

# MorphoMetriX v2 Manual

Elliot Chimienti, Clara Bird, Walter Torres, KC Bierlich

*Center of Drone Excellence (CODEX),  
Marine Mammal Institute,  
Oregon State University*

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# Table of Contents (click to go to page)

- Getting started
  - [Download files](#)...p.3
  - [Launching MorphoMetriX](#)...p.4
- Measuring Set Up
  - [Import image](#)...p.5
  - [Input metadata](#)...p.6-7
- Measuring
  - [Quick tips](#)...p.8
  - Measuring lengths
    - [Measuring](#)...p.9
    - [Piecewise v. Bezier fit](#)...p.10
    - [Additional measurements](#)...p.11
  - Measuring widths
    - [Set up](#)...p.12
    - [Measuring](#)...p.13
    - [Mirror side](#)...p.14
  - [Measuring area](#)...p.15
  - [Measuring angle](#)...p.16
- Post-measuring
  - [Export and open new image](#)...p.17
  - [Crash reporting](#)...p.18

*If you ever want to come back to this page, just click on this icon (its in the bottom right corner of every slide!)*

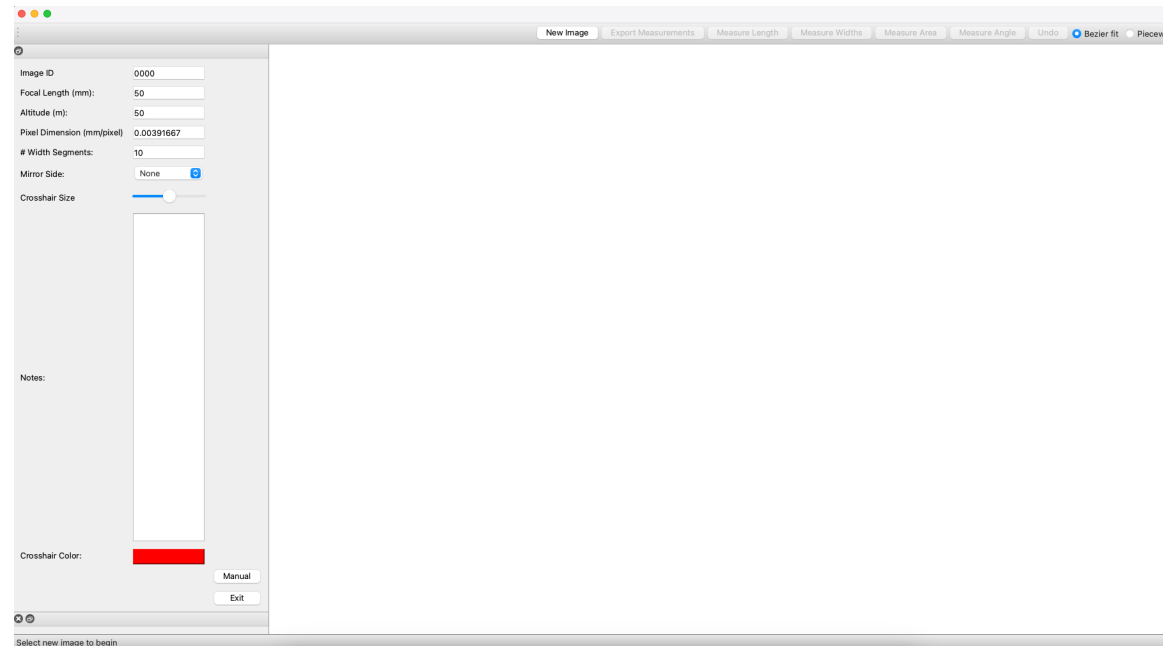
[TOC](#)

# To start: download files

- Example drone images of whale to measure are available here:
  - <https://oregonstate.box.com/s/qx93o6lbp2ddgcsg9gctjz85a8je3cpc>
- Download the beta version of MorphoMetriX v2 here
  - <https://github.com/ZappyMan/morphometrix/releases/tag/v1.2.0-beta>
  - To download just click on the file you want
    - If you have a windows download the .exe version
    - If you have a mac download the .dmg version
      - Make sure to download the right dmg for the chip you have (intel or M1/M2), the files are named accordingly
    - If you get a security warning...
      - Windows: click on open anyway
      - Mac: go to settings > privacy & security > allow the app to open anyway

# Launching MorphoMetriX

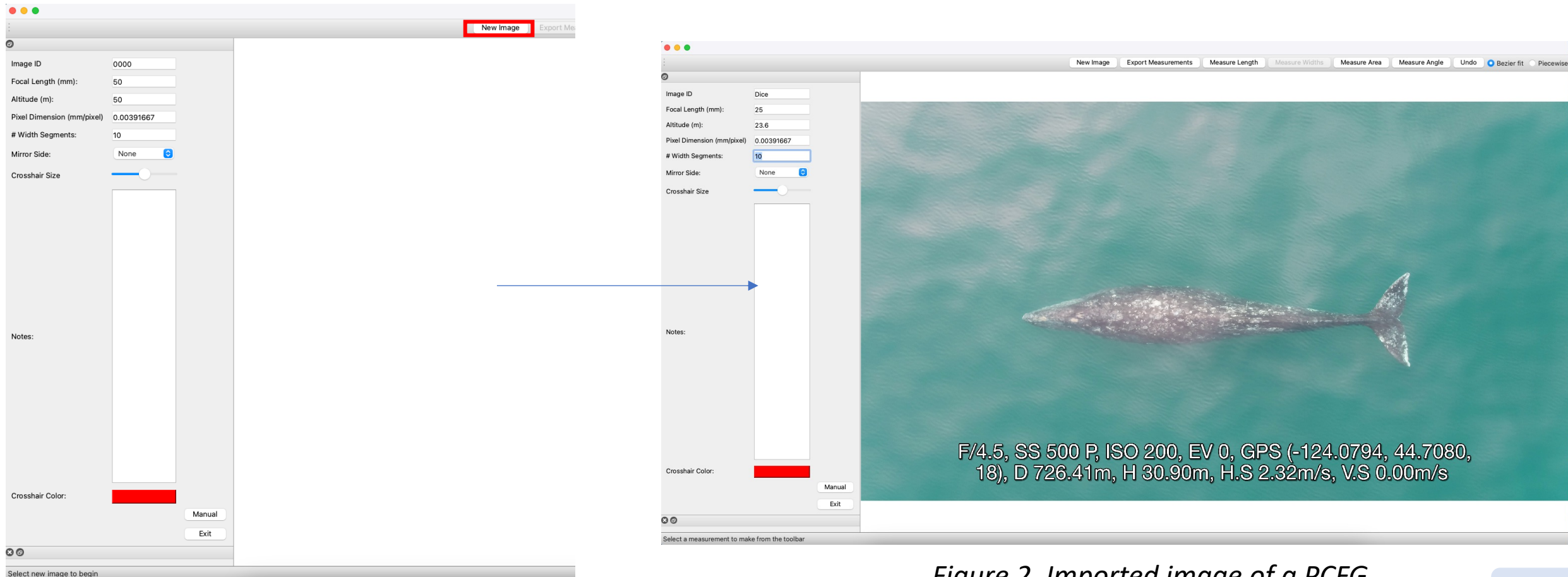
- Launch MorphoMetriX by opening the application (once opened it will look like Figure 1).
  - To launch, just double click on the file you downloaded
- Note, that the program may take longer to launch its first time opening. To open, just double click on the file.



