International Council for the Exploration of the Sea

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Administrative Report

Gear and Behaviour Committee

by P. J. G. Carrothers

1974

Belgium

(G. Vanden Broucke)

The investigations on the double beam trawls were continued. These investigations have shown that an optimum net opening must be realized in order to increase the catch capacity: this may be obtained by an adaptation of the taper ratio. Further experiments were carried out to this effect. A series of preliminary comparative fishing experiments were also carried out and the warp tension was measured.

As regards the semi-pelagic nets for pair-trawling an extensive study on the net, the rigging, hauling and shooting and the fishing grounds was carried out on board 20 middle water trawlers. This method may be considered as successful.

The study of a one boat semi-pelagic net was also continued. Mainly the rigging and the height of the net were investigated by means of echograms recorded by echosounders. It was observed that it is of great importance to determine the correct flotation, ballasting and the different leg systems.

A study of a pelagic net for pair trawling was started to investigate the behaviour of the net in relation to flotation, weights, speed of the vessels and warp length.

With respect to the electrical fishery the study on the practical possibilities of this fishery at national and international level was further extended. A first series of comparative experiments with a traditional and an electrified bottom trawl was undertaken. The method of alternative hauls was applied.

The research concerned the adjustment of the pulse generator (frequencies, peak voltages), the variations between the electrodes and the different environmental factors. A compact pulse generator will be designed. The experiments will be carried out on roundfish and Norwegian lobster.

As regards the fishery with artificial light a preliminary programme is being drawn up.

Via log-sheets of fishermen an analysis was made of sole and plaice catches by day and by night on the same fishing ground.

A preliminary series of acoustical measurements on fishing gear was carried out.

The effect of the vessel on the selectivity was studied for two vessels of different size but fishing with the same type of net.

Comparative fishing experiments will be undertaken with two vessels, one fishing with a bottom trawl and the other fishing with a beam trawl.

A theoretical study on the polyvalency of side trawlers was carried out.

The wear of netting will be determined as a function of its location in the net, the fishing method and the fishing ground.

Research was also carried out on wear, on degradation of yarns by marine bacteria and on identification of synthetic fibres.

A theorectical study on an automatic feeding system for the shrimp rinsing and sorting machine on board commercial vessels was started.

Future Work

Plans for future work include:

Experiments with double beam trawls on middle water beam-trawl vessels.

Study of the behaviour of semi-pelagic and pelagic nets (length of bridles, taper ratio, etc.).

Development of a compact pulse generator for the electrical fishery.

Further research on the design of multi-purpose vessels.

Further acoustical measurements on fishing gear.

Continuation of testing of netting yarns and netting (breaking load, mesh sizes, etc.).

Canada

(P. J. G. Carrothers)

Fishing gear engineering research has concentrated on the demersal otter trawl study, with little progress in the netting hydrodynamics project. After failure of a trawl data processing contract, good progress is now being made in-house and a major report on trawl behaviour and data analysis techniques is planned for 1975.

The computerized, echo-counting system (not integrator) has been applied to groundfish stock assessment problems, calibrating against trawl catches. Count/catch correlation was good by day but not significant from dusk to dawn. Development of techniques for direct calibration of the system has taken priority over studies of fish reaction to trawling, pending further development of the towed, servo-altitude-control, instrument vehicle.

Three different methods for estimating variance in acoustic information on fish densities were studied. Cluster sampling appears to be the best model currently available, autocorrelated regression techniques are being explored further, but the method based on successive differences has been dropped.

Acoustic survey design experiments have been initiated and will be continued in 1975 to establish optimal survey patterns, and system appraisal will continue.

The groundfish counter system is being modified to store digitized voltages of incoming echos for refined estimates of fish size and density. Also, an integration routine is being developed for abundance estimates of small, densely-schooled, pelagic fish, particularly capelin and herring.

As a feasibility study, the distribution of euphasiids in three areas were mapped and vertical movement over a 24-hour period was recorded, using a 120-200 kH_z transducer in a towed vehicle. Accurate abundance estimates will be difficult but apparently not impossible. The system will be computerized for future work.

The distribution of phytoplankton continues to be studied by means of a Variosens fluorometer on a "batfish" manoeuverable towed vehicle, with magnetic tape recording of data.

An 18-m. long-liner has been converted to stern seining. The double-ended drum seine, with bunt centre and no purse line, is handled on two net reels by four men to compete successfully with pair ring nets requiring two boats and eight men. Operation has been at the surface for herring and mackerel, but modifications are planned for operation in mid-water and on the sea bed.

A 50-m. stern ramp trawler has been converted to the "triple-parallel" gear handling system. The main deck is divided into three lanes, each with a net reel at its forward end. Normally, the trawl is shot and hauled over the ramp in the centre lane. However, a mid-water or a demersal trawl can readily be shot in very little time from either of the side lanes without clearing the centre lane if the net in use becomes torn or if the type of trawling should be changed. Both pelagic and demersal doors are immediately accessible from their positions inboard at the rail in the two outer lanes. The gallows are hydraulic gantries which can lower the blocks into the ramp for towing in ice. A stern seine suitable for this vessel is to be designed.

