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Report of Activities

FISH CAPTURE COMMITTEE

by

K. Olsen

1989

BELGIUM

(R. Fonteyne)

Attention was paid to four main topics, viz.

- gear research,
- research on selectivity,
- research on netting materials and
- the introduction of computer techniques in technical fisheries research.

Gear Research

The gear research aimed at the development of efficient fishing gear from a technical, biological and economical point of view. As a consequence this research is often carried out in close cooperation with the fishing industry. The types of gears involved in this research were beamtrawls for flatfish as well as for shrimps, semi pelagic and high opening bottom trawls and pair trawls. As in the past years a reduction in towing resistance was still of a major concern in the development or improvement of fishing gear. A 10 % reduction in the towing resistance of shrimp beam trawls could be achieved by increasing the mesh size in the front part of the trawl. A first study was carried out with twin shrimp trawls on board a coastal stern trawler.Line trawls were also introduced in the Belgian fisheries. A new semi-pelagic trawl for smaller trawlers was developed. The initial tests showed a better manoeuvrability and a lower drag compared to earlier designs.

Selectivity studies

Experiments on codend selectivity for sole were carried out on board a coastal beamtrawler. The codend parameters involved were the mesh size, the netting material, the mesh shape (diamond versus square) and the codend length. Of these only the mesh size proved to have a significant effect on the selectivity for sole.

Netting materials

The research on netting materials concentrated on the shrinkage of netting due to the absorption of bottom sediments (mud and sand). A new experimental method permits to control the tension on the netting sample during testing. Nettings of different materials and construction were tested. Dependent on the tension on the netting (0, 2 or 4 kgf per mesh) mesh size reductions of up to 6 % were noted.

Computer techniques

The application of computer techniques in technical fisheries research was started. Computer programs for the analysis of data from selectivity experiments and the design and drawing of net plans were introduced. A database of technical characteristics of fishing gears used in the Belgian fleet was compiled.

CANADA

(P. Koeller)

Gear Trials, Sampling Gear

The Department of Fisheries and Oceans, Quebec Region, conducted gear trials on the URI 81/114 shrimp trawl, to be used on the Northern Gulf of St. Lawrence groundfish and shrimp surveys starting in 1990. The gear configuration was optimized, and its performance described using SCANMAR.

The use of sunken gillnets to determine species composition of rockfish on deep, hard bottom grounds was tested by DFO, Pacific Region. Modifications to the research trawler W.E. RICKER,were planned as part of the development of a twin beam trawl for surface sampling of juvenile salmon.

Fishing Gear Selectivity

Testing was completed by DFO Pacific Region, to evaluate the optimal size of trap escape rings in the British Columbia Dungeness crab fishery. Experiments were also conducted to mitigate ghost fishing in this fishery.

In DFO Scotia-Fundy Region four additional cruises were completed in 1989, using trouser trawls to gather data on the selectivity of 135, 140 and 155 millimeter square and diamond knotless mesh cod-ends. A joint Canada/US experiment with two vessels was also conducted on Georges Bank using 140 mm Square mesh and 155 Diamond mesh. Results showed that the selectivity of 140 mm square and 155 mm diamond were identical. Preliminary tests were also completed using a metal grate in a shrimp trawl to separate fish from shrimp. Mermaid Explorer was used to view and record the action of a Western II survey trawl on a "trawl-proof" instrument package which will be used to house a doppler current profiler during physical oceanographic studies at the heavily fished ice-margin zone off Newfoundland.

Fishing Gear Design

The Province of Newfoundland and Labrador solved the problem of oversupply of trapped cod by designing holding pens which receive cod released from filled traps, thereby allowing the traps to keep fishing, while maintaining live cod for optimum market conditions. The holding pens also increase fish quality by allowing capelin-glutted fish to digest, and to acclimate for aquaculture purposes. Methods of freeing whales from fishing gear were developed which reduce gear loss to fishermen while minimizing whale deaths. Various underwater camera equipment was tested imn preparation for a project determining the feasibility of locating and monitoring lost fishing nets.

The Marine Institute, St. John's, completed work on the design, construction and testing of apparatus for measuring C_L and C_D of Otterboards. Work has just commenced on the design and testing of Newfoundland fish traps at the Institute's flume tank. Phase 1 involves monitoring the movement of fish in and around cod traps using underwater video cameras and a sector scanning sonar. Work was completed on measurements of the swimming speed and endurance of small cod at low temperatures in the flume tank. Existing camera equipment is being modified to conduct studies of fish behaviour in and around different fishing gears. Projects using this equipment initiated to date include studies of a new design surf clam dredge and movements of fish in and

around fixed gear.

Acoustic Stock Assessments

DFO Quebec Region conducted two cruises in the Gulf of St. Lawrence using a 2 frequency (38 and 120 Khz) dual-beam Biosonics Model 102 System. The first cruise looked at spatial organization of plankton scattering layers and fish echoes on a northern shrimp fishing ground (depth = 200 m) and explored the possibility of detecting shrimp aggregations with hydroacoustics. No clear evidence of back-scattering due to shrimp was observed. The second cruise determined the distribution and abundance of herring in NAFO Division 4R (west coast of Newfoundland) using the stratified random sampling design of parallel transects recommended by the Canadian Atlantic Scientific Advisory Committee.

Hydracoustic assessments were conducted by DFO, Pacific Region on: the offshore hake populations in relation to the commercial fishery; the inshore hake population in relation to predation on migrating salmon; juvenile herring in the Strait of Georgia; rockfish on untrawlable hard bottom; and limnetic fish populations, as part of the lake enrichment program.

DFO Scotia-Fundy Region conducted acoustic abundance estimates of the 4WX winter herring stock in 1989 and early 1990 using parallel transect surveys. The herring were usually aggregated in one or more patches a few square miles in area, and were mobile within a range of 4 mi by 24 mi. The appropriate survey design is a series of synoptic night time surveys that monitor the buildup and decline of the population in the area and estimate the abundance at the optimum time.

DFO Central and Arctic Region competed a hydroacoustic study of marine fish abundance and distribution in Barrow Strait, Northwest Territories. Part of this work involved the examination of Arctic cod distributional behaviour in relation to feeding aggregations of marine mammals and sea birds. Fish abundance in six interior lakes was examined as part of the Red Lake Climate Change Study. Studies of herring biomass in Lake Superior's Black Bay, where the fishery remains closed due to low fish abundance, were also continued. An ongoing study to estimate the seasonal abundance of forage species in Batchawana Bay, in order to assess appropriate stocking levels for Chinook salmon and their impact on the forage base, revealed an unexpected increase in biomass, likely the result of immigration into the bay.

