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PRESEMO Windows navigating manual

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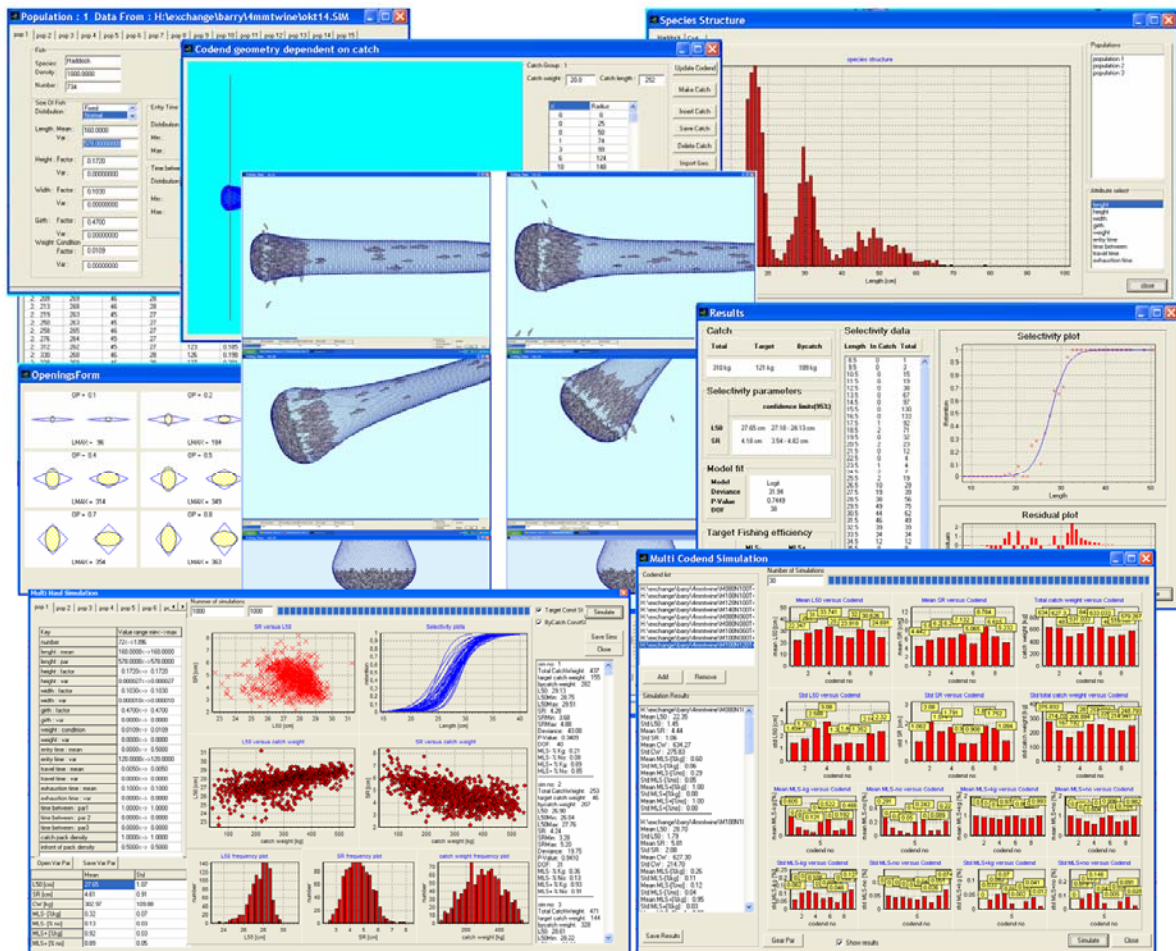
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PRESEMO WINDOWS



NAVIGATING MANUAL

Bent Herrmann 2007

Introduction

This manual gives a short overview of the facilities implemented in the PRESEMO (PREdictive SElective MOdel) cod-end simulator tool. It shows the different windows in the tool and how to navigate between them. It also briefly describes what the different windows can be used to do.

PRESEMO is based on an individual-based structural model of the selection process in the cod-end of a trawl fishing gear. It models different populations of fish entering the cod-end during a tow. Each fish is assigned a weight and a maximum width and height dependent on its length, and is assumed to be of elliptical cross-section. Each is also allocated a travel time down the cod-end, a time it can swim in the cod-end without being exhausted, a time between escape attempts and a packing density for swimming in front of the catch. An escape attempt is deemed successful, if the fish can pass through the mesh opening at the point of the cod-end, where the attempt takes place. The openness of a mesh is a function of the cod-end geometry, calculated external to PRESEMO and imported into PRESEMO. Fish that do not escape fall back and become part of the catch when their exhaustion time is reached. The cod-end shape is continually updated, as the catch builds up during the tow. At the end of a simulation, a logistic function is automatically fitted to the simulated selection data to obtain estimates of the 50% retention length (L_{50}) and selection range (SR). The model is thus based on information about the fundamental mechanical, hydrodynamic and biological processes that govern cod-end selection.

PRESEMO requires information on cod-end design, the fish behaviour, the escape process, the fish population structure, and the fish morphology. It contains a number of facilities to set up and test different ways of modelling and simulating these aspects. Figure 1 to Figure 3 illustrates the main sequence to simulate a fishing process using PRESEMO.

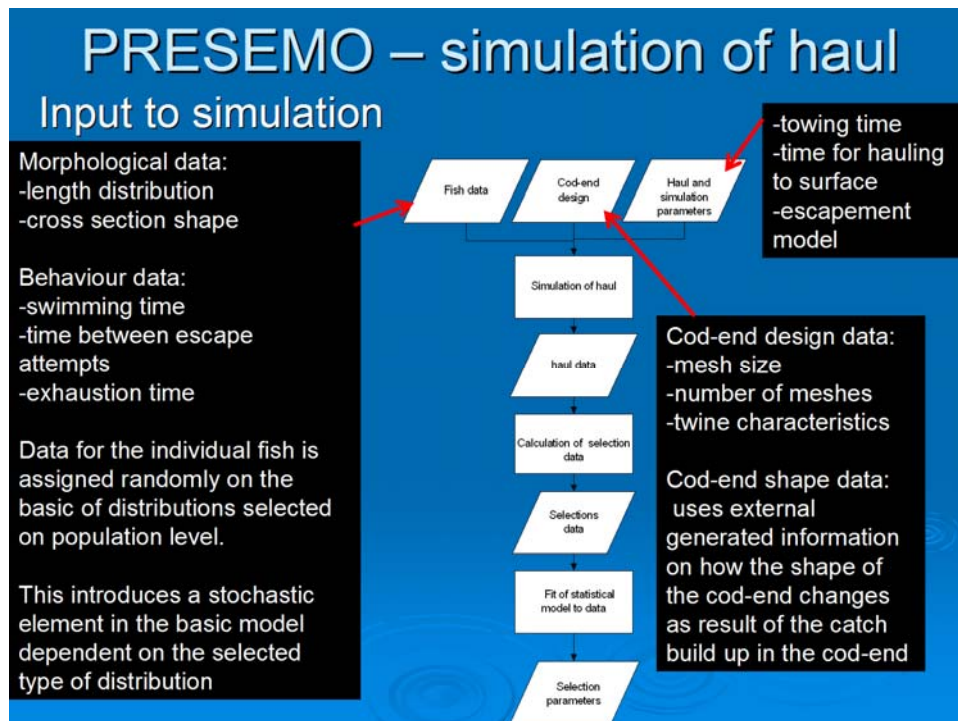


Figure 1: PRESEMO input to simulation.

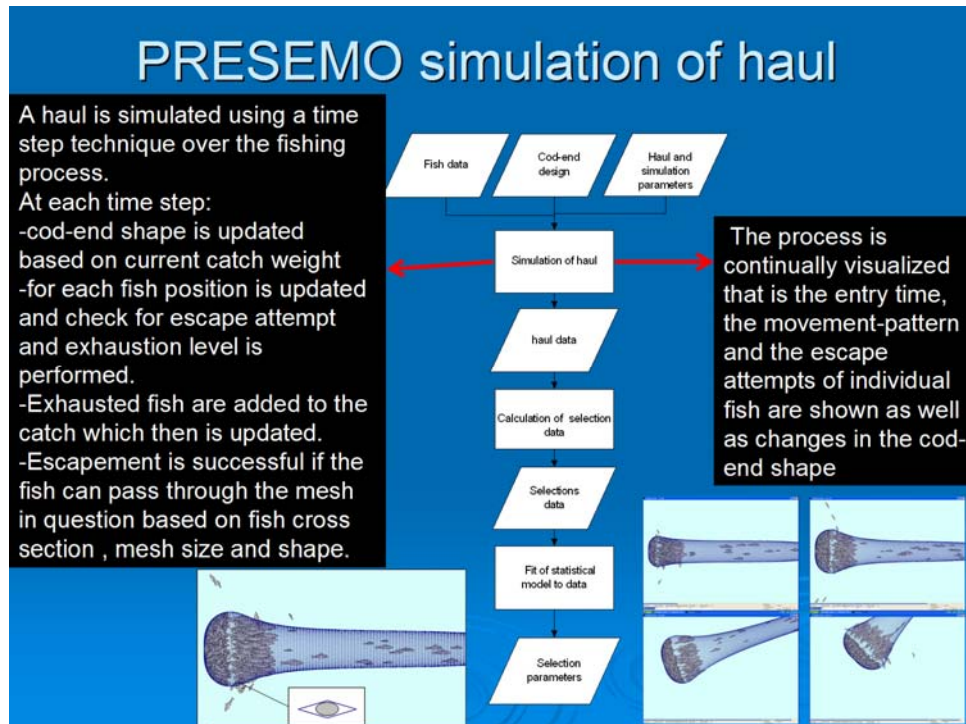


Figure 2: PRESEMO simulation of haul.

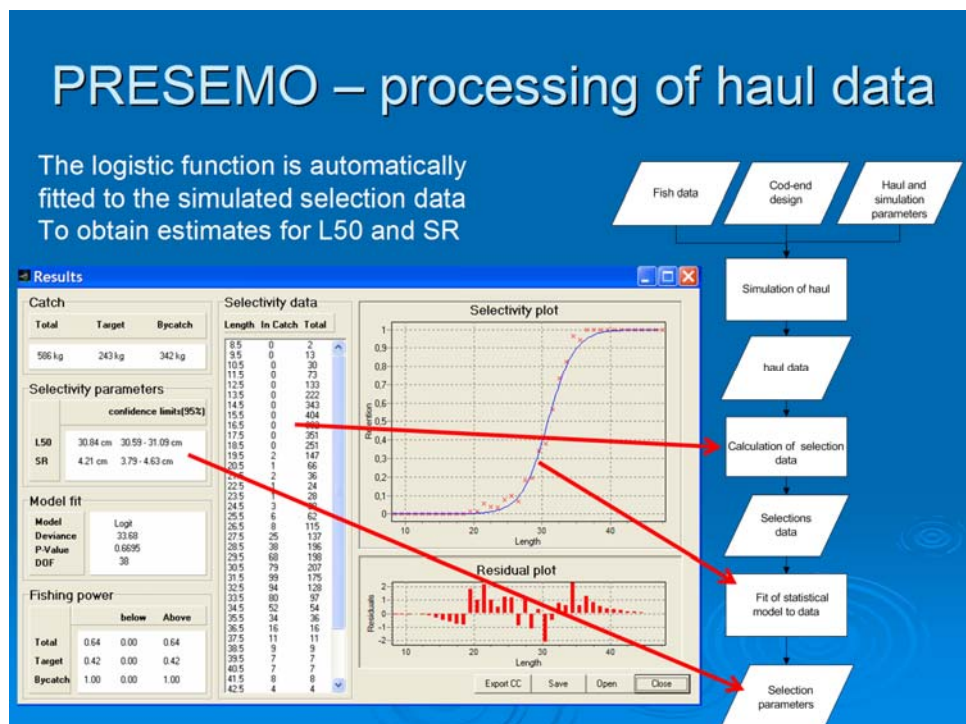


Figure 3: PRESEMO processing of haul data.

PRESEMO contains facilities to model between haul variation, testing different cod-end designs against each other under the same varying fishing conditions and to look into details on individual fish to examine why it got the fate it did in a specific simulated fishing process.

PRESEMO also has a number of facilities to export haul data to be analysed external to PRESEMO.

The model behind PRESEMO is described in detail in the scientific journal Fisheries Research 71 page 1-15 (2005) and a Ph.D. thesis “modelling and simulation of size selectivity in diamond mesh trawl cod-ends” by B. Herrmann (Aalborg University Denmark; 2005; ISBN 87-91200-50-4). How to applied PRESEMO taking into account between haul variation in the selection process is described in Fisheries Research 74 page 243-252. For detailed information on the model and how to use it see these sources.

Implementation of the model into the computer program PRESEMO has been carried out by use of the commercially available programming tool Delphi version 7.0 from Borland Software Corporation. This tool allows users to develop Pascal code programs with a graphical user interface. The compiled code can be run on a Microsoft Windows operating system on a personal computer.

Table 1 contain a list of the different windows in PRESEMO and on which page in this manual they are shown and described.

Window	Page
Main	5
Population	7
Fish Data (single pop.)	13
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Run Mix Set Up	35
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Table 1: Windows in the PRESEMO simulation tool.

Main Window

When starting PRESEMO from Microsoft Windows the PRESEMO Main Window shows up.