*Figure 1. Opening MorphoMetriX*

# Import image

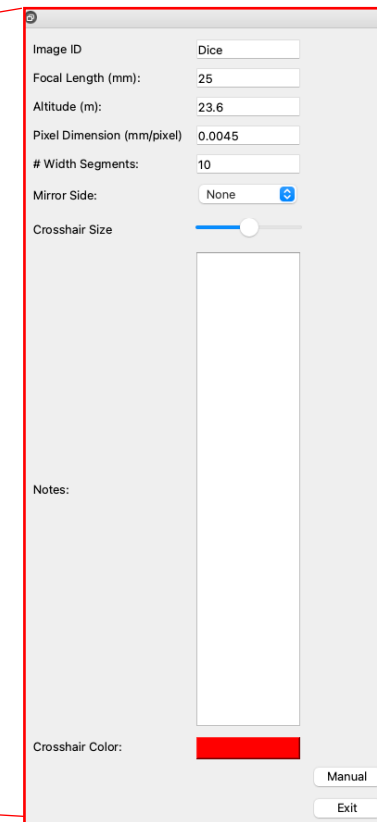
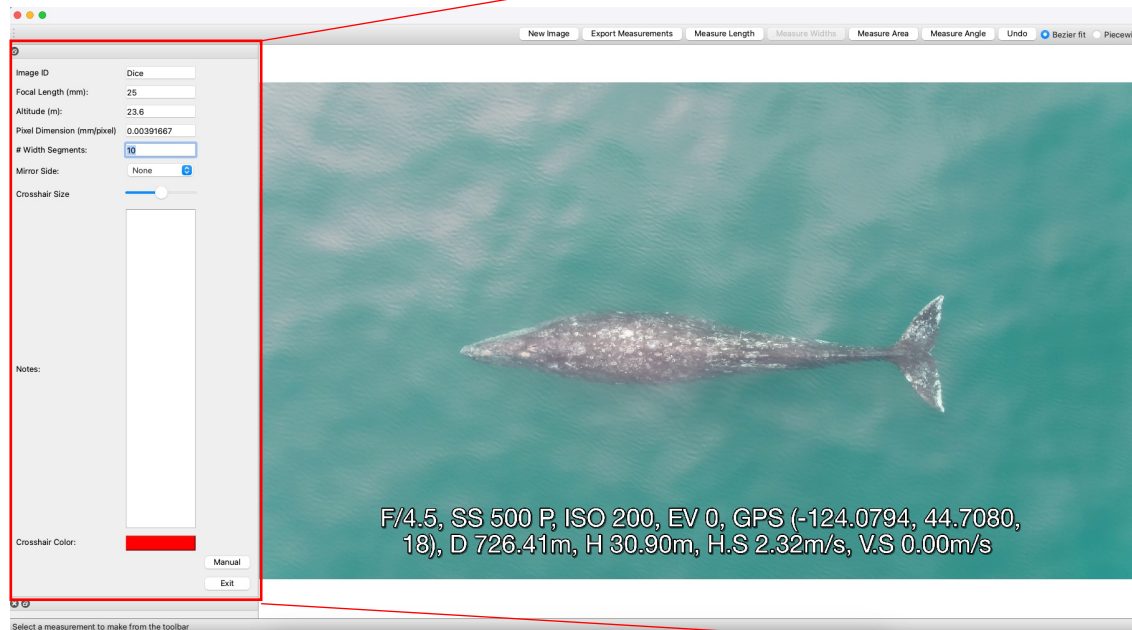
- Select “New Image” to import an image (.jpg, .png) for photogrammetric analysis (Figure 2).



*Figure 2. Imported image of a PCFG gray whale into MorphoMetriX.*

# Input metadata

- Use the input window on the left to enter image or animal ID details, camera specifications, altitude, number of width segments desired, and any notes (Figure 3). The user can select the color of the width points using “Crosshairs Color” and can designate which side of the animal (if any) to use for measuring widths, i.e., if one of the sides of the animal is obstructed, using ‘Mirror side’ (see Widths section below for more details).



*Figure 3.  
Metadata input  
window*

# Input metadata (continued)

- Enter metadata into the dialog panel.
- **“Image ID”** can be used to create a unique ID for the animal or object
- **“Focal Length (mm)”** = the focal length of the camera in millimeters
- **“Altitude (m)”** = the altitude of the drone when the image was collected in meters
- **“Pixel Dimensions (mm/pixel)”** = sensor width (mm)/image width (px)
- **“# Width Segments”** = the number of perpendicular width segments to divide a measurement (often used for measuring the body condition of an animal), here 20 equates to segments in 5% increments of the length
- **“Mirror Side”** = the user can specify to use a single side of the animal to calculate the body width (Side A, Side B, or none). This is useful for when the one of the sides is obstructed (see Widths section below)
- **“Crosshair Size”** = adjust the size of the crosshairs by dragging the slider. The size can be changed after selecting the “Measure Widths” button.
- **“Notes”** = enter any notes
- **“Crosshair Color”** = adjust the color of the crosshairs width points. Note that the color must be specified before selecting the “Measure Widths” button.
- *Once an image has been imported, you can begin making measurements by selecting “Measure Length”, “Measure Widths” (followed by a length measurement), “Measure Area” or “Measure Angle”. Details for each are described below.*

