ZEdit Pro 1.0

Tutorial 2 – Black Bass

First Edition

DeskArtes: “ZEdit Pro 1.0: Tutorial 2 – Black Bass”

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Chapter 1 – Foreword

The *ZEdit Pro 1.0 Tutorial 2 – Black Bass* tutorial introduces a more advanced level of repair functionality available with ZEdit Pro. Through this sequence, you will learn how to repair the *Black Bass.zpr* model by using the Auto Repair functionality as well as more specific repair functions, like joining surfaces to form solid shells. In the final step, you will output the repaired model for printing with Z Corporation color printers.

This tutorial is the second in a set of five tutorials, each of which covers different aspects of model repair, coloring, and print preparation. The following tutorials are available in the software distribution package:

- *Tutorial 1 – Lamp* introduces basic automatic repair and coloring. Estimated completion time is 60 minutes.
- *Tutorial 2 – Black Bass* covers more advanced repair, including joining surfaces and adding thickness. Estimated completion time is 30 minutes.
- *Tutorial 3 – Annie* addresses repair with hollowing and adding drain holes. Estimated completion time is 20 minutes.
- *Tutorial 4 – Cow* relates to splitting and connecting. Estimated completion time is 20 minutes.
- *Tutorial 5 – Explorer* involves repair with offsetting and joining surfaces. Estimated completion time is 20 minutes.

The tutorial documents and the geometry files for the tutorial examples are found in the *Tutorials* folder and its sub-folders (*Tutorial 1*, *Tutorial 2,* etc.) in the ZEdit Pro installation directory.

If you are using ZEdit Pro for the first time, going through the tutorials in the given order will help to familiarize you with the application. Tutorial 1 is especially helpful because it includes information on the basic use (auto repair, viewing, selecting, painting, and texturing) and different concepts (modes, windows, etc.) in the software.

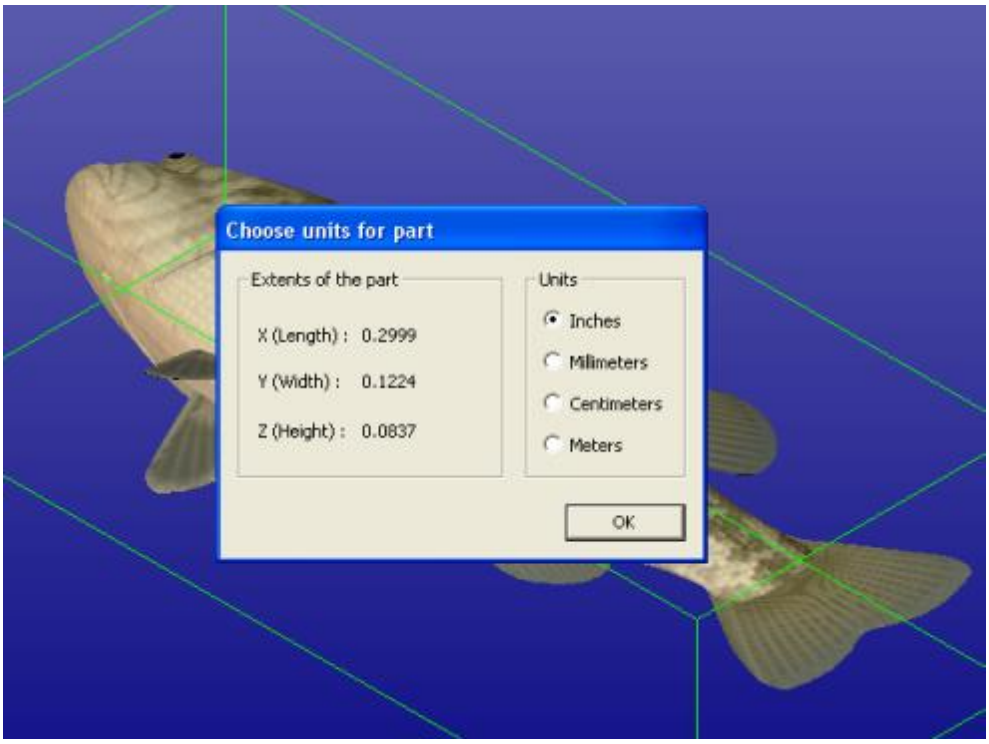
The **boldface** and *italics* used in this tutorial have designated meanings. A **boldfaced command** is a command or operation that alters the model or is otherwise necessary to reach results similar to the example. A statement in *italics* denotes the different parameters and their values; menu commands; mouse clicks; file names; Model Tree items; or any new terms introduced to the reader.

ZEdit Pro allows you to do full repair and advanced coloring for 3D models for 3D printing with Z Corporation color printers. The Import Package and 3Data Expert® software from DeskArtes (www.deskartes.com) provide additional model manipulation functionality, including surface input and triangulation, and Boolean operations. ZEdit Pro is part of the DeskArtes Expert Series software suite. Optional tools are available through DeskArtes.

Chapter 2 – Fixing the Black Bass model

In this example, you will go through the steps required to fix a *Black Bass* model. The *BLACK BASS.zpr* model is available in ZPR format (.zpr) on the ZEdit Pro installation directory (*Tutorials/Tutorial 2 – The Black Bass* directory). You will use both Automatic Repair and Join Gaps commands to generate a model with solid shells. You will add thickness to thin shells in the model. After completing model repair, painting, and texturing, you will save and store the model in ZPR format for 3D color printing.

