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Report of Activities

FISH CAPTURE COMMITTEE

by

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BELGIUM

(R Fonteyne)

Trawl Gear

In the field of energy-saving studies, the influence of increasing the mesh size in beam trawls for shrimps has been investigated. Using 34 mm instead of 28 mm meshes in the front part of the net resulted in a 10% reduction of drag without any loss in catching efficiency.

The use of multiple rig trawls was studied.

Several types of high opening bottom trawls for engine powers ranging from 150 to 900 hp were developed and tested on commercial trawlers. These trawls are gaining popularity in the Belgian fishery.

Electrical Fishing

Work on electrical fishing was concentrated on the development of a pulse generator to be incorporated in the beam of a flatfish beam trawl. The electrical field strength between two electrodes was studied under laboratory conditions.

Selectivity

Several factors which may influence the selectivity of beam trawls for sole were studied. The experiments were carried out on a coastal beam trawler. The effect of the codend mesh shape (diamond versus square), the mesh size, yarn material (braided PA and PES and twisted PE) and the length of the codend were investigated. Of these only the mesh size had a significant influence on the codend selectivity for the target species.

Netting Materials

Research on the shrinkage of meshes due to the penetration of bottom sediments was continued. A new experimental method permits control of the tension on the netting sample during testing. Netting of different materials and yarn construction have been tested with sand and mud.

Safety

In relation to the improvement of safety on board beam trawlers, work with the new overload protection system continued. The system automatically opens the winch brakes if a preset overload occurs in one of the two warps, if a given load difference between the two warps is detected, or in the event of a sudden, well defined increase in towing resistance.

CANADA

(P Koeller)

Fishing Gear Selectivity

Fisheries Development Division, Department of Fisheries and Oceans (DFO), Newfoundland Region, conducted comparative fishing trials of moored monofilament longlines using "feather" hooks vs baited hooks. The feather hook and monofilament ganglion attached to the groundlines have replaced the moored baited hook in specific areas of Newfoundland. Catching efficiency was greater for feather hooks, which caught 57% of the total cod catch of 17,293 kg. A total of 46,100 hooks were fished during a period of 42 days.

Size selectivity of 155 mm diamond and square mesh codends was determined during a joint programme between DFO Scotia-Fundy Fisheries Development Branch and DFO Newfoundland Science Branch. The trouser trawl experiments showed that the diamond mesh codend retains more small cod, but that the square mesh codend retains more small plaice.

Scotia-Fundy Region also conducted selectivity experiments with 135 and 140 mm square/diamond mesh codends during the year, producing selectivity curves for cod, haddock, pollock and American plaice.

Scotia-Fundy Region Fisheries Development Branch also reported the conduct of selectivity experiments with inshore scallop gear. Although large catches made selectivity analysis difficult, results did show that Digby Rakes with rubber washers require a ring size of about 3 5/8" to allow escapement equal to rakes with 3" rings having standard steel washers.

A series of tests was completed by DFO Science Branch, Pacific Region, to design and evaluate various escape mechanisms for the range of solid sided, wire mesh and web mesh covered traps employed in the British Columbia prawn trap fishery.

DFO's Biological Sciences Branch, Newfoundland Region measured escapement of capelin from a Diamond IX midwater trawl using small mesh experimental bags attached at various locations outside the trawl. Most escapement occurred near the codend and consisted of smaller capelin, Arctic cod and sand lance. Escapement underneath the footrope of the standard groundfish survey trawl (Engels 145 High Lift) was also measured. Three net bags covering the full length of the footrope were mounted beneath the trawl, behind the footgear. Net efficiency parameters indicated that the percentage of escapement is highest amongst smaller cod, yellowtail flounder, American plaice, and thorny skate. Both midwater and bottom trawl escapements were measured to determine their effect on survey abundance estimates.

Fish Behaviour and Underwater Observations

Researchers from DFO's Central and Arctic Region, in conjunction with colleagues from Quebec and Newfoundland, used acoustics to monitor the diel vertical migration of striped pink shrimp in eastern Hudson Strait. Acoustics were also used in Admiralty Inlet, Baffin Island, to examine the distribution of pelagic fish under landfast ice near an ice

edge where whales, narwal and beluga were congregating. In Barrow Strait, diel behaviour of pelagic fish beneath landfast ice was studied to determine the effects of tidal currents on the availability of food species to ringed seals.

Scotia-Fundy Fisheries Development Branch and the Department of the Environment supported a proposal by Lobsinger Associates Ltd to develop three solid state underwater cameras. The first camera is intended as an inexpensive low-light B&W camera rated for 100 m, suitable for monitoring cod traps, herring weirs and shallow water scallop fishing operations. The second camera is an image-intensified low-light camera rated to 300 m that will replace the Osprey camera currently used on the Mermaid vehicle. The third camera will incorporate an internal pan and tilt cradle for 180° peripheral vision, for direct mounting on trawls.

Distribution and abundance of planktonic larval stages of commercial species during a seismic airgun survey was studied in Queen Charlotte Sound and Hecate Strait by DFO's Biological Sciences Branch, Pacific Region. Data will be combined with experimental work on airgun mortalities conducted at Washington State University to evaluate environmental impact of seismic surveys.

Development of Commercial and Survey Fishing Gear

The Province of New Brunswick's Department of Fisheries and Aquaculture continued an active programme within its Technical Services Branch. The effectiveness of a special shrimp trawl on a shrimp trawler converted from side to stern trawling was evaluated. The net uses kites instead of floats to obtain headline lift. A new rope counter for Scottish seining will indicate lengths of rope set or hauled in the wheelhouse and will eliminate the need for coil counting during fishing operations. Trials were conducted on a flounder trawl that is easily converted to a cod trawl by adding floats, and on a rough-bottom Scottish seine with light "rock hopper" footgear and combination wire seine ropes. Two vessels were fitted with monitoring equipment for a study of energy efficiency in fishing vessels. The next phase of this programme will see the application of energy efficient technologies to these vessels.

