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Report of Activities

FISH CAPTURE COMMITTEE

by

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1990

BELGIUM

(R. Fonteyne)

Attention was paid to four main topics, viz.
- gear research,
- research on selectivity,
- research on netting materials and
- the introduction of computer techniques in technical fisheries research.

Gear Research

The gear research aimed at the development of efficient fishing gear from a technical, biological and economical point of view. As a consequence this research is often carried out in close cooperation with the fishing industry. The types of gears involved in this research were beamtrawls for flatfish as well as for shrimps, semi pelagic and high opening bottom trawls and pair trawls. As in the past years a reduction in towing resistance was still of a major concern in the development or improvement of fishing gear.

The technical parameters of two semi-pelagic trawls for small trawlers (240 hp) were compared. The parameters were measured with SCANMAR equipment. New equipment to measure warp tension and warp length was also installed on board the RV "Belgica".

A study with twin shrimp trawls on board a coastal stern trawler was finished. The nets used did not satisfy completely and new designs will be considered in the future.

The catching performance of different designed nets for the sole beam trawls fishery was compared. Other comparative fishing experiments were carried out to study the influence of the ground rope design on the catching efficiency of shrimp beam trawls.

Selectivity studies

A study on codend selectivity for sole in the coastal beam trawl fishery was completed. The codend parameters involved were the mesh size, the netting material, the mesh shape (diamond versus square) and the codend length. Of these only the mesh size proved to have a significant effect on the

selectivity for sole. Contrary to the results obtained with roundfishes, no influence of the mesh shape on the selectivity could be shown for sole. As a consequence further selectivity research will emphasize on the use of square meshes to improve species selectivity. This problem is also the subject of an EC cooperative research project (FAR-program DG XIV) with RIVO in IJmuiden and Seafish in Hull.

The methodology of selectivity experiments was studied during several research cruises with the RV "Belgica". In these experiments use was made of a twin beam trawl consisting of two four meter beam trawls rigged to an 8 m beam. The covered codend method was compared with the twin trawl method. In these experiments special attention was paid to the masking effect occurring in the covered cod end method.

Netting materials

The research on netting materials concentrated on the shrinkage of netting due to the absorption of bottom sediments. A new experimental method permits to control the tension on the netting sample during testing. Nettings of different materials and construction were tested. Dependent on the tension on the netting (0, 2 or 4 kgf per mesh), the nature of the sediment (sand or mud) and the yarn characteristics (multi or monofilaments, twisted or braided), mesh size reductions of up to 6 % were noted.

Computer techniques

The application of computer techniques in technical fisheries research was continued. A computer program for the analysis of data from selectivity experiments was improved. A database of technical characteristics of fishing gears used in the Belgian fleet was compiled. PLANCHALUT software is used to store, edit and modify trawl specifications and to plot the net plans.

Data from warp tension measurements and from SCANMAR gear control sensors can now be stored on disk for later analysis.

Work is going on to handle the large number of data of obstacles on the fishing grounds operated by Belgian fishermen.

CANADA

(P.Koeller)

Pacific Biological Station, Nanaimo, B.C.

Fishing Gear, Fish Behaviour, Selectivity: The Marine Survival of Salmon (MASS) Program investigated the migration routes of juvenile sockeye, pink, and chum salmon using twin 'Bernard-Sigmund' beam trawls (length: 83m, opening: 10 x10m); two cruises conducted to investigate the effect of trawling on rockfish behaviour included simultaneous fishing and hydroacoustic observations on diel distribution patterns and behaviour; sampling properties of a small, portable midwater trawl used for pelagic fish populations in sockeye salmon nursery lakes were studied - trawling and acoustics comparisons indicated CPUE alone is an unreliable abundance indicator and trawl/trap comparisons provided trawl size selectivity.

Acoustics: A fishing and acoustic study of rock fish (*Sebastes* spp.) on untrawlable bottom identified distinct fish concentrations but encountered difficulties resolving fish from steep and rough bottom; a Simrad FS-3300 Trawl Sonar has been added to the existing trawl and acoustic survey tools and its use is being considered for rockfish behaviourial studies; acoustic surveys continue to census fish populations in salmon nursery lakes; acoustics provided information on changes in distribution of adult salmon responding to deteriorating water quality in Alberni Inlet; a fifth annual acoustic estimate of herring in Hecate Strait was completed on two distinct overwintering locations, roughly about 30 km square, with survey activity concentrated around dusk and dawn to decrease variability due to diurnal migrations; an extended hydroacoustic assessment of summer feeding aggregations of Pacific hake was conducted; the problem of expanding transect surveys to cover an entire survey area is being addressed using a graphic information system; several algorithms can now be developed to objectively expand echo integration based on acoustic density measurements of the survey area and to combine them objectively with related fishing, bathometric and oceanographic data; a breakthrough in acoustic data processing has been achieved by using standard and customized image processing techniques to discriminate complex bottom and identify/analyse individual schools for better biomass estimates of demersal fishes, fish behaviour studies, "acoustic species recognition" and species specific acoustic estimates.

Freshwater Institute, Saulte Ste. Marie Lab, Saulte Ste. Marie, Ontario

Fishing Gear, Fish Behaviour, Selectivity: Further study of Arctic cod schooling behaviour and marine mammal/sea bird predation in Lancaster Sound (Canadian Arctic archipelago) was completed; a study of fish abundance/distribution in three lakes of the Red lake Climate Change study group was also completed successfully, allowing three other lakes to be evaluated; work continues on the study of fish migration through hydroelectric diversion channels; research was initiated in the Great Lakes Habitat Restoration Program (Thunder and Nipigon bays, Lake Superior); the response of fish populations to restoration measures is being studied with acoustics and traditional fishery science techniques, initially to establish baseline data prior to implementation of restoration measures.

Acoustics: A hydroacoustic (120 kHz) study of shrimp in eastern Hudson Strait (depth 300m), groundtruthed with a BIONESS multistage plankton sampler and a bottom trawl, was completed. Shrimp were readily detectable near the bottom and within the water column. Diel vertical migration was extensive.

Institut Maurice-Lamontagne, Mt Joli, Quebec

Fishing Gear, Fish Behaviour, Selectivity: The fisheries Research Division continued comparative gear trials with the URI81/114 and the Western-2A shrimp trawls.

Acoustics: The two-frequency (38 and 120 kHz) dual-beam Biosonics system was used along regularly-spaced parallel transects in the NW Gulf to map ecological resources and fin, humpback and blue whale aggregations - a meso-scale upwelling/mixing front was found, bordered by large-amplitude high-frequency internal-waves that were traced by vertical displacements of sound scattering layers, and an exceptionally rich copepod scattering layer was detected at 120 kHz in a 200 m-deep basin; herring was surveyed on the west coast of Newfoundland, although most efforts were directed to developing the acoustic system, including a 120 kHz sounder, a DAT recording unit and the new FEMTO-HDPS 9001 menu-driven digital data acquisition and editing unit (Femto Electronics Ltd. Halifax).

New Brunswick Department of Fisheries

Fishing Gear, Fish Behaviour, Selectivity: A shrimp trawler was provided with a Scanmar multi-catch sensor to enable cod end monitoring; a bottom trawl was built with a new twine which is 30% stronger than conventional braided twine; a semi-pelagic shrimp trawl was evaluated for catch rates during day and night hours for harvesting shrimp as they rise off bottom at night; a fibreglass lobster holding tank equipped with a compact circulating refrigerated sea water system was installed on an inshore lobster boat, the first small system which can be successfully installed for use on an inshore fishing boat; a net drum and accessories were evaluated for inshore ground fishing.

DFO Scotia-Fundy Region Biological Sciences Branch

Fishing Gear, Fish Behaviour, Selectivity: Measurements with Scanmar sensors continued on standard groundfish trawl surveys and special gear trials to describe variations in gear geometry and determine methodologies required for a more constant sampling unit. A new speed sensor was purchased for use on survey sets. Protocols for survey gear deployment were developed.

