



GEAR AND BEHAVIOUR COMMITTEE

by J.G. de Wit

1971

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Belgium  
(P. Hovart)

The combined double beam trawl designed for the beam trawl fishery to increase the catch capacity for fish during the shrimp fishery was tested. The first results show that the taper ratio of the bottom net needs adjustment in order to reduce the drag.

A new series of experiments with a one boat pelagic trawl was carried out during the past year. The net which attempts to substitute the pair trawl was adapted for vessels equipped for the beam trawl fishery. The experiments were very satisfactory and steps are being taken to increase the catches still further by adjusting the rigging.

For the semi-pelagic fishery with large trawlers (1.000 h.p.) a first series of experiments was carried out in Icelandic waters. The experiments with the net itself did not yield the anticipated results. The temperature measurements however around the net and the fish detection by means of a sonar came up to the expectations.

For cod, saithe and redfish temperature ranges were registered. The fishing ground, the depth fished and the season seemed to constitute the determinant elements.

In view of substituting the so-called ticklers or chains used during the fishing with bottom trawls the theoretical study concerning a system of electrical impulses was continued. An apparatus for the electrical fishing on shrimps and flat fish was designed and a first series of experiments was carried out on laboratory scale.

Calculations were further made on the relationship between the vessel characteristics (gross tonnage, engine power and length) and the fishing power. This study was carried out for vessels fishing in the Icelandic waters.

Experiments were also carried out to study the effect of the ticklers on the catches and on the sea-bed.

Via log-sheets of fishermen, data were collected to check the diurnal activities of certain fish species on certain fishing grounds, as well as the effect of certain weather conditions on the catches.

Special attention was paid to the proposed I.S.O. recommendations and preliminary experiments in connection with the identification of netting yarns were carried out.

A newly designed security system for beam trawl vessels was further tested on board commercial fishing vessels.

In view of determining the acoustical characteristics of fishing vessels, a series of preliminary measurements was carried out in collaboration with the section "Study and Research" of the Belgian Navy. During these measurements, attention was specially paid to the frequency characteristics of the apparatuses.

Within the scope of the work-time studies in the fishing industry, a further series of experiments with the rinsing and sorting machine for shrimps was also undertaken.

Yarns for net-making were 70% polyethylene and 30% polyamide.

Canada  
(J.M. Anderson)

#### Gear

Engineering research included studies on the fluid mechanics of trawl netting, and the evolution of basic engineering theory for the rational design of otter trawls (demersal and midwater). Development work included modification of vessels for combined midwater and bottom trawling, development of an improved fish-detecting scanning sonar, and experiments with paired seining techniques.

#### Underwater Technology

Use of the two-manned Perry submersible, PC-8, with a 120° acrylic 3-ft diameter viewing section forward, confirmed that good visibility greatly increases the usefulness of a submersible for certain fisheries experiments. An acoustical tag used in telemetry work was developed which can monitor the depth of free-swimming fish, such as salmon, during tracking experiments. A Fish Orientation and Activity Monitor (FOAM), to which a fish is harnessed, was devised which allows the automatic recording of the reaction of a fish on the bottom to noise such as that from approaching fishing gear. A door-instrument package is being developed for the engineering study of trawl nets, including an acoustic door-spread meter.

### Behaviour

The PC-8 was used to investigate the behaviour of snow crab (Chionoecetes opilio) in and around traps, and to examine how fishing gear which disturbs the bottom, such as the scallop dredge and the doors of otter trawls, appears to make the bottom attractive to fish. A class of receptor on the antennule of the male lobster was deduced, by electro-physiological studies, to be a pheromone receptor. Using the FOAM, cod appeared to be able to detect the approach of an otter trawl at least a mile away.

### Denmark

(K. Popp Madsen)

No work carried out in 1971.

### France

(M. Portier)

Les chaluts de fond à grande ouverture verticale pour bateaux de plus de 1 200 CV, mis au point en 1970, ont été essayés par des chalutiers de pêche industrielle qui ont obtenu de bons résultats. Une adaptation aux fonds durs, de ces chaluts, a été éprouvée au cours d'une campagne du navire océanographique "Thalassa" sur les sondes de 400 à 600 m au nord/ouest des Iles Shetlands et a montré qu'un gréement convenable les rendait utilisable dans tous les fonds

Le développement du chalutage pélagique à un bateau se poursuit. Pour les chalutiers de 2 000 CV et plus, un compromis doit être adopté entre l'agrandissement des mailles et la résistance des matériaux. Les mailles de 400 mm sont couramment utilisées pour la pêche du hareng, du maquereau et de la morue.