Please **input the *Black Bass* model (*File > Open*)** from the *BLACK BASS.zpr* file. You should see the following result on your computer screen:

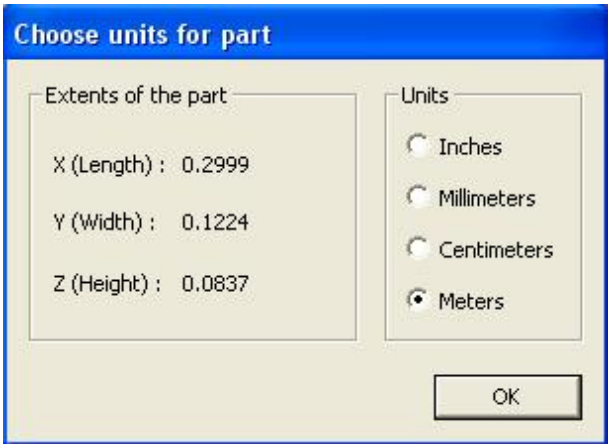


You can also start ZEdit Pro through the ZEdit Pro icon in the ZPrint software (or through the *Edit > Start ZEdit Pro* command). In this case, the model will automatically load to ZEdit Pro.

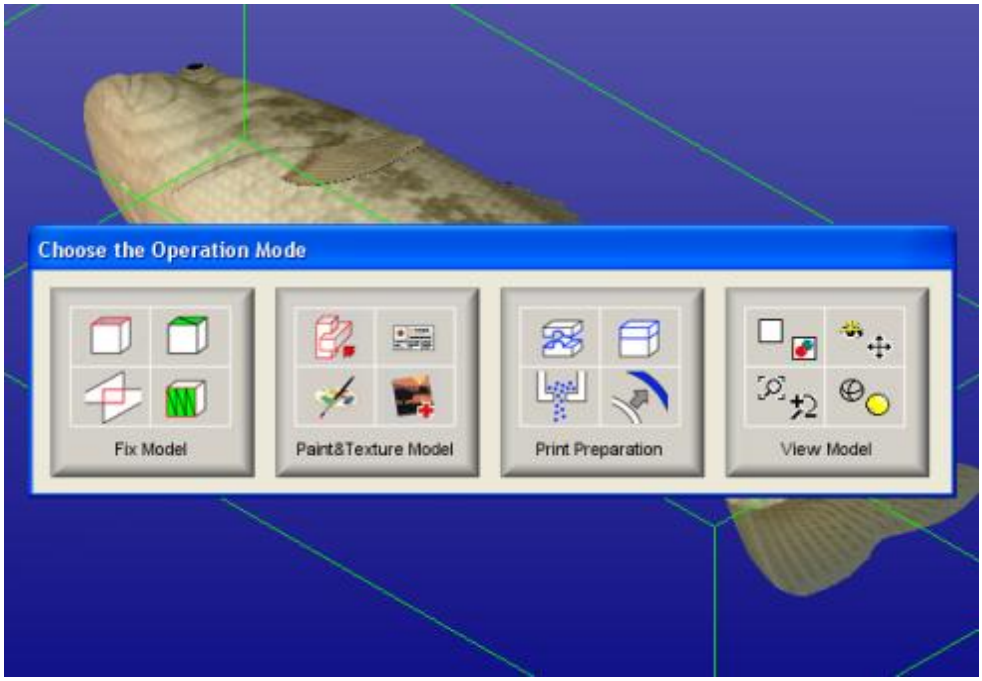
You will notice that the Black Bass model comes with full fish-like colors. ZPR files, like VRML files, can store model colors and textures for maximum realism with 3D color printing.

The first ZEdit Pro dialog allows you to check and set the units for the inputted part. ZPR (.zpr) files include the unit information, but in this case, the units seem to produce a very small object. **You will change the units to meters**. This is a

more realistic size, and it also fits into the 3D printer build volume nicely. When you output the model into ZPR file in the end of the repair process, the new units will be stored in the file.



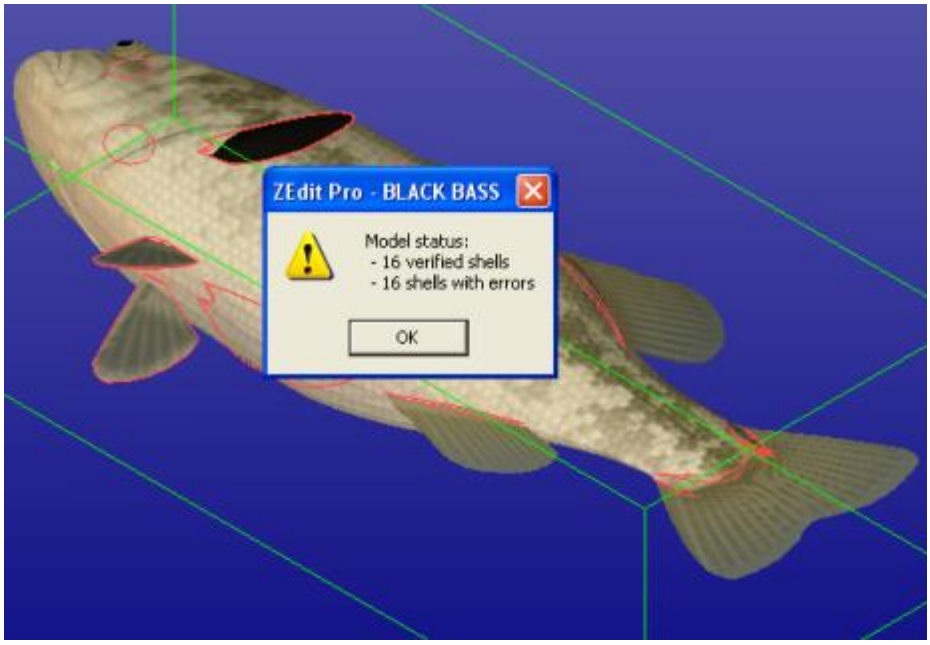
Press OK to continue. The *Operation Mode* window will appear:



ZEdit Pro has three main operation modes: *Fix Model*, *Paint & Texture Model,* and *Print Preparation* mode, as well as a temporary *View Model* mode. The different modes are used for different tasks, but in this instance, you want to verify and repair the model to produce a solid geometry ready for 3D printing. Select the Fix Model mode for model repair.

