

# COPO

**Alice Minotto**

[Alice.Minotto@earlham.ac.uk](mailto:Alice.Minotto@earlham.ac.uk), @rosysnake

**Felix Shaw**

[felix.shaw@earlham.ac.uk](mailto:felix.shaw@earlham.ac.uk), @shaw2thefloor

**Robert Davey**

[robert.davey@earlham.ac.uk](mailto:robert.davey@earlham.ac.uk), @froggleston



**E** Earlham  
Institute

Decoding Living Systems

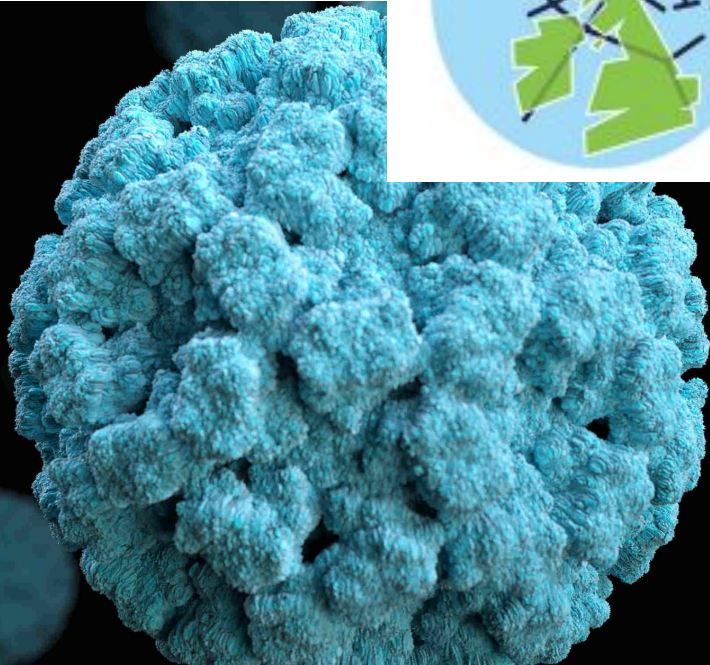




# VISUAL DOCUMENTATION FOR MANIFEST SUBMISSION



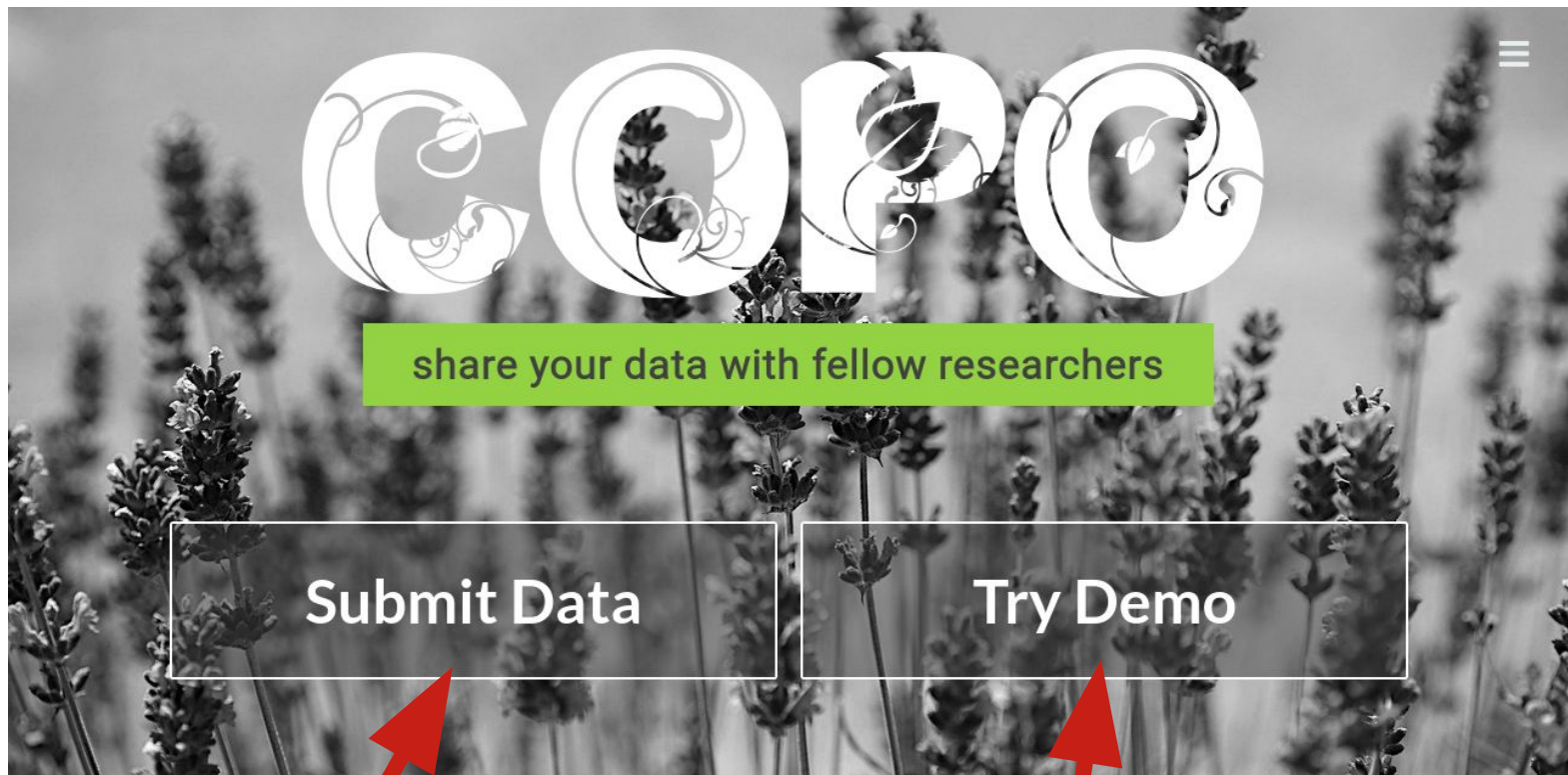
Darwin  
**TREE**  
of  
**LIFE**



## What you need before starting:

- an ORCID account ([here](#) to register)
- contact [EI.COPO@earlham.ac.uk](mailto:EI.COPO@earlham.ac.uk) to be added to the DToL group
- make sure you have the latest version of the DToL manifest ([here](#))
  - if you are submitting as part of the ASG project, please refer to the latest metadata manifest





**Once you are confident**

**To familiarize with the platform**

**IMPORTANT** - Submissions to ENA through the demo server won't persist, any accessions will be deleted after 24 hours.

We also update this server quite frequently, so it may occasionally be unreachable and you may find we deleted your past uploads.



**Earlham Institute**

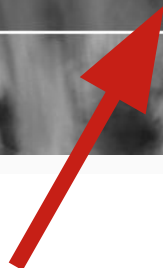
Log in with your ORCID credentials:



share your data with fellow researchers

Submit Data

Try Demo



Earlham Institute

# Create a profile:

The screenshot displays the COPO Work Profiles interface. At the top, there is a dark header with the COPO logo, a search bar labeled "Search COPO", and user controls for notifications, documents, and a user profile labeled "alice". Below the header, the "Work Profiles" section features a light blue bar with a lightbulb icon and a blue circular button with a white plus sign. A red arrow points to this plus button. Below this bar are buttons for "Select all", "Select none", "+ Add", and "Edit". A search bar labeled "Search Work Profiles" is also present. The main content area shows "Showing 1 to 1 of 1 entries" and a profile card for "dtoI (DTOL)". The profile card includes the text "Created: Mon, 26 Oct 2020 17:38" and "Description: test". At the bottom of the profile card is a horizontal bar with six colored buttons: "Samples" (yellow, 0), "Datafiles" (black, 0), "Submissions" (green, 0), "Publications" (orange, 0), "Metadata Template" (blue, 0), and "People" (red, 1). At the bottom left, there is a "Show 10 entries" dropdown menu. On the right side, a sidebar contains "Info" and "Help" tabs. The "Help" tab is active, showing a "Search Help" bar and a list of "Help Topics" with five items, each preceded by a plus icon. At the bottom of the sidebar, it says "1 to 5 of 5 topics" and includes "Previous", "1", and "Next" navigation buttons.

COPO

Search COPO

alice

Work Profiles

Select all Select none + Add Edit

Search Work Profiles

Showing 1 to 1 of 1 entries

dtoI (DTOL)

Created:  
Mon, 26 Oct 2020 17:38

Description:  
test

Samples 0 Datafiles 0 Submissions 0 Publications 0 Metadata Template 0 People 1

Show 10 entries

Info Help

Search Help

Help Topics

- + What is a COPO profile?
- + How do I create a profile?
- + How many profiles can I have in COPO?
- + What is a profile component?
- + How do I create components within a profile?

1 to 5 of 5 topics

Previous 1 Next

# Create a DTOL profile:

**Add Profile**

**Title required** ⓘ

DTOL

**Description required** ⓘ

**Profile Type** ⓘ

Darwin Tree of Life

Cancel Save

**IMPORTANT** - name the profile according to the Sample Set ID assigned to the samples you are submitting

**IMPORTANT** - If you can't select Darwin Tree of Life in the profile type drop down menu, you need to be added to the DTOL group. Please stop here and get in touch with [EI.COPO@earlham.ac.uk](mailto:EI.COPO@earlham.ac.uk)

## OR create an ASG profile:

**Add Profile**

**Title** required ⓘ

**Description** required ⓘ

**Profile Type** ⓘ

Aquatic Symbiosis Genomics (ASG)


Cancel Save

**IMPORTANT** - name the profile according to the Sample Set ID assigned to the samples you are submitting





**IMPORTANT** - If you can't select Aquatic Symbiosis Genomics in the profile type drop down menu, you need to be added to the DTOL/ASG group. Please stop here and get in touch with [EI.COPO@earlham.ac.uk](mailto:EI.COPO@earlham.ac.uk)







# This is your new DToL profile:



Search COPO

alice

Work Profiles  

Select all Select none  


Search Work Profiles


Showing 1 to 2 of 2 entries


DTOL (DTOL)


Created:  
Tue, 27 Oct 2020 15:46


Description:  
IMPORTANT: we use this information to submit a study to ENA


 Samples 0

 Datafiles 0

 Submissions 0

 Publications 0

 Metadata Template 0

 People 1

dtol (DTOL)

New profile record created! Info [Help](#)

