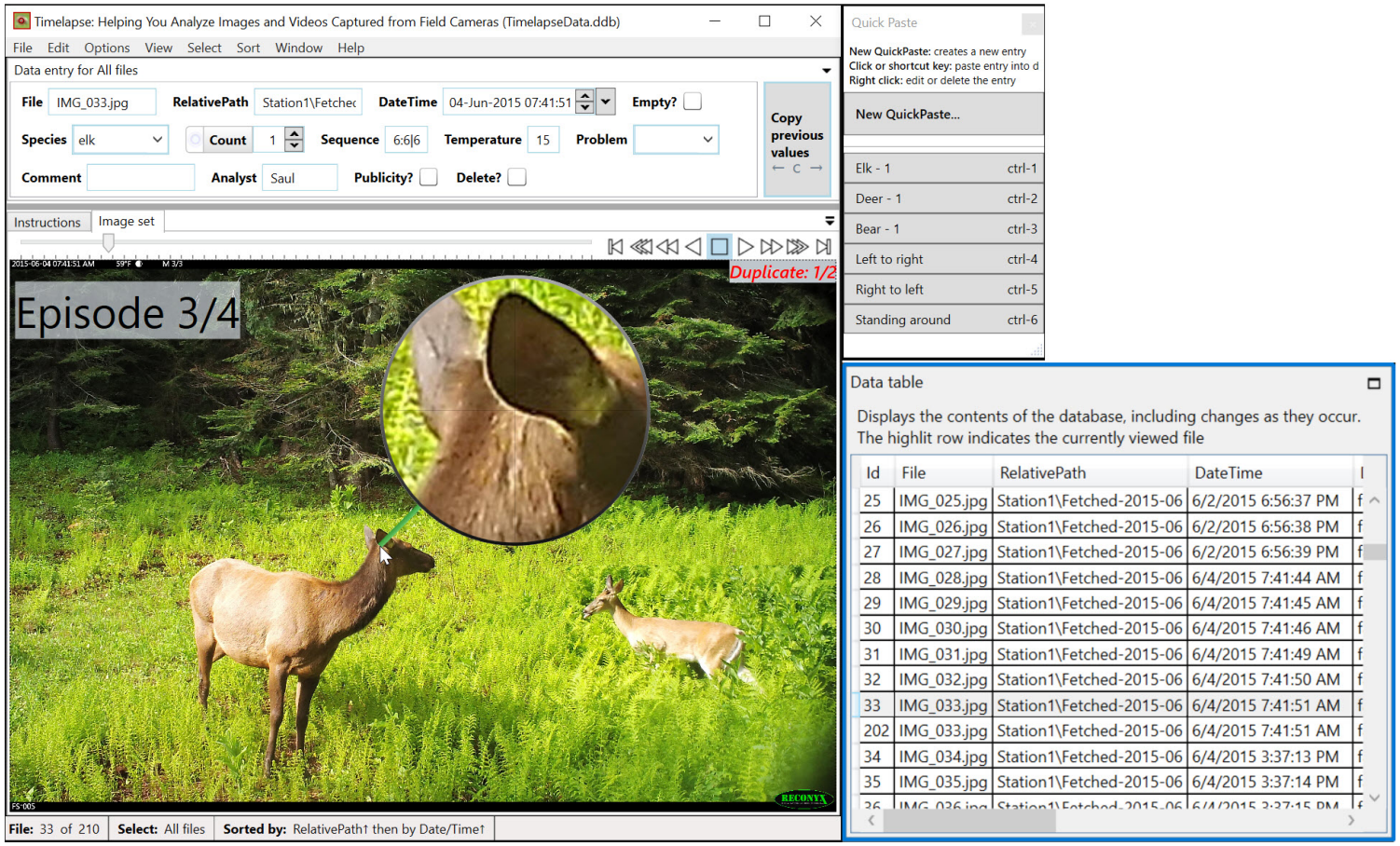
Timelapse Reference Guide

A reference guide to Timelapse and its features



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Abstract

Camera traps (aka trail / game / remote cameras) are field-deployable cameras placed at strategic locations, where they automatically take images (and even videos) at either regular intervals (e.g., every 5 minutes, every hour), or when motion is detected (e.g., an animal or person moving through the scene). Scientists use camera traps for many purposes: to track and count entities (such as people and wildlife) and to track conditions that occur in a particular place over time (such as weather and visibility). A technician usually retrieves the camera's card (e.g., after several months), and organizes the captured image and video files into one or more computer folders as an image set (the set of images and videos captured by that camera). An analyst then visually examines each image and video for features of interest to their project, and encodes data describing those features.

Timelapse simplifies this last visual examination and encoding step. In brief, the project manager uses the ***Timelapse Template Editor*** to create a custom template that defines the project-specific data that he or she wants an analyst to encode (see the *Timelapse Template Guide*). An analyst then uses Timelapse to open that template and one or more folders containing images and/or videos (the image set). Timelapse automatically goes through all image and video files and extracts information from them (e.g., file name, date and time taken). The Timelapse interface then displays a series of fill-in data fields corresponding to the desired tag data as specified in the template, along with the image or video. The analyst then goes through each image and video, where he or she encodes data by typing into fields, by selecting from menus, or (for counting) simply clicking on entities seen in the image.

Because much data entry is repetitive, Timelapse includes various means to copy data over a group of images and videos. Because the analyst may have to find and identify small details in an image or video, Timelapse includes a magnifying glass, pan and zoom capabilities (where switching images will keep the same pan/zoom levels), and image enhancement methods. The analyst can also examine and encode multiple images at the same time via an overview. Because the project manager may use other software to analyzed the data (Excel, databases, statistical packages, R), data is stored in a standard SQLite database that can be exported as a *CSV* file readable by these other software systems. Many other features are also described in this reference guide.

Finally, Timelapse can incorporate image recognition data produced by a 3rd party, currently Microsoft's ***Megadetector***, where the analyst can use that data for a more efficient workflow (see *Timelapse Image Recognition Guide*). A recognized entity is currently classified as being empty, or containing people or wildlife with a bounding box drawn around them. The analyst can select and inspect image subsets by its recognized type and confidence level.

Don’t Panic!

The length of this manual may give the impression that Timelapse is difficult to use. It isn’t. The tutorial is long only because it provides step by step details (and lots of illustrations). It also covers various functions that may not be relevant to all readers.

[1]What you see when you run Timelapse software may not exactly match the screen images in this guide, due to updates made in the software after these screen images were taken. These differences should not affect your general understanding.

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Credits. Camera trap images used in this manual are used with permission or obtained from public repositories. *Sources*: Parks Canada; Lila Science- Idaho Fish and Game data set; Lana M. Ciarniello, Aklak Wildlife Consulting.

Part 1

Getting Ready

There are a handful of things that you need to know or do before using Timelapse, as explained in the following sections. You should, of course, download the Timelapse software, and be aware of what computers it will run on. You also need to understand the structure of the folders and files that Timelapse creates, uses and expects.

You may want to download the practice image set (camera trap images and an example template file, all in a folder) from the Timelapse web site, so that you can try things out as you read this guide.

Why bother reading this?

Many people are used to downloading software and using it without reading the manual, where they learn by doing and experimenting. You may be able to get away with this strategy in Timelapse, but perhaps at the cost of missing out on the nuances of many features that can help you create an effective and efficient workflow, or resolve problems that you may encounter.

Understanding these features and their uses is important. Timelapse grew organically over many years of use by a broad audience. As people used it, they often requested features that would improve their efficiency when tagging images, or to resolve particular issues they encountered. Those same features can help you.

If you don't read (or at least scan) this manual, you may miss out. While this reference manual is long (not really, as there are many images), the time spent reading it or trying out its features on the practice image set will be amply regained later through a more efficient workflow.

Introduction

Camera trap images and videos are a valuable source of data, for they visually capture events occurring in the camera's field of view over time. Once images are collected, they must be analyzed by an ***analyst***. That analyst is the person whose task it is to visually inspect each image and video for features of interest to their project, where they encode that information as ***tags,*** i.e., data fields containing values describing those features. That data can then be analyzed further, for example, by statistics.

The *Timelapse Quickstart Guide* introduced two tools for managing and tagging camera trap files. In brief, whoever is managing the project — the ***project manager*** — uses the ***Timelapse Template Editor*** program to create a custom template that defines the project-specific data that he or she wants an analyst to encode. The *Timelapse Template Guide* provides further details of how to use the editor. An analyst then uses the ***Timelapse*** program to open that template and one or more folders containing images and/or videos (collectively called the ***image set***). The analyst then uses the various Timelapse facilities to visually inspect and tag all images[1].

Timelapse saves data in a *.ddb* file, by default named *TimelapseData.ddb*. This file is created in the root folder of your image set. Internally, the *.ddb* file is actually an SQLite database, where your data is saved in a database table. However, you don't have to know anything about SQL or databases, as Timelapse takes care of all the grotty technical details.

This guide delves into details about the Timelapse that go beyond the *Timelapse QuickStart Guide* (although you should read that first, as it will get you started on the most basic Timelapse workflow). These include:

- various methods that analysts can use to visualize and inspect images and videos, such as zooming, panning and magnifying image details, an overview showing multiple files at once, image enhancements for poor quality images, image differencing to make changes between images pop out...;
- the ability to select a subset of images based on a query;
- the capabilities of the fill-in data fields that correspond to the desired tag data as specified in the custom template;
- how Timelapse can automatically extract and populate fields with certain image and video file information, such as the file name and location, date and time taken, file metadata, whether the image is a dark nighttime shot...;
- methods for rapid data entry;
- many shortcuts for managing repetitive data entry, including: the ability to backfill or copy data values across fields, a ***Copy previous values*** button that copies data from the previously seen file to the current one, a ***QuickPaste*** facility for quickly applying common tag patterns, multiple selection in the ***Overview*** where data fields for the selected files are set in a single action...;
- identifying and managing ***episodes***, i.e., sequences of images taken within a short time interval that tend to capture a single event;
- methods to correct common problems, such as erroneous dates and times;
- exporting and importing data via *CSV* files (a common data standard used by many software systems, including spreadsheets such as ***Excel*** and statistical packages such as ***R***;)
- the ability to incorporate image recognition data produced by a 3rd party (currently Microsoft's ***Megadetector***), where the analyst can use that data to improve workflow efficiency. Recognized entities are classified, and a bounding box is drawn around that entity. The analyst can select and inspect image subsets by its recognized type and confidence level. Full details are provided separately in the *Timelapse Image Recognition Guide*;
- automatic backup facilities in case things go wrong (rare!).

This guide will detail Timelapse's primary concepts and functions, with examples. When appropriate, the guide will also present workflow tips on how to make the best use of these features.

What you need to use Timelapse

Your computer

Hardware. Timelapse does not require any specialized computer hardware, as long as it can run Microsoft Windows. However, it will perform best on a fast modern computer with a reasonable amount of memory. Because you may be reviewing many images and videos (hundreds, thousands, and even millions), it's best to have them stored on a (fast) local hard drive rather than a slow network drive.

Microsoft Windows. Timelapse runs within most versions of Microsoft Windows, even quite old ones. It can also run on an Apple computer or Linux running a Windows emulator (e.g.,Parallels, VMWare), or on a Windows-based Virtual Machine.

Mouse with a scroll wheel. Some interactions (such as zooming) are operated by the mouse scroll wheel.

Good quality large screen. In our experience, the larger your screen and the better its resolution, the easier it will be for you to examine your files, especially if you are looking for small details in the images or videos.

Other software. Timelapse requires the Windows .Net Framework 4.8, which should be included in most up-to-date versions of Windows. If TImelapse crashes on startup (rare), your system may be missing that framework version. In those cases, the Timelapse download page gives how-to instructions for installing the 4.8 framework.

Software License. Timelapse is generally licensed under the Creative Commons Attribution-Non-commercial-ShareAlike 4.0 International license. A web page provides license details specific to Timelapse are available here.

Installing Timelapse

See details in the Timelapse QuickStart Guide and/or the Timelapse download page.

In brief, Timelapse is downloaded as a single zip file. Most Window-based systems include a program that will uncompress a zip file when you select it, where you can extract the files and folders contained within it.

When you uncompress that file, you will see a folder containing the Timelapse software and some other software it depends on. To make it easier to access the software, we recommend creating desktop shortcuts to the two programs you will find there:

- Timelapse2.exe
- Timelapse2TemplateEditor.exe

Installing the practice image set

See details in the *Timelapse QuickStart Guide* and the Timelapse User Guides and Image Sets web page, which explains how to download the *PracticeImageSet.zip* file, and what is included.

In brief, the practice image set is a folder containing a sample template and various sub-folders that collect camera trap image and video files. Use the practice image set to follow the steps described in this guide, as this guide uses the same image set to illustrate various Timelapse concepts.

License terms for images and videos in the PracticeImageSet folders. The practice image and video files were made available by other agencies. Their use beyond Timelapse-specific educational purposes must adhere to the license terms described in the file *Description.LicenseTerms.Credits.pdf*, included in the *PracticeImageSet* folder.

Preparing your files

Before starting Timelapse, you need a folder containing:

- The images and video files, possibly located in sub-folders.
- A valid template *.tdb* file that specifies your tags of interest as data fields

Start Timelapse by selecting the template in that folder.

Updating Timelapse

When started, Timelapse checks if an update is available. If so, it tells you and directs you to the Timelapse download page. To update, simply download the new version, delete the old Timelapse software folder and shortcuts, and install the new version.

Selecting the ***Help | About*** menu in either Timelapse or the TimelapseTemplateEditor will also tell you if you are running the latest version. If not, it will tell you where to get it.

Part 2

Folders and files

Timelapse requires a basic folder/file organization. For it to run, it needs a folder (called the root folder) that contains a template and your images (possibly organized as sub-folders). Timelapse then creates a few other files and folders within that root folder as it is being used.

There are many nuances to organizing your folders and files, where it can affect your efficiency. This section discusses these, including various timelapse features that can help manager your folders and files.

A subsequent section will continue on this them, where it describes a somewhat more advanced way of managing large projects by merging data into a master database.

Basic folder and file structure

Timelapse creates a few different files and folders. While there aren't that many, its worth understanding what they are and the Timelapse terminology that references them.

Root folders. Timelapse operates within the constraints of a single root folder that contains everything you wish to analyze as a group. Think of a root folder as a self-contained folder. It has your images, the various files needed by Timelapse (i.e., the template), and the various files and folders created by Timelapse as you use it. For example, when you download the practice image set, the *PracticeImageSet* folder is the root folder.

The big win of root folders. You can move the root folder anywhere you want, and Timelapse will still run properly. This includes moving it to: a different location on you computer; another computer or laptop; an external drive or thumb drive; and even a network file server. For example, an analyst working in the field can create a root folder, copy the camera trap images retrieved from a camera card into that folder, copy a template into that folder (more on that shortly), and analyse the images within them. When returning to the office, the analyst can move that folder onto their main workstation or network drive and continue their work. They can also hand off the folder to someone else to work on.

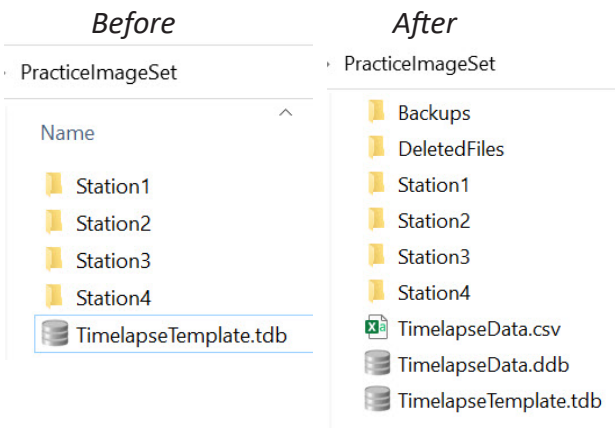
You can also have multiple root folders, each which is self-contained and each which can be independently used to analyze the image and video files contained within it. This means that you can parcel out the work to different people, each responsible for analyzing a subset of images.

This all works because Timelapse stores the location of your images and video files relative to the root folder, rather than its absolute location on your file system. Other files created by Timelapse that it will need are also located in that root folder. The key point is that, as long as the contents of your root folder are unchanged, its location should not matter.

Contents of the root folder. Before starting Timelapse, your root folder should contain the following.

- The images and video files that will be inspected and tagged, possibly located in sub-folders. In the practice image set, they are divided into various sub-folders within the *Station1- Station4* sub-folders.
- The template *.tdb* file that specifies your tags of interest as data fields, which is created using the Timelapse Template Editor. In the PracticeImageSet, the template is named *TimelapseTemplate.tdb*

As you use Timelapse, new files and folders will be created.



- the database *.ddb* file created by Timelapse and used to store your tag data;
- comma separated values *.csv* files containing data exported by Timelapse.
- a *Backups* folder that contains backups of your database file; and
- a *DeletedFiles* folder that contains backups of any images or videos deleted through Timelapse, if any.

Image set are all the image (*.jpg*) and / or video (*.avi* , *.mp4* or *.asf*) files you will be tagging. They can be located in one or more subfolders within the root folder, or directly in the root folder. New images can be added to Timelapse at any time simply by copying them into the root folder or its sub-folders and adding them through a Timelapse menu option. The *PracticeImageSet* defines the image set as it contains the files in the *Station1 - Station4* subfolders.

Timelapse Template (.tdb) file is a database file located in your root folder. The template specifies your project-specific tags of interest as data fields. The template is normally created by a project manager (see the *Timelapse QuickStart Guide* and the *Timelapse Template guide* for details). That file is then copied into the top-level root folder. Timelapse uses the template to construct its user interface containing the fill-in data fields, as well as how your data is named and saved. By definition, the folder containing the template is the root folder.

The default template file name is *TimelapseTemplate.tdb*. However,you can rename it as long as you keep the *.tdb* suffix.

Timelapse Data (.ddb) file is a database file created and updated by Timelapse as you load and analyze your image set. This file stores all the data that you entered, as well as other information required by Timelapse.

The default file name is *TimelapseDate.ddb*. However, you can rename it as long as you keep the *.ddb* suffix.

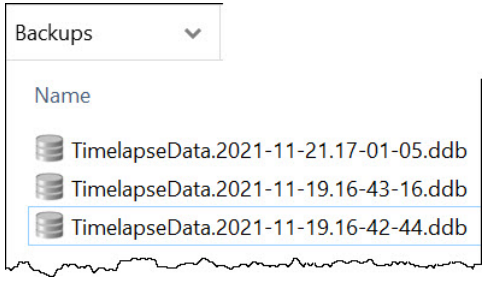
Comma separated value (.csv) files obey a simple standardized format so that they can be opened, imported and/or exported by various software. This includes most spreadsheet packages (e.g., ***Excel***), database systems, and statistical analysis tools (e.g., ***R***). The first line in a *.csv* file contains comma-separated column headers describing the data, while subsequent lines contain comma-separated data.

Using Timelapse, you can export your data into a *.csv* file (you can exclude particular data fields by clearing its ***Export*** checkbox in the template).It normally has the same name as your data file, except it has a *.csv* suffix (e.g., *TimelapseData.csv*).

You can also create or edit a *.csv* file (albeit with restrictions) and import it back into Timelapse. This will update the data ind the *.ddb* file.

The default *.csv* file name is *TimelapseData.csv*. However,you can rename it as long as you keep the *.csv* suffix.

Backups is a folder created by the Timelapse software in your root folder. As you use Timelapse, it periodically creates a time-stamped backup of your *.ddb* file within the *Backups* folder, and any existing *.csv* file whenever you export a new one. In case of major problems, you can revert to using your backups by copying it back into your root folder.



For example, *Timelaps eData.2021-11-21.17-01-05.ddb* would have been backed up on November 11, 2021 at 17:01:05. Similarly, Timelapse would back up any existing *.csv* file whenever you export a new one. To conserve space, Timelapse deletes older backups as new ones are created (around 8 backups of each file type are maintained).

DeletedFiles is a folder that may be created by Timelapse in your root folder. If you ask Timelapse to delete any of your images or videos, Timelapse will actually just copy those files by moving them into the *DeletedFiles* folder just in case. The actual deletion versus backup behaviour is configurable through the Timelapse ***Options | Preferences*** dialog.

[1]For brevity, images will cover both pictures and videos.

Best practices for organizing your files

Timelapse only requires that your template and the database it creates are located in the top-level of the root folder. Images can be located anywhere, as long as they are somewhere in the root folder or its sub-folders.

What follows is just a suggestion of how you can organize your root folder. It is optional, as Timelapse does not require it. The description is based on best practices that some other heavy users of Timelapse have found beneficial.

The file and folder organization is up to you. Depending on your needs and other factors, it can vary greatly between agencies. For example, some agencies don't use sub-folders. Instead, they rename files so that the name itself contain some of the information suggested below. The main point is that you should think about how you want to organize your files before you do a massive amount of work.

Use of subfolders

Large projects contain millions of images and videos. These need to be carefully organized. For example, projects often use multiple cameras, each located at a different ***station***: an area under observation. Each station can contain several camera ***deployments***, each a unique placement of the camera in that area. For example, a station may be a field with several cameras deployed to capture what is going on from different vantage points. Image and video sequences representing a particular time period are usually retrieved from each deployed camera's SD card over time (***retrievals***).

Depending upon your situation, a logical way to organize your folders and files mimics where your cameras are located and when images are retrieve. Sub-folders are created and named in a manner that reflects the names of your station/deployment/retrievals. The image and video files would be located in the retrievals sub-folder. For example:

- ProjectName
  - Station Name 1
    - Deployment Name 1
      - Retrieval date 1
        --- *image and video files for retrieval 1 located here*
      - Retrieval date 2 ...
        --- *image and video files for retrieval 2 located here*
    - Deployment Name 2 ...
  - Station Name2 ...

The *PracticeImageSet* folder structure assumes only a single deployment for each station, so a simpler *Station/Retrieval* subfolder structure was used.

PracticeImageSet
- Station1
  - Fetched-2015-06
    --- *image files retrieved at Station 1 on June, 2015*
  - Fetched-2015-09
    --- *image files retrieved at Station 1 on September, 2015*
- Station2
  - Fetched-2016-04
    --- *image files retrieved at Station 2 on April, 2016*
- Station3
  - Fetched-2010-09
    --- *image files retrieved at Station 3 on September, 2010*
- Station4
  - Fetched-2016-04
    --- *image and video files retrieved at Station 4 on September, 2016*

This or a similar organization has several advantages.

- Adding new stations, deployments and retrievals is simple, as it is just a matter of creating sub-folders to reflect their location and retrievals.
- Whenever camera cards for a particular camera deployment are retrieved, a new folder under that deployment is created and the files on those cards are copied into it. Timelapse can add those new files via a simple menu selection.

Other significant advantages relate to how Timelapse works.

- Timelapse stores the location of images as a ***Relative Path*** from the root folder, rather than an absolute path. As an example, Timelapse would store a particular *PracticeImageSet* file location in its database as (say)
  RelativePath=*Station1/Fetched-2015-06,* ***File*** = *IMG_001.jpg.*
  Since the Timelapse database is located in the root folder, Timelapse will be able to locate its loaded image files even if the root folder and its contents are moved around.
- As previously mentioned, any folder can be structured as a self-contained image set simply by copying a template into it. An analyst can then work on that folder (which would then contain the Timelapse database within it) without affecting other folders. If that folder is kept on a file server or network server, the analyst can copy it to their local machine, do the analysis, and then simply copy the *.ddb* file back to the original location. However, this only works if that analyst is the only one working

on that folder during that time, as there is a danger of multiple analysts over-writing each other's work.

To summarize, other folder/file organizations are possible and have been used. Some keep all image and video files in the root folder, but alter the file names to indicate the station and deployment information. Timelapse itself does not require that any particular naming or folder scheme be followed, as long as the template and database remains at the top level of the root folder, and the image and video files are somewhere within that root folder.

Workflow tip. Think deeply about your folder and file organization. Keep records that completely describe your project, each station, and each deployment. Things quickly become chaotic when hundreds of thousands to millions of images are captured from multiple cameras from various locations over time.

Other camera trap researchers are currently developing discipline-specific standards for these records, such as the open standard for wildlife monitoring.

Note. Somewhat surprisingly, Windows imposes a length limit on a file's path of 260 characters (a path includes the complete folder sequence and file name, such as *C:\User\...Camera1\TimelapseTemplate.tdb*). Problems can occur when your file paths, including to your images, are near or above that length limit.

While Timelapse will warn you when this happens, you should try to avoid this issue by keeping your paths well below that limit. This is most easily done by:
- using shorter folder and file names,
- making shallower folder hierarchies, and/or
- moving the Timelapse folder up the hierarchy .

Naming your files

TImelapse doesn't require you to follow a naming scheme for your files. By default, Timelapse sorts and displays your files by the date and time the image or video was taken, although other sort options are available. Even so, good file naming can help avoid confusion.

Most cameras name images by combining some common text with a sequence number that reflects the order that images were taken. For example:

- IMG_0001.jpg, IMG_0002.jpg, …
- IMG_1.jpg, IMG_2.jpg, …
- image (00912).jpg, image (00913).jpg, …

If your file has a sequence number, you may expect the alphabetic ordering to be the same as the sequence order. But this is not the case when sequence numbering do not including leading 0's. For example, the sequence

image1.jpg, image2.jpg, image3.jpg, … image9.jpg, image10.jpg, image11.jpg

is alphabetically ordered as:

image1.jpg, image10.jpg, image11.jpg.image2.jpg, image3.jpg… image9.jpg

Leading 0's fix this problem:

image001.jpg, image002.jpg, image003.jpg, … image010.jpg, image11.jpg.

While not strictly necessary, you will find it easier to find files in Windows' File Explorer or other software when the sequence numbers and alphabetic order are the same.

Note. Various off-the-shelf photo software include facilities to rename your photos. The Timelapse Utility Program web page includes a link to *Renamer*: 3rd party software that provides many file renaming options.

Managing millions of images

While Timelapse will work over millions of images, several limitations can occur when massive numbers of images are contained in a single Timelapse database.

- Certain Timelapse operations slow down when its database contain a massive number of records. This is because every image has at least one record – sometimes more – representing data describing that image.
- It limits how multiple people can analyze files at the same time. Normally, only one person should access the Timelapse database at a time to analyze the files, as otherwise database conflicts may occur.

In our experience, you can run Timelapse effectively on the project's root folder if you expect your image set to contain up to a million images or so, although the actual amount may depend on your computer's capabilities. However, If you do expect massive numbers of images, we recommend running Timelapse on a smaller sub-folders, such as at the Station level because:

- most timelapse operations are fast when done on tens or a few hundred thousand files;
- different people can analyze files concurrently, as long as they work on different root folders.

For example, if you want to run Timelapse at the Station level, you would copy your template into each sub-folder representing a station, and run Timelapse from there. This will generate a Timelapse .ddb database file in each of those sub-folders.

For very large projects, you may want to consider using a *master database* approach, where data is collected from the multiple child databases tpresent in sub-folders. This will be discussed in Part 3: Merging databases for large projects.

Note. The downside of running Timelapse within different sub-folders is that Timelapse will produce a different database in each of them. However, you can merge that data from ***child databases*** present in subfolders into a a single ***master database*** in the root folder. This is explained in detail in *Part 3: Merging databases for large projects*. Alternately, you can export and combine *CSV* files with other software such as Excel.

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Missing folders and files

In the following discussion, knowing some Timelapse definitions may help.

- ***Absolute path*** is the location of a file specified as a complete path to that file from the start of the file system. For example, *C:\Users\Documents\PracticeImageSet\Station1\Fetched-2015-06\Image001.jpg*
- ***File name*** is the case-sensitive name of the file, including its extension. In the above, it is *Image001.jpg*.
- ***Folder*** or ***Root folder*** is the name of the root folder containing the *.tdb* template, image and video files (possibly located in subfolders), and other Timelapse files (such as the *.ddb* file, if its has been created). In the above example, the template is in *PracticeImageSet*, which makes it the root folder.
- ***Relative path*** is the path after the root folder to your image. In the above example, the relative path to *Image001.jpg* is *Station1\Fetched-2015-06.* The file name and root folder name are not included

When images and videos are loaded for the first time, Timelapse stores the file's location by its file name and relative path in ***File*** and ***RelativePath*** data fields. The name of the root folder, while recorded in the ***Folder*** data field, is not used for determining a file's location. As previously described, the advantage is that the entire root folder containing your files, data and template can be moved to a new location. Timelapse will still be able to find the files as long as its relative paths remain unchanged.

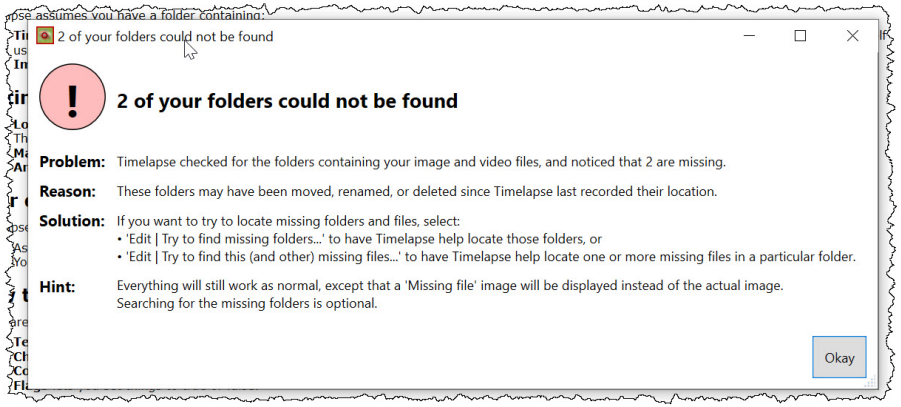
However, people sometimes change file names, folder names, and folder structures for various reasons. If changes occur from the root folder and above, Timelapse will still be able to find your files. But changes occur below the root folder (i.e., to the sub-folders and files contained by the root folder, Timelapse won't be able to find the files. The good news is that everything will mostly work. Any previously recorded data will still be there, and the analyst will still be able to work with it. However, as Timelapse cannot find the actual video or image file, it will display a placeholder image instead of the real image.

If folders and file are missing, you can use several Timelapse facilities to help you locate them, as described below.

Note. The description below is likely harder to read than to just do. If you have any missing files or folders, just try out the various options. However, verify that the possible new locations are correct before accepting them.

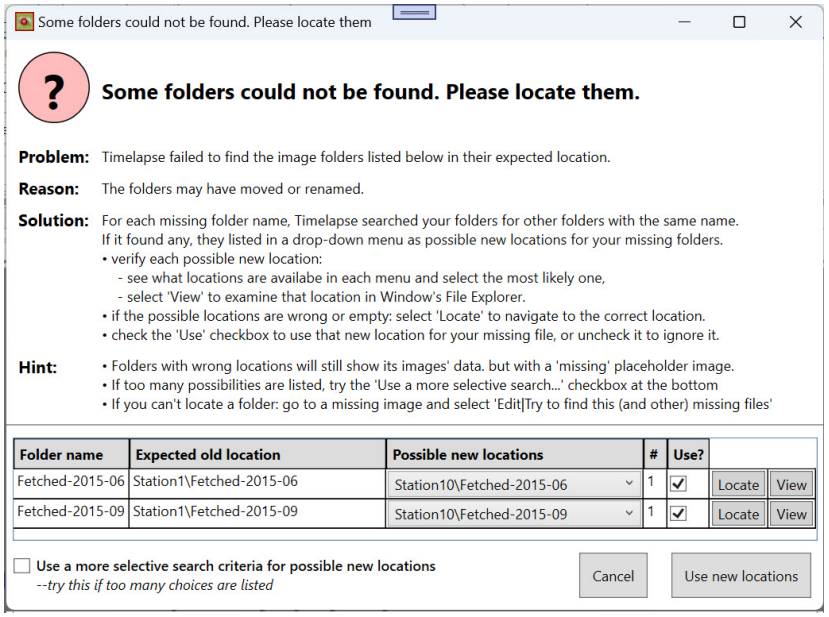
The missing folders dialog

When Timelapse loads files that have been seen before, it checks the relative paths to ensure that all folders are actually there. If any are missing, it raises a warning dialog. For example, if the *Station1* folder in the practice image set was renamed to *Station10*, Timelapse would raise the following dialog. As the original ***Station1*** folder contained two sub-folders, 2 folders are reported missing.



Missing folders can be caused by folders being moved, renamed, or deleted. Timelapse may be able to find these missing folders with a bit of help from you using the ***Edit | Try find any missing folders***... dialog.

When activated, Timelapse searches the various sub-folders under the root folder to see if they contain folders whose names match the missing folder. This will usually be successful if a sub-folder was moved to a different location under the root folder but not renamed, or if a folder containing that sub-folder was renamed. A dialog box then displays what is missing, its expected location, and a selectable list of possible new locations, if any.



In the above dialog, both missing folders are listed. As two sub-folders with the same name was found under Station10, Timelapse suggests that these are the possible new location of those folders. Timelapse will also indicate if no matches were found. Three buttons are available for each missing folder.

- *View* will open the Windows file explorer. The analyst can then check that folder to see if it is indeed the missing folder.
- *Locate* will allow the analyst to manually locate the missing folder.
- *Use?* checkbox should be checked if you want TImelapse to use the new location for that missing folder.
- *Use a more selective search...* checkbox can be tried if too many location possibilities are returned, where a more stringent search is used.

Clicking the ***Use new locations*** will then update the ***RelativePath*** data fields accordingly.

The missing files dialog

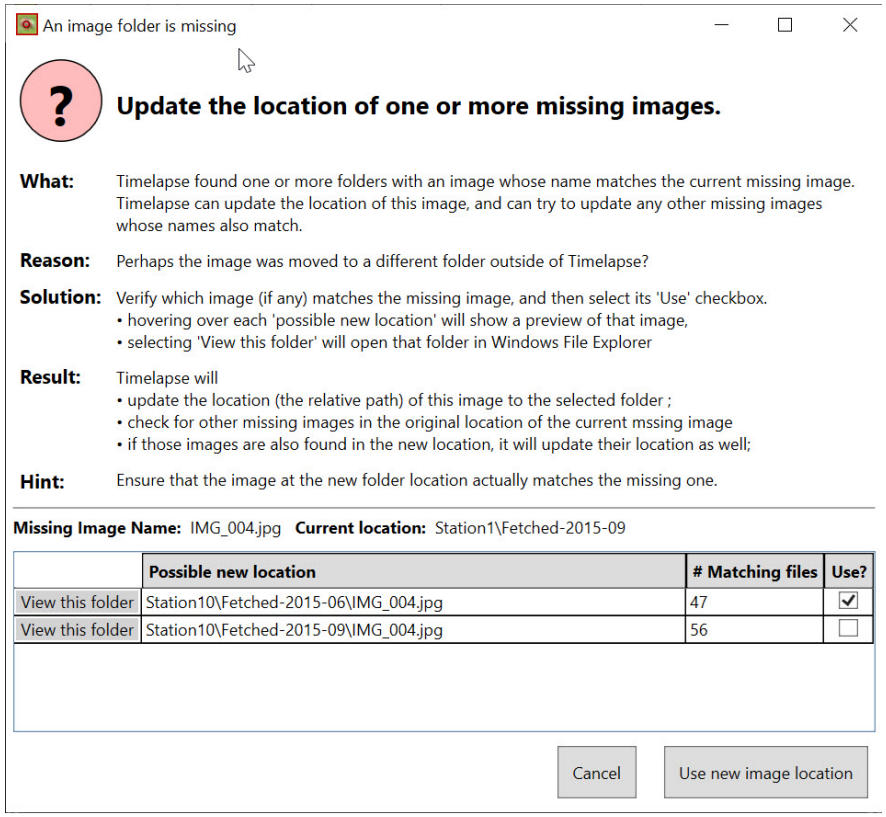
If the analyst is viewing a missing file (i.e., showing the missing images placeholder), the ***Edit | Try to find this (and other) missing files...*** can help locate that file and perhaps other missing files.

Timelapse will search all your image set folders for files whose name matches the missing file. It will also check to see if it is an orphan file, i.e.

that is not currently listed in your image set. Timelapse will present all possible matches as a list. It will also indicate if it found any other missing files in the same folder as your missing file in that new location. Hovering over a row will display a pop-up preview of that file so it can be checked to see if it matches (e.g., by comparing the banner date with the DateTime data field). possible match. The relative paths of all those files will be updated accordingly. This works well if some of your images were moved from one folder to another, or if a folder was renamed.

To illustrate, assume again that the Station1 folder was renamed to Station 10. The analyst navigates to the *IMG_004.jpg* file in the *Station1\Fetched-2015-09*, but that file is now marked as missing. When the dialog is raised, Timelapse suggests two possible locations for this image, and reports the number of other missing files that could be in those locations.

- *View this folder* opens the folder in File Explorer, so you can see its files.
- The *Use?* checkbox indications which of those locations to use.
- *Use new image location* button updates all the missing files in that folder.



Which approach is best?

Missing folders dialog is best at finding relocated folders whose names are unchanged, such as sub-folders moved into or out of other folders, including new containing folders.

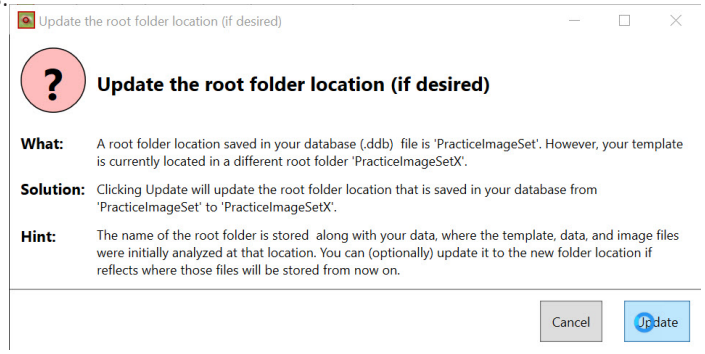
Missing files dialog is best at finding relocated files whose names are unchanged. These include files moved from one folder to another, or files in a sub-folder where that sub-folder's name was changed.

When in doubt, try either method. Remember that both methods require the various folders and files to be somewhere within the root folder.

Moving the root folder

There are instances when the analyst may have to change the name of the root folder. To illustrate, consider an analyst who initially stored and analyzed images (along with the template) in a root folder named 'toProcess', but then later renames that folder to a more descriptive name, such as '2018-10-LakeMagenta'. When this happens, the *Folder* field would contain the wrong root folder name.

When the analyst next loads the images in that folder, Timelapse detects that the stored vs. actual root folder names differ. It will raise A dialog that will provide the opportunity to update the *Folder* data field to the new root folder name for all files.



Workflow tip. Updating the name is optional, as the root folder name is stored only for informational purposes: Timelapse does not use it to locate any of its files. You may not need to update the root folder name if you moved or copied your files to a temporarily folder to work on them, and plan to move them back to their original location later.

The Folder Editor

The problem

Consider an analyst who has loaded the PracticeImageSet into Timelapse, where the path to one of the image files is:

C:\users\george\desktop\PracticeImageSet\Station1\Fetched-2015-06\IMG_001.jpg

As previously explained, Timelapse would store the location of this image in two fields:

- *File:* IMG_001.jpg
- *RelativePath:* Station1\Fetched-2015-06

The ***RelativePath*** describes the location of the image in sub-folders relative to the *PracticeImageSet* root folder containing the Timelapse database.

The problem is that Timelapse will not be able to find this (and other) files if the analyst renames or moves the sub-folder containing it, even if it remains somewhere within the *PracticeImageSet* folder. For example, if you use Windows Explorer to rename the *Station1* folder to (say) *Site1*, Timelapse would not be able to find the *Station1* folder or its sub-folders or any files within them as ***RelativePath*** would still point to *Station1* instead of *Site1*. The only way to resolve this is by using ***Edit | Try to find any missing folders*** to locate and update the folder location, as described a few pages ago.

Note. Whenever a user opens a database with Timelapse, it records the path location of the root folder (e.g., *C:\users\george\desktop\PracticeImageSet*). Timelapse then combines the root folder path with the ***RelativePath*** and ***File*** fields to determine the file's actual location in the file system. This is why Timelapse can find files even if the user rename or move root folder elsewhere.

The solution

Timelapse now includes a **Folder Editor,** invoked by selecting

Edit | Folder Editor (move, rename etc)...

You can use the Folder Editor to change your sub-folder names and locations, to create new sub-folders, and even to delete empty folders. As you edit, Timelapse will update the folder's location in the Windows file system, and the ***RelativePath*** locations in the Timelapse database.

The example folder editor window below is displaying the *PracticeImageSet* sub-folder structure as a hierarchical tree. A context menu containing various actions appears when you right-click the folder name.

Each folder's icon has the following meaning:

Timelapse does not associate any image or video files with this folder.

As above, but tagged as a missing folder, as Timelapse cannot find it.

