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FISHING TECHNOLOGY COMMITTEE

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G. Kurc

Belgium

(G. Vanden Broucke)

Investigations on double beam trawls were carried out especially as regards their polyvalent character and the relation cutting rate - waterflow pattern through the upper net.

In the field of electrical fishing, further experiments were carried out with a compact pulse generator. The investigations concerned the design and testing of the pulse generator with settled frequencies, peak load and pulse length in function of the fish species. Experiments at sea have been conducted with shrimps and sole.

During the investigations on semi-pelagic nets, netsonde and sonar were introduced in order to obtain data respectively on the position and behaviour of the nets on the fish concentrations, the position of wrecks and bottom state.

The data on the catches made by a trawler fishing in the Liverpool Bay were studied. A relation was sought between the catches, the wind force and the wind direction.

Further data on the temperature of the sea-water were compiled for the North Sea in order to ascertain a possible relation between temperature and catches.

An enquiry among ship-owners and fishermen made it possible to define the hindrance caused by offshore oil- and gas exploitation at sea.

The difficulties encountered during fishing operations on the traditional fishing grounds caused by the laying of pipelines are considered to be the main obstacle.

Technical advice was extended to ship-owners as regards the conversion of fishing vessels and adaptations to new fishing methods. Advice on the use of sonar was provided.

Various yarns and netting were tested for yarn strength, knot strength, mesh strength, mesh size, etc. mainly on request of industry.

A work-time study on the automatic feeding system for the shrimp rinsing and sorting machine was started.

Future work

- Practical experiments with a double beam trawl and semi-pelagic nets.
- Trials with a compact battery powered underwater pulse generator.
- Experiments with set gill-nets for cod.
- Further investigations in the field of netting materials.
- Further study on the hindrance caused by gas and oil pipelines on the fishing operations.
- Compilation of a "List of Wrecks" for the North Sea and Irish Sea.
- Comparative work-time study on the handling of the catches with the traditional sieve and with the automatic feeding system for the shrimp rinsing and sorting machine.

Canada

(P. J. G. Carrothers)

Development and research projects of concern to the Fishing Technology Committee are conducted by many divergent agencies in Canada. The federal government sponsors "national" projects as well as "regional" projects of particular interest to the Newfoundland, Maritimes, Quebec and Pacific regions respectively. The provincial governments with marine fisheries also sponsor projects, often with financial assistance from the federal government. Also, some of the universities are showing increasing interest, particularly with the advent of jurisdiction over the fisheries to 200 miles offshore. Voluntary coordination of the programmes executed by these various agencies in eastern Canada is achieved through the Canadian Atlantic Fisheries Technological Advisory Committee (CAFTAC).

With this diversity of interests and thrusts it is difficult, and probably not desirable, for this submission to detail all the projects. Instead, the following is a summary with apologies to those whose pet projects have been omitted.

Improvement of shrimp trawling has been tackled on three fronts, with emphasis on minimising the by-catch of juvenile redfish. The national projects, in cooperation with New Brunswick, include a midwater trawl for night fishing to complement the traditional bottom trawl. Also, a variable-depth sonar for improved resolution in shrimp detection has been developed and the beam trawl developed in the Pacific is to be tried in the Gulf of St Lawrence. In Quebec and Newfoundland, various types of separator trawl have been tried.

Other national projects include further development and promotion of mechanised longlining, trials for stern drum seining on larger vessels, a rope-wing bottom trawl for cleaner catches, and a trawl-net instrument package primarily for mensuration of mid-water trawls,but also adaptable to bottom trawls.

In Newfoundland, much of the effort goes to adapting techniques already developed elsewhere in an effort to improve the viability of inshore fisheries of local economic importance. Such projects include Irish lobster-pot hauler, purse-seining for capelin inshore and offshore, gill-netting lumpfish for roe, updating seine-net techniques, pair bottom trawling, vessel stability converting from longlining to seining, and conversion of a Pacific coast 65 foot vessel for Newfoundland conditions. Two innovations include handling and unloading from catch from the hold in netting bags and mesh-size experiments with cod traps to minimise the catch of undersized fish. Also, the effectiveness of crab and lobster traps as a function of design and soak time have been studied.

In the Maritime region,fishing trials for sand launce were conducted, effects of hole size and material on selectivity of lobster traps were studied, and a modified scallop rake has been designed in an effort to reduce damage to lobster grounds. Two experimental onboard washers for scallop meats are being tried.

In addition to the shrimp trawl trials, Quebec has conducted trials with the Western and Yankeee 41 trawls including a modification for cleaner catches. Trawl models have been studied in the Boulogne tank. Trawl instrumentation has included a warp tension meter and an improved battery for the Furuno net sounder.

In the Pacific region, promotion of stern ramp trawling on smaller vessels continues, an improved tub washer for fish using hydraulic principles and an onboard jet and air-lift unloading system are being developed, the upright-oval cambered doors are being refined and warp tension meters are being designed.

In addition to the above projects which are addressed specifically to the commercial fisheries, government groups are conducting research to improve fishery resource inventory techniques and to provide other technical advice related to fishing methodology for management of the fishery resource, particularly under extended jurisdiction. Techniques for acoustic surveys are subjected to coordinated studies in three laboratories : development of hardware and data analysis techniques at the Marine Ecology Laboratory in Dartmouth, groundfish echo strength studies at St Andrews, and pelagic fish techniques in St John's. The traditional trawl engineering studies have been specifically directed toward a critical examination of trawl survey methods. It is hoped that interest in fishing gear standards can be maintained.

