Rapid Digitisation Project

Australian Museum

A Guide to the Handling and Digitising of Specimens

nature culture **discover**

Australian museum

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The Atlas of Living Australia (ALA) is building a better picture of Australia's animals, plants, fungi and micro-organisms for research, taxonomy, management, education and other uses.
It aims to enable anyone to locate, access and combine information on all aspects of Australian biodiversity, online.
The ALA website already holds over 23 million records on the distribution of Australia's fauna and flora, as well as maps, images and literature.
Anyone using the ALA site can create lists and maps of the species around a location and access species pages, distribution maps, photos and other multimedia.
The ALA site also provides access to reference lists of species' names and classifications, databases on specimens held in natural history collections, databases of field observations, published literature, identification keys and a wide range of other databases and web sites.
The ALA needs more information about all Australian species to help protect and manage Australia's biodiversity. Members of the public can help by contributing photos and information to the Atlas site (www.ala.org.au).
Key outcomes will deliver more integrated data, new tools and services which will provide further possibilities for research and management.

This document has been written by the following staff in the Australian Museum's Collection Informatics Unit: Paul Flemons, Manager, Leonie Prater (Digitisation Officer), Rhiannon Stephens (Digitisation Officer), Michael Elliot (Senior Technical Officer). Special thanks to Dave Britton (Entomology Collection Manager) and Jacquie Recsei (Technical Officer) for their valuable contribution.

1. Introduction

1.1 Entomology Collection

Entomology is the study of insects. Insects are the class of animals that have an exoskeleton, a body divided into three parts (head, thorax and abdomen), three pairs of jointed legs and a pair of antennae. Insects are the most diverse group of animals on the planet.

The Australian Museum (AM) Entomology Collection contains over six million specimens. Most of the specimens in the collection are Australian but there is a strong non-Australian representation of beetles, psocids (booklice), flies, butterflies and moths. The collection also has many undescribed species, and species found in no other collections. The Australian Museum has one of the the world's largest collections of bark lice and Australian acalyptrate and asilid flies, along with major collections of antlions, dragonflies, butterflies, ants, alderflies and beetles.

The Entomology Collection consists of five sections in the lower ground Vernon wing and two large areas in the Research and Collection Building.

Specimens come from amateur collectors, staff, field surveys and donated private collections. The Collection is used by entomologists, ecologists, educators and many others for research and taxonomic purposes. They can be loaned out to different institutions and scientists for research purposes.

1.2 Why digitise museum collections?

The data attached to objects in museum collections are as important as the objects themselves. Data in natural history collections is usually in the form of labels attached to specimens. Information on labels includes details on where the specimen was collected, such as location, date of collection, collector name, and method of collection. In some cases there will be a separate label with taxonomic information, such as the specific name of the specimen.

The role of this Digitisation Project is to make specimen label data accessible without needing to go to the physical collection and laboriously transcribe label data. Every time a worker handles specimens to obtain specimen data it increases the risk of damage to fragile and often irreplaceable specimens. The digitised specimen data that is created in this project can then be accessed through portals such as those associated with the ALA. Digitisation of specimens in the collection also assists collection management in routine tasks such as specimen inventory and loan preparation.

2. Process and procedures

2.1 Storage of specimens within the collection

The storage environment for museum specimens in the collection means that dried insect specimens can last indefinitely provided they are properly protected and carefully handled. The dry collection rooms have controlled temperature and humidity to prevent mould and discourage pests which would otherwise damage or destroy specimens. In addition new incoming material is frozen to eliminate any living pests in the collected specimens. Previous collection management practices relied on chemical barriers such as naphthalene ("moth balls") to prevent pests entering dry collection storage. This practice stopped several years ago, but there is still a legacy of naphthalene present in older drawers.

Cabinets, drawers and unit trays

Specimens are stored within the collection in cabinets. Each cabinet holds drawers and within each drawer there are unit trays. The unit trays store individual specimens from the same family, genus and species.

Cabinets

Drawers

Unit Tray

Naphthalene

Naphthalene was historically used as a deterrent against insect pests to avoid damage of the specimens in the museum collections.

Although naphthalene is no longer added to the collection it is still present within drawers. Unfortunately removal of this naphthalene from the drawers is impractical in terms of time, worker safety, and the safety of collection items.

The air levels of naphthalene have been measured in the collection areas and are a tiny fraction (1.2%) of the nationally recognised safe exposure limit. However, some people are sensitive to this chemical and may have adverse reactions. Collection management is taking active steps to replace older impregnated drawers to ensure that collection workers are able to work in a safe environment, but this is dependent on additional funding for purchase of new storage items.

Naphthalene ingrained in edge of drawer.

2.2 Equipment

The equipment used in the collection that are most relevant to our project include:

- Entomological forceps: stainless steel forceps used for handling pins
- Fine curved or straight forceps: forceps used for removing and handling labels
- Pins: stainless steel entomological pins of different thickness (or gauge). The gauge of the pin is measured by a number, with larger numbers indicating large gauge pins. These pins are used for pinning specimens or pinning staged mounts
- Minuten pins: tiny headless stainless steel pins, used for pinning small specimens onto stages of pith and foam.
- Foam or cork: used to line drawers and unit trays in which specimens are pinned.

2.3 Drawers

Drawers should always be placed on a trolley to transport them. Always use two hands to move drawers, keeping the drawers flat. When a drawer is not being used a sheet of paper should be placed over the lid to stop light causing specimen deterioration. No more than 3 drawers should be put on top of each other at a time to avoid the drawers being damaged by the weight and possibly falling off each other and causing damage to the specimens.

Trolley with drawers, note: only three on top of each other and sheet of paper on top.

Although a standard size drawer has been used in the collection, minor changes to manufacture and design of the drawers mean that some drawer lids do not fit well. Some lids may be too tight and some may be too loose. Please make sure that a drawer lid is not separated and is returned to that drawer. Care should be taken when removing ill fitting lids.

Lids should be removed slowly to avoid a sudden gust of air damaging the specimens. The lid should then be placed in a safe spot to avoid it being broken. Do not place the lid in a position where it could fall and damage the specimens as well as breaking the lids.

When working over the drawers avoid wearing loose clothing, pendants and other jewellery, access cards on lanyards or other objects that might damage specimens. Avoid carrying unnecessary objects over drawers in case they damage specimens. Care must be taken using forceps within the drawers. Be aware that some unit trays may be tight fitting in the drawer and care needs to be taken when removing them from and returning them to the drawer.

