

Manual for FISH 3.1

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Brief Introduction to FISH 3.1

FISH 3.1 is a microworld designed by University of Victoria professor Dr. Robert Gifford and programmed by Jonas Gifford for studying the resource management decision-making of individuals and small groups. It is especially useful for conducting studies that examine situations often called commons dilemmas, resource dilemmas, or social dilemmas. These situations focus on valuable, limited, common pool resources in which individuals make decisions whether to cooperate (harvest little, resulting in modest short-term gain but long-term conservation of the resource) or defect (harvest a large amount, resulting in large short-term gains but endangering or even extinguishing the common resource; Gifford & Gifford, 2000). FISH 3.1 can be run in standalone mode (running it on a single machine), or in two types of networked modes: either all human fishers, or both human and computer-simulated fishers. In standalone mode it runs with one human fisher and any number of computer fishers. It is written entirely in Java 1.1 and is portable to any Java-enabled platform. For a brief description of how a typical FISH 3.1 session proceeds, see “How to Fish” on page 15.

Note: This manual for the FISH 3.1 program is written for users of Microsoft Windows 95/98/2000/NT/XP because, at present, it runs only on Windows. Another manual is being written for Macintosh users. To get started with FISH 3.1, see the quick-start instructions for standalone mode on the next page. In general: If FISH 3.1 does not work for you, send the programmer, [Jonas Gifford, an email](#) because there is likely a simple solution that is not worth wasting time on.

Access to FISH 3.1

Copies of the FISH 3.1 program are available by request to Dr. Robert Gifford, at no charge. To request a copy, contact him at rgifford@uvic.ca. The FISH 3.1 package includes the Sun Java runtime environment (`java`), the FISH 3.1 program, and sample batch files required for running the program.

You will be provided with a copy of the package and instructions for running the software in standalone mode on a Windows XP-based machine (the quick-start instructions). A link to more detailed instructions (this manual) for running the program on other platforms and in network modes is included.

FISH 3.1 Quick-Start Instructions

Below are simple instructions for running FISH 3.1 on a Windows XP machine in standalone mode. Complete instructions for running and installing FISH 3.1 with all possible options are outlined on page 5 of this manual.

When you receive an e-mail with the program attached right-click on it and select “Save Target As” and save it wherever you like. Then extract all the files from the ZIP file provided.

Using Windows Explorer, locate the directory to which FISH 3.1 was unzipped and click “local.bat”. The program should start at this point. Read the instructions on the screen and when you are ready to begin, click on “Go fishing.”

If your screen displays a taskbar, as is usually the case, it interferes with FISH 3.1 because it blocks part of the display. The easiest solution to this is to hide the taskbar while FISH 3.1 is running. You may do so by right-clicking on an unused spot on the taskbar (the bottom right hand corner usually works), clicking “Properties,” selecting “Auto-hide the taskbar,” and then clicking OK.

To start fishing, click on the “Go out to sea” button. You can now “Cast for one fish” by clicking on the button, or “Cast for any number” by entering the number of fish you wish to catch in the white text box beside the button, and then clicking on it.

Refer to the sample screen shot on page 14 of this manual for a view of the features displayed on the screen of the program.

End the session by catching all the fish. You can speed up this process by entering a large number of fish (i.e., 100) in the “Cast for any number” text box and then clicking the button.

A report describing the results of your session is automatically written to the file “fish.out.” Each time a FISH 3.1 session is completed this file is placed in the same location as the FISH batch files.

Many parameters for varying FISH 3.1 conditions can be selected using Notepad in the “local.cfg” and “local.set” files (see <http://web.uvic.ca/~rgifford/fish/> and the latter portion of this manual). These are simple ASCII files and should be saved as such - Notepad will do this by default.

If you wish to restore the taskbar after finishing with FISH 3.1, turn taskbar Auto-hiding “off” by using the same procedure as described for hiding it.

FISH 3.1’s Programs and Modes

FISH 3.1 consists of two programs: a client program and a server program, which allow the system to be run either in standalone or networked mode. The client software is required for *standalone* mode, and both the client and the server programs are required for *networked* mode.

Standalone Mode

Standalone is the simpler mode because it involves only the client program, which can be run on an individual computer. Computers that run FISH 3.1 in standalone mode operate independently from other computers (no network is needed).

Any number of independent computers can be set up so that individuals each can share a separate ocean with any number of computer-simulated fishers, which are set up by the researcher in the program's configuration file (`.cfg`) on each computer. When running FISH 3.1 in standalone mode, all configuration files, setting files, and output files reside on that computer's local file system. The content and set-up of these files is discussed in more detail on pages 6 through 11 of this manual.

