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Administrative Report

FISHING TECHNOLOGY COMMITTEE

1978

G. Kurc

Belgium

(G. Vanden Broucke)

The technical parameters of the traditional nets (net opening, rigging, drag, wear) were further studied.

Comparative studies with beam trawls were started with the aim to increase the fished surface and to adapt the rigging in function of the fishing ground and the characteristics of the vessel.

The investigations on double beam trawls were continued and concerned mainly the problem of lessening the drag through adaptations of the mesh size and the cutting rate.

Within the framework of the project "Comparative semi-pelagic fishery in coastal waters", three types of semi-pelagic nets and their rigging were tested.

Investigations on the use of oval boards were started.

Various yarns and netting were tested for yarn strength, knot strength, mesh strength, mesh size, shrinkage and elongation, etc. on request by the industry.

Research was carried out on the effect of repeated moistening and drying of netting on the mesh size.

Several series of experiments with electrified nets were carried out on shrimps and sole.

Technical advice was extended to ship-owners wishing to adopt other fishing methods such as the fishery with semi-pelagic nets combined with the beam trawl system.

A comparative work-time study on the catch processing by means of a traditional sieve and a sorting and rinsing machine with automatic feeding system was concluded.

Use of synthetic yarns in Belgium : Polyamide : 65%; Polyethylene: 35%.

Application of ISO standards in Belgium: Only by the Fisheries Research Station; a) during its research projects and b) during the tests carried out on request by the industry.

Future Work

- Experiments with double beam trawls, rope trawls and semi-pelagic nets.
- Trials with a compact battery powered underwater pulse generator.
- 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 the Irish Sea.
- Study on the automatic feeding system for the flatfish rinsing machine.

Canada

(P.J.G. Carrothers)

Work of interest to the Fishing Technology Committee is done in Canada by the Federal Government in Newfoundland, the Maritimes (Nova Scotia, New Brunswick and Prince Edward Island), British Columbia, Central region (freshwater fisheries) and increasingly in Quebec. It is done by the provincial governments, particularly in Newfoundland and Quebec, but also in Nova Scotia and New Brunswick. Two universities, Memorial University of Newfoundland and Nova Scotia Technical College, are showing increasing interest in fishing technology.

The Federal Industrial Development Branch in Newfoundland is primarily involved in improving the viability of the extensive local fisheries, mostly through technology transfer and exploratory fishing. Automated longlining has been demonstrated on a 38-m Norwegian vessel off the east coast of Newfoundland and Labrador to show that, with labour saved by automation, this method can compete with gill-netting, which produces poorer quality cod and is harder on the resource. Pair bottom trawling has been demonstrated on 15- to 20-m vessels, with improved equipment and methods, to promote conversion from hand-baited longlining, gill-netting and bottom seining. Improved Scottish seining, involving new gear designs, closer matching of gear to engine, rope reels, power block and echo-sounder has been demonstrated on 15- to 20-m vessels to upgrade an existing fishery. Trials have been conducted with the middle distance trawl/Scottish seine fishery to increase the versatility of existing 25- to 35-m vessels and to develop design criteria for new vessels of this size. Experiments with capelin fishing were conducted to increase the proportion of ripe females in the catch for the roe market. Purse seines offshore and traps inshore proved effective. Trials and demonstration of shrimp sorting trawls to retain marketable by-catch have continued. Exploratory fishing, mostly in relatively unexploited areas off Labrador, has been conducted for shrimp with a Sputnik 1800 shrimp trawl, getting good clean catches, and for scallop with Digby-type dredges in conjunction with a scuba team from Memorial University.

The Federal Research and Resource Services Directorate in Newfoundland has established design criteria for baited crab traps. The bait odour trail should lead crabs specifically to the entrance. In side-entrance traps set independent of current direction, 3-entrance traps caught 49% of crabs attempting entry whereas 2-entrance traps caught only 31%. In these traps, centre-placement of bait is optimum. In top-entrance traps the bait must be within a critical distance of the bottom or the crabs lose the trail. Standard methods for preventing escape are effective. Trap entrances should be above the bottom of the traps to reduce conflict of crabs entering with those already caught. Trap saturation starts restricting catches within as little as 2 hours and may eliminate 80% of the potential catch over a standard 48-hour soak time. Saturation level can be increased by increasing trap size, increasing quantity of bait or in some cases exposing the bait, and by preventing crab escape. They also investigated the diurnal variability of biomass estimates of redfish in ICNAF Divisions 3MNO and found this to be less than variability caused by non-uniform fish distribution. Acoustic surveys are conducted throughout the year in an attempt to provide biomass estimates of pelagic capelin. Development of this technique has included a new micro processor data acquisition system, free-drop underwater camera and television observations in situ of capelin to determine frequency of tilt angle, improved software for echo interpretation, and studies of capelin target strength as related to aspect angle in the acoustic beam.

The Federal Marine Fish Division in St. Andrews is continuing measurements of acoustic echo strength of cod and herring in relation to fish size, roll angle and pitch angle in a vertical beam as necessary input into interpretation of acoustic counts for fishery resource inventory, and acoustic survey techniques are being developed in conjunction with trawl surveys for young herring. The sea-bed referencing towed camera and television vehicle BRUTIV being developed in St. Andrews is functioning more satisfactorily and is to be used for truthing acoustic fish counts and for studying the reaction of fish ahead of the trawl to fishing systems. The on-board computer system for acoustic surveys developed by the Federal Marine Ecology Laboratory in Dartmouth is becoming old, unreliable and obsolete and is being replaced by a micro processor data logging system for data processing on more sophisticated computer systems ashore for both the St. Andrews and Dartmouth laboratories.

The Federal laboratories at the Canadian Centre for Inland Waters have been concentrating recently on the biological interpretation of accumulated acoustic data rather than on hardware development. Acoustic methods have been compared with conventional methods of fish assessment and some ground truthing attempted. They have been used to examine fish communities in the nearshore Great Lakes while they respond to perturbations in water quality, and they have been used to assess an exploited herring population to relate stock to harvest. Known sizes and numbers of fish have been introduced into an unpopulated lake as a target to improve interpretation of acoustic data for numerical assessment and, to some extent, for echo sizing of fish. They plan a feasibility study for acoustic assessment of trout in inland lakes and to characterize further the diversity and distribution of the nearshore Great Lakes fish community by acoustic means. Acoustic procedures are also used frequently in conjunction with midwater trawls to characterize fish populations. They believe that development of acoustic techniques for fresh water should now be directed toward refinement of acoustic applications in soft bottom areas and interpretation of results for sizing fish.

