



DiSSCo-Flanders

WP2 – task 2.1

Detailed inventory of the collections: Report

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Colophon

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1. Summary

This report presents the results of [DiSSCo-Flanders](#) WP2 task 2.1 'Detailed inventory of the collections'. Building on previous work done as part of the SYNTHESYS+ project, a survey was set up aimed at obtaining high level information on the natural science collections held by the 14 members of the DiSSCo-Flanders consortium. This information consists of quantitative data on the overall size of the collections, as well as size by taxonomic groups, preservation types, stratigraphic age, geographic region, and level of digitization.

This report focuses primarily on the survey design.

2. Funding

This work was facilitated by the Research Foundation – Flanders research infrastructure under grant number FWO I001721N.

3. Author contributions

AVB and NP coordinated WP2 task 2.1 'Detailed inventory of the collections'. AVB wrote the report. LB, SDS, TC, CD, JO, ZP, DS, LS, PS, AVB, LV and EV were responsible for following up WP2 task 2.1 within their respective institutes and compiled the data for the different natural science collections housed within their institute with the help of the curators. AB, EB, HE, FL, SDS, ZP, DS, PS, MT, EV and AVB contributed to the survey design. MT is DiSSCo-Flanders project coordinator.

4. Introduction

This survey is part of WP2 task 2.1 and is aimed at obtaining high level information on the Natural Science Collections (NSCs) held in the institutions that participate in [DiSSCo-Flanders](#). This information consists of quantitative data on the overall size of the collections, as well as size by taxonomic groups, preservation types, stratigraphic age, geographic region, and level of digitization. When the phase of data collection is completed, these statistics will be visualized in the form of a DiSSCo-Flanders Collections Digitization Dashboard.

The current survey design is largely based on [deliverable D2.2](#) of the SYNTHESYS+ project during which a [pilot Collections Digitization Dashboard](#) was constructed using data provided by the nine European partner institutions involved (Tilley *et al.* 2018). Similar to this pilot dashboard, the DiSSCo-Flanders dashboard is conceived as a dynamic window for stakeholders to discover the contents of Flemish/Belgian NSCs (both digitized and undigitized) and as a tool for digitization prioritization and high-level decision making on a governmental, institutional and research level. There are, however, two important differences:

- (1) Whereas the SYNTHESYS+ dashboard and corresponding survey primarily focused on preserved collections, the DiSSCo-Flanders survey also includes **living collections** (e.g. botanical gardens, zoos) alongside an important number of **tissue and DNA samples**.
- (2) Whereas the SYNTHESYS+ Collections Digitization Dashboard provides information on institute level, the DiSSCo-Flanders Dashboard includes a more fine grained level (where possible) by including **information for each individual NSC housed within an institute**.

An update of the original SYNTHESYS+ survey design was therefore required.

Overall, however, the different fields in the survey follow the recommendations of the TDWG [Collection Descriptions Interest Group](#) and are in line with the [Collection Registry](#) that is being developed by CETAF¹. This will result in standard and harmonized descriptions of the DiSSCo-Flanders collections, in view of their registration in central registries and systems to be used by DiSSCo, such as [GBIF Registry of Scientific Collections](#) and [ELViS](#).

¹ <http://collections.naturalsciences.be/cpb/cetaf-passport-and-collections-registry-manual>

5. Definitions & abbreviations

- **Collection**

“A collection is any set of physical things (material/natural objects) or image, audio and video recordings (either analogue or digital) treated together for curative purposes” (Addink et al. 2020: p. 2).

- **Collection Digitization Dashboard (CDD)**

A Collection Digitization Dashboard (CDD) is *“a system that collects and presents reliable, complete and up-to-date information on the taxonomic and geographic scope of collections as well as the degree and level of digitization already achieved and remaining” (Hardisty et al. 2020: p. 132).*

- **Collection Management System (CMS)**

A Collection Management System (CMS) is *“a system (typically a database) for recording and organizing information about the objects in a museum or other collection” (Hardisty et al. 2020: p. 132).*

In the ICEDIG [deliverable D4.4](#) Dillen et al. (2019) provide the following background information: *“Most natural history museums and herbaria have some form of catalogue of their collection. Traditionally, these may have been maintained on paper. However, in most institutions such a catalogue is nowadays being maintained digitally in what is called a Collection Management System (CMS). (...) While most institutions have a digital catalogue, most do not have a complete catalogue. Even if every accession were recorded in such a database, it would be an exceptional institution where every detail of every specimen were entered in the database. (...) Data may be stored in a completely denormalized (‘flat’) manner, such as CSV (Comma Separated Values) text files or Microsoft Excel spreadsheets, but also in markup language formats such as XML (Extensible Markup Language) and JSON (JavaScript Object Notation). (...) But larger datasets tend to still be stored in relational databases, where data are stored in tables linked to each other with key fields. (...) Data fields may follow a controlled vocabulary derived, or inspired by, international standard organizations, such as International Organization for Standardization (ISO) or Biodiversity Information Standards (TDWG), or follow a local standard.”*

Examples of Collection Management Systems used for NSCs are ActiMuseo, Arctos, BgBASE, BRAHMS, CB 3.0, DaRWIn, Filemaker, JACQ, Kotka, MS Access, MS Excel, PlutoF, SPECIFY, ... In addition to these examples many other in-house and not in-house developed systems exist as well.

- **Digital specimen**

A digital specimen is *“a digital representation (surrogate) corresponding to an identifiable physical specimen in a NSC” (Hardisty et al. 2020: p. 133).*

It acts as a digital twin or surrogate in cyberspace for a specific physical specimen, identifying its actual location and authoritatively saying something about its collection event (who, when, where) and taxonomy (what), as well as providing links to high-resolution images. A digital specimen furthermore exposes supplementary information about related literature, traits, tissue samples and DNA sequences, chemical analyses, environmental information, and much more, stored elsewhere than in the NSC itself.

