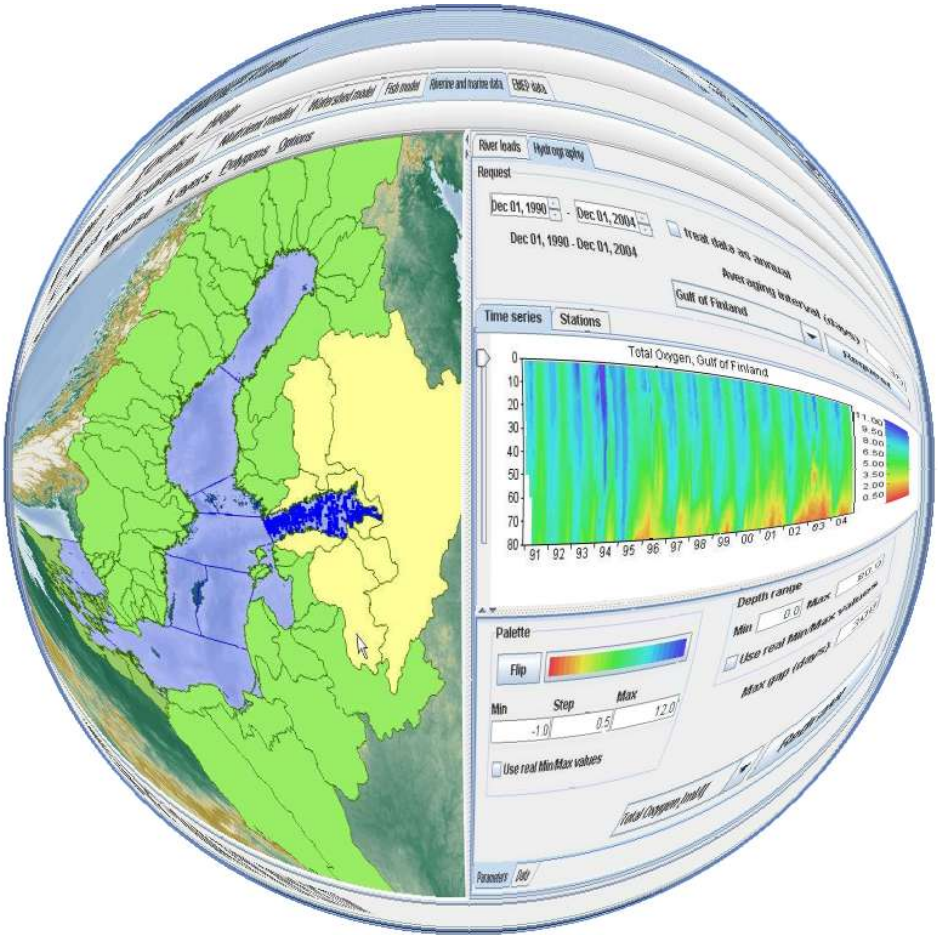
Nest – a decision support system for management of eutrophication in the Baltic Sea

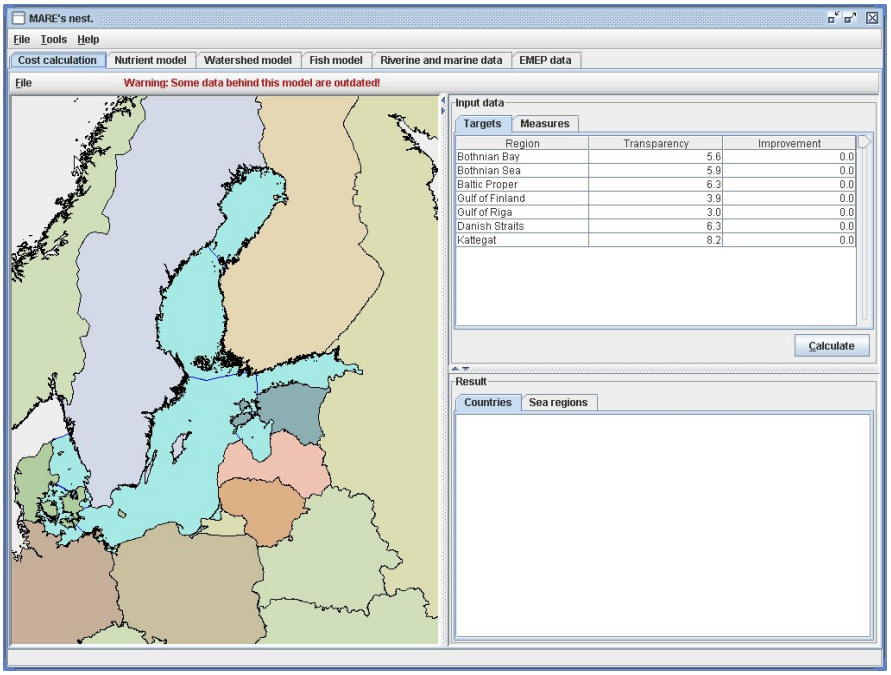
A user's manual

Version 3

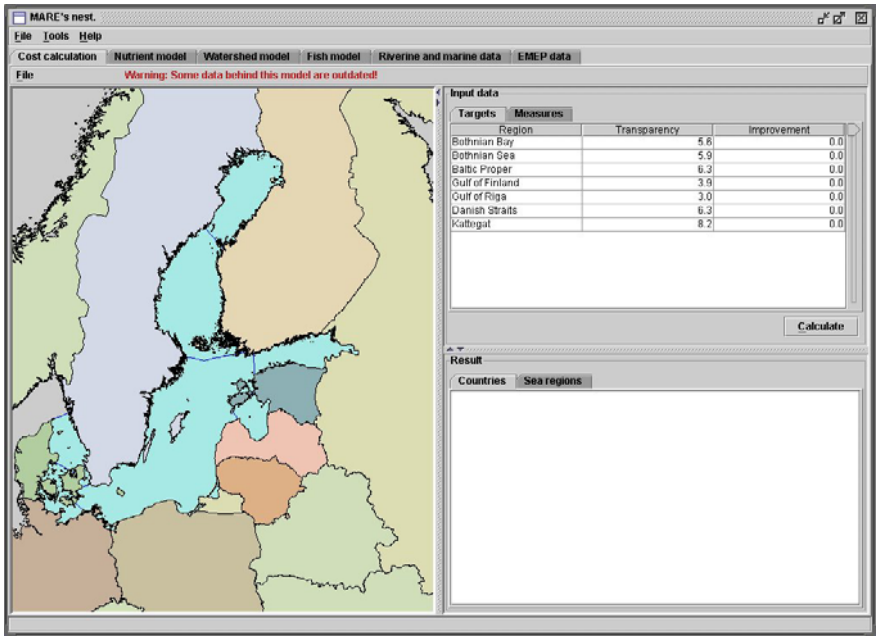


ETT MISTRA FINANSIERAT FORSKNINGSPROGRAM

MARE



NEST can be installed and run on a PC (above), a MAC (below) or on any Java-enabled computer.



Marine eutrophication - a remaining problem

Input of nutrients like nitrogen and phosphorus to the sea is a natural prerequisite for life, not an environmental problem. It becomes a problem only when the input increases to such an extent that the original properties or functions of the ecosystem change. Then it has become too much of a good thing. When that happens in a marine area or a lake we refer to it as eutrophication, which is a concept that covers a series of events in the aquatic environment. Eutrophication occurs when production and consumption of organic matter in the sea do no longer cancel each other out. The natural cycle of accumulation and decomposition are no longer in reasonable balance. In addition, the semi-enclosed and brackish-water Baltic Sea, with its slow water exchange and built-in natural barriers, is in many respects particularly sensitive to eutrophication.

Despite measures taken nationally and internationally during the last decades, eutrophication continues to be a priority environmental problem of major concern in the Baltic Sea Region. There are several reasons for that. A large proportion of the total load of waterborne and airborne nutrients to the sea originates from diffuse sources like agriculture, a sector where national legislation is not as efficient as for point sources, but where many of the measures to counteract eutrophication need to be taken. There are also considerable time delays between measures taken in a drainage basin and detectable reductions in the input of nutrients to the sea. The long residence of nutrients (many years) means that outputs from one region are likely to affect other regions. The open coastal zones are not only affected by nutrient inputs from land but also from the open sea and thus also from other basins.

Since the effects of eutrophication are the result of nutrient transports and transformations in a number of different systems, management without understanding the links between the systems is likely to result in more costly mitigation programs than necessary. Currently, our understanding of this is large but highly fragmented. There is a need to utilize and synthesize scientific information pertinent to the relevant problem and management scale. A common language for communication between scientists and managers, and a consensus about scales, problems and causes, needs to be established. Such a holistic approach takes into account e.g. the entire hydrological and biogeochemical cycles.

The decision support system – objective and goal

The overall goal of the MARE program is to develop a user-friendly, computer-based decision support system and to introduce it to managers as a tool for identifying cost-effective strategies to counteract eutrophication of the Baltic Sea. Interlinked models that synthesize knowledge in ecology, physical oceanography, biogeochemistry, and economics, are used to develop this system. The decision support system being developed within the MARE research program has been named Nest.

Main target groups in this respect are decision-makers within the Helsinki Commission (HELCOM), as well as those in the Baltic Sea States working on the implementation of the EU Water Framework Directive and the Marine Strategy

Thus, the aim is to assist scientists and decision-makers in their effort to identify cost-effective measures or combinations of such measures to reduce nutrient loads and, consequently, counteract eutrophication to the Baltic Sea for the purpose of reaching the environmental targets that have been set.

This manual is not complete: it is meant as a ‘Read me first’ introduction to Nest. It will enable the users to install and explore the various components on their own computer. The detailed documentation of the various components are available on our WWW-site

http://www.mare.su.se

The manual is by no means final: it will be continuously improved and modified, due to both user inputs and when components of Nest are modified. The most recent version of Nest as well of the manual will always be available from our WWW-site.

Welcome to NEST

Introduction

To run the program you must have access to Internet; some components are installed on your (client) computer, others are installed on the server that you communicate with. Each time that you start the program, your client software is checked and updated if a new version is available. This procedure ensures that you always have access to the most recent version of Nest. A detailed technical documentation and a description of the architecture of Nest can be downloaded from the start page (see below).

How to get started – launching Nest

The Nest system is accessed through a special web page on the Internet site hosted by the Department of Systems Ecology at the Stockholm University. In order to launch and run Nest you need to have Java Virtual Machine (JVM) installed on your computer.

If you do not have Java installed

If you do not have Java Virtual Machine installed you can click Installation in the right hand upper corner of the Nest home page or just manually type in http://java.com and access the Sun Microsystems Inc. Java download page. The Java software can be downloaded free of charge from this site. After installation you will be able to start Nest from the Nest home page:

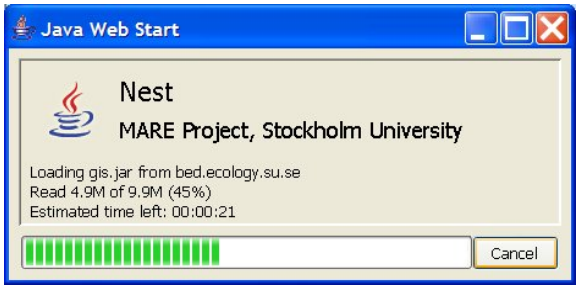
http:/mare.su.se/nest/

If you have Java installed

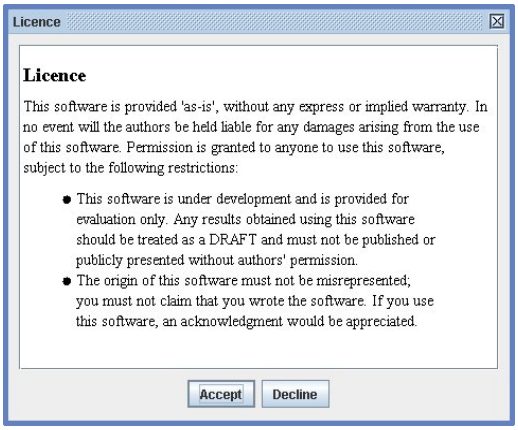
Click Start Nest in the upper right corner of the Nest launch page. The system will now start loading. If this is the first time you run the program, you will have to accept:

You will then see the Java Icon.