The Federal Industrial Development Division in Halifax, N.S., has continued development of the stern drum seine system, improving shooting and hauling procedures, with the net-sounder cable, improved control of the codend, and refining construction of the net for better fishing shapes and less tangling. The rope-wing midwater trawl is receiving notable commercial acceptance, and trials of groundfish longline and capelin fishing methods continue. The development of midwater shrimp trawls continues, with improved fish-finding capability, to complement the traditional night-time bottom fishery and to reduce the by-catch of juvenile redfish.

The Federal Industrial Development Division on the Pacific coast has tried a 3/4 scale version of the Polish rope-wing trawl earlier introduced on the Atlantic coast. The wire footrope was replaced with 13-mm trawlex chain and the resulting net has fished successfully, both on bottom and in midwater, for rockfish, food herring and pollock. An Engel-type high-lift bottom trawl has been modified by the insertion of side panels to make a 4-seam net with a 9-m vertical opening without kites or extra floats, as compared with 6-m usual vertical opening. This net has worked well on ocean perch and other rockfish. A 9-m Dutch-type beam trawl has been fitted with hinges so the gear can be collapsed while steaming, for use on 12- to 15-m shrimp trawlers. Experiments continue with the upright oval cambered doors (spherical doors with a cylindrical centre section) to find the best tow points for bottom and midwater trawling. After seeing these doors, commercial fishermen have experimented with high aspect ratio (1.3) cambered bottom doors. These are easier to construct than the oval doors and show promise, but probably need some refinement. Three-wheel warp tension meters have been constructed to help with gear and other trials on vessels of 450 to 1000 horsepower. They are made mostly of aluminum and can measure loads in running warps. Preliminary bottom pair trawling was tried but the boats were poorly matched and there were little fish. The method shows enough promise that further trials will be conducted in 1979. Also two sail kites (Ben-Yami type) have been constructed for trial.

The provincial Department of Fisheries in Newfoundland has been testing and developing two automated longline systems, one of them original, different from that being demonstrated by the Federal government, to show that this method can now compete economically with other methods to advantage in fish quality and resource protection. Experiments with different mesh sizes in various parts of two types of cod traps have been conducted to reduce the catch of immature fish. Observations were made to minimize the gilling of fish. Exploratory fishing and stock assessment have commenced to establish the viable size of the lumpfish roe fishery. Trials have been conducted for fishing under the ice with gill-nets and traps for rock cod in the Lake Melville area. Three experimental fishing vessels to provide capability between the wooden outboard-motor powered boats and the small longliners have been designed and constructed, two in aluminum and one in steel. A 14-m steel longliner/gill-netter has been designed and will be available about April 1979.

The provincial Direction générales des Pêches Maritimes in Quebec has constructed and evaluated a hydraulic clam rake to be used in the Ste-Anne-de-Portneuf area. They have constructed and tested a new design of Mediterranean-type, steel, shrimp-trawl door for fishing over muddy bottom, which will be given commercial trials in 1979. A Lofoten 78'/42' trawl has been constructed and tried for introduction on 20-m vessels in the Newport area. It is planned to test oval trawl doors for these vessels in 1979. Further trials with selective shrimp trawls have been conducted in cooperation with the Federal Industrial Development groups in Newfoundland and Halifax. It is planned to study the vertical distribution of shrimp in more detail in 1979 as a basis for better trawl designs. A device for measuring the horizontal and vertical mouth opening of trawls is being designed and it is hoped to measure horizontal openings in 1979. Trials of a rechargeable power pack for wireless net sounders have been completed.

Development and technology transfer in fishing vessels, gear and methods have been conducted by the provincial governments of Nova Scotia and New Brunswick, but details are not available at the present time.

The Crown Corporation, Newfoundland Oceans Research and Development Corporation (NORDCO), established its Fisheries Division early in 1978 and has been mainly concerned with the acquisition of accommodations, staff and testing equipment. Theoretical work is well under way in the preparation and testing of computer programs for fishing gear performance analysis and to some extent performance prediction. Feasibility studies have been conducted with respect to commercial fish harvesting, including fishing vessel and gear designs, aquaculture and instrumentation. Some work is being done in techo/economics, involving considerable data collection and analytical evaluation of fisheries investment. One specific project has been started to modify and introduce Aberdeen 4-panel trawls for use on rough bottom.

Denmark

(P.Kanneworff et H.Jakupsstovu)

No work has been carried out in 1978 in Greenland.

In the Faroe Islands apart from experiments with very big meshed (French type) pelagic trawls in 1978 there have been no activities relating to the fishing technology committee at the Faroese Fisheries Laboratory.

The experiments with the big meshed trawl are in collaboration with the Norwegian institute of Fisheries Technology (FTFI). They started in 1978 and will continue in 1979.

Finland

(V. Sjöblom)

No research on fishing technology was conducted in 1978.

No changes in the information on materials used in nets reported to Administrative Report 1977.

France

(J.C. Brabant)

Chaluts

Le chalut de fond pour fonds durs, adopté l'année dernière par la pêche industrielle, est toujours utilisé avec succès sur le poisson situé à quelque distance du fond.

Les pêcheurs artisans en Manche ont considérablement diminué les avaries sur certains fonds, en utilisant une version réduite (16 m de corde de dos en moyenne) d'un chalut de 33 m de corde de dos qui équipe habituellement les chalutiers de Grande Pêche. Les ailes inférieures sont coupées, le bourrelet est lourd et les fils sont de fort diamètre.

Un chalut de fond à 4 faces a été essayé avec succès dans la pêche des encornets par un chalutier de Grande Pêche.

Pour le chalutage de fond par des unités moyennes ou petites (inférieures à 30 m), on assiste au développement de chaluts à 4 faces (250 ch, ouverture verticale : 4 m, corde de dos : 20 m) et de chaluts boeufs avec des filets à 2 ou 4 faces. La dimension des mailles à l'entêture varie de 160 à 1 200 mm. La principale espèce recherchée est le merlu.

