VIT (windows version): Software for fisheries analysis

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PREPARATION OF THIS DOCUMENT AND THE SOFTWARE

The program VIT was originally created for MS-DOS in FORTRAN. The program and the models underlying it were conceived for the analysis of fisheries where the time depth of the information available is limited and where the technical interaction among fishing gears is an important facto to account for. Due to the interest shown by fisheries sicentists working with fisheries of similar characteristics, the program VIT was first published in Spanish (Lleonart and Salat 1992) and later in English as volume 11 of the FAO Computerized Information Series (FAO, 1997).

For this release of the VIT program, the code has been revised and rewritten in Borland's Delphi 3.0 and implemented in MS Windows 95/98/NT. The new implementation has striven for compatibility with the original version, while some improvements have been added, specially regarding the data management routines (input), and the tables and graphics output.

ACKNOWLEDGEMENTS

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ABSTRACT

The program VIT is designed for the analysis of marine populations, exploited by one or several gears, based on single species' catch data (structured by age or size). The main assumption underlying the model is that of steady state, because the program works with pseudo-cohorts and it is therefore not suitable for historical data series. The program uses the catch data and ancillary parameters for rebuilding the population of the species and the mortality vectors affecting it by means of Virtual Population Analysis (VPA). Once the virtual population has been rebuilt, an analysis of the fishery can be carried out with the aid of several tools: Comprehensive VPA results, Yield-per-Recruit analysis based on the fishing mortality vector, analysis of sensitivity to parameter values and transition analysis. The latter permits non-equilibrium analysis of how a shift in exploitation regime is reflected in the fisheries. All these tools can be applied to specific studies of competition among fishing gears.

The program can be used to carry out the numerical analysis, the edition of data and parameters, to obtain an age-structured data file from a size-structured data file and to visualize results. The results can also be exported to other Windows applications to refine specific details of the analysis or for the final presentation of the results.

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1 INTRODUCTION

A number of packages are available to the fisheries biologist for the analysis of exploited marine populations, based on the methods and models of population dynamics. Often, the large amount of data needed to run such programs restrict in practice their use, as is the case in many fisheries, where long historical series are not available or are of poor quality. At this point, the fisheries biologist may choose to wait until a good-quality data set becomes available, or use whatever data is at hand and try to ascertain something about the fisheries under study with less restrictive models and programs. Needless to say, the VIT program is intended for the latter fisheries biologists.

In order to use appropriately the VIT software and obtain the maximum information from it, it is necessary to understand the hypotheses and assumptions underlying the models used. First, when a long time series is not available, it is necessary to assume that the fishery is in steady state, or equilibrium. Thus the size structure of the stock is identical to the size structure of the cohorts (and in this case, they are known as pseudo-cohorts). This is clearly a very restrictive hypothesis, because in general, the population is not in equilibrium, as neither recruitment nor mortality is constant over time. To understand these hypotheses does not eliminate the errors derived from them, but helps make a well-founded interpretation of the results and produce an objective assessment of the population under study.

2 PROGRAM OVERVIEW

The main objective of the VIT program is to study the dynamics of a single species' population subject to exploitation. This study is conducted by means of pseudo-cohort analysis on frequency data and ancillary parameters. More particularly, VIT helps study variations in the exploitation rate, the interaction among fishing gears and the reaction of the population to changes in the exploitation pattern. The models behind the VIT program are Virtual Population Analysis and Yield per Recruit models. The theory was sufficiently well presented in previous releases of this program (FAO 1997, Section 5) and is not retaken here. See also standard textbooks on marine population dynamics and fisheries, such as Beverton

and Holt (1957), Ricker (1975), Laurec and Le Guen (1981), Pitcher and Hart (1982) and Sparre et al. (1989).

The program starts by conducting a VPA and reconstructing the population under the assumption of steady state. Two methods of pseudo-cohort analysis exist: The classic catch equation (Gulland 1965) and Pope's cohort analysis (Pope 1972). Both methods can be used in the program VIT, either on catch-at-age or catch-at-length data.

The program follows by proposing Y/R analyses on the rebuilt population, or studying the transient effects of changes in the fishing patterns or the effort level on a non-equilibrium population. The sensitivity of the parameters can also be analyzed in the program VIT. Due to the assumption of steady state, it is not possible to work on time series data.