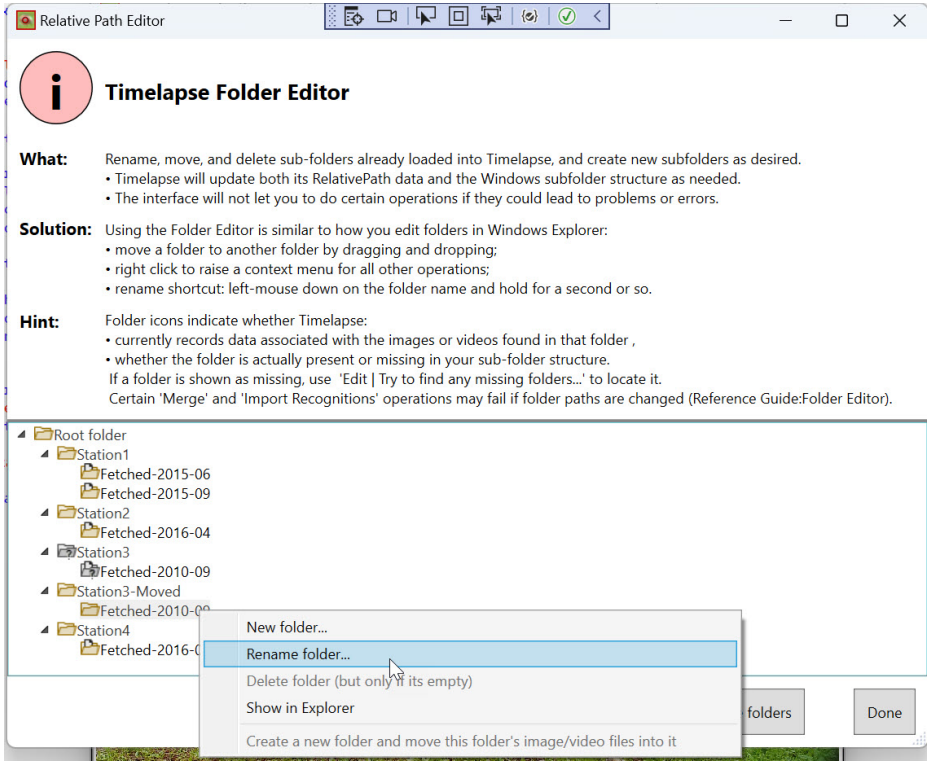
Timelapse associates at least one image or video file with this folder.

As above, but tagged as a missing folder, as Timelapse cannot find it.

Editing actions are invoked either through the context menu, or by dragging and dropping folders.

Moving a folder into another sub-folder. Moving is done by dragging and dropping a folder onto another folder. Certain moves are not permitted. For example, you cannot drag a folder into one of its sub-folders, or move a missing folder, or move the root folder. Timelapse shows you what is allowed or disallowed as you select and drag folders around.

Renaming a folder. The folder name is edited in place, confirmed by pressing 'Enter' or canceled by pressing 'Escape'. Timelapse checks to see if its a valid name.



Creating a new folder. A sub-folder is created under the selected folder, where its name can be edited (if desired) to something that is meaningful.

Create a new folder and move this folder's image/video files into it. If a folder contains image and video files, this operation will create a new sub-folder under that folder and move the image/video files into it.

Show in Explorer will open a Windows Explorer window displaying that folder and its contents.

Caveats.

1. Avoid using Windows Explorer to move or rename folders while using the Folder Editor. The Folder Editor combines both the information held in its database (i.e., the RelativePaths) and Window's physical folder structure to generate and display the folder hierarchy. The two will go out of sync if you simultaneously edit your folders with Windows Explorer, possibly leading to unintended consequences.

2. Problems will occur if you use *Merge* to check out a sub-folder, and then change the sub-folder structure. When you check that sub-folder back into the master database at a later time, the merge will not be able to match any of the edited folder names as they now differ. To avoid this, folder edits should be done in the master database before child databases are checked out.

3. When *importing recognitions*, Timelapse will try to match the file location stored in the recognition files with those stored in the database. This will fail if the folder names are edited after the recognition file is created, as the two locations would no longer match. To avoid this, the recognition file should be imported before the folder is edited, or generated after the edits are done. Alternately, and as explained in the *Timelapse Image Recognition Guide,* recognition files could be generated for each folder that directly contains the actual image files, as Timelapse would just look in the folder to locate the images specified in the recognition file.

Part 3

Merging database files for large projects

The previous section described the advantages of either creating a single database to handle all your images, or creating multiple Timelapse databases where each database handling a subset of your total files as an image set.

Both approaches suffer problems with large projects. A single database can be unweiledy, especially when multiple analysts need to process a subset of its images. Multiple databases fragment the data, where it becomes more difficult to deal with that data as a whole. The solution, as described here, is to use a master/child database scheme where subsets of data can be exchanged between them.

Note: The workflow described in this section is optional, and is considered a somewhat advanced topic. However, its worthwhile reading and understanding this section to see if you want to use it, as organizing things using a master database may help you as your project grows.

Having said that, you can revisit this idea at any time, as you can easily retrofit existing Timelapse projects into using a master database scheme.

Large projects are characterized by some (or all) of these criteria.

1. Images are periodically collected from many cameras over time.
2. Because of that, images are incrementally added as they are collected.
3. To make image management and incremental analysis easer, images are often grouped into some organizational structure as they are collected, such as through the use of sub-folders.
4. The sum of all collected images is huge (e.g., > 1-2 million).
5. As a whole, the collection contains analyzed and unanalyzed images.
6. Multiple analysts are often involved in the image tagging process, each working independently.
7. Data is preferably structured and stored in a way that allows it to be easily accessed and shared by others, usually via a single centralized database

The multiple Timelapse database approach solves points 1-6. They collect images as manageable image sets. Each image set is organized as a logical subset in a folder/sub-folder structure (e.g. where the folder hierarchy represents a small project, a location, cameras at that location, collection period). Different sub-folder trees can be analyzed by different analysts, where each sub-folder tree contains a Timelapse database in its root folder.. The problem is that having multiple Timelapse databases conflicts with point 7: the data is fragmented across multiple databases rather than available in a single source.

This section describes how Timelapse solves this dilemma by merging and copying data between ***child database*** *.ddb* files and a single centralized ***master database*** *.ddb* file. It begins by explaining what these terms mean, and then describing the merge functions Timelapse offers. Subsequent sub-sections offer several example workflows of how to create and exchange data between a master child databases. While each workflow illustrates a particular scenario, its methods can be combined to create your own workflow that fits the nuances of your situation.

Terminology

- ***Master database:*** a Timelapse database that works as a single centralized database for a large project. It is located in a root folder that contains sub-folders of image sets. The master database's primary role is to store all relevant data collected from the child databases found its sub-folders.
- ***Child database*** is a Timelapse database responsible for a particular image set, where that database and its images are contained in a sub-folder.
- ***Check-out function*** lets a project manager copy data (including recognition data, if any) from the master database into a child database located in a sub-folder. Only data relevant to that particular sub-folder is copied over.
- ***Check-in function*** lets a project manager merge data (including recognition data, if any) from a child database into the master database.

The Timelapse merge functions

Timelapse includes three functions for creating and managing master and child databases, found under the ***File | Merge databases…*** menu item.

- *Create and load an empty master database*
  - » asks you to locate a template,
  - » creates an empty Timelapse database in a folder based on that template,
  - » for that database to work as a master, it must be located in the root folder whose sub-folders are structured to contain image sets.
- *Check out (copy) a sub-folder database from the master database*
  - » asks you to locate a sub-folder,
  - » creates a child database in that sub-folder,
  - » searches the master database for data that shares the relative path to that sub-folder, and
  - » populates the child database with that found data.
- *Check in (merge) a sub-folder's database into the master database*
  - » asks the manager to select one or more child databases found in its sub-folders,
  - » merges each selected child's data back into the master database by:
    - deleting all data from the master that shares the relative path of that sub-folder,
    - inserting all (likely updated) data from the child into the master.
  - » creates a backup of the original master file in the *Backups* folder.

[1]For brevity, images will cover both pictures and videos.

Workflow #1: Starting from scratch.

This and other workflow examples illustrate how merging works, where we will copy files and sub-folders from the *PracticeImageSet* as we go along. The example assumes that the *PracticeImageSet* organization is used, where images fetched from a particular camera are located in folder structure identifying the camera station (e.g., *Station1*, *Station2*...), and when they were retrieved (e.g., *Station1/ Fetched-2015-06*, *Station1/ Fetched-2015-09*).

Note: While this example uses a simple sub-folder structure and only a few images, the same workflow could be applied to a much larger and more complex sub-folder structure containing huge numbers of images.

Prepare a folder with a template for your project

1. Create an empty folder somewhere for your project called (say, *MyLargeProject*. This will be the root folder for this exercise.
2. Create or copy a template into the root folder. For this example, you may as well copy the *TimelapseTemplate.tdb* template file that is found in the PracticeImageSet.

Create a master database in that folder

3. Open Timelapse and select ***File|Merge Databases| Create and load an empty master database...***
4. In the dialog that appears,
   - » locate the *TimelapseTemplate.tdb* file in *MyLargeProject* folder
   - » click the ***Create an empty database*** button.
5. An empty database will be created in the *MyLargeProject* folder called *TimelapseData_Master.ddb*.
6. That database is automatically loaded, and Timelapse will display an image saying 'No files to display'.

Add several image sets to the empty database.

Let's assume that unanalyzed images retrieved from two cameras over several time periods just became available, as organized in the *Station1* and Station2 folders.

7. Copy those folders from the PracticeImageSet into MyLargeProject.
8. Add those images to Timelapse using ***File|Add image and video files to this image set...*** and locating the *MyLargeProject* folder.

9. Timelapse should now contain and display images from both those sets.

Check out a child database for the Station1 folder.

Let's assume that you want to give the *Station1* folder to another analyst to process, where they will return the results to you after they are done.

10. Select ***File|Merge Databases| Check out (copy) a sub-folder database from the master database...***
11. In the dialog that appears,
    - » locate and select the *Station1* sub-folder ;
    - » click the ***Check out the database*** button.
12. Examine the *Station1* folder in Windows Explorer. You should see that the check-out operation created two files in that folder:
    - » TimelapseTemplate.tdb, a copy of the template file in MyLargeProject
    - » TimelapseData.tdb containing data relating to Station1, as extracted from the master database.

Analyze the child folder

Let's assume that you want to give the *Station1* folder to an analyst to analyze. If you want (although its not necessary) you can simulate this by copying the *Station1* folder to a location outside of the PracticeImageSet, and even perhaps to a different computer.

13. Open Timelapse, select the (optionally moved) *Station1* folder, and analyze the images by filling in the various Timelapse fields as normal.

Return the updated child database.

Assuming the *Station1* folder was moved outside the *MyLargeProject* folder, the now-updated *TimelapseData.ddb* file needs to replace the original one found *MyLargeProject/Station1.* The analyst, for example, can deliver the *TimelapseData.ddb* file to the project manager to do, or do it themselves. Images do not have to be copied back, as they are already present in the Station1 folder

14. Copy and replace the old *TimelapseData.ddb* file in *Station1* with the updated *TimelapseData.ddb.*

Check in the updated child database back into the master database.

15. Open Timelapse and select the *TimelapseData_Master.ddb* in the *MyLargeProject* folder.
16. Select ***File|Merge Databases| Check in (merge) a sub-folder's database into the master database...***
17. Timelapse searches and lists all available child .ddb files in its sub-folders. You should see *Station1TimelapseData.ddb* listed. Select it and click the ***Check in database(s)*** button.
18. If the check-in succeeded, we recommend moving the child .ddb file to the Backups folder. This helps avoid uncertainty about whether that file was merged back into the master databases.

Examine the updated data.

19. Examine the images in that folder to verify that they now contain the updated data. An easy way to do that by *File|Select|All files in a folder and its subfolders|Station1*.

Incrementally adding other images and data as they become available

As new image sets are retrieved from the field, they can be incrementally added to the sub-folder structure and into the master using the same steps as described above, and checked-out/in as desired.

20. If a child database was created in that sub-folder, it could be checked into the master database.
21. If its a set of images and no child database was present, then the ***File|Add image and video files to this image set...*** could be used to add references to them in the master data base.

Other steps.

The project manager could easily have checked out both *Station1* and *Station2*, given those folders to different analysts to analyze, and check them back in as they are returned. As new image sets are retrieved from the field, they can be incrementally added to the sub-folder structure and into the master using the same steps, and checked-out/in as desired.

Caveats

Before illustrating other workflows, there are several caveats you should know about when checking child databases out and in.

1. ***The templates used by master and child must be the same.*** The database files in the sub-folders should all have been built around the same basic template structure (although only the DataLabels really matter). Timelapse will warn you if a child's template conflicts when checking it back into the master database.
2. ***Sub-folder location and relative paths must correspond.*** Sub-folder and image names / locations should not change between check out/in. This is critically important, as otherwise the data can be corrupted. To explain:
   - As with any Timelapse database, the relative paths in the child database must correspond to the relative paths in the images found in its folders and sub-folders. Otherwise those images will not be found
   - If the location of the sub-folder in the master database folder hierarchy changes between the check-out and check-in processes, the check-in merge will be wrong. This could be serious, where previous data could be inadvertantly deleted or over-written.
3. ***Child databases should not overlap in the sub-folders they represent.*** Consider the case where two child databases are created in (say) *Station1*, and another in (say) *Station1/Fetched-2015-06* and then sent for analysis. The problem is that conflicts could occur, because both databases refer to the images in *Fetched-2015-06.* When they are both checked back in, the second check-in will over-write the *Station1/Fetched-2015-06* data from the first check-in.
   While TImelapse will warn you if detects you trying to check-in overlapping child databases, this only occurs if you are trying to do this as a single check-in operation.
4. ***The master database and child database files are completely independent of one another.*** Changes are only propagated by the check-in/check-out functions.
5. ***The manager/analyst need to track and manage what child databases are checked out/in in order to avoid conflicts.*** Timelapse does not enforce any restrictions on how child databases are checked out or in: it is up to the project manager to ensure that potential conflicts are avoided. However, Timelapse does record when and what files were checked out or in, as a record in the image set's notes. These notes can be viewed (and edited) by selecting
   Edit|Edit notes for this image set.
   We recommend checking and perhaps editing those notes as needed to minimize potential conflicts of inadvertant duplicate and/or overlapping check-outs and check-ins of child databases.

Workflow #2: Converting an existing Timelapse folder to a master database scheme

It is also possible to create a master database with an existing Timelapse folder setup. The root folder or its sub-folders already contain Timelapse template and data files, and perhaps some or all the images have already been analyzed. Fortunately, it is quite easy to add a master database to this, albeit with certain constraints as described below.

Example 1. A single timelapse database in the root folder

As our first example, let's assume that the *PracticeImageSet* already has a single Timelapse database in its root folder, and no other databases are present in its subfolders. In this case, no extra work needs to be done. For example, the manager can immediately check out child databases in a chosen sub-folder, such as *Station1*, and check it back in later.

The manager may want to append *_master* to the database name to indicate that it is used as one.

Example 2. Multiple timelapse databases somewhere in the folder structure

Actions in our second example depend upon a few things.

- All databases need to be based on the same template. If they aren't, you may have to modify them until they are the same.
- If a child databases overlap in the sub-folders they represent, they must be reconfigured so they no longer do so. This usually relies on you knowing which one holds the most up to data and valid data. You may be able to remix that by temporarily using one as a master where you can check in the data held by the child, although this does require some thought to get it right. Alternately, you can skip over potentially conflicting children database during the check-in process.

1. Repeat the first few steps of the previous workflow for preparing a folder (e.g., *MyLargeProject)* and creating an empty master database within it.

2. Copy the desired folder (in this case the folder PracticeImageSet) into the *MyLargeProject* folder. It should appear as a sub-folder.
3. If the image set as a whole is completely described by the child databases, you can use the Check-in function to select all those databases, which will merge them into the master.
4. If only some sub-folders are described by the child databases, or if you are uncertain, use the *File|Add images and video files to this image set* to add references to all the images. Then use the *Check-in* function to select all the child databases, which will merge their data into the master.

To illustrate, the PracticeImageSet could have been configured with four root folders Station 1- 4, each containing a database. each using an identical template, and each analyzed independently. After a master database is created (as illustrated below) and the four databases in the various *Station* folders checked in, the master will then contain all the data for this *PracticeImageSet* folder.

PracticeImageSet

- template.tdb,
- **TimelapseDatabase_master.ddb**

Station1

- template.tdb, database.ddb, image files (perhaps in subfolders)

Station2

- template.tdb, database.ddb, image files (perhaps in subfolders)

Station3

- template.tdb, database.ddb, image files (perhaps in subfolders)

Station4

- template.tdb, database.ddb, image files (perhaps in subfolders)

Technical note: Understanding how check-in and check-out actually works may help avoid problems. Timelapse uses and manipulates the ***RelativePath*** data associated with each image to perform these functions, where it expects the ***RelativePath*** to correspond with the sub-folder location of the child database.

For example, if a user wanted to check out a child database into the sub-folder Station1, it will search the master database for all image data whose ***RelativePath*** match Station1 or begins with Station1\ (for its sub-folders), and then copy only that data into the child database (incluidng a modified ***RelativePath***).

Similarly, if a user wanted to check in a child database from a sub-folder Station1, it will first find and delete all image data whose ***RelativePath*** match Station1 or begins with Station1\. It will then copy the child database's data into the master database (includng a modified ***RelativePath***).

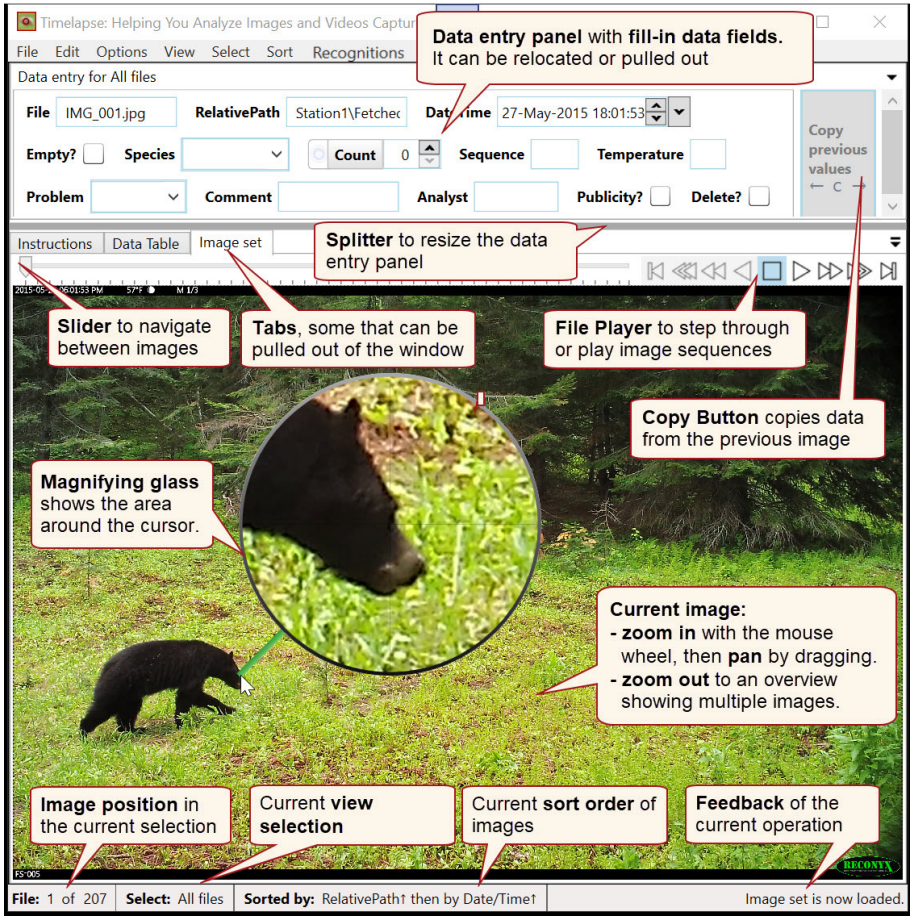
Part 4

Timelapse Windows

When you first start Timelapse, its main window appears. This part explains some of the fundamental components of what you see: several tabs, a data entry panel, menus for accessing functions. It also explains the various ways you can view your files: as an image, as video, as an overview page of thumbnails, and as a data table recorded each file's data tags. It also describes how you can customize the layout of the window and its various components.

The main window

The *Timelapse Quickstart Guide* summarized how files are loaded into Timelapse. Once loaded, the main Timelapse window will look something like this. While most elements seen in the window will be described in greater detail later in this guide, a brief explanation is provided below.



The data entry panel (top) contains the fill-in data fields used for tagging images. It can be resized via the ***splitter,*** and relocated or popped out by dragging its title bar (see section on *Managing your window layout*).

Fill-in data fields are of various types. Some are automatically filled in by Timelapse. For example, ***DateTime*** is filled in with the date and time the image was taken, but can be edited if needed. Some are not editable, such

File and RelativePath that specify a file's location. Other fields are based on generic types. Using Timelapse jargon, ***notes*** provide text entry fields, ***choices*** provide a drop down menu for making selections, ***flags*** provide checkboxes for setting true/false values, and ***counters*** allow numeric entry and optional markers placed atop of counted entities. (see *Part 7 Data entry*)

Tabs can be relocated or popped out by dragging the tab title (see the section *Managing your window layout*).

Copy previous values button lets you copy data from certain fields in the previous file to the current file.

Navigation slider lets you navigate or scrub through the next or previous files (see *Part 6 Navigation*).

File Player lets you step through or automatically play the next or previous files in the sequence (see *Part 6 Navigation*).

Tabs comprise three ***Instructions***, ***Data table***, and ***Image set*** panels, all contained within the main area of the Timelapse window. You can switch between them by clicking a tab's title (see section on *Managing your window layout*).

Status bar (bottom) displays brief status information as you perform your task.

- *File*: indicates the file number and the total number of file in the current image set. The total number is affected by your selection from the ***Select*** menu.
- *Select*: indicates your current selection i.e., what subset of images you are viewing (see *Part 9 Selecting subsets of files*).
- *Sorted by*: indicates the current criteria used to sort the order that files are presented to you. This is affected by the sort criteria specified via the Sort menu (see *Part 9 Selecting subsets of files*).
- *Message area* provides occasional feedback of what you are doing as you are doing it.

Current image displays the current file or video in full size.

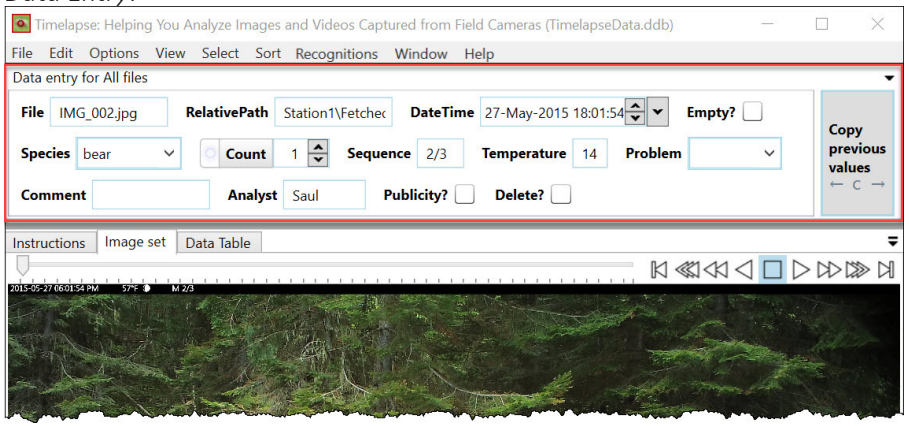
- Zooming into the image magnifies it so you can inspect its details. An optional magnifying glass is also available. See the section *Magnifying image and video regions*.
- Zooming out switches to an ***Overview*** containing multiple images, discussed shortly.

The data entry panel

The Timelapse window contains a data entry panel, which contains the primary interface you will use to enter your tag data. It comprises a variety of fill-in data fields. Some, such as the file location and the Date/Time, are automatically filled in by Timelapse. Others are manually filled in by you.

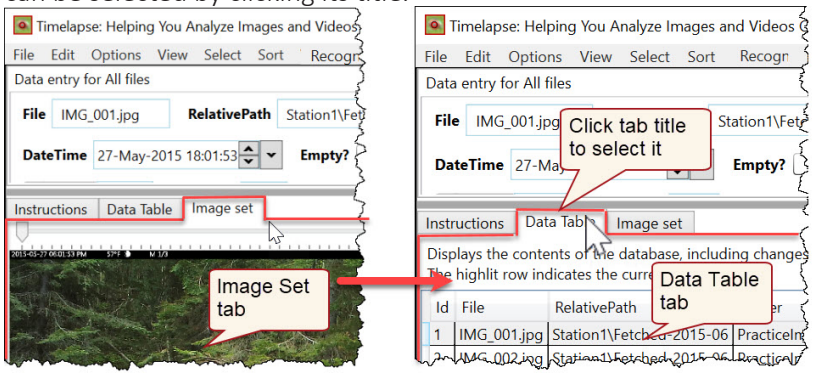
The template file specifies what data fields are displayed and how they are named. That is, the fields are customized to your tagging needs.

The data entry panel contains special facilities supporting rapid data entry, such as the 'Copy previous values' button. These will be discussed in *Part 7 Data Entry*.



The tab panels

The Timelapse window contains a data entry panel and three tabs. Any tab can be selected by clicking its title.



Instructions tab

The *instructions tab* provides a reminder of several Timelapse functions, as well as a list of common keyboard shortcuts. It appears when you first start Timelapse, but can be accessed at any time by selecting its tab.

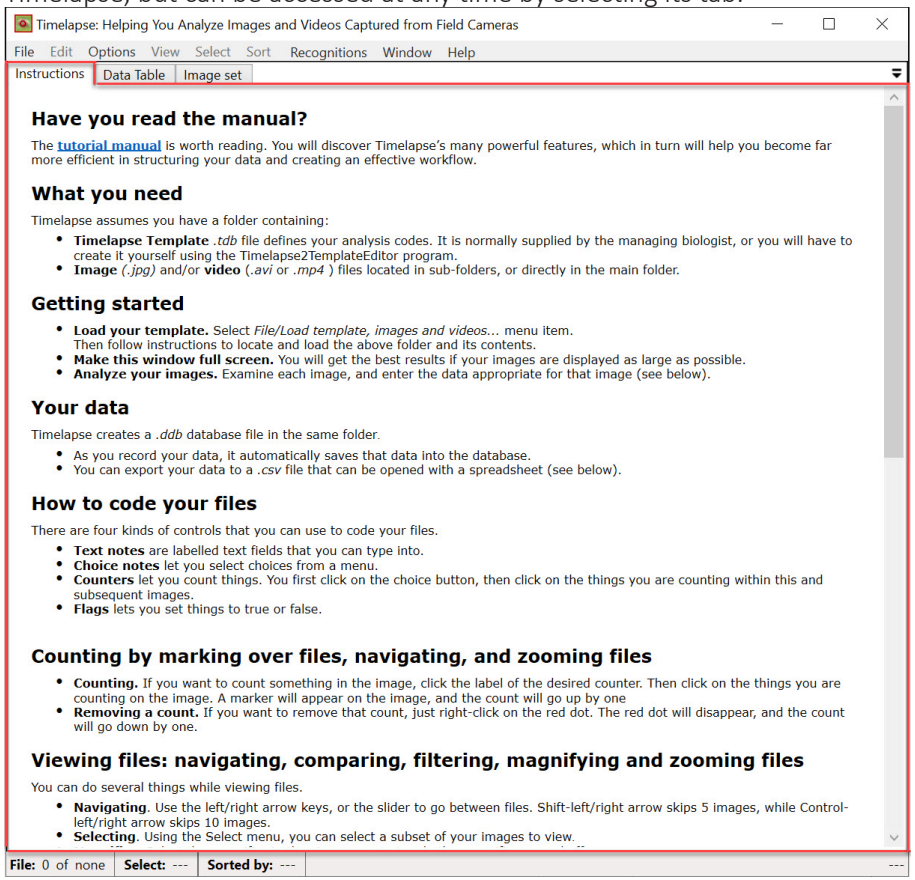


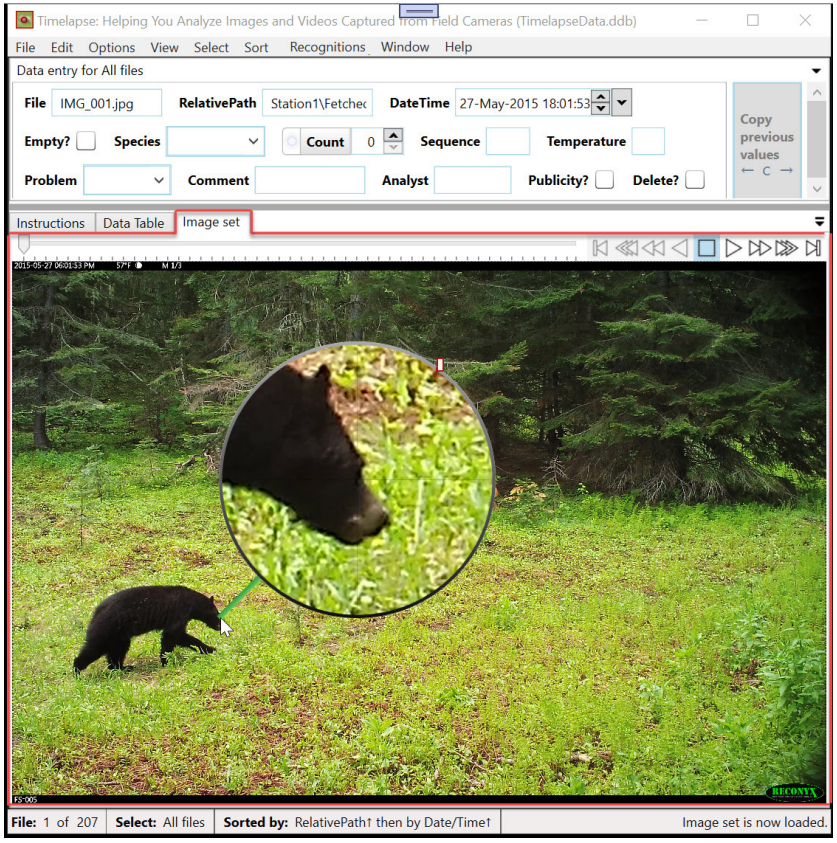
Image set tab

The *image set tab* displays each file's contents as you navigate through them. You will use this tab to inspect your image and video files. It includes various tools simplifying the inspection process, as well as a navigation slider and file player for navigating through your files.

The image set tab uses three different mechanisms to present your files.

Photo viewer

The *photo viewer* displays image files, such as *jpg* files. The viewer includes the ability to zoom into the image or video or raise a magnifying glass over particular areas of interest.



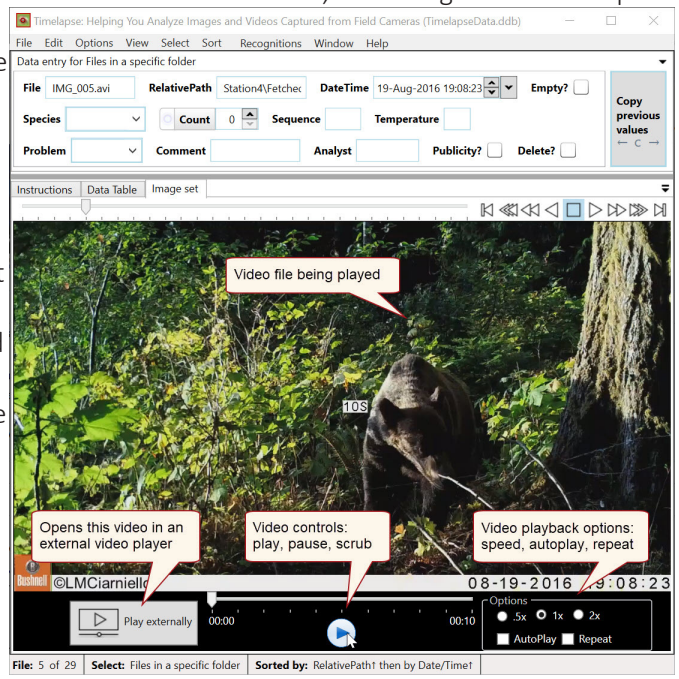
The video player

Timelapse can display video (*.mp4*, *.avi*, and *.asf*) files. When you navigate to a video file, Timelapse will show the video player and its various controls.

- ***Video play, pause or scrub controls*** similar to most video players
- ***Video playback options*** includes playback speed (.5x, 1x, 2x), autoplay to automatically begin playing the video, and whether playback should be repeated.
- ***Play externally***, when pressed, opens your video in your external – and possibly more sophisticated – system video player.
- ***Zoom and pan controls*** are like those in the photo viewer. Use the mouse wheel to zoom in and out of any video area, then click and drag to pan (scroll)the video.
- ***Magnifying glass*** (shortcut '*M*') is also similar, where it will display a magnifying glass (visible only on unzoomed videos)
- ***Shortcuts*** toggle between play and pause using the spacebar or by clicking the video itself.

There are a few limitations of videos compared to images.

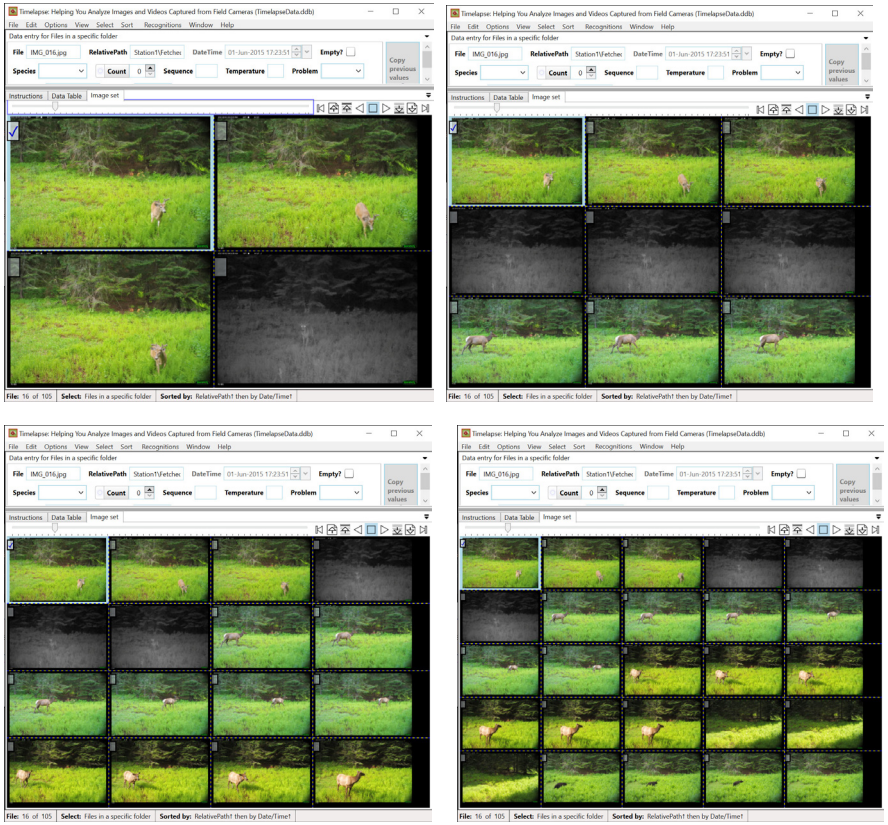
- As videos are slower to load than images, the player may briefly display a black frame before playing the video
- Because video metadata is not standardized, extracting the timestamp for video creation may not produce correct results. Timelapse does fallback to using the file's creation time, but that may not be the same. Date/times need to be verified.
- You cannot place a marker on a video using the *Count* button.



The overview

If you are on the full-sized image and continue to zoom out, Timelapse will switch to the ***Overview***: a grid containing multiple images. Zooming back in again will bring you to the single image view. The number of images displayed will depend on your computer's display size and resolution. Videos, while displayed in the overview, are not playable.

Overviews are especially powerful for inspecting and tagging multiple images at the same time. This will be explained further in Part 7 Data entry: Data entry in the overview.



Data table tab

The *Data Table* shows the current state of all your image set's data. It looks somewhat similar to the spreadsheet that you can export from Timelapse, where each file's data is shown in a row.

The currently select file is shown highlit. If multiple files are selected in the Overview, then all the corresponding rows in the Data Table will be highlit.

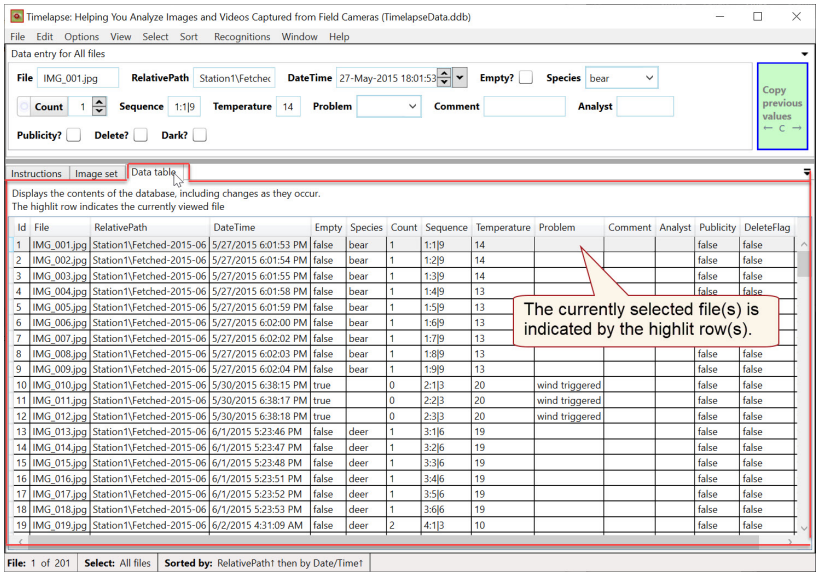
The column headers in the data table reflect the internal naming scheme for your data as specified by the *DataLabel* in your template, rather than the *Label* used to label that field in the Timelapse interface.

You can sort data by clicking the column title. For example, if you wanted to see which images have the most wildlife in it, clicking the *Count* column will sort the images by the count number.

All data fields and their contained values are displayed, including those not normally shown in Timelapse. Date information is displayed using Timelapse's internal format as a single *Date Time* column.

The data table provides rudimentary navigation. Clicking on any row in the data table will immediately:

- navigate to that file;
- switch to the *Image Set* tab; and
- display that file's image or video in full size.

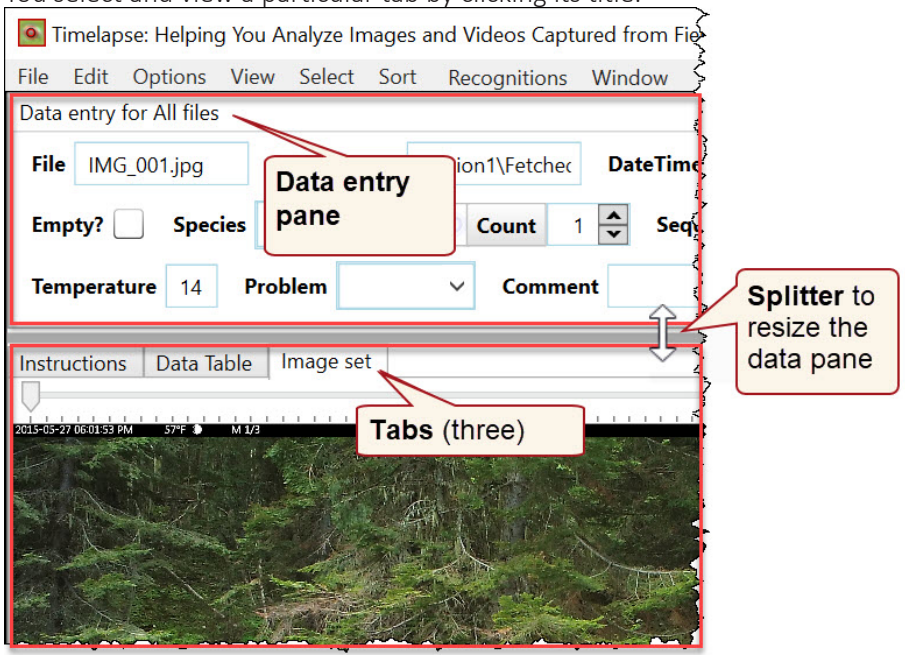


Managing your window layout

As mentioned, Timelapse provides its major informational components within one data pane and three tabs.

- *Data entry pane* contains all the fill-in data fields associated with the image being displayed.
- *Instructions tab* contains a brief summary of how to use Timelapse.
- *Data table tab* displays at table of rows and columns, each row representing a file and each column representing a tag value.
- *Image set tab* displays the current image or video, or an *Overview* presenting multiple images in a grid.