A twin beam trawl for surface sampling of juvenile salmon was modified and tested by DFO, Pacific Region. The gear was developed for assessment of juvenile salmon as they migrate through inshore waters. The region also supported the development of fishing methods for flying squid. A high speed midwater trawl showed some potential and offers an alternative to the traditional high seas gill netting method which has unacceptably high marine mammal by-catches.

The Department of Fisheries, Province of Nova Scotia, undertook a number of projects focussing on fishing vessel design. A contract to the Technical University of Nova Scotia continued work on small boat stability, with emphasis on the traditional Cape Island style inshore fishing vessel. Another project involved construction of an aluminum deck and hatch system which features a folding work deck for containerised unloading. Tests of an anti-icing agent on a trawler fishing for northern cod were not successful. Modifications in hull form were made to a vessel equipped with a controllable pitch

propellor, to decrease vibrations in the propulsion system and hull. In addition to decreasing vibrations, the modifications also increased bollard pull.

The Marine Institute in St John's, Newfoundland, began developing a CAD package for drawing fishing gears. The routines are written using the CADKEY programming language CAD L, but may later be transferred to AUTOCAD using LISP, and expanded to CAM. The Institute is also developing techniques for determining otterboard lift and drag coefficients, including accurate measurements of heel, pitch and angle of attack.

The Technical University of Nova Scotia has developed computer programs for calculating the forces and shapes of simple towed fishing nets. The computations were carried out on an IBM personal computer. Simulated results were verified experimentally.

Acoustics and Stock Assessments

DFO Biological Sciences Branch, Scotia-Fundy Region, determined the mesoscale distribution of a spawning population of haddock on Browns Bank. A combined acoustic and trawl survey was completed for pollock on the eastern Scotian Shelf to determine the feasibility of acoustic methodologies in biomass estimation for this species. The annual acoustic herring survey in Chedabucto Bay was also completed.

DFO Pacific Region used an upward-looking echo sounder on a gimbaled frame sitting on the bottom for salmon smolt outward migration assessments. Results were compared and calibrated with horizontal sonar data. Mixed species of juvenile salmon appear to school together and migrate outward with herring schools. Analyses are aimed at determining school characteristics and target strengths to allow separation and identification of schooling targets.

The Biological Sciences Branch, DFO, Newfoundland Region conducted nine acoustic surveys, variously targetted on cod, capelin, redfish and herring, during the review year.

DFO Gulf Region conducted a snow crab survey using a 20 m Nephrops trawl equipped with SCANMAR net sensor to estimate the swept area. Biomass and recruitment estimates showed that the southwestern Gulf stock is depending increasingly on annual recruitment. The Region again conducted the annual southern Gulf herring survey, but with several changes to survey design. In particular, the randomised zig-zag transects used since 1984 were replaced by random parallel transects in 1988. Geostatistical techniques (kriging) were developed for processing acoustic survey data, in order to map and assess herring schools.

Acoustics Development

DFO Scotia-Fundy (Bedford Institute of Oceanography) continued field testing of algorithms for ECOLOG I. Field trials for ECOLOG II were also conducted off Nova Scotia and at Resolute, Northwest Territories. Additional development on ECOLOG II incorporated test results and a completed system will be delivered in early 1989. The acoustic system in St Andrews incorporated a DMA card for recording digitised data through a PC.

DFO Pacific Region's hydroacoustic assessment of hake and herring underwent a change from dependance on a VAX 780 to a PC-based data collection and analysis system. Theoretical work was conducted to extend and improve dual beam algorithms for determining fish size. A collaborative project with the Institute of Marine Research in Bergen resulted in a simple process for calibrating a split beam echo sounder.

Extensive modifications to the "wet" end of DFO Newfoundland Region's HYDAS-2 analog subsystem have enhanced performance and reliability significantly. Most of the HYDAS-2's data aquisition computer hardware has been designed and about half of the software written. The hydroacoustic data editing system (HYED) was delivered, tested and modified. Potential sources of variation in HYDAS calibration measurements were also investigated.

DENMARK

(P Degnbol)

Fishing gear development at the Danish Fisheries Technology Institute has included the following activities.

Development of improved trawl designs for mixed flat and roundfish and for deep water fishing for grenadiers.

Studies of the effective mesh openings in codends under different conditions and design styles.

Studies of trawl drag under different netting attack angles and mesh openings.

Development of a computer-aided engineering system for otterboard design.

Investigation of the properties of various netting materials when subjected to strain. This project has now ended.

Acoustic work at the Danish Institute for Fisheries and Marine Research has included the following activities.

Acoustic survey in the North Sea in July-August in cooperation with Norway and Scotland.

Development of new acoustic data acquisition and analysis system to be implemented in 1989.

Work on echo-selection criteria for single echo analysis.

FINLAND

(P Suuronen)

Echo-sounding observations of midwater trawling on Baltic herring were conducted in May-September on commercial fishing grounds off the southwestern coast of Finland by allowing the trawl to pass beneath a stationary echo-sounder. The objective was to find out whether and to what extent Baltic herring avoid and escape from midwater trawls.

Bottom and midwater-trawl trials were conducted in October in the northern Baltic proper in order to find out the vertical size distribution and abundance of Baltic herring during daytime. Simrad FS 3300 Trawl Sonar was used to evaluate the herding effect of the experimental gear.

Underwater observations with a low-light-level video camera were made of the behaviour and swimming patterns of Baltic herring schools towards the funnel of a herring trapnet.

Testing of the resistance of the different kinds of netting materials used in herring trapnets was continued in collaboration with the Institut für Fangtechnik (Hamburg).

An acoustic survey was conducted in July-August in subdivisions 29-32. The species studied were Baltic herring and sprat.

