Chapter 2. Users Manual

Table of Contents

2.1 - Installation

System Requirements

Make sure your computer meets these requirements before installing CRiSP Harvest Model on your PC. Read the **`readme.txt`** file included with the distribution for any special requirements.

Required Hardware:

- IBM or compatible computer
- 486/66 or better
- 3.5” floppy disk drive
- Two button mouse
- 8 MB of RAM
- 10 MB available hard disk space
- VGA monitor (color not required)
- Printer (optional)

Required Software:

- Windows 95 or Windows NT
- Text editor (optional)

Installation

Installation from floppy disks

1. Run Windows 95 (or Windows NT).
2. Insert CRiSP Harvest Disk 1 into the floppy drive.
3. Click the Windows 95 Start button and choose Run.
4. In the dialog box, type **`a:\setup`**. If your floppy drive is not **`a:`**, substitute the appropriate letter for **`a:`**
5. Choose OK.
6. Follow the SETUP program’s directions. Unless otherwise directed, the setup program will install all the CRiSP Harvest files in a folder labeled **`c:\program files\cbr`**. See the section entitled “File Structure” for a complete description of the files.

Installation of a downloaded self-extracting file

1. Run Windows 95 (or Windows NT).
2. Run Netscape or other WWW browser.
3. From **`http://www.cqs.washington.edu/crisp/crisp2pc.html`** follow instructions for downloading.
4. Choose destination directory on your system and save the **`crisph.exe`** file on your hard drive.
5. Double click on this self-extracting file or launch it from a Run dialog box. This creates an Install directory and sub-directories.
6. Open the **`install\disk1`** directory and double-click the **`setup.exe`** icon.
7. Follow on-screen instructions.

Other Platforms

A separate version of CRiSP Harvest is available to run on the UNIX platform. No Macintosh version is available.

2.2 - Getting Started

File Structure

CRiSP Harvest is composed of files that fall broadly into four categories:

1. An executable file (**`crisph.exe`**) that is the main computation engine.
2. One or more control files (**`proto.opt`** is the default) that tells the computation engine what data files to use for that session of running the model.
3. Several data files that allow you to simulate various biological and fishing processes. These are in a sub-directory named **`input.`**
4. Other files not integral for running the model such as those used by the help engine, the help engine itself and the output files (**`*.prn`** files).

None of these files can be edited from within the executable program. However, many of the data imported from the various data files can be changed interactively through the Graphical User Interface (GUI) to simulate and run different types of future management scenarios. For example, catch quotas and hatchery smolt production can be changed through the GUI. The basic model configuration (e.g. number of stocks and fisheries, years to be modeled, data for past years) cannot be changed interactively.

When the executable program starts, it first looks for an **`*.opt`** file to tell it what data to use. If no **`*.opt`** file is specified by you, it uses the default **`*.opt`** file, named **`proto.opt`**.

The file structure has been maintained for backwards compatibility with other versions of the model that have run on different platforms and/or with different features.

Launching CRiSP Harvest

Whenever CRiSP Harvest is launched, the management scenario specified in the **`*.opt`** (see "Files of type `*.opt`" on page 2.55) and associated files is run and output files are produced.

Once the CRiSP Harvest window is open, it is possible to interact with the map, icons and graphs to alter the parameters and rerun the model. Below are the options for launching the model for the first time. Subsequent interactions are described in the sections that follow.

To start CRiSP Harvest from the Program Folder

- Click the Start button.

- Select Programs.
- Click on the CRiSP Harvest icon:

To start CRiSP Harvest from the Run dialog box

- Click the Start button.
- Select Run.
- In the dialog box type:

  “c:\program files\cbr\crisp harvest\crisph.exe”
  (or another path if you did not use the default installation path).
  Note: the location of quotation marks is important!
- Click OK to start the program.

To run CRiSP Harvest in “No Graphics” mode

For scientific applications that require running more than one scenario, it is often convenient to run CRiSP Harvest without using the GUI. When run in this “No Graphics” mode, the output files specified in the ***.opt** file are still produced automatically. Note that it is important to keep track of output files because there is no other way of examining model output.

- Follow the instructions for running CRiSP Harvest from the Windows Run dialog box and add the **-ng** flag following the ***.exe** file name. For example:

  “c:\program files\cbr\crisp harvest\crisph.exe” -ng

To specify a `*.opt` *file*

- Follow the instructions for running CRiSP Harvest from the Windows Run dialog box and add the flag **-f*** following the file name, where * is the name of the desired ***.opt** file. For example:

  “c:\ ... \crisph.exe” -fmyfile.opt

  There is a default *.opt file called **proto.opt** that is used if none is specified. See "Files of type `*.opt`" on page 2.55 for details on this file.

Other options

Multiple flags can be used together. For example to run the model with a specific ***.opt** file and in no graphics mode:

“c:\ ... \crisph.exe” -fmyfile.opt -ng

2.3 - The Map

The map shows the approximate geographic location of the 25 fisheries and 30 stocks used in the model. Fisheries are designated by boat icons and stocks by fish icons . Remember that this model only contains chinook stocks and fisheries that are of concern to the Pacific Salmon Commission.

For discussion purposes, mouse, pointer, and click operations are described for the default settings. As you become more comfortable with the model, you may want to alter them to suit your needs.

Identifying Location

As the mouse pointer is moved over the map, the approximate latitude (LAT) and longitude (LON) of the pointer is given in the right portion of the status bar 

(located below the map).

Identifying Fisheries and Stocks

Move the mouse pointer over the desired icon. The name of the highlighted icon is displayed in the left portion of the status bar.

Creating a Sub-Map

1. Place the mouse pointer at the upper left corner of the region you want to include in the sub-map.
2. Left-click and drag the mouse pointer to the lower right corner of the desired region.
3. Release the mouse button.

The new sub-map is drawn and has all the features of the main map window.

Returning to the Full Map

1. Move the mouse pointer so it is NOT located over a stock or fishery icon.
2. Right-click.

Automatic Stock and Fishery Information

1. Click on the Context Sensitive Help button to select it (background whitens) to enable the automatic information system.
2. Move the mouse pointer over a stock or fishery icon so that it is selected with a black highlight. The CRiSP Harvest Manual appears in a separate window and automatically opens a description of that stock or fishery. If

the window is already open, the content is updated to reflect the new request.

☞ At this time, not all stocks and fisheries have information datafiles.

Turning off Automatic Stock and Fishery Information

1. Click on the Context Sensitive Help  button to select it (background darkens ) to disable the automatic information system.
2. Click on the close window button () in the upper right-hand corner of the information window if you want it to close the Help system.

Finding Fisheries Harvesting A Given Stock

1. Enable Stock Circles (default) by clicking on the Stock Circles button  to select it (background lightens and a circle is displayed with the fish ). Disable this by clicking the button again.
2. Left-click on a stock icon. A circle is drawn around all fishery icons harvesting that stock. The diameter of the circle is proportional to the sum of the age specific harvest rates for that stock in that fishery.

   ☞ Right-click a stock icon to open an Abundance Graph for the stock.

Finding Stocks Harvested By A Given Fishery

1. Enable Fishery Circles (default) by clicking on the Fishery Circles button  to select it (background lightens and a circle is displayed with the hook ). Disable this by clicking the button again.
2. Left-click on a fishery icon. A circle is drawn around all stocks harvested by that fishery. The diameter of the circle is proportional to the sum of the age specific harvest rates for that stock in that fishery.

   ☞ Right-clicking on a fishery icon opens an Abundance Index Graph for that fishery.

Closing the Map Window

Left-click on the Map button  so that it appears dulled:  .

Opening the Map Window

Left-click on the dulled Map button  to darken it  .

2.4 - Drop-Down Menus

All CRiSP Harvest commands are available on a drop-down menu. Many of the commands are also available on the toolbar (described in the next section). More details on these operations is described in "Model Operations" on page 2.34

Menu	Item	What It Does
File	Print Map..	Prints the current screen.
	Mouse Tool	Opens a dialog box for setting mouse button controls.
	Exit	Exits CRiSP Harvest.
Fishery	PNV..	Opens a dialog box for adjusting “Proportions Non Vulnerable” for each fishery. PNVs are used to simulate changes in size limits in the fisheries. For example, increasing the size limit will increase the proportion of some age classes that are no longer vulnerable to retention by the fishery.
	CNR..	This is currently under development. When implemented, it will open a dialog box for adjusting “Chinook Non-Retention” mortality parameters in some fisheries.
	Catch Ceilings..	Opens a dialog box for adjusting catch ceilings (quotas) in fisheries that have this type of management control. For example, use it to set future catch ceilings in the ocean troll fisheries.
	Fishery Graphs	Opens a sub-menu for producing graphs of fishery statistics over time, including: Abundance Index, Catches (Total, Pre-terminal and Terminal) and Incidental Mortality (Total, Sublegal and Legal). Graphs generated are for the currently selected fishery.

Menu	Item	What It Does
Stock	Inter-Dam Loss..	Opens a dialog box for adjusting the “Inter-Dam Loss” rates for three Columbia River stocks. The IDLs are actually the survival rates from the time the fish leave the river fisheries and arrive on the spawning grounds. Warning: at present only three stocks actually have IDL. The fact that all stocks display is a bug to be corrected in a future release.
	EV Scalars..	Opens a dialog box for adjusting the annual “Environmental Variability” Scalars for each stock. The EV Scalars can be thought of as brood year survival rates that determine the relative spawning success each year.
	Enhancement..	Opens a dialog box for adjusting parameters associated with hatchery stocks.
	Maturation Rates...	Opens a dialog box for adjusting maturation rates for each of the stocks (i.e., the fraction of each age class that returns to spawn in a given year).
	Stock Graphs	Opens a sub-menu for producing graphs of stock statistics over time including: Abundances, Escapements, CNR mortalities (Sublegal and Legal), Catches (Total, Preterminal and Terminal), True Term Run. Graphs generated are for the currently selected stock.
Harvest	Harvest Rate Scalars..	Opens a dialog box for adjusting annual stock/fishery specific harvest rates. For example, to simulate changes in fishery regulations (e.g., time/area closures) that increase or decrease harvest rates relative to the base period.
	Base Period Harvest Rates..	Opens a dialog box displaying the stock/age/fishery specific harvest rates during the base period (1979-1982). These values cannot be changed. Use Harvest Rate Scalars to adjust harvest rates relative to base period values.
	Mortality Graphs	Opens a sub-menu for producing graphs of Total and Incidental mortality by stock and fishery. Graphs generated are for the currently selected stock and fishery.

Menu	Item	What It Does
Run	Scenario	Runs the model in a scenario mode—a single instance of the model in deterministic mode (i.e., all parameters are fixed).
	Monte Carlo..	Opens a dialog box where the model is run in a Monte Carlo model. One or more “games” (a game is one instance of the model) are run using a different set of Brood Year Survival Rates (EV Scalars) during each run. The EV Scalars are selected randomly from designated probability distributions. **Note: This mode of model operation is still under development for the PC platform**.
	Calibrate	Calibrates the model to observed data. Calibration runs require special configuration files that most users will not have.
Help	Contents	Opens a window giving the table of contents of the CRiSP Harvest help files: README, FAQ, Model Overview, and CRiSP Harvest manual. Click on a subject to read about it.
	Glossary	Opens a window giving definitions for CRiSP Harvest terminology (Chapter 2. User’s Manual, Appendix 2.4).
	About CRiSP Harvest	Gives the version number of the model.

2.5 - The Toolbar

The table below describes the various features of the toolbar.

Button	Name	What It Does
	Default Fishery	Selects the default fishery. When drop-down menu items are selected, they open with the default fishery selected.
	Default Stock	Selects the default stock. When drop-down menu items are selected, they open with the default stock selected.
	Print	Prints the current view.
	Stock Circles	When enabled, clicking on a fishery icon on the map draws hatched red circles around all stocks harvested by that fishery. The size of each circle is roughly proportional to the amount of the harvest. Right click also displays abundance data (default).
	Fishery Circles	When enabled, clicking on a stock icon on the map draws hatched green circles around all fisheries that harvest that stock. The size of each circle is roughly proportional to the amount of the harvest. Right click also displays abundance index (default).
	Help	When enabled, moving the mouse pointer over a stock or fishery icon will bring up information about that stock or fishery.
	Map On/ Off	Minimizes (hides) the map section of the screen.
	Run	Runs the model in scenario mode.
	Mouse-Pointer	Lets you set the functions of the left and right mouse buttons.

2.6 - Graph Windows

Most outputs from a simulation run can be displayed in a graph—usually one or more state variables plotted against time (years). Graph windows can be brought up directly and multiple graphs can be displayed at any time. A typical graph window (shown below) has several buttons and two information boxes. A vertical dashed line separates the calibration (to the left) and simulation (to the right) time periods.

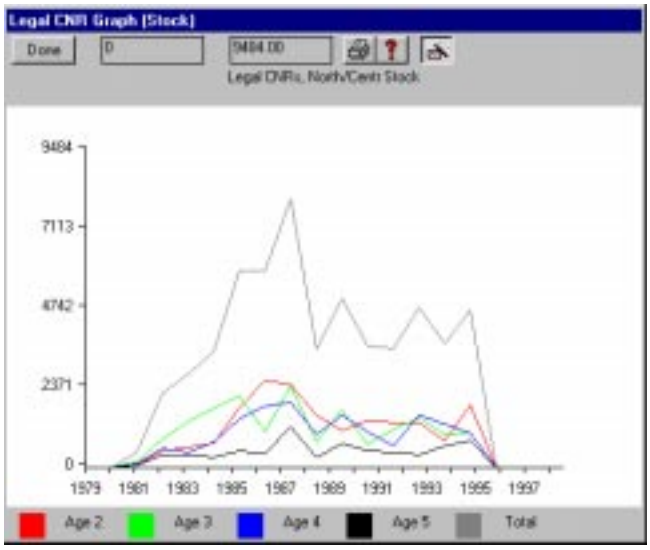
Opening Graphs

Opening Graphs from the main menu

1. Choose a Fishery and/or Stock on the toolbar (see "The Toolbar" on page 2.27 for changing these).
2. Choose from the submenus under Graphs on the Fishery, Stock and Harvest menus.

Opening Graphs from the map

1. Click on the map according to the Mouse Tools settings. These settings are described more in the section entitled "The Map" on page 2.22.