Although standalone mode is simple, it is limited because each computer must have its own configuration file and will leave the output from the session on its own file system, so the data from the different fishers are slightly more difficult to integrate into a single combined data set for analysis. The networked mode allows all client computers to submit their summary data to one output file on the server computer's file system.

Networked Mode

In networked mode, both programs (`client.bat` and `server.bat`) interact in one of two sub-modes:

- 1) There are only human fishers (no computer fishers) and the participants are divided into any number of oceans, which they share with the other human fishers in their ocean. For example, if there are nine participants and they are divided into three groups of three, each group of three human fishers would share an ocean. Thus, there would be three oceans operating simultaneously, which are controlled by the same server computer.
- 2) There are both human and computer-simulated fishers and each group of human fishers (one or more, but often only one) shares an ocean with some computer-simulated fishers and with each other (if there is more than one human). For example, if there are three groups of two human fishers, each group would share an ocean with the computer-simulated fishers. There would be three separate oceans, one for each group. If there are two computer-simulated fishers, each group of two human fishers would share an ocean or fishing environment with those same two computer-simulated fishers and with each other.

In both sub-modes, one computer must run the server program; it co-ordinates all the sessions. This is the computer that you use to manipulate the parameters (in the settings file) and instructions that will run the client programs. Because the manipulations of the client programs are set up on the server, all oceans that are operating at the same time will have the same fishing conditions or parameters.

When testing a manipulation, at least one more experimental session may need to be conducted after you have changed the parameters of interest in the settings file. Depending on the manipulation, you may need to modify the instructions file or the configuration file as well. More detailed instructions for running an actual experiment with FISH 3.1 are provided later in this manual.

After the session, the summary output files for each ocean are combined and one output file (`fish.out`) is created on the server computer. The output is organized so that individual data for each fisher, as well as the group data of each separate ocean, are easily displayed.

FISH 3.1's Features

In network mode, FISH 3.1 supports a fully interactive environment. That is, the networked computers actually interact with one another in such a way that when a fisher takes fish from the ocean, those fish disappear from the screens of the other fishers in the same ocean. Any number of oceans can be managed by one server program, and any number of fishers from any mixture of Java-enabled platforms can share these oceans and fish with one another in real time.

Many different scenarios are possible with FISH 3.1. Specifically, by using the configuration (`.cfg`) and settings (`.set`) files, FISH 3.1 allows investigators to define:

- the initial and maximum size of the fish stock in each ocean (the limit is several hundred)
- the number of seasons (replenishment trials) for the session (no limit set)
- the regeneration rate of the fish stock (a multiplier, i.e., 2 doubles the fish remaining at the end of a season during spawning)
- the computer fishers' level of greediness (as a decimal number from 0 = not greedy at all to 1 = entirely greedy)
- the degree of uncertainty in the fish stock (as a maximum number of "uncertain" or "mystery" fish displayed as outlines in the ocean)
- the probability that each cast will be successful (a decimal number from 0 = never to 1 = always)
- the information displayed about the other fishers (e.g., number of fish caught, profit made, whether they are at ocean fishing or have returned to port)
- the profits and expenses of fishing (all are in cents; thus, 5 = 5 cents and 500 = 5 dollars), including:
 - the cost of leaving port to begin each fishing season
 - the cost per second of being out on the ocean, fishing
 - the profits made while fishing
- the initial balances of all fishers (also in cents)
- the message that appears as instructions before the session begins (in an `.ins` file)
- and the messages that are shown after the session ends (either that all fish have been taken and the resource is depleted or that the number of seasons of this particular session are over)

Note: Costs, expenses, and profits may be in hypothetical money, or in real money that fishers actually get paid by the researcher at the end of the session. If real money is used, it increases the mundane realism of the study because most real-world resource-sharing situations offer the opportunity for personal profit.

Installing and Running FISH 3.1

Installing FISH 3.1

FISH 3.1 is shipped via email as a compressed ZIP file. Unzip it into a folder such as `C:\FISH3`. To do this, right-click on the attachment, select “Save As” or “Save Target As” and choose a location to save it. For example, you could type `C:\fish_sun.zip` as the name of the file and click “Save”.

Using Windows Explorer, locate the directory in which FISH was saved and unzip the archive by extracting all its files. To do this in Windows XP, on the left hand side of the screen under “Folder Tasks”, click on “Extract all files” and it will automatically do so. A folder will be created called `fish_sun`.

Note for Users of Windows 98

Windows 98 requires third-party software such as “Stuffit Expander” or “WinZip” in order to unzip compressed files. “Stuffit Expander” can be downloaded free from <http://www.stuffit.com/win/index.html> and “WinZip” can be found at <http://www.5star-shareware.com/Windows/Utilities/CompressionUtilities/CompressionUtilities1.html>. Once one of these is installed, double-click on the FISH ZIP file and it will then automatically unzip the files and create a folder called `fish_sun`.