Automatic long-lining is being used successfully on three 20-m vessels and on one 14-m. vessel. However, success depends on extensive training of the crew in operating and maintaining the equipment and on the proper condition of the bait. Frozen bait of the right size is held in the hold and transferred to two coolers which are used alternately to supply the baiting machine.

A powered rotor on the headline of a "diamond"-type, high-lift, bottom trawl was able to lift the trawl as much as 55 m. off bottom in a very short time and to maintain a stable altitude, demonstrating its value for "aimed" trawling. All problems were technical and the principle has been proven, but no further development is planned for 1975.

A prototype hydraulic dredge, initially for sampling benthos in relatively deep water, shows promise for eventual commercial application.

The government of the Province of Quebec is becoming increasingly active in matters of interest to the Committee. Acoustic methods are being used to study capelin behaviour, selective and experimental shrimp trawls are being designed and built, new high-lift bottom trawls are being tried, comparative fishing studies on bottom trawls are being conducted in conjunction with a French vessel, and a trawl dynamometer is under development.

Denmark

(O. Bagge)

Mesh selection experiments on cod with Nymplex 50 - 3/20 have been carried out in the Baltic and the Sound.

Catch of cod and flatfish in bottom trawl has been investigated in relation to salinity and oxygen content near the bottom in the Sound.

In the Kattegat the catchability of Norway lobster has been related to oxygen content and temperature near the bottom in the eastern Kattegat.

The investigations will be continued in 1975.

Finland

(Veikko Sjöblom)

No gear and behaviour work carried out.

France

(Marcel Portier)

Chaluts, chalutage

Les essais sur le fond de chaluts à 4 faces de grande dimension, dérivés des chaluts pélagiques et munis de bourrelets ont été poursuivis. Les filets qui possèdent généralement des mailles de 400 mm (maille étirée) à l'entrée ont été utilisés: soit avec un gréement semblable à celui du pélagique, comprenant des panneaux travaillant entre deux eaux et le contrôle permanent du netsonde, soit avec un gréement à fourches et des panneaux de fond.

On a tenté de déterminer l'influence de la posée du bourrelet, généralement constitué de fil d'acier garni de caoutchouc, sur les captures. Les observations sont encore insuffisantes mais on sait que des poissons ronds sont susceptibles, généralement la nuit ou à certaines saisons, d'effectuer des migrations verticales. Dans ces conditions, une grande adhérence du bourrelet au fond n'est pas nécessaire.

Par contre, il a été possible de capturer, au cours d'une campagne effectuée en Mer de Barents, des espèces (morue, églefin) fortement collées sur le fond avec le gréement comportant des panneaux entre deux eaux. Dans ce cas, la posée du bourrelet, contrôlée par le netsonde était importante. Des essais ont également été faits en plaçant des lests à 50 m en avant du chalut pour obtenir un effet de rabattement des bras.

Ces travaux sur le chalutage contrôlé seront poursuivis en 1975 et on y ajoutera les essais de chaluts dont les maquettes ont été étudiées en bassin.

Il s'agira d'un chalut à 4 faces de petite dimension spécialement adapté à la prospection sur les fonds durs ou accidentés que l'on emploiera avec des panneaux dégagés du fond et d'un chalut de fond également à 4 faces dérivé de l'Atlantic Western Trawl et que l'on utilisera avec des panneaux de fond.

Les parties antérieures de ces chaluts seront réalisées en mailles de 200 et 400 mm étirées.

Les chaluts pélagiques à un ou deux bateaux possèdent généralement des mailles de 800 mm étirées et des essais ont été effectués avec des mailles de 1 200 mm. Le changement des maillages dans les parties adjacentes des chaluts est généralement progressif et l'on trouve après le 200 mm des mailles de 160, 120, 80 et 50 mm. Toutefois, l'efficacité de nombreux chaluts de fond employés par la pêche artisanale et qui étaient en mailles de 120 mm a été augmentée par l'adjonction d'une entêture en 200 mm.

Le textile le plus utilisé pour la construction des chaluts est le polyamide, mais occasionnellement le polyéthylène est employé pour réaliser certaines pièces du dessous du filet. Les poches sont toujours faites en polyamide.

Chaluts sélectifs, sélectivité

Une expérience a été faite pour déterminer le coefficient de sélectivité des poches de chaluts à langoustines et une étude entreprise par les laboratoires de Lorient et de Boulogne - pour mettre au point un chalut sélectif à langoustine. Deux maquettes de chalut plat type américain ont été réalisées et les essais devraient en être effectués cette année.

Pour tenter d'estimer l'influence de la force motrice sur la sélectivité des culs de chalut, on a comparé au moyen de la méthode de la double poche la sélection du merlu par deux chaluts de fond de taille différente remorqués respectivement par un navire de 300 CV dont la vitesse de traîne était en moyenne 3,5 noeuds et un navire utilisant 720 CV et chalutant à 3,7 noeuds.