Buttons and Boxes

Button	Name	What It Does
	Done	Closes the Graph window.
	X-axis value box	Displays the x-axis (ordinate) value of the mouse pointer as it is moved over the graph.
	Y-axis value box	Displays the y-axis (abscissa) value of the mouse pointer as it is moved over the graph.
	Print	Print the current view.
	Help	At this time this feature is not available. To get help, use the Help button on the main Toolbar.
	Auto-update	When enabled (shown), graphs update automatically when mouse is moved over a new fishery or stock icon.

Graph Windows Operations

Estimate Y-Axis Values

Move the mouse pointer into the graph region. The approximate Y-axis value at the tip of the mouse pointer is displayed in the Y-axis value box. The accuracy of the value depends on the scale of the y-axis.

Estimate X-Axis Values

Move the mouse pointer into the graph region. The approximate X-axis value at the tip of the mouse pointer is displayed in the X-axis value box. The accuracy of the value depends on the scale of the X-axis. Generally, the X-axis displays the year and the value displayed in the X-axis display box is the closest year value.

Rescaling The Y-Axis

Left-click on the graph to make the Y-axis scale larger (i.e., show a smaller range of values). Right-click on the graph to decrease the scale (i.e., show a larger range of values).

Closing a Graph Window

Left-click on the Done Button 

.

Printing a Graph Window

Click on the Print Button  .

Getting Help for Graph Windows

This feature() is not implemented in this version.

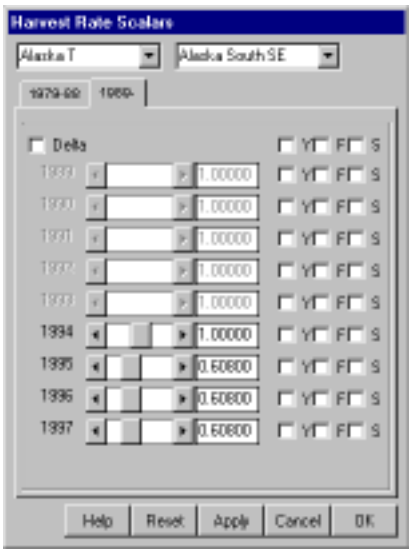
Automatic Graph Updates

When this is selected (default ) any open graphs update automatically when the mouse is moved over a controlling icon on the map. There are basically three categories of graphs: “Fishery”, “Stock”, and “Harvest”. The Fishery and Harvest graphs are updated when the mouse pointer is moved over a fishery icon. The Stock and Harvest graphs are updated when the mouse pointer is moved over a stock icon. This is disabled by de-selecting the icon.

2.7 - Dialog Boxes

Dialog boxes open when sub-menu items with ".." at the end of the name are chosen from the main drop-down menus. The exceptions to this are "Print.." and "Mouse Tool" on the File menu. "Print.." opens a box where you are apprised of printing status. "Mouse Tool" opens a dialog box.

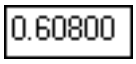
Dialog boxes have several features in common. They are exemplified by the Harvest Rate Scalars dialog box shown here. All of its elements are summarized in the table on the next page.



In general, these dialog boxes are used to change parameter values. For example, the Proportion Not Vulnerable (PNV) of Age 2 fish in 1996 for the Alaska Troll Fishery can be specifically altered from the default values read into the model at start-up from the ***.pnv** file (see "Getting Started" on page 2.20). When the dialog boxes are opened they show the default values. The parameter values are altered individually or in groups by one or more of the following methods:

- moving sliders
- clicking on scrollbar arrows
- typing in value boxes
- grouping different parameters so that the change of a single value affects other values absolutely or relatively.

The table that follows shows how these controls work.

Feature	Name	Description (using Harvest Rate Scalars dialog box as an example)
	Fishery	Choose a Fishery to which Harvest Rate Scalars will apply. The drop-down menu has the entire list of Fisheries recognized by the model. When a Fishery is highlighted you can use up and down keys to scroll up and down the list. Note: It is possible to select combinations of Fishery and Stock that never interact.
	Stock	Choose a Stock to which Harvest Rate scalars will apply. The drop-down menu has the entire list of Stocks recognized by the model. When a Stock is highlighted you can use up and down keys to scroll up and down the list. Note: It is possible to select combinations of Fishery and Stock that never interact.
	Year groups	Toggle on the tabs to display different year groupings. (Putting them all on display at once could make the dialog boxes very large!)
	Delta	When checked, all linked values change linearly instead of proportionally, adding the difference between the new and old value to all linked values
	Dulled Year	The Harvest Rate Scalars for this year are part of the calibration data and can not be adjusted from the dialog box
	Bold Year	The Harvest Rate Scalars for this year can be adjusted by using the Slider, Value box, Y box, F box and S box methods described below.
	Slider	Use the slider to adjust the Harvest Rate Scalars (displayed in the Value box) with the mouse pointer. Left-click and hold left and right arrows to adjust the value, or click and drag the central slider to the desired value.
	Value Box	Displays current value of the Harvest Rate Scalar for that Year for the particular stock shown in the Stock Select area and the fishery shown in the Fishery Select area unless the Y, F, and/or S box is selected on that line. These values persist between uses of the dialog box if Apply or OK is chosen during this run of the model.

Feature	Name	Description (using Harvest Rate Scalars dialog box as an example)
	Y box	Check box used to set the Harvest Rate Scalars for a group of years to a common value in the selected Fisher(y/ies) and Stock(s). When selected, all checked years are adjusted as a group to the shared value set the next time any one of them is altered. The Y box at the top of the column selects or de-selects the entire range (all years) of Y boxes. This box can be used in conjunction with other check boxes. The settings of the Y boxes do not persist in-between uses of the dialog box.
	F box	Check box used to set the Harvest Rate Scalars for a group of Fisheries to a common value for the selected year(s) and the selected Stock(s). It is analogous to the Y box described above.
	S box	Check box used to set the Harvest Rate Scalars for a group of Stocks to a common value for the selected year(s) and the selected fisheries. It is analogous to the Y box described above.
	Help	Opens the Manual in a separate window.
	Reset	Resets the dialog box to the last applied values. Note that this does not reset values to those from the input files used when the program was first launched.
	Apply	Incorporates changes into the next model run.
	Cancel	Resets and closes the dialog box.
	OK	Incorporates changes in the next model run and closes the dialog box.
	Forced box	Only appears in the Catch Ceilings dialog box (Fishery menu). Used to make the modeled catch equal to the catch ceiling even if the unconstrained catch is below the ceiling. In practice, Forced catches are generally used for the calibration period to force the catches to equal the observed catches. Unforced catches are more likely to be used for simulations.

2.8 - Model Operations

Introduction

Once the model has been launched, you can interactively adjust various parameters and run the model as frequently as desired in Scenario mode. This section describes in detail how to interactively adjust model parameters. To alter parameters for several modeling sessions, we advise altering the input files directly and saving these under separate names. The model can then be run with a specific **`*.opt`** file that identifies the parameter files that you want to use (see "Files of type `*.opt`" on page 2.55 and "File Structure" on page 2.20). For help on using individual model features see "Dialog Boxes" on page 2.31, "The Toolbar" on page 2.27, and "Drop-Down Menus" on page 2.24.

Fishery Menu

Changing PNVs (Proportion Non-Vulnerable)

The Proportion Non-Vulnerable is the proportion of a cohort that is below the legal size limit. The tacit assumption is that all stocks have the same growth rate so these values vary by year, age and fishery.

1. Choose PNV.. from the Fishery menu.
2. Choose a fishery from the drop-down sub-menu next to the default fishery.
3. Choose a year from the drop-down sub-menu next to the default year.
4. Change and apply values according to the methods described in "Dialog Boxes" on page 2.31.

Reminder: PNV values during the calibration period (1979-1993) can not be changed.

Changing CNR Mortalities

Chinook Non-retention (CNR) mortalities are incidental mortalities that occur when a fishery is targeting on other salmon species (e.g., coho). These mortalities usually are restricted to the few troll fisheries. This feature is not available in this release. You must alter the **`*.cnr`** file directly if you want to alter CNR values.

Changing Catch Ceilings

Catch ceilings are the principle tool for managing many fisheries. They represent the numerical upper limit on the number of fish that can be caught during a given year.

1. Choose Catch Ceilings.. from the Fishery menu.
2. Choose a fishery from the fishery list.
3. Left-click the Ceilings button to get a list of sliders for controlling catch ceilings.
4. Change and apply values according to the methods described in "Dialog Boxes" on page 2.31.

   Reminder: Catch Ceilings during the calibration period (1979-1993) can not be changed.

Graphing Abundance Index for a Fishery

The Abundance Index for a given fishery in a given year is a scalar value comparing the catch under the simulated regulations to what catch would have been if the base period harvest rates had been used.

See "Graph Windows" on page 2.28 for details on graph windows.

1. Choose a fishery on the Toolbar (See "The Toolbar" on page 2.27).
2. Choose Fishery Graphs from the Fishery menu.
3. Choose Abundance Index from the Fishery Graphs sub-menu.
4. To view another fishery, repeat steps 1 through 3 above.

Graphing Catches for a Fishery

See "Graph Windows" on page 2.28 for details on graph windows.

1. Choose a fishery on the Toolbar (See "The Toolbar" on page 2.27).
2. Choose Fishery Graphs from the Fishery menu.
3. Choose Catches from the Fishery Graphs sub-menu.
4. Choose Total, Preterminal, or Terminal from the Catches sub-menu.
   - “Total” refers to the “Preterminal” plus “Terminal” catches.
5. To view another fishery, repeat steps 1 through 4 above.

Graphing Incidental Mortality for a Fishery

“Incidental Mortality” refers to fish that die as a result of the fishing process, but are not part of the legal catch or harvest. These mortalities include shakers (i.e., chinook that are hooked and brought up to the boat but are released (“shaken”) because they are not of legal size) and CNRs (Chinook Non-Retention mortalities are both legal and sub-legal chinook that are hooked and brought up to the boat during coho fisheries at times when all chinook are not legal to land and sell). Shakers and CNRs have increased natural mortality rates due to the handling process.

See "Graph Windows" on page 2.28 for details on graph windows.

1. Choose a fishery on the Toolbar (See "The Toolbar" on page 2.27).
2. Choose Fishery Graphs from the Fishery menu.
3. Choose Total, Sublegal, or Legal from the Incidental Mortality sub-menu.
   - Total refers to the “shakers” plus Chinook Non-Retention mortalities.
4. To view another fishery, repeat steps 1 through 3 above.

Stock Menu

Changing Inter-Dam Loss

Inter-Dam Loss (IDL) is applied to Columbia River stocks that spawn upstream from one or more dams. This is also called pre-spawning mortality.

1. Choose a stock on the Toolbar (See "The Toolbar" on page 2.27).
2. Choose Inter-Dam Loss.. from the Stock menu.
3. Change and apply values according to the methods described in "Dialog Boxes" on page 2.31.

   Reminder: IDL values during the calibration period (1979-1993) can not be changed.

Changing EV Scalars

The EV (Environmental Variability) Scalars represent brood year survival rates to age one.

1. Choose a stock on the Toolbar (See "The Toolbar" on page 2.27).
2. Choose EV Scalars.. from the Stock menu.
3. Change and apply values according to the methods described in "Dialog Boxes" on page 2.31.

   Reminder: EV Scalars during the calibration period (1979-1993) can not be changed.

Changing Stock Enhancements

Hatchery fish production is assumed to stay at a level equal to the average production between 1979-1981. Any levels above or below this level are considered enhancement changes (positive or negative). For each year, you can adjust the number of Age 1 fish that the hatchery produces. Since there may be limitations on the number of spawners that can be used for hatchery production and/or the hatchery efficiency in producing age 1 fish, other sliders are available for adjusting these parameters.

1. Choose a stock on the Toolbar (See "The Toolbar" on page 2.27).
2. Choose Enhancement.. from the Stock menu.

3. Change and apply values according to the methods described in "Dialog Boxes" on page 2.31.

Changing Maturation Rates

Maturation rates refer to the proportion of a stock that is mature and ready to return to the spawning ground. These are age and stock specific and can vary between years. Because the model does not allow for age six fish, the maturation rate for age five fish should always be 1. The mature portion of a cohort is considered the terminal run.

1. Choose a stock on the Toolbar (See "The Toolbar" on page 2.27).
2. Choose Maturation Rates.. from the Stock menu.
3. Change and apply values according to the methods described in "Dialog Boxes" on page 2.31.

Graphing Start of Year Abundances

See "Graph Windows" on page 2.28 for details on graph windows.

1. Choose a stock on the Toolbar (See "The Toolbar" on page 2.27).
2. Choose Stock Graphs from the Stock menu.
3. Choose Abundances from the sub-menu.

Graphing Escapements

See "Graph Windows" on page 2.28 for details on graph windows.

1. Choose a stock on the Toolbar (See "The Toolbar" on page 2.27).
2. Choose Escapements from the sub-menu.

Graphing CNR Mortalities

See "Graph Windows" on page 2.28 for details on graph windows.

1. Choose a stock on the Toolbar (See "The Toolbar" on page 2.27).
2. Choose CNR from the sub-menu.
3. Choose Sublegal or Legal from the sub-menu.

Graphing Legal Catches

See "Graph Windows" on page 2.28 for details on graph windows.

1. Choose a stock on the Toolbar (See "The Toolbar" on page 2.27).
2. Choose Catches from the sub-menu.
3. Choose Total, Preterminal or Terminal from the sub-menu.

Graphing True Terminal Run Sizes

See "Graph Windows" on page 2.28 for details on graph windows.

1. Choose a stock on the Toolbar (See "The Toolbar" on page 2.27).
2. Choose True Term Run from the sub-menu.

Harvest Menu

Base Period Harvest Rates

The Base Period Harvest Rates are determined during parameter estimation and model calibration. They represent the average harvest rates on each age class of each stock in each fishery during the period 1979-1982. They cannot be changed by the user. This tool is only for viewing these values.

Changing Harvest Rate Scalars

The Harvest Rate Scalars are used to simulate the effects of changes in fishery policies that disproportionately impact different stocks relative to the base period (e.g. changing the timing of the fishing period may impact the stocks differently).

1. Choose Harvest Rate Scalars.. from the Harvest menu.
2. Change and apply values according to the methods described in "Dialog Boxes" on page 2.31.

Reminder: During simulation runs to compare different harvest rate strategies, HR Scalars during the calibration period (1979-1993) can not be changed.

Graphing Stock/Fishery Specific Mortality

See "Graph Windows" on page 2.28 for details on graph windows.

