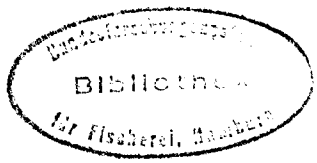
INTERNATIONAL COUNCIL FOR THE EXPLORATION OF THE SEA

ICES C.M. 1991/B:28
Fish Capture Committee
Ref. Demersal Fish, Pelagic Fish
and Baltic Fish Committees



REPORT OF THE WORKING GROUP ON FISHING TECHNOLOGY AND FISH BEHAVIOUR (FTFB)

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1. INTRODUCTION

Convener:	B. van Marlen, Netherlands Institute of Fisheries Research, IJmuiden, The Netherlands
Rapporteur:	John W. Valdemarsen, Institute of Marine Research, Bergen, Norway
Meeting place:	Ancona, Italy
Dates:	22–24 April, 1991

In accordance with ICES Resolution C. Res. 1990/2:8, the Working Group met in Ancona, 23–24 April 1991, convened by Mr. B. van Marlen, to:

a) Evaluate the sources of inconsistent performance in existing survey trawls, in particular the GOV net, and improve performance monitoring methods for survey trawls;

b) Provide a critical review of the application of net construction, in particular square mesh, aimed at improving the selectivity of these nets, and report on this to ACFM and the Baltic, Demersal, and Pelagic Fish Committees;

c) Consider in particular the latest developments in fishing gear and vessel engineering, with special emphasis on the survival of fish and shellfish that come into contact with fishing gear, but are not captured;

d) Coordinate further research on gear selectivity questions in ICES Member Countries.

In accordance with ICES Resolution C. Res. 1990/2:9, a joint session of this Working Group and the Working Group on Fisheries Acoustic Science and Technology, chaired by Dr. P.A.M. Stewart, was held on 25 April 1991, to discuss matters of mutual interest, in particular fish avoidance problems in surveys.

2. PARTICIPANTS TO THE FTFB AND FAST WORKING GROUPS

Country	Name
Argentina	José A. Perez Comas
Belgium	Ronald Fonteyne Hans Polet
Canada	Pingguo, He Peter Koeller Richard Crawford David Tait Yvan Simard Eric W. Way Stephen Walsh Dan Miller Frank Chopin

Denmark	Nikolai Poulsen Poul Degnbol Bo Lundgren Karl-Johan Staehr Klaus Lehmann
England	John Tumilty Catherine Mitchell
Faroe Islands	Bjarti Thomsen
Finland	Petri Suuronen
France	François Gerlotto Pierre Freon François Theret Alain Weill
Germany	Klaus Lange Wilfried Thiele
Iceland	Pall Reynisson
Italy	Otello Giovanardi Antonio Carmelo Antonello Sala Loris Fiorentini Giulio Cosimi Vito Palumbo Manlio Luna Gaetano Messina Sandro Bolognini Aldemaro Pietrucci Massimo Azzali Janusz Kalinowski
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Scotland	Ed Simmonds Peter Stewart

	Dick Ferro
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USSR	V.A. Goldobin W.D. Tesler
Venezuela	Juan J. Cardenas

3. AGENDA

3.1 Special Topics

1. "Selectivity of fishing gears in wider perspective"
(B. van Marlen - introduction paper)

3.1.1 Sources of inconsistent performance in existing survey trawls, in particular the GOV-net, and improvement of performance-monitoring methods for survey trawls. (*survey methodology*)

2. "A review of studies on sampling gears from 1985 to 1990"
(B. van Marlen - paper)

3. "A method to limit the variability of survey trawl geometry and performance"
(A. Engås & E. Ona - paper, presented by A. Engås)

4. "Full scale trials with GOV"
(K. Lange, no paper, video)

5. "Effect of tow duration on catch per unit effort and length composition of bottom trawl surveys: a preliminary analysis"
(S.J. Walsh - paper)

6. "Survey Trawl Mensuration Workshop, St. John's Newfoundland, March 18-19, 1991. Summary of discussions"
(S.J. Walsh, P. Koeller & D. McKone - paper, presented by P. Koeller)

DISCUSSION ON THE TOPIC "SURVEY METHODOLOGY"

3.1.2 Critical review of the application of net construction, in particular square mesh, aimed at improving the selectivity of these nets. (Gear Selectivity)

INTRODUCTION

7. "A review of fishing gear selectivity studies from 1985 to 1990"
(B. van Marlen - paper)

SQUARE MESH APPLICATIONS

8. "Comparative fishing tests with square and diamond mesh codends"
(N. Poulsen, D. Wileman & N.A. Nielsen - paper, presented by N. Poulsen)

9. "The use of square mesh panels to reduce the discarding of white fish from Nephrops trawls"
(J.E. Tumilty - paper and video)

10. "Irish square mesh selectivity trials, 1990"
(J.P. Hillis, R. McCormack, D. Rihan & M. Geary - paper, presented by B. van Marlen)

11. "Fishing trials with 70 mm square mesh in the top of a Norwegian lobster trawl"
(M. Ulmestrand & P.O. Larsson - paper presented by O. Hagström)

OTHER SELECTIVITY IMPROVING GEAR CONSTRUCTIONS

12. "Preliminary tests with a grid arrangement to select sizes of shrimp in trawls"
(J.W. Valdemarsen & L. Mikalsen - paper, presented by J.W. Valdemarsen)

13. "Size selective effects of a plastic body on longline hooks"
(S. Løkkeborg, Å. Bjordal & R. Skeide - paper, presented by Å. Bjordal)

14. "Size selectivity in bottom trawls with shortened lace ropes"
(J.A. Jacobsen - paper, presented by B. Thomson)

15. "Sort-X Fish sorting device"
(R. Larsen - no paper, video, presented by J.W. Valdemarsen)

METHODOLOGY OF SELECTIVITY EXPERIMENTS

16. "Catch comparison trials of cod ends with square mesh windows"
(R.S.T. Ferro - no paper)

17. "Comparison between the covered codend method and the twin trawl method in beam trawl selectivity experiments - preliminary results"
(R. Fonteyne - paper)

18. "Codend covers"
(P.A.M. Stewart - video)

19. "U.S.-Westcoast Meshsize Study, part 1; Experiments conducted during production fishing: Can they work?"
(D. Erickson - no paper, copy of overhead sheets available)

20. "U.S. Westcoast Meshsize Study, part 2: Selecting a selectivity model, a simulation approach"
(J.A. Perez Comes - no paper, copy of overhead sheets available)

SELECTIVITY STUDIES IN VARIOUS FISHERIES

21. "Effect of attractant concentration on catch rate and size selection of Nephrops pots"
(Å. Bjordal, S. Løkkeborg & R. Skeide - paper)

22. "Herring trawl selectivity"
(P. Suuronen - video)

23. "Selectivity in shrimp trawl"
(H. Degel, H. Lassen & K. Lehmann - paper, presented by K. Lehmann)

24. "A selection factor estimate for shrimp in grading machines"
(K. Lehmann & H. Degel - paper, presented by K. Lehmann)

25. "Selectivity of flatfish fishery in Faroe Islands"
(B. Thomson - no paper)

DISCUSSION ON THE TOPIC "GEAR SELECTIVITY"

3.1.3 Latest development in fishing gear and vessel engineering, with special emphasis on the survival of fish and shellfish that come into contact with fishing gears but are not captured

FISHING VESSEL ENGINEERING TOPICS

26. "IQAS flatfish processing on board Beamer 2000"
(F.A. Veenstra & N. Mul - paper, presented by F.A. Veenstra)