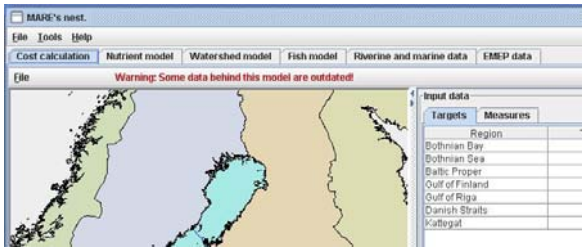
If you don't have the most recent client version of the program installed the program (JVM) will search for and download the latest version



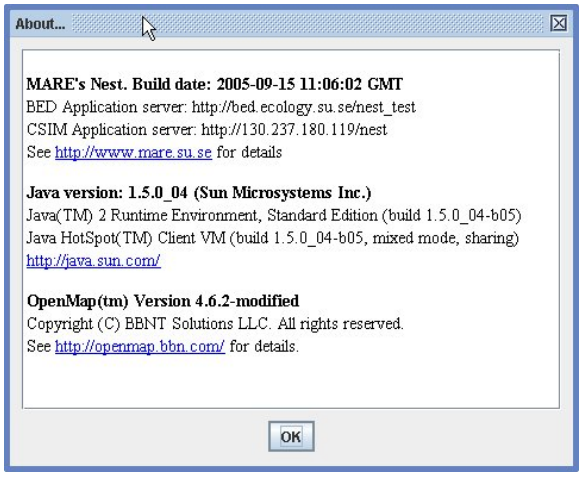
When this is installed you have to accept the license agreements for using Nest

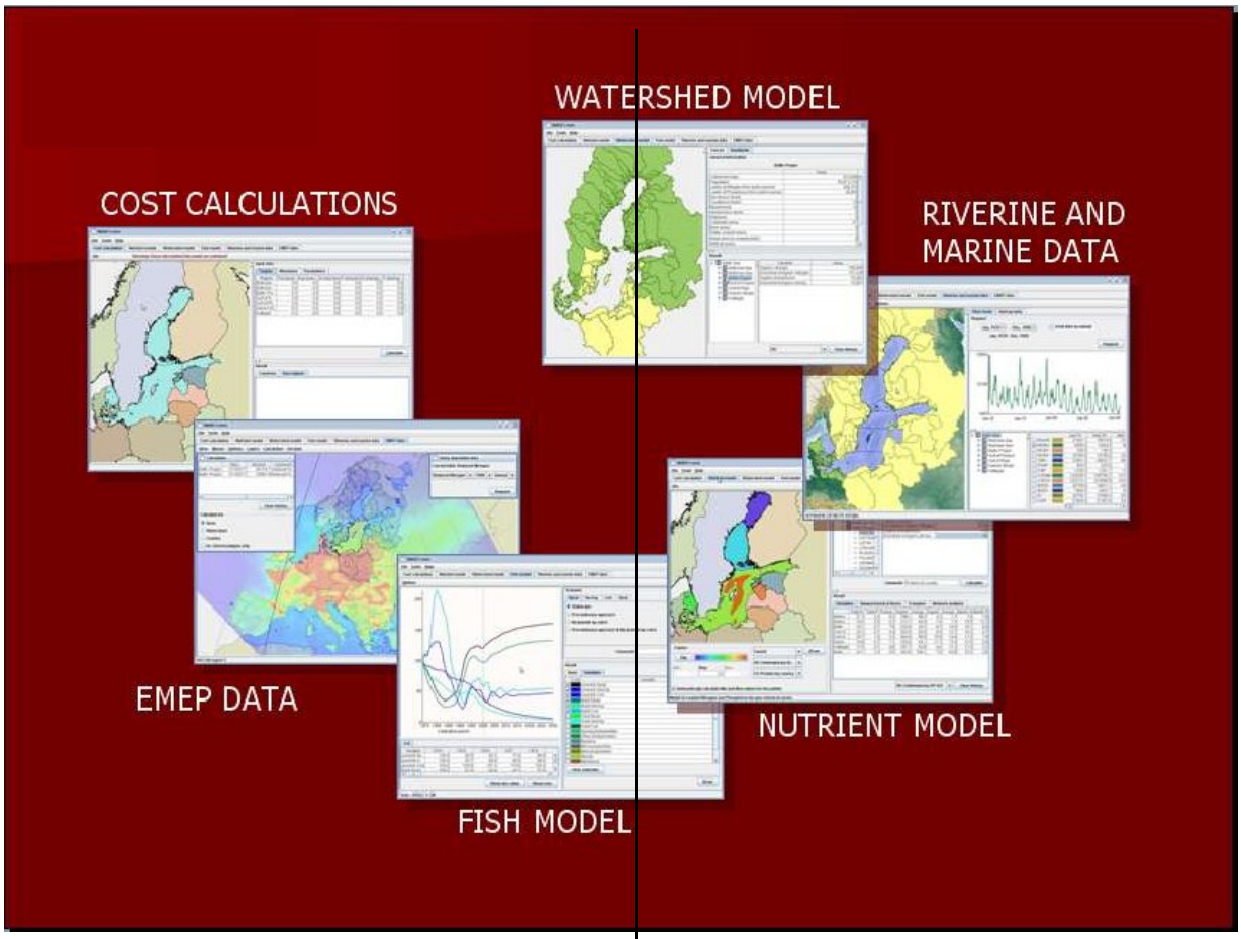


After having pressed *Accept*, the initial window of Nest will appear. When Nest is opened, you automatically come to the COST CALCULATIONS module of the system, currently with a total of six key modules, seen in the top panel:



When you move the cursor over items in the various windows, you will usually find an explanation of that particular item in the lower left corner. When you click on *Help* you will find a link to the web site with links to detailed *Documentation* of various components of NEST. The *About* panel under Help will show what version of NEST you are using





THE CURRENT SIX KEY ELEMENTS

COST CALCULATION

Provides tools to calculate minimum-cost solutions (measures to be taken within major sectors of society) to achieve a specific improvement in water quality in any of the seven major Baltic Sea sub-basins.

MODEL RESULTS

A physical-biogeochemical marine model can be used to calculate and visualize effects of changing nutrient (nitrogen and phosphorus) initial conditions and loads on conditions in the major sub-basins of the Baltic Sea

LOADS

Includes tools that can be used to estimate loads of nutrients to the Baltic Sea basins from a variety of sources and different drainage basins. You can also view the corresponding hydrochemical conditions (concentrations of nutrients) in the sea. Data from extensive databases are used for these calculations.

EMEP LOADS

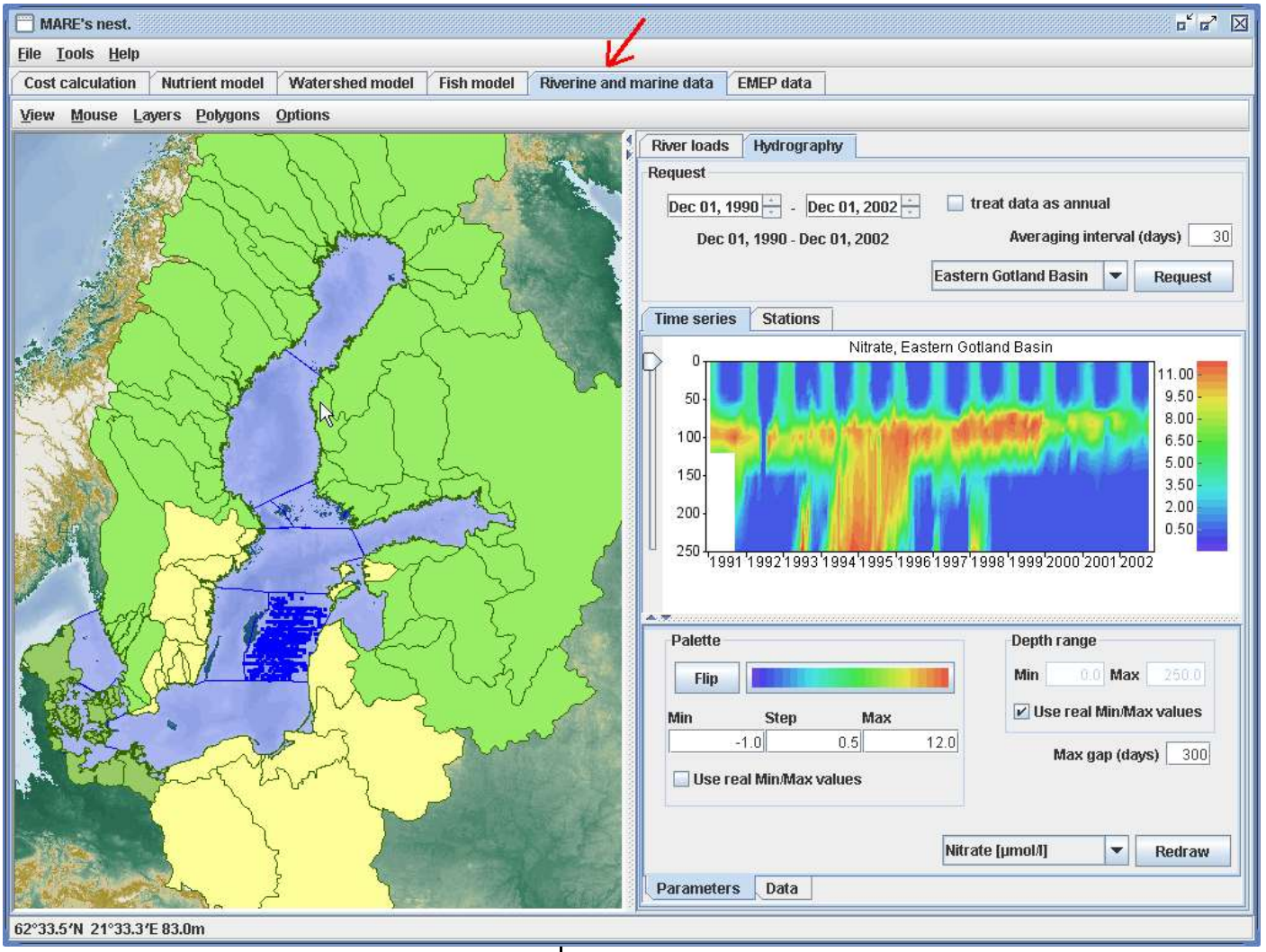
Atmospheric nitrogen and sulphur deposition to the Baltic Sea major basins and drainages basins as well as all countries in Europe, extracted via Internet from the UNECE/EMEP database in Oslo.

FISH MODEL

A detailed model of the food web of the Baltic proper than can be used to evaluate the effects of various fishery management options on cod, herring and sprat.

WATERSHED MODEL

A model of the nutrient loads from the Baltic drainage basin is under development here. Detailed descriptions of the drainages basin characteristics, in term on land use, populations, etc are available as well.



Riverine and Marine Data

RIVERINE AND MARINE DATA

This module is primarily intended as a convenient tool for evaluating some of the data needed to develop and validate the various models used in Nest.

The databases are regularly updated as new data compilations become available, on riverine loads and hydrochemical marine observations. These data are presented in great detail. The purpose for doing so is to permit a free and open evaluation.

The left panel shows the Baltic Sea and the drainage basins and by clicking on the objects above, provides options for analyzing the loads in graphical formats. In the control panel above the map one can chose:

View = for manipulation of the map (zoom in, zoom out).

Layers = to select visualizing layers on the map. The different features are

- *Graticule*: Places a latitude-longitude grid over the map
- *River loads*; a map of the sub drainage basins. By clicking on any of these (colors change) you select data on loads from the database.

- *Country*; a map layer showing country borders.

- *Stations*; shows the position of hydrographic stations, selected from the database.

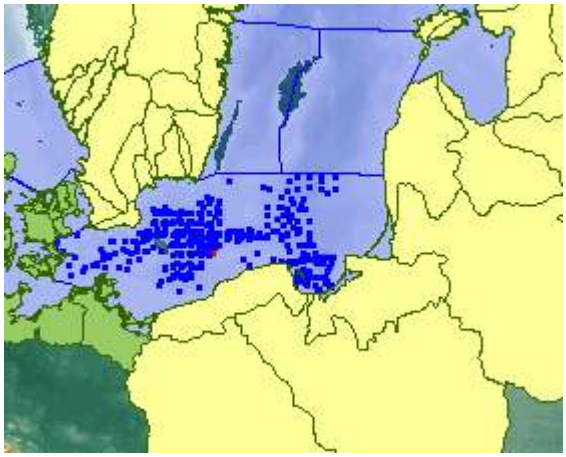
- *Hydrographic polygons*; Put boundary polygons, encompassing the 13 major marine regions in the Baltic Sea. Clicking within one of these, all stations inside the boundaries are shown as blue dots on the map. By clicking on any of these dots (turns into red) the actual measurements here are shown on the lower right *Stations* panel.

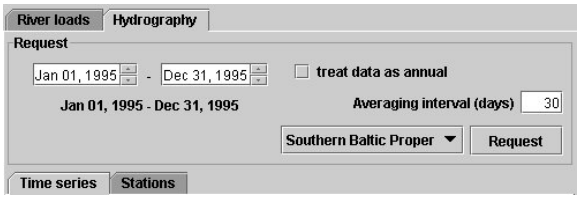
- *Topography*; A topographic map. Hidden when the Country and River loads layers are also selected. Water depths and land elevations at the point of the cursor are shown in the lower left corner.

Mouse = gives you the option to select between mouse modes (Gesture or Navigate). In Gesture mode the mouse is used to interact with the map and evaluate different kind of data while in the Navigate mode the mouse is used for manipulations of the map (zoom, change scale, move).

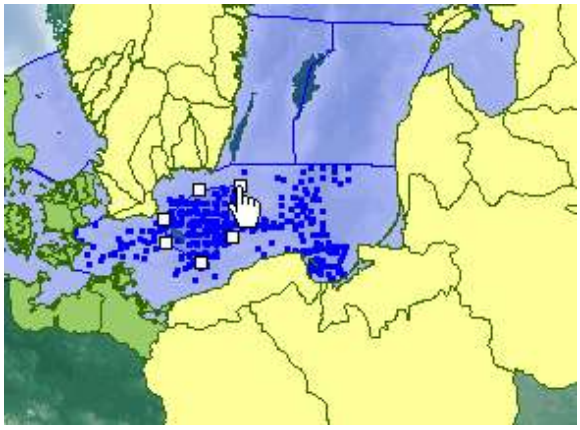
Polygons

By default, there are 13 polygons bordering the major sea regions in the Baltic. If you click in any of these all stations as selected and extracted from the database within the time interval set in the upper right *Hydrography/Request* panel. The name of the basin is also shown there.

