INTERNATIONAL COUNCIL FOR
THE EXPLORATION OF THE SEA

C.M. 1989/B:44
Fish Capture Committee

REPORT OF THE STUDY GROUP ON NET DRAWING.

General Secretary
ICES
Palaegade 2 - 4,
DK-1261 COPENHAGEN-K,
Denmark.

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REPORT OF THE STUDY GROUP ON NET DRAWING

Netherlands Institute for Fishery Investigations
P.O. Box 68, 1970 AB IJmuiden
The Netherlands

* General Secretary, ICES, Palaegade 2-4, DK-1261, Copenhagen K, Denmark.

Abstract

The Study Group met in conjunction with the FTFB Group in Ostend, Belgium 1988 and in Dublin, Ireland in 1989. Problems concerning standardization of net drawings in relation to the current development of computer software have been discussed and a list of items, that should be specified is produced and reviewed at the second meeting. Some participants demonstrated developed computer software on available facilities.

Meeting Places:

1988 : Rijksstation voor de Zeevisserij
Ankerstraat 1
Ostend, Belgium

1989 : Geological Survey of Ireland
Beggars Bush, Haddington Road
Dublin 4, Ireland

Dates:

April 21-22, 1988. and April 27-28, 1989.

Terms of reference

According to C.Res. 1987/2:6:

a) to review the draft ISO standard (3169) on net drawing and current practices in net design and manufacture, paying particular attention to computer-aided design conventions;
b) to recommend an international standard for drafting net plans;
c) to report to the Fish Capture Committee at the 1989 Statutory Meeting.

Participants (further information in Appendix A)

1988:		1989:	
Gerard Bais			
Jean Claude Brabant			
Sander Calisal			
Frank Chopin		Frank Chopin	(rapporteur)
Erdmann Dahm			
Bill Dickson		Bill Dickson	
Pierre-Yves Dremiere		Bertil Johansson	
Dick Ferro		Dick Ferro	
Sven Floen		Andy Fisher	
Ronald Fonteyne		Ronald Fonteyne	
Gudmunder Gunnarsson			
Kurt Hansen		Kurt Hansen	
		Victor Henriques	
		Klaus Lange	
Bob van Marlen	(convenor)	Bob van Marlen	(convenor)
Ron Moermans		Harry Stengel	
Gudni Thorsteinsson		Dai Tianyuan	
Bill West		Bill West	
David Wileman	(rapporteur)	David Wileman	

1. INTRODUCTION OF PARTICIPANTS

Each participant explained in a few words his relevant knowledge and experience and present activities at the start of both meetings. Experience varied concerning net design, net mending and computer programming, but a good coverage of all these skills have been available.

2. PROBLEM DEFINITION AND CURRENT STATE OF THE ART

Meeting of April 1988.

It was generally acknowledged, that a standard for net drawing and construction would be beneficial to the scientific community, as international research programmes such as fish stock surveys require equal fishing gear and sampling methods.
Standards are less important in commercial practice where in many cases a particular format has been chosen, but may avoid differences in interpretations of net specifications, leading to different constructions.

A short review of the background and identified problems leading to the establishment of this working group has been given by the convenor (appendix B).

The discussion started with an exploration of problems concerning computer aided net design and net drawing. Some of the encountered problems were presented in written form and handed out during this first meeting.

Mr. Bais presented an application on the RIVO-VAX computer explaining the structure of the programme and the various options to be choosen from a start- and workmenu (appendix C). Details concerning the algorithm of determination of cutting rates were revealed. Samples of output were shown. Upper/lower/side-panels are stored in separate files.

Mr. Brabant presented several problems arising from use of very large meshes in trawls when counting individual meshes and describes the package "PLANCHALUT" developed at IFREMER (appendix D). Technical specifications of net sections, ropes and materials used are put in tables on the drawing. This programme can draw front parts of nets mesh for mesh. Some samples of output were given.

Mr. Ferro explained the "CADNET" package developed in co-operation with the Marine Laboratory of Aberdeen. Problems were encountered with the specification of twine, meshsize definition used and dealing with double braided twine.
The input works along similar lines as the previous programmes using a screen menu. Some samples of output were given.

Mr. West described the use of the "AUTOCAD" package on IBM-XT/AT micro's.
Anything can be drawn, also rig plans etc., but it takes some time to learn to work with the software, that is not specifically aimed at net drawings.

Mr. Wileman and Mr. Hansen explained the package developed at the Danish Institute for Fishing Technology of Hirtshals. The starting point was the "CADNET" software as used in Aberdeen, which was altered and modified to run on a Danish computer.
This programme features material lists and costs specifications and was developed from the net manufacturers point of view. In- and output are screen menu orientated. Drawing specifications make it easy to determine how to cut sections out of sheet netting. F.i. the number of knots in the selvedges are given. It can draw big mesh parts mesh for mesh and strengthening netting around frame lines. Frame rope specifications are not included so far.

Meeting of April 1989.
After a year of reflection on the problem it was still considered necessary to come to some form of standardisation in net drawings, although representatives from the industry expressed doubt for immediate implementation.

3. DEMONSTRATIONS OF SOFTWARE

Meeting of April 1988.
RIVO's programme was demonstrated by Mr. Bais, using a modem connection to the VAX-computer at the Dutch institute in IJmuiden.

Mr. Brabant showed his programme on a IBM XT/AT machine.

Wileman and Hansen demonstrated their software on an IBM-compatible machine.

Meeting of April 1989.
Mr. Fisher demonstrated the use of AUTO-CAD on a laptop personal computer, showing the ease to draw nets mesh for mesh and the possibility to zoom in to details of the construction. His application is still under development..

4. DEVELOPMENT OF A NEW STANDARD FOR DRAWING TRAWL NET PLANS.

From the discussion at both meetings a document to specify a trawl net has been prepared.
A number of items necessary to specify a trawl net were mentioned and formats recommended after extensive discussion during the first meeting and reviewed and extended during the second meeting. The document is included in this report.

SPECIFICATION DOCUMENT OF A TRAWL NET:
Minimum information required on a net drawing.

GENERIC TERMS.

1) Components of a net.

A trawl is regarded as being composed of **panels** of netting, selvedged together along their lateral sides.
Examples of a four-panel and a two-panel trawl are given in Figure 1 below, seen from the front and from aside.

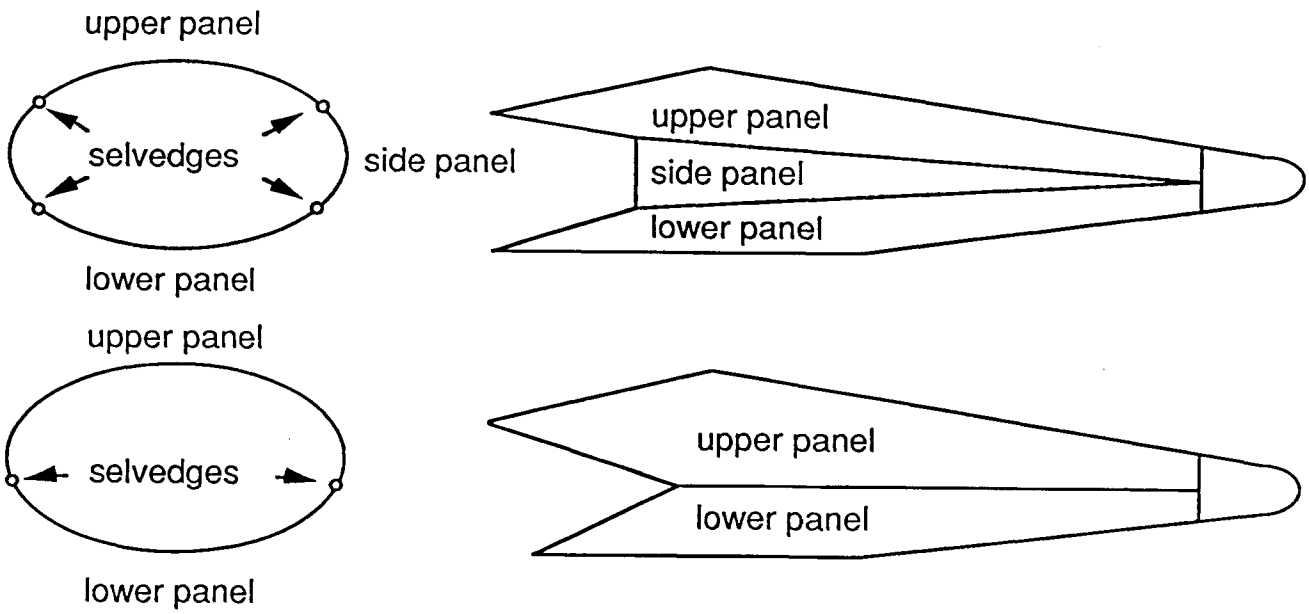


Figure 1 : Basic trawl shapes, four panel and two panel trawls.