The digital specimen concept largely corresponds to the ‘extended specimen’ concept (Lendemer *et al.* 2019) and provides the means to manage virtual collections in the future.

Further information: [What is a Digital Specimen? – DiSSCoTech, mids/MIDS-definition-v0.15-29Jul2021.md at working-draft · tdwg/mids · GitHub](#)

- **Digitization**

In its most general sense, the term digitization refers to “*the process of converting analog information about physical specimens to digital format, which includes electronic text, images and other representations*” (Hardisty *et al.* 2020: p. 134).

- **DiSSCo**

[Distributed System of Scientific Collections](#) (DiSSCo) is a new world-class Research Infrastructure (RI) for NSCs that aims to digitally unify all European natural science collections under common access, curation, policies and practices that ensure that all the data is easily findable, accessible, interoperable and reusable (FAIR).

DiSSCo officially launched its preparatory phase in 2020 with [DiSSCo Prepare](#), the primary vehicle through which DiSSCo will reach the overall readiness necessary for its construction and eventual operation. The DiSSCo RI is planned to be operational by 2026.

- **DiSSCo-Flanders**

[DiSSCo-Flanders](#) is an IRI (International Research Infrastructure) project (2021-2024) funded by the Research Foundation – Flanders (FWO) that aims to mobilize Flemish NSCs for DiSSCo and bring them to the expected maturity level to be fully integrated in the European DiSSCo infrastructure. It brings together ten Flemish institutions and four associated Belgian partner institutions in the form of a consortium.

- **Minimum Information about a Digital Specimen (MIDS)**

Minimum Information about a Digital Specimen (MIDS) is a standard that is currently being developed by the TDWG [Collections Descriptions Interest Group](#). It specifies the mandatory and optional information elements that must be present in a digital specimen at various levels of digitization (Hardisty *et al.* 2020).

Although in its most general sense the term ‘digitization’ refers to the process of converting analog information about physical specimens to digital form (*supra*), in practice it can still be used and understood in diverse ways (e.g. creating database records, making images of specimens and/or their labels, semantic enrichment of data,...). The MIDS standard aims at providing a harmonizing framework that can help clarify different levels (depth) of digitization and the minimum information captured and published at each level. In other words, it is a specification defining the information elements expected to be present when publishing digitized information about specimens at various levels of digitization.

As this standard is still under development, this survey uses the version that was current at the start of this work package (i.e. version of March 2021).

Further information: [mids/MIDS-definition-v0.15-29Jul2021.md at working-draft · tdwg/mids · GitHub](#), [Minimum Information about a Digital Specimen \(MIDS\) - TDWG](#)

- **Natural Science Collection (NSC)**

“A collection is a Natural Science Collection (NSC) when its items are evidence of nature’s biodiversity or geodiversity and are preserved, catalogued, and managed for the purpose of scientific study” (Addink et al. 2020: p. 3).

Medical collections, ethnographic collections, drawings, sketches, paintings and notebooks are not in the scope of this survey and are not included in the counts.

6. Survey manual

6.1 General information

The survey consists of **two Excel documents** (Appendix 1-2: survey part 1 + part 2) in which all DiSSCo-Flanders partners were invited to enter data about their institute's NSCs. Most institutes have multiple NSCs, each of which is organized and managed in a very specific way. **Part 1** of the survey therefore focuses on the **general information** about the participating institutes and the way their collections are structured. It furthermore contains a questionnaire aimed at providing feedback on the survey and an optional sheet ('Collection notes') to provide additional relevant information. Part 1 of the survey is completed once by each institute.

Part 2 of the survey focuses on quantitative **data on the NSCs housed within each institute**. All partners were requested to **submit a part 2 document for each NSC in their institute**. If, for instance, four different NSCs are listed in the sheet 'Collection structure', four separate copies of part 2 of the survey form should be submitted (i.e. one copy for each collection). The document name should clearly indicate which collection data it contains (e.g. DiSSCo_WP2_Task2.1_SurveyPart2_Herbarium, or DiSSCo_WP2_Task2.1_SurveyPart2_Paleontology).

For the purpose of this study, it is assumed that **an specimen/object belongs to only one collection**.

The subdivisions in this chapter correspond to the different sheets of the Excel survey forms:

APPENDIX 1: DiSSCo_WP2_Task 2.1_SurveyPart1

- | | |
|-------------------------|-------------|
| - Institute information | Chapter 6.2 |
| - Collection structure | Chapter 6.3 |
| - Contributor feedback | Chapter 6.6 |
| - Collection notes | Chapter 6.7 |

APPENDIX 2: DiSSCo_WP2_Task 2.1_SurveyPart2

- | | |
|---------------------|-------------|
| - Collection data | Chapter 6.4 |
| - Stratigraphic age | Chapter 6.5 |

All **mandatory survey elements** are indicated in the text **in blue**, all other data elements are optional.

6.2 Institute information

The Excel sheet 'Institute information' contains fields to enter the institute's name, plus its unique acronym (provided by e.g. CETAF registries, Index Herbarium and/or GRID) as well as additional identifiers (i.e. ROR identifier, WikiData link). The web addresses listed in Table 1 provide more information on the different identifiers:

	Institute information label	Description
1.	Official institute name (English)	
2.	Official acronym	CETAF registry https://cetaf.org/explore/search-by-collections/ Index Herbarium: http://sweetgum.nybg.org/science/ih Grid: https://www.grid.ac/
3.	ROR identifier	https://ror.org/
4.	WikiData	https://www.wikidata.org/wiki/Wikidata:Main_Page

Table 1: Overview and description of the fields in the Excel sheet 'Institute information'.

Mandatory data elements: All fields in this Excel sheet are mandatory.

6.3 Collection structure

In the Excel sheet 'Collection structure' participants are requested to provide information on the **manner in which the NSCs in their institute are organized and managed**. For example, if an institute holds a living plant collection, a herbarium, a seed bank and a paleontological collection, collection details should be entered in four different rows.