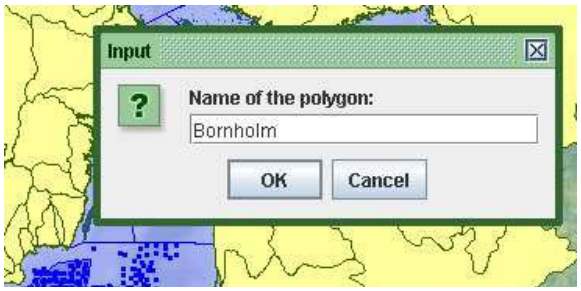




You can select an area different from the sub-basins by creating a *New* polygon from the drop-down menu. Draw the polygon by clicking with the cursor around the boundaries:



Double-click on the last node when you have finished and then click outside the polygon to name it in the window that now appears on the map:

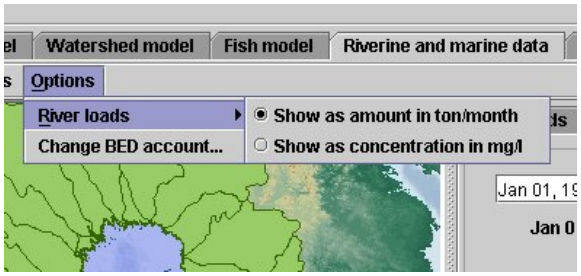


The name of this ‘sub-area’ will then appear in the drop-down menu to the right as well, as the last item. You can also save it, together with all the other basins, with the *Save* option on the *Polygons* drop-down menu.

If you choose the *Allow editing* option, you can then *Add*, *Delete* or change the shape of any polygon

Options

Here you can alternative ways to show riverine loads or change user accounts:

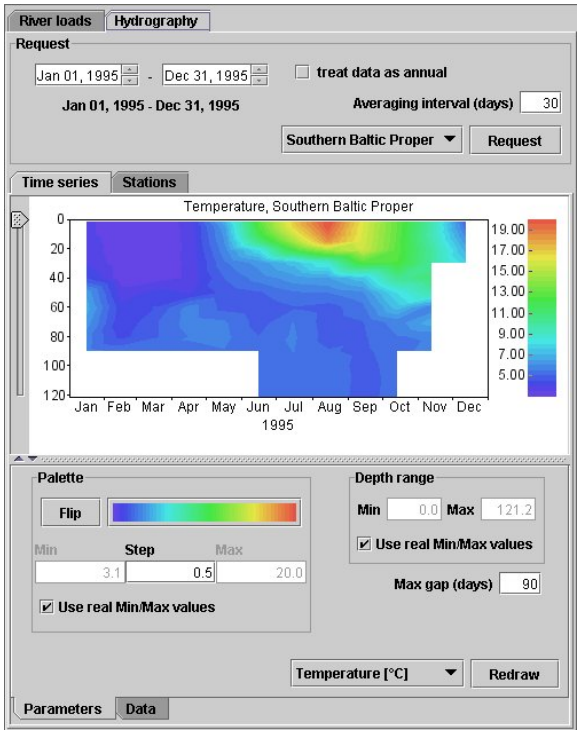


The default account 'guest/guest' will cover most of the databases but there are some restrictions particularly to hydrochemical observations, for the latest four years (see details under Help/Documentation).

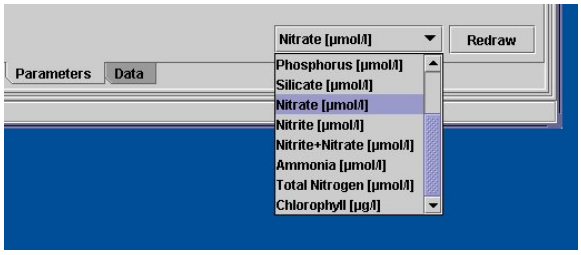
Request

This right hand panel is used to set parameters for requesting data from the databases for a chosen time period. The data requested will appear in the **River loads** panel below or the panel **Hydrography**. Only in those drainage basins where complete data coverage is available, are highlighted on the map.

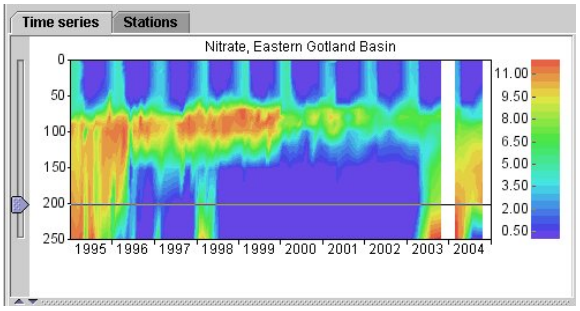
Hydrography panel will show observations from the area you had chosen on the map or in the request panel. By default a time-depth plot of temperature is shown in the **Time series** panel.

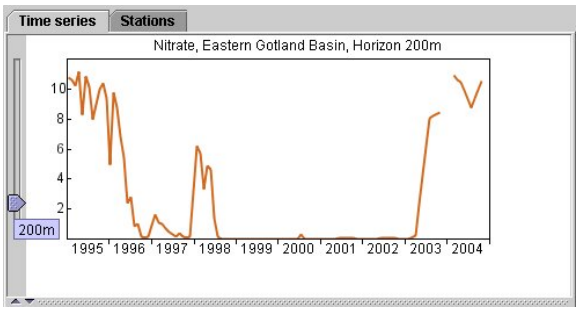


You can select any of the available variables in the drop-down menu:

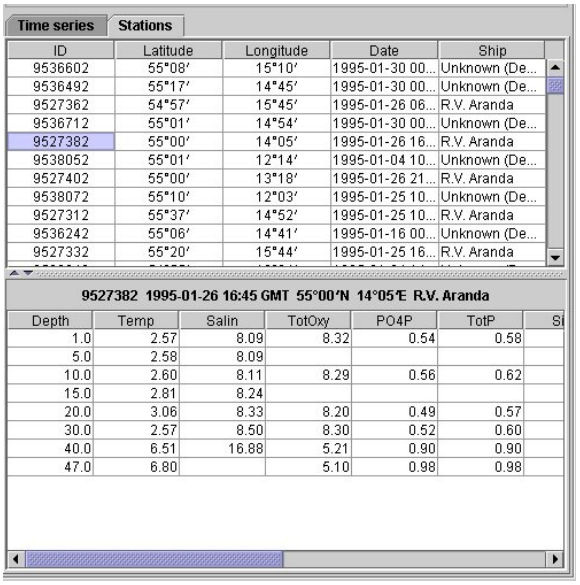


You can change depth range and color scale with the buttons below the graph. The slider to the left of the graph allows you to se a time series of observations at a specific depth.



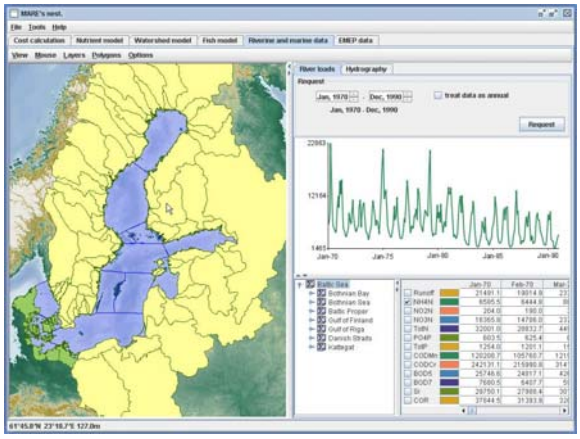


If you click on the **Stations** tab, you will se the actual data in the panel. The observations are shown then you click on a specific station, either on the row in the table or on the map.

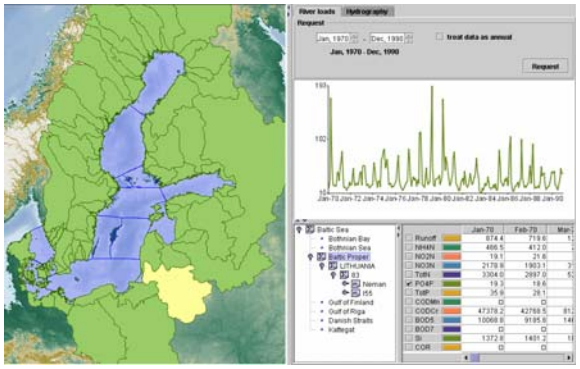


With the **Time series** tab selected you will se only the data behind this graph when you click the **Data** tab below the window. All data in these tables can be copied and pasted into other applications.

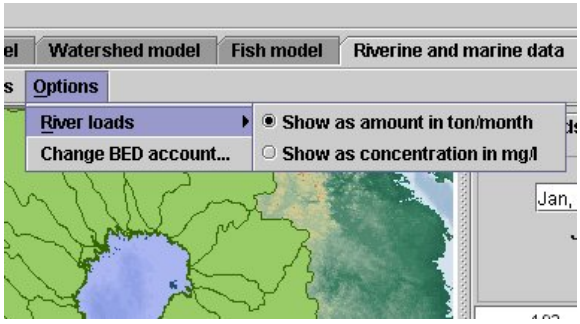
The **River loads** panel comprises three parts:

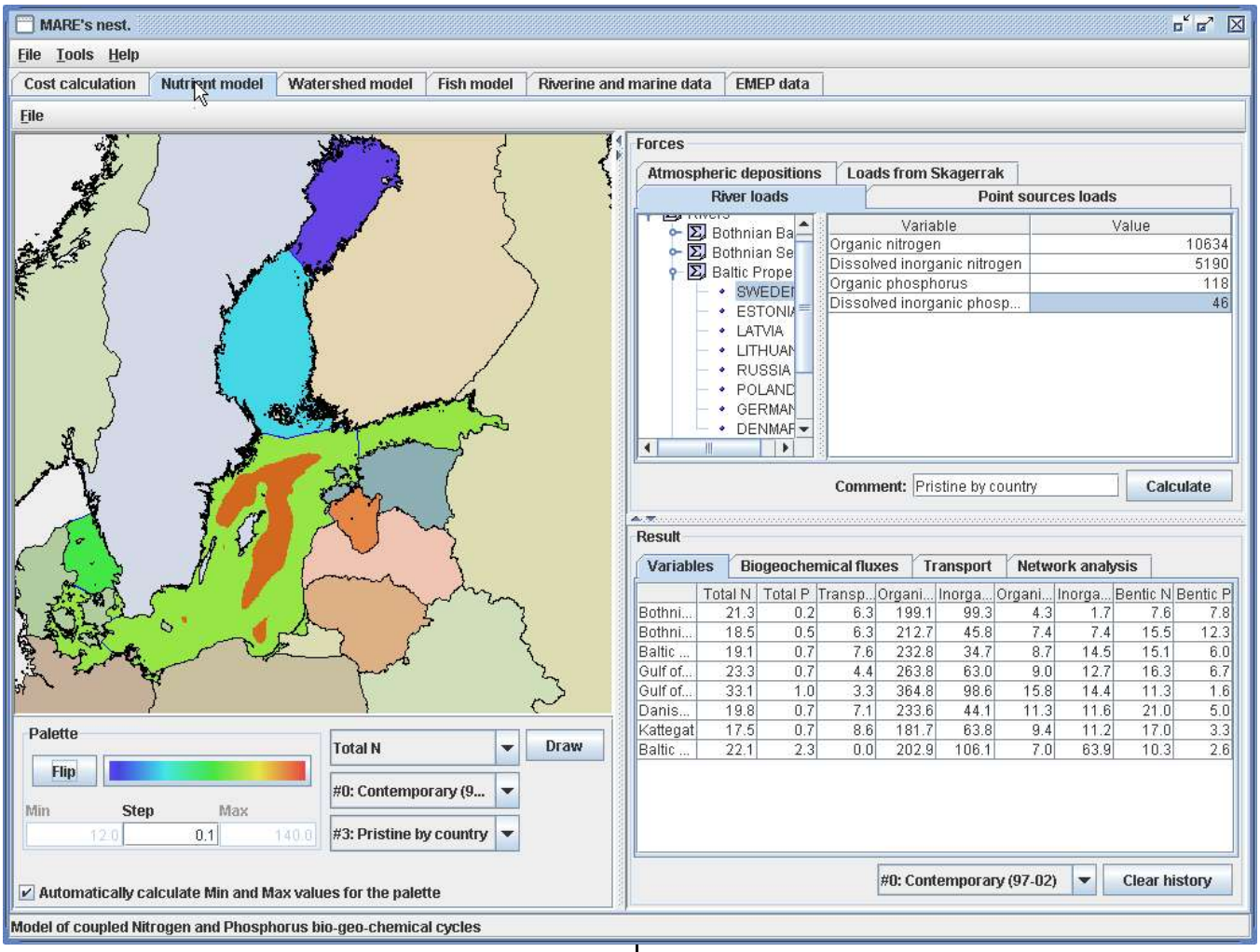


The **map** to the show all the sub drainage basins for whish data are available. The graph to the right shows the variable(s) with monthly resolutions, which you select by clicking on a check mark on the lower right panel. The areas selected are highlighted (from green to yellow) in the map. You can select a sub region by clicking on the map or in the tree below the graph.