En Méditerranée, l'utilisation pour la pêche au fond de chalut à 4 faces gréé à fourches se confirme. Deux types coexistent, l'un avec une entêture en 800 mm pour le dessus et les côtés, 400 mm pour le dessous et des faces de côté hautes; l'autre avec une entêture en 200 mm et des faces de côté peu importantes.

Des films T.V. ont été réalisés lors d'une mission franco-écossaise d'observation d'un chalut de fond à grande ouverture verticale, à bord du "Clupea".

Sélectivité

Un chalut sélectif a été essayé sur une pêcherie mixte langoustine/merlu ; il s'agit d'un chalut à 4 faces, très plat à grand recouvrement de dos avec 2 poches superposées et une nappe oblique : la présence d'une poche supérieure permet de concentrer la capture de poissons mais diminue globalement le pouvoir de pêche.

Une étude de la sélectivité des chaluts dans la pêche de la langoustine a montré que l'emploi du polyéthylène ne modifiait pas la valeur du facteur de sélectivité, mais que cette fibre améliorait la sélection. Le facteur de sélectivité est toujours influencé par l'importance de la capture accessoire.

Des mailles ont été mesurées alternativement avec une jauge plate triangulaire et avec une jauge type CIEM, afin de comparer les deux méthodes.

Senne à thon

Des observations et mesures effectuées à bord des senneurs en pêche dans le Golfe de Guinée ont montré l'importance déterminante des opérations liées à la manoeuvre de la remorque (longueur, vitesse de filage et de virage) sur les performances des sennes (vitesse de chute, profondeur maximale atteinte). La hauteur pratique des sennes observées est en moyenne de 60 % de la hauteur de l'alèze étirée au milieu, 50 % pour le quart avant, 45 % pour le quart arrière. Dans deux cas sur trois, le filet ne peut se déployer au maximum parce que la coulisse est virée trop vite.

Engins divers

Dans la région d'Arcachon, on observe une renaissance de la pêche aux filets maillants.

Une étude est entreprise sur les dragues à coquille pour retarder l'âge du recrutement dans la pêcherie en modifiant l'écartement des dents et la taille des anneaux métalliques.

Equipement des chalutiers

On observe une utilisation de plus en plus grande des treuils hydrauliques ainsi que des enrouleurs de chaluts.

Bassin d'essais

Le bassin d'essais de Lorient est ouvert aux professionnels depuis mars 1978. Rappelons que les caractéristiques principales en sont : largeur 2,60 m ; profondeur 1,50 m; vitesse maximum du courant d'eau 1 m/sec ; homogénéité de la veine + 5 %.

Applications des normes ISO

Elles sont progressivement appliquées en ce qui concerne les dessins de filets. Pour l'usage national seul, les coupes sont indiquées par une terminologie française (p., m., m.f.) et la dimension des mailles est donnée en côté de maille.

Textiles utilisés.

Sans changement.

On note cependant l'utilisation de cordage en polyester (Ø 8 mm pour 2 bateaux de 400 ch). On observe après deux ou trois mois d'utilisation un allongement de 7 à 10 % de ces cordages.

Echo-intégration.

Au début de l'année 1978, l'ISTPM s'est doté d'un ensemble d'évaluation des stocks par écho-intégration installé sur le n/o "Thalassa", et depuis deux campagnes d'un mois chacune ont été effectuées. La première, en mars-avril qui s'est déroulée dans le golfe de Gascogne était essentiellement une campagne expérimentale pour la mise en oeuvre du matériel. La seconde, en juillet, avait pour objectif l'évaluation des stocks de merlan bleu dans le secteur est-Islande-nord Féroé.

Coopération avec les pays en développement

Plusieurs chaluts de fond ont été étudiés pour la pêche semi-industrielle du Maroc et du Cameroun.

Un cours de technologie des pêches à Nantes pendant un mois a été dispensé par les instructeurs de la FAO et de l'ISTPM à 19 cadres venant de 10 pays francophones (Afrique, Syrie, Haïti).

Un instructeur d'une école de pêche de Madagascar a effectué un stage de deux semaines à l'ISTPM.

Les possibilités de développement de la pêche au Pakistan et en Tunisie ont été étudiées lors de missions dans ces pays.

En Tunisie, a eu lieu une campagne d'essais de pêche de la sardine au chalut pélagique sur un bateau de l'Office National des Pêches.

German Democratic Republic

(H.J. Fischer)

The system for carrying out underwater observation consisting of a towed manouvrable body equipped with a low light level TV-unit has been applied aboard the R.V. "Ernst Haeckel" and aboard a commercial fishing vessel in order to observe the behaviour of different types of otter boards and constructional elements of bottom trawls. The results have been recorded on video-tapes for later analysis on shore. First conclusions for the improvement of the design of trawls have been drawn.

Investigations concerning the pre-treating of the netting used for trawl cod-ends (heat treatment, preservation) have been carried out including testing at sea during commercial trials. The results showed a very high constancy of mesh size during a longer time of application.

Further activities for the development of mid-water rope trawls have been conducted which aimed at the extension of the rope part. On certain fishing areas and catch objects good results could be obtained.

An electromagnetic log for remote measuring on trawls was developed. First trials at sea showed the applicability of the measuring principle for this purpose.

The analysis of hydrodynamic data of netting measured in wind tunnel tests (drag, lift coefficient) relating to small angles of attack has been completed. It showed the considerable influence of the surface structure on the magnitude of the measured data.

Nearly all fishing gear used in 1978 were made of polyamide fibres.
A considerable amount of netting is replaced by knotless braided netting.

Federal Republic of Germany

(H. Bohl)

As in the previous year, gear technological research was concentrated on rope trawls. As far as trawls of original size are concerned, simple twist-free ropes proved superior to ropes with core and braided sheathing. With respect to the handling, it was found advantageous to use differently coloured ropes for each panel of the trawl.

In the cutter fishery first trials were made with rope trawls, in which the ropes were replaced by belts identical with those used as seat belts in cars and planes. Up to now, there is no striking evidence that the net opening could be increased by this means, but the resistance of the belts against wear and tear was clearly higher than that of the ropes. In pair trawling comparative fishing between rope trawls and conventional four-panel-trawls were carried out in the autumn herring fishery of the Baltic. The main advantage of the rope trawls was, on average, a bigger herring catch and a lesser by-catch of jelly-fish.

As to otter boards, those used in midwater trawling have partly reached sizes which make their construction and handling difficult. Promising results were obtained from tests in which so-called "tandem boards" were used.