Dans les conditions de l'expérience les facteurs de sélection n'ont pas différé de façon significative pour les deux puissances et se sont situés entre 3,6 et 3,9.

Dragues

En 1974 une étude a été entreprise pour étudier le comportement des dragues à coquilles Saint-Jacques (Pecten maximus) et en particulier la sélectivité des dragues avec ou sans volet . Il a été remarqué que les dragues à volet remorquées à vitesse élevée (3 à 4 noeuds) permettaient une pénétration maximum des dents et ne laissaient pratiquement aucune chance aux jeunes coquilles de s'échapper. On a pu observer également qu'une certaine sélectivité se produisait au niveau de la partie supérieure du sac.

Une étude à long terme de l'effet de ces dragues sur le benthos figure au programme d'un laboratoire de Nantes, spécialisé dans la coquille Saint-Jacques.

Etudes sur maquettes

Les travaux sur maquettes se sont poursuivis dans le bassin de Boulogne où on a , en particulier, tenté de déterminer la répartition des forces agissant sur différents types de panneaux divergents.

L'ouverture du bassin d'essais de chalut de Lorient, initialement prévue pour l'automne 1974, a dû être retardée. Elle devrait avoir lieu vers la fin de 1975.

Senne à thon

L'étude de la senne à thon entreprise à Lorient en 1973 n'a pas pu être poursuivie, le matériel de mesure ayant fait défaut.

Bateaux de pêche, aménagements

Il faut noter dans le Nord de la France le développement d'une série de chalutiers en fer destinés à la pêche artisanale et conçus pour pêcher par l'arrière. La majorité de ces navires a une longueur de 20 m et leur puissance varie de 500 à 700 CV ; ils sont souvent munis d'une tuyère fixe destinée à augmenter leur force de traction et possèdent des tambours enrouleurs de chalut.

Sur la côte Atlantique, la construction reste, à quelques exceptions près, plus traditionnelle - bateaux en bois pêchant par le côté - mais on observe également le développement des tuyères.

En 1974, a véritablement débuté l'installation des tambours enrouleurs sur certains navires rampe arrière de gros tonnage. Ce sont généralement des engins puissants et de grande dimension qui sont utilisés pour virer les chaluts pélagiques et les chaluts de fond, et servent également à hisser la pêche sur le pont.

Pêche électrique

L'étude en laboratoire du comportement des poissons marins soumis à un champ électrique qui a fait l'objet d'un contrat avec le CNEXO, devait permettre de définir le stimulus le plus efficace pour la pêche électrique en mer. A la suite des expériences effectuées, il est apparu deux points qu'il fallait élucider :

- la directionnalité des taxies aux basses fréquences (20 Hz environ) qui s'avèrent par ailleurs intéressantes quant à l'écart entre les seuils de taxie et de tétanie.

- la différence apparente de comportement des poissons suivant qu'ils ont ou non déjà subi les effets du courant électrique.

En 1975, ces deux points vont être étudiés dans des bacs de plus grandes dimensions que ceux dont nous disposions pour les premières expériences.

Acoustique

Pour 1975, un programme de cartographie acoustique des bancs de poissons pélagiques côtiers (sardines, anchois, sprats) a été élaboré.

Ce programme comporte 7 campagnes dans le Golfe de Gascogne, au cours desquelles des chalutages pélagiques sont prévus pour l'identification des espèces détectées. A la suite de chaque campagne, seront établies des cartes indiquant les zones de concentration des bancs et leur importance principalement par rapport à la situation thermique.

Federal Repulic of Germany

(H. Bohl)

Fishing Gear and Apparatus

In 1974, research on high-opening bottom trawls was continued. The work was mainly concentrated on the relationship between the length of the wings, the types of otter boards and dynamic head-line lifting devices on the one hand and the vertical net opening on the other.

As to midwater trawls, the influence of different weights, lengths of legs and types of otter boards, kites and floats on the shape of the net mouth was observed by means of a multi-netsonde. The so-called "Tauwerk-Netz", whose fore part consists of parallel ropes, proved very successful in catching spawning saithe off the Shetland Islands. The complicated handling of the gear requires further trials.

Concerning deep water trawling for commercial application, in 1974 two cruises were conducted to the continental slope west of the British Isles. Hauls were systematically carried out in depths from 400 - 1200 m and occasionally down to 1800 m. The gears used were modern high-opening bottom trawls specially designed for deep sea trawling (solid plastic bobbins, inflatable floats etc). On rough grounds (corals) a standard (140-foot) trawl was used which was less exposed to damage but also less efficient. On the same grounds the catches of grenadiers, scabbards, smoothheads, rabbit-fish and sharks were much better in spring than in winter.

Due to the facts that full-scale experiments with trawls are very expensive and that small models often do not yield results transferable to trawls of commercial size, models of the scale 1:4 were tested as already done several years ago. The experiments were conducted in the shallow and rather clear coastal waters of the western Baltic and a number of recently developed trawls were investigated under controlled conditions. The gears were observed by means of a multi-netsonde and by skin-divers equipped with underwater cameras.