Polyethylene and nylon nettings are used almost exclusively in mid-water and bottom trawls in Atlantic Canada, with the latter predominating in cod-ends.

Denmark

(P. Kanneworff)

No work has been carried out.

Faroe Islands

(H. Jakupsstovu)

No work carried out.

Finland

(V. Sjöblom)

No research on fishing technology was conducted in 1977. According to information by fishermen, various materials were used in nets as follows (%):

	Pelagic herring trawl	Herring bottom trawl	Salmon gill-net
Polyamide 6.6	52.2	50.0	38.9
Polyamide 6	4.3	5.3	11.1
Polyester	37.0	39.3	38.9
Polypropylene	6.5	5.3	11.1
Total	100.0	99.9	100.0

France

(J.C. Brabant)

1. Chaluts

Un chalut de fond avec un dos très large et des ailes inférieures coupées a été utilisé largement par les bateaux de Boulogne-sur-Mer, d'une puissance supérieure à 1 000 ch et par quelques chalutiers bretons.

L'augmentation des captures peut être attribuée à l'amélioration de l'ouverture verticale, à la possibilité de pêcher sur des fonds très durs, grâce à l'utilisation d'un bourrelet en caoutchouc moulé fortement lesté, et à l'utilisation des panneaux ovales concaves (type MORGERE) qui n'avaient pas été utilisés jusqu'ici à Boulogne-sur-Mer.

Pendant une semaine, un essai de pèche comparative a été effectué entre 2 chalutiers de Boulogne-sur-Mer, utilisant alternativement un chalut de fond classique et un chalut de fond 4 faces qui est une version modifiée du chalut "Atlantic Western" (ce chalut est utilisé par quelques bateaux de 3000 à 1 100 ch).

Le gain de 7% obtenu avec le nouveau chalut au cours de cette expérience où l'on s'est trouvé en présence de poisson collé au fond serait, sans doute, supérieur dans le cas de poisson décollé, compte tenu de sa plus grande ouverture verticale.

Pour tenter d'assurer la diversification de sa production, un navire congélateur a entrepris, au printemps, une campagne de pêche du merlu en Afrique du Sud. Au cours de cette campagne, on a utilisé des chaluts de fond à grande ouverture verticale à 2 faces et de chaluts à 4 faces de type pélagique, réalisés en mailles de 800 mm à l'entrée et munis d'un bourrelet de caoutchouc. Les meilleures captures ont été réalisées avec ce dernier chalut qui, remorqué à la vitesse de 4.5 neouds, avec des panneaux SUBERKRUB de 8 m^2, présentait une ouverture verticale de 18 m lorsqu'il était posé sur le fond.

L'utilisation de chaluts pélagiques avec des mailles de 12, 16, 20 m dans la partie antérieure s'est développée considérablement surout pour le chalutage en boeuf avec des chalutiers de pêche artisanale d'une puissance de 2000 à 600 ch. Les cordes de dos ont une longueur de 75 à 130 m et l'ouverture verticale atteint 20 à 30 m.

Les grandes mailles de la partie antérieure sont réalisées soit en tresse de gros diamètre nouée, soit en cordage câble avec un oeil épissé aux 2 extremités de chaque côté de maille.

Sur les côtes de la Manche, ce nouveau type de filet a progressivement remplacé les chaluts comportant des mailles de 1.60 m tandis que sur tout le littoral atlantique, de nombreuses paires de chalutiers se sont récemment formées et la brusque apparition de ce type de pêche efficace a provoqué des problèmes de coexistence avec les autres métiers (chalutage de fond, pêche aux casiers, aux palangres, aux filets maillants). Cette pêche s'exerce essentiellement sur les sparidés, en hiver et la nuit, sur les clupéidés en été et plutôt de jour.

Les bateaux de pêche industrielle limités dans leur possibilité de pêche pélagique (interdiction de pêcher le hareng) ont peu utlisé ce type d'engin.

Un chalut de 183 m de cordes de dos avec des mailles de 16m à l'entrée, remorqué par 2 chalutiers de 1 500 ch a été essayé pour la pêche du thon blanc (germon). La concentration insuffisante du thon au moment de l'essai ne permet pas de tirer des conclusions valables.

2. Senne à thon

Une mission en Afrique à bord de plusieurs thoniers-senneurs a permis d'effectuer une centaine de relevés de vitesse de chute et de profondeur maximale atteinte par les filets dans les conditions réelles de la pêche; il s'agit de quantifier l'influence sur le comportement de ces engins de facteurs :

interne: tels que le montage du filet ou le poids du lest,

externe: courant, vitesse filage et boursage.

Une senne de 140 m de hauteur maille étirée atteint en moyenne la profondeur de 85/90 m, mais l'on peut constater des variations très importantes selon la façon dont est conduite la manoeuvre, ces éléments extérieurs apparaissent souvent les plus déterminants.

3. Sélectivité

Un chalut sélectif à langoustine a été essayé sur une pêcherie mixte langoustine/merlu; il s'agit d'augmenter la capture de langoustine tout en limitant les prises de petits merluchons. Le filet, 4 faces, très plat à grand recouvrement de dos, a donné des résultats satisfaisants sur la langoustine et la mise en place d'une nappe sélective au niveau de l'amorce n'a pas modifié la capture en crustacés alors qu'elle semble avoir permis la fuite de petits merluchons. Les essais doivent se poursuivre en 1978 avec la comparaison des captures de cet engin avec celle du matériel traditionnel.