DFO Newfoundland Region conducted three capelin biomass surveys, one redfish biomass survey, one experimental survey to test the feasibility of winter acoustic surveys on northern cod, and one cod-capelin interaction study using acoustic techniques. A near shore acoustic study on the migration of cod and capelin in the Avalon Channel was also conducted. In addition, two calibration cruises were completed and individual cod were tracked in Conception Bay using acoustic tags.

Acoustic Development

DFO Pacific Region conducted theoretical work on the use of side scanning sonar to determine its usefulness in identifying and assessing juvenile salmon schools by depth strata (surface to 60 m). Work was also conducted on the development of acoustic methods to discriminate fish species grouping of rockfish by bottom type and depth. Another study compared assessment of adult sockeye salmon using an active synoptic survey of transects and downward looking acoustic equipment with a passive survey using a fixed, upward looking array of transducers.

DFO Scotia-Fundy Region received the ECOLOG II dual beam acoustic system for counting and sizing individual fish targets in the marine environment. Field trials identified several problems

which are being corrected in an updated version to be delivered by summer 1990. An analytical model of the echo reflection from fish was developed. The results agree with empirical observations and existing numerical models in identifying the "perspective" which is the combined effect of the transducer beam patter and fish tilt angle, as a major source of variation in fish target strength.

DFO Central and Arcic Region continued work on: the comparison of fisheries acoustics techniques with traditional methods for estimating fish biomass in small lakes, fixed aspect examinations of fish migration through channels and rivers, the development of an acoustically-triggered underwater camera for identifying plankton and nekton detected beneath ice, and the refinement of a technique for editing and presenting fisheries acoustics data using computer graphics.

At DFO Newfoundland Region research in acoustics development proceeded along several fronts including investigations into the sources of variation in calibration measurements from the Hydroacoustic Data Acquisition System (HYDAS) A stern deployment and retrieval system for conducting acoustic surveys in ice infested waters was successfully tested. In situ experiments to determine target strengths of herring schools were conducted. Work continued on acoustic species identification, including its theoretical basis. Experiments were conducted on spatial and temporal scales of target strength variability. Comparative field trials were conducted with the HYDAS and BioSonics acoustic systems, but the results were inconclusive. An investigation of optimal acoustic survey designs was initiated.

DENMARK

No information received.

FINLAND
(P. Suuronen)

The codend selectivity (A=32 mm) of pelagic herring trawl was studied in the Gulf of Finland (SD 32) in October in collaboration with the Tallinn Department of the Baltic Fisheries Research Institute by using small mesh cover bag and twin-codend methods.

Preliminary trials with square mesh codend in herring trawl were made in the Archipelago Sea (SD 29N) with a twin-codend trawl.

Echo-sounding observations of herring trawls in action were continued in the Archipelago Sea. Preliminary trials with a pelagic herring trawl constructed of "glow-rope" were made in December in the Archipelago Sea.

Underwater TV-observations on the capture process of herring gillnets (PA monofilament, diameter 0.17-0.30 mm) were carried out in an indoor fiberglass tank.

The study on the reaction of Baltic herring schools to underwater light stimuli were continued in the Archipelago Sea. The movements of the schools were tracked by a scanning sonar.

Trials on the effect of bait size on the salmon long-line catch were continued.

Two acoustic surveys were conducted. The first survey was done in July-August in Sub-divisions 29, 30 and 32 and the second survey in November in Sub-division 32. Species studied were Baltic herring and sprat.

FRANCE
(M G. Massart)

1. Acoustique sous-marine

IFREMER :

Le système INES-MOVIES de traitement (numérisation, stockage, intégration) des données sondeur par ordinateur compatible PC a été terminé. Son industrialisation a été réalisée et il est commercialisé par une société de la région brestoise.

Suite aux premiers essais concluants du prototype de sondeur multifaisceaux conçu pour la pêche (24 voies de 2°), l'industrialisation est actuellement en cours, dans le cadre du projet EUREKA-HALIOS, par des sociétés française et espagnole.

Des essais préliminaires de la maquette d'un sondeur large-bande (20 à 80 kHz) ont été effectués. Le développement continue et ce sondeur devrait être pleinement opérationnel en mer en juin 90.

Lors d'une campagne méthodologique en acoustique, des premières données intéressantes sur les index de réflexion de poissons pélagiques dans le golfe de Gascogne ont été acquises grâce au système Dual Beam Biosonics de l'ORSTOM.

La gestion du stock d'anchois du golfe de Gascogne a été poursuivie, en collaboration avec l'Espagne, avec comme support une campagne d'écho-intégration effectuée en avril-mai.

ORSTOM :

L'ORSTOM a poursuivi ses travaux en hydroacoustique suivant quatre orientations :

- évaluation des stocks de pélagiques par écho-intégration grâce à des campagnes effectuées en Mauritanie, Sénégal, Secteur Caraïbe (Vénézuéla, Cuba)
- identification des biais introduits par l'utilisation de l'acoustique dans les évaluations de stocks
- étude du comportement de structures agrégées (distributions internes, déplacements, dispersions, agrégations).
- identification d'espèces à partir d'émission large-bande.

L'issue des traitements statistiques est très encourageante dans les 2 bandes de fréquence étudiées - 50 à 145 kHz et 140 à 430 kHz - avec toutefois des résultats moins spectaculaires dans la seconde.

2) Amélioration des techniques de capture

2.1. Amélioration des chaluts et de leurs apparaux

2.1.1. Conception des chaluts assistée par ordinateur

Le calcul de la forme prise par un chalut en pêche sous l'effet des forces hydrodynamiques appliquées par l'eau à chaque fil constituant les mailles donne actuellement des résultats très satisfaisants pour un chalut pélagique et la visualisation à l'écran permet de suivre sa déformation lors du changement d'un des éléments qui le constituent.

L'extension de ce programme à l'ensemble du train de pêche (funes, panneaux, chalut) en chalutage de fond comme en chalutage pélagique ne pose plus maintenant de problèmes théoriques.

Les difficultés qui restent à résoudre sont

- la diminution des temps de calculs qui devront être raisonnables soit quelques minutes pour le calcul d'une configuration sur un ordinateur abordable pour un fabricant de filets alors qu'actuellement un gros ordinateur scientifique est nécessaire pour faire le calcul dans un temps comparable.
- la prise en compte des zones où le filet est complètement détendu alors qu'actuellement, si une telle zone occupe une surface trop importante, le calcul s'interrompt.