Each panel consists of a number of netting **sections**, as depicted in Figure 2.

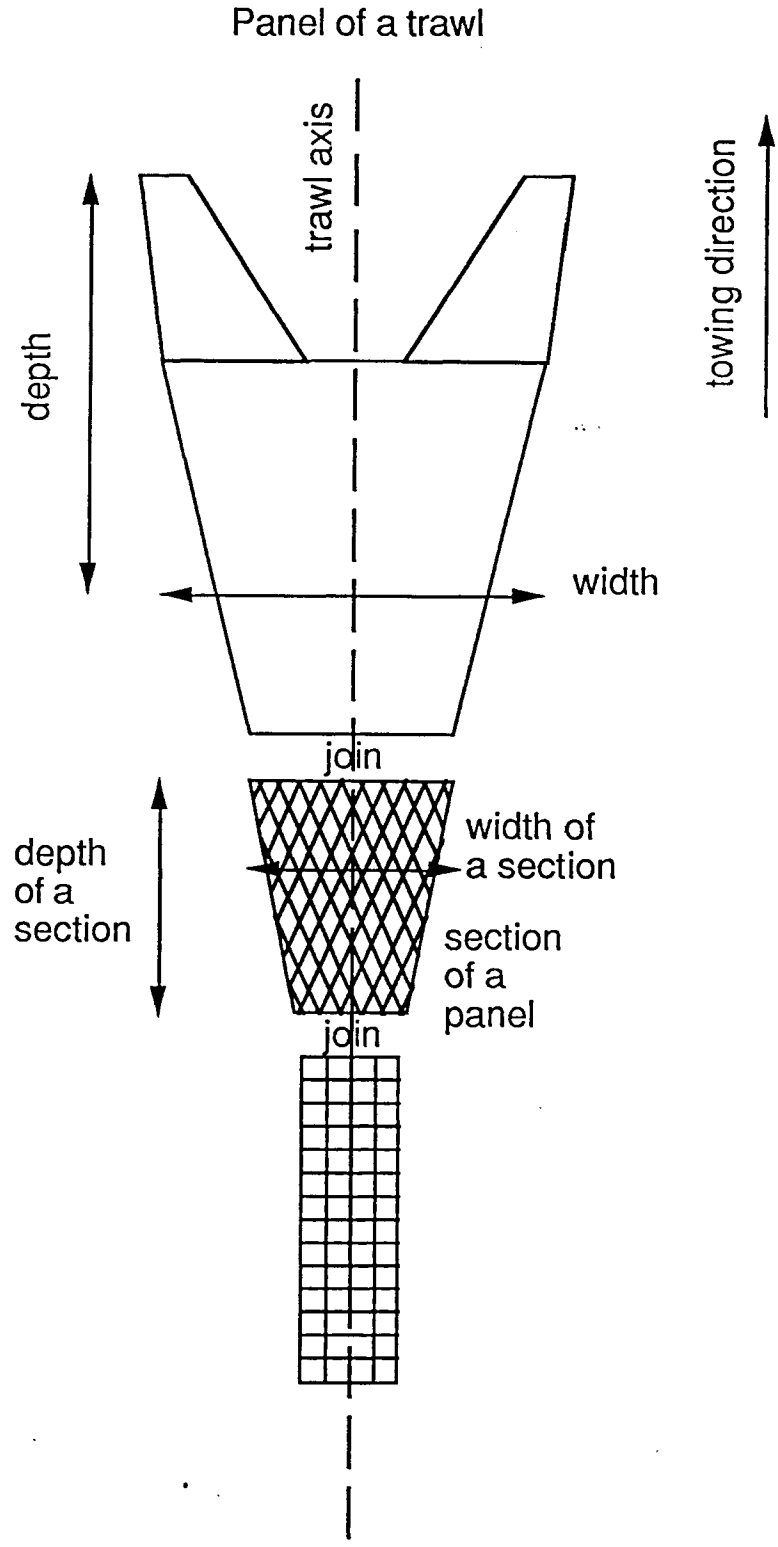


Figure 2 : Orientation of trawl parts.

2) Directions of measurements.

The basic dimensions of a section, **depth** and **width** are respectively parallel and at right angles to the trawl axis in the towing direction.
The **trawl axis** is defined as the line of symmetry along the longest dimension of the trawl, normally coinciding with the towing direction.

3) Designation of a netting section in a trawl

A section is defined as a part of a trawl panel throughout which the mesh size and netting yarn are the same. For simplicity joining rows used to attach pieces of netting together can be included with the section where the join meshsize is the same as the section mesh size. All joins must either be included within sections or specified as separate sections.

Essential information to include in a section :

3.1. The mesh size
3.2. The twine
3.3. The knot construction
3.4. The cut on the lefthand side
3.5. The cut on the righthand side

} as defined in the next Chapter.

3.6. Double yarn: Indicate by symbol **DY**, when netting made of double yarn is used.
3.7. The number of knots in the selvedge on the lefthand side
3.8. The number of knots in the selvedge on the righthand side

In order to avoid ambiguity about the number of knots the following system of counting has been suggested.

Counting the knots:

Example: number of knots = 3

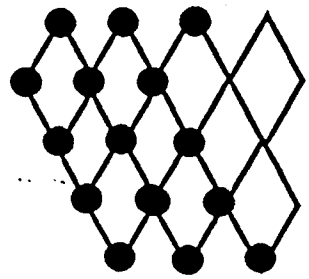


Figure 3 : Counting knots.

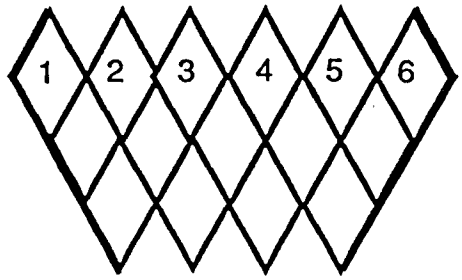
The sides of the netting have been closed up to and including the bars joining the 3rd knots from the netting edge.

3.9. The number of open meshes across the top of the section between the closed selvedges.

3.9.1 Diamond Mesh Sections.
Half mesh legs such as the ones shown in Figure 4a and 4b should not be included in the open mesh width, but designated as "1/2" on the plan as illustrated below.

Counting the meshes:

Example



selvedge

Figure 4a Counting meshes at top. top.

Count is 6

Example

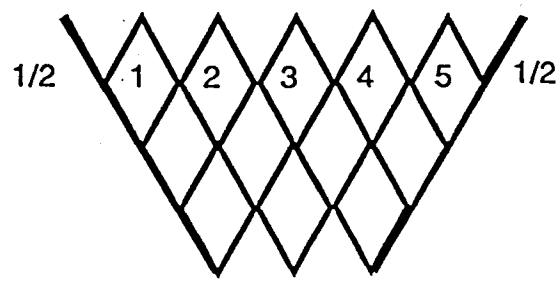


Figure 4b. Counting meshes at top.