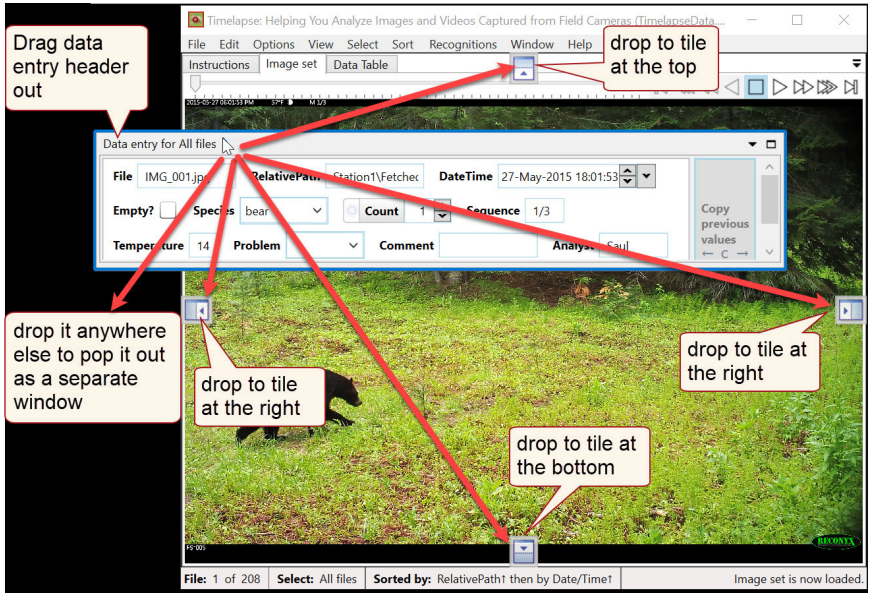
You select and view a particular tab by clicking its title.



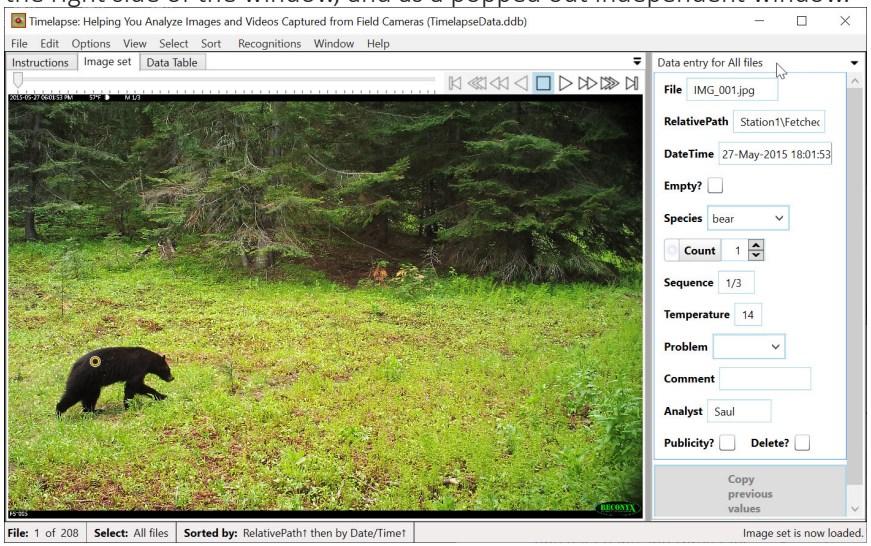
Customizing window, tab and pane layout

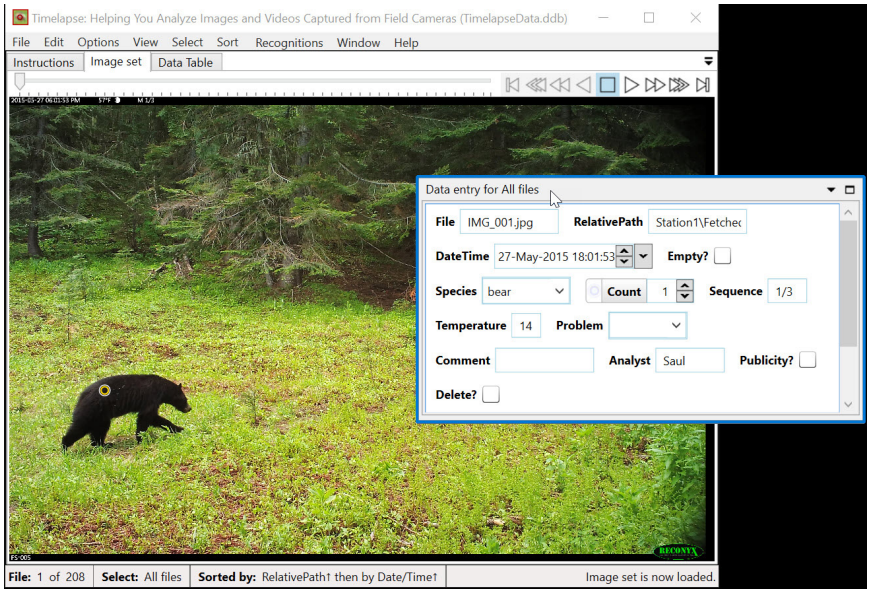
You can re-arrange the window tabs and data pane on the display to best fit your working style, screen size, and whether or not you use multiple monitors. This includes resizing the data entry pane, adjusting how panes and tabs appear within the main Timelapse window, or popping some of them out as a separate floating window. Try the following.

1. ***Resize the data entry pane height*** by clicking and dragging the gray *splitter* that separates the data pane from the tabs (see previous figure). A scrollbar appears if the data pane becomes too small to show all its contents.
2. ***Rearrange the location of the data entry pane, or pop it out.*** Click and drag the data entry pane's title bar. Arrows appear on the left, right, top and bottom sides.
   - » Dropping it on an arrow tiles the data entry pane on that side.
   - » Dropping it anywhere else pops out the data entry pane as a separate window that can be independently moved and resized.



For example, the images below shows the data pane arranged vertically on the right side of the window, and as a popped out independent window.

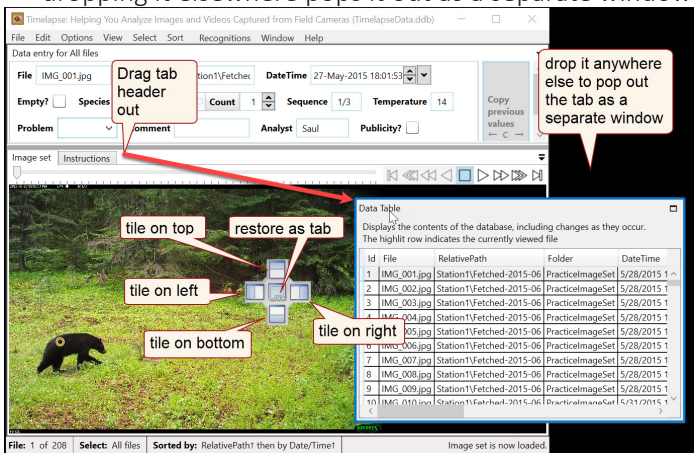




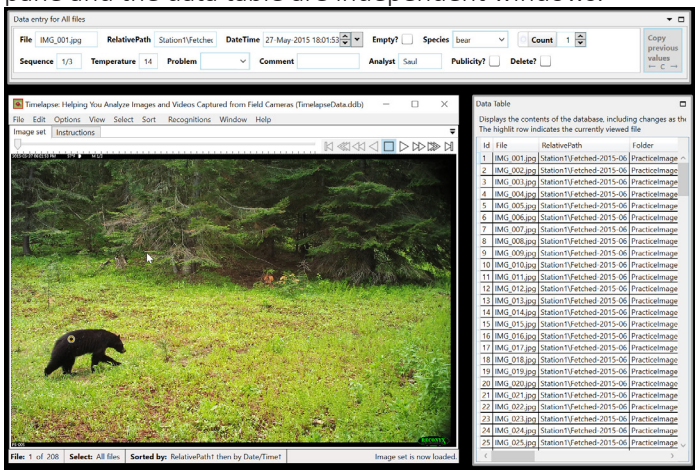
Customizing the tab layout

The Instructions tab and the Data Table tab can also be moved. Try the following.

1. Switch between tabs by clicking the tab header.
2. Pop out either tab by selecting and dragging the tab header. Arrows appear, where
   - » dropping it on an outside arrow tiles it on that side of the window;
   - » dropping it back to the tab headers or on the center arrow restores it as a tab;
   - » dropping it elsewhere pops it out as a separate window



In the example below, the analyst has created a layout where the data pane and the data table are independent windows.



Default layouts

The *Window* menu contains three options that automatically configure your window layout, where you can rapidly switch between them.

- *Data Entry On Top.* The data entry pane is tiled at the top of the Timelapse window. This is the Timelapse default
- *Data Entry On Side.* The data entry pane is tiled at the right side of the Timelapse window.
- *Data Entry Floating.* The data entry pane is configured as a separate 'floating' window atop the Timelapse window.

For all the above, you can fine tune the data entry pane size by dragging its splitter.

Saving and restoring layouts

Timelapse will automatically remember and restore whatever window layout you had when you last used it. However, you can also save layouts and switch between them.

1. Saving layouts. Once you have a layout you like, you can save it in one of three available custom layouts using the ***Window |Save the current window layout***. The position and size of the various windows, tabs and the data entry pane will be saved.
2. Restoring layouts. You can restore a previously saved custom layout by selecting it from ***Window |Restore a saved window layout.***

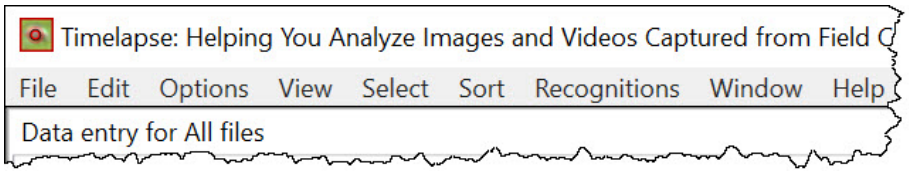
In some cases, Timelapse may not be able to restore the layout exactly, usually because of changes to your display resolution or the number of monitors available. In that case, it tries the best it can to fit things into the available space.

- If Timelapse messes up restoring a layout, you can always select ***Window | Reset to Default***. This restores the layout to the system default layout.
- If you have a saved custom layout that becomes problematic, over-write it with something that works.

Part 5

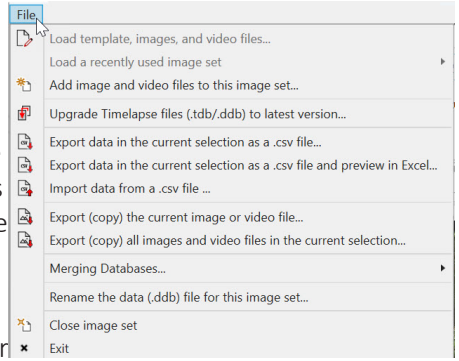
The menus

There are seven pull-down menus available at the top of the Timelapse window. Every menu item includes a tooltip to remind you of its purpose, which appear when you hover the mouse over it. This part briefly describes each menu and their items, which also serve as a summary of many facilities available in Timelapse.



Note: Timelapse lets you select a subset of your files to view and work on via its ***Select*** menu. Many Timelapse menu operations restrict their actions to only those currently selected files.

File menu



All file operations concerned with loading, adding, renaming, importing and exporting files related to an image set are located here, as well as options for closing an image set and exiting the program.

Load template, images, and video files... is the primary way you load your image set into TImelapse. It will ask you to select a Timelapse Template *.tdb* file from the root folder.

- On initial use, it loads every image it can find in your root folder and its sub-folders, it extracts certain data such as the date and time from each file, and creates the TImelapse *.ddb* database file to store your data.
- If you load an image set that has been previously loaded, it re-opens your image set from where you previously left off.

Load a recently used image set displays a submenu listing the last few Template *.tdb* file you had opened, in recency order. Select one to reopen that image set.

Add images and video files to image set... lets you add images and videos to an already loaded image set. This is useful if you an image set that grows over time, e.g., a station whose camera cards are retrieved every few months and added to the image set. You specify the folder containing the new files, which can be the root folder or a sub-folder within it. Timelapse searches that folder and its sub-folders for any image or video files that it has not seen before: files that have been previously loaded are skipped over, while new unseen files are added.

Upgrade Timelapse files (.tdb/.ddb) to latest version... Timelapse changed its internal file format as of version 2.3.0.0. This option raises a dialog where you to bulk-update your older files quickly by selecting either folders (which will be searched automatically) or individual files. Alternately, you can just allow updates to happen as you load these older files(e.g., using the Load template option), as Timelapse detects these older files and will ask you if you want to update them.

Export data for this image set as a CSV file… exports the data for the currently selected files as a comma-separated value *.csv* file that can then be opened in a spreadsheet or analytics package such as Excel or R. The format for the Date and Time can be specified in the *Options | Preferences | Exporting CSV files – Adjust Date and Time formats.* Data whose *Export* field is unchecked in the Template will not be exported.

Export data for this image set as a CSV file and preview in Excel... as above, but which also opens the *.csv* file in Excel for you to view and/or edit.

Import data from a CSV file… imports data from a comma-separated value (*.csv*) file. For example, you can export your data to a *.csv* file, and then edit some of the values in that file using Excel. You can than import the edited *.csv* file back into Timelapse, which will update the data accordingly. However, restrictions apply. See the section on *Exporting and importing data*.

Export a copy of the current image or video file… save a copy of the current image/video to a folder of your choice. Original files are unaffected.

Export all images and video files in the current selection… lets you save a copy of all images or videos in the current selection to a folder of your choosing. The originals are unaffected.

Merging databases|Create and load an empty master database creates an empty Timelapse database in a root folder. For that database to work as a master, it must be located in the root folder whose sub-folders are structured to contain image sets.

Merging databases|Check out (copy) a sub-folder database from the master database creates a child database in a sub-folder, where it searches the master database for data that shares the relative path to that sub-folder, and populates the child database with that found data.

Merging databases|Check in (merge) a sub-folder's database into the master database merges child database data back into the master database

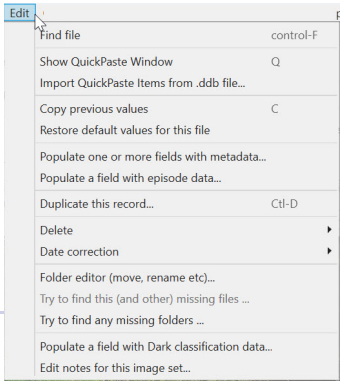
Rename the data file… lets you rename your .ddb file.

Close image set closes the current image set, where you can then load another image set if desired.

Exit quits the program.

Note: There is no ***Save*** menu item as Timelapse saves your data as you enter it.

Edit menu



Many editing-related operations, including finding file, populating files with data, file deletion, and data correction are found under this menu.

Find Image finds the next or previous image that contains the case-insensitive text.

Show QuickPaste Window… displays the QuickPaste window, which lets you bulk-paste previously copied data. Use the window to create, select, edit, delete QuickPaste items and past them as desired. See section in *Part 7 Data Entry*.

Import QuickPaste Items from .ddb file… lets you retrieve and add quick paste items that were created for another image set, and saved in that image set's .ddb file.

Copy Previous Values performs the same action as the *Copy previous values* button, where certain data in the previous image are copied to the current image. See section in *Part 7 Data Entry*.

Restore default values for this file restores the data fields associated with either the current file or {if in the overview) the files selected with a checkmark to the default values specified in the template. However, the file/ relative path/ folder fields and the date/time field are left as is. This option is also accessible by right clicking an empty area in the data entry pane, which raises a context menu.

Populate one or more fields with metadata… raises a dialog box to: inspect the metadata included in the current file, associate metadata fields of interest with Note data fields; populate the selected Note fields for all your files with the associated metadata values found in those files. See section in *Part 7 Data Entry*.

Populate a field with episode data… raises a dialog box allowing you to choose a Note field, and then have Timelapse write Episode information into that field for all the files in your current selection. See Part 8 Episodes.

Duplicate this record creates a duplicate of the current record. This is helpful if you need to use the same data field to record several different things in a single image. See section in *Part 7 Data Entry* to understand its usefulness.

Delete opens a sub-menu with several options to delete files and/or the data associated with those files. All delete operations raise a dialog box asking for confirmation. Operations are constrained to the currently selected files. See section in *Part 11 A few more things.*

- ***The current image or video file…*** deletes the currently displayed image or video, but not the data associated with it
- ***The current image or video file and its data…*** is similar, except it also deletes the data associated with the current image or video
- ***Only the data associated with the current file…*** deletes the data associated with the current image or video, but leaves the image or video file intact. This is helpful in cases where you made a duplicate record but no longer want it.
- ***All selected images or video files marked for deletion…*** deletes all images and videos that have the *Delete?* flag checked
- ***All selected image or video files marked for deletion and their data…*** is similar, except it also deletes the data associated with the images and videos that have the *Delete?* flag checked
- ***Only the data associated with all selected image or video files marked for deletion…*** deletes the data associated with all images or videos that have the *Delete?* flag checked, but leaves the image or video files intact. This is helpful in cases where you made several duplicate records but no longer want them.

Note. The Delete operation does not actually delete the images. Rather, it moves those images into a sub-folder titled *DeletedImages* just in case you need to undo that operation. You can later delete the images within that (or the entire folder) at your leisure. Various file deletion behaviours can be set in *Options | Preferences | How deleted files are managed* (see the section *Setting preferences* in *Part 11 A few more things*).

Date Correction opens a sub-menu with several options for correcting common date and time problems. All correction operations are constrained to the currently selected files. See section *Correcting dates and times.*

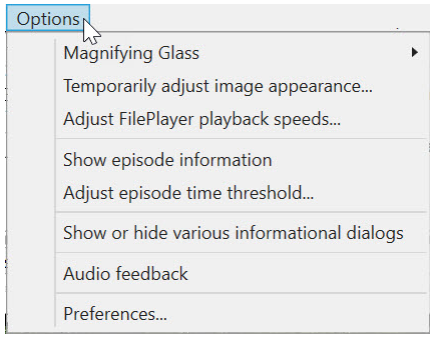
- ***Re-read dates and times from files…*** displays a dialog box that will let you re-read the original dates and times from your image and video files. This is useful if you altered some dates or times, and want to revert back to the original ones.
- ***Correct for standard and daylight savings time changes…*** displays a dialog box that lets you adjust the date to account for the extra / lost hour during time changes. This is useful for cameras that do not handle time changes automatically.
- ***Correct for cameras not set to the right date and time…*** a dialog box lets you adjust all dates and times. This is useful if your camera was not initialized to the correct date/time. All you have to do is supply the correct date/time for the first image, and all others image dates/times will be adjusted accordingly.
- ***Correct for cameras whose clock runs fast or slow…*** a dialog box let you correct for clock drift, i.e., cameras whose clocks run slow or fast. All you have to do is to supply the correct date and time for the last image, and all other dates and times will be proportionally adjusted.
- ***Check and correct for ambiguous dates…*** its dialog box examines the first image of each day to see if its date is ambiguous, i.e., uncertainties about whether certain dates are in day/month or month/day order. You can then selectively swap the day/month order for images taken on those days, or swap all ambiguous dates.
- ***Read dates and times from a metadata field…*** a dialog box lists all metadata containing what appears to be a date or time value for the currently selected file. If one contains the correct date/time, you can ask Timelapse to update the Date/Time field for all selected files to the each file's value for that metadata field. Files that do not have that field are left unchanged. This is valuable for correcting video file date/times, where the correct date/time may be stored in a non-standard metadata field.

Folder Editor (move, rename, etc)... to edit sub-folder names and locations.
Try to find this (and other) missing files… and
Try to find missing folders… help you locate missing files and folders that can result from files and folders being renamed or moved around. See the section on *Missing folders and files.*

Classify dark files now… analyzes and records in the *ImageQuality* field whether each file in your current selection is a daytime (light) or night-time (dark) image. Its dialog lets you set thresholds that fine-tune how Timelapse does this. See the section on *ImageQuality and classifying dark images*.

Edit notes for this image set... allows you to create a note associated with this image set, e.g., a description of the project and the particular information regarding this image set, comments as a whole, your own 'to do' list, messages to other analysts who may go through these images, etc.

Options Menu



This menu lets you adjust various Timelapse settings on the fly.

Magnifying Glass provides a sub-menu that lets you toggle the magnifying glass on and off, and to increase or decrease the magnification level.

Temporarily adjust image appearance... raises a small window that lets you temporarily adjust an image's clarity through brightness, contrast, sharpness, and other controls.

Adjust File Player playback speeds... raises a dialog box that lets you adjust how many images per second you would prefer to see when using the *File Player's* play forward/backwards buttons. This feature is really useful for letting you review images rapidly, but you should experiment with the speed to find a setting suitable for you. Note that your computer may not be able to keep up with really fast speeds, especially if you have large images.

Show episode information. Timelapse identifies images as belonging together in an episode, i.e., a sequence of images separated by a short time duration. An episode, for example, can group together the multiple images taken of an animal moving through a scene. Episode information is shown as a text overlay atop the image. See *Part 8 Episodes*.

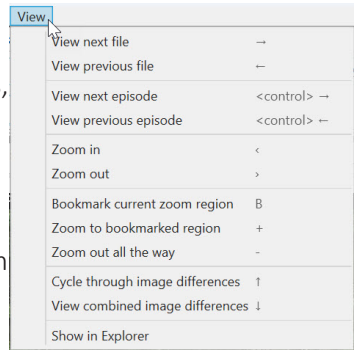
Adjust episode time threshold... raises a dialog box allowing you to adjust the time threshold for determining how images are collected as episodes.

Show or hide various informational dialogs... Invoking some Timelapse operations raise information dialog boxes that provide help information for that operation. When that help is no longer needed, the dialog can be hidden. This menu shows a list of these dialog boxes that you can optionally show or hide.

Audio feedback toggles whether Timelapse 'speaks' what you are counting when using the ***Count*** button to click on entities in the image.

Preferences... is a dialog allowing you to set various options that affect how Timelapse behaves, and which are remembered on your computer across your Timelapse sessions. The default settings are restored when you click each preference's Reset button. See the section on *Setting preferences*.

View Menu



This menu allows you to navigate between files, and to view files in various ways, e.g., through zooming and through image differencing. Because these are frequent actions, most people user the keyboard shortcuts (displayed in the menu) rather than selecting directly from the menu.

View next file
View previous file navigates to the next and previous image. They perform the same action as using the left/right arrow keys on your keyboard.

View next episode
View previous episode navigates to the first image of the next and previous episodes (see *Part 8 Episodes*). They perform the same action as using the <control> left/right arrow keys on your keyboard.

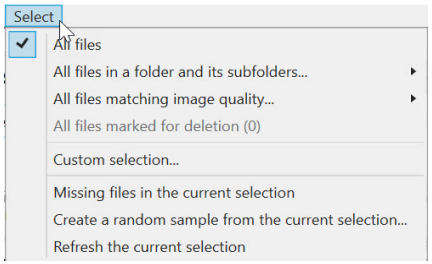
Zoom in
Zoom out zooms into and out of the image. Continuing to zoom out of a full-sized image switches to the Overview to display multiple images in the window. The more you zoom out, the more images you will see. Use the scroll wheel on your mouse as another way to zoom in and out.

Bookmark current region
Zoom to bookmarked region
Zoom out all the way allows you to 'bookmark' your current zoomed in region, then return to that zoomed-in region, or zoom out all the way. They perform the same action as using the **B**, **+** and **-** keys on your keyboard as previously explained. Zooming out all the way shows the full sized image.

Cycle through image differences
View combined image differences visually displays an image that shows the differences between the current image and / or the previous and next image. It is useful for spotting small visual changes that you could easily miss. See the section on *Image Differencing*.

Show in Explorer. Open Windows files explorer on the folder that contains the currently displayed file, with the file name selected.

Select Menu



This menu lets you selectively display and work with a subset of the images from your image set. Selection operations are applied to select (i.e., filter) which images will be displayed. The subset of images you select are normally displayed by the sort order as specified in the *Sort* menu.

Selections are actually 'database queries'. A selection creates a query which is used to internally to search the Timelapse database. Only those images whose data match the queries are returned.

All files display every single image and video.

All files in a folder and its subfolders… displays a submenu listing all the folders in your image set. When you select a folder, it displays every single image and video in that particular folder and its subfolders.
All folders matching image quality… lets you select the subset of images whose ImageQuality tag is Ok vs. Dark (i.e., night-time shot). While the ImageQuality field can be set manually, its best done by having Timelapse automatically dark-classify your images via *Edit | Classify dark files now…*

All files marked for deletion displays all files that have the *Delete?* flag checked. This lets you review those files before you actually delete them.

Custom selection… displays a query form that allows you to precisely specify the properties of only those images that should be displayed.

Missing files in the current selection displays only those files that are no longer present, i.e., where the file is missing. Missing files are usually those that have been deleted or moved, but where the data still exists.

Create a random sample from the current selection… randomly samples the current selection to produce a subset of files, where you set the number of files you want in it. Sampling is a convenient way to quickly review a particular selection against some criteria. See section on *Random Sampling*.

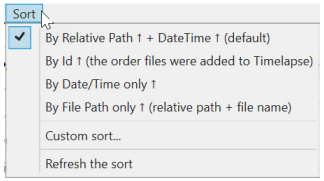
Refresh the selection will re-select the files based on the current values of your selection filters. This may be useful if you entered data on the currently selected files that changes whether it fits within the selection criteria.

Workflow tips.

Selecting by *All files in a folder and its subfolders* is a convenient and natural way of analyzing a subset of your files. For example, if images from a single camera's SD card retrieval were stored in a single folder, you can just select that folder to analyze that retrieval.

Custom Selection is an extremely powerful work aid. It can help you speed up your workflow hugely. See Part 9 Selecting subsets of files.

Sort menu



The Sort menu lets you set the criteria for how files are sorted when displayed in Timelapse. See section in Part 9 Selecting subsets of files.

By Relative Path↑ then by Date/Time↑. This is the default and recommended sort setting. It is by far the most useful sort setting is by *Relative Path and then by Date/Time*, as this is likely how you will want to go through your images. This sort criteria will;

- first sort your images into first into their folders (the *Relative Path* is the path from the root folder to the sub-folder containing your image)
- then sort the images in each folder by their Date and Time.

By Id↑. Files are given a sequential ID number as they are added to Timelapse. Sorting by Id sorts files by the same order they were added.

By Date/Time only↑. Files are sorted by date and time in ascending ↑ order, beginning with the image with the earliest date. Use this with caution: if you have multiple folders where images across folders are taken at similar times, they will be intermixed. It can be useful if, for example, you have multiple cameras at the same location and you want to view all images taken at that location in date order regardless of which cameras took them.

By File Path only↑. Files are sorted alphabetically in ascending order by the file path, that is, a combination of the relative path (if you are storing images in subfolders) and the file name.

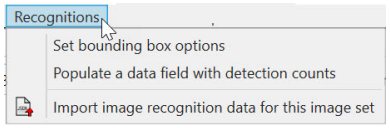
Custom sort raises a dialog box that lets you sort in ascending or descending order on any two terms i.e., the data fields that appear in Timelapse. For example, lets say you had three analysts working on the image set, where each had put their name in the Analyst box. Sorting by Analyst (ascending) and DateTime (descending) will group each analyst's images together, where their subset of images be sorted by date.

Refresh the sort will resort on the current values of your sort criteria.

Tip. Sort and Select work together. For example, the *PracticeImageSet* has a *Species* field and *Count* field. If you wanted to display only your files with *Species* = deer, and then sort the images by the count (i.e. from most deer to least deer, you would:

- *Select* | *Custom selection*, 'Species = deer',
- *Sort* | Count↑ + Date/Time↑

Recognitions Menu



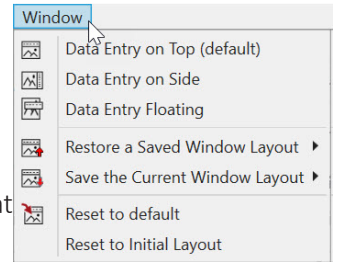
This menu contains items related to image recognition. Recognition is done by a 3rd party,with recognition results imported into Timelapse. The *Timelapse Image Recognition Guide* and *Timelapse Web Site* details this very useful capability.

Set bounding box options. Customize how and when bounding boxes appear over recognized entities. Enabled when recognitions are imported.

Populate a data field with detection counts. For all your currently selected files, count the number of detected entities above a given confidence value in each file, and place it in a counter data field of your choice. Enabled when recognitions are imported.

Import recognition data for this image set... imports image recognition data, if available.

Window Menu



This menu lets you selectively rearrange the various Timelapse panels and windows. See section *Managing your window layout*.

Data Entry On Top. The data entry pane is tiled at the top of the Timelapse window.

Data Entry On Side. The data entry pane is tiled at the right side of the Timelapse window.

Data Entry Floating. The data entry pane is configured as a separate 'floating' window atop the Timelapse window.

For all the above, you can fine tune the pane size by dragging its grey border.

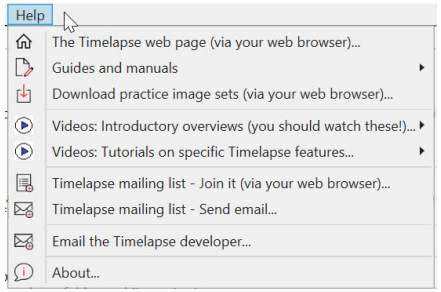
Restore a Saved Window Layout. Choose and load one of your previously saved layouts.

Save the Current Window Layout, i.e. the size and position of the various Timelapse window tabs and panes, in one of several custom settings.

Reset to Default. Restores the layout to the system default layout.

Reset to Initial Layout. Restores the layout to the initial layout of the current Timelapse session.

Help menu



The help menu should be fairly self-explanatory.

The Timelapse Web Page will display the main Timelapse web page in your browser.

Guides and manuals will let you view and download one of the several available guides to using Timelapse.

Download practice image sets will go to a web page that lists several sample image sets, such as the practice image set used in this guide. You can use these image sets to practice on as you follow the manual's instructions.

Videos: Introductory overviews… provides direct links to videos giving overviews of Timelapse and other important topics. Videos are displayed in your web browser. Definitely worth the time, as it may tell you about features and capabilities you didn't know about!

Videos: Tutorials on specific Timelapse features… well, the title says it all. Watching a video of a feature is sometimes faster and clearer than reading a document describing that feature.

Timelapse Mailing List – Join it will let you join the Timelapse mailing list, which will keep you informed of software updates and occasional news. Mailings are fairly infrequent. All emails are moderated, so spam is highly unlikely. We highly recommend you join, as otherwise you can easily miss updates and bug fixes.

Timelapse Mailing List – Send Email will let you send email to the mailing list.

Email the Timelapse developer will let you send comments, feedback, bug reports, feature requests, experiences, suggestions, questions or whatever else you want to the Timelapse developer. Feel free to email at any time: your feedback is valued as it helps improve TImelapse.

About... gives information about the software (such as its version number) as well as how to contact the Timelapse team if you have issues, problems, or questions. It also lets you check to see if a newer version of Timelapse is available.

Part 6

Inspecting images and videos

A critical part of the analyst's task is inspecting images and videos for features of interest. That can sometimes be easy if what you are looking for is clearly visible, such as a large animal in the middle of the scene. In that case, for efficiency sake, the analyst may want to look at a large group of files and inspect them collectively. Other times features may be difficult to notice or find. For example, some things could be easily missed when rapidly scanning files. The image may be of poor quality, perhaps due to weather conditions, bad lighting, or deep shadows masking their content. The things you are looking for may be far from the camera lens and thus very small . Alternately, for efficiency sake, the analyst may want to look at a large group of files.

Timelapse includes several facilities to ease image inspection. For easily seen features, it provides an overview where multiple images can be scanned simultaneously. For small features, Timelapse includes zooming and magnification tools, image differencing visualizations to make differences between images pop out, and tools to enhance poor quality images.

Magnifying image and video regions

Depending on what you are looking for, image or video inspection sometimes requires you to magnify otherwise hard-to-see details. Examples include cameras that captures distant (and thus small) entities, and images where you have to identify some attribute through its details.

Timelapse includes two facilities to support magnification: a ***magnifying glass***, and ***zooming/panning*** into an image. These are illustrated below using the first image in the *Station3* folder in the *PracticeImageSet*. Try it yourself!

Note. The magnification resolution is only be as good as your camera's resolution.

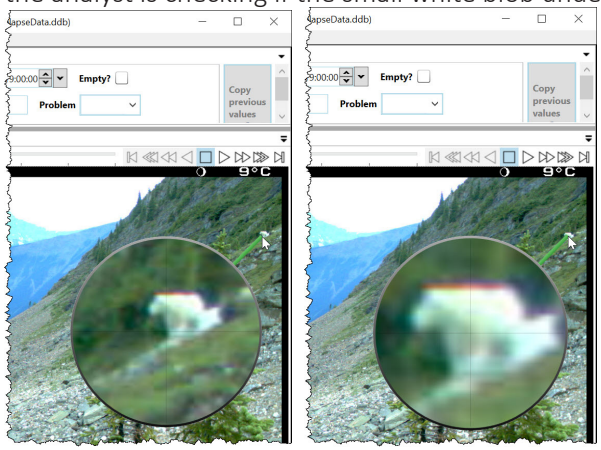
The magnifying glass

The magnifying glass magnifies the area under your mouse cursor as you move over the image or video. For videos, the magnifying glass only appears when the video is zoomed out to its full size.

You can control the presence and magnification level of the magnifying glass though the ***Options | Magnifying Glass*** menu. Alternately, you can type the following keyboard shortcuts when the image (rather than a fill-in data field) is selected:

- *M* – (for Magnifier) toggles the visibility of the magnifying glass;
- *U* – increases the amount of magnification;
- *D* – decreases the amount of magnification.

These images show the magnifier at two different magnification levels. Here, the analyst is checking if the small white blob under the cursor is a goat.



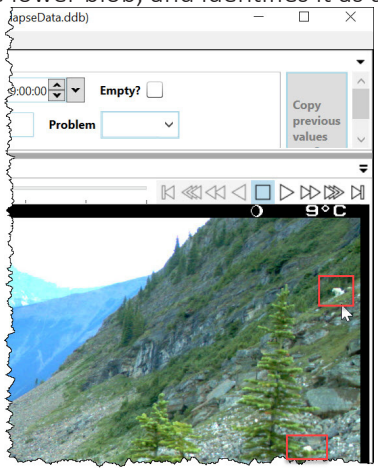
Zooming and panning into the image

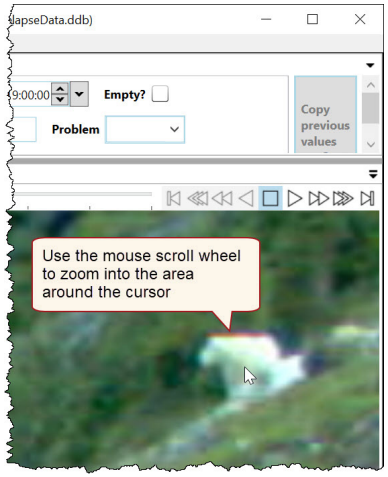
Zooming magnifies the region under the cursor. Panning scrolls to different image regions. Zoom / pan levels are maintained when navigating images.

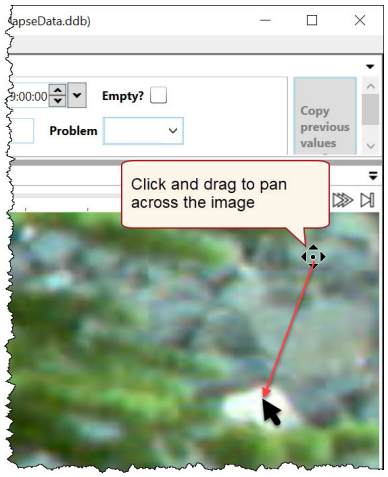
You can zoom into or out of the image through several means:

- the *View* menu's *Zoom in* and *Zoom out;*
- rotating the scroll wheel in either direction using your mouse (fastest);
- typing the keyboard shortcuts < > when the image (rather than a fill-in data field) is selected;

In this example, the analyst sees two white blobs that could be goats (top). Zooming into the upper blob verifies it is a goat (left). While still zoomed in, the analyst pans to the lower blob, and identifies it as a rock (right).







Zooming bookmarks

The Zoom Bookmark remembers your last zoomed-in region, where it can be applied to any image. Bookmarks are an easy way for you to return to zoomed-in area of interest.

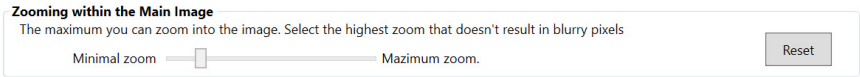
You can create and navigate a bookmark through the *View* menu, or keyboard shortcuts when the image (rather than a fill-in data field) is selected:

- *Bookmark current zoom region,* keyboard shortcuts *B*: creates a zoom bookmark of that region;
- *Zoom to bookmarked region,* keyboard shortcut *+:* zooms to the region saved by the bookmark;
- *Zoom out all the way,* keyboard shortcuts -: zooms out all the way to see the entire image.

Zoom preferences

As you zoom into the image, Timelapse will stop zooming when it reaches a particular maximum zoom setting. You can increase or decrease the maximum zoom allowable through the panel below, available via *Options | Preferences*. The effect of this varies with your image resolution. The reason you may want to adjust this parameter is that really high zooms will be of little value for low-resolution images, as you will just see a bunch of blurry pixels.

Zooming within the main image

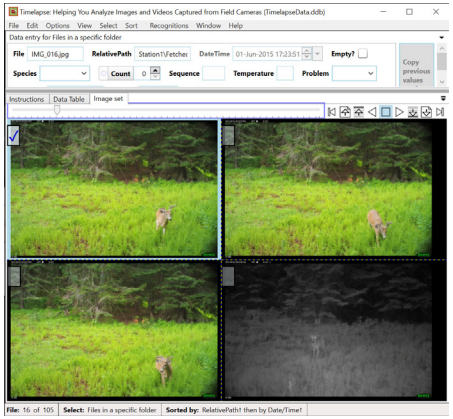


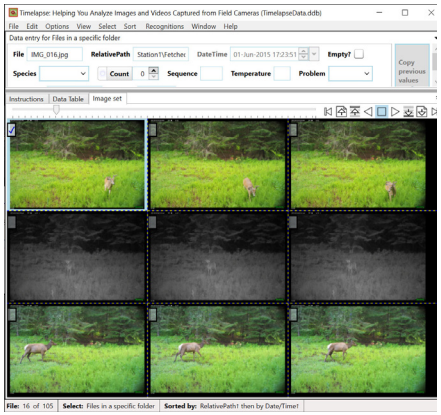
Zooming out to the overview

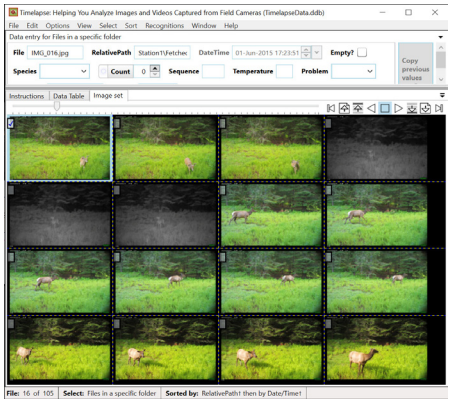
If you are on the full-sized image and continue to zoom out, Timelapse will switch to the ***Overview***: a grid containing multiple images. Zooming back in again will bring you to the single image view. The number of images displayed will depend on your computer's display size and resolution. Videos, while displayed in the overview, are not playable.

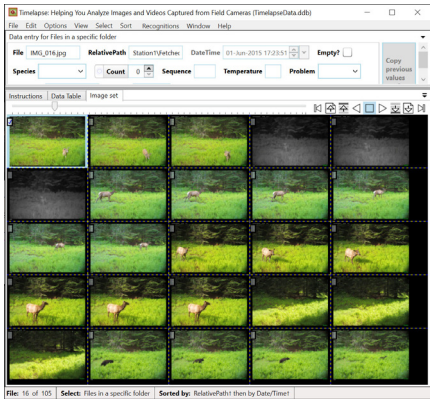
You can zoom out through several different overview levels, each showing more and more images but at smaller sizes.

The section *Data entry in the overview* provides details about its capabilities.

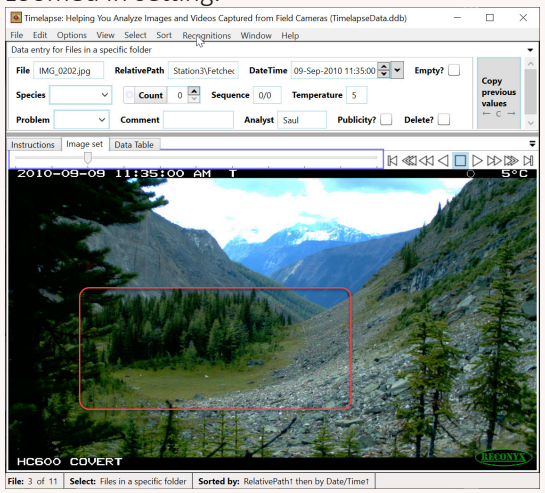








Workflow tip. Some cameras capture a broad field of view, which may include areas of no interest. For example, consider the first image below (taken from the Station3 folder). The analyzer is only interested in mountain goat presence in the meadow, as outlined in red. The scree slope, distant mountains, and sky are of little interest. Zooming into the area of interest makes it easier to focus just on that area, as in the second screenshot of zoomed-in meadow: the goats within them are much more apparent. Because Timelapse maintains its zoom level between images, the desired zoom level only needs to be set once rather than for every image. Alternately the zoom bookmarks, as discussed above, can return to the zoomed in setting.