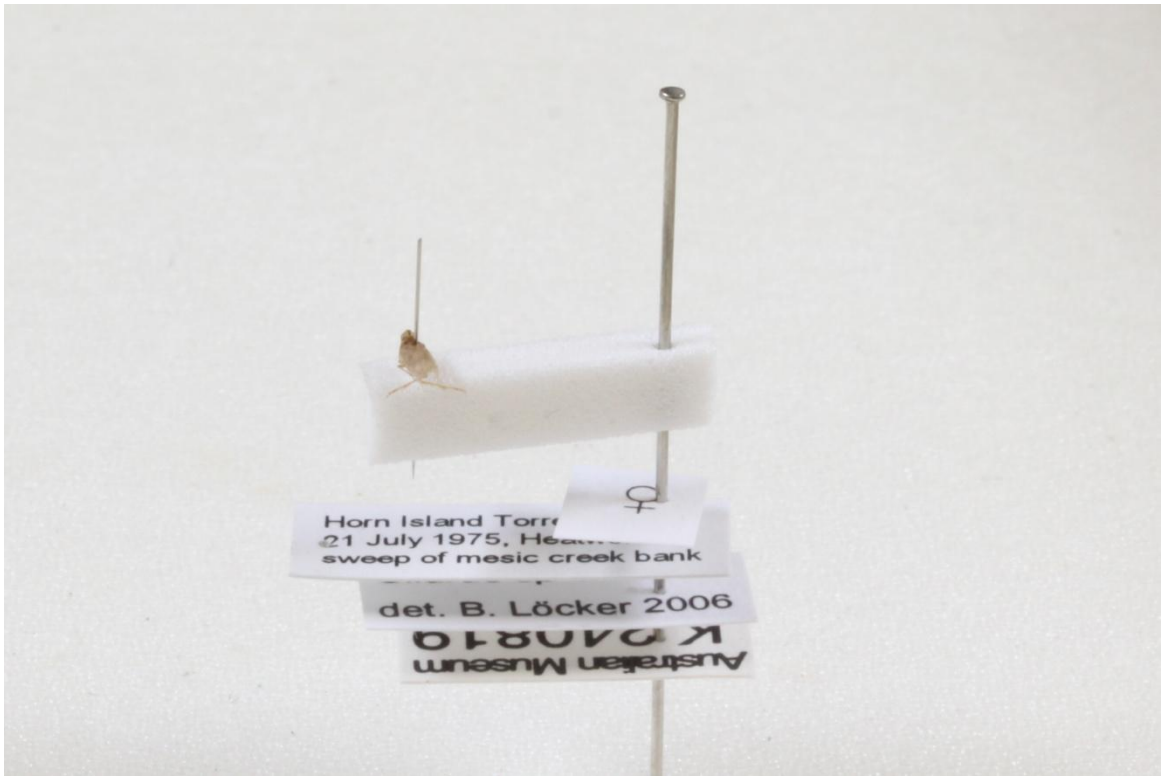
2.4 How specimens are mounted

Dried insect specimens are very fragile. They are mounted in a way that preserves them and allows parts of the insect to be observed.

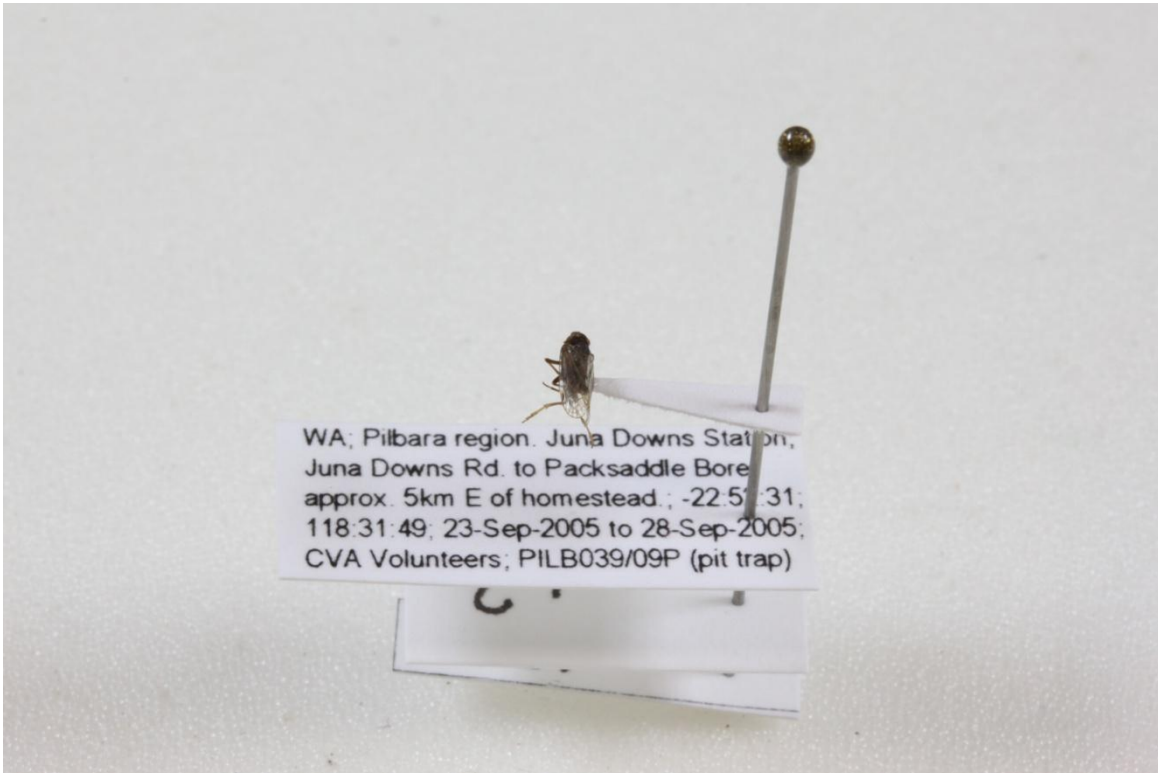
The four main ways that dried specimens are mounted are:

- Specimens pinned directly through the body using a size 2 or 3 entomological pin.

- Smaller specimens may be pinned with a minuten pin to a stage made of pith or foam which is then mounted on a size 2 or 3 pin



- Small specimens can also be glued to the tip of a card point mounted on a pin or



- Glued directly on a card mounted on a pin

Data labels are attached to the bottom of the pin underneath the specimen. Multiple labels are common on specimen pins. The order in which the labels are on the pin is of historical interest with the first (and often oldest) label being closest to the specimen. Typically the label which details collecting data is uppermost.

2.5 Working with specimens in the collection

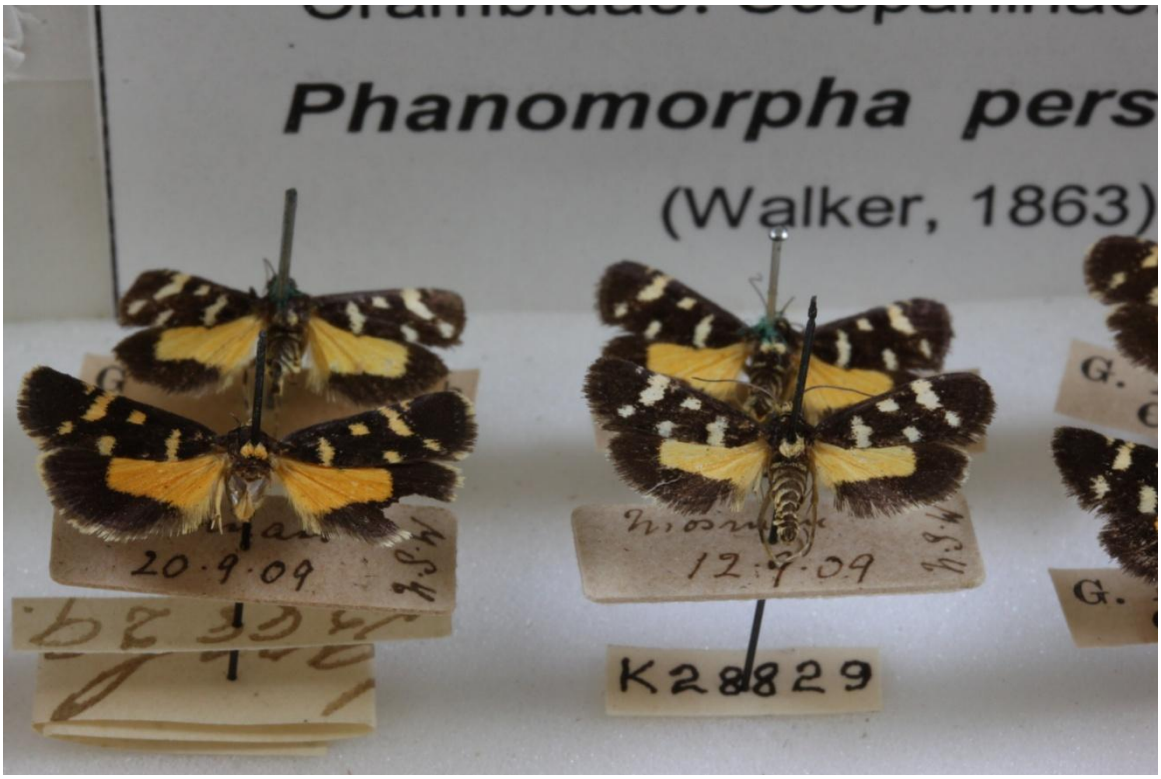
Every drawer and each specimen within the drawer is to be returned in exactly the same way in which it has come to us from the collection with a new registration label attached to each specimen.