The data required for these analyses consist of age or length frequency distribution for one or more fishing gears. The sample distributions are assumed to be representative of the catch for the period of the analysis (in general, one year). The class interval is fixed for age or size classes, but the last class can be open and is called the plus class (+ class). It contains all individuals above a given value or age or size.

The ancillary parameters of the population under study comprise: The parameters of von Bertalanffy's growth equation, the parameters of the length-weight relationship, the vectors of natural and fishing mortalities, sexual maturity ratio, and catch proportions by each fishing gear.

The program is structured in two parts: First data and parameters are created, modified or retrieved in order to create a data structure on which to run a VPA. The parameters can be modified at any time during the program's execution. There is no need to specify an output file name, as the results can be copied or displayed at any time during the execution of the program and saved in other applications, such as MicroSoft Word and Excel. The results can be displayed synthetically (Summary) or comprehensively (Full Results).

After the VPA, the other analyses become available on the program's menu: Yield per Recruit, Transition and Sensitivity. The Transition analysis is only available for age-structured data. A size-structured data set can be converted to an age-structured data set with the command Size → Age, under Options.

Three series of graphs can be produced by the program: The VPA results plotted over class intervals, the Y/R results on varying factor of effort and the evolution of Y/R trajectories in the case of transition analysis. Alternatively, the data can be exported to other Windows applications for final presentation or the graphs themselves copied for touching up.

The input file formats are compatible with the file format used in the DOS version, with the exception that comma-separated values are no longer accepted by the program. This is to avoid incompatibilities when the program runs under Windows versions configured with comma as a decimal separator.

Summary requirements

Computer: IBM PC and compatibles with 32 bits CPU.

Operating system: Windows 95/98/NT

Data:

- size or age classes with constant class intervals (unlimited maximum number of classes*[1])
- Admits plus class (+ class)
- Any number of fishing gears (inverse Y/R analysis restricted to 2 gears)
- Not appropriate for historical data series.

Parameters:

- Von Bertalanffy's growth equation (Linf, k, t0)
- Length-weight relationship (a, b)

[1] in practice, the maximum number of classes and gears depends on the available physical memory of the computer, but this should be of no concern in most applications.

- Vector of Natural Mortality (M_i)
- Terminal fishing mortality (F_{term})
- Proportions (or percentages) by fishing gear
- Sexual maturity factor by class

VPA options: Catch equation / Cohort analysis (Pope)

Units: Any, but the same for parameters and data

3 USER MANUAL

3.1 Installing and running the program

Run the program *setup.exe* in the accompanying diskette to install the self-extracting program. You will be prompted to select a program folder (default: C:\PROGRAM FILES\VIT4WIN\) and a folder for the Start Menu. The program can be executed by double-clicking the **vit4win** icon in the Explorer or by selecting it in the Start Menu. On start, the program has the following aspect:

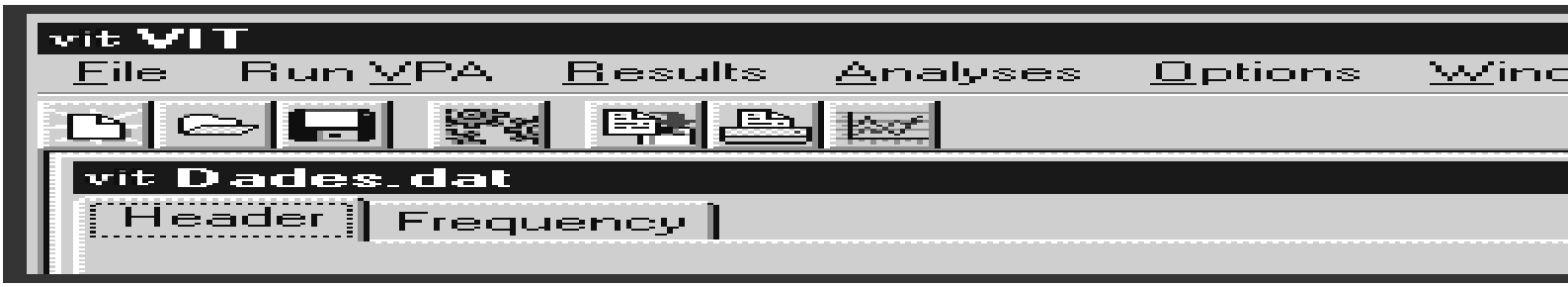


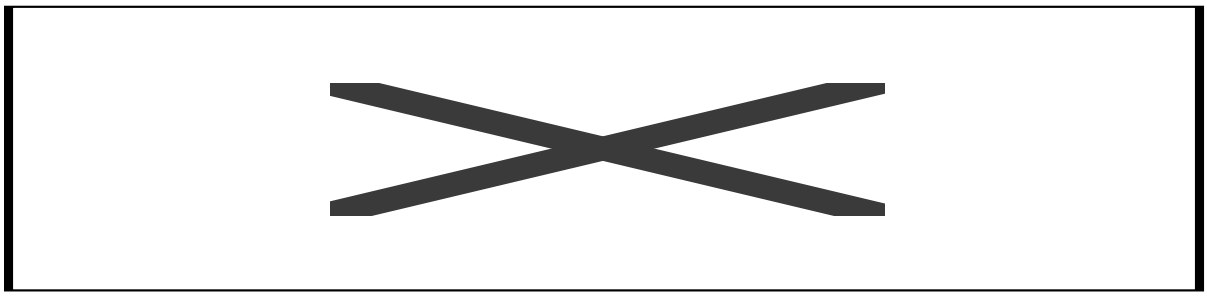
Fig. 1 Menu and Tool Bar

The menu items and their function is explained in the following table:

Menu command	**Menu Item**	**What it does**
File	New	Brings up dialog box to select a new "Data" or "Parameters" window
	Open	Brings up dialog box to select "Data" or "Parameters" files to be opened.
	Save	Brings up dialog box to select "Data" or "Parameters" files to be saved
	Exit	Exits the program
Run VPA	Standard VPA	Runs a standard (catch equation) Virtual Population Analysis
	Cohort Analysis	Runs a Virtual Population Analysis using Pope's equation

Results	General Information	Brings up a dialog box displaying general information about the data and the files
	Summary	Displays tables with a summary of the VPA results, for the virtual population and for the catch
	Full Results	Displays several tables with the full results of the analysis, the different categories of results can be accessed by selecting the desired tab
Analyses	Yield per Recruit	Yield per Recruit analysis under changing conditions of fishing effort and with different methods of gear interaction
	Transition	Deterministic or stochastic analysis of the transition to new exploitation patterns under different recruitment models
	Sensitivity	Analysis of the sensitivity of Y/R results to miss-specification of parameters
Options	Environment	Change VPA precision value
	Size → Age	Converts size-structured files to age-structured files
Window	---	Standard window arrangement routines. Includes a Close All item that closes all windows with one mouse click
Help	Help	On-line help
	About	Displays information about the authors and the date and version of the program

The toolbar contains icons for often-used tasks and are the only way to export and print data or graphs (Copy and Print buttons) and to produce graphs with the results in tabular from. The printouts obtained with the Print button are only draft quality, you should export data or graphs to other applications for best quality output. The toolbar looks like this:



3.2 Program flow

To carry out analyses with VIT, you will have to both load data and parameters from existing files or create new data and parameters with the aid of the Data and Parameter boxes (see sections 3.3. and 3.4.). The format of the data and parameter files are documented in Chapter 4.

Once a data structure exists in the computer's memory, you can rebuild the virtual population by means of the VPA analysis. The results of the VPA can be visualized in summary or full form as tables or graphs. The other analyses (Y/R, Transition (in the case of age-structured files), Sensitivity) become available after a VPA has been executed. In the case of size-structured files, a new age-structured file can be created. At any time, setting an appropriate precision value in Options... Environment can change the precision of the VPA.