27. "Bridge layout Beamer 2000"
(A.M. Buijs & A.M. van der Sluijs - paper, presented by A.M. Buijs)

FISHING GEAR ENGINEERING TOPICS

28. "Comparison of full scale and model (1:6 and 1:3) tests on Italian bottom trawls"
(L. Fiorintini, K. Hansen & D. Wileman - paper, presented by L. Fiorintini)

29. "Investigation on the hydrodynamic load on nettings in the range of small angles of attack"
(H. Stengel - paper, presented by W. Thiele)

30. "Model research on a single-door trawl at Lake Insko in 1990"
(H. de Jong & B. van Marlen - paper, presented by B. van Marlen)

31. "Additional tests of a pelagic single-door trawl"
(M. Paschen & J.W. Valdemarsen - paper, presented by J.W. Valdemarsen)

32. "Wind tunnel tests with cambered V-doors of increased aspect ratio"
(K. Lange - paper)

33. "Calculations and Experiments with a Trawl Concept for Bottom and Pelagic Trawling"
(B. Johansson & R. Karlsson - paper, presented by R. Karlsson)

OBSERVATION TECHNIQUES AND BEHAVIOUR

34. The performance of a Horizontal Split level Trawl in the Gulf of St. Lawrence Segregating Cod from Flatfish"
(M. Boudreau & D. Tait - paper, presented by D. Tait)

35. "Behaviour of cod in and around a Newfoundland trap"
(H. Pingguo - no paper, video)

36. "Survival of fish after escapement from trawls"
(A. Engås - no paper)

3.2 National Progress Reports

3.3 Recommendations

4.1 SUMMARIES OF PAPERS, VIDEOS AND VERBAL CONTRIBUTIONS ON SPECIAL TOPICS.

1. Selectivity of fishing gears in wider perspective (B. van Marlen)
The paper analysed the present situation in the fishing industry characterized by overcapacity in fishing fleets. Reduced fishing effort, improved selectivity of fishing gears, increased fish production by hatchery, and increasing biomass by catching fish alive and let grow further are suggested as possible future strategies. Various ways to improve the size and species selectivity of fishing gears are mentioned with related problems concerning implementation. The role of scientific advice is described and the importance of credibility of stock assessment with current effort to increase the accuracy of such estimates.

2. A review of studies on sampling gears from 1985 to 1990. (B. van Marlen)
Research aimed at improving precision of trawl surveys is reviewed in this paper. Such research has included direct observation and comparative fishing trials, gathering data on the geometrical behaviour of the trawl during surveys by using measuring equipment, fish behaviour and vertical diurnal migration on its effect on the catchability.

3. A method to limit the variability of survey trawl geometry and performance. (A. Engås)
The report describes preliminary tests with a restrain rope of some 9m length between the warps, fixed 150 m in front of the trawl doors, to decrease door spread variability during bottom trawl surveys. The results indicate that this technique can be used to obtain the same door spread irrespective of fishing depth and warp length.

4. Full scale trials with GOV. (K. Lange)
Underwater observations of the GOV-trawl using RCTV were presented on a video tape. The performance of the trawl with various riggings was documented. The rigging specified in the ICES-manual was found not to be optimal. The effect of different sweep lengths which are allowed seemed to be large. Modifications of the rigging were suggested, such as to cut of the lower wings, to keep the spread constant and to allow only one sweep length.

5. Effect of tow duration on catch per unit effort and length composition of bottom trawl surveys: a preliminary analysis. (S.J. Walsh)
The catches per unit effort of various sizes of cod, american plaice, yellowtail flounder and thorny skate, with trawl haul duration of 5, 15 and 30 minutes, were compared in experiments on Grand Banks. The highest CPUE was found for 5 minues tows, while 15 and 30 minutes tows gave similar, but smaller CPUE. A reduction of tow duration from 30 to 15 minutes is suggested for sampling hauls, as no gain in precision was found for 30 minutes over 15 minutes. The 15 minute case deserves further investigation. An exact definition of the start of a tow is however required.

6. Survey trawl mensuration workshop, St. John's, Newfoundland, 18-19 March 1991; Summary of discussions. (S.J. Walsh, P. Koeller & D. McKone, presented by P. Koeller)

Nineteen scientists attended a 2-day workshop on "Trawl Mensuration". Survey trawl mensuration research in various institutes was presented. Three major topics were discussed: 1) sources of bias and variances associated with survey trawl efficiency; 2) application of trawl mensuration equipment and data to improve survey methodology and survey estimates; and 3) standardization of a trawl survey protocol. An extended list of all variables concerning the accuracy of trawl surveys has been drafted with ways to measure them and how they can be controlled. Various recommendations were given to decrease the variability in this kind of survey work including calibration of measuring devices, standardization of gear components, training of scientists conducting surveys, coordination of surveys, further (interactive) control of geometry. Extended contact with working groups like FTFB is also recommended.

7. A review of fishing gear selectivity studies from 1985 to 1990. (B. van Marlen)

The review includes findings from research on more selective fishing gears reported in written form to the FTFB working groups from 1985 to 1990 (27 papers, documentated in the reference lists of the ICES - Fish Capture Committee). Major topics covered are: 1) selectivity in Nephrops fishery; 2) application of square mesh in fishing gears; 3) other net constructions improving selectivity; 4) methodology of selectivity experiments; and 5) legal aspects. The paper summarises various experiments with results, methodology and selection parameters found and is meant to stimulate the discussion on selectivity.

8. Comparative fishing tests with square and diamond mesh codends. (N. Poulsen, D. Wileman & N.A. Nielsen, presented by N. Poulsen)

Two commersial Danish trawlers using the twin-trawl system were used to evaluate the effect on catches of the codend design proposed by the EEC for the main North Sea fisheries for flatfish. The catch composition in codends with 110 mm meshes was compared with 100 mm meshes, and also the effect of 90, 100, 105 and 135 mm square mesh top panels were compared with traditional diamond meshes. Square mesh codends were not found to improve the selectivity of flatfish, and selection factor for cod was higher than for diamond meshes, while no effect was seen on the selection range.

9. The use of square mesh panels to reduce discarding of white fish from Nephrops trawls. (J.E. Tumilty)

This paper describes observations with underwater TV and comparative fishing trials with twin trawls using a square mesh panel or "window" fitted into the top section of the extension and/or cod-end of a net with diamond meshes elsewhere. Square mesh panels were found to reduce the bycatch of whiting and haddock in Nephrops trawls substantially without any loss of Nephrops. Discards of whiting fell an average of 71%, but the loss of marketable sized whiting was also significant at 42% on average. The juvenile bycatch was smaller during the day and the loss of fish above the minimum landing size (MLS) large during the night. Haddock discards fell by 47% and the loss of fish above MLS by 6% using square mesh. The UK government will unilaterally impose the compulsory fitting of square mesh panels to vessels fishing for Nephrops from 1 July 1991.

10. Irish square mesh selectivity trials 1990. (J. P. Hillis, R. McCormack, D. Rihan & M. Geary, presented by B. van Marlen)
Three different insets of square mesh were compared with 70 mm diamond meshes using two trawlers towing in the same area. A square mesh window in the top panel in front of codend released 38% of sublegal sized whiting as commercial sized whiting increased with 15%. Square mesh top panel in the whole codend and in the front part of the codend decreased the commercial sized whiting substantially. No effect on plaice was recorded.

11. Fishing trials with 70 mm square mesh in the top of a Norwegian lobster trawl. (M. Ulmestrand & P.O. Larsson, presented by O. Hagström)
In this paper the escapement of small sized whiting and cod through a square 70mm mesh top panel and through diamond mesh using a twin trawl arrangement is compared. A reduction of bycatch of whiting was found, but the data for cod was inconclusive. No loss of Nephrops was observed.