Due to the fragility of the specimens and the way they have been mounted it is expected that there will be potential problems when handling them. Listed below are the most common issues that you will encounter when handling specimens:

- When handling a small specimen near plastic, the static charge created by the plastic can remove wings and other appendages from the specimen, so care must be taken.

- Specimens usually stay in place on the pin because their body fluids act as glue when the insects dry. However some specimens will come loose and spin on the pin potentially damaging themselves and adjacent specimens.
- An insect mounted on pith, foam, points or card may also become loose, or the pith/foam/point/card itself can be loose and spin on the pin.
- Sometimes minuten pins can protrude down through the pith. When the label is returned to the main pin care must be taken to ensure that the minuten pin doesn't push into the label.
- Insects that are point or card mounted can have the glue fail and the specimen can fall off the mount.

- Old pins made of brass and steel are often corroded, especially with humidity and by chemical reactions with insect body fluids. This can make them break in half, or cause damage to the specimen. The heads of old pins can also break off so care must be taken when removing them from the drawer. In some cases the heads have been cut off to allow the specimen to fit in obsolete shallow drawers. Use forceps if appropriate.



- Corroded brass pins are often recognised from the green copper oxide evident around the specimen and labels on the pin. Damaged specimens from copper oxide can explode or break in half. Always take care when removing pins with obvious corrosion as both they and the specimen they hold will be fragile. There will often be a node or nodes of corroded material on the pin on which the label can get stuck. Again use forceps to slowly and carefully push the label over the nodule, holding the tips of the forceps as close to the pin as possible without actually gripping the pin. It will often be necessary to pre-pin a hole when attaching a new registration label to specimens with corroded pins. Use a pin with a slightly smaller diameter than the specimen pin to create the hole. When you are replacing a specimen with a copper oxide affected pin into cork or foam make sure that you use the forceps below the labels and guide the top of the pin with your fingers.

- Narrow gauge (size 1 or less) pins are sometimes used for direct pinning of smaller insects but they bend very easily and can flick when released after pinning. Even size 2 pins can easily bend when replaced into hard cork drawers. The hardness of cork varies greatly between drawers and within drawers.
- When a specimen is pinned too high it can lead to damage being done to the specimen when the pin is handled by the head. Use forceps to handle the pin below the specimen to avoid this where possible.
- When a specimen is pinned too low it may allow only limited room for labels to be attached beneath the specimen. Take care to avoid pushing the labels up into the specimen.

A short training session before starting each family will be provided to avoid potential problems particular to that family.

2.6 Labels

Labels display important data about the specimen including the collection event (location, date, collector and method), the species name and other determinations, and sometimes a registration number that relates either to paper registers or the collections database, or both.

Labelling methods and materials vary considerably throughout the collection. Many labels are fragile as the paper or card used may be acidic, poorly manufactured or very old. Old labels are often recognised because they are yellowing or dark brown and crumbling.

As with the specimens, handling and interpreting labels raise many issues including:

- Labels can be handwritten or printed. Some may be very difficult to read.

- Labels can become loose on pins, and swing potentially damaging adjacent specimens. Labels can be made more secure by gently pushing the paper fibres back in on the hole. This is preferable to creating a new hole in the label.
- Labels which have been removed and then reattached to pins by users often have multiple holes, which can obscure data. It is important that you don't make a new hole in the label and obscure data.
- Large labels can create a risk of damage to other specimens when they are being moved in the collection.
- Sometimes a label may be folded up then placed on the pin. These labels need to be carefully unfolded after being removed. A microscope slide may be used to weigh down the label for photography. After the image has been taken it is important to fold the label up the same way and replace the pin in the holes that have already been made.

- The order of multiple labels is of historical interest and they should always be replaced in the same order in which they were taken off the pin.
- Multiple labels should be spaced appropriately on the pin and not bunched together and should be orientated so that the critically important labels (collection information and registration label) are visible in at least part without removing the specimen from the drawer. For registration numbers, it helps if at least the last three digits of the number are visible without having to move the specimen, or take off labels. This orientation should also consider the shape of the insect, and whether the labels will interfere with or damage adjacent specimens. Avoid handling the labels more than necessary, as this will make them loose on the pin.

- There can be labels that have information written on the back, in this case the label needs to be photocopied, cut out neatly and imaged along side the label 'right side up'.
- If the paper of the label is very old and brittle check with the supervisor, as there may be a need to return it back to the collection staff for conservation treatment.

3. Workstation setup

Each workstation is set up with a camera on a copy stand, the specimen drawer and stage and a computer with dual screens.

It is a three step process to capture the image of the specimen and label data:

1. Preparing the specimen for imaging by removing its labels and placing it in the stage
2. Imaging the specimen and data entry
3. Reassembling by putting the labels back on the specimen and returning it to the drawer.

At each workstation there will be two volunteers. One volunteer will be handling the specimen (the Specimen Handler) and the other volunteer will be imaging the specimen (the Digitiser).

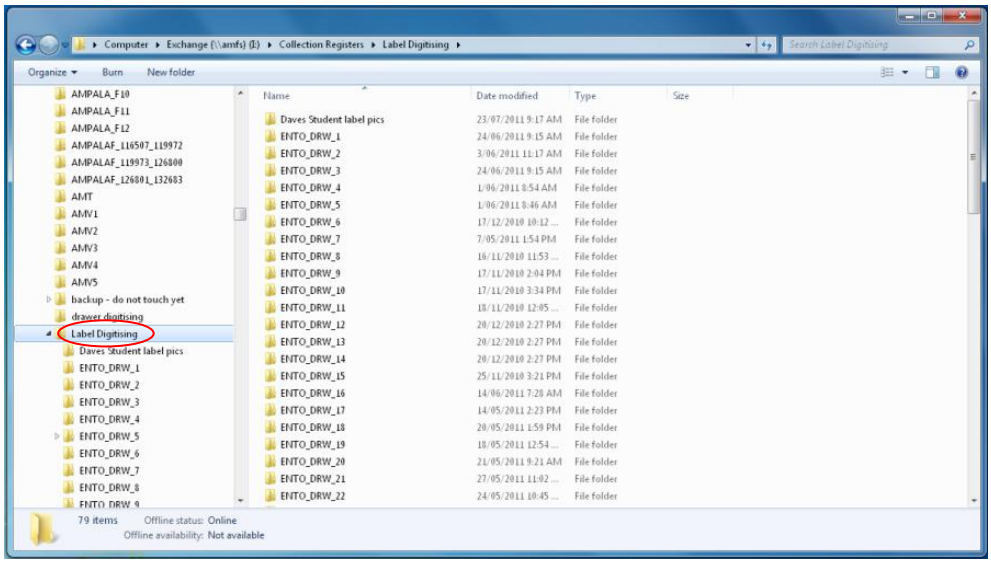
The following steps will guide you in the systematic usage of the equipment (ie computer, camera and database) for digitising the specimens.

- Use the generic login to log onto the computer.
- Turn the camera on and remove the lens cap, place the lens cap in the equipment box.
- Turn on the ringflash.