FRANCE

(G Massart)

Par rapport à 1987, des avancées significatives ont été réalisées dans les domaines suivants :

- Acoustique sous-marine appliquée à la pêche

L'activité essentielle du groupe acoustique pêche a porté sur la mise au point de l'ensemble INES-MOVIES. INES (Interface de Numérisation des Echos de Sondeur) est une interface électronique entre un sondeur et un micro-ordinateur de type compatible PC-AT. MOVIES (Module pour la Visualisation, l'Intégration des Echos et leur Stockage) est l'appellation donnée à un logiciel, développé également à TNP, qui traite les données fournies par INES. L'ensemble permet de réaliser les opérations suivantes :

- numériser les données sondeur, y compris l'écho du fond,
- rechercher automatiquement la sonde,
- stocker l'ensemble des données sur le disque dur du micro-ordinateur,
- visualiser en temps réel ou différé les données détection sur l'écran couleur du micro-ordinateur,

- réaliser l'écho-intégration des détections par tranche d'eau avec compensation de la cadence de sondage et de la vitesse du navire,

- sortir en différé, éventuellement en temps réel, sur imprimante couleur, les données détection et écho-intégration,

- fournir une aide à l'étalonnage acoustique de l'ensemble.

Ce système a été essayé avec succès en mer sur les N/O THALASSA et GWEN DREZ et a permis, avec un plein succès, la réalisation des différentes fonctions listées ci-dessus, avec des sondeurs de marques et de types différents, même sur un navire de taille modeste.

Un tel équipement est destiné en premier lieu à la recherche océanographique :

- évaluation des stocks de poissons par écho-intégration,

- toute application exigeant le stockage avec traitement ultérieur possible des données de sondage vertical.

A court terme, un tel équipement pourrait constituer le maillon "acquisition de données de détection" du réseau "bord". Cet équipement pourra alors trouver également un débouché dans le domaine de la pêche professionnelle.

II.2. Développement de nouveaux matériels

En liaison étroite avec le Département DIT/ICA (Instrumentation, Capteurs, Acoustique), l'équipe "acoustique-pêche" de DIT/TNP a participé aux essais d'une maquette opérationnelle d'un sondeur de pêche multi-faisceaux susceptible d'améliorer très sensiblement la précision des détections au fond (prévision de la topographie et résolution des détections de poissons près du fond). Elle a de même participé aux essais préliminaires d'une maquette de sondeur large bande qui devrait apporter, outre une amélioration de la résolution au voisinage du fond, une meilleure identification des poissons.

II.3. Missions à la mer

En dehors de l'expérimentation de nombreux matériels (campagne METEVAC 88 : du 20.09 au 4.10.88 à bord du N/O THALASSA et embarquement à bord du N/O GWEN DREZ les 3 et 4.11.88), la campagne METEVAC 88 a permis de :

- compléter les observations sur le comportement des bancs de poissons détectés et en déduire les perturbations induites par les réactions des bancs sur l'évaluation acoustique des stocks.

- comparer les détections planctoniques obtenues à diverses fréquences à la fois pour donner aux planctonologistes l'outil le mieux adapté à leurs études, et trouver, pour les pêcheurs, les fréquences qui permettent de s'affranchir du "brouillage" induit par le plancton.

III. APPLICATION DE L'INFORMATIQUE A LA CONCEPTION DES CHALUTS

III.1. Tracé informatisé des plans de chaluts

Le logiciel "PLANCHALUT" commercialisé depuis deux ans ne comportait pas la visualisation à l'écran et la modification interactive des plans dont il permettait la sortie - figée après entrée des données constitutives du plan - sur table traçante. Les modifications apportées cette année au logiciel lui donnent cette interactivité et cette possibilité de travail à l'écran, et augmentent très sensiblement sa souplesse d'emploi et son attrait pour les professionnels.

Ce travail a été réalisé à Boulogne-sur-Mer, avec l'aide de deux étudiants de l'Ecole des Hautes Etudes Industrielles de Lille et en liaison avec le Centre National de la Mer de Boulogne, co-propriétaire du logiciel avec IFREMER.

III.2. Conception des chaluts assistée par ordinateur

Le programme de recherche lancé en 1987, en collaboration avec l'Ecole Nationale Supérieure de Nantes, progresse de façon satisfaisante. La modélisation physique des filets s'appuyant sur l'hydrodynamique des fils permet une description correcte des formes de filets de plus en plus proches des chaluts pélagiques ainsi qu'une estimation réaliste des efforts de traînée. L'introduction de dissymétries dans les formes de filets et de charges ponctuelles appliquées aux filets est également prise en compte. Le calcul des formes et des efforts à l'ordinateur, à partir des hypothèses hydrodynamiques, se fait par itérations successives et converge assez rapidement pour que l'on puisse réellement espérer en tirer une méthode de CAO des chaluts. La plus grosse inconnue qui subsiste actuellement concerne la prévision des écoulements à travers le filet, prévision très utile à la prédiction des performances des chaluts.

IV. MODERNISATION DES TECHNIQUES DE CAPTURE

IV.1. Chaluts

IV.1.1. Visualisation des chaluts en pêche

L'acquisition en 1988 d'un engin remorqué d'observations in situ des chaluts en pêche a doté notre Département d'un outil parfaitement adapté à la vérification in situ des performances des engins prévues à partir des essais sur maquettes en bassin. L'engin peut-être mis en oeuvre à partir du GWEN DREZ, donc d'un bateau de 25 mètres ou plus, ce qui lui ouvre l'accès à des travaux réalisés pour des professionnels, sur leurs propres bateaux. Une campagne est programmée, en avril 1989, pour étudier le fonctionnement des divers types de panneaux. Un certain nombre de caractéristiques des panneaux (stabilité, aptitude à se relever automatiquement après avoir été couché accidentellement, etc...) sont en effet impossibles à analyser en bassin d'essais et l'observation in situ est irremplaçable pour définir les critères de choix des panneaux adaptés à tel ou tel chalut ou à tel type de pêche.

