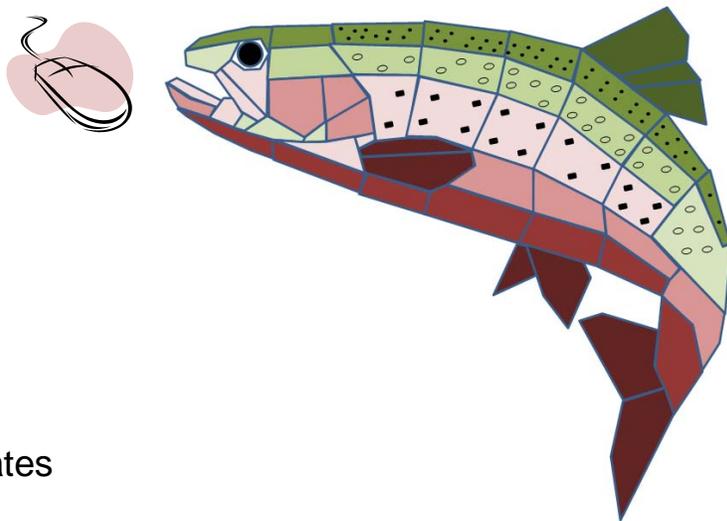


***inSTREAM*: The Individual-based Stream Trout Research and Environmental Assessment Model**

Version 5.0

Graphical User Interface Guide



Prepared by:

Steven F. Railsback
Lang, Railsback & Associates
Arcata, CA
www.LangRailsback.com

Colin Sheppard
Arcata, CA

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1. Introduction

1.1. Document objectives

This digital document provides user instructions and guidance for the graphical user interface (GUI) for version 5.0 of *inSTREAM*. The GUI is an optional software tool for setting up, executing, and observing *inSTREAM* simulations.

The GUI, and this documentation of it, were adapted from similar software developed for version 1.0 of the *inSALMO* individual-based salmon model, as part of the project “Improvement of Salmon Life-Cycle Framework Model (*inSALMO*)” conducted by Lang, Railsback and Associates (LRA) and USDA Forest Service, Pacific Southwest Research Station, for the US Bureau of Reclamation. The adaptation to *inSTREAM* was funded by the USDA Forest Service.

This document is packaged with the GUI as a help file. Users will also need to be familiar with the contents of three other documents that are also provided as help files:

- The Model Description provides all the detailed methods, assumptions, parameter values, etc. defining what *inSTREAM* does.
- The Software Documentation describes in detail the input files needed to run the model, and the graphical and file outputs it produces.
- The Limiting Factors Tool Documentation describes the part of the GUI that automates experiments to evaluate the strength of different factors that could limit trout populations.

1.2. Document format

This help file is organized around the different tasks that users typically conduct in using *inSTREAM*. It therefore consists of many short sections that each tell how to do one task. However, these are organized into categories corresponding to the major phases of a model application: setting the model up for a new site or application, setting up simulation experiments, executing the model, and analyzing results. Hence, users typically will use the help file by looking up what they are trying to do and reading how to do it.

The index is designed to support users trying to understand some particular function or part of the GUI. When in need of help for how some particular button or tab works, the index is where to look.

2. Terminology

This document and the GUI use the following specific definitions. Users should also be familiar with the terms and conventions used in the model itself, defined in Section 2 of the model description document.

Application: A modeling analysis of a particular question about a particular site. Examples include (a) calibrating trout abundance and size at a particular site, and (b) predicting changes in trout abundance due to three alternative instream flow scenarios. Typically there is one **project** for each application.

Project: All the computer files needed to apply *inSTREAM* to a particular study site and question. Behind the GUI, a project is simply a directory (folder) of *inSTREAM* input, control, and output files for an application. A project's name is the same as the name of the directory it resides in. Separate projects can be created for separate study sites, or for separate analyses at the same site.

Parameter: In the GUI, "parameter" refers to any variable that appears in the model's setup and parameter files. Hence, parameters can include variables that control the model's input and execution (e.g., input file names; names of habitat reaches and fish species) as well as the habitat and fish parameters that are parameters in the conventional sense of coefficients for the model's equations.

3. Basic Tasks

3.1. Which files are where?

When *inSTREAM* is installed on a Windows computer, all its components reside in a directory tree that can be located anywhere. Typically the model is installed to the "My Documents" folder so that its directory tree starts at `C:\Documents and Settings\ (USER NAME) \My Documents\inSTREAM_1-1`. (The "1-1" refers to the version number of the GUI software, not the version of *inSTREAM*.) However, the model can be installed anywhere, e.g., to `C:\inSTREAM_1-1`. The remainder of this section refers to directories under this `inSTREAM_1-1` directory, no matter where the model is installed.