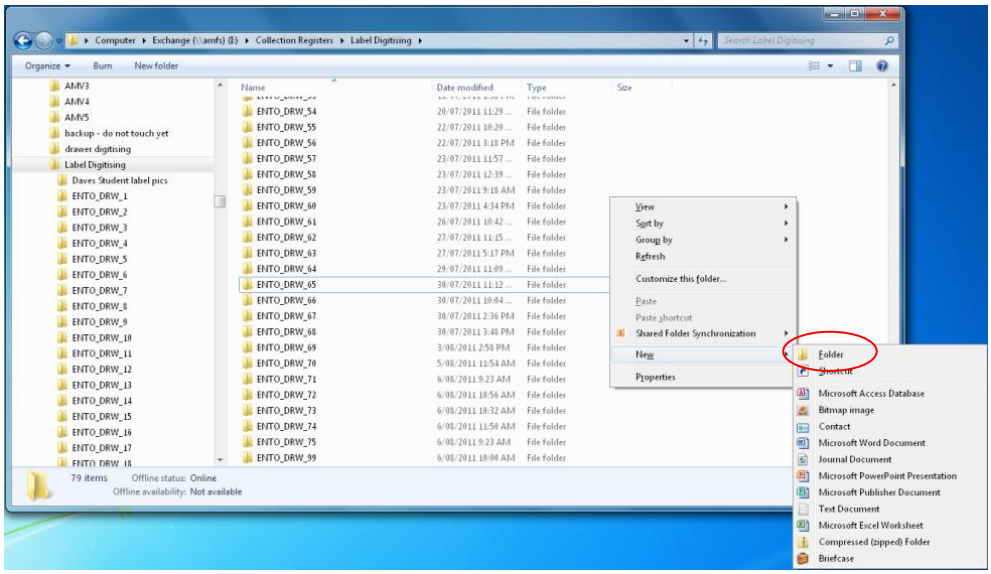
3.1 Creating a new folder

Before starting each new drawer, a new folder must be created.

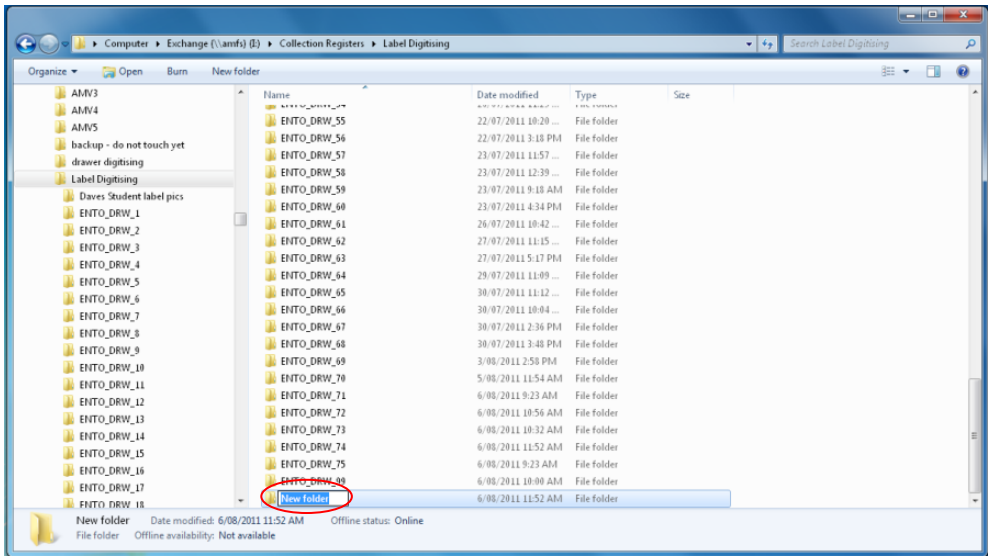
Create a new folder in I:/Collection Registers/Label Digitising. To do this go to Windows Explorer, open Collection Registers on the left hand side and then Label Digitising.



Click on the right hand side of the window with the right mouse button to get a new folder as shown below.



Type in the name of the folder, for example, ENTO_DRW_1.



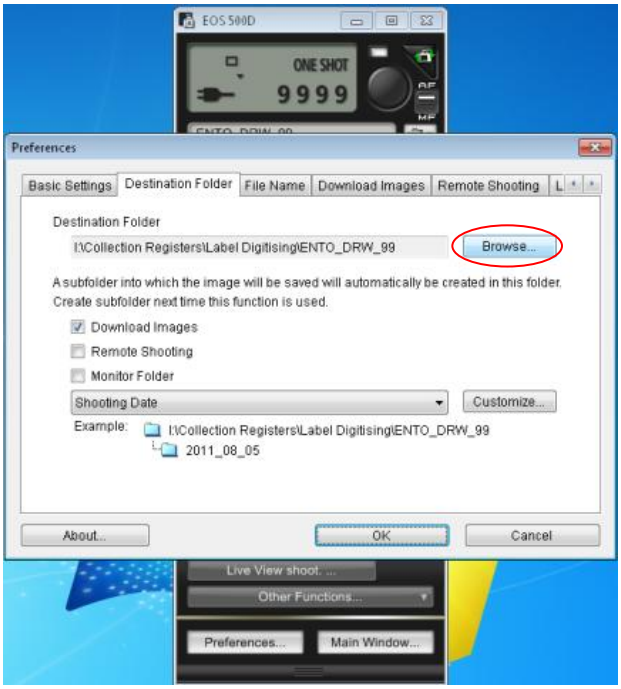
3.2 Applications to open on the desktop

3.2.1 EOS utility

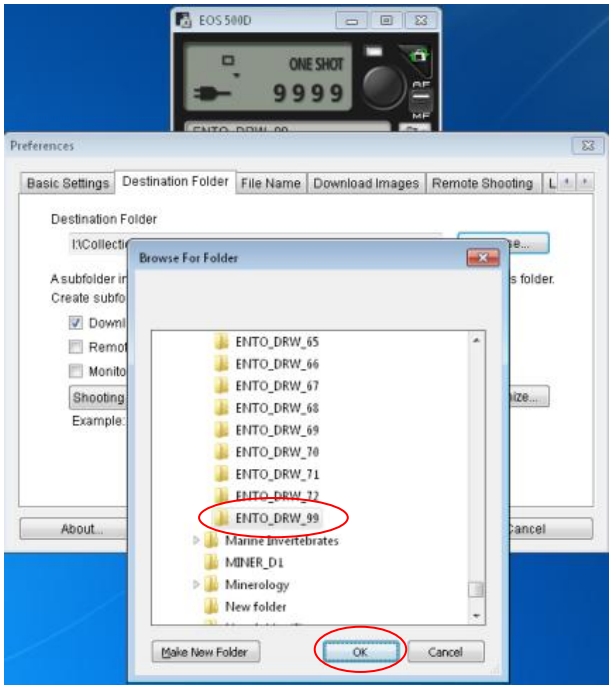
Double click on the EOS Utility icon on the desktop (unless it opened automatically when the camera was turned on), this will open up the below window. Click on Camera settings/Remote shooting.

By clicking on Camera settings/Remote shooting, the EOS 500D window will open to the camera's remote shutter control. Click on the folder icon to change the folder where the images are saved if needed.

Click on Browse in the Preferences box.



Navigate to and select the folder where the images for the drawer will be saved and press OK.