IV.1.2. Etude de nouveaux chaluts

a) Chalut polyvalent pour fonds durs

Ce chalut à quatre faces doit pouvoir être utilisé sur des fonds variés, y compris les mauvais fonds, accepter différents types de gréement et être capables de garder une bonne ouverture verticale. Après les essais sur maquettes effectués en 1988, il doit maintenant être essayé en mer.

b) chalut trois ailes

Ce chalut dont l'originalité réside dans l'aile supérieure tendue par une troisième fune vise à accroître l'ouverture verticale et le recouvrement de dos sans que cela se fasse au détriment des autres caractéristiques du chalut. Les essais en mer ont été faits en 1988 et ont donné des résultats satisfaisants, conformes aux prévisions résultant des essais sur maquettes.

c) chalut sélectif à langoustines

En liaison avec les professionnels et les chercheurs de la Direction des Ressources Vivantes, des essais ont été entrepris pour trouver une solution aux problèmes créés par les captures accessoires effectuées lors du chalutage des langoustines et aux querelles sur les maillages qui leur sont liés. Un chalut à deux culs séparés par une nappe de filet orientant les poissons vers le haut et laissant les langoustines au ras du fond permet d'offrir aux poissons le grand maillage qui préserve les juvéniles, et de capturer les langoustines grâce au maillage minimum autorisé ; il permet également, en séparant les poissons fragiles des langoustines de conserver aux premiers la meilleure valeur marchande.

Des essais sur maquettes ont permis de définir la forme, l'emplacement et le montage de la nappe sélective. Deux marées effectuées sur deux bateaux professionnels différents ont montré la très bonne quantité des résultats obtenus (taux de séparation supérieur à 90 % dans les deux poches).

d) Chalut pélagique à germon

Reprenant une idée proposée en 1977, abandonnée faute d'avoir été suffisamment explorée, les pêcheurs spécialisés dans le chalutage en boeufs (à deux bateaux) de petits poissons pélagiques ont voulu se diversifier et tenter le chalutage du germon, jamais réussi - et à peine tenté - jusqu'alors. Des essais préliminaires ayant montré la possibilité de succès de cette technique en 1987, nous avons étudié en bassin, puis fait réaliser avec le concours très actif des fabricants de filets un modèle de chalut spécialement adapté à cette pêche (corde de dos en surface, recouvrement de ventre pour éviter la fuite du poisson vers le bas). Les résultats obtenus par la quarantaine de bateaux (au moins 20 paires de "boeufs" des ports de Bretagne Sud et Nord Gascogne) ont montré que tous les chaluts pêchent quand les conditions sont bonnes et que le chalut IFREMER apportait un avantage sensible

quand la pêche devenait plus difficile.

IV.2. Sennes à thon

A partir de la réflexion menée pour concevoir un thonier senneur "rustique" adapté aux besoins des pays proches des lieux de pêche de l'Océan Indien et de l'Atlantique tropical s'est dégagé le besoin de concevoir une senne à thons moins lourde, moins chère mais d'aussi grandes dimensions que les sennes actuellement mises en oeuvre par les grands thoniers océaniques.

Pour se donner les moyens d'étudier de nouveaux modèles de senne, le département Technologies Navale et Pêche a réalisé une installation d'essais dans le grand bassin du centre de Brest. des maquettes de sennes de 30 mètres de long et plus de 3 mètres de haut (échelle 1/50) ont été filées depuis une maquette de bateau simulant le thonier. La vitesse de chute des sennes, les temps de fermeture de la poche, les efforts exercés par les treuils virant le câble assurant cette fermeture ont été mesurés au cours d'essais comparatifs dont la représentativité a été soumise à la critique des armateurs, commandants de thoniers et boscos spécialistes de la manoeuvre des sennes.

IV.3. Trémails et filets maillants

- Sélectivité des filets maillants

Le travail réalisé pour la Région Nord-Pas-de-Calais a donné lieu à un rapport sur la sélectivité des trémails à soles. La méthodologie est bien au point et le travail pourrait être complété par une étude de l'effet des matériaux et rapports d'armement pour le montage des filets.

- Essais de nouveaux filets droits

. trémails à raie et à turbot, avec essais comparatifs de différents matériaux et de différents types de montage.

. filets maillants dérivant pour la pêche à la morue et au bar.

Ces filets devraient être particulièrement adaptés au métier pratiqué par les pêcheurs côtiers de Manche Est.

V. Navires de pêche

V.1. Thonier tropical

Le dossier de réalisation de ce petit thonier senneur de 41 m étudié dans une optique de recherche maximale d'économie est achevé et des contacts sont en cours avec des armateurs.

V.2. Tri du poisson par analyse d'image

Le tri automatique, par espèces, de poissons très variés peut être envisagé par analyse d'image des poissons arrivant sur un convoyeur. Une caméra de télévision génère une image dont les

caractéristiques sont analysées par un ordinateur et comparées à une banque de données.

La pré-étude d'un tel système pour lequel on recherche à la fois la fiabilité, l'économie, et une cadence élevée est achevée. Il semble qu'un tel équipement soit envisageable en restant dans des limites de coût et d'encombrement acceptables.

GERMAN DEMOCRATIC REPUBLIC

(H Stengel and W Thiele)

Deep Sea Fishing

A midwater trawl model with a new type of wings was tested in a wind tunnel. The aim of the investigations was to achieve a headline height of 100 m for this net. Full scale trawls were tested under fishing conditions. The designed headline height could be obtained with an engine power of 3500 hp at a trawling speed of 5 knots. The catching efficiency proved to be excellent for blue whiting in the Northeast Atlantic and for horse mackerel in the Southeast Atlantic.

Investigations of fish behaviour in midwater trawls continued using an underwater television camera. The observations were recorded on video cassettes. These tapes supplied valuable information for current midwater trawl projects. From investigations of midwater trawls with large mesh netting made from different kinds of material it was found that the choice of material can have a distinct influence on the catching efficiency of such nets. Braided ropes caused a considerable decrease in catchability compared to twisted ropes, for the knotted large mesh trawls used in the redfish fishery in the Irminger Sea, the trawl rigging parameters being the same. An explanation for this phenomenon has not yet been found.