The files that users need to be aware of are:

- The actual GUI program is an executable file at `\inSTREAM_1-1\GUI\inSTREAM-GUI.exe`. (The actual name may be slightly different, as different versions may be identified by including their release date in the file name.)
- The *inSTREAM* model executable is at `\inSTREAM_1-1\Code\inSTREAM\libs\inSTREAM.exe`.
- Projects can actually reside anywhere on the computer. By default each project is in a separate subdirectory of `\inSTREAM_1-1\Projects`. A built-in project packaged with *inSTREAM* is at `\inSTREAM_1-1\Projects\ExampleProject`.
- Help files are at `\inSTREAM_1-1\Help`. (The help files are accessed via the GUI menu but can also be opened by clicking on them from Windows Explorer. They can also be updated by simply replacing them with new versions.)

This diagram illustrates the basic structure of the *inSTREAM* file system but omits many subdirectories that users need not be familiar with:

```

\inSTREAM_1-1
  \Code\inSTREAM
  |
  \Help
  |
  \GUI
  |
  \Projects\ExampleProject
            |
            \Project2
            |
            \(\etc.)

```

3.2. Installing the GUI and *inSTREAM*

The graphical interface, the *inSTREAM* model, and example input files are distributed in a zip archive file, typically named something like `inSTREAM_1-1.zip`. The model is installed in two simple steps:

- Extract the zip file to the directory where you want it (typically, your “My Documents” folder). This will create the `\inSTREAM_1-1` directory tree underneath the directory where it is extracted. If using Windows’ build-in unzip utility, make sure it extracts *all* the files.
- In the Windows Explorer, right-click on the GUI executable file `\inSTREAM_1-1\GUI\inSTREAM-GUI.exe`. Select “Create Shortcut” to create a shortcut file. Drag this new shortcut file to your desktop.

3.3. Starting the GUI

To launch the *inSTREAM* GUI, simply double-click on the `inSTREAM-GUI` shortcut on the desktop. (Alternatively, you can double-click on `\inSTREAM_1-1\GUI\inSTREAM-GUI.exe` in Windows Explorer.)

3.4. Using the help files

To use the help files packaged with the GUI, open any of the four help files by clicking on the “Help” item on the GUI’s main menu. This opens a list from which the help files can be selected. Each help file includes an expandable table of contents, an index, and a search function.

3.5. Opening a project

To open an *inSTREAM* project, either click on the button labeled “Open”, or use the GUI menu selections `Project > Open`. These let you browse to select a project by selecting the directory (folder) containing the project. You can only select a directory, not a file.

3.6. Saving and closing a project

Changes to a project must be saved before executing it. To do so, either click on the button labeled “Save”, or use the GUI menu selections `Project > Save`. You can save the project’s changes when closing it.

To close an *inSTREAM* project, click on the GUI menu selections Project > Close. If you have unsaved changes, you will be prompted to save them or quit without saving the changes.

3.7. Saving a project as a new project

To save a project with a new name, as a new project, click on the GUI menu selections Project > Save as. This takes you to a dialog where you can simply type in a new project name, and the GUI will save the project in a new directory with that name, under the \inSTREAM_1-1 \Projects directory. You can also browse to a different directory if you want to save the new project elsewhere. Other options are to:

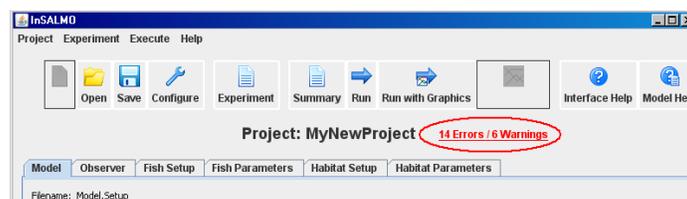
- Select an existing directory, in which case any project in it will be overwritten, or
- Select the project's current directory, which is the same as simply saving the project and does not create a new project.

3.8. Deleting a project

There is no function in the GUI to delete projects. Instead, you can simply delete the project directory, for example by using Windows Explorer.

3.9. Finding errors and warnings

The GUI identifies obvious input errors and warnings about questionable parameter values. The number of errors and warnings present at any time appears in red text near the project title (illustrated below).



Clicking on this red text opens a table showing all the errors and warnings in the project. Clicking anywhere in this table takes you to where the error or warning occurs, where it is flagged for you to correct.

4. Creating Projects

This section discusses when to create a new project instead of just modifying an existing one, and describes the three alternative ways to create a new project.