12. Preliminary tests with a grid arrangement to select sizes of shrimp in trawls. (J.W. Valdemarsen & L. Mikalsen, presented by J.W. Valdemarsen)
Following the success of using metal grates (grids) to reduce bycatch of fish in shrimp trawls, this paper describes preliminary tests with a similar device to select sizes of shrimp in trawls. In addition the selectivity of 35 mm codends is estimated using the twin trawl technique. The selectivity of a V-shaped grid using 8-10 mm bar distance, was superior to selectivity of the codend.

13. Size selective effect of a plastic body on longline hooks. (S. Løkkeborg, Å. Bjordal & R. Skeide, presented by Å. Bjordal)
As bait size is regarded as a possible method to size select fish on longline, experiments with a plastic body on the hook in addition to the ordinary fish bait were carried out for tusk and ling on the west coast of Norway. The effect was not significant. The catch rates and length distributions for both fish species were similar.

14. Size selectivity in bottom trawls with shortened lace rope. (J.A. Jacobson, presented by B. Thomson)
Size selectivity studies in recent years have mainly featured various designs of square mesh codends and use of various designs of sorting grates (e.g. Sort-X). This report describes the results from catch comparison experiments between a standard 135 mm trouser codend and a similar codend with 15% shortened lace (or lastridge) ropes. The data consisted of 110 hauls for the standard codend against 107 hauls for the test codend. The codend with the shortened lace ropes caught less small fish compared to the standard codend. These results apply for the species saithe, cod, haddock and redfish around the Faroe Islands.

15. Sort-X; Fish sorting device. (J.W. Valdemarsen)
Ten different models of a fish size sorting system based on solid and stiff metal grates have been tested in the Barents Sea on 5 cruises with commercial trawlers. These experiments did include observations with RCTV and several hauls to establish selectivity curves for the various sorting systems. An improved selectivity for cod and haddock

compared to conventional codends with diamond meshes was found. Improved selectivity means a narrower selection range and less fish caught below the minimum legal landing size. The selectivity of cod and haddock with the Sort-X system seems to be independent of factors such as codend meshsize, codend construction and catch size.

16. Catch comparison trials of codends with square mesh windows. (R.S.T. Ferro)

Catches below and above the minimum legal landing size (MLS) with 80 and 90 mm square mesh windows were compared with a 90 mm diamond codend using a white fish trawl. Discards of haddock and whiting below MLS were reduced with 61-64% using square mesh windows of 90 mm compared to a 90 mm diamond codend. The loss of marketable haddock was 38-44% and whiting 72-82% for these cases. The reduction of discard using 80 mm square mesh windows was 31% and 46% for haddock and whiting, respectively, and the loss of marketable haddock was 20% and whiting 35%.

17. Comparisons between the covered codend method and the twin trawl method in beam trawl selectivity experiments - preliminary results. (R. Fonteyne)

This study compares the covered codend method and the twin trawl method for beam trawl selectivity experiments. Several cover types and cover mesh sizes were tested, a total of three different designs, two of 60mm and one of 40mm mesh size. A twin beam trawl was used to investigate the masking effect in the covered codend experiments. The twin gear yielded higher 50% retention lengths and selection factors than the covered codend for sole and dab and is preferred over the covered codend method. The 40mm cover yielded acceptable results, while the 60mm covers were not recommended for further use.

18. Cod end covers. (P.A.M. Stewart)

Direct observations of codend covers and their effect on fish escapement from the ordinary codend were done using the RCTV-system and recorded on video tapes. Fish that escaped through the meshes of the main codend into the cover accumulated in the wake behind the main codend. Use of large rings of 2 m diameter increased the clearance between codend and cover, and will be an improvement when using covers for selectivity experiments.

19. U.S. Westcoast Mesh Size Study. Part I. Can an experiment be conducted on vessels operating under production conditions? (D. Erickson)

On the U.S. Westcoast the fishing industry has initiated experiments to evaluate short and long term effects on fish stocks of changes in codend mesh sizes and shapes. Field studies have been conducted for three years, using commercial trawlers. A total of **1196** experimental tows were conducted on a total of 47 vessels and 102 trips, involving over 150 fishermen. Various mesh sizes were under investigation (76, 114, 127 and 140 mm diamond and 114 and 127 mm square). The **alternate haul method** was used throughout the experiments. Statistical significant results about selectivity have been the outcome. Predictions in yield and revenues will be done during the years 1991 and 1992. The results presented were of preliminary nature and the project will continue.

20. U.S. Westcoast Mesh Size Study. Part II. Selecting a selecitivity model - A simulation approach. (J.A. Perez Comes)

Progress in the work to generate a model to assess the long-term effect of introducing mesh size regulations in the multi-species of the U.S. Westcoast was described. The goal of this work is to incorporate the whole selection range of the 19 most important species into the yield assessment instead of traditional approach of representing selection by L50 % (mean selection length).

21. Effect of attractant concentration on catch rate and size selection of Nephrops pots. (A. Bjordal, S. Løkkeborg & R. Skeide, presented by A. Bjordal)

Comparative fishing trials with pots for Norway lobster were conducted to test possible differences in catch between mackerel bait and mackerel extract. A **three times higher catch rate** with mackerel bait compared to the extract was found. The mean length of lobster caught with mackerel bait was significantly higher than with the extract bait. The explanation for these results can be a lower release rate of smell from the extract. As a consequence mackerel bait triggered food search in Norway lobster over a larger area, and hence attracted more and larger individuals than the extract.

22. Herring trawl selectivity. (P. Suuronen)

The selection effect on herring of a square mesh codend (18 mm bar length) was compared with diamond meshes in a twin codend type. Escapement of fish was observed with underwater TV. Increased escapement of small herring in the square mesh codend was observed and documented in comparative fishing when low catch rates. When the square mesh codend filled up with catch, herring blocked the meshes, creating a hollow inside. Escapement of small fish was reduced. Preliminary tests with a metal grate, 1 m long, 0.7 m wide, 11 mm bar distance, were conducted and observed with underwater television equipment, showing many escapes of juvenile fish. Further work will include studies of survival rate of herring escaping from codend meshes and grids.

23. Selectivity in shrimp trawl. (H. Degel, H. Lassen & K. Lehmann, presented by K. Lehmann)

The selectivity of shrimp trawl with 43 mm stretched mesh was investigated by fishing with alternating 18 mm meshes and 43 mm meshes in a total of 44 hauls. The hauls were made with four different tow durations: 0.5, 1, 2 and 4 hours. There was little difference in selecitivity factors for these various durations. SF was found to be 0.34 in these experiments. The selection range decreased with increasing haul duration. Values of 3.95 were found with short hauls, whereas 0.4 resulted with long hauls. No explanation could be given and this result is contradictionary to earlier ones obtained by Norwegian scientists. Normally the selection range will increase with catch size, that is expected to rise with tow duration.

24. A selection factor estimate for shrimp in grading machines. (K. Lehmann)

Selection factors (L50 carapace length divided by grading bar distance) of about 2 (2.15-2.19) for shrimps, were calculated, using size distribution obtained from samples collected on shrimp trawlers before and after the shrimp were sorted with a commercial shrimp grading

machine. Behaviour in trawls may be different however, resulting in other values.