4. Bassin d'essais (Lorient)

Les derniers problèmes techniques qui empêchaient la mise en service ont été résolus au cours de l'année; le bassin devrait être ouvert aux professionnels au cours du premier trimestre 1978.

5. Matériaux

Tous les chaluts sont réalisés en polyamide (nylon 6). Seules quelques pièces des chaluts de fonds sont parfois réalisées en polyéthylène pour profiter de sa faible densité.

Le fil tressé est généralement utilisé :

- tresse carrée à 8 fuseaux pour les fils fins jusqu'à 400 m/kg (2 500 Rtex)
- tresse plate à 16 fuseaux pour les fils 280 m/kg (3 600 Rtex) et au-dessus.

La partie antérieure des chaluts pélagiques est parfois réalisée en fils câblés (jusqu'au Rtex 1 000 environ).

Les sennes à thon sont réalisées en tresse nylon, la nappe en Rtex 2 500/ 2 700, la poche en Rtex 10 000.

6. Coopération avec les pays en voie de développement

Pendant un an, un jeune agronome tunisien s'est initié à la technologie des engins au laboratoire de Lorient. Il a participé à une campagne de prospection des espèces pélagiques le long des côtes tunisiennes à bord du navire de recherches français ICHTHYS. Un chalut pélagique à grandes mailles (8 m) a permis d'importantes captures de sardines. La fin du stage a été sanctionnée par la soutenance d'un mémoire pour l'obtention du titre d'ingénieur principal des pêches.

Un stagiaire marocain (ingénieur halieute sorti de l'ENSAR, Rennes) a séjourné au laboratoire de Boulogne-sur Mer pour connaître le fonctionnement et l'organisation d'un Service de technologie des engins en vue de la création d'un même service au Maroc.

Les laboratoires de Boulogne-sur-Mer et Lorient ont étudié des équipements de pêche (principalement des chaluts de fond classiques et à grande ouverture verticale) pour la pêche artisanale ou semi-industrielle dans la région de Pointe-Noire, au large des côtes brésiliennes et guyanaises.

En collaboration avec la FAO, une publication a été préparée sur l'utilisation des chaluts de fond à grande ouverture verticale pour des bateaux de faible puissance.

7. Comportement

En ce qui concerne la pêche du germon (Thunnus alalunga) à la traîne, l'expérimentation sur l'efficacité comparée des leurres de différentes couleurs a été poursuivie en 1977. D'excellents résultats ont en particulier été obtenus par temps sombre avec des leurres de couleur noir réalisant dans certains cas 70 à 80% des captures.

German Democratic Republic

(H.J. Fischer)

A device for carrying out underwater observation of fishing gear and fish behaviour has been developed, constructed and tested. It consists of a low light level TV-unit, a set of measuring instruments and a towed manoeuverable body (or "fish"), wherein all the equipment is fitted. The body is towed by the help of a steel armoured cable, serving simultaneously for transmission of the TV-signals, the data of the measuring instruments and the control signals for the rudder engines and operating the TV-camera (direction, zoom, distance). The cable is of the coaxial type with only one core. For the transmission of a lot of signals through such a cable it was necessary to develop a device allowing the processing of each type of signals in a different manner. The tests under sea conditions showed the proper function of the whole system. For the first time, it will be used for observations of fish behaviour around a towed trawl on RV "Ernst Haeckel" in 1978.

Bottom-trawl cod-ends made out of knotless braided netting have been applied and tested in commercial fishery. The results showed that the weight of net material for one cod-end can be reduced up to 50%.

Further activities to ascertain the best method of pre-treating of the netting (heat treatment, preservation) in order to prevent mesh size shrinking will be carried out in 1978. The commercial application of this netting will take place at the end of this year.

A pelagic trawl for catching krill was developed and constructed and has been tested in the South Atlantic in the period 1977/78. Because of low abundance of the krill, it is not possible to give a final assertation at present.

The mid-water pair trawl for high-powered stern trawlers developed in 1976 was improved using the results of the first trials in 1976. Now a pair trawl has been developed for application on factory trawlers (up to 2 500 hp each).

For application on inshore fishing vessels (cutters) a new type of otter boards for pelagic trawls has been developed and tested in the Baltic Sea, using the experience obtained during development of otter boards for big stern trawlers.

A big amount of hydrodynamic data of netting (drag, lift coefficient dependent on angle of attack, Re-number, d/a value) has been measured using a new, more exact method in wind tunnel tests. Nearly all fishing gear used in 1977 were made of polyamide fibres (Dederon), mainly twisted. The amount of other fibres used is below 1%.

Federal Republic of Germany

(H. Mohr)

Gear Technology

In 1977 research was concentrated on rope trawls. In this gear the anterior part is replaced by an arrangement of parallel running ropes. In order to find the best suitable ones, experiments were carried out with different types of rope. Twisted ones were unfavourable, because they tended to twist together the tips of the netting. Most suitable proved braided ropes with a core of polyamide and a sheath of mixed monofilament and multifilament fibres with a high abrasion resistance.

In fishing experiments with the R.V. "W. Herwig" a rope trawl was very efficient in concentrating and catching widely dispersed redfish in the Irminger Sea.

In close connection with net making firms a rope trawl with 750 meshes (800 mm stretched) in circumference and ropes exceeding 100 m in length was contructed. This trawl is now already used by commercial trawlers.

