Taxon Concept and Taxon Name in TCS 2 are the Taxon Concept and Taxon Name in TCS 1 and the same goes for all other terms. No completely new terms have been added.

Where possible, we borrow terms from other existing standards, rather than defining them in TCS. The parsed name properties, as well as some other Taxon Name properties, are borrowed from Darwin Core and some Taxon Concept properties from Dublin Core. There are some other terms which have been defined in TCS as IRI properties, which have literal equivalents in Darwin Core. In most cases, they will share the same label.

While the formal TDWG standard we are replacing is an XML Schema (XSD), we were influenced by and borrowed from the TDWG Taxon Concept and Taxon Name LSID Ontologies, (with non-resolving URIs: `http://rs.tdwg.org/ontology/voc/TaxonConcept` and `http://rs.tdwg.org/ontology/voc/TaxonName`), which were primarily developed by Roger Hyam. These were a rather precise translation of the TCS XML Schema into OWL ontologies. Because the TDWG Ontologies were never standardized, we could not directly import terms from them, but, conceptually, much from the TDWG Ontologies can be found back in TCS 2.

Changes

The most important change is that while in TCS 1 only the `Name` element is required—and then a `Name` can either be a text node, so a string, or a reference (`ref`) to a `TaxonName` element with an `id` attribute—and the `AccordingTo` element is not, in TCS 2 both `taxonName` and `accordingTo` are required and both properties are IRI or object properties. Every TCS 2 Taxon Concept object has to have a source, or `accordingTo`, which is a publication or other other form of communication where a taxon is defined in a certain way. This means that every Taxon Concept is traceable to a source and identifiable. Every TaxonConcept also must have a label and, while there are alternative properties, like `dcterms:title` and `dwc:scientificName`, for providing labels we think that for interoperability of TCS data sets it is important that the label is always provided with the same property. Therefore, the `taxonName` property is also required.

The most important structural change we made was dismantling the Taxon Relationship object that both TCS 1 and the Taxon Concept Ontology have. We want TCS to be a vocabulary standard, i.e. a set of terms and definitions, so TCS should not prescribe a certain syntax.

Another problem with an all-purpose relationship object is that it obscures the nature of the relationship. Not all relationship types in TCS 1 are relationships between Taxon Concepts, some are relationships between Taxon Concepts and Taxon Names. Also, relationships between Taxon Names in TCS 1 are elements

(owl:objectProperty in the TDWG Taxon Name LSID Ontology), while relationships between Taxon Concepts (and some between Taxon Concepts and Taxon Names) are values in an enumeration (owl:Class in the TDWG Taxon Concept LSID Ontology).

By elevating the values from the Taxon Relationship Type enumeration to first-class TCS properties and leaving the syntax out of the standard, people can choose whether to connect them to the subject Taxon Concept, or use them in a utility object outside TCS, for example the Darwin Core Resource Relationship class. The shape of the data may dictate the use of a relationship object, but the terms have the same meaning, regardless of the syntax.

The one thing that really needed to be fixed in TCS was the 'has synonym' relationship type. The documentation of the term in TCS 1 already identifies 'has synonym' as a mixed concept:

> The target concept is considered a synonym of the current concept. This is an ambiguous relationship. It can mean: 1) a nomenclatural relationship where all that is implied is that the type of the target concept is included in the current circumscription. This is more precisely expressed as a SpecimenCircumscription (for heterotypic synonyms) or as TaxonName basionym relationships (for homotypic synonyms) 2) a concept relationship where some part of (or all of) the target concept is included in the current circumscription. This is more precisely expressed using the set relationships such as 'is congruent to'. This is intended for handling legacy data.

To resolve this issue, we have split the term into `synonym` (for meaning 1) and `intersects` (for meaning 2). `intersects` is a mapping property that is the union of the `isCongruentWith`, `includes`, `isIncludedIn` and `partiallyOverlaps` (and the opposite of `isDisjointFrom`) mapping properties and thus can be used when the exact nature of the relationship is not known, or not indicated. We have found that this relation is not only useful for dealing with references to other treatments in the nomenclature section of a treatment (what the TCS 1 definition calls 'legacy data'), but for any references to other treatments, *e.g.* the references in a Catalogue of Life entry (see the *Megalorhipida leucodactylus* example).

We currently recognise the following relations between the major entities in TCS:

Relationships between Taxon Concepts (taxa)

Hierarchical relationships

- tcs:parent

Horizontal relationships*

- tcs:isCongruentWith
- tcs:includes
- tcs:isIncludedIn
- tcs:partiallyOverlaps
- tcs:isDisjointWith
- tcs:intersects

*Horizontal relationships between Taxon Concepts are relationships between Taxon Concepts in different taxonomies (or different versions of a taxonomy), or between Taxon Concepts in rank-free systems, e.g., cladograms.