Acoustics: Recent research utilizing a multi-frequency acoustic system at 12, 50 and 200 kHz resulted in a new acoustic model for euphausiid target strength; recent sampling experiments using lights on a net sampler produced closer agreement between the net and acoustic euphausiid estimates than previously; a new 8 frequency (1 mHz - 50kHz) acoustic system will be tested this fall with the first field trials planned for 1992 - the system will be towed or vertically lowered to depths of 300m; acoustic abundance estimates of the NAFO Div. 4WX winter herring stock were again made from parallel transit surveys; an exploratory demersal first survey on Georges Bank showed that cod and haddock caught by bottom trawl were too close to bottom to be detected by the acoustic equipment - a higher frequency sounder and a long cable to tow the transducer closer to the bottom are being purchased to increase resolution near bottom; a new field method for deriving unbiased estimates of maximum dorsal aspect target strength of individual gadoid fish was developed for use with dual or split beam acoustic systems; analysis of dual-beam acoustic data obtained from a concentration of spawning haddock has demonstrated that the high degree of mesoscale aggregation is body-size dependent.

DFO Scotia-Fundy Region Fisheries Development

Fishing Gear, Fish Behaviour, Selectivity: An experiment was carried out to fish sea cucumbers, initially with trawls which had a high groundfish and lobster bycatch, then with modified scallop drags which was very successful; a metal grate similar to the Norwegian Nordmore Grate was tried in the shrimp grounds off Nova Scotia and found effective in reducing the bycatch of fish from 35-

40 percent (by weight) to less than 10 percent; A ghost gillnets experiment was initiated by setting gillnets and observing them periodically with UWTV to determine how long the nets continue to fish; a strobe light was used to determine the reaction of fish to a trawl at night; preliminary experiments were carried out to test separator trawls with a horizontal panel similar to the one tested by DAFS Aberdeen; more experiments were carried out with offshore trawlers to demonstrate the impact that the change to 140mm square and 155mm diamond codends will have on catch rates and species composition; a hook selectivity experiment was conducted to see if catches of small swordfish could be reduced.

DFO Newfoundland Region Biological Sciences Branch

Fishing Gear, Fish Behaviour, Selectivity: Engineering sea trails with the Engel 145 High Lift and juvenile flatfish survey trawls were conducted using Scanmar, including net performance with varying vessel speed, scopes and depths; two small studies were initiated to monitor diel changes in fish reactions to trawls using an underwater ROV to take video and still pictures during both day and night - the trawl was also fitted with glow lights on the footgear to determine bioluminescence effects; square/diamond mesh selectivity (130 mm) in cod and flatfish was examined on the Grand Bank with a trouser trawl; the effect of tow duration (5, 15, and 30 min) on catches of cod, plaice, and yellowtail in a survey trawl was also studied.

Acoustics: Two inshore surveys estimated herring abundance off the southeast and northeast coasts of Newfoundland; offshore cruises comprised two capelin biomass surveys, one redfish biomass survey, one experimental survey evaluating procedures for estimating cod biomass during winter spawning aggregations, and one experimental cod survey to track a large cod aggregation during spring migrations; target strengths of net-enclosed herring at frequencies of both 38 kHz and 120 kHz were determined and a target strength/length relationship at 120kHz derived from the experimental data was used to estimate herring biomass; development activities included a preliminary design for a 'standard target' calibration capability for the offshore acoustic data acquisition system; refinement and evaluation of the 'standard hydrophone' calibration technique was continued; additional successful testing and trials of the towed body stern deployment and retrieval system for the R.V. *Gadus Atlantica* were carried out.

DFO Newfoundland Region, Fisheries Development

Fishing Gear, Fish Behaviour, Selectivity: Work continued with UWTV to determine the extent of lost gillnets and their effect on the fishery; an entangled (in fishing gear) whale release program has developed methods of freezing entrapped whales which has reduced losses to fishermen and reduced whale deaths - research also continued on acoustic alarm devices which assist whales in locating fishing gear; cod trap mesh size selectivity was investigated to reduce the catch rates of small fish; vessels were chartered to fish for Turbot using gillnets in water depths ranging from 700 to 1300 meters and larger than usual gillnet mesh sizes to enhance selectivity; Norwegian seining trials for Turbot fishing on rough grounds and in deeper waters (1200) were also conducted; square vs. diamond mesh cod end trials for juvenile cod fish escapement during the northern cod fishery were conducted.

Marine Institute, St. John's, Newfoundland

Fishing Gear, Fish Behaviour, Selectivity: Underwater observations of the behaviour of cod in and around a modified Newfoundland cod trap using a video camera and a sector scanning sonar were conducted; a series of checklists designed to capture errors in construction/repair of groundfish survey trawls was developed for DFO Newfoundland Region Biological Sciences Branch; the performance of an innovative harvesting concept for the Stimpson Surf Clam fishery on the Grand Banks was evaluated; a project to transfer deep water (1300m) small trawler (20m) capability from Australia and New Zealand to Newfoundland was also conducted.

DENMARK
(P. Degnbol)

Danish Institute for Fisheries and Marine Research

Acoustics

Acoustic methods have been implemented in routine stock surveys in the North Sea and the western Baltic. Acoustic data with high resolution have furthermore served as a major input in a special study on spatial structure of biological targets in hydrographic fronts in the North Sea.

Development work on an echoanalyzer system (Echoann) has continued. The system is operational and has been used in abovementioned cruises. Further development work is mainly concerned with algorithm development for bottom tracking and pattern recognition.

Codend selectivity

A study comprising comparisons between catches using various mesh sizes and diamond/square mesh was conducted as a cooperative project with Danish Institute for Fisheries Technology and Aquaculture, see details under that institute.

Greenland Fishery Research Institute

Estimation of selectivity in shrimptrawl.

The estimation was done by alternate use of a 43 and 18 mm stretched mesh size in codend. The haulswere made with four different haul durations : 0.5, 1.0, 2.0 and 3.0 hours and the selection parameters were cmpared. A total of 44 hauls were made.

Shrimp sorting device test.

The device was incorporated in the trawl and was designed to let small less valuable shrimp pass through a grafting, directing only the bigger shrimp into the codend.

Danish Institute for Fisheries Technology and Aquaculture

Change of institute name

The Danish Fisheries Technology Institute was on 1 April 1990 merged with 3 other existing institute departments into the Danish Institute for Fisheries Technology and Aquaculture, DIFTA. There are 4 departments in the new institute Fishing Gear Technology, Fish Processing, Fisheries Economics and Aquaculture.

Codend selectivity studies
Contact persons David Wileman and Nikolai Poulsen

DIFTA and the Danish Institute for Fisheries and Marine Research (Charlottenlund) made catch comparisons between different types of codend using commercial trawlers and 2 trawl systems. The comparisons made were

100 mm diamond v 120 mm with square mesh in upper
v 100 mm with square mesh in upper
v 90 mm diamond

90 mm diamond v 120 mm with square mesh in upper
v 105 mm with square mesh in upper
v 90 mm with square mesh in upper

The first series was with a vessel primarily catching plaice. The second with a vessel catching nephrops and whitefish. Changes in catch weight, catch value and discards were measured. Estimates of the change in selection factor for cod and plaice with the codends with square mesh in the upper were obtained based on the assumption that the selection factor is known for the standard codend and the selection range is the same for the standard and test codend.

An EEC funded study of anchor seine selectivity was started. The trouser codend technique is to be used with the last 11 m of the belly divided into 2 compartments by a vertical panel. This arrangement was tested full scale in the flume tank. The selectivity measurements at sea are to be made in 1991. The small mesh codend is 30 mm. The test codends will be 90 mm and 100 mm with alterations to codend circumference and length. Normal diamond mesh codends and codends with square mesh in the upper will be tested.

Development of species selective trawls
Contact persons David Wileman and Nikolai Poulsen

Work started on two EEC funded projects to develop species selective trawls.

One is in partnership with INIP, Portugal and aims at separating fish from Portuguese nephrops/shrimp trawls. Observations of 3 standard trawls were made with the towed underwater vehicle FOCUS and one selected for redesign to the selective trawl. An oblique large mesh separator panel located in the last 10 m of the belly will be used together with a twin codend system, the upper codend is for the fish bycatch. The panel design is similar to that developed for a Danish North Sea shrimp trawl. There is clearance between the separator and the lower belly panel such that flatfish and rubbish enter the lower codend.

The second EEC project is in partnership with the Marine Laboratory, Aberdeen and aims at separating herring and whiting in Norway pout trawls by means of a horizontal separator panel. The bosom of the separator panel is to be 1 m to 2 m off the seabed and located directly above or 1 m behind the footrope.

DIFTA was contacted by the Faroese Fisheries Research Institute to assist in the development and testing of a selective lemon sole trawl where bycatches of cod were to be reduced. The gear was model tested in the flume tank and observed at sea using FOCUS. The trawl footrope was towed in front of the headline.