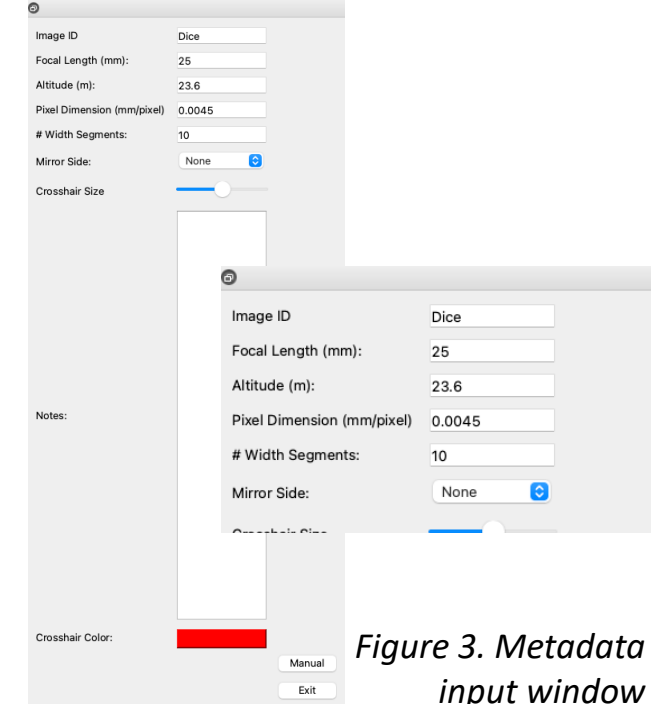


Figure 3. Metadata input window

# Measuring: quick tips

- **Zoom in/out** – Scroll.
- **Pan** - ↑ Shift + scroll.
- **Place a point** - Single click.
- **Complete a length measurement** - Double click.
- **Replace last point** - Select “Undo”.



# Measuring lengths

- The user can label each measurement with a unique name (i.e., “Total Length”, “TL”) (Figure 4).
- In the upper right-hand corner, you can specify if you want to apply a Bezier fit or Piecewise fit to the length measurement (Figure 5). The Bezier fit is especially useful if the animal is curved, as it will apply a smooth fitting curve to a length measurement with 3 or more points (Figure 6).
- Make single clicks to along a length measurement and double click to finish.
- You can continue to make other length measurements by selecting “Measure Length” and assigning a new label, i.e., “Fluke Span”, or “Fs”, etc. (Figure 7, 8).

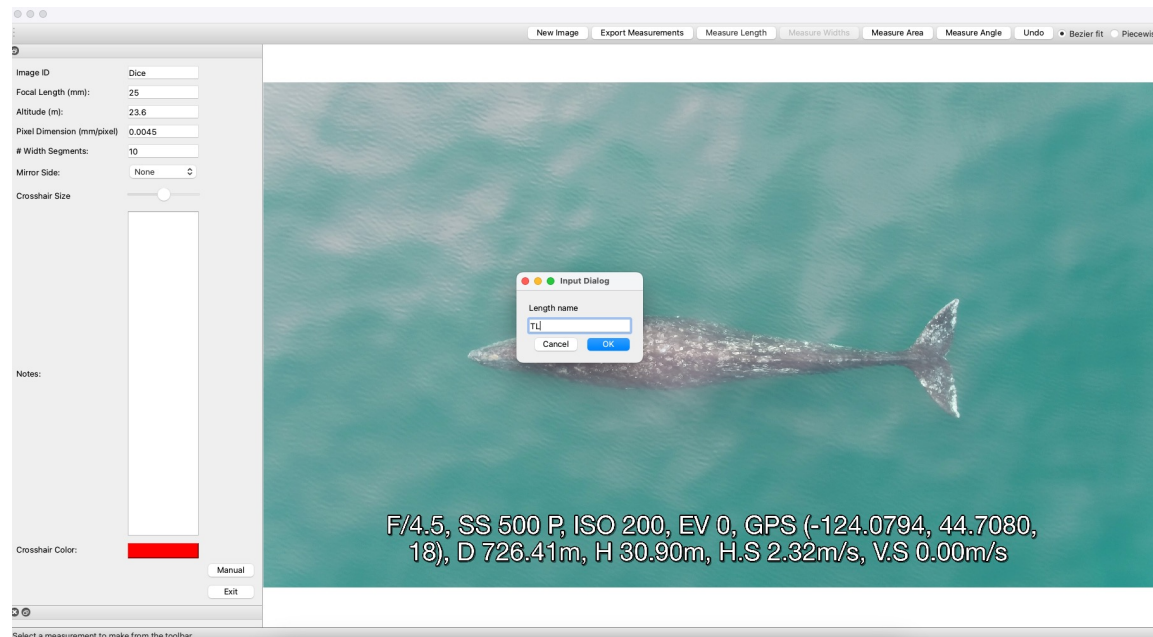


Figure 4. Creating a label for a length measurement. Here, "TL" is for total length of the animal.