Sea and Coastal Fishery

Essential topics of research and development included the problems of mechanisation of fixed gillnet fishery and longline fishery as well as re-introduction of bottom seining. It was discovered that the level of mechanisation in the fixed gillnet fishery could be increased substantially with a net lifting device, designed and made in the GDR. New foamed floats were developed to meet the special demands of mechanisation.

Preliminary fishing and technological trials with a prototype fully automatic longline system onboard of small vessels were conducted successfully. These tests were carried out on demersal fish. New types of warp were used successfully during pair seining investigations.

Fundamental Research Topics

With regard to fundamental studies, the method of discreticised towing systems was successfully applied for solving dynamic problems of floating fish cage constructions which are subjected to regular waves. Experimental investigations were done on the dynamics and stability of trawl boards and on the determination of the hydrodynamic coefficients of net lattice models at angles of attack in the range -4 to +15 degrees. Studies were also done in the field of Computer Aided Design (CAD) applied to trawls.

FEDERAL REPUBLIC OF GERMANY

(K Lange and E Dahm)

Major research activities in the Federal Republic of Germany included:

- energy saving methods in fisheries,
- effects of rigging on the performance of fishing gear for stock surveys and effects of beam trawls on the seabed,
- improvements of components of commercial fishing gear and evaluation of new methods,
- basic principles of selection in fishing gear,
- applications of Personal Computers in fisheries research,
- weathering resistance of different netting material,
- utilization of artificial reefs.

Energy Saving Methods in Fisheries

Investigations of energy saving fishing gear - especially gill nets and trammel nets - were continued. Fishing for sole in the German Bight with gill nets proved to be much more effective than using the traditional beam trawls.

There was a considerable number of small inshore fishing vessels from the North Sea and the Baltic which took up gill netting for soles during last season.

Due to declining cod stocks in the Baltic, the herring fishery with gill nets may become more important. The investigations of the Institute for Fishing Technology concentrated on the influence of netting yarn structure and colour on catch rates. The best results were obtained from nets made of monofilament and multifilament twine. Catches increased with decreasing twine diameter.

Effects of Rigging on the Performance of Fishing Gear for Stock Surveys and Effects of Beam Trawls on the Seabed

The methodological work on stock assessment gear continued. This year one of the main objectives was the measurement of the effect of depth on the spread of the trawl when maintaining the same rig. With two trawls it was found that the spread increases with the depth eg at 75 m the same trawl shows 60% more spread than at 25 m. This cannot be attributed to the longer towing warp length only, because an increase of the latter from 300 to 350 m at the same water depth did not result in an appreciable change in spread.

Heavy bottom trawls eg beam trawls as used in the sole fishery are detrimental to the bottom fauna. This was demonstrated after repeated towing along the same track with a heavy beam trawl. Bottom grab samples and underwater TV observations showed that a great number of bottom dwellers had been excavated and destroyed. Parts of them were

found in the stomachs of fishes caught during these tows, whereas during the first tow the average stomach content revealed a completely different composition. However, the long-term effects of a repeated fishery on the same ground, which could result in complete devastation of the seabed, and the period necessary for recovery have still to be investigated in a joint research project of gear technologists and marine benthologists.

Improvements of Components of Commercial Fishing Gear and Evaluation of New Methods

The activities in trawl research, using an underwater TV camera mounted on a remote controlled towed vehicle (RCTV) were extended to big bottom trawls with heavy bobbin ground ropes as used by German distant water trawlers.

A system of flexible sail kites combined with pressure resistant hydrostatic floats was developed to give sufficient lift to the headline of trawls.

Based on earlier results of model tests with cambered V-doors in the windtunnel of the Institute of Naval Architecture, Hamburg, full scale tests with 4.5 m^2 otterboards of the same type were performed. Compared to flat V-doors a considerable increase in the spread of the upper wing tips of a bottom trawl for inshore trawlers was obtained. Observing the performance of both types of otterboards on rough bottom by means of the underwater TV camera, no disadvantage with the cambered V-doors compared to the flat ones could be found. First trials were performed with two three-warp twin trawls to investigate the problems which occur when using this type of gear on a fishing vessel with traditional deck arrangement (two warp drum winch).

Basic Principles of Selection in Fishing Gear

Underwater TV equipment has been used to study the process of selection in towed trawls. TV video tape records made in summer on board FRV "Solea" show that almost all the species caught (haddock, whiting, mackerel, horse mackerel, spiny dogfish and skate) attempted to escape through the rearmost part of the codend. A different behaviour was only found with sandeels which could escape from the trawl in the area of the belly.

Applications of Personal Computers in Fishing Gear Research

PC's are very useful tools for many aspects of fishing gear research. This has been demonstrated by many applications. The Institute for Fishing Technology used PC's for the generation of two data bases containing a) the catch data of all experimental gill net catches made by the Institute during the last 8 years and b) the videoscenes collected in its videotape library.

Weathering Resistance of Different Netting Materials

Netting yarns of different material and construction were exposed for two years to natural sunlight and seawater in a joint exercise of the Finnish Game and Fisheries Research Institute and the Institute for Fishing Technology, Hamburg.

Utilization of Artificial Reefs

The concentration of fish at wrecks or similar underwater obstacles makes fishing in their vicinity highly efficient. The construction of artificial reefs and other fish attracting devices (FAD) in many parts of the world has been the consequence of this effect.
In cooperation with a local fisheries research institute, the Institute for Fishing Technology commenced research in this field in Lake Constance. A steel construction of about 150 cubic metres was placed in the lake at a water depth of 10 m.

ICELAND

(G Thorsteinsson)

Experiments on the selectivity of square mesh of 155 mm mesh opening were concluded. As observed elsewhere, the selectivity of the square mesh netting was better than that of diamond shaped netting, resulting in a drastic reduction of the undersized fish catch. However, too many fish of marketable size also escaped, so the use of square mesh of that mesh size could not be recommended. The difference in selectivity between square and diamond mesh netting disappeared in heavy fishing.