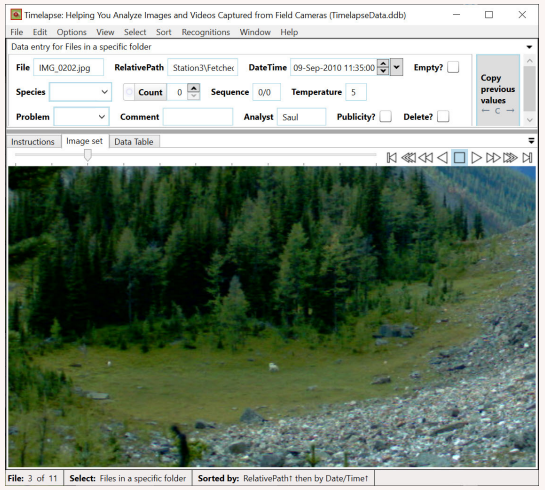


Image differencing

Many times, the entities we are looking for — people, vehicles, and wildlife —change across images over time. They enter and leave the camera's field of view, or move within it.

Inspection can exploit this. Images are often analyzed as a sequence taken from a single camera at a fixed location, where successive images contain the same background visuals. As such, it is sometimes its easier to see what changes between images.

For example, consider the images in the *Station3/Fetched-2010-09* subfolder in *PracticeImageSet*. Here, the camera was set to capture mountain goat use of an alpine meadow. The inspection problem should be immediately apparent: spotting and counting goats, if any are present, would be difficult as they are far away. For example, *IMG_0209.jpg* contains three goats (circled in red), which are barely discernible as the white dots.

Let's zoom in to take a closer look of the area containing the goats, where we compare the same scene across three images:

- *IMG_0208.jpg* shows three goats in the lower left area;
- *IMG_0209.jpg* shows the goats have moved to the upper right area;
- *IMG_0210.jpg* shows they left the camera's field of view.

Because the background is more or less identical in all three images, we can use a few techniques to make its changed elements 'pop out' of the scene, as described below. We strongly recommend you try out these techniques using the *Station3/Fetched-2010-09* images, as the static page cannot capture the animations that make these techniques work well.

Note. These techniques work best when the background visuals between successive images are more or less stable. They do not work as well when there are large visual changes in the background, which could be caused by unintended camera motion due to wind, by changes in lighting (e.g., sun vs. clouds), and by wind moving background elements such as grass and leaves.

Typically, images taken at short intervals work best, as they maintain similar backgrounds. Examples include a sequence of images taken in motion detection mode, or images are taken frequently in timelapse mode.

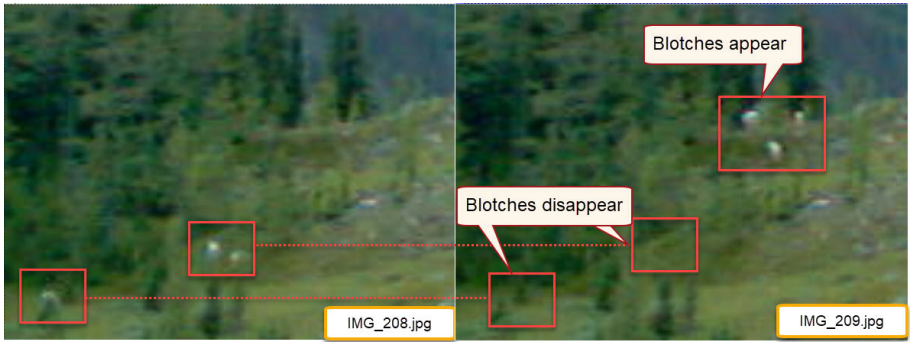
Rapid image switching

Rapidly switching back and forth between two successive images is perhaps the simplest and perhaps most effective technique to have changes between images visually 'pop out'.

The method is easy and fast to do. When viewing an image, simply navigate rapidly back and forth between the current image and the previous image, or the current image and the next image. This rapid image switching is best done using the left and right arrow keys on your keyboard (see *Part 6 Navigating files*).

For example, *IMG_0208.jpg* (left) contains three faint white blotches in the far lower-left corner. Not only are they easy to miss, but its difficult to tell if they are goats, or if its just part of the background, such as lightly colored boulders.

However, when you rapidly switch back and forth between *IMG_0208.jpg* to its neighboring *IMG_0209.jpg*, the white blotch disappears from those surrounding images because it has moved, and three other blotches appear in a new location. Because our eyes are so attuned to spotting changes, the appearance and disappearance of these blotches pop out. This provides strong evidence that there are three goats present, all moving around the scene.



Workflow tip. Rapid image switching also works when you are zoomed into an image, or when you are using a magnifying glass. This is because Timelapse maintains the current zoom and magnifying level during image navigation.

Automated differencing

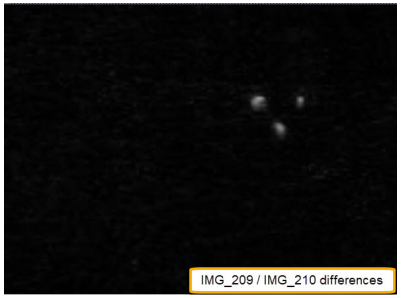
Timelapse includes an image processing algorithm that automatically highlights the visual differences between the current image and its surrounding images. It works by comparing the differences between pixels in the same location across images to a threshold value. If the difference is large, it displays that pixel in white, otherwise block. The visual effect is that entities that appear, disappear or move between images are shown in white.

Some of these differences may be due to lighting and shadow changes, slight movements of the camera, and wind effects. However, people and animals that move in the scene tend to stand out.

The visuals are activated using successive ***up/down*** arrow keys as follows. All methods also work at all image zoom levels.

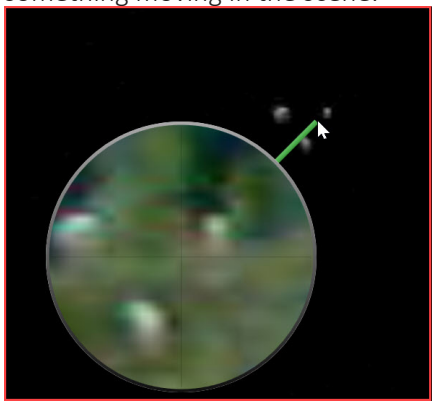
- ***Up-arrow*** displays the visual difference between the current and previous image. If done again, it displays the difference between the current and next image.
- ***Down-arrow*** displays the combined differences between the current image and both surrounding images.
- Successive up / down arrow key presses return to the original image.

To illustrate, the visual difference (albeit zoomed in here for clarity) between *IMG_0209* (left) and the next image *IMG_210* (right), is shown below. The three goats pop out, as they are the only thing that differs between them.

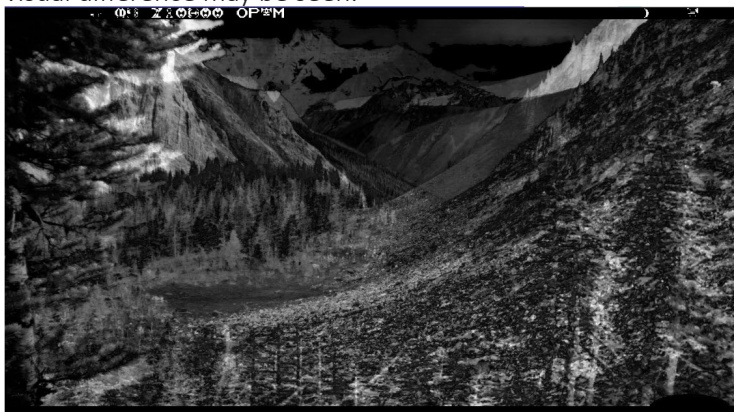


The visual difference between the preceding *IMG_0208* (left) and *IMG_209* (right), is similarly shown below. As both contain the moving goats, we see them duplicated across both images showing both locations.

The analyst can then use the magnifying glass to reveal the unaltered differences, in this case to see which goats are in the current image. Or, the analyst can simply keep pressing the arrow key, which will cycle back to the unaltered image. Rapid image switching, but this time knowing where in the scene to look, can further check if these white blobs are caused by something moving in the scene.



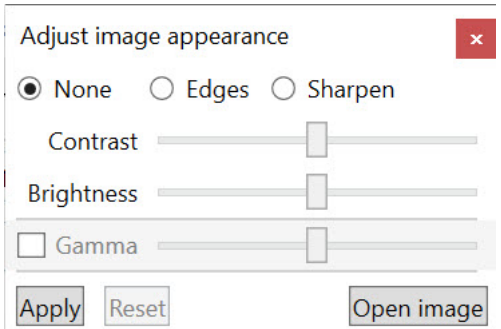
Automated image differencing doesn't always produce such striking effects. For example, the visual difference below between *IMG_0200.jpg* and *IMG_0201.jpg* is too extreme to be useful, as the camera has shifted its position somewhat between the two photos. Similar large visual difference occur due to wind effects on foliage, lighting changes due to clouds and weather, and others. As well, if the animal is stationary between images, no visual difference may be seen.



Workflow tip. If you unclear as to how all this works, don't worry. Let the visuals attract your attention, and then use the magnifying glass, zooming, flip backing to the normal image, and comparing what you see to surrounding images to check if something is there. The more you experimenting with it, the more you will acquire a sense of where it works well, and where it doesn't. Automated image differencing is not a panacea. Rather it is just another tool in your arsenal that may help on particular images, particularly those that are stable and that may have small hard-to-detect features moving within it.

But to explain a bit further, you can image difference with the previous, next or both surrounding images. Which works best depends upon how the surrounding images differ from the current one. The previous (or next) difference creates a composite of the difference between the current image and the previous (or next) one. This means that if an entity (e.g., a goat) appears in 1 image, and that entity moves to a different position in the next image, you will likely see 2 entities in the differenced image. That is, it is a union of the differences. In contrast, the combined differences will only show those things that appears in the current image and that does not appear in either of the surrounding images. Thus if you see something there, it is likely only in the current image.

Temporarily adjusting image appearance



Images can be of poor quality, usually because of poor lighting conditions. Timelapse provides a few rudimentary ways to temporary adjust the appearance of your image without altering your file, which may help enhance otherwise obscure details.

Choosing *Options | Temporarily Adjusting Image Appearance...* raises a popup window, which will stay on your display until you close it (or close your image set). Its controls are somewhat similar to those found on most image editors. Adjusting any of the controls will temporarily apply the current settings to the current image.

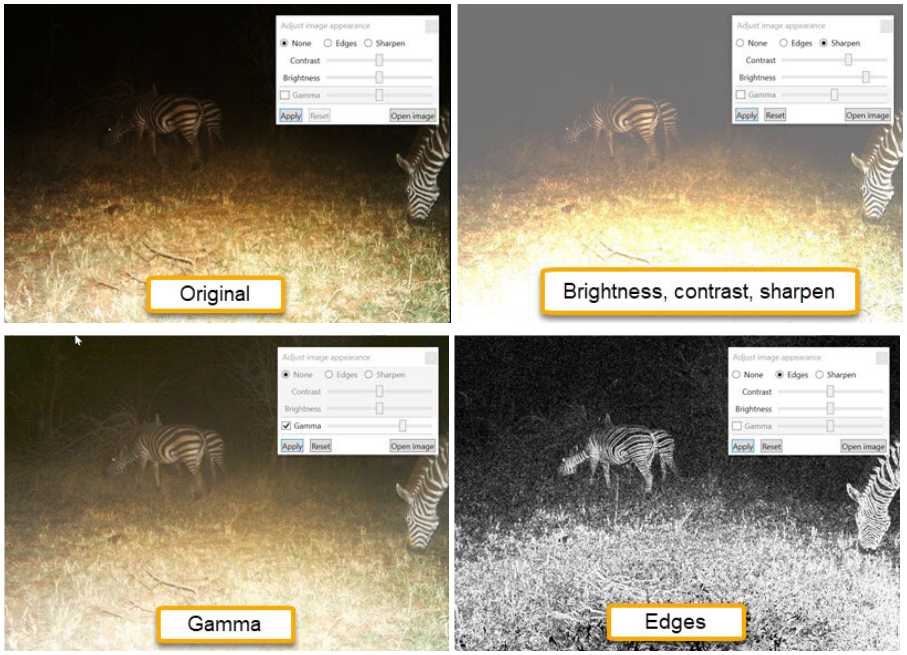
The benefits of particular image enhancements, if any, will vary greatly with the image, so some experimentation is usually necessary.

For example, consider the somewhat dark image (top left), where the analyst is trying to inspect and better identify the somewhat dark zebra at the center left part of the image.

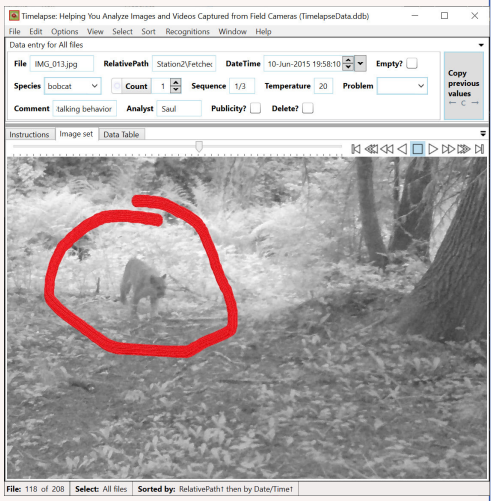
- Using the *brightness*, *contrast* and *sharpness* controls, it becomes apparent that two zebras are standing next to each other(top right), although the image is now quite hazy.
- *Gamma* is an alternate image enhancement control that tends to do a better job exposing extremely dark or light regions of the image without overly brightening or darkening the rest of the image. Gamma is activated by selecting the Gamma checkbox or by adjusting its slider. In this case, the image as a whole is much clearer (bottom left)
- *Edges* transforms the image into black & white, and enhances any edges it can find. In this case, the zebra stripes now stand out (bottom right).

Several other controls are available.

- *Apply* applies the settings to the current image. Use it when you navigate to a new image).
- *Reset* resets the controls back to their default neutral values.
- *Open image* opens the current image in your external default Windows photo viewer. That viewer may have more powerful image manipulation features.



Workflow tip. The *Open image* button can be used to permanently annotate or alter the image.



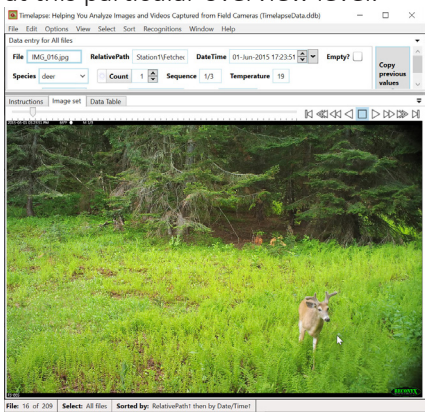
As a trivial example, consider the case where an analyst wants to highlight the animal in a scene, perhaps simply by drawing a circle around it. While Timelapse does not have that facility, your photo viewer may have it. The analyst can quickly open up the image in the external viewer, draw a circle around the animal, and save the file. Similarly, the analyst can save other edits, such as enhancements and rescaling. At the extreme, think about the power of Adobe Photoshop.

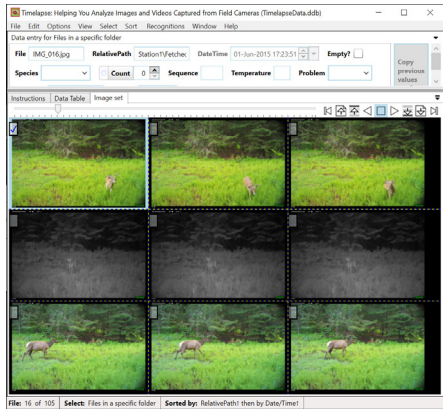
The caveat is that Timelapse may not immediately display the changed image. You may also have to experiment to find a viewer that does what you want.

Workflow inspection strategies

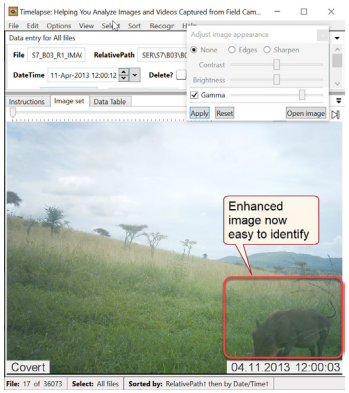
The workflow for inspecting images depends upon many things.

Large easy-to-identify entities. If your image typically contains large easy-to-identify entities, such as wildlife moving immediately in front of the camera's field of view, then simply displaying the image at normal size will likely suffice in most cases. The overview, which displays smaller versions of your images, would also come into play, where you can inspect multiple images at a glance. The best overview level (which trades off displaying increasingly more images but at smaller sizes) depends upon how easily you can see your entities at that image size. For example, the large mammals are identifiable at this particular overview level.



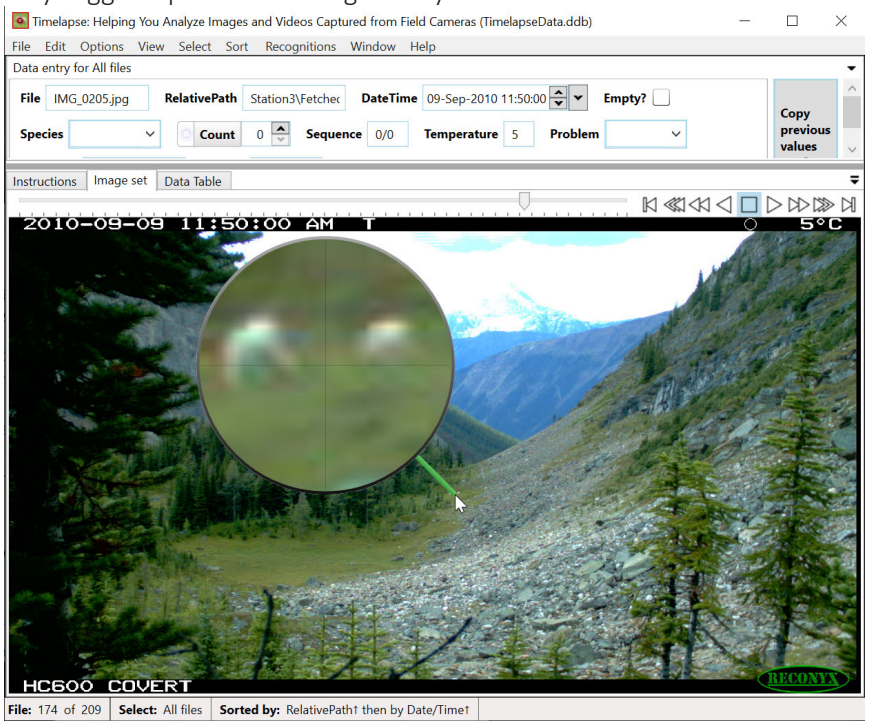


Poor quality images, especially with dark shadows. Try to see if the image enhancer helps reveal what is in the dark shadows. If the image enhancement tools available within TImelapse don't suffice, try a more sophisticated external image enhancement tool.



Small or distant entities. If your image typically contains small hard-to-see entities, then some of the tools and strategies mentioned in this section may come into play.

- Look at common areas you expect those entities to be. Zoom into those areas if appropriate, especially if other areas are unlikely to contain what you are looking for.
- Rapidly switch between the current and surrounding images by using the left/right arrow keys. Your eye will be drawn to things that change between them.
- Use the magnifying glass and / or the zoom facilities to see details, especially to review high-probability places.
- Combine the above steps if you see something in the magnifying glass. If you are unsure if it is actually something of interest, try using the left/right arrow keys to see if it's the same across images (suggesting it is not something that moves), or if it is no longer there (and thus likely something of interest).
- Use the image differencing enhancers via the up / down arrow keys as it may suggest spots in the image that you missed.



How your images were taken. Cameras set to timelapse mode (images taken at regular time intervals) tend to produce many images. As only a few images contain something of interest, the analyst will tend to run through many images quickly. In contrast, cameras set to motion triggering tend to produce a flurry of images when motion is detected. Here, the analyst needs to examine each image to identify a sequence and to see if that sequence contains something of interest, or if triggering occurred as a result of vegetation motion due to wind. See *Part 8 Episodes*, which may help.

Your particular project needs. Some projects only require you to code a few things in your image, such as the type of animal or person in the scene. Others may require considerable detail for each image, which is much more time-intensive. See *Part 7 Data entry*, as the many shortcuts it describes for intensive data entry can help.

Accuracy. Some projects may require highly accurate image analysis, where data entries must be scrutinized carefully and perhaps double-checked by others. Others may just require estimates, where occasional errors due to mis-categorizations, false positives, or false negatives are tolerable. This section provided tips on how to inspect images. *Part 9 Selecting subsets of files* can perhaps help you understand how you can have others verify your data entry by, for example, selecting and checking a random sample of the files in a particular data category.

Part 7

Navigating Files

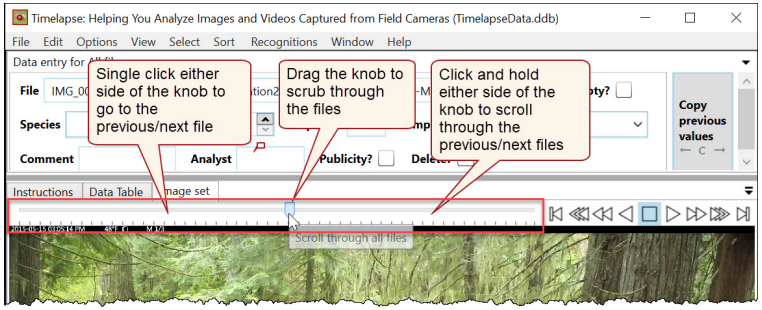
You will frequently navigate through the files in your image set, mostly from one to the next. You can do this in various ways, some which will be familiar, and some which are unique to Timelapse.

Timelapse includes various methods for navigating through the multitude of captured images. These include keyboard shortcuts for going to the next and previous items in the sequence, a file player with several navigation functions including autoplay, and others.

The navigation slider

Use the navigation slider to scroll through your files.

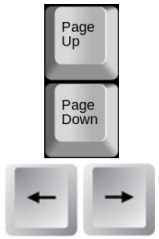
- a single click on the left / right side of the slider's knob goes to the previous / next file
- clicking and holding on the left / right side of the slider's knob rapidly moves through all your files in sequence.
- drag the knob to scrub or jump to other parts of your file sequence.



Keyboard navigation

The ***left/right arrow keys*** and the ***page-up/page-down keys*** sequentially navigates backwards and forwards through the files. Use the following key presses to navigate in both the single image view and the overview.

- A quick key press moves to the previous / next file. This is the same as ***View|View previous / next file.***
- Pressing and holding the key continually moves through the previous / next file sequence.
- Pressing ***control-left/right arrow*** moves to the first image of the previous or next episode (see *Part 8 Episodes*). This is the same as selecting ***View|View previous / next episode.***



The Overview includes several other keyboard shortcuts.

- ***Down arrow*** / ***Up arrow*** goes to the next or previous row of files.
- ***Page down*** / ***Page up*** goes to the next or previous page of files .

Tip. If a date, note or counter control has the input focus (because you selected it), that control will use the left/right arrow keys to move through its text rather than to navigate to the previous / next image. Using ***<Shift> left/right arrow*** in these cases (or in fact, at any time) will move back and forth through the files instead.

The file player

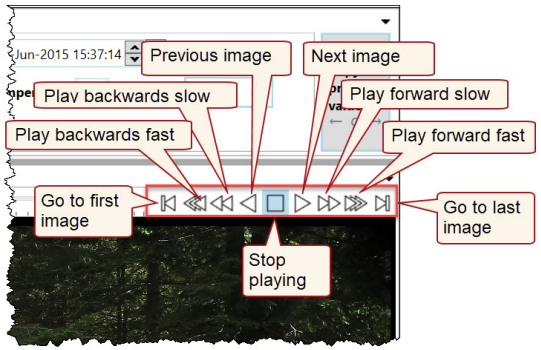
The *FilePlayer* is located to the right of the slider. It has multiple controls for navigating through your files, or for automatically playing them one after the other at various speeds.

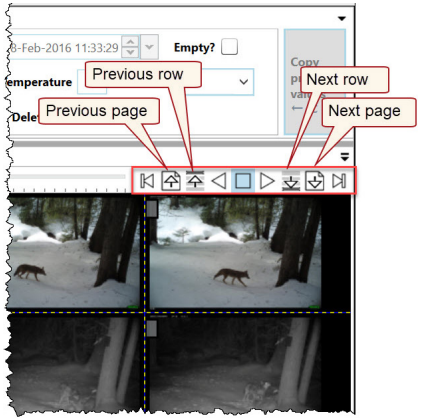
If you are in the single image view (see left image), the File Player controls lets you:

- step through your files backwards or forwards one file at a time;
- go to the first or last file;
- automatically play files backwards or forwards at different speeds

The *FilePlayer* work a bit differently in the Overview (see right image). The four auto-play controls are replaced by four navigational controls that lets you scroll the grid:

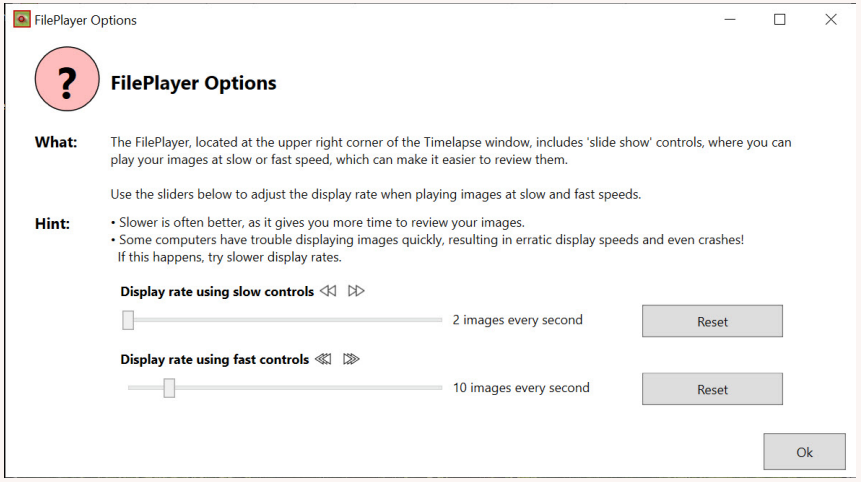
- next or previous row scrolls to the next or previous row of files in the grid;
- next or previous page scrolls to the next or previous page of files in the grid.





Workflow tip. The file player's ability to automatically play files is a very handy way to rapidly review files, especially for finding the beginnings and ends of long sequences where little changes in between them. For example, wildlife ecologist often end up with long runs of 'empty' images as they are motion-triggered by wind effects rather than by wildlife. Automatically playing through those images at a rate that still makes them scanable for wildlife presence helps remove the tedium of constantly clicking the arrow key. Another use is to just play through your files rapidly, which gives you a sense of what is in your image set.

The trick is to find the right playback speed. Timelapse includes the option to adjust both the fast and normal playback speeds. Select ***Options | Adjust FilePlayer playback speeds...*** to raise the dialog. A bit of experimentation will result in a display rate that is useful to your needs.



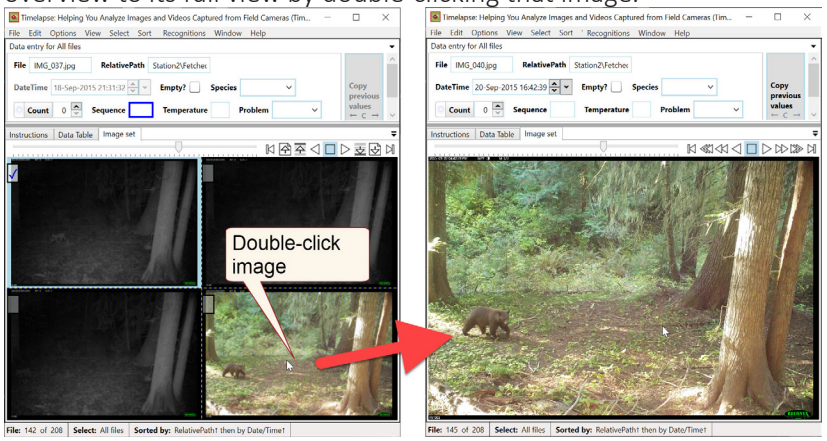
Navigation in the overview

The *Overview* displays a grid of sequential images. Most navigational controls work the same as in the single view.

- *Left arrow* / *Right arrow* goes to the next or previous file.
- *control-left/right arrow* goes to the first file in the next or previous episode.
- *Page down* / *Page up* goes to the next or previous page of files .

However, there are a few differences.

1. Additional keystroke shortcuts.
   - » *Down arrow* / *Up arrow* goes to the next or previous row of files.
   - » *Page down* / *Page up* goes to the next or previous page of files .
2. For the file player, the four auto-play buttons are replaced by navigational buttons that lets you scroll the grid in different ways. The other buttons work as in the single view.
   - » *Previous / next row* buttons scrolls to the previous / next row of files;.
   - » *Previous / next* page scrolls to the previous / next page of files in the grid.
3. You can navigate from any image thumbnail that is visible in the overview to its full view by double-clicking that image.

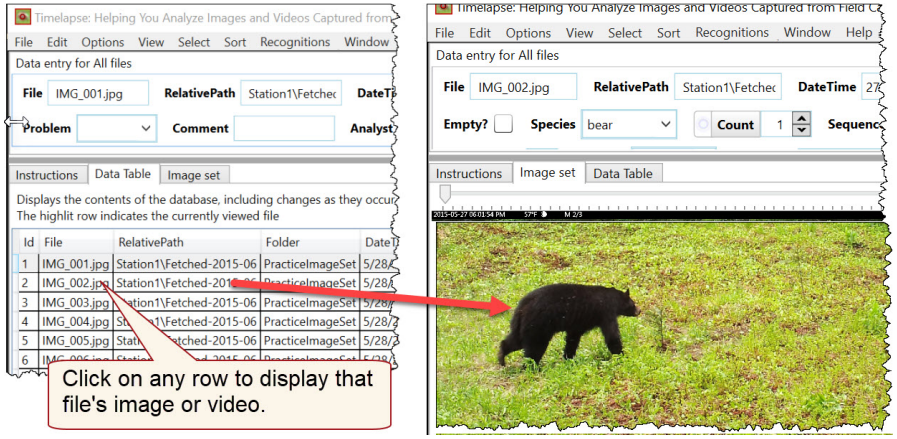


Navigation in the data table

The data table tab provides rudimentary navigation.

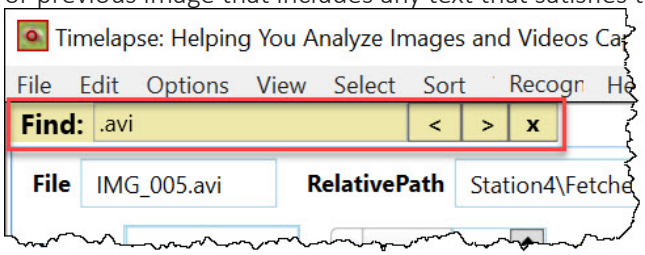
Clicking on any row in the data table will:

- switch to the *Image Set* tab,
- navigate to the file represented by that row, and
- display that file's image or video in full size.



Find file

Timelapse includes a simple search facility that navigates to the next or previous image that includes any text that satisfies the search term.



Find file is invoked either by

- selecting *Edit|Find file*, or
- pressing *<Control>-f*.

To use *Find file*:

- Enter a search term. Search terms are case-insensitive, which means you don't have to worry about capitalization.
- Use the < > buttons to find the next or previous image whose file name contains that search term. Repeat this using the same buttons or by pressing the ***return*** key.

For example, in the illustration above, the analyst is searching the Station4 folder in the practice image set for the video files,which are intermixed with image files. As these videos are suffix '*.avi*', the analyst has typed '*.avi*' into the ***Find file*** box, and pressed enter (or >). This searches for and displays the next file name in the sequence (if any) that contains the text '*.avi*'. In this case, *IMG_005.avi* is found and displayed. If the analyst presses enter two more times, it displays I*MG_009.avi* and then *IMG_013.avi*. On the next enter, no subsequent matches are found, so it restarts the search from the first file in your selection.

Of course, ***Find file*** can be used to find a particular file by name. For example, searching for '*_013*' will find *IMG_013.avi*.

Part 8

Data entry

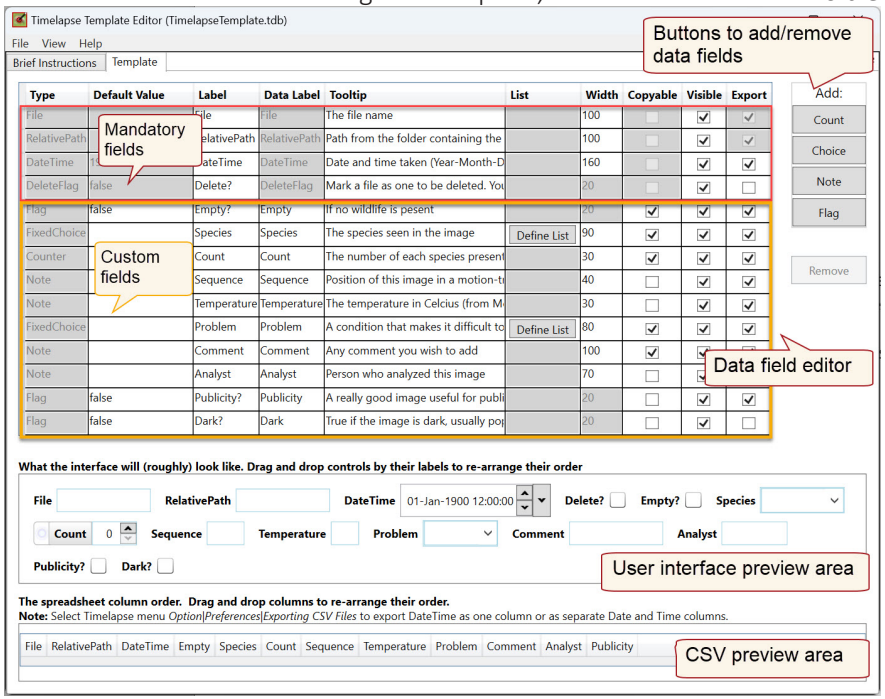
Data entry is fundamental to tagging. If not done efficiently, data entry can consume enormous amount of time, be incredibly tedious, and tends to be error-prone. Timelapse helps mitigate data entry issues by providing a variety of methods for inputting data, for dealing with repetitious data entry, for automatically populating some fields (e.g., with existing file metadata). It also includes facilities for correcting common errors such as dates.

The template defines your data fields

The *Timelapse Quickstart Guide* and the *Timelapse Template Guide* describes how the template file defines the data fields you see in the ***data entry panel***. To summarize...

- A project manager uses the ***Timelapse Template Editor*** to create the template *.tdb* file.
- The template file is copied into your root folder.
- To load an image set, the analyst uses Timelapse to select that template, where :
  - » the root folder containing the template is searched for images;
  - » the data fields in the data entry panel are created based on the template specifications;
  - » the database *.ddb* file that holds the data is created, also based on the template specifications.

An example template, shown in the template editor, is below. It is slightly different from the PracticeImageSet template, as all fields are set to ***Visible***.

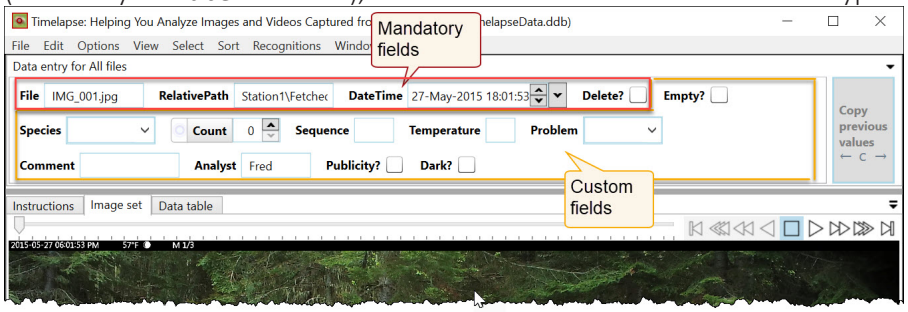


In brief, the upper part of the editor is the data field editor. It always includes several mandatory data fields that will hold file information (file name and folder location, date/time), and a ***DeleteFlag*** that an analyst can use to tag files for later deletion. The data field editor can also define various custom fields to hold the data specific to the project.

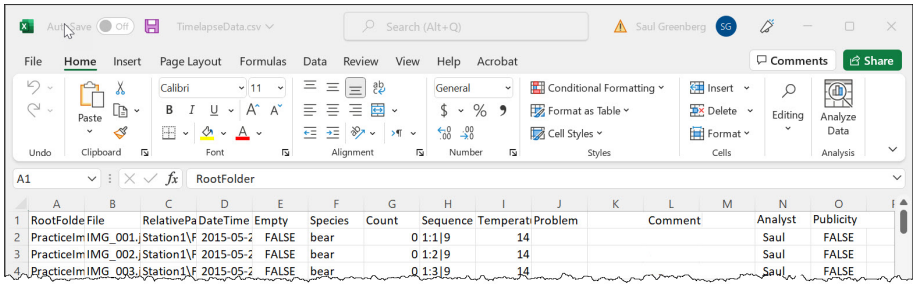
Various attributes can be set for each field: its ***type*** (***Count***, ***Choice***, ***Note*** or Flag), its ***label*** appearing in the user interface, its ***data label*** that names the column ***storing*** the data in both the database and the exported *.csv* file, its initial ***default value***, the ***width*** of the data field in the user interface, whether its ***copyable*** (more on this later), and whether the data field should be ***visible*** or hidden. For ***Choice*** fields, a list defines the entries in its drop-down menu.

The lower panel provides a preview of how the data fields will appear in the user interface. The bottom pane previews the data column names in the exported *.csv* file (fields whose ***Export*** option are unset are excluded).

When this template is loaded into Timelapse, the data entry panel is created based on the template, as illustrated below. Note the one to one correspondence between the rows in the template and the data fields in the panel (named by the ***label*** attribute), and how the various fields reflect their type.



Similarly, here is the exported *.csv* file, whose column names (defined by the ***datalabel*** attribute) also correspond to the template.



The data fields

Timelapse provides a variety of data fields, both mandatory and custom, as described below. Every field will show a ***tooltip*** — the brief help message defined in the template — when you hover over it with the mouse cursor. A right mouse button click also raises a context menu, where its contents depend upon the type of data field.

Mandatory data fields

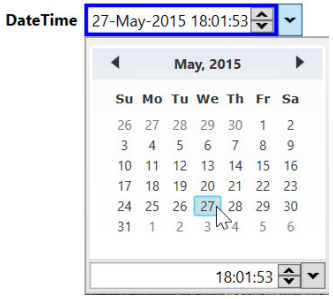
Several mandatory data fields are always included in the Timelapse database. However, the template defines whether they are visible or hidden in the Timelapse user interface. Each field is detailed below.

File, RelativePath fields are not directly editable. They specify attributes concerning the location of a file in the filing system. These fields are automatically filled in by Timelapse when a file is loaded for the first time. Consider, for example, the file *IMG_001.jpg,* located in the sub-folder *Station1\Fetched-2015-06* within the *PracticeImageSet*.

- *File* contains the file's name, i.e., IMG_001.jpg.
- *RelativePath* contains the sub-folder path, if any, from the root folder to the file, i.e., *Station1\Fetched-2015-06.*

Because all references are relative to the root folder, the file's location is determined by combining the contents of its ***RelativePath*** and the ***File*** field: *Station1\Fetched-2015-06\IMG_001.jpg*. This is why Timelapse can still find the file even if the root folder is moved.

DateTime contains the file's timestamp in local time. It is automatically filled in by Timelapse when a file is loaded for the first time. Timelapse first searches the file's metadata to see if it contains the date the image or video was created. If it cannot find that, it falls back to use the date maintained by the file system. That fallback date, if used, may or may not be accurate as it is sometimes changed when files are copied.

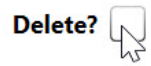


The ***DateTime*** field is editable. You can click any of its textual parts (e.g., month) to change that value either by typing or by using the up/down

buttons. Alternately, you can show a drop-down calendar / time field and change the date/time that way.