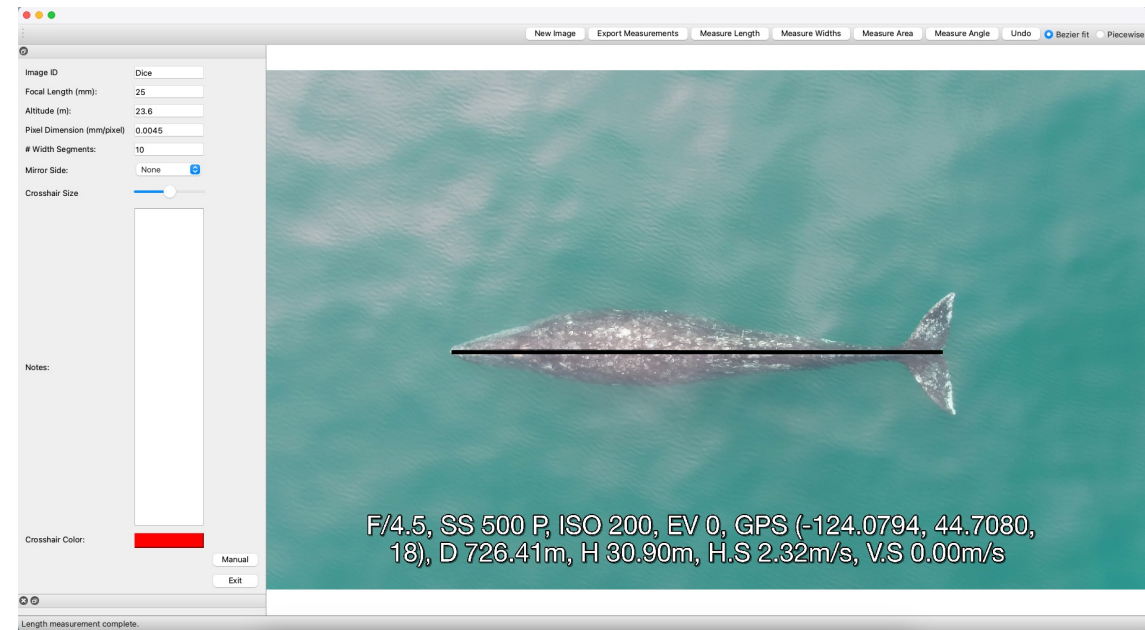
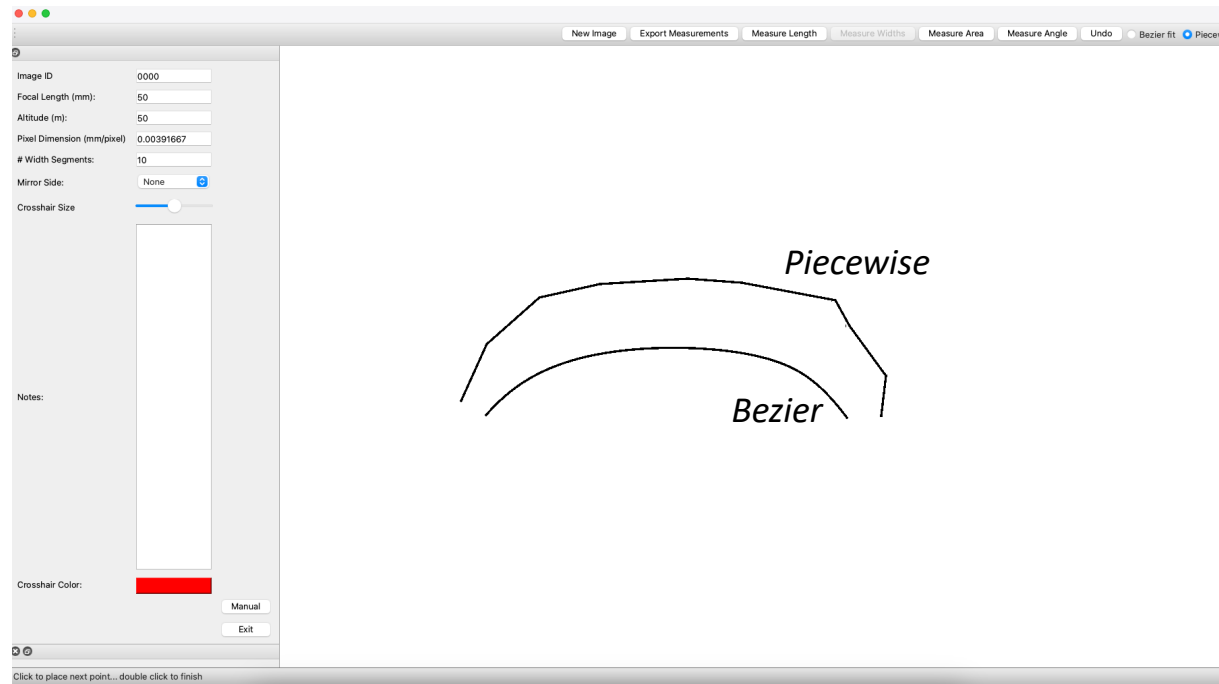


Figure 5. Completed “Total length” or “TL” measurement. Note that line has been edited to make easier to see in the manual

# Measuring lengths: Piecewise vs. Bezier fit

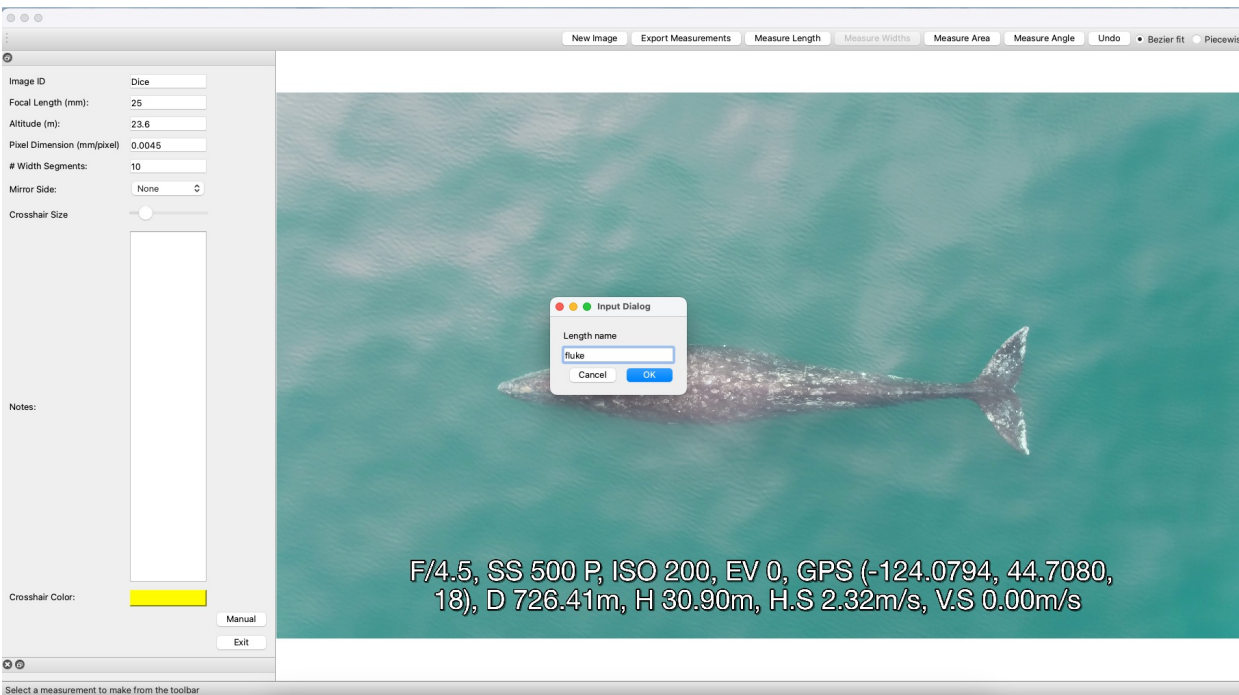
- Bezier fit applies a smooth fitting curve between 3 or more points in a length measurement, which is particularly useful for measuring curvy animals or objects.
  - When fitting a bezier line on a curved animal, placing more points is better and will improve the measurement