25. Selectivity of flatfish fishery in the Faroe Islands. (B. Thomson)
In the flatfish fishery in the Faroe Islands, the bycatch of cod and haddock is above an acceptable level. A selective trawl for flatfish where the square and front part of the top panel was removed to allow haddock to escape in the trawl mouth, and a large mesh section (4*135mm) in the top panel in front of the codend to release cod, have been developed. Successful tests including RCTV-observations and comparative fishing, indicate 99% escapement of haddock and 40% release of cod without affecting the efficiency for flatfish.

26. IQAS flatfish processing on board Beamer 2000. (F.A. Veenstra)
In this paper the research possibilities are described for the improvement of the flatfish processing line on board a "Beamer 2000" (an innovative design for a beamtrawler with 2000hp engine power for the year 2000), based on adoption and extension of existing flatfish handling equipment, incorporating the IQAS (Integrated Quality Assurance of cilled food at Sea) and Kindunos approach (a safety integrated methodology of design). Central in the approach is the development of an automatic fish weighing and sorting device based on image analysis techniques (called FISHEYE), simulation studies of the fish processing line onboard, and incorporating safety aspects. Without interfering the beam trawl fisheries too much, the general arrangement (lay out and outfit), the quality of the landed fresh fish, and quality of the working stations (well-being of the crew) can be improved considerably, also taking into account positive effects on the marine environment. Technical solutions are given, resulting in a vessel with the trawl winches placed in the forecastle and the processing line amidships. This design is checked against stability requirements with good results and remarks are given about the costs involved for the new processing line. Plans exist to lift the approach to a European level by aiming at an EEC-funded project in the "FAR"-programme, based on small trawlers.

27. Bridge lay out Beamer 2000. (A.M. Buijs & A.M. van der Sluijs, presented by A.M. Buijs)
The design and building of Dutch beam trawlers is still based on traditional methods. Within the "Beamer 2000 project" a study was done on an improved bridge lay-out, based on ergonomic insights. A study was also made for an integrated screen presentation of navigation data, engine room alarms and fish finding. A range of lay-outs are presented starting with moderate adaptions and progressing to a completely new design. This approach will improve the acceptance by the industry where costs and traditional views play an important role. The new bridge design will have a positive bearing on the working conditions and the safety of the skipper and crew.

28. Comparison of full scale and model (1:6 and 1:3) tests on Italian bottom trawls. (L. Fiorentini, K. Hansen & D. Wileman, presented by L. Fiorintini)
This paper presents and discusses the differences in the results encountered in full-scale and model tests on the "Tartana" trawl, which is the typical Italian bottom trawl. The models were tested in the flume tank of DIFTA in Denmark, the full-scale trials were done in the Adriatic Sea off Ancona. Froude scaling was used and care taken to

obtain the right ratio of twine surface areas. There was little difference in drag between both models. A 25-30% higher drag was found for the full-scale gear compared to the equivalent full-scale value of the models. These differences can be explained by the difference in ground friction at sea compared to the tank. The 1:6 model fitted the full scale data better than the 1:3 model, although its twine area was actually smaller than required (46.9m^2 vs 58m^2).

29. Investigation on the hydrodynamic load of netting in the range of small angles of attack. (H. Stengel, presented by W. Thiele)
A net grid model have been tested in a wind tunnel to get better understanding of the flow around and through the netting with high degree of coverage and small angle of attack. There is surprisingly little data on drag coefficients for this range of attack angles. It is known, that differences exist in the deflection of the flow between flat net panels in a frame and conical nets. In detail the influence of knots, the influence of the hanging coefficient, and the effect of a symmetry disk have been investigated. For a better assessment of the test results, in some cases the flow conditions have been visualized by means of inserted smoke. It was observed that at angles higher than 4 degrees the smoke penetrates through the meshes. Higher drag coefficients and lower lift coefficients resulted from knots. The symmetry disc gave higher drag coefficients as well.

30. Model research on a single-door trawl at Lake Insko in 1990 (H. de Jong & B. van Marlen, presented by B. van Marlen)
Experiments on a 1 to 7 scale trawl model of a net of type "FANNY II", rigged with one door at the port side and a Dan-leno at the starboard side are described in this paper. The aim of this rigging is to catch fish in close proximity of the sea surface outside the wake of the trawler thus making use of avoidance reactions of fish to emitted sound in the path of the vessel. The trials were conducted at station Insko, Poland in cooperation with the University of Agriculture, Szczecin and the University and "Institut für Hochseefischerei und Fischverarbeitung - (IfH)" of Rostock, Germany in June 1990. The geometry and resistance of the trawl model were measured and recorded with variable components of the rigging and the results are explained. A variant with two doors spreading in the same direction has also been tried with success. It is recommended to prove the concept of this rigging prior to further technical optimization. The rigging may become appropriate for a sampling gear for pelagic fish close to the surface.

31. Additional tests of a pelagic single-door trawl. (M. Paschen & J.W. Valdemarsen, presented by J.W. Valdemarsen)
Performance studies of the single-door trawl concept were carried out with a 2 m^2 Süberkrüb door and a 100 m circumference 4-bridle pelagic trawl, towed from a small trawler with 170 hp engine. With 200 m warp and 7 m difference in length of starboard and port, the trawl performed well, and its path was 60 m to the side of the ship's track. Accurate adjustment of warp length and balancing of weight on the door and danleno side is a must for this technique to have practical applications. This gear concept may prove beneficial for stock assessment purposes. Further trials with this technique will be the evaluation of the efficiency compared to traditional trawling using 0-

group fish as experimental targets. This can be done for instance by introducing a system with two trawls towed on the P and S-side, and one in the centre of the wake.

32. Wind tunnel tests with chambered V-doors of increased aspect ratio. (K. Lange)
Measurements were done in a wind tunnel to compare the hydro–dynamic performance of flat and cambered (0% and 13%) V-doors with an aspect ratio of 0.5 with a cambered (10%) V-door with an aspect ratio of 1.0. Diagrams of lift vs drag coefficient for midwater and bottom trawling were presented. In both conditions the drag coefficient of the cambered door is decreased by increasing the aspect ratio. In comparison with a cambered V-door with aspect ratio of 0.5, the drag can be reduced with 23% for the same spreading force when the aspect ratio is increased to 1.0. The area of the high aspect ratio door has to be 24% larger than the low aspect ratio door to get the same spreading force.

33. Calculations and Experiments with a Trawl Concept for Bottom and Pelagic Trawling. (B. Johansson and R. Karlsson, presented by R. Karlsson)
The report describes tests for Norway lobster with a double-codend trawl design, named MICRO-trawl. The design opens the meshes between the codends, which is claimed to improve selectivity. An increased mouth opening of 30-50% is found compared to a traditional trawl. The drag of the new trawl was slightly higher in midwater condition (8-20%). The same concept has been used in shrimp and cod trawl design with success. For Norwegian lobster catches rose 27% for the MICRO compared to a conventional type of trawl, whereas fish catches dropped by 12%.

34. The performance of a horizontal split level trawl in the Gulf of St. Lawrence segregating cod from flatfish. (M. Boudreau & D. Tait, presented by D. Tait)
Horizontal divided trawls were designed and tested in the Gulf of St. Lawrence to find out if roundfish bycatch could be reduced when trawling for flounder. With the horizontal panel set at 4 and 3 feet above the fishing line, 80-100% of the cod was caught in the upper codend, contrary to earlier findings for the North Sea cod fishery, where most cod appeared in the lower codend. **Behaviour patterns may differ in different areas and circumstances.** Temperature differences may play a role in this. 100% of the flounder was caught in the bottom level, which meant that the separation of cod and flounder worked well. Fish quality improved dramatically, and less time was spent sorting different species. The costs for the separtor panel was estimated at 20%-25% of the total cost of the trawl. Further experiments will be undertaken in 1991.