You can show the results either in tons or in concentration by selection an **option**.





NUTRIENT LOADS AND EFFECTS IN THE BALTIC SEA(NUTRIENT MODEL)

The physical/biogeochemical marine model behind this module uses data on nutrient loads to calculate nutrient flows between Baltic Sea basins, transformation processes, and nutrient flows out of and between the Baltic/Kattegat basins. External nitrogen inputs are separated into terrestrial, atmospheric and advective sources as well as labile and inorganic and refractory and labile organic components.

Panels

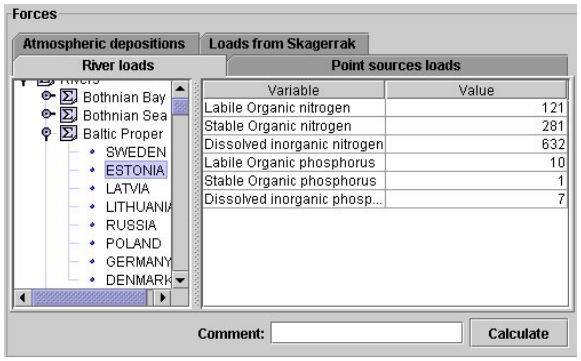
Forces

By default, loads are an average for the year s 1997 - 2002, as compiled by HELCOM but you can also use a data set compiled for 1995 (PLC3) or 2000 (PLC4) or modify these precompiled sets, save these and reuse these (from **File** in the upper left corner immediately above the map) The data are shown in the

Forces window, separated into

- **River loads, (coastal)**
- **Point sources,**
- **Atmospheric depositions**
- **Loads from Skagerrak.**

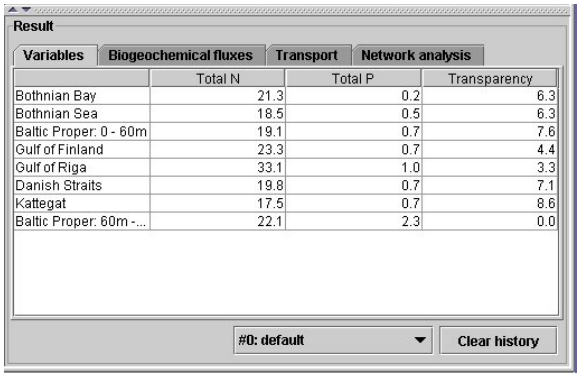
You can explore and change loads from a country to a particular basin by clicking on the basin and the load from each country will appear:



You can assign a name for a model run for particular load scenario in the **Comment** window. When you press **Calculate**, the results will appear in **Results** and **Map** panels

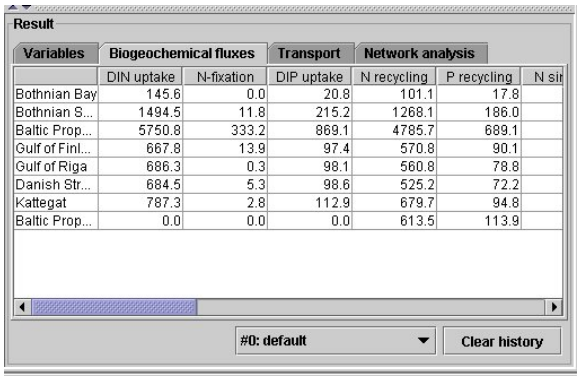
Results

Variables



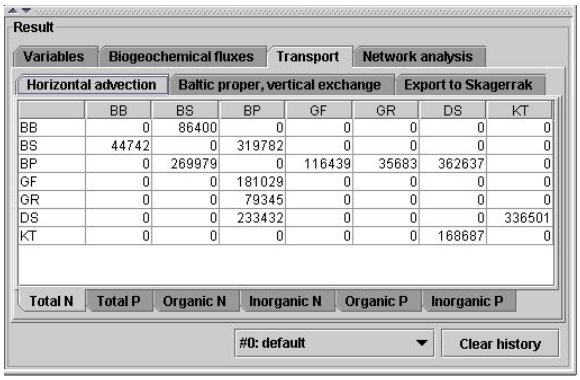
Here the results in terms on nutrient concentrations for the eight basins consists of two boxes) of this model are shown. The inorganic and organic fractions of nitrogen and phosphorus are merged. In Expert mode you will see each fraction, including concentrations in the sediments.

Biogeochemical fluxes



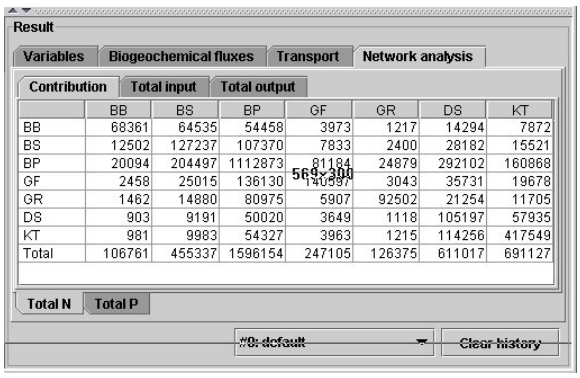
The major source and sink terms in the model and units are, as usual, shown in the lower left corner.

Transport



Advective flows between basins and between the upper and lower box in the Baltic proper, as well as the export to Skagerrak can be explored here.

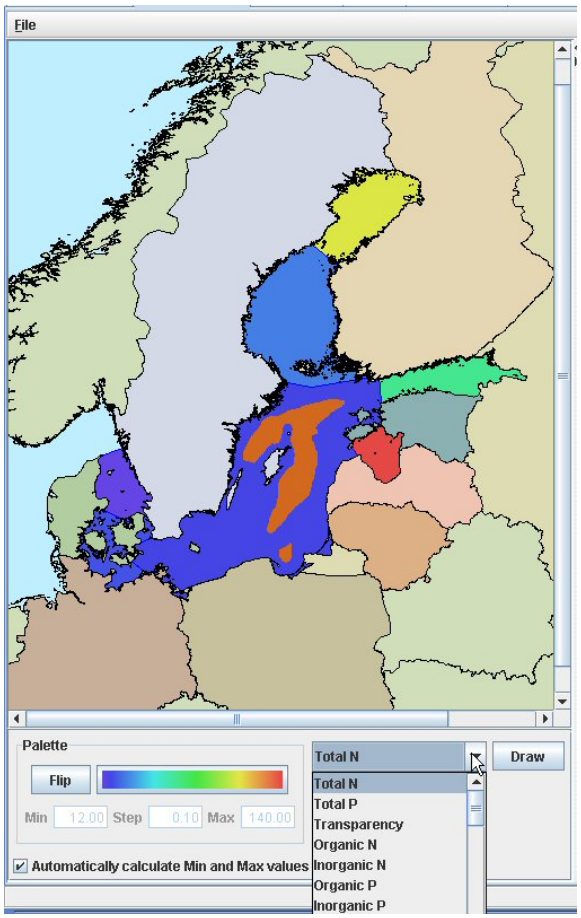
Network analysis



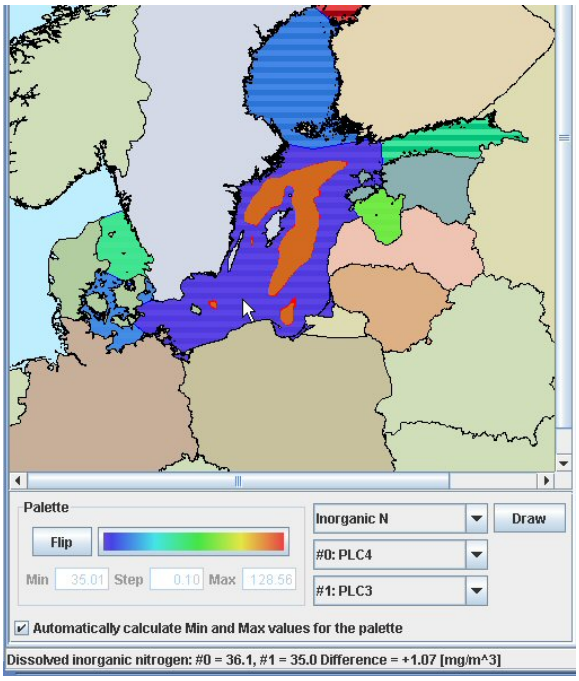
Here you have three additional panels for both nitrogen and phosphorus. In **Contributions** you can see how much of the inputs to one basin reach a particular basin. The **Total Input** panel gives a detail account of the sources to each basin. The **Total output** panel gives an account of the exports

for each basin, by advection or by internal processes.

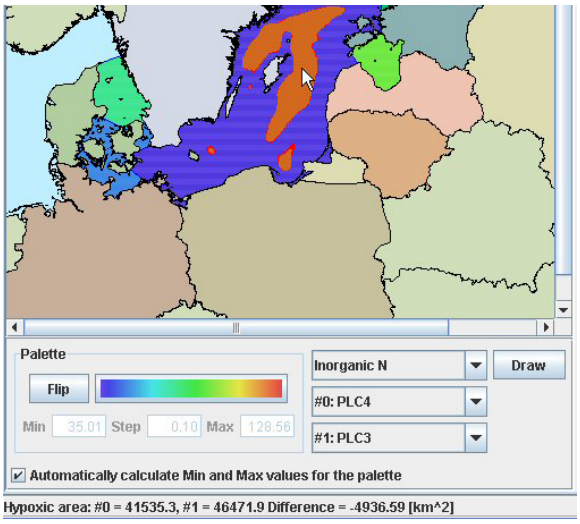
MAP



Here, you can select any of the model variables, through the pull-down menu to be visualized. Click on color scale to change it and set different minimum and maximum values. Move the cursor over the different basins and see the actual values of the particular model variable. When you have run another simulation you can compare the result in the map panel.

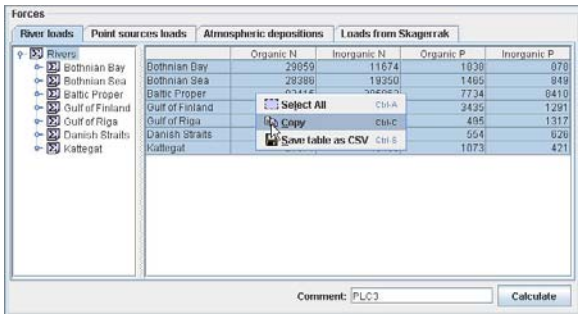


In the lower left corner you can see a comparison between the model runs. If you move the cursor over the center of the Baltic proper, you will get information on area extension of the hypoxic bottoms and the depth to this (by clicking on it)



Additional comments

You can always extract the numbers that appear in the panels by clicking on these with the right button on the mouse:

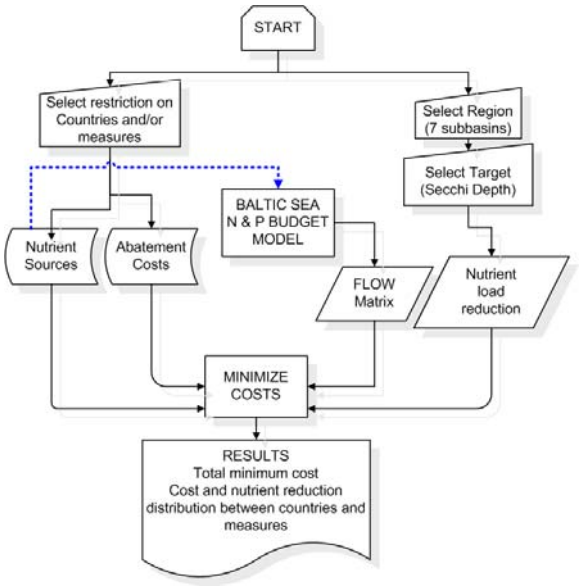


This feature is implemented in all modules of Nest. 'Cut and paste' the information into any other program that you use to further analyze and graph the data.

COST-EFFECTIVE MEASURES TO COUNTERACT EUTROPHICATION IN THE BALTIC SEA (COST CALCULATIONS)

COST CALCULATIONS

The cost calculation module provides you with a number of alternatives for calculating the most cost effective way to achieve a desired improvement in water transparency (presently the only environmental target included in the Nest system; see above"Basic structure"). The basic logic is the following:

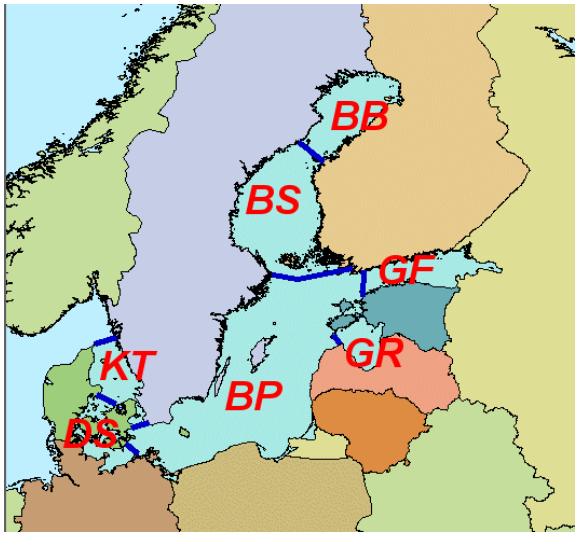


You are, in this module, primarily working in **Target** mode, i.e., you first set an environmental target - an improvement in water quality for one or several regions. You may also set restrains on what measures and what countries (and sub-drainage basins) that should be involved. The program then calculates a minimum cost solution to reach this objective. You also have the option to change various parameters in the models and see whether these will affect the results.