1. Choose a stock on the Toolbar (See "The Toolbar" on page 2.27).
2. Choose a fishery on the Toolbar (See "The Toolbar" on page 2.27).
3. Choose Mortality Graphs from the Harvest menu.
4. Choose Total or Incidental from the sub-menu.
   - “Incidental” mortalities include shakers and CNR mortalities.
   - “Total” mortalities include legal catches plus incidental mortalities.

Run Menu

Running the model in Scenario mode

The scenario mode runs a single instance of the model. When CRiSP Harvest is first launched it runs with the parameters specified in the **`*.opt`** file. The map and other GUI tools allow you to interpret the **`*.opt`** run, make changes to the parameters during the simulation period and make additional runs.

1. Adjust simulation period parameters as desired according to methods described under "Fishery Menu" on page 2.34, "Stock Menu" on page 2.36, and "Harvest Menu" on page 2.38.
2. Choose Scenario from the Run menu.
3. Evaluate results (see "Graph Windows" on page 2.28 and ?? something on model results).

Running the model in Monte Carlo mode

In Monte Carlo mode, results are determined stochastically (i.e., in a random manner) instead of deterministically. When run in deterministic mode (a scenario), model results are sensitive to the EV Scalars set for the simulation period. If one is optimistic about “Environmental Variability” (i.e., predicting good brood year survival rates), stocks have good production. Conversely, if one is pessimistic about future survival rates, stocks have poor production.

Under Monte Carlo mode, the EV Scalars for all stocks are selected in a random manner. Each random run is referred to as a “game.” The EV Scalar for any game can be randomly selected using one of two methods: “bootstrapping” from the calibration period EV values in the **`*.evo`** file or drawing from a log-normal distribution fit to the calibration period EV values. The method is specified by the **`*.monte`** file identified in the **`*.opt`** file (see "Files of type `*.opt`" on page 2.55). The stock escapements for each game are stored and analyzed to provide a measure of the variability one might expect in the future.

1. Choose Monte Carlo from the Run menu.
2. Choose the number of games in the dialog box.
3. Click the Run Monte button.

A status bar in the dialog box shows the current game. Once all games are completed, a graph of escapements for the default stock is displayed. See "Graph Windows" on page 2.28 for details on using the graph windows.

2.9 - Modeling Management Alternatives

Overview

Human impacts on salmon stocks can be grouped into two broad categories—those that affect production and those that affect harvest. Production impacts include a broad range of watershed activities. A few examples are hatcheries and spawning channels that enhance reproductive success, dams that increase mortality of both upstream adult migrants and downstream smolt migrants, fish ladders that help improve upstream survival, bypass systems that help reduce downstream mortalities at dams, and logging practices that reduce available spawning habitat.

Harvest management involves both long- and short-term decisions. Over the long term, managers must decide on a general harvesting strategy. There are three basic types of harvest strategies—fixed catch, fixed harvest rate, and fixed escapement. Fixed catch means setting a quota for a fishery and keeping the same quota for several years. A fixed harvest rate policy takes a fixed percentage of the available run each year. Finally, a fixed escapement policy adjusts catches such that a given number of spawners return to the spawning grounds each year. Each type of long-term strategy usually involves establishing size limits, also. Within each long-term strategy are the annual decisions regarding specific times and areas where fishing can occur in order to meet the specific long-term strategy.

Each management action (e.g., setting catch ceilings, adjusting size limits, changing hatchery production) affects the fisheries and stocks in CRiSP Harvest. Some of these are easier to simulate than others. In practice, it is often most useful to compare alternatives to a “base case” or “status quo” scenario specified by the default **`*.opt`** file.

In the sections that follow, management actions are discussed in greater detail. Production alternatives include:

- Brood Year Survival Rates (page 2.44)
- Enhancement (page 2.45)
- Inter-Dam Loss (page 2.47).

Fishery alternatives include:

- Catch Ceilings (page 2.48)
- Harvest Rate Strategies (page 2.49)
- Fixed Escapements
- Size Limit Changes (page 2.51)

There are two different methods for modeling management alternatives: the “Interactive Method” and the “Input File Method”. The Interactive Method uses the CRiSP Harvest toolbars, dialog boxes and menus for altering the parameters and assumes that you are familiar with these controls. Review the appropriate sections of the manual before following the procedures for this method.

Input File Methods require manipulating the files used by CRiSP Harvest *before* launching the model from the “Run” dialog box. This enables you to specify a particular **`*.opt`** file (see "File Structure" on page 2.20) which has detailed instructions on which files the model should use for each alternative. For more information on these files consult the appropriate sections of this manual (especially "Files used by CRiSP Harvest" on page 2.54).

Comparison of alternatives is done by creating output files for the different alternatives and/or comparing graphs of different output. For this reason, users who prefer the Interactive methods should be familiar with the file structure used by CRiSP Harvest and in particular be able to (see "Graph Windows" on page 2.28).

As noted in previous sections, many CRiSP Harvest parameters can not be changed while modeling alternative management strategies. These parameters are valid only when used in concert with other parameters from the same calibration run.

The following tables detail some of the limitations to Modeling Management alternatives:

- Table 2.1 summarizes which Fishery Alternatives can be used with a particular fishery.
- Table 2.2 summarizes which Production Alternatives can be used with particular stocks.
- Table 2.3 summarizes the parameters that can not be changed.

Table 2.1 Cross-reference of Fisheries and Fishery Alternatives available in CRiSP Harvest.

	Fishery	Fishery Alternatives			
		Fixed Catch	**Fixed HR**	**Fixed Esc**	**Size Limits**
1	Alaska Troll	x			
2	Northern B.C. Troll	x			x
3	Central B.C. Troll	x			x
4	West Coast Vancouver Island Troll	x			x
5	Washington/Oregon Troll	x			
6	Strait of Georgia Troll	x			x
7	Alaska Net	x			x
8	Northern B.C. Net	x			
9	Central B.C. Net	x			
10	West Coast Vancouver Island Net		x		
11	Juan de Fuca Net		x		
12	North Puget Sound Net		x		
13	South Puget Sound Net		x		
14	Washington Coast Net		x		
15	Columbia River Net		x	x	
16	Johnstone Strait Net		x		
17	Fraser River Net		x		
18	Alaska Sport	x			
19	North/Central B.C. Sport	x			
20	West Coast Vancouver Island Sport	x			
21	Washington Ocean Sport	x			
22	North Puget Sound Sport	x			
23	South Puget Sound Sport	x			
24	Strait of Georgia Sport	x			x
25	Columbia River Sport		x		

Table 2.2 Cross-reference of stocks and available Production Alternatives in CRiSP Harvest (EV = Environmental Variability Scalars; Enh = Enhancement; IDL = Inter-Dam Loss).

	Stock	Production Alternative		
		EV	Enh	IDL
1	Alaska South SE	x		
2	Northern/Central B.C.	x		
3	Fraser River Early	x		
4	Fraser River Late	x		
5	West Coast Vancouver Island Hatchery	x	x	
6	West Coast Vancouver Island Natural	x		
7	Upper Strait of Georgia	x		
8	Lower Strait of Georgia Natural	x	x	
9	Lower Strait of Georgia Hatchery	x	x	
10	Nooksack River Fall	x	x	
11	Puget Sound Fingerling	x	x	
12	Puget Sound Natural Fingerling	x		
13	Puget Sound Yearling	x	x	
14	Nooksack River Spring	x		
15	Skagit River Wild	x		
16	Stillaguamish River Wild	x		
17	Snohomish River Wild	x		
18	Washington Coastal Hatchery	x	x	
19	Columbia River Upriver Brights	x		x
20	Spring Creek Hatchery	x		x
21	Lower Bonneville Hatchery	x		
22	Fall Cowlitz River Hatchery	x		
23	Lewis River Wild	x		
24	Willamette River	x		
25	Spring Cowlitz Hatchery	x		
26	Columbia River Summers	x		
27	Oregon Coastal	x		
28	Washington Coastal Wild	x		
29	Snake River Wild Fall	x		x
30	Mid Columbia River Brights	x	x	x

Table 2.3 CRiSP Harvest parameters that can not be changed when modeling alternative management strategies.

Fixed Parameters	Years
Environmental Variability (EV) Scalars	1979-1994
Enhancement	1979-1994
IDL (Inter-Dam Losses, or pre-spawning mortality)	1979-1994
Catch Ceilings	1979-1994
Harvest Rate Scalars	1979-1994
PNV (Percent Non-Vulnerable)	1979-1994

Production Alternatives

Brood Year Survival

Brood year survival rates, also known as pre-recruitment survival rates or EV (Environmental Variability) Scalars, compensate for both environmental variation and any bias in the original production parameters. There is a lot of variability in the spawner-recruit relationship and these scalars take that into consideration. Thus, EV Scalars include factors associated with early life history rearing, downstream smolt survival and early ocean survival prior to age one.

Model results are very sensitive to assumptions regarding future survivals. You can evaluate effects of different assumptions regarding projected survival on stock specific rebuilding schedules by specifying different EV values.

The **`*.evo`** file produced during calibration contains (1) stock specific annual age one survival scalars and (2) the estimated EV values as survival projections for all subsequent years.

When Running in scenario mode, the model uses the appropriate value from the file and applies it during the simulation. When run in Monte Carlo mode there are two ways that the model can choose an EV scalar. It can “Bootstrap” the value from the set of values for that stock or it can draw from a distribution of the EV scalars that are fitted to a log normal distribution. The log normal values are assumed to be independent of each other. The form of this sampling is determined by the **`*.monte`** file, and the EV values used should be appropriate for the method being chosen.

Two options are available for changing the EV Scalars. Either create separate **`*.evo`** files for each option or use dialog box controls for modifying the EV Scalars immediately before running the model.

Analysis Procedure

Interactive Method:

1. Change run title in **`*.opt`** file (Line 1) to document the new conditions being modeled.
2. Change “PREFIX FOR SAVE FILE” in **`*.opt`** file so output files can be identified.
3. Check that output flags are set on lines 9* so that stock and fishery output is produced.
4. Save **`*.opt`** file under new file name.
5. Launch Model with new **`*.opt`** file.
6. Open the EV scalars dialog box from the Stock menu.
7. Edit the EV scalars (see "Dialog Boxes" on page 2.31).
8. Click OK.
9. Run the model.

Input File Method:

1. Change **`*.evo`** file by using an ASCII text editor.
2. Save **`*.evo`** under new file name.
3. Change **`*.evo`** file name in the **`*.opt`** file (Line 9a).
4. Change run title in **`*.opt`** file (Line 1).
5. Change “PREFIX FOR SAVE FILE” in **`*.opt`** file (can include a path).
6. Check that output flags are set on lines 9* so that stock and fishery output is produced.
7. Save **`*.opt`** file under new file name.
8. Launch Model with new **`*.opt`** file.

Interpretation of Results

The impacts of changes in EV Scalars can be observed by viewing the escapements of affected stocks. Remember that there is a time lag between the application of the scalar and the resultant escapement.

Look for effects of the change in catch in non-ceilinged fisheries with substantial harvest of the stock or in stock escapement statistics.

Enhancement

Production from enhancement activities can affect the performance of stocks and fisheries. The PSC chinook model incorporates enhancement through two primary means: (a) by including hatchery stocks in the model; and (b) by providing for supplementation of natural production. The Model assumes

that enhancement is maintained at base period average levels (1979-1981) unless instructed otherwise. It is the *changes* in enhancement that are evaluated.

The ***.enh** file has information on changes in enhancement schedules for hatchery and natural supplementation programs. Modifications of the ***.enh** values can be made either: (1) to incorporate actual changes in the enhancement schedule; (2) to assess possible changes in enhancement. All enhancement changes are relative to average levels during the 1979-1981 base period.

Analysis Procedure

Interactive Method:

1. Change run title in ***.opt** file (Line 1).
2. Change "PREFIX FOR SAVE FILE" in ***.opt** file (Line 9a).
3. Check other file names in ***.opt** file.
4. Save ***.opt** file under new file name.
5. Run Model with new ***.opt** file.
6. Open the Enhancements dialog box from the Stock menu.
7. Edit Enhancement values.
8. Click OK.
9. Run model.

Input File Method:

1. Change the ***.enh** file using an ASCII text editor.
2. Save modified ***.enh** file under new name.
3. Change run title in ***.opt** file (Line 1).
4. Change "PREFIX FOR SAVE FILE" in ***.opt** file (Line 9a).
5. Ensure ***.opt** file has the correct "NUMBER OF STOCKS WITH ENHANCEMENT" (Line 21).
6. Specify in ***.opt** file if density dependence is on or off (Line 21a). Enter 1 to indicate that production is considered to be density dependent for natural stocks that are supplemented by hatchery releases. Under most circumstances, this line will read 1.
7. Change ***.enh** file name in ***.opt** file (Line 21b).
8. Check other file names in ***.opt** file.
9. Save ***.opt** file under new file name.
10. Run model with new ***.opt** file.

Interpretation of Results

The most direct way of identifying changes is to look at the escapement of the enhanced stocks in graphs or output files. You can also look to see if the enhancement affected the catch and escapement of other stocks.

Inter-Dam Loss

Effects of post-fishery, pre-spawning mortality can be examined through use of **`*.idl`** files. The **`*.idl`** file contains estimates of pre-spawning survival that occurs after fisheries. Currently, this file only includes estimates of inter-dam loss for Columbia River stocks. Since most inter-dam loss occurs after all fisheries, inter-dam loss is essentially treated as escapement when calculating ocean and terminal area harvest rates. Estimated IDL values are used through the present year, then an average of all estimated values is used for future years.

Changes in estimates of inter-dam loss rates can be assessed by modifying this file. It should be noted, however, that the numbers in the **`*.idl`** files are actually estimates of total adult *survival* past all Columbia River dams.

Analysis Procedure

Interactive Method:

1. Change run title in **`*.opt`** file (Line 1).
2. Change “PREFIX FOR SAVE FILE’ in **`*.opt`** file (Line 9a).
3. Check other file names in **`*.opt`** file.
4. Save **`*.opt`** file under new file name.
5. Launch Model with new **`*.opt`** file.
6. Open the Inter Dam Loss dialog box from the Stock menu.
7. Edit IDL values.
8. Click OK.
9. Run Model.

Input File Method:

1. Change **`*.idl`** file using an ASCII text editor.
2. Save modified **`*.idl`** file under new name.
3. Change **`*.idl`** file name in the **`*.opt`** file (Line 8a).
4. Change run title in **`*.opt`** file (Line 1).
5. Change “PREFIX FOR SAVE FILE’ in **`*.opt`** file (Line 9a).
6. Check other file names in **`*.opt`** file.
7. Save **`*.opt`** file under new file name.