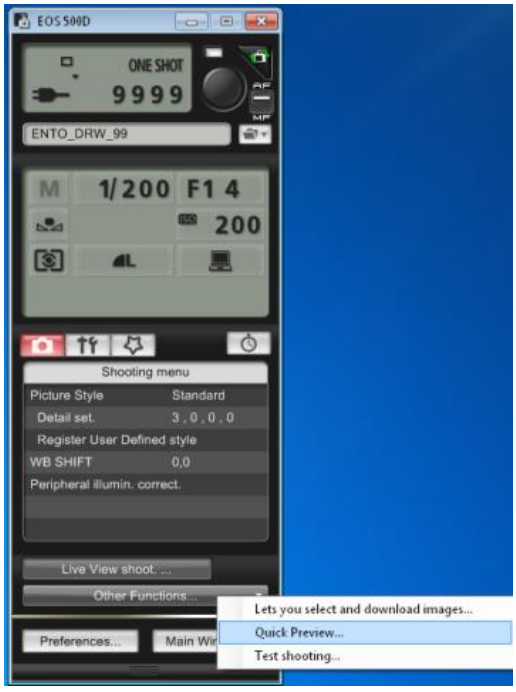
3.2.2 Remote Live View Window

Click on Live View Shoot on EOS utility.

This will open the Remote Live View window.

3.2.3 Quick Preview

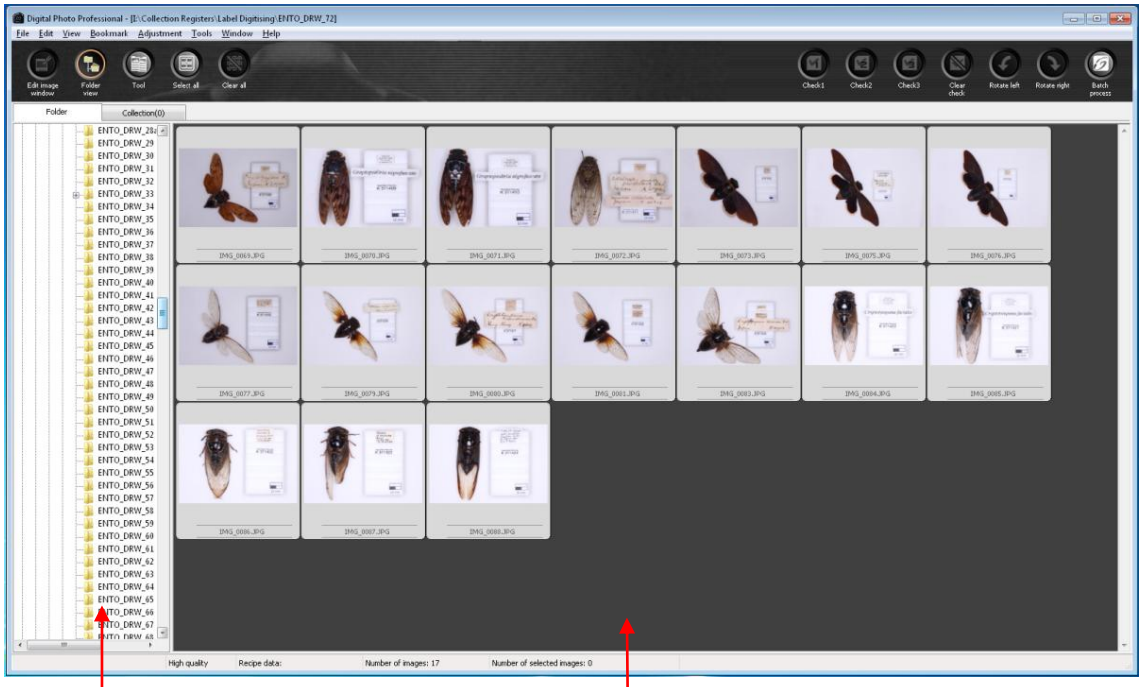
Click on Other Functions on EOS utility and then on Quick Preview.



This will open the Quick Preview window.

3.2.4 Digital Photo Professional

Double click on the Digital Photo Professional icon on the desktop. On the far left hand side go to: My Computer/I:/Collection Register/Label Digitising/ENTO_DRW_... (the name of the drawer that is being digitised).