The increasing size of midwater trawls demands very large otter-boards. Thus, on German distant-water trawlers Süberkrüb boards up to 12 m^2 are in use. In 1974, full-scale trials with different types of otter board were started in order to compare their performance and efficiency. For 1975 additional wind tunnel tests are planned to determine the lift and drag coefficients of the boards.

The distances between the otter boards during towing and of the tensions in the warps and legs were measured and the data processed by ship-borne computer.

As in previous years, and in compliance with C.Res.1972/5:7, the relationship between fish distribution and water temperature was studied by means of a combined thermo-netsonde in the Spitzbergen/Barents Sea area and in the Gulf of St. Lawrence.

Little progress was made in the field of electrical fishing. The work was restricted to preliminary trials with an electrified beam trawl which is intended to replace the heavy gears now in use for catching flatfish.

Net Materials

Polyamide is still the most important material for the manufacture of trawls in the FRG: 100% of the midwater trawls and about 90% of the bottom trawls are made of this material. The remaining 10% of the bottom trawls are made of plaited polyethylene yarns.

Although the prices for net materials are rising rapidly, the extra strong cod-end netting yarns (R 14-18 ktex) are now used more frequently than ever before in bottom trawling.

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

A new method for measuring the flexural stiffness of fairly thick netting yarns has been developed, and the influence of a repeated wetting on the mesh opening was studied.

Selectivity Experiments

The long-term research program on the influence of the load/elongation properties of polyamide netting yarns on the selectivity of bottom trawl cod-ends was brought to completion in April/May 1974 in the Gulf of St. Lawrence. As in 1973, cod selection factors could be established for two double-braided cod-ends which were made of a) the original Soviet CAPRON (50,1% elongation) and b) the PA standard netting yarn (23,8% elongation). The selection factors obtained were 3,16 for CAPRON and 3,25 for PA standard in ICNAF Div. 4T, and 3,38 for CAPRON and 3,23 for PA standard in ICNAF Div. 4R. These results and those of the previous experiments show clearly that there is no scientific basis for a mesh differential within the group of PA netting yarns.

Experiments carried out in September 1974 with FRV "Solea" in the central Baltic yielded cod selection factors of 2,82 and 2,96 for single-braided, bottom-trawl, PA cod-ends of 92 mm and 103 mm mesh opening. These factors are much lower than those found aboard Polish and German research vessels during the period 1972/73 (3,00 - 3,43). Further effort is needed to establish reliable selection data for the mesh regulations in the Baltic.

The research program for 1975 and the following years includes studies of the selectivity of midwater trawls.

Fish Behaviour, Noise Measurements

Concerning the reactions of fish during trawling, observations by various echo sounding equipment were continued to prepare a comprehensive catalogue of the behaviour patterns of the commercially important species.

Since the behaviour of fish is often influenced by acoustic stimuli, noise measurements were conducted while towing a recently designed 250-foot trawl. The intensity of the noise was shown to depend on the contact of the bobbins with the sea-bed. Since bottom type and weather conditions affect the noise considerably, the influence of these factors will be studied in more detail in the future.

Iceland

(G. Thorsteinsson)

In 1974 selective prawn trawl experiments were resumed and two types of experimental trawl were tested. In the first type there was no overhang and the whole trawl opening was closed by a separator of 60 mm mesh. Three midlines were used along the separator panel but there were no trash chutes. In the second type, a separator panel of 60 mm mesh was mounted into the front part of the belly of a conventional trawl thus closing it completely. In order to get rid of the trash a few holes were made in the lower panel just in front of the separator. Here the separator was oblique (15-23°) and cut on the bar on all sides. Both selective trawl types happened to catch similar quantities of prawns as did conventional trawls, but the comparative hauls were too few for reliable conclusions. The number of undersized fish of commercial value taken differed somewhat, depending on fishing ground, species and probably several other factors. Roughly speaking, as compared to conventional gear, the first trawl excluded 75-95% of the important species available (cod, haddock, herring) whereas the second type did not do quite so well. In this case the limited number of hauls must also be taken into account. Commercial fishermen have already tested the belly-selective type of trawl. They found the experimental gear worked satisfactorily on hard bottom, whereas on soft ground the trash did not pass through the belly holes but was collected by the separator. This is to some extent caused by the otter boards, which were smaller than those used by the research vessel, not stretching the separator panel enough horizontally.

Experimental midwater trawling for redfish and blue whiting was unsuccessful because dense enough schools could not be found. On the other hand, commercial trawlers got good catches of cod off the NW coast during August and September. Thus this fishing method, so successfully carried out in the fifties, has now been rediscovered.

In the 1975 program the selective prawn trawl experiments will be given preference to other investigations. Selection experiments on demersal species (cod, redfish) in midwater trawls will be carried out if pelagic occurrence of these species permits.

Ireland

(F. A. Gibson)

No report received.

