

# Trawl Vision Simulator



**CATCHING EFFICIENCY**

**CATCHING ECONOMY**

**OVER 900 UNITS INSTALLED**

**GOLD MEDAL TO THE INVENTION IN SWITZERLAND**



# TrawlVisionSimulator

## Limited using the software TrawlVisionSimulator

### System description

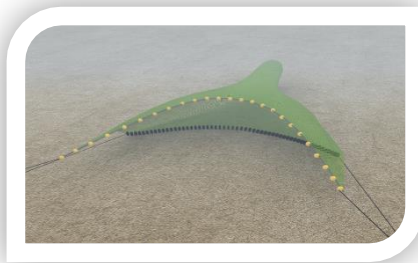
The suite TRAWL PROFESSIONAL VISION is divided into 2 modules



The TVS user will be able to see, with an extremely friendly 3D user interface, the behavior of different trawl nets, door models, interacting with any kind of settings and models of the fishing gear components.



TrawlVisionDesigner – TVD - Its fast and easy user interface increases the interaction between the user and the software, allowing you to create a trawl net quick, easy and accurately. It contains over 120 models with cutting edge designs. Trawl Vision Designer is a powerful software tool designed to contribute to the fishing industry, directed to all people connected with the activity of trawling. The user can create a new trawling net, store and evaluate rapid changes in the design and its effect on the whole rigging.



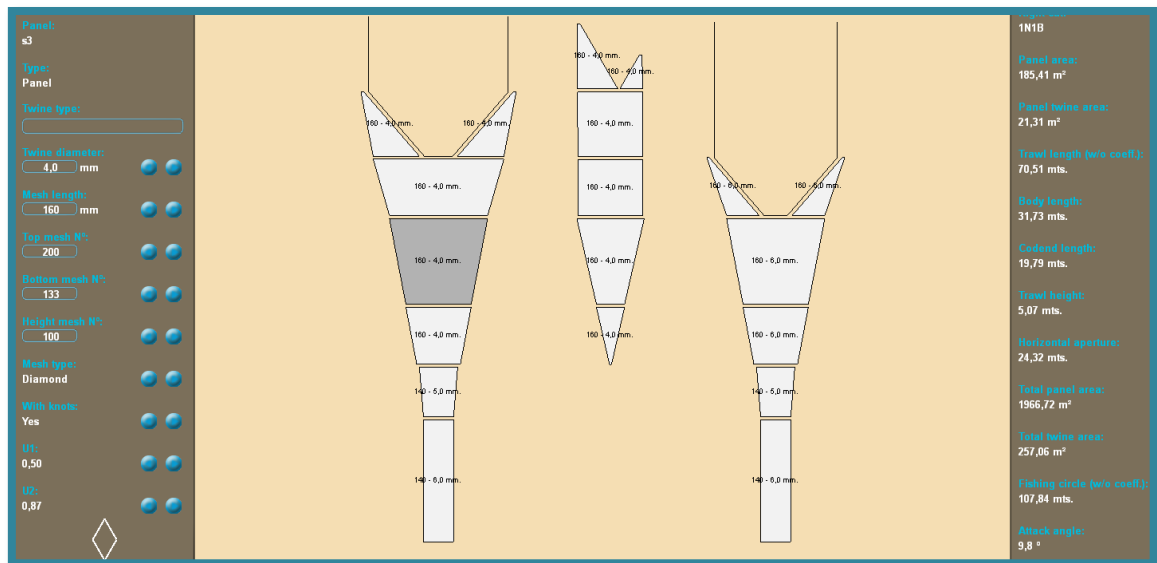
AcruxSoft is a Uruguayan company, devoted to providing technology solutions for continuously improving the fishing activity.

Make your best choice by comparing various strategies in the shortest time.

This product was developed by engineers and fisheries experts from AcruxSoft SRL, integrating their knowledge and experience to improve fishing gear. TrawlVision generates fast and efficient solutions, minimizing the corrective actions at sea.

## Example of use and optimization of your trawling gear

- 1) We enter the data of the trawl "Larsen" in TVD software
- 2) We project the design to scale.
- 3) We analyze and evaluate its characteristics.



These components are verified and calculated with the TVD software:



- a. Cuts
- b. Twine area
- c. Panel area
- d. Body length
- e. Codend length
- f. Trawl Length
- g. Trawl height
- h. Trawl Spread
- i. Total panel area
- j. Total twine area
- k. Fishing circle
- l. Attack angle
- m. Filtration level U1 & U2 of the meshes
- n. Length of wings in relation to the headrope and footrope
- o. Overlap of panels

Through TVD you can: evaluate, edit, modify, create, print, and save the prototypes...

With TrawlVision, the net-worker will be able to compare the theoretical design parameters with the ones received from the vessel.



After digitalizing the trawl and optimizing the design details, we run the simulation software - TrawlVisionSimulator

## VESSEL

First we upload the following characteristics of the vessel and fishing gear:

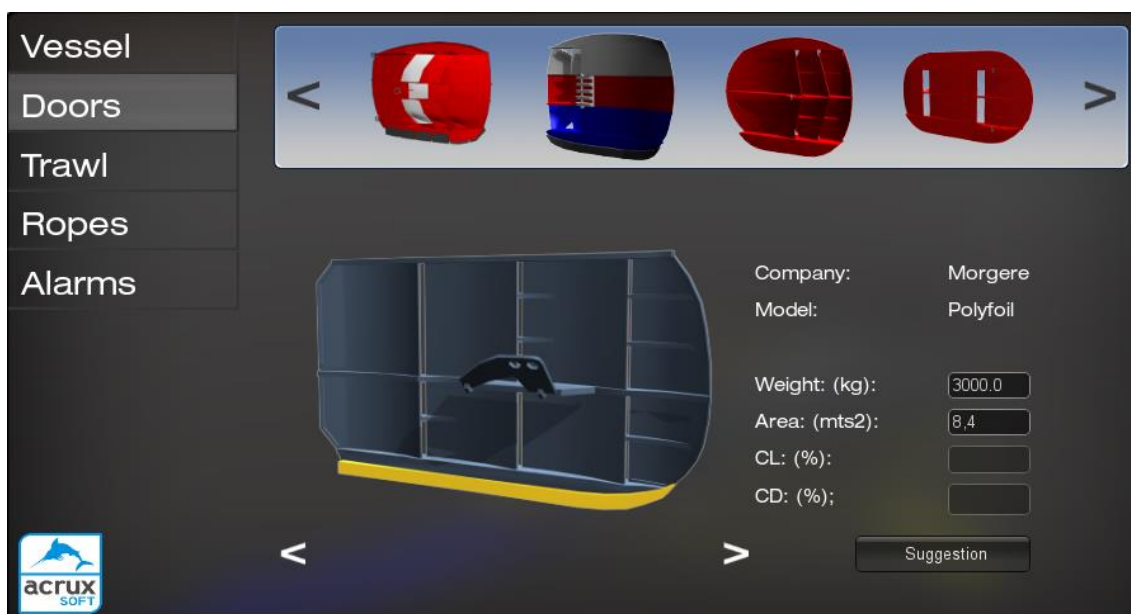
Speed kts. 3,7

Power Hp = 3,300



## DOORS

The characteristics of the doors, the software determines that the area and weight are correct