Workflow tip. While you can change each file's *DateTime* field individually, Timelapse includes a variety of facilities to correct most date and time errors across all your files, accessed via ***Edit | Date correction...*** See the later section in this part on *Correcting dates and times*.

Delete? is a specialized field used by analyst to tag files for deletion. Deletion of tagged files is not actually done until the analyst selects the ***Edit | Delete*** menu, where the delete operation is performed on those files marked for deletion. That menu option includes sub-menus where the analyst can choose to delete the file, or the data associated with that file, or both. See *Part 4 Menus*.

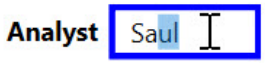


Custom data fields

As mentioned, the Timelapse template can be edited to create custom data fields specific to the project needs. Using Timelapse, analysts can fill in those fields with tag data.

All custom data fields are one of four types, as described below. Each custom data field also includes a context menu, raised by clicking the right mouse button.

Notes hold any text, and can be edited by typing. The template in the practice image set specifies four custom note fields: ***Sequence***, ***Temperature***, ***Comments*** and ***Analyst***.



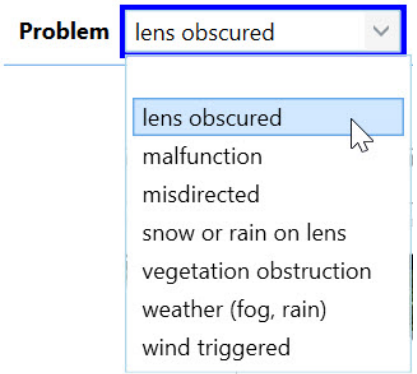
Notes include auto-completion, where each note field predicts the rest of the word you are typing based on previous note entries. . Predictions appear highlighted in blue. In the example above, the analyst has typed the letters 'Sa'. The ***Note*** field predicts that the letters 'ul' will be typed next, highlit in blue. At this point, the analyst can ignore the prection simply by typing, or accept it by pressing return or tab.

You can also have Timelapse automatically populate - for all your currently selected files- a particular note field with certain kinds of data.

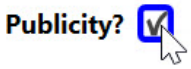
- *Metadata.* You can direct Timelapse to look up a particular file's metadata field, and fill in the note field with that file's metadata value (see section ***Populating fields from metadata***).
- *Episode information*. You can direct Timelapse to examine and identify image sequences, where each image in a sequence is separated from the other by a short time interval. Note fields are filled in with an identifying sequence number plus the position of that image in the sequence (see section ***Episodes***).

Choices are limited to a predefined list of items (defined in the template). The analyst can select an item from the Choice's drop-down menu. Alternately, the analyst can type an item's first letter to select it, and/or use the down/up arrow keys to navigate through the items. The template in the practice image set specifies two custom choice fields: ***Species*** and ***Problem***.

For example, the ***Problem*** choice field shows eight selectable values on the drop-down menu (the first item is an 'empty' choice that lets you clear the field). The selected item will appear in the text box.



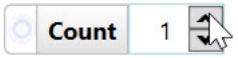
Flags are either checked or unchecked. When checked, its data value is set to *true*. When unchecked, its data value is *false*. The template in the practice image set specifies two custom flag fields: ***Empty?*** and ***Publicty?***.



You can also have Timelapse automatically populate - for all your currently selected files- a particular flag field with certain kinds of data.

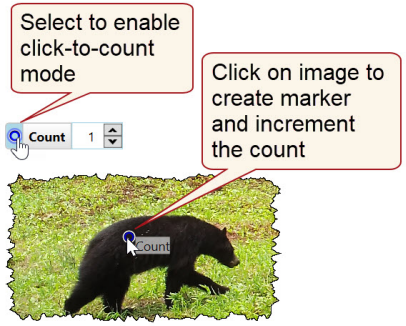
- *Dark information.* You can direct Timelapse to examine each image to see if its dark (i.e. a night-time). The flag will be set to true if it is dark, otherwise false. See section ***Classifying dark images.***

Counters hold a numeric count, usually of the things you are counting in your image. The template in the practice image set specifies one custom counter field: *Count*.



Count fields are set in one of three ways.

- *Type in a number* directly into the count field.
- *Click the up/down arrows* to increment or decrement the count
- *Count by marking*. The left side of the counter field is a toggle button. Select it to activate it (which turns blue). You can then click on the things you see in the image to increment the count and to leave a ***marker*** on the image to show what has been counted. See the upcoming section on *Counting with markers* for more detail.

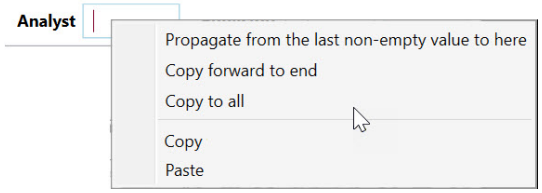


Workflow tip. Timelapse includes many methods for filling in these data fields, as will be discussed in the following sections. When used effectively, these methods can save you a massive amount of time when tagging images. It is definitely worth your while to become familiar with them.

The *Quickstart Guide* provided an introductory tour through some of them. Its a good place to start. Then come back here and read about their details and the various ways these methods can be applied in your own workflow.

The data field's context menu

All data fields include a context menu that can be raised by right-clicking its field. The contents and actions triggered by each menu depends somewhat on the data field. Copy/Paste is familiar.



The three items below simplify repetitive data entry on a single field, They all work by copying a file's data field value to other files.

Propagate from the last non-empty value to here searches backwards from the current file until it finds a non-empty value in the selected data field. It then goes forward again, where it copies that last non-empty value into each file's data field up to the current file. This is somewhat equivalent to back-filling in spreadsheet, where empty values are filled in by taking the last non-empty value and copying it forwards to the current row.

Copy forward to end will copy the current field's value to all subsequent files in the sequence. Values in those fields, if any, will be over-written.

Copy to all will copy the current field's value to all files in the sequence. Values in those fields, if any, will be over-written.

Workflow tip. *Propagate from*, *Copy forward*, and *Copy to all* only affect the currently selected files. Consquently, the analyst can use the ***Select*** menu to narrow the files affected (see *Part 9 Selecting subsets of files*).

For example, if the Select menu was used to select a particular folder, ***Copy to all*** would only apply to the files in that folder.

Workflow tips.
Copy to all is a very easy way to populate a data field with a constant value. For example, the *Analyst* field in the practice image set should contain the name of the analyst tagging each file. If the analyst was solely responsible for analyzing all files, the name could be entered in the *Analyst* field for a single file . Invoking *Copy to all* on that *Analyst* field would then copy that name to the *Analyst* field for all other files.

Propagate from the last non-empty value to here. The analyst fills in a field on one image, and then navigates sequentially through subsequent images until the last one that should also contain that field's value. The analyst can then backfill the entries from that first file to the current one. This only works if those in-between images have no value set in that field.

Copy forward to end is somewhat similar. Again, the analyst fills in a data field on one file, but then immediately does a *Copy forward to end.* This copies that field's value to all subsequent images in the current selection. The analyst would then navigate through the photos until that field should hold a different value. The new value is entered, and copy forward is applied again. This is repeated for all files. *Copy forward to end* does demand discipline. Care must be taken not to over-write existing values (e.g., if things were filled in out of order), and the process needs to be repeated across all images. Otherwise some filled in fields would be incorrect.

Try each method using the practice image set. Narrow the file selection to the *Station1\Fetched-2015-06* folder via ***Select | All files in a folder and its subfolders***. Use files IMG_001 - IMG_010. The first nine contain bears, and the last one has no animal in it. Fill in the *Analyst* field for IMG_001 with your name and the *Species* field with 'Bear'. Then do the following.

- *Copy to all* on IMG_001's *Analyst* field results in your name being copied to the *Analyst* field for all files in the currently selected folder.
- Navigate forward to IMG_010 (which is empty) and then back to IMG_009 (bear). *Propagate from the last non-empty value to here* on the *Species* field will back-fill IMG_002-009 with Bear.
- *Copy forward to end* on IMG_001's *Species* field will copy 'Bear' to all subsequent files. Navigate forward to IMG_010.jpg, set the *Species* field to blank, and *Copy forwards* again. Navigate until the next species change, and repeat as needed until all files in the folder are processed.

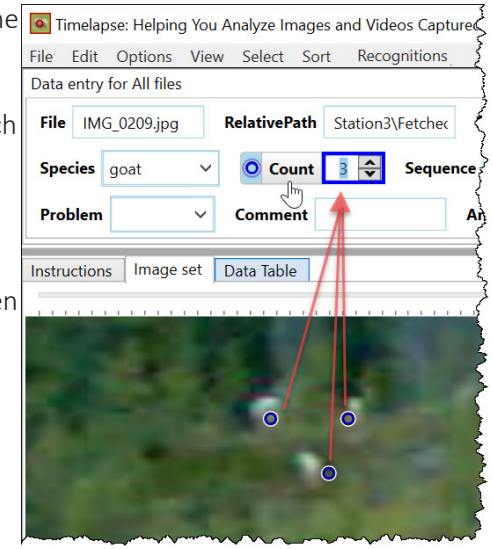
Counting with markers

As previously mentioned, *Counter* fields can be incremented and decrements several different ways. In particular, counting with *markers* presents an alternative to typing. Counting is by clicking on the entities in the image, which increments the count and creates a visual marker indicating that location. If there are multiple counters, each marker remembers and can indicate which counter was used to create it.

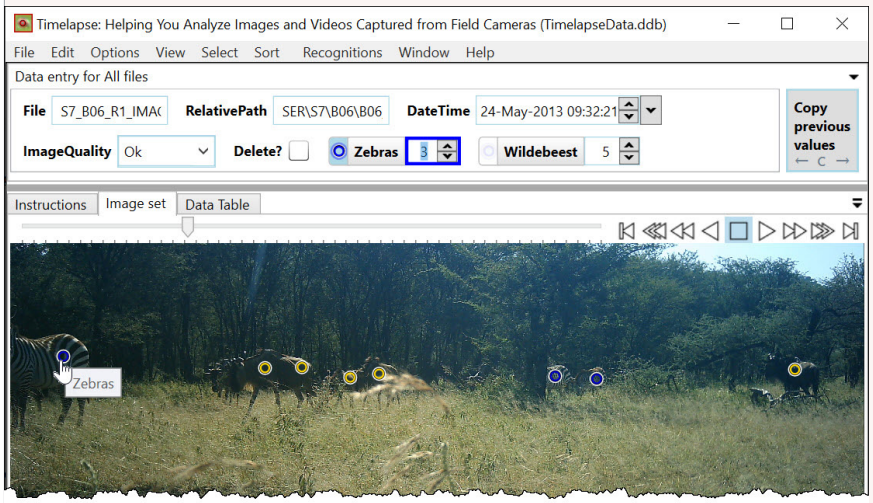
- ***Activate a counter*** by clicking its radio button, which turns it blue.
- ***De-activated a counter*** by clicking it again, or by selecting another counter to activate that one instead.
- ***Create a marker*** by left clicking atop the thing you want to count on the image. Note that the counter must be selected (indicated by its blue radio button).
- ***Highlight which markers belong to a counter*** by hovering your mouse cursor over that counter.
- ***Identify a marker*** by hovering your cursor over it. A tooltip appears displaying the label of the counter used to create that marker.
- ***Delete a marker*** by right clicking on it.

If there are multiple counters, markers matching an activated (blue) counter appear in blue. Other markers representing other entities are in yellow (matching the yellow color of the other unselected counter buttons).

In this example, the analyst has zoomed into *IMG_0209.jpg* in the practice image set, identified three goats (the white blobs), filled in the *Species*, and activated the *Count* counter. The analyst then clicked next to each goat, automatically increasing the count to 3 (for each click). Three blue markers now appear atop the goats. These markers are remembered by Timelapse, and will be seen whenever the analyst displays that file.



Workflow tip. Consider the example below, which contains a Zebras counter and a Wildebeest counter. The analyst has used those counters to tag three zebras (the blue markers, as the Zebra marker is still active), and Wildebeest (the yellow markers). Note how the tooltip over the blue marker reveals that it is associated with the Zebras counter.

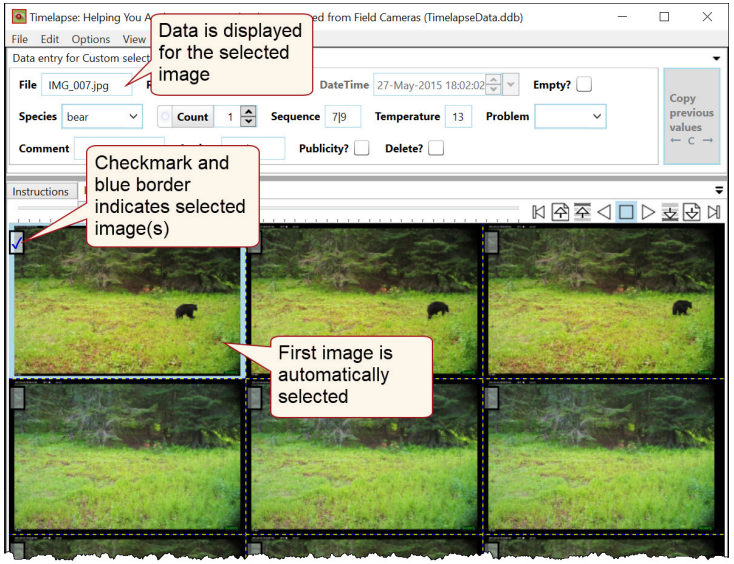


This example illustrates two useful purposes for markers that go beyond rapid input.

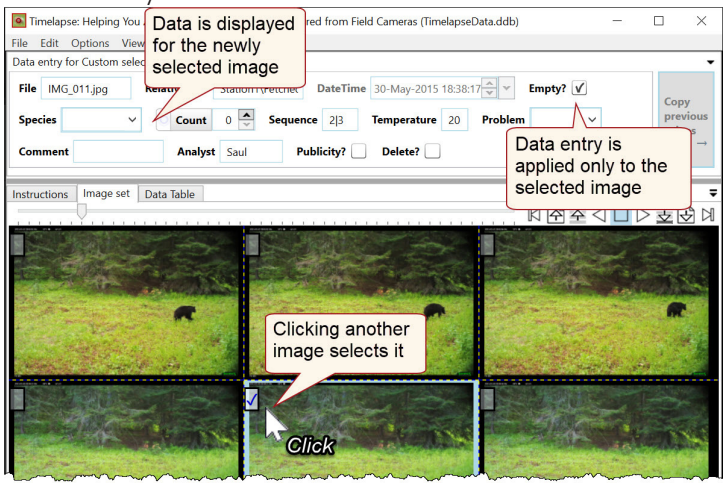
1. *Seeing what was counted.* When there are many entities in an image, the analyst can easily lose track of what has been counted, especially if they have to repeatedly zoom into different areas to identify what was seen. This can result in double counting, or in missing an entity because they thought it had been included. When markers are used, they reveal what has been counted.
2. *Validating counts.* Ins some cases, an analyst's work may be reviewed for accuracy. Markers directly associate the numbers in each count field to the entities that were counted. This helps the reviewer check for mis-classifications and/or miscounting. Markers also help the reviewer to find tagged entities that are hard to see, e.g., lost in the shadows, behind other wildlife or landscape features, that are distant and small, or that are otherwise obscurred.
3. *Training.* New analysts often need to be trained on how to inspect images, especially for finding and classifying obscur details. Having them review a filled in image set can aid training, where markers help the trainee identify where to look in an image.

Data entry in the overview

The overview, introduced early, is an especially powerful way to manage data entry for multiple files at a time. When the analyst switches to the overview, or scrolls within the overview, the top-left file (in this case *IMG_007.jpg*) is automatically selected and its data displayed. Selected files are highlit with a checkmark and blue border.



A single click on another file selects and displays data for that file (in this case *IMG_011.jpg*). If the analyst enters any data, that data is applied only to the currently selected file.



The analyst can also select multiple files and change data for all of them. Multiple selection obeys the Windows standard, as follows .

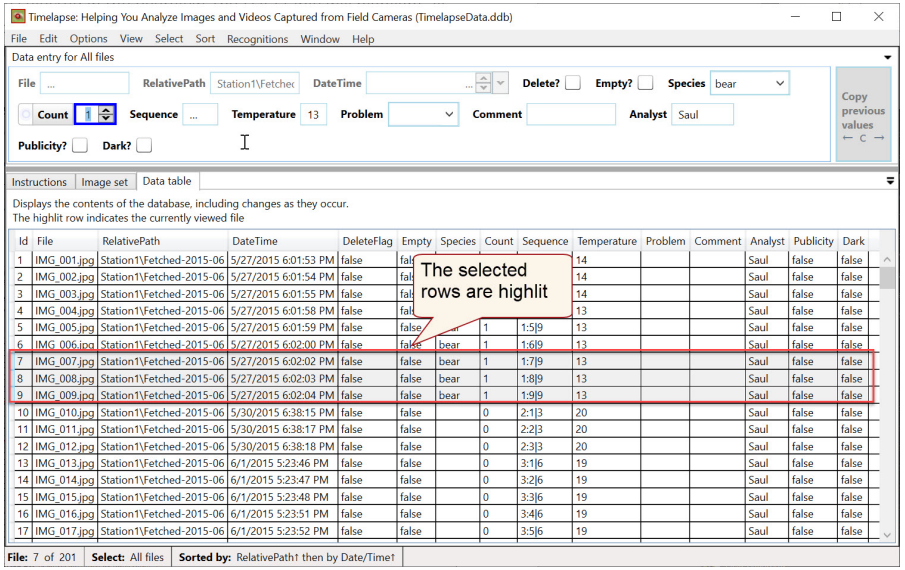
- *Click and drag selects a range of files:* Mouse down on the first file, then drag to and release over the last desired file. All file between the two will be selected.
- *Control-click adds or removes a file to the current selection.*
  - » an unselected file is selected and added to the set of selected files.
  - » a selected file is unselected and removed from the set.
- *Shift-click a file extends the selection* from the previous selected file to the current file. If there is no previously selected file, it will extend the selection to the next selected file.

When multiple files are selected, data is displayed only if it is common to all selected images. If data differs, an ellipses '...' will be displayed instead.

In the example below, the analyst is about to tag several files simultaneously as having a single bear in it. She dragged over the first three files (which all have a bear in them) to select them. The data fields displaying an '...' indicates that they don't share a common value (e.g., ***Species*** was previously set to bear for the first file, but was not yet set for the 2nd and 3rd file). In contrast, the ***Temperature*** field indicates that those selected files are currently set with a common value (13). Tagging ***Species*** as 'Bear' and ***Count*** as '1' applies those tags simultaneously to all three files.

If multiple files are selected in the overview, the Data table will highlight all currently selected rows in light grey. The data fields also displays the values as they are filled in.

The figure below reflects what the data table would look like in the previous example after the analyst had entered the data for ***Species*** = bear, ***Count*** = 1 for the three selected image.



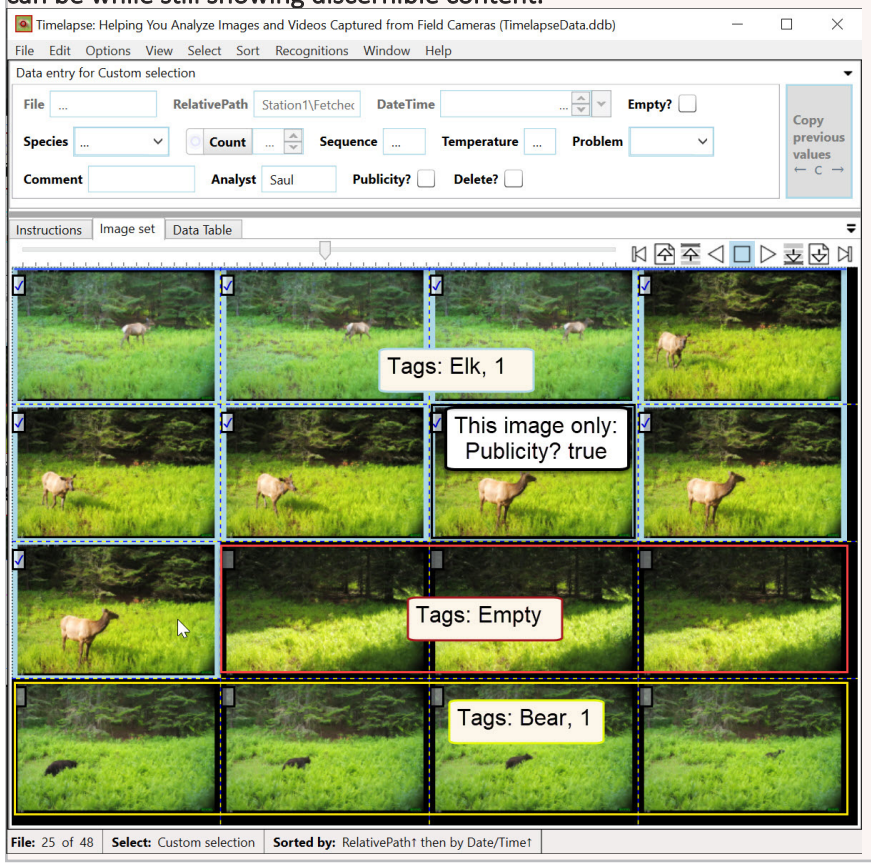
Note. The *Copy previous values* button and the *markers* function of the *Counter* button are disabled in the Overview.

QuickPaste works as expected in the Overview. It provides a very useful and efficient way to quickly entering multiple tags on a series of similar images. See the section in *Part 7 Data entry.*

Workflow tip. Working over a page of files can simplify tagging, especially if there are runs of similar images where its contents are clearly visible in the smaller files. Consider how these 16 files could be tagged.

- The first nine files are selected and simultaneously tagged with 1 elk.
- The next three files are selected and tagged as Empty.
- The next four files are selected and tagged with 1 bear.
- The seventh file is selected and tagged as a potential publicity shot.
- The analyst scrolls to the next page and repeats the process.

In practice, many more files can be simultaneously displayed, inspected, and tagged simultaneously. A large screen, for example, easily shows 50- 100 file at a time. The actual amount depends upon how small the displayed image can be while still showing discernible content.

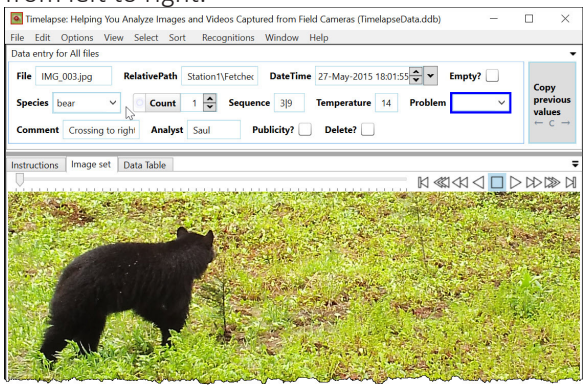


Copy previous values button

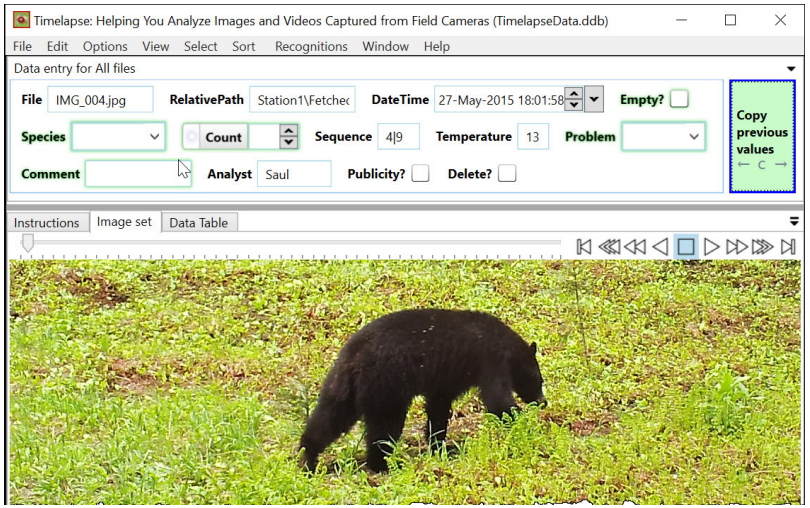
Camera traps often capture long sequential runs of similar images, where an analyst would repetitively tag each file with similar values. An example is a motion-triggered camera that takes many shots of an animal grazing in front of it, where all would be tagged identically.

The *Copy previous values* button, located on the right side of the data entry panel, increases the efficiency of repetitive data entry while reducing tedium. The idea is simple: The analyst clicks this button to selectively copy data from the previous file to the current file. The *QuickStart Guide* gave an example of how it can be used within a typical workflow.

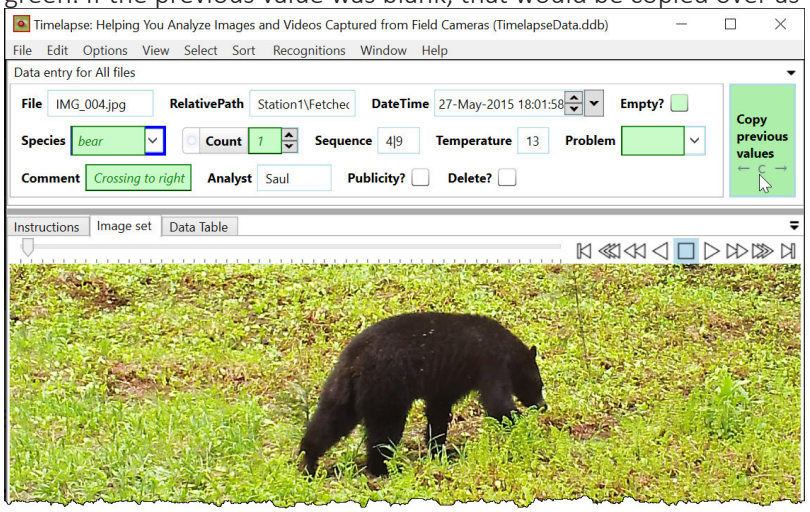
To illustrate further, consider an analyst inspecting *IMG_003.jpg* within the *Station1/ Fetched-2015-06* folder in the practice image set. Amongst other things, she tags a single bear and comments that it is crossing the meadow from left to right.



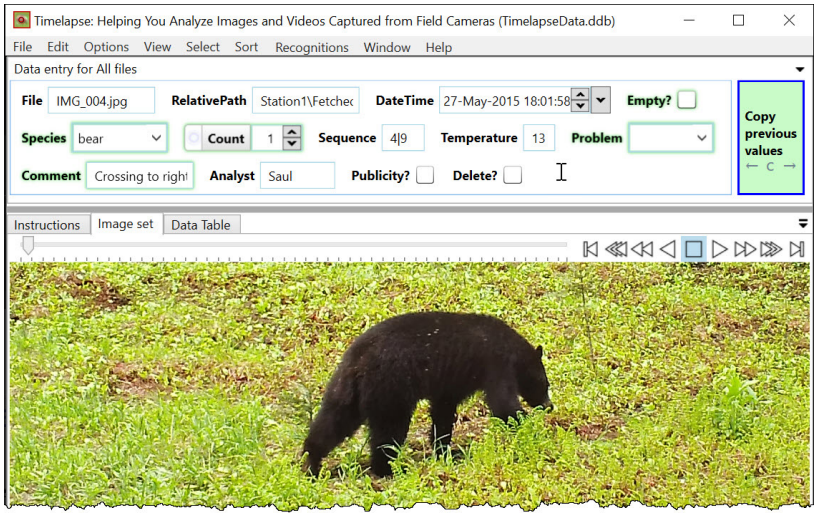
The analyst then navigates to the next image *IMG004.jpg*, which is similar to the previous image. Several fields now need to be filled in. Because the cursor is in the data entry panel, she sees the several fields outlined in green, which indicates that these fields eligible for copying. These are ***Empty?***, ***Species***, ***Count***, ***Problem***, and ***Comment***.



Rather than re-enter the same information manualy, she hovers her cursor over the *Copy previous values button*. The copyable fields now display a preview of what would be copied over from the previous image, all highlit in green. If the previous value was blank, that would be copied over as well.

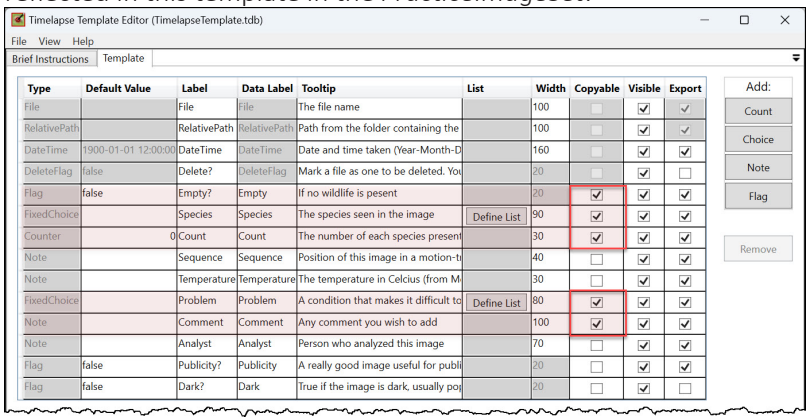


She now clicks the *Copy previous values button*, which copies over the data entered in those copyable fields from the previous image to the current image. The copied over fields are still editable. For example, the comment can be altered or deleted.



One button press has replaced several separate manual data entry operations. This operation can repeated over successive files, until the desired tags differ.

The Timelapse template determines which data fields are copyable, as reflected in this template in the *PracticeImageSet*.



Workflow tip. Determining which fields should be copyable deserves some thought. Typically, copyable fields should only be the ones that are likely to be common across a run of files. Non-copyable fields are typically the ones that will differ between files, or that are filled in bulk (such as via metadata or *Copy to all*).

Note. The *Copy previous values* button is disabled in the Overview.

QuickPaste

When tagging images in an image set, certain tagging patterns frequently occur, where the same set of tags are entered over and over again. For example, an analyst tagging wildlife (such as in the PracticeImageSet) may see the following data entry patterns over and over again:

» *Empty* = checked, *Problem* = wind triggered
» *Species* = deer, *Count* = 1
» *Species* = elk, *Count* = 1
» *Species* = bear, *Count* = 1

To make this a bit more interesting, let's also assume that the analyst often indicates, through their comments, three typical text entries of how the animal is moving through the scene, where these comments can occur over any animal.

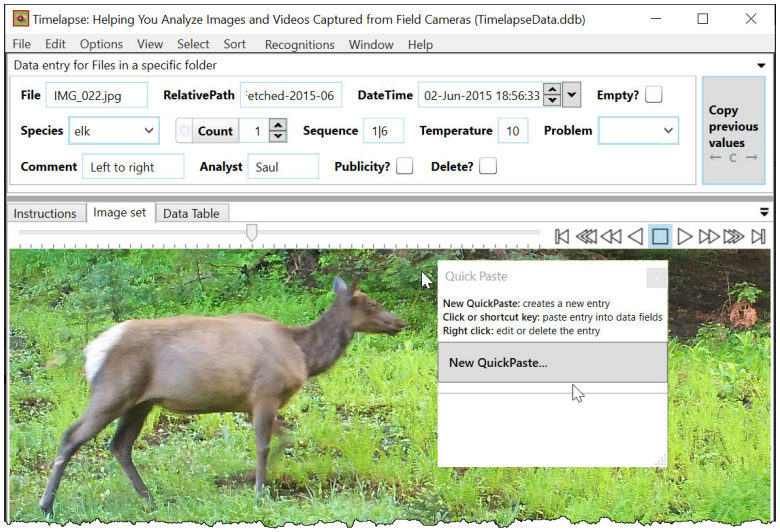
» *Comment* = left to right
» *Comment* = right to left
» *Comment* = standing around.

Timelapse includes a facility called ***Quickpaste***, where patterns can be recorded and applied with a single button click. In brief, Quickpaste lets you define a custum set of ***Quickpaste entries***, where each entry describes what data fields to use and their tagging values (e.g., ***Species*** = deer, ***Count*** = 1). No other fields are affected. Each entry is then presented as a ***Quickpaste button***. Selecting that button pastes those tag values in the corresponding data field. That is, a single button click replaces manually filling in multiple data fields.

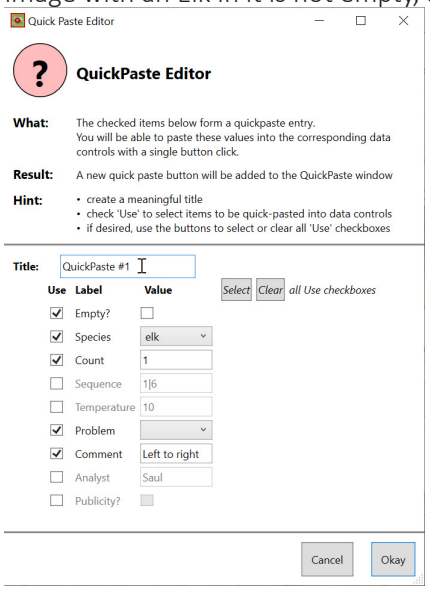
The sequence below illustrates several essential elements of Quickpaste and how it works. It begins at *IMG_022.jpg* in the *Station1\Fetched-2015-06* folder of the practice image set.

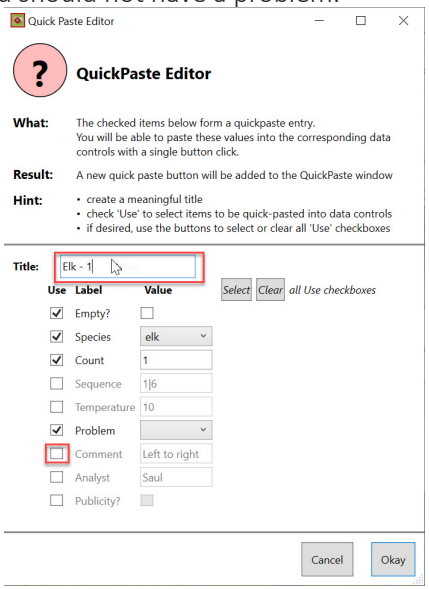
Creating and using Quickpaste entries

Let's assume that the analyst has filled in the data for this image with a single elk in it. Because this is an oft-seen pattern, she decides to create her first Quickpaste entry. She raises the Quickpaste window by selecting ***Edit | Show Quickpaste Window***, or by typing the shortcut key 'Q'.

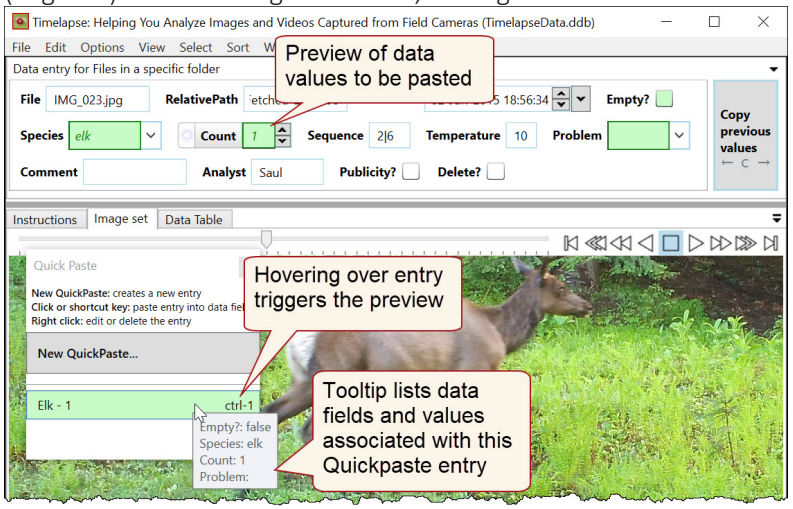


She clicks the ***New Quickpaste...*** button, which raises the ***Quickpaste Editor*** window. All fields eligible for pasting are displayed, and automatically populated with values taken from the currently displayed file. Data fields that are marked as copyable in the template are also automatically selected. She edits the ***Title*** to make it descriptive, and deselects ***Comment*** as she plans to make separate Quickpaste entries for that. She leaves the others as is, as an image with an Elk in it is not empty, and should not have a problem.

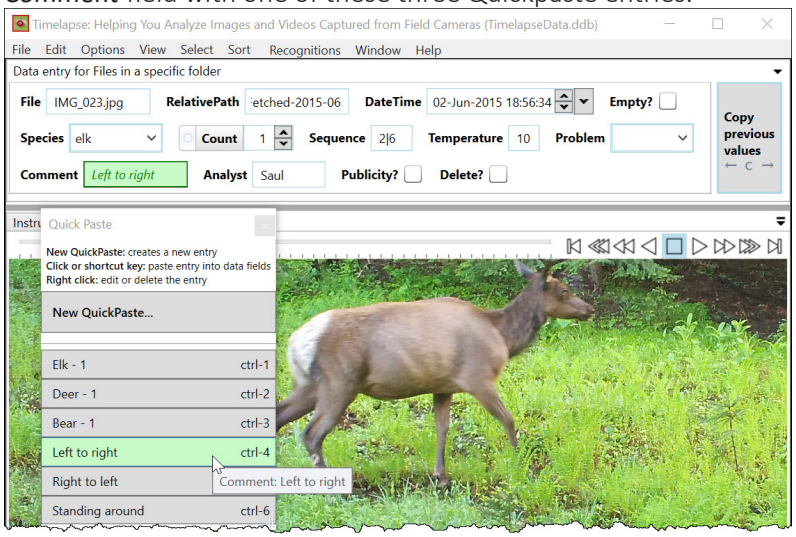




After saving the entry, the Quickpaste window now contains a single button labelled with the title provided. She navigates to the next image, which also contains a single elk. She hovers over the Quickpaste entry, which provides a preview of which fields would be filled in and the values they would contain (in green). After clicking the button, the highlit fields will be filled in.

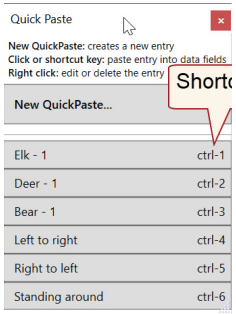


She creates two similar Quickpaste buttons for *Deer - 1 and Bear - 1.* She then creates three more to hold the specialized comments. She deselects *Use* for all but the *Comment* field, and sets the comment value to 'left to right', 'right to left' and 'standing around'. She can now populate the *Comment* field with one of these three Quickpaste entries.



Other Quickpaste features

Editing, deleting an existing entry or moving the quickpaste button up or down the list is done by right clicking a Quickpaste entry button, which raises a context menu containing those options.



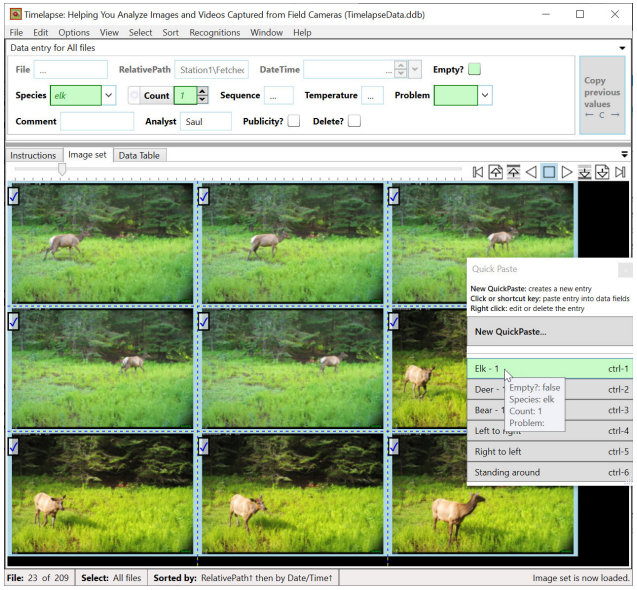
Quickpaste entry shortcut keys are assigned to each entry as they are being created. These shortcut keys only work if the Quickpaste window is open. Typing the shortcut key is the same as clicking the associated entry. The data fields will flash briefly to show they have been updated.

Saving Quickpaste entries. Timelapse remembers your QuickPaste entries in your image set's database (*.ddb*) file. When you re-open that image set, your QuickPaste entries will be there for you to use again. This also means that:

- Quickpaste entries can be customized for different image sets, as long as each has its own database;
- If you move your folder from machine to machine, the Quickpaste entries accompany them.

Importing Quickpaste entries. If you have a set of Quickpaste entries associated with another Timelapse database (*.ddb*) file, you can import them into your own database using *Edit | Import Quickpaste entries from a ddb file*... Only entries that match your data fields are imported.

Quickpaste works in the Overview. Select multiple files, and use Quickpaste to set multiple fields with a click.



Populating fields from metadata

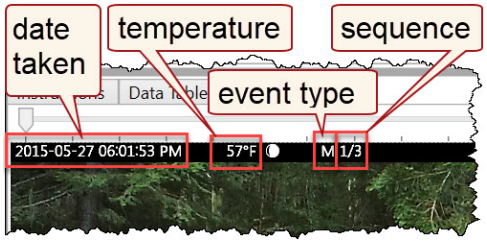
What is Metadata?