Le but visé reste la mise à disposition des fabricants de chaluts d'un outil interactif de conception des filets sur ordinateur.

2.1.2. Etude des caractéristiques hydrodynamiques des panneaux divergents et élévateurs

- L'IFREMER participe, avec la SFIA et le DFTI à l'étude systématique des performances et des conditions d'utilisation des panneaux de chaluts. Par ailleurs, une étude a été conduite à Lorient sur la mesure des écoulements autour des panneaux aux forts angles d'incidence. La méthodologie a été mise au point, les mesures complètes ne sont pas encore faites.

- Un système de panneau élévateur souple lacé sur le chalut a été étudié et breveté. Plusieurs engins de présérie sont actuellement en essais sur différents navires professionnels et la commercialisation confiée à un fabricant de panneaux très connu doit débuter en avril 1990. Il semble que le produit auquel l'IFREMER est arrivé soit très performant, fiable et très simple de mise en oeuvre.

2.2. Amélioration des dragues à coquillages (coquilles St Jacques, pétoncles)

La drague aspirante à effet Magnus dont l'étude a été menée à l'IFREMER conjointement avec les Forges LE BEON est maintenant au point, et les Forges LE BEON en assureront la commercialisation. Les buts recherchés (diminution du risque de croche, diminution de la force de traction requise, diminution des dommages causés au fond) sont atteints. L'efficacité de la drague en usage professionnel normal n'a pas encore été comparée à celle d'une drague classique.

3) Amélioration de l'aménagement des navires

3.1. Thoniers

Des recherches sont en cours, à la fois sur la senne et sur le gréement du thonier pour accélérer et faciliter la manoeuvre de la senne.

Les recherches portent sur

- la forme de la senne
- les maillages utilisés
- sur le gréement du navire, en particulier pour des thoniers senneurs de petite taille (< 45 m environ).

3.2. Chalutiers

L'aménagement des chalutiers d'une longueur inférieure à 25 m environ est étudiée dans le but

- de faciliter et d'accélérer le travail des captures
- de limiter les risques d'accidents sur la plage arrière
- d'améliorer le confort de l'équipage.

3.3. Tri du poisson par analyse d'images

L'IFREMER a participé à deux études sur le tri du poisson par analyse d'image

- l'une, de portée très générale, mettant en oeuvre un système expert de reconnaissance de forme
- l'autre utilisant l'apprentissage par l'ordinateur des critères de reconnaissance d'un certain nombre d'espèces assez limité.

L'étude en est au stade de la réalisation d'une maquette de laboratoire montrant que des cadences de reconnaissance d'espèces comparables à ce que ferait un opérateur humain sont très accessibles à un coût abordable. Il manque par contre

- l'analyse d'un nombre suffisant d'échantillons de poissons d'une même espèce pour être sûr que leur variabilité n'induit pas le système de reconnaissance en erreur
- la vérification de la tenue de l'ensemble aux conditions d'environnement.

GERMAN DEMOCRATIC REPUBLIC

(H. Stengel)

Deep sea fishery

New mid-water trawls have been designed using a modular concept. That means, that distinct parts of a trawl can be combined with other moduls forming a new trawl adapted to other conditions. First tests conducted by Namibia at the Patagonian slope outside 200 sm and within the fishery zone (east coast) of the USA proved to be encouraging.
Underwater observations of the behaviour of red fish in the Irminger Sea showed, that reactions are very poor and slow. Directed attempts to escape were nearly zero. The observations have been conducted in depths between 180 - 400 m from May to July 1989.
Using the same technique (underwater TV) the behaviour of squid in the South West Atlantic region within a semi-pelagic trawl has been observed. The results showed, that the swimming pattern of squid is similar to that of horse mackerel except that squid is swimming with the tail in the direction of towing. Even big specimens are not able to swim with the speed of the towed trawl (4.3 - 4.5 kn).
The development of a system of programmes for calculation and design of a trawl using a personal computer and a broad data basis continues. The system bases on the theory of discreticized towing systems.

Sea and coastal fishery

In 1989 works have been proceeded dealing with the introduction of fishing gear into practice at a low consumption of energy, a higher selectivity and a lower influence on the environment. Developments of different floats and flexible leadlines of various size have been finished for the set gillnet fishery adapted to requirements of mechanization.
Researches and developments were started using multimonofilament nets for catching codfish and flatfish.

For the long-lining of codfish and eel a model of a fully mechanized equipment including periphery units was developed, constructed and tested at sea.
Works have been proceeded for the improvement of the efficiency of the pair seining of flatfish. A novel rope element was tested.
Using a special underwater TV equipment underwater observations of pond nets, pair seining and trawls were carried out.

Basic investigations

For the CAD system "fishing gear" programmes were developed for calculating the processes of seining and for drawing set nets.
Wind tunnel experiments were carried out with plane net lattices in the range of angles of attack from 0 to 30 degrees, solidity ratios in the range from 0.20 to 0.64 and mesh openings from 0.15 to 0.3. The hydrodynamical forces and the magnitude and direction of the velocity have been determined.
Furthermore observations have been carried out with a smoke sound. It could be shown that results of measurements on even net lattices can be used also for net lattices with the structure of twines if the friction part of the coefficient of stiff lattices will be multiplied by the surface ratio of rough and even cylinders. Moreover a computer programme was developed for determining the load on a frame of a net cage in a sea way.

Federal Republic of Germany

(K. Lange)

Energy saving fishing methods

The activities of the Institut für Fangtechnik in the field of energy saving fishing methods concentrated on gill nets and trammel nets. In the Baltic the decline of the cod stocks forced the coastal small scale fishery to look for other species e.g. herring and flatfish. In cooperation with commercial fishermen the institute performed investigations in the design and material of gill nets and trammel nets to adapt this fishing gear to the different species.

In the North Sea the increase of the minimum codend mesh opening of beam trawls in the sole fishery up to 80 mm made fishing for sole with trammel nets more profitable compared to beam trawls. Again several inshore fishing vessels moved from the Baltic to the German Bight during the last season to take part in the sole fishery with trammel nets.

The efficiency of longlines depends mainly on the type of bait and on the reaction of the different species to the bait.
Investigations with a number of different baits were performed on the Nordsee-Plattform, a research rig in the North Sea some 40 miles north-west of Heligoland, where cod, whiting pout pollock and plaice could be found.