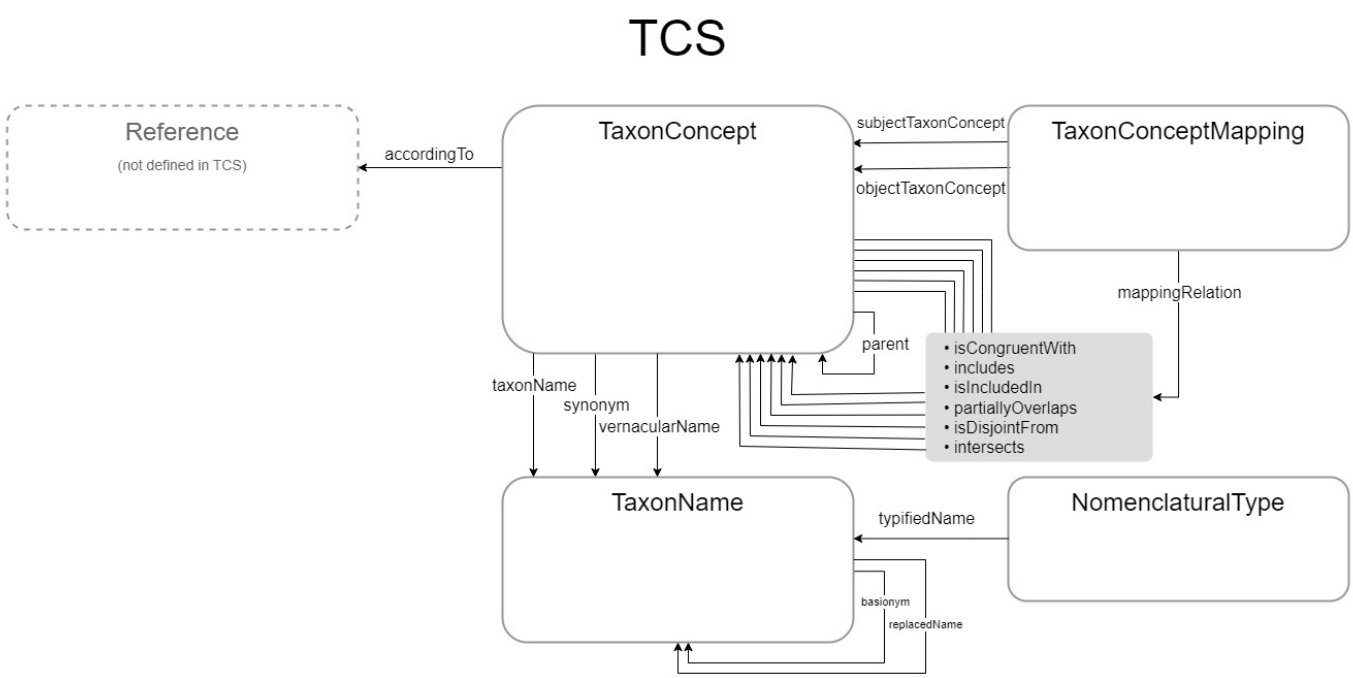
Relationships between Taxon Concepts and Taxon Names

- tcs:taxonName
- tcs:synonym
- tcs:vernacularName

Relationships between Taxon Names

- tcs:basionym
- tcs:replacedSynonym
- tcs:basedOn
- tcs:conservedAgainst
- tcs:laterHomonymOf

We have included a TaxonConceptMapping class, as it is often useful to have objects for Taxon Concept mappings that can be shared. The TaxonConceptMapping class replaces the TaxonRelationshipAssertion element in TCS 1, but is only to be used with the relationship types that TCS 1 calls 'set relationships'. In TCS 2, the properties that can be used as object for the `mappingRelation` property are the mapping properties, *i.e.* `isCongruentWith`, `includes`, `isIncludedIn`, `partiallyOverlaps`, `isDisjointFrom` and `intersects`.



A full mapping of elements in the TCS XML Schema to terms in TCS 2 can be found in Appendix 1.

Terms omitted from the initial release

The most significant thing that has been left out of TCS 2 for now is the circumscription or definition of taxa. TCS 1 has the `CharacterCircumscription` and `SpecimenCircumscription` elements, translated to `DescribedBy` and `CircumscribedBy`, respectively, in the TDWG Ontology. These have been left out of the initial release of TCS 2, because we are not aware of any systems using them and because it is not immediately apparent how they should be used, especially for `CharacterCircumscription`, or that they are the only and best way to express circumscription in TCS. Just because it is not included yet does not mean circumscription is not important. The TCS Maintenance Group has every intention of adding circumscription to TCS at a later stage in a separate effort. If we are to include circumscription in TCS, it should be done in a way that it is operational and computer-tractable. Lists of characters (or descriptions) and lists of specimens are better accommodated in other TDWG standards, like Plinian Core and SDD.