35. Behaviour of cod in and around a modified Newfoundland trap. (Pingguo He)
The behaviour of cod in and around a modified Newfoundland trap was documented in a videofilm taken with an underwater camera placed on the seabed 4 m away from the entrance of the trap and scanning sonar installed 30 m from the entrance and 15 m away from the leader. Observations lasted for 11 days, from 26 July to 5 August 1990. The swimming speed of cod entering and leaving the trap was very slow, less than 1 knot. Cod inside the trap swam in circles. In rare cases the

cod swam through the meshes of the leader. Many cod were observed to escape from the trap through the entrance. Improvements of the trap design based on the behaviour observations were suggested.

36. Survival of fish after escapement from trawls. (A. Engås)
Experiments with large cages, catching fish escaping through codend meshes of trawls, released in fishing depth and observed regularly with a ROV for 2 weeks, were described. Fish caught in a cage attached to the rear end of the codend and released in the same way as the others were used for the control group in the experiment. Problems with controlling the amount of fish in the cages before release make the results inconclusive. The survival of cod, however, seemed to be near 100%, but the mortality of smaller haddock was significant.

4.2 DISCUSSION ON TOPIC "SOURCES OF INCONSISTENT PERFORMANCE IN EXISTING SURVEY TRAWLS, IN PARTICULAR THE GOV-NET, AND IMPROVEMENT OF PERFORMANCE MONITORING METHODS FOR SURVEY TRAWLS"

The various papers presented about this special topic formed the background for a discussion on how the objective, namely to improve sampling methods, can be achieved.

The participants agreed that recent findings about the inconsistency in performance and efficiency of survey trawls should be used to review existing manuals and suggest improvements. A smaller group consisting of: A. Engås, B. van Marlen, O. Hagström, P. Stewart, P. Koeller and K. Lange, convened by O. Hagström, was appointed to discuss these matters and to agree upon further action.

This group defined their Terms of Reference (See Appendix III) as:

Objectives : *Review of factors that could be the source of bias and variation in trawl performance.*
Review the present manual for ICES's IYFS/IBTS.

A written report of their findings will be presented on the 79-th ICES Statutory meeting in La Rochelle, France, September - October 1991.

4.3 DISCUSSION ON TOPIC "CRITICAL REVIEW OF THE APPLICATION OF NET CONSTRUCTION, IN PARTICULAR SQUARE MESH, AIMED AT IMPROVING THE SELECTIVITY OF THESE NETS"

The various contributions to this special topic dealt with the selection effect of square meshes in Nephrops and white fish trawl fisheries in the North Sea and Irish Sea, other selective gear constructions including metal grates in fish and shrimp trawls, and shortened lastridge ropes along the codend of fish trawls.

The methodology of selectivity experiments was discussed in 5 presentations. Catch comparisons using various designs of twin trawls, including split beam trawls as well as problems encountered when using codend covers, were discussed. A large scale mesh size study using data from the commercial trawler fleet equipped with various codends on the U.S. Westcoast, was presented.

Other selectivity studies in various fisheries included how attractant concentration affect size selection in Nephrops creels, selectivity with standard codend meshes, and preliminary test of grids in a herring trawl.

In the Nephrops fishery, square mesh windows are found to reduce discards of fish significantly. Consequently, such devices will be enforced in the UK Nephrops fishery.

The effect on selectivity of square mesh codends or windows in white fish trawls can reduce the discards of cod, haddock and whiting compared to diamond meshes with the same mesh size. The experiments however also demonstrate significant loss of haddock and whiting in particular, above the minimum landing size. The experiments with lastridge ropes confirmed earlier findings by Norwegians that the selection effect on cod, haddock, saithe and redfish is at least as good as square meshed codends.

The grate (or grid) system is a new approach to improve selectivity, and the results obtained with such a device are encouraging.

Following a plenary discussion, a smaller group was appointed to consider the selectivity matters related to the ICES Council request. The members of this group were: S.J. Walsh, J.W. Valdemarsen, C.W. West, R. Fonteyne, R.S.T. Ferro, H. Arnold Carr, B. van Marlen, and A. Odlin. This group drafted a report titled "**A critical review on gear constructions that improve size selectivity**". The report was finalized after the meeting, and a draft was distributed to the participants of the group for comments. After the meeting the document was edited by correspondence and sent to ACFM prior to their meeting in May this year. The contents are given in Appendix I of this paper. The findings given in this report were used during the discussions within ACFM, and a reply has been sent to the Chairman of the FTFB-Working Group on June 20, 1991. This reaction is given in Appendix II. It should particularly be noted that our work was very much appreciated and "ACFM would like to encourage closer cross-Committee interactions within ICES, and enhanced communication between the FTFB WG, the Fish Capture Committee, and ACFM is certainly desirable."

4. NATIONAL PROGRESS REPORTS

Progress reports were submitted in written form by several countries, but not discussed at the meeting. The information given is summarised below for the ICES countries when available.

COUNTRY CODE / TOPIC:	1 B	2 CAN	3 DK	4 FIN	5 F	6 D	7 ICE	8 IR	9 NL	10 N	11 PL	12 P	13 E	14 S	15 GB	16 USA	17 USSR
1. Survey gears																	
GOV-net						X									X		
other gears		X				X				X					X	X	
plankton torpedos						X			X						X		
methodology		X				X				X					X	X	
2. Selectivity																	
bottom trawls		X				X			X					X	X	X	
beam trawls	X					X			X								
midwater trawls						X											
seine nets		X	X			X			X						X		
gill nets		X				X											
longlines										X							
pound nets														X			
pots/traps		X				X				X						X	
methodology	X	X													X	X	
roundfish	X		X			X			X	X					X		
pelagic fish				X		X											
flatfish	X								X								
shrimps			X							X				X		X	
Nephrops			X												X		
square mesh netting	X	X	X	X					X	X					X	X	
shortened lace ropes			X							X							
grates		X	X	X						X						X	
separator panels		X	X						X					X	X		
other devices			X													X	
4. Survival																	
roundfish										X					X		
pelagic fish				X						X							
flatfish																	
non-fish species		X														X	
from trawls		X		X						X					X	X	
from seines																	
from gillnets																	
from purse seines																	
from longlines										X							
5. Gear engineering																	
model tests		X	X			X			X	X				X	X	X	
f/s measurements	X	X				X			X	X				X	X		
door tests			X			X									X		
new materials		X															
single-door trawl						X			X	X							
net drag studies	X		X			X			X						X	X	

COUNTRY CODE TOPIC:	1 B	2 CAN	3 DK	4 FIN	5 F	6 D	7 ICE	8 IR	9 NL	10 N	11 PL	12 P	13 E	14 S	15 GB	16 USA	17 USSR
5. Direct observation																	
ROV-development									X							X	
towed gears		X	X			X			X	X					X	X	
static gears		X															
6. Vessel topics																	
vessel design		X							X	X				X			
safety aspects									X					X	X	X	
working conditions									X	X				X			
noise reduction									X					X			
fuel consumption		X														X	
sound emission									X								
live fish transport										X							
catamarans										X							

4.4 RECOMMENDATIONS

After the discussion the following recommendation was drafted:

1. The Working Group on Fishing Technology and Fish Behaviour (Chairman: Mr. B. van Marlen) recommends that the next meeting shall be held in **Bergen, Norway, 14–15 June 1992.**

   This meeting place and these dates are selected because the Symposium on "Fish Behaviour in Relation to Fishing Operations" is arranged to take place in Bergen from 11 to 13 June 1992. Many of the participants of the Working Group will attend the Symposium, and therefore a combination of these arrangements will be practical and save costs of travel.

