# User's manual for the Excel application "Temas" or "Evalutation Frame"

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# USER'S MANUAL FOR THE EXCEL APPLICATION "TEMAS" or "Evaluation Frame"

*By*

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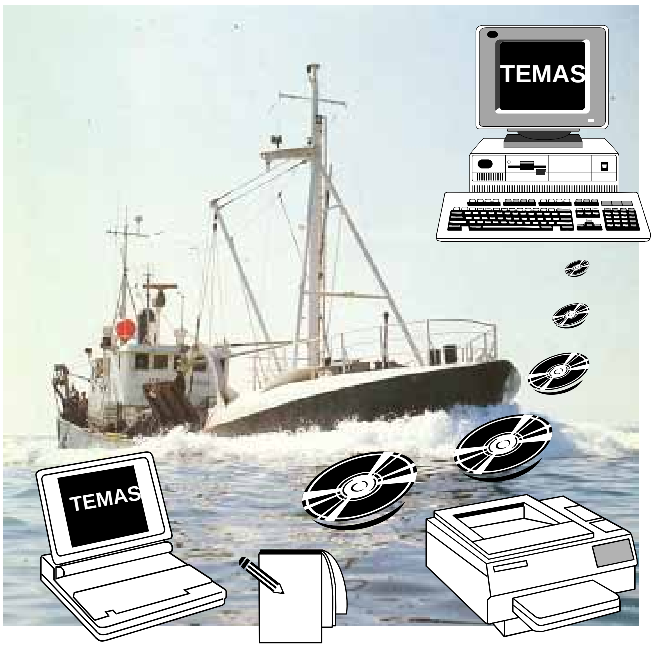

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**Abstract.**

*This DTU-Aqua report contains an user's manual and a reference manual for the EXCEL/Visual Basic implementation of the TEMAS model (Technical measures – Development of evaluation model and application in Danish fisheries) or the Evaluation Frame (EF). The implementation is based on EXCEL/Visual Basic, because of the wide use of this software in fisheries institutes and elsewhere. Microsoft Office is chosen only because of its abundance, not because it is considered suitable for fisheries modelling. The source code is open, and the coding has been prepared with the intension that the users should be able to check it and if needed to modify it. The highest level of user-friendliness has been attempted in the implementation. The report also contains a "demonstration" of the software with a set of hypothetical data.*

*The present application of TEMAS is for the analysis of the effect of closed seasons and areas in the Baltic, for the recovery of the Baltic cod stocks. These applications are contributions (case studies) to the EU-FP6-Projects EFIMAS (mainly Closed seasons) and PROTECT (mainly Closed areas, Marine Protected Areas, MPAs).*

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# 1. INTRODUCTION

## 1.1. WHAT IS TEMAS OR THE EVALUATION FRAME?

The software package presented here is named “TEMAS” (Technical Measures) because it was originally developed to assess the effect of mainly technical management measures. A broader broad descriptive name is Evaluation Frame (EF). (The first version of the package for technical management measures was presented in Ulrich *et al*, 2002 and a more comprehensive version is presented in Ulrich *et al.*, 2007, while the present manual represents the latest version). The TEMAS software is implemented in EXCEL with extensive use of macros written in Visual Basic. In the context of the EU-FP6 EFIMAS and PROTECT projects it should be noted that closed seasons and MPAs in the terminology of TEMAS is technical management measures. Therefore, this latest version of TEMAS reported here contains components to evaluate closed seasons and MPAs. The case study of this application is the Baltic fisheries with focus on the cod fisheries and the areas and seasons closed to protect the cod spawners.

The overall contents of TEMAS are illustrated by the data-flowchart in Figure 1.1.1. The system compares two management regimes, A and B, by simulating the fisheries system over a series of years for both regimes, and eventually it compares the performance of the two regimes during the time period. Thus the figure illustrates a dynamic system, where the arrows indicate the processes of one single time period (month, quarter or year). The “operating system” (Figure 1.1.1) is a model simulation of the eco-system and the fisheries system. The boxes “Management regime A” and “Management regime B” indicates two models which can simulate the management processes (which may include simulation of ICES WG, setting of TACs, etc.). The operating system generates (“fake” or “hypothetical”) input data to the management models, and it predicts the effect of the management regulations on the eco-system and the fisheries. Thus, you may consider TEMAS as a triple, model. Firstly, it executes the simulation of management regime A, using the operational model to produce input to the management simulation. Secondly, it does the same of management regime B, and thirdly it compares the two simulations.

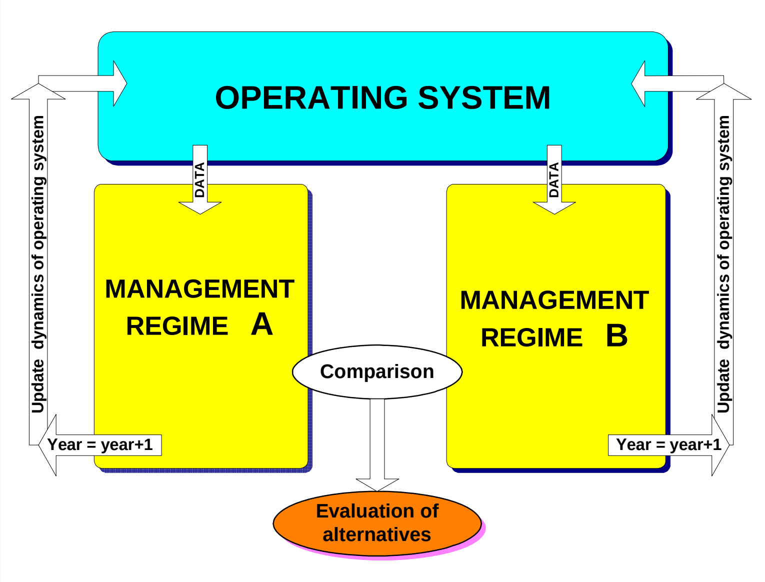


***Figure 1.1.1 The principal components of TEMAS for one time period of a dynamic process.***

The operating model produces input to the management model for year “y”
The management produces management regulations for year “y+1”
The management regulations for year “y+1” is used as input to the operational model, to produce input to the management model in year y+1, …. Etc.

In the context of evaluation of MPAs and closed seasons, the alternative management regimes could be:

- The current management regime with no closed seasons and MPAs. (The current regime could be Eg. TAC and maximum number of sea days, mesh size regulations etc.)
- The current management regime with closed seasons and MPAs

In the standard implementation of TEMAS, five pairs of alternative management regimes are considered Table 1.1.1). The six pairs or regime comparisons suggested here may not be the most relevant examples one could think of, and should be considered illustrations of the concepts, rather than the only examples for TEMAS.

| | **Regime Comparisons** | Regime A | Regime B |
|---|---|---|---|
| 1 | Scientific advice /<br>No scientific advice | ACFM Advice (TAC based on harvest control rule) | No ACFM Advice (TAC based on last years landings, and selected CPUE trends) |
| 2 | TAC regime with<br>No misreporting /<br>With Misreporting | ACFM Advice (TAC based on harvest control rule)<br>No misreporting | Misreporting (Various assumptions, effect of regulations on misreporting) |
| 3 | With / without new Technical manage-ment measures. E.g. closed seasons and/or closed areas (MPA). | TAC (With current, Technical management measures, except for closed areas and seasons) | TAC with NEW Technical management measures. E.g. closed seasons and/or closed areas (MPA). |
| 4 | TAC / Effort regimes with ACFM's harvest control rule. | TAC (based on the current HCR of ACFM) | Effort, An alternative regime, management by effort regulations. Both regimes based on the current HCR of ACFM" |
| 5 | TAC / Effort regimes with NEW harvest control rule. | TAC (based on the current HCR of ACFM) | Effort, An alternative regime, management by effort regulations. Based on an alternative HCR, (mixed fisheries, - fleet based …) |
| 6 | Two alternatives for definition of MPAs and closed seasons | TAC, with first option for closed season and MPA | TAC, with second option for closed season and MPA |

***Table 1.1.1. The five pairs of regime comparisons of the current TEMAS program.***

The operational model is the same in all regime comparisons. The operational model simulates fish stocks, fishing fleets etc,. and from the simulates quantities it simulates input data to the pair of management models.

The TEMAS model can do single deterministic simulations or multiple stochastic simulations. The multiple stochastic simulations executes a number of single deterministic simulations (say 1000 simulations), each of which based on parameters drawn by a random number generator. We shall forget about multiple stochastic simulations for the time being, and concentrate on single deterministic simulations.
In the present context of MPA and closed seasons of Baltic fisheries, focus will be on case study 3, but also the other cases are more or less relevant. Misreporting, for example, is considered a major problem in the Baltic cod fisheries (ICES, 2006).

TEMAS accounts for a number of different types of "errors" in the system. An error means a "deviation from the model", or "something that can go wrong" .

1. Measurement error. Errors in input data, such as catch at age data, caused by data being estimated from samples, and not from complete enumeration.
2. Estimation error. Errors caused by the method used to estimate parameters, or erroneous assumption about the data.
3. Model misspecification error. Errors caused by incomplete or wrong understandings of the mechanism behind the system dynamics. The assumed Stock/recruitment relationships may be candidates for model misspecifications.
4. Implementation error. The errors caused by regulations not being reacted to as assumed. The fishers may find ways to implement regulations, which do not lead to the achievements of the intensions of regulations.

The software will be able to simulate the effect of errors and bias, by stochastic simulations. Stochastic simulation is simple to repeat the same calculations a large number of times, each time with new parameter-values drawn by a random number generator. The stochastic simulation requires specifications of probability distributions of those parameters which are considered stochastic variables.

The stochastic simulation module simply executes TEMAS a large number of times (say, 1000 times), and each time it draws parameters and initial condition variables by random number generators, executes a simulation over a series of years. At the end it retrieves the results of all 1000 simulations and converts them into, for example, frequency diagrams.

Finally it should be noted that the operational model of TEMAS contains many parameters which cannot be estimated by the data currently available. Therefore a large number of parameters will have be assigned "plausible" values, that is, values not estimated by statistical methods and observations but values which are believed to be "reasonable". Likewise, TEMAS will contain a number of sub-models which has not been verified by recognized statistical tests. Therefore, the concept of "prediction power" may not be applicable to TEMAS.

We will simply not be in a position to say anything about the prediction power. The output of the model is in the best case of the nature: "It is likely that management regime A gives a better performance than management regime B" with respect of a selected measure of performance. TEMAS should not be used to quantify, for example, the expected spawning stock biomasses.

There is no alternative to this approach, when it comes to test alternative management regimes, which has not been tested earlier. A real statistical experimental design would require that the two alternative management regimes were test on two identical ecosystems, and such an experiment will never become possible in practice.

## WHAT IS THE NATURE A FISHERIES EVALUATION FRAME?

Perhaps the best presentation of an evaluation frame is to compare it to a flight-simulator. Figure 1.1.2 shows a flight-simulator from the outside. From the outside you can see that it is not an aeroplane and it cannot fly.

However, stepping inside (Figure 1.1.3) you will get the illusion that you are in the cockpit of an aeroplane. What you see in the windows of the cockpit are produced by a Video film, and what the video film shows depends on how you operate the navigation instruments.
Thus everything is fake and has no relationship to the real world. However, despite its illusion-features, the flight simulator is a very useful tool, because it is almost the same as the real world, and the pilot-trainees achieve experiences in a safer way than in real aeroplanes. They can actually see what happens when they break rules, without making any damage.

*Figure 1.1.2. Look at a flight simulator from the outside.*

Hitting the virtual control tower of the virtual airport is (kind of) ok in a flight simulator. Nobody get killed or anything damaged in a flight simulator.

The Evaluation Frame is like a flight simulator. The simulated management system, is like the fake cockpit of the flight simulator. The operational model of TEMAS is like the video-film you see on the windows of the flight simulator.

The principles in this comparison are correct, but when it comes to the details you may claim that the operational model cannot mimic the ecosystem to the same degree as the flight simulator can mimic, say, the run-way and the airport.

*Figure 1.1.3. Look at a flight simulator from the inside.*

The simulation of the cockpit is almost perfect in the flight simulator, and although it is easier for us to simulate the management procedure than the eco-system, it is still a lot more difficult than simulation a cockpit.
The physical flight simulator (Figure 1.1.2) may be considered the parallel to the source code of the Evaluation Frame. If you are a designer of the flight simulator or the evaluation frame, you must master the “bricks” from which the thing is build.

But the features that there is no relationship to the real world, and all input and output is created inside the simulator are the same for Evaluation Frame and Flight Simulator.
The idea with the Evaluation Frame is to give the managers the opportunity to test alternative management strategies, which may or may not lead to a catastrophe (Figure 1.1.4). The philosophy is that “one should never test anything for the first time in the real world”.
If you cannot simulate it, you should not implement it in the real world!

*Figure 1.1.4. Running the Evaluation Frame*

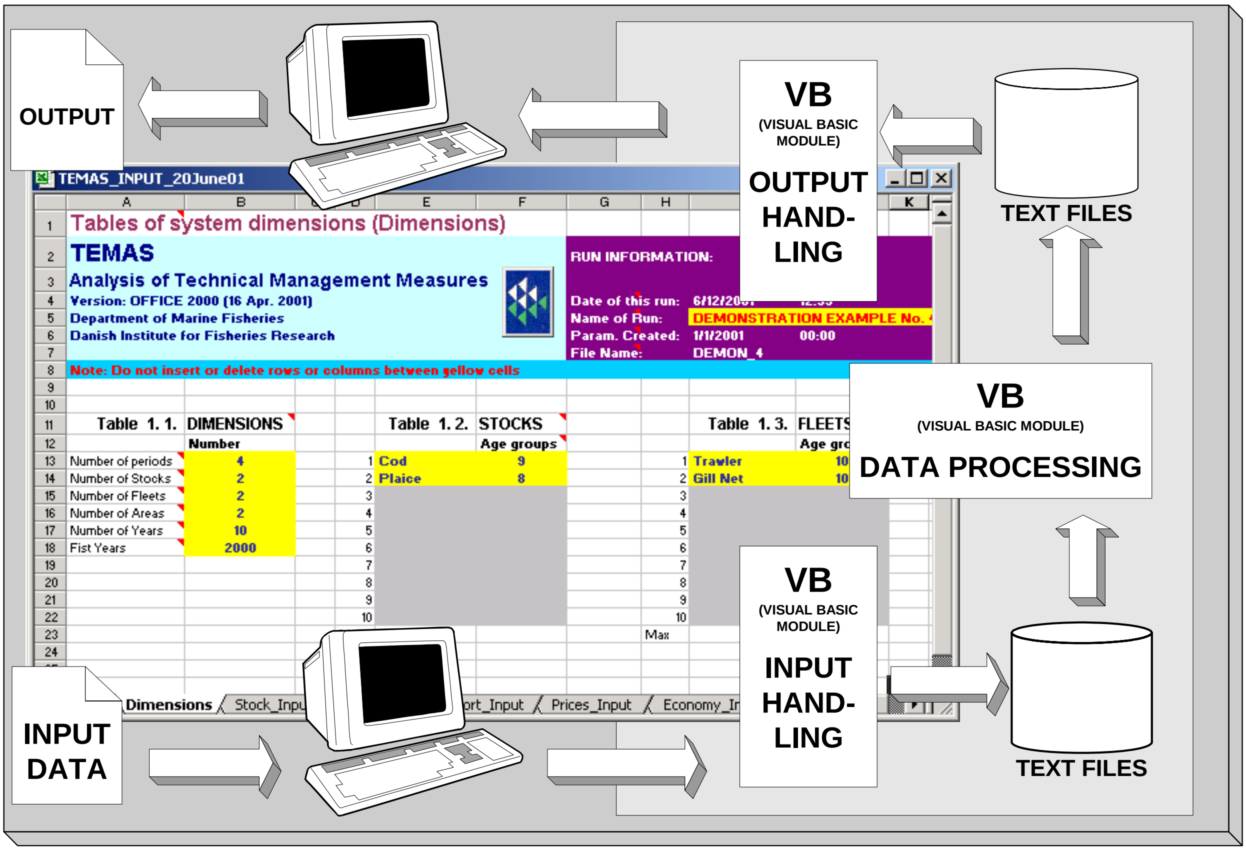


*Figure 1.2.1. Flowchart for data and results of the TEMAS software.*

## 1.2. HOW IS TEMAS IMPLEMENTED?

The software implementation of TEMAS is intended to become a public software package. That is, to become of a professional standard, with extensive documentation and user-friendly design.

As DIFRES (like most other fisheries research institutes associated with ICES) use Microsoft Office as their standard package, and most fisheries scientists are familiar with EXCEL, this commercial software was considered suitable as user-interface. However, this choice does not imply any validation or recommendation as to the qualities of MS Office. Once EXCEL is selected, the obvious choice for computer language is VISUAL BASIC (VB), the macro language of EXCEL (and other MS Office components).

The present version of TEMAS is implemented in EXCEL 2003.

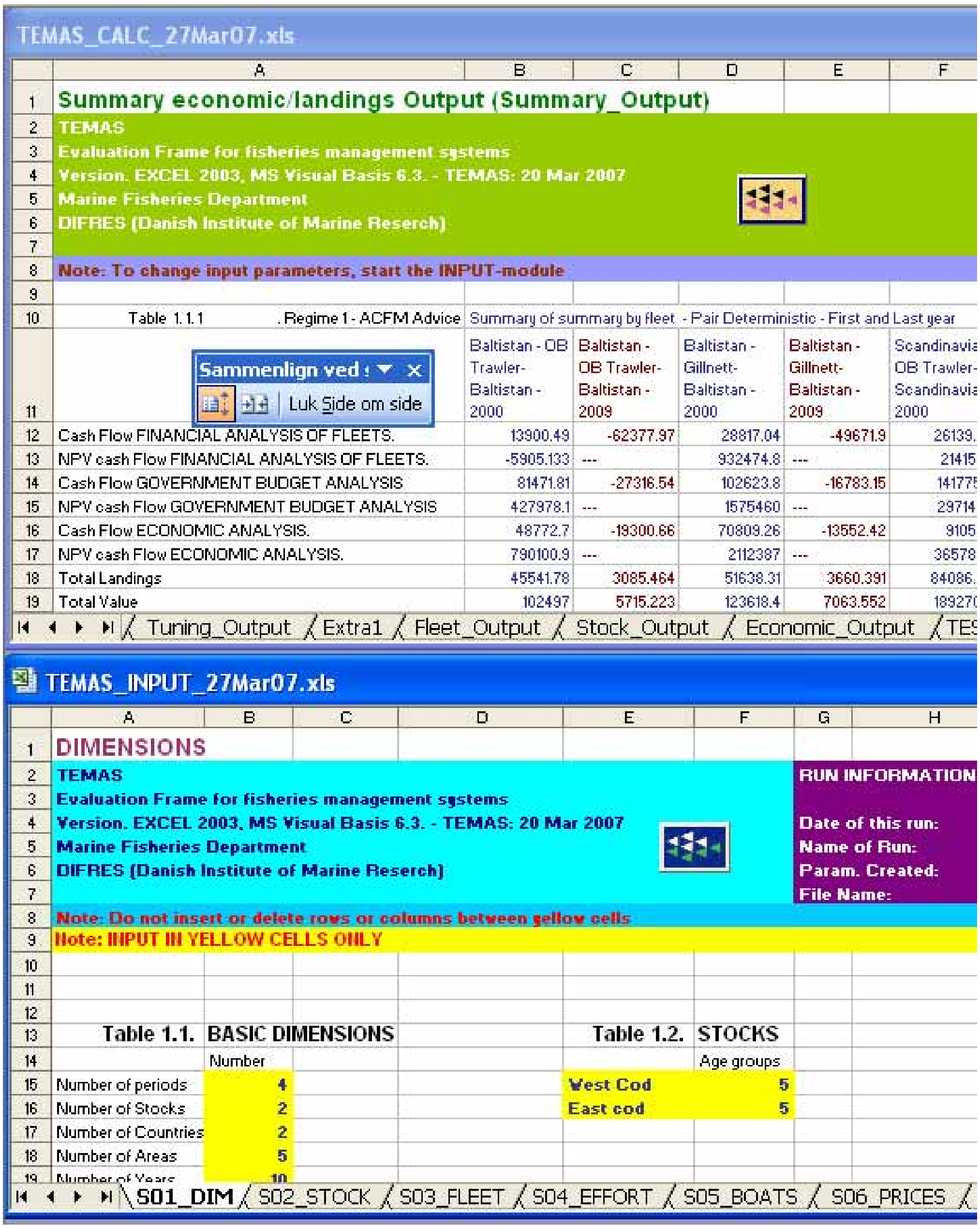
Actually, the developer of TEMAS encountered many programming problems in implementing TEMAS. Often the VB-program broke down, for no obvious reason, and when restarted it appeared to be functioning perfect. Thus, the problems appeared not to be caused only by the “programming bugs” of the TEMAS-developers, but also but bugs in the Microsoft Office package.

The present TEMAS implementation uses the EXCEL worksheets for input and output only.

The cells of the worksheets do not contain any formulas, such as “A3 = A1 + A2”. All calculations are made by VB-code, in the so-called VB-modules, which you can inspect, by clicking on the icon for the “VB-editor”.

Thus TEMAS is 100% open source software. It is an experience that complicated models should not be coded as EXCEL-formulas (although this is possible), because the documentation and maintenance of large spreadsheet application becomes very cumbersome. Therefore, VB modules make all data manipulation in TEMAS. The advantage of using EXCEL is that the user is in a well-known environment and can use all the facilities of EXCEL for entry of input, pre-processing, further processing and presentation of results from TEMAS.

It is furthermore the idea that the implementation TEMAS should be so that model and VB-program can be modified by the users to meet special request from users. Thus, the user should also consider her/himself a developer of TEMAS, and with some knowledge of the EXCEL macro language the user can change the model behind TEMAS. However, once the user starts to modify the source code (the Visual Basic module of TEMAS) he/she should assume the full responsibility for the version of TEMAS he/she has created.



TEMAS_CALC_27Mar07.xls

**Summary economic/landings Output (Summary_Output)**

**TEMAS**
**Evaluation Frame for fisheries management systems**
**Version. EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 20 Mar 2007**
**Marine Fisheries Department**
**DIFRES (Danish Institute of Marine Reserch)**

**Note: To change input parameters, start the INPUT-module**

Table 1.1.1 . Regime 1 - ACFM Advice — Summary of summary by fleet - Pair Deterministic - First and Last year

| | Baltistan - OB Trawler-Baltistan - 2000 | Baltistan - OB Trawler-Baltistan - 2009 | Baltistan - Gillnett-Baltistan - 2000 | Baltistan - Gillnett-Baltistan - 2009 | Scandinavia OB Trawler-Scandinavia 2000 |
|---|---|---|---|---|---|
| Cash Flow FINANCIAL ANALYSIS OF FLEETS. | 13900.49 | -62377.97 | 28817.04 | -49671.9 | 26139. |
| NPV cash Flow FINANCIAL ANALYSIS OF FLEETS. | -5905.133 | --- | 932474.8 | --- | 21415 |
| Cash Flow GOVERNMENT BUDGET ANALYSIS | 81471.81 | -27316.54 | 102623.8 | -16783.15 | 14177 |
| NPV cash Flow GOVERNMENT BUDGET ANALYSIS | 427978.1 | --- | 1575460 | --- | 29714 |
| Cash Flow ECONOMIC ANALYSIS. | 48772.7 | -19300.66 | 70809.26 | -13552.42 | 9105 |
| NPV cash Flow ECONOMIC ANALYSIS. | 790100.9 | --- | 2112387 | --- | 36578 |
| Total Landings | 45541.78 | 3085.464 | 51638.31 | 3660.391 | 84086. |
| Total Value | 102497 | 5715.223 | 123618.4 | 7063.552 | 18927 |

TEMAS_INPUT_27Mar07.xls

**DIMENSIONS**

**TEMAS**
**Evaluation Frame for fisheries management systems**
**Version. EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 20 Mar 2007**
**Marine Fisheries Department**
**DIFRES (Danish Institute of Marine Reserch)**

**RUN INFORMATION**
**Date of this run:**
**Name of Run:**
**Param. Created:**
**File Name:**

**Note: Do not insert or delete rows or columns between yellow cells**
**Note: INPUT IN YELLOW CELLS ONLY**

**Table 1.1. BASIC DIMENSIONS**

| | Number |
|---|---|
| Number of periods | 4 |
| Number of Stocks | 2 |
| Number of Countries | 2 |
| Number of Areas | 5 |
| Number of Years | 10 |

**Table 1.2. STOCKS**

| | Age groups |
|---|---|
| West Cod | 5 |
| East cod | 5 |

***Figure 1.2.1. Screen image of TEMAS_INPUT and TEMAS_CALC run in parallel.***

It is the experience, that running TEMAS, requires the participation of one or more people who can program in VISUAL BASIC. Sometimes, the program crashes, because of tiny problems for a VB-programmer. Most often, these problems are associated with reading the data files from the hard disk. An experienced VB-programmer can fix such problems in short time. The Visual Basic system has powerful debugging facilities, but if you do not know how to use it, even tiny VB-problems may prevent you from operating TEMAS.

Thus, operating TEMAS does not formerly require any knowledge of VISUAL BASIC, but practice has shown that some knowledge of VB-programming is very useful, or rather, it is almost a prerequisite for a successful execution of TEMAS.

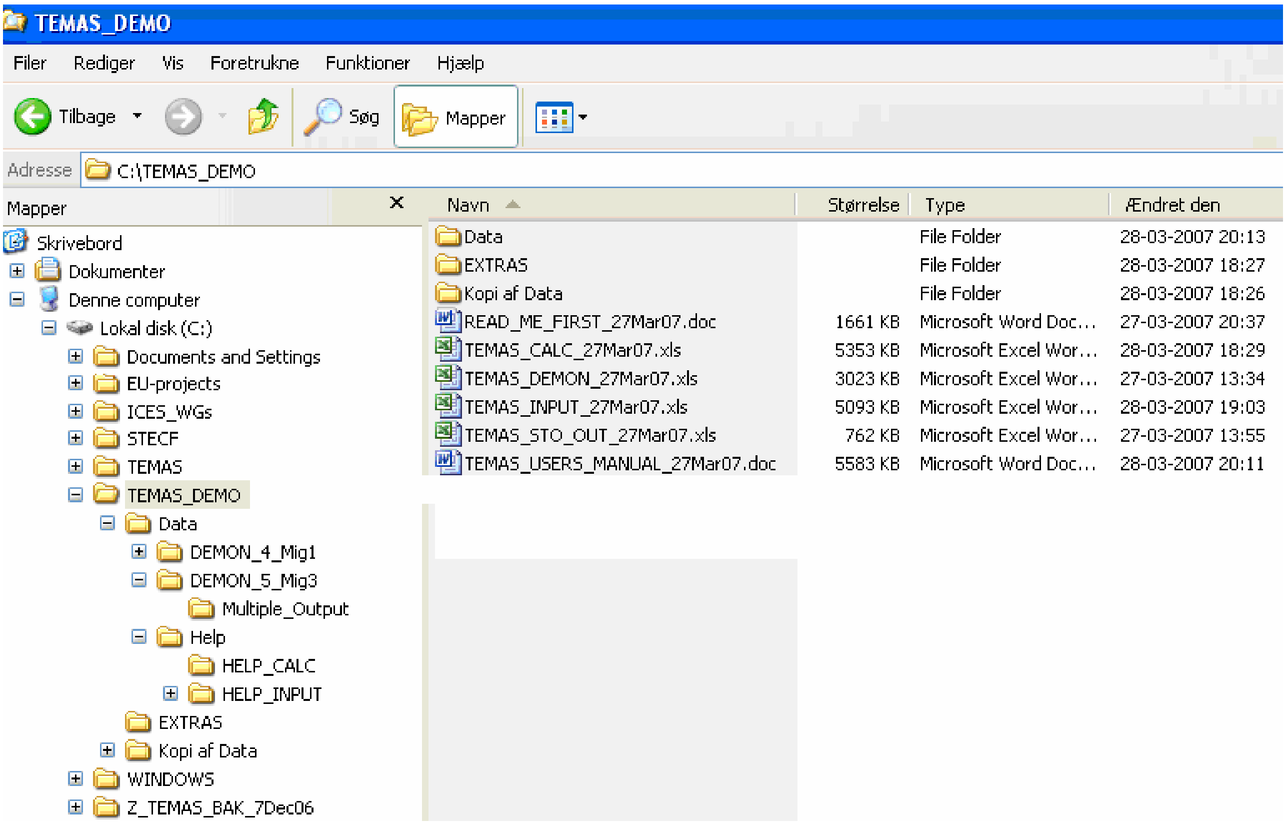
TEMAS is implemented in the form of 4 independent workbooks:

1) TEMAS_INPUT (entry of input to TEMAS)
2) TEMAS_CALC (Simulations and output from TEMAS)
3) TEMAS_STO_OUT (Stochastic simulation output)
4) TEMAS_TUNING (calibration of parameters)

TEMAS_INPUT must be executed before TEMAS_CALC as will be further explained in Section 4. Most often you will run the two workbooks in parallel (Figure 1.2.1). You will make changes to the input parameters by TEMAS_INPUT and then you will move to TEMAS_CALC to make a simulation with the modified parameters. The module "TEMAS_TUNING" is optional, and may be used to condition the model (the parameters) on a suite of observations.

## 1.3. INSTALLATION AND START UP OF TEMAS

As TEMAS is implemented in EXCEL 2003 (MS Office 2003), you need MS Office 2003 (or later) on your PC to run TEMAS. You may downgrade TEMAS, to MS Office 97-8, and it appears that the workbooks are still working properly (however, this has not been thoroughly tested).



- Skrivebord
  - Dokumenter
  - Denne computer
    - Lokal disk (C:)
      - Documents and Settings
      - EU-projects
      - ICES_WGs
      - STECF
      - TEMAS
      - TEMAS_DEMO
        - Data
          - DEMON_4_Mig1
          - DEMON_5_Mig3
            - Multiple_Output
          - Help
            - HELP_CALC
            - HELP_INPUT
        - EXTRAS
        - Kopi af Data
      - WINDOWS
      - Z_TEMAS_BAK_7Dec06

| Navn | Størrelse | Type | Ændret den |
|---|---|---|---|
| Data | | File Folder | 28-03-2007 20:13 |
| EXTRAS | | File Folder | 28-03-2007 18:27 |
| Kopi af Data | | File Folder | 28-03-2007 18:26 |
| READ_ME_FIRST_27Mar07.doc | 1661 KB | Microsoft Word Doc... | 27-03-2007 20:37 |
| TEMAS_CALC_27Mar07.xls | 5353 KB | Microsoft Excel Wor... | 28-03-2007 18:29 |
| TEMAS_DEMON_27Mar07.xls | 3023 KB | Microsoft Excel Wor... | 27-03-2007 13:34 |
| TEMAS_INPUT_27Mar07.xls | 5093 KB | Microsoft Excel Wor... | 28-03-2007 19:03 |
| TEMAS_STO_OUT_27Mar07.xls | 762 KB | Microsoft Excel Wor... | 27-03-2007 13:55 |
| TEMAS_USERS_MANUAL_27Mar07.doc | 5583 KB | Microsoft Word Doc... | 28-03-2007 20:11 |

***Figure 1.3.1. Location of the directories and subdirectories of TEMAS, as shown by the WINDOWS explorer.***

It is difficult to predict the size of the TEMAS package, but for most applications 20 Mb of hard disk should be sufficient. Often you will need less space. As TEMAS consists of three EXCEL workbooks, their size depends on how much is contained in the cells of the worksheets.

The TEMAS package can be delivered in three ZIP-files by email, or you may get the original files (not zipped) on CD or TEMAS may be downloaded from PROTECT of EFIMAS website. There is no installation procedure as such for TEMAS. You just copy the directorates and put them on the C-drives as shown in figure 1.3.1. Note that the location is in the first level: C:\TEMAS\ or C:\TEMAS_DEMO\ in case you install the demonstration version of TEMAS. In the following, we shall use the demonstration version of TEMAS to explain the software.

The location of directories must be as shown in Figure 1.3.1, as TEMAS otherwise will not function. The important thing is the location of the data files as the TEMAS programs, TEMAS_CALC and TEMAS_INPUT must know where data-files are located. Note that the date "27Mar07" has been added to the names of the TEMAS excel files. Actually, you may change the names of the TEMAS EXCEL files as you like. But you should **not** change the names of the standard directories of TEMAS, and these are (See Figure 1.3.1):

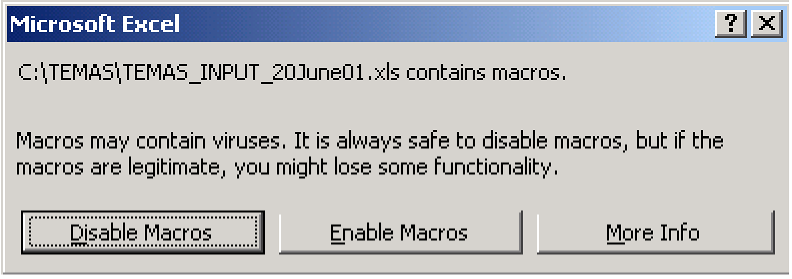
***C:\TEMAS***

C:\TEMAS\DATA\
C:\TEMAS\DATA\Help
C:\TEMAS\DATA\Help\HELP_CALC
C:\TEMAS\DATA\Help\HELP_INPUT

There are two non-standard directories shown in Figure 1.3.1, namely “Copy of Data” and “EXTRAS”. You are free to add any new subdirectories to the standard directories of TEMAS. It is recommended always to have a backup copy of both data and EXCEL files.

Actually, it is rather easy to change the name and location of the main directory “C:\TEMAS\” by changing one single line[1] in the declaration modules of the VIRTUAL BASIC, but the other standard directories cannot be changed, relative to the main directory.

TEMAS is ready to run without any further preparation. The programs are ordinary EXCEL workbooks. You start TEMAS by clicking on TEMAS_INPUT (see figure 1.3.1). Actually, you may also start by TEMAS_CALC, if your input data has already been prepared, but the first time you run TEMAS, you should start with clicking on “TEMAS_INPUT”.
When activated, the first image you should see is shown on figure 1.3.2. You click on “Enable Macros” (there are no viruses or “worms” in the macros of TEMAS, if they come in the original form from the author) TEMAS
cannot run without the macros.



C:\TEMAS\TEMAS_INPUT_20June01.xls contains macros.

Macros may contain viruses. It is always safe to disable macros, but if the macros are legitimate, you might lose some functionality.

***Figure 1.3.2. The first form shown when starting up TEMAS.***

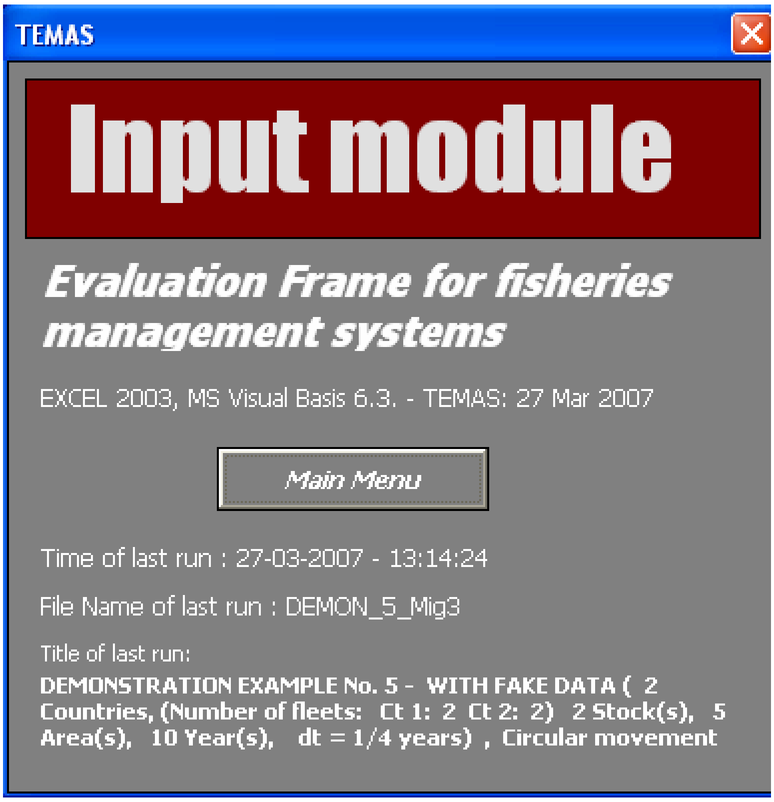
The next form appearing on the screen is the opening form of TEMAS as shown in figure 1.3.3

The purpose of the opening form is primarily to inform you that TEMAS has been started up properly. It also gives you some information of the data set currently in use (if any) Clicking on “main menu” takes you to the main menu for data entry (Figure 1.3.4).

Clicking the question-mark-buttons, displays some textbox with additional information about the button next to the question mark.

---

[1] In “TEMAS_INPUT” module “M01_DECLARATIONS”, change the line (at the beginning of the module): “Public Const DirNm As String = "C:\TEMAS\"”, and similarly in “TEMAS_CALC”.



Input module

Evaluation Frame for fisheries management systems

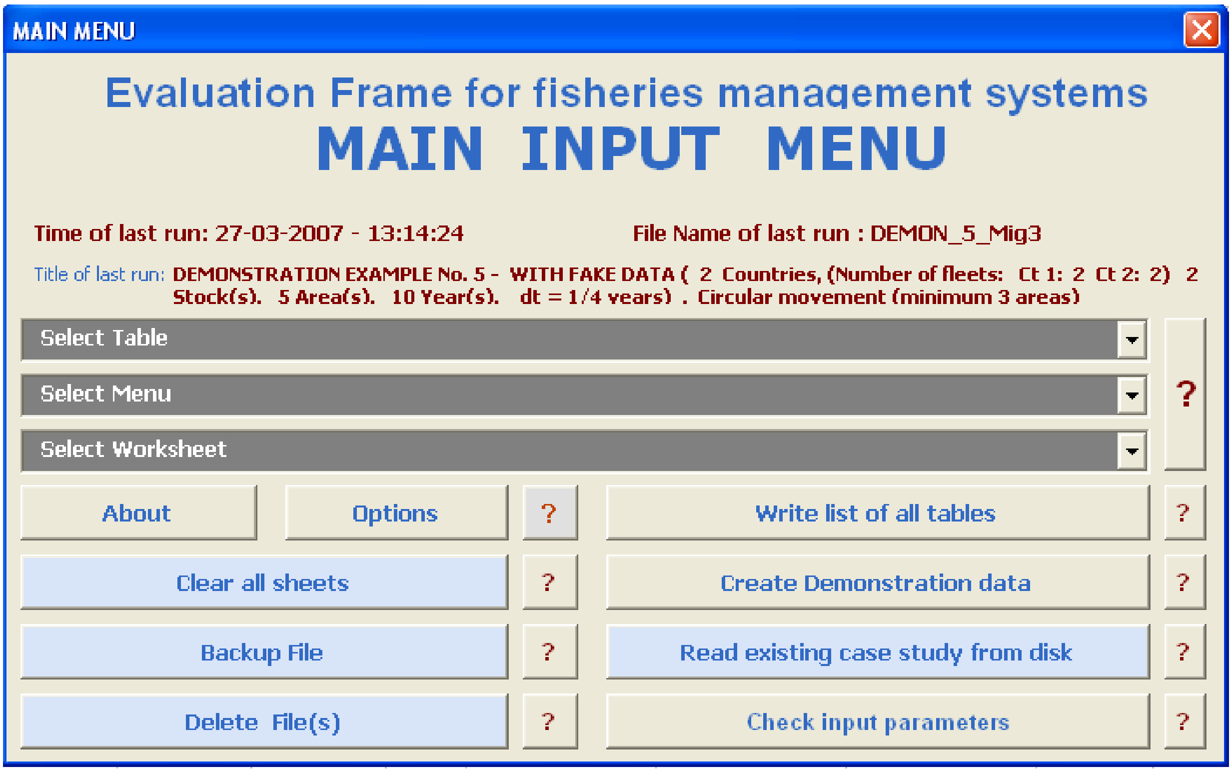
EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 27 Mar 2007

Time of last run : 27-03-2007 - 13:14:24

File Name of last run : DEMON_5_Mig3

Title of last run:
DEMONSTRATION EXAMPLE No. 5 -  WITH FAKE DATA (  2 Countries, (Number of fleets:  Ct 1:  2  Ct 2:  2)   2 Stock(s),   5 Area(s),   10 Year(s),   dt = 1/4 years)  ,  Circular movement

***Figure 1.3.4. The opening form of TEMAS_INPUT***



Evaluation Frame for fisheries management systems
MAIN  INPUT  MENU

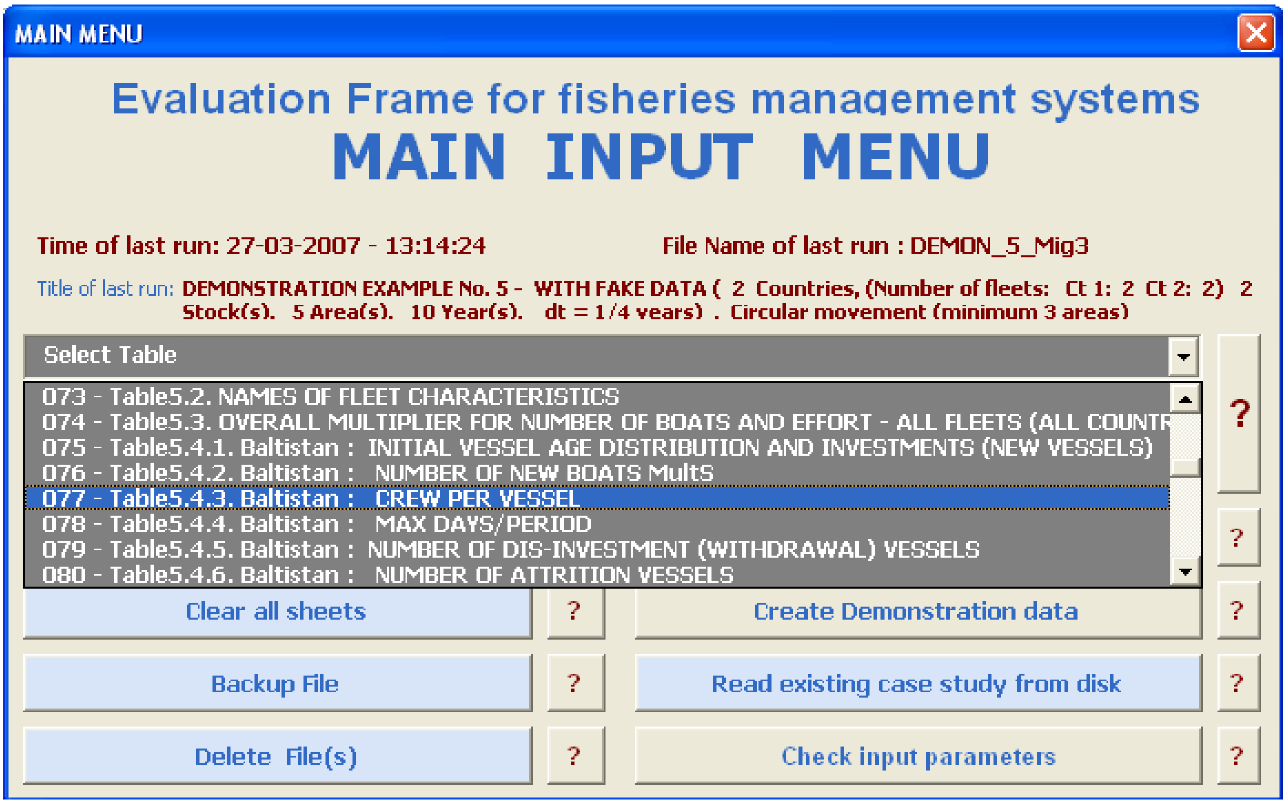
Time of last run: 27-03-2007 - 13:14:24    File Name of last run : DEMON_5_Mig3

Title of last run: DEMONSTRATION EXAMPLE No. 5 -  WITH FAKE DATA (  2  Countries, (Number of fleets:  Ct 1:  2  Ct 2:  2)   2 Stock(s).   5 Area(s).   10 Year(s).   dt = 1/4 years)  .  Circular movement (minimum 3 areas)

***Figure 1.3.4. Main menu of TEMAS_INPUT.*** ).

The “Main-menu” button takes you to the menu shown in Figure 1.3.4. The main purpose of the main menu is to let you easily navigate between the component of the workbook, that is, the table, the worksheets and the menus (the user-forms). This is done by aid of the three pull-down lists (see Figure 1.3.5

When clicking on one of the items in the list, you will be moved to that element (table, worksheet or user-form). The main menu also contains a number of auxiliary functions, the eight buttons under the pull-down lists.



MAIN MENU

Evaluation Frame for fisheries management systems

MAIN INPUT MENU

Time of last run: 27-03-2007 - 13:14:24    File Name of last run : DEMON_5_Mig3

Title of last run: DEMONSTRATION EXAMPLE No. 5 - WITH FAKE DATA ( 2 Countries, (Number of fleets: Ct 1: 2 Ct 2: 2) 2 Stock(s). 5 Area(s). 10 Year(s). dt = 1/4 years) . Circular movement (minimum 3 areas)

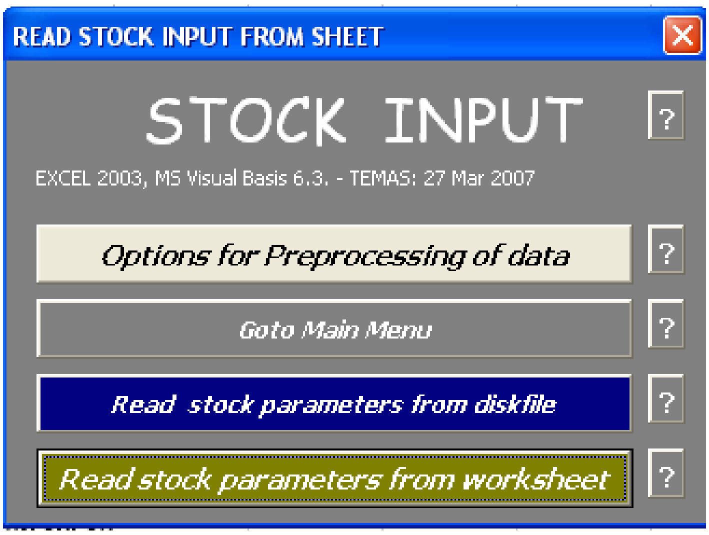
Select Table

073 - Table5.2. NAMES OF FLEET CHARACTERISTICS
074 - Table5.3. OVERALL MULTIPLIER FOR NUMBER OF BOATS AND EFFORT - ALL FLEETS (ALL COUNTR
075 - Table5.4.1. Baltistan : INITIAL VESSEL AGE DISTRIBUTION AND INVESTMENTS (NEW VESSELS)
076 - Table5.4.2. Baltistan : NUMBER OF NEW BOATS MultS
077 - Table5.4.3. Baltistan : CREW PER VESSEL
078 - Table5.4.4. Baltistan : MAX DAYS/PERIOD
079 - Table5.4.5. Baltistan : NUMBER OF DIS-INVESTMENT (WITHDRAWAL) VESSELS
080 - Table5.4.6. Baltistan : NUMBER OF ATTRITION VESSELS

*Figure 1.3.5. Pull-down list (for "finding table") of the main menu of TEMAS_INPUT.*

The explanations of the other buttons on the main menu will be given in Section 4. Here the main menu is shown just to illustrate how a successful start up of TEMAS should be. To each worksheet of TEMAS is linked a user-form. All these user-forms have the same basic layout. As an example is shown the user-form of work-sheet "Stock_Input" in Figure 1.3.6. Each worksheet has a button with the TEMAS-logo, and clicking on that button activates the user-form.

The start up of the TEMAS_CALC workbook follows a similar pattern (see Figure 1.3.7). TEMAS_CALC also has a main menu, which has the same basic features as that of TEMAS_INPUT.



READ STOCK INPUT FROM SHEET

STOCK INPUT

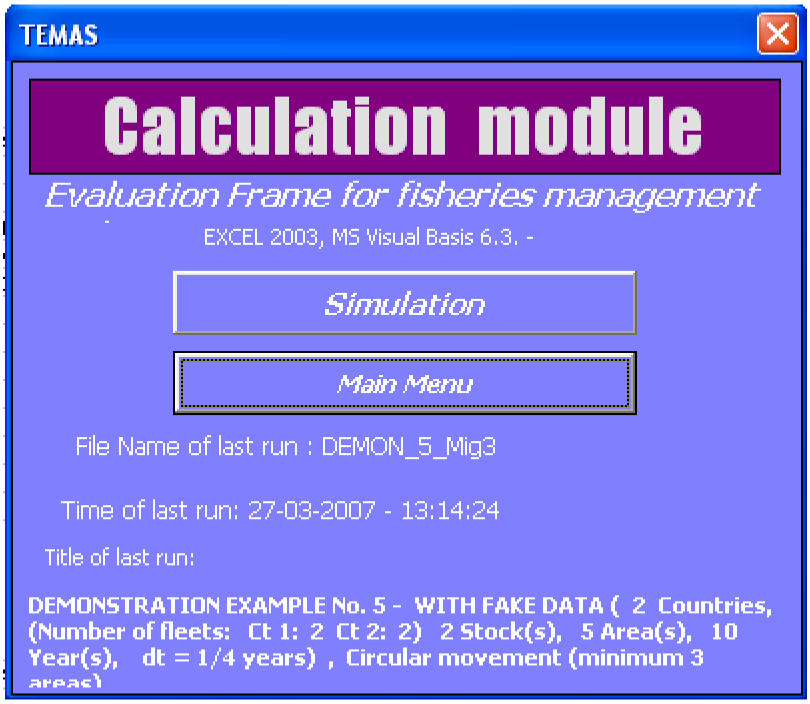
EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 27 Mar 2007

*Figure 1.3.6. The menu for stock data entry of TEMAS (workbook TEMAS_INPUT)*

If you are a new user of TEMAS and just want a demonstration of if, you don't need to prepare a set of input data. TEMAS_INPUT offers a suite of already made demonstration examples (click on button "Create demonstration example"), as will be explained in Section 2.3.
Thus, within a few minutes you should be able to run TEMAS with the pre-prepared input data sets.

The sizes of the TEMAS workbooks given in Figure 1.3.1 are 2560 Kb and 2850 Kb. These sizes however, changes with the case study. TEMAS has a tendency to grow in size, if you do not from time to time clear the sheets by the button "Clear all sheets" (in the main menu, Figure 1.3.5). This will not delete input data (which are stored in text files on the hard disk). Only output and cells prepared by the user will be deleted. Output can easily be regenerated. If you don't want your additional calculations to be deleted, write then on an additional worksheet. "Clear all sheets" only applies to the standard sheets of TEMAS.

***Several of the topics dealt with in this section will be further elaborated in the following sections.***



File Name of last run : DEMON_5_Mig3

Time of last run: 27-03-2007 - 13:14:24

Title of last run:

DEMONSTRATION EXAMPLE No. 5 - WITH FAKE DATA ( 2 Countries, (Number of fleets: Ct 1: 2 Ct 2: 2) 2 Stock(s), 5 Area(s), 10 Year(s), dt = 1/4 years) , Circular movement (minimum 3

***Figure 1.3.7. The opening form of TEMAS_CALC.***

When running the program, you may do any calculation or manipulation of the input tables and output tables by aid of the facilities in EXCEL. With the output produced by the calculation workbook, there is no special instruction on things you should not do. You can do anything you like with the output workbooks, except for deleting the sheets or renaming them. There are five general warnings on thing you should not when running the package

WARNING 1: Do NOT delete any of the standard spreadsheets of the workbook, as that action will cause the program to crash.
WARNING 2: Do NOT insert or delete rows or columns between the input cells (cells indicated by colours, predominantly yellow colour). The yellow cell occur only in the data entry workbook.
WARNING 3: Do NOT change the names of the standard worksheets. If you do, the package will not function.
WARNING 4: Do NOT change the location of the standard directories.
WARNING 5: Do NOT delete files or folders in the directory "C:\TEMAS\Data\" by aid of Windows explorer: (where "TEMAS" is a generic name of the main directory of the system, as chosen by the user)

The data files can be deleted from main input menu, and when you want to delete data files, do it with the button "Delete File(s)" in the menu of the main menu.

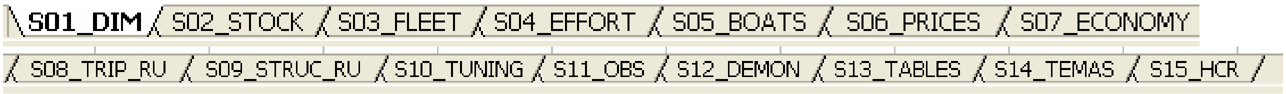
RECOMMENDATION 1: Do always keep a Backup file of your original data set. To be on the safe side you may from time to time make a copy of the entire data subdirectory.
Make also a backup of the entire system, so that in case everything goes wrong you can start up with a fresh version of system and your input data.
Making these backups takes very short time (seconds), whereas you may loose days of work if you loose your original data.

RECOMMENDATION 2: Use the ”Clear All sheets” button from time to time, as the workbook otherwise will grow in size. Without any data in the work sheets, each of the workbooks takes up about 2 Mb, but they may easily grow to 10 Mb after a number of applications.

# 2. INPUT TO TEMAS

## 2.1. WORKSHEETS OF THE INPUT-MODULE OF TEMAS

Input to TEMAS is entered by ten EXCEL worksheets, of the TEMAS_INPUT workbook.



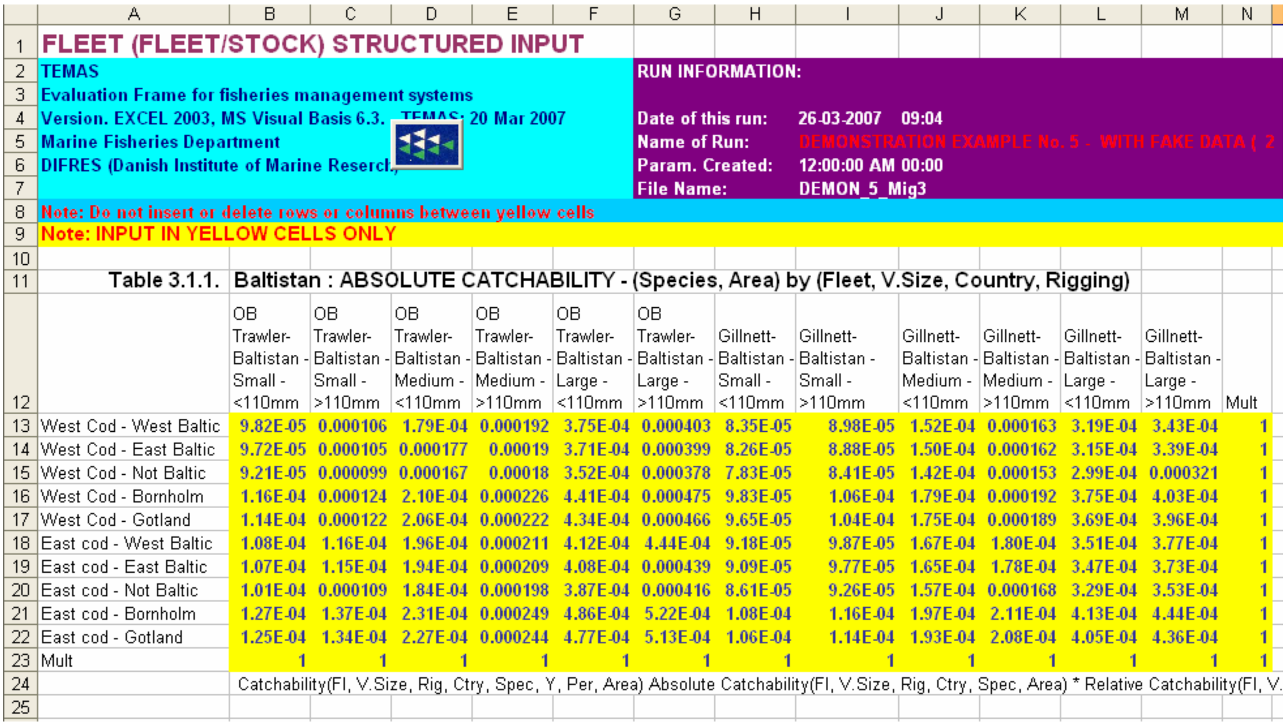
There is in addition a worksheet “Table-list” which gives only information (generated by the program) about the contents of the input sheets. Thus, the TEMAS_INPUT workbook consists of 11 spreadsheets.

Input to TEMAS is partitioned into ten main groups (as structured by the worksheets of TEMAS_INPUT):

| | |
|---|---|
| S01_DIM | Dimensions of case study |
| S02_STOCK | Stock input (input independent of the fleet structure) |
| S03_FLEET | Fleet input (which may or may not be fleet structured) |
| S04_EFFORT | Effort input (optional) |
| S05_BOATS | Boats input |
| S06_PRICES | Prices input |
| S07_ECONOMY | Economic input |
| S08_ TRIP_RU | Trip rules input (Parameters of the short term behaviour algorithms) |
| S09_ STRUC_RU | Structural rules input (Parameters of the long term behaviour algorithms) |
| S10_TUNING | Tuning data, for fish stock assessment |
| S11_OBS | Observation used for model calibration |
| S12_DEMON | List of demonstration examples |
| S13_TABLES | List of all tables in TEMAS_INPUT |
| S14_TEMAS | Parameters of technical management measures |
| S15_HCR | Parameters of harvest control rule |

The input parameters are organized in tables. All tables of TEMAS_INPUT (and TEMAS_CALC) have exactly the same layout, exemplified by Table 2.1.1. (They are all produced by the same VB subroutine).

The cells used to enter input parameters have yellow background-colour. Thus, you should enter input values only in yellow cells. Tables without yellow cells in the worksheets of TEMAS_INPUT, are tables derived from the input tables, for the information of the user. Such information tables are made for checking purposes.



FLEET (FLEET/STOCK) STRUCTURED INPUT

TEMAS
Evaluation Frame for fisheries management systems
Version. EXCEL 2003, MS Visual Basis 6.3. TEMAS: 20 Mar 2007
Marine Fisheries Department
DIFRES (Danish Institute of Marine Reserch)

RUN INFORMATION:

Date of this run: 26-03-2007 09:04
Name of Run: DEMONSTRATION EXAMPLE No. 5 - WITH FAKE DATA ( 2
Param. Created: 12:00:00 AM 00:00
File Name: DEMON_5_Mig3

Note: Do not insert or delete rows or columns between yellow cells
Note: INPUT IN YELLOW CELLS ONLY

Table 3.1.1. Baltistan : ABSOLUTE CATCHABILITY - (Species, Area) by (Fleet, V.Size, Country, Rigging)

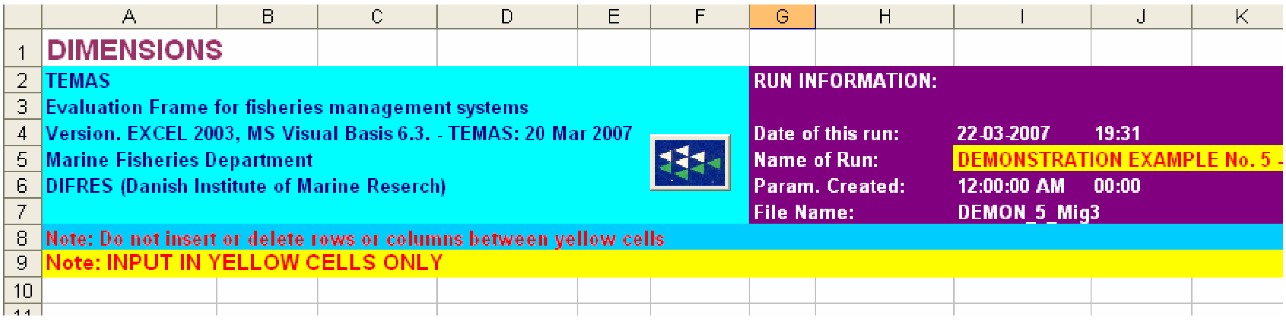
| | OB Trawler-Baltistan - Small - <110mm | OB Trawler-Baltistan - Small - >110mm | OB Trawler-Baltistan - Medium - <110mm | OB Trawler-Baltistan - Medium - >110mm | OB Trawler-Baltistan - Large - <110mm | OB Trawler-Baltistan - Large - >110mm | Gillnett-Baltistan - Small - <110mm | Gillnett-Baltistan - Small - >110mm | Gillnett-Baltistan - Medium - <110mm | Gillnett-Baltistan - Medium - >110mm | Gillnett-Baltistan - Large - <110mm | Gillnett-Baltistan - Large - >110mm | Mult |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| West Cod - West Baltic | 9.82E-05 | 0.000106 | 1.79E-04 | 0.000192 | 3.75E-04 | 0.000403 | 8.35E-05 | 8.98E-05 | 1.52E-04 | 0.000163 | 3.19E-04 | 3.43E-04 | 1 |
| West Cod - East Baltic | 9.72E-05 | 0.000105 | 0.000177 | 0.00019 | 3.71E-04 | 0.000399 | 8.26E-05 | 8.88E-05 | 1.50E-04 | 0.000162 | 3.15E-04 | 3.39E-04 | 1 |
| West Cod - Not Baltic | 9.21E-05 | 0.000099 | 0.000167 | 0.00018 | 3.52E-04 | 0.000378 | 7.83E-05 | 8.41E-05 | 1.42E-04 | 0.000153 | 2.99E-04 | 0.000321 | 1 |
| West Cod - Bornholm | 1.16E-04 | 0.000124 | 2.10E-04 | 0.000226 | 4.41E-04 | 0.000475 | 9.83E-05 | 1.06E-04 | 1.79E-04 | 0.000192 | 3.75E-04 | 4.03E-04 | 1 |
| West Cod - Gotland | 1.14E-04 | 0.000122 | 2.06E-04 | 0.000222 | 4.34E-04 | 0.000466 | 9.65E-05 | 1.04E-04 | 1.75E-04 | 0.000189 | 3.69E-04 | 3.96E-04 | 1 |
| East cod - West Baltic | 1.08E-04 | 1.16E-04 | 1.96E-04 | 0.000211 | 4.12E-04 | 4.44E-04 | 9.18E-05 | 9.87E-05 | 1.67E-04 | 1.80E-04 | 3.51E-04 | 3.77E-04 | 1 |
| East cod - East Baltic | 1.07E-04 | 1.15E-04 | 1.94E-04 | 0.000209 | 4.08E-04 | 0.000439 | 9.09E-05 | 9.77E-05 | 1.65E-04 | 1.78E-04 | 3.47E-04 | 3.73E-04 | 1 |
| East cod - Not Baltic | 1.01E-04 | 0.000109 | 1.84E-04 | 0.000198 | 3.87E-04 | 0.000416 | 8.61E-05 | 9.26E-05 | 1.57E-04 | 0.000168 | 3.29E-04 | 3.53E-04 | 1 |
| East cod - Bornholm | 1.27E-04 | 1.37E-04 | 2.31E-04 | 0.000249 | 4.86E-04 | 5.22E-04 | 1.08E-04 | 1.16E-04 | 1.97E-04 | 2.11E-04 | 4.13E-04 | 4.44E-04 | 1 |
| East cod - Gotland | 1.25E-04 | 1.34E-04 | 2.27E-04 | 0.000244 | 4.77E-04 | 5.13E-04 | 1.06E-04 | 1.14E-04 | 1.93E-04 | 2.08E-04 | 4.05E-04 | 4.36E-04 | 1 |
| Mult | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

Catchability(Fl, V.Size, Rig, Ctry, Spec, Y, Per, Area) Absolute Catchability(Fl, V.Size, Rig, Ctry, Spec, Area) * Relative Catchability(Fl, V.

*Table 2.1.1. Example of the standard table layout of TEMAS_INPUT (and TEMAS_CALC).*

All tables have got assigned a unique number, with a hierarchical structure, such as “Table 3.4.2.1” for “Work sheet no. 3”, “Fleet No. 4”, “Stock No, 2” and “Area No. 1”

The first 8 rows of the worksheet is the “heading” for the worksheet (see example in Figure 2.2.2). All worksheets of TEMAS has a similar heading. The first line is the title of the worksheet. Cells A2-A6 contains the program-identification. The most interesting part for you is probably cell A4, which contains the version number of TEMAS. Versions are simply indicated by the data of release.



DIMENSIONS

TEMAS
Evaluation Frame for fisheries management systems
Version. EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 20 Mar 2007
Marine Fisheries Department
DIFRES (Danish Institute of Marine Reserch)

RUN INFORMATION:

Date of this run: 22-03-2007 19:31
Name of Run: DEMONSTRATION EXAMPLE No. 5 -
Param. Created: 12:00:00 AM 00:00
File Name: DEMON_5_Mig3

Note: Do not insert or delete rows or columns between yellow cells
Note: INPUT IN YELLOW CELLS ONLY

***Figure 2.1.2. Example of the worksheet heading (heading for worksheet “Dimensions”).***

Cells G2-J7 contains information on the current case.
Cell I5 contains the “Name of Run”, which can be any text-string on the user choice, which may help her/him identifying the case study. In TEMAS_CALC the “Name of Run” can also be used to lable alternative runs with the model. In this example only a part of the “Name of Run” is shown in Figure 2.1.2.
The file name (Cell I7) is the name of the text-file in subdirectory “Data”, which contains the input parameter values. Her the name is “DEMON_5_Mig3”, which is a set of fake data prepared by the program for demonstration-purposes only.
The heading gives the date and time the worksheet was created or modified last time (Cell I2), and the date the parameters (under the given File name) were created for the first time (Cell I6). In this case the date of creation is also fake.

## 2.2. SYSTEM DIMEMSIONS OF TEMAS (S01_DIM)

The “system-specification”. inputs are stored in the work sheet “S01_DIM “

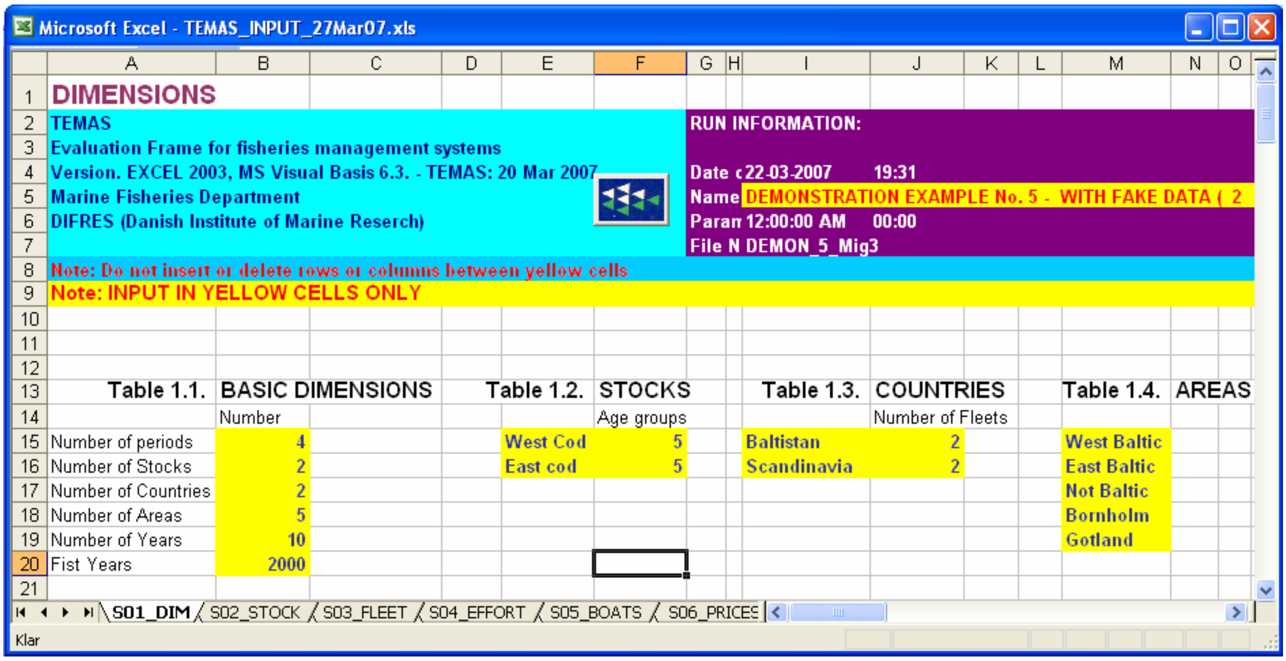
By the “dimensions of a case study” in TEMAS is meant (see example in Figure 2.2.1).

1) The number of stocks and the name of each stock
2) The number of age groups of each stock
3) The number of fleets and the name of each fleet
4) The number of vessel age groups of each fleet
5) The number of areas and the name of each area
6) The number of time steps per year, (or the basic time step, dt, of the simulation).
7) The first year and the number of years simulated.

“The basic time step” is the optional division of the year. Examples are “dt = 1.0 “, “dt = 0.25” and “dt = 1/12”, which corresponds to using a time step of one year, a time step of a quarter of the year and one month, respectively.

The “first year” is the year (say 1999, 2001 or 2002), which you want it to appear in the output tables. Its value has no significance for the simulation outputs. The “number of years” determines the length of the time series of simulation results. There will be a results for each (Number of years) * (Number of time steps per year).

The cells of the tables are either yellow or grey. The yellow cells are the cells containing input values, whereas the grey cells are empty. The grey cells indicate the maximum dimensions of the current version of TEMAS. As can be seen, the maximum numbers of stocks, fleets and areas all have the same value, namely 10. These limits, however, can be changed by changing a few lines on the Visual Basic code.



DIMENSIONS

TEMAS
Evaluation Frame for fisheries management systems
Version. EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 20 Mar 2007
Marine Fisheries Department
DIFRES (Danish Institute of Marine Reserch)

RUN INFORMATION:
Date c 22-03-2007 19:31
Name DEMONSTRATION EXAMPLE No. 5 - WITH FAKE DATA ( 2
Paran 12:00:00 AM 00:00
File N DEMON_5_Mig3

Note: Do not insert or delete rows or columns between yellow cells
Note: INPUT IN YELLOW CELLS ONLY

| Table 1.1. | BASIC DIMENSIONS | Table 1.2. | STOCKS | Table 1.3. | COUNTRIES | Table 1.4. AREAS |
|---|---|---|---|---|---|---|
| | Number | | Age groups | | Number of Fleets | |
| Number of periods | 4 | West Cod | 5 | Baltistan | 2 | West Baltic |
| Number of Stocks | 2 | East cod | 5 | Scandinavia | 2 | East Baltic |
| Number of Countries | 2 | | | | | Not Baltic |
| Number of Areas | 5 | | | | | Bornholm |
| Number of Years | 10 | | | | | Gotland |
| Fist Years | 2000 | | | | | |

*Figure 2.2.1. Example of system dimensions of a case study*

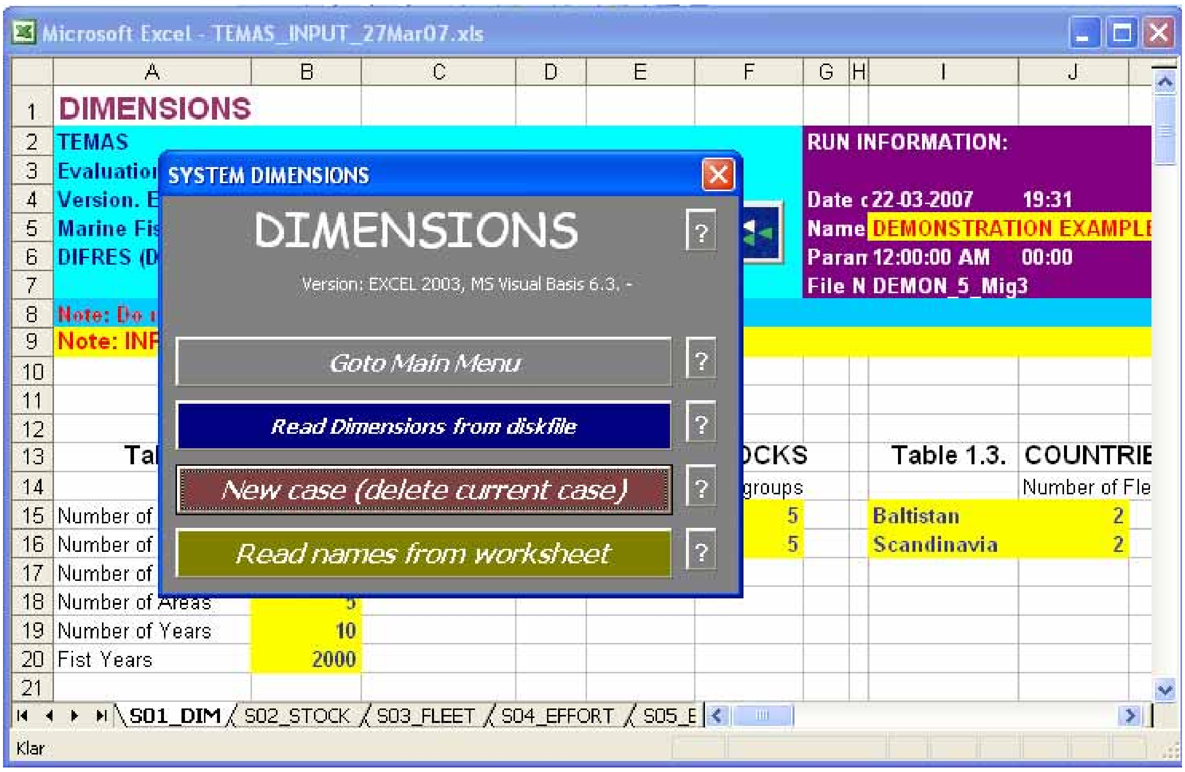


*Figure 2.2.3. The menu of the worksheet,*

The yellow cells are not easily reproduced in a black and white copy of this report, so in case you cannot spot the yellow cells, you are told that they are B13-18, E13-F14, I13-J14 and M13-M14, altogether 12 cells. You activate the menu of the worksheet by clicking on the button with the idealised fish school (the logo of TEMAS).

The menu for the "dimensions" worksheet (S01_DIM) is shown in Figure 2.2.3. Once you have activated the user-form, you cannot access the worksheet. The get out of the user-form, click on the "X" in the upper right corner of the user-form

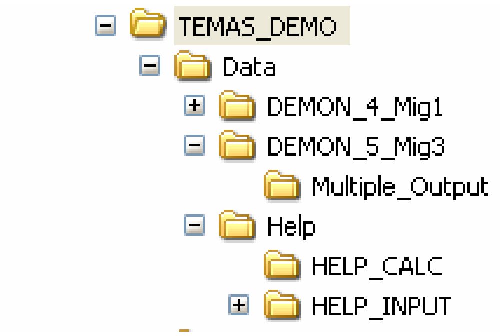
The menus of the worksheets all have the same basic design. They all contain the tree buttons: a blue one: "Read XXXX from disk-file", a yellow one: "Read XXXX from worksheet" and a grey one: "Goto Main Menu", where "XXXX" is the name of the content of the worksheet.

The menu for dimensions, has in addtion a button which are not in other userforms.

"Read dimensions from disk-file" (Figure 2.2.3) will delete the content of the worksheet, read the dimensions from the disk-file and display a new set of Tables. "Read names from worksheet" will do the opposite, it will read the names from the worksheet and store the results in the disk-file. Thus, if you want to change the name of, say, one of the fleets, you overwrite the old fleet name and click on "Read names from worksheet". To change the dimensions, you need to click on "New case". All other worksheets will have only one button to read the content of the worksheet, and that option will read all input values of the worksheet. The dimensions, however, have a different status, compared to other input. The dimensions will change the format of all input tables; so changing the dimensions is a different concept compared to changing the non-dimension parameters, which you can modify without influencing the values of other parameters,

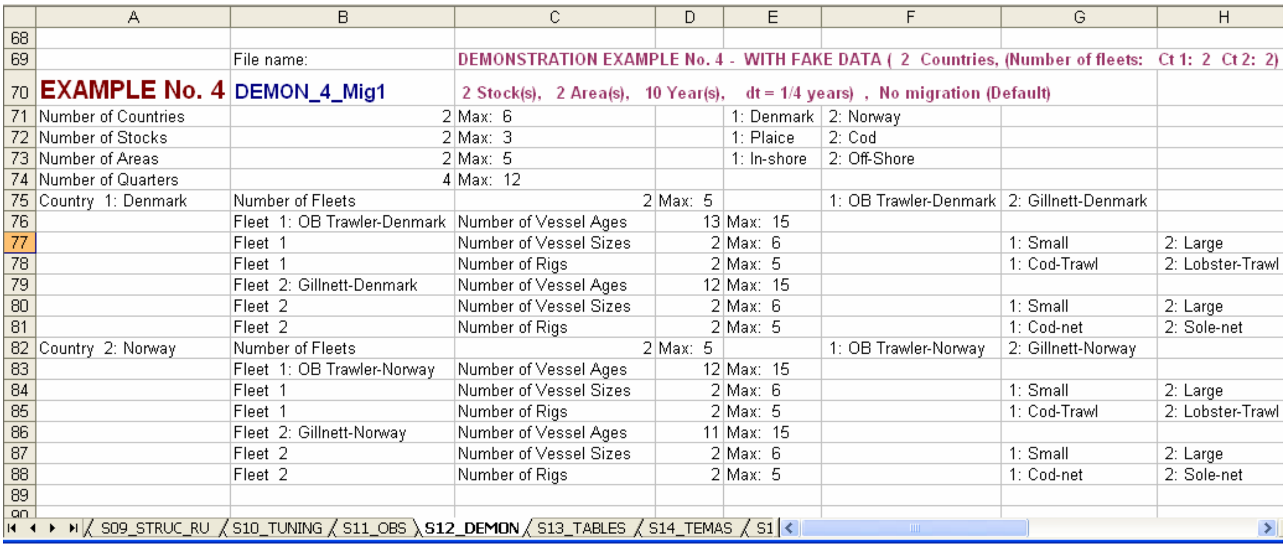
Which units to use for numbers, length and weight are entirely up to the user of TEMAS. It is not essential for the calculations which units are used (cm, mm, gram, kilo, tons, thousands, millions, etc.). It is the users responsibility to secure that the units are matching each other. This applies to input as well to output. As will appear, TEMAS never assigns units to variables or parameters. The only unit, which is fixed, is that of time. Here is used the unit of "one year", as is the tradition in fish stock assessment. Thus all mortality rates as well as discount rates are given in the unit “per year”.

## 2.3. DEMONSTRATION EXAMPLES OF TEMAS



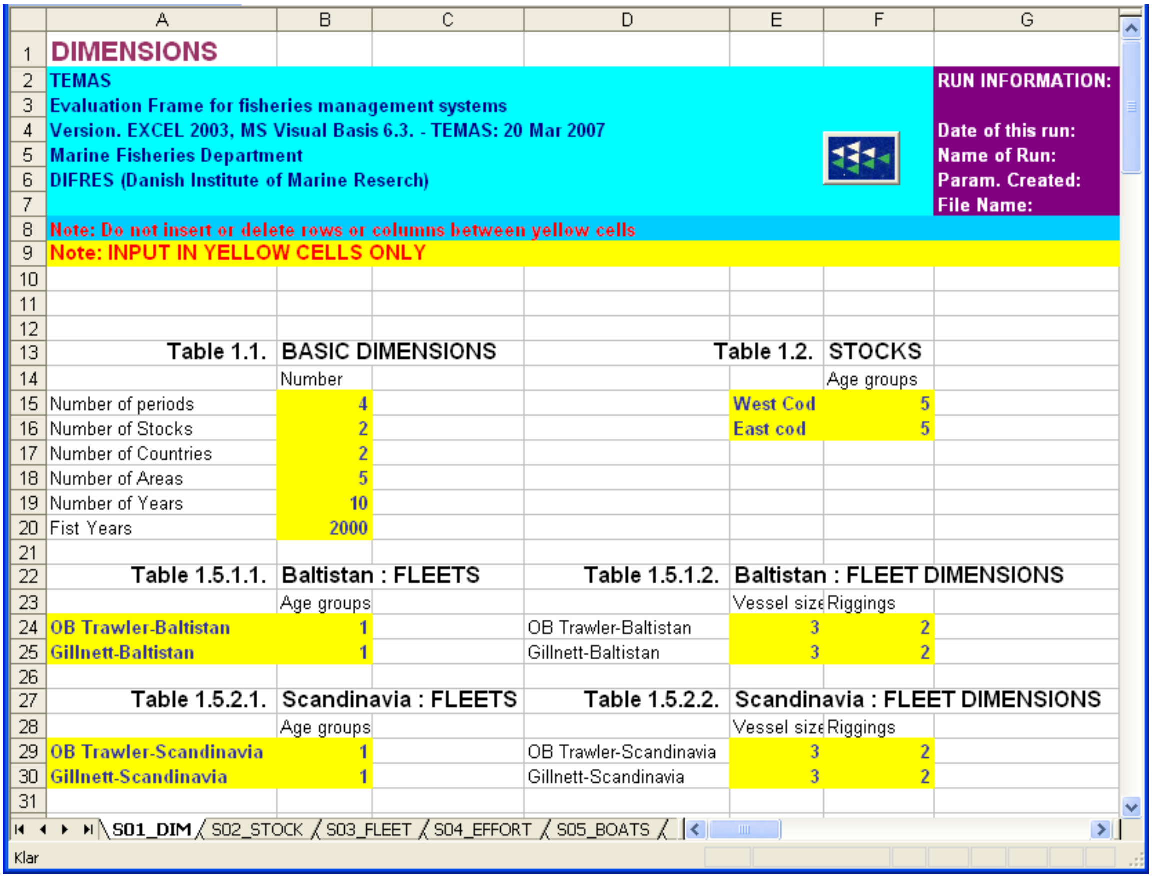
- ⊟ TEMAS_DEMO
  - ⊟ Data
    - ⊞ DEMON_4_Mig1
    - ⊟ DEMON_5_Mig3
      - Multiple_Output
  - ⊟ Help
    - HELP_CALC
    - ⊞ HELP_INPUT

The TEMAS program contains two pre-prepared (fake) demonstration examples:
DEMON_4_Mig1 and DEMON_5_Mig3. Each demonstration data set is stored in sub directory in the “DATA”-directory. DEMON_4_Mig1 is the all-purpose demonstration example, whereas DEMON_5_Mig3 is an example with a number of features that resembles the Baltic cod case study. This manual uses the DEMON_5_Mig3 demonstration example to illustrate the TEMAS software.



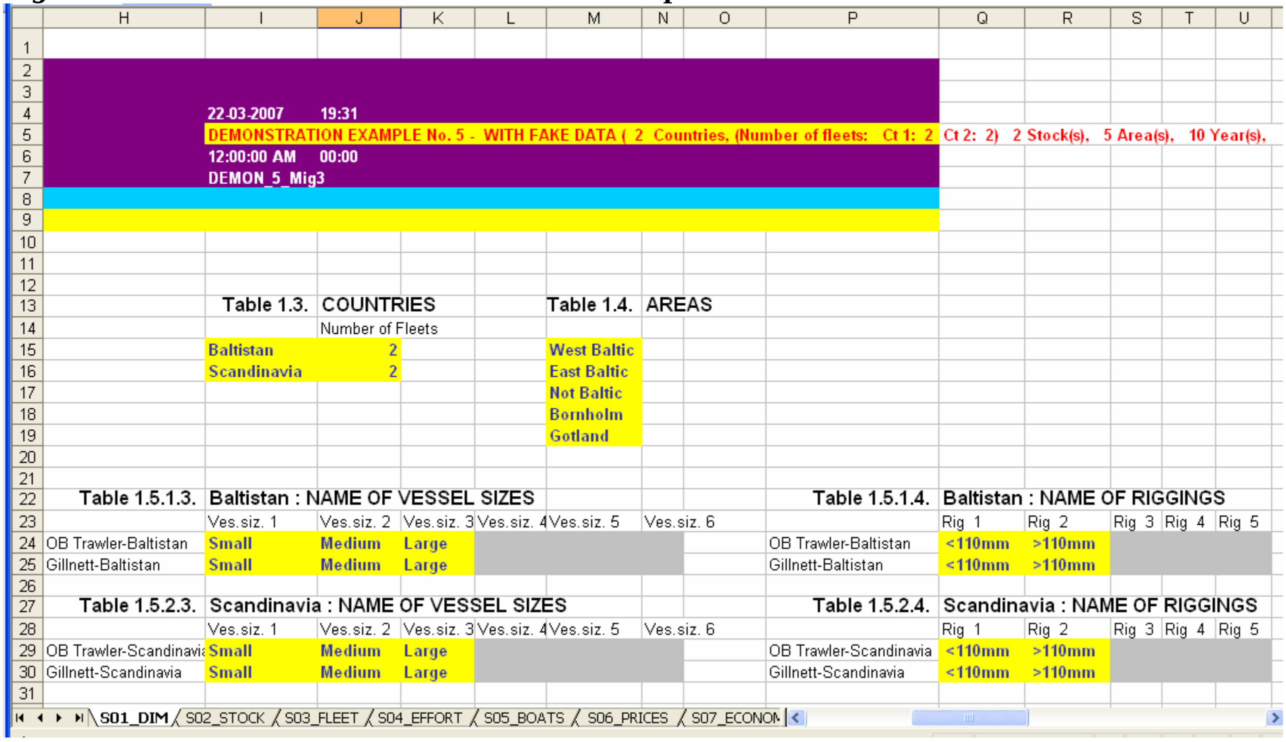
| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| 68 | | | | | | | | |
| 69 | | File name: | DEMONSTRATION EXAMPLE No. 4 - WITH FAKE DATA ( 2 Countries, (Number of fleets: Ct 1: 2 Ct 2: 2) | | | | | |
| 70 | **EXAMPLE No. 4** | **DEMON_4_Mig1** | **2 Stock(s), 2 Area(s), 10 Year(s), dt = 1/4 years) , No migration (Default)** | | | | | |
| 71 | Number of Countries | 2 | Max: 6 | | 1: Denmark | 2: Norway | | |
| 72 | Number of Stocks | 2 | Max: 3 | | 1: Plaice | 2: Cod | | |
| 73 | Number of Areas | 2 | Max: 5 | | 1: In-shore | 2: Off-Shore | | |
| 74 | Number of Quarters | 4 | Max: 12 | | | | | |
| 75 | Country 1: Denmark | Number of Fleets | 2 | Max: 5 | | 1: OB Trawler-Denmark | 2: Gillnett-Denmark | |
| 76 | | Fleet 1: OB Trawler-Denmark | Number of Vessel Ages | 13 | Max: 15 | | | |
| 77 | | Fleet 1 | Number of Vessel Sizes | 2 | Max: 6 | | 1: Small | 2: Large |
| 78 | | Fleet 1 | Number of Rigs | 2 | Max: 5 | | 1: Cod-Trawl | 2: Lobster-Trawl |
| 79 | | Fleet 2: Gillnett-Denmark | Number of Vessel Ages | 12 | Max: 15 | | | |
| 80 | | Fleet 2 | Number of Vessel Sizes | 2 | Max: 6 | | 1: Small | 2: Large |
| 81 | | Fleet 2 | Number of Rigs | 2 | Max: 5 | | 1: Cod-net | 2: Sole-net |
| 82 | Country 2: Norway | Number of Fleets | 2 | Max: 5 | | 1: OB Trawler-Norway | 2: Gillnett-Norway | |
| 83 | | Fleet 1: OB Trawler-Norway | Number of Vessel Ages | 12 | Max: 15 | | | |
| 84 | | Fleet 1 | Number of Vessel Sizes | 2 | Max: 6 | | 1: Small | 2: Large |
| 85 | | Fleet 1 | Number of Rigs | 2 | Max: 5 | | 1: Cod-Trawl | 2: Lobster-Trawl |
| 86 | | Fleet 2: Gillnett-Norway | Number of Vessel Ages | 11 | Max: 15 | | | |
| 87 | | Fleet 2 | Number of Vessel Sizes | 2 | Max: 6 | | 1: Small | 2: Large |
| 88 | | Fleet 2 | Number of Rigs | 2 | Max: 5 | | 1: Cod-net | 2: Sole-net |
| 89 | | | | | | | | |

*Figure 2.3.1. Dimensions of Demonstration example No.4.*



| | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| 1 | DIMENSIONS | | | | | | |
| 2 | TEMAS | | | | | | RUN INFORMATION: |
| 3 | Evaluation Frame for fisheries management systems | | | | | | |
| 4 | Version. EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 20 Mar 2007 | | | | | | Date of this run: |
| 5 | Marine Fisheries Department | | | | | | Name of Run: |
| 6 | DIFRES (Danish Institute of Marine Reserch) | | | | | | Param. Created: |
| 7 | | | | | | | File Name: |
| 8 | Note: Do not insert or delete rows or columns between yellow cells | | | | | | |
| 9 | Note: INPUT IN YELLOW CELLS ONLY | | | | | | |
| 10 | | | | | | | |
| 11 | | | | | | | |
| 12 | | | | | | | |
| 13 | Table 1.1. | BASIC DIMENSIONS | | | Table 1.2. | STOCKS | |
| 14 | | Number | | | | Age groups | |
| 15 | Number of periods | 4 | | | West Cod | 5 | |
| 16 | Number of Stocks | 2 | | | East cod | 5 | |
| 17 | Number of Countries | 2 | | | | | |
| 18 | Number of Areas | 5 | | | | | |
| 19 | Number of Years | 10 | | | | | |
| 20 | Fist Years | 2000 | | | | | |
| 21 | | | | | | | |
| 22 | Table 1.5.1.1. | Baltistan : FLEETS | | Table 1.5.1.2. | Baltistan : FLEET DIMENSIONS | | |
| 23 | | Age groups | | | Vessel size | Riggings | |
| 24 | OB Trawler-Baltistan | 1 | | OB Trawler-Baltistan | 3 | 2 | |
| 25 | Gillnett-Baltistan | 1 | | Gillnett-Baltistan | 3 | 2 | |
| 26 | | | | | | | |
| 27 | Table 1.5.2.1. | Scandinavia : FLEETS | | Table 1.5.2.2. | Scandinavia : FLEET DIMENSIONS | | |
| 28 | | Age groups | | | Vessel size | Riggings | |
| 29 | OB Trawler-Scandinavia | 1 | | OB Trawler-Scandinavia | 3 | 2 | |
| 30 | Gillnett-Scandinavia | 1 | | Gillnett-Scandinavia | 3 | 2 | |
| 31 | | | | | | | |

*Figure 2.3.2.a. Pseudo Baltic demonstration example*

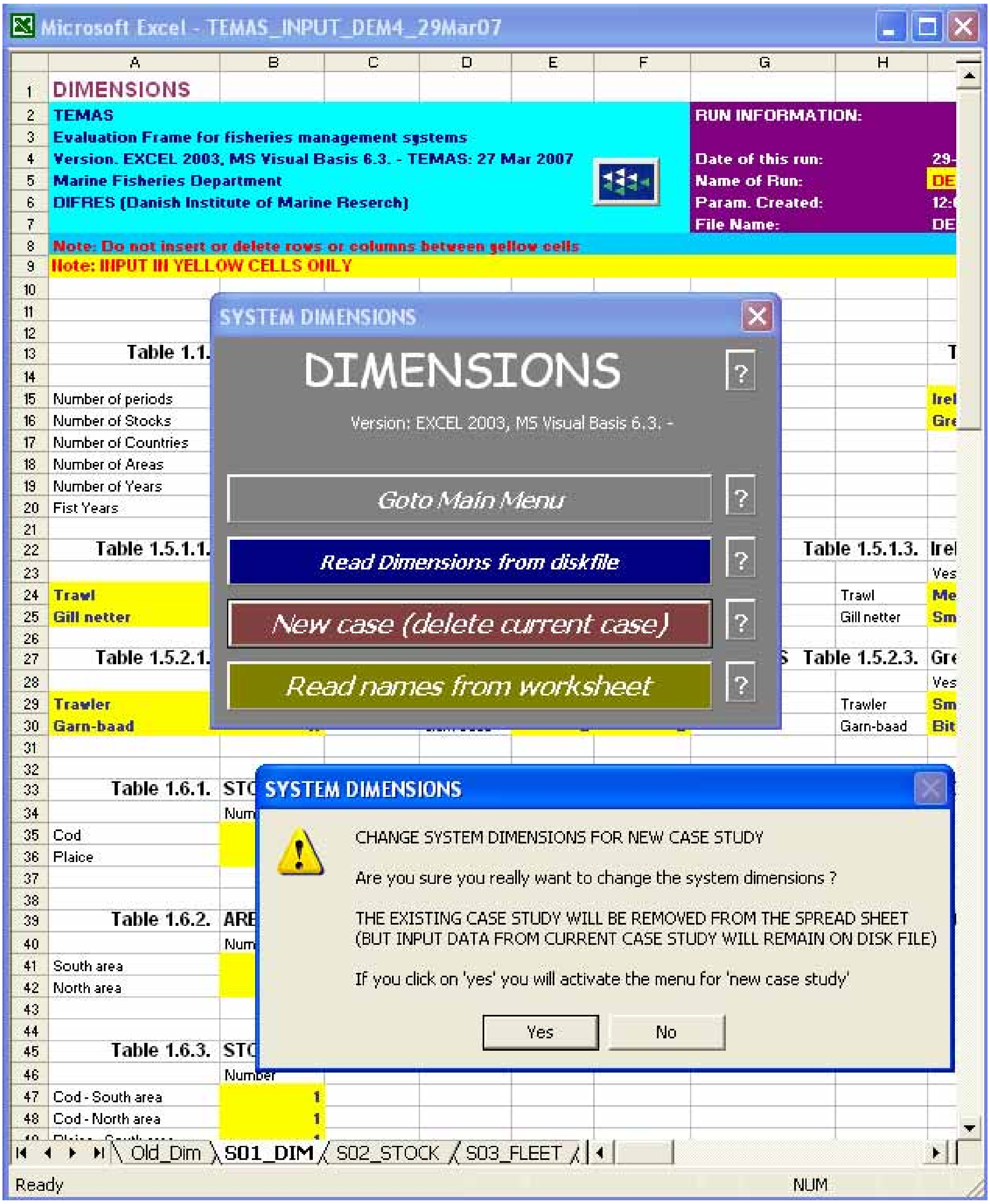


| | H | I | J | K | L | M | N | O | P | Q | R | S | T | U |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | |
| 4 | | 22-03-2007 | 19:31 | | | | | | | | | | | |
| 5 | | DEMONSTRATION EXAMPLE No. 5 - WITH FAKE DATA ( 2 Countries, (Number of fleets: Ct 1: 2 Ct 2: 2) 2 Stock(s), 5 Area(s), 10 Year(s), | | | | | | | | | | | | |
| 6 | | 12:00:00 AM | 00:00 | | | | | | | | | | | |
| 7 | | DEMON_5_Mig3 | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | |
| 13 | | Table 1.3. | COUNTRIES | | | Table 1.4. | AREAS | | | | | | | |
| 14 | | | Number of Fleets | | | | | | | | | | | |
| 15 | | Baltistan | 2 | | | West Baltic | | | | | | | | |
| 16 | | Scandinavia | 2 | | | East Baltic | | | | | | | | |
| 17 | | | | | | Not Baltic | | | | | | | | |
| 18 | | | | | | Bornholm | | | | | | | | |
| 19 | | | | | | Gotland | | | | | | | | |
| 20 | | | | | | | | | | | | | | |
| 21 | | | | | | | | | | | | | | |
| 22 | Table 1.5.1.3. | Baltistan : NAME OF VESSEL SIZES | | | | | | | Table 1.5.1.4. | Baltistan : NAME OF RIGGINGS | | | | |
| 23 | | Ves.siz. 1 | Ves.siz. 2 | Ves.siz. 3 | Ves.siz. 4 | Ves.siz. 5 | Ves.siz. 6 | | | Rig 1 | Rig 2 | Rig 3 | Rig 4 | Rig 5 |
| 24 | OB Trawler-Baltistan | Small | Medium | Large | | | | | OB Trawler-Baltistan | <110mm | >110mm | | | |
| 25 | Gillnett-Baltistan | Small | Medium | Large | | | | | Gillnett-Baltistan | <110mm | >110mm | | | |
| 26 | | | | | | | | | | | | | | |
| 27 | Table 1.5.2.3. | Scandinavia : NAME OF VESSEL SIZES | | | | | | | Table 1.5.2.4. | Scandinavia : NAME OF RIGGINGS | | | | |
| 28 | | Ves.siz. 1 | Ves.siz. 2 | Ves.siz. 3 | Ves.siz. 4 | Ves.siz. 5 | Ves.siz. 6 | | | Rig 1 | Rig 2 | Rig 3 | Rig 4 | Rig 5 |
| 29 | OB Trawler-Scandinavi | Small | Medium | Large | | | | | OB Trawler-Scandinavia | <110mm | >110mm | | | |
| 30 | Gillnett-Scandinavia | Small | Medium | Large | | | | | Gillnett-Scandinavia | <110mm | >110mm | | | |
| 31 | | | | | | | | | | | | | | |

*Figure 2.3.2.b. Pseudo Baltic demonstration example*

## 2.4. STARTING UP A NEW CASE STUDY WITH TEMAS, S01_DIM

To start up a new case study, the first thing to do is to enter the system dimensions (see example in Figure 2.2.1) and then click on “New case (Delete current case)” in the menu (Figure 2.4.1).



DIMENSIONS

TEMAS
Evaluation Frame for fisheries management systems
Version. EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 27 Mar 2007
Marine Fisheries Department
DIFRES (Danish Institute of Marine Reserch)

RUN INFORMATION:
Date of this run:
Name of Run:
Param. Created:
File Name:

Note: Do not insert or delete rows or columns between yellow cells
Note: INPUT IN YELLOW CELLS ONLY

Version: EXCEL 2003, MS Visual Basis 6.3. -

SYSTEM DIMENSIONS

CHANGE SYSTEM DIMENSIONS FOR NEW CASE STUDY

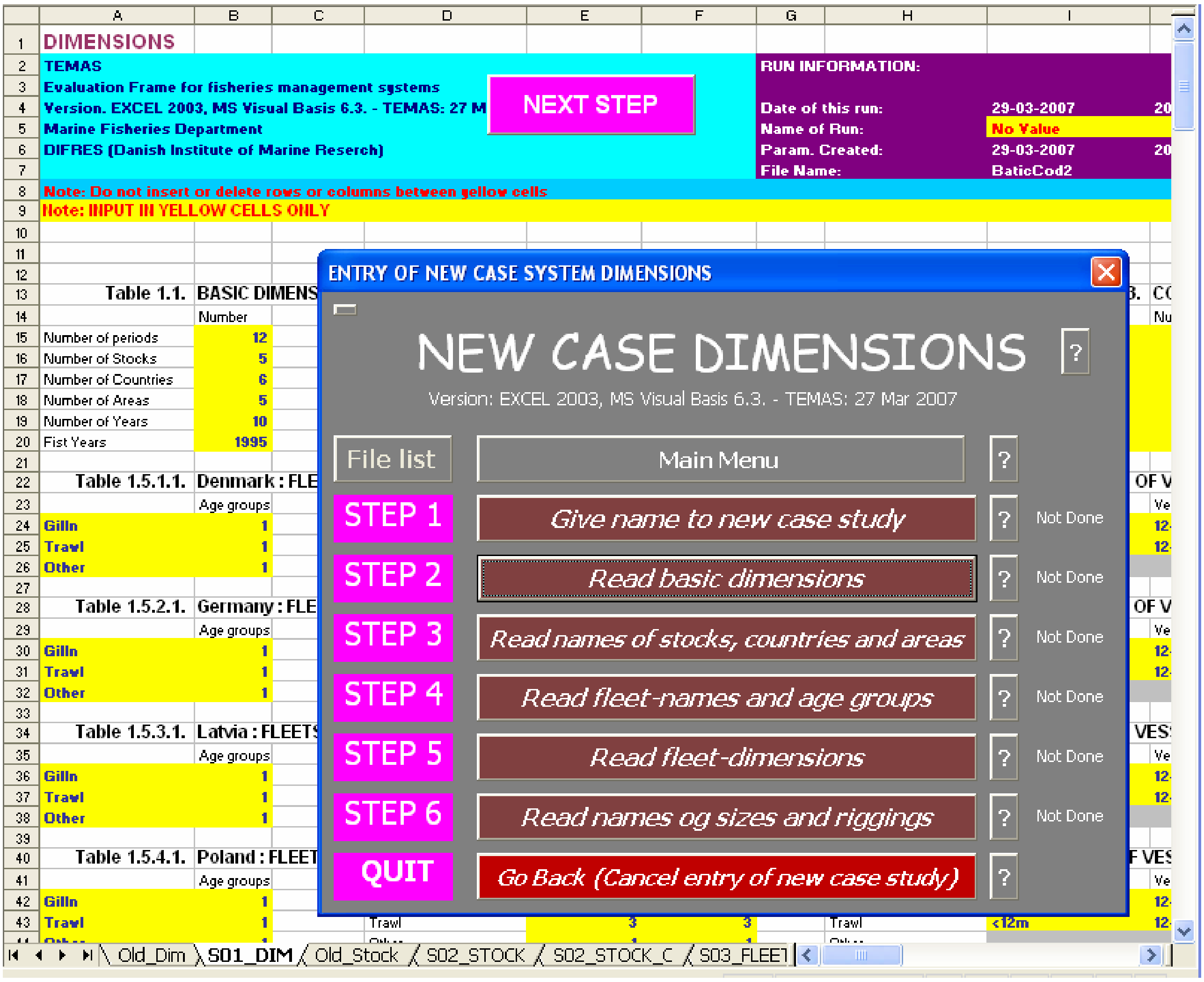
Are you sure you really want to change the system dimensions ?

THE EXISTING CASE STUDY WILL BE REMOVED FROM THE SPREAD SHEET
(BUT INPUT DATA FROM CURRENT CASE STUDY WILL REMAIN ON DISK FILE)

If you click on 'yes' you will activate the menu for 'new case study'

***Figure 2.4.1.Starting up a new case study with TEMAS.***

Clicking on “Yes” gives you the menu for “New case study” and the “Next Step”-button (Figure 2.4.2). As appears, the procedure for starting up a new case study is organized in steps. What happens in each step, is that TEMAS creates the data-files on the hard disk that will contain the parameters, variables and results. It is important that the steps are executed in the given order, as TEMAS will otherwise not be able organize the data-files. E.g. it must know the number of fleets in each country, before it can add further details to the fleets, such as gear riggings, vessel size classes etc.



DIMENSIONS

TEMAS

Evaluation Frame for fisheries management systems

Version. EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 27 M

Marine Fisheries Department

DIFRES (Danish Institute of Marine Reserch)

RUN INFORMATION:

Date of this run: 29-03-2007

Name of Run: No Value

Param. Created: 29-03-2007

File Name: BaticCod2

Note: Do not insert or delete rows or columns between yellow cells

Note: INPUT IN YELLOW CELLS ONLY

Table 1.1. BASIC DIMENS

| | Number |
|---|---|
| Number of periods | 12 |
| Number of Stocks | 5 |
| Number of Countries | 6 |
| Number of Areas | 5 |
| Number of Years | 10 |
| Fist Years | 1995 |

Table 1.5.1.1. Denmark : FLE

| | Age groups |
|---|---|
| Gilln | 1 |
| Trawl | 1 |
| Other | 1 |

Table 1.5.2.1. Germany : FLE

| | Age groups |
|---|---|
| Gilln | 1 |
| Trawl | 1 |
| Other | 1 |

Table 1.5.3.1. Latvia : FLEETS

| | Age groups |
|---|---|
| Gilln | 1 |
| Trawl | 1 |
| Other | 1 |

Table 1.5.4.1. Poland : FLEET

| | Age groups |
|---|---|
| Gilln | 1 |
| Trawl | 1 |

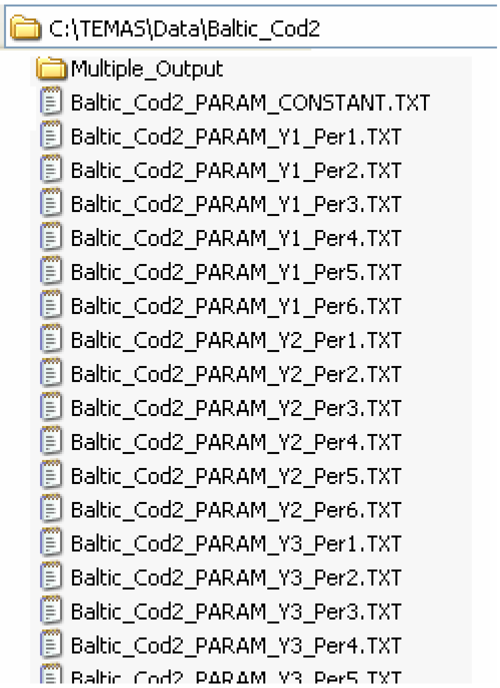
ENTRY OF NEW CASE SYSTEM DIMENSIONS

NEW CASE DIMENSIONS

Version: EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 27 Mar 2007

| | | |
|---|---|---|
| STEP 1 | Give name to new case study | Not Done |
| STEP 2 | Read basic dimensions | Not Done |
| STEP 3 | Read names of stocks, countries and areas | Not Done |
| STEP 4 | Read fleet-names and age groups | Not Done |
| STEP 5 | Read fleet-dimensions | Not Done |
| STEP 6 | Read names og sizes and riggings | Not Done |
| QUIT | Go Back (Cancel entry of new case study) | |

*Figure 2.4.2. Menu for Starting up a new case study with TEMAS.*



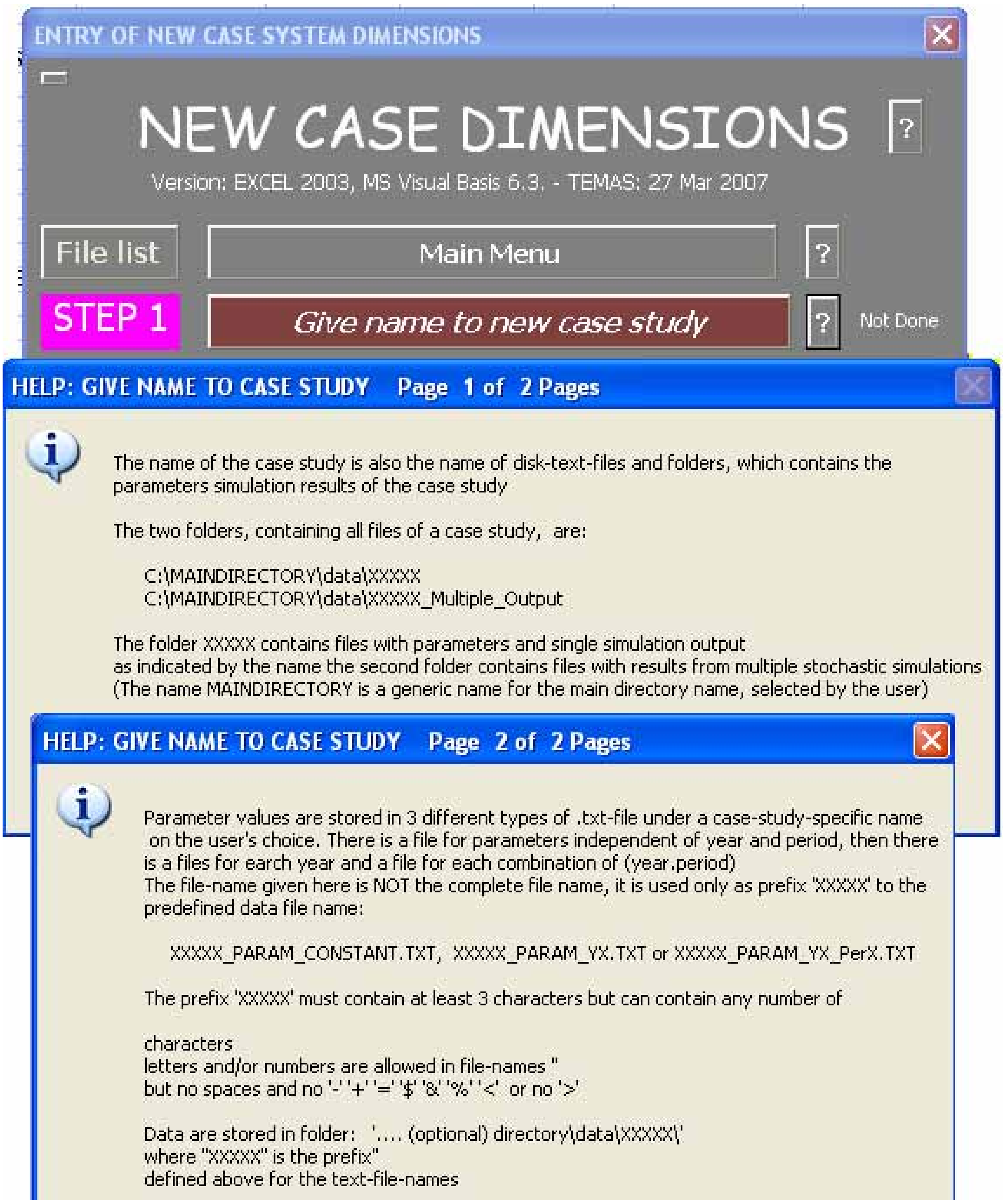
C:\TEMAS\Data\Baltic_Cod2

Multiple_Output
Baltic_Cod2_PARAM_CONSTANT.TXT
Baltic_Cod2_PARAM_Y1_Per1.TXT
Baltic_Cod2_PARAM_Y1_Per2.TXT
Baltic_Cod2_PARAM_Y1_Per3.TXT
Baltic_Cod2_PARAM_Y1_Per4.TXT
Baltic_Cod2_PARAM_Y1_Per5.TXT
Baltic_Cod2_PARAM_Y1_Per6.TXT
Baltic_Cod2_PARAM_Y2_Per1.TXT
Baltic_Cod2_PARAM_Y2_Per2.TXT
Baltic_Cod2_PARAM_Y2_Per3.TXT
Baltic_Cod2_PARAM_Y2_Per4.TXT
Baltic_Cod2_PARAM_Y2_Per5.TXT
Baltic_Cod2_PARAM_Y2_Per6.TXT
Baltic_Cod2_PARAM_Y3_Per1.TXT
Baltic_Cod2_PARAM_Y3_Per2.TXT
Baltic_Cod2_PARAM_Y3_Per3.TXT
Baltic_Cod2_PARAM_Y3_Per4.TXT
Baltic_Cod2_PARAM_Y3_Per5.TXT

There are 6 steps in the procedure, and the user form will keep track of where you are in the process, as indicated in the right hand side column with “Not Done”. As you proceed “Not done” will be replaced by “Done”. Clicking on  the question mark next to STEP 1: “Give name to new case study” gives an explanation of what a “name” means in the context of TEMAS (Figure 2.4.3), as well as the conventions for names used in TEMAS. It is important to choose names that makes sense and are explanatory, so that at a later state you will be able to remember the particulars about the case study.

Note that the name of the case study will also become is  a part of the names of data files and data-directories cerated by TEMAS. If the name “BalticCod2” was given the names given to files would be those shown in the picture to the left. This time series of files contains the set of parameter-files, that all have “BalticCod2” as a part of their name.

These files and their names are created automatically by the TEMAS, and the user should never modify the names.



Version: EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 27 Mar 2007

HELP: GIVE NAME TO CASE STUDY Page 1 of 2 Pages

The name of the case study is also the name of disk-text-files and folders, which contains the parameters simulation results of the case study

The two folders, containing all files of a case study, are:

C:\MAINDIRECTORY\data\XXXXX
C:\MAINDIRECTORY\data\XXXXX_Multiple_Output

The folder XXXXX contains files with parameters and single simulation output
as indicated by the name the second folder contains files with results from multiple stochastic simulations
(The name MAINDIRECTORY is a generic name for the main directory name, selected by the user)

HELP: GIVE NAME TO CASE STUDY Page 2 of 2 Pages

Parameter values are stored in 3 different types of .txt-file under a case-study-specific name
on the user's choice. There is a file for parameters independent of year and period, then there
is a files for earch year and a file for each combination of (year.period)
The file-name given here is NOT the complete file name, it is used only as prefix 'XXXXX' to the
predefined data file name:

XXXXX_PARAM_CONSTANT.TXT, XXXXX_PARAM_YX.TXT or XXXXX_PARAM_YX_PerX.TXT

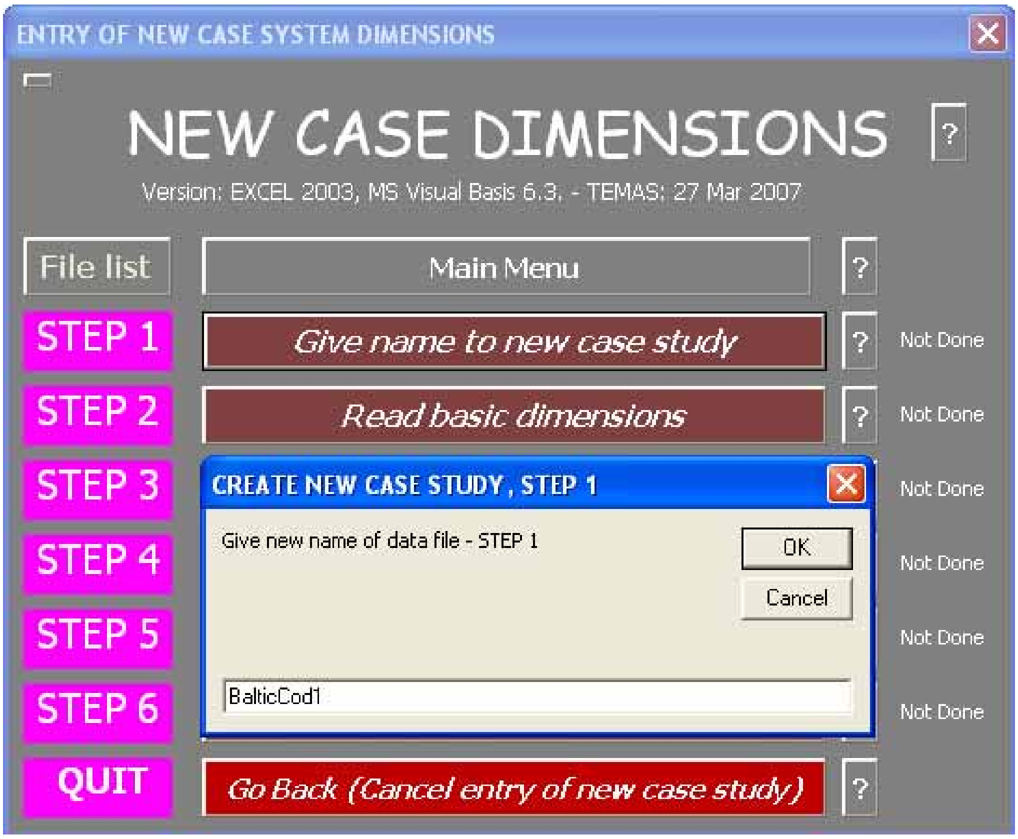
The prefix 'XXXXX' must contain at least 3 characters but can contain any number of

characters
letters and/or numbers are allowed in file-names "
but no spaces and no '-' '+' '=' '$' '&' '%' '<' or no '>'

Data are stored in folder: '.... (optional) directory\data\XXXXX\'
where "XXXXX" is the prefix"
defined above for the text-file-names

***Figure 2.4.3. Name of case study explanation . (Click on the "?"-button). Starting up a new case study with TEMAS. Step 1***

Clicking on "Give name to new case study" gives the input form shown in Figure 2.4.4. The name given here is "BalticCod1". "BalticCod" indicates that the TEMAS simulation focuses on the cod fisheris in the Baltic. The meaning of the number "1" is more cryptic, but it might refer to the first simulation in as series of alternative simulations.

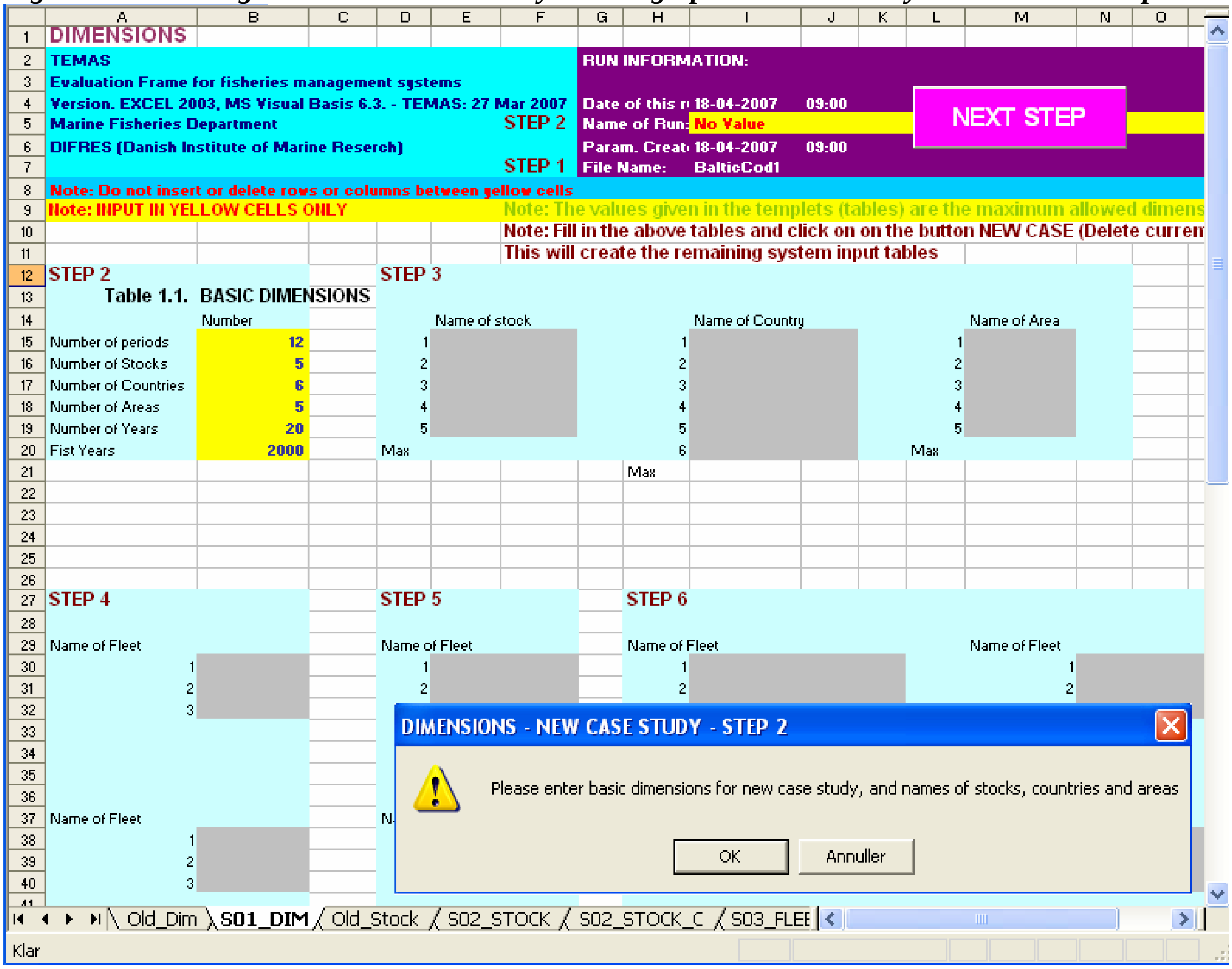


Version: EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 27 Mar 2007

Give new name of data file - STEP 1

BalticCod1

Figure 2.4.4. Giving name to new case study. Starting up a new case study with TEMAS. Step 1



DIMENSIONS

TEMAS
Evaluation Frame for fisheries management systems
Version. EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 27 Mar 2007
Marine Fisheries Department
DIFRES (Danish Institute of Marine Reserch)

RUN INFORMATION:
Date of this r 18-04-2007 09:00
Name of Run: No Value
Param. Creat 18-04-2007 09:00
File Name: BalticCod1

Note: Do not insert or delete rows or columns between yellow cells
Note: INPUT IN YELLOW CELLS ONLY
Note: The values given in the templets (tables) are the maximum allowed dimens
Note: Fill in the above tables and click on on the button NEW CASE (Delete curren
This will create the remaining system input tables

Table 1.1. BASIC DIMENSIONS

| | Number |
|---|---|
| Number of periods | 12 |
| Number of Stocks | 5 |
| Number of Countries | 6 |
| Number of Areas | 5 |
| Number of Years | 20 |
| Fist Years | 2000 |

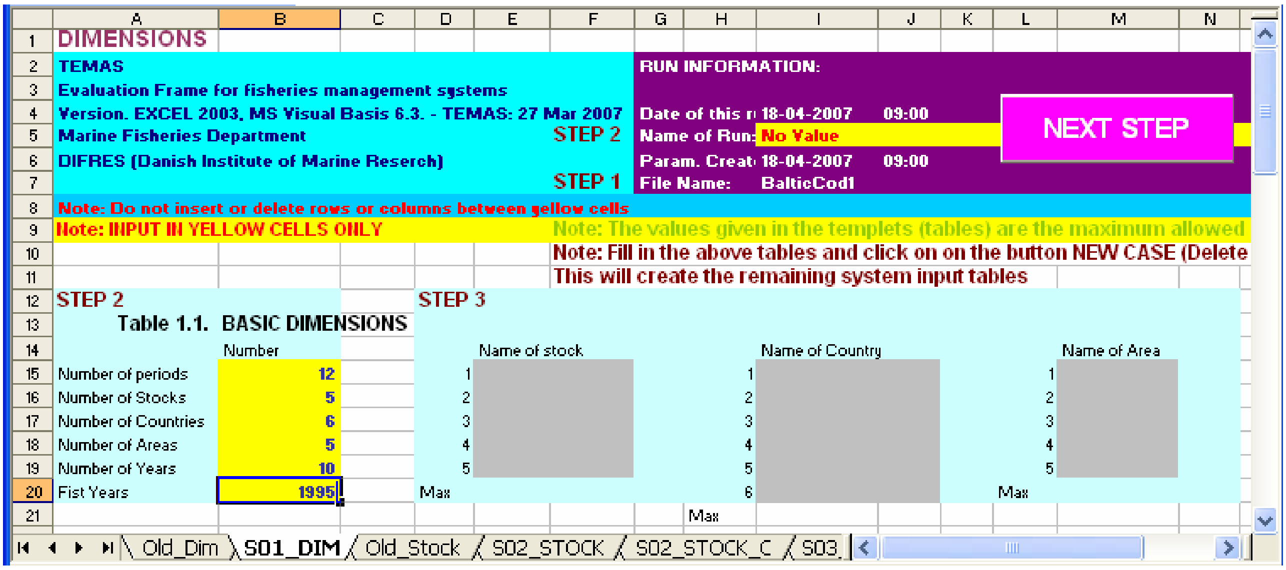
Name of stock: 1, 2, 3, 4, 5, Max
Name of Country: 1, 2, 3, 4, 5, 6, Max
Name of Area: 1, 2, 3, 4, 5, Max

Name of Fleet: 1, 2, 3
Name of Fleet: 1, 2
Name of Fleet: 1, 2
Name of Fleet: 1, 2
Name of Fleet: 1, 2, 3

Please enter basic dimensions for new case study, and names of stocks, countries and areas

Figure 2.4.5.Starting up a new case study with TEMAS. Step 2

After “OK” the screen will turn into Figure 2.4.5. You are now ready to enter the dimensions of the new case study. The “basic dimensions” (12, 5, 6, 5) shown in Figure 2.4.5 are the maximum values allowed in the current implementation of TEMAS. (These maximum values of dimensions can easily be changed in the Visual Basic code). The number of years, (“20” in Figure 2.4.5) is a default value, not a maximum value, as TEMAS can handle a time series of any length.



DIMENSIONS
TEMAS
Evaluation Frame for fisheries management systems
Version. EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 27 Mar 2007
Marine Fisheries Department
DIFRES (Danish Institute of Marine Reserch)
STEP 2
STEP 1

RUN INFORMATION:
Date of this r 18-04-2007 09:00
Name of Run: No Value
Param. Creat 18-04-2007 09:00
File Name: BalticCod1

Note: Do not insert or delete rows or columns between yellow cells
Note: INPUT IN YELLOW CELLS ONLY
Note: The values given in the templets (tables) are the maximum allowed
Note: Fill in the above tables and click on on the button NEW CASE (Delete
This will create the remaining system input tables

STEP 2
Table 1.1. BASIC DIMENSIONS

| | Number |
|---|---|
| Number of periods | 12 |
| Number of Stocks | 5 |
| Number of Countries | 6 |
| Number of Areas | 5 |
| Number of Years | 10 |
| Fist Years | 1995 |

STEP 3

*Figure 2.4.6. Entry of basic dimensions Starting up a new case study with TEMAS. Step 2*

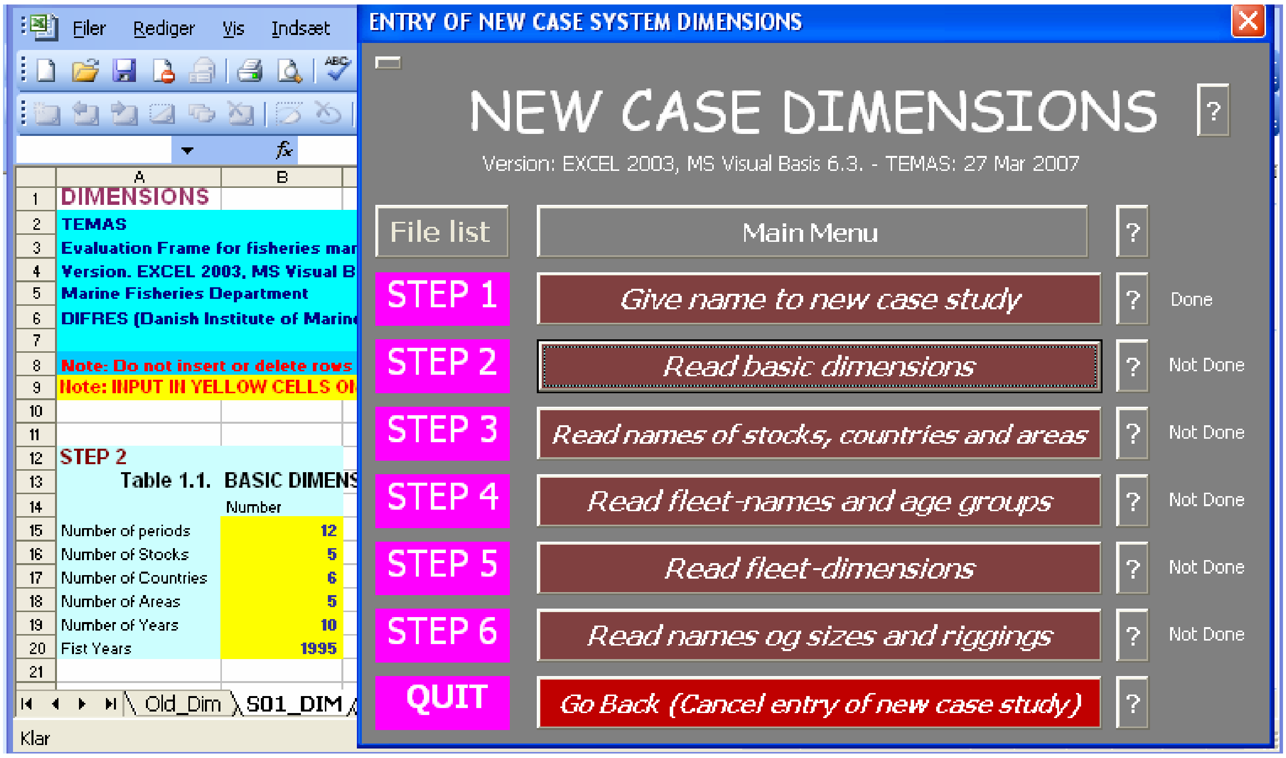


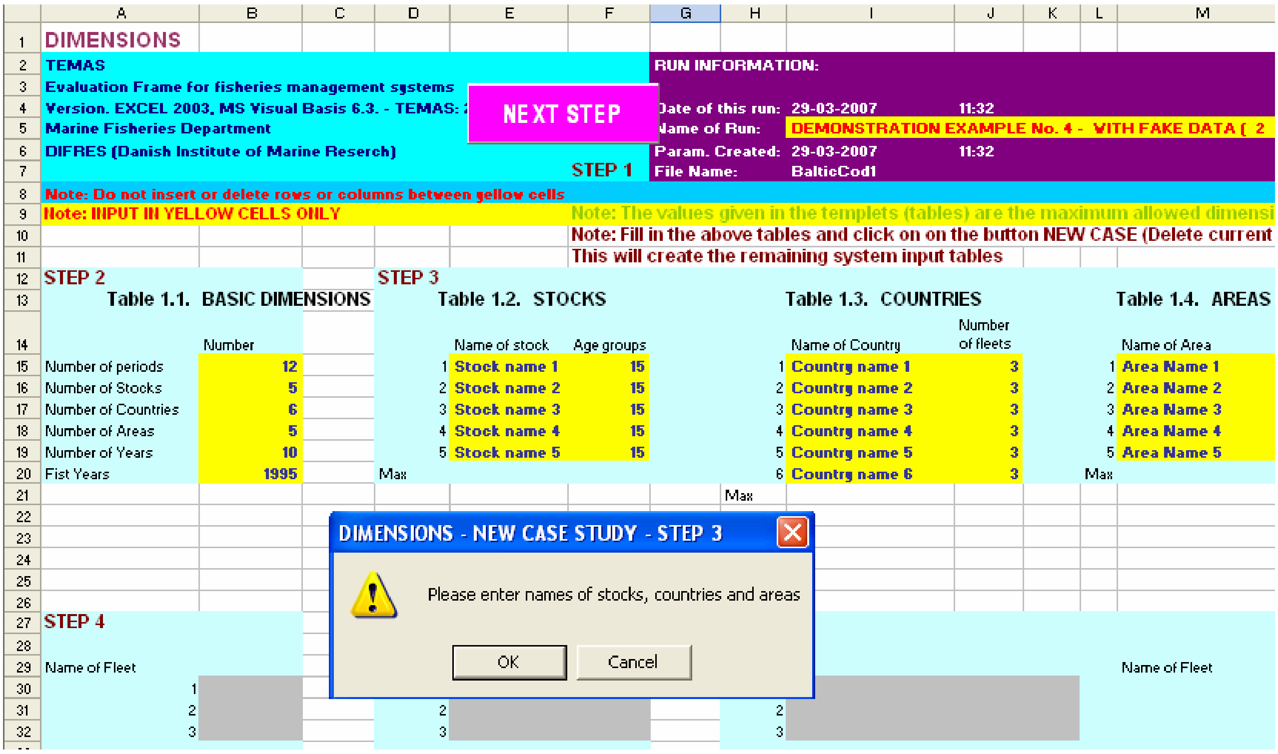
*Figure 2.4.7.End of step 2. Starting up a new case study with TEMAS.*

Also the “First year” (“2000” is Figure 2.4.5) is a default value, and any positive value will be accepted.

Next to the table with basic dimensions (Figure 2.4.5) are grey table templates, which indicate the current maximum allowed dimensions. If you exceed the limits, TEMAS will give an error message and stop. Clicking on “OK” allows you to enter the new “basic dimensions” (Figure 2.4.6), and after clicking on the “NEXT STEP”-button, you get Figure 2.4.7. Note that step 1 is “Done”, but step 2 is not. Only after clicking on “Read basic dimensions”, will step 2 be completed.

In the example in Figure 2.4.6 is chosen the maximum dimensions as input (12 time period per year, months, 5 stocks, 6 counties, and 5 areas). The number of years in the simulated time series is reduced from the defaults value of 20 to 10 and the starting year is chosen to be 1995.

Clicking on “Read basic dimensions” will make TEMAS read the values of Table 1.1 and store the values on the hard disk. It will also produce the yellow tables shown in Figure 2.4.8. The yellow tables has changed colour from grey, because TEMAS now knows the number of names to be expected. Figure 2.4.8 shows the table templates for entry of names of stocks, countries and areas. Note that the tables has the dimensions given in step 2, the basic dimensions. These dimensions need not be equal to the maximum values as is the case for Table 2.4.6-8. , but could have been smaller. The names given in Figure 2.4.8 are the standard names given by TEMAS.



**DIMENSIONS**

**TEMAS**
**Evaluation Frame for fisheries management systems**
**Version. EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 2**
**Marine Fisheries Department**
**DIFRES (Danish Institute of Marine Reserch)**

**STEP 1**

**RUN INFORMATION:**
**Date of this run:** 29-03-2007 11:32
**Name of Run:** DEMONSTRATION EXAMPLE No. 4 - VITH FAKE DATA ( 2
**Param. Created:** 29-03-2007 11:32
**File Name:** BalticCod1

Note: Do not insert or delete rows or columns between yellow cells
Note: INPUT IN YELLOW CELLS ONLY
Note: The values given in the templets (tables) are the maximum allowed dimensi
Note: Fill in the above tables and click on on the button NEW CASE (Delete current
This will create the remaining system input tables

**STEP 2**

Table 1.1. BASIC DIMENSIONS

| | Number |
|---|---|
| Number of periods | 12 |
| Number of Stocks | 5 |
| Number of Countries | 6 |
| Number of Areas | 5 |
| Number of Years | 10 |
| Fist Years | 1995 |

**STEP 3**

Table 1.2. STOCKS

| | Name of stock | Age groups |
|---|---|---|
| 1 | Stock name 1 | 15 |
| 2 | Stock name 2 | 15 |
| 3 | Stock name 3 | 15 |
| 4 | Stock name 4 | 15 |
| 5 | Stock name 5 | 15 |
| Max | | |

Table 1.3. COUNTRIES

| | Name of Country | Number of fleets |
|---|---|---|
| 1 | Country name 1 | 3 |
| 2 | Country name 2 | 3 |
| 3 | Country name 3 | 3 |
| 4 | Country name 4 | 3 |
| 5 | Country name 5 | 3 |
| 6 | Country name 6 | 3 |
| Max | | |

Table 1.4. AREAS

| | Name of Area |
|---|---|
| 1 | Area Name 1 |
| 2 | Area Name 2 |
| 3 | Area Name 3 |
| 4 | Area Name 4 |
| 5 | Area Name 5 |
| Max | |

**STEP 4**

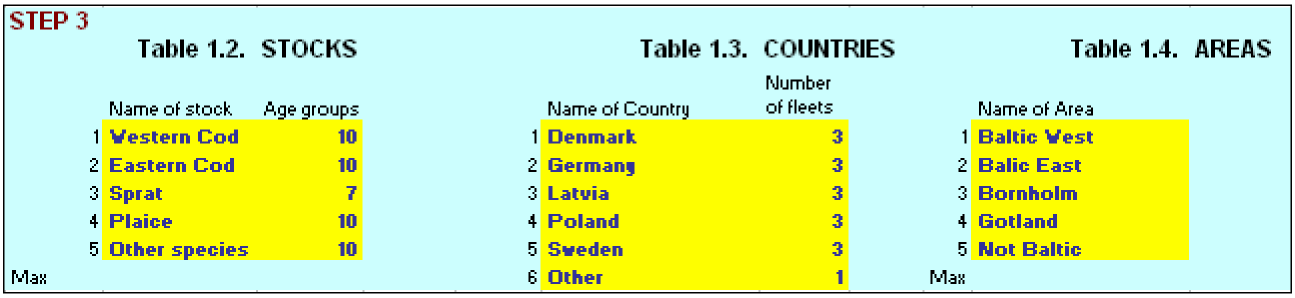
Name of Fleet
1
2
3

DIMENSIONS - NEW CASE STUDY - STEP 3

Please enter names of stocks, countries and areas

*Figure 2.4.8.Starting up a new case study with TEMAS. Step 3: Entry of names of stocks, countries and areas.*

You are now expected to overwrite the standard names as illustrated by Figure 2.4.9. This is step 3 in the procedure. Together with the names of stocks you must specify the number of age groups, and together with the names of countries you must specify the number of fleets in each country. Note that the last name in each Table represents “Other”. Thereby we include “all species”, all countries” and all “areas (of the world)” in the groupings. This inclusion of all landings in all areas by all countries is appropriate when modelling the economics and the behaviour of fishing fleets.



**STEP 3**

Table 1.2. STOCKS

| | Name of stock | Age groups |
|---|---|---|
| 1 | Western Cod | 10 |
| 2 | Eastern Cod | 10 |
| 3 | Sprat | 7 |
| 4 | Plaice | 10 |
| 5 | Other species | 10 |
| Max | | |

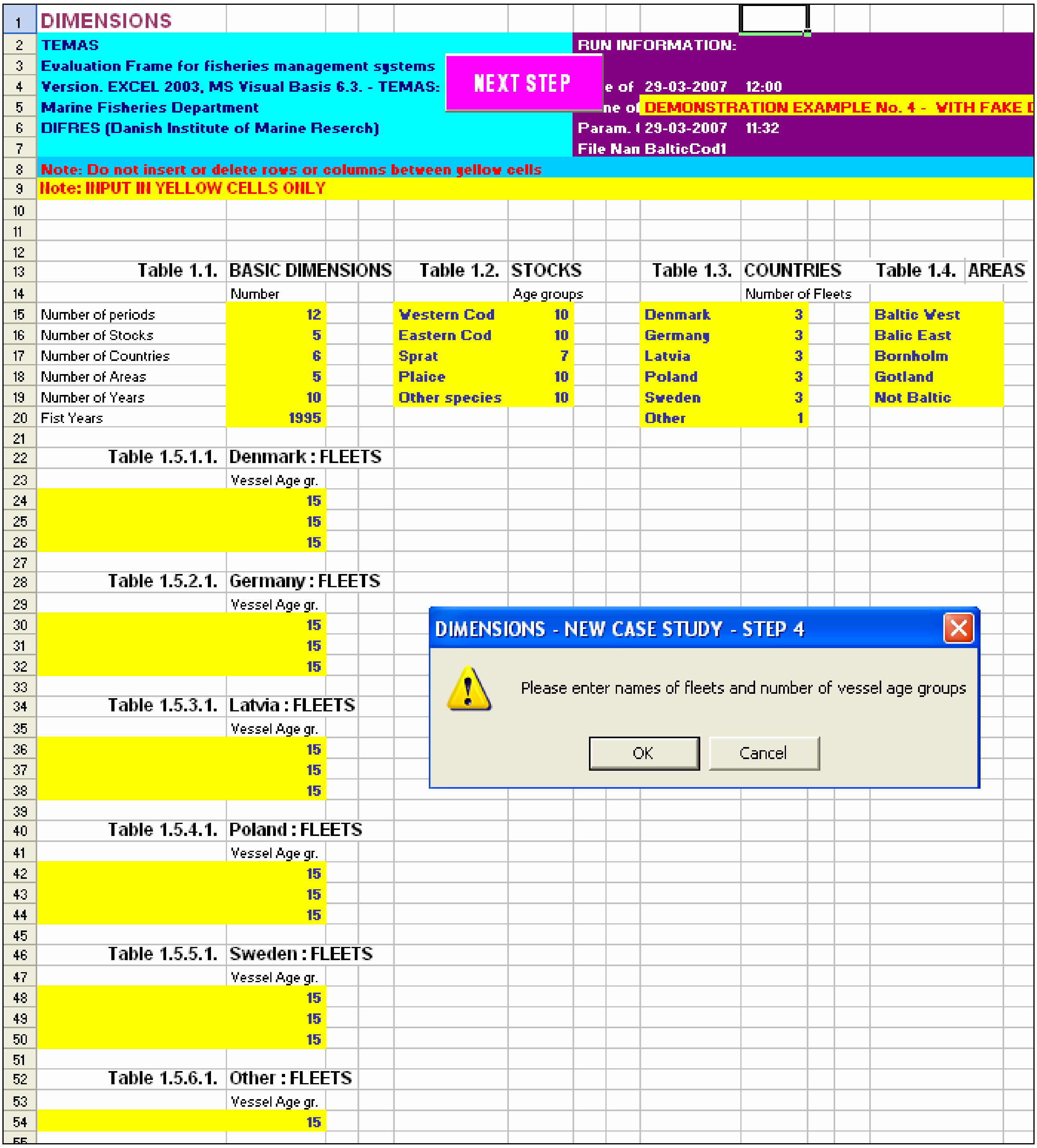
Table 1.3. COUNTRIES

| | Name of Country | Number of fleets |
|---|---|---|
| 1 | Denmark | 3 |
| 2 | Germany | 3 |
| 3 | Latvia | 3 |
| 4 | Poland | 3 |
| 5 | Sweden | 3 |
| 6 | Other | 1 |

Table 1.4. AREAS

| | Name of Area |
|---|---|
| 1 | Baltic West |
| 2 | Balic East |
| 3 | Bornholm |
| 4 | Gotland |
| 5 | Not Baltic |
| Max | |

*Figure 2.4.9. Names of stocks, countries and areas.Starting up a new case study with TEMAS. Step 3*



1 DIMENSIONS

2 TEMAS

3 Evaluation Frame for fisheries management systems

4 Version. EXCEL 2003, MS Visual Basis 6.3. - TEMAS:

5 Marine Fisheries Department

6 DIFRES (Danish Institute of Marine Reserch)

RUN INFORMATION:

e of 29-03-2007 12:00

ne of DEMONSTRATION EXAMPLE No. 4 - WITH FAKE D

Param. I 29-03-2007 11:32

File Nan BalticCod1

8 Note: Do not insert or delete rows or columns between yellow cells

9 Note: INPUT IN YELLOW CELLS ONLY

| Row | Table 1.1. | BASIC DIMENSIONS | Table 1.2. | STOCKS | Table 1.3. | COUNTRIES | Table 1.4. | AREAS |
|---|---|---|---|---|---|---|---|---|
| 14 | | Number | | Age groups | | Number of Fleets | | |
| 15 | Number of periods | 12 | Western Cod | 10 | Denmark | 3 | Baltic West | |
| 16 | Number of Stocks | 5 | Eastern Cod | 10 | Germany | 3 | Balic East | |
| 17 | Number of Countries | 6 | Sprat | 7 | Latvia | 3 | Bornholm | |
| 18 | Number of Areas | 5 | Plaice | 10 | Poland | 3 | Gotland | |
| 19 | Number of Years | 10 | Other species | 10 | Sweden | 3 | Not Baltic | |
| 20 | Fist Years | 1995 | | | Other | 1 | | |

| Row | Table 1.5.1.1. | Denmark : FLEETS |
|---|---|---|
| 23 | | Vessel Age gr. |
| 24 | | 15 |
| 25 | | 15 |
| 26 | | 15 |

| Row | Table 1.5.2.1. | Germany : FLEETS |
|---|---|---|
| 29 | | Vessel Age gr. |
| 30 | | 15 |
| 31 | | 15 |
| 32 | | 15 |

| Row | Table 1.5.3.1. | Latvia : FLEETS |
|---|---|---|
| 35 | | Vessel Age gr. |
| 36 | | 15 |
| 37 | | 15 |
| 38 | | 15 |

| Row | Table 1.5.4.1. | Poland : FLEETS |
|---|---|---|
| 41 | | Vessel Age gr. |
| 42 | | 15 |
| 43 | | 15 |
| 44 | | 15 |

| Row | Table 1.5.5.1. | Sweden : FLEETS |
|---|---|---|
| 47 | | Vessel Age gr. |
| 48 | | 15 |
| 49 | | 15 |
| 50 | | 15 |

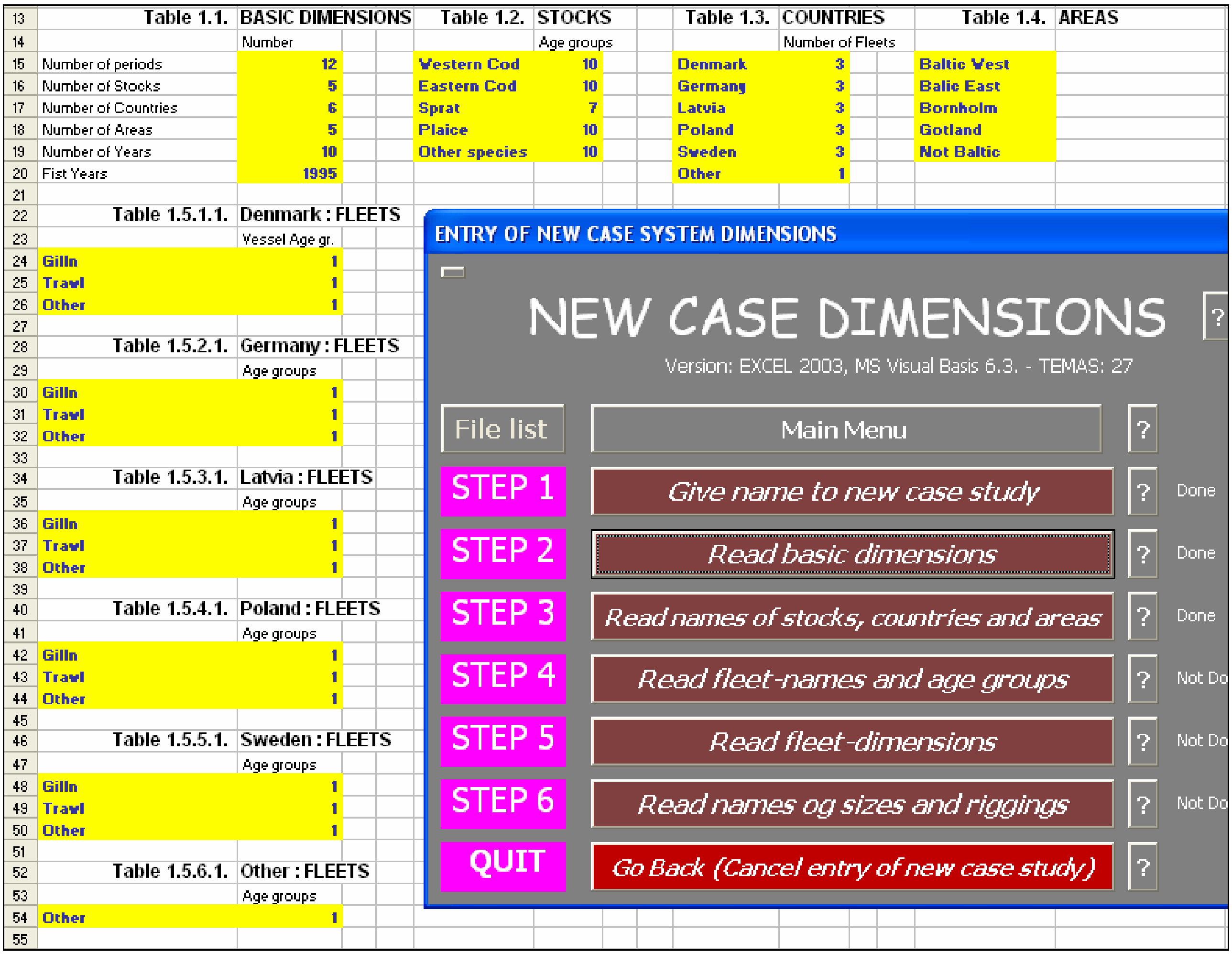
| Row | Table 1.5.6.1. | Other : FLEETS |
|---|---|---|
| 53 | | Vessel Age gr. |
| 54 | | 15 |

DIMENSIONS - NEW CASE STUDY - STEP 4

Please enter names of fleets and number of vessel age groups

*Figure 2.4.10.Starting up a new case study with TEMAS. Step 4*

With the information on the number of fleets, TEMAS is now able to create the table templates shown in Figure 2.4.10. These tables are for the entry of country specific names of fleets, and the number of vessel-age groups. TEMAS allows for an account of vessel-ages (e.g. in connection with decommission). The value "15" is the maximum allowed number of vessel groups in the current implementation of TEMAS.