8. Launch Model with new ***.opt** file.

Interpretation of Results

Effects of changing inter-dam loss values are most evident in escapement statistics. In addition, changes will also be reflected in harvest rates of Columbia River stocks in the ***prefix*ohr.prn** and ***prefix*thr.prn** output if these have been selected. Ocean and terminal harvest rates should decrease as inter-dam loss increases. Since the file actually contains estimates of inter-dam survival, this means that as the numbers in the file increase, harvest rates should also increase.

Fisheries Alternatives

Catch Ceilings

Catch ceilings are the primary means used by the PSC to reduce stock exploitation rates. The ***.cei** file is used: (1) to specify fisheries with ceilings; (2) to set ceiling levels (catch levels); and (3) to allow the user to force Model catches to equal the ceiling. Note: the catches given in the ***.cei** file and the model catches will not be equal. A scalar is applied to the simulation period modeled catches that is determined from the ratio of base period modeled catches and the preterminal and terminal catches. In a word, CRiSP Harvest does not recognize all available stocks that the given fishery harvests and accounts for this difference with this method.

Analysis Procedure

Interactive Method:

1. Change run title in ***.opt** file (Line 1).
2. Change “PREFIX FOR SAVE FILE” in ***.opt** file (can include a path).
3. If desired, check that output flags are set on lines 9* so that stock and fishery output is produced.
4. Save ***.opt** file under new file name.
5. Launch Model with new ***.opt** file.
6. Open Catch Ceilings dialog box from the Fishery menu.
7. Edit the Catch Ceilings (see "Dialog Boxes" on page 2.31).
8. Click OK.
9. Run the model.

Input File Method:

1. Make appropriate changes in the ***.cei** file using an ASCII text editor.

2. Save modified **`*.cei`** file under new name.
3. Change **`*.cei`** file name in the **`*.opt`** file (Line 26a).
4. Change run title in **`*.opt`** file (Line 1).
5. Change "PREFIX FOR SAVE FILE" in **`*.opt`** file (can include a path).
6. If desired, check that output flags are set on lines 9* so that stock and fishery output is produced.
7. Save **`*.opt`** file under new file name.
8. Launch Model with new **`*.opt`** file.

Interpretation of Results

Effects can be observed by viewing the escapements of affected stocks. Remember that there is a time lag between the application of the scalar and the resultant escapement.

Look for effects of the change in catch in non-ceilinged fisheries with substantial harvest of the stock or in stock escapement statistics. The impacts of changes in Catch Ceilings can be seen by comparing output files and/or graphs. First, check the effect on catch in the fishery. Next, check for effects on escapement or terminal run size of stocks caught in the fishery. CNR mortality could also change, depending on the method specified. To compare harvest rates to the base period, check the RT values for the fishery in the **`prefixrt.prn`** file.

Harvest Rate Strategies

For each stock, age, and fishery, Base Period Harvest Rates are the estimated average rate for the years 1979-1982. All other Harvest Rates in the model are scaled up or down from these base period rates by using Harvest Rate (HR) Scalars. HR Scalars are stock and fishery dependent and can be used to reflect changes in fishing patterns (e.g., time/area closures) designed to alter harvest rates on individual stocks. For example, delaying harvest in a fishery may reduce the harvest rate on early migrating stocks while increasing the harvest rate on late migrating stocks.

The HR Scalars can be used to examine a general set of questions regarding harvest rate strategies, including:

- How are harvest rates on particular stocks affected by harvest rate changes in terminal fisheries?
- How would specific harvest rate strategies affect rebuilding?
- How do shaping options differently impact particular stocks?

Such questions can be evaluated through the use of **`*.fp`** files (the "fp" suffix stands for "Fishery Policy"). HR Scalars are stock, fishery, and year

specific scalars that modify fishery exploitation/harvest rates relative to the base period; for example, an FP value of 0.75 would reduce base period exploitation/harvest rates for a stock by 25%.

Currently, HR Scalars other than 1.0 are used to reflect: (1) changes in terminal fishing patterns from the base period for particular stocks; (2) the 25% reduction in harvest rates by Canadian net fisheries expected under Canadian management; (3) fishery indices estimated through exploitation rate analysis; and (4) differential impacts associated with fishery shaping options.

Analysis Procedure

Interactive Method:

1. Change run title in **`*.opt`** file (Line 1).
2. Change "PREFIX FOR SAVE FILE" in **`*.opt`** file (can include a path).
3. If desired, check that output flags are set on lines 9* so that stock and fishery output is produced.
4. Save **`*.opt`** file under new file name.
5. Launch Model with new **`*.opt`** file.
6. Open the Harvest Rate Scalars dialog box from the Harvest menu.
7. Change Harvest Rate Scalar values.
8. Click OK.
9. Run the model.

Input File Method:

1. Make appropriate changes in the **`*.fp`** file using an ASCII text editor.
2. Save modified **`*.fp`** file under new name.
3. Change **`*.fp`** file name in the **`*.opt`** file (Line 26a).
4. Change run title in **`*.opt`** file (Line 1).
5. Change "PREFIX FOR SAVE FILE" in **`*.opt`** file (can include a path).
6. If desired, check that output flags are set on lines 9* so that stock and fishery output is produced.
7. Save **`*.opt`** file under new file name.
8. Launch Model with new **`*.opt`** file.

Interpretation of Results

To see the effects of a harvest rate change, look for alterations in the catch and/or escapement abundances.

Fixed Escapements

Unlike pre-terminal fisheries, terminal fisheries target only stocks in a particular river. The most common strategy for in-river management is fixed escapement. An escapement goal is established for one or more stocks and catches are adjusted to meet the escapement goal.

The **`*.riv`** file specified on line 31 of the **`*.opt`** file details the exact method of applying in-river harvest strategies and details of this method. There are three different management types that can be used for fixed escapement: a weak stock strategy, a combined stock strategy and a fixed harvest rate strategy. Examples of each of these file types are shown in "Files of type `*.riv`" on page 2.77.

Analysis Procedure

Interactive Method: Not available

Input File Method:

1. Make appropriate changes in the **`*.riv`** file using an ASCII text editor.
2. Save modified **`*.riv`** file under new name.
3. Change **`*.riv`** file name in the **`*.opt`** file (Line 26a).
4. Change run title in **`*.opt`** file (Line 1).
5. Change “PREFIX FOR SAVE FILE” in **`*.opt`** file (can include a path).
6. If desired, check that output flags are set on lines 9* so that stock and fishery output is produced.
7. Save **`*.opt`** file under new file name.
8. Launch Model with new **`*.opt`** file.

Interpretation of Result

Compare a fixed escapement strategy with a base case run. Note that only Columbia River stocks can be affected by this alternative and that it affects only the Columbia River Net fishery.

Size Limit Changes (PNV)

Management agencies have altered minimum size limits when implementing PSC catch ceiling regimes. Changes in size limits affect incidental mortality losses since the proportion of the population that can be legally retained changes in response. Impacts of size limit changes can be evaluated through the use of **`*.pnv`** files.

The **`*.bse`** file specified in line 4 of the **`*.opt`** file contains data that defines the proportion of a population of a given age which is not vulnerable to

each fishery. These proportion non-vulnerable (PNV) specifications remain fixed unless changed by the user. “PNV” is an abbreviation for “proportion non-vulnerable,” a phrase that is slightly misleading since this file actually provides data on the proportion of each age class in a fishery that is recruited to the gear, but is below the legal size limit.

***.pnv** files were originally created with the assistance of a LOTUS 123 spreadsheet file **pvcalc3.wk1**. The size distribution data in **pvcalc3.wk1** were compiled in 1986, based upon CWT recovery data that provided a means for positive aging and size at recovery. Where available, data for troll and seine recoveries were combined because troll fisheries tend to crop a substantial portion of larger fish from the population while recoveries by seine gear, believed to be the least size-selective gear type, provide size distribution of fish in the remaining population.

When a fishery size limit is input into **pvcalc3.wk1**, the total proportion of the population below the size limit is initially estimated using area-specific, length distribution data. The proportion initially estimated by the program includes a portion that is not yet recruited to the gear. Encounters of age 2 fish are adjusted so that the estimate of total encounters is consistent with estimates reported by the agencies. The final result is an estimate of the proportion of each age class in a fishery that is vulnerable to the gear but is below the legal size limit. This adjusted estimate is incorporated into the ***.pnv** file. The values in the ***.pnv** file are actual proportions, not changes relative to the base period. The ***.pnv** file is infrequently revised (usually only once a year).

A separate ***.pnv** file is created for each fishery in which one or more changes in the minimum size limit have occurred since the base period. The proportion in a ***.pnv** file replace those proportions in the ***.bse** file for each fishery specified by a ***.pnv** file.

Analysis Procedure

Interactive Method:

1. Change run title in ***.opt** file (Line 1).
2. Change “PREFIX FOR SAVE FILE” in ***.opt** file (can include a path).
3. Save ***.opt** file under new file name.
4. Launch Model with new ***.opt** file.
5. Open the PNV dialog box from the Fishery menu.
6. Edit PNV values.
7. Click OK.
8. Run model.

Input File Method:

1. Change appropriate column(s) in the ***.pnv*** file using an ASCII text editor.
2. Save modified ***.pnv*** file under new name.
3. Change corresponding ***.pnv*** file name in the ***.opt*** file (Line 23a-f).
4. If this is a new fishery, change "number of ***.pnv*** changes" in ***.opt*** file (Line 23).
5. Check that this number agrees with the number of ***.pnv*** file names listed in the ***.opt*** file
6. Change run title in ***.opt*** file (Line 1).
7. Change "PREFIX FOR SAVE FILE" in ***.opt*** file (can include a path).
8. If desired, check that output flags are set on lines 9* so that stock and fishery output is produced.
9. Save ***.opt*** file under new file name.
10. Launch Model with new ***.opt*** file.

Interpretation of Results

Examine incidental and total mortality output and graphs. Increases or decreases in incidental mortalities resulting from the size limit change can be seen directly in the incidental mortality files (***prefix*tim.prn**, ***prefix*sim.prn**, and ***prefix*lim.prn**). Changes in non-retention fisheries will have other impacts throughout the Model output, for example, in escapement statistics.

Appendix: 2.1 - Files used by CRiSP Harvest

CRiSP Harvest uses the following files:

- **crisph.exe** - CRiSP Harvest executable code.
- **map.dat** - Map data file (coastline, rivers, icon locations).
- ***.opt** - Option file containing instructions for running the model.
- ***.bse** - Base data file (includes Spawner/Recruit Relationships).
- ***.stk** - Stock data file listing initial cohort sizes, maturation rates, adult equivalence factors, and stock/age/fishery specific harvest rates.
- ***.msc** - Maturation schedule file listing stocks that have variable maturation rates.
- ***.mat** - Maturation data file for stocks listed in ***.msc.**
- ***.evo** - EV (Environmental Variability) scalar file for calibrated and projected brood year survival rates.
- ***.idl** - Inter-Dam Loss file for adjusting pre-spawning survival rates.
- ***.enh** - Enhancement file to simulate changes in enhancement activities.
- ***.cnr** - Chinook non-retention file to simulate mortalities in chinook non-retention fisheries.
- ***.pnv** - Percent non-vulnerable files to simulate size limit changes (one file for each fishery with size limit changes).
- ***.fp** - Fishery policy file with data for adjusting stock/fishery/year specific harvest rates.
- ***.cei** - Catch ceiling file to simulate changes in catch ceiling management.
- ***.monte** - Monte Carlo control file.
- ***.config** - Monte Carlo output configuration file.
- ***.riv** - River management parameters.
- ***.dlg** - A Print information and configuration file.
- ***.prn** - An output file that can be printed.
- ***.zhp** - help file.
- ***.isu, *.dll** - other files used to run the model in Windows.

Files need not be in the same directory. When doing analyses that require many runs of the model with incremental changes in specific parameters, it is convenient to store groups of files in separate directories.

If alternative directories are used, the ***.opt** file must contain path information for all the input and output files. The following sections describe the file structure in more detail.

File Structure Details

Files of type `*.opt`

The **`*.opt`** file contains the instructions for running the PSC Model. The **`*.opt`** file specifies the options employed, the input file names (and their paths if necessary), the structure of the Model run, and the output to be produced. Each line of the **`*.opt`** file contains an instruction followed by a comma and accompanying text description. Please note that inputs are not case sensitive, e.g., Y and y are considered identical. Input routines will automatically extract the data appearing before the first comma in each line; therefore, there are no limitations on the types of characters allowed in description fields for each line. For instructions requiring a yes or no answer, the first character of the first word is automatically examined, so you can use a large variety of terms if desired (e.g., n, N, nope, nada, not on your life, etc. are all interpreted as N).