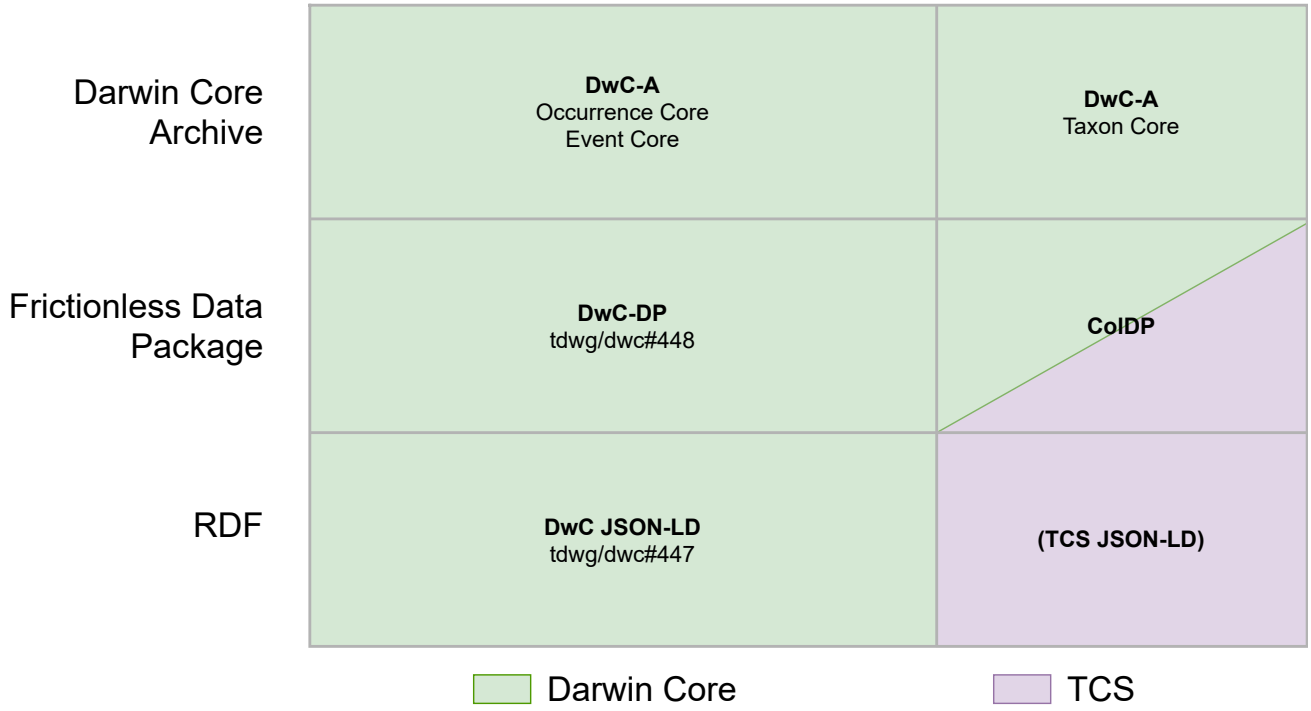
All parsed name terms, except 'uninomial', are in Darwin Core and have been borrowed from there. We think that, if people have a need for a 'uninomial' term, it might be best to have that in Darwin Core as well.

Finally, several of the relations in the Taxon Relationship Type enumeration have not (yet) been included as properties. Some of these are negations of adopted terms that are in groups of more than two, making their meaning ambiguous, e.g. `does not include`. Others, like the hybrid parent terms seem to have more to do with the format of hybrid formulas than with relationships between taxa, and yet others, e.g., `anamorph of`, only apply to certain groups of organisms and are not used in systems designed specifically for these groups.

Place in TDWG ecosystem

Unlike other TDWG standards like Audiovisual Core and Latimer Core—and also unlike the time when TCS shared the stage with ABCD and SDD—TCS does not have its own subdomain within the TDWG infrastructure but falls completely within the domain that is also covered by Darwin Core. TCS shines where the data becomes more structured and more semantic.

The figure below shows the application profiles that already exist or are being planned in the domain that is covered by Darwin Core.



On the left is occurrence or specimen data and on the right is taxonomic and nomenclatural data. From top to bottom, or from Darwin Core Archive to Frictionless Data Package to RDF, the structure of and semantics in the data increases.

The niche of TCS is in the bottom-right of the figure. It has already been said before that the Darwin Core Taxon class does not work with RDF and that TCS is meant to fill the gap. It is to be expected that the Darwin Core Data Package (DwC-DP) will not have an equivalent to the Darwin Core Archive Taxon Core, because the Catalogue of Life Data Package (CoLDP) already occupies that space. CoLDP has got two different schemas, one with a NameUsage table, which is equivalent to the Darwin Core Taxon, and another with Taxon and Name tables, which are equivalent to the TCS Taxon Concept and Taxon Name respectively. The latter schema is already very nearly TCS compliant. It is therefore the intention that we won't develop a TDWG TCS Data Package, but that we work with Catalogue of Life to make ColDP fully TCS compliant, so that CoLDP can be the Data Package application profile for TCS.