A Danish trawl manufacturer has further developed oblique separation panels for removing unwanted fish bycatches in shrimp trawls. They are of the type described in the INIP FAR project and have been introduced in Greenland and Swedish deep water shrimp fisheries.

Underwater observation of commercial gears
Contact person Mogens Andersen

FOCUS was used on board a Danish commercial trawler to observe the midwater 4 bridle trawls used in the cod fishery.

Trawl design development
Contact person David Wileman

The inventor of the Y-design concept Stig Yngvesson left the institute to return to work in the trawl manufacturing industry itself. Development of trawl designs using the concept has now been taken over by the industry itself. Results have been mixed with the best results obtained by trawls with higher openings and large meshes in the mouth.

A Hirtshals fisherman received funding for the development of trawls where a large mesh square/wing section is laced to an existing trawl headline. It is referred to as a Paraply (umbrella). The false headline is slackened such that the netting balloons up, giving 60-100% extra height for little increase in drag or loss of bottom contact. The intention is to scare higher swimming fish down into the trawl. The design has been model and full scale tested. 6 commercial vessels have had a "paraply" fitted to their trawls. No practical problems have been experienced and the anticipated increases in headline height achieved.

Netting drag studies
Contact persons Lars Høgh Knudsen and Kurt Hansen

Further measurements were taken of the drag and lift of inclined planes of sheet netting in order to separate the effects of mesh opening, diameter/mesh length and knots. An improved mathematical model of the netting drag was developed based on cross flow theory, shadow effects and a non-spherical knot shape.

Trawl door studies
Contact persons Kurt Hansen and Lars Høgh Knudsen

Work continued on the EEC FAR Project carried out in partnership with SFIA, England and IFREMER, France. Model tests in the flume tank were carried out to measure lift and drag coefficients for 2 Vee doors of 0.5 and 0.66 aspect ratio, 2 different sizes of cambered Vee door and a spherical door.

The project studying the efficiency of midwater trawl doors was completed. 5 basic plate profiles were studied in which camber and aspect ratio were varied. Lift and drag forces were measured in flume tank tests at different angles of attack. Lift was dependent on aspect ratio, camber and angle of attack. Drag was not significantly dependent upon aspect ratio. Empirical models were developed for predicting lift and drag for door profiles without slots and also for determining optimum towing point/towing chain arrangements for a given warp/door/trawl towing configuration. Model tests were then made with multifoil doors and a high aspect ratio Vee door with a narrow foil mounted behind the leading edge. A door manufacturer is to develop and test the last named door full scale for introduction to the fishing fleet.

FAROE ISLANDS
(B. Thomsen)

Fishing Technology

Tventy years ago a fishery for flatfish, with small trawlers, commenced inside the 12-mile limit at Faroe. Although this fishery has been restricted to certain areas where flatfishes are most abundant, an unacceptable amount of the catches have been roundfish (cod and haddock).
In order to reduce the catch of roundfish Fiskirannsóknarstovan (Fish. Lab.) last year carried out some experiments to alter a trawl used in this fishery.
This work included model eksperiments in flume tank in Hirtshals, monitoring of fish reaction on the altered trawl on fishground at Faroe with a TV-Remote Controlled Vehicle (on hire from Hirtshals) and comparable fishing with an altered/unaltered trawl.
In the altered trawl it was possible to almost avoid bycatch of haddock and reduce the bycatch of cod by 40% without reducing the catch of flatfish.

The fish stocks on the faroe-plateau are severely over-exploited. As an example the mean length of saith in the catches is reduced from 77 cm to 63 cm within the last decade.
In the beginning of 1989 the legal mesh size in trawl codend was increased from 135 mm to 155 mm. Due to pressure from the boat owners the mesh size was reduced to 145 mm 3 months later. Parallel to research on how young fish can be preserved by closing areas for fishery, effort is put into gear selectivity research. During autumn 1990 the difference in selectivety in two twin trousers trawls, one with the lace in the codend shortened 15%, was tested. Results comparable to norwegian experiments was found.
Further experiments with the norwegian developed Troll-X sorting grid system are planned in 1991.

Acoustics

As previous years surveys including acoustic integration were carried out to map distribution of blue-withing. Also acoustics were used on a herring survey. To estimate the density of herring schools in the upper waterlayers, a side looking sounder in a towed body was used. These surveys are reported to the Pelagic Fish Committee.

FINLAND
(P. Suuronen)

Gear Selectivity and Technology

The size selectivity of a square mesh codend was compared with that of a diamond mesh codend of the same nominal mesh size (A=36 mm) in pelagic herring trawls in the Archipelago Sea, northern Baltic (ICES SD 29N), in May-June.

Preliminary selectivity trials with a hexagonal mesh (A=32 mm) in the codend of a pelagic herring trawl were made in the Gulf of Finland (ICES SD 32) in October in collaboration with the Tallinn Department of the Baltic Fisheries Research Institute.

The selectivity of square and diamond mesh codends (A = 20, 24 and 30 mm) in pelagic vendace trawls was studied in September-October in Lake Oulujärvi in Central Finland by using a small mesh cover bag. The survival of escaped vendace was studied.

Trials for constructing a species-selective trapnet for whitefish were conducted on the coastal waters of the Northern Quark (ICES SD 31).

Trials on the effect of bait size on the salmon long-line catch composition were continued in the eastern part of the Gulf of Finland.

Testing of the effectiveness, selectivity and durability of the different types of gillnet materials (bar length 50 mm) used in the pike-perch fishery was started in the Archipelago Sea in autumn.

Preliminary trials on leading herring schools into a floating pound-net with the help of underwater lamps were conducted in the Archipelago Sea in October-December.

The effect of winter conditions (freezing) on the physical properties of different netting materials was studied in the Merenkurkku Fisheries Research Station.

Acoustic Surveys

Four combined hydroacoustic-trawl surveys were conducted in the northern Baltic in 1990. Surveys covered in ICES Division IIId Sub-divisions 29 and 32. The dates of survey were:

1. January 09.01.-23.01. (Gulf of Finland; SD 32)
2. March-April 27.03.-06.04. (Gulf of Finland; SD 32)
3. July-August 24.07.-09.08. (Gulf of Finland and northern Baltic Proper; SD 32 and 29)
4. October 16.10.-27.10. (Gulf of Finland and northern Baltic Proper: SD 32 and 29)

The main aim of the surveys were to estimate seasonal changes of Baltic herring and sprat abundance in the northern Baltic and Baltic herring migration between SD 29 and 32. A total of 3871 nautical miles were echointegrated and 57 hauls with Larsen-type pelagic trawl made. Equipments used were EK-400 connected to SIORS-echointegrator and EK-500.

FRANCE
(G. Massart)

I. AMELIORATION DES TECHNIQUES DE CAPTURE

1.1. Amélioration des chaluts et de leurs apparaux

1.1.1. Conception des chaluts assistée par ordinateur

Poursuivie maintenant dans le cadre du programme FAR en coopération avec le Danish Institute for Fisheries Technology and Aquaculture (DIFTA) et le Danish Maritime Institute (DMI), l'étude du logiciel de CAO des chaluts progresse correctement. En particulier l'ensemble des câbles du gréement est maintenant pris en compte et les zones où le filet est détendu sont correctement représentées. L'initialisation du calcul itératif est également rendue plus facile et plus rapide.

1.1.2. Etude des panneaux de chaluts

Menée dans le cadre du programme FAR en collaboration avec la Sea Fish Industry Authority et le DIFTA, cette étude a permis la mesure des performances de différents panneaux en bassin et à la mer, et a donné lieu à des travaux d'intercalibration entre les trois instituts. Quelques difficultés sont apparues, qui montrent le caractère indispensable de ces travaux d'intercalibration. Douze panneaux ont été testés en bassin, six l'ont été en mer et les résultats sont en cours d'analyse.

1.1.3. Chalutage profond

Des études sont en cours pour déterminer les conditions de capture de crevettes vivant au delà du plateau continental en Méditerranée Occidentale. Ces études portent sur les zones de pêche comme sur les types de chaluts et de gréements les mieux adaptés à cette pêcherie.

1.1.4. Chaluts siamois

Dans un souci d'accroître l'ouverture horizontale des chaluts sans en accroître la traînée, sans accroître exagérément la complexité du gréement, nous avons étudié des chaluts "siamois", intermédiaires entre chalut simple et chaluts jumeaux.