Besides rope trawl, experiments were conducted with cutters. Here, a comparison between a rope trawl and a conventional one proved that the latter needed 20% power in order to achieve the same towing speed; moreover, the mouth area of the rope trawl was 60 to 100% larger. In mid-water trawling, conducted by a pair of cutters, a rope trawl proved very useful for fishing herring out of a scattered layer.

Concerning model tests (scale: 1:4), conducted in the central Baltic, emphasis was attached on rope trawls too. As expected, the results were very favourable in respect to towing resistance and opening area and the gear was as easily manoeuverable as a conventional midwater trawl.

Model tests with otter boards, especially with spherical and symmetric ones (in the latter P.- and St.B. are exchangeable) gave promising results, but have to be continued.

Theoretical investigations on the dynamic loading of trawls were extended to shooting and hauling conditions. Especially the vertical movement of the gear during shooting is of great importance in aimed trawling. Measurements of movements of a trawler caused by the motion of the sea were continued in cooperation with the Institute For Ship Design, University of Trondheim.

Investigations carried out in order to replace the heavy and thus destructive flatfish beam-trawl by a light electrified one were continued. The electrified version caught larger quantities and besides it was possible to influence the length composition of the fish caught by changing the voltage and the duration of the electrical pulses.

For measurements dealing with the gear geometry a new ultrasonic "multi-netzsonde" was constructed as a part of a data acquisition system. It is equipped with six channels. Time sharing allows to measure two distances with each channel at the same time and to display them on a graph recorder.

Krill fishing

In October 1977 a second expedition into Antarctic waters was started in order to locate and catch krill on a semi-commercial basis.

Especially developed high frequency vertical and horizontal echosounders proved successful for finding and observing krill schools. Modified mid-water trawls with a lining of fine netting proved very suitable for catching krill in commercial quantities.

Net materials

All midwater trawls and more than 90% of the bottom trawls manufactured in the Federal Republic of Germany are made of polyamide. In 1977, some revival in the use of polypropylene yarns in the form of mixed yarns (PP, PA of higher R-tex value for application in cod-ends could be observed.

Research on elasticity changes of netting yarns after repeated loading revealed the magnitude of the imposed load to be the most important factor for an elasticity decrease whereas the number of repetitions of the same load showed relatively little influence.

The cooperation with national and international bodies concerned with net materials and standardisation of testing methods was maintained.

Selectivity experiments

In 1977 for the first time reliable results were obtained on the selectivity of saithe, which is now the most important species in the German deep sea fishery. For a cod-end made from polyamide (mesh opening 151 mm) a selection factor of 3.5 to 3.9 (depending on the amount of catch) was ascertained.

Fish behaviour

Investigations on the relations between water temperature and the distribution of fish were continued. In 1977 observations on saithe were conducted by means of a combined thermo-netsonde.

Observations by means of different echo-sounding equipment during fishing with rope trawls revealed that redfish were efficiently herded by the ropes into the path of the trawl, whereas Blue whiting showed no recognisable reactions.

Iceland

(G. Thorsteinsson)

Underwater observations on the behaviour of plaice and related species to Danish seining were started. The aim of these observations is to find out how close to the bottom the net foot-rope and the warps have to be towed in order to sweep the fish into the net. The knowledge of the behaviour is also important as to improve the gear rigging and the fishing tactics. It is hoped that some definite results will be obtained in 1978.

Some trials were made with selective prawn trawls. This type of gear is efficient if the prawns and the samll fish are more or less evenly distributed, but does not work successfully if the prawns concentrate into rather dense schools, resulting in very big prawn catches.

Ten national standards on netting technology were edited in 1977. They are in agreement with the ISO standards.

All types of Icelandic bottom trawls are made entirely of PE; the only exception being a special design consisting of PA used in the Norway pout fishery. Mid-water trawls are made to some 85% of PA, 15% of PE (only bellies and cod-ends). Danish seines are only made of PE, purse seines only of PA, handlines only of PA-monofilament and gillnets only of PA of different construction. Finally, all longlines consist of a mixed material of PES and PP.

Ireland

(J. P. Hillis)

No work done in Ireland in 1977.

Netherlands

(E.J. de Boer)

The geometry of rigging and net opening of several rope trawls were studied during a cruise of the F.R.V. "Tridens" in which also staff and instruments of the Marine Laboratory, Aberdeen, participated. One of the tested rope trawls had a meshed upper panel intended to decrease the large difference in depth position between otter doors and headline which, so far, has been observed. Another attempt to improve this difference in depth position was the rigging of strings of floats along the headline of a rope trawl.

Prolonged comparative fishing trials with an electrified beam trawl were carried out onboard a commercial trawler. The fishing area was along the Dutch coast and in the German Bight. The main species caught was sole (Solea solea). In both technical performance and in catch rates improvements in relation to the results of the past years were observed.

The prototype of the flatfish grader was tested on a commercial beam-trawler. The first tests with the grader were very successful, especially in relation to the improved working conditions. The sorting work, which to this very moment does not meet egronomic criteria, will now be done by the grader. In March and April 1978 the tests will be continued. The aspects of the influence on both the quality of the landings and the survival chances of the discards will be studied. These tests will partly be carried out in combination with fishing experiments on flatfish species with an electrified beam-trawl.

Further investigations on collecting mussels from the sea bed by hydraulic transport with an improved mouth piece on the suction pipe of the pump installation had good results. The application of this gear for clearing the mussel beds has been successful. Experiments showed that loading and unloading of the vessels by hydraulic transport with both mussels and mussel seed is possible.