Table 2 provides an overview of the different fields:

	Collection structure label	Description	
1.	Collection	Title	<i>Title of the collection.</i>
		Description	<i>A brief description of the collection.</i>
2.	Contact person	Name	<i>Name of the curator/person responsible for the collection.</i>
		E-mail	<i>Contact details of the curator/person responsible for the collection.</i>
		GDPR	<i>Check this box to indicate that the curator/person responsible for the collection agrees with his/her name and email address being made visible to the members of DiSSCo-Flanders consortium.</i>
3.	Which CMS(s)?	<i>Specify the name of the CMS that is being used for this collection. You can also add multiple CMSs, if applicable.</i>	
4.	Object total	<i>Specify the total number of objects in this collection. This count (or estimate) should be based on the number of objects/specimens that are given a unique identifier/inventory number (i.e. managed as an individual object).</i>	
5.	Collecting events	Earliest year	<i>These fields contain information on the time period during which the specimens/objects in the collection were collected (format: yyyy). In case new specimens are still being added to the collection, the current year is entered in the field 'Latest year'. In case information on collecting events is unknown, the term 'Unknown' is entered.</i>
		Latest year	

Table 2: Overview and description of the fields in the Excel sheet 'Collection structure'.

Mandatory data elements: All fields in this Excel sheet are mandatory.

6.4 Collection data (All disciplines)

6.4.1 Discipline

The highest level of categorization are the Natural Science disciplines (Table 3). The following amendments were made with regard to the SYNTHESYS+ survey:

- The category 'Botany' was renamed to 'Macroscopic algae, fungi, plants' to stay congruent with the CETAF collections registry and to clearly differentiate it from the category 'Microbiology'.
- The category 'Multiple disciplines' was added to group Biobank collections that refer to multiple taxonomic groups and/or disciplines at the same time (*cf.* metabarcoding).

If an institute has no specimens belonging to a specific discipline, these cells are left blank.

6.4.2 Taxonomy

This field forms a breakdown of the different Natural Science disciplines into taxonomic categories (Table 3). In addition to a series of discipline specific taxonomic categories, each discipline also comprises the categories 'Unspecified' and 'Other':

- The **category 'Unspecified'** contains collection size data which cannot be broken down further into individual taxonomic groups (*e.g.* Mammals) and is only available at the higher discipline level (*e.g.* Zoology vertebrates).
- The **category 'Other'** contains data that falls within the scope of the dashboard but does not fit into any of the taxonomic categories provided. The nature of these specimens can be recorded in the contributor remarks field.

The **category 'Multiple taxonomic groups'** contains data from Biobank collections that relate to multiple taxonomic groups and/or disciplines at the same time (*cf.* metabarcoding).

If an institute has no specimens belonging to a specific taxonomic group, these cells are left blank.

Discipline label	Category label
Anthropology	Unspecified
	Human biology
	Other
Macroscopic algae, fungi, plants	Unspecified
	Macroalgae
	Bryophytes
	Fern & fern allies
	Macrofungi/Lichens
	Seed plants
	Other
Microbiology	Unspecified
	Bacteria & Archaea
	Chromista
	Green algae
	Phages

	Plasmids
	Protozoa
	Virus - animal/human
	Virus - plant
	Yeast & fungi
	Other
Zoology vertebrates	Unspecified
	Amphibians
	Birds
	Fishes
	Mammals
	Reptiles
	Other
Zoology invertebrates	Unspecified
	Arthropods - arachnids
	Arthropods - crustaceans & myriapods
	Arthropods - insects (Lepidoptera, Diptera, Hymenoptera, Coleoptera)
	Arthropods - other insects
	Mollusca (bivalves, gastropods, cephalopods)
	Porifera (sponges)
	Other
Geology	Rocks
	Minerals
	Sediment
Paleontology	Unspecified
	Botany
	Invertebrates
	Microfossils
	Mycology
	Trace fossils
	Vertebrates
	Other
Extraterrestrial	Unspecified
	Collected in space
	Collected on earth
	Other
Multiple disciplines	Multiple taxonomic groups

Table 3: Overview of the different disciplines and corresponding taxonomic categories.

6.4.3 Status

Whereas the SYNTHESIS+ survey primarily focused on preserved collections, the institutes that participate in DiSSCo-Flanders also hold living collections alongside a large number of biological samples. In order to accommodate this variation, a column (Table 4) describing the status of the collections was added to the survey form:

Status label	Examples
Unspecified	<i>The status (Biobank/Living/Preserved/Fossil/NA) of a specimen is unknown</i>
Biobank	<i>A collection of biological samples (consisting of tissue, blood, gametes, isolated DNA, ...) for research or conservation purposes that reflect nature's biodiversity</i>
Fossil	<i>A preserved specimen that is a fossil (e.g. a piece of a petrified tree, an ichnofossil, a coprolite, a gastrolith)</i>
Living	<i>A specimen that is alive (e.g. a living plant in a botanical garden, a living animal in a zoo)</i>
Active	<i>A collection of active microbiological samples/cultures.</i>
Preserved	<i>A specimen that has been preserved (e.g. a plant on an herbarium sheet, a cataloged lot of fish in a jar)</i>
NA	<i>Not relevant (in case of rocks, minerals, sediment or extraterrestrial specimens)</i>

Table 4: Overview of status types.

6.4.4 Preservation type

The field 'Preservation type' refers to the form in which an object is stored (e.g. 'Microscope slides', 'Fluid preserved', 'Dried and pinned'). Collection size data and MIDS data at this level is useful for comparison between different taxonomic categories, and for digitization prioritization and decision making (as different storage types may require different digitization techniques or equipment).

In addition to a series of preservation types specific for each taxonomic group and status (Table 5-Table 13), the categories 'Unspecified' and 'Other' have been added to all groups:

- The **category 'Unspecified'** contains collection size data which cannot be broken down further into individual preservation types (e.g. Pinned - dried) and is only available at the higher taxonomic and status level (e.g. Arthropods - insects < Preserved).
- The **category 'Other'** contains data that falls within the scope of the dashboard but does not fit into any of the categories provided. The nature of these specimens can be recorded in the contributor remarks field.