1.1.5. Drague à coquillages enfouis

Une diversification des conditions d'emploi de la drague à pétoncles et coquilles Saint Jacques dite "à effet MAGNUS" est en cours d'étude. En installant en avant de la drague une batterie de jets d'eau qui brassent le sable et mettent en suspension les coquillages qu'il contient (bivalves fouisseurs), il est possible de les collecter en profitant de l'avantage de la drague à effet MAGNUS constitué par son absence de lame. On diminue ainsi radicalement la casse de coquillages survenant normalement pendant leur désenfouissement et leur collecte.

2.2. Etudes sur l'aménagement des navires

2.2.1. Thoniers senneurs

La flottille française des thoniers senneurs opérant en zone tropicale utilise exclusivement le gréement dit "californien" avec power block de virage de la senne en bout de corne. Une étude est en cours pour analyser les avantages qu'il y aurait à transposer aux navires de ce type un gréement utilisant un vire filet sur la lisse, le power block sur grue ou sur mât de charge ne servant plus qu'au rangement de la senne.

2.2.2. Chalutiers

Les problèmes de sécurité et d'ergonomie sur les chalutiers pêche arrière d'une longueur de l'ordre de 25 mètres sont recensés et analysés dans le but d'alimenter la réflexion en cours dans les chantiers pour résoudre au mieux ces problèmes.

2.2.3. Tri du poisson par analyse d'image

La recherche entreprise précédemment a été suspendue en 1990, la maquette qui avait fonctionné en 1989 n'étant pas embarquable et le travail en laboratoire sur de vrais poissons n'étant pas réaliste. Nous avons donc entrepris la création d'une photothèque constituée de photographies de poissons prises au sortir du chalut et censée fournir des images assez variées et en assez grand nombre de chaque espèce commerciale pour que leur analyse fournisse des critères d'identification reconnaissables par ordinateur statistiquement valables.

Il faut enfin signaler, dans le domaine de l'hydrodynamique et de la technologie des pêches, l'entrée du chantier du bassin d'essais de chaluts de Boulogne-sur-Mer dans sa phase finale, celle des essais, à la fin de 1990.

II. ACOUSTIQUE SOUS-MARINE APPLIQUEE A LA PECHE

2.1. IFREMER

Une nouvelle version du logiciel MOVIES de traitement de données sondeur par ordinateur compatible PC a été étudiée ; ce logiciel reconnaît automatiquement des bancs de poissons et il est maintenant possible d'effectuer l'écho-intégration par banc et non plus uniquement par tranche d'eau.

Les premiers essais en mer d'un prototype de sondeur large-bande (20-80 kHz) ont été effectués à bord de la THALASSA. Sur le plan fréquentiel, des études sont entreprises pour déterminer le type de traitement le plus pertinent. La résolution en distance de ce sondeur s'est avérée remarquable.

Une étude sur la détermination de la nature des fonds sous-marins est en cours à partir de signaux émis par des sondeurs standard.

La gestion du stock d'anchois du Golfe de Gascogne a été poursuivie en collaboration avec l'Espagne, avec comme support une campagne d'écho-intégration effectuée en avril-mai.

Une deuxième campagne acoustique s'est déroulée en août dans le golfe de Gascogne avec pour objectif l'abondance et la distribution de ressources pélagiques potentielles pour des produits transformés type surimi.

2.2. Centre d'Océanologie de Marseille-Luminy

Les recherches en matière de détection de particules - plancton ou autre - avec pour objectif leur identification ont été poursuivies. Plusieurs fréquences d'émission sont utilisées simultanément - 28 à 200 kHz - monofréquence ou large-bande. Les échos réverbérés par des populations naturelles complexes ou expérimentales simplifiées sont enregistrées et font l'objet d'un traitement approprié du signal. L'élaboration d'un modèle est en cours pour expliquer les accumulations de particules ainsi détectées.

2.3. ORSTOM

- Poursuite de la collaboration au programme d'évaluation des stocks pélagiques par campagnes d'écho-intégration au Sénégal.

- Observations précises de la répartition des concentrations de poissons et de leur évolution dans le temps dans le Golfe de Cariaco (Vénézuéla). L'utilisation des méthodes géostatistiques a été développée.

- Prospection acoustique des fonds de faible profondeur dans le Golfe de Batabano (Cuba) en collaboration avec l'Institut Océanographique de l'Académie des Sciences de ce pays ; une méthodologie particulière a été développée.

- Aboutissement d'une première phase dans les essais d'identification par spectroscopie ulta-sonore dans les bandes 50 à 145 kHz et 140 à 430 kHz, avec un taux de réussite de 80 % environ pour deux espèces dans des conditions expérimentales.

Iceland

(P. Reynisson, G. Thorsteinsson)

Gear and behaviour

Observations on bottom trawl designs with underwater TV camera were continued in 1990. Special attention was paid to different colors in the netting and to the performace of rockhopper footrope. Interesting observations on the behaviour of saithe were obtained. A video film on the highlights of these observations was published with Icelandic and English texts.

The behaviour of Nephrops near their burrows on the bottom was observed prior to the Nephrops fishing season in May. Some observations on the behaviour of shrimp in relation to bottom trawl and square mesh codend were carried out in October. A TV-film on longlining was produced in a cooperation between the Marine Research Institute and the Icelandic state TV station.

A new regulation on minimum meshsizes in trawls, methods of meshsize measurements, codend riggings and related items was prepared in 1990 to become effective in January 1991. The minimum mesh opening in wings and bellies was increased from 135 to 155 mm but the areas where 135 meshopening in codends is permitted were extended.

Some Icelandic freezer trawlers participated in midwater trawl fishing on oceanic redfish SW of Iceland. Gigant trawls with maximum meshopening of 32 metres proved well in spite of some handling problems.

Acoustics

Several acoustic surveys on the stock of the Icelandic capelin were carried out. The results were used for fisheries management purposes.

Separate surveys were conducted on the juvenile and adult stock of the Icelandic summer spawning herring.

An acoustic survey was carried out on zooplankton in a sheltered fjord using 38 and 120 kHz echo sounders. Comparison at these two frequencies show that the target strength of krill is considerably lower at 38 kHz than it is at 120 kHz. Echo abundance figures were considerably lower at night than in daylight, which might be related to the orientation of the animals.

A pilot study of the possibility of doing acoustic abundance estimates of redfish in the area west of Iceland, was conducted in April. This does not look promising at this time of the year due to mixing with other species. Another survey is planned in summer 1991.

The acoustic instrument room onboard R/V Árni Fridriksson was enlarged and rebuilt, resulting in far better working conditions.

GERMANY
(E. Dahm)

a) Institute for Fishing Technology, Hamburg

Energy saving methods

Due to the deplorable status of the cod stocks in the inshore waters of Germany which hampered set net trials on this species research effort was concentrated on a comparison of catches of sole made by beam trawls and by trammel nets. The last ones proved a superior catch efficiency as well as to the amount as to the size of the single fishes. On the other hand, plaice catches were better with beam trawls. The development of a special type of plaice trammel nets is intended.

A comparison between armouring meshes of trammel nets made from twisted yarn and from monofilament yarn revealed no difference in catching efficiency. However, the lint between the monofilament armouring meshes showed less vulnerability. This reduces the maintenance costs for such a type of net.

Fishing trials discovered a few more possibilities for wreckfishing with gillnets for cod in the German Bight.

Investigations with trawls

Research carried out on stock assessment trawls which have been used since many years stressed the necessity of strict prescriptions for construction and rigging of these nets. The change from one type of otterboards to another one of equal size and more or less similar shape which occured nearly unattended lead to a severe distortion of the trawl due to the considerably higher shearing efficiency of the replacing boards.

A further trawl introduced as stock assessment gear according to international conventions showed rather unsatisfactory function when rigged exactly in agreement with the existing rigging prescription. Especially vexing is the inclination of the lower wings to roll around the roller gear. The phenomenon could be removed by a slight increase of the lifting force at the headline.

On difficult ground the use of a bigger roller gear of arbitrary construction is allowed with this trawl. The comparison of different types of roller gear showed clearly the need for a convention on this point. Too heavy constructions lead to distortions of the gear which cannot be compensated by other means.

Preliminary trials were made with bagnets under the fishing line and with one above the headline of a stock assessment trawl. First results are very encouraging with regard to the knowledge of the overall selectivity of this trawl.