Note for Users of Windows XP

Unfortunately, the taskbar in Windows XP interferes with FISH 3.1 because it blocks the display to some degree. The easiest solution to this is to hide the taskbar while FISH 3.1 is running. Do this by right-clicking on some unused spot on the taskbar (either the bottom right hand corner or the start icon in the bottom left hand corner should both work), clicking “Properties” then selecting “Auto-hide the taskbar”. Then click OK.

Running FISH 3.1

The `fish_sun` folder in both XP and 98 should contain the Sun `jre` folder as well as some sample batch files to run the program in its various modes, including some configuration (`.cfg`) and settings (`.set`) files required for the samples. FISH 3.1 cannot run without a configuration file. Configuration and settings can be edited and customized in “Notepad”. These files are described in detail in the next section.

Creating Desktop Shortcuts in Windows XP

When conducting an experiment using FISH 3.1, it can be convenient to have some of FISH 3.1’s files on the desktop. To create icons or shortcuts on your desktop to any of the batch files, right-click on the file you want (i.e., `local.bat`) and select “Create Shortcut”. The shortcut should automatically appear on the desktop. If you are using Windows XP, the shortcut should work at this point.

Creating Desktop Shortcuts in Windows 98

In Windows 98 use the same procedure as above, and once the desired shortcut appears on the desktop, right-click on it and select “Properties.” Change the initial environment from “Auto” to “1024” by scrolling through the numbers provided. Then click OK.

This allows you to click on the shortcut to any batch file you wish to run (e.g., `local.bat`, `client.bat` or `server.bat`).

The table below indicates the intended use of each of the files that are shipped with FISH 3.1 and the associated settings files that must be used in each context. Note that in all cases the first term is an executable file or the fishing microworld itself (`.bat`) followed by the name of the configuration file to be used to choose between the network sub-modes, etc. (`.cfg`).

Sun Files Supplied	Intended Use
local.bat local.cfg	This starts the FISH 3.1 program in local or standalone mode. It is ready to run simple one-participant microworlds. Settings file used: local.set
client.bat client.cfg	This starts the FISH 3.1 program in network mode. It is ready to connect to a server program (once you set the server IP in <code>client.cfg</code> ; see page 8). Settings file used: None (settings from server)
server.bat server.cfg	This runs the FISH 3.1 server program in both networked modes. When participants share an ocean with computer fishers or when participants are divided into oceans that they share with each other. Settings file used: server.set

Configuring FISH 3.1

Two types of files are used to set up FISH 3.1. A configuration file contains features pertaining to the overall setup of the experimental setting. It contains property definitions such as whether and how to network. The settings file contains property definitions relevant to the specific microworld settings, such as how many seasons the session should last, remuneration per fish caught, and how many fish are in the ocean at the beginning. Many details are specified below, and so some sample files are provided to help clarify the settings files.

Small modifications to the samples, using the guidelines below, should be sufficient for customization. All configuration and settings files consist of providing values for properties, and have the format of one definition per line, as below:

```
<property name>=<property value>.
```

The client and server are separately configured.

Configuring the Client Computer

Whether in network or standalone mode, the client computer (the one used by the human fisher) must have a configuration file (`client.cfg`).

The simplest approach is to use the sample files as templates and change the settings to how you want them. To change the settings in the sample configuration file, double-click on the `.cfg` file and scroll down the list of programs to open it in Notepad or Textpad. You can also open it by right-clicking on the file and choosing to open it as a text document. If you want to keep the sample files, save them under a different name (using “Save As”). Or, you may replace the sample files with your own by saving them under the same name, thus replacing the existing file. This procedure is the same for modifying configuration files (`.cfg`), settings files (`.set`), and instructions files (`.ins`) for both the client and the server. When configuring client computers, the file of each client computer must be individually configured.

The table below lists the properties that can be set and their possible values:

Property Name	Values or Usage	Default
Mode	Set to <code>local</code> for standalone mode, or set to <code>network</code> to networked mode.	<code>local</code>
Instructions	The file name for the instructions file.	<code>fish.ins</code> , or the server's instructions file if in network mode.
<code>allowMultipleCasts</code>	Whether a button should appear allowing the fisher to request more than one fish. Set to <code>y</code> for yes, <code>n</code> for no.	<code>N</code>
Fishover	The file name for the message that shows when the maximum number of seasons has passed.	<code>fishover.txt</code> , or the server's fishover file if in network mode.
Fishgone	The file name for the message that shows when all the fish have been taken.	<code>fishgone.txt</code> , or the server's fishgone file if in network mode.
<code>settingsFile</code>	The name of the settings file. See below for how to make a settings file. Use only for local mode.	<code>local.set</code>
<code>seasonDelaySeconds</code>	The number of seconds between seasons.	10, or server value if in network mode.
<code>initialDelaySeconds</code>	The number of seconds to pause while supposedly waiting for other fishers. Use only for local mode.	15

outputFile	The name of the file for writing the session output to. Use only for local mode.	fish.out
Host	The IP number of the server. The main screen on the server program shows the IP it is running on. Use only for network mode.	Required