Because *inSTREAM* uses many input files, some of which depend on each other, the process of creating a new project is complex. New projects are therefore easiest to create by modifying existing ones; *inSTREAM* is packaged with a “template” project to facilitate this.

4.1. When to create a new project

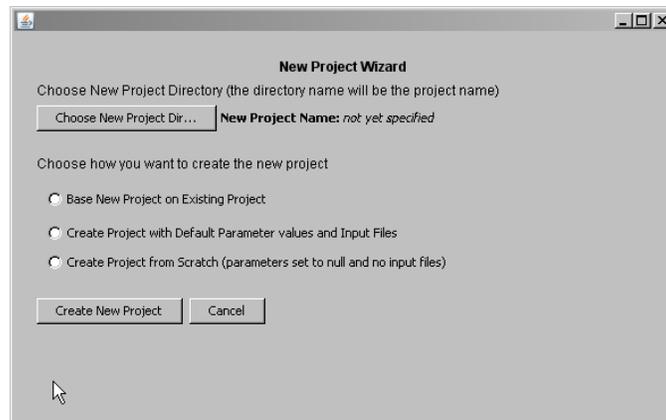
A new project should be created whenever you want to create a new application or analysis and keep it separate from previous applications. Keep in mind that any time you change a project or

re-run *inSTREAM*, previous results for the project will be destroyed. Examples of when to create a new project include:

- When modeling a new study site, or making substantial changes to an existing site (e.g., adding another reach);
- When starting a new analysis, or kind of analysis (calibration, limiting factors study, comparison of management alternatives) that you want to save separately from previous analyses;
- When model input changes substantially (e.g., a new year is added to the input set; spawner initialization data are revised); and
- When you want to play around with the model, making experimental or temporary model runs, without destroying previous results or worrying about documenting or un-doing the changes you make. Just save the project as a new project that you can delete when done.

4.2. Creating a new project

The GUI includes a new project wizard that provides three alternative ways to create a new project. Start the wizard by selecting Project > New from the main menu.



Click the “Choose New Project Directory” to select a directory location (which is normally just a new subdirectory of `\inSTREAM_1-1\Projects`) and name. The new directory name becomes the project name.

You then choose from three alternative ways to create project:

- Base new project on an existing project, which copies an existing project and opens it as the new one. This has the same effect as saving the existing project as a new one (Section 3.7).
- Create project with default parameters and inputs, which copies *inSTREAM*'s default project as the new project.

- Create project from scratch, which requires you to input all parameter values, input file names, etc.

Finally, click the Create New Project button to finish creating the project. The steps at Section 5 guide the process of completing a new project once it has been created.

5. Adapting the New Project to an Application

Once you have created a new project, the next step is to adapt it to the application you want to conduct. If you are creating an entirely new study at a new site, the process can be extensive and typically requires many iterations of finding and correcting errors. But this process can be very simple if you are just conducting a new analysis of an existing application.

The process of adapting a project to a new application is a matter of updating or replacing the model's configuration (number of reaches or their configuration; number of species), inputs (flow, temperature, or turbidity files; cell data files), or parameter values. Here is a guide to what you might need to change.

- If you are just running new simulation experiments that do not require new input files, you can just use the Experiment Manager (Section 6) instead of making any of the permanent changes described in this section.
- If your application requires new flow, temperature, or turbidity input files, see Section 5.1.2.
- If you are applying the model to a new site for the first time, then you will need to carefully update all the inputs. To do so, go through the steps in sections 5.1 through 5.3 carefully, consulting the software guide to understand each setup, parameter, and input file. Use the GUI's error and warning checking (Section 3.9) to help find and correct mistakes.

These kinds of changes are made through the GUI's Configure Interface, which is accessed by clicking on the Configure button.

5.1. Habitat reaches

The reach setup information defines how many reaches are in a project, how those reaches are linked (which is downstream of which, etc.), and which files contain the input needed for each reach. This information corresponds to the Reach Setup file described in the *inSTREAM* software guide.

5.1.1. Adding or removing reaches

To add a reach to the project: Click on the Habitat Setup tab. (If this tab is not visible, click the Configure button.) Near the top of this tab is a box labeled Add Reach. Click on that box, and choose whether to add a reach by copying an existing one or creating one with default values.

To remove a reach from the project: Click on the Remove Reach box in the Habitat Setup tab, and select which reach to remove.

5.1.2. Editing a reach's setup

Each reach is defined by setup information providing its name, input file names, and junction numbers.

To edit the reach's setup information: Click on the Habitat Setup tab. (If this tab is not visible, click the Configure button.) Use the selector near the top of the tab to select the reach you want to edit. The reach selector looks like this:



Each of the reach's setup parameters is displayed in a table. The first column describes the parameter, and the third column contains the name of the corresponding variable in the *inSTREAM* software. The second column provides the parameter's current value. Double-click on the values in the second column to change them.