Count is 1/2 5 1/2

3.9.2 If the width of the section corresponds to the nettings N-direction and not the T-direction, then this should be specified.

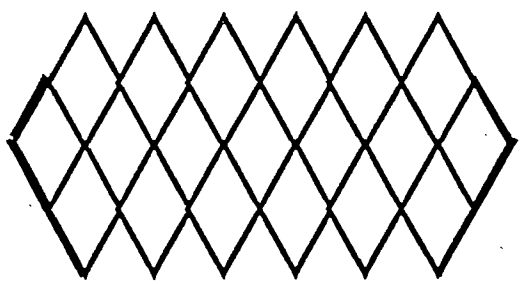
3.9.3 Square Mesh Sections.
In this case the width across the top should be taken as the number of bars between the selvedges. See Figure 5c.

3.9.4 For sections other than square mesh sections where the width of the sections does not correspond to either the nettings N- or T-direction the following action should be taken: The number of open meshes in the N- and T-directions should be obtained following the principles in 3.9-3.11. The orientation of the section in the trawl panel should be specified by indicating the N-direction and which sides attach to other sections.

3.10. The number of open meshes across the bottom of the section and between the selvedges.

Counting the meshes: (Only the open meshes are counted).

Example



Count is 6

Example

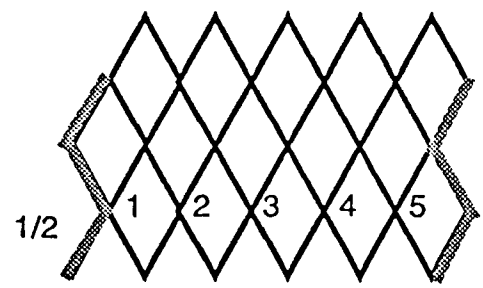


Figure 5a & 5b : Counting meshes at bottom.

Count is 1/2 5

3.11 Depth of a section.

3.11.1 Diamond mesh sections.
The depth should be specified as the number of meshes between the upper and the lower edges of the sections.

3.11.2 Square mesh sections.(See Figure 5c)
In this case the depth of a section should be specified as the number of bars between the upper and lower edges of the section.
Additionally the full extended length of the section may be given in metres.

3.11.3 Hexagonal meshes.(See Figure 5d)
Difficulties may arise when counting hexagonal meshes. It seems best to count the individual bars. The convention of drawing mesh for mesh at larger meshsizes than 80cm will overcome this problem in most cases, as hexagonal meshes are mostly used in the front part of a trawl.

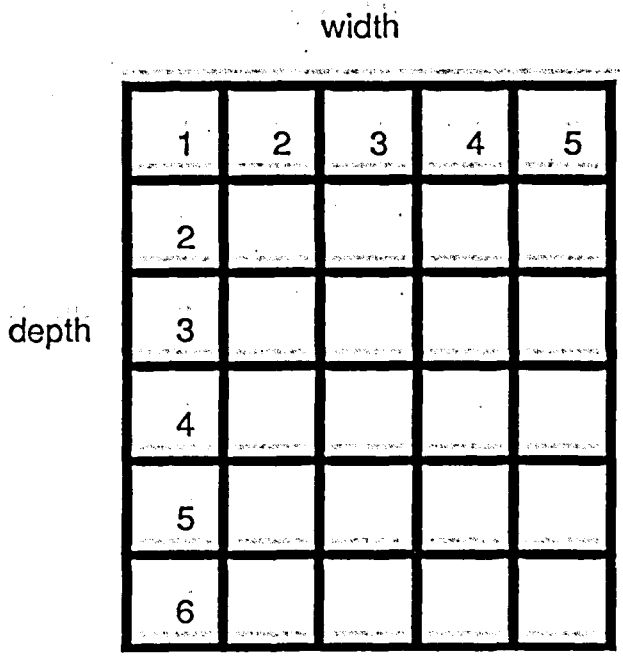


Figure 5c : Counting Square Meshes.

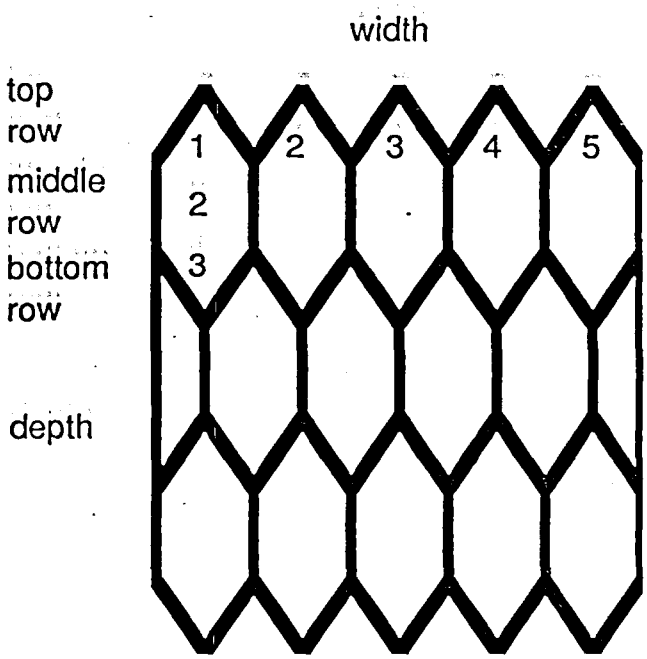


Figure 5d : Complications when counting hexagonal meshes.

3.12 Joining row.
A joining row is a handbraided row of netting used to join two sections of netting together. It should be specified as follows:

3.12.1 Material used. (See section 1)
3.12.2 Type of join. (refer to ISO 3660)
3.12.3 Mesh size (defined in section 5).
3.12.4 If the join consists of more than one row, the number of rows should be specified.
3.12.5 The joining row can be included in the net section and if so, then the position should be specified as top or bottom of that section.

Possible constructions are given in Figure 6.

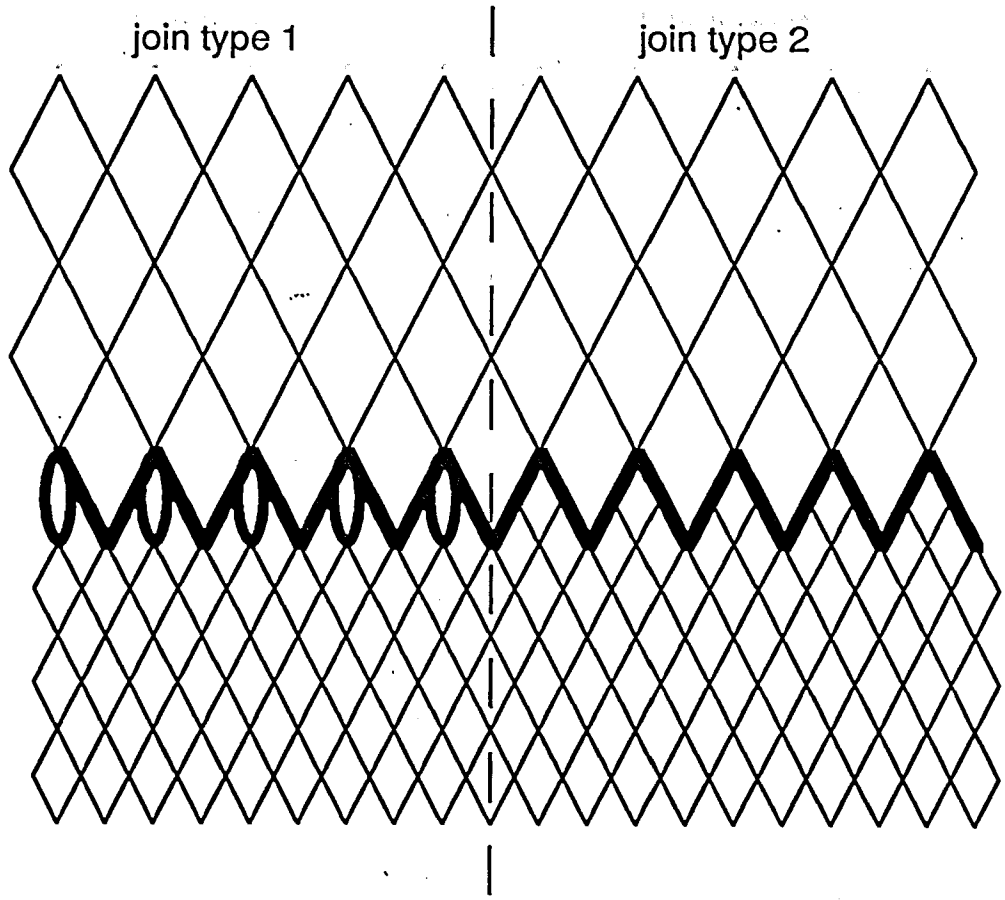


Figure 6 : Different ways to join two pieces of netting together.