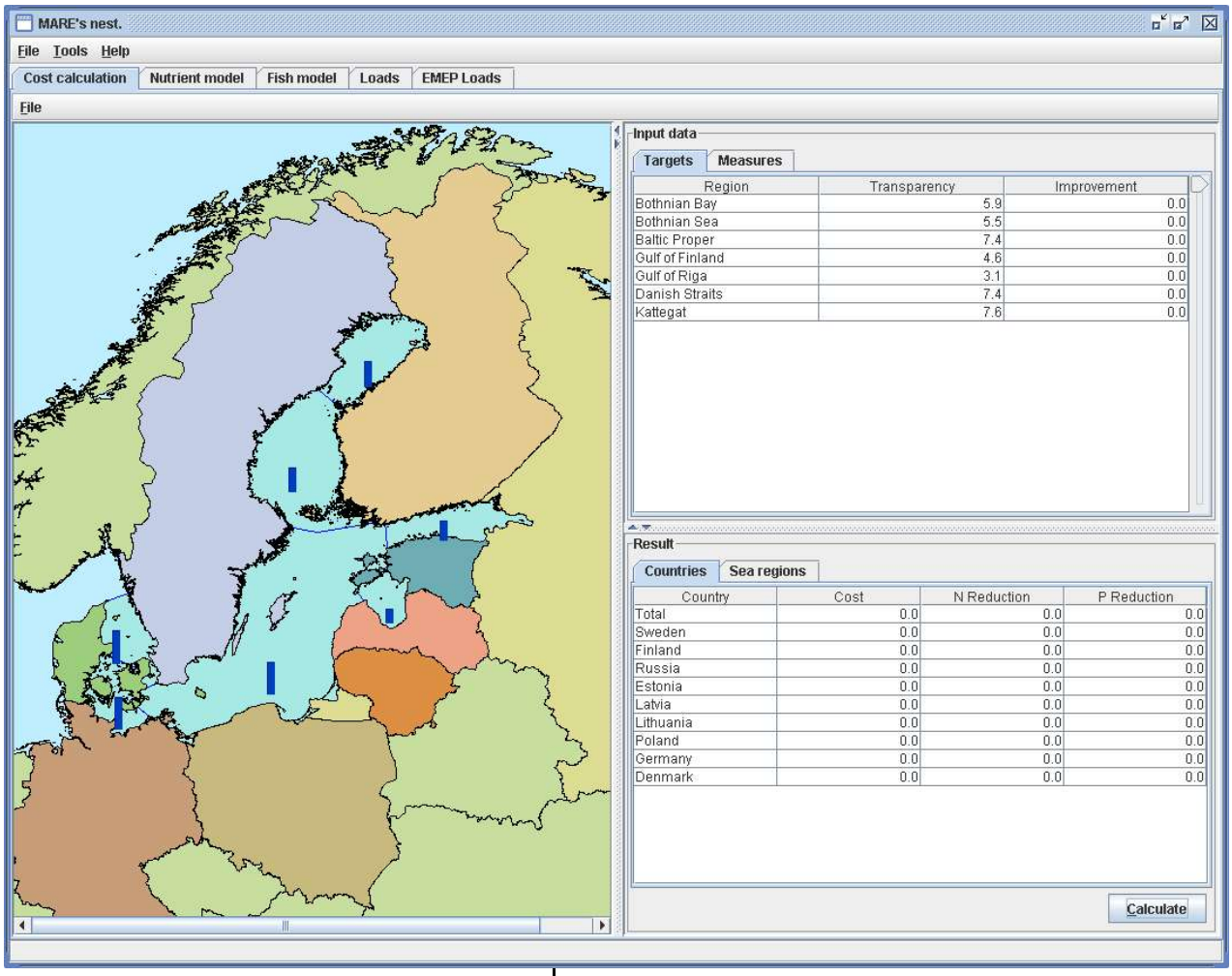
Measures in 23 sub-drainage basins and effects in 7 sub basins

The minimum-cost solutions are calculated from cost estimates of a number of different mitigation measures in a total of 23 sub-drainage basins around the Baltic Sea. Nest contains options to change various parameters and to exclude measures as well as countries or sub-drainage basins in scenario analyses. The 23 sub-drainage basins included in the system are shown here:

The Baltic Sea is divided into 7 sub-basins:



The 7 sub-basins are the Bothnian Bay (BB), Bothnian Sea (BS), Baltic Proper (BP), Gulf of Finland (GF), Gulf of Riga (GR) , Danish straits (DS) and Kattegat (KT).



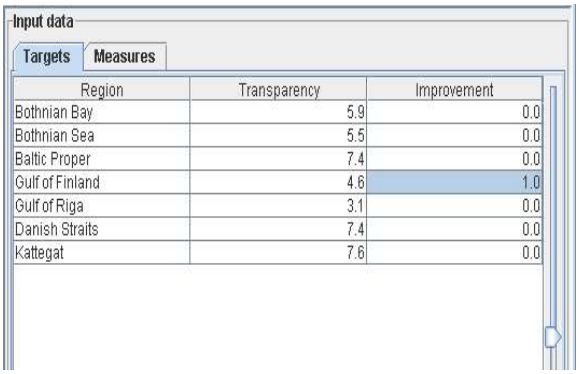
WHAT YOU SEE ON THIS PAGE

- To the left, a map of the Baltic Sea Region.
- To the right, two panels:
  - Input data with
    - + Targets
    - + Measures
  - Result, with
    - + Countries
    - + Sea Regions

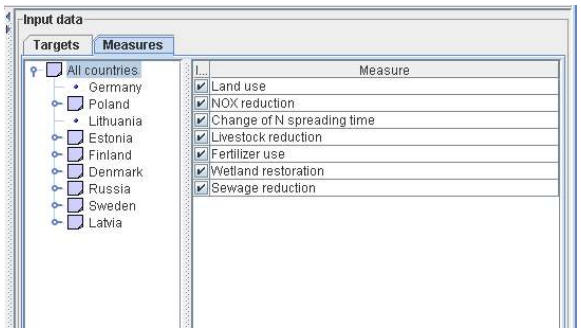
If you click on the **Calculate** button, the solution is calculated (initially blank). In this example the costs (and nutrient reduction) are zero, since a target has not yet been chosen in the upper right panel.

Targets

Start by selecting a desired improvement in water transparency in one (or several) of the Baltic Sea basins. You do this by either typing a value of desired improvement into the column, or by moving the slider to the far right. In the example below an improvement in the water quality in the Gulf of Finland by 1 meter has been selected.



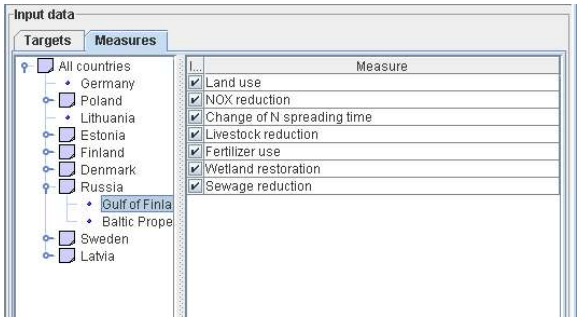
Click **Measures** for the following panel:



Choose the combination of measures you would like to explore by"unticking" the measures you want to exclude. These are aggregated in 7 major groups:

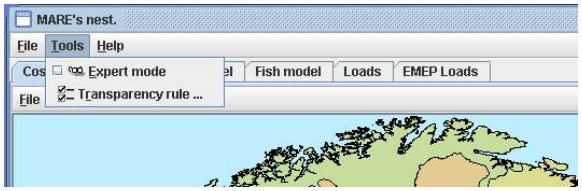
- Land use
- NO_x reduction
- Change of N spreading time
- Livestock reduction
- Fertilizer use
- Wetland restoration
- Sewage reduction

You can also choose whether these measures should be taken in all countries around the Baltic Sea, or just in one or more countries. Countries or specific sub-basins of that country can be excluded by clicking:



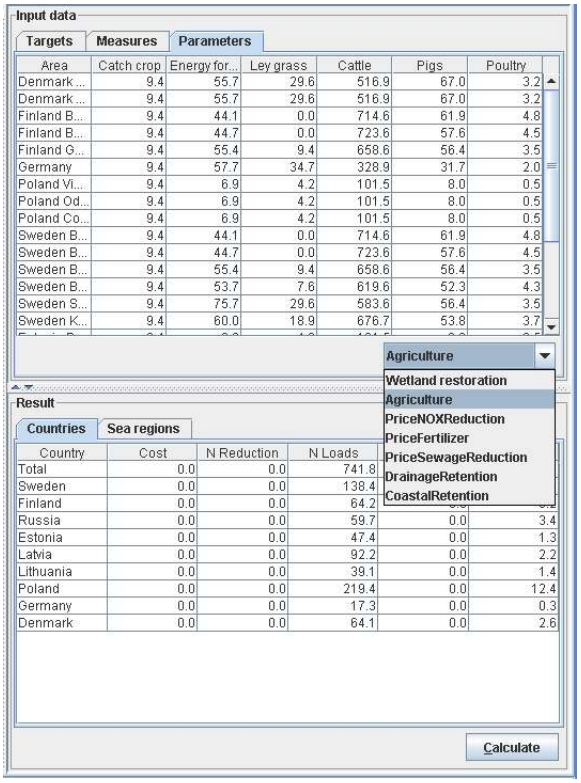
Please note that if you select too radical improvements it may generate infeasible solutions if the desired improvement cannot be achieved without measures being taken within a certain country or sector(s). For example, a large increase in transparency in the Gulf of Finland cannot be achieved without measures being taken in Russia. You will also get a message if you choose an unrealistically large improvement of water transparency.

A more detailed choice of the parameters used in various measures can be found under **TOOLS**, where you select **EXPERT MODE.**



You will then see a third panel called **Parameters** in the **Input Data** panel.

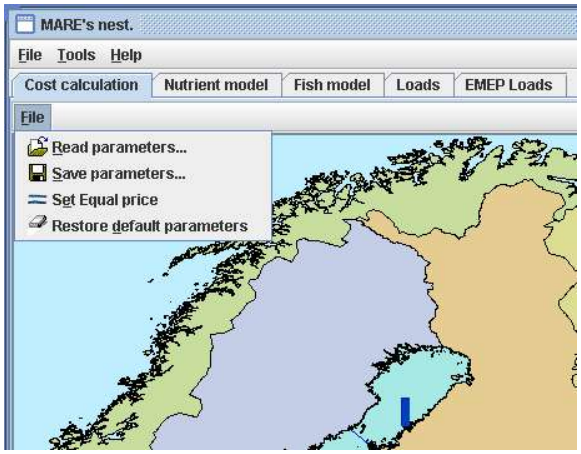
The parameter panel gives you the option to change a large number of parameters for all 23 sub drainage areas. In the example below you can see the parameters that you can change related to **Agriculture**, show after selection of this in the drop-down menu.



The meanings of all these parameters are explained in the lower left corner under the map.

In the **File** menu you have the options to store and read your own set of parameters from a file or restore the default parameters.

You can also see the effects of using the same parameter values for the larger regions, without having to key in each number separately. You select this by using"Set equal price".



You will see a new panel where you can select prices and regions:

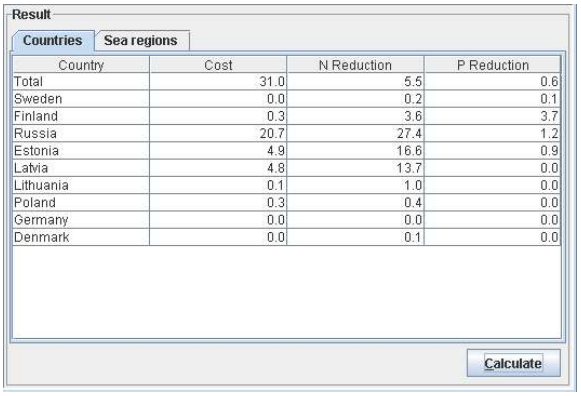
- Go to the **Results** panel
- Click **Calculate**, at the bottom of this panel.

Results

Results from the calculations you just made will be shown in two modes:

Countries = The total costs (in million € per year) of achieving the selected improvement in transparency and the distribution of costs between the countries involved if the most cost-effective measures are to be implemented. In addition, this table shows the total reduction (in per cent) of the load of nitrogen and phosphorus needed from each country.