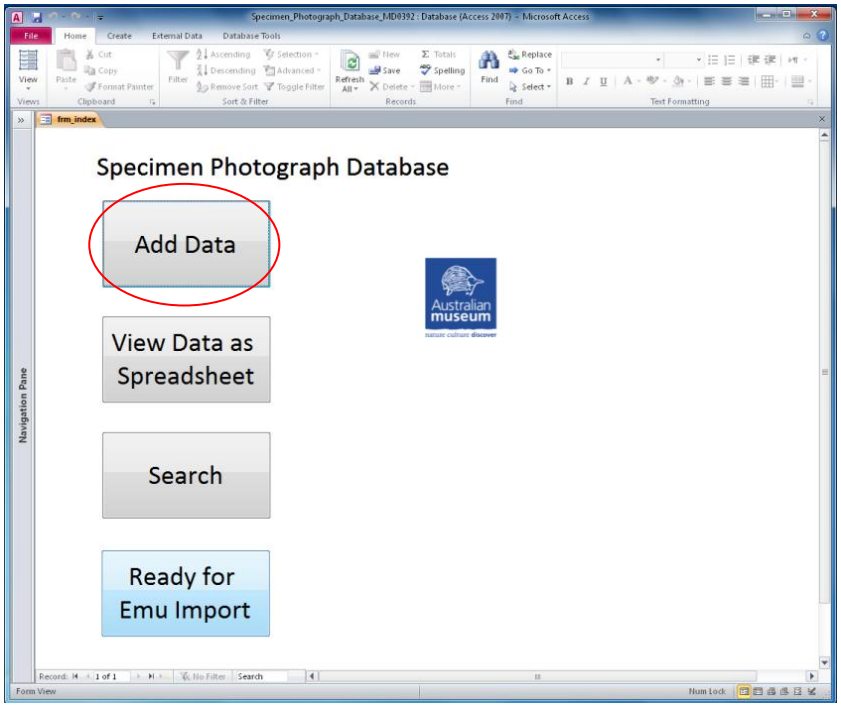


Folder where the image is saved

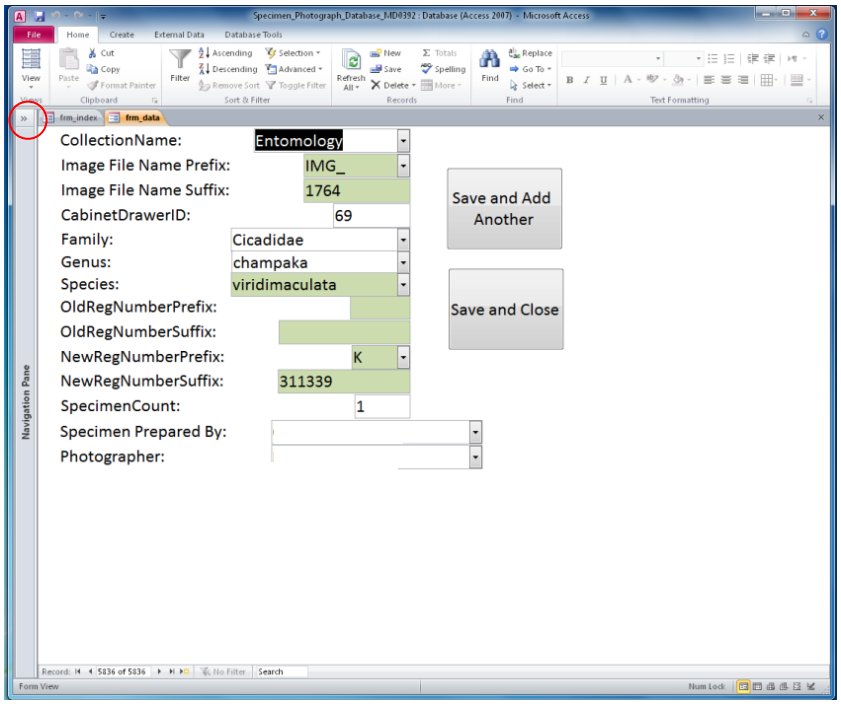
Image library

3.2.5 Database

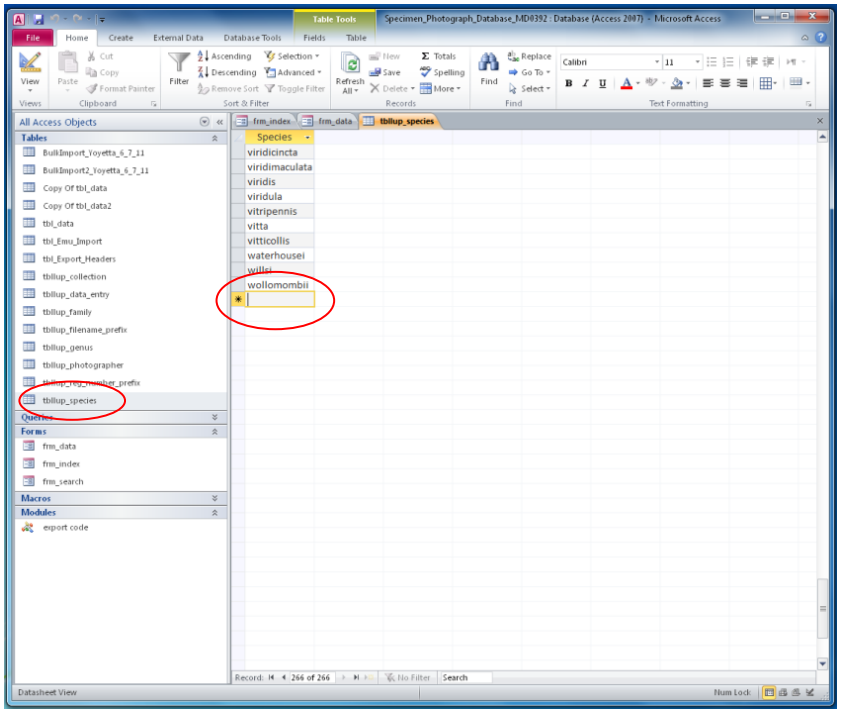
Open Specimen_Photo_Database which can be found on the computer desktop. If you need to add new family, generic or species names, see below, otherwise click on the Add Data button.



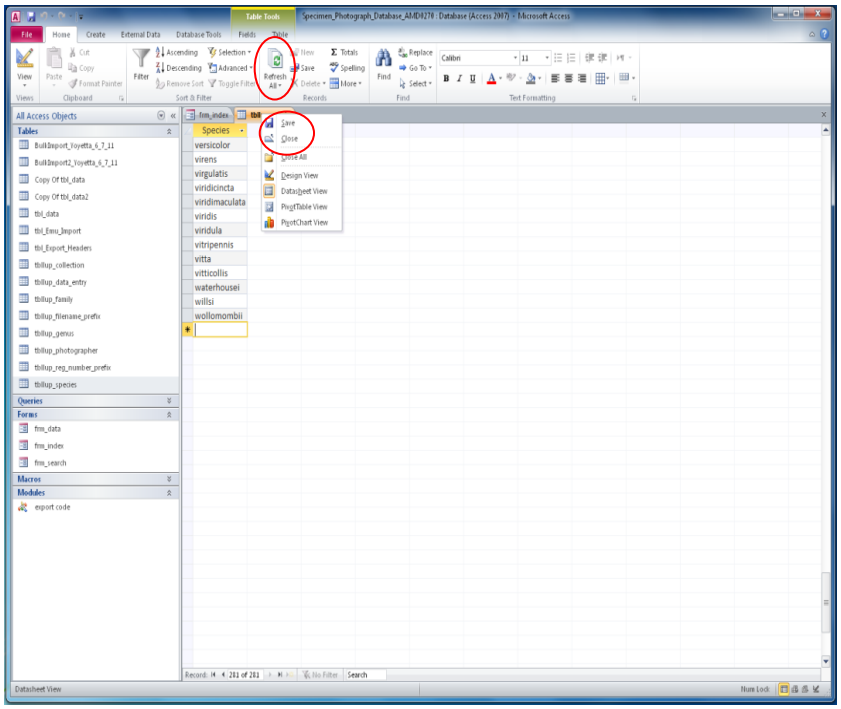
To add names click on the double arrow to open the navigation pane.



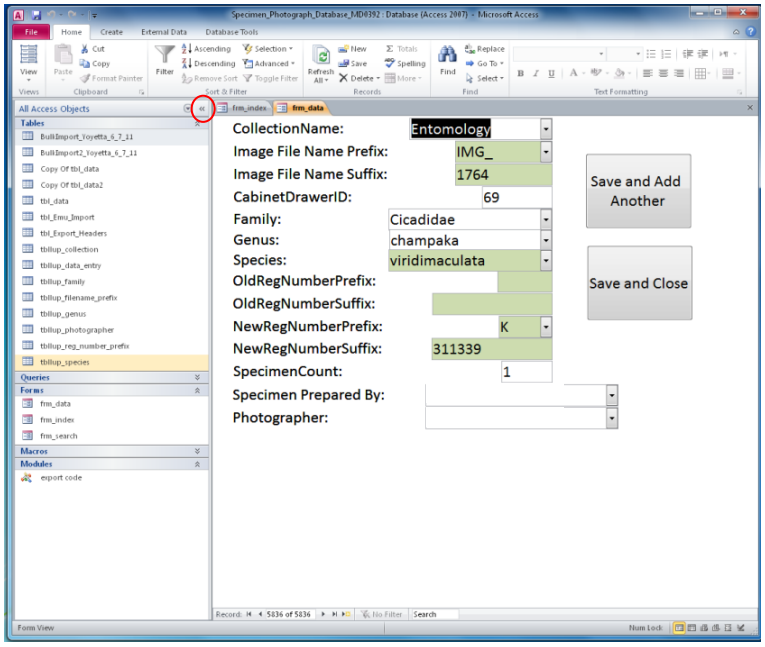
Double click on the table that needs updating e.g. tbllup_species. Scroll down on the right hand side table column and add the name in the field with the asterisk. Arrow down or press Enter to add another name.



When all names have been added, right click on the top tab and save and then close. Click on Refresh to make sure the names have been added to the drop down boxes.



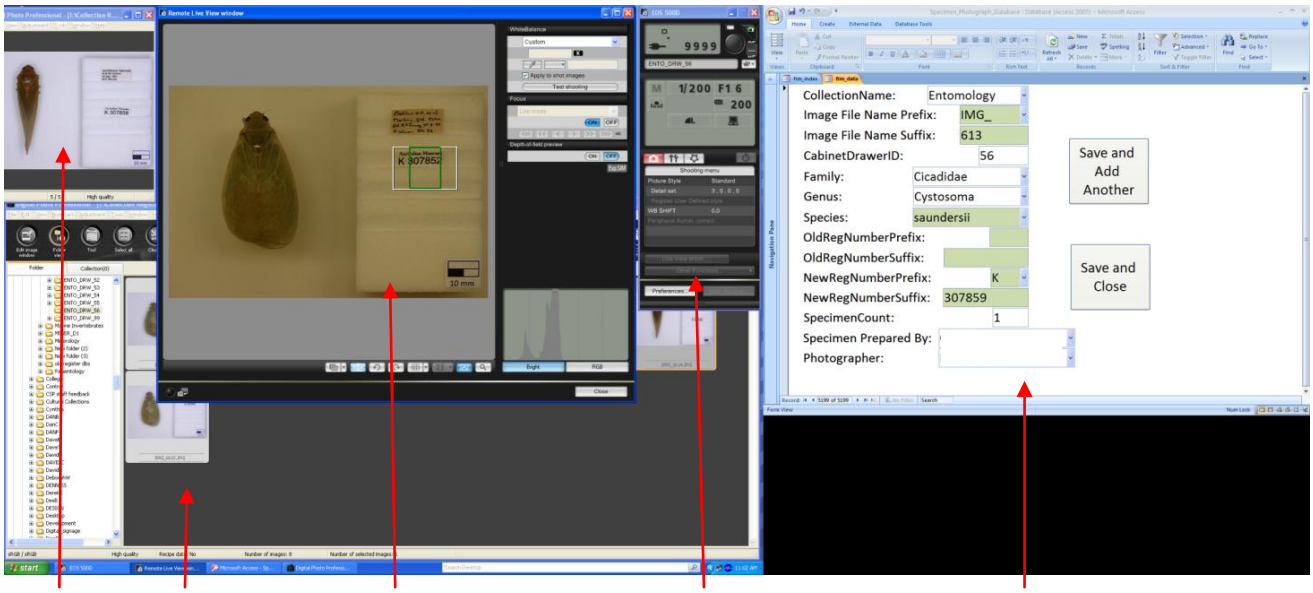
Click on the double arrows to close the navigation pane.