Broader context: SKOS and OpenBiodiv-O

TCS can be usefully compared with SKOS (Simple Knowledge Organization System), with the Taxon Concept equivalent to the `skos:Concept` and the Taxon Name to the `skosxl:Label`. The taxonomy or publication the Taxon Concepts are in can be compared to the `skos:ConceptScheme` and therefore the `accordingTo` property to the `skos:inScheme` property. `taxonName`, `synonym` and `vernacularName` can be seen as `skosxl:prefLabel`, `skosxl:hiddenLabel` and `skosxl:altLabel` respectively. Relationships between names are `skosxl:labelRelation` properties and relationships between taxa `skos:semanticRelation` properties, with the hierarchical relationships being `skos:broader` and `skos:narrower` and the horizontal ones `skos:mappingRelation`s. In SKOS, `skos:broader` and `skos:narrower` are used between Concepts in the same Concept Scheme, while the `skos:mappingRelation` properties are used to map Concepts from different Concept Schemes. Likewise, in TCS, hierarchical relationship terms are only used within the same taxonomy, while the horizontal relationship terms are primarily used to align Taxon Concepts between different taxonomies or different versions of a taxonomy.

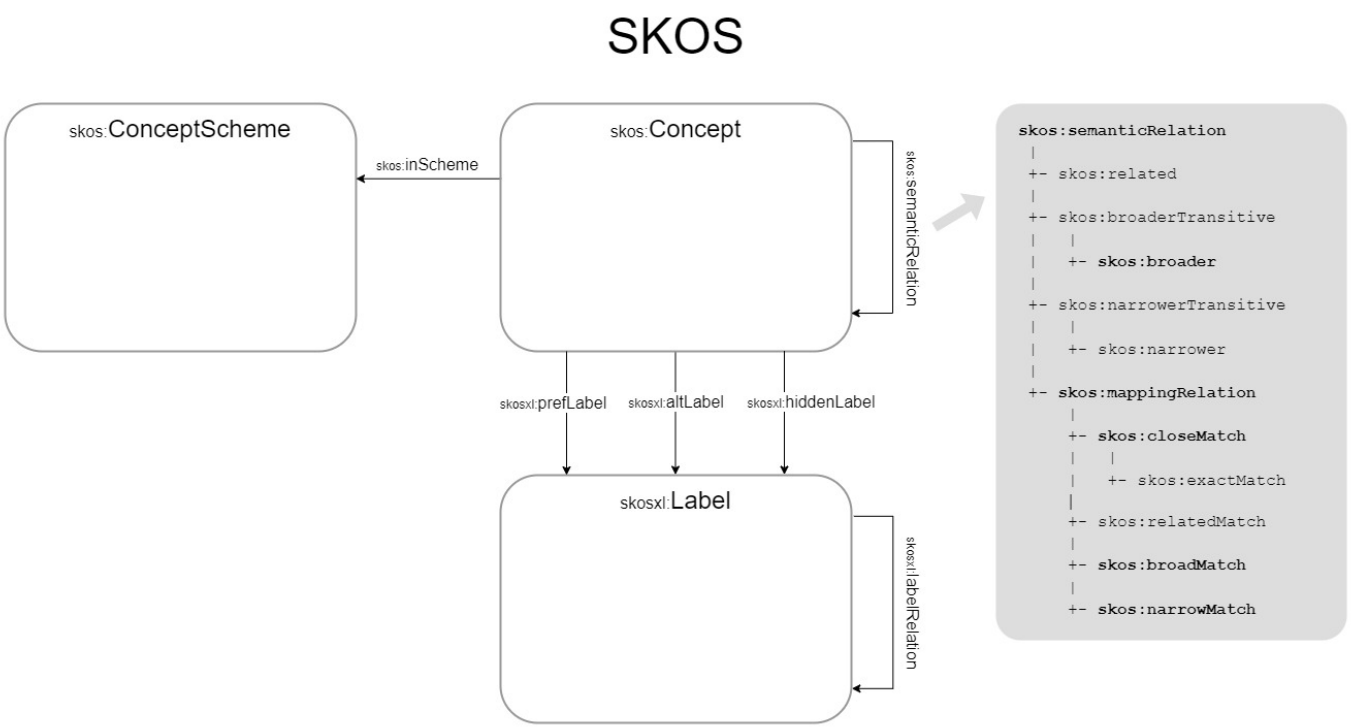


Table 1: Mapping of TCS relations to SKOS terms

TCS	SKOS
tcs:TaxonConcept	**skos:Concept**
tcs:accordingTo	skos:inScheme
tcs:taxonName	skosxl:prefLabel
tcs:synonym	skosxl:hiddenLabel
tcs:vernacularName	skosxl:altLabel
tcs:parent	skos:broader
tcs:isCongruentWith	skos:closeMatch
tcs:includes	skos:narrowMatch
tcs:isIncludedIn	skos:broadMatch
tcs:partiallyOverlaps	skos:relatedMatch
tcs:isDisjointWith	skos:relatedMatch
tcs:intersects	skos:relatedMatch
tcs:TaxonName	**skosxl:Label**
tcs:nameString	skosxl:literalForm
tcs:basionym	skosxl:labelRelation
tcs:replacedSynonym	skosxl:labelRelation
tcs:conservedAgainst	skosxl:labelRelation
tcs:spellingCorrectionOf	skosxl:labelRelation
tcs:laterHomonymOf	skosxl:labelRelation