Fixing the Black Bass automatically

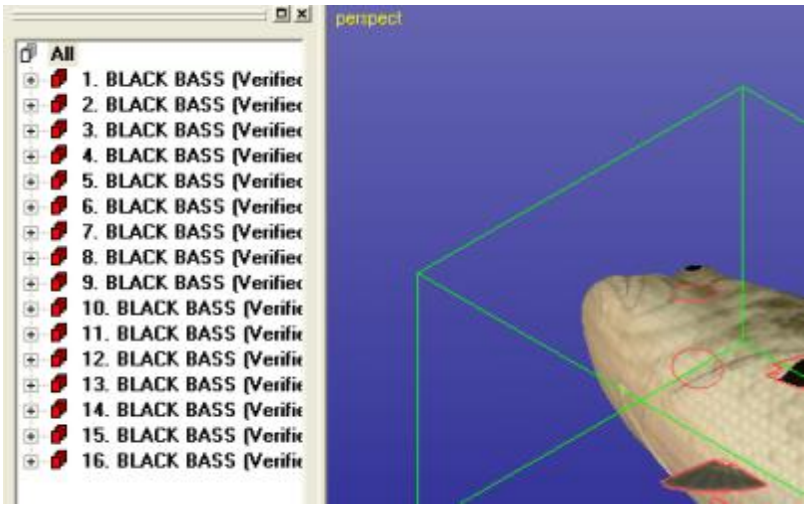
The normal way to begin repairing a model is to start with the Fix Model mode. To start fixing **press the Fix Model button** in the Operation Mode dialog now**.** ZEdit Pro will begin automatic model verification (*Fix Model* > *Verify Shells* command). The screen is erased and a progress toolbar appears. When the analysis is ready, a *Model status* message box displays:



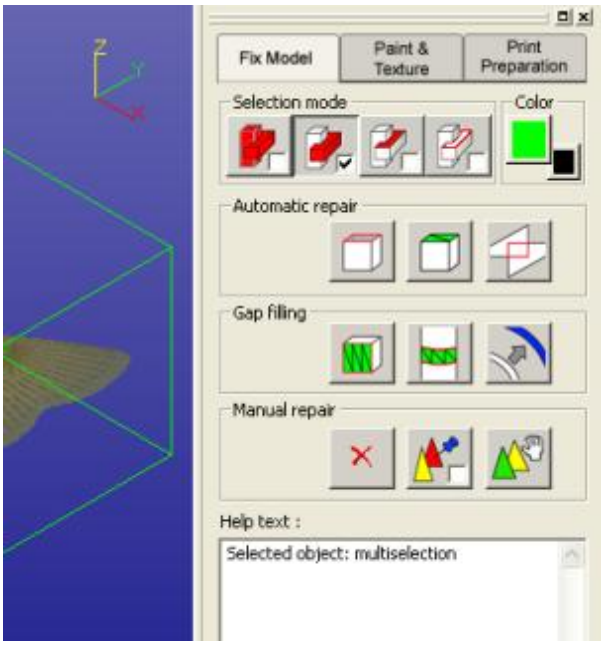
The message indicates that there are 16 verified shells, of which 16 shells contain errors. The display shows red *Gap curves* through the surfaces. Gaps are an error type you must fix during the repair process.

The model is divided into separate shells during verification. **Press the OK button** in the *Model status* dialog to see the full model structure with different shells in the *Model Tree* (on the left-hand side of the image that follows). The error shells have red icons, and the correct shells have green icons in the Model Tree. The *Fix Model Tab* on the *Tools Window* (on the right-hand side) provides shortcuts to the commands available for repair. The *Help text* window at the lower part of the Fix Model Tab also contains information for repair actions.

In the Model Tree image that follows you can see that all shells have errors and have red icons.



The Fix Model Tab on the right-hand side provides tools for object selection and shortcuts to fixing commands:



You are now in the middle of the automatic verification and repair process. ZEdit Pro now asks if you wish to continue with *Auto Repair*:

Auto Repair is the best path to follow when repairing models with normal errors so **press the Yes button** to initiate Auto Repair. Auto Repair will attempt to fix all shells with errors in the Model Tree.

When Auto Repair is started each shell is run through the automatic repair command (*Fix Model* > *Repair Shells* command) using automatically calculated parameters. For each shell, a progress bar shows the progress of the repair (and this may cause some flickering on the screen when shells with only a few triangles are repaired). You will then receive the following message:

You are prompted for the *Repair color* mode. **Press Yes** as you will now need to find and fix all remaining errors in the Black Bass model. You will see the *Model status* window:

You may also see the short “Introduction to File Fixing” splash screen. The “Introduction to File Fixing” page includes a description of what file fixing is and where to find more help.

Press the OK button to close the *Model status* window after Auto Repair. A *Tip Window* is displayed with hints on how to start working with the errors in the model.

A *Tip Window* with useful tips on viewing and selection mechanisms may be displayed after Auto Repair (please see the *Tutorial 1 – Lamp* page 14 for details). You can just **Close** or **Minimize** the *Tip Window* and the “Introduction to File Fixing” page for later reference during the repair. You can also permanently turn them off when you become more familiar with the use of the repair tools through the *Show Command Tips* and *Don't show the window after Auto Repair* settings in the dialogs. You can restart both windows through the Help menu.

During Auto Repair, ZEdit Pro attempts to fill all gaps and remove non-manifold triangles from the model (to see more about triangle errors, please access the “Triangle errors” page in the Online Help chapter “Handling Faceted Models”). The Black Bass model includes several shells that are flat and open, and cannot just be filled with triangles, because that would leave several gaps in the file. Many shells are also fixed (green icon) during the Auto Repair.