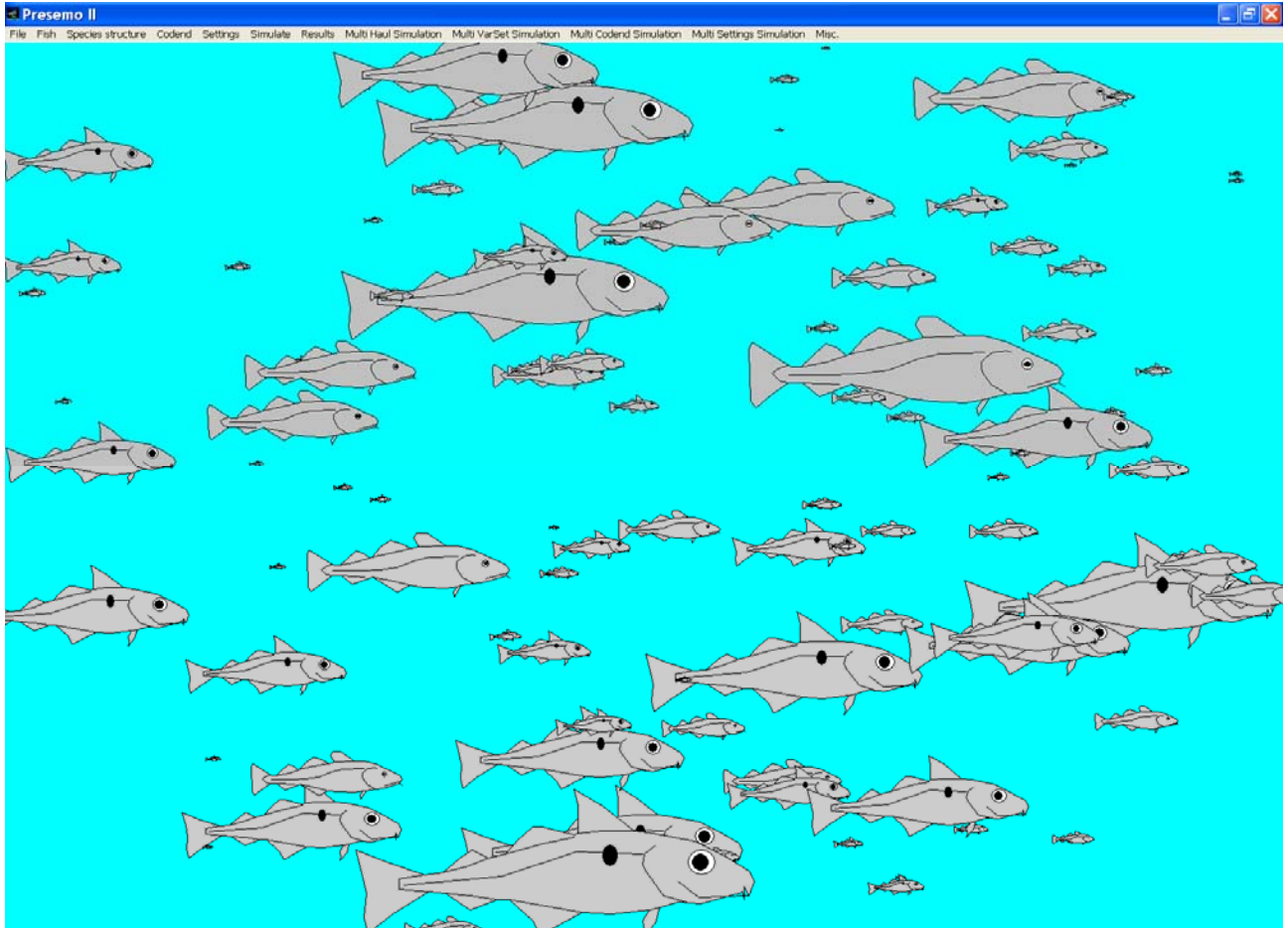


Figure 4: Main Window in PRESEMO.

The user controls what goes on in PRESEMO from this **Main Window**. Use the mouse to activate the different options in the menu bar: File, Fish, Species Structure, Codend, Settings, Simulate, Results, Multi haul Simulation, Multi Varset Simulation, Multi Codend Simulation, Multi Settings Simulation, Misc.

In the most basic use of PRESEMO where the user only wants to simulate a single haul of fishing using a specified population structure of fish, a specified codend and a specified fishing process the user have to follow the sequence of activities described below:

1. Use menu option Fish: to set up the fish data for the fish entering the gear under the fishing process.
2. Use menu option Codend: to define and load the data for the codend used in the fishing process.
3. Use menu option Settings: to set up the fishing process and some of the assumption applied in this.

4. Use menu option Simulate: to start and carry out a single simulated haul using the conditions set up in 1-3 (above). A result window showing the main results from the simulation automatic show up at the end of the simulation.
5. Use menu option Results: to optionally view some details above the results for the last simulated fishing process.

File option in the menu gives a sub-option open simulation file which can be used to automatically load all the fish and settings data from a previous run single haul simulation (the codend data still need to be loaded separately). The way to save data in a simulation file (file with extension SIM) is to use the File sub-option save simulation file.

The sub-option Color in the file gives the option of adjusting the colours used for fish in different states, sea, codend and air.

The Main Window option Species structure enables view the structure of the fish data defined in the option fish.

The Main Window options: Multi haul Simulation, Multi Varsset Simulation, Simulation, Multi Settings Simulation are all advanced options which enables the user to set up to run repeated simulations under varying conditions in an quick and easy way.

The Main Window option Multi Codend Simulation enables the user to setup and run repeated simulations under the same varying conditions for different codend designs. Thus enables a quick and easy way to predict the consequences of making changes to a codend design in a described fishery.

The Main Window option Misc. is used assess very special facilities in the PRESEMO simulation toolbox.

The following sections describe the Main window menu options and sub-options in greater detail.

Population Window

Figure 5: Population Window.

Up to 15 different sub-population of fish (population 1 to 15) can be used to describe the fish that enter the fishing gear during the simulated fishing process in PRESEMO. This should make it possible to simulate the selection process in multi species fisheries and to handle complex length distribution compositions of species. The Population Window for one of these sub-populations is assessed from the Main Window selecting the population number from the sub-options given in the main option Fish.

In the population window a set of parameters have to be inputted to define a population. PRESEMO then generates the data for all the fish in this population that will enter the codend during the tow using stochastic methods. The following parameters need to be specified.

1. Species:

The program uses this to group the different populations together species by species.

2. Density:

The density in kg/m^3 for the species of fish in this population.

3. Number:

Defines the number of fish in this population. Should be a value between 0 and 10.000.

4. Size of Fish Distribution:

Defines the type of distribution that is used to generate the lengths of the individual fish in this population.

The following options are possible:

FIXED : all fish in the population have the same length = Length in mm.

NORMAL : the lengths of the fish in the population are normally distributed with mean length = Mean in mm and variance = Var in mm².

UNIFORM : the lengths of the fish in the population are uniformly distributed between the lengths Min and Max both in mm.

RANDOM : the lengths of the individual fish are randomly selected to a value between Min and Max both in mm.

Height:

The Height of a fish is calculated from its length by:

$$\boxed{Height = Factor * Length}$$

The height to length Factor is dimensionless and values for individual fish are generated by assuming that this Factor is normally distributed about the mean value input with variance Var that is also to be input.

5. Width:

The Width of a fish is calculated from its length by:

$$\boxed{Width = Factor * Length}$$

The width to length Factor is dimensionless and values for individual fish are generated by assuming that this Factor is normally distributed about the mean value input with variance Var that is also to be input.

6. Girth:

This parameter is not used anymore and the value has no effect on the simulations as the girth is approximated based on the fish width and height.

7. Weight:

The Weight of a fish is calculated from its length by:

$$\text{Weight} = \text{ConditionFactor} * \text{Length}^3$$

The Condition Factor has the dimensions g/cm^3 and values for individual fish are generated by assuming that this Factor is normally distributed about the mean value input with variance Var which is also to be input.

8. Entry Time Distribution:

Defines the type of distribution that is used to generate the time when each fish in this population enters the codend during the tow.

All times input should be specified in minutes. PRESEMO actually works in seconds so fish are subsequently allocated entry times in seconds (fractions can be used) but that PRESEMO will subsequently convert these to seconds.

These entry times and all other times that are specified for the fish population should be consistent with the towing time which is input later in the window Settings.

The following options are possible:

- FIXED : all fish in the population enter the codend at the same time = time in minutes.
- NORMAL : the entry times of the fish in this population are normally distributed with mean entry time = Mean in minutes and variance = Var in minutes².
- UNIFORM : the entry times of the fish in this population are uniformly distributed between Min and Max both in minutes. Normally Min would be set to zero and Max to the towing time in minutes.
- RANDOM : the entry times of the fish are randomly selected from values between Min and Max both in minutes. Normally Min would be set to zero and Max to the towing time in minutes.

9. Time to travel down the codend :

Defines the type of distribution that is used to generate the times fish in this population take to travel down the codend to a position just in front of the catch.

The following options are possible at present:

- FIXED : all fish in the population take the same time to travel down the codend to a position just in front of the catch, time = time in minutes.
- NORMAL : the times taken are normally distributed with mean time = Mean in minutes and variance = Var in minutes².

UNIFORM : the times taken are uniformly distributed between Min and Max both in minutes.

RANDOM : the times are randomly selected from values between Min and Max both in minutes.

LINEAR : the time taken is linearly dependent upon the length of the fish:

$$Time = A \bullet Length$$

In this case the parameter B that needs to be specified describes the variance of the normal distribution from which A is selected. The value of A is the mean value of the distribution.

10. Exhaustion Time :

Defines the type of distribution that is used to generate the maximum time periods for fish in this population can swim in the codend and try to escape. Once exhausted they fall back and become part of the catch.

The following options are possible at present:

FIXED : all fish in this population have the same exhaustion time, time = time in minutes.

NORMAL : the exhaustion times of fish in this population are normally distributed with mean exhaustion time = Mean in minutes and variance = Var in minutes².

UNIFORM : the exhaustion times of fish in this population are uniformly distributed between Min and Max both in minutes.

RANDOM : the exhaustion times of fish are randomly selected from values between Min and Max both in minutes.

LINEAR : the exhaustion times of the fish are linearly dependent on their length:

$$Time = A \bullet Length$$

In this case the parameter B that needs to be specified describes the variance of the normal distribution from which A is selected. The value of A is the mean value of the distribution.

11. Time Between Escape Attempts :

Defines which type of distribution is used to generate the times between successive escape attempts (both when travelling down the codend and when in the area in front of the catch) for the fish in this population.

The following options are possible:

FIXED : all fish in the population have the same time between escape attempts, time = time in minutes. The time after entry into the codend for the first escape attempt is a randomly selected value between 1 and the time interval in seconds.

NORMAL : the times between escape attempts are normally distributed with mean time between escape attempts = Mean in minutes and variance = Var in minutes².

UNIFORM : the times between escape attempts are uniformly distributed between Min and Max both in minutes.

RANDOM : the times between escape attempts are randomly selected from values between Min and Max both in minutes.

LINEAR ON : the times between escape attempts for the fish are linearly dependent upon their length:

$$\boxed{Time = A \bullet Length}$$

In this case the parameter B that needs to be specified describes the variance of the normal distribution from which A is selected. The value of A is the mean value of the distribution.

12. Catch Packing Density :

Defines the volume packing density for fish in the catch. This value is used during the simulation to calculate the volume the catch fills in the codend at a given time. It is calculated from:

$$\boxed{CatchVolume = \sum_{FishInCatch} \frac{Fish.Vol_i}{CatchPackingDensity}}$$

Where the sum is over the fish from this population that at the given time have been caught.

Catch Packing Density = 1.0 means that the fish are packed 100 %.

Catch Packing Density = 1.25 means that the fish are squeezed and fill only 80 % of their natural volume.

Catch Packing Density = 0.8 means that the fish are loosely packed and fill 25 % more than their own volume.

The volume of fish number i is calculated from:

$$Fish.Vol_i = \frac{Fish.Weight_i}{Density}$$

13. Fish Packing Density in Front of the Catch :

Defines the volume-packing density for fish that have travelled down the codend to reach the catch but are not yet exhausted and are keeping station and making escape attempts from positions just in front of the catch. It is used during the simulation to calculate the volume occupied by the fish that are in a position just in front of the catch at a given time.

This is calculated using:

$$VolumeOccupiedByFishInFrontOfCatch = \sum_{FishInFrontOfCatch} \frac{Fish.Vol_i}{InfrontOfPackingDensity}$$

A **low** value of the fish packing density means that the fish occupy a large volume and are **less** tightly packed.

There are several buttons in the **Population Window** that can be activated using the mouse. These are described below.

When the data describing the population have been defined they are used to generate the properties of the individual fish in this population. To do this activate the button **Make Data**. On completion a new window called **Fish Window** is automatically called up. **Fish Window** shows the data for the individual fish in the population.

By use of the button **Copy Pop. To** it is possible to copy data from the active population to a different one.

The button **Delete** will delete the properties of the individual fish in the active population.

Distribution data for the properties of the fish in the population can be shown by use of the button **Show Distr**. This automatically calls up a new window **Species Structure**. Again there is the precondition that the button **Make Data** has been activated prior to this.

It is possible by activating the button **Open Pop. File** to read in data for defining the active population data from an existing file.

It is possible to save the data defining a population in a file. Activating the button **Save Pop File** does this. This calls up a window where the user has to input a name for the file and where to save the data.

Fish Data Window for single population

fish no	length	height	width	airt	weight	entry time	travel time	exhaustion time	time between	fate	time fate	initial att.	main att.	time last att.
1	176	30	18	83	0.060	3396	53	1057	374	INSEA	-1	0	0	3396
2	147	25	15	69	0.035	4481	44	882	159	INSEA	-1	0	0	4481
3	173	30	18	81	0.057	2014	52	1040	590	INSEA	-1	0	0	2014
4	135	23	14	63	0.027	6280	40	807	370	INSEA	-1	0	0	6280
5	158	27	16	74	0.043	3894	47	948	552	INSEA	-1	0	0	3894
6	197	34	20	93	0.083	3951	59	1181	461	INSEA	-1	0	0	3951
7	158	27	16	74	0.043	6038	48	950	216	INSEA	-1	0	0	6038
8	161	28	17	76	0.045	2972	48	965	278	INSEA	-1	0	0	2972
9	135	23	14	63	0.027	3860	40	808	254	INSEA	-1	0	0	3860
10	197	34	20	93	0.084	5724	59	1185	334	INSEA	-1	0	0	5724
11	162	28	17	76	0.046	3292	49	971	503	INSEA	-1	0	0	3292
12	148	26	15	70	0.036	4555	44	890	84	INSEA	-1	0	0	4555
13	115	20	12	54	0.016	1600	34	688	481	INSEA	-1	0	0	1600
14	181	31	19	85	0.064	6629	54	1085	226	INSEA	-1	0	0	6629
15	159	27	16	75	0.044	2620	48	956	209	INSEA	-1	0	0	2620
16	199	34	20	93	0.086	4148	60	1193	350	INSEA	-1	0	0	4148
17	157	27	16	74	0.043	593	47	944	551	INSEA	-1	0	0	593
18	135	23	14	63	0.027	2785	41	810	185	INSEA	-1	0	0	2785
19	124	21	13	58	0.021	6306	37	744	554	INSEA	-1	0	0	6306
20	149	26	15	70	0.036	4613	45	896	564	INSEA	-1	0	0	4613
21	180	31	19	85	0.064	6566	54	1081	336	INSEA	-1	0	0	6566
22	141	24	14	66	0.030	7186	42	844	219	INSEA	-1	0	0	7186
23	149	26	15	70	0.036	5753	45	883	344	INSEA	-1	0	0	5753
24	159	27	16	75	0.044	3721	48	956	361	INSEA	-1	0	0	3721
25	168	29	17	79	0.052	1956	51	1010	496	INSEA	-1	0	0	1956
26	134	23	14	63	0.026	1849	40	805	348	INSEA	-1	0	0	1849
27	158	27	16	74	0.043	2769	47	946	405	INSEA	-1	0	0	2769
28	195	34	20	92	0.081	6514	59	1171	324	INSEA	-1	0	0	6514
29	173	30	18	81	0.056	3387	52	1038	165	INSEA	-1	0	0	3387
30	166	29	17	78	0.050	1260	50	996	324	INSEA	-1	0	0	1260
31	162	28	17	76	0.046	4137	49	971	381	INSEA	-1	0	0	4137
32	135	23	14	63	0.027	4914	40	808	271	INSEA	-1	0	0	4914
33	163	28	17	77	0.047	4707	49	979	301	INSEA	-1	0	0	4707
34	172	30	18	81	0.055	2448	51	1030	182	INSEA	-1	0	0	2448
35	139	24	14	65	0.029	3763	42	836	246	INSEA	-1	0	0	3763
36	162	28	17	76	0.046	3209	49	971	544	INSEA	-1	0	0	3209
37	151	26	16	71	0.037	4558	45	904	566	INSEA	-1	0	0	4558
38	135	23	14	63	0.027	2043	40	809	232	INSEA	-1	0	0	2043
39	146	25	15	69	0.034	4483	44	877	95	INSEA	-1	0	0	4483
40	136	23	14	64	0.027	4254	41	814	152	INSEA	-1	0	0	4254
41	156	27	16	73	0.041	1940	47	935	370	INSEA	-1	0	0	1940

Figure 6: Fish Data Window for single population.