## TRAWL

We load the trawl file, the gear, trawl depth and we evaluate the contact of the trawl with the seabed

The screenshot shows the 'Trawl' configuration screen in the TVS software. The left sidebar has 'Trawl' selected. The main area contains various input fields and a 'Load' button. The parameters are as follows:

Parameter	Value
Select a trawl:	C:\01 RedesPesca TVD\Trawls_tvd\Larsen\TrawlPrototype.tdf
Average mesh length (mm):	155.87
Average twine diameter (mm):	4.79
Fishing circle (w/o coeff) (m):	107.84
Trawl length (w/o coeff) (m):	70.51
Trawl height (mts):	5.07
Headrope (mts):	56.80
Design speed (kts.):	3.50
Horizontal coefficient (%):	40.00
Ballast (kg):	3000.00
Trawl depth (mts):	600.00
Floater count:	54
Floater force (kgf):	6.50
Floater diameter (mm):	275.00
Cable weight (Kg):	4.50
Warp length (mts):	1250.00
Warps diameter (mm):	30.00
Muddy seabed:	<input type="checkbox"/>
Vertical coefficient (%):	160.0
Angular coefficient:	0.23

A 'Suggestion' button is located below the horizontal coefficient field. The 'acruX SOFT' logo is in the bottom left corner.

The software calculates in this screen, according to the entered data:

- 1) The contact between the trawl and the seabed
- 2) It calculates that 470 kg of ballast is needed to lift the net without losing contact with the seabed

## ROPES

We enter the data of the rope of trawl as presented on the screen

The screenshot shows the 'Ropes' configuration screen in the TVS software. The left sidebar has 'Ropes' selected. The main area features three trawl diagrams: 'With SweepLine', 'Without SweepLine', and 'Only Bride'. The 'With SweepLine' diagram is selected. Below the diagrams are input fields for rope parameters:

Parameter	Value
Backstop length (mts):	8.0
SweepLines diameter (mm):	40
Sweepline length (mts):	180
Top bridle diameter (mm):	24
Bottom bridle diameter (mm):	28
Bottom bridle length (mts):	55
Offset top bridle (mts):	0.0

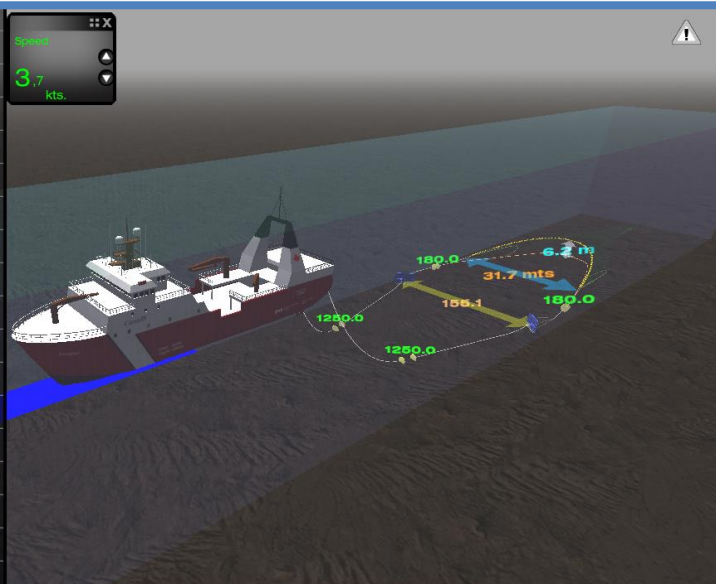
The 'acruX SOFT' logo is in the bottom left corner.

Horizontal aperture	31.7	mts
Trawl resistance	6637.3	Kgf
Filtered Water Volume	278.7	mts3
Trawl angle	13.4	°
Doors lift coefficient	1.56	
Door resistance	6311.5	Kgf
Doors attack angle	45.0	°
Bottom bridle resistance	163.4	Kgf
Sweepelines length	180.0	mts
Doors spread	155.1	mts
Doors drag coefficient	1.04	
Warp resistance	3978.6	Kgf
Ballast resistance	1261.9	Kgf
Top bridle resistance	140.0	Kgf
Total resistance	19566.9	Kgf
Floater's resistance	310.3	Kgf
Door expansion	2482.6	Kgf
Horizontal opening ratio	55.7	%