DEFINITION OF SPECIFIC TERMS.

4) Netting yarn

Essential:

4.1 A measure of linear density. Rtex to be used unless Rtex >30000 when the ISO-standard for ropes of kg/100 m should be used instead.

4.2 Material composition
Materials are indicated by abbreviations, which are based on terms in common international use (See Draft International Standard ISO 3169) and should include high density and blended twines.
Examples are : PA, PES, PE.

4.3 Designation of netting yarns.
The structural characterization of the netting yarn (eg. medium load, soft laid, braided, with or without core) should be specified, refer to ISO 858.

4.4 Special treatment or finished, where these have been applied to impart unique physical properties and/or appearance, including colouring shall be identified.

Optional: Diameter and any other number system eg. denier.

5) Mesh size

Essential: Full extended mesh length (as per ISO 1107 3.5.2.) between knot centres in the N direction.
For special cases such as hexagonal meshes a more detailed description should be given.
Mesh size should be expressed in mm. Definitions are depicted in Figure 7 below.

Optional: Inside mesh length (opening of mesh as defined ISO 1107 3.5.3.).
This measure is taken for cod-ends in most cases.

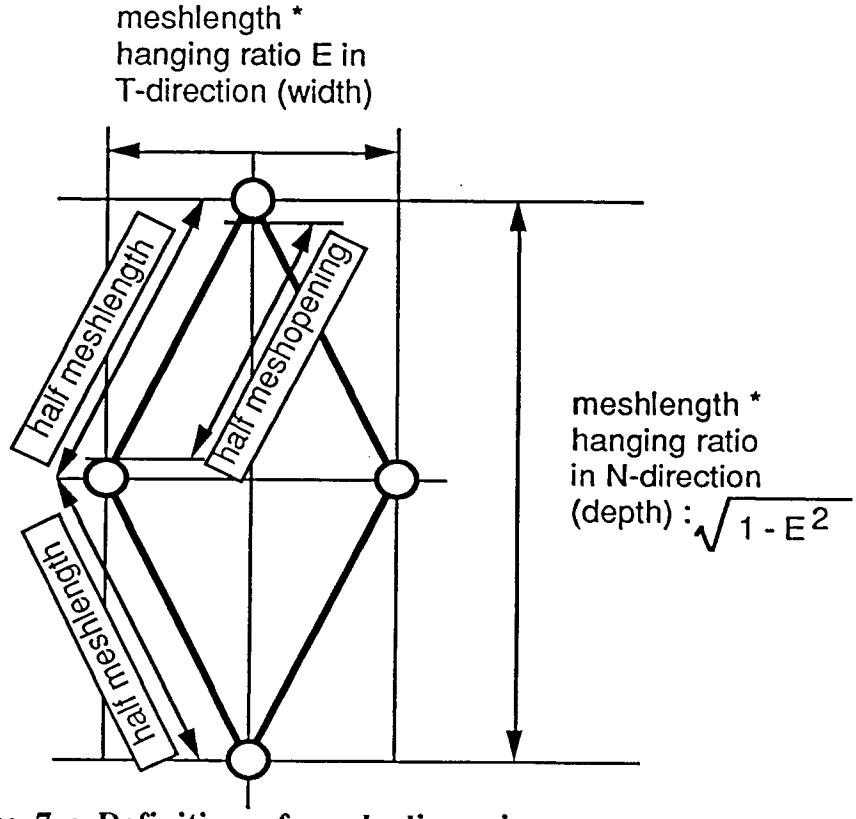


Figure 7 : Definition of mesh dimensions.

5) Knot construction
Assumed to be single weavers knot, refer to ISO 1530 - 1973 (E)..
Knotless or other knot constructions should be named.

6) Simple cutting rates/tapers (constant cutting angle)
Essential: Cut as defined by ISO 1532 e.g. 1T2B, 1N2B.
Optional: Table listing equivalent descriptions in other systems.

7) Mixed cutting rates (constant cutting sequence)
Express in the form e.g. 1N2B + 1N3B
2 x 1N2B + 1N3B
and named in sequential order they are cut.

8) Mixed cutting rates (varying cutting angle)
Express in the form e.g.

1 x 1T1B	or	20 x 1N2B
2 x 1T2B		4 x 1N3B
2 x 1T4B	or	20 x 1N2B
AB		AN

(from the widest end of the section towards the narrowest without a residual)

Where a series of different cuts are made in a netting section by varying the cutting rate, they should be expressed in the form as shown in Figure 8a and 8b.

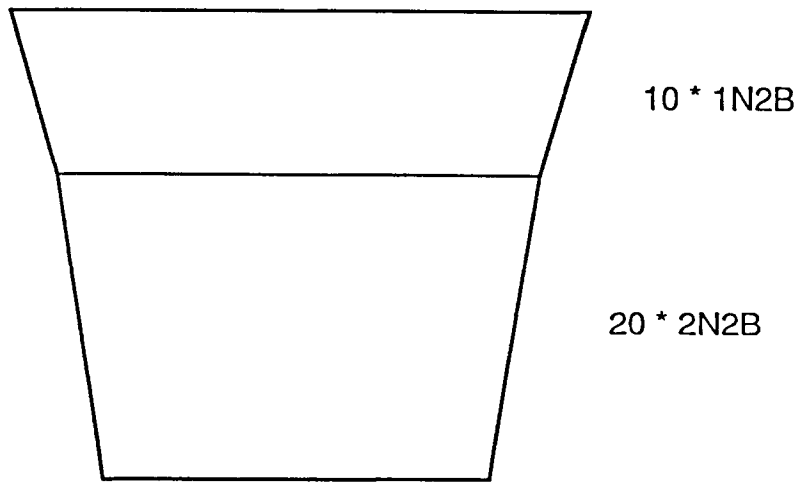


Figure 8a : Mixed cutting rates with varying angle.