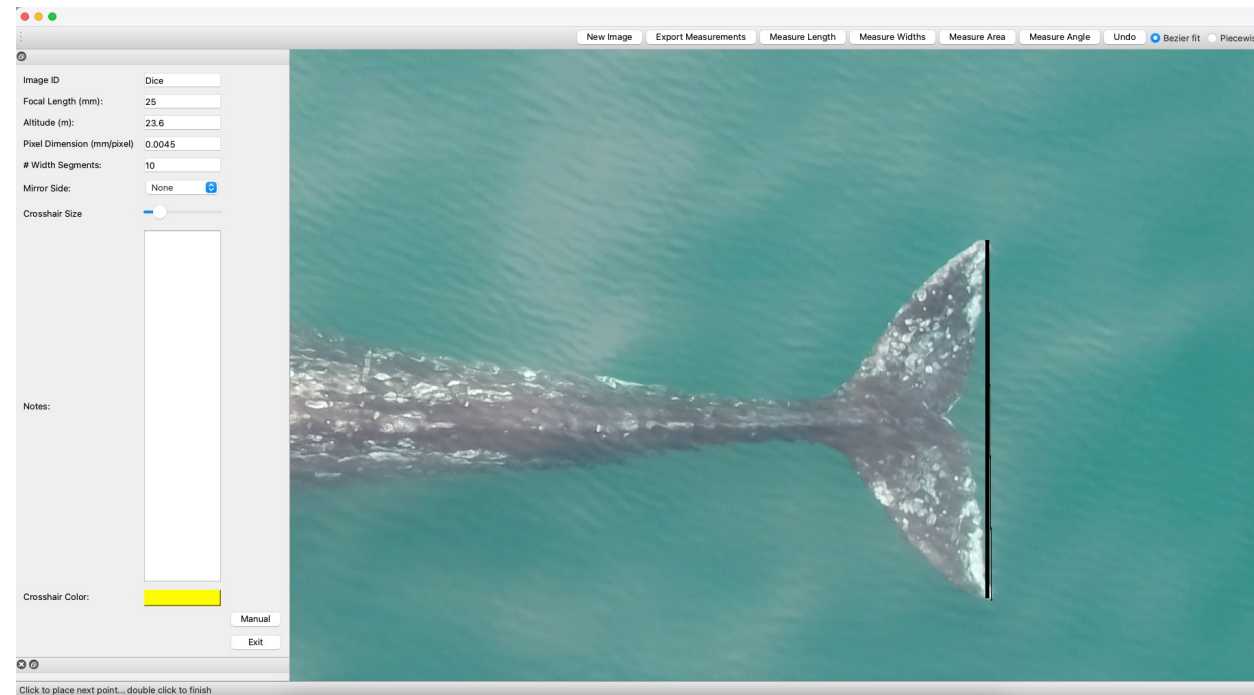
*Figure 6. An example of a Piecewise vs. Bezier fit.*

# Measuring lengths: additional measurements

- You can continue to make other length measurements by selecting “Measure Length” and assigning a new label, i.e., “Fluke Span”, or “Fs”, etc. (Figure 7, 8).



*Figure 7. Label for an additional length measurement, here "Fs" for "fluke span".*



*Figure 8. Completed “Fluke Span” or “Fs” measurement. Note, the line has been edited to make it easier to see in the manual.*



# Measuring widths: set up

- Measuring widths perpendicular to a body length measurement is often used to estimate an animal's body condition.
- The 'Measure Widths' button will automatically divide a length measurement into perpendicular widths.
- First specify the number of width segments desired using “# Width Segments” in the input frame.
  - The picture below has 20 width segments, in 5% increments of the body length measurement.
- Then select the color of the width crosshairs, if desired.
- Next, select “Measure Widths”, which will automatically divide the length measurement by the designated number of segments and place slidable crosshairs on each perpendicular width line (Figure 9).
- Note, that a Bezier fit must be applied to the length measurement to measure widths.

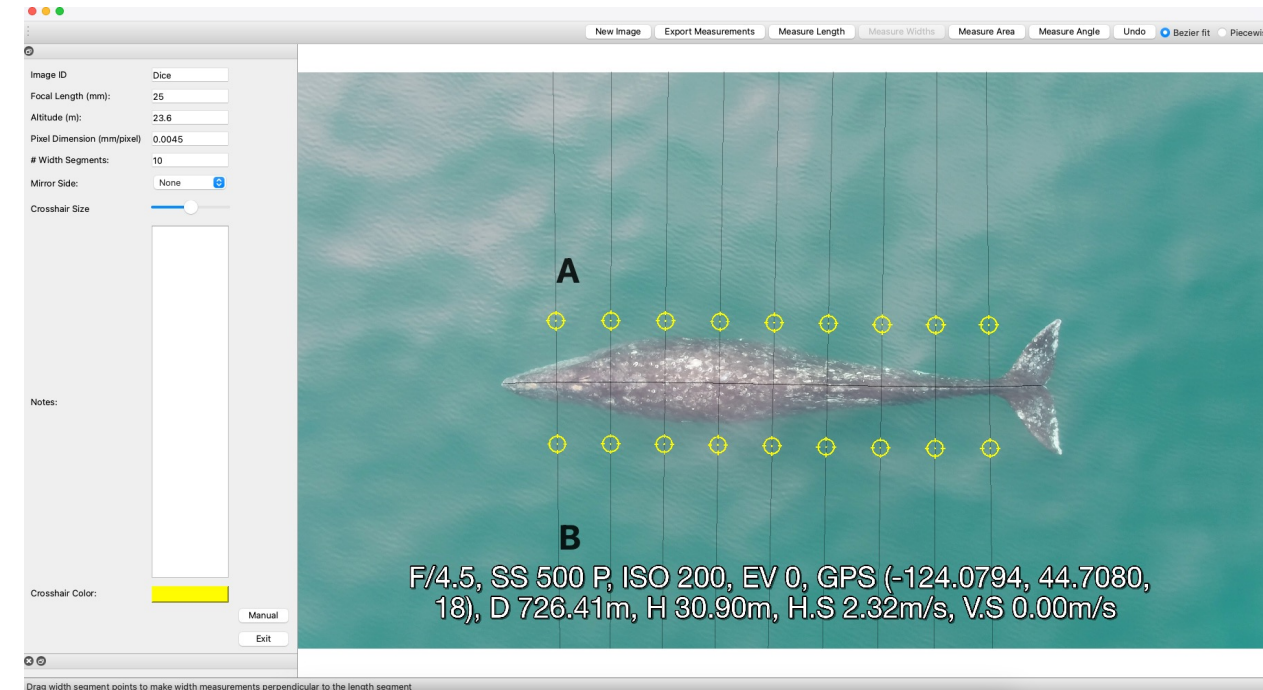


Figure 9. Width segments automatically generated with slidable crosshairs (yellow). Shown here, 10 width segments, or 10% increments of total length.