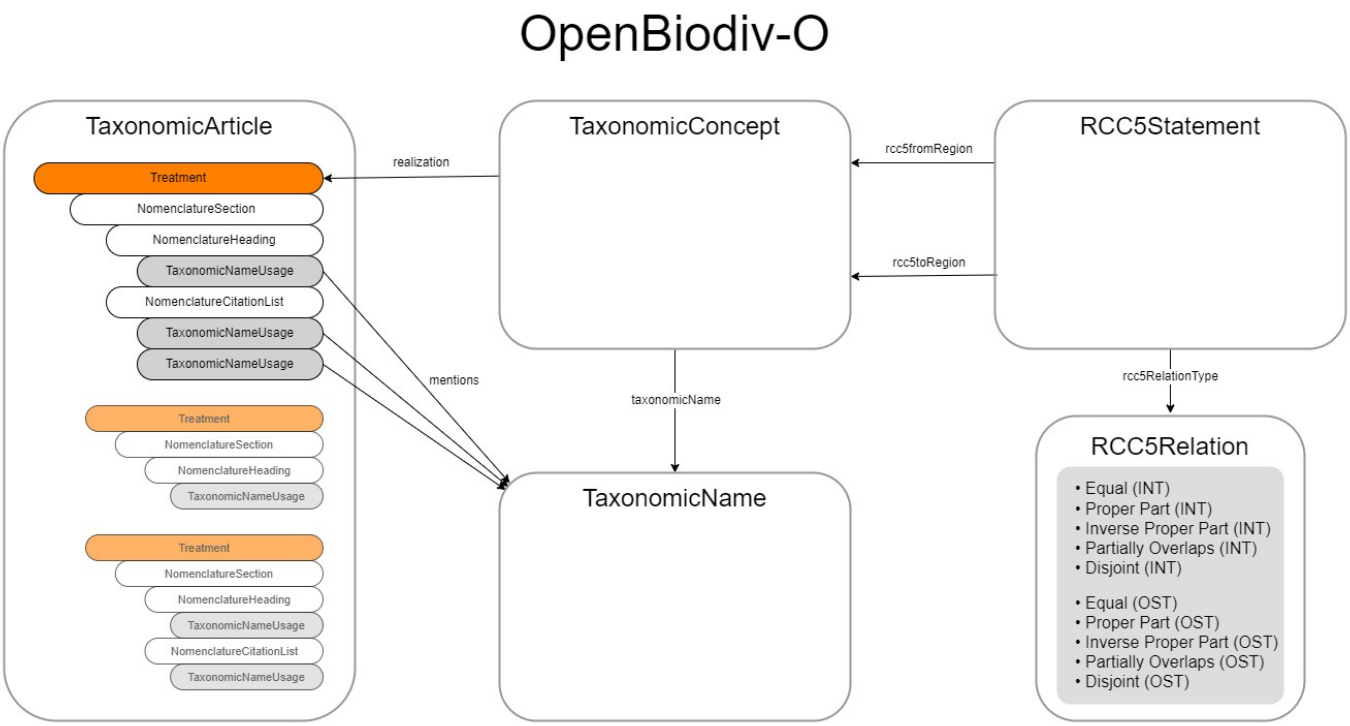
The OpenBiodiv Ontology (OpenBiodiv-O) defines the `TaxonomicConcept` as a Work under the FRBR (Functional Requirements for Bibliographic Records) data model as well as a SKOS Concept. A `Work` in FRBR is the product of an intellectual process of one or more persons, about which only indirect evidence is

at our hand. The Expression that realises this Work is the Treatment. While in FRBR a Work can have more than one Expression, there is a one-to-one relationship between Taxonomic Concepts and Treatment. This is exactly how we think of Taxon Concepts in TCS and forms a nice bridge between Taxon (or Taxonomic) Concepts and the literature. Librarians among us will recognise FRBR as the data model, or one of the data models, behind RDA (Resource Description and Access), a cataloguing standard that is used world-wide.

One or more Treatments are contained in a `TaxonomicArticle`. Therefore, the `accordingTo` property in TCS can point to either a Taxonomic Article or an individual Treatment. It should be noted that the Taxonomic Article and everything contained in it have no counterparts in TCS and that TCS relies on other specifications for those.