Image and video files almost always contain ***metadata***: data describing various properties of that file. Metadata is often written to the file when an image or video is taken. The examples below illustrate different metadata that could be included in camera trap files.

- *Exif standard* defines what metadata JPEG image files should include, such as camera model, exposure time, whether a flash was used, etc.
- *File metadata* describes general file attributes, e.g., the file size.
- *Makernotes* are camera and model-specific data that the camera manufacturer decides to include. For example, some camera trap models record the ambient outside temperature at the time an image was taken.
- *Video metadata* is idiosyncratic, where what is recorded can vary greatly. Its metadata may or may not include fields such as the video frame rate, duration, audio sample rate, etc.

Why is it useful?

While most file metadata is uninteresting, a few are quite valuable. Some camera traps even burn certain metadata values into the image's banner.



- *Date the image or video was taken* records the time the camera took the photo.
- *Ambient temperature* is recorded at the time the image was taken.
- *Event type* is if the image was taken in ***timelapse mode*** (at specified time intervals) or ***motion-triggered mode*** (when motion was detected).
- *Sequence.* Some cameras, especially when motion-triggered, will take a sequence of images. The sequence metadata records where the image is in that sequence (e.g., 1 of 3). See *Part 8 Episodes*, which is an alternative way to consider sequences of images.
- *Camera make, model and serial number* identifies the camera used.

Benefits and pitfalls of metadata

Exploiting metadata can have considerable benefits. First, the camera can record data that would be otherwise lost or unobtainable. Second, Timelapse can bulk-populate data fields with metadata extracted from the files.

However, metadata isn't perfect.

There is no guarantee that all your files will include the desired metadata. Your camera should follow a standard for some of its metadata fields, at least for *.jpg* files. Beyond that, what is written tends to be specific to the camera vendor or even the model. When your image set contains files taken by different cameras or models, they may not share the same metadata. Metadata present in files from one camera model may be absent from a file taken with a different camera model. This problem is somewhat worse if your image set has a mix of photo and video files, as video files do not seem to obey any standard.

Metadata may be labeled differently, and values recorded differently. Even if files from different camera models do include the same metadata, they may name that field differently. Similarly, they may record the data in different formats.

These pitfalls are not show stoppers. If the image set comes from similar camera models, there should be no issue. If the image set comes from a mix of different camera models, you should check and compare a sample file from each camera model used in your image set, in order to see:

- what metadata is present,
- how the metadata is named,
- the format of the metadata values.

Timelapse exploits metadata, while trying to limit its pitfalls. When files are first loaded, Timelapse examines each file for metadata that records the time the camera took the photo. This is more reliable than using the file system's creation data, as that may change when files are copied or edited. Analysts can also use Timelapse to:

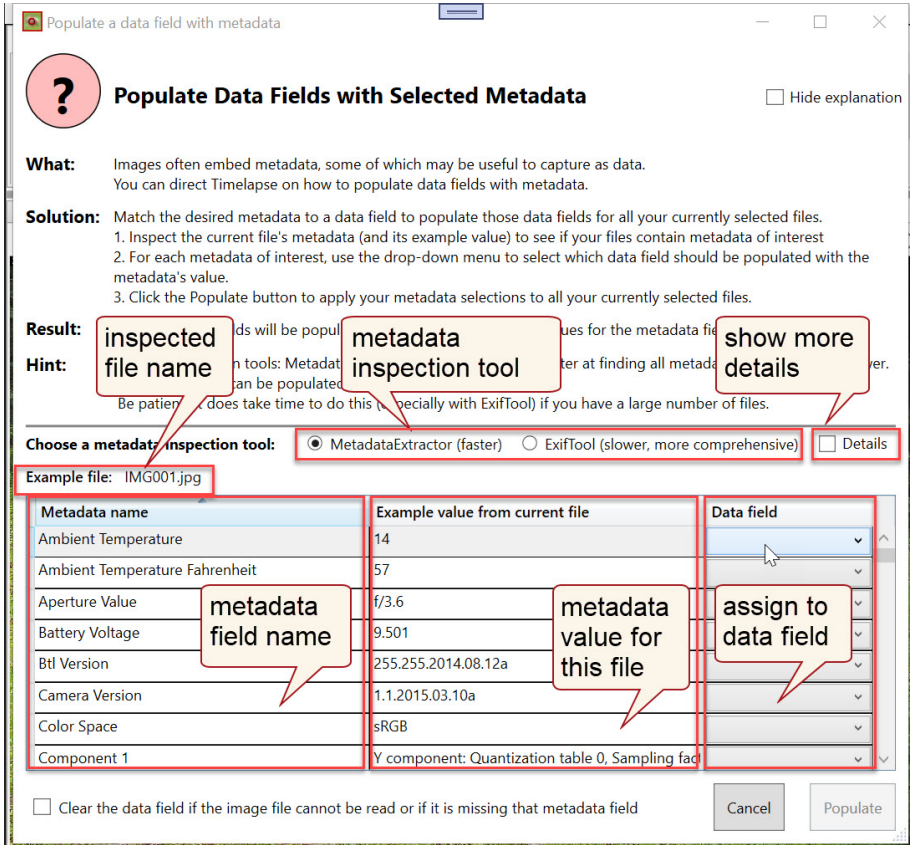
- inspect a file's metadata to see what it contains;
- associate metadata fields of interest with data fields of your choosing;
- populate those data fields with the metadata values found in each file;
- skip over metadata if the file does not contain that metadata, where that file's fields can be optionally cleared or left as is.

Inspecting file metadata

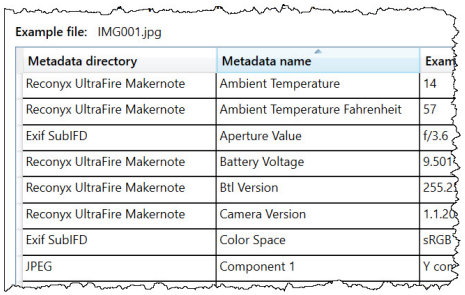
Analysts can inspect the metadata associated with a file by ***Edit | Populate one or more fields with metadata***[1]. A dialog box appears that displays:

- the name of the file being inspected;
- all metadata fields available in the current file (left column) ;
- the file's recorded value for each metadata field (middle) ;
- menus listing all the Note data fields (right, discussed shortly).

For example, the first row shows that file *IMG001.jpg* in the *Station1\ Fetched-2015-06* folder of the practice image set contains a metadata field named ***Ambient Temperature***, with a recorded value of '14'.



The ***Details*** checkbox, when checked, will display a further column called ***Metadata directory***, which further qualifies the metadata field name. The directory name describes the standard (if any) used to specify that metadata. This is equivalent to a namespace, and it helps resolves conflicts if two standards happen to use the same metadata field name. In this example, we see that:

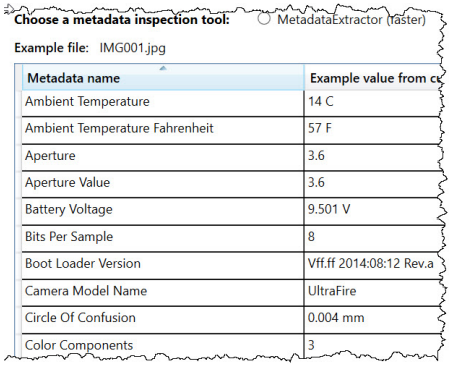


- the first two fields are created via the camera model standard, in this case Reconyx UltraFire Makernote
- the third field is defined by the Exif standard, etc.

The dialog also includes the option to inspect the file metadata using two different tools. Both have different capabilities.

- ***MetadataExtractor*** is very fast, but may not be able to read all the metadata available in the file.
- ***ExifTool*** is significantly slower, but much better at finding the available metadata, especially those that are vendor-specific. Note that if details are turned on, the Metadata directory column will be empty.

The screen snapshot on the right was taken on the same file using ***ExifTool.*** When compared to the ***MetadataExtractor*** tool, we see that its better at revealing extra fields. For example, the ***Camera Model Name*** is now included. We also see some formatting differences in the recorded value, e.g., ***Ambient Temperature*** is '14' *vs.* '14 C'.



Workflow tip. Use *MetadataExtractor* if you can, as it is significantly faster at populating your data fields with metadata values (see next section). Use *ExifTool* only if it is the only way to get the metadata you need. Its still way faster than typing the value into each field.

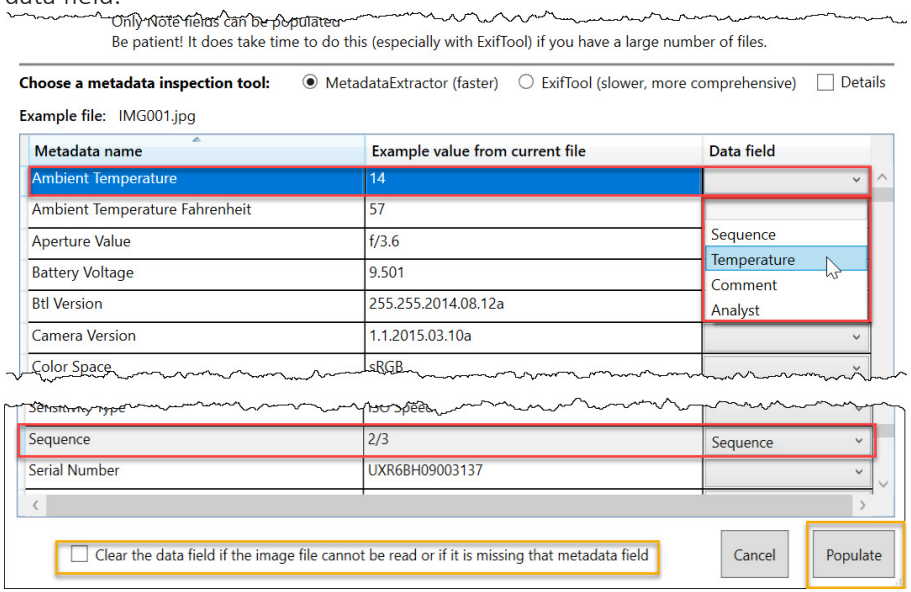
[1]The Timelapse Template Editor includes a similar menu ***View | inspect file metadata***.

Populating data fields with metadata

Using the metadata dialog, the analyst can associate one or more metadata fields with one or more existing Timelapse data fields. This is done via the third ***Data field*** column.

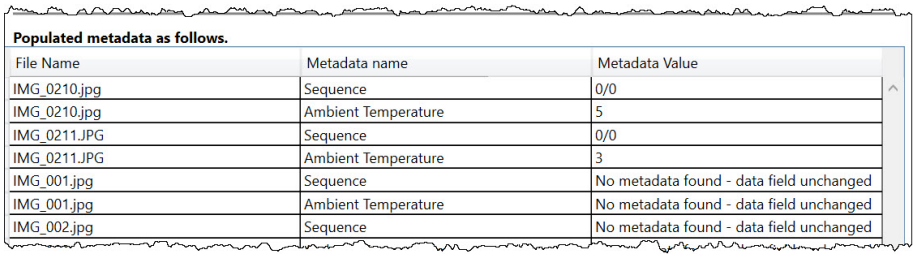
The data fields used are normally anticipated ahead of time, where the template defines and names those data fields as needed. For this example, the project manager has created two data fields ***Temperature*** and ***Sequence.*** Both are of type ***Note***, as only that type (which can contain any text) is suitable for holding metadata values.

Each ***Data field*** drop-down menu displays all ***Note*** fields. The analyst then associates the two by choosing and setting the ***Data field*** drop-down menu in the desired metadata's row. In the example below, the ***Sequence*** metadata has already been associated with the ***Sequence*** data field while the analyst is currently associating ***Ambient Temperature*** metadata to the ***Temperature*** data field.



The analyst can configure Timelapse to take different actions if it detects that the metadata is not present in a file during the data field population process. The checkbox option at the bottom of the screen is set if that file's data field should be left as is (the default) or cleared.

When the analyst clicks Populate, Timelapse will go through all currently selected files, check if the chosen metadata fields exist, and if so will populate the associated fields with the metadata field values. Timelapse will also provide feedback on what has happened, as illustrated below.



Populated metadata as follows.

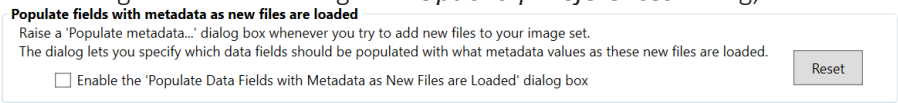
File Name	Metadata name	Metadata Value
IMG_0210.jpg	Sequence	0/0
IMG_0210.jpg	Ambient Temperature	5
IMG_0211.JPG	Sequence	0/0
IMG_0211.JPG	Ambient Temperature	3
IMG_001.jpg	Sequence	No metadata found - data field unchanged
IMG_001.jpg	Ambient Temperature	No metadata found - data field unchanged
IMG_002.jpg	Sequence	No metadata found - data field unchanged

Populating on file loading or on demand

The previous example illustrated how an analyst can populate metadata on demand using ***Edit | Populate one or more fields with metadata***. This occurs after an image set is already loaded. If there are many files, the analyst may have to wait for this operation to complete, as it could take some time to do.

Alternately, the analyst can set Timelapse to populate data fields with metadata as new (previously unseen) files are being loaded or added. The advantage is that both operations are done in a single step, instead of as two separate steps.

This setting is available through the ***Options | Preferences*** dialog, as follows.



When set, Timelapse takes special action when the analyst uses ***File | Load template, images and video files...*** to load a new image set, or ***File | Add image and video files to this image set...*** to add new images to the existing image set. The ***Populate metadata*** dialog will appear before loading is done, allowing the analyst to indicate the desired metadata of interest as before. Subsequently, as new files are loaded, its data fields are updated with those metadata values. However, the feedback dialog will not be displayed.

Workflow tip. The choice of populating metadata on file load or on demand is yours. Both achieve the same effect. But if you expect to populate metadata on an image set, it is more time-efficient to load new files and its particular metadata values as a single operation.

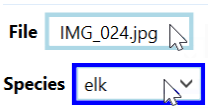
Tabbing between fields and the text focus

Data fields can be selected for input either by clicking on them with the mouse, or by tabbing between fields. Tabbing is useful: both data entry and data field navigation uses the keyboard, which minimizes the back and forth shifting between keyboard and mouse. While tabbing takes some getting used to, it can be a very handy way to enter data quickly. Tabbing nuances are explained below.

Definition: Focus is the data field or user interface control currently accepting text input.

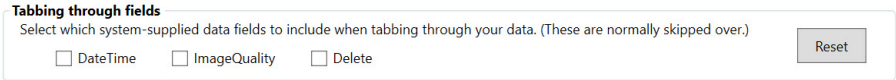
Whenever a data field is selected, either with the mouse or through the tab key, it obtains the ***focus***, where:

- read-only fields are outlined in thick light blue;
- editable fields are outlined in thick dark blue.



When a data field in the ***Data entry*** pane has the focus, tabbing works as follows.

- *Tabbing* cycles through the editable data fields in the pane. When the last field is reached, tabbing goes to the ***Copy previous values*** button. Another tab then goes the first editable data field.
- *Shift-Tabbing* goes backwards to the previous editable data field in your Data Entry pane. When the first field is reached, tabbing goes to the ***Copy previous values*** button. Another tab then goes the last editable data field.
- *Tabbing* and *Shift-Tabbing* normally skips over ***DateTime***, ***ImageQuality***, and ***Delete?*** data fields, as these fields are rarely edited. However, which of these three fields are included in the tab order can be set in the ***Options| Preferences*** dialog.



Workflow tip. Other Timelapse interface controls can also obtain the focus. For example, the image or video obtains the focus when clicked, thus enabling (for example) the left/right arrow shortcut keys for navigating through images. However, Timelapse does some optimizations to minimize constant clicking between panels. For example, if the image has the focus and the mouse cursor is moved over the data panel, the focus will automatically switch to the last data field that had the focus.

Particular keyboard actions / shortcuts work in somewhat different ways over the particular controls that have the focus.

- *All controls:*
  - » *Shift left/right arrow* or *shift page up/down*: navigate to the previous/ next image
- *Notes:*
  - » Type to enter or edit the data.
  - » *Left/right arrow*: character navigation as expected.
- *Counters:*
  - » Type to enter or edit the data
  - » *Up/down arrow*: increment/decrement the value.
  - » *Left/right arrow*: character navigation as expected.
- *Choice* menus:
  - » When you type a letter, the first menu entry that matches that letter is selected.
  - » *Up/Down arrow*: cycle through the menu items.
  - » *Left/right arrow*: navigate to the previous/next image
- *Flag* checkboxes:
  - » *Space*: toggle the checkbox.
  - » *Left/right arrow*: navigate to the previous/next image
- *DateTime*:
  - » *Up/down arrow*: increment/decrement the values.
  - » *Left/right arrow*: move between year/month/day fields,
- *Copy previous values* button
  - » *C* activates the button as if you pressed it
  - » *Left/right arrow*: navigate to the previous/next image

Workflow tip. Efficient data entry using only the keyboard is possible, and typically involves the following steps.

4. If a data field is not selected, select one.
5. Tab through each data field, until you reach one you want to edit.
6. Using the shortcut keys above, set each data field as desired.
7. When all data fields are filled in as needed, tab to the ***Copy previous values*** button. Use the *right-arrow* key to go to the next image.
8. Repeat steps 2- 5.

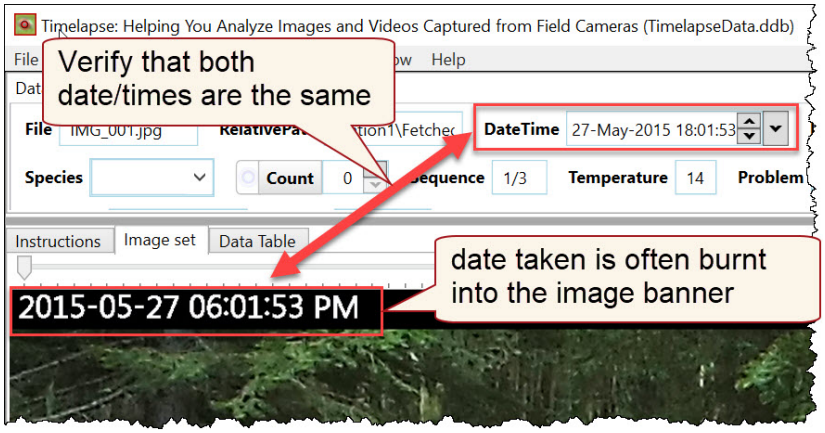
The above may take some practice, mostly in becoming familiar with the shortcut keys above.

Correcting dates and times

How a file's timestamp is determined

When loading a file for the first time, Timelapse tries to determine the date and time the image or video was taken. Ideally, the date/time is included in the file's metadata. This is usually the case with jpeg files, as including that timestamp is part of the jpeg metadata standard. If Timelapse cannot obtain the metadata timestamp, it uses the file's timestamp, which is set by the system when files are created, and modified. However, the file timestamp is less reliable, as they can change when files are copied.

The analyst should always check a few files after loading them for the first time to ensure that the dates are correct. Since most camera traps burn the date and time the image or video was taken into the image, this is an easy check to do. The good news is that, in most cases, the date/times will be the same.



Typical date/time issues

Dates and times can be problematic for many reasons, albeit rarely .

- If a photo or video editor is used to edit a file, the metadata or file timestamp may be altered. This is because some editors actually create a new file, where the old timestamp information is not copied over.
- If your file is copied (especially to the cloud), its file timestamps may be changed. This is why metadata timestamps are more reliable, as they are embedded in the file.
- Video files often do not include a standard metadata timestamp, which means the file timestamp is used. This makes videos more susceptible to problems, as its file timestamp can easily be altered during any copying process.

Other problems can arise from the way the camera trap records the time.

- The camera's date and time setting may be wrong, so all images are 'off' by a given amount.
- Some cameras record dates ambiguously. For example, if your camera records the date as (say) 01/02/2021, this could be interpreted as January 2, 2021 or February 1, 2021.
- A change between daylight savings time and standard time may have occurred, which isn't handled by your camera.
- The camera may keep time inaccurately, where times can drift (i.e., similar to a slow or fast clock)
- Even if time change is handled by your camera, your particular project may want all times to be recorded in Standard time vs. Daylight Savings Time.
- Cameras may be sited across different time zones, where – depending upon your particular project – you need to adjust the image times to account for that.

Resolving date/time issues

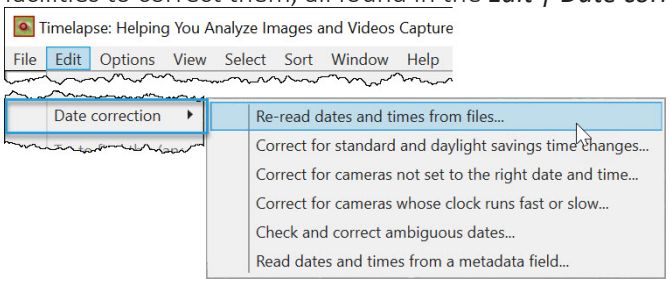
Timelapse includes various facilities to bulk-correct common problems across multiple files. While you can always correct erroneous dates individually via the *DateTime* control, you should only do this in exceptional cases, as manual date entry is extremely tedious.

Before delving into these Timelapse facilities, we should mention that the best way to handle date/time errors is to ensure they do not occur.

- Check your cameras before deploying them to ensure that they are both set to the correct time, and that they keep time accurately.
- If videos are crucial to you, it helps to buy cameras that encode the date/time the video was taken as metadata. This will require checking, as vendor web sites rarely provide this detail.
- Consider how files are managed when moved from the camera card to where they are stored on line. If files are copied or manipulated, check to see if the dates/times are maintained correctly (especially for video). You can do this by importing a few test files into Timelapse at various stages, where you can see what dates are extracted.

Workflow tip. If your file management process unavoidably changes your file's timestamp, a workaround is to load your files into Timelapse before the step that changes your files. If the folder structure and file name is the same, Timelapse will work on the altered files, as the dates and times are already extracted. If your folder structure differs, TImelapse includes facilities to let you match the original folder name with the new one , albeit with a bit of extra work.

When date/time problems do occur, , Timelapse provides various facilities to correct them, all found in the *Edit | Date correction* menu.

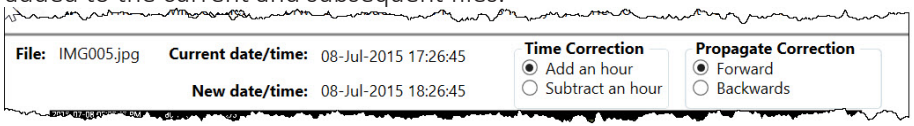


The descriptions below extends the summary previously provided in *Part 4 Menus* section. All correction operations are constrained to the currently selected files. Feedback is also provided after each operation listing how each file's date/time was changed.

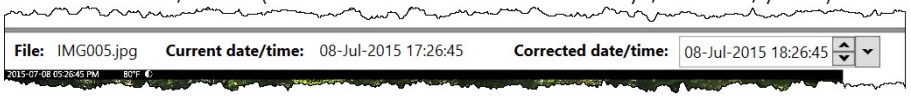
Re-read dates and times from files... displays a dialog box that will let you re-read the original dates and times from your currently selected image and video files. This is useful if you altered some dates or times, and want to revert back to the original ones. Internally, Timelapse only updates the date/time if the two differ. A dialog box provides feedback on what file date/tomes were changed, and whether the metadata or the file timestamp was used.

File name (only for files whose date differs)	Old date → New Date if it differs
---	Updated 3/209 files whose dates have changed.
IMG_001.jpg	✓27-Apr-2015 18:01:53 → 27-May-2015 18:01:53 (read from metadata)
IMG_002.jpg	✓27-Apr-2015 18:01:54 → 27-May-2015 18:01:54 (read from metadata)
IMG_003.jpg	✓27-Apr-2015 18:01:55 → 27-May-2015 18:01:55 (read from metadata)

Correct for standard and daylight savings time changes... displays a dialog box that lets you adjust the date to account for the extra / lost hour during time changes. This is useful for cameras that do not handle time changes automatically. This dialog asks you to navigate to the file where the time change occurs, and then provides the option to add or delete and hour to the date/times before or after that file. In the example below, an hour will be added to the current and subsequent files.

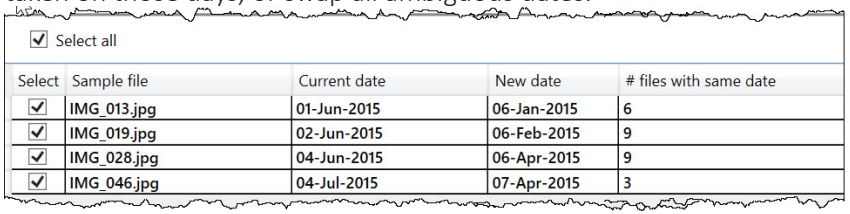


Correct for cameras not set to the right date and time... displays a dialog box that will let you adjust all dates and times. This is useful if your camera was not initialized to the correct date/time. All you have to do is supply the correct date/time for any image, and all others image dates/times will be adjusted by the same date/time difference. In the example below, an hour will be added to every file as that is the difference between the current an corrected date/times (this also works for incorrect days/months/years).

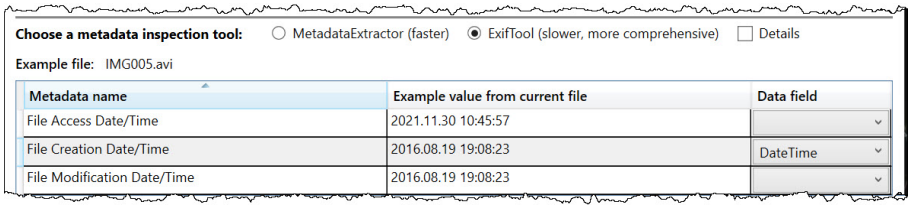


Correct for cameras whose clock runs fast or slow... displays a dialog box that will let you correct for clock drift, i.e., cameras whose clocks run slow or fast. The files with the earliest and latest date/times will be displayed. All you have to do is to supply the correct date and time for the last image, and all other dates and times will be adjusted proportionally. Note that this can be combined with the 'Cameras not set to the right date and time' if needed.

Check and correct for ambiguous dates... examines the first image of each day to see if its date is ambiguous, i.e., uncertainties about whether certain dates are in day/month or month/day order (e.g., is 01-06-2015 June 1st or January 6th?). Ambiguous dates are then displayed in the dialog box. Hovering over a date will display that image in a pop-up, so you can check the image itself. You can selectively swap the day/month order for images taken on those days, or swap all ambiguous dates.



Read dates and times from a metadata field… displays a dialog box that lists all metadata containing what appears to be a date or time value in the currently selected file. If no correct metadata date is returned by MetadataExtractor, try the ExifTool. If a correct date is available, you would assign that metadata to the DateTime field, and then ask Timelapse to populate all selected files to each file's value for that metadata field. Files that do not have that field are left unchanged. This is particularly valuable for correcting video file date/times, where the correct date/time may be stored in a non-standard metadata field.



Workflow tips. When correcting video dates by reading dates and times from a metadata field, you may want to constrain your files to only video files. You can do this through ***Select | Custom select***, where you select files that end with the video file suffix, e.g., *.avi*. The ***Glob*** expression allows for pattern matching, where the '*' matches any text. See *Part 9 Selecting subsets of files.*

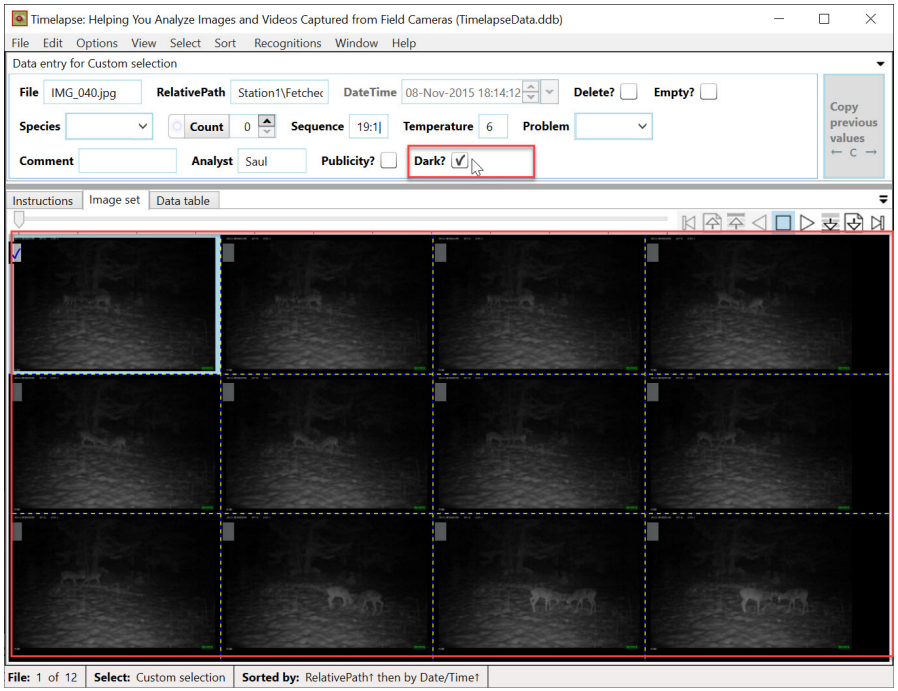
No matter which date/time correction facility you use, always check the new dates. If something went wrong, you can re-read the original dates back from the image by selecting *Edit | Date Correction | Re-read dates from files*. If things go really bad (but they shouldn't), you can always try to revert to a saved backup file in the *Backups* folder.

Classifying dark images

In certain situations, the analyst can find it helpful if the system could distinguish between night-time (mostly dark) images from day-time images. This is particularly useful for cameras that are in timelapse mode (images taken at fixed time intervals), as it allows the analyst to later filter out (and possibly delete) many hundreds or thousands of images that are less than useful.

Timelapse includes the ability to automatically classify *.jpg* files as day-time vs. night-time photos. Classification results are written to a flag field of your choice as either *true* if dark, otherwise false. The analyst can trigger this classification by ***Edit | Populate a field with Dark classification data…***

To illustrate, the analyst below has dark-classified the folder *Station1\Fetched-2015-09*. She then narrowed the selection to show only those dark files via ***Select | All files matching image quality | Dark files = true***, and then views them in the overview. The analyst can now manage them in bulk, for example, to delete the all.



When *Edit | Populate a field with Dark classification data...* the following dialog appears. When the analyst clicks the ***Start*** button, all files in the current selection will be classified.

The dialog also allows the analyst to tweak the threshold between dark and okay files. To understand how this works, we need to explain how Timelapse does this classification.

For each image, Timelapse samples many of its pixels. It then classifies an image as 'dark' by:

- checking to see if a large majority of image pixels are grey-scale vs color;
- counting the number of grey-scale pixels darker than a grey-scale threshold;
- checking if the total ratio of dark pixels in the image exceeds a dark percentage threshold.

The analyst can fine-tune how Timelapse uses these two thresholds to determine which images are dark vs. light.

To illustrate this, the analyst is checking previously classified images using the navigation slider at the bottom. The analyst has noticed that some of the dark files contain an identifiable animal. Consequently, she adjusts and increases the thresholds for determining what is Dark vs. Ok, where she observes the results on the example image.

1. The dark pixel threshold slider determines how dark the pixel has to be before it is considered a 'dark' pixel. It is currently set to a grey-level of 60 (the actual color is used to color the bar at the right), which is currently a very dark grey. Adjusting this to (say) 50 would reclassify this image as Ok.
2. The dark percentage threshold slider (the red vertical bar) determines how many pixels in the image have to be dark before the image is considered dark. It is currently set to 90%. Resetting it to a higher number (e.g., 95%) requires more pixels in the image to be dark.

3. Feedback is provided on the above operations. The length of the bar indicates the actual percentage of dark pixels in this image, where the actual percentage is textually described below it ('93% of the pixels are darker than the (grey color) threshold').
4. Examine other images to see how this classification works by using the navigation slider at the bottom. In particular, check for:
   - » false positives (i.e., images you consider light that have been mis-classified as dark)
   - » false negatives (i.e., images you consider dark that have been mis-classified as light).
   - » Readjust the thresholds as needed.
5. If you are happy with what you see, apply these thresholds to reclassify all your images. The image quality field for each image will be reset accordingly.

Timelapse saves these threshold settings, and will apply them to future image classifications. At any time, you can use the 'Reset' button to either:

- revert to the default system settings
- revert back to your own initial settings (e.g., if you made threshold changes in the dialog box that you did not like).

While thresholds can be achieved by trial and error, examining your images can help determine which threshold adjustment is best (as the two interact). In the example image above, the infrared camera flash brightens an area in the image, while leaving other areas very dark. Thus setting the dark percentage threshold to a higher value is the better approach, as it would require most of the image to be dark.

Duplicating a record

Timelapse includes the ability to create a duplicate of a file's record, where its data fields can be filled in independently. That is, two or more records can be associated with any file.

Why have duplicates?

To explain why duplicating a record is useful, consider the following (simplified) scenario using the practice image set.

The analyst is asked to tag wildlife seen in a file by filling in the species in the Species data field, and how many of that species are present in the Count data field. Yet a problem arises when more than one wildlife species is present in the image,as only one set of those data fields are available to fill in per file.

One solution would involve modifying the template to include multiple versions of each field (e.g., Species1, Count1, Species2, Count2…), but this adds considerable clutter. As well, if the number of different wildlife seen in an image exceed the number of extra fields made, the problem still remains.

A second solution, used by some agencies, relies on the use of motion triggers to create sequences (or Episodes), where several files are created in short interval of time. The strategy is to tag what is seen across the files in the sequence in only one of its files, that is, tagging is done once per Episode. However if multiple instances of a field are needed, the data fields in the second file in the episode would be used to record the extra data. Using our example above, if an analysts sees two different wildlife in a episode (e.g., a deer and a coyote), the deer and its count would be filled in on one file in the episode, while the coyote and its count would be filled in on another file. This can be repeated as long as there are sufficient files available in an episode. However, this too has limitations (it only works with motion-triggered cameras), and is not applicable in cases where every file in an episode need to be tagged (e.g. to track animal activities over that episode).

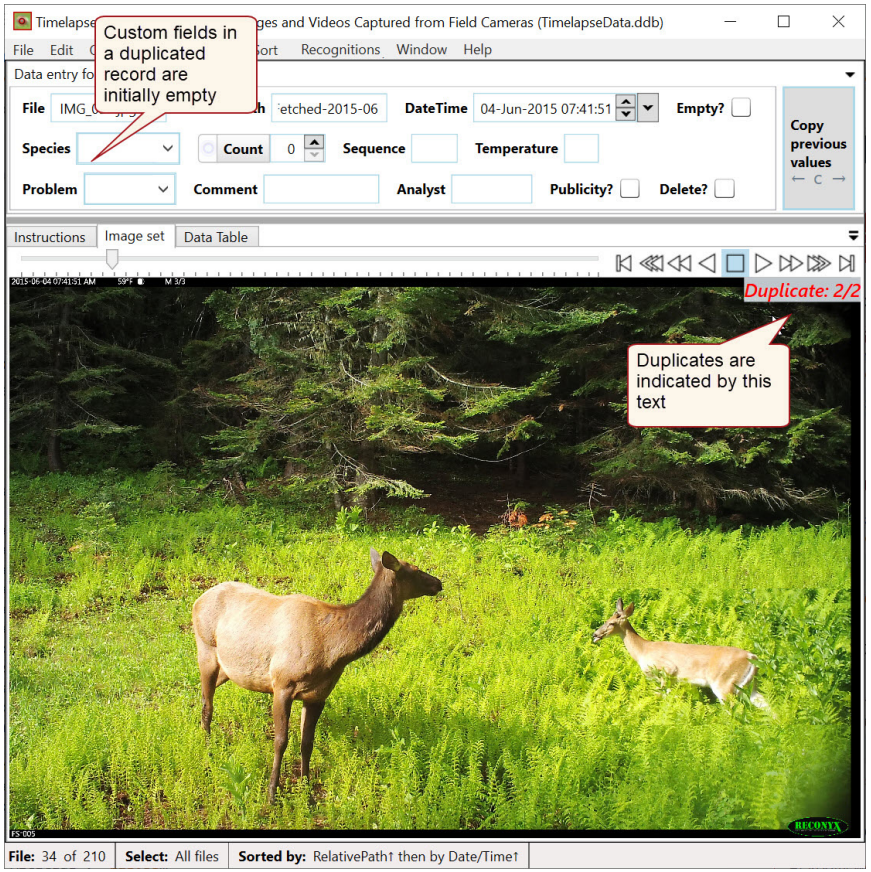
A third solution uses Timelapse's ***Edit|Duplicate this record*** facility, where one or more copies of the current record can be made.

How duplicate records work.

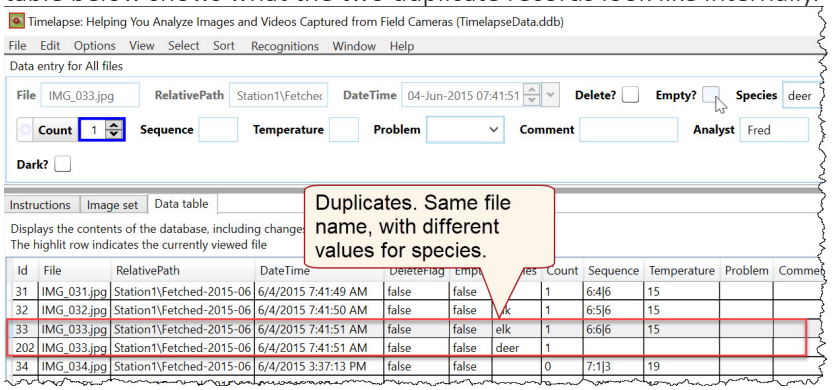
IMG_033.jpg in the *Station1\Fetched-2015-06* folder of the practice image set contains two different wildlife species in it: a single elk and a single deer. The steps below illustrate how the duplicate records facility is used to enter data for both wildlife species.

1. Fill in the data fields as normal, with ***Species***=Elk and ***Count***=1.
2. Select ***Edit | Duplicate this record***. A duplicate record of the file will be created, with all fields reset to their default values, excepting the stock data fields used to hold file location and date/time data. That duplicated record will be displayed.

Note. Duplicate records (and when you navigate, any other duplicated records) are identified by text on the upper right of the image, as illustrated below.



3. Enter the data fields for this duplicated record i.e., ***Species***=deer, ***Count***=1. Update the other data fields if needed, e.g., ***Analyst***, ***Sequence***, ***Temperature*** (see the Workflow tip below for guidance). The data table below shows what the two duplicate records look like internally.



Workflow tip. When duplicate records are expected, the project manager should have a strategy in place for how they should be handled. For example, the analyst could be told to update only those fields in the duplicate record that adds new information, and leave the others blank. The strategy, then, would be to look for what data fields in the duplicate are not set to their defaults, where non-default data are considered extra information. Alternately, the analyst could be told to fill in all fields. In that case, the strategy would be to compare the fields in the original and the duplicate, where the ones that have changes are considered the extra information. Neither is perfect, so some thought must be put into this.
Important note. How your files are sorted affects where the duplicate record is located relative to the original file while you are navigating, and whether the duplicate label appears. Ideally, you are using the ***Sort | by Relative Path + DateTime*** (the Timelapse default), or perhaps by ***DateTime***. These sorting options should order duplicates so they appear one after the other. If they are not sorted, then expect confusion as that duplicate may be located at some random place in your visual stream.

To understand why this is so, look at the ***Id*** column above. The original record has an ***Id*** of 33, while the duplicate record has an ***Id*** of 211. This is because that duplicate is the last record added to the database, and numbered accordingly. If you do a ***Sort | by Id***, you would see the original record as the 33rd file, and the duplicate as the last 211th file. Because ***Sort | by Relative Path + DateTime*** is much more common, Timelapse's strategy is to detect and label duplicates by comparing two adjacent files.

Deleting duplicates

Edit | Delete | Only the data … will delete the duplicate record while leaving the image or video file intact. As the file is still there, the original or other duplicates of that record can still display the image or video.

Duplicates and CSV files

When exporting data to a CSV file, duplicates appear as separate rows with the same ***RelativePath*** and ***File*** name, similar to what was illustrated in the DataTable figure. Whether duplicates appear next to one another depends on the sorting order set in Timelapse (see above note), although you can, of course, resort the CSV file with your favorite spreadsheet application.

Workflow tip. If you need to identify duplicate rows when processing your CSV file, you can do this by just searching for rows with the same ***RelativePath*** and ***File*** name. While Timelapse does not add a column identifying duplicates, such a column can be added to the spreadsheet via a formula that compares the RelativePath/File cells in the current row with the cells in the surrounding rows (again, assuming they are in sorted order).