Underwater-TV-observations with the aid of a remote controlled vehicle affirmated the calculations and model experiments made in former years with a trawl with big meshes and one with long ropes running parallel to each other in the forenet.

Progress was made in the recalculation of the shape of a trawl during operation from video images taken by the underwater-TV-camera.

Model tests in the wind tunnel of the University of Hamburg with an otterboard of the cambered V-type resulted in considerable improvements in the design of these boards.

Practical fishing trials with a new type of sail kite revealed the necessity of improving the lifting force at the forward edge. This gives sufficient initial lift to get it into the right shape for proper function.

Selection experiments

Comparative fishing trials for cod with square and diamond meshes in the codend were severely impeded by the scarcity of adequate fish aggregations in the North Sea.

Selection experiments for herring which have been carried out now since a number of years were completed by a series of experiments with diamond mesh codends. The hanging coefficient of the meshes in this part of the trawl was deliberately controlled by the length of the codend or the hanging ratio at combination wire ropes used as lestridge enforcements. L-50 value was considerably shifted upwards with decreasing codend length and hanging coefficient. However, because of heavily increased problems with gilled fishes these results are without practical significance. Square meshes show the giller problem only to a limited extent and, thus, may play an eminent role as technical measure for the management of herring stocks in the future.

Material investigations

A longterm study of the change of meshsizes in netting stored under normal environmental conditions in a netshed was begun. All netting used is handmade and conditioned by own means to have an exactly defined starting point.

Electronic measurement board

The electronic fish data acquisition board which was developed in the institute and is capable of recording much more than simply fish lengths was further improved and tested successfully under sea conditions on research ships and on chartered commercial vessels.

b) Institute for Deep-sea Fisheries and Fish Processing, Rostock

In 1990 the works on fishing technology in the institute were concentrated on the development and introduction of stock and environment protecting fishing gear for the Baltic Sea. The mechanization gear for handling long lines existing in Baltic fishery was designed for a more universal application to enable even snood lengths up to 5 m, other hook sizes and greater water depths. There was also provided a whole fish baiting possibility by choice. The complete system is actually designed, built and offered for test in Southern Europe (Italy, Spain, France).

For selective cod fishery a new trawl type (similar to the Y-design) has been designed, built and technically tested jointly with the Federal Research Centre for Fisheries, Hamburg. The following introduction in fishery was successful. On the basis of the same construction principle a twin trawl for stock research in the Baltic has been successfully tested.

In order to improve the efficiency of pair-seining fishery an analysis of the moving behaviour of the whole system was made by model experiments. Evaluating these tests new constructions of the ropes before the seine and of the Danish seine have been worked out and tested technically as well as in the fishery by means of underwater observation technics.

The development of the trawl towed sideward was finished. Within the international hydroacoustic stock surveys of pelagic commercial fishes in the Baltic the trawl was used aboard the FRV "Ernst Haeckel".

In order to improve the efficiency of fishing gear constructions and to carry out check-up calculations extensive soft ware solutions were elaborated. Thus, for instance, a construction programme renders it possible to develop a bottom trawl of any kind of construction up to the technical design and the list of parts in less than 15 minutes.

On the part of the University of Rostock in 1990 were carried out the following research projects:
The investigations about statics and dynamics of pelagic otter boards were brought up to a preliminary end. Now computer programmes are available for the calculation of the fixation points of the otter boards in the case of given position of the otter boards in space. Furthermore it is possible to make check-up calculations for given trawls which depend on working parameters. Moreover it is possible to valuate the stability of the equilibrium position of the otter boards in the project stage.

The research work for developing a CAD-module "set nets" was carried on. First test calculations with graphic representation were realized. Conceptional considerations were made about experimental verification of the calculation results.

Furtheron experimental investigations with a model of a otter board trawl (trawl towed sideward of the ship) in the model test station Insko were carried out. These test results are the basis for further investigations on a full scale trawl.

NETHERLAND
(F. Veenstra & van Marlen)

General
Within the scope of the Community Research programme in the fisheries sector (FAR/DG XIV, 2nd call) various research proposals were sent to brussels. The proposals TE 2.554 " Improved selectivity of fishing gears in the North Sea fishery - beamtrawling" (The Netherlands, Belgium, U.K.) and UP 2.537 "Integrated quality assurance of chilled food fish at sea, phase II" ()Denmark, The Netherlands, Scotland) have been granted.
Much technical manpower was needed for the sea trials and maiden research cruises of the new research vessel TRIDENS. Drawbacks such as vision lines, noise levels and fishing line measurement equiment have been reported and must be improved in the near future.

Projects in developing countries
Besides various technical discussion with Engineering Bureaus about potentional 3rd world fishery projects, no actual missions were carried out this year. Together with a Dutch netmanafacturer New Foundland fishermen were instructed in the use of pelagic trawls onboard of the Canadian research vessel GADUS ATLANTICA.

Safety and working conditions
The in 1988 started project "Safety in the beamtrawl fisheries" (RIVO, TU-Delft, Safety Science Group, granted by the Directorate General of Labour) have been finalized. The conclusions of the definitive reports were reported at the Dutch Ministry of Social Affairs, accompanied with an instruction video-film concerning unsafe working procedures with regard to fresh fish handling.
Generally speaking the occupational accident rate onboard sea-going fishing vessels is 5 times higher than for example similar heavy workload in the building industry ashore.
Local and (re)design solutions were presented at a mini-symposium for the fishing sector (skippers, crew, suppliers) and the Dutch Shipping Inspectorate.
Within the scope of the EG-project UP 1.67 "Integrated quality assurance of chilled fresh fish at sea, Phase I (Denmark, The Netherlands, Scotland) the laboratory prototype for fresh flatfish weighing have been extended for sorting and weighing of more species and was tested onboard of the research vessel. The results are promising to install the equipment onboard a beamtrawler in 1991 (Phase II - EC-project).
With the Maritime Technical Highschool preliminary time-space studies were carried out to incorporate the RIVO fish eye sorter based on real time image analysis principle in a beamer processing line as a drawing board study.

Fishery engine room
By means of the Beamer 2000 approach: safety and environmental integrated redesign of a beamer, the existing ER-layout have been studies as a cooperative research project between RIVO and the Technical University Delft (Safety and Maritime Science). Generally speaking after the beamer up-scaling the main and auxiliary systems are not matching quite well with regard to energy consumptions, remotely controlling and alarming and diesel engine versus engineroom air supply. The NO-x and CO exhaust emissions of marine diesel engines exceed the shore based recommendations (3-5 times).

By means of a RIVO report, articles and a mini-symposium the Dutch fisheries have been informed about the marine gasoils bunkered in the various fishing ports. Although the fuels are within the quality constraints of the (inter)national marine fuel specifications (ISO), these oils are not the most economic (and environmental friendly) fuelks matched to the installed diesel engines and its associated fuel system.

Together with a Dutch supplier of oil filters a debugfilter was tested onboard the GO 22 to reduce, preferably to stop, bacterial and organic grow of constituents in the oiltanks

of the beamers, clogging engine filters. After 3 months testing of the "demagnetizing filter", in 90% of the sampling analysis no bacterial and/or mouldy constituents had been found.

(Re)design of fishing vessels
Although the modern beamers are hightech and excellent flatfish catching fishing vessels, a number of severe drawbacks are the case when considering the designs from a safety point of view:
- wheelhouse layout (vision lines, interfacing bridge electronics)
- deck layout (occupational accidents, workload)
- accommodation (high noise levels)
- engineroom layout (remotely control/alarms, energy (over) supply, emissions)

With safety integrated redesign spiral techniques the working deck has been redesigned extensively. Local engineering solution as well as redesign and organisational solutions have been discussed with the sector. For the wheelhouse layout, together with the Radio Holland Group (bridge electronics) the existing consoles have been redesigned for a bridge of the nineties (full scale with existing equipment). and a bridge 2000 (model scale, with new, still to develop one screen electronics). Both were presented at the Dutch fishery exhibition as a co-project between RIVO, TU Delft and Radio Holland. Together wirh cost/benefit effects and rest risks all the solutions have been published (ICES papers, articles). The beamer 2000 concept: redesign working deck, wheelhouse- and engineroom layout within the general arrangement and without interfering with the beamtrawl fisheries, will be extensively reported in 1991.