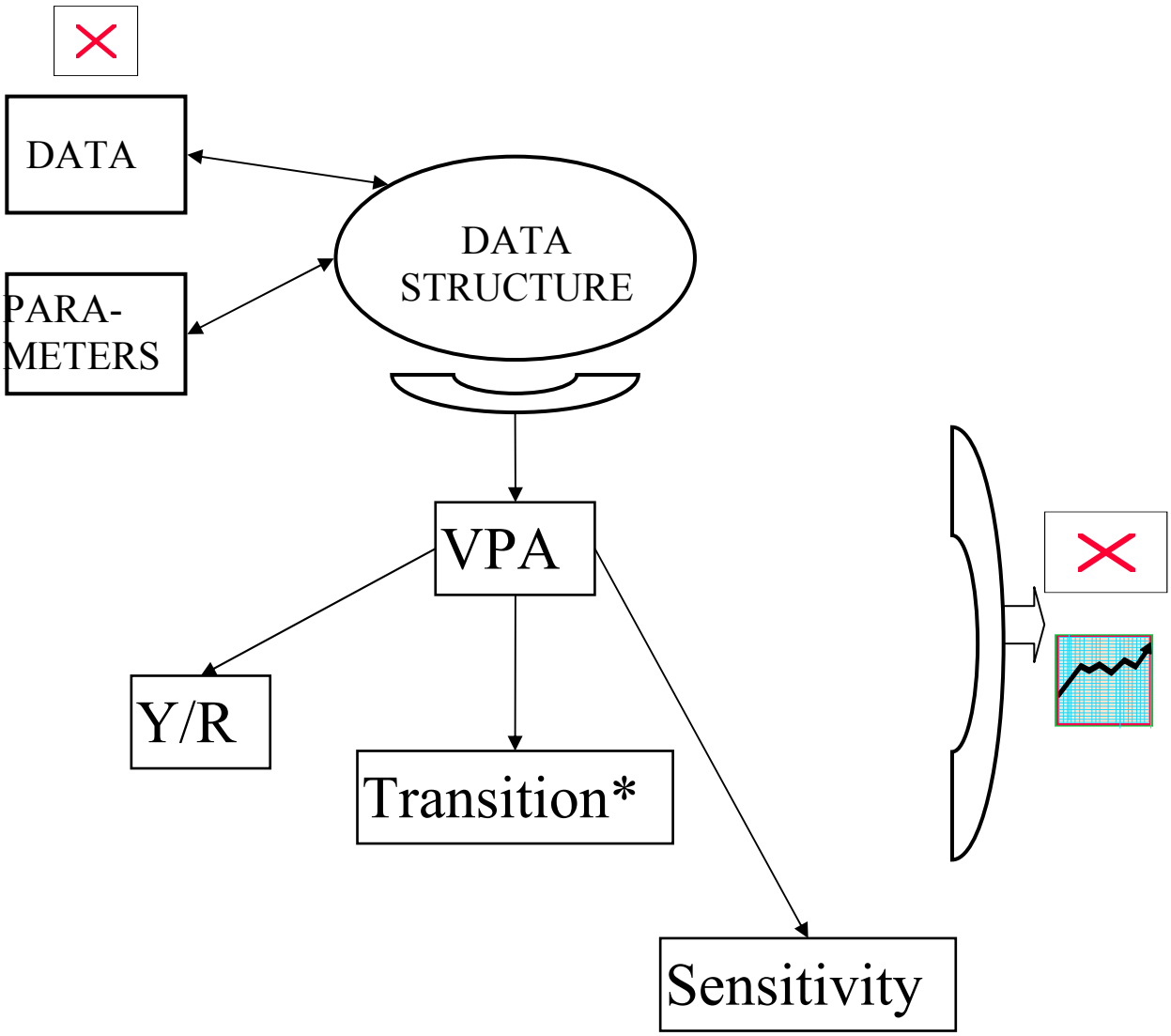


Fig. 2 Program flow.

3.3 Creating and editing new data files

Executing the File… New in the menu(or clicking on the New icon) and choosing Data in the dialog box that appears, a new data set can be created using the "Data" window displayed by the program. You can define the data structure in the first sheet: Title, number of classes, number of gears, lower limit of the first class, class interval, class type (e.g., the classes represent size or age classes) and whether to consider a class plus (+ class). With the data definition ready, you can pass on to fill the frequency data. Attempting to fill in the frequency data before the header sheet is filled in, results in an error. In the frequency sheet the columns represent the different gears and the rows the different classes, and the entries are the actual

frequencies obtained. If you attempt to enter a non-numeric value, either in the Header sheet or the Frequency grid, the program advises to correct the value.

Once the data structure is filled in, you can create a data structure (Button *Create Data* in Frequency sheet), or save the data (Button *Save data*) or display general information on the data (Button *General Information*). Note that these two last options can be accessed as well by the main menu.

The data created can also be saved in a file with the command File … Save … (or clicking on the icon Save) and clicking on Data. Note that this command is used only for saving data and parameter files, not results. In this version of VIT the results are exported or copied into other Windows application for further analysis or display and not saved in plain text files as in the DOS version.

The data file is saved following the plain text (ASCII) format of the previous version of VIT, to ensure compatibility. By default the files are saved with the extension DAT, although any valid name can be used.