When importing a CSV file, duplicate records should work well as long as there are the same number of duplicate records for a file in both the CSV and Timelapse .ddb file. However, if there is a mismatch between the numbers available, Timelapse will fill in what it can, but will generate warnings. That is, duplicate records can be exported, altered and imported back into Timelapse. However, if a duplicate row is manually added to the CSV file and imported back into Timelapse, TImelapse is not able to add a duplicate record for that row.

Best practices for data entry

This section introduced myriads of methods for entering data, all which can be combined in many ways to create an effective workflow. While the particular combination can depends on many things, it may be difficult to know where to start. The suggestions below are based on typical best practices. Try these until you find your own particular combination that works best for you and your image sets.

1. Select a subset of files to work on using the Select menu option (see section on *Selecting subsets of files*). This is usually a folder containing files taken from one camera at a station, or perhaps one camera card retrieval from that station. As these files capture images or videos from a single site, they may often have similar properties, such as common patterns.
2. Check your dates and times. If there are any problems, see if they can be bulk corrected with the various ***Edit | Date correction*** options.
3. If a data field for your selected files all share the same value, fill out one data field and select ***Copy to all*** from its context menu. That field will now be filled in for all files. An example is the ***Analyst*** field in the practice image set, where the analyst's name is entered once and then copied to all files.
4. If a field should be populated with metadata, either do it after narrowing to the selected files, or when files are first added to the image set. Two examples in the practice image set are populating the ***Temperature*** data field with the ***Ambient temperature*** metadata, and the ***Sequence*** data field with the ***Sequence*** metadata.
5. If you need to discriminate night-time vs day-time images, select ***Edit | Classify dark images now***, which updates in the ImageQuality field as needed.
6. Create ***Quickpaste*** entries for common data patterns. This can be done ahead of time by quickly scanning the files for emergent patterns (e.g., using the FilePlayer's fast autoplay). Quickpaste entries can always be edited or added to as you fill in your images. While it does take a bit of extra time to create a Quickpaste entry, it more than pays for itself in the long run. For example, because the practice image set has sub-folders containing runs with a single deer, bear, or elk, creating a Quickpaste entry that fills in the species with that animal and the count as '1' would be convenient.

7. If the entities you are looking for are reasonably evident in the image, use the ***overview*** to inspect and select multiple similar images, and enter data for them all at once. If you have a ***Quickpaste*** entry for the desired data entries, many files can be tagged at once with just a few clicks. You can always switch to the single image view if you need to view the file's details.
8. When going through images one by one, the ***Copy previous values*** button is particularly useful in those cases where the copyable fields repeat across a run of images. Even if one field differs, it may be easier to copy the values and then change that single field. Note that you can always change which fields are copyable by editing the template.
9. Try to anticipate repetitious data entry. The ***Propagate from the last non-empty value to here***, or the ***Copy forward to end*** context menu can simplify common data entries across a run of images. If used properly, you set the data field's value in the first image, and then go forward until the last image where that value should be applied. The value is then propagated or copied over those intervening files.
10. If you have to enter data into a file's fields one at a time, consider using tabs to navigate between fields. Its faster than constantly switching between the keyboard and mouse.
11. If you need to count small entities, or many entities in an image, consider using the Counter marker function. The presence of the marker mitigates counting errors.

Part 9

Episodes

Files are rarely independent of one another. In particular, sequences (or episodes) of images can capture an event over time. An example is a camera that automatically takes several images when motion is detected, such as an animal walking through a scene. Timelapse contains several facilities that let you detect these episodes, capture them as data, and even navigate through your files episode by episode.

Motion triggering

Camera traps often include a passive infrared sensor that detects motion in its field of view. When set in motion triggered mode, the camera will automatically take phots or videos. Detals are configurable. The Reconyx Hyperfire 2 camera, for example, includes these settings in its Trigger tab:

- whether a photo or video is taken when motion is detected;
- the length of video;
- how many photos per trigger, e.g., 1,2,3 ... 90;
- the time interval between photos, e.g., no delay, 1s,2s...,60s;
- motion sensitivity,
- a quiet period that determines how long subsequent motion after an initial trigger should be ignored.

Various cameras also include metadata indicating whether it was in motion triggered vs. timelapse mode, and the position of a photo in a sequence of triggered photos (e.g., 1 of 3). As previously described, Timelapse data fields can be populated with this metadata if it is available, where the analyst can use that to identify image sequences. However, this metadata is somewhat limited.

- Some cameras may not include the metadata, or Timelapse may not be able to extract it.
- The format of the sequence numbering is ideosyncratic per camera (e.g., 1 of 3, 1/3, 1:3).
- Activity in front of a camera may persist, resulting in several separate motion triggering events. Even though these images are related, the sequence numbering will not reflect that.
- Motion triggering is not perfect. It can suffer many accidental triggers (e.g., from wind effects on foilage), which can result in multiple persistent bursts, each separated only by the quiet period.

Timelapse includes an ***Episodes*** feature to identify photo sequences more robustly than metadata, along with facilities to leverage how Episodes can be inspected and used.

Why Episodes?

When motion triggering works well, it captures an entity entering or moving in a scene. An analyst can view the motion-triggered sequence to see and tag what the entity was doing and even how long it was in the camera's field of view.

Analysts may need to group images together as an 'episode' in order to analyze them. For example, consider an analyst counting the number of hikers using a trail. Yet a single hiker may appear on several images over time, perhaps due to motion triggering, or because the hiker is milling about in front of the camera. To avoid double-counting, the analyst would only count the hiker once in this series.

Manually identifying a series of images as an episode can be tedious and time-consuming. The analyst may examine various cues: distinctive features of the hiker or animal, and the direction of movement of the entity across the scene. The analyst may also check the date/time of the images: if images are separated by a short time interval, it is reasonable to assume that those images are related. The catch is that checking times is both tedious and time-consuming. While metadata can help, it still requires the anlayst to somehow group together multiple motion-triggered photo bursts capturing what is essentialy the same event.

The example below illustrates how multiple sequences can comprise an episode. This camera took three images per motion trigger event, with a quiet period set to 'no delay' (the Reconyx default). The first three sequences contain the same bear walking through the field (9 images). We then see an accidental trigger sequence (3 images), and 2 sequences with the single deer (6 images), 1 night sequence (3 images), 2 sequences of an elk (6 images) and so on. The 12 trigger sequences distill to only 7 episodes.

Timelapse episodes

How Timelapse determines episodes

Timelapse uses time differences to determine what images belong in an episode. It compares the time difference between successive images against a time threshold. If the time difference is less than the threshold, it adds that image to the episode. To illustrate, consider these image times, and a time threshold of 2 minutes.

Name	Image1	Image2	Image3	Image4	Image5	Image 6	Image 7
Time (hh:mm)	8:45	8:46	8:48	9:30	9:32	10:00	10:05
Time difference from previous image (minutes)		1	2	42	2	28	5
Episode (image # / total)	1/3	2/3	3/3	1/2	2/2	1/1	…

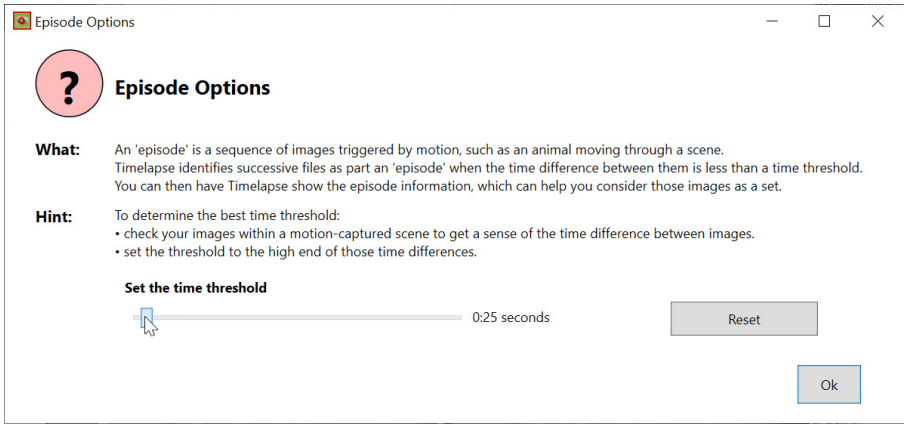
- The first 3 images form one episode as the time difference between each is 2 minutes or less.
- A new episode begins on Image4: it was taken 42 minutes after Image3.
- Image4 and Image5 are an episode as their time difference 2 minutes.
- Image6 is an episode with only 1 image. as the time differences between it and the surrounding images is more than 2 minutes.

Episodes only make sense when your images are in some kind of date/time order. ***Sort | by RelativePath + Date/Time***, which is the Timelapse default sort order, works best.

Setting episode time thresholds

The time threshold determines which files are collected together in an episode. Timelapse allows you to set the time threshold via the ***Options |Adjust episode time threshold…*** dialog, where it can be set very short (e.g., 1 second) or somewhat long (e.g., 10 minutes).

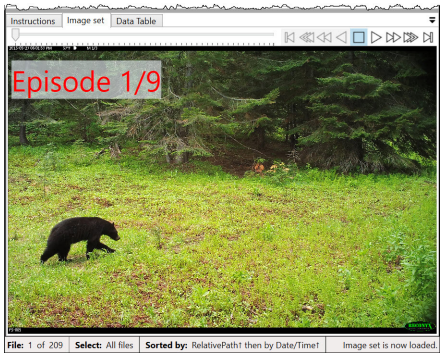
As using time to delimit episodes is a heuristic rather than a guarantee, we suggest examining a few of your images to determine what time threshold works best for your image set. Experiment with different threshold values and see how the episode groupings change.

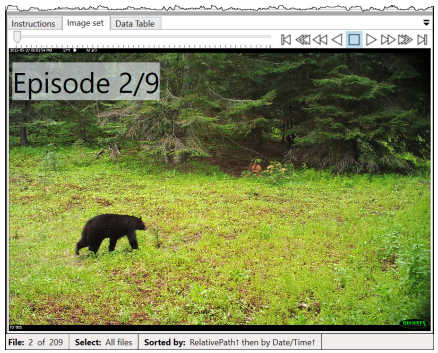


How Timelapse displays episodes

Options | Show episode information, or pressing the shortcut key ***E*** overlays episode information at the top of each file, as illustrated below.

Viewing a single image. Identifying episode text is overlaid on the top left corner of the image. The text is colored red if it's the first image in the sequence, otherwise black. For example, these images are the 1st and 2nd in an episode of 9. An episode containing only one image is labelled 'single'.

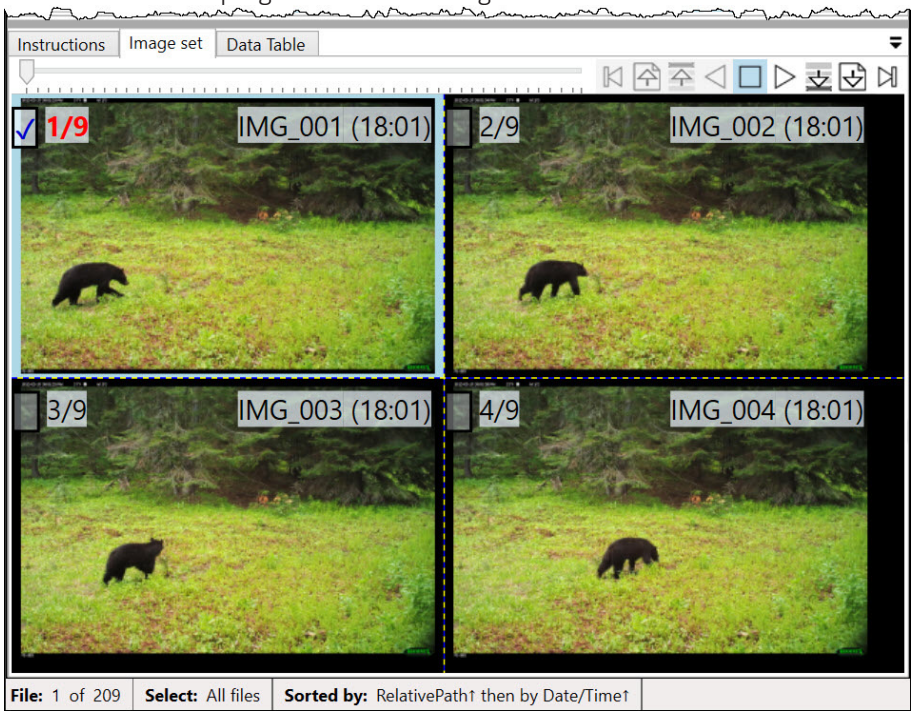




If a relatively large number of images belong to a single episode, Timelapse will just display an ∞ (infinity) symbol rather than the episode numbers.

If you have a selection activated to show only a subset of your files (e.g., via a choice on the Select menu), episode numbering will not include the filtered out files.

Viewing multiple images is similar, except the image name and timestamp is included on the top right side of the image.



Navigating between episodes

Episodes can have a few images or many images. When inspecting files (and especially after tagging an episode), it can be convenient to skip to the first image of an episode, rather than navigating all intervening files. Several keyboard shortcuts will let you do this.

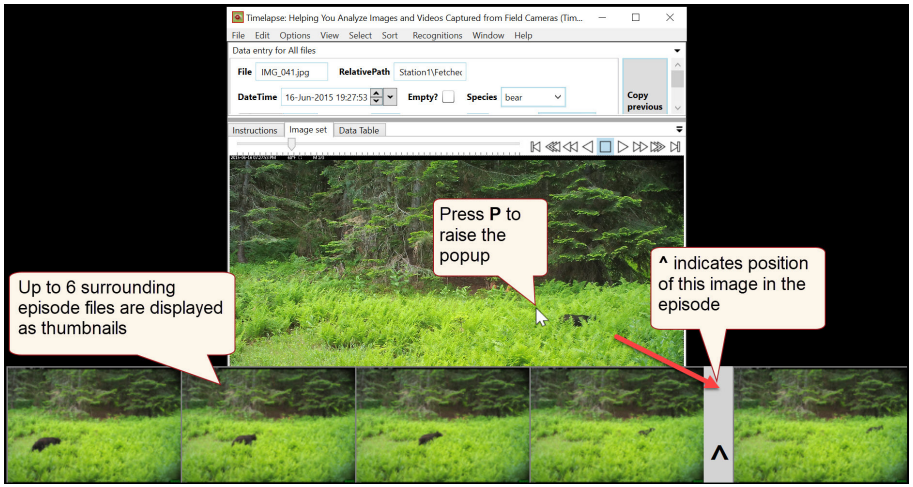
Simultaneously pressing these keys will let you quickly navigate backwards or forwards to the first image in an episode. It works in both the single image view and the overview. The Episode information overlay will appear if it isn't already on.

- <control> → goes to the 1st image of the next episode
- <control> ← goes to the 1st image of the current episode if you aren't on it, or to the 1st image of the previous episode.

The episode popup

If you have a selection activated to show only a subset of your files (e.g., via a choice on the Select menu), some of your files in an episode may be filtered out. Yet when viewing a file, being able to see all other files in the episode may help you better interpret what is going on. For example, if the entity you are interested in is difficult to see in the image (perhaps because it is too close to the camera), seeing all other episode images may help you find a better shot. Similarly, it can help you understand what activity is occuring in the episode as a whole. The Episode Popup is a quick way to do this.

Pressing the *P* key on the keyboard while the cursor is over the image will immediately display an episode popup. The popup disappears when the *P* key is released. An example is shown below.



The popup will contain up to six thumbnails of images immediatly surrounding the current image in the same episode. The **^** indicates where the current image would be in the episode. In this case, because we are in the middle of an episode of 6 files. We see the first four files as thumbnails on the left, and the 6th file on the right. The 5th file is already being displayed in the main view, so is not included in the thumbnails. However, if we were (say) at the beginning of an episode, it would show the next 4 images to its right.

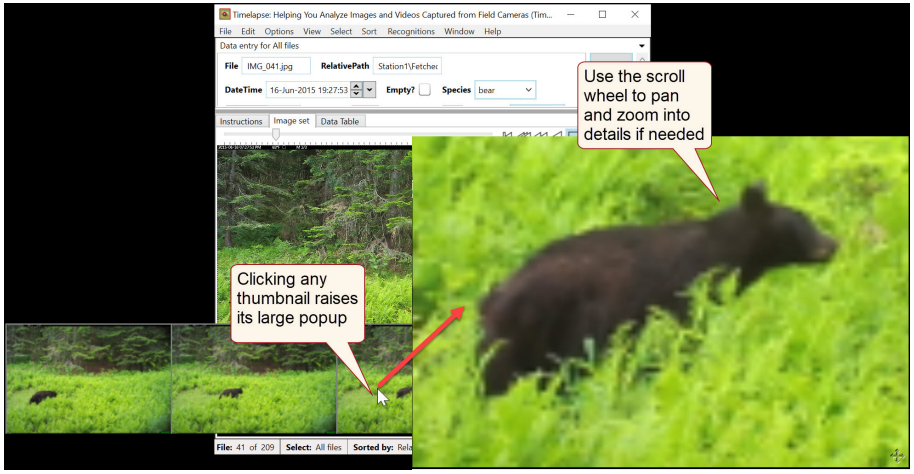
Because the popups thumbnails are relatively small, some of the details you may want to examine may not be clearly visible. To see those details, you can click on any of the popups (while still pressing the **P** key), which will temporarily raise a newer, larger popup, as illustrated below. Clicking on any other popup thumbnail will switch to that file in that larger popup, allowing them to be rapidly scanned.

Similar to how you can pan and zoom images and videos to examine its details, you can also use the scroll wheel to zoom into the larger popup, and drag the image by panning.

For example, in the screen shot below, the analyst

- pressed **P** to raise the pop up,
- clicked on the 3rd popup thumbnail to raise the details popup (as annotated with the red arrow),
- used the scroll wheel to zoom into the detail popup to better identify the bear within the image.

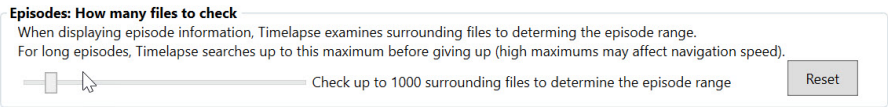
When the **P** key is released, all popups disappear.



Episode preferences

When displaying episode information atop an image, Timelapse examines the files surrounding the current file to determine the beginning and end of the episode. Because some episodes may be really long (e.g., a camera set in Timelapse mode taking images very rapidly), Timelapse limits how many surrounding files it should examine, as otherwise there may be some performance penalty (although it doesn't seem to be much). If it hits this limit, an ∞ symbol is displayed.

Options | Preferences... raises a dialog that includes an Episodes preferences panel, as illustrated below. Its slider lets you adjust how many surrounding files Timelapse should examine. For example, you may want to increase it if you have many long episodes but still want to ensure you find the beginnings and ends of those episodes. In practice, the performance hits don't seem substantial, unless the episode lengths are massive.

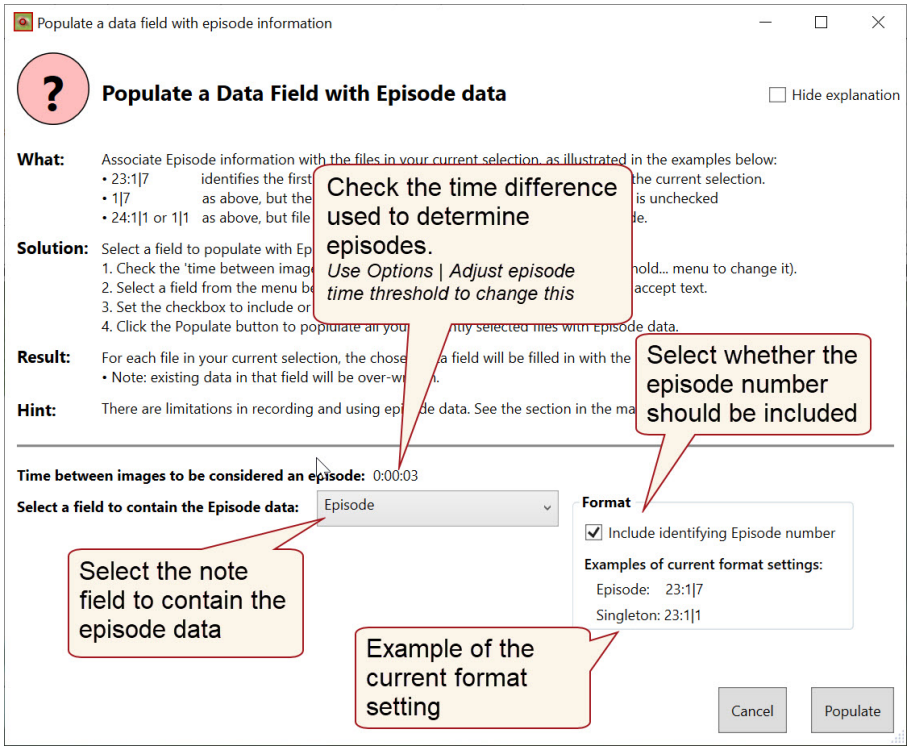


Populating a data field with episode data

You can record episode data into any Note field selecting *Edit | Populate a field with Episode data*. This raises a dialog box that allows you to select one of your *Note* fields (if you have one available). Episode data will then be written into that field for all your currently selected files. The time threshold used is the one last set via the *Options | Adjust episode time threshold*.

The dialog box lets you set the episode data format written to that Note field. Timelapse can identifiy each new episode seen, count the number of files in that episode, indicate that file's position in the episode, and optionally give that episode an identifying episode number. As illustrated by the examples below, the episode number can be included or excluded..

- Full format. **23:1|7** identifies the 1st of 7 files located in the 23rd Episode.
- No identifier. **1|7** identifies the first of 7 files
- Singletons are episodes with containing ony one file. They appear as either:
  - » **24:1|1** (full format)
  - » **1|1** (no identifier)



Note. Episode information displayed atop the image (e.g., when you press the **E** key) may differ from the episode information recorded and displayed in the populated data field. This happens because the displayed episode information is calculated on the fly, and conditions may have changed since you populated the data field.

1. Changing the *episode time threshold* (discussed early) will likely alter which files are grouped into episodes. For example, increasing the time threshold will likely produce fewer but longer episode sequences, as more files will be considered as belonging to an episode.
2. A *Select* operation may add or filter out files, which again will affect how files are grouped into episodes. For example, if an episode originally contained a mix of images with and without deer and you then did a *Select | Custom* select on deer, the new episode would not only contain fewer image. As well, it may change how those images are split into episodes, as the time gap between the remaining images would increase due to the flitered out image not being included in the calculation.

Part 10

Selecting subsets of files

The ***Select*** menu is perhaps the most powerful feature within Timelapse. Its function is apparently simple: it allow the analyst to view and work on a subset of files. The analyst uses the Select menu to specify the selection criteria, where only those files that match those criteria are returned. In database speak (and Timelapse does use a database), each selection creates an SQL query that retrieves records that match that query.

Selections are a critical feature in Timelapse, as they can significantly enhance the analyst's workflow.

For example, if files are managed in sub-folders that contain camera card retrievals at particular stations, the analyst can select a sub-folder and view only those files. Almost all Timelapse operations are then applied only to those currently selected files, The analyst can inspect and work on those files without seeing or affecting files outside that folder.

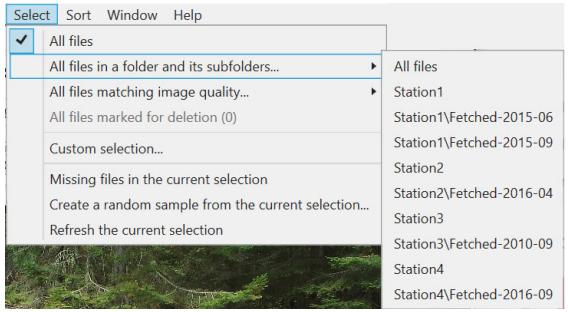
As another example, the analyst can create and select files based upon the contents of one or more data fields. To illustrate, consider the ***Publicity?*** data field in the practice image set, which is checked if its a particularly good image. If an analyst or project manager wishes to review only those files, they can select for files where the ***Publicity?*** = checked.

More complex queries involving multiple data fields are also allowed. If an analyst wished to review all files in (say) the *Station1\Fetched-2015-06* folder that are tagged with two or more deer, they would select on ***RelativePath***=Station1\Fetched-2015-06, ***Species*** = deer, and ***Count*** > 1. Other examples are provided below.

The Select menu

The Select menu contains several shortcut selections to common queries. Its items are described below.

All Files displays all your image and video files.



All files in a folder and its subfolders displays only those files in the selected folder and its subfolders. (Timelapse uses the RelativePath values to dynamically create this menu.) The example screenshot illustrates this menu for the practice image set. If a folder is selected that contains sub-folders (e.g., *Station1*), then all files found *Station1* and its sub-folders will be selected.

All files matching image quality displays *Dark* or ***Ok*** (not dark) files.

All files marked for deletion display those files whose ***Delete?*** field is checked.

Missing Files in the current selection displays all entries in the current selection where the image or video file appears to be missing.

Custom Selection lets you choose your criteria. See below.

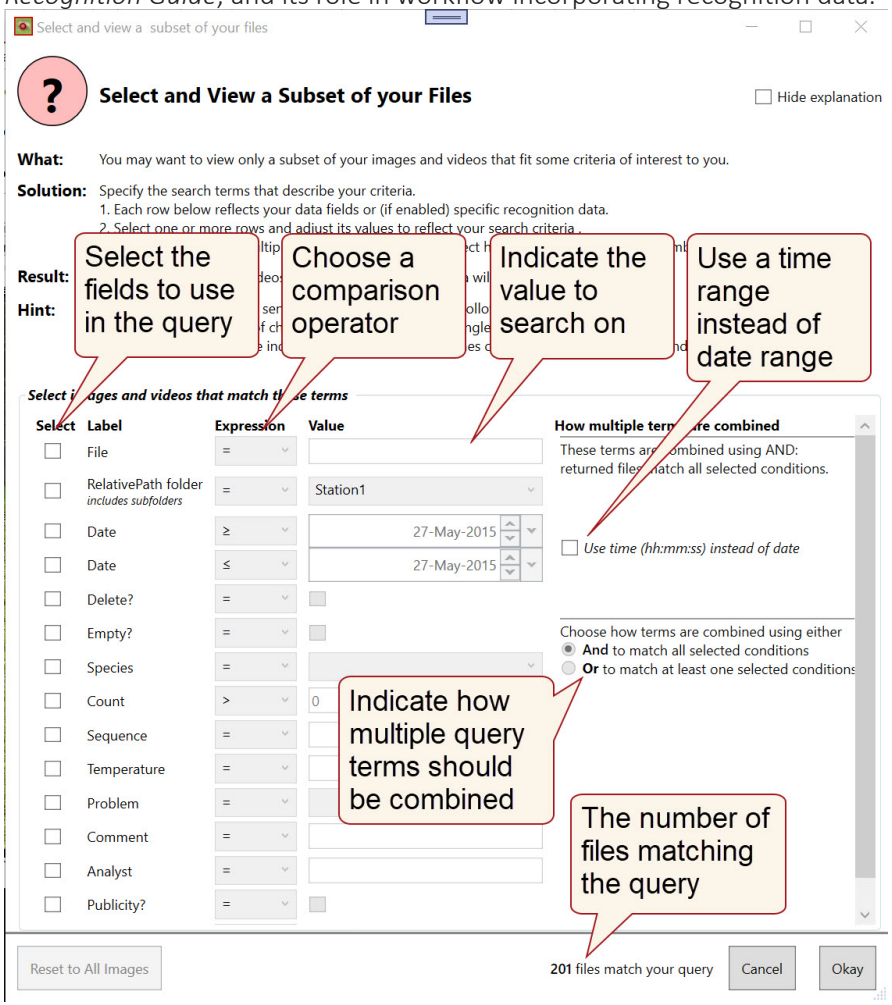
Create a random sample from the current selection randomly samples the current selection to produce a subset of files, also described below.

Refresh the selection redoes the selection. If you updated some file data since the previous selection, it may no longer conform to the current selection criteria. Running the selection again will include only those files that conform.

Custom selections

The *Select | Custom selection* menu option is an extremely powerful Timelapse feature. Its dialog box allows you to create a custom selection by composing a query. The dialog lists most data fields. A query is formed by selecting one or more fields to use in the query, choosing a comparison operator from the expression menu, and entering a search value.

If image recognition turned on, additional query fields are displayed for selecting recognition data. This is explained in the *Timelapse Image Recognition Guide*, and its role in workflow incorporating recognition data.



As you form a query, the dialog will indicate, at the bottom right, the number of files matching your query. If no files match, the *Okay* button will be disabled as there would be nothing to select.

Queries include an *Expression* drop-down menu setting. Most are familiar mathematical expressions, as shown on the image. The special *GLOB* item allows for regular expressions. This will be explained later in the *Select examples* section. The expressions shown in the menu will vary with the data field type, as not all comparison expression makes sense for some types.

Most selections will likely be simple queries, where the analyst will select only a single term to form a query by checking a field's *Use* checkbox. For example, selecting and setting *Species* = deer will select all fields tagged as deer.

Using one or both Date fields, you can select only images falling within a particular Date range. Selecting the *Use time (hh:mm:ss) instead of date* checkbox changes the Date fields to Time fields, where you can select images falling within a particular time of day range.

If the analyst selects two or more fields, then the analyst will need to indicate how those query terms should be combined using And versus Or. The examples below assume that the analyst has already tagged the files.

- *And.* When two terms are combined with *And*, both must be true for it to satisfy the query. For example, '*Species* = Deer' AND '*Publicity*? = ☑' will display only those files whose tags include both of the above, i.e., only deer files with the publicity value field checked.
- *Or.* When two terms are combined with *Or*, only one of them must be true for it to satisfy the query. 'Empty? = ☑' OR 'Problem ≠ <blank> will display files tagged as empty, and files tagged as having any of the listed problems.

Timelapse automatically combines its standard terms (*File*, *RelativePath*, *Date* or *Time*, *ImageQuality*, *Delete?*) using *AND*. This makes sense, for normally an analyst will be selecting files (for example) in a particular folder and matching a particular data range. However, all other terms give you the option of combining them together using *And* or *Or*. The examples below illustrate how this works.

Select examples

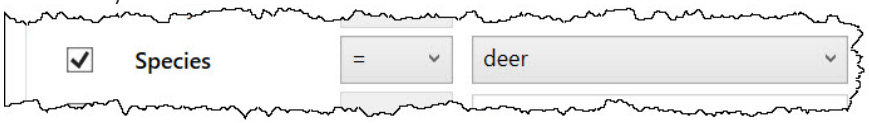
Several example selections, starting from simple to more complex ones, are described below. If you have completed analyzing the practice image set, you can use try these examples to your image set to see how they work.

Querying on a single field

1. Show only files that are Publicity? shots.

Result. Only files with the Publicity? field checked will be displayed.

2. Show only files that have a deer in it.



Result: Only files whose *Species* is set to Deer will be displayed.

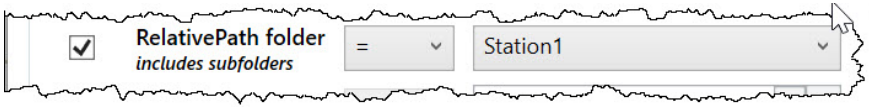
3. Show only files with a Malfunction problem.

Result: Only files where 'malfunction' was tagged via the *Problem menu* will be displayed.

4. Show only files that have at least two or more of any species in it.

Result: Only files with a Count whose value is greater or equal to 2 will be displayed. This could also be paired with Species ≠ <blank> using AND, although this should be redundant if the practice image set was tagged correctly.

5. Show all files in the Station1 folder and its subfolders.



Result: Only files whose RelativePath begins with Station1 will be returned. This includes all sub-folders of Station1. This query is exactly the same as *Select | All files in a folder and its subfolders | Station1.*

6. Show only files whose temperature is > 5.

An unexpected result. Only *Counters* (such as the *Count* field) are treated as numbers. For other fields, any comparisons are based on alphabetic ordering. This can lead to confusing results if you are not aware of it. For example, while Temperature values look like a number, it is treated as an alphabetic string. Thus the > and < expressions may not give you the results you expect. For example, a temperature value of 10 would not match this query as 10 is alphabetically less than 5.

Querying using GLOB and ^GLOB pattern matching

Two expressions available in the pull-down menu for some of your fields is 'GLOB' . GLOB expressions lets you use 'wildcards' to match various character patterns as follow. ^GLOB stands for 'NOT GLOB', and matches everything except the pattern.

- ***** matches any number of characters
- **?** matches any single character
- **[abc]** matches one character only if it is present within the brackets
- **[a-z]** matches one character only if it is within the given character range

1. Using Glob to partially match a string (e.g., to find particular comments).

Result: Only files whose *Comment* text begins with the 'Great' will be displayed.

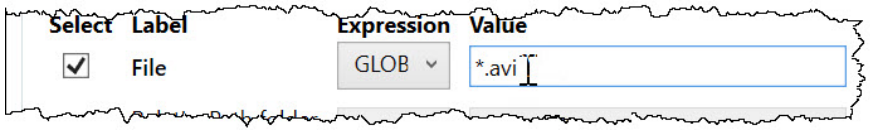
2. Finding a set of character matches. We previously saw that we cannot use '>' or '<' reliably on Temperature, as it is an alphabetic rather than a numeric field. In a limited number of cases, GLOB can give us what we want. For example, to find Temperatures ≥ 10:

Result: Only Temperatures whose first character is 1 through 9, followed by any other character will match (i.e., 10-99). Thus 10 matches, as does 25. However, 5 won't match as it only has one digit. If the expression was [1-9]?* then any number 10 or higher would match.

3. Find all temperatures above the freezing level

Result: **^**GLOB (not glob) returns all values except those that begin with a '-' sign. Note that this will also include temperature fields that are empty.

4. Finding all *.avi* video files



Result: Only files with a *.avi* suffix will be returned. If the video files also included those with a *.mpg* suffix, then both suffixes could be returned by indicating the 1st, 2nd and 3rd characters of each suffix as *.[am][vp][ig]. Similarly, if video files mixed lower and upper case suffixes (e.g., .avi and .AVI), the query to find them all would be *.[aA][vV][iI].

5. Finding all video files (actually all non-JPG files) using **^**GLOB.

Result: Because this is a **^**GLOB expression, only files that ***don't*** end with .jpg suffix are returned, which would be all video files regardless of whether they are mpg or avi or asf or some other future video format recognized by Timelapse. The supplied pattern indicates any combination of lower and upper case jpg suffixes.

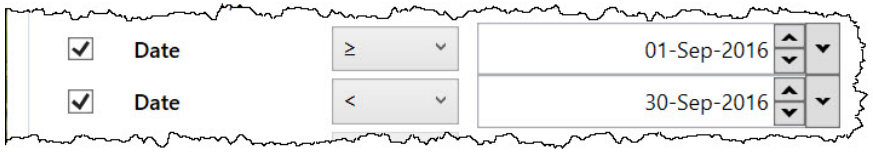
Querying on Date

The selection dialog box includes two Date fields. If both are selected, they are *AND*'ed together, where the returned files need to match both conditions.

1. Find all files on or after a given date.

Result: The above query returns all files on or after September 2, 2016.

2. Find all files taken in the month of September, 2016. For this query, we need to use both DateTime controls to specify a range of dates.



Result: Only images taken between September 1 and September 30, 2016 will be displayed.

Tip. Timelapse includes all matching images on the selected day regardless of the time.

Querying on Time

Selecting the ***Use time (hh:mm:ss) instead of date*** checkbox changes the Date fields to Time fields. Both Time fields are typically used to select images falling within a time range, including over midnight (e.g., between 20:00 and 7:00). Selecting one Time field is less useful: a '<' operation will implicitly use 00:00:00 as the lower bound while a '>' operation will implicitly use 23:59:59 as the upper bound.

1. Find all files between 8pm and7am (e.g., night-time shots).

Result: The above query returns all files on or after 20:00 (i.e., 8pm) and on or before 7:00 (7am). Under the covers, Timelapse is smart enough to know that you are searching over midnight, and composes the correct search criteria to do that.

2. Find all files between 7 am and 8pm (e.g., day time shots).

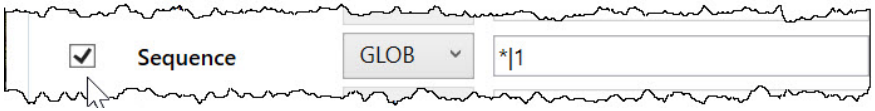
Result: The above query returns all files on or after 7:00 (i.e., 7am) and on or before 22:00 (8pm).

3. Find all files between 7am and 8pm and between Sept 2-10, 2016
Result: This search cannot be done, as Timelapse currently allows you to select on either Date or Time, but not both. However, you can combine Time queries with other criteria. For example, you can select a time range for images in a particular folder by using and specifying the RelativePath field as well.

Querying on Episodes

As mentioned elsewhere in this document, you can use the Timelapse populate episode feature to identify sequences of images a separated by a short time span. Images are tagged with a unique episode ID, followed by the image number in the episode. For example 23:4|5 is the 4th image out of 5 images in the 23rd episode.Singletons that are not part of a sequence appear something like 24:1|1 (i.e., the first image out of 1 image in the 24th episode.

1. Find all singletons



This glob expression returns everything ending in |1, which would only include singletons.

2. Find all episodes with more than one file in them

This ^glob expression returns everything except those ending in |1, which would only include episodes including more than one file.

Multiple Queries using And vs. Or.

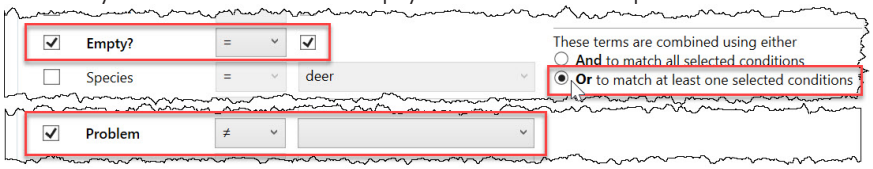
As stated previously, the Custom Selection allows you to specify several search terms at the same time. While the stock Timelapse terms are always combined using *And*, you can indicate whether the remaining terms are combined using *And* vs. *Or*. Both are illustrated in the examples below. As a reminder:

- *And*: The file's data field values must match every search term.
- *Or*: The file's data field values must match at least one search term.

1. Find all files that contain 2 or more deer.

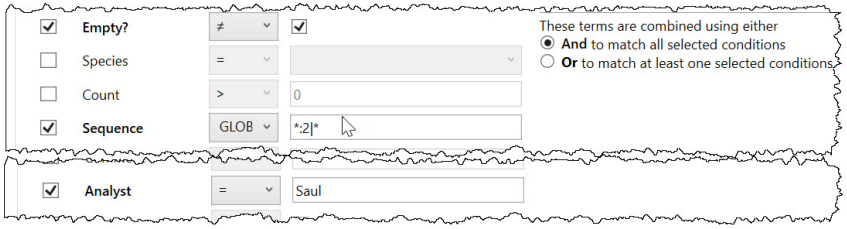
Result: Returns only files with Species=deer ***and*** a ***Count*** of 2 or more.

2. Find only those files that are Empty or that indicate a problem.



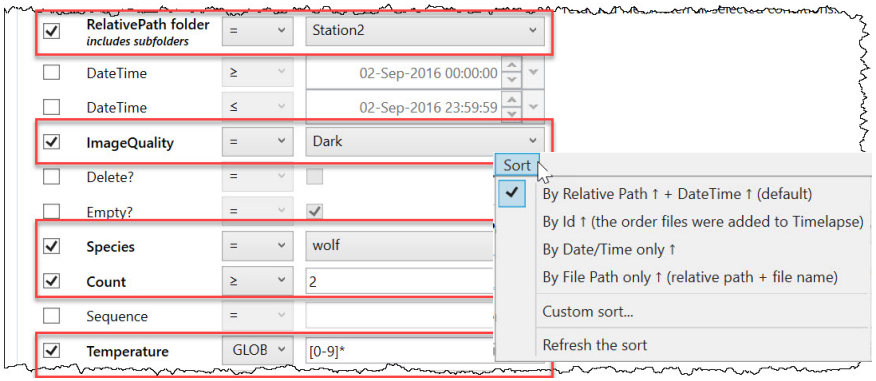
Result: An file with the ***Empty***? field checked, ***or*** any file with a non-empty ***Problem*** field is returned.

3. Find the 2nd image of a non-empty sequence analyzed by Saul.



Result: As expected. Note that the Sequence glob matches the 2nd file in any episode.

4. Find any night-time shots in the Station2 folder (including sub-folders) with two or more wolves in it where the temperature is at freezing level or above.



Result: This is an example of a complex query that used many search terms. Look it over to see why it returns the expected result. The only unusual aspect of it is the temperature. As the first character must be a number, negative numbers would not be returned as they begin with a '-'.