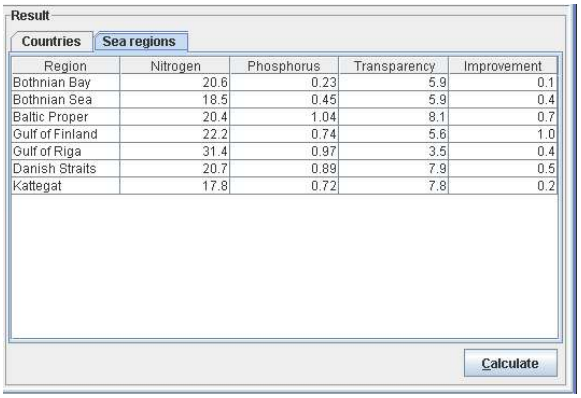
Sea regions = The resulting concentrations of nitrogen and phosphorus in the various Baltic Sea basins after the chosen measures have been taken. Furthermore, the table illustrates data on the improvement of the transparency in the target basin (the selected value), as well as the corresponding improvement in the other Baltic Sea basins.


Result

Countries | Sea regions

Country	Cost	N Reduction	P Reduction
Total	31.0	5.5	0.6
Sweden	0.0	0.2	0.1
Finland	0.3	3.6	3.7
Russia	20.7	27.4	1.2
Estonia	4.9	16.6	0.9
Latvia	4.8	13.7	0.0
Lithuania	0.1	1.0	0.0
Poland	0.3	0.4	0.0
Germany	0.0	0.0	0.0
Denmark	0.0	0.1	0.0

Calculate


Result

Countries | Sea regions

Region	Nitrogen	Phosphorus	Transparency	Improvement
Bothnian Bay	20.6	0.23	5.9	0.1
Bothnian Sea	18.5	0.45	5.9	0.4
Baltic Proper	20.4	1.04	8.1	0.7
Gulf of Finland	22.2	0.74	5.6	1.0
Gulf of Riga	31.4	0.97	3.5	0.4
Danish Straits	20.7	0.89	7.9	0.5
Kattegat	17.8	0.72	7.8	0.2

Calculate

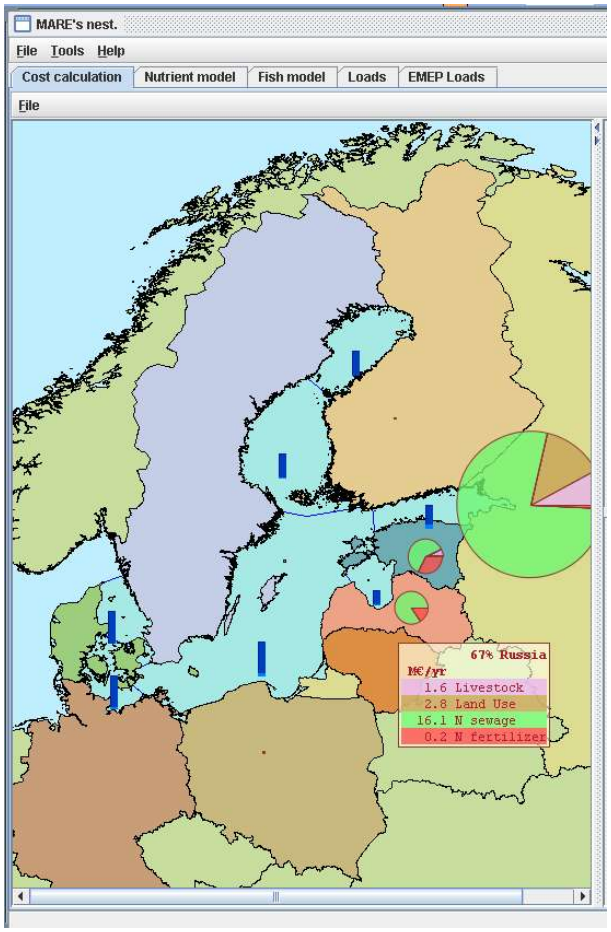
The basic assumption used in this context is that transparency is a function of the concentration of total nitrogen in all basins, expect for the Bothnian Bay, where it is determined by the concentration of phosphorous. You can change these assumptions using the "Transparency rule…" under Tools. The relationship between concentrations of total nitrogen and water transparency has been determined using data from many years of monitoring in the Baltic Sea Area. Please also note that the figures given in Nest of water transparency refer to the annual average transparency of seawater in the open sea.
It is also important to note that the concentrations of nitrogen and phosphorus are calculated independently of each other, which is of course not the case in nature. A linking of the two occurs in the Nutrient model module but is not yet implemented in the Cost module.

You will anyway often see reductions in both N and P, since many measures will reduce the load of both nutrients.

Map

The results from the calculations shown under **Results** are also automatically presented graphically on the map to the left, as:

- Country pie charts, placed upon or near the relevant country (for costs and for measures),
- Blue bars located in the various sea basins (for water transparency). The light blue section of the bars represents the improvement, compared to initial conditions.



Country pie charts

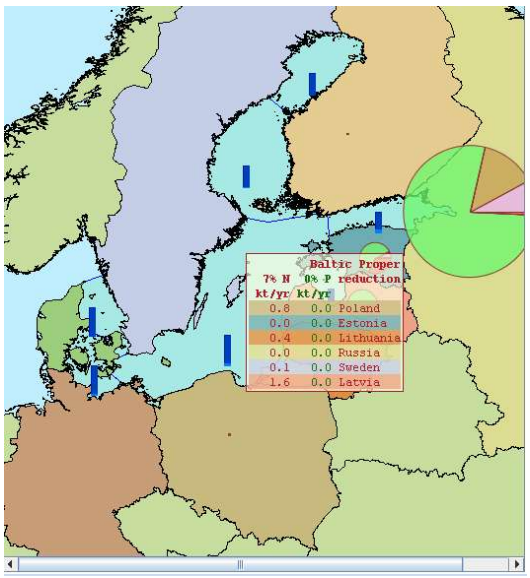
• The size of a pie chart illustrates a share of the total cost (percentage) for each country, whereas each colored segment (piece of the pie) of the chart represents the size of the measures where something needs to be done within a specific sector. If you click on either the pie chart for a country, or on the country itself, a table will appear. This table shows how large the investment in each sector needs to be in that particular country in order to achieve the environmental target set (increased water transparency).

Blue bars

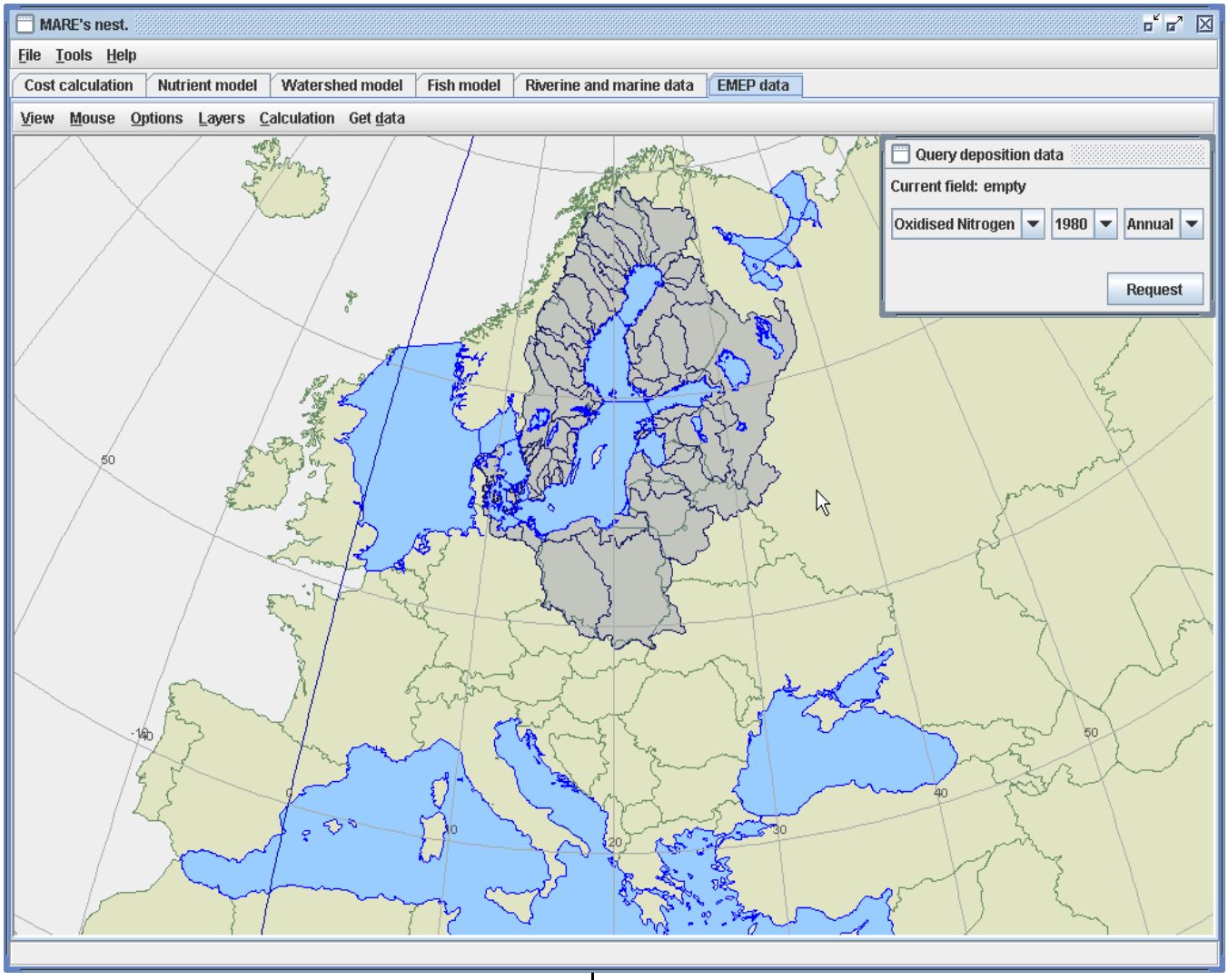
The blue bars found in each sea basin show the water transparency (Secchi depth). The dark blue color indicates the original transparency, before measures were taken, and the light blue color indicates the improvement as a result of the measures taken. The total height of the bar = the new water transparency.

Reduced loads

You can also get additional graphic information in the map by clicking on sea basins. Click on a chosen sea basin. Then, a table will appear, showing the results of the measures taken in terms of reductions of nitrogen and phosphorous for this particular basin. Data is provided in the table on reductions in loads to the particular basin, as percentage of the total reduction to the entire Baltic. The additional table shows the reductions in absolute numbers (kt/yr) from each country bordering the basin.



,



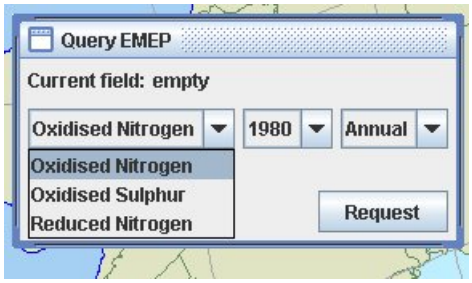
ATMOSPHERIC LOADS ON EUROPE AND THE BALTIC SEA (EMEP data)

This is an interface to the modeled deposition fields, with a 50x50km resolution from the model run by EMEP for Europe. Above the map, you have 6 different options:

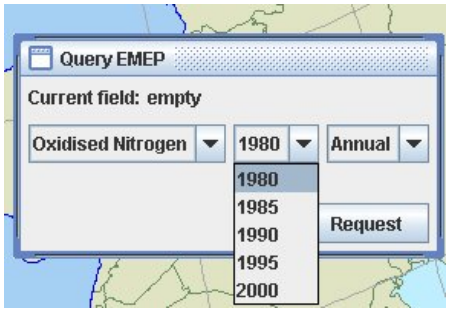
Get data

Here you can select whether you want to query emissions or depositions:

A window will then appear in the lower right corner on the map where you can select a variable

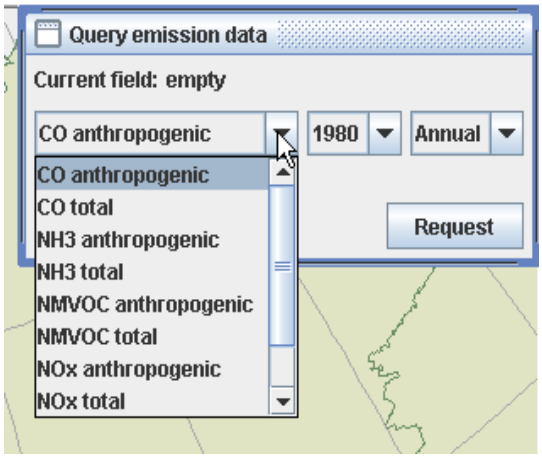


You can then select a particular year



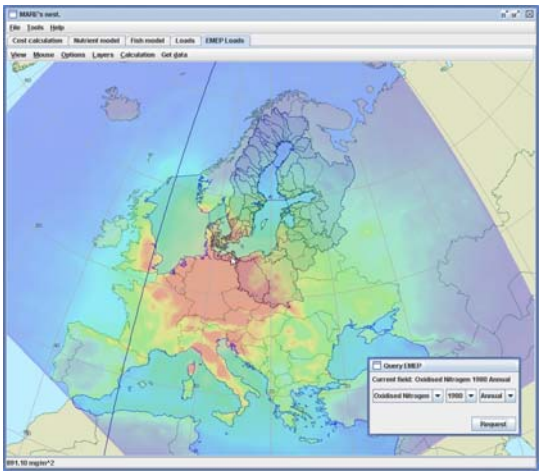
So far, only the estimates of annual loads or emissions are available (monthly values will be added later when EMEP have provided these). When you press **Request**, the data are retrieved from the EMEP Internet site in Oslo.