Stock assessment fishery gear

The basic data for the calculation of stock size and catch quotas are obtained from catches with standard fishing gear for stock assessment. Therefore the degree of standardization in design and performance of this gear has to be as high as possible to get reliable data. Especially the influence of towing speed and rig on the size and shape of the net opening of standard trawls was investigated by means of a cabless netsonde and underwater tv-observation.

Impact of fishing gear on benthos and sediment

Investigations with beam trawls in this field were continued. Excavated and destroyed bottom fauna in the track of a beam trawl attracts bottom fish which could be observed with an underwater tv-camera and which was proved additionally by increased catch rates of gill nets, set after repeated beam trawl tows in a certain area.

Investigations in trawl gear

The underwater-tv-system, available at the Institut für Fangtechnik since 1985 is still the most important instrument in trawl gear research. Some of the topies investigated with this system in 1989 were pony board performance, bottom contact of bobbin groundropes, stress distribution in rope trawls, influence of rig variations on the shape of a trawl. A serie of trials with different types of otterboards proved the high efficieny of cambered doors compared to flat ones.

Selection experiments

A comparison of diamond and square mesh codends for cod proved the much more effective selectivity of the square mesh type. The selection range decreased by 37% compared to the diamond mesh codend with equal mesh opening.

Investigations in the shape of a trawl net

Using the underwater-tv-camera for measuring distances between marked points distributed all over the surface of a trawl net a set of data was obtained which will be the base for calculating form and load of the net in relation to the trawling speed. A calibration method was developed to get a correct correlation between the real distance and the image produced by the camera.

Iceland

(G. Thorsteinsson)

Considerable effort was made to revise regulations on minimum allowable mesh sizes in bottom and midwater trawls. Two trips were made on a commercial stern trawler with 155 mm mesh size in belly and wings instead of the usual 135 mm netting in these parts of the trawl. The aim of these observations was to check on possible escape and/or gilling of fish. Due to positive results it has been proposed that the minimum allowable mesh size in the bellies and wings of bottom and midwater trawls should be 155 mm in the new regulation.

In June underwater TV obervations were made on Danish seining and the behaviour of different fish species in relation to towing wires, ropes and the seine net itself. A video tape has been made on these investigations. An English version of the tape is in preparation.

Testing of netting yarns and netting was performed in a similar way as in previous years.

An acoustic survey was carried out in late summer on the juvenile capelin stock for early management purposes.

Routine acoustic surveys were carried out on the adult stocks of herring and capelin in November and December.

A promising pilot study for zooplankton was carried out at 38 and 120 kHz. Further work along these lines is planned.

A rebuilding of the acoustic instrument room onboard on one of our research vessels, rv. Árni Friðriksson, has been planned.

IRELAND

No information received.

NETHERLANDS

(B. van Marlen)

General

Great efforts have been made to stimulate contract research projects, especially by drafting and sending EC-proposals (FAR-program DG XIV) in collaboration with various European sister-institutes.

The cooperation with IfH (Rostock, GDR) started in 1988 and continued according to plans.

Technical support and ad hoc advice has been given to the Ministry during the building phase of the new fisheries research vessel of the Merwede Shipyard (The Netherlands). The sea trials will take place in January/February 1990.

Projects in developing countries

As follow-up of the FMO contract (Netherlands Development Finance Company) and to supervise the building and delivery of 4 Dutch built Senegalese shrimp trawlers, a RIVO skipper sailed locally for 6 months with emphasis on bottom trawling over the stern, which is a new fishing method for squid for the Senegalese shrimp fishery.

Safety and working conditions

Within the framework of the project "Safety in the beam trawler fishery" started in 1988, (RIVO, TU-Delft Safety Science Group, sponsored by the Directorate General of Labour), the occupational accident and workload analysis was finalised. Besides retrospective and prospective solutions, matrices were drawn and a safety integrated redesign of the beamer workdeck was put on the drawing board and thorough calculations were made (stability, etc.). By means of changing the winch house aft with the flatfish processing in the forecastle, a great number of safety solutions have been introduced. These (local) improvements (no warp heads) and cost-effective studies will be concluded in 1990. In close cooperation with skippers and fishery schools the conclusions will be promoted in the industry.

An EC proposal "Integrated quality assurance of landing fresh fish" was awarded by DG XIV (FAR program). RIVO and IVP/TNO started to work on flatfish processing aboard Dutch beam trawlers, while Denmark (Lyngby) and Scotland (Torrey) are doing the same for roundfish.

Because of reduced subsidies, RIVO will mainly focus on developing a laboratory model for weighing and sorting flatfish, based on real time image analysis techniques. With the prototype so far an accuracy of 95% has been reached.

Reducing energy costs

Although the fuel costs are relatively low, the energy saving possibilities for fishing vessels have still to be focussed on.

Because energy optimisation means the greatest overall benefit of the individual fishing enterprise, national economy within the quota constraints, and the global environment.

Together with some marine fuel companies, engine manufacturers and an expertise bureau, RIVO started a fact-finding project concerning the increased beam trawler complaints and damages after bunkering of gas oil in various fishing ports in the Netherlands. The conclusions show that the (inter)national marine fuel specifications/ISO standards are so broad that between refinery and delivery undesirable blending/constituents are possible.

Although the bunkered fuel quality is within the constraints of the specifications, for the beam trawl fishery these oils are not the most economic fuels matched to the appropriate engine (use) and its associated fuel system.

The Dutch oil suppliers will join forces to deliver only marine fuel to the beamers with restricted specifications, the so-called vignette oil. Because of the increased number of harbour days and the above mentioned problems, organic constituents are growing in the fishing vessel tanks, clogging the engine filters.

(Re-)design of fishing vessels

A lecture at the Technical University of Delft has been given on the changing design requirements for Dutch fishing vessels.

Because of increasing national and international regulations concerning fisheries policy, safety, working and environmental conditions, an integrated re-design is inevitable instead of ad hoc approaches. Only by means of design-spiral techniques a cost effective, safe (working conditions) and environmental-friendly fishing vessel can be realised.

Implemantation of the 1986-1988 noise control studies remains incomplete, partly owing to new construction of beam trawlers, planned earlier but now resulting in overcapacity, and to the absence of regulations and recommendations for fishing vessel noise levels The existing noise levels are 10-15 dB(A) too high, while with an additional investment of 0.5- 2% a reduction can be realised of 5-10 dB(A) in the accommodation and working spaces.

The final computer versions FISPOW (a resistance and propulsion prediction program) has been delivered to the Dutch industries by the contractors RIVO and MARIN (Model Basin Tank - Wageningen). The necessary sea performance tank tests have been postponed because of lack of subsidies.