Below is an example of a client configuration file when in networked mode:

```
mode=network
instructions=fish.ins
allowMultipleCasts=y
fishover=fishover.txt
Fishgone=fishgone.txt
seasonDelaySeconds=10
host=(IP number of server)
```

If you are configuring FISH 3.1 to run in Networked mode, it is essential that all the `client.cfg` files contain the IP address of the host or server. This tells the client computers the server to which they will connect.

If you are unsure of the server's IP address, you can discover this by using a Windows utility called IP config., which can be downloaded from the Windows website at <http://www.microsoft.com/windows2000/techinfo/reskit/tools/existing/wntipcfg-o.asp>. Further instructions for its use are available at <http://helpdesk.powergate.ca/winipcfg.htm>.

Configuring the Server Computer

When in networked mode, the server computer (the one used by the researcher) also requires a configuration file, and if none is given as a command-line argument, a file called `server.cfg` in the working directory will be used. This file can be used as a template in the same way as the one for the client computers. To configure the server, only the `.cfg` file on the server computer must be changed.

Property Name	Values or Usage	Default
settingsFile	The name of the settings file to be shipped to the clients. See below for creating a settings file.	server.set
opponents	Set to <code>computer</code> to have each participant share an ocean with computer players, or set to <code>others</code> to have participants share oceans with each other.	computer
NFishers	The number of fishers.	Required

outputFile	The name of the output file.	fish.out
NOceans	The number of separate oceans. Use only when opponents=others.	1
realPlayerNumber	The player number of the real player. Use only when opponents=computer.	1
initialDelaySeconds	The number of seconds that pass while supposedly waiting for other fishers. Use only when opponents=computer.	15
seasonDelaySeconds	The number of seconds between seasons.	10
Instructions	The name of the instructions file to show participants after logging on.	fish.ins
Fishgone	The name of the file containing the message for when all fish are gone.	fishgone.txt
Fishover	The name of the file containing the message for when all seasons have passed.	fishover.txt

Here is an example of a server configuration file in networked mode with all human fishers (four oceans of three fishers each):

```
settingsFile=server.set
opponents=others
NFishers=12
outputFile=fish.out
NOceans=4
seasonDelaySeconds=10
instructions=fish.ins
Fishgone=fishgone.txt
Fishover=fishover.txt
```

Note: If you have a limited number of computers available for the session, it may be of use to know that both the `server.cfg` and the `client.cfg` files can be modified on the server computer so that the client program of that computer connects to its own server program. This allows both the `server.bat` and the `client.bat` programs to run simultaneously on the same machine. Open the server program first, and when the client computers are connecting to it, minimize the server program and then the client program can connect to it and run normally.

The Settings File

The properties that are required in the settings file are displayed below.

Note that while the configuration file is required on each client computer for any mode, the settings file is required on the individual computer only in standalone mode. In networked mode, the settings come from the server's settings file and, thus, only the settings file on the server computer needs to be used.

Property Name	Values or Usage
costPerSecond	The number of cents charged per second while out fishing (can be zero).
costPerDeparture	The number of cents charged to fishers each time they leave port (can be zero).
maxRealFish	The initial stock size and the maximum number of fish the ocean can hold.
maxMysteryFish	The uncertainty of the fish stock, giving the range of uncertain fish that may exist in the stock (i.e., 40 = 0 - 40 uncertain fish at any given time).
maxNumberOfSeasons	The maximum number of seasons for the session.
chanceOfCatch	A decimal number between 0 and 1, where 1 means all casts are successful, 0.5 means half are successful (on a random basis), etc.
spawnFactor	The amount by which the stock multiplies at the end of each season during spawning (i.e., 2 = remaining fish double for next season).
showEachFisher	Whether the table on the participant's screen should show each fisher's data separately (y for yes or n for no).
showNames	Whether the table on the participant's screen should show each fisher's name (y for yes or n for no).
showNCaught	Whether the table on the participant's screen should show the number of fish caught for each fisher (y for yes or n for no).
showBalance	Whether the table on the participant's screen should show each fisher's money balance (y for yes or n for no).