If an institute has no specimens belonging to a specific preservation type, these cells are left blank.

ANTHROPOLOGY		
Status	Preservation type	Description
Preserved	Unspecified	<i>This category is used for preserved human biology specimens for which no further information on preservation type is available.</i>
	Cryopreserved / frozen (not Biobank)	
	Climate controlled conditions	<i>Specimens kept in rooms or units where temperature and/or humidity are regulated (not cryopreservation/frozen); e.g. specimens kept in air conditioned rooms</i>
	Dried/skeletonized - assembled	<i>Multiple assembled body parts or entire assembled skeleton</i>
	Dried/skeletonized - not assembled	<i>Single body parts, loose (not assembled) bones/teeth, ...</i>
	Fluid preserved	<i>Specimens preserved in alcohol/formalin/glycerin</i>
	Microscope slides	
	No climate controlled conditions	<i>Specimens that do not fit into any of the above categories; Temperature and/or humidity are not regulated; can include mummies</i>
	Other	<i>Specimens that do not fit into any of the categories above. Specify the type of collections in the contributor remarks field.</i>

Table 5: Overview of preservation types for anthropological specimens.

MACROSCOPIC ALGAE, FUNGI, PLANTS		
Status	Preservation type	Description
Unspecified	Unspecified	<i>This category is used for specimens of a specific taxonomic group (e.g. Seed plants) for which no further information on the status (Biobank/Living/Preserved) is available.</i>
Biobank	Unspecified	<i>This category is used for Biobank specimens of a specific taxonomic group (e.g. Seed plants) for which no further information on preservation type is available.</i>
	DNA/RNA	<i>DNA/RNA samples (frozen)</i>
	Tissue (or matrix ²)	<i>Tissue (or matrix) samples, typically silica dried</i>
	Other	<i>This category is used for Biobank specimens of a specific taxonomic group (e.g. Seed plants) that do not fit into any of the categories above. Specify the type of collections in the contributor remarks field.</i>
Living	Unspecified	<i>This category is used for living specimens of a specific taxonomic group (e.g. Seed plants) for which no further information on preservation type is available.</i>
	Greenhouses	<i>Living specimens in a greenhouse</i>
	In vitro	<i>Living specimens that have been cultured in artificial growing media</i>
	Outdoors, in the wild (in situ)	<i>Living specimens, in the wild</i>
	Outdoors, not in the wild (ex situ)	<i>Living specimens, in a botanical garden (outdoors)</i>
	Seeds/spores (in Seed bank)	<i>Seeds/spores stored in a seed bank (typically dried and frozen at -20°C)</i>
	Cryopreserved	
	Other	<i>This category is used for living specimens of a specific taxonomic group (e.g. Seed plants) that do not fit into any of the categories above. Specify the type of collections in the contributor remarks field.</i>
Preserved	Unspecified	<i>This category is used for preserved specimens of a specific taxonomic group (e.g. Seed plants) for which no further information on preservation type is available.</i>
	Dried	<i>Not preserved in fluid, not pressed: e.g. dried fruits, wood samples, dried fungi, ...</i>
	Fluid preserved	<i>Preserved in alcohol/formalin/glycerin</i>
	Microscope slides	
	Pressed & dried	<i>Herbarium specimens</i>
	Spore print	
	Other	<i>This category should be used for preserved specimens of a specific taxonomic group (e.g. Seed plants) that do not fit into any of the categories above. Specify the type of collections in the contributor remarks field.</i>

Table 6: Overview of preservation types for Macroscopic algae, fungi and plants.

² In the context of the Biobank, the term 'matrix' refers to the sample from which the DNA/RNA is extracted. This can be tissue, but can for instance also be a swab in a cloaca or feces of a wolf.

MICROBIOLOGY		
Status	Preservation type	Description
Unspecified	Unspecified	<i>This category is used for specimens of a specific taxonomic group (e.g. Virus - plant) for which no further information on the status (Biobank/Living/Active/Preserved) is available.</i>
Biobank	Unspecified	<i>This category is used for Biobank specimens of a specific taxonomic group (e.g. Green algae) for which no further information on preservation type is available.</i>
	DNA/RNA	<i>DNA/RNA samples (frozen)</i>
	Other	<i>This category is used for Biobank specimens of a specific taxonomic group (e.g. Green algae) that do not fit into any of the categories above. Specify the type of collections in the contributor remarks field.</i>
Living/Active	Unspecified	<i>This category is used for living/active specimens of a specific taxonomic group (e.g. Virus - plant) for which no further information on preservation type is available.</i>
	Cultures: active other (not freeze-dried, not frozen)	<i>Including fluid preserved</i>
	Cultures: freeze-dried	
	Cultures: frozen	
	Other	<i>This category is used for living specimens of a specific taxonomic group (e.g. Virus - plant) that do not fit into any of the categories above. Specify the type of collections in the contributor remarks field.</i>
Preserved	Unspecified	<i>This category is used for preserved specimens of a specific taxonomic group (e.g. Virus - plant) for which no further information on preservation type is available.</i>
	Microscope slides	
	Frozen	
	Other	<i>This category is used for preserved specimens of a specific taxonomic group (e.g. Virus - plant) that do not fit into any of the categories above. Specify the type of collections in the contributor remarks field.</i>

Table 7: Overview of preservation types for microbiological specimens.