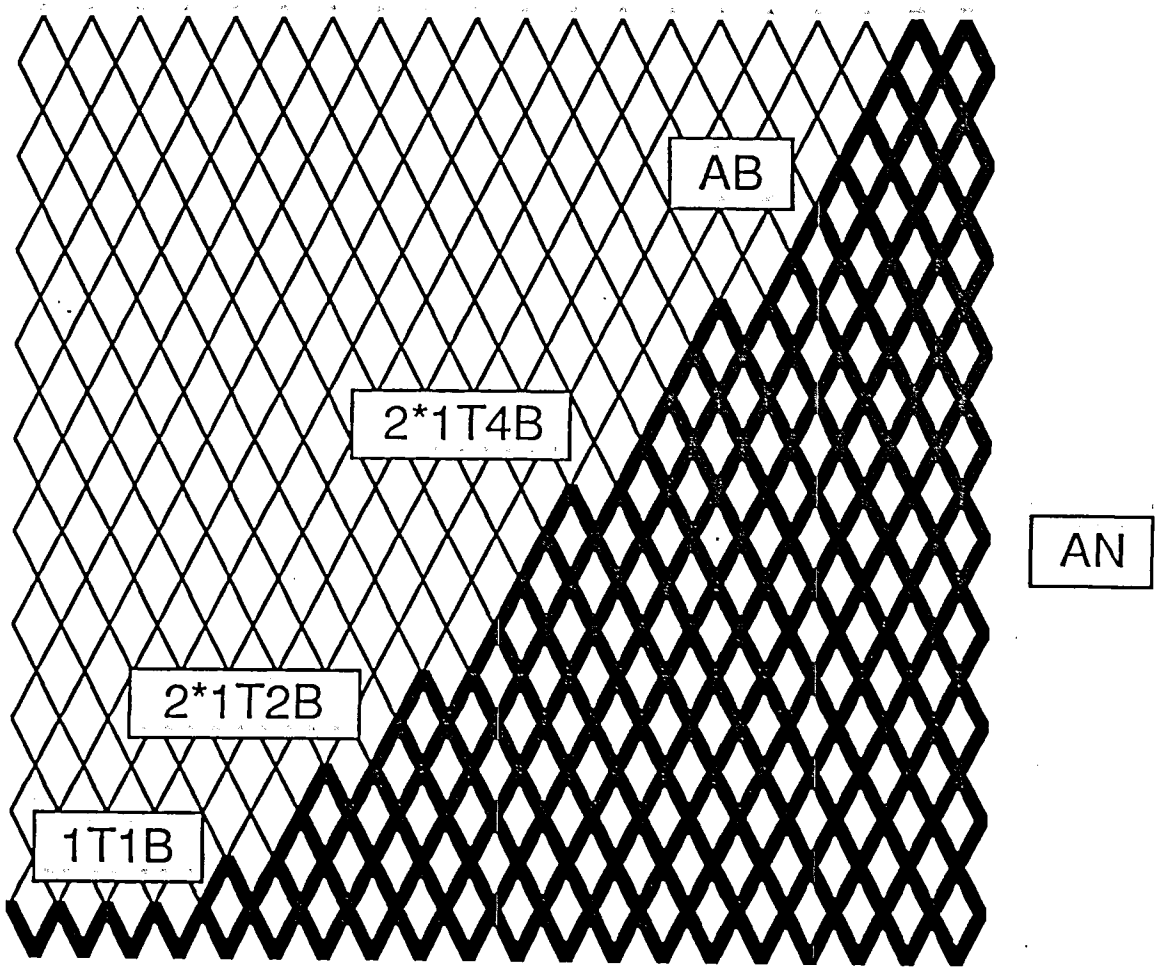


Figure 8b : Detailed layout of cuts with varying cutting angle in a wing section.

LAY-OUT OF THE DRAWING.

10) Drawing of a netting section

If the meshsize >800 mm, than the individual meshes should be drawn. Otherwise a line drawing is given describing the width at the top and bottom and the cutting angles at the sides. Only the open meshes between the selvedges are included. The widths are calculated as if all meshes are open by half their full extended length. The depth of the section (length) is calculated as if all the meshes were closed (full extended length). Each net section shall be drawn to scale at hanging ratio E = 0.5 in the T-direction (width) and extended measure in the N-direction (depth), where

$$E = \frac{\text{Distance between adjacent knots in the T-direction}}{\text{Full extended mesh length}}$$

Alternatively, the net sections may be drawn to scale at any hanging coefficient E in the T-direction (width) and with the corresponding hanging coefficient in the N-direction (depth) according to the formula: $\sqrt{1 - E^2}$ This hanging coefficient must be specified.

11) Drawing of a netting panel

Sections are drawn such that the centre of the bottom of one section coincides with the centre of the top of the following section. Pairs of wings are drawn such that their separation corresponds to the scaled width of the bosom meshes of the section to which they are attached.

Examples:

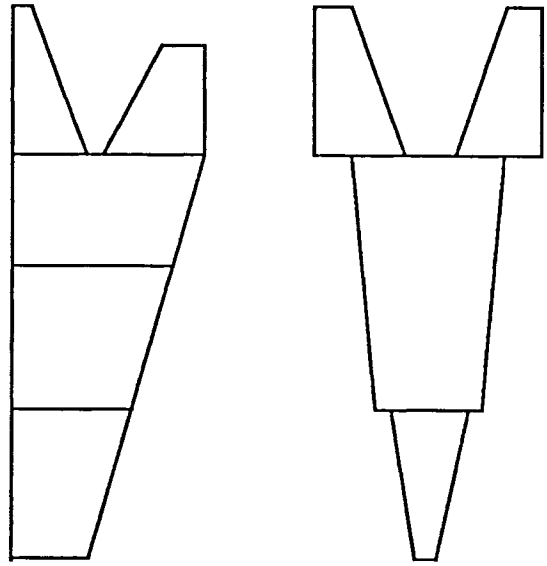


Figure 9 : Drawing of net sections and panels

12) Identification of different panels

The following symbols can be used for the upper, starboard side, port side and lower panels. Oblique panels can be named likewise, for instance in a three panel trawl.The convention used here is looking from the inside of the trawl in the direction of tow.
Otherwise all panels should be named.

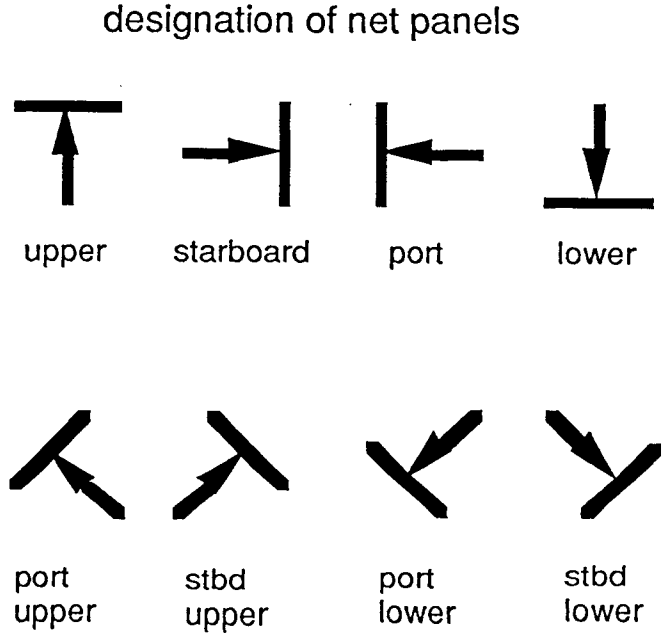


Figure 10 : Designation of netting panels.

13) Layout of different panels
No convention is adopted due to the enormous variation in trawls designs. It is important that drawings should contain all relevant information yet in such a way that the basic net shape and construction can also be seen.

14) Selvedging together of panels and distribution of slack
Refer to ISO 3660
Not all methods of selvedging are shown in this ISO standard. Where this is the case, the method should be accompanied with an illustration.