Here is an example of a settings file for a server in networked mode:

```

fishValue=2000
costPerSecond=25
costPerDeparture=100
maxRealFish=100
maxMysteryFish=30
maxNumberOfSeasons=10
chanceOfCatch=1.
spawnFactor=2.
showEachFisher=y
showNames=y
showStatus=y
showNCaught=y
showBalance=y
    
```

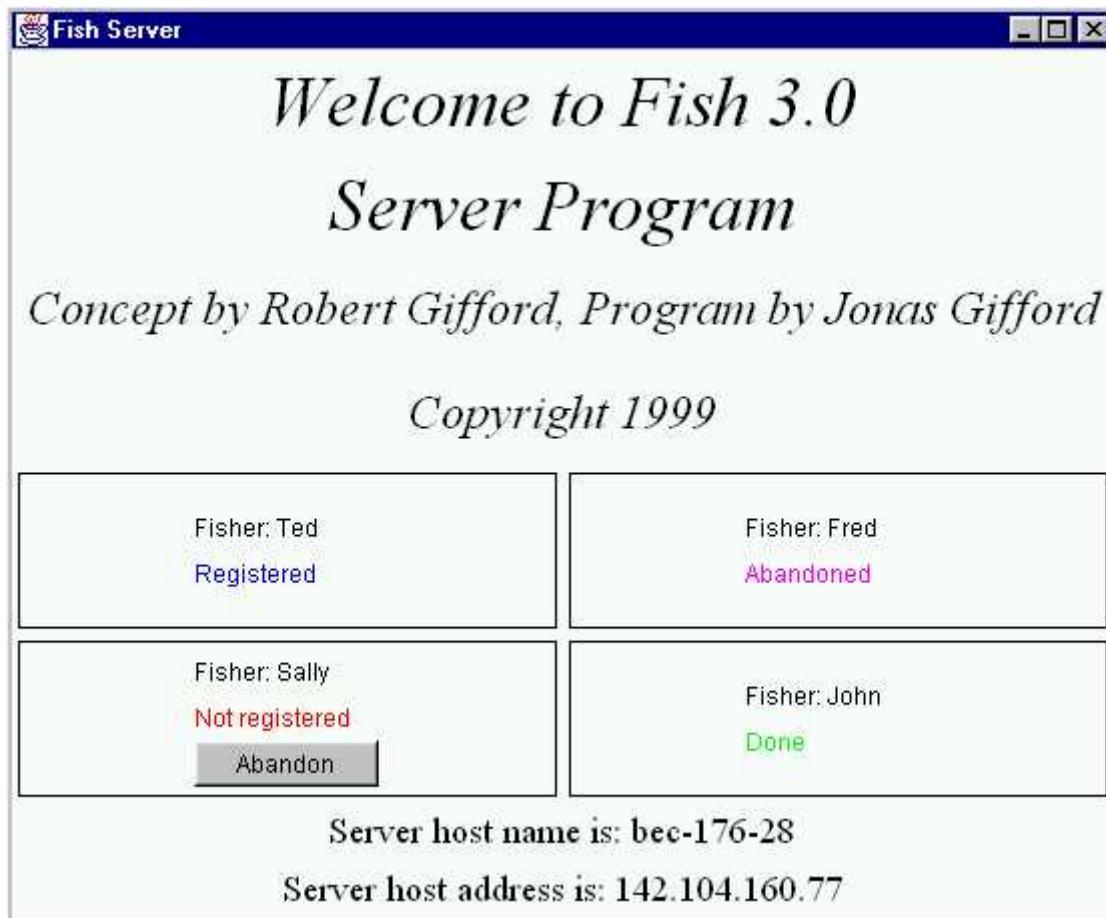
The remaining settings are optional, depending on the mode. Because they are all array-style settings, you do not set one parameter and value, but a list of values for each parameter. There are three array properties (`name`, `greediness`, and `initialBalance`), and their uses are summarized in the following table:

Mode	name	greediness	initialBalance	Example
Standalone (e.g., using <code>local.cfg</code>) where the client does not connect to a server (the client configuration property <code>mode</code> is set to <code>local</code>).	Set one name for each fisher (one name for human fisher and one for each computer fisher).	Set one value for each computer fisher between 0 and 1.	Either set one for each fisher (human and computer-simulated) or none at all.	<pre> name1=Terry name2=John greediness2=.6 name3=Jane greediness3=.4 </pre> <p>Here one human fisher (Terry) shares an ocean with two computer fishers: John (with greediness of 0.6) and Jane (with greediness of 0.4). They all begin with \$0.00.</p>
Networked , with computer opponents (e.g., client using <code>client.cfg</code> with server using <code>server.cfg</code>) where human fishers share an ocean with computer fishers (the <code>server.cfg</code> property <code>opponents</code> is set to <code>computer</code>).	Set one for each computer fisher only.	Set one value for each computer fisher.	Either set none, or set one for each computer fisher plus another for the human fisher.	<pre> name1=Terry initialBalance1=0 name2=John Greediness2=.6 initialBalance2=2000 name3=Jane greediness3=.4 initialBalance3=2000 </pre> <p>Here the human fisher (fisher # 1) begins with no money, the two computer fishers begin with \$20.00.</p>