Netherlands

(J. G. de Wit)

The newly developed high-opening bottom trawl has been introduced in the trawler fleet. Many beam trawlers had to be adjusted to this fishing method. This conversion transferred them to multi-purpose trawlers. A major problem was presented by the different warp requirements for beam trawling and for demersal or pelagic trawling. In the first case they are thicker and shorter. A method has been developed to use thinner warps for beam trawling.

Experiments on the use of polyvalent otterboards (Morgère-type) for pelagic trawling have been started and proved to be promising. Preliminary data showed an otterboard spread of 60 m at a warp length of 230 m and of 70 m at a warp length of 320 m. The Morgère-type otterboards were found to be about 8 m above the headrope.

Performances of trawlers and beam trawlers during fishing operations have been measured. Special attention was paid to the performance of the main engine and trawl winch equipment on board a 54 m (2000 hp) trawler and a 37.7 m (1115 hp) beam trawler. The results of these measurements are expected to become of value for modern trawler designs.

Electrical fishing has further been investigated in an experiment on board a commercial shrimp trawler in the Scheldt estuaries. One rig was electrified and the other one was of the normal shrimp beam trawl type. Teething troubles in the pulse-generators and electrodes systems when used under commercial conditions can be corrected. It is expected that catches of an electrified beam

trawl will further increase by decreasing the towing speed. A lower speed will result in reduced damage to the undersized by-catch. However, during the above-mentioned experiments, the speed could not be reduced below 1.28 m/sec (4.6 kn), because of the stability of the fishing gear. An adaptation of the gear to towing speeds less than 1 m/sec (3.6 kn) proved to be necessary.

Although the selectivity effects of an electrified beam trawl require further investigations, the experiments tentatively show that the electrified shrimp beam trawl catches fewer undersized soles as a by-catch. Sole larger than 24 cm and plaice larger than 27 cm seem to increase in the by-catch.

Continuation of electrical shrimp fishing experiments is planned for other areas with other types of bottom, together with the electrical stimulation of flat fish to increase the selectivity.

In the present situation there is an increasing interest among Netherlands fishermen in more selective fishing gears and slower towing speeds. The expectation that the electrified beam trawl can satisfy these requirements is growing.

A mechanical feeder for the rotating shrimp grader has been developed and was tested on board a commercial shrimp trawler for two months. The system proved to be successful by improving the efficiency of the grader and by preventing the unwanted by-catch from further deterioration after the catch is on board. This mechanical feeder is coming into commercial use.

Work has started adapting the rotating shrimp grader for brown shrimps to Pandalus for the fishery in the Farne Deeps.

The experiments to collect mussels from the sea bed by suction has been continued. Several suction heads were compared. The influence of this method on the benthos, in comparison to dredging, is being studied.

Experiments on cleaning internal sand and silt from mussels, while stored in a vessel in layers of 0.75 to 1.0 m and subjected to a vertical flow of water through this layer, have been continued with promising results.

Norway

(S. Olsen)

The previously developed Autoline system for mechanized long lining on larger vessels was thoroughly tested with a new baiting machine which appeared to be a significant improvement, facilitating satisfactory baiting at all practical shooting speeds.

Similar tests were conducted with a small scale line hauling/splitting/storing system, which performed reasonably well as such, but not well enough in combination with one of the existing baiting machines.

Extensive tank experiments to test the cod's preference of various chemical stimuli were carried out and a progress report submitted to the last Council Meeting. This work is part of a project to develop "artifical" bait.

Deep sea traps similar to those developed for black cod fishing on the Pacific coast of USA were tried in coastal waters. These proved to catch most of the usual bottom species (cod, haddock, saithe, tusk, ling, redfish etc.), but as yet not in commercial quantities.

Experiments to establish the relative efficiency of gill nets made of different materials were carried out in Lofoten, as reported to the last Council Meeting. Further tests with sorting net on the commonly used prawn trawls confirmed the previous findings that this does not work quite well with the Norwegian "Sputnik"-trawl, which is widely used in our prawn fisheries.

Reactions of blue whiting to an approaching trawl have been observed and experiments carried out with a high intensity light source. These studies confirm previous observations that the blue whiting are greatly affected by acoustic and optic stimuli and usually react by diving to greater depths.

A study was started for extending the use of modern acoustic fish assessment equipment to accurate detection and mapping of bottom types. The results are promising, confirming a close relationship between reflection coefficient and types of sea bed, e.g. mud, sand, gravel, rocks etc.

Initial trials were successfully carried out in Lofoten with acoustic tags for plotting individual movements of free swimming cod.

An electronic system for pin point plotting of fish movement within a closed off bay was tested with good results and utilized for free field behaviour studies on saithe exposed to various sources of man-made stimuli.

The long line mechanization program is in 1975 being extended and continued with the aim of developing systems for use also on the coastal fleet of smaller vessels.

Similarly, a programme for increased mechanization in the gill net fisheries is being started in 1975.

Trials with deep sea traps will in 1975 be continued and extended to various parts of the Norwegian coast.