Pour les bateaux moins forts le problème ne se pose pas de la même façon, mais l'encombrement et la manoeuvre de chaluts de grande dimension va nécessiter l'utilisation des tambours enrouleurs. C'est ainsi que les chalutiers-boeufs qui emploient des mailles de 800 et 1 000 mm sont en train de s'équiper. En dehors de la saison du hareng, ces bateaux ont fait d'intéressantes captures de morues et de daurades dans le Pas-de-Calais.

Des essais de pêche de la sardine au chalut pélagique, en Atlantique, ont été entrepris en 1971 et seront poursuivis en 1972.

Suivant les idées de nos collègues Ecosais, nous avons réalisé une maquette de cul-vivier destinée à la capture de poissons pour le marquage. Après les études en bassin, un exemplaire de ce dispositif a été employé pour des marquages de morue en Mer du Nord et a donné satisfaction.

Au cours de l'année 1971, aucune étude de sélectivité des maillages des culs de chalut et aucun travail sur l'effet des chaînes utilisées sur les chaluts à perche n'ont été entrepris.

Le matériau le plus utilisé dans la pêche au chalut reste le polyamide.

Germany  
(H. Bohl)

#### Fishing Gear and Apparatus

In 1971 emphasis in gear development was again on high opening bottom trawls. With 200-foot-trawls of this type a vertical net opening of 10 m and a horizontal one of 30 m could be reached. Also for small trawlers (cutters) such nets were constructed. During comparative fishing experiments carried out with trawlers and cutters the high opening bottom trawls were more efficient than the traditional ones, especially in the case of dispersed occurrence of fish. In cutter fisheries a promising experiment with a trawl made of transparent monofilament netting yarns was started. During these experiments new types of otter boards, shaped according to hydrodynamic demands, were tested.

Concerning echo-sounding techniques a multi-transducer system attached to the headline was developed in order to close the still existing gap between ship and pelagic trawl.

For searching and catching cod an improved type of thermo-sonde (combined with the netsonde) was used.

Aboard commercial fishing vessels the time needed for different processes of work was measured.

The last mentioned three items may be considered as contributions to the project "Integrated Trawling System". In cooperation with governmental and private institutions automatization of trawling is planned step by step. In the first stage only pelagic trawling is under consideration.

#### Selectivity Experiments

Studies of the influence of the elongation properties of polyamide netting yarns on the selectivity started in April 1970 and were continued in August 1971. The first experiments did not reveal any clear relationship between elongation and selectivity. The second experiments, however, led to conflicting results: In this case the cod selection factor for netting yarn with an elongation of 46.1% at half the knot breaking load was found to be 3.65, whilst that for the ICES standard polyamide netting yarn with an elongation of 23.8% was found to be 3.36. Nevertheless, it would be premature to draw definite conclusions from these findings, all the more since the unusual stiffness of the codend netting yarn with the high elongation did not allow an exact measurement of the mesh opening by means of the ICES gauge (pressure 4 kg). Further experiments are needed to elucidate the effect of elongation on selectivity.

### Net Materials

As in previous years, almost entirely polyanide netting yarns were used for the manufacture of trawls; the share of plaited polyethylene yarns decreasing further (less than 1%).

The commercial use of extra strong netting yarns by German stern trawlers changed from about R 18 000 tex (diameter 7 mm) in 1969 to mainly R 15 000 tex (diameter 6 mm) in 1970. In the year under consideration codends of R 11 500 tex (diam. 5 mm) were also used. The reason for these changes were lower costs, easier manufacture and higher resistance against abrasion of the knots.

As in previous years, the cooperation with national and international bodies concerned with standardisation of net materials and testing methods was continued. Activity was concentrated on elongation and abrasion of netting yarns and nettings.

### Fish Behaviour

During trawling experiments observations of reactions of fish to the gear were continued by means of the "multi-netsonde". Data on red fish, saithe and spiny dogfish were obtained. Experiments on the learning abilities of fish were carried out in tanks.

### Noises caused by Ship and Gear

Investigations on noises caused by fishing vessels and towed trawls, including acceleration measurements on cutters were continued. By normal bedding of the engine in rubber cushions, a damping factor of 30 dB can be reached between engine bed and hull of a cutter. According to measurements the noise and dynamic pressure of bottom trawls and mid-water trawls show considerable differences. Even in the case of a smooth sea-bed a bottom trawl may temporarily lose the contact with the bottom and thus produce a discontinuous noise. With older cutters much parasitic noise, including pulsiform components, is produced by damaged bearings and fluttering rudders.