<p>Networked, with human fisher opponents (e.g., client using <code>client.cfg</code> with server using <code>server.cfg</code>) where human fishers share oceans with each other (the <code>server.cfg</code> property <code>opponents</code> is set to others).</p>	None.	None.	<p>Either set none, or a long enough list that there is a value for each fisher in the largest ocean (e.g., for an ocean of three fishers, the first three numbers from the list go to the first three fishers). Note that the order (i.e., who is <i>first</i>, <i>second</i>, etc.) is random.</p>	<pre>initialBalance1=0 initialBalance2=5000 initialBalance3=6000</pre> <p>This will work as long as no ocean has more than three fishers.</p>
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Screen Shots

The Server Computer



The screen displayed above is a shot of the server in a mode in which human fishers share an ocean with computer-simulated fishers. Each separate box on the screen represents an ocean. There are four oceans in this session. The status of each fisher is displayed, as is the IP number on which the server is running. You need this to tell the client computers where to connect to the server computer.

Note: This screen shot is of the previous version of the FISH program (FISH 3.0), but, the screen is identical for the current version (FISH 3.1).

How to Reach this Screen

The instructions to get to this screen are as follows: When you are ready to run the session, click on the `server.bat` file on the server computer. *Make sure when you do this that all the fishers are on the desktops of the client computers, or at least not in the fish program, because you cannot set up the configuration or settings files of the server if any fishers are in the program.* This is important because the client computers will interfere with the server computer if they do not wait to open the program and connect to the server *after* it is properly set up.

Once you have clicked on the `server.bat` file, the first screen you see will allow you to enter the client ID numbers of each participant. These are random and anonymous, so they can be anything (i.e., single-digit numbers or lower-case letters). Once you have entered these IDs and clicked OK, you will see the screen above.

Connecting the Client Computers to the Server Computer

When this screen is displayed, you then ask fishers to click on the `client.bat` programs on their computers and give them their individual ID codes so they can connect to the server. The instructions screen will then come up on their computers and they can begin the session. When they have successfully logged on to the server, the message by their name on the server's screen will read "registered." While they are fishing, the screen will show information such as which season they are in and how many fish they have left in their ocean. When the session is over, the message will read "done."

Note that the server computer will automatically and randomly assign the client IDs that you enter into groups or oceans. If the participants are already seated at their computers and you want the groups or oceans to be seated together, it is easiest to enter the IDs first, get to the screen displayed above, and then give participants their IDs to log in based on where the groups or oceans are situated. This is the easiest way to keep track of the separate oceans if there are multiple oceans in one room. Make sure that the IDs displayed in groups on the server screen correspond to the actual groups or oceans in the room. However, if you want the participants to be spread apart around the room rather than seated in close proximity to those in their ocean, then it does not matter how you decide to assign the fishers their random IDs.

The server also automatically divides fishers into equal groups for the number of oceans specified. For example, if you indicate in the configuration file that there are twelve fishers and three oceans, there will automatically be four fishers in each ocean.

If for any reason the total number of fishers does not evenly divide into the desired amount of oceans, the server will do its best to divide the fishers up equally. For example, if there are thirteen fishers and three oceans, there will be two oceans of four fishers and one ocean of five fishers.

The Client Computer

Below is an image of the client program, that is, what the fishers see on their screen. (The blurriness is caused by image rendering; it is not part of the program. The image is clear during an actual session.) The shot was chosen to display many features of FISH 3.1, although not all of these features would be selected in every study. The larger fish with numerical labels enable the program to display how many fish are left in the ocean without displaying each one and overcrowding the screen. The program will "make change" for these fish as the stock is harvested and they will be "cashed in" for the amount of individual fish they represent.

Rules:
 Each fish earns you \$20.00.
 Each minute at sea costs you \$15.00.

Now in season 2. There are 83 - 118 fish in the sea.

You caught 8 fish.

	This Season	Overall
Time at sea	0:00:28	0:00:33
Fish caught	21	34
Expenses	\$7.00	\$8.25
Income	\$420.00	\$680.00
Profits	\$413.00	\$671.75

Fisher	Status	Fish Caught		Balance	
		This Season	Overall	This Season	Overall
You	Fishing	21	34	\$413.00	\$671.75
Sally	Fishing	14	29	\$272.25	\$566.00
Jesse	At Port	25	50	\$493.75	\$986.00

How to Fish

All choices are made with the grey rectangular buttons along the left hand side of the screen. To begin a fishing season, participants must click on the “Go out to sea” button. *Only after all the fishers in that ocean have hit the “Go out to sea” button will the fishing season begin.* This is true for all fishing seasons in the fishing session.