A study to design the optimum (beam) trawler for the Dutch conditions has been started. Economical criteria and a parameter study are at the moment the most important items.

Norway

(S. Olsen)

Longline studies off the Finnmark coast were continued in May/June and in November, for evaluating effects on catch rates of cod and haddock of various gear parameters, such as line material, hook spacing, hook shapes, snood length, etc. Laboratory and field experiments with artificial long line bait

were progressing and the development of a mechanised gear handling system for small and medium vessels using lines with detachable snoods is approaching completion.

The hydraulic gill net drum system was modified and tested on commercial vessels in March/April at the Finnmark coast and again in November/December in the North Sea. At the same time, full scale trials with the new float line were carried out. Initial tests with components of a new simpler gill net mechanisation system for small and medium vessels were started.

A study of the possibilities for trap/pot fishing for Nephrops was taken up.

Fishing experiments with a 75 footer fitted for mechanised Scottish seining in late 1976 were continued in the North Sea, and a trip was also made in the spring to the Barents Sea making seine trials in waters up to 220 fathoms deep.

The development of the prawn sorting trawl was brought forward, and in addition to continuing the tests of sorting panels installed in nets of commercial coastal prawn trawlers, the system was also tested on a larger trawler in the Barents Sea.

Successful tests were carried out in May/June in the North Sea area and on the Faroe Bank with two blue whiting trawls, one with ropes instead of meshes in the lower front panel, the other with 2 m meshes throughout in the forward part of the trawl. The latter, equipped with a small mesh cod-end, was in October tried for capelin fishing in the Barents Sea. These trawl studies included instrumented measurements of various gear parameters.

A saithe purse seine made of net with hexagonal meshes was manufactured and tested in May/June on a 70 ft vessel. At the same time further trials with the mechanised seine stacking system were conducted. A fully automatic, electronically controlled operation unit was developed for use with this system, but installation and sea trials were postponed till 1978.

Fish behaviour studies relevant to most of the gear technology projects mentioned above were pursued. These included free field studies with UWTV of fish approaching baited hooks and traps, reaction of capelin towards trawl, tank studies of fish hooking and of bait preference and approach. Localities have been identified near Bergen which appear suitable for free field studies of fish reaction and behaviour towards passive gears and for experiments with fish concentrations around artificial structures.

Sound/food conditioning of a big quantity of saithe stored in a closed inlet has been continued. A fair success in the method of automatic conditioning has been achieved, but the intention of combining this with a practical recapturing method of the fish is still difficult.

A prototype of an electric fish fence in salt water has been successfully tested on single specimens of saithe. The basic principle is electric field combined with visual conditioning of the fish. Experiments on larger quantities of fish are planned.

Studies of eventual avoidance reaction by fish in upper waters when vessels are passing have been continued by use of high resolution echo sounders. Further experiments are planned also making use of underwater photography and television.

Further tests of a computer display system of vessel and gear position/fish distribution during trawling have been carried out. As the advanced electronics involved in the system have been seen to require considerable and highly expensive maintenance, the project is temporarily shelved.

A towed body, housing up and down sounding transducers, has been tried for routine full-speed echo surveying, the objectives being to reduce interference in bad weather, improve resolution of near bottom recordings and to facilitate acoustic detection of organisms distributed near the surface.

A study on behaviour and distribution of small mesopelagic fish (Myctophydae) relevant to harvesting has been conducted, and a programme of gear development and experimental fishing with subsequent application in tropical areas is planned.

No change in the use of textiles for net materials is recorded since the last reporting on this matter.

Poland

(S. Richert)

In 1977 model tests were continued on 3 bottom trawls in a 1:3 scale and their wagging systems in the trawl set.

The following seven types of bottom otter boards were investigated:

- oval, Matrosov type;
- 3 kinds of oval convex (polyvalent);
- round, Rykunow type
- profile, Süberkrüb type, bottom version;
- V-shaped;

in order to establish their operational parameters.

A special hydroacoustic apparatus was applied to measure the linear parameters of gear, and underwater dynamographs to measure various forces and also direct underwater observations were conducted by scuba divers from an open towed underwater vehicle. The investigations were carried out on the R.V."Dr Lubecki" belonging to the SFI in Gdynia (240 hp) in cooperation with specialist from the German Democratic Republic.

During the second Polish Antarctic Expedition 1977/78 the gear and krill fishery technique was investigated. It was found that conventional pelagic gear with small mesh inserts could be used with good results.

Net fabric

The Polish fishery used polyamide net fabrics for 95% of bottom and pelagic trawls. The remaining 5% was made of plaited polyethylene and polyester-torleno twine.

Selectivity investigations

The investigations were conducted on the cod-ends of the bottom trawls made of stylon pocket tape. A tape 7 mm wide and 1 mm thick was used in the cutter fishery and a tape of 20mm width and 3.5mm thickness was used in the deep sea fishery.

The investigations carried out were to determine the selectivity of the new cod-ends and in particular, the influence of the size and shape of mesh on the selectivity.

These investigations were carried out in the North Sea and in the Baltic on the following species of fish : haddock, cod, blue whiting.

Portugal

(F. Rebordão + F. Lima)

In 1977 the inventory of the fishing gear and fishing methods used by professional fishermen was practically finished.

It was also possible to start with experiments on mid-water trawling, using the R.V. "Mestre Costeiro" with promising results, especially concerning sardine catches.