# Measuring widths: measuring

- Zoom in and slide the crosshairs along the perpendicular width line to the edge of the whale on both sides (Figure 10).
- Continue adjusting each crosshair until satisfied with the edges selected (Figure 11).

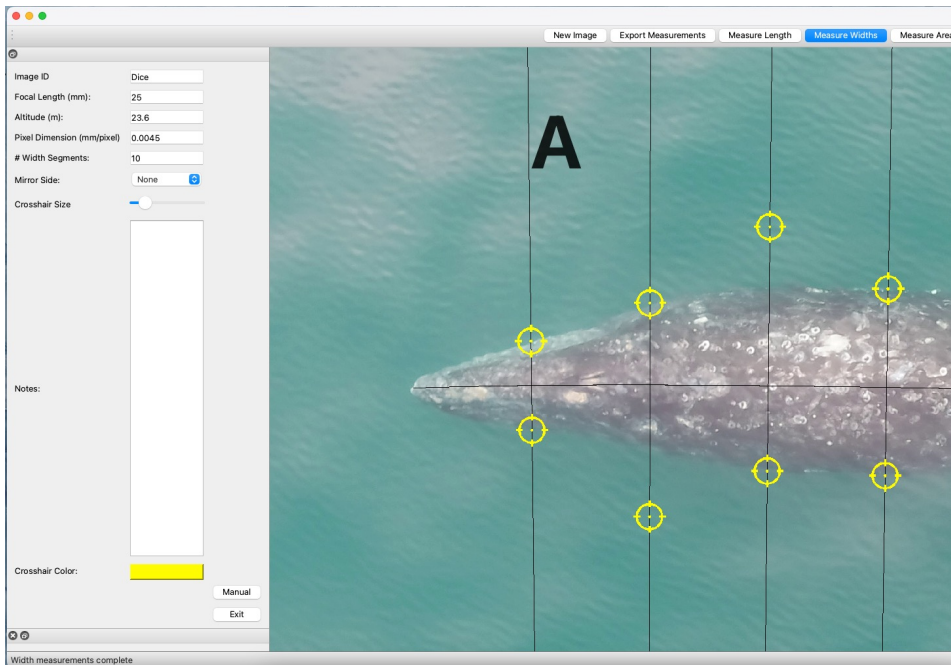


Figure 10. Slide each crosshair width point to the edge of the whale to measure the width at each increment of total length.