The **`*.opt`** file is quite complex but is the backbone of data structure for the model. The actual number of lines may vary from file to file depending on the exact configuration. A line-by-line description of an example file is given in Fig. 2.1. The file is backwards compatible with the PSC Model **`*.opt`** file.

```
1     Example simulation run using the 9525 calibration.
2     1979 ,              START YEAR FOR MODEL RUN
3     2017 ,              NUMBER OF YEARS - 1 OR the final year
4     input/clb9401.bse,  BASE DATA FILE NAME
5     input/clb9401.stk,  STOCK DATA FILE
6     N    ,              A CALIBRATION RUN (Y OR N)
6a    input/mat94.msc,    Fixed maturation schedule
7     30   ,              NUMBER OF STOCKS WITH EXISTING EV SCALARS
7a    input/9525.evo,     Name of EV Scalar file
8     Y    ,              USE IDL FILE
8a    input/clb9501.idl,  File name for IDL
9     Y    ,              SAVE STATISTICS IN DISK FILES
9a    proto,              Prefix for save files (a good way to distinguish
                          runs)
9b    1    ,              Catch statistics (1=YES)
9c    1    ,              Terminal run stats (1=YES)
9d    1    ,              Escapement statistics (1=YES)
9e    0    ,              Ocn expl rate stats (0=No; 1=Total Mortality Method;
                          2=Cohort Method)
9f    0    ,              Total exploitation rate stats (0=No; 1=Total
                          Mortality Method; 2=Cohort Method)
9g    0    ,              Mortalities by stock & fishery (1=Yes)
9h    0    ,              Incidental mortality stats (1=Yes)
9i    1    ,              ABUNDANCE INDICES (# fisheries; followed by fishery
                          #'s)
9i(1) 1    ,              Southeast Alaska troll
10    header,             REPORT GENERATION INSTRUCTIONS
11    N    ,              Stock composition (Y/N)
12    Y    ,              RT (Y/N)
13    N    ,              Catch (Y/N)
14    0    ,              Stock/Fishery (0=N; 1=Total; 2=Catch; 3=TIM)
15    n    ,              Incidental mortality loss (Y/N)
16    N    ,              Terminal catch (Y/N)
17    N    ,              Escapement (Y/N)
18    n    ,              Exploitation rate (N=No; C=Cohort Method; T=Total
                          Mortality Method)
19    0    ,              Compare statistics to base year (1=YES)
20    N    ,              Document model setup (Y/N)
21    8    ,              NUMBER OF STOCKS WITH ENHANCEMENT CHANGES
21a   1    ,              Density Dependence (1=On)
21b   input/clb9501.enh,  File namedest Coast Vancouver Island
23e   input/ntrclb.pnv,   PNV file name Northern BC Troll
23f   input/gssclb.pnv,   PNV file name Georgia Strait Sport
24    clb9501.fp,         STOCK SPECIFIC FP FILE NAME
25    3    ,              MINIMUM AGE FOR TERMINAL RUN STATS (3=Adults;
                          2=Jacks)
26    Y    ,              CEILING STRATEGIES
26a   input/clb9501.cei,  File name for ceiling strategy
27    1995 ,              FIRST SIMULATION YEAR
28    Y    ,              MONTE CARLO CONFIGURATION SPECIFIED
28a   input/9525.monte,   Monte Carlo configuration file
29    N    ,              SAVE STATISTICS FOR SLCMc
30    N    ,              IN-RIVER MANAGEMENT STRATEGIES
```

Fig. 2.1 Sample `*.opt` file. The line numbers do NOT appear in the actual file.

The line specifications for the ***.opt** file are given below. Unless otherwise noted, CRiSP Harvest requires the same formats and supports the same output options as the original PSC Chinook Model on which it is based.

Line 1: Run Title (required). A run title provides a means to uniquely identify Model runs. The title can be up to 256 characters. There is no limitation on the types of characters that can be used.

Line 2: Start Year (required). The start year must match the start year used for calibration, usually 1979.

Line 3: Number of Years for Simulation (required). You can enter either: (a) the number of years (equal to the total number of years minus one since the model considers the first year to be zero; or (b) the last year for the simulation.

Line 4: ***.bse** File Name (required). The ***.bse** file contains basic information regarding the numbers and names of stocks and fisheries. The same ***.bse** file is normally used for all simulations once a model is calibrated. You enter only the name of this file. The file is prepared automatically when the model is calibrated and there is no further need to modify it.

Line 5: ***.stk** File Name (required). The ***.stk** file contains data for individual stocks. The same ***.stk** files is normally used for all simulations once a model is calibrated. Therefore, you enter only the name of this file. The file is prepared automatically when the model is calibrated and there is no need to modify it.

Line 6: Calibration Run (required). This line specifies whether or not the instructions are for a calibration run or a simulation run. Most end-user runs are simulation runs not calibration runs. Enter N for simulation runs and include line 6a.

Line 6a: ***.msc** file name. This file must be specified for simulation runs. Results of annual exploitation rate analyses indicate that maturation schedules can vary substantially from year to year. This information can be incorporated into the Model through the use of an ***.msc** file. The ***.msc** file identifies stocks with annual estimates of year-specific maturation schedules and provides the name of the file that actually contains the maturation data (***.mat**). The ***.mat**, ***.bse**, and ***.stk** files must correspond to a particular Model calibration; you must insure that the same maturation schedules are used for both calibration and model runs so that results will be compatible. You should enter “NONE” if the model was calibrated with no annual variation in maturation schedules.

Line 7: Number of Stocks With Existing EV Scalars (required). EV scalars are stock and year-specific survival factors of age 1 fish. For simulation runs, enter the number of stocks. All Model stocks should have EV scalars, so this number should be equal to the total number

of Model stocks (currently = 30). If this entry > 0 then include the following line in the ***.opt** file.

Line 7a: ***.evo** File Name. This file must be specified if Line 7 > 0. This file is produced during calibration. The ***.evo** file contains estimates of stock and brood specific productivity scalars up through the last year of available data (in 1995, up through the 1992 brood year), then uses estimates for all subsequent years. You can modify the EV's for years following the last estimated year using procedures described later. It is not necessary for the number of years of productivity scalars to be equal to the number of years of the simulation run as specified in the ***.opt** file (extra years of data at either end of the years in the simulation will be discarded).

Line 8: Use ***.idl** File (required). Enter Y or N as the model instruction for this line. This line should always read Y if Columbia River stocks are included.

Line 8a: ***.idl** File Name. If Y is entered on Line 8, enter the name of the ***.idl** file to use (see section 2.2.7 for format). If it reads N, this line should not be included in the ***.opt** file.

Line 9: Save Statistics (required). Enter Y or N as the model instruction for this line to control the generation of statistics in disk files. Disk files are useful for producing graphs or for computing differences in escapement or terminal run between model runs. If Line 9 reads Y, include the following lines in the ***.opt** file:

Line 9a: Prefix. Enter the prefix to be used to identify the disk files to be saved. The PSC Model will utilize up to 5 characters as the file identifier for each type of file specified in lines 9b through 9h. For example, if the prefix RUN92 is specified, then the ***.prn** output files will be named RUN92???.prn. (The default prefix is "PROTO")

Line 9b: Catch Statistics. Enter a 1 to save annual catch statistics for all fisheries on disk in file ***prefix*cat.prn**; enter 0 to skip generation of this disk file.

Line 9c: True Terminal Run Statistics. Enter a 1 to save true terminal run size annual statistics (i.e., terminal run size minus ocean net catches of age 4 and above) for all stocks on disk in the file ***prefix*trm.prn**; enter 0 to skip generation of this disk file.

Line 9d: Escapement Statistics. Enter a 1 to save annual escapement statistics for each stock on disk (saved in file ***prefix*esc.prn**); enter 0 to skip generation of this disk file. Statistics in this file will contain the size of adult escapements. [NOTE: When CRiSP Harvest is run in Monte Carlo mode, the median escapements are printed in this file.]

Line 9e: Ocean Exploitation Rate Statistics. This variable controls generation of annual adult equivalent exploitation rates by preterminal fisheries. Enter a 1 to save ocean exploitation rate statistics computed as a

proportion of catch plus escapement; enter a 2 to save ocean exploitation rates computed as a proportion of the total catch plus escapement plus incidental mortality loss; enter 0 to skip generation of this disk file. Statistics are generated for each stock and simulation year and saved in ***prefix*ohr.prn**.

Line 9f: Total Exploitation Rate Statistics. This variable controls generation of annual adult equivalent exploitation rates by all fisheries. Enter a 1 to save total exploitation rate statistics computed as a proportion of catch plus escapement; enter a 2 to save total exploitation rates computed as a proportion of the total catch plus escapement plus incidental mortality loss; enter 0 to skip generation of this disk file. Statistics are generated for each stock and simulation year and saved in ***prefix*thr.prn**.

Line 9g: Mortalities By Stock and Fishery. This variable controls generation of annual stock-specific mortalities by fishery. Statistics are generated for each stock and simulation year and saved in a set of files named ***prefix*???.prn**, where ??? represents the stock abbreviation (in capital letters). Permitted values for this variables are:

0 = Do not generate stock/fishery data files

1 = Total mortality

2 = Catch

3 = Incidental mortality

11 = Total mortality in adult equivalents

12 = Catch in adult equivalents

13 = Incidental mortality in adult equivalents

You can generate statistics for a specific list of stocks by listing the desired stock abbreviations after the code using blank spaces as delimiters in the list. For example:

```
1 STL FRL (...) , (... comments)
```

For a list of stocks and their abbreviations see "Stock Abbreviations" on page 2.85.

Line 9h: Incidental Mortalities By Fishery. This variable controls generation of annual incidental mortality statistics by fishery. Enter a 1 to save incidental mortality statistics; enter 0 to skip generation of this disk file. Three files are generated containing incidental mortality statistics for each fishery and simulation year: (a) ***prefix*tim.prn** contains total incidental mortality statistics; (b) ***prefix*lim.prn** contains incidental mortality statistics for legal-sized fish; and (c) ***prefix*sim.prn** contains incidental mortality statistics for sub-legal sized fish.

Line 9i: Abundance Indices (required). Enter the number of fisheries for which abundance indices are to be generated. The Model will

compute an abundance index that represents the expected catch (given size limit regulations, cohort sizes of individual stocks and ages, and 1979-1982 base period average harvest rates). Total abundance indices for each fishery will be contained in disk file ***prefix*abd.prn**. Abundance by stock for each fishery requested will be in the file ***prefix*coh.prn**. **[PSC Chinook Model only allowed 6 fisheries maximum per model run]**

If Line 9i > 0: Enter one line for each fishery for which an abundance index is to be computed. Each line consists of a fishery index number, followed by a comma and text description.

Line 10: Header (required). This line is included in the ***.opt** files just to increase readability by indicating the start of instructions for specifying formatted reports. All selected report types are combined into a single formatted report.

Line 11: Stock Composition Report (required). Use “Y” or “N” to instruct the model whether or not to generate stock composition reports. The disk file ***prefix*PRP.prn** will contain the stock composition report. [**NOTE: CRiSP Harvest does not support this option. Always enter "N" for CRiSP Harvest runs.]**

If Line 11 indicates "Y", then include the following lines in the ***.opt** file.

Line 11a:Number of fisheries for which stock composition estimates are to be generated (up to a maximum of 6).

Line 11b:Enter one line for each fishery for which stock composition estimates are to be computed. Each line consists of a fishery index number, followed by a comma and text description.

Line 12: RT factors (required). Enter "Y" or "N" to instruct the model whether or not to generate RT scalar reports. RT factors are computed for each fishery that is simulated to operate under a catch ceiling. RTs represent scalar values that are applied to base period fishery exploitation and harvest rates to generate catch ceilings (target catches) for all fisheries. The RT is calculated as the ratio (RT is an abbreviation for “ratio”) of the catch ceiling to the catch you would obtain given base period harvest rates and specified FP factors (Line 25). If FPs are unchanged, then an RT value greater than 1 indicates a harvest rate that is above based period levels, while an RT value less than 1 indicates a harvest rate that is below base period levels.

Line 13: Catch (required). Enter "Y" or "N" to instruct the model whether or not to generate reports on annual catches by fishery. [**NOTE: CRiSP Harvest does not support this option. Always enter "N" for CRiSP Harvest runs.]**

Line 14: Stock/Fishery Reports (required). This variable controls generation of reports on the distribution of stock-specific mortalities. Permitted values for this variable are:

0 = Do not generate stock/fishery reports

1 = Total mortality

2 = Catch

3 = Incidental mortality

11 = Total mortality in adult equivalents

12 = Catch in adult equivalents

13 = Incidental mortality in adult equivalents

Reminder: If the variable in line 9g is not zero, it will override the value specified in this line to assure consistency in disk file and report data and to conserve memory.

At the end of the simulation run, if you specify an output device for the report, prompts will appear to allow selection of stocks for which these reports are to be generated. If you do not specify an output device (i.e., use the model default), these reports will not be generated. [**NOTE: CRiSP Harvest does not support this option. Always enter 0 for CRiSP Harvest runs.]**

Line 15: Incidental Mortality Reports (required). Enter "Y" to instruct the model to generate reports on incidental mortality loss. Reports on total, legal, and sublegal mortalities will be generated if yes is specified. Enter "N" to skip generation of these reports. [**NOTE: CRiSP Harvest does not support this option. Always enter "N" for CRiSP Harvest runs.]**

Line 16: Terminal Catch Report (required). Enter "Y" to instruct the model to generate reports on catches by terminal fisheries. Enter "N" to skip generation of this report. [**NOTE: CRiSP Harvest does not support this option. Always enter "N" for CRiSP Harvest runs.]**

Line 17: Escapement Report (required). Enter "Y" to instruct the model to generate reports on adult spawning escapements by stock. Enter "N" to skip generation of this report. [**NOTE: CRiSP Harvest does not support this option. Always enter "N" for CRiSP Harvest runs.]**

Line 18: Exploitation Rate Reports (required). Enter C(ohort) to select generation of adult equivalent exploitation rate reports based on catch plus escapement; enter T(otal) to select generation of adult equivalent exploitation rate statistics based on catch plus escapement plus incidental mortality; enter "N" to skip generation of these reports. If Cohort or Total is selected, reports on ocean and total exploitation rates will be generated by year and stock. [**NOTE: CRiSP Harvest does not support this option. Always enter "N" for CRiSP Harvest runs.]**

Line 19: Compare to Base Year (required). This allows you to compare statistics to a single base year. If the line reads "Y", then a line must be added below to specify which year to use for the comparison. This option is seldom used; generally, you should specify "N". [**NOTE:**

CRiSP Harvest does not support this option. Always enter N for CRiSP Harvest runs.]

Line 19a: If line 19 indicates "Y", then include the year to use as the base, followed by a comma and a descriptor.

Line 20: Model Setup (required). This line should always read "Y". This will ensure that the output report includes a section that specifies all of the files and setup parameters for the Model run. [**NOTE: CRiSP Harvest does not support this option. Always enter N for CRiSP Harvest runs.]**

Line 21: Number of Enhanced Stocks (required). This line specifies the number of stocks with enhancement. If >0, then include the following lines:

Line 21a:Density Dependence. Enter 1 to indicate that production is considered to be density dependent for natural stocks that are supplemented by hatchery releases. Under most circumstances, this line will read 1.

Line 21b:.ENH File Name. Enter the name of the **`*.enh`** file containing specifications for enhancement.

Line 22: Number of CNR Fisheries (required). Enter the number of fisheries that have chinook non retention (CNR) regulations to be evaluated. If the number of CNR fisheries is > 0, then include the following line in the **`*.opt`** file:

Line 22a:.CNR File Name. Enter the name of the **`*.cnr`** file containing specifications for CNR fisheries.

Line 23: Number of Fisheries With Size Limit Changes (required). Enter the number of fisheries that have size limit changes. If this number > 0, then include the following:

Line 23a:enter one line for each fishery which has size limit changes.

Line 24: Fishery Policy File Name. Enter the name of the **`*.fp`** (fishery policy) file name containing stock, year, and fishery scalars that are to be applied to base period harvest rates. The **`*.fp`** file is a random access file created with the program **`creatfp3.bas`**. These scalars are used to model harvest rate management strategies and shaping options that disproportionately impact different stocks.