Assess through the Population window by pressing the button Show Fish or from the main window by selecting menu option Results and then sub-option Show Fish Data.

The Fish Data Window shows the values of the attributes used to describe the state of each fish in the PRESEMO model. For this type of assess the information is given on population basis. Select a specific population by selection pop1 to pop15 in the top of the window.

Fish Distribution Window for single population

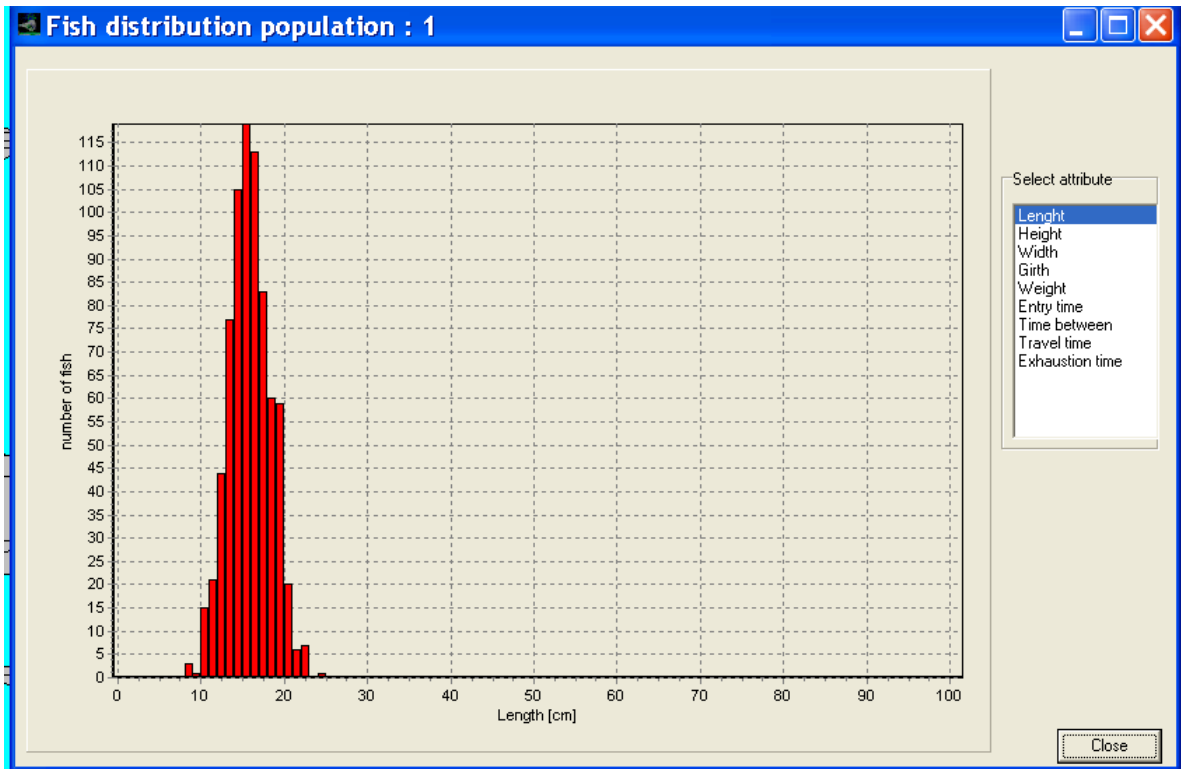


Figure 7: Fish Distribution Window for single population.

Assess through the Population window by pressing the button Show Distr.

The Fish Distribution Window shows the distribution for the selected attribute used to describe the state of each fish in the PRESEMO model. For this type of assess the information is given on population basis.

Select a specific attribute to show the distribution for by selecting it in the list in right side of the window.

Species structure Window

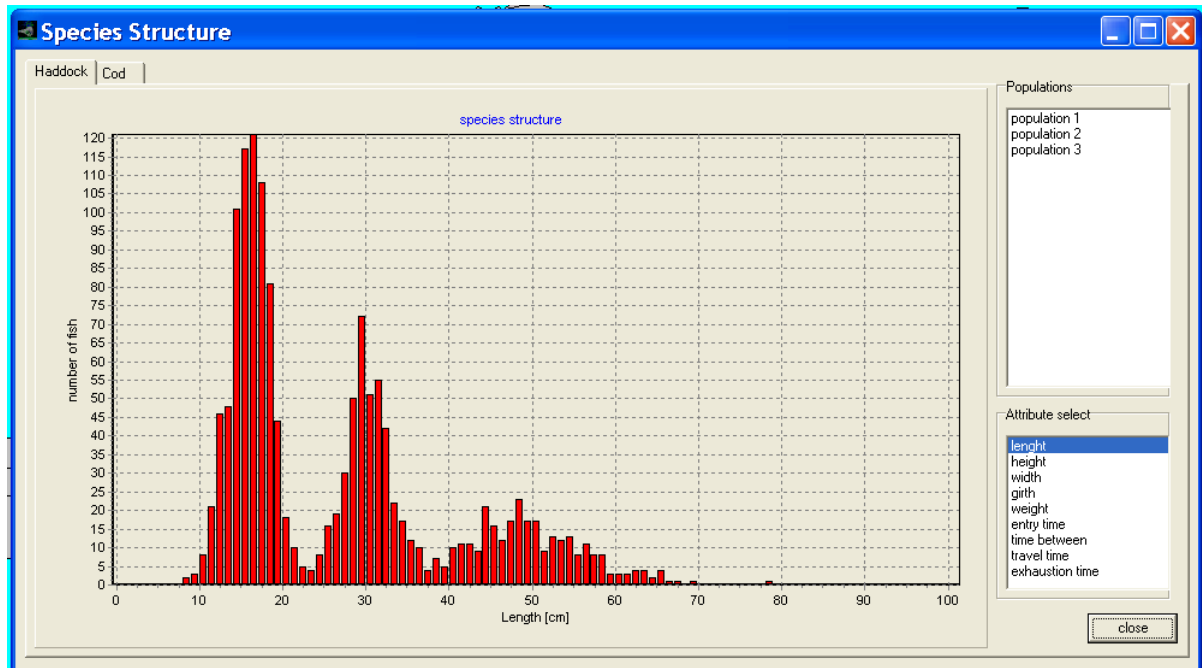


Figure 8: Species Structure Window.

Assess the species structure Window from the main window by selecting menu option Species Structure.

The Species Structure Window shows the distribution for the selected attribute used to describe the state of each fish in the PRESEMO model. The information is given on species basis.

A specific species is selected at the top of the Window. Then the list top-right in the window shows which populations are used to describe the selected species.

Select a specific attribute to show the distribution for by selecting it in the list in right side of the window.

Codend Window

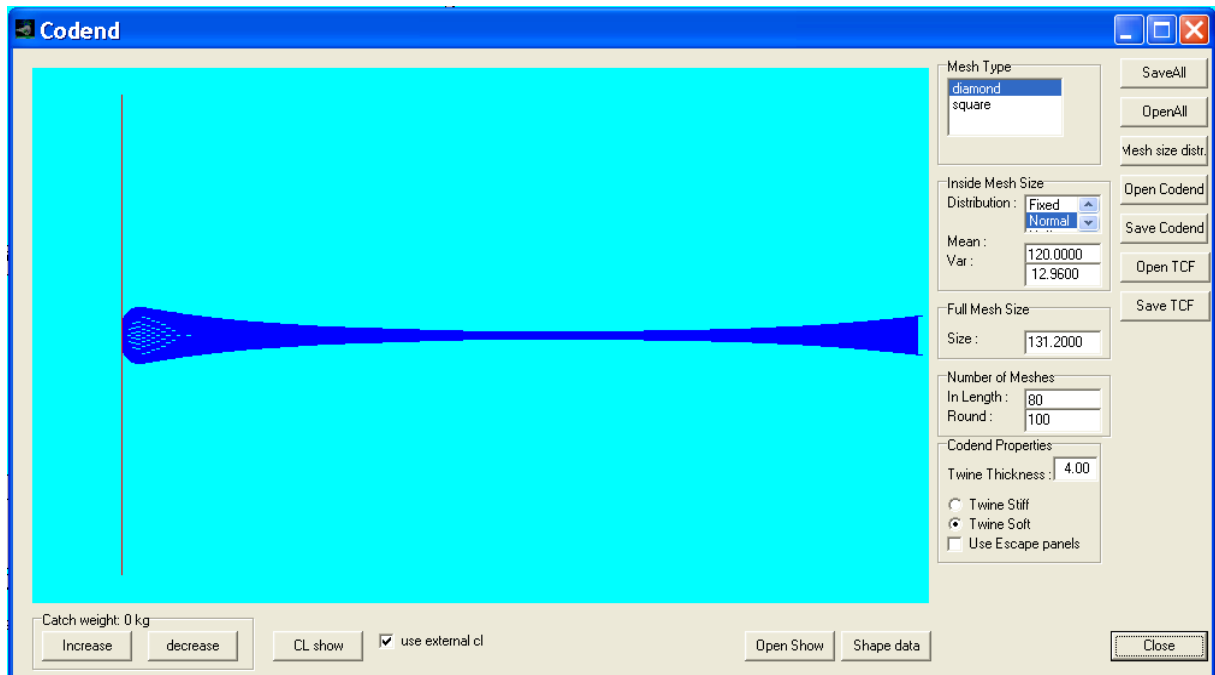


Figure 9: Codend Window.

Assess the Codend Window from the main window by selecting menu option Codend. The Codend Window is used to define and load data for the codend that is used in the simulated fishing process.

The Codend is described by the following properties that have to be specified:

- 1. Mesh Type:**

Defines which type of mesh is used in the codend. Only Diamond can be selected in this version of PRESEMO.

- 2. Twine Thickness:**

The twine thickness in mm. This is not used in PRESEMO directly but is used in the external program generating Codend geometry.

- 3. Twine Properties:**

This option is no longer used. It has been replaced by more advanced options in the Settings Window.

- 4. Use Escape Panel:**

This option is not implemented in the current version of PRESEMO.

- 5. Inside Mesh Size Distribution :**

Defines the type of distribution that is used to generate the inside mesh size of the individual meshes in the codend. Mean mesh size is assumed to be the same for each row of meshes.

The options are:

- FIXED** : all meshes have the same inside mesh size = Size in mm.
- NORMAL** : the inside mesh sizes of the meshes in a row are normally distributed with mean mesh size = Mean in mm and variance = Var in mm².
- UNIFORM** : the inside mesh sizes of the meshes in a row are uniformly distributed between the sizes Min and Max both in mm.
- RANDOM** : the inside mesh sizes of the meshes in a row are selected randomly from sizes between Min and Max both in mm.

6. Full Mesh Size

The mean full stretched mesh size in mm.

It is the inside mesh size (often referred to as the mesh opening) as measured by fishery inspection officers that governs whether meshes are large enough for fish to escape. The full mesh size (= inside mesh size + size of a knot) is the measurement that governs codend geometry. The difference between these two measurements can be quite large particularly for double twines where the knot size can be up to 15% of the inside mesh size. Full mesh size is traditionally measured by netting manufacturers by measuring down the length of a sheet of netting with the meshes fully closed. In fact it should be measured diagonally along a series of bars of the netting which gives mesh sizes up to 3% higher.

7. Number of Meshes In Length :

Defines the number of meshes in length of the codend. Codend lengths of up to 500 meshes are allowed. The length can be an exact number of meshes or include a half mesh.

8. Number of Open Meshes Round :

Defines the number of open meshes round the codend. Up to 500 meshes is allowed. The closed meshes in the selvages are excluded.

By using the buttons **Open TCF** and **Save TCF** it is possible to read codend data from files or save them to files.

By using the button shape data the Codend Geometry Window is shown.

By using the button open show the Openings Window is shown.

By using the button CL show the Escape possibility at catch edge Window is shown.

Use the **Close** button to return to the *Main Window* on completion of specifying the codend.