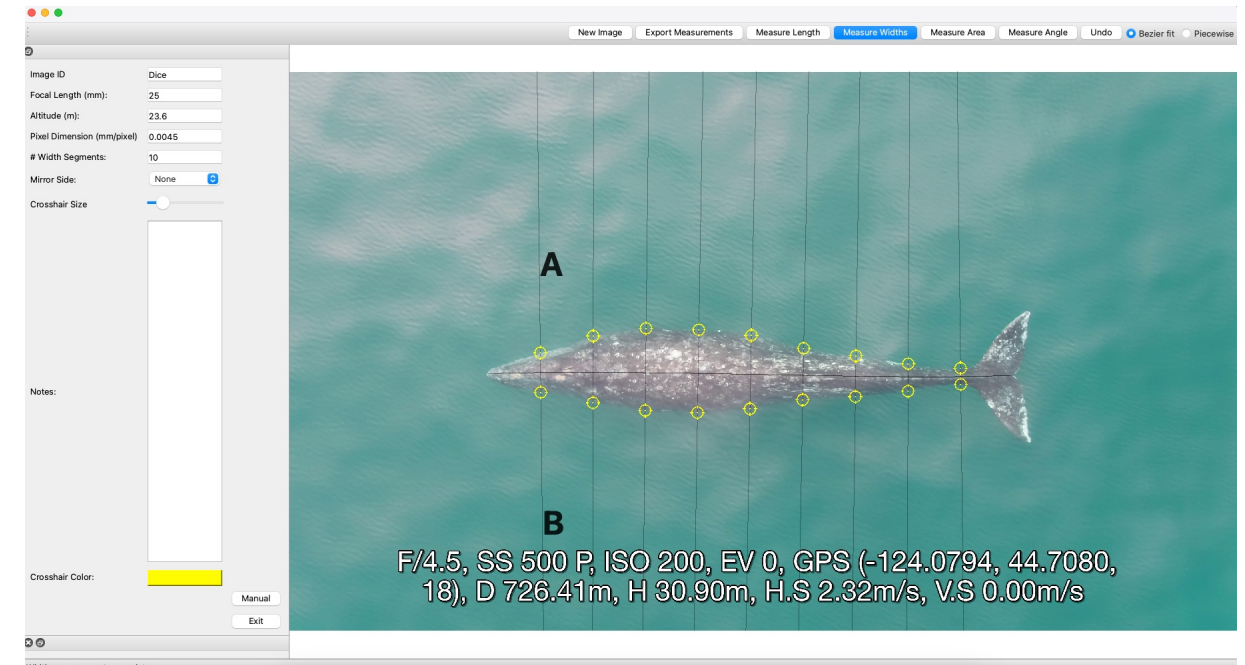


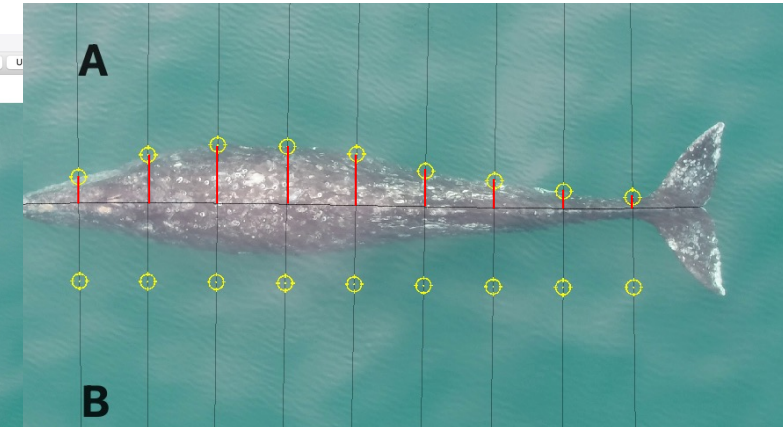
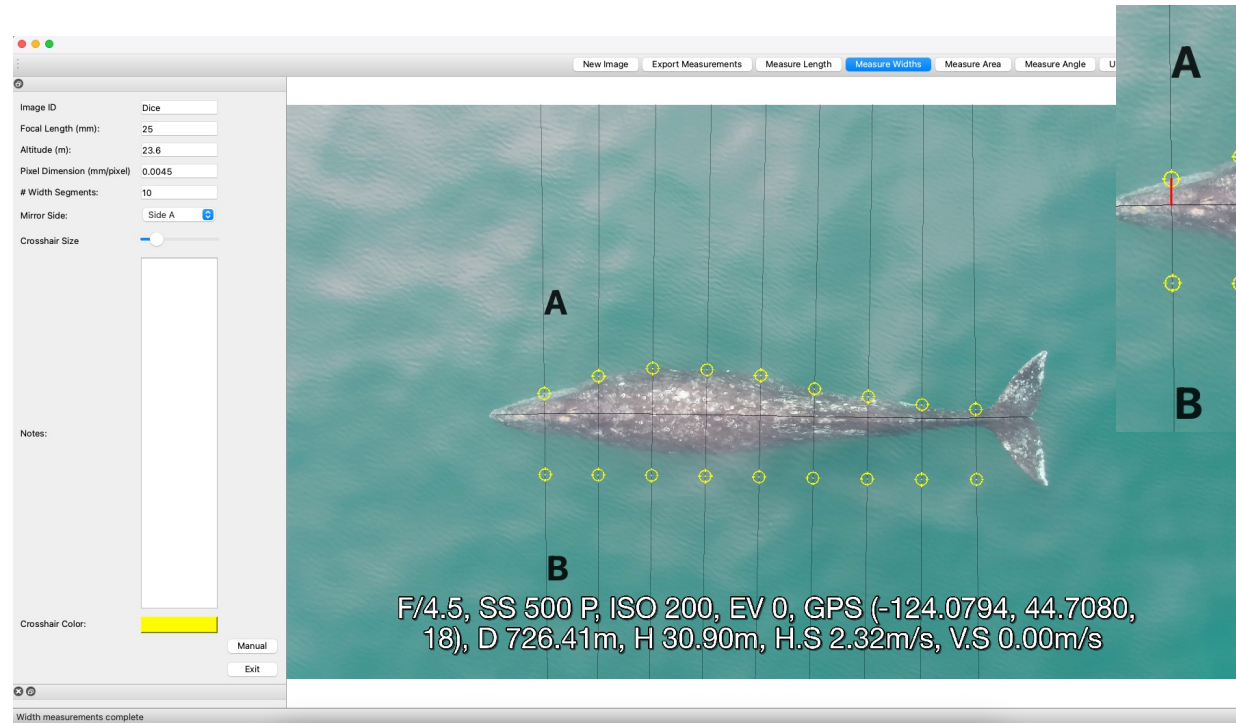
Figure 11. Width measurements complete.

# Measuring widths: mirror side

- Mirror Side allows you to calculate the body widths of an animal using the edge of the width of one side (A or B) to the center line (Figure 12a,b).
- This is particularly useful if one of the sides is obstructed, i.e., from glare, refraction, shadows.
- The width measurement assumes symmetry between both sides (A and B), and multiplies the selected side by two to get the full width measurement (i.e., width =  $A \times 2$ ; Figure 12b).
- The default is “none”, which measures the distance between the edge of the whale from Side A to B.

*Figure 12a. Designating which side (A or B) to mirror. This is particularly useful when the edge of one side of the whale is obstructed, i.e., waves, glare, refraction, shadows, etc.*