The experiments with an electrified beam-trawl were continued. The results confirmed the previously described advantages of this technique (protective effect on under-sized sole and bottom structure). The method is considered to be so far developped that it might be introduced in commercial fisheries within the near future.

In the wadden-sea area of the German Bight recently Grey Mullets occured in larger quantities. These could provide additional earnings for inshore fishermen. Experiments with different types of gear (traps, seines, gill nets, trammel nets) showed the monofilament gill nets to be most effective.

In addition to that what has been reported on the second German Antarctic expedition 1977/78 in the previous Administrative Report, it has to be mentioned that first trials were made to bring the krill catches on board by pumping. For this purpose a hydraulic pump was mounted to the topside of the codend; the pumping took place after hauling the cod-end close to the stern ramp.

Model tests with different types of midwater trawls and rope trawls as well as otter boards (scale 1:4) were conducted in the Mediterranean. A spherical otter board proved so suitable, especially on rough grounds , that it could be recommended for commercial use.

Comparative model tests in a flume tank with two-panel-trawls in the conventional rig and in a rope version showed the latter to be superior due to the markedly lower towing resistance.

The development of a program-controlled multi-netzsonde with 12 channels as a part of a ship-borne data collection system reached its final stage.

In addition to routine work concerning the testing of netting materials, in the year under discussion investigations were conducted on the influence of the method applied. It was found that the physical properties of the netting yarns changed by gradual loadings rather than by abrupt ones. This implies that during towing continuous strain is more important than sudden energy (peaks) of the same amount.

ISO-standards are strictly followed by scientific institutions only, whereas the commercial fishery still sticks to the traditional designations (denier, metric numbers, etc.).

All pelagic trawls and more than 90% of the bottom trawls manufactured in the Federal Republic of Germany are made of polyamide. A very slight increase in the use of polypropylene in the form of mixed PA/PP netting yarns of higher Rtex-values for the manufacture of bottom trawl cod-ends could again be observed.

In 1978, selection experiments with bottom trawls were carried out on Baltic cod. In the course of these trials it could be shown that the rig of the cover exerts a remarkable influence on the selection factor. The latter was found to be 2.84 - 2.93 using a topside cover and 3.23 by using a full cover.

Since it is well-known that during fishing for shrimps temporarely large by-catches of under-sized flatfish and/or jelly-fish occur, a Dutch type of a savings beam trawl was successfully tested. This construction is characterized by a larger-meshed funnel within the anterior part of the trawl through which the undesired catch components are released.

Iceland

(G. Thorsteinsson)

In July and August some experimental fishing on blue whiting took place off the east coast of Iceland. Only a few Icelandic purse seiners are powerful enough for successful mid-water trawling. As the purse seiners are not in operation at this time of the year they could be used as transport vessels for the more powerful stern trawlers whose fish holds are not designed for industrial fish. Thus the purpose of the experiment was to develop a method to transfer the codend from the fishing vessel to a transport vessel which pumps up the catch and brings it to a factory ashore. Two purse seiners participated in the experiment as transport vessels. The transfering of the codends was solved successfully.

In 1979 and 1980 fishing gear trials on blue whiting with rope midwater trawls and high opening bottom trawls are scheduled.

Observations on fish behaviour against Danish seine were continued. As the results are still incomplete these observations will be continued.

With reference to C. Res. 1977/4:3 it can be stated that no shellfish is captured in fixed gear in Iceland.

Iceland´s activities in fish capture technology for developing countries have not taken place so far, except through FAO.

As reported in the last Administrative Report, ten national standards on netting technology have been edited in Iceland. These standards, which all are in accordance with the ISO standards have been introduced to Icelandic net-makers in special courses. From now on, all Icelandic netmaker students will be taught according to the standardised methods.

Al 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 90% of PA, 10% of PE (only codends). Danish seines are only made of PE, purse seines only of PA, handlines only of PA-monofilament and gill-nets only of PA of different construction. Finally, all longlines consist of a mixed material of PES and PP.

Ireland

(J.P. Hillis)

The catch of Nephrops obtained by a traditional Nephrops trawl of mesh ranging from 43 mm in the codend to 57 mm in the wings was compared with that of one built to the same specifications of 70 mm mesh throughout, using two trawlers of similar power performing parallel tows.

Netherlands

(E. J. de Boer)

A parameter study to be used when designing the optimum (beam) trawler has been finalised. The collected and analysed parameters are : main dimensions, hull form coefficients, furl and fish hold capacities, propulsive data, light weight of the vessel and the position of the center of gravity (GK). At the moment a study into the application of multi-chine hull forms is carried out.

The prototype of the flatfish grader was further tested on board a commercial beam-trawler. In addition to technical and ergonomical research, also research into the influence of the grader on the survival chances of discarded flatfish was carried out.

Technical research in the field of mussel farming was directed to cleanse mussels from internal sand and silt when stored in the hold of the dredger by pumping water in a vertical direction through the layer of mussels. These experiments were carried out with mussels which were hydraulically transported from the seabed into the hold. A new type of rotating de-watering machine for separating mussels from water when applying hydraulic dredging was developed and tested. The amount of damage to the mussels caused by the fishing operation and the machinery in the shore-based processing line was also subject matter of research activities.

A new type of bilge water separator was tested on board a wet-fish stern trawler. After some minor modifications, the separated water fulfilled the quality standards of IMCO resolution no. A.393 (X).

A special research group was set up to investigate the application and efficiency of electrical barriers to prevent fresh water fish to enter the cooling water intake and/or discharge systems of industrial plants. After a literature study the reaction of fish species in electrical fields was studied.

Comparative fishing trials with an electrified beam-trawl were furthered on board a commercial trawler. The fishing area was in the southern part of the North Sea.

Both technical performance and catch rates could not meet the results of last year's experiments.

The drop in catch rate was probably due to the high fishing speed of this particular vessel. Reduced speed caused instability of the gears. To overcome the encountered technical difficulties, a new type of pulse-generator is developed.

The geometry of rigging and net-opening of several rope trawls was further studied during a cruise of the R.V. "Tridens" in which also staff and instruments of the Marine Laboratory, Aberdeen, participated. During this cruise, also new developed instruments for gear performance research and a Scottish blue whiting midwater trawlwere tested. In advance to these full scale tests,model tests on scale 1:25 were carried out in the Flume Tank of the Fisheries Training Centre in Hull. In order to compare full scale results with the results of the model tests,a staff member of the said Training Centre participated also in the cruise.