Two studies have been realised to improve the beamer wheelhouse, firstly, an inventory of modern beam trawlers and secondly the interface possibilities of wheelhouse electronics. Mock-up studies are still necessary to introduce an ergonomic wheelhouse, to which remote winch control, navigation, fish and engine room control tasks could be incorporated effectively.

For deep freezer trawlers a techno-economic design study has been continued with emphasis on simulation models of fish catch and

processing operations. Together with economists a report was written regarding the economic results of the large Dutch freezer trawlers in relation to technical parameters.

Direct observation on fishing gears

Since, in general, little is known about the influence of the present beam trawl fisheries on the benthic ecosystem of the North Sea, the BEON members (Ministry of Transport and Public Works/North Sea Directorate, RIVO and the Netherlands Institute of Sea Research) have carried out a study on the effects of this type of fishing. The aim was to get insight into the penetration depth of the sediment and the direct short-term effects on the benthic fauna. This was done with the aid of underwater video equipment, side-scan sonars and trawl catches for numbers and condition of macrobenthic organisms and fish. In order to estimate the number and survival of animals escaping through the mesh, hauls were carried out with a fine net covered codend. Furthermore, macrobenthic fauna was sampled with a box corer. This study only indicates short-term effects. A penetration of up to 6 cm in the sediments and various macrobenthic fauna (e.g., Asteria rubens, Lanice conchilega, a small crustacean, brittle star) are affected. The results were in line with previous research, but cannot be translated into long-term predictions. To be able to study long term effects of bottom trawling on the North Sea ecosystem, more extensive and cooperative research should be carried out for 1-20 years, preferably in protected areas.

Development of new fishing gears

To get insight into the underwater noise emission vs fish behaviour and possibly acoustic flatfish stimulation, together with the Dutch Navy the noise of a modern beam trawler with/without beam trawls and of the R/V "Tridens" was measured. From this beamer the diesel engine noise was dominating, while the propeller and beam trial noise contribute very little.

Techno-economic research

A paper entitled "Ein Jahrzehnt in der Forschung und Entwicklung pelagischer Schleppnetze in den Niederlanden" (A decade of research and development of pelagic trawls in the Netherlands) was presented at the "Internationales Rostocker Schiffstechnisches Symposium" in October 1989.

A deterministic model has been written in Microsoft Excel to determine the main variables of the performance of a stern freezer trawler. The results are given in ICES C.M. 1989/B:50 and were presented at the ICES Working Group meeting in Dublin. The freezing rate and freezing percentage and hold capacity turn out to have the strongest influence on the achievable landings.

A stochastic simulation model has been written in Personal Prosim with a coarse animation of the catch input and throughput. The model is used to determine the optimum freezing rate for a given catch input probability distribution. A stochastic description is necessary for a proper adjustment of freezing rate to the input.

Time measurements and observations on the fish handling process were carried out on board the SCH-21 during tests of a new drag trawl and on board the SCH-33 during a herring trip. Some valuable data were found which can be used in further modelling.

Mr Dai Tianyuan from the Peoples Republic of China investigated relationships between technical design parameters and economic performance of Dutch stern trawlers under the guidance of RIVO and LEI. The results are presented in his paper "Economic results of stern freezer trawlers in relation to technical parameters", published by the Agricultural Economics Research Institute (LEI).

Remotely operated vehicle (ROV)

Further engineering work took place on the ROV in close collaboration with a private company. The objectives of these new developments are to extend the scope of the ROV to greater depths and lengths of cable and to enable a quick shift from a towed operation to a self-propelling operation. This will make observations of midwater trawls and stationary gear like gillnets possible.

Measurements on trawls

Gear performance measurements were done in the waters around Madeira. The purpose of these trials was to determine the potential of the new fibre Dyneema, called SK-60 for drag reduction in midwater trawls. Two trawls called GM3 and GM6, with the latter partly made out of the new twine, were compared. Although their sizes are not equal, the swept volume increase for the bigger net turned out to be impressive. A small trawler like the "Tridens" with only 1,800 hp engine power was able to manage the big trawl with 5,600 mesh circumference with ease, due to the reduced drag which comparable nets made out of polyamide have. The document ICES C.M. 1989/B:51 "Engineering trials on super mesh trawls GM3 (4,320 mesh circumference) made of polyamide and GM6 (5,640 mesh circumference) with a front part made of Dyneema SK-60" supplies more details. Commercial trials on the SCH-21 were carried out later this year on a 5,600 and a 7,440 mesh net. The nets showed some damage during hauling. Due to a lower density of the twine, some knots slipped and some mesh broke in the wings. The trials were therefore limited to a few hauls only. A possible explanation is the difference in material properties of the mesh (SK-60) and the frame lines (nylon). Further tests are planned to optimise the material endurance in the net. Comparative fishing trials were carried out in March on the FRV "Tridens" with the 5,600 mesh net and 8 m2 Dangren doors. The few hauls did not supply enough information to draw definite conclusions.

Experiments on a single-door pelagic trawl

In September a joint cruise with RIVO and IfH Rostock (Institut für Hochseefischerei und Fischverarbeitung) was carried out on the FRV "Ernst Haeckel" in mid-Atlantic waters. The purpose was to investigate the possibility of towing a trawl at the surface in a oblique position to the vessel and out of the influence of its wake. Earlier trials in the Baltic had shown potential for this development. Due to bad weather at the time, the number of

days (seven out of a month) on which measurements could be made was rather limited. It is recommended to seek shelter from swells in such trials. The results of the trials will be presented at the next meeting of the ICES Fishing Technology and Fish Behaviour Working Group in Rostock.

EC-programme "Large Scale Scientific Facilities Plan"

The Danish Fishery Technology Institute (DFTI), North Sea Centre, invited several scientists who might use their facilities in the future, to a collaborative attempt to obtain funds from this EC programme. The idea was enthusiastically welcomed by many colleagues working in the field of fishing gear technology but, unfortunately, financial support was denied by the Commission.

Pair-seining on flatfish

Part of the collaboration agreement between RIVO and IfH was the exchange of personnel of both institutes for their sea trials. A scientist from the IfH joined the "Tridens" cruise and later visited Dutch pair-seiners. A scientist from RIVO joined the GDR vessel "Clupea" for direct observation of their seine operations. It was recommended by the Dutch researcher to improve the state of technology of the GDR gear. It is estimated that new designs and materials could be introduced with success in the GDR fleet.

A more selective net to catch eel in Lake IJssel

A trouser trawl was designed for catching eel in Lake IJssel for stock surveys. The new design enables a better comparison between catches, by fishing simultaneously with two parallel cod-ends.