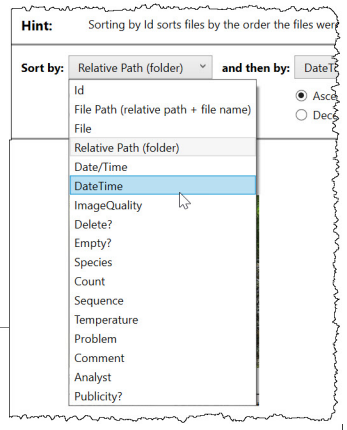
Note. The *Select | Custom* dialog was designed to make it relatively easy to form various queries by form-filling and clicking rather than by writing complex SQL database query statements. While powerful, the dialog does have limitations. For example, all but the DateTime field can be set only once, which makes it impossible to form certain queries (e.g. *Count* > 2 *AND* Count < 5).

If you are database-savvy and SQL-savvy, you can open the *.ddb* file with any SQLite browser (e.g. *DB Browser*) and query the database directly. The Timelapse Database Guide describes the structures of the various database tables held in the *.ddb* file.

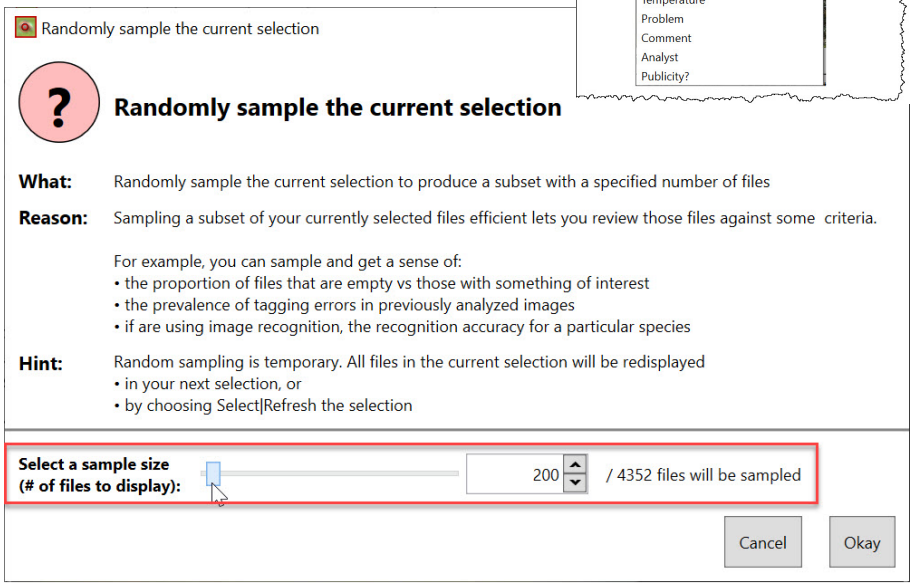
By the way, if you are curious as to what an SQL statement looks like, this is what Timelapse would actually compose for query #4 above. Quotes, commas and other syntax done correctly. Internally, this would be one of the simpler queries that Timelapse uses.

```
SELECT * FROM DataTable WHERE DataTable.RelativePath GLOB
'Station1*' AND ImageQuality = 'Dark' AND Species = "wolf" AND Count
>= 2 AND Temperature GLOB '[0-9]|*' ORDER BY DataTable.RelativePath
ASCENDING, File ASCENDING, DateTime ASCENDING
```

Random selection



One of the options available in the *Select* menu is *Create a random sample from the current selection*. When you select this option, Timelapse will randomly sample the current selection to produce a subset of those files. The analyst can determine the number of randomly selected files from the dialog box that appears.



Sampling a subset of your currently selected files lets you review those files efficiently against some criteria. For example, the dialog box above shows that there are over 4000 files in the current selection (in this case a folder containing a retrieved camera card). By requesting a random sample of (say) 200 of those files, those files can be reviewed for various purposes.

- For newly downloaded files, the analyst can get a sense of the proportion of files that are empty (e.g., triggered by wind effects) vs those with something of interest.
- For previously tagged files, a second analyst can perform a quick check to see the frequency of tagging errors made by the first analyst, if any.
- If image recognition is being used, a species can be selected and the recognition accuracy for a particular species can be checked.

Random sampling is a temporary setting. All files in the current selection will

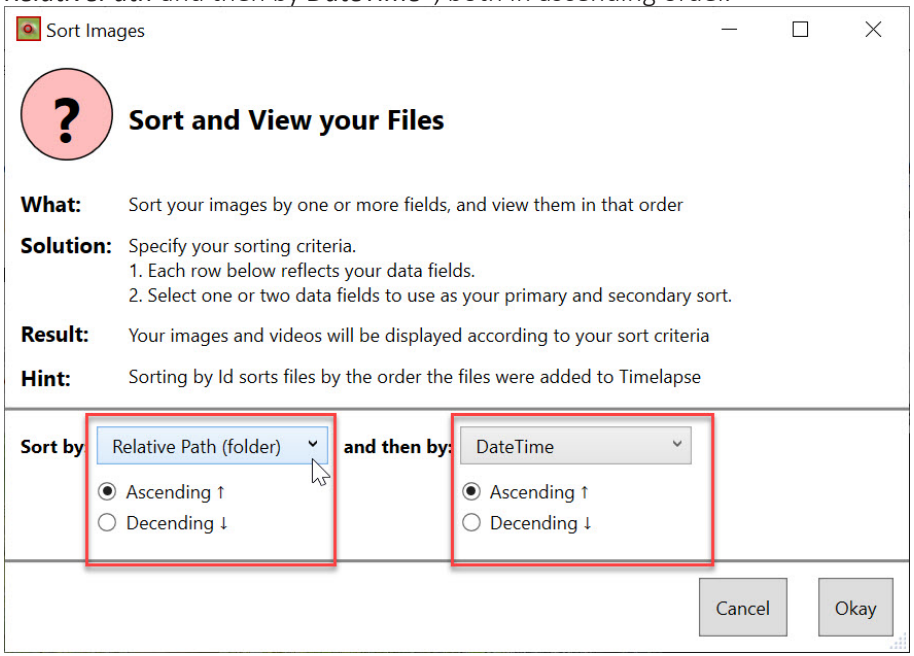
be redisplayed in your next selection, or refreshed immediately by choosing *Select|Refresh the current selection*.

Sorting files

Whenever files are selected, they are automatically sorted and presented in that sort order. By default, Timelapse will automatically sort your files by its *RelativePath* (i.e., the folder/sub-folder it is in), and then by *DateTime* (i.e., the time that the image was taken). While you can change this sort order, the default is the one that you will likely use almost all the time.

The *Sort* menu does provide other sorting options. As these were previously explained in the Menus section of this guide, only the *Custom sort* entry will be elaborated here.

When Sort | Custom sort is selected, a dialog box appears. Two drop down menus display the current sort criteria, in this case the default: "Sort by *RelativePath* and then by *DateTime*", both in ascending order.

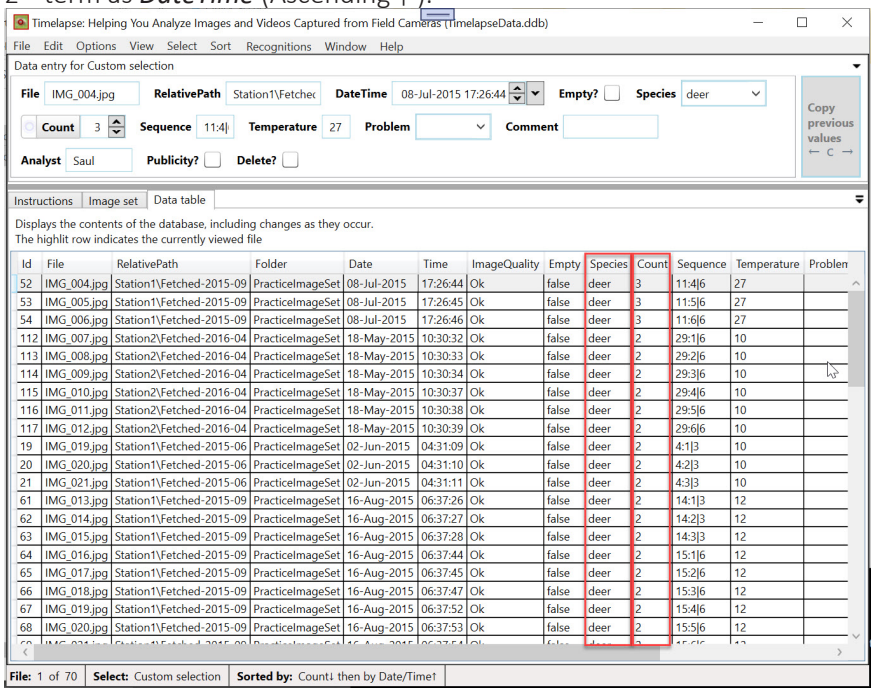


The analyst can change whether the sort order is ascending or descending on either term simply by clicking the *Ascending* or *Descending* checkbox below that term.

The analyst can also change the sort terms. Each drop down menu composes a set of sort terms based on various stock TImelapse data fields, plus the data fields defined in the template (these are the same fields that are presented in the *Custom select* dialog). For example, the drop-down sort menu for the practice image set is illustrated below.

As mentioned, *Sort* and *Select* work together. For example, lets the analyst had tagged all the files, and then wanted to review the deer species sorted by count with files with the most counts appearing first. Files with the same amount of deer should be presented in time order. The following actions would do this.

- *Select | Custom selection*'. Set '*Species* = deer',
- *Sort | Custom sort. S*et the 1st term as *Count* (Descending↓), and the 2nd term as *DateTime* (Ascending↑).



Of course, the Select could be narrower or broader than that. For example, if the analyst wanted to do the above but only for a folder and its sub-folders, the RelativePath could be set to the desired folder as well.

Part 11

Exporting and importing data

Timelapse does not expect to work in isolation from other software. Critically, Timelapse needs to be able to export its data so that other software can access it, for example, to do statiscal analysis of that data. Similarly, Timelapse needs to be able to import data that is either produced or manipulated by another software package. This section details how CSV files are used as the medium for importing and exporting data.

What is a CSV file?

A ***CSV file*** is a plain text file, usually suffixed as *.csv*, that represents a table of of rows and columns. Each line is a separate row: the first row defines column headers (i.e., names), and subsequent rows hold the data values. Data fields are separated by commas, where each comma defines the column boundary. This explains why CSV stands for ***Comma Separated Values***.

As a simple example, the data table at the left is a list of people by name and age. The CSV file describing this table is on ther right. The first row contains the column header (First, Last, Age), while subsequent rows define the data in each column for that person (e.g., Fred, Jones, 23).

Data table

First	Last	Age
Fred	Jones	23
Martha	Smith	41
Tony	Wells	26

CSV file

```
First,Last,Age
Fred,Jones,23
Martha,Smith,41
Tony,Wells,26
```

Because CSV files are so simple, they are often used for exchanging data between different applications. For example, spreadsheets, R, databases and contact managers, and a host of other applications and programming languages can usually export and import data as CSV files.

Timelapse also includes the ability to export and import tag data as a CSV file. This allow analysts to tag their data in Timelapse, save it as a .csv file, and then open that .csv file with their preferred package for statistical processing (e.g., Excel, R, etc.). Alternately, CSV files created or manipulated by other software can be imported into Timelapse, as long as the data table it defines follows a few rules (discussed later).

Exporting data to a CSV file

The analyst can export tag data for the currently selected files at any time. Two similar options are available.

- ***Export data for this image set as a CSV file…*** exports the data for the currently selected files as a comma-separated value *.csv* file that can then be opened in a spreadsheet or analytics package. Data whose ***Export*** field is unchecked in the Template is excluded.
- ***Export data for this image set as a CSV file and preview in Excel…*** as above but it will also try to open the *.csv* file in Excel (if it is installed).

The Timelapse CSV file format

When the tagged practice image set data is exported as CSV and opened in Excel, the result will look something like this.

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	RootFolder	File	RelativePath	DateTime	Empty	Species	Count	Sequence	Temperature	Problem	Comment	Analyst	Publicity
2	PracticeImageSet	IMG_001.jpg	Station1\Fetched-2015-06	2015-05-27 18:01:53	FALSE	bear	1	1:1|9	14		Left to right	Saul	FALSE
3	PracticeImageSet	IMG_002.jpg	Station1\Fetched-2015-06	2015-05-27 18:01:54	FALSE	bear	1	1:2|9	14		Left to right	Saul	FALSE
4	PracticeImageSet	IMG_003.jpg	Station1\Fetched-2015-06	2015-05-27 18:01:55	FALSE	bear	1	1:3|9	14		Left to right	Saul	FALSE
5	PracticeImageSet	IMG_004.jpg	Station1\Fetched-2015-06	2015-05-27 18:01:58	FALSE	bear	1	1:4|9	13		Left to right	Saul	FALSE
6	PracticeImageSet	IMG_005.jpg	Station1\Fetched-2015-06	2015-05-27 18:01:59	FALSE	bear	1	1:5|9	13		Left to right	Saul	FALSE
7	PracticeImageSet	IMG_006.jpg	Station1\Fetched-2015-06	2015-05-27 18:02:00	FALSE	bear	1	1:6|9	13		Left to right	Saul	FALSE
8	PracticeImageSet	IMG_007.jpg	Station1\Fetched-2015-06	2015-05-27 18:02:02	FALSE	bear	1	1:7|9	13		Left to right	Saul	FALSE
9	PracticeImageSet	IMG_008.jpg	Station1\Fetched-2015-06	2015-05-27 18:02:03	FALSE	bear	1	1:8|9	13		Left to right	Saul	FALSE
10	PracticeImageSet	IMG_009.jpg	Station1\Fetched-2015-06	2015-05-27 18:02:04	FALSE	bear	1	1:9|9	13		Left to right	Saul	FALSE
11	PracticeImageSet	IMG_010.jpg	Station1\Fetched-2015-06	2015-05-30 18:38:15	TRUE		0	2:1|3	20	wind triggered		Saul	FALSE

TimelapseData

Note. The *Dark* and *DeleteFlag* fields are not included in this CSV file as their *Export* tickbox was unchecked in the Template.

When Excel opens the csv file, it is displayed in a vanilla format. You may have to adjust the formats to make it look good. Formatting the column width and bolding the headers are a good start. You can now apply whatever formulas or statistical analysis you want to this file. At some point, you may want to save the modified file as an Excel file rather than a csv file if you want to keep the formatting information.

Headers, Rows, Columns

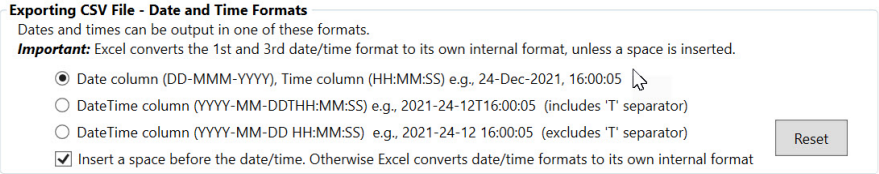
As seen above, the first row of the CSV file is a header, where each column is identified by the field's *DataLabel* as defined in the Timelapse template *.tdb* file. The order of the columns also follows the order as specified in the template. The data for each image is then written as a row, where the comma-separated data values are placed in the appropriate column.

Selection and Sorting

The presentation of rows in the csv file are based on the current selection and sorting settings. That is, only data for files in the current selection are exported, where they are sorted according to the current sort order (see the section on *Selecting subsets of files*, which includes sorting).

Date/Time formats and issues

Dates and times can have many different representations. Timelapse allows you to select one of thre different date/time formats when exporting to a csv file through the ***Options | Preferences | Exporting CSV Files – Date and Time Formats***. As well, there is an option of including a space character before the date and time. In all cases, time is shown in 24 hour notation. The format will be remembered across future Timelapse invocations on your computer. The particular date format chosen has significant implications on what happens when your CSV file is opened in ***Excel***.



Important note: *'Insert a space before the date / time...'* needs explaining. Some applications, and in particular ***Excel***, examine *CSV* fields to infer its type, such as if it is resembles a date/time. If ***Excel*** thinks the field is a date or time, it converts it to its own internal format: a number representing a time offset from a fixed date. You won't see that number. Instead, ***Excel*** display that date/time according to the current cell formatting options.

This has the advantage that you can adjust the date and time appearance, for example using your cultural settings (e.g., February in Spain would be displayed as Febrero). You can also use Excel's date/time formulas on it.

However, there are several disadvantages.

1. Critically, if you then wrote your ***Excel*** file out as a *CSV* file, the date/time fields would be written in the cell's current format. If you then try to import the *CSV* file back into Timelapse, Timelapse won't know what to do with the modifed date/time, as it is not in its expected formats.
2. The displayed format can lead to confusion if you don't know that ***Excel*** changes the date/time text on you. For example, some cell formats will only show the dates, but not the times. Others may eliminate the seconds off the time.It all depends on the cell format.

When you check the ***Insert a space before the date / time...*** box, TImelapse will add a space to the beginning of the date. This stops ***Excel*** from converting it, where ***Excel*** will now treat it as plain text.

The *CSV* preferences panel includes three ways for you to specify the Date/Time format in the *CSV* file. As an example, assume a row where the time is December 24, 2021 4:00:05 pm. We describe how each format will appear in the *CSV* file, and how ***Excel*** will interpret and display that date/time.

1. ***Two columns: Date*** *(DD-MMM-YYYY) and* ***Time*** *column (HH:MM:SS).*
   Recommended with ***Insert a space...*** checked.
   Example *CSV* output:

File,	,...,	*Date*,	*Time*,	...,
Img001.jpg,	,...,	24-Dec-2021,	16:00:05,	...,

   » ***Excel*** displays a ***Date*** column and a ***Time*** column.
   » If ***Insert a space...*** box is unchecked, ***Excel*** converts the ***Date*** and ***Time*** to its internal representation and displays it using the cell's format.

2. ***One column****:* ***DateTime in T format*** *(YYYY-MM-DD**T**HH:MM:SS).*
   Recommended with ***Insert a space...*** unchecked.
   Example *CSV* output

File,	,...,	*DateTime*,
Img001.jpg	,...,	2021-12-24T16:00:05

   » This format follows ISO 8601 standard. The ***T*** character separates the year-month-day portion from the hour-minute-second portion.
   » ***Excel*** always treats this Date/Time format as an uninterpretted text, so it does not need that extra space inserted.
   This format is likely to stay unaffected by applications, while still being relatively easy to separate into a Date and Time component if needed.

3. ***One column: DateTime*** *(YYYY-MM-DD HH:MM:SS)*.
   Recommended with ***Insert a space...*** checked. This is the default.
   Example *CSV* output:

File,	,...,	*DateTime*,
Img001.jpg,	,...,	2021-12-24 16:00:05

   » Similar to 2, but with no ***T*** separator.
   » If ***Insert a space..*** box is unchecked, ***Excel*** converts the ***Date*** and ***Time*** to its internal representation and displays it using the cell's format.

Workflow tip.
Pay close attention to the above differences. They matter, especially if you plan to import your *CSV* file back into Timelapse after it has been opened and saved again by ***Excel***.

Important note:
Another way to manage Excel's undesired data conversion.

As mentioned, when opening a file Excel examines each field to determine its type. While sometimes handy, this leads to issues when your *CSV* file includes any data resembling Excel's many *Date* formats. An example was illustrated in the *QuickStart Guide*, where data held in a ***Sequence*** column contained text looking something like *1/3.* Excel, in its wisdom, interpreted even that as a date. Excel transformed that data into its own internal date format (which means the original text is not retrievable), and then displayed it according to the cell's date format, e.g., *03-Mar*.

Different methods solve this, albeit each requires a few extra steps.

- Import the file using Excel's ***Data*** | ***From Text/CSV***, which will display options for handling a particular column's data.
- Change the file's *.csv* suffix to *.txt* and open it in Excel as a text file. Again, column data-handling options will be displayed.
- Similar to what Timelapse does for DateTime, insert a leading space in front of each data field, which tells Excel to interpret the data as plain text. However, this may not be a good solution if its part of some metadata you imported, as you would then have to edit each field.

Various web pages detail how to do each of the above (e.g., see this link).

Importing data from a CSV file

The analyst can import tag data from a CSV file into Timelapse, albeit with restrictions. Import is done through ***File menu | Import data from a csv file,*** where a dialog box appears that provides instructions. When a CSV file is imported, Timelapse will update most – but not all – of its data to match what is found in the CSV file. Errors, if any, are listed.

The value of importing CSV files

Importing CSV files is valuable for several reasons.

- Data manipulation is easier to do in a third party system (e.g., Excel), especially if Timelapse does not have equivalent functions. To illustrate, the analyst exports the Timelapse tag data as a CSV file, opens that file in Excel, manipulates the data and saves the changed CSV file, and then imports the changed file back into Timelapse. For example:
  - an existing tag field is altered (e.g., to transform a lower case to upper case),
  - an existing tag field is populated based on calculations of other existing tag fields (e.g., a ***RunningTotal*** field is calculated based on a ***Count*** field),
  - an existing tag field is filled in with data available elsewhere.
- The analyst is working both with Timelapse and another 3rd party camera trap system. Data is interchanged between the two via the CSV file import/export facility, where either may make changes to the data or add to it. For example, the 3rd party system may provide specialized camera trap management and data analysis facilities, while Timelapse provides better tagging facilities.

CSV importing rules

Timelapse can import CSV files as long as those files adhere to certain rules.

- The ***File*** column is compulsory. The file name must exactly match the name of the file being updated. This field is case-sensitive.
- The ***RelativePath*** column is compulsory if sub-folders are used to store files. It should hold the name of the relative path to the image's subfolder. If images are located in the root folder, the RelativePath should be blank. This field is case-sensitive.
- The first row is a list of column headers, each matching a case-sensitive ***DataLabel*** as listed in the *.tdb* template file.
- Subsequent rows hold each file's data, where each value is under in the matching Header.
- Data rows can comprise a subset of files. Timelapse will only update the data for files listed in each row of the CSV file; other files will not be affected.
- Excepting ***File*** and ***RelativePath,*** all other data columns are optional. Only the data for the included columns will be updated.
- Data values in each column must adhere to the data type, as defined in the .tdb template file: ***Flags*** and ***DeleteFlag*** can only have true/false values.
  - ***Choices*** and ***ImageQuality*** can only have values that exactly match the text in the choice menu.
  - ***Counts*** can only be 0, positive integers or blanks.
  - ***Notes*** can comprise any text.

Timelapse does several checks and actions when importing a CSV file.

- It checks for possible mismatches when importing data from a CSV file (e.g., missing ***File/Relative*** path columns, unexpected column names, unexpected value types). If any are found, it aborts the import operation and raises a dialog box listing those errors. This allows you to fix those errors and try again.
- **Important:** If the ***File/Relative*** path in the CSV file doesn't match a file in the Timelapse database, that row's data is ignored.

Timelapse will not update the following fields.

- Fields locating the File (***File***, ***RelativePath***) are never updated. As Timelapse uses the File/RelativePath values to find the particular image or video file, they have to be identical to what is already there. Thus there is no need to change them.
- Fields relating to Date andTime (***DateTime***, ***Date***, ***Time***) are updated only if they match one of the exported formats (see previous section). See previous note on how ***Excel*** may modify certain date/time fields (affecting how they are subsequently saved in a *CSV* file) in unpredictable ways.
- If you had used the ***Edit|Duplicate*** this record… facility to create duplicate data, Timelapse will also manage that. Essentially it tries to match and update duplicate entries in the *CSV* file with corresponding duplicate entries in the database.

For example, the CSV file below (shown within Excel) only contains columns for ***File***, ***RelativePath*** and ***Comments*** data, which match those defined in the practice image set *.tdb* template file. It also contains only four rows, where

their *RelativePath*/*File* values identifies four existing files in the practice image set. When this csv file is imported, only the *Comments* field for these four files will be updated.

	A	B	C	D
1	**File**	**RelativePath**	**Comment**	
2	IMG_001.jpg	Station1\Fetched-2015-06	See the bear	
3	IMG_002.jpg	Station1\Fetched-2015-06	Its moving.	
4	IMG_003.jpg	Station1\Fetched-2015-06	Still going!	
5	IMG_004.jpg	Station1\Fetched-2015-06	A happy bear.	
6				

Common CSV importing issues

The easiest way to make sure that the CSV file adheres to the above rules is to export the CSV file first. This is because all relevant and correctly named columns and headers will be included, and the file/relative path values of any files to be updated will be correct. The analyst can then manipulate that data, as long as she is being careful to adhere to the expected data types. The analyst can delete columns if desired (except for ***File/Relative*** path). The analyst can also delete rows if only a subset of files are of interest.

Yet creating a well-formed CSV file is more challenging if the CSV file is created manually or by 3rd party software. For example, we have seen cases where some agencies began tagging with a different tagging tool (with CSV export capabilities), and then decided to switch to Timelapse. We have also seen some analysts want to go back and forth between two camera trap management systems, with a CSV file used to exchange data between them

The list below describes several typical challenges importing CSV files created outside of Timelapse. Several can be quickly fixed using the *UpdateCSVFile.exe* utility, described in the next section. For others, you would have to adjust the CSV file by other means, e.g., editing the CSV file, using formulas or macros to update fields to the Timelapse format, or by writing a script in your programming language of choice (e.g., R).

1. ***File locations are stored as a full path or in a single field***, rather than as separate ***RelativePath*** and ***File*** fields.
   - » *Example*: A location is stored as *C:/Documents/PracticeImageSet/Station1/Fetched-2015-06/IMG_0001.jpg*). The fix requires manipulating the path and putting it into separate columns ***RelativePath*** and ***File*** columns (e.g., ***RelativePath*** = *Station1/Fetched-2015-06;* ***File =*** *IMG_0001.jpg).* The *UpdateCSVFile.exe* utility can do this for you.
2. ***Column headers do not conform to matching DataLabels***. You may have to change your CSV column headers to match the corresponding data label is found in your Timelapse Template. The *UpdateCSVFile* program can also be used to fix this.
   - » *Example*: the CSV file contains a column of file names with the header *Image Name*. This would have to be changed to the matching ***File*** header.
3. ***CSV data values do not conform to the expected type***.
   - » *Example*: the CSV file contains a column indicating whether something is present or not as Yes/No. If the matching data type is a Flag, Yes/No would have to be updated to true/false.
4. ***The CSV column describes data that has no matching data field*** in the template. Fix this by adding a new data field to the template, where the data label of the two are the same.
   - » *Example*: the CSV file contains a column with the header ***Person*** whose data counts the number of people seen in an image. The TImelapse Template has no matching data field. Edit the Timelapse template to specify a new data field called Person as a Count. When the image set is re-opened, the Bear field will now be included.
5. ***The CSV column for DateTime or Date or Time*** are in the incorrect format. Fix this by converting them into the correct format (see previous section). Alternately, if the date and time match what is in the database, then you can just leave it as is as Timelapse will ignore those fields.
   - » *Example*: the DateTime is set to January 12, 2021 4:13 am. While a legitimate date and time, it is not in one of the three expected formats.

> ***Note.*** The syntax is:
> ```
> {
>  "old header 1": "new header 1",
>  "old header 2": "new header 2",
>  ...
>  "old header n": "new header n",
> }
> ```
> Braces, quotes, colons and commas are all required. Unchanged headers do not have to be included.

6. ***A Timelapse data file does not yet exist***. Fix by creating a template whose data labels and types match the contents of the CSV file, and place it in the image set as normal. Load the image set, which will create the Timelapse data file correctly populated with the file locations, date/times, and data labels. Then load up the matching CSV file. This should work well

as long as the CSV file conforms to the template as described previously. Remember that Timelapse data labels are somewhat restrictive, e.g., they cannot have spaces or some special characters in them. If so, the CSV column header names should be altered to conform.

The UpdateCSVFile utility

Timelapse includes a utility program called *UpdateCSVFile.exe* (see Timelapse website navigation bar, 'Other utility Programs').It partially helps update CSV files to match what is expected by Timelapse:

- update the headers of CSV files to conform to Timelapse data labels;
- repair file names that don't conform to File / RelativePath expectations.

The CSV output file is your old CSV file name suffixed with _updated.csv.

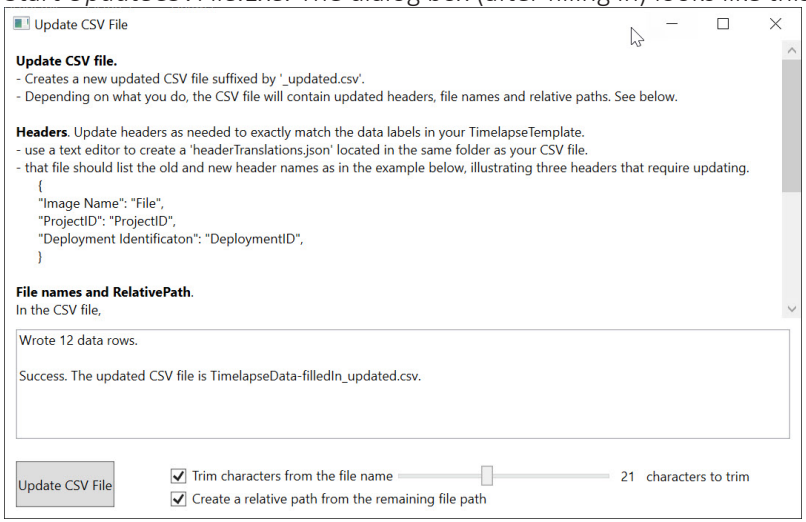
Using this program requires the following steps, as illustrated by example.

- Your CSV file currently contains four columns, whose headers are: ***Image Name***, ***Project ID***, ***Genus Species***, ***Count.***
- Three headers need to be renamed to match the template's DataLabels: ***File***, ***ProjectID*** and ***Species***.
- The ***Image Name*** column contains file location in the form of a complete path: *C:/Documents/Project/site1/image01.jpg*
- The template is located in the *Project* folder, where various subfolders (e.g., *site1*, *site2*) contain the files. Thus each file location in ***Image Name*** must be transformed e.g., where the ***RelativePath*** and ***File*** fields contain *site1* and *image01.jpg*.

1. The UpdateCSVFile.exe program requires you to create a text file (e.g., using WordPad) titled *headerTranslations.json*. This file should list the headers in your CSV file that you want to change, and what those headers should be changed to. This is best illustrated by the example above (***Count*** is not included as it exactly matches an existing template DataLabel). The example text file would look like this.

```
{
 "Image Name": "File",
 "Project ID": "ProjectID",
 "Genus Species": "Species"
}
```

2. Copy the headerTranslations.json file into the same folder as your CSV file.
3. Start *UpdateCSVFile.Exe*. The dialog box (after filling in) looks like this.



4. To trim C:/Documents/Project/ (21 characters) off of the file names,
   » check the ***Trim characters..*** checkbox
   » adjust the slider to 21
5. To split the remaining file path into the ***RelativePath*** / ***File*** columns, check the ***Create a relative path…*** checkbox. This will place the file name portion (e.g., image01.jpg) into a *File* Column, and the text preceding trimmed file path into a *RelativePath* column (e.g.,'site1'). A RelativePath column will be created if none exists in your CSV file.
6. Click UpdateCSV File and specify the location of the CSV file to update. Error messages (if any) will be reported in the above dialog box.
7. Open the updated CSV file to ensure that everything was done correctly. You should see the updated header names, and the shortened file names.
8. If anything appears wrong, correct those errors and try again.

Note. If all your files are located in the root folder (e.g., if *Site1* was your root folder), then you would just trim whatever characters lead up to the file name. For example, to trim off *C:/Documents/Project/site1/* you would set the ***Trim*** to 27 characters but do not check the '***Create a relative path…***' checkbox.

Part 12

A few more things

This section describes a few other functions that didn't neatly fit into the previous categories. Still, they are worth knowing! These include...

- Deleting files and data
- Setting preferences
- Dialog boxes
- Opening Timelapse in view only mode, where data changes are not allowed
- Image recognition.

Deleting files and data

Timelapse allows you to delete files, data records, or both. As explained in the section on *Menus*, the ***Edit | Delete*** menu includes several deletion options. All raise a dialog box asking for confirmation before action is taken.

The first three menu are for deletions that apply only the currently displayed file. The options include deleting the file only, deleting the file and the data associated with the file, or just the data (leaving the file intact).

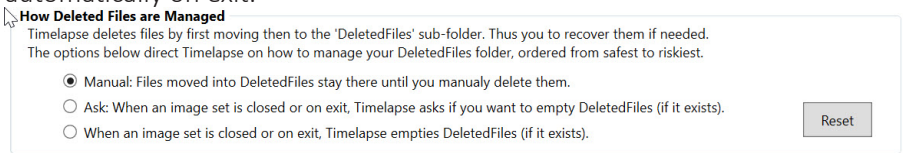
- ***The current image or video file…***
- ***The current image or video file and its data…***
- ***Only the data associated with the current file…***

The next three menu are for deletions that apply to all files in the currently selected files where the ***Delete?*** flag is checked. Similar to the above, options include deleting the files only, deleting the files and the data associated with those files, or just the data (leaving the files intact)

- ***All selected images or video files marked for deletion***
- ***All selected image or video files marked for deletion and their data***
- ***Only the data associated with all selected image or video files marked for deletion…***

In both cases, deleting only the data is useful if you created a duplicate record and no longer need that duplicate.

Files are not immediately deleted. Instead, they are moved to the DeletedFiles folder, which will be created in the root directory. This provides some opportunity to recover those files if needed(albeit by manually moving files back to their original folder). You can determine what happens to those files in the ***Options | Preferences*** dialog: to just keep those files there, to ask you if you want to delete them when closing an image set, or to delete them automatically on exit.

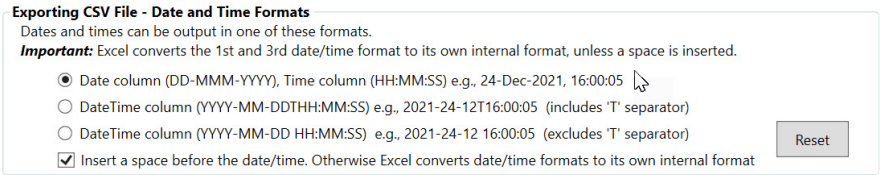


Workflow tip. Select can help bulk manage files you no longer need. In the practice image set, for example, you can ***Select | Custom select*** all files tagged as ***Empty***. Then set the ***Delete?*** flag on one of those files. From the ***Delete?*** context menu, select ***Copy to All***. You can then (for example) use the ***Edit | Delete*** menu to remove all those files and (if desired) their data.

Setting preferences

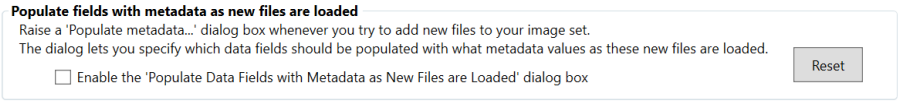
You can set various parameters that affect how Timelapse operates through a dialog box raised by selecting ***Options | Preferences...*** . Your settings are remembered on your computer across your Timelapse sessions. Each set of related parameters includes a ***Reset*** button that restores those parameters back to their default values. Parameters are displayed as sub-panels in the preference dialog as described below. Each preference is also explained in the various sections dealing with the preference topic.

Exporting CSV files – Date and Time formats



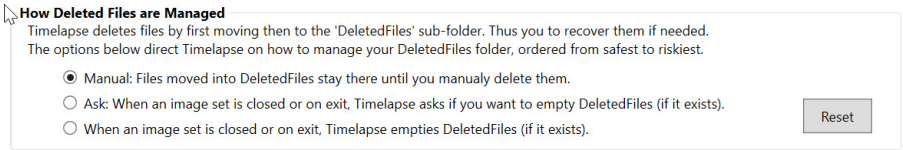
Timelapse lets you choose how dates and times are exported to *CSV* files. The various options include using two separate ***Date*** and ***Time*** columns, or as a single ***DateTime*** column set in various date/time formats. A space can also be inserted before the date/time to stop Excel from converting it to its internal format. See the section *Exporting and importing data* for further information.

Populate fields with metadata as new files are loaded



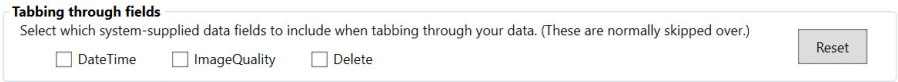
This preference raises the ***Populate metadata*** dialog whenever Timelapse is adding new (previously unseen) files.This occurs when you use ***File | Load template, images and video files...*** to load a new image set, or with ***File | Add image and video files to this image set...*** to add new images to your existing image set. While you can always use the ***Edit |Populate metadata...*** on your files to achieve the same effect, it may be more time-efficient for you to load new files and its particular metadata values as a single operation. See the section *Populating fields from metadata*.

How deleted files are managed



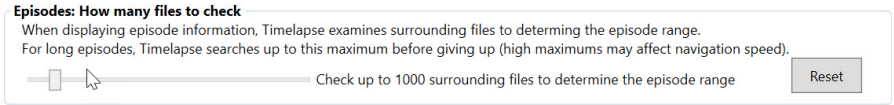
When you delete files within Timelapse, it actually moves them into a *DeletedFiles* sub-folder so you can recover them if needed. These options direct Timelapse on how to manage your *DeletedFiles* folder: to just keep those files there, or to ask you if you want to delete them when closing an image set, or to delete them automatically on exit.

Tabbing between fields



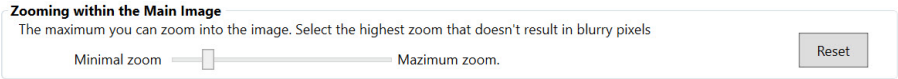
If you tab between fields in the data entry area, you can select which system-supplied data fields to include or skip in the tab order.

Episodes: How many files to check



When displaying episode information, Timelapse examines the surrounding files to determine the beginning and end of the episode. Because some episodes may be really long (e.g., a camera set in Timelapse mode taking images very rapidly), TImelapse limits how many surrounding files it should examine, as otherwise there may be some performance penalty (although it doesn't seem to be much). Use this preference's slider to adjust how many surrounding files Timelapse should examine.

Zooming within the main image



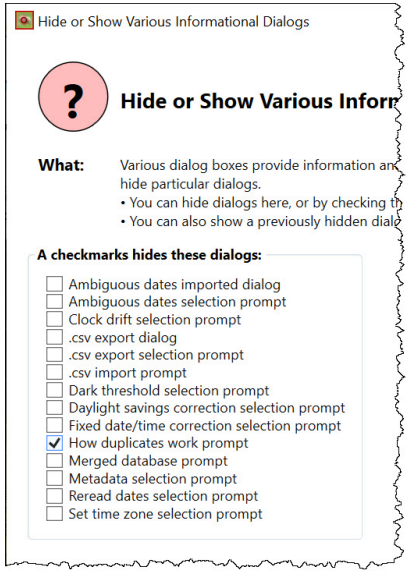
As you zoom into the image, Timelapse will stop zooming after it reaches a particular zoom setting. You can increase or decrease the maximum zoom allowable through this control. Note that really high zooms be of little value for low-resolution images, as you will just see a bunch of blurry pixels. The effect of this varies with your image resolution.

Dialog boxes

Dialog Boxes will appear as you use the Timelapse. Depending on the circumstances, they may display feedback, offer instructions and suggestions about choices you can make, request information from you, or inform you about any issues that arise.

Certain dialog boxes that offer instructions (and once read, perhaps are not needed again) let you controll whether or not they will be displayed in the future. This is done in one of two ways.

- Select the ***Don't show this message again*** checkbox that appears at the bottom of the dialog box's information panel.
- Select Options | Show or hide various informational dialogs, which lets you select which dialog boxes to show or hide (via another dialog box, as illustrated on the right)



Opening Timelapse in view only mode

Timelapse can be started in a ***view-only*** mode. In this mode a person can open and view existing images, videos and any previously entered data. as normal. However, the person

- cannot edit or alter that data,
- cannot create a new image set,
- cannot add new images to an existing image set.

This Timelapse version is handy if (for example) a person only wants to view an image set and its data, as it ensures that no accidental changes to the data will be made." It is also handy if that image set is given to others to view, where those others should not be able to change data.

There are several ways to start Timelapse in view-only mode.The first is by far the simplest.

1. *Timelapse-ViewOnly.exe* is a very small program included in the Timelapse executables folder whose sole purpose is to start Timelapse in view-only mode. As with Timelapse, you can create a shortcut to it and place it on the desktop.
2. ***Using a command window.*** Invoke Timelapse with a *-viewonly* argument. For example, if the command window was set to the Timelapse executable folder, you would type *.\Timelapse2.exe -viewonly*
3. ***Creating a shortcut.*** Create a shortcut to the Timelapse.exe program. Open its properties. In the target field, add *-viewonly* to the end of the executable path.

Image Recognition

Timelapse works with 3rd party software that does the actual image recognition. This is described separately in the ***Timelapse Image Recognition Guide***.

Image recognition can be incredibly helpful, so its worth your while to try it. We do recommend that you familiarize yourself with the basic Timelapse facilities first before jumping into image recognition, as trying to do every-thing at once may be overwhelming (although its really not that hard).