The Tip text (if displayed) recommends:

“*Please select each shell with errors (red icon) from the Model Tree to see the required repair action in the Fix Model Help text window. Compare also to neighboring shells to see if Join Gaps or Offset should be used to create solids.*”

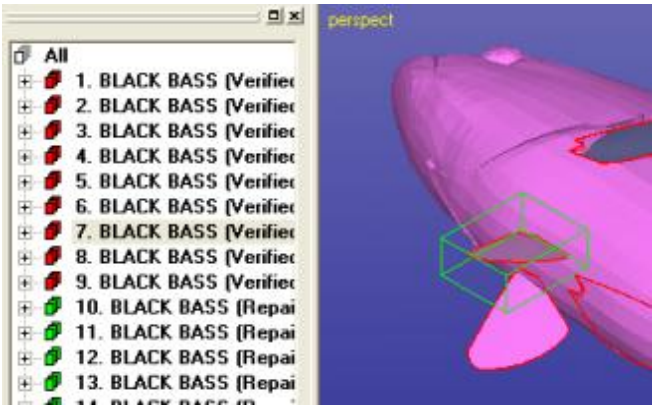
This is exactly what you need to do. You will gain a general understanding of the remaining errors through a visual investigation and from the Help text in the Fix Model Tab. But first, you will learn how to select objects from the Model Tree and the display area for fixing.

Selecting objects for fixing

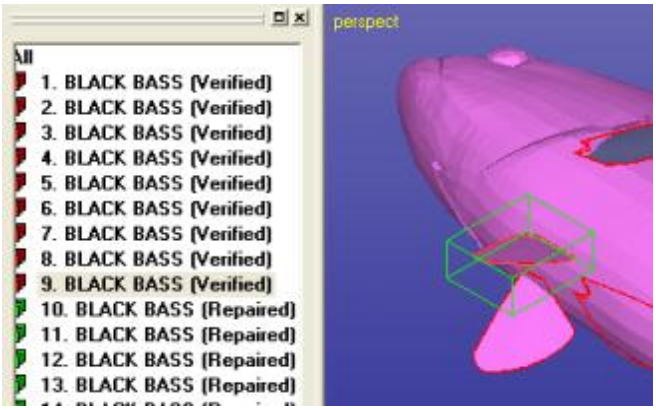
The selection mechanisms for selecting objects in Fix Model mode are very similar to the selection of objects for coloring in Paint & Texturing mode as described in the *Tutorial 1 – Lamp* tutorial. First, you should set the correct selection level using the Selection mode buttons in the Fix Model Tab:

The four buttons refer to the following selection levels: whole model (part), shell, surface, and gap. The *Shell selection* level is the default when the software is initialized. If not activated now, you should **press the Shell selection button** as selected above.

Now **single-click different parts of the Black Bass** on the screen. You will see that the selection in the Model Tree changes and is highlighted (grayed). Also, a green bounding box is displayed on the newly selected object (if not, make sure that the *Show bounding box* icon is activated) and the surface color is slightly lighter. In the image that follows, a fin, shell 7, is selected:



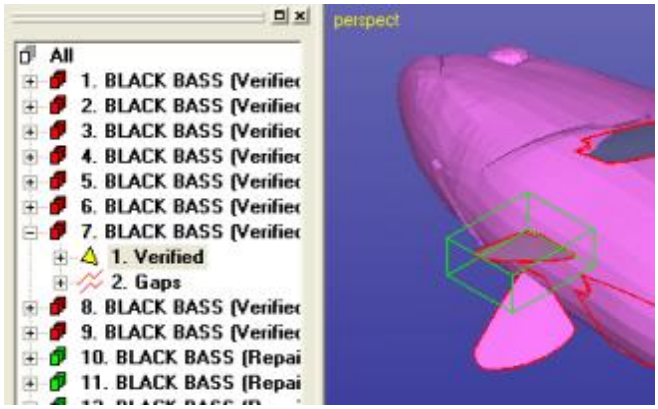
Now keep the cursor on top of the already selected *7. BLACK BASS (Verified)* shell on the display area. **Click a couple of times without moving the cursor** at all. You will see that the new shells will be selected. These shells are behind shell 7 but in the line of sight. If a shell (or any object) is behind another shell, it can be selected by clicking continuously in the same cursor location:



In the image above, shell 9 is selected, which is almost in the same location as shell 7 but just below it.

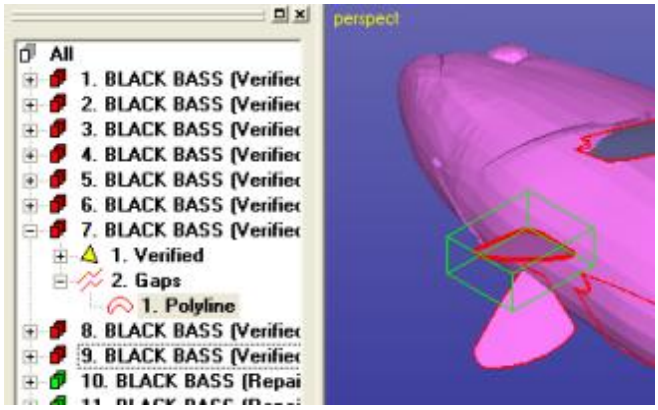
Shells are made of surfaces and you can easily select them by **turning on the Surface selection mode**

and **clicking on the display area**:



Similarly, **gaps can be selected by turning on the Gap selection mode**

and **clicking on the display area:**



Any model you can select on the display area can also be selected directly from the Model Tree. After experimenting with the selection, press the - icons

(7.) to close the Shell nodes (folders) in the Model Tree.

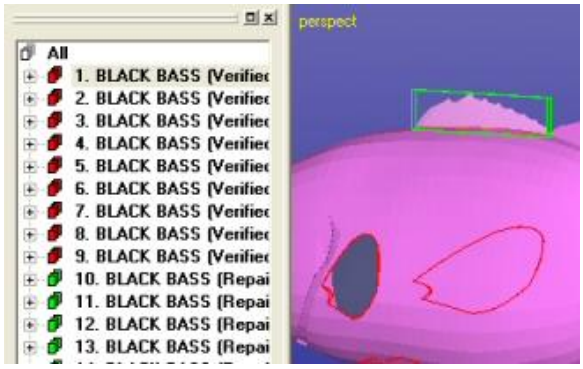
Generally, you can also use the + and – keys on the keyboard to open or close a tree branch. The *right mouse button* (RMB) menu on the Model Tree also contains the **Collapse All** command, which will close all shells at once.