You can continue to edit data after the file has been saved. However it is recommended to press the *Create data* button before attempting to run an analysis.

3.4 Creating and editing parameter files

Parameters can be entered in the same way as data, clicking on the File… New… menu item (or clicking the New icon) and checking Parameters in the dialog box. The first part of the "Parameters" window comprises the parameters of von Bertalanffy's growth equation, the length-weight relationship and the terminal fishing mortality. The proportions caught by the different gears may be expressed as numbers (multiplicative factor by gear) or weight (percentage by gear), checking the appropriate box. If the total biomass caught is unknown, then you must check the "Convert according to number" option and the edit box for biomass is dimmed. The proportions are entered in the grid next to it. If the total biomass caught is known, then you may choose to check the "Convert according to weight" option and fill in the total biomass and the percentage by gear.

After the header sheet is filled in, you must enter the sexual maturity and mortality vectors, by class in the grid belonging to the Maturity and Natural Mortality sheet.

During data input, the program checks for erroneous input and you are advised to correct the value.

The parameters may be saved, by using File... Save (or clicking the Save icon) and checking Parameters in the dialog box, in a plain text (ASCII file) compatible with the previous version. By default, files are named ending in .INI.

3.5 Opening data or parameter files

Data and parameter files already existing in the computer can be opened with the commands File... Open... (or clicking on the Open icon) and checking Data or Parameters in the ensuing dialog box. The data obtained by the Open command cannot be edited in the "Data" window, because changes on the data structure can yield to erroneous results or can halt the program. Instead, the parameters can be edited at any time in the "Parameters" window to facilitate the study of the influence of parameter variation on the results.

Any combination of New.../Open... can be used with data and parameters, but attention should be paid to ensure that the structure of the data and the structure of the parameters are compatible.

If the parameters are entered first and the program does not have information on the number of classes, number of gears, lower limit or class interval, you will be requested to fill in these data.

The parameters can be modified at any time during the execution of the program and the word 'Modified' appears in the left panel of the bottom status bar. The program doesn't carry out a new VPA every time a parameter is modified as in the DOS version of VIT.

A set of example files accompanies the installation diskette to help you become familiar with the data structures and the program. You can now open the size-structured data set comprising the data file DADES.DAT and the parameter file PARAM.INI (or its equivalent age-structured files EDATS.DAT and EDATS.INI) before continuing with the VPA or enter your own new data and parameters.

3.6 Virtual Population Analysis

A VPA can only be run when the program knows both data and parameters. To carry out a VPA analysis, click the Run VPA menu item and choose the appropriate VPA mode (Standard with the Catch equation or Pope's VPA with the Cohort Equation). The selected VPA mode is checked and can be looked upon at any moment during the analyses. Clicking on the VPA icon in the tool bar results in a new VPA being performed with the method that was checked (default: Standard VPA).

Before actually carrying out the computations, the program checks for the validity of data and parameters. One specific incompatibility may appear with the parameter t_0, when working with age structured data. In case of age-structured data, if t_0 is larger than the lower limit of the first age class, the program warns that negative weights may be obtained for the smaller age classes. This problem appears occasionally when converting size-structured data to age-structured data with the Option Size → Age. You may choose to continue the analysis or to correct the value of t_0 in the Parameters box.

Another problem that may arise when working with size-structured data is that parameter L_∞ is smaller than the size of the last class. In this case, a VPA can't be performed and the program expects you to enter a new value L_∞ value larger than the upper size of the last class in the "Parameters" window.

The results (in full or as a summary) can be obtained under the Results menu, together with general information on the analysis. Both the summary and the full results can be copied or printed by clicking the appropriate icon in the toolbar, but only the full results can be used in charts, by clicking the Graphs icon.

3.7 Yield per Recruit Analysis

With the stock rebuilt by means of VPA, other analyses can be performed and the Menu item Analyses becomes available. By clicking on the Yield per Recruit menu option, the Y/R analysis can be defined and executed. You need to select the method for computation of weights (the default method is the exact one) and the option of either producing a large number of points for Y/R curves tabulation and charting or to calculate only reference points. If you select the latter, no analysis of gear interaction is undertaken. You can modify the number of points of the Y/R curves

and the maximum level of effort by entering the appropriate parameters in the edit boxes. Note that an effort factor of 1 corresponds to the present level of fishing and a factor of 2 represents a doubling of the fishing effort.