Activities to introduce fish capture technology in developing countries were directed to fishery projects in Kenya (Mombasa) Egypt (Lake Fayoum), Sri Lanka (Valaichenai), Cape Verde Islands (Santo Antão), Tanzania, Mwanza (Lake Victoria).

Norway

(S. Olsen)

Long-line studies were continued, in particular experiments with new hook shapes, line materials and artificial bait, and a new line mechanisation system for coastal vessels was tested.

Work on gill-nets was concentrated on studies of catch rate effects and selectivity by varying the flotation, hanging rate and method of mounting the net; and on small boat net handling systems.

Tests of prawn sorting panels installed in the trawls of commercial vessels were continued and the system was also tried on larger off-shore prawn trawlers. Initial experiments with a pelagic trawl for prawns were started in the Barents Sea.

Further work on trawls included tests of pelagic trawl boards; development, testing and measurements on blue whiting trawls with large meshes in the front part (in cooperation with the Faroese laboratory); capelin trawl studies in the Barents Sea, especially escapement through the large mesh part of the trawl; and experiments in the North Sea area with semi-pelagic trawling for blue whiting and Argentina by varying the amount and location of weights, floats and sweep wire lengths. A special project, financed by NORAD, for the development of suitable methods for catching small mesopelagic fish is in progress and will be continued in 1979 with trials in tropical waters.

The coalfish purse-seine with hexagonal meshes was made deeper and very successfully tried in commercial fishing. Work on developing methods for making an improved H-net with less material has been started. Testing of the automated mechanical net stacking system for coastal purse-seiners was completed and development of a modified system for large vessels has been started.

A remote controlled (by cable) un-manned tow-off boat (skiff) for purse-seiners has been successfully tested.

Fish behaviour studies have been pursued in many fields, particularly such which are relevant to the ongoing gear technology projects. Thus, further UWTV-studies have been made on the behaviour of cod, haddock and whiting towards long-lines and baits and on the behaviour of Nephrops towards baited traps.

The studies of avoidance reaction by fish concentrations in upper waters at night when vessels are passing were continued, applying various echo-sounder/ sonar techniques. These investigations are initiated by the possible importance of such phenomena in acoustic fish-finding and echo surveying.

The migration of smolts away from the home river has been studied by use of acoustic tags. The technique has been found promising and the experiments are continuing.

Smolt is also tried conditioned (sound/food) with the intention of facilitating easy recapture of adult salmon grown in big seawater basins.

The distribution of fish in relation to oil platforms has been investigated and studies of fish behaviour as factors responsible for the concentration of fish around structures are planned.

A shipboard echointegrator was used to estimate the density of capelin schools through which the pelagic trawl passed. By comparing this with the actual catch a measure of the trawl efficiency was obtained. In addition, behaviour of capelin inside the trawl was studied with the aid of an underwater camera.

The relationship between light intensity, vertical migration and effectiveness of a semi-pelagic trawl in catching blue whiting has been investigated in the Norwegian Trench.

Possible damages to salmon caught with drift nets have been investigated in tank experiments. No research has been conducted which is relevant to fishing effort studies in commercial shellfish fisheries (C.Res.1977/4:3).

During the reporting period no work has been carried out on the effect of the force on the mesh during measurement of mesh size (C.Res.1977/5:1).

No marked change has occurred in recent years with regard to the use of the different textiles in nets. Thus, practically
all gill nets aremade of polyamide and so are also purse-seines and pelagic trawls. The material for webbing of Danish seines is 70% polyethylene and 30% polyamide. Shrimp trawls are either made from polyethylene (50%) or polyamide (50%), while North Sea Trawls for industrial fish (Norway pout etc.) are of polyamide (55%), polyester (40%) or polyethylene (5%).

ISO standards are not fully applied in the fishing gear industry of this country and the terminology is little known by the fishermen.

Poland

(S. Richert)

In 1978, model tests of mid-water trawls were carried out in a wind tunnel, in conjunction with specialists from the German Democratic Republic, within the framework of bilateral cooperation between our two countries. Six models were tested, large-mesh, very large mesh, line trawls and those with six-sided mesh. The parameters of the net opening in various types of trawls, depending upon their rigging and speed, were tested.

Very large mesh mid-water trawls with large net openings have been introduced into commercial fishery for the extraction of blue whiting, large mackerel and horse mackerel.

Investigations on the technique, tactics and trawls for krill fishing in the Antarctic region are still under way. Technical investigations of ground trawls for vessels with 3 500-4 000 HP main engines were carried out on the research vessel "Professor Bogucki". Süberkrüb-type universal otter boards with an area of 6.7 m^2 and elongation of 1.1 were used in investigations of these trawls. They were found to be successful in the rigging of ground- and mid-water trawls.

During surveys of stock abundance in the open water of the Atlantic Ocean, the technique of fishing for squid by means of jiggers with the use of light to attract the squid, was tested.

Net materials

The mid-water and pair trawls, as well as about 95% of the ground trawls are made from polyamide materials (stylon). Polyethylene (PE) is becoming more widely used for ground trawls in cutter fishery.

Investigations are under way on net materials for the production of cod-ends in particular pocket tapes and twine of greater diameter and higher R-tex value.

Selectivity tests

Experiments on the assessment of selectivity of cutter cod-ends made of "stylon" tapes (PA), are being continued. These cod-ends differed in shape and size of rectangular mesh. The results indicate the distinct effect of the arrangement and shape of mesh on the selection of Baltic cod. The meshes in which the longer sides were set perpendicular to the longitudinal axis of the cod-end proved best. Such a cod end had a selectivity coefficient 7% to 17% higher than the others, and the lowest selection interval of 5% to 61%. Experience has shown this type of construction to be sufficiently strong mechanically and to have satisfactory stability of mesh shape if the proper finishing measures are taken.

As the cod-ends made of tape have to be made by hand, this restricts their wider introduction into commercial fisheries.

Portugal

(F. Rebordão and F. Lima)

In 1978 trials of mid-water trawling have been continued. Experiments with traps to be operated in deep zones were started.

We proceeded with an echo-survey project, aiming at the study of pelagic resources availability, relative abundance and respective spacial and seasonal variation at the Portuguese coast.

Portuguese technicians took part in an echo-survey cruise on board the Norwegian vessel "Libas".