Example:

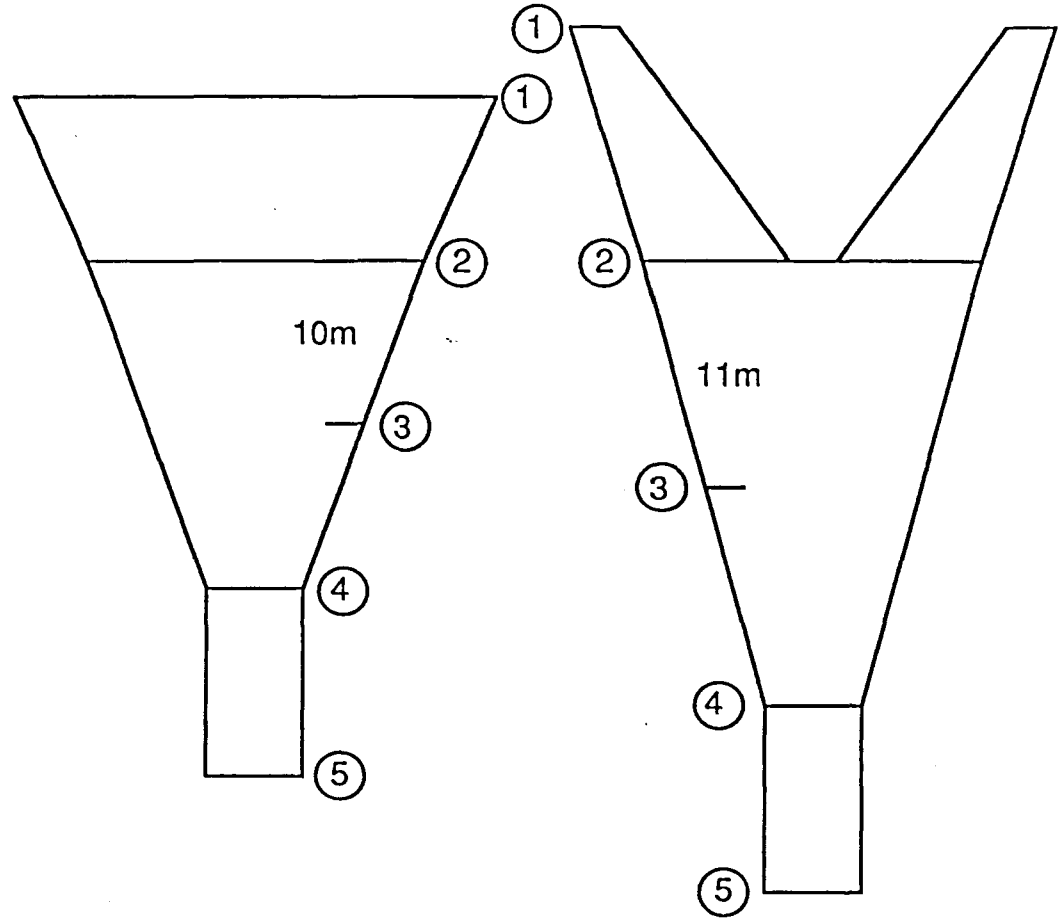


Figure 11 : Connecting net panels.

A system of number or letter codes should be used to show at which points the panels should be selvedged together. The forward and aft end of the selvedge must be shown. If there is slack between one panel and another and the slack is not constant along the whole selvedge length it must be split up into lengths where the slack is constant. If intermediate points do no coincide with the top of sections then the length in metres or meshes to the nearest top of section must be shown. The amount of slack should be specified in stretched length of nettings, i.e. 10 metres to 11 metres as given in Figure 11 above.

15) Framing ropes

Essential information:

15.1. Linear density in kg 1100 m (as.per ISO);
15.2. Material composition
15.3. Construction
15.4. Conditioning : Any conditioning of frame ropes should be specified e.g. pre-tensioning before mounting.

16) Rope lengths

The total length of each rope should be shown and in addition that part to which each individual netting section is attached. If the cutting angle for the side of the netting section to be attached is not constant or the ratio of slack/stretch is not constant along the rope length then further detailed specification is essential. For netting sections with T-cuts the distance between each T-mesh should be specified.

Example:

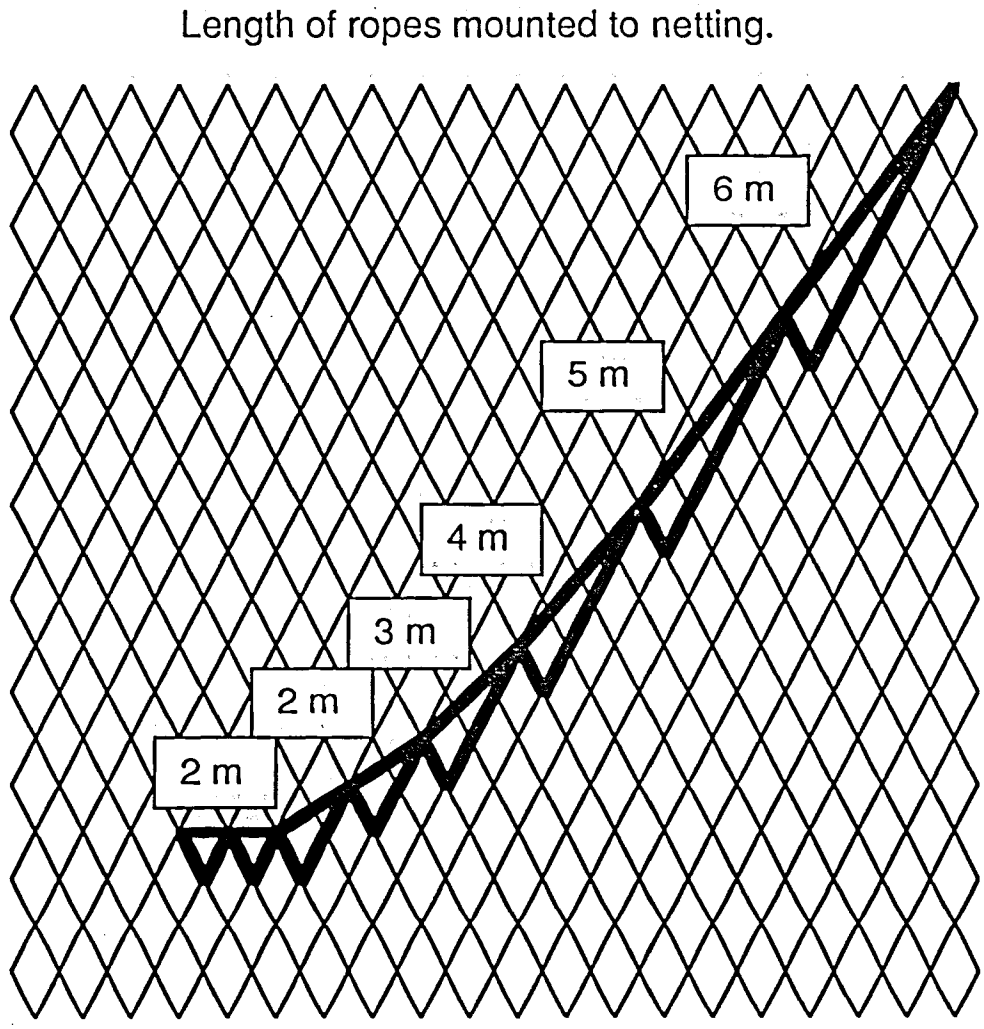


Figure 13 : Length of ropes along netting.

5. RECOMMENDATIONS

The Study Group has written a document defining the minimum information needed to specify a trawl net, comprising the netting and attached mounting ropes. It is recommended, that the Fishing Technology and Fish Behaviour Working Group consider the need to extend this document to include specification of wire rigging and doors ahead of the net which can have a significant effect on fishing efficiency. It is also recommended, that the FTFB Working Group with reference to the Demersal Fish Committee consider the need to prepare new manuals for each intenational survey gear for use in checking that nets conform to the given standard.

Members of the Study Group will use the specification document to prepare net drawings of the ICES standard young fish sampling trawl, denoted GOV-trawl, during the next twelve months and a paper summarising the experiences and degree of success will be presented to the FTFB Working Group meeting to be held in 1990.

-.-.-.-

vM/vM: 10-May-1989
IJmuiden.