Codend Geometry Window

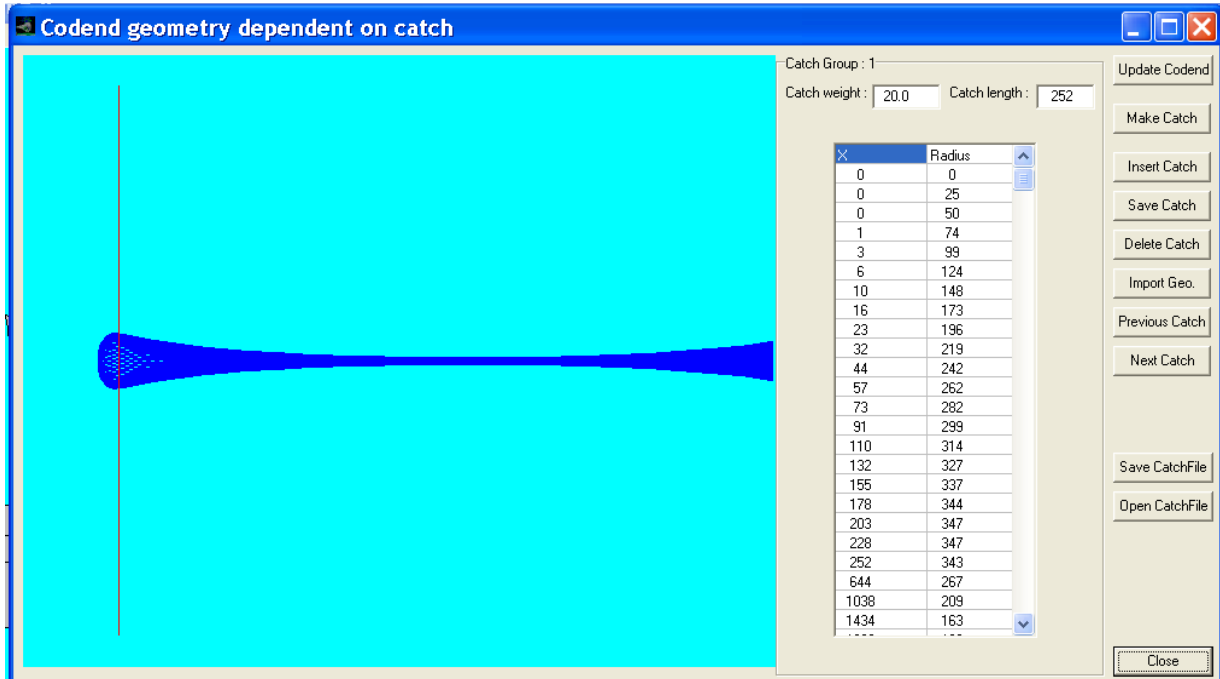


Figure 10: Codend Geometry Window.

Assess from Codend Window by using the button shape data.

The Codend Geometry Window shows for different catch weight the catch length (red line through codend) and values for the codend radius (r) along the axis (x) starting from the codeline ($x = 0$). Data is given mm.

Use button Next Catch to show data for the next catch weight.

Use button Previous Catch to show data for the previous catch weight.

Openings Window

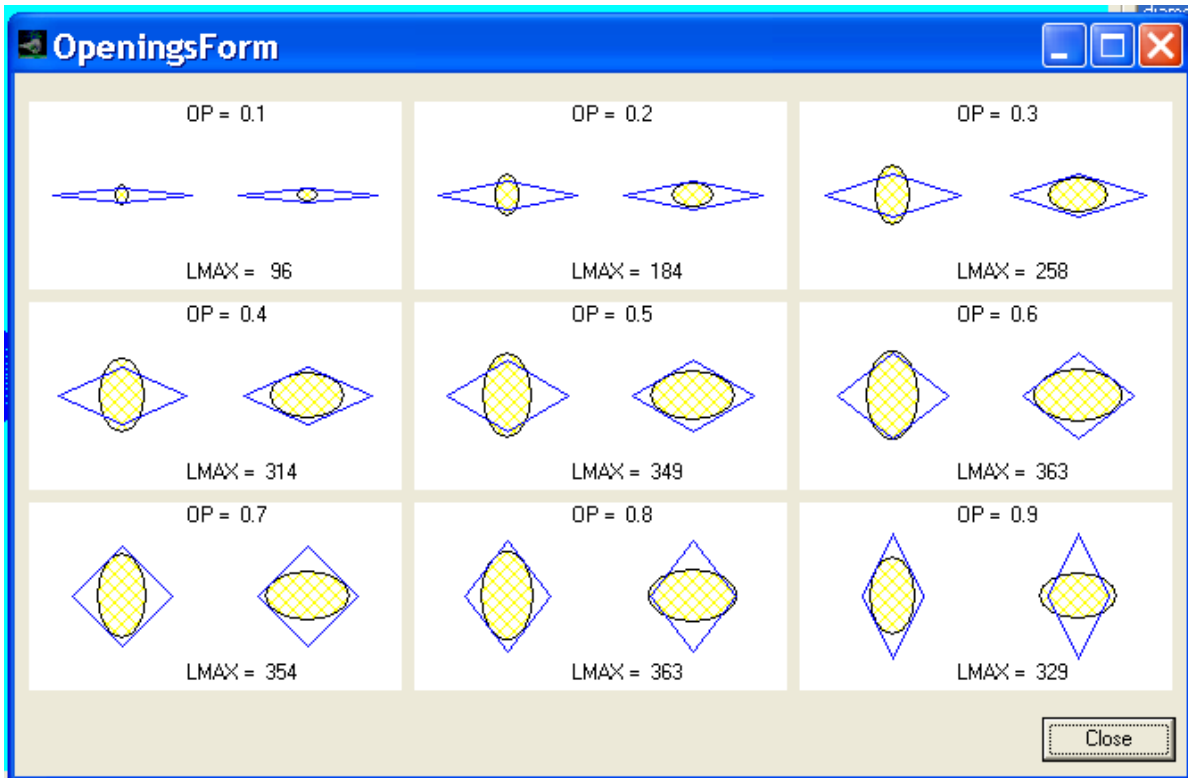


Figure 11: Openings Window.

Assess from Codend Window by using the button open show.

For a stiff diamond shaped mesh the maximum length of a fish that can pass through the mesh depends on the mesh size, the openness of the mesh (OP) and the cross section size and shape of the fish. In PRESEMO the cross section shape of the fish is described by an ellipse and is correlated to the length of the fish through two parameters describing the height to length ratio and the width to length ratio. These two parameters then describe the shape of the cross section. The maximum length of a fish having a given cross section shape that can pass through a given mesh is called the maximum escapement length l_{max} . For the same species and same mesh size l_{max} will have different values for different degree of mesh openness. To enable a quick and first view on the selective properties of a given mesh size for a specified species this facility enabling viewing l_{max} versus op.

Maximum escapement length l_{max} in mm for different degrees of mesh openness OP. Showing mesh shape and the cross section of the biggest fish that can pass through. Left picture in the pair show fish op-right while the left shows where the fish is turned 90° in order to pass through.

Escape possibility at catch edge Window

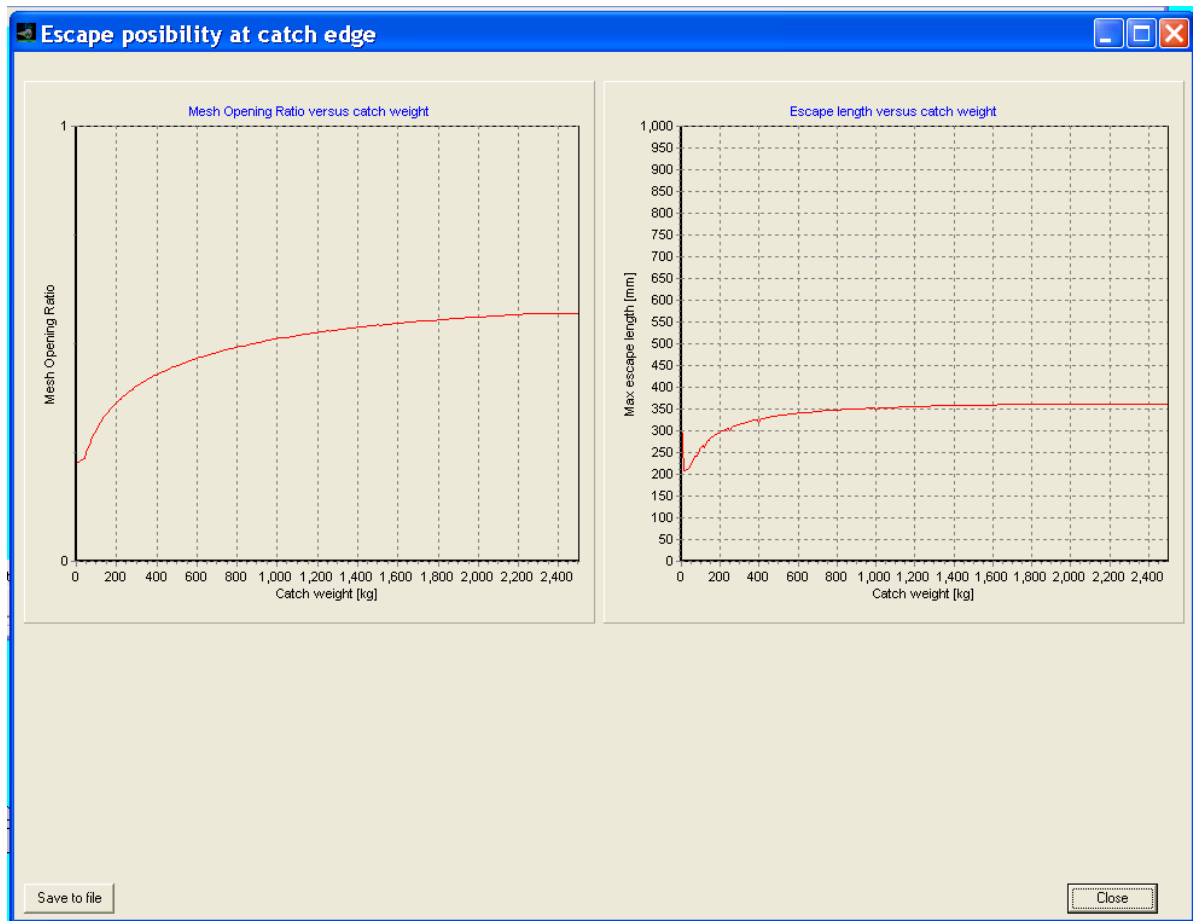


Figure 12: Escape Possibility at catch edge Window.

Assess from Codend Window by using the button CL show.

Knowing that most escapes from diamond mesh cod-ends happens from a few rows of meshes just ahead of the catch (CL from the codline) a facility was implemented showing how the mesh openness OP at the catch edge in the cod-end depends on the total amount of catch. Then based on the concept of maximum escapement length also how l_{max} at the catch edge depends on total amount of catch in the cod-end is shown. l_{max} in this window is calculated on the basis of the selected escapement model in the Settings Window. Thus also take into account if mesh distortion is allowed to take place.

By using the button Save to File the information showed in the window can be exported.

Settings Window

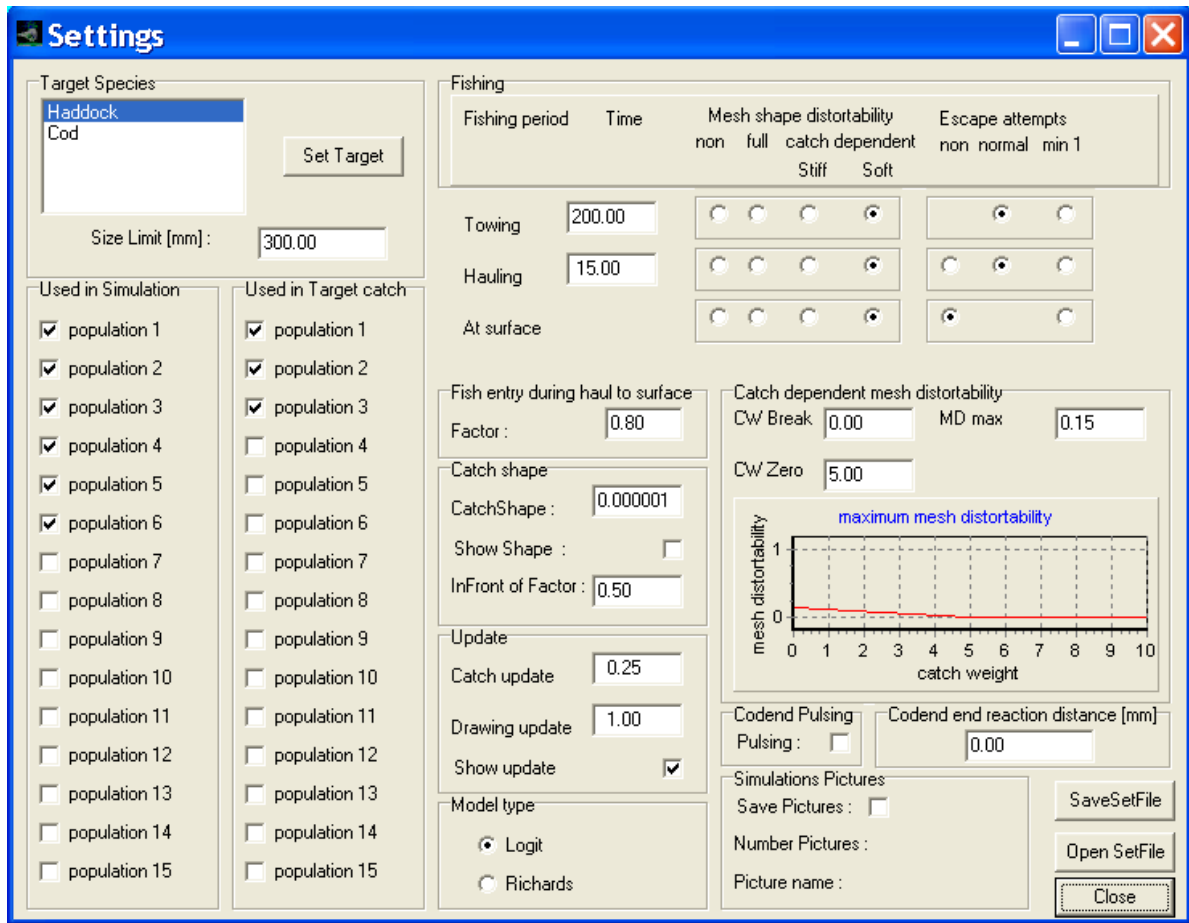


Figure 13: Settings Window.

Assess the Settings Window from the main window by selecting menu option Settings. The Settings Window is used to specify towing time and hauling time in the simulated fishing process. Several options are given for modelling fish escapement in the beginning of towing, during towing, during hauling to the surface and at the surface. The different escapement models are documented in a Ph. D. work on PRESEMO (ISBN 87-91200-50-4, paper 4). Four different classes of models are implemented:

- Basic model. No distortion of meshes for fish trying to escape thus mesh size and shape compared to fish shape is determining success of an attempt.
- Full distortion. Fish able to distort the mesh shape 100% thus mesh size compared to fish circumference is alone determining success of an attempt.
- Stiff distortion. Fish able to change the mesh opening ratio to a given degree but the diamond shape of the mesh is conserved.
- Soft distortion. Fish able to change the mesh opening ratio to a given degree and the mesh takes partly shape after the fish circumference.