# Upload a manifest:

The screenshot displays the COPO Work Profiles interface. At the top, there is a dark header with the COPO logo, a search bar labeled "Search COPO", and user controls including a search icon, a bell icon, a document icon, and the name "alice" with a dropdown arrow. Below the header, the "Work Profiles" section features a light blue background with a lightbulb icon and a plus icon. A notification box on the right states "New profile record created!". The main content area includes buttons for "Select all", "Select none", "+ Add", and "Edit". A search bar labeled "Search Work Profiles" is positioned above a list of entries. The first entry, "DTOL (DTOL)", is highlighted with a dark green header. Below the header, the "Created:" date is "Tue, 27 Oct 2020 15:46", and the "Description:" is "IMPORTANT: we use this information to submit a study to ENA". A red arrow points to the "Samples" button in the bottom row of the entry, which shows a count of 0. Other buttons in the row include "Datafiles" (0), "Submissions" (0), "Publications" (0), "Metadata Template" (0), and "People" (1). The second entry, "dtol (DTOL)", is partially visible at the bottom.

COPO

Search COPO

alice

Work Profiles

Info Help

New profile record created!

Select all Select none + Add Edit

Search Work Profiles

Showing 1 to 2 of 2 entries

DTOL (DTOL)

Created:  
Tue, 27 Oct 2020 15:46

Description:  
IMPORTANT: we use this information to submit a study to ENA

Samples 0 Datafiles 0 Submissions 0 Publications 0 Metadata Template 0 People 1

dtol (DTOL)

# Upload a manifest:

The screenshot displays the COPO web application interface. At the top, there is a dark header with the COPO logo on the left, a search bar labeled 'Search COPO' in the center, and user controls on the right including a bell icon, a document icon, and a user profile labeled 'alice'. Below the header, the main content area is titled 'Profile: DTOL' and 'Samples'. A row of four circular icons is shown: an orange lightbulb, a blue plus sign, a green grid, and a teal list icon. A red arrow points to the teal list icon. A tooltip above the icons reads 'Add Sample(s) from DTOL Spreadsheet'. On the right side, there is a 'Help' sidebar with a 'Search Help' bar and a list of 'Help Topics' including 'Describing samples' and 'Sample types'. A 'Quick Tour' panel on the left provides instructions on how to use the sample description wizard and the various icons.

COPO

Search COPO

alice

Profile: DTOL

Samples

Add Sample(s) from DTOL Spreadsheet

Samples - Getting started

The samples page provides a platform for describing and managing biological samples, obtained as part of a project.

The description functionality presents a wizard that guides the user through a step-by-step process of sample metadata attribution.

Use the to initiate sample description and follow the steps presented by the wizard.