Speed

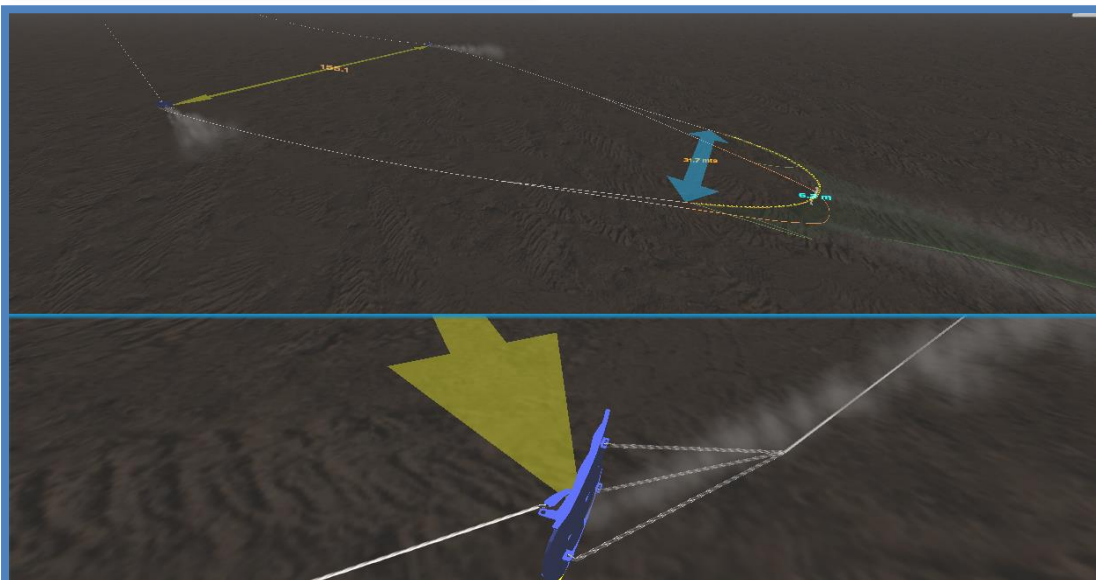
3.7

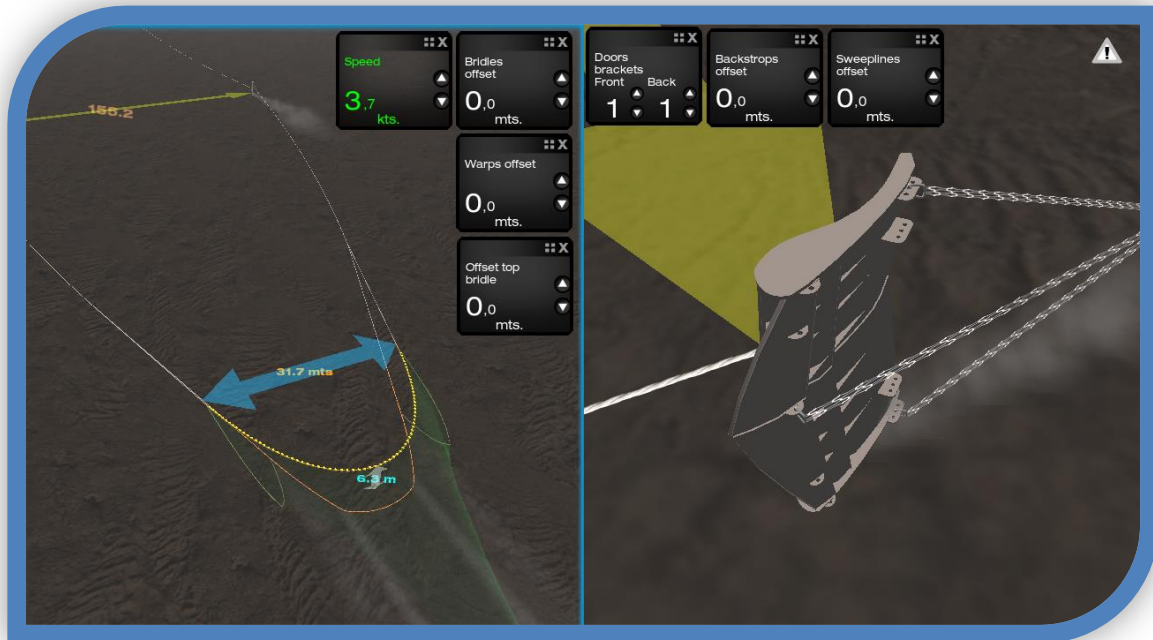
kts.



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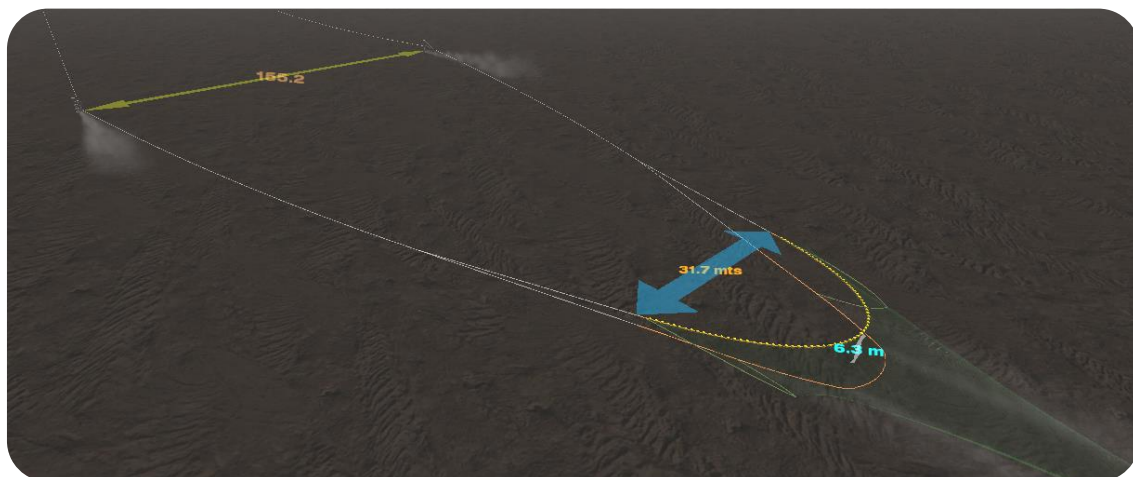
Doors spread	155.1	mts
Doors drag coefficient	1.04	
Warp resistance	3978.6	Kgf
Ballast resistance	1261.9	Kgf
Top bridle resistance	140.0	Kgf
Total resistance	19566.9	Kgf
Floater's resistance	310.3	Kgf
Door expansion	2482.6	Kgf
Horizontal opening ratio	55.7	%
Speed	3.7	kts.
Warps length	1250.0	mts





During the simulation changes are made in:

- a. Door brackets
- b. Doors CL & CD
- c. Bridle length
- d. Sweepelines length
- e. Speed
- f. Changes of trawl
- g. Warps length
- h. We analyzed the relation between warps length and depth
- i. We can change up to 27 models of doors

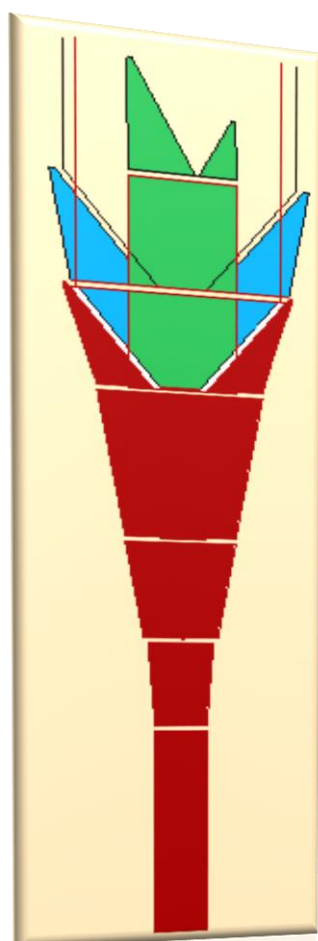


## Analysis and suggestion

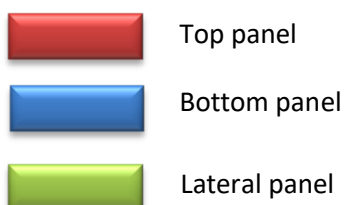
Considering the data provided and processed by the software, we see:

### TRAWL LARSEN

Trawl attack angle	9,8°
Fishing circle (w/o coeff.)	907,84 meters
Total twine area	257,03 meters <sup>2</sup>
Total panel area	1966,17 meters <sup>2</sup>
Trawl spread (by design)	24,32 meters
Trawl length	64,51 meters
Trawl height (by design)	5,07 meters (can increase one meter with the use of rockhopper)
Body length (w/o coeff.)	31,73 meters
Codend length	19,79 meters
Projection of the trawl meshes	U1 = 0,50 & U2 = 0,87



#### OVERLAP OF PANELS



We see that the sections: upper, bottom and side, all match perfectly in their angles and deployment.

