

YASMEEN SMALLEY PHOTOGRAPHY

UNDERWATER PHOTOGRAPHY
& PHOTOGRAMMETRY 101

THE BASICS OF PHOTOGRAPHY

- Photography is all about measuring light to achieve the proper exposure. To do that we use 3 settings: **ISO, Aperture and Shutter Speed**. Each setting changes the amount of light that the sensor receives.

ISO: SENSOR SENSITIVITY



ISO 200



ISO 400



ISO 800



ISO 1600

ISO measures how sensitive the sensor is to light. ISO ranges from 100-6400 and up; the lower the ISO, the less sensitive to light. If you're shooting in bright daylight, ISO 100 or 200 is appropriate, whereas night photography calls for at least 1600.

HOWEVER...

HIGH ISO CAN EQUAL GRAIN



APERTURE

More light

Less light

LIGHT ON SENSOR

Large Aperture

Medium Aperture

Small Aperture



f/2.0

f/4.0

f/5.6

f/11

f/22

DOF - DEPTH OF FIELD

Little DOF
(blurred back)

Much DOF
(whole picture sharp)

Example of large aperture (small number) =
shallow Depth of Field



EXAMPLE OF SMALL APERTURE (HIGH NUMBER = LOTS OF DEPTH OF FIELD)



LAST BUT NOT LEAST!

SHUTTER SPEED

Shutter Speed can be used to slow motion, or to freeze motion.



SHUTTER SPEED CONTINUED



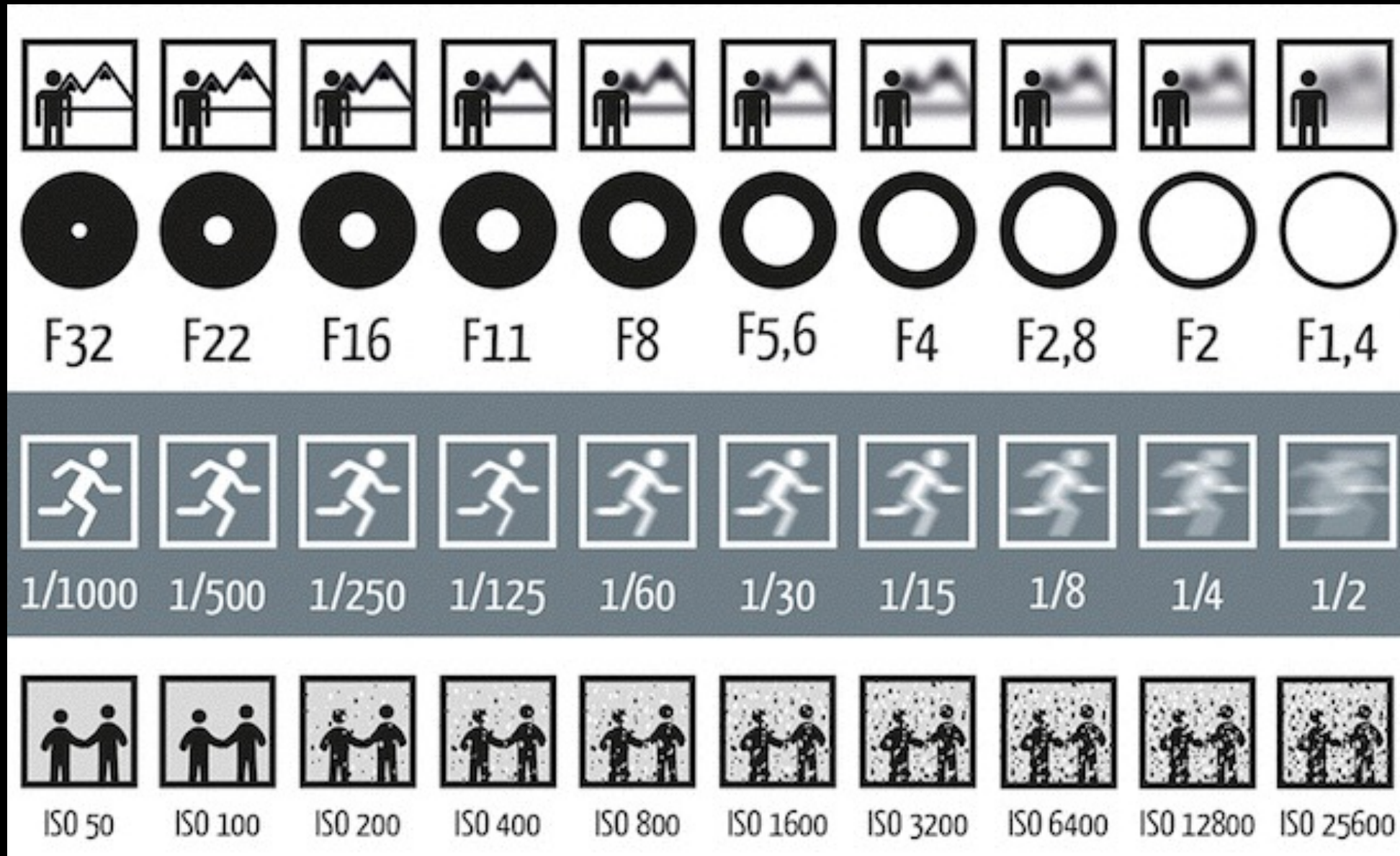
Shutter Speed is measured by fractions of a second, for example 1/60th of a second. The larger the number, the faster the shutter speed and more likely you will be to freeze motion.

However, the faster the shutter speed, the less light reaches the sensor; it's difficult to use a high shutter speed underwater unless you have powerful lights.

Flash units (including underwater strobes) will not sync at more than 1/250th of a second shutter speed.

COMING TOGETHER

SHUTTER SPEED + APERTURE + ISO



Starting points for underwater photography exposures:

- With strobes: 1/160 shutter speed, f/8 and ISO 200
- Without strobes: 1/100 shutter speed, f/5.6 and ISO 800

GETTING THE PERFECT EXPOSURE

METERING



Metering is how you balance your ISO, Shutter Speed and Aperture in-camera. In the above example, the first meter reading shows a perfect exposure. The second shows one stop overexposed, and the third meter reading shows one stop underexposed.

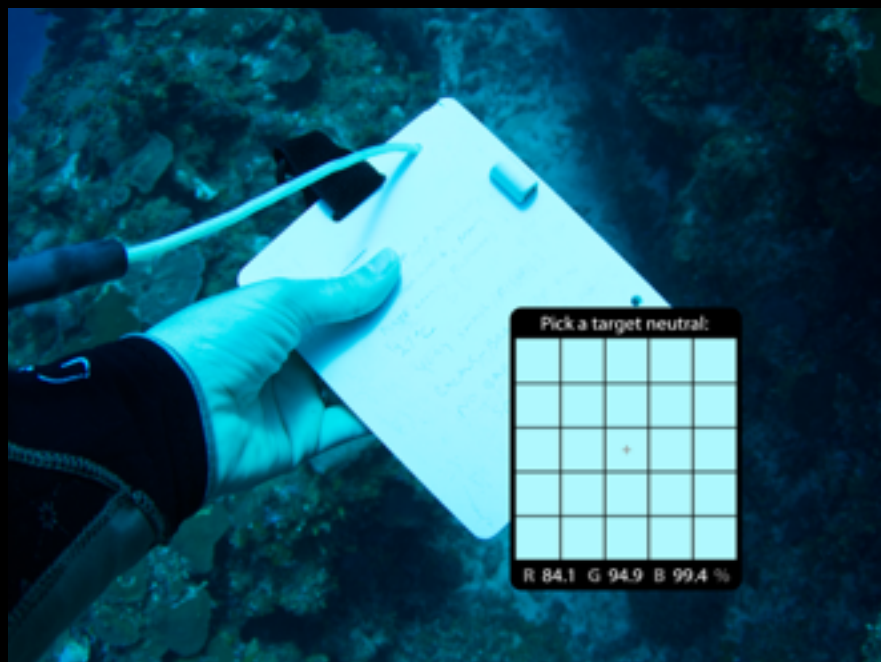
Each camera will have a different display to indicate proper exposure.