If the box turns red, you entered an invalid value (e.g., an alphanumeric character string for a floating point variable). If the box turns yellow, you entered a value outside the parameter's normal range (as defined by the model's authors); the value will be accepted and used, but you should check it carefully.

The input files providing cell variables, hydraulic data, and daily flow, temperature, and turbidity input are identified as part of habitat setup for each reach. These daily values cannot be edited from within the GUI but only by editing the individual input file. Simulation experiments to compare alternative flow and temperature regimes require multiple input files for these variables. How to set up such experiments is described in the Experiment Interface discussion at Section 6.3.3.

To select input files: Some of the parameters in the reach setup are the names of input files for the reach. Clicking on their value in the parameter table opens a dialog that lets you browse to select a file.

- Selecting a file copies that file into the project directory; you can find a file anywhere on your computer or network and it will be permanently copied into your project directory.
- You are responsible for making sure the file is in the proper format. *inSTREAM* does some error checking when it executes, but the GUI does no checking of whether selected files will work.

5.1.3. Reach habitat parameters

This step corresponds to editing a reach's habitat parameter file.

To edit the parameter values for a reach: Click on the Habitat Parameters tab. (If this tab is not visible, click the Configure button.) Use the selector near the top of the tab to select the reach you want to edit.

The reach's habitat parameters are displayed in a table. The first column describes the parameter, the third column contains the name of the corresponding variable in the *inSTREAM*

software, while the second column provides the parameter's current value. Double-click on the values in the second column to change them.

If the box turns red, you entered an invalid value (e.g., an alphanumeric character string for a floating point variable). If the box turns yellow, you entered a value outside the parameter's normal range (as defined by the model's authors); the value will be accepted and used, but you should check it carefully.

5.2. Species or races

Trout species can be added to or removed from a project, but doing so requires corresponding changes in the *inSTREAM* software; see the software guide for how to do so. Once an additional species is in the software, it must then be included in a project via the GUI as described here. *Simply adding a species to the project as described here, without also modifying the inSTREAM software, does **not** add a new species to the model!* Instead, it will just cause the model to fail when executed.

5.2.1. Adding or removing a species

To add a species, click on the Fish Setup tab. (If this tab is not visible, click the Configure button.) Click the Add Species box near the top of the tab. The dialog that pops up lets you select between copying an existing species (and later editing its setup and parameter values) or using the default species values. The dialog is also where you enter the name of the new species. Remember that the new species must be added to the *inSTREAM* code, and that the species name given here must be exactly the same as in the code.

When the software includes more than one species, the number of species in a project can be reduced by removing species here in the GUI. (It is OK for a species to exist in the *inSTREAM* code but not in the GUI project.)

To remove a species from the project, first click on the Fish Setup tab. (If this tab is not visible, click the Configure button.) Near the top of this tab is a box labeled Remove Species. Click on that box, which lets you select which species to remove.

(These steps correspond to editing the Species setup file.)

5.2.2. Editing species setup information

Each species has setup variables for the name of the input file for initialization, the name of its parameter file, and the display color.

To edit a species' setup information, click on the Fish Setup tab. (If this tab is not visible, click the Configure button.) Use the selector near the top of the tab to select the species you want to edit.

The species setup parameters are displayed in a table. The first column describes the parameter, and the third column contains the name of the corresponding variable in the *inSTREAM* software. The second column provides the parameter's current value. Double-click on the values in the second column to change them.

If the box turns red, you entered an invalid value (e.g., an alphanumeric character string for a floating point variable). If the box turns yellow, you entered a value outside the parameter's normal range (as defined by the model's authors); the value will be accepted and used, but you should check it carefully.

Population initialization data (the number, size, etc. of trout to be created at the start of a model run; which can be provided for one or more "population initialization dates") are provided via an input file identified as part of the fish setup information. This input cannot be edited from within the GUI, but only by editing the population initialization data file itself. See the software documentation for information on doing so.

One parameter in the species setup is the name the file containing initial population data. Clicking on its value in the parameter table opens a dialog that lets you browse to select a file.

- Selecting a file copies that file into the project directory; you can find a file anywhere on your computer or network and it will be permanently copied into your project directory.
- You are responsible for making sure the file is in the proper format. The GUI does no checking of whether selected files will work. (However, the *inSTREAM* code does some error checking of input when you execute it; see the Software Guide.)

(The GUI does not let you select a fish parameter file for the species in this way. Instead, you can edit and save the default fish parameters.)