Selectivity experiments on square mesh codends in the shrimp fishery were very successful in reducing the bycatch of 0-group gadoids and I and II groups of herring and capelin. The square mesh netting was also very effective in releasing small shrimp of no market value. The use of square mesh codends has now been made mandatory on the two most important inshore shrimping grounds. The practical experience has been very good with the consequence that the fishermen on the third most important shrimping ground have voluntarily adapted square mesh codends to release the smallest shrimp and herring which is the only abundant fish species on these grounds.

Direct observations on bottom trawls and fish behaviour were continued. These observations have resulted in new and in many respects better trawl designs which are already in commercial use. A video film has been published about these investigations.

A small TV underwater vehicle (Phantom HD) has been proved by observing passing fishing gears. Interesting observations were made on bottom set cod gillnets and longline.

Routine acoustic surveys were carried out on the juvenile and adult stocks of the Icelandic herring and capelin.

Hardware and software for sampling all available information from an ES 400 split-beam echo sounder have been developed. Target strength measurements have been conducted on herring and cod, using the split-beam technique.

IRELAND

(J.P. Hillis)

The experiments on separating Nephrops from whiting in two parts of a Nephrops trawl codend equipped with a separator panel were concluded. They showed a limited degree of separation with 79-87% of Nephrops in the preferred (lower) section of the codend and 73-95% of whiting in the preferred (upper) section.

A further experiment using a standard Nephrops trawl of standard body (bag) length, and lessened taper to accommodate upper and lower codends gave 72-100% Nephrops and 65-93% of whiting in the respective preferred codends, but with rather variable results. It is felt that a shorter bag with extension pieces on both codend may yield improved separation.

NORWAY

(A Bjordal)

This report includes contributions from the following institutions:

1 Institute of Fishery Technology Research (FTFI)/Fishing Gear and Methods Division, Bergen

2 Institute of Fishery 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

5 The Norwegian Institute of Technology, Trondheim

(Numbers in parentheses indicate institution(s) involved in different activities.)

Fish Behaviour and Reactions to Fishing Gear

- The behaviour of fish towards different trap-designs has been studied in the field by underwater television (UTV) (1).
- Studies of schooling behaviour of herring, including measurements of school dimension and density have been conducted (1).
- Further trials have confirmed the possible manipulation of herring behaviour (vertical migration) by underwater light and sound stimuli (1).
- A stationary telemetry fish tracking system has been tested with promising results. The system gives the position and swimming speed and direction of the fish with updating every five seconds (1).

Selective Fishing (Including Sampling Gear)

Shrimp trawls

- Fishing trials with a new type of (solid) sorting device (5).
- Fishing trials with separator panels (70 mm HH-net) (4,5).
- UTV-observations of square mesh codend in shrimp trawls (4,5).
- Studies on the effect of ground gear (rock hopper, bobbins) on shrimp trawl catch composition (size and maturity) (1,3).

Fish trawls

- Joint investigations with USSR have been conducted to evaluate the effect on codend selectivity of two types of codend (1).

- Selectivity of codends with 10-20% shorter selvedge ropes has been compared with traditional codend design, using the modified trouser codend method. Improved escape of small cod and haddock was found (1).

- A combined square-diamond mesh codend gave improved size selectivity compared with standard codends (4).

- Trials have been conducted to investigate the effect of towing time on species and size selectivity of bottom trawls (1,3).

- Experiments with a pelagic trawl (600 m circumference) to test the utility of this gear for representative sampling of cod and haddock (1,3).

Longline

- Further trials confirm earlier findings on the improved size-selective properties of artificial bait (Probait) for cod (1).

Improvements of Fishing Gear and Methods

Fish traps

- Several coastal vessels are now successfully using fish traps for catching tusk. The traps are operated in fleets of 50, with trap spacing of 40-50 m (1).

Longline

- The work on artificial bait (Probait) has continued (1). More effective longline gear (swivel, EZ-hook and monofilament ganglion) has now been adopted by several autoline vessels. Compared with traditional gear, the long term improvement in catch rate is at least 30% (1).

Gill nets

- Experiments with different twine materials in gill nets have continued (5).

Purse seine

- Based on promising results with large meshes in the last part of purse seines, several purse seiners have lengthened their nets with large mesh panels (1).

Trawl

- Development of a new multipanel fish trawl design (1,4).

- A fish trawl designed to be towed by 3 warps has been tested in a flume tank. Vertical opening could be increased by 50-70% by pulling in the 3rd warp which is attached to a tongue at the centre of the headline (1,4).

- An investigation of otterboards performance has begun (5).

- Successful results have been obtained with a 4 winch system for handling 2 (standard) trawls on a factory trawler.

Vessel Technology and Marine Engineering (2)

In the program Information Technology in the Fishing Fleet, the main topics have been:

- Future functional requirements for instrumentation systems and bridge desing on fishing vessels.

- Decision Support System on fishing vessels.

- Systems for ship to shore data communication in the fishing fleet.

The project Robotization of Catch Handling has focused on the need and requirements for an automated system for loading and unloading of frozen fish in the hold of a freezer trawler.

The program Integrated Production Systems in the Fishing Industry has aimed at finding the most efficient division of tasks between the fishing fleet and the shore plants in the fishing industry, and to develop the technology for such production systems.

The objective of the program Renewal and Increased Efficiency in the Fishing Fleet has been to analyse future requirements to Norwegian fishing vessels, and to study how alternative fisheries management regimes will affect the possibilities of meeting these requirements.

The program Cost Reduction in the Fishing Fleet has focused on how to reduce running and maintenance costs, and on improving profits by means of preventive maintenance, thus reducing the probability of non-planned interruptions in fishing operations.

Among the activities outside the main areas mentioned above, the following topics of relevance to the interests of the Fish Capture Committee have been studied.