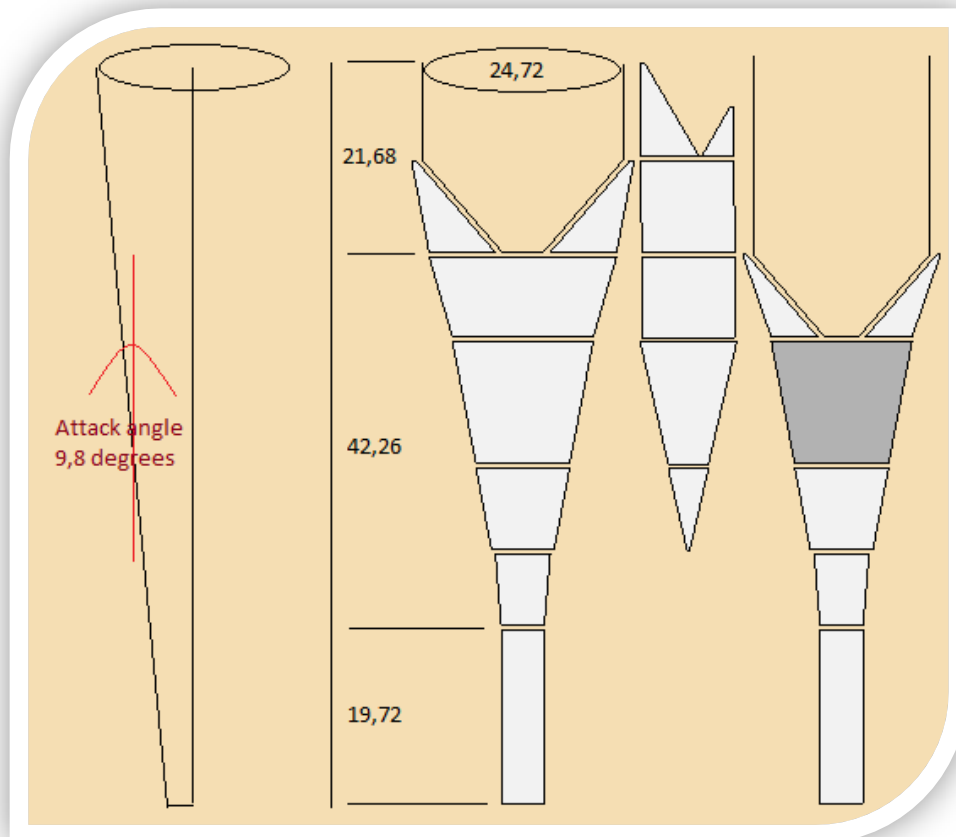
We also see that it is a type of trawl semi pelagic, with a very sharp angle of attack and a low wing spread 56,5 meters for the relation of the total length of the body. We see an excellent trawl for stone seabed's for their short wings and low angle of attack. But you could achieve a larger horizontal sweep area with a different design.

# Properties of the Trawl Larsen

Projection of meshes  $U1 = 0,50$  &  $U2 = 0,87$

The wings represent 13% of the body of the trawl.

Trawl attack angle =  $9^{\circ},8$



If we compare the angle of the body of the trawl, we see that it is closer to a pelagic design than a bottom type design.

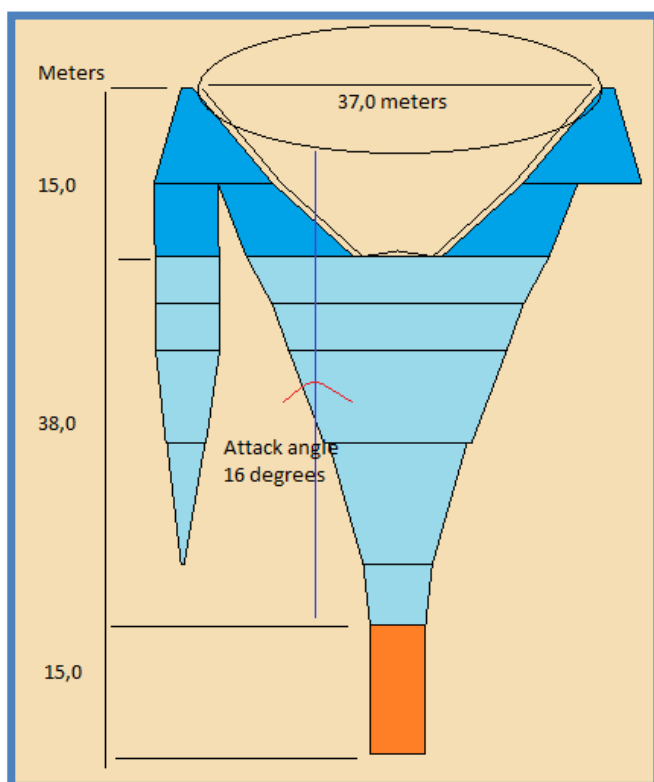
Classification of trawls according to their angles of attack

Guide to Fishery education and training FAO Tech. Paper, 1973.  
 Authors S.L Okonsky and L.W Martini "Artes y Metodos de Pesca"

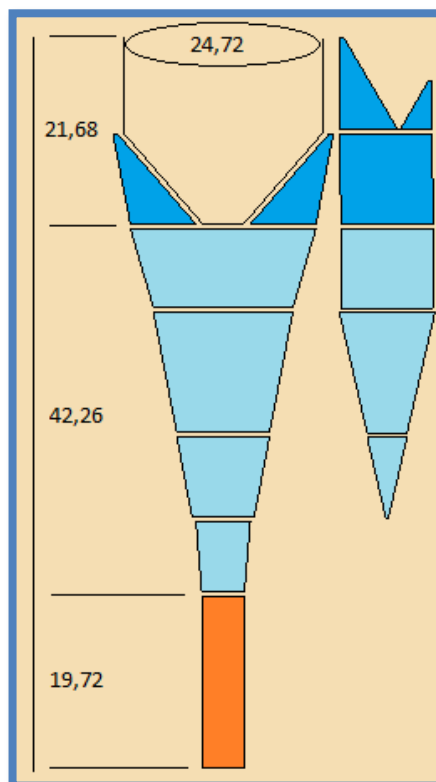
Bottom - Ground fish	From $25^{\circ}$ to $20^{\circ}$
Demersal fish	From $20^{\circ}$ to $13^{\circ}$
Pelagic fish	From $13^{\circ}$ to $9^{\circ}$