In other respects, TCS is a bit broader than OpenBiodiv-O. Every `OperationalTaxonomicUnit`, which is a superclass of `TaxonomicConcept` in OpenBiodiv-O, can be expressed as a TCS Taxon Concept, if there is a reason to do so. Also, there are categories of Taxon Concepts that TCS needs to be able to deal with, like entries in Catalogue of Life or AviBase, that, while fitting the definition of a Taxonomic Concept, can (probably) not be expressed in OpenBiodiv-O.

The `RCC5Statement` in OpenBiodiv-O is equivalent to the `TaxonConceptMapping` in TCS.



Appendix 1: Mapping of TCS 1 and TDWG Ontology terms

Taxon Concept

TCS 1	TDWG Ontology	TCS 2
/DataSet/TaxonConcepts/TaxonConcept	tc:TaxonConcept	**TaxonConcept**
/DataSet/TaxonConcepts/TaxonConcept/@type	—	—
/DataSet/TaxonConcepts/TaxonConcept/Rank	tc:rankString	dwc:verbatimTaxonRank
/DataSet/TaxonConcepts/TaxonConcept/Rank/@code	tc:rank	taxonomicRank
/DataSet/TaxonConcepts/TaxonConcept/Name	tc:nameString	dcterms:title | dwc:scientificName | dwc:vernacularName
/DataSet/TaxonConcepts/TaxonConcept/Name/@ref	tc:hasName	taxonName
/DataSet/TaxonConcepts/TaxonConcept/AccordingTo/AccordingToDetailed	tc:accordingTo	accordingTo
/DataSet/TaxonConcepts/TaxonConcept/AccordingTo/AccordingToSimple	tc:accordingToString	—
/DataSet/TaxonConcepts/TaxonConcept/SpecimenCircumscription	tc:circumscribedBy	—
/DataSet/TaxonConcepts/TaxonConcept/CharacterCircumscription	tc:describedBy	—

Taxon Relationship / Taxon Relationship Assertion

* TaxonConceptMapping in TCS 2 is only used for the subset of relationship types that TCS 1 calls set relationships.

TCS 1	TDWG Ontology	TCS 2*
/DataSet/TaxonConcepts/TaxonConcept/TaxonRelationships/TaxonRelationship | /DataSet/TaxonRelationshipAssertions/TaxonRelationshipAssertion	tc:Relationship	TaxonConceptMapping
/DataSet/TaxonConcepts/TaxonConcept/Relationships/Relationship/@type | /DataSet/TaxonRelationshipAssertions/TaxonRelationshipAssertion/@type	tc:relationshipCategory	mappingRelation
/DataSet/TaxonRelationshipAssertions/TaxonRelationshipAssertion/FromTaxonConcept	tc:fromTaxon	subjectTaxonConcept
/DataSet/TaxonRelationshipAssertions/TaxonRelationshipAssertion/ToTaxonConcept | /DataSet/TaxonConcepts/TaxonConcept/TaxonRelationships/TaxonRelationship/ToTaxonConcept	tc:toTaxon	objectTaxonConcept
/DataSet/TaxonRelationshipAssertions/TaxonRelationshipAssertion/AccordingTo	—	mappingAccordingTo

Relationship Type vocabulary

TCS 1	TDWG Ontology	TCS 2
is congruent to	tc:IsCongruentTo	isCongruentWith
is not congruent to	tc:IsNotCongruentTo	—
includes	tc:Includes	includes
does not include	tc:DoesNotInclude	—
excludes	tc:Excludes	isDisjointFrom
is included in	tc:IsIncludedIn	isIncludedIn
is not included in	tc:IsNotIncludedIn	—
overlaps	tc:Overlaps	partiallyOverlaps
does not overlap	tc:DoesNotOverlap	—
is child taxon of	tc:IsChildTaxonOf	parent
is parent taxon of	tc:IsParentTaxonOf	child
is anamorph of	tc:IsAnamorphOf	—
is teleomorph of	tc:IsTeleomorphOf	—
is second parent of	tc:IsSecondParentOf	—
is female parent of	tc:IsFemaleParentOf	—
is first parent of	tc:IsFirstParentOf	—
is male parent of	tc:IsMaleParentOf	—
is hybrid parent of	tc:sHybridParentOf	—
is hybrid child of	tc:IsHybridChildOf	—
is ambiregnal of	tc:IsAmbiregnalOf	—
is vernacular for	tc:IsVernacularFor	—
has vernacular	tc:HasVernacular	vernacularName
has synonym	tc:HasSynonym	synonym | intersects

Taxon Concept type vocabulary

TCS 1	TDWG Ontology	TCS 2
original	—	—
revision	—	—
incomplete	—	—

TCS 1	TDWG Ontology	TCS 2
aggregate	—	—
nominal	—	—

Taxonomic Rank vocabulary

* TCS 2 recommends the Taxonomic Rank GBIF Vocabulary

TaxonomicRankAboveSuperfamilyEnum

TCS 1	TDWG Ontology	TCS 2*
dom	—	domain
superreg	—	—
reg	—	kingdom
subreg	—	subkingdom
infrareg	—	—
superphyl_div	—	superphylum
phyl_div	—	phylum
subphyl_div	—	subphylum
infraphyl_div	—	—
supercl	—	superclass
cl	—	class
subcl	—	subclass
infracl	—	—
—	—	supercohort
—	—	cohort
—	—	subcohort
superord	—	superorder
ord	—	order
subord	—	suborder
infraord	—	infraorder
taxsupragen	—	—