Some results are presented in ICES C.M. 1989/B:52 "Eel-net selectivity using a dual cod-end beam trawl".

Fishtrap

A special design has been developed for a survey net in a fish trap. Using this net, the passage of fish can be monitored.

Plankton torpedo

Initial trials were carried out in the small towing basin of the Delft Hydromechanics] Laboratory on a sampler of the type Gulf III.

The inflow was measured with a calibrated impeller and in addition flow visualisation tests were done. A definite suction effect could be shown. The streamlines were bending inwards to the nose cone. An accurate measurement of the amount of water passing through the sampler is vital for a sound estimate of the number of larvae in the path of the sampler. The numbers given by different countries differ substantially. Further tests and standardisation are therefore recommended. Trial on the Gulf III and the German sampler will be carried out in a towing tank of MARIN in February 1990. The idea has been raised to propose further research through the EC FAR programme of DG XIV.

Selectivity of beam trawls

A project proposal "Low Drag High Selectivity Beam Trawl" submitted to the EEC has, until now, been denied financial support. A second proposal was sent to the Commission under the programme of "Fishery Research on Biological Nature" but was delayed due to mistakes in the application procedure. The problem of by-catch is significant for the Dutch beam trawl fleet. By-catch of mainly cod and haddock in the beam trawl fishery is limited by legislation. Trials on the FRV "Isis" with a different attachment of the headline to the shoes of the gear indicate some potential to reduce the by-catch of cod.

Technical design studies on fishing gear

The proposal "Fishing Gear Model and Full Scale Relationship" received financial back-up from the European Commission. The project will run for three years. RIVO, DFTI of Hirtshals and DAFS-ML of Aberdeen are collaborating on this project. The aim is to improve the value of predictions of full scale nets through model studies. Extensive measurements will be done on a full scale midwater trawl, with derived models of scale ratios of approximately 1/2, 1/4, 1/16. 1/32 and possibly 1/64. The larger models will be tested in Loch Ness, the smaller ones in the flume tank of Hirtshals.

Informatics

Various computer programs have been developed. A spreadsheet program was written for the comparison of measuring data of two trawls with different twines. A data collection program was written for collecting CTD data over an IEEE-488 bus and storing it in a special ICES format on a Macintosh.

RIVO was consulted concerning a study on the use of remote sensing data for the fisheries. The possibility of combining research data and remote sensing data in a geographical information system was also evaluated.

For image analysis, a new SUN 4/330 work station was installed with some Data Cube image processing modules. With this equipment, a vision system for measuring the weight of flatfish on a conveyor belt was developed for an EEC project on fish handling. Another project on automatic determinations of the age of fish by means of image analysis of their otoliths was started.

RIVO is planning to develop a new plankton sampler. The Technical Department assisted in defining the required electronics for the data acquisition systems.

NORWAY

(Å. Bjordal)

This report include contributions from the following institutions:

1) Institute of Fisheries Technology Research (FTFI)/Fishing Gear and Methods Divison, Bergen
2) Institute of Fisheries Technology Research (FTFI)/Vessel and Marine Engineering Divison, Trondheim
3) Institute of Marine Research, Bergen
4) The Norwegian College of Fisheries Science/University of Tromsø
5) The Norwegian Institute of Technology, Trondheim

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

FISH BEHAVIOUR AND REACTION TO FISHING GEAR

Behaviour of cod and shrimp was observed with remote controlled TV-vehicle (RCTV) in a shrimp trawl with special emphasis on the behaviour when passing the grid sorting device. (1)

The effect on escape behaviour of cod and haddock in the codend of fishtrawls covered with different covers was observed with RCTV. (1)

Avoidance of cod and haddock to vessel during trawling were studied. (1, 3)

Reaction of penned cod and herring to original, time smoothed and filtered vessel noise playback were studied (1)

FISHERIES-RELATED ACOUSTICS

Abundance estimation of fish - deep-towed transducer

This project aims at improving acoustic estimates of the abundance of fish in deep water, exceeding 500 m depth, and along steeply sloped bottoms, e.g., along the edge of the Continental Shelf. In the course of the first phase of the project, both mechanical and electronic components of a current towed vehicle have been adapted, replaced or upgraded. At the end of 1989 the new system was ready for full-scale testing. (3)

Sonar measurement of fish

The aim of this project is development of a sonar and method for abundance estimation of fish in near-surface schools. The system is being developed in collaboration with

SIMRAD and SINTEF. As a foundation for specification of the measurement system, a dual system analysis has been undertaken by users and by engineers. New sonar data on school echoes have been gathered, and a programme package with a sound propagation model has been procured. (3)

Effect of seismological investigations of fish

As a consequence of injuries to farmed fish from light seismic work and mine detonation in a fjord, the Institute of Marine Research has become strongly engaged in the overall problem. To a considerable degree the Institute has acted in a consulting role. It is also contributing to new research projects in this area by acting as a coordination resource.(3)

Expanded split-beam transducer

An expanded split-beam transducer, with both narrow and wide beams, has been built by SIMRAD. Considerable amplitude-weighting or shading applied to the non-core elements has resulted in a reduction of performance compared to the specified design. The transducer has been mounted on R/V "G.O. Sars". Its calibration in December 1989 was successful. The transducer is ready for field use. (3)

Acoustic sampling volume for cod

Computations have been carried out to show how echo integrator values should be adjusted or compensated when the echo threshold effect is significant. (3)

Trials of a new commercial echo sounder

The new SIMRAD EK 500 scientific echo sounding system is still under development, but it has been used by the Institute of Marine Research for ordinary fish stock surveys since summer 1989. A number of errors in the system have been identified and others are being investigated. Including among these, inter alia, are the following: (a) mixing of ASCII and binary data in datagrams sent out by the EK500 over Ethernet to a workstation-based postprocessing system, (b) jitter due to the receiver processor alone which is at least 0.6 dBin magnitude, (c) incorrect compensation of values of S_A for rejected echoes, when the bottom echo is not detected, and (d) display of the angular position of single-fish echoes in a circular PPI which covers only a fraction of the indicated area for the kinds of transducer beamwidths used in fisheries research. (3)

Data system for research vessels

Development of the Bergen Echo Integrator continues. The following functions or "windows" have now been integrated: main window with the echogram, interpretation window, and target strength window. Three other windows have been constructed: fish station window, STD window, and navigation window, but these await integration. (3)