When clicking *OK*, the analysis requested is performed and the results displayed in two grids, the top one for the situation of virgin stock (factor of effort 0) and the bottom one for the various levels of effort variation.

The results of the Y/R analysis can be copied and pasted in other Windows applications, or printed or graphed by means of the corresponding icons.

3.8 Transition

When the data corresponds to an age-structured sample you can run a transition analysis. Transition analysis helps you forecast the behavior of the exploited population under changes in the pattern of exploitation by simulating its population dynamics. The changes in fishing patterns are incorporated in VIT as changes in the factor of effort or the fishing mortality applied to the various age classes and can be applied in several ways. The analysis of fishing regime shifts can be done under conditions of deterministic or stochastic recruitment and with any of three recruitment models (constant recruitment, Beverton and Holt's model and Ricker's model). A graphical assistant helps you define the recruitment model and its variance in the case of a stochastic analysis.

The new fishing mortality (F) given by the factor of effort (f) will be a function of the value of f taken at each time period and for each age class. On the other hand, the changes in f can be applied only during the first year of the simulation or all along the simulation. Thus, four combinations are possible:

	f by years	*f by age class*
f first year only	case 1 (manual input)	case 2 (requires file)
f each year	case 3 (requires file)	case 4 (requires file)

First, a change in exploitation pattern can be incorporated in the first year of the simulation, homogeneously for all age classes. You need to select the first item in each of the radio button boxes at the top of the Transition form and fill in the grid with the new factors for each fishing gear.

In case two, the fishing mortality applied to the different age classes varies (simulating changes in selectivity patterns) and it is applied during the first year only. When you select the second option in the first radio button box at the top of the form you are prompted for a file containing the information on fishing changes, for example the file T21.DAT contained in the program's diskette (see section 4.2 for information regarding file formats).

In the third case, when you want to examine the behavior of the population under yearly changing fishing pressure, you will be prompted to enter a file name containing the changes in the effort factor by year and gear. You can use the example file T12.DAT to test this option (see section 4.2 for information regarding file formats).

Finally, case four corresponds to the selection of the second option in the two top-row radio button groups. This option requires a file containing the factor of effort for *each year* of the simulation and *each age class*. In the case of the test data supplied with the program (EDATS.DAT and EDATS.INI) this would require a file containing 39 (age classes) x 20 (years of simulation) x 2 (gears) = 1560 records, but no example is provided.

The simulation conditions (deterministic or stochastic) and the recruitment model are selected in the middle-row radio button boxes. The recruitment model can be defined by clicking on the Parameters assistant button, where the parameters A and B of Beverton and Holt's or Ricker's models can be obtained. Alternatively, A and B can be entered directly in the edit boxes, when known beforehand. In the case of a stochastic simulation, the variance of the recruitment must be defined. Due to the difficulty of providing an appropriate variance for a lognormal distribution function, a variance assistant has been incorporated in the program to help you define and visualize the variance model.

Finally, you will need to enter the number of years of the simulation and the number of iterations (in case of stochastic analysis) before executing the simulation (button *Proceed*). The results of the simulation are presented as Y/R analysis, in tabular form at the bottom of the "Transition" window and can be exported or graphed with the Graphics assistant.

3.9 Sensitivity analysis

Sensitivity analysis can be used to estimate the effects of parameter variation or precision errors on the results of the Y/R analysis. The program computes a new run of Y/R analysis by changing each parameter by the extreme values *parameter* * (1+factor) and *parameter* * (1-factor). The factor is constant for all the parameters selected in one Sensitivity analysis run. The parameters to be tested are the 3 parameters of von Bertalanffy's growth equation (L_∞, k and t_0), the two parameters of the length-weight relationship (a and b), the terminal fishing mortality (F_{term}), the natural mortality (M) and the proportion caught by each gear. The parameters can be selected by checking each item in the top left check box.

You can select to perform an independent analysis of each parameter (default) by a factor specified in the Factor edit box or perform combined analysis of 2 or more factors. In the case of independent analysis, only the affected parameter is changed and all the others remain at their original value, while in the case of combined analysis, each combination of parameters is tested. It is recommended to perform an independent analysis of each parameter before attempting to study the interaction among parameters, due to the complexity of result interpretation.

When L_∞ is found among the parameters to be tested, the program checks that L_∞ * (1-factor) does not fall below the size of the last class, otherwise that would halt the program. If the case arises, you may choose to re-enter an appropriate L_∞ value in the "Parameters" window or continue the analysis with L_∞ as lower limit, or reduce the amount of variation (i.e., enter a smaller factor).