An echo-survey project aiming at the study of pelagic resources availability, relative abundance and respective spacial and seasonal variation at the south coast of Portugal has been carried out.

The first trials using the pre-coiled nylon monofilament for long-lines have been carried out.

All these activities will be continued next year in order to provide information to professional fishermen and to increase the spreading of new fishing techniques not yet used in our country.

The "Instituto Nacional de Investigacão das Pescas" hopes to start with experiments on deep-sea traps.

The prospection of new fishing grounds especially in our 200 mile fishing zone and this fishing method is also our objective.

The "Instituto Nacional de Investigacão das Pescas" will start to register the exact rigging of the most common fishing gears with a view to the introduction of eventual modifications, especially in the materials used and the way of rigging them.

Spain

(J. Bravo de-Laguna)

During 1977 the investigations have been directed towards the improvement of the technique of stock assessment by means of acoustic methods. In this sense, during the month of July various experiments have been carried out around the Balearic Islands, by personnel of the Spanish Institute of Oceanography. The main items covered were : new trials on the calibration with fish in a net cage; comparison of calibrations done counting single fish on an echogram and using a digital frequencimeter PH 5308A; measurements of TS of single fish placed under the transducer; improvement of the techniques used in identifying trawling operations.

Sweden

(G. Otterlind)

Some experiments have been carried out on the selectivity of cod trawls in the Baltic, using the parallel haul technique and mesh-sizes of about 90, 100 and 110 mm (single bound, plaited nylon, 3 mm). The investigations have been completed at the beginning of 1978, using the covered cod-end technique. The results will be presented at the Council Meeting 1978.

In cooperation with the Chalmers University of Technology (Div. of Ship Hydrodynamics), Gothenburg, a number of trials were carried out. Prof. J. Lunde reports as follows :

Propeller nozzle on trawlers - In this project extended studies were carried out of the environmental and economical importance when a trawler is fitted out with a propeller nozzle. In particular, fishing gear parameters, noise and hull vibrations were registered. The level of noise and vibrations, both with and without nozzle exceeds the recommended level for fishing boats and with small mutual variations in the levels in the two cases.

The saving in fuel with the nozzle was quite noticeable when the propeller was heavily loaded(i.e. during trawling and bollard pull tests). On the other hand, variation in fuel consumption during steaming with and without nozzle was quite small.

Fishing tests carried out with a Danish bottom trawl fitted with Danish otter boards - In this project a comparison was carried out of catching rates for a conventional Swedish bottom trawl with rectangular flat otter boards and a Danish bottom trawl fitted out with V-type otter boards. The Danish gear was larger than the Swedish one which increased the demands upon the trawler.

The ship, a 81 ft side trawler, was for the Danish gear fitted out with a sheave on the stern frame, so that the warp leads from the aft gallow round the stern sheave to the gear. This leads to improved directional stability and the use of less rudder angle than before. The skipper also reported a lower level of hull vibrations, but no measurements were carried out to confirm this. However, the test period was too short for a proper conclusion to be drawn regarding catching rates.

Preliminary studies of a combination trawl - In this introductional study two types of otter boards with the same area, conventional flat otter boards and O-type otter boards were compared. The O-type otter board was highly efficient, compared with the flat otter board with the same area. Earlier studies with same trawl and flat otter boards with 65% larger area than the O-type boards gave a spreading force comparable to that of the O-type boards.

During the trials a team of 6 divers was observing the gear. A two-man towed vehicle was constructed for this purpose and it was towed by the fishing ship itself. Two divers were transported by the towed vehicle to the trawl for measuring the water velocity through the trawl. These measurements were carried out from the headline to a point 30 m behind it. The films which were taken during the tests were not a success due to, among other things, the poor visibility in the water. These tests are to be continued in 1978.

United Kingdom

(G. P. Arnold)

Two cruises were conducted during the year to determine the effect of a door-to-door tickler chain on the efficiency of a Granton trawl using sector scanning sonar and acoustically tagged plaice. The results suggested that the rate of capture of fish which encounter the gear between the door and the wing end is increased from 22% to 41% by addition of the chain.

Development work has continued with miniature acoustic tags designed to telemeter the orientation, speed and heart rate of the fish back to the tracking ship. Field trials are to take place shortly.

Research into the acoustic estimation of fish abundance continues to be concentrated upon the measurement of fish target strength. Experiments have been made with dead mackerel and a model has been constructed which relates these acoustic measurements to the physical characteristics of the fish. With this technique, it may be possible to assess the extent of seasonal variations in target strength resulting from changes in fat content. Studies have continued of methods of measuring in situ fish target strengths. A statistical transformation technique is under development to convert single fish echo amplitudes into target strength distributions by removing the effects of transducer directivity. Acoustic surveys have been made of sprat and mackerel stocks off the east and south-west coasts of England.

The effectiveness of escape gaps in crab and lobster traps was tested in the Norfolk fishery during 1977. Preliminary results indicate that the proportion of undersized crabs and lobsters retained in the traps was significantly reduced and that the commercial catch of crabs increased slightly.

White Fish Authority, Hull (J.F. Foster)

The Krupp-Atlas D.S. 79U steerable narrow beam echosounder designed for operation down to 730 m has been evaluated on a commercial stern trawler for a 6 months period. For the limited period that the vessel spent fishing in deep water, the performance of the equipment fulfilled the manufacturers claims. An assessment has also been made of commercial electric fishing equipment of American origin. Considerable difficulties were experienced in handling the gear in conjunction with a Lowestoft, C3 otter trawl and work was finally concentrated on the use of the equipment with a beam trawl. Further research is needed into the pulse length and field strength required for plaice fishing.