Figure 14 shows escape attempt and mesh shape and shows examples of mesh shape for the different escapement models.

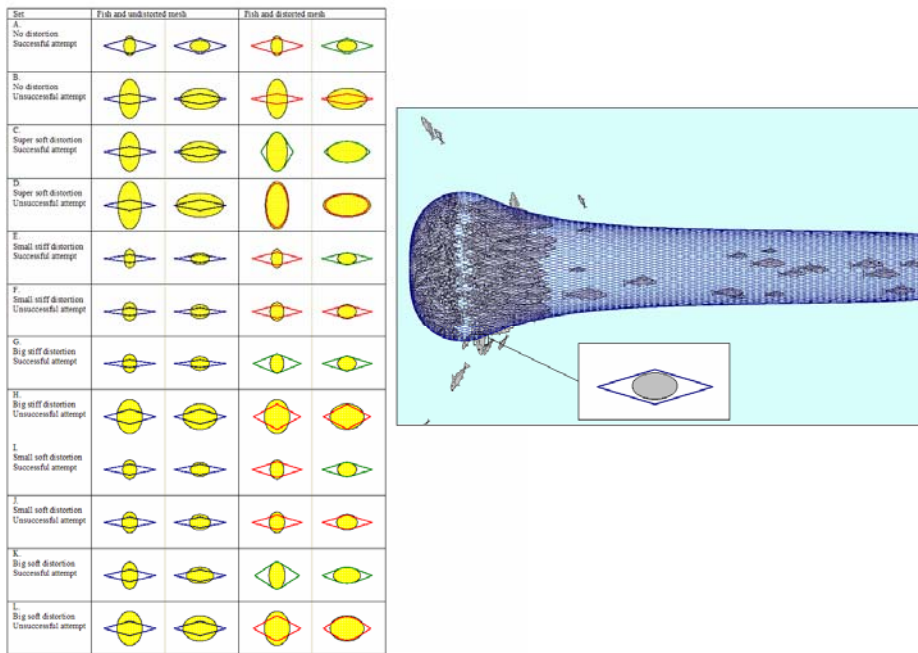


Figure 14: Mesh escape geometries for different escape models.

In the PRESEMO model fish escape attempting take place when fish travel down the cod-end towards the catch or when swimming just in front of the catch. In the previous version of PRESEMO the precise position for an attempt for a swimming fish just in front of the catch was assumed to be random within the section of the cod-end occupied of fish swimming in front of the catch. A more flexible facility is now implemented by a parameter L_x (= infront factor). The following facilities are given:

- $L_x = 1.0$: attempt random within the zone occupied of fish swimming in front of catch
- $L_x = 0.0$: attempt always just in front of catch
- $0.0 < L_x < 1.0$: attempt random in zone from just in front of catch to $L_x * \text{Infront_length}$ (zone occupied by fish in front of catch).

Figure 15 shows the different zones.

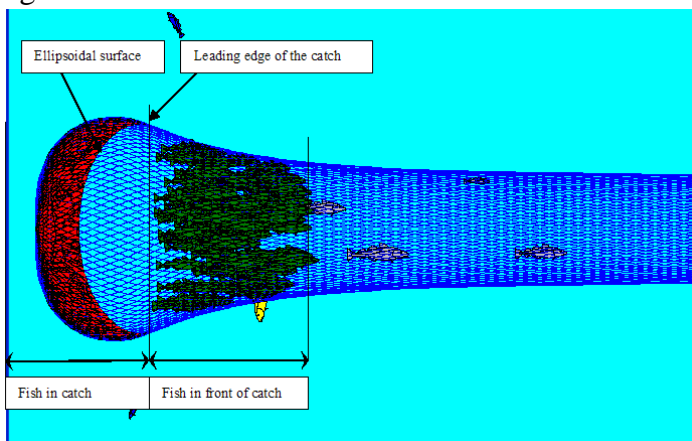


Figure 15: Shows different zones. Fish in front of catch length = L_x .

Fishing Window

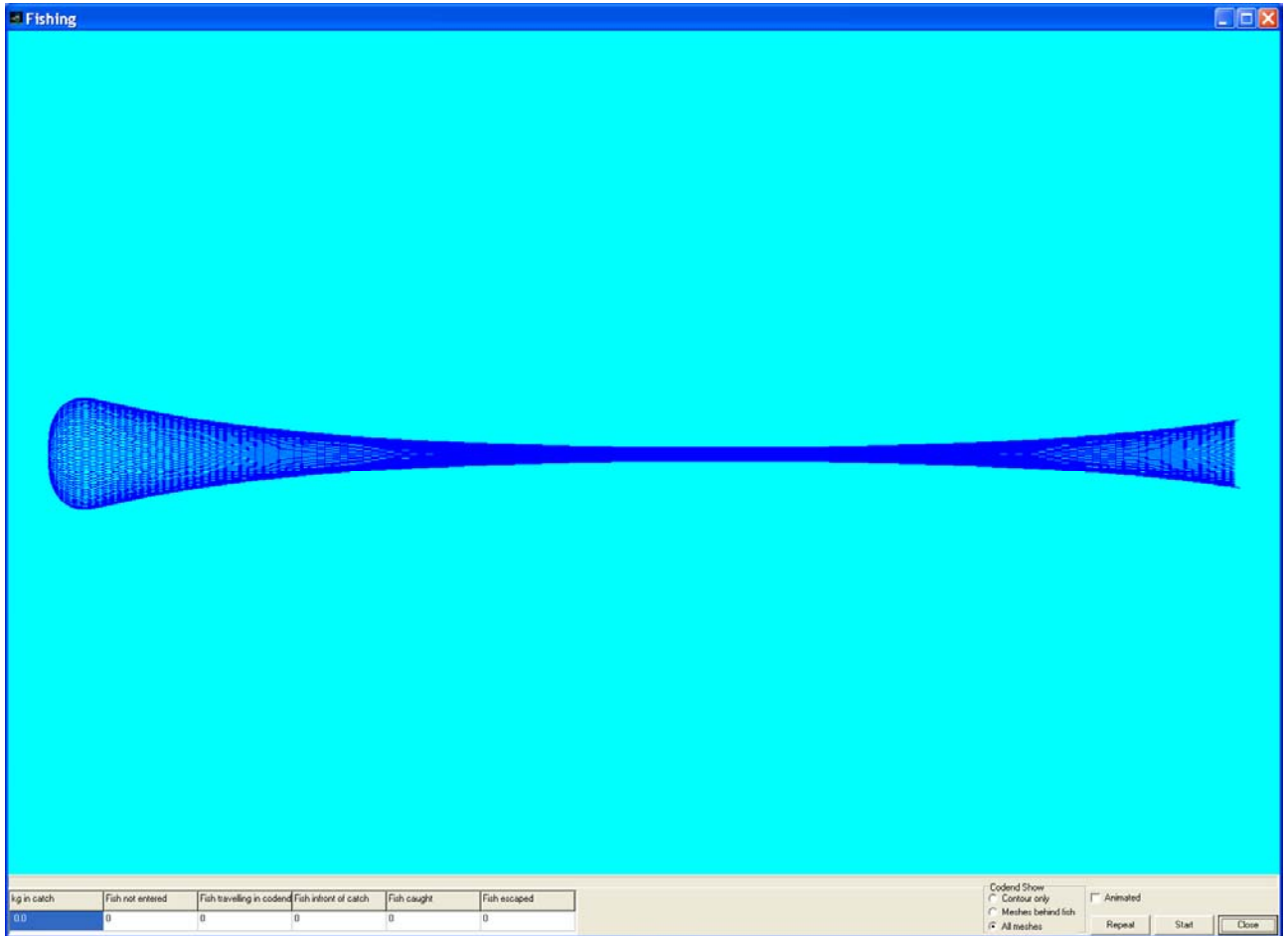


Figure 16: Fishing Window.

Assess the Fishing Window from the main window by selecting menu option Simulate. During a simulated fishing process PRESEMO visualize the process by drawing cod-end, catch and the individual fish and their escape attempts. This facility also show the process when the gear is hauled to surface and at the surface (see Figure 17).

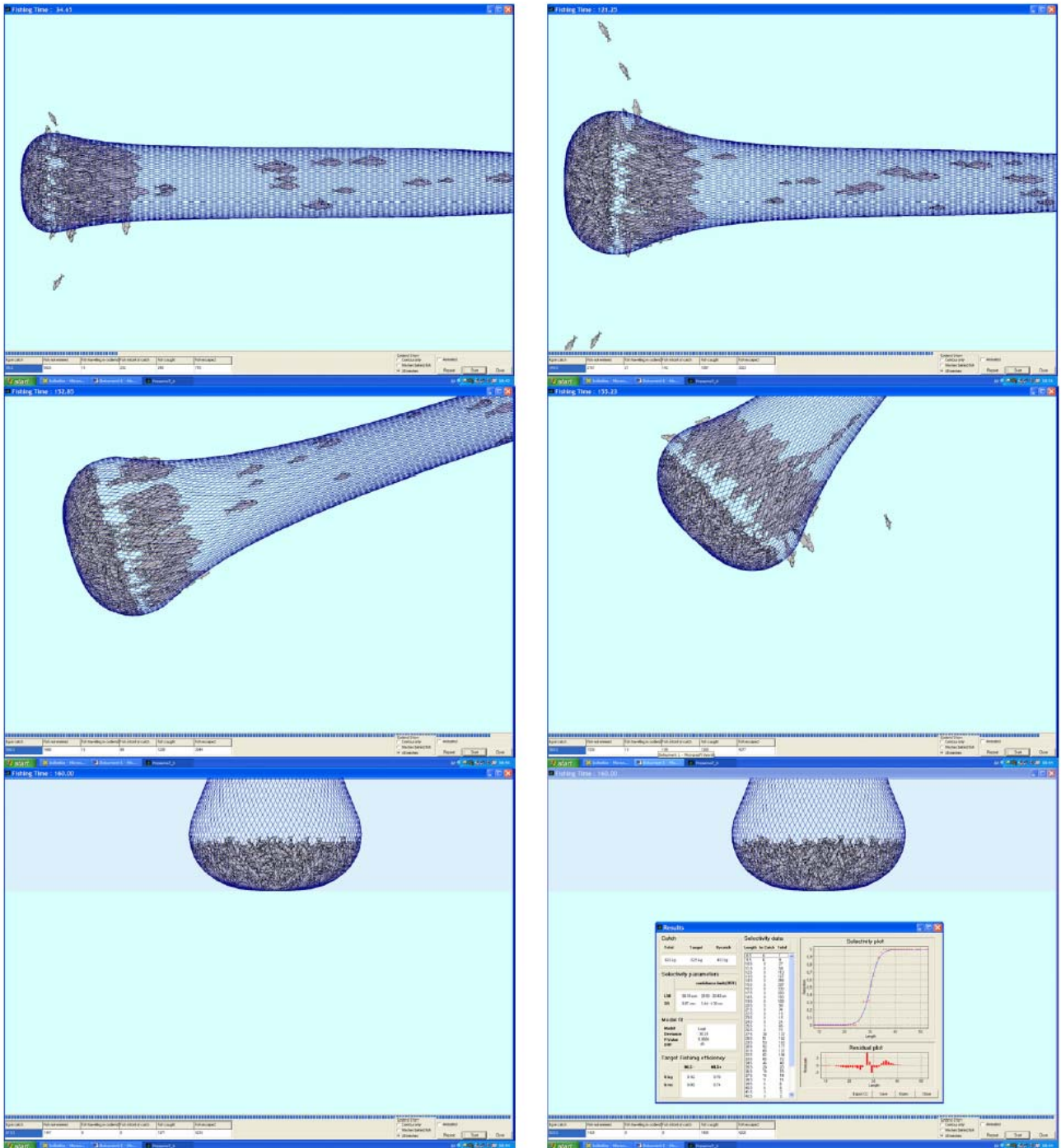


Figure 17: Screen dumps from different stages of a simulated fishing process.

Start simulation of one haul by pressing the button Start.

At the end of a simulation the Result Window automatically shows up.

Result Window

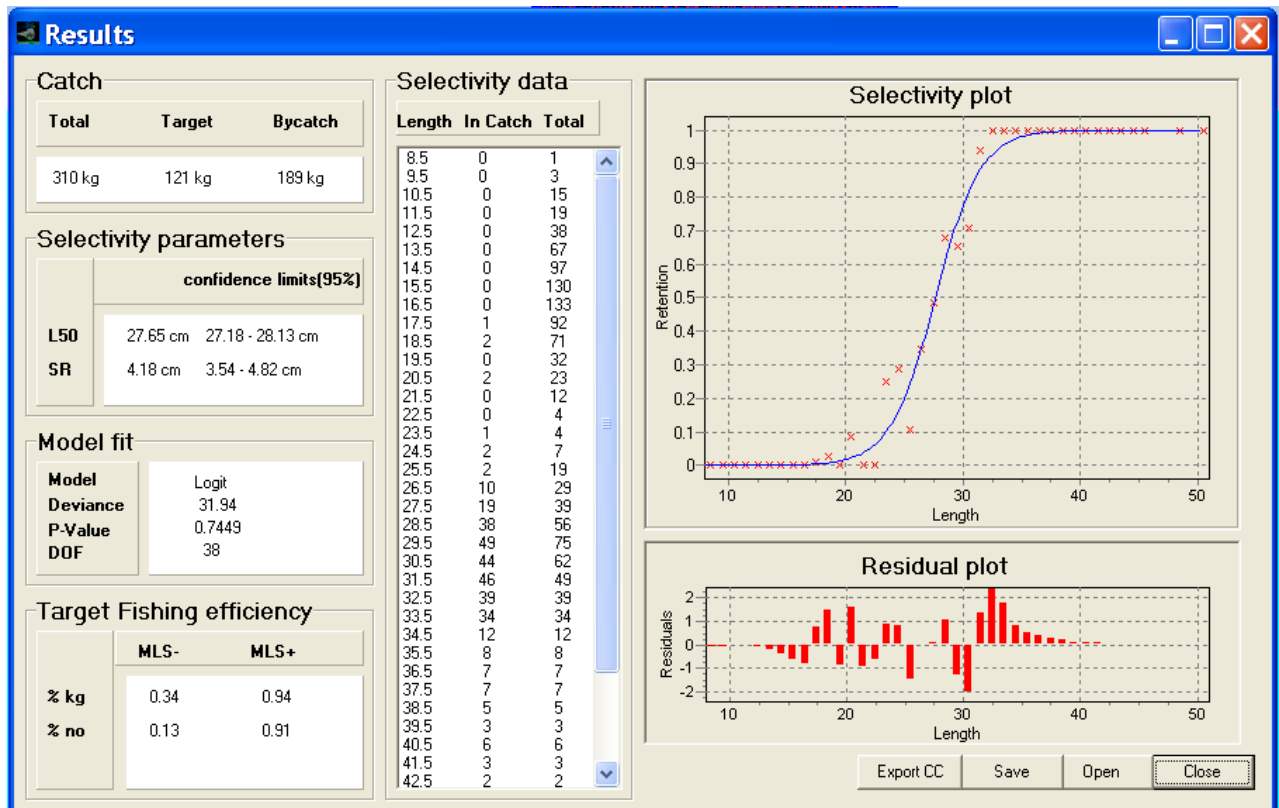


Figure 18: Result Window.