To cast for one fish, the fisher clicks on the “cast for one fish” button. To cast for multiple fish at once, he or she clicks in the white text box beside the “cast for multiple fish” button, types in the number desired, and then clicks on that button.

When a fisher decides to stop fishing for the season, he or she clicks the “return to port” button. Each fishing season will end once all the fishers in each ocean have returned to port. Once the season ends, the fishers wait for the remaining fish (if any) to spawn in order to begin the next fishing season. The session can go on for multiple fishing seasons. The maximum number of seasons is set by you, in the settings file.

Mystery Fish

If you have chosen to include stock size uncertainty as a factor in the study, some fish will appear as outlines of fish on the screen. These “mystery fish” may or may not exist because the exact number of fish is unknown to the fisher. Those that do exist may be caught and can spawn. The mystery fish are used to manipulate the degree of uncertainty about the number of fish in the ocean.

Other Details of the Screen Shot

The other details of the screen shot should be self-explanatory. For example, the program keeps track of the number of fish harvested, profits, time spent fishing, etc. for each fisher, and stores them in an output file that can be used later for data analysis. Additionally, if there are any computer fishers, they can be programmed to harvest with any level of greed (as a decimal number between 0 and 1).

Ending the Fishing Session

The session will end in one of two ways. If all the fish are caught (the resource is depleted), regardless of the season, the session will shut down and a message will be displayed to fishers telling them it has shut down because all the fish are gone. The second way the session may end is when the specified number of seasons is complete. In this case, the program will shut down and fishers will receive a message indicating that the last fishing season is over.

If the program needs to be immediately shut down during the session, press Control + Alt + Delete on the keyboard. This should immediately end the program. Otherwise, you can use the cast for multiple fish option to quickly deplete the resource and the program will shut itself down.

Suggestions for Using FISH 3.1 in Research

Run a Practice Session

It is a good idea to allow fishers to engage in a practice session at the beginning of their participation. The practice session need only be two or three seasons long so that fishers can see how the program works and how the fishing conditions change from one season to the next. Once the practice session is over, instruct fishers to remain on their desktop and out of FISH 3.1 while you open the settings file on the server computer and change the maximum number of seasons to the desired amount for the actual session. Then you can re-open the program, assign new ID numbers for the clients' re-entry into the program, and proceed as usual.

Experimental Manipulations

To create different experimental conditions, enter the server files and set up the instructions (`.ins`), configuration (`.cfg`), and settings (`.set`) files in Notepad or Textpad prior to each experimental session, "Save" your changes to ensure that they reflect the condition being tested in that session. You may wish to save each of these files with a separate desktop icon so they may be easily accessed for each experimental session. For example, you might name the files `uncertainty.set` and `certainty.set` if the study investigates the effect of uncertainty.

Output Files

FISH automatically collects, aggregates, and stores information about each fisher's harvesting behavior in each season. It also computes four different cooperation formulae that measure both harvest restraint and harvest efficiency at both the individual and group levels for each season and over all seasons (refer to Hine & Gifford, 1996 and the next section of this manual). From this information, rates of *defection* (harvesting a large amount, resulting in large short-term gain but endangering or even extinguishing the common resource) and *cooperation* (harvesting little, resulting in modest short-term gain but long-term conservation of the resource) can be determined. This is the information (dependent variables) that researchers use to conduct data analyses on the individual or group behavior of participants during the session.

Collecting and Saving the Output from FISH 3.1 Sessions

In standalone mode, each computer will produce an output file on its own file system and you must collect each file from each computer. The networked mode allows all client computers to submit their summary data to a single output file on the server's file system so that you need only collect the one file. It is recommended that you save each output file onto a disk under a different name from the default name `fish.out` to avoid confusion and to keep track of the various fishing sessions and their associated output files.

Note: The output accumulates over sessions into the same file, which can produce an extremely long output file. To avoid this, after you have saved the output that you need and have removed your disk, delete the output in the file that was produced and choose "File" and "Save" (*not* "Save As") and replace the existing `.out` file. This yields a "clean slate" for new output to be written.

Transferring the Output into a Statistical Package for Analysis

The output information is automatically written into an output file (usually `fish.out`) and sent to the server when in networked mode or to the individual computer when in standalone mode. The output is organized so that the individual data for each fisher, as well as the group data of each separate ocean are easily displayed. The numbers produced in the output file can be transferred into statistical packages such as SPSS or Excel for statistical analysis.