3.2.6 Position of open windows

The positioning of the open window applications on the dual monitors is a personal preference however guidelines are outlined below.

Monitor 1 (left) Monitor 2 (right)



Quick Preview *Digital Photo Professional* *Remote Live View* *EOS Utility* *Database*

4. Removing a specimen from a drawer ready for imaging

Most of the specimens in the collection should be considered as irreplaceable. The security and condition of the specimens is of utmost importance, and must not be compromised for imaging.

Both the Specimen Handler and the Digitiser need to assess each new drawer to get a 'feel' for that particular drawer. Species labels are generally placed below the series of specimens but that is not always the case. Spend the time to assess how many species changes there are in the drawer and note the approximate numbers of specimens in each species. This is to help the Digitiser to avoid errors when entering data into the database. If a specimen already has a new registration label, it has already been databased and therefore there is no need to image that specimen and data. Check that all family, subfamily, genus and species names in the drawer are entered into the database before imaging.

Follow the steps below to prepare a specimen for imaging.

- The Specimen Handler starts by putting the stage in front of them and will always work within the stage.
- The specimen is removed from the drawer using fingers or forceps, bracing fingers on the edge of the drawer or unit tray to assist in pulling the pin out in a controlled fashion.
- The position of the specimen within the drawer is noted using a stage labelled pin.
- The labels are then removed from the pin using forceps.
- The labels are placed centrally on the rungs of the label block with the label closest to the specimen on the top rung and subsequent labels on the rungs below. Check that there is no writing on the underside of the label. If so, photocopy the label and cut it out and image it along with the label 'right side up'.
- Place a new 'K' registration number on the rung below the lowest label that was set on the pin.
- Position the specimen on the stage with the head in the same orientation as the label block.
- The specimen is ready to be imaged.

5. Taking the image

Before adjusting anything on the camera or copy stand, make sure you have moved the specimen away from underneath.

The camera that we are using in the workstation is a Canon EOS 500D or 550D with a ring flash mounted to a copy stand.

The Digitiser positions the stage under the camera 'upside down' in the same orientation of the camera. This step saves the image being rotated after it has been taken.

Use the camera's remote live view finder, to ensure that the specimens and labels are in the camera frame. The specimen and label should be centred in the image and take up as much of the field of view as possible.

The base line settings for the camera when the copy stand is at a height of 44 ½ cm are shutter speed 1/200, Aperture F16, ISO 200, Custom lighting, Flash 1/16, this needs to be assessed at any change to the copy stand's height.

A basic explanation of the camera settings is as follows:

Shutter speed. The time that the shutter is open. These settings are usually measured in seconds or fractions of a second e.g. 1/30, 1/60 and so on. The smaller the fraction the faster the speed (e.g. 1/1000 is much faster than 1/30). The greater the seconds or fraction of a second setting the longer the shutter is open. This can create problems with camera shake due to movement of the copy stand for long exposure times.

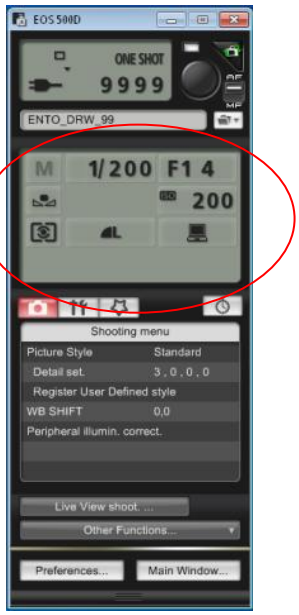
Aperture. The aperture is the size of the iris in the lens that also controls the amount of light that the lens lets into the camera and the depth of field (i.e. how much of the image is in focus). The settings for aperture are called f-stops and are usually a standard set of numbers f/2.8, f/5.6, f/8, f/11, f/16, f/22, f/32. These numbers are actually fractions (where the number 1 has been replaced by the letter f), but are usually expressed as full numbers (e.g. f 1/16 is usually expressed as "f sixteen").

Each step up in aperture value halves the amount of light reaching the sensor. Each step down in aperture value doubles it.

Larger apertures (where lots of light gets through) are given smaller f-stop numbers and have shallower depth of field. Smaller apertures (where less light gets through) have larger f-stop numbers and a greater depth of field.

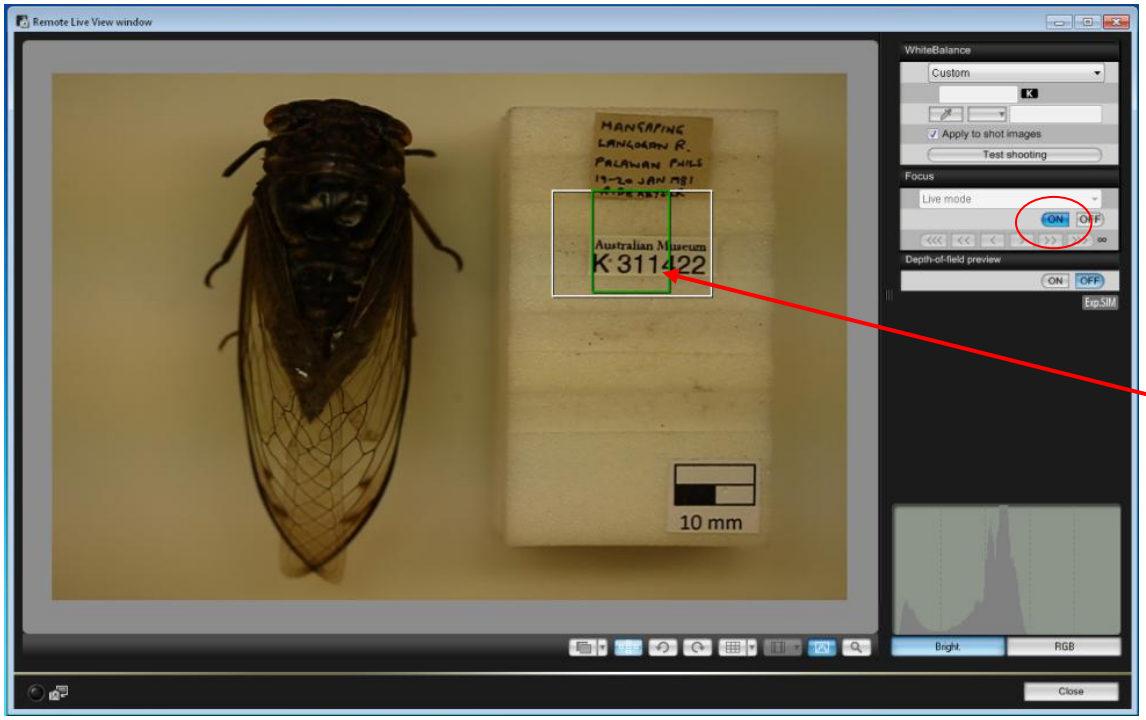
ISO Settings. ISO is the sensitivity to light of the imaging chip in the camera. The lower the number the less sensitive the camera is to light, and the lower the electronic noise.. Higher ISO are generally used in darker situations to allow for a faster shutter speed (like in the Dinosaur exhibition). However, the cost is noisier shots. ISO 200 is sufficient for adequate image quality for specimen data capture.