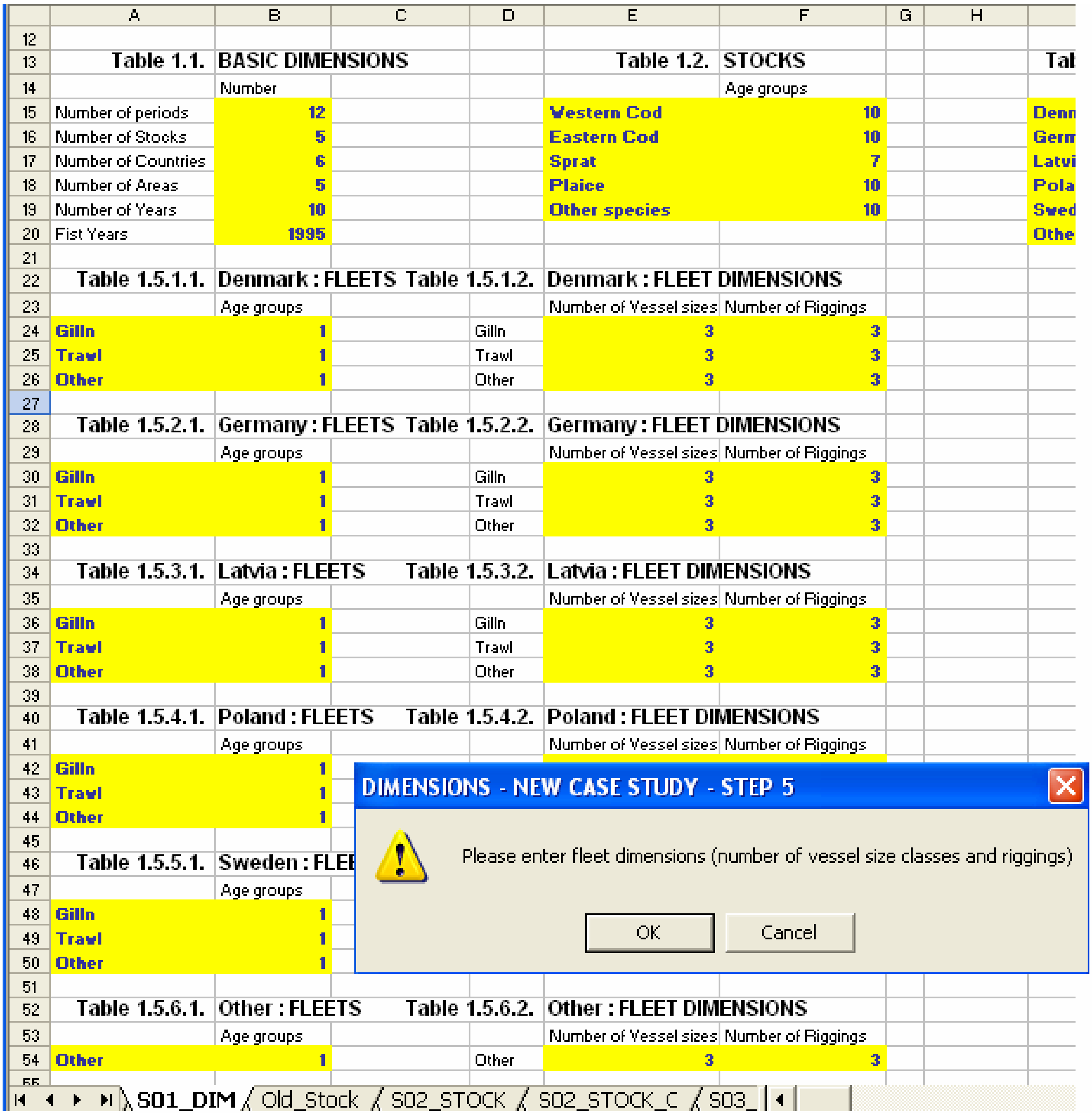
| 13 | Table 1.1. | BASIC DIMENSIONS | Table 1.2. | STOCKS | Table 1.3. | COUNTRIES | Table 1.4. | AREAS |
|---|---|---|---|---|---|---|---|---|
| 14 | | Number | | Age groups | | Number of Fleets | | |
| 15 | Number of periods | 12 | Vestern Cod | 10 | Denmark | 3 | Baltic Vest | |
| 16 | Number of Stocks | 5 | Eastern Cod | 10 | Germany | 3 | Balic East | |
| 17 | Number of Countries | 6 | Sprat | 7 | Latvia | 3 | Bornholm | |
| 18 | Number of Areas | 5 | Plaice | 10 | Poland | 3 | Gotland | |
| 19 | Number of Years | 10 | Other species | 10 | Sweden | 3 | Not Baltic | |
| 20 | Fist Years | 1995 | | | Other | 1 | | |
| 21 | | | | | | | | |

| 22 | Table 1.5.1.1. | Denmark : FLEETS |
|---|---|---|
| 23 | | Vessel Age gr. |
| 24 | Gilln | 1 |
| 25 | Trawl | 1 |
| 26 | Other | 1 |
| 27 | | |
| 28 | Table 1.5.2.1. | Germany : FLEETS |
| 29 | | Age groups |
| 30 | Gilln | 1 |
| 31 | Trawl | 1 |
| 32 | Other | 1 |
| 33 | | |
| 34 | Table 1.5.3.1. | Latvia : FLEETS |
| 35 | | Age groups |
| 36 | Gilln | 1 |
| 37 | Trawl | 1 |
| 38 | Other | 1 |
| 39 | | |
| 40 | Table 1.5.4.1. | Poland : FLEETS |
| 41 | | Age groups |
| 42 | Gilln | 1 |
| 43 | Trawl | 1 |
| 44 | Other | 1 |
| 45 | | |
| 46 | Table 1.5.5.1. | Sweden : FLEETS |
| 47 | | Age groups |
| 48 | Gilln | 1 |
| 49 | Trawl | 1 |
| 50 | Other | 1 |
| 51 | | |
| 52 | Table 1.5.6.1. | Other : FLEETS |
| 53 | | Age groups |
| 54 | Other | 1 |
| 55 | | |

***Figure 2.4.11.Starting up a new case study with TEMAS. Step 4***

In table 2.4.11, the names of fleets have been given for all countries. In this case (see Table 2.4.12), we use the same 3 fleet names for all countries (Gill netters, trawlers and "other fleets"), but any country specific fleet definition would be accepted. In this case, the option to account for vessel ages is not used, that is only one vessel age group is chosen. One vessel age group does not mean that vessels are scrapped after one year, but that all vessels are in a plus group (1+). The option to account for vessel ages is mainly relevant when decommission programs are being investigated. Usually, it is easy to get the age distribution of vessels from vessel registers.

Table 2.4.12 creates templates for entry of fleet-dimensions, that is, the number of fleet specific vessel size groups and number of gear riggings. The number shown in Figure 2.4.12 are the maximum allowed values (3 vessel size groups and 3 riggings), with the current TEMAS configuration.



| | A | B | C | D | E | F | G | H | |
|---|---|---|---|---|---|---|---|---|---|
| 12 | | | | | | | | | |
| 13 | Table 1.1. | BASIC DIMENSIONS | | | Table 1.2. | STOCKS | | | Tal |
| 14 | | Number | | | | Age groups | | | |
| 15 | Number of periods | 12 | | | Western Cod | 10 | | | Denn |
| 16 | Number of Stocks | 5 | | | Eastern Cod | 10 | | | Gerr |
| 17 | Number of Countries | 6 | | | Sprat | 7 | | | Latvi |
| 18 | Number of Areas | 5 | | | Plaice | 10 | | | Pola |
| 19 | Number of Years | 10 | | | Other species | 10 | | | Swed |
| 20 | Fist Years | 1995 | | | | | | | Othe |
| 21 | | | | | | | | | |
| 22 | Table 1.5.1.1. | Denmark : FLEETS | | Table 1.5.1.2. | Denmark : FLEET DIMENSIONS | | | | |
| 23 | | Age groups | | | Number of Vessel sizes | Number of Riggings | | | |
| 24 | Gilln | 1 | | Gilln | 3 | 3 | | | |
| 25 | Trawl | 1 | | Trawl | 3 | 3 | | | |
| 26 | Other | 1 | | Other | 3 | 3 | | | |
| 27 | | | | | | | | | |
| 28 | Table 1.5.2.1. | Germany : FLEETS | | Table 1.5.2.2. | Germany : FLEET DIMENSIONS | | | | |
| 29 | | Age groups | | | Number of Vessel sizes | Number of Riggings | | | |
| 30 | Gilln | 1 | | Gilln | 3 | 3 | | | |
| 31 | Trawl | 1 | | Trawl | 3 | 3 | | | |
| 32 | Other | 1 | | Other | 3 | 3 | | | |
| 33 | | | | | | | | | |
| 34 | Table 1.5.3.1. | Latvia : FLEETS | | Table 1.5.3.2. | Latvia : FLEET DIMENSIONS | | | | |
| 35 | | Age groups | | | Number of Vessel sizes | Number of Riggings | | | |
| 36 | Gilln | 1 | | Gilln | 3 | 3 | | | |
| 37 | Trawl | 1 | | Trawl | 3 | 3 | | | |
| 38 | Other | 1 | | Other | 3 | 3 | | | |
| 39 | | | | | | | | | |
| 40 | Table 1.5.4.1. | Poland : FLEETS | | Table 1.5.4.2. | Poland : FLEET DIMENSIONS | | | | |
| 41 | | Age groups | | | Number of Vessel sizes | Number of Riggings | | | |
| 42 | Gilln | 1 | | | | | | | |
| 43 | Trawl | 1 | | | | | | | |
| 44 | Other | 1 | | | | | | | |
| 45 | | | | | | | | | |
| 46 | Table 1.5.5.1. | Sweden : FLEE | | | | | | | |
| 47 | | Age groups | | | | | | | |
| 48 | Gilln | 1 | | | | | | | |
| 49 | Trawl | 1 | | | | | | | |
| 50 | Other | 1 | | | | | | | |
| 51 | | | | | | | | | |
| 52 | Table 1.5.6.1. | Other : FLEETS | | Table 1.5.6.2. | Other : FLEET DIMENSIONS | | | | |
| 53 | | Age groups | | | Number of Vessel sizes | Number of Riggings | | | |
| 54 | Other | 1 | | Other | 3 | 3 | | | |

DIMENSIONS - NEW CASE STUDY - STEP 5

Please enter fleet dimensions (number of vessel size classes and riggings)

*Figure 2.4.12.Starting up a new case study with TEMAS. Step 5*

Again note that there is an “other”-group in each country, and that there is an “other” vessel group accounting for “other countries”. The groups should always be chosen so that the “other”-groups are relatively small, as it will usually be difficult to get parameters for other groups. Therefore, it is desirably that “other”-groups are small so that the approximations they usually represent will not influence too much on the overall simulation results.

Figure 2.4.13 shows that the same dimensions are chosen for all countries, but other options are available. It is, however, desirable to homogenize the fleets and their particulars across countries as far as possible, for the purpose of presenting and surveying simulation results.

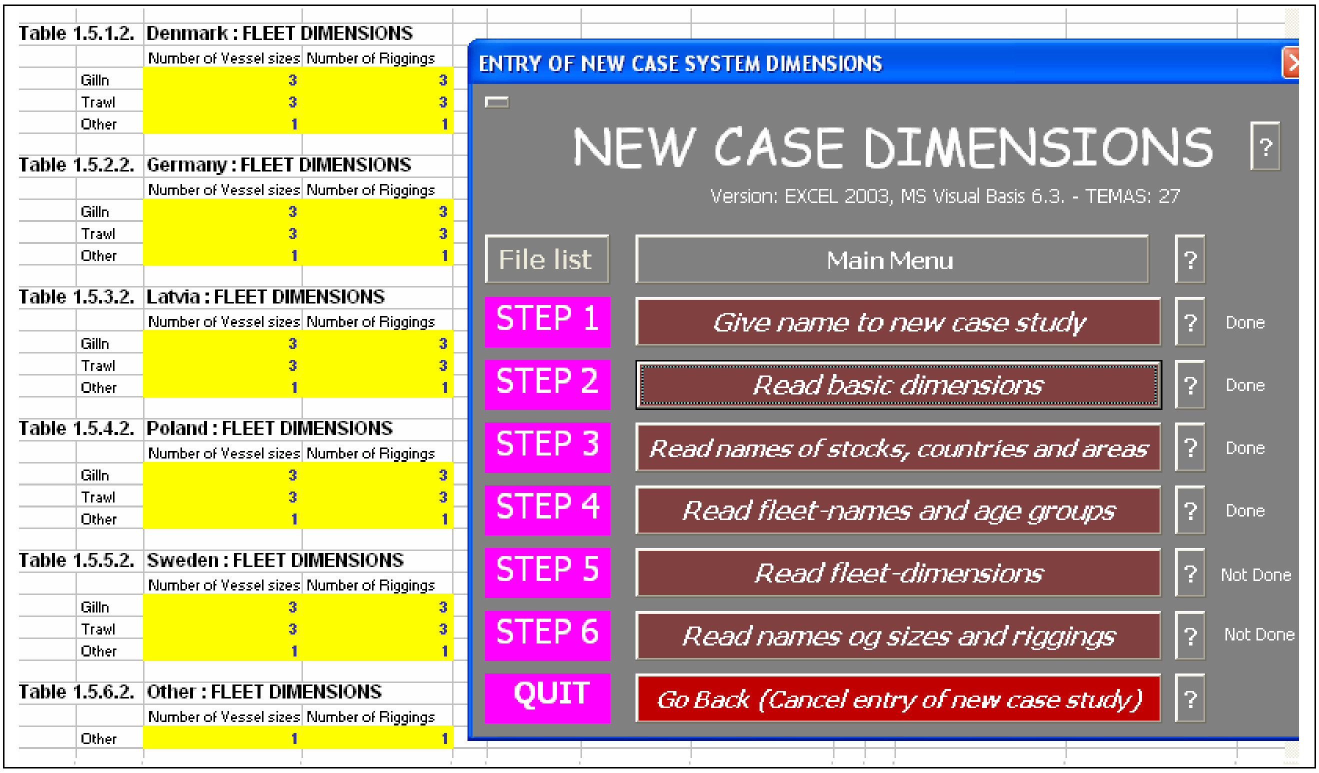


Table 1.5.1.2. Denmark : FLEET DIMENSIONS

| | Number of Vessel sizes | Number of Riggings |
|---|---|---|
| Gilln | 3 | 3 |
| Trawl | 3 | 3 |
| Other | 1 | 1 |

Table 1.5.2.2. Germany : FLEET DIMENSIONS

| | Number of Vessel sizes | Number of Riggings |
|---|---|---|
| Gilln | 3 | 3 |
| Trawl | 3 | 3 |
| Other | 1 | 1 |

Table 1.5.3.2. Latvia : FLEET DIMENSIONS

| | Number of Vessel sizes | Number of Riggings |
|---|---|---|
| Gilln | 3 | 3 |
| Trawl | 3 | 3 |
| Other | 1 | 1 |

Table 1.5.4.2. Poland : FLEET DIMENSIONS

| | Number of Vessel sizes | Number of Riggings |
|---|---|---|
| Gilln | 3 | 3 |
| Trawl | 3 | 3 |
| Other | 1 | 1 |

Table 1.5.5.2. Sweden : FLEET DIMENSIONS

| | Number of Vessel sizes | Number of Riggings |
|---|---|---|
| Gilln | 3 | 3 |
| Trawl | 3 | 3 |
| Other | 1 | 1 |

Table 1.5.6.2. Other : FLEET DIMENSIONS

| | Number of Vessel sizes | Number of Riggings |
|---|---|---|
| Other | 1 | 1 |

ENTRY OF NEW CASE SYSTEM DIMENSIONS

NEW CASE DIMENSIONS

Version: EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 27

STEP 1 Give name to new case study ? Done

STEP 2 Read basic dimensions ? Done

STEP 3 Read names of stocks, countries and areas ? Done

STEP 4 Read fleet-names and age groups ? Done

STEP 5 Read fleet-dimensions ? Not Done

STEP 6 Read names og sizes and riggings ? Not Done

QUIT Go Back (Cancel entry of new case study) ?

*Figure 2.4.13.Starting up a new case study with TEMAS. Step 5*

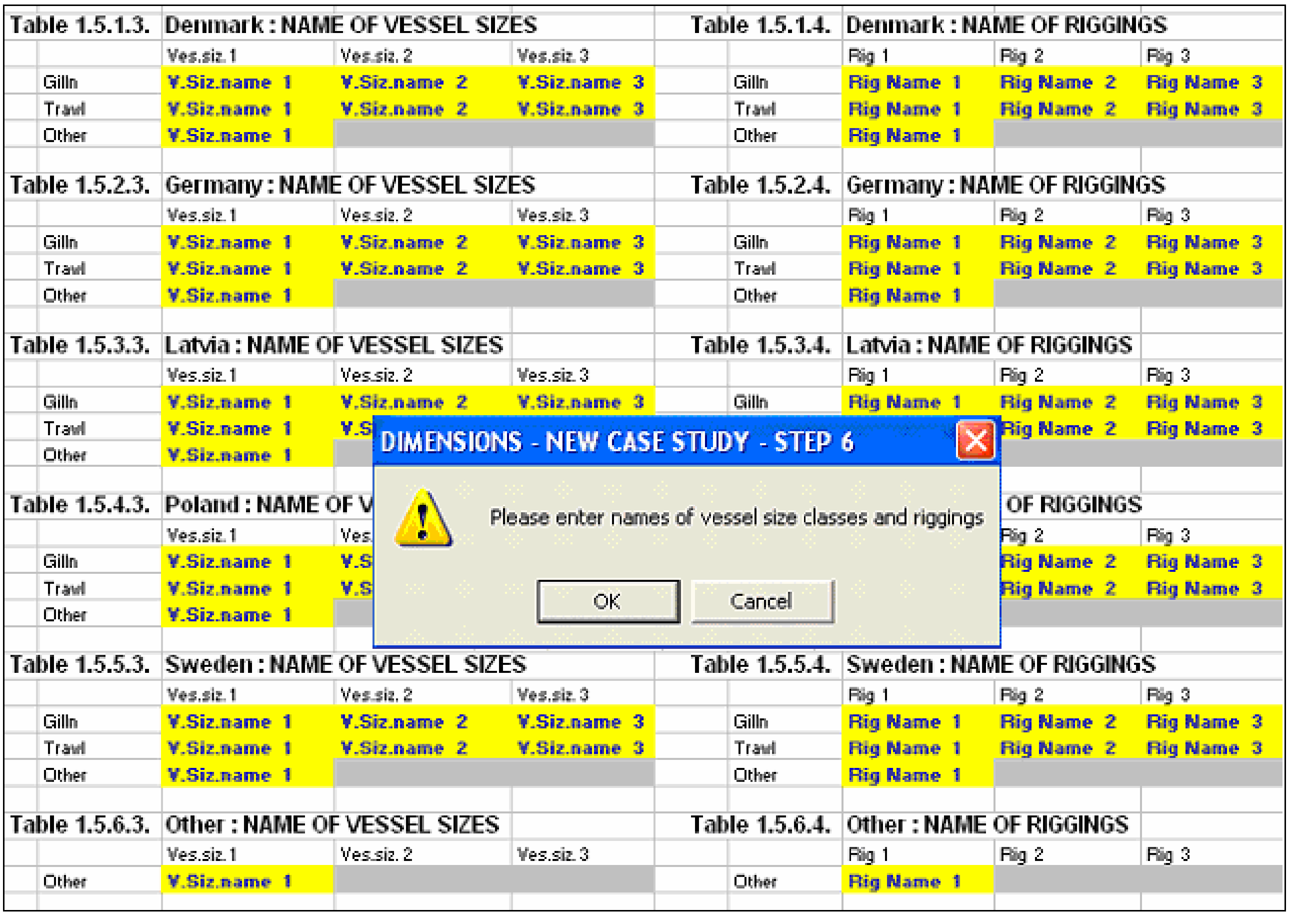


Table 1.5.1.3. Denmark : NAME OF VESSEL SIZES

| | Ves.siz. 1 | Ves.siz. 2 | Ves.siz. 3 |
|---|---|---|---|
| Gilln | V.Siz.name 1 | V.Siz.name 2 | V.Siz.name 3 |
| Trawl | V.Siz.name 1 | V.Siz.name 2 | V.Siz.name 3 |
| Other | V.Siz.name 1 | | |

Table 1.5.1.4. Denmark : NAME OF RIGGINGS

| | Rig 1 | Rig 2 | Rig 3 |
|---|---|---|---|
| Gilln | Rig Name 1 | Rig Name 2 | Rig Name 3 |
| Trawl | Rig Name 1 | Rig Name 2 | Rig Name 3 |
| Other | Rig Name 1 | | |

Table 1.5.2.3. Germany : NAME OF VESSEL SIZES

| | Ves.siz. 1 | Ves.siz. 2 | Ves.siz. 3 |
|---|---|---|---|
| Gilln | V.Siz.name 1 | V.Siz.name 2 | V.Siz.name 3 |
| Trawl | V.Siz.name 1 | V.Siz.name 2 | V.Siz.name 3 |
| Other | V.Siz.name 1 | | |

Table 1.5.2.4. Germany : NAME OF RIGGINGS

| | Rig 1 | Rig 2 | Rig 3 |
|---|---|---|---|
| Gilln | Rig Name 1 | Rig Name 2 | Rig Name 3 |
| Trawl | Rig Name 1 | Rig Name 2 | Rig Name 3 |
| Other | Rig Name 1 | | |

Table 1.5.3.3. Latvia : NAME OF VESSEL SIZES

| | Ves.siz. 1 | Ves.siz. 2 | Ves.siz. 3 |
|---|---|---|---|
| Gilln | V.Siz.name 1 | V.Siz.name 2 | V.Siz.name 3 |
| Trawl | V.Siz.name 1 | V.S | |
| Other | V.Siz.name 1 | | |

Table 1.5.3.4. Latvia : NAME OF RIGGINGS

| | Rig 1 | Rig 2 | Rig 3 |
|---|---|---|---|
| Gilln | Rig Name 1 | Rig Name 2 | Rig Name 3 |
| | | Rig Name 2 | Rig Name 3 |

Table 1.5.4.3. Poland : NAME OF V

| | Ves.siz. 1 | Ves. |
|---|---|---|
| Gilln | V.Siz.name 1 | V.S |
| Trawl | V.Siz.name 1 | V.S |
| Other | V.Siz.name 1 | |

OF RIGGINGS

| Rig 2 | Rig 3 |
|---|---|
| Rig Name 2 | Rig Name 3 |
| Rig Name 2 | Rig Name 3 |

DIMENSIONS - NEW CASE STUDY - STEP 6

Please enter names of vessel size classes and riggings

Table 1.5.5.3. Sweden : NAME OF VESSEL SIZES

| | Ves.siz. 1 | Ves.siz. 2 | Ves.siz. 3 |
|---|---|---|---|
| Gilln | V.Siz.name 1 | V.Siz.name 2 | V.Siz.name 3 |
| Trawl | V.Siz.name 1 | V.Siz.name 2 | V.Siz.name 3 |
| Other | V.Siz.name 1 | | |

Table 1.5.5.4. Sweden : NAME OF RIGGINGS

| | Rig 1 | Rig 2 | Rig 3 |
|---|---|---|---|
| Gilln | Rig Name 1 | Rig Name 2 | Rig Name 3 |
| Trawl | Rig Name 1 | Rig Name 2 | Rig Name 3 |
| Other | Rig Name 1 | | |

Table 1.5.6.3. Other : NAME OF VESSEL SIZES

| | Ves.siz. 1 | Ves.siz. 2 | Ves.siz. 3 |
|---|---|---|---|
| Other | V.Siz.name 1 | | |

Table 1.5.6.4. Other : NAME OF RIGGINGS

| | Rig 1 | Rig 2 | Rig 3 |
|---|---|---|---|
| Other | Rig Name 1 | | |

*Figure 2.4.14.Starting up a new case study with TEMAS. Step 6*

After Table 2.4.13 TEMAS is ready to take the number of vessel sizes and gear riggings as input. In this case we choose 3 vessel sizes and 3 riggings for gillnet and trawlers, where as for “other gears” there is only one vessel size group and one rigging.

Table 2.4.14 shows the templates for entry of names of vessel size classes and gear rigging names. The names shown in Table 2.4.14 are the standard names given by TEMAS, which you are supposed to overwrite. The names given of vessel size classes and gear riggings are shown in Figure 2.4.15. Again, the same vessel size names and gear rigging names are chosen for all fleets in all countries. That is, vessel sizes are small vessels less than 12 meters, medium size vessels between 12 and 24 meters and large vessels over 24 meters. The names “Small”, “Medium” and “Large” might have been chosen as well.

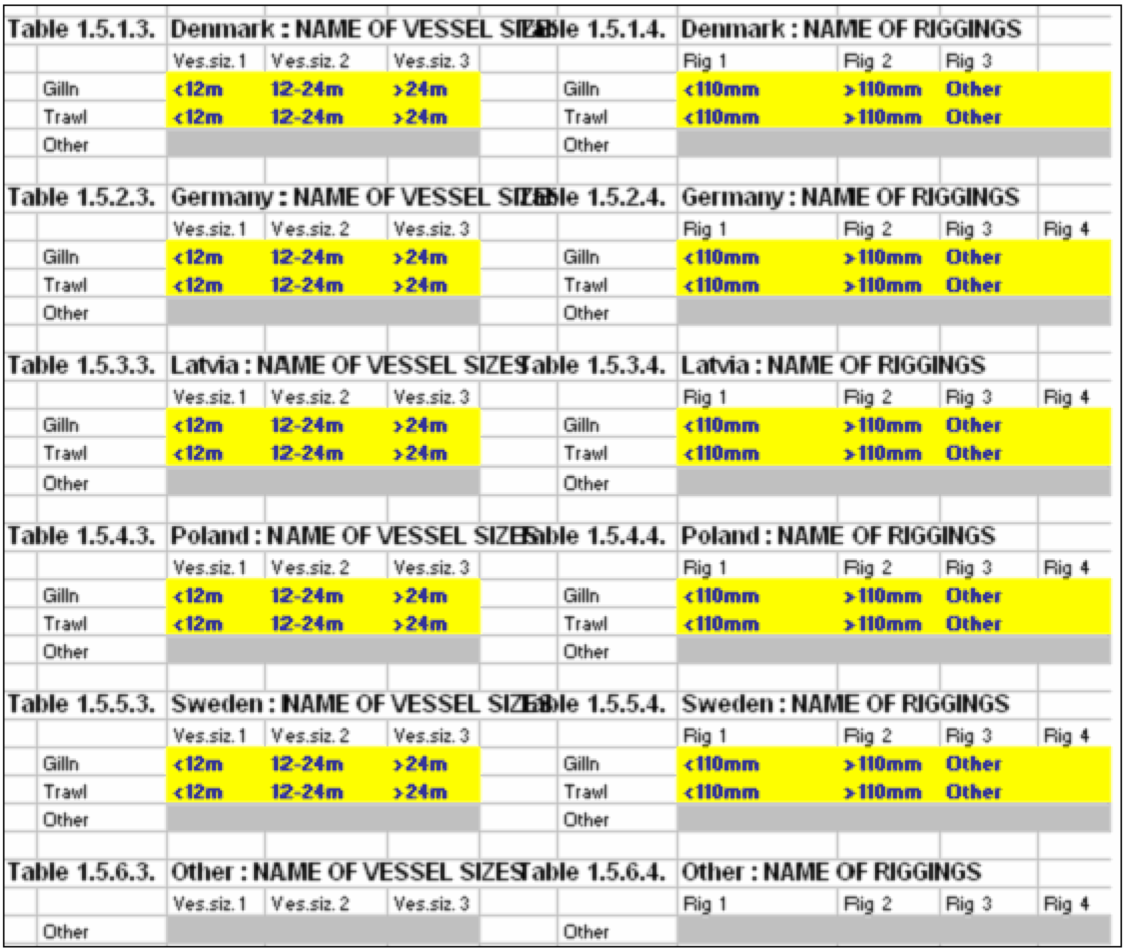


Table 1.5.1.3. Denmark : NAME OF VESSEL SIZE | Table 1.5.1.4. Denmark : NAME OF RIGGINGS

| | Ves.siz. 1 | Ves.siz. 2 | Ves.siz. 3 | | Rig 1 | Rig 2 | Rig 3 |
|---|---|---|---|---|---|---|---|
| Gilln | <12m | 12-24m | >24m | Gilln | <110mm | >110mm | Other |
| Trawl | <12m | 12-24m | >24m | Trawl | <110mm | >110mm | Other |
| Other | | | | Other | | | |

Table 1.5.2.3. Germany : NAME OF VESSEL SIZE | Table 1.5.2.4. Germany : NAME OF RIGGINGS

| | Ves.siz. 1 | Ves.siz. 2 | Ves.siz. 3 | | Rig 1 | Rig 2 | Rig 3 | Rig 4 |
|---|---|---|---|---|---|---|---|---|
| Gilln | <12m | 12-24m | >24m | Gilln | <110mm | >110mm | Other | |
| Trawl | <12m | 12-24m | >24m | Trawl | <110mm | >110mm | Other | |
| Other | | | | Other | | | | |

Table 1.5.3.3. Latvia : NAME OF VESSEL SIZES | Table 1.5.3.4. Latvia : NAME OF RIGGINGS

| | Ves.siz. 1 | Ves.siz. 2 | Ves.siz. 3 | | Rig 1 | Rig 2 | Rig 3 | Rig 4 |
|---|---|---|---|---|---|---|---|---|
| Gilln | <12m | 12-24m | >24m | Gilln | <110mm | >110mm | Other | |
| Trawl | <12m | 12-24m | >24m | Trawl | <110mm | >110mm | Other | |
| Other | | | | Other | | | | |

Table 1.5.4.3. Poland : NAME OF VESSEL SIZE | Table 1.5.4.4. Poland : NAME OF RIGGINGS

| | Ves.siz. 1 | Ves.siz. 2 | Ves.siz. 3 | | Rig 1 | Rig 2 | Rig 3 | Rig 4 |
|---|---|---|---|---|---|---|---|---|
| Gilln | <12m | 12-24m | >24m | Gilln | <110mm | >110mm | Other | |
| Trawl | <12m | 12-24m | >24m | Trawl | <110mm | >110mm | Other | |
| Other | | | | Other | | | | |

Table 1.5.5.3. Sweden : NAME OF VESSEL SIZE | Table 1.5.5.4. Sweden : NAME OF RIGGINGS

| | Ves.siz. 1 | Ves.siz. 2 | Ves.siz. 3 | | Rig 1 | Rig 2 | Rig 3 | Rig 4 |
|---|---|---|---|---|---|---|---|---|
| Gilln | <12m | 12-24m | >24m | Gilln | <110mm | >110mm | Other | |
| Trawl | <12m | 12-24m | >24m | Trawl | <110mm | >110mm | Other | |
| Other | | | | Other | | | | |

Table 1.5.6.3. Other : NAME OF VESSEL SIZES | Table 1.5.6.4. Other : NAME OF RIGGINGS

| | Ves.siz. 1 | Ves.siz. 2 | Ves.siz. 3 | | Rig 1 | Rig 2 | Rig 3 | Rig 4 |
|---|---|---|---|---|---|---|---|---|
| Other | | | | Other | | | | |

***Figure 2.4.15.Starting up a new case study with TEMAS. Step 6***

This brings us to the end of definition of dimensions of a new case study ( Table 2.4.16). At this point TEMAS will start creating the data structured matching the dimensions just entered. That may take a while, depending on the magnitudes of dimensions. TEMAS will create table templates in all the standard input worksheets according to the dimensions and names given as input (S01_DIM, S02_STOCK, S03_FLEET, S04_EFFORT, S05_BOATS, S06_PRICES, S07_ECONOMY, S08_ TRIP_RU, S09_ STRUC_RU, S10_TUNING, S11_OBS, S14_TEMAS and S15_HCR).

Once this is done, it is relatively difficult to change the case study set up, although it is possible. The names, however, can easily be changed, as the “Dimensions” user form contains an option “Read names from worksheet” (Figure 2.2.3). This option allows for modifications of all names, but not dimensions. If dimensions are to be changed, you will have to repeat the six step procedure.

Furthermore, all input parameters will have to be re-entered. With a copy of the original input sheets, this may be done quickly, if only few dimensions are changed.

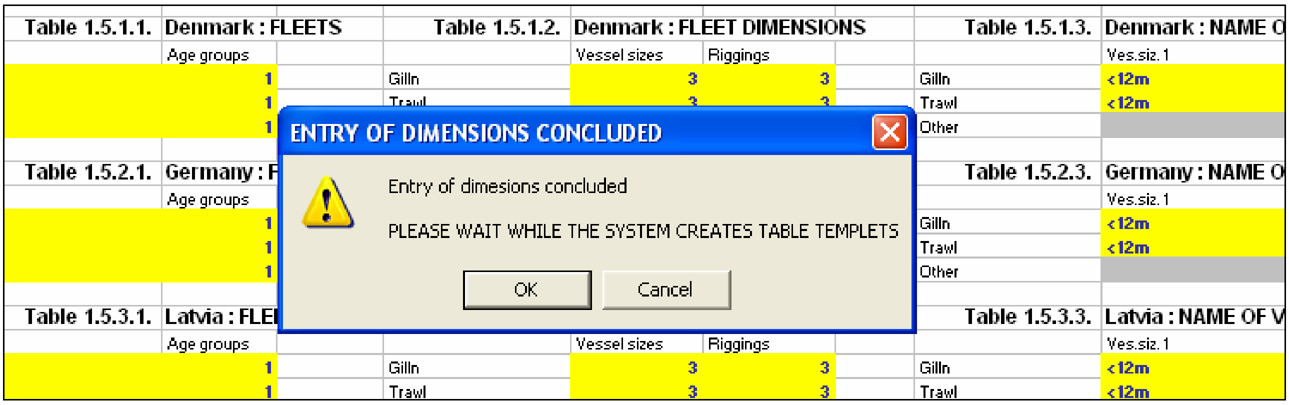


Table 1.5.1.1. Denmark : FLEETS
Age groups
1
1
1

Table 1.5.1.2. Denmark : FLEET DIMENSIONS
Vessel sizes Riggings
Gilln 3 3
Trawl 3 3

Table 1.5.1.3. Denmark : NAME O
Ves.siz. 1
Gilln <12m
Trawl <12m
Other

Table 1.5.2.1. Germany : F
Age groups
1
1
1

Table 1.5.2.3. Germany : NAME O
Ves.siz. 1
Gilln <12m
Trawl <12m
Other

Table 1.5.3.1. Latvia : FLE
Age groups
1
1

Vessel sizes Riggings
Gilln 3 3
Trawl 3 3

Table 1.5.3.3. Latvia : NAME OF V
Ves.siz. 1
Gilln <12m
Trawl <12m

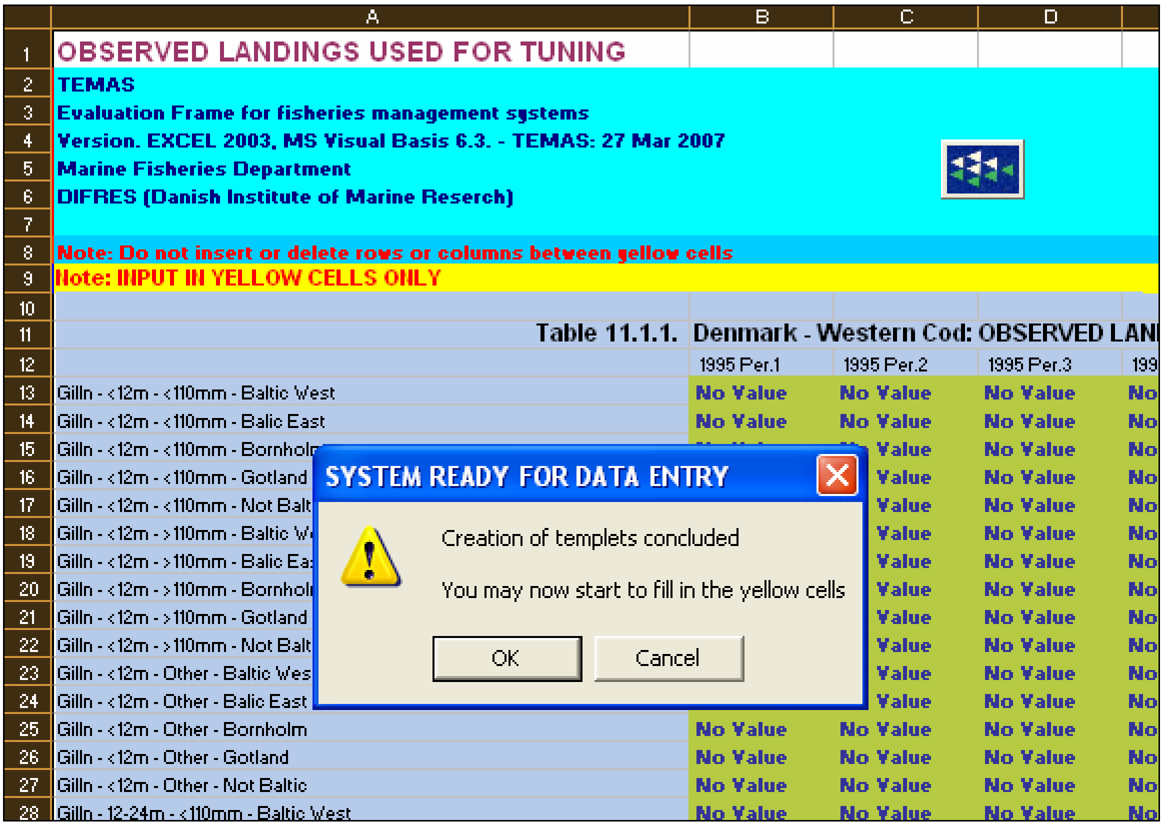
ENTRY OF DIMENSIONS CONCLUDED

Entry of dimesions concluded

PLEASE WAIT WHILE THE SYSTEM CREATES TABLE TEMPLETS

*Figure 2.4.16. End of entry of data for Starting up a new case study with TEMAS.*

Eventually, Figure 2.4.17 shows the last message from TEMAS concerning start of new case study. The tables created at this point will have all field filled in with “No Value”, as indicated in Figure 2.4.17. Table 2.4.18 shows the table templates for entry of biological stock parameters. Whenever you try to start a simulation, TEMAS will check that all cells with “No Value” has been changed to contain a numerical value. If that is not the case, TEMAS will refuse to carry out the simulations.



1 OBSERVED LANDINGS USED FOR TUNING
2 TEMAS
3 Evaluation Frame for fisheries management systems
4 Version. EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 27 Mar 2007
5 Marine Fisheries Department
6 DIFRES (Danish Institute of Marine Reserch)
8 Note: Do not insert or delete rows or columns between yellow cells
9 Note: INPUT IN YELLOW CELLS ONLY
11 Table 11.1.1. Denmark - Western Cod: OBSERVED LAN

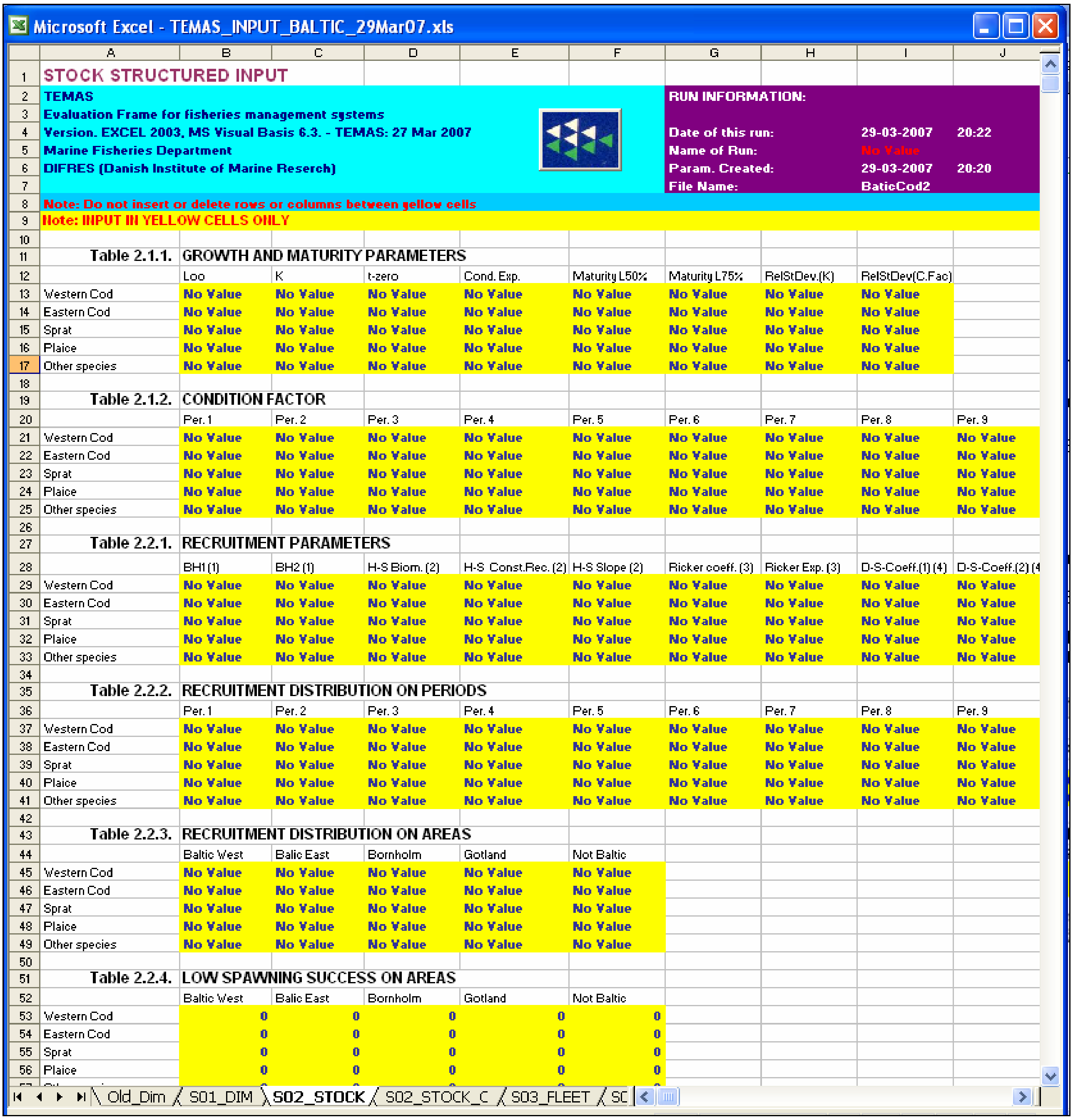
| | A | B | C | D | |
|---|---|---|---|---|---|
| 12 | | 1995 Per.1 | 1995 Per.2 | 1995 Per.3 | 199 |
| 13 | Gilln - <12m - <110mm - Baltic West | No Value | No Value | No Value | No |
| 14 | Gilln - <12m - <110mm - Balic East | No Value | No Value | No Value | No |
| 15 | Gilln - <12m - <110mm - Bornholm | | Value | No Value | No |
| 16 | Gilln - <12m - <110mm - Gotland | | Value | No Value | No |
| 17 | Gilln - <12m - <110mm - Not Balt | | Value | No Value | No |
| 18 | Gilln - <12m - >110mm - Baltic W | | Value | No Value | No |
| 19 | Gilln - <12m - >110mm - Balic Ea | | Value | No Value | No |
| 20 | Gilln - <12m - >110mm - Bornhol | | Value | No Value | No |
| 21 | Gilln - <12m - >110mm - Gotland | | Value | No Value | No |
| 22 | Gilln - <12m - >110mm - Not Balt | | Value | No Value | No |
| 23 | Gilln - <12m - Other - Baltic Wes | | Value | No Value | No |
| 24 | Gilln - <12m - Other - Balic East | | Value | No Value | No |
| 25 | Gilln - <12m - Other - Bornholm | No Value | No Value | No Value | No |
| 26 | Gilln - <12m - Other - Gotland | No Value | No Value | No Value | No |
| 27 | Gilln - <12m - Other - Not Baltic | No Value | No Value | No Value | No |
| 28 | Gilln - 12-24m - <110mm - Baltic West | No Value | No Value | No Value | No |

SYSTEM READY FOR DATA ENTRY

Creation of templets concluded

You may now start to fill in the yellow cells

*Figure 2.4.17. End of Starting up a new case study with TEMAS.*



STOCK STRUCTURED INPUT

TEMAS
Evaluation Frame for fisheries management systems
Version. EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 27 Mar 2007
Marine Fisheries Department
DIFRES (Danish Institute of Marine Reserch)

RUN INFORMATION:

| | | |
|---|---|---|
| Date of this run: | 29-03-2007 | 20:22 |
| Name of Run: | No Value | |
| Param. Created: | 29-03-2007 | 20:20 |
| File Name: | BaticCod2 | |

Note: Do not insert or delete rows or columns between yellow cells
Note: INPUT IN YELLOW CELLS ONLY

Table 2.1.1. GROWTH AND MATURITY PARAMETERS

| | Loo | K | t-zero | Cond. Exp. | Maturity L50% | Maturity L75% | RelStDev.(K) | RelStDev(C.Fac) |
|---|---|---|---|---|---|---|---|---|
| Western Cod | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| Eastern Cod | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| Sprat | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| Plaice | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| Other species | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |

Table 2.1.2. CONDITION FACTOR

| | Per. 1 | Per. 2 | Per. 3 | Per. 4 | Per. 5 | Per. 6 | Per. 7 | Per. 8 | Per. 9 |
|---|---|---|---|---|---|---|---|---|---|
| Western Cod | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| Eastern Cod | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| Sprat | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| Plaice | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| Other species | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |

Table 2.2.1. RECRUITMENT PARAMETERS

| | BH1 (1) | BH2 (1) | H-S Biom. (2) | H-S Const.Rec. (2) | H-S Slope (2) | Ricker coeff. (3) | Ricker Exp. (3) | D-S-Coeff.(1) (4) | D-S-Coeff.(2) (4 |
|---|---|---|---|---|---|---|---|---|---|
| Western Cod | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| Eastern Cod | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| Sprat | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| Plaice | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| Other species | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |

Table 2.2.2. RECRUITMENT DISTRIBUTION ON PERIODS

| | Per. 1 | Per. 2 | Per. 3 | Per. 4 | Per. 5 | Per. 6 | Per. 7 | Per. 8 | Per. 9 |
|---|---|---|---|---|---|---|---|---|---|
| Western Cod | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| Eastern Cod | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| Sprat | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| Plaice | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| Other species | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |

Table 2.2.3. RECRUITMENT DISTRIBUTION ON AREAS

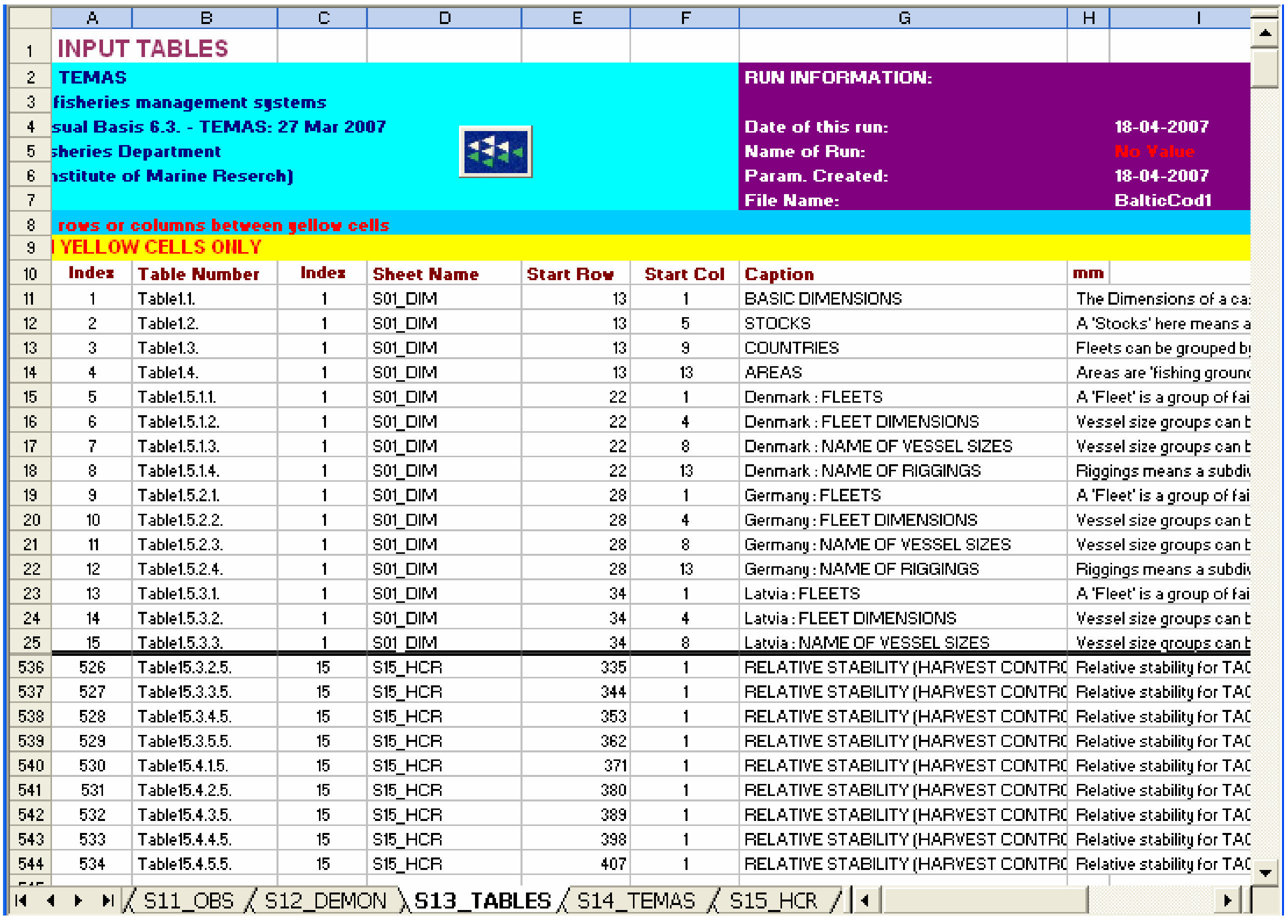
| | Baltic West | Balic East | Bornholm | Gotland | Not Baltic |
|---|---|---|---|---|---|
| Western Cod | No Value | No Value | No Value | No Value | No Value |
| Eastern Cod | No Value | No Value | No Value | No Value | No Value |
| Sprat | No Value | No Value | No Value | No Value | No Value |
| Plaice | No Value | No Value | No Value | No Value | No Value |
| Other species | No Value | No Value | No Value | No Value | No Value |

Table 2.2.4. LOW SPAWNING SUCCESS ON AREAS

| | Baltic West | Balic East | Bornholm | Gotland | Not Baltic |
|---|---|---|---|---|---|
| Western Cod | 0 | 0 | 0 | 0 | 0 |
| Eastern Cod | 0 | 0 | 0 | 0 | 0 |
| Sprat | 0 | 0 | 0 | 0 | 0 |
| Plaice | 0 | 0 | 0 | 0 | 0 |

***Figure 2.4.18. Table templates for new case study.***

Depending on the dimensions, TEMAS can produce a number of output tables. A complete list of all tables can be achieved through the main menu (Figure 1.3.4) by option "Write list of all tables). The list is long and a part of it is shown in Figure 2.4.19. In the present case there is a total of 534 Input tables. When it comes to simulation results (output from TEMAS_CALC) the list is a lot longer. The total output is so large that it becomes more or less inaccessible. In most practical applications, only a subset of the potential output tables will be used. TEMAS offers options to exclude certain combinations of output tables. Table 2.4.20 shows some of the tables to select output options. Worksheet Table 1.6.1 (in Table 2.4.20), for example, specifies, that tables shall be made for Western cod, Eastern cod, sprat and plaice, but no tables shall be printed for "other species". Worksheet Table 1.6.2 exclude "Not Baltic" area from printing.



INPUT TABLES

TEMAS
fisheries management systems
sual Basis 6.3. - TEMAS: 27 Mar 2007
sheries Department
nstitute of Marine Reserch)

RUN INFORMATION:

| | |
|---|---|
| Date of this run: | 18-04-2007 |
| Name of Run: | No Value |
| Param. Created: | 18-04-2007 |
| File Name: | BalticCod1 |

rows or columns between yellow cells
I YELLOW CELLS ONLY

| | Index | Table Number | Index | Sheet Name | Start Row | Start Col | Caption | mm |
|---|---|---|---|---|---|---|---|---|
| 11 | 1 | Table1.1. | 1 | S01_DIM | 13 | 1 | BASIC DIMENSIONS | The Dimensions of a ca |
| 12 | 2 | Table1.2. | 1 | S01_DIM | 13 | 5 | STOCKS | A 'Stocks' here means a |
| 13 | 3 | Table1.3. | 1 | S01_DIM | 13 | 9 | COUNTRIES | Fleets can be grouped b |
| 14 | 4 | Table1.4. | 1 | S01_DIM | 13 | 13 | AREAS | Areas are 'fishing groun |
| 15 | 5 | Table1.5.1.1. | 1 | S01_DIM | 22 | 1 | Denmark : FLEETS | A 'Fleet' is a group of fai |
| 16 | 6 | Table1.5.1.2. | 1 | S01_DIM | 22 | 4 | Denmark : FLEET DIMENSIONS | Vessel size groups can |
| 17 | 7 | Table1.5.1.3. | 1 | S01_DIM | 22 | 8 | Denmark : NAME OF VESSEL SIZES | Vessel size groups can |
| 18 | 8 | Table1.5.1.4. | 1 | S01_DIM | 22 | 13 | Denmark : NAME OF RIGGINGS | Riggings means a subdi |
| 19 | 9 | Table1.5.2.1. | 1 | S01_DIM | 28 | 1 | Germany : FLEETS | A 'Fleet' is a group of fai |
| 20 | 10 | Table1.5.2.2. | 1 | S01_DIM | 28 | 4 | Germany : FLEET DIMENSIONS | Vessel size groups can |
| 21 | 11 | Table1.5.2.3. | 1 | S01_DIM | 28 | 8 | Germany : NAME OF VESSEL SIZES | Vessel size groups can |
| 22 | 12 | Table1.5.2.4. | 1 | S01_DIM | 28 | 13 | Germany : NAME OF RIGGINGS | Riggings means a subdi |
| 23 | 13 | Table1.5.3.1. | 1 | S01_DIM | 34 | 1 | Latvia : FLEETS | A 'Fleet' is a group of fai |
| 24 | 14 | Table1.5.3.2. | 1 | S01_DIM | 34 | 4 | Latvia : FLEET DIMENSIONS | Vessel size groups can |
| 25 | 15 | Table1.5.3.3. | 1 | S01_DIM | 34 | 8 | Latvia : NAME OF VESSEL SIZES | Vessel size groups can |
| 536 | 526 | Table15.3.2.5. | 15 | S15_HCR | 335 | 1 | RELATIVE STABILITY (HARVEST CONTR | Relative stability for TA |
| 537 | 527 | Table15.3.3.5. | 15 | S15_HCR | 344 | 1 | RELATIVE STABILITY (HARVEST CONTR | Relative stability for TA |
| 538 | 528 | Table15.3.4.5. | 15 | S15_HCR | 353 | 1 | RELATIVE STABILITY (HARVEST CONTR | Relative stability for TA |
| 539 | 529 | Table15.3.5.5. | 15 | S15_HCR | 362 | 1 | RELATIVE STABILITY (HARVEST CONTR | Relative stability for TA |
| 540 | 530 | Table15.4.1.5. | 15 | S15_HCR | 371 | 1 | RELATIVE STABILITY (HARVEST CONTR | Relative stability for TA |
| 541 | 531 | Table15.4.2.5. | 15 | S15_HCR | 380 | 1 | RELATIVE STABILITY (HARVEST CONTR | Relative stability for TA |
| 542 | 532 | Table15.4.3.5. | 15 | S15_HCR | 389 | 1 | RELATIVE STABILITY (HARVEST CONTR | Relative stability for TA |
| 543 | 533 | Table15.4.4.5. | 15 | S15_HCR | 398 | 1 | RELATIVE STABILITY (HARVEST CONTR | Relative stability for TA |
| 544 | 534 | Table15.4.5.5. | 15 | S15_HCR | 407 | 1 | RELATIVE STABILITY (HARVEST CONTR | Relative stability for TA |

*Figure 2.4.19.  List of tables in TEMAS_INPUT.*

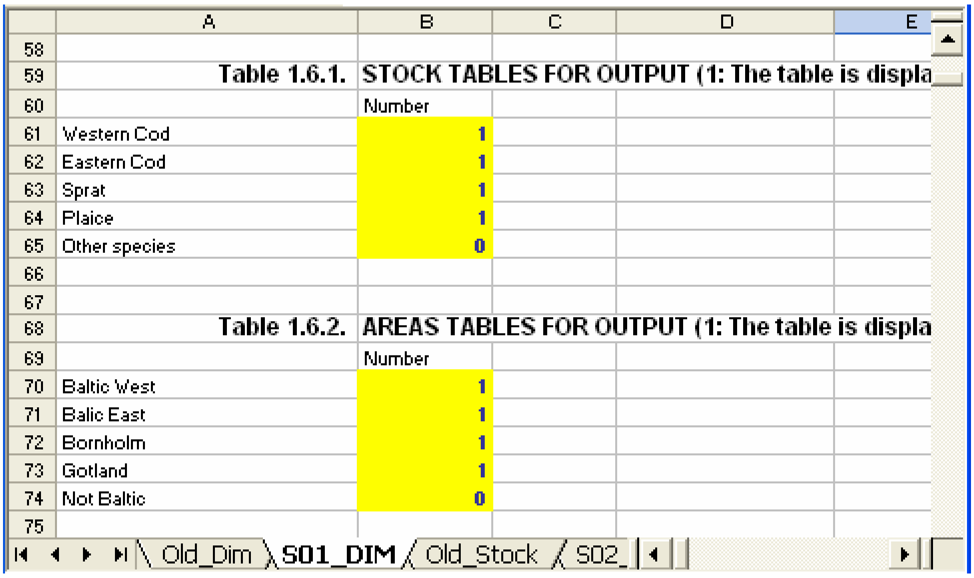


Table 1.6.1. STOCK TABLES FOR OUTPUT (1: The table is displa

| | Number |
|---|---|
| Western Cod | 1 |
| Eastern Cod | 1 |
| Sprat | 1 |
| Plaice | 1 |
| Other species | 0 |

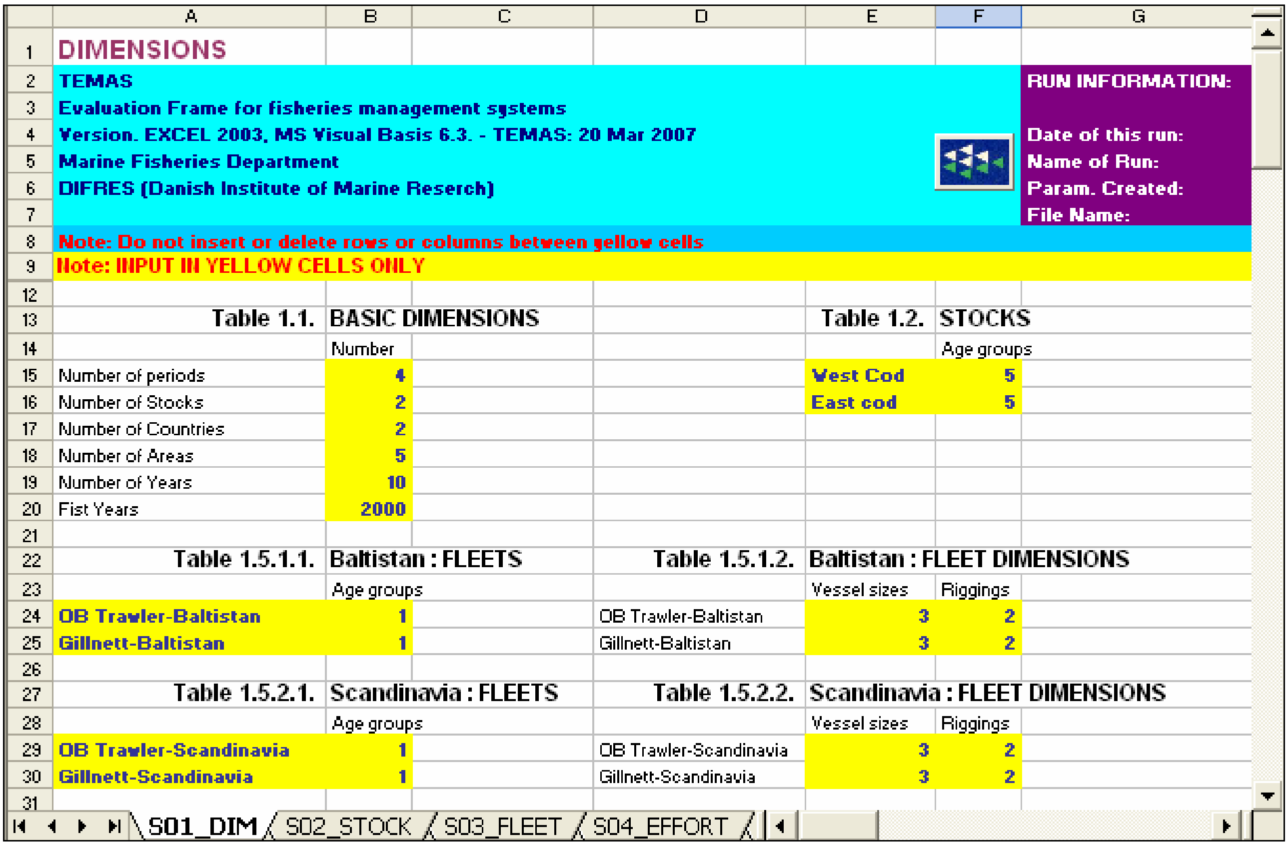
Table 1.6.2. AREAS TABLES FOR OUTPUT (1: The table is displa

| | Number |
|---|---|
| Baltic West | 1 |
| Balic East | 1 |
| Bornholm | 1 |
| Gotland | 1 |
| Not Baltic | 0 |

*Figure 2.4.20. Output table options.*

## 2.5. STOCK INPUT, S02_STOCK

This section and the following section will introduce the formats of TEMAS input by a hypothetical example, which has some resemblance with the Baltic cod fisheries. The dimensions of this demonstration example are shown in Figure 2.5.1.a-b.



DIMENSIONS

TEMAS
Evaluation Frame for fisheries management systems
Version. EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 20 Mar 2007
Marine Fisheries Department
DIFRES (Danish Institute of Marine Reserch)

RUN INFORMATION:
Date of this run:
Name of Run:
Param. Created:
File Name:

Note: Do not insert or delete rows or columns between yellow cells
Note: INPUT IN YELLOW CELLS ONLY

Table 1.1. BASIC DIMENSIONS

| | Number |
|---|---|
| Number of periods | 4 |
| Number of Stocks | 2 |
| Number of Countries | 2 |
| Number of Areas | 5 |
| Number of Years | 10 |
| Fist Years | 2000 |

Table 1.2. STOCKS

| | Age groups |
|---|---|
| West Cod | 5 |
| East cod | 5 |

Table 1.5.1.1. Baltistan : FLEETS

| | Age groups |
|---|---|
| OB Trawler-Baltistan | 1 |
| Gillnett-Baltistan | 1 |

Table 1.5.1.2. Baltistan : FLEET DIMENSIONS

| | Vessel sizes | Riggings |
|---|---|---|
| OB Trawler-Baltistan | 3 | 2 |
| Gillnett-Baltistan | 3 | 2 |

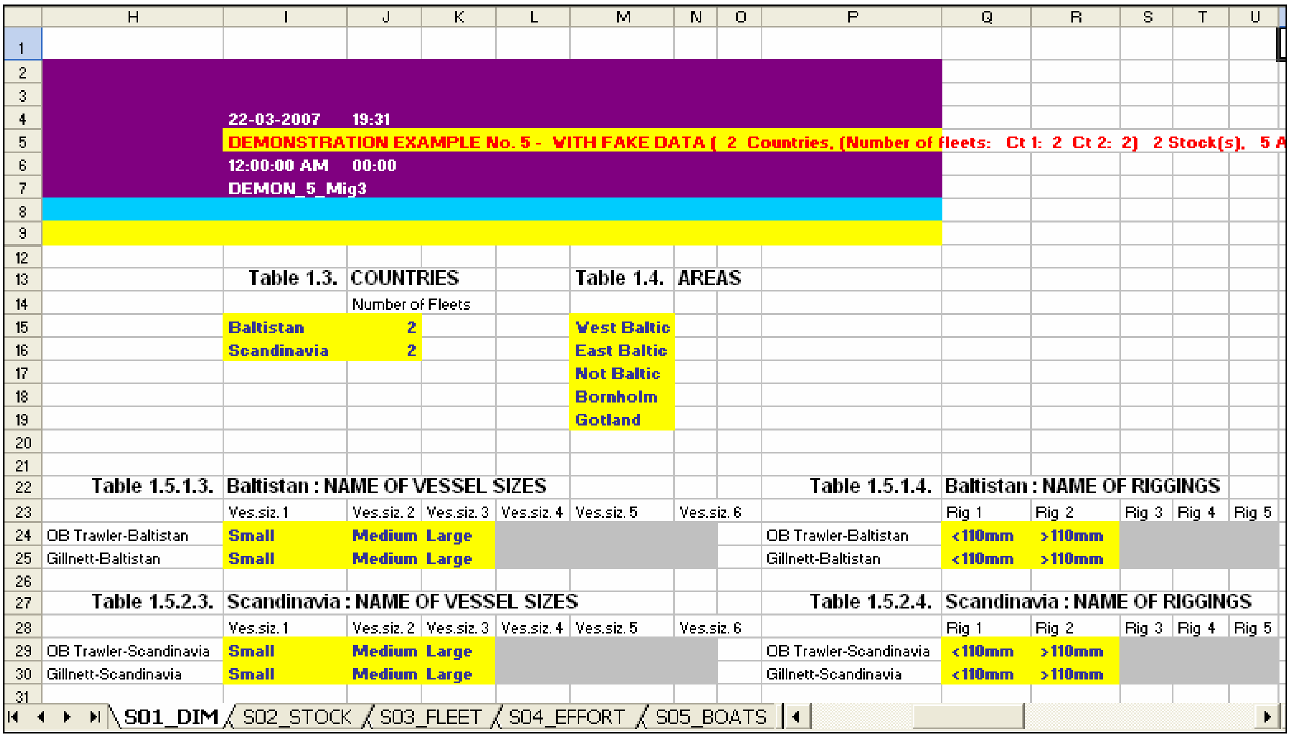
Table 1.5.2.1. Scandinavia : FLEETS

| | Age groups |
|---|---|
| OB Trawler-Scandinavia | 1 |
| Gillnett-Scandinavia | 1 |

Table 1.5.2.2. Scandinavia : FLEET DIMENSIONS

| | Vessel sizes | Riggings |
|---|---|---|
| OB Trawler-Scandinavia | 3 | 2 |
| Gillnett-Scandinavia | 3 | 2 |

*Figure 2.5.1.a. Dimensions of Demonstration example used to illustrate input formats*



22-03-2007 19:31
DEMONSTRATION EXAMPLE No. 5 - WITH FAKE DATA ( 2 Countries, (Number of fleets: Ct 1: 2 Ct 2: 2) 2 Stock(s), 5 A
12:00:00 AM 00:00
DEMON_5_Mig3

Table 1.3. COUNTRIES

| | Number of Fleets |
|---|---|
| Baltistan | 2 |
| Scandinavia | 2 |

Table 1.4. AREAS

West Baltic
East Baltic
Not Baltic
Bornholm
Gotland

Table 1.5.1.3. Baltistan : NAME OF VESSEL SIZES

| | Ves.siz. 1 | Ves.siz. 2 | Ves.siz. 3 | Ves.siz. 4 | Ves.siz. 5 | Ves.siz. 6 |
|---|---|---|---|---|---|---|
| OB Trawler-Baltistan | Small | Medium | Large | | | |
| Gillnett-Baltistan | Small | Medium | Large | | | |

Table 1.5.1.4. Baltistan : NAME OF RIGGINGS

| | Rig 1 | Rig 2 | Rig 3 | Rig 4 | Rig 5 |
|---|---|---|---|---|---|
| OB Trawler-Baltistan | <110mm | >110mm | | | |
| Gillnett-Baltistan | <110mm | >110mm | | | |

Table 1.5.2.3. Scandinavia : NAME OF VESSEL SIZES

| | Ves.siz. 1 | Ves.siz. 2 | Ves.siz. 3 | Ves.siz. 4 | Ves.siz. 5 | Ves.siz. 6 |
|---|---|---|---|---|---|---|
| OB Trawler-Scandinavia | Small | Medium | Large | | | |
| Gillnett-Scandinavia | Small | Medium | Large | | | |

Table 1.5.2.4. Scandinavia : NAME OF RIGGINGS

| | Rig 1 | Rig 2 | Rig 3 | Rig 4 | Rig 5 |
|---|---|---|---|---|---|
| OB Trawler-Scandinavia | <110mm | >110mm | | | |
| Gillnett-Scandinavia | <110mm | >110mm | | | |

*Figure 2.5.1.b. Dimensions of Demonstration example used to illustrate input formats*

There are two hypothetical countries, “Scandinavia” and “Baltistan”, two stocks “Western cod” and “Eastern cod”. The dimensions are smaller than the real case as the input tables otherwise would become rather big. The time step is a quarter of the year. The number of areas is 5. This number is chosen to allow for more realistic demonstration of spatial aspects in connection with MPA’s. The number of fleets per country is 2, each with 3 vessel size classes and 2 gear riggings. The number of age groups of fish stocks is 5 for both stocks (to reduce size of tables), and the number of vessel size classes is 1, that is, the age structure of fleets is ignored.

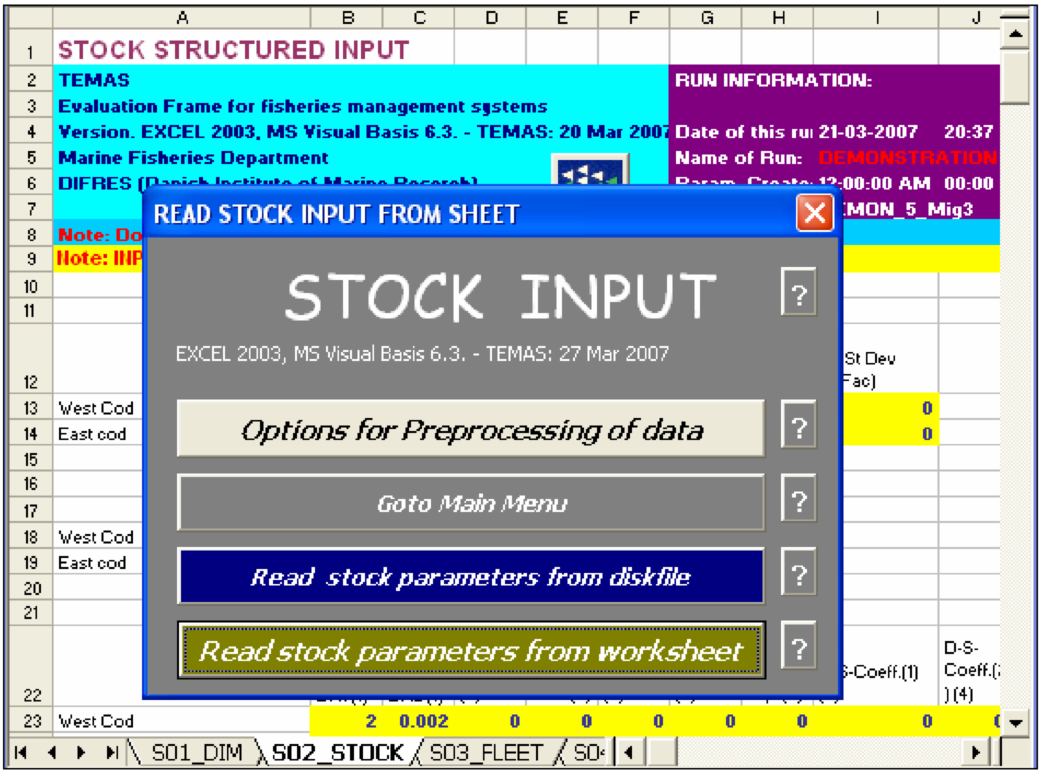


*Figure 2.5.2. User-form for entry of stock related parameters.*

| Index | EXCEL Table | Caption |
|---|---|---|
| 23 | Table 2.1.1. | GROWTH AND MATURITY PARAMETERS |
| 24 | Table 2.1.2. | CONDITION FACTOR |
| 25 | Table 2.2.1. | RECRUITMENT PARAMETERS |
| 26 | Table 2.2.2. | RECRUITMENT DISTRIBUTION ON PERIODS |
| 27 | Table 2.2.3. | RECRUITMENT DISTRIBUTION ON AREAS |
| 28 | Table 2.2.4. | LOW SPAWNING SUCCESS ON AREAS |
| 29 | Table 2.2.5. | HIGH SPAWNING SUCCESS ON AREAS |
| 30 | Table 2.2.6. | RECRUITMENT TREND OVER YEARS |
| 31 | Table 2.3.1. | STOCK NUMBERS FIRST PERIOD OF FIRST YEAR - Age 0- 1 |
| 32 | Table 2.3.2. | STOCK NUMBERS FIRST PERIOD OF FIRST YEAR - Age  2+ |
| 33 | Table 2.4.1. | WEIGHTING FACTORS FOR MEAN F CALCULATION - Age 0- 1 |
| 34 | Table 2.4.2. | WEIGHTING FACTORS FOR MEAN F CALCULATION - Age  2+ |
| 35 | Table 2.5.1. | West Cod: MIGRATION  - AGE GR.0-1 |
| 36 | Table 2.5.2. | West Cod: MIGRATION  - AGE GR.2+ |
| 37 | Table 2.5.3. | East cod: MIGRATION  - AGE GR.0-1 |
| 38 | Table 2.5.4. | East cod: MIGRATION  - AGE GR.2+ |
| 39 | Table 2.6.1. | NATURAL MORTALITY - West Cod |
| 40 | Table 2.6.2. | NATURAL MORTALITY - East cod |

*Table 2.5.1. Tables in the Stock input sheet, S02_STOCK.*

Figure 2.5.2 shows the input user-form for worksheet “S02_STOCK”. As you will see, the layout of this userform is repeated for all other input sheets. Only the text on the command buttons are slightly modified, to reflect the type of input of the worksheet in question. Then four command buttons are

1) Options for pre-processing of data
2) Go to Main menu
3) Read Stock Parameters from disk file
4) Read Stock parameters from works sheet

Option 1 for pre-processing of data takes you to a new user-form, which will offer you a number of options for pre-processing of data. “Pre-processing” essentially means to assign values to parameters according to some rules, for example:"
. 1) Assign the same value to all years
2) Assign the same value to all time periods
3) Assign zero to all parameters of a certain type
..... etc.

You might have got the same explanation by clicking on the question mark next to the command button.

Option 4 reads the values currently in the worksheet and store them in text file on the hard disk. Thus, there is always a backup of your parameter values on the hard disk. They remain unchanged until next time you click on the yellow button, “Read stock parameters from worksheet”. You can always refresh the worksheet values with the values from the text file by clicking on the blue button “Read stock parameters from disk file”. Al parameters are stores in one single subdirectory, and you may take a copy of that subdirectory, to get a second backup of parameter values.

Table 2.5.1 shows a list of the “EXCEL Tables” of S02_STOCK, the tables you will have to fill in with parameter values. We shall use the name “EXCEL Tables” to separate the Tables shown in the figures (the worksheet examples) from the Tables of the manual. Recall that the yellow cells are those to fill in with numerical values. The column “index” in Table 2.5.1 is simply to count the number of tables in the input module of TEMAS. As will appear, there is a total of 204 input tables in this demonstration example. With more dimensions the number and the size of Tables will increase. That is one reason why the full data set for the Baltic is not used for demonstration.

The first item in Table 2.5.1 is the table for input of growth and maturity parameters (EXCEL table 2.1.1 in Figure 2.5.3). The first three columns in WXCEL Table 2.1.1 contain the three von Bertalanffy growth parameters by species. Mean Body length of stock “St”, in the middle of time period q of year “y” of age group “a”, LGT(St,a,y) is given by:

$$\mathrm{Lgt(St,\,y,a,q)} = \mathrm{Loo}(St) * \Big(\ 1 - \exp\Big[\ -K\ \ (St) * (Age(a,q,qa) - Tzero(St))\Big]\ \Big)$$

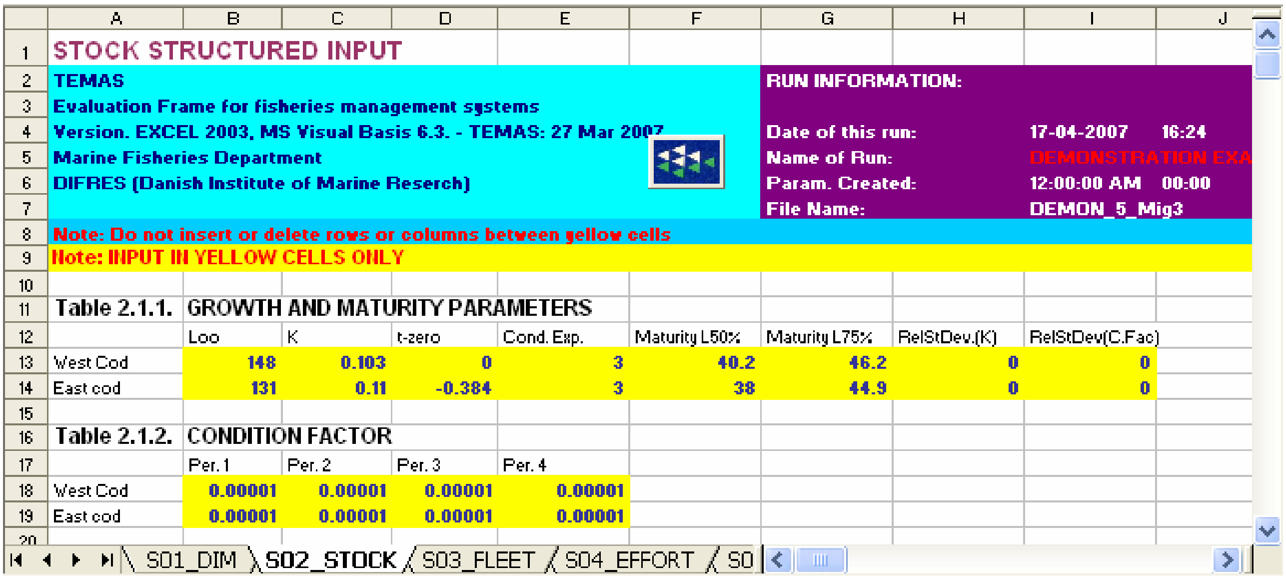
The age of the fish (or cohort) in units of years is defined:

$$Age(a,q,qa) = \begin{cases} a + (q - qa + 0.5) * dt & if\ a < 2 \\ \\ a - da_{Mean}(St) + (q - 0.5) * dt & if\ \ a \geq 2 \end{cases}$$

$$where \quad da_{Mean}(St) = \sum_{qa=1}^{q_{\max}} (qa - 1)\ \ * \ \mathrm{RecDistPeriod(St,\,qa)}$$

RecDistPeriod(St,qa) is the fraction of the annual recruitment which occurs in period qa, from which the mean time at recruitment, $da_{Mean}(st)$, is derived (to be defined in connection with EXCEL Table 2.2.2). This is the basis of age allocated to fish at age 2 and older.

For details behind the definition of growth parameters and all other parameters, the reader is referred to the report on the TEMAS model.



**STOCK STRUCTURED INPUT**

TEMAS
Evaluation Frame for fisheries management systems
Version. EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 27 Mar 2007
Marine Fisheries Department
DIFRES (Danish Institute of Marine Reserch)

RUN INFORMATION:
Date of this run: 17-04-2007 16:24
Name of Run: DEMONSTRATION EXA
Param. Created: 12:00:00 AM 00:00
File Name: DEMON_5_Mig3

Note: Do not insert or delete rows or columns between yellow cells
Note: INPUT IN YELLOW CELLS ONLY

Table 2.1.1. GROWTH AND MATURITY PARAMETERS

| | Loo | K | t-zero | Cond. Exp. | Maturity L50% | Maturity L75% | RelStDev.(K) | RelStDev(C.Fac) |
|---|---|---|---|---|---|---|---|---|
| West Cod | 148 | 0.103 | 0 | 3 | 40.2 | 46.2 | 0 | 0 |
| East cod | 131 | 0.11 | -0.384 | 3 | 38 | 44.9 | 0 | 0 |

Table 2.1.2. CONDITION FACTOR

| | Per. 1 | Per. 2 | Per. 3 | Per. 4 |
|---|---|---|---|---|
| West Cod | 0.00001 | 0.00001 | 0.00001 | 0.00001 |
| East cod | 0.00001 | 0.00001 | 0.00001 | 0.00001 |

*Figure 2.5.3. First part of stock parameters, growth parameters.*

The fourth column “Cond. Exp.” Refers to the exponent in the model for relationship between length and weight. The other parameter in the length/weight relationship is the “condition factor”, which is period specific, and therefore has been given a separate table (EXCEL Table 2.1.2)

Mean Body weight is derived from the body length

$$Wgt\ (St,y,a,q) = ConditionFactor\ (St,q) * Lgt(St,y,a,q)^{CondExp\ (St)}$$

The condition factors is assumed to depend on the time of the year, q. That means that the user has the option to let the condition factor vary over seasons of the year. The condition exponent is assumed to remain constant during the year.

The columns “Maturity L50%” and “Maturity L75%” are the parameters in the logistic model of maturity as a function of body length. Maturity ogive, that is the fraction of mature fish as a function of body length is

$$\mathrm{Mat(St, y,a,q)} = \frac{1}{1+\exp(\mathrm{Mat1(St)} - \mathrm{Mat2(St)} * \mathrm{Lgt}(St,a,y,q))}$$

where

$\mathrm{Mat1(St)} = \ln(3) * L_{50\%Mat}(St)/(L_{75\%Mat}(St) - L_{50\%Mat}(St))$, $\mathrm{Mat2(St)} = \ln(3)/(L_{75\%Mat}(St) - L_{50\%Mat}(St))$ and

$L_{X\%DMat}(St)$ = Length at which X % are mature.

The columns RelStDev(K) and RelStDev(C.Fac) are parameters in the stochastic model of growth. The body length at age can be made a stochastic variable in TEMAS, by introduction of the stochastic factor, $\varepsilon_K$

$$\mathrm{Lgt}\,(\mathrm{St},\ \mathrm{y},\mathrm{a},\mathrm{q}) =$$

$$\mathrm{L}_{\infty}(St) * \left(\ 1 - \exp\left[\ -K\ (St) * \varepsilon_K(St,y) * (Age(a,q) - T_0(St))\right]\ \right)\ if\ \ a \geq 2$$

$$\mathrm{Lgt}\,(\mathrm{St},\ \mathrm{y},\mathrm{a},\mathrm{q},\mathrm{qa}) =$$

$$\mathrm{L}_{\infty}(St) * \left(\ 1 - \exp\left[\ -K\ (St) * \varepsilon_K(St,y) * (Age(a,q,aq) - T_0(St))\right]\ \right)\ if\ \ a \leq 2$$

where $\varepsilon_K$(St, y) is a year and stock dependent normally distributed stochastic variable with mean value 1.0 and standard deviation RelStDev(K). The length/weight relationship can be made stochastic in TEMAS through the stochastic factor, $\varepsilon_{QF}$

$$Wgt\ \ (St,y,a,q) = QF\ \ (St,q) * \varepsilon_{QF}\ (St,y) * Lgt(St,y,a,q)^{QE\ \ (St)}$$

where $\varepsilon_{QF}$(St, y) = ($\varepsilon_K$(St, y) +$\varepsilon'_{QF}$(St, y))/2 and where $\varepsilon'_{QF}$(St, y)) is a year and stock dependent normally distributed stochastic variable with mean value 1.0 and standard deviation RelStDev(C.Fac). Body weight is assumed to be the same for stock, landings and discards in the operational model.

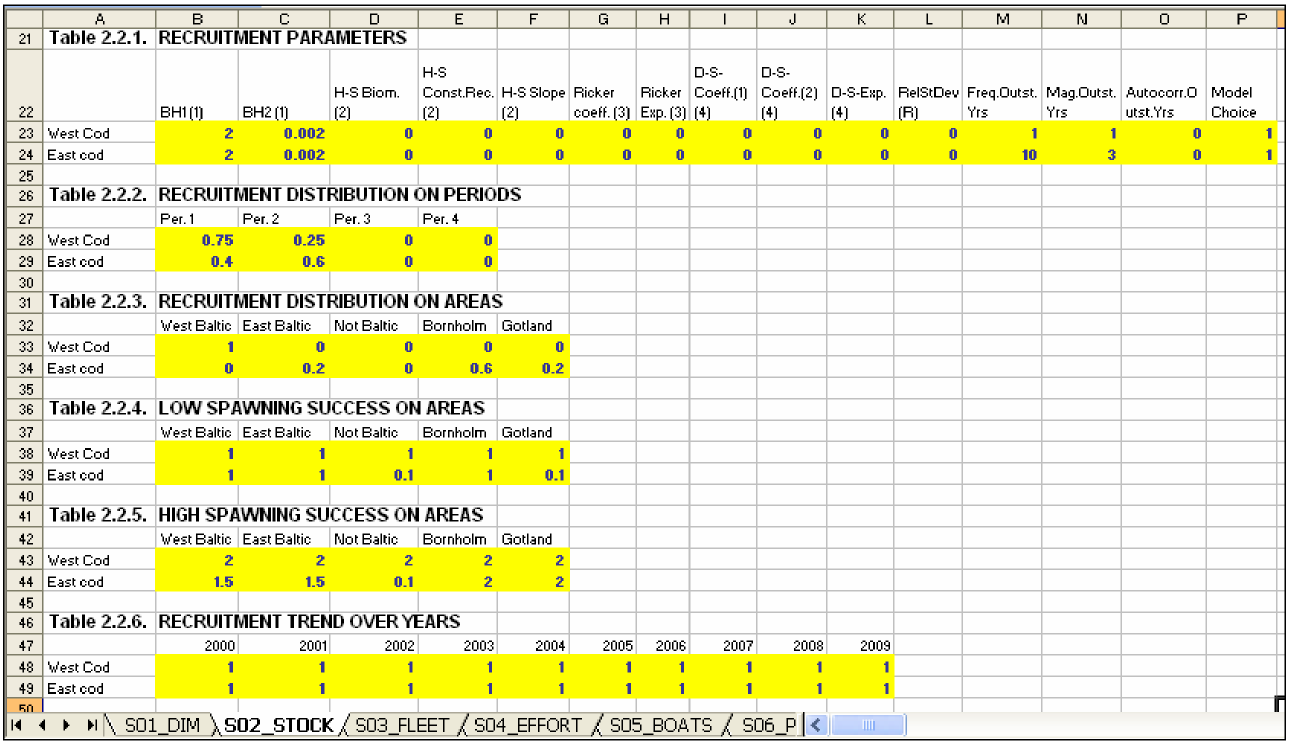


**Table 2.2.1. RECRUITMENT PARAMETERS**

| | BH1 (1) | BH2 (1) | H-S Biom. (2) | H-S Const.Rec. (2) | H-S Slope (2) | Ricker coeff. (3) | Ricker Exp. (3) | D-S-Coeff.(1) (4) | D-S-Coeff.(2) (4) | D-S-Exp. (4) | RelStDev (R) | Freq.Outst. Yrs | Mag.Outst. Yrs | Autocorr.Outst.Yrs | Model Choice |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| West Cod | 2 | 0.002 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 |
| East cod | 2 | 0.002 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 3 | 0 | 1 |

**Table 2.2.2. RECRUITMENT DISTRIBUTION ON PERIODS**

| | Per. 1 | Per. 2 | Per. 3 | Per. 4 |
|---|---|---|---|---|
| West Cod | 0.75 | 0.25 | 0 | 0 |
| East cod | 0.4 | 0.6 | 0 | 0 |

**Table 2.2.3. RECRUITMENT DISTRIBUTION ON AREAS**

| | West Baltic | East Baltic | Not Baltic | Bornholm | Gotland |
|---|---|---|---|---|---|
| West Cod | 1 | 0 | 0 | 0 | 0 |
| East cod | 0 | 0.2 | 0 | 0.6 | 0.2 |

**Table 2.2.4. LOW SPAWNING SUCCESS ON AREAS**

| | West Baltic | East Baltic | Not Baltic | Bornholm | Gotland |
|---|---|---|---|---|---|
| West Cod | 1 | 1 | 1 | 1 | 1 |
| East cod | 1 | 1 | 0.1 | 1 | 0.1 |

**Table 2.2.5. HIGH SPAWNING SUCCESS ON AREAS**

| | West Baltic | East Baltic | Not Baltic | Bornholm | Gotland |
|---|---|---|---|---|---|
| West Cod | 2 | 2 | 2 | 2 | 2 |
| East cod | 1.5 | 1.5 | 0.1 | 2 | 2 |

**Table 2.2.6. RECRUITMENT TREND OVER YEARS**

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|---|---|---|
| West Cod | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| East cod | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

*Figure 2.5.4. Second part of stock parameters, stock/recruitment parameters.*

EXCEL Table 2.2.1 (Figure 2.5.4) contains the parameters of the chosen stock and recruitment model. There are four options, and the last column "Model Choice" points at the selected model. The four S/R-model options are:

| | |
|---|---|
| 1.<br>Beverton and Holt stock/recruitment model | $STR_1(SSB(St,y-1,\bullet,\bullet)) = \dfrac{BH1(St) * SSB(St,y-1,\bullet,\bullet)}{1 + BH2(St) * SSB(St,y-1,\bullet,\bullet)}$<br>where BH1(St) and BH2(St) are the parameters. . |
| 2.<br>"Hockey stick" stock/recruitment model | If SSB > HSBiom(St) then<br>$STR_2(SSB(St,y-1,\bullet,\bullet)) = HSConRec(St)$ |

| | |
|---|---|
| | If SSB < HSBiom(St) then<br>$STR_2(SSB(St,y-1,\bullet,\bullet)) = HSSlope(St)*SSB(St,y-1,\bullet,\bullet)$<br>where the parameters are HSBiom(St) and HSConstRec(St).The slope is not a parameter as it is defined by the two parameters:<br>HSSlope(St) = HSConstRec(St) / HSBiom(St). |
| 3.<br>Ricker stock/recruitment model | $STR_3(SSB(St,y-1,\bullet,\bullet)) =$<br>$Ric\ker Coeff(St)*SSB(St,y-1,\bullet,\bullet)*\exp(-Ric\ker Exp(St)*SSB(St,y-1,\bullet,\bullet))$<br>where the parameters are RickerCoeff(St) and RickerExp(St) |
| 4.<br>Deriso-Schnute stock / recruitment model | $STR_4(SSB(St,y-1,\bullet,\bullet)) = DSCoeff1(St)*SSB(St,y-1,\bullet,\bullet)$<br>$*\{\ 1-DSCoeff2(St)*SSB(St,y-1,\bullet,\bullet)\ \}^{DSExp(St)}$<br>where the parameters are: DSCoeff1(St), DSCoeff2(St) and DSExp( St) |

It is only required to fill the parameters matching the choice of model. Parameters of other model can be assigned any values as they are ignored by the program. In the example of EXCEL Table 2.2.1, the Beverton and Holt model (Model no. 1) is chosen. Parameters of other models are zero.

The names of stock and recruitment parameters are explained in Table 2.5.2.

| | Column name | Explanation |
|---|---|---|
| 1 | BH1 (1) | Beverton & Holt |
| 2 | BH2 (1) | Beverton & Holt |
| 3 | H-S Biom. (2) | Critical biomass in Hockey stick model |
| 4 | H-S Const.Rec. (2) | Constant recruitment in Hockey stick model |
| 5 | H-S Slope (2) | Slope of line in Hockey stick model |
| 6 | Ricker coeff. (3) | Coefficient in Ricker model |
| 7 | Ricker Exp. (3) | Exponent in Ricker Model |
| 8 | D-S-Coeff.(1) (4) | First coefficient in Deriso-schnute model |
| 9 | D-S-Coeff.(2) (4) | Second coefficient in Deriso-schnute model |
| 10 | D-S-Exp. (4) | Exponent in Deriso-schnute model |
| 11 | RelStDev(R) | Relative standard deviation of recruitment |
| 12 | Freq.Outst.Yrs | Frequency of outstanding years |
| 13 | Mag.Outst.Yrs | Magnitude of outstanding years |
| 14 | Autocorr.Outst.Yrs | Autocorrelation of outstanding years |
| 15 | Model Choice | 1,2,3 or 4 (B&H, Hockey Stick, Ricker, Deriso-Schnute) |

**Table 2.5.2. Names of Stock recruitment parameters (EXCEL Table 2.2.1).**

The parameter “RelStDev(R)” is a parameter in stochastic model of recruitment

$$Re\,c(\,St,y,\bullet,\bullet\,) = STR_X(\,SSB_{RV}(\,St,y-1,\bullet,\bullet\,))*\varepsilon_{SR}(\,St\,)$$

Where $\varepsilon_{SR}(St) = \varepsilon_{SR1}(St) * R_{RepVol}(St)$

is the product of two stochastic factors of stock/recruitment relationship, of stock “St”. The factor $\varepsilon_{SR1}(St)$ is a stock dependent log-normally distributed stochastic variable with mean value 1.0 and standard deviation RelStDev(R).

The factor $R_{RepVol}(St)$, the “reproductive volume factor”, is specially designed to accommodate the dynamics of Baltic cod, where the recruitment is believed to be enhanced by large reproductive volumes (outstanding years). This happens only in certain years, and $\varepsilon_{SR2}(St)$ is a uniformly distributed stochastic variable controlling a reproductive volume factor, $R_{RepVol}(St)$

$$R_{\mathrm{Re}\,pVol}(St)=\begin{cases} MagOutstYrs(St)\;\; if \;\; \varepsilon_{SR2}(st)\le IF\,\mathrm{Pr}(St,y) \\ 1 \;\; if \;\; \varepsilon_{SR2}(St) > IF\,\mathrm{Pr}(St,y) \end{cases}$$

Where the "Inflow probability" is given by the model

IFPr(Sy,y)=(1+AutocorrOutstYrs(St)*Inflow(y-1))/FreqOutstYrs(St)

Where AutocorrOutstYrs(St) is the autocorrelation parameter of inflow years. and FreqOutstYrs(St) is the average number of years between occurrences of large reproductive volumes. "MagOutstYrs(St)" is the average relative magnitude of recruitment in years of high reproductive volume.

Hereby all S/R parameter in EXCEL Table 2.2.1 have been explained.

EXCEL Tables 2.2.2 and 3 keeps the distribution of recruitment on periods and areas respectively. After the total stock recruitment is derived, it is subsequently distributed on areas and time periods by the input parameters, $RecDist_{Area}(St,Ar)$ and $RecDist_{Period}(St,q)$, the relative distribution of recruitment on areas and time periods.

$$\mathrm{Re}c(St,y,q,Ar)=\mathrm{Re}cDist_{Area}(St,Ar)*\mathrm{Re}cDist_{Period}(St,q)*STR_X(SSB_{RV}(St,y-1,\bullet,\bullet))$$

$$\mathrm{Re}cDist_{Area}(St,Ar)=\frac{\mathrm{Re}cruitment\;\; number\;\; in\;\; area\;\; "ar"}{Total\;\; \mathrm{Re}cruitment\;\; Number}=\frac{N(St,y,0,q,Ar)}{\sum_{i=1}^{Ar_{Max}} N(St,y,0,q,i)}$$

Thus, $RecDist_{Area}(St, Ar)$ is assumed to be independent of time period, "q". The distribution on time periods is defined the same way, $RecDist_{Period}(St, q)$ is assumed to be independent of area, "Ar".

EXCEL Tables 2.2.4 and 5 contain the spawning success parameters, rfs, for low success and high success respectively. These parameters are used to define the SSB (Spawning stock biomass) in two aleternative cases, namely when the year is an inflow year and when it is not an inflow year.

$$SSB_{RV}(St,y,\bullet,\bullet)=\sum_{q=1}^{q_{Max}}\sum_{Ar=1}^{Ar_{Max}}\sum_{a=0}^{a_{Max}(St)} N_{Mean}(St,y,a,q,Ar)*$$

$$Wgt(St,y,a,q)*Mat(St,a,q)*RDist_{Period}(St,q)*RSF_{MPA}(St,Ar)$$

$$RSF_{MPA}(St,Ar,\varepsilon_{SR2}(St))=\begin{cases} rsf_{NotMPA}(St,Ar,\varepsilon_{SR2}(St)) \;\; if \;\; Ar\ne MPA \\ 1 \;\; if \;\; Ar=MPA \end{cases}$$

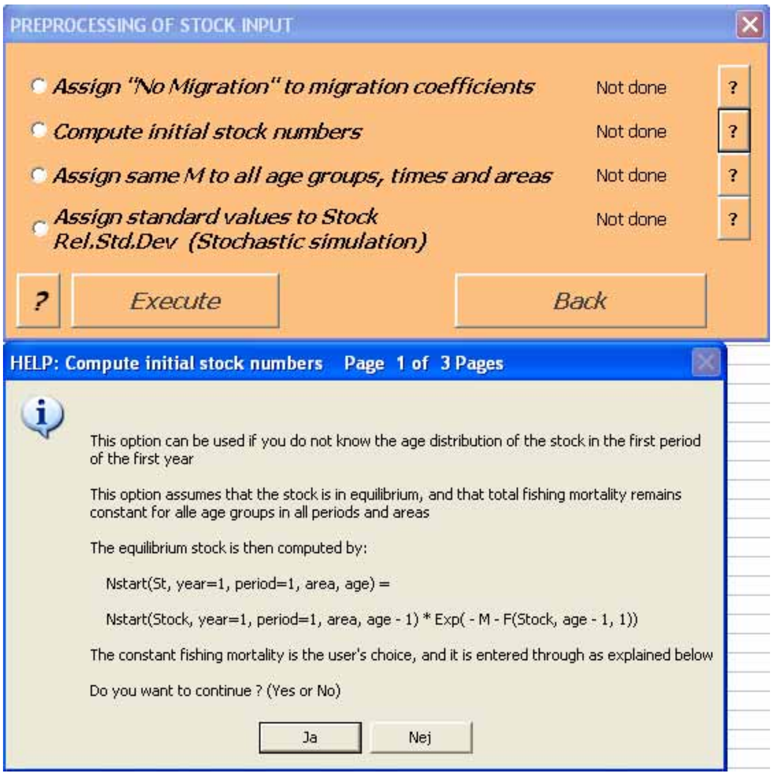
where the "Spawning success factor" is defined as

$$rsf_{NotMPA}(St,Ar,\varepsilon_{SR2}(St))=\begin{cases} rsf_{NotMPA}^{High}(St,Ar,\varepsilon_{SR2}(St)) \;\; if \;\; \varepsilon_{SR2}(St)\le IF\,\mathrm{Pr}(St,y) \\ rsf_{NotMPA}^{Low}(St,Ar,\varepsilon_{SR2}(St)) \;\; if \;\; \varepsilon_{SR2}(St) > IF\,\mathrm{Pr}(St,y) \end{cases}$$

where $0 \le rsf_{NotMPA}^{Low}(St,Ar,\varepsilon_{SR2}(St)) \le rsf_{NotMPA}^{High}(St,Ar,\varepsilon_{SR2}(St)) \le 1$

EXCEL Table 2.2.6 is the last recruitment parameter table. It contains the exogenous recruitment trend parameters.  TEMAS allows for analysing the effect of a “recruitment trend”, that is, analysing the effect of average recruitment slowly going downwards  or going upwards.

$$\mathrm{Re}c(St,y,q,Ar)= \mathrm{Re}cDist_{Area}(St,Ar)*\mathrm{Re}cDist_{Period}(St,q)*STR_{X}(SSB_{RV}(St,y-1,\bullet,\bullet))*\mathrm{Re}cTrend(St,y) \qquad (A.9.2.3)$$


PREPROCESSING OF STOCK INPUT

○ Assign "No Migration" to migration coefficients — Not done — ?

○ Compute initial stock numbers — Not done — ?

○ Assign same M to all age groups, times and areas — Not done — ?

○ Assign standard values to Stock Rel.Std.Dev  (Stochastic simulation) — Not done — ?

HELP: Compute initial stock numbers   Page  1 of  3 Pages

This option can be used if you do not know the age distribution of the stock in the first period of the first year

This option assumes that the stock is in equilibrium, and that total fishing mortality remains constant for alle age groups in all periods and areas

The equilibrium stock is then computed by:

Nstart(St, year=1, period=1, area, age) =

Nstart(Stock, year=1, period=1, area, age - 1) * Exp( - M - F(Stock, age - 1, 1))

The constant fishing mortality is the user's choice, and it is entered through as explained below

Do you want to continue ? (Yes or No)

RecTrend(St,y) can be any function of y (year). Recruitment sometimes shows such a trend over a long series of years, for reasons which are not understood by science. As such phenomena do occur in reality, and sometimes with catastrophic consequences for fisheries and ecosystem, they are accounted for as exogenous impacts.

Thus RecTrend(St,y) can take any value (based on any assumption) the user of TEMAS want to test.

EXCEL Table 2.3.1and 2 (Figure 2.5.5.a) contain the initial stock numbers in each area for juveniles and adults respectively. The initial stock numbers can be given as input, or they can be computed by the program under the assumption of equilibrium and constant fishing mortality (constant over age groups). This is an option in the userform “PRE-PROCES-SING OF STOCK INPUT”, which will be discussed below Figures 2.5.5.b shows the input to a calculation of initial stock numbers, and Figure 2.5.5.c shows the result of the calculation.

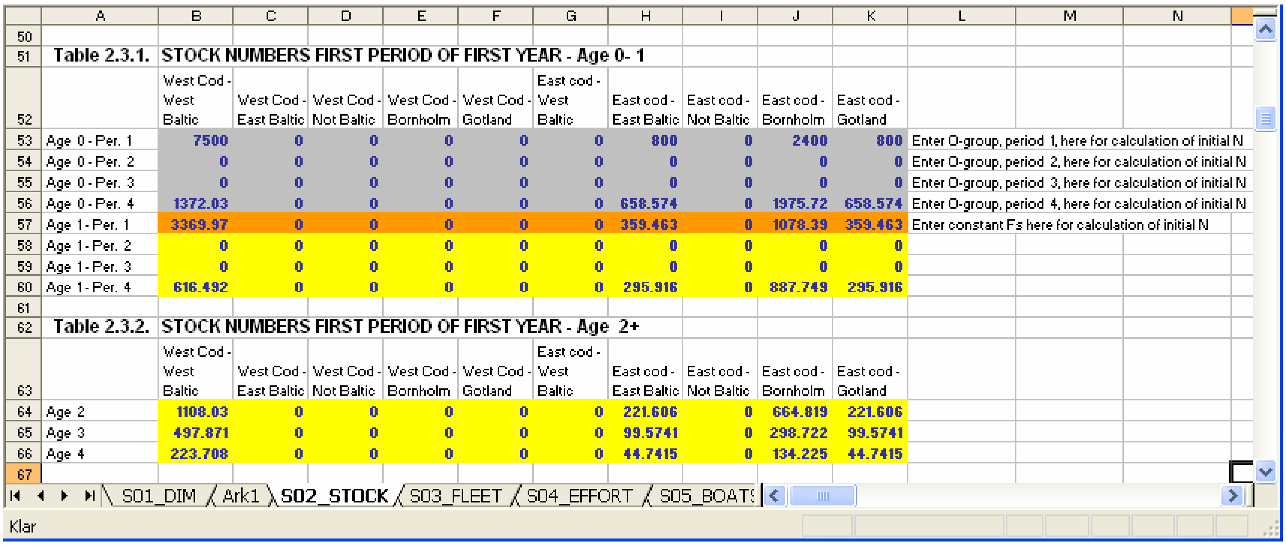


Table 2.3.1. STOCK NUMBERS FIRST PERIOD OF FIRST YEAR - Age 0- 1

| | West Cod - West Baltic | West Cod - East Baltic | West Cod - Not Baltic | West Cod - Bornholm | West Cod - Gotland | East cod - West Baltic | East cod - East Baltic | East cod - Not Baltic | East cod - Bornholm | East cod - Gotland | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Age 0 - Per. 1 | 7500 | 0 | 0 | 0 | 0 | 0 | 800 | 0 | 2400 | 800 | Enter O-group, period 1, here for calculation of initial N |
| Age 0 - Per. 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Enter O-group, period 2, here for calculation of initial N |
| Age 0 - Per. 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Enter O-group, period 3, here for calculation of initial N |
| Age 0 - Per. 4 | 1372.03 | 0 | 0 | 0 | 0 | 0 | 658.574 | 0 | 1975.72 | 658.574 | Enter O-group, period 4, here for calculation of initial N |
| Age 1 - Per. 1 | 3369.97 | 0 | 0 | 0 | 0 | 0 | 359.463 | 0 | 1078.39 | 359.463 | Enter constant Fs here for calculation of initial N |
| Age 1 - Per. 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Age 1 - Per. 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Age 1 - Per. 4 | 616.492 | 0 | 0 | 0 | 0 | 0 | 295.916 | 0 | 887.749 | 295.916 | |

Table 2.3.2. STOCK NUMBERS FIRST PERIOD OF FIRST YEAR - Age  2+

| | West Cod - West Baltic | West Cod - East Baltic | West Cod - Not Baltic | West Cod - Bornholm | West Cod - Gotland | East cod - West Baltic | East cod - East Baltic | East cod - Not Baltic | East cod - Bornholm | East cod - Gotland |
|---|---|---|---|---|---|---|---|---|---|---|
| Age 2 | 1108.03 | 0 | 0 | 0 | 0 | 0 | 221.606 | 0 | 664.819 | 221.606 |
| Age 3 | 497.871 | 0 | 0 | 0 | 0 | 0 | 99.5741 | 0 | 298.722 | 99.5741 |
| Age 4 | 223.708 | 0 | 0 | 0 | 0 | 0 | 44.7415 | 0 | 134.225 | 44.7415 |

*Figure 2.5.5.a. Third part of stock parameters, stock numbers first period of first year.*

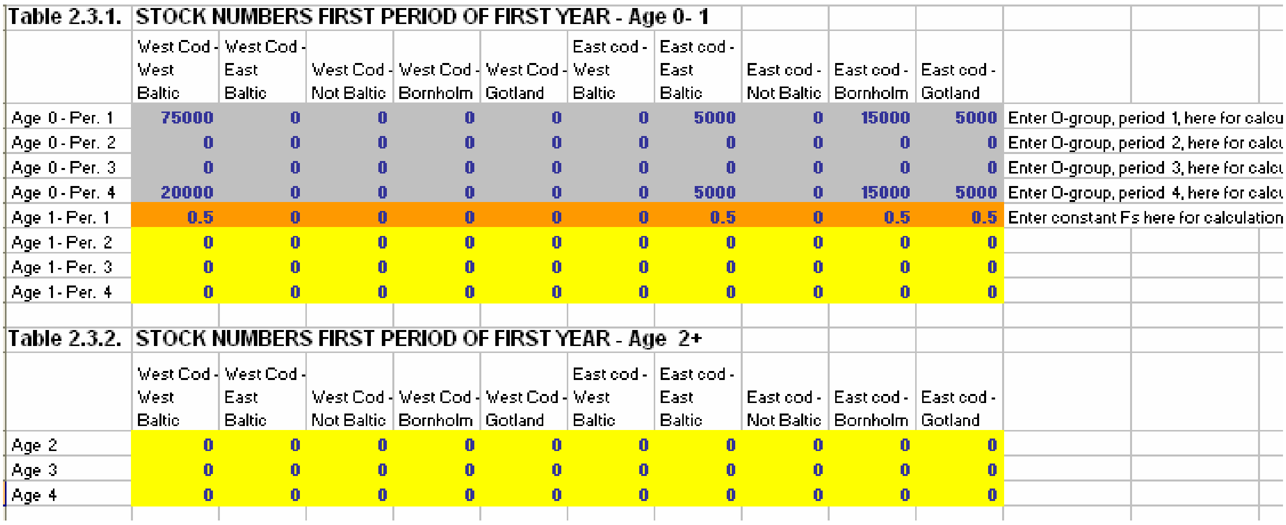


Table 2.3.1. STOCK NUMBERS FIRST PERIOD OF FIRST YEAR - Age 0- 1

| | West Cod - West Baltic | West Cod - East Baltic | West Cod - Not Baltic | West Cod - Bornholm | West Cod - Gotland | East cod - West Baltic | East cod - East Baltic | East cod - Not Baltic | East cod - Bornholm | East cod - Gotland | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Age 0 - Per. 1 | 75000 | 0 | 0 | 0 | 0 | 0 | 5000 | 0 | 15000 | 5000 | Enter O-group, period 1, here for calcu |
| Age 0 - Per. 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Enter O-group, period 2, here for calcu |
| Age 0 - Per. 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Enter O-group, period 3, here for calcu |
| Age 0 - Per. 4 | 20000 | 0 | 0 | 0 | 0 | 0 | 5000 | 0 | 15000 | 5000 | Enter O-group, period 4, here for calcu |
| Age 1 - Per. 1 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0.5 | 0 | 0.5 | 0.5 | Enter constant Fs here for calculation |
| Age 1 - Per. 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Age 1 - Per. 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Age 1 - Per. 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |

Table 2.3.2. STOCK NUMBERS FIRST PERIOD OF FIRST YEAR - Age 2+

| | West Cod - West Baltic | West Cod - East Baltic | West Cod - Not Baltic | West Cod - Bornholm | West Cod - Gotland | East cod - West Baltic | East cod - East Baltic | East cod - Not Baltic | East cod - Bornholm | East cod - Gotland |
|---|---|---|---|---|---|---|---|---|---|---|
| Age 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Age 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Age 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

***Figure 2.5.5.b. Input for calculation of initial stock numbers. Input data are in the gray and orange coloured cells. Note that the constant fishing mortality is given in the row for period 1 age group 1. The yellow cells are used for input in this special case.***

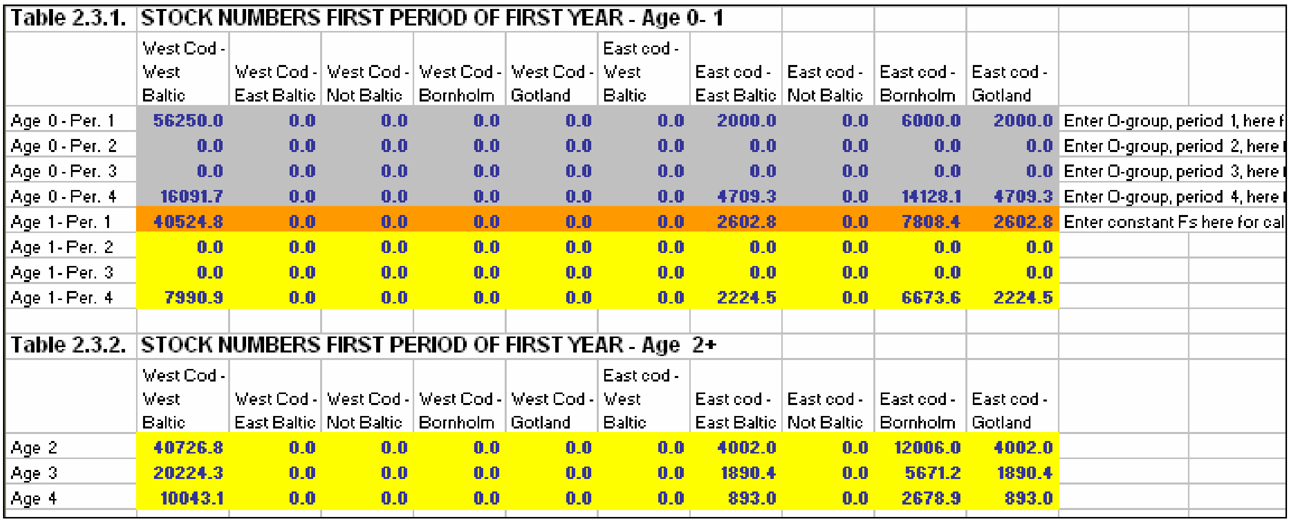


Table 2.3.1. STOCK NUMBERS FIRST PERIOD OF FIRST YEAR - Age 0- 1

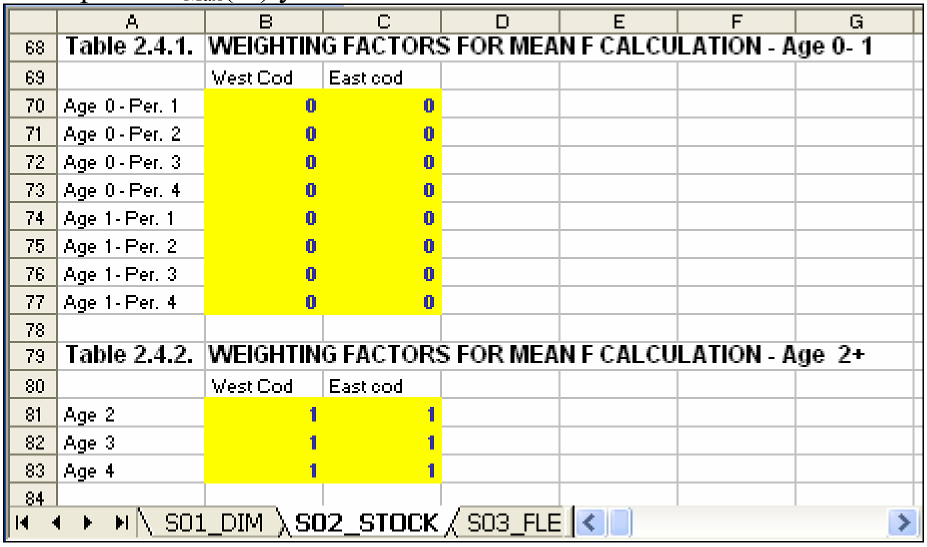
| | West Cod - West Baltic | West Cod - East Baltic | West Cod - Not Baltic | West Cod - Bornholm | West Cod - Gotland | East cod - West Baltic | East cod - East Baltic | East cod - Not Baltic | East cod - Bornholm | East cod - Gotland | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Age 0 - Per. 1 | 56250.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2000.0 | 0.0 | 6000.0 | 2000.0 | Enter O-group, period 1, here f |
| Age 0 - Per. 2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | Enter O-group, period 2, here |
| Age 0 - Per. 3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | Enter O-group, period 3, here |
| Age 0 - Per. 4 | 16091.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4709.3 | 0.0 | 14128.1 | 4709.3 | Enter O-group, period 4, here |
| Age 1 - Per. 1 | 40524.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2602.8 | 0.0 | 7808.4 | 2602.8 | Enter constant Fs here for cal |
| Age 1 - Per. 2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Age 1 - Per. 3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Age 1 - Per. 4 | 7990.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2224.5 | 0.0 | 6673.6 | 2224.5 | |

Table 2.3.2. STOCK NUMBERS FIRST PERIOD OF FIRST YEAR - Age 2+

| | West Cod - West Baltic | West Cod - East Baltic | West Cod - Not Baltic | West Cod - Bornholm | West Cod - Gotland | East cod - West Baltic | East cod - East Baltic | East cod - Not Baltic | East cod - Bornholm | East cod - Gotland |
|---|---|---|---|---|---|---|---|---|---|---|
| Age 2 | 40726.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4002.0 | 0.0 | 12006.0 | 4002.0 |
| Age 3 | 20224.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1890.4 | 0.0 | 5671.2 | 1890.4 |
| Age 4 | 10043.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 893.0 | 0.0 | 2678.9 | 893.0 |

***Figure 2.5.5.c. Result of the calculation with input from Figure 2.5.5.b.***

The calculations are straight forward, and are done in first quarter of first year, as if it was over a time span of $a_{Max}(St)$ years.



| | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| 68 | Table 2.4.1. | WEIGHTING FACTORS FOR MEAN F CALCULATION - Age 0- 1 | | | | | |
| 69 | | West Cod | East cod | | | | |
| 70 | Age 0 - Per. 1 | 0 | 0 | | | | |
| 71 | Age 0 - Per. 2 | 0 | 0 | | | | |
| 72 | Age 0 - Per. 3 | 0 | 0 | | | | |
| 73 | Age 0 - Per. 4 | 0 | 0 | | | | |
| 74 | Age 1 - Per. 1 | 0 | 0 | | | | |
| 75 | Age 1 - Per. 2 | 0 | 0 | | | | |
| 76 | Age 1 - Per. 3 | 0 | 0 | | | | |
| 77 | Age 1 - Per. 4 | 0 | 0 | | | | |
| 78 | | | | | | | |
| 79 | Table 2.4.2. | WEIGHTING FACTORS FOR MEAN F CALCULATION - Age 2+ | | | | | |
| 80 | | West Cod | East cod | | | | |
| 81 | Age 2 | 1 | 1 | | | | |
| 82 | Age 3 | 1 | 1 | | | | |
| 83 | Age 4 | 1 | 1 | | | | |
| 84 | | | | | | | |

***Figure 2.5.6. Sixth part of stock parameters, Weighting factors for calculation of mean F.***

Figure 2.5.6 (EXCEL Tables 2.4.1 and 2) show the weighting factors (WF) in the calculation of stock mean F.

$$F_{Mean}(St) = \frac{\sum_{a=0}^{a_{Max}(St)} F(St,a)*WF(St,a)}{\sum_{a=0}^{a_{Max}(St)} WF(St,a)}$$

These weighting factors can be used to compute the traditional mean F as presented by ICES Working Groups, with WF(St,a) = 1 or 0. The example above corresponds to the ICES concept of $F_{Mean}$(2-4)

Figures 2.5.7.a-c. (EXCEL Tables 2.5.1-4) show the migration coefficients. The full set of migration coefficients for one species (Eastern cod) is presented in Table 2.5.3 as an example.

The migration is modelled in a time discrete manner:

a) Migration takes place at the end of each time period and the process of migration takes zero time.
b) During a time period the fish/shrimps are assumed to be homogeneously distributed within the area.

The "Migration Coefficient", MC, from area A to area B is defined as the fraction of the animals in area A which moves to area B. In this definition, the "movements" include the "move" from area A to area A, i.e., the event that the animal does not move. The migration coefficient depends on (or has the indices):

FAr: Starting area   TAr: Destination area

Note that the sum of migration coefficients over destination areas always becomes 1.0, as the starting area is also considered a destination area: $1.0 = \sum_{TAr} MC(FAr, TAr, q, a)$ where a = age group and q = time period (division of year).

Note that there are two tables for each species

1) Migration coefficients for age groups 0 and 1 (each year with $Q_{Max}$ .period cohorts)
2) Migration coefficient for age groups 2 to $a_{Max}$(St) with one (combined) age group each year.

Each of these tables are organised so that columns comes in period groups (Figure 2.5.7.a)

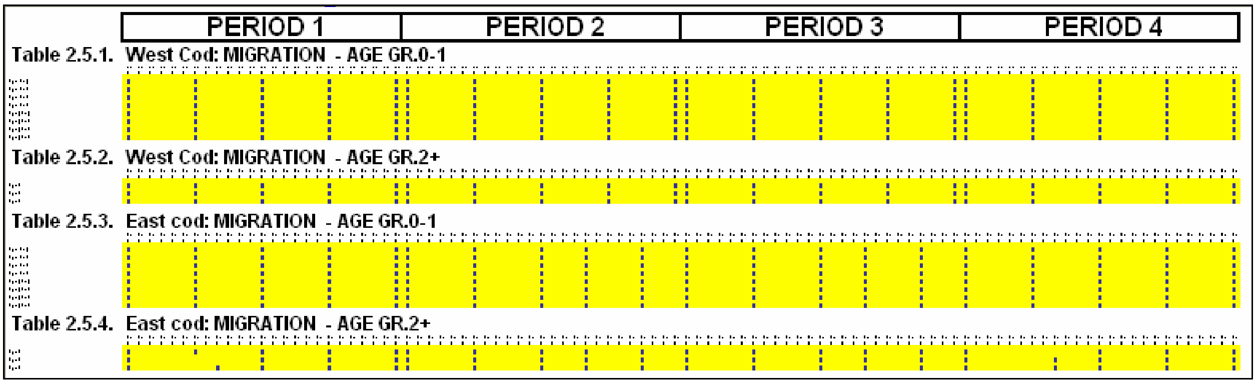
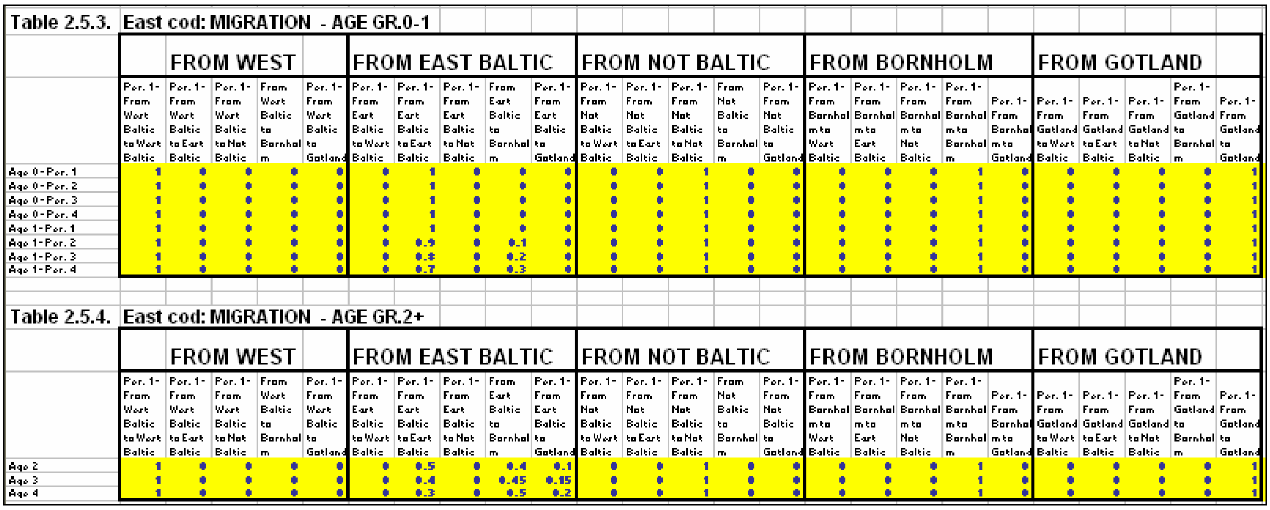


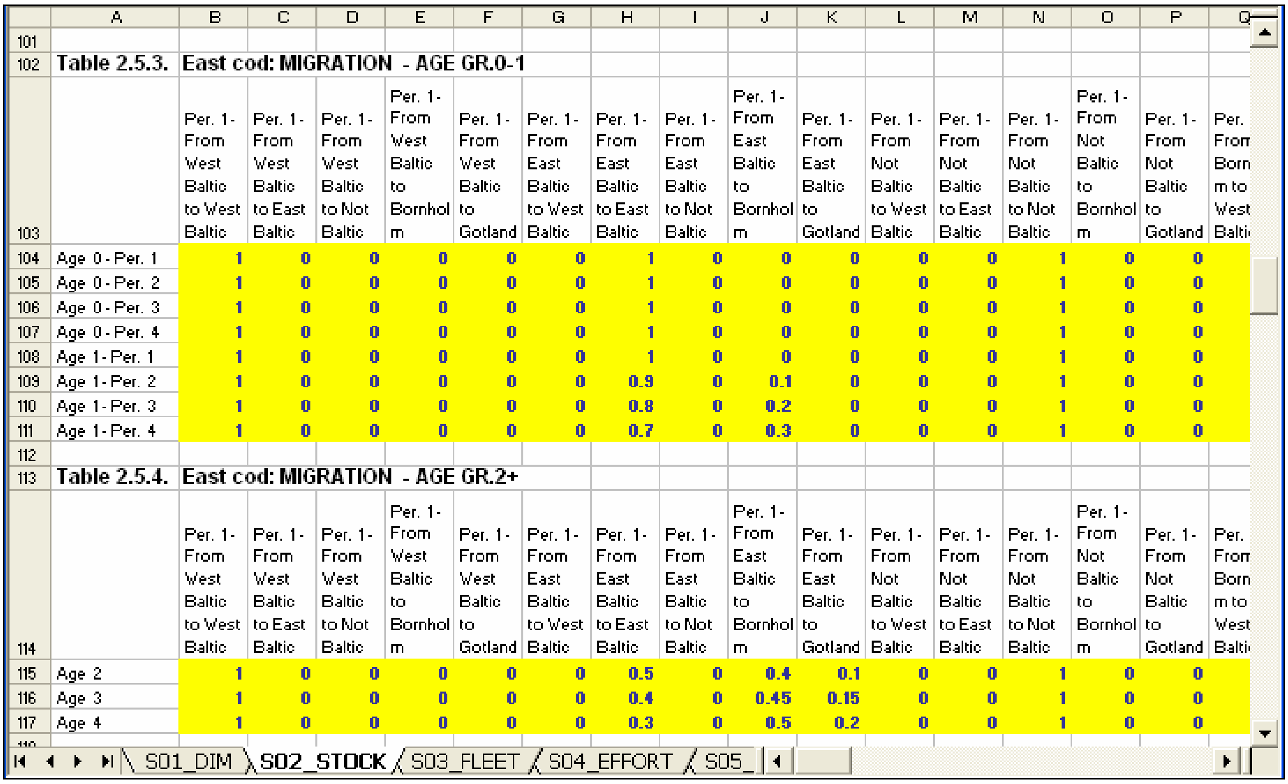
***Figure 2.5.7.a. Third part of stock parameters. Migration coefficient for Eastern Cod. The EXCEL sheet is reduced to a size so that all periods are displayed. Details are not detectable.***



| Table 2.5.3. | East cod: MIGRATION - AGE GR.0-1 | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | FROM WEST | | | | | FROM EAST BALTIC | | | | | FROM NOT BALTIC | | | | | FROM BORNHOLM | | | | | FROM GOTLAND | | | | |
| | Per. 1- From West Baltic to West Baltic | Per. 1- From West Baltic to East Baltic | Per. 1- From West Baltic to Not Baltic | From West Baltic to Bornholm | Per. 1- From West Baltic to Gotland | Per. 1- From East Baltic to West Baltic | Per. 1- From East Baltic to East Baltic | Per. 1- From East Baltic to Not Baltic | From East Baltic to Bornholm | Per. 1- From East Baltic to Gotland | Per. 1- From Not Baltic to West Baltic | Per. 1- From Not Baltic to East Baltic | Per. 1- From Not Baltic to Not Baltic | From Not Baltic to Bornholm | Per. 1- From Not Baltic to Gotland | Per. 1- From Bornholm to West Baltic | Per. 1- From Bornholm to East Baltic | Per. 1- From Bornholm to Not Baltic | Per. 1- From Bornholm to Bornholm | Per. 1- From Bornholm to Gotland | Per. 1- From Gotland to West Baltic | Per. 1- From Gotland to East Baltic | Per. 1- From Gotland to Not Baltic | Per. 1- From Gotland to Bornholm | Per. 1- From Gotland to Gotland |
| Age 0 - Per. 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| Age 0 - Per. 2 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| Age 0 - Per. 3 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| Age 0 - Per. 4 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| Age 1 - Per. 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| Age 1 - Per. 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0.9 | 0 | 0.1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| Age 1 - Per. 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0.8 | 0 | 0.2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| Age 1 - Per. 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0.7 | 0 | 0.3 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |

| Table 2.5.4. | East cod: MIGRATION - AGE GR.2+ | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | FROM WEST | | | | | FROM EAST BALTIC | | | | | FROM NOT BALTIC | | | | | FROM BORNHOLM | | | | | FROM GOTLAND | | | | |
| | Per. 1- From West Baltic to West Baltic | Per. 1- From West Baltic to East Baltic | Per. 1- From West Baltic to Not Baltic | From West Baltic to Bornholm | Per. 1- From West Baltic to Gotland | Per. 1- From East Baltic to West Baltic | Per. 1- From East Baltic to East Baltic | Per. 1- From East Baltic to Not Baltic | From East Baltic to Bornholm | Per. 1- From East Baltic to Gotland | Per. 1- From Not Baltic to West Baltic | Per. 1- From Not Baltic to East Baltic | Per. 1- From Not Baltic to Not Baltic | From Not Baltic to Bornholm | Per. 1- From Not Baltic to Gotland | Per. 1- From Bornholm to West Baltic | Per. 1- From Bornholm to East Baltic | Per. 1- From Bornholm to Not Baltic | Per. 1- From Bornholm to Bornholm | Per. 1- From Bornholm to Gotland | Per. 1- From Gotland to West Baltic | Per. 1- From Gotland to East Baltic | Per. 1- From Gotland to Not Baltic | Per. 1- From Gotland to Bornholm | Per. 1- From Gotland to Gotland |
| Age 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0.5 | 0 | 0.4 | 0.1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| Age 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0.4 | 0 | 0.45 | 0.15 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| Age 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0.3 | 0 | 0.5 | 0.2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |

*Figure 2.5.7.b. Third part of stock parameters.  Migration coefficient for Eastern Cod, first period. The EXCEL sheet is reduced to a size so that all "From area"'s  are displayed. Details are not detectable.*



| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 101 | | | | | | | | | | | | | | | | | |
| 102 | Table 2.5.3. | East cod: MIGRATION - AGE GR.0-1 | | | | | | | | | | | | | | | |
| 103 | | Per. 1- From West Baltic to West Baltic | Per. 1- From West Baltic to East Baltic | Per. 1- From West Baltic to Not Baltic | Per. 1- From West Baltic to Bornholm | Per. 1- From West Baltic to Gotland | Per. 1- From East Baltic to West Baltic | Per. 1- From East Baltic to East Baltic | Per. 1- From East Baltic to Not Baltic | Per. 1- From East Baltic to Bornholm | Per. 1- From East Baltic to Gotland | Per. 1- From Not Baltic to West Baltic | Per. 1- From Not Baltic to East Baltic | Per. 1- From Not Baltic to Not Baltic | Per. 1- From Not Baltic to Bornholm | Per. 1- From Not Baltic to Gotland | Per. Fron Born m to West Balti |
| 104 | Age 0 - Per. 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | |
| 105 | Age 0 - Per. 2 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | |
| 106 | Age 0 - Per. 3 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | |
| 107 | Age 0 - Per. 4 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | |
| 108 | Age 1 - Per. 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | |
| 109 | Age 1 - Per. 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0.9 | 0 | 0.1 | 0 | 0 | 0 | 1 | 0 | 0 | |
| 110 | Age 1 - Per. 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0.8 | 0 | 0.2 | 0 | 0 | 0 | 1 | 0 | 0 | |
| 111 | Age 1 - Per. 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0.7 | 0 | 0.3 | 0 | 0 | 0 | 1 | 0 | 0 | |
| 112 | | | | | | | | | | | | | | | | | |
| 113 | Table 2.5.4. | East cod: MIGRATION - AGE GR.2+ | | | | | | | | | | | | | | | |
| 114 | | Per. 1- From West Baltic to West Baltic | Per. 1- From West Baltic to East Baltic | Per. 1- From West Baltic to Not Baltic | Per. 1- From West Baltic to Bornholm | Per. 1- From West Baltic to Gotland | Per. 1- From East Baltic to West Baltic | Per. 1- From East Baltic to East Baltic | Per. 1- From East Baltic to Not Baltic | Per. 1- From East Baltic to Bornholm | Per. 1- From East Baltic to Gotland | Per. 1- From Not Baltic to West Baltic | Per. 1- From Not Baltic to East Baltic | Per. 1- From Not Baltic to Not Baltic | Per. 1- From Not Baltic to Bornholm | Per. 1- From Not Baltic to Gotland | Per. Fron Born m to West Balti |
| 115 | Age 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0.5 | 0 | 0.4 | 0.1 | 0 | 0 | 1 | 0 | 0 | |
| 116 | Age 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0.4 | 0 | 0.45 | 0.15 | 0 | 0 | 1 | 0 | 0 | |
| 117 | Age 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0.3 | 0 | 0.5 | 0.2 | 0 | 0 | 1 | 0 | 0 | |

*Figure 2.5.7.c. Third part of stock parameters. Some Migration coefficient for Eastern Cod. Only in Figure c are details visible.*

**Q1**

| From: | West | | | | | East | | | | | Not Batlic | | | | | Bornholm | | | | | Gotland | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| to: | W | E | N | B | G | W | E | N | B | G | W | E | N | B | G | W | E | N | B | G | W | E | N | B | G |
| A 0 - Q 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| A 0 - Q 2 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| A 0 - Q 3 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| A 0 - Q 4 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| A 1 - Q 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| A 1 - Q 2 | 1 | 0 | 0 | 0 | 0 | 0 | **0.9** | 0 | **0.1** | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| A 1 - Q 3 | 1 | 0 | 0 | 0 | 0 | 0 | **0.8** | 0 | **0.2** | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| A 1 - Q 4 | 1 | 0 | 0 | 0 | 0 | 0 | **0.7** | 0 | **0.3** | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| A 2 | 1 | 0 | 0 | 0 | 0 | 0 | **0.5** | 0 | **0.4** | **0.1** | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| A 3 | 1 | 0 | 0 | 0 | 0 | 0 | **0.4** | 0 | **0.5** | **0.15** | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| A 4 | 1 | 0 | 0 | 0 | 0 | 0 | **0.3** | 0 | **0.5** | **0.2** | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |

**Q2**

| From: | West | | | | | East | | | | | Not Batlic | | | | | Bornholm | | | | | Gotland | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| to: | W | E | N | B | G | W | E | N | B | G | W | E | N | B | G | W | E | N | B | G | W | E | N | B | G |
| A 0 - Q 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0.6 | 0 | 0.2 | 0.2 | 0 | 0.5 | 0 | 0.2 | 0.3 |
| A 0 - Q 2 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0.6 | 0 | 0.2 | 0.2 | 0 | 0.5 | 0 | 0.2 | 0.3 |
| A 0 - Q 3 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0.6 | 0 | 0.2 | 0.2 | 0 | 0.5 | 0 | 0.2 | 0.3 |
| A 0 - Q 4 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0.6 | 0 | 0.2 | 0.2 | 0 | 0.5 | 0 | 0.2 | 0.3 |
| A 1 - Q 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0.6 | 0 | 0.2 | 0.2 | 0 | 0.5 | 0 | 0.2 | 0.3 |
| A 1 - Q 2 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0.6 | 0 | 0.2 | 0.2 | 0 | 0.5 | 0 | 0.2 | 0.3 |
| A 1 - Q 3 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0.6 | 0 | 0.2 | 0.2 | 0 | 0.5 | 0 | 0.2 | 0.3 |
| A 1 - Q 4 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0.6 | 0 | 0.2 | 0.2 | 0 | 0.5 | 0 | 0.2 | 0.3 |
| A 2 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0.6 | 0 | 0.2 | 0.2 | 0 | 0.5 | 0 | 0.2 | 0.3 |
| A 3 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0.6 | 0 | 0.2 | 0.2 | 0 | 0.5 | 0 | 0.2 | 0.3 |
| A 4 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0.6 | 0 | 0.2 | 0.2 | 0 | 0.5 | 0 | 0.2 | 0.3 |

**Q3**

| From: | West | | | | | East | | | | | Not Batlic | | | | | Bornholm | | | | | Gotland | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| to: | W | E | N | B | G | W | E | N | B | G | W | E | N | B | G | W | E | N | B | G | W | E | N | B | G |
| A 0 - Q 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0.67 | 0 | 0.2 | 0.13 | 0 | 0 | 1 | 0 | 0 | 0 | 0.6 | 0 | 0.2 | 0.2 | 0 | 0.5 | 0 | 0.2 | 0.3 |
| A 0 - Q 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0.67 | 0 | 0.2 | 0.13 | 0 | 0 | 1 | 0 | 0 | 0 | 0.6 | 0 | 0.2 | 0.2 | 0 | 0.5 | 0 | 0.2 | 0.3 |
| A 0 - Q 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0.67 | 0 | 0.2 | 0.13 | 0 | 0 | 1 | 0 | 0 | 0 | 0.6 | 0 | 0.2 | 0.2 | 0 | 0.5 | 0 | 0.2 | 0.3 |
| A 0 - Q 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0.67 | 0 | 0.2 | 0.13 | 0 | 0 | 1 | 0 | 0 | 0 | 0.6 | 0 | 0.2 | 0.2 | 0 | 0.5 | 0 | 0.2 | 0.3 |
| A 1 - Q 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0.67 | 0 | 0.2 | 0.13 | 0 | 0 | 1 | 0 | 0 | 0 | 0.6 | 0 | 0.2 | 0.2 | 0 | 0.5 | 0 | 0.2 | 0.3 |
| A 1 - Q 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0.67 | 0 | 0.2 | 0.13 | 0 | 0 | 1 | 0 | 0 | 0 | 0.6 | 0 | 0.2 | 0.2 | 0 | 0.5 | 0 | 0.2 | 0.3 |
| A 1 - Q 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0.67 | 0 | 0.2 | 0.13 | 0 | 0 | 1 | 0 | 0 | 0 | 0.6 | 0 | 0.2 | 0.2 | 0 | 0.5 | 0 | 0.2 | 0.3 |
| A 1 - Q 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0.67 | 0 | 0.2 | 0.13 | 0 | 0 | 1 | 0 | 0 | 0 | 0.6 | 0 | 0.2 | 0.2 | 0 | 0.5 | 0 | 0.2 | 0.3 |
| A 2 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0.6 | 0 | 0.2 | 0.2 | 0 | 0.5 | 0 | 0.2 | 0.3 |
| A 3 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0.6 | 0 | 0.2 | 0.2 | 0 | 0.5 | 0 | 0.2 | 0.3 |
| A 4 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0.6 | 0 | 0.2 | 0.2 | 0 | 0.5 | 0 | 0.2 | 0.3 |

**Q4**

| From: | West | | | | | East | | | | | Not Batlic | | | | | Bornholm | | | | | Gotland | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| to: | W | E | N | B | G | W | E | N | B | G | W | E | N | B | G | W | E | N | B | G | W | E | N | B | G |
| A 0 - Q 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| A 0 - Q 2 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| A 0 - Q 3 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| A 0 - Q 4 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| A 1 - Q 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| A 1 - Q 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0.87 | 0 | 0.1 | 0.03 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| A 1 - Q 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0.85 | 0 | 0.2 | 0.05 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| A 1 - Q 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0.7 | 0 | 0.2 | 0.1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| A 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0.4 | 0 | 0.4 | 0.2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| A 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0.3 | 0 | 0.6 | 0.15 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| A 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0.2 | 0 | 0.7 | 0.15 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |

***Table 2.5.3. Migration coefficients for Eastern cod.(W:West, E:East, N:Not Baltic, B:Bornholm, G:Gotland)***

Within each period, the columns are organised in groups according to where the migration starts, that from which area the migration starts (Figure 2.5.7.b). In the present case there are five areas. From each of these five areas the migration can go to 5 areas (as staying in the area is also an option for migration, i.e. no migration). As appears it is not possible to make a readable version of the EXCEL table, and therefore, Table2.5.3 was made. Table 2.5.7.c shows a part of the EXCEL table with all details visible.

Table 2.5.2 is reorganized to match the A4 format, so that period groups are placed on top of each other.

There are no movements in the two areas “West” and “Not Baltic” in the hypothetical example of Table 2.5.3. This is because “From West to West” is 1 and other cells 0. And from “Not Baltic to Not Baltic” is 1 and other cells 0. Thus is this example the movements are only between East, Bornholm and Gotland.

To explain the nature of “migration coefficients” the text below translate to migration matrix in Table 2.5.3 into words:

**Movements in Quarter 1:**
**Ages 0-1**: Movements from East to Bornholm, but only age gr 1.
No movements out of Bornholm or Gotland
**Ages 2-4**: Movements from East to Bornholm and Gotland.
No movements out of Bornholm or Gotland
**Movements in Quarter 2:**
**Ages 0-4**: 60% moves from Bornholm to East, 20% to Gotland, 20% remain in Bornholm
50% moves Gotland to East, 20% tol Bornholm and 30% remain in Gotland
No movements out of East Baltic
**Movements in Quarter 3:**
**Ages 0-1**: 20% moves from East to Bornholm, 13% moves to Gotland and 67% remain in East
60% moves from Bornholm to East, 20% to Gotland and 20% remain in Bornholm
50% moves from Gotland to East, 20% to Gotland and 30% remain in Gotland.
**Ages 2-4**: No movements out of East.
60% moves from Bornholm to East, 20% to Gotland and 20% remain in Bornholm
50% moves from Gotland to East, 20% to Gotland and 30% remain in Gotland.
**Movements in Quarter 4:**
**Ages 0-4:** No movements in age group 0. No movements out of Bornholm and Gotland.
Some movements from East to Bornholm and Gotland.

The last stock-table (EXCEL Table 2.6.1) is shown in Figure 2.5.8.a-b. It contains the natural mortality (M).
Here it is possible to let natural mortality depend on area, time and age. Figure 2.5.8 shows the organization of the EXCEL table for one stock. The columns are the years divided into periods, and the rows are the areas and the age/period groups. In this case, however, the traditional “ICES approach” to let M = 0.2 for all ages to all times in all areas. In that case you may either use the facilities of EXCEL to fill in the table with 0.2 everywhere (you may here ignore that some cells contain the text “No value”), or you use the “pre-processing of stock-data” (Figure 2.5.9). The option “Assign same “M to all age groups, times and areas” will take the value in the upper left corner of the table (indicated with a red frame in Figure 2.5.9) and use that value elsewhere in the table.