WHITE BALANCE

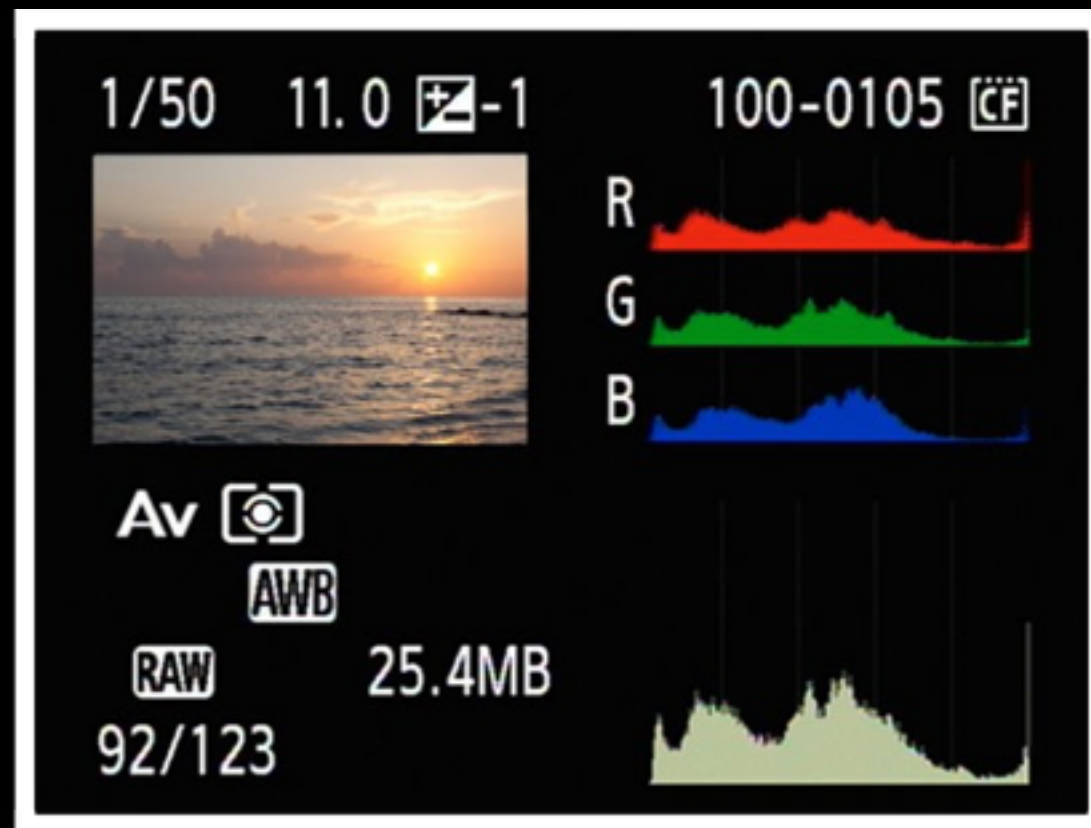
If you're using strobes or video lights, simply set your white balance to "Auto," since strobes are balanced to 5500 kelvin, or daylight.

If you're not using external light sources, you'll want to color balance your photos in camera. To do this, take a picture of your white slate underwater (you can take a photo of sand in a pinch). Next, go to your Menu and select "Custom White Balance" and select the photo you just took. This will calibrate the camera to recognize the picture of your slate/sand as "true white."

You can also color balance "in post," or while you're post-processing your images. In Lightroom, simply click the eyedropper tool or press "w" and select a white area in the scene. But be aware, photos will always look better if they've been color balanced while photographing.



EXPOSING FOR COLOR



One way to check if your white balance is accurate is to check your histogram. To do this, go to "Image Playback" and select the "Info" button. You may need to toggle through the "Info" options several times to see the color histogram above.

Aim to have the red color channel "kiss" the right side of the histogram. Since we lose the red channel first in underwater photography, it's the most important color in our photographs. Reintroduce the red color by using strobes or by using custom white balance.

UNDERWATER 3D MODELING / PHOTOGRAMMETRY

3D MODELING - CAMERA SETTINGS

The ideal set of photographs for a 3D model should have:

- The same exposure. Experiment and adjust your exposure before starting the sequence, and take a photo of your hand before and after you photograph your specimen. This helps you mark the start and end points when you're editing your photographs later.
- Adequate depth of field. Avoid apertures lower than 5.6. F/8 or higher is ideal, as this gives you more information in the background, which in turn makes it easier for the software to stitch together relevant pixels.
- No camera shake or blur! Increase your ISO if you need to.
- Accurate color. Use a strobe for best results, or white balance your camera with the Custom setting before photographing.



How to photograph underwater for 3D

If you're using a scale, place it carefully in the scene. Take several test shots to test your exposure- make sure to look at your histogram to verify proper exposure.

Take photographs of coral or other stationary subject by working in a spiral pattern: start photographing at bottom of the coral and continue photographing either clockwise/ counterclockwise in a spiral pattern. Make at least 3 circular passes of the subject, and finish photographing at a birds' eye view.



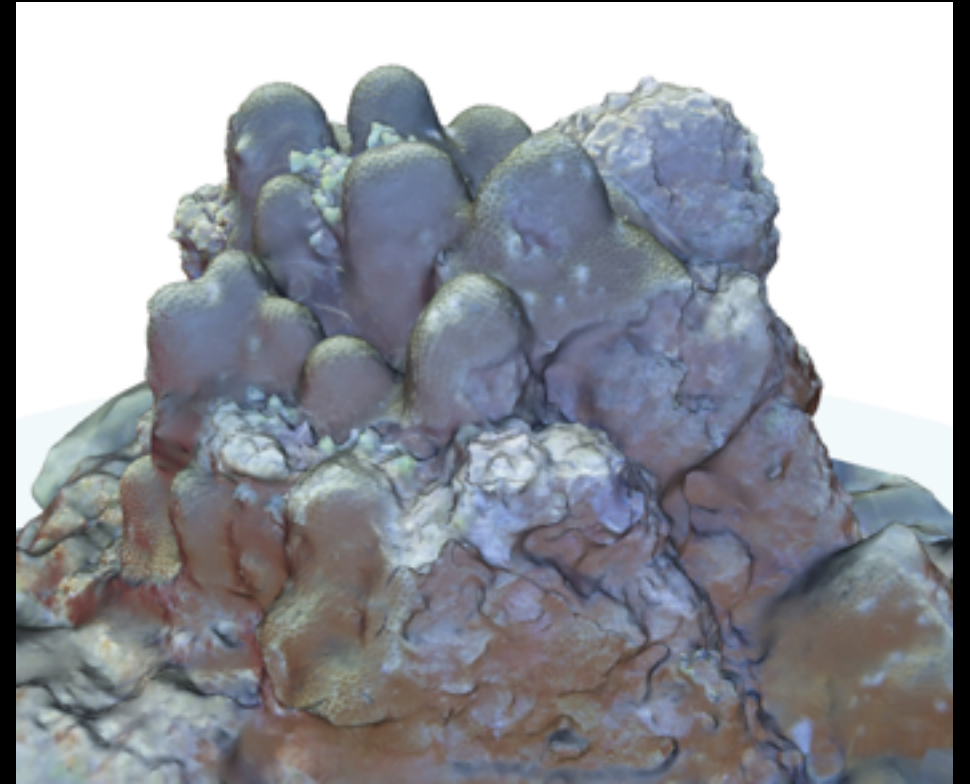
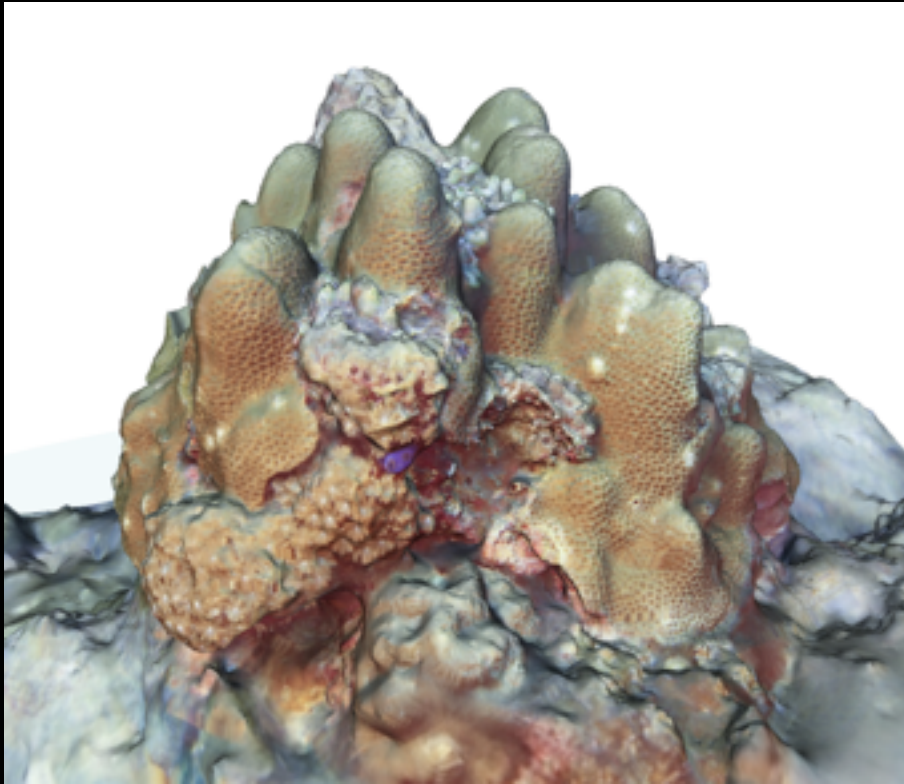
The larger the subject, the more photos required. Aim for 50% coverage between photos- the more photos the better! The average number of photos for my models is 75 for a smaller coral, 200 for a table-sized coral.