ZOOLOGY (vertebrates & invertebrates)		
Status	Preservation type	Description
Unspecified	Unspecified	<i>This category is used for specimens of a specific taxonomic group (e.g. Mammals) for which no further information on the status (Biobank/Living/Preserved) is available.</i>
Biobank	Unspecified	<i>This category is used for Biobank specimens of a specific taxonomic group (e.g. Mammals) for which no further information on preservation type is available.</i>
	DNA/RNA	<i>DNA/RNA samples (frozen)</i>
	Tissue (or matrix ³)	<i>Tissue (or matrix) samples (frozen)</i>
	Gametes	<i>Gametes (frozen)</i>
	Other	<i>This category should be used for Biobank specimens of a specific taxonomic group (e.g. Mammals) that do not fit into any of the categories above. Please specify the type of collections in the contributor remarks field.</i>
Living	Unspecified	<i>This category should be used for living specimens of a specific taxonomic group (e.g. Mammals) for which no further information on preservation type is available.</i>
	In vivo, in the wild (in situ)	<i>Living animals in wildlife conservancies.</i>
	In vivo, not in the wild (ex situ)	<i>Living animals in zoos.</i>
	In vitro	<i>Living specimens that have been cultured in artificial growing media</i>
	Other	<i>This category should be used for living specimens of a specific taxonomic group (e.g. Mammals) that do not fit into any of the categories above. Please specify the type of collections in the contributor remarks field.</i>
Preserved	Unspecified	<i>This category should be used for preserved specimens of a specific taxonomic group (e.g. Mammals) for which no further information on preservation type is available.</i>
	Dried - assembled	<i>Multiple animal parts or entire skeletons, stuffed animals, ...</i>
	Dried - not assembled	<i>Animal parts (not assembled), tanned skin, egg shell, ...</i>
	Dried - pinned	<i>Pinned insects</i>
	Fluid preserved	<i>Preserved in alcohol/formalin/glycerin</i>
	Frozen (not Biobank)	
	Microscope slides	
	Other	<i>This category should be used for preserved specimens of a specific taxonomic group (e.g. Mammals) that do not fit into any of the categories above. Please specify the type of collections in the contributor remarks field.</i>

Table 8: Overview of preservation types for zoological specimens.

³ In the context of the Biobank, the term 'matrix' refers to the sample from which the DNA/RNA is extracted. This can be tissue, but can for instance also be a swab in a cloaca or feces of a wolf.

PALEONTOLOGY (Botany & mycology)			
Status	Preservation type	Description	
Fossil	Unspecified	<i>Fossil specimens for which no further information on preservation type is available.</i>	
	Dry preserved	Macrofossils	<i>Fossils in the form of dry samples (i.e. not preserved in fluid) stored in jars, trays etc. These include handspecimens/slabs/matrix support (i.e. surrounded by original sediment) as well as matrix free (free from original sediment) specimens.</i>
		Mesofossils	<i>Small fossilized parts of plants (e.g. fruits, leaves, and seeds) in the form of dry samples (i.e. not preserved in fluid) stored in jars, Franke cells, etc.</i>
	Fluid preserved	Macrofossils	<i>Fossils preserved in fluid in a jar or other type of concealed unit.</i>
		Mesofossils	<i>Small fossilized parts of plants (e.g. fruits, leaves, and seeds) preserved in fluid in a jar or other type of concealed unit.</i>
	Fossils preserved in amber, natural resin		<i>Require to be kept in humidity and light controlled storage units.</i>
	Microscope slides		
	Oversized fossils		<i>Require extra space because objects are too large for standard units/containers.</i>
Other		<i>Does not fit into any of the categories above</i>	

PALEONTOLOGY (Invertebrates, vertebrates & trace fossils)			
Status	Preservation type	Description	
Fossil	Unspecified	<i>Fossil specimens for which no further information on preservation type is available.</i>	
	Dry preserved	Macrofossils	<i>Vertebrate, invertebrate or trace fossils in the form of dry samples (i.e. not preserved in fluid) stored in jars, trays etc. These include handspecimens/slabs/matrix support (i.e. surrounded by original sediment) as well as matrix free (free from original sediment) specimens.</i>
		Macrofossils	<i>Vertebrate, invertebrate or trace fossils preserved in fluid in a jar or other type of concealed unit.</i>
	Fossils preserved in amber, natural resin		<i>Require to be kept in humidity and light controlled storage units.</i>
	Microscope slides		
	Oversized fossils		<i>Require extra space because objects are too large for standard units/containers.</i>
	Other		<i>Does not fit into any of the categories above</i>

PALEONTOLOGY (Microfossils)		
Status	Preservation type	Description
Fossil	Unspecified	<i>Microfossils for which no further information on preservation type is available.</i>
	Dry preserved	Microfossils

		<i>preserved as dry samples (i.e. not preserved in fluid) stored in jars, trays, etc.</i>
Fluid preserved	Microfossils	<i>Fossilized microorganisms/micro-remains of fauna and flora such as bacteria, algae, pollen, spores, crustaceans (e.g. ostracods), dinoflagellates, foraminifera, conodonts, microvertebrates (e.g. hamster teeth, bones), etc. which are preserved in fluid in a jar or other type of concealed unit.</i>
Fossils preserved in amber, natural resin		<i>Require to be kept in humidity and light controlled storage units.</i>
Microscope slides		
Other		<i>Does not fit into any of the categories above</i>

Table 9: Overview of preservation types for paleontological specimens.

ROCKS & MINERALS		
Status	Preservation type	Description
NA	Unspecified	<i>This category is used for rock or mineral specimens for which no further information on preservation type is available.</i>
	Cut/polished gemstones	<i>High-expense/rare/precious stones that need careful handling and are contained in secure units.</i>
	Hazardous material/objects	<i>Specimens that are hazardous to health: containing asbestos, radioactive, toxic, etc.</i>
	Macro-object	<i>Handspecimens/hand-held objects/slabs that can be contained in standard units (draws, shelves, cabinets).</i>
	Micro-object	<i>Specimens that can only be handled/observed with the aid of a microscope. Contained in jars.</i>
	Microscope slides	
	Oversized object	<i>Requires extra space because objects are too large for standard units/containers.</i>
	Rock core	<i>Undisturbed sample obtained by drilling or other sampling method. Stored in liners, steel rings, etc.</i>
	Other	<i>Rock and mineral specimens that do not fit into any of the categories above. Please specify the type of collections in the contributor remarks field.</i>

Table 10: Overview of preservation types for rocks and minerals.