APPENDIX A

name	country	institute/company	telephone	telex	fax
Bais, G.	Netherlands	Rijks Instituut voor Visserij Onderzoek (RIVO) Postbus 68, 1970 AB IJMUIDEN, THE NETHERLANDS	(31)-2550-64646 (31)-2550-64791	71044 rivo nl	(31)-2550-64644
Brabant, J.C.	France	L'institut Francais de Recherche pour l'Exploitation de la Mer (IFREMER) 150 Quai Gambetta B.P. 699, 62321 BOULOGNE-SUR-MER, Cedex, FRANCE	(33)-21316148	131565 f	(33)-21834721
Calisal, S.M.	Canada	Department of Mechanical Engineering University of British Columbia 2075 Westbrook Mall VANCOUVER B.C., CANADA V6T 1W5	(1)-604-228-2836		(1)-604-228-7006
Chopin, F.S.	Canada	Marine Institute Newfoundland and Labrador Institute of Fisheries and Marine Technology P.O. Box 4920 St. JOHN'S, Nfld. A1C 5R3, CANADA	(1)-709-778-0466	016-4721	(1)-709-778-0346
Dahm, E.	Germany, F.R.	Institut für Fangtechnik Palmaille 9 2000 HAMBURG 50, GERMANY F.R.	(49)-40-38905/189 (49)-40-38905/186	215716 bfafi d	
Dai, T.	China	Fujian Fisheries Institute Xiamen City PEOPLES REPUBLIC OF CHINA			
	Netherlands (temporary)	Rijks Instituut voor Visserij Onderzoek (RIVO) Postbus 68, 1970 AB IJMUIDEN, THE NETHERLANDS	(31)-2550-64780	71044 rivo nl	(31)-2550-64644
Dremiere, P.Y.	France	L'institut Francais de Recherche pour l'Exploitation de la Mer (IFREMER) 1 Rue Jean Vilar 34200 SETE, FRANCE	(33)-67-747767	490503	
Dickson, W.	Norway	Fiskeriteknologisk Forskningsinstitutt (FTFI) C. Sundtsgt. 64, P.O. Box 1964, N-5011 BERGEN, NORWAY	(47)-5-323770		(47)-5-315852
Ferro, R.S.T.	Scotland (U.K.)	DAFS Marine Laboratory P.O. Box 101 Victoria Road Torry, ABERDEEN AB9 8D8, SCOTLAND	(44)-224-876544	73587 marlab g	(44)-224-879156
Fisher, A.	Canada	Marine Institute Newfoundland and Labrador Institute of Fisheries and Marine Technology P.O. Box 4920 St. JOHN'S, Nfld. A1C 5R3, CANADA	(1)-709-778-0466	016-4721	(1)-709-778-0346
Floen, S.	Norway	Fiskeriteknologisk Forskningsinstitutt (FTFI) C. Sundtsgt. 64, P.O. Box 1964, N-5011 BERGEN, NORWAY	(47)-5-323770		(47)-5-315852
Fonteyne, R.	Belgium	Rijksstation voor Zeevisserij Ankerstraat 1 B-8400 OOSTENDE, BELGIE	(32)-320805 (32)-320388		
Gunnarsson, G.	Iceland	Hampidjan, net manufacturers Stakkholt 2-4 P.O. Box 5136 125 REYKJAVIK, ICELAND	(354)-1-28100	2274 hampis	
Hansen, K.	Danmark	Dansk Fiskeriteknologisk Institut Sydvestkajen 1 DK-9850 HIRSTHALS, DENMARK	(45)-8-944300	67757 fti dkv	(45)-8-944833

name	country	institute/company	telephone	telex	fax
Henriques, V.	Portugal	Instituto Nacional de Investigaçao das Pescas Dep. Tecnologia da Pesca Av. Brasilia, 1400 LISBOA, PORTUGAL	(351)-610814 (351)-616361	15857 inip p	
Johansson, B.	Sweden	National Swedish Board of Fisheries Office for commercial fisheries and aquaculture P.O. Box 2565 S-40317 GOTEBORG, SWEDEN	(46)-31-630300	27108 natfish s	
Lange, K.	Germany, F.R.	Institut für Fangtechnik Palmaille 9 2000 HAMBURG 50, GERMANY F.R.	(49)-40-38905/189 (49)-40-38905/186	215716 bfafi d	
Van Marlen, B.	Netherlands	Rijks Instituut voor Visserij Onderzoek (RIVO) Postbus 68, 1970 AB IJMUIDEN, THE NETHERLANDS	(31)-2550-64780	71044 rivo nl	(31)-2550-64644
Moermans, R.	Belgium	Rijksstation voor Zeevisserij Ankerstraat 1 B-8400 OOSTENDE, BELGIE	(32)-320805 (32)-320388		
Stengel, H.	German Democratic Republic	Wilhelm Pieck Universität Rostock Sektion Schiffstechnik Albert Einsteinstraße 2 Rostock 6, 2500, GERMAN DEMOCRATIC REPUBLIC	(37)- 4 53 20		
Thorsteinsson, G.	Iceland	Marine Research Institute Skulagata 4 P.O.Box 1390, 121 REYKJAVIK, ICELAND	(354)-1-20240		
West, Ch. W.	U.S.A.	Nor'Eastern Trawl Systems, Inc. 7910 N.E. Day Road West, BAINBRIDGE ISLAND, WA 98110, U.S.A.	(1)-206-842-5623		(1)-206-842-6832
Wileman, D.A.	Denmark	Dansk Fiskeriteknologisk Institut Nordsøcentret P.O. Box 93 DK-9850 HIRSTHALS, DENMARK	(45)-8-944300	67757 fti dkv	(45)-8-944833