Make sure photos are landscape or horizontal photos, instead of vertical portrait photos, as this can cause a bug with Autodesk ReMake.



As you improve your photography skills and buoyancy skills, the time it takes to photograph a coral will decrease. Aim for 15-20 minutes per coral when starting out, and see if you can get it down to 5-10 minutes as you learn.

Photographing with Natural Light

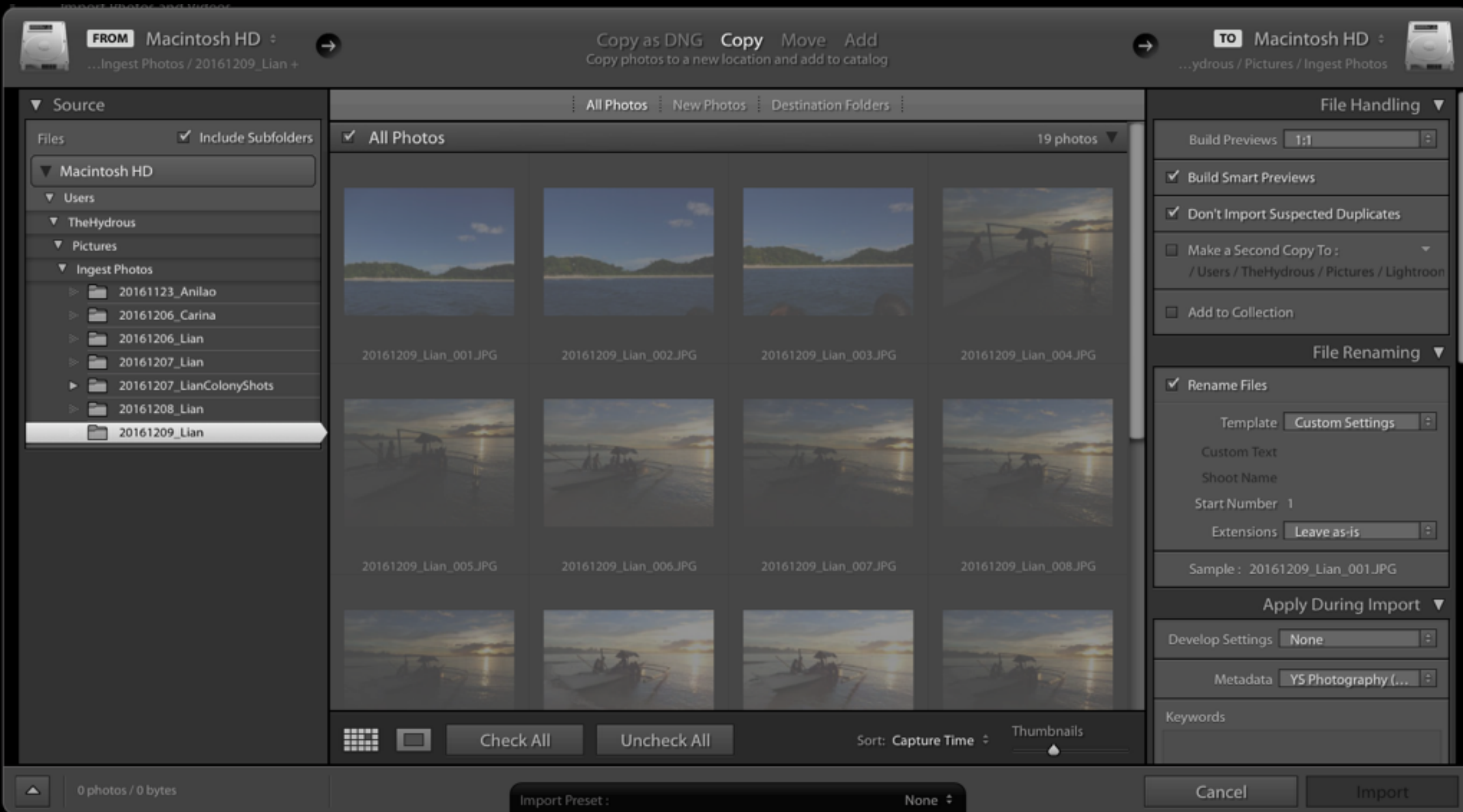


Photographing with only natural light with strong contrast (ex: at sunset) can result in obvious shadows in your 3D model. If you're photographing in light that is strongly angled, you'll have to change your exposure as you photograph around the coral.

Photographing with a strobe provides a consistent light and exposure for entire series of photos.

ADOBE LIGHTROOM
TUTORIAL

IMPORTING PHOTOS TO LIGHTROOM



When you have Lightroom open and plug in your memory card, the Import screen will open. Check the "ReName Files" box and select Custom Settings to rename files by date and location.

Import Page continued

Select the Metadata drop down menu to add copyright information, location, date, etc.

Add keywords that you can use to search for photos later

Use a chronological file and folder system to make it easier to find your photos

Once you fill out the information on the drop down menus, click the "Import" button on the bottom right of the screen



THE LIGHTROOM LIBRARY

The screenshot displays the Adobe Lightroom Library grid view. The main window shows a large photograph of a coral reef with a red marker and a diver's hand. The left sidebar contains a Navigator and a folder list with the following items:

- 20161127_Knit... 38
- 20161206_Carina 153
- 20161206_Lian 307
- 20161207_Lian 1480
- 20161208_Lian 550**
- 20161209_Lian 19
- Patchi's Photos 77
- Model 2 72
- Recap 1 73
- Recap 3 105
- Siete Pecados - Lob... 47
- Twin Peaks - Leptoria 40

The top right corner features a Histogram panel with technical data: ISO 320, 14 mm, f / 8.0, 1/200 sec. Below it is the Keywording panel, which includes a list of keyword tags: 3D, 3D coral modeling, Batangas, Br. Alfred Shields FSC Marine Station, coral, Lian, photogrammetry, vulnerable. The bottom of the interface shows a grid of photo thumbnails, with the current photo selected.

This is your "home page." Use the Library to toggle in between folders, check out your exposure (top right) and add any keywords you might have missed.