SEDIMENT		
Status	Preservation type	Description
NA	Unspecified	<i>This category is used for sediment specimens for which no further information on preservation type is available.</i>
	Hazardous material/objects	<i>Specimens that are hazardous to health: containing asbestos, radioactive, toxic, etc.</i>
	Microscope slides	
	Sediment core	<i>Undisturbed sample obtained by drilling or other sampling method. Stored in liners, steel rings, etc.</i>
	Sediment sample	<i>Disturbed sample consisting of loose sediment (e.g. mineral soil samples, organic soil samples)</i>
	Soil monoliths	<i>A vertical soil section mounted on a board for display</i>
	Other	<i>Specimens that do not fit into any of the categories above. Please specify the type of collections in the contributor remarks field.</i>

Table 11: Overview of preservation types for sediment/soil.

EXTRATERRESTRIAL		
Status	Preservation type	Description
NA	Unspecified	<i>This category is used for specimens of a specific taxonomic group (e.g. Collected in space) for which no further information on preservation type is available.</i>
	Macro-objects	<i>Handspecimens/hand-held/slabs: Moon rock, Meteorites, ...</i>
	Micro-objects	<i>Can only be handled/observed with the aid of a microscope; Contained in jars, sample bags, ...</i>
	Microscope slides	
	Oversized objects	<i>Requires extra space because objects are too large for standard units/containers.</i>
	Other	<i>Does not fit into any of the categories above. Please specify the type of collections in the contributor remarks field.</i>

Table 12: Overview of preservation types for extraterrestrial specimens.

BIOBANK		
Status	Preservation type	Description
Biobank	Unspecified	<i>This category is used for Biobank specimens that do not fit into any of Biobank categories above which are linked to a specific taxonomic group (e.g. in case of metabarcoding). The category 'unspecified' is used when no further information on preservation type is available. If relevant, additional information can be provided in the contributor remarks field.</i>
	DNA/RNA	<i>This category is used for (frozen) DNA/RNA samples that do not fit into any of the Biobank categories linked to a specific taxonomic group (e.g. in case of metabarcoding). If relevant, additional information can be provided in the contributor remarks field.</i>
	Tissue/matrix ⁴	<i>This category is used for (frozen) tissue/matrix samples that do not fit into any of the Biobank categories linked to a specific taxonomic group (e.g. in case of metabarcoding). If relevant, additional information can be provided in the contributor remarks field.</i>
	Other	<i>Does not fit into any of the categories above. Please specify the type of collections in the contributor remarks field.</i>

Table 13: Overview of preservation types for the category Biobank.

⁴ In the context of the Biobank, the term 'matrix' refers to the sample from which the DNA/RNA is extracted. This can be tissue, but can for instance also be a swab in a cloaca or feces of a wolf.

6.4.5 Region

The field 'Region' refers to the **geographic region where a specimen/object was collected**. The geographic region should therefore NOT be inferred from the distribution of the species in the wild. For specimens coming from a zoo, a botanic garden or a park, the geographic region refers to the location of the zoo/botanic garden/park.

Four main categories are differentiated (terrestrial regions, freshwater regions, marine regions and region unknown), each of which contains one or more subcategories (Table 14):

- The **terrestrial regions** are based on level 1 of the TDWG [World Geographical Scheme for Recording Plant Distributions](#) (Figure 1; Brummitt *et al.* 2001). A shapefile of the TDWG level 1 regions is provided by Kew Gardens and can be downloaded [here](#). The full list of countries per region can be found in Brummitt *et al.* 2001 (table 4, p. 35-52).
- Like the terrestrial regions, the **freshwater regions** are based on level 1 of the TDWG [World Geographical Scheme for Recording Plant Distributions](#) (Table 14; Figure 1; Brummitt *et al.* 2001). A shapefile of the TDWG level 1 regions is provided by Kew Gardens and can be downloaded [here](#).
- The **marine regions** are based on the 'International Hydrographic Organisation (IHO) World Seas – Version 3' (Figure 2; Flanders Marine Institute 2018) which can be downloaded [here](#) as a shapefile. Eight main marine categories (*i.e.* oceans) are differentiated (*e.g.* North Atlantic, Indian Ocean, ...), four of which have been subdivided into three categories as part of the SYNTHESYS+ survey. These additional categories allowed differentiating between specimens from 'deep sea' contexts and specimens coming from smaller marine territories/seas ('shelf area and adjacent seas') such as the Mediterranean and the Red Sea.
- If the location where a specimen/object was collected is unknown and the type of region (terrestrial, freshwater or marine) where it was collected is also unknown, the object/specimen is classified as '**Region unknown**'. The categories 'Terrestrial < World/NA', 'Freshwater < World/NA' and 'Marine < World/NA' are used for specimens/objects that cannot be assigned to a more specific terrestrial, freshwater or marine region.

If an institute has no specimens belonging to a specific region, these cells are left blank.

Region level 1	Region level 2	Description	
Region unknown	Region unknown	<i>The location where a specimen/object was collected is unknown and also the type of region (terrestrial, freshwater, marine) is unclear.</i>	
Terrestrial	Africa	<i>See figure 1 See Brummitt et al. 2001</i>	
	Antarctica		
	Asia temperate		
	Asia tropical		
	Australasia		
	Europe		
	North America		
	Pacific		
	South America		
	World/NA	<i>Specimens/objects that were collected in a terrestrial context, but cannot be assigned to a specific terrestrial region.</i>	
Freshwater	Africa	<i>See figure 1 See Brummitt et al. 2001</i>	
	Antarctica		
	Asia temperate		
	Asia tropical		
	Australasia		
	Europe		
	North America		
	Pacific		
	South America		
	World/NA	<i>Specimens/objects that were collected in a freshwater context, but cannot be assigned to a specific freshwater region.</i>	
Marine	Arctic Ocean	<i>See figure 2 See Flanders Marine Institute 2018</i>	
	Indian Ocean		
	North Atlantic		Unknown Deep sea Shelf area & adjacent seas
	South Atlantic		Unknown Deep sea Shelf area & adjacent seas
	North Pacific		Unknown Deep sea Shelf area & adjacent seas
	South Pacific		Unknown Deep sea Shelf area & adjacent seas
	Southern Ocean		
	World/NA	<i>Specimens/objects that were collected in a marine context, but cannot be assigned to a specific marine region.</i>	

Table 14: Overview of the different geographic regions.