Plans for 1975 include further work on selectivety of prawn trawls, as well as selection experiments with pelagic trawls, and for blue whiting fishing a pelagic trawl with ropes replacing the meshes in the front part of the trawl will be tried out.

Further use of acoustic tags is being planned in 1975 for distribution and behaviour studies, and a programme for acoustic mapping of prawn grounds in the Barents Sea is contemplated.

Poland

(W. Cieglewicz)

No report received.

Portugal

(B. Gil)

No gear and behaviour work carried out.

Spain

(R. Robles)

No gear and behaviour work carried out.

Sweden

(G. Otterlind)

No special activity reported and no major changes in gear construction and netting material noted.

United Kingdom

1. England

(A. R. Margetts)

The measurement of the efficiency of a trawl, using the sector-scanning sonar and acoustically tagged plaice, was completed for a particular rig of Granton trawl at a level of accuracy of ± 10% for the fish positioned in the zones 'between otter boards' and 'in the path of the net'; results are in press. Studies of behavioural aspects of trawling, using the same methods, were continued.

Further observations were made on the depth of disturbance of the sea bed by an otter trawl with tickler chains. The effects of multiple tickler chains on the working parameters of an otter trawl were measured.

Again in cooperation with Scotland, observations were made, using the sector-scanning sonar, of the configuration and mode of action of a fly-dragged Danish seine; the ropes were marked with acoustic tags and a running check was kept of the positions of these, the net and the seiner. The seine was also shot round acoustically tagged plaice and their reactions to the ropes observed.

The very deep trawling meter to measure closeness of the trawl to the sea bed was used satisfactorily on the deep trawling cruises.

Studies on adaptation of cod to pressure changes were continued.

Collection and analysis of commercial trawl haul by haul data was continued to determine the effects of environmental factors on catch rates of cod and plaice.

The experimental flume tank at the Fisheries Laboratory, Lowestoft, was refurbished during the year. Drag forces of an acoustic tag on a fish were measured.

A prototype telemetry device for measuring fish heart beat rate in the open sea was made and tested. The digital system employed for this was shown to be feasible. Micro-miniaturization presented many difficulties but a technique was developed which should allow the production of a multichannel instrument.

A survey was made of the morphology of red and white muscle in various marine fishes. Further samples were analysed in an examination of the possibility of classifying separate stocks of North Sea herring by counting numbers of white muscle fibres.

A new solid state sector scanning sonar has been produced at the Fisheries Laboratory, Lowestoft, and brought into service recently. Its performance is slightly improved over that of the original A R L system and it occupies about one-tenth of the volume of the earlier model.

Adaptation of a 'flying spot' recorder which selects signals from the sector scanner led to the provision of a very high resolution side scan sonar which has recently been of use in mapping the extent and shape of fish shoals.

2. Scotland

(J. J. Foster)

No report received.

U.S.A.

(E. G. Woods)

DIRECT SAMPLING SURVEY GEAR

The modified candidate groundfish survey, high-opening, Yankee Trawl (No. 41) was designed and tested in 1974. The trawl was employed for "interim use" during the Spring Groundfish Survey in ICNAF sub-areas 4, 5, and 6. Additional field trials were made to calibrate No. 41 Trawl against the old standard No. 36. Formulation of catch coefficients by species remains to be completed.

Development of the electric shrimp trawl system as a defined efficiency survey sampling system was accomplished. A mathematical model was established and verified in the laboratory and during field studies. This model, together with the electric shrimp trawl system, can be utilized to accurately estimate shrimp resource abundance during resource assessment cruises either by day or night. Much more accurate population estimates, than those which have been obtained in the past using standard gear, are now possible using this technique.

The work on development of instrumentation for monitoring otter trawl performance has continued with modifications to circuitry and transducer design. The system is intended primarily for use with trawls used in resource assessment surveys, rather than in engineering studies of trawl performance. The system acoustically measures wing spread, headrope height from bottom and footrope height from bottom and records the data on tape in the headrope unit. Results are subsequently plotted by computer.

DIRECT OBSERVATION AND PHOTOGRAPHY

Three field trials were accomplished to further evaluate the Remote Underwater Fisheries Assessment System (RUFAS)-II. The basic design of the system was found to be sound. Upgrading of the electronics packaging will be necessary before the system can be considered fully operational.

The operational Remote Underwater Fisheries Assessment System (RUFAS)-I was modified to include an "anchor/drift mode", expanded field of view television cameras; and temperature, salinity, turbidity measurement capabilities.

Off southern California, photographic techniques were used for analyzing pelagic fish (anchovy) school densities and three dimensional spacing.

A positively buoyant 35 mm camera with a strope light was dropped into anchovy fish schools. The camera sank at an established rate taking pictures through the school. The system automatically returned to the surface for recovery and subsequently the data were analyzed and recorded in a computer compatible format.