**Quick Tour:** To explore the various controls available on this page, click the icon.

Search Help

Help Topics

- + Describing samples
- + Sample types

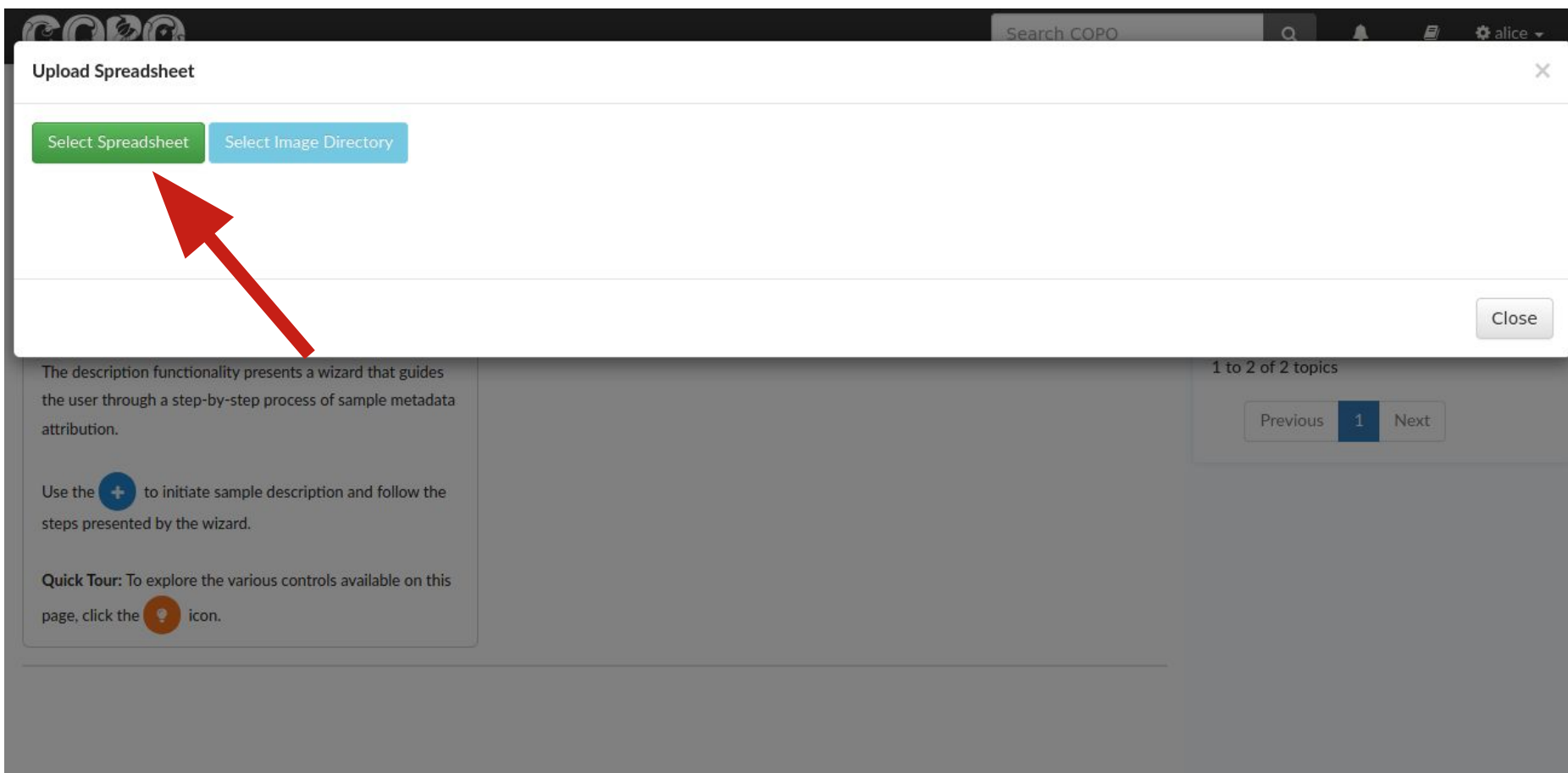
1 to 2 of 2 topics

Previous 1 Next

\*Only DToL sample managers will see the fourth light blue button next to the green one, if this is not your role don't worry about that, you won't need it



# Upload a manifest:




The screenshot shows a web application interface with a dark header bar. On the left, there are four circular icons. The header contains a search bar with the text "Search COPO", a magnifying glass icon, a bell icon, a document icon, and a user profile icon labeled "alice". A white modal dialog box titled "Upload Spreadsheet" is open, featuring two buttons: "Select Spreadsheet" (green) and "Select Image Directory" (blue). A large red arrow points to the "Select Spreadsheet" button. The dialog has a close button (X) in the top right corner and a "Close" button in the bottom right corner. The background is dimmed and shows a sidebar with text about a description wizard, a main content area, and a pagination control showing "1 to 2 of 2 topics" with "Previous", "1", and "Next" buttons.


Upload Spreadsheet

Select Spreadsheet Select Image Directory

Close

The description functionality presents a wizard that guides the user through a step-by-step process of sample metadata attribution.

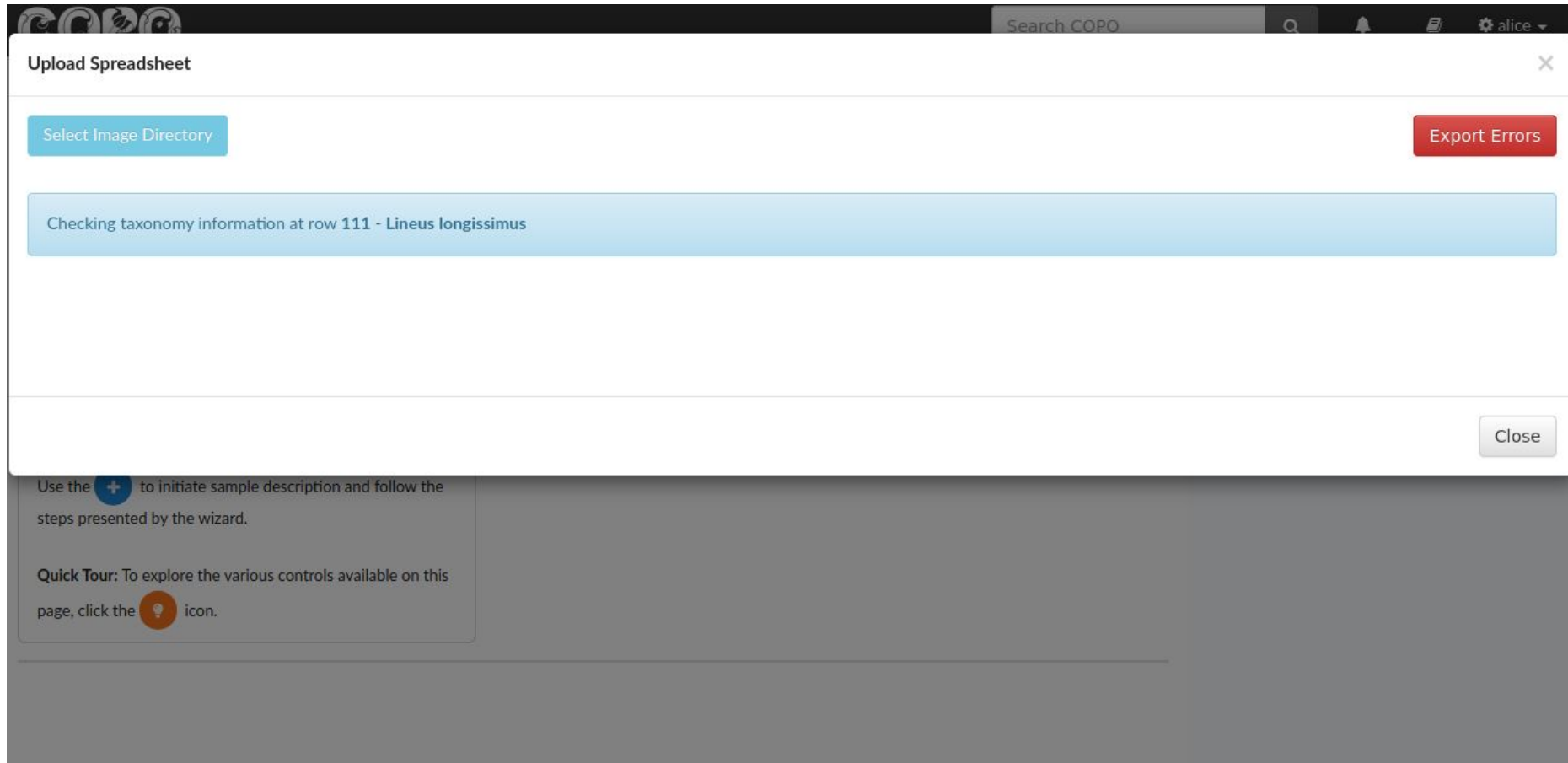
Use the  to initiate sample description and follow the steps presented by the wizard.