Filling a gap in a shell

The Model Tree contains several shells with errors as indicated by red icons. The errors involve gaps left in the shells. Auto Repair will not fill flat shells with large gaps or small shells with relatively large gap areas to avoid creating erroneous geometry. The final repair decision on these shells is left to you, the user.

You should now examine each error shell with a red icon in the Model Tree. Make sure **the Shell selection mode is on**:

Start with the first shell *1. BLACK BASS (Verified).* You can **select it directly from the Model Tree** (or click on it on the display area), as shown in the left-hand image that follows. When the shell is selected, Help text is displayed on the Fix Model Tab as shown in the below image:

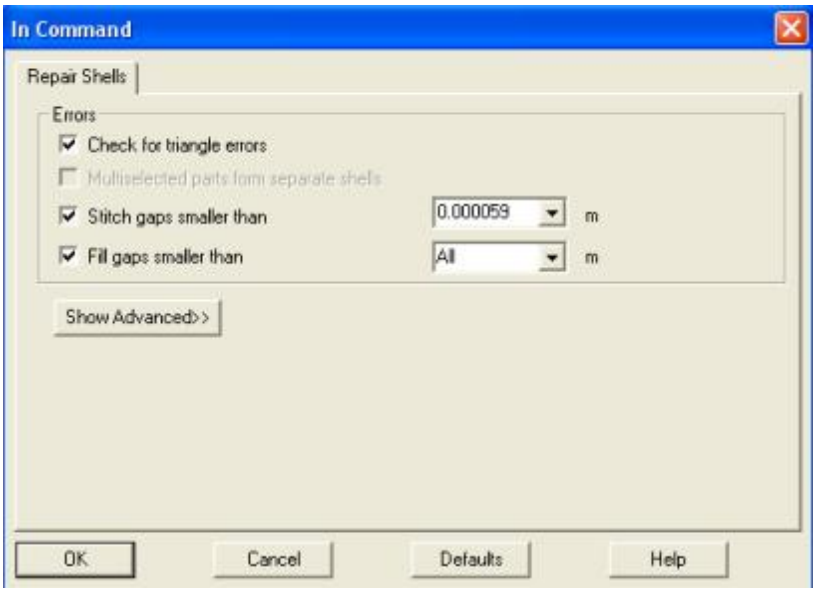


The Help text gives the status of the selected shell first: *verified, flat/open shell, thin shell, and 1 gaps*. Each shell must be a solid so we need to fill the gap in shell 1.

The Help text suggests two ways to fix the model: either use the *Fix Model > Join Gaps* or run the *Fix Model > Repair Shells* commands on the shell. Closer investigation (**zoom in**) of shell 1 reveals that there are no other shells with a similar gap curve nearby, so you should select the second suggestion and use the Repair Shells command to fill the remaining gap.

The Repair Shells command is executed by **pressing the Repair Shells**

button in the Fix Model Tab. This will show the Repair Shells parameter dialog:



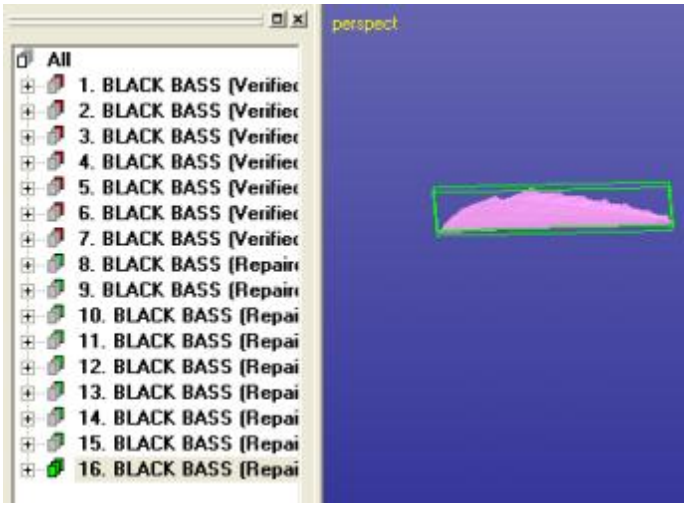
The parameters have the following meanings:

- *Check for triangle errors* will recheck any intersecting or overlapping triangles in the shell when repairing it (on by default).
- *Stitch gaps smaller than* will give the maximum width of a gap to fix by stitching (i.e., by connecting close, opposite gap edges together with the value automatically calculated for each shell).
- *Fill gaps smaller than* gives the limit on how large triangles can be added to fill a larger round gap (all gaps are filled by default).

You should normally not change the values of these parameters; they are correctly set for the model repair for Z Corporation 3D printers. When you become more experienced with the software and go through some advanced training material, you can tune the repair results by changing the values. For more details press the Help button, which takes you directly to the *Repair Shells* command Help page.

Press OK to accept the parameters and to **run the Repair Shells command**. After a while the message

appears. The shell is correct. Whenever the *Repair Shells* command is run on a shell, the result is moved to the end of the Model Tree. Also, the *(Verified)* suffix is replaced with *(Repaired)* text. The green icon indicates that there are no more errors in the shell:

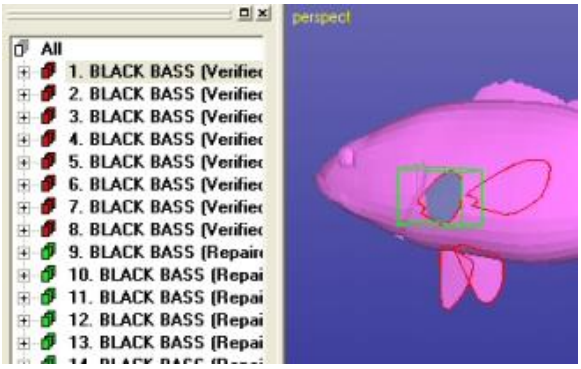


After the repair, only the resulting repaired shell is shown on the screen and all other shells are grayed out in the Model Tree. To display the whole model **select**

the Model Tree root *All* or **press the *View > Fit All*** **icon with the left mouse button** (*LMB*).