HYDROACOUSTICS

Cooperative investigations into the nature of acoustic backscattering from fishes and other objects in sea water were conducted along lines agreed to during ICNAF meetings in January and June 1974. Cooperative cruises were conducted aboard the USSR R/V Khronometer in March-April 1974, and the Polish R/V Wieczno in October 1974.

Significant progress was made on the development of the hydroacoustic data acquisition and processing system. It is designed to provide estimates of integrated signal intensity, fish target strength/size distributions and fish density in up to 60 depth intervals simultaneously. The towed vehicle and shipboard control system were extensively tested together with a PDP-8 Computer during a Pacific hake survey in 1974.

Sonar mapping techniques for measuring pelagic fish aggregations have been under development off the southern California coast. The investigation focused on the interpretation of "what is seen" concurrent with the development of automatic data collection techniques.

REMOTE SENSING

Data collected from the Earth Resource Technology Satellite (ERTS) 1972 Investigation has been analyzed. Results show that predictions can be made with remotely sensed (water-quality indicators) on the location of menhaden fish schools in the north central Gulf of Mexico. In 1974, plans were made to refine the ERTS-1 model and expand investigations to other species and locations.

The Low Light Level Intensifier System underwent a historical review and a report was prepared. The report describes the success of field operations for the previous five years.

Data collected from the 1973 Skylab Gamefish Tournament was analyzed with favorable results. Experimental results indicated that there is a prediction capability, using remote sensing data for the distribution of white marlin.

COMMERCIAL FISHING GEAR DEVELOPMENT

Development of a shrimp separator trawl for the Gulf of Mexico was initiated. A "state of the art" survey of separator trawls was accomplished. A proposed system design was completed with a preliminarily evaluation. The separation problem in the Gulf of Mexico is quite different than that found in other areas of the world and new techniques must be developed. Generally, 90% of a normal shrimp trawl catch is discards and a broad range of shrimp size and fish size is found. Quite often 35-40% of a catch is composed of fish which are as small or smaller than the shrimp. Two preliminary field trials were conducted to establish baseline criteria on the separation techniques proposed for the Gulf of Mexico shrimp separator trawl. Results indicate that a vertical separator panel utilizing a "V" shape tapering back to the cod end of the net has good potential as the basic separator design for the Gulf of Mexico system. A laboratory study has presently been initiated to optimize the separation of shrimp through webbing panels.

A shrimp trawl mesh-selection project was concluded under the State-Federal Management Program. Under this project a trawl-mesh regulation for taking Pandalus borealis shrimp from Gulf of Maine waters was established. The current mesh regulation provides a minimum mesh size of 1-3/4" stretched mesh measured between knots in the trawl body and 1-1/2" in the cod end as an interim measure. A revised regulation for a minimum of 1-3/4" body and 1-3/4" cod end was proposed for promulgation as of June 1975.

Field experiments on means to avoid destructive fishing of lost lobster pots ("ghost pots") were concluded in 1974. This work included observation of trap-related lobster behavior, development of calibrated escape panels, and testing of degradable materials and panels designed to release all entrapped lobsters, crabs, and other animals upon elapse of desired time periods. Analysis and manuscript work are in progress.

A controlled experiment was conducted on the commercial fishing grounds near Kodiak, Alaska, to determine the ability of king crab to escape from pots. Results demonstrated that they were capable of exiting with little difficulty and consequently lost or derelict pots as presently constructed, should present no conservation problem by continuing to fish. In contrast, another experiment in Puget Sound with Dungeness crab pots equipped with tunnel triggers demonstrated that Dungeness crab were retained in the commercial pots by the trigger devices. These are not used in king crab pot tunnels.

The selective pollock trawl development is aimed at providing gear and techniques to resolve the problem of incidental catches of halibut and Tanner crab in the trawl fishery for Alaska pollock in the Bering Sea. Present estimates suggest that 3 to 4 million halibut (mostly juveniles) and 120 million Tanner crabs are destroyed annually in that fishery. Development efforts have been aimed at gear capable of operation "near bottom" and trawls capable of separating crabs and halibut from the target species in the event that off-bottom fishing is impractical.

U.S.S.R.

(A. I. Treschev)

In the field of fishing technique tests were continued on large-meshed pelagic trawls and some of their component parts, such as, depressors, hydrodynamic door lifters, wing-shaped doors, and bobbins designed for depths greater than 1000 m. Information on the hydrodynamic resistance of conical nets with large meshes (up to 600 mm mesh-side length) was obtained for the first time on full-scale models at sea for more reliable data on the dependence of netting resistance on mesh size, hanging coefficients, yarn thickness, taper ratio, and trawling speeds between 1,5 and 3,0 m/sec. These data can be used when designing trawls.

In 1974 fish behaviour was studied during cruises of R/V "Gemma", "Alaid", "Protsion", "Peseus III", and others. Mackerel, Atlantic saury, herring, cod and some other species were studied, and observations were made with the help of photocamera "Triton", hydrostate "Sever-I", and hydroacoustic devices.

New data were obtained on fish behaviour in natural conditions and in front of the trawl. The probability of different fishes becoming trapped in the trawl was assessed quantitatively. The principles were formulated for a procedure for determining the abundance of demersal and pelagic fishes with the help of instruments.