Essays with pre-coiled nylon monofilament for long-lines have been continued. For this purpose, the Norwegian vessel "Eldorado" with both staff and equipment enabled us to carry out trials which allowed the comparison of Norwegian methods and equipment with our own. This cooperation also led to the divulgation of Norwegian techniques. Our Institute, on the other hand, contributed greatly to the planning and execution of the trials. Results achieved clearly demonstrated the necessity to keep on with trials which would lead to more accurate conclusions.

Another Norwegian vessel "Visund" carried out several fishing experiments at our coast with long-lines, gill and seine nets. Results obtained till its departure to the Azores were, however, not conclusive.

In November our vessel "Noruega" started to operate and, after eliminating certain deficiencies, we expect to obtain very useful information for Portugal, both qualitative and quantitative, in the field of practical methods of capture not yet employed by our professionals.

Spain

(J. Bravo de Laguna)

During 1978, the main Spanish activities related to this Committee have been conducted in the Canary Islands. These were selectivity experiments for gill nets. The working area was the shelves of Tenerife and El Hierro. In Tenerife, 20 experiments were carried out and 60 in El Hierro. In each experiment, gill nets with a mesh size between 25 and 55 mm were used. The main species sought were of the families Sparidae, Serranidae and Scaride.

Sweden

(G. Otterlind)

Selectivity experiments

In 1978 the Swedish mesh selctivity investigations were continued concerning cod trawls used in the Baltic. As a complement to the parallel haul technique used in 1977 the covered haul technique was applied for the mesh sizes 88.5mm and 100.5 mm. The cod-end material was plaited nylon (polyamide), diam. 3 mm and single braided. The cover used was a complete cover with a mesh size of ca. 40 mm. The selectivity was checked also by studying the frequency of fish meshed in the cod-end in relation to the number of fish of the same length groups caught in the cod-end. The results were presented at the Council Meeting 1978 (C.M.1978/B:2). The mesh size has been measured using the ICES mesh gauge with a strain force of 4 kg.

Net materials

Mid-water trawls are manufactured exclusively of polyamide (nylon). This material is used also for the cod-end and posterior part of bottom trawls for herring and sprat, the wings and anterior part being made of polyester (terylene).

In trawls for demersal fish the netting material is more varying. The main materials are at present polyethylene and polyester (60 and 40% of the gears, respectively), in the Baltic fishery almost exclusively polyethylene. The posterior part of the trawl and the cod-end are usually manufactured of polyamide (nylon). To some extent polyethylene is used here too (in the Baltic ca. 25%) and the whole gear may thus be made of this material.
In trawls for deep water prawn the material has been exclusively polyester (terylene) during recent years. Large-meshed wings made of polyamide (nylon) have been successfully tested, however. Polypropylene is no longer in use.

In Danish seines the main material is terylene; the posterior part and the cod-end is made of nylon.

Purse-seines and "ring-nets" are manufactured of polyamide netting and this material is used also in most pound nets for silver eels, etc. When stakes are used for the latter, the enclosure and leaders are usually made of terylene (floating leaders of nylon, however). For salmon traps in the Gulf of Bothnia

nylon is used except in the bottom which is made of terylene and the leader made of polyethylene.

Salmon drift nets are manufactured of polyester (terylene), in the Baltic proper almost 100%, in the Gulf of Bothnia to some extent of polyamide (nylon); for anchored salmon nets nylon in more frequently used. Spun or monofilament polyamide materials dominate in herring, mackerel, cod and flounder nets. Cod lines are made of nylon or terylene, lines for salmon fishing frequently of polypropylene, but also of nylon, and lines for the ling fishery are made of polyvinyl alcohol (kuralon).

For net materials the ISO standards are not in common use among Swedish manufacturers of fishing gears. The old trade designations are predominating.

United Kingdom

(England and Wales)

Fisheries Laboratory, Lowestoft (G.P. Arnold)

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. Used in conjunction with sector scanning sonar these transponding tags enable the position of the fish to be determined at the same time. Measurements of heart rate have been made in real time from a freely swimming plaice.

Research into the acoustic estimation of fish abundance continues to be concentrated upon the measurement of fish target strength. A microprocessor system has been developed to identify and extract single fish echoes from the echo signal distributions produced by single beam echo sounders. Blue Whiting data are being analysed and an attempt is being made to extend the technique to mackerel and sprat. The equipment used for acoustic survey has been considerably improved by the adoption of a variable depth towed body and a TVG receiver of high accuracy and stability controlled by a microprocessor. These modifications have allowed the equipment to be calibrated to a much higher degree of accuracy than previously possible. Acoustic surveys have been made of mackerel stocks off southwest England and of sprats off the northeast coast of England.

A comparison of the efficiency of the standard north east coast of England creel with parlour pots showed the latter to be on average 2.4 times more effective for lobsters and 1.8 more effective for crabs. With extended soak-time parlour pots could be more than 5 times more effective. The size composition of both lobster and crab catches was similar for the two types of pot. Further trials with escape gaps demonstrated their effectiveness in reducing the number of undersized crabs and lobsters in the catches.

Of the seven British Standards which relate to fishing gear, six are either identical to or in complete conformity with their ISO counterparts. Full details are appended to this report.

APPENDIX

BS 4406: 1969. 'Designation in the tex system of netting yarns for fishing nets'.

In complete conformity with ISO/R 858

BS 4440: 1974. 'Glossary of basic terms for fishing nets'.

In complete conformity with ISO 1107 and ISO 1531

BS 4650: 1970. 'Determination of mesh breaking load of netting for fish'.

In complete conformity with Draft ISO Recommendation No 1806

BS 4674: 1971. 'Methods for the determination of the breaking load and knot breaking load of netting yarns for fishing nets'.

In complete conformity with ISO/R 1805

BS 5171: 1974. 'Netting yarns: Determination of change in length after immersion in water (ISO 3090)'.

Identical with ISO 3090

BS 5172: 1975. 'Fishing nets: description and designation of knotted netting (ISO 1530)'.

Identical with ISO 1530

BS 5398: 1976. 'Mounting and joining of fishing nets'.

ISO 3660 is on the same subject and gives illustrations with definitions and explanations. The United Kingdom voted against the International Standard because many of the explanations were unacceptable; however, the majority of the illustrations were agreed and are used in this British Standard.