   The **special topic** that should be discussed at the Working Group meeting is: **"Selectivity in trawls with emphasis on methodology and manuals for survey trawls."**

Appendix I:

"A critical review on gear constructions that improve size selectivity."

FTFB-WG April 1991, Ancona.

1. Introduction

Many studies on how to improve the selectivity of various fishing gears were presented over the past few years at meetings of the ICES Working Group on Fishing Technology & Fish Behaviour of the Fish Capture Committee. This paper summarises the main findings and provides a critical review on **trawl and seine net constructions** that improve the **size** selectivity of **towed** fishing gears. Other gears such as long lines are not dealt with.

It should be borne in mind, that properties describing the selectivity curve may not indicate all the possibilities to decrease the by-catch of undersized fish with great precision. In some studies, the selection ogives took a **bimodal** shape. Large amounts of small fish were reported to be retained in these cases, similar to fish in the length range above L-50, but in between the percentages retained were far less. When this is the case, a more selective gear construction might reduce unwanted by-catch of small fish to a greater extent than expressed by the parameters Selection Factor (SF), 50%-retention length (L-50) and Selection Range (SR).

Methods to improve the **SIZE SELECTIVITY** of towed fishing gears are given for three categories of fish, namely:

a. Flatfish
b. Demersal Fish
c. Pelagic Fish

Several of the most important species are dealt with separately for each of these categories. The effect of several net constructions is given for a number of species. The emphasis is put on the application of **square mesh panels** in trawls and seines. Recently other constructions have been investigated, some with great success.

Comments are made in Chapter 4 about the way to introduce new net constructions in the fishing industry. In most cases introduction requires strict definitions of these constructions to create effective legistation. This document does not give these definitions. More general conceptual descriptions are used instead.

2. Fishing gear constructions that improve size selectivity.

1. Square Mesh Panels (SMPs)

2.1.a Square mesh codends or square mesh codend panels.
Meshes can be hang in such a manner, that their opening forms a square rather than a diamond shape. Square meshes remain open all along the codend, whereas diamond meshes tend to close in front of the poke line when the codend fills up and the tension on the mesh bars increases. Square mesh panels can be inserted in any part of the codend. Many applications today consist of a panel in the top part of the codend only, as most escapes were reported through the upper part.

2.1.b Square mesh windows.
In order to overcome handling or problems concerning strength square mesh panels can also be inserted in other parts of a net than the codend. These are referred to as square mesh windows.

2.2 Shortened lastridge ropes (SLRs)
Longitudinal ropes of a length shorter than the stretched length of meshes can be used to open meshes wider by taking the strain of. They are also mentioned riblines.

2.3 Grids
Some studies are reported on other selective devices aimed to release (small sized) fish or shrimps. Grids are lattices of metal bars placed at a fixed or varying distance where intended escape can take place. Net funnels are added to lead fish or shrimp to the grid.

2.4 Other net design features, such as codend width or length of extension piece were found to affect selectivity. Selectivity improvement is based on creating a wider opening of meshes enabling fish of adequate girth shape to escape better.

3. Effects.

3.1 Flatfish.

General

Research does not supply evidence for a change in selectivity using SMPs of the same mesh size as conventional codends. This statement may not hold when a SMP is used in the top part of the codend only. The reason is that escape can also take place in the lower parts.

Preliminary reports suggest that grid systems may be used to separate roundfish species from flatfish. Size selection of grids has just recently been investigated, but results are too premature to draw conclusions.

Species	SMPs	Effect of: SLRs	Grids	Others
Sole	no change	no data	no data	no data
American Plaice	retains more small fish	no data	no data	no data
Yellowtail Flounder	retains more small fish	no data	no data	no data

3.2 Demersal fish.

The next table shows the effect of several net constructions on some major target species as found in recent literature.

Species	SMPs	Effect of: SLRs	Grids	Others
Cod	increase in SF, L-50, no effect on SR	similar to SMPs	SR reduced, reduction of catch of juveniles	limited effect
Haddock	increase in SF, lower SR for trawls	similar to SMPs	SR reduced, reduction of catch of juveniles	no significant variation in SR
Whiting	increase in SF, effective release of juvenile fish	no data	no data	no data
Saithe	not enough data	more release < 60cm	not enough data	no data
Redfish	not enough data	less undersized fish in catch < 45cm	no data	no data

Remarks:

- SMPs taken in both the upper panel and the lower panel of the codend. Effects are given for equal mesh sizes in both the square mesh and diamond mesh codends.
- Not enough evidence from experiments in the Baltic Sea. The results are based on other areas.

3.3 Pelagic fish.

The next table shows the effect of several net constructions on some major target species as found in recent literature.

Species	SMPs	Effect of: SLRs	Grids	Others
Herring	higher SF, decrease in SR (dependent on catch size)	no data	no data	no data
Mackerel	not enough data	no data	no data	no data

4. Discussion.

The research summarised above demonstrates that many techniques are available for manipulating the selectivity characteristics of trawls and seines by specifying various elements in the physical construction of the gear. These techniques, along with others not discussed here, may be applied to help achieve various fisheries management and conservation goals. For instance, while the focus of this discussion is on within species **size selection**, all these techniques have greater or lesser impacts on the **species selectivity** characteristics of trawls and seines.

It is quite possible to sort species within a trawl and then further sort these species, or species groups, by size, which may be a desirable management strategy in mixed-species fisheries. Good results were obtained in the Nephrops and the shrimp fisheries.

In any instance where fisheries managers are considering gear design regulations in order to achieve management goals several factors must be weighed. Naturally the **effectiveness** of the technique(s) under consideration must come first, but only in the context of all the important management and conservation goals. Most trawl fisheries, like it or not, are **mixed-species fisheries.**
Many of these selectivity affecting measures have varying results for different species, so concerns for a particular species or species group should not blindly drive a decision in favor of one technique over others if it will have a negative impact on other species, especially if other techniques are available that might offer a better overall result.

After overall effectiveness, the next factor that must be weighed in choosing a technique is its **likely reception** by the fishing industry. Results obtained in a research setting are very important, but in the end the effectiveness of any selectivity affecting technique will depend on the enthusiasm and skill with which fishermen use it in their day-to-day operations.

In general fishermen will prefer the technique that has the lowest overall cost based on a wide range of factors including: **initial purchase and installation costs: reduced catch value; increases in fishing time or other operational expenses; increased labor costs, and safety.** After cost considerations, fishermen will generally prefer, and have the greatest confidence in the alternative that is **most compatible** with their customary gear and operational techniques.

Selectivity-affecting measures may be ranked according their increasing expense **complexity**, and/or novelty. In general fishermen's acceptance of a measure will be related to where it falls on this scale. The techniques discussed above may arguably be ranked as follows: at the lower end of the spectrum would fall shortened extensions, then shortened selvedge ropes, narrow codends, and square mesh windows, followed by codends with square mesh tops, full square mesh codends, then grids. Others may attribute a different ranking order.

Modifications to conventional codends

This category would include **shortened extension sections, narrow codends,** and **shortened selvedge ropes,** sorting **grids** could conceivably fall into this category, but because of their recent introduction they will be discussed separately.

The selectivity benefits of reducing the **lengths of extension pieces** have been demonstrated. The operating principle is clear: the open meshes of the trawl body are better able to support the codend meshes in an opened configuration. Costs to the fishermen are low. In some cases practical constraints exist on the length of extension

chosen such as the distance onboard from where the net is heaved in to where the codend is emptied. Selectivity benefits may be variable and unpredictable due to factors that are difficult to predict or control such as towing speed, codend load, and overall gear geometry.