**Quick Tour:** To explore the various controls available on this page, click the  icon.

1 to 2 of 2 topics

Previous 1 Next

# COPPO will validate taxonomy information and manifest format:



The screenshot displays the 'Upload Spreadsheet' window of the COPPO application. The window has a title bar with the COPPO logo and a search bar labeled 'Search COPPO'. Inside the window, there is a 'Select Image Directory' button on the left and an 'Export Errors' button on the right. A blue progress bar indicates the current status: 'Checking taxonomy information at row 111 - Lineus longissimus'. A 'Close' button is located in the bottom right corner of the window. Below the window, a grey sidebar contains instructions: 'Use the + icon to initiate sample description and follow the steps presented by the wizard.' and 'Quick Tour: To explore the various controls available on this page, click the icon.' with a lightbulb icon.

Upload Spreadsheet

Select Image Directory

Export Errors

Checking taxonomy information at row 111 - Lineus longissimus

Close

Use the + icon to initiate sample description and follow the steps presented by the wizard.

Quick Tour: To explore the various controls available on this page, click the icon.

## What's happening (part 1):


- COPO is retrieving information from NCBI (National Center for Biotechnology Information) to check the taxonomy information provided is correct. We also check the TAXON\_ID is submittable to ENA.
- If some of the taxonomy fields are missing (excluding SCIENTIFIC\_NAME) COPO will make an educated guess about what these fields should be and will display warnings about what is going to be filled in.

**The taxonomy checks will be much quicker if you fill in TAXON\_ID.**





- COPO will substitute scientific name synonyms with the official scientific name. It will display a warning and also record the change in OTHER\_INFORMATION
- If any taxonomy field is incorrect COPO will display an error and reject the manifest. You can download the error list with the red “Export Errors” button on the top right.
- **If you are unhappy with any of the warning/errors DO NOT press finish. Instead contact NCBI to discuss the taxonomy**



# Manifest uploaded -taxonomy warnings:-



Search COPO

alice

Upload Spreadsheet

Select Image Directory

Export Errors

Synonym warning: *Asterina gibbosa* at row 294 is a synonym of *Asterina gibbosa* (Pennant, 1777). COPO will substitute the official scientific name.

Synonym warning: *Asterina gibbosa* at row 295 is a synonym of *Asterina gibbosa* (Pennant, 1777). COPO will substitute the official scientific name.

Synonym warning: *Asterina gibbosa* at row 296 is a synonym of *Asterina gibbosa* (Pennant, 1777). COPO will substitute the official scientific name.

Synonym warning: *Asterina gibbosa* at row 297 is a synonym of *Asterina gibbosa* (Pennant, 1777). COPO will substitute the official scientific name.

Synonym warning: *Aglais io* at row 336 is a synonym of *Inachis io*. COPO will substitute the official scientific name.

Synonym warning: *Aglais io* at row 337 is a synonym of *Inachis io*. COPO will substitute the official scientific name.

Synonym warning: *Aglais io* at row 338 is a synonym of *Inachis io*. COPO will substitute the official scientific name.

Synonym warning: *Satyrrium walbum* at row 359 is a synonym of *Satyrrium w-album*. COPO will substitute the official scientific name.

Synonym warning: *Aglais io* at row 385 is a synonym of *Inachis io*. COPO will substitute the official scientific name.

Synonym warning: *Melitaea athalia* at row 450 is a synonym of *Mellicta athalia*. COPO will substitute the official scientific name.

Synonym warning: *Colias crocea* at row 498 is a synonym of *Colias croceus*. COPO will substitute the official scientific name.

Synonym warning: *Colias crocea* at row 499 is a synonym of *Colias croceus*. COPO will substitute the official scientific name.

Synonym warning: *Colias crocea* at row 500 is a synonym of *Colias croceus*. COPO will substitute the official scientific name.

Synonym warning: *Colias crocea* at row 501 is a synonym of *Colias croceus*. COPO will substitute the official scientific name.

Synonym warning: *Colias crocea* at row 502 is a synonym of *Colias croceus*. COPO will substitute the official scientific name.

Synonym warning: *Colias crocea* at row 503 is a synonym of *Colias croceus*. COPO will substitute the official scientific name.

Synonym warning: *Colias crocea* at row 504 is a synonym of *Colias croceus*. COPO will substitute the official scientific name.

Synonym warning: *Melitaea athalia* at row 516 is a synonym of *Mellicta athalia*. COPO will substitute the official scientific name.