# Comparative studies

Typical demersal trawl HVT

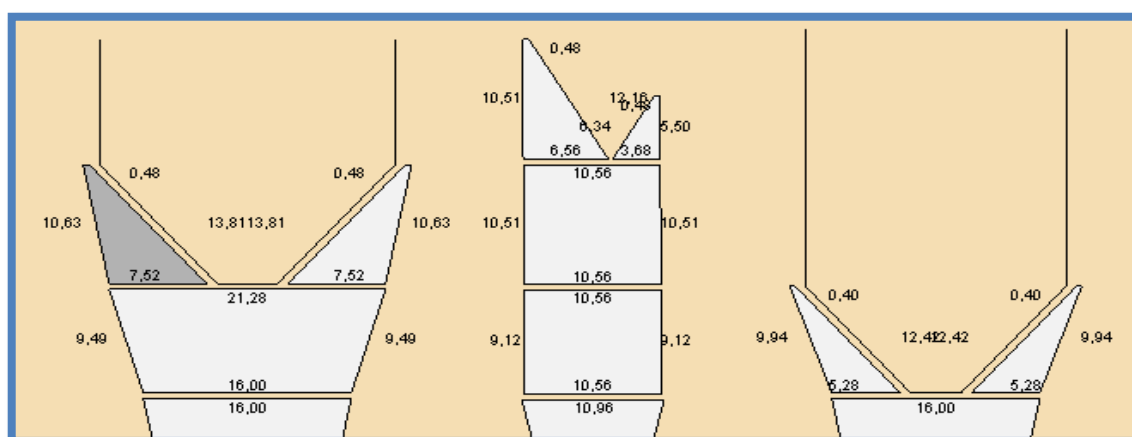


Trawl Larsen



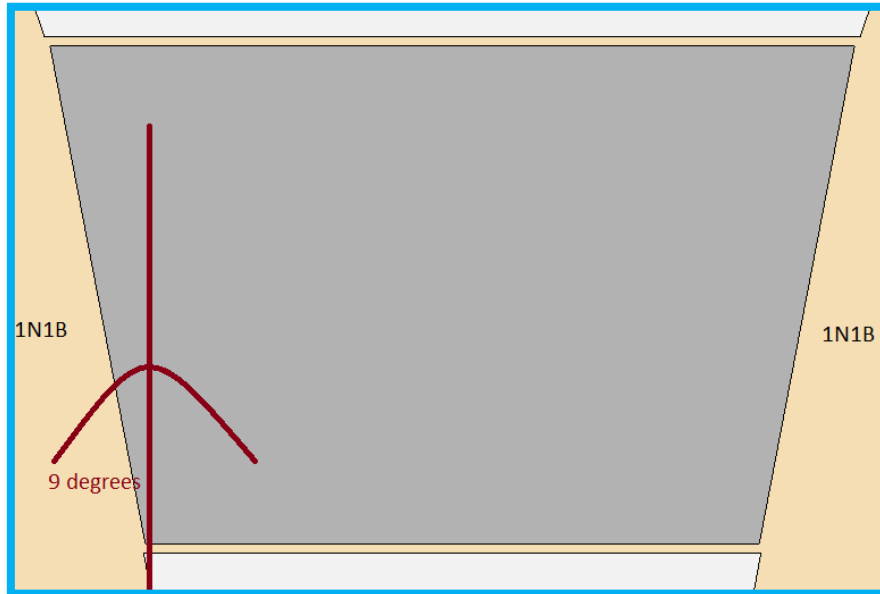
The trawl a type of trawl is used for difficult backgrounds but is less effective in catching bottom fish like hake.

We can print or see, details of the meters by section, mesh size, number of meshes, filter coefficient (U1 and U2), cuts, deployment, angles, areas of the threads, area of the cloths, with a single click we can change the size of the trawl while preserving its characteristics.

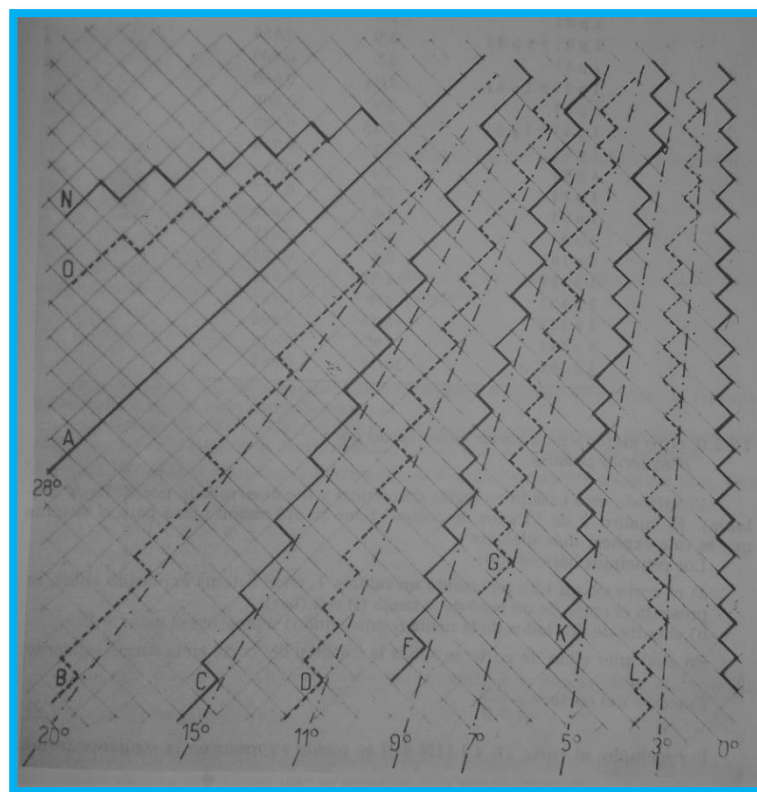


# CUTS

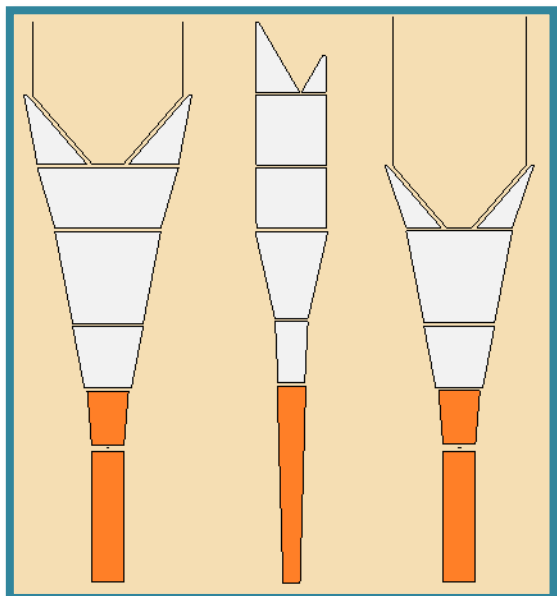
In the following analysis, we evaluated the effects of the cuts and angles of attacks, we can see that the average of the cuts of the trawl are of 1N1B, representing an angle of 9 degrees.



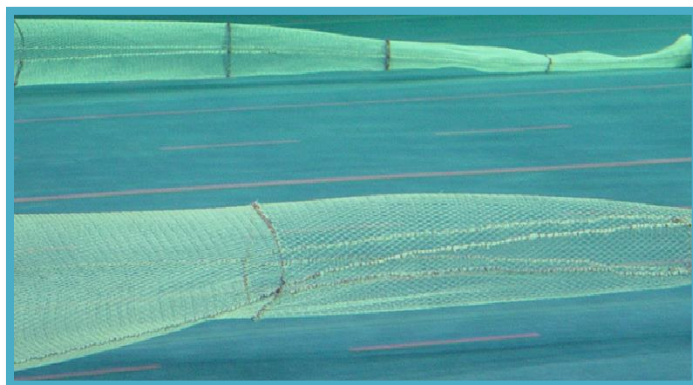
Graphic of FAO, which links the type of cutting angles of attack



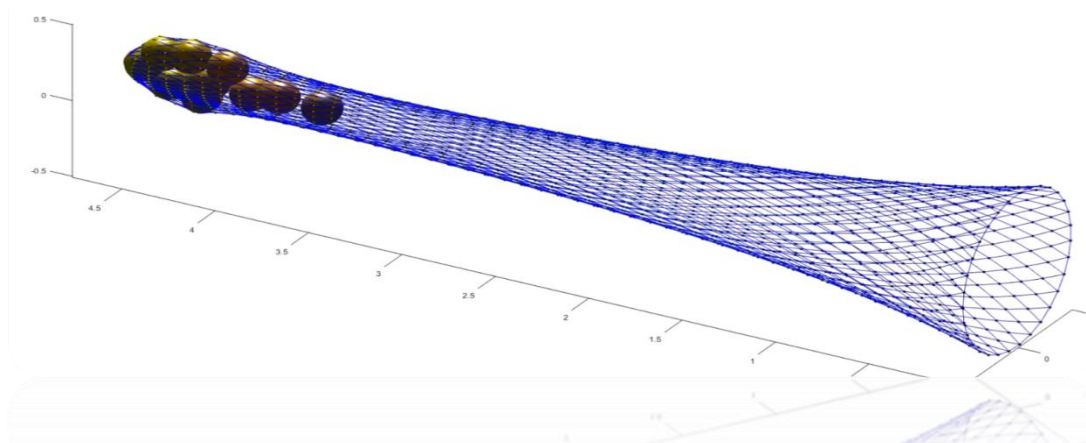
## Codend optimization



The codend of 4 panels, offers the following advantage: allows better filtration, selectivity, less resistance to advance and better quality of the catch caused by less movement of the codend during the trawl.