Line 25: Minimum Age for Terminal Run Stats. This line specifies the minimum ocean age of fish to be included in terminal run statistics. This line usually reads 3 (adults) as opposed to 2 (jacks).

Line 26: Ceiling Strategies. Enter "Y" or "N" to indicate whether or not catch ceilings are to be evaluated. If "Y", then add the following line to the **`*.opt`** file:

Line 26a: File Name for Ceiling Strategy. Enter the name of the file that contains the specifications for catch ceilings. Section 2.2.2 describes the format of the **`*.cei`** file.

Note: The following are options for running CRiSP Harvest. The PSC Chinook Model does not support the options described below. Leave the following lines blank when running the PSC Chinook (QuickBasic) model.

Line 27: First simulation year (FirstSimYr). This year is used to deactivate sliders during the calibration period. EV Scalars are deactivated for 1979 through FirstSimYr -3; harvest rate, PNV, and catch ceiling sliders are deactivated for 1979 through FirstSimYr - 1.

Line 28: Monte Carlo configuration specifications. Enter "Y" or "N" to indicate whether or not Monte Carlo runs are to be conducted. If "Y", then add the following line to the **`*.opt`** file:

Line 28a: File Name for the **`*.monte`** file. Enter the name of the file that contains the specifications for the Monte Carlo setup.

Line 29: SLCMc Statistics. Enter "Y" or "N" to indicate whether or not SLCMc statistics are to be saved. These statistics track catches of individual cohorts for selected stocks to simulate CWT recovery data. These data can then be used to estimate parameters required by the SLCMc model. See Section 2.6 for more details. [**NOTE: CRiSP Harvest does not support this option. Always enter N for CRiSP Harvest runs.]** If "Y", then add the following line to the **`*.opt`** file:

Line 29a: File Name for SLCMc statistics. Enter the name of the file that contains the specifications for SLCMc output.

Line 30: In-River Management. Enter "Y" or "N" to indicate whether or not in-river management strategies are to be included. These strategies include fixed escapement goals using strong, weak, or combined stock management and fixed combined harvest rate goals. If "Y", then add the following line to the **`*.opt`** file:

Line 30a: File Name for **`*.riv`** file. Enter the name of the file that contains the specifications for in-river management.

Files of type `*.bse`

The **`*.bse`** file (Fig. 2.2.) contains basic information regarding the numbers and names of stocks and fisheries and essential parameters from the calibration. The same **`*.bse`** file is normally used for all simulations once a model is calibrated. You enter only the name of this file. The file is prepared

automatically when the model is calibrated and there should be no further need to modify it.

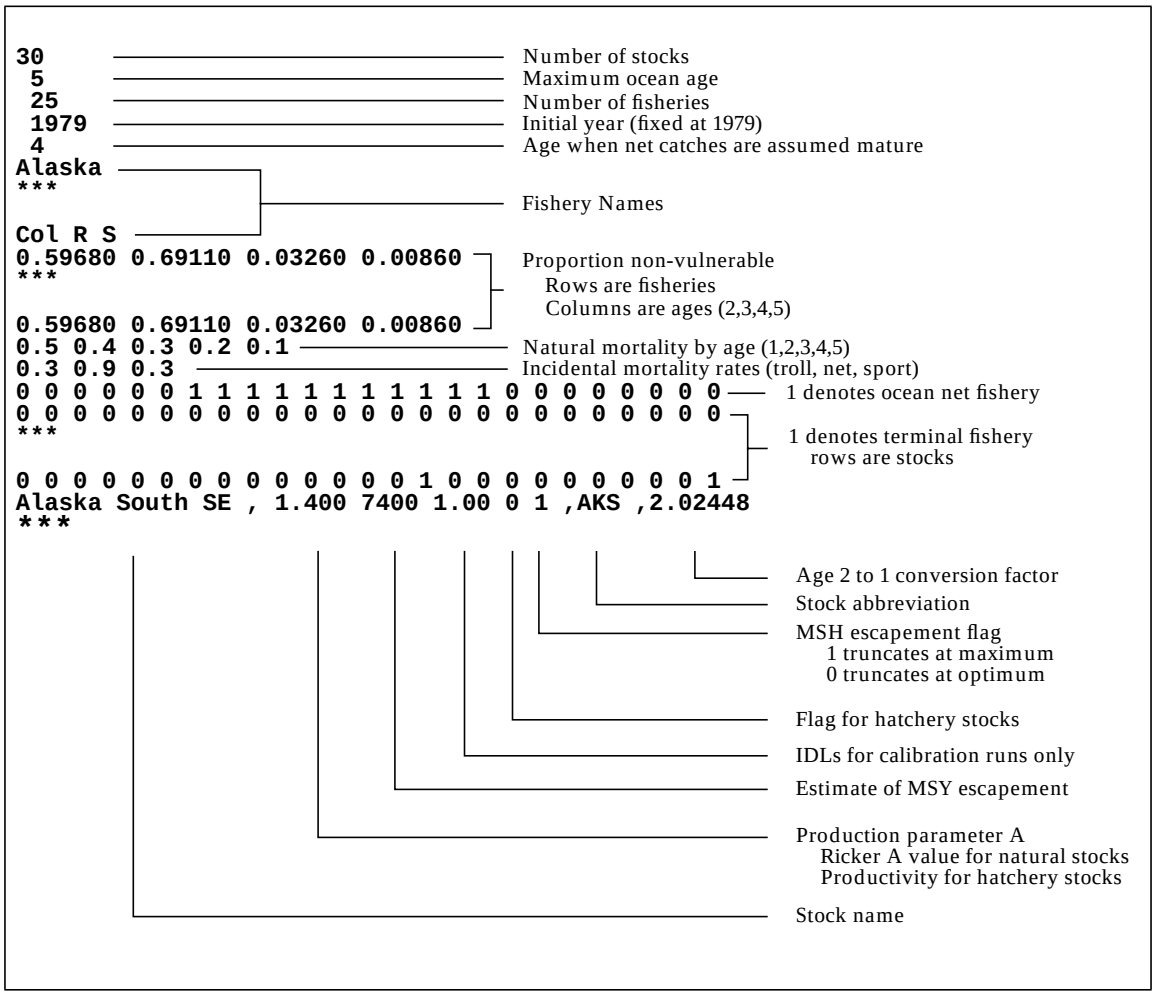


Fig. 2.2 Sample **`*.bse`** file.

Files of type `*.stk`

The **`*.stk`** file contains data for individual stocks (Fig. 2.3). This file is generally the same for all simulations after calibration. The elements of the **`*.stk`** file are shown in Fig. 2.2. A line-by-line description follows.

```
Line
1       AKS
2       0.16082775E+05 0.88410469E+04 0.42651133E+04 0.72223273E+03
3       0.53398825E-01 0.14530915E+00 0.69034618E+00 0.10000001E+01
4       0.58872306E+00 0.80788922E+00 0.96903467E+00 0.10000001E+01
5a      0.00000000E+00 0.41631317E+00 0.24833483E+00 0.25773025E+00
        ***

5y      0.00000000E+00 0.00000000E+00 0.00000000E+00 0.00000000E+00
        *** Repeat For Each Stock ***
```

Fig. 2.3 Sample **`*.stk`** file.

Line 1: Stock designator.

Line 2: Initial cohort abundance (age 2, 3, 4, and 5)

Line 3: Maturation rates (age 2, 3, 4, and 5)

Line 4: Adult equivalent factors (age 2, 3, 4, and 5)

Lines 5+: Fishery exploitation rates. Columns are ages (2, 3, 4, and 5) and rows are fisheries. These are the values that are viewed in the Base Period Harvest Rates dialog box.

Files of type `*.msc`

This file must be specified for simulation runs. Results of annual exploitation rate analyses indicate that maturation schedules can vary substantially from year to year. This information can be incorporated into CRiSP Harvest through the use of an **`*.msc`** file (Fig. 2.4). The **`*.msc`** file identifies stocks with annual estimates of year-specific maturation schedules and provides the name of the file that actually contains the maturation data (.MAT). The **`*.mat`**, **`*.bse`**, and **`*.stk`** files must correspond to a particular Model calibration; you must insure that the same maturation schedules are used for both calibration and model runs so that results will be compatible. You should enter "NONE" if the model was calibrated with no annual variation in maturation schedules.

```
hanford.mat , Name of maturation data file
AKS, Alaska Spring
BON, Bonneville
CWF, Cowlitz Fall
GSH, Georgia Strait Hatchery
LRW, Lewis River Wild
ORC, Oregon Coastal
RBH, Robertson Creek Hatchery
RBT, WCVI Wild
SPR, Spring Creek
URB, Columbia River Upriver Bright
WSH, Willamette Spring
```

Fig. 2.4 Sample **`*.msc`** file.

Line 1: Name of file containing annual maturity schedules, Descriptor

Lines 2,3,4,...:One line for each stock

Item 1: Stock abbreviation (see Introduction for list)

Item 2: Descriptor

Files of type `*.mat`

The **`*.mat`** file is used in conjunction with the **`*.msc`** file. See "**`*.msc`** File Structure" above. The information appears in blocks in the file (Fig. 2.5). Each block corresponds to a year and begins with the year in the first column followed by rows corresponding to each stock. Subsequent values on each row are the maturation rates and adult equivalents for the stock.

```
1979
  AKS,  0.0534 0.1453 0.6903 0.5887 0.8079 0.9690
  BON,  0.0000 0.2404 0.9877 0.5626 0.8418 0.9988
  CWF,  0.0011 0.1295 0.8170 0.5665 0.8132 0.9817
  GSH,  0.0340 0.3559 0.9533 0.6032 0.8690 0.9953
  LRW,  0.0515 0.1139 0.6604 0.5799 0.7987 0.9660
  ORC,  0.2627 0.1792 0.4807 0.6819 0.8017 0.9481
  RBH,  0.0914 0.1444 0.6035 0.5999 0.8096 0.9604
  RBT,  0.0914 0.1444 0.6035 0.5999 0.8096 0.9604
  SPR,  0.0171 0.4362 0.9635 0.6567 0.8845 0.9963
  URB,  0.0376 0.0508 0.4887 0.5886 0.7670 0.9489
  WSH,  0.0081 0.6895 0.9351 0.6395 0.9308 0.9935
1980
etc. for remaining years
```

Fig. 2.5 Sample **`*.mat`** file.

Col 1: Stock abbreviation.

Cols 2, 4, 6:Maturation rates (ages 2, 3, and 4)

Cols 3, 5, 7:Adult equivalent factors (ages 2, 3, and 4).

Files of type *.evo

The ***.evo*** files (Fig. 2.6) contain estimates of stock and brood specific productivity scalars (EV scalars) up through the last year of available data and then uses averages for all subsequent years. You can modify the EV's for years following the last estimated year using the dialog boxes (see "Dialog Boxes" on page 2.31) opened from the drop-down menus (see "Drop-Down Menus" on page 2.24) or by modifying the ***.evo*** file with a text editor.

EV values are approximately log-normally distributed and future versions of the model will incorporate this feature which will be useful for running the model in Monte Carlo mode when the model has to select a value for the EV for each stock for each year. The standard method is to "Bootstrap" the value from the historical values.

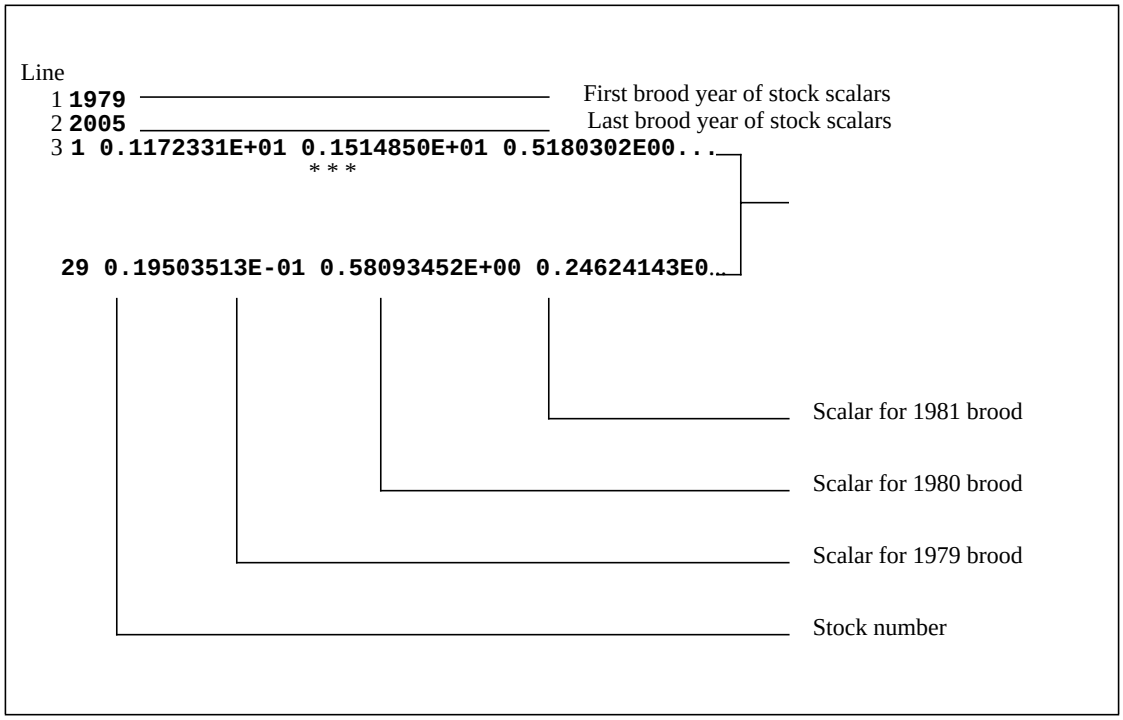


Fig. 2.6 Sample ***.evo*** file.