This is a warning:  
COPO will make  
these changes

SAN.xlsx

# Manifest uploaded -taxonomy errors-:

The screenshot shows a web browser window with the COPO interface. A modal titled 'Upload Spreadsheet' is open. Inside the modal, there is a blue button labeled 'Select Image Directory' and a red button labeled 'Export Errors'. A red error message box contains the text: '1row\_updated\_ashdiebacksyn\_wrongtaxid2.xlsx' and '1. Invalid data: couldn't retrieve TAXON\_ID 7893 at row 2'. To the right of the error box, the text reads: 'This is an error: COPO won't accept the manifest'. A 'Close' button is located at the bottom right of the modal. In the background, a 'Quick Tour' box is visible with the text: 'Quick Tour: To explore the various controls available on this page, click the icon.' and a lightbulb icon.

Upload Spreadsheet

Select Image Directory

Export Errors

1row\_updated\_ashdiebacksyn\_wrongtaxid2.xlsx

1. Invalid data: couldn't retrieve TAXON\_ID 7893 at row 2

This is an error: COPO won't accept the manifest

Close

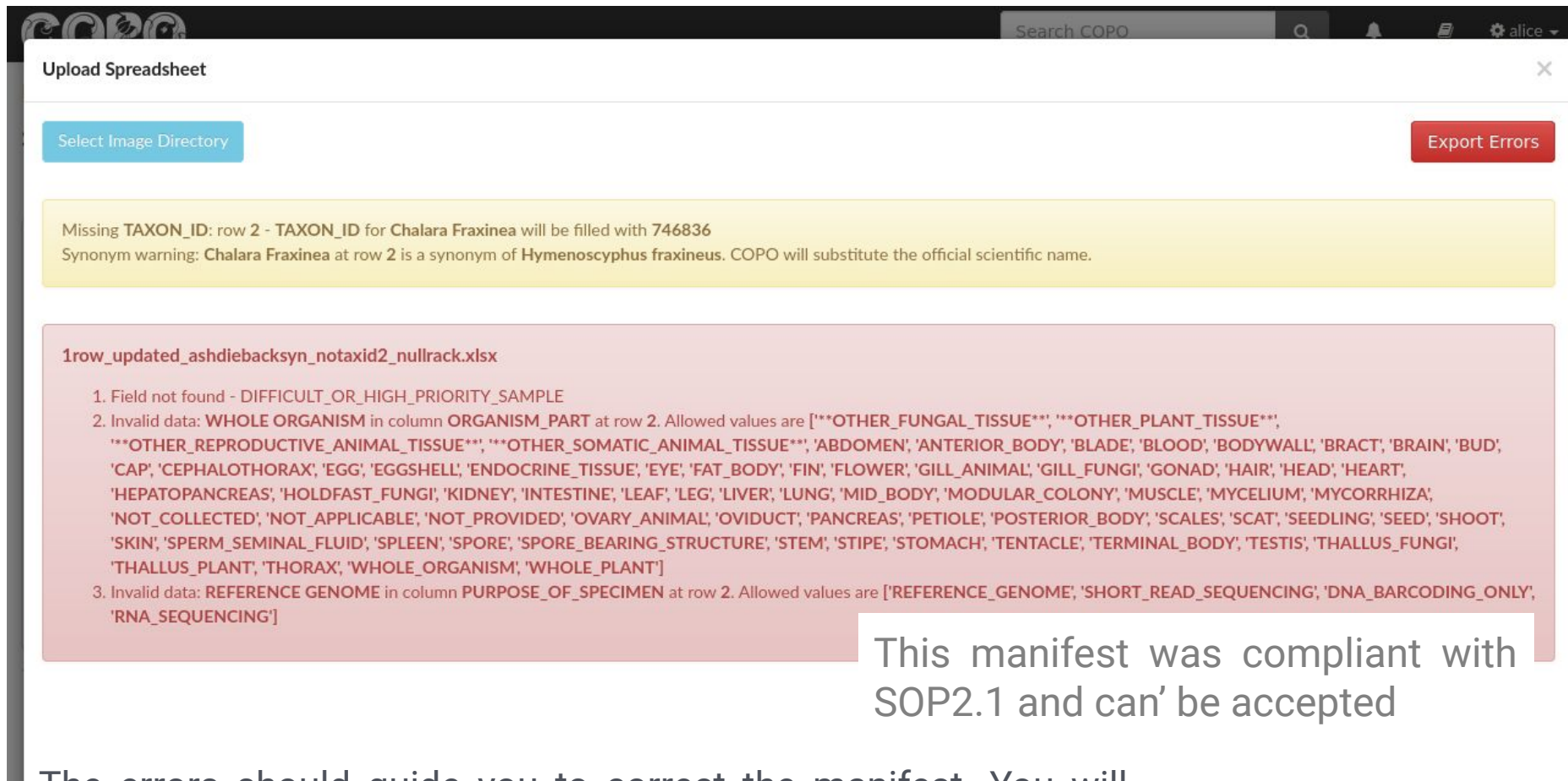
Quick Tour: To explore the various controls available on this page, click the icon.

## What's happening (part 2):

- **ONLY IF** the taxonomy validation was successful and produced no errors, will COPO check the manifest against SOP specifications. This includes checks for general format, missing data, cells that have restricted values, etc.