### Iceland

(G. Thorsteinsson)

#### Bottom trawling

Some types of high opening bottom trawls for smaller fishing vessels were tested. The increased vertical net opening offers promise in commercial fishing. A similar trawl for bigger trawlers will be tested in 1972.

#### Midwater trawling

Experimental midwater trawling was carried out on capelin, blue whiting and white fish. The fishing for capelin gave good results. This fishing method is now applied in the commercial capelin fishery. The efforts in catching blue whiting and white fish in commercial quantities by midwater trawls gave only moderate results due to very scattered fish occurrence in the pelagic at the time of the experiments. These trawl experiments will be continued and intensified in 1972.

Further trawling

Further experiments were made with selective prawn trawls in order to avoid the capture of undersized haddock on the prawn grounds off the south-west coast. The selective trawl proved to catch three times fewer small haddock than conventional trawls but the prawn catch did not reach commercial level. Modifications in the conventional gear decreased the capture of the haddock youth while maintaining the same prawn catches. The experiments will be continued.

Material

Material in use as stated in Administrative Report for 1970.

Ireland

(J. . Hillis)

No Gear and Behaviour work to report.

Italy

(F. Matta)

No Gear and Behaviour work undertaken.

Netherlands

(J.G. de Wit)

After an initial period of time of about five years, the selective beam trawl for shrimps provided with a funnel of large meshes has in general been accepted by the shrimp fishermen of the northern part of the Netherlands.

Research to improve the catching ability of beam trawls for shrimps by means of electric ticklers continued. Preliminary results showed significantly bigger catches for the electrified shrimp trawl.

Further development work has been undertaken to achieve a more even feeding of the rotating sieve for shrimps. It proved that an even feeding of this machine could still further improve the sorting efficiency. The rotating sieve has been evaluated against a shaking sieve for shrimps. Young plaice from both machines have been tagged.

Research to reduce the number of heavy tickler chains of beam trawls for flat fish by means of electric ticklers has also been continued with promising results.

Investigations on the influence of trawls on the bottom started in 1971 and will be continued.

The trend to apply bigger meshes in the forward part of the net continued to exist for bottom, pair and midwater trawling. Many new net designs were made. To simplify net design and net making and mending the number of different mesh lengths could be reduced. The number of netdrums to handle the big-meshed trawls has increased. Experiments with an improved 90' herring bottom trawl have been continued.

Three side trawlers of 1 100 h.p. have been reconstructed for combined bottom trawling over the side and midwater trawling over the stern.

Studies to improve the fishing effort measurements of the beam trawl for flat fish by using warp pull instead of horse power continued, but little progress could be made. In 1971 a lower priority has been attached to this project because the results of a ship model basin programme had to be awaited.

The collection of operational data of stern trawlers under fishing conditions has been started.

Work on standardisation of fishing nets continued in co-operation with ISO.

Yarns for net making were 80% polyamide and 20% polyethylene. Codends, however, are 100% polyamide.

#### Norway

(O. Nakken)

The investigations on different types of shrimp trawls to evaluate methods to separate fish and shrimps were continued. It was possible to decrease the trawls' capability to catch fish by up to 90%, while the shrimp catch remained unchanged.

A group working on improving the efficiency of fishing vessels has designed and constructed an "optimal" vessel for long-lining.

The investigations on feedback-control of fish were continued. Schooling herring was observed to have directional escape reactions at 70 m range. Low frequency sound caused more distinct responses than high frequencies. The herring showed also nervous reactions on high frequency sound (produced by a 3 h.p. outboard engine) at a distance of 700 m. The studies continue.

The dorsal and side aspect target strengths were determined for a total of 350 fish from 8 different species. The observations were made with two echo-sounders at 38 kHz and 120 kHz. The work on improving acoustic methods for abundance estimation was continued and stock estimates were attempted for 3 species, cod, capelin and blue whiting.

Yarns for netting material were mainly polyamide.

Poland

(W. Strzyzewski)

Investigations were carried out (North Sea) on the selectivity of haddock and whiting as regards to codends made of polyamides (PA) and polyesters (PES).

For haddock selectivity coefficients were obtained of 3.10 for PA 6, of 3.5 for PA 6 (Dutch Standard) and of 3.4 for PES. For whiting the selectivity coefficients were 3.33 for PA 6 and 3.23 for PES.