Assess the Result Window from the main window by selecting menu option Results and then sub-option Selection + Data. The Result Window also automatically shows up after completion of a simulated fishing process.

The Result Window shows the selection parameters L50 and SR and their confidence intervals; selection data; the selection curve and model fit information. The fit is a maximum likelihood fit of the logit function.

To export selection data to be analyzed in the commercially available tool CC2000 press button Export CC.

To show Fish Data Window for one specific length class press left mouse button on the specific length class in the Selectivity data section of the Window.

Fish Data window for selected length class

fish no.	length	height	width	girth	weight	entry time	travel time	exhaustion time	time between	fate	time fate	initial att.	main att.	time last att.
2. 19	266	46	27	125	0.193	6101	80	1594	60	ESCAPED	6958	2	13	6958
2. 48	269	46	28	127	0.201	6811	81	1616	60	ESCAPED	7684	1	14	7684
2. 53	266	46	27	125	0.194	735	80	1597	60	ESCAPED	637	1	1	637
2. 91	270	46	28	127	0.202	6797	81	1618	60	ESCAPED	7063	1	4	7063
2. 94	264	45	27	124	0.189	151	79	1581	60	ESCAPED	291	2	1	291
2. 112	268	46	28	126	0.198	6527	80	1607	60	ESCAPED	7083	2	8	7083
2. 136	267	46	28	126	0.196	5160	80	1602	60	ESCAPED	6694	1	25	6694
2. 174	266	46	27	125	0.195	1917	80	1598	60	ESCAPED	2020	1	1	2020
2. 184	267	46	27	125	0.196	5619	80	1601	60	ESCAPED	6493	1	14	6493
2. 197	264	45	27	124	0.190	5705	79	1585	60	ESCAPED	5807	1	1	5807
2. 203	261	45	27	123	0.184	2273	78	1568	60	INCATCH	3841	1	24	3780
2. 209	269	46	28	126	0.201	602	81	1614	60	ESCAPED	737	2	1	737
2. 213	268	46	28	126	0.198	5007	80	1609	60	ESCAPED	6124	1	18	6124
2. 219	263	45	27	124	0.188	3503	79	1579	60	INCATCH	5082	1	24	5026
2. 250	263	45	27	123	0.186	4353	79	1575	60	INCATCH	5928	1	25	5898
2. 258	265	46	27	124	0.191	1878	79	1587	60	ESCAPED	1954	1	1	1954
2. 276	264	45	27	124	0.189	225	79	1582	60	ESCAPED	309	1	1	309
2. 312	262	45	27	123	0.185	5717	79	1573	60	ESCAPED	6259	1	8	6259
2. 330	268	46	28	126	0.198	1294	80	1607	60	ESCAPED	1416	1	1	1416
2. 338	269	46	28	127	0.201	2036	81	1616	60	ESCAPED	2191	1	2	2191
2. 347	269	46	28	126	0.200	1784	81	1612	60	ESCAPED	1954	1	2	1954
2. 353	270	46	28	127	0.202	2684	81	1617	60	INCATCH	4301	1	25	4253
2. 362	270	46	28	127	0.202	2523	81	1618	60	INCATCH	4141	1	25	4092
2. 382	269	46	28	127	0.201	2813	81	1616	60	INCATCH	4429	1	26	4428
2. 396	265	46	27	125	0.192	1506	80	1591	60	ESCAPED	1624	1	1	1624
3. 5	261	45	27	170	0.183	3002	78	1565	60	INCATCH	4567	1	24	4506
3. 13	268	46	28	174	0.198	2475	80	1607	60	INCATCH	4082	1	25	4061
3. 19	261	45	27	169	0.182	2898	78	1563	60	INCATCH	4461	1	24	4406
3. 28	266	46	27	173	0.193	2469	80	1594	60	INCATCH	4063	1	25	4032

Figure 19: Fish Data Window for selected length class.

Assess through pressing left mouse button on the specific length class in the Selectivity data section of the Result Window.

This window is used to show detailed information on the individual fish in the length class selected to find out why it escaped or was retained.

Further detailed information can be shown on the last escape attempt for a selected fish by pressing the left mouse button on it. Then the Last escape attempt Window is shown.

Last escape attempt Window

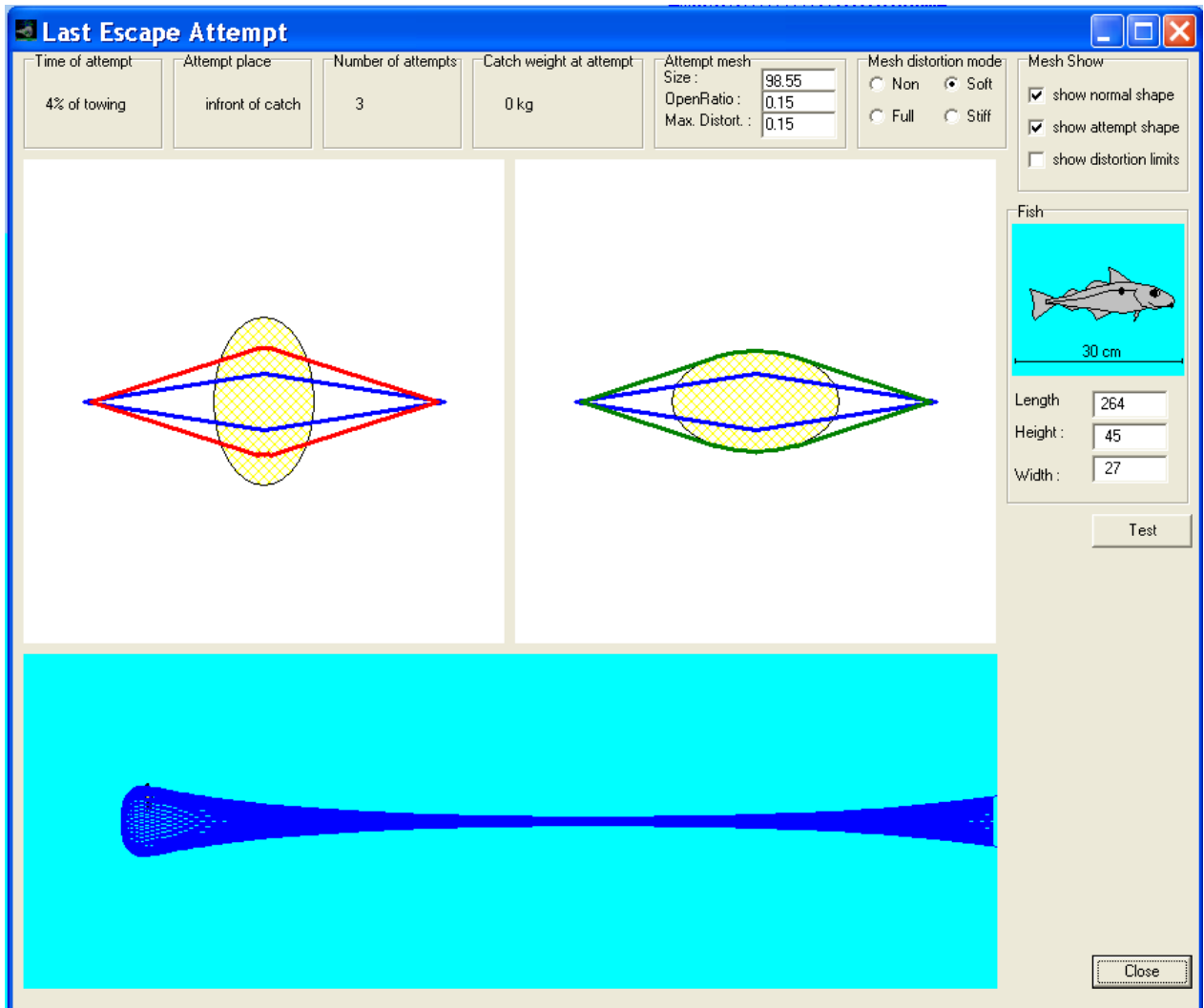


Figure 20: Last Escape Attempt Window.

Assess by pressing the left mouse button on a selected fish in the Fish Data for selected length class Window. This involves showing cod-end shape, where and when last escape attempt took place, mesh shape, fish cross-section, catch weight and total number of attempts for this fish. The blue mesh is the actual shape the red or green is the shape when taking into account the allowed mesh distortion specified in the Settings Window. Red colour is used if the attempt is not successful and green is used if it is successful. A facility even permits investigating what would happen for that specific fish if the mesh deformation conditions were different. Do this by changing the values in the Window and then press button Test.

Multi haul simulation window

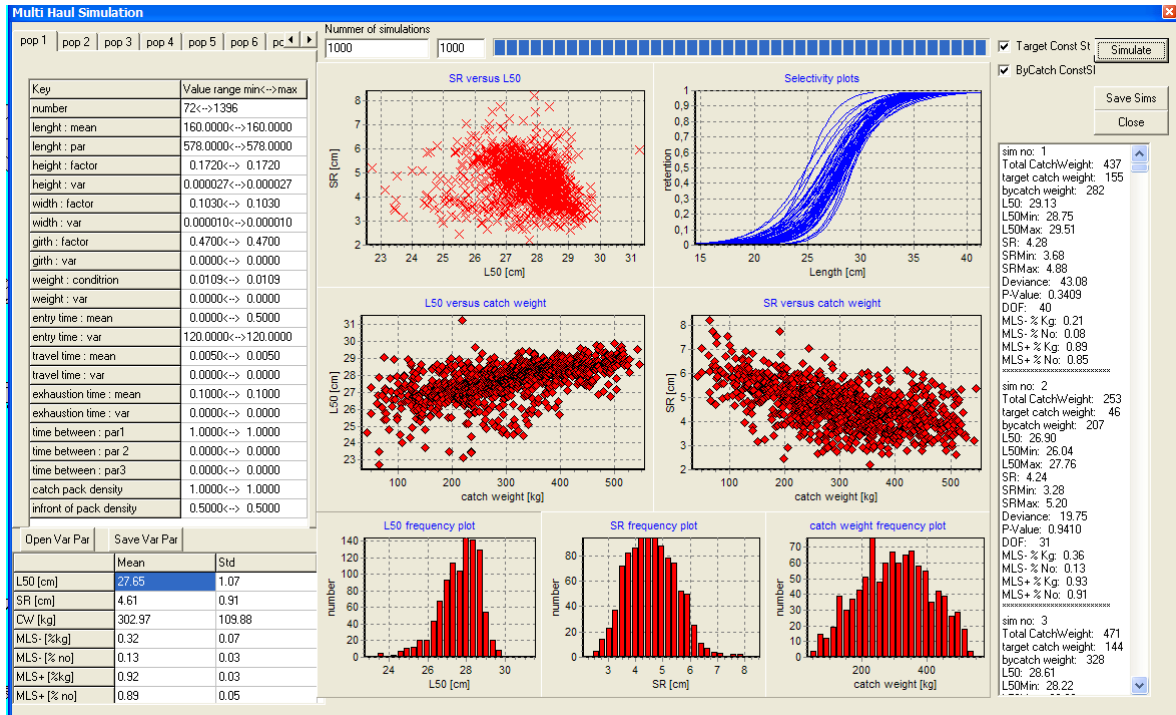


Figure 21: Multi Haul Simulation Window.

Assess the Multi haul simulation Window from the main window by selecting menu option Multi Haul Simulation.

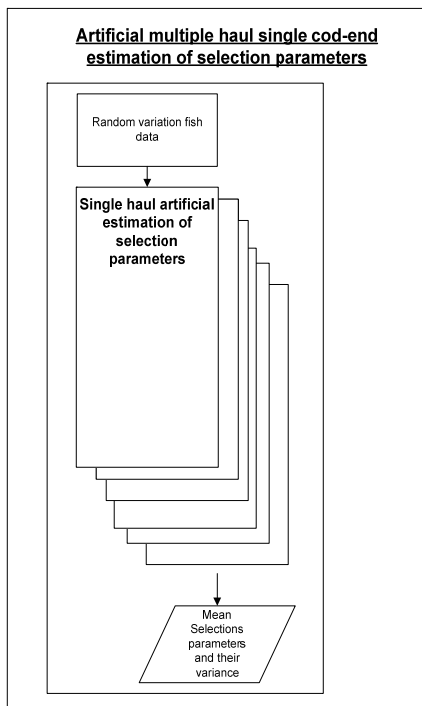


Figure 22: Flow chart for multi haul simulation.

Cod-end selectivity results obtained from sea trials often have a significant variation from haul to haul on the same fishing vessel using the same gear and gear rigging. To model this between haul variability a stochastic simulation technique were implemented in PRESEMO where values for parameters assumed to affect selectivity could be varied randomly between simulated hauls. This approach is illustrated in Figure 22 and the window to perform such a multiple set of simulated hauls is shown in Figure 21 . Figure 21 shows a situation where 1000 hauls were performed and the data show selection of haddock in a 100 mm diamond mesh cod-end. On a personal computer this can be carried out in approximately 2 hours dependent on the selected mesh distortion model. The Multi Haul Simulation Window is used for this purpose. The way to set up to run this between haul random simulation process is in the left part of the window to define the range for the variation of the parameters listed. This need to be done for each of the populations used in the simulations. xx ↔ yy mean setting the variation to be random between hauls in the range from xx to yy. The parameters have the same meaning

as in the Population Window except for two entry time parameters which in this Window mean the following:

Entry time mean: fraction length of entry period for fish. For example does 0.0 \leftrightarrow 0.5 mean that fish is assigned a random entry time period that is between 0.0% to 50% of the total entry period set up for fish in that specific haul. Placed randomly in the total period.

Entry time var: sets up the total entry period in minutes for fish in this population.