Besides the safety, working conditions and environmental aspects a techno-economic analysis is inevitable to introduce this beamer 2000. For the sterntrawlers similar economical studies have been already carried out as presented in two ICES-papers "Economic results of sterntrawlers vs technical parameters" and "A simulation model to determine the optimal freezing rate of a stern".

ROV development.
Remotely Operated Vehicles (ROV's) are used to a great extent in fisheries research today to study the performance of fishing gears and the reaction of fish to these gears. Several configurations of magnusrotors have been tested to optimise the performance of the ROV. Normally these rotors are cylindrically shaped. A spherical shape with the objective to generate an omni-directional lift in a very compact unit did not meet the expectations and should be discarded as a viable solution. A cylindrical rotor is a better lift generator. Future solutions will therefore be sought along this line.

Ecological impact of beamtrawling.
The impact of fishing gears on Benthic organisms has become an important issue for international debate, due to growing awareness of environmental problems. A research project started in 1989 at a national level between RIVO, RWS-Directorate North Sea and NIOZ ("Nederlands Instituut voor Onderzoek der Zee"), and has been continued this year. The results indicate severe impact on some Benthic species, but modest impact on others, and were presented at the North Sea Conference of Ministers.

Trawl studies.
The resistance of a trawl depends greatly on its openings and the area of twines used. Thinner and stronger twines will enable a reduction of the twine area and thus result in less drag and consequently fuel savings. Trials done in 1989 showed perspective for new fibres like Dyneema SK-60. Further experiments were conducted this year to appraise the feasibility of these high strength fibres in pelagic trawls. The net used was bigger than the ones tried out in 1989. It had a circumference of 7700 meshes, and preliminary engineering trials showed that it could be towed on FRV "TRIDENS II" at a speed of 5 knots with an engine power of approximately 3000hp.

Last year trials were done on a rig with one door at one side and a danleno on the other in collaboration with the Deep Sea fisheries Institute (IfH) and the University of Rostock. The objective of this gear is to tow a net at the surface outside the wake of the vessel, thus using suspected avoidance reactions of fish in this region to improve catchability. Model tests and full-scale trials on this single-door trawl, developed at the University of Rostock were conducted this year. Dutch midwater trawls were tested with this rigging in the flume tank of DFTI in Hirtshals, Denmark at scale ratio 1 to 25 and 1 to 35 in cooperation with a Dutch net manufacturer in April 1990. From these trials it seemed possible to use two trawl doors of different size rigged to generate a spreading force in the same direction. Full scale tests on "TRIDENS II" were conducted in May. The technical feasibility of the single-door rig was proven during this cruise. A try-out of the variant with two doors spreading in the same direction did not encounter any problems from a gear handling point of view, and resulted in an enhanced sideways displacement of the gear, against a minor loss in spread. Comparative fishing trials were planned on a commercial boat, but did not take place this year. A further technical optimisation of the gear can be the objective, once it has been proven that the principle of avoiding the wake of the vessel for catching fish close to the surface pays off.

A model of the type "Fanny 2" was tested at scale 1 to 7 at Lake Insko, Poland in collaboration with the University of Rostock, the Deep Sea fisheries Institute ("Institut für Hochseefischerei und Fischverarbeitung IfH-Rostock") and the Faculty of Marine Fisheries and Food Technology ("Instytut Akwakultury i Techniki Rybacki") of the University of Agriculture of Stettin. The trials were conducted from a specially developed catamaran. This boat provides excellent opportunity to test large models in open water, not only concerning the shape of the net, but also in relation to gear handling. Measurements were done on the drag and openings of the net, and underwater photographs were taken. The results will be presented at the next meeting of the FTFB Working Group of ICES.

The political changes in East-Europe enforce a re-assessment of the cooperation between RIVO and the University Rostock and the Deep Sea fisheries Institute (IfH) of Rostock. The future concerning fisheries research in former East-Germany is very uncertain. A cooperation at a smaller scale may be the result. Funding from the EC will be studied to set up a tri-partite cooperation between RIVO, the University of Rostock and the University of Stettin.

Plankton torpedo.

The efficiency of high speed samplers which are designed to catch fish larvae has been an issue for debate since a long time. Larvae counts per unit of water filtered by the sampler serve to estimate the biomass of fish populations. It is essential therefore to measure the speed and volume intake of these samplers with high precision. Preliminary tests in the towing tank of the Delft Technical University showed distinct other flow characteristics than given by other workers in this field. It was therefore decided to carry out some more elaborate tests on these samplers. The Dutch Gulf III and the German HAI samplers were tested in the large deep water towing tank of MARIN in Wageningen in February 1990. The flow field in the nose cone opening was measured and the accuracy of the impeller speed log appraised. The amount of water filtered per unit of time depends strongly on the flow characteristics at the nose cone and the performance of the impeller log. For the Gulf III it was found that a trim angle of 10 degrees affects the reading of the log substantially, although the volume of filtered water was not significantly altered. The HAI sampler showed a dependency of the flow field at the nose cone with speed, resulting in an under-estimation of the filtered volume at low speeds and an over-estimation at high speeds. It is recommended to extent these measurements to other samplers used in the EEC and to consider a hydrodynamical re-design of the nose cone, which could encoporate attempts to diminish the visual stimulus and thus avoidance reactions of larvae.

Pair trawling on flatfish species.
Experiments were conducted in the Baltic on Danish pair trawls of East-German design as part of the cooperation between RIVO and IfH-Rostock, and attended by scientists of both organisations. Direct observations were done simultaneously and showed that the net was not touching the ground hard enough. Changes in the rigging enabled a better ground contact. The Technical Research Department assisted in alterations to the rigging and suggested to use newer designs for the net. Problems with the availability of the proper materials hampered the implementation of these new designs up to now.

Selectivity of Cod, Haddock and Whiting.
Roundfish selectivity is a major problem in North Sea fisheries, as some species are relatively abundant (Whiting) while others (Cod) are scarce and should be protected. Both species are mostly caught simultaneously in existing nets. Three weeks of research were dedicated to the problem of roundfish selectivity in pair trawling. A separator panel was used to select Cod from Haddock and Whiting, based on existing knowledge of differences in behaviour. The trials indicated Cod to appear in the lower codend of the net and the other species in the upper codend. Firm conclusions could not be drawn due to a very poor fishery at the time, resulting in small numbers of fish caught.

Fishladders.
Fishladders are intended to enable fish to pass barriers such as locks in a river to migrate upstream. Flow measurements were done in fishladders in some Dutch rivers. Samples were taken in the traps of Vechterweerd and Linne to appraise the passage of fish in these ladders with a specially designed lift net.

Sound emission on research vessels.
Sound emission of research boats may affect the catchability of these ships, for instance during fish stock surveys. It is important to monitor the circumstances under which surveys are carried out. Sound generated by various sources such as the propeller, the engines and the gear box as well as sound generated by fishing gears has been measured in cooperation with the naval electronic and optical company "Marine Electronisch en Optisch Bedrijf (MEOB)" on a track in the "Haringvliet". At first the old vessel "TRIDENS" has been measured, and the new vessel and the smaller boat "ISIS" will be measured in 1991.

Selectivity of fishing gears.
Selectivity has always played a part in the selection of projects at RIVO, but due to increased attention more emphasis will be given to this topic in future research. An EC-proposal in the "FAR"-programme No. TE 2.554 "Improved selectivity of fishing gears in the North Sea fishery - beam trawling" has been granted financial support. The project will run for two years. Other contractors are the "Rijksstation voor Zeevisserij" of Ostend, Belgium and SEAFISH of Hull, England. A planning and coordination meeting has been held in December 1990 at RIVO. It has been decided to work on six different configurations of more selective nets. Prior to full scale trials at sea a first selection will be done on models to be studied in the flume tank of SEAFISH in Hull. The performance of the remaining most promising solutions will be appraised using direct observation techniques, after which full-scale comparative fishing trials will be conducted. The major aim is to improve the selectivity for roundfish while maintaining flatfish catches.

Preliminary trials have been done in the flume tank in October 1990, and sea trials were conducted in November on "TRIDENS II" to assess the feasibility of the solutions suggested. The results show potential of success along these lines.

Design and engineering studies on fishing gears.
The possibility of predicting the performance of new fishing gear from scale models is an important issue in the design process of fishing gears. Attempts to quantify the

relation between models of different size will be done in EC-project TE 1.154 "Fishing gear model and full-scale relationships", which was granted last year. A planning and coordination meeting took place in February 1990 in Aberdeen, Scotland. Some delay was met in the contract procedure, but the project will be continued next year, with model studies and full-scale measurements at sea. An interesting scientific debate between the various contractors has come up and will continue during the project.