The Authority is continuing to develop the autoclip system for the mechanisation of longlining on vessels under 24 m length with encouraging results. It is also cooperating with the West German Baader Company on the development of a machine for processing Blue whiting for human consumption. Evaluation of the Japanese method of catching squid with automatic jiggin machines and lights has shown that while the technique will catch squid in UK fisheries, the lights do not have the desired attraction effect.

The flume tank in Hull has now been in continuous operation for two years without developing any major faults. Extensive use of the tank is made by the Authority for supporting its various training courses in fishing gear technology. Increasing use is being made of the facilities by both national and international scientific and commercial organisations in the development and evaluation of new types of trawl.

Marine Laboratory, Aberdeen (R.E. Craig)

a) Gear Technology

The development of semi-pelagic trawl gear has continued and particular attention was given to the reactions of fish to the lower panel of the "de-lagic" gear with the footrope on the sea bed. This panel rises steeply behind the footrope to prevent damage to the net, but depending on the

mesh size roundfish may find an escape route through the lower panel. Smaller versions of the delagic gear were designed and tested to extend the range of gears available to industry down to 50 HP vessels.

The performance of rope trawls was studied in collaboration with RIVO, IJmuiden, and a team from the Marine Laboratory participated in gear trials on board the Dutch research vessel "Tridens".

A new project began this year to investigate the asymmetry of a trawl during turning manoeuvres. Time can be saved during fishing operations if the maximum rate of turn can be determined at which the gear will remain undamaged. Four acoustic transmitters (pingers) were attached to a small pelagic trawl, one on each otterboard and one at each wingend of the net. The trawl was towed over a tracking range in a sea loch so that the position of each pinger relative to the towing vessel could be monitored. This tracking system was found to be sufficiently accurate to measure the asymmetry in horizontal plan between corresponding points of the gear inside and outside of the turning circle.

A data bank is being set up on the Laboratory's PDP11/55 computer, containing records of towing loads and other engineering parameters of gears collected over the years on research and commercial fishing vessels. By making such data more readily available in a convenient form, methods of designing fishing gear can be improved and it is easier to predict the performance of gears a the design stage.

Work has continued on the development of computer models to simulate the performance of full scale trawl gears and to study features such as the hydrodynamic force on otterboards which are difficult to measure directly.

b) Electrical fishing

Studies of the behaviour of flatfish in electric fields were continued, concentrating on the development of a fixed underwater electric barrier as a simple means of fencing large bodies of sea water. Comparative studies of the reactions of roundfish and flatfish to air curtains were undertaken and initial results were promising. The development of electrical fishing equipment for use on otter trawls was continued with emphasis on the design of robust lectrode systems. Preparatory engineering work was carried out for commercial trials of electrified beam trawls for flatfish. Investigation of the physiological basis of fish reaction to electrical stimulation was continued.

c) Fish behaviour studies

Long-lining

Research to improve the efficiency of long-lining has continued, with different line configurations, different hooks, and different baits being compared. Underwater television observations on long-lines laid in the sea have yielded valuable information on the way fish are attracted to particular baits, and their subsequent behaviour in taking the baited hook.

The sensory capacities of fish

Work to examine the sensory capacities of fish has continued, experiments being performed on the vision, hearing and chemosensitivity of fish. Particular attention has been paid to brightness contrast perception, directional hearing in the vertical plane, and the sensitivity of fish to dissolved amino-acids.

The movements of fish

Further experiments have been performed by means of an acoustic tracking arrangement to determine the natural patterns of movement of fish in Scottish sea lochs. The effects of towed fishing gears upon the behaviour of the fish will be examined in the future.

d) Fishing process

The latest gear diving technique uses a wet vehicle with sufficient control to move to any part of the gear, including the codend and the trawl boards, at commercial towing speeds up to 4 to 4½ knots. Experiments observing many aspects of the behaviour of various gears and the fish reacting to them have given successful results during the year.

In order to fill in knowledge for behaviour and reaction of fish to gear at greater depths the SITCON underwater camera has been mounted at various points on the gear with a motor driven mirror device to adjust the pointing of the camera. This apparatus was found to give satisfactory pictures down to 90 m depth using natural daylight. The fish behaviour observations are being used to develop general descriptions of how fish are caught in the gears, which allows further development of the small details of engineering of the fishing gears. Another important aspect of the same observations is the development of a greater knowledge of where fish of specific size are lost from the gear during the capture process and the subsequent development of an overall fish selectivity theory.

The four-panel trawl, developed from engineering and behaviour studies at the Marine Laboratory, Aberdeen, is now widely accepted by the British fishing industry as a trawl which suffers less damage during fishing, but catches at least as much as other commercial trawls. The high headline leads to capture of some species of fish off the bottom not caught by trawls with lower headlines fishing in the same area. The current research effort is to match the trawl size to the power of the towing ship. Further developments in progress are to increase the headline height still further, while maintaining the other properties of the gear.

Reaction and behaviour experiments have been made to find the effect of the angle of rise of the belly panels and the constriction of side panels of fishing gears. An interesting relationship between angle and fish performance exists, where at certain angles fish up to a certain size are unable to rise across or cross over these netting panels at the particular towing speed. Changes in towing speed of angle of attack alter the size of fish affected because of their different swimming performance.