Narrow codends (reduced circumference relative to the trawl body), also offer improved selectivity due to increased mesh openings, and may appeal to fishermen due to low cost. Existing codends can be easily and inexpensively modified while new codends should even be cheaper. The disadvantages associated with this technique arise from the reduced numbers of bars now sharing the codend loads: codend strength and/or longevity may be less unless compensatory measures are taken, and fish struggling through the meshes may suffer additional injuries.

Shortened selvedge ropes represent another means to improve the selectivity properties of conventionally-constructed codends. The ropes relieve some of the longitudinal loads on the codend netting, allowing the meshes to more easily open transversely throughout the codends length. Early reports show selectivity effects comparable to those obtained with square mesh codends. Since the mesh opening effects are less dependent on overall trawl geometry, the selectivity characteristics of these codends will be more predictable. This technique may be retro-filled to existing codends or easily incorporated into new constructions that otherwise employ conventional materials and construction techniques, so incremental costs to the fishermen are relatively low. Disadvantages include the cost of the ropes and their installation, which must be carefully carried out, and increased towing resistance. However, the universal **voluntary use** of such codends by Asian and North American fishermen in the North Pacific fisheries supports the notion that these difficulties can be overcome.

Square mesh

Square mesh netting has shown selectivity benefits in several applications: square mesh **windows** in the codend or trawl body codend top panels of square mesh with diamond mesh lower panels, and codends made entirely of square mesh. In general square mesh selectivity benefits seem to apply only to round-bodied species, with undetectable or even negative effects for flatfish. This could be an important consideration in mixed-species fisheries, in which case mixed square- and diamond-mesh constructions might be optimal.

The **cost** of square mesh is an important issue due to initial expense, potential maintenance and repair problems, and codend longevity, especially as the application moves from square mesh windows through square mesh top panels to full square mesh codends. Manufactured netting comes from the loom in the diamond orientation so converting it into a raw square mesh panel involves additional labor, materials, and wastage costs. **Knot slippage** has been an recurring problem in square mesh made from knotted netting, but **knotless** netting typically costs more initially and may suffer problems from unravelling of the twines unless properly installed and repaired. These problems are exaggerated with larger catch sizes. **Longevity** can be improved if reinforcing longitudinal and circumferential ropes are installed, but attendant costs are significant. It should be noted that most of these technical problems can be solved according to net manufacturers.
Despite these problems many fishermen on both sides of the Atlantic have **voluntarily** adopted full and partial square mesh codends.

Sorting grids

Sorting grids installed in front of the codend have been recently introduced into commercial use in several Scandinavian shrimp fisheries.
Despite their brief history the practical results have been impressive, reflected by their voluntary acceptance by fishermen not required to use them.

These devices were originally designed to release juvenile roundfish and redfish from shrimp trawls and they have proven to be very effective for this purpose. Early results showed that these grid systems showed promise for releasing small shrimp as well, which has been demonstrated in the most recent experiments.
Preliminary experiments aimed at extending the technique to size selection in gadoid fisheries have given encouraging results, and development is continuing in this area.

5. References.

The following tables list references related to the effects of gear construction on selectivity. These experiments have been split up in two major groups:

1. **Selectivity experiments** in which values are given for the selection parameters (L-50, SF, SR)
2. **Catch comparison experiments** in which the selective properties are estimated by comparing experimental and standard gear constructions.

Legend to the expressions used in the reference tables below.

Fishing Gear Type:

OT	Otter trawl
PT	Pelagic trawl
NT	Nephrops trawl
BT	Beam trawl
SS	Scottish seine
DS	Danish seine

Fish Species:

C	Cod
D	Dab (Common)
G	Herring
H	Haddock
L	Long rough dab (American Plaice)
N	Nephrops
O	Pandalus Borealis
P	Plaice (European)
Q	Pollack
R	Saithe
S	Sole
T	Sebastes (Red fish)
W	Whiting

The suffix attached to the species code refers to the appropriate report of the **selectivity** or **catch comparison** trials. These two methodologies of research are referred to separately.

Tables with codes for appropriate references and species involved.

Selectivity Experiments - Full square mesh codends

Gear type	Mesh size													
	30	35	50	55	60	70	75	80	85	90	120	135	140	155
OT						H_5 W_5	H_5 W_5	H_5 W_5	H_5 W_5			C_2 H_2 H_8	C_8 H_8 L_7 Q_8	C_2 L_7
PT	G_6	G_3												
NT				N_1		N_1								
SS					W_5			H_5 W_5	H_5 W_5					
DS											C_4			
BT							S_9							

Selectivity Experiments - Codend width

Gear type	Mesh size		
	80	90	100
OT	C_1 H_1 W_1	C_1 H_1 W_1	C_1 H_1 W_1
SS	C_1 H_1 W_1	C_1 H_1 W_1	C_1 H_1 W_1

Selectivity Experiments - Extension lengths

Gear type	Mesh size		
	80	90	100
OT	C_1 H_1 W_1	C_1 H_1 W_1	C_1 H_1 W_1
SS	C_1 H_1 W_1	C_1 H_1 W_1	C_1 H_1 W_1

Selectivity Experiments - Shortened selvedge ropes

Gear type	Mesh size
	135
OT	C_1

Selectivity Experiments - Grids

Gear type	Mesh size
	135
OT	C_1 H_1

Catch comparison - Full square mesh codend

Gear type	mesh size				
	standard	35	40	95	135
	test	35	35	95	120
OT		O_3	O_3		
PT				C_2	
DS					C_1 H_1

Catch comparison - Square mesh top panels

Gear type	mesh size					
	standard diamond	90	90	90	100	100
	test square	90	105	120	100	120
	test diamond	90	105	120	100	120
OT		C_1 H_1 N_1 R_1 W_1	C_1 H_1 N_1 R_1 W_1	C_1 H_1 H_2 N_1 R_1 W_1 W_2	C_1 P_1	C_1 P_1

Catch comparison - Square mesh windows

Gear type	mesh size						
	standard diamond	70	70	70	90	90	110
	test square	70	75	80	80	90	80
	test diamond	70	70	70	90	90	90
OT		N_2 W_2 P_2 R_1 W_1	N_1 N_3 W_1 W_3 C_3 P_3 D_3	N_1 W_2	C_4 H_4 W_4	C_4 H_4 H_5 W_4 W_5	C_4 H_4 W_4

Catch comparison - Shortenend selvedge ropes

Gear type	Mesh size
	135
OT	C_1 H_1 R_1 T_1

Catch comparison - Grids

Gear type	Mesh size
	135
OT	O_1

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[3] Thorsteinsson, G. 1989
"Icelandic experiments with square mesh netting in the shrimp fishery"
ICES C.M. 1989/B:49

Square top panels

[1] Poulsen, Wileman & Nielsen 1991
"Comparative fishing tests with square and diamond mesh codends"
FTFB meeting Ancona, 1991

[2] Anon. 1991
"Aberdeen experiments on EC- codends"

Square mesh windows

[1] Tumilty, J.E. 1991
"The use of square mesh panels to reduce discarding of White Fish from Nephrops trawls"
FTFB meeting Ancona, 1991

[2] Hillis, McCormack, Rihan, Geary 1991
"Irish square mesh selectivity trials 1990"
FTFB meeting Ancona, 1991

[3] Ulmestrand, M. & Larsson, P.O. 1991
"Fishing trials with 70mm square mesh in the top of a Norwegian Lobster trawl"
FTFB meeting Ancona, 1991

[4] Anon. 1991
"Sunbeam trials by Abdn"