The option for calculation of initial stock size has already been discussed. The option for “no migration” assigns 0 and 1 to all migration coefficients

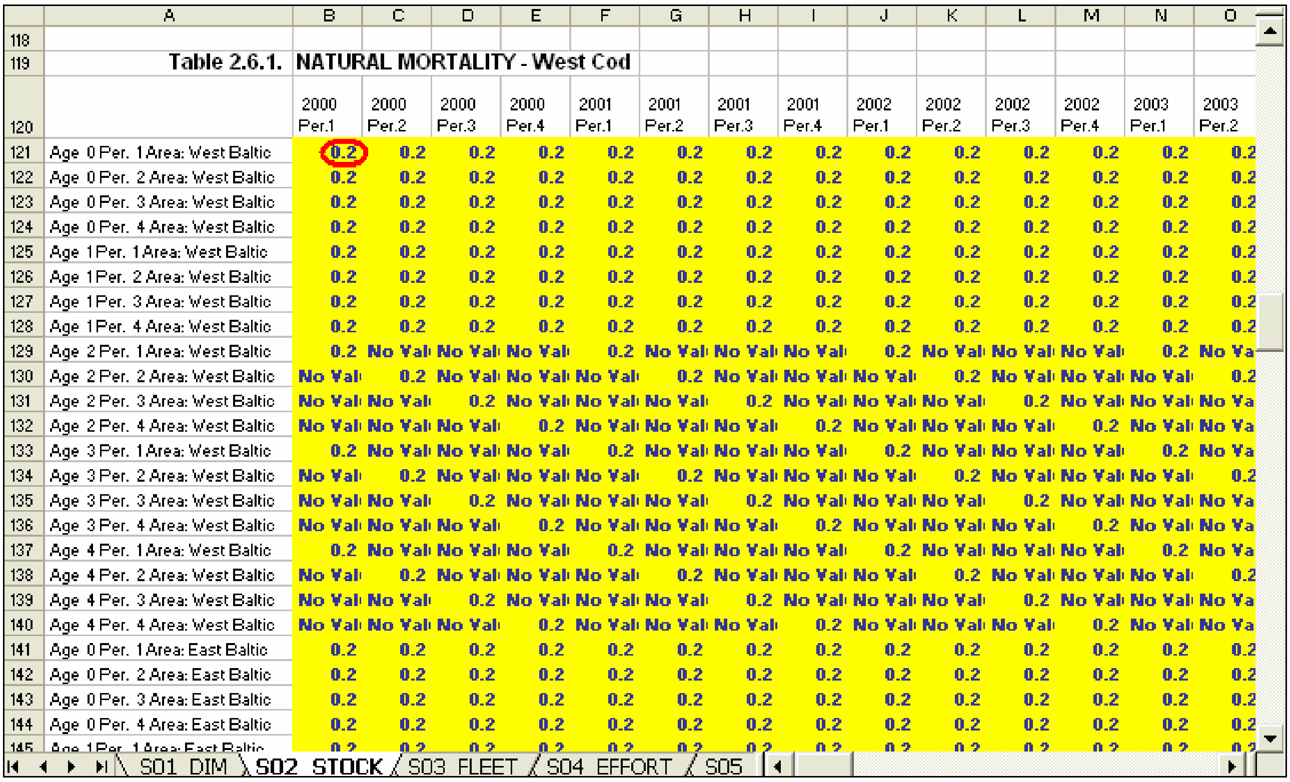
$$MC(\mathit{from}\ \ \mathit{Area}\ \ A,\quad \mathit{to}\ \ \mathit{Area}\ \ B) = \begin{cases} 1 \ \ \mathit{if}\ \ \ A = B \\ 0 \ \ \mathit{otherwise} \end{cases}$$

The standard values of relative standard deviations for stochastic simulation are

Rel. Std.Dev. Von Bertalanffy parameter, K, = 0.1 (normally distributed)
Rel. Std.Dev. of Condition Factor = 0.1 (normally distributed)
Rel. Std.Dev. of Recruitment = 0.5 (log-normally distributed)
Rel. Std.Dev. of Catchability, Q, = 0.1 (normally distributed)

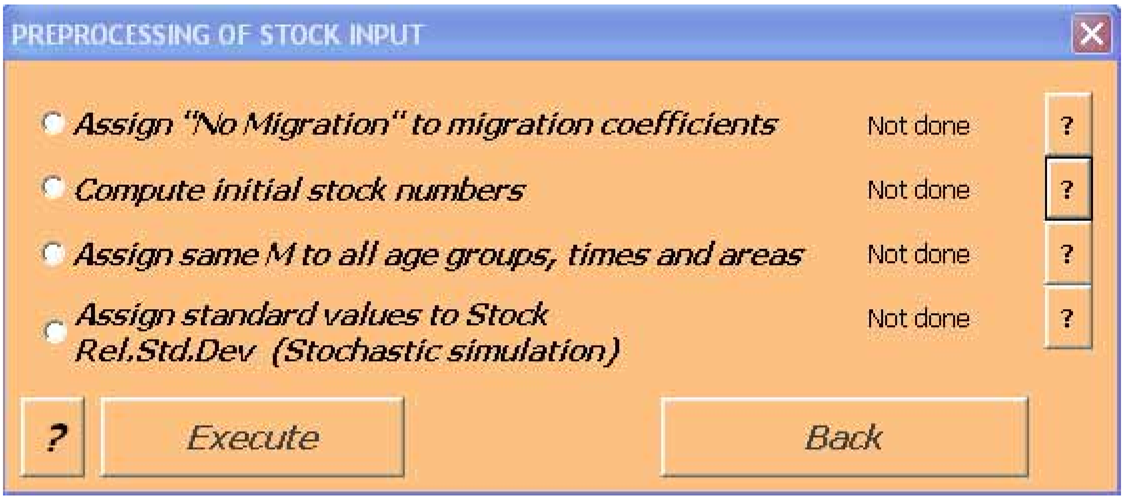

Table 2.6.2. NATURAL MORTALITY - East cod

*Figure 2.5.8.b. Fourth part of stock parameters. Natural mortalities.*



| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 118 | | | | | | | | | | | | | | | |
| 119 | Table 2.6.1. | NATURAL MORTALITY - West Cod | | | | | | | | | | | | | |
| 120 | | 2000 Per.1 | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 2002 Per.1 | 2002 Per.2 | 2002 Per.3 | 2002 Per.4 | 2003 Per.1 | 2003 Per.2 |
| 121 | Age 0 Per. 1 Area: West Baltic | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| 122 | Age 0 Per. 2 Area: West Baltic | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| 123 | Age 0 Per. 3 Area: West Baltic | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| 124 | Age 0 Per. 4 Area: West Baltic | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| 125 | Age 1 Per. 1 Area: West Baltic | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| 126 | Age 1 Per. 2 Area: West Baltic | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| 127 | Age 1 Per. 3 Area: West Baltic | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| 128 | Age 1 Per. 4 Area: West Baltic | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| 129 | Age 2 Per. 1 Area: West Baltic | 0.2 | No Val | No Val | No Val | 0.2 | No Val | No Val | No Val | 0.2 | No Val | No Val | No Val | 0.2 | No Va |
| 130 | Age 2 Per. 2 Area: West Baltic | No Val | 0.2 | No Val | No Val | No Val | 0.2 | No Val | No Val | No Val | 0.2 | No Val | No Val | No Val | 0.2 |
| 131 | Age 2 Per. 3 Area: West Baltic | No Val | No Val | 0.2 | No Val | No Val | No Val | 0.2 | No Val | No Val | No Val | 0.2 | No Val | No Val | No Va |
| 132 | Age 2 Per. 4 Area: West Baltic | No Val | No Val | No Val | 0.2 | No Val | No Val | No Val | 0.2 | No Val | No Val | No Val | 0.2 | No Val | No Va |
| 133 | Age 3 Per. 1 Area: West Baltic | 0.2 | No Val | No Val | No Val | 0.2 | No Val | No Val | No Val | 0.2 | No Val | No Val | No Val | 0.2 | No Va |
| 134 | Age 3 Per. 2 Area: West Baltic | No Val | 0.2 | No Val | No Val | No Val | 0.2 | No Val | No Val | No Val | 0.2 | No Val | No Val | No Val | 0.2 |
| 135 | Age 3 Per. 3 Area: West Baltic | No Val | No Val | 0.2 | No Val | No Val | No Val | 0.2 | No Val | No Val | No Val | 0.2 | No Val | No Val | No Va |
| 136 | Age 3 Per. 4 Area: West Baltic | No Val | No Val | No Val | 0.2 | No Val | No Val | No Val | 0.2 | No Val | No Val | No Val | 0.2 | No Val | No Va |
| 137 | Age 4 Per. 1 Area: West Baltic | 0.2 | No Val | No Val | No Val | 0.2 | No Val | No Val | No Val | 0.2 | No Val | No Val | No Val | 0.2 | No Va |
| 138 | Age 4 Per. 2 Area: West Baltic | No Val | 0.2 | No Val | No Val | No Val | 0.2 | No Val | No Val | No Val | 0.2 | No Val | No Val | No Val | 0.2 |
| 139 | Age 4 Per. 3 Area: West Baltic | No Val | No Val | 0.2 | No Val | No Val | No Val | 0.2 | No Val | No Val | No Val | 0.2 | No Val | No Val | No Va |
| 140 | Age 4 Per. 4 Area: West Baltic | No Val | No Val | No Val | 0.2 | No Val | No Val | No Val | 0.2 | No Val | No Val | No Val | 0.2 | No Val | No Va |
| 141 | Age 0 Per. 1 Area: East Baltic | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| 142 | Age 0 Per. 2 Area: East Baltic | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| 143 | Age 0 Per. 3 Area: East Baltic | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| 144 | Age 0 Per. 4 Area: East Baltic | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| 145 | Age 1 Per. 1 Area: East Baltic | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |

*Figure 2.5.8.b. Fourth part of stock parameters. Some Natural mortalities.*



PREPROCESSING OF STOCK INPUT

○ Assign "No Migration" to migration coefficients — Not done

○ Compute initial stock numbers — Not done

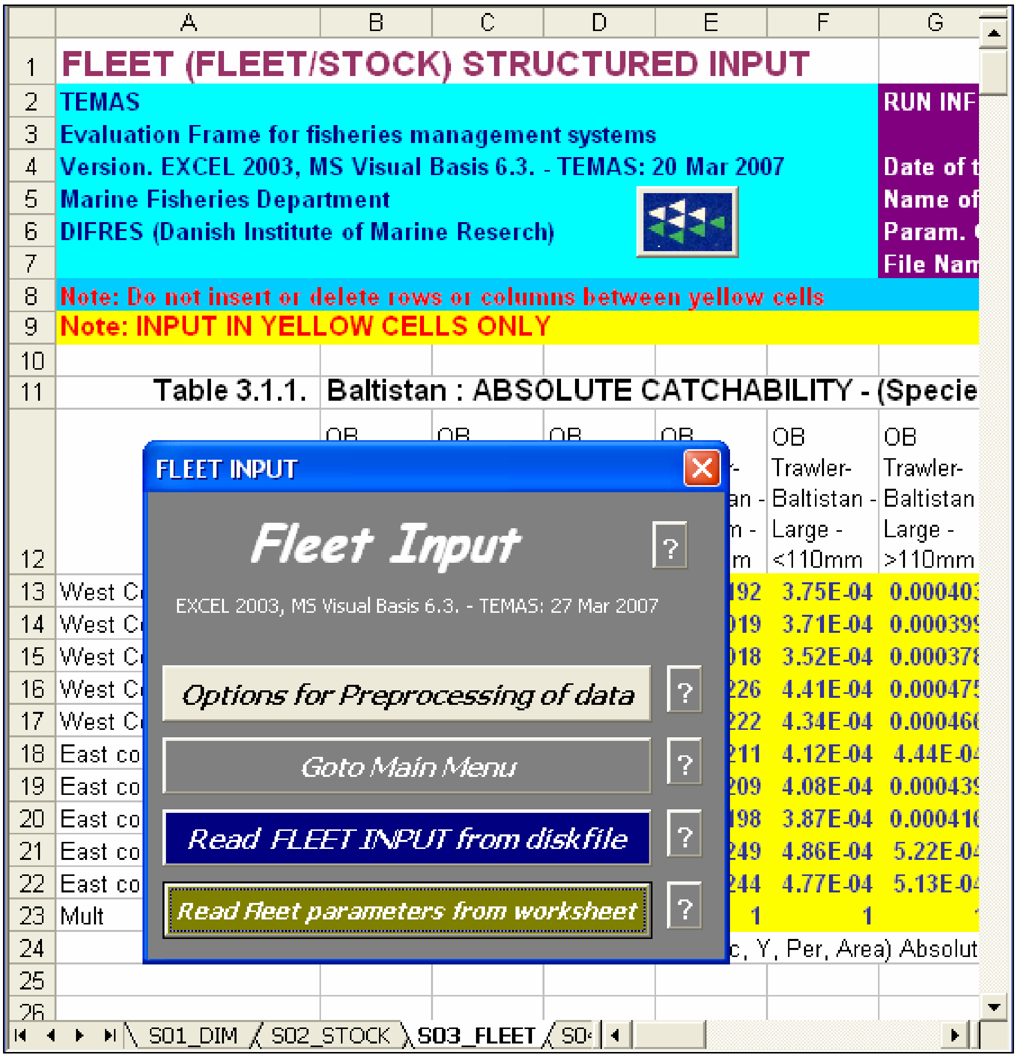
○ Assign same M to all age groups, times and areas — Not done

○ Assign standard values to Stock Rel.Std.Dev (Stochastic simulation) — Not done

*Figure 2.5.9. Options for pre-processing of stock parameters.*

## 2.6. FLEET INPUT, S03_FLEET

Figure 2.6.1 shows the input user-form for worksheet "S03_FLEET", fleet structured input. The layout of the userform is the same as the userform for the stock-structured input, S02_STOCK .



FLEET (FLEET/STOCK) STRUCTURED INPUT
TEMAS
Evaluation Frame for fisheries management systems
Version. EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 20 Mar 2007
Marine Fisheries Department
DIFRES (Danish Institute of Marine Reserch)
Note: Do not insert or delete rows or columns between yellow cells
Note: INPUT IN YELLOW CELLS ONLY
Table 3.1.1. Baltistan : ABSOLUTE CATCHABILITY - (Specie

FLEET INPUT
Fleet Input
EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 27 Mar 2007

*Figure 2.6.1. User-form for entry of fleet related parameters.*

Table 2.6.1 lists the tables in userform S03_FLEET. Note that all tables in S03_FLEETS are country-specific. The parameters in the fleet-structured tables are all related to the relationship between effort and area fishing mortality. Area-Fishing mortality is the sum of area-landing mortality and area-discard mortality:

$$F(Fl, Vs, Rg, Ct, St, y, a, q, Ar) = F_{land}(-) + F_{disc}(-)$$

Where "(-)" indicates the full set of indices "(Fl, Vs, Rg, Ct, St, y, a, q, Ar)" and
$F_{land}(-)$ = Area-landing mortality, $F_{disc}(-)$ = Area-discard mortality and
$F(-)$ = Area-Fishing mortality.

They are defined by: $F_{land}(-) = F(-) * (1 – DIS(-))$ and $F_{disc}(-) = F(-) * DIS(-)$, where DIS = fraction of fish caught, which are discarded. The discard ogive gives the fraction of fish discarded (for any reason) as a function of body length, is modelled by "one minus the logistic curve":

| Index | EXCEL Table | Caption |
|---|---|---|
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| 42 | Table3.1.2. | Baltistan : PARAMETERS IN MODEL FOR CATCHABILITY |
| 43 | Table3.1.3. | Scandinavia : ABSOLUTE CATCHABILITY |
| 44 | Table3.1.4. | Scandinavia : PARAMETERS IN MODEL FOR CATCHABILITY |
| 45 | Table3.2.1. | Baltistan : MESH SIZE (generalized concept) |
| 46 | Table3.2.2. | Baltistan : GEAR SELECTION FACTOR |
| 47 | Table3.2.3. | Baltistan : GEAR SELECTION RANGE |
| 48 | Table3.2.4. | Baltistan : DISCARDS L50% |
| 49 | Table3.2.5. | Baltistan : DISCARDS L75% |
| 50 | Table3.2.6.1. | Baltistan : West Baltic RELATIVE (PERIOD) CATCHABILITY |
| 51 | Table3.2.6.2. | Baltistan : East Baltic RELATIVE (PERIOD) CATCHABILITY |
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| 53 | Table3.2.6.4. | Baltistan : Bornholm RELATIVE (PERIOD) CATCHABILITY |
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| 55 | Table3.2.7 | Scandinavia : MESH SIZE (generalized concept) |
| 56 | Table3.2.8 | Scandinavia : GEAR SELECTION FACTOR |
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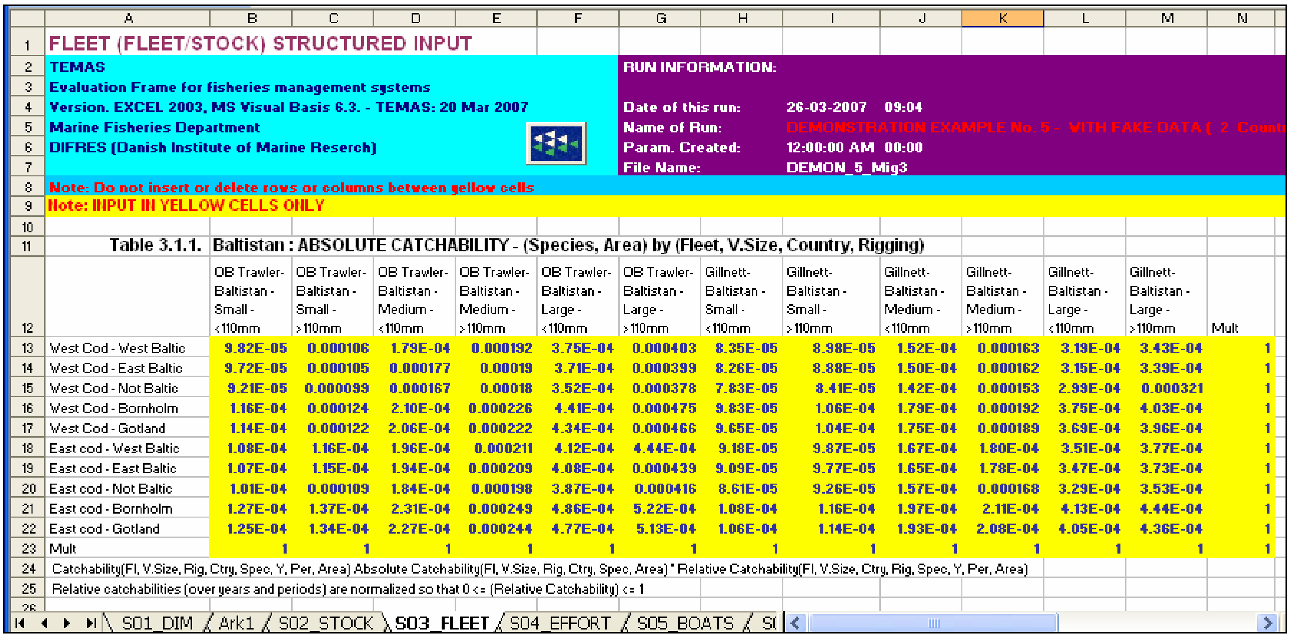
| 64 | Table3.2.12.5. | Scandinavia : Gotland RELATIVE (PERIOD) CATCHABILITY |

***Table 2.6.1. Tables in the Fleet input sheet, S03_FLEET.***



FLEET (FLEET/STOCK) STRUCTURED INPUT

TEMAS
Evaluation Frame for fisheries management systems
Version. EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 20 Mar 2007
Marine Fisheries Department
DIFRES (Danish Institute of Marine Reserch)

RUN INFORMATION:
Date of this run: 26-03-2007 09:04
Name of Run: DEMONSTRATION EXAMPLE No. 5 - VITH FAKE DATA ( 2 Count
Param. Created: 12:00:00 AM 00:00
File Name: DEMON_5_Mig3

Note: Do not insert or delete rows or columns between yellow cells
Note: INPUT IN YELLOW CELLS ONLY

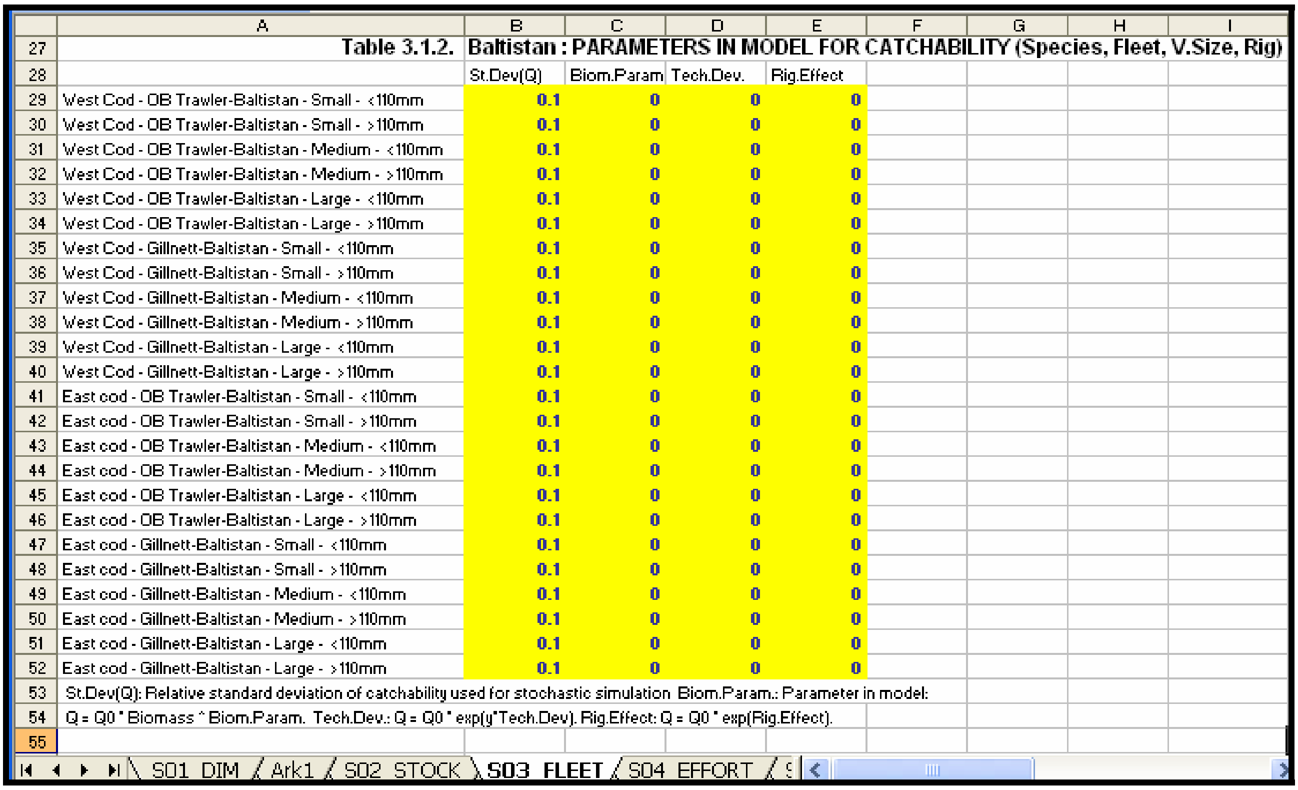
Table 3.1.1. Baltistan : ABSOLUTE CATCHABILITY - (Species, Area) by (Fleet, V.Size, Country, Rigging)

| | OB Trawler-Baltistan - Small - <110mm | OB Trawler-Baltistan - Small - >110mm | OB Trawler-Baltistan - Medium - <110mm | OB Trawler-Baltistan - Medium - >110mm | OB Trawler-Baltistan - Large - <110mm | OB Trawler-Baltistan - Large - >110mm | Gillnett-Baltistan - Small - <110mm | Gillnett-Baltistan - Small - >110mm | Gillnett-Baltistan - Medium - <110mm | Gillnett-Baltistan - Medium - >110mm | Gillnett-Baltistan - Large - <110mm | Gillnett-Baltistan - Large - >110mm | Mult |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| West Cod - West Baltic | 9.82E-05 | 0.000106 | 1.79E-04 | 0.000192 | 3.75E-04 | 0.000403 | 8.35E-05 | 8.98E-05 | 1.52E-04 | 0.000163 | 3.19E-04 | 3.43E-04 | 1 |
| West Cod - East Baltic | 9.72E-05 | 0.000105 | 0.000177 | 0.00019 | 3.71E-04 | 0.000399 | 8.26E-05 | 8.88E-05 | 1.50E-04 | 0.000162 | 3.15E-04 | 3.39E-04 | 1 |
| West Cod - Not Baltic | 9.21E-05 | 0.000099 | 0.000167 | 0.00018 | 3.52E-04 | 0.000378 | 7.83E-05 | 8.41E-05 | 1.42E-04 | 0.000153 | 2.99E-04 | 0.000321 | 1 |
| West Cod - Bornholm | 1.16E-04 | 0.000124 | 2.10E-04 | 0.000226 | 4.41E-04 | 0.000475 | 9.83E-05 | 1.06E-04 | 1.79E-04 | 0.000192 | 3.75E-04 | 4.03E-04 | 1 |
| West Cod - Gotland | 1.14E-04 | 0.000122 | 2.06E-04 | 0.000222 | 4.34E-04 | 0.000466 | 9.65E-05 | 1.04E-04 | 1.75E-04 | 0.000189 | 3.69E-04 | 3.96E-04 | 1 |
| East cod - West Baltic | 1.08E-04 | 1.16E-04 | 1.96E-04 | 0.000211 | 4.12E-04 | 4.44E-04 | 9.18E-05 | 9.87E-05 | 1.67E-04 | 1.80E-04 | 3.51E-04 | 3.77E-04 | 1 |
| East cod - East Baltic | 1.07E-04 | 1.15E-04 | 1.94E-04 | 0.000209 | 4.08E-04 | 0.000439 | 9.09E-05 | 9.77E-05 | 1.65E-04 | 1.78E-04 | 3.47E-04 | 3.73E-04 | 1 |
| East cod - Not Baltic | 1.01E-04 | 0.000109 | 1.84E-04 | 0.000198 | 3.87E-04 | 0.000416 | 8.61E-05 | 9.26E-05 | 1.57E-04 | 0.000168 | 3.29E-04 | 3.53E-04 | 1 |
| East cod - Bornholm | 1.27E-04 | 1.37E-04 | 2.31E-04 | 0.000249 | 4.86E-04 | 5.22E-04 | 1.08E-04 | 1.16E-04 | 1.97E-04 | 2.11E-04 | 4.13E-04 | 4.44E-04 | 1 |
| East cod - Gotland | 1.25E-04 | 1.34E-04 | 2.27E-04 | 0.000244 | 4.77E-04 | 5.13E-04 | 1.06E-04 | 1.14E-04 | 1.93E-04 | 2.08E-04 | 4.05E-04 | 4.36E-04 | 1 |
| Mult | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

Catchability(Fl, V.Size, Rig, Ctry, Spec, Y, Per, Area) Absolute Catchability(Fl, V.Size, Rig, Ctry, Spec, Area) * Relative Catchability(Fl, V.Size, Ctry, Rig, Spec, Y, Per, Area)

Relative catchabilities (over years and periods) are normalized so that 0 <= (Relative Catchability) <= 1

***Figure 2.6.2. Fleet structured input: Absolute catchability coefficients. The explanation below the table (row 24-25) says: Catchability(Fl, V.Size, Rig, Ctry, Spec, Y, Per, Area) =***
***Absolute Catchability(Fl, V.Size, Rig, Ctry, Spec, Area) ****
***Relative Catchability(Fl, V.Size, Ctry, Rig, Spec, Y, Per, Area).***
***Relative catchabilities (over years and periods) are normalized so that***
***0 <= (Relative Catchability) <= 1***



| | A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|---|
| 27 | Table 3.1.2. | Baltistan : PARAMETERS IN MODEL FOR CATCHABILITY (Species, Fleet, V.Size, Rig) | | | | | | | |
| 28 | | St.Dev(Q) | Biom.Param | Tech.Dev. | Rig.Effect | | | | |
| 29 | West Cod - OB Trawler-Baltistan - Small - <110mm | 0.1 | 0 | 0 | 0 | | | | |
| 30 | West Cod - OB Trawler-Baltistan - Small - >110mm | 0.1 | 0 | 0 | 0 | | | | |
| 31 | West Cod - OB Trawler-Baltistan - Medium - <110mm | 0.1 | 0 | 0 | 0 | | | | |
| 32 | West Cod - OB Trawler-Baltistan - Medium - >110mm | 0.1 | 0 | 0 | 0 | | | | |
| 33 | West Cod - OB Trawler-Baltistan - Large - <110mm | 0.1 | 0 | 0 | 0 | | | | |
| 34 | West Cod - OB Trawler-Baltistan - Large - >110mm | 0.1 | 0 | 0 | 0 | | | | |
| 35 | West Cod - Gillnett-Baltistan - Small - <110mm | 0.1 | 0 | 0 | 0 | | | | |
| 36 | West Cod - Gillnett-Baltistan - Small - >110mm | 0.1 | 0 | 0 | 0 | | | | |
| 37 | West Cod - Gillnett-Baltistan - Medium - <110mm | 0.1 | 0 | 0 | 0 | | | | |
| 38 | West Cod - Gillnett-Baltistan - Medium - >110mm | 0.1 | 0 | 0 | 0 | | | | |
| 39 | West Cod - Gillnett-Baltistan - Large - <110mm | 0.1 | 0 | 0 | 0 | | | | |
| 40 | West Cod - Gillnett-Baltistan - Large - >110mm | 0.1 | 0 | 0 | 0 | | | | |
| 41 | East cod - OB Trawler-Baltistan - Small - <110mm | 0.1 | 0 | 0 | 0 | | | | |
| 42 | East cod - OB Trawler-Baltistan - Small - >110mm | 0.1 | 0 | 0 | 0 | | | | |
| 43 | East cod - OB Trawler-Baltistan - Medium - <110mm | 0.1 | 0 | 0 | 0 | | | | |
| 44 | East cod - OB Trawler-Baltistan - Medium - >110mm | 0.1 | 0 | 0 | 0 | | | | |
| 45 | East cod - OB Trawler-Baltistan - Large - <110mm | 0.1 | 0 | 0 | 0 | | | | |
| 46 | East cod - OB Trawler-Baltistan - Large - >110mm | 0.1 | 0 | 0 | 0 | | | | |
| 47 | East cod - Gillnett-Baltistan - Small - <110mm | 0.1 | 0 | 0 | 0 | | | | |
| 48 | East cod - Gillnett-Baltistan - Small - >110mm | 0.1 | 0 | 0 | 0 | | | | |
| 49 | East cod - Gillnett-Baltistan - Medium - <110mm | 0.1 | 0 | 0 | 0 | | | | |
| 50 | East cod - Gillnett-Baltistan - Medium - >110mm | 0.1 | 0 | 0 | 0 | | | | |
| 51 | East cod - Gillnett-Baltistan - Large - <110mm | 0.1 | 0 | 0 | 0 | | | | |
| 52 | East cod - Gillnett-Baltistan - Large - >110mm | 0.1 | 0 | 0 | 0 | | | | |
| 53 | St.Dev(Q): Relative standard deviation of catchability used for stochastic simulation Biom.Param.: Parameter in model: | | | | | | | | |
| 54 | Q = Q0 * Biomass ^ Biom.Param. Tech.Dev.: Q = Q0 * exp(y*Tech.Dev). Rig.Effect: Q = Q0 * exp(Rig.Effect). | | | | | | | | |
| 55 | | | | | | | | | |

***Figure 2.6.3. Parameters in model for catchability. The text below the Table (rows 53-54) says: St.Dev(Q): Relative standard deviation of catchability used for stochastic simulation Biom.Param.: Parameter in model: Q = Q0 * Biomass ^ Biom.Param.***
***Tech.Dev.: Q = Q0 * exp(y*Tech.Dev). Rig.Effect: Q = Q0 * exp(Rig.Effect).***

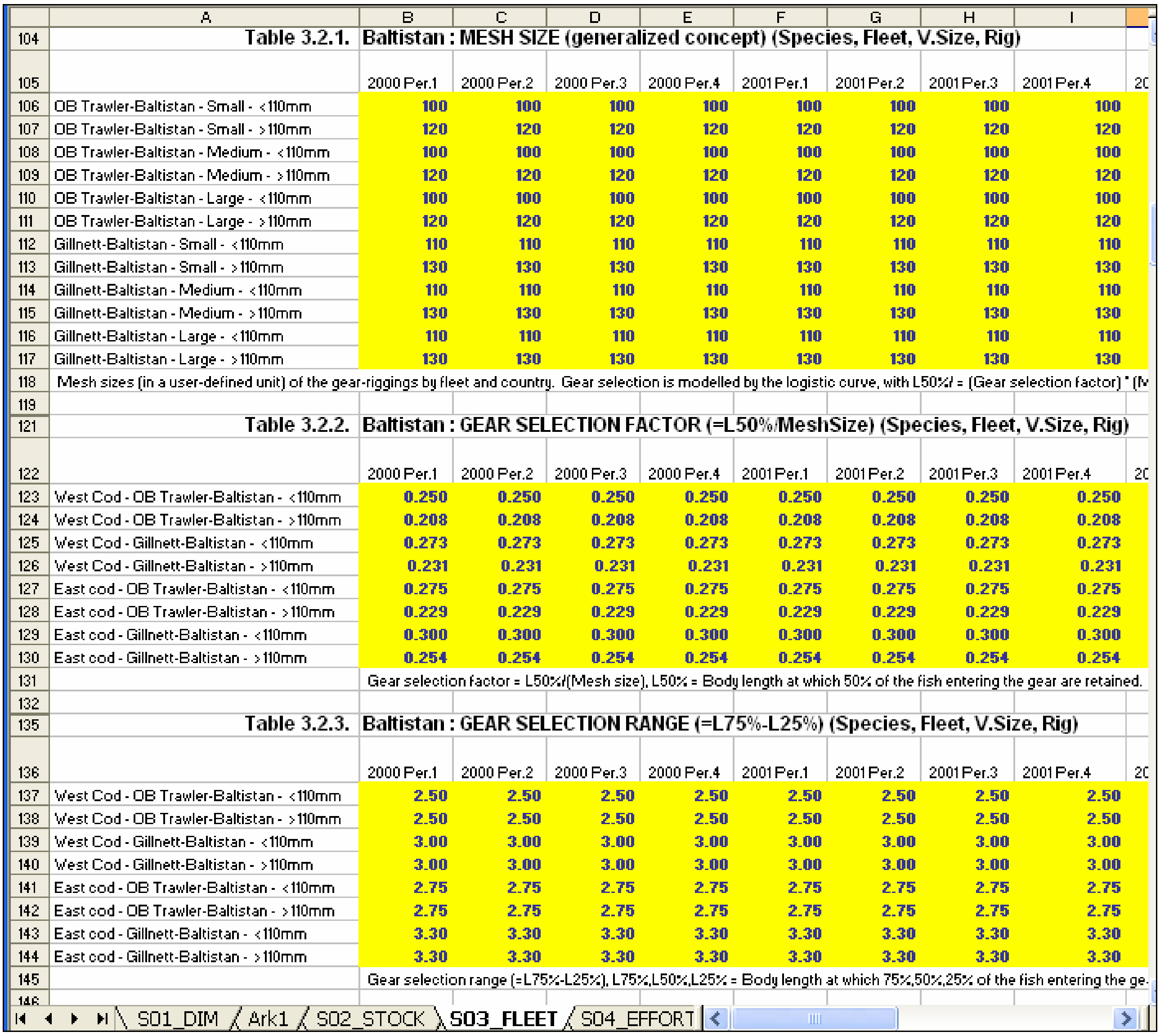
$$\mathrm{DIS}(\mathrm{Fl},\mathrm{Vs},\mathrm{Rg},\mathrm{Ct},\mathrm{St},\mathrm{y},\mathrm{a},\mathrm{q}) =$$

$$1 - \frac{1}{1+\exp(\mathrm{Dis1}\,(\mathrm{Fl},\mathrm{Vs},\mathrm{Rg},\mathrm{Ct},\mathrm{St},\mathrm{y},\mathrm{q}) - \mathrm{Dis2}(\mathrm{Fl},\mathrm{Vs},\mathrm{Rg},\mathrm{Ct},\mathrm{St},\mathrm{y},\mathrm{q}) * \mathrm{Lgt}(St,a,q))}$$

where parameters of the logistic ogive are defined as those of the maturity ogive.
Thus,
Dis1(Fl,Vs,Rg,Ct,St,y,q) =
ln(3)* $\mathrm{LGT}_{50\%\mathrm{Discards}}$(Fl,Vs,Rg,Ct,St,y,q,St)/( $\mathrm{LGT}_{25\%\mathrm{Discards}}$(-) - $\mathrm{LGT}_{50\%\mathrm{Discards}}$(-)),
Dis2(Fl,Vs,Rg,Ct,St,y,q) = ln(3)/( $\mathrm{LGT}_{25\%\mathrm{Discards}}$(Fl,Vs,Rg,Ct,St,y,q,St) - $\mathrm{LGT}_{50\%\mathrm{Discards}}$(-)) and
$\mathrm{LGT}_{X\%\mathrm{Discards}}$(Fl,Vs,Rg,Ct,St,y,q,St) = Length at which X % are retained.

EXCEL Tables 3.2.4-5 and EXCEL Table 3.2.10-11 contain the discard parameters $\mathrm{LGT}_{25\%\mathrm{Discards}}$ and $\mathrm{LGT}_{50\%\mathrm{Discards}}$ (Figure 2.6.5). The discard parameters can be modified in any time period of any year.
The remaining tables gives the parameters in the model that links effort (E) to total area fishing mortality (F):

$$\begin{aligned}
&F(Fl,Vs,Rg,Ct,St,y,a,q,Ar) = E(Fl,Vs,Rg,Ct,y,q,Ar)*\\
&Q_1^{Absolute}(Fl,Vs,Rg,Ct,St,Ar)*Q_1^{\mathrm{Re}lative}(Fl,Vs,Rg,Ct,St,y,q,Ar)*\\
&B(St,Ar,y,q-1)^{QB_{Exp}(Fl,Vs,Rg,St)}*\\
&\exp(y*Q_{Tech-Dev}(Fl,Vs,Rg,St,y))*\exp(RE(Fl,Vs,Rg,St))*\\
&SEL(Fl,Vs,Rg,Ct,St,y,a,q)*\varepsilon_Q(Fl,St,y)
\end{aligned}$$

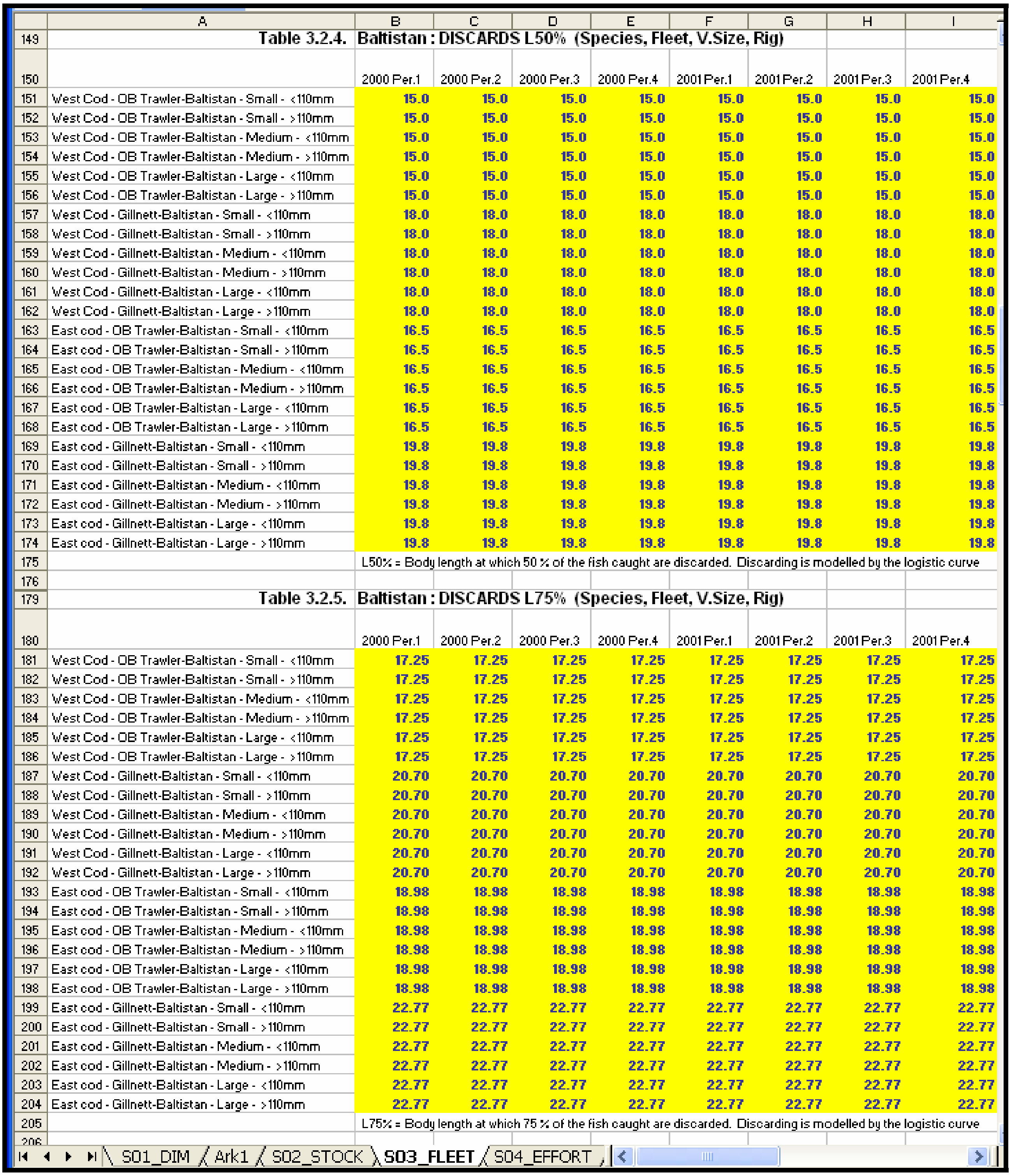


| | A | B | C | D | E | F | G | H | I | |
|---|---|---|---|---|---|---|---|---|---|---|
| 104 | **Table 3.2.1.** | **Baltistan : MESH SIZE (generalized concept) (Species, Fleet, V.Size, Rig)** | | | | | | | | |
| 105 | | 2000 Per.1 | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 20 |
| 106 | OB Trawler-Baltistan - Small - <110mm | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | |
| 107 | OB Trawler-Baltistan - Small - >110mm | 120 | 120 | 120 | 120 | 120 | 120 | 120 | 120 | |
| 108 | OB Trawler-Baltistan - Medium - <110mm | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | |
| 109 | OB Trawler-Baltistan - Medium - >110mm | 120 | 120 | 120 | 120 | 120 | 120 | 120 | 120 | |
| 110 | OB Trawler-Baltistan - Large - <110mm | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | |
| 111 | OB Trawler-Baltistan - Large - >110mm | 120 | 120 | 120 | 120 | 120 | 120 | 120 | 120 | |
| 112 | Gillnett-Baltistan - Small - <110mm | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 | |
| 113 | Gillnett-Baltistan - Small - >110mm | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 130 | |
| 114 | Gillnett-Baltistan - Medium - <110mm | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 | |
| 115 | Gillnett-Baltistan - Medium - >110mm | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 130 | |
| 116 | Gillnett-Baltistan - Large - <110mm | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 | |
| 117 | Gillnett-Baltistan - Large - >110mm | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 130 | |
| 118 | Mesh sizes (in a user-defined unit) of the gear-riggings by fleet and country. Gear selection is modelled by the logistic curve, with L50%/ = (Gear selection factor) * (M | | | | | | | | | |
| 119 | | | | | | | | | | |
| 121 | **Table 3.2.2.** | **Baltistan : GEAR SELECTION FACTOR (=L50%/MeshSize) (Species, Fleet, V.Size, Rig)** | | | | | | | | |
| 122 | | 2000 Per.1 | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 20 |
| 123 | West Cod - OB Trawler-Baltistan - <110mm | 0.250 | 0.250 | 0.250 | 0.250 | 0.250 | 0.250 | 0.250 | 0.250 | |
| 124 | West Cod - OB Trawler-Baltistan - >110mm | 0.208 | 0.208 | 0.208 | 0.208 | 0.208 | 0.208 | 0.208 | 0.208 | |
| 125 | West Cod - Gillnett-Baltistan - <110mm | 0.273 | 0.273 | 0.273 | 0.273 | 0.273 | 0.273 | 0.273 | 0.273 | |
| 126 | West Cod - Gillnett-Baltistan - >110mm | 0.231 | 0.231 | 0.231 | 0.231 | 0.231 | 0.231 | 0.231 | 0.231 | |
| 127 | East cod - OB Trawler-Baltistan - <110mm | 0.275 | 0.275 | 0.275 | 0.275 | 0.275 | 0.275 | 0.275 | 0.275 | |
| 128 | East cod - OB Trawler-Baltistan - >110mm | 0.229 | 0.229 | 0.229 | 0.229 | 0.229 | 0.229 | 0.229 | 0.229 | |
| 129 | East cod - Gillnett-Baltistan - <110mm | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | |
| 130 | East cod - Gillnett-Baltistan - >110mm | 0.254 | 0.254 | 0.254 | 0.254 | 0.254 | 0.254 | 0.254 | 0.254 | |
| 131 | | Gear selection factor = L50%/(Mesh size), L50% = Body length at which 50% of the fish entering the gear are retained. | | | | | | | | |
| 132 | | | | | | | | | | |
| 135 | **Table 3.2.3.** | **Baltistan : GEAR SELECTION RANGE (=L75%-L25%) (Species, Fleet, V.Size, Rig)** | | | | | | | | |
| 136 | | 2000 Per.1 | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 20 |
| 137 | West Cod - OB Trawler-Baltistan - <110mm | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | |
| 138 | West Cod - OB Trawler-Baltistan - >110mm | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | |
| 139 | West Cod - Gillnett-Baltistan - <110mm | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | |
| 140 | West Cod - Gillnett-Baltistan - >110mm | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | |
| 141 | East cod - OB Trawler-Baltistan - <110mm | 2.75 | 2.75 | 2.75 | 2.75 | 2.75 | 2.75 | 2.75 | 2.75 | |
| 142 | East cod - OB Trawler-Baltistan - >110mm | 2.75 | 2.75 | 2.75 | 2.75 | 2.75 | 2.75 | 2.75 | 2.75 | |
| 143 | East cod - Gillnett-Baltistan - <110mm | 3.30 | 3.30 | 3.30 | 3.30 | 3.30 | 3.30 | 3.30 | 3.30 | |
| 144 | East cod - Gillnett-Baltistan - >110mm | 3.30 | 3.30 | 3.30 | 3.30 | 3.30 | 3.30 | 3.30 | 3.30 | |
| 145 | | Gear selection range (=L75%-L25%), L75%,L50%,L25% = Body length at which 75%,50%,25% of the fish entering the ge. | | | | | | | | |

*Figure 2.6.4. Gear selection parameters.*

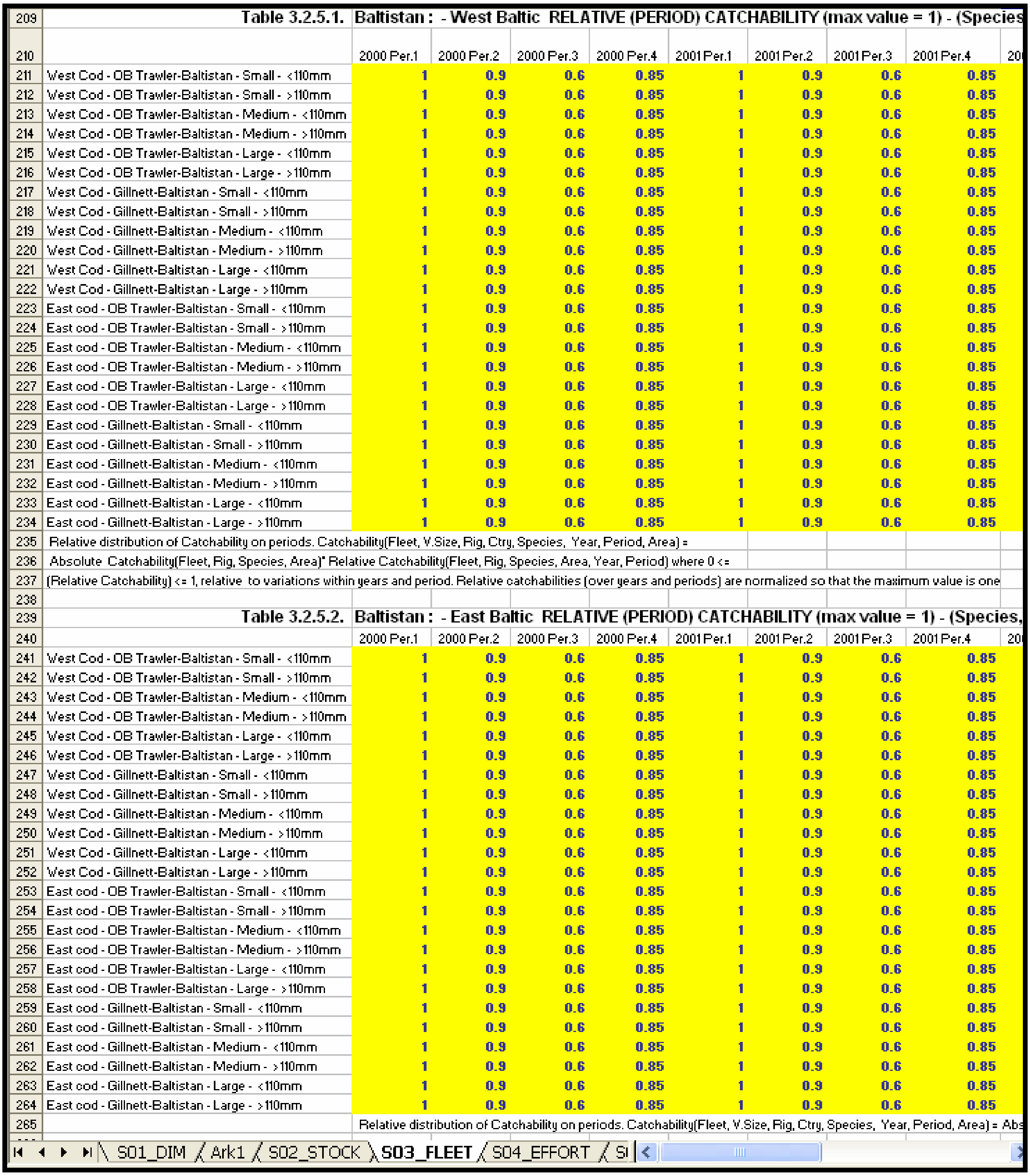
The absolute catchability coefficient is EXCEL Table 3.1.1 (Baltistan) $Q_1^{Absolute}(Fl,Vs,Rg,Ct,St,Ar)$ and 3.1.3 (Scandinavia) The absolute catchability for Baltistan is shown in Figure 2.6.2. EXCEL Tables 3.2.6.1-5 (Baltistan) and EXCEL Tables 3.2.12.1-5 (Scandinavia) contain the area specific relative catchability $Q_1^{\mathrm{Re}\,lative}(Fl,Vs,Rg,Ct,St,y,q,Ar)$ ,.(Figure 2.6.6). The relative catchability can take only values between 0 and 1, and is used to model changes in fishing efficiency over time. The table for absolute catchability, contains a row and a column for multipliers (Figure 2.6.2). The multipliers in the row (line 23) are applied to the column above, and the column of multiplier (column N) is applied to the row. The multiplier in rightmost corner is applied to the entire table.

The relative standard deviation of catchability, $\varepsilon_Q(Fl,St,y)$ , the parameters in the model biomass dependence $B(St,Ar,y,q-1)^{QB_{Exp}(Fl,Vs,Rg,St)}$ , the model of technical creeping $\exp(y*Q_{Tech-Dev}(Fl,Vs,Rg,St,y))$ and the rigging effect $\exp(RE(Fl,Vs,Rg,St))$ are contained in EXCEL Tables 3.1.2 and 3.1.4. (Figure 2.6.3).



| | A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|---|
| 149 | Table 3.2.4. | Baltistan : DISCARDS L50% (Species, Fleet, V.Size, Rig) | | | | | | | |
| 150 | | 2000 Per.1 | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 |
| 151 | West Cod - OB Trawler-Baltistan - Small - <110mm | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 |
| 152 | West Cod - OB Trawler-Baltistan - Small - >110mm | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 |
| 153 | West Cod - OB Trawler-Baltistan - Medium - <110mm | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 |
| 154 | West Cod - OB Trawler-Baltistan - Medium - >110mm | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 |
| 155 | West Cod - OB Trawler-Baltistan - Large - <110mm | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 |
| 156 | West Cod - OB Trawler-Baltistan - Large - >110mm | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 |
| 157 | West Cod - Gillnett-Baltistan - Small - <110mm | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 158 | West Cod - Gillnett-Baltistan - Small - >110mm | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 159 | West Cod - Gillnett-Baltistan - Medium - <110mm | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 160 | West Cod - Gillnett-Baltistan - Medium - >110mm | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 161 | West Cod - Gillnett-Baltistan - Large - <110mm | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 162 | West Cod - Gillnett-Baltistan - Large - >110mm | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 |
| 163 | East cod - OB Trawler-Baltistan - Small - <110mm | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 |
| 164 | East cod - OB Trawler-Baltistan - Small - >110mm | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 |
| 165 | East cod - OB Trawler-Baltistan - Medium - <110mm | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 |
| 166 | East cod - OB Trawler-Baltistan - Medium - >110mm | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 |
| 167 | East cod - OB Trawler-Baltistan - Large - <110mm | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 |
| 168 | East cod - OB Trawler-Baltistan - Large - >110mm | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 |
| 169 | East cod - Gillnett-Baltistan - Small - <110mm | 19.8 | 19.8 | 19.8 | 19.8 | 19.8 | 19.8 | 19.8 | 19.8 |
| 170 | East cod - Gillnett-Baltistan - Small - >110mm | 19.8 | 19.8 | 19.8 | 19.8 | 19.8 | 19.8 | 19.8 | 19.8 |
| 171 | East cod - Gillnett-Baltistan - Medium - <110mm | 19.8 | 19.8 | 19.8 | 19.8 | 19.8 | 19.8 | 19.8 | 19.8 |
| 172 | East cod - Gillnett-Baltistan - Medium - >110mm | 19.8 | 19.8 | 19.8 | 19.8 | 19.8 | 19.8 | 19.8 | 19.8 |
| 173 | East cod - Gillnett-Baltistan - Large - <110mm | 19.8 | 19.8 | 19.8 | 19.8 | 19.8 | 19.8 | 19.8 | 19.8 |
| 174 | East cod - Gillnett-Baltistan - Large - >110mm | 19.8 | 19.8 | 19.8 | 19.8 | 19.8 | 19.8 | 19.8 | 19.8 |
| 175 | | L50% = Body length at which 50 % of the fish caught are discarded. Discarding is modelled by the logistic curve | | | | | | | |
| 176 | | | | | | | | | |
| 179 | Table 3.2.5. | Baltistan : DISCARDS L75% (Species, Fleet, V.Size, Rig) | | | | | | | |
| 180 | | 2000 Per.1 | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 |
| 181 | West Cod - OB Trawler-Baltistan - Small - <110mm | 17.25 | 17.25 | 17.25 | 17.25 | 17.25 | 17.25 | 17.25 | 17.25 |
| 182 | West Cod - OB Trawler-Baltistan - Small - >110mm | 17.25 | 17.25 | 17.25 | 17.25 | 17.25 | 17.25 | 17.25 | 17.25 |
| 183 | West Cod - OB Trawler-Baltistan - Medium - <110mm | 17.25 | 17.25 | 17.25 | 17.25 | 17.25 | 17.25 | 17.25 | 17.25 |
| 184 | West Cod - OB Trawler-Baltistan - Medium - >110mm | 17.25 | 17.25 | 17.25 | 17.25 | 17.25 | 17.25 | 17.25 | 17.25 |
| 185 | West Cod - OB Trawler-Baltistan - Large - <110mm | 17.25 | 17.25 | 17.25 | 17.25 | 17.25 | 17.25 | 17.25 | 17.25 |
| 186 | West Cod - OB Trawler-Baltistan - Large - >110mm | 17.25 | 17.25 | 17.25 | 17.25 | 17.25 | 17.25 | 17.25 | 17.25 |
| 187 | West Cod - Gillnett-Baltistan - Small - <110mm | 20.70 | 20.70 | 20.70 | 20.70 | 20.70 | 20.70 | 20.70 | 20.70 |
| 188 | West Cod - Gillnett-Baltistan - Small - >110mm | 20.70 | 20.70 | 20.70 | 20.70 | 20.70 | 20.70 | 20.70 | 20.70 |
| 189 | West Cod - Gillnett-Baltistan - Medium - <110mm | 20.70 | 20.70 | 20.70 | 20.70 | 20.70 | 20.70 | 20.70 | 20.70 |
| 190 | West Cod - Gillnett-Baltistan - Medium - >110mm | 20.70 | 20.70 | 20.70 | 20.70 | 20.70 | 20.70 | 20.70 | 20.70 |
| 191 | West Cod - Gillnett-Baltistan - Large - <110mm | 20.70 | 20.70 | 20.70 | 20.70 | 20.70 | 20.70 | 20.70 | 20.70 |
| 192 | West Cod - Gillnett-Baltistan - Large - >110mm | 20.70 | 20.70 | 20.70 | 20.70 | 20.70 | 20.70 | 20.70 | 20.70 |
| 193 | East cod - OB Trawler-Baltistan - Small - <110mm | 18.98 | 18.98 | 18.98 | 18.98 | 18.98 | 18.98 | 18.98 | 18.98 |
| 194 | East cod - OB Trawler-Baltistan - Small - >110mm | 18.98 | 18.98 | 18.98 | 18.98 | 18.98 | 18.98 | 18.98 | 18.98 |
| 195 | East cod - OB Trawler-Baltistan - Medium - <110mm | 18.98 | 18.98 | 18.98 | 18.98 | 18.98 | 18.98 | 18.98 | 18.98 |
| 196 | East cod - OB Trawler-Baltistan - Medium - >110mm | 18.98 | 18.98 | 18.98 | 18.98 | 18.98 | 18.98 | 18.98 | 18.98 |
| 197 | East cod - OB Trawler-Baltistan - Large - <110mm | 18.98 | 18.98 | 18.98 | 18.98 | 18.98 | 18.98 | 18.98 | 18.98 |
| 198 | East cod - OB Trawler-Baltistan - Large - >110mm | 18.98 | 18.98 | 18.98 | 18.98 | 18.98 | 18.98 | 18.98 | 18.98 |
| 199 | East cod - Gillnett-Baltistan - Small - <110mm | 22.77 | 22.77 | 22.77 | 22.77 | 22.77 | 22.77 | 22.77 | 22.77 |
| 200 | East cod - Gillnett-Baltistan - Small - >110mm | 22.77 | 22.77 | 22.77 | 22.77 | 22.77 | 22.77 | 22.77 | 22.77 |
| 201 | East cod - Gillnett-Baltistan - Medium - <110mm | 22.77 | 22.77 | 22.77 | 22.77 | 22.77 | 22.77 | 22.77 | 22.77 |
| 202 | East cod - Gillnett-Baltistan - Medium - >110mm | 22.77 | 22.77 | 22.77 | 22.77 | 22.77 | 22.77 | 22.77 | 22.77 |
| 203 | East cod - Gillnett-Baltistan - Large - <110mm | 22.77 | 22.77 | 22.77 | 22.77 | 22.77 | 22.77 | 22.77 | 22.77 |
| 204 | East cod - Gillnett-Baltistan - Large - >110mm | 22.77 | 22.77 | 22.77 | 22.77 | 22.77 | 22.77 | 22.77 | 22.77 |
| 205 | | L75% = Body length at which 75 % of the fish caught are discarded. Discarding is modelled by the logistic curve | | | | | | | |

*Figure 2.6.5. Discard selection parameters.*



| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 209 | **Table 3.2.5.1.** | **Baltistan : - West Baltic RELATIVE (PERIOD) CATCHABILITY (max value = 1) - (Species** | | | | | | | | |
| 210 | | 2000 Per.1 | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 20 |
| 211 | West Cod - OB Trawler-Baltistan - Small - <110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 212 | West Cod - OB Trawler-Baltistan - Small - >110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 213 | West Cod - OB Trawler-Baltistan - Medium - <110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 214 | West Cod - OB Trawler-Baltistan - Medium - >110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 215 | West Cod - OB Trawler-Baltistan - Large - <110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 216 | West Cod - OB Trawler-Baltistan - Large - >110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 217 | West Cod - Gillnett-Baltistan - Small - <110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 218 | West Cod - Gillnett-Baltistan - Small - >110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 219 | West Cod - Gillnett-Baltistan - Medium - <110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 220 | West Cod - Gillnett-Baltistan - Medium - >110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 221 | West Cod - Gillnett-Baltistan - Large - <110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 222 | West Cod - Gillnett-Baltistan - Large - >110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 223 | East cod - OB Trawler-Baltistan - Small - <110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 224 | East cod - OB Trawler-Baltistan - Small - >110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 225 | East cod - OB Trawler-Baltistan - Medium - <110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 226 | East cod - OB Trawler-Baltistan - Medium - >110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 227 | East cod - OB Trawler-Baltistan - Large - <110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 228 | East cod - OB Trawler-Baltistan - Large - >110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 229 | East cod - Gillnett-Baltistan - Small - <110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 230 | East cod - Gillnett-Baltistan - Small - >110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 231 | East cod - Gillnett-Baltistan - Medium - <110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 232 | East cod - Gillnett-Baltistan - Medium - >110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 233 | East cod - Gillnett-Baltistan - Large - <110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 234 | East cod - Gillnett-Baltistan - Large - >110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 235 | Relative distribution of Catchability on periods. Catchability(Fleet, V.Size, Rig, Ctry, Species, Year, Period, Area) = | | | | | | | | | |
| 236 | Absolute Catchability(Fleet, Rig, Species, Area)* Relative Catchability(Fleet, Rig, Species, Area, Year, Period) where 0 <= | | | | | | | | | |
| 237 | (Relative Catchability) <= 1, relative to variations within years and period. Relative catchabilities (over years and periods) are normalized so that the maximum value is one | | | | | | | | | |
| 238 | | | | | | | | | | |
| 239 | **Table 3.2.5.2.** | **Baltistan : - East Baltic RELATIVE (PERIOD) CATCHABILITY (max value = 1) - (Species,** | | | | | | | | |
| 240 | | 2000 Per.1 | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 20 |
| 241 | West Cod - OB Trawler-Baltistan - Small - <110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 242 | West Cod - OB Trawler-Baltistan - Small - >110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 243 | West Cod - OB Trawler-Baltistan - Medium - <110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 244 | West Cod - OB Trawler-Baltistan - Medium - >110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 245 | West Cod - OB Trawler-Baltistan - Large - <110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 246 | West Cod - OB Trawler-Baltistan - Large - >110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 247 | West Cod - Gillnett-Baltistan - Small - <110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 248 | West Cod - Gillnett-Baltistan - Small - >110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 249 | West Cod - Gillnett-Baltistan - Medium - <110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 250 | West Cod - Gillnett-Baltistan - Medium - >110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 251 | West Cod - Gillnett-Baltistan - Large - <110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 252 | West Cod - Gillnett-Baltistan - Large - >110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 253 | East cod - OB Trawler-Baltistan - Small - <110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 254 | East cod - OB Trawler-Baltistan - Small - >110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 255 | East cod - OB Trawler-Baltistan - Medium - <110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 256 | East cod - OB Trawler-Baltistan - Medium - >110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 257 | East cod - OB Trawler-Baltistan - Large - <110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 258 | East cod - OB Trawler-Baltistan - Large - >110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 259 | East cod - Gillnett-Baltistan - Small - <110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 260 | East cod - Gillnett-Baltistan - Small - >110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 261 | East cod - Gillnett-Baltistan - Medium - <110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 262 | East cod - Gillnett-Baltistan - Medium - >110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 263 | East cod - Gillnett-Baltistan - Large - <110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 264 | East cod - Gillnett-Baltistan - Large - >110mm | 1 | 0.9 | 0.6 | 0.85 | 1 | 0.9 | 0.6 | 0.85 | |
| 265 | | Relative distribution of Catchability on periods. Catchability(Fleet, V.Size, Rig, Ctry, Species, Year, Period, Area) = Abs | | | | | | | | |

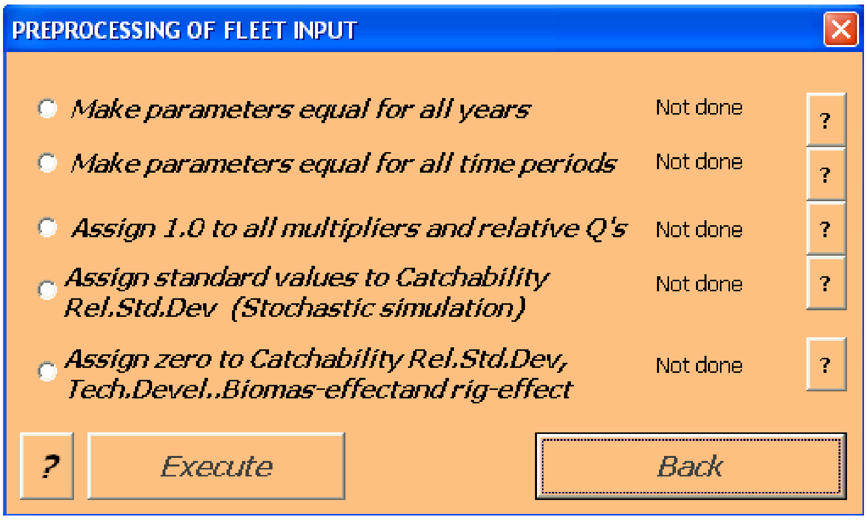
***Figure 2.6.6. Relative (Period) catchability coefficients. The explanation below the table says:***
***Relative distribution of Catchability on periods.***
***Catchability(Fleet, V.Size, Rig, Ctry, Species, Year, Period, Area) =***
***Absolute Catchability(Fleet, Rig, Species, Area)****
***Relative Catchability(Fleet, Rig, Species, Area, Year, Period)***
***where 0 <= (Relative Catchability) <= 1, relative to variations within years and period.***
***Relative catchabilities (over years and periods) are normalized so that the maximum value is one***

The parameters of the gear selction ogive $SEL(Fl, Vs, Rg, Ct, St, y, a, q)$ are in EXCEL Tables 3.2.1-3 (Baltistan) and EXCEL Tables 3.2.7-9 (Scandinavia). (Figure 2.6.4). The logistic curve is used to model the selection of fishing gears

$$\mathrm{SEL(Fl, Vs, Rg, Ct, St, y, a, q)} = \frac{1}{1+\exp(\mathrm{Sel1\ (Fl, Vs, Rg, Ct, St, y)} - \mathrm{Sel2(Fl, Vs, Rg, Ct, St, y)} * \mathrm{Lgt}\ \ (St, y, a, q))}$$

where parameters of the logistic ogive are defined

Sel1(Fl, Vs, Rg, Ct, St, y) = ln(3)* $LGT_{50\%}$(Fl, Vs, Rg, Ct, St, y) /( $LGT_{75\%}$(-) - $LGT_{50\%Mat}$(-)),
Sel2(Fl, Vs, Rg, Ct, St, y) = ln(3)/( $LGT_{75\%}$(Fl, Vs, Rg, Ct, St, y) - $LGT_{50\%}$(-)) and
$LGT_{50\%}$(Fl, Vs, Rg, Ct, St, y) = MS(Fl, Vs, Rg, Ct, y) * SF(Fl, Vs,. Rg, Ct, St, y),
$LGT_{75\%}$(Fl, Vs, Rg, Ct, St, y) = $LGT_{50\%}$(Fl, Vs, Rg, Ct, St, y) + SR(Fl, Vs, Rg, Ct, St, y)/2
MS(Fl, Vs, Rg, Ct, y) = Mesh size of fleet Fl in year y,
SF(Fl, Vs, Rg, Ct, St, y) = Selection factor and
SR(Fl, Vs, Rg, Ct, St, y) = Selection range (=$LGT_{75\%}$-$LGT_{25\%}$)



○ Make parameters equal for all years Not done
○ Make parameters equal for all time periods Not done
○ Assign 1.0 to all multipliers and relative Q's Not done
○ Assign standard values to Catchability Rel.Std.Dev (Stochastic simulation) Not done
○ Assign zero to Catchability Rel.Std.Dev, Tech.Devel..Biomas-effectand rig-effect Not done

***Figure 2.6.7. Options for pre-processing of fleet parameters.***

The menu for pre-processing of fleet data is shown in Figure 2.6.7. There are five options for pre-processing:

1) Make parameters equal for all years. This option will take the value for first year and apply it to all other years, for all y-dependent parameters:

MS(Fl, Vs, Rg, Ct, y) = MS(Fl, Vs, Rg, Ct, $y_{first}$)
SF(Fl, Vs, Rg, Ct, St, y) = SF(Fl, Vs, Rg, Ct, St, $y_{first}$)
SR(Fl, Vs, Rg, Ct, St, y) = SR(Fl, Vs, Rg, Ct, St, $y_{first}$)

$$Q_1^{Relative}(Fl,Vs,Rg,Ct,St,y,q,Ar) = Q_1^{Relative}(Fl,Vs,Rg,Ct,St,y_{first},q,Ar)$$

$$Q_{Tech-Dev}(Fl,Vs,Rg,St,y) = Q_{Tech-Dev}(Fl,Vs,Rg,St,y_{first})$$

2) Make parameters equal for all time periods This option will take the value for first year and apply it to all other years, for all y-dependent parameters:

$$Q_1^{Relative}(Fl,Vs,Rg,Ct,St,y,q,Ar) = Q_1^{Relative}(Fl,Vs,Rg,Ct,St,y,1,Ar)$$

3) Assign 1.0 to all multipliers and relative Q's $Q_1^{Relative}(Fl,Vs,Rg,Ct,St,y,q,Ar) = 1.0$

4) Assign standard values to catchabilityRel.Std.Dev (Stochastic simulation)

The relative Standard deviation of $\varepsilon_Q(Fl,St,y)$ is given the value 0.1

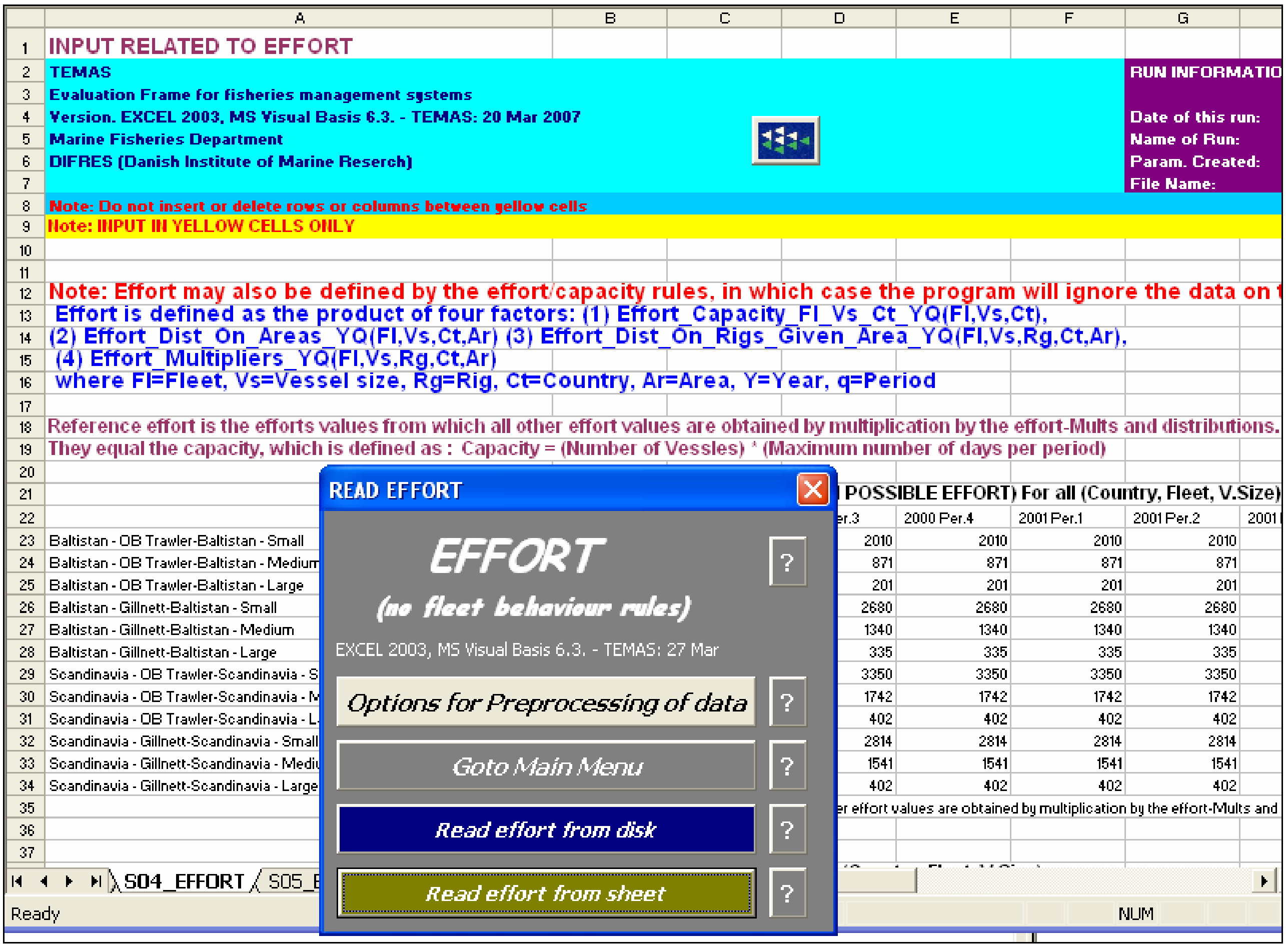
5) Assign zero to catchability std dev, Tech.devel..Biomass effect and rig effect.

$$\varepsilon_Q(Fl,St,y) = 0,\quad QB_{Exp}(Fl,Vs,Rg,St) = 0,\quad Q_{Tech-Dev}(Fl,Vs,Rg,St,y) = 0$$

$$RE(Fl,Vs,Rg,St) = 0$$

## 2.7. EFFORT INPUT (OPTIONAL), S04_EFFORT

Figure 2.7.1 shows the input user-form for worksheet “S04_EFFORT”, fleet structured input.



1 INPUT RELATED TO EFFORT
2 TEMAS
3 Evaluation Frame for fisheries management systems
4 Version. EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 20 Mar 2007
5 Marine Fisheries Department
6 DIFRES (Danish Institute of Marine Reserch)

RUN INFORMATIO
Date of this run:
Name of Run:
Param. Created:
File Name:

8 Note: Do not insert or delete rows or columns between yellow cells
9 Note: INPUT IN YELLOW CELLS ONLY

12 Note: Effort may also be defined by the effort/capacity rules, in which case the program will ignore the data on t
13 Effort is defined as the product of four factors: (1) Effort_Capacity_Fl_Vs_Ct_YQ(Fl,Vs,Ct),
14 (2) Effort_Dist_On_Areas_YQ(Fl,Vs,Ct,Ar) (3) Effort_Dist_On_Rigs_Given_Area_YQ(Fl,Vs,Rg,Ct,Ar),
15 (4) Effort_Multipliers_YQ(Fl,Vs,Rg,Ct,Ar)
16 where Fl=Fleet, Vs=Vessel size, Rg=Rig, Ct=Country, Ar=Area, Y=Year, q=Period

18 Reference effort is the efforts values from which all other effort values are obtained by multiplication by the effort-Mults and distributions.
19 They equal the capacity, which is defined as : Capacity = (Number of Vessles) * (Maximum number of days per period)

EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 27 Mar

21 POSSIBLE EFFORT) For all (Country, Fleet, V.Size)

| | | | | | | |
|---|---|---|---|---|---|---|
| 22 | | er.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 |
| 23 | Baltistan - OB Trawler-Baltistan - Small | 2010 | 2010 | 2010 | 2010 | |
| 24 | Baltistan - OB Trawler-Baltistan - Medium | 871 | 871 | 871 | 871 | |
| 25 | Baltistan - OB Trawler-Baltistan - Large | 201 | 201 | 201 | 201 | |
| 26 | Baltistan - Gillnett-Baltistan - Small | 2680 | 2680 | 2680 | 2680 | |
| 27 | Baltistan - Gillnett-Baltistan - Medium | 1340 | 1340 | 1340 | 1340 | |
| 28 | Baltistan - Gillnett-Baltistan - Large | 335 | 335 | 335 | 335 | |
| 29 | Scandinavia - OB Trawler-Scandinavia - S | 3350 | 3350 | 3350 | 3350 | |
| 30 | Scandinavia - OB Trawler-Scandinavia - M | 1742 | 1742 | 1742 | 1742 | |
| 31 | Scandinavia - OB Trawler-Scandinavia - L | 402 | 402 | 402 | 402 | |
| 32 | Scandinavia - Gillnett-Scandinavia - Small | 2814 | 2814 | 2814 | 2814 | |
| 33 | Scandinavia - Gillnett-Scandinavia - Mediu | 1541 | 1541 | 1541 | 1541 | |
| 34 | Scandinavia - Gillnett-Scandinavia - Large | 402 | 402 | 402 | 402 | |

35 r effort values are obtained by multiplication by the effort-Mults and

*Figure 2.7.1. User-form for entry of effort related data and parameters, worksheet S04_EFFORT. The text in rows 12-19 reads: Note: Effort may also be defined by the effort/capacity rules, in which case the program will ignore the data on this sheet.*
*Effort is defined as the product of four factors:*
*(1) Effort_Capacity_Fl_Vs_Ct_YQ(Fl, Vs, Ct),*
*(2) Effort_Dist_On_Areas_YQ(Fl, Vs, Ct, Ar)*
*(3) Effort_Dist_On_Rigs_Given_Area_YQ(Fl, Vs, Rg, Ct, Ar),*
*(4) Effort_Multipliers_YQ(Fl, Vs, Rg, Ct, Ar)*
*where Fl=Fleet, Vs=Vessel size, Rg=Rig, Ct=Country, Ar=Area, Y=Year, q=Period*
*Reference effort is the efforts values from which all other effort values are obtained by multiplication by the effort-Mults and distributions.*
*They equal the capacity, which is defined as :*
*Capacity = (Number of Vessels) * (Maximum number of days per period)*

The EXCEL Tables of worksheet S04_EFFORT are listed in Table 2.7.1. Only three out of seven EXCEL tables are yellow input tables. The remaining four (white) tables are so-called “resulting tables”, that is, tables derived from input tables, as information and check-options for the user.

| Index | EXCEL Table | Caption |
|---|---|---|
| 65 | Table4.1. | REFERENCE EFFORT (MAXIMUM POSSIBLE EFFORT) Not input |
| 66 | Table4.2. | EFFORT DISTRIBUTION ON AREAS |
| 67 | Table4.3. | RESULTING EFFORT AFTER DISTRIBUTION ON AREAS Not input |
| 68 | Table4.4. | EFFORT DISTRIBUTION ON RIGS (AFTER DISTRIBUTION ON AREAS) |
| 69 | Table4.5. | RESULTING EFFORT AFTER DISTRIBUTION ON RIGS AND AREAS Not input |
| 70 | Table4.6. | EFFORT MULTIPLIERS |
| 71 | Table4.7. | RESULTING EFFORT DISTRIBUTION ON RIGS (AFTER DISTRIBUTION ON AREAS) |

***Table 2.7.1. Tables in the effort input sheet, S04_EFFORT.***

Effort can be controlled in TEMAS in two ways:

(1) Giving effort as input
(2) Let the "Effort-rule" decide the effort (see Section 5).

Worksheet S04-EFFORT deals with only the first way of entering effort in the TEMAS model. This feature of effort input in the context of TEMAS is why the data are said to be optional. In case you chose the option to let the effort be determined by the effort rules (the short term and long term behaviour models also called "trip-behaviour" and "structural behaviour") you do not need to give effort as input.

The effort exerted (the actual number of days at sea) is a function of the effort entered in worksheet S04-EFFORT as well as the number of vessels (boats) entered in worksheet S05_BOATS. The number of vessels defines an upper limit for the number sea days that can be exerted. The effort capacity of a vessel, $EY_{MAX}$ ,is the maximum number of fishing effort units (fishing days or sea days) that a fleet can exert in a time period. It is given by the variable:

$EY_{MAX}(Fl, Vs, Ct, y, q, Ar)$ = The maximum physical number of effort units per vessel per time unit in Area Ar (in worksheet S05_BOATS).

The total effort exerted by fleet (Fl,Vs,Ct) during time period q is the sum over riggings and areas

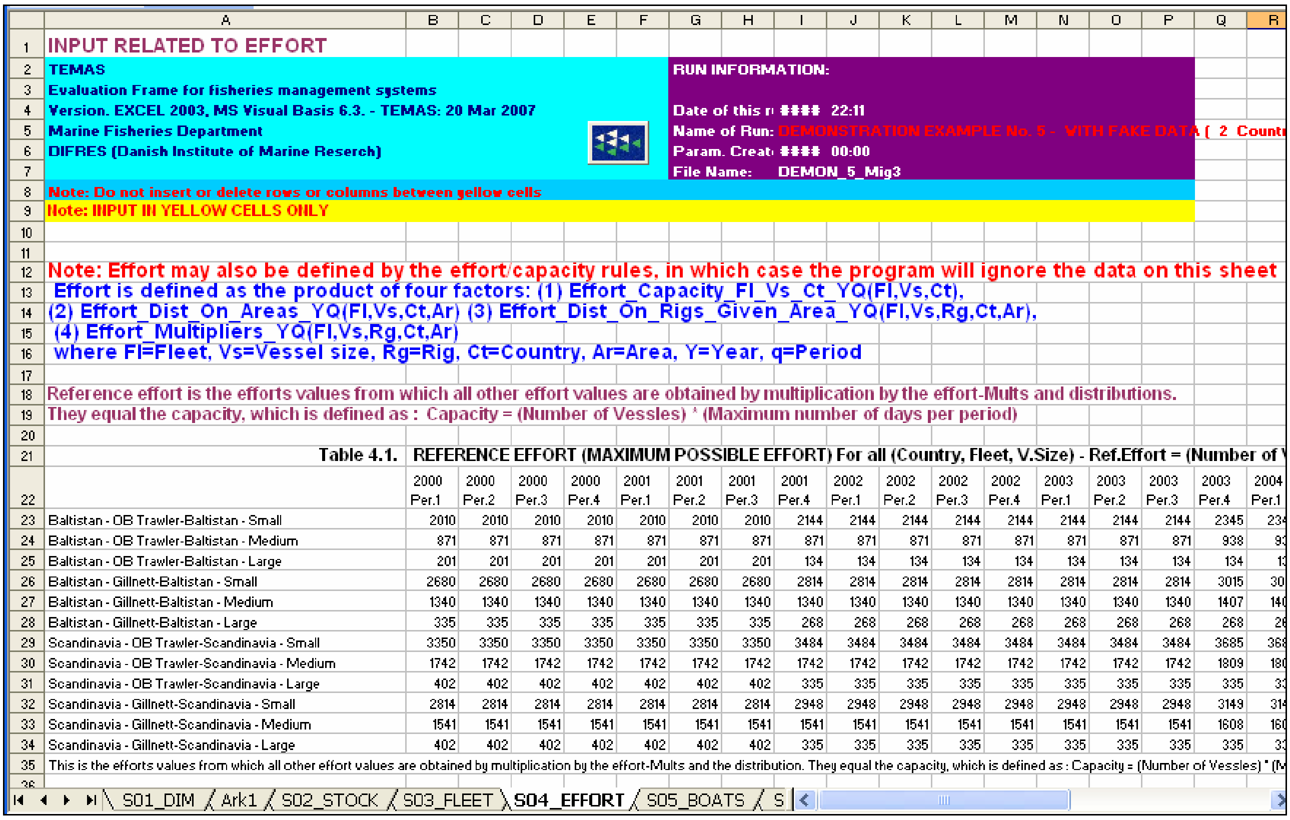
$$E(Fl,Vs,\bullet,Ct,y,q,\bullet) = \sum_{Ar=1}^{NU_{Area}} \sum_{Rg=1}^{Rg(Fl)} E(Fl,Vs,Rg,Ct.y,q,Ar)$$

According to the definition of, $EY_{MAX}$, it is not dependent on the rigging. We define the "reference effort" or the "maximum effort" by

$$E_{REF}(Fl,Vs,Ct,y,q,Ar) \;=\; NU_{Vessel}(Fl,Vs,Ct,y,q,\bullet) * EY_{Max}(Fl,Vs,Ct,y,q,Ar)$$

The number of vessels, $NU_{Vessel}(Fl,Vs,Ct,y,q,\bullet)$, are contained in worksheet S05_BOATS.

The reference effort is shown in EXCEL Table 4.1 (Figure 2.7.2). The cell background in this table is white indicating that the values are not input, but are the results of a calculation. They are the product (Number of Vessels) * (Maximum number of days per period) which are given in two tables in worksheet S05_BOATS (see next section).



INPUT RELATED TO EFFORT

**TEMAS**
**Evaluation Frame for fisheries management systems**
**Version. EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 20 Mar 2007**
**Marine Fisheries Department**
**DIFRES (Danish Institute of Marine Reserch)**

**RUN INFORMATION:**
**Date of this r ####  22:11**
**Name of Run: DEMONSTRATION EXAMPLE No. 5 -  WITH FAKE DATA (  2  Countr**
**Param. Creat ####  00:00**
**File Name:      DEMON_5_Mig3**

**Note: Do not insert or delete rows or columns between yellow cells**
**Note: INPUT IN YELLOW CELLS ONLY**

**Note: Effort may also be defined by the effort/capacity rules, in which case the program will ignore the data on this sheet**
**Effort is defined as the product of four factors: (1) Effort_Capacity_Fl_Vs_Ct_YQ(Fl,Vs,Ct),**
**(2) Effort_Dist_On_Areas_YQ(Fl,Vs,Ct,Ar) (3) Effort_Dist_On_Rigs_Given_Area_YQ(Fl,Vs,Rg,Ct,Ar),**
**(4) Effort_Multipliers_YQ(Fl,Vs,Rg,Ct,Ar)**
**where Fl=Fleet, Vs=Vessel size, Rg=Rig, Ct=Country, Ar=Area, Y=Year, q=Period**

Reference effort is the efforts values from which all other effort values are obtained by multiplication by the effort-Mults and distributions.
They equal the capacity, which is defined as :  Capacity = (Number of Vessles) * (Maximum number of days per period)

**Table 4.1.  REFERENCE EFFORT (MAXIMUM POSSIBLE EFFORT) For all (Country, Fleet, V.Size) - Ref.Effort = (Number of V**

| | 2000<br>Per.1 | 2000<br>Per.2 | 2000<br>Per.3 | 2000<br>Per.4 | 2001<br>Per.1 | 2001<br>Per.2 | 2001<br>Per.3 | 2001<br>Per.4 | 2002<br>Per.1 | 2002<br>Per.2 | 2002<br>Per.3 | 2002<br>Per.4 | 2003<br>Per.1 | 2003<br>Per.2 | 2003<br>Per.3 | 2003<br>Per.4 | 2004<br>Per.1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Baltistan - OB Trawler-Baltistan - Small | 2010 | 2010 | 2010 | 2010 | 2010 | 2010 | 2010 | 2144 | 2144 | 2144 | 2144 | 2144 | 2144 | 2144 | 2144 | 2345 | 234 |
| Baltistan - OB Trawler-Baltistan - Medium | 871 | 871 | 871 | 871 | 871 | 871 | 871 | 871 | 871 | 871 | 871 | 871 | 871 | 871 | 871 | 938 | 93 |
| Baltistan - OB Trawler-Baltistan - Large | 201 | 201 | 201 | 201 | 201 | 201 | 201 | 134 | 134 | 134 | 134 | 134 | 134 | 134 | 134 | 134 | 13 |
| Baltistan - Gillnett-Baltistan - Small | 2680 | 2680 | 2680 | 2680 | 2680 | 2680 | 2680 | 2814 | 2814 | 2814 | 2814 | 2814 | 2814 | 2814 | 2814 | 3015 | 30 |
| Baltistan - Gillnett-Baltistan - Medium | 1340 | 1340 | 1340 | 1340 | 1340 | 1340 | 1340 | 1340 | 1340 | 1340 | 1340 | 1340 | 1340 | 1340 | 1340 | 1407 | 140 |
| Baltistan - Gillnett-Baltistan - Large | 335 | 335 | 335 | 335 | 335 | 335 | 335 | 268 | 268 | 268 | 268 | 268 | 268 | 268 | 268 | 268 | 26 |
| Scandinavia - OB Trawler-Scandinavia - Small | 3350 | 3350 | 3350 | 3350 | 3350 | 3350 | 3350 | 3484 | 3484 | 3484 | 3484 | 3484 | 3484 | 3484 | 3484 | 3685 | 368 |
| Scandinavia - OB Trawler-Scandinavia - Medium | 1742 | 1742 | 1742 | 1742 | 1742 | 1742 | 1742 | 1742 | 1742 | 1742 | 1742 | 1742 | 1742 | 1742 | 1742 | 1809 | 180 |
| Scandinavia - OB Trawler-Scandinavia - Large | 402 | 402 | 402 | 402 | 402 | 402 | 402 | 335 | 335 | 335 | 335 | 335 | 335 | 335 | 335 | 335 | 33 |
| Scandinavia - Gillnett-Scandinavia - Small | 2814 | 2814 | 2814 | 2814 | 2814 | 2814 | 2814 | 2948 | 2948 | 2948 | 2948 | 2948 | 2948 | 2948 | 2948 | 3149 | 314 |
| Scandinavia - Gillnett-Scandinavia - Medium | 1541 | 1541 | 1541 | 1541 | 1541 | 1541 | 1541 | 1541 | 1541 | 1541 | 1541 | 1541 | 1541 | 1541 | 1541 | 1608 | 160 |
| Scandinavia - Gillnett-Scandinavia - Large | 402 | 402 | 402 | 402 | 402 | 402 | 402 | 335 | 335 | 335 | 335 | 335 | 335 | 335 | 335 | 335 | 33 |

This is the efforts values from which all other effort values are obtained by multiplication by the effort-Mults and the distribution. They equal the capacity, which is defined as : Capacity = (Number of Vessles) * (M

*Figure 2.7.2. Reference effort. The explanation below the tables says: This is the efforts values from which all other effort values are obtained by multiplication by the effort-multipliers and the distribution. They equal the capacity, which is defined as :*
*Capacity = (Number of Vessels) * (Maximum number of days per period)*

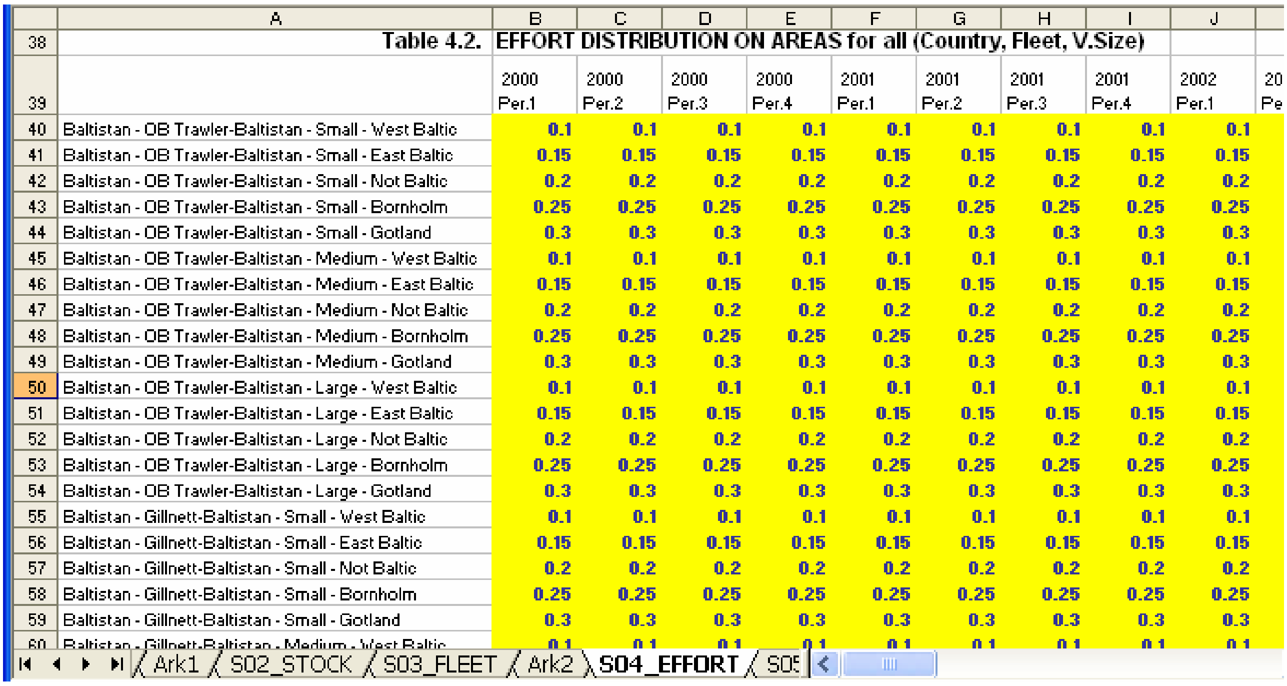


**Table 4.2.  EFFORT DISTRIBUTION ON AREAS for all (Country, Fleet, V.Size)**

| | 2000<br>Per.1 | 2000<br>Per.2 | 2000<br>Per.3 | 2000<br>Per.4 | 2001<br>Per.1 | 2001<br>Per.2 | 2001<br>Per.3 | 2001<br>Per.4 | 2002<br>Per.1 | 20<br>Pe |
|---|---|---|---|---|---|---|---|---|---|---|
| Baltistan - OB Trawler-Baltistan - Small - West Baltic | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | |
| Baltistan - OB Trawler-Baltistan - Small - East Baltic | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | |
| Baltistan - OB Trawler-Baltistan - Small - Not Baltic | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | |
| Baltistan - OB Trawler-Baltistan - Small - Bornholm | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | |
| Baltistan - OB Trawler-Baltistan - Small - Gotland | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | |
| Baltistan - OB Trawler-Baltistan - Medium - West Baltic | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | |
| Baltistan - OB Trawler-Baltistan - Medium - East Baltic | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | |
| Baltistan - OB Trawler-Baltistan - Medium - Not Baltic | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | |
| Baltistan - OB Trawler-Baltistan - Medium - Bornholm | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | |
| Baltistan - OB Trawler-Baltistan - Medium - Gotland | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | |
| Baltistan - OB Trawler-Baltistan - Large - West Baltic | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | |
| Baltistan - OB Trawler-Baltistan - Large - East Baltic | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | |
| Baltistan - OB Trawler-Baltistan - Large - Not Baltic | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | |
| Baltistan - OB Trawler-Baltistan - Large - Bornholm | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | |
| Baltistan - OB Trawler-Baltistan - Large - Gotland | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | |
| Baltistan - Gillnett-Baltistan - Small - West Baltic | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | |
| Baltistan - Gillnett-Baltistan - Small - East Baltic | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | |
| Baltistan - Gillnett-Baltistan - Small - Not Baltic | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | |
| Baltistan - Gillnett-Baltistan - Small - Bornholm | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | |
| Baltistan - Gillnett-Baltistan - Small - Gotland | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | |
| Baltistan - Gillnett-Baltistan - Medium - West Baltic | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | |

*Figure 2.7.3.a. Effort distribution on areas (Compare Figure 2.7.3.b, which highlight the table structure). The explanation below the table says: Distribution of effort on areas for each combination of (Country, Fleet, V. Size). For given (Country, Fleet, V. Size) they sum up to 1 over areas.*

The input effort in the present version of TEMAS is E(Fl, Vs, Ct, y, q,•), that is, the total effort summed over areas, together with the relative distribution of effort over areas:

$$E_{Area-Dist}(Fl,Vs,\bullet,Ct,y,q,Ar)=\frac{E(Fl,Vs,\bullet,Ct,y,q,Ar)}{E(Fl,Vs,\bullet,Ct,y,q,\bullet)}$$

The effort distribution can be given as input each period each year, in the case where the behaviour rules are not applied. Thus, effort is derived from the product of the two input parameters,

$E(Fl, Vs, \bullet, Ct, y, q,\bullet)$ and $E_{Area\text{-}Dist}(Fl, Vs, \bullet ,Ct, y, q, Ar)$

Which in turn gives the effort distribution on fleets, vessels sizes and countries:

$E(Fl, Vs, \bullet , Ct, y, q, Ar) = E(Fl, Vs, \bullet, Ct, y, q, \bullet)* E_{Area\text{-}Dist} (Fl, Vs, \bullet, Ct, y, q, Ar)$

The next step in the distribution of effort is the distribution on riggings for given area:

$E(Fl, Vs, Rg, Ct, y, q, Ar) = E(Fl, Vs, \bullet ,Ct, y, q, Ar)* E_{Rig\text{-}Dist}(Fl, Vs, Rg, Ct, y, q, Ar)$

The definition of effort distribution on riggings for given area, Ar is

$$E_{Rig-Dist}(Fl,Vs,Rg,Ct,y,q,Ar)=\frac{E(Fl,Vs,Rg,Ct,y,q,Ar)}{E(Fl,Vs,\bullet,Ct,y,q,Ar)}$$

To summarize the distribution, the complete model of effort distribution on areas, and on rigs for given area read:

$$E(Fl,Vs,Rg,Ct,y,q,Ar)=E_{REF}(Fl,Vs,\bullet,Ct,y,q,\bullet)*$$
$$E_{Rig-dist}(Fl,Vs,Rg,y,q,Ar)*E_{Area-dist}(Fl,Vs,\bullet,Ct,y,q,Ar)$$

EXCEL Table 4.2 (Figure 2.7.3.a) shows the distribution of effort on areas. Figure 2.7.3.a shows only a part of the table. Figure 2.7.3.b shows the complete tables, with an indication of the table hierarchical structure: Country, Gear, Vessel size, area.

Thus, each group of five cells (one for each area) sums up to 1.0. E.g. the sum of cells B40, B41, B42, B43 and B44 is 1.0.

In case you enter numbers that do not sum up to 1.0, the program will normalize the values so that the sum becomes 1.0, as illustrated in Figure 2.7.3.c. In this case cells B40,…,B44 contain the numbers 20, 30, 40, 50 and 60 which normalized become 0.10,0.15,0.20,0.25 and 0.30

In case you enter only zeroes, the program cannot normalize, and the values “no value” will appear in the EXCEL table.

The resulting effort (summed over riggings) after distribution on areas

$$E(Fl,Vs,\bullet,Ct,y,q,Ar)=E_{REF}(Fl,Vs,\bullet,Ct,y,q,\bullet)*E_{Area-dist}(Fl,Vs,\bullet,Ct,y,q,Ar)$$

are shown in EXCEL table 4.3 (Figure 2.7.4).

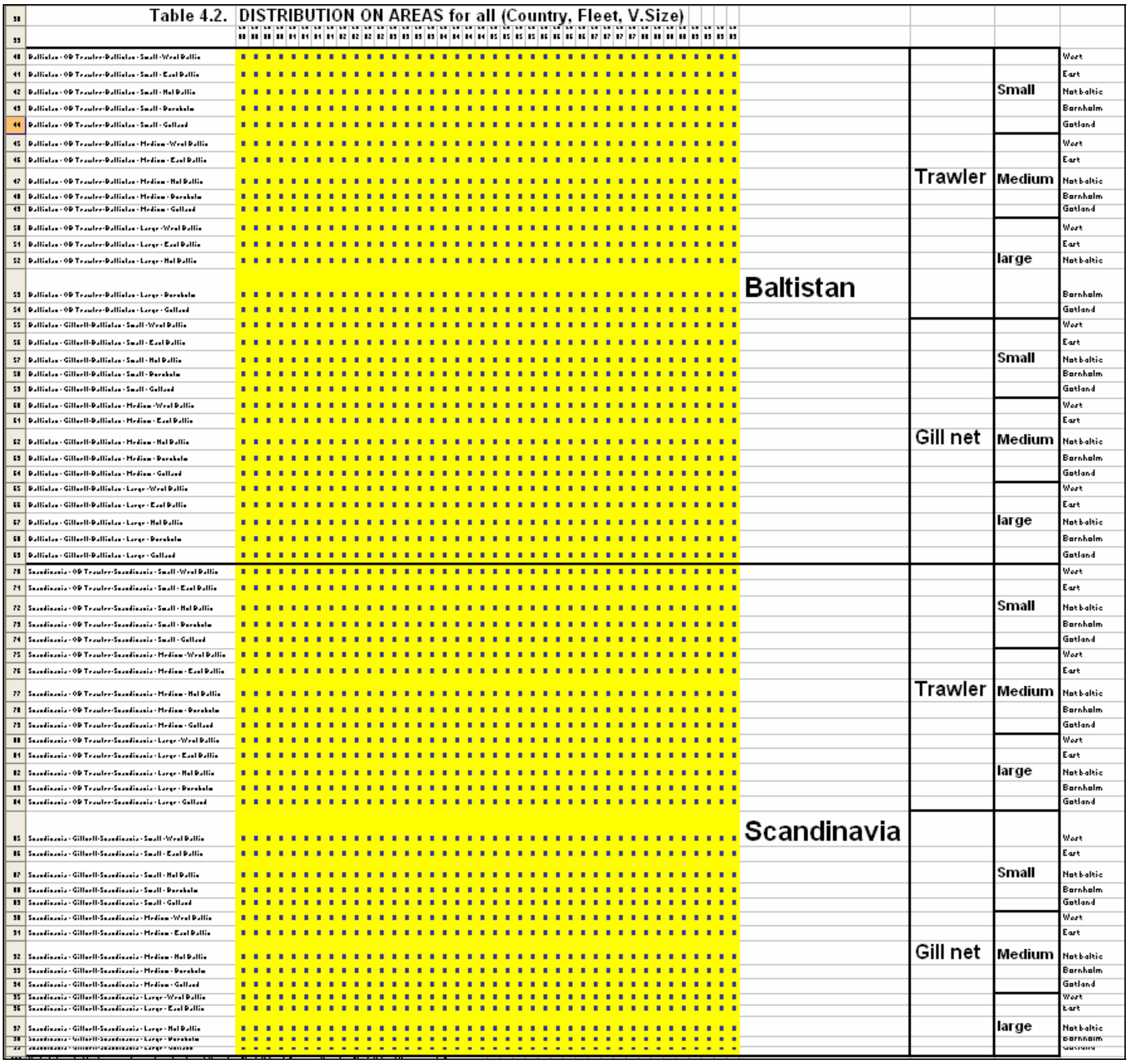
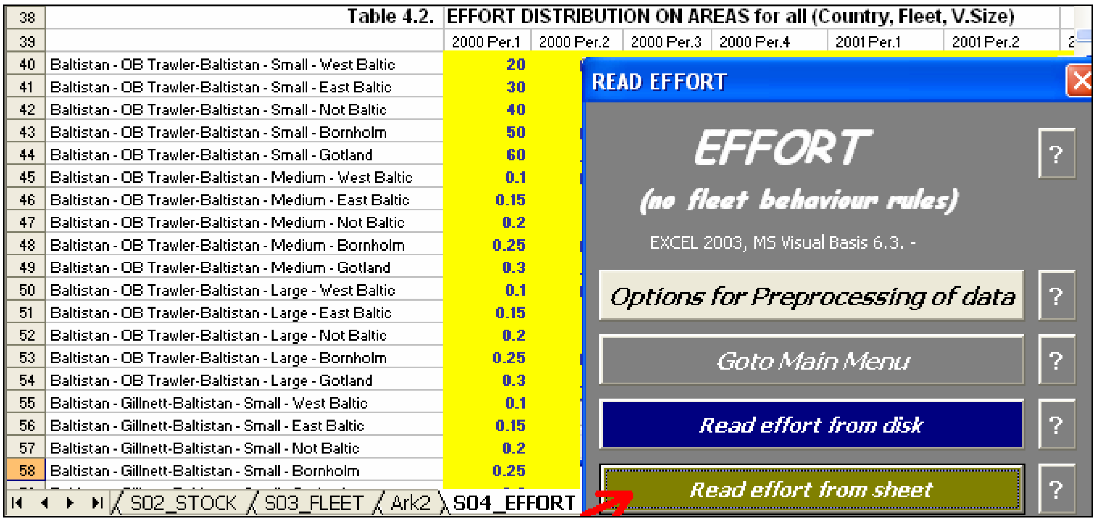
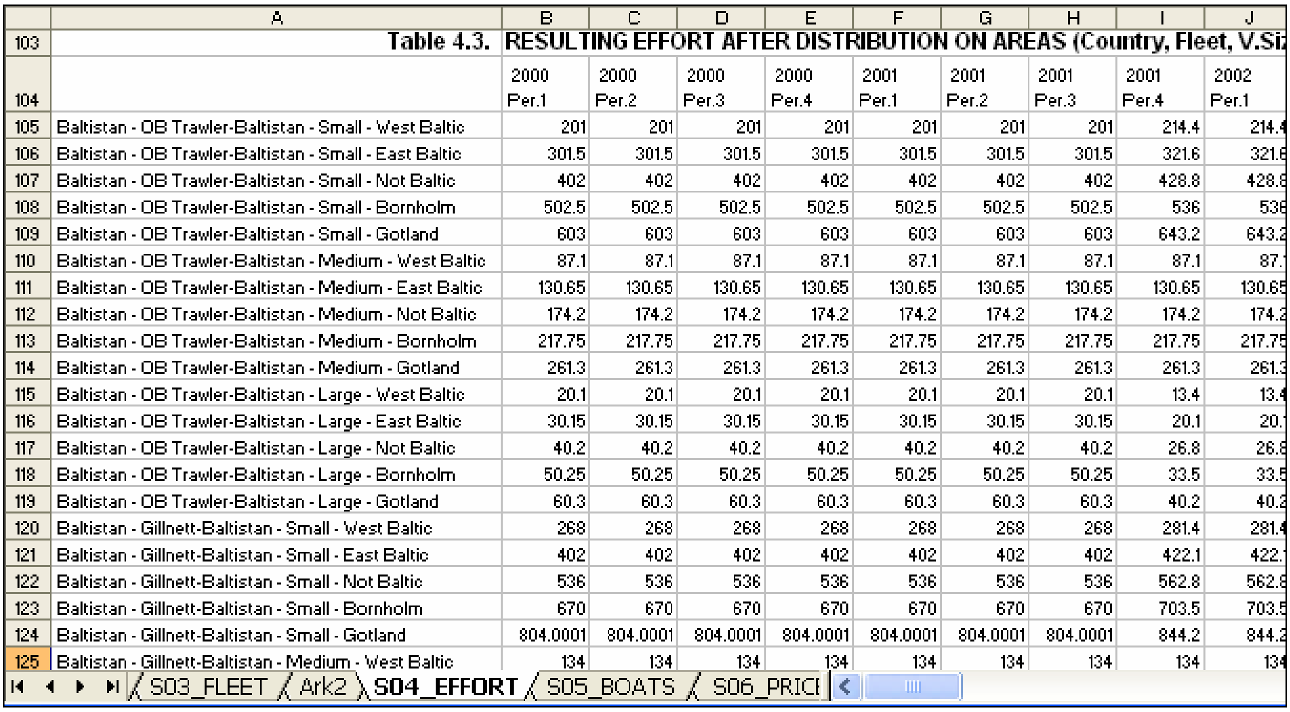


Figure 2.7.3.b. Effort distribution on areas with focus on the table structure. This version shows the entire table, the cells of  which are hardly readable.  The last column (hardly readable) contains the area names "West","East","Not Baltic","Bornhol" and "Gotland", for each vessel size.



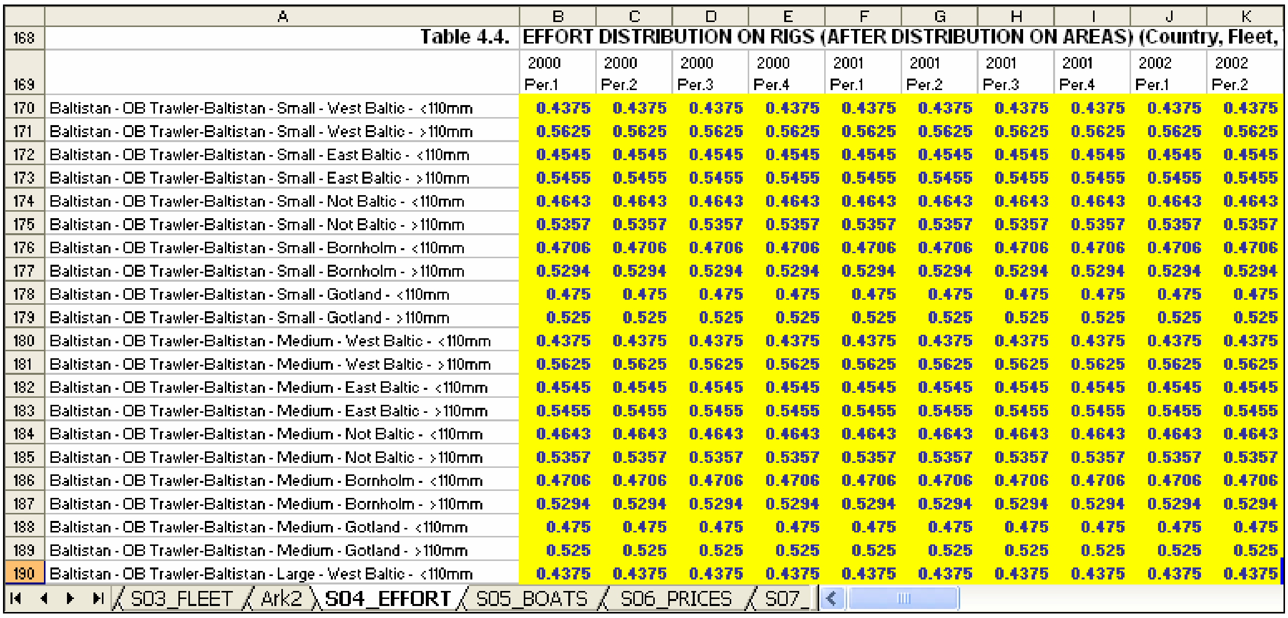
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 38 | Table 4.2. | EFFORT DISTRIBUTION ON AREAS for all (Country, Fleet, V.Size) | | | | | |
| 39 | | 2000 Per.1 | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 |
| 40 | Baltistan - OB Trawler-Baltistan - Small - West Baltic | 20 | | | | | |
| 41 | Baltistan - OB Trawler-Baltistan - Small - East Baltic | 30 | | | | | |
| 42 | Baltistan - OB Trawler-Baltistan - Small - Not Baltic | 40 | | | | | |
| 43 | Baltistan - OB Trawler-Baltistan - Small - Bornholm | 50 | | | | | |
| 44 | Baltistan - OB Trawler-Baltistan - Small - Gotland | 60 | | | | | |
| 45 | Baltistan - OB Trawler-Baltistan - Medium - West Baltic | 0.1 | | | | | |
| 46 | Baltistan - OB Trawler-Baltistan - Medium - East Baltic | 0.15 | | | | | |
| 47 | Baltistan - OB Trawler-Baltistan - Medium - Not Baltic | 0.2 | | | | | |
| 48 | Baltistan - OB Trawler-Baltistan - Medium - Bornholm | 0.25 | | | | | |
| 49 | Baltistan - OB Trawler-Baltistan - Medium - Gotland | 0.3 | | | | | |
| 50 | Baltistan - OB Trawler-Baltistan - Large - West Baltic | 0.1 | | | | | |
| 51 | Baltistan - OB Trawler-Baltistan - Large - East Baltic | 0.15 | | | | | |
| 52 | Baltistan - OB Trawler-Baltistan - Large - Not Baltic | 0.2 | | | | | |
| 53 | Baltistan - OB Trawler-Baltistan - Large - Bornholm | 0.25 | | | | | |
| 54 | Baltistan - OB Trawler-Baltistan - Large - Gotland | 0.3 | | | | | |
| 55 | Baltistan - Gillnett-Baltistan - Small - West Baltic | 0.1 | | | | | |
| 56 | Baltistan - Gillnett-Baltistan - Small - East Baltic | 0.15 | | | | | |
| 57 | Baltistan - Gillnett-Baltistan - Small - Not Baltic | 0.2 | | | | | |
| 58 | Baltistan - Gillnett-Baltistan - Small - Bornholm | 0.25 | | | | | |

Figure 2.7.3.c. Effort distribution on areas. Example to illustrate the normalization of input. After clicking on "Read effort from sheet", cells B40,…,B44 will sum up to 1.0.



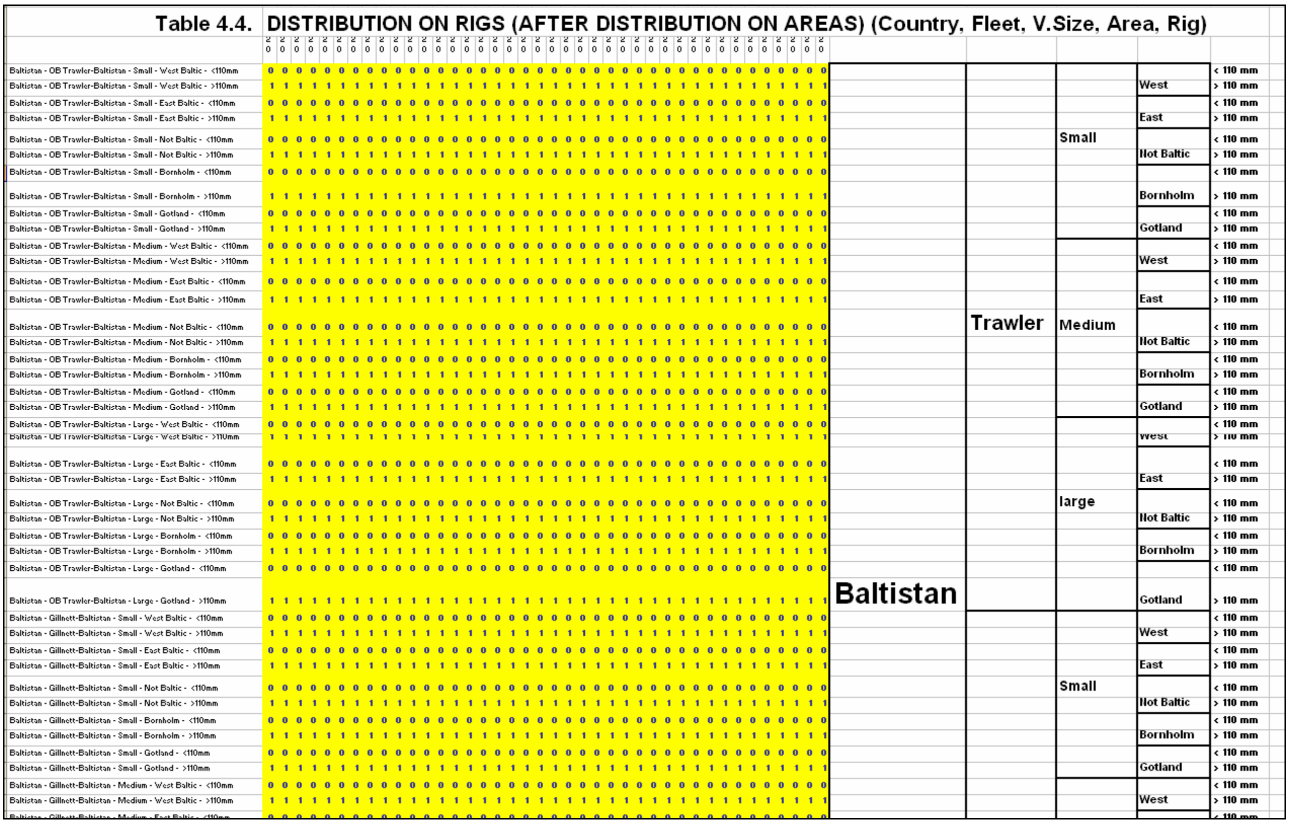
| | A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|---|
| 103 | Table 4.3. | RESULTING EFFORT AFTER DISTRIBUTION ON AREAS (Country, Fleet, V.Si | | | | | | | | |
| 104 | | 2000<br>Per.1 | 2000<br>Per.2 | 2000<br>Per.3 | 2000<br>Per.4 | 2001<br>Per.1 | 2001<br>Per.2 | 2001<br>Per.3 | 2001<br>Per.4 | 2002<br>Per.1 |
| 105 | Baltistan - OB Trawler-Baltistan - Small - West Baltic | 201 | 201 | 201 | 201 | 201 | 201 | 201 | 214.4 | 214.4 |
| 106 | Baltistan - OB Trawler-Baltistan - Small - East Baltic | 301.5 | 301.5 | 301.5 | 301.5 | 301.5 | 301.5 | 301.5 | 321.6 | 321.6 |
| 107 | Baltistan - OB Trawler-Baltistan - Small - Not Baltic | 402 | 402 | 402 | 402 | 402 | 402 | 402 | 428.8 | 428.8 |
| 108 | Baltistan - OB Trawler-Baltistan - Small - Bornholm | 502.5 | 502.5 | 502.5 | 502.5 | 502.5 | 502.5 | 502.5 | 536 | 536 |
| 109 | Baltistan - OB Trawler-Baltistan - Small - Gotland | 603 | 603 | 603 | 603 | 603 | 603 | 603 | 643.2 | 643.2 |
| 110 | Baltistan - OB Trawler-Baltistan - Medium - West Baltic | 87.1 | 87.1 | 87.1 | 87.1 | 87.1 | 87.1 | 87.1 | 87.1 | 87.1 |
| 111 | Baltistan - OB Trawler-Baltistan - Medium - East Baltic | 130.65 | 130.65 | 130.65 | 130.65 | 130.65 | 130.65 | 130.65 | 130.65 | 130.65 |
| 112 | Baltistan - OB Trawler-Baltistan - Medium - Not Baltic | 174.2 | 174.2 | 174.2 | 174.2 | 174.2 | 174.2 | 174.2 | 174.2 | 174.2 |
| 113 | Baltistan - OB Trawler-Baltistan - Medium - Bornholm | 217.75 | 217.75 | 217.75 | 217.75 | 217.75 | 217.75 | 217.75 | 217.75 | 217.75 |
| 114 | Baltistan - OB Trawler-Baltistan - Medium - Gotland | 261.3 | 261.3 | 261.3 | 261.3 | 261.3 | 261.3 | 261.3 | 261.3 | 261.3 |
| 115 | Baltistan - OB Trawler-Baltistan - Large - West Baltic | 20.1 | 20.1 | 20.1 | 20.1 | 20.1 | 20.1 | 20.1 | 13.4 | 13.4 |
| 116 | Baltistan - OB Trawler-Baltistan - Large - East Baltic | 30.15 | 30.15 | 30.15 | 30.15 | 30.15 | 30.15 | 30.15 | 20.1 | 20.1 |
| 117 | Baltistan - OB Trawler-Baltistan - Large - Not Baltic | 40.2 | 40.2 | 40.2 | 40.2 | 40.2 | 40.2 | 40.2 | 26.8 | 26.8 |
| 118 | Baltistan - OB Trawler-Baltistan - Large - Bornholm | 50.25 | 50.25 | 50.25 | 50.25 | 50.25 | 50.25 | 50.25 | 33.5 | 33.5 |
| 119 | Baltistan - OB Trawler-Baltistan - Large - Gotland | 60.3 | 60.3 | 60.3 | 60.3 | 60.3 | 60.3 | 60.3 | 40.2 | 40.2 |
| 120 | Baltistan - Gillnett-Baltistan - Small - West Baltic | 268 | 268 | 268 | 268 | 268 | 268 | 268 | 281.4 | 281.4 |
| 121 | Baltistan - Gillnett-Baltistan - Small - East Baltic | 402 | 402 | 402 | 402 | 402 | 402 | 402 | 422.1 | 422.1 |
| 122 | Baltistan - Gillnett-Baltistan - Small - Not Baltic | 536 | 536 | 536 | 536 | 536 | 536 | 536 | 562.8 | 562.8 |
| 123 | Baltistan - Gillnett-Baltistan - Small - Bornholm | 670 | 670 | 670 | 670 | 670 | 670 | 670 | 703.5 | 703.5 |
| 124 | Baltistan - Gillnett-Baltistan - Small - Gotland | 804.0001 | 804.0001 | 804.0001 | 804.0001 | 804.0001 | 804.0001 | 804.0001 | 844.2 | 844.2 |
| 125 | Baltistan - Gillnett-Baltistan - Medium - West Baltic | 134 | 134 | 134 | 134 | 134 | 134 | 134 | 134 | 134 |

*Figure 2.7.4. Resulting effort after distribution on areas. These data are derived from EXCEL Table 4.1 and 4.2 by multiplications (Figure 2.7.2 and Figure 2.7.3).*



| | A | B | C | D | E | F | G | H | I | J | K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 168 | Table 4.4. | EFFORT DISTRIBUTION ON RIGS (AFTER DISTRIBUTION ON AREAS) (Country, Fleet, | | | | | | | | | |
| 169 | | 2000<br>Per.1 | 2000<br>Per.2 | 2000<br>Per.3 | 2000<br>Per.4 | 2001<br>Per.1 | 2001<br>Per.2 | 2001<br>Per.3 | 2001<br>Per.4 | 2002<br>Per.1 | 2002<br>Per.2 |
| 170 | Baltistan - OB Trawler-Baltistan - Small - West Baltic - <110mm | 0.4375 | 0.4375 | 0.4375 | 0.4375 | 0.4375 | 0.4375 | 0.4375 | 0.4375 | 0.4375 | 0.4375 |
| 171 | Baltistan - OB Trawler-Baltistan - Small - West Baltic - >110mm | 0.5625 | 0.5625 | 0.5625 | 0.5625 | 0.5625 | 0.5625 | 0.5625 | 0.5625 | 0.5625 | 0.5625 |
| 172 | Baltistan - OB Trawler-Baltistan - Small - East Baltic - <110mm | 0.4545 | 0.4545 | 0.4545 | 0.4545 | 0.4545 | 0.4545 | 0.4545 | 0.4545 | 0.4545 | 0.4545 |
| 173 | Baltistan - OB Trawler-Baltistan - Small - East Baltic - >110mm | 0.5455 | 0.5455 | 0.5455 | 0.5455 | 0.5455 | 0.5455 | 0.5455 | 0.5455 | 0.5455 | 0.5455 |
| 174 | Baltistan - OB Trawler-Baltistan - Small - Not Baltic - <110mm | 0.4643 | 0.4643 | 0.4643 | 0.4643 | 0.4643 | 0.4643 | 0.4643 | 0.4643 | 0.4643 | 0.4643 |
| 175 | Baltistan - OB Trawler-Baltistan - Small - Not Baltic - >110mm | 0.5357 | 0.5357 | 0.5357 | 0.5357 | 0.5357 | 0.5357 | 0.5357 | 0.5357 | 0.5357 | 0.5357 |
| 176 | Baltistan - OB Trawler-Baltistan - Small - Bornholm - <110mm | 0.4706 | 0.4706 | 0.4706 | 0.4706 | 0.4706 | 0.4706 | 0.4706 | 0.4706 | 0.4706 | 0.4706 |
| 177 | Baltistan - OB Trawler-Baltistan - Small - Bornholm - >110mm | 0.5294 | 0.5294 | 0.5294 | 0.5294 | 0.5294 | 0.5294 | 0.5294 | 0.5294 | 0.5294 | 0.5294 |
| 178 | Baltistan - OB Trawler-Baltistan - Small - Gotland - <110mm | 0.475 | 0.475 | 0.475 | 0.475 | 0.475 | 0.475 | 0.475 | 0.475 | 0.475 | 0.475 |
| 179 | Baltistan - OB Trawler-Baltistan - Small - Gotland - >110mm | 0.525 | 0.525 | 0.525 | 0.525 | 0.525 | 0.525 | 0.525 | 0.525 | 0.525 | 0.525 |
| 180 | Baltistan - OB Trawler-Baltistan - Medium - West Baltic - <110mm | 0.4375 | 0.4375 | 0.4375 | 0.4375 | 0.4375 | 0.4375 | 0.4375 | 0.4375 | 0.4375 | 0.4375 |
| 181 | Baltistan - OB Trawler-Baltistan - Medium - West Baltic - >110mm | 0.5625 | 0.5625 | 0.5625 | 0.5625 | 0.5625 | 0.5625 | 0.5625 | 0.5625 | 0.5625 | 0.5625 |
| 182 | Baltistan - OB Trawler-Baltistan - Medium - East Baltic - <110mm | 0.4545 | 0.4545 | 0.4545 | 0.4545 | 0.4545 | 0.4545 | 0.4545 | 0.4545 | 0.4545 | 0.4545 |
| 183 | Baltistan - OB Trawler-Baltistan - Medium - East Baltic - >110mm | 0.5455 | 0.5455 | 0.5455 | 0.5455 | 0.5455 | 0.5455 | 0.5455 | 0.5455 | 0.5455 | 0.5455 |
| 184 | Baltistan - OB Trawler-Baltistan - Medium - Not Baltic - <110mm | 0.4643 | 0.4643 | 0.4643 | 0.4643 | 0.4643 | 0.4643 | 0.4643 | 0.4643 | 0.4643 | 0.4643 |
| 185 | Baltistan - OB Trawler-Baltistan - Medium - Not Baltic - >110mm | 0.5357 | 0.5357 | 0.5357 | 0.5357 | 0.5357 | 0.5357 | 0.5357 | 0.5357 | 0.5357 | 0.5357 |
| 186 | Baltistan - OB Trawler-Baltistan - Medium - Bornholm - <110mm | 0.4706 | 0.4706 | 0.4706 | 0.4706 | 0.4706 | 0.4706 | 0.4706 | 0.4706 | 0.4706 | 0.4706 |
| 187 | Baltistan - OB Trawler-Baltistan - Medium - Bornholm - >110mm | 0.5294 | 0.5294 | 0.5294 | 0.5294 | 0.5294 | 0.5294 | 0.5294 | 0.5294 | 0.5294 | 0.5294 |
| 188 | Baltistan - OB Trawler-Baltistan - Medium - Gotland - <110mm | 0.475 | 0.475 | 0.475 | 0.475 | 0.475 | 0.475 | 0.475 | 0.475 | 0.475 | 0.475 |
| 189 | Baltistan - OB Trawler-Baltistan - Medium - Gotland - >110mm | 0.525 | 0.525 | 0.525 | 0.525 | 0.525 | 0.525 | 0.525 | 0.525 | 0.525 | 0.525 |
| 190 | Baltistan - OB Trawler-Baltistan - Large - West Baltic - <110mm | 0.4375 | 0.4375 | 0.4375 | 0.4375 | 0.4375 | 0.4375 | 0.4375 | 0.4375 | 0.4375 | 0.4375 |

*Figure 2.7.5.a Effort distribution on riggings (after distribution on areas). The structure of EXCEL Table 4.4 is illustrated in Figure 2.7.5.b..*



| Table 4.4. | DISTRIBUTION ON RIGS (AFTER DISTRIBUTION ON AREAS) (Country, Fleet, V.Size, Area, Rig) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |  |  |  |  |  |
| Baltistan - OB Trawler-Baltistan - Small - West Baltic - <110mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Baltistan | Trawler | Small | West | < 110 mm |
| Baltistan - OB Trawler-Baltistan - Small - West Baltic - >110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |  |  |  | > 110 mm |
| Baltistan - OB Trawler-Baltistan - Small - East Baltic - <110mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |  |  | East | < 110 mm |
| Baltistan - OB Trawler-Baltistan - Small - East Baltic - >110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |  |  |  | > 110 mm |
| Baltistan - OB Trawler-Baltistan - Small - Not Baltic - <110mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |  |  | Not Baltic | < 110 mm |
| Baltistan - OB Trawler-Baltistan - Small - Not Baltic - >110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |  |  |  | > 110 mm |
| Baltistan - OB Trawler-Baltistan - Small - Bornholm - <110mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |  |  | Bornholm | < 110 mm |
| Baltistan - OB Trawler-Baltistan - Small - Bornholm - >110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |  |  |  | > 110 mm |
| Baltistan - OB Trawler-Baltistan - Small - Gotland - <110mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |  |  | Gotland | < 110 mm |
| Baltistan - OB Trawler-Baltistan - Small - Gotland - >110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |  |  |  | > 110 mm |
| Baltistan - OB Trawler-Baltistan - Medium - West Baltic - <110mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |  | Medium | West | < 110 mm |
| Baltistan - OB Trawler-Baltistan - Medium - West Baltic - >110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |  |  |  | > 110 mm |
| Baltistan - OB Trawler-Baltistan - Medium - East Baltic - <110mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |  |  | East | < 110 mm |
| Baltistan - OB Trawler-Baltistan - Medium - East Baltic - >110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |  |  |  | > 110 mm |
| Baltistan - OB Trawler-Baltistan - Medium - Not Baltic - <110mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |  |  | Not Baltic | < 110 mm |
| Baltistan - OB Trawler-Baltistan - Medium - Not Baltic - >110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |  |  |  | > 110 mm |
| Baltistan - OB Trawler-Baltistan - Medium - Bornholm - <110mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |  |  | Bornholm | < 110 mm |
| Baltistan - OB Trawler-Baltistan - Medium - Bornholm - >110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |  |  |  | > 110 mm |
| Baltistan - OB Trawler-Baltistan - Medium - Gotland - <110mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |  |  | Gotland | < 110 mm |
| Baltistan - OB Trawler-Baltistan - Medium - Gotland - >110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |  |  |  | > 110 mm |
| Baltistan - OB Trawler-Baltistan - Large - West Baltic - <110mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |  | large | West | < 110 mm |
| Baltistan - OB Trawler-Baltistan - Large - West Baltic - >110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |  |  |  | > 110 mm |
| Baltistan - OB Trawler-Baltistan - Large - East Baltic - <110mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |  |  | East | < 110 mm |
| Baltistan - OB Trawler-Baltistan - Large - East Baltic - >110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |  |  |  | > 110 mm |
| Baltistan - OB Trawler-Baltistan - Large - Not Baltic - <110mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |  |  | Not Baltic | < 110 mm |
| Baltistan - OB Trawler-Baltistan - Large - Not Baltic - >110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |  |  |  | > 110 mm |
| Baltistan - OB Trawler-Baltistan - Large - Bornholm - <110mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |  |  | Bornholm | < 110 mm |
| Baltistan - OB Trawler-Baltistan - Large - Bornholm - >110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |  |  |  | > 110 mm |
| Baltistan - OB Trawler-Baltistan - Large - Gotland - <110mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |  |  | Gotland | < 110 mm |
| Baltistan - OB Trawler-Baltistan - Large - Gotland - >110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |  |  |  | > 110 mm |
| Baltistan - Gillnett-Baltistan - Small - West Baltic - <110mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |  | Small | West | < 110 mm |
| Baltistan - Gillnett-Baltistan - Small - West Baltic - >110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |  |  |  | > 110 mm |
| Baltistan - Gillnett-Baltistan - Small - East Baltic - <110mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |  |  | East | < 110 mm |
| Baltistan - Gillnett-Baltistan - Small - East Baltic - >110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |  |  |  | > 110 mm |
| Baltistan - Gillnett-Baltistan - Small - Not Baltic - <110mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |  |  | Not Baltic | < 110 mm |
| Baltistan - Gillnett-Baltistan - Small - Not Baltic - >110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |  |  |  | > 110 mm |
| Baltistan - Gillnett-Baltistan - Small - Bornholm - <110mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |  |  | Bornholm | < 110 mm |
| Baltistan - Gillnett-Baltistan - Small - Bornholm - >110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |  |  |  | > 110 mm |
| Baltistan - Gillnett-Baltistan - Small - Gotland - <110mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |  |  | Gotland | < 110 mm |
| Baltistan - Gillnett-Baltistan - Small - Gotland - >110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |  |  |  | > 110 mm |
| Baltistan - Gillnett-Baltistan - Medium - West Baltic - <110mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |  |  | West | < 110 mm |
| Baltistan - Gillnett-Baltistan - Medium - West Baltic - >110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |  |  |  | > 110 mm |
| Baltistan - Gillnett-Baltistan - Medium - East Baltic - <110mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |  |  |  | < 110 mm |

*Figure 2.7.5.b.* ***Effort distribution on riggings (after distribution on areas) with focus on the structure of EXCEL Table 4.4. The table shown here represents about 40% of EXCEL Table 4.4.***

Figure 2.7.5.a and b shows the effort distribution on riggings (after distribution on areas). In this case there are only two riggings “>110mm” and “>110mm”. There fore each of the two cells for given (Country, Fleet, Vessel Size, Area) sum up to 1.0. E.g. cells B170 and B171 sum up to 1.0.

Figure 2.7.5.a. shows only a minor part of EXCEL Table 4.4. Figure 2.7.5.b shows a larger part, but not all of EXCEL Table 4.4. Figure 2.7.5.b shows some 40% of EXCEL Table 4.4, which is considered enough to reveal the table structure.

Figure 2.7.6 (EXCEL Table 4.5) shows the resulting effort after multiplication with the distribution on riggings.

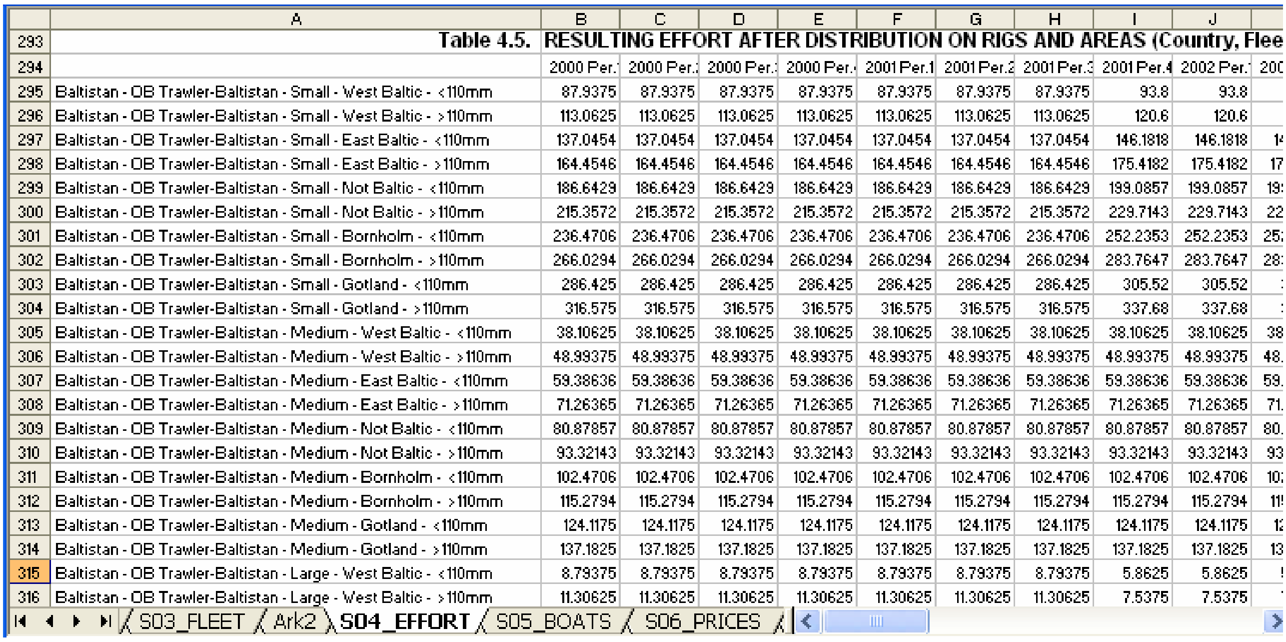
$$E(Fl,Vs,Rg,Ct,y,q,Ar) = E_{REF}(Fl,Vs,\bullet,Ct,y,q,\bullet)*$$

$$E_{Area-dist}(Fl,Vs,\bullet,Ct,y,q,Ar)*E_{Rig-Dist}(Fl,Vs,Rg,Ct,y,q,Ar)$$

Assessing the effect of changing effort by fleet, rigging, area and season is the key-exercise of TEMAS. Therefore, a “multiplier” (“$X_E$”) to facilitate the manipulation of effort has been introduced. Actual effort used in the simulation is thus defined as the product of a “Reference-effort”, $E_{Ref}(Fl, y, q, Ar)$, and the multipliers ($X_E$):

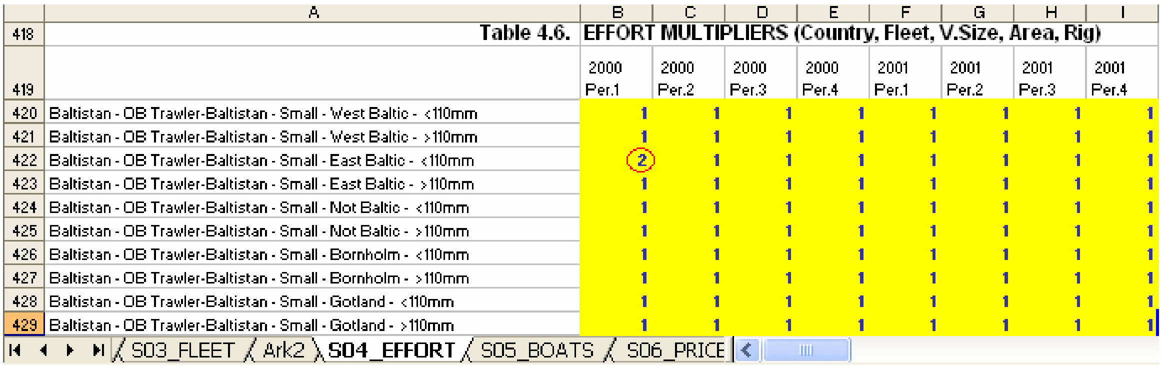
$$E(Fl,Vs,Rg,Ct,y,q,Ar) = E_{Re\,f}(Fl,Vs,Rg,Ct,y,q,Ar)*X_E(Fl,Vs,Rg,Ct,y,q,Ar)$$

Using only multipliers less than or equal to one will guarantee that the effort never will exceed the physical upper limit of possible number of sea days.