- Predesign studies of the benefits of catamarans as fishing vessels (large deck areas, moderate motions in a seaway, etc).

- Model tests of antipitching tank for reduction of vessel motions and resistance in a seaway.

- Evaluation of water draining systems for the working deck area of shelter decked longliners and gillnetters.

- Survey of location and maintenance of survival suits onboard Norwegian fishing vessels.

- Development of fishing vessels designed for landing their catch alive.

- Recording and reduction of vessel noise affecting fish behaviour.

Other Relevant Activities

- A model has been developed to simulate the sinking of a purse seine (1).

- In a project aimed at catching cod fry as seed fish for farming, about 600,000 0-group cod were caught with a small meshed Danish seine in shallow waters along the outer coastline of Finnmark, during August/September 1988. The fry were easily located with a 38 kHz echosounder. Assessment of the 0-group cod stock in coastal waters of Finnmark was estimated at about 40 million individuals (1).

- Trawling across pipelines was observed by underwater TV (Ocean Rover) in the North Sea. At low angles (less than 45°) the trawl door would slide along the pipe, giving reduced door spread and a distorted trawl geometry. When crossing the pipe, it had a minor effect on the trawl (1).

- A data bank on fishing vessel economy and technology is being established (5).

Acoustics

SIMRAD Subsea A/S, Horten:

The SIMRAD EK500 echo sounder is under development. A prototype may be complete by summer 1989.

ELAB, Trondheim:

At ELAB SINTEF Group, Trondheim, the first parts of a project within aquaculture research were carried out to develop a low frequency acoustic fence to keep fish in larger areas. The project continues.

A new method to measure sound particle velocity is under development. The method and instrumentation have since December 1988 been applied in tasks to measure radiated noise from fishing vessels.

Norges Fiskerihøgskole, Tromsø, and Department of Fisheries Science, Tromsø:

A project is under way to investigate the significance of vertical migration, especially its effect on acoustic estimates of fish abundance. The three particular techniques being used are the following: measurement of distributions of in situ target strength, measurement of the change in target strength of confined fish subjected to controlled depth changes, and determination of the depth adaption mechanism by means of Løvik and Dalen's swimbladder-resonance method.

Another ongoing project seeks to determine the effect of absorption in dense schools of fish.

Institute of Marine Research, Bergen:

Acoustics is being used as a survey tool in 1989 on the following fish stocks: cod, haddock, capelin, North Sea and Norwegian spring-spawning herring, saithe, redfish, blue whiting, and greater silver smelt. It is also being employed in work on multispecies modelling.

The method is being developed and improved through a number of projects. Five are enumerated.

Acoustic zooplankton measurement system

An 11-frequency system is being built for measurement of zooplankton of lengths 1-50 mm. This is intended to be used as a drop-sonde, but it is adaptable for use in a towed body. Recent work has included trials of a new 360° transducer assembly. The prototype is planned to be completed by the end of 1989.

Deep-towed transducer

This project aims to improve acoustic estimation in two different situations: at depths greater than 500 m and in the vicinity of steeply sloped bottoms. The objectives of the first phase are development of a towed body with split-beam transducer, long cable and a means of steering. Construction of prototype equipment is in progress.

Sonar estimation of schooling fish

This project will develop a horizontal-looking sonar and method for measuring fish schools. The sonar is being developed in collaboration with SIMRAD, and the project is currently in a specification phase.

Representative sampling by trawl

Acoustics is the principal tool being used to investigate how representative are samples taken by bottom trawl. Fish behaviour, including reactions to trawling, has also been studied.

Bergen echo integrator

The Institute of Marine Research, through an internal, non-commercial project, has completed the core of a new post-processing system based on a graphics workstation and international standard software. Several guiding principles have been (1) machine independence, (2) openness and accessibility, (3) user friendliness, and (4) thorough documentation on all levels. Engineers, fishery biologists, computer specialists and some other researchers have cooperated in this undertaking. The Pattern Recognition Group at Chr Michelsens Institute, Bergen, has provided invaluable consulting service.

Institute of Fishery Technology Research, Bergen:

A PC-based echo integrator is developed for use in marine net pens. A version is now being developed for use on vessels.

POLAND

(D Dutkiowicz)

The following research work was carried out at the Sea Fisheries Institute in Gdynia.

1 Improvement of Baltic trawl construction for stern cutters with 420 kW engines and a length of 25-27 m.

2 Study of possibilities of extending the use of trap nets in the Baltic fishery to catch various fish species.

3 Elaboration of computer-based design methods for trawls and pair trawls.

4 Improvement of fishing equipment of Baltic cutters to increase the fishing efficiency.

5 Study of the application of mechanised fishing systems for cod in the Baltic/longlines.

6 Elaboration of longline gear for the capture of large fish, such as tunas and sharks, for stern freezer trawlers.

7 Study of fishing technique for krill in order to increase fishing efficiency.

PORTUGAL

(A M Leite)

During 1988 the Fishing Gear Department of the Instituto Nacional de Investigacao das Pescas has conducted work on:

- Engineering and comparative fishing trials on Portuguese and Spanish traditional bottom trawls on board the FRV "Noruega", with Scanmar net sounder. This work was conducted in cooperation with professional fishermen.

- Fishing trials on long-lines, traps and gill nets in the inshore waters of the Republic of Guine-Bissau.

SPAIN

(C P Lago)

Acoustic Surveys

Sardine in North Atlantic area of Iberian Peninsula has been evaluated with acoustic echo surveys carried out in Spanish waters. 4393 miles of cruise track have been surveyed, with 43 fishing stations, obtaining a stock estimate of 292464 tonnes.

The ECOMED-88 cruise included an echo survey of all the Mediterranean shelf from Punta Europa to Cape Covisset in the Gulf of Leon. The objective was the estimation of both abundance and distribution of pelagic species.