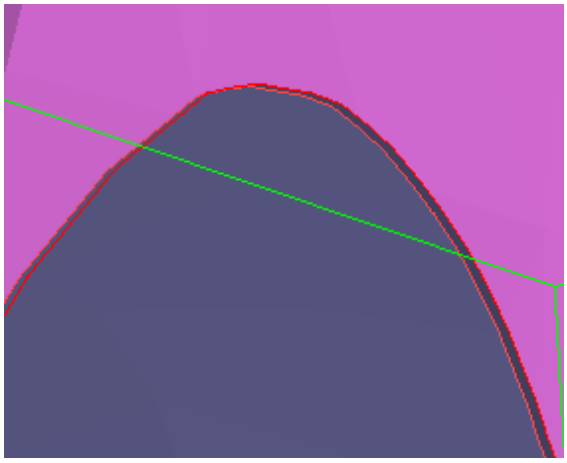
Joining open shells

Now select shell 1 in the Model Tree again. The first shell contains the left front fin, as shown in the left-hand image that follows. The blue color indicates that we are looking at the inverted normal side of a surface in the *Repair* color mode, (pink is the normal side color).

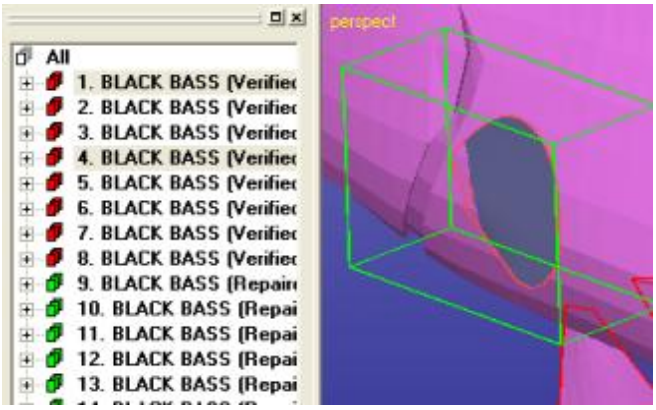


Help text for the selected shell is available on the Fix Model Tab (right-hand image above). Now you have three repair possibilities to create a solid: *Offset* can be used to create a solid from the flat and open shell, *Join Gaps* can be used to connect to nearby shell, or normal *Repair Shells* can be used to fill gaps. As mentioned earlier, you need to make a visual inspection of the nearby shells to find the correct answer.

Now **zoom closer to the fin**:

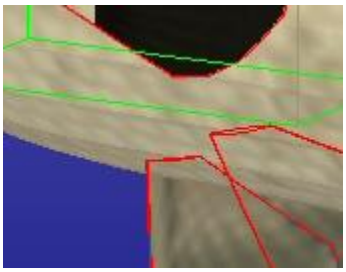


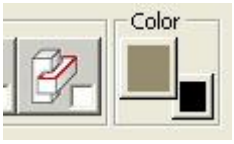
A close inspection reveals that there is a similar fin surface very close to the selected shell. These two shells are obvious candidates for surface joining with the *Fix Model* > *Join Gaps* command. The two nearby and similar shells are shells 1 and 4:



Before running the *Join Gaps* command, you need to set the color for the new connecting surfaces correctly. The *Color* beside the *Selection mode* in the Fix Model Tab is important when creating new surfaces to fill gaps or when joining shells. The new fill triangles will have the color shown in the *Foreground* color button.

Now select a correct color for the *Foreground* button. **Turn the 3D Printer color mode on by pressing the 3D Printer colors** **con**. Then use the eyedropper to pick the color from the Black Bass model. The eyedropper is started by clicking the *Foreground* color button with the *right mouse button (RMB)*. **Select a suitable color from one of the fins or fish flanks with the eyedropper**. Your color setting should be similar to the images that follow, the fish in the *3D printer color* mode with the *Foreground* color picked with the eyedropper:

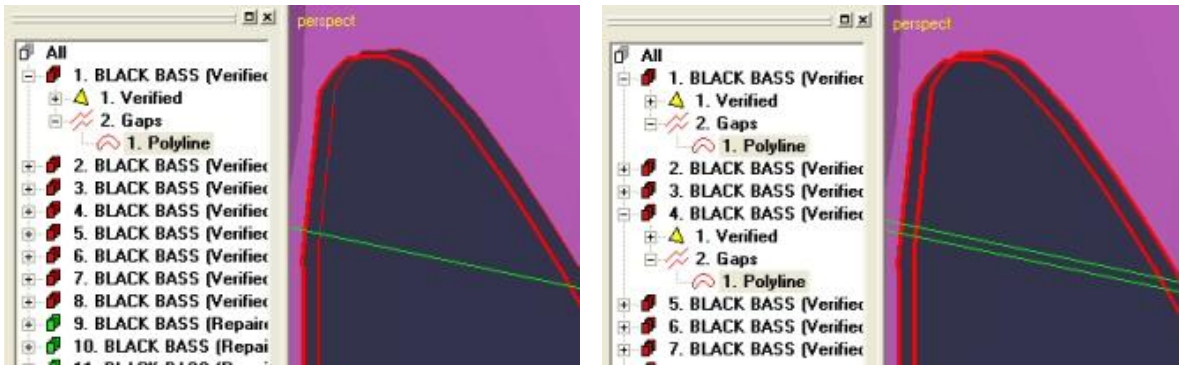




When ready **press the 3D Printer color icon again** to return to the *Repair color* mode.