White Fish Authority, Hull (H.D. McDiarmid)

Project 1.1., Commercial introduction of the Marine Laboratory 4 panel demersal trawl.

This work has continued. A 2000 H.P. version has been purchased and is intended to be fished during the late spring, early summer fishing for Blue Ling, North West of Ireland, by the freezer trawler'ST. Benedict' 2650 H.P.

An Aberdeen trawler 1200 H.P., fished the 127' headline version and reported improved catches of the order of 20 - 40%, haddock and cod also less damage. The latter has always been a good feature of this gear.

The side trawler'Picton Sea Eagle'500 H.P., of Milford Haven also increased his roundfish catches by the order of 100% and took hake which had not been seen in Milford landings for some time. 86' headline version.

Project 1.2., Trials using rope sweeps on demersal pair trawl.

Two pair trawlers each 850 H.P. working soft ground in the Minches had reported difficulty with gear sinking into soft bottoms (mud). The warp adjacent to the trawl was replaced with 5" circumference 40mm diameter combination, synthetic/natural fibre rope and leaded polypropelene ropes of 4" circumference, 33mm diameter. Lengths of 200 metres and 400 metres per side were tried. The latter allowed the gear to tow without snagging but results were inconclusive owing to a lack of fish in the area.

Project 2.1., Development of a rope trawl.

A standard 300 H.P. pelagic trawl has been modified by replacing the wings and leading panels with rope sections. The rope lengths have been calculated using a formula based on equal tensions about specific points on the head and footropes and side lines respectively.

The trawl used was 240 meshes x 800mm round the mouth, twine in leading panels was 210/180. Ropes substituted were 40 off, double braided polyester 10mm diameter. Recent instrumented trials indicated mouth openings of 10.5 and 7 fathoms respectively at 3 knots.

$2m^2$ suberkrable doors and 30 fathom bridles were used. This trawl is also intended to be used as a pair trawl by two x 150 H.P. boats fishing mackerel. Commercial evaluation will continue to establish catch rates in comparison with conventional trawls.

Project 2.2., Instruction in pelagic trawling

Vessels normally working low headline demersal trawls for groundfish in the Clyde area have successfully fished pelagic gears near the bottom for hake and saithe after instruction by IDU master fishermen.

Electric Fishing

Two sets of trials were conducted in 1978, using both electrified and chain rigged beam trawls to establish the catching efficiency of the former. The White Fish Authority equipment used was that produced by Ocean Harvester Corporation of Texas for shrimp fishing. The Marine Laboratory Unit was also used but inconclusively due to the failure of electrical components early in the trials. The American unit produced catches similar to a beam fitted with six tickler chains. Further trials are planned for this summer, the main aim will be to establish optimum speeds / catch rates of different rigs so that a better analysis of results may be made.

Squid Fishery

No further trials have been carried out with the Japanese electric jigging machines. However it is planned to use the Japanese gear on small boat hand gurdies to assess its applicability to these vessels on squid whilst engaged on lining for fish.

There is also interest in a small high lift cuttlefish trawl for use on seasonal stocks of this species. This may be an opportunity to use the smallest of the Marine Laboratory's four panel trawls i.e. 50 - 100 H.P.

Scallop Fishing

A paper study has been made of two possible new designs of scallop dredges and their likely applicability. The main aim of these developments will be to reduce the quantity of rubbish, often large stones, taken with scallops.

Shellfish Pots

A multiparlor crab/lobster pot has been undergoing commercial evaluation for several months. Indications are that crab catches are improved over the single compartment pot but lobster catches are disappointing.

Longlining

The White Fish Authority "Autoclip" automatic snood attaching detaching and baiting system is currently undergoing sea trials on a commercial vessel (20m). Baiting efficiency is now 90 - 95%. Trials continue, to assess the catching efficiency in comparison with vessels using conventional gear.

Assistance has been given to a Cornish designed mechanised lining system. In particular the storage system for snoods was designed for easy use and compact stowage on small boats. Snoods are manually attached and detached. This system is now commercially available from a Falmouth Company.

Gear Performance trials

Instrumented trials have been carried out on six demersal, semi-pelagic and pelagic full scale trawls to compare results with 1/20 to 1/10 scale flume tank models.

In addition, information on the dynamic performance of pelagic trawls in relation to towing loads, speed, manoeuvering etc. has been obtained for the Hull Nautical College, fishing vessel simulator installation.

United Kingdom

(Scotland, R.E. Craig)

a. GEAR TECHNOLOGY

Fishermen generally have to use different nets when fishing a light ground rope gear (for example on sand) as opposed to the heavy bobbin rig necessary on hard ground. Model tests have been conducted in the WFA flume tank to investigate 3-bridle bottom trawls, aimed at producing a high lift net which will be equally suitable for use with light and heavy ground ropes.

Further studies of rope trawl designs have been made in the course of a joint project with RIVO, Ijmuiden and the WFA. A team from the Marine Laboratory participated in gear trials on board the Dutch research vessel "Tridens" when the engineering performance of various rope trawl designs was compared with that of a conventional pelagic trawl.

A 200 HP semi-pelagic trawl has been produced with a belly panel in half the mesh size of the top and side panels, which should reduce fish escape through the belly panel. Observation of this gear by divers and model tests have shown how such a net should be tailored to avoid distortions in the netting due to the higher drag of the smaller mesh panel.

An acoustic tracking range has again been used to investigate the dynamic behaviour of pelagic trawls while the towing vessel is turning. Improvements are being made to the tracking system to allow the depth to be measured as well as horizontal plan position.

A prototype set of rotor boards - otter-boards incorporating a vertical spinning rotor which is controlled to move the gear sideways - has been tested at sea. It was found that a board could be moved 18 m sideways by applying only 4 kw of power to the rotor.

Tests have been conducted on three types of scallop dredge - a standard dredge, one with a V-shaped tooth bar and one with a trash vent behind a straight tooth bar. The gear with the trash vent was found to give the best rejection of stones while maintaining the catch of scallops.

Theoretical studies have continued on the construction of computer models to simulate the behaviour of gear under fishing conditions, and on methods for predicting the drag of trawls.

b. INSTRUMENTATION AND SONAR

Electrical Fishing

The Marine Laboratory electrical fishing system was tested on a commercial beam trawler in a combined trial with the White Fish Authority. Results were disappointing and the apparent ineffectiveness of the electric "ticklers" was attributed to the high towing speed needed to drag the heavy beams over the bottom.