Figure 1: Map showing the level 1 and 2 categories of the World Geographical Scheme for Recording Plant Distributions (Source: Brummitt et al. 2001 : Map 1, p. 105). In this survey the level 1 categories (i.e. continents; 1-9) are used to define the terrestrial and freshwater regions.



Figure 2: Map showing the IHO (World Seas – version 3) marine regions used in the geographic region classification, and the adjacent seas that occur next to the region boundaries (Source: Flanders Marine Institute, 2018; Tilley et al. 2020: figure A2, p. 50)

6.4.6 Statistics

Two types of numerical data are collected as part of this survey:

- Counts and/or estimates relating to the number of physical specimens/objects (Table 15);
- Counts relating to the levels (depth) of digitization (MIDS-levels; Table 16).

	Label	Description
1.	# Objects digitized	Number of digitized objects: This column contains the exact number of digitized objects, regardless of the type of software that is used and regardless of whether this data is publicly available or not. A definition of the term 'digitization' is provided in chapter 5 of this manual.
2.	# Objects not digitized (documented)	Number of objects not digitized, but documented: This column contains the exact number of objects that have been documented (e.g. on a paper inventory list) but have not (yet) been digitized. The sum of the columns '# Objects not digitized (documented)' and '# Objects not digitized (not documented)' provides the amount of objects that has yet to be digitized.
3.	# Objects not digitized (not documented)	Number of objects not digitized, not documented: This column provides an estimate of the objects that have not (yet) been digitized and are not (yet) documented. The sum of the columns '# Objects not digitized (documented)' and '# Objects not digitized (not documented)' provides the amount of objects that has yet to be digitized.
4.	Object total:	Object total: This column is the sum of the three previous columns: <ul style="list-style-type: none"> - # Objects digitized - # Objects not digitized (documented) - # Objects not digitized (not documented)
5.	# Objects with images	Number of objects with images: This column specifies the number of objects for which images (such as a photograph, 3D model, ...) are available, regardless of the type or resolution of the image. It is possible that digitized objects have no image yet.
6.	# Type specimens	Number of type specimens: This column contains information on the number of type specimens in a collection. These might be holotypes, paratypes, ... in zoological and botanical collections, or type strains in bacterial collections. This field might be important to set future digitization priorities.

Table 15: Overview of the counts and/or estimates relating to the number of physical specimens/objects.

All counts in the Excel sheets 'Collection data' are **based on objects/specimens that are given a unique identifier/inventory number** (i.e. managed as an individual object). Each object/specimen with an individual unique identifier/inventory number counts for one entry in this excel sheet:

- Example 1: If an object/specimen is digitized in Specify6 and in Excel, it is counted only once as a digitized object.
- Example 2: If a specimen/object is digitized in a CMS but also has an entry on a paper inventory list, it is once as a digitized object.

However, within the DiSSCo-Flanders consortium **different policies** might exist with regard to giving objects/specimens unique identifiers. For instance, when a DNA sample is taken from a specimen, the DNA sample might be given the same identifier as the specimen or a different one, resulting in resp. one or two entries in the survey form. Likewise, a botanical garden might have a plant in its living collection, as well as seeds or a herbarium voucher specimen, ... from that same plant. Depending on the number of identifiers that are given, this will result in one, two, three, ... entries in the survey form.

When relevant, institutional policies on handing out unique identifiers and details on counting methods used when completing the survey should therefore be specified. This can be done in the column 'Contributor remarks' in the Collection data sheet and by replying to the questions (especially questions 9 and 10) in the Contributor Feedback sheet.

Table 16 provides a description of the different MIDS levels. In order **to assign a digital specimen to a specific MIDS level, all criteria of that level have to be met.**

MIDS levels are entered as absolute numbers.

Mandatory data elements: The five columns highlighted in red (Object total, MIDS-0, MIDS-1, MIDS-2 and MIDS-3) in the survey form are mandatory. These columns should be completed at least on discipline level (*e.g.* Zoology invertebrates) for all collections.

Desirable (optional) data elements: More granular collection size data can be provided by taxonomic categories, by preservation type and by region. This is optional, but recommended as it will result in a more detailed representation of the collections on the Collection Digitization Dashboard.

6.4.7 Contributor remarks

The field 'Contributor remarks' can be used in case of difficulties when completing a specific field, or to specify the type of objects/specimens entered as 'Other'.