*Here side A is the selected side.*

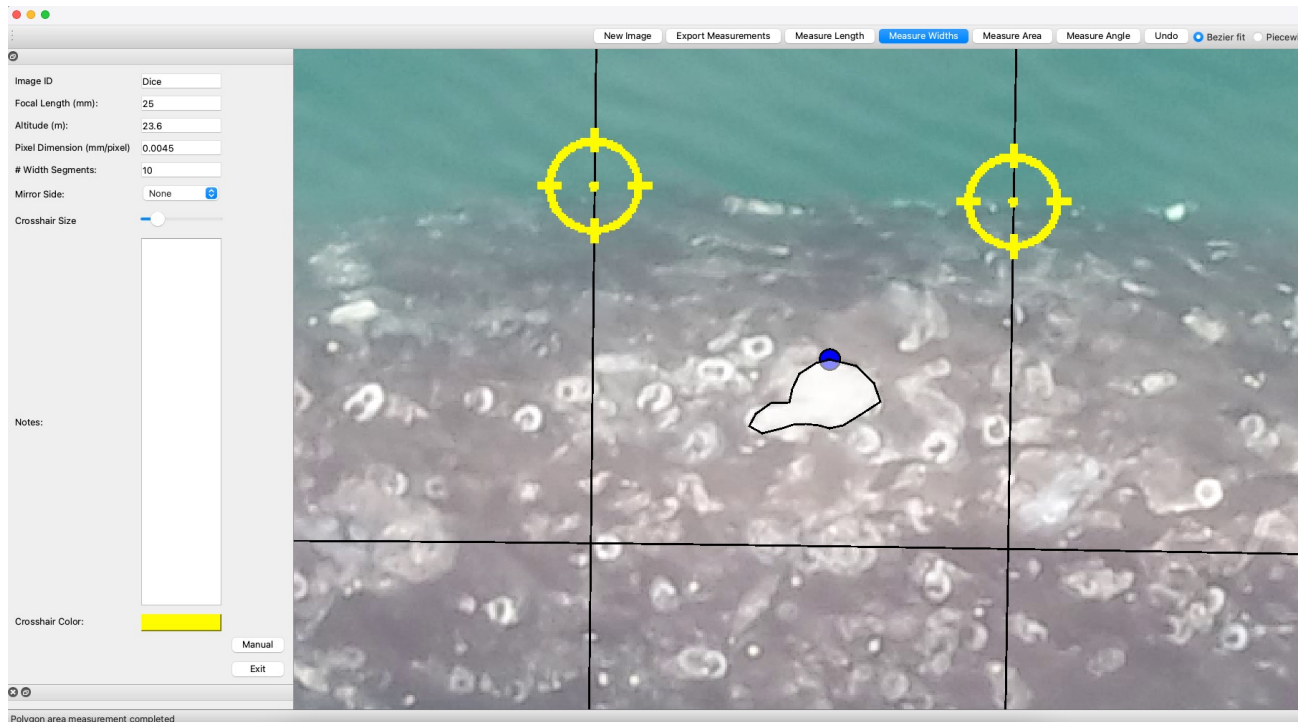


*Figure 12b. The red lines represent the distance from side A to the the center line.*



# Measuring area

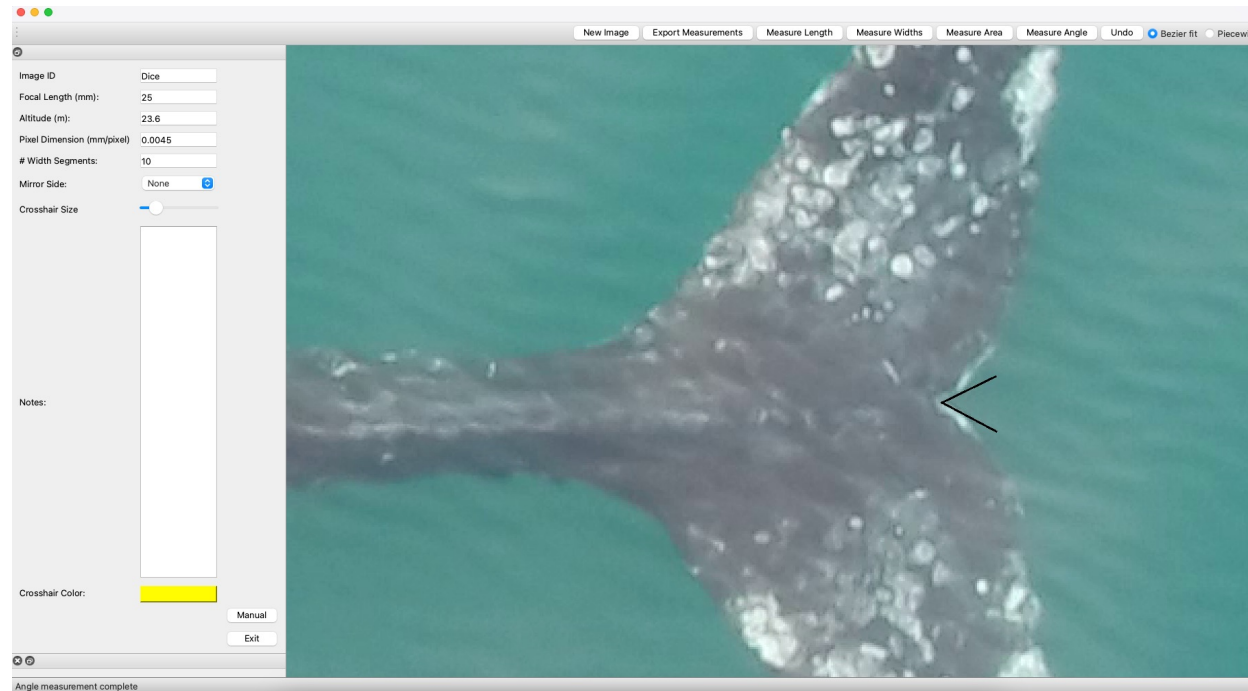
- To create a custom area measurement, select “Measure Area”.
- A box will appear for the user to create a unique label, i.e. “Fluke Area” or “white patch”.
- Once a label is created, click points to draw a polygon around the desired area.
- A blue dot will denote the final connecting point of the polygon and the area measured will be shaded (Figure 13).



*Figure 13. Completed area measurement of a white patch on skin.*

# Measuring angle

- To create a custom angle measurement, select “Measure Angle”.
- A box will appear for the user to create a unique label, i.e., “Sweep Angle” or “fluke notch angle”.
- Draw the first vector, click to create a vertex, then draw the second vector (Figure 14).
- The angle will be calculated between the two vectors.



*Figure 14. Completed angle measurement of the fluke notch.*



# Export measurements and open new image

## Exporting Measurements

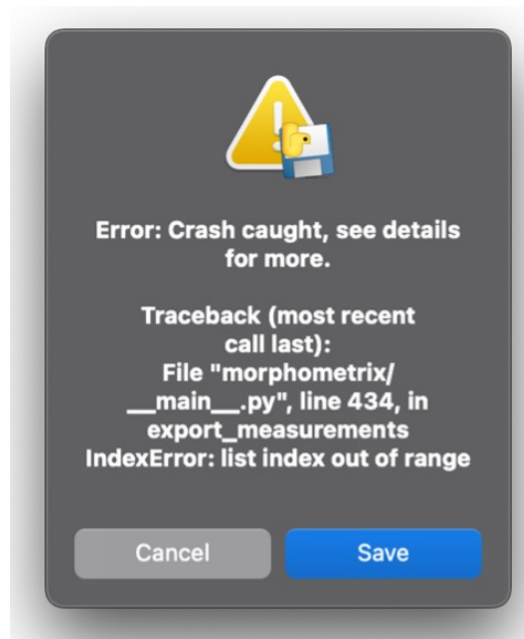
- Once measurements are complete, select “Export Measurements”
- You will be asked to select a folder to save a .csv containing all the measurements (in pixels and meters) with their corresponding labels and a .png “image receipt” of the measurement lines drawn on the image.

## Open Next Image

- To measure a new animal/image select “New Image”, enter updated parameters in the left input window (if any), and begin measuring.

# Crash Reporting

- If MorphoMetriX crashes, a window should appear to save the crash report error code (Figure 15).
- You can then open an “Issue” and upload the crash report on the MorphoMetriX GitHub page <https://github.com/ZappyMan/morphometrix>.



*Figure 15. Crash report. Save the crash report text file to easily share with MorphoMetriX Team.*