Investigations are being carried out of the influence of the elongation of polyamides on the selectivity coefficients in the case of Baltic cod. Two types of PA 6-yarns are being used of different yarn constructions and finish (thermo fixation).

The elongations at the 1/2-weaver knot breaking load (wet) are 22.4 and 34.4%, the R-tex values are 6339 and 8075 respectively and the amount of twist per meter 74 S and 85 S respectively.

Investigations were continued on the behaviour of cod, herring and flatfish in the Baltic region in the mouth and the forward part of the codend of a bottom trawl. For these experiments the trawl has been divided into two parts by a horizontal plane of webbing.

The catch composition was :

	<u>upper part</u>	<u>bottom part</u>
herring	97.4%	2.6%
cod	27.3%	72.7%
flatfish	19.8%	80.2%

For a horizontal division of the codend only the catch composition was:

herring	60.2%	39.8%
cod	26.0%	74.0%
flatfish	17.8%	82.2%

Portugal

No report.

Spain

(R. Robles)

A notre côte méditerranéenne ont été effectuées des pêches expérimentales avec nasses, palangres, filet-maillant sur les fonds du bord du plateau et le talus continental des Iles Baléares.

En ce qui concerne la zone atlantique, le Laboratoire Océanographique des Iles Canaries a fait des essais, avec des résultats encourageants, dans les eaux littorales de l'Ile de Hierro; surtout avec le palangre, la moyenne de capture du poisson commercial a été de 57 kg pour chaque palangre d'un cent d'hameçons. Le temps de pêche a été de 4 heures pour chaque palangre. On a essayé 10 palangres avec trois types d'hameçons.

A la côte de la Galice, dans le port de Vigo, on prépare la mise en marche d'un canal d'expérimentation du chalut.



Sweden

(G. Otterlind)

For 1971, no investigation activity is to be reported. No change has occurred in the use of net materials since 1970. As a consequence of the low oxygen content in the deep water of the Baltic, pelagic trawls have more frequently been used, especially for herring, but also for cod (in the southern Baltic).

United Kingdom

1. England

(A.R. Margetts)

Scuba divers and underwater television were used to investigate the effect on the sea bed of a 9.5 m beamtrawl with tickler chains. The tracks of the trawl could usually be easily identified, especially where tides were not strong. The amount of disturbance of the sea-bed varied with sediment type. Another experiment investigated damage to fish by commercial beam trawling; it produced no evidence of uncaught fish being damaged but showed that heavy beam trawls caught many more soles and much more zoobenthos normally buried in the sea-bed than did lightly rigged otter trawls.

The ARL-sector-scanning sonar was used with the transponding acoustic fish tag to study the movements of individual plaice in the zone of action of a bottom trawl.

The sector-scanner and acoustic tags were also used to study fish movements and migrations, both horizontally and vertically, in relation to environmental conditions, especially tidal streams. Individual tagged plaice have been followed for periods up to 52 hours.

Aquarium experiments were made in an analysis, including the isolation and identification, of the olfactory attractants in baits.

The diurnal activity of sand-eels was studied in an aquarium. In particular, the effects of light intensity, food availability and temperature were investigated; the fish behaviour was linked with all three factors, with a marked difference in activity being noted between the temperatures 5° and 10°C.

In the acoustic fish-counting project, a calibration system was developed for a towed transducer to be used for estimating fish abundance. This will be used in the 1972 0-group surveys.

Equipment was developed and used for the acoustic discrimination of single fish and shoals.

Cooperation was maintained with British Standards Institution and International Standards Organisation on standards for fishing nets. The material most used in British demersal trawl and seine fisheries was polyethylene. Polypropylene was widely used and polyamide infrequently, except for some distant-water codends.

## 2. Scotland

(B. B. Parrish)

Research relevant to the Committee's activities undertaken at the Marine Laboratory, Aberdeen in 1971 included gear technology and associated fish behaviour investigations, aimed at determining the principal factors governing the fish capture by commercial fishing gears, and further studies of the use of echocounting techniques for the estimation of fish abundance. The following main projects were pursued: -

1. Gear Engineering Studies of the demersal trawl were continued, with reference to the design and operational performance of large mouth opening nets. Special attention was given in sea trials aboard research vessels to the effect of groundrope weight, overall balance of buoyancy and weight, pulsation of net and otterboards due to hydrodynamic effects and ground conditions, etc. Studies of pelagic trawling (single and pair trawl) techniques were also continued. Single boat trawls were tested for vessels varying from 200 to 1 600 HP, and some preliminary collaborative work with Dutch scientists was carried out on the research vessel "Tridens".