Software development for split-beam echo data

Software is being developed for detailed analysis of raw data derived from the parallel data

ports of the SIMRAD EK400 echo sounder. This has been documented for (1) logging and calibration of the echo sounder, (2) beam-pattern compensation and calibration, and (3) determining single-fish-echo selection criteria based on the effective pulse duration and angle stability. (3)

SELECTIVE FISHING

Shrimp trawls

The new fish/shrimp separator system (metal grid) has been tested under different conditions and in different shrimp trawl designs. Based on very promising results, this sorting device is now introduced by law in major parts of the Norwegian shrimp fishery. (1, 4, 5)

RCTV observations of the performance of the selective grid in front of a shrimp trawl codend and its effect on selectivity of fish and escapement of shrimp. (1, 4)

Testing of hourglass-shaped funnels and metal grid with 8 - 10 mm rod distance to select size of shrimp in trawl.(1)

Comparison of selectivity of 35 and 43 cm mesh size in shrimp trawl codend using two paralell trawls towed from one vessel. No difference in selectivity was recorded.(1)

Fish trawls

A small scale experiment was conducted to test survival rates of cod and haddock after escapement from trawl codend (1).

A new sorting device for cod trawls, releasing undersized fish in front of the codend has proven to give a sharper selection curve and a narrower selection range (1, 4).

Joint investigation with USSR of the selection in 135 mm codend meshsize using two different design of covers and the modified house codend method.(1)

Longline

Further fishing trials have confirmed earlier findings on the size selective properties of artificial bait (Probait) in cod fishing (1). Behaviour of cod relative to baits of variours shapes were studied in the field (1).

IMPROVEMENTS OF FISHING GEAR AND METHODS

Fish traps/pots

A pot fishery for tusk has been established. Development work to adapt pots for other species has been continued (1)

Longline

Artificial bait (Probait) with shrimp, mackerel and squid flavour were compared with

natural bait in fishing trials (1).

Co-operative research on artificial bait has been initiated with the Klaipeda Branch of NPO (Lithuania) (1)

Purse seine

A new purse seine of polyester webbing were tested with promissing results. The sinking speed of the polyester seine was considerably higher than polyamide seines (1).

Trials including transfer of sinking weight from leadline to the purse wire were conducted with promissing results. (1)

Trawl

1:3 scale testing of a new multipanel fishtrawl design from a 18 " vessel. Drag and geometry was measured and the performance observed with RCTV and FS 3300 trawl sonar. The netsonde cable was successfully used as a 3 pulling warp. (1, 4).

OTHER RELEVANT ACTIVITIES

A PC-based echo integrator has been developed. A card with its own microprocessor does the integration and sends the results to the PC where the final calculations are performed. A menu based window system is used for setup and presentation. (1)

Attempts to repeat the 1987 and 1988 experimental fisheries for O-group cod for use as seedfish in fish farms, failed due to apparent low concentrations of cod fry in coastal waters. (1)

POLAND

No information received.

PORTUGAL

(Alberto Machado leite)

During 1989 the Fishing Gear Department of the Instituto Nacional de Investigação das Pescas has been involved in:

Engineering and comparative fishing trials with Portuguese and Spanish traditional, and twin bottom trawls on board the FRV "Noriuega". This work was coducted in cooperation with professional fishermen.

Fishing trials on long-lines and traps in the inshore waters of the Republic of Guiné-Bissau.

Fishing trials with gillnets of different meshes along the south coast of Portugal.

SPAIN

(F.J. Pereiro)

No relevant information to be reported.

SWEDEN

(L.-E. Palmén)

During 1989, Sweden carried out in cooperation with Denmark two hydroacoustic surveys on herring and sprat. One survey covered the Kattegat and the western part of the Skagerrak. In the Baltic, an international survey was carried out in cooperation with the German Democratic Republic, Poland and the USSR. Two intercalibrations were carried out between the Swedish R.V. "Argos" and the Polish R.V. "Professor Siedlecki" and one between the R.V. "Argos" and the German Democratic Republic R.V. "Eisbär" and the USSR R.V. "Issledovatel Baltiki".

UK
SCOTLAND

(P.A.M. Stewart)

Fish Survival and Energetics in Codends

Fish survival after escape from nominal 80 mm square mesh and 90 mm and 100 mm diamond mesh codends was studied. Replicated experiments using a trawl with a separator panel gave results for the survival of 20-32 cm haddock escaping from the upper codend in each case, compared to that of the handline-caught control fish.

Experiment	1	2	3
80 mm square mesh survival	90%	97%	86%
90 mm diamond mesh survival	60%	86%	80%
100 mm diamond mesh survival	93%	83%	97%
Control survival	100%	100%	100%

These results are in substantial agreement with the 1988 data and indicate that survival may be correlated with the 50% retention length.

The study of haddock behaviour escaping from both 90 mm diamond and square mesh codends towed in a frame was continued. Measurements of lactic acid and glycogen levels were taken to establish the degree of exhaustion during the capture process. Water flow, codend geometry and mesh tension were also monitored.

Separator Trawls

An investigation was initiated to see if cod could be separated from flatfish within the lower level of a separating trawl. While over 85% of both haddock and whiting were separated into the top compartment only 65% of the flatfish were retained in the lower level of the lower compartment and the cod were split evenly between the two levels of the lower compartment. Further modifications will be made to the design to improve these figures.

Using a twin trawl, catch comparison data have been obtained between a standard dual purpose fish/prawn trawl with a 70 mm codend and the same net fished with a 70 mm separator panel and 90 mm upper codend. The results from eight hauls showed that, compared to the standard net, the separator net retained markedly fewer undersized haddock and whiting but the same quantity of marketable haddock and *Nephrops*.

Sampling Trawls

The effect of gear and environmental factors on the catch of fish sampling gears was monitored on two further stock assessment cruises on FRV *Scotia*. The GOV trawl was used on both surveys. Door spread was added to the gear parameters already measured on previous cruises. In collaboration with the Hamburg Institute, the influence of rig and groundgear changes on the efficiency of survey gears was investigated on FRV *Solea*.

Selectivity

Further testing of the twin trawl as a gear for selectivity trials was done, including measurement of the geometry of the two sides of the gear and, in March 1990, a catch comparison trial using a 70 mm diamond mesh codend on each side. The results are not available yet. The variation of selectivity with towing speed was studied briefly on FRV *Clupea* using a divided trawl. Discrete towing speeds (high and low) could not be achieved because of the variability of the tide in the working area. Over the fairly narrow range of speeds tested there was no clear dependence of selection parameters on speed.