To transfer the output into a statistical program such as SPSS, make sure that it is saved as a text (`.txt`) document (this can be done in Notepad). Then edit the document so that it is single-spaced with at least one space between each number on each row. Double check to make sure that the rows and columns of data are set up the same as you would like them in the SPSS spreadsheet and then save the document.

Once the text document is edited and saved, open SPSS and choose “File”--“Open”--“Data” and in the box that says “Files of Type” choose “Text” or “All files”. Then find the text document that you saved the data as and click “Open”. When the “Text Import Wizard” box comes up click “Next” for all options (unless you wish to modify how the data will be imported) until you get to the screen that says “Finish” at the bottom and click on “Finish”. The data should then be automatically transferred into SPSS’s database.

Note that the data are produced for each season separately. This is useful for examining behavior during each season or identifying behavioral patterns across seasons. However, an average across all seasons for individual or group data may have to be calculated by hand or in the statistical package in order to examine behavior patterns across all seasons for the entire session (FISH 3.1 does not do this).

The Cooperation Formulae for FISH 3.1

Cooperation may be measured for each individual fisher, or for the group. It also may be measured in terms of harvest restraint in an absolute sense (i.e., x fish taken), or in the context of current stock size, that is efficiency (AKA conservationism or sustainability, i.e., x fish taken *when y fish were available*). This implies four different measures of cooperation, as follows.

IR: Individual Restraint

IR ranges from 1 (if this harvester was totally restrained i.e., took no fish) to 0 (if this harvester took $1/N$ th of the entire pool), to $1 - N$ (a negative number, if this harvester took 100% of the pool), where N is the number of fishers. If this harvester has a score of 0, and all others did the same, the pool was exhausted and all harvesters had equal harvests. Scores less than 0 indicate very little restraint – this harvester was taking enough fish to rapidly deplete the pool by him- or herself. IR says nothing directly about sustainability, but a sustainable harvest pattern will receive a score between 0 and 1, depending on the spawning rate. IR is also the proportion of fish that would be left in the pool if all harvesters acted exactly as this one did.

GR: Group Restraint

GR ranges from 1 (no harvester in the group took any fish) down to 0 (if the harvesters as a group extinguished the resource). No restraint is 0, up to full restraint, which is 1.

IE: Individual Efficiency (No-Danger and In-Danger Forms)

Efficiency (both individual and group) is computed in one of two ways, depending on whether the stock (in any given season) was endangered or not (see Hine & Gifford, 1996 for details).

IEND is the value for an individual fisher when the resource could regenerate to its original level, with enough harvester restraint, that is, OSS is less than or equal to $R*S$, where OSS is the original stock size, R is the regeneration rate, and S is the initial stock size at the beginning of the current season. Perfect efficiency or sustainability (i.e., this harvester took just enough fish so that, once spawning occurs, the resource would regenerate to its original size – ignoring what other harvesters do) receives a score of 1. Scores above 1 mean that the harvester took less than the most efficient amount (i.e., he or she was following a preservationist strategy rather than an efficiency or sustainability strategy, which could be called inefficient: not taking fish that would have been replenished naturally). Scores below 1 indicate the other kind of inefficiency – taking so much of the resource that it will be unable to regenerate to its original level when spawning occurs. A score of 0 means the harvester took 1/Nth of the whole existing pool, far too much for the pool to regenerate. Scores below 0 indicate even greater inefficiency or greed.

IED is the value for an individual fisher when the resource cannot regenerate to its original level even if all harvesters take nothing, that is, OSS is greater than $R*S$. IED ranges from 1 (full restraint – no fish taken) to negative numbers, exactly like IR does.

GE: Group Efficiency (No-Danger and In-Danger Forms)

GEND scores will be 1 when the group as a whole harvests exactly enough to allow full resource regeneration, no more and no less; thus, perfect efficiency. Scores greater than 1 indicate group harvesting that reflects preservationism or underharvesting. More of the resource could have been taken and full regeneration would still occur. Scores smaller than 1 indicate some greed-based inefficiency at the group level; a score of 0 indicates the group exhausted the resource.

GED can range from 1, when the group engages in maximum restraint (i.e., takes none of the resource) to 0, when the group takes all the resource.

Questions or Comments

Questions or comments about the program's concept and design should be directed to Dr. Robert Gifford (at rgifford@uvic.ca). Questions about the software implementation and usage should be directed to Jonas Gifford (at jgifford@uvic.ca).

References

- Gifford, J., & Gifford, R. (2000). FISH 3: A microworld for studying social dilemmas and resource management. *Behavior Research Methods, Instruments, & Computers*, 32, 417-422.
- Hine, D.W., & Gifford, R. (1996). Individual restraint and group efficiency in commons dilemmas: The effects of two types of environmental uncertainty. *Journal of Applied Social Psychology*, 26, 993-1009.