5.2.3. Trout parameters

The parameter values used by each species of trout can be edited via the GUI. (This step corresponds to editing a trout parameter file.) These edits permanently change the parameter values; to make temporary changes in simulation experiments, see Section 6.

To review and edit trout parameters, click on the Fish Parameters tab. (If this tab is not visible, click the Configure button.) Use the selector near the top of the tab to select the species you want.

The fish parameters are displayed in a table. The first column describes the parameter, and the third column contains the name of the corresponding variable in the *inSTREAM* software. The second column provides the parameter's current value. Double-click on the values in the second column to change them.

If the box turns red, you entered an invalid value (e.g., a floating point number for a date variable). If the box turns yellow, you entered a value outside the parameter's normal range (as defined by the model's authors); the value will be accepted and used, but you should check it carefully.

5.3. Model run settings and output file names

Model parameters control the dates when simulations start and end, the random number generator seed, and output file names. (These parameters are in the Model Setup file.)

To change model parameter values, click on the Model tab. (Click on the Configure button if this tab is not visible.) You will then see a table of model run parameters; edit the values in the second column. Invalid values will result in their box turning red.

6. Setting Up Experiments

Setting up and running simulation experiments should be the most common use of the *inSTREAM* GUI. Once the model has been applied to a site, simulation experiments are how the model is used to address management and research problems.

Simulation experiments include designing a set of model runs to address a particular question (e.g., how does outmigration success vary with fish predation risk? with instream flow?), executing the runs, and analyzing the results. This section addresses setting up and executing the model runs.

The GUI's Experiment Interface is accessed by clicking on the Experiment button. (The tasks described in this section all correspond to controlling *inSTREAM*'s Experiment Manager via the Experiment Setup file, which is described in the Software Guide.)

6.1. Why to always check the Experiment Interface

The Experiment Interface can control selected model inputs and parameters, and it overrides the project's standard values for those inputs and parameters. Hence, to know exactly what input the model is using, you must look at the Experiment Interface. Otherwise, you might not realize that the Experiment Interface is causing the model to use input other than what you expect.

If you just want to run the model with only standard input files and parameter values, click on the Experiment button. On the Control tab is a "Clear Experiment" button that clears out the Experiment Interface so it has no effect. After clicking this button the number of scenarios is 1, the number of replicates is 1, and, on the Parameters tab, there are no parameters added to the experiment.

6.2. General information on experiments

The purpose of the Experiment Interface is to allow users to set up and execute simulation experiments that use multiple model runs with different inputs, without having to modify other parts of their project. With a few simple menu selections, a complex experiment can be set up to run automatically. The experiments can include both scenarios and replicates.

- A scenario is a set of inputs and parameter values; different scenarios are defined by specifying which inputs or parameters differ among them.
- Replicates are repeated runs of the same scenario, with only the pseudorandom numbers (which primarily affect mortality) differing among replicates. Replicates are typically used to see how much of the variation in model results among scenarios is due only to the model's stochasticity.

The Experiment Interface can be used to set up a simulation experiment with multiple scenarios and replicates; it then can execute the experiment by running *inSTREAM* repeatedly while automatically changing the model's parameters or inputs for each scenario and replicate. For

example, the user may set up an experiment with 10 scenarios (perhaps five different values for some parameter, for each of two flow input files) and five replicates. The Experiment Manager would determine that 50 model runs are needed and start one run after another. At the start of each model run the Experiment Interface overwrites the value of any parameters that are part of the experiment. For replicates, the Experiment Interface simply changes the random number seed. The Experiment Interface then has no more effect until the next run starts.

The Experiment Interface can be used to set up “factorial” experiments in which two or more parameters are varied, and all combinations of each parameter are executed. However, you must set the experiment up manually; the Experiment Interface cannot automatically generate all combinations of parameter values. For example, a calibration experiment might include four values of drift food concentration (*habDriftConc* = 1.0, 2.0, 3.0, and 4.0E-10) and three values of aquatic predation risk (*mortFishAqPredMin* = 0.95, 0.97, 0.99). The factorial experiment requires the user to set up 12 scenarios:

Scenario	habDriftConc	mortFishAqPredMin
1	1.0E-10	0.95
2	1.0E-10	0.97
3	1.0E-10	0.99
4	2.0E-10	0.95
5	2.0E-10	0.97
6	2.0E-10	0.99
7	3.0E-10	0.95
8	3.0E-10	0.97
9	3.0E-10	0.99
10	4.0E-10	0.95
11	4.0E-10	0.97
12	4.0E-10	0.99

Below is general guidance for setting up an experiment. The Experiment Manager section of the *inSTREAM* Software Guide provides detailed examples of many kinds of experiment; users are referred to that section for an understanding of how the Experiment Interface is typically used and how to set up common experiments.