An investigation of the between-haul variability in selectivity data indicated that the selection characteristics of a codend change from haul to haul. Observations of fish in codends suggested that rate and timing of entry of fish into codends may be important in generating the variability, and that mixing of the catch may be involved as well as mesh opening. Fish behaviour observations in several new codend designs incorporating features such as square mesh "windows" were made.

Some observations on practical procedures and analytical techniques for catch comparison trials will be presented to the working group.

Selectivity data were obtained using various square and diamond mesh codends on a divided trawl. The results were inconclusive, mainly because of lack of fish and possibly unequal fishing efficiency of the two sides of the gear. Detailed analysis will be done.

The selectivity of a complete Nephrops trawl (not just the codend) was measured using a twin trawl having a standard 70 mm net with 150 mm wings on one side and a net in 35 mm mesh netting with a similar wingend spread on the other side. Preliminary analysis suggests that the selection factor obtained for *Nephrops* agreed with typical values obtained for 70 mm codends but that the selection range was smaller. Further analysis is required before this result can be confirmed.

Dredging

The impact of suction dredging on the sea bed and benthic fauna such as *Ensis* and *Venerupus* was studied with underwater television.

French dredges, of width 2 m and tooth length 11 cm, were observed on sandy ground. Under tow the teeth were fully sunk into the sea bed. The tracks consisted of two low parallel sand ridges - small fish and crustacea were seen to be feeding on damaged animals in the tracks.

Seine Net Performance

All the performance data collected on three previous cruises have been combined and a report has been produced, with the emphasis on estimation of swept area.

Fish Behaviour

Continuing studies on the rules that determine the visibility of objects underwater have led to tests on sampling gears for small fish. The evidence suggests that larval fish are avoiding the Gulf III sampler during daylight but not after dark. To render the device less visible, concentric mirrored rings were fitted to the nose cone and the central hole coated inside with reflecting material. Fishing tests comparing standard and modified devices are continuing.

It has been shown that fish cease to react to trawls when the light level is below 10^{-6} lux. Preliminary tests have been made of the practical application of netting constructed from "glow" twine. In collaboration with IFT, Hamburg a striped net was rigged and observed. Fishing trials on dark nights are planned.

Surveys of herring were carried out 1) in the Clyde and 2) in the Orkney, Shetland and Buchan areas in July 1989. The latter survey was in conjunction with the Norwegian and the Danish fisheries research laboratories. In addition, a survey of herring was conducted in ICES division IVa. During these surveys data were collected in individual sample format for each transmission and with 0.5 m range definition.

Dual beam data on herring were collected during July in the Orkney, Shetland and Buchan area and on an additional survey cruise following the main survey in the Clyde. Analysis of data has not yet been completed.

Routine measurements (bi-annual) of survey transducer beam patterns continue and so far no long term changes have been found.

Target strength data were collected, at the field station at Loch Duich, from single caged herring using the dual beam system along with stereo photographs to provide position and angle information. These data are being analysed relating fish orientation to measured target strength for a caged but free swimming fish. Initial analysis shows a variable relationship between tilt angle and target strengths.

Experiments are continuing on the extinction effects of caged dense fish aggregations. Measurements were carried out on aggregations of herring mackerel and cod. Results of this work are published in the proceedings of the Institute of Acoustics.

Work is continuing on the process of integration by echo trace rather than by layer.

Fisheries Laboratory, Lowestoft,

(G.P. Arnold)

1. An acoustic survey was carried out between the trawl stations of the English groundfish survey in the North Sea using 38 kHz Simrad EK400 and ES400 systems.

2. The Multi-frequency Acoustic Profiling System (MAPS) developed by Dr D V Holliday was successfully deployed 71 times during a cruise in the Irish Sea. This system uses 21 discrete frequencies in the range 100 kHz to 10 MHz and was used to assess plankton abundance versus depth and size. Measurements were made along transects between Gt Ormes Head and Dundalk Bay and also at stations near Port Erin, Isle of Man where data were collected at 2 hour intervals. The purpose was to study diel patterns in zooplankton distributions in relation to physical structure and phytoplankton abundance. Both 38 kHz and 120 kHz echo-integrator systems were run during the cruise. The dominant scattering varied between the frequencies with a tendency for higher peaks at 38 kHz.

3. Further sea trials were carried out to investigate the size selectivity of square mesh cod-ends in pelagic trawls. Experiments were undertaken with a 3700 Engel midwater trawl to compare the performance of 60 mm square mesh cod-ends and extension pieces with that of standard 40 mm diamond meshes. The trials took place on board FV "Marbella" (H99) in the western English Channel approximately 12 miles south of Start Point. Fourteen hauls produced 470 t of mackerel and 15 t of scad. No detectable size selection occurred. A full report will be published soon.

USA

No information received.

USSR

(G.I. Luka, PINRO, Murmansk)

During 1989 experimental studies of the selectivity and fishing efficiency of bottom trawls, and the survival of haddock escaped through the trawl bag were carried out. The feasibility of longline fishing was checked. As a result, the following material was collected:

Data on selectivity of trawl bags of polyamide material with 125 mm mesh by using whole cover and trouser trawl.

Data on selectivity of trawl bags of polyamide material with square mesh.

Data on differentiated (by length) fishing efficiency of bottom trawls by using alternate tows and underwater TV.

Data on traumatic death of haddock, escaped through the trawl bag during hauling.

Data on the producitivity, of operation modes with a longline of small boats.

(A.I. Treshev, Moscow)

In 1989, investigations were carried out on the size selection properties of the trawl codend with a hexagonal mesh of 10 mm x 6 (B = 31 mm) in the fishery for herring in the Gulf of Riga. Paior trawling was conducted with 2 trawls of 17.4/47.5 m. The codend of the second trawl was made of ordinary knotted netting with a diamond and square shape mesh (B = 28 mm). The results indicated that a hexagonal mesh has higher size-selective properties ($l_{n\ 50\%}$ = 8.96 cm; $l_{n\ 75\%} - l_{n\ 25\%}$ = 1.76 cm) than a diamond shape one $l_{n\ 50\%}$ = 8.70 cm and $l_{n\ 75\%} - l_{n\ 25\%}$ = 1.54 cm.

In mixed concentrations of sprat and herring, a lower amount of fish entangled in the codend of a hexagonal mesh.

The rates of traumatism were compared between the herring that have passed through the hexagonal mesh of 10 mm x 6 and those escaping through the square on (B = 28 mm): 13.2% and 22.3% (by number) respectively. The fish that could not move actively in th schoal were considered to be traumatised.