The results of the Sensitivity analysis are presented as:

Parameters	Y/R	Biomass	SSB	Y/R G. 1	Y/R G. 2
'ooooooooo'	92.85	340.96	262.28	35.79	57.07
'-ooooooooo'	90.00	330.50	254.23	34.69	55.32
'+ooooooooo'	95.76	351.64	270.50	36.91	58.86

where the marks under 'Parameters' represent: o → no change, - → extreme lower value, + → extreme higher value. The first 7 marks correspond to 3 parameters of von Beratlanffy's equation plus 2 parameters of the length-weight relationship plus Fterm and M, while the remaining marks correspond to the proportions of each fishing gear. The marks are placed in sequential order, following the order of the parameters in the checkbox. In the example above, the first row is

the Y/R analysis with no changes, the second row contains the Y/R analysis of the lower limit of L_∞ and the third row contains the Y/R analysis of the higher limit of L_∞. In this example, L_∞ was made to vary by 1% (i.e. the factor entered was 0.01).

3.10 Options

Under the menu item Options... Environment, you can change the precision of VPA when there appear problems of convergence with the catch equation. By defaults, the precision is 10^{-12} (shown as 1.0e-12) and any change to this value, whether automatically by the program or manually by the user is reflected in the program's bottom status bar.

The menu item Options... Size → Age is only available when working with size structured files and allows you to generate an age-structured data set. When you click this option, you will be prompted to enter the names of the new data and parameter files. To work on the age-structured file it is necessary to load the new data and parameter files with the menu File... Open... Data/Parameters.

3.11 The parameters assistant

This new feature of VIT allows you to define the recruitment model's parameters. When you select a non-constant recruitment model you can either enter directly the values of the parameters A and B that define the model or use the parameters assistant to obtain them directly from the program. The recruitment models are formulated per unit recruit (i.e., R=1). On clicking the *Parameters assistant* button, a window appears in which you can select the kind of parameter to be entered: Spawning Stock Biomass for 50% of maximum recruitment S(1/2), slope at the origin, or and asymptotic value of R in Beverton and Holt's model. In Ricker's model you need to enter the Spawning Stock Biomass yielding the maximum recruitment (Smax) or the slope at the origin.

Once you have selected a parameter and its value, you can try the resulting model definition by clicking on *Try*. The process can be repeated indefinitely. When you are satisfied with a recruitment model definition, just click *OK* and the program returns to the "Transition" window, where the values of A and B have been computed from the values you entered. Note that these values of A and B can be immediately overridden by entering new values in the edit boxes.

3.12 Variance assistant

The variance assistant works in a similarly to the parameters assistant. It works only when dealing with stochastic recruitment and can be used with constant or non-constant recruitment. On clicking the button *Variance assistant*, the "Variance assistant" window appears. Here you need to specify only a variance value and click on *Try* to see the effect of variance on the recruitment model. The lognormal distribution error model is plotted on the recruitment model with its 95% confidence interval. Several values of variance can be tried and the program returns to the "Transition" window when you press the *OK* button. The final value tried is shown in the variance edit box and will be used in the transition analysis if not overridden manually.

3.13 Graph assistant

Another new feature of VIT for Windows is the Graph assistant. It works together with those windows displaying tabular results, i.e. the "Full results" window, the "Yield per Recruit" window and the "Transition" window. In the upper left corner a checklist box appears by which you can select the variables to be plotted. The Graph assistant is 'intelligent' in the sense that it displays only the list of variables that relate to the last analysis shown in the active window; that is, if you clicked the Graph assistant after performing a Y/R analysis only results from the Y/R analysis can be charted. You can select one or more variables. They will be plotted on the right-hand chart when you click *OK*. The graph can be exported for retouching with another application as a Windows metafile, or printed by selecting the appropriate button in the tool bar. Note also that you can export the base data of the graph of each analysis to other Windows applications to obtain custom graphs or combine several analyses.

4 INPUT AND OUTPUT FILES

4.1 Data Files (Input)

The data set can be created and edited by the user (File...New..."Data" window) or can be a plain text (ASCII) data file (File... Open... "Data" window), created or saved previously, and fully compatible with the data files used in the DOS version of VIT. There are no restrictions on naming the data file other than the limitations provided by the operating system, however for backward compatibility with the DOS version, it is recommended to use the "8.3" naming convention of DOS. By default, the program opens/saves the data with the extension .DAT.