Extensive measurements were done on the drag of beamtrawls. A gear of the Northern type for 2000hp boats showed a percentage of 21% of the drag contributed by the tickler chains, and a contribution of 50% to the total drag from hydrodynamic resistance of the netting. Tickler chains are observed to skim the bottom and jump off locally, contradictionnary to the common belief that these chains dig into the ground several inches.

Informatica

The new Tridens II research vessel is equipped with a network over which the scientists can gather ships related data. To facilitate this, a driver-program was developed that can be used to log these data on files, eventually combined with locally collected data from other equipment.

For the EC-project "Integrated quality assurance of chilled fresh fish at sea" a computer vision system is under development that estimates length, weight and species of fish.

RIVO started to use the new EK-500 echo integrator on board of the Tridens II for stock assessment.

Progress was made for the automatic analysis of otoliths by means of image analysis. Emphasis was laid on improving the data collection method and the underlying chemistry and physics.

For the automatic sorting and counting of fish-eggs in plankton samples new equipment was installed.

NORWAY
(A. Bjordal)

This report includes contributions from the following institutions:

1) Institute of Fisheries Technology Research (FTFI), Fishing Gear and Methods Division, Bergen.
2) Institute of Fisheries Technology Research (FTFI), Vessel and Marine Engineering Division, Trondheim.
3) Institute of Marine Research, Bergen.
4) The Norwegian College of Fisheries Science, University of Tromsø, Tromsø.

(Numbers in parenthesis indicate respective institutions involved in the different activities.)

REORGANIZATION

It should be noted that the Institute of Fisheries Technology (FTFI) was reorganized in 1990. The Fishing Gear and Methods Division has been transferred to the Institute of Marine Research (Bergen), and renamed to the Fish Capture Division, on out of four divisions of the institute's Department of Marine Resources. The Vessel and Marine Engineering Division has been transferred to the Norwegian Marine Technology Research Institute (MARINTEK) in Trondheim.

FISH BEHAVIOUR AND REACTION TO FISHING GEAR

Field observations have shown that the shape of longline baits is of minor importance. Studies of fish behaviour, with respect to different pot entrances, are conducted (1). Fish reaction to vessel noise is studied with playback noise from different trawlers (1, 2) and by telemetric observations of fish reaction to vessel and trawl gear (1).

Vertical migration of shrimp has been studied, using a towed rigid fram (3 x 8 m) with different sections/compartments. The results indicate that catches taken by normal shrimp sampling trawls are not representative (4).

Studies of shrimp behaviour to sorting grid were carried out in a ring tank (1).

The migration pattern of salmon released from fish farms was studied by telemetry as part of a programme for development of recapture techniques for escaped farm salmon (1).

SELECTIVE FISHING AND SURVIVAL AFTER ESCAPEMENT

Investigations on sorting grids in trawls have been continued. Extensive field trials have shown that sorting grid in bottom trawls give a marked improvement in size selectivity for cod and haddock, with negligible catches of juveniles and sharper selection curves compared with the selection in normal codends (4, 1).

Promising results are obtained with a double sorting grid system, where both fish and small shrimp are released (1).

Increasing the total size of hook and bait by adding a neutral (plastic) body to the hook, gave no significant improvement in longline selectivity for tusk and ling (1).

Further investigations were carried out on acoustic observations of fish escapement during retrieval of longline gear. Studies of survival after escapement from trawl codends showed moderate mortality for haddock, and insignificant mortality for cod. Investigations of herring survival after escapement from purse seines or during storing in net pens, indicate high mortality after scale loss due to physical contact with the webbing (1).

IMPROVEMENT OF FISHING GEAR AND METHODS

Good catch rates were obtained in trials with a double trawl system for flatfish. A new pelagic trawl concept has been developed. A mechanized trolling system gave promising results in the haddock fishery. Fish pots are now widely used for tusk, but further trials have not lead to an effective pot for cod (1).

Technology for capture, transport and short- or long term storage of live fish in net pens is under development. Introductory work has shown that this can be done successfully with cod (survival of 80-90%), based on capture with seine net and live transport in circulated sea water in the hold of the fishing vessel from the fishing ground to the storing pens (1, 2).

FISHING VESSEL TECHNOLOGY

The very first catamaran fishing vessels in Norway were launched in 1990. Besides the obvious advantage of a larger deck area, compared to a conventional vessel of similar length, these catamarans have a higher energy efficiency and better sea keeping qualities (2).

An on board computer/sattelite communication system for the fishing fleet has been tested on a purse seiner in commercial operation (2).

FISHERIES ACOUSTICS

The packing structure of herring schools has been studied, using an echo integrator unit, with outprints at short intervals. Preliminary analysis shows large internal packing density variation (1). A model that corrects for acoustic energy absorption in dense aggregations of herring has been developed (3).

A new towed body with a split beam transducer and a hull recessed launching system, has been tested for acoustic estimation of fish abundance along steep slopes and in deep water (exceeding 500 m) (3).

New sonar technology for abundance estimation of near surface schools is being developed in collaboration with SINTEF and SIMRAD. A dual system analysis for specification of the measurement system hs been conducted, and measurements have been gathered from mackerel and herring schools (1, 3).

The EK500/BEI echo sounder/echo integration system are now installed on all the Institute of Marine Research's vessels, and hardware/software are under continual revision (3).

Data from target strength determinations have been collected from the EK500 and ES400 split-beam systems, for further development of improved algorithms and methods for single fish recognition and thresholding (3).

Multiple-frequency echo sounder measurements of plankton and fish at 18, 38, 120 and 200 kHz have revealed interesting differences (3).

The work on sound speed measurements in euphausids and acoustic zooplankton measurement system was continued (3).

An acoustic system for automatic feeding control in pen rearing of salmon has been developed (1).

OTHER ACTIVITIES

The effects of seismological investigations were studied with respect to: egg and larvae, (in situ) avoidance of and mortality of larvae, change in catch rates and abundance of fish (3). Behavioural, physiological effects on fish from underwater detonations were studied (1).

Further investigations on capture of 0-group cod for seedlings in fish farming, have revealed great yearly variations in near shore abundance and availability (1).

POLAND
(D. Dutkiewicz)

The following investigations in the field of fishing technigue were carried out in 1990:

1. Exploitation studies on Antarctic krill catching by means of B-22 factory trawlers (main engine power 1840 kW) were finished; as a result, the most useful trawl for the capture of these crustaceans was elaborated for these vessels.

2. Studies aimed at elaboration of an effective trawl gear (pair trawl) for stern Baltic cutters, type B-410 (engine power 420 kW) for catching shoaling fish in the Baltic were continued.

3. A cycle of research work on the usefulness of a trap net for capture of various fish, especially flounder and cod, positioned on different fishing grounds along the shore of the Polish fishery zone, was finished. The studies revealed limitations in the use of this type of gear resulting from very difficult weather conditions (autumn and winter storms) and from material expenses on this gear. From the point of view of marine environment and exploited fish protection the trap net received favourable opinions.

4. Work on improvement of a mechanized longline set for capture of cod was continued.

5. A method of designing the shape of trawl belly which is assumed in reality under the impact of water flow was elaborated. The method makes extensive use of computer calculations.

SWEDEN

(L-E. Palmén)

During 1990 two hydroacoustic surveys were carried out on herring and sprat. One survey covered the eastern part of the North Sea, Skagerak and Kattegat within the framework of ICES Planning Group for acoustic surveys in the North Sea, Skagerak and Kattegat. In the Baltic an International survey was carried out in cooperation with GDR, Polen, USSR and Finland. Three intercalibrations was carried out:

a) Swedish R/V Argos - Polish R/V Profesor Siedlecki
- GDR R/V Ernst Haeckel

b) R/V Argos - USSR R/V Issledovatel Baltiki
- USSR R/V Integral (chartered by the Finnish Institute)

c) R/V Argos - GDR R/V Ernst Haeckel

A trial fishery with a new shrimp trawl was carried out by a private firm where the catches was separated into fish/shrimps by two vertical cod-ends.

A new trawlconcept called Microtrawl have been developed. By increasing the bosom compared to the wings a lower water resistance and better selectivity was achieved which increased the catch rates. The new concept is at present applied in the nephrops and shrimp fisheries. Tests will also be carried out in the cod fishery in the Baltic.