6.3. Setting up an experiment

Setting up an experiment includes the following three steps.

6.3.1. Set the number of scenarios

The first step is determining how many scenarios the experiment has. Each scenario is one combination of the parameter values, input files, etc. that are varied in the experiment.

To set the number of scenarios in an experiment:

- Click on the Experiment button if necessary to enter the Experiment Interface.
- Click on the Control tab, then the box in the second (“Value”) column of the parameter table, in the row labeled “Number of Scenarios”.
- Enter the number of scenarios in the box.

The number of scenarios can be as low as 1 (which is common if the purpose of the experiment is only to execute replicates with a project's standard input values). Otherwise, users must calculate the number of parameter and input combinations in their experiment.

6.3.2. Set the number of replicates

Adding replicates to an experiment simply causes each scenario to be repeated with a new random number generator seed. Replicates can be used even if no scenarios other than the standard input are defined. Just change the number of replicates and add nothing else to the experiment. It is also common to use just one replicate when running many scenarios.

To set the number of replicates in an experiment, click on the Control tab of the Experiment Interface. Click on and edit the box containing the value of the parameter "Number of Random Replicates".

6.3.3. Select parameters and their values

The third step is to identify the parameters to vary among the scenarios, and set their value for each scenario. This step is not necessary if the experiment only includes replicates of the standard input values.

To select experiment parameters and their values:

- Click on the Parameters tab of the Experiment Interface. Initially this tab will be blank except for the "Add Parameter" and "Remove Parameter" buttons.
- Click on the Add Parameter button. In the dialog that opens, select the kind of parameter to include in the experiment; the options are input filenames, output filenames, model parameters, fish parameters, and habitat parameters.
- After selecting the kind of parameter, click on the box labeled "Select the parameter" to select from a list of the available parameters; the list depends on which kind of parameter is being chosen.
- If the parameter is an input filename, a fish parameter, or a habitat parameter, there is a second box with a label that depends on which kind of parameter is chosen. This box lets you choose whether the experiment should be applied to all species (or habitat reaches) or just one.
- Click the dialog's "Add Parameter" button to close it and return to the Parameters tab.
- The Experiment Parameters table on the Parameters tab now includes the selected parameter. The table also includes information on which code class the parameter belongs to, which reach or species the experiment applies to, and what type of value the variable is; you do not need to understand and should not edit this information.
- The Experiment Parameters table also includes one row labeled "Value" for each scenario. (If the experiment was given 15 scenarios in the first step, Section 6.3.1, then there will be 15 "Value" lines.) You must now manually enter the parameter's values for all scenarios. Click on the value boxes in the second column and add the new values.

The box will turn red if an invalid value type is entered, and yellow if the value is outside the range of recommended values.

- In revising an experiment, the number of scenarios can be changed on the Control tab. In that case, use the Experiment Parameters table's buttons labeled "Remove Value" and "Add Value" to change the number of values for each parameter.

6.4. Removing parameters from an experiment

In revising an experiment, you may choose to remove a parameter from those controlled by the Experiment Interface.

To remove a parameter from an experiment, click on the Parameters tab of the Experiment Interface. Click on the "Remove Parameter" button and select the parameter to remove from the dialog that pops up.

7. Executing and Observing Model Runs

This section explains how to execute *inSTREAM* model runs once they are set up. When the GUI executes *inSTREAM*, it always executes whatever experiment has been defined in the Experiment Interface. If the Experiment Interface is set up to modify no model parameters or inputs and not to run multiple replicates (Section 6.1), then *inSTREAM* is executed once with standard inputs.

7.1. Batch vs. graphics modes

inSTREAM can be executed in one of two modes.

Graphics mode execution runs the model with its graphical displays, which are updated after each simulated day. These graphics are described in the Software Guide. When a model run is started, the main control panel opens, and the user must click on "Start" **two times**. If an experiment with multiple model runs is set up, the model stops at the end of each run, so the user must click "Start" on the main control panel again to start the next run. (This control panel is not visible from the GUI; it appears when the first run starts.) Graphics mode is usually used when setting up new projects to check and observe the model's behavior.



The main control panel

Batch mode execution runs the model with no output other than a line written to the GUI's output window each simulated day to report what scenario, replicate, and date was just

simulated. (This output window appears on the GUI's Summary Interface when a model run is started.) In batch mode, all the model runs in an experiment are executed sequentially and automatically, without stopping. Batch mode is therefore typically used for simulation experiments. *inSTREAM* executes substantially faster in batch mode.