The between haul variation parameters are not save or opened with a total simulation file these parameters need to be saved and opened within the Multi Haul Simulation Window. Do this by using the buttons Open Var Par and Save Var Par.

If the checkbox Target ConstSt is checked the between haul variation of fish of the target species is restricted thus that the length structure is conserved from haul to haul.

If the checkbox ByCatch ConstSt is checked the between haul variation of fish of the by catch species are restricted thus that the length structure is conserved from haul to haul.

If the checkbox Deviance limit is checked then only hauls where the model fit deviance is within 3 times the degree of freedom is stored.

If the checkbox HaulData is checked then the selection data (length class data) for each simulated haul is saved automatically in a single file.

Set up the number of simulations to run in the top of the window.

Use the button Simulate to start the multi haul simulation.

Use the button Save Sims to save the results of the simulations in a number of different files.

Multi Var Set Simulation Window

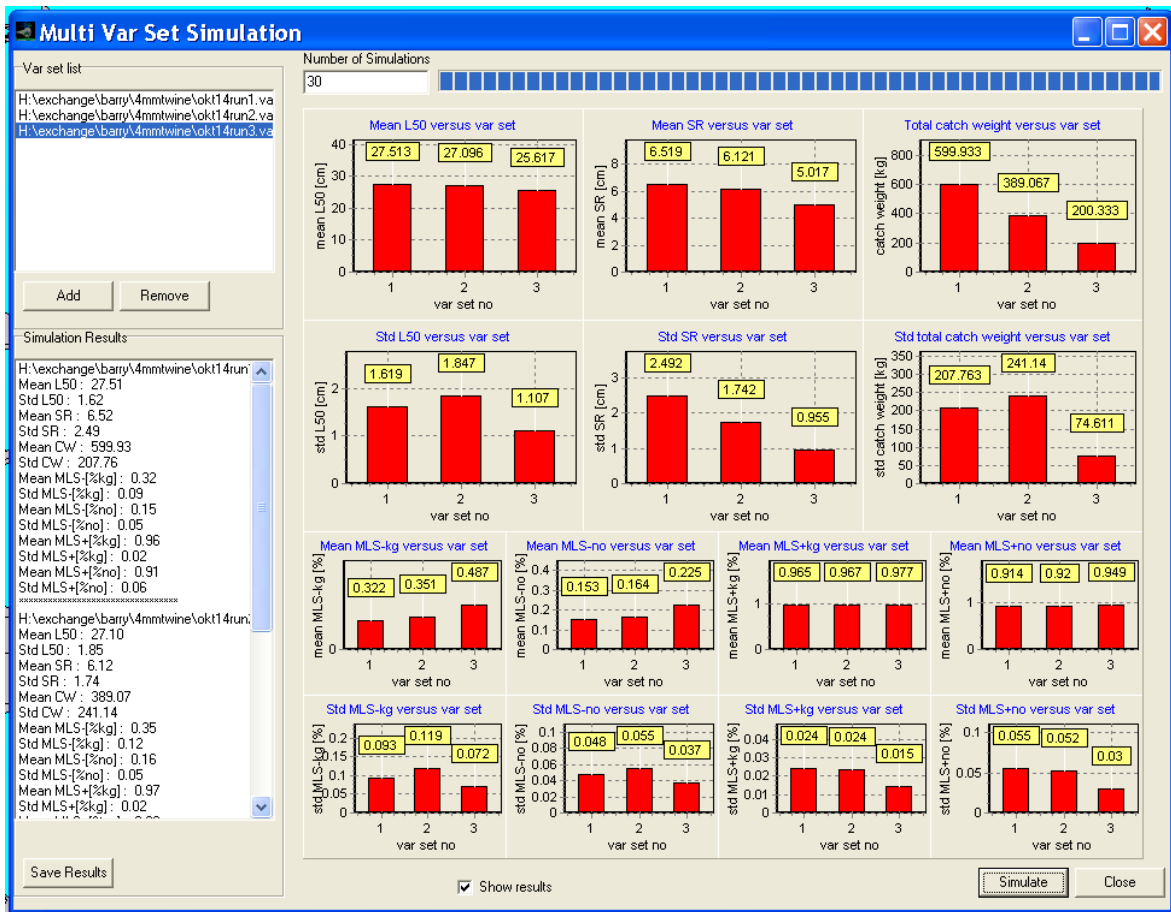


Figure 23: Multi Var Set Simulation Window.

Assess the Multi Var Set simulation Window from the main window by selecting menu option Multi Var Set Simulation.

This Window is used to for the same cod-end to investigate in an easy way how dependent the simulated selectivity is for the variation patterns between hauls that can be set up in the Multi Haul Simulation Window.

Use button Add to load a Varset data file created in the Multi Haul Simulation Window.

Set up the number of simulations to run for each Varset data file.

Use button simulate to start the simulations.

Use button Save Results to save the results of the multi varset simulations to a file.

Multi Codend Simulation Window

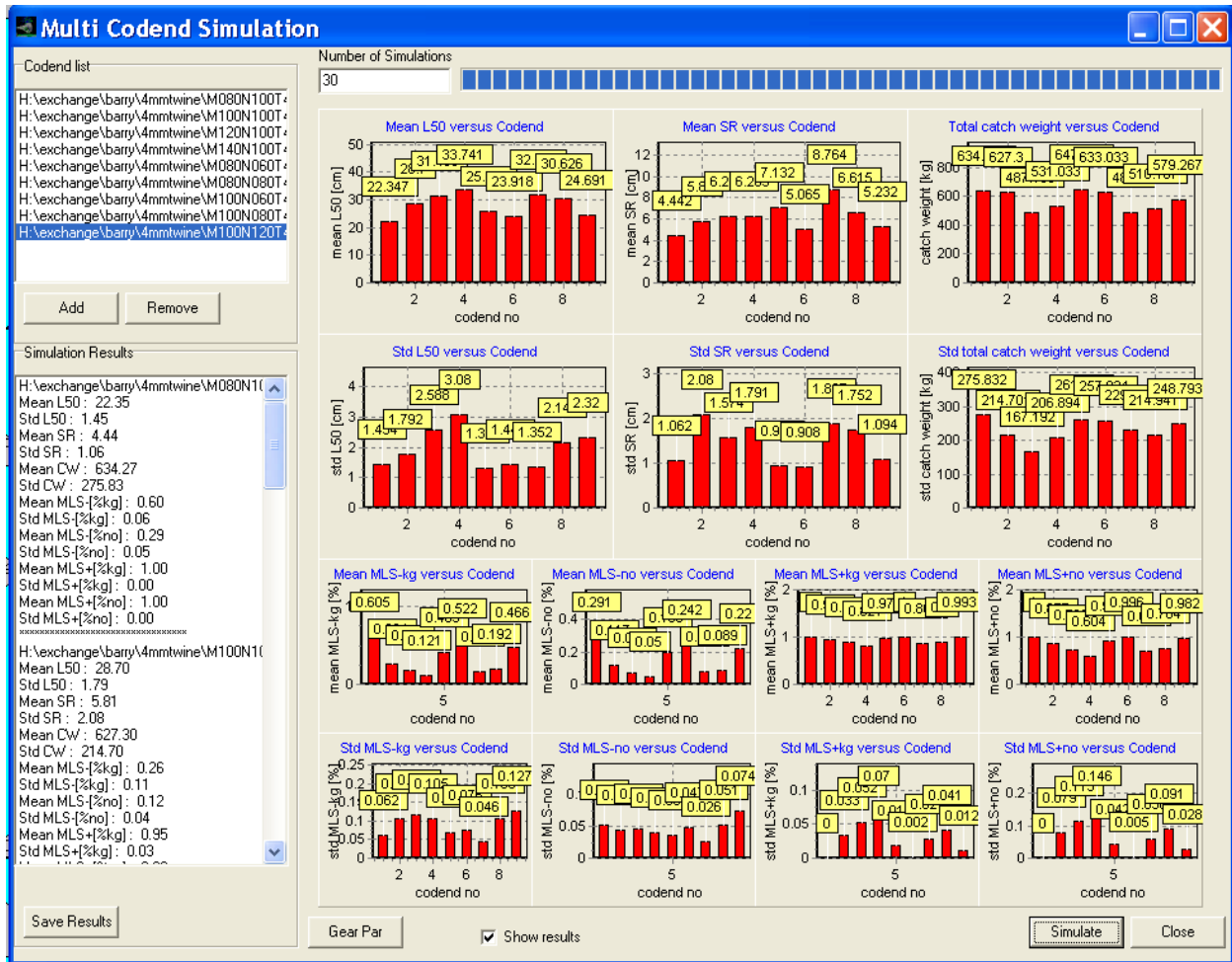


Figure 24: Multi Codend Simulation Window.

Assess the Multi Codend simulation Window from the main window by selecting menu option Multi Codend Simulation.

This window is used to set up simulating the selective properties of different cod-end designs under the same varying haul conditions. It thus uses the between haul variation set up in the Multi Haul Simulation Window.

Use button Add to add a cod-end to the codend list.

Set up the number of simulations to carry out for each cod-end in the cod-end list.

Use button Simulate to start the simulations.

Use button Save Results to save the results to a specified file.

Results for the individual hauls are though automatically saved in files labelled CD1....CDX. A haul selection data file is also generated which enables fixed and random effect analysis external to PRESEMO.

Use button Gear Par to show the Gear Par Dependency Window.

Codend Par dependency Window

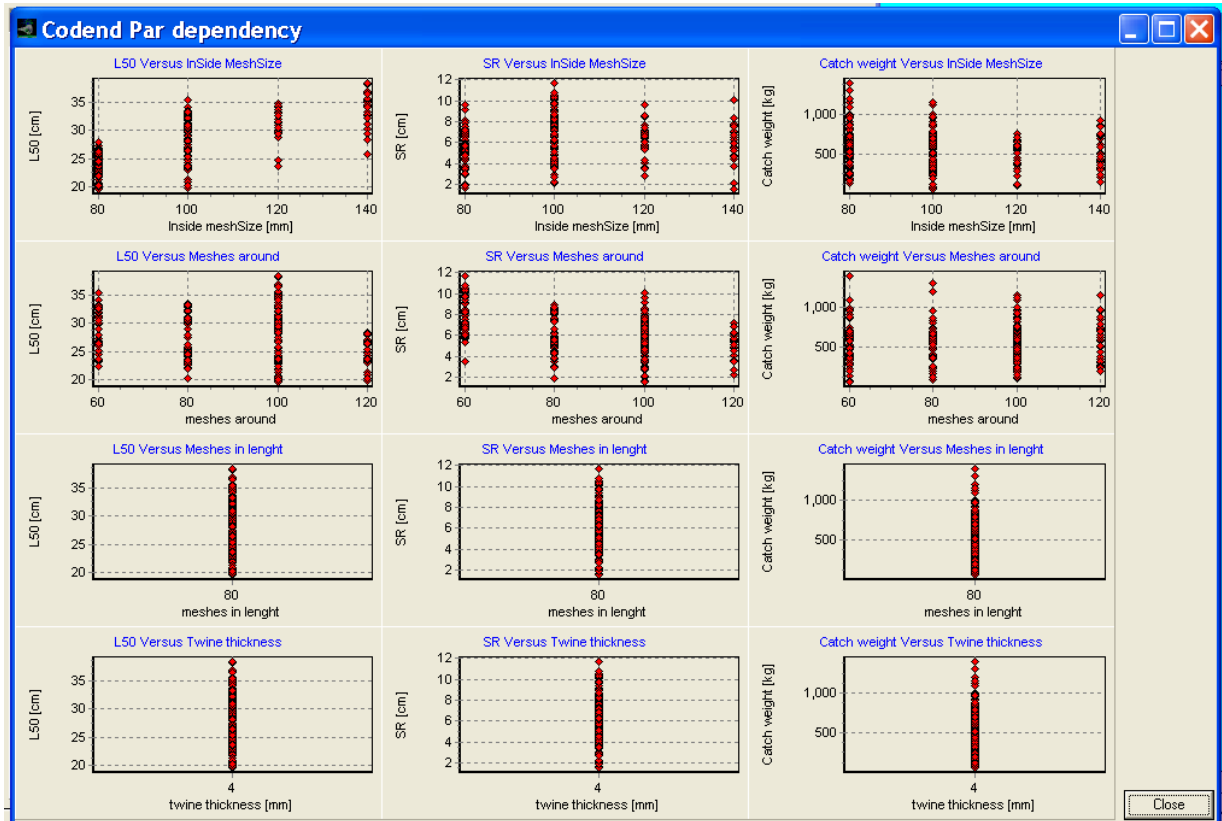


Figure 25: Codend Par Dependency Window.

Assess the Codend Par Dependency Window from the Multi Codend Simulation Window by pressing the Gear Par button.

This window is used to view results obtained from a multi codend simulation not on cod-end by cod-end basis but on the basis of the value of the main cod-end design parameters mesh size, number of meshes around, number of meshes in length and twine thickness.

To switch back to the Multi Codend Simulation Window press button Close.