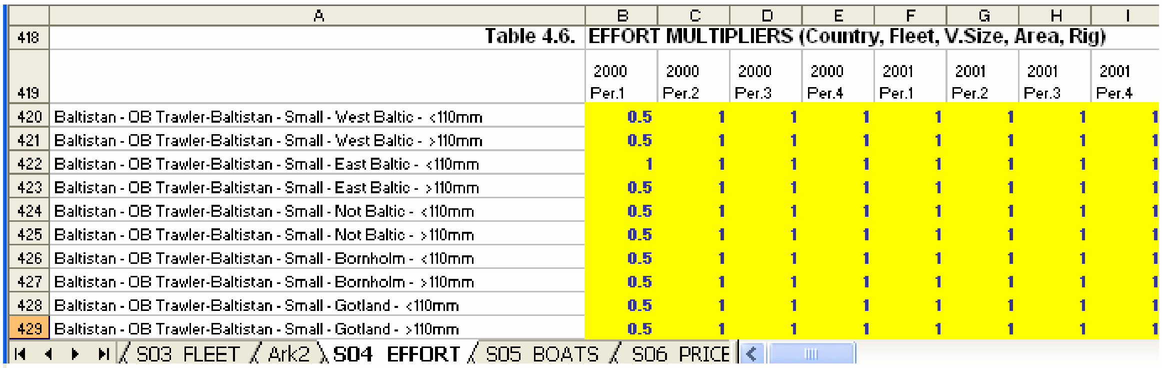
| | A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|---|
| 293 | Table 4.5. | RESULTING EFFORT AFTER DISTRIBUTION ON RIGS AND AREAS (Country, Flee | | | | | | | | |
| 294 | | 2000 Per. | 2000 Per. | 2000 Per. | 2000 Per. | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 2002 Per. |
| 295 | Baltistan - OB Trawler-Baltistan - Small - West Baltic - <110mm | 87.9375 | 87.9375 | 87.9375 | 87.9375 | 87.9375 | 87.9375 | 87.9375 | 93.8 | 93.8 |
| 296 | Baltistan - OB Trawler-Baltistan - Small - West Baltic - >110mm | 113.0625 | 113.0625 | 113.0625 | 113.0625 | 113.0625 | 113.0625 | 113.0625 | 120.6 | 120.6 |
| 297 | Baltistan - OB Trawler-Baltistan - Small - East Baltic - <110mm | 137.0454 | 137.0454 | 137.0454 | 137.0454 | 137.0454 | 137.0454 | 137.0454 | 146.1818 | 146.1818 |
| 298 | Baltistan - OB Trawler-Baltistan - Small - East Baltic - >110mm | 164.4546 | 164.4546 | 164.4546 | 164.4546 | 164.4546 | 164.4546 | 164.4546 | 175.4182 | 175.4182 |
| 299 | Baltistan - OB Trawler-Baltistan - Small - Not Baltic - <110mm | 186.6429 | 186.6429 | 186.6429 | 186.6429 | 186.6429 | 186.6429 | 186.6429 | 199.0857 | 199.0857 |
| 300 | Baltistan - OB Trawler-Baltistan - Small - Not Baltic - >110mm | 215.3572 | 215.3572 | 215.3572 | 215.3572 | 215.3572 | 215.3572 | 215.3572 | 229.7143 | 229.7143 |
| 301 | Baltistan - OB Trawler-Baltistan - Small - Bornholm - <110mm | 236.4706 | 236.4706 | 236.4706 | 236.4706 | 236.4706 | 236.4706 | 236.4706 | 252.2353 | 252.2353 |
| 302 | Baltistan - OB Trawler-Baltistan - Small - Bornholm - >110mm | 266.0294 | 266.0294 | 266.0294 | 266.0294 | 266.0294 | 266.0294 | 266.0294 | 283.7647 | 283.7647 |
| 303 | Baltistan - OB Trawler-Baltistan - Small - Gotland - <110mm | 286.425 | 286.425 | 286.425 | 286.425 | 286.425 | 286.425 | 286.425 | 305.52 | 305.52 |
| 304 | Baltistan - OB Trawler-Baltistan - Small - Gotland - >110mm | 316.575 | 316.575 | 316.575 | 316.575 | 316.575 | 316.575 | 316.575 | 337.68 | 337.68 |
| 305 | Baltistan - OB Trawler-Baltistan - Medium - West Baltic - <110mm | 38.10625 | 38.10625 | 38.10625 | 38.10625 | 38.10625 | 38.10625 | 38.10625 | 38.10625 | 38.10625 |
| 306 | Baltistan - OB Trawler-Baltistan - Medium - West Baltic - >110mm | 48.99375 | 48.99375 | 48.99375 | 48.99375 | 48.99375 | 48.99375 | 48.99375 | 48.99375 | 48.99375 |
| 307 | Baltistan - OB Trawler-Baltistan - Medium - East Baltic - <110mm | 59.38636 | 59.38636 | 59.38636 | 59.38636 | 59.38636 | 59.38636 | 59.38636 | 59.38636 | 59.38636 |
| 308 | Baltistan - OB Trawler-Baltistan - Medium - East Baltic - >110mm | 71.26365 | 71.26365 | 71.26365 | 71.26365 | 71.26365 | 71.26365 | 71.26365 | 71.26365 | 71.26365 |
| 309 | Baltistan - OB Trawler-Baltistan - Medium - Not Baltic - <110mm | 80.87857 | 80.87857 | 80.87857 | 80.87857 | 80.87857 | 80.87857 | 80.87857 | 80.87857 | 80.87857 |
| 310 | Baltistan - OB Trawler-Baltistan - Medium - Not Baltic - >110mm | 93.32143 | 93.32143 | 93.32143 | 93.32143 | 93.32143 | 93.32143 | 93.32143 | 93.32143 | 93.32143 |
| 311 | Baltistan - OB Trawler-Baltistan - Medium - Bornholm - <110mm | 102.4706 | 102.4706 | 102.4706 | 102.4706 | 102.4706 | 102.4706 | 102.4706 | 102.4706 | 102.4706 |
| 312 | Baltistan - OB Trawler-Baltistan - Medium - Bornholm - >110mm | 115.2794 | 115.2794 | 115.2794 | 115.2794 | 115.2794 | 115.2794 | 115.2794 | 115.2794 | 115.2794 |
| 313 | Baltistan - OB Trawler-Baltistan - Medium - Gotland - <110mm | 124.1175 | 124.1175 | 124.1175 | 124.1175 | 124.1175 | 124.1175 | 124.1175 | 124.1175 | 124.1175 |
| 314 | Baltistan - OB Trawler-Baltistan - Medium - Gotland - >110mm | 137.1825 | 137.1825 | 137.1825 | 137.1825 | 137.1825 | 137.1825 | 137.1825 | 137.1825 | 137.1825 |
| 315 | Baltistan - OB Trawler-Baltistan - Large - West Baltic - <110mm | 8.79375 | 8.79375 | 8.79375 | 8.79375 | 8.79375 | 8.79375 | 8.79375 | 5.8625 | 5.8625 |
| 316 | Baltistan - OB Trawler-Baltistan - Large - West Baltic - >110mm | 11.30625 | 11.30625 | 11.30625 | 11.30625 | 11.30625 | 11.30625 | 11.30625 | 7.5375 | 7.5375 |

**Figure 2.7.6. Resulting effort distribution on riggings and areas. Explanation below EXCEL table: Calculated from the effort by area by: Ref.Effort(Ct,Fl,Vs,Ar,Rig) = Rig_Distribution(Ct,Fl,Vs,Area,Rig) *Ref.Effort(Ct,Fl,Vs,Ar)**



| | A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|---|
| 418 | Table 4.6. | EFFORT MULTIPLIERS (Country, Fleet, V.Size, Area, Rig) | | | | | | | |
| 419 | | 2000 Per.1 | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 |
| 420 | Baltistan - OB Trawler-Baltistan - Small - West Baltic - <110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 421 | Baltistan - OB Trawler-Baltistan - Small - West Baltic - >110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 422 | Baltistan - OB Trawler-Baltistan - Small - East Baltic - <110mm | ② | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 423 | Baltistan - OB Trawler-Baltistan - Small - East Baltic - >110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 424 | Baltistan - OB Trawler-Baltistan - Small - Not Baltic - <110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 425 | Baltistan - OB Trawler-Baltistan - Small - Not Baltic - >110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 426 | Baltistan - OB Trawler-Baltistan - Small - Bornholm - <110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 427 | Baltistan - OB Trawler-Baltistan - Small - Bornholm - >110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 428 | Baltistan - OB Trawler-Baltistan - Small - Gotland - <110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 429 | Baltistan - OB Trawler-Baltistan - Small - Gotland - >110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

**A**

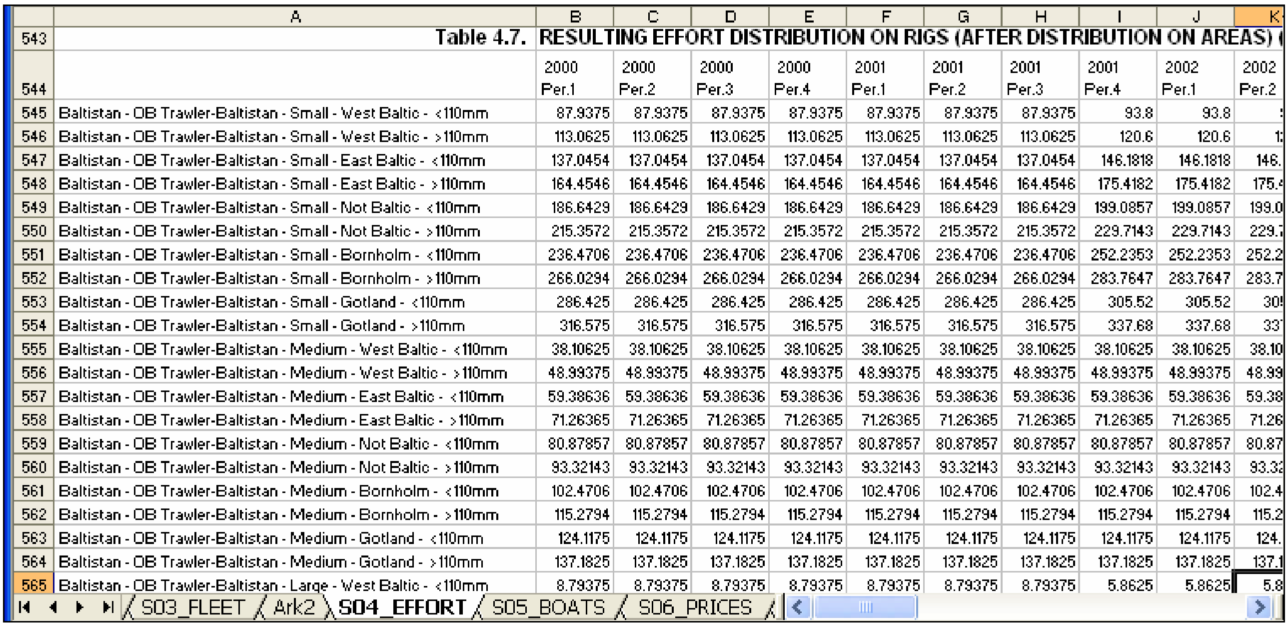


| | A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|---|
| 418 | Table 4.6. | EFFORT MULTIPLIERS (Country, Fleet, V.Size, Area, Rig) | | | | | | | |
| 419 | | 2000 Per.1 | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 |
| 420 | Baltistan - OB Trawler-Baltistan - Small - West Baltic - <110mm | 0.5 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 421 | Baltistan - OB Trawler-Baltistan - Small - West Baltic - >110mm | 0.5 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 422 | Baltistan - OB Trawler-Baltistan - Small - East Baltic - <110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 423 | Baltistan - OB Trawler-Baltistan - Small - East Baltic - >110mm | 0.5 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 424 | Baltistan - OB Trawler-Baltistan - Small - Not Baltic - <110mm | 0.5 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 425 | Baltistan - OB Trawler-Baltistan - Small - Not Baltic - >110mm | 0.5 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 426 | Baltistan - OB Trawler-Baltistan - Small - Bornholm - <110mm | 0.5 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 427 | Baltistan - OB Trawler-Baltistan - Small - Bornholm - >110mm | 0.5 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 428 | Baltistan - OB Trawler-Baltistan - Small - Gotland - <110mm | 0.5 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 429 | Baltistan - OB Trawler-Baltistan - Small - Gotland - >110mm | 0.5 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

**B**

**Figure 2.7.7. Effort multipliers. A: Before clicking on "Read effort from sheet",  B: After clicking on "Read effort from sheet". Explanation below EXCEL table: Effort Mults by Country, Fleet, V.Size, Area and Rig, by which you can change effort  Effort(Ct,Fl,Vs,Ar,Rig)= Mult(Ct,Fl,Vs,Ar,Rig) * Ref.Effort(Ct,Fl,Vs,Ar,Rig). NOTE That 0 <= Mult <= 1**

Figure 2.7.7 (EXCEL Table 4.6) contains effort multipliers. In this case they have all got the maximum value of 1 except for cell B422, which has got value 2 (Figure A). Figure B shows the results after clicking on "read effort from sheet". The program will normalize the multipliers within the period in question, so that the maximum value becomes one. Any multiplier value above 1 is absurd, as the multiplier is applied to the maximum possible effort.



| | A | B | C | D | E | F | G | H | I | J | K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 543 | **Table 4.7.** | **RESULTING EFFORT DISTRIBUTION ON RIGS (AFTER DISTRIBUTION ON AREAS) (** | | | | | | | | | |
| 544 | | 2000<br>Per.1 | 2000<br>Per.2 | 2000<br>Per.3 | 2000<br>Per.4 | 2001<br>Per.1 | 2001<br>Per.2 | 2001<br>Per.3 | 2001<br>Per.4 | 2002<br>Per.1 | 2002<br>Per.2 |
| 545 | Baltistan - OB Trawler-Baltistan - Small - West Baltic - <110mm | 87.9375 | 87.9375 | 87.9375 | 87.9375 | 87.9375 | 87.9375 | 87.9375 | 93.8 | 93.8 | |
| 546 | Baltistan - OB Trawler-Baltistan - Small - West Baltic - >110mm | 113.0625 | 113.0625 | 113.0625 | 113.0625 | 113.0625 | 113.0625 | 113.0625 | 120.6 | 120.6 | 1 |
| 547 | Baltistan - OB Trawler-Baltistan - Small - East Baltic - <110mm | 137.0454 | 137.0454 | 137.0454 | 137.0454 | 137.0454 | 137.0454 | 137.0454 | 146.1818 | 146.1818 | 146. |
| 548 | Baltistan - OB Trawler-Baltistan - Small - East Baltic - >110mm | 164.4546 | 164.4546 | 164.4546 | 164.4546 | 164.4546 | 164.4546 | 164.4546 | 175.4182 | 175.4182 | 175. |
| 549 | Baltistan - OB Trawler-Baltistan - Small - Not Baltic - <110mm | 186.6429 | 186.6429 | 186.6429 | 186.6429 | 186.6429 | 186.6429 | 186.6429 | 199.0857 | 199.0857 | 199.0 |
| 550 | Baltistan - OB Trawler-Baltistan - Small - Not Baltic - >110mm | 215.3572 | 215.3572 | 215.3572 | 215.3572 | 215.3572 | 215.3572 | 215.3572 | 229.7143 | 229.7143 | 229. |
| 551 | Baltistan - OB Trawler-Baltistan - Small - Bornholm - <110mm | 236.4706 | 236.4706 | 236.4706 | 236.4706 | 236.4706 | 236.4706 | 236.4706 | 252.2353 | 252.2353 | 252.2 |
| 552 | Baltistan - OB Trawler-Baltistan - Small - Bornholm - >110mm | 266.0294 | 266.0294 | 266.0294 | 266.0294 | 266.0294 | 266.0294 | 266.0294 | 283.7647 | 283.7647 | 283.7 |
| 553 | Baltistan - OB Trawler-Baltistan - Small - Gotland - <110mm | 286.425 | 286.425 | 286.425 | 286.425 | 286.425 | 286.425 | 286.425 | 305.52 | 305.52 | 30 |
| 554 | Baltistan - OB Trawler-Baltistan - Small - Gotland - >110mm | 316.575 | 316.575 | 316.575 | 316.575 | 316.575 | 316.575 | 316.575 | 337.68 | 337.68 | 33 |
| 555 | Baltistan - OB Trawler-Baltistan - Medium - West Baltic - <110mm | 38.10625 | 38.10625 | 38.10625 | 38.10625 | 38.10625 | 38.10625 | 38.10625 | 38.10625 | 38.10625 | 38.10 |
| 556 | Baltistan - OB Trawler-Baltistan - Medium - West Baltic - >110mm | 48.99375 | 48.99375 | 48.99375 | 48.99375 | 48.99375 | 48.99375 | 48.99375 | 48.99375 | 48.99375 | 48.99 |
| 557 | Baltistan - OB Trawler-Baltistan - Medium - East Baltic - <110mm | 59.38636 | 59.38636 | 59.38636 | 59.38636 | 59.38636 | 59.38636 | 59.38636 | 59.38636 | 59.38636 | 59.38 |
| 558 | Baltistan - OB Trawler-Baltistan - Medium - East Baltic - >110mm | 71.26365 | 71.26365 | 71.26365 | 71.26365 | 71.26365 | 71.26365 | 71.26365 | 71.26365 | 71.26365 | 71.26 |
| 559 | Baltistan - OB Trawler-Baltistan - Medium - Not Baltic - <110mm | 80.87857 | 80.87857 | 80.87857 | 80.87857 | 80.87857 | 80.87857 | 80.87857 | 80.87857 | 80.87857 | 80.87 |
| 560 | Baltistan - OB Trawler-Baltistan - Medium - Not Baltic - >110mm | 93.32143 | 93.32143 | 93.32143 | 93.32143 | 93.32143 | 93.32143 | 93.32143 | 93.32143 | 93.32143 | 93.3 |
| 561 | Baltistan - OB Trawler-Baltistan - Medium - Bornholm - <110mm | 102.4706 | 102.4706 | 102.4706 | 102.4706 | 102.4706 | 102.4706 | 102.4706 | 102.4706 | 102.4706 | 102.4 |
| 562 | Baltistan - OB Trawler-Baltistan - Medium - Bornholm - >110mm | 115.2794 | 115.2794 | 115.2794 | 115.2794 | 115.2794 | 115.2794 | 115.2794 | 115.2794 | 115.2794 | 115.2 |
| 563 | Baltistan - OB Trawler-Baltistan - Medium - Gotland - <110mm | 124.1175 | 124.1175 | 124.1175 | 124.1175 | 124.1175 | 124.1175 | 124.1175 | 124.1175 | 124.1175 | 124. |
| 564 | Baltistan - OB Trawler-Baltistan - Medium - Gotland - >110mm | 137.1825 | 137.1825 | 137.1825 | 137.1825 | 137.1825 | 137.1825 | 137.1825 | 137.1825 | 137.1825 | 137.1 |
| 565 | Baltistan - OB Trawler-Baltistan - Large - West Baltic - <110mm | 8.79375 | 8.79375 | 8.79375 | 8.79375 | 8.79375 | 8.79375 | 8.79375 | 5.8625 | 5.8625 | 5.8 |

***Figure 2.7.8. Resulting effort after application of effort multipliers. Explanation below EXCEL table: Calculated by:***

***Effort(Ct,Fl,Vs,Ar,Rig)= Mult(Ct,Fl,Vs,Ar,Rig) * Ref.Effort(Ct,Fl,Vs,Ar,Rig)***

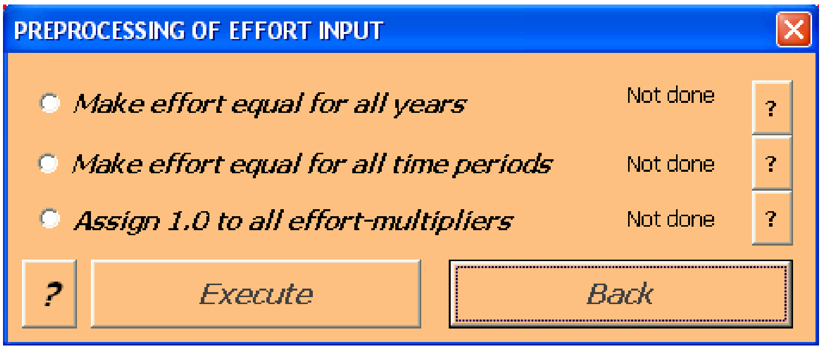
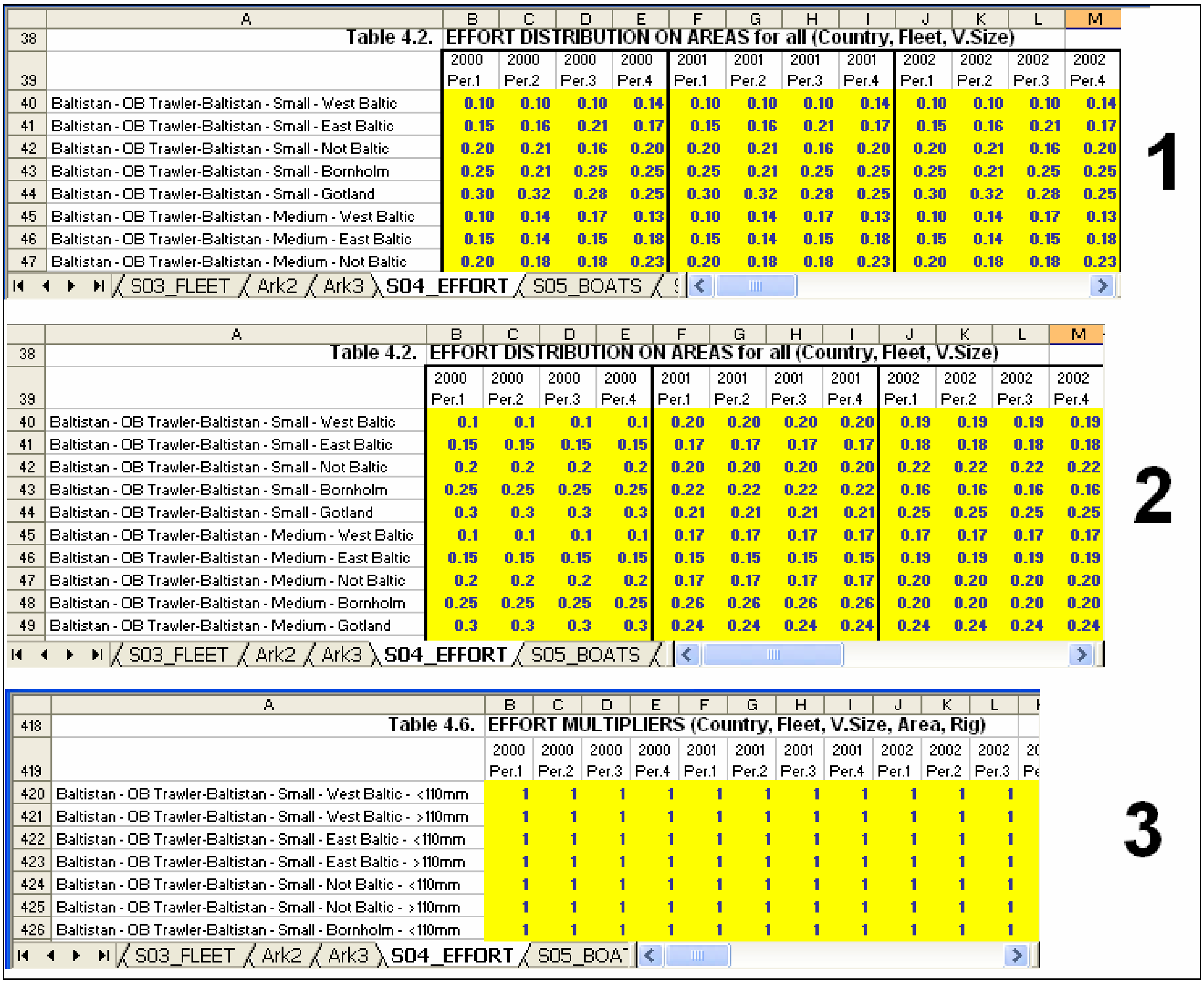


***Figure 2.7.9.a. Options for pre-processing of effort data and parameters.***

Figure 2.7.9.a shows the user form for pre-processing of effort input. Figure 2.7.9.b shows examples of the three options for pre-processing. Option 1 makes the data equal from year to year, but allow for variations between periods. Option 2 makes data equal for all periods, but allow for variations between years. Option 3 makes the multipliers equal and 1.0 for all periods and years.



| | A | B | C | D | E | F | G | H | I | J | K | L | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 38 | Table 4.2. | EFFORT DISTRIBUTION ON AREAS for all (Country, Fleet, V.Size) | | | | | | | | | | | |
| 39 | | 2000 Per.1 | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 2002 Per.1 | 2002 Per.2 | 2002 Per.3 | 2002 Per.4 |
| 40 | Baltistan - OB Trawler-Baltistan - Small - West Baltic | 0.10 | 0.10 | 0.10 | 0.14 | 0.10 | 0.10 | 0.10 | 0.14 | 0.10 | 0.10 | 0.10 | 0.14 |
| 41 | Baltistan - OB Trawler-Baltistan - Small - East Baltic | 0.15 | 0.16 | 0.21 | 0.17 | 0.15 | 0.16 | 0.21 | 0.17 | 0.15 | 0.16 | 0.21 | 0.17 |
| 42 | Baltistan - OB Trawler-Baltistan - Small - Not Baltic | 0.20 | 0.21 | 0.16 | 0.20 | 0.20 | 0.21 | 0.16 | 0.20 | 0.20 | 0.21 | 0.16 | 0.20 |
| 43 | Baltistan - OB Trawler-Baltistan - Small - Bornholm | 0.25 | 0.21 | 0.25 | 0.25 | 0.25 | 0.21 | 0.25 | 0.25 | 0.25 | 0.21 | 0.25 | 0.25 |
| 44 | Baltistan - OB Trawler-Baltistan - Small - Gotland | 0.30 | 0.32 | 0.28 | 0.25 | 0.30 | 0.32 | 0.28 | 0.25 | 0.30 | 0.32 | 0.28 | 0.25 |
| 45 | Baltistan - OB Trawler-Baltistan - Medium - West Baltic | 0.10 | 0.14 | 0.17 | 0.13 | 0.10 | 0.14 | 0.17 | 0.13 | 0.10 | 0.14 | 0.17 | 0.13 |
| 46 | Baltistan - OB Trawler-Baltistan - Medium - East Baltic | 0.15 | 0.14 | 0.15 | 0.18 | 0.15 | 0.14 | 0.15 | 0.18 | 0.15 | 0.14 | 0.15 | 0.18 |
| 47 | Baltistan - OB Trawler-Baltistan - Medium - Not Baltic | 0.20 | 0.18 | 0.18 | 0.23 | 0.20 | 0.18 | 0.18 | 0.23 | 0.20 | 0.18 | 0.18 | 0.23 |

| | A | B | C | D | E | F | G | H | I | J | K | L | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 38 | Table 4.2. | EFFORT DISTRIBUTION ON AREAS for all (Country, Fleet, V.Size) | | | | | | | | | | | |
| 39 | | 2000 Per.1 | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 2002 Per.1 | 2002 Per.2 | 2002 Per.3 | 2002 Per.4 |
| 40 | Baltistan - OB Trawler-Baltistan - Small - West Baltic | 0.1 | 0.1 | 0.1 | 0.1 | 0.20 | 0.20 | 0.20 | 0.20 | 0.19 | 0.19 | 0.19 | 0.19 |
| 41 | Baltistan - OB Trawler-Baltistan - Small - East Baltic | 0.15 | 0.15 | 0.15 | 0.15 | 0.17 | 0.17 | 0.17 | 0.17 | 0.18 | 0.18 | 0.18 | 0.18 |
| 42 | Baltistan - OB Trawler-Baltistan - Small - Not Baltic | 0.2 | 0.2 | 0.2 | 0.2 | 0.20 | 0.20 | 0.20 | 0.20 | 0.22 | 0.22 | 0.22 | 0.22 |
| 43 | Baltistan - OB Trawler-Baltistan - Small - Bornholm | 0.25 | 0.25 | 0.25 | 0.25 | 0.22 | 0.22 | 0.22 | 0.22 | 0.16 | 0.16 | 0.16 | 0.16 |
| 44 | Baltistan - OB Trawler-Baltistan - Small - Gotland | 0.3 | 0.3 | 0.3 | 0.3 | 0.21 | 0.21 | 0.21 | 0.21 | 0.25 | 0.25 | 0.25 | 0.25 |
| 45 | Baltistan - OB Trawler-Baltistan - Medium - West Baltic | 0.1 | 0.1 | 0.1 | 0.1 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 |
| 46 | Baltistan - OB Trawler-Baltistan - Medium - East Baltic | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.19 | 0.19 | 0.19 | 0.19 |
| 47 | Baltistan - OB Trawler-Baltistan - Medium - Not Baltic | 0.2 | 0.2 | 0.2 | 0.2 | 0.17 | 0.17 | 0.17 | 0.17 | 0.20 | 0.20 | 0.20 | 0.20 |
| 48 | Baltistan - OB Trawler-Baltistan - Medium - Bornholm | 0.25 | 0.25 | 0.25 | 0.25 | 0.26 | 0.26 | 0.26 | 0.26 | 0.20 | 0.20 | 0.20 | 0.20 |
| 49 | Baltistan - OB Trawler-Baltistan - Medium - Gotland | 0.3 | 0.3 | 0.3 | 0.3 | 0.24 | 0.24 | 0.24 | 0.24 | 0.24 | 0.24 | 0.24 | 0.24 |

| | A | B | C | D | E | F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 418 | Table 4.6. | EFFORT MULTIPLIERS (Country, Fleet, V.Size, Area, Rig) | | | | | | | | | | |
| 419 | | 2000 Per.1 | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 2002 Per.1 | 2002 Per.2 | 2002 Per.3 |
| 420 | Baltistan - OB Trawler-Baltistan - Small - West Baltic - <110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 421 | Baltistan - OB Trawler-Baltistan - Small - West Baltic - >110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 422 | Baltistan - OB Trawler-Baltistan - Small - East Baltic - <110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 423 | Baltistan - OB Trawler-Baltistan - Small - East Baltic - >110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 424 | Baltistan - OB Trawler-Baltistan - Small - Not Baltic - <110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 425 | Baltistan - OB Trawler-Baltistan - Small - Not Baltic - >110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 426 | Baltistan - OB Trawler-Baltistan - Small - Bornholm - <110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

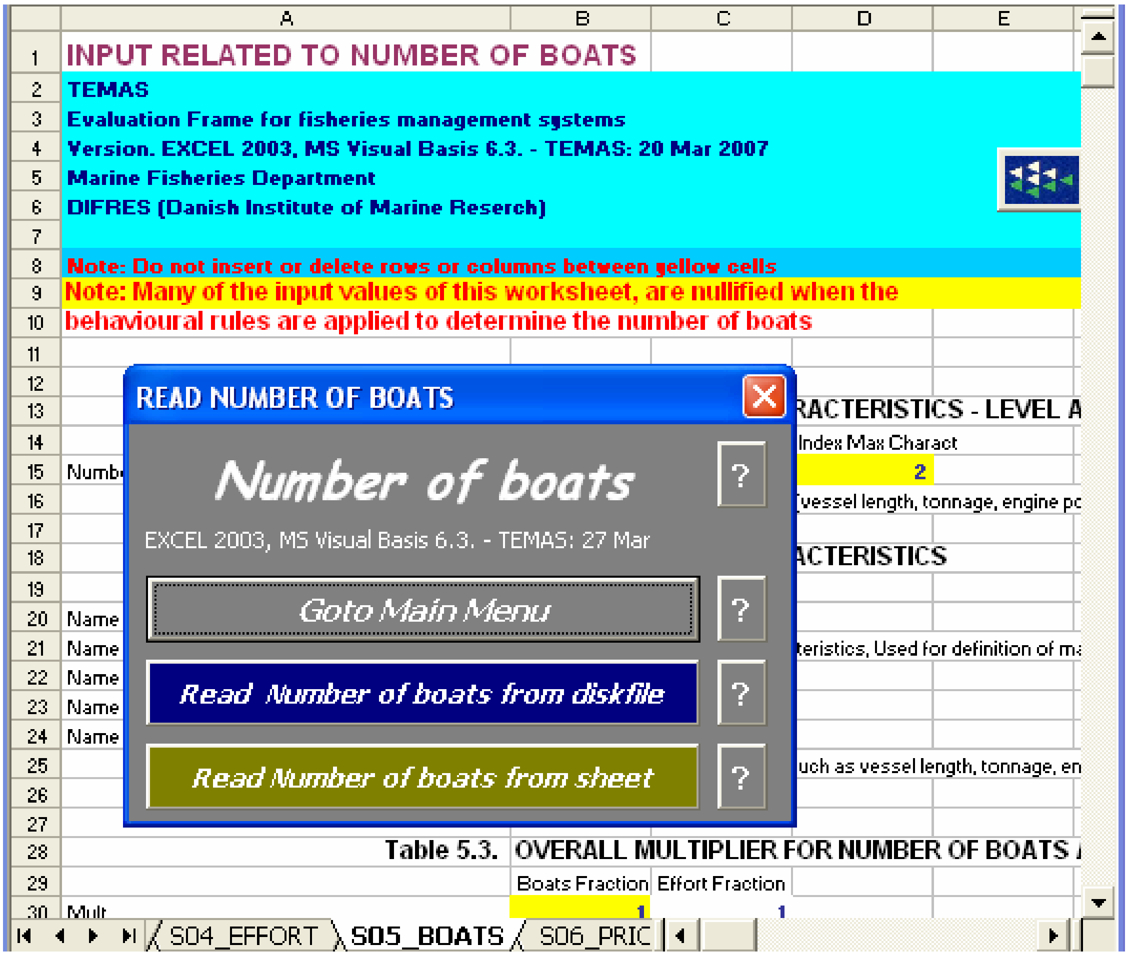
***Figure 2.7.9.b. Examples of applications of options for pre-processing of effort data and parameters (compare figure 2.7.9.b). (1) Make effort equal for all years (2) Make effort equal for all periods (3)Assign 1 to all effort multipliers.***

## 2.8. BOATS INPUT, S05_BOATS

Figure 2.8.1 shows the user form for entry of boats (or number of vessel) input data in worksheet S05_BOATS.

Table 2.8.1.a shows a list of the EXCEL tables in worksheet B05_BOATS used in the present demonstration example. Worksheet S05_BOATS offers a suite of options for definition of the so-called “fleet characteristics”, and if an option is not utilized, the table is not deleted, but displayed as a “blue template” filled in vith “no value”. This is done to facilitate the comprehension of data data structure. Table 2.8.1.b lists the tables of “fleet characteristics” that are deselected in the present demonstration example.

Note that except for the three first EXCEL tables, all EXCEL tables are country specific.



INPUT RELATED TO NUMBER OF BOATS

TEMAS

Evaluation Frame for fisheries management systems

Version. EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 20 Mar 2007

Marine Fisheries Department

DIFRES (Danish Institute of Marine Reserch)

Note: Do not insert or delete rows or columns between yellow cells

Note: Many of the input values of this worksheet, are nullified when the behavioural rules are applied to determine the number of boats

READ NUMBER OF BOATS

Number of boats

EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 27 Mar

*Figure 2.8.1. Userform for entry of boat-related data and parameters.*

| Index | EXCEL Table | Caption |
|---|---|---|
| 72 | Table5.1. | NUMBER OF FLEET CHARACTERISTICS - LEVEL AND INDEX OF MAX TOTAL CHARACTERISTICS |
| 73 | Table5.2. | NAMES OF FLEET CHARACTERISTICS |
| 74 | Table5.3. | OVERALL MULTIPLIER FOR NUMBER OF BOATS AND EFFORT |
| 75 | Table5.4.1. | Baltistan : INITIAL VESSEL AGE DISTRIBUTION AND INVESTMENTS (NEW VESSELS) |
| 76 | Table5.4.2. | Baltistan : NUMBER OF NEW BOATS MultS |
| 77 | Table5.4.3. | Baltistan : CREW PER VESSEL |
| 78 | Table5.4.4. | Baltistan : MAX DAYS/PERIOD |
| 79 | Table5.4.5. | Baltistan : NUMBER OF DIS-INVESTMENT (WITHDRAWAL) VESSELS |
| 80 | Table5.4.6. | Baltistan : NUMBER OF ATTRITION VESSELS |
| 81 | Table5.4.7. | Baltistan : NUMBER OF DECOMMISIONED VESSELS |
| 82 | Table5.4.8. | Baltistan : RESULTING VESSEL AGE DISTRIBUTION |
| 83 | Table5.4.9. | Baltistan : RESULTING NUMBER OF DECOMMISIONED VESSELS |
| 84 | Table5.4.10. | Baltistan : NUMBER OF VESSESLS (SUMMARY) |
| 85 | Table5.4.11. | Scandinavia : INITIAL VESSEL AGE DISTRIBUTION AND INVESTMENTS (NEW VESSELS) |
| 86 | Table5.4.12. | Scandinavia : NUMBER OF NEW BOATS MultS |
| 87 | Table5.4.13. | Scandinavia : CREW PER VESSEL |
| 88 | Table5.4.14. | Scandinavia : MAX DAYS/PERIOD |
| 89 | Table5.4.15. | Scandinavia : NUMBER OF DIS-INVESTMENT (WITHDRAWAL) VESSELS |
| 90 | Table5.4.16. | Scandinavia : NUMBER OF ATTRITION VESSELS |
| 91 | Table5.4.17. | Scandinavia : NUMBER OF DECOMMISIONED VESSELS |
| 92 | Table5.4.18. | Scandinavia : RESULTING VESSEL AGE DISTRIBUTION |
| 93 | Table5.4.19. | Scandinavia : RESULTING NUMBER OF DECOMMISIONED VESSELS |
| 94 | Table5.4.20. | Scandinavia : NUMBER OF VESSESLS (SUMMARY) |
| 95 | Table5.5.1. | Baltistan : FLEET CHARACTERISTICS: Length |
| 96 | Table5.5.2. | Baltistan : (START NUMBER OF VESSELS)* (FLEET CHARACTERISTICS): Length |
| 100 | Table5.5.6. | Baltistan : FLEET CHARACTERISTICS: Tonnage |

| | | |
|---|---|---|
| 101 | Table5.5.7. | Baltistan : (START NUMBER OF VESSELS)* (FLEET CHARACTERISTICS): Tonnage |
| 102 | Table5.5.8. | Baltistan : MAXIMUM TOTAL ALLOWED FLEET CHARACTERISTICS (BY COUNTRY): Tonnage |
| 105 | Table5.5.11. | Baltistan : FLEET CHARACTERISTICS: KgWat |
| 106 | Table5.5.12. | Baltistan : (START NUMBER OF VESSELS)* (FLEET CHARACTERISTICS): KgWat |
| 120 | Table5.5.26. | Scandinavia : FLEET CHARACTERISTICS: Length |
| 121 | Table5.5.27. | Scandinavia : (START NUMBER OF VESSELS)* (FLEET CHARACTERISTICS): Length |
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| 126 | Table5.5.32. | Scandinavia : (START NUMBER OF VESSELS)* (FLEET CHARACTERISTICS): Tonnage |
| 127 | Table5.5.33. | Scandinavia : MAXIMUM TOTAL ALLOWED FLEET CHARACTERISTICS (BY CTRY): Tonnage |
| 130 | Table5.5.36. | Scandinavia : FLEET CHARACTERISTICS: KgWat |
| 131 | Table5.5.37. | Scandinavia : (START NUMBER OF VESSELS)* (FLEET CHARACTERISTICS): KgWat |

***Table 2.8.1.a. Tables in the boats input sheet, which are actually used, S05_BOATS.***

| Index | EXCEL Table | Caption |
|---|---|---|
| *97* | *Table5.5.3.* | *Baltistan : MAXIMUM TOTAL ALLOWED FLEET CHARACTERISTICS (BY COUNTRY): Length - Not Used* |
| *98* | *Table5.5.4.* | *Baltistan : MAXIMUM TOTAL ALLOWED FLEET CHARACTERISTICS (BY COUNTRY AND FLEET): Length - Not Used* |
| *99* | *Table5.5.5.* | *Baltistan : MAXIMUM TOTAL ALLOWED FLEET CHARACTERISTICS (BY COUNTRY, FLEET AND VESSEL SIZE): Length - Not Used* |
| *103* | *Table5.5.9.* | *Baltistan : MAXIMUM TOTAL ALLOWED FLEET CHARACTERISTICS (BY COUNTRY AND FLEET): Tonnage - Not Used* |
| *104* | *Table5.5.10.* | *Baltistan : MAXIMUM TOTAL ALLOWED FLEET CHARACTERISTICS (BY COUNTRY, FLEET AND VESSEL SIZE): Tonnage - Not Used* |
| *107* | *Table5.5.13.* | *Baltistan : MAXIMUM TOTAL ALLOWED FLEET CHARACTERISTICS (BY COUNTRY): KgWat - Not Used* |
| *108* | *Table5.5.14.* | *Baltistan : MAXIMUM TOTAL ALLOWED FLEET CHARACTERISTICS (BY COUNTRY AND FLEET): KgWat - Not Used* |
| *109* | *Table5.5.15.* | *Baltistan : MAXIMUM TOTAL ALLOWED FLEET CHARACTERISTICS (BY COUNTRY, FLEET AND VESSEL SIZE): KgWat - Not Used* |
| *110* | *Table5.5.16.* | *Baltistan : FLEET CHARACTERISTICS: Not Used* |
| *111* | *Table5.5.17.* | *Baltistan : (START NUMBER OF VESSELS)* (FLEET CHARACTERISTICS): Not Used* |
| *112* | *Table5.5.18.* | *Baltistan : MAXIMUM TOTAL ALLOWED FLEET CHARACTERISTICS (BY COUNTRY): Not Used - Not Used* |
| *113* | *Table5.5.19.* | *Baltistan : MAXIMUM TOTAL ALLOWED FLEET CHARACTERISTICS (BY COUNTRY AND FLEET): Not Used - Not Used* |
| *114* | *Table5.5.20.* | *Baltistan : MAXIMUM TOTAL ALLOWED FLEET CHARACTERISTICS (BY COUNTRY, FLEET AND VESSEL SIZE): Not Used - Not Used* |
| *115* | *Table5.5.21.* | *Baltistan : FLEET CHARACTERISTICS: Not Used* |
| *116* | *Table5.5.22.* | *Baltistan : (START NUMBER OF VESSELS)* (FLEET CHARACTERISTICS): Not Used* |
| *117* | *Table5.5.23.* | *Baltistan : MAXIMUM TOTAL ALLOWED FLEET CHARACTERISTICS (BY COUNTRY): Not Used - Not Used* |
| *118* | *Table5.5.24.* | *Baltistan : MAXIMUM TOTAL ALLOWED FLEET CHARACTERISTICS (BY COUNTRY AND FLEET): Not Used - Not Used* |
| *119* | *Table5.5.25.* | *Baltistan : MAXIMUM TOTAL ALLOWED FLEET CHARACTERISTICS (BY COUNTRY, FLEET AND VESSEL SIZE): Not Used - Not Used* |
| *122* | *Table5.5.28.* | *Scandinavia : MAXIMUM TOTAL ALLOWED FLEET CHARACTERISTICS (BY COUNTRY): Length - Not Used* |
| *123* | *Table5.5.29.* | *Scandinavia : MAXIMUM TOTAL ALLOWED FLEET CHARACTERISTICS (BY COUNTRY AND FLEET): Length - Not Used* |
| *124* | *Table5.5.30.* | *Scandinavia : MAXIMUM TOTAL ALLOWED FLEET CHARACTERISTICS (BY COUNTRY, FLEET AND VESSEL SIZE): Length - Not Used* |
| *128* | *Table5.5.34.* | *Scandinavia : MAXIMUM TOTAL ALLOWED FLEET CHARACTERISTICS (BY COUNTRY AND FLEET): Tonnage - Not Used* |
| *129* | *Table5.5.35.* | *Scandinavia : MAXIMUM TOTAL ALLOWED FLEET CHARACTERISTICS (BY CTRY, FLEET AND VESSEL SIZE): Tonnage - Not Used* |
| *132* | *Table5.5.38.* | *Scandinavia : MAXIMUM TOTAL ALLOWED FLEET CHARACTERISTICS (BY COUNTRY): KgWat - Not Used* |
| *133* | *Table5.5.39.* | *Scandinavia : MAXIMUM TOTAL ALLOWED FLEET CHARACTERISTICS (BY COUNTRY AND FLEET): KgWat - Not Used* |
| *134* | *Table5.5.40.* | *Scandinavia : MAXIMUM TOTAL ALLOWED FLEET CHARACTERISTICS (BY COUNTRY, FLEET AND VESSEL SIZE): KgWat - Not Used* |
| *135* | *Table5.5.41.* | *Scandinavia : FLEET CHARACTERISTICS: Not Used* |
| *136* | *Table5.5.42.* | *Scandinavia : (START NUMBER OF VESSELS)* (FLEET CHARACTERISTICS): Not Used* |
| *137* | *Table5.5.43.* | *Scandinavia : MAXIMUM TOTAL ALLOWED FLEET CHARACTERISTICS (BY COUNTRY): Not Used - Not Used* |
| *138* | *Table5.5.44.* | *Scandinavia : MAXIMUM TOTAL ALLOWED FLEET CHARACTERISTICS (BY COUNTRY AND FLEET): Not Used - Not Used* |
| *139* | *Table5.5.45.* | *Scandinavia : MAXIMUM TOTAL ALLOWED FLEET CHARACTERISTICS (BY CTRY, FLEET AND VESSEL SIZE): Not Used - Not Used* |
| *140* | *Table5.5.46.* | *Scandinavia : FLEET CHARACTERISTICS: Not Used* |
| *141* | *Table5.5.47.* | *Scandinavia : (START NUMBER OF VESSELS)* (FLEET CHARACTERISTICS): Not Used* |
| *142* | *Table5.5.48.* | *Scandinavia : MAXIMUM TOTAL ALLOWED FLEET CHARACTERISTICS (BY COUNTRY): Not Used - Not Used* |
| *143* | *Table5.5.49.* | *Scandinavia : MAXIMUM TOTAL ALLOWED FLEET CHARACTERISTICS (BY COUNTRY AND FLEET): Not Used - Not Used* |
| *144* | *Table5.5.50.* | *Scandinavia : MAXIMUM TOTAL ALLOWED FLEET CHARACTERISTICS (BY CTRY, FLEET AND VESSEL SIZE): Not Used - Not Used* |

***Table 2.8.1.b. Tables in the boats input sheet, which are not used, S05_BOATS.***

The number of boats or vessels is in TEMAS composed of “vessel age groups” (Index “Va”), that is.

$$NU_{Vessel}(Fl,Vs,Ct,y,q,\bullet) = \sum_{Va=1}^{Va_{Max}} NU_{Nessel}(Fl,Vs,Ct,y,q,Va)$$

where $NU_{Vessel}$(Fl, Vs, Ct, y, q, Va) = Number of vessels which has age “Va”.

The number of vessels, $NU_{Vessel}$(Fl, Vs, Ct, y, q,Va), is defined by iteration:

| | q > 1 | q = 1 |
|---|---|---|
| Va = 0 | $NU_{Vessel}$(Fl, Vs, Ct, y, q, 0) =<br>$NU_{New\text{-}Vessel}$(Fl, Vs, Ct, y,q) | $NU_{Vessel}$(Fl, Vs, Ct, y,1,0) =<br>$NU_{New\text{-}Vessel}$(Fl, Vs, Ct, y,q) |
| Va =<br>1,2,…,$Va_{max}$-1 | $NU_{Vessel}$(Fl, Vs, Ct, y, q,Va) =<br>$NU_{vessel}$(Fl, y , q-1,Va) –<br>$NU_{Decomm}$(Fl, Vs, Ct, y, q,Va) –<br>$NU_{Withdrawal}$(Fl, Vs, Ct, y, q, Va) –<br>$NU_{Attrition}$(Fl, Vs, Ct, y, q, Va) | $NU_{Vessel}$(Fl, Vs, Ct, y,Va) =<br>$NU_{vessel}$(Fl, y-1, $q_{Max}$,Va) –<br>$NU_{Decomm}$(Fl, Vs, Ct, y, 1,Va) –<br>$NU_{Withdrawal}$(Fl, Vs, Ct, y, 1, Va) –<br>$NU_{Attrition}$(Fl, Vs, Ct, y, 1, Va) |
| Va = $Va_{Max}$<br>(plus group) | $NU_{vessel}$(Fl, Vs, Ct, y, q,Va) =<br>$NU_{vessel}$(Fl, Vs, Ct, y, q-1, $Va_{Max}$ ) +<br>$NU_{Decomm}$(Fl, Vs, Ct, y, q, $Va_{Max}$) –<br>$NU_{Withdrawal}$(Fl, Vs, Ct, y, q, $Va_{Max}$) –<br>$NU_{Attrition}$(Fl, Vs, Ct, y, q, $Va_{Max}$) | $NU_{vessel}$(Fl, Vs, Ct, y, 1,Va) =<br>$NU_{vessel}$(Fl, y-1, $q_{Max}$, $Va_{Max}$ ) +<br>$NU_{vessel}$(Fl, y-1, $q_{Max}$, $Va_{Max}$ -1) –<br>$NU_{Decomm}$(Fl, Vs, Ct, y, 1, $Va_{Max}$) –<br>$NU_{Withdrawal}$(Fl, Vs, Ct, y, 1, $Va_{Max}$) –<br>$NU_{Attrition}$(Fl, Vs, Ct, y, 1, $Va_{Max}$) |

Where $NU_{Decomm}$, $NU_{Attrition}$ and $NU_{Withdrawal}$ are the numbers of vessels withdrawn due to a vessel decommissioning, retired vessels having reached the end of their techno-economic lifetime and withdrawal. $NU_{New\text{-}Vessel}$(Fl, Vs, Ct, y, q) is the (simulated or predicted) number of new vessels (number of investments in new vessels).

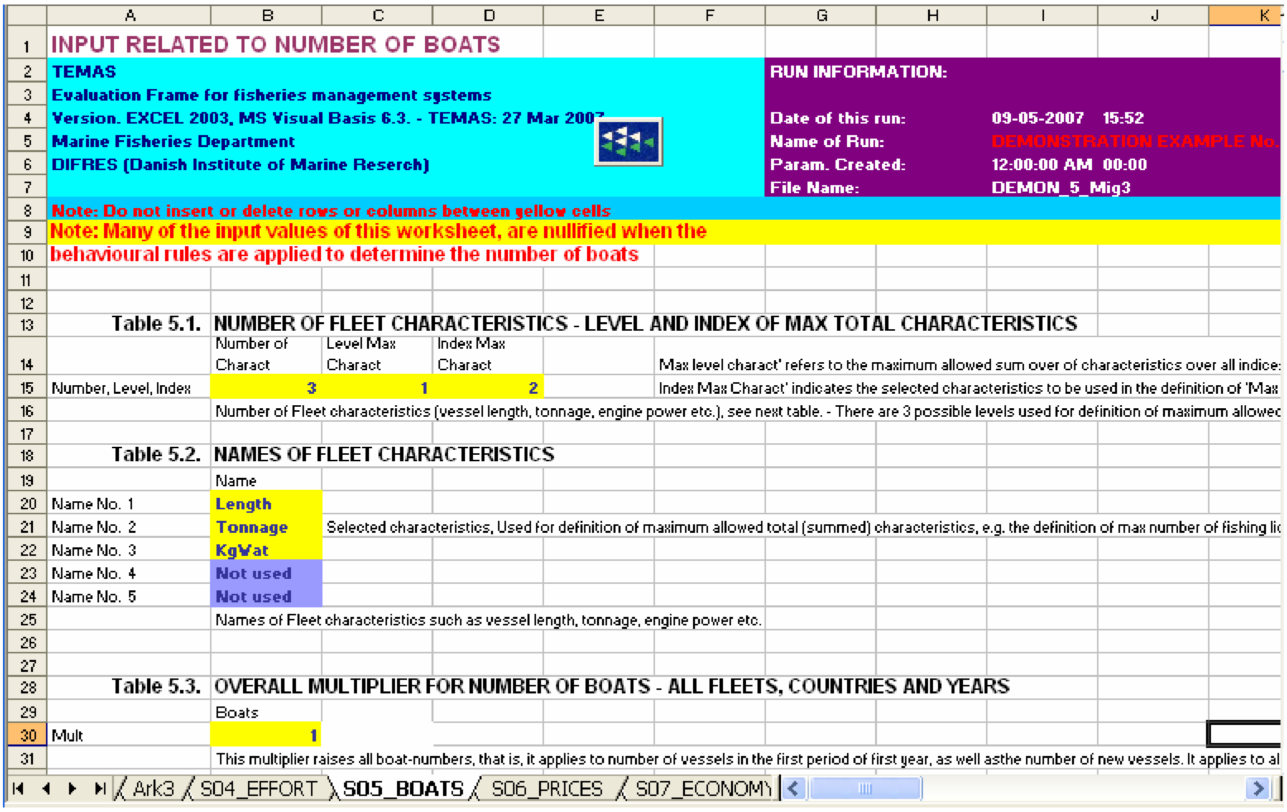
The (simulated or predicted) numbers may be either given as input parameters or be determined by the "Structural or long term Fleet behaviour rules". When the number of vessels are computed according to the so-called "structural behaviour rules", they are computed as a fraction of the existing number of vessels and it becomes essential in which sequence numbers are computed. The sequence of events is (1) Decommission (2) Disinvestments (3) Attritions (4) Recruitments (Investments).

EXCEL Tables 5.1 and 2. (Figure 2.8.2) contain the number and names of the fleet characteristics. The values of the fleet characteristics are given in subsequent EXCEL tables.

Examples of fleet characteristics are "Vessel tonnage", "Length of vessel" and "KgW of engine". The TEMAS model allow for a user selected number of fleet characteristics to be accounted for. These fleet characteristics may be used in two ways:

1) The definition of fisheries regulations (as in the example with tonnage above)
2) Measures of fleet features used in output tables, as additional information and explanation.

EXCEL table 5.1 contains the number of fleet characteristics, and indicates which of them are used for definition of fisheries regulations. As appear from EXCEL table 5.1. are three fleet characteristics. The names of the three fleet characteristics are given in EXCEL Table 5.2 (Figure 2.8.2): "Length","Tonnage" and "KgWat". The column "Index Max Charact" indcates the it is characteristics no 2, that is, "tonnage" which is used to define the "Maximum regulation". Only one choice is available.



INPUT RELATED TO NUMBER OF BOATS

TEMAS
Evaluation Frame for fisheries management systems
Version. EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 27 Mar 2007
Marine Fisheries Department
DIFRES (Danish Institute of Marine Reserch)

RUN INFORMATION:
Date of this run: 09-05-2007 15:52
Name of Run: DEMONSTRATION EXAMPLE No.
Param. Created: 12:00:00 AM 00:00
File Name: DEMON_5_Mig3

Note: Do not insert or delete rows or columns between yellow cells
Note: Many of the input values of this worksheet, are nullified when the behavioural rules are applied to determine the number of boats

Table 5.1. NUMBER OF FLEET CHARACTERISTICS - LEVEL AND INDEX OF MAX TOTAL CHARACTERISTICS

| | Number of Charact | Level Max Charact | Index Max Charact |
|---|---|---|---|
| Number, Level, Index | 3 | 1 | 2 |

Max level charact' refers to the maximum allowed sum over of characteristics over all indice
Index Max Charact' indicates the selected characteristics to be used in the definition of 'Max
Number of Fleet characteristics (vessel length, tonnage, engine power etc.), see next table. - There are 3 possible levels used for definition of maximum allowed

Table 5.2. NAMES OF FLEET CHARACTERISTICS

| | Name |
|---|---|
| Name No. 1 | Length |
| Name No. 2 | Tonnage |
| Name No. 3 | KgWat |
| Name No. 4 | Not used |
| Name No. 5 | Not used |

Selected characteristics, Used for definition of maximum allowed total (summed) characteristics, e.g. the definition of max number of fishing li
Names of Fleet characteristics such as vessel length, tonnage, engine power etc.

Table 5.3. OVERALL MULTIPLIER FOR NUMBER OF BOATS - ALL FLEETS, COUNTRIES AND YEARS

| | Boats |
|---|---|
| Mult | 1 |

This multiplier raises all boat-numbers, that is, it applies to number of vessels in the first period of first year, as well asthe number of new vessels. It applies to al

*Figure 2.8.2. EXCEL Tables 5.1-2. Fleet characteristics and EXCEL Table 5.3: Overall multiplier for number of boats and effort.*

***The explanations to EXCEL Table 5.1 . say:***

***Row 14: 'Max level charact' refers to the maximum allowed sum over of characteristics over all indices in the Aggregation level: Level 1: Ct Level 2: (Fl,Ct) Level 3: (Fl,Vs,Ct)***

***Row 15: 'Index Max Charact' indicates the selected characteristics to be used in the definition of 'Max level charactert' , e.g. If levet is 1, then it could be the maximum allowed total KgWat of all fleets in a country***

***Row 16: Number of Fleet characteristics (vessel length, tonnage, engine power etc.), see next table. - There are 3 possible levels used for definition of maximum allowed characteristics: (Level 1:by Country),(Level 2:by Fleet and Country), (Level 3: by Fleet, Vessel size and Country). - 'Index' means 'index of fleet characteristics' used for definition of maximum allowed characteristics (note: only one choice possible)***

***The explanations to EXCEL Table 5.2 . say:***

***Row 21: Selected characteristics, Used for definition of maximum allowed total (summed) characteristics, e.g. the definition of max number of fishing licenses***

***Row 25: Names of Fleet characteristics such as vessel length, tonnage, engine power etc.***

***The explanations to EXCEL Table 5.3 . say:***

***Row 30: This multiplier raises all boat-numbers, that is, it applies to number of vessels in the first period of first year, as well as the number of new vessels. It applies to all fleets of all counties in all years.***

The “maximum regulation” is an upper limit, MAL (Maximum allowed level) of the characteristics summed over vessels. TEMAS allows for limitations of total characteristics of three levels Country, Fleet and Vessel Size:

Level 1: Country level

$$\sum_{Fl=1}^{Fl_{Max}(Ct)} \sum_{Vs=1}^{Vs_{Max}(Fl,Ct)} NU_{Vessel}(Fl,Vs,Ct,y,\bullet) * CHARACT(Fl,Vs,Ct) \leq MAL_{Charact}^{Level\ 1}(Ct)$$

Level 2: Fleet level:

$$\sum_{Vs=1}^{Vs_{Max}(Fl,Ct)} NU_{Vessel}(Fl,Vs,Ct,y,\bullet) * CHARACT(Fl,Vs,Ct) \leq MAL_{Charact}^{Level\ 2}(Fl,Ct)$$

Level 3: Vessel size level:

$$NU_{Vessel}(Fl,Vs,Ct,y,\bullet) * CHARACT(Fl,Vs,Ct) \leq MAL_{Charact}^{Level\ 3}(Fl,Vs,Ct)$$

The column ”Level Max Charact” in EXCEL Table 5.1 indicates “Level 1”, that it, the country level. Thus there is an upper limit for the total tonnage of all vessels of each country in this example. EXCEL Table 5.2 shows that there are options for up to 5 different fleet characteristics in the present version of TEMAS, but only three of them are used.

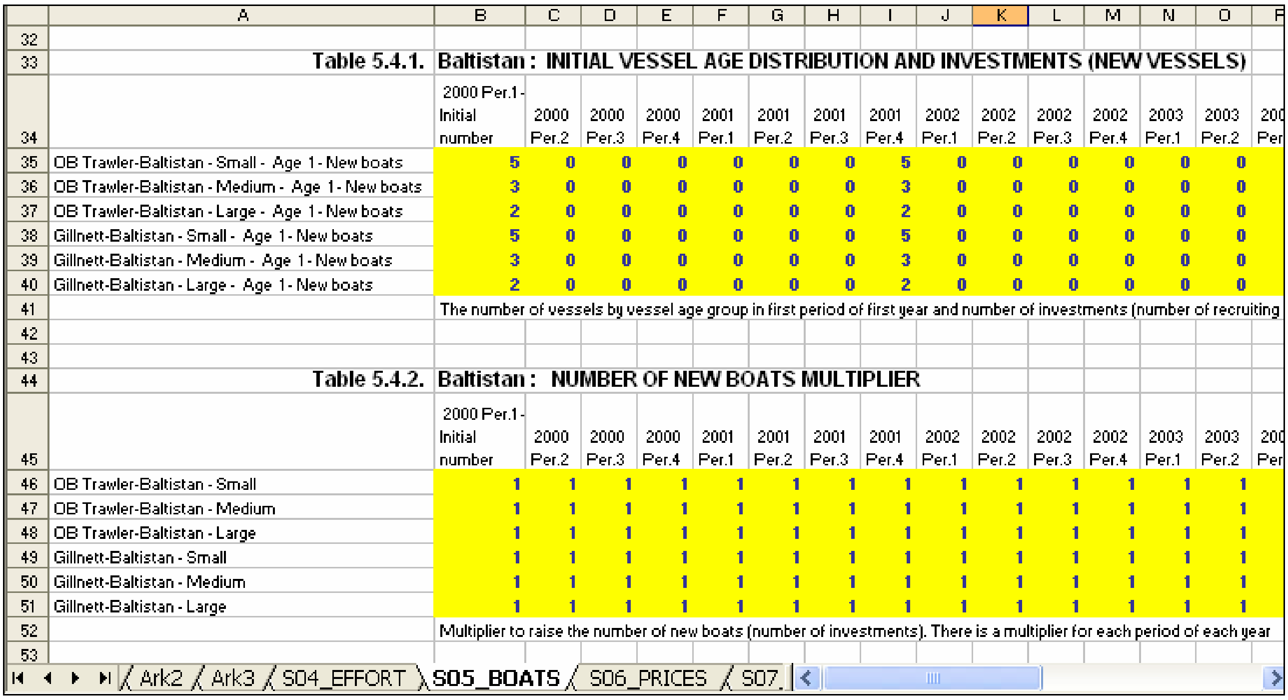


**Table 5.4.1. Baltistan : INITIAL VESSEL AGE DISTRIBUTION AND INVESTMENTS (NEW VESSELS)**

| | 2000 Per.1 - Initial number | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 2002 Per.1 | 2002 Per.2 | 2002 Per.3 | 2002 Per.4 | 2003 Per.1 | 2003 Per.2 | 200 Per |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OB Trawler-Baltistan - Small - Age 1 - New boats | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | |
| OB Trawler-Baltistan - Medium - Age 1 - New boats | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | |
| OB Trawler-Baltistan - Large - Age 1 - New boats | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Gillnett-Baltistan - Small - Age 1 - New boats | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Gillnett-Baltistan - Medium - Age 1 - New boats | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Gillnett-Baltistan - Large - Age 1 - New boats | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | |

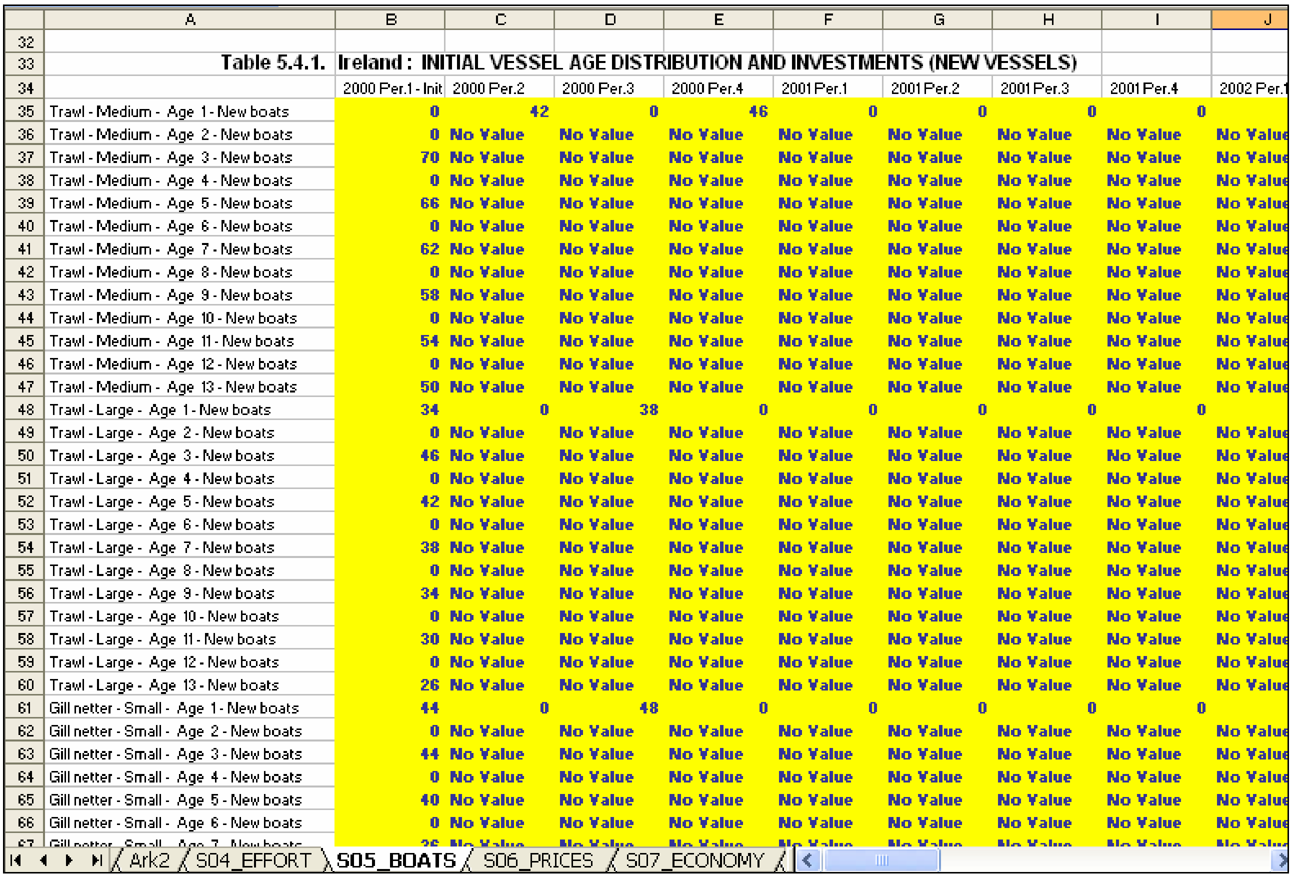
The number of vessels by vessel age group in first period of first year and number of investments (number of recruiting

**Table 5.4.2. Baltistan : NUMBER OF NEW BOATS MULTIPLIER**

| | 2000 Per.1 - Initial number | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 2002 Per.1 | 2002 Per.2 | 2002 Per.3 | 2002 Per.4 | 2003 Per.1 | 2003 Per.2 | 200 Per |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OB Trawler-Baltistan - Small | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| OB Trawler-Baltistan - Medium | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| OB Trawler-Baltistan - Large | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Gillnett-Baltistan - Small | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Gillnett-Baltistan - Medium | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Gillnett-Baltistan - Large | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |

Multiplier to raise the number of new boats (number of investments). There is a multiplier for each period of each year

***Figure 2.8.2.a. Initial number of vessels and number of new vessels in the case where the vessel age distribution is ignored. Figure 2.8.2.b shows an example woth vessel age distribution.***
***The explanation below EXCEL Table 5.4.1. says: The number of vessels by vessel age group in first period of first year and number of investments (number of recruiting vessels in first age group). This is the input number of vessels. Other table-entries are labeled 'No value' because they are derived from the input numbers. Recall that fishing vessels are treated as fish stocks, so that the input is sufficient to fill in the entire tables. (See the table 'Resulting number of vessels')***
***The explanation below EXCEL Table 5.4.2. says: Multiplier to raise the number of new boats (number of investments). There is a multiplier for each period of each year***



|  | A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|---|
| 32 |  |  |  |  |  |  |  |  |  |  |
| 33 | Table 5.4.1. | Ireland : INITIAL VESSEL AGE DISTRIBUTION AND INVESTMENTS (NEW VESSELS) |  |  |  |  |  |  |  |  |
| 34 |  | 2000 Per.1 - Init | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 2002 Per.1 |
| 35 | Trawl - Medium - Age 1 - New boats | 0 | 42 | 0 | 46 | 0 | 0 | 0 | 0 |  |
| 36 | Trawl - Medium - Age 2 - New boats | 0 | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| 37 | Trawl - Medium - Age 3 - New boats | 70 | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| 38 | Trawl - Medium - Age 4 - New boats | 0 | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| 39 | Trawl - Medium - Age 5 - New boats | 66 | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| 40 | Trawl - Medium - Age 6 - New boats | 0 | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| 41 | Trawl - Medium - Age 7 - New boats | 62 | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| 42 | Trawl - Medium - Age 8 - New boats | 0 | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| 43 | Trawl - Medium - Age 9 - New boats | 58 | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| 44 | Trawl - Medium - Age 10 - New boats | 0 | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| 45 | Trawl - Medium - Age 11 - New boats | 54 | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| 46 | Trawl - Medium - Age 12 - New boats | 0 | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| 47 | Trawl - Medium - Age 13 - New boats | 50 | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| 48 | Trawl - Large - Age 1 - New boats | 34 | 0 | 38 | 0 | 0 | 0 | 0 | 0 |  |
| 49 | Trawl - Large - Age 2 - New boats | 0 | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| 50 | Trawl - Large - Age 3 - New boats | 46 | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| 51 | Trawl - Large - Age 4 - New boats | 0 | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| 52 | Trawl - Large - Age 5 - New boats | 42 | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| 53 | Trawl - Large - Age 6 - New boats | 0 | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| 54 | Trawl - Large - Age 7 - New boats | 38 | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| 55 | Trawl - Large - Age 8 - New boats | 0 | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| 56 | Trawl - Large - Age 9 - New boats | 34 | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| 57 | Trawl - Large - Age 10 - New boats | 0 | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| 58 | Trawl - Large - Age 11 - New boats | 30 | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| 59 | Trawl - Large - Age 12 - New boats | 0 | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| 60 | Trawl - Large - Age 13 - New boats | 26 | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| 61 | Gill netter - Small - Age 1 - New boats | 44 | 0 | 48 | 0 | 0 | 0 | 0 | 0 |  |
| 62 | Gill netter - Small - Age 2 - New boats | 0 | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| 63 | Gill netter - Small - Age 3 - New boats | 44 | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| 64 | Gill netter - Small - Age 4 - New boats | 0 | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| 65 | Gill netter - Small - Age 5 - New boats | 40 | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |
| 66 | Gill netter - Small - Age 6 - New boats | 0 | No Value | No Value | No Value | No Value | No Value | No Value | No Value | No Value |

***Figure 2.8.2.b. Initial number of vessels and number of new vessels in with vessel age distribution.***

EXCEL Table 5.3 contains the overall multiplier for new boats. The number of new vessels (investments) is created from a "reference number" multiplied by a "Multiplier":

$$NU_{Vessel}(Fl,Vs,Ct,y,q,0) = X_0^{Vessels} * X_1^{Vessels}(Fl,Vs,Ct,y) * NU_{New\ Vessels}^{Re\ ference}(Fl,Vs,Ct,y)$$

The multiplier is composed of two factors, where the first factor is independent $X_0^{Vessels}$ (EXCEL Table 5.3), and applies to all fleets in all time periods, whereas the second factor depends on fleet and time period. $X_1^{Vessels}(Fl,Vs,Ct,y)$ (EXCEL Table 5.4.2)

Figure 2.8.2.a (EXCEL Table 5.4.1) shows the initial number of vessels, i.e. the number of vessels in first period of first year, $NU_{Vessel}$(Fl, Vs, Ct, y=1, q=1, Va) and number of new vessels, i.e. the number of "recruiting vessels" or "vessel investments" in all years (and all periods) $NU_{Vessel}$(Fl, Vs, Ct, y, q, 0) = $NU_{New\text{-}Vessel}$(Fl, Vs, Ct, y,q). The example in Figure 2.8.2.a deals with only one vessel age group. Figure 2.8.2.b shows an example with 13 vessel age groups. In this example it becomes clearer that the new vessels are "recruits" i.e. belong to age group 0. As new vessels can enter only age group 0, the values for age group 1+ are not detfines, which is indicated by "No Value". Only the first period in first year can contain the 1+ vessel age group.

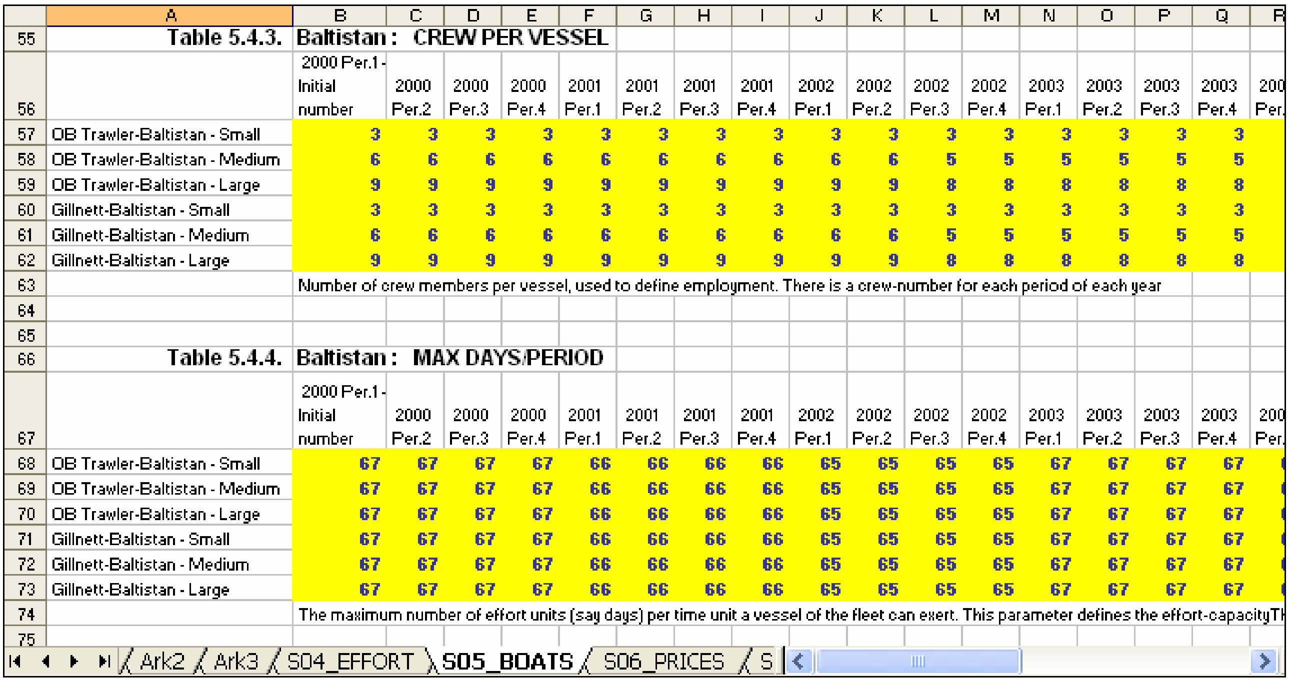
EXCEL Table 5.4.2 (Figure 2.8.2.a) contains the multipliers for the initial vessels numbers and the numbers of new vessels, $X_1^{Vessels}(Fl,Vs,Ct,y)$. The resulting number of vessels will become the product of EXCEL tables 5.4.1. and EXCEL Table 5.4.2. This multiplier will also be applied to the initial number of vessels in first period of first year. For the initial fleet, the multiplier applies to all vessel age groups.

Figure 2.8.3 shows the number of crew per vessel (EXCEL Table 5.4.3) and the maximum number of days per months (EXCEL Table 5.4.4). The "crew per vessel" is used to compute the employment by multiplication with number of vessels, and to compute other indicators of performance in the economic model.

The maximum number of sea days, $EY_{MAX}(Fl, Vs, Ct, y, q, Ar)$ , multiplied by the number of vessels, gives the upper limit of the effort (sea days) that can be exerted. We define the "reference effort" or the "maximum effort" by

$$E_{REF}(Fl,Vs,Ct,y,q,Ar) \;=\; NU_{Vessel}(Fl,Vs,Ct,y,q,\bullet) * EY_{Max}(Fl,Vs,Ct,y,q,Ar)$$

As the time periods are quarters of the year in this example, the upper limit of maximum number of days becomes 90-92 days. Here the values 65-67 are given, so that vessels stay 33-35 days in port every time period.



| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 55 | **Table 5.4.3.** | **Baltistan : CREW PER VESSEL** | | | | | | | | | | | | | | | | |
| 56 | | 2000 Per.1 - Initial number | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 2002 Per.1 | 2002 Per.2 | 2002 Per.3 | 2002 Per.4 | 2003 Per.1 | 2003 Per.2 | 2003 Per.3 | 2003 Per.4 | 200 Per. |
| 57 | OB Trawler-Baltistan - Small | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | |
| 58 | OB Trawler-Baltistan - Medium | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | |
| 59 | OB Trawler-Baltistan - Large | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 8 | 8 | 8 | 8 | 8 | 8 | |
| 60 | Gillnett-Baltistan - Small | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | |
| 61 | Gillnett-Baltistan - Medium | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | |
| 62 | Gillnett-Baltistan - Large | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 8 | 8 | 8 | 8 | 8 | 8 | |
| 63 | | Number of crew members per vessel, used to define employment. There is a crew-number for each period of each year | | | | | | | | | | | | | | | | |
| 64 | | | | | | | | | | | | | | | | | | |
| 65 | | | | | | | | | | | | | | | | | | |
| 66 | **Table 5.4.4.** | **Baltistan : MAX DAYS/PERIOD** | | | | | | | | | | | | | | | | |
| 67 | | 2000 Per.1 - Initial number | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 2002 Per.1 | 2002 Per.2 | 2002 Per.3 | 2002 Per.4 | 2003 Per.1 | 2003 Per.2 | 2003 Per.3 | 2003 Per.4 | 200 Per. |
| 68 | OB Trawler-Baltistan - Small | 67 | 67 | 67 | 67 | 66 | 66 | 66 | 66 | 65 | 65 | 65 | 65 | 67 | 67 | 67 | 67 | |
| 69 | OB Trawler-Baltistan - Medium | 67 | 67 | 67 | 67 | 66 | 66 | 66 | 66 | 65 | 65 | 65 | 65 | 67 | 67 | 67 | 67 | |
| 70 | OB Trawler-Baltistan - Large | 67 | 67 | 67 | 67 | 66 | 66 | 66 | 66 | 65 | 65 | 65 | 65 | 67 | 67 | 67 | 67 | |
| 71 | Gillnett-Baltistan - Small | 67 | 67 | 67 | 67 | 66 | 66 | 66 | 66 | 65 | 65 | 65 | 65 | 67 | 67 | 67 | 67 | |
| 72 | Gillnett-Baltistan - Medium | 67 | 67 | 67 | 67 | 66 | 66 | 66 | 66 | 65 | 65 | 65 | 65 | 67 | 67 | 67 | 67 | |
| 73 | Gillnett-Baltistan - Large | 67 | 67 | 67 | 67 | 66 | 66 | 66 | 66 | 65 | 65 | 65 | 65 | 67 | 67 | 67 | 67 | |
| 74 | | The maximum number of effort units (say days) per time unit a vessel of the fleet can exert. This parameter defines the effort-capacityT | | | | | | | | | | | | | | | | |
| 75 | | | | | | | | | | | | | | | | | | |

***Figure 2.8.3. Crew per vessel and maximum number of sea days per period.***
***Explanation below EXCEL Table 5.4.3: Number of crew members per vessel, used to define employment. There is a crew-number for each period of each year.***
***Explanation below EXCEL Table 5.4.4: The maximum number of effort units (say days) per time unit a vessel of the fleet can exert. This parameter defines the effort-capacity. There is a value of this parameter for each period of each year.***

Figure 2.8.4. shows the Number of disinvestments (or vessel withdrawals), $NU_{Withdrawal}(Fl, Vs, Ct, y, q, Va)$ (EXCEL Table 5.4.5), number of attritions, $NU_{Attrition}(Fl, Vs, Ct, y, q, Va)$ (EXCEL Table 5.4.6) and number of decommissioned vessels $NU_{Decomm}(Fl, Vs, Ct, y, q,Va)$ (EXCEL Table 5.4.7).

The input values of removals, $NU_{Withdrawal}(Fl, Vs, Ct, y, q, Va)$, $NU_{Attrition}(Fl, Vs, Ct, y, q, Va)$, and $NU_{Decomm}(Fl, Vs, Ct, y, q,Va)$ should match the number af vessels, in the sense that the number of removal connot exceed the current number of vessel, $NU_{Vessel}(Fl, Vs, Ct, y, q, Va)$.

When calculation the resulting number of vessels, the chronological order is (1) Decommission (2) Attrition (3) Dis-investment. If it is attepted to remove more vessels than there are, the input values are changed, so that the removals become feasible, as described in the 3-steps algorithm. (We use the sign “ ← “ to denote assignment). The fourth step, the recruitment of new vessels, will never create inconsistencies. Step 4 is included to show that vessel recruitment is the last step in the calculation of “resulting number of vessels”.

Step 1: Decommission

```
If
    $NU_{Vessel}(Fl, Vs, Ct, y, q, Va) \geq NU_{Decomm}(Fl, Vs, Ct, y, q,Va)$
Then
    $NU_{Vessel}(Fl, Vs, Ct, y, q, Va) \leftarrow NU_{Vessel}(Fl, Vs, Ct, y, q, Va) - NU_{Decomm}(Fl, Vs, Ct, y, q,Va)$
Else
    $NU_{Decomm}(Fl, Vs, Ct, y, q,Va) \leftarrow NU_{Vessel}(Fl, Vs, Ct, y, q, Va)$
    and
    $NU_{Vessel}(Fl, Vs, Ct, y, q, Va) \leftarrow 0$
```

Step 2: Attrition

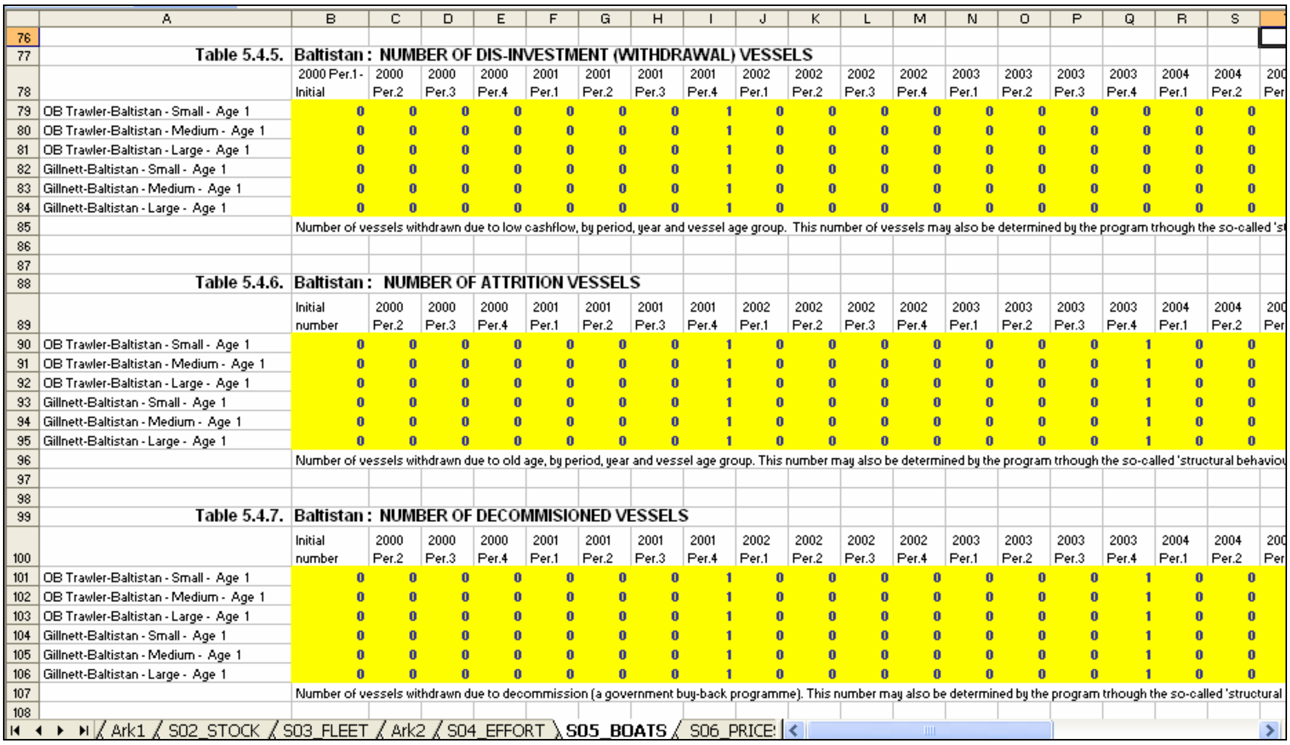
```
If
    $NU_{Vessel}(Fl, Vs, Ct, y, q, Va) \geq NU_{Attrition}(Fl, Vs, Ct, y, q,Va)$
Then
    $NU_{Vessel}(Fl, Vs, Ct, y, q, Va) \leftarrow NU_{Vessel}(Fl, Vs, Ct, y, q, Va) - NU_{Attrition}(Fl, Vs, Ct, y, q,Va)$
Else
    $NU_{Attrition}(Fl, Vs, Ct, y, q,Va) \leftarrow NU_{Vessel}(Fl, Vs, Ct, y, q, Va)$
    and
    $NU_{Vessel}(Fl, Vs, Ct, y, q, Va) \leftarrow 0$
```

Step 3: Disinvestment (Withdrawal)

```
If
    $NU_{Vessel}(Fl, Vs, Ct, y, q, Va) \geq NU_{Withdrawal}(Fl, Vs, Ct, y, q,Va)$
Then
    $NU_{Vessel}(Fl, Vs, Ct, y, q, Va) \leftarrow NU_{Vessel}(Fl, Vs, Ct, y, q, Va) - NU_{Withdrawal}(Fl, Vs, Ct, y, q,Va)$
Else
    $NU_{Withdrawal}(Fl, Vs, Ct, y, q,Va) \leftarrow NU_{Vessel}(Fl, Vs, Ct, y, q, Va)$
    and
    $NU_{Vessel}(Fl, Vs, Ct, y, q, Va) \leftarrow 0$
```

Step 4: Recruitment

$$NU_{Vessel}(Fl, Vs, Ct, y, q, 0) = NU_{New\text{-}Vessel}(Fl, Vs, Ct, y,q) * \text{Multiplier}$$

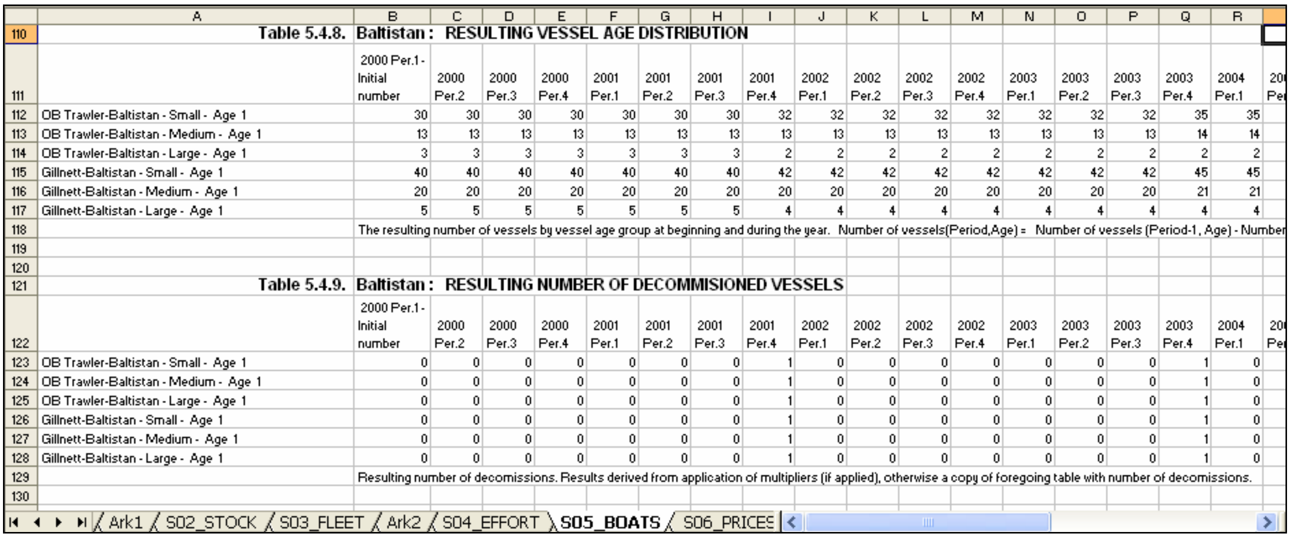


|  | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 76 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 77 | Table 5.4.5. | Baltistan : NUMBER OF DIS-INVESTMENT (WITHDRAWAL) VESSELS |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 78 |  | 2000 Per.1 - Initial | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 2002 Per.1 | 2002 Per.2 | 2002 Per.3 | 2002 Per.4 | 2003 Per.1 | 2003 Per.2 | 2003 Per.3 | 2003 Per.4 | 2004 Per.1 | 2004 Per.2 |
| 79 | OB Trawler-Baltistan - Small - Age 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 80 | OB Trawler-Baltistan - Medium - Age 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 81 | OB Trawler-Baltistan - Large - Age 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 82 | Gillnett-Baltistan - Small - Age 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 83 | Gillnett-Baltistan - Medium - Age 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 84 | Gillnett-Baltistan - Large - Age 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 85 |  | Number of vessels withdrawn due to low cashflow, by period, year and vessel age group. This number of vessels may also be determined by the program trhough the so-called 'st |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 86 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 87 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 88 | Table 5.4.6. | Baltistan : NUMBER OF ATTRITION VESSELS |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 89 |  | Initial number | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 2002 Per.1 | 2002 Per.2 | 2002 Per.3 | 2002 Per.4 | 2003 Per.1 | 2003 Per.2 | 2003 Per.3 | 2003 Per.4 | 2004 Per.1 | 2004 Per.2 |
| 90 | OB Trawler-Baltistan - Small - Age 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 91 | OB Trawler-Baltistan - Medium - Age 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 92 | OB Trawler-Baltistan - Large - Age 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 93 | Gillnett-Baltistan - Small - Age 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 94 | Gillnett-Baltistan - Medium - Age 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 95 | Gillnett-Baltistan - Large - Age 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 96 |  | Number of vessels withdrawn due to old age, by period, year and vessel age group. This number may also be determined by the program trhough the so-called 'structural behaviou |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 97 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 98 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 99 | Table 5.4.7. | Baltistan : NUMBER OF DECOMMISIONED VESSELS |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 100 |  | Initial number | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 2002 Per.1 | 2002 Per.2 | 2002 Per.3 | 2002 Per.4 | 2003 Per.1 | 2003 Per.2 | 2003 Per.3 | 2003 Per.4 | 2004 Per.1 | 2004 Per.2 |
| 101 | OB Trawler-Baltistan - Small - Age 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 102 | OB Trawler-Baltistan - Medium - Age 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 103 | OB Trawler-Baltistan - Large - Age 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 104 | Gillnett-Baltistan - Small - Age 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 105 | Gillnett-Baltistan - Medium - Age 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 106 | Gillnett-Baltistan - Large - Age 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 107 |  | Number of vessels withdrawn due to decommission (a government buy-back programme). This number may also be determined by the program trhough the so-called 'structural |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 108 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

***Figure 2.8.4. Number of disinvestments, number of attritions and decommissioned vessels.***
***Explanation below EXCEL Table 5.4.5: Number of vessels withdrawn due to low cash flow, by period, year and vessel age group. This number of vessels may also be determined by the program trough the so-called 'structural behaviour rules'***
***Explanation below EXCEL Table 5.4.6: Number of vessels withdrawn due to old age, by period, year and vessel age group. This number may also be determined by the program trough the so-called 'structural behaviour rules'***
***Explanation below EXCEL Table 5.4.7: Number of vessels withdrawn due to decommission (a government buy-back programme). This number may also be determined by the program trough the so-called 'structural behaviour rules'***

Figure 2.8.5 (EXCEL Table 5.4.8) shows the resulting number of vessels after vessel recruitment (Investment) the execution of the algorithm above, and after application of multipliers to number of new vessels (EXCEL Table 5.4.2).
EXCEL Table 5.4.9 (Figure 2.8.5) shows the resulting number of decommissions

Figure 2.8.6 (EXCEL Table 5.4.10, summarises the resulting number of vessels, in that it gives results (new vessels, decommissions, attritions and dis-investments) summed over vessel age groups. In the present case of only one vessel age group, this table may not be so interesting. The purpose is to illustrate the vessel number manipulations and to produce a table for presentation in reports.



110 **Table 5.4.8. Baltistan : RESULTING VESSEL AGE DISTRIBUTION**

| 111 | | 2000 Per.1 - Initial number | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 2002 Per.1 | 2002 Per.2 | 2002 Per.3 | 2002 Per.4 | 2003 Per.1 | 2003 Per.2 | 2003 Per.3 | 2003 Per.4 | 2004 Per.1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 112 | OB Trawler-Baltistan - Small - Age 1 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 35 | 35 |
| 113 | OB Trawler-Baltistan - Medium - Age 1 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 14 | 14 |
| 114 | OB Trawler-Baltistan - Large - Age 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 115 | Gillnett-Baltistan - Small - Age 1 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 45 | 45 |
| 116 | Gillnett-Baltistan - Medium - Age 1 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 21 | 21 |
| 117 | Gillnett-Baltistan - Large - Age 1 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |

118 The resulting number of vessels by vessel age group at beginning and during the year. Number of vessels(Period,Age) = Number of vessels (Period-1, Age) - Number

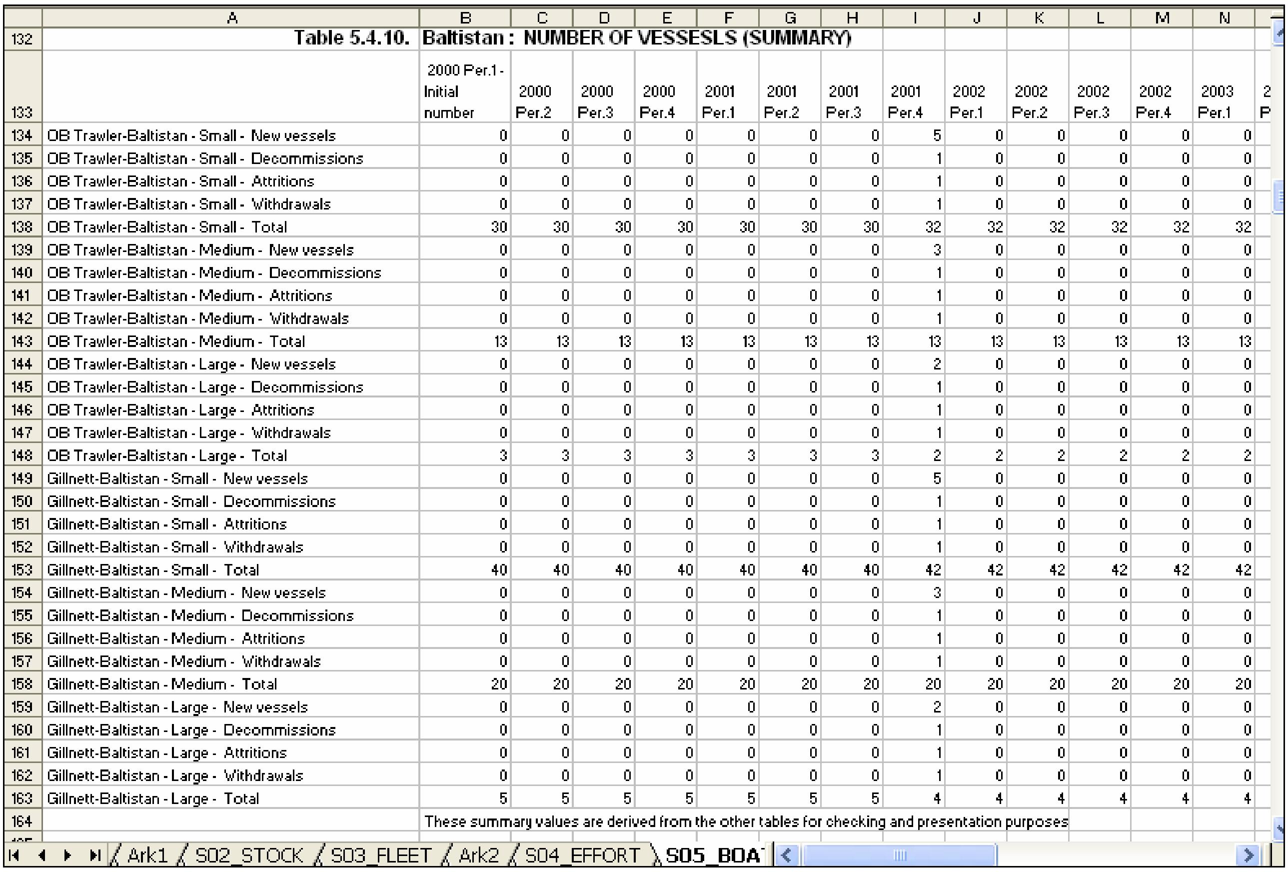
121 **Table 5.4.9. Baltistan : RESULTING NUMBER OF DECOMMISIONED VESSELS**

| 122 | | 2000 Per.1 - Initial number | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 2002 Per.1 | 2002 Per.2 | 2002 Per.3 | 2002 Per.4 | 2003 Per.1 | 2003 Per.2 | 2003 Per.3 | 2003 Per.4 | 2004 Per.1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 123 | OB Trawler-Baltistan - Small - Age 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 124 | OB Trawler-Baltistan - Medium - Age 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 125 | OB Trawler-Baltistan - Large - Age 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 126 | Gillnett-Baltistan - Small - Age 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 127 | Gillnett-Baltistan - Medium - Age 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 128 | Gillnett-Baltistan - Large - Age 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |

129 Resulting number of decomissions. Results derived from application of multipliers (if applied), otherwise a copy of foregoing table with number of decomissions.

**Figure 2.8.5. Resulting number of vessels and resulting numbers of decommissions. Explanation below EXCEL Table 5.4.8: The resulting number of vessels by vessel age group at beginning and during the year. Number of vessels (Period, Age) = Number of vessels (Period-1 , Age) - Number of decommissioned vessels (Period , Age) - Number of attrition vessels (Period , Age) - Number of disinvestment vessels (Period , Age) + Number of investment(Period,1). The last term is non-zero only if age = 1**

**Explanation below EXCEL Table 5.4.9: Resulting number of decommissions. Results derived from application of multipliers (if applied), otherwise a copy of foregoing table with number of decommissions.**

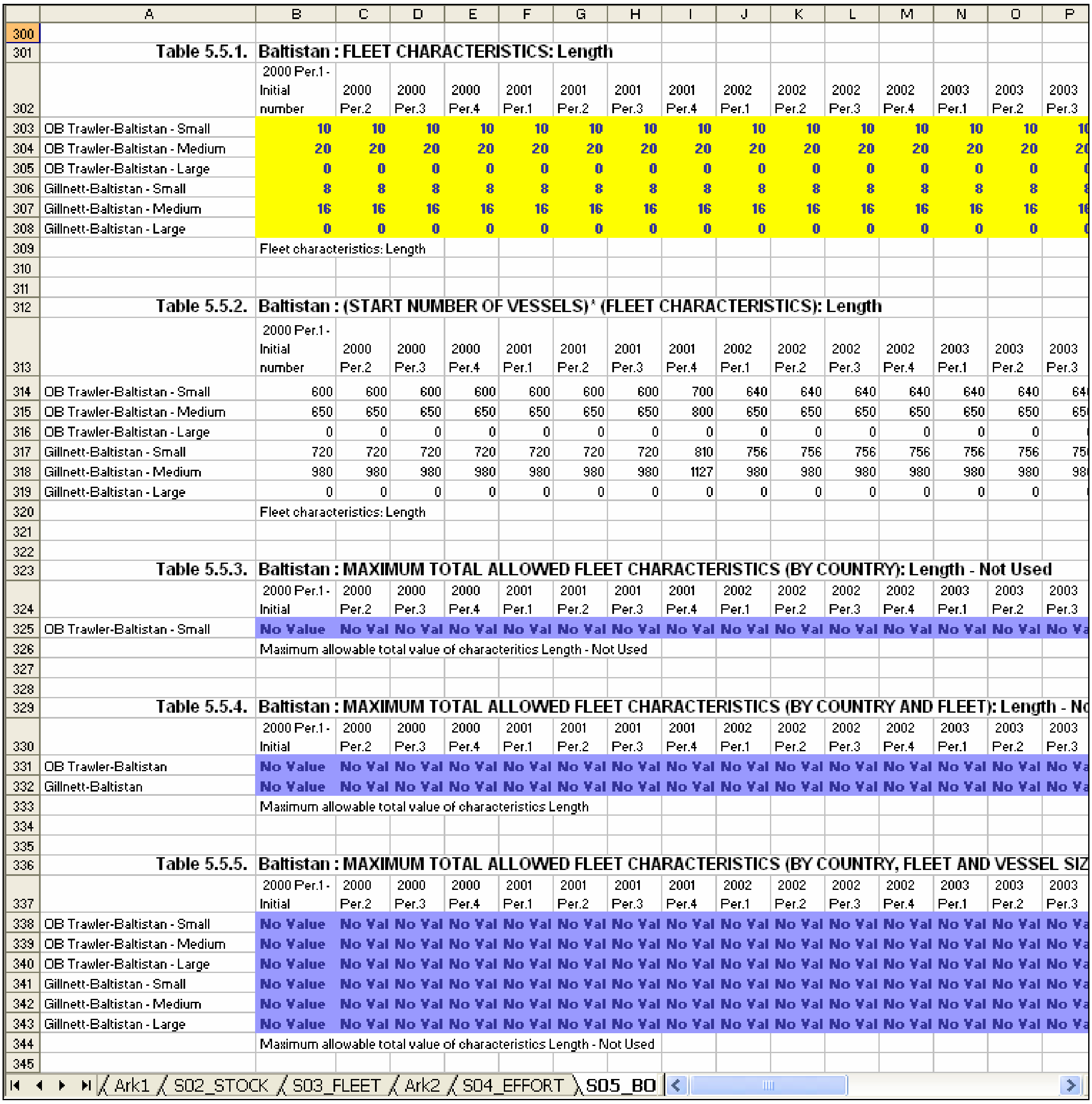


132 **Table 5.4.10. Baltistan : NUMBER OF VESSESLS (SUMMARY)**

| 133 | | 2000 Per.1 - Initial number | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 2002 Per.1 | 2002 Per.2 | 2002 Per.3 | 2002 Per.4 | 2003 Per.1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 134 | OB Trawler-Baltistan - Small - New vessels | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 |
| 135 | OB Trawler-Baltistan - Small - Decommissions | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 136 | OB Trawler-Baltistan - Small - Attritions | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 137 | OB Trawler-Baltistan - Small - Withdrawals | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 138 | OB Trawler-Baltistan - Small - Total | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 32 | 32 | 32 | 32 | 32 | 32 |
| 139 | OB Trawler-Baltistan - Medium - New vessels | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 |
| 140 | OB Trawler-Baltistan - Medium - Decommissions | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 141 | OB Trawler-Baltistan - Medium - Attritions | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 142 | OB Trawler-Baltistan - Medium - Withdrawals | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 143 | OB Trawler-Baltistan - Medium - Total | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 144 | OB Trawler-Baltistan - Large - New vessels | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| 145 | OB Trawler-Baltistan - Large - Decommissions | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 146 | OB Trawler-Baltistan - Large - Attritions | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 147 | OB Trawler-Baltistan - Large - Withdrawals | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 148 | OB Trawler-Baltistan - Large - Total | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 |
| 149 | Gillnett-Baltistan - Small - New vessels | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 |
| 150 | Gillnett-Baltistan - Small - Decommissions | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 151 | Gillnett-Baltistan - Small - Attritions | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 152 | Gillnett-Baltistan - Small - Withdrawals | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 153 | Gillnett-Baltistan - Small - Total | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 42 | 42 | 42 | 42 | 42 | 42 |
| 154 | Gillnett-Baltistan - Medium - New vessels | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 |
| 155 | Gillnett-Baltistan - Medium - Decommissions | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 156 | Gillnett-Baltistan - Medium - Attritions | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 157 | Gillnett-Baltistan - Medium - Withdrawals | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 158 | Gillnett-Baltistan - Medium - Total | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| 159 | Gillnett-Baltistan - Large - New vessels | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| 160 | Gillnett-Baltistan - Large - Decommissions | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 161 | Gillnett-Baltistan - Large - Attritions | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 162 | Gillnett-Baltistan - Large - Withdrawals | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 163 | Gillnett-Baltistan - Large - Total | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 |

164 These summary values are derived from the other tables for checking and presentation purposes

**Figure 2.8.6. Summary of number of vessels, showing New vessels, Decommissions, Attritions and Withdrawals. Explanation below EXCEL Table 5.4.10: These summary values are derived from the other tables for checking and presentation purposes**



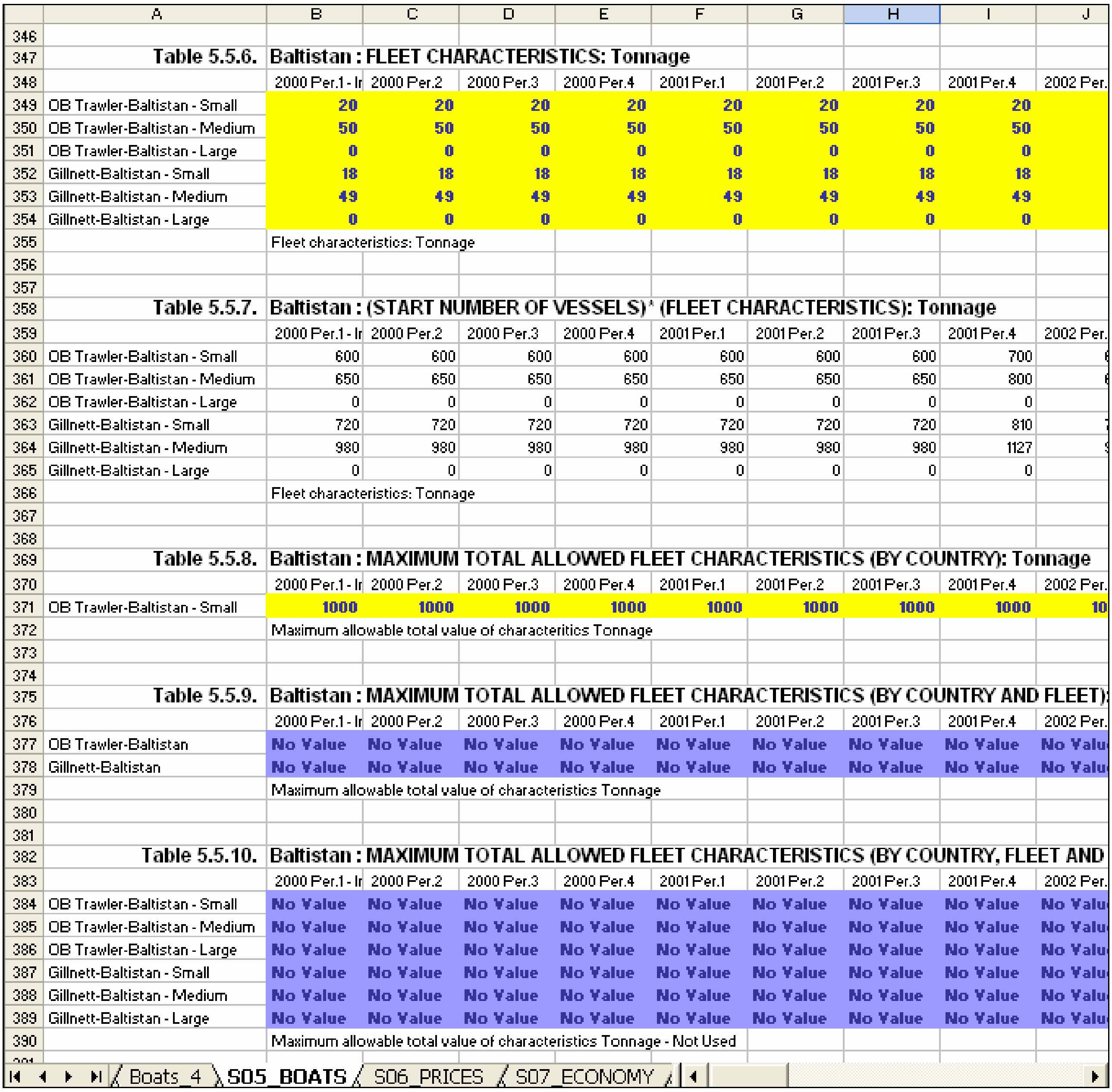
|  | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 300 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 301 | **Table 5.5.1.** | **Baltistan : FLEET CHARACTERISTICS: Length** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 302 |  | 2000 Per.1 - Initial number | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 2002 Per.1 | 2002 Per.2 | 2002 Per.3 | 2002 Per.4 | 2003 Per.1 | 2003 Per.2 | 2003 Per.3 |
| 303 | OB Trawler-Baltistan - Small | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 1 |
| 304 | OB Trawler-Baltistan - Medium | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 2 |
| 305 | OB Trawler-Baltistan - Large | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |
| 306 | Gillnett-Baltistan - Small | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |  |
| 307 | Gillnett-Baltistan - Medium | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 1 |
| 308 | Gillnett-Baltistan - Large | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |
| 309 |  | Fleet characteristics: Length |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 310 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 311 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 312 | **Table 5.5.2.** | **Baltistan : (START NUMBER OF VESSELS) * (FLEET CHARACTERISTICS): Length** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 313 |  | 2000 Per.1 - Initial number | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 2002 Per.1 | 2002 Per.2 | 2002 Per.3 | 2002 Per.4 | 2003 Per.1 | 2003 Per.2 | 2003 Per.3 |
| 314 | OB Trawler-Baltistan - Small | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 700 | 640 | 640 | 640 | 640 | 640 | 640 | 64 |
| 315 | OB Trawler-Baltistan - Medium | 650 | 650 | 650 | 650 | 650 | 650 | 650 | 800 | 650 | 650 | 650 | 650 | 650 | 650 | 65 |
| 316 | OB Trawler-Baltistan - Large | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |
| 317 | Gillnett-Baltistan - Small | 720 | 720 | 720 | 720 | 720 | 720 | 720 | 810 | 756 | 756 | 756 | 756 | 756 | 756 | 75 |
| 318 | Gillnett-Baltistan - Medium | 980 | 980 | 980 | 980 | 980 | 980 | 980 | 1127 | 980 | 980 | 980 | 980 | 980 | 980 | 98 |
| 319 | Gillnett-Baltistan - Large | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |
| 320 |  | Fleet characteristics: Length |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 321 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 322 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 323 | **Table 5.5.3.** | **Baltistan : MAXIMUM TOTAL ALLOWED FLEET CHARACTERISTICS (BY COUNTRY): Length - Not Used** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 324 |  | 2000 Per.1 - Initial | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 2002 Per.1 | 2002 Per.2 | 2002 Per.3 | 2002 Per.4 | 2003 Per.1 | 2003 Per.2 | 2003 Per.3 |
| 325 | OB Trawler-Baltistan - Small | No Value | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Va |
| 326 |  | Maximum allowable total value of characteritics Length - Not Used |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 327 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 328 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 329 | **Table 5.5.4.** | **Baltistan : MAXIMUM TOTAL ALLOWED FLEET CHARACTERISTICS (BY COUNTRY AND FLEET): Length - No** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 330 |  | 2000 Per.1 - Initial | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 2002 Per.1 | 2002 Per.2 | 2002 Per.3 | 2002 Per.4 | 2003 Per.1 | 2003 Per.2 | 2003 Per.3 |
| 331 | OB Trawler-Baltistan | No Value | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Va |
| 332 | Gillnett-Baltistan | No Value | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Va |
| 333 |  | Maximum allowable total value of characteristics Length |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 334 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 335 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 336 | **Table 5.5.5.** | **Baltistan : MAXIMUM TOTAL ALLOWED FLEET CHARACTERISTICS (BY COUNTRY, FLEET AND VESSEL SIZ** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 337 |  | 2000 Per.1 - Initial | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 2002 Per.1 | 2002 Per.2 | 2002 Per.3 | 2002 Per.4 | 2003 Per.1 | 2003 Per.2 | 2003 Per.3 |
| 338 | OB Trawler-Baltistan - Small | No Value | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Va |
| 339 | OB Trawler-Baltistan - Medium | No Value | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Va |
| 340 | OB Trawler-Baltistan - Large | No Value | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Va |
| 341 | Gillnett-Baltistan - Small | No Value | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Va |
| 342 | Gillnett-Baltistan - Medium | No Value | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Va |
| 343 | Gillnett-Baltistan - Large | No Value | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Val | No Va |
| 344 |  | Maximum allowable total value of characteristics Length - Not Used |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 345 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

***Figure 2.8.7.a. First fleet characteristics, vessel length, ("used" or "not used").***

Figures 2.8.7.a and b show the vessel characteristics. Recall EXCEL Tables 5.1-2, that specifies 3 fleet characteristics,

|  |  |
|---|---|
| 1 | Vessel length |
| 2 | Vessel tonnage |
| 3 | Engine KgWat |

of which the second characteristics, vessel tonnage, is used for regulation on the country-level. EXCEL Table 5.5.1 (Figure 2.8.7.a) contains the vessel lengths and EXCEL Table 5.5.2 contain the total characteristics for the fleets. EXCEL Tables 5.5.3-5 are the tables for regulations, that is, the maximum level of the total characteristics. There are three possible levels for the regulation (1) By Country (2) By (Fleet, Country) (3) by (Fleet, Vessel size, Country). Nome of the three options (EXCEL Tables 5.5.3-5 are used). In figure 2.8.7.b, containing the tables with vessel tonnage, it can be seen that this characteristics on country level is used for regulation, i.e. there is an upper limit for the total vessel tonnage of the country (EXCEL Table 5.5.8).



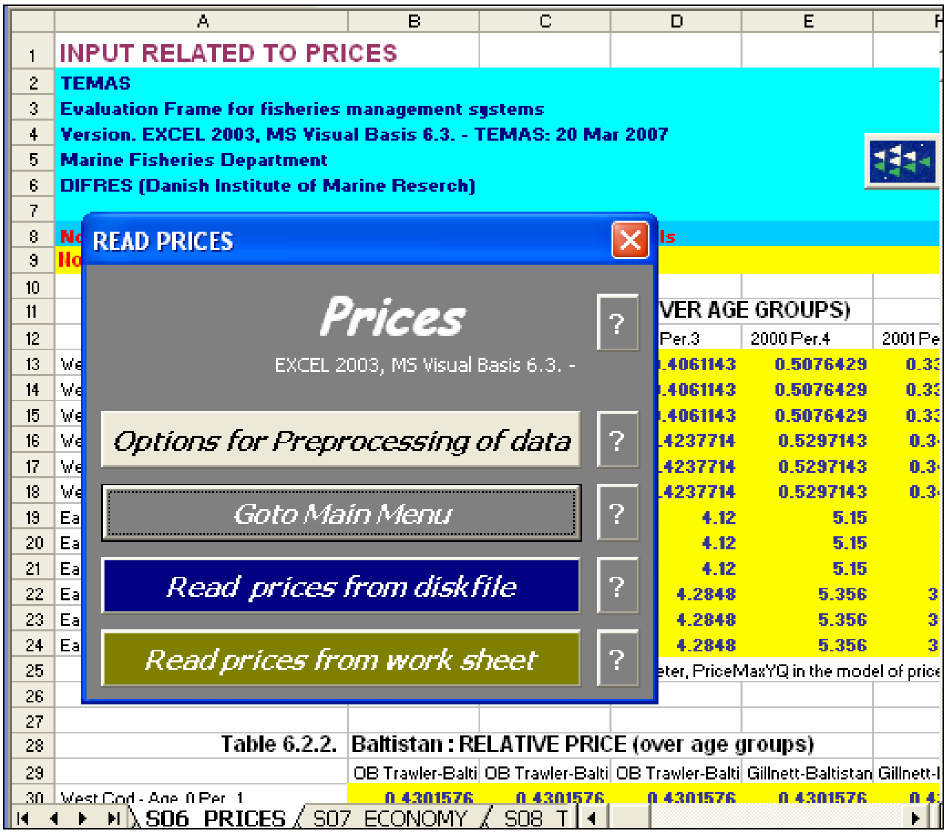
| | A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|---|
| 346 | | | | | | | | | | |
| 347 | **Table 5.5.6.** | **Baltistan : FLEET CHARACTERISTICS: Tonnage** | | | | | | | | |
| 348 | | 2000 Per.1 - Ir | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 2002 Per. |
| 349 | OB Trawler-Baltistan - Small | **20** | **20** | **20** | **20** | **20** | **20** | **20** | **20** | |
| 350 | OB Trawler-Baltistan - Medium | **50** | **50** | **50** | **50** | **50** | **50** | **50** | **50** | |
| 351 | OB Trawler-Baltistan - Large | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | |
| 352 | Gillnett-Baltistan - Small | **18** | **18** | **18** | **18** | **18** | **18** | **18** | **18** | |
| 353 | Gillnett-Baltistan - Medium | **49** | **49** | **49** | **49** | **49** | **49** | **49** | **49** | |
| 354 | Gillnett-Baltistan - Large | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | |
| 355 | | Fleet characteristics: Tonnage | | | | | | | | |
| 356 | | | | | | | | | | |
| 357 | | | | | | | | | | |
| 358 | **Table 5.5.7.** | **Baltistan : (START NUMBER OF VESSELS) * (FLEET CHARACTERISTICS): Tonnage** | | | | | | | | |
| 359 | | 2000 Per.1 - Ir | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 2002 Per. |
| 360 | OB Trawler-Baltistan - Small | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 700 | 6 |
| 361 | OB Trawler-Baltistan - Medium | 650 | 650 | 650 | 650 | 650 | 650 | 650 | 800 | 6 |
| 362 | OB Trawler-Baltistan - Large | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 363 | Gillnett-Baltistan - Small | 720 | 720 | 720 | 720 | 720 | 720 | 720 | 810 | 7 |
| 364 | Gillnett-Baltistan - Medium | 980 | 980 | 980 | 980 | 980 | 980 | 980 | 1127 | 9 |
| 365 | Gillnett-Baltistan - Large | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 366 | | Fleet characteristics: Tonnage | | | | | | | | |
| 367 | | | | | | | | | | |
| 368 | | | | | | | | | | |
| 369 | **Table 5.5.8.** | **Baltistan : MAXIMUM TOTAL ALLOWED FLEET CHARACTERISTICS (BY COUNTRY): Tonnage** | | | | | | | | |
| 370 | | 2000 Per.1 - Ir | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 2002 Per. |
| 371 | OB Trawler-Baltistan - Small | **1000** | **1000** | **1000** | **1000** | **1000** | **1000** | **1000** | **1000** | **10** |
| 372 | | Maximum allowable total value of characteritics Tonnage | | | | | | | | |
| 373 | | | | | | | | | | |
| 374 | | | | | | | | | | |
| 375 | **Table 5.5.9.** | **Baltistan : MAXIMUM TOTAL ALLOWED FLEET CHARACTERISTICS (BY COUNTRY AND FLEET):** | | | | | | | | |
| 376 | | 2000 Per.1 - Ir | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 2002 Per. |
| 377 | OB Trawler-Baltistan | **No Value** | **No Value** | **No Value** | **No Value** | **No Value** | **No Value** | **No Value** | **No Value** | **No Valu** |
| 378 | Gillnett-Baltistan | **No Value** | **No Value** | **No Value** | **No Value** | **No Value** | **No Value** | **No Value** | **No Value** | **No Valu** |
| 379 | | Maximum allowable total value of characteristics Tonnage | | | | | | | | |
| 380 | | | | | | | | | | |
| 381 | | | | | | | | | | |
| 382 | **Table 5.5.10.** | **Baltistan : MAXIMUM TOTAL ALLOWED FLEET CHARACTERISTICS (BY COUNTRY, FLEET AND** | | | | | | | | |
| 383 | | 2000 Per.1 - Ir | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 2002 Per. |
| 384 | OB Trawler-Baltistan - Small | **No Value** | **No Value** | **No Value** | **No Value** | **No Value** | **No Value** | **No Value** | **No Value** | **No Valu** |
| 385 | OB Trawler-Baltistan - Medium | **No Value** | **No Value** | **No Value** | **No Value** | **No Value** | **No Value** | **No Value** | **No Value** | **No Valu** |
| 386 | OB Trawler-Baltistan - Large | **No Value** | **No Value** | **No Value** | **No Value** | **No Value** | **No Value** | **No Value** | **No Value** | **No Valu** |
| 387 | Gillnett-Baltistan - Small | **No Value** | **No Value** | **No Value** | **No Value** | **No Value** | **No Value** | **No Value** | **No Value** | **No Valu** |
| 388 | Gillnett-Baltistan - Medium | **No Value** | **No Value** | **No Value** | **No Value** | **No Value** | **No Value** | **No Value** | **No Value** | **No Valu** |
| 389 | Gillnett-Baltistan - Large | **No Value** | **No Value** | **No Value** | **No Value** | **No Value** | **No Value** | **No Value** | **No Value** | **No Valu** |
| 390 | | Maximum allowable total value of characteristics Tonnage - Not Used | | | | | | | | |

*Figure 2.8.7.a. Second fleet characteristics, vessel tonnage, ("used" or "not used").*

Note that there are no options for pre-processing of boats data (Figure 2.8.1 )

## 2.9. PRICES INPUT. S06_PRICES

The userform for entry of price-data in worksheet S06_PRICES, is shown in Figure 2.9.1, and Table 2.9.1 shows the list of EXCEL tables in S06_PRICES.



INPUT RELATED TO PRICES

TEMAS

Evaluation Frame for fisheries management systems

Version. EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 20 Mar 2007

Marine Fisheries Department

DIFRES (Danish Institute of Marine Reserch)

Table 6.2.2. Baltistan : RELATIVE PRICE (over age groups)

*Figure 2.9.1. User-form for entry of prices related data and parameters.*

| Index | EXCEL Table | Caption |
|---|---|---|
| 145 | Table6.2.1. | Baltistan : MAXIMUM PRICE (over age groups) |
| 146 | Table6.2.2. | Baltistan : RELATIVE PRICE (over age groups) |
| 147 | Table6.2.3. | Baltistan : PRICE FLEXIBILITY |
| 148 | Table6.3.1. | Scandinavia : MAXIMUM PRICE (over age groups) |
| 149 | Table6.3.2. | Scandinavia : RELATIVE PRICE (over age groups) |
| 150 | Table6.3.3. | Scandinavia : PRICE FLEXIBILITY |

*Table 2.9.1. Tables in the prices input sheet, S06_PRICES.*

The price concept used in TEMAS is the “Ex-vessel price”, that is the price of the landings given to the vessel (the vessel owner). They are given as a maximum price over age groups and a relative price by age:

$P_{Max}(Fl,Vs,Rg,Ct, St, y, q)$ = Maximum Price (over age groups)

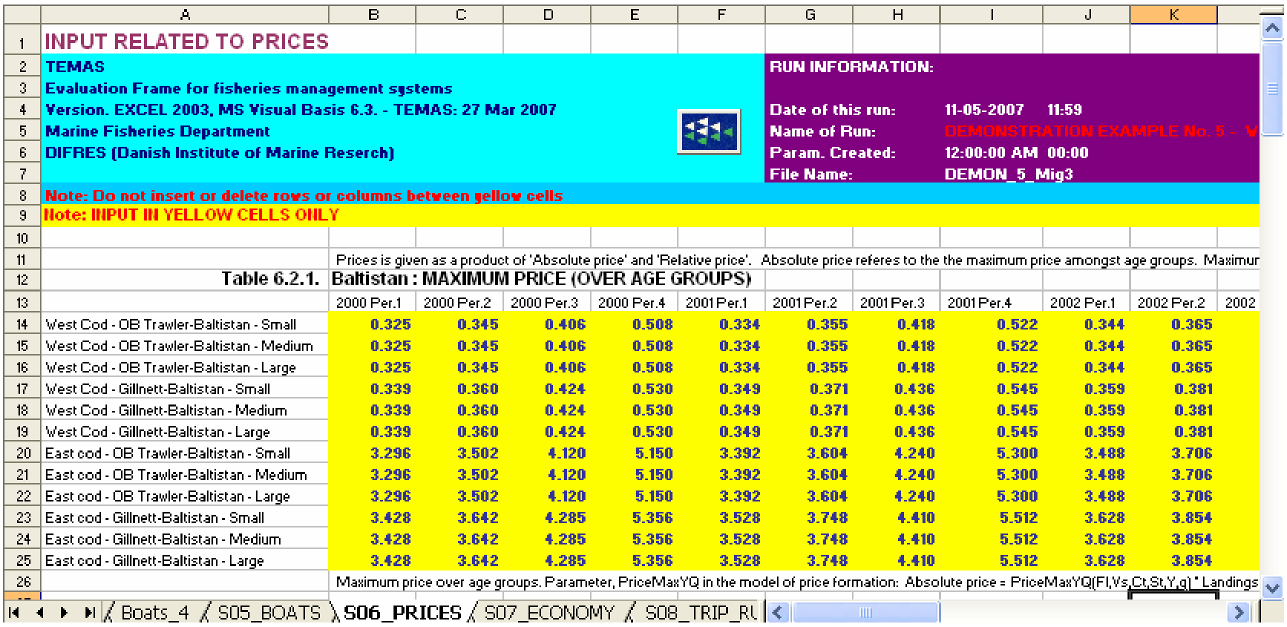
and

$P_{Rel}(Fl,Vs, Rg, Ct, St, a, q)$ is the relative price of age group “a”.

Note that $P_{Max}$ depends on the year and the period, but not the age group, whereas $P_{Rel}$ depends on the age group of the animals but not the year. The product becomes the age-dependent absolute price:

$$P(Fl,Vs, Rg, Ct, St, y, a, q) = P_{Max}(Fl,Vs, Rg, Ct, St, y, q)* P_{Rel}(Fl,Vs, Rg, Ct, St, q, a)$$

The maximum prices are shown in Table 2.9.2 (EXCEL Table 6.2.1) and the relative price is shown in Figure 2.9.3 (EXCEL Table 6.2.2).



INPUT RELATED TO PRICES

TEMAS
Evaluation Frame for fisheries management systems
Version. EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 27 Mar 2007
Marine Fisheries Department
DIFRES (Danish Institute of Marine Reserch)

RUN INFORMATION:
Date of this run: 11-05-2007 11:59
Name of Run: DEMONSTRATION EXAMPLE No. 5 - V
Param. Created: 12:00:00 AM 00:00
File Name: DEMON_5_Mig3

Note: Do not insert or delete rows or columns between yellow cells
Note: INPUT IN YELLOW CELLS ONLY

Prices is given as a product of 'Absolute price' and 'Relative price'.  Absolute price referes to the the maximum price amongst age groups.  Maximur

Table 6.2.1. Baltistan : MAXIMUM PRICE (OVER AGE GROUPS)

| | 2000 Per.1 | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 2002 Per.1 | 2002 Per.2 | 2002 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| West Cod - OB Trawler-Baltistan - Small | 0.325 | 0.345 | 0.406 | 0.508 | 0.334 | 0.355 | 0.418 | 0.522 | 0.344 | 0.365 | |
| West Cod - OB Trawler-Baltistan - Medium | 0.325 | 0.345 | 0.406 | 0.508 | 0.334 | 0.355 | 0.418 | 0.522 | 0.344 | 0.365 | |
| West Cod - OB Trawler-Baltistan - Large | 0.325 | 0.345 | 0.406 | 0.508 | 0.334 | 0.355 | 0.418 | 0.522 | 0.344 | 0.365 | |
| West Cod - Gillnett-Baltistan - Small | 0.339 | 0.360 | 0.424 | 0.530 | 0.349 | 0.371 | 0.436 | 0.545 | 0.359 | 0.381 | |
| West Cod - Gillnett-Baltistan - Medium | 0.339 | 0.360 | 0.424 | 0.530 | 0.349 | 0.371 | 0.436 | 0.545 | 0.359 | 0.381 | |
| West Cod - Gillnett-Baltistan - Large | 0.339 | 0.360 | 0.424 | 0.530 | 0.349 | 0.371 | 0.436 | 0.545 | 0.359 | 0.381 | |
| East cod - OB Trawler-Baltistan - Small | 3.296 | 3.502 | 4.120 | 5.150 | 3.392 | 3.604 | 4.240 | 5.300 | 3.488 | 3.706 | |
| East cod - OB Trawler-Baltistan - Medium | 3.296 | 3.502 | 4.120 | 5.150 | 3.392 | 3.604 | 4.240 | 5.300 | 3.488 | 3.706 | |
| East cod - OB Trawler-Baltistan - Large | 3.296 | 3.502 | 4.120 | 5.150 | 3.392 | 3.604 | 4.240 | 5.300 | 3.488 | 3.706 | |
| East cod - Gillnett-Baltistan - Small | 3.428 | 3.642 | 4.285 | 5.356 | 3.528 | 3.748 | 4.410 | 5.512 | 3.628 | 3.854 | |
| East cod - Gillnett-Baltistan - Medium | 3.428 | 3.642 | 4.285 | 5.356 | 3.528 | 3.748 | 4.410 | 5.512 | 3.628 | 3.854 | |
| East cod - Gillnett-Baltistan - Large | 3.428 | 3.642 | 4.285 | 5.356 | 3.528 | 3.748 | 4.410 | 5.512 | 3.628 | 3.854 | |

Maximum price over age groups. Parameter, PriceMaxYQ in the model of price formation:  Absolute price = PriceMaxYQ(Fl,Vs,Ct,St,Y,q) * Landings

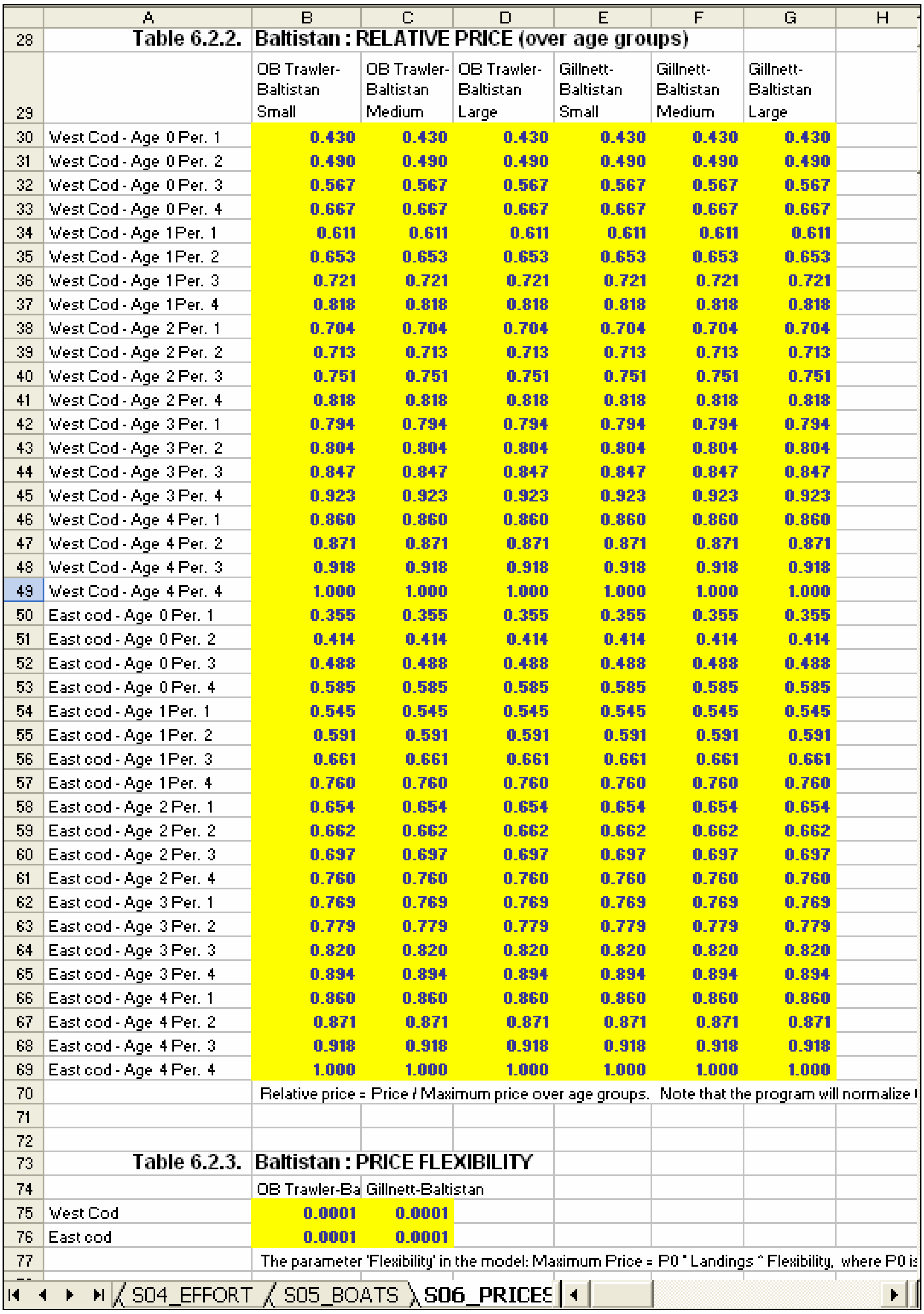
***Figure 2.9.2. Maximum price over age groups.***
***The explanation above the EXCEL table says:***
***Prices are given as a product of 'Absolute price' and 'Relative price'.***
***Absolute price refers to  the maximum price amongst age groups. "***
***Maximum prices can either be given as input (for all years) or be calculated by the model:***
***PriceMax(Y+1) = PriceMax0(Y) * LandingsWeight_Y(Y) ^ PriceFlex(Y).***
***The relative values are between zero and one and defines the relative value over age of fish (ages, period), and over periods  during the year.  All together the price model reads:***
***Price(Fl,Vs,Ct,St,q,a,Y,q) = PriceMaxYQ(Fl,Vs,Ct,St,Y,q) * LandingsWeight(St,y,q) ^ PriceFlex(Fl,Vs,Ct) * PriceRelbyAge(Fl,Vs,Ct,St,q,a).***
***Where Fl = Fleet, Vs = Vessel size, Ct = Country, St = Stock, y = year, q = Period, a = age group.***
***The explanation below the EXCEL table says:***
***Maximum price over age groups. Parameter, PriceMaxYQ in the model of price formation:***
***Absolute price = PriceMaxYQ(Fl,Vs,Ct,St,Y,q) * LandingsWeight(St,y,q) ^ PriceFlex(Fl,Vs,Ct)***

In the current version of TEMAS,  prices are given as  input parameters. They can either be assumed to remain constant (i.e. no changes in response to changes in supply) or to vary as a result of changes in supply (i.e. in landings).  Where variations in supply are assumed to have an effect on prices, TEMAS provides a simple price formation function that, however, disregards changes in demand. In the simple version, price flexibility is only related to changes in the supply (i.e. landings of the fishery) of the same species:

$$P_{Max}(Fl,Vs,Rg,Ct,St,y,q) =$$
$$P_{Max,0}(Fl,Vs,Rg,Ct,St,q) * Y_{Land}(\bullet,St,y-1,\bullet,\bullet,\bullet)^{PFlex(Fl,St)}$$

where PFlex(Fl, Vs, Rg, Ct, St), is the price flexibility and  $P_{max,0}$ (Fl, Vs, Rg, Ct, St, y) is a constant coefficient

The price flexibility is shown in Figure 2.9.3 (EXCEL Table 6.2.3).



| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| 28 | Table 6.2.2. | Baltistan : RELATIVE PRICE (over age groups) | | | | | | |
| 29 | | OB Trawler-Baltistan Small | OB Trawler-Baltistan Medium | OB Trawler-Baltistan Large | Gillnett-Baltistan Small | Gillnett-Baltistan Medium | Gillnett-Baltistan Large | |
| 30 | West Cod - Age 0 Per. 1 | 0.430 | 0.430 | 0.430 | 0.430 | 0.430 | 0.430 | |
| 31 | West Cod - Age 0 Per. 2 | 0.490 | 0.490 | 0.490 | 0.490 | 0.490 | 0.490 | |
| 32 | West Cod - Age 0 Per. 3 | 0.567 | 0.567 | 0.567 | 0.567 | 0.567 | 0.567 | |
| 33 | West Cod - Age 0 Per. 4 | 0.667 | 0.667 | 0.667 | 0.667 | 0.667 | 0.667 | |
| 34 | West Cod - Age 1 Per. 1 | 0.611 | 0.611 | 0.611 | 0.611 | 0.611 | 0.611 | |
| 35 | West Cod - Age 1 Per. 2 | 0.653 | 0.653 | 0.653 | 0.653 | 0.653 | 0.653 | |
| 36 | West Cod - Age 1 Per. 3 | 0.721 | 0.721 | 0.721 | 0.721 | 0.721 | 0.721 | |
| 37 | West Cod - Age 1 Per. 4 | 0.818 | 0.818 | 0.818 | 0.818 | 0.818 | 0.818 | |
| 38 | West Cod - Age 2 Per. 1 | 0.704 | 0.704 | 0.704 | 0.704 | 0.704 | 0.704 | |
| 39 | West Cod - Age 2 Per. 2 | 0.713 | 0.713 | 0.713 | 0.713 | 0.713 | 0.713 | |
| 40 | West Cod - Age 2 Per. 3 | 0.751 | 0.751 | 0.751 | 0.751 | 0.751 | 0.751 | |
| 41 | West Cod - Age 2 Per. 4 | 0.818 | 0.818 | 0.818 | 0.818 | 0.818 | 0.818 | |
| 42 | West Cod - Age 3 Per. 1 | 0.794 | 0.794 | 0.794 | 0.794 | 0.794 | 0.794 | |
| 43 | West Cod - Age 3 Per. 2 | 0.804 | 0.804 | 0.804 | 0.804 | 0.804 | 0.804 | |
| 44 | West Cod - Age 3 Per. 3 | 0.847 | 0.847 | 0.847 | 0.847 | 0.847 | 0.847 | |
| 45 | West Cod - Age 3 Per. 4 | 0.923 | 0.923 | 0.923 | 0.923 | 0.923 | 0.923 | |
| 46 | West Cod - Age 4 Per. 1 | 0.860 | 0.860 | 0.860 | 0.860 | 0.860 | 0.860 | |
| 47 | West Cod - Age 4 Per. 2 | 0.871 | 0.871 | 0.871 | 0.871 | 0.871 | 0.871 | |
| 48 | West Cod - Age 4 Per. 3 | 0.918 | 0.918 | 0.918 | 0.918 | 0.918 | 0.918 | |
| 49 | West Cod - Age 4 Per. 4 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | |
| 50 | East cod - Age 0 Per. 1 | 0.355 | 0.355 | 0.355 | 0.355 | 0.355 | 0.355 | |
| 51 | East cod - Age 0 Per. 2 | 0.414 | 0.414 | 0.414 | 0.414 | 0.414 | 0.414 | |
| 52 | East cod - Age 0 Per. 3 | 0.488 | 0.488 | 0.488 | 0.488 | 0.488 | 0.488 | |
| 53 | East cod - Age 0 Per. 4 | 0.585 | 0.585 | 0.585 | 0.585 | 0.585 | 0.585 | |
| 54 | East cod - Age 1 Per. 1 | 0.545 | 0.545 | 0.545 | 0.545 | 0.545 | 0.545 | |
| 55 | East cod - Age 1 Per. 2 | 0.591 | 0.591 | 0.591 | 0.591 | 0.591 | 0.591 | |
| 56 | East cod - Age 1 Per. 3 | 0.661 | 0.661 | 0.661 | 0.661 | 0.661 | 0.661 | |
| 57 | East cod - Age 1 Per. 4 | 0.760 | 0.760 | 0.760 | 0.760 | 0.760 | 0.760 | |
| 58 | East cod - Age 2 Per. 1 | 0.654 | 0.654 | 0.654 | 0.654 | 0.654 | 0.654 | |
| 59 | East cod - Age 2 Per. 2 | 0.662 | 0.662 | 0.662 | 0.662 | 0.662 | 0.662 | |
| 60 | East cod - Age 2 Per. 3 | 0.697 | 0.697 | 0.697 | 0.697 | 0.697 | 0.697 | |
| 61 | East cod - Age 2 Per. 4 | 0.760 | 0.760 | 0.760 | 0.760 | 0.760 | 0.760 | |
| 62 | East cod - Age 3 Per. 1 | 0.769 | 0.769 | 0.769 | 0.769 | 0.769 | 0.769 | |
| 63 | East cod - Age 3 Per. 2 | 0.779 | 0.779 | 0.779 | 0.779 | 0.779 | 0.779 | |
| 64 | East cod - Age 3 Per. 3 | 0.820 | 0.820 | 0.820 | 0.820 | 0.820 | 0.820 | |
| 65 | East cod - Age 3 Per. 4 | 0.894 | 0.894 | 0.894 | 0.894 | 0.894 | 0.894 | |
| 66 | East cod - Age 4 Per. 1 | 0.860 | 0.860 | 0.860 | 0.860 | 0.860 | 0.860 | |
| 67 | East cod - Age 4 Per. 2 | 0.871 | 0.871 | 0.871 | 0.871 | 0.871 | 0.871 | |
| 68 | East cod - Age 4 Per. 3 | 0.918 | 0.918 | 0.918 | 0.918 | 0.918 | 0.918 | |
| 69 | East cod - Age 4 Per. 4 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | |
| 70 | | Relative price = Price / Maximum price over age groups.   Note that the program will normalize | | | | | | |
| 71 | | | | | | | | |
| 72 | | | | | | | | |
| 73 | Table 6.2.3. | Baltistan : PRICE FLEXIBILITY | | | | | | |
| 74 | | OB Trawler-Ba | Gillnett-Baltistan | | | | | |
| 75 | West Cod | 0.0001 | 0.0001 | | | | | |
| 76 | East cod | 0.0001 | 0.0001 | | | | | |
| 77 | | The parameter 'Flexibility' in the model: Maximum Price = P0 * Landings ^ Flexibility,  where P0 is | | | | | | |

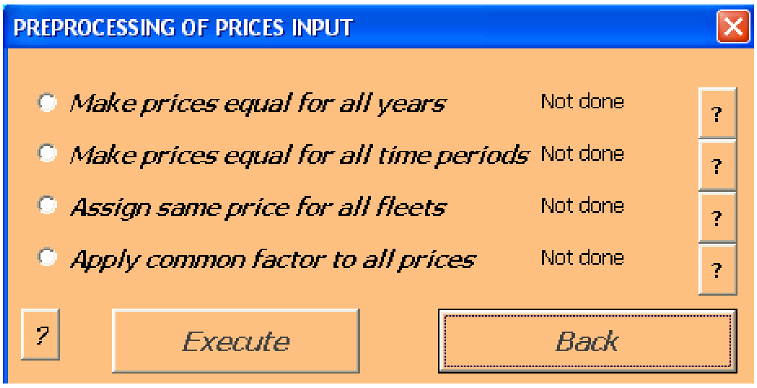
*Figure 2.9.3. Relative prices.*

***The explanation below the EXCEL table 6.2.2. says:***

***Relative price = Price / Maximum price over age groups.   Note that the program will normalize the values you  give as input, so that maximum becomes 1.0***

***The explanation below the EXCEL table 6.2.3. says:***

***The parameter 'Flexibility' in the model: Maximum Price = P0 * Landings ^ Flexibility,  where P0 is a constant***



PREPROCESSING OF PRICES INPUT

○ Make prices equal for all years Not done ?
○ Make prices equal for all time periods Not done ?
○ Assign same price for all fleets Not done ?
○ Apply common factor to all prices Not done ?

**Figure 2.9.4. Options for pre-processing of prices data and parameters.**

Figure 2.9.4 shows the user form for four options for pre-processing of price input.

1) "Make prices equal for all years"

This option applies to the maximum price only (the relative price is not dependent on year). It takes price for the first year and assigns that value to all the later years.

$P_{\mathrm{Max}}(Fl,Vs,Rg,Ct, St, y,q) = P_{\mathrm{Max}}(Fl,Vs,Rg,Ct, St, 1,q)$

If you select that option the content of the cells for years after first year becomes irrelevant

2) "Make prices equal for all time periods"

This applies to the relative price only (the maximum price is not dependent on period). It takes price for the first period and assigns that value to all the later periods:"

$P_{\mathrm{Rel}}(Fl,Vs, Rg, Ct, St, a, q) = P_{\mathrm{Rel}}(Fl,Vs, Rg, Ct, St, a, 1)$

If you select that option the content of the cells for periods after first period becomes irrelevant

3) "Make prices equal for all fleets"

This option applies to the relative price and the maximum price. It takes price for the fleet first year and assigns that value to all the later periods:

$P_{\mathrm{Max}}(Fl,Vs,Rg,Ct, St, y,q) = P_{\mathrm{Max}}(1, 1, 1, Ct, St, y, q)$
$P_{\mathrm{Rel}}(Fl,Vs, Rg, Ct, St, a, q) = P_{\mathrm{Rel}}( 1, 1, 1, Ct, St, a, q)$

Note that between (year,period)- variation is maintained
If you select that option the content of the cells for fleets after first fleet becomes irrelevant

4) "Apply common factor to all prices"

This option lets you read a common price multiplier, X, by an 'input-box'. Then the multiplier is then applie to the maximum price:

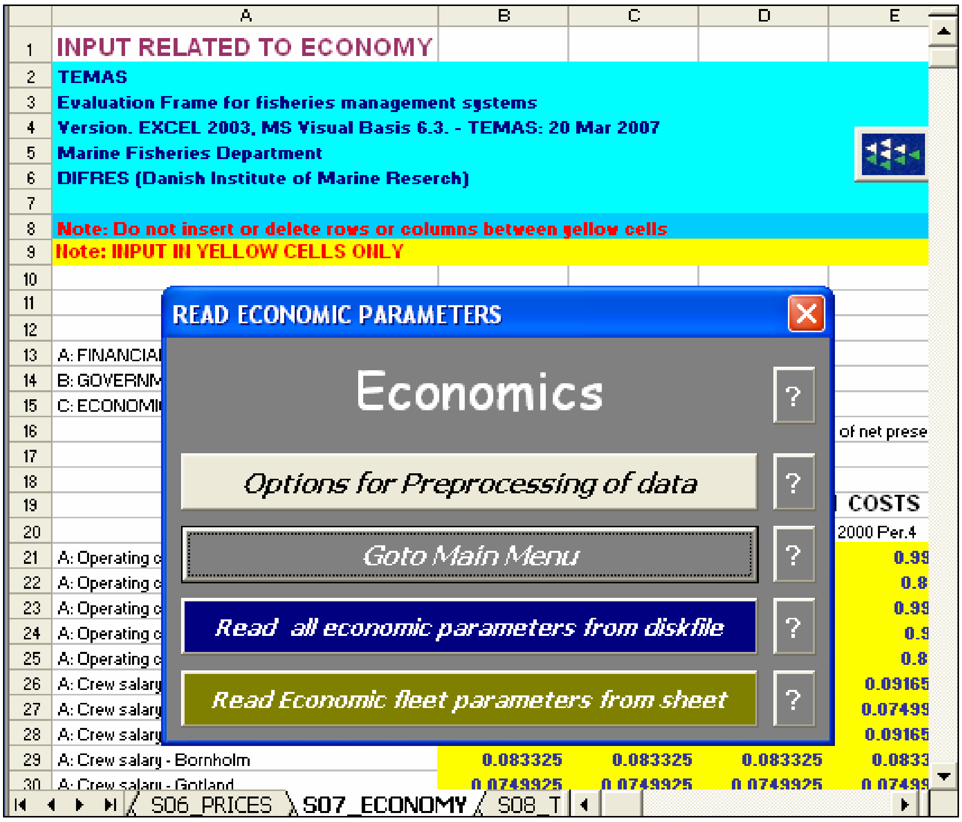
$P_{\mathrm{Max}}(Fl,Vs,Rg,Ct, St, y,q) = X * P_{\mathrm{Max}}(Fl, Vs, Rg, Ct, St, y, q)$

## 2.10. ECONOMIC INPUT, S07_ECONOMY

There are 3 economic models in the current version of TEMAS, reflecting the views of three groups of stakeholders

A) FINANCIAL ANALYSIS OF FLEETS: From the point of view of vessel owners.
B) GOVERNMENT BUDGET: The impact of the fleets on the government budget
C) ECONOMIC ANALYSIS: The economic performance from of the economy as a whole.

Figure 2.10.1 shows the user form for entry of economy related input.



INPUT RELATED TO ECONOMY
TEMAS
Evaluation Frame for fisheries management systems
Version. EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 20 Mar 2007
Marine Fisheries Department
DIFRES (Danish Institute of Marine Reserch)
Note: Do not insert or delete rows or columns between yellow cells
Note: INPUT IN YELLOW CELLS ONLY

*Figure 2.10.1 User-form for entry of economy  related parameters.*

| Index | EXCEL Table | Caption |
|---|---|---|
| 151 | Table7.1. | Rate of discount |
| 152 | Table7.2.1.1.1. | Baltistan : OB Trawler-Baltistan - Small  COSTS |
| 153 | Table7.2.1.1.2. | Baltistan : OB Trawler-Baltistan - Medium  COSTS |
| 154 | Table7.2.1.1.3. | Baltistan : OB Trawler-Baltistan - Large  COSTS |
| 155 | Table7.2.1.2.1. | Baltistan : Gillnett-Baltistan - Small  COSTS |
| 156 | Table7.2.1.2.2. | Baltistan : Gillnett-Baltistan - Medium  COSTS |
| 157 | Table7.2.1.2.3. | Baltistan : Gillnett-Baltistan - Large  COSTS |
| 158 | Table7.2.2.1.1. | Scandinavia : OB Trawler-Scandinavia - Small  COSTS |
| 159 | Table7.2.2.1.2. | Scandinavia : OB Trawler-Scandinavia - Medium  COSTS |
| 160 | Table7.2.2.1.3. | Scandinavia : OB Trawler-Scandinavia - Large  COSTS |
| 161 | Table7.2.2.2.1. | Scandinavia : Gillnett-Scandinavia - Small  COSTS |
| 162 | Table7.2.2.2.2. | Scandinavia : Gillnett-Scandinavia - Medium  COSTS |
| 163 | Table7.2.2.2.3. | Scandinavia : Gillnett-Scandinavia - Large  COSTS |
| 164 | Table7.2.2.2.3.1. | Revenue from other species |

*Table 2.10.1. Tables in the economy  input sheet, S07_ECONOMY.*

The Visual Basic code of the TEMAS program for the economy has been constructed so that it is flexible. That means that the economic model can be modified, extended or reduced, should a special application required it. The tables shown as examples below are slightly simpler than the theory explaned in Annex C of the TEMAS report. For example, it is a relatively simple thing for the programmer to change the number of economic models.

Whenever a feature from Annex C is not in the current version of TEMAS, this is explained.

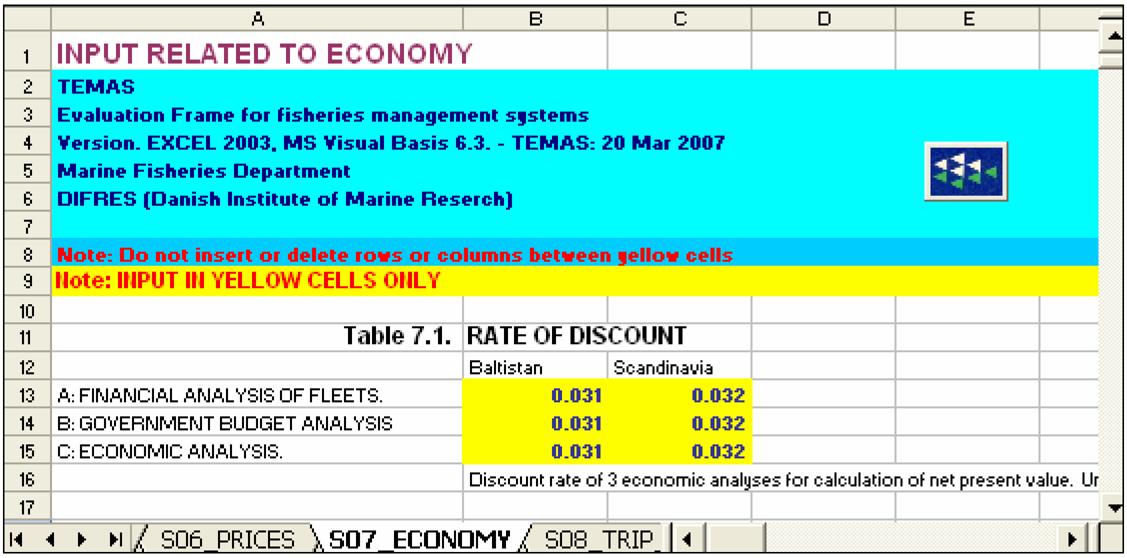
All three models operate with the same concepts of costs, earnings and investments, but (possibly) with different parameters.

The economic model calculates the cash flow (revenue – costs) for each time period and eventual it computes the net present value over the time horizon simulated. The economic model was designed by Mr. Rolf Willmann,  of the fisheries department of  FAO, Rome (Sparre and Willmann, 1993).

The key performance measures of project analysis are the net present value (NPV), equal to the discounted net cash flow. The NPV is defined:

$$NPV(r) = \sum_{y=y_{first}}^{y_{last}} \frac{Value_y}{(1+r)^{y-y_{first}}}$$

where “r” is a user defined input parameter, the “discount rate”. The discount rate is country specific and model-specific, as appears from Figure 2.10.2, which shows the input table for Discount rates.