Is you have selected to look as emissions, a larger number of variables (and more years) are available:



Layers

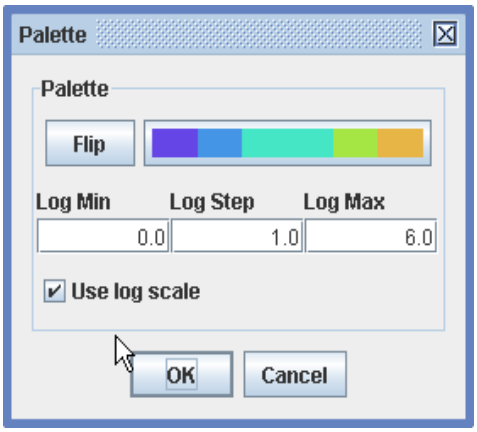
Here you select if you want to see boundaries for all **countries** in Europe, **watersheds** of the Baltic and **seas**. Boundaries for the North Sea and the official (HELCOM) boundaries for Baltic Sea sub-basins are used. The **graticule** option draws latitude and longitudes, 10° apart on the map. If deposition/emissions is selected, concentrations of the selected variable are shown.



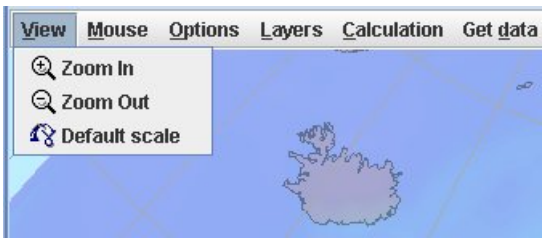
By moving the cursor over the map, the deposition in that particular position is shown in the lower left corner.

Options

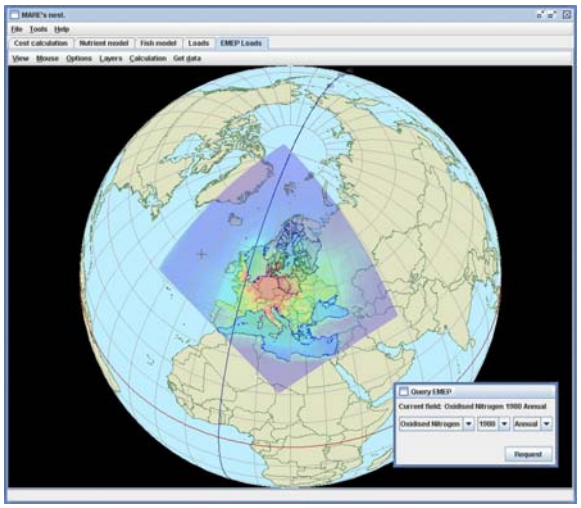
By selecting this, a palette is shown on the map that can be used to change the color scheme of the deposition/emission fields.



View

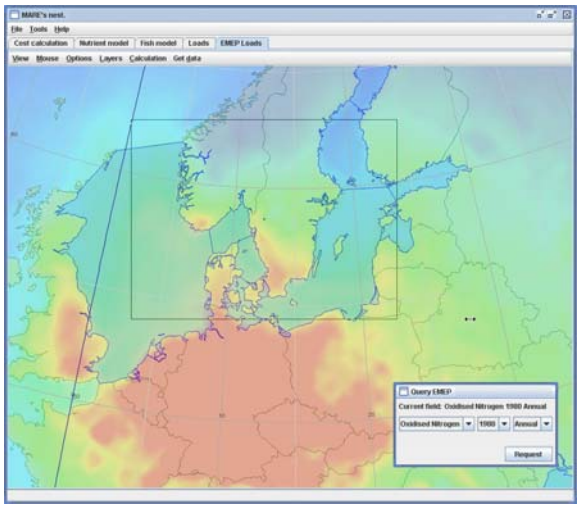


Here you have options for changing the scale on the map by zooming in or out



Mouse

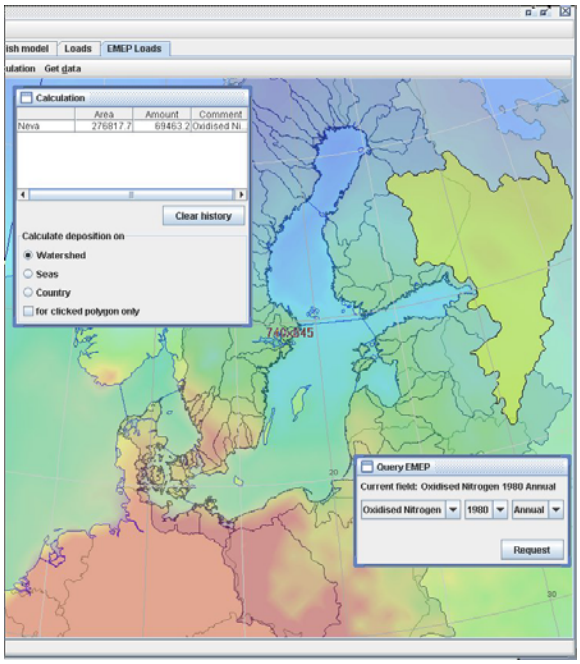
If you select **Navigate** (crosshair) you can choose a specific area in the map.



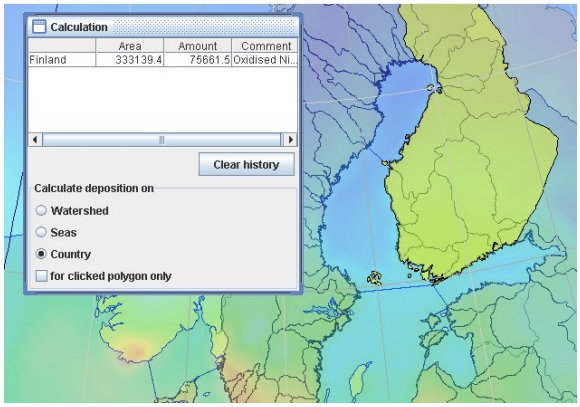
The map is redrawn with this boundary. Remember to reset the cursor to **Gesture** (arrow) if you want to select other options later.

Calculation

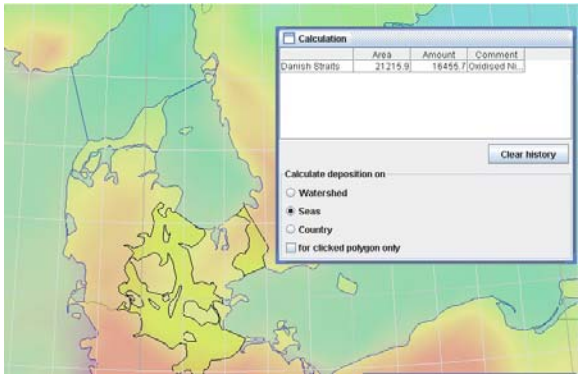
If you select this, another panel opens over the map and you can select to calculated integrated deposition for an entire **Watershed**



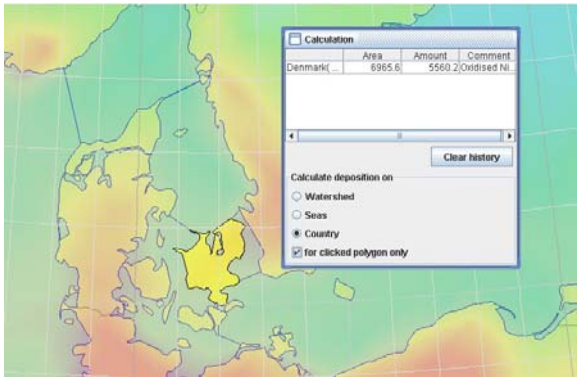
You can also calculate total depositions for a **Country** (any Country in Europe) by selecting it on the map



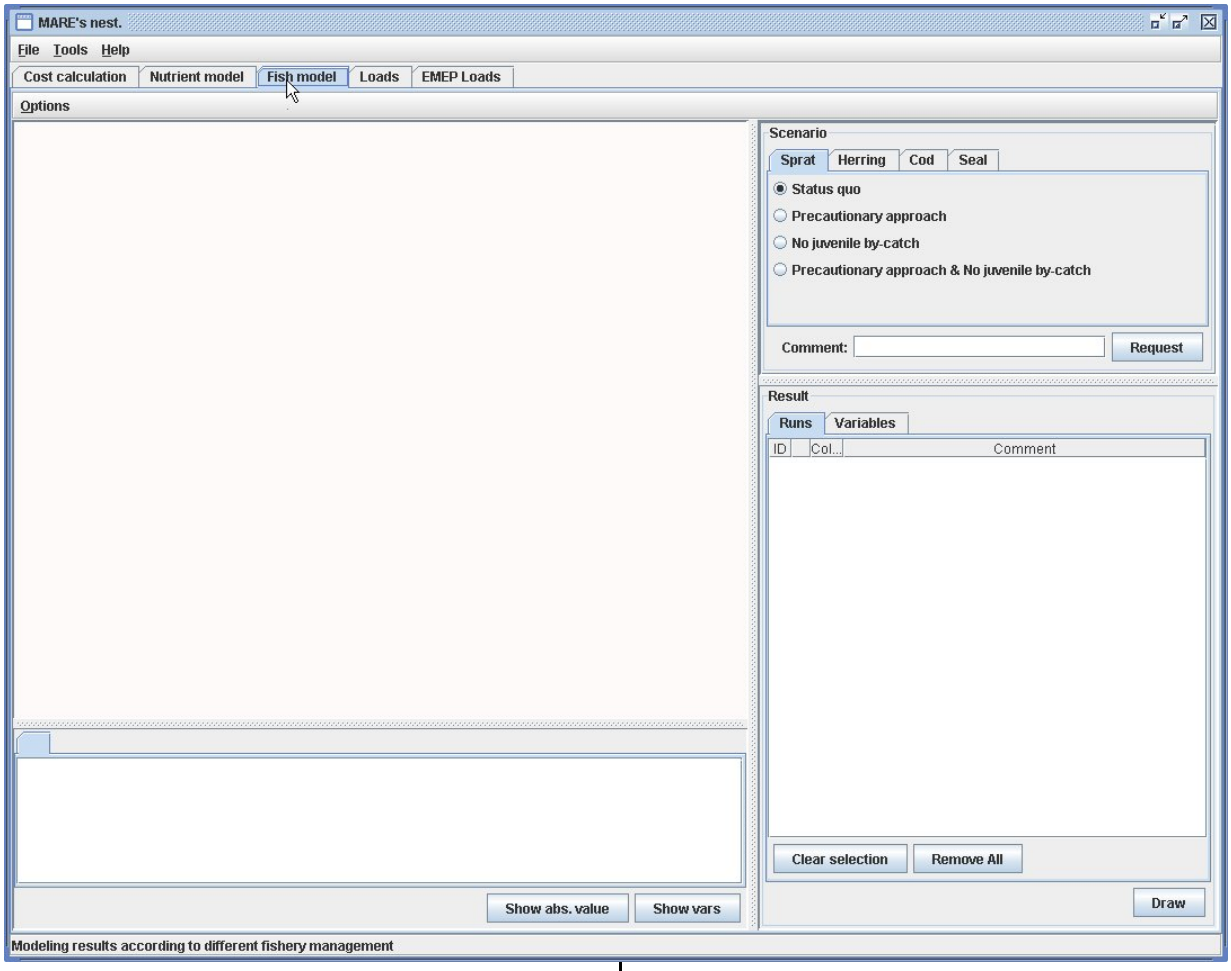
Correspondingly, you can select **Seas** (sub-basin). The table shows the area of the selected region as well as total amounts. Earlier calculations can be deleted by selecting **Clear history**.



You can also select an area, surrounded by a closed **Polygon** (usually an island**)**, within a greater region.



All the data within the tables can be 'cut and pasted' into other applications (right-click on the table). All the panels shown on the map can be moved into other positions, if the default positions are inconvenient.



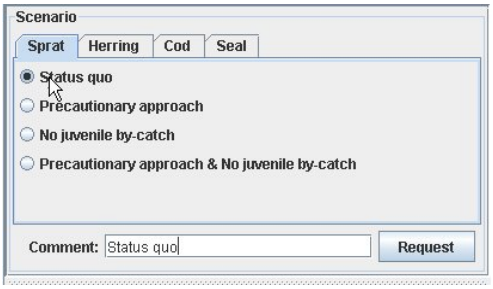
MANAGEMENT OF OPEN SEA FISHERIES (Fish Model)

In this module, you can explore the effect of various alternative fishing strategies for the future stock and yield of the three major species: cod, herring and sprat in the Baltic proper.

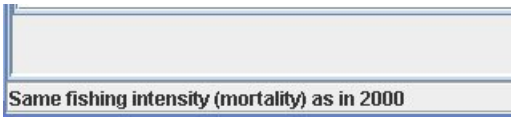
There are four major panels:

Scenario

Here your select fishery management options for sprat, herring, cod and seals



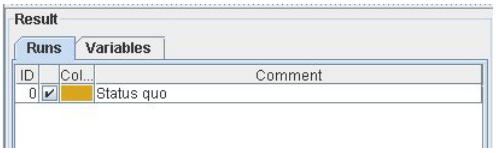
When you move the cursor over the options, an explanation will appear in the lower left corner.