Line 1: First brood year for EV scalars

Line 2: Last brood year for EV scalars

Line 3: EV scalars

Item 1: Stock number

Item 2,3,4,...: EV scalars (one for each year)

Files of type `*.idl`

Effects of post-fishery, pre-spawning mortality can be examined through use of **`*.idl`** files. Currently, this file (see Fig. 2.7) only includes estimates of inter-dam loss for Columbia River stocks. Since most inter-dam loss occurs after all fisheries, inter-dam loss is essentially treated as escapement when calculating ocean and terminal area harvest rates. Changes in estimates of inter-dam loss rates can be assessed by modifying this file. It should be noted, however, that the numbers in the **`*.idl`** files are actually estimates of total adult *survival* past all Columbia River dams. Estimated IDL values are used through the present year, then an average of all estimated values is used for future years.

```
3
URB
1973
1994
0.993,1.036,0.613,1.194,1.279,0.930,0.923,0.535,0.475,0.501,0.804,0.8
79,0.943,0.952,0.867,0.922,0.856,0.790,0.733,0.874,0.815,0.809
SPR
1973
1994
0.550,0.550,0.743,0.362,0.488,0.402,0.518,0.859,0.626,1.002,0.666,0.5
45,0.355,1.003,1.020,1.026,0.981,0.975,0.636,0.655,0.853,0.969
LYF
1973
1994
0.519,0.545,0.202,0.286,0.702,1.419,0.626,0.319,0.222,0.286,0.390,0.9
10,0.507,0.308,0.331,0.273,0.336,0.339,0.209,0.466,0.603,0.750
```

Fig. 2.7 Sample **`*.idl`** file.

Line 1: Number of stocks with IDL factor.

For each stock, sets of 4 data lines:

Line 2: Three character identifier for stock (defined in **`*.bse`** file)

Line 3: First year for start of IDL scalars

Line 4: Last year for IDL scalars

Line 5: Post-fishery, prespawning survival, one entry per year

Files of type `*.enh`

The **`*.enh`** file (see Fig. 2.8) has information on changes in enhancement schedules for hatchery and natural supplementation programs. Modifications of the **`*.enh`** file can be made either: (1) to incorporate actual changes in the enhancement schedule; (2) to assess possible changes in enhancement. All

enhancement changes are relative to average levels during the 1979-1981 base period.

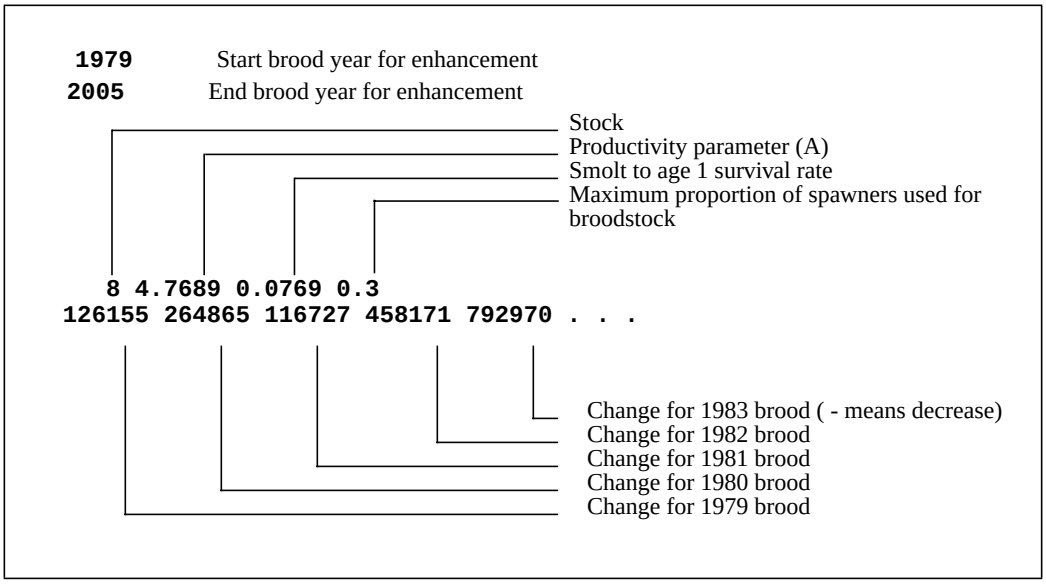


Fig. 2.8 Sample ***.enh** file

Line 1: First year for enhancement changes, Descriptor

Line 2: Last year for enhancement changes, Descriptor

Line 3: For each stock with enhancement changes, include 2-line sets of data

Item 1: Stock number

Item 2: 'A' value for enhancement productivity, simulated using exponential function (e^a)

Item 3: Smolt to age 1 survival

Item 4: Maximum proportion of spawners that can be used for broodstock (used for supplementation).

Line 4: This line must contain one data element for each year in the period indicated by lines 1 and 2. Data entry values represent smolt production changes from the base period by brood year (measured as yearly releases minus average base period releases).

Files of type *.cnr

Management agencies have implemented non-retention restrictions to prevent the catch in a fishery from exceeding an established ceiling. These chinook non-retention (CNR) fisheries result in incidental mortality losses of

adults and juveniles. The format of the ***.cnr** file (see Fig. 2.9) is described below.

```
Line
1  1979 , Start year
2  2005 , end year
3  1 , Fishery index
4  0.34    ,        1, Legal Sublegal Selectivity
5a  0      ,        NO CNR encounters / year = 1979
5b  0      ,        NO CNR encounters / year = 1980
5c  1      ,        2, 18225, 18578, 248800 ... = 1981
 ...
3  2 , Fishery Index
4  0.2 , 1, Legal Sublegal Selectivity
5a ...
```

Fig. 2.9 Sample ***.cnr** file

Line 1: First year for CNR data, Descriptor

Line 2: Last year for CNR data, Descriptor

Sets of data for each CNR fishery

Line 3: Number of fishery with CNR regulations, Descriptor

Line 4: Legal selectivity scalar, Sublegal selectivity scalar, Descriptor

Selectivity scalars are used to compensate for changes in fleet behavior during CNR restrictions. Scalar values are all relative to 1.0 (no change). Values in the example above indicate a 66% reduction in impacts on legal-sized chinook retention.

Line 5: Specifications for CNR fisheries, one for each year

Currently, there are three different methods that can be used to calculate CNR mortality. Each method requires different types of data. The section that follows details how to describe this data in the ***.cnr** files.

Methods for determining CNR mortality

Method 0 ("RT Method") estimates CNR mortality through ratio (RT) factors generated by the Model. RT factors represent the ratio between harvest rates associated with a catch ceiling and base period rates. Consequently, RTs can be considered as surrogate indicators for season length. If the RT method is selected, the Model estimates CNR mortality of legals and sublegals by multiplying mortalities associated with the catch ceiling by the selectivity scalars and mortality rates appropriate for the gear involved. This method is generally applied when no other data are available or when projecting regimes into the future. If this method is used, Line 5 will have the following format:

Item 1: Flag for CNR fishery (0 = no CNR fishery; 1 = CNR fishery)

Item 2: CNR method (0 = RT method; 1 = Season length; 2 = encounters)

Item 3: Descriptor

e.g. `1, 0, CNR RT 1990`

Different CNR mortality methods can be used to determine how mortalities are calculated during the calibration period. during the simulation period, however, the current version of CRiSP Harvest uses the "RT Method" exclusively.

Method 1 ("Season Length Method") can be used to model past seasons when only information about season length is available. This method uses the ratio of regular season length to the CNR season length.

Item 1: Flag for CNR fishery (0 = no CNR fishery; 1 = CNR fishery)

Item 2: CNR method (0 = RT method; 1 = Season length; 2 = encounters)

Item 3: Season length (days)

Item 4: CNR Season length (days)

Item 5: Descriptor

e.g. `1, 1, 60, 9, Season length/legal season/ CNR days for 1990`

Method 2 ("Encounter Rate Method") is used when specific data on encounter rates are available. To use this method, you must enter the following data.

Item 1: Flag for CNR fishery (0 = no CNR fishery; 1 = CNR fishery)

Item 2: CNR method (0 = RT method; 1 = Season length; 2 = encounters)

Item 3: Encounters of legal sized fish during CNR fishery

Item 4: Encounters of sublegal sized fish during CNR fishery

Item 5: Total landed catch in fishery

Item 6: Descriptor

e.g. `1, 2, 18225, 18578, 248000, Enc./Est of CNR enc/year = 1990`

Files of type `*.pnv`

A separate **`*.pnv`** file (see Fig. 2.10) is created for each fishery in which one or more changes in the minimum size limit have occurred since the base period. The proportions in a **`*.pnv`** file replace those proportions in the **`*.bse`** file for each fishery specified by a **`*.pnv`** file.

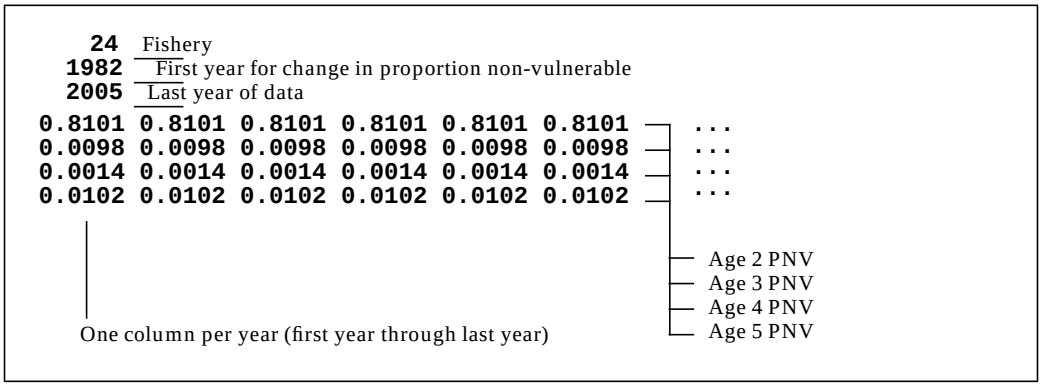


Fig. 2.10 Sample **`*.pnv`** file

Files of type `*.fp`

The **`*.fp`** files are used for detailed Fishery Policy (Harvest Rate) scalars that alter the impact of a given fishery on the stocks on a year-by-year basis. The format is to place all of the FP values in a block for a year. Each year has a separate block. Within each block the 30 rows are for the 30 stocks and each of the 25 columns is one of the fisheries. There are no other flags, values or tokens in this file.

Files of type `*.cei`

The ***.cei** files (see Fig. 2.11) is used to set catch ceilings which are the primary means selected by the PSC to reduce stock exploitation rates. The ***.cei** file is used: (1) to specify fisheries with ceilings; (2) to set ceiling levels (catch levels); and (3) to allow you to force Model catches to equal the ceiling.

```
1979       ,        Start of base period
1984       ,        End of base period
1985       ,        First year of ceiling management
1998       ,        Last year for ceiling management
11         ,        Number of fisheries with ceilings
7          ,        Number of ceiling level changes
1986 1987 1988 1990 1991 1992 , years to change ceilings
.................. S.E. Alaska Troll (excluding hatchery add-ON)......
1          ,        1st Fishery Number
           338000   ,1979,catch
                    ... continue for each year
           230712   ,1990,catch
           162995   ,1992, THROUGH LAST YEAR OF CLG MGMT
           8        ,Number of years to force ceilings
           1985 1986 1987 1988 1989 1990 1991 1992 , years to force
.................. (etc for remaining Fisheries)
```

Fig. 2.11 Sample **`*.cei`** file.

Line 1: Start of base period. The Model computes average catches during a user-specified based period and then compares subsequent ceiling levels with these averages.

Line 2: End of base period.

Line 3: First year for ceiling management to be applied.

Line 4: Last year for ceiling management to be applied. After the last year, the Model will use RT factors associated with the last ceiling level to constrain fishery exploitation/harvest rates.

Line 5: Number of fisheries with ceilings.

Line 6: Number of changes in ceiling levels.

Line 7: Years in which ceiling levels are changed.

Lines 8a through 8r: One set per ceilinged fishery.

Line 8a: Header to improve readability. Contents are ignored by the Model.

Line 8b: Number of Ceilinged Fishery, descriptor.

Lines 8c-8p: Ceiling level (Catches), year, descriptor.

Line 8q: Number of years to treat ceilings as quotas ("forcing"). When a ceiling is not treated as a quota, the harvest rate in a fishery will be held at or below base period levels as modified by the **`*.fp`** file. Under conditions of low abundance, catches will be less than the ceiling level if base period harvest rates are maintained. If the ceiling is forced, then the harvest rate in the fishery is allowed to increase so that the ceiling is reached. In most circumstances, all ceilings are forced all years.

Line 8r: Years to treat ceiling as quotas, followed by descriptor.

Files of type `*.monte`

The **`*.monte`** file (see Fig. 2.12) uses a token based structure and hence the specific keywords are expected by the file parser. The **`*.monte`** file is used to configure the model for Monte Carlo simulations. See "Running the model in Monte Carlo mode" on page 2.39.

```
monte Log Normal Indep
 seed 14297
 games 250
 start_year 1993
 track escapement
 output_config_file log.config
end monte
```

Fig. 2.12 Sample *.MONTE file.

Line 1: Keyword “monte” followed by a second keyword (“Bootstrap” or “Log Normal Indep.”) describing the type of sampling method to use for EV scalars.

If the “Bootstrap” method is used, then for each year during the simulation period (i.e., future years) this method randomly selects a year from the calibration period (e.g. 1979-1991), with each calibration year having equal probability of being selected. For each stock, the program then sets the EV Scalar for the simulation year equal to the EV Scalar value for that stock in the selected calibration year. For example, if the simulation year is 2002 and the calibration period is 1979-1991, the program randomly selects a year between 1979 and 1991, say 1983. For each stock, the program then sets the EV Scalar in year 2002 to the same value used in year 1983. The basic idea of this method is to allow for correlations between stocks. Instead of letting the EV Scalars vary independently, this methods says "lets make future year 2002 look just like year 1983 for all stocks."

If the “Log Normal Indep.” method is used, then for each year during the simulation period (i.e., future years), the model randomly selects EV Scalars for each stock from a log normal distribution unique to that stock. The two parameters defining each stock's log normal distribution are included in the **`*.evo`** file and typically are estimated from the calibration period EV Scalars computed during the calibration process. This method allows the EV Scalars for each stock to vary independently.

Line 2: Keyword “seed” followed by a random number seed value (an integer)

Line 3: Keyword “games” followed by the number of “games” or simulations to be “played” (run).

Line 4: Keyword “start_year” followed by the first year in which the random EV scalars are to be used. The EV Scalars (brood year survival rates) can only be estimated after all the age classes from a given brood year have returned to the spawning grounds (five year lag). For example, once the data for 1996 have been gathered it is possible to estimate the EV Scalars for the brood year 1991, but not for brood years 1992-1995. In this example, the “start_year” should be set to 1992.