The following research was carried out in the University of the Republic, Institute of Mechanics of the Fluids and Environmental Engineering of Uruguay.  
Researchers: Phd. Jorge Freiria and Phd. Gabriel Usera (Simulator by CFD and Channel of hydrodynamic tests, Cap. Frank Chalkling link: <https://www.fing.edu.uy/imfia/> - <https://www.fing.edu.uy/node/10412/instalaciones-y-servicios/canal-de-pruebas-navales-y-pesqueras>



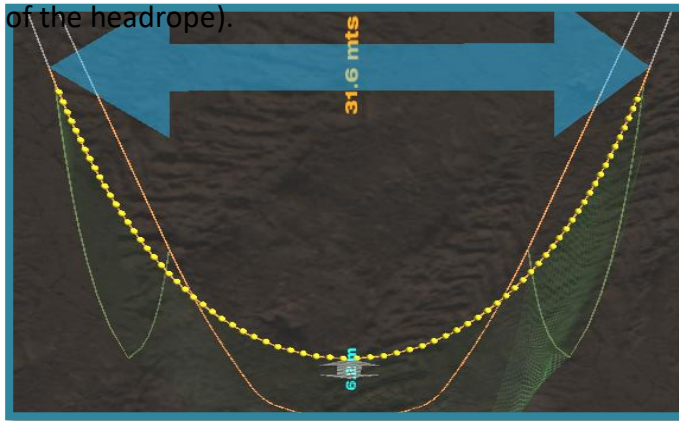
# Headrope and horizontal opening radio

In the following analysis, we evaluated the effects of: trawl spread, headrope length, horizontal opening radius and the coefficients of the meshes  $u_1$ , in the Hunter trawl.

Trawl Hunter

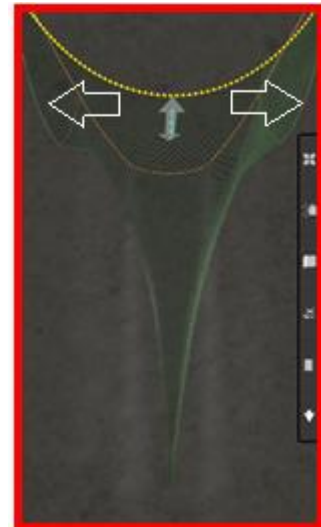
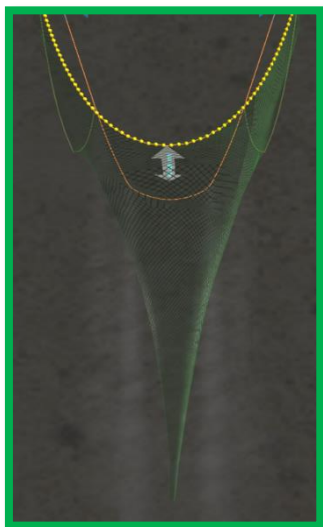
Headrope length = 31,6 meters

Trawl spread for designer = 31,6 meters (currently we see that the trawl reaches optimum values of trawl spread "horizontal", generating excellent filtration of the meshes and stretching of the headrope).



31,6 meters | 55 % horizontal opening radio

45,4 meters | 80 % horizontal opening radio



## Hanging Ratio

The hanging ratio is an important part to achieve a better filtration of the trawl to achieve greater efficiency and profitability. In the following 3D drawing you can see how the hanging ratio affects the horizontal, when modifying during the simulation a change in the area and force of propagation of the doors.

## Depth - warps ratio

For the calculation of the ratio, warps length and depth, we recommend the following table. The data, comes from the experience of different skippers, North Atlantic, South Atlantic, Mediterranean.

Depth	Max.	Min.	Depth	Max.	Min.	Depth	Max.	Min.
0 - 10	25,000	30,000	140-150	3,178	4,624	280 -290	3,089	3,500
10 - 20	25,000	30,000	150-160	3,1666	4,800	290-300	3,086	3,517
20 -30	12,500	15,000	160-170	3,125	4,750	300-310	3,083	3,500
30-40	8,333	10,000	170-180	3,235	4,529	310-320	3,080	3,387
40-50	6,250	7,500	180-190	3,333	4,444	320-330	3,078	3,375
50-60	5,000	9,000	190-200	3,157	4,210	330-340	3,030	3,500
60-70	4,166	7,500	200-210	3,000	4,100	340-350	3,073	3,500
70-80	4,285	7,142	210-220	3,119	4,047	350-360	3,000	3,500
80-90	3,750	6,250	220-230	3,127	3,863	360-370	3,069	3,500
90-100	3,888	5,555	230-240	3,108	3,913	370-380	2,972	3,500
100-110	4,000	6,000	240-250	3,104	3,750	380-500	2,400	3,300
110-120	3,636	5,000	250-260	3,100	3,600	500-700	2,400	3,300
120-130	3,500	5,000	260-270	3,076	4,615	700-1000	2,300	3,200
130-140	3,230	4,615	270-280	3,092	4,407	1000 - 9999	2,000	3,200

Example:

Wire length=Depth 100 \*4 = 400 meters

Wire length=Depth 200 \*3 = 600 meters

Wire length=Depth 600 \*2,4 = 1,440 meters

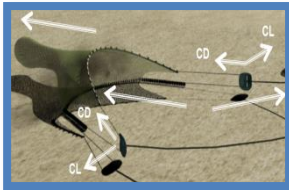
The accuracy of the ratio warps length is calculated in practice and will depend on the doors spread, the door weight, speed, the currents and the expansion force of the doors. We check that the data provided by the staff of the company is correct.

## Twine diameter

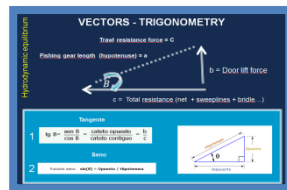
Twine diameter: recently, new products as Dyneema fibre and polyethylene Ultra are reducing gear weight and hence the resistance, helping in reducing fuel consumption or increasing the gear sizes. By means of the software TrawlVision, we can modify the twine diameter, to evaluate the benefits between gear sizes and consumption.

# Experiments through TVS

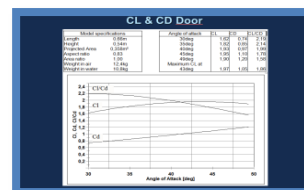
We evaluate the lateral forces and consumptions of the trawl door, vessel and the trawl, modifying: speed, type of trawl net, sweepline length, bridle length, type of seabed, angle of attack of the doors, warps length, angle of attack of the fishing gear.