# Manifest uploaded -compliance errors-:



The screenshot shows a web interface for uploading a spreadsheet to COPO. At the top, there's a search bar labeled "Search COPO" and a user profile "alice". Below this is a header "Upload Spreadsheet" with a close button. On the left, there's a blue button "Select Image Directory". On the right, there's a red button "Export Errors". A yellow warning box states: "Missing TAXON\_ID: row 2 - TAXON\_ID for *Chalara Fraxinea* will be filled with 746836. Synonym warning: *Chalara Fraxinea* at row 2 is a synonym of *Hymenoscyphus fraxineus*. COPO will substitute the official scientific name." Below this, a red box titled "1row\_updated\_ashdiebacksyn\_notaxid2\_nullrack.xlsx" contains three error messages: 1. "Field not found - DIFFICULT\_OR\_HIGH\_PRIORITY\_SAMPLE"; 2. "Invalid data: WHOLE ORGANISM in column ORGANISM\_PART at row 2. Allowed values are [...]"; 3. "Invalid data: REFERENCE GENOME in column PURPOSE\_OF\_SPECIMEN at row 2. Allowed values are [...]". A white text box on the right of the red box says: "This manifest was compliant with SOP2.1 and can't be accepted".

Upload Spreadsheet

Select Image Directory

Export Errors

Missing **TAXON\_ID**: row 2 - **TAXON\_ID** for *Chalara Fraxinea* will be filled with 746836  
Synonym warning: *Chalara Fraxinea* at row 2 is a synonym of *Hymenoscyphus fraxineus*. COPO will substitute the official scientific name.

1row\_updated\_ashdiebacksyn\_notaxid2\_nullrack.xlsx

1. Field not found - DIFFICULT\_OR\_HIGH\_PRIORITY\_SAMPLE
2. Invalid data: **WHOLE ORGANISM** in column **ORGANISM\_PART** at row 2. Allowed values are ['\*\*OTHER\_FUNGAL\_TISSUE\*\*', '\*\*OTHER\_PLANT\_TISSUE\*\*', '\*\*OTHER\_REPRODUCTIVE\_ANIMAL\_TISSUE\*\*', '\*\*OTHER\_SOMATIC\_ANIMAL\_TISSUE\*\*', 'ABDOMEN', 'ANTERIOR\_BODY', 'BLADE', 'BLOOD', 'BODYWALL', 'BRACT', 'BRAIN', 'BUD', 'CAP', 'CEPHALOTHORAX', 'EGG', 'EGGSHELL', 'ENDOCRINE\_TISSUE', 'EYE', 'FAT\_BODY', 'FIN', 'FLOWER', 'GILL\_ANIMAL', 'GILL\_FUNGI', 'GONAD', 'HAIR', 'HEAD', 'HEART', 'HEPATOPANCREAS', 'HOLDFAST\_FUNGI', 'KIDNEY', 'INTESTINE', 'LEAF', 'LEG', 'LIVER', 'LUNG', 'MID\_BODY', 'MODULAR\_COLONY', 'MUSCLE', 'MYCELIUM', 'MYCORRHIZA', 'NOT\_COLLECTED', 'NOT\_APPLICABLE', 'NOT\_PROVIDED', 'OVARY\_ANIMAL', 'OVIDUCT', 'PANCREAS', 'PETIOLE', 'POSTERIOR\_BODY', 'SCALES', 'SCAT', 'SEEDLING', 'SEED', 'SHOOT', 'SKIN', 'SPERM\_SEMINAL\_FLUID', 'SPLEEN', 'SPORE', 'SPORE\_BEARING\_STRUCTURE', 'STEM', 'STIPE', 'STOMACH', 'TENTACLE', 'TERMINAL\_BODY', 'TESTIS', 'THALLUS\_FUNGI', 'THALLUS\_PLANT', 'THORAX', 'WHOLE\_ORGANISM', 'WHOLE\_PLANT']
3. Invalid data: **REFERENCE GENOME** in column **PURPOSE\_OF\_SPECIMEN** at row 2. Allowed values are ['REFERENCE\_GENOME', 'SHORT\_READ\_SEQUENCING', 'DNA\_BARCODING\_ONLY', 'RNA\_SEQUENCING']

This manifest was compliant with SOP2.1 and can't be accepted

The errors should guide you to correct the manifest. You will have to correct and re-upload the updated spreadsheet

# Manifest uploaded -correct manifest-:

Search COPO

alice

Upload Spreadsheet

Select Image Directory

Finish

Export Errors

Missing TAXON\_ID: row 2 - TAXON\_ID for Chalara Fraxinea will be filled with 746836  
Synonym warning: Chalara Fraxinea at row 2 is a synonym of Hymenoscyphus fraxineus. COPO will substitute the official scientific name.

Sample Metadata

Sample Images

Show 10 entries

Search:

SERIES	RACK_OR_PLATE_ID	TUBE_OR_WELL_ID	SPECIMEN_ID	ORDER_OR_GROUP	FAMILY	GENUS	TAXON_ID	SCIENTIFIC_NAME
1	null	FF06763795	SAN0000100	HELOTIALES	HELOTIACEAE	HYMENOSCYPHUS	746836	HYMENOSCYPHUS FRAXINEUS

check the warnings if present

# Manifest uploaded -correct manifest-:

Search COPO

alice

Upload Spreadsheet

Select Image DirectoryFinishExport Errors

Missing TAXON\_ID: row 2 - TAXON\_ID for Chalara Fraxinea will be filled with 746836  
Synonym warning: Chalara Fraxinea at row 2 is a synonym of Hymenoscyphus fraxineus. COPO will substitute the official scientific name.