To start the model in graphics mode, click the GUI's "Run with Graphics" button. The GUI displays its Summary Interface, and a the main control panel opens. Click the main control panel's "Start" button two times. The model's other graphical controls and displays (as described in the Software Guide) then open and the first model run starts.

To start the model in batch mode, click the GUI's "Run" button. The GUI switches to its Summary Interface, and execution starts immediately.

7.2. Terminating a run

Model runs can be stopped before they are complete by clicking on the "Terminate Model Run" button at the bottom of the Summary Interface.

7.3. Changing Observer setup values

The user can control several characteristics of *inSTREAM*'s graphical displays, such as whether cell depth or velocity is displayed, and how big the animation raster is. These controls are described in the Observer Setup section of the Software Guide. (Display size is increased by *reducing* the resolution variables.)

To change Observer setup parameters, click on the Configure button to switch to the GUI's Configure Interface. Click on the Observer tab, and edit values in the second column of the parameter table. These changes must be done before, not during, a model run.

8. Analyzing Output

The GUI provides a tool for opening key model results in Excel and rapidly viewing summary tables and graphs from simulation experiments. This tool is accessed by clicking on the "View Results" button. This section describes this tool and other methods for analyzing output.

8.1. Purpose of the View Results tool

Individual-based models such as *inSTREAM* produce many kinds of output and hence can be "viewed" and analyzed in many ways; imagine a real fish population from which data could be obtained with almost no cost and no uncertainty. Clearly, deciding how much output to analyze in how many ways requires a tradeoff: looking at too much output can be overwhelming and confusing, while looking at too little does not take advantage of the model's most important capability: providing explanation of what processes and factors are most important, given the model's assumptions and a particular set of inputs. Users are certainly discouraged from blindly believing model results; instead, results should be scrutinized to determine *why* they arose and how believable they are.

The View Results tool is intended to provide a rapid overview of *inSTREAM*'s most important results and a quick comparison among the scenarios included in a project's simulation experiment.

The tool is designed to take advantage of Excel's powerful PivotTable and PivotChart facilities, which can break out and summarize data easily and flexibly. The View Results tool imports key results to Excel and updates a number of built-in PivotTables and PivotCharts. The Tool will be much more useful if you are familiar with these Excel facilities.

8.2. Using the tool

The View Results tool can be used any time *after* a model run or simulation experiment has been executed fully. The tool displays *results of the last model run or experiment executed*. If a simulation experiment was conducted then its project saved, the project can be re-opened in the GUI and the View Results tool used to look at the experiment's results without re-running the experiment. (This is one reason it is good to save each major simulation experiment in a separate project.)

Once a project's simulations have been executed, you can click on the "View Results" button. The button causes several things to happen. First, the GUI opens an analysis workbook in Excel; this workbook is called Analysis_Setup.xlsxm (the extension ".xlsxm" means it is a macro-enabled workbook). This workbook contains macro code that automatically imports two output files produced by *inSTREAM* the last time the project was executed. These are the live fish output file (typically named something like LiveFish_Out.csv) and the redd output file (typically named something like Redds_Out.csv). **This Excel import process will very likely halt, with Excel displaying a "Security warning" saying that macros have been disabled (Figure 1). You must choose the option to allow macro content for the analysis to proceed.**

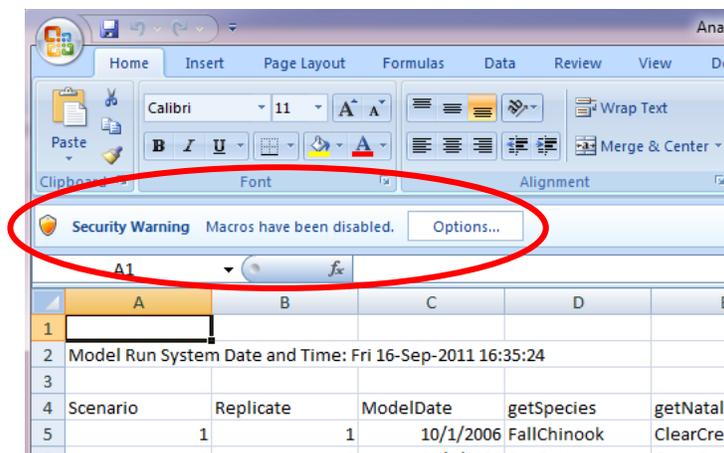


Figure 1. For the View Results Excel workbook to finish importing model results and display results, macros must be enabled manually by clicking on the "Options" button.

Next, the workbook code automatically updates its results tables and graphs. Finally, the user is prompted to save the workbook as a new, standard Excel file (with macros disabled; extension .xlsx).