For this work, considerable use was again made of computer facilities, both on the research vessel "Explorer" at sea, to aid data collection and reduction, and in the laboratory for subsequent analysis. A number of special purpose computer programmes relating to fishing gear technology have been prepared and data obtained at sea converted to and stored on magnetic tape.

2. Noise Studies. Studies of the noise generated by trawls and other fishing equipment were continued. A mobile sound range, comprising an array of hydrophones was developed and used to record the ship and gear noise generated during demersal trawling operations. Plans have been prepared for using transmitting tags attached to fish released in the sound range to record the responses of fish to the gear during fishing operations. Further related research was done on the sensitivity of fish to sounds with special reference to their directional hearing ability. Preliminary results show that some commercially important gadoids do have "directional hearing" ability.

3. Electrical Fishing. Research on electrical fishing techniques was continued. Tank and field experiments on the reactions of Nephrops to pulsed electric fields showed that the animals could be made to leave their burrows by the application of quite small electric field strengths. The reactions of other shellfish and marine fish species to electric fields are now being studied.

4. Fish Swimming Speeds. Studies were made in the laboratory's experimental annular tank of the cruising and burst swimming speeds of commercially important marine fish species.

5. Fish Behaviour in relation to the seine-net and underwater visibility. Further observations were made by divers of the behaviour of fish in relation to the Danish seine-net whilst fishing. Associated research on underwater visibility and the factors governing it was also continued.

6. Fish Detection. Further sea trials were made with the echo-counting system developed at the Laboratory for use in fish abundance estimation. Two research vessel cruises were undertaken; one in collaboration with Norwegian scientists aboard the "G.O. Sars" and a second to the Faroes on "Explorer". On both occasions the counting system was used successfully with the laboratory's 400 kHz narrow beam sounder and the Simrad scientific sounder. Further trials to assess the full potentialities and accuracy of the system are planned.

7. Mesh selection. Experiments were undertaken to determine the effects of codend mesh selectivity when using a large-meshed topside cover. The results indicate that there was no reduction in the selection factor for haddock and whiting but a slight reduction was indicated for cod.

U.S.S.R.

(A. Treschev)

In 1971, the investigations on the Committee's subject in the field of commercial fishing gear were carried out in the direction of using the large sized mesh netting in the front parts of trawls.

Based on the results of these investigations, it turned out to be possible that the perimeter of the mouth of the trawls increases sharply, increasing insignificantly the total effort of their towing.

The investigations of wing-shaped otter boards with the elongation  $\lambda = 1.0$  were continued.

Interrelation between the shearing and resistance forces at the optimum angles of attack has improved from 2.5 to 3.0.

In March-April 1971 eight submersions of the autonomous apparatus "SEVER 2" were performed in the Black Sea, aiming at the studies of behaviour of whiting and horse mackerel.

It was found that during night time these fish are scarcely active and keep dispersed, whiting sinking to the bottom. Having been caught by the light of a lamp, whiting began to move and left the illuminated space.

From 25 October to 1 December 1971 the behaviour of capelin and blue whiting was studied by the vessel "POISK" in the Barents and Norwegian Seas. An automatic photocamera was used in the investigations; it was submerged into fish concentrations from the drifting vessel.

The observations showed that during the day time capelin are easily frightened, form dense mobile shoals, whereas during night time they are scarcely mobile and keep dispersed; weak reactions to strange objects are observed.

The behaviour of blue whiting had much in common with that of capelin. However, in day time capelin keep considerably deeper compared with the dark time of the day.

The Baltic Institute of Fisheries conducted investigations on selectivity of bottom trawl codends in the Baltic herring fishery in the Gulf of Riga.

The experimental fishery was conducted from vessels of 150 h.p. Trawl codends were made of kapron netting with mesh sizes of 24, 28 and 32 mm.

Herring selectivity length (L 50%) was 8.8 - 9.3 cm in cod ends with a mesh size of 24 mm, 9.5 - 11.6 cm in cod ends with a mesh size of 28 mm and 13.6 cm in cod ends with a mesh size of 32 mm.

Selectivity factors were 3.85 - 4.07 for a mesh size of 24 mm, 4.23 - 4.34 for a mesh size of 28 mm and 4.48 for a mesh size of 32 mm.

In 1971, all trawls used in the ICES area were made of kapron

In 1972 the investigations on the subject of the Committee will be continued. In addition to the investigations on fish behaviour, experiments to study the effect of stretching of material on selectivity of trawls are supposed to be carried out.