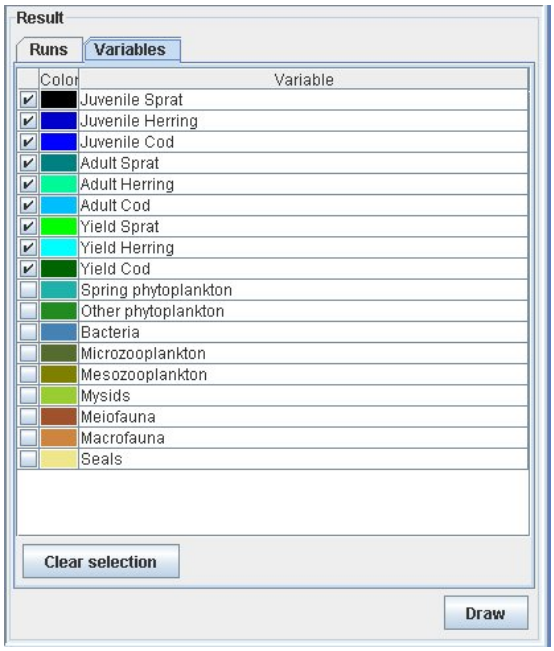
Default is the status quo situation for year 2000 for all stocks and seals.

Results

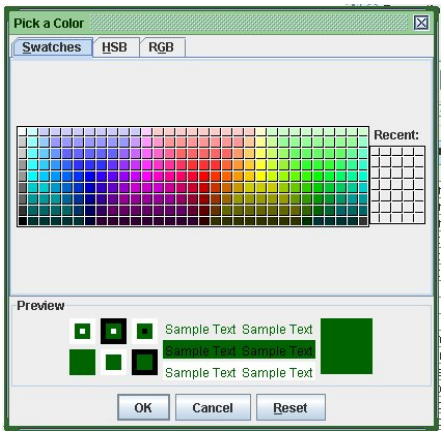
When you press Request, this model run will appear in the Result panel.



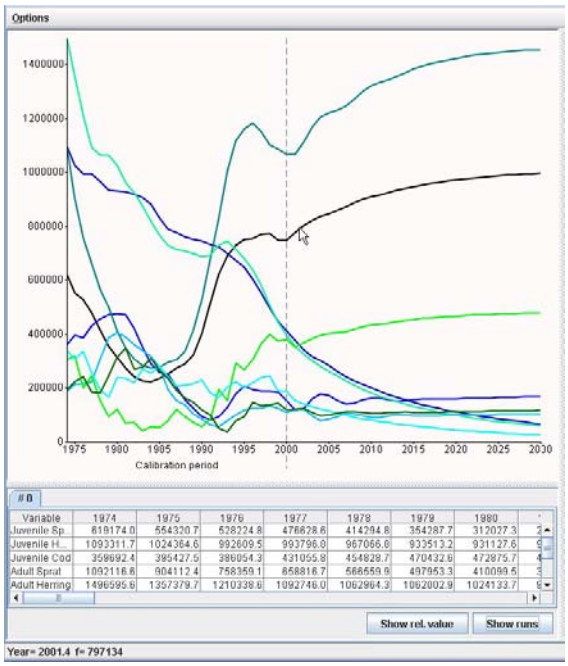
If you select Variables, you can see the default variables. All the variables in the model can be shown by using Expert Mode from the Tool menu in the upper left corner



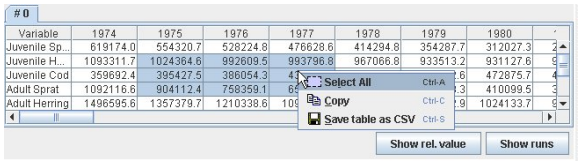
You can Clear selection of all variables and then select (click) on only those variables you want to see when you press Draw. By clicking on a colored box, a panel will appear that allows you to change its colors



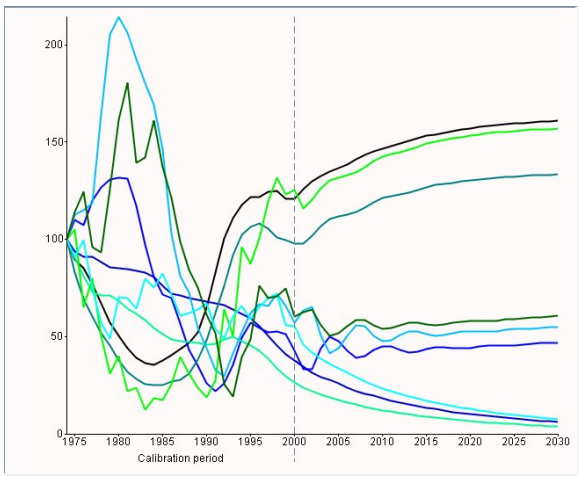
When you select Draw in the Results panel the temporal variations of the variables that you selected will appear in the right panel.



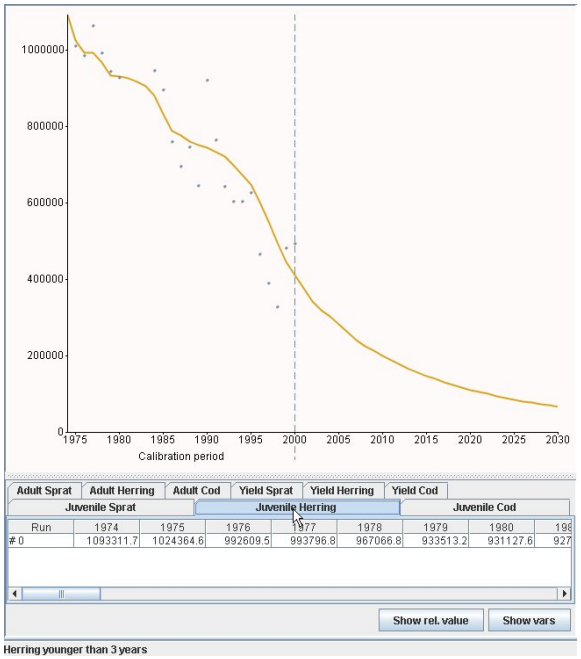
In the lower left corner you will see the values corresponding to the position of the cursor. The actual values for all the variables are shown in the table below. Select and save the whole or a part of the table for use in other programs by 'right-click' on it



If you select Show rel. value, the graph is redrawn using year 1975 as the reference.

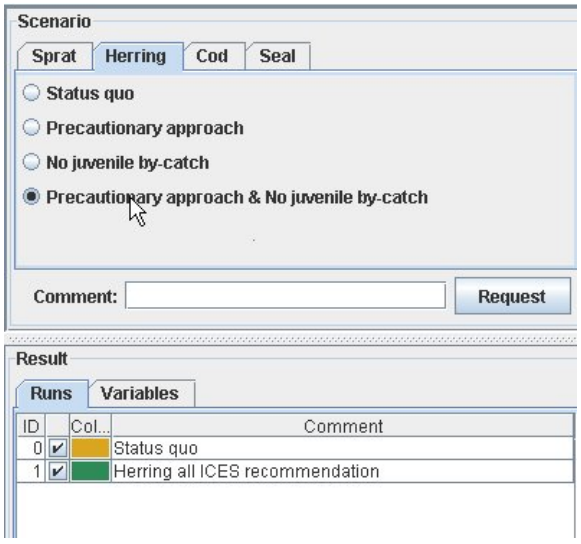


You can inspect individual variables in the model run by selecting Show absolute Value and Show runs, below the graph.

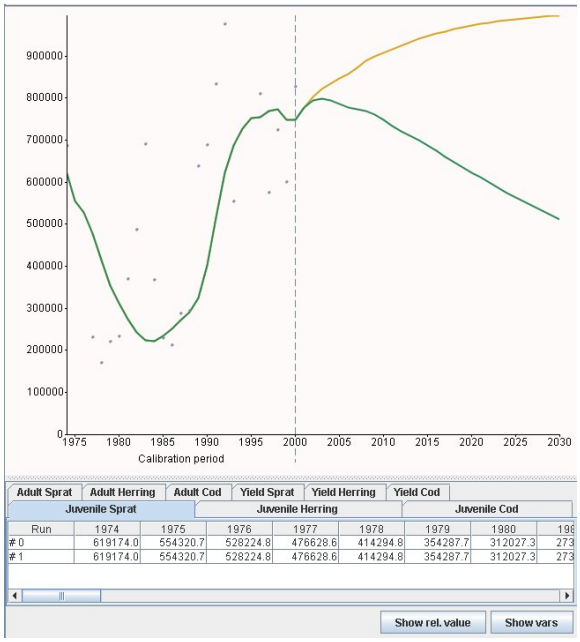


The actual observations, used to calibrate the model, are then show for the period before 2000.

Select another fishery management option in the Scenario panel and the result will be shown by another color in the Result panel

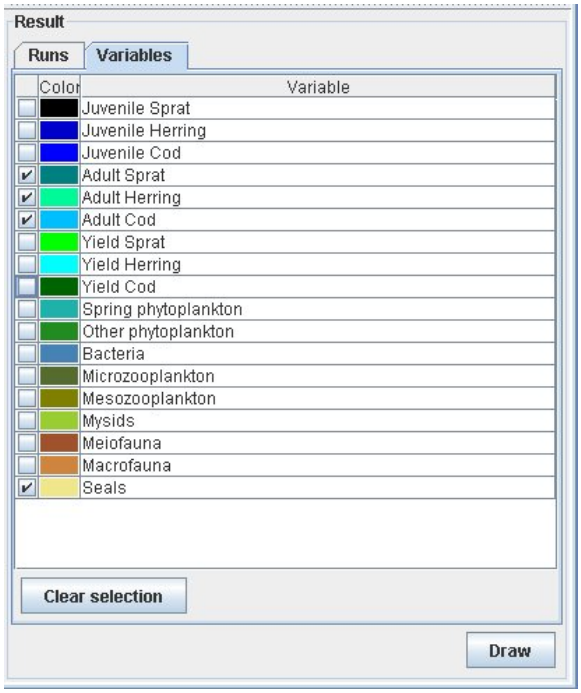


The graph will then show both scenarios in the graph panel:



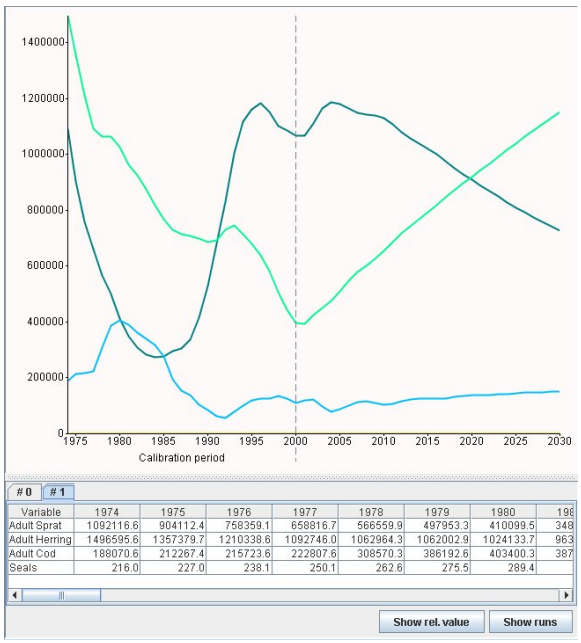
Again, you can select different variables to display by selecting them from the panels below the graph.

You can also go back to the Results panel under Variables in Expert mode and select and additional variables that were not initially included. You can also deselect some of the initial variables, by clicking on the boxes (tick marks).

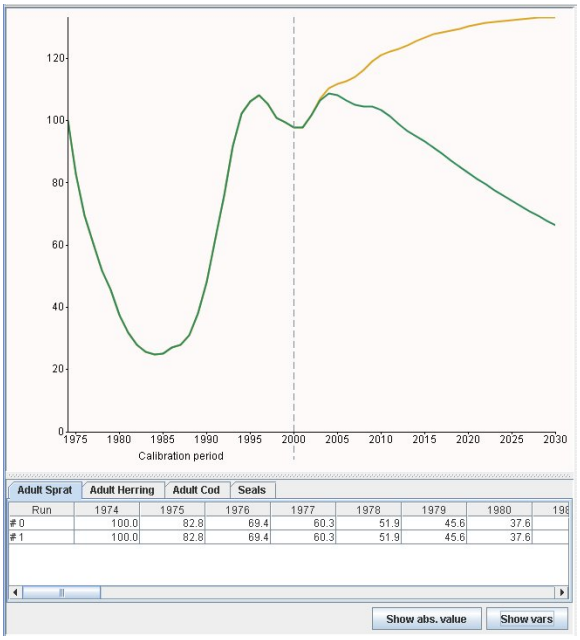


The panels below the graph will then display your new selection of variables.

You can either display all variables for a particular run by selecting the tabs for these below the graph, after selecting Show runs.



Alternatively, you can see all runs for a particular variable by pressing the same (right) button again and it will display Show vars.



In both these modes you can show absolute and relative values for all the variables. You can also go back to the Scenario panel and add more model runs

Feedback from users of the Nest system is essential and very welcome! Please, contact Fredrik Wulff (Fred@ecology.su.se), or Alexander Sokolov (sokolov@ecology.su.se), at the Department of Systems Ecology, Stockholm University.

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