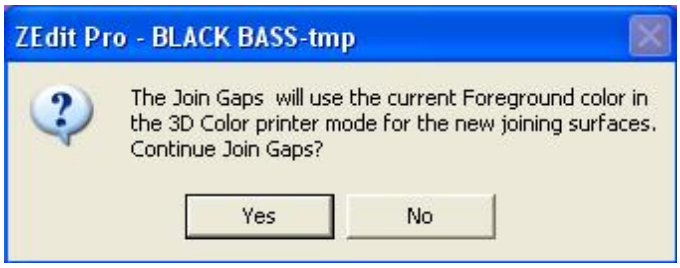
Now you are ready to run the Join Gaps command. You first need to select the two gap curves at shells 1 and 4 using multiselection. First, **turn Gap selection on**

and then zoom in to **select one of the two gap curves graphically** with the *LMB* (on the left):

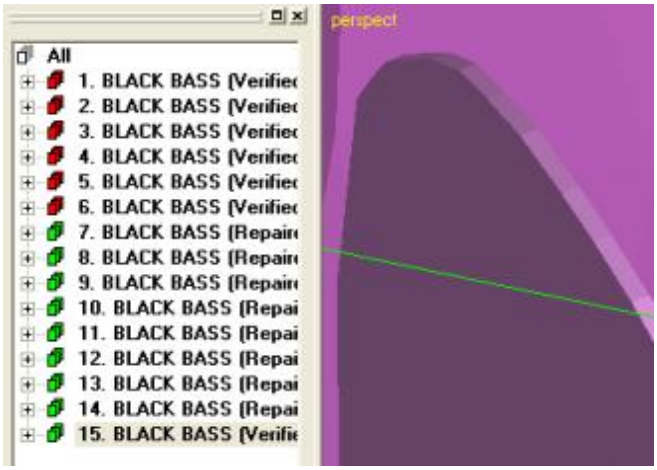


Then **press the Ctrl key down** and **multiselect the second gap curve with the *LMB***, as seen in the right-hand image above. The Model Tree is opened and the selections are highlighted in the Model Tree. Then join the gaps by **clicking the Join Gaps**

button in the Fix Model Tab. You will get the warning



Press Yes to continue. After a while, a new shell 15 will appear at the end of the Model Tree containing the combination of the original shells 1 and 4, which have been removed from the Model Tree:



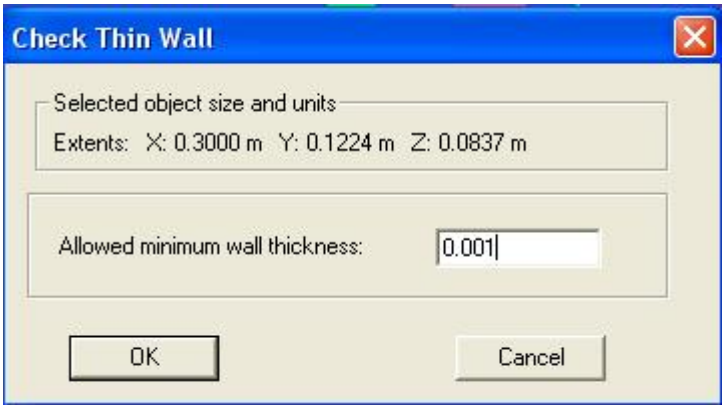
You can fix the remaining six shells with errors the same way, by joining three pairs of shells. These repairs are left for you to do. A fully repaired Black Bass model can be found in the *BLACK BASS-repaired.zpr* file in the *Tutorials/Tutorial 2 – The Black Bass* directory.

It is also possible to generate solid shells from open shells by Offsetting. The use of this command is described in more detail in the *Tutorial 5 – Explorer.*

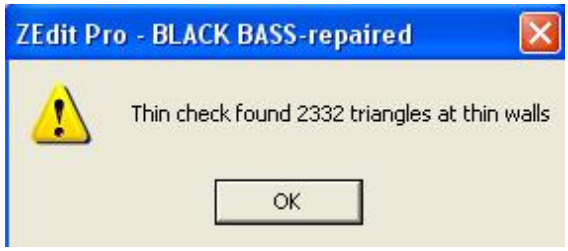
Adding thickness to thin shells

The Black Bass model has several thin shells at the fins. Features that are too thin may break down when removed from the 3D printer, and it may be necessary to add thickness to some shells to make them stronger.

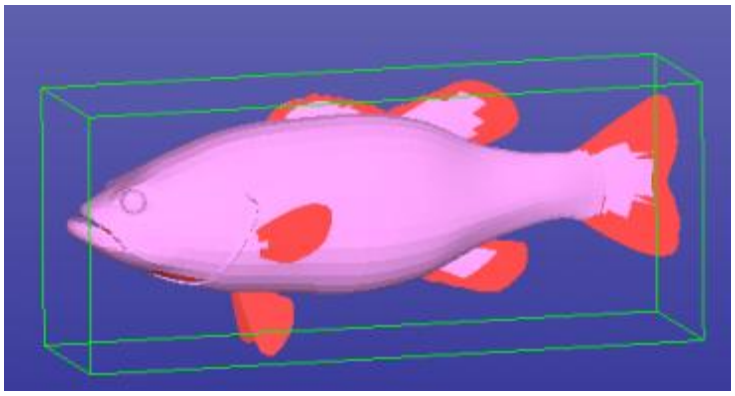
Checking for walls that are too thin can be done with the *Fix Model* > *Check Thin Wall* command. **Select the Model Tree root All** (whole model) and **give the command Fix Model > Check Thin Wall**. The parameters dialog will appear:



Fill in the value above (0.001 meters = 1 mm) and **press OK**. After a while the result dialog appears:



The thin wall triangles are displayed in red in the display area (shell icons in the Model Tree also change to red):

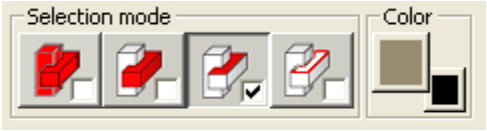


Checking has identified areas where the thickness of a shell is less than the given value. It is up to you to decide if something is really too thin, requiring material to be added to the shell. The decision depends on the geometry type, such as if the geometry is a high wall or just a low ridge. You can use Dimensioning tools (*Dimensions menu*) and the clipping icon to aid in making this decision.