Vectors of force



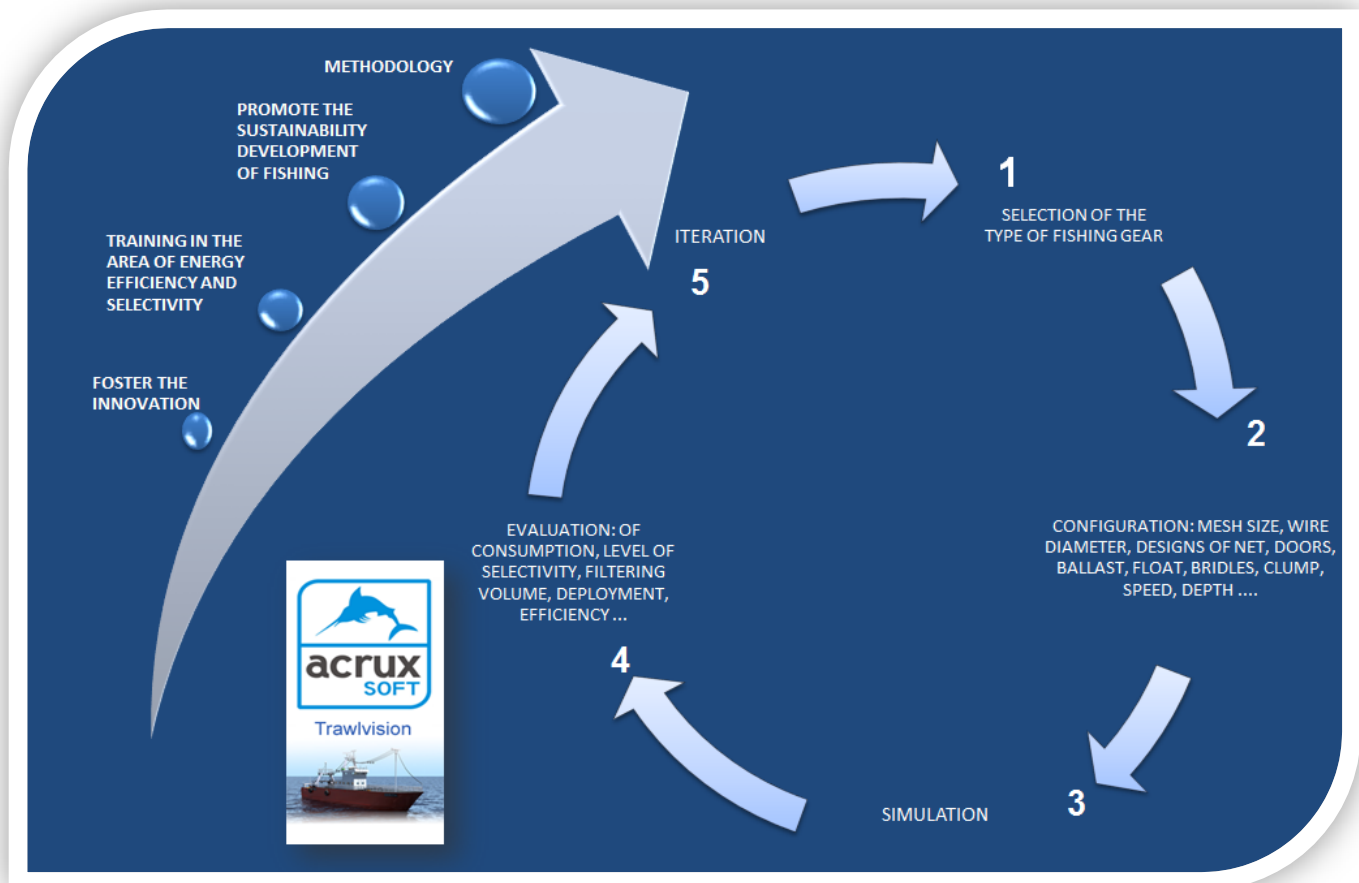
Angles of attack



Cl & CD of doors



Evaluation of doors



# Percentage analysis of the consumption

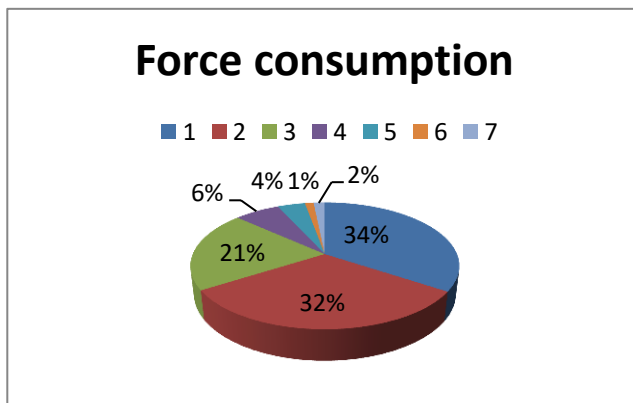
We present a percentage analysis of the consumption of fishing gear, results calculated by the software TrawlVisionSimulator, with the trawl Larsen at a speed of 3.7 and a depth of 600 meters. We can see the importance of trawl consumption

Horizontal aperture	31.6	mts
Trawl resistance	6616.4	Kgf
Filtered Water Volume	277.9	mts3
Trawl angle	13.3	°
Doors lift coefficient	1.54	
Door resistance	6120.5	Kgf
Doors attack angle	40.0	°
Bottom bridle resistance	163.4	Kgf
Sweepelines length	180.0	mts
Doors spread	154.5	mts

Doors drag coefficient	0.98	
Warp resistance	3978.6	Kgf
Ballast resistance	1261.9	Kgf
Top bridle resistance	140.0	Kgf
Total resistance	19355.0	Kgf
Floater's resistance	310.3	Kgf
Door expansion	2450.8	Kgf
Horizontal opening ratio	55.6	%
Speed	3.7	kts.
Warps length	1250.0	mts

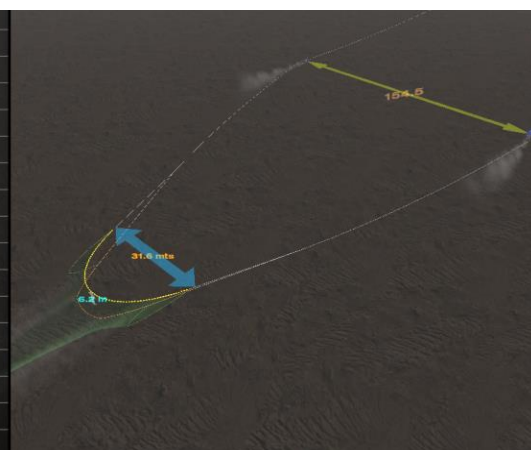
All fishermen know that the catch starts from the door spread, for this reason we consider that if we modify the trawl with better hydrodynamic properties, we increase the sweepelines length and the angles of attack we will achieve a bigger catch with lower fuel consumption