LIGHTROOM: DEVELOP

mobile ▶

Library | Develop | Map | Book | Slideshow | Print | W

Histogram ▼

ISO 320 14 mm f / 8.0 1/200 sec

Original + Smart Preview

WB: Custom

Temp 5,400

Tint +42

Tone Auto

Exposure -0.60

Contrast 0

Highlights -26

Shadows +26

Whites 0

Blacks 0

Presence

Clarity +15

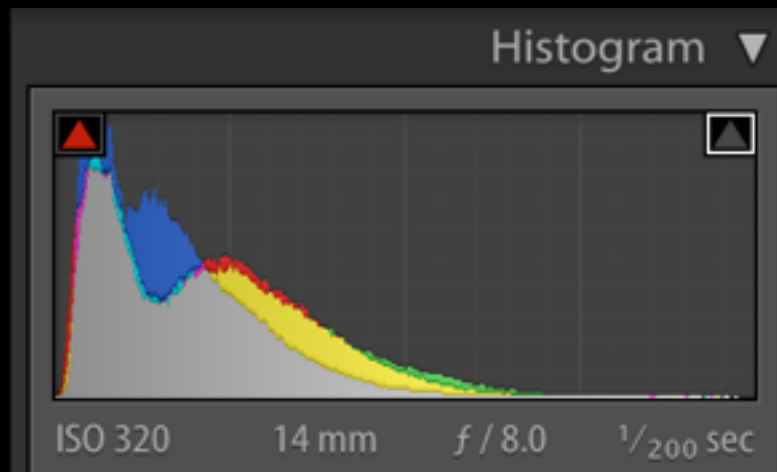
Soft Proofing

Previous Reset

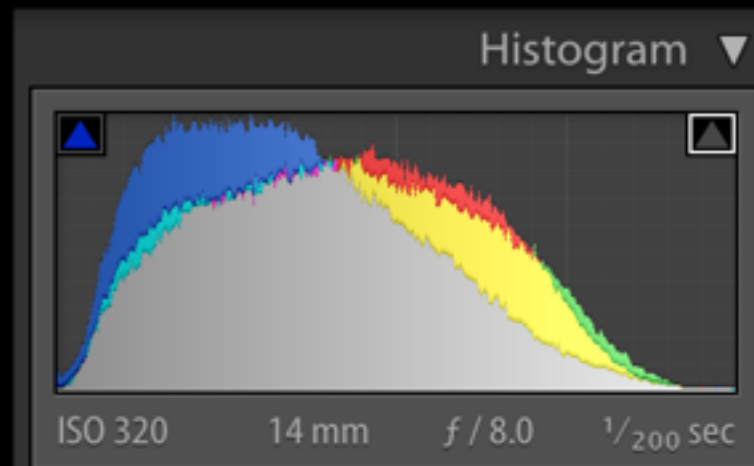
Use the Develop page to make any exposure edits to your photo. I usually adjust the white balance, exposure, highlights, shadows and clarity.

LIGHTROOM DEVELOP: PROPER EXPOSURE

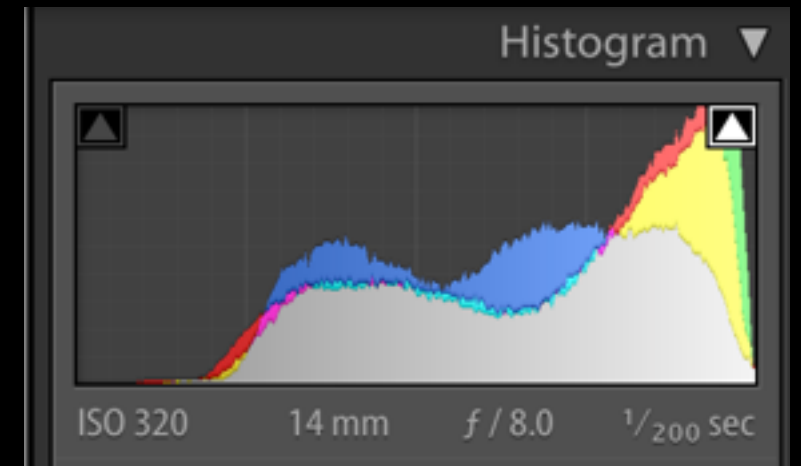
Use the histogram to guide the editing process



Underexposed



Perfect exposure



Overexposed

LIGHTROOM DEVELOP: SYNCING EDITS TO MULTIPLE PHOTOS

Adobe Lightroom CC 2015
Get started with Lightroom mobile ▶

Library | Develop | Map | Book | Slideshow | Print | Web

▼ Navigator FIT FILL 1:1 1:4

Lock to Second Window ⌘⇧↔
Show in Finder
Go to Folder in Library
Go to Collection ▶
Edit In ▶
Photo Merge ▶
Set Flag ▶
Set Rating ▶
Set Color Label ▶
Add Shortcut Keyword
Add to Quick Collection and Next ⌘⇧B
Stacking ▶
Create Virtual Copies
Develop Settings ▶
Metadata Presets ▶
Rotate Left (CCW)
Rotate Right (CW)
Metadata ▶
Export ▶
Email Photos...
Remove Photos...
View Options ▶

Reset
Update to Current Process (2012)
Proof
Copy Settings...
Paste Settings
Paste Settings from Previous
Sync Settings... ⌘⇧S
Auto White Balance ⌘⇧U
Auto Tone ⌘U
Convert to Black & White

Histogram ▼
ISO 320 14 mm f / 8.0 1/200 sec
Original + Smart Preview

WB: Custom
Temp 5,400
Tint +42

Tone Auto
Exposure -0.60
Contrast 0
Highlights -26
Shadows +26
Whites 0
Blacks 0

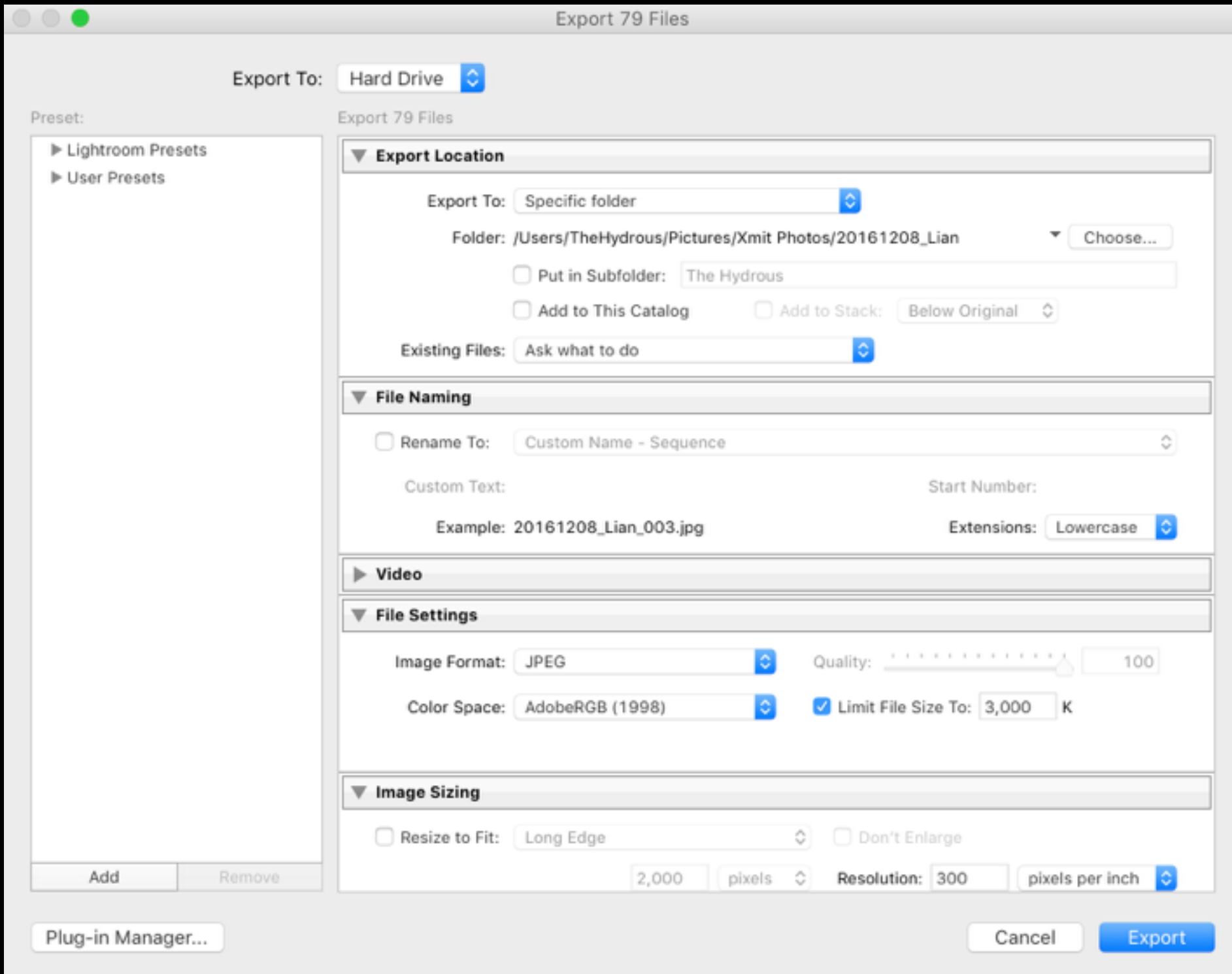
Presence
Clarity +15

Sync... Reset

Filters Off

LIGHTROOM- EXPORT PHOTOS

Highlight the series of photos you want to export, then left click on any of the photos and select "Export."