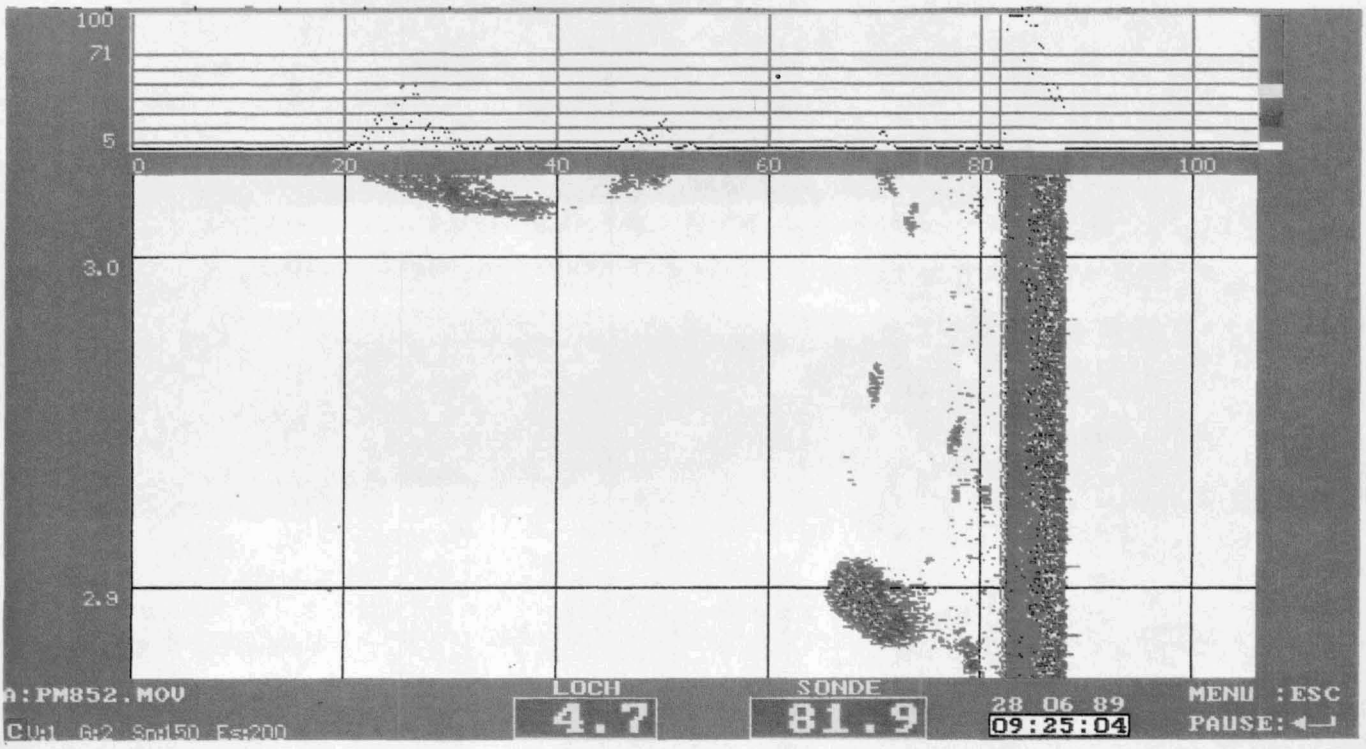


Fig. 2 : Hard copy of the screen in oscilloscope mode

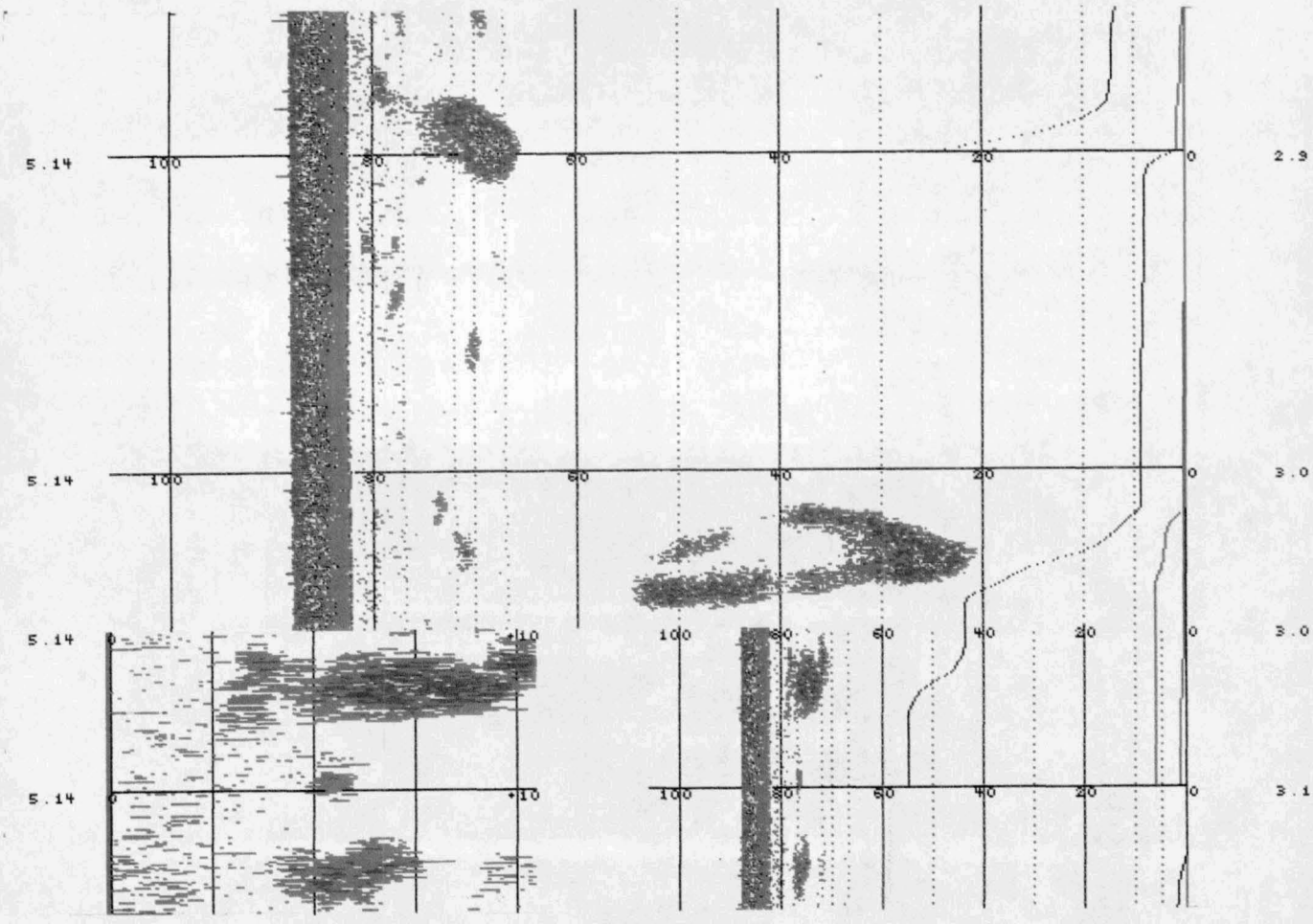


Fig. 3 : Color reprint in normal (up) and bottom expansion (low) modes.
Echo-integration layers and deviations are also displayed.

**** METEVAC R.V. THALASSA **** (06 28 89) ← Survey vessel and date

echo-integration in western channel ← Comments

Sondeur : EK 400 Transd. : 13°*8° 10 log Psi :-16.9 dB SL+VR :131.0 dB Gain-S : -10 dB Dur.Imp : 1.0 ms

Frequ. : 38.0kHz PmaxTVG :581.0 m Loi TVG : 20 log R Cte S :-48.3 dB Qd * 5.00 ← Echo-sounder settings

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	F1	F2	F3	F4	Total
	5	15	25	35	45	55	65	75	85	95	105	1.0	2	4	6	8	← Surface and bottom layers
L:	0.2 M	P: 57.1 m	V: 12.2 N	NE: 0	Gn:2 (2)	Sn: 100	Si: 0	16:41:25	← Distance, depth, vessel speed, nb soundins, INES gain, thresholds, hour
Qd:	51	2	1	11	16	0	49	4	1	1	130	← Deviation
Rv:	-75.2	-89.5	-92.1	-81.9	-80.1	-86.3	-65.3	-79.3	-84.0	-84.3	-78.2	← Volume backscattering strength
N:	3849	227	166	1354	2090	13	216	361	302	227	7915	← nb samplings above thresholds
L:	0.7 M	P: 58.8 m	V: 12.1 N	NE: 307	Gn:2 (2)	Sn: 100	Si: 0	16:43:54
Qd:	30	24	3	6	10	2	42	1	0	1	117
Rv:	-77.5	-78.5	-87.8	-84.7	-82.1	-84.6	-66.0	-84.0	-88.5	-84.5	-78.9
N:	4213	2835	432	629	1525	224	178	185	101	207	10036
L:	1.2 M	P: 59.3 m	V: 10.8 N	NE: 302	Gn:2 (2)	Sn: 100	Si: 0	16:46:19
Qd:	115	57	11	90	24	1	59	1	2	3	357
Rv:	-71.6	-74.7	-81.9	-72.7	-78.5	-84.5	-64.6	-84.6	-82.4	-80.0	-74.0
N:	7721	6820	1026	6976	3190	217	127	205	221	585	26077
L:	1.7 M	P: 58.6 m	V: 10.8 N	NE: 345	Gn:2 (2)	Sn: 100	Si: 0	16:49:04
Qd:	21	15	7	19	7	2	1678	190	15	49	65	102	1953
Rv:	-79.1	-80.5	-83.7	-79.4	-84.1	-89.3	-59.1	-65.9	-70.5	-68.4	-67.1	-65.2	-67.9
N:	3033	2448	1424	2336	1235	441	4934	3418	771	1590	1378	786	20040
L:	2.2 M	P: 82.2 m	V: 11.9 N	NE: 334	Gn:2 (2)	Sn: 100	Si: 205	16:51:47
Qd:	0	257	701	193	301	0	319	263	8	28	84	256	2042
Rv:	-97.2	-68.2	-63.8	-69.4	-67.5	*	-67.2	-65.3	-73.2	-70.8	-66.0	-61.2	-68.0
N:	20	662	2843	1671	1900	2	1767	2749	381	884	1100	1106	11995
L:	2.7 M	P: 82.3 m	V: 13.5 N	NE: 276	Gn:2 (2)	Sn: 100	Si: 205	16:53:59

Fig. 4 : Printed list of echo-integrated data