Line 5: Keyword “track” followed by the type of output to be tracked. Currently, only “escapement” can be tracked during monte carlo runs so this line must read “track escapement”.

Line 6: Keyword “output_config_file” followed by a filename in which the data will be stored.

Line 7: Keyword “end monte”.

Files of type `*.config`

The **`*.config`** file (see Fig. 2.13) is used to configure output from Monte Carlo runs.

```
config
 output escapement
 stocks 1 LYF
 years 2 1998 2017
 end output
 output escapement_quantiles
 stocks 1 LYF
 end output
end config
```

Fig. 2.13 Sample *.CONFIG file.

Line 1: Keyword “config”.

Line 2: Keyword "output" followed by keyword "escapement". This tells the program to store the escapement data for all games for the stocks and years given in lines 3 and 4 below.

Line 3: Keyword "stocks" followed by the number of stocks to store outputs for and a list of the stock abbreviations (e.g., LYF, URB). The stock abbreviations must be the same as the ones used in the *.BSE file.

Line 4: Keyword "years" followed by the number of years to store outputs for and a list of the years.

Line 5: Keywords "end output".

Line 6: Keyword "output" followed by keyword "escapement_quantiles". This tells the program to compute and store the median and 75th and 95th quantiles of the escapements from all games for the stocks listed in line 7 below.

Line 7: Keyword "stocks" followed by the number of stocks to store outputs for and a list of the stock abbreviations (e.g., LYF, URB). The stock abbreviations must be the same as the ones used in the **`*.bse`** file.

Line 8: Keywords "end output".

Line 9: Keywords "end config".

Files of type `*.riv`

The **`*.riv`** file (see Fig. 2.14, Fig. 2.15 and Fig. 2.16) uses a token based structure and hence the specific keywords are expected by the file parser. The **`*.riv`** files are used to specify the management parameters controlling in-river harvest.

Fixed Escapements, Weak Stock Management

```
policy fixed_escapement
 river Columbia

           fishery Col R N
           mgmt_type weak
           mgmt_years 1995 1996 1997 1998 1999
           forced_years 1995 1996 1997 1998 1999
           stock URB
            mgmt_idls 0.815 0.815 0.815 0.815 0.815
            escapements 45000 45000 45000 45000 45000
           end (stock)
           stock LYF
            mgmt_idls 0.815 0.815 0.815 0.815 0.815
            escapements 1500 1500 1500 1500 1500
           end (stock)

 end (river)
end (policy)
```

Fig. 2.14 Sample **`*.riv`** file for fixed escapement, weak stock management.

Fixed Escapements, Combined Stock Management

```
policy fixed_escapement
 river Columbia

           fishery Col R N
           mgmt_type combined
           mgmt_years 1995 1996 1997 1998 1999
           forced_years 1995 1996 1997 1998 1999
           escapements 45000 45000 45000 45000 45000
           stock URB
            mgmt_idls 0.815 0.815 0.815 0.815 0.815
           end (stock)
           stock LYF
            mgmt_idls 0.815 0.815 0.815 0.815 0.815
           end (stock)

 end (river)
end (policy)
```

Fig. 2.15 Sample **`*.riv`** file for fixed escapement, combined stock management.

Fixed Escapements, Fixed Harvest Rate Management

```
policy combined_harvest_rate
 river Columbia
           fishery Col R N
           mgmt_years 1995 1996 1997 1998 1999
           forced_years 1995 1996 1997 1998 1999
           harvest_rates 0.15 0.15 0.15 0.15 0.15
           stock URB
            mgmt_idls 0.815 0.815 0.815 0.815 0.815
           end (stock)
           stock LYF
            mgmt_idls 0.603 0.603 0.603 0.603 0.603
           end (stock)
 end (river)
end (policy)
```

Fig. 2.16 Sample **`*.riv`** file using combined fixed harvest rate management.

Appendix: 2.2 - CRiSP Harvest Output Files

Depending on the configuration of the model as specified by the ***.opt** file. One or more of the following files may be produced.

*prefix***???.prn**	Stock specific mortality by year (rows) and fishery (columns)
*prefix***abd.prn**	Abundance indices in blocks for each fishery by years for the fisheries specified for abundance generation in the ***.opt** file (lines 9i+)
*prefix***cat.prn**	Catch by year (rows) and fishery (columns)
*prefix***coh.prn**	Abundance indices in blocks for the fisheries specified for abundance generation in the ***.opt** file (lines 9i+) by year (rows) and stock (columns).
*prefix***esc.prn**	Spawning escapement by year (rows) and stock (columns)
*prefix***lim.prn**	Incidental mortality estimates of legal sized chinook by year (rows) and fishery (columns).
*prefix***ohr.prn**	Adult equivalent total exploitation rates by year (rows) and stock (columns). Notes: this does not include shaker losses. The values in this file are affected by the selection of method in line 9f of the ***.opt** file.
*prefix***sim.prn**	Incidental mortality estimates for sub-legal sized chinook by year (rows) and fishery (columns).
*prefix***thr.prn**	Adult equivalent total exploitation rates by stock and year. See notes for *prefix***ohr.prn**.
*prefix***tim.prn**	Total incidental mortalities by year (rows) and fishery (column)
*prefix***trm.prn**	Terminal run by year (row) and stock (column) This is affected by the choice of “minimum age for terminal run stats” in the ***.opt** file.

Appendix: 2.3 - Editing CRiSP Harvest Files

It is important to retain the file extensions for the CRiSP Harvest parameter files. The extensions identify the type of file to the executable. Unfortunately, Windows NT and Windows 95 try to associate an application with each type of file. The best editor for looking at and editing these ASCII files is called WordPad but it is not the default application for any of the files. Currently, the filename extensions used for various CRiSP Harvest files help identify the type of file and allow cross-platform compatibility between PC and Unix versions of the model.

To use WordPad to look at or edit the CRiSP Harvest ASCII files you do one of the following:

Launch WordPad and then open the file

1. From the Windows Start menu select “Programs”.
2. Select “Accessories”.
3. Select “WordPad”.
4. Open CRiSP Harvest ASCII files using the Open command on the File menu.

Attempt to associate individual file types with an application

Note: not all files with various extensions used by CRiSP Harvest can be mapped to a specific application. Some of these extensions are reserved.

1. Highlight the file from an Explorer window.
2. Select “Options...” from the “View” menu.
3. Select the “File Types” tab.
4. Click “New Type...”
5. Follow dialog box instructions.
6. Be sure to add “Open” to the Actions list and choose “**`c:\program files\accessories\wordpad.exe`**” as the application.

Appendix: 2.4 - Glossary

Table 2.4 Some terms used in CRiSP Harvest.

Term	Definition
Abundance Index	The expected catch given the current year size limits and cohort sizes but the base period (1979-1981) harvest rates.
Adult Equivalence Factors	Used to adjust fishery catches to a common impact on the spawning stock. For example, on average a three year old fish harvested by an ocean fishery has less impact on the spawning stock than a five year old fish harvested by a river fishery, because some three year old fish would normally die of natural causes before they had an opportunity to spawn. Thus, one three year old fish eliminated from the ocean catch will result in less than one additional fish in the spawning stock, whereas one five year old fish eliminated from the river catch will result in one additional fish in the spawning stock.
Adult Escapement	Terminal Run fish that survive the terminal fisheries and pre-spawning mortality. Age two fish returning to the river are not considered reproductively viable and are not included in the adult escapement for each stock.
Base Period Harvest Rate	Average stock, age, and fishery specific harvest rate between 1979-1982. Harvest Rate scalars are relative to this rate.
Brood Year	The year in which a fish was propogated or spawned (i.e., the year in which the eggs were fertilized). Chinook salmon typically migrate downstream the following year (most Fall chinook), or the year after (most Spring chinook).
Catch Ceilings	Maximum catch (numbers of fish) for a fishery or group of fisheries for a specified time period. These are not established for specific stocks. This is the Pacific Salmon Commission's primary management tool.
Chinook Non-Retention Mortalities	Mortalities of legal and sub-legal chinook that are caught and brought up to the boat in coho fisheries at times when it is not legal to land and sell any chinook.
CNR (mortalities)	See Chinook Non-Retention Mortalities.

Table 2.4 Some terms used in CRiSP Harvest.

Term	Definition
Coded-Wire-Tag (CWT)	Tiny wire tags (1.0 x 0.25 mm) inserted in the nose cartilage of salmon fingerlings or fry, typically in the hatchery, to identify the origin of an individual fish. Each tagged fish has the adipose fin clipped to indicate that it has a CWT in its snout. Scientists use CWT recoveries to estimate harvest rates and migration patterns.
Cohort	A group of fish that have the same demographic characteristics, such as belonging to the same age class of a given stock.
Cohort Analysis	Same as Virtual Population Analysis.
Enhancement	Production of fish at facilities such as hatcheries.
Escapement	Fish that are not caught by any fisheries (i.e, they "escape" the fisheries).
EV Scalar	Scalars used to adjust the average production of age one fish by a spawning stock to account for inter-annual Environmental Variability (EV).
Gillnet	A harvest method in which fish are trapped in a net stretched across their migration path. The net may either be set from a drifting boat (drift gillnetting) or from a fixed position (set gillnetting). The fish become entangled by their gill plates or jaws, and can neither back out nor move forward.
Harvest Rate Scalars	Scalars used to adjust the harvest rate during a given year compared to the Base Period.
IDL (rate)	See Inter-Dam Loss rate.
Inter-Dam Loss rate	These are actually *survival* rates between the last fishery and the spawning grounds. Also called the Pre-spawning mortality. IDLs are stock specific, but are not age (or size) specific. This mortality is applied to Columbia River stocks that spawn upriver from dams and is assessed after fishing mortality to account for losses between dams.
Legal (size)	Above a certain size criteria.

Table 2.4 Some terms used in CRiSP Harvest.

Term	Definition
Maturation Rates	The proportion of a stock that is mature and ready to return to the spawning ground. These are age and stock specific and can vary across years as well. However the model does not allow for age 6 fish so the MR for age 5 fish should always be 1. The stock that is mature is considered the terminal run.
Natural Ocean Mortality	Non-fishing mortality assessed at the beginning of each year in the model. This mortality is age specific, but not stock specific.
Net Fisheries	In CRiSP Harvest, this refers to fisheries using gillnet and purse seine gears.
Pacific Salmon Commission	International regulatory agency created by the 1985 Pacific Salmon Treaty between the United States and Canada with responsibility for management of North American salmon stocks and fisheries.
Percent Non-Vulnerable	Fraction of a cohort that is below the legal size limit. PNVs vary by year, age, and fishery, but not by stock.
PNV	See Percent Non-Vulnerable.
Pre-Spawning Mortality	See Inter-Dam Loss.
Preterminal (catch)	Catch that occurs before the mature segment of a cohort begins migrating back to the spawning grounds. Thus, preterminal catches are primarily ocean catches.
PSC	See Pacific Salmon Commission.
Purse Seine	A commercial fishing system in which a school of fish are encircled by a vertically hanging net and then are trapped by closing the bottom of the net (pursing).
Recruitment	Fish from a given stock that become available (i.e., recruit) to a fishery.
Recruitment Age	The age at which fish from a given stock become available to a fishery.
Ricker Function	A popular type of Spawner/Recruit Relationship (named after Dr. William Ricker) in which the number of recruits per spawner declines exponentially. The resulting curve has a desending right hand limb (i.e., too many spawners produce fewer recruits).

Table 2.4 Some terms used in CRiSP Harvest.

Term	Definition
Shakers	Sublegal chinook that are caught (i.e., hooked and brought up to the boat) and released (i.e., "shaken" off the gear) during directed chinook fisheries.
Spawner/Recruit Relationship	A mathematical relationship between the number of spawners in a given year and the resulting number of progeny that become available (i.e., recruit) to the fisheries in some future year. Usually estimated from historical data and used in simulation models to predict future recruitment from a given spawning stock.
Sub-legal (size)	Below a certain size criteria.
Supplementation	Artificial propogation intended to reestablish or increase the abundance of natural populations.
Terminal Catch	Catch of the mature segment of a cohort as it migrates back to the spawning grounds. Some ocean net catches that occur in nearshore waters are considered terminal catches.
Terminal Run	Mature fish leaving the open ocean and returning to the spawning grounds. Compare to True Terminal Run.
Total Catch	Sum of the Preterminal and Terminal catches.
Troll	A commercial harvest method for chinook and coho salmon, usually in the open ocean, that captures individual fish on lures or baited hooks being slowly pulled through the water.
True Terminal Run	The Terminal Run minus nearshore ocean net catches. Thus, it is the number of fish entering the natal river (as opposed to the number of mature fish leaving the ocean feeding areas). Compare to Terminal Run.
Virtual Population Analysis	A technique (sometime referred to as VPA) for reconstructing the history of a cohort of fish. By counting the number of spawners and the catches and making estimates of the natural mortalities it is possible to reconstruct the history of a cohort.

Appendix: 2.5 - Stock Abbreviations

The stocks are listed alphabetically by their three letter code and cross-referenced to their number and name. The numbers are used in place of the abbreviations in some of the parameter files. The stocks appear in numerical order in the drop-down menu of stocks on the CRiSP Harvest toolbar.

Abbreviation	Number	Stock Name
AKS	1	Alaska South SE
BON	21	Lower Bonneville Hatchery
CWF	22	Fall Cowlitz Hatchery
CWS	25	Spring Cowlitz Hatchery
FRE	3	Fraser Early
FRL	4	Fraser Late
GSH	9	Upper Straight of Georgia Hatchery
GSQ	7	Upper Straight of Georgia
GST	8	Upper Straight of Georgia Natural
LRW	23	Lewis River Wild
LYF	29	Lyons Ferry
MCB	30	Mid-Columbia River Brights
NKF	10	Nooksack Fall
NKS	14	Nooksack Spring
NTH	2	North/ Central BC
ORC	27	Oregon Coast
PSF	11	Puget Sound Fingerling
PSN	12	Puget Sound Natural F.
PSY	13	Puget Sound Yearling
RBH	5	West Coast Vancouver Island (WCVI) Hatchery
RBT	6	West Coast Vancouver Island (WCVI) Natural
SKG	15	Skagit Wild

Abbreviation	Number	Stock Name
SNO	17	Snohomish Wild
SPR	20	Spring Creek Hatchery
STL	16	Stillaguamish Wild
SUM	26	Columbia River Summers
URB	19	Columbia Upriver Brights
WCH	18	Washington Coastal Hatchery
WCN	28	Washington Coastal Wild
WSH	24	Willamette River