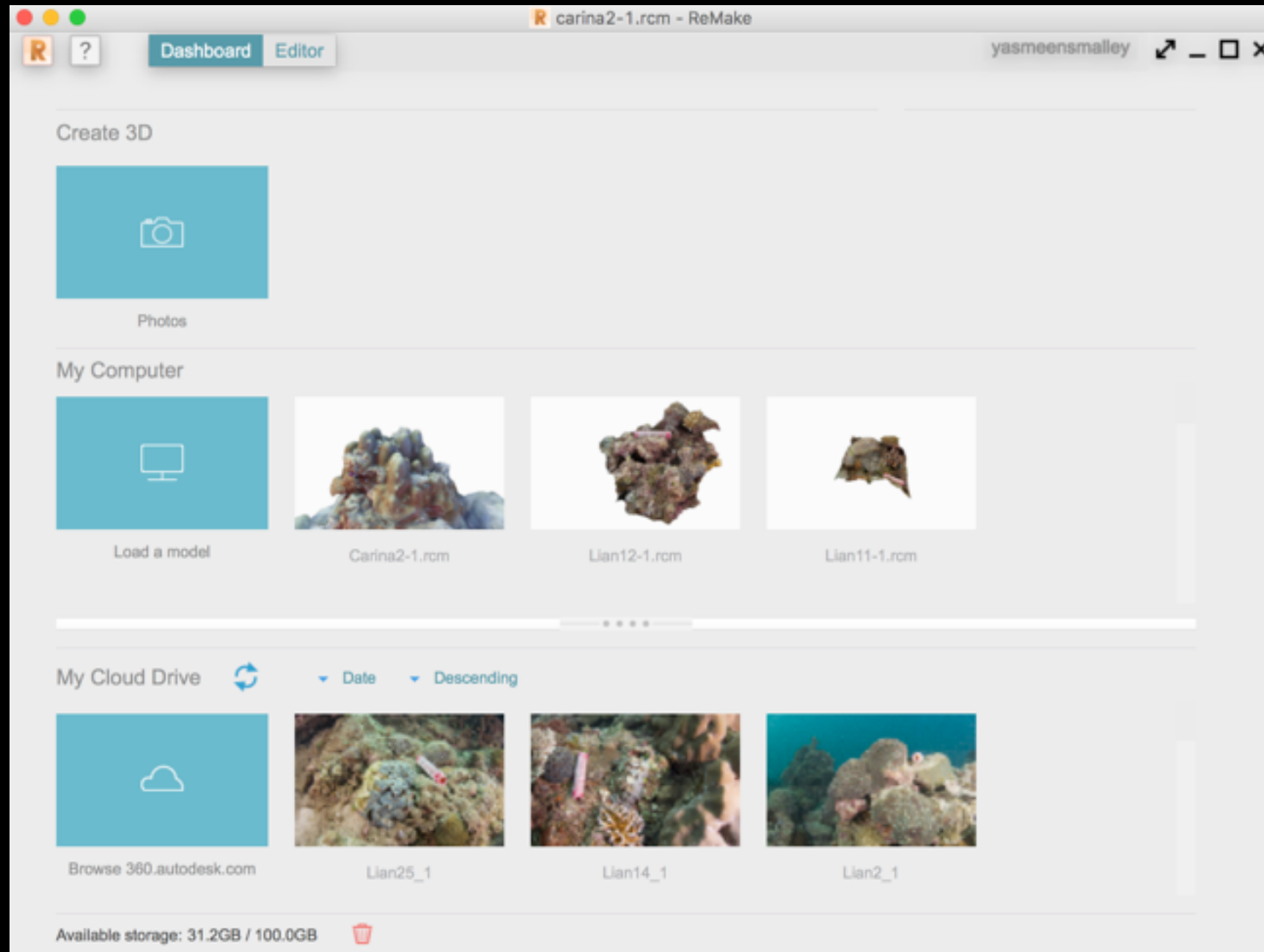
Select the folder that you want the files exported to

Limit the file size to 3mb per photo, otherwise the modeling process will take a long time

And export!

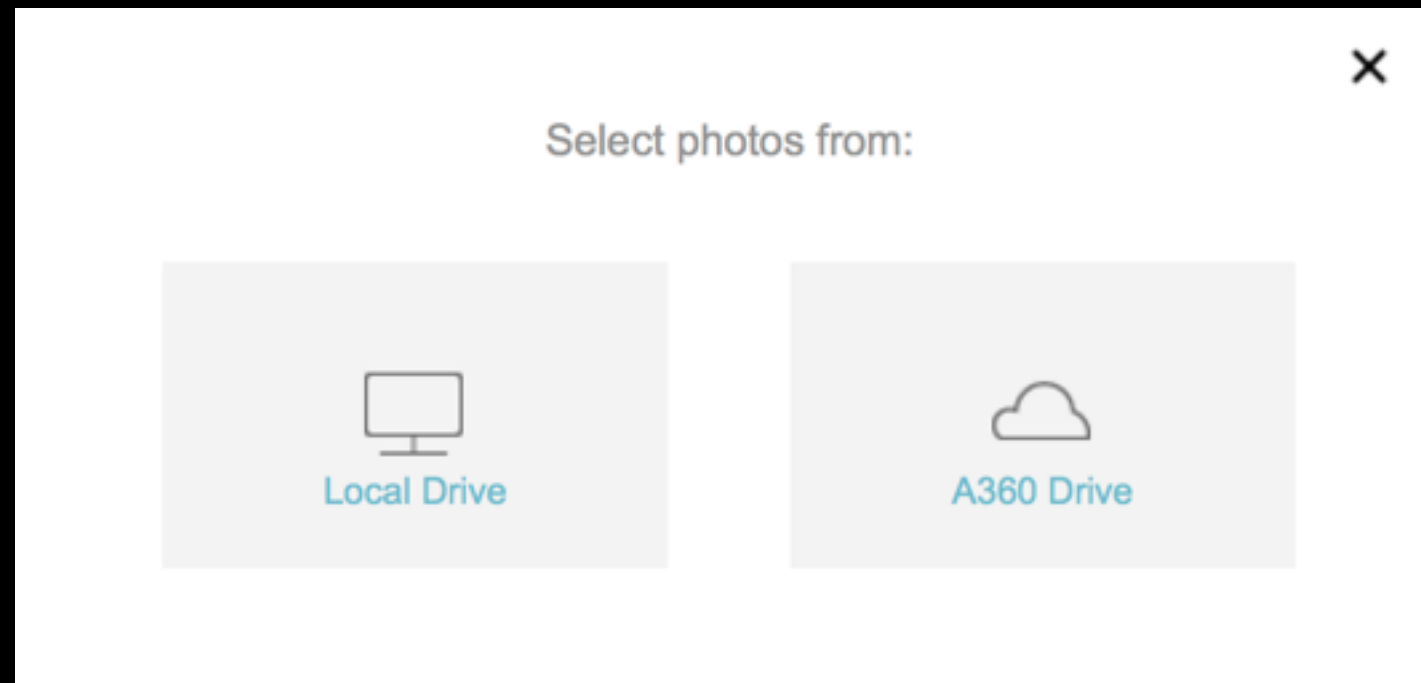
AUTODESK REMAKE TUTORIAL

AUTODESK REMAKE



This is the ReMake software home page. "Create 3D" starts the process to create 3D models, "My Computer" shows models that you've recently viewed and allows you to load a model from a local file, and "My Cloud Drive" sends you to view the models on your Autodesk Account. The bottom left of the screen shows your remaining storage space.