Swimming performance studies have yielded useful figures for the maximum cruising and maximum burst swimming speeds of most commercial fish species. Current studies are investigating the surprisingly large effect that temperature has on these swimming speeds.

e) Sonar

Fish surveys have been carried out on sprat, herring and Blue whiting using the Simrad EK38 echosounder coupled to the Aberdeen integrator. The results have been interpreted utilising an assumed target strength of -34 dB/kg for all these species. Absolute calibrations have in each case been made using a standard target (a table tennis ball) suspended beneath the towed body which carries the transducer.

Continuing studies have been made on caged gadoid fish to obtain better measures of their target strength. In general it was found that values of the order of -30 dB/kg applied to fully acclimatised fish, whereas values as low as -36 dB/kg were obtained after forced vertical movements. It is clear that swimming attitudes affect the traget strength, as well as changes in swimbladder condition.

U.S.A.

(A.-J. Kemmerer)

Fishery technology activities in the United States during 1977 tended to focus on conservation engineering. Emphasis was placed on systems to reduce or eliminate the incidental capture of unwanted species during fishing operations, and systems to gain assessment, biological, and life history information on selected species. Highlights follow :

Porpoise containment system - A facility for handling porpoises at sea was developed. The design goal was to provide a non-injurous system for tagging and acquiring biological information from porpoises captured in tuna purse seines. The facility consists primarily of inflatable frames and small mesh webbing to minimize storage requirements aboard tuna purse seiners. It is scheduled for use during a dedicated porpoise research cruise (chartered tuna purse seiner) this year.

Tuna purse seines - Minor refinements and modifications to webbing and net configurations were continued to reduce porpoise mortalities in purse seines used in the eastern tropical Pacific. Behavioural research is being emphasised to separate tuna from porpoises while they are in the seines. Techniques considered include lights, bubble screens and olfactory stimulants.

Satellite tracking of marine animals - A small satellite-linked transmitter is being developed for long-term tracking of marine mammals and sea turtles. The transmitters will weigh less than 800 grams (including batteries and attachment system) and operate for periods of up to one year. Preliminary tests with a transmitter harnessed to the dorsal surface of a captive bottle-nose dolphin and linked to the NIMBUS-6 spacecraft this year demonstrated technique feasibility. Tests are continuing.

Turtle conservation shrimp trawl - A unique webbing pannel was designed for incorporation into shrimp trawls to prevent incidental capture of sea turtles. Design goals are 100 percent elimination of sea turtles from shrimp trawls and 100 percent maintenance of shrimp catch efficiencies. Preliminary tests suggest the goals are achievable. Extensive testing of the panel is planned over the next two years from cooperating shrimp trawlers operating off the southeastern coast of the United States and the northern Gulf of Mexico.

Trawl door environmental data recorder - A system for *in situ* measurements and recording of salinity, depth, temperature and time has been developed for attachment to trawl doors. The concept was to provide a relatively inexpensive system that would operate without attention or maintenance during groundfish survey cruises. Data are recorded digitally on a small cassette recorder for read-out either aboard the vessel or directly into computer data files at the end of a cruise. The system currently is undergoing final field tests.

Trawl mensuration system - Work is continuing on the development of a trawl mensuration system for use during resource assessment surveys. The design goal is to provide a system capable of monitoring trawl spread, vertical opening, and footrope height off bottom that can be operated with minimum handling and maintenance. A prototype system already is available which demonstrated that trawl performance is variable and should be considered in computations of biomass estimates.

Photographic crab stock assessment - An evaluation of photographic techniques for assessing crab stocks in the Bering Sea with a Remote Underwater Assessment System (RUFAS) was conducted. The system used essentially consists

of a towed underwater sled equipped with lights, a photographic camera, and a television camera. The sled is designed to operate automatically at selected heights above the bottom. Preliminary results indicate that the technique provides useful data.

U.S.S.R.

(S.G. Fedorov)

In 1977 further precision was made on two methods, i.e. to estimate fishing parameters and to find out optimum mesh size in cod-ends. The method of trawl survey underwent further precision. The construction of bottom trawls, now in operation, was analysed. Furthermore, the following studies were made within the same range of problems :

- In order to study resources of the near-shore zone off Murman, during the second semester fishing tests were made with bottom and pelagic long lines and drift and fixed nets from SRT-300 type vessels.
- To determine the krill biomass in fishing areas of the Barents Sea, a multi-depth trawl 17.4/28 m, made of small mesh net, was tested.
- The fishing productivity was tested with various bottom trap nets in the Murman coastal zone.
- A further study of the twin trawling productivity was made for medium tonnage (side) vessels and heavy-tonnage (stern) vessels.
- The selectiveness of various trawls and their parts was studied.

The behaviour of fish was surveyed around fishing gear (trawls in expeditions of the scientific research vessels"Odissey", "Persey III", "Artemida" in the Barents Sea and the North-west Atlantic. Bold-snouted macrurus, Greenland halibut, red-fish and capelin were the object of this study.

The fixed hydrostate "Sever-I", autonomous "Sever II", underwater photo-cameras, hydroacoustic fishing devices, both Soviet-made and of Norwegian origin were used during the expeditions. The distribution and behaviour regularities of fish in the Barents Sea were studied.

In the Baltic Sea and the Gulf of Riga the effect of various fishing selective-ness on Baltic herring resources was studied. Further experiments were made on the study of the reaction of the Baltic herring to electric and sound fields.

All fishing gear used in 1977 was manufactured of polyamide fibre kapron (nylon).