Sample MetadataSample Images

Preview of the manifest

Show 10 entriesSearch:

SERIES	RACK_OR_PLATE_ID	TUBE_OR_WELL_ID	SPECIMEN_ID	ORDER_OR_GROUP	FAMILY	GENUS	TAXON_ID	SCIENTIFIC_NAME
1	null	FF06763795	SAN0000100	HELOTIALES	HELOTIACEAE	HYMENOSCYPHUS	746836	HYMENOSCYPHUS FRAXINEUS

# Upload images:



Search COPO

alice

Upload Spreadsheet

Select Image Directory

Finish

Export Errors

Missing TAXON\_ID: row 2 TAXON\_ID for Chalar Fraxinea will be filled with 746836

Synonym warning: Chalar Fraxinea at row 2 is a synonym of Hymenoscyphus fraxineus. COPO will substitute the official scientific name.

Sample Metadata

Sample Images

Show 10 entries

Search:

SERIES	RACK_OR_PLATE_ID	TUBE_OR_WELL_ID	SPECIMEN_ID	ORDER_OR_GROUP	FAMILY	GENUS	TAXON_ID	SCIENTIFIC_NAME
1	null	FF06763795	SAN0000100	HELOTIALES	HELOTIACEAE	HYMENOSCYPHUS	746836	HYMENOSCYPHUS FRAXINEUS

File names of any associated images must be the same as "SPECIMEN\_ID" with the extension ".jpg" or ".png"



# Upload images:

Search COPO

alice

Upload Spreadsheet

Select Image Directory

Finish

Export Errors

Missing TAXON\_ID: row 2 - TAXON\_ID for *Chalara Fraxinea* will be filled with 746836


Synonym warning: *Chalara Fraxinea* at row 2 is a synonym of *Hymenoscyphus fraxineus*. COPO will substitute the official scientific name.

Sample Metadata

Sample Images

Show 10 entries

Search:

Specimen ID	Image File	Image
SAN0000100	SAN0000100.png	


Showing 1 to 1 of 1 entries

Previous

1

Next

# Create the samples in COPO by clicking “Finish”:



Search COPO

alice

Upload Spreadsheet

Select Image Directory

Finish

Export Errors


Missing TAXON\_ID: row 2 - TAXON\_ID for *Chalara Fraxinea* will be filled with 746836  
Synonym warning: *Chalara Fraxinea* at row 2 is a synonym of *Hymenoscyphus fraxineus*. COPO will substitute the official scientific name.

Sample Metadata

Sample Images

Show 10 entries

Search:

Specimen ID	Image File	Image
SAN0000100	SAN0000100.png	

Showing 1 to 1 of 1 entries

Previous

1

Next

# Uploaded samples:



alice ▾

Profile: DTOL

Samples



Info

Help

Help Topics



+ Describing samples

+ Sample types

1 to 2 of 2 topics

Previous

1

Next

Select all

Select filtered

Clear selection

Export CSV

Source list

Describe

Edit

Showing 1 to 1 of 1 records Click  beside a record to view extra details

	Name	Collected By	Date of Collection	Sex	Lifestage	Identified By	Identifier Affiliation	Common Name	Speci Id
		JULIE AHRINGER   RICHARD DURBIN	2020-08-22	MALE	SPORE_BEARING_STRUCTURE	MARK BLAXTER	SANGER INSTITUTE	lugworm	SANC




Earlham Institute

## DToL Sample Managers:





- At this point the DToL and ASG sample managers will be emailed that a new manifest has been uploaded. They will be able to accept or reject each sample after inspection.

After samples are approved by a sample manager they will be submitted to ENA (European Nucleotide Archive). Accessions can be inspected by scrolling right in the previous view.

# Accepted samples:







Search COPPO

alice

Profile: DTOL

Samples



Select all

Select filtered

Clear selection


Export CSV

Source list

Describe

Edit

Search Samples

Showing 1 to 1 of 1 records Click  beside a record to view extra details

Voucher ID	Manifest ID	Biosample Accession	SRA Accession	Submission Accession	Status	Public Name	Date Modified
NOT APPLICABLE	1943d3d2-7976-4563-859e-6877fb1d2560	SAMEA7491029	ERS5247681	ERA3031374	accepted	gyHymFrax1	[object Object]

InfoHelp

Search Help

Help Topics

+ Describing samples

+ Sample types

1 to 2 of 2 topics

Previous

1

Next





If you encounter any error or unexpected behaviour please email [EI.COPO@earlham.ac.uk](mailto:EI.COPO@earlham.ac.uk) or open a github issue in the repository at the bottom of the page.

If you have a feature request for future releases please open an issue in the github repository.

We are currently working on a pipeline to update uploaded samples. For the time being, if you need to update a sample please email us at [EI.COPO@earlham.ac.uk](mailto:EI.COPO@earlham.ac.uk) specifying the biosample accession, the field to update and the new value. (If you need to update the taxonomy please send biosample accession and new scientific name, we will update all the taxonomy fields accordingly.)





CyVerseUK is supported by the BBSRC through strategic funding and the capital grant BB/M018431/1.

CyVerse is supported by the National Science Foundation under Award Numbers DBI-0735191 and DBI-1265383. URL: [www.cyverse.org](http://www.cyverse.org)



---

Decoding Living Systems