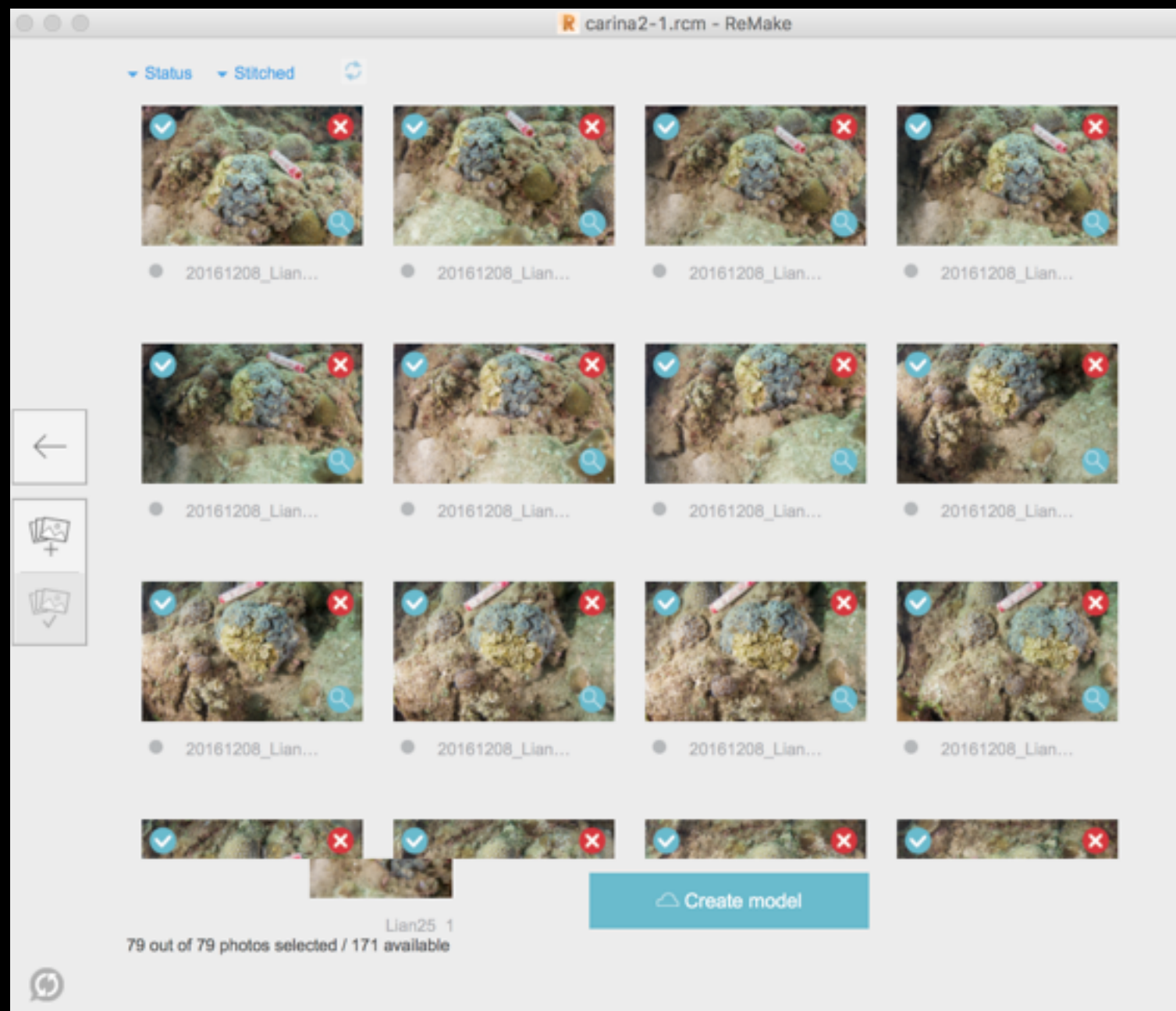
CREATING A 3D MODEL



When you select "Create 3D" on the home page, it opens this window asking you to select a source for photos. If you have not yet uploaded the photos for your model, select "Local Drive."

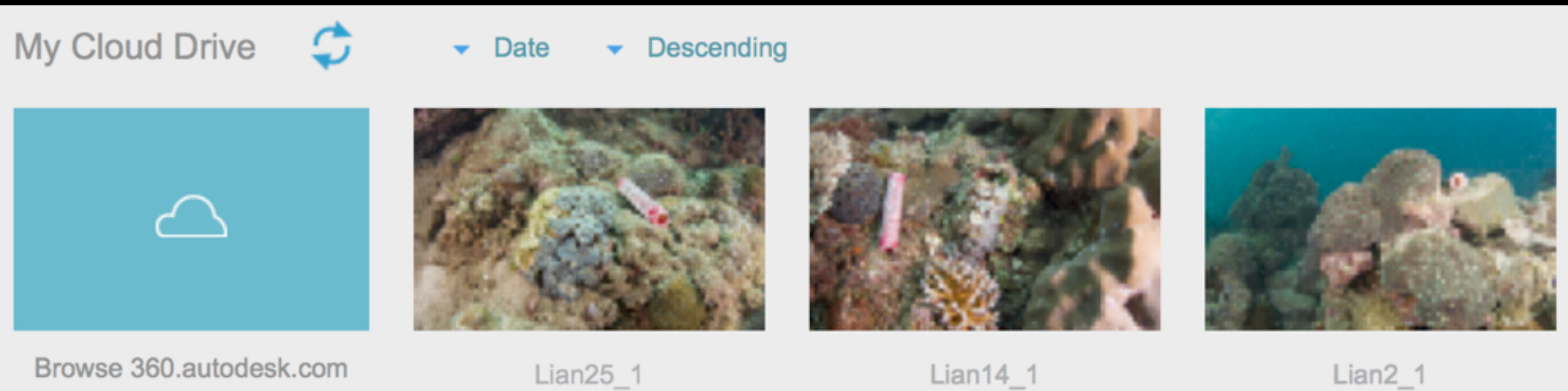
If you have already uploaded the models to your Autodesk account and need to run the process again, select A360 Drive. One reason for processing a model a second time with the same photos could be if the first model had a glitch.

CREATING A 3D MODEL



Once you select "Local Drive," find the photos that you previously exported from Lightroom and select them all. ReMake supports models made of up to 250 images. After you select your photos you should see them automatically on the above screen. Just click Create model, enter your model name and hit start!

CREATING A 3D MODEL: NOW WE WAIT



Because 3D models are created in the cloud, we have to wait for the images to upload to the cloud. You can see the process in the above screen under "My Cloud Drive." Once the images are uploaded, you'll see a progress bar as the model "processes."

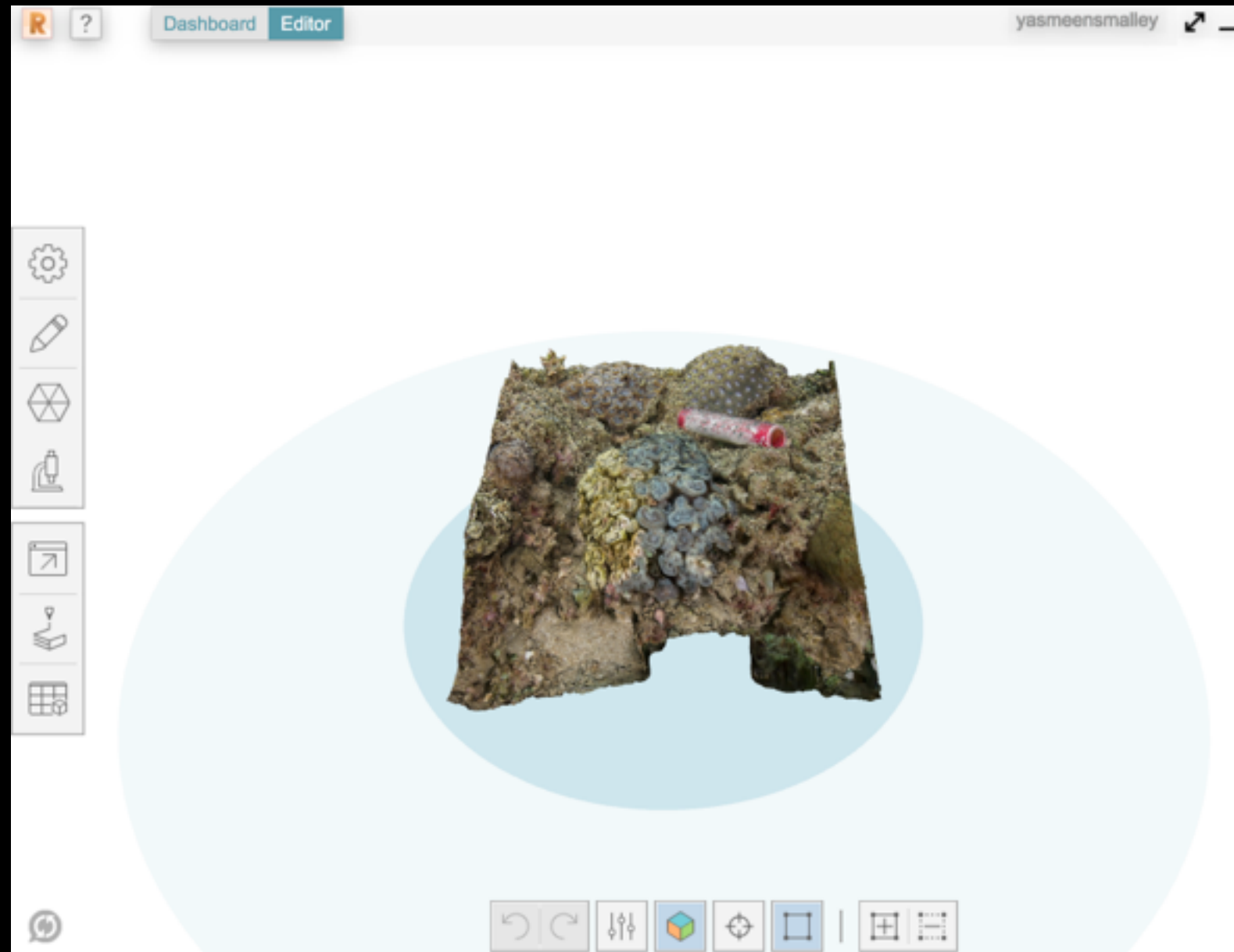
Depending on how many images you uploaded, this can take several hours.