Level	Title	Purpose	Description
MIDS-0	Minimally digitized	A bare or skeletal record making the association between an identifier of a physical specimen and its digital representation, allowing for unambiguous attachment of all other information.	Modern mass-digitization techniques are based on imaging all specimens and their labels and creating a basic DSO (Digital Specimen Object) by interpreting any identifiers (such as barcodes) among the labels. At this level the DSO only contains metadata and zero or more media files. This level includes the following Darwin Core (DwC) elements: <ul style="list-style-type: none"> • DwC:modified – UTC date/time of date/time of first creation or subsequent modification if any. • DwC:institutionCode – from <i>e.g.</i> Index Herbariorum and other catalogues (<i>e.g.</i> from GRID) • DwC:catalogNumber – automatically readable from the specimen label; must be attached to the specimen prior to imaging (PhysicalSpecimenID)
MIDS-1	Regularly digitized	A basic record of specimen information.	Includes MIDS-0 but adds basic data elements that can be entered in a bulk operation by a human operator for a number of DSOs. These elements typically are: <ul style="list-style-type: none"> • DwC:modified – UTC date/time of date/time of first creation or subsequent modification if any. • DwC:institutionCode – from <i>e.g.</i> Index Herbariorum and other catalogues (<i>e.g.</i> from GRID) • DwC:catalogNumber – automatically readable from the specimen label; must be attached to the specimen prior to imaging (PhysicalSpecimenID) • DwC:Preparations - MaterialType (<i>e.g.</i> Herbarium) • DwC:Name - A name given to the object. Equivalent to the Dublin Core term dc:title. An image and/or other multimedia may be present.
MIDS-2	Regular	Key information fields that have been agreed over time as essential for most scientific purposes.	Includes MIDS-1 and the most important data elements describing the specimen and the collecting event, and which have been transcribed and interpreted from the specimen labels. These data include: <ul style="list-style-type: none"> • DwC:modified – UTC date/time of date/time of first creation or subsequent modification if any. • DwC:institutionCode – from <i>e.g.</i> Index Herbariorum and other catalogues (<i>e.g.</i> from GRID) • DwC:catalogNumber – automatically readable from the specimen label; must be attached to the specimen prior to imaging (PhysicalSpecimenID) • DwC:Preparations – MaterialType • DwC:Name - A name given to the object. Equivalent to the Dublin Core term dc:title • DwC:Continent • DwC:Country • DwC:stateProvince • DwC:county – GeoNames • DwC:locality – GeoNames • DwC:decimalLatitude – decimalLongitude • DwC:verbatimElevation – verbatimDepth: Altitude/depth • DwC:recordedBy: collector name – referent • DwC:recordNumber • DwC:eventDate: collection date

			<ul style="list-style-type: none"> • DwC:collectionCode: collection code/name • DwC:typeStatus • DwC:higherGeography: Geographical region • Deposited/accession date – Accession/hasDate • DwC:identificationID: uniquely identifying name – scientific name
MIDS-3	Extended	Other data present or information known about the specimen, including links to third-party sources.	<p>Includes MIDS-2 but adds interpretations made using external information sources (beyond what can be determined from specimen and collection labels).</p> <p>Example of this is finding the geographic coordinates of the collecting locality through research on gazetteers or field notebooks. Also an interpretation is asserting a taxonomic concept to the specimen (DwC:taxonID) and the currently valid scientific name (MIDS-1 and MIDS-2 level scientific names are not necessarily the valid ones). Mapping text in the verbatim DwC elements from MIDS-2 into the corresponding well-structured DwC elements and updating their values to the current situation also counts as interpretation.</p>
Additional data			Includes images and additional media such as sounds, chemical extracts, DNA barcodes, 3D models, and OCR results that do not fit in the above classification. Such media can be added at any MIDS level and should be flagged up separately in metadata. Another form of data that should be considered are links between specimens and external data sources.

Table 16: Overview of the different MIDS levels (v2021/03; Source: <https://github.com/tdwg/mids/blob/working-draft/old-drafts/MIDS-definition-v0.14-29Mar2021.md>).

6.5 Stratigraphic age (Anthropology & Paleontology)

This Excel sheet is specifically devoted to **Anthropology** and **Paleontology collections**. It addresses the fact that these collections are divided by stratigraphy as well as taxonomy, and adds another level of detail for discovering bio- and geodiversity on the DiSSCo-Flanders Collections Digitization Dashboard. The categories in the survey form are based on the [International Chronostratigraphic Chart](#) (v2021/10) by the International Commission on Stratigraphy (ICS).

Table 17 provides an overview of the counts and/or estimates relating to the number of physical specimens/objects that are requested:

	Label	Description
1.	# Objects digitized	see definitions in Table 15
2.	# Objects not digitized (documented)	
3.	# Objects not digitized (not documented)	
4.	Object total	

Table 17: Overview of the counts and/or estimates relating to the number of physical specimens/objects in the Excel sheet 'Stratigraphic age'.

Table 18 provides an overview of the information on MIDS levels included in this Excel sheet:

	Label	Description
5.	MIDS-0	see definitions in Table 16
6.	MIDS-1	
7.	MIDS-2	
8.	MIDS-3	

Table 18: Overview of the different MIDS-levels in the Excel sheet 'Stratigraphic age'.

All counts in this Excel sheet are **based on objects/specimens that are given a unique identifier/inventory number** (*i.e.* managed as an individual object).

In order **to assign a digital specimen to a specific MIDS level, all criteria of that level have to be met.**

MIDS levels are entered as absolute numbers.

In case specimens span multiple time periods, data is entered in one of the 'Any era', 'Any period' or 'Any epoch' categories. For instance, counts for objects spanning the Paleocene and Eocene are entered in the category 'Paleogene < Any epoch'. If collections span multiple periods/epochs, more detailed counts and percentages according to periods/epochs can be provided in the Collection Notes Sheet. The (obsolete) category 'Tertiary' was added as many specimens in older collections are expected to have been labelled as such.

If an institute has no paleontological or anthropological specimens belonging to a specific time period, these cells are left blank.

Mandatory data elements: This excel sheet of the survey is meant for Anthropology and Paleontology collections only. The five columns highlighted in red (Object total, MIDS-0, MIDS-1, MIDS-2 and MIDS-3) are mandatory.

6.6 Contributor feedback

The Excel sheet 'Contributor feedback' contains a series of questions relating to the experience of completing this survey and provides the possibility to formulate recommendations aimed at improving the survey.

Mandatory data elements: All fields in this Excel sheet are mandatory.

6.7 Collection notes

In this Excel sheet additional information on the collections can be provided that cannot be entered elsewhere in the survey form.

7. Timing & deadlines

Deadline	Task	Cut-off entry date for specimens/objects/samples to be included in the survey
30/04/2022	Survey completed by all DiSSCo-Flanders partners (round 1)	01/03/2022
30/04/2024	Survey completed by all DiSSCo-Flanders partners (round 2)	01/03/2024

Table 19: List of tasks and corresponding deadlines as part of WP2, task 2.1.

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