TaxonomicRankFamilyGroupEnum

TCS 1	TDWG Ontology	TCS 2*
superfam	—	superfamily
fam	—	family
subfam	—	subfamily
infrafam	—	—

TaxonomicRankFamilySubdivisionEnum

TCS 1	TDWG Ontology	TCS 2*
supertrib	—	—
trib	—	tribe
subtrib	—	subtribe
infratrib	—	—

TaxonomicRankGenusGroupEnum

TCS 1	TDWG Ontology	TCS 2*
gen	—	genus
subgen	—	subgenus
infragen	—	—

TaxonomicRankGenusSubdivisionEnum

TCS 1	TDWG Ontology	TCS 2*
sect	—	section
subsect	—	subsection
ser	—	series
subser	—	subseries
aggr	—	speciesAggregate
taxinfragen	—	—

TaxonomicRankSpeciesGroupEnum

TCS 1	TDWG Ontology	TCS 2*
sp	—	species
subsp_aggr	—	subspecificAggregate
subsp	—	subspecies

TaxonomicRankBelowSubspeciesEnum

TCS 1	TDWG Ontology	TCS 2*
bv	—	—
pv	—	—
var	—	variety
subvar	—	subvariety
subsubvar	—	—
fm	—	form
subfm	—	subform
subsubfm	—	—
fsp	—	—
taxinfrasp	—	—
cand	—	—
infrasp	—	—

TaxonomicRankCultivatedPlants

TCS 1	TDWG Ontology	TCS 2*
cvgroup	—	cultivarGroup
grex	—	—
cv	—	cultivar
convar	—	—
graftchimaera	—	—

TCS 1	TDWG Ontology	TCS 2*
denomclass	—	—

TCS 1	TDWG Ontology	TCS 2
—	—	strain

Taxon Name

TCS 1	TDWG Ontology	TCS 2
/DataSet/TaxonNames/TaxonName	tn:TaxonName	**TaxonName**
/DataSet/TaxonNames/TaxonName/@nomenclaturalCode	tn:nomenclaturalCode	nomenclaturalCode
/DataSet/TaxonNames/TaxonName/@isAnamorphic	—	—
/DataSet/TaxonNames/TaxonName/Simple	tn:nameComplete	nameString
/DataSet/TaxonNames/TaxonName/Rank	tn:rankString	dwc:verbatimTaxonRank
/DataSet/TaxonNames/TaxonName/Rank/@code	tn:rank	taxonRank
/DataSet/TaxonNames/TaxonName/CanonicalName/Uninomial	tn:uninomial	—
/DataSet/TaxonNames/TaxonName/CanonicalName/Genus	tn:genusPart	dwc:genericName
/DataSet/TaxonNames/TaxonName/CanonicalName/InfragenericEpithet	tn:infragenericEpithet	dwc:infragenericEpithet
/DataSet/TaxonNames/TaxonName/CanonicalName/SpecificEpithet	tn:specificEpithet	dwc:specificEpithet
/DataSet/TaxonNames/TaxonName/CanonicalName/InfraspecificEpithet	tn:infraspecificEpithet	dwc:infraspecificEpithet
/DataSet/TaxonNames/TaxonName/CanonicalName/CultivarNameGroup	tn:cultivarNameGroup	dwc:cultivarEpithet
/DataSet/TaxonNames/TaxonName/CanonicalAuthorship/Simple	tn:authorship	dwc:scientificNameAuthorship
/DataSet/TaxonNames/TaxonName/CanonicalAuthorship/Authorship/Simple	tn:combinationAuthorship	combinationAuthorLiteral | combinationAscribedAuthorLiteral
/DataSet/TaxonNames/TaxonName/CanonicalAuthorship/Authorship/Authors	—	combinationAuthor | combinationAscribedAuthor
/DataSet/TaxonNames/TaxonName/CanonicalAuthorship/BasionymAuthorship/Simple	tn:basionymAuthorship	basionymAuthorLiteral | basionymAsctibedAuthorLiteral
/DataSet/TaxonNames/TaxonName/CanonicalAuthorship/BasionymAuthorship/Authors	—	basionymAuthor | basionymAscribedAuthor
/DataSet/TaxonNames/TaxonName/CanonicalAuthorship/CombinationAuthorship/Simple	tn:combinationAuthorship	combinationAuthorLiteral | combinationAscribedAuthorLiteral
/DataSet/TaxonNames/TaxonName/CanonicalAuthorship/CombinationAuthorship/Authors	—	combinationAuthor | combinationAscribedAuthor
/DataSet/TaxonNames/TaxonName/PublishedIn	—	namePublishedIn
/DataSet/TaxonNames/TaxonName/Year	tn:year	dwc:namePublishedInYear
/DataSet/TaxonNames/TaxonName/MicroReference | //element(*,NomenclaturalNoteType)/MicroReference	—	microReference
/DataSet/TaxonNames/TaxonName/Typification	—	typification
/DataSet/TaxonNames/TaxonName/Typification/Simple	—	typificationLiteral
/DataSet/TaxonNames/TaxonName/SpellingCorrectionOf	tn:spellingCorrection	—
/DataSet/TaxonNames/TaxonName/Basionym	tn:hasBasionym	basionym
/DataSet/TaxonNames/TaxonName/BasedOn	tn:BasedOn	basedOn
/DataSet/TaxonNames/TaxonName/ConservedAgainst	tn:ConservedAgainst	conservedAgainst
/DataSet/TaxonNames/TaxonName/LaterHomonymOf	tn:LaterHomonymOf	laterHomonymOf
/DataSet/TaxonNames/TaxonName/Sanctioned	—	—
/DataSet/TaxonNames/TaxonName/ReplacementNameFor	tn:ReplacementNameFor	replacedName
/DataSet/TaxonNames/TaxonName/PublicationStatus	tn:publicationStatus	nomenclaturalStatus