Methods were developed for assessing fishing power of systems, fishing effort, and fishing productivity.

The selectivity of trawls with capron cod-ends of the following mesh openings were investigated in the Baltic Sea by 300 trawlers with 300-horsepower engines:

(a) 80 mm (93,5 tex x 12 yarn) and 90 mm (93,5 tex x 24 yarn) for cod.

(b) 20 mm, 32 mm and 36 mm (93,5 tex x 12 yarn) for Baltic herring.

The dependence of the by-catch of undersize fish on their abundance in the fishing area and on the length composition of the population was determined.

Commercial, biological and biochemical investigations were continued on the quantity of wounded fish and the survival rate of Baltic herring which had escaped through trawl meshes. The mortality rate of wounded herring was not high, supporting the fact that it is possible and advisable to regulate mesh size for conservation of herring stocks.

In 1974, all trawlers which conducted investigations in the ICES area used trawls made of capron fibres.

In 1975, investigations will be continued on the development of fishing techniques, on clarification of methods for assessing fishing effort, intensity and selectivity, and on fish behaviour studies.

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Addendum No. 1

Gear and Behaviour Committee

Scotland

(J. J. Foster)

The main subjects covered in the fish capture and fish detection programme of interest to the committee are indicated without detailed reference to the support facilities, e.g. design and development of instrumentation. Such facilities are described in papers presented to the engineering working group of the committee.

Gear Technology

Research and development work on a range of 4-panel wide opening demersal trawls was continued; special emphasis was placed on reducing susceptibility of the gears to damage whilst at the same time reducing material thicknesses etc to give low drag characteristics. Some successful commercial trials have been carried out and further trials are planned. It has been found necessary to use both instrumentation techniques and direct observation by divers in order to tune these gears which were scaled versions of the original 4-panel designs previously reported, designed to suit a range of horse power.

The main studies on pelagic trawling were continued and extended to investigate the possibility of using pelagic trawls close to and touching the sea bed without incurring damage. Special rigging in front of the net was found necessary to allow the high aspect ratio boards to run at a fixed distance from the sea bed even when the groundrope is on the sea bed. Fast vertical movements of the gear have been achieved such that it can readily be manoeuvred over pinnacles, etc.

Although the project investigating the use of powered rotors on the trawl boards of pelagic trawls was somewhat curtailed through lack of available sea time, a large rotor was designed for use with existing motors and geared to run at 700 rpm. The equipment worked well with 4.4 sq.m. midwater otter boards operated with a 46 m. headline pelagic trawl. It proved possible to control depths of the boards by $\pm$ 20 fathoms even using short warp lengths.

Danish seine net studies were largely directed to the production of a film showing the operation of various nets using film material obtained in the programme reported previously. Further studies on the shapes taken up and movement of ropes during the fishing operation were carried out using diving and sector scanner observation techniques.

Electrical fishing investigations aimed at increasing the efficiency of trawls and other towed gears were continued. Several reports of this work have been published. With flatfish, comparative fishing results were encouraging and the work is being extended initially to study the reaction of roundfish to static and moving electrical barriers with a view to enhancing the effectiveness of, for example, traps and passive gears.

The gear technology, data logging and analytical processing work has been expanded. An extensive data bank system is now in operation and will ultimately allow rapid search of vast quantities of data using computer programmes. The extracted data can then be used in further computer programmes to analyse and predict gear performance.

Fish Behaviour

The sensitivity and reactivity of commercially important fish to acoustic and visual stimuli during fishing operations and the swimming ability of fish when subjected to fright and herding stimuli continued to be the main aspects of the behaviour research programme.

It was established that at sound frequencies below 110 Hz cod are able to determine the direction of sound sources. Other experiments designed to attract or scare free-living fish produced consistent results. Observation of fish behaviour using underwater television and sector scanning sonar has shown that low frequency pure tones are much more effective than high frequency tones in attracting fish to the sound source whereas broad band pulsed low frequency sounds often produce a pronounced flight reaction.

Development of acoustic tags for use in this work was continued in collaboration with the Lowestoft Laboratory and a new form of barbed detachment device for use with ultrasonic transmitting tags was developed and proved. Field work involving tracking of fish indicated that cod show a strong tendency for 'home range keeping' behaviour which may be of major importance in population studies.

Initial trials with the use of acoustic stimuli to scare seals from fixed salmon stations in coastal waters were undertaken and gave promising results. Extension of this work is planned.

Studies on swimming performance (burst speed capability and endurance) have led to a revision of previously accepted theories on aspects of swimming mechanisms of fish. The actual performance equations previously used (e.g. swimming speed is directly related to fish length) have had to be modified considerably.

Fish Detection and Abundance Estimation

Several successful surveys were carried out using the 400 channel echo integrator, particularly for blue whiting stocks. A simplified integrator using digital techniques throughout was planned, and the design was almost completed and construction started by the end of the year.