INPUT RELATED TO ECONOMY

TEMAS

Evaluation Frame for fisheries management systems

Version. EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 20 Mar 2007

Marine Fisheries Department

DIFRES (Danish Institute of Marine Reserch)

Note: Do not insert or delete rows or columns between yellow cells

Note: INPUT IN YELLOW CELLS ONLY

Table 7.1. RATE OF DISCOUNT

| | Baltistan | Scandinavia |
|---|---|---|
| A: FINANCIAL ANALYSIS OF FLEETS. | 0.031 | 0.032 |
| B: GOVERNMENT BUDGET ANALYSIS | 0.031 | 0.032 |
| C: ECONOMIC ANALYSIS. | 0.031 | 0.032 |

Discount rate of 3 economic analyses for calculation of net present value. Ur

***Figure 2.10.2.  Rate of discount***

***The explanation below EXCEL Table 7.1 says: Discount rate of  3 economic analyses for calculation of net present value.  Unit: Per year (absolute number, not percent) There are 3 economic analyses: (A) FINANCIAL ANALYSIS OF FLEETS: The financial input parameters to analyse the finacial performance of  fishing fleets (i.e. from the point of view of vessel owners),  (B): GOVERNMENT BUDGET ANALYSIS: The financial input parameters to analyse  the impact of the fleets on the government budget. (B): ECONOMIC ANALYSIS: The economic input arameters to analyse the economic performance  of fishing fleet(s) and the entire fishery (i.e. from the point of view of the economy as a whole)***

Figures 2.10.3.a-b contain the rates of costs, investment and decommission of the three models (A) FINANCIAL ANALYSIS OF FLEETS (B) GOVERNMENT BUDGET (C) ECONOMIC ANALYSIS, where the models are indicated by A,B and C. The table is country, fleet and vessel size specific. Some of the costs are area-specific

| | A | B | C | D | E | |
|---|---|---|---|---|---|---|
| 18 | | | | | | |
| 19 | Table 7.2.1.1.1. | Baltistan : OB Trawler-Baltistan - Small COSTS | | | | |
| 20 | | 2000 Per.1 | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 F |
| 21 | A: Operating cost - West Baltic | 1.00 | 1.00 | 1.00 | 1.00 | |
| 22 | A: Operating cost - East Baltic | 0.82 | 0.82 | 0.82 | 0.82 | |
| 23 | A: Operating cost - Not Baltic | 1.00 | 1.00 | 1.00 | 1.00 | |
| 24 | A: Operating cost - Bornholm | 0.91 | 0.91 | 0.91 | 0.91 | |
| 25 | A: Operating cost - Gotland | 0.82 | 0.82 | 0.82 | 0.82 | |
| 26 | A: Crew salary - West Baltic | 0.09 | 0.09 | 0.09 | 0.09 | |
| 27 | A: Crew salary - East Baltic | 0.07 | 0.07 | 0.07 | 0.07 | |
| 28 | A: Crew salary - Not Baltic | 0.09 | 0.09 | 0.09 | 0.09 | |
| 29 | A: Crew salary - Bornholm | 0.08 | 0.08 | 0.08 | 0.08 | |
| 30 | A: Crew salary - Gotland | 0.07 | 0.07 | 0.07 | 0.07 | |
| 31 | A: Handling cost - West Baltic | 0.06 | 0.06 | 0.06 | 0.06 | |
| 32 | A: Handling cost - East Baltic | 0.05 | 0.05 | 0.05 | 0.05 | |
| 33 | A: Handling cost - Not Baltic | 0.06 | 0.06 | 0.06 | 0.06 | |
| 34 | A: Handling cost - Bornholm | 0.06 | 0.06 | 0.06 | 0.06 | |
| 35 | A: Handling cost - Gotland | 0.05 | 0.05 | 0.05 | 0.05 | |
| 36 | A: Sale cost - West Baltic | 0.05 | 0.05 | 0.05 | 0.05 | |
| 37 | A: Sale cost - East Baltic | 0.04 | 0.04 | 0.04 | 0.04 | |
| 38 | A: Sale cost - Not Baltic | 0.05 | 0.05 | 0.05 | 0.05 | |
| 39 | A: Sale cost - Bornholm | 0.04 | 0.04 | 0.04 | 0.04 | |
| 40 | A: Sale cost - Gotland | 0.04 | 0.04 | 0.04 | 0.04 | |
| 41 | A: Crew share | 0.30 | 0.30 | 0.30 | 0.30 | |
| 42 | A: License fee | 9.09 | 9.09 | 9.09 | 9.09 | |
| 43 | A: Insurance | 11.11 | 11.11 | 11.11 | 11.11 | |
| 44 | A: Other fixed costs | 25.25 | 25.25 | 25.25 | 25.25 | |
| 45 | A: Investment per new vessel | 1010.00 | 1010.00 | 1010.00 | 1010.00 | |
| 46 | A: Vessel Decommission Age 1 | 680.07 | 680.07 | 680.07 | 680.07 | |
| 47 | B: Tax on operating cost - West Baltic | 0.19 | 0.19 | 0.19 | 0.19 | |
| 48 | B: Tax on operating cost - East Baltic | 0.15 | 0.15 | 0.15 | 0.15 | |
| 49 | B: Tax on operating cost - Not Baltic | 0.19 | 0.19 | 0.19 | 0.19 | |
| 50 | B: Tax on operating cost - Bornholm | 0.17 | 0.17 | 0.17 | 0.17 | |
| 51 | B: Tax on operating cost - Gotland | 0.15 | 0.15 | 0.15 | 0.15 | |
| 52 | B: Subsidy on operating cost - West Baltic | 0.09 | 0.09 | 0.09 | 0.09 | |
| 53 | B: Subsidy on operating cost - East Baltic | 0.07 | 0.07 | 0.07 | 0.07 | |
| 54 | B: Subsidy on operating cost - Not Baltic | 0.09 | 0.09 | 0.09 | 0.09 | |
| 55 | B: Subsidy on operating cost - Bornholm | 0.08 | 0.08 | 0.08 | 0.08 | |
| 56 | B: Subsidy on operating cost - Gotland | 0.07 | 0.07 | 0.07 | 0.07 | |
| 57 | B: Revenue tax rate - West Baltic | 0.05 | 0.05 | 0.05 | 0.05 | |
| 58 | B: Revenue tax rate - East Baltic | 0.04 | 0.04 | 0.04 | 0.04 | |
| 59 | B: Revenue tax rate - Not Baltic | 0.05 | 0.05 | 0.05 | 0.05 | |
| 60 | B: Revenue tax rate - Bornholm | 0.04 | 0.04 | 0.04 | 0.04 | |
| 61 | B: Revenue tax rate - Gotland | 0.04 | 0.04 | 0.04 | 0.04 | |
| 62 | B: License fee | 9.09 | 9.09 | 9.09 | 9.09 | |
| 63 | B: Decommission crew | 101.00 | 101.00 | 101.00 | 101.00 | |
| 64 | B: Total vessel decommission Age 1 | 17.17 | 17.17 | 17.17 | 17.17 | |

***Figure 2.10.3.a. Variable costs and fixed costs of three economic models (continued).***

The parameters in EXCEL Table 7.2.1.1.1 are:

**Economic model A: Financial analysis of fleets:**

Financial operating costs of handling (Figure 2.10.3.a)

$COR^{i}_{Yield}(Fl,Vs,Rg,Ct,y,q,Ar)$ Cost rate (cost per weight unit) depending on the yield.

Financial crew salary: (Figure 2.10.3.a)

$COR^{Salary}_{Crew}(Fl,Vs,Rg,Ct,y,q,Ar)$: salary per unit of effort.

Financial operating costs of harvesting: (Figure 2.10.3.a)

$COR^{i}_{E}(Fl,Vs,Rg,Ct,y,q,Ar)$ Cost rate (cost per effort unit) depending on the effort in area Ar.

Financial operating costs of landings: (Figure 2.10.3.a)

$COR^{i}_{VAL}(Fl,Vs,Rg,Ct,y,q,Ar)$ Cost rate (cost per value unit) depending on the value of landings.

Crew share income (Figure 2.10.3.a)

$COF^{Share}_{Crew}(Fl,Vs,Ct,y,q)$ Relative crew share, Fraction of divisible earnings

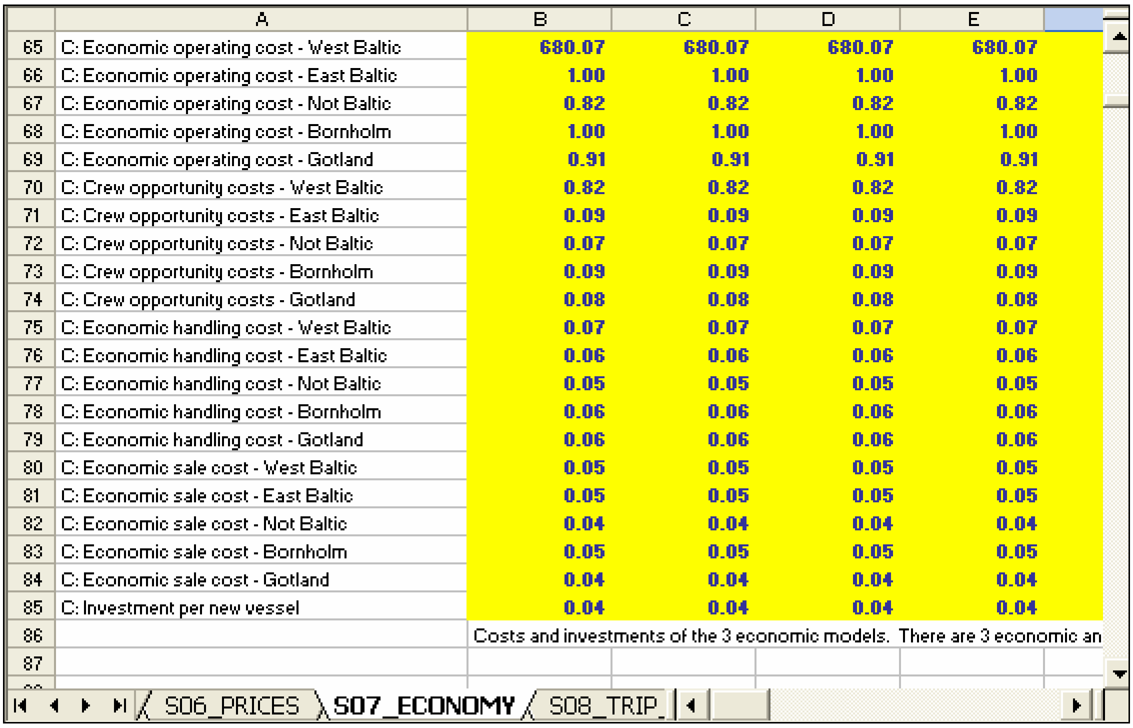
Financial Fixed costs (Figure 2.10.3.a)

$COR^{1}_{Fix}(Fl,Vs,Ct,y,q)$: Period Licence fee per vessel

$COR^{2}_{Fix}(Fl,Vs,Ct,y,q)$: Period Insurance per vessels

$COR^{3}_{Fix}(Fl,Vs,Ct,y,q)$: Other fixed costs per vessel per period

Financial investment cost in harvesting capacity (Figure 2.10.3.a)



| | A | B | C | D | E |
|---|---|---|---|---|---|
| 65 | C: Economic operating cost - West Baltic | 680.07 | 680.07 | 680.07 | 680.07 |
| 66 | C: Economic operating cost - East Baltic | 1.00 | 1.00 | 1.00 | 1.00 |
| 67 | C: Economic operating cost - Not Baltic | 0.82 | 0.82 | 0.82 | 0.82 |
| 68 | C: Economic operating cost - Bornholm | 1.00 | 1.00 | 1.00 | 1.00 |
| 69 | C: Economic operating cost - Gotland | 0.91 | 0.91 | 0.91 | 0.91 |
| 70 | C: Crew opportunity costs - West Baltic | 0.82 | 0.82 | 0.82 | 0.82 |
| 71 | C: Crew opportunity costs - East Baltic | 0.09 | 0.09 | 0.09 | 0.09 |
| 72 | C: Crew opportunity costs - Not Baltic | 0.07 | 0.07 | 0.07 | 0.07 |
| 73 | C: Crew opportunity costs - Bornholm | 0.09 | 0.09 | 0.09 | 0.09 |
| 74 | C: Crew opportunity costs - Gotland | 0.08 | 0.08 | 0.08 | 0.08 |
| 75 | C: Economic handling cost - West Baltic | 0.07 | 0.07 | 0.07 | 0.07 |
| 76 | C: Economic handling cost - East Baltic | 0.06 | 0.06 | 0.06 | 0.06 |
| 77 | C: Economic handling cost - Not Baltic | 0.05 | 0.05 | 0.05 | 0.05 |
| 78 | C: Economic handling cost - Bornholm | 0.06 | 0.06 | 0.06 | 0.06 |
| 79 | C: Economic handling cost - Gotland | 0.06 | 0.06 | 0.06 | 0.06 |
| 80 | C: Economic sale cost - West Baltic | 0.05 | 0.05 | 0.05 | 0.05 |
| 81 | C: Economic sale cost - East Baltic | 0.05 | 0.05 | 0.05 | 0.05 |
| 82 | C: Economic sale cost - Not Baltic | 0.04 | 0.04 | 0.04 | 0.04 |
| 83 | C: Economic sale cost - Bornholm | 0.05 | 0.05 | 0.05 | 0.05 |
| 84 | C: Economic sale cost - Gotland | 0.04 | 0.04 | 0.04 | 0.04 |
| 85 | C: Investment per new vessel | 0.04 | 0.04 | 0.04 | 0.04 |
| 86 | | Costs and investments of the 3 economic models. There are 3 economic an | | | |
| 87 | | | | | |

***Figure 2.10.3.b. Continued from Figure 2.10.3.a.Variable costs and fixed costs of three economic models). The explanation below the EXCEL table says:***

***Costs and investments of the 3 economic models. There are 3 economic analyses: (A) FINANCIAL ANALYSIS OF FLEETS: The financial input parameters to analyse the finacial performance of fishing fleets (i.e. from the point of view of vessel owners), (B): GOVERNMENT BUDGET ANALYSIS: The financial input parameters to analyse the impact of the fleets on the government budget. (C): ECONOMIC ANALYSIS: The economic input arameters to analyse the economic performance of fishing fleet(s) and the entire fishery (i.e. from the point of view of the economy as a whole)***

$INVR^{Total}(Fl,Vs,Ct,y,q)$: Cost of one new vessel

Vessel decommission payment: (Figure 2.10.3.a and c)

$DECVR(Fl,Vs,Ct,y,q,Va)$: Decommission fee of one vessel of age Va. In Figure 2.10.3.a, only one vessel age is considered. See example in Figure 2.10.3.c with 13 vessel age groups

### Economic model B: Government treasury

The cost rates are the same in model A, B and C, and therefore they do not appear under model B. The taxes are also the same. Taxes however, are given under model B in EXCEL table 7.2.1.1

Tax on Operating Costs (Figure 2.10.3.a)

$TAXR_{Operation}(Fl,Vs,Rg,Ct,y,q)$ = Tax rate of operation costs (tax per value unit)

Tax on gross revenue (Figure 2.10.3.a):

$TAXR_{REV}(Fl,Vs,Ct,y,q)$ :Tax rate of revenue (tax per value unit)

Subsidy on Operating Costs and prices

$SUBR_{Yield}(Fl,Vs,Rg,Ct,y,q)$ :Subsidy rate on landings (not used in current version of TEMAS)

$SUBR_{E}(Fl,Vs,Rg,Ct,y,q)$ :Subsidy rate on effort (called operation costs in current version of TEMAS)

$SUBR_{VAL}(Fl,Vs,Rg,Ct,y,q)$ :Subsidy rate on value of landings (not used in current version of TEMAS)

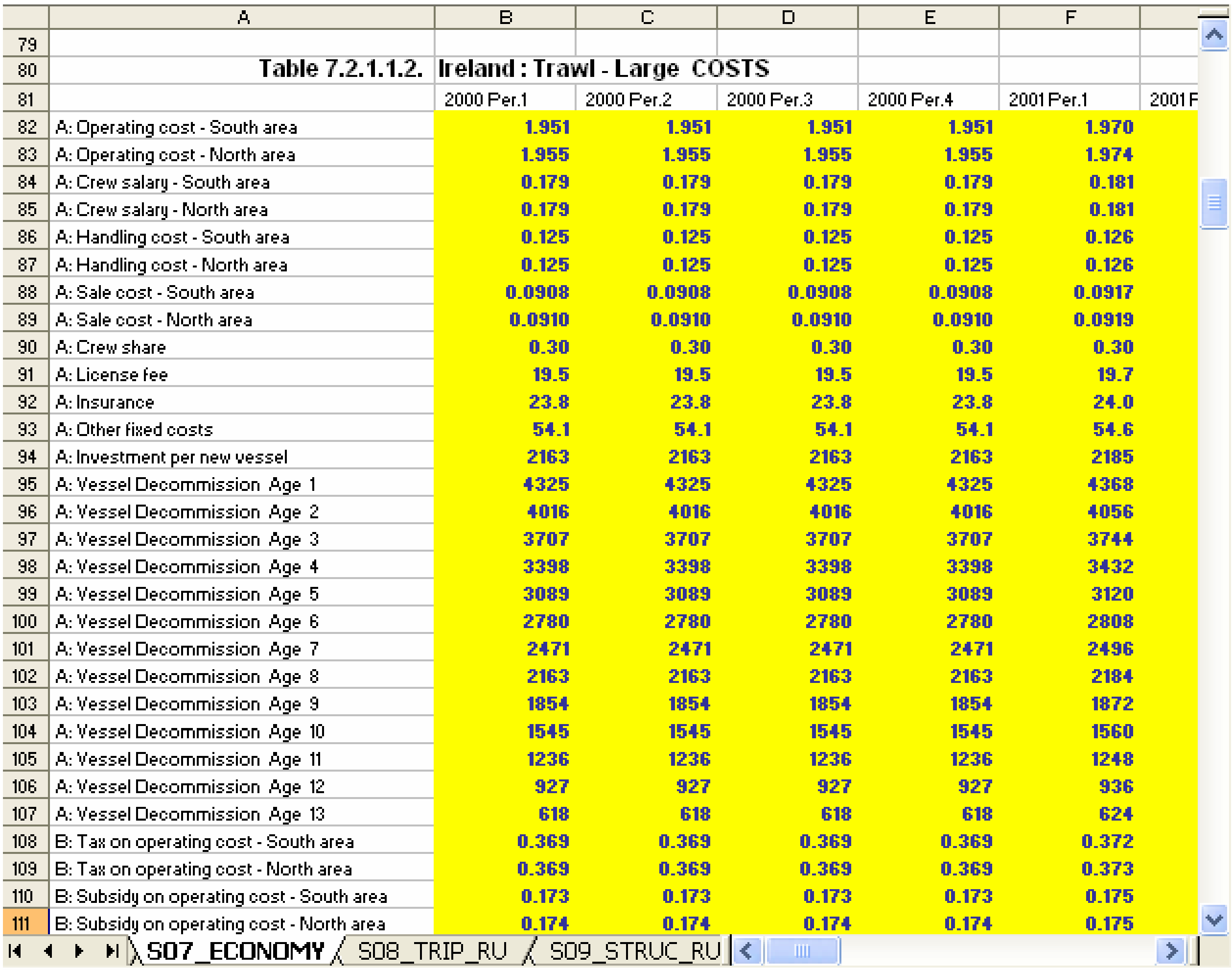
$P_{MinPO}$(Fl,Vs,Rg,Ct,St,y,a,q): Intervention price (the PO-price) is not used in the present version of TEMAS

$LICR(Fl,Vs,Ct,y)$ : Annual license fee of one vessel

$DECCR(Fl,Vs,Ct,y,q)$ : Decommission fee of one crew member

$DECVR(Fl,Vs,Ct,y,q,Va)$ : Decommission fee of one vessel

$CO_{Management}(Ct,y,q)$ : Cost of fisheries management is not in the current version of TEMAS



| | A | B | C | D | E | F | |
|---|---|---|---|---|---|---|---|
| 79 | | | | | | | |
| 80 | **Table 7.2.1.1.2.** | **Ireland : Trawl - Large  COSTS** | | | | | |
| 81 | | 2000 Per.1 | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 F |
| 82 | A: Operating cost - South area | 1.951 | 1.951 | 1.951 | 1.951 | 1.970 | |
| 83 | A: Operating cost - North area | 1.955 | 1.955 | 1.955 | 1.955 | 1.974 | |
| 84 | A: Crew salary - South area | 0.179 | 0.179 | 0.179 | 0.179 | 0.181 | |
| 85 | A: Crew salary - North area | 0.179 | 0.179 | 0.179 | 0.179 | 0.181 | |
| 86 | A: Handling cost - South area | 0.125 | 0.125 | 0.125 | 0.125 | 0.126 | |
| 87 | A: Handling cost - North area | 0.125 | 0.125 | 0.125 | 0.125 | 0.126 | |
| 88 | A: Sale cost - South area | 0.0908 | 0.0908 | 0.0908 | 0.0908 | 0.0917 | |
| 89 | A: Sale cost - North area | 0.0910 | 0.0910 | 0.0910 | 0.0910 | 0.0919 | |
| 90 | A: Crew share | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | |
| 91 | A: License fee | 19.5 | 19.5 | 19.5 | 19.5 | 19.7 | |
| 92 | A: Insurance | 23.8 | 23.8 | 23.8 | 23.8 | 24.0 | |
| 93 | A: Other fixed costs | 54.1 | 54.1 | 54.1 | 54.1 | 54.6 | |
| 94 | A: Investment per new vessel | 2163 | 2163 | 2163 | 2163 | 2185 | |
| 95 | A: Vessel Decommission  Age 1 | 4325 | 4325 | 4325 | 4325 | 4368 | |
| 96 | A: Vessel Decommission  Age 2 | 4016 | 4016 | 4016 | 4016 | 4056 | |
| 97 | A: Vessel Decommission  Age 3 | 3707 | 3707 | 3707 | 3707 | 3744 | |
| 98 | A: Vessel Decommission  Age 4 | 3398 | 3398 | 3398 | 3398 | 3432 | |
| 99 | A: Vessel Decommission  Age 5 | 3089 | 3089 | 3089 | 3089 | 3120 | |
| 100 | A: Vessel Decommission  Age 6 | 2780 | 2780 | 2780 | 2780 | 2808 | |
| 101 | A: Vessel Decommission  Age 7 | 2471 | 2471 | 2471 | 2471 | 2496 | |
| 102 | A: Vessel Decommission  Age 8 | 2163 | 2163 | 2163 | 2163 | 2184 | |
| 103 | A: Vessel Decommission  Age 9 | 1854 | 1854 | 1854 | 1854 | 1872 | |
| 104 | A: Vessel Decommission  Age 10 | 1545 | 1545 | 1545 | 1545 | 1560 | |
| 105 | A: Vessel Decommission  Age 11 | 1236 | 1236 | 1236 | 1236 | 1248 | |
| 106 | A: Vessel Decommission  Age 12 | 927 | 927 | 927 | 927 | 936 | |
| 107 | A: Vessel Decommission  Age 13 | 618 | 618 | 618 | 618 | 624 | |
| 108 | B: Tax on operating cost - South area | 0.369 | 0.369 | 0.369 | 0.369 | 0.372 | |
| 109 | B: Tax on operating cost - North area | 0.369 | 0.369 | 0.369 | 0.369 | 0.373 | |
| 110 | B: Subsidy on operating cost - South area | 0.173 | 0.173 | 0.173 | 0.173 | 0.175 | |
| 111 | B: Subsidy on operating cost - North area | 0.174 | 0.174 | 0.174 | 0.174 | 0.175 | |

*Figure 2.10.3.c. Example with vessel age specific decommission fee. The decommission in Figure 2.10.3.a  (line 46) is for only one vessel age group, because vessel age are ignored in that example.*

## Economic model C: Economic model (for the Society)

$COR^{i}_{Yield}(Fl,Vs,Rg,Ct,y,q,Ar)$    Economic Cost rate (cost per weight unit) depending on the yield.

Financial crew salary: (Figure 2.10.3.b)

$COR^{Salary}_{Crew}(Fl,Vs,Rg,Ct,y,q,Ar)$ : salary per unit of effort.

Financial operating costs of harvesting: (Figure 2.10.3.b)

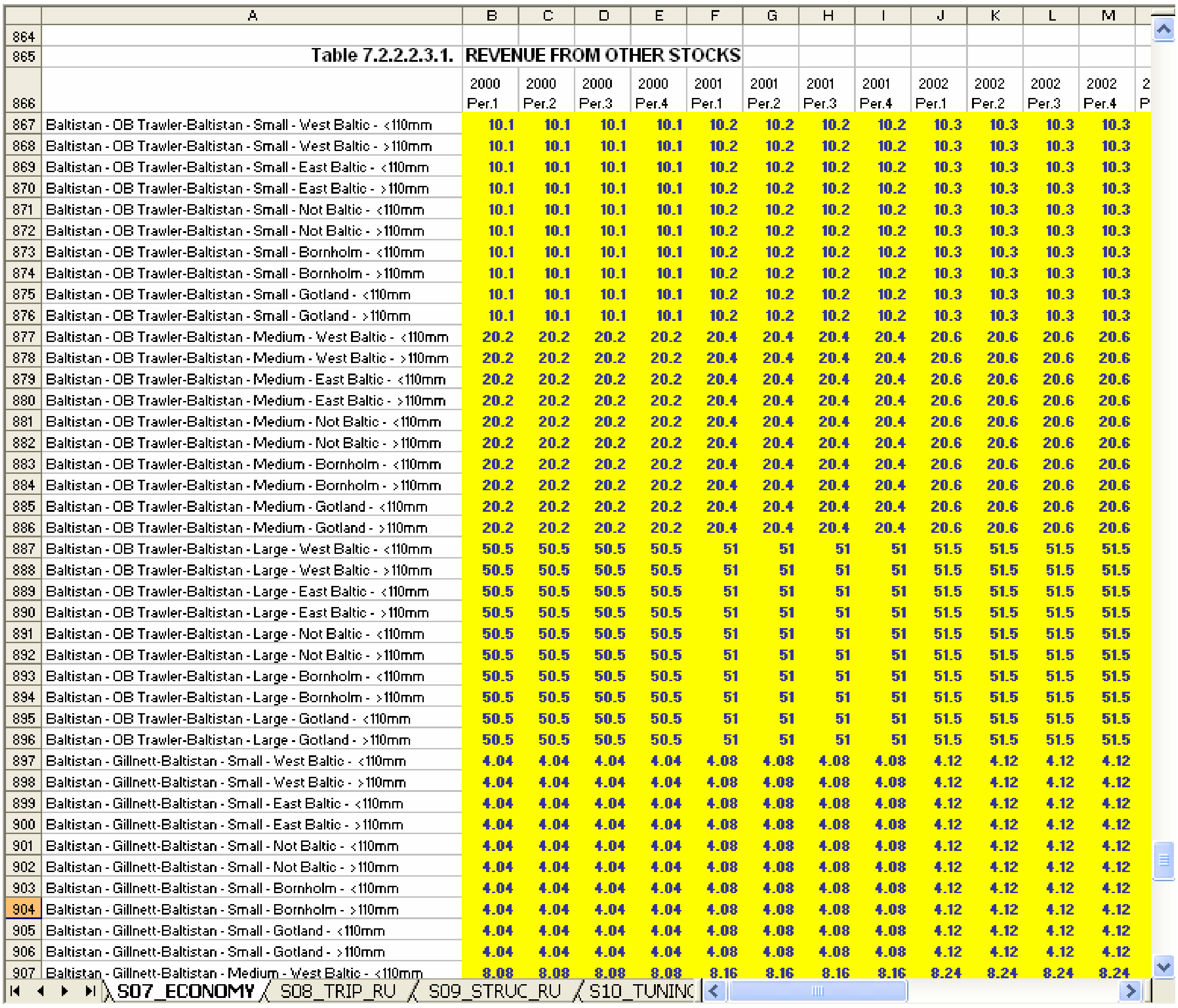
$COR^{i}_{E}(Fl,Vs,Rg,Ct,y,q,Ar)$ : Economic Cost rate depending on the effort in area Ar.

Financial operating costs of landings: (Figure 2.10.3.b)

$COR^{i}_{VAL}(Fl,Vs,Rg,Ct,y,q,Ar)$ : Economic Cost rate depending on the value of landings.

$COR_{Oprtunity}(Fl,Vs,Ct,y,q)$ : Opportunity cost rate (per crew member per period)

$INVR^{Total}(Fl,Vs,Ct,y,q)$: Cost of one new vessel



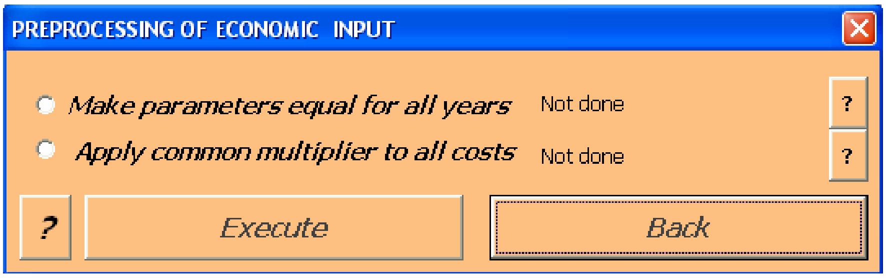
|  | A | B | C | D | E | F | G | H | I | J | K | L | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 864 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 865 | Table 7.2.2.2.3.1. | REVENUE FROM OTHER STOCKS |  |  |  |  |  |  |  |  |  |  |  |
| 866 |  | 2000 Per.1 | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 2002 Per.1 | 2002 Per.2 | 2002 Per.3 | 2002 Per.4 |
| 867 | Baltistan - OB Trawler-Baltistan - Small - West Baltic - <110mm | 10.1 | 10.1 | 10.1 | 10.1 | 10.2 | 10.2 | 10.2 | 10.2 | 10.3 | 10.3 | 10.3 | 10.3 |
| 868 | Baltistan - OB Trawler-Baltistan - Small - West Baltic - >110mm | 10.1 | 10.1 | 10.1 | 10.1 | 10.2 | 10.2 | 10.2 | 10.2 | 10.3 | 10.3 | 10.3 | 10.3 |
| 869 | Baltistan - OB Trawler-Baltistan - Small - East Baltic - <110mm | 10.1 | 10.1 | 10.1 | 10.1 | 10.2 | 10.2 | 10.2 | 10.2 | 10.3 | 10.3 | 10.3 | 10.3 |
| 870 | Baltistan - OB Trawler-Baltistan - Small - East Baltic - >110mm | 10.1 | 10.1 | 10.1 | 10.1 | 10.2 | 10.2 | 10.2 | 10.2 | 10.3 | 10.3 | 10.3 | 10.3 |
| 871 | Baltistan - OB Trawler-Baltistan - Small - Not Baltic - <110mm | 10.1 | 10.1 | 10.1 | 10.1 | 10.2 | 10.2 | 10.2 | 10.2 | 10.3 | 10.3 | 10.3 | 10.3 |
| 872 | Baltistan - OB Trawler-Baltistan - Small - Not Baltic - >110mm | 10.1 | 10.1 | 10.1 | 10.1 | 10.2 | 10.2 | 10.2 | 10.2 | 10.3 | 10.3 | 10.3 | 10.3 |
| 873 | Baltistan - OB Trawler-Baltistan - Small - Bornholm - <110mm | 10.1 | 10.1 | 10.1 | 10.1 | 10.2 | 10.2 | 10.2 | 10.2 | 10.3 | 10.3 | 10.3 | 10.3 |
| 874 | Baltistan - OB Trawler-Baltistan - Small - Bornholm - >110mm | 10.1 | 10.1 | 10.1 | 10.1 | 10.2 | 10.2 | 10.2 | 10.2 | 10.3 | 10.3 | 10.3 | 10.3 |
| 875 | Baltistan - OB Trawler-Baltistan - Small - Gotland - <110mm | 10.1 | 10.1 | 10.1 | 10.1 | 10.2 | 10.2 | 10.2 | 10.2 | 10.3 | 10.3 | 10.3 | 10.3 |
| 876 | Baltistan - OB Trawler-Baltistan - Small - Gotland - >110mm | 10.1 | 10.1 | 10.1 | 10.1 | 10.2 | 10.2 | 10.2 | 10.2 | 10.3 | 10.3 | 10.3 | 10.3 |
| 877 | Baltistan - OB Trawler-Baltistan - Medium - West Baltic - <110mm | 20.2 | 20.2 | 20.2 | 20.2 | 20.4 | 20.4 | 20.4 | 20.4 | 20.6 | 20.6 | 20.6 | 20.6 |
| 878 | Baltistan - OB Trawler-Baltistan - Medium - West Baltic - >110mm | 20.2 | 20.2 | 20.2 | 20.2 | 20.4 | 20.4 | 20.4 | 20.4 | 20.6 | 20.6 | 20.6 | 20.6 |
| 879 | Baltistan - OB Trawler-Baltistan - Medium - East Baltic - <110mm | 20.2 | 20.2 | 20.2 | 20.2 | 20.4 | 20.4 | 20.4 | 20.4 | 20.6 | 20.6 | 20.6 | 20.6 |
| 880 | Baltistan - OB Trawler-Baltistan - Medium - East Baltic - >110mm | 20.2 | 20.2 | 20.2 | 20.2 | 20.4 | 20.4 | 20.4 | 20.4 | 20.6 | 20.6 | 20.6 | 20.6 |
| 881 | Baltistan - OB Trawler-Baltistan - Medium - Not Baltic - <110mm | 20.2 | 20.2 | 20.2 | 20.2 | 20.4 | 20.4 | 20.4 | 20.4 | 20.6 | 20.6 | 20.6 | 20.6 |
| 882 | Baltistan - OB Trawler-Baltistan - Medium - Not Baltic - >110mm | 20.2 | 20.2 | 20.2 | 20.2 | 20.4 | 20.4 | 20.4 | 20.4 | 20.6 | 20.6 | 20.6 | 20.6 |
| 883 | Baltistan - OB Trawler-Baltistan - Medium - Bornholm - <110mm | 20.2 | 20.2 | 20.2 | 20.2 | 20.4 | 20.4 | 20.4 | 20.4 | 20.6 | 20.6 | 20.6 | 20.6 |
| 884 | Baltistan - OB Trawler-Baltistan - Medium - Bornholm - >110mm | 20.2 | 20.2 | 20.2 | 20.2 | 20.4 | 20.4 | 20.4 | 20.4 | 20.6 | 20.6 | 20.6 | 20.6 |
| 885 | Baltistan - OB Trawler-Baltistan - Medium - Gotland - <110mm | 20.2 | 20.2 | 20.2 | 20.2 | 20.4 | 20.4 | 20.4 | 20.4 | 20.6 | 20.6 | 20.6 | 20.6 |
| 886 | Baltistan - OB Trawler-Baltistan - Medium - Gotland - >110mm | 20.2 | 20.2 | 20.2 | 20.2 | 20.4 | 20.4 | 20.4 | 20.4 | 20.6 | 20.6 | 20.6 | 20.6 |
| 887 | Baltistan - OB Trawler-Baltistan - Large - West Baltic - <110mm | 50.5 | 50.5 | 50.5 | 50.5 | 51 | 51 | 51 | 51 | 51.5 | 51.5 | 51.5 | 51.5 |
| 888 | Baltistan - OB Trawler-Baltistan - Large - West Baltic - >110mm | 50.5 | 50.5 | 50.5 | 50.5 | 51 | 51 | 51 | 51 | 51.5 | 51.5 | 51.5 | 51.5 |
| 889 | Baltistan - OB Trawler-Baltistan - Large - East Baltic - <110mm | 50.5 | 50.5 | 50.5 | 50.5 | 51 | 51 | 51 | 51 | 51.5 | 51.5 | 51.5 | 51.5 |
| 890 | Baltistan - OB Trawler-Baltistan - Large - East Baltic - >110mm | 50.5 | 50.5 | 50.5 | 50.5 | 51 | 51 | 51 | 51 | 51.5 | 51.5 | 51.5 | 51.5 |
| 891 | Baltistan - OB Trawler-Baltistan - Large - Not Baltic - <110mm | 50.5 | 50.5 | 50.5 | 50.5 | 51 | 51 | 51 | 51 | 51.5 | 51.5 | 51.5 | 51.5 |
| 892 | Baltistan - OB Trawler-Baltistan - Large - Not Baltic - >110mm | 50.5 | 50.5 | 50.5 | 50.5 | 51 | 51 | 51 | 51 | 51.5 | 51.5 | 51.5 | 51.5 |
| 893 | Baltistan - OB Trawler-Baltistan - Large - Bornholm - <110mm | 50.5 | 50.5 | 50.5 | 50.5 | 51 | 51 | 51 | 51 | 51.5 | 51.5 | 51.5 | 51.5 |
| 894 | Baltistan - OB Trawler-Baltistan - Large - Bornholm - >110mm | 50.5 | 50.5 | 50.5 | 50.5 | 51 | 51 | 51 | 51 | 51.5 | 51.5 | 51.5 | 51.5 |
| 895 | Baltistan - OB Trawler-Baltistan - Large - Gotland - <110mm | 50.5 | 50.5 | 50.5 | 50.5 | 51 | 51 | 51 | 51 | 51.5 | 51.5 | 51.5 | 51.5 |
| 896 | Baltistan - OB Trawler-Baltistan - Large - Gotland - >110mm | 50.5 | 50.5 | 50.5 | 50.5 | 51 | 51 | 51 | 51 | 51.5 | 51.5 | 51.5 | 51.5 |
| 897 | Baltistan - Gillnett-Baltistan - Small - West Baltic - <110mm | 4.04 | 4.04 | 4.04 | 4.04 | 4.08 | 4.08 | 4.08 | 4.08 | 4.12 | 4.12 | 4.12 | 4.12 |
| 898 | Baltistan - Gillnett-Baltistan - Small - West Baltic - >110mm | 4.04 | 4.04 | 4.04 | 4.04 | 4.08 | 4.08 | 4.08 | 4.08 | 4.12 | 4.12 | 4.12 | 4.12 |
| 899 | Baltistan - Gillnett-Baltistan - Small - East Baltic - <110mm | 4.04 | 4.04 | 4.04 | 4.04 | 4.08 | 4.08 | 4.08 | 4.08 | 4.12 | 4.12 | 4.12 | 4.12 |
| 900 | Baltistan - Gillnett-Baltistan - Small - East Baltic - >110mm | 4.04 | 4.04 | 4.04 | 4.04 | 4.08 | 4.08 | 4.08 | 4.08 | 4.12 | 4.12 | 4.12 | 4.12 |
| 901 | Baltistan - Gillnett-Baltistan - Small - Not Baltic - <110mm | 4.04 | 4.04 | 4.04 | 4.04 | 4.08 | 4.08 | 4.08 | 4.08 | 4.12 | 4.12 | 4.12 | 4.12 |
| 902 | Baltistan - Gillnett-Baltistan - Small - Not Baltic - >110mm | 4.04 | 4.04 | 4.04 | 4.04 | 4.08 | 4.08 | 4.08 | 4.08 | 4.12 | 4.12 | 4.12 | 4.12 |
| 903 | Baltistan - Gillnett-Baltistan - Small - Bornholm - <110mm | 4.04 | 4.04 | 4.04 | 4.04 | 4.08 | 4.08 | 4.08 | 4.08 | 4.12 | 4.12 | 4.12 | 4.12 |
| 904 | Baltistan - Gillnett-Baltistan - Small - Bornholm - >110mm | 4.04 | 4.04 | 4.04 | 4.04 | 4.08 | 4.08 | 4.08 | 4.08 | 4.12 | 4.12 | 4.12 | 4.12 |
| 905 | Baltistan - Gillnett-Baltistan - Small - Gotland - <110mm | 4.04 | 4.04 | 4.04 | 4.04 | 4.08 | 4.08 | 4.08 | 4.08 | 4.12 | 4.12 | 4.12 | 4.12 |
| 906 | Baltistan - Gillnett-Baltistan - Small - Gotland - >110mm | 4.04 | 4.04 | 4.04 | 4.04 | 4.08 | 4.08 | 4.08 | 4.08 | 4.12 | 4.12 | 4.12 | 4.12 |
| 907 | Baltistan - Gillnett-Baltistan - Medium - West Baltic - <110mm | 8.08 | 8.08 | 8.08 | 8.08 | 8.16 | 8.16 | 8.16 | 8.16 | 8.24 | 8.24 | 8.24 | 8.24 |

***Figure 2.10.4. Constant revenue from "Other stocks". Explanation below table says: Revenue from other stocks is a lump sum accounting for the revenue generated by landings of species which are not modelled explicitly in TEMAS. Note, this is a (Year, period, Fl, Vs, Rg, Ct, Ar)-specific constant***

Figure 2.10.4 (EXCEL Table 7.2.2.2.3.1) shows the "Revenue from other stocks". The revenue from other stocks is a lump sum accounting for the revenue generated by landings of species which are not modelled explicitly in TEMAS. The revenue from other stocks is a (Year, period, Fleet, Vessel size, Rigging, Country, Area)-specific constant.

Figure 2.10.5 shows the userform for pre-processing of economic data. The options are

1) Make all parameters equal for all years. This potion will take the values for first year and apply it to all years.
2) Multiply all costs with a common multiplier. This option will present a form where the common factor can be entered. And then all costs will be multiplied by that factor.



PREPROCESSING OF ECONOMIC INPUT

○ Make parameters equal for all years Not done

○ Apply common multiplier to all costs Not done

*Figure 2.10.5. Options for pre-processing of economy data and parameters.*

## 2.11. TRIP RULES INPUT, S08_ TRIP_RU

The sheet, “S08_TRIP_RU” (Trip Rules), contains the input parameters in the RUM (Random Utility Model) for short term behaviour (or “trip-related” behaviour). The RUM is also named a “discrete choice model”, because it operates with a finite number of choices. The model is mathematically equal to that for long term behaviour.

TEMAS offers two alternative ways of setting effort and capacity, namely to let it be determined by the behaviour rules, or to let it be given as input from the worksheet. If the effort/capacity is determined by the behaviour rules, then the age distributions of vessels given as input data are not used by TEMAS. The initial age distribution of vessels however, is used in both options for effort input. We shall comment further on this issue at the end of this section.

The probability that choice maker “i” will select choice “j” is designated

$p_{ij}$ = The probability that choice-maker “i” will select choice “j”. A choice maker is in the present context a “fleet”, (Fl,Vs,Ct). A choice can be, for example, an “area” or a “rigging”.

RUM uses the “logit model” for the finite number of choices: $p_{i,Choice} = \dfrac{\exp(U_{i,Choice})}{\sum_{j=1}^{M} \exp(U_{i,j})}$

The utility, $U_{i,j}$ , is defined by the linear model in “Characteristics” and “Attributes”:

$$U_{i,j} = \sum_{r=1(Characteristics)}^{R} \beta_{ij,r} * X_{i,r} + \sum_{s=1(Attributes)}^{S} \gamma_{i,s} * W_{ij,s}$$

Thus, there are two types of independent variables to model U:

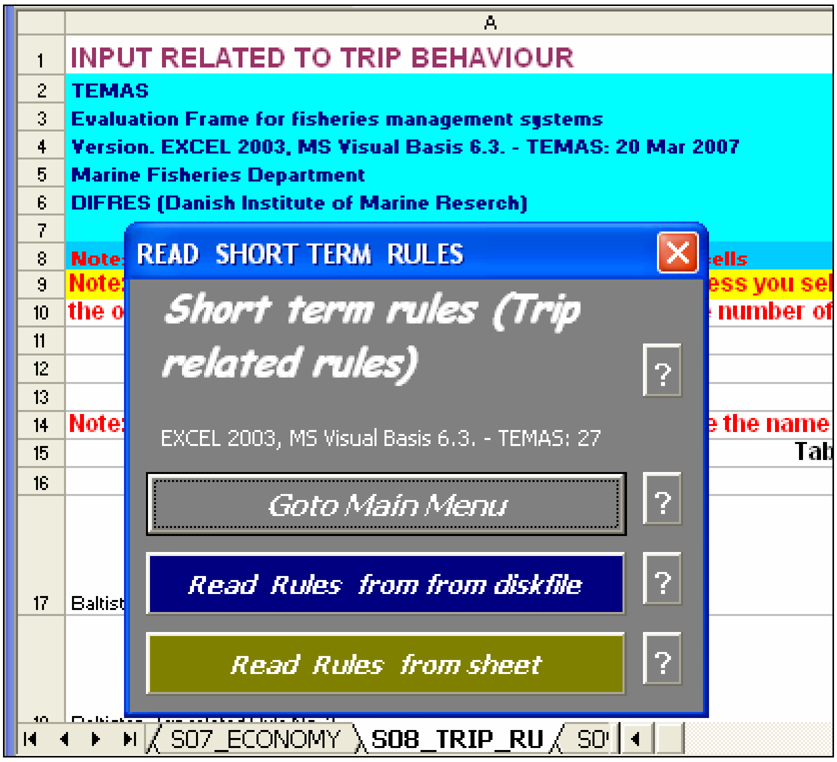
| Independent variable | Features of variable | Symbol | Associated Parameter |
|---|---|---|---|
| Characteristics | Dependent of choice-maker<br>Independent of choice | $X_{i,r}$ | $\beta_{ij,r}$ |
| Attributes | Independent of choice-maker<br>Dependent of choice | $W_{ij,s}$ | $\gamma_{i,s}$ |

Note that $\gamma_{i,s}$ and $X_{i,r}$ are independent of choice (“j”) .

There are four trip related behaviour models in the current version of the TEMAS model:

1) Model for fishing/not fishing (Effort rule)
2) Model for choice of area (fishing grounds)
3) Model for choice of rigging
4) Model for discarding

Figure 2.11.1 shows the user-form for sheet S08_TRIP_RU and Table 2.11.1 lists the tables in sheet S08_TRIP_RU. The first table (Figure 2.11.2, EXCEL Table 8.1) allows for definition of rules, by entry of names of rules. This is possible, because any rule is represented by the same basic mathematical model, so it is only the number of parameters and their values that makes rules different. The Table is white, however, so that it is not an input table.  This is simply because the TEMAS program is under development, and the option to define rules is not yet implemented. For the time being, there is only the fixed options given in EXCEL table 8.1)



INPUT RELATED TO TRIP BEHAVIOUR

TEMAS

Evaluation Frame for fisheries management systems

Version. EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 20 Mar 2007

Marine Fisheries Department

DIFRES (Danish Institute of Marine Reserch)

READ  SHORT TERM  RULES

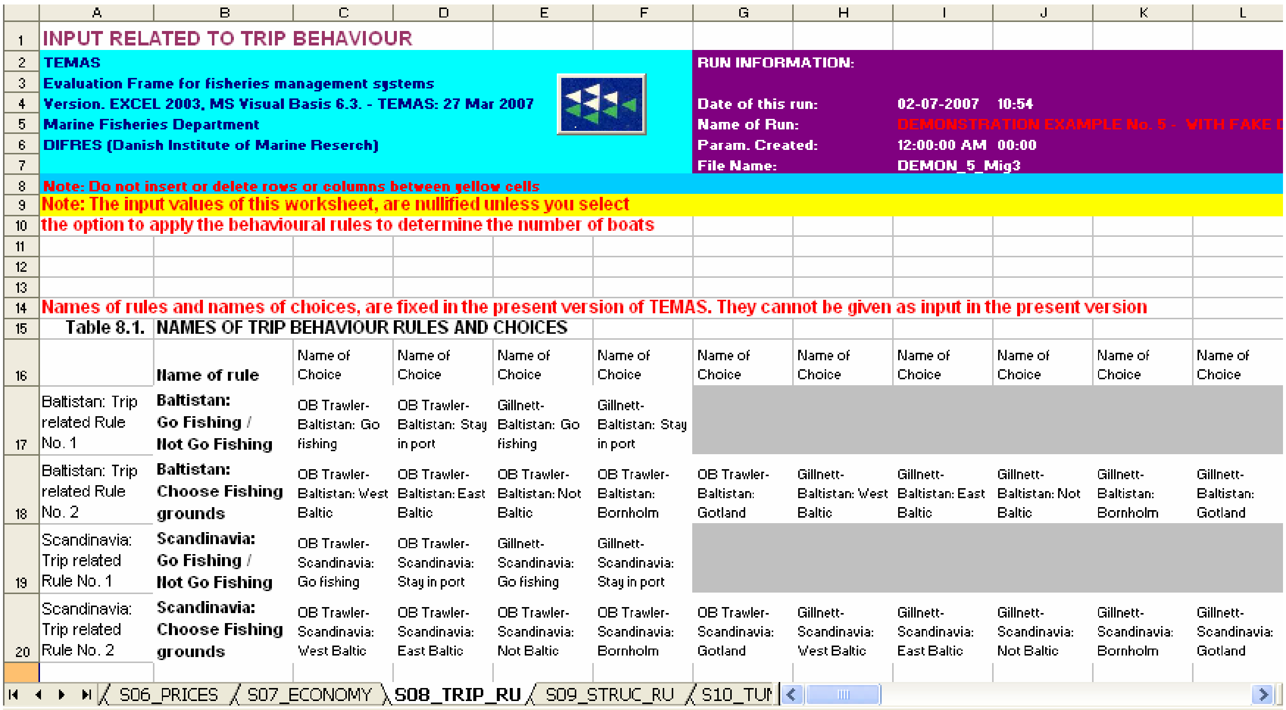
Short term rules (Trip related rules)

EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 27

*Figure 2.11.1. User-form for entry of trip behaviour  related parameters.*

| Index | EXCEL Table | Caption |
|---|---|---|
| 165 | Table 8.1. | NAMES OF TRIP BEHAVIOUR RULES AND CHOICES |
| 166 | Table 8.2. | Baltistan : TRIP BEHAVIOUR COEFFICIENTS OF R.U.M. |
| 167 | Table 8.3. | Scandinavia : TRIP BEHAVIOUR COEFFICIENTS OF R.U.M. |

*Table C.2.11.1. Tables in the trip behaviour  input sheet, S08_TRIP_RU.*



INPUT RELATED TO TRIP BEHAVIOUR

**TEMAS**
**Evaluation Frame for fisheries management systems**
**Version. EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 27 Mar 2007**
**Marine Fisheries Department**
**DIFRES (Danish Institute of Marine Reserch)**

**RUN INFORMATION:**
**Date of this run:** 02-07-2007 10:54
**Name of Run:** DEMONSTRATION EXAMPLE No. 5 - WITH FAKE
**Param. Created:** 12:00:00 AM 00:00
**File Name:** DEMON_5_Mig3

Note: Do not insert or delete rows or columns between yellow cells

Note: The input values of this worksheet, are nullified unless you select
the option to apply the behavioural rules to determine the number of boats

Names of rules and names of choices, are fixed in the present version of TEMAS. They cannot be given as input in the present version

Table 8.1. NAMES OF TRIP BEHAVIOUR RULES AND CHOICES

| | **Name of rule** | Name of Choice | Name of Choice | Name of Choice | Name of Choice | Name of Choice | Name of Choice | Name of Choice | Name of Choice | Name of Choice | Name of Choice |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Baltistan: Trip related Rule No. 1 | **Baltistan: Go Fishing / Not Go Fishing** | OB Trawler-Baltistan: Go fishing | OB Trawler-Baltistan: Stay in port | Gillnett-Baltistan: Go fishing | Gillnett-Baltistan: Stay in port | | | | | | |
| Baltistan: Trip related Rule No. 2 | **Baltistan: Choose Fishing grounds** | OB Trawler-Baltistan: West Baltic | OB Trawler-Baltistan: East Baltic | OB Trawler-Baltistan: Not Baltic | OB Trawler-Baltistan: Bornholm | OB Trawler-Baltistan: Gotland | Gillnett-Baltistan: West Baltic | Gillnett-Baltistan: East Baltic | Gillnett-Baltistan: Not Baltic | Gillnett-Baltistan: Bornholm | Gillnett-Baltistan: Gotland |
| Scandinavia: Trip related Rule No. 1 | **Scandinavia: Go Fishing / Not Go Fishing** | OB Trawler-Scandinavia: Go fishing | OB Trawler-Scandinavia: Stay in port | Gillnett-Scandinavia: Go fishing | Gillnett-Scandinavia: Stay in port | | | | | | |
| Scandinavia: Trip related Rule No. 2 | **Scandinavia: Choose Fishing grounds** | OB Trawler-Scandinavia: West Baltic | OB Trawler-Scandinavia: East Baltic | OB Trawler-Scandinavia: Not Baltic | OB Trawler-Scandinavia: Bornholm | OB Trawler-Scandinavia: Gotland | Gillnett-Scandinavia: West Baltic | Gillnett-Scandinavia: East Baltic | Gillnett-Scandinavia: Not Baltic | Gillnett-Scandinavia: Bornholm | Gillnett-Scandinavia: Gotland |

***Figure 2.11.2 Names of rules and choices in short term behaviour model.***

Furthermore, the present version of TEMAS does not implement the “Ad Hoc” rules as introduced in Annex C of the TEMAS report. The reason for this is that the philosophy behind the RUM essentially is the same as the Ad Hoc models, but the RUM has “nicer” mathematically properties. It was not considered necessary to have two almost equal options for behaviour models in TEMAS.

EXCEL Table 8.1 (Figure 2.11.2) shows that names of rules are organized by country, four rules for country “Baltistan” followed by four rules for country “Scandinavia”. Column “B” in EXCEL Table 8.1, contains the name of the rule, for example “Choose fishing ground” in cell “B18”. The rest of the line contains the available choises, which in the case of fishing grounds are the 5 areas “West Baltic”,”East Baltic”,”Not Baltic”,”Bornholm” and “Gotland”. There is a set for each fleet (“Trawlers” and “Gill netters”).

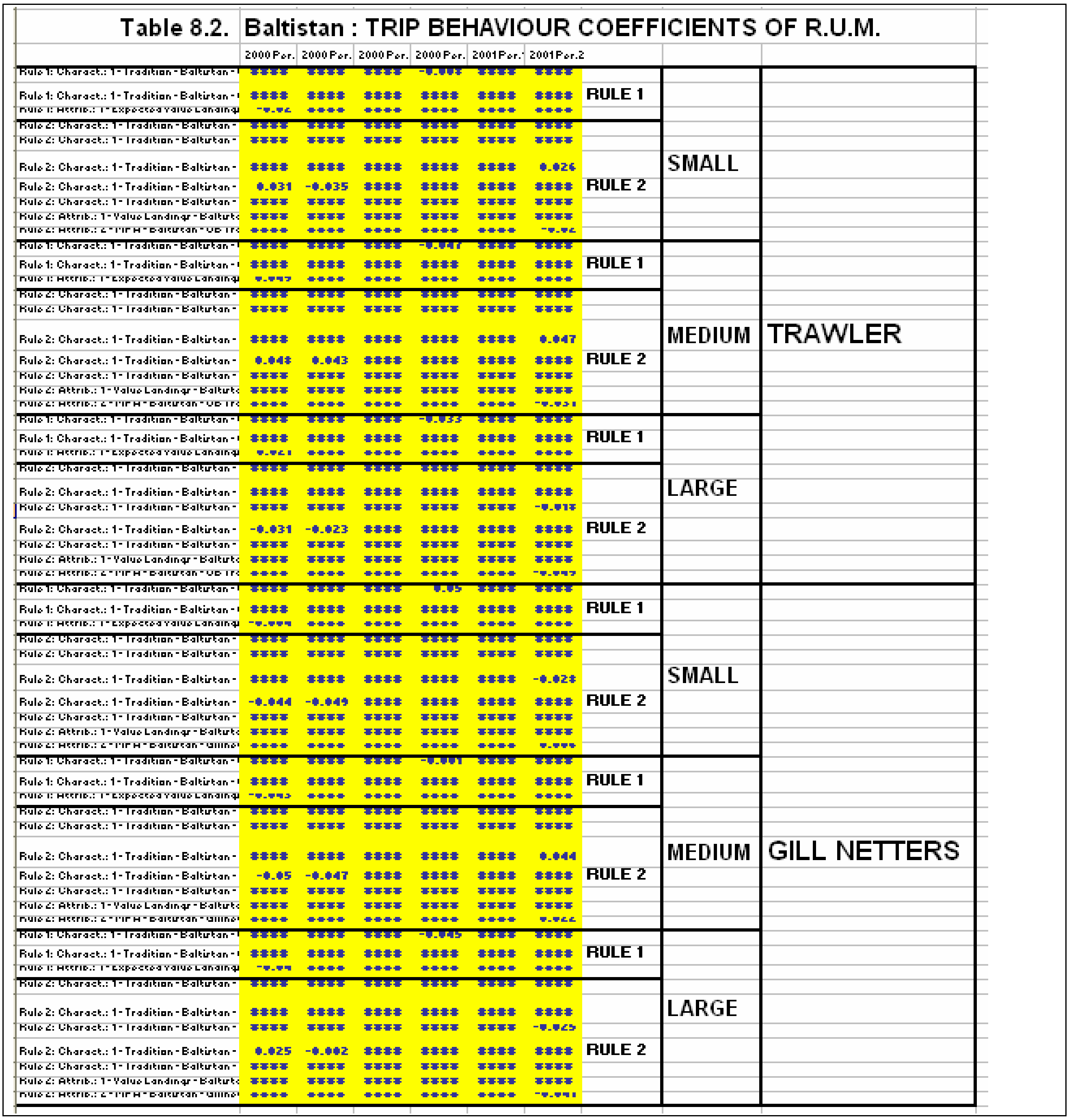
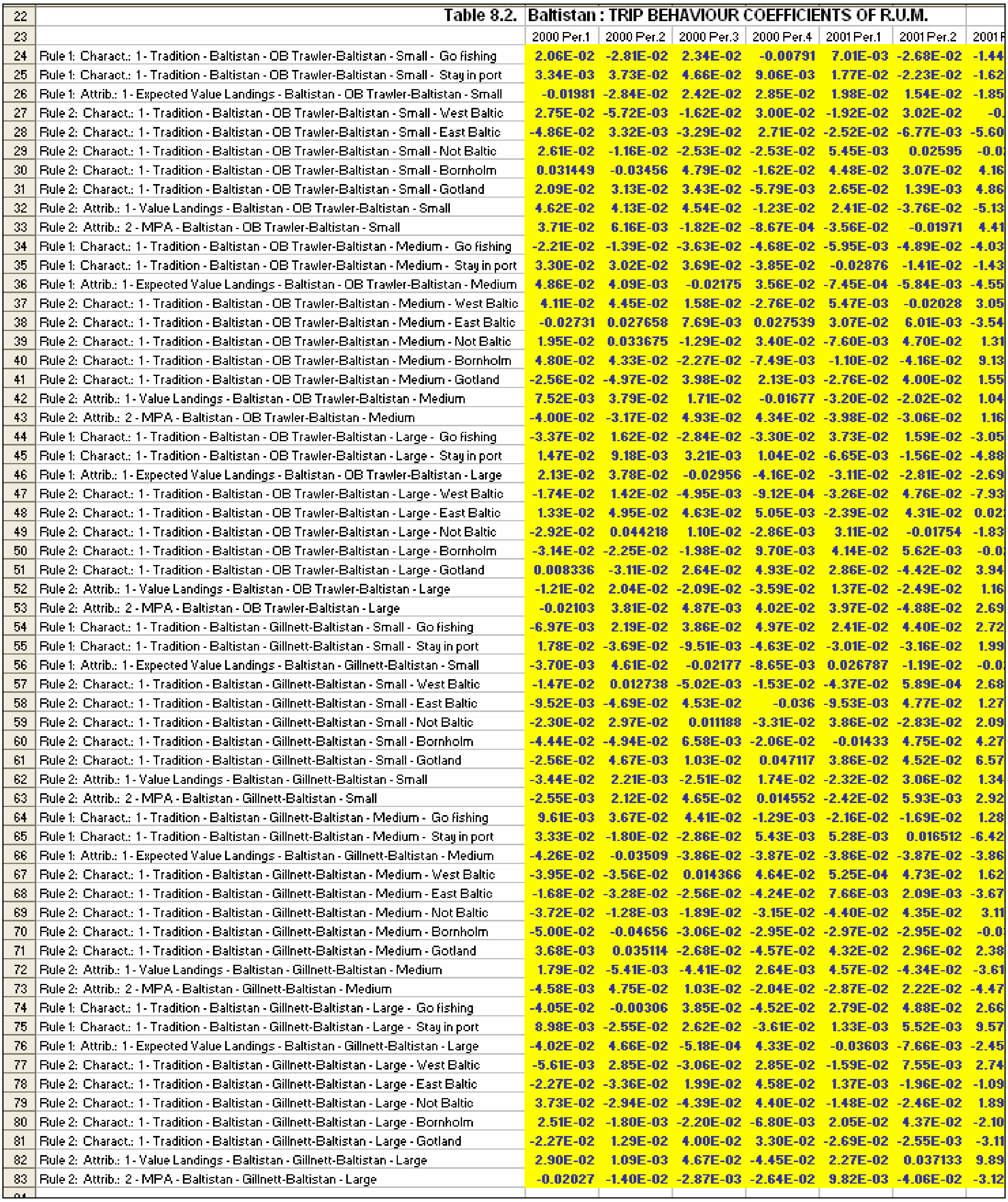


Table 8.2. Baltistan : TRIP BEHAVIOUR COEFFICIENTS OF R.U.M.

| | 2000 Per. | 2000 Per. | 2000 Per. | 2000 Per. | 2001 Per.1 | 2001 Per.2 | | | |
|---|---|---|---|---|---|---|---|---|---|
| Rule 1: Charact.: 1 - Tradition - Baltistan - | #### | #### | #### | [illegible] | #### | #### | | | |
| Rule 1: Charact.: 1 - Tradition - Baltistan - | #### | #### | #### | #### | #### | #### | RULE 1 | | |
| Rule 1: Attrib.: 1 - Expected Value Landings | -0.02 | #### | #### | #### | #### | #### | | | |
| Rule 2: Charact.: 1 - Tradition - Baltistan - | #### | #### | #### | #### | #### | #### | | | |
| Rule 2: Charact.: 1 - Tradition - Baltistan - | #### | #### | #### | #### | #### | #### | | | |
| Rule 2: Charact.: 1 - Tradition - Baltistan - | #### | #### | #### | #### | #### | 0.026 | | SMALL | |
| Rule 2: Charact.: 1 - Tradition - Baltistan - | 0.031 | -0.035 | #### | #### | #### | #### | RULE 2 | | |
| Rule 2: Charact.: 1 - Tradition - Baltistan - | #### | #### | #### | #### | #### | #### | | | |
| Rule 2: Attrib.: 1 - Value Landings - Baltistan | #### | #### | #### | #### | #### | #### | | | |
| Rule 2: Attrib.: 2 - TIP A - Baltistan - OB Tra | #### | #### | #### | #### | #### | -0.02 | | | |
| Rule 1: Charact.: 1 - Tradition - Baltistan - | #### | #### | #### | -0.047 | #### | #### | | | |
| Rule 1: Charact.: 1 - Tradition - Baltistan - | #### | #### | #### | #### | #### | #### | RULE 1 | | |
| Rule 1: Attrib.: 1 - Expected Value Landings | 0.007 | #### | #### | #### | #### | #### | | | |
| Rule 2: Charact.: 1 - Tradition - Baltistan - | #### | #### | #### | #### | #### | #### | | | |
| Rule 2: Charact.: 1 - Tradition - Baltistan - | #### | #### | #### | #### | #### | #### | | | |
| Rule 2: Charact.: 1 - Tradition - Baltistan - | #### | #### | #### | #### | #### | 0.047 | | MEDIUM | TRAWLER |
| Rule 2: Charact.: 1 - Tradition - Baltistan - | 0.048 | 0.043 | #### | #### | #### | #### | RULE 2 | | |
| Rule 2: Charact.: 1 - Tradition - Baltistan - | #### | #### | #### | #### | #### | #### | | | |
| Rule 2: Attrib.: 1 - Value Landings - Baltistan | #### | #### | #### | #### | #### | #### | | | |
| Rule 2: Attrib.: 2 - TIP A - Baltistan - OB Tra | #### | #### | #### | #### | #### | -0.031 | | | |
| Rule 1: Charact.: 1 - Tradition - Baltistan - | #### | #### | #### | -0.033 | #### | #### | | | |
| Rule 1: Charact.: 1 - Tradition - Baltistan - | #### | #### | #### | #### | #### | #### | RULE 1 | | |
| Rule 1: Attrib.: 1 - Expected Value Landings | 0.021 | #### | #### | #### | #### | #### | | | |
| Rule 2: Charact.: 1 - Tradition - Baltistan - | #### | #### | #### | #### | #### | #### | | | |
| Rule 2: Charact.: 1 - Tradition - Baltistan - | #### | #### | #### | #### | #### | #### | | LARGE | |
| Rule 2: Charact.: 1 - Tradition - Baltistan - | #### | #### | #### | #### | #### | -0.018 | | | |
| Rule 2: Charact.: 1 - Tradition - Baltistan - | -0.031 | -0.023 | #### | #### | #### | #### | RULE 2 | | |
| Rule 2: Charact.: 1 - Tradition - Baltistan - | #### | #### | #### | #### | #### | #### | | | |
| Rule 2: Attrib.: 1 - Value Landings - Baltistan | #### | #### | #### | #### | #### | #### | | | |
| Rule 2: Attrib.: 2 - TIP A - Baltistan - OB Tra | #### | #### | #### | #### | #### | -0.007 | | | |
| Rule 1: Charact.: 1 - Tradition - Baltistan - | #### | #### | #### | 0.05 | #### | #### | | | |
| Rule 1: Charact.: 1 - Tradition - Baltistan - | #### | #### | #### | #### | #### | #### | RULE 1 | | |
| Rule 1: Attrib.: 1 - Expected Value Landings | [illegible] | #### | #### | #### | #### | #### | | | |
| Rule 2: Charact.: 1 - Tradition - Baltistan - | #### | #### | #### | #### | #### | #### | | | |
| Rule 2: Charact.: 1 - Tradition - Baltistan - | #### | #### | #### | #### | #### | #### | | | |
| Rule 2: Charact.: 1 - Tradition - Baltistan - | #### | #### | #### | #### | #### | -0.028 | | SMALL | |
| Rule 2: Charact.: 1 - Tradition - Baltistan - | -0.044 | -0.049 | #### | #### | #### | #### | RULE 2 | | |
| Rule 2: Charact.: 1 - Tradition - Baltistan - | #### | #### | #### | #### | #### | #### | | | |
| Rule 2: Attrib.: 1 - Value Landings - Baltistan | #### | #### | #### | #### | #### | #### | | | |
| Rule 2: Attrib.: 2 - TIP A - Baltistan - Gillne | #### | #### | #### | #### | #### | [illegible] | | | |
| Rule 1: Charact.: 1 - Tradition - Baltistan - | #### | #### | #### | -0.001 | #### | #### | | | |
| Rule 1: Charact.: 1 - Tradition - Baltistan - | #### | #### | #### | #### | #### | #### | RULE 1 | | |
| Rule 1: Attrib.: 1 - Expected Value Landings | [illegible] | #### | #### | #### | #### | #### | | | |
| Rule 2: Charact.: 1 - Tradition - Baltistan - | #### | #### | #### | #### | #### | #### | | | |
| Rule 2: Charact.: 1 - Tradition - Baltistan - | #### | #### | #### | #### | #### | #### | | | |
| Rule 2: Charact.: 1 - Tradition - Baltistan - | #### | #### | #### | #### | #### | 0.044 | | MEDIUM | GILL NETTERS |
| Rule 2: Charact.: 1 - Tradition - Baltistan - | -0.05 | -0.047 | #### | #### | #### | #### | RULE 2 | | |
| Rule 2: Charact.: 1 - Tradition - Baltistan - | #### | #### | #### | #### | #### | #### | | | |
| Rule 2: Attrib.: 1 - Value Landings - Baltistan | #### | #### | #### | #### | #### | #### | | | |
| Rule 2: Attrib.: 2 - TIP A - Baltistan - Gillne | #### | #### | #### | #### | #### | 0.022 | | | |
| Rule 1: Charact.: 1 - Tradition - Baltistan - | #### | #### | #### | -0.045 | #### | #### | | | |
| Rule 1: Charact.: 1 - Tradition - Baltistan - | #### | #### | #### | #### | #### | #### | RULE 1 | | |
| Rule 1: Attrib.: 1 - Expected Value Landings | -0.04 | #### | #### | #### | #### | #### | | | |
| Rule 2: Charact.: 1 - Tradition - Baltistan - | #### | #### | #### | #### | #### | #### | | | |
| Rule 2: Charact.: 1 - Tradition - Baltistan - | #### | #### | #### | #### | #### | #### | | LARGE | |
| Rule 2: Charact.: 1 - Tradition - Baltistan - | #### | #### | #### | #### | #### | -0.025 | | | |
| Rule 2: Charact.: 1 - Tradition - Baltistan - | 0.025 | -0.002 | #### | #### | #### | #### | RULE 2 | | |
| Rule 2: Charact.: 1 - Tradition - Baltistan - | #### | #### | #### | #### | #### | #### | | | |
| Rule 2: Attrib.: 1 - Value Landings - Baltistan | #### | #### | #### | #### | #### | #### | | | |
| Rule 2: Attrib.: 2 - TIP A - Baltistan - Gillne | #### | #### | #### | #### | #### | [illegible] | | | |

*Figure2.11.3.a. The RUM table structure for trip behaviour of one country.*



| 22 | Table 8.2. | Baltistan : TRIP BEHAVIOUR COEFFICIENTS OF R.U.M. | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 23 | | 2000 Per.1 | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 F |
| 24 | Rule 1: Charact.: 1 - Tradition - Baltistan - OB Trawler-Baltistan - Small - Go fishing | 2.06E-02 | -2.81E-02 | 2.34E-02 | -0.00791 | 7.01E-03 | -2.68E-02 | -1.44 |
| 25 | Rule 1: Charact.: 1 - Tradition - Baltistan - OB Trawler-Baltistan - Small - Stay in port | 3.34E-03 | 3.73E-02 | 4.66E-02 | 9.06E-03 | 1.77E-02 | -2.23E-02 | -1.62 |
| 26 | Rule 1: Attrib.: 1 - Expected Value Landings - Baltistan - OB Trawler-Baltistan - Small | -0.01981 | -2.84E-02 | 2.42E-02 | 2.85E-02 | 1.98E-02 | 1.54E-02 | -1.85 |
| 27 | Rule 2: Charact.: 1 - Tradition - Baltistan - OB Trawler-Baltistan - Small - West Baltic | 2.75E-02 | -5.72E-03 | -1.62E-02 | 3.00E-02 | -1.92E-02 | 3.02E-02 | -0. |
| 28 | Rule 2: Charact.: 1 - Tradition - Baltistan - OB Trawler-Baltistan - Small - East Baltic | -4.86E-02 | 3.32E-03 | -3.29E-02 | 2.71E-02 | -2.52E-02 | -6.77E-03 | -5.60 |
| 29 | Rule 2: Charact.: 1 - Tradition - Baltistan - OB Trawler-Baltistan - Small - Not Baltic | 2.61E-02 | -1.16E-02 | -2.53E-02 | -2.53E-02 | 5.45E-03 | 0.02595 | -0.0 |
| 30 | Rule 2: Charact.: 1 - Tradition - Baltistan - OB Trawler-Baltistan - Small - Bornholm | 0.031449 | -0.03456 | 4.79E-02 | -1.62E-02 | 4.48E-02 | 3.07E-02 | 4.16 |
| 31 | Rule 2: Charact.: 1 - Tradition - Baltistan - OB Trawler-Baltistan - Small - Gotland | 2.09E-02 | 3.13E-02 | 3.43E-02 | -5.79E-03 | 2.65E-02 | 1.39E-03 | 4.86 |
| 32 | Rule 2: Attrib.: 1 - Value Landings - Baltistan - OB Trawler-Baltistan - Small | 4.62E-02 | 4.13E-02 | 4.54E-02 | -1.23E-02 | 2.41E-02 | -3.76E-02 | -5.13 |
| 33 | Rule 2: Attrib.: 2 - MPA - Baltistan - OB Trawler-Baltistan - Small | 3.71E-02 | 6.16E-03 | -1.82E-02 | -8.67E-04 | -3.56E-02 | -0.01971 | 4.41 |
| 34 | Rule 1: Charact.: 1 - Tradition - Baltistan - OB Trawler-Baltistan - Medium - Go fishing | -2.21E-02 | -1.39E-02 | -3.63E-02 | -4.68E-02 | -5.95E-03 | -4.89E-02 | -4.03 |
| 35 | Rule 1: Charact.: 1 - Tradition - Baltistan - OB Trawler-Baltistan - Medium - Stay in port | 3.30E-02 | 3.02E-02 | 3.69E-02 | -3.85E-02 | -0.02876 | -1.41E-02 | -1.43 |
| 36 | Rule 1: Attrib.: 1 - Expected Value Landings - Baltistan - OB Trawler-Baltistan - Medium | 4.86E-02 | 4.09E-03 | -0.02175 | 3.56E-02 | -7.45E-04 | -5.84E-03 | -4.55 |
| 37 | Rule 2: Charact.: 1 - Tradition - Baltistan - OB Trawler-Baltistan - Medium - West Baltic | 4.11E-02 | 4.45E-02 | 1.58E-02 | -2.76E-02 | 5.47E-03 | -0.02028 | 3.05 |
| 38 | Rule 2: Charact.: 1 - Tradition - Baltistan - OB Trawler-Baltistan - Medium - East Baltic | -0.02731 | 0.027658 | 7.69E-03 | 0.027539 | 3.07E-02 | 6.01E-03 | -3.54 |
| 39 | Rule 2: Charact.: 1 - Tradition - Baltistan - OB Trawler-Baltistan - Medium - Not Baltic | 1.95E-02 | 0.033675 | -1.29E-02 | 3.40E-02 | -7.60E-03 | 4.70E-02 | 1.31 |
| 40 | Rule 2: Charact.: 1 - Tradition - Baltistan - OB Trawler-Baltistan - Medium - Bornholm | 4.80E-02 | 4.33E-02 | -2.27E-02 | -7.49E-03 | -1.10E-02 | -4.16E-02 | 9.13 |
| 41 | Rule 2: Charact.: 1 - Tradition - Baltistan - OB Trawler-Baltistan - Medium - Gotland | -2.56E-02 | -4.97E-02 | 3.98E-02 | 2.13E-03 | -2.76E-02 | 4.00E-02 | 1.55 |
| 42 | Rule 2: Attrib.: 1 - Value Landings - Baltistan - OB Trawler-Baltistan - Medium | 7.52E-03 | 3.79E-02 | 1.71E-02 | -0.01677 | -3.20E-02 | -2.02E-02 | 1.04 |
| 43 | Rule 2: Attrib.: 2 - MPA - Baltistan - OB Trawler-Baltistan - Medium | -4.00E-02 | -3.17E-02 | 4.93E-02 | 4.34E-02 | -3.98E-02 | -3.06E-02 | 1.16 |
| 44 | Rule 1: Charact.: 1 - Tradition - Baltistan - OB Trawler-Baltistan - Large - Go fishing | -3.37E-02 | 1.62E-02 | -2.84E-02 | -3.30E-02 | 3.73E-02 | 1.59E-02 | -3.05 |
| 45 | Rule 1: Charact.: 1 - Tradition - Baltistan - OB Trawler-Baltistan - Large - Stay in port | 1.47E-02 | 9.18E-03 | 3.21E-03 | 1.04E-02 | -6.65E-03 | -1.56E-02 | -4.88 |
| 46 | Rule 1: Attrib.: 1 - Expected Value Landings - Baltistan - OB Trawler-Baltistan - Large | 2.13E-02 | 3.78E-02 | -0.02956 | -4.16E-02 | -3.11E-02 | -2.81E-02 | -2.69 |
| 47 | Rule 2: Charact.: 1 - Tradition - Baltistan - OB Trawler-Baltistan - Large - West Baltic | -1.74E-02 | 1.42E-02 | -4.95E-03 | -9.12E-04 | -3.26E-02 | 4.76E-02 | -7.93 |
| 48 | Rule 2: Charact.: 1 - Tradition - Baltistan - OB Trawler-Baltistan - Large - East Baltic | 1.33E-02 | 4.95E-02 | 4.63E-02 | 5.05E-03 | -2.39E-02 | 4.31E-02 | 0.02 |
| 49 | Rule 2: Charact.: 1 - Tradition - Baltistan - OB Trawler-Baltistan - Large - Not Baltic | -2.92E-02 | 0.044218 | 1.10E-02 | -2.86E-03 | 3.11E-02 | -0.01754 | -1.83 |
| 50 | Rule 2: Charact.: 1 - Tradition - Baltistan - OB Trawler-Baltistan - Large - Bornholm | -3.14E-02 | -2.25E-02 | -1.98E-02 | 9.70E-03 | 4.14E-02 | 5.62E-03 | -0.0 |
| 51 | Rule 2: Charact.: 1 - Tradition - Baltistan - OB Trawler-Baltistan - Large - Gotland | 0.008336 | -3.11E-02 | 2.64E-02 | 4.93E-02 | 2.86E-02 | -4.42E-02 | 3.94 |
| 52 | Rule 2: Attrib.: 1 - Value Landings - Baltistan - OB Trawler-Baltistan - Large | -1.21E-02 | 2.04E-02 | -2.09E-02 | -3.59E-02 | 1.37E-02 | -2.49E-02 | 1.16 |
| 53 | Rule 2: Attrib.: 2 - MPA - Baltistan - OB Trawler-Baltistan - Large | -0.02103 | 3.81E-02 | 4.87E-03 | 4.02E-02 | 3.97E-02 | -4.88E-02 | 2.69 |
| 54 | Rule 1: Charact.: 1 - Tradition - Baltistan - Gillnett-Baltistan - Small - Go fishing | -6.97E-03 | 2.19E-02 | 3.86E-02 | 4.97E-02 | 2.41E-02 | 4.40E-02 | 2.72 |
| 55 | Rule 1: Charact.: 1 - Tradition - Baltistan - Gillnett-Baltistan - Small - Stay in port | 1.78E-02 | -3.69E-02 | -9.51E-03 | -4.63E-02 | -3.01E-02 | -3.16E-02 | 1.99 |
| 56 | Rule 1: Attrib.: 1 - Expected Value Landings - Baltistan - Gillnett-Baltistan - Small | -3.70E-03 | 4.61E-02 | -0.02177 | -8.65E-03 | 0.026787 | -1.19E-02 | -0.0 |
| 57 | Rule 2: Charact.: 1 - Tradition - Baltistan - Gillnett-Baltistan - Small - West Baltic | -1.47E-02 | 0.012738 | -5.02E-03 | -1.53E-02 | -4.37E-02 | 5.89E-04 | 2.68 |
| 58 | Rule 2: Charact.: 1 - Tradition - Baltistan - Gillnett-Baltistan - Small - East Baltic | -9.52E-03 | -4.69E-02 | 4.53E-02 | -0.036 | -9.53E-03 | 4.77E-02 | 1.27 |
| 59 | Rule 2: Charact.: 1 - Tradition - Baltistan - Gillnett-Baltistan - Small - Not Baltic | -2.30E-02 | 2.97E-02 | 0.011188 | -3.31E-02 | 3.86E-02 | -2.83E-02 | 2.09 |
| 60 | Rule 2: Charact.: 1 - Tradition - Baltistan - Gillnett-Baltistan - Small - Bornholm | -4.44E-02 | -4.94E-02 | 6.58E-03 | -2.06E-02 | -0.01433 | 4.75E-02 | 4.27 |
| 61 | Rule 2: Charact.: 1 - Tradition - Baltistan - Gillnett-Baltistan - Small - Gotland | -2.56E-02 | 4.67E-03 | 1.03E-02 | 0.047117 | 3.86E-02 | 4.52E-02 | 6.57 |
| 62 | Rule 2: Attrib.: 1 - Value Landings - Baltistan - Gillnett-Baltistan - Small | -3.44E-02 | 2.21E-03 | -2.51E-02 | 1.74E-02 | -2.32E-02 | 3.06E-02 | 1.34 |
| 63 | Rule 2: Attrib.: 2 - MPA - Baltistan - Gillnett-Baltistan - Small | -2.55E-03 | 2.12E-02 | 4.65E-02 | 0.014552 | -2.42E-02 | 5.93E-03 | 2.92 |
| 64 | Rule 1: Charact.: 1 - Tradition - Baltistan - Gillnett-Baltistan - Medium - Go fishing | 9.61E-03 | 3.67E-02 | 4.41E-02 | -1.29E-03 | -2.16E-02 | -1.69E-02 | 1.28 |
| 65 | Rule 1: Charact.: 1 - Tradition - Baltistan - Gillnett-Baltistan - Medium - Stay in port | 3.33E-02 | -1.80E-02 | -2.86E-02 | 5.43E-03 | 5.28E-03 | 0.016512 | -6.42 |
| 66 | Rule 1: Attrib.: 1 - Expected Value Landings - Baltistan - Gillnett-Baltistan - Medium | -4.26E-02 | -0.03509 | -3.86E-02 | -3.87E-02 | -3.86E-02 | -3.87E-02 | -3.86 |
| 67 | Rule 2: Charact.: 1 - Tradition - Baltistan - Gillnett-Baltistan - Medium - West Baltic | -3.95E-02 | -3.56E-02 | 0.014366 | 4.64E-02 | 5.25E-04 | 4.73E-02 | 1.62 |
| 68 | Rule 2: Charact.: 1 - Tradition - Baltistan - Gillnett-Baltistan - Medium - East Baltic | -1.68E-02 | -3.28E-02 | -2.56E-02 | -4.24E-02 | 7.66E-03 | 2.09E-03 | -3.67 |
| 69 | Rule 2: Charact.: 1 - Tradition - Baltistan - Gillnett-Baltistan - Medium - Not Baltic | -3.72E-02 | -1.28E-03 | -1.89E-02 | -3.15E-02 | -4.40E-02 | 4.35E-02 | 3.11 |
| 70 | Rule 2: Charact.: 1 - Tradition - Baltistan - Gillnett-Baltistan - Medium - Bornholm | -5.00E-02 | -0.04656 | -3.06E-02 | -2.95E-02 | -2.97E-02 | -2.95E-02 | -0.0 |
| 71 | Rule 2: Charact.: 1 - Tradition - Baltistan - Gillnett-Baltistan - Medium - Gotland | 3.68E-03 | 0.035114 | -2.68E-02 | -4.57E-02 | 4.32E-02 | 2.96E-02 | 2.38 |
| 72 | Rule 2: Attrib.: 1 - Value Landings - Baltistan - Gillnett-Baltistan - Medium | 1.79E-02 | -5.41E-03 | -4.41E-02 | 2.64E-03 | 4.57E-02 | -4.34E-02 | -3.61 |
| 73 | Rule 2: Attrib.: 2 - MPA - Baltistan - Gillnett-Baltistan - Medium | -4.58E-03 | 4.75E-02 | 1.03E-02 | -2.04E-02 | -2.87E-02 | 2.22E-02 | -4.47 |
| 74 | Rule 1: Charact.: 1 - Tradition - Baltistan - Gillnett-Baltistan - Large - Go fishing | -4.05E-02 | -0.00306 | 3.85E-02 | -4.52E-02 | 2.79E-02 | 4.88E-02 | 2.66 |
| 75 | Rule 1: Charact.: 1 - Tradition - Baltistan - Gillnett-Baltistan - Large - Stay in port | 8.98E-03 | -2.55E-02 | 2.62E-02 | -3.61E-02 | 1.33E-03 | 5.52E-03 | 9.57 |
| 76 | Rule 1: Attrib.: 1 - Expected Value Landings - Baltistan - Gillnett-Baltistan - Large | -4.02E-02 | 4.66E-02 | -5.18E-04 | 4.33E-02 | -0.03603 | -7.66E-03 | -2.45 |
| 77 | Rule 2: Charact.: 1 - Tradition - Baltistan - Gillnett-Baltistan - Large - West Baltic | -5.61E-03 | 2.85E-02 | -3.06E-02 | 2.85E-02 | -1.59E-02 | 7.55E-03 | 2.74 |
| 78 | Rule 2: Charact.: 1 - Tradition - Baltistan - Gillnett-Baltistan - Large - East Baltic | -2.27E-02 | -3.36E-02 | 1.99E-02 | 4.58E-02 | 1.37E-03 | -1.96E-02 | -1.09 |
| 79 | Rule 2: Charact.: 1 - Tradition - Baltistan - Gillnett-Baltistan - Large - Not Baltic | 3.73E-02 | -2.94E-02 | -4.39E-02 | 4.40E-02 | -1.48E-02 | -2.46E-02 | 1.89 |
| 80 | Rule 2: Charact.: 1 - Tradition - Baltistan - Gillnett-Baltistan - Large - Bornholm | 2.51E-02 | -1.80E-03 | -2.20E-02 | -6.80E-03 | 2.05E-02 | 4.37E-02 | -2.10 |
| 81 | Rule 2: Charact.: 1 - Tradition - Baltistan - Gillnett-Baltistan - Large - Gotland | -2.27E-02 | 1.29E-02 | 4.00E-02 | 3.30E-02 | -2.69E-02 | -2.55E-03 | -3.11 |
| 82 | Rule 2: Attrib.: 1 - Value Landings - Baltistan - Gillnett-Baltistan - Large | 2.90E-02 | 1.09E-03 | 4.67E-02 | -4.45E-02 | 2.27E-02 | 0.037133 | 9.89 |
| 83 | Rule 2: Attrib.: 2 - MPA - Baltistan - Gillnett-Baltistan - Large | -0.02027 | -1.40E-02 | -2.87E-03 | -2.64E-02 | 9.82E-03 | -4.06E-02 | -3.12 |

***Figure2.11.3.b. The RUM table for one trip-behaviour of one country.***

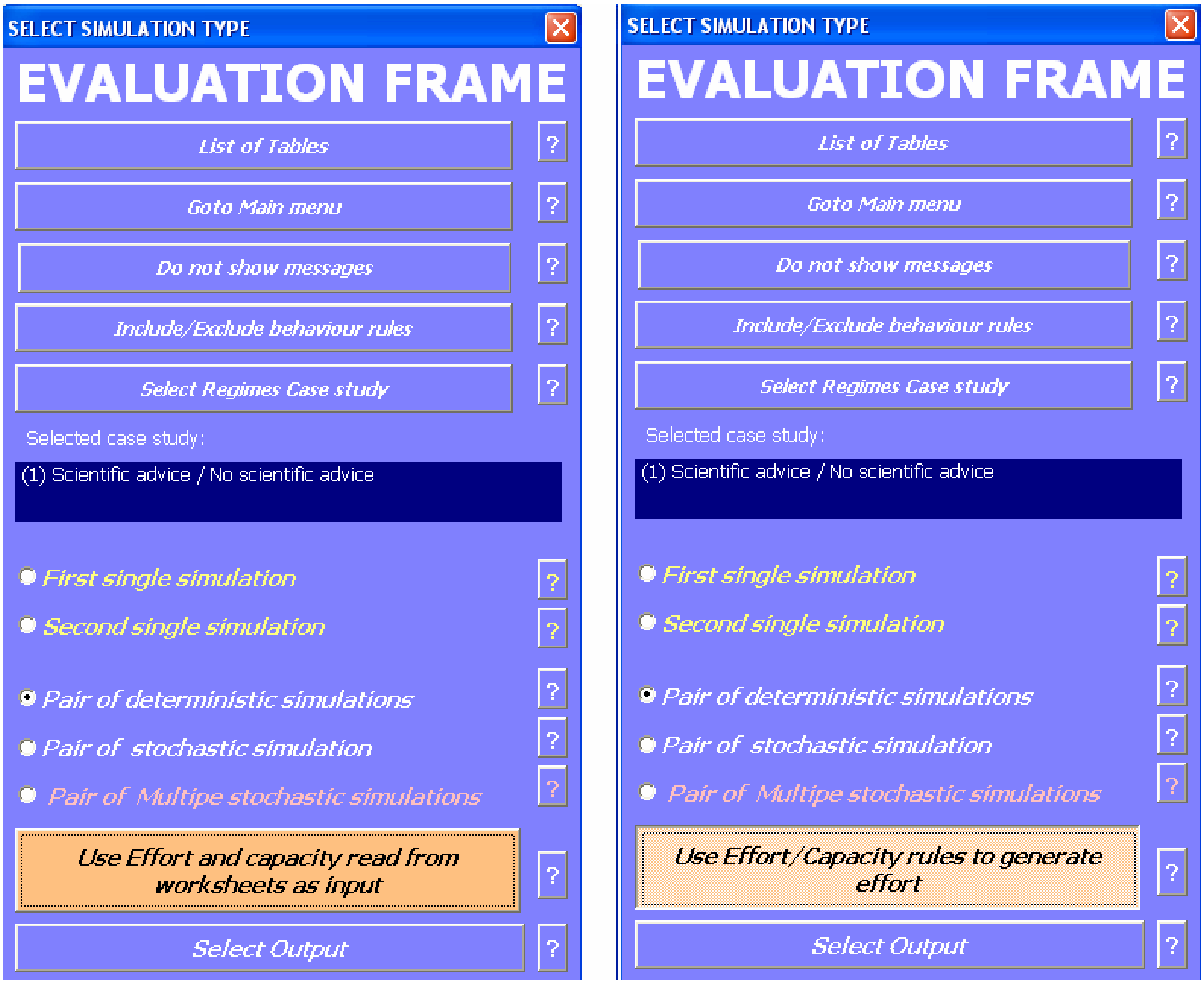
Table 2.11.1 shows that there is a table for each country. Table 2.11.3.a shows the structure of each country-table, which is structured by fleet and vessel size (Fl,Vs), and for each (Fl,Vs) input parameters are organice by "rule". Table 2.11.3.b shows that for each (Fl,Vs), the input data (coefficient in the utility fubction) for each rule are organized by characteristics ( $\beta_{ij,r}$ ) and attributes ( $\gamma_{i,s}$ )

As already explained, TEMAS offers two alternative ways of setting effort and capacity, namely to let it be determined by the behaviour rules, or to let it be given as input from the worksheet. If the effort/capacity is determined by the behaviour rules, then the age distribution of vessels (input data) is not used by TEMAS. The initial age distribution (first line in Table 5.2.1 in Figure 2.8.2) however, is used in both options for effort input.

Figure 2.11.4 shows the form used to start up the simulation (in workbook "TEMAS_CALC"). This user form contains a toggle-button, which allows the use to toggle between the two options for input of effort and fleet capacity:

"***Use Effort/Capacity rules to generate effort***" and
"***Use Effort and Capacity read from worksheet as input.***"

The remaining options offered in the user form of Figure 2.11.4 will be further discussed below.



Selected case study:
(1) Scientific advice / No scientific advice

○ First single simulation
○ Second single simulation
● Pair of deterministic simulations
○ Pair of stochastic simulation
○ Pair of Multipe stochastic simulations

***Figure 2.11.4. The user form for selection of type of simulation, including the toggle-button to select between the two effort/capacity options.***

## 2.12. STRUCTURAL RULES INPUT, S09_ STRUC_RU

The sheet, “S09_STRUC_RU”, contains the input parameters in the RUM (Random Utility Model) for long term (or “structural”) behaviour. This model is mathematically the same as that for short term behaviour. For a definition of the RUM model, see foregoing section (Section 2.11).

The four structural rules currently in the TEMAS package are:

1) Decommission (Rule). This (and the three following rules) are the so-called long term rules, which determines the capacity of the fishing fleets. The decommission rules takes the decision on accept of a decommission compensation based on the recent economic performance of the fleet and the age structure of the fleet.
2) Dis-investment rule. This rule decides on the bankruptcy of a vessel based on the recent economic performance of the fleet.
3) Attrition rule: The attrition rule takes the decision on scrapping a vessel due to old age based on the age structure of the fleet (not implemented in the Baltic case).
4) Investment rule: This rule decides on the investment in a new vessel based on the recent economic performance of the fleet.

The probabilities of accepting, $p_{Decomm}^{Accept}$, $p_{Withdrawal}^{Accept}$, $p_{Attrition}^{Accept}$, $p_{New-Vessel}^{Accept}$ thus determines the exit/entry model.

They can be modelled by the RUM, (Random Utility Model). For a more comprehensive explanation of the RUM applied to fisheries, see Annex A. The decommision rule is presented here as an example of the structural rules. The mathematical formulations is similar for all 4 structural rules.

$$p_{Decomm}^{Accept} = \frac{\exp(U_{Decomm}^{Accept})}{\exp(U_{Decomm}^{\mathrm{Re}\,ject}) + \exp(U_{Decomm}^{Accept})} \quad \text{and} \quad p_{Decomm}^{\mathrm{Re}\,ject} = 1 - p_{Decom}^{Accept}$$

$U_{Decomm}^{Accept}$ is the “utility” of accepting decommission and $U_{Decomm}^{\mathrm{Re}\,ject}$ is the utility of rejecting decommission. The general expression for utility fransformed to the vessel exit/entry model reads

$$U_{Decomm}^{Accept}(Fl,Vs,Ct,y,q) =$$

$$\sum_{r=1(Characteristics)}^{R_{Decomm}} \beta_{Decomm.\ r}^{Accept} * X_{Decomm,\ r}(Fl,Vs,Ct,y,q)$$

$$+ \sum_{s=1(Attributes)}^{S_{Decomm}} \gamma_{Decomm,\ s} * W_{Decomm,\ s}^{Accept}(Fl,Vs,Ct,y,q)$$

The RUM applied in the Baltic case is summarized in the Table 2.12.1. The idea is that if the “historical cash flow” is low during a certain period, then decommission is accepted, if it exists, and if no decommission is available, dis-investment (withdrawal from fishing industry) applies. If cash flow has been high for a while, and there are free licenses available, then investments are made. If no free licenses are available, investments may be preceded by scrapping (dis-investment) of old vessels. For example, small vessels may be replaced by large vessels if large vessels give higher cash flow. Also move of investments from one fleet to another fleet can occur.

| **Coefficient** | **Structural rule** | | |
|---|---|---|---|
| | **Decommission** | **Dis-Investment** | **Investment** |
| Characteristics (1) | Historical cash flow | Historical cash flow | Historical cash flow |
| Characteristics (2) | | Maximum Allowed capacity | Maximum Allowed capacity |
| Attributes (1) | Decommission fee | | |

***Table 2.12.1. Characteristics and attributes for three RUM models of fleet capacity dynamics applied to the Baltic Case study.***

Characteristics in the three rules are

$$X_{Decomm,\ 1}(Fl,Vs,Ct,y,q) = CF_{RUM}(Fl,Vs,Ct,y,q)$$

$$X_{Dis-Invest,\ 1}(Fl,Vs,Ct,y,q) = CF_{RUM}(Fl,Vs,Ct,y,q)$$

$$X_{Dis-Invest,\ 2}(Fl,Vs,Ct,y,q) = \text{ Vacant Licenses}$$

$$X_{Invest,\ 1}(Fl,Vs,Ct,y,q) = CF_{RUM}(Fl,Vs,Ct,y,q)$$

$$X_{Invest,\ 2}(Fl,Vs,Ct,y,q) = \text{Vacant Licencses}$$

and the single attribute considered in the decommission rule is

$$W^{Accept}_{Decomm,1}(Fl,Vs,Ct,y,q) \ = \text{Decommission fee for one vessel}$$

The cash flow concept, $CF_{RUM}(Fl,Vs,Ct,y,q)$, used in the present RUM is the average cashflow per period during the period $y-dy_{RUM}, y-dy_{RUM}+1,...,y-1$ and the periods for year y: 1,2,…,q-1.

The cash flows of hesorical years are weighted by a factor, $Fac_u^{RUM}$, which could be $Fac_u^{RUM} = (Fac^{RUM})^{-(y-u)}$ where $Fac^{RUM}$ is a constant $0 < Fac^{RUM} \le 1$.

$$CF_{RUM}(Fl,Vs,Ct,y,q) = \frac{1}{dy_{RUM} * q_{Max}} \sum_{u=y-dy_{RUM}}^{y-1} \sum_{q=1}^{q_{Max}} FNCF_{RUM}(Fl,Vs,Ct,u,q,\bullet) * Fac_u^{RUM}$$

$$+ \ \frac{1}{q-1}\sum_{v=1}^{q-1} FNCF_{RUM}(Fl,Vs,Ct,y,q,\bullet)$$ and the net cash flow summed over areas is defined

$$FNCF_{RUM}(Fl,Vs,Ct,y,q,\bullet) = REV(Fl,Vs,Ct,y,q,\bullet) - VCO(Fl,Vs,Ct,y,q,\bullet) - CO_{Fix}^{Total}(Fl,Vs,Ct,y,q)$$

where REV is the revenue from landings, VCO is the total variable costs, and $CO_{Fix}^{Total}$ is the total fixed costs.

The number of vessels is usually limited. The usual condition for introduction of a new vessel is that a vessel of similar size is removed from fishery. These conditions are often linked to capacity rather than the number of vessels, so that, for example, one big vessel, can be replacement three small vessel, if the total fishing capacity of the small vessels equals that of the new big vessel. Let TON(Fl, Vs, Ct) be the tonnage of an average vessel in vessel size Vs in Fleet Fl country Ct. If the entry of new vessels is conditions of removal of old vessels with the same tonnage, this would lead to lead to the country specific constraint:

$$\sum_{Fl=1}^{Fl_{Max}(Ct)} \sum_{Vs=1}^{Vs_{Max}(Fl,Ct)} NU_{New-Vessel}(Fl,Vs,Ct,y,q,\bullet)*TON(Fl,Vs,Ct) \leq$$
$$\sum_{Fl=1}^{Fl_{Max}(Ct)} \sum_{Vs=1}^{Vs_{Max}(Fl,Ct)} NU_{Decomm}(Fl,Vs,Ct,y,q,\bullet)*TON(Fl,Vs,Ct) +$$
$$\sum_{Fl=1}^{Fl_{Max}(Ct)} \sum_{Vs=1}^{Vs_{Max}(Fl,Ct)} NU_{Withdrawal}(Fl,Vs,Ct,y,q,\bullet)*TON(Fl,Vs,Ct) +$$
$$\sum_{Fl=1}^{Fl_{Max}(Ct)} \sum_{Vs=1}^{Vs_{Max}(Fl,Ct)} NU_{Attrition}(Fl,Vs,Ct,y,q.\bullet)*TON(Fl,Vs,Ct)$$

If furthermore, decommisioned vessels cannot be replaced the term

$\sum_{Fl=1}^{Fl_{Max}(Ct)} \sum_{Vs=1}^{Vs_{Max}(Fl,Ct)} NU_{Decomm}(Fl,Vs,Ct,y,q,\bullet)*TON(Fl,Vs,Ct)$ should be removed from the inequality

above. The vessel tonnage is just one example of a “fleet characteristics”. Other examples of fleet characteristics are “Length of vessel” and “KgW of engine”.

The “maximum regulations” are thought of as an upper limit, MAL (Maximum allowed level) of the characteristics summed over vessels. TEMAS allows for limitations of total characteristics of three levels Country, Fleet and Vessel Size:

Level 1: Country level

$$\sum_{Fl=}^{Fl_{Max}(Ct)} \sum_{Vs=1}^{Vs_{Max}(Fl,Ct)} NU_{Vessel}(Fl,Vs,Ct,y,q,\bullet)*TON(Fl,Vs,Ct) \leq MAL_{Ton}^{Level\ 1}(Ct,y)$$

Level 2: Fleet level:

$$\sum_{Vs=1}^{Vs_{Max}(Fl,Ct)} NU_{Vessel}(Fl,Vs,Ct,y,q,\bullet)*TON(Fl,Vs,Ct) \leq MAL_{Ton}^{Level\ 2}(Fl,Ct,y)$$

Level 3: Vessel size level:

$$NU_{Vessel}(Fl,Vs,Ct,y,\bullet)*TON(Fl,Vs,Ct) \leq MAL_{Ton}^{Level\ 3}(Fl,Vs,Ct)$$

To indicate a maximum regulation defined by a fleet characteristics, is thus required a specification of the characteristics (tonnage, vessel length, KWat etc.) and the level at which the MAL shall be applied. As illustrated by the example above on investment/replace above, the characteristics may be used for other types of regulations than maximum regulations.

$X_{Dis-Invest,\ 2}(Fl,Vs,Ct,y,q) = X_{Invest,\ 2}(Fl,Vs,Ct,y,q) =$ Max Capacity - Actual capacity

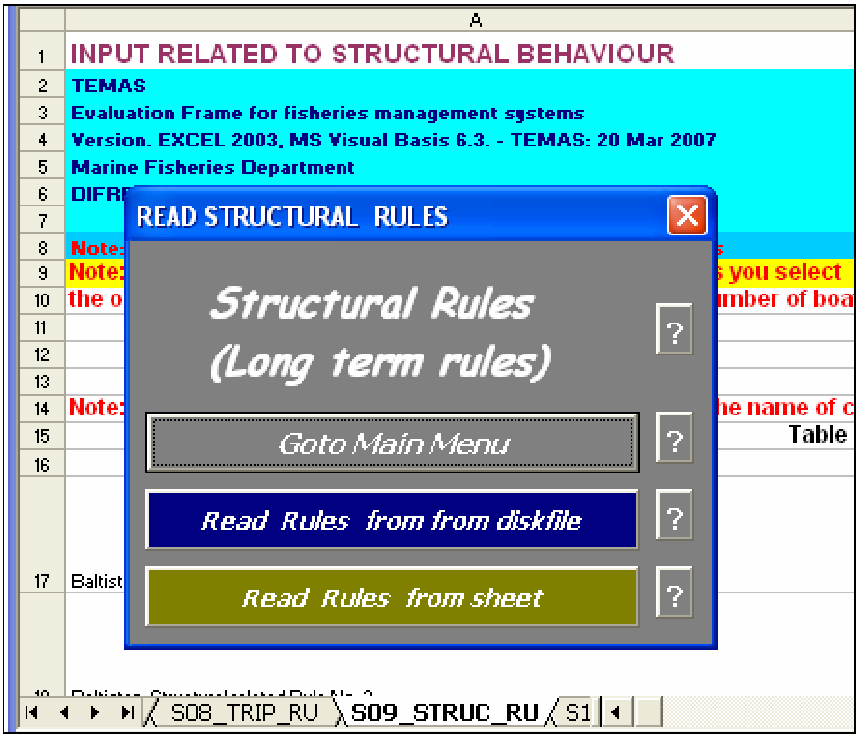
is not (Fl,Vs)-specific, it depends only on the country in the present TEMAS version for the Baltic

(Max Capacity - Actual capacity) =

$$MAL_{Ton}^{Level\ 1}(Ct) - \sum_{Fl=}^{Fl_{Max}(Ct)} \sum_{Vs=1}^{Vs_{Max}(Fl,Ct)} NU_{Vessel}(Fl,Vs,Ct,y.q,\bullet)*TON(Fl,Vs,Ct,y)$$

The variable “vacant licenses” is defined to prevent investment when no licenses are vacant, that is

$$Vacant\ \ Licenses = \begin{cases} 0\ \ if\ \ MAL_{Ton}^{Level\ \ 1}(Ct) > \sum_{Fl=}^{Fl_{Max}(Ct)} \sum_{Vs=1}^{Vs_{Max}(Fl,Ct)} NU_{Vessel}(Fl,Vs,Ct,y.q,\bullet) * TON(Fl,Vs,Ct,y) \\ -\infty\ if\ \ MAL_{Ton}^{Level\ \ 1}(Ct) \leq \sum_{Fl=}^{Fl_{Max}(Ct)} \sum_{Vs=1}^{Vs_{Max}(Fl,Ct)} NU_{Vessel}(Fl,Vs,Ct,y.q,\bullet) * TON(Fl,Vs,Ct,y) \end{cases}$$



INPUT RELATED TO STRUCTURAL BEHAVIOUR

TEMAS

Evaluation Frame for fisheries management systems

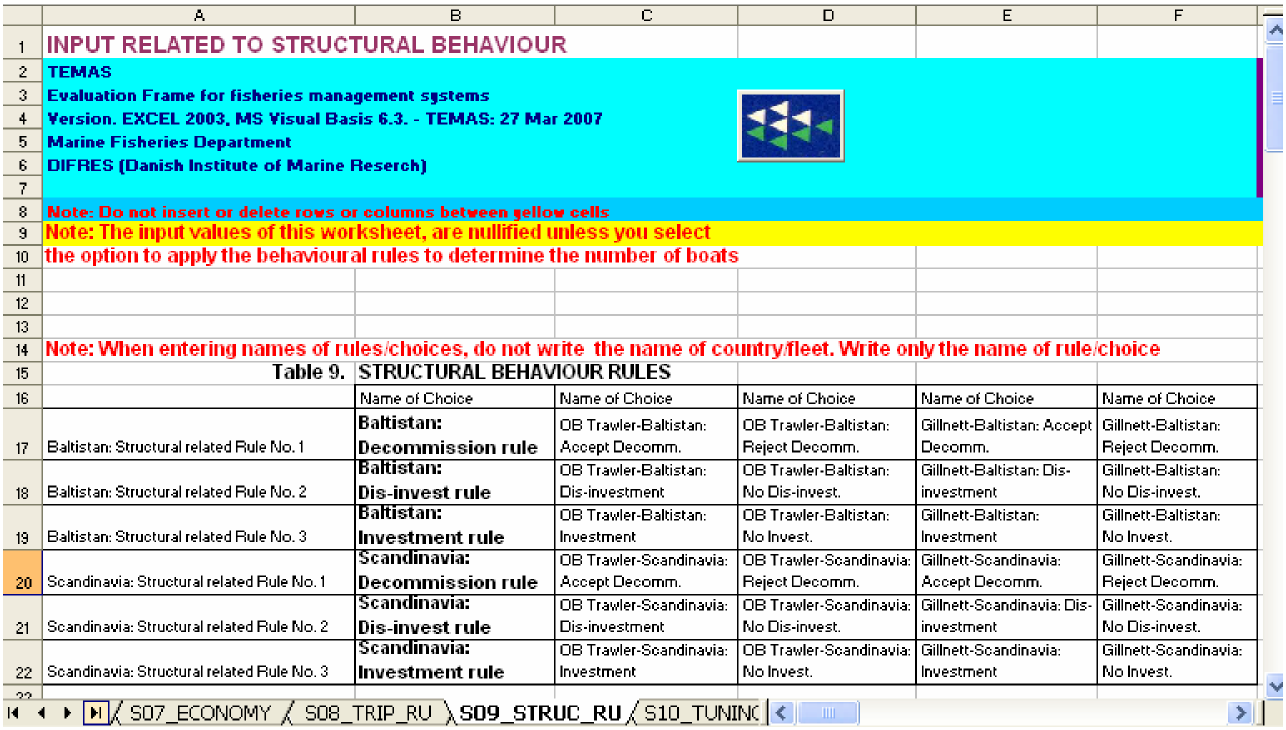
Version. EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 20 Mar 2007

Marine Fisheries Department

*Figure 2.12.1. User-form for entry of structural behaviour related parameters.*

| **Index** | **EXCEL Table** | **Caption** |
|---|---|---|
| 168 | Table9. | STRUCTURAL BEHAVIOUR RULES |
| 169 | Table9.1.1. | Baltistan : STRUCTURAL BEHAVIOUR COEFFICIENTS OF R.U.M. |
| 170 | Table9.1.2. | Scandinavia : STRUCTURAL BEHAVIOUR COEFFICIENTS OF R.U.M. |

*Table 2.12.2. Tables in the structural behaviour input sheet, S09_STRUC_RU.*



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DIFRES (Danish Institute of Marine Reserch)

Note: Do not insert or delete rows or columns between yellow cells

Note: The input values of this worksheet, are nullified unless you select the option to apply the behavioural rules to determine the number of boats

Note: When entering names of rules/choices, do not write  the name of country/fleet. Write only the name of rule/choice

Table 9.  STRUCTURAL BEHAVIOUR RULES

| | | | | | |
|---|---|---|---|---|---|
| | Name of Choice | Name of Choice | Name of Choice | Name of Choice | Name of Choice |
| Baltistan: Structural related Rule No. 1 | **Baltistan: Decommission rule** | OB Trawler-Baltistan: Accept Decomm. | OB Trawler-Baltistan: Reject Decomm. | Gillnett-Baltistan: Accept Decomm. | Gillnett-Baltistan: Reject Decomm. |
| Baltistan: Structural related Rule No. 2 | **Baltistan: Dis-invest rule** | OB Trawler-Baltistan: Dis-investment | OB Trawler-Baltistan: No Dis-invest. | Gillnett-Baltistan: Dis-investment | Gillnett-Baltistan: No Dis-invest. |
| Baltistan: Structural related Rule No. 3 | **Baltistan: Investment rule** | OB Trawler-Baltistan: Investment | OB Trawler-Baltistan: No Invest. | Gillnett-Baltistan: Investment | Gillnett-Baltistan: No Invest. |
| Scandinavia: Structural related Rule No. 1 | **Scandinavia: Decommission rule** | OB Trawler-Scandinavia: Accept Decomm. | OB Trawler-Scandinavia: Reject Decomm. | Gillnett-Scandinavia: Accept Decomm. | Gillnett-Scandinavia: Reject Decomm. |
| Scandinavia: Structural related Rule No. 2 | **Scandinavia: Dis-invest rule** | OB Trawler-Scandinavia: Dis-investment | OB Trawler-Scandinavia: No Dis-invest. | Gillnett-Scandinavia: Dis-investment | Gillnett-Scandinavia: No Dis-invest. |
| Scandinavia: Structural related Rule No. 3 | **Scandinavia: Investment rule** | OB Trawler-Scandinavia: Investment | OB Trawler-Scandinavia: No Invest. | Gillnett-Scandinavia: Investment | Gillnett-Scandinavia: No Invest. |

*Figure 2.12.2. Names of structural  behaviour rules and choices*

Figure 2.12.1 shows the userform of sheet S09_STRUC_RU, and Table 2.12.2 lists the three tables of the sheet. The structure is exactly the same as for sheet “S08_TRIP_RU”

Figure 2.12.2 shows the names of rules (EXCEL Table 9), and is exactly the same format as that for the trip related RUM (Figure 2.11.2).
Figure 2.12.3 shows the parameters of the RUM for structural behaviour, (in the Baltic case). The structure of this table is the same as that for the trip related RUM (Figures 2.11.3.a-b)

| | | | | | |
|---|---|---|---|---|---|
| 24 | Table 9.1.1. Baltistan : STRUCTURAL BEHAVIOUR COEFFICIENTS OF R.U.M. | | | | |
| 25 | | 2000 Per.1 | 2000 Per.2 | 2000 Per.3 | 2000 Per |
| 26 | Rule 1: Charact.: 1: Hist. Cashflow - Baltistan - OB Trawler-Baltistan - Small - Accept Decomm. | -2.25E-02 | 3.62E-02 | -2.74E-02 | 4.54E- |
| 27 | Rule 1: Charact.: 1: Hist. Cashflow - Baltistan - OB Trawler-Baltistan - Small - Reject Decomm. | -2.66E-02 | -3.66E-02 | -0.04867 | -1.82E- |
| 28 | Rule 1: Attrib.: 1: Decommission fee - Baltistan - OB Trawler-Baltistan - Small | -4.36E-02 | 3.85E-02 | 3.30E-02 | 4.53E- |
| 29 | Rule 2: Charact.: 1: Hist. Cashflow - Baltistan - OB Trawler-Baltistan - Small - Dis-investment | 1.42E-02 | -3.84E-02 | -4.69E-02 | -0.0447 |
| 30 | Rule 2: Charact.: 1: Hist. Cashflow - Baltistan - OB Trawler-Baltistan - Small - No Dis-invest. | -3.61E-02 | -9.39E-03 | 4.13E-02 | -3.21E- |
| 31 | Rule 2: Charact.: 2: Max Capacity - Baltistan - OB Trawler-Baltistan - Small - Dis-investment | 1.42E-02 | -0.022587 | -3.28E-05 | -2.87E- |
| 32 | Rule 2: Charact.: 2: Max Capacity - Baltistan - OB Trawler-Baltistan - Small - No Dis-invest. | -4.13E-02 | -1.07E-02 | 4.79E-02 | 3.06E- |
| 33 | Rule 3: Charact.: 1: Hist. Cashflow - Baltistan - OB Trawler-Baltistan - Small - Investment | -4.26E-02 | -4.44E-02 | -4.94E-02 | -3.72E- |
| 34 | Rule 3: Charact.: 1: Hist. Cashflow - Baltistan - OB Trawler-Baltistan - Small - No Invest. | 8.63E-03 | -5.21E-03 | 4.64E-02 | -2.04E- |
| 35 | Rule 3: Charact.: 2: Max Capacity - Baltistan - OB Trawler-Baltistan - Small - Investment | -1.80E-02 | 3.17E-02 | 0.016219 | -4.22E- |
| 36 | Rule 3: Charact.: 2: Max Capacity - Baltistan - OB Trawler-Baltistan - Small - No Invest. | -2.55E-02 | -4.90E-02 | 2.92E-02 | 3.17E- |
| 37 | Rule 1: Charact.: 1: Hist. Cashflow - Baltistan - OB Trawler-Baltistan - Medium - Accept Decomm. | 2.29E-02 | -1.38E-02 | 2.34E-02 | -4.74E- |
| 38 | Rule 1: Charact.: 1: Hist. Cashflow - Baltistan - OB Trawler-Baltistan - Medium - Reject Decomm. | 4.79E-03 | -2.40E-03 | 0.04994 | 4.04E- |
| 39 | Rule 1: Attrib.: 1: Decommission fee - Baltistan - OB Trawler-Baltistan - Medium | -2.78E-02 | -4.54E-03 | -3.60E-03 | 4.08E- |
| 40 | Rule 2: Charact.: 1: Hist. Cashflow - Baltistan - OB Trawler-Baltistan - Medium - Dis-investment | -7.27E-04 | -2.57E-02 | 4.76E-02 | 1.71E- |
| 41 | Rule 2: Charact.: 1: Hist. Cashflow - Baltistan - OB Trawler-Baltistan - Medium - No Dis-invest. | 2.39E-02 | 1.41E-02 | 1.58E-02 | 4.93E- |
| 42 | Rule 2: Charact.: 2: Max Capacity - Baltistan - OB Trawler-Baltistan - Medium - Dis-investment | -4.89E-02 | -1.56E-02 | -3.57E-02 | -1.19E- |
| 43 | Rule 2: Charact.: 2: Max Capacity - Baltistan - OB Trawler-Baltistan - Medium - No Dis-invest. | 9.85E-03 | 4.86E-02 | 3.30E-03 | 9.44E- |
| 44 | Rule 3: Charact.: 1: Hist. Cashflow - Baltistan - OB Trawler-Baltistan - Medium - Investment | -1.88E-02 | -1.49E-04 | 1.57E-03 | 6.70E- |
| 45 | Rule 3: Charact.: 1: Hist. Cashflow - Baltistan - OB Trawler-Baltistan - Medium - No Invest. | 1.81E-02 | 8.18E-03 | -4.49E-02 | -4.48E- |
| 46 | Rule 3: Charact.: 2: Max Capacity - Baltistan - OB Trawler-Baltistan - Medium - Investment | -2.71E-02 | 1.53E-02 | -3.19E-02 | 0.0255 |
| 47 | Rule 3: Charact.: 2: Max Capacity - Baltistan - OB Trawler-Baltistan - Medium - No Invest. | -4.41E-02 | 4.15E-02 | -4.82E-02 | -4.38E- |
| 48 | Rule 1: Charact.: 1: Hist. Cashflow - Baltistan - OB Trawler-Baltistan - Large - Accept Decomm. | -1.18E-02 | 4.66E-02 | -3.23E-02 | 2.64E- |
| 49 | Rule 1: Charact.: 1: Hist. Cashflow - Baltistan - OB Trawler-Baltistan - Large - Reject Decomm. | -0.018512 | 2.56E-03 | -3.30E-02 | -4.65E- |
| 50 | Rule 1: Attrib.: 1: Decommission fee - Baltistan - OB Trawler-Baltistan - Large | 0.036584 | 3.41E-02 | 7.68E-03 | -4.01E- |
| 51 | Rule 2: Charact.: 1: Hist. Cashflow - Baltistan - OB Trawler-Baltistan - Large - Dis-investment | -1.49E-02 | -3.94E-02 | -1.11E-02 | -2.95E- |
| 52 | Rule 2: Charact.: 1: Hist. Cashflow - Baltistan - OB Trawler-Baltistan - Large - No Dis-invest. | 4.18E-02 | -3.84E-02 | -2.08E-02 | -3.04E- |
| 53 | Rule 2: Charact.: 2: Max Capacity - Baltistan - OB Trawler-Baltistan - Large - Dis-investment | 3.34E-02 | -0.014414 | -2.47E-02 | 4.82E- |
| 54 | Rule 2: Charact.: 2: Max Capacity - Baltistan - OB Trawler-Baltistan - Large - No Dis-invest. | -0.033016 | 2.67E-02 | -0.020133 | -2.09E- |
| 55 | Rule 3: Charact.: 1: Hist. Cashflow - Baltistan - OB Trawler-Baltistan - Large - Investment | -3.99E-02 | -0.01751 | 5.77E-03 | 4.87E- |
| 56 | Rule 3: Charact.: 1: Hist. Cashflow - Baltistan - OB Trawler-Baltistan - Large - No Invest. | 4.30E-02 | 2.15E-02 | -4.67E-02 | 1.56E- |
| 57 | Rule 3: Charact.: 2: Max Capacity - Baltistan - OB Trawler-Baltistan - Large - Investment | -2.40E-02 | -4.56E-02 | 3.64E-03 | -1.16E- |
| 58 | Rule 3: Charact.: 2: Max Capacity - Baltistan - OB Trawler-Baltistan - Large - No Invest. | 2.60E-02 | 2.94E-06 | -3.24E-02 | 4.91E- |
| 59 | Rule 1: Charact.: 1: Hist. Cashflow - Baltistan - Gillnett-Baltistan - Small - Accept Decomm. | 3.76E-02 | -4.60E-02 | -7.59E-03 | 4.53E- |
| 60 | Rule 1: Charact.: 1: Hist. Cashflow - Baltistan - Gillnett-Baltistan - Small - Reject Decomm. | -1.30E-02 | 0.019801 | -3.23E-02 | 0.0111 |
| 61 | Rule 1: Attrib.: 1: Decommission fee - Baltistan - Gillnett-Baltistan - Small | -0.028428 | -2.27E-02 | -5.96E-03 | 6.58E- |
| 62 | Rule 2: Charact.: 1: Hist. Cashflow - Baltistan - Gillnett-Baltistan - Small - Dis-investment | -1.22E-02 | 8.37E-03 | 2.73E-02 | 1.03E- |
| 63 | Rule 2: Charact.: 1: Hist. Cashflow - Baltistan - Gillnett-Baltistan - Small - No Dis-invest. | 2.35E-02 | -1.85E-03 | -1.60E-02 | 2.30E- |
| 64 | Rule 2: Charact.: 2: Max Capacity - Baltistan - Gillnett-Baltistan - Small - Dis-investment | -1.78E-02 | -1.22E-03 | -3.71E-02 | 0.0319 |
| 65 | Rule 2: Charact.: 2: Max Capacity - Baltistan - Gillnett-Baltistan - Small - No Dis-invest. | -4.79E-02 | 3.07E-02 | 2.28E-02 | 8.05E- |
| 66 | Rule 3: Charact.: 1: Hist. Cashflow - Baltistan - Gillnett-Baltistan - Small - Investment | -2.72E-02 | 2.04E-03 | 2.23E-02 | 3.95E- |
| 67 | Rule 3: Charact.: 1: Hist. Cashflow - Baltistan - Gillnett-Baltistan - Small - No Invest. | 1.37E-02 | -0.019657 | -0.019843 | -4.05E- |
| 68 | Rule 3: Charact.: 2: Max Capacity - Baltistan - Gillnett-Baltistan - Small - Investment | 7.88E-04 | -1.24E-02 | -4.40E-02 | -2.51E- |
| 69 | Rule 3: Charact.: 2: Max Capacity - Baltistan - Gillnett-Baltistan - Small - No Invest. | -4.64E-02 | -1.68E-02 | 2.40E-02 | 4.65E- |
| 70 | Rule 1: Charact.: 1: Hist. Cashflow - Baltistan - Gillnett-Baltistan - Medium - Accept Decomm. | -3.87E-02 | -1.53E-02 | -3.67E-02 | 0.012 |
| 71 | Rule 1: Charact.: 1: Hist. Cashflow - Baltistan - Gillnett-Baltistan - Medium - Reject Decomm. | 7.47E-03 | -4.83E-02 | -3.86E-02 | -3.86E- |
| 72 | Rule 1: Attrib.: 1: Decommission fee - Baltistan - Gillnett-Baltistan - Medium | 4.79E-02 | 2.19E-02 | 6.06E-03 | 0.0143 |
| 73 | Rule 2: Charact.: 1: Hist. Cashflow - Baltistan - Gillnett-Baltistan - Medium - Dis-investment | 8.28E-03 | 1.60E-02 | -2.56E-02 | -2.56E- |
| 74 | Rule 2: Charact.: 1: Hist. Cashflow - Baltistan - Gillnett-Baltistan - Medium - No Dis-invest. | 0.025858 | -3.63E-02 | 6.07E-03 | -1.89E- |
| 75 | Rule 2: Charact.: 2: Max Capacity - Baltistan - Gillnett-Baltistan - Medium - Dis-investment | 4.58E-02 | -8.48E-04 | -3.01E-02 | -3.06E- |
| 76 | Rule 2: Charact.: 2: Max Capacity - Baltistan - Gillnett-Baltistan - Medium - No Dis-invest. | -0.038203 | -4.85E-02 | -4.79E-03 | -2.68E- |
| 77 | Rule 3: Charact.: 1: Hist. Cashflow - Baltistan - Gillnett-Baltistan - Medium - Investment | 5.12E-03 | 3.69E-02 | -0.012403 | -2.52E- |
| 78 | Rule 3: Charact.: 1: Hist. Cashflow - Baltistan - Gillnett-Baltistan - Medium - No Invest. | 4.48E-02 | -2.57E-03 | 4.93E-02 | -2.55E- |
| 79 | Rule 3: Charact.: 2: Max Capacity - Baltistan - Gillnett-Baltistan - Medium - Investment | -1.47E-02 | 3.42E-02 | 1.65E-02 | 3.03E- |
| 80 | Rule 3: Charact.: 2: Max Capacity - Baltistan - Gillnett-Baltistan - Medium - No Invest. | -2.14E-02 | -3.76E-02 | -4.81E-02 | -7.67E- |
| 81 | Rule 1: Charact.: 1: Hist. Cashflow - Baltistan - Gillnett-Baltistan - Large - Accept Decomm. | 8.41E-03 | -4.50E-02 | -7.82E-03 | 3.85E- |
| 82 | Rule 1: Charact.: 1: Hist. Cashflow - Baltistan - Gillnett-Baltistan - Large - Reject Decomm. | -1.61E-02 | 1.28E-02 | -4.87E-02 | 2.62E- |
| 83 | Rule 1: Attrib.: 1: Decommission fee - Baltistan - Gillnett-Baltistan - Large | -2.27E-02 | 3.48E-02 | 1.93E-02 | 2.44E- |
| 84 | Rule 2: Charact.: 1: Hist. Cashflow - Baltistan - Gillnett-Baltistan - Large - Dis-investment | 5.93E-03 | -4.81E-02 | 4.79E-02 | 2.46E- |
| 85 | Rule 2: Charact.: 1: Hist. Cashflow - Baltistan - Gillnett-Baltistan - Large - No Dis-invest. | -1.24E-02 | 4.48E-02 | -4.18E-02 | -5.18E- |
| 86 | Rule 2: Charact.: 2: Max Capacity - Baltistan - Gillnett-Baltistan - Large - Dis-investment | -4.08E-02 | -4.76E-02 | -4.18E-02 | -3.06E- |
| 87 | Rule 2: Charact.: 2: Max Capacity - Baltistan - Gillnett-Baltistan - Large - No Dis-invest. | 3.84E-02 | 1.43E-02 | 8.80E-03 | 1.99E- |
| 88 | Rule 3: Charact.: 1: Hist. Cashflow - Baltistan - Gillnett-Baltistan - Large - Investment | -1.29E-02 | 4.26E-02 | -2.64E-02 | -4.39E- |
| 89 | Rule 3: Charact.: 1: Hist. Cashflow - Baltistan - Gillnett-Baltistan - Large - No Invest. | -2.44E-02 | 9.66E-03 | 2.35E-02 | -2.20E- |
| 90 | Rule 3: Charact.: 2: Max Capacity - Baltistan - Gillnett-Baltistan - Large - Investment | 2.53E-02 | -2.84E-02 | -4.02E-02 | 4.00E- |
| 91 | Rule 3: Charact.: 2: Max Capacity - Baltistan - Gillnett-Baltistan - Large - No Invest. | -2.58E-02 | 4.01E-02 | 3.65E-02 | 1.50E- |

***Figure 2.12.3. Parameters in structural  behaviour model (RUM)***

## 2.13 TUNING INPUT, S_10_TUNING

By “tuning” is meant the processes of finding the “reference simulation” of TEMAS. The reference simulation is the situation (scenario) relative to which all the other simulations are made, and are compared to, when addressing the "'What-if-then-questions'.

The reference simulation will usually be chosen to be a simulation in equilibrium, that is, a simulation where all results are equal in all years of the time series under study. The reference simulation will usually be chosen to be the fisheries situation of the current situation (current year). TEMAS is said to reproduce the current situation when it can reproduce the landings (in weight) observed the last data year for each combination of fleet, stock, time period and.

The idea of “calibration” is closely related to “tuning”. Calibration means to adjust certain parameters of TEMAS, so that TEMAS can make a simulated prediction for a historical period, that does not “deviate too much” from the observed fisheries. For example, TEMAS should be able to simulate predicted catches from 1995 to 2005 that do not deviate too much from the actual (observed) catches 1995-2005. TEMAS calibrates some of its parameters by aid of the so-called modified $\chi^2$-criterion (Sokal and Rohlf, 1981)

$$\chi_X^2 = \sum\nolimits_{Indices} \frac{(X_{Observed} - X_{Calculated})^2}{X_{Calculated}}$$

where “$X_{calculated}$” symbolises a prediction-variable of the model, for example, the weight of cod, caught by a certain gear rigging of a fleet fleet, at a certain time, in a certain area. “$X_{observed}$” indicates the value of X observed from a historical period. The variables “X” are selected so that they are easy to access.

The options for calibration data are:

1) Catches, (Landings and discards) on various dis-aggregation levels. From (Fl, Vs, Rg, Ct, St, y, a, q, Va, Ar) to (•,•,•,•, St, y,•,•,•,•) . These data are entered through worksheet “S11_OBS”.
2) Index of stock numbers from research vessel survey or from catch per unit of effort of commercial vessels.
3) Index of stock biomass or SSB from research vessel survey or from catch per unit of effort of commercial vessels.
4) Mean stock F (Fishing mortality) from (for example) fish stock assessment of ICES working groups.

The $\chi^2$ for landings summed over age groups is:

$$\chi_{Yield}^2 = \sum_{Ct=1}^{Ct_{Max}} \sum_{Fl=1}^{Fl_{Max}(Ct)} \sum_{Vs=1}^{Vs_{Max}(Fl,Ct)} \sum_{Rg=1}^{Rg_{Max}(Fl,Ct)} \sum_{St=1}^{St_{Max}} \sum_{y=y_{first}}^{y_{last}} \sum_{q=1}^{q_{Max}} \sum_{Ar=1}^{Ar_{Max}}$$

$$\frac{(Y_{Landings}^{Obs}(Fl,Vs,Rg,Ct,St,y,\bullet,q,\bullet,Ar) - Y_{Landings}^{Calc}(Fl,Vs,Rg,Ct,St,y,\bullet,q,\bullet,Ar))^2}{Y^{Calc}(Fl,Vs,Rg,Ct,St,y,\bullet,q,\bullet,Ar)}$$

Landings summed over vessel age groups and fish age groups, are the “observations” expected in the current version of TEMAS. These data are entered in worksheet “S11_OBS”

The index of stock numbers can be catch per day by age group, converted into relative numbers, to make them compatible with relative numbers predicted by TEMAS.

$$\chi^2_N = \sum_{St=1}^{St_{Max}} \sum_{y=y_{first}}^{y_{last}} \sum_{q=1}^{q_{Max}} \sum_{a=1}^{a_{Max}(St)} \frac{(N^{Obs}_{Index}(St,y,q,a,Ar) - N^{Calc}_{Index}(St,y,q,a,A))^2}{N^{Calc}_{Index}(St,y,q,a)}$$

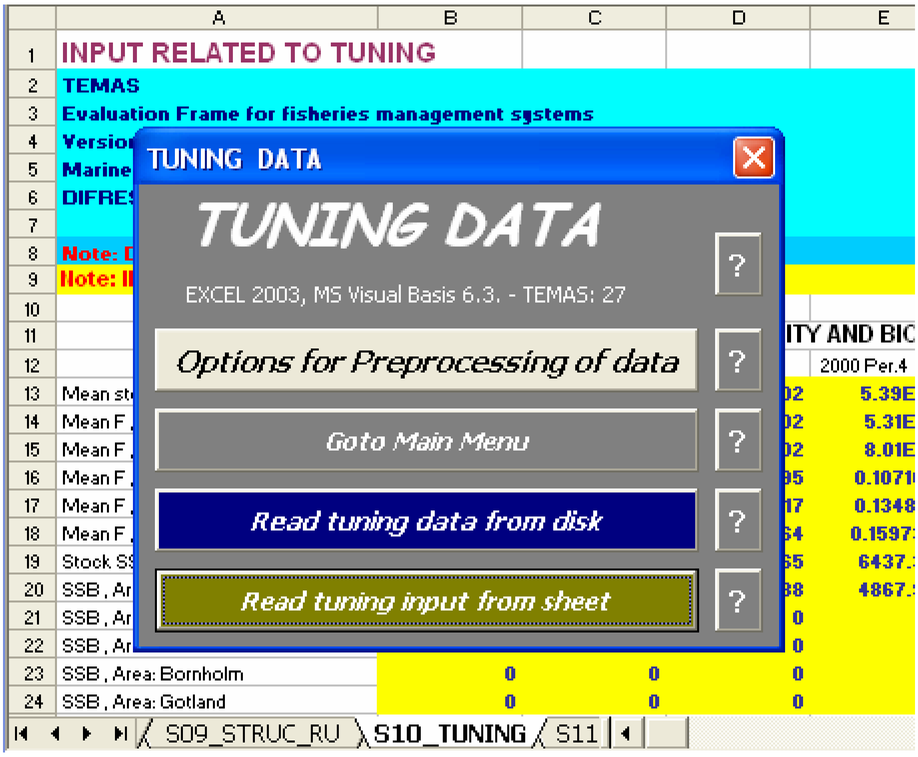
Where, for example, $N^{Calc}_{Index}(St,y,q,a,Ar) = \dfrac{N(St,y,q,a,Ar)}{\sum_{i=1}^{a_{Max}(St)} N(St,y,q,i,Ar)}$ and the survey index is derived from, say, catch per hour, CPUE$_{Survey}$, $N^{Obs}_{Index}(St,y,q,a,Ar) = \dfrac{CPUE_{Survey}(St,y,q,a,Ar)}{\sum_{i=1}^{a_{Max}(St)} CPUE_{Survey}(St,y,q,i,Ar)}$

Also indices of biomass (or SSB) can be made relative and compared to indices predicted by TEMAS.

$$\chi^2_{SSB} = \sum_{St=1}^{St_{Max}} \sum_{y=y_{first}}^{y_{last}} \sum_{q=1}^{q_{Max}} \frac{(SSB^{Obs}_{Index}(St,y,q) - SSB^{Calc}_{Index}(St,y,q))^2}{SSB^{Calc}_{Index}(St,y,q)}$$

Fishing mortality can be compared to fishing mortalities estimated by persons independent of TEMAS (e.g. ICES WGs).

$$\chi^2_{F_{MEAN}} = \sum_{St=1}^{St_{Max}} \sum_{y=y_{first}}^{y_{last}} \sum_{q=1}^{q_{Max}} \frac{(F^{Obs}_{Mean}(St,y,q) - F^{Calc}_{Mean}(St,y,q))^2}{F^{Calc}_{Mean}(St,y,q)}$$



INPUT RELATED TO TUNING

TEMAS

Evaluation Frame for fisheries management systems

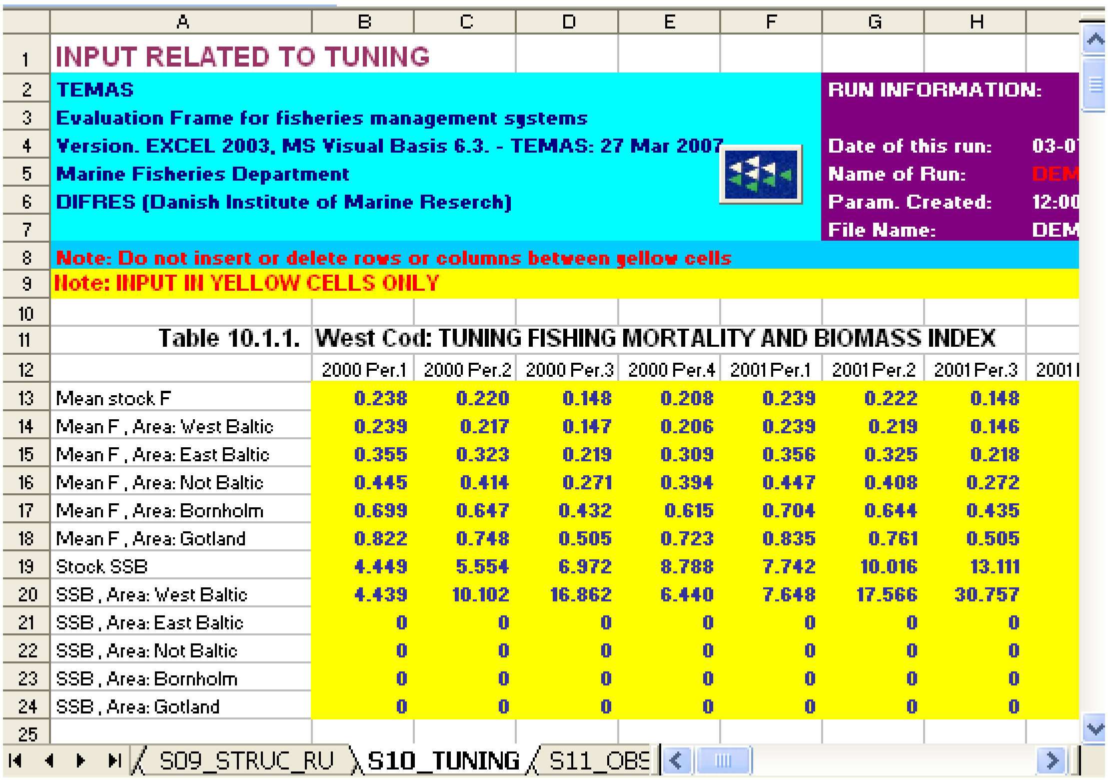
TUNING DATA

EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 27

*Figure 2.13.1. User-form for entry of tuning data.*

| Index | EXCEL Table | Caption |
|---|---|---|
| 171 | Table10.1.1. | West Cod: TUNING FISHING MORTALITY AND BIOMASS INDEX |
| 172 | Table10.1.2. | West Cod: INDEX OF ABUNDANCE (Numbers at age) |
| 173 | Table10.2.1. | East cod: TUNING FISHING MORTALITY AND BIOMASS INDEX |
| 174 | Table10.2.2. | East cod: INDEX OF ABUNDANCE (Numbers at age) |

***Table 2.13.1. Tables in the tuning input sheet, S010_TUNING.***



INPUT RELATED TO TUNING

**TEMAS**
**Evaluation Frame for fisheries management systems**
**Version. EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 27 Mar 2007**
**Marine Fisheries Department**
**DIFRES (Danish Institute of Marine Reserch)**

**RUN INFORMATION:**
**Date of this run:** 03-0
**Name of Run:** DEM
**Param. Created:** 12:00
**File Name:** DEM

**Note: Do not insert or delete rows or columns between yellow cells**
**Note: INPUT IN YELLOW CELLS ONLY**

Table 10.1.1. West Cod: TUNING FISHING MORTALITY AND BIOMASS INDEX

| | 2000 Per.1 | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 |
|---|---|---|---|---|---|---|---|---|
| Mean stock F | 0.238 | 0.220 | 0.148 | 0.208 | 0.239 | 0.222 | 0.148 | |
| Mean F , Area: West Baltic | 0.239 | 0.217 | 0.147 | 0.206 | 0.239 | 0.219 | 0.146 | |
| Mean F , Area: East Baltic | 0.355 | 0.323 | 0.219 | 0.309 | 0.356 | 0.325 | 0.218 | |
| Mean F , Area: Not Baltic | 0.445 | 0.414 | 0.271 | 0.394 | 0.447 | 0.408 | 0.272 | |
| Mean F , Area: Bornholm | 0.699 | 0.647 | 0.432 | 0.615 | 0.704 | 0.644 | 0.435 | |
| Mean F , Area: Gotland | 0.822 | 0.748 | 0.505 | 0.723 | 0.835 | 0.761 | 0.505 | |
| Stock SSB | 4.449 | 5.554 | 6.972 | 8.788 | 7.742 | 10.016 | 13.111 | |
| SSB , Area: West Baltic | 4.439 | 10.102 | 16.862 | 6.440 | 7.648 | 17.566 | 30.757 | |
| SSB , Area: East Baltic | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| SSB , Area: Not Baltic | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| SSB , Area: Bornholm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| SSB , Area: Gotland | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |

***Figure 2.13.2. From worksheet Tuning_Input.***

Figure 2.13.2 contains the index of stock biomass or SSB from research vessel survey or from catch per unit of effort of commercial vessels and mean stock F (Fishing mortality) from (for example) fish stock assessment of ICES working groups. Mean F and SSB can be given for the stock (in all areas) and by area.

Figure 2.13.3 .a and b contain the indices of stock numbers, from research vessel survey or from commercial vessels. TEMAS offers the option for one index only. Should more indices be available (as is often the case for ICES WG assessments), the user of TEMAS must combine into one index before entry in TEMAS. Figure 2.13.3.a shows the structure of the index-table, which starts with the index for all area combined and then gives the data by area. Figure 2.13.3.b shows that individual index-data must be structured as the stock numbers are structured in TEMAS. That is with period groups in ages 0 and 1, period groups merged into age groups for age 2 and older.

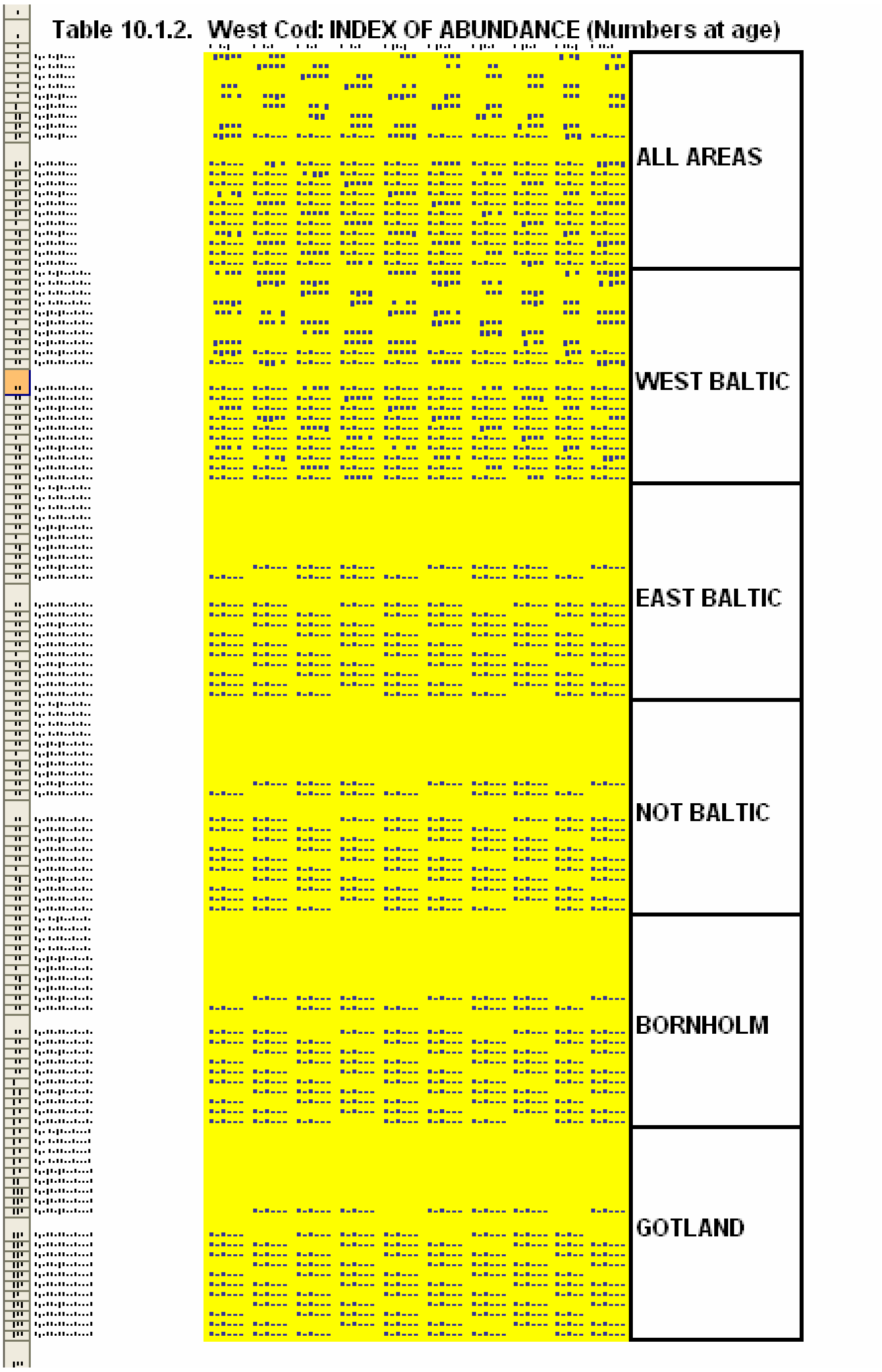


Table 10.1.2. West Cod: INDEX OF ABUNDANCE (Numbers at age)

ALL AREAS

WEST BALTIC

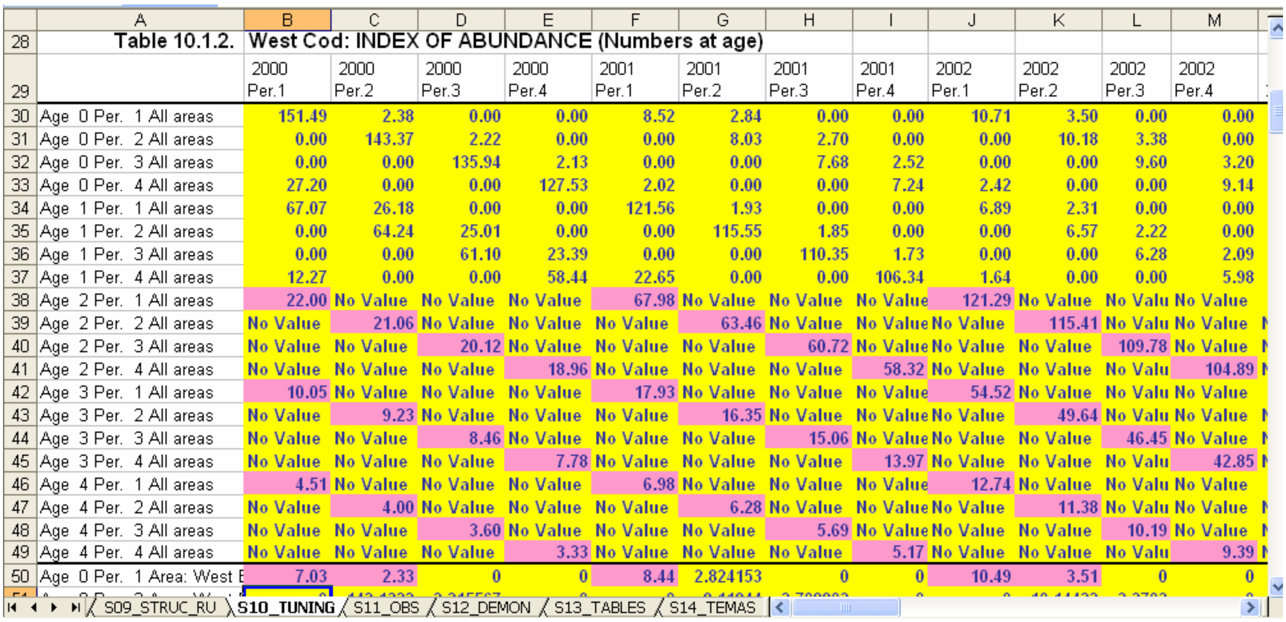
EAST BALTIC

NOT BALTIC

BORNHOLM

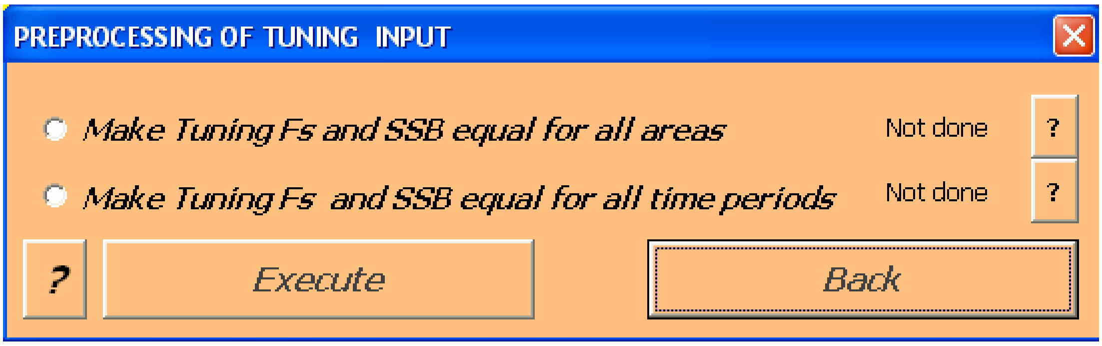
GOTLAND

Figure 2.13.3.a. Structure of table for Research survey (or commercial fisheries) indices of stock numbers



| | A | B | C | D | E | F | G | H | I | J | K | L | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 28 | Table 10.1.2. | West Cod: INDEX OF ABUNDANCE (Numbers at age) | | | | | | | | | | | |
| 29 | | 2000 Per.1 | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 2002 Per.1 | 2002 Per.2 | 2002 Per.3 | 2002 Per.4 |
| 30 | Age 0 Per. 1 All areas | 151.49 | 2.38 | 0.00 | 0.00 | 8.52 | 2.84 | 0.00 | 0.00 | 10.71 | 3.50 | 0.00 | 0.00 |
| 31 | Age 0 Per. 2 All areas | 0.00 | 143.37 | 2.22 | 0.00 | 0.00 | 8.03 | 2.70 | 0.00 | 0.00 | 10.18 | 3.38 | 0.00 |
| 32 | Age 0 Per. 3 All areas | 0.00 | 0.00 | 135.94 | 2.13 | 0.00 | 0.00 | 7.68 | 2.52 | 0.00 | 0.00 | 9.60 | 3.20 |
| 33 | Age 0 Per. 4 All areas | 27.20 | 0.00 | 0.00 | 127.53 | 2.02 | 0.00 | 0.00 | 7.24 | 2.42 | 0.00 | 0.00 | 9.14 |
| 34 | Age 1 Per. 1 All areas | 67.07 | 26.18 | 0.00 | 0.00 | 121.56 | 1.93 | 0.00 | 0.00 | 6.89 | 2.31 | 0.00 | 0.00 |
| 35 | Age 1 Per. 2 All areas | 0.00 | 64.24 | 25.01 | 0.00 | 0.00 | 115.55 | 1.85 | 0.00 | 0.00 | 6.57 | 2.22 | 0.00 |
| 36 | Age 1 Per. 3 All areas | 0.00 | 0.00 | 61.10 | 23.39 | 0.00 | 0.00 | 110.35 | 1.73 | 0.00 | 0.00 | 6.28 | 2.09 |
| 37 | Age 1 Per. 4 All areas | 12.27 | 0.00 | 0.00 | 58.44 | 22.65 | 0.00 | 0.00 | 106.34 | 1.64 | 0.00 | 0.00 | 5.98 |
| 38 | Age 2 Per. 1 All areas | 22.00 | No Value | No Value | No Value | 67.98 | No Value | No Value | No Value | 121.29 | No Value | No Valu | No Value |
| 39 | Age 2 Per. 2 All areas | No Value | 21.06 | No Value | No Value | No Value | 63.46 | No Value | No Value | No Value | 115.41 | No Valu | No Value |
| 40 | Age 2 Per. 3 All areas | No Value | No Value | 20.12 | No Value | No Value | No Value | 60.72 | No Value | No Value | No Value | 109.78 | No Value |
| 41 | Age 2 Per. 4 All areas | No Value | No Value | No Value | 18.96 | No Value | No Value | No Value | 58.32 | No Value | No Value | No Valu | 104.89 |
| 42 | Age 3 Per. 1 All areas | 10.05 | No Value | No Value | No Value | 17.93 | No Value | No Value | No Value | 54.52 | No Value | No Valu | No Value |
| 43 | Age 3 Per. 2 All areas | No Value | 9.23 | No Value | No Value | No Value | 16.35 | No Value | No Value | No Value | 49.64 | No Valu | No Value |
| 44 | Age 3 Per. 3 All areas | No Value | No Value | 8.46 | No Value | No Value | No Value | 15.06 | No Value | No Value | No Value | 46.45 | No Value |
| 45 | Age 3 Per. 4 All areas | No Value | No Value | No Value | 7.78 | No Value | No Value | No Value | 13.97 | No Value | No Value | No Valu | 42.85 |
| 46 | Age 4 Per. 1 All areas | 4.51 | No Value | No Value | No Value | 6.98 | No Value | No Value | No Value | 12.74 | No Value | No Valu | No Value |
| 47 | Age 4 Per. 2 All areas | No Value | 4.00 | No Value | No Value | No Value | 6.28 | No Value | No Value | No Value | 11.38 | No Valu | No Value |
| 48 | Age 4 Per. 3 All areas | No Value | No Value | 3.60 | No Value | No Value | No Value | 5.69 | No Value | No Value | No Value | 10.19 | No Value |
| 49 | Age 4 Per. 4 All areas | No Value | No Value | No Value | 3.33 | No Value | No Value | No Value | 5.17 | No Value | No Value | No Valu | 9.39 |
| 50 | Age 0 Per. 1 Area: West E | 7.03 | 2.33 | 0 | 0 | 8.44 | 2.824153 | 0 | 0 | 10.49 | 3.51 | 0 | 0 |

*Figure 2.13.3.b. Research survey (or commercial fisheries) indices of stock numbers*



PREPROCESSING OF TUNING INPUT

○ Make Tuning Fs and SSB equal for all areas    Not done

○ Make Tuning Fs and SSB equal for all time periods    Not done

***Figure 2.13.3. Options for pre-processing of tuning data.***

The option "Make Tuning Fs equal for all areas" takes the tuning F of first area, and assigns that value to all other areas $F_{Mean}^{Obs}(St,y,q,Ar) = F_{Mean}^{Obs}(St,y,q,1)$. If you select that option the value in the cells for other areas than the first areas will become irrelevant.