[5] Ferro, 1991
"Keila trials"

Shortened Lastridge Ropes (SLRs)

[1] Jacobsen, J.A. 1991
"Size selectivity in bottom trawls with shortened lace ropes"
FTFB meeting Ancona, 1991

Grids

[1] Valdemarsen, J.W. & Mikalsen, L. 1991
"Preliminary tests with a grid arrangement to select sizes of shrimp in trawls"
FTFB meeting Ancona, 1991

APPENDIX II

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northeast Fisheries Center
Woods Hole Laboratory
Woods Hole, Massachusetts 02543

June 20, 1991

TO: Mr. B. van Marlen, Chairman
ICES WG on Fishing Technology and Fish Behaviour (FTFB)

FROM: Dr. F. Serchuk, Chairman
ICES Advisory Committee on Fishery Management (ACFM)

SUBJECT: ACFM Review of Extract of 1991 Report of the Working Group on Fishing Technology and Fish Behaviour related to *"A critical review on gear constructions that improve size selectivity, in particular square mesh."*

On behalf of ACFM, I extend my greetings to you and gratefully acknowledge your efforts in providing ACFM with a copy of your Working Group's *"critical review on gear constructions that improve selectivity"* developed at the FTFB WG meeting during 22-24 April 1991 in Ancona, Italy. ACFM considered this document at its May 1991 meeting in accord with Council Resolution 1990/2:8 (b). Your report generated a healthy and constructive discussion at ACFM which I feel was informative and relevant.

Attached is a copy of the ACFM statement on the FTFB report. This statement will appear in the *Minutes of the May 1991 ACFM Meeting* (which you will receive when available). In my opinion, I believe that ACFM felt that the FTFB report provided a good review of the available information on gear constructions in relation to selectivity, but the Committee was somewhat disappointed that the FTFB WG was not able to provide a clearer evaluation of their usefulness, particularly concerning square mesh. From the note that you provided to ACFM on the FTFB report, I sense that you had a similar feeling (i.e., *"we found it extremely difficult to make very strict statements on the use of square mesh in fishing gears with the aim to protect juvenile fish"*).

ACFM would like to encourage closer cross-Committee interactions within ICES, and enhanced communication between the FTFB WG, the Fish Capture Committee, and ACFM is certainly desirable. As you are probably aware, your 1991 WG Report (B:28) has been selected for presentation at the ACFM Theme Session at this year's Statutory Meeting in France. I see this an important start in fostering a closer relationship between your WG and ACFM. I hope you agree.

Again, your cooperation and assistance in addressing ACFM's request for a review of net constructions to improve selectivity is very much appreciated.

I look forward to further interactions with you and the FTFB WG in the future.

cc: Dr. R. Grainger, ICES Statistician
Prof. K. Olsen, Chairman, ICES Fish Capture Committee

Fishing Technology

Following a request from ACFM, the WG on Fishing Technology and Fish Behaviour of the ICES Fish Capture Committee reviewed the present knowledge of trawl and seine constructions that are expected to improve the size selectivity of towed fishing gears.

Most attention was paid by the WG to the effects of square mesh netting (SMN) in cod ends, both full square mesh cod ends and square mesh windows in the upper part of the cod end or extension of trawls with otherwise diamond shape meshes. Other subjects dealt with were shortened lastridge ropes (SLR) which keep meshes open by reducing the pressure on the netting caused by the catch, and grids designed to release small-sized fish or shrimps.

For each of these devices, the WG considered selectivity in terms of the selection factor and selection range. When considering the advantages of these devices over a simple increase in mesh size, however, it is the selection range (that is to say, the steepness of the selection ogive) that is the central factor.

For most groundfish species, increased escapement of small specimens can be achieved by application of square meshes as well as by increasing the diamond mesh size. One experiment has shown that, for haddock, application of square meshes will also give a lower selection range resulting in a greater degree of selectivity between large and small fish. In general, however, most experiments have failed to show a decreased selection range.

Changes in mesh sizes, mesh shapes, or gear configurations can be used to:

- reduce the capture and therefore discarding of small specimens of a valuable species.
- increase the survival of escaping individuals.
- change the species composition in the catch.
- avoid the risk of overfishing.

Gear assessments in which fishermen are directly involved will normally produce more reliable results. They will also be more convincing regarding the likely effect of gear changes because fishermen generally overestimate negative effects such as the possibility of losing valuable elements of the catch. This is particularly important when effects on catch composition, quality of the landings, changes in catch rates, and the possibility of giving access to fishing areas otherwise closed, are investigated.

If direct benefits are not clear, or do not balance the disadvantages (such as higher costs of construction and maintenance of the modified gear, and loss of [valuable] catch), the acceptability by the industry will be low. In such cases, the benefits and problems of enforcing gear adaptations must be carefully weighed against those of more straight-forward measures (increasing mesh size, closing of areas) to achieve the management objectives.

APPENDIX III

FTFB SUB-GROUP ON SURVEY TRAWLS.

OBJECTIVES:

1. Review of factors that could be the source of bias and variation in trawl performance.
2. Review of the present Manual for ICES's IYFS/IBTS.

Time schedule: The Report of the Group should be presented to the Fish Capture Committee at the 1991 Statutory Meeting in La Rochelle. The time available is rather short and the final draft must be ready for printing by mid September and be handed over at the meeting. It was agreed that the first draft should be ready and received at Marine Inst. of Res. ,Lysekil by early August and distributed to all participants as soon as possible by fax.

Workings schedule:

Item 1. Evaluation of the sources of inconsistent performance in existing survey trawls, in particular the GOV net.

Suggestion: We take the discussion at the Workshop in St. Johns's as a start point and concentrate on gear and vessel effects.
This part could either be an own paper or a part of the report. We could decide later on this matter.

First draft: Peter Koeller.

Item 2. Review of the existing Manual for IYFS/IBTS.

Section 1. Background and present recommendation

First draft: Olle Hagström and Ad Corten/Henk Heessen

Section 2. Description of the GOV trawl

- description of the net(is the present net drawing detailed enough to exclude misunderstandings by manufactors).
- description of rigging(see above and add for the user crew, scientists).
- description of standard ground gear(same as above).
- recommendation on trawl doors.
- mounting of sensors on the trawl and on trawl doors.
- check list of important measures that should be checked prior to a survey and if some should be carried out during a survey.(Could F. Chopin's check list be a start point).
- compare with the recommendation by Net design Study Group.

First draft: Bob van Marlen.

Section 3. Fishing method.
- constrain on door spread, recommendations.
- depth warp ratio.
- speed (ground speed, speed of the net ?).
- shooting and hauling procedure.
- how to define start and stop time of the haul.
- fixed sweep length
- etc.

First draft: Arill Engås.

Section 4. Monitoring of trawl performance and environmental parameters. It was agreed to recommend a passive approach. At present the following parameters are recommended:
- door spread.
- vertical opening.
- surface and bottom temperature and salinity.

Which more parameters should be monitored? This section could also be aiming at establishing a platform for future research by creating a data base of environmental parameters that could have impact on fishing power and fish behavior.

First draft: Peter Stewart.

Section 5. Effects of alteration in rigging and fishing method.
A list of possible effects on the trawl performance if the standard rigging and method is not adhered to. This section could be based on existing information from flume tank tests and field experiments carried out on the GOV trawl. If possible a video package demonstrating the effects could be included for training/education purpose.

First draft: Klaus Lange

Section 6. A new standard trawl for multispecies bottom trawl surveys. Should the group consider a recommendation of change of the GOV trawl?

FTFB SUBGROUP

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