Multi Setting Set simulation Window

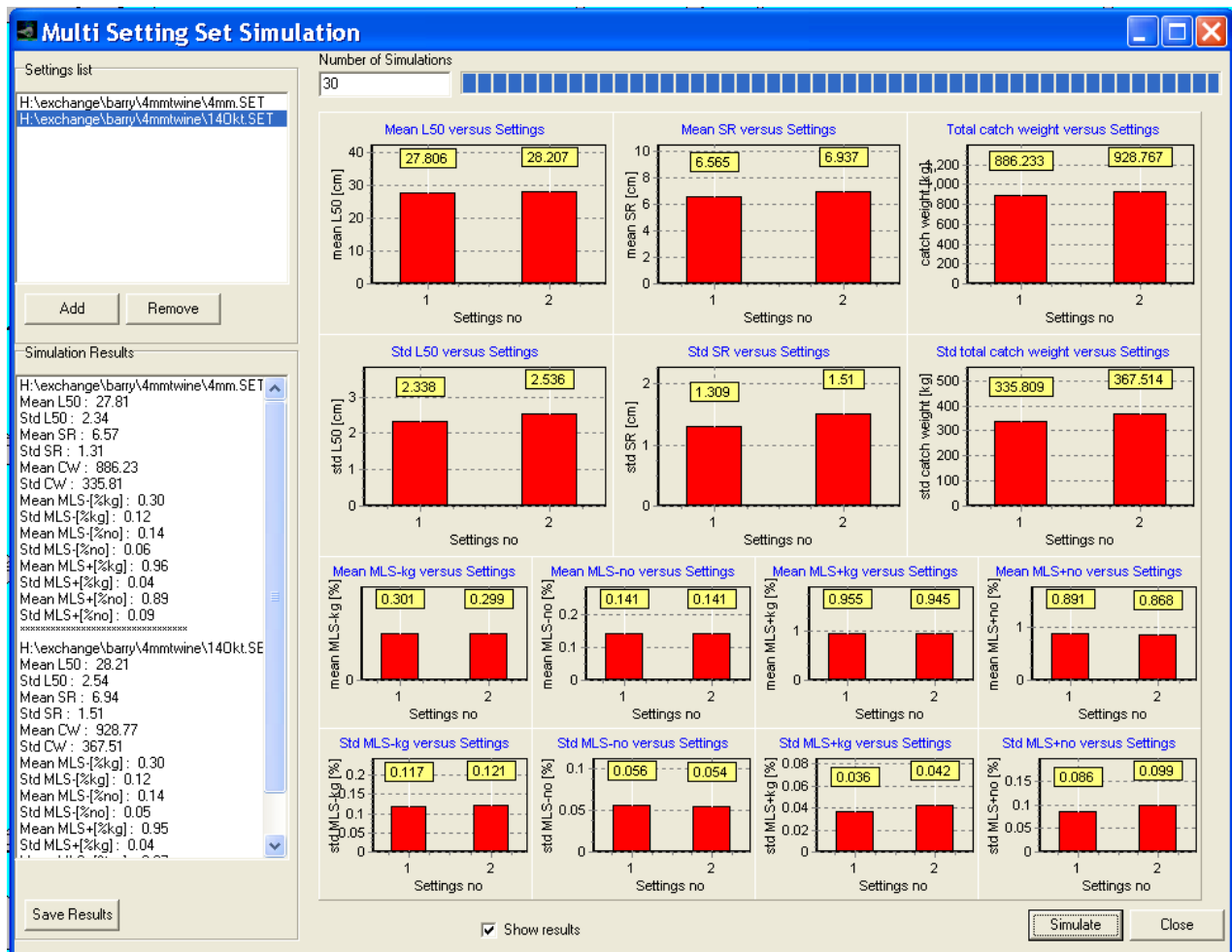


Figure 26: Multi Setting Set Simulation Window.

Assess the Multi Setting Set Simulation Window from the main window by selecting menu option Multi Setting Set Simulation.

This Window is used to for the same cod-end to investigate in an easy way how dependent the simulated selectivity is on the settings defined in the Settings Window. For example on the applied escapement model. It uses the between haul variation set up in the Multi Haul Simulation Window.

Use button Add to add a setting set to the list.

Set up the number of simulations to carry out for each setting set in the list.

Use button Simulate to start the simulations.

Use button Save Results to save the results to a specified file.

Mean & STD Window

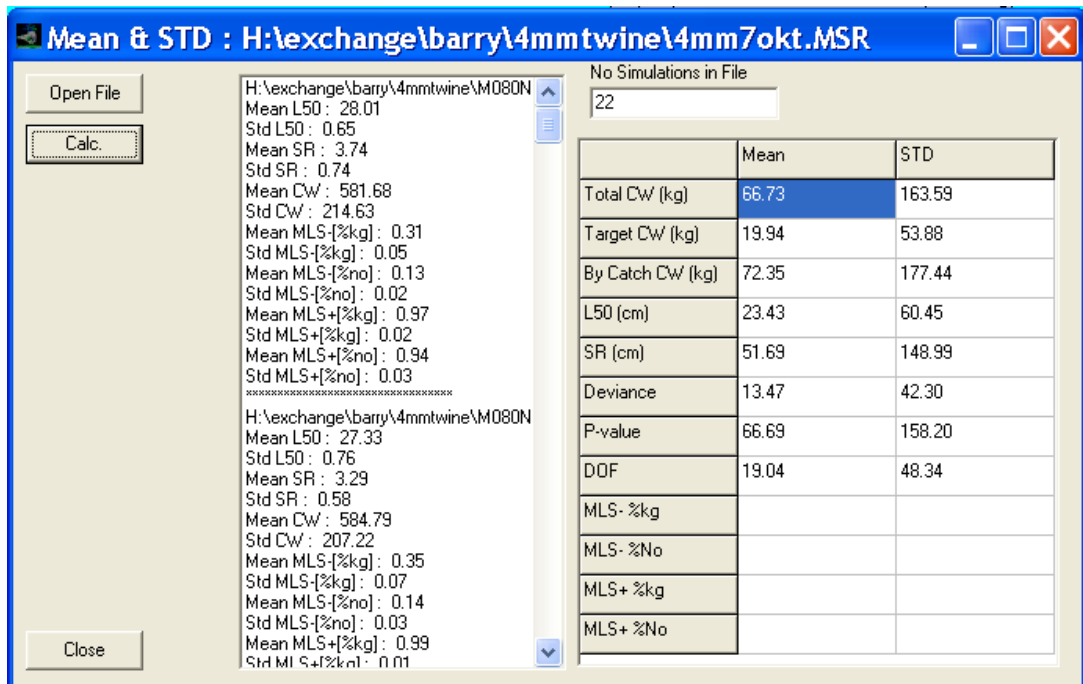


Figure 27: Mean & STD Window.

Assess from the menu option Misc. in the Main Window by selecting sub-option Mean STD.

Use this window to extract information from a save multi haul simulation file to calculate means and standard deviations for the different parameters stored.

Use button Open File to select a multi haul simulation file.

Use button Calc to analyze the selected file.

Run Mix Setup Window

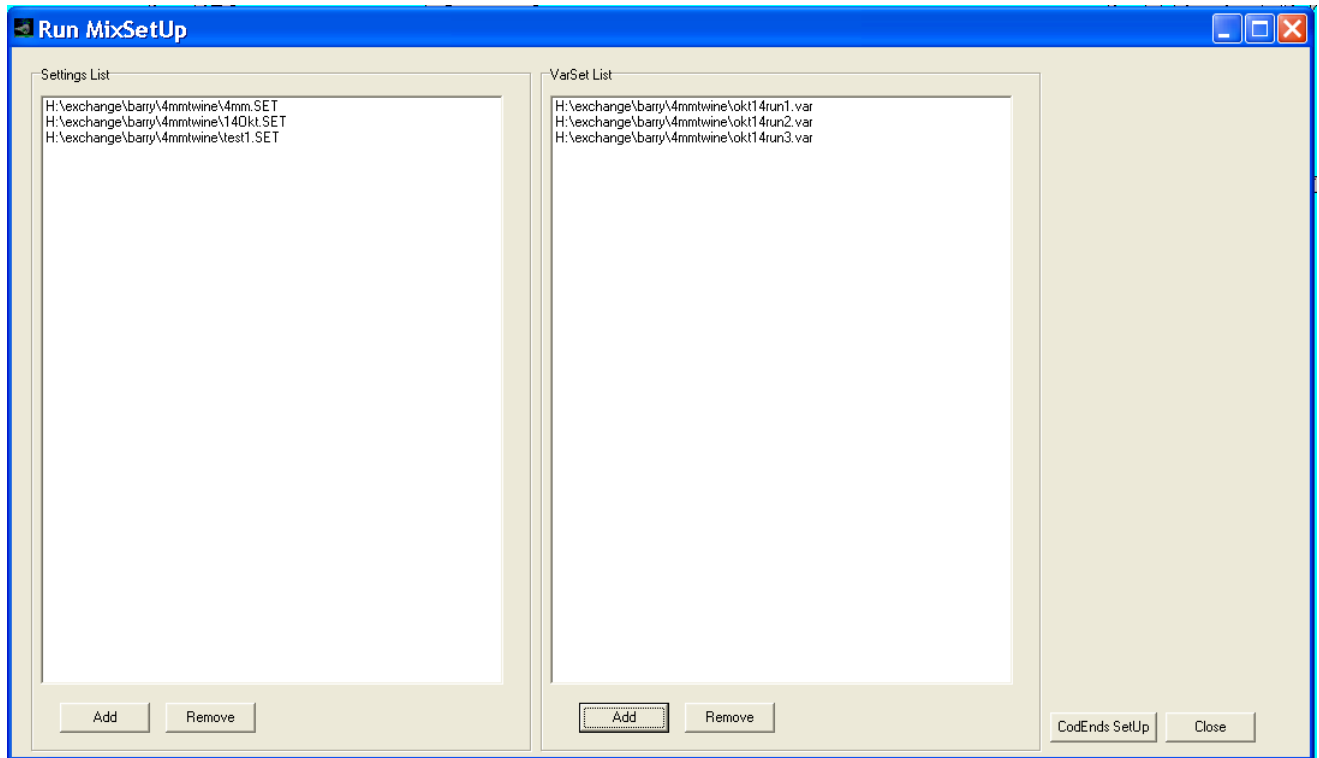


Figure 28: Run Mix Setup Window.

Assess from the menu option Misc. in the Main Window by selecting sub-option RunMix. This Window is used to run what could be called a full matrix design experiment by for different selected cod-ends to simulate the selective properties under different combinations of varset and setting set. Thus for each cod-end design haul combinations of the selected settings set and selected var sets are carried out.

In the left part of the window use the Add button to add a setting set to the settings list. In the right part of the window use the Add button to add a var set to the varset list. After the matrix design for var set and setting set is completed then use button CodEnds Setup to switch to the Multi Codend Simulation Window. Here the different cod-end designs can be loaded to run in the simulations.

Trouser simulation Window

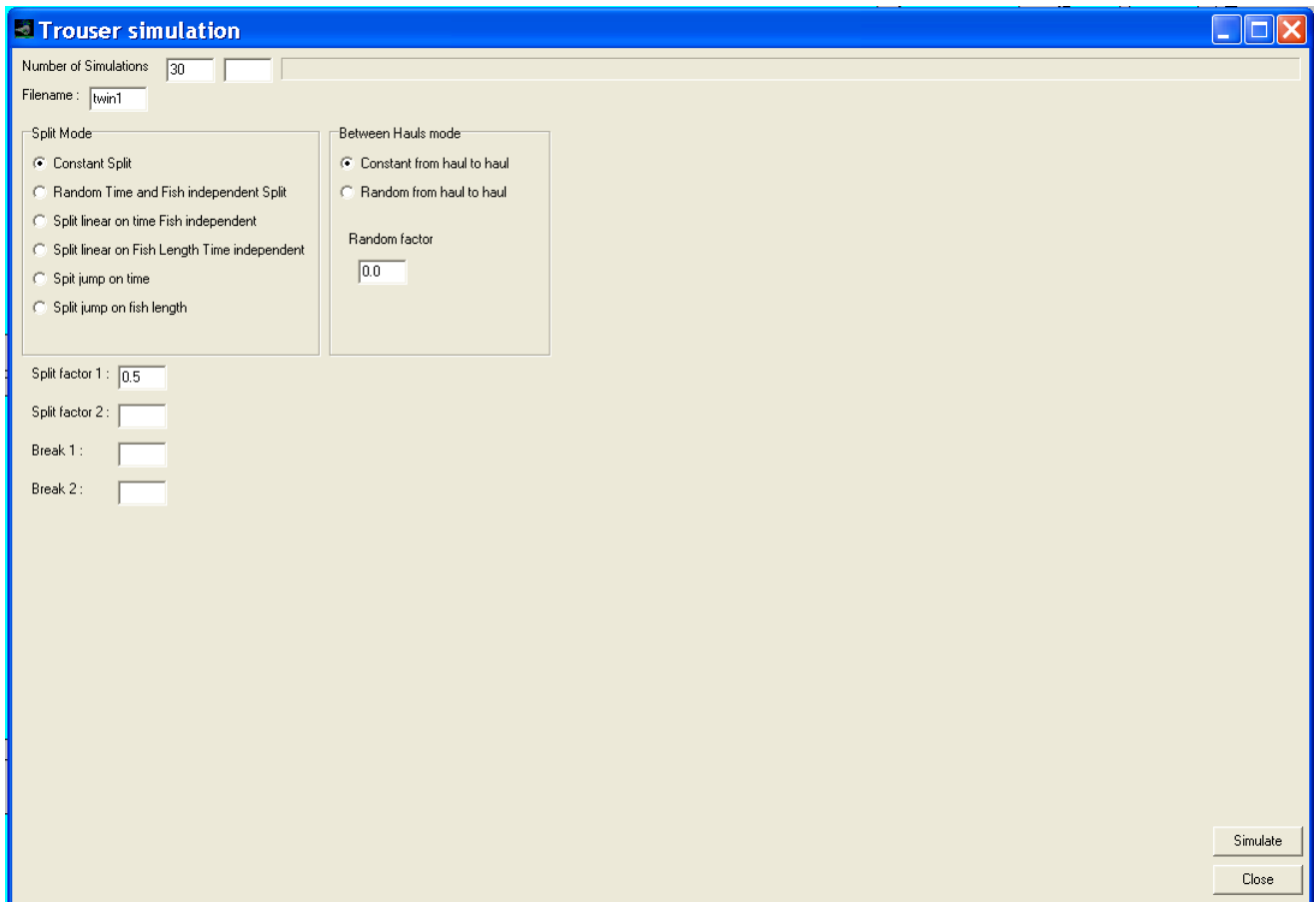


Figure 29: Trouser Simulation Window.

Assess from the menu option Misc. in the Main Window by selecting sub-option RunTrouser.

The standard mode PRESEMO simulate cod-end selection can be described as to follow the covered cod-end method. In this window the experimental design is a little different because it beside covered haul data also produces data to be analysed by the twin/trouser method. This is done letting actual entry of each individual fish to the test cod-end being dependent on the value of the split factor SP at that time in the simulated fishing process. Fish that were set to enter but did not due to the splitting process were then collected by an artificial control cod-end beside the covered test cod-end. On haul by haul basis two selection data files are produced C_namexx and T_namexx. Where C is selection data for haul number xx to be analyzed by the covered method. name is the user-specified label for the simulations. Similar T is selection data to be analyzed by the twin/trouser method. Thus comparable files are produced for the two methods. The files are in format to be analyzed applying the commercially available tool CC2000.

The between haul variation in the fishing process set up in the Multi Haul Simulation Window is automatically applied.

Various facilities for simulating the split SP in a fishing process are implemented in PRESEMO:

- constant split during the entire fishing process
- split varying randomly within a specified range during the fishing process

- split increasing or decreasing linearly during the fishing process
- split being linearly dependent on the length of the fish

For the between haul variation in the splitting process two facilities were developed:

- A constant splitting process between hauls using anyone of the facilities described above for the within haul splitting process.
- A random varying splitting process between hauls at a specified level using anyone of the facilities described above for the within haul splitting process.

These facilities are set up in the window.