Nomenclatural Code vocabulary

* TCS 2 recommends the GBIF Nomenclatural Codes vocabulary

TCS 1	TDWG Ontology	TCS 2*
Viral	tn:Viral	ICVCN
Bacteriological	tn:Bacteriological	ICNB
Botanical	tn:ICBN	ICN
Zoological	tn:ICZN	ICZN
CultivatedPlant	tn:ICNCP	ICNCP
Indeterminate	—	—
—	—	BioCode

Typification

TCS 1	TDWG Ontology	TCS 2
/DataSet/TaxonNames/TaxonName/Typification/TypeVouchers/TypeVoucher | /DataSet/TaxonNames/TaxonName/Typification/TypeName	tn:NomenclaturalType	**NomenclaturalType**
—	—	typifiedName
/DataSet/TaxonNames/TaxonName/Typification/TypeVouchers/TypeVoucher/@typeofType	tn:typeOfType	typeOfType
/DataSet/TaxonNames/TaxonName/Typification/TypeVouchers/TypeVoucher/VoucherReference	tn:typeSpecimen	typeSpecimen
/DataSet/TaxonNames/TaxonName/Typification/TypeName/LectotypePublication | /DataSet/TaxonNames/TaxonName/Typification/TypeVouchers/TypeVoucher/LectotypePublication | /DataSet/TaxonNames/TaxonName/Typification/TypeName/LectotypePublication	—	typePublishedIn
/DataSet/TaxonNames/TaxonName/Typification/TypeName/NameReference	tn:typeName	typeName

Type of Type vocabulary

* TCS 2 recommends the GBIF Nomenclatural Type Status Vocabulary

TCS 1	TDWG Ontology	TCS 2*
allo	tn:Allotype	allotype
allolecto	tn:Allolectotype	allolectotype
alloneo	tn:Alloneotype	alloneotype
co	tn:Cotype	cotype
epi	tn:Epitype	epitype
ex	tn:ExType	extype
exepi	tn:ExEpitype	exepitype
exholo	tn:ExHolotype	exholotype
exiso	tn:ExIsotype	exisotype
exlecto	tn:ExLectotype	exlectotype
exneo	tn:ExNeotype	exneotype
expara	tn:ExParatype	exparatype
exsyn	tn:ExSyntype	exsyntype
hapanto	tn:Hapantotype	hapantotype
holo	tn:Holotype	holotype
icono	tn:Iconotype	iconotype
iso	tn:Isotype	isotype
isolecto	tn:IsoLectotype	isolectotype

TCS 1	TDWG Ontology	TCS 2*
isoneo	tn:Isoneotype	isoneotype
isosyn	tn:Isosyntype	isosyntype
lecto	tn:Lectotype	lectotype
neo	tn:Neotype	lectotype
para	tn:Paratype	paratype
paralecto	tn:Paralectotype	paralectotype
paraneo	tn:Paraneotype	paraneotype
plasto	tn:Plastotype	plastotype
plastoholo	tn:Plastoholotype	plastoholotype
plastoiso	tn:Plastoisotype	plastoisotype
plastolecto	tn:Plastolectotype	plastolectotype
plastoneo	tn:Plastoneotype	plastoneotype
plastopara	tn:Plastoparatype	plastoparatype
plastosyn	tn:Plastosyntype	plastosyntype
sec	tn:SecondaryType	secondarytype
supp	tn:SupplementaryType	supplementarytype
syn	tn:Syntype	syntype
topo	tn:Topotype	topotype
type	tn:Type	type
not	tn:NotAType	notatype
—	—	originalmaterial
—	—	typeSpecies
—	—	typeGenus