These parameters can be changed in the EOS 500D/550D window.

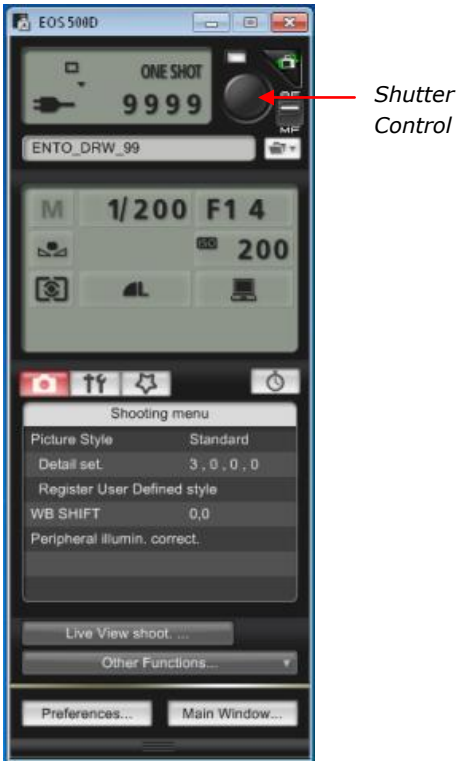


In Remote Live View window the point of focus is used to ensure that the labels and specimen are sharp.

Click on Focus>Live Mode>On to focus the image.



The computer operated shutter control on EOS Utility is used to take the final image.



Take the photo and maximise the Quick Preview window to check the positioning of the specimen and label block. Double clicking on the image in Digital Photo Professional can also be used to zoom in on an image to check the focus and clarity.

If the image is not satisfactory, go into Digital Photo Professional and click on the image so that a yellow outline appears, press the delete button and yes to delete the image. Care must be taken that only one image is selected for deletion and that the image number correlates in the database.

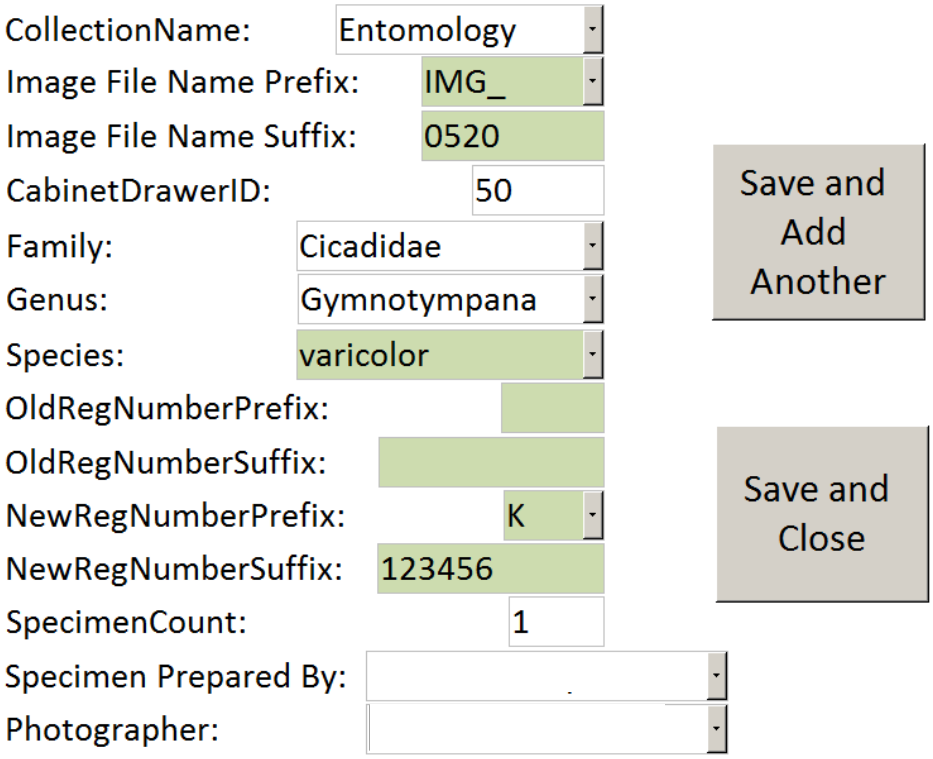
Positioning of specimen and label block in the camera frame.

Once the Digitiser is satisfied with the final image they will pass the stage back to the Specimen Handler to reassemble the label stack with the specimen.

The Digitiser will then enter the label information into the database.

6. Database steps

The fields of the database need to be filled out to correspond with that of the specimen image.



Collection Name: The collection from where the specimens come from e.g. Entomology

Image File Name Prefix: Camera file name of the image i.e. IMG_

Image File Name Suffix: The number of the camera file name which is found under the image in Digital Photo Professional

CabinetDrawerID: The number on the front of the drawer.

Family: The name of the family of specimens (on the front of the drawer).

Genus: The genus name (first letter is always a capital letter).

Species: The species name (first letter is always a lower case letter).

OldRegNumberPrefix: The prefix letter of the old registration number (in the drop down box)

OldRegNumberSuffix: The number after the letter of the old registration number.

NewRegNumberPrefix: The prefix letter of the new registration number (in the drop down box)

NewRegNumberSuffix: The number after the letter of the new registration number.

SpecimenCount: How many specimens can be seen in the image or on the one pin.

Specimen Prepared By: Specimen Handler's name.

Photographer: Digitiser's name

Most of the fields will automatically populate except for the old registration number. Care must be taken when changing from one genus or species to another, using the drop down boxes in the database. Check that the "Image file name" and "New registration number" fields match the image taken.

Once the database fields have been checked and are correct, the image can be closed and the Digitiser can click on Save and Add Another in the database and is ready to receive another specimen for imaging.

7. Replacing a specimen after imaging

After the specimen has been imaged it can be replaced in the drawer. Move the labels to the foam 'pinning' block alongside the label block and pin them in the order that they were removed from the specimen i.e. start at the top and work down.

Pre-pin a new 'K' registration label, so you don't need to force the specimen pin through the card. Attach the registration label to the bottom of the pin underneath the original labels. Pin through the space between the K and the number.

The labels should be orientated in line with the body or wings of the specimen. The new registration label should be slightly angled to the right with the last 3 numbers visible from above. The distance between adjacent specimens may influence how the labels are attached. If spacing between specimens is very tight, it may be necessary to align labels to avoid damage.

Replace the insect in the same pin hole in the drawer where you have removed the stage labelled pin.

At the end of each drawer, review the information you have entered in the database by using the arrows at the bottom. Double check that the new registration number matches the image file number and that species names have been changed appropriately.

8. What to do with damaged specimens

If any part of the specimen breaks off immediately consult your supervisor. Any pieces must be associated with the parent specimen, and preserved and appropriately handled.

A damaged specimen is placed in a unit tray within the hospital drawer. Each damaged specimen will have a hospital drawer label inserted in the unit tray for further drawer identification purposes.

At the end of the day, close everything on the computer desktop and shut the computer down. Turn off the camera, put the lens cap on and turn off the flash. Put away all forceps and other equipment and make sure the workstation is neat.