Finally, you will see your model without a progress bar, like the ones above. This indicates that the model is ready for downloading, which you can do by clicking the bottom right of the model photo.

Unfortunately, you won't know if you have created a successful until the photos have been upload, the model has been processed and then downloaded!

EDITING YOUR 3D MODEL

Once your 3D model has finished downloading, you will find under the "My Computer" tab. Double click it to open it and view your model.



If using a trackpad, use two fingers to zoom in and out. Press the trackpad and use two fingers to rotate around the model. Press "X" and use one finger to reposition model on screen. Use one finger to highlight an area. (Using a mouse for this software is recommended)

EDITING YOUR 3D MODEL

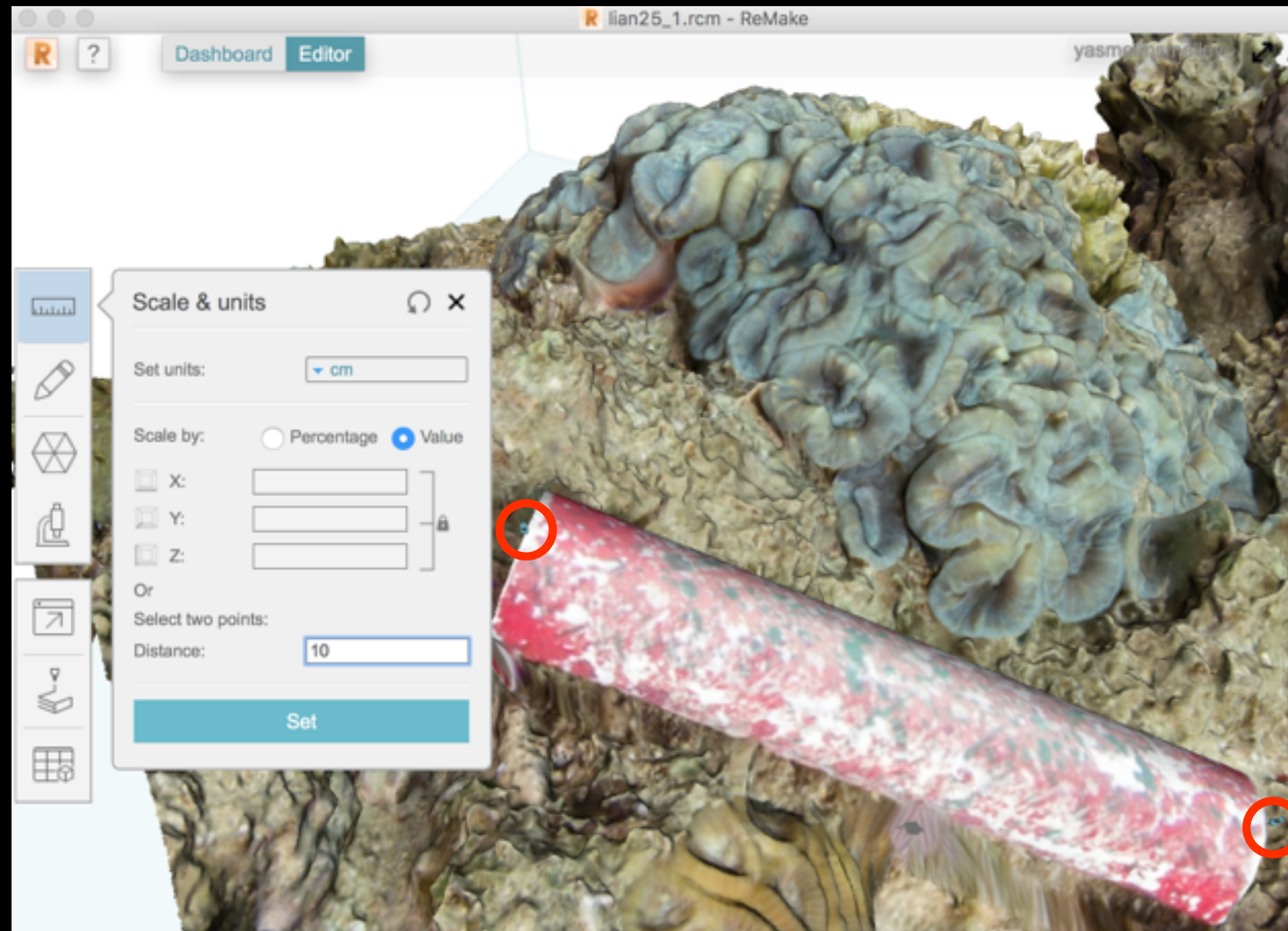


To edit out unnecessary parts of the model, highlight what you want to keep. Then click the button above to invert the highlighted area.

Click the trash button on the panel on the left side of the screen to delete the highlighted parts of the model.



HOW TO SET A KNOWN DISTANCE FOR SCALE



Using the measurement tool on the panel you can set a scale by using an object of known length.

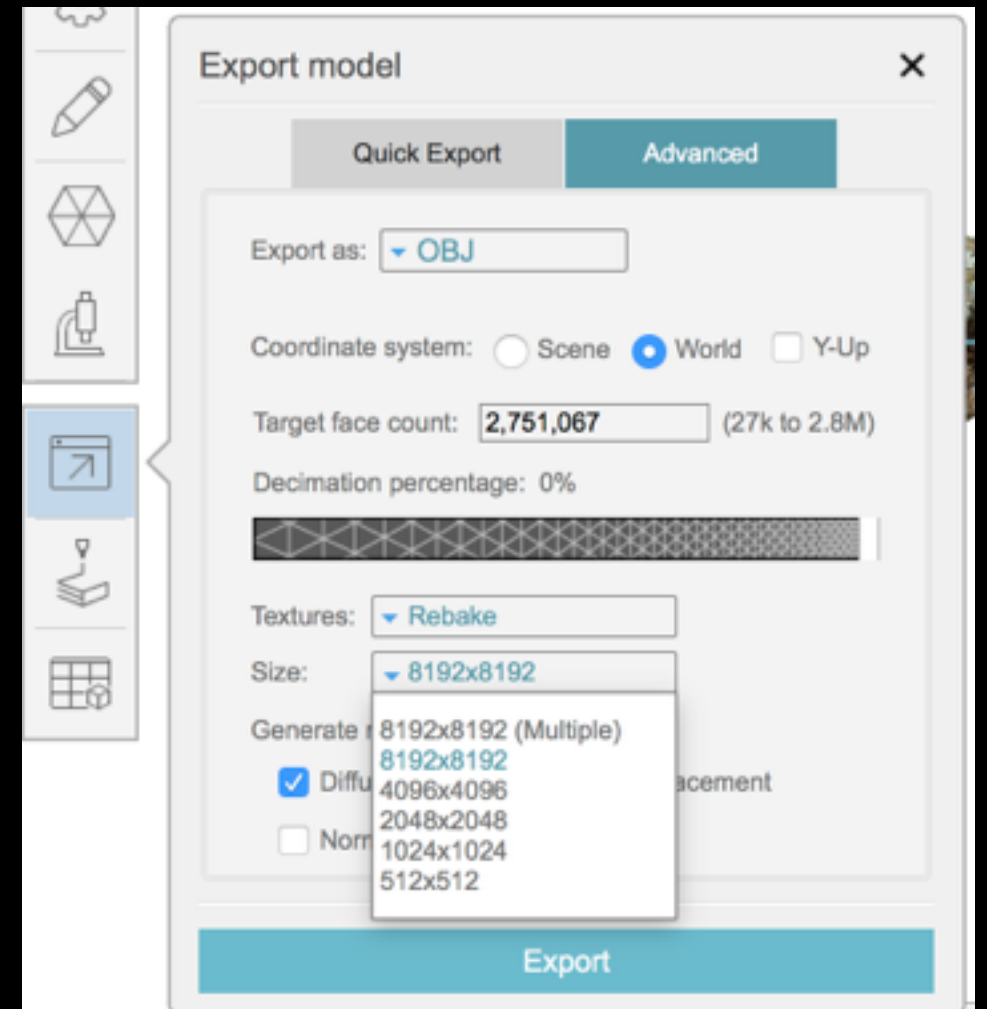
Be sure when you place the pins that you're setting them on your scale, not on the substrate beneath.