The option "Make Tuning Fs equal for all time periods" takes the tuning F of first time period, and assigns that value to all other periods
$F_{Mean}^{Obs}(St,y,q,Ar) = F_{Mean}^{Obs}(St,y,1,Ar)$ and $F_{Stock,Mean}^{Obs}(St,y,q) = F_{Stock,Mean}^{Obs}(St,y,1)$

If you select that option the value in the cells for periods later than first period will become irrelevant

## 2.14. OBSERVATIONS INPUT, S11_OBS

“Observations” plays the same role in TEMAS as “tuning data”, actually “Observations! are tuning or calibration data in the context of TEMAS. The concepts “tuning” and “calibrations” (which are almost the same) are explained in Section 2.13. Observations mean “observed landings” in the present version of TEMAS. Figure 2.14.1 shows the user-form for sheet “S11_OBS”, and Table 2.14.1 shows the tables of “S11_OBS”. There is a table for each combination of stock and country.

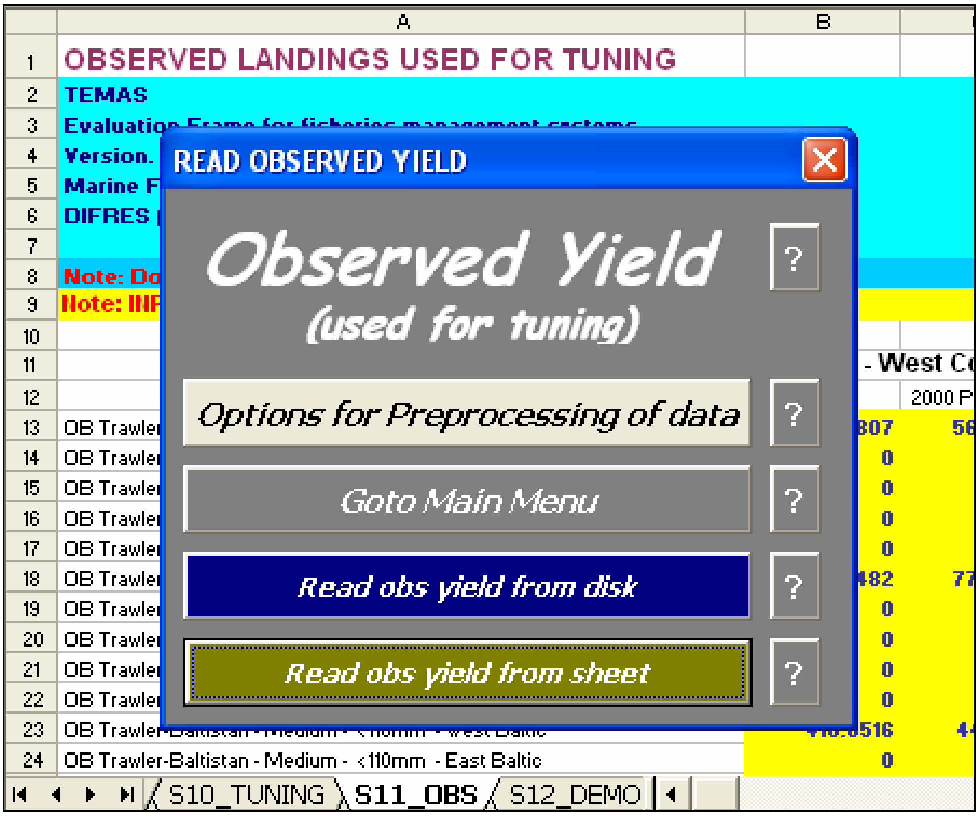


*Figure 2.14.1. . User-form for entry of observations.*

| Index | EXCEL Table | Caption |
|---|---|---|
| 175 | Table 11.1. | Time series of observed landings |
| 176 | Table 11.2.1. | Baltistan - West Cod: OBSERVED LANDINGS |
| 177 | Table 11.2.2. | Baltistan - East cod: OBSERVED LANDINGS |
| 178 | Table 11.3.1. | Scandinavia - West Cod: OBSERVED LANDINGS |
| 179 | Table 11.3.2. | Scandinavia - East cod: OBSERVED LANDINGS |

*Table 2.14.1. Tables in the observations input sheet, S011_OBS.*

Figure 2.14.3.  shows EXCEL Table 11.1, giving the length of time series of observations. This range, from (First period of first year) to (Last period of last year) may be equal to or shorter than the time span of the simulation. In this example the observation runs from (second quarter of 2001) to (third quarter of 2007) whereas the simulation runs from (first quarter of 2000) to (last qyarter of 2009). EXCEL Table 11.2.1 shows the actual observations for West cod landed by one country (Baltistan).  The periods for which data are not available will automatically be filled in with “No Value”, and need not be filled in by you. Figure 2.14.2 shows the entire table for West cod landed by Baltistan.

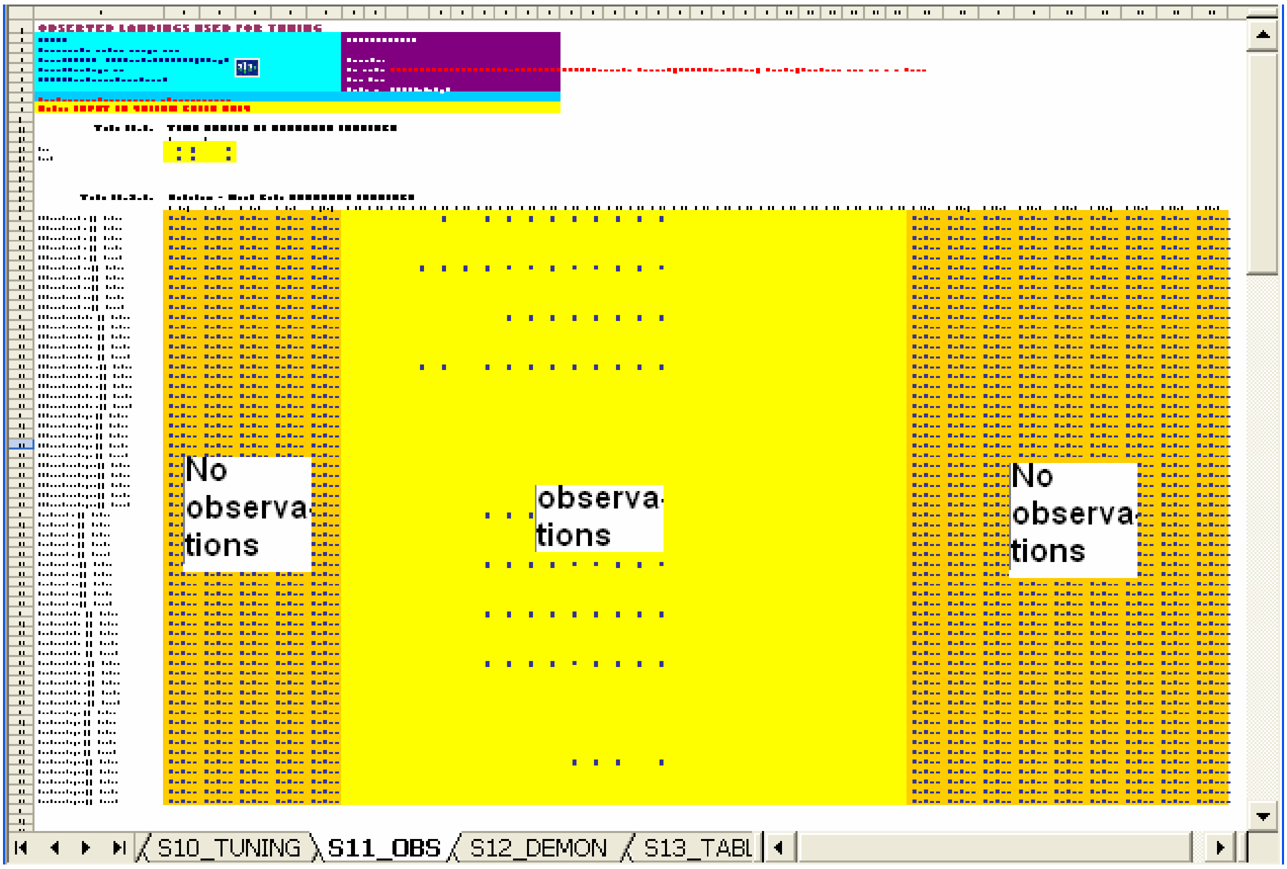
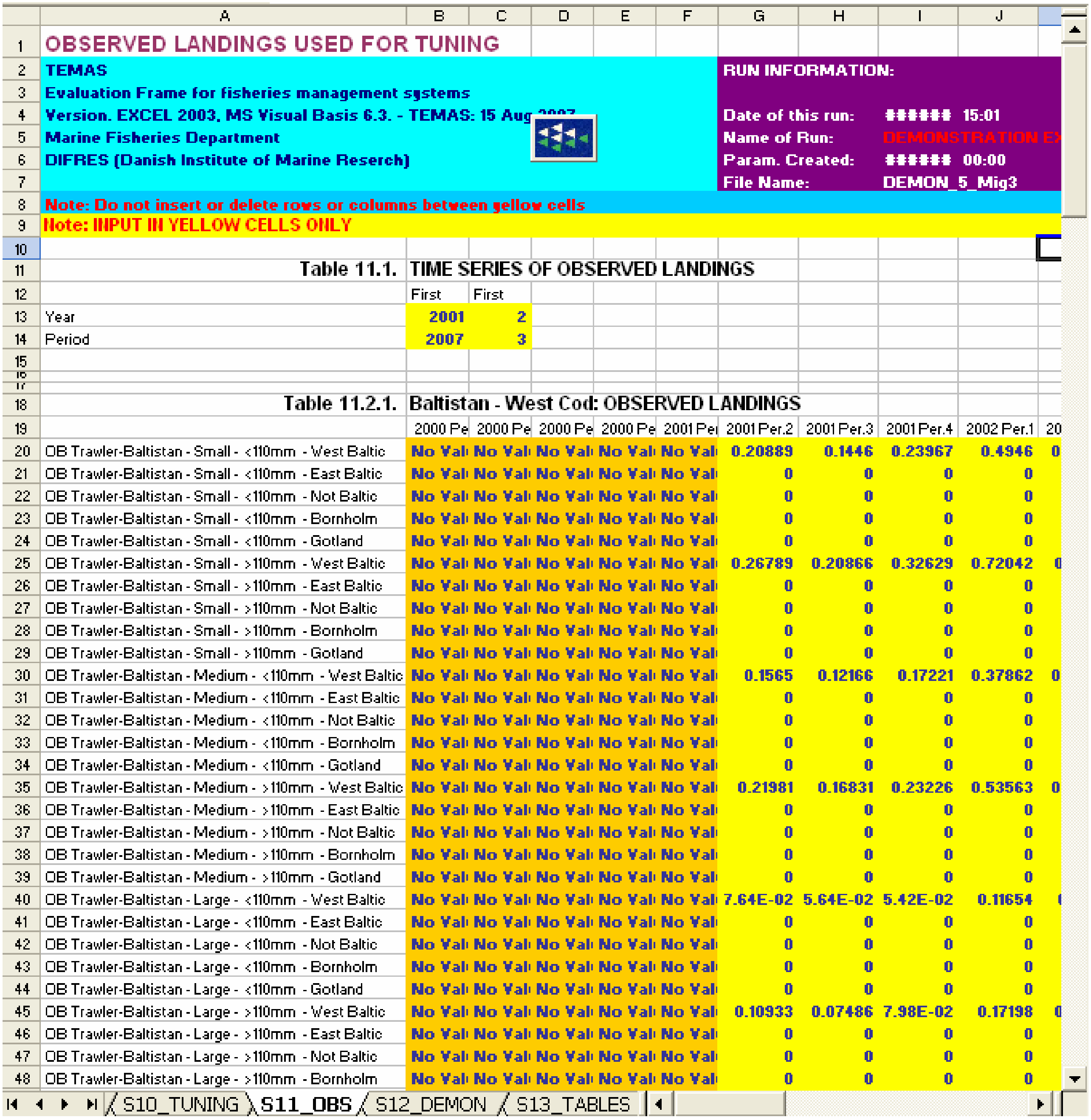


*Figure 2.14.2. Observatins. Landings by fleet, vessel size, rigging and area (Fl,Vs,Rg,Ar) and area by one country (Scandinavia). Illustration of time series of observations.*

| Frequency | Aggregation level of landings used for tuning | | | | |
|---|---|---|---|---|---|
| Data per period | Area | Country | Fleet | Vessel size | Rigging |
| | Area | Country | Fleet | Vessel size | |
| | Area | Country | Fleet | | |
| | Area | | | | |
| | Country | | Fleet | Vessel size | Rigging |
| | Country | | Fleet | Vessel size | |
| | Country | | Fleet | | |
| | Country | | | | |
| | Total stock | | | | |
| Annual data | Area | Country | Fleet | Vessel size | Rigging |
| | Area | Country | Fleet | Vessel size | |
| | Area | Country | Fleet | | |
| | Area | | | | |
| | Country | | Fleet | Vessel size | Rigging |
| | Country | | Fleet | Vessel size | |
| | Country | | Fleet | | |
| | Country | | | | |
| | Total stock | | | | |

*Table 2.14.2. Options for aggregation levels when tuning TEMAS with observations of stock specific landings.*

In the present  case the West cod is caught only in the Western Baltic. The observations can be aggregated in various ways, before they are used in the calibration, as illustrated in Table 2.14.2. It may also well happen that observation data are not available in the highest aggregation level (Area, Country, Fleet, Vessel size, Rigging). EXCEL Table 11.2.1, however, only offers data entry at the highest aggregation level.



OBSERVED LANDINGS USED FOR TUNING

TEMAS
Evaluation Frame for fisheries management systems
Version. EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 15 Aug 2007
Marine Fisheries Department
DIFRES (Danish Institute of Marine Reserch)

RUN INFORMATION:
Date of this run: ###### 15:01
Name of Run: DEMONSTRATION EX
Param. Created: ###### 00:00
File Name: DEMON_5_Mig3

Note: Do not insert or delete rows or columns between yellow cells
Note: INPUT IN YELLOW CELLS ONLY

Table 11.1. TIME SERIES OF OBSERVED LANDINGS

| | First | First |
|---|---|---|
| Year | 2001 | 2 |
| Period | 2007 | 3 |

Table 11.2.1. Baltistan - West Cod: OBSERVED LANDINGS

| | 2000 Pe | 2000 Pe | 2000 Pe | 2000 Pe | 2001 Per | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 2002 Per.1 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|
| OB Trawler-Baltistan - Small - <110mm - West Baltic | No Val | No Val | No Val | No Val | No Val | 0.20889 | 0.1446 | 0.23967 | 0.4946 | 0 |
| OB Trawler-Baltistan - Small - <110mm - East Baltic | No Val | No Val | No Val | No Val | No Val | 0 | 0 | 0 | 0 | |
| OB Trawler-Baltistan - Small - <110mm - Not Baltic | No Val | No Val | No Val | No Val | No Val | 0 | 0 | 0 | 0 | |
| OB Trawler-Baltistan - Small - <110mm - Bornholm | No Val | No Val | No Val | No Val | No Val | 0 | 0 | 0 | 0 | |
| OB Trawler-Baltistan - Small - <110mm - Gotland | No Val | No Val | No Val | No Val | No Val | 0 | 0 | 0 | 0 | |
| OB Trawler-Baltistan - Small - >110mm - West Baltic | No Val | No Val | No Val | No Val | No Val | 0.26789 | 0.20866 | 0.32629 | 0.72042 | 0 |
| OB Trawler-Baltistan - Small - >110mm - East Baltic | No Val | No Val | No Val | No Val | No Val | 0 | 0 | 0 | 0 | |
| OB Trawler-Baltistan - Small - >110mm - Not Baltic | No Val | No Val | No Val | No Val | No Val | 0 | 0 | 0 | 0 | |
| OB Trawler-Baltistan - Small - >110mm - Bornholm | No Val | No Val | No Val | No Val | No Val | 0 | 0 | 0 | 0 | |
| OB Trawler-Baltistan - Small - >110mm - Gotland | No Val | No Val | No Val | No Val | No Val | 0 | 0 | 0 | 0 | |
| OB Trawler-Baltistan - Medium - <110mm - West Baltic | No Val | No Val | No Val | No Val | No Val | 0.1565 | 0.12166 | 0.17221 | 0.37862 | 0 |
| OB Trawler-Baltistan - Medium - <110mm - East Baltic | No Val | No Val | No Val | No Val | No Val | 0 | 0 | 0 | 0 | |
| OB Trawler-Baltistan - Medium - <110mm - Not Baltic | No Val | No Val | No Val | No Val | No Val | 0 | 0 | 0 | 0 | |
| OB Trawler-Baltistan - Medium - <110mm - Bornholm | No Val | No Val | No Val | No Val | No Val | 0 | 0 | 0 | 0 | |
| OB Trawler-Baltistan - Medium - <110mm - Gotland | No Val | No Val | No Val | No Val | No Val | 0 | 0 | 0 | 0 | |
| OB Trawler-Baltistan - Medium - >110mm - West Baltic | No Val | No Val | No Val | No Val | No Val | 0.21981 | 0.16831 | 0.23226 | 0.53563 | 0 |
| OB Trawler-Baltistan - Medium - >110mm - East Baltic | No Val | No Val | No Val | No Val | No Val | 0 | 0 | 0 | 0 | |
| OB Trawler-Baltistan - Medium - >110mm - Not Baltic | No Val | No Val | No Val | No Val | No Val | 0 | 0 | 0 | 0 | |
| OB Trawler-Baltistan - Medium - >110mm - Bornholm | No Val | No Val | No Val | No Val | No Val | 0 | 0 | 0 | 0 | |
| OB Trawler-Baltistan - Medium - >110mm - Gotland | No Val | No Val | No Val | No Val | No Val | 0 | 0 | 0 | 0 | |
| OB Trawler-Baltistan - Large - <110mm - West Baltic | No Val | No Val | No Val | No Val | No Val | 7.64E-02 | 5.64E-02 | 5.42E-02 | 0.11654 | |
| OB Trawler-Baltistan - Large - <110mm - East Baltic | No Val | No Val | No Val | No Val | No Val | 0 | 0 | 0 | 0 | |
| OB Trawler-Baltistan - Large - <110mm - Not Baltic | No Val | No Val | No Val | No Val | No Val | 0 | 0 | 0 | 0 | |
| OB Trawler-Baltistan - Large - <110mm - Bornholm | No Val | No Val | No Val | No Val | No Val | 0 | 0 | 0 | 0 | |
| OB Trawler-Baltistan - Large - <110mm - Gotland | No Val | No Val | No Val | No Val | No Val | 0 | 0 | 0 | 0 | |
| OB Trawler-Baltistan - Large - >110mm - West Baltic | No Val | No Val | No Val | No Val | No Val | 0.10933 | 0.07486 | 7.98E-02 | 0.17198 | |
| OB Trawler-Baltistan - Large - >110mm - East Baltic | No Val | No Val | No Val | No Val | No Val | 0 | 0 | 0 | 0 | |
| OB Trawler-Baltistan - Large - >110mm - Not Baltic | No Val | No Val | No Val | No Val | No Val | 0 | 0 | 0 | 0 | |
| OB Trawler-Baltistan - Large - >110mm - Bornholm | No Val | No Val | No Val | No Val | No Val | 0 | 0 | 0 | 0 | |

***Figure 2.14.3. Observatins. Landings by fleet, vessel size, rigging and area (Fl,Vs,Rg,Ar) and area by one country (Scandinavia).***

If the data are available on an aggregated level, the disaggregated table can still be used for data entry. The aggregated data just have to be filled in cells representing the aggregation as illustrated in Table. Which cell is chosen to represent an aggregation is irrelevant. When the data subsequently ae used in the calibration process, the user must choose the aggregation level of the input data, or data further disaggregated. The tuning module, will then automatically aggregate the data before using them.

The same procedure applies if only annual data are available. In that case the annual data are entered in one period (any period) of the year in question. Before applied, the program will convert the data into annual data, by summation over periods.

| Area, Country, Fleet, Vessel size, Rig | Ctry, Fleet, V.size, Rig | Ctry, Fleet, V.size | Country, Fleet | Country | Total stock |
|---|---|---|---|---|---|
| OB Trawler-Baltistan - Small - <110mm - West Baltic | OB Trawler-Baltistan - Small - <110mm | OB Trawler-Baltistan - Small - | OB Trawler-Baltistan | Baltistan | Total stock |
| OB Trawler-Baltistan - Small - <110mm - East Baltic | | | | | |
| OB Trawler-Baltistan - Small - <110mm - Not Baltic | | | | | |
| OB Trawler-Baltistan - Small - <110mm - Bornholm | | | | | |
| OB Trawler-Baltistan - Small - <110mm - Gotland | | | | | |
| OB Trawler-Baltistan - Small - >110mm - West Baltic | OB Trawler-Baltistan - Small - >110mm | | | | |
| OB Trawler-Baltistan - Small - >110mm - East Baltic | | | | | |
| OB Trawler-Baltistan - Small - >110mm - Not Baltic | | | | | |
| OB Trawler-Baltistan - Small - >110mm - Bornholm | | | | | |
| OB Trawler-Baltistan - Small - >110mm - Gotland | | | | | |
| OB Trawler-Baltistan - Medium - <110mm - West Baltic | OB Trawler-Baltistan - Medium - <110mm | OB Trawler-Baltistan - Medium | | | |
| OB Trawler-Baltistan - Medium - <110mm - East Baltic | | | | | |
| OB Trawler-Baltistan - Medium - <110mm - Not Baltic | | | | | |
| OB Trawler-Baltistan - Medium - <110mm - Bornholm | | | | | |
| OB Trawler-Baltistan - Medium - <110mm - Gotland | | | | | |
| OB Trawler-Baltistan - Medium - >110mm - West Baltic | OB Trawler-Baltistan - Medium - >110mm | | | | |
| OB Trawler-Baltistan - Medium - >110mm - East Baltic | | | | | |
| OB Trawler-Baltistan - Medium - >110mm - Not Baltic | | | | | |
| OB Trawler-Baltistan - Medium - >110mm - Bornholm | | | | | |
| OB Trawler-Baltistan - Medium - >110mm - Gotland | | | | | |
| OB Trawler-Baltistan - Large - <110mm - West Baltic | OB Trawler-Baltistan - Large - <110mm | OB Trawler-Baltistan - Large | | | |
| OB Trawler-Baltistan - Large - <110mm - East Baltic | | | | | |
| OB Trawler-Baltistan - Large - <110mm - Not Baltic | | | | | |
| OB Trawler-Baltistan - Large - <110mm - Bornholm | | | | | |
| OB Trawler-Baltistan - Large - <110mm - Gotland | | | | | |
| OB Trawler-Baltistan - Large - >110mm - West Baltic | OB Trawler-Baltistan - Large - >110mm | | | | |
| OB Trawler-Baltistan - Large - >110mm - East Baltic | | | | | |
| OB Trawler-Baltistan - Large - >110mm - Not Baltic | | | | | |
| OB Trawler-Baltistan - Large - >110mm - Bornholm | | | | | |
| OB Trawler-Baltistan - Large - >110mm - Gotland | | | | | |
| Gillnett-Baltistan - Small - <110mm - West Baltic | Gillnett-Baltistan - Small - <110mm | Gillnett-Baltistan - Small | Gillnett-Baltistan | | |
| Gillnett-Baltistan - Small - <110mm - East Baltic | | | | | |
| Gillnett-Baltistan - Small - <110mm - Not Baltic | | | | | |
| Gillnett-Baltistan - Small - <110mm - Bornholm | | | | | |
| Gillnett-Baltistan - Small - <110mm - Gotland | | | | | |
| Gillnett-Baltistan - Small - >110mm - West Baltic | Gillnett-Baltistan - Small - >110mm | | | | |
| Gillnett-Baltistan - Small - >110mm - East Baltic | | | | | |
| Gillnett-Baltistan - Small - >110mm - Not Baltic | | | | | |
| Gillnett-Baltistan - Small - >110mm - Bornholm | | | | | |
| Gillnett-Baltistan - Small - >110mm - Gotland | | | | | |
| Gillnett-Baltistan - Medium - <110mm - West Baltic | Gillnett-Baltistan - Medium - <110mm | Gillnett-Baltistan - Medium | | | |
| Gillnett-Baltistan - Medium - <110mm - East Baltic | | | | | |
| Gillnett-Baltistan - Medium - <110mm - Not Baltic | | | | | |
| Gillnett-Baltistan - Medium - <110mm - Bornholm | | | | | |
| Gillnett-Baltistan - Medium - <110mm - Gotland | | | | | |
| Gillnett-Baltistan - Medium - >110mm - West Baltic | Gillnett-Baltistan - Medium - >110mm | | | | |
| Gillnett-Baltistan - Medium - >110mm - East Baltic | | | | | |
| Gillnett-Baltistan - Medium - >110mm - Not Baltic | | | | | |
| Gillnett-Baltistan - Medium - >110mm - Bornholm | | | | | |
| Gillnett-Baltistan - Medium - >110mm - Gotland | | | | | |
| Gillnett-Baltistan - Large - <110mm - West Baltic | Gillnett-Baltistan - Large - <110mm | Gillnett-Baltistan - Large | | | |
| Gillnett-Baltistan - Large - <110mm - East Baltic | | | | | |
| Gillnett-Baltistan - Large - <110mm - Not Baltic | | | | | |
| Gillnett-Baltistan - Large - <110mm - Bornholm | | | | | |
| Gillnett-Baltistan - Large - <110mm - Gotland | | | | | |
| Gillnett-Baltistan - Large - >110mm - West Baltic | Gillnett-Baltistan - Large - >110mm | | | | |
| Gillnett-Baltistan - Large - >110mm - East Baltic | | | | | |
| Gillnett-Baltistan - Large - >110mm - Not Baltic | | | | | |
| Gillnett-Baltistan - Large - >110mm - Bornholm | | | | | |
| Gillnett-Baltistan - Large - >110mm - Gotland | | | | | |
| ……………………………………………………………………………………………………… **Scandinavia** | | | | | |

***Table 2.14.3. Examples of aggrecation levels of observations. When data are aggregated, they must be filled in cells belonging to the aggregation.***

The “observation” in question is the “Total landings” by stock, fleet, area, year and time period (Figure 2.14.2). Total landings means landings in units of (whole body wet) weight summed over age groups. This kind of data is often available from the annual statistics of fisheries.

Such data may be used to tune TEMAS, that is, to modify selected parameters of TEMAS so that TEMAS becomes able to reproduce the observed landings as output from the simulation. How this tuning of TEMAS is made will be discussed in Appendix E.

The tuning can be made in many ways. The main techniques suggested by TEMAS is to “tune the recruitment” to produce the observed catches. Ignoring a suite of details, it is essentially true that:

**Weight of landings = (“Almost” constant Factor) * (Number of recruits)**

Thus when you raise the recruitment you raise the landings, and when you reduce the recruits you reduce the landings. It is also essentially true that

**Weight of landings = (“Almost” constant Factor) * Catchability* Effort**

if the effort is not given very high or very low values. The equation above is valid only in a limited range of stock biomasses. Anyway, essentially, we can tune the catchability to reproduce an observed landings.

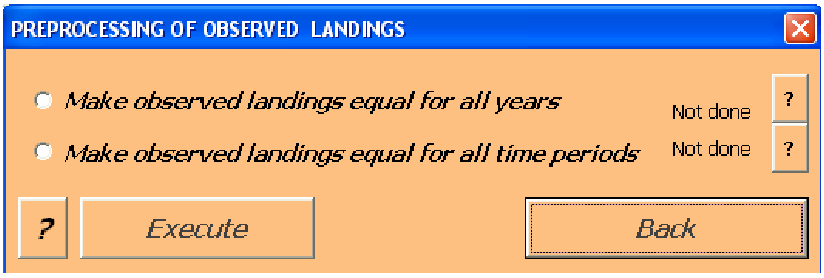


*Figure 2.14.4. Options for pre-processing of observation data.*

Table 2.14.4 shows the Pre-processing menu of worksheet “S11_OBS”
The option "Make observed landings equal for all years" takes the observed landings from the first year and assigns that value to all other years:"

$$Y_{Land}^{Obs}(Fl,Vs,Rg,Ct,St,y,q,Ar)=Y_{Land}^{Obs}(Fl,Vs,Rg,Ct,St,1,q,Ar)$$

If you select that option, the values of the cells of years later than first year become irrelevant.

The option "Make observed landings equal for all time periods" takes the observed landings from the first period and assigns that value to all other periods:"

$$Y_{Land}^{Obs}(Fl,Vs,Rg,Ct,St,y,q,Ar)=Y_{Land}^{Obs}(Fl,Vs,Rg,Ct,St,y,1,Ar)$$

If you select that option, the values of the cells of periods later than first period become irrelevant.

## *2.15. INPUT OF TECHNICAL MANAGEMENT MEASURES, S14_TEMAS*

Technical management measures (TEMAS) are measures which are not catch quotas in the terminology of the TEMAS model. In the present version of TEMAS there are considered only four technical management measures, namely

1) Minimum landing size
2) MPA (Marine Protected Areas)
3) Maximum number of sea days
4) Closed seasons

Other technical measures are e.g. mesh size regulations. These measures are indirectly covered by the selection of parameters in gear selection ogives.

Also MPAs are indirectly covered by the input effort (effort is zero in MPAs) or by the RUM (Random Utility Model) for the behaviour of fishers. The utility of selecting an MPA as fishing ground is assigned the value of "-∞".
Sheet S14_TEMAS, however also contains options for direct handling of MPAs and closed seasons, which makes it simple to compare two alternative management regimes, which differ in terms of closed areas and closed seasons. This is "regime comparison" No 6 in Table 1.1.1

| | **Regime Comparisons** | Regime A | Regime B |
|---|---|---|---|
| 6 | Two alternatives for definition of MPAs and closed seasons | TAC, with first option for closed season and MPA | TAC, with second option for closed season and MPA |

Figure 2.15.1 shows the user-form of sheet "S14_TEMAS", and Table 2.15.1 lists the EXCEL tables in the sheet. There is one table for the minimum landing sizes, and one table with maximum number of sea days for each combination of country and area.

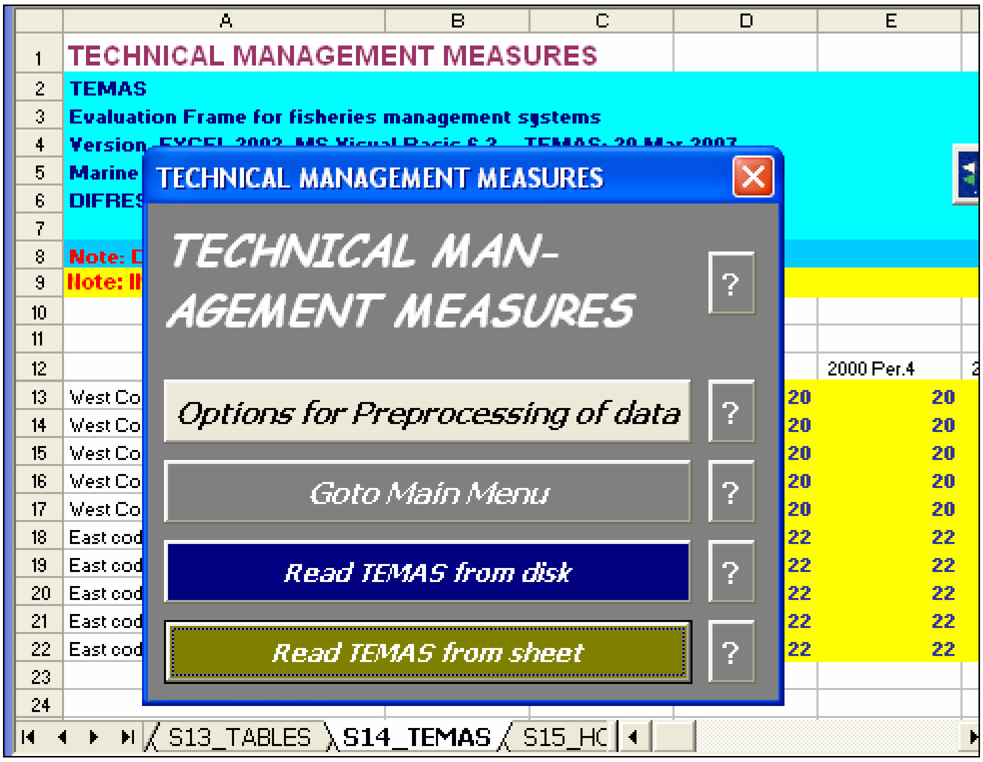


*Figure 2.15.1. User-form for entry of parameters for technical management measures.*

| Index | EXCEL Table | Caption |
|---|---|---|
| 177 | Table14.2.1.1.1.1. | Baltistan - West Baltic MAXIMUM NUMBER OF SEA DAYS Regime 1 |
| 178 | Table14.2.1.1.1.2. | Baltistan - West Baltic SEASONAL CLOSURE Regime 1 |
| 179 | Table14.2.1.1.2.1. | Baltistan - East Baltic MAXIMUM NUMBER OF SEA DAYS Regime 1 |
| 180 | Table14.2.1.1.2.2. | Baltistan - East Baltic SEASONAL CLOSURE Regime 1 |
| 181 | Table14.2.1.1.3.1. | Baltistan - Bornholm MAXIMUM NUMBER OF SEA DAYS Regime 1 |
| 182 | Table14.2.1.1.3.2. | Baltistan - Bornholm SEASONAL CLOSURE Regime 1 |
| 183 | Table14.2.1.1.4.1. | Baltistan - Gotland MAXIMUM NUMBER OF SEA DAYS Regime 1 |
| 184 | Table14.2.1.1.4.2. | Baltistan - Gotland SEASONAL CLOSURE Regime 1 |
| 185 | Table14.2.1.1.5.1. | Baltistan - Not Baltic MAXIMUM NUMBER OF SEA DAYS Regime 1 |
| 186 | Table14.2.1.1.5.2. | Baltistan - Not Baltic SEASONAL CLOSURE Regime 1 |
| 187 | Table14.2.1.2.1.1. | Scandinavia - West Baltic MAXIMUM NUMBER OF SEA DAYS Regime 1 |
| 188 | Table14.2.1.2.1.2. | Scandinavia - West Baltic SEASONAL CLOSURE Regime 1 |
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| 190 | Table14.2.1.2.2.2. | Scandinavia - East Baltic SEASONAL CLOSURE Regime 1 |
| 191 | Table14.2.1.2.3.1. | Scandinavia - Bornholm MAXIMUM NUMBER OF SEA DAYS Regime 1 |
| 192 | Table14.2.1.2.3.2. | Scandinavia - Bornholm SEASONAL CLOSURE Regime 1 |
| 193 | Table14.2.1.2.4.1. | Scandinavia - Gotland MAXIMUM NUMBER OF SEA DAYS Regime 1 |
| 194 | Table14.2.1.2.4.2. | Scandinavia - Gotland SEASONAL CLOSURE Regime 1 |
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| 197 | Table14.2.2.1.1.1. | Baltistan - West Baltic MAXIMUM NUMBER OF SEA DAYS Regime 2 |
| 198 | Table14.2.2.1.1.2. | Baltistan - West Baltic SEASONAL CLOSURE Regime 2 |
| 199 | Table14.2.2.1.2.1. | Baltistan - East Baltic MAXIMUM NUMBER OF SEA DAYS Regime 2 |
| 200 | Table14.2.2.1.2.2. | Baltistan - East Baltic SEASONAL CLOSURE Regime 2 |
| 201 | Table14.2.2.1.3.1. | Baltistan - Bornholm MAXIMUM NUMBER OF SEA DAYS Regime 2 |
| 202 | Table14.2.2.1.3.2. | Baltistan - Bornholm SEASONAL CLOSURE Regime 2 |
| 203 | Table14.2.2.1.4.1. | Baltistan - Gotland MAXIMUM NUMBER OF SEA DAYS Regime 2 |
| 204 | Table14.2.2.1.4.2. | Baltistan - Gotland SEASONAL CLOSURE Regime 2 |
| 205 | Table14.2.2.1.5.1. | Baltistan - Not Baltic MAXIMUM NUMBER OF SEA DAYS Regime 2 |
| 206 | Table14.2.2.1.5.2. | Baltistan - Not Baltic SEASONAL CLOSURE Regime 2 |
| 207 | Table14.2.2.2.1.1. | Scandinavia - West Baltic MAXIMUM NUMBER OF SEA DAYS Regime 2 |
| 208 | Table14.2.2.2.1.2. | Scandinavia - West Baltic SEASONAL CLOSURE Regime 2 |
| 209 | Table14.2.2.2.2.1. | Scandinavia - East Baltic MAXIMUM NUMBER OF SEA DAYS Regime 2 |
| 210 | Table14.2.2.2.2.2. | Scandinavia - East Baltic SEASONAL CLOSURE Regime 2 |
| 211 | Table14.2.2.2.3.1. | Scandinavia - Bornholm MAXIMUM NUMBER OF SEA DAYS Regime 2 |
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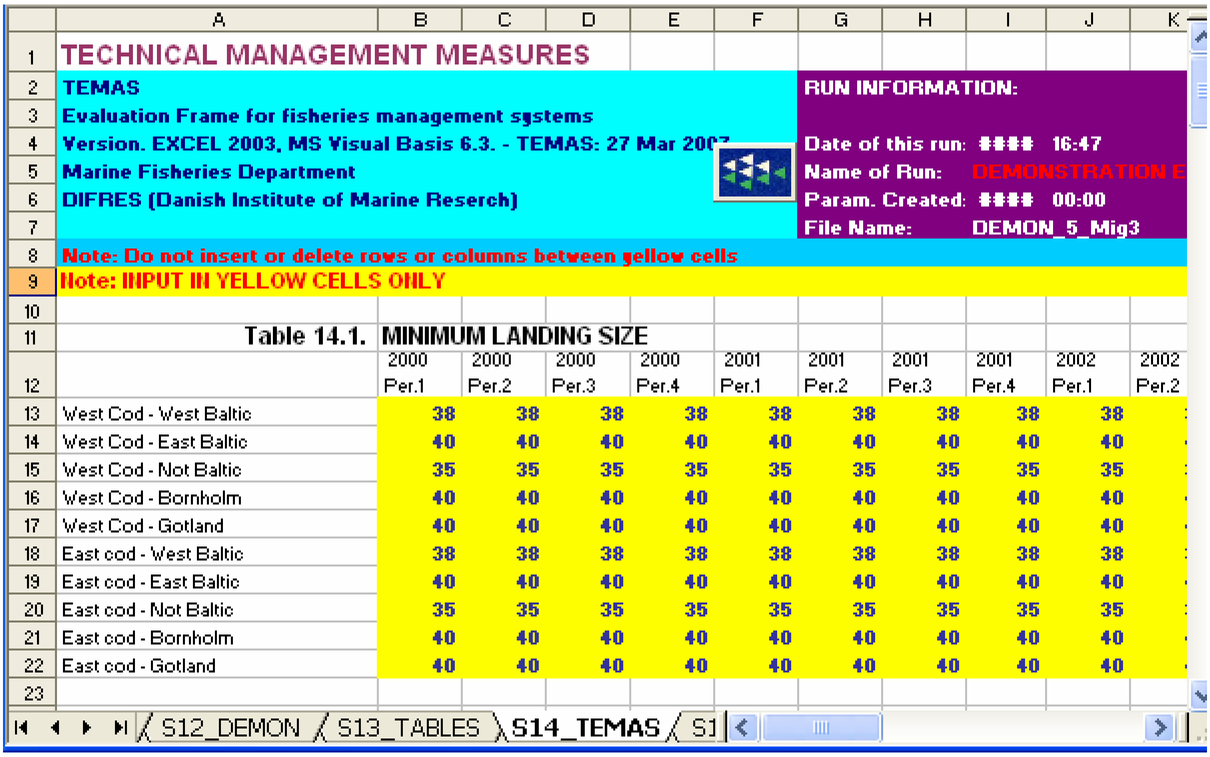
| 213 | Table14.2.2.2.4.1. | Scandinavia - Gotland MAXIMUM NUMBER OF SEA DAYS Regime 2 |
| 214 | Table14.2.2.2.4.2. | Scandinavia - Gotland SEASONAL CLOSURE Regime 2 |
| 215 | Table14.2.2.2.5.1. | Scandinavia - Not Baltic MAXIMUM NUMBER OF SEA DAYS Regime 2 |

***Table 2.15.1. Tables in the technical management measures input sheet, S014_TEMAS.***



TECHNICAL MANAGEMENT MEASURES

TEMAS
Evaluation Frame for fisheries management systems
Version. EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 27 Mar 2007
Marine Fisheries Department
DIFRES (Danish Institute of Marine Reserch)

RUN INFORMATION:
Date of this run: #### 16:47
Name of Run: DEMONSTRATION E
Param. Created: #### 00:00
File Name: DEMON_5_Mig3

Note: Do not insert or delete rows or columns between yellow cells
Note: INPUT IN YELLOW CELLS ONLY

Table 14.1. MINIMUM LANDING SIZE

| | 2000<br>Per.1 | 2000<br>Per.2 | 2000<br>Per.3 | 2000<br>Per.4 | 2001<br>Per.1 | 2001<br>Per.2 | 2001<br>Per.3 | 2001<br>Per.4 | 2002<br>Per.1 | 2002<br>Per.2 |
|---|---|---|---|---|---|---|---|---|---|---|
| West Cod - West Baltic | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | |
| West Cod - East Baltic | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | |
| West Cod - Not Baltic | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | |
| West Cod - Bornholm | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | |
| West Cod - Gotland | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | |
| East cod - West Baltic | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | |
| East cod - East Baltic | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | |
| East cod - Not Baltic | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | |
| East cod - Bornholm | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | |
| East cod - Gotland | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | |

***Figure 2.15.2. Minimum landing sizes,*** $Lgt_{Min}^{Land}(St,y,q,Ar)$

Figure 2.15.2 (EXCEL Table 2.15.2) shows the minimum landing sizes, $Lgt_{Min}^{Land}(St,y,q,Ar)$. The fish below the minimum allowed landing length is named "undersized fish". The influence of minimum legal landing $Lgt_{Min}^{Land}(St,y,q,Ar)$ size is accounted for in TEMAS in two ways

1) The choice of mesh size and thereby the choice of gear selection parameters,
2) The discard-model practice.

If the minimum landing size is smaller than $LGT_{25\%}$, the length at which 25% are retained by the gear if encountered $Lgt_{Min}^{Land}(St,y,q,Ar) \geq LGT_{25\%}(Fl,Vs,Rg,St,Ct,y,q)$, then few undersized fish will be caught.

The discard practice in TEMAS can be determined in two ways

1) Using the behaviour model (RUM) for discard practice
2) Not using the behaviour model for discard practice, i.e. use a fixed assumption for discard practice.

The model of option 2, lets all undersized fish be discarded, in case the behaviour model for discard practice is turned off. One of the choices available for discard practice is to let all undersized fish be discarded. The model reads (Section A.3.2)

$$\mathrm{DIS}(\mathrm{St},\mathrm{Fl},\mathrm{Vs},\mathrm{Rg},\mathrm{y},\mathrm{a},\mathrm{q},\mathrm{Ar}) \;=$$

$$\begin{cases} 1 - \dfrac{1}{1+\exp(\mathrm{Dis1}\,(\mathrm{Fl},\mathrm{Vs},\mathrm{Rg},\mathrm{St},\mathrm{y}) - \mathrm{Dis2}(\mathrm{Fl},\mathrm{Vs},\mathrm{Rg},\mathrm{St},\mathrm{y}) * \mathrm{Lgt}(St,a,q))} \\ \qquad\qquad\qquad if \quad Lgt(St,a,.q) > Lgt_{Min}^{Land}\,(St,y,q,Ar) \\ \\ 1 \quad if \qquad Lgt(St,a,q) \le Lgt_{Min}^{Land}\,(St,y,q,Ar) \end{cases}$$

Dis1(St) = $\ln(3) * \mathrm{LGT}_{50\%Discards}(\mathrm{St}) / (\mathrm{LGT}_{25\%Discards}(\mathrm{St}) - \mathrm{LGT}_{50\%Discards}(\mathrm{St}))$,
Dis2(St) = $\ln(3) / (\mathrm{LGT}_{25\%Discards}(\mathrm{St}) - \mathrm{LGT}_{50\%Discards}(\mathrm{St}))$ and
$\mathrm{LGT}_{X\%Discards}(\mathrm{St})$ = Length at which X % are retained.

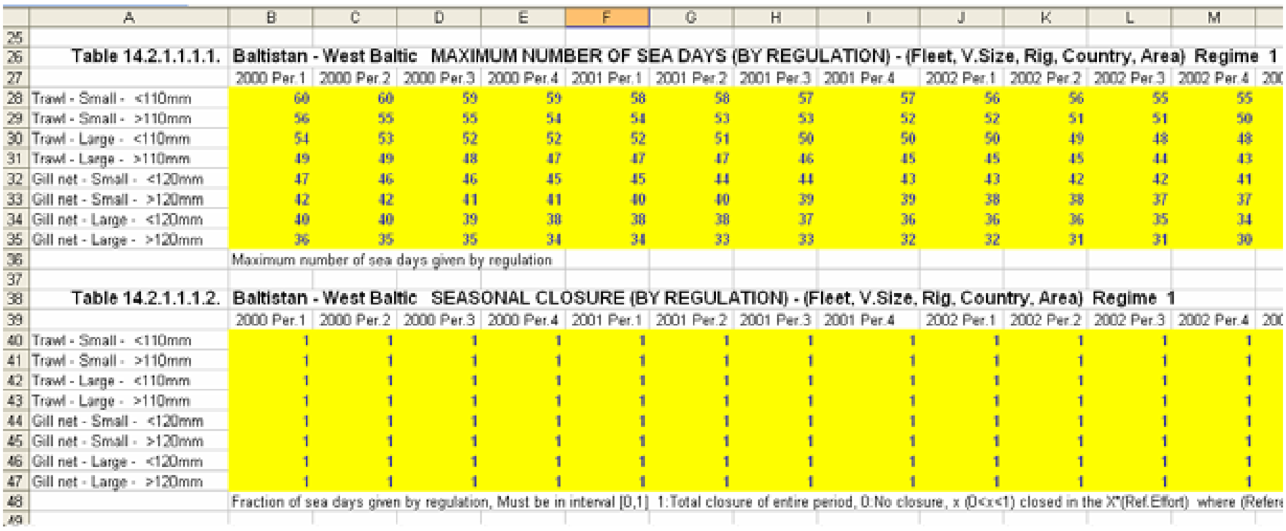


**Table 14.2.1.1.1.1.** **Baltistan - West Baltic MAXIMUM NUMBER OF SEA DAYS (BY REGULATION) - (Fleet, V.Size, Rig, Country, Area) Regime 1**

| | 2000 Per.1 | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 2002 Per.1 | 2002 Per.2 | 2002 Per.3 | 2002 Per.4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Trawl - Small - <110mm | 60 | 60 | 59 | 59 | 58 | 58 | 57 | 57 | 56 | 56 | 55 | 55 |
| Trawl - Small - >110mm | 56 | 55 | 55 | 54 | 54 | 53 | 53 | 52 | 52 | 51 | 51 | 50 |
| Trawl - Large - <110mm | 54 | 53 | 52 | 52 | 52 | 51 | 50 | 50 | 50 | 49 | 48 | 48 |
| Trawl - Large - >110mm | 49 | 49 | 48 | 47 | 47 | 47 | 46 | 45 | 45 | 45 | 44 | 43 |
| Gill net - Small - <120mm | 47 | 46 | 46 | 45 | 45 | 44 | 44 | 43 | 43 | 42 | 42 | 41 |
| Gill net - Small - >120mm | 42 | 42 | 41 | 41 | 40 | 40 | 39 | 39 | 38 | 38 | 37 | 37 |
| Gill net - Large - <120mm | 40 | 40 | 39 | 38 | 38 | 38 | 37 | 36 | 36 | 36 | 35 | 34 |
| Gill net - Large - >120mm | 36 | 35 | 35 | 34 | 34 | 33 | 33 | 32 | 32 | 31 | 31 | 30 |

Maximum number of sea days given by regulation

**Table 14.2.1.1.1.2.** **Baltistan - West Baltic SEASONAL CLOSURE (BY REGULATION) - (Fleet, V.Size, Rig, Country, Area) Regime 1**

| | 2000 Per.1 | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 2002 Per.1 | 2002 Per.2 | 2002 Per.3 | 2002 Per.4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Trawl - Small - <110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Trawl - Small - >110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Trawl - Large - <110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Trawl - Large - >110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Gill net - Small - <120mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Gill net - Small - >120mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Gill net - Large - <120mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Gill net - Large - >120mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

Fraction of sea days given by regulation, Must be in interval [0,1] 1:Total closure of entire period, 0:No closure, x (0<x<1) closed in the X*(Ref.Effort) where (Refere

***Figure 2.15.3. Maximum number of sea days and seasonal closure (MPA), given by regulations.*** $EY_{\mathrm{Re}\,g}(Fl,Vs,Rg,Ct,y,q,Ar)$ ***and*** $X^{MPA-Closure}(Fl,Vs,Rg,Ct,y,q,Ar),\; 0 \le X^{MPA-Closure} \le 1$ ***for one country (Baltistan) in one area (West Baltic). The text under EXCEL Table 14.2.1.1.1.2 reads: Fraction of sea days given by regulation, Must be in interval [0,1] 1:Total closure of entire period, 0:No closure, x (0<x<1) closed in the X*(Ref.Effort) where (Reference Effort) = (Maximum Possible Effort in units of fishing days)***

Figure 2.15.3 shows the maximum number of allowed sea days per time period (Section D.5.3), $EY_{\mathrm{Re}\,g}(Fl,Vs,Rg,Ct,y,q,Ar)$ and the MPA-closure reduction factor, $X^{MPA-Closure}(Fl,Vs,Rg,Ct,y,q,Ar)$, for one combination of country and area (in this example: Per quarter of the year).

Area specific effort can be reduced in three major different ways

1) Reduction of overall capacity (reduce upper limit of total sea days for all areas)
2) Area specific reduction of maximum number of sea days
3) MPA, - seasonal closure of selected areas.

We shall combine the three effort reduction methods in one combined model.

Recall the definitions of the concepts $F_{HCR}^{Before}(St,y,q,Ar)$, $E^{Before}(Fl,Vs,Rg,Ct,St,y,q,Ar)$ and $E^{After}(Fl,Vs,Rg,Ct,y,q,Ar)$ given in Section 5.1. For each stock one can then set the efforts of fleets to match each stock specific F (Eq, D.5.1.1):

$$F_{HCR}^{Before}(St,y,Ar) =$$

$$\sum_{Ct=1}^{Ct_{Max}} \sum_{Fl=1}^{Fl_{Max}(Ct)} \sum_{Vs=1}^{Vs_{Max}(Fl,Ct)} \sum_{Rg=1}^{Rg_{Max}(Fl,Ct)} E^{Before}(Fl,Vs,Rg,Ct,St,y,q,Ar) * Q(Fl,Vs,Rg,Ct,St,y,q,Ar)$$

The relative distribution of efforts on (Fl, Vs, Rg, Ct) is assume to be given, for example by the relative stability and a common factor is applied to all (Fl, Vs, Rg, Ct) to achieve it. The suffix "Before" refers to "Before the modifications of efforts to match the set of HCRs for all stocks combined". The $E^{Before}$ has "St" index, so this (artificial) effort concept is stock specific. The "after modification" effort concept $E^{After}$ has no "St"-index, and the equal sign is replaced by an "smaller than" sign.

$$F_{HCR}^{Before}(St,y,Ar) \geq$$

$$\sum_{Ct=1}^{Ct_{Max}} \sum_{Fl=1}^{Fl_{Max}(Ct)} \sum_{Vs=1}^{Vs_{Max}(Fl,Ct)} \sum_{Rg=1}^{Rg_{Max}(Fl,Ct)} E^{After}(Fl,Vs,Rg,Ct,y,q,Ar) * Q(Fl,Vs,Rg,Ct,St,y,q,Ar)$$

The effort after modification of fleet specific effort can be expressed as the product of the effort before modification multiplied with the reduction factors $X^{SeaDays}$ and $X^{MPA-Closure}$

$$E^{After}(\bullet,\bullet,\bullet,\bullet,St,y,q,Ar) = \sum_{Ct=1} \sum_{Fl=1} \sum_{Vs=1} \sum_{Rg=1} X^{SeaDays}(Fl,Vs,Rg,Ct,y,q,Ar) *$$

$$X^{MPA-Closure}(Fl,Vs,Rg,Ct,y,q,Ar) * E^{Before}(Fl,Vs,Rg,Ct,St,y,q,Ar)$$

where the factor, $X^{SeaDays}(Fl,Vs,Rg,Ct,y,q,Ar)$, is defined by the management regulation, combined with some harvest control rule and the upper limit for sea days (the "maximum possible number of sea days per period" (Eqs. D.5.3.2.a and b)

$$X^{SeaDays}(Fl,Vs,Rg,Ct,y,q,Ar) = \frac{EY_{\mathrm{Re}g}(Fl,Vs,Rg,Ct,y,q,Ar)}{EY_{Max}(Fl,Vs,Ct,y,q,Ar)}$$ where $EY_{MAX}$ is The maximum physical number of effort units per vessel per time unit and $EY_{\mathrm{Re}g}(Fl,Vs,Rg,Ct,y,q,Ar)$ is the maximum number of sea days per time period dictated by the regulation,

and the "MPA-factor", $X^{MPA-Closure}(Fl,Vs,Rg,Ct,y,q,Ar)$, is the fraction of time period (y,q) which is closed for fishing. Thus

$$0 \leq X^{MPA-Closure}(Fl,Vs,Rg,Ct,y,q,Ar) \leq 1$$

Effort cannot exceed a physical upper limit (Eq. A.4.4.1)

$$E(Fl,Vs,\bullet,Ct,y,q,Ar) \leq NU_{Vessel}(Fl,Vs,Ct,y,q,\bullet) * EY_{Max}(Fl,Vs,Ct,y,q,Ar)$$

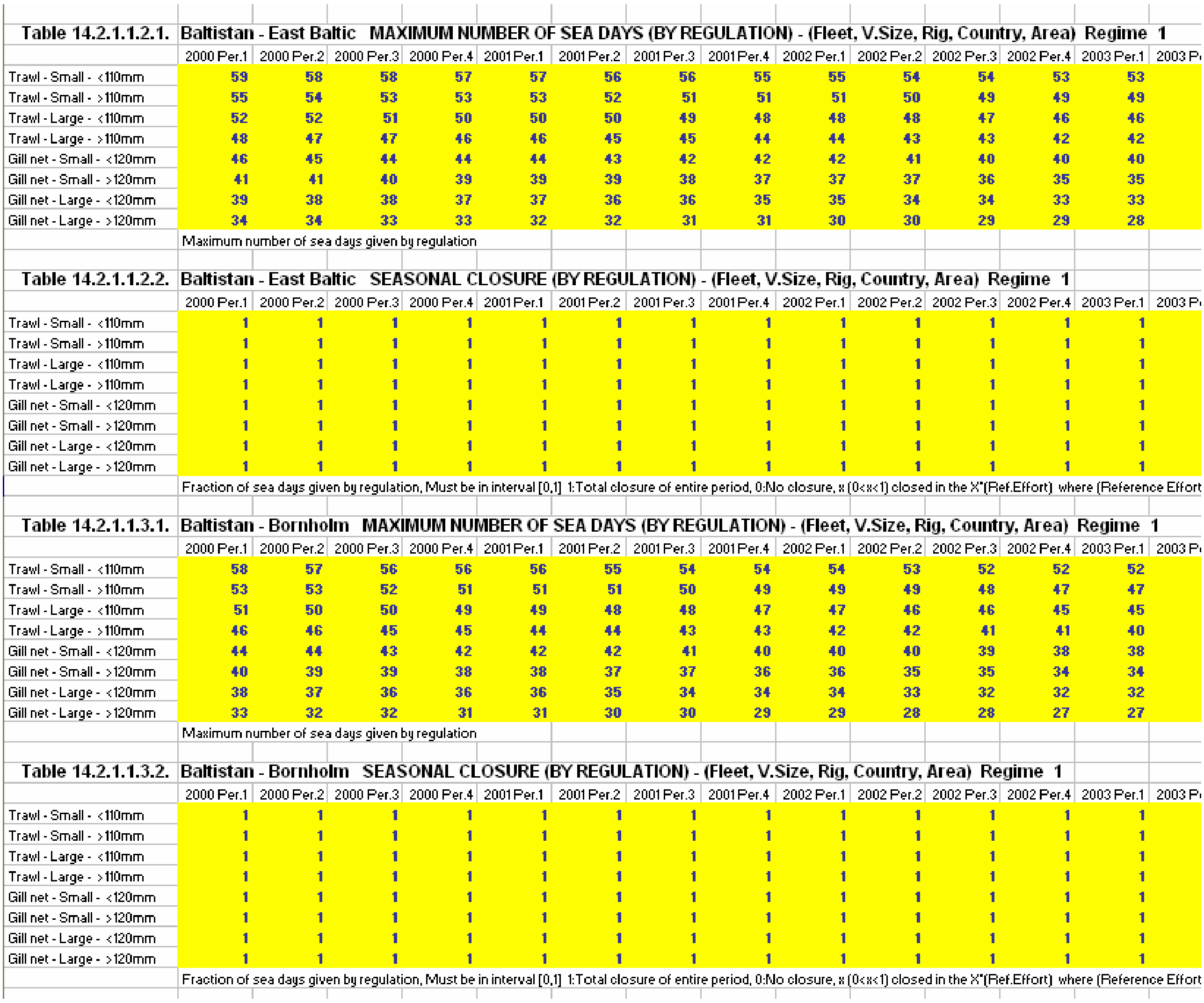


**Table 14.2.1.1.2.1.** Baltistan - East Baltic  MAXIMUM NUMBER OF SEA DAYS (BY REGULATION) - (Fleet, V.Size, Rig, Country, Area)  Regime  1

| | 2000 Per.1 | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 2002 Per.1 | 2002 Per.2 | 2002 Per.3 | 2002 Per.4 | 2003 Per.1 | 2003 P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Trawl - Small - <110mm | 59 | 58 | 58 | 57 | 57 | 56 | 56 | 55 | 55 | 54 | 54 | 53 | 53 | |
| Trawl - Small - >110mm | 55 | 54 | 53 | 53 | 53 | 52 | 51 | 51 | 51 | 50 | 49 | 49 | 49 | |
| Trawl - Large - <110mm | 52 | 52 | 51 | 50 | 50 | 50 | 49 | 48 | 48 | 48 | 47 | 46 | 46 | |
| Trawl - Large - >110mm | 48 | 47 | 47 | 46 | 46 | 45 | 45 | 44 | 44 | 43 | 43 | 42 | 42 | |
| Gill net - Small - <120mm | 46 | 45 | 44 | 44 | 44 | 43 | 42 | 42 | 42 | 41 | 40 | 40 | 40 | |
| Gill net - Small - >120mm | 41 | 41 | 40 | 39 | 39 | 39 | 38 | 37 | 37 | 37 | 36 | 35 | 35 | |
| Gill net - Large - <120mm | 39 | 38 | 38 | 37 | 37 | 36 | 36 | 35 | 35 | 34 | 34 | 33 | 33 | |
| Gill net - Large - >120mm | 34 | 34 | 33 | 33 | 32 | 32 | 31 | 31 | 30 | 30 | 29 | 29 | 28 | |

Maximum number of sea days given by regulation

**Table 14.2.1.1.2.2.** Baltistan - East Baltic  SEASONAL CLOSURE (BY REGULATION) - (Fleet, V.Size, Rig, Country, Area)  Regime  1

| | 2000 Per.1 | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 2002 Per.1 | 2002 Per.2 | 2002 Per.3 | 2002 Per.4 | 2003 Per.1 | 2003 P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Trawl - Small - <110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Trawl - Small - >110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Trawl - Large - <110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Trawl - Large - >110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Gill net - Small - <120mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Gill net - Small - >120mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Gill net - Large - <120mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Gill net - Large - >120mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |

Fraction of sea days given by regulation, Must be in interval [0,1]  1:Total closure of entire period, 0:No closure, x (0<x<1) closed in the X*(Ref.Effort)  where (Reference Effort

**Table 14.2.1.1.3.1.** Baltistan - Bornholm  MAXIMUM NUMBER OF SEA DAYS (BY REGULATION) - (Fleet, V.Size, Rig, Country, Area)  Regime  1

| | 2000 Per.1 | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 2002 Per.1 | 2002 Per.2 | 2002 Per.3 | 2002 Per.4 | 2003 Per.1 | 2003 P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Trawl - Small - <110mm | 58 | 57 | 56 | 56 | 56 | 55 | 54 | 54 | 54 | 53 | 52 | 52 | 52 | |
| Trawl - Small - >110mm | 53 | 53 | 52 | 51 | 51 | 51 | 50 | 49 | 49 | 49 | 48 | 47 | 47 | |
| Trawl - Large - <110mm | 51 | 50 | 50 | 49 | 49 | 48 | 48 | 47 | 47 | 46 | 46 | 45 | 45 | |
| Trawl - Large - >110mm | 46 | 46 | 45 | 45 | 44 | 44 | 43 | 43 | 42 | 42 | 41 | 41 | 40 | |
| Gill net - Small - <120mm | 44 | 44 | 43 | 42 | 42 | 42 | 41 | 40 | 40 | 40 | 39 | 38 | 38 | |
| Gill net - Small - >120mm | 40 | 39 | 39 | 38 | 38 | 37 | 37 | 36 | 36 | 35 | 35 | 34 | 34 | |
| Gill net - Large - <120mm | 38 | 37 | 36 | 36 | 36 | 35 | 34 | 34 | 34 | 33 | 32 | 32 | 32 | |
| Gill net - Large - >120mm | 33 | 32 | 32 | 31 | 31 | 30 | 30 | 29 | 29 | 28 | 28 | 27 | 27 | |

Maximum number of sea days given by regulation

**Table 14.2.1.1.3.2.** Baltistan - Bornholm  SEASONAL CLOSURE (BY REGULATION) - (Fleet, V.Size, Rig, Country, Area)  Regime  1

| | 2000 Per.1 | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 2002 Per.1 | 2002 Per.2 | 2002 Per.3 | 2002 Per.4 | 2003 Per.1 | 2003 P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Trawl - Small - <110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Trawl - Small - >110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Trawl - Large - <110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Trawl - Large - >110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Gill net - Small - <120mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Gill net - Small - >120mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Gill net - Large - <120mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Gill net - Large - >120mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |

Fraction of sea days given by regulation, Must be in interval [0,1]  1:Total closure of entire period, 0:No closure, x (0<x<1) closed in the X*(Ref.Effort)  where (Reference Effort

***Figure 2.15.4.a Maximum number of sea days and seasonal closure (MPA), for one country (Baltistan) and two areas (East Baltic and Bornholm) in REGIME 1, with no MPA and no closed season.***

Combining maximum number of sea days, capacity and MPA gives the effort expression after modification of stock specific effort.

$$E^{After}(\bullet,\bullet,\bullet,\bullet,St,y,q,Ar)=$$

$$\sum_{Ct=1}^{Ct_{Max}}\sum_{Fl=1}^{Fl_{Max}(Ct)}\sum_{Vs=1}^{Vs_{Max}(Fl,Ct)}\sum_{Rg=1}^{Rg_{Max}(Fl,Ct)} MAX\{\ X^{SeaDays}(Fl,Vs,Rg,Ct,y,q,Ar)*$$

$$X^{MPA-Closure}(Fl,Vs,Rg,Ct,y,q,Ar)*E^{Before}(Fl,Vs,Rg,Ct,St,y,q,Ar),$$

$$NU_{Vessel}(Fl,Vs,Ct,y,q,\bullet)*EY_{Max}(Fl,Vs.Ct,y,q,Ar)\ \}$$

The modification of stock specific effort is contained in the factor $X^{SeaDays}(Fl,Vs,Rg,Ct,y,q,Ar)$

The number of vessels was introduced in Section A.4.1. Omitting all special cases the general equations

| Vessel age | Number of vessels in period q where q > 1 |
|---|---|
| $Va = 0$ | $NU_{Vessel}(Fl, Vs, Ct, y, q, 0) = NU_{New\text{-}Vessel}(Fl, Vs, Ct, y,q)$ |
| $Va = 1,2,\ldots,Va_{max}-1$ | $NU_{Vessel}(Fl, Vs, Ct, y, q,Va) = NU_{vessel}(Fl, y , q-1,Va) - NU_{Decomm}(Fl, Vs, Ct, y, q,Va) - NU_{Withdrawal}(Fl, Vs, Ct, y, q, Va) - NU_{Attrition}(Fl, Vs, Ct, y, q, Va)$ |

The dynamics of the number of vessels, that is what creates an investment in a new vessel or withdrawal of a vessel is covered in the economic part of the TEMAS model.

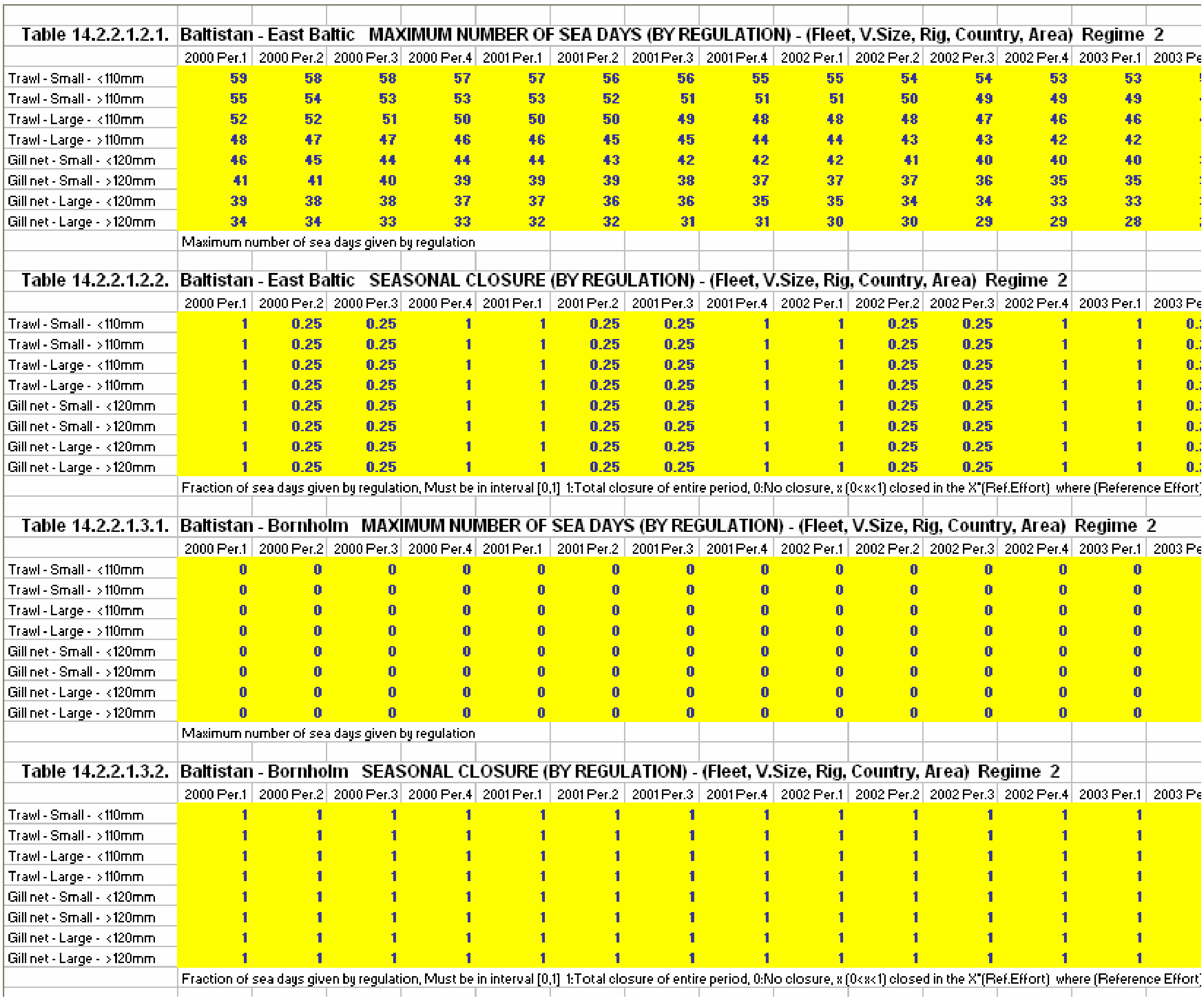


**Table 14.2.2.1.2.1.** Baltistan - East Baltic MAXIMUM NUMBER OF SEA DAYS (BY REGULATION) - (Fleet, V.Size, Rig, Country, Area) Regime 2

| | 2000 Per.1 | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 2002 Per.1 | 2002 Per.2 | 2002 Per.3 | 2002 Per.4 | 2003 Per.1 | 2003 Pe |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Trawl - Small - <110mm | 59 | 58 | 58 | 57 | 57 | 56 | 56 | 55 | 55 | 54 | 54 | 53 | 53 | |
| Trawl - Small - >110mm | 55 | 54 | 53 | 53 | 53 | 52 | 51 | 51 | 51 | 50 | 49 | 49 | 49 | |
| Trawl - Large - <110mm | 52 | 52 | 51 | 50 | 50 | 50 | 49 | 48 | 48 | 48 | 47 | 46 | 46 | |
| Trawl - Large - >110mm | 48 | 47 | 47 | 46 | 46 | 45 | 45 | 44 | 44 | 43 | 43 | 42 | 42 | |
| Gill net - Small - <120mm | 46 | 45 | 44 | 44 | 44 | 43 | 42 | 42 | 42 | 41 | 40 | 40 | 40 | |
| Gill net - Small - >120mm | 41 | 41 | 40 | 39 | 39 | 39 | 38 | 37 | 37 | 37 | 36 | 35 | 35 | |
| Gill net - Large - <120mm | 39 | 38 | 38 | 37 | 37 | 36 | 36 | 35 | 35 | 34 | 34 | 33 | 33 | |
| Gill net - Large - >120mm | 34 | 34 | 33 | 33 | 32 | 32 | 31 | 31 | 30 | 30 | 29 | 29 | 28 | |

Maximum number of sea days given by regulation

**Table 14.2.2.1.2.2.** Baltistan - East Baltic SEASONAL CLOSURE (BY REGULATION) - (Fleet, V.Size, Rig, Country, Area) Regime 2

| | 2000 Per.1 | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 2002 Per.1 | 2002 Per.2 | 2002 Per.3 | 2002 Per.4 | 2003 Per.1 | 2003 Pe |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Trawl - Small - <110mm | 1 | 0.25 | 0.25 | 1 | 1 | 0.25 | 0.25 | 1 | 1 | 0.25 | 0.25 | 1 | 1 | |
| Trawl - Small - >110mm | 1 | 0.25 | 0.25 | 1 | 1 | 0.25 | 0.25 | 1 | 1 | 0.25 | 0.25 | 1 | 1 | |
| Trawl - Large - <110mm | 1 | 0.25 | 0.25 | 1 | 1 | 0.25 | 0.25 | 1 | 1 | 0.25 | 0.25 | 1 | 1 | |
| Trawl - Large - >110mm | 1 | 0.25 | 0.25 | 1 | 1 | 0.25 | 0.25 | 1 | 1 | 0.25 | 0.25 | 1 | 1 | |
| Gill net - Small - <120mm | 1 | 0.25 | 0.25 | 1 | 1 | 0.25 | 0.25 | 1 | 1 | 0.25 | 0.25 | 1 | 1 | |
| Gill net - Small - >120mm | 1 | 0.25 | 0.25 | 1 | 1 | 0.25 | 0.25 | 1 | 1 | 0.25 | 0.25 | 1 | 1 | |
| Gill net - Large - <120mm | 1 | 0.25 | 0.25 | 1 | 1 | 0.25 | 0.25 | 1 | 1 | 0.25 | 0.25 | 1 | 1 | |
| Gill net - Large - >120mm | 1 | 0.25 | 0.25 | 1 | 1 | 0.25 | 0.25 | 1 | 1 | 0.25 | 0.25 | 1 | 1 | |

Fraction of sea days given by regulation, Must be in interval [0,1] 1:Total closure of entire period, 0:No closure, x (0<x<1) closed in the X*(Ref.Effort) where (Reference Effort)

**Table 14.2.2.1.3.1.** Baltistan - Bornholm MAXIMUM NUMBER OF SEA DAYS (BY REGULATION) - (Fleet, V.Size, Rig, Country, Area) Regime 2

| | 2000 Per.1 | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 2002 Per.1 | 2002 Per.2 | 2002 Per.3 | 2002 Per.4 | 2003 Per.1 | 2003 Pe |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Trawl - Small - <110mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Trawl - Small - >110mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Trawl - Large - <110mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Trawl - Large - >110mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Gill net - Small - <120mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Gill net - Small - >120mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Gill net - Large - <120mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Gill net - Large - >120mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |

Maximum number of sea days given by regulation

**Table 14.2.2.1.3.2.** Baltistan - Bornholm SEASONAL CLOSURE (BY REGULATION) - (Fleet, V.Size, Rig, Country, Area) Regime 2

| | 2000 Per.1 | 2000 Per.2 | 2000 Per.3 | 2000 Per.4 | 2001 Per.1 | 2001 Per.2 | 2001 Per.3 | 2001 Per.4 | 2002 Per.1 | 2002 Per.2 | 2002 Per.3 | 2002 Per.4 | 2003 Per.1 | 2003 Pe |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Trawl - Small - <110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Trawl - Small - >110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Trawl - Large - <110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Trawl - Large - >110mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Gill net - Small - <120mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Gill net - Small - >120mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Gill net - Large - <120mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Gill net - Large - >120mm | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |

Fraction of sea days given by regulation, Must be in interval [0,1] 1:Total closure of entire period, 0:No closure, x (0<x<1) closed in the X*(Ref.Effort) where (Reference Effort)

***Figure 2.15.4.b Maximum number of sea days and seasonal closure (MPA), for one country (Baltistan) and two areas (East Baltic and Bornholm) in REGIME 2 with MPA (Bornholm) and closed season (2$^{nd}$ and 3$^{rd}$ quarter) in area East Baltic.***

Tables 2.15.4 a and b illustrate the data structure by management regimes. Figure a) represents a strategy with no closed areas (no MPA) and with no closed season.

EXEL Table 14.2.1.1.2.2 has “1” everywhere, indicating that fishing is allowed through out all periods, whereas EXEL Table 14.2.2.1.2.2 shows that for Regime 2 only 25% of time period 2 and 3 are open for fishing. Thus in Regime 2, periods 2 and 3 are 75% closed seasons.

EXCEL Table 14.2.1.1.3.1 has maximum number of sea days larger than zero, so the Bornholm area is not a MPA in Regime 1, where EXCEL Table 14.2.2.1.3.1 has zero’s everywhere indicating that fishing is prohibited throughout the year. Thus the Bornholm area is an MPA in Regime 2. The

MPA needs not to be in action all year round. It might, for example, be active only in period 2 and 3.

Figure 2.15.5.a. shows the overall structure of all MPA and all closed season parameters for all countries and two alternative rimes. Figure 2.15.5.b shows the upper 25 % of Figure 2.15.5.a, namely the complete set of parameters for one regime (no 1) , one country (Baltistan) and all areas.

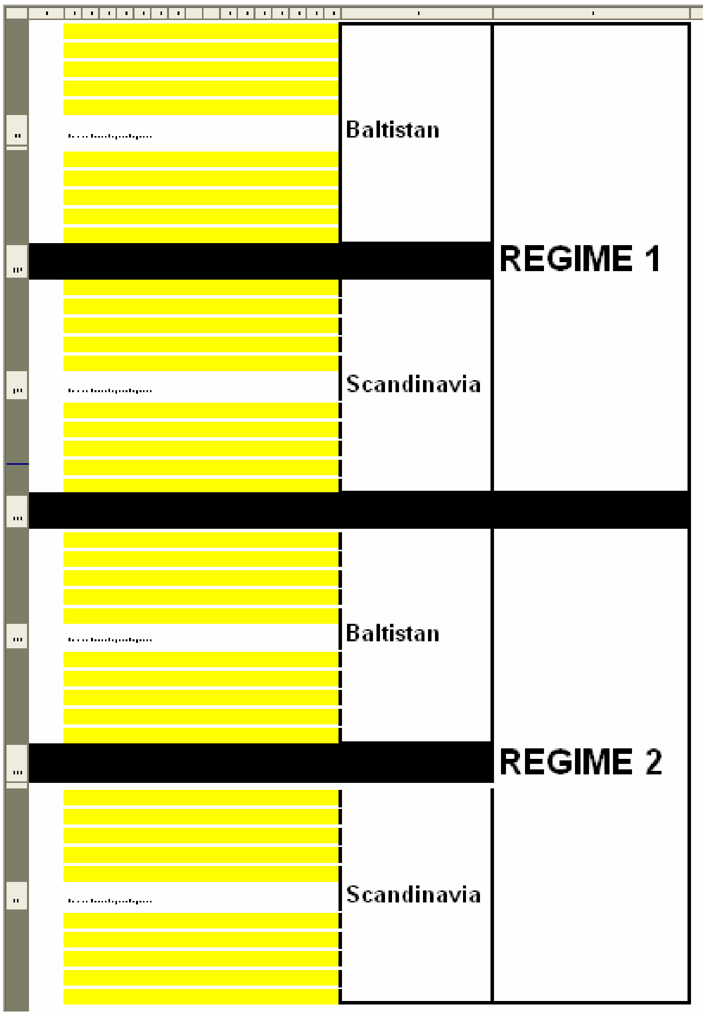


*Figure 2.15.5.a. The overall structure of MPA and closed season parameters.*

Figure 2.15.6 shows the 6 options for pre-processing of minimum landing size and maximum sea days/seasonal closure parameters.

Option 1 ”Make minimum landing size equal for all areas" copies the parameter values for the first area to all other areas.

Option 2 "Make maximum regulation sea days and closed seasons equal for all areas "copies the parameter values for the first area to all other areas.

Option 3 "Make minimum landing size equal for all years and time periods "copies the parameter values for the first period in the first year to all other periods in all other years.

Option 4 " Make maximum regulation sea days and closed seasons equal for all years and time periods " copies the parameter values for the first period in the first year to all other periods in all other years

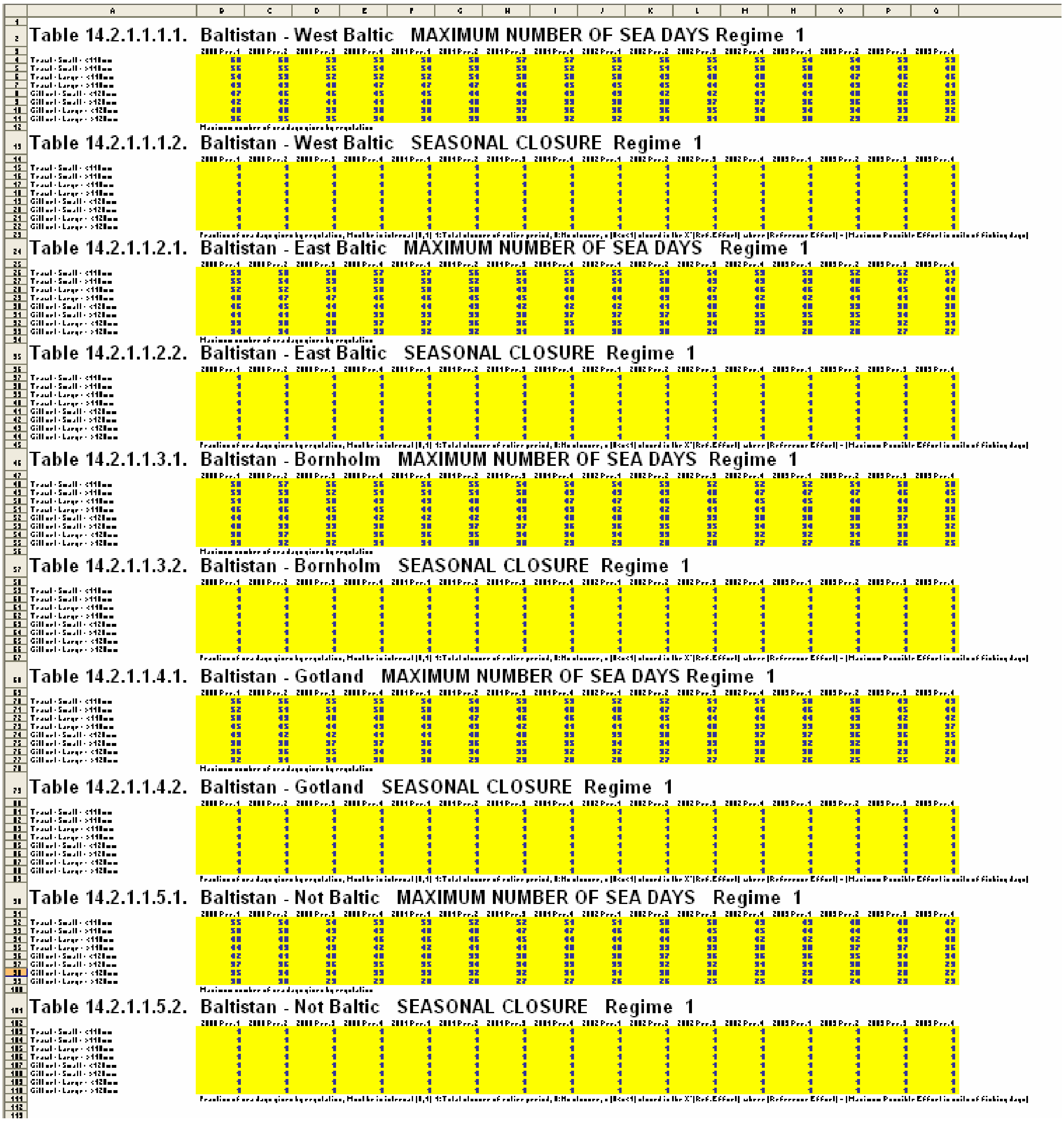


Table 14.2.1.1.1.1. Baltistan - West Baltic MAXIMUM NUMBER OF SEA DAYS Regime 1

Table 14.2.1.1.1.2. Baltistan - West Baltic SEASONAL CLOSURE Regime 1

Table 14.2.1.1.2.1. Baltistan - East Baltic MAXIMUM NUMBER OF SEA DAYS Regime 1

Table 14.2.1.1.2.2. Baltistan - East Baltic SEASONAL CLOSURE Regime 1

Table 14.2.1.1.3.1. Baltistan - Bornholm MAXIMUM NUMBER OF SEA DAYS Regime 1

Table 14.2.1.1.3.2. Baltistan - Bornholm SEASONAL CLOSURE Regime 1

Table 14.2.1.1.4.1. Baltistan - Gotland MAXIMUM NUMBER OF SEA DAYS Regime 1

Table 14.2.1.1.4.2. Baltistan - Gotland SEASONAL CLOSURE Regime 1

Table 14.2.1.1.5.1. Baltistan - Not Baltic MAXIMUM NUMBER OF SEA DAYS Regime 1

Table 14.2.1.1.5.2. Baltistan - Not Baltic SEASONAL CLOSURE Regime 1

***Figure 2.15.5.b. The overall structure of MPA and closed season parameters for one regime (the upper part of Figure 2.15.5.a.). One country and all areas.***

Option 5 "Make maximum regulation sea days and closed seasons equal for regimes 1 and 2 " can be used in case you don't want to assess the effect of closed seasons and MPAs. It simply copies the parameter values for regime 1 to regime 2"

Option 6 "Remove maximum regulation sea days and closed seasons for regimes 1 and 2" assigns the maximum possible number of sea days (entered in work sheet S05_BOATS) to the parameter for maximum regulation sea days. It opens all closed areas for fishery, by assigning the value 1 the closed area factor

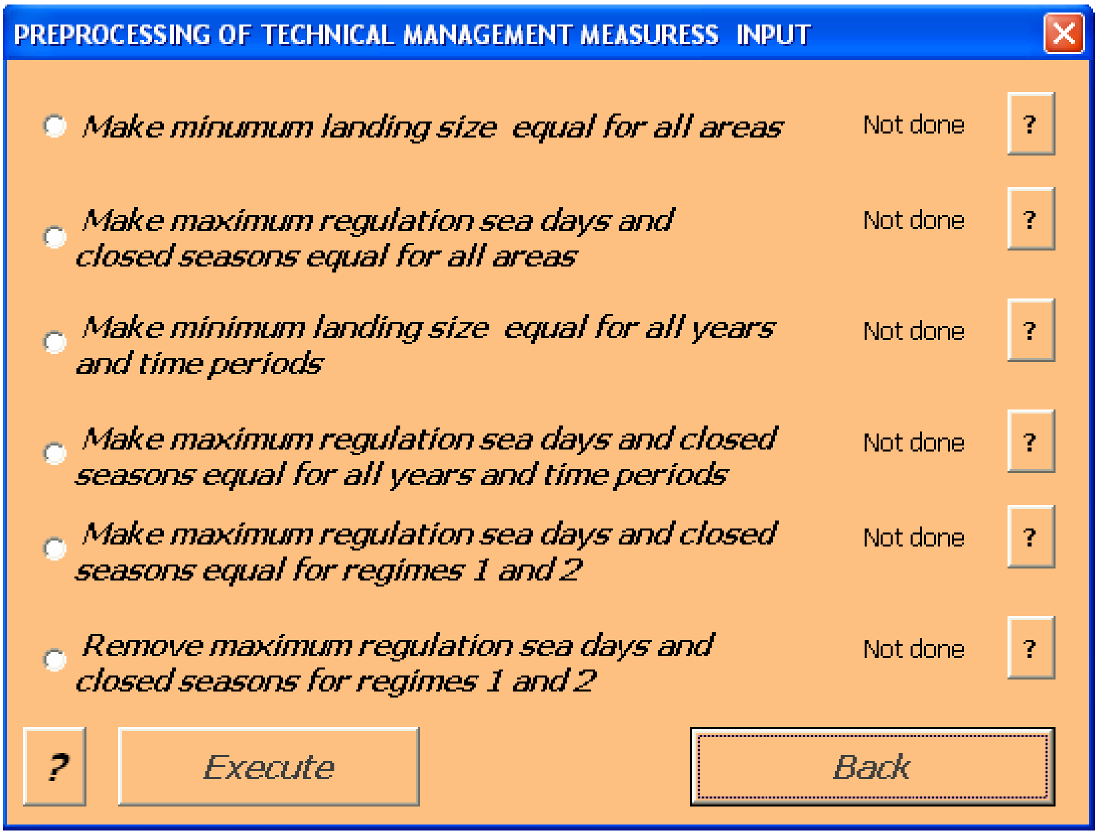


***Figure 2.15.6. Options for pre-processing of parameters of technical management measures (TEMAS).***

## 2.16. INPUT OF HARVEST CONTROL RULES, S15_HCR

Figure 2.15.1 shows the user-form of sheet "S15_HCR", and Table 2.16.1 lists the EXCEL tables in the sheet. There is one table for for the HCR of the precautionary approach (the HCR of ICES), and one table with relative stability for each combination of stock and area.

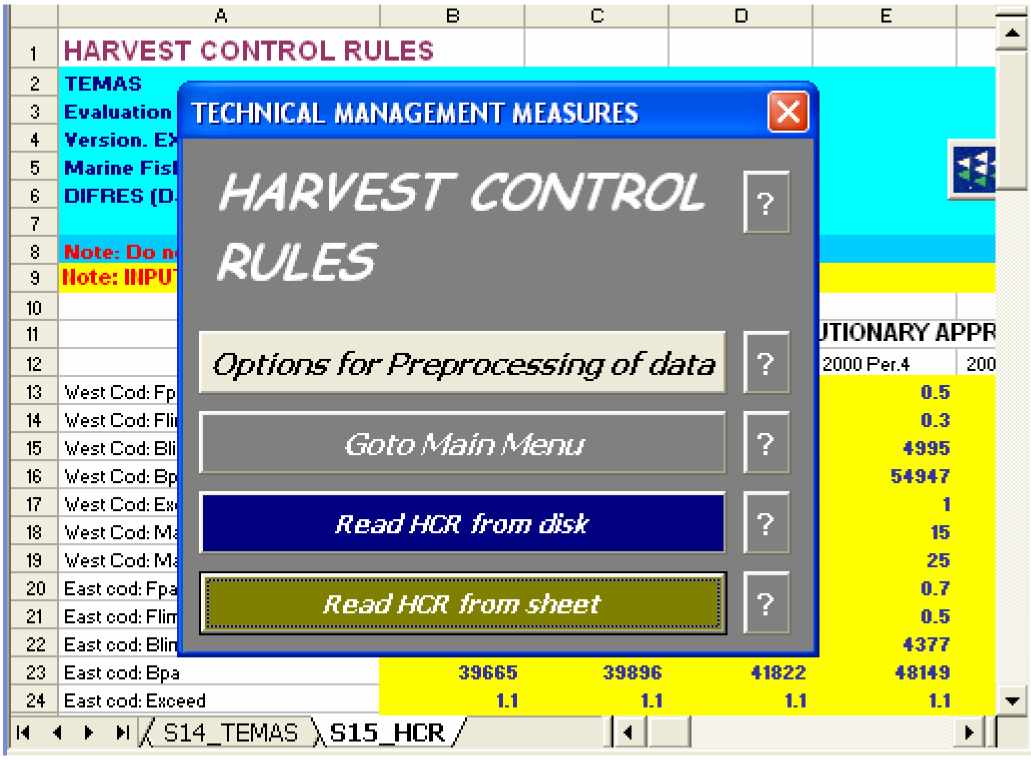
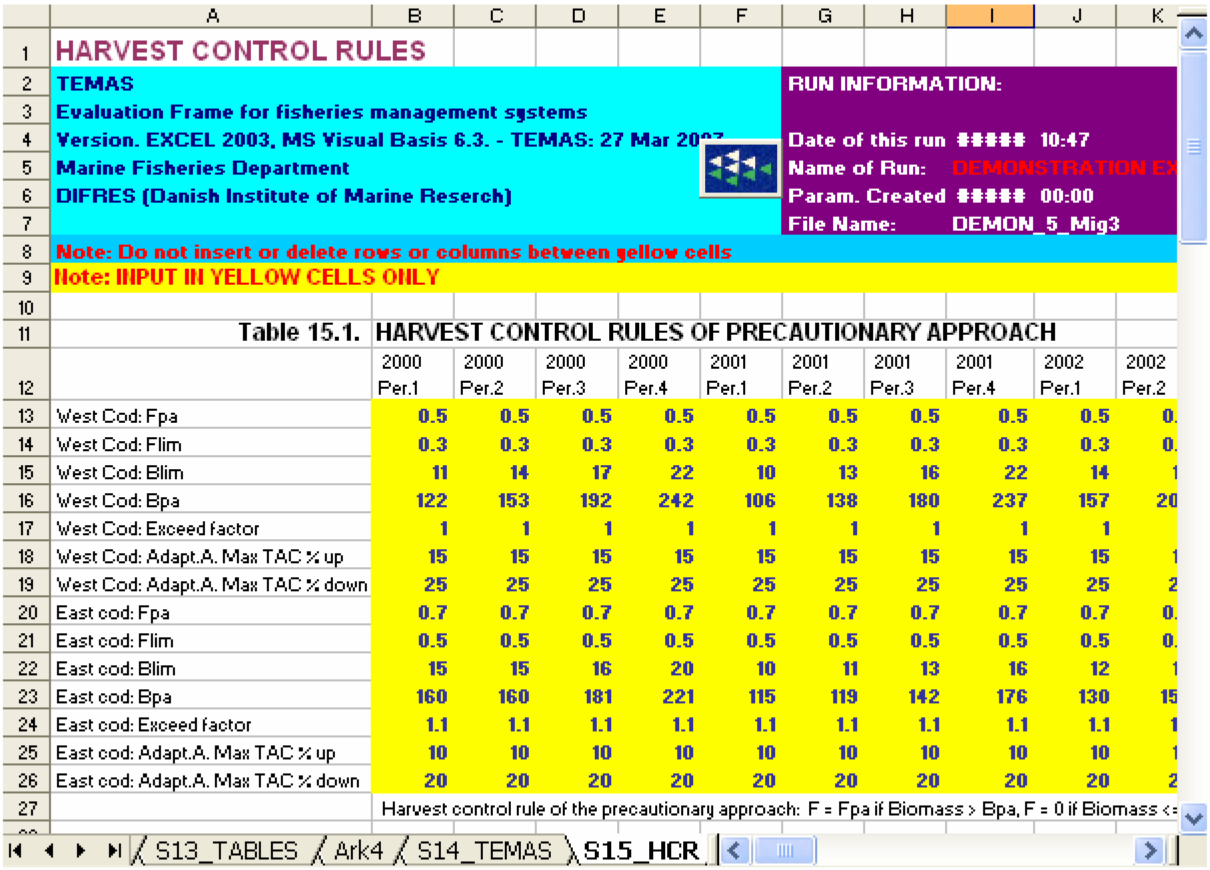


*Figure 2.16.1. User-form for entry of parameters for harvest control rules.*

| Index | EXCEL Table | Caption |
|---|---|---|
| 190 | Table15.1. | HARVEST CONTROL RULES OF PRECAUTIONARY APPROACH |
| 191 | Table15.2.1.1. | RELATIVE STABILITY (HARVEST CONTROL RULES) - West Cod - West Baltic |
| 192 | Table15.2.1.2. | RELATIVE STABILITY (HARVEST CONTROL RULES) - West Cod - East Baltic |
| 193 | Table15.2.1.3. | RELATIVE STABILITY (HARVEST CONTROL RULES) - West Cod - Not Baltic |
| 194 | Table15.2.1.4. | RELATIVE STABILITY (HARVEST CONTROL RULES) - West Cod - Bornholm |
| 195 | Table15.2.1.5. | RELATIVE STABILITY (HARVEST CONTROL RULES) - West Cod - Gotland |
| 196 | Table15.2.2.1. | RELATIVE STABILITY (HARVEST CONTROL RULES) - East cod - West Baltic |
| 197 | Table15.2.2.2. | RELATIVE STABILITY (HARVEST CONTROL RULES) - East cod - East Baltic |
| 198 | Table15.2.2.3. | RELATIVE STABILITY (HARVEST CONTROL RULES) - East cod - Not Baltic |
| 199 | Table15.2.2.4. | RELATIVE STABILITY (HARVEST CONTROL RULES) - East cod - Bornholm |
| 200 | Table15.2.2.5. | RELATIVE STABILITY (HARVEST CONTROL RULES) - East cod - Gotland |
| 201 | Table15.3.1.5. | RELATIVE STABILITY (HARVEST CONTROL RULES, summed over areas) - West Cod |
| 202 | Table15.3.2.5. | RELATIVE STABILITY (HARVEST CONTROL RULES, summed over areas) - East cod |
| 203 | Table15.4.1.5. | RELATIVE STABILITY (HARVEST CONTROL RULES, by country) - West Cod |
| 204 | Table15.4.2.5. | RELATIVE STABILITY (HARVEST CONTROL RULES, by country) - East cod |

*Table 2.16.1. Tables in the harvest control rule input sheet, S015_HCR.*



**HARVEST CONTROL RULES**

TEMAS
Evaluation Frame for fisheries management systems
Version. EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 27 Mar 20
Marine Fisheries Department
DIFRES (Danish Institute of Marine Reserch)

RUN INFORMATION:
Date of this run ##### 10:47
Name of Run: DEMONSTRATION EX
Param. Created ##### 00:00
File Name: DEMON_5_Mig3

Note: Do not insert or delete rows or columns between yellow cells
Note: INPUT IN YELLOW CELLS ONLY

Table 15.1. HARVEST CONTROL RULES OF PRECAUTIONARY APPROACH

| | 2000<br>Per.1 | 2000<br>Per.2 | 2000<br>Per.3 | 2000<br>Per.4 | 2001<br>Per.1 | 2001<br>Per.2 | 2001<br>Per.3 | 2001<br>Per.4 | 2002<br>Per.1 | 2002<br>Per.2 |
|---|---|---|---|---|---|---|---|---|---|---|
| West Cod: Fpa | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0. |
| West Cod: Flim | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0. |
| West Cod: Blim | 11 | 14 | 17 | 22 | 10 | 13 | 16 | 22 | 14 | 1 |
| West Cod: Bpa | 122 | 153 | 192 | 242 | 106 | 138 | 180 | 237 | 157 | 20 |
| West Cod: Exceed factor | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| West Cod: Adapt.A. Max TAC % up | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 1 |
| West Cod: Adapt.A. Max TAC % down | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 2 |
| East cod: Fpa | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0. |
| East cod: Flim | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0. |
| East cod: Blim | 15 | 15 | 16 | 20 | 10 | 11 | 13 | 16 | 12 | 1 |
| East cod: Bpa | 160 | 160 | 181 | 221 | 115 | 119 | 142 | 176 | 130 | 15 |
| East cod: Exceed factor | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1 |
| East cod: Adapt.A. Max TAC % up | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 1 |
| East cod: Adapt.A. Max TAC % down | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 2 |

Harvest control rule of the precautionary approach: F = Fpa if Biomass > Bpa, F = 0 if Biomass <=

S13_TABLES / Ark4 / S14_TEMAS / S15_HCR

***Figure 2.16.2.***

***The comment below the table says: Harvest control rule of the precautionary approach:***
***$F = F_{pa}$ if Biomass > $B_{pa}$,***
***$F = 0$ if Biomass <= $B_{lim}$,***
***if $B_{lim}$ < Biomass < $B_{pa}$ then $F = F_{pa}*(\text{Biomass}-B_{lim})/(B_{pa}-B_{lim})$***
***$F_{pa}$: Fishing mortality of the precautionary approach***
***$F_{lim}$: Critical lower limit of Fishing mortality***
***$B_{lim}$: Lower biomass-limit of the precautionary approach***
***$B_{pa}$: Biomass of the precautionary approach***
***The amount af HCR-excess accepted, here given as a factor (Exceed factor).***
***That is: Landings <= Exceed Factor * TAC.***
***The adaptive appraoch maximum changes in TAC is defined :***
***Maximum change up (%) of TAC in two consecutive years, when F > $F_{pa}$ or B < $B_{pa}$***
***Maximum change down (%) of TAC when F <= $F_{pa}$ or B <= $B_{pa}$***

Figure 2.16.2 (EXCEL Table 15.1) contains the parameters of the ICES harvest control rule $F_{pa}$: (fishing mortality of the precautionary approach), $F_{lim}$, (Critical lower limit of Fishing mortality). $B_{lim}$ (lower biomass-limit of the precautionary approach) and $B_{pa}$ (Biomass of the precautionary approach). Figure 2.16.2 also contains "acceptable exceed factor", $X_{TAX}^{Exceed}(St,y)$, for TAC and the maximum relative change of TAC between consecutive years of the adaptive approach., that is, if the TAC increases, $TAC_{CH}^{UP}(St,y)$ and if TAC decreases $TAC_{CH}^{Down}(St,y)$.

The Harvest control rule of ICES is implemented by assigning a value, $F_{HCR}$,to the mean fishing mortality in the forecast, $F_{FOR\text{-}Mean}$(St,y+2), The forecast is made in year y+1 (this year) , based on data in last data year, y, for next year, "y+2" : $F_{HCR}$ (St,y+2) = $F_{FOR\text{-}Mean}$(St,y+2). The mathematical expression for the ICES harvest control rule, with all indices, reads.

$$F_{HCR}(St,y+2)=\begin{cases}0 \ \ if \ SSB(St.y)\le B_{\lim}(St) \\ F_{pa}(St)\dfrac{SSB(St,y)-B_{\lim}}{B_{pa}(St)-B_{\lim}(St)} \ \ if \ B_{\lim}(St)\le SSB(St,y)\le B_{pa}(St) \\ F_{pa}(St) \ \ if \ SSB(St,y)>B_{pa}\end{cases} \qquad \text{(D.4.3.2.1)}$$

That means that the F dictated by the HCR is used in the catch prediction "next year" relative to the assessment year, y+1. Year y is the last "data-year". The same HCR dictated fishing mortality derived foregoing year is used in the simulation model for the "current" year - that is the year of the ICES assessment (y+1).

The $F_{HCR}$ of the HCR is converted into a TAC for the quota management regime (Eq. D.4.3.3.1.a)

$$TAC(St,y)=\sum_{a=o}^{a_{Max}(St)}C_{FOR}(St,y,a)*w(St,y,a)$$

which will be applied in the simulation model to stop the fishery under quota regime, if the TAC is exceeded. In practice, however, the TAC is often counted against the landings The catch is divided into landings and discards, and the condition for quota management now becomes (Eq. D.4.3.3.2).

$$TAC(St,y)\ge\sum_{a=o}^{a_{Max}(St)}\sum_{Ct=1}^{Ct_{Max}}\sum_{Fl=1}^{Fl_{Max}(Ct)}\sum_{Vs=1}^{Vs(Fl,Ct)}\sum_{Rg=1}^{Rg_{Max}(Fl,Ct)}\sum_{Ar=1}^{Ar_{Max}}$$

$$C_{Land}(Fl,Vs,Rg,Ct,St,y,a,q,Ar)*w(St,y,a,q)$$

Technically, the TEMAS program does not search for the F that produces a given TAC. It starts with the $F_{PA}$ and from that it produces the "right" TAC. The overall $F_{PA}$, is subsequently distributed on countries, fleets, riggings and areas, and the combined landings will automatically sum up to the desired TAC.

If the effort corresponding to $F_{PA}$ exceeds the capacity of the fleets,

$$E(Fl,Vs,\bullet,Ct,y,q,\bullet)\le NU_{Vessel}(Fl,Vs,Ct,y,q)*EY_{Max}(Fl,Vs,Ct,y,q)$$

then fishing mortality is reduced below $F_{PA}$, with the reduction factor

$$\frac{E(Fl,Vs,\bullet,Ct,y,q,\bullet)}{NU_{Vessel}(Fl,Vs,Ct,y,q)*EY_{Max}(Fl,Vs,Ct,y,q)}$$

That is, no F can be bigger than the maximum capacity allows for.

TEMAS contains an option to distribute effort according to the relative stability, that is the distribution of effort is in the same proportions as the historical rights (see Section D.6).

One feature of the adaptive approach, as implemented by the EU is that the change of TAC from year to year, TAC(St, y)-TAC(St, y-1) is not allowed to exceed a certain percentage of TAC(St,y-1) if the TAC increases, $TAC_{CH}^{UP}(St,y)$ and if TAC decreases $TAC_{CH}^{Down}(St,y)$.

$$\frac{TAC(St,y-1)-TAC(St,y)}{TAC(St,y-1)} \quad \leq \quad TAC_{CH}^{Down}(St,y) \quad if \quad TAC(St,y-1) \geq TAC(St,y)$$

$$\frac{TAC(St,y)-TAC(St,y-1)}{TAC(St,y-1)} \quad \leq \quad TAC_{CH}^{Up}(St,y) \quad if \quad TAC(St,y-1) < TAC(St,y)$$

This lead to the definition of a TAC concept, we call "TAC of the adaptive approach": (Eq. D.7.1.2)

$$TAC_{ADapt}(St,y) = \begin{cases} Min\{\ TAC(St,y),\ TAC(St,y-1)*(1-TAC_{CH}^{Down}(St,y))\}\ if\ \ TAC(St,y) < TAC(St,y-1) \\ Max\{\ TAC(St,y),\ TAC(St,y-1)*(1+TAC_{CH}^{Up}(St,y))\}\ \ if\ \ TAC(St,y) > TAC(St,y-1) \end{cases}$$

The $F_{HCR}$ of the HCR is converted into a TAC for the quota management regime by Eq D.4.3.3.1.a. In practice, it is often accepted that the TAC advised by ICES is exceeded. With the acceptable exceed factor $X_{TAX}^{Exceed}(St,y)$, the inequality of Eq D.4.3.3.1.a becomes replaced by the weaker inequality (because $X_{TAX}^{Exceed}(St,y) \geq 1.0$).

$$TAC(St,y) < X_{TAX}^{Exceed}(St,y) * \sum_{a=o}^{a_{Max}(St)} C_{FOR}(St,y,a) * w(St,y,a)$$

The historical right relative to landings is defined as the historical overage shares of landings

$$RELHRgt_{Land}(Fl,Vs,Rg,Ct,St,y,q,Ar) = \frac{HRgt_{Land}(Fl,Vs,Rg,Ct,St,y,q,Ar)}{HRgt_{Land}(\bullet,\bullet,\bullet,\bullet,St,y,q,Ar)}$$

where

$$HRgt_{Land}(Fl,Vs,Rg,Ct,St,y,q,Ar) = \sum_{u=y-Ny_{Hist}}^{y-1} Y_{Land}(Fl,Vs,Rg,Ct,St,y,q,Ar) * HFac^{u-y}$$

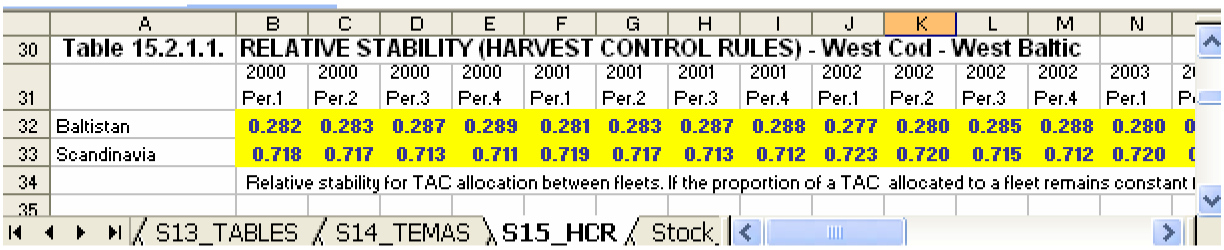
Where HFac is a discount factor, assigning lower values to years the longer in the past. Therefore, HFac $\leq$1.0. When HFac = 1.0, all years have assigned the same importance.
Note that $RELHRgt_{Land}(\bullet,\bullet,\bullet,\bullet,St,y,q,Ar) = 1$

The general historical right with respect of measure "X" is

$$RELHRgt_X(Fl,Vs,Rg,Ct,St,y,q,Ar) = \frac{HRgt_X(Fl,Vs,Rg,Ct,St,y,q,Ar)}{HRgt_X(\bullet,\bullet,\bullet,\bullet,St,y,q,Ar)}$$

$$HRgt_X(Fl,Vs,Rg,Ct,St,y,q,Ar) = \sum_{u=y-Ny_{Hist}}^{y-1} X(Fl,Vs,Rg,Ct,St,y,q,Ar) * HFac^{u-y}$$

Note that $RELHRgt_X(\bullet,\bullet,\bullet,\bullet,St,y,q,Ar) = 1$



| | A | B | C | D | E | F | G | H | I | J | K | L | M | N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | Table 15.2.1.1. | RELATIVE STABILITY (HARVEST CONTROL RULES) - West Cod - West Baltic | | | | | | | | | | | | |
| 31 | | 2000<br>Per.1 | 2000<br>Per.2 | 2000<br>Per.3 | 2000<br>Per.4 | 2001<br>Per.1 | 2001<br>Per.2 | 2001<br>Per.3 | 2001<br>Per.4 | 2002<br>Per.1 | 2002<br>Per.2 | 2002<br>Per.3 | 2002<br>Per.4 | 2003<br>Per.1 |
| 32 | Baltistan | 0.282 | 0.283 | 0.287 | 0.289 | 0.281 | 0.283 | 0.287 | 0.288 | 0.277 | 0.280 | 0.285 | 0.288 | 0.280 |
| 33 | Scandinavia | 0.718 | 0.717 | 0.713 | 0.711 | 0.719 | 0.717 | 0.713 | 0.712 | 0.723 | 0.720 | 0.715 | 0.712 | 0.720 |
| 34 | | Relative stability for TAC allocation between fleets. If the proportion of a TAC allocated to a fleet remains constant | | | | | | | | | | | | |
| 35 | | | | | | | | | | | | | | |

*Figure 2.16.2. Relative stability for one combination of stock and area.*

***The comment below the table says: Relative stability for TAC allocation between fleets. If the proportion of a TAC allocated to a fleet remains constant from year to year, it is called relative stability. The parameters of this tables gives the proportions of an area specific TAC for a given stock. A TAC share is given by a vessel size of a fleet of a country. Thus the index of relative stability is (Fleet, vessel size, country, stock, area).***

The current version of TEMAS has three X- From the basic definition with all indices in use, options

1) X = Landings
2) X = Value of landings
3) X = Effort (in this case index “St” is omitted)

various aggregated historical rights can be defined. The present version of TEMAS contains the following options aggregated historical rights:

| X=Landings and Value of landings: | X=Effort: |
|---|---|
| $RELHRgt_X(Fl,Vs,Rg,Ct,St,y,q,\bullet)$ | $RELHRgt_X(Fl,Vs,Rg,Ct,y,q,\bullet)$ |
| $RELHRgt_X(Fl,Vs,\bullet,Ct,St,y,q,\bullet)$ | $RELHRgt_X(Fl,Vs,\bullet,Ct,y,q,\bullet)$ |
| $RELHRgt_X(\bullet,\bullet,\bullet,Ct,St,y,q,\bullet)$ | |
| $RELHRgt_X(\bullet,\bullet,\bullet,\bullet,St,y,q,Ar)$ | |
| $RELHRgt_X(\bullet,\bullet,\bullet,\bullet,St,y,q,\bullet)$ | |

One traditional use of historical rights concerns distribution of a total TAC on countries. The TAC of a country in time period q of year y is

$$TAC(Ct,St,y,q) = TAC(\bullet,St,y,q) * RELHRgt_{Land}(\bullet,\bullet,\bullet,Ct,y,q,\bullet)$$

If the TAC is annual, and we assign the same value, $RELHRgt_{Land}^{Annual}(\bullet,\bullet,\bullet,Ct,y,\bullet)$, of the historical right to all time periods, then the annual TAC share of country Ct becomes

$$TAC(Ct,St,y,\bullet) = TAC(\bullet,St,y,\bullet) * RELHRgt_{Land}^{Annual}(\bullet,\bullet,\bullet,Ct,y,\bullet)$$

This is the basic principle behind the TAC sharing between counties as is has been executed by the EU (and other management bodies) for decades.

The relative stability could be extended to effort quotas, but this option has not yet been implemented in TEMAS, because the actual legislation (the EU regulations) has not been formulated along that line. Effort based management in the EU is introduced in the form of “structural policy for fishing capacity”, “Maximum number of sea days” (Section D.7.2) and closed areas (Section D.8).

TEMAS offers options to use the principle of relative stability on various disaggregated levels and based on various different measures (landings, value of landings and effort).

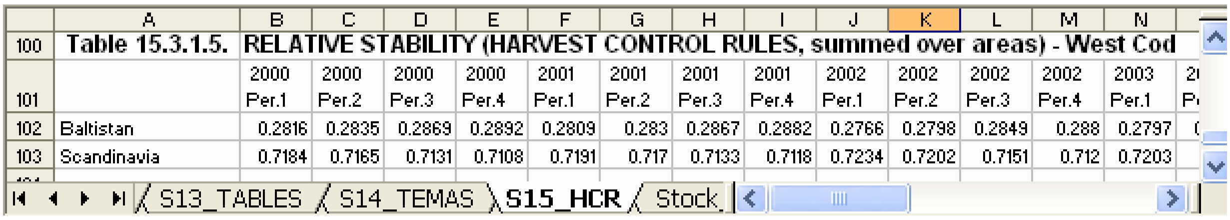
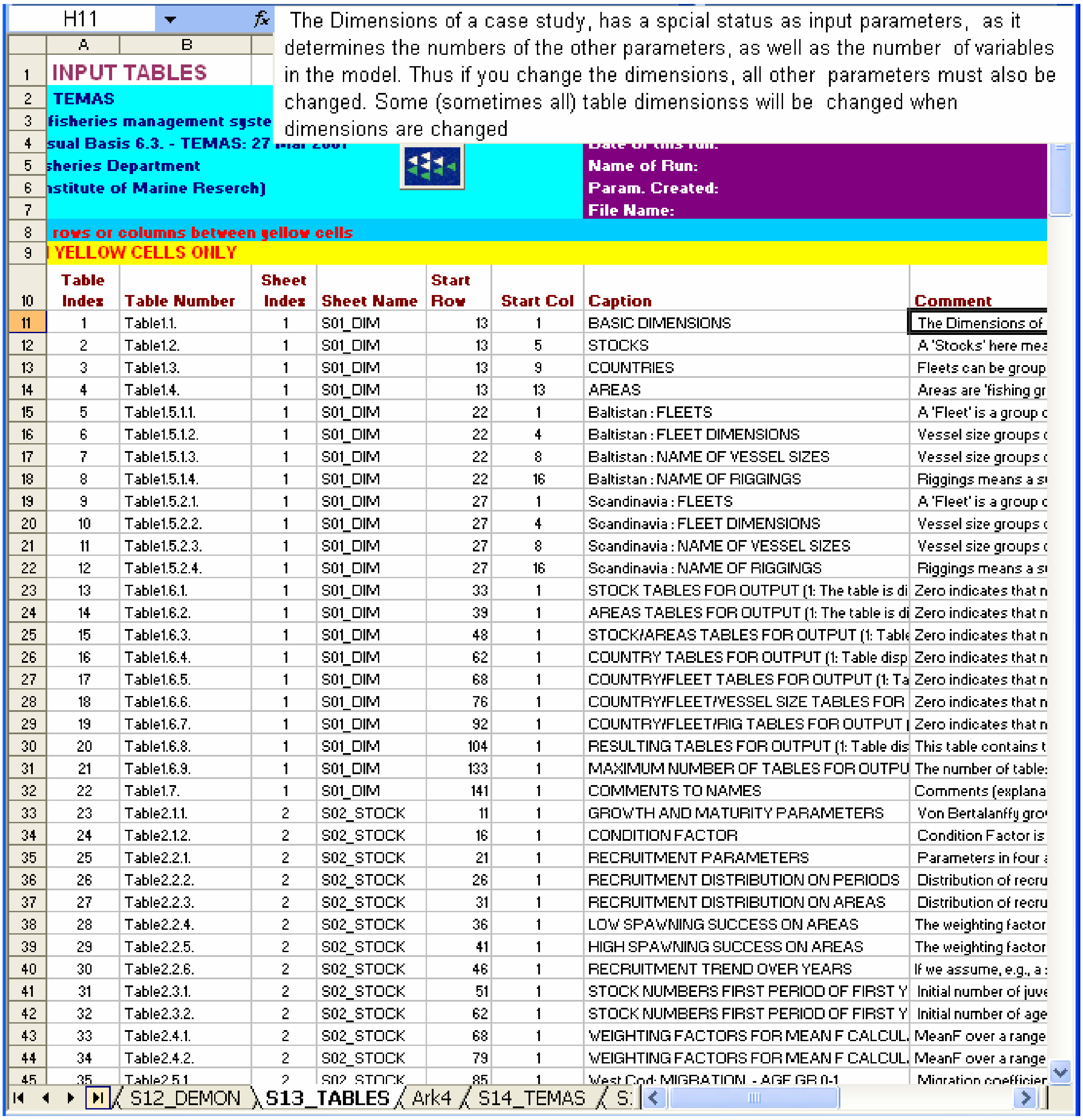


**Table 15.3.1.5. RELATIVE STABILITY (HARVEST CONTROL RULES, summed over areas) - West Cod**

| | 2000<br>Per.1 | 2000<br>Per.2 | 2000<br>Per.3 | 2000<br>Per.4 | 2001<br>Per.1 | 2001<br>Per.2 | 2001<br>Per.3 | 2001<br>Per.4 | 2002<br>Per.1 | 2002<br>Per.2 | 2002<br>Per.3 | 2002<br>Per.4 | 2003<br>Per.1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Baltistan | 0.2816 | 0.2835 | 0.2869 | 0.2892 | 0.2809 | 0.283 | 0.2867 | 0.2882 | 0.2766 | 0.2798 | 0.2849 | 0.288 | 0.2797 |
| Scandinavia | 0.7184 | 0.7165 | 0.7131 | 0.7108 | 0.7191 | 0.717 | 0.7133 | 0.7118 | 0.7234 | 0.7202 | 0.7151 | 0.712 | 0.7203 |

*Figure 2.16.3. Relative stability for one stock summed over  areas (Information table).*

## 2.17. LIST OF TABLES, S13_TABLES



The Dimensions of a case study, has a spcial status as input parameters,  as it determines the numbers of the other parameters, as well as the number  of variables in the model. Thus if you change the dimensions, all other  parameters must also be changed. Some (sometimes all) table dimensionss will be  changed when dimensions are changed

INPUT TABLES
TEMAS
fisheries management syste
sual Basis 6.3. - TEMAS: 27
sheries Department
nstitute of Marine Reserch)

Name of Run:
Param. Created:
File Name:

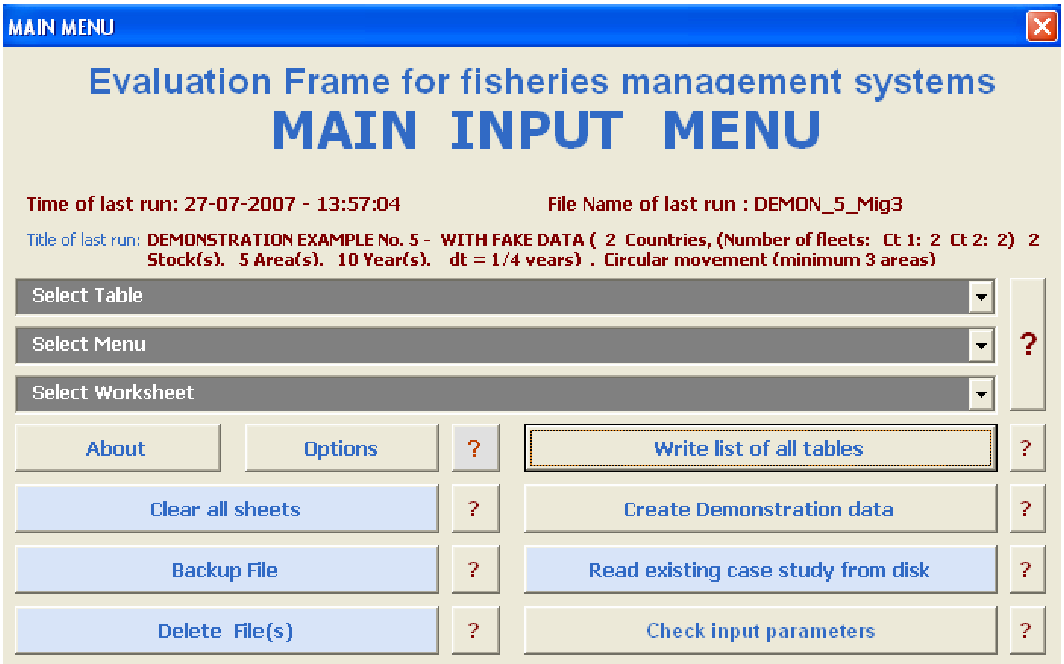
rows or columns between yellow cells
YELLOW CELLS ONLY

| Table Index | Table Number | Sheet Index | Sheet Name | Start Row | Start Col | Caption | Comment |
|---|---|---|---|---|---|---|---|
| 1 | Table1.1. | 1 | S01_DIM | 13 | 1 | BASIC DIMENSIONS | The Dimensions of |
| 2 | Table1.2. | 1 | S01_DIM | 13 | 5 | STOCKS | A 'Stocks' here mea |
| 3 | Table1.3. | 1 | S01_DIM | 13 | 9 | COUNTRIES | Fleets can be group |
| 4 | Table1.4. | 1 | S01_DIM | 13 | 13 | AREAS | Areas are 'fishing gr |
| 5 | Table1.5.1.1. | 1 | S01_DIM | 22 | 1 | Baltistan : FLEETS | A 'Fleet' is a group c |
| 6 | Table1.5.1.2. | 1 | S01_DIM | 22 | 4 | Baltistan : FLEET DIMENSIONS | Vessel size groups c |
| 7 | Table1.5.1.3. | 1 | S01_DIM | 22 | 8 | Baltistan : NAME OF VESSEL SIZES | Vessel size groups c |
| 8 | Table1.5.1.4. | 1 | S01_DIM | 22 | 16 | Baltistan : NAME OF RIGGINGS | Riggings means a s |
| 9 | Table1.5.2.1. | 1 | S01_DIM | 27 | 1 | Scandinavia : FLEETS | A 'Fleet' is a group c |
| 10 | Table1.5.2.2. | 1 | S01_DIM | 27 | 4 | Scandinavia : FLEET DIMENSIONS | Vessel size groups c |
| 11 | Table1.5.2.3. | 1 | S01_DIM | 27 | 8 | Scandinavia : NAME OF VESSEL SIZES | Vessel size groups c |
| 12 | Table1.5.2.4. | 1 | S01_DIM | 27 | 16 | Scandinavia : NAME OF RIGGINGS | Riggings means a s |
| 13 | Table1.6.1. | 1 | S01_DIM | 33 | 1 | STOCK TABLES FOR OUTPUT (1: The table is di | Zero indicates that n |
| 14 | Table1.6.2. | 1 | S01_DIM | 39 | 1 | AREAS TABLES FOR OUTPUT (1: The table is di | Zero indicates that n |
| 15 | Table1.6.3. | 1 | S01_DIM | 48 | 1 | STOCK/AREAS TABLES FOR OUTPUT (1: Table | Zero indicates that n |
| 16 | Table1.6.4. | 1 | S01_DIM | 62 | 1 | COUNTRY TABLES FOR OUTPUT (1: Table disp | Zero indicates that n |
| 17 | Table1.6.5. | 1 | S01_DIM | 68 | 1 | COUNTRY/FLEET TABLES FOR OUTPUT (1: Ta | Zero indicates that n |
| 18 | Table1.6.6. | 1 | S01_DIM | 76 | 1 | COUNTRY/FLEET/VESSEL SIZE TABLES FOR | Zero indicates that n |
| 19 | Table1.6.7. | 1 | S01_DIM | 92 | 1 | COUNTRY/FLEET/RIG TABLES FOR OUTPUT ( | Zero indicates that n |
| 20 | Table1.6.8. | 1 | S01_DIM | 104 | 1 | RESULTING TABLES FOR OUTPUT (1: Table dis | This table contains t |
| 21 | Table1.6.9. | 1 | S01_DIM | 133 | 1 | MAXIMUM NUMBER OF TABLES FOR OUTPU | The number of table: |
| 22 | Table1.7. | 1 | S01_DIM | 141 | 1 | COMMENTS TO NAMES | Comments (explana |
| 23 | Table2.1.1. | 2 | S02_STOCK | 11 | 1 | GROWTH AND MATURITY PARAMETERS | Von Bertalanffy gro |
| 24 | Table2.1.2. | 2 | S02_STOCK | 16 | 1 | CONDITION FACTOR | Condition Factor is |
| 25 | Table2.2.1. | 2 | S02_STOCK | 21 | 1 | RECRUITMENT PARAMETERS | Parameters in four a |
| 26 | Table2.2.2. | 2 | S02_STOCK | 26 | 1 | RECRUITMENT DISTRIBUTION ON PERIODS | Distribution of recru |
| 27 | Table2.2.3. | 2 | S02_STOCK | 31 | 1 | RECRUITMENT DISTRIBUTION ON AREAS | Distribution of recru |
| 28 | Table2.2.4. | 2 | S02_STOCK | 36 | 1 | LOW SPAWNING SUCCESS ON AREAS | The weighting factor |
| 29 | Table2.2.5. | 2 | S02_STOCK | 41 | 1 | HIGH SPAWNING SUCCESS ON AREAS | The weighting factor |
| 30 | Table2.2.6. | 2 | S02_STOCK | 46 | 1 | RECRUITMENT TREND OVER YEARS | If we assume, e.g., a : |
| 31 | Table2.3.1. | 2 | S02_STOCK | 51 | 1 | STOCK NUMBERS FIRST PERIOD OF FIRST Y | Initial number of juve |
| 32 | Table2.3.2. | 2 | S02_STOCK | 62 | 1 | STOCK NUMBERS FIRST PERIOD OF FIRST Y | Initial number of age |
| 33 | Table2.4.1. | 2 | S02_STOCK | 68 | 1 | WEIGHTING FACTORS FOR MEAN F CALCUL. | MeanF over a range |
| 34 | Table2.4.2. | 2 | S02_STOCK | 79 | 1 | WEIGHTING FACTORS FOR MEAN F CALCUL. | MeanF over a range |
| 35 | Table2.5.1. | 2 | S02_STOCK | 85 | 1 | West Cod: MIGRATION - AGE GR 0-1 | Migration coefficier |

*Figure 2.17.2. Complete list of tables.*

Figure 2.17.1 shows the user-form of sheet “S13_TABLES”. This is different from the menus ofthe input sheets. The user form of S13_TABLES, is the main menu of TEMAS_INPUT.
Clicking on “write list of all tables” gives you two tables. One table (Figure 2.17.2) is a complete list of all tables produced by the current case study. Figure 2.17.3 shows a summary list of tables,

i.e. a list which shows on the first tables in each group of tables. “A group of tables” for example can be a group of “stock-tables” or “country-tables”.



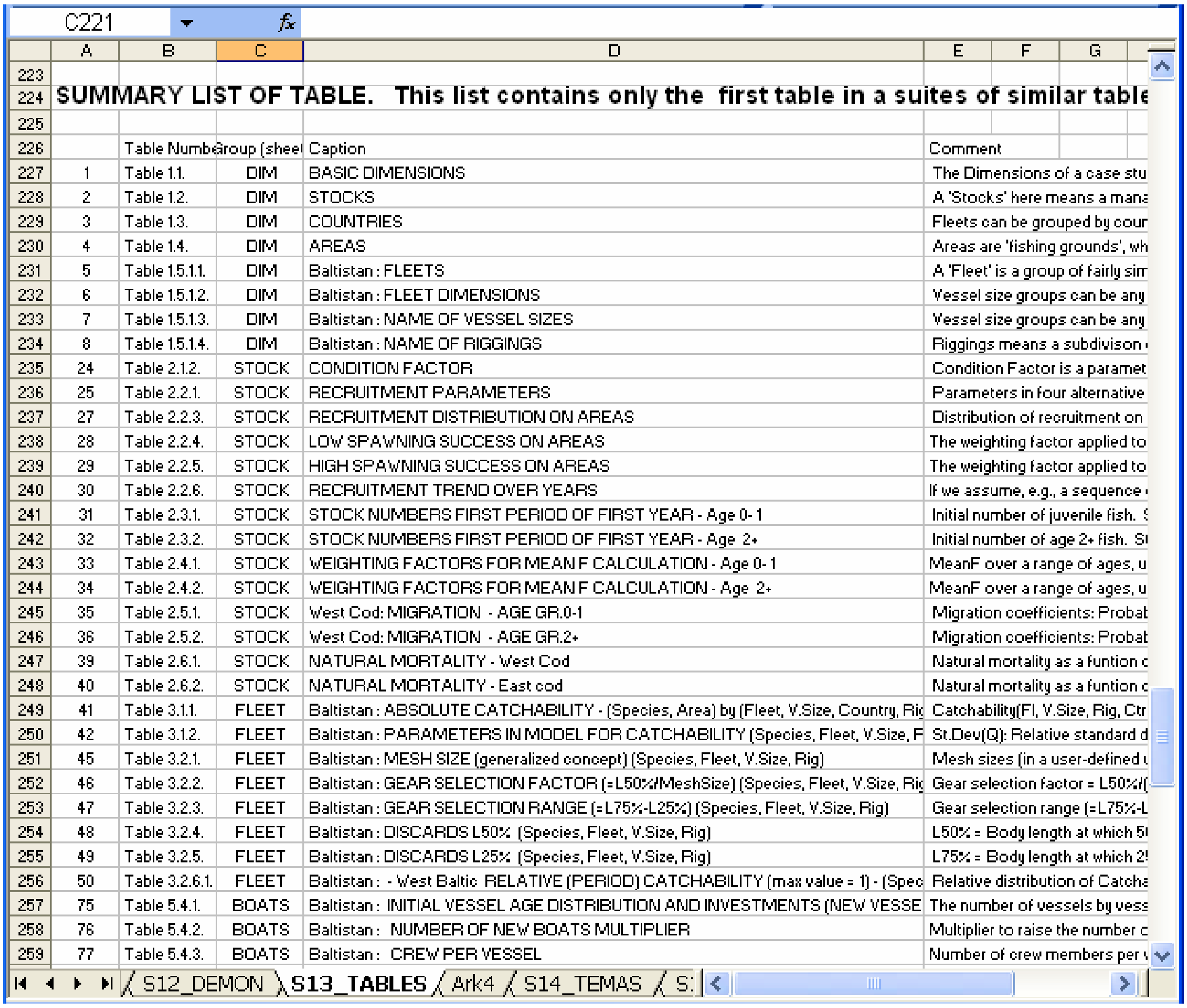
Evaluation Frame for fisheries management systems

MAIN INPUT MENU

Time of last run: 27-07-2007 - 13:57:04 File Name of last run : DEMON_5_Mig3

Title of last run: DEMONSTRATION EXAMPLE No. 5 - WITH FAKE DATA ( 2 Countries, (Number of fleets: Ct 1: 2 Ct 2: 2) 2 Stock(s). 5 Area(s). 10 Year(s). dt = 1/4 years) . Circular movement (minimum 3 areas)

*Figure 2.17.1. Main menu of TEMAS input.*



| | A | B | C | D | E |
|---|---|---|---|---|---|
| 223 | | | | | |
| 224 | SUMMARY LIST OF TABLE. This list contains only the first table in a suites of similar table | | | | |
| 225 | | | | | |
| 226 | | Table Numbe | Group (sheet | Caption | Comment |
| 227 | 1 | Table 1.1. | DIM | BASIC DIMENSIONS | The Dimensions of a case stu |
| 228 | 2 | Table 1.2. | DIM | STOCKS | A 'Stocks' here means a mana |
| 229 | 3 | Table 1.3. | DIM | COUNTRIES | Fleets can be grouped by cour |
| 230 | 4 | Table 1.4. | DIM | AREAS | Areas are 'fishing grounds', wh |
| 231 | 5 | Table 1.5.1.1. | DIM | Baltistan : FLEETS | A 'Fleet' is a group of fairly sim |
| 232 | 6 | Table 1.5.1.2. | DIM | Baltistan : FLEET DIMENSIONS | Vessel size groups can be any |
| 233 | 7 | Table 1.5.1.3. | DIM | Baltistan : NAME OF VESSEL SIZES | Vessel size groups can be any |
| 234 | 8 | Table 1.5.1.4. | DIM | Baltistan : NAME OF RIGGINGS | Riggings means a subdivison |
| 235 | 24 | Table 2.1.2. | STOCK | CONDITION FACTOR | Condition Factor is a paramet |
| 236 | 25 | Table 2.2.1. | STOCK | RECRUITMENT PARAMETERS | Parameters in four alternative |
| 237 | 27 | Table 2.2.3. | STOCK | RECRUITMENT DISTRIBUTION ON AREAS | Distribution of recruitment on |
| 238 | 28 | Table 2.2.4. | STOCK | LOW SPAWNING SUCCESS ON AREAS | The weighting factor applied to |
| 239 | 29 | Table 2.2.5. | STOCK | HIGH SPAWNING SUCCESS ON AREAS | The weighting factor applied to |
| 240 | 30 | Table 2.2.6. | STOCK | RECRUITMENT TREND OVER YEARS | If we assume, e.g., a sequence |
| 241 | 31 | Table 2.3.1. | STOCK | STOCK NUMBERS FIRST PERIOD OF FIRST YEAR - Age 0- 1 | Initial number of juvenile fish. |
| 242 | 32 | Table 2.3.2. | STOCK | STOCK NUMBERS FIRST PERIOD OF FIRST YEAR - Age 2+ | Initial number of age 2+ fish. S |
| 243 | 33 | Table 2.4.1. | STOCK | WEIGHTING FACTORS FOR MEAN F CALCULATION - Age 0- 1 | MeanF over a range of ages, u |
| 244 | 34 | Table 2.4.2. | STOCK | WEIGHTING FACTORS FOR MEAN F CALCULATION - Age 2+ | MeanF over a range of ages, u |
| 245 | 35 | Table 2.5.1. | STOCK | West Cod: MIGRATION - AGE GR.0-1 | Migration coefficients: Probab |
| 246 | 36 | Table 2.5.2. | STOCK | West Cod: MIGRATION - AGE GR.2+ | Migration coefficients: Probab |
| 247 | 39 | Table 2.6.1. | STOCK | NATURAL MORTALITY - West Cod | Natural mortality as a funtion c |
| 248 | 40 | Table 2.6.2. | STOCK | NATURAL MORTALITY - East cod | Natural mortality as a funtion c |
| 249 | 41 | Table 3.1.1. | FLEET | Baltistan : ABSOLUTE CATCHABILITY - (Species, Area) by (Fleet, V.Size, Country, Rig | Catchability(Fl, V.Size, Rig, Ctr |
| 250 | 42 | Table 3.1.2. | FLEET | Baltistan : PARAMETERS IN MODEL FOR CATCHABILITY (Species, Fleet, V.Size, F | St.Dev(Q): Relative standard d |
| 251 | 45 | Table 3.2.1. | FLEET | Baltistan : MESH SIZE (generalized concept) (Species, Fleet, V.Size, Rig) | Mesh sizes (in a user-defined |
| 252 | 46 | Table 3.2.2. | FLEET | Baltistan : GEAR SELECTION FACTOR (=L50%/MeshSize) (Species, Fleet, V.Size, Rig | Gear selection factor = L50%/( |
| 253 | 47 | Table 3.2.3. | FLEET | Baltistan : GEAR SELECTION RANGE (=L75%-L25%) (Species, Fleet, V.Size, Rig) | Gear selection range (=L75%-L |
| 254 | 48 | Table 3.2.4. | FLEET | Baltistan : DISCARDS L50% (Species, Fleet, V.Size, Rig) | L50% = Body length at which 5 |
| 255 | 49 | Table 3.2.5. | FLEET | Baltistan : DISCARDS L25% (Species, Fleet, V.Size, Rig) | L75% = Body length at which 2 |
| 256 | 50 | Table 3.2.6.1. | FLEET | Baltistan : - West Baltic RELATIVE (PERIOD) CATCHABILITY (max value = 1) - (Spec | Relative distribution of Catcha |
| 257 | 75 | Table 5.4.1. | BOATS | Baltistan : INITIAL VESSEL AGE DISTRIBUTION AND INVESTMENTS (NEW VESSE | The number of vessels by vess |
| 258 | 76 | Table 5.4.2. | BOATS | Baltistan : NUMBER OF NEW BOATS MULTIPLIER | Multiplier to raise the number c |
| 259 | 77 | Table 5.4.3. | BOATS | Baltistan : CREW PER VESSEL | Number of crew members per |

*Figure 2.17.3 Summary list of tables.*

## 2.18. PARAMETERS USED TO CREATE STOCHASTIC FACTORS.

No model in fisheries can predict the exact value of any predictor. To the simple model one should ideally add a stochastic term, ε, (or multiply a stochastic factor) so a general stochastic model reads

Model(**Input**,**Parameters**) = **Output** **+** ε. Or
Model(**Input**,**Parameters**) = **Output** ***** ε.

The stochastic term, ε , takes an unpredictable value from a probability distribution which we may have some knowledge about. Usually, ε, is assumed to be normally (symmetric) or log-normally (skewed to the left) distributed in fisheries models. The stochastic term accounts for all the elements not accounted for in the conceptual model. If the model actually reflects the true relationship between input and output (that is rarely the case in any fisheries model), the stochastic term has a known mean value (usually zero). However, the fisheries models are always incomplete with an unknown bias.

The deterministic model predicts a single value, whereas the stochastic model predicts a probability distribution of the output, $:\Pr\left\{\ Y_i \le Output < Y_{i+1}\right\}$ where $Y_i$ and $Y_{i+1}$ are limits defining some intervals of output (Figure 2.18.1). The probability distribution depends on the stochastic term **ε,** which may have an assumed distribution or a distribution estimated from time series of observation of (Input,Output).

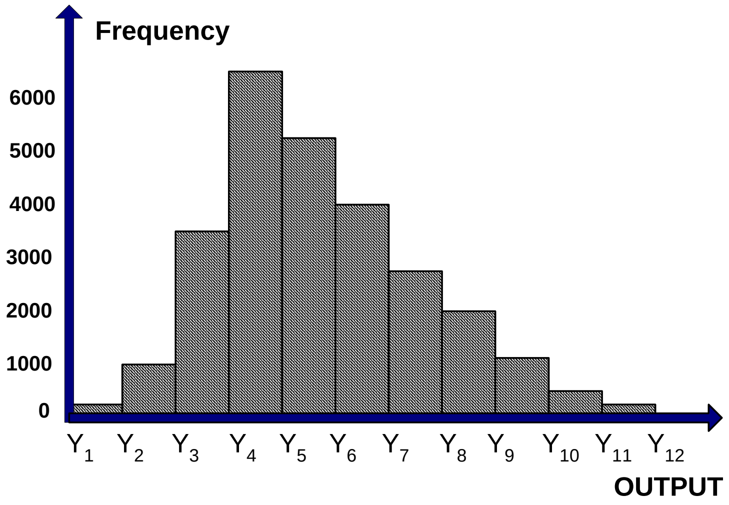


**Figure 2.18.1. Output from stochastic simulation.**

When using a stochastic model for prediction, the standard procedure is to let a computer program repeat the same prediction (or simulations) many times, say 1000 times or 10000 times. In each simulation the computer program draws the values of parameters from a random number generator. Eventually, the probability distribution is estimated by the frequency distribution of output (see Figure 2.18.1). That means that a stochastic model requires the parameters of the probability distribution of parameter estimates as input. (For a general introduction see for example Manly, 1998).

TEMAS uses a stochastic factor. The value of the stochastic factor is in TEMAS drawn from a random number generator, which assumes either

a) A normally distributed stochastic variable with mean value 1.0
b) A log normally distributed stochastic variable with mean value 1.0

In addition to the man value, these distributions need the variance as parameter, which in TEMAS is derived from the "relative standard deviation" (Standard deviation / mean value), which in this case is the same as standard deviation since the mean value is one.