## Fishing gear suggested by AcruXsoft

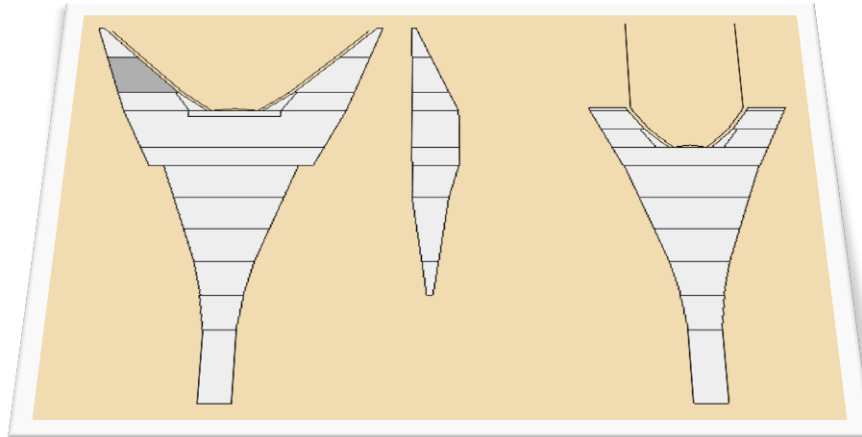


1	Trawl resistance	34 %
2	Doors resistance	32 %
3	Warp resistance	21%
4	Ballast resistance	6 %
5	Sweepelines resistance	4 %
6	Bridle resistance	1 %
7	Floater's resistance	2 %

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Trawl angle	13.3	°
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## Through the use of the software we can compare the performance with other design of trawl



**Carmen**

Total panel area	2655 m <sup>2</sup>
Total twine area	205,1 m <sup>2</sup>
Fishing circle	141,80 m
Trawl attack angle	16,3 °
Trawl height	7,2 m
Body length	41,60 m
Trawl horizontal	36 m
Headrope	61 m
Horizontal opening ratio	58,60 %
Filtered water volume	366,1 m <sup>3</sup>
Speed	3,7 kts.
Trawl resistance	5269 kgf

**Larsen**

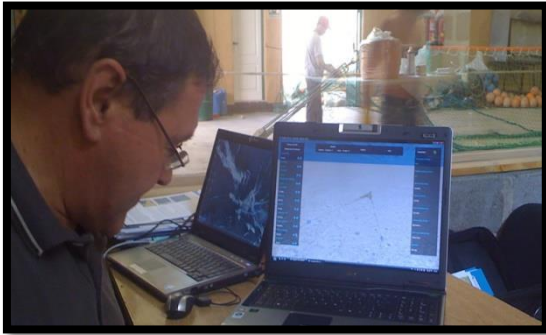
Total panel area	1966,2 m <sup>2</sup>
Total twine area	257 m <sup>2</sup>
Fishing circle (w/o coeff.)	907,8 m
Trawl attack angle	10°
Body length	14,62 m
Trawl height	6,2 m
Trawl horizontal	31,6 m
Headrope	56,8 m
Horizontal opening ratio	56 %
Filtered water volume	278 m <sup>3</sup>
Speed	3,7 Kts.
Trawl resistance	6616 kgf

The results presented were estimated by the software Trawl Vision, during the simulation, the same fishing gear was maintained and we only modified the design of the trawl.

We can visualize the wide advantages that the new trawl presents:

- a) Higher trawling area.
- b) Lower consumption.
- c) Optimal angle of attack in the deployment.

# Working group on trawl | Acruxsoft



# TrawlVision



TrawlVision is an advanced scientific tool that allows very precise measurements in order to predict the behavior of fishing gear. Its use allows scientific and technological progress, accelerating the development of production and helping the formation of new generations of professionals. Briefly, it is a software focused on simulating the fishing gear and creating designs of fishing nets, in order to contribute to savings and promote sustainable fishing.

Its functionality allows to evaluate and predict the behavior of the gear. You will be able to simulate your own designs and analyze trawl behavior with different settings.

Its sophisticated features allow you to use it for both scientific research by universities and industrial development, allowing the fishing industry to achieve excellence in the design and development of industrial fishing.

Its use allows to evaluate all types of fishing nets model, gear such as pelagic, simple system, pair trawling, pelagic pair trawling, beam trawlers, dual trawl with three trailers, dual trawl with two trailers.

Several institutes and universities in countries like France, United Kingdom, Norway, Spain, Greece, Italy, India, USA, Denmark, Mexico, Brazil, Peru, Portugal, Argentina, Chile, New Zealand, South Africa, Uruguay, ...and Uruguay, which use this software have been benefited in the area of research and development of innovative fishing gear designs.

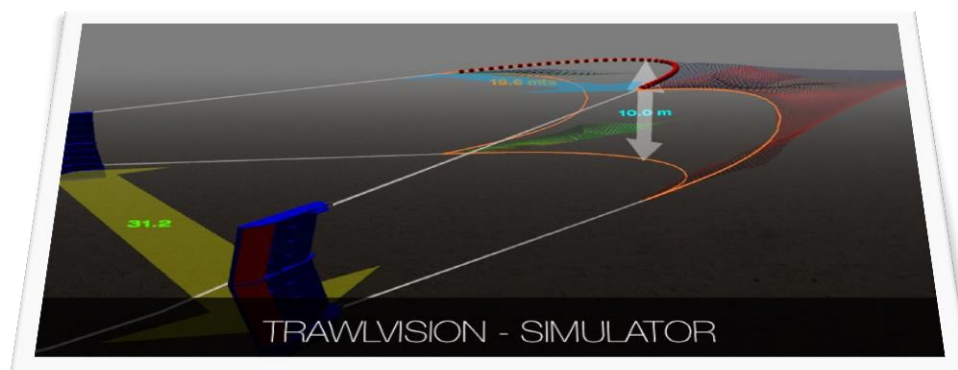
The measurement of multiple physical and behavioral parameters, such as the geometry of the arts, deployment, performance, endurance, rigging, etc. allow

input changes to the design, avoiding costly field testing, reducing corrective actions and minimizing investment in launching new gear.

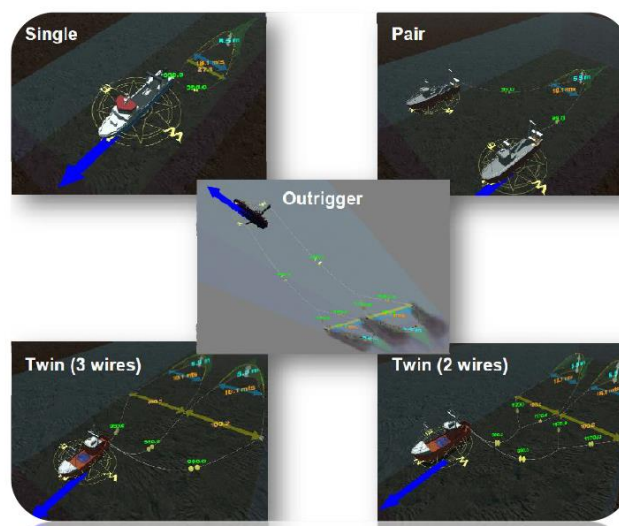
The fishing industry in particular is strongly favored because it has a secure mechanism to ensure optimum performance of fishing gear to develop at little cost, thanks to the facilities through software simulation.

### TRAWL VISION SIMULATOR

In order to perform and to anticipate net settings, the exclusive new "TRAWLVISION", software brings new vision, and knowledge to the skipper. He can adjust the net gear according to the "TRAWLVISION" recommendations and increase catch while reducing fuel consumption.



BOTTOM TRAWLING



## TECHNOLOGY FOR SUSTAINABLE FISHERIES

Information: [info@acruxsoft.com.uy](mailto:info@acruxsoft.com.uy)