The format of the data file is:

Row 1:	Title, comment or message
Row 2:	6 parameters describing data: number of classes (by age or size), number of fishing gears, age or size code (1 – classes by age, 2 – classes by size), lower limit of the first class, class interval (1 if classes by age), code for plus group (1 – no plus class, 2 – plus class)
Row 3:	Frequency of the first class for each fishing gear (by columns)
Row 4:	Frequency of the second class for each fishing gear (by columns)
Etc.	

The data file contains classes arranged in ascending order. If the frequency for any class is zero, there must still be a record for it. See for example, the data sets included as examples with this release (DADES.DAT or EDATS.DAT).

Note that no units appear in the file.

4.2 Parameter file (Input)

The use of a parameter file is optional, but highly recommended. A new parameter set can be created or edited with the commands File... New... and using the "Parameters" window or a previously existing parameter set (ASCII or plain text file) can be loaded with the commands File... Open... in the "Parameters" window. There are no restrictions on naming the parameters file other than the limitations provided by the operating system, however for backward compatibility with the DOS

version, it is recommended to use the "8.3" naming convention. By default, the program opens/saves the data with the extension .INI.

The format of the parameter file is:

Row 1: Growth parameters of von Bertalanffy's model: Linf, k, t0
Row 2: Length-weight parameters: a and b
Row 3: Natural mortality value (if constant) or any negative number if M is specified below as a vector
Row 4: Terminal fishing mortality: Fterm
Rows 5-6: Proportion factors or percentages by gear (used for calculating the proportion factors). They are two options:
Option 1: When the total catch (in weight) is unknown, row 5 contains 0 and row 6 contains the multiplicative proportion factor for each gear
Option 2: When the total catch is known, row 5 contains the total catch (in weight) and row 6 contains the fraction of the catch, as percentage, for each fishing gear
Row 7: Fraction of mature individuals in the first class, natural mortality of the first class
Row 8: Fraction of mature individuals in the second class, natural mortality of the second class
Etc.

The fraction of sexually mature individuals ranges from 0 (none are mature) to 1 (all are mature).

The example parameter files accompanying the example data files described in the previous section are PARAM.INI and EDATS.INI. In the case of age-structured data, a conflict may appear regarding the parameter t0 (3rd parameter in the 1st row of the parameter file) and the lower limit of the first class (4th parameter in the 2nd row of the data file), as noted in section 3.6. The conflict arises when t0 is larger

than the lower limit of the first class. To proceed with the analysis, you must either set t0 to a lower value or reorganize the data set (or ultimately, accept the errors derived from obtaining negative weights). This problem may arise when size-structured data are transformed to age-structured data. Given that the goal of the transformation is often to perform a transition analysis, we generally have either to accept the errors or change the parameters appropriately.

4.3 Other input files

4.3.1 Files for change in exploitation patterns

In Transition analysis cases 2 to 4 (refer to section 3.8) additional files are required specifying the way the changes in exploitation patterns are applied. In case 2, when the changes are applied to the F vector for each class during the first year only the file format is a matrix of (number of classes) rows x (number of gears) columns:

Row 1:	Fishing mortality for the 1st class by fishing gear (columns)
Row 2:	Fishing mortality for the 2nd class by fishing gear (columns)
Etc.	

See the example file T21.DAT

In case 3, when the changes are applied as a factor f affecting all size classes homogeneously but with varying levels for each year, the file containing the transition specifications is a matrix of (number of years) rows x (number of gears) columns:

Row 1:	factor of effort for the 1st year by fishing gear (columns)
Row 2:	factor of effort for the 2nd year by fishing gear (columns)
Etc.	

See the example file T12.DAT

In case 4, when the changes are to be applied by year and by class, the file required has the same structure as case 3, but repeated as many times as classes:

Row 1: factor of effort for the 1st year by fishing gear for the first class
Row 2: factor of effort for the 2nd year by fishing gear for the first class
...
Row (number of years+1): factor of effort for the 1st year by fishing gear for the 2nd class
Row (number of years +2): factor of effort for the 2nd year by fishing gear for the 2nd class
...
Etc.

No example is provided for this case.

4.4 Output files

In VIT for Windows there is no standard output file, as was the case in the DOS version. Both the results of the analyses and the graphs can be exported to other Windows applications for further analyses or retouching.

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