The parameters, which can be made stochastic variable in TEMAS, are indicated by light blue cells in the work sheet. These are:

1) Bertalanffy growth parameter, K (normally distributed) (EXCEL Table 2.1.1, Figure 2.18.2)
2) Condition factor (normally distributed) ) (EXCEL Table 2.1.1, Figure 2.18.2)
3) The stock recruitment relationship (log-normally distributed) (EXCEL Table 2.2.1, Figyre 2.1.8.2)
4) Catchability coefficient (EXCEL Table 3.1.2, Figure 2.18.3)

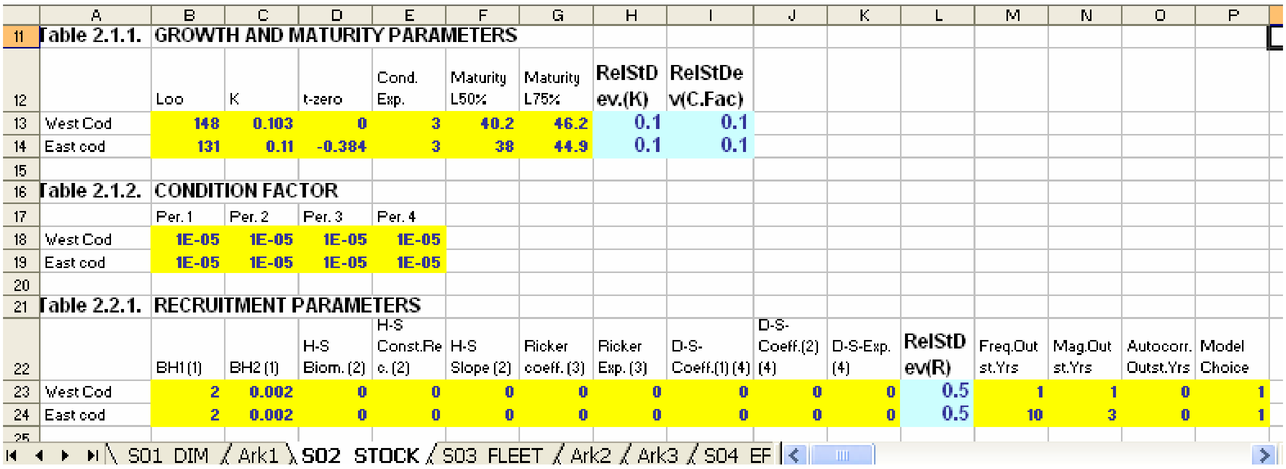


Table 2.1.1. GROWTH AND MATURITY PARAMETERS

| | Loo | K | t-zero | Cond. Exp. | Maturity L50% | Maturity L75% | RelStDev.(K) | RelStDev(C.Fac) |
|---|---|---|---|---|---|---|---|---|
| West Cod | 148 | 0.103 | 0 | 3 | 40.2 | 46.2 | 0.1 | 0.1 |
| East cod | 131 | 0.11 | -0.384 | 3 | 38 | 44.9 | 0.1 | 0.1 |

Table 2.1.2. CONDITION FACTOR

| | Per. 1 | Per. 2 | Per. 3 | Per. 4 |
|---|---|---|---|---|
| West Cod | 1E-05 | 1E-05 | 1E-05 | 1E-05 |
| East cod | 1E-05 | 1E-05 | 1E-05 | 1E-05 |

Table 2.2.1. RECRUITMENT PARAMETERS

| | BH1 (1) | BH2 (1) | H-S Biom. (2) | H-S Const.Rec. (2) | H-S Slope (2) | Ricker coeff. (3) | Ricker Exp. (3) | D-S-Coeff.(1) (4) | D-S-Coeff.(2) (4) | D-S-Exp. (4) | RelStDev(R) | Freq.Out st.Yrs | Mag.Out st.Yrs | Autocorr. Outst.Yrs | Model Choice |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| West Cod | 2 | 0.002 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.5 | 1 | 1 | 0 | 1 |
| East cod | 2 | 0.002 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.5 | 10 | 3 | 0 | 1 |

Figure 2.18.2. Relative standard deviations of Bertalanffy growth parameter, K (normally distributed) and Condition factor (normally distributed)

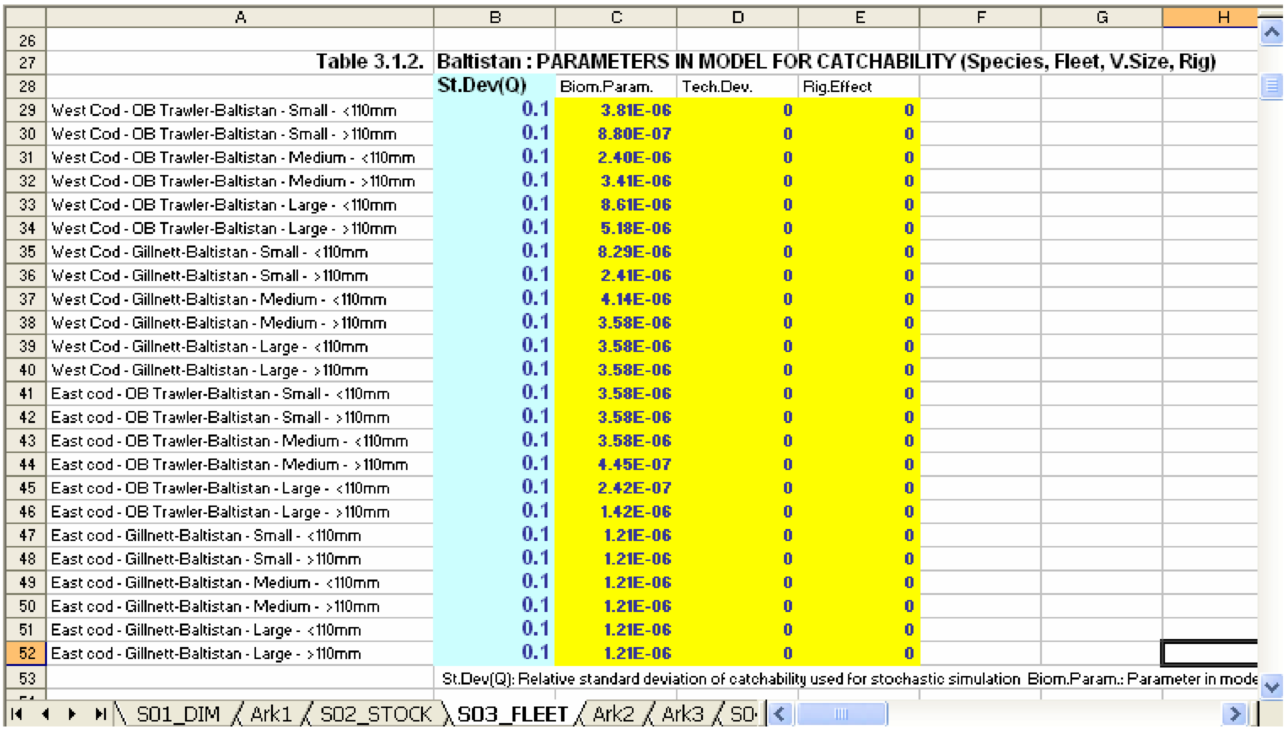


Table 3.1.2. Baltistan : PARAMETERS IN MODEL FOR CATCHABILITY (Species, Fleet, V.Size, Rig)

| | St.Dev(Q) | Biom.Param. | Tech.Dev. | Rig.Effect |
|---|---|---|---|---|
| West Cod - OB Trawler-Baltistan - Small - <110mm | 0.1 | 3.81E-06 | 0 | 0 |
| West Cod - OB Trawler-Baltistan - Small - >110mm | 0.1 | 8.80E-07 | 0 | 0 |
| West Cod - OB Trawler-Baltistan - Medium - <110mm | 0.1 | 2.40E-06 | 0 | 0 |
| West Cod - OB Trawler-Baltistan - Medium - >110mm | 0.1 | 3.41E-06 | 0 | 0 |
| West Cod - OB Trawler-Baltistan - Large - <110mm | 0.1 | 8.61E-06 | 0 | 0 |
| West Cod - OB Trawler-Baltistan - Large - >110mm | 0.1 | 5.18E-06 | 0 | 0 |
| West Cod - Gillnett-Baltistan - Small - <110mm | 0.1 | 8.29E-06 | 0 | 0 |
| West Cod - Gillnett-Baltistan - Small - >110mm | 0.1 | 2.41E-06 | 0 | 0 |
| West Cod - Gillnett-Baltistan - Medium - <110mm | 0.1 | 4.14E-06 | 0 | 0 |
| West Cod - Gillnett-Baltistan - Medium - >110mm | 0.1 | 3.58E-06 | 0 | 0 |
| West Cod - Gillnett-Baltistan - Large - <110mm | 0.1 | 3.58E-06 | 0 | 0 |
| West Cod - Gillnett-Baltistan - Large - >110mm | 0.1 | 3.58E-06 | 0 | 0 |
| East cod - OB Trawler-Baltistan - Small - <110mm | 0.1 | 3.58E-06 | 0 | 0 |
| East cod - OB Trawler-Baltistan - Small - >110mm | 0.1 | 3.58E-06 | 0 | 0 |
| East cod - OB Trawler-Baltistan - Medium - <110mm | 0.1 | 3.58E-06 | 0 | 0 |
| East cod - OB Trawler-Baltistan - Medium - >110mm | 0.1 | 4.45E-07 | 0 | 0 |
| East cod - OB Trawler-Baltistan - Large - <110mm | 0.1 | 2.42E-07 | 0 | 0 |
| East cod - OB Trawler-Baltistan - Large - >110mm | 0.1 | 1.42E-06 | 0 | 0 |
| East cod - Gillnett-Baltistan - Small - <110mm | 0.1 | 1.21E-06 | 0 | 0 |
| East cod - Gillnett-Baltistan - Small - >110mm | 0.1 | 1.21E-06 | 0 | 0 |
| East cod - Gillnett-Baltistan - Medium - <110mm | 0.1 | 1.21E-06 | 0 | 0 |
| East cod - Gillnett-Baltistan - Medium - >110mm | 0.1 | 1.21E-06 | 0 | 0 |
| East cod - Gillnett-Baltistan - Large - <110mm | 0.1 | 1.21E-06 | 0 | 0 |
| East cod - Gillnett-Baltistan - Large - >110mm | 0.1 | 1.21E-06 | 0 | 0 |

St.Dev(Q): Relative standard deviation of catchability used for stochastic simulation Biom.Param.: Parameter in mode

***Figure 2.18.3. Relative standard deviation of catchability coefficients for one country, Baltistan. The explanation below the table says:***

***St.Dev(Q): Relative standard deviation of catchability used for stochastic simulation***

***Biom.Param.: Parameter in model: $Q = Q_0 * Biomass \wedge Biom.Param.$***

***Tech.Dev.: $Q = Q_0 * exp(y*Tech.Dev)$. Rig.Effect: $Q = Q_0 * exp(Rig.Effect)$.***

# 3. EXECUTION OF A SIMULATION

TEMAS is implemented in the form of 4 independent workbooks:

5) TEMAS_INPUT (entry of input to TEMAS)
6) TEMAS_CALC (Simulations and output from TEMAS)
7) TEMAS_STO_OUT (Stochastic simulation output)
8) TEMAS_TUNING (calibration of parameters)

Chapter 3 deals with the worksheet TEMAS_CALC, which executes the simulations and produces the output from single simulations. Output from stochastic multiple simulations is handled by the worksheet TEMAS_STO_OUT. Worksheet TEMAS_CALC appears very much as TEMAS_INPUT. Menus are activated by a “fish school” command button. The following sections will explain the menus of TEMAS_CALC.

When running the program, you may do any calculation or manipulation of the input tables and output tables by aid of the facilities in EXCEL.

With the output produced by the calculation workbook, there is no special instruction on things you should not do. You can do anything you like with the output workbooks, except for deleting the sheets or renaming them.

There are five general warnings on thing you should not when running the package

WARNING 1: Do NOT delete any of the standard spreadsheets of the workbook, as that action will cause the program to crash.

WARNING 2: Do NOT insert or delete rows or columns between the input cells (cells indicated by colours, predominantly yellow colour). The yellow cell occur only in the data entry workbook.

WARNING 3: Do NOT change the names of the standard worksheets. If you do, the package will not function.

WARNING 4: Do NOT change the location of the standard directories.

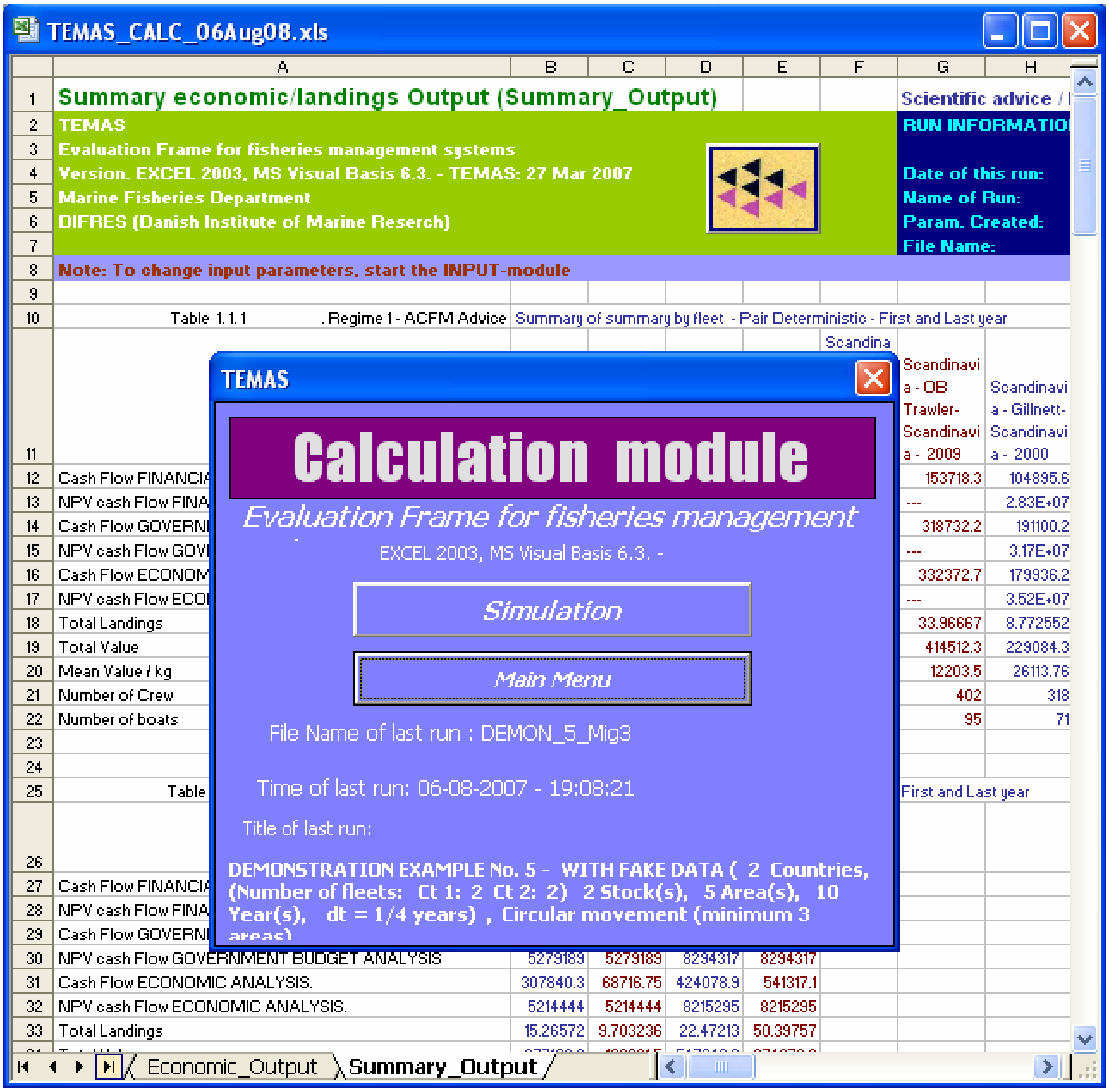
WARNING 5: Do NOT delete files or folders in the directory ”C:\TEMAS\Data\” by aid of Windows explorer: (where “TEMAS” is a generic name of the main directory of the system, as chosen by the user)

The data files can be deleted from main input menu, and when you want to delete data files, do it with the button ”Delete File(s)” in the menu of the main menu.

RECOMMENDATION 1: Do always keep a Backup file of your original data set. To be on the safe side you may from time to time make a copy of the entire data subdirectory.
Make also a backup of the entire system, so that in case everything goes wrong you can start up with a fresh version of system and your input data.
Making these backups takes very short time (seconds), whereas you may loose days of work if you loose your original data.

RECOMMENDATION 2: Use the ”Clear All sheets” button from time to time, as the workbook otherwise will grow in size. Without any data in the work sheets, each of the workbooks takes up about 2 Mb, but they may easily grow to 10 Mb after a number of applications.

In general: The package consists of two EXCEL workbooks. Follow the normal precautionary approaches when running EXCEL workbooks.



Summary economic/landings Output (Summary_Output)

TEMAS
Evaluation Frame for fisheries management systems
Version. EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 27 Mar 2007
Marine Fisheries Department
DIFRES (Danish Institute of Marine Reserch)

Scientific advice / I
RUN INFORMATIO
Date of this run:
Name of Run:
Param. Created:
File Name:

Note: To change input parameters, start the INPUT-module

Table 1.1.1 . Regime 1 - ACFM Advice Summary of summary by fleet - Pair Deterministic - First and Last year

| | | G | H |
|---|---|---|---|
| 11 | | Scandinavi a - OB Trawler- Scandinavi a - 2009 | Scandinavi a - Gillnett- Scandinavi a - 2000 |
| 12 | Cash Flow FINANCIA | 153718.3 | 104895.6 |
| 13 | NPV cash Flow FINA | --- | 2.83E+07 |
| 14 | Cash Flow GOVERNI | 318732.2 | 191100.2 |
| 15 | NPV cash Flow GOVI | --- | 3.17E+07 |
| 16 | Cash Flow ECONOM | 332372.7 | 179936.2 |
| 17 | NPV cash Flow ECOI | --- | 3.52E+07 |
| 18 | Total Landings | 33.96667 | 8.772552 |
| 19 | Total Value | 414512.3 | 229084.3 |
| 20 | Mean Value / kg | 12203.5 | 26113.76 |
| 21 | Number of Crew | 402 | 318 |
| 22 | Number of boats | 95 | 71 |

25 Table ... First and Last year

| | | B | C | D | E |
|---|---|---|---|---|---|
| 27 | Cash Flow FINANCIA | | | | |
| 28 | NPV cash Flow FINA | | | | |
| 29 | Cash Flow GOVERNI | | | | |
| 30 | NPV cash Flow GOVERNMENT BUDGET ANALYSIS | 5279189 | 5279189 | 8294317 | 8294317 |
| 31 | Cash Flow ECONOMIC ANALYSIS. | 307840.3 | 68716.75 | 424078.9 | 541317.1 |
| 32 | NPV cash Flow ECONOMIC ANALYSIS. | 5214444 | 5214444 | 8215295 | 8215295 |
| 33 | Total Landings | 15.26572 | 9.703236 | 22.47213 | 50.39757 |

TEMAS

Calculation module

Evaluation Frame for fisheries management

EXCEL 2003, MS Visual Basis 6.3. -

File Name of last run : DEMON_5_Mig3

Time of last run: 06-08-2007 - 19:08:21

Title of last run:

DEMONSTRATION EXAMPLE No. 5 - WITH FAKE DATA ( 2 Countries, (Number of fleets: Ct 1: 2 Ct 2: 2) 2 Stock(s), 5 Area(s), 10 Year(s), dt = 1/4 years) , Circular movement (minimum 3 areas)

***Figure 3.1.1. Opening of calculation module.***

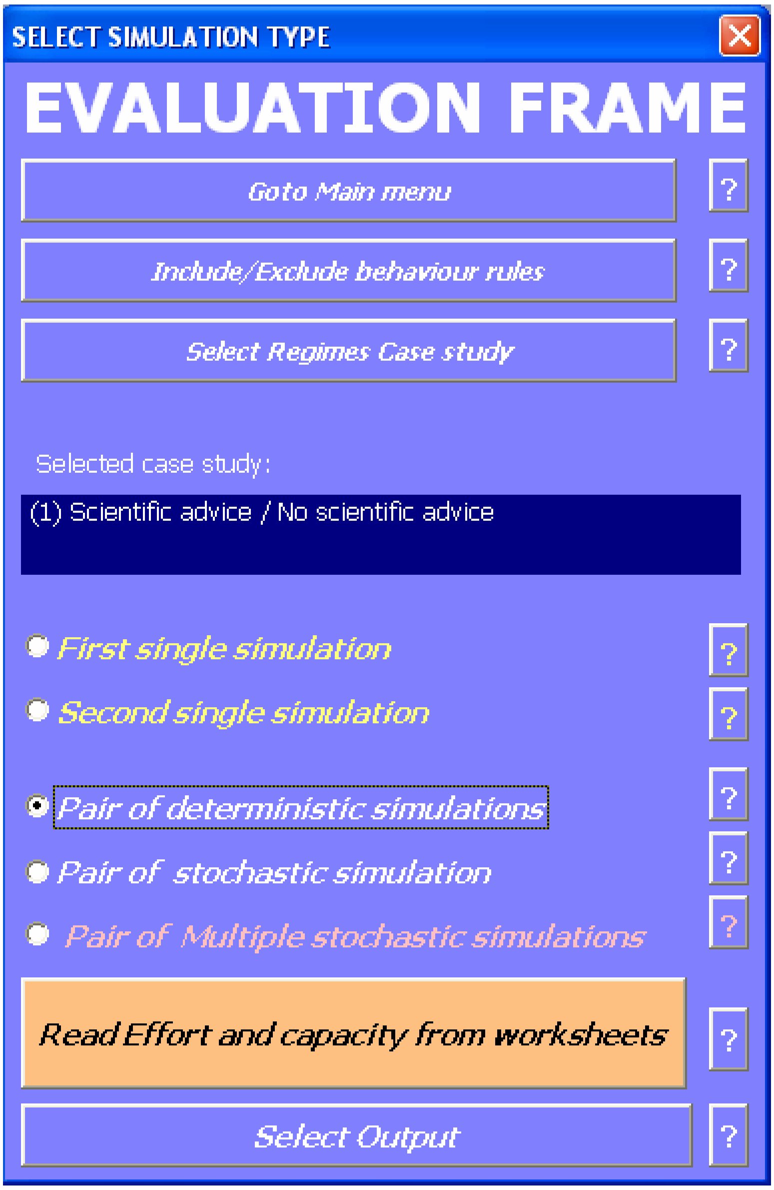
## 3.1. START UP

Figure 3.1.1 shows the opening form appearing after activating the workbook, “TEMAS_CALC_Date”. To start the calculations (the simulation) click on “simulations”. That will activate the userform for selection of type of simulation you want to execute (see the following section). Commandbutton “Main frame” allows you to make various types of file manipulation, and it offers the option for tuning of model, which is executed by a new userform (see Section 3.6).

## 3.2. SELECT SIMULATION

Figure 3.2.1 shows the user form for selection of type of simulation. Recall that TEMAS executes two alternative simulations (two alternative scenarios) and makes a comparison. We call the alternatives “first simulation” and “second simulation”. You may execute the simulations as a single simulation or as a pair of comparative simulations. You may execute the simulation in deterministic mode or stochastic mode. In stochastic mode there is the option to make many simulations of pairs of alternative scenarios, in order to estimate probability distributions of outputs. These options lead to 5 different types of simulations (five option buttons ◉)

| Type | Num-ber of scena-rios | Sto-chas-tic | Number of Simu-lations | Explanation |
|---|---|---|---|---|
| 1 | 1 | No | 1 | First deterministic single simulation. |
| 2 | 1 | No | 1 | Second deterministic single simulation. |
| 3 | 2 | No | 2 | Two deterministic (alternatives) simulations |
| 4 | 2 | Yes | 2 | Two stochastic (alternatives) simulations |
| 5 | 2 | yes | Many | Many repetitions of two stochastic (alternatives) simulations |



Selected case study:

(1) Scientific advice / No scientific advice

○ First single simulation

○ Second single simulation

● Pair of deterministic simulations

○ Pair of stochastic simulation

○ Pair of Multiple stochastic simulations

*Figure 3.2.1. Userform for selection of case study, behaviour models and run-type.*

The option to select a single deterministic simulation allocates the constant value ”1.0” to all stochastic factors. That is, the input values of parameters as they appear on the spreadsheet are used It produces output distributed over 16 (optional) worksheets. The details about the output sheets are presented in chapter 4.

| | | |
|---|---|---|
| 1 | Summary_Output | Summary Output |
| 2 | Economic_Output | Economic Output |
| 3 | Stock_Output | Annual Stock Output |
| 4 | Fleet_Output | Annual Fleet Output |
| 7 | Tuning_Output | Tuning Output |
| 8 | Rules | Behaviour Rules Output |
| 10 | St_Out_Period | Stock output by time period |
| 11 | St_Out_Area | Annual Stock output by area |
| 12 | St_Out_Per_Ar | Stock output by time period and area |
| 13 | Fl_Out_Period | Fleet output by time period |
| 14 | Fl_Out_Area | Annual Fleet output by area |
| 15 | Fl_Out_Per_Ar | Fleet output by time period and area |
| 16 | ICES_Output | Output from simulation of ICES assessment/advice |

The single simulation can be of the first or the second alternative.
The pair of deterministic simulations executes both alternative scenarios and makes a comparison.

This option “pair of stochastic simulations” draws the stochastic factors from random number generators. Parameters in the model which are modified by the so-called stochastic factors

(Modified Parameter) = (Reference Parameter) * (Stochastic Factor)

The stochastic parameters are described in Section 2.18.

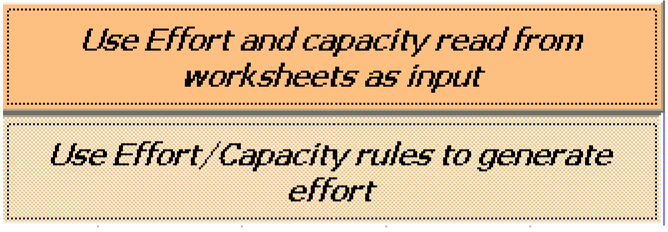
It makes two comparative simulations and displays detailed results in the work sheets
It also compares the two simulations. The format of output is exactly the same as that for the single stochastic simulation.

The last option “pair of multiple stochastic simulations” uses stochastic input described above.

It makes a number of simulations (the number on the user’s choice) and displays distributions of selected output variables in the work book “TEMAS_STO_OUT”.

Thus the multiple stochastic simulation repeats the calculations a large number of times (say, 1000 times), and each time with a new set of input parameters. The outputs are frequency diagrams of selected key output values

The “toggle button” in Figure 3.2.1



lets you choose the between two options for the creation of effort by fleet, area and time period:

1) Give all efforts as input parameters (in module TEMAS_INPUT).
2) Let the effort be determined by the behaviour rules (structural and trip-behaviour rules).

The behaviour model contains eight Effort/Capacity rules for the

1) Fishing effort rule
2) Dis-Investment rule
3) Investment rule
4) Attrition rule
5) Dis-investment rule

STOP

1) FISHING EFFORT RULE:

If during A time periods (e.g. one month):
Gross revenue < [F-operating cost + F-landing cost + crew share income + crew effort income]

Then a percentage X of the fleet will stop fishing for Y time periods

2) DIS-INVESTMENT RULE:

If for a continuous period of T years:
Financial net cash flow (excluding vessel decommission) <0
"Then a percentage Z of the fleet (round to integer) will withdraw from the fishery
T and Z are input variables

Withdrawal is either with or without decommission compensation

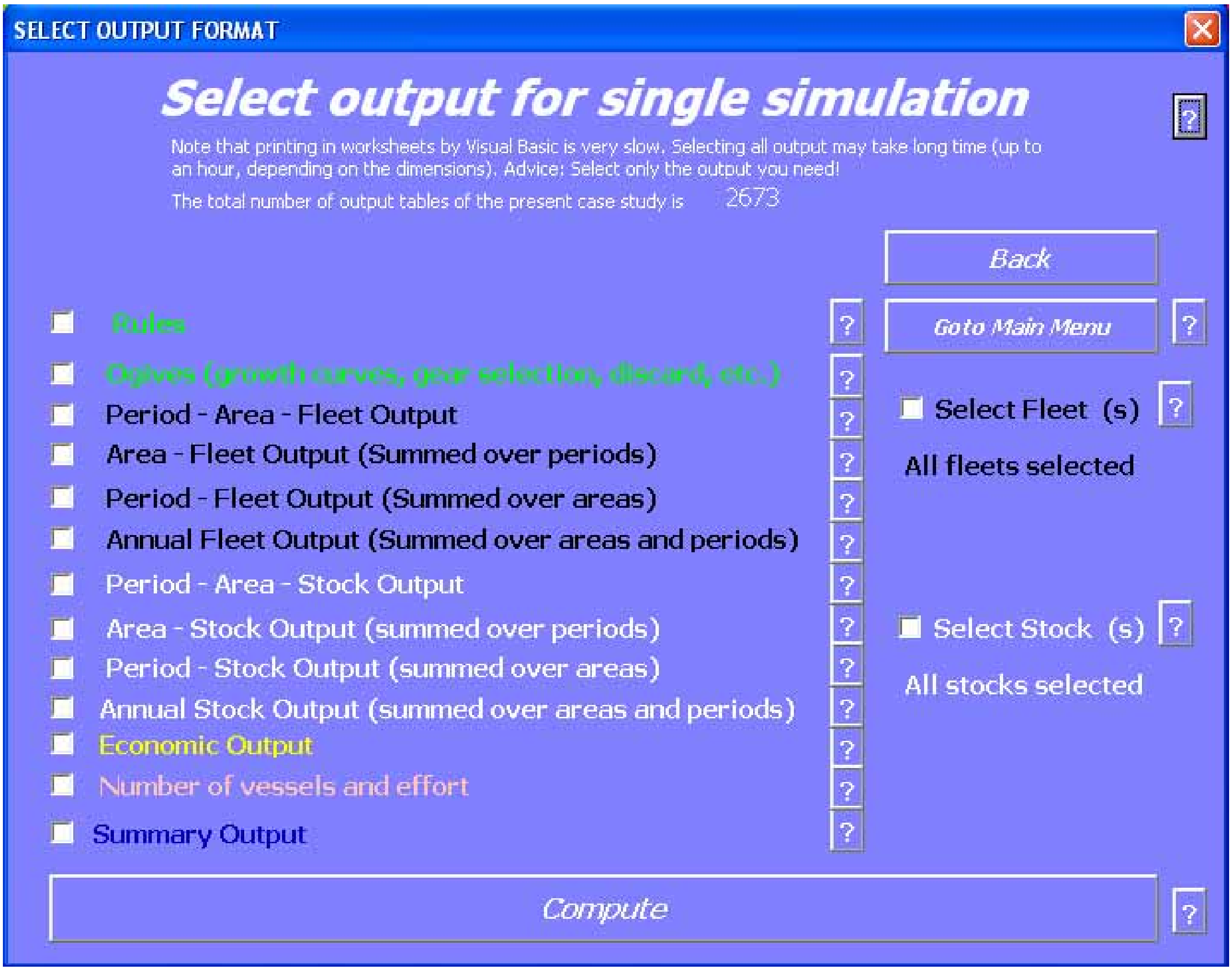
STOP
3) INVESTMENT RULE:

If for a continuous period of G years: Financial net cash flow > W
Then a percentage Q (round to integer) of the fleet will be added

4) ATTRITION RULE:

Every year a percentage B (round to integer) of the fleet retires due
to having reached the end of the technical life time of the vessels

## 3.3. SELECT OUTPUT FOR SINGLE SIMULATION



Note that printing in worksheets by Visual Basic is very slow. Selecting all output may take long time (up to an hour, depending on the dimensions). Advice: Select only the output you need!

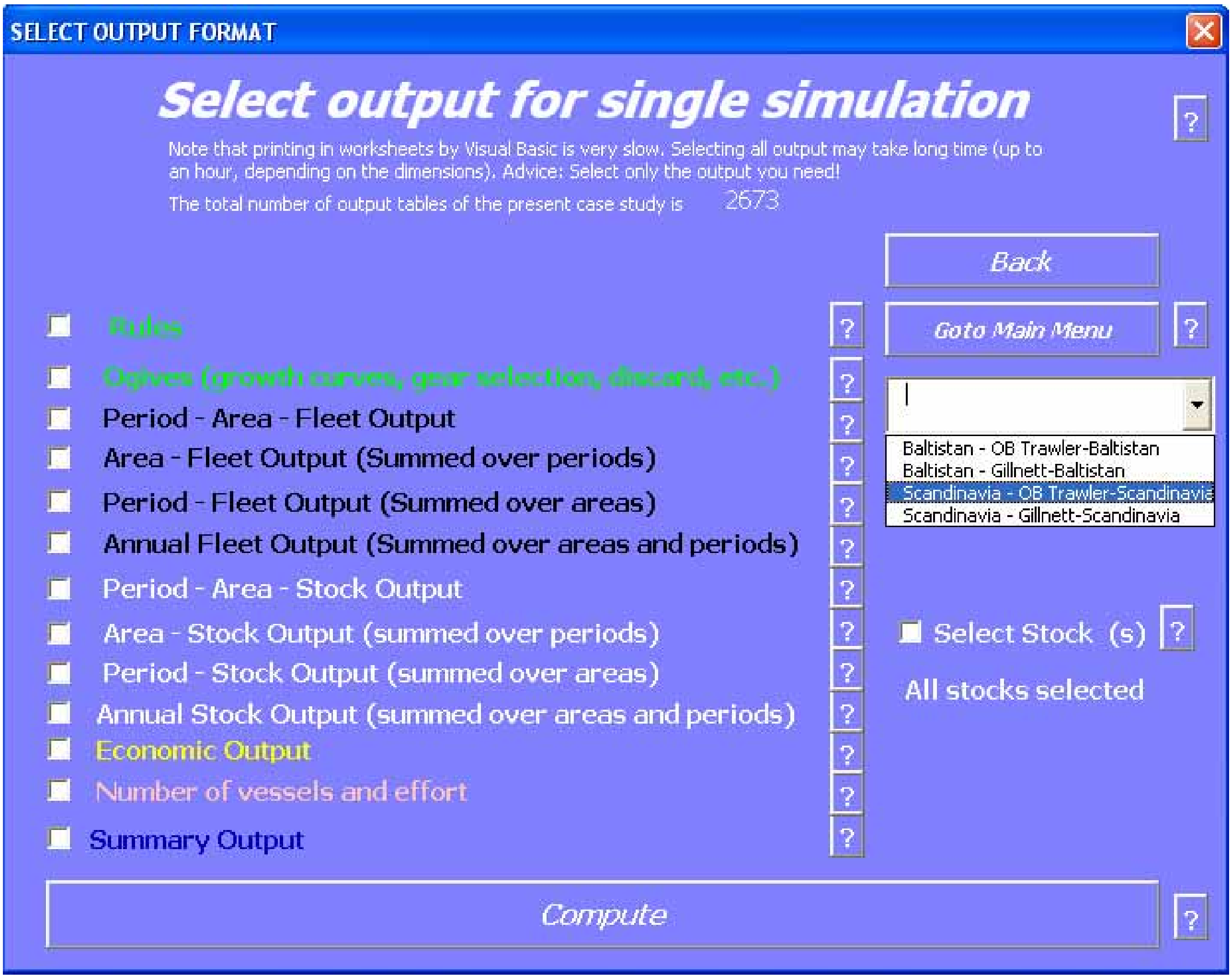
The total number of output tables of the present case study is 2673

☐ Rules
☐ Ogives (growth curves, gear selection, discard, etc.)
☐ Period - Area - Fleet Output
☐ Area - Fleet Output (Summed over periods)
☐ Period - Fleet Output (Summed over areas)
☐ Annual Fleet Output (Summed over areas and periods)
☐ Period - Area - Stock Output
☐ Area - Stock Output (summed over periods)
☐ Period - Stock Output (summed over areas)
☐ Annual Stock Output (summed over areas and periods)
☐ Economic Output
☐ Number of vessels and effort
☐ Summary Output

☐ Select Fleet (s)
All fleets selected

☐ Select Stock (s)
All stocks selected

*Figure 3.3.1. Userform for selection of output from the chosen simulation.*



Select output for single simulation

Note that printing in worksheets by Visual Basic is very slow. Selecting all output may take long time (up to an hour, depending on the dimensions). Advice: Select only the output you need!

The total number of output tables of the present case study is 2673

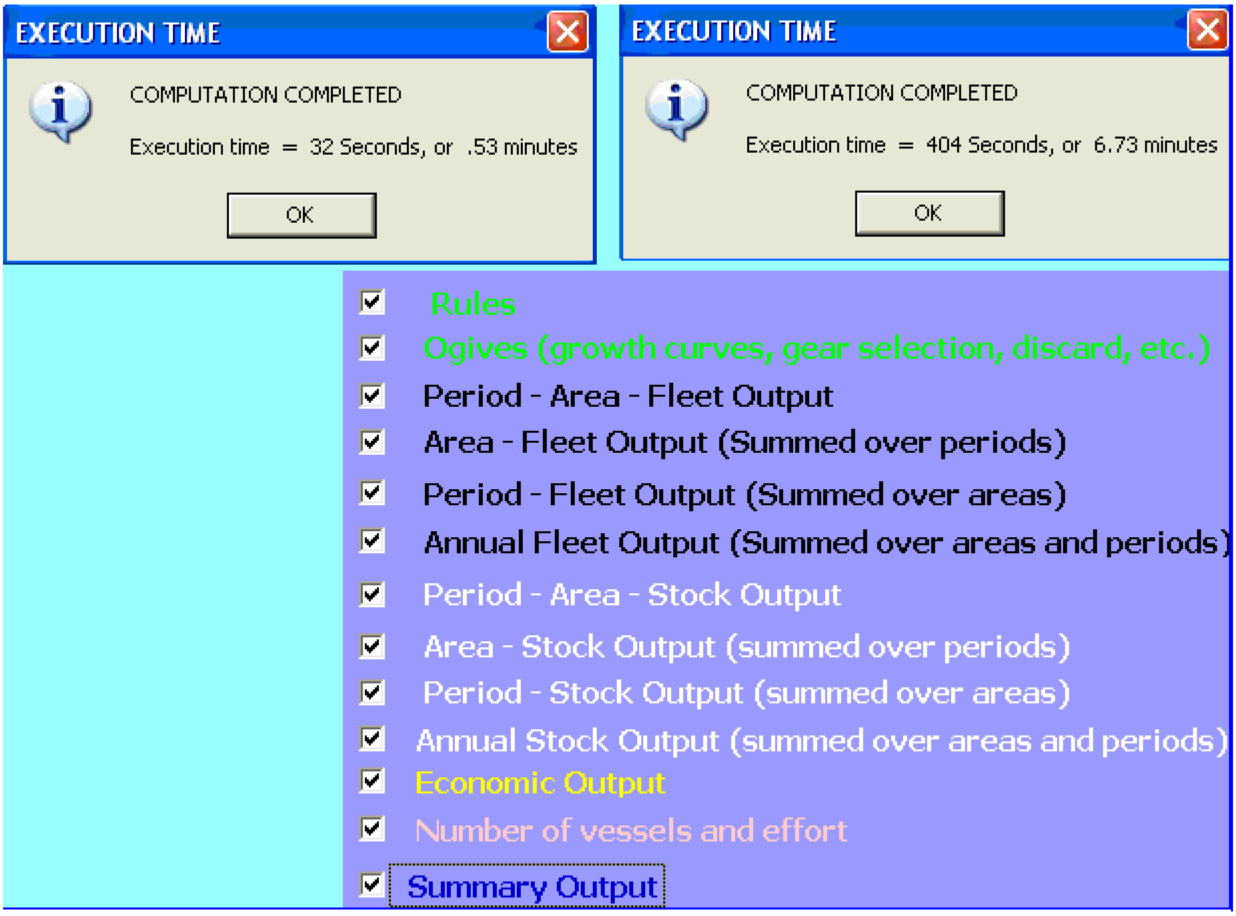
- ☐ Rules
- ☐ Ogives (growth curves, gear selection, discard, etc.)
- ☐ Period - Area - Fleet Output
- ☐ Area - Fleet Output (Summed over periods)
- ☐ Period - Fleet Output (Summed over areas)
- ☐ Annual Fleet Output (Summed over areas and periods)
- ☐ Period - Area - Stock Output
- ☐ Area - Stock Output (summed over periods)
- ☐ Period - Stock Output (summed over areas)
- ☐ Annual Stock Output (summed over areas and periods)
- ☐ Economic Output
- ☐ Number of vessels and effort
- ☐ Summary Output

Baltistan - OB Trawler-Baltistan
Baltistan - Gillnett-Baltistan
Scandinavia - OB Trawler-Scandinavia
Scandinavia - Gillnett-Scandinavia

☐ Select Stock (s)

All stocks selected

***Figure 3.3.2 Userform for selection of output from the chosen simulation. Her illustration of selection of a single fleet, which will be the only one for which results are displayed.***



COMPUTATION COMPLETED

Execution time = 32 Seconds, or .53 minutes

COMPUTATION COMPLETED

Execution time = 404 Seconds, or 6.73 minutes

☑ Rules
☑ Ogives (growth curves, gear selection, discard, etc.)
☑ Period - Area - Fleet Output
☑ Area - Fleet Output (Summed over periods)
☑ Period - Fleet Output (Summed over areas)
☑ Annual Fleet Output (Summed over areas and periods)
☑ Period - Area - Stock Output
☑ Area - Stock Output (summed over periods)
☑ Period - Stock Output (summed over areas)
☑ Annual Stock Output (summed over areas and periods)
☑ Economic Output
☑ Number of vessels and effort
☑ Summary Output

***Figure 3.3.3. Message at the end of simulation. The left hand side completion message represents a run with no display of output, and the right hand side the maximum number of tables displayed (as indicated on the lower part of the picture)***

## 3.4. INCLUDE/EXCLUDE BEHAVIOUR RULES

Behaviour Rules

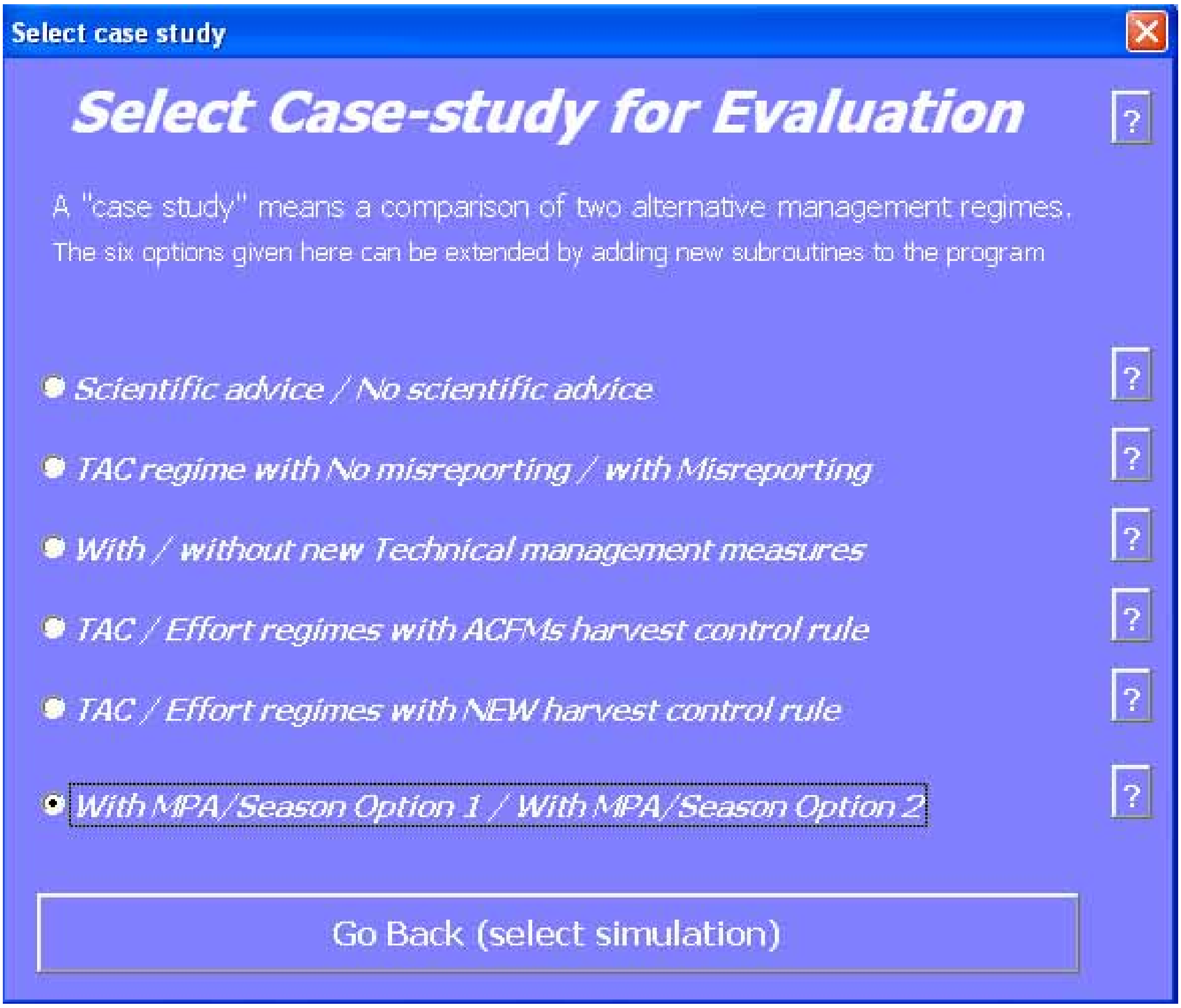
Include/Exclude Rules

Select the rules to be applied in sthe simulation.

- ☑ Apply Attrition rules
- ☑ Apply Dis-investment rules
- ☑ Apply Investment rules
- ☑ Apply Decommission rules
- ☑ Apply discard practice rule
- ☑ Apply Effort rigging allocation rule
- ☑ Apply Effort area allocation rule
- ☑ Apply Effort level rule

*Figure 3.4.1. Selection of behaviour rules for inclusion/exclusion.*

## 3.5. SELECT CASE STUDY



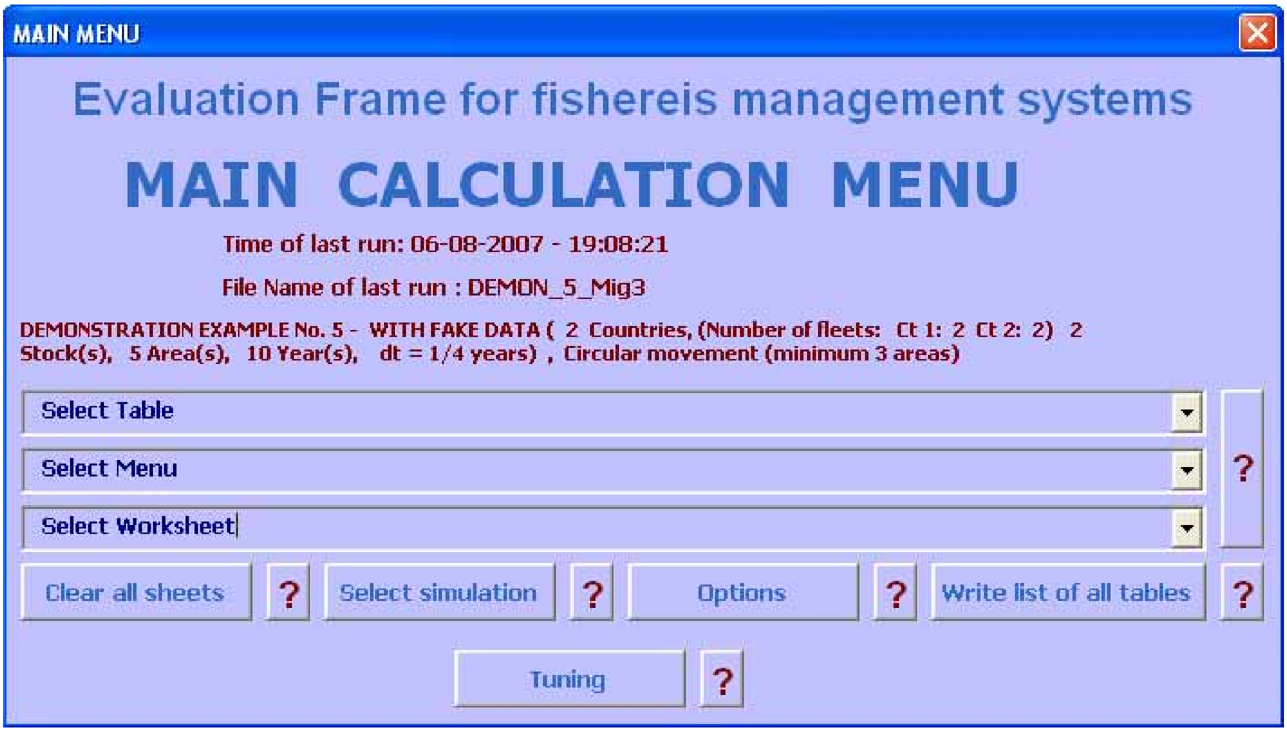
Select Case-study for Evaluation

A "case study" means a comparison of two alternative management regimes.
The six options given here can be extended by adding new subroutines to the program

- ○ Scientific advice / No scientific advice
- ○ TAC regime with No misreporting / with Misreporting
- ○ With / without new Technical management measures
- ○ TAC / Effort regimes with ACFMs harvest control rule
- ○ TAC / Effort regimes with NEW harvest control rule
- ● With MPA/Season Option 1 / With MPA/Season Option 2

*Figure 3.5.1. Selection of case study.*

## 3.6. MAIN MENU FOR CALCULATION MODULE



MAIN MENU

Evaluation Frame for fishereis management systems

MAIN CALCULATION MENU

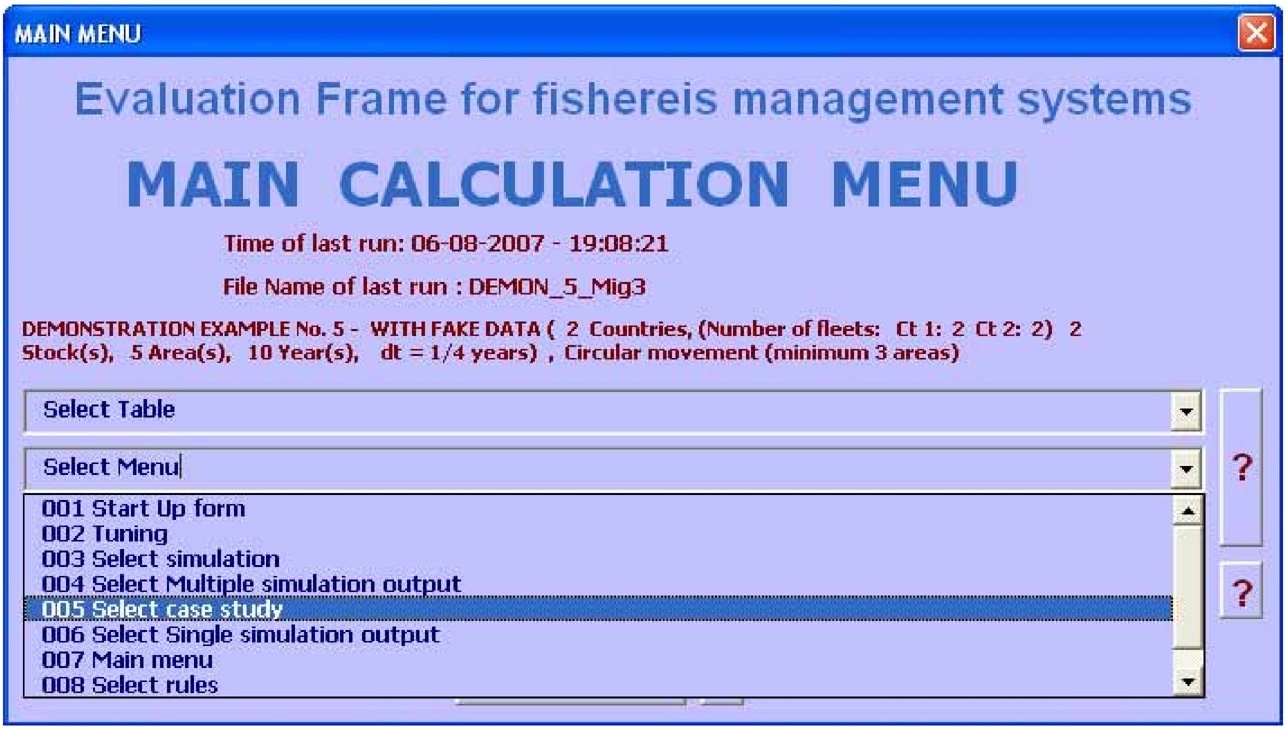
Time of last run: 06-08-2007 - 19:08:21

File Name of last run : DEMON_5_Mig3

DEMONSTRATION EXAMPLE No. 5 - WITH FAKE DATA ( 2 Countries, (Number of fleets: Ct 1: 2 Ct 2: 2) 2 Stock(s), 5 Area(s), 10 Year(s), dt = 1/4 years) , Circular movement (minimum 3 areas)

*Figure 3.6.1.a. Main menu of calculation module.*

…



MAIN MENU

Evaluation Frame for fishereis management systems

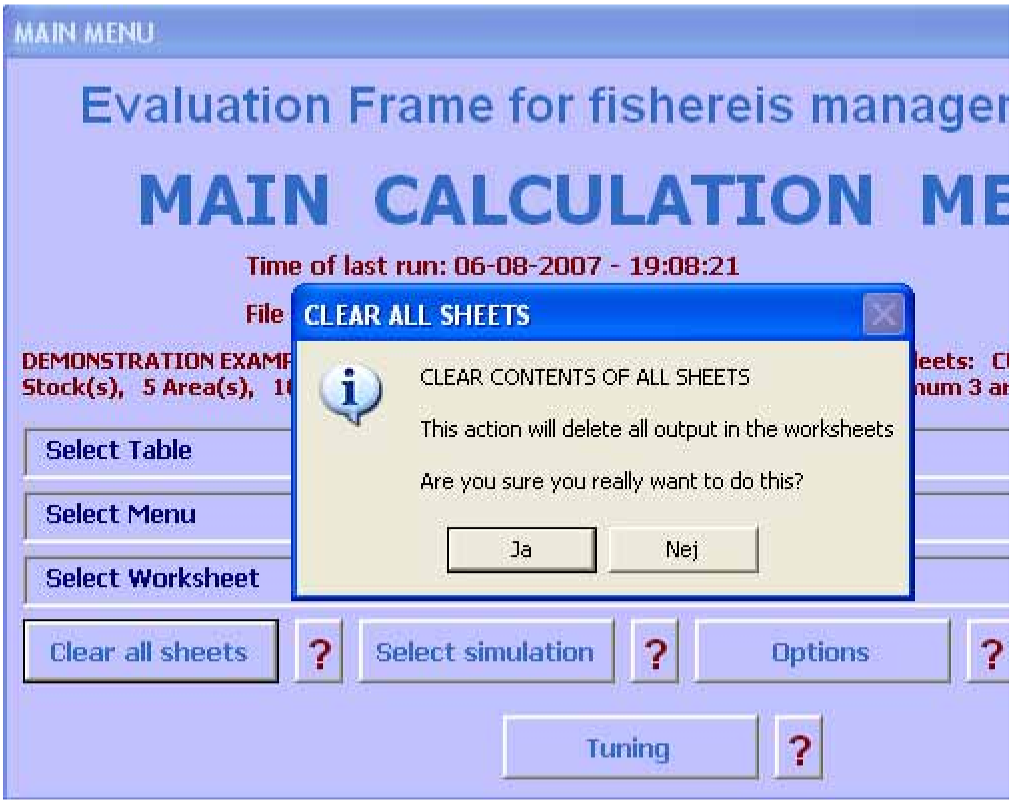
MAIN CALCULATION MENU

Time of last run: 06-08-2007 - 19:08:21

File Name of last run : DEMON_5_Mig3

DEMONSTRATION EXAMPLE No. 5 - WITH FAKE DATA ( 2 Countries, (Number of fleets: Ct 1: 2 Ct 2: 2) 2 Stock(s), 5 Area(s), 10 Year(s), dt = 1/4 years) , Circular movement (minimum 3 areas)

*Figure 3.6.1.b. Main menu of calculation module, with illustration of selection of menu.*



CLEAR CONTENTS OF ALL SHEETS

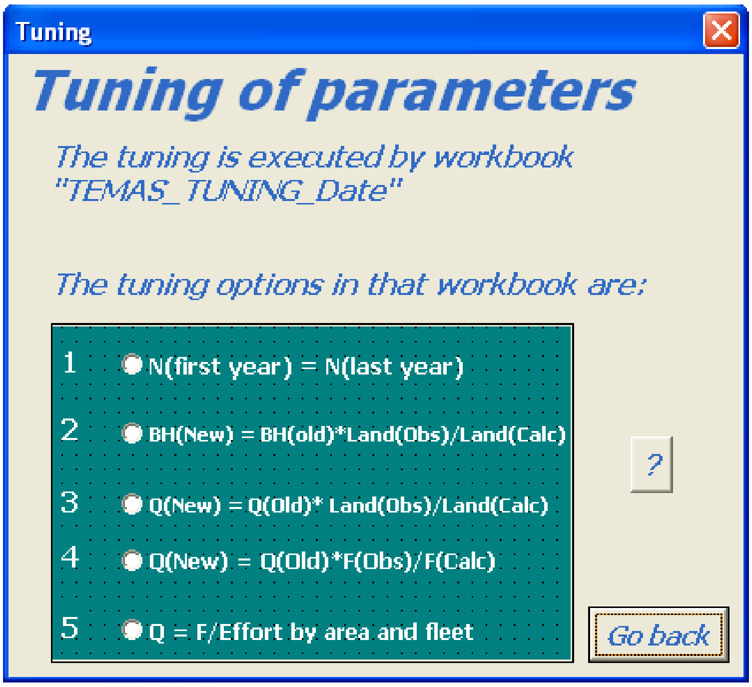
This action will delete all output in the worksheets

Are you sure you really want to do this?

*Figure 3.6.1.c. Main menu of calculation module, with illustration of"clear all sheets".*

☐ Show cell comments

*Figure 3.6.2. "Options in Main menu.*



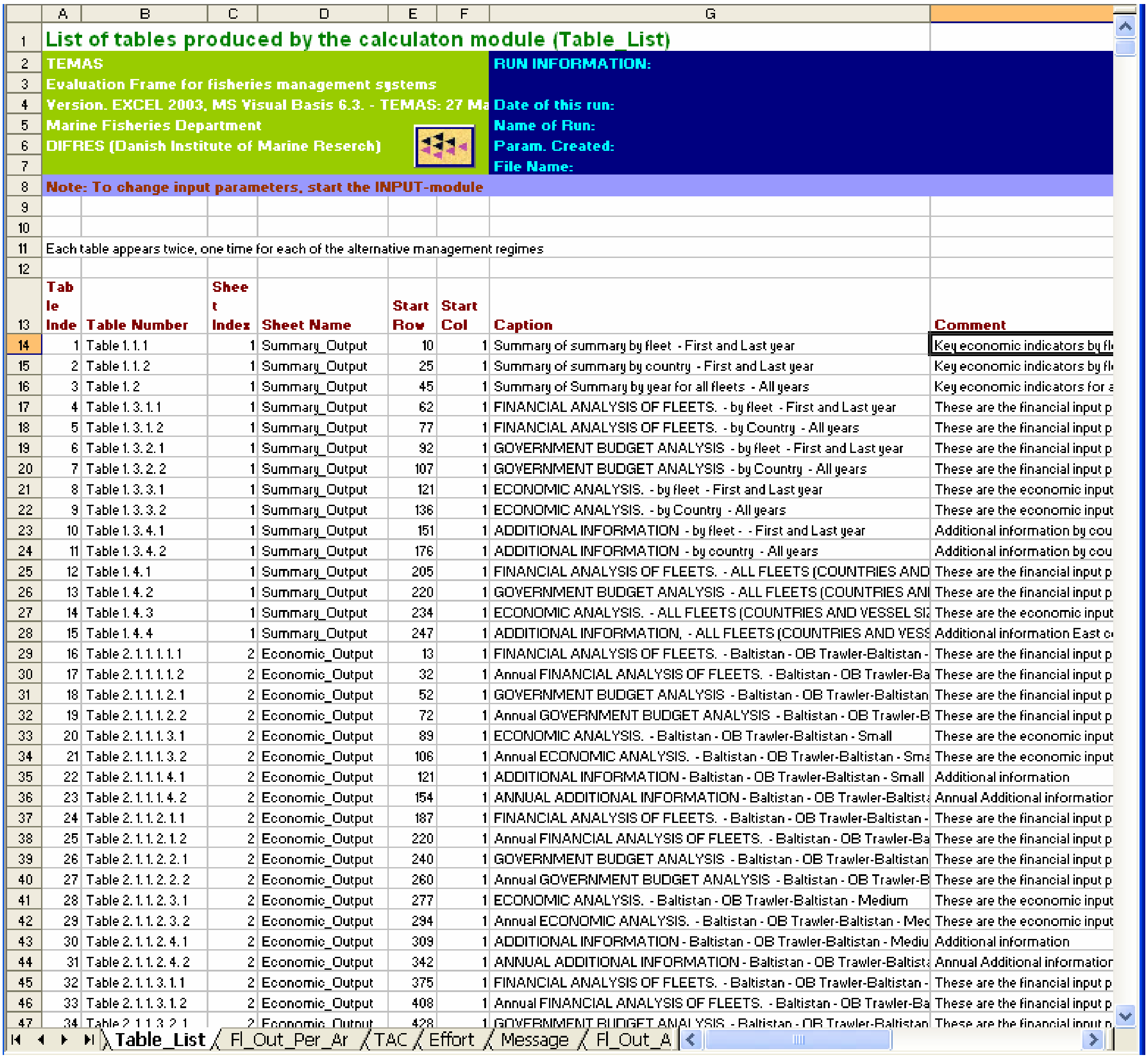
**Tuning of parameters**

*The tuning is executed by workbook "TEMAS_TUNING_Date"*

*The tuning options in that workbook are:*

1 ○ N(first year) = N(last year)
2 ○ BH(New) = BH(old)*Land(Obs)/Land(Calc)
3 ○ Q(New) = Q(Old)* Land(Obs)/Land(Calc)
4 ○ Q(New) = Q(Old)*F(Obs)/F(Calc)
5 ○ Q = F/Effort by area and fleet

***Figure 3.6.3. Message when clicking on "Tuning", which is executed by another workbook, "TEMAS_TUNING"***



**List of tables produced by the calculaton module (Table_List)**

**TEMAS**
**Evaluation Frame for fisheries management systems**
**Version. EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 27 Ma**
**Marine Fisheries Department**
**DIFRES (Danish Institute of Marine Reserch)**

**RUN INFORMATION:**
**Date of this run:**
**Name of Run:**
**Param. Created:**
**File Name:**

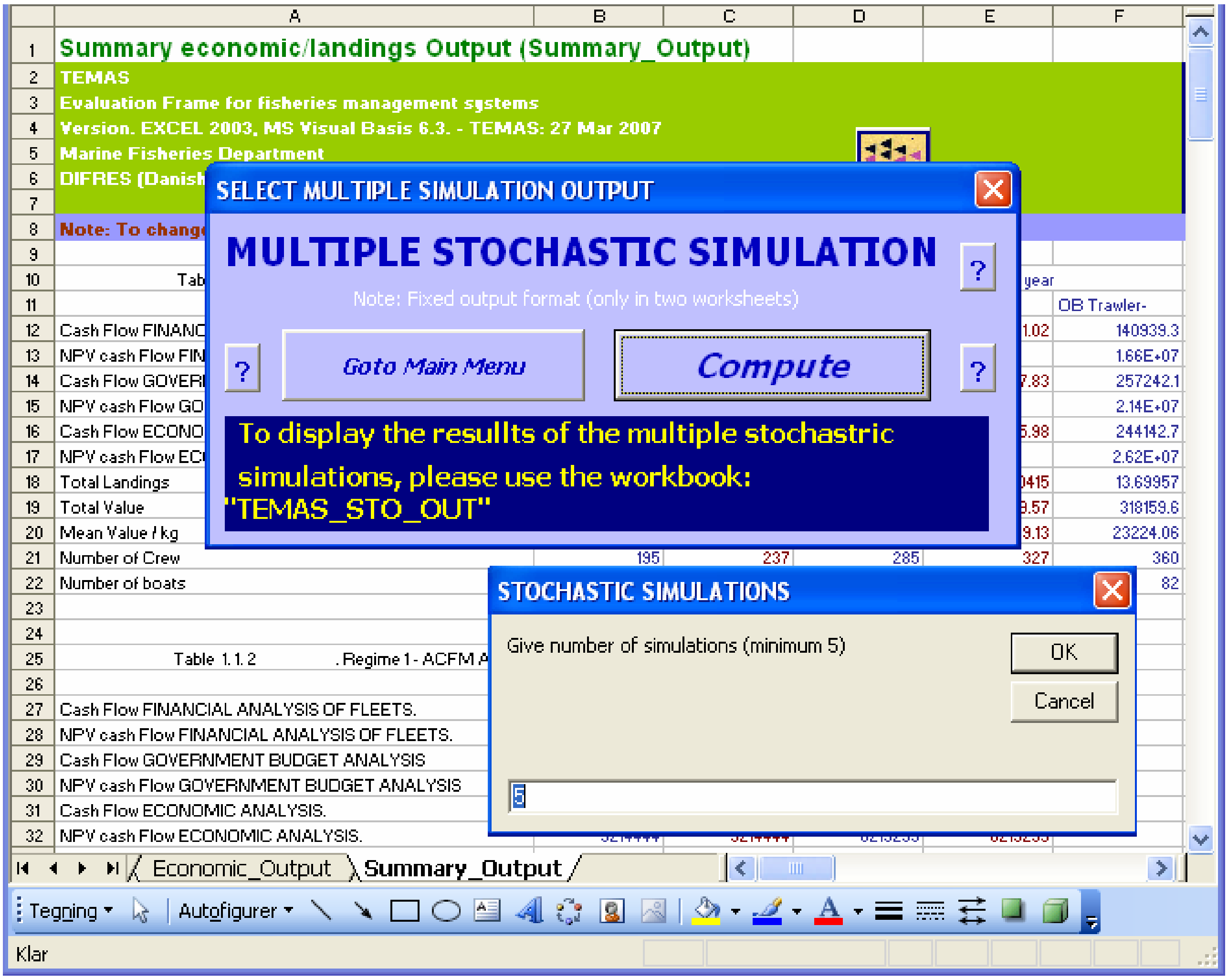
**Note: To change input parameters, start the INPUT-module**

Each table appears twice, one time for each of the alternative management regimes

| | Table Inde | Table Number | Sheet Index | Sheet Name | Start Row | Start Col | Caption | Comment |
|---|---|---|---|---|---|---|---|---|
| 14 | 1 | Table 1.1.1 | 1 | Summary_Output | 10 | 1 | Summary of summary by fleet - First and Last year | Key economic indicators by fl |
| 15 | 2 | Table 1.1.2 | 1 | Summary_Output | 25 | 1 | Summary of summary by country - First and Last year | Key economic indicators by fl |
| 16 | 3 | Table 1.2 | 1 | Summary_Output | 45 | 1 | Summary of Summary by year for all fleets - All years | Key economic indicators for a |
| 17 | 4 | Table 1.3.1.1 | 1 | Summary_Output | 62 | 1 | FINANCIAL ANALYSIS OF FLEETS. - by fleet - First and Last year | These are the financial input p |
| 18 | 5 | Table 1.3.1.2 | 1 | Summary_Output | 77 | 1 | FINANCIAL ANALYSIS OF FLEETS. - by Country - All years | These are the financial input p |
| 19 | 6 | Table 1.3.2.1 | 1 | Summary_Output | 92 | 1 | GOVERNMENT BUDGET ANALYSIS - by fleet - First and Last year | These are the financial input p |
| 20 | 7 | Table 1.3.2.2 | 1 | Summary_Output | 107 | 1 | GOVERNMENT BUDGET ANALYSIS - by Country - All years | These are the financial input p |
| 21 | 8 | Table 1.3.3.1 | 1 | Summary_Output | 121 | 1 | ECONOMIC ANALYSIS. - by fleet - First and Last year | These are the economic input |
| 22 | 9 | Table 1.3.3.2 | 1 | Summary_Output | 136 | 1 | ECONOMIC ANALYSIS. - by Country - All years | These are the economic input |
| 23 | 10 | Table 1.3.4.1 | 1 | Summary_Output | 151 | 1 | ADDITIONAL INFORMATION - by fleet - - First and Last year | Additional information by cou |
| 24 | 11 | Table 1.3.4.2 | 1 | Summary_Output | 176 | 1 | ADDITIONAL INFORMATION - by country - All years | Additional information by cou |
| 25 | 12 | Table 1.4.1 | 1 | Summary_Output | 205 | 1 | FINANCIAL ANALYSIS OF FLEETS. - ALL FLEETS (COUNTRIES AND | These are the financial input p |
| 26 | 13 | Table 1.4.2 | 1 | Summary_Output | 220 | 1 | GOVERNMENT BUDGET ANALYSIS - ALL FLEETS (COUNTRIES ANI | These are the financial input p |
| 27 | 14 | Table 1.4.3 | 1 | Summary_Output | 234 | 1 | ECONOMIC ANALYSIS. - ALL FLEETS (COUNTRIES AND VESSEL SI: | These are the economic input |
| 28 | 15 | Table 1.4.4 | 1 | Summary_Output | 247 | 1 | ADDITIONAL INFORMATION, - ALL FLEETS (COUNTRIES AND VESS | Additional information East c |
| 29 | 16 | Table 2.1.1.1.1.1 | 2 | Economic_Output | 13 | 1 | FINANCIAL ANALYSIS OF FLEETS. - Baltistan - OB Trawler-Baltistan - | These are the financial input p |
| 30 | 17 | Table 2.1.1.1.1.2 | 2 | Economic_Output | 32 | 1 | Annual FINANCIAL ANALYSIS OF FLEETS. - Baltistan - OB Trawler-Ba | These are the financial input p |
| 31 | 18 | Table 2.1.1.1.2.1 | 2 | Economic_Output | 52 | 1 | GOVERNMENT BUDGET ANALYSIS - Baltistan - OB Trawler-Baltistan | These are the financial input p |
| 32 | 19 | Table 2.1.1.1.2.2 | 2 | Economic_Output | 72 | 1 | Annual GOVERNMENT BUDGET ANALYSIS - Baltistan - OB Trawler-B | These are the financial input p |
| 33 | 20 | Table 2.1.1.1.3.1 | 2 | Economic_Output | 89 | 1 | ECONOMIC ANALYSIS. - Baltistan - OB Trawler-Baltistan - Small | These are the economic input |
| 34 | 21 | Table 2.1.1.1.3.2 | 2 | Economic_Output | 106 | 1 | Annual ECONOMIC ANALYSIS. - Baltistan - OB Trawler-Baltistan - Sma | These are the economic input |
| 35 | 22 | Table 2.1.1.1.4.1 | 2 | Economic_Output | 121 | 1 | ADDITIONAL INFORMATION - Baltistan - OB Trawler-Baltistan - Small | Additional information |
| 36 | 23 | Table 2.1.1.1.4.2 | 2 | Economic_Output | 154 | 1 | ANNUAL ADDITIONAL INFORMATION - Baltistan - OB Trawler-Baltist: | Annual Additional informatior |
| 37 | 24 | Table 2.1.1.2.1.1 | 2 | Economic_Output | 187 | 1 | FINANCIAL ANALYSIS OF FLEETS. - Baltistan - OB Trawler-Baltistan - | These are the financial input p |
| 38 | 25 | Table 2.1.1.2.1.2 | 2 | Economic_Output | 220 | 1 | Annual FINANCIAL ANALYSIS OF FLEETS. - Baltistan - OB Trawler-Ba | These are the financial input p |
| 39 | 26 | Table 2.1.1.2.2.1 | 2 | Economic_Output | 240 | 1 | GOVERNMENT BUDGET ANALYSIS - Baltistan - OB Trawler-Baltistan | These are the financial input p |
| 40 | 27 | Table 2.1.1.2.2.2 | 2 | Economic_Output | 260 | 1 | Annual GOVERNMENT BUDGET ANALYSIS - Baltistan - OB Trawler-B | These are the financial input p |
| 41 | 28 | Table 2.1.1.2.3.1 | 2 | Economic_Output | 277 | 1 | ECONOMIC ANALYSIS. - Baltistan - OB Trawler-Baltistan - Medium | These are the economic input |
| 42 | 29 | Table 2.1.1.2.3.2 | 2 | Economic_Output | 294 | 1 | Annual ECONOMIC ANALYSIS. - Baltistan - OB Trawler-Baltistan - Mec | These are the economic input |
| 43 | 30 | Table 2.1.1.2.4.1 | 2 | Economic_Output | 309 | 1 | ADDITIONAL INFORMATION - Baltistan - OB Trawler-Baltistan - Mediu | Additional information |
| 44 | 31 | Table 2.1.1.2.4.2 | 2 | Economic_Output | 342 | 1 | ANNUAL ADDITIONAL INFORMATION - Baltistan - OB Trawler-Baltist: | Annual Additional informatior |
| 45 | 32 | Table 2.1.1.3.1.1 | 2 | Economic_Output | 375 | 1 | FINANCIAL ANALYSIS OF FLEETS. - Baltistan - OB Trawler-Baltistan - | These are the financial input p |
| 46 | 33 | Table 2.1.1.3.1.2 | 2 | Economic_Output | 408 | 1 | Annual FINANCIAL ANALYSIS OF FLEETS. - Baltistan - OB Trawler-Ba | These are the financial input p |
| 47 | 34 | Table 2.1.1.3.2.1 | 2 | Economic_Output | 428 | 1 | GOVERNMENT BUDGET ANALYSIS - Baltistan - OB Trawler-Baltistan | These are the financial input p |

*Figure 3.6.4. List of tables produced by the “TEMAS_CALC” workbook.*

### 3.7. MULTIPLE STOCHASTIC SIMULATION



Summary economic/landings Output (Summary_Output)
TEMAS
Evaluation Frame for fisheries management systems
Version. EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 27 Mar 2007
Marine Fisheries Department
DIFRES (Danish

Note: To change

SELECT MULTIPLE SIMULATION OUTPUT

MULTIPLE STOCHASTIC SIMULATION

Note: Fixed output format (only in two worksheets)

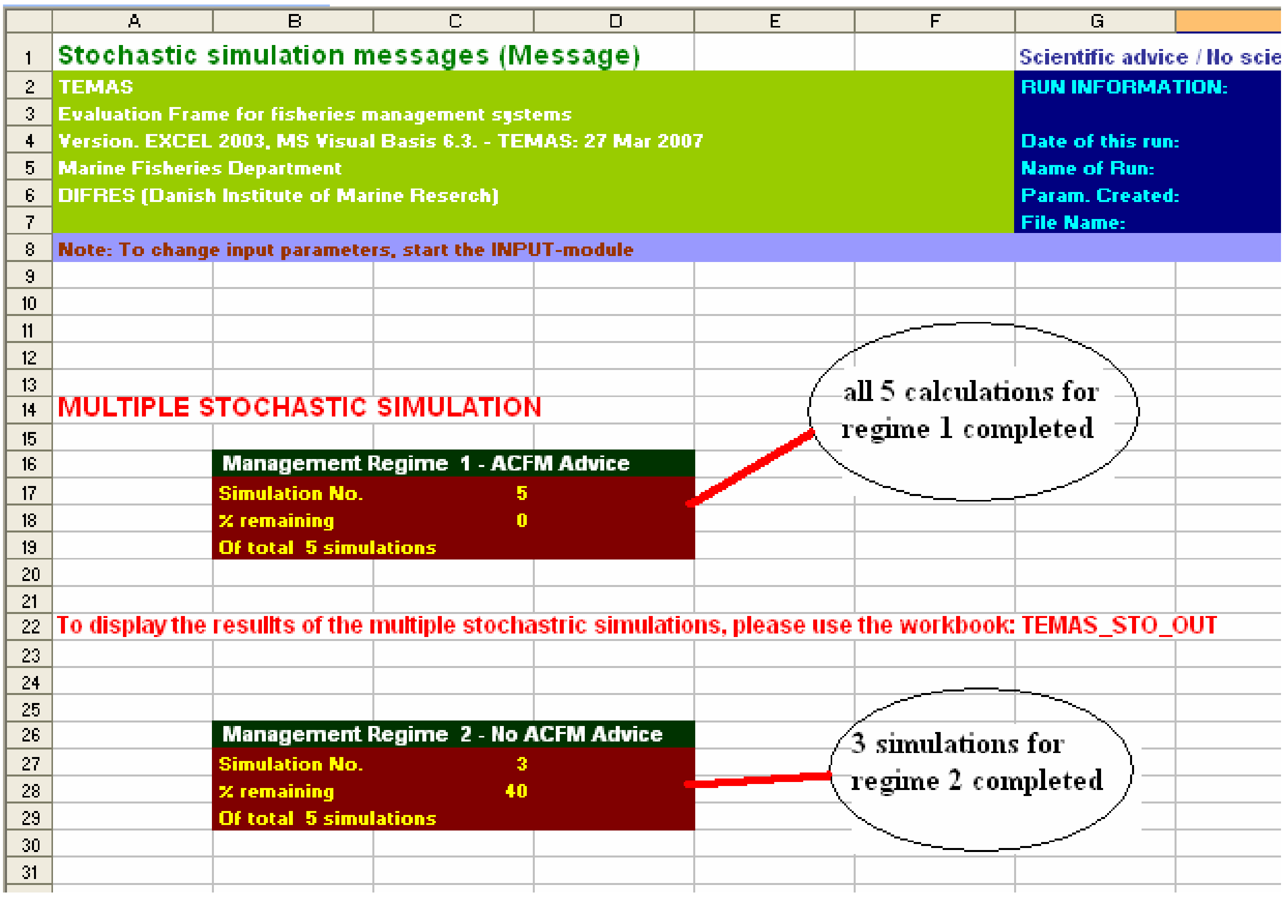
To display the resullts of the multiple stochastric simulations, please use the workbook: "TEMAS_STO_OUT"

STOCHASTIC SIMULATIONS

Give number of simulations (minimum 5)

5

*Figure 3.7.1. Userform to start the stochastic (multiple) simulations.*



Stochastic simulation messages (Message)

Scientific advice / No scie

TEMAS

Evaluation Frame for fisheries management systems

Version. EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 27 Mar 2007

Marine Fisheries Department

DIFRES (Danish Institute of Marine Reserch)

RUN INFORMATION:

Date of this run:

Name of Run:

Param. Created:

File Name:

Note: To change input parameters, start the INPUT-module

MULTIPLE STOCHASTIC SIMULATION

Management Regime 1 - ACFM Advice

Simulation No. 5

% remaining 0

Of total 5 simulations

all 5 calculations for regime 1 completed

To display the resullts of the multiple stochastric simulations, please use the workbook: TEMAS_STO_OUT

Management Regime 2 - No ACFM Advice

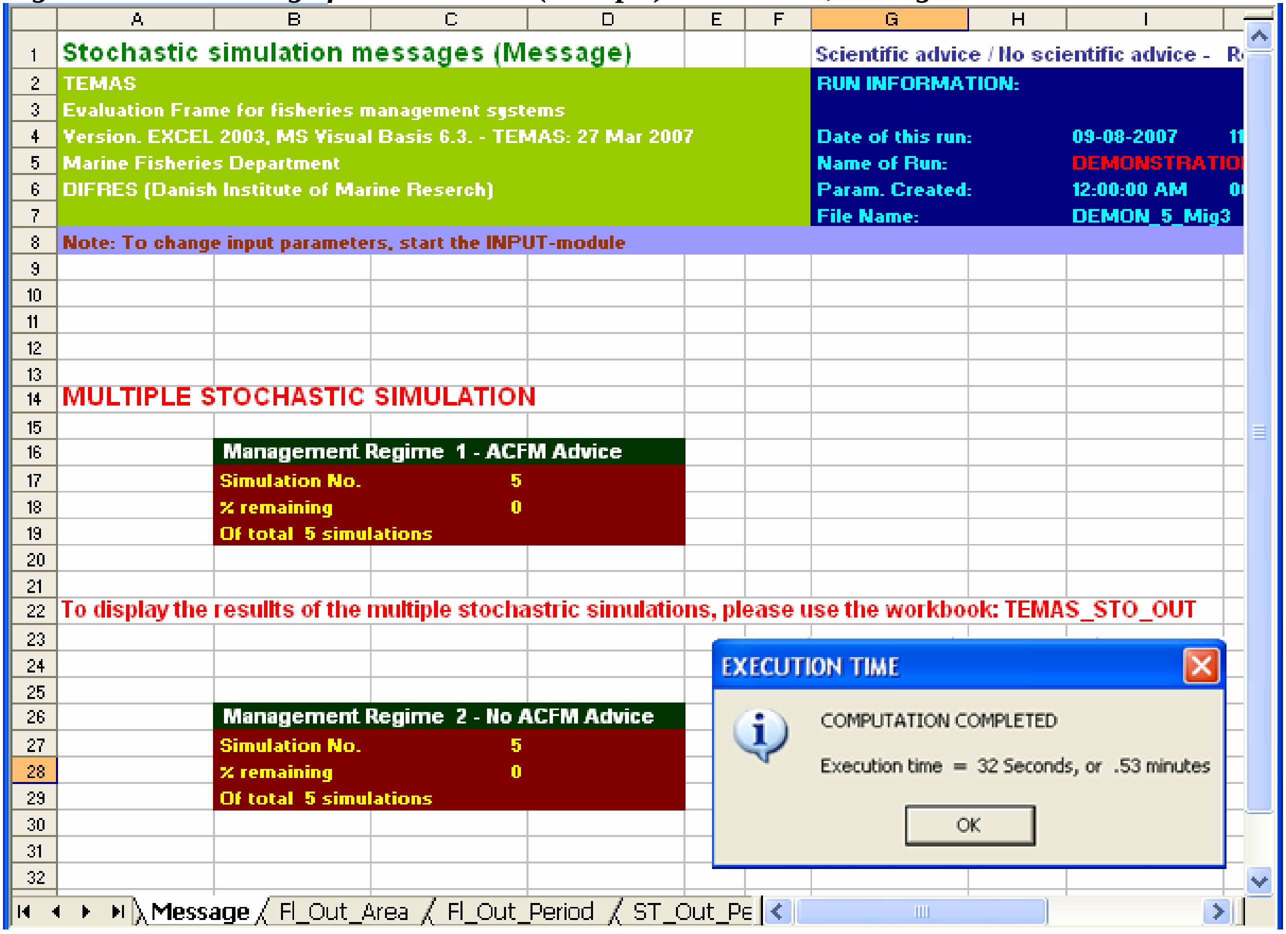
Simulation No. 3

% remaining 40

Of total 5 simulations

3 simulations for regime 2 completed

*Figure 3.7.2.a. Message from stochastic (multiple) simulations, during execution.*



Stochastic simulation messages (Message)

Scientific advice / No scientific advice - R

TEMAS

Evaluation Frame for fisheries management systems

Version. EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 27 Mar 2007

Marine Fisheries Department

DIFRES (Danish Institute of Marine Reserch)

RUN INFORMATION:

Date of this run: 09-08-2007 11

Name of Run: DEMONSTRATIO

Param. Created: 12:00:00 AM 0

File Name: DEMON_5_Mig3

Note: To change input parameters, start the INPUT-module

MULTIPLE STOCHASTIC SIMULATION

Management Regime 1 - ACFM Advice

Simulation No. 5

% remaining 0

Of total 5 simulations

To display the resullts of the multiple stochastric simulations, please use the workbook: TEMAS_STO_OUT

Management Regime 2 - No ACFM Advice

Simulation No. 5

% remaining 0

Of total 5 simulations

EXECUTION TIME

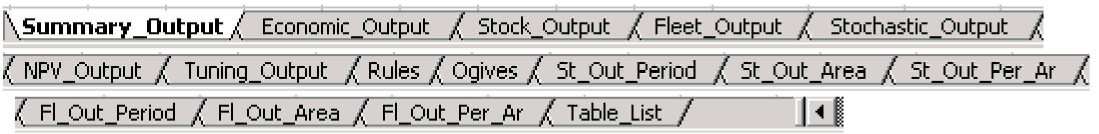
COMPUTATION COMPLETED

Execution time = 32 Seconds, or .53 minutes

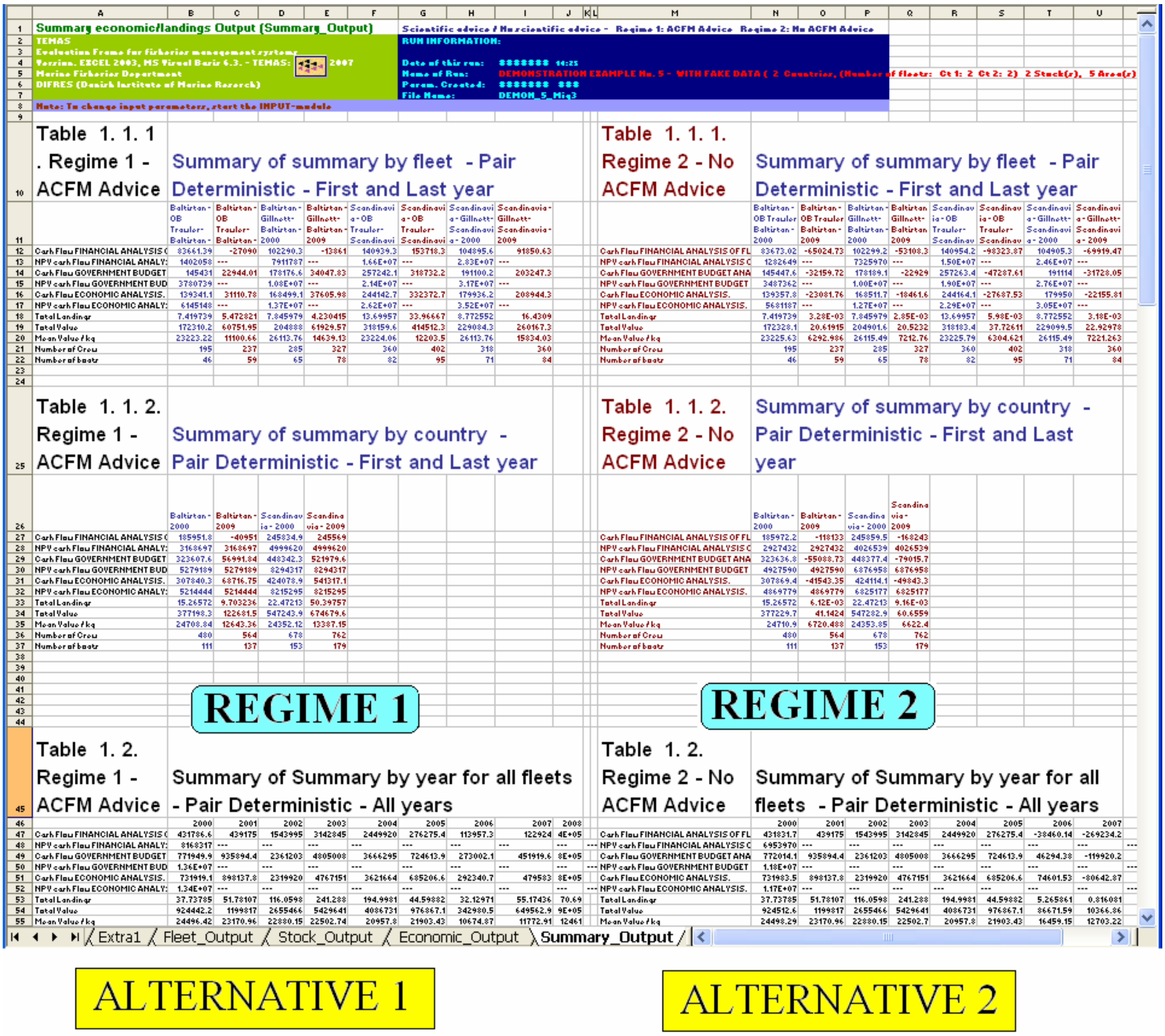
*Figure 3.7.2.b. Message from stochastic (multiple) simulations when completed.*

# 4. OUTPUT FROM TEMAS

As input to TEMAS, the Output is also separated into stock structured output and fleet structured output, as indicated by the names of the 16 output worksheets in workbook TEMAS_CALC:



1) “Summary_output” (Figure 3.1.1-2)
2) “Stock_Output” (stock structured output, Tables 3.3.1-2)
3) “Fleet_Output”, (Fleet and fleet/stock structured output, Tables 3.3.3-4)
4) “Economy_Output”, (Table 3.4.1-2)
5) “Stochastic_Output” (Figures 3.2.1 and 3.5.1, Tables 3.5.1-2)
6) “NPV_Output” (NPV = “Net Present Value”).
7) “Tuning_Output” (Figure 4.6.2)
8) “Rules”
9) “Ogives” (gear selection ogive, discard ogives and growth curves, not shown here)
10) "St_Out_Period", "Stock output by time period (summed over areas)"
11) "St_Out_Area", "Annual Stock output by area (summed over periods)"
12) "St_Out_Per_Ar", "Stock output by time period and area"
13) "Fl_Out_Period", "Fleet output by time period (summed over areas)"
14) "Fl_Out_Area", "Annual Fleet output by area (summed over periods)"
15) "Fl_Out_Per_Ar","Fleet output by time period and area"
16) "Table_List","List of all tables produced by TEMAS_CALC"



Summary economic/landings Output (Summary_Output)
TEMAS
Evaluation Frame for fisheries management systems
Version. EXCEL 2003, MS Visual Basic 6.3. - TEMAS: 2007
Marine Fisheries Department
DIFRES (Danish Institute of Marine Research)
Note: To change input parameters, start the INPUT-module

Scientific advice / No scientific advice - Regime 1: ACFM Advice Regime 2: No ACFM Advice
RUN INFORMATION:
Date of this run: ####### 14:25
Name of Run: DEMONSTRATION EXAMPLE No. 5 - WITH FAKE DATA ( 2 Countries, (Number of fleets: Ct 1: 2 Ct 2: 2) 2 Stock(s), 5 Area(s)
Param. Created: ####### ###
File Name: DEMON_5_Mig3

Table 1. 1. 1 . Regime 1 - ACFM Advice — Summary of summary by fleet - Pair Deterministic - First and Last year

| | Baltistan - OB Trawler- Baltistan - | Baltistan - OB Trawler- Baltistan - | Baltistan - Gillnett- Baltistan - 2000 | Baltistan - Gillnett- Baltistan - 2009 | Scandinavi a - OB Trawler- Scandinavi | Scandinavi a - OB Trawler- Scandinavi | Scandinavi a - Gillnett- Scandinavi a - 2000 | Scandinavia - Gillnett- Scandinavia - 2009 |
|---|---|---|---|---|---|---|---|---|
| Cash Flow FINANCIAL ANALYSIS ( | 83661.39 | -27090 | 102290.3 | -13861 | 140939.3 | 153718.3 | 104895.6 | 91850.63 |
| NPV cash Flow FINANCIAL ANALY: | 1402058 | --- | 7911787 | --- | 1.66E+07 | --- | 2.83E+07 | --- |
| Cash Flow GOVERNMENT BUDGET | 145431 | 22944.01 | 178176.6 | 34047.83 | 257242.1 | 318732.2 | 191100.2 | 203247.3 |
| NPV cash Flow GOVERNMENT BUD | 3780739 | --- | 1.08E+07 | --- | 2.14E+07 | --- | 3.17E+07 | --- |
| Cash Flow ECONOMIC ANALYSIS. | 139341.1 | 31110.78 | 168499.1 | 37605.98 | 244142.7 | 332372.7 | 179936.2 | 208944.3 |
| NPV cash Flow ECONOMIC ANALY: | 6145148 | --- | 1.37E+07 | --- | 2.62E+07 | --- | 3.52E+07 | --- |
| Total Landings | 7.419739 | 5.472821 | 7.845979 | 4.230415 | 13.69957 | 33.96667 | 8.772552 | 16.4309 |
| Total Value | 172310.2 | 60751.95 | 204888 | 61929.57 | 318159.6 | 414512.3 | 229084.3 | 260167.3 |
| Mean Value / kg | 23223.22 | 11100.66 | 26113.76 | 14639.13 | 23224.06 | 12203.5 | 26113.76 | 15834.03 |
| Number of Crew | 195 | 237 | 285 | 327 | 360 | 402 | 318 | 360 |
| Number of boats | 46 | 59 | 65 | 78 | 82 | 95 | 71 | 84 |

Table 1. 1. 1. Regime 2 - No ACFM Advice — Summary of summary by fleet - Pair Deterministic - First and Last year

| | Baltistan - OB Trawler Baltistan - 2000 | Baltistan - OB Trawler Baltistan - 2009 | Baltistan - Gillnett- Baltistan - 2000 | Baltistan Gillnett- Baltistan 2009 | Scandinav ia - OB Trawler- Scandinav | Scandinav ia - OB Trawler- Scandinav | Scandinavi a - Gillnett- Scandinavi a - 2000 | Scandinavi a - Gillnett- Scandinavi a - 2009 |
|---|---|---|---|---|---|---|---|---|
| Cash Flow FINANCIAL ANALYSIS OF FL | 83673.02 | -65024.73 | 102299.2 | -53108.3 | 140954.2 | -98323.87 | 104905.3 | -69919.47 |
| NPV cash Flow FINANCIAL ANALYSIS ( | 1282649 | --- | 7325970 | --- | 1.50E+07 | --- | 2.46E+07 | --- |
| Cash Flow GOVERNMENT BUDGET ANA | 145447.6 | -32159.72 | 178189.1 | -22929 | 257263.4 | -47287.61 | 191114 | -31728.05 |
| NPV cash Flow GOVERNMENT BUDGET | 3487362 | --- | 1.00E+07 | --- | 1.90E+07 | --- | 2.76E+07 | --- |
| Cash Flow ECONOMIC ANALYSIS. | 139357.8 | -23081.76 | 168511.7 | -18461.6 | 244164.1 | -27687.53 | 179950 | -22155.81 |
| NPV cash Flow ECONOMIC ANALYSIS. | 5681187 | --- | 1.27E+07 | --- | 2.29E+07 | --- | 3.05E+07 | --- |
| Total Landings | 7.419739 | 3.28E-03 | 7.845979 | 2.85E-03 | 13.69957 | 5.98E-03 | 8.772552 | 3.18E-03 |
| Total Value | 172328.1 | 20.61915 | 204901.6 | 20.5232 | 318183.4 | 37.72611 | 229099.5 | 22.92978 |
| Mean Value / kg | 23225.63 | 6292.986 | 26115.49 | 7212.76 | 23225.79 | 6304.621 | 26115.49 | 7221.263 |
| Number of Crew | 195 | 237 | 285 | 327 | 360 | 402 | 318 | 360 |
| Number of boats | 46 | 59 | 65 | 78 | 82 | 95 | 71 | 84 |

Table 1. 1. 2. Regime 1 - ACFM Advice — Summary of summary by country - Pair Deterministic - First and Last year

| | Baltistan - 2000 | Baltistan - 2009 | Scandinav ia - 2000 | Scandina via - 2009 |
|---|---|---|---|---|
| Cash Flow FINANCIAL ANALYSIS ( | 185951.8 | -40951 | 245834.9 | 245569 |
| NPV cash Flow FINANCIAL ANALY: | 3168697 | 3168697 | 4999620 | 4999620 |
| Cash Flow GOVERNMENT BUDGET | 323607.6 | 56991.84 | 448342.3 | 521979.6 |
| NPV cash Flow GOVERNMENT BUD | 5279189 | 5279189 | 8294317 | 8294317 |
| Cash Flow ECONOMIC ANALYSIS. | 307840.3 | 68716.75 | 424078.9 | 541317.1 |
| NPV cash Flow ECONOMIC ANALY: | 5214444 | 5214444 | 8215295 | 8215295 |
| Total Landings | 15.26572 | 9.703236 | 22.47213 | 50.39757 |
| Total Value | 377198.3 | 122681.5 | 547243.9 | 674679.6 |
| Mean Value / kg | 24708.84 | 12643.36 | 24352.12 | 13387.15 |
| Number of Crew | 480 | 564 | 678 | 762 |
| Number of boats | 111 | 137 | 153 | 179 |

Table 1. 1. 2. Regime 2 - No ACFM Advice — Summary of summary by country - Pair Deterministic - First and Last year

| | Baltistan - 2000 | Baltistan - 2009 | Scandina via - 2000 | Scandina via - 2009 |
|---|---|---|---|---|
| Cash Flow FINANCIAL ANALYSIS OF FL | 185972.2 | -118133 | 245859.5 | -168243 |
| NPV cash Flow FINANCIAL ANALYSIS ( | 2927432 | 2927432 | 4026539 | 4026539 |
| Cash Flow GOVERNMENT BUDGET ANA | 323636.8 | -55088.73 | 448377.4 | -79015.7 |
| NPV cash Flow GOVERNMENT BUDGET | 4927590 | 4927590 | 6876958 | 6876958 |
| Cash Flow ECONOMIC ANALYSIS. | 307869.4 | -41543.35 | 424114.1 | -49843.3 |
| NPV cash Flow ECONOMIC ANALYSIS. | 4869779 | 4869779 | 6825177 | 6825177 |
| Total Landings | 15.26572 | 6.12E-03 | 22.47213 | 9.16E-03 |
| Total Value | 377229.7 | 41.1424 | 547282.9 | 60.6559 |
| Mean Value / kg | 24710.9 | 6720.488 | 24353.85 | 6622.4 |
| Number of Crew | 480 | 564 | 678 | 762 |
| Number of boats | 111 | 137 | 153 | 179 |

Table 1. 2. Regime 1 - ACFM Advice — Summary of Summary by year for all fleets - Pair Deterministic - All years

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Cash Flow FINANCIAL ANALYSIS ( | 431786.6 | 439175 | 1543995 | 3142845 | 2449920 | 276275.4 | 113957.3 | 122924 | 4E+05 | |
| NPV cash Flow FINANCIAL ANALY: | 8168317 | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cash Flow GOVERNMENT BUDGET | 771949.9 | 935894.4 | 2361203 | 4805008 | 3666295 | 724613.9 | 273002.1 | 451919.6 | 8E+05 | |
| NPV cash Flow GOVERNMENT BUD | 1.36E+07 | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cash Flow ECONOMIC ANALYSIS. | 731919.1 | 898137.8 | 2319920 | 4767151 | 3621664 | 685206.6 | 292340.7 | 479583 | 8E+05 | |
| NPV cash Flow ECONOMIC ANALY: | 1.34E+07 | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Total Landings | 37.73785 | 51.78107 | 116.0598 | 241.288 | 194.9981 | 44.59882 | 32.12971 | 55.17436 | 70.69 | |
| Total Value | 924442.2 | 1199817 | 2655466 | 5429641 | 4086731 | 976867.1 | 342980.5 | 649562.9 | 9E+05 | |
| Mean Value / kg | 24496.42 | 23170.96 | 22880.15 | 22502.74 | 20957.8 | 21903.43 | 10674.87 | 11772.91 | 12461 | |

Table 1. 2. Regime 2 - No ACFM Advice — Summary of Summary by year for all fleets - Pair Deterministic - All years

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | |
|---|---|---|---|---|---|---|---|---|---|
| Cash Flow FINANCIAL ANALYSIS OF FL | 431831.7 | 439175 | 1543995 | 3142845 | 2449920 | 276275.4 | -38460.14 | -269234.2 | |
| NPV cash Flow FINANCIAL ANALYSIS ( | 6953970 | --- | --- | --- | --- | --- | --- | --- | --- |
| Cash Flow GOVERNMENT BUDGET ANA | 772014.1 | 935894.4 | 2361203 | 4805008 | 3666295 | 724613.9 | 46294.38 | -119920.2 | |
| NPV cash Flow GOVERNMENT BUDGET | 1.18E+07 | --- | --- | --- | --- | --- | --- | --- | --- |
| Cash Flow ECONOMIC ANALYSIS. | 731983.5 | 898137.8 | 2319920 | 4767151 | 3621664 | 685206.6 | 74601.53 | -80642.87 | |
| NPV cash Flow ECONOMIC ANALYSIS. | 1.17E+07 | --- | --- | --- | --- | --- | --- | --- | --- |
| Total Landings | 37.73785 | 51.78107 | 116.0598 | 241.288 | 194.9981 | 44.59882 | 5.265861 | 0.816081 | |
| Total Value | 924512.6 | 1199817 | 2655466 | 5429641 | 4086731 | 976867.1 | 86671.59 | 10366.86 | |
| Mean Value / kg | 24498.29 | 23170.96 | 22880.15 | 22502.7 | 20957.8 | 21903.43 | 16459.15 | 12703.22 | |

*Figure 4.1.1.a.  First portion of Summary output with two alternatives.*

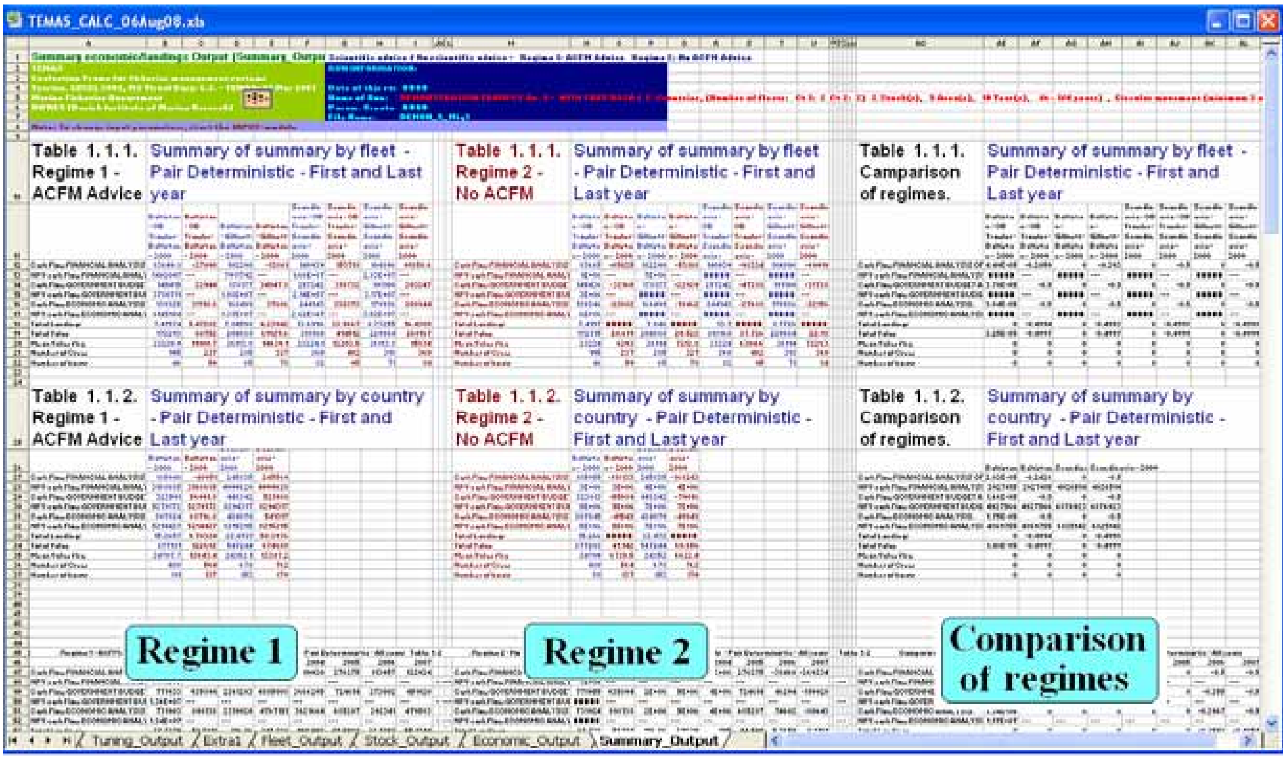


Table 1.1.1. Regime 1 - ACFM Advice Summary of summary by fleet - Pair Deterministic - First and Last year

Table 1.1.1. Regime 2 - No ACFM Summary of summary by fleet - Pair Deterministic - First and Last year

Table 1.1.1. Camparison of regimes. Summary of summary by fleet - Pair Deterministic - First and Last year

Table 1.1.2. Regime 1 - ACFM Advice Summary of summary by country - Pair Deterministic - First and Last year

Table 1.1.2. Regime 2 - No ACFM Summary of summary by country - Pair Deterministic - First and Last year

Table 1.1.2. Camparison of regimes. Summary of summary by country - Pair Deterministic - First and Last year

***Figure 4.1.1.1.b. First portion of Summary output with two alternatives, and comparison of alternatives. Note that the left hand side is identical to Figure a.***

The output for single simulations (deterministic or stochastic) provides many more details than the output from stochastic simulations. The output from stochastic simulations comprises a set of selected key-results only.

Output (produced by workbook TEMAS_CALC) is divided into the groups

1) Stock structured Output (Output independent of the fleet structure)
2) Fleet structured Output (which may or may not be fleet structured)
3) Economic output

Each output group is further divided into

1) Results from single deterministic simulation
2) Results from single stochastic simulation
3) Results from multiple stochastic simulation

TEMAS produces large amounts of output for single simulations. The total output for a single simulation is so voluminous that it is not likely ever to be used in full. The idea with the large amounts of output, is that the user should select whatever subset she/he considers useful in the context of the case study.

The detailed output from single simulations produced by the TEMAS is rather extensive, and the reader is referred to the demonstration example of TEMAS to see further details.

TEMAS, however, contains a suggestion for such a sub-set of output from a single simulation (Figures 3.1.1-3). To fully understand the content of the Tables in Figures 3.3.1-3, you should read Sections 5 and 6, but the titles of table entries should indicate the overall meaning of the table contents.

## 4.1. SUMMARY OUTPUT FROM SINGLE SIMULATION

The first part of the summary single simulation output contains two tables Table 3.3.1. One table summarising the results by fleet, by showing some key results for the first and the last year by fleet. The second table shows the same results for all fleets combined, and now for all years in the time series simulated. As appear all the key results given in the “Summary” of “Summary” are of an economic/technical nature. It also shows the total employment of the fleets. There is only one direct biological result, namely the total landings in weight units.

The output is divided into the three economic analyses:

1) Financial analysis of the harvesting (stakeholder: Fishing industry)
2) Financial analysis of the government treasury
3) Economic analysis (stakeholder: Society in general)

For each analysis is shown the Net cash flow, and the net present value of cash flow.

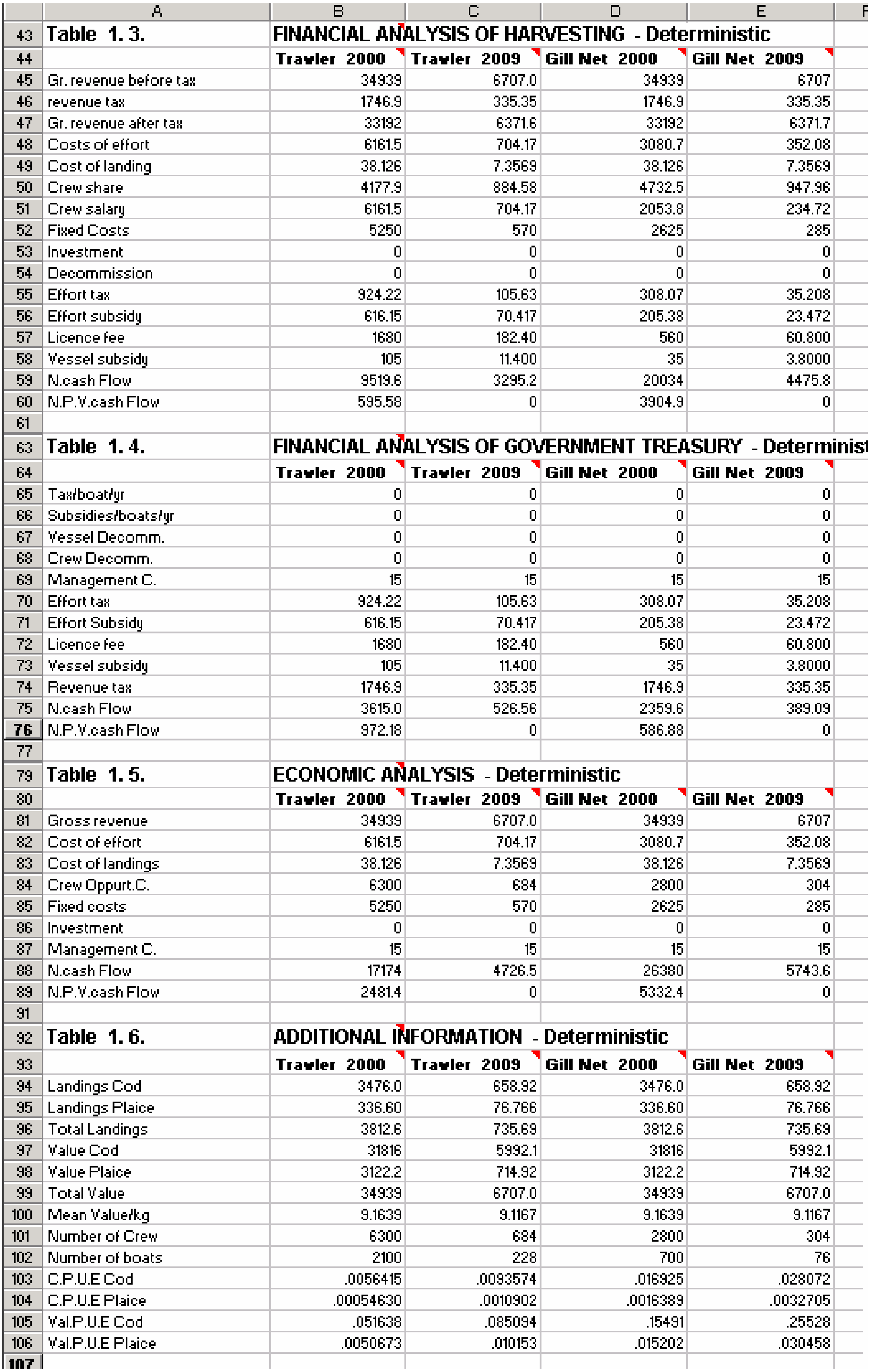
To that is added information on total landings, number of boats and crew.

This is a choice made by the authors, to emphasize on the economic/technical/employment aspects. TEMAS however, offers you the possibility to create your own summary of output, by aid of the facilities of EXCEL. If you master the VISUAL BASIC language, you can change the modules of TEMAS_CALC, but you can also manipulate the output by spreadsheet formulas.

Part two (Table 3.3.2) of the summary single simulation output extends the first table in Figure 3.3.1 with more details. It shows some details of the costs of fishing and it split the landings by stocks. The results are shown by fleet, for the first year and the last year of simulation.
In addition to first part of the summary, part two gives the CPUE (Catch Per Unit of Effort) by stock.

Part 3 , (Table 3.3.3) gives the single-simulation results for all fleets combined, but now for all years in the time series.

Behind these summary tables of single simulations are tables with more details about the single simulations, as will be exemplified in the following.



| | A | B | C | D | E |
|---|---|---|---|---|---|
| 43 | **Table 1. 3.** | **FINANCIAL ANALYSIS OF HARVESTING - Deterministic** | | | |
| 44 | | **Trawler 2000** | **Trawler 2009** | **Gill Net 2000** | **Gill Net 2009** |
| 45 | Gr. revenue before tax | 34939 | 6707.0 | 34939 | 6707 |
| 46 | revenue tax | 1746.9 | 335.35 | 1746.9 | 335.35 |
| 47 | Gr. revenue after tax | 33192 | 6371.6 | 33192 | 6371.7 |
| 48 | Costs of effort | 6161.5 | 704.17 | 3080.7 | 352.08 |
| 49 | Cost of landing | 38.126 | 7.3569 | 38.126 | 7.3569 |
| 50 | Crew share | 4177.9 | 884.58 | 4732.5 | 947.96 |
| 51 | Crew salary | 6161.5 | 704.17 | 2053.8 | 234.72 |
| 52 | Fixed Costs | 5250 | 570 | 2625 | 285 |
| 53 | Investment | 0 | 0 | 0 | 0 |
| 54 | Decommission | 0 | 0 | 0 | 0 |
| 55 | Effort tax | 924.22 | 105.63 | 308.07 | 35.208 |
| 56 | Effort subsidy | 616.15 | 70.417 | 205.38 | 23.472 |
| 57 | Licence fee | 1680 | 182.40 | 560 | 60.800 |
| 58 | Vessel subsidy | 105 | 11.400 | 35 | 3.8000 |
| 59 | N.cash Flow | 9519.6 | 3295.2 | 20034 | 4475.8 |
| 60 | N.P.V.cash Flow | 595.58 | 0 | 3904.9 | 0 |
| 61 | | | | | |
| 63 | **Table 1. 4.** | **FINANCIAL ANALYSIS OF GOVERNMENT TREASURY - Deterministi** | | | |
| 64 | | **Trawler 2000** | **Trawler 2009** | **Gill Net 2000** | **Gill Net 2009** |
| 65 | Tax/boat/yr | 0 | 0 | 0 | 0 |
| 66 | Subsidies/boats/yr | 0 | 0 | 0 | 0 |
| 67 | Vessel Decomm. | 0 | 0 | 0 | 0 |
| 68 | Crew Decomm. | 0 | 0 | 0 | 0 |
| 69 | Management C. | 15 | 15 | 15 | 15 |
| 70 | Effort tax | 924.22 | 105.63 | 308.07 | 35.208 |
| 71 | Effort Subsidy | 616.15 | 70.417 | 205.38 | 23.472 |
| 72 | Licence fee | 1680 | 182.40 | 560 | 60.800 |
| 73 | Vessel subsidy | 105 | 11.400 | 35 | 3.8000 |
| 74 | Revenue tax | 1746.9 | 335.35 | 1746.9 | 335.35 |
| 75 | N.cash Flow | 3615.0 | 526.56 | 2359.6 | 389.09 |
| 76 | N.P.V.cash Flow | 972.18 | 0 | 586.88 | 0 |
| 77 | | | | | |
| 79 | **Table 1. 5.** | **ECONOMIC ANALYSIS - Deterministic** | | | |
| 80 | | **Trawler 2000** | **Trawler 2009** | **Gill Net 2000** | **Gill Net 2009** |
| 81 | Gross revenue | 34939 | 6707.0 | 34939 | 6707 |
| 82 | Cost of effort | 6161.5 | 704.17 | 3080.7 | 352.08 |
| 83 | Cost of landings | 38.126 | 7.3569 | 38.126 | 7.3569 |
| 84 | Crew Oppurt.C. | 6300 | 684 | 2800 | 304 |
| 85 | Fixed costs | 5250 | 570 | 2625 | 285 |
| 86 | Investment | 0 | 0 | 0 | 0 |
| 87 | Management C. | 15 | 15 | 15 | 15 |
| 88 | N.cash Flow | 17174 | 4726.5 | 26380 | 5743.6 |
| 89 | N.P.V.cash Flow | 2481.4 | 0 | 5332.4 | 0 |
| 91 | | | | | |
| 92 | **Table 1. 6.** | **ADDITIONAL INFORMATION - Deterministic** | | | |
| 93 | | **Trawler 2000** | **Trawler 2009** | **Gill Net 2000** | **Gill Net 2009** |
| 94 | Landings Cod | 3476.0 | 658.92 | 3476.0 | 658.92 |
| 95 | Landings Plaice | 336.60 | 76.766 | 336.60 | 76.766 |
| 96 | Total Landings | 3812.6 | 735.69 | 3812.6 | 735.69 |
| 97 | Value Cod | 31816 | 5992.1 | 31816 | 5992.1 |
| 98 | Value Plaice | 3122.2 | 714.92 | 3122.2 | 714.92 |
| 99 | Total Value | 34939 | 6707.0 | 34939 | 6707.0 |
| 100 | Mean Value/kg | 9.1639 | 9.1167 | 9.1639 | 9.1167 |
| 101 | Number of Crew | 6300 | 684 | 2800 | 304 |
| 102 | Number of boats | 2100 | 228 | 700 | 76 |
| 103 | C.P.U.E Cod | .0056415 | .0093574 | .016925 | .028072 |
| 104 | C.P.U.E Plaice | .00054630 | .0010902 | .0016389 | .0032705 |
| 105 | Val.P.U.E Cod | .051638 | .085094 | .15491 | .25528 |
| 106 | Val.P.U.E Plaice | .0050673 | .010153 | .015202 | .030458 |
| 107 | | | | | |

***Figure 3.1.2. Second portion of Summary output.***

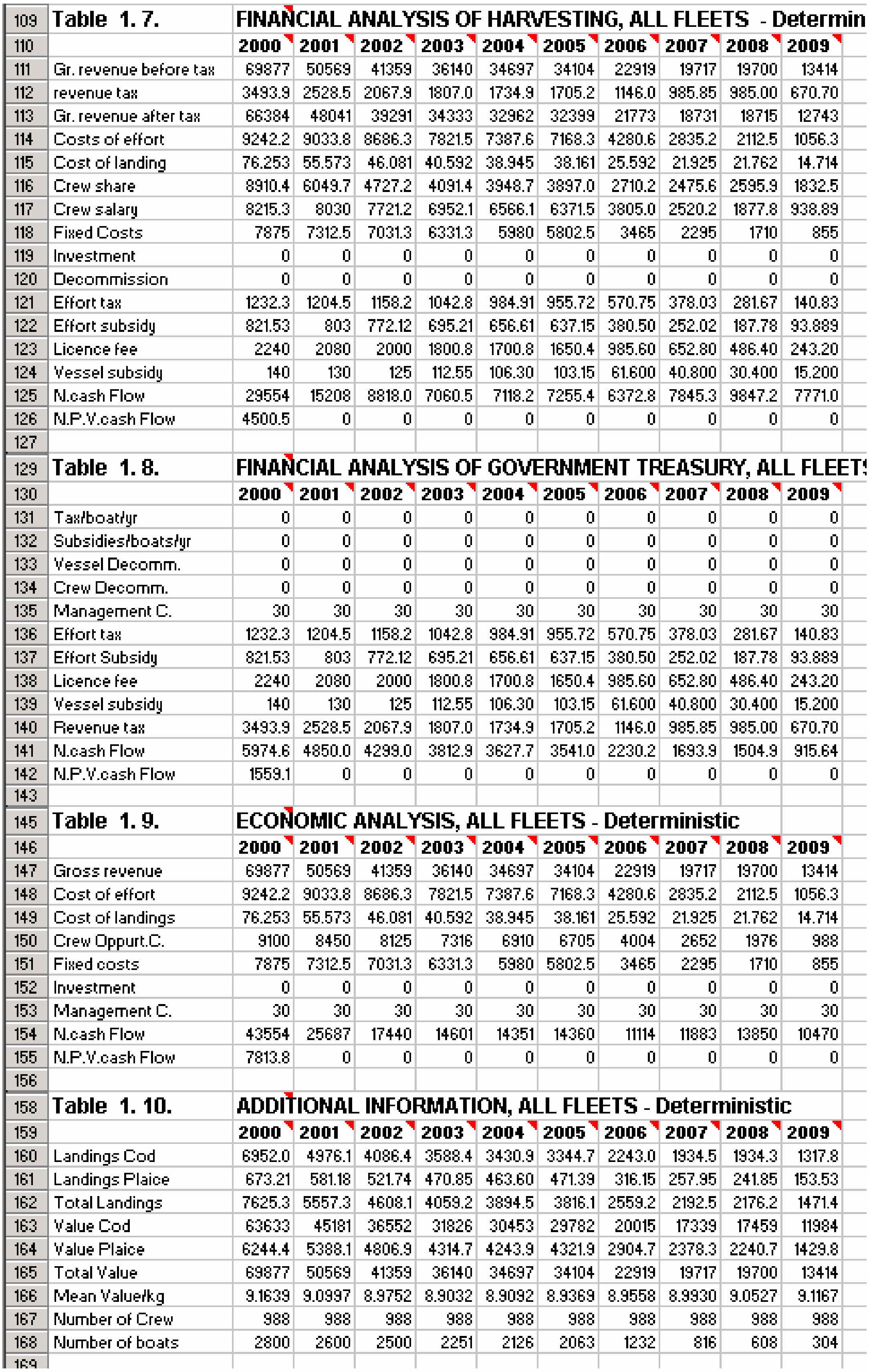


**Table 1. 7.** FINANCIAL ANALYSIS OF HARVESTING, ALL FLEETS - Determin

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|---|---|---|
| Gr. revenue before tax | 69877 | 50569 | 41359 | 36140 | 34697 | 34104 | 22919 | 19717 | 19700 | 13414 |
| revenue tax | 3493.9 | 2528.5 | 2067.9 | 1807.0 | 1734.9 | 1705.2 | 1146.0 | 985.85 | 985.00 | 670.70 |
| Gr. revenue after tax | 66384 | 48041 | 39291 | 34333 | 32962 | 32399 | 21773 | 18731 | 18715 | 12743 |
| Costs of effort | 9242.2 | 9033.8 | 8686.3 | 7821.5 | 7387.6 | 7168.3 | 4280.6 | 2835.2 | 2112.5 | 1056.3 |
| Cost of landing | 76.253 | 55.573 | 46.081 | 40.592 | 38.945 | 38.161 | 25.592 | 21.925 | 21.762 | 14.714 |
| Crew share | 8910.4 | 6049.7 | 4727.2 | 4091.4 | 3948.7 | 3897.0 | 2710.2 | 2475.6 | 2595.9 | 1832.5 |
| Crew salary | 8215.3 | 8030 | 7721.2 | 6952.1 | 6566.1 | 6371.5 | 3805.0 | 2520.2 | 1877.8 | 938.89 |
| Fixed Costs | 7875 | 7312.5 | 7031.3 | 6331.3 | 5980 | 5802.5 | 3465 | 2295 | 1710 | 855 |
| Investment | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Decommission | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Effort tax | 1232.3 | 1204.5 | 1158.2 | 1042.8 | 984.91 | 955.72 | 570.75 | 378.03 | 281.67 | 140.83 |
| Effort subsidy | 821.53 | 803 | 772.12 | 695.21 | 656.61 | 637.15 | 380.50 | 252.02 | 187.78 | 93.889 |
| Licence fee | 2240 | 2080 | 2000 | 1800.8 | 1700.8 | 1650.4 | 985.60 | 652.80 | 486.40 | 243.20 |
| Vessel subsidy | 140 | 130 | 125 | 112.55 | 106.30 | 103.15 | 61.600 | 40.800 | 30.400 | 15.200 |
| N.cash Flow | 29554 | 15208 | 8818.0 | 7060.5 | 7118.2 | 7255.4 | 6372.8 | 7845.3 | 9847.2 | 7771.0 |
| N.P.V.cash Flow | 4500.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**Table 1. 8.** FINANCIAL ANALYSIS OF GOVERNMENT TREASURY, ALL FLEET

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|---|---|---|
| Tax/boat/yr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Subsidies/boats/yr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Vessel Decomm. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Crew Decomm. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Management C. | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| Effort tax | 1232.3 | 1204.5 | 1158.2 | 1042.8 | 984.91 | 955.72 | 570.75 | 378.03 | 281.67 | 140.83 |
| Effort Subsidy | 821.53 | 803 | 772.12 | 695.21 | 656.61 | 637.15 | 380.50 | 252.02 | 187.78 | 93.889 |
| Licence fee | 2240 | 2080 | 2000 | 1800.8 | 1700.8 | 1650.4 | 985.60 | 652.80 | 486.40 | 243.20 |
| Vessel subsidy | 140 | 130 | 125 | 112.55 | 106.30 | 103.15 | 61.600 | 40.800 | 30.400 | 15.200 |
| Revenue tax | 3493.9 | 2528.5 | 2067.9 | 1807.0 | 1734.9 | 1705.2 | 1146.0 | 985.85 | 985.00 | 670.70 |
| N.cash Flow | 5974.6 | 4850.0 | 4299.0 | 3812.9 | 3627.7 | 3541.0 | 2230.2 | 1693.9 | 1504.9 | 915.64 |
| N.P.V.cash Flow | 1559.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**Table 1. 9.** ECONOMIC ANALYSIS, ALL FLEETS - Deterministic

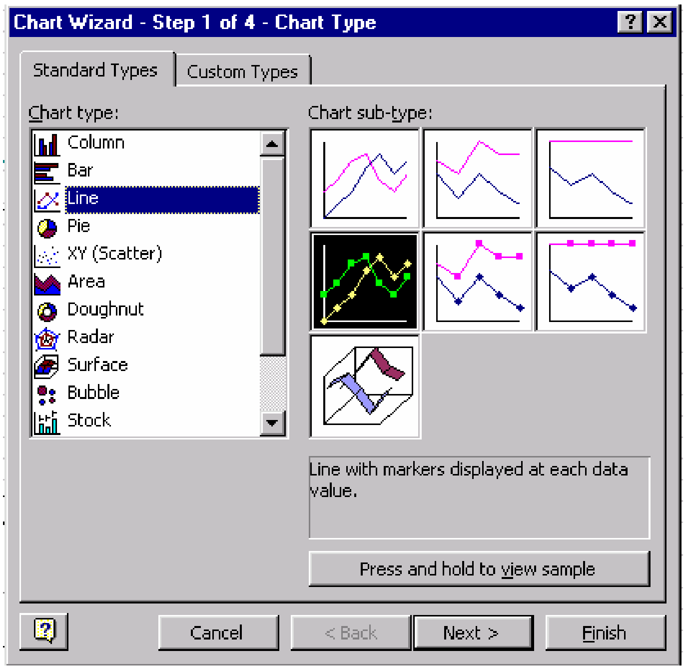
| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|---|---|---|
| Gross revenue | 69877 | 50569 | 41359 | 36140 | 34697 | 34104 | 22919 | 19717 | 19700 | 13414 |
| Cost of effort | 9242.2 | 9033.8 | 8686.3 | 7821.5 | 7387.6 | 7168.3 | 4280.6 | 2835.2 | 2112.5 | 1056.3 |
| Cost of landings | 76.253 | 55.573 | 46.081 | 40.592 | 38.945 | 38.161 | 25.592 | 21.925 | 21.762 | 14.714 |
| Crew Oppurt.C. | 9100 | 8450 | 8125 | 7316 | 6910 | 6705 | 4004 | 2652 | 1976 | 988 |
| Fixed costs | 7875 | 7312.5 | 7031.3 | 6331.3 | 5980 | 5802.5 | 3465 | 2295 | 1710 | 855 |
| Investment | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Management C. | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| N.cash Flow | 43554 | 25687 | 17440 | 14601 | 14351 | 14360 | 11114 | 11883 | 13850 | 10470 |
| N.P.V.cash Flow | 7813.8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**Table 1. 10.** ADDITIONAL INFORMATION, ALL FLEETS - Deterministic

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|---|---|---|
| Landings Cod | 6952.0 | 4976.1 | 4086.4 | 3588.4 | 3430.9 | 3344.7 | 2243.0 | 1934.5 | 1934.3 | 1317.8 |
| Landings Plaice | 673.21 | 581.18 | 521.74 | 470.85 | 463.60 | 471.39 | 316.15 | 257.95 | 241.85 | 153.53 |
| Total Landings | 7625.3 | 5557.3 | 4608.1 | 4059.2 | 3894.5 | 3816.1 | 2559.2 | 2192.5 | 2176.2 | 1471.4 |
| Value Cod | 63633 | 45181 | 36552 | 31826 | 30453 | 29782 | 20015 | 17339 | 17459 | 11984 |
| Value Plaice | 6244.4 | 5388.1 | 4806.9 | 4314.7 | 4243.9 | 4321.9 | 2904.7 | 2378.3 | 2240.7 | 1429.8 |
| Total Value | 69877 | 50569 | 41359 | 36140 | 34697 | 34104 | 22919 | 19717 | 19700 | 13414 |
| Mean Value/kg | 9.1639 | 9.0997 | 8.9752 | 8.9032 | 8.9092 | 8.9369 | 8.9558 | 8.9930 | 9.0527 | 9.1167 |
| Number of Crew | 988 | 988 | 988 | 988 | 988 | 988 | 988 | 988 | 988 | 988 |
| Number of boats | 2800 | 2600 | 2500 | 2251 | 2126 | 2063 | 1232 | 816 | 608 | 304 |

*Figure 4.1.3. Third portion of Summary output.*

## 3.2. GRAPHICAL OUTPUT FROM TEMAS



Line with markers displayed at each data value.

Except "NPV_Output", all output is structured as time series.

The output from TEMAS consists only of tables with numbers. TEMAS does not produce any graphs.

It is up to the user of TEMAS to apply the facilities of EXCEL to produce whatever graphs she/he considers useful.

Some tables are designed by TEMAS to make the transformation into a graph easy. Figure 3.2.1, for example, shows a typical output from 500 multiple stochastic simulations. In this case the graph shows the frequency distribution of present net value of financial net cash flow of the harvesting for two fleets (Trawlers and Gill-netters)

| Financial NPV of Fleet | | |
|---|---|---|
| | Trawler | Gill net |
| Mean | 120492 | 61139 |
| Std.dev. | 36550 | 18789 |
| Min | 23346 | 5884 |
| Max | 267985 | 123501 |
| Rel.Std. dev % | 30 | 31 |
| | | |
| Class index | Trawler | Gill net |
| 1 | 1 | 3 |
| 2 | 4 | 1 |
| 3 | 4 | 2 |
| 4 | 6 | 6 |
| 5 | 21 | 3 |
| 6 | 39 | 18 |
| 7 | 35 | 21 |
| 8 | 47 | 27 |
| 9 | 54 | 50 |
| 10 | 56 | 45 |
| 11 | 52 | 46 |
| 12 | 43 | 54 |
| 13 | 37 | 35 |
| 14 | 37 | 36 |
| 15 | 22 | 45 |
| 16 | 7 | 35 |
| 17 | 11 | 25 |
| 18 | 8 | 16 |
| 19 | 9 | 12 |
| 20 | 2 | 8 |
| 21 | 3 | 5 |
| 22 | 1 | 4 |
| 23 | 0 | 2 |
| 24 | 0 | 0 |
| 25 | 1 | 1 |

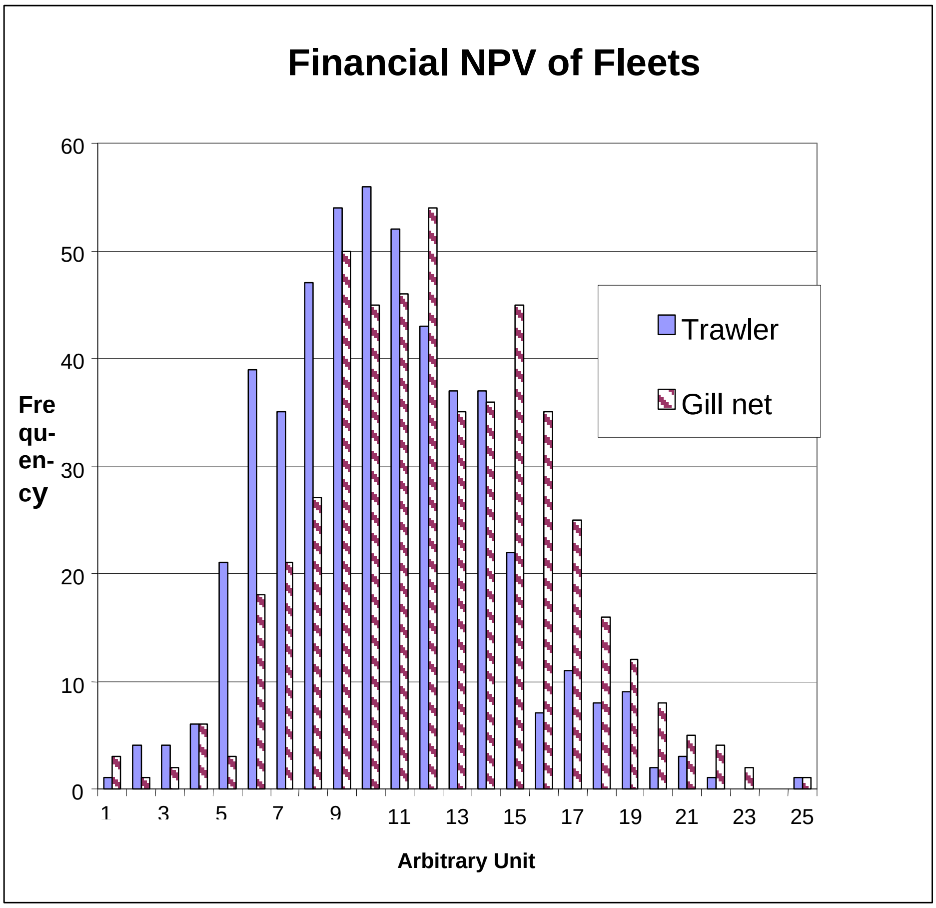


*Figure 3.2.1. Example of graph produced from the output tables of TEMAS.*

The unit on the x-axis is arbitrary. TEMAS finds the minimum and the maximum values simulated, and computes the “Range = Maximum – Minimum”. Then for each simulated value, X, it assigns the

$$Class\ \ Index = INT\Big[\ \ \frac{X - Minimum}{Range} + 0.5\ \ \Big]$$

where “Int” is the integer part of a real number. The “Frequency” is then the number of times a “Class index” was simulated.

Other types of output graphs from multiple stochastic simulations are shown in Section 7.2.

The table left of the graph in Figure 3.2.1, is the table appearance on the work sheet “NPV_Output”.

To get the graph, the user must on her/his own activate the “Chart wizard” of EXCEL. In this case, the production of the graph was straightforward. In other cases, the output of TEMAS may not match the wishes of the user, the user will then need to do some pre-processing of the output before the graph can be made. Alternatively, the user may modify the VISUAL BASIC code of TEMAS, to make it produce a suitable output table.

## 4.3. DETAILED BIOLOGICAL OUPUT FROM SINGLE SIMULATION

TEMAS does not provide any facilities on its own for printing hard copies of output. The user is supposed to manage on her/his own by aid of the print facilities of EXCEL. Table 3.3.1 shows an example of a table with annual stock structured output produced by TEMAS. In this case the output comes from a single simulation, which allows for very detailed output.

**Species A : STOCK NUMBERS – Deterministic**

| Age/Year | ***2000*** | ***2001*** | ***2002*** | ***2003*** | ***2004*** | ***2005*** | ***2006*** | ***2007*** | ***2008*** | ***2009*** | ***2010*** | ***2011*** | ***2012*** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 2000.0 | 1300.0 | 1296.4 | 1296.0 | 1295.1 | 1293.6 | 1291.7 | 1289.6 | 1287.4 | 1285.3 | 1283.5 | 1281.8 | 1280.6 |
| 1 | 1637.5 | 1630.1 | 1063.1 | 1060.1 | 1059.8 | 1059.0 | 1057.9 | 1056.3 | 1054.6 | 1052.9 | 1051.2 | 1049.7 | 1048.3 |
| 2 | 1340.6 | 1237.4 | 1294.9 | 844.6 | 842.4 | 842.6 | 842.6 | 841.7 | 840.8 | 840.1 | 838.7 | 837.7 | 837.1 |
| 3 | 1097.6 | 902.0 | 924.9 | 968.5 | 632.3 | 631.3 | 632.9 | 632.9 | 632.7 | 633.6 | 633.0 | 632.5 | 633.3 |
| 4 | 898.7 | 717.0 | 662.8 | 680.9 | 713.7 | 466.4 | 466.9 | 468.0 | 468.5 | 469.7 | 470.3 | 470.3 | 471.3 |
| 5 | 735.8 | 584.6 | 525.6 | 487.2 | 501.5 | 525.9 | 344.6 | 345.0 | 346.2 | 347.5 | 348.4 | 349.1 | 350.1 |
| 6 | 602.4 | 478.3 | 428.4 | 386.3 | 359.1 | 370.1 | 389.2 | 255.0 | 255.5 | 257.0 | 258.0 | 258.9 | 260.1 |
| 7 | 493.2 | 391.5 | 350.4 | 314.8 | 284.7 | 265.3 | 274.3 | 288.4 | 189.1 | 190.0 | 191.1 | 192.0 | 193.1 |
| 8 | 403.8 | 320.5 | 286.8 | 257.5 | 232.0 | 210.3 | 196.8 | 203.7 | 214.2 | 140.8 | 141.5 | 142.4 | 143.4 |
| 9 | 330.6 | 477.3 | 584.5 | 640.3 | 661.7 | 660.3 | 646.1 | 626.4 | 618.1 | 621.8 | 570.2 | 532.8 | 506.9 |
| **Biomass** | **142323** | **127434** | **125697** | **121980** | **116900** | **111223** | **105802** | **100766** | **96422** | **92936** | **89988** | **87877** | **86532** |
| **SSB** | **130086** | **116857** | **115657** | **112803** | **108507** | **103377** | **98296** | **93477** | **89271** | **85864** | **82970** | **80899** | **79574** |

**Species A : CATCH NUMBERS – Deterministic**

| Age/Year | ***2000*** | ***2001*** | ***2002*** | ***2003*** | ***2004*** | ***2005*** | ***2006*** | ***2007*** | ***2008*** | ***2009*** | ***2010*** | ***2011*** | ***2012*** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 33.7 | 6.3 | 6.2 | 6.1 | 6.0 | 5.9 | 5.9 | 5.8 | 5.6 | 5.6 | 5.5 | 5.4 | 5.4 |
| 1 | 477.4 | 189.6 | 122.7 | 121.4 | 119.5 | 116.6 | 116.5 | 114.4 | 111.4 | 111.2 | 109.2 | 106.2 | 106.0 |
| 2 | 909.7 | 420.8 | 436.9 | 282.2 | 278.7 | 271.8 | 271.8 | 268.7 | 261.4 | 261.2 | 258.0 | 250.7 | 250.5 |
| 3 | 845.7 | 360.9 | 364.0 | 378.0 | 244.8 | 238.2 | 238.9 | 236.8 | 230.5 | 230.9 | 228.6 | 222.2 | 222.5 |
| 4 | 704.0 | 292.8 | 264.3 | 267.0 | 278.2 | 177.2 | 177.5 | 176.5 | 172.0 | 172.6 | 171.3 | 166.7 | 167.1 |
| 5 | 578.0 | 239.6 | 210.0 | 190.0 | 192.8 | 197.6 | 129.6 | 128.7 | 125.8 | 126.3 | 125.6 | 122.5 | 122.9 |
| 6 | 473.6 | 196.1 | 171.3 | 150.5 | 136.9 | 136.7 | 144.2 | 93.8 | 91.5 | 92.2 | 91.8 | 89.6 | 90.1 |
| 7 | 387.8 | 160.6 | 140.1 | 122.7 | 108.4 | 97.1 | 99.9 | 104.5 | 66.7 | 67.1 | 67.0 | 65.5 | 66.0 |
| 8 | 317.5 | 131.5 | 114.7 | 100.4 | 88.4 | 76.9 | 71.0 | 72.5 | 74.4 | 49.0 | 48.9 | 47.9 | 48.3 |
| 9 | 260.0 | 195.8 | 233.8 | 249.6 | 252.0 | 241.4 | 232.8 | 220.7 | 209.5 | 209.3 | 189.0 | 170.8 | 162.1 |
| YIELD | **114208** | **51207** | **49462** | **47034** | **44229** | **40599** | **38317** | **35967** | **33350** | **32065** | **30738** | **29165** | **28730** |

**Species A : FISHING MORTALITY - Deterministic**

| Age/Year | ***2000*** | ***2001*** | ***2002*** | ***2003*** | ***2004*** | ***2005*** | ***2006*** | ***2007*** | ***2008*** | ***2009*** | ***2010*** | ***2011*** | ***2012*** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.009 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| 1 | 0.161 | 0.061 | 0.060 | 0.060 | 0.059 | 0.057 | 0.057 | 0.056 | 0.055 | 0.055 | 0.054 | 0.053 | 0.053 |
| 2 | 0.394 | 0.185 | 0.183 | 0.181 | 0.179 | 0.175 | 0.175 | 0.173 | 0.168 | 0.168 | 0.166 | 0.161 | 0.161 |
| 3 | 0.453 | 0.221 | 0.219 | 0.216 | 0.214 | 0.209 | 0.209 | 0.207 | 0.201 | 0.201 | 0.199 | 0.193 | 0.193 |
| 4 | 0.462 | 0.226 | 0.224 | 0.221 | 0.219 | 0.213 | 0.213 | 0.211 | 0.205 | 0.205 | 0.204 | 0.198 | 0.198 |
| 5 | 0.463 | 0.227 | 0.225 | 0.222 | 0.220 | 0.214 | 0.214 | 0.212 | 0.206 | 0.206 | 0.204 | 0.198 | 0.198 |
| 6 | 0.464 | 0.227 | 0.225 | 0.222 | 0.220 | 0.214 | 0.214 | 0.212 | 0.206 | 0.206 | 0.204 | 0.198 | 0.198 |
| 7 | 0.464 | 0.227 | 0.225 | 0.222 | 0.220 | 0.214 | 0.214 | 0.212 | 0.206 | 0.206 | 0.205 | 0.199 | 0.199 |
| 8 | 0.464 | 0.227 | 0.225 | 0.222 | 0.220 | 0.214 | 0.214 | 0.212 | 0.207 | 0.207 | 0.205 | 0.199 | 0.199 |
| 9 | 0.464 | 0.227 | 0.225 | 0.222 | 0.220 | 0.214 | 0.214 | 0.212 | 0.207 | 0.207 | 0.205 | 0.199 | 0.199 |

***Table 3.3.1. Example of stock structured annual output from worksheet “Stock_Output”***

Table 3.3.2 shows an example of finer details, namely results by time period (here by quarters). In this case the output tables has been transferred from EXCEL into MS WORD, and has been subject to various editing. In the present case, the table is very close to the table as it appears in the worksheet “Stock_Output”, but the idea is that the user should define the final design of output.