EXPLORING THE FEATURES OF REMAKE

Once you set the scale you can measure the size of objects in the scene or the whole scene itself. There are also many other features, including analyzing two models of the same object for differences, which can be used to measure coral growth.

To learn more about the features of ReMake, visit <https://remake.autodesk.com/resources> for video tutorials and a PDF guide.

EXPORTING THE MODEL FOR THE WEB



Click the "Export" button on the left panel. Here you have the option to export your model as a picture, as a video or as a model to be published online. Click the far right button for online export.

If your model is large, you will want to select the 8192x8192 size to save space and decrease upload times. The face count is a unit of measurement for quality of a model, much like pixels are for pictures. Then hit Export and select a local destination for your model!

SKETCHFAB TUTORIAL

Once you've exported your 3D model, you should have 3 files: a .mtl, .obj and .jpg file. Compress the three files to form a .zip file. Next, log in to Sketchfab and upload the zip file.



yasmeensmalley **PRO**

Underwater Photographer & 3D Modeler

EDIT PROFILE

SUMMARY

100 MODELS

SUCCEEDED

Upload new model



File format

OR

File + Materials

.fbx, .obj, .dae, .blend, .stl... ?

.zip, .rar, .7z ?

CHOOSE FILE

Tip: Upload directly from your 3D editor with one of [our exporters](#).

CANCEL

CONTINUE

Platygyra sp.

a week ago

Montastrea sp.

a week ago

Platygyra verweyi #2

a week ago

SKETCHFAB TUTORIAL CONTINUED

While the 3D model is uploading, you have the option to write a caption for your model, add the model to categories and add keywords.

Model properties ✕

Model name 📄

Description B I H 🗨️ ☰ ☷ 🔗 🖼️ 825 characters left EDIT PREVIEW

This model of a *Platygyra* coral was photographed in Lian, Philippines in December, 2016.

This model was produced by Yasmeen Smalley-Norman as part of her research as a 2016-2017 Fulbright Scholar.

Categories ▼

Tags Add another

Suggested tags: [coral](#), [philippines](#), [science](#), [photogrammetry](#), [3d](#), [conservation](#)

Private model 🔒 OFF

Allow download 🔒 OFF

Age-restricted content 🔒 OFF

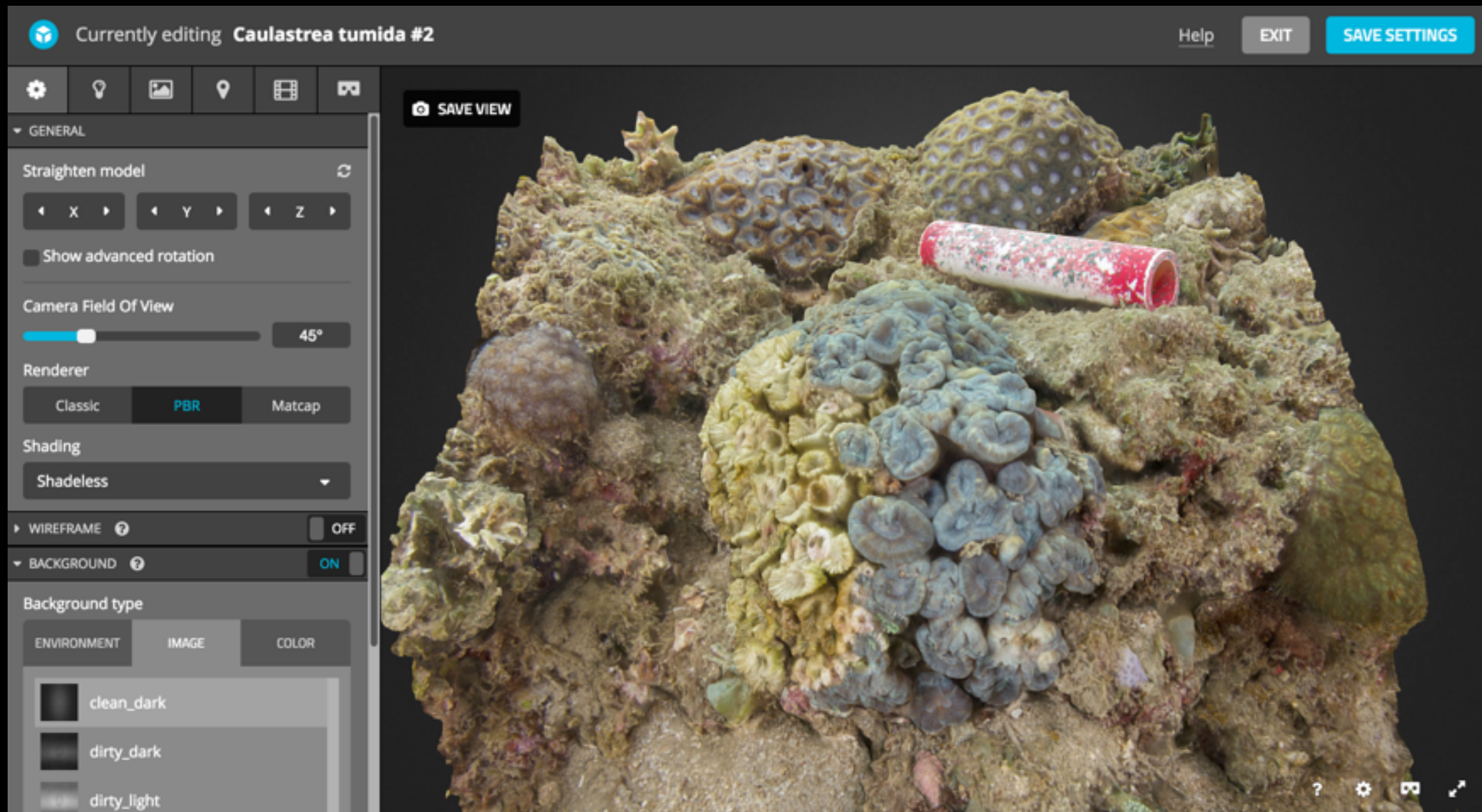
Discoverability 👍

Write a good description, add categories and tags to help your model get discovered.
[More tips to get exposure](#)

CANCEL SAVE

SKETCHFAB TUTORIAL CONTINUED



When the model is done uploading, you'll be directed to the 3D Settings page.




You may need to straighten the model by adjusting the X axis, and you'll want to change the Shading from "Lit" to "Shadeless" for better color accuracy. Change the background type to "clean_dark" image, and set the Sharpness level to 14 under Post Processing Filters. Save the view and the settings to publish the model.


SKETCHFAB TUTORIAL CONTINUED

And you're done! You can now share the model on social media, embed it in blog posts or websites and create a collection of similar models. Enjoy!

 EXPLORE ▾ COMMUNITY ▾ BLOG ▾ UPLOAD 

Caulastrea tumida #2



 by yasmeensmalley **PRO**

ABOUT THIS MODEL

This model of a *Caulastrea tumida* coral was photographed in Lian, Philippines in December, 2016. *Caulastrea tumida* is listed as "Near Threatened" on the IUCN Red List.

<http://www.iucnredlist.org/details/133246/0>

This model was produced by Yasmeen Smalley-Norman as part of her research as a 2016-2017 Fulbright Scholar.

Published a week ago

Animals & Creatures

Science, Nature & Education

coral philippines science

★ 1 👁 10

0 comments

+ ADD TO </> EMBED ↪ SHARE ★ LIKE ⚙