Selectivity

Experiments with codends of 65 and 80 mm mesh size used to catch megrim (Lepidorhombus boscii and L. whiffiagonis) have been conducted in the Cantabrian Sea (ICES Divisions VIIIc). The 25% retention sizes obtained for those meshes have been estimated as 19.9 and 24.4 cm respectively.

Similar experiments have been conducted on Dicologoglosa cuneata in ICES Division IXa obtaining 25% retention sizes of 14.5 and 17.2 respectively.

UNITED KINGDOM

1 England and Wales

(G P Arnold)

The MAFF 300 kHz sector-scanning sonar with improved controls, digital signal processing, new displays and computer data-logging facilities was installed in RV "Corystes" and commissioned in 1988.

Brief sea trials were conducted with an acoustic telemetry tilt tag attached to a live cod.

A second series of selectivity experiments for mackerel was carried out in the western English Channel during February 1988 using 70 and 80 mm square-mesh cod ends attached to a midwater trawl. The results were largely inconclusive because of a series of technical difficulties and bad weather. The results of this work and the preliminary experiments carried out in the previous year were presented to International Workshop on Selectivity and Application of Square-mesh cod ends in trawls held in St John's, Newfoundland on 21 November 1988.

2 Scotland

(P Stewart)

Fish damage and survival as a result of escape from 90 mm diamond and square mesh codends were studied. Replicated experiments gave consistent results for the survival of 15-35 cm haddock in each case compared to that of the handline caught control fish.

Experiment	1	2	3
Diamond mesh escape survival	67%	74%	73%
Square mesh escape survival	92%	94%	92%
Control survival	97%	100%	100%

Survival depends on the openness of the mesh relative to the size of the fish.

A study was started of gadoid fish reactions to both diamond and square mesh codends towed in a frame. The length and girth of each fish was measured before introduction to the codend. The opening and tension of the actual mesh through which the fish escaped were also measured. Individual fish were killed at various times during the haul to collect muscle samples for lactic acid and glycogen level analysis to assess exhaustion states.

Further catch comparisons were made on prawn trawls using standard, longitudinally roped and square mesh codends. Discards of small prawns were reduced to some extent with both the roped and square mesh codends.

A vertically divided 600 hp trawl was used to compare the catches of roundfish and flatfish in different codends. A range of sizes of square mesh codend were compared with a 90 mm diamond mesh codend. The trawl was also used to measure the selectivity of 90 mm diamond and square mesh codends for comparison with the results of covered codend experiments. The results are not yet available. The variation of selection range with gear design parameters has been investigated using a large data set and no significant relationships found with codend diameter and extension length for haddock, whiting and cod. Mesh size was found to have a significant influence on the selectivity range of all three species in seines but not in trawls.

Further television observations of novel codend designs were made. Gathering meshes at intervals along the codend and around the codend circumference was found to increase the mesh opening of those meshes which were not gathered. A wire reeved through rings across the codend, instead of a normal codline, effectively maintains wide-open meshes near the aft end of a codend to allow small fish to escape.

The effect of gear and environmental factors on the catch of fish sampling gears was monitored on two stock assessment cruises on FRV "Scotia". The GOV trawl was used on both surveys.

The performance of Scottish seines was studied on a 500 hp vessel by measuring the tensions and rope geometry throughout the hauling process, using up to 14 coils (3080 m) of rope per side. Long-range rope spread measurements (>300 m), during the early stages of hauling, again proved difficult to obtain.

The fishing performance of a two warp twin trawl was studied on FRV "Clupea" to assess the suitability of this type of trawl for selection experiments. The cathces in the two sides were similar in terms of total numbers of fish of all species. On an individual species basis only whiting were found to be more abundant in one side. The length compositions of each species indicated no significant difference in selection occurring in the two codends.

Further measurements on the flow in codends and pelagic trawls confirmed that flow is reduced by more than 10% only when netting of high solidity is used, eg open meshes of less than 30 mm or closed meshes in a 90 mm codend perhaps.

Preliminary tests to predict the flow in codends using computational fluid dynamics have shown encouraging results. A method of measuring codend shape using a laser and TV mounted on an underwater vehicle is being developed.

Major improvements have been made in modelling demersal and pelagic trawls by computer. Convergence techniques continue to be investigated and improved and the possibilities for integrating flow prediction in the model are being considered. The model has been used to study the variation of net geometry with codend load.

A cruise was undertaken to monitor the hydrodynamic performance of plankton and larval fish samplers using the remote controlled television vehicle. Some good videos of a multi-depth plankton sampler, the standard Methot net and the 5.2 sq m area Lochness sampling device were obtained.

Further studies on the rules that determine the appearance of objects underwater have led to tests on sampling gears for small fish. The evidence suggests that larval fish are avoiding the Gulf III sampler during daylight but not after dark. Observations of the frontal appearance of the device show it to be a high contrast visual image when it is viewed horizontally from directly in front against the grey water background. Because the device is always towed horizontally concentric mirrored rings were used to make the nose cone invisible. The central hole appears black and the inside of this aperture was coated with reflex reflector material. Filmed observations have shown both treatments successful. Fishing tests comparing the treated and untreated device are to be carried out during the next larval survey session.

USSR

(S A Studenetsky)

In 1988 PINRO carried out experimental studies of bottom trawl selectivity and catchability and investigated feasibility of long-line fishing for bottom fish.

The following results were obtained:-

- information on the effect of the ICES cover and whole cover on selective properties of trawl bags;
- data on selectivity of trawl bags of polyamide with 128 and 138 mm mesh in relation to cod and haddock from the Rybach'ya bank area;
- data on differentiated catchability (by size) of bottom trawls as a function of warp length;
- information on likely sites, efficiency of long-line fishing for Barents Sea bottom fish, long-line fishing patterns.

VNIRO together with BaltNIIRCH carried out the investigations aimed at assessing the survival of fish which escaped through nets with different mesh form (square-, hexagonal- and diamond shaped mesh).

Research data were also collected from trials of codends used with commercial trawl designs.