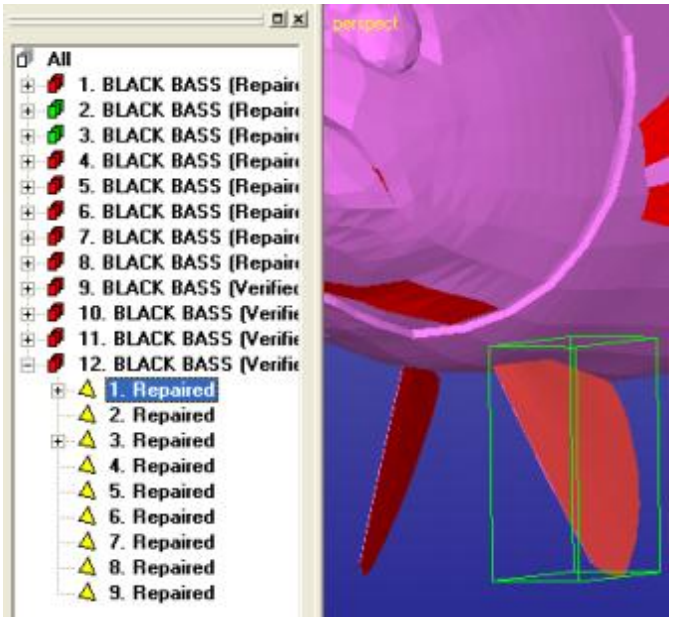
Here you decide to add material to the two front fins below the fish. To add material to a closed shell you will use the *Create Geometry* > *Extrude surface* > *from Surface* command. This command is also available in the Print Preparation Tab through the

Extrude from Surface button.

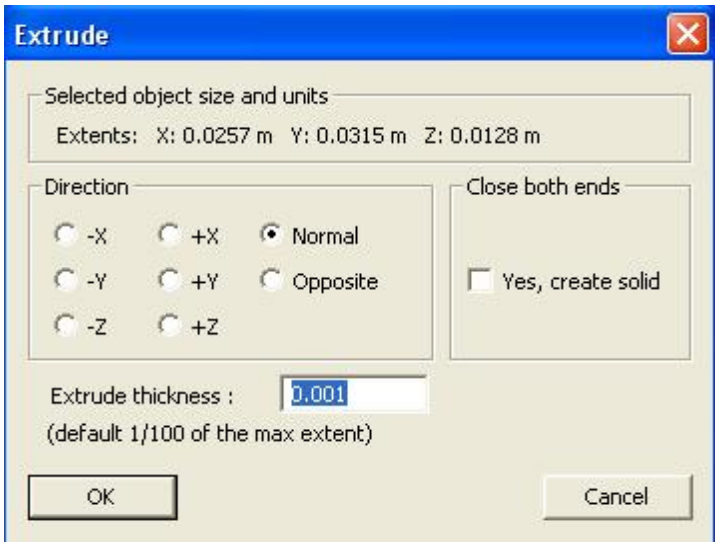
To add material to a shell you first need to select a surface from the shell. **Set the Selection mode to Surface selection**:



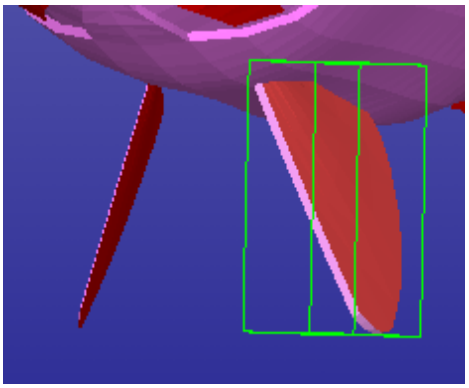
and **pick a surface from the left bottom fin**:



To add material **give the command *Create Geometry* > *Extrude Surfaces* > *from Surface*** and the following dialog will appear:



Fill in the Extrude thickness 0.001 m (1 mm) and accept the parameters. **Press OK to run the extrude command**. Material is added to the selected shell:



The thin triangle errors are not updated after the extrusion. You must **run the Check Thin Walls command again on shell 12** with the same parameters as before to update the thin triangles, as well as to change the Model Tree information back to green. The result can be found in the *BLACK BASS-extruded-fin.zpr* file in the *Tutorials/Tutorial 2 – The Black Bass* directory. Adding material to other fins is left to you to do.

Saving the file

When saving the file to the ZPR format with the *File* > *Save As* command, you must take some care. The final model contains several shells (12) that can all be outputted separately without making the whole model. The best practice is to display the Model Tree (*F8* key) and **select the whole model first** (i.e., the Model Tree root *All*). When *All* is selected, every shell will be written to the output file. If something other than the *All* root is selected a warning is issued before the file is written.

If ZEdit Pro was started from the ZPrint software, **pressing the *Return to ZPrint*** icon will transfer the whole model back to ZPrint automatically.

Chapter 4 – Conclusions

Congratulations for reaching the end of this tutorial! The process and commands you have just learned will help you to fix models when Auto Repair leaves gaps in the file. In this example, the Join Gaps command is used to connect open flat shells into one solid shell and extrusion is used to add material on a thin shell.

We recommend that you to continue on to *Tutorial 3 – Annie* to learn more about the ZEdit Pro software and its model manipulation capabilities, such as hollowing and adding drain holes.

ZEdit Pro is part of the DeskArtes Expert Series software suite. To learn more about the capabilities of other Expert Series software for 3D data fixing, coloring, preparation, or 3D model generation, please visit www.deskartes.com:

- 3Data Expert for full model repair and manipulation, including 2D Dimensioning; triangle reduction and refine; support generation; model slicing; etc.
- Import Package for importing native surface models from ProENGINEER®, Unigraphics®, and Catia® 3D CAD systems, and STEP files for 3D Printing.
- Design Expert for generating your own free-form 3D geometries with an easy-to-use and powerful 3D CAD system.