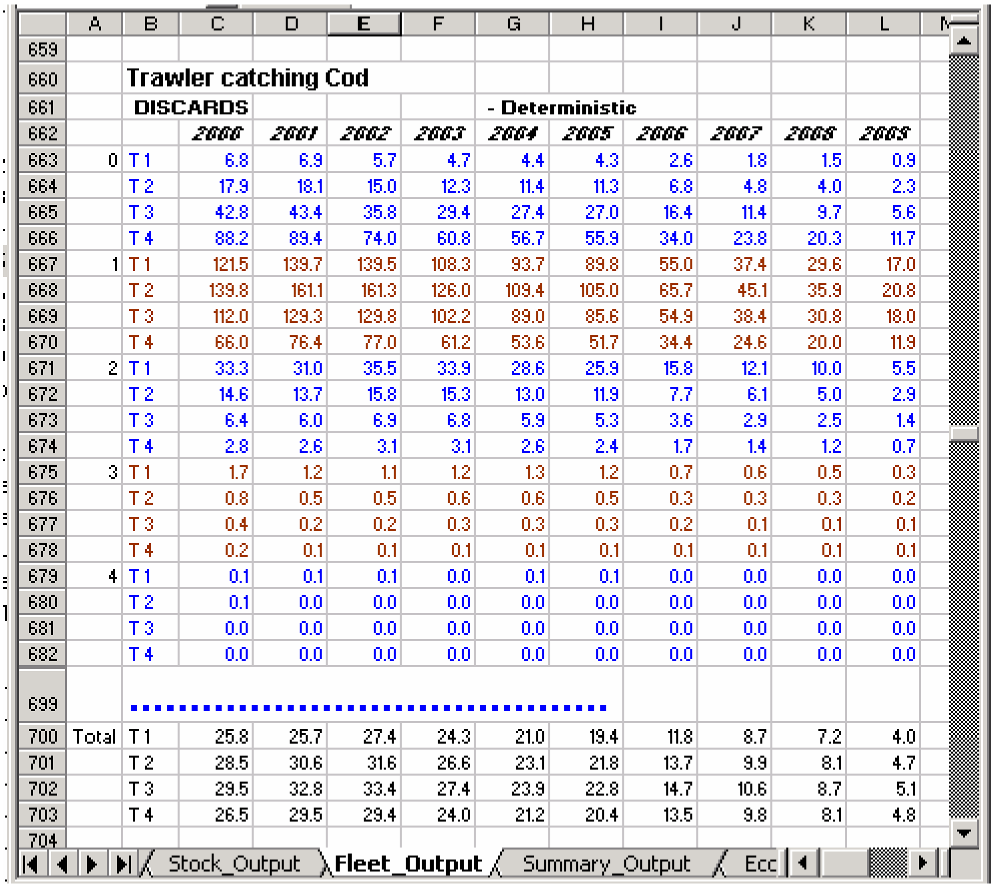
The results shown in Table 3.3.1and 3.3.2 represents only one species, accumulated over all fleets. Catch number and fishing mortality (Table 3.3.1) could be given for each fleet as well. In case there are several areas there will also be a Table for each combination of Fleet, Stock and Area. With several fleets and stocks and areas, the output from TEMAS will be overwhelming. In many cases, only a few selected, if any, tables like Tables 3.3.1-2 or more detailed tables, will be used in the report of the fisheries assessment made by TEMAS.

| **Age/Year** | | ***2000*** | ***2001*** | ***2002*** | ***2003*** | ***2004*** | ***2005*** | ***2006*** | ***2007*** | ***2008*** | ***2009*** | ***2010*** | ***2011*** | ***2012*** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | Q 1 | 2000.0 | 1300.0 | 1296.4 | 1296.0 | 1295.1 | 1293.6 | 1291.7 | 1289.6 | 1287.4 | 1285.3 | 1283.5 | 1281.8 | 1280.6 |
| | Q 2 | 1900.1 | 1235.1 | 1231.6 | 1231.3 | 1230.4 | 1229.1 | 1227.3 | 1225.3 | 1223.3 | 1221.3 | 1219.6 | 1218.0 | 1216.8 |
| | Q 3 | 1801.6 | 1174.9 | 1171.6 | 1171.2 | 1170.4 | 1169.1 | 1167.4 | 1165.5 | 1163.6 | 1161.7 | 1160.1 | 1158.6 | 1157.5 |
| | Q 4 | 1713.7 | 1117.6 | 1114.4 | 1114.1 | 1113.3 | 1112.1 | 1110.5 | 1108.7 | 1106.9 | 1105.1 | 1103.5 | 1102.1 | 1101.0 |
| 1 | Q 1 | 1637.5 | 1630.1 | 1063.1 | 1060.1 | 1059.8 | 1059.0 | 1057.9 | 1056.3 | 1054.6 | 1052.9 | 1051.2 | 1049.7 | 1048.3 |
| | Q 2 | 1510.4 | 1504.4 | 981.3 | 978.8 | 979.0 | 979.0 | 977.9 | 976.9 | 976.0 | 974.4 | 973.3 | 972.6 | 971.4 |
| | Q 3 | 1367.6 | 1431.0 | 933.4 | 931.0 | 931.2 | 931.2 | 930.2 | 929.3 | 928.4 | 926.9 | 925.8 | 925.2 | 924.0 |
| | Q 4 | 1300.9 | 1361.2 | 887.9 | 885.6 | 885.8 | 885.8 | 884.8 | 883.9 | 883.2 | 881.7 | 880.7 | 880.1 | 878.9 |
| 2 | Q 1 | 1340.6 | 1237.4 | 1294.9 | 844.6 | 842.4 | 842.6 | 842.6 | 841.7 | 840.8 | 840.1 | 838.7 | 837.7 | 837.1 |
| | Q 2 | 1162.3 | 1074.5 | 1125.2 | 734.6 | 733.4 | 735.3 | 735.3 | 735.1 | 736.1 | 735.4 | 734.9 | 735.8 | 735.2 |
| | Q 3 | 996.9 | 1022.1 | 1070.3 | 698.8 | 697.7 | 699.4 | 699.4 | 699.3 | 700.2 | 699.6 | 699.1 | 699.9 | 699.4 |
| | Q 4 | 948.3 | 972.3 | 1018.1 | 664.7 | 663.6 | 665.3 | 665.3 | 665.2 | 666.1 | 665.5 | 665.0 | 665.8 | 665.3 |
| 3 | Q 1 | 1097.6 | 902.0 | 924.9 | 968.5 | 632.3 | 631.3 | 632.9 | 632.9 | 632.7 | 633.6 | 633.0 | 632.5 | 633.3 |
| | Q 2 | 934.7 | 770.1 | 791.1 | 829.1 | 541.8 | 542.4 | 543.8 | 544.3 | 545.7 | 546.4 | 546.4 | 547.6 | 548.2 |
| | Q 3 | 792.4 | 732.5 | 752.5 | 788.7 | 515.4 | 516.0 | 517.3 | 517.7 | 519.1 | 519.8 | 519.8 | 520.8 | 521.4 |
| | Q 4 | 753.8 | 696.8 | 715.8 | 750.2 | 490.3 | 490.8 | 492.0 | 492.5 | 493.8 | 494.4 | 494.4 | 495.4 | 496.0 |
| 4 | Q 1 | 898.7 | 717.0 | 662.8 | 680.9 | 713.7 | 466.4 | 466.9 | 468.0 | 468.5 | 469.7 | 470.3 | 470.3 | 471.3 |
| | Q 2 | 763.3 | 610.7 | 566.1 | 582.6 | 611.1 | 400.4 | 400.9 | 402.2 | 403.7 | 404.7 | 405.6 | 406.8 | 407.6 |
| | Q 3 | 646.0 | 580.9 | 538.5 | 554.2 | 581.3 | 380.9 | 381.3 | 382.6 | 384.0 | 385.0 | 385.8 | 386.9 | 387.7 |
| | Q 4 | 614.5 | 552.6 | 512.2 | 527.2 | 552.9 | 362.3 | 362.7 | 363.9 | 365.3 | 366.2 | 367.0 | 368.1 | 368.8 |
| 5 | Q 1 | 735.8 | 584.6 | 525.6 | 487.2 | 501.5 | 525.9 | 344.6 | 345.0 | 346.2 | 347.5 | 348.4 | 349.1 | 350.1 |
| | Q 2 | 624.7 | 497.7 | 448.8 | 417.2 | 430.0 | 452.1 | 296.3 | 296.8 | 298.6 | 299.7 | 300.8 | 302.2 | 303.1 |
| | Q 3 | 528.6 | 473.4 | 426.9 | 396.8 | 409.0 | 430.1 | 281.8 | 282.4 | 284.1 | 285.1 | 286.1 | 287.5 | 288.3 |
| | Q 4 | 502.8 | 450.3 | 406.1 | 377.5 | 389.1 | 409.1 | 268.1 | 268.6 | 270.2 | 271.2 | 272.1 | 273.5 | 274.2 |
| 6 | Q 1 | 602.4 | 478.3 | 428.4 | 386.3 | 359.1 | 370.1 | 389.2 | 255.0 | 255.5 | 257.0 | 258.0 | 258.9 | 260.1 |
| | Q 2 | 511.4 | 407.1 | 365.7 | 330.8 | 308.2 | 318.7 | 335.0 | 219.7 | 220.7 | 222.0 | 223.0 | 224.4 | 225.5 |
| | Q 3 | 432.7 | 387.3 | 347.9 | 314.6 | 293.1 | 303.2 | 318.7 | 209.0 | 210.0 | 211.2 | 212.2 | 213.5 | 214.5 |
| | Q 4 | 411.6 | 368.4 | 330.9 | 299.3 | 278.9 | 288.4 | 303.2 | 198.8 | 199.7 | 200.9 | 201.8 | 203.1 | 204.0 |
| 7 | Q 1 | 493.2 | 391.5 | 350.4 | 314.8 | 284.7 | 265.3 | 274.3 | 288.4 | 189.1 | 190.0 | 191.1 | 192.0 | 193.1 |
| | Q 2 | 418.7 | 333.3 | 299.2 | 269.5 | 244.4 | 228.6 | 236.6 | 248.9 | 163.6 | 164.4 | 165.5 | 166.6 | 167.7 |
| | Q 3 | 354.2 | 317.0 | 284.6 | 256.4 | 232.5 | 217.5 | 225.1 | 236.7 | 155.6 | 156.3 | 157.4 | 158.5 | 159.5 |
| | Q 4 | 336.9 | 301.6 | 270.7 | 243.9 | 221.1 | 206.9 | 214.1 | 225.2 | 148.0 | 148.7 | 149.7 | 150.8 | 151.7 |
| 8 | Q 1 | 403.8 | 320.5 | 286.8 | 257.5 | 232.0 | 210.3 | 196.8 | 203.7 | 214.2 | 140.8 | 141.5 | 142.4 | 143.4 |
| | Q 2 | 342.8 | 272.8 | 244.9 | 220.5 | 199.2 | 181.3 | 169.9 | 176.1 | 185.6 | 122.0 | 122.6 | 123.8 | 124.7 |
| | Q 3 | 290.0 | 259.5 | 233.0 | 209.7 | 189.4 | 172.5 | 161.6 | 167.5 | 176.5 | 116.1 | 116.7 | 117.8 | 118.6 |
| | Q 4 | 275.9 | 246.9 | 221.6 | 199.5 | 180.2 | 164.1 | 153.7 | 159.3 | 167.9 | 110.4 | 111.0 | 112.0 | 112.8 |
| 9 | Q 1 | 330.6 | 477.3 | 584.5 | 640.3 | 661.7 | 660.3 | 646.1 | 626.4 | 618.1 | 621.8 | 570.2 | 532.8 | 506.9 |
| | Q 2 | 280.7 | 406.3 | 499.1 | 548.3 | 568.0 | 569.3 | 557.9 | 542.0 | 536.9 | 540.5 | 496.4 | 465.2 | 442.7 |
| | Q 3 | 237.4 | 386.5 | 474.7 | 521.6 | 540.3 | 541.5 | 530.6 | 515.6 | 510.7 | 514.1 | 472.2 | 442.5 | 421.1 |
| | Q 4 | 225.9 | 367.6 | 451.6 | 496.1 | 514.0 | 515.1 | 504.8 | 490.5 | 485.8 | 489.1 | 449.1 | 420.9 | 400.6 |
| **Biomass** | Q 1 | 142323 | 127434 | 125697 | 121980 | 116900 | 111223 | 105802 | 100766 | 96422 | 92936 | 89988 | 87877 | 86532 |
| | Q 2 | 131594 | 117819 | 116092 | 112560 | 107862 | 102911 | 97978 | 93524 | 89877 | 86771 | 84225 | 82564 | 81364 |
| | Q 3 | 121207 | 121271 | 119070 | 115101 | 110087 | 104957 | 99950 | 95490 | 91880 | 88829 | 86347 | 84735 | 83567 |
| | Q 4 | 125032 | 124639 | 121939 | 117540 | 112235 | 106951 | 101888 | 97437 | 93872 | 90880 | 88464 | 86901 | 85766 |
| **SSB** | **Q 1** | 130086 | 116857 | 115657 | 112803 | 108507 | 103377 | 98296 | 93477 | 89271 | 85864 | 82970 | 80899 | 79574 |
| | **Q 2** | 120418 | 108071 | 106952 | 104228 | 100197 | 95683 | 91031 | 86751 | 83204 | 80165 | 77660 | 76019 | 74836 |
| | **Q 3** | 110960 | 111393 | 109910 | 106760 | 102377 | 97650 | 92899 | 88600 | 85081 | 82093 | 79650 | 78057 | 76906 |
| | **Q 4** | 114618 | 114672 | 112779 | 109192 | 104478 | 99564 | 94737 | 90434 | 86952 | 84019 | 81641 | 80096 | 78977 |

***Table 3.3.2. Example of stock structured output (Stock numbers, Biomass and SSB) from worksheet “Stock_Output”, by time period (here by quarter).***

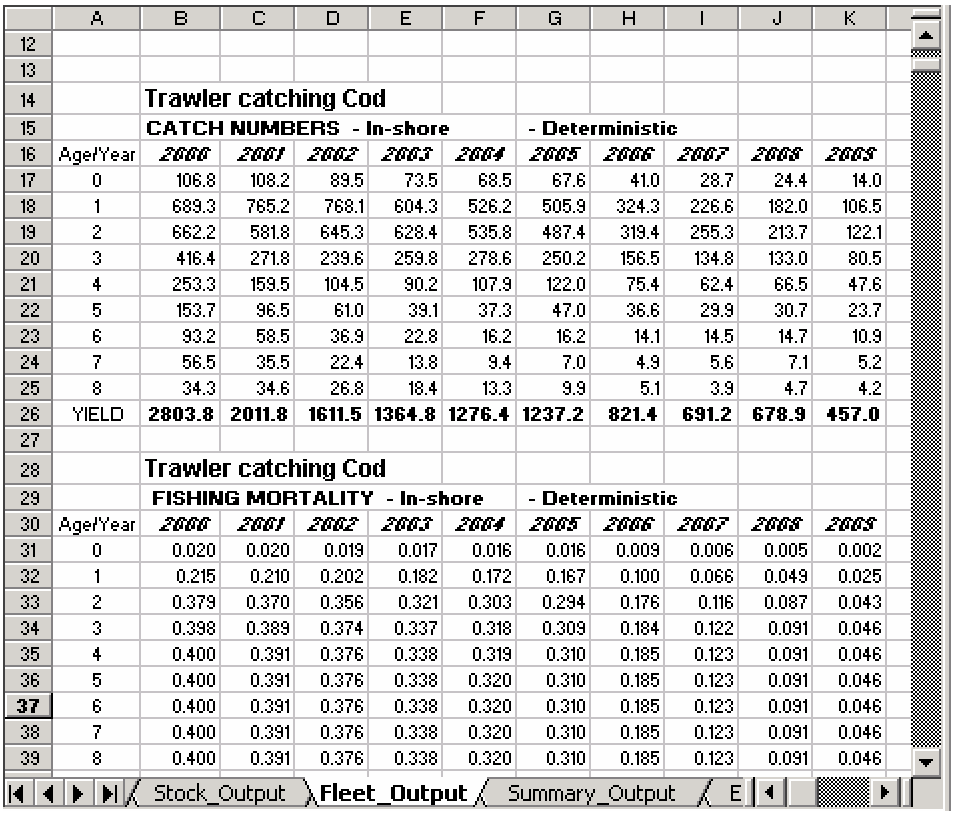
Figures 3.3.3-4 shows examples of output tables which are less aggregated than Tables 3.3.1-2, which refers to all fleets and areas combined. Figures 3.3.3-4 are tables from worksheet “Fleet_Output”.

Figure 3.3.3 refers to one selected fleet, whereas Figure 3.3.4 refers to a combination of selected fleet and selected area. Figure 3.3.3 gives the results by time period, whereas Table 3.3.4 give result by year. The numbers caught from Table 3.3.4 are given a graphical presentation in Figure 3.3.1.



| | A | B | C | D | E | F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 659 | | | | | | | | | | | | |
| 660 | | Trawler catching Cod | | | | | | | | | | |
| 661 | | DISCARDS | | | | - Deterministic | | | | | | |
| 662 | | | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
| 663 | 0 | T 1 | 6.8 | 6.9 | 5.7 | 4.7 | 4.4 | 4.3 | 2.6 | 1.8 | 1.5 | 0.9 |
| 664 | | T 2 | 17.9 | 18.1 | 15.0 | 12.3 | 11.4 | 11.3 | 6.8 | 4.8 | 4.0 | 2.3 |
| 665 | | T 3 | 42.8 | 43.4 | 35.8 | 29.4 | 27.4 | 27.0 | 16.4 | 11.4 | 9.7 | 5.6 |
| 666 | | T 4 | 88.2 | 89.4 | 74.0 | 60.8 | 56.7 | 55.9 | 34.0 | 23.8 | 20.3 | 11.7 |
| 667 | 1 | T 1 | 121.5 | 139.7 | 139.5 | 108.3 | 93.7 | 89.8 | 55.0 | 37.4 | 29.6 | 17.0 |
| 668 | | T 2 | 139.8 | 161.1 | 161.3 | 126.0 | 109.4 | 105.0 | 65.7 | 45.1 | 35.9 | 20.8 |
| 669 | | T 3 | 112.0 | 129.3 | 129.8 | 102.2 | 89.0 | 85.6 | 54.9 | 38.4 | 30.8 | 18.0 |
| 670 | | T 4 | 66.0 | 76.4 | 77.0 | 61.2 | 53.6 | 51.7 | 34.4 | 24.6 | 20.0 | 11.9 |
| 671 | 2 | T 1 | 33.3 | 31.0 | 35.5 | 33.9 | 28.6 | 25.9 | 15.8 | 12.1 | 10.0 | 5.5 |
| 672 | | T 2 | 14.6 | 13.7 | 15.8 | 15.3 | 13.0 | 11.9 | 7.7 | 6.1 | 5.0 | 2.9 |
| 673 | | T 3 | 6.4 | 6.0 | 6.9 | 6.8 | 5.9 | 5.3 | 3.6 | 2.9 | 2.5 | 1.4 |
| 674 | | T 4 | 2.8 | 2.6 | 3.1 | 3.1 | 2.6 | 2.4 | 1.7 | 1.4 | 1.2 | 0.7 |
| 675 | 3 | T 1 | 1.7 | 1.2 | 1.1 | 1.2 | 1.3 | 1.2 | 0.7 | 0.6 | 0.5 | 0.3 |
| 676 | | T 2 | 0.8 | 0.5 | 0.5 | 0.6 | 0.6 | 0.5 | 0.3 | 0.3 | 0.3 | 0.2 |
| 677 | | T 3 | 0.4 | 0.2 | 0.2 | 0.3 | 0.3 | 0.3 | 0.2 | 0.1 | 0.1 | 0.1 |
| 678 | | T 4 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| 679 | 4 | T 1 | 0.1 | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 |
| 680 | | T 2 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 681 | | T 3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 682 | | T 4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 699 | | .................................... | | | | | | | | | | |
| 700 | Total | T 1 | 25.8 | 25.7 | 27.4 | 24.3 | 21.0 | 19.4 | 11.8 | 8.7 | 7.2 | 4.0 |
| 701 | | T 2 | 28.5 | 30.6 | 31.6 | 26.6 | 23.1 | 21.8 | 13.7 | 9.9 | 8.1 | 4.7 |
| 702 | | T 3 | 29.5 | 32.8 | 33.4 | 27.4 | 23.9 | 22.8 | 14.7 | 10.6 | 8.7 | 5.1 |
| 703 | | T 4 | 26.5 | 29.5 | 29.4 | 24.0 | 21.2 | 20.4 | 13.5 | 9.8 | 8.1 | 4.8 |
| 704 | | | | | | | | | | | | |

*Figure 3.3.3. Stock and Fleet specific output by time period (from worksheet "Fl_Out_Period")*



| | A | B | C | D | E | F | G | H | I | J | K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 12 | | | | | | | | | | | |
| 13 | | | | | | | | | | | |
| 14 | | Trawler catching Cod | | | | | | | | | |
| 15 | | CATCH NUMBERS - In-shore | | | | - Deterministic | | | | | |
| 16 | Age/Year | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
| 17 | 0 | 106.8 | 108.2 | 89.5 | 73.5 | 68.5 | 67.6 | 41.0 | 28.7 | 24.4 | 14.0 |
| 18 | 1 | 689.3 | 765.2 | 768.1 | 604.3 | 526.2 | 505.9 | 324.3 | 226.6 | 182.0 | 106.5 |
| 19 | 2 | 662.2 | 581.8 | 645.3 | 628.4 | 535.8 | 487.4 | 319.4 | 255.3 | 213.7 | 122.1 |
| 20 | 3 | 416.4 | 271.8 | 239.6 | 259.8 | 278.6 | 250.2 | 156.5 | 134.8 | 133.0 | 80.5 |
| 21 | 4 | 253.3 | 159.5 | 104.5 | 90.2 | 107.9 | 122.0 | 75.4 | 62.4 | 66.5 | 47.6 |
| 22 | 5 | 153.7 | 96.5 | 61.0 | 39.1 | 37.3 | 47.0 | 36.6 | 29.9 | 30.7 | 23.7 |
| 23 | 6 | 93.2 | 58.5 | 36.9 | 22.8 | 16.2 | 16.2 | 14.1 | 14.5 | 14.7 | 10.9 |
| 24 | 7 | 56.5 | 35.5 | 22.4 | 13.8 | 9.4 | 7.0 | 4.9 | 5.6 | 7.1 | 5.2 |
| 25 | 8 | 34.3 | 34.6 | 26.8 | 18.4 | 13.3 | 9.9 | 5.1 | 3.9 | 4.7 | 4.2 |
| 26 | YIELD | **2803.8** | **2011.8** | **1611.5** | **1364.8** | **1276.4** | **1237.2** | **821.4** | **691.2** | **678.9** | **457.0** |
| 27 | | | | | | | | | | | |
| 28 | | Trawler catching Cod | | | | | | | | | |
| 29 | | FISHING MORTALITY - In-shore | | | | - Deterministic | | | | | |
| 30 | Age/Year | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
| 31 | 0 | 0.020 | 0.020 | 0.019 | 0.017 | 0.016 | 0.016 | 0.009 | 0.006 | 0.005 | 0.002 |
| 32 | 1 | 0.215 | 0.210 | 0.202 | 0.182 | 0.172 | 0.167 | 0.100 | 0.066 | 0.049 | 0.025 |
| 33 | 2 | 0.379 | 0.370 | 0.356 | 0.321 | 0.303 | 0.294 | 0.176 | 0.116 | 0.087 | 0.043 |
| 34 | 3 | 0.398 | 0.389 | 0.374 | 0.337 | 0.318 | 0.309 | 0.184 | 0.122 | 0.091 | 0.046 |
| 35 | 4 | 0.400 | 0.391 | 0.376 | 0.338 | 0.319 | 0.310 | 0.185 | 0.123 | 0.091 | 0.046 |
| 36 | 5 | 0.400 | 0.391 | 0.376 | 0.338 | 0.320 | 0.310 | 0.185 | 0.123 | 0.091 | 0.046 |
| 37 | 6 | 0.400 | 0.391 | 0.376 | 0.338 | 0.320 | 0.310 | 0.185 | 0.123 | 0.091 | 0.046 |
| 38 | 7 | 0.400 | 0.391 | 0.376 | 0.338 | 0.320 | 0.310 | 0.185 | 0.123 | 0.091 | 0.046 |
| 39 | 8 | 0.400 | 0.391 | 0.376 | 0.338 | 0.320 | 0.310 | 0.185 | 0.123 | 0.091 | 0.046 |

*Figure 3.3.4. Stock, Fleet and area specific annual output. (from worksheet "Fl_Out_Area")*

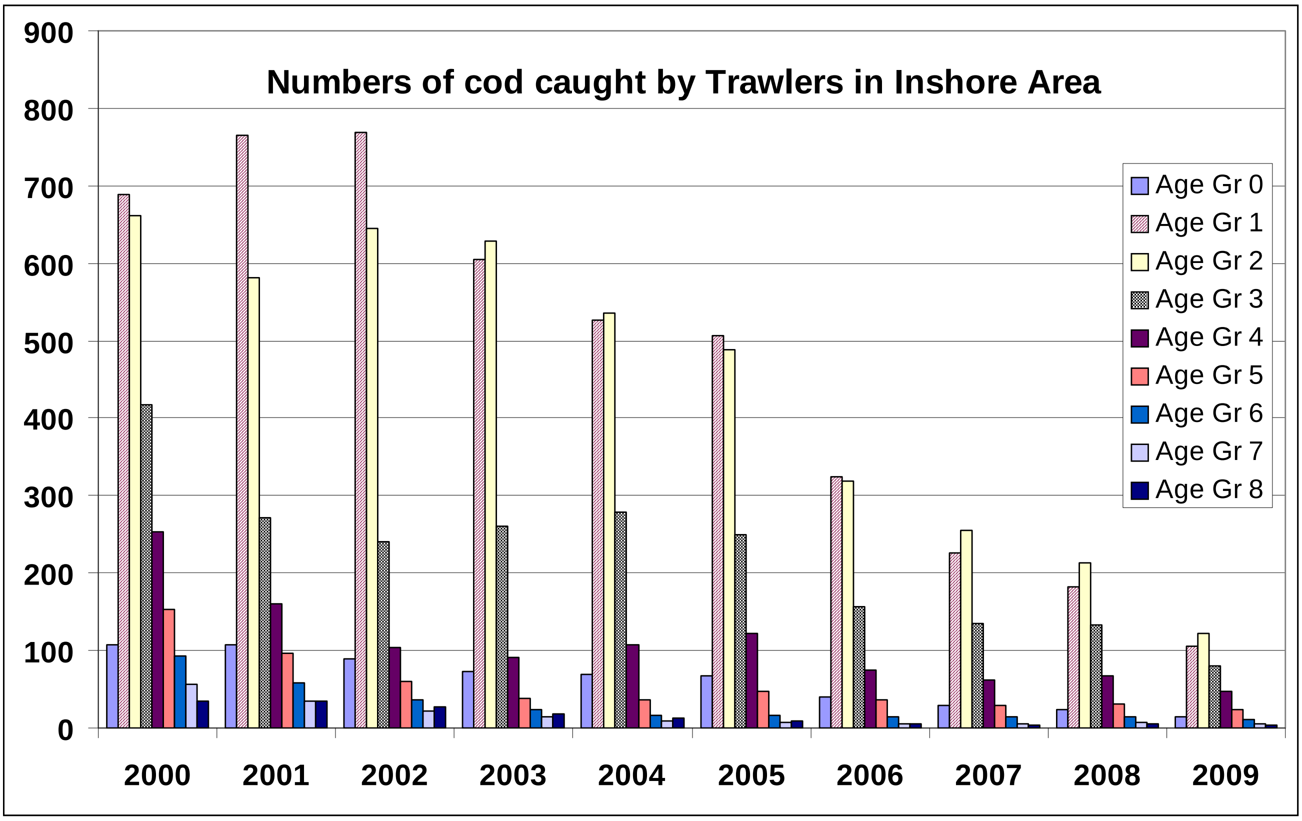


Figure 3.3.1. Example of graphical presentation of fleet structured output. Derived from Figure 3.3.4.

Figure 3.3.1 uses lines 16-25 of Table 3.3.4 as input to the EXCEL graph wizard, without any modifications of the data. Naturally, you must know how to operate the graph wizard of EXCEL, but once you master that technique, it takes little time to produce Figure 3.3.1. Once you have the graph, it will stay in the worksheet, and be modified every time you make a new simulation. Like that you can “customize” the graphical output of TEMAS.

If you master the VISUAL BASIC language, you may add sub-routines, which produces tables for graphs on your own choice.

You may as well make your own tables derived from the standard output tables of TEMAS, but then you should remember that TEMAS clears the output sheets, when it restart the calculations. Thus, you should make a copy your private tables in a separate (non-standard) sheet in TEMAS_CALC. This is the main reason why EXCEL has been chosen for the implementation of TEMAS, namely to give the user the maximum freedom to customize input and output handling and presentation by aid of a well-known tool.

Section 4.3 describes an example of a user-defined table, to manipulate input data to TEMAS.

One problem with the TEMAS output is that the there is so much of it. It is necessary to be rather selective concerning the choice of results to present in the report on the TEMAS analysis. Probably one will not show age structured results in the final report, unless there is a request to address questions related to size distribution. A TEMAS analysis aiming at assessing the effect of mesh size changes may require the presentation of age/size structured data, whereas for other analyses if will suffice to present only total landings by weight and/or by value. Thus, there is no set of standard output tables of TEMAS. It all depends on the objectives of using TEMAS in the actual situation.

The detailed output is thought of as a options for the user, by which she/he can check and assess the simulations. The detailed results may reveal inconsistencies and questionable assumptions in the input parameters.

## 4.4. DETAILED ECONOMIC OUPUT FROM SINGLE SIMULATION

The economic output combined with a few biological summary results is considered the principal output of TEMAS, as explained in Section 3.1. This section present some detailed economic results as well as some results of a technical/employment/biological nature.

Table 3.4.1 shows an example of fleet specific economic output from a single deterministic simulation. In this case it shows the two financial analyses and the economic analysis for the trawler fleet, together with some "additional information". The economic analyses are explained in detail in the theoretical paper on TEMAS.

The economic results are shown for each fleet (Table 3.4.1), as well as for all fleets combined (in the summary outpt).

The additional information for the fleet-specific economic analysis (Table 3.4.1) shows the total landings, the value, the CPUE (Catch Per Unit of Effort) the Val.PUE (Value Per Unit of Effort) for each stock. In the example of Table 3.4.1, there are two species "Cod" and "Plaice". The additional information thus is a summary of the biological output related to the production of fleets. Furthermore, the additional information shows the capacity (the number of vessels) and the employment. All these results are key-results, and may be used as indicators for the performance of the fleets.

CPUE and Val.PUE represent the production in the economic model. But CPUE also indicates the stock biomass, so, somehow, these are central indicators of the system, of interest both to biologists and economists.

The "gross revenue" (Table 3.4.1) is derived as the product of Val.P.U.E and price. The gross revenue minus the costs of fishing and investments gives the "Cash flow" in the financial analysis of the harvesting sector. The cash flow represents the "profit" of the fleet (Table 3.4.1) or the industry (summary output). A similar concept is used in the economic analysis, where the stakeholder is considered to be the society. For the government treasury, the perspective is kind of turned around, with for example, tax being an income, not a cost.

Note that table 3.1.3 and 3.4.1 does not match in all lines. Table 3.1.3 shows results for all fleets combined, and then it does not make sense to give any results on effort, CPUE and Val.PUE., as these concepts are linked to individual fleets. Table 3.1.3 contains only output for which the units are fleet-independent, so that they can be summed over fleets.

Some output of the economic tables, can in a meaningful way be given by stock, area and by time period, but not all of them. From the (pure) economic point of view it is irrelevant where the landings come from in terms of stock and area, and therefore it may usually not make sense to make an economic analysis for a fish stock or a fishing area in isolation.

The NPVs (Net Present Values) of the net cash flows are shown below the column for the first year, but it refers to the entire time series by the formula, where "r" is either the discount rate for the financial analysis or the discount rate for the economic analysis (see discussion in the theoretical paper on TEMAS).

$$NPV(r) = \sum_{y=2000}^{2012} \frac{Net\_Value_y}{(1+r)^{y-2000}}$$

**Table 2. 1. 1.** **FINANCIAL ANALYSIS OF HARVESTING Trawler - Deterministic**

| . | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|---|---|---|
| Gr. revenue before tax | 37444 | 26329 | 17037 | 12195 | 9730.5 | 9114.3 | 4509.0 | 3277.9 | 3585.1 | 1265.7 |
| Revenue tax | 1872.2 | 1316.5 | 851.83 | 609.77 | 486.53 | 455.71 | 225.45 | 163.89 | 179.25 | 63.287 |
| Gr. revenue after tax | 35572 | 25013 | 16185 | 11586 | 9244.0 | 8658.6 | 4283.6 | 3114.0 | 3405.8 | 1202.5 |
| Costs of effort | 6161.5 | 6141.8 | 5583.4 | 5054.6 | 4595.5 | 4671.9 | 2194.9 | 1260.7 | 1017.2 | 254.10 |
| Cost of landing | 38.524 | 25.887 | 16.405 | 11.585 | 9.1260 | 8.4157 | 4.0987 | 2.9368 | 3.1639 | 1.0994 |
| Crew share | 4411.5 | 2830.6 | 1590.2 | 979.64 | 697.27 | 598.00 | 313.31 | 277.99 | 358.29 | 142.25 |
| Crew salary | 6161.5 | 6141.8 | 5583.4 | 5054.7 | 4595.5 | 4671.9 | 2194.9 | 1260.7 | 1017.2 | 254.10 |
| Fixed Costs | 5250 | 4985.3 | 4532 | 4102.8 | 3730.1 | 3792.2 | 1781.6 | 1023.3 | 825.68 | 206.25 |
| Investment | 0 | 255 | 0 | 260 | 0 | 530 | 0 | 1350 | 272.50 | 0 |
| Decommission | 0 | 0 | 14.400 | 0 | 18.300 | 0 | 42.600 | 0 | 10.500 | 0 |
| Effort tax | 9.2422 | 9.2127 | 8.3751 | 7.5820 | 6.8933 | 7.0079 | 3.2923 | 1.8911 | 1.5258 | .38115 |
| Effort subsidy | 6.1615 | 6.1418 | 5.5834 | 5.0547 | 4.5955 | 4.6719 | 2.1949 | 1.2607 | 1.0172 | .25410 |
| Licence fee | 1680 | 1564 | 1408 | 1262.4 | 1136.8 | 1144.8 | 532.80 | 303.20 | 242.40 | 60 |
| N.cash Flow | 11866 | 3065.3 | -2517.1 | -5142.7 | -5504.4 | -6761.0 | -2696.4 | -2365.5 | -320.66 | 284.53 |
| N.P.V.cash Flow | -19042 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**Table 2. 1. 2.** **FINANCIAL ANALYSIS OF GOVERNMENT TREASURY, Trawler - Deterministic**

| . | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|---|---|---|
| Subsidies/boats/yr | 16800 | 15953 | 14502 | 13129 | 11936 | 12135 | 5701.0 | 3274.6 | 2642.2 | 660 |
| Vessel Decomm. | 0 | 0 | 48 | 0 | 61 | 0 | 142 | 0 | 35 | 0 |
| Crew Decomm. | 0 | 0 | 5487.8 | 0 | 7109.6 | 0 | 16865 | 0 | 4234.7 | 0 |
| Management C. | 15 | 15.300 | 15.450 | 15.600 | 15.750 | 15.900 | 16.050 | 16.200 | 16.350 | 16.500 |
| Effort tax | 9.2422 | 9.2127 | 8.3751 | 7.5820 | 6.8933 | 7.0079 | 3.2923 | 1.8911 | 1.5258 | .38115 |
| Effort Subsidy | 6.1615 | 6.1418 | 5.5834 | 5.0547 | 4.5955 | 4.6719 | 2.1949 | 1.2607 | 1.0172 | .25410 |
| Licence fee | 1680 | 1564 | 1408 | 1262.4 | 1136.8 | 1144.8 | 532.80 | 303.20 | 242.40 | 60 |
| Revenue tax | 1872.2 | 1316.5 | 851.83 | 609.77 | 486.53 | 455.71 | 225.45 | 163.89 | 179.25 | 63.287 |
| N.cash Flow | -13260 | -13085 | -17791 | -11270 | -17497 | -10548 | -21965 | -2823.0 | -6506.0 | -553.09 |
| N.P.V.cash Flow | -90682 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**Table 2. 1. 3.** **ECONOMIC ANALYSIS - Trawler - Deterministic**

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|---|---|---|
| Gross revenue | 37444 | 26329 | 17037 | 12195 | 9730.5 | 9114.3 | 4509.0 | 3277.9 | 3585.1 | 1265.7 |
| Cost of effort | 6161.5 | 6141.8 | 5583.4 | 5054.6 | 4595.5 | 4671.9 | 2194.9 | 1260.7 | 1017.2 | 254.10 |
| Cost of landings | 38.524 | 25.887 | 16.405 | 11.585 | 9.1260 | 8.4157 | 4.0987 | 2.9368 | 3.1639 | 1.0994 |
| Crew Oppurt.C. | 6300 | 5982.3 | 5438.4 | 4923.4 | 4476.2 | 4550.6 | 2137.9 | 1228.0 | 990.81 | 247.50 |
| Fixed costs | 5250 | 4985.3 | 4532 | 4102.8 | 3730.1 | 3792.2 | 1781.6 | 1023.3 | 825.68 | 206.25 |
| Investment | 0 | 255 | 0 | 260 | 0 | 530 | 0 | 1350 | 272.50 | 0 |
| Management C. | 15 | 15.300 | 15.450 | 15.600 | 15.750 | 15.900 | 16.050 | 16.200 | 16.350 | 16.500 |
| N.cash Flow | 19679 | 8923.7 | 1450.9 | -2172.6 | -3096.2 | -4454.7 | -1625.4 | -1603.2 | 459.37 | 540.29 |
| N.P.V.cash Flow | -613.38 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**Table 2. 1. 4.** **ADDITIONAL INFORMATION - Trawler - Deterministic**

| . | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|---|---|---|
| Landings Cod | 3512.4 | 2258.8 | 1381.0 | 944.57 | 724.62 | 651.58 | 311.86 | 222.62 | 240.10 | 83.768 |
| Landings Plaice | 340.02 | 279.11 | 211.81 | 169.36 | 144.53 | 142.35 | 71.192 | 49.304 | 50.159 | 16.178 |
| Total Landings | 3852.4 | 2537.9 | 1592.8 | 1113.9 | 869.15 | 793.93 | 383.05 | 271.92 | 290.26 | 99.946 |
| Value Cod | 40012 | 29047 | 19924 | 15029 | 12383 | 11826 | 5704.7 | 3837.1 | 3878.0 | 1282.2 |
| Value Plaice | 8981.6 | 8250.0 | 7082.9 | 6192.2 | 5554.1 | 5631.4 | 2723.7 | 1692.0 | 1523.6 | 437.33 |
| Total Value | 37444 | 26329 | 17037 | 12195 | 9730.5 | 9114.3 | 4509.0 | 3277.9 | 3585.1 | 1265.7 |
| Mean Value/kg | 9.7196 | 10.374 | 10.696 | 10.948 | 11.195 | 11.480 | 11.771 | 12.054 | 12.351 | 12.664 |
| Number of Crew | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Number of boats | 2100 | 1955 | 1760 | 1578 | 1421 | 1431 | 666 | 379 | 303 | 75 |
| C.P.U.E Cod | .0057 | .0038 | .0025 | .0019 | .0017 | .0015 | .0015 | .0019 | .0026 | .0036 |
| C.P.U.E Plaice | .0006 | .0005 | .0004 | .0003 | .0003 | .0003 | .0003 | .0004 | .0005 | .0007 |
| Val.P.U.E Cod | .0547 | .0383 | .0267 | .0208 | .0181 | .0165 | .0174 | .0224 | .0309 | .0448 |
| Val.P.U.E Plaice | .0061 | .0054 | .0047 | .0043 | .0042 | .0042 | .0046 | .0057 | .0075 | .0100 |

***Table 3.4.1. Example of economic output. The three analyses for a selected fleet (From worksheet "Economic_Output")***

## 4.5. OUTPUT FROM STOCHASTIC SIMULATIONS

The output from multiple simulations is in worksheets “Stochastic_Output” (Tables 3.5.1-2) and “NPV_Output” (NPV = Net Present Value”, Table 3.5.3),.

The results in worksheet “NPV_Output” is derived from the results in worksheet “Stochastic Output”, by the formula:

$$NPV(r) = \sum_{y=First\ Year}^{Lasty\ year} \frac{Net\_Value_y}{(1+r)^{y-First\ Year}}$$

Thus, the detailed results are shown in “Stochastic_Output” and the summary results in “NPV_Output”

The output from multiple stochastic simulations only shows time series of a few selected key results, and their net present values. (stochastic simulation is also discussed in Section 7)

The annual output is given in the form of a frequency distribution for each year, as illustrated by the example in Table 3.5.1, which shows the time series of frequencies of 500 simulations of the Cash Flow of Harvesting for a selected fleet.

The row “Class low.lim.” (Lower limit of class interval) divides the range of output values in interval of equal length. The sum of the table entries in each “year-row” is 500. The number in each row gives the number of simulation where the result felt in the interval in question. For example, in year 2000, there were 54 simulations, which gave a “Total cash flow “ in the interval from 165 to 192.

The graph shown in Figure 3.2.1 is derived from two tables like Table 3.5.1, one for each fleet. From table 3.5.1. one could make 13 graphs. In Figure 3.2.1, the 13 graphs has been combined into one single graph, by computing the net present value of all net cash flows of 13 years.

Table 3.5.2 presents a complete list of the key results from the multiple stochastic simulations, in the case where there are two stocks and two fleets. Figure 3.5.1 shows an example of a graph easily produced from the first sub-table of Table 3.5.2.

| **Class index** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Class low. Lim.** | -76 | -49 | -22 | 5 | 31 | 58 | 85 | 112 | 138 | 165 | 192 | 219 | 245 | 272 | 299 | 326 | 353 | 379 | 406 | 433 | 460 | 486 | 513 | 540 | 567 |
| **2000** | 0 | 0 | 0 | 1 | 4 | 6 | 11 | 21 | 31 | 54 | 51 | 51 | 69 | 46 | 36 | 40 | 34 | 10 | 13 | 13 | 4 | 4 | 0 | 0 | 1 |
| **2001** | 0 | 0 | 0 | 0 | 1 | 6 | 19 | 32 | 51 | 76 | 66 | 77 | 50 | 51 | 31 | 17 | 11 | 6 | 2 | 1 | 2 | 1 | 0 | 0 | 0 |
| **2002** | 0 | 0 | 0 | 0 | 1 | 17 | 23 | 59 | 69 | 89 | 73 | 66 | 45 | 24 | 15 | 11 | 2 | 3 | 0 | 2 | 0 | 1 | 0 | 0 | 0 |
| **2003** | 0 | 0 | 0 | 0 | 2 | 14 | 29 | 73 | 92 | 89 | 93 | 55 | 34 | 7 | 7 | 3 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| **2004** | 0 | 0 | 0 | 1 | 18 | 55 | 111 | 105 | 95 | 63 | 25 | 10 | 10 | 4 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| **2005** | 0 | 0 | 0 | 17 | 53 | 120 | 132 | 98 | 38 | 18 | 12 | 4 | 3 | 2 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2006** | 0 | 3 | 37 | 76 | 127 | 101 | 68 | 48 | 17 | 14 | 3 | 1 | 3 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2007** | 9 | 30 | 101 | 127 | 100 | 66 | 26 | 19 | 9 | 6 | 3 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2008** | 0 | 4 | 32 | 109 | 128 | 97 | 53 | 35 | 19 | 9 | 7 | 2 | 1 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2009** | 33 | 82 | 123 | 103 | 76 | 36 | 22 | 11 | 7 | 4 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2010** | 5 | 33 | 104 | 121 | 106 | 66 | 26 | 16 | 13 | 7 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2011** | 3 | 13 | 84 | 138 | 106 | 72 | 41 | 22 | 8 | 5 | 3 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2012** | 23 | 73 | 113 | 109 | 94 | 41 | 22 | 10 | 8 | 2 | 1 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

***Table 3.5.1. Time series of Frequency in 500 simulations of Cash Flow of Financial analysis of Harvest for fleet: Trawler***

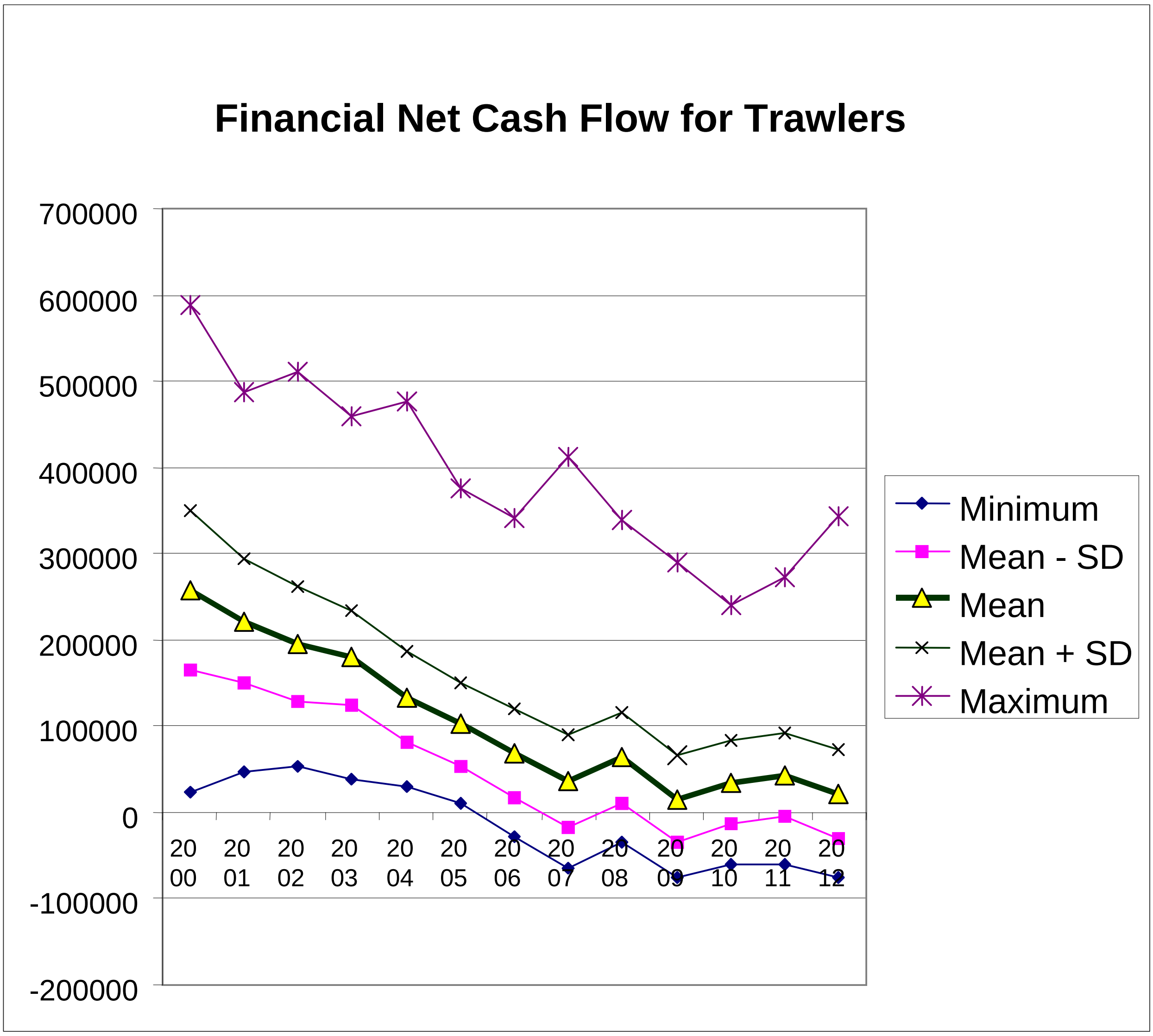


***Figure 3.5.1. Graphical presentation of time series, produced by multiple stochastic simulations.***

Figure 3.5.1 shows an alternative way of presenting distributions of net cash flow, compared to Figure 3.2.1 Figure 3.5.1 indicates the probability distributions for the cash flow every year in the time series. The probability distributions are indicated by the mean value of the distribution, and mean value plus/minus standard deviation (SD). The graph also shows the minimum and the maximum values among the simulations made.

Figure 3.5.1 is very easy to produce with the present version of TEMAS, as TEMAS produces the number shown in Table 3.5.2. These tables can easily be converted into graphs by aid of the EXCEL graph wizard. One does not need to make any modifications of the numbers in Table 3.5.2 to produce the graph 3.5.1.

Table 3.5.3 shows the complete content of sheet “NPV_Output”, which gives estimated probability distribution the Net Present Values of the three analyses by fleets. The probability distributions are estimated by the frequencies, in this case, of only 100 simulations.

Somehow, one may claim that Table 3.5.3 represents the overall summary output of a TEMAS exercise, as it shows both the economic key results as well as their probability estimation. Actually, it is the **estimate of** the probability distribution, which Table 3.5.3 shows, and that estimate is based on the (questionable) assumption that TEMAS gives an unbiased reflection of the real world.

.

**Cash Flow Financial Harvest – Trawler**

| Year | Minimum | Mean - SD | Mean | Mean + SD | Maximum |
|---|---|---|---|---|---|
| **2000** | 23241 | 165590 | 257635 | 349679 | 587675 |
| **2001** | 47711 | 149707 | 222028 | 294349 | 487046 |
| **2002** | 53439 | 128339 | 195438 | 262536 | 511103 |
| **2003** | 38095 | 125416 | 179472 | 233528 | 458392 |
| **2004** | 30880 | 81675 | 133833 | 185990 | 475772 |
| **2005** | 10716 | 54350 | 102182 | 150015 | 375716 |
| **2006** | -27280 | 16267 | 67677 | 119086 | 341541 |
| **2007** | -64380 | -16984 | 36166 | 89315 | 412615 |
| **2008** | -35454 | 10670 | 63394 | 116117 | 338330 |
| **2009** | -74500 | -35381 | 15398 | 66177 | 289954 |
| **2010** | -60386 | -13650 | 35137 | 83923 | 241085 |
| **2011** | -60851 | -5422 | 43758 | 92938 | 273627 |
| **2012** | -75042 | -30735 | 20785 | 72304 | 344137 |

**Cash Flow Financial Harvest - Gill net**

| Year | Minimum | Mean - SD | Mean | Mean + SD | Maximum |
|---|---|---|---|---|---|
| **2000** | 814 | 89875 | 137323 | 184772 | 263896 |
| **2001** | -33039 | 47439 | 89822 | 132206 | 232303 |
| **2002** | 14159 | 69120 | 108069 | 147018 | 238287 |
| **2003** | 1770 | 59968 | 95593 | 131218 | 240079 |
| **2004** | -15971 | 25358 | 60622 | 95885 | 219077 |
| **2005** | -25115 | 11301 | 46766 | 82231 | 297860 |
| **2006** | -59739 | -18217 | 17858 | 53934 | 305817 |
| **2007** | -63265 | -20228 | 16318 | 52863 | 304579 |
| **2008** | -69560 | -37698 | -1863 | 33972 | 175787 |
| **2009** | -75000 | -42083 | -6182 | 29720 | 137661 |
| **2010** | -94366 | -58776 | -25128 | 8520 | 99068 |
| **2011** | -69533 | -29577 | 2862 | 35302 | 155575 |
| **2012** | -76635 | -37965 | -4330 | 29305 | 158348 |

**Cash Flow Financial Government Treasury – Trawler**

| Year | Minimum | Mean - SD | Mean | Mean + SD | Maximum |
|---|---|---|---|---|---|

**……… etc…..**

**Cash Flow Financial  Government Treasury – Gill net**

| Year | Minimum | Mean - SD | Mean | Mean + SD | Maximum |
|---|---|---|---|---|---|

**……… etc…..**

**Cash Flow Economic Analysis – Trawler**

| Year | Minimum | Mean - SD | Mean | Mean + SD | Maximum |
|---|---|---|---|---|---|

**……… etc…..**

**Cash Flow Economic Analysis - Gill net**

| Year | Minimum | Mean - SD | Mean | Mean + SD | Maximum |
|---|---|---|---|---|---|

**……… etc…..**

**Revenue – Trawler**

| Year | Minimum | Mean - SD | Mean | Mean + SD | Maximum |
|---|---|---|---|---|---|

**……… etc…..**

**Revenue – Gill net**

| Year | Minimum | Mean - SD | Mean | Mean + SD | Maximum |
|---|---|---|---|---|---|

**……… etc…..**

**SSB – Shrimp**

| Year | Minimum | Mean - SD | Mean | Mean + SD | Maximum |
|---|---|---|---|---|---|

**……… etc…..**

**SSB – Squid**

| Year | Minimum | Mean - SD | Mean | Mean + SD | Maximum |
|---|---|---|---|---|---|

**……… etc…..**

**Yield – Shrimp**

| Year | Minimum | Mean - SD | Mean | Mean + SD | Maximum |
|---|---|---|---|---|---|

**……… etc…..**

**Yield – Squid**

| Year | Minimum | Mean - SD | Mean | Mean + SD | Maximum |
|---|---|---|---|---|---|
| **2000** | 12244 | 22805 | 28532 | 34258 | 44489 |
| **2001** | 17002 | 23367 | 28275 | 33182 | 45969 |
| **2002** | 17109 | 21618 | 25873 | 30128 | 42462 |
| **2003** | 14274 | 18651 | 22356 | 26061 | 39904 |
| **2004** | 11492 | 15514 | 19181 | 22847 | 38796 |
| **2005** | 9544 | 13114 | 16938 | 20763 | 51297 |
| **2006** | 9217 | 11762 | 15329 | 18897 | 48093 |
| **2007** | 7727 | 10932 | 14358 | 17784 | 45159 |
| **2008** | 6774 | 10184 | 13389 | 16594 | 32878 |
| **2009** | 6537 | 9373 | 12726 | 16080 | 32111 |
| **2010** | 5605 | 9044 | 12049 | 15054 | 27375 |
| **2011** | 6296 | 8902 | 11750 | 14599 | 25565 |
| **2012** | 5467 | 8287 | 11233 | 14179 | 22675 |

***Table 3.5.2. Complete list of the key results from multiple stochastic simulations, in the case where there are two stocks and two fleets (the time series, however, are only shown for the two first key results and the last one).***

Frequency in 100 simulations of Net Prevent Values

| | Trawler | | | Gill Net | | |
|---|---|---|---|---|---|---|
| | Financial Harvest N.P.Val. Cash.Fl. | Financial Govt. Tr. N.P.Val. Cash.Fl. | Economic Net Present Val. Cash.Fl. | Financial Harvest N.P.Val. Cash.Fl. | Financial Govt. Tr. N.P.Val. Cash.Fl. | Economic Net Present Val. Cash.Fl. |
| **Mean** | 1333.9 | 2274.6 | 3387.4 | 4619.4 | 1050.0 | 6221.3 |
| **Std.dev.** | 1185.8 | 77.7 | 1483.0 | 1139.7 | 72.0 | 1425.2 |
| **Min** | -1397.5 | 2105.2 | 6.6 | 2049.1 | 889.1 | 3007.5 |
| **Max** | 4459.4 | 2514.3 | 7329.9 | 7624.4 | 1253.4 | 9987.5 |
| **Rel.Std.dev.** | 88.9 | 3.4 | 43.8 | 24.7 | 6.9 | 22.9 |

The simulated range is divided into 25 intervals, and frequencies refer to these intervals

| | Trawler | | | Gill Net | | |
|---|---|---|---|---|---|---|
| **Class index** | Financial Harvest N.P.Val. Cash.Fl. | Financial Govt. Tr. N.P.Val. Cash.Fl. | Economic Net Present Val. Cash.Fl. | Financial Harvest N.P.Val. Cash.Fl. | Financial Govt. Tr. N.P.Val. Cash.Fl. | Economic Net Present Val. Cash.Fl. |
| 1 | 1 | 0 | 1 | 1 | 1 | 1 |
| 2 | 0 | 1 | 0 | 0 | 0 | 0 |
| 3 | 1 | 0 | 1 | 3 | 0 | 3 |
| 4 | 3 | 1 | 3 | 2 | 4 | 2 |
| 5 | 3 | 4 | 3 | 3 | 4 | 3 |
| 6 | 2 | 2 | 2 | 1 | 1 | 1 |
| 7 | 6 | 3 | 7 | 10 | 3 | 10 |
| 8 | 14 | 13 | 13 | 4 | 11 | 4 |
| 9 | 4 | 10 | 4 | 8 | 7 | 8 |
| 10 | 7 | 6 | 7 | 11 | 10 | 11 |
| 11 | 8 | 5 | 8 | 5 | 6 | 5 |
| 12 | 6 | 10 | 6 | 8 | 8 | 8 |
| 13 | 4 | 4 | 4 | 3 | 4 | 3 |
| 14 | 5 | 8 | 6 | 8 | 8 | 8 |
| 15 | 11 | 11 | 11 | 6 | 6 | 6 |
| 16 | 8 | 5 | 7 | 2 | 3 | 2 |
| 17 | 2 | 4 | 2 | 9 | 9 | 9 |
| 18 | 3 | 2 | 3 | 6 | 7 | 6 |
| 19 | 4 | 6 | 4 | 5 | 3 | 5 |
| 20 | 3 | 0 | 3 | 0 | 0 | 0 |
| 21 | 0 | 2 | 0 | 0 | 0 | 0 |
| 22 | 2 | 0 | 2 | 1 | 2 | 1 |
| 23 | 0 | 2 | 0 | 2 | 1 | 2 |
| 24 | 2 | 1 | 2 | 0 | 1 | 0 |
| 25 | 1 | 0 | 1 | 2 | 1 | 2 |

***TABLE 3.5.3. Summary output of stochastic simulations from work sheet “NPV_Output”.***

# 5. RUNNING THE TEMAS

## 5.1. DO'S AND DON'TS

When running TEMAS, you may do any calculation or manipulation of the TEMAS input tables and output tables by aid of the facilities in EXCEL. With the output tables, produced by workbook TEMAS_CALC, there is no special instruction on things you should not do. You can do anything you like with the output workbooks, except for deleting the sheets or renaming them. There are four general warnings on thing you should not when running TEMAS, in particular TEMAS_INPUT.

**WARNING 1:** Do NOT delete any of the standard spreadsheets of TEMAS, as that action will cause the TEMAS to crash.

**WARNING 2:** Do NOT insert or delete rows or columns between the input cells (cells indicated by colours, predominantly yellow colour). The yellow cells occur only in workbook TEMAS_INPUT.

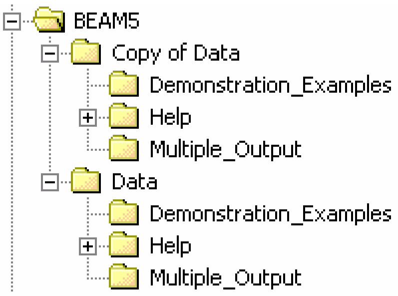
**WARNING 3:** Do NOT change the names of the standard worksheets of TEMAS. If you do, TEMAS will not function.

**WARNING 4:** Do NOT change the location of the TEMAS directories (as shown in Figure 1.3.1) (You may, however, change the location of C:\TEMAS\ if you make the corresponding change the to the "Declarations" -VB-modules.

**WARNING 5:** Do NOT delete files in the directories by aid of "Windows explorer":

C:\TEMAS\Data\
C:\TEMAS\Data\Demonstration_examples
C:\TEMAS\Data\Multiple_Output
C:\TEMAS\Data\Help

The data files can be deleted by options in the menu, and when you want to delete data files, do it with the button "Delete File(s)" in the main menu of the input module (Figures 1.3.5-6).



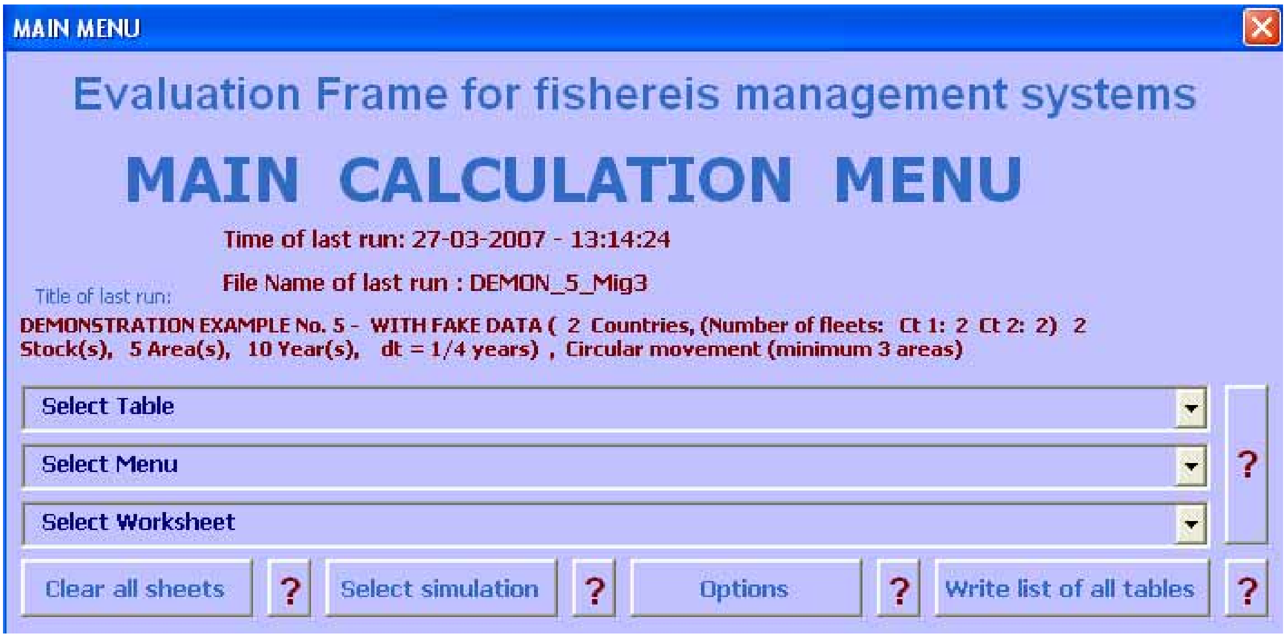
**RECOMMENDATION 1:** Do always keep a Backup file of your original data set. To be on the safe side you may from time to time make a copy of the entire data subdirectory.

Make also a backup of the entire TEMAS system, so that in case everything goes wrong you can start up with a fresh version of TEMAS system and your input data.

Making these backups takes very short time (seconds), whereas you may loose days of work if you loose your original data.

In general: TEMAS consists of two EXCEL workbooks. Follow the normal precautionary approaches when running EXCEL workbooks.

**RECOMMENDATION 2:** Use the "Clear All sheets" button from time to time , as TEMAS otherwise will grow in size. Without any data in the work sheets, each of the workbooks takes up about 2 Mb, but they may easily grow to 10 Mb after a number of applications. Both main menus (main menu of the input module, Figure 1.3.5-6 and the calculation module, Figure 4.4.1) contains the option to "Clear all sheets".



MAIN MENU

Evaluation Frame for fishereis management systems

MAIN CALCULATION MENU

Time of last run: 27-03-2007 - 13:14:24

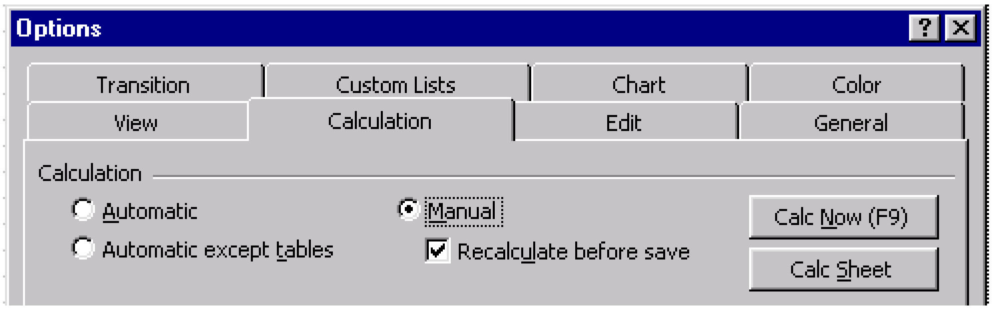
File Name of last run : DEMON_5_Mig3

Title of last run:

DEMONSTRATION EXAMPLE No. 5 - WITH FAKE DATA ( 2 Countries, (Number of fleets: Ct 1: 2 Ct 2: 2) 2 Stock(s), 5 Area(s), 10 Year(s), dt = 1/4 years) , Circular movement (minimum 3 areas)

*Figure 4.1.1. The main menu for the calculation module.*

## 5.2. START CALCULATIONS



Options

Calculation

○ Automatic

○ Automatic except tables

● Manual

☑ Recalculate before save

Calculation in TEMAS is executed by TEMAS_CALC. It should be kept in mind that TEMAS does not automatically execute the computations, when you modify the content of a cell, as in an ordinary spreadsheet. Actually, there is an option in EXCEL for “manual calculation”. If you select this option, calculations will be made only when you press the “F9-key”. Likewise, TEMAS 5 will only execute when you request it to do so, corresponding to pressing the “F9” key. You give the commands to TEMAS by clicking on buttons in the “User forms”.

Like the input module, the calculation module contains a “main menu” (Figure 4.1.1). The main menus have the same basic layout, but the main menu for to input module (Figures 1.3.5-6) contains more option buttons than the main menu for calculations.

The calculation module contains only 6 menus (see Figure 4.2.1), compared to the input module containing 25 menus (see Table 4.2.1).

,

***Figure 4.2.1. List of menus on the calculation module (from the main menu for the calculation module, Figure 4.1.1).***

| | |
|---|---|
| 1 | Start Up Form |
| 2 | About (the software) |
| 3 | Particulars about the author (Per Sparre) |
| 4 | Particulars about the author (Rolf Willmann) |
| 5 | Main Menu |
| 6 | Input: Dimensions of case study |
| 7 | Input: Stocks structured input |
| 8 | Input: Fleet/Stock - structured input |
| 9 | Input: Effort |
| 10 | Input: No. of boats |
| 11 | Input: Price per kg |
| 12 | Input: Economic input |
| 13 | Input: Landings |
| 14 | Input: Estimate of F |
| 15 | Input: Behaivioral rules of the fishing industry |
| 16 | Select demonstration example |
| 17 | Select type of migration |
| 18 | Pre-processing of Stocks structured input |
| 19 | Pre-processing of Fleets and Fleet/Stock - structured input |
| 20 | Pre-processing of Effort |
| 21 | Pre-processing of Number of boats |
| 22 | Pre-processing of Price per kg |
| 23 | Pre-processing of Fleets structured oconomic input |
| 24 | Pre-processing of Observed landings used for tuning |
| 25 | Pre-processing of Fishing mortality as additional data used for tuning |

***Table 4.2.1. List of menus in the input module. (This can be achieved from the main menu of the input module, see Figure 1.3.5, option "Select menu")***

Figure 4.2.2 shows the user forms by which you can start the simulation, by clicking on "compute". There are two user-forms from which the computations can be started in the calculation module. The first menu "SELECT SIMULATION TYPE" lets you choose between deterministic/stochastic simulation, and in case of stochastic simulation you can choose between "single simulation" and "multiple simulation".

The second menu "SELECT OUTPUT" in Figure 4.2.2 starts the computation of single simulations, which produces a suite of detailed output. The form is used to select output and to start the computations.

Once you are in the scope of user-forms, you loose access to the spreadsheet, but you can at any time easily toggle between user-forms and spreadsheets. You go from sheets to user-forms by clicking on the green button with the "Fish school" and "Start" on it. You leave the user forms by clicking on the "Go to Sheets" button, or the "X" in the upper right corner of the form. As an example of a user form, Figure 1.3.5 shows the form for entry of stock structured input.

Changing parameter values of the worksheet cells in TEMAS_INPUT will have an effect on the simulation results, only after the modified parameter values have been copied to the disk-files, from which the computation module of TEMAS takes its input.

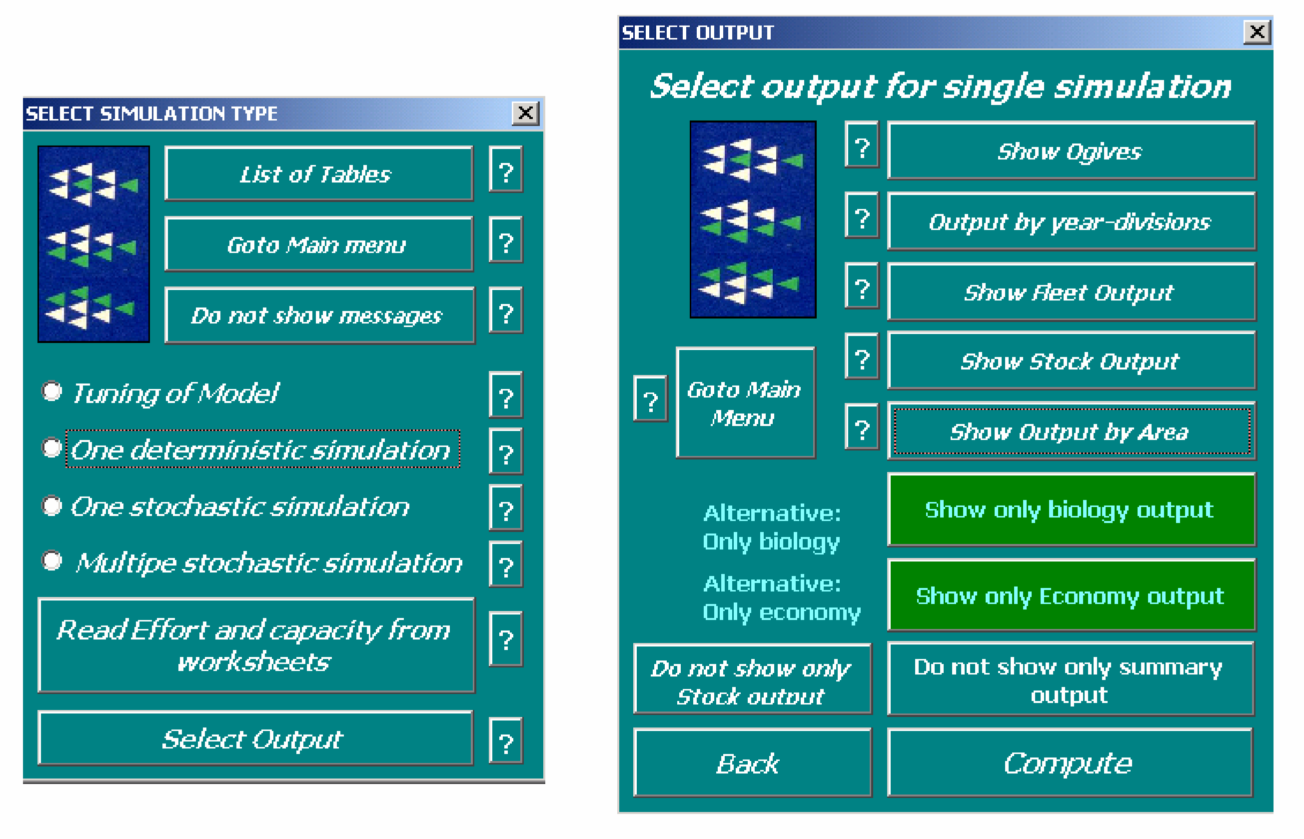


Figure 4.2.2. User-form to start up the computation.

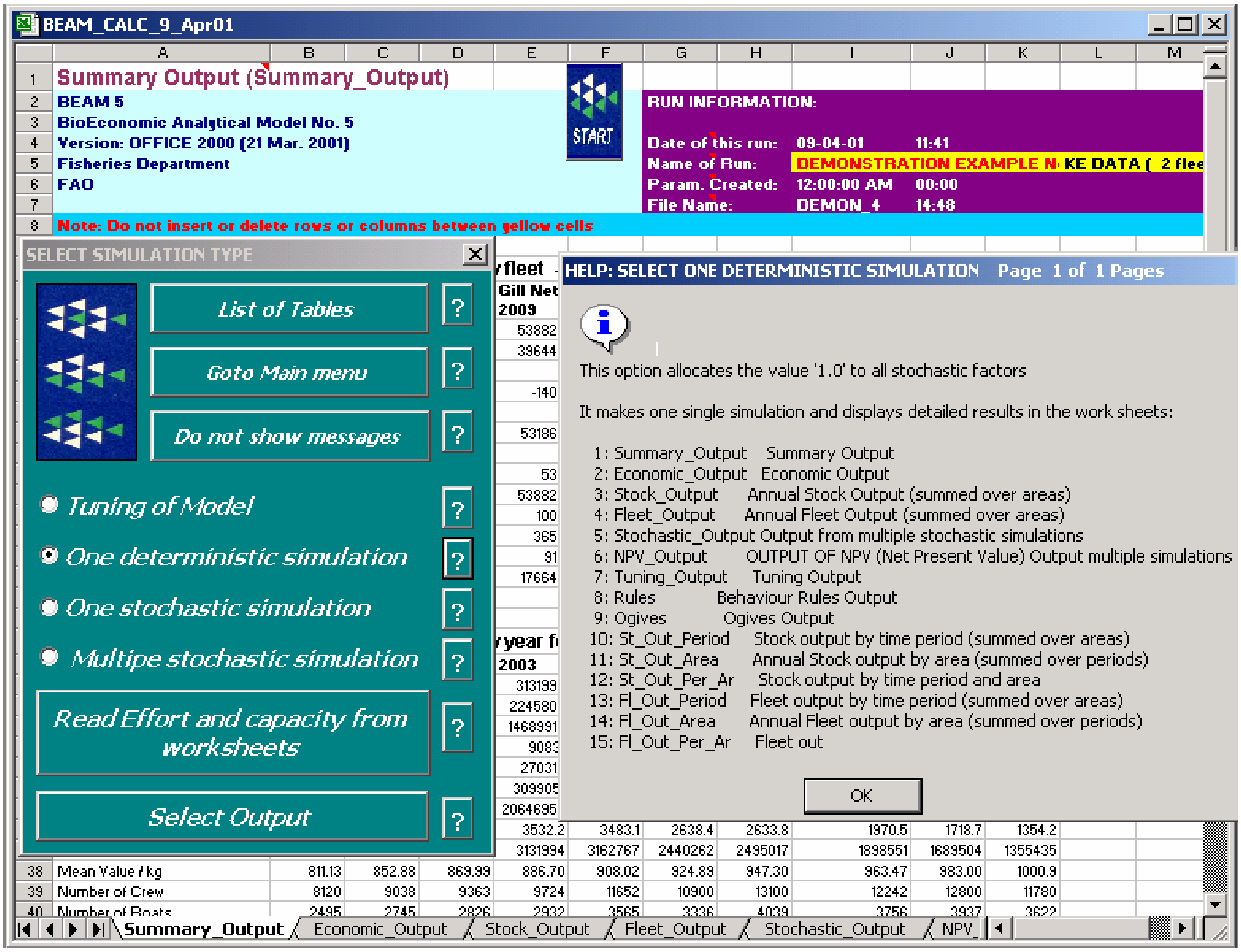
## 5.4. RUN OPTIONS OF TEMAS AND RUN MESSAGES

Running TEMAS, that is, execute simulations is done with workbook TEMAS_CALC. The run option in workbook TEMAS_CALC relates to management regime and type of stochastic/ deterministic simulation.

The options for stochastic/deterministic simulation are (see Figure 2.7.2, and Figure 4.4.1).

1) Single deterministic simulation
2) Single stochastic simulation
3) Multiple stochastic simulations.

In case 3 you are also requested to enter the number of simulations you want TEMAS to execute.



HELP: SELECT ONE DETERMINISTIC SIMULATION Page 1 of 1 Pages

This option allocates the value '1.0' to all stochastic factors

It makes one single simulation and displays detailed results in the work sheets:

1: Summary_Output Summary Output
2: Economic_Output Economic Output
3: Stock_Output Annual Stock Output (summed over areas)
4: Fleet_Output Annual Fleet Output (summed over areas)
5: Stochastic_Output Output from multiple stochastic simulations
6: NPV_Output OUTPUT OF NPV (Net Present Value) Output multiple simulations
7: Tuning_Output Tuning Output
8: Rules Behaviour Rules Output
9: Ogives Ogives Output
10: St_Out_Period Stock output by time period (summed over areas)
11: St_Out_Area Annual Stock output by area (summed over periods)
12: St_Out_Per_Ar Stock output by time period and area
13: Fl_Out_Period Fleet output by time period (summed over areas)
14: Fl_Out_Area Annual Fleet output by area (summed over periods)
15: Fl_Out_Per_Ar Fleet out

***Figure 5.4.1. The menu for selection of simulation type, with an example of help-text-box. (compare Figure 2.7.2)***

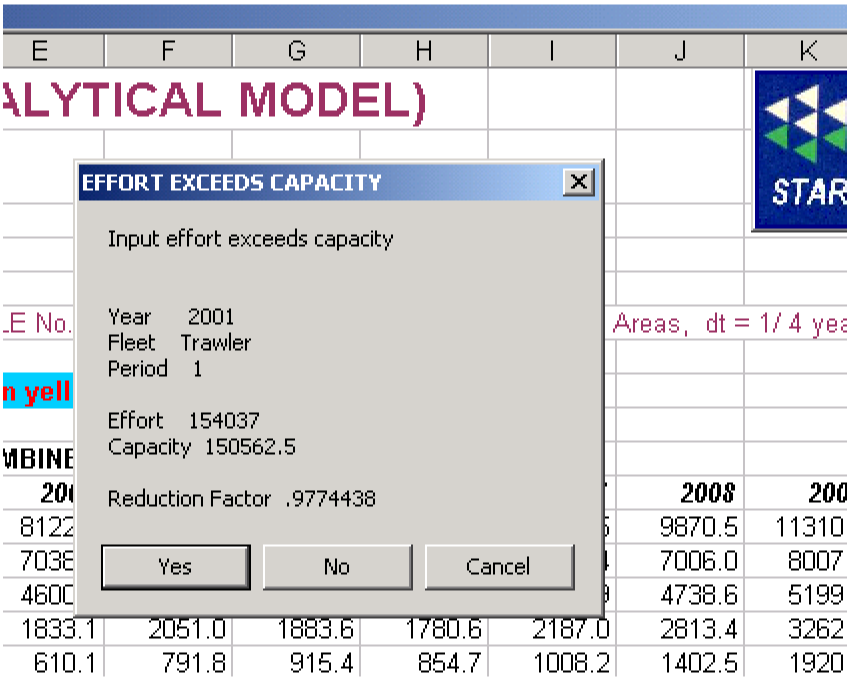
In addition, there are two options for creation of effort/capacity input (See Figure 4.4.1), which are:

1) Use the Effort/Capacity rules to let TEMAS determine the effort and number of vessels
2) Read effort and number of vessels from the worksheets.

After, you have selected the simulation type, you can proceed with the selection of output tables (As shown in Figure 4.2.1 in the case of single simulations).

## 5.5. RUN MESSAGES

When you start a simulation with TEMAS, it will sometimes produce messages on the screen as the calculations proceed. Figure 4.5.1 shows such an example. Here it tells you that the input effort exceeds the capacity for trawlers in first time period of year 2001. Then TEMAS will reduce the input effort to the capacity, by application of an effort reduction factor (in this case it will reduce effort with about 2.2 % (Reduction factor = 0.977). Now you may not want all these massages (there may be many of them) and you can suppress them by clicking on “Cancel”. That will suppress all the following messages.



Input effort exceeds capacity

Year 2001
Fleet Trawler
Period 1

Effort 154037
Capacity 150562.5

Reduction Factor .9774438

***Figure 5.5.1. Run-message that input effort has exceeded the capacity of a fleet. (Compare Table 4.5.1)***

Clicking on “cancel”, however, will only make the messages not appear on the screen. Messages will always be kept in two text files.:

“RULES_MESSAGES”
and
“RUN_MESSAGES”
in directory TEMAS. The file “RULES_MESSAGES” contains a message for each time a behavioural rule of the industry (Sections 2.11 and 6.6). The text file “RUN_MESSAGES” contains all other messages. The message shown in Figure 4.5.1 will go to text-file “RUN_MESSAGE”. Table 4.5.1 shows an example of the contents of “RUN_MESSAGES”. Whenever you start a simulation, these two text-files will be deleted and overwritten with the new messages.

```
EFFORT > CAPACITY Trawler   2001  Per= 1  Eff= 154037  Capcty=  150563  ReducFct=  0.977444
EFFORT > CAPACITY Gill Net  2001  Per= 1  Eff=  51346  Capcty=   50188  ReducFct=  0.977444
EFFORT > CAPACITY Trawler   2001  Per= 2  Eff= 154037  Capcty=  150563  ReducFct=  0.977444
EFFORT > CAPACITY Gill Net  2001  Per= 2  Eff=  51346  Capcty=   50188  ReducFct=  0.977444
EFFORT > CAPACITY Trawler   2001  Per= 3  Eff= 154037  Capcty=  150563  ReducFct=  0.977444
EFFORT > CAPACITY Trawler   2001  Per= 4  Eff= 154037  Capcty=  150563  ReducFct=  0.977444
EFFORT > CAPACITY Gill Net  2001  Per= 4  Eff=  51346  Capcty=   50188  ReducFct=  0.977444
EFFORT > CAPACITY Trawler   2002  Per= 1  Eff= 154037  Capcty=  144772  ReducFct=  0.939850
EFFORT > CAPACITY Gill Net  2002  Per= 1  Eff=  51346  Capcty=   48257  ReducFct=  0.939850
EFFORT > CAPACITY Trawler   2002  Per= 2  Eff= 154037  Capcty=  144772  ReducFct=  0.939850
EFFORT > CAPACITY Gill Net  2002  Per= 2  Eff=  51346  Capcty=   48257  ReducFct=  0.939850
EFFORT > CAPACITY Trawler   2002  Per= 3  Eff= 154037  Capcty=  144772  ReducFct=  0.939850
EFFORT > CAPACITY Trawler   2002  Per= 4  Eff= 154037  Capcty=  144772  ReducFct=  0.939850
EFFORT > CAPACITY Gill Net  2002  Per= 4  Eff=  51346  Capcty=   48257  ReducFct=  0.939850
EFFORT > CAPACITY Trawler   2003  Per= 1  Eff= 154037  Capcty=  130333  ReducFct=  0.846115
EFFORT > CAPACITY Gill Net  2003  Per= 1  Eff=  51346  Capcty=   43470  ReducFct=  0.846616
EFFORT > CAPACITY Trawler   2003  Per= 2  Eff= 154037  Capcty=  130333  ReducFct=  0.846115
EFFORT > CAPACITY Gill Net  2003  Per= 2  Eff=  51346  Capcty=   43470  ReducFct=  0.846616
EFFORT > CAPACITY Trawler   2003  Per= 3  Eff= 154037  Capcty=  130333  ReducFct=  0.846115
 ……… etc. ……..
```

***Table 5.5.1. Run-messages that input effort has exceeded the capacity of a fleet in text file "RUN_MESSAGES". (Compare Figure 4.5.1)***

# 6. CALIBRATION

## 6.1. INTRODUCTION

The statistical estimation of parameters in TEMAS, is more or less assumed to be a problem isolated from the simulations with TEMAS. Somehow, we assume that parameters are available from various (not specified, by "reliable" sources). Needless to say, this will never strictly be the case in any application of TEMAS. Actually, many of the crucial parameters of TEMAS cannot be estimated by robust statistical methods, involving estimation of variance and co-variances and all their derivatives in the form of statistical diagnostics. The general parameter estimation problem in fisheries is illustrated by the fact that most fish stock assessments in ICES are made by highly questionable non-standard methods like the XSA, that is methods that do not live up to the standards of textbooks in bio-statistical analysis (e.g. Sokal and Rohlf, 1981). ICES could have chosen to apply strict statistical methods, like those of the SAS, the S or the R system of methods, but have so far refrained from using the standard approach. The TEMAS is not in any better situation, than any other current model currently available to fisheries science. TEMAS perhaps differs from other approaches in that it accepts and fully accounts for its limited capability in parameter estimation. TEMAS lacks a proper methodology for parameter estimation, and many (most) parameters of TEMAS are "guesstimates" rather than "estimates" (as defined in standard textbooks of statistical inference). The reason for this is not that parameter estimation methodology is not available, but that available data are of a poor quality, but perhaps more important is, that the basic mechanism behind the system dynamics is not understood. The so-called "process errors" of TEMAS are not known. Thus, it is not possible to separate "process errors" and "measurement errors", but both are probably big

However, it is not satisfactory to make a complete separation between the "real world" and the simulations by TEMAS. One would like to maintain the humble illusion that TEMAS does indeed resemble to the real world, although we do not dare make statements about the "prediction power" of TEMAS. The calibration of TEMAS is a rather ad hoc attempt to make TEMAS not deviate "too much" from the reality.

## 6.2. CALIBRATION OF TEMAS

The idea of "calibration" means to adjust certain parameters of TEMAS, so that TEMAS can make a simulated prediction for a historical period, that does not "deviate too much" from the observed fisheries. For example, TEMAS should be able to simulate predicted catches from 1995 to 2005 that do not deviate too much from the actual (observed) catches 1995-2005.

TEMAS calibrates some of its parameters by aid of the so-called modified $\chi^2$-criterion (Sokal and Rohlf, 1981)

$$\chi_X^2 = \sum\nolimits_{Indices} \frac{(X_{Observed} - X_{Calculated})^2}{X_{Calculated}} \qquad \text{(E.1.2.1)}$$

where "$X_{calculated}$" symbolises a prediction-variable of the model, for example, the weight of cod, caught by a certain gear rigging of a fleet fleet, at a certain time, in a certain area. "$X_{observed}$" indicates the value of X observed from a historical period. The variables "X" are selected so that they are easy to access. The example given above can be easily extracted from the logbooks. The same model is used for both prediction and estimation. $X_{calculated}$ depends on the indigenous parameters, and $\chi^2$ is minimised with respect of the indigenous parameters. "Indices" is a subset of the indices available in TEMAS[1] The most detailed version of Eq E.1.2.1 is achieved with the

---

[1] 1:

| | Index | Explanation | Range | Note that the sequence of indices will be |
|---|---|---|---|---|
| 1 | a | Age group | a = 0,1,2,…,$a_{max}$(St) | (Fl, Vs, Rg, Ct, St, y, a, qa, Va, Ar) for all variables. |
| 2 | Ar | Area | Ar = 1,2,…,$Ar_{max}$ | |
| 3 | Ct | Country | Ct = 1,…,$Ct_{Max}$ | Time variables in alphabetical order |

complete set of all indices used in TEMAS, i.e. (Fl, Vs, Rg, Ct, St, y, a, q, Va, Ar) is given by Eq. E.1.2.2

$$\chi^2_{Yield} = \sum_{Ct=1}^{Ct_{Max}} \sum_{Fl=1}^{Fl_{Max}(Ct)} \sum_{Vs=1}^{Vs_{Max}(Fl,Ct)} \sum_{Rg=1}^{Rg_{Max}(Fl,Ct)} \sum_{St=1}^{St_{Max}} \sum_{y=y_{first}}^{y_{last}} \sum_{a=1}^{a_{Max}(St)} \sum_{q=1}^{q_{Max}} \sum_{Va=}^{Va_{Max}(Ct,Fl)} \sum_{Ar=1}^{Ar_{Max}}$$

$$\frac{(Y^{Obs}_{Landings}(Fl,Vs,Rg,Ct,St,y,a,q,Va,Ar) - Y^{Calc}_{Landings}(Fl,Vs,Rg,Ct,St,y,a,q,Va,Ar))^2}{Y^{Calc}(Fl,Vs,Rg,Ct,St,y,a,q,Va,Ar)} + \qquad (E.1.2.2)$$

$$\frac{(Y^{Obs}_{Discards}(Fl,Vs,Rg,Ct,St,y,a,q,Va,Ar) - Y^{Calc}_{Discards}(Fl,Vs,Rg,Ct,St,y,a,q,Va,Ar))^2}{Y^{Calc}_{Discards}(Fl,Vs,Rg,Ct,St,y,a,q,Va,Ar)}$$

Eq. contains the sum of squares of deviation (SSD) for both landings and discards, for each vessel age group. Removing the discards, which are usually not (rather never) direct observations, as well as the vessel age group data, which will usually not be available, we come to Eq E.1.2.3 .

$$\chi^2_{Yield} = \sum_{Ct=1}^{Ct_{Max}} \sum_{Fl=1}^{Fl_{Max}(Ct)} \sum_{Vs=1}^{Vs_{Max}(Fl,Ct)} \sum_{Rg=1}^{Rg_{Max}(Fl,Ct)} \sum_{St=1}^{St_{Max}} \sum_{y=y_{first}}^{y_{last}} \sum_{a=1}^{a_{Max}(St)} \sum_{q=1}^{q_{Max}} \sum_{Ar=1}^{Ar_{Max}}$$

$$\frac{(Y^{Obs}_{Landings}(Fl,Vs,Rg,Ct,St,y,a,q,\bullet,Ar) - Y^{Calc}_{Landings}(Fl,Vs,Rg,Ct,St,y,a,q,\bullet,Ar))^2}{Y^{Calc}(Fl,Vs,Rg,Ct,St,y,a,q,\bullet,Ar)} +$$

***(E.1.2.3)***

Eq. E.12.3 gives the SSD's by age group, which again will be "observations" estimated from samples. However, Eq, may be applicable in some cases, where a comprehensive biological/technical data collection program is being implemented.

The chi-squared expression for landings summed over age groups is given in Eq. E.1.2.4. This is the standard expression used in the current version of TEMAS.

$$\chi^2_{Yield} = \sum_{Ct=1}^{Ct_{Max}} \sum_{Fl=1}^{Fl_{Max}(Ct)} \sum_{Vs=1}^{Vs_{Max}(Fl,Ct)} \sum_{Rg=1}^{Rg_{Max}(Fl,Ct)} \sum_{St=1}^{St_{Max}} \sum_{y=y_{first}}^{y_{last}} \sum_{q=1}^{q_{Max}} \sum_{Ar=1}^{Ar_{Max}}$$

$$\frac{(Y^{Obs}_{Landings}(Fl,Vs,Rg,Ct,St,y,\bullet,q,\bullet,Ar) - Y^{Calc}_{Landings}(Fl,Vs,Rg,Ct,St,y,\bullet,q,\bullet,Ar))^2}{Y^{Calc}(Fl,Vs,Rg,Ct,St,y,\bullet,q,\bullet,Ar)}$$

(E.1.2.4)

Landings summed over vessel age groups and fish age groups, are the "observations" expected in the current version of TEMAS. This feature of the current TEMAS can easily be changed.

Eq. E.1.2.4 calculates SSD by rigging. In case rigging data are not available, the next version with landings aggregated over riggings is shown in Figure E.1.2.5.

$$\chi^2_{Yield} = \sum_{Ct=1}^{Ct_{Max}} \sum_{Fl=1}^{Fl_{Max}(Ct)} \sum_{Vs=1}^{Vs_{Max}(Fl,Ct)} \sum_{St=1}^{St_{Max}} \sum_{y=y_{first}}^{y_{last}} \sum_{q=1}^{q_{Max}} \sum_{Ar=1}^{Ar_{Max}}$$

(E.1.2.5)

$$\frac{(Y^{Obs}_{Landings}(Fl,Vs,\bullet,Ct,St,y,\bullet,q,\bullet,Ar) - Y^{Calc}_{Landings}(Fl,Vs,\bullet,Ct,St,y,\bullet,q,\bullet,Ar))^2}{Y^{Calc}(Fl,Vs,\bullet,Ct,St,y,\bullet,q,\bullet,Ar)}$$

---

| | | | | |
|---|---|---|---|---|
| *4* | Fl | Fleet | Fl = 1,2,…,Fl$_{max}$(Ct) | |
| *5* | q | Time period (as time) | q = 1,..,q$_{max}$ | |
| *6* | qa | Time period (as age) | qa = 1,..,q$_{max}$, | |
| *7* | Rg | Rigging of gear | Rg = 1,…,Rg$_{max}$(Fl,Ct) | |
| *8* | y | Year | y = y$_{firSt,\ yfirst}$+1,…,y$_{last}$ | |
| *9* | St | Stock | St = 1,…,St$_{max}$ | |
| *10* | Va | Vessel age group | Va = 1,…Va$_{max}$(Fl,Ct) | |
| *11* | Vs | Vessel size group | Vs = 1,…Vs$_{max}$(Fl,Ct) | |

From Eq. E.1.2.5 one may reduce the number of indices of SSD further, depending on the actual case study. E.g. one might consider only the total annual landings by stock:

$$\chi^2_{Yield} = \sum_{St=1}^{St_{Max}} \sum_{y=y_{first}}^{y_{last}} \frac{(Y^{Obs}_{Landings}(\bullet,\bullet,\bullet,\bullet,St,y,\bullet,\bullet,\bullet,\bullet) - Y^{Calc}_{Landings}(\bullet,\bullet,\bullet,\bullet,St,y,\bullet,\bullet,\bullet,\bullet))^2}{Y^{Calc}(\bullet,\bullet,\bullet,\bullet,St,y,\bullet,\bullet,\bullet,\bullet)} \qquad \text{(E.1.2.6)}$$

In addition to yield (landings and discards), the TEMAS software offers three more options for calibration to observations. The options for calibration data are:

5) Catches, (Landings and discards) on various dis-aggregation levels. From (Fl, Vs, Rg, Ct, St, y, a, q, Va, Ar) to (•,•,•,•, St, y,•,•,•,•)
6) Index of stock numbers from research vessel survey or from catch per unit of effort of commercial vessels.
7) Index of stock biomass or SSB from research vessel survey or from catch per unit of effort of commercial vessels.
8) Mean stock F (Fishing mortality) from (for example) fish stock assessment of ICES working groups.

The index of stock numbers can be catch per day by age group, converted into relative numbers, to make them compatible with relative numbers predicted by TEMAS.

$$\chi^2_N = \sum_{St=1}^{St_{Max}} \sum_{y=y_{first}}^{y_{last}} \sum_{q=1}^{q_{Max}} \sum_{a=1}^{a_{Max}(St)} \frac{(N^{Obs}_{Index}(St,y,q,a,Ar) - N^{Calc}_{Index}(St,y,q,a,A))^2}{N^{Calc}_{Index}(St,y,q,a)} \qquad \text{(E.1.2.7)}$$

Where, for example, $N^{Calc}_{Index}(St,y,q,a,Ar) = \dfrac{N(St,y,q,a,Ar)}{\sum_{i=1}^{a_{Max}(St)} N(St,y,q,i,Ar)}$ and the survey index is derived from, say, catch per hour, CPUE$_{\text{Survey}}$, $N^{Obs}_{Index}(St,y,q,a,Ar) = \dfrac{CPUE_{Survey}(St,y,q,a,Ar)}{\sum_{i=1}^{a_{Max}(St)} CPUE_{Survey}(St,y,q,i,Ar)}$

Also indices of biomass (or SSB) can be made relative and compared to indices predicted by TEMAS.

$$\chi^2_{SSB} = \sum_{St=1}^{St_{Max}} \sum_{y=y_{first}}^{y_{last}} \sum_{q=1}^{q_{Max}} \frac{(SSB^{Obs}_{Index}(St,y,q) - SSB^{Calc}_{Index}(St,y,q))^2}{SSB^{Calc}_{Index}(St,y,q)} \qquad \text{(E.1.2.8)}$$

Fishing mortality can be compared to fishing mortalities estimated by persons independent of TEMAS (e.g. ICES WGs).

$$\chi^2_{F_{MEAN}} = \sum_{St=1}^{St_{Max}} \sum_{y=y_{first}}^{y_{last}} \sum_{q=1}^{q_{Max}} \frac{(F^{Obs}_{Mean}(St,y,q) - F^{Calc}_{Mean}(St,y,q))^2}{F^{Calc}_{Mean}(St,y,q)} \qquad \text{(E.1.2.9)}$$

In theory, the $\chi^2$ expression could make the basis for estimating the parameters, (designated “P” in Eq E.1.2.9), by minimization. Because of the large number of parameters, and the small number of degrees of freedom, this approach would be very problematic in practice.

$$\chi^2_X(X^{Obs},P) = \sum\nolimits_{Indices} \frac{(X^{Obs} - X^{Calc}(P))^2}{X^{Calc}(P)} = Minimum$$

(E.1.2.10)

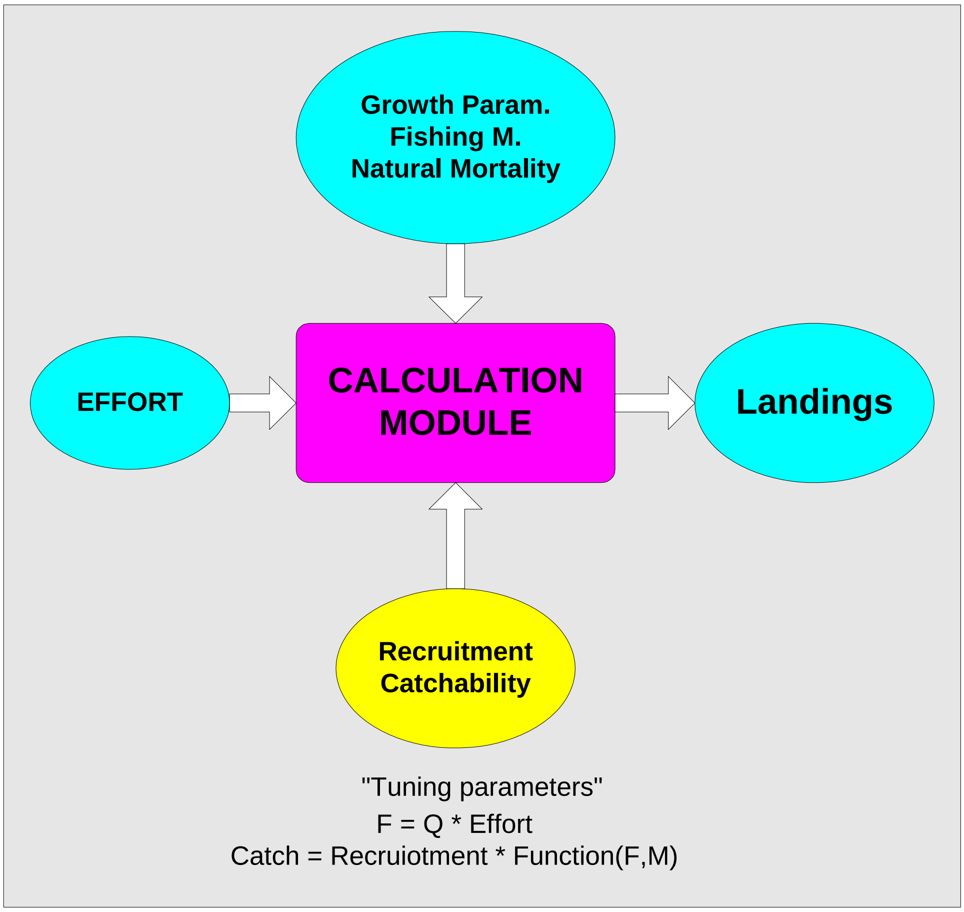
Some parameters (a subset of P), however, may be estimated that way. That could apply to the catchability coefficients.

Other “observations” than landings can be used to calibrate TEMAS. That could be CPUE observations from research surveys that are believed to be a proxy for SSB or recruitment.

# 6.3. TUNING OF TEMAS

By tuning is meant the processes of finding the reference simulation of TEMAS. The reference simulation is the situation (scenario) relative to which all the other simulations are made, and are compared to, when addressing the "'What-if-then-questions' " Tuning involves the calculation of certain parameters, as discussed Sections 2.12. It should be noted that tuning does not involve a proper statistical estimation of parameters.

The reference simulation will usually be chosen to be a simulation in equilibrium, that is, a simulation where all results are equal in all years of the time series under study. Furthermore, the reference simulation will usually be chosen to be the fisheries situation of the current situation (current year). TEMAS is said to reproduce the current situation when it can reproduce the landings (in weight) observed the last data year for each combination of fleet, stock, time period and area. To achieve this goal completely is usually impossible, so one can only hope for a reasonable approximation. Taking in to account all the sources of uncertainties involved in TEMAS, there is no reason to make too much effort in achieving a complete reproduction of observed catches.



The five types of tuning offered by TEMAS is (see also Figure 4.6.1 showing the tuning menu form)

1) N(first year) = N(last year). To achieve equilibrium
2) BH(New)=BH(old)*Land(Obs)/Land(Calc). Tune recruitment to observed landings
3) Q(New)=Q(old )*Land(Obs)/Land(Calc). Tune catchability to observed landings
4) Q(New)=Q(old )*F(Obs)/F(Calc). Tune catchability to observed total fishing mortality.
5) Q=F/Effort by area and fleet. Compute individual catchabilities to observed area fishing mortalities

The total landings from a stock is (almost) proportional to the parameters 'BH1' in the stock and recruitment model (Beverton & Holt model), with all other parameters kept constant. Thus, for a given fishing mortality, BH1 can be selected to give any landings you want. As the parameter 'BH1' is usually an unknown parameter, you may consider the tuning of TEMAS as a pseudo estimation of BH1 (it is not a proper estimation). You calibrate BH1 to produce the observed landings

The procedure of calibrating BH1 gives you the total landings for a given total fishing mortality. Next step in the tuning is then to distribute the landings from the stock in question on the fleets. This is achieved by assigning the values to catchability coefficients that produces the fishing mortalities, which in turn gives the observed landings by fleet, area and time period.

To summarize: Tuning means assigning values to:

1) The Beverton and Holt parameter BH1(Stock)
2) Catchability coefficient, Q(Stock, Fleet, Area, Time period)

so that: Observed landings = Calculated landings for all combinations of Stock, Fleet, Area and Time period in a given year (which is usually the most recent data year) so that the system is in equilibrium (gives the same results in all years)

Recommendation: The tuning procedure changes the input files in the disk:

1) The stock input files are changed
2) The fleet input files are changed

Therefore: **MAKE A BACKUP OF THE DISKFILES BEFORE TUNING**. You may regret the tuning, and want to return to the starting point. Returning to the starting point is difficult unless you made a backup

TUNING OF TEMAS

TUNING module

Evaluation Frame for fisheries management

EXCEL 2003, MS Visual Basis 6.3. -

File Name of last run : DEMON_5_Mig3

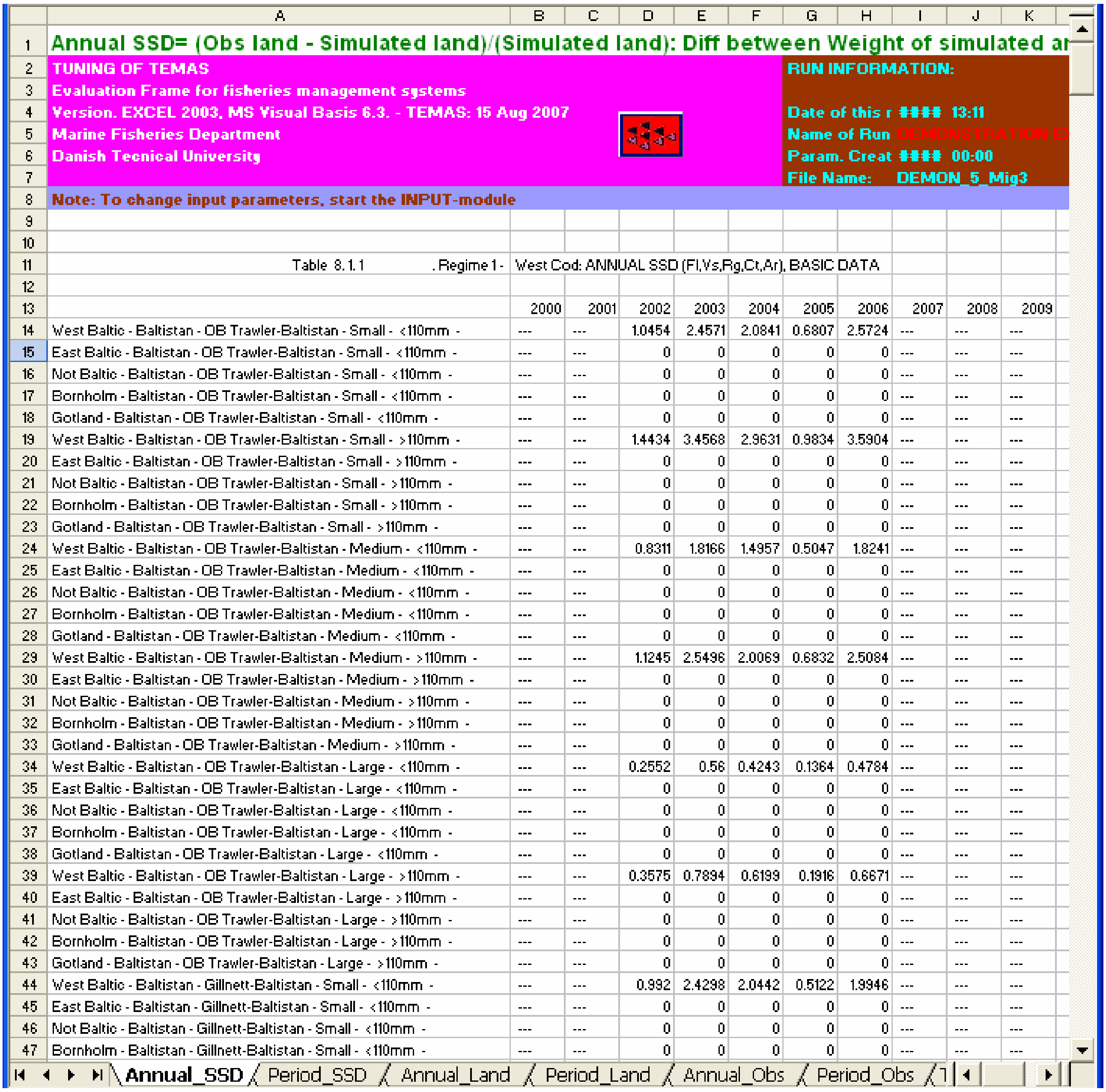
Time of last run: 15-08-2007 - 15:24:27

Title of last run:

DEMONSTRATION EXAMPLE No. 5 - WITH FAKE DATA ( 2 Countries, (Number of fleets: Ct 1: 2 Ct 2: 2) 2 Stock(s), 5 Area(s), 10 Year(s), dt = 1/4 years) , Circular movement (minimum 3 areas)

Choose aggregation level:

| Option | Aggregation level of landings used for tuning | | | | |
|---|---|---|---|---|---|
| ● 1 | Area | Country | Fleet | Vessel size | Rig |
| ○ 2 | Area | Country | Fleet | Vessel size | |
| ○ 3 | Area | Country | Fleet | | |
| ○ 4 | Area | | | | |
| ○ 5 | Country | | Fleet | Vessel size | Rig |
| ○ 6 | Country | | Fleet | Vessel size | |
| ○ 7 | Country | | Fleet | | |
| ○ 8 | Country | | | | |
| ○ 9 | Total stock | | | | |



**Annual SSD= (Obs land - Simulated land)/(Simulated land): Diff between Weight of simulated ar**

**TUNING OF TEMAS**
**Evaluation Frame for fisheries management systems**
**Version. EXCEL 2003, MS Visual Basis 6.3. - TEMAS: 15 Aug 2007**
**Marine Fisheries Department**
**Danish Tecnical University**

**RUN INFORMATION:**

**Date of this r #### 13:11**
**Name of Run DEMONSTRATION EX**
**Param. Creat #### 00:00**
**File Name: DEMON_5_Mig3**

**Note: To change input parameters, start the INPUT-module**

Table 8.1.1 . Regime 1 - West Cod: ANNUAL SSD (Fl,Vs,Rg,Ct,Ar), BASIC DATA

| | | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 14 | West Baltic - Baltistan - OB Trawler-Baltistan - Small - <110mm - | --- | --- | 1.0454 | 2.4571 | 2.0841 | 0.6807 | 2.5724 | --- | --- | --- |
| 15 | East Baltic - Baltistan - OB Trawler-Baltistan - Small - <110mm - | --- | --- | 0 | 0 | 0 | 0 | 0 | --- | --- | --- |
| 16 | Not Baltic - Baltistan - OB Trawler-Baltistan - Small - <110mm - | --- | --- | 0 | 0 | 0 | 0 | 0 | --- | --- | --- |
| 17 | Bornholm - Baltistan - OB Trawler-Baltistan - Small - <110mm - | --- | --- | 0 | 0 | 0 | 0 | 0 | --- | --- | --- |
| 18 | Gotland - Baltistan - OB Trawler-Baltistan - Small - <110mm - | --- | --- | 0 | 0 | 0 | 0 | 0 | --- | --- | --- |
| 19 | West Baltic - Baltistan - OB Trawler-Baltistan - Small - >110mm - | --- | --- | 1.4434 | 3.4568 | 2.9631 | 0.9834 | 3.5904 | --- | --- | --- |
| 20 | East Baltic - Baltistan - OB Trawler-Baltistan - Small - >110mm - | --- | --- | 0 | 0 | 0 | 0 | 0 | --- | --- | --- |
| 21 | Not Baltic - Baltistan - OB Trawler-Baltistan - Small - >110mm - | --- | --- | 0 | 0 | 0 | 0 | 0 | --- | --- | --- |
| 22 | Bornholm - Baltistan - OB Trawler-Baltistan - Small - >110mm - | --- | --- | 0 | 0 | 0 | 0 | 0 | --- | --- | --- |
| 23 | Gotland - Baltistan - OB Trawler-Baltistan - Small - >110mm - | --- | --- | 0 | 0 | 0 | 0 | 0 | --- | --- | --- |
| 24 | West Baltic - Baltistan - OB Trawler-Baltistan - Medium - <110mm - | --- | --- | 0.8311 | 1.8166 | 1.4957 | 0.5047 | 1.8241 | --- | --- | --- |
| 25 | East Baltic - Baltistan - OB Trawler-Baltistan - Medium - <110mm - | --- | --- | 0 | 0 | 0 | 0 | 0 | --- | --- | --- |
| 26 | Not Baltic - Baltistan - OB Trawler-Baltistan - Medium - <110mm - | --- | --- | 0 | 0 | 0 | 0 | 0 | --- | --- | --- |
| 27 | Bornholm - Baltistan - OB Trawler-Baltistan - Medium - <110mm - | --- | --- | 0 | 0 | 0 | 0 | 0 | --- | --- | --- |
| 28 | Gotland - Baltistan - OB Trawler-Baltistan - Medium - <110mm - | --- | --- | 0 | 0 | 0 | 0 | 0 | --- | --- | --- |
| 29 | West Baltic - Baltistan - OB Trawler-Baltistan - Medium - >110mm - | --- | --- | 1.1245 | 2.5496 | 2.0069 | 0.6832 | 2.5084 | --- | --- | --- |
| 30 | East Baltic - Baltistan - OB Trawler-Baltistan - Medium - >110mm - | --- | --- | 0 | 0 | 0 | 0 | 0 | --- | --- | --- |
| 31 | Not Baltic - Baltistan - OB Trawler-Baltistan - Medium - >110mm - | --- | --- | 0 | 0 | 0 | 0 | 0 | --- | --- | --- |
| 32 | Bornholm - Baltistan - OB Trawler-Baltistan - Medium - >110mm - | --- | --- | 0 | 0 | 0 | 0 | 0 | --- | --- | --- |
| 33 | Gotland - Baltistan - OB Trawler-Baltistan - Medium - >110mm - | --- | --- | 0 | 0 | 0 | 0 | 0 | --- | --- | --- |
| 34 | West Baltic - Baltistan - OB Trawler-Baltistan - Large - <110mm - | --- | --- | 0.2552 | 0.56 | 0.4243 | 0.1364 | 0.4784 | --- | --- | --- |
| 35 | East Baltic - Baltistan - OB Trawler-Baltistan - Large - <110mm - | --- | --- | 0 | 0 | 0 | 0 | 0 | --- | --- | --- |
| 36 | Not Baltic - Baltistan - OB Trawler-Baltistan - Large - <110mm - | --- | --- | 0 | 0 | 0 | 0 | 0 | --- | --- | --- |
| 37 | Bornholm - Baltistan - OB Trawler-Baltistan - Large - <110mm - | --- | --- | 0 | 0 | 0 | 0 | 0 | --- | --- | --- |
| 38 | Gotland - Baltistan - OB Trawler-Baltistan - Large - <110mm - | --- | --- | 0 | 0 | 0 | 0 | 0 | --- | --- | --- |
| 39 | West Baltic - Baltistan - OB Trawler-Baltistan - Large - >110mm - | --- | --- | 0.3575 | 0.7894 | 0.6199 | 0.1916 | 0.6671 | --- | --- | --- |
| 40 | East Baltic - Baltistan - OB Trawler-Baltistan - Large - >110mm - | --- | --- | 0 | 0 | 0 | 0 | 0 | --- | --- | --- |
| 41 | Not Baltic - Baltistan - OB Trawler-Baltistan - Large - >110mm - | --- | --- | 0 | 0 | 0 | 0 | 0 | --- | --- | --- |
| 42 | Bornholm - Baltistan - OB Trawler-Baltistan - Large - >110mm - | --- | --- | 0 | 0 | 0 | 0 | 0 | --- | --- | --- |
| 43 | Gotland - Baltistan - OB Trawler-Baltistan - Large - >110mm - | --- | --- | 0 | 0 | 0 | 0 | 0 | --- | --- | --- |
| 44 | West Baltic - Baltistan - Gillnett-Baltistan - Small - <110mm - | --- | --- | 0.992 | 2.4298 | 2.0442 | 0.5122 | 1.9946 | --- | --- | --- |
| 45 | East Baltic - Baltistan - Gillnett-Baltistan - Small - <110mm - | --- | --- | 0 | 0 | 0 | 0 | 0 | --- | --- | --- |
| 46 | Not Baltic - Baltistan - Gillnett-Baltistan - Small - <110mm - | --- | --- | 0 | 0 | 0 | 0 | 0 | --- | --- | --- |
| 47 | Bornholm - Baltistan - Gillnett-Baltistan - Small - <110mm - | --- | --- | 0 | 0 | 0 | 0 | 0 | --- | --- | --- |

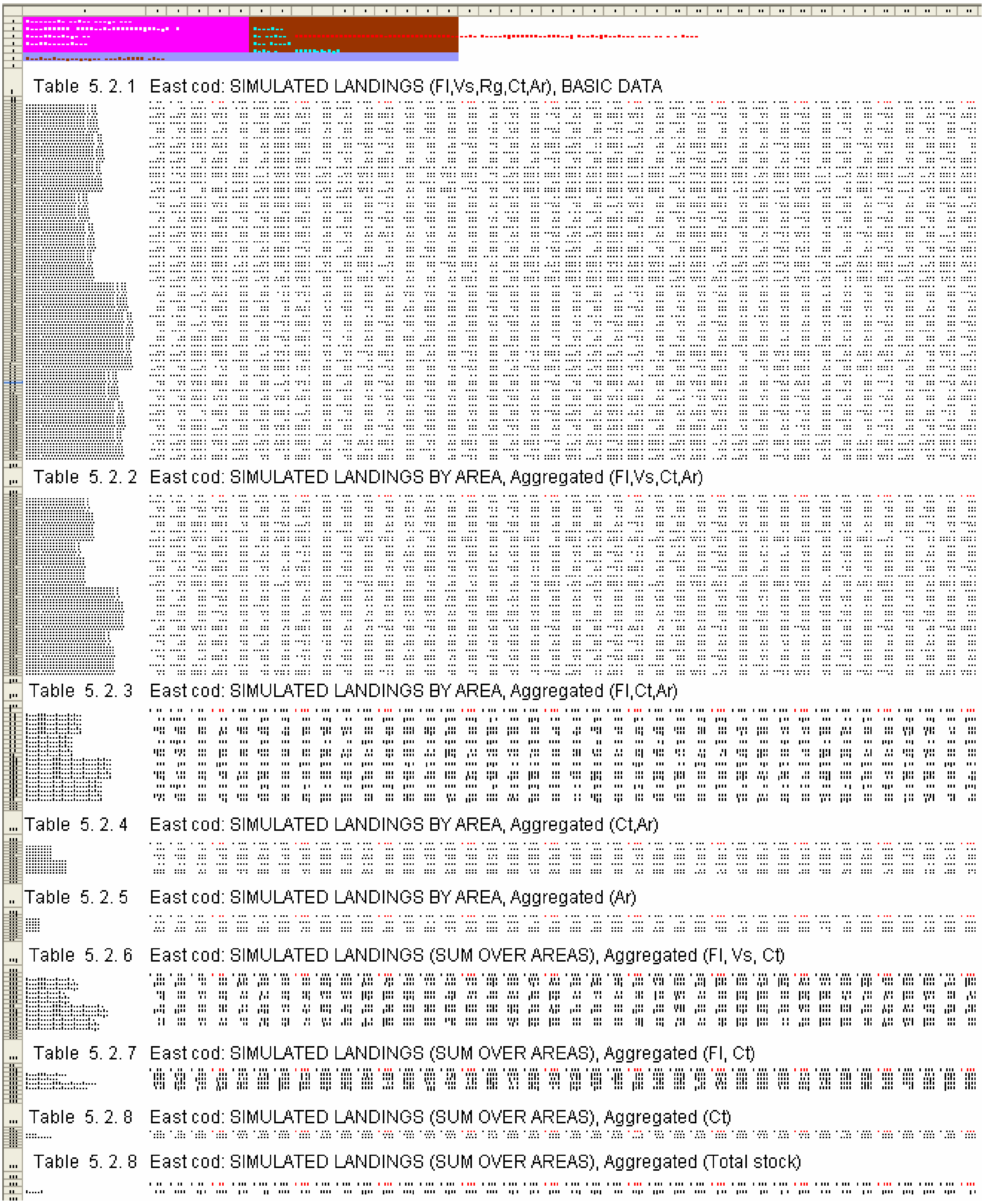


Table 5. 2. 1 East cod: SIMULATED LANDINGS (Fl,Vs,Rg,Ct,Ar), BASIC DATA

Table 5. 2. 2 East cod: SIMULATED LANDINGS BY AREA, Aggregated (Fl,Vs,Ct,Ar)

Table 5. 2. 3 East cod: SIMULATED LANDINGS BY AREA, Aggregated (Fl,Ct,Ar)

Table 5. 2. 4 East cod: SIMULATED LANDINGS BY AREA, Aggregated (Ct,Ar)

Table 5. 2. 5 East cod: SIMULATED LANDINGS BY AREA, Aggregated (Ar)

Table 5. 2. 6 East cod: SIMULATED LANDINGS (SUM OVER AREAS), Aggregated (Fl, Vs, Ct)

Table 5. 2. 7 East cod: SIMULATED LANDINGS (SUM OVER AREAS), Aggregated (Fl, Ct)

Table 5. 2. 8 East cod: SIMULATED LANDINGS (SUM OVER AREAS), Aggregated (Ct)

Table 5. 2. 8 East cod: SIMULATED LANDINGS (SUM OVER AREAS), Aggregated (Total stock)

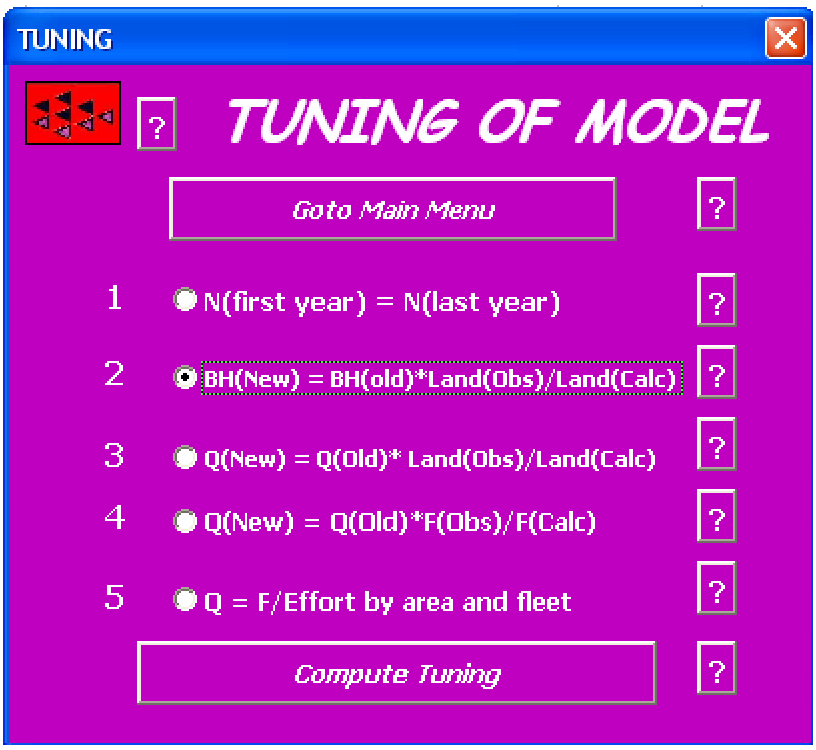
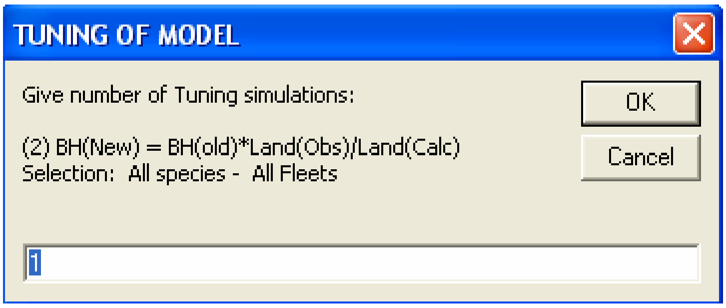


***Figure 5.6.1. The tuning menu.***



Give number of Tuning simulations:

(2) BH(New) = BH(old)*Land(Obs)/Land(Calc)
Selection: All species - All Fleets

1

***N(first year) = N(last year)***

This tuning is used to make the reference simulation an equilibrium situation "After the completion of a simulation it assigns the calculated stock numbers of the last year, to the initial stock numbers (first years)

N(Stock, First year, age, period, area) := N(Stock, Last year, age, period, area)

***BH(New)=BH(old)*Land(Obs)/Land(Calc)***

This tuning changes the first stock/recruitment parameter, BH1, so that:

Total Observed Landings (Stock, First year) = Total Calculated Landings (Stock, First year)

Recall that:

$$\mathrm{Re}c(year, Period, Area) = \mathrm{Re}cDist_{Area} * \mathrm{Re}cDist_{Period} * \frac{BH1 * SSB(year-1)}{1 + BH2 * SSB(year-1)}$$

where SSB = Spawning Stock Biomass and Recruitment, Rec, is the number in the 0-group: "N(St, year, 0, period, area)

First step is to calculate the tuning factor:

$$TuningFactor = \frac{Total\ \ Observed\ \ Landings(Stock, First\ \ year)}{Total\ \ Calculated\ \ Landings(Stock, First\ \ year)}$$

Second step is to change the Beverton & Holt parameter, BH1, by the tuning factor:

BH1(Stock) is replaced by TuningFactor * BH1(Stock)

***Q(New)=Q(old )*Land(Obs)/Land(Calc)***

Tune Catchability to landings. This tuning uses the landings (by weight) for each combination of Stock, fleet area and time period as input. If modifies the catchabilities of each combination so that:

Observed landings = Calculate landings, for each combination.

The tuning factor is thus

$$TuningFactor = \frac{Observed\ \ Landings(Stock, Year, Period, Area, Fleet)}{Calculated\ \ Landings(Stock, Year, Period, Area, Fleet)}$$

And the computation of the tuning becomes (Q = catchability coefficient):

Q(Stock, Year, period, area, fleet) is replaced by (Tuning Factor) * Q(Stock, Year, period, area, fleet

***Q(New)=Q(old )*F(Obs)/F(Calc)***

This tuning uses the total (stock) fishing mortality given as input: '$F_{Tuning}$'
The tuning changes the Reference catchability, so that:

$F_{Calculated}$(Stock, period) = $F_{Tuning}$(Stock, period)

"Recall that: $F_{Calculated}$ = Effort * (Reference catchability)* Selection

First step is to calculate the tuning factor:

TuningFactor = $F_{Tuning}$(Stock, period) / $F_{Stock}$(Stock, First Year, period, Oldest age)

Second step is to change the catchability, Q, by the tuning factor:

Q(Stock, Year, period, area, fleet) is replaced by TuningFactor * Q(Stock, First year, period, area, fleet)

***Q=F/Effort by area and fleet***

This tuning requires that fishing mortalities, $F_{TUNING}$, has been estimated (or can be assigned plausible values) by period, area and fleet, and that effort also have been been observed. Then the catchability is computed by

$$Q(Stock, \ first\ \ year, Period, Area, Fleet) = \frac{F_{TUNING}(Stock, Period, Area, Fleet)}{Effort(First\ \ year, Period, Area, Fleet)}$$

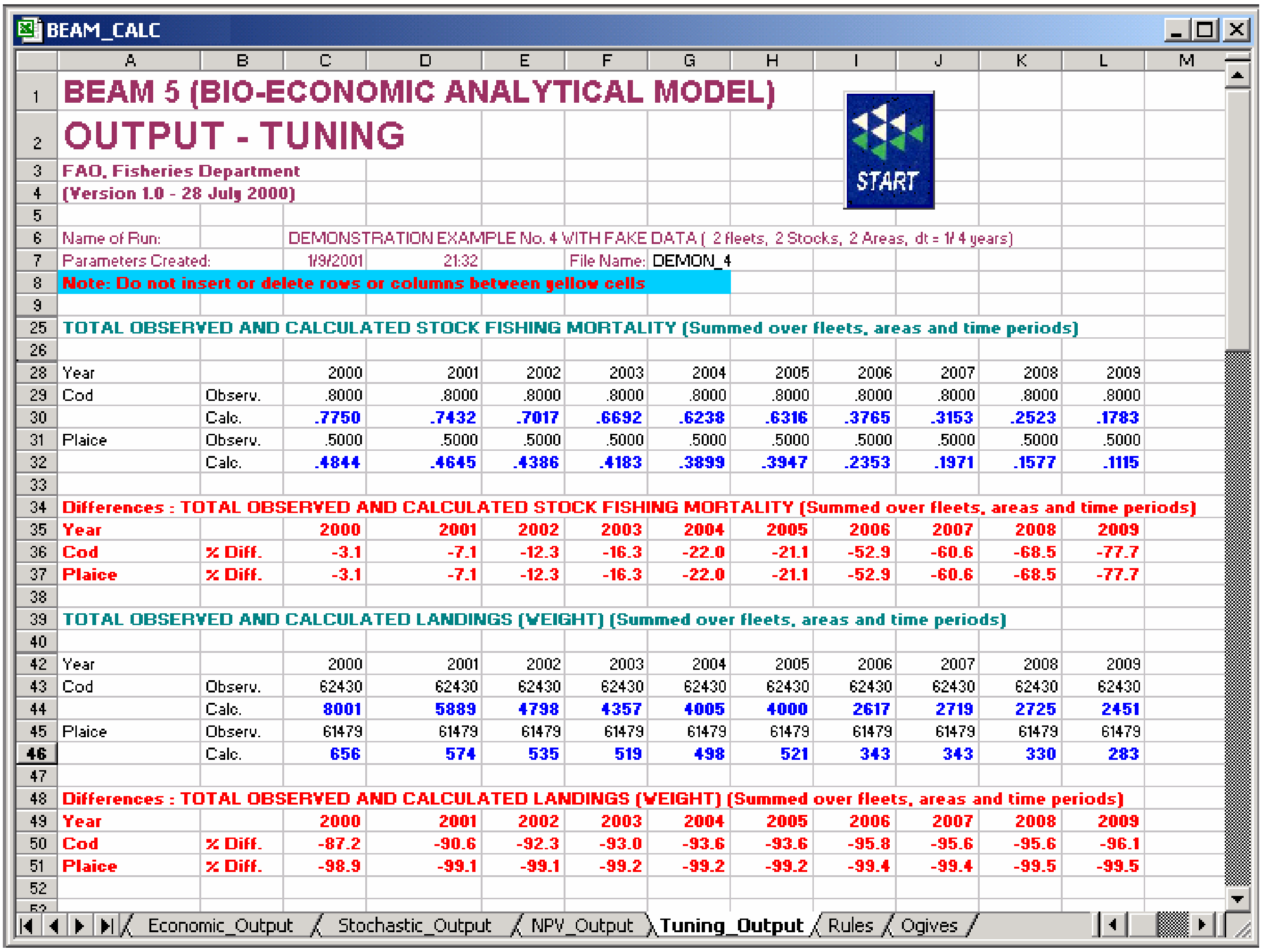
for the first year. Subsequently all years are assigned the same values:

$$Q(Stock, year, Period, Area, Fleet) = Q(Stock, First\ \ year, Period, Area, Fleet)$$

### How to tune TEMAS

To tune TEMAS can somewhat be called an art, rather than a science. Basically, you find a satisfactory tuning by trial and error.

The worksheet, “Tuning_Output” in workbook “TEMAS_CALC” contains some diagnostic output, showing the relative deviation between observations and calculated values (see Figure 4.4.2)



BEAM 5 (BIO-ECONOMIC ANALYTICAL MODEL)

OUTPUT - TUNING

FAO, Fisheries Department

(Version 1.0 - 28 July 2000)

Name of Run: DEMONSTRATION EXAMPLE No. 4 WITH FAKE DATA ( 2 fleets, 2 Stocks, 2 Areas, dt = 1/ 4 years)

Parameters Created: 1/9/2001 21:32 File Name: DEMON_4

Note: Do not insert or delete rows or columns between yellow cells

TOTAL OBSERVED AND CALCULATED STOCK FISHING MORTALITY (Summed over fleets, areas and time periods)

| Year | | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Cod | Observ. | .8000 | .8000 | .8000 | .8000 | .8000 | .8000 | .8000 | .8000 | .8000 | .8000 |
| | Calc. | .7750 | .7432 | .7017 | .6692 | .6238 | .6316 | .3765 | .3153 | .2523 | .1783 |
| Plaice | Observ. | .5000 | .5000 | .5000 | .5000 | .5000 | .5000 | .5000 | .5000 | .5000 | .5000 |
| | Calc. | .4844 | .4645 | .4386 | .4183 | .3899 | .3947 | .2353 | .1971 | .1577 | .1115 |

Differences : TOTAL OBSERVED AND CALCULATED STOCK FISHING MORTALITY (Summed over fleets, areas and time periods)

| Year | | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Cod | % Diff. | -3.1 | -7.1 | -12.3 | -16.3 | -22.0 | -21.1 | -52.9 | -60.6 | -68.5 | -77.7 |
| Plaice | % Diff. | -3.1 | -7.1 | -12.3 | -16.3 | -22.0 | -21.1 | -52.9 | -60.6 | -68.5 | -77.7 |

TOTAL OBSERVED AND CALCULATED LANDINGS (WEIGHT) (Summed over fleets, areas and time periods)

| Year | | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Cod | Observ. | 62430 | 62430 | 62430 | 62430 | 62430 | 62430 | 62430 | 62430 | 62430 | 62430 |
| | Calc. | 8001 | 5889 | 4798 | 4357 | 4005 | 4000 | 2617 | 2719 | 2725 | 2451 |
| Plaice | Observ. | 61479 | 61479 | 61479 | 61479 | 61479 | 61479 | 61479 | 61479 | 61479 | 61479 |
| | Calc. | 656 | 574 | 535 | 519 | 498 | 521 | 343 | 343 | 330 | 283 |

Differences : TOTAL OBSERVED AND CALCULATED LANDINGS (WEIGHT) (Summed over fleets, areas and time periods)

| Year | | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Cod | % Diff. | -87.2 | -90.6 | -92.3 | -93.0 | -93.6 | -93.6 | -95.8 | -95.6 | -95.6 | -96.1 |
| Plaice | % Diff. | -98.9 | -99.1 | -99.1 | -99.2 | -99.2 | -99.2 | -99.4 | -99.4 | -99.5 | -99.5 |

***Figure 4.6.2. Selected output from Tuning.***

The “diagnostics” are the relative differences between observations and model-predicted values:

$$Difference = 100 \frac{(Observed\ Value\ \ -\ \ Calculated\ Value)}{Calulated\ Value} \quad \%$$

which you by manipulation of parameter values tries to make as close as possible to zero. The example of Figure 4.4.2 refers to the entire stock and fishery.

There are other similar tables with area and fleet specific diagnostics in work sheet “Tuning”. Usually, you will firstly, tune the overall results, and subsequently “fine-tune” to the detailed results.

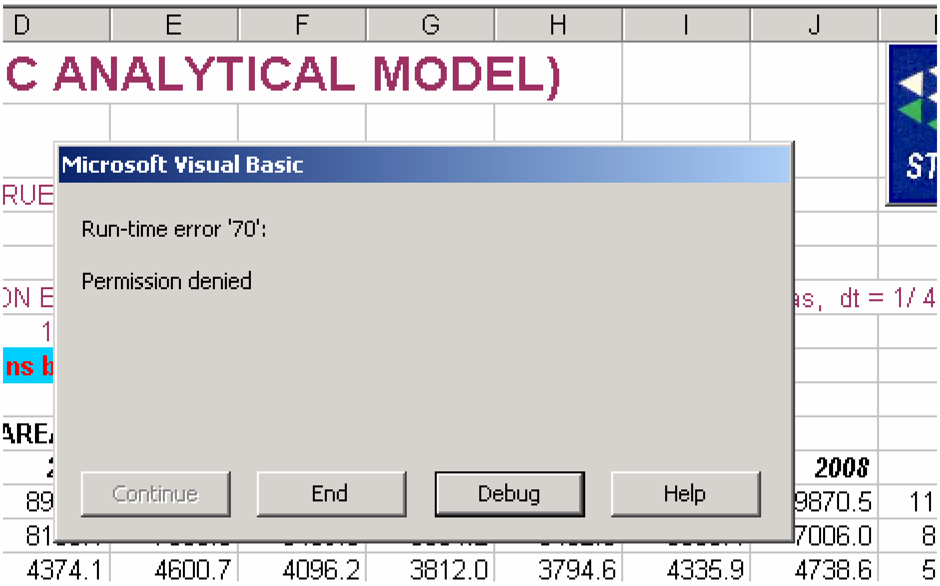
# 7. BREAK DOWN OF TEMAS - ERROR MESSAGES

TEMAS may break down. TEMAS as any other program contains “bugs”. EXCEL contains “bugs”. You may make errors. There are many reasons why TEMAS may break down.

There is one general rule for the user not familiar with VISUAL BASIC:

**“Close TEMAS and restart it”**

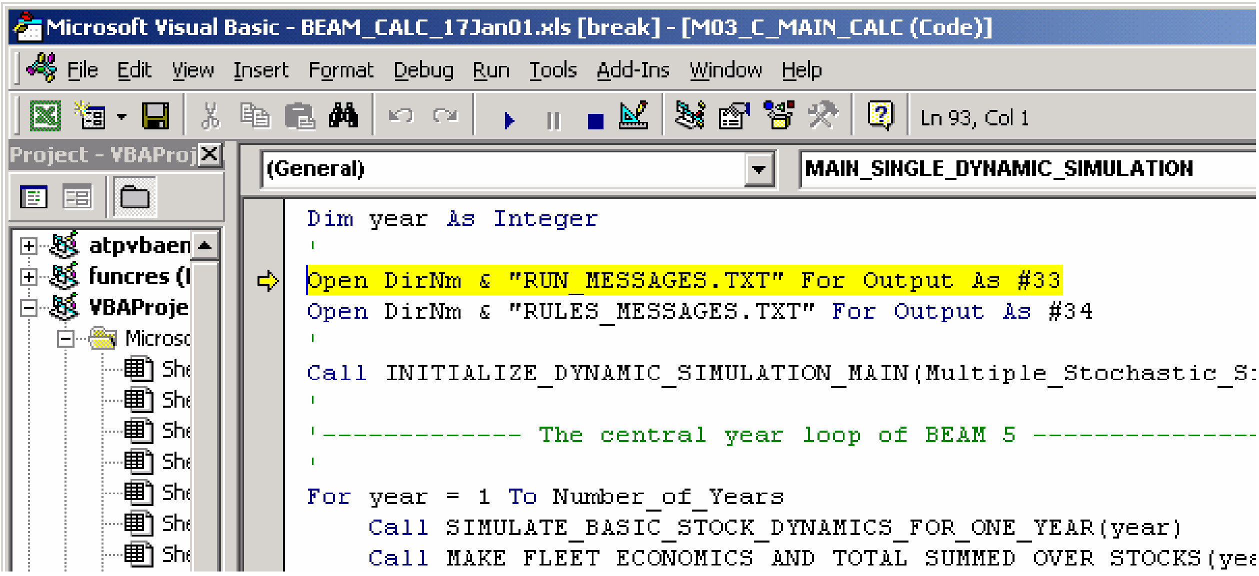
In the example below an error was made on purpose to demonstrate a run-time-error message of EXCEL. In this case the message file “RUN_MESSAGES.TXT” (Section 4.6) was opened by EXCEL. Then no other EXCEL workbook can open RUN_MESSAGES. When you start TEMAS_CALC it will try to open the message file, and find out that it is already being used be another application. That will cause the error message shown in Figure 2.1.4.1. TEMAS will break down.



Run-time error '70':

Permission denied

*Figure 4.7.1. Example of error message from EXCEL.*



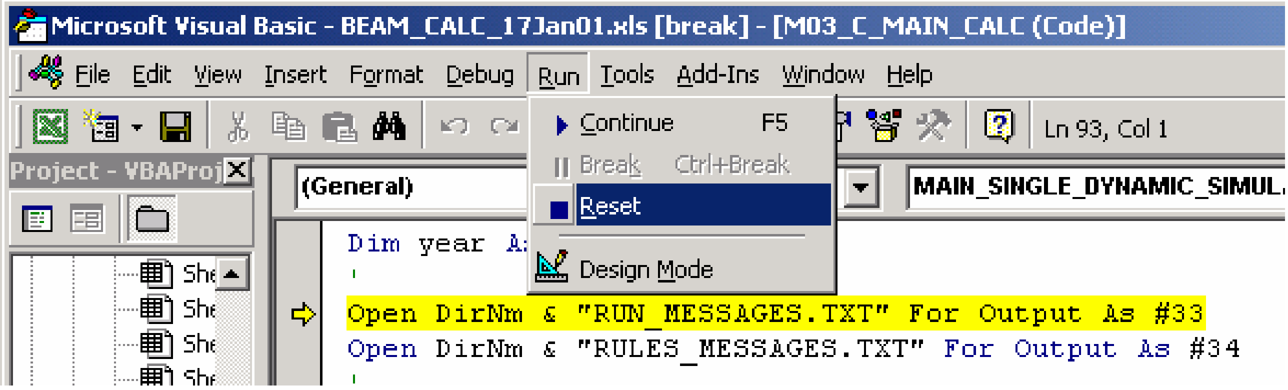
```
Dim year As Integer
'
Open DirNm & "RUN_MESSAGES.TXT" For Output As #33
Open DirNm & "RULES_MESSAGES.TXT" For Output As #34
'
Call INITIALIZE_DYNAMIC_SIMULATION_MAIN(Multiple_Stochastic_S:
'
'-------------- The central year loop of BEAM 5 ---------------
'
For year = 1 To Number_of_Years
    Call SIMULATE_BASIC_STOCK_DYNAMICS_FOR_ONE_YEAR(year)
    Call MAKE FLEET ECONOMICS AND TOTAL SUMMED OVER STOCKS(yea
```

*Figure 4.7.2. Example of EXCEL debugger.*

At this stage you may close TEMAS_CALC and restart it. That will be the standard way of handling error messages from EXCEL. The problem may be caused by a bug in TEMAS, or it may be caused by you doing something you should not do. The latter explanation applies to Figure 4.7.1.

You may also try to handle the error message yourself. If you click on “debug”, EXCEL will take you to the VISUAL BASIC editor, and an arrow will point at the VISUAL BASIC line where the Run-Time-Error occurred, and the line will be highlighted by yellow background as shown in Figure 2.14.2.

As can be seen, this should give you an indication that something might be wrong with the file “RUN_MESSAGES.TXT”, and you may get the idea to close the EXCEL workbook, which uses the message file, and TEMAS will be running again.


Microsoft Visual Basic - BEAM_CALC_17Jan01.xls [break] - [M03_C_MAIN_CALC (Code)]

```
Dim year A
'
Open DirNm & "RUN_MESSAGES.TXT" For Output As #33
Open DirNm & "RULES_MESSAGES.TXT" For Output As #34
'
```

*Figure 4.7.3. How to restart TEMAS.*

However, to restart TEMAS you may either close it down and restart it, or you may restart it by clicking on “Reset” in the VISUAL BASIC editor, as shown in Figure 2.14.3.

# DTU Aqua-rapportindex

Denne liste dækker rapporter udgivet i indeværende år samt de foregående to kalenderår. Hele listen kan ses på DTU Aquas hjemmeside www.aqua.dtu.dk, hvor de fleste nyere rapporter også findes som PDF-filer.

| | |
|---|---|
| Nr. 158-06 | Østers (*Ostrea edulis*) i Limfjorden. Per Sand Kristensen og Erik Hoffmann |
| Nr. 159-06 | Optimering af fangstværdien for jomfruhummere (*Nephrops norvegicus*) – forsøg med fangst og opbevaring af levende jomfruhummere. Lars-Flemming Pedersen |
| Nr. 160-06 | Undersøgelse af smoltudtrækket fra Skjern Å samt smoltdødelighed ved passage af Ringkøbing Fjord 2005. Anders Koed |
| Nr. 161-06 | Udsætning af geddeyngel i danske søer: Effektvurdering og perspektivering. Christian Skov, Lene Jacobsen, Søren Berg, Jimmi Olsen og Dorte Bekkevold |
| Nr. 162-06 | Avlsprogram for regnbueørred i Danmark. Alfred Jokumsen, Ivar Lund, Mark Henryon, Peer Berg, Torben Nielsen, Simon B. Madsen, Torben Filt Jensen og Peter Faber |
| Nr. 162a-06 | Avlsprogram for regnbueørred i Danmark. Bilagsrapport. Alfred Jokumsen, Ivar Lund, Mark Henryon, Peer Berg, Torben Nielsen, Simon B. Madsen, Torben Filt Jensen og Peter Faber |
| Nr. 163-06 | Skarven (*Phalacrocorax carbo sinensis* L.) og den spættede sæls (*Phoca vitulina* L.) indvirkning på fiskebestanden i Limfjorden: Ecopath modellering som redskab i økosystem beskrivelse. Rasmus Skoven |
| Nr. 164-06 | Kongeåens Dambrug – et modeldambrug under forsøgsordningen. Statusrapport for første måleår af moniteringsprojektet. Lars M. Svendsen, Ole Sortkjær, Niels Bering Ovesen, Jens Skriver, Søren Erik Larsen, Per Bovbjerg Pedersen, Richard Skøtt Rasmussen og Anne Johanne Tang Dalsgaard. |
| Nr. 165-06 | A pilot-study: Evaluating the possibility that Atlantic Herring (*Clupea harengus* L.) exerts a negative effect on lesser sandeel (*Ammodytes marinus*) in the North Sea, using IBTS-and TBM-data. Mikael van Deurs |
| Nr. 166-06 | Ejstrupholm Dambrug – et modeldambrug under forsøgsordningen. Statusrapport for første måleår af moniteringsprojektet. Lars M. Svendsen, Ole Sortkjær, Niels Bering Ovesen, Jens Skriver, Søren Erik Larsen, Per Bovbjerg Pedersen, Richard Skøtt Rasmussen og Anne Johanne Tang Dalsgaard. |
| Nr. 167-06 | Blåmuslinge- og Stillehavsøstersbestanden i det danske Vadehav efteråret 2006. Per Sand Kristensen og Niels Jørgen Pihl |
| Nr. 168-06 | Tvilho Dambrug – et modeldambrug under forsøgsordningen. Statusrapport for første måleår af moniteringsprojektet. Lars M. Svendsen, Ole Sortkjær, Niels Bering Ovesen, Jens Skriver, Søren Erik Larsen, Per Bovbjerg Pedersen, Richard Skøtt Rasmussen og Anne Johanne Tang Dalsgaard. |

| | |
|---|---|
| Nr. 169-07 | Produktion af blødskallede strandkrabber i Danmark - en ny marin akvakulturproduktion. Knud Fischer, Ulrik Cold, Kevin Jørgensen, Erling P. Larsen, Ole Saugmann Rasmussen og Jens J. Sloth. |
| Nr. 170-07 | Den invasive stillehavsøsters, Crassostrea gigas, i Limfjorden - inddragelse af borgere og interessenter i forslag til en forvaltningsplan. Helle Torp Christensen og Ingrid Elmedal. |
| Nr. 171-07 | Kystfodring og kystøkologi - Evaluering af revlefodring ud for Fjaltring. Josianne Støttrup, Per Dolmer, Maria Røjbek, Else Nielsen, Signe Ingvardsen, Per Sørensen og Sune Riis Sørensen. |
| Nr. 172-07 | Løjstrup Dambrug (øst) - et modeldambrug under forsøgsordningen. Statusrapport for 1. måleår af moniteringsprojektet. Lars M. Svendsen, Ole Sortkjær, Niels Bering Ovesen, Jens Skriver, Søren Erik Larsen, Per Bovbjerg Pedersen, Richard Skøtt Rasmussen og Anne Johanne Tang Dalsgaard. |
| Nr. 173-07 | Tingkærvad Dambrug - et modeldambrug under forsøgsordningen. Statusrapport for 1. måleår af moniteringsprojektet. Lars M. Svendsen, Ole Sortkjær, Niels Bering Ovesen, Jens Skriver, Søren Erik Larsen, Per Bovbjerg Pedersen, Richard Skøtt Rasmussen og Anne Johanne Tang Dalsgaard. |
| Nr. 174-07 | Abildtrup Dambrug – et modeldambrug under forsøgsordningen. Statusrapport for 1. måleår af monitoreringsprojektet. Lars M. Svendsen, Ole Sortkjær, Niels Bering Ovesen, Jens Skriver, Søren Erik Larsen, Per Bovbjerg Pedersen, Richard Skøtt Rasmussen, Anne Johanne Tang Dalsgaard. |
| Nr. 175-07 | Nørå Dambrug – et modeldambrug under forsøgsordningen. Statusrapport for 1. måleår af moniteringsprojektet. Lars M. Svendsen, Ole Sortkjær, Niels Bering Ovesen, Jens Skriver, Søren Erik Larsen, Per Bovbjerg Pedersen, Richard Skøtt Rasmussen, Anne Johanne Tang Dalsgaard. |
| Nr. 176-07 | Rens Dambrug – et modeldambrug under forsøgsordningen. Statusrapport for 1. måleår af moniteringsprojektet. Lars M. Svendsen, Ole Sortkjær, Niels Bering Ovesen, Jens Skriver, Søren Erik Larsen, Per Bovbjerg Pedersen, Richard Skøtt Rasmussen og Anne Johanne Tang Dalsgaard. |
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| Nr. 179-08 | Undersøgelse af sammenhængen mellem udviklingen af skarvkolonien ved Toftesø og forekomsten af fladfiskeyngel i Ålborg Bugt. Else Nielsen, Josianne Støttrup, Hanne Nicolajsen og Thomas Bregnballe. |

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|---|---|
| Nr. 180-08 | Kunstig reproduktion af ål: ROE II og IIB. Jonna Tomkiewicz, Henrik Jarlbæk |
| Nr. 181-08 | Blåmuslinge- og stillehavsøstersbestandene i det danske Vadehav 2007. Per Sand Kristensen og Niels Jørgen Pihl |
| Nr. 182-08 | Kongeåens Dambrug – et modeldambrug under forsøgsordningen. Statusrapport for 2. måleår af moniteringsprojektet med væsentlige resultater fra 1. måleår. Lars M. Svendsen, Ole Sortkjær, Niels Bering Ovesen, Jens Skriver, Søren Erik Larsen, Per Bovbjerg Pedersen, Richard Skøtt Rasmussen og Anne Johanne Tang Dalsgaard. |
| Nr. 183-08 | Taskekrabben – Biologi, fiskeri, afsætning og forvaltningsplan. Claus Stenberg, Per Dolmer, Carsten Krog, Siz Madsen, Lars Nannerup, Maja Wall og Kerstin Geitner. |
| Nr. 184-08 | Tvilho Dambrug – et modeldambrug under forsøgsordningen. Statusrapport for 2. måleår af moniteringsprojektet med væsentlige resultater fra 1. måleår. Lars M. Svendsen, Ole Sortkjær, Niels Bering Ovesen, Jens Skriver, Søren Erik Larsen, Per Bovbjerg Pedersen, Richard Skøtt Rasmussen og Anne Johanne Tang Dalsgaard. |
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| Nr. 186-08 | Smoltudvandring fra Storå 2007 samt smoltdødelighed under udvandringen gennem Felsted Kog og Nissum Fjord. Henrik Baktoft og Anders Koed. |
| Nr. 187-08 | Tingkærvad Dambrug - et modeldambrug under forsøgsordningen. Statusrapport for 2. måleår af moniteringsprojektet med væsentlige resultater fra første måleår. Lars M. Svendsen, Ole Sortkjær, Niels Bering Ovesen, Jens Skriver, Søren Erik Larsen, Per Bovbjerg Pedersen, Richard Skøtt Rasmussen og Anne Johanne Tang Dalsgaard. |
| Nr. 188-08 | Ejstrupholm Dambrug - et modeldambrug under forsøgsordningen. Statusrapport for 2. måleår af moniteringsprojektet med væsentlige resultater fra første måleår. Lars M. Svendsen, Ole Sortkjær, Niels Bering Ovesen, Jens Skriver, Søren Erik Larsen, Per Bovbjerg Pedersen, Richard Skøtt Rasmussen og Anne Johanne Tang Dalsgaard. |
| Nr. 189-08 | The production of Baltic cod larvae for restocking in the eastern Baltic. RESTOCK I. 2005-2007. Josianne G. Støttrup, Julia L. Overton, Sune R. Sørensen (eds.) |
| Nr. 190-08 | USER'S MANUAL FOR THE EXCEL APPLICATION "TEMAS" or "Evaluation Frame". Per J. Sparre. |