In 1990 an investigation was started at the Swedish Skagerrak coast aiming at evaluating the effect of bottom-trawling on the macro-fauna. Nine samples were taken in an area heavily fished by Nephrops-trawlers and nine in an area where trawling is prohibited. The stations were chosen to be similar in depth and degree of exposure. The results indicated no effect of the heavy trawling. The number of species (54 per station in the trawled area, 51 per station in the not trawled area as averages), number of individuals per station (433 in trawled area, 352 in not trawled area) and diversity index (Shannon-Wiener) do not show any significant differences.

UNITED KINGDOM
England, Fisheries Laboratory, Lowestoft
(G.P. Arnold)

Successful field trials were carried out with a prototype data storage tag designed to record measurements of depth and temperature at frequent intervals over a period of several months and store the data for a year or more. Following these trials it is intended to build a miniature version of the tag to be attached routinely to large plaice and cod. Development work was also undertaken on a prototype 300 kHz pressure-sensitive telemetry tag for use in conjunction with the sector scanning sonar. Work was completed on a similar tag designed to telemeter information about the tilt angle of a single fish.

Scotland, Marine Laboratories, Aberdeen
P. Stewart)

Fish Survival

Further studies have been made of survival and escapes from nominal 90 mm codends with both 100 and 120 meshes on the round. A third codend of 90 mm diamond mesh having an 80 mm square mesh window in the top panel was also investigated.

Replicated trials using a standard commercial trawl assessed the survival of haddock, whiting and cod, ranging in length from 21-37, 21-27 and 19-38 respectively, after they had escaped from these codends. Handline-caught fish of a similar size range were used as controls.

Survival rates (%) were:

Experiment	Haddock			Whiting			Cod*		
	1	2	3	1	2	3	1	2	3
90 mm diamond x 120 meshes	0	43	83	83	97	95	91	100	100
90 mm diamond x 100 meshes	97	93	93	89	70	86	-	-	-
90 mm diamond + 80 mm square mesh window	72	73	82	88	97	100	-	-	100
Controls	100	94	100	100	100	100	86	-	-

* Few cod were caught. One control fish out of seven died.

In the 90 x 120 codend, cage 1 had no survivors. This was attributed to a large quantity of debris held in the almost closed meshes of the codend in this haul.

Species separation

Separation of cod and flatfish, into an upper and lower codend in the lower level of a Marine Laboratory separator trawl, was attempted. Due to lack of cod, effort was directed at guiding flatfish into the lowest level. Significant improvement was achieved over the 1989 performance, with over 85% of all flatfish entering the lowest of the three codends. Again over 85% of haddock and whiting were separated into the top level of the trawl.

An EC funded project to develop a trawl which separates human consumption species from Norway pout has been started in collaboration with DIFTA, Hirtshals. Model tests have been done.

Sampling trawls

The effect of gear and environmental factors on the catch of the GOV trawl used by FRV *Scotia* during the International Young Fish Survey was monitored, with net speed relative to the water added to the measured parameters from previous years. A preliminary analysis of the data obtained during 1989 and 1990 indicates that the water temperature at fishing depth has a significant influence on the catch rates or perhaps the availability of fish to capture. For small haddock and whiting (<20 cm) there is a correlation between catch and both headline height and wing-end spread. Cod catches were not analysed due to the small numbers caught.

Seine net performance

One cruise concentrating on gear and fish behaviour observations was carried out using a second vessel to tow the underwater TV vehicle. For the first time small roundfish were observed being herded by the seine net ropes. Fish were observed entering the net throughout the haul. Escapes from a square mesh panel in front of the codend were also studied. Limited instrumentation was used to obtain gear parameters such as net speed and gear drag.

Selectivity

The catches in 90 mm trawl codends with and without 80 and 90 mm square mesh panels in the codend have been compared using twin trawls. Significant reductions in whiting and haddock discards were achieved with windows and a larger mesh size in the window caused a greater reduction. There was also some loss of the smaller marketable fish. The effect was greatest on whiting, less on haddock and only marginal on cod. The acceptability to fishermen of a particular window mesh size would depend on the fish population on the grounds.

Square mesh windows inserted ahead of the codend were also found to reduce the catch of small whiting in *Nephrops* fisheries where a smaller minimum mesh size of 70 mm is used. The catch of *Nephrops* was not affected.

A brief experiment was conducted to compare the catch in a standard 90 mm codend with that in a 120 mm codend proposed by the EC. Very few haddock or whiting were caught in the large mesh codend, suggesting that 120 mm mesh would not be economically viable for much of the Scottish fleet.

A cruise on FRV *Clupea* studied the effect of codend mouth diameter on selectivity but no correlation was found in the limited time available.

Analysis methods for catch comparison experiments were developed further.

Modelling

A three year EC funded project to investigate the relationships between model and full scale trawls was started.

Fish behaviour

The study of fish behaviour in codends continued to clarify the key parameters governing escape. A series of scaring devices was examined in conjunction with a square mesh escape panel. Fish response was found to be variable and many fish did not attempt to leave via the panel in daylight. During darkness some fish did pass through the panel to be caught in a small mesh bag. In this case escape was thought to be a result of random movement.

Observations on the reactions of schooling fish to netting barriers have been made in the aquarium. The herding ability of a range of twines of different thickness and colour were investigated with a school of mackerel. Additional experiments are planned to investigate whether fish can be induced to approach and penetrate meshes in aquarium trials and with fishing gears at sea.

Further tests on the visibility of a high speed plankton sampler have been conducted. Previous trials demonstrated that the mouth of the sampler appeared as a dark aperture, in marked contrast to the background in daylight. An alternative design allowing the penetration of ambient top-lighting has recently been evaluated in field trials and remains to be tested in future larval sampling investigations.

Acoustics

Surveys of herring were carried out: 1) in the Clyde; and 2) in the Orkney, Shetland and Buchan areas in July 1989. The latter survey was in conjunction with Norwegian, Danish and Dutch fisheries research laboratories. During these surveys data was collected in individual sample format for each transmission and with 0.5 m depth definition at 38 and 120 kHz.

Analysis of photographic and dual beam target strength data from caged fish shows little relationship between target strength and tilt angle for herring at 38 kHz. This data has been examined with careful attention to detail in the analysis of errors. Over the range of angles observed during normal swimming behaviour in the cage no systematic relationship was found.

Work on the automatic identification and classification of shoals has developed considerably. The objective of the work is to aid extraction of shoal statistics to assist with understanding of stock distribution and species recognition. The echosounder output is treated as an image and loaded into a Unix based system using Imaging Technology high speed image processing cards. Image processing techniques involving smoothing, edge enhancement, multiple binary thresholds, erosion and dilation are used to isolate and define the locations and shapes of fish shoals and the sea bed from the image. Timing is dominated by data recovery and the association of adjacent pixels into connected objects. Typical image recovery and processing is less than 20 seconds for 512 acoustic transmissions.

USSR

PINRO, Murmansk
(A.A. Eligarov)

Investigations on selectivity and fishing efficiency of bottom trawls, selective characteristics of design on the basis of metallic grid in a trawl bag have been carried out during shrimp fishery early in 1990. The following data have been obtained:

- data on fishing efficiency of two-codend trawl compared to one-codend;
- data on number of fish escaping through a trawl bag when hauling and trawl lifting;
- data on differential (by length) efficiency of bottom trawls using underwater apparatus "TETIS";
- data on fishing efficiency of a sorting grid on the basis of metallic grid in a trawl bag during shrimp fishery in the southern Barents Sea.

USSR (Cont.)
REPUBLIC OF LATVIA

(E. Rimsh)

In 1990 investigations were carried out concerning:
- size-selective properties of monofilament cod-ends (Mesh size 104 and 112 mm) (manufactured in Denmark) in bottom trawls. The fishing boat of 300 h.p. (MRTK) conducted fishing for cod in August-September. The obtained selectivity coefficients were 3.3 and 3.4 respectively. The results indicated a considerable increase in escape of fish above 30 cm (com. size).

In November, 10 trawlings with a pair trawl of 60.4/155.2 with hexagonal mesh in a cod-end of 10 mmx6 (polyamid A, thread of 93.5 tex x 3) in the mixed-species fishery (herring and sprat) were carried out. The selectivity coefficient was estimated to be 3.8. The loss of comercial sized fish (herring 1≥ 11 cm) were estimated to be as high as up to 50 %.