The analysis workbook can then be examined and customized as desired. The workbook contains separate analyses on separate pages; these include summary analyses such as:

- Tables with the number of adult trout broken out by scenario and replicate (so that the mean and standard deviation across replicates can be calculated for each scenario);
- Bar charts showing the number of adult trout by scenario; and
- Tables with the number of redds and emergent fry broken out by scenario and replicate.

Additional analyses are easily created from the raw results in the spreadsheet.

8.3. Additional outputs

Users of the GUI are not restricted to examining only the outputs in the View Results tool. The model also produces detailed results on the number and size of live fish (in each reach, and broken into several age classes), and the number of fish that died of each kind of mortality. These results are not included in the View Results tool because they are extensive and complex, and not always important for understanding simulation experiments.

These additional outputs can also be somewhat confusing; for example, the number of dead fish can often appear high not because conditions suddenly became more risky but just because more live fish were created.

Live fish censuses and dead fish counts are available from the “Population output file” and “Mortality output file”, the names of which are specified in the Model parameters table (Section 5.3). These files are written in .csv format and open readily in Excel. They can be found in the project directory.

There are a number of optional output files that *inSTREAM* can be modified to produce. These files, and the other output files described here, are documented in the Software Guide help file.

9. The Limiting Factors Tool

The *inSTREAM* GUI includes a button to access the Limiting Factors Tool, which automates simulation experiments to analyze the relative strength of various factors that can affect trout populations. This tool is documented separately in its own help file.

10. Changing Defaults

The GUI can be customized by the various kinds of default values it provides. Changing these defaults is simply a matter of finding and editing the correct file.

10.1. Default parameter values and recommended ranges

The GUI provides default values for all *inSTREAM* parameters, and recommended ranges of acceptable values for some parameters. These default values and ranges are stored in plain text files in the subdirectory `inSTREAM_1-1\GUI\metaprojectdata`. These `metaprojectdata` files have names describing their function: the file name includes “Param” or “Setup” for whether they provide default parameter values or setup information, and “exp”, “hab”, etc. for whether they apply to the Experiment Manager (Section 6), habitat (Section 5.1), the model (Section 5.3), the observer (Section 7.3), or fish species (Section 5.2). (The file `lftSetup.txt` is discussed below at Section 10.3.)

The default parameter values and ranges are changed by simply editing the appropriate `metaprojectdata` file. The files are in plain text with values separated by tab characters. The files can be edited either with a text editor (Notepad, etc.) or imported to Excel and exported as tab-separated plain text. The `metaprojectdata` files are self-explanatory with the exception of a variable “DisplayOrder” for each parameter. When parameters are displayed in the GUI, they appear in the order of this DisplayOrder variable.

If a new parameter is added to the model, it is added to the GUI simply by adding it to the appropriate `metaprojectdata` file. For example, if `inSTREAM` is modified so that fish require a new parameter `fishRespirationParamZ`, then this parameter is added to the GUI by editing the file `speParam.txt` to include the parameter, its default value, its description, display order, variable type, and (optionally) lower and upper bounds on its recommended values.

The default parameter values are used only when creating a new project from scratch (Section 4.2). When a project is created by copying an existing project, including the default project, all its parameters are copied from the source project.

10.2. The default project

New projects can be created by opening and editing a default project (Section 4.2). This default project is stored in the directory `inSTREAM_1-1\GUI\DefaultProject`. It can be revised or replaced by editing or replacing the model input files in that directory.

10.3. Limiting Factor Tool default parameters

The Limiting Factors Tool (LFT; Section 9) uses a number of parameters, and their default values are stored in the file `inSTREAM_1-1\GUI\metaprojectdata\lftSetup.txt`. These defaults can be updated and changed the same way that other default parameters are (Section 10.1).

Note that the default parameters for the LFT are used only when a new project is created from scratch (Section 4.2). When a project is created by copying an existing project, or from the default project, its LFT parameters are copied from the source project. These parameters are in a file `LimitingFactorsTool.Setup` in the project directory.

11. Troubleshooting

If you have problems installing or running the GUI, some things to check are:

- Make sure that all the files and directories in the zip file used to distribute `inSTREAM` and the GUI were extracted. In some cases, the Windows unzip utility has not extracted all files.
- Check for confusion among the different “My Documents” directories that can be on one computer. On some computers there can be separate “My Documents” directories for “All Users” as well as for the specific individual user(s), and it is easy to extract the model into the wrong one.

If you have problems getting *inSTREAM* to run when you click the “Run” or “Run with Graphics” buttons, see the extensive Troubleshooting Guide at the end of the Software Documentation help file.

Note that error messages from the *inSTREAM* code appear in the “Model Execution Output” window on the Summary Interface. These error messages can be extremely important and helpful.

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