Work on the effect of electrified barriers and bubble curtains was continued. Limited data was obtained in 1978 but tended to confirm observations made in previous years that bubble curtains were effective in confining roundfish but ineffective on flatfish, whereas electric barriers were effective on flatfish but ineffective on roundfish. The behaviour of dogfish close to electric barriers was studied.

Sonar

Stock surveys were again carried out on blue whiting, herring and sprats using a Simrad EK 38 echosounder coupled to the Aberdeen echo integrator. The results were interpreted using an assumed target strength of -34dB/kg for all species. The equipment was calibrated by the standard technique using a ping-pong ball of assumed target strength -42 dB.

Further experiments on the target strength of caged fish have been carried out using cod ranging in size from 29-64cm.

Acoustic Tracking

The technique of acoustic tracking of moving underwater objects has been successfully continued for following the movements of individual fish and extended to tracking fishing gear. Sound pulses, transmitted from the fish or gear, are detected by a number of hydrophones laid on the sea bed several hundreds of metres apart and from the relative time of arrival of the pulses the position of the transmitter can be calculated.

Two new types of transmitter for insertion in fish and for attachment to fishing gear have been produced for us by the Fisheries Laboratory, Lowestoft and new receiving and processing equipment has been developed at Aberdeen. This new equipment includes a mini-computer which is used to perform the timing, calculate successive positions and output this information to a printer.

Fishing Gear Instruments

The development of instruments using miniature tape recorders has been successfully continued, and a satisfactory unit for measuring otter board angles, including the angle of attack, has been produced. A new tension cell using this tape recorder is undergoing trials. Difficulties have been experienced with the net-mounted electro-magnetic speed log and a new design is being considered. Preliminary work on the development of solid state memories for the whole range of instruments has been started.

c. FISHING PROCESSES

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 $4\frac{1}{2}$ 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 metres depth using natural daylight and a major step forward will be the development of a remote vehicle to carry the camera to all parts of the gear in commercial fishing grounds. 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.

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 or 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.

U.S.A.

(A. J. Kemmerer and J.B. Suomala)

Fishing technology activities in the United States during 1978 emphasized conservation engineering and development of new or improved sampling systems. Highlights follow:

Sea Turtle Conservation Shrimp Trawl - The incidental capture of sea turtles in shrimp trawls has become a problem of major concern in the United States. In response to this concern, a three-year research project was initiated in 1977 to evaluate incorporation of large mesh panels across the mouth of shrimp trawls to prevent the capture of turtles. Design goals are to reduce the incidental capture of turtles to near zero while maintaining an acceptable efficiency for shrimp. Initial results were good from cooperating commercial shrimp vessels in the Gulf of Mexico and Atlantic. The excluder panels significantly reduced turtle capture, although some reduction in shrimp catch also was experienced. Shrimp loss, however, was sufficiently small to warrant continued development and evaluation.

Shellfish Sampling System - An improved shellfish sampling system has been developed for use from research vessels. The system incorporates a large steel dredge with a 152-cm blade. Water, under pressure, is supplied to a manifold forward of the blade to dig and soften the bottom in front of the blade. Power is supplied to a submersible pump on the dredge through an electrical cable from the vessel. This cable, independent of the towing cable, is stored on a slave winch that responds to the external stimulus of the towing cable.

Beam Trawls - Beam trawls are being evaluated both in the Atlantic and Gulf of Mexico for sampling and commercial application. These trawls appear to have significant potential for reducing the incidental capture of certain unwanted species while at the same time increasing capture rates for selected target species.

Juvenile Sea Turtle Tracking - Small radio tags have been developed for tracking headstarted sea turtles as part of a research program to evaluate the value of headstarting as a means to increase dwindling populations of endangered sea turtles. The tags are mounted in a hydrodynamically stable float attached by a short lanyard to the carapace of the turtle. Overall weight of the tags is 25.3 grams.

Porpoise Tags - Several new concepts in tag design and marking techniques are being evaluated as part of a program to assess and monitor porpoise stocks in the Pacific. Prototype plastic disc tags were developed for attachment to dorsal fins of porpoises and a portable liquid nitrogen freeze branding system was constructed. Flow tank and live animal testing of the tags produced good results, but field application trials yielded mixed results. Tests of the brand also produced mixed results, especially in the length of time a brand mark remained visible on test animals. This work is continuing.

Porpoise Containment System - The facility for handling porpoises at sea reported on last year is now being used operationally from chartered tuna seiners in the Pacific. The system is designed for handling up to 500 porpoises in such a way that they can be handled individually for collection of biological data.

Tuna Purse Seines - Work is continuing on modifications to purse seines used in the eastern tropical Pacific tuna fishery to reduce the mortality of porpoise caught incidental to tuna. Most of this work involves changes in the seines to prevent porpoise suffocation.

Satellite Tracking of Marine Animals - A 1000-gm satellite transmitter has been developed and tested on captive porpoises. The transmitter successfully linked to Nimbus-6 for location positioning accurate to about 5 kilometers. Tests scheduled this spring include wild animal tracking near Hawaii. Additionally, a larger transmitter is being developed for tests on sea turtles this summer.

Shrimp Assessment - A shrimp detector and counter system is being developed as a potential means to assess shrimp stocks. An electrical pulse generator is used to stimulate a characteristic jump response of shrimp from the bottom and the character of the resulting Doppler signal is used to discriminate between shrimp and other animals by a detector/counter.

U.S.S.R.

(A. Bogdanov)

The following research work was carried out in 1978:

Programmes for computer analysis of fishing data by swept volume method for all areas and kinds of fisheries were worked out.

To study fish resources in the coastal zone of Murman by the vessel of SRT-300 type experimental fishing with bottom-net, long-lines and bottom gill-nets was carried out all the year round.

Selectivity of bottom trawls was studied in relation to cod, haddock and redfish in the Barents Sea and to Baltic herring and flounder in the Baltic Sea.

Experiments with bottom trap-nets of the ring type were carried out in the coastal zone of Murman in December.

Fish behaviour in the area of bottom trawl operations was studied and catchability coefficients for cod, halibut and Baltic herring were calculated.

Investigations of reaction of fishes to physical fields of various origin and modality were continued.

All fishing gears